

Radio Regulations

Resolutions and Recommendations

Edition of 2024

3



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Edition of 2024



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Note by the Secretariat

This revision of the Radio Regulations, complementing the Constitution and the Convention of the International Telecommunication Union, incorporates the decisions of the World Radio-communication Conferences of 1995 (WRC-95), 1997 (WRC-97), 2000 (WRC-2000), 2003 (WRC-03), 2007 (WRC-07), 2012 (WRC-12), 2015 (WRC-15), 2019 (WRC-19) and 2023 (WRC-23). The majority of the provisions of these Regulations shall enter into force as from 1 January 2025; the remaining provisions shall apply as from the special dates of application indicated in Article 59 of the revised Radio Regulations.

In preparing the Radio Regulations, Edition of 2024, the Secretariat corrected the typographical errors that were drawn to the attention of WRC-23 and which were approved by WRC-23.

This edition uses the same numbering scheme as the 2001 edition of the Radio Regulations, notably:

With respect to *Article numbers*, this edition follows the standard sequential numbering. The Article numbers are not followed by any abbreviation (such as “(WRC-97)”, “(WRC-2000)”, “(WRC-03)”, “(WRC-07)”, “(WRC-12)”, “(WRC-15)”, “(WRC-19)” or “(WRC-23)”). Consequently, any reference to an Article, in any of the provisions of these Radio Regulations (e.g. in No. 13.1 of Article 13), in the texts of the Appendices as contained in Volume 2 of this edition (e.g. in § 1 of Appendix 2), in the texts of the Resolutions included in Volume 3 of this edition (e.g. in Resolution 1 (Rev.WRC-97)), and in the texts of the Recommendations included in Volume 3 of this edition (e.g. in Recommendation 8), is considered as a reference to the text of the concerned Article which appears in this edition, unless otherwise specified.

With respect to *provision numbers in Articles*, this edition continues to use composite numbers indicating the number of the Article and the provision number within that Article (e.g. No. 9.2B means provision No. 2B of Article 9). The abbreviation “(WRC-23)”, “(WRC-19)”, “(WRC-15)”, “(WRC-12)”, “(WRC-07)”, “(WRC-03)”, “(WRC-2000)” or “(WRC-97)” at the end of such a provision means that the relevant provision was modified or added by WRC-23, by WRC-19, by WRC-15, by WRC-12, by WRC-07, by WRC-03, by WRC-2000 or by WRC-97, as applicable. The absence of an abbreviation at the end of the provision means that the provision is identical with the provision of the simplified Radio Regulations as approved by WRC-95, and whose complete text was contained in Document 2 of WRC-97.

With respect to *Appendix numbers*, this edition follows the standard sequential numbering, with the addition of the appropriate abbreviation after the Appendix number (such as “(WRC-97)”, “(WRC-2000)”, “(WRC-03)”, “(WRC-07)”, “(WRC-12)”, “(WRC-15)”, “(WRC-19)” or “(WRC-23)”), where applicable. As a rule, any reference to an Appendix, in any of the provisions of these Radio Regulations, in the texts of the Appendices as contained in Volume 2 of this edition, in the texts of the Resolutions and of the Recommendations included in Volume 3 of this edition, is presented in the standard manner (e.g. “Appendix 30 (Rev.WRC-23)”) if not explicitly described in the text (e.g. Appendix 4 as modified by WRC-23). In the texts of Appendices that were partially modified by WRC-23, the provisions that were modified by WRC-23 are indicated with the abbreviation “(WRC-23)” at the end of the concerned text. If an Appendix is referenced without any abbreviation after the Appendix number, in the texts of this edition (e.g. in No. 13.1), or without other description, such reference is considered as a reference to the text of the concerned Appendix which appears in this edition.

Within the text of the Radio Regulations, the symbol, ↑, has been used to represent quantities associated with an uplink. Similarly, the symbol, ↓, has been used to represent quantities associated with a downlink.

Abbreviations have generally been used for the names of world administrative radio conferences and world radiocommunication conferences. These abbreviations are shown below.

Abbreviation	Conference
WARC Mar	World Administrative Radio Conference to Deal with Matters Relating to the Maritime Mobile Service (Geneva, 1967)
WARC-71	World Administrative Radio Conference for Space Telecommunications (Geneva, 1971)
WMARC-74	World Maritime Administrative Radio Conference (Geneva, 1974)
WARC SAT-77	World Broadcasting-Satellite Administrative Radio Conference (Geneva, 1977)
WARC-Aer2	World Administrative Radio Conference on the Aeronautical Mobile (R) Service (Geneva, 1978)
WARC-79	World Administrative Radio Conference (Geneva, 1979)
WARC Mob-83	World Administrative Radio Conference for the Mobile Services (Geneva, 1983)
WARC HFBC-84	World Administrative Radio Conference for the Planning of the HF Bands Allocated to the Broadcasting Service (Geneva, 1984)
WARC Orb-85	World Administrative Radio Conference on the Use of the Geostationary-Satellite Orbit and the Planning of Space Services Utilising It (First Session – Geneva, 1985)
WARC HFBC-87	World Administrative Radio Conference for the Planning of the HF Bands Allocated to the Broadcasting Service (Geneva, 1987)
WARC Mob-87	World Administrative Radio Conference for the Mobile Services (Geneva, 1987)
WARC Orb-88	World Administrative Radio Conference on the Use of the Geostationary-Satellite Orbit and the Planning of Space Services Utilising It (Second Session – Geneva, 1988)
WARC-92	World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum (Malaga-Torremolinos, 1992)
WRC-95	World Radiocommunication Conference (Geneva, 1995)
WRC-97	World Radiocommunication Conference (Geneva, 1997)
WRC-2000	World Radiocommunication Conference (Istanbul, 2000)
WRC-03	World Radiocommunication Conference (Geneva, 2003)
WRC-07	World Radiocommunication Conference (Geneva, 2007)
WRC-12	World Radiocommunication Conference (Geneva, 2012)
WRC-15	World Radiocommunication Conference (Geneva, 2015)
WRC-19	World Radiocommunication Conference (Sharm El-Sheikh, 2019)
WRC-23	World Radiocommunication Conference (Dubai, 2023)
WRC-27	World Radiocommunication Conference, 2027 ¹

¹ The date of this conference has not been finalized.

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RESOLUTIONS

RESOLUTION 1 (REV.WRC-97)

Notification of frequency assignments¹

The World Radiocommunication Conference (Geneva, 1997),

referring to

- the Preamble of the Constitution,
- Article 42 of the Constitution (Special Arrangements),
- Article 6 of the Radio Regulations (Special agreements),
- Article 11 of the Radio Regulations (Notification and recording of frequency assignments),
- Article 12 of the Radio Regulations (Seasonal planning of the HF bands allocated to the broadcasting service between 5 900 kHz and 26 100 kHz),

resolves

that, unless specifically stipulated otherwise by special arrangements communicated to the Union by administrations, any notification of a frequency assignment to a station shall be made by the administration of the country on whose territory the station is located.

¹ WRC-97 made editorial amendments to this Resolution.

RESOLUTION 2 (REV.WRC-03)

Equitable use, by all countries, with equal rights, of the geostationary-satellite and other satellite orbits and of frequency bands for space radiocommunication services

The World Radiocommunication Conference (Geneva, 2003),

considering

that all countries have equal rights in the use of both the radio frequencies allocated to various space radiocommunication services and the geostationary-satellite orbit and other satellite orbits for these services,

taking into account

that the radio-frequency spectrum and the geostationary-satellite orbit and other satellite orbits are limited natural resources and should be most effectively and economically used,

resolves

1 that the registration with the Radiocommunication Bureau of frequency assignments for space radiocommunication services and their use do not provide any permanent priority for any individual country or groups of countries and do not create an obstacle to the establishment of space systems by other countries;

2 that, accordingly, a country or a group of countries having registered with the Bureau frequencies for their space radiocommunication services need to take all practicable measures to facilitate the use of new space systems by other countries or groups of countries, in particular those of developing countries and least developed countries, so desiring;

3 that *resolves* 1 and 2 of this Resolution shall be taken into account by the administrations and the Bureau.

RESOLUTION 4 (REV.WRC-03)

Period of validity of frequency assignments to space stations using the geostationary-satellite and other satellite orbits¹

The World Radiocommunication Conference (Geneva, 2003),

considering

- a)* that rational and efficient use must be made of the frequency spectrum and the geostationary-satellite orbit and that account should be taken of the provisions of Resolution 2 (Rev.WRC-03) relating to the use by all countries, with equal rights and equitable access to the frequency bands and the associated satellite orbits for space radiocommunication services;
- b)* that limiting the period of validity of frequency assignments to space stations using the geostationary-satellite orbit and other satellite orbits is a concept which would promote the attainment of these objectives;
- c)* that amortizing the considerable investments made in connection with the development of space radiocommunications is a heavy burden for all administrations and that these investments should be spread over a predetermined and realistic period;
- d)* that every effort should be made to encourage administrations in a position to do so to develop techniques designed to improve the utilization of the frequency spectrum and the geostationary-satellite orbit and other satellite orbits with a view to increasing the total radiocommunication facilities available to the world community;
- e)* that an experimental procedure to gain experience from application of the new concept of notifying the period of validity of an assignment in space radiocommunication was introduced by WARC-79 and has been used by the Radiocommunication Bureau and administrations since then but that it is not possible to impose on administrations a statutory period identical in all cases;
- f)* that administrations should be left to propose the period of validity themselves in the light of their operational service requirements and of the common interest, however the period of validity shall take into account, *inter alia*, the operational lifetime of the satellite systems, including space and earth stations, and the type of service provided,

¹ This Resolution does not apply to the frequency bands covered by the Allotment Plan contained in Appendix 30B.

resolves

1 that, until this Resolution is reviewed by the next competent world radiocommunication conference, frequency assignments to space radiocommunication stations located on the geostationary-satellite and other satellite orbits, noting *considering e) and f)*, shall not be considered perpetual and shall be dealt with as follows:

1.1 a frequency assignment to a space station² shall be deemed definitively discontinued after the expiry of the period of operation shown on the assignment notice, reckoned from the date on which the assignment was brought into service. This period shall be limited to that for which the satellite network was designed. The Bureau shall then invite the notifying administration to take steps to cancel the assignment. If the Bureau receives no reply within three months following the expiry of the period of operation, it shall insert a symbol in the Remarks Column of the Master Register to indicate that the assignment is not in conformity with this Resolution;

1.2 if a notifying administration which wishes to extend the period of operation originally shown on the assignment notice of a frequency assignment of an existing space station² informs the Bureau accordingly more than three years before the expiry of the period in question and if all other basic characteristics of that assignment remain unchanged, the Bureau shall amend as requested the period of operation originally recorded in the Master Register and publish that information in a special section of the Bureau's International Frequency Information Circular (BR IFIC);

1.3 if, at least three years before the expiry of the period of operation recorded in the Master Register of a frequency assignment to an existing space station², an administration initiates the coordination procedure specified in No. 9.7 to bring into service a new space station using the same assigned frequency and the same orbital position but with different technical characteristics, and if the Bureau finds after the notification that the new assignment conforms with the provisions of No. 11.31 and does not increase, in relation to the preceding assignment, the probability of interference to the detriment of a frequency assignment recorded in the Master Register or involved in the coordination procedure, the new assignment shall be given a favourable finding and shall be entered in the Master Register;

1.4 a notifying administration which wishes to modify a basic characteristic of a frequency assignment of a space station² recorded in the Master Register shall initiate, in any case other than those covered by *resolves* 1.2 and 1.3, the appropriate modification procedure in accordance with the provisions of Nos. 11.43A to 11.46;

2 that, for the application of the provisions of *resolves* 1.1 above, the information concerning the period of validity of frequency assignments to space stations shall be notified in addition to that contained in Appendix 4;

3 that the application of this Resolution shall not prejudice in any way the decisions of future radiocommunication conferences,

² The expression "space station" may apply to more than one satellite provided that only one satellite is in operation at any particular moment and that the stations installed on board successive satellites have identical basic characteristics.

invites ITU-R

to undertake studies with respect to the implementation of this Resolution,

invites the next competent world radiocommunication conference

to take cognizance of the results of ITU-R studies undertaken as a result of this Resolution and take action, as appropriate,

instructs the Secretary-General

to bring this Resolution to the attention of the Council.

RESOLUTION 5 (REV.WRC-23)

Technical cooperation with the developing countries in the study of propagation in tropical and similar areas

The World Radiocommunication Conference (Dubai, 2023),

having noted

that the assistance provided for the developing countries by the Union in the field of telecommunications in cooperation with other United Nations specialized agencies, such as the United Nations Development Programme (UNDP), augurs well for the future,

aware

a) of the fact that the developing countries, particularly those in tropical and similar areas, (including the area referred to as zone C in the Final Acts of the Regional Administrative Conference for the Planning of VHF/UHF Television Broadcasting in the African Broadcasting Area and Neighbouring Countries (Geneva, 1989 and Geneva, 2006), the Red Sea, East Mediterranean, etc.), require adequate knowledge of radio wave propagation in their territories in order to make rational and economical use of the radio-frequency spectrum;

b) of the importance of propagation in radiocommunications;

c) of the importance of the work of ITU-T and ITU-R Study Groups for the development of telecommunications in general and radiocommunications in particular,

considering

a) the need for the developing countries themselves to study telecommunications in general and propagation in particular in their territories, this being the best means of enabling them to acquire telecommunication techniques and to plan their systems effectively and in conformity with the special conditions in the tropical areas;

b) the scarcity of resources available in these countries,

resolves to instruct the Secretary-General

1 to offer the assistance of the Union to developing countries in the tropical areas which endeavour to carry out national propagation studies in order to improve and develop their radiocommunications;

2 to assist these countries, if necessary with the collaboration of international and regional organizations such as the Asia-Pacific Broadcasting Union (ABU), Arab States Broadcasting Union (ASBU), African Telecommunication Union (ATU) and the African Union of Broadcasting (AUB) which may be concerned, in carrying out national propagation measurement programmes, including collecting appropriate meteorological data, on the basis of ITU-R Recommendations and Questions in order to improve the use of the radio-frequency spectrum;

RES5-2

3 to arrange funds and resources for this purpose from the UNDP or other sources in order to enable the Union to provide the countries concerned with adequate and effective technical assistance for the purpose of this Resolution,

resolves to instruct the Director of the Radiocommunication Bureau

to include this activity in the operational plan, within existing budgetary resources of the Sector,

invites administrations

to submit the results of these propagation measurements to ITU-R for consideration in its studies,

invites the Council

to follow the progress made in carrying out programmes of propagation measurements and the results achieved, and to take any action that it considers necessary.

RESOLUTION 7 (REV.WRC-19)

Development of national radio-frequency management

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that the Radio Regulations contain, *inter alia*, procedures for the coordination, notification and registration of frequencies which specify the rights and obligations of Member States;
- b) that the application of the above-mentioned procedures necessitates an appropriate radio-frequency management unit in each Member State;
- c) that the existence of such a unit helps Member States to safeguard their rights and to discharge their obligations under the Radio Regulations;
- d) that the application of the Radio Regulations through the agency of such units is in the interest of the international community as a whole,

noting

that such a unit requires an adequate number of suitably qualified staff,

noting further

that the administrations of many developing countries need to create or to strengthen such a unit, appropriate to their administrative structure, with responsibility for the application of the Radio Regulations at the national and international levels,

resolves

- 1 that meetings shall be organized between representatives of the Radiocommunication Bureau and the personnel involved in frequency management matters from administrations of developing and developed countries;
- 2 that such meetings shall be aimed at designing standard structures suitable for administrations of developing countries and include discussions concerning the establishment and operation of radio-frequency management units;
- 3 that such meetings should also identify the particular needs of developing countries in establishing such units, and the means required to meet those needs,

recommends

that developing countries, when planning the use of funds, particularly those received from international sources, make provision for participation in these meetings as well as taking appropriate action for the introduction and development of such units,

invites the ITU Council

to take the necessary measures for the organization of such meetings,

instructs the Secretary-General

- 1 to circulate this Resolution to all Member States, drawing their attention to its importance;
- 2 to circulate the results of such meetings, particularly to the developing countries;
- 3 to inform the developing countries of the types of assistance ITU can provide in setting up the desired structure,

instructs the Director of the Radiocommunication Bureau

to include this activity in the Operational Plan, within existing budgetary resources of the Sector,

draws the attention of the next plenipotentiary conference

- 1 to the particular problems identified in this Resolution;
- 2 to the need for prompt and effective action to resolve them;
- 3 to the need to take all practicable measures to ensure that resources are made available for this purpose.

RESOLUTION 8 (WRC-23)

**Tolerances for certain orbital characteristics of space stations
deployed as part of non-geostationary-satellite orbit systems in the fixed-
satellite, broadcasting-satellite or mobile-satellite service**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that WRC-19 invited the ITU Radiocommunication Sector (ITU-R) to study, as a matter of urgency, tolerances for certain orbital characteristics of non-geostationary-satellite orbit (non-GSO) space stations of the fixed-satellite service (FSS), the broadcasting-satellite service (BSS) and the mobile-satellite service (MSS) to account for the potential differences between the notified and deployed orbital characteristics for the inclination of the orbital plane, the altitude of the apogee of the space station, the altitude of the perigee of the space station and the argument of the perigee of the orbital plane;
- b)* that satellites on highly-elliptical orbits and highly-inclined orbits having an apogee altitude greater than 15 000 km and an orbital inclination between 35° and 145° have significant orbital precession rates and, consequently, restrictive orbital-keeping requirements and correction of orbital parameters may lead to a reduction of such satellites' lifetime and to frequent replacement;
- c)* that design considerations (including the impact of atmospheric drag¹ characteristics of the altitude chosen and solar cycle effects for systems at altitudes lower than 600 km); maintaining separation between satellites in the same and other systems to ensure safe flight operations and minimize the risk of collisions; and other operational considerations can lead to notifying administrations needing to operate some space stations in orbital planes with some deviation from the notified orbital planes for their non-GSO systems;
- d)* that significant deviations between the operational orbital plane(s) of a non-GSO system and the notified orbital plane(s) for those systems as recorded in the Master International Frequency Register (MIFR) could negatively impact the efficient use of orbit and spectrum resources;

¹ Atmospheric drag is the atmospheric force acting opposite to the relative motion of an object. Atmospheric drag is important for a space station as it hinders the space station exiting the atmosphere, and also pulls orbital satellites back towards Earth over time.

e) that it is important, for consideration of instances where a non-GSO system operates with orbital planes that deviate from the system's notified orbital planes, that there is a mechanism developed for determining that such operation does not now and will not in the future result in the space stations of the non-GSO system causing more interference or claiming a higher need for protection than would have been the case if the operational orbital planes exactly matched the notified orbital planes for the system;

f) that adherence to a transparent approach to the question of orbital tolerances is desirable, as it reduces uncertainty with respect to the deployment of non-GSO systems,

recognizing

a) that Nos. **11.44C** and **11.49.2** require the deployment of satellites on notified orbital planes;

b) that No. **13.6** is applicable to non-GSO systems with frequency assignments in the frequency bands and services to which this Resolution applies;

c) that orbital tolerances should ensure an adequate level of operational flexibility for non-GSO system operations, while ensuring that the interference environment into other systems and services is not degraded;

d) that orbit and spectrum resources are a shared resource, and this Resolution does not preclude coordination requests or notification filings under Articles **9** and **11** for other non-GSO systems at the same altitude and tolerance,

noting

that for the purpose of this Resolution:

- the term “frequency assignments” is understood to refer to frequency assignments to a space station of a non-GSO system;
- the term “notified orbital plane” means an orbital plane of the non-GSO system, as provided to the Bureau in the most recent notification information for the system's frequency assignments, that possesses the general characteristics of items:
 - A.4.b.4.a, the angle of inclination of the orbital plane of the space station;
 - A.4.b.4.d, the altitude of the apogee of the space station;
 - A.4.b.4.e, the altitude of the perigee of the space station;
 - A.4.b.4.i, the argument of the perigee of the orbit of the space station (only for orbits whose altitudes of the apogee and perigee are different);
 - A.4.b.4.r, the distance to the apogee of the space station; and
 - A.4.b.4.s, the distance to the perigee of the space station;

in Table A of Annex 2 to Appendix 4;

- the term “observed distance to the apogee” refers to the distance in kilometres from the centre of the Earth to the deployed space station at its apogee;

- the term “observed distance to the perigee” refers to the distance in kilometres from the centre of the Earth to the deployed space station at its perigee;
- the term “tolerances” refers to deviations between the value notified and/or recorded for the orbital characteristics as referred to in this *noting* and those observed for the actual deployment of satellites of the non-GSO FSS, BSS or MSS system under consideration,

resolves

1 that this Resolution applies to frequency assignments to non-GSO systems, for orbital planes having an orbital eccentricity² less than 0.5 and an apogee altitude less than 15 000 km notified as part of a non-GSO FSS, BSS or MSS system subject to Resolution **35 (Rev.WRC-23)**;

2 that, for frequency assignments to which *resolves* 1 applies, and for which information concerning the bringing into use or bringing back into use, or the deployment information under Resolution **35 (Rev.WRC-23)**, has been provided to the Bureau prior to 1 January 2025, the notifying administration shall communicate to the Bureau the required information regarding the system’s deployed space stations in accordance with Annex 1 to this Resolution no later than 1 April 2025 and include in that submission, for each orbital plane and without submitting a modification to the notification information, the information under Appendix 4 data items A.4.b.4.r and A.4.b.4.s (distances to the apogee and perigee of the space station);

3 that, for frequency assignments to which *resolves* 1 applies, and for which information concerning the bringing into use or bringing back into use of the frequency assignments is provided to the Bureau on or after 1 January 2025, the notifying administration shall communicate to the Bureau the required information regarding the system’s deployed space station(s) in accordance with Annex 1 to this Resolution at the same time as the notifying administration informs the Bureau of the bringing into use of applicable frequency assignments under No. **11.44C** or the bringing back into use of applicable frequency assignments under No. **11.49.2**, and, for each orbital plane, include in that submission, if not already provided, and without submitting a modification to the notification information, the information under Appendix 4 data items A.4.b.4.r and A.4.b.4.s (distances to the apogee and perigee of the space station);

4 that, for frequency assignments to which *resolves* 1 applies, and which retain the remark in the MIFR entry that was added under *resolves* 5b) of Resolution **35 (Rev.WRC-23)**, and for which deployment information under Resolution **35 (Rev.WRC-23)** is provided to the Bureau on or after 1 January 2025, the notifying administration shall communicate to the Bureau the required information regarding the system’s deployed space stations in accordance with Annex 1 to this Resolution at the same time as the notifying administration communicates to the Bureau the required information under *resolves* 7 or 8, as applicable, from Resolution **35 (Rev.WRC-23)**;

² The eccentricity e is equal to: $e = (R_a - R_p) / (R_a + R_p)$

where:

R_a : distance between the centre of the Earth and the space station at apogee
 R_p : distance between the centre of the Earth and the space station at perigee.

5 that, for frequency assignments to which *resolves* 1 applies, and for which a modification to the characteristics of the notified or recorded frequency assignments has been submitted pursuant to *resolves* 11c) of Resolution **35 (Rev.WRC-23)**, the notifying administration shall communicate to the Bureau the required information regarding the system's deployed space stations in accordance with Annex 1 to this Resolution within 30 days after notification information reflecting the modified characteristics is published in the Radiocommunication Bureau International Frequency Information Circular (BR IFIC) (Part II-S);

6 that, based on the latest notification information published in the BR IFIC (Part II-S, if available, or Part I-S if Part II-S is not available), and for each space station reported to have been deployed and operated, when:

- a) the magnitude of the difference between the observed and the notified distances to the apogee of the space station and between the observed and the notified distances to the perigee of the space station is 70 km or less (for a notified altitude of the apogee/notified altitude of the perigee of 2 000 km or less) or of 5% in km or less (for a notified altitude of the apogee/notified altitude of the perigee greater than 2 000 km); and
- b) the magnitude of the difference between the observed and the notified angle of inclination of the orbital plane of the space station is 2° or less (for a notified altitude of the apogee/notified altitude of the perigee of 2 000 km or less), or 3° or less (for a notified altitude of the apogee/notified altitude of the perigee greater than 2 000 km),

the notifying administration shall provide as part of its report under Annex 1 to this Resolution in accordance with *resolves* 2, 3, 4 or 5, as appropriate, an explanation of why there is a difference between the observed and the notified values for the orbital characteristics of the space station;

7 that, based on the latest notification information published in the BR IFIC (Part II-S, if available, or Part I-S if Part II-S is not available), and for each space station reported to have been deployed and operated, when one or both of the following conditions apply:

- a) the magnitude of the difference between the observed and the notified distances to the apogee of the space station or between the observed and the notified distances to the perigee of the space station is between 70 km and 100 km (for a notified altitude of the apogee/notified altitude of the perigee of 2 000 km or less)³ or between 5% and 10% in km (for a notified altitude of the apogee/notified altitude of the perigee greater than 2 000 km)⁴;

³ This *resolves* applies if the magnitude of the difference between the observed and notified distances to the apogee is between 70 km and 100 km while the magnitude of the difference between the observed and notified distances to the perigee is less than 70 km, as well as if the magnitude of the difference between the observed and notified deviation of the distance to the apogee is less than 70 km and the magnitude of the difference between the observed and notified distances to the perigee is between 70 km and 100 km.

⁴ This *resolves* applies if the magnitude of the difference between the observed and notified distances to the apogee is between 5% and 10% in km while the magnitude of the difference between the observed and notified distances to the perigee is below 5% in km, as well as if the magnitude of the difference between the observed and notified distances to the apogee is below 5% in km and the magnitude of the difference between the observed and notified distances to the perigee is between 5% and 10% in km.

- b) the magnitude of the difference between the observed and the notified angle of inclination of the orbital plane of the space station is between 2° and 3° (for a notified altitude of the apogee/notified altitude of the perigee of 2 000 km or less), or between 3° and 4° (for a notified altitude of the apogee/notified altitude of the perigee greater than 2 000 km),

the notifying administration shall provide as part of its report under Annex 1 to this Resolution in accordance with *resolves* 2, 3, 4 or 5, as appropriate, an explanation of why there is a difference between the observed and the notified values for the orbital characteristics of the space station and a technical demonstration confirming that a difference between the observed and the notified distances to the apogee of the space station or a difference between the observed and the notified distances to the perigee of the space station greater than 70 km but less than or equal to 100 km (for a notified altitude of the apogee/notified altitude of the perigee of 2 000 km or less) or greater than 5% but less than or equal to 10% in km (for a notified altitude of the apogee/notified altitude of the perigee greater than 2 000 km), as applicable, does not result in any increased interference protection requirements as compared to those requirements for operation in accordance with the notified orbital characteristics for the space station under consideration;

8 that, upon receipt of the required information submitted in accordance with *resolves* 2, 3, 4 or 5 above, the Bureau shall promptly make that information available “as received” on the ITU website;

9 that, if the information to be provided in any Annex 1 submission in accordance with *resolves* 2, 3, 4 or 5 above shows a difference between the observed and notified/recorded distances to the apogee or perigee of the space station, or a difference between the observed and notified/recorded angles of inclination of the orbital plane of the space station, that is greater than the values specified in *resolves* 7 above, the notifying administration shall also submit to the Bureau, no later than the deadline for the Annex 1 submissions in accordance with *resolves* 2, 3, 4 or 5 above, modifications to the characteristics of the notified or recorded frequency assignments reflecting the revised orbital parameters; a failure to provide such a modification will result in the frequency assignments subject to this *resolves* 9 not being considered as brought into use under No. **11.44C** or brought back into use under No. **11.49.2**, or counted towards a milestone under the procedures in Resolution **35 (Rev.WRC-23)**;

10 that, where a notifying administration has communicated to the Bureau the required information regarding the system’s deployed space stations in accordance with Annex 1 to this Resolution under *resolves* 4 or 5 (in reference to *resolves* 11c) of Resolution **35 (Rev.WRC-23)**, and where *resolves* 9 of this Resolution does not apply), the notifying administration shall ensure that its notification information aligns with the fully-deployed system, and that any such modification be considered under *resolves* 16 below;

11 that, for any space stations in non-GSO systems with frequency assignments subject to this Resolution that have either been brought into use under No. **11.44C** or brought back into use under No. **11.49.2**, or where the space stations themselves have been counted towards a milestone under the procedures in Resolution **35 (Rev.WRC-23)**:

- a) the maximum allowed difference between the observed distance to the apogee or perigee of the space station and the distances to the apogee or perigee of a space station previously declared under this Resolution is 30 km;
- b) the maximum allowed difference between the observed angle of inclination of the orbital plane of the space station and the angle of inclination of the orbital plane of a space station previously declared under this Resolution is 2° (for a notified altitude of the apogee/notified altitude of the perigee of 2 000 km or less), or 3° (for a notified altitude of the apogee/notified altitude of the perigee greater than 2 000 km);

for purposes of this *resolves* 11, the tolerance required can be maintained as against any notified orbital plane in the system or against any distance to the apogee and perigee previously declared under this Resolution if different than a notified orbital plane;

12 that any space station deployed as part of a non-GSO FSS, BSS or MSS system subject to this Resolution that has been counted towards a milestone under the procedures in Resolution **35 (Rev.WRC-23)** for systems that have not completed the milestone process shall be considered in the deployment information submitted under *resolves* 7 or 8 of Resolution **35 (Rev.WRC-23)**, as applicable, for any subsequent milestone submission if the tolerances referred to in *resolves* 11 above have not been exceeded for a maximum of 60 consecutive days;

13 that any space station deployed as part of a non-GSO FSS, BSS or MSS system subject to this Resolution that has completed the milestone process in *resolves* 6 or *resolves* 7 to 18 of Resolution **35 (Rev.WRC-23)** shall not exceed the tolerances referred to in *resolves* 11 above for a maximum of 60 consecutive days;

14 that, for any space stations under *resolves* 12 or 13 above that have exceeded the maximum allowed differences in *resolves* 11 above for more than 60 consecutive days, the notifying administration shall provide the Bureau with the information in Annex 1 to this Resolution for these space stations only within 30 days after the end of that 60-day period (unless *resolves* 15 below is applied) and, within 90 days after the end of that 60-day period, submit modifications to the characteristics of the notified or recorded frequency assignments reflecting the revised parameters;

15 that, instead of applying the procedure in *resolves* 14 of this Resolution, if the notifying administration has informed the Bureau before the end of the 60-day period that it is temporarily discontinuing use of the frequency assignments, it may, within 3 years after the initiation of the discontinued use, inform the Bureau of the resumption of use within the maximum allowed differences in *resolves* 11, subject to the condition that the space stations with those frequency assignments cannot be counted towards any milestone submission under Resolution **35 (Rev.WRC-23)** prior to such resumption;

16 that, upon receipt of the modifications to the characteristics of the notified or recorded frequency assignments as referred to in *resolves* 10, the Bureau shall:

- a) promptly make this information available “as received” on the ITU website;
- b) conduct an examination for compliance with Nos. **11.43A/11.43B**, as appropriate;
- c) for the purpose of No. **11.43B**, retain the original dates of entry of the frequency assignments in the MIFR, in the modifications submitted pursuant to *resolves* 10, if:
 - i) the Bureau reaches a favourable finding under No. **11.31**; and
 - ii) the modifications are limited to any Appendix 4 data item A.4.b.4 except Appendix 4 data item A.4.b.4.b (i.e. the number of satellites in the orbital plane) and any Appendix 4 data items A.14, A.4.b.6.a and A.4.b.7; and
 - iii) the notifying administration provides a commitment stating that the characteristics as modified will not cause more interference or require more protection than the characteristics provided in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments (see Appendix 4 data item A.39.a);
- d) publish the information provided and its findings under No. **11.43B** in the BR IFIC;

17 that the Bureau shall, no later than 45 days before any deadline for submission by a notifying administration under *resolves* 2, 3, 4, 5 or 14, send a reminder to the notifying administration to provide the information required;

18 that, if a notifying administration fails to communicate the information required under *resolves* 2, 3, 4, 5 or 14, as appropriate, the Bureau shall promptly send the notifying administration a reminder asking the administration to provide the required information within 30 days from the date of that reminder from the Bureau;

19 that, if a notifying administration fails to provide information after the reminder sent under *resolves* 18, the Bureau shall send the notifying administration a second reminder asking it to provide the required information within 15 days from the date of the second reminder;

20 that, if a notifying administration fails to provide the required information under resolves 2, 3, 4, 5 or 14, as appropriate, following the reminders under resolves 18 and 19, the Bureau shall:

- a) continue to take the entry in the MIFR into account when conducting its examinations, until the Radio Regulations Board confirms that *resolves* 20 b) shall apply;
- b) no longer consider the frequency assignments in subsequent examinations under Nos. **9.36**, **11.32** or **11.32A** and inform administrations having frequency assignments subject to Sub-Section IA of Article **9** that those assignments shall not cause harmful interference to, or claim protection from, other frequency assignments recorded in the MIFR with a favourable finding under No. **11.31**;

21 that, if information provided by a notifying administration under *resolves* 4 or 5 of this Resolution results in frequency assignments not retaining their original dates of entry in the MIFR after application of *resolves* 9 or 14 of this Resolution, those space stations with altitude or inclination deviations that caused this result shall not be included in the total number of space stations deployed as part of the system for purposes of the milestone submission under Resolution **35 (Rev.WRC-23)** with which the information under *resolves* 4 or 5 of this Resolution is associated,

further resolves

to apply the provisions of this Resolution on a provisional basis as from 1 January 2025 pending review by a future competent conference,

instructs the Radiocommunication Bureau

1 to take the necessary actions to implement this Resolution and to report on any difficulties it or administrations encounter in the implementation or application of this Resolution to future world radiocommunication conferences;

2 not to revisit or review, in connection with submissions from administrations under this Resolution, any prior confirmations that frequency assignments subject to this Resolution have been brought into use or brought back into use or any prior milestone determinations under Resolution **35 (Rev.WRC-23)**;

3 to develop tools, including a naming convention applicable to large non-GSO systems complying with this Resolution, to help with implementation of this Resolution,

invites the ITU Radiocommunication Sector

to continue studies with a view to identifying a methodology or methodologies for determining whether specific changes to a notified orbital plane will cause more interference or require more protection than the characteristics provided in the latest notification information published in the BR IFIC (Part II-S, if available, or Part I-S if Part II-S is not available) for the frequency assignments.

ANNEX 1 TO RESOLUTION 8 (WRC-23)

Information to be submitted about the deployed space stations**A Satellite system information**

- 1) Name of the satellite system;
- 2) Name of the notifying administration;
- 3) Country symbol;
- 4) Reference to the advance publication information or the request for coordination, or the notification information, if available;
- 5) Total number of space stations deployed into each notified orbital plane of the satellite system with the capability of transmitting or receiving the frequency assignments;
- 6) Orbital plane number indicated in the latest notification information published in the Radiocommunication Bureau International Frequency Information Circular (BR IFIC) (Part II-S, if available, or Part I-S if Part II-S is not available) for the frequency assignments into which each space station is deployed.

B Space station characteristics for each space station deployed

- 1) Name of the space station;
- 2) Orbital plane number with which the space station is associated and, for information purposes, the initial phase angle of the space station in the orbital plane;
- 3) Observed distance to the apogee and observed distance to the perigee of the space station, and observed angle of inclination of the orbital plane of the space station.

C Commitment of non-interference/non-protection

By providing a submission under this Annex, the notifying administration commits that the operation of its notified frequency assignments using the orbital characteristics of the submission that are in deviation from the notified orbital plane(s) will not cause more interference or require more protection than would otherwise be the case for operation in accordance with the characteristics provided in the latest notification information published in the BR IFIC (Part II-S, if available, or Part I-S if Part II-S is not available) for the frequency assignments to the non-geostationary-satellite system.

RESOLUTION 10 (REV.WRC-2000)

Use of two-way wireless telecommunications by the International Red Cross and Red Crescent Movement

The World Radiocommunication Conference (Istanbul, 2000),

considering

- a)* that the worldwide humanitarian operations carried out by the International Red Cross and Red Crescent Movement – composed of the International Committee of the Red Cross, the International Federation of Red Cross and Red Crescent Societies and national Red Cross and Red Crescent societies – are of great importance and often indispensable;
- b)* that in such circumstances normal communication facilities are frequently overloaded, damaged, completely interrupted or not available;
- c)* that it is necessary to facilitate by all possible measures the reliable intervention of these national and international organizations;
- d)* that rapid and independent contact is essential to the intervention of these organizations;
- e)* that for the efficient and safe conduct of their humanitarian operations, these organizations rely heavily on two-way wireless telecommunication facilities, and particularly on an extensive HF and VHF radio network,

resolves to urge administrations

- 1 to take account of the possible needs of the International Red Cross and Red Crescent Movement for two-way wireless telecommunication means when normal communication facilities are interrupted or not available;
- 2 to assign to these organizations the minimum number of necessary working frequencies in accordance with the Radio Regulations;
- 3 to take all practicable steps to protect such communications from harmful interference.

RESOLUTION 12 (REV.WRC-23)

Assistance and support to Palestine

The World Radiocommunication Conference (Dubai, 2023),

recalling

- a)* the Charter of the United Nations and the Universal Declaration of Human Rights;
- b)* the terms of Resolution 67/19 of the United Nations General Assembly (UNGA), which decides “to accord to Palestine” non-member observer State status in the United Nations;
- c)* UNGA Resolution 72/240, which recognizes the Palestinian people’s right to permanent sovereignty over their natural resources, specifically land, water, energy and other natural resources, in the occupied Palestinian territory, including East Jerusalem;
- d)* Resolution 32 (Kyoto, 1994) of the ITU Plenipotentiary Conference, on technical assistance to Palestine for the development of telecommunications;
- e)* Resolution 125 (Rev. Bucharest, 2022), Resolution 125 (Rev. Dubai, 2018), Resolution 125 (Rev. Busan, 2014), Resolution 125 (Rev. Guadalajara, 2010), Resolution 125 (Rev. Antalya, 2006) and Resolution 125 (Marrakesh, 2002) of the Plenipotentiary Conference, on assistance and support to Palestine for infrastructure development and capacity building in the telecommunication and information technology sector;
- f)* Resolution 99 (Rev. Dubai, 2018), Resolution 99 (Rev. Busan, 2014) and Resolution 99 (Rev. Guadalajara, 2010) of the Plenipotentiary Conference, on the status of Palestine in ITU;
- g)* Resolution 18 (Rev. Kigali, 2022), Resolution 18 (Rev. Buenos Aires, 2017), Resolution 18 (Rev. Dubai, 2014) and Resolution 18 (Rev. Hyderabad, 2010) of the World Telecommunication Development Conference (WTDC), on special technical assistance to Palestine;
- h)* Resolution 9 (Rev. Kigali, 2022), Resolution 9 (Rev. Buenos Aires, 2017) and Resolution 9 (Rev. Dubai, 2014) of WTDC, which recognize that it is the sovereign right of every State to manage spectrum use within its territories;
- i)* Nos. 6 and 7 of the ITU Constitution indicating among the purposes of the Union “to promote the extension of the benefits of the new telecommunication technologies to all the world’s inhabitants” and “to promote the use of telecommunication services with the objective of facilitating peaceful relations”;

considering

- a) that the Constitution and ITU Convention are designed to strengthen peace and security in the world for the development of international cooperation and better understanding among the peoples concerned;
- b) Resolution 125 (Rev. Bucharest, 2022), which recognizes that ITU's policy of assistance to Palestine for the development of its telecommunication sector has been efficient but has not yet fulfilled its goals due to the prevailing situation,

considering further

- a) the need to continue assisting Palestine to manage, similar to ITU administrations, its radio spectrum resources required to advance the economic and social development of Palestine;
- b) that the frequency assignments and frequency spectrum management requirements of Palestine must be respected and safeguarded in accordance with the provisions and resolutions of ITU and international law in this regard;
- c) the right of Palestine to manage and plan its own spectrum resources in accordance with the Interim Agreement and the provisions of the Radio Regulations and the various resolutions adopted by global and regional radiocommunication assemblies and conferences;
- d) The Israeli-Palestinian Interim Agreement signed between the parties,

mindful

of the fundamental principles contained in the Constitution,

noting with concern

the restrictions and difficulties related to the current situation in Palestine, preventing access to telecommunication means, services and applications, which constitute a continuing obstacle for the telecommunication sector in Palestine,

welcomes

- 1 the recent bilateral agreement elaborated through the JTC by concerned parties on 27 December 2022, for assignment of frequencies which will enable the deployment of IMT-Advanced and IMT-2020 technologies in Palestine,
- 2 the commitment of concerned parties to advance efforts to facilitate the entry of necessary equipment for the construction and operation of telecommunication networks for use by Palestinian operators;
- 3 the continued support of ITU, including its Secretary-General, in achieving the goals of this Resolution,

urges Member States

including concerned parties, to make every effort with a view to facilitating the acquisition and deployment of the equipment needed by Palestine for the establishment of their networks,

resolves

- 1 to continue to provide assistance to Palestine, through the ITU Radiocommunication Sector and in collaboration with the ITU Telecommunication Development Sector, pursuant to the relevant ITU resolutions and decisions, in particular in the areas of capacity building, spectrum management and frequency assignment, with a view to enabling Palestine to manage and exploit its radio spectrum;
- 2 to enable Palestine to modernize its telecommunication networks, including building and operating 4G and 5G networks, through support and technical assistance;
- 3 that Palestine should operate its telecommunication networks, including building and operating 4G and 5G networks, through support and technical assistance;
- 4 to urgently empower Palestine, through assistance provided to it, in order to ensure that Palestine is able to obtain and manage the necessary frequencies for microwave links, which are considered essential to the operation of 4G and 5G services, and identify mechanisms to ensure that Palestine is able to exploit the additional bands needed for new, modern mobile telecommunication networks, such as IMT-2020 in accordance with the Interim Agreement;
- 5 to enable Palestine to urgently extend, install, own, manage and operate optical fibre broadband telecommunication networks (and optical fibre links) between governorates and major cities to ensure a more robust digital transformation in Palestine in accordance with the Interim Agreement;
- 6 to support Palestine in obtaining VHF and UHF frequencies for fixed and mobile telecommunication services;
- 7 to enable Palestine to obtain FM frequencies for the broadcasting service;
- 8 to instruct the Director of the Radiocommunication Bureau to ensure the implementation of this Resolution,

urges concerned parties

- 1 to make all possible efforts to achieve the following:
 - i) facilitation of the import and deployment of equipment for the implementation of the agreement signed on 27 December 2022 with respect to the operation of 4G and 5G services, for the Palestinian operators in accordance with the Interim Agreement;
 - ii) enabling the establishment of Palestine's own international access networks including satellite earth stations, submarine cables, optical fibre and microwave systems in accordance with the Interim Agreement,

RES12-4

instructs the Director of the Radiocommunication Bureau

1 to take appropriate measures within the mandate of the Radiocommunication Bureau, in cooperation with the respective Sectors, in order to assist in the implementation of this Resolution;

2 to report to the next world radiocommunication conference on progress achieved in the implementation of this Resolution;

3 to ensure support and assistance in the mobilization and development of financial and human resources and capacity building for the radiocommunication sector in Palestine through innovation and financing in various fields;

4 to assist in the delivery of telecommunication networks and Internet services to remote areas (and all health centres in Palestine);

5 to assist in the implementation of projects of the three ITU Bureaux, including the regional initiatives,

instructs the Secretary-General

1 to ensure the implementation of this Resolution and to submit an annual report to the ITU Council on progress made in implementing this Resolution;

2 to coordinate the activities carried out by the three ITU Sectors in accordance with *resolves* above, to ensure that the Union's action in favour of Palestine is as effective as possible, and to report on the matter to the Council on the progress achieved on these issues.

RESOLUTION 13 (REV.WRC-97)

Formation of call signs and allocation of new international series

The World Radiocommunication Conference (Geneva, 1997),

considering

the increasing demand for call signs justified by the increased number of Member States and by the increased requirements of countries which are already Member States,

believing

that call signs already in use should, as far as possible, not be changed,

noting

a) that the former call-sign series formed of three letters, or a figure and two letters, having been exhausted, a new series has been introduced formed of a letter, a figure and a letter; but in no case may the figure be 0 or 1;

b) that the method referred to in *noting a)* is not applicable to series beginning with one of the following letters: B, F, G, I, K, M, N, R, W,

resolves

1 that the Director of the Radiocommunication Bureau shall continue to urge administrations:

1.1 to make maximum use of the possibilities of the series at present allocated, in order to avoid, as far as possible, further requests;

1.2 to review the call-sign assignments they have already made from their present allocations, with a view to releasing any series and placing them at the disposal of the Union;

2 that the Director of the Radiocommunication Bureau shall, upon request, furnish advice to administrations on the means of effecting the greatest economy, which should be the rule, in the use of a series of call signs;

3 that if, nevertheless, before the next competent world radiocommunication conference, it appears that all the possibilities of the present system of forming call signs will be exhausted, the Director of the Radiocommunication Bureau shall:

3.1 explore the possibility of extending the present allocations of international call-sign series by lifting the limitation on use of the letter "Q" and the digits "0" and "1";

3.2 issue a circular-letter:

3.2.1 explaining the position;

3.2.2 urging administrations to send in their proposals for possible solutions;

4 that, from the information thus submitted, the Director of the Radiocommunication Bureau shall prepare a report, together with his comments and suggestions, for submission to the next competent world radiocommunication conference.

RESOLUTION 14 (WRC-23)

Studies on development of regulatory measures, and implementability thereof, to limit the unauthorized operations of non-geostationary-satellite orbit (non-GSO) earth stations in the fixed-satellite service (FSS) and mobile-satellite service (MSS) and associated issues related to the service area of non-GSO FSS and MSS satellite systems

The World Radiocommunication Conference (Dubai, 2023)

considering

- a)* the active implementation of non-geostationary-satellite orbit (non-GSO) systems in the fixed-satellite service (FSS) and mobile-satellite service (MSS) with a global service area;
- b)* reports to the Radio Regulations Board (RRB) from administrations regarding the presence of unauthorized transmissions of transmitting earth stations of non-GSO FSS and MSS systems within their territory;

noting

- a)* that Article **18** specifies the requirements for licensing the operation of stations within any given territory;
- b)* that No. **18.1** provides that no transmitting station may be established or operated by a private person or by any enterprise without a licence issued in an appropriate form and in conformity with the provisions of the Radio Regulations by or on behalf of the government of the country to which the station in question is subject;
- c)* that administrations involved in the provision of satellite services, including notifying administrations of satellite networks or systems, are subject to Article **18**;
- d)* that Resolution **22 (Rev.WRC-23)**, on measures to limit unauthorized uplink transmissions from earth stations, resolves that the operation of transmitting earth stations within the territory of an administration shall be carried out only if authorized by that administration;
- e)* that Resolution **25 (Rev.WRC-23)**, on operation of global satellite systems for personal communications, *resolves* that administrations licensing global satellite systems and stations intended to provide public personal communications by means of fixed, mobile or transportable terminals shall ensure, when licensing these systems and stations, that they can be operated only from the territory or territories of administrations having authorized such service and stations in compliance with Articles **17** and **18**, in particular No. **18.1**;

f) that Resolution 219 (Bucharest, 2022) of the Plenipotentiary Conference encourages Member States, when authorizing non-GSO systems, to take all necessary actions to avoid unacceptable interference to GSO and other non-GSO systems, as well as to other radio services of other administrations, and to ensure the efficient use of radio-frequency spectrum and associated satellite orbit resources; to this effect, the necessary regulatory frameworks need to be developed for the operation of non-GSO systems;

g) that No. 15.5 b) provides that “radiation in and reception from unnecessary directions shall be minimized by taking the maximum practical advantage of the properties of directional antennas whenever the nature of the service permits”;

h) that earth stations may be equipped with devices allowing geolocation as well as cessation of emissions in the Earth-to-space direction,

recognizing

a) that the ITU Constitution recognizes the sovereign right of each Member State to regulate its telecommunications;

b) that Member States have the sovereign right to license the use of non-GSO systems in their territories and that radiation in and reception from unnecessary directions shall be minimized;

c) that Member States may wish to exclude its territory from the service area of the non-GSO satellite system;

d) that unauthorized use of non-GSO FSS and MSS earth stations is prohibited,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 studies on regulatory measures to limit the unauthorized operations of non-GSO FSS and MSS earth stations in the Earth-to-space direction in order to address and cease such operations, taking into account technical and operational aspects, as appropriate;

2 studies on regulatory measures, taking into account *recognizing c)* with regard to non-GSO FSS and MSS satellite systems, and the implementability of such measures, without adversely affecting the provision of service in the rest of the service area of the non-GSO satellite system,

invites administrations

to participate actively in the studies and provide the information required for the studies listed under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* by submitting contributions to ITU Radiocommunication Sector,

resolves to invite the 2027 world radiocommunication conference

to consider the results of the studies under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* above and take appropriate action.

RESOLUTION 15 (REV.WRC-03)

**International cooperation and technical assistance in the field of space
radiocommunications**

The World Radiocommunication Conference (Geneva, 2003),

considering

- a)* that a large number of Member States are not in a position to take immediate advantage of satellite techniques for the development of their telecommunication services;
- b)* that such Member States would benefit immensely through the technical assistance programmes sponsored by the Union,

recognizing

- a)* that international satellite-communication systems are subject to the Convention and Regulations of the Union and that they permit participation of all countries including, in particular, the developing countries, in space communication systems;
- b)* that a number of problems need to be solved in order that the developing countries may participate effectively in international space communication systems and integrate these systems with their national telecommunication networks,

resolves to instruct the Director of the Radiocommunication Bureau

to include this activity in the Operational Plan, within existing budgetary resources of the Sector,

invites the Council

- 1 to draw the attention of administrations to the means by which they may avail themselves of technical assistance in connection with the introduction of space communications;
- 2 to consider the most effective manner in which requests for such assistance by Member States may be formulated and presented in order to secure maximum financial and other assistance, including the allocation of the funds in the regular budget of ITU for implementing this Resolution, preferably within the budget of the Sector identified for the implementation of this Resolution;
- 3 to consider how best to make use of funds made available by the United Nations in accordance with its Resolution 1721 to give technical and other assistance to administrations of Member States to make effective use of space communications;
- 4 to consider in what way the work of the ITU-T, ITU-R and ITU-D and other organs of the Union may be utilized in the most effective way for the information and assistance of administrations of Member States in the development of space radiocommunications.

RESOLUTION 18 (REV.WRC-23)

Relating to the procedure for identifying and announcing the position of ships and aircraft of States not parties to an armed conflict

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that ships and aircraft encounter considerable risk in the vicinity of an area of armed conflict;
- b)* that for the safety of life and property it is desirable for ships and aircraft of States not parties to an armed conflict to be able to identify themselves and announce their position in such circumstances;
- c)* that radiocommunication offers such ships and aircraft a rapid means of self-identification and providing location information prior to their entering areas of armed conflict and during their passage through the areas;
- d)* that it is considered desirable to provide a supplementary signal and procedure for use, in accordance with customary practice, in the area of armed conflict by ships and aircraft of States representing themselves as not parties to an armed conflict,

noting

that Recommendations ITU-R M.493 and ITU-R M.1371 may include appropriate signals for the digital selective-calling systems and automatic identification systems in the maritime mobile service,

resolves

1 that the frequencies for urgency signal and messages specified in the Radio Regulations may be used by ships and aircraft of States not parties to an armed conflict for self-identification and establishing communications; the transmission will consist of the urgency or safety signals, as appropriate, described in Article 33 followed by the addition of the single word “NEUTRAL” pronounced as in French “neutral” in radiotelephony; as soon as practicable, communications shall be transferred to an appropriate working frequency;

2 that the use of the signal as described in the preceding paragraph indicates that the message which follows concerns a ship or aircraft of a State not party to an armed conflict. The message shall convey at least the following data:

- a)* call sign or other recognized means of identification of such ship or aircraft;
- b)* position of such ship or aircraft;

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- c) number and type of such ships or aircraft;
- d) intended route;
- e) estimated time en route and of departure and arrival, as appropriate;
- f) any other information, such as flight altitude, radio frequencies guarded, languages and secondary surveillance radar modes and codes;

3 that the provisions of Article 33 relating to urgency and safety transmissions, and medical transports shall apply as appropriate to the use of the urgency and safety signals, respectively, by such ship or aircraft;

4 that the identification and location of ships of a State not party to an armed conflict may be effected by means of appropriate standard maritime radio equipment (for example automatic identification system (AIS) or long-range identification and tracking (LRIT)); the identification and location of aircraft of a State not party to an armed conflict may be effected by the use of the secondary surveillance radar (SSR) system in accordance with procedures to be recommended by the International Civil Aviation Organization (ICAO);

5 that the use of the signals described above would not confer or imply recognition of any rights or duties of a State not party to an armed conflict or a party to the conflict, except as may be recognized by common agreement between the parties to the conflict and a non-party;

6 to encourage parties to a conflict to enter into such agreements,

requests the Secretary-General

to communicate the contents of this Resolution to the International Maritime Organization, the International Civil Aviation Organization, the International Committee of the Red Cross, and the International Federation of Red Cross and Red Crescent Societies for such action as they may consider appropriate.

RESOLUTION 20 (REV.WRC-03)

**Technical cooperation with developing countries in the field of
aeronautical telecommunications**

The World Radiocommunication Conference (Geneva, 2003),

considering

- a)* that the allocations of the frequency bands and the provisions concerning various aeronautical mobile services have been revised several times by recent conferences;
- b)* that some of these frequency bands and provisions support the worldwide implementation of new aeronautical telecommunication systems;
- c)* that on the other hand, some of these frequency bands and provisions support existing aeronautical systems that may be affected by the revision;
- d)* that, as a consequence of *a)*, *b)* and *c)*, technological modernization will be necessary in order to maintain and improve the safety and regularity of international civil aviation, the accuracy and security of aeronautical radionavigation and the efficiency of distress and rescue systems;
- e)* that the developing countries may require assistance in improving the training of technical staff, as well as in introducing new systems, in coping with technological modernization and enhancing the operation of aeronautical telecommunications,

recognizing

- a)* the value of the assistance which, in conjunction with other international organizations, the Union has provided and may continue to provide to developing countries in the field of telecommunications;
- b)* that the original version of Resolution **20 (Mob-87)** established a good basis for the technical cooperation with developing countries in the field of aeronautical telecommunications that has been undertaken by the International Civil Aviation Organization (ICAO),

resolves to instruct the Secretary-General

- 1 to encourage ICAO to continue its assistance to developing countries which are endeavouring to improve their aeronautical telecommunications, in particular by providing them with technical advice for the planning, establishment, operation and maintenance of equipment, as well as help with the training of staff, essentially in matters relating to the new technologies;
- 2 for this purpose, to seek the continued collaboration of ICAO, the United Nations Conference for Trade and Development (UNCTAD) and other specialized agencies of the United Nations, as appropriate;
- 3 to continue to give special attention to seeking the aid of the United Nations Development Programme (UNDP) and other sources of financial support, to enable the Union to render sufficient and effective technical assistance in the field of aeronautical telecommunications,

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invites the developing countries

so far as possible, to give a high level of priority to and include in their national programmes of requests for technical assistance projects relating to aeronautical telecommunications and to support multinational projects in that field.

RESOLUTION 22 (REV.WRC-23)

**Measures to limit unauthorized uplink transmissions
from earth stations**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that, in accordance with Resolution **958 (WRC-15)**^{*},¹ and Resolution ITU-R 64 of the Radiocommunication Assembly, the following issues were studied:
- whether there is a need for possible additional measures in order to limit uplink transmissions of terminals to those terminals authorized in accordance with No. **18.1**;
 - possible methods that will assist administrations in managing the unauthorized operation of earth station terminals deployed within their territory, as a tool to guide their national spectrum-management programme;
- b)* that demand has been increasing for global satellite broadband communication services throughout the world,

recognizing

- a)* that training and monitoring capabilities, along with ITU Reports and Handbooks, may assist national administrations in inhibiting the unauthorized uplink transmissions of earth stations and can facilitate the location and termination of unauthorized earth station transmissions which do not comply with the provisions of Article **18**;
- b)* that Article **18** specifies the requirements for licensing the operation of stations within any given territory;
- c)* that administrations involved in the provision of satellite services, including notifying administrations of satellite networks or systems, are subject to Article **18**;
- d)* that successful coordination of a satellite network or system does not imply licensing/authorization to provide a service within the territory of a Member State,

noting

- a)* that the ITU Constitution recognizes the sovereign right of each Member State to regulate its telecommunications;

^{*} *Note by the Secretariat:* This Resolution was abrogated by WRC-19.

¹ Reference to Resolution **958 (WRC-15)** is provided as background information.

b) that multiple administrations are involved in the provision of satellite services, including notifying administrations of satellite networks or systems,

resolves

1 that the operation of transmitting earth stations within the territory of an administration shall be carried out only if authorized by that administration;

2 that the notifying administration for a satellite network or system shall, to the extent practicable, limit the operation of transmitting earth stations on the territory of an administration on which they are located and operated to only those licensed or authorized by that administration;

3 that, when an administration identifies the presence of unauthorized transmitting earth station transmissions in its territories:

i) it should take all appropriate actions at its disposal to the extent of its ability to stop such unauthorized transmissions; and

ii) if the matter is not resolved, this administration may report the details of such unauthorized transmissions, if available, to the notifying administrations of the satellite networks or systems that may be associated with these unauthorized transmissions, and the notifying administrations of these satellite networks or systems shall cooperate with the reporting administration, to the maximum extent possible, in order to resolve the matter in a satisfactory and timely manner,

invites administrations

1 to take all appropriate actions to make publicly and readily available the procedures for licensing/authorizing the operation of earth stations in their territories;

2 that have identified unauthorized operation of earth stations within their territories to provide relevant information to the Radiocommunication Bureau (BR) to report such cases;

3 when requested by BR or another administration, to cooperate to the maximum extent practicable with assistance in identifying unauthorized earth stations, with monitoring or geolocation services,

instructs the Director of the Radiocommunication Bureau

1 upon receipt of information from an administration detecting an unauthorized uplink transmission from its territory, to immediately inform Member States and satellite operating agencies of the matter by appropriate means and work with the administrations involved to resolve the matter;

2 to inform the administrations on the type of assistance ITU can provide on this issue,

instructs the Secretary-General

to stress the importance and ensure the circulation of this Resolution to all Member States.

RESOLUTION 25 (REV.WRC-23)

Operation of global satellite systems for personal communications

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that, in accordance with No. 6 of its Constitution, one of the purposes of the Union is “to promote the extension of the benefits of the new telecommunication technologies to all the world’s inhabitants”;
- b)* that, to this end, the Union is fostering the use of new technologies in telecommunications and is studying questions relating to this use in the Radiocommunication and the Telecommunication Standardization Sectors;
- c)* that the Telecommunication Development Sector is studying questions aimed at identifying the benefits that developing countries may derive from using new technologies;
- d)* that, among these new technologies, some constellations of non-geostationary satellites may provide global coverage and facilitate low-cost communications;
- e)* that the theme “global mobile personal communications by satellite” (GMPCS) was discussed at the first World Telecommunication Policy Forum established by Resolution 2 (Kyoto, 1994) of the Plenipotentiary Conference;
- f)* that Council Resolution 1116 instructs the Secretary-General to act as depositary of the GMPCS Memorandum of Understanding (MoU) and its Arrangements, to act as the registry for type-approval procedures and terminal types and to authorize the use of the abbreviation “ITU” as part of the GMPCS-MoU mark;
- g)* Recommendations ITU-R M.1343 and ITU-R M.1480 on the essential technical requirements of GMPCS earth stations that should be used by administrations as a common technical basis facilitating the global circulation and use of such GMPCS terminals in conformity with these Recommendations,

recognizing

- a)* that the spectrum available to global satellite systems for personal communications is limited;
- b)* that successful coordination does not in any way imply licensing authorization to provide a service within the territory of a Member State,

considering further

that other countries intending to use these systems should be guaranteed that they will be operated in accordance with the Constitution, the Convention and the Administrative Regulations,

noting

- a) that the Constitution recognizes the sovereign right of each State to regulate its telecommunications;
- b) that the International Telecommunication Regulations “recognize the right of any Member, subject to national law and should it decide to do so, to require that administrations and private operating agencies, which operate in its territory and provide an international telecommunication service to the public, be authorized by that Member”, and specifies that “within the framework of the present Regulations, the provision and operation of international telecommunication services in each relation is pursuant to mutual agreement between administrations”;
- c) that Article **18** specifies the authorities for licensing the operation of stations within any given territory;
- d) the right of each Member State to decide on its participation in these systems, and the obligations for entities and organizations providing international or national telecommunication services by means of these systems to comply with the legal, financial and regulatory requirements of the administrations in whose territory these services are authorized,

resolves

that administrations licensing global satellite systems and stations intended to provide public personal communications by means of fixed, mobile or transportable terminals shall ensure, when licensing these systems and stations, that they can be operated only from the territory or territories of administrations having authorized such service and stations in compliance with Articles **17** and **18**, in particular No. **18.1**,

requests administrations

- 1 to continue cooperating with worldwide satellite system operators in improving the established arrangements for the provision of service within their territories and with the Secretary-General in implementing the GMPCS-MoU and its Arrangements;
- 2 to participate actively in ITU-R studies in developing and improving relevant Recommendations,

reminds operators of such systems

to take account, when contracting agreements on the operation of their systems from the territory of a country, of any potential loss of revenue that the country may suffer from a possible reduction of its international traffic existing at the time such agreements are executed.

RESOLUTION 26 (REV.WRC-23)

Footnotes to the Table of Frequency Allocations in Article 5 of the Radio Regulations

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that footnotes are an integral part of the Table of Frequency Allocations in the Radio Regulations and, as such, form part of an international treaty text;
- b)* that footnotes to the Table of Frequency Allocations should be clear, concise and easy to understand;
- c)* that footnotes should relate directly to matters of frequency allocation;
- d)* that, in order to ensure that footnotes allow modification of the Table of Frequency Allocations without introducing unnecessary complications, principles relating to the use of footnotes are needed;
- e)* that, currently, footnotes are adopted by competent world radiocommunication conferences (WRCs) and any addition, modification or deletion of a footnote is considered and adopted by the competent conference;
- f)* that some problems concerning country footnotes may be resolved through the application of a special agreement envisaged by Article 6;
- g)* that, in certain cases, administrations are confronted with major difficulties due to inconsistencies or omissions in footnotes;
- h)* that, in order to keep the footnotes to the Table of Frequency Allocations up to date, there should be clear and effective guidelines for additions, modifications and deletions of footnotes,

noting

- a)* that some footnotes have been developed and revised under relevant agenda items of WRCs, while footnotes which are not related to those agenda items were considered by previous WRCs, as described in Annex 1 to this Resolution, under the standing agenda item referred to in *further resolves* 2;
- b)* that, under certain circumstances and on a purely exceptional basis, previous WRCs considered proposals for the addition of country names to existing footnotes which were not related to the case mentioned in *further resolves* 1;
- c)* that previous conferences also received proposals for the addition of new country footnotes not related to any agenda items, and that these proposals were not accepted;

d) that administrations need sufficient time to examine the potential consequences of changes to footnotes to the Table of Frequency Allocations;

e) the importance of coordination between countries before a WRC to agree on changes related to country footnotes,

resolves

1 that, wherever possible, footnotes to the Table of Frequency Allocations should be confined to altering, limiting or otherwise changing the relevant allocations rather than dealing with the operation of stations, assignment of frequencies or other matters;

2 that the Table of Frequency Allocations should include only those footnotes which have international implications for the use of the radio-frequency spectrum;

3 that new footnotes to the Table of Frequency Allocations should only be adopted in order to:

a) achieve flexibility in the Table of Frequency Allocations;

b) protect the relevant allocations in the body of the Table and in other footnotes in accordance with Section II of Article 5;

c) introduce either transitional or permanent restrictions on a new service to achieve compatibility; or

d) meet the specific requirements of a country or area when it is impracticable to satisfy such needs otherwise within the Table of Frequency Allocations;

4 that footnotes serving a common purpose should be in a common format, and, where possible, be grouped into a single footnote with appropriate references to the relevant frequency bands,

further resolves

1 that any addition of a new footnote or modification of an existing footnote should be considered by a WRC only when:

a) the agenda of that WRC explicitly includes the frequency band to which the proposed additional or modified footnote relates; or

b) the frequency bands to which the desired additions or modifications of the footnote belong are considered during WRC and WRC decides to make a change in those frequency bands; or

c) the addition or modification of footnotes is specifically included in the agenda of WRC as a result of the consideration of proposals submitted by one or more interested administration(s);

2 that recommended agendas for future WRCs should include a standing agenda item which would allow for the consideration of proposals by administrations for deletion of country footnotes, or country names in footnotes, if no longer required¹;

¹ See also Annex 1 to this Resolution.

3 that in cases not covered by *further resolves* 1 and 2, proposals for new footnotes or modification of existing footnotes could exceptionally be considered by a WRC if they concern corrections of obvious omissions, inconsistencies, ambiguities or editorial errors and have been submitted to ITU as stipulated in No. 40 of the General Rules of conferences, assemblies and meetings of the Union,

urges administrations

1 to review footnotes periodically and to propose the deletion of their country footnotes or of their country names from footnotes, as appropriate;

2 to take account of *further resolves* above in making proposals to WRCs in relation to footnotes or country names in footnotes;

3 to submit their proposals to a WRC in the cases addressed by *further resolves* 1, under the relevant agenda items of the conference, as appropriate (see Section B of Annex 1 to this Resolution);

4 to submit their proposals under the WRC standing agenda item described in *further resolves* 2 to the second session of the corresponding conference preparatory meeting for information only, if available, to allow for discussion with affected administrations.

ANNEX 1 TO RESOLUTION 26 (REV.WRC-23)

Previous world radiocommunication conferences (WRCs) have recognized that the scope of the WRC standing agenda item described in *further resolves* 2 of this Resolution is only related to requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required. However, previous WRCs have also received proposals on the addition of country names to existing footnotes and on the addition of new country footnotes.

It is recognized that it is not the intention of WRCs to encourage the addition of country names to existing footnotes.

Taking into account the decisions of WRC-12, WRC-15 and WRC-19 on the same subject, it is suggested that future WRCs may apply a similar approach to previous WRCs.

Future WRCs may consider the following guidance derived from the above-mentioned decisions.

A) The work of WRC on proposals submitted under the standing agenda item described in *further resolves* 2 of this Resolution may be based on the following:

- i) Under certain circumstances, on a purely exceptional basis and if justified, proposals for the addition of country names to existing footnotes may be considered by WRCs, but their acceptance is subject to the express condition that there are no objections from affected countries.

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- ii) Should a WRC decide to accept submissions of additional proposals for the addition of country names to existing footnotes based on the proposals received, it may establish a deadline for such further contributions to WRC.
- iii) A deadline may also be established for proposals on the deletion of country names, if appropriate, taking into account that administrations require sufficient time to analyse the proposals.
- iv) Proposals for the addition of new country footnotes which are not related to agenda items of a WRC or cases described in *further resolves* 1 of this Resolution should not be considered.

B) The proposals on additions of country names to existing footnotes or new country footnotes in the cases addressed by *further resolves* 1 of this Resolution are to be treated under the relevant agenda item of the WRC, as appropriate.

Administrations are urged to submit their proposals under relevant agenda items of the WRC.

Proposals for additions which do not fall within the categories referred to in *further resolves* 1 of this Resolution may be considered under the standing agenda item described in *further resolves* 2 of this Resolution and are subject to the principles mentioned in A) above.

RESOLUTION 27 (REV.WRC-19)

Use of incorporation by reference in the Radio Regulations

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that the Voluntary Group of Experts (VGE) on simplification of the Radio Regulations proposed the transfer of certain texts of the Radio Regulations to other documents, especially to the ITU Radiocommunication Sector (ITU-R) Recommendations, using the incorporation by reference procedure;
- b) that the principles of incorporation by reference were adopted by WRC-95 and revised by subsequent conferences;
- c) that, in some cases, there are provisions in the Radio Regulations containing references which fail to distinguish adequately whether the status of the referenced text is mandatory or non-mandatory;
- d) that all texts of ITU-R Recommendations incorporated by reference are published in a volume of the Radio Regulations;
- e) that, taking into account the rapid evolution of technology, ITU-R may revise the ITU-R Recommendations containing text incorporated by reference at short intervals;
- f) that, following revision of an ITU-R Recommendation containing text incorporated by reference, the reference in the Radio Regulations shall continue to apply to the earlier version until such time as a competent world radiocommunication conference (WRC) agrees to incorporate the new version;
- g) that it would be desirable that texts incorporated by reference reflect the most recent technical developments,

noting

- a) that references to Resolutions or Recommendations of a WRC require no special procedures, and are acceptable for consideration, since such texts will have been agreed by a WRC;
- b) that administrations need sufficient time to examine the potential consequences of changes to ITU-R Recommendations containing text incorporated by reference and would therefore benefit greatly from being advised, as early as possible, of which ITU-R Recommendations have been revised and approved during the elapsed study period or at the Radiocommunication Assembly (RA) preceding WRC,

resolves

- 1 that, for the purposes of the Radio Regulations, the term “incorporation by reference” shall only apply to those references intended to be mandatory;
- 2 that the text incorporated by reference shall have the same treaty status as the Radio Regulations themselves;

3 that the reference shall be explicit, specifying the specific part of the text (if appropriate) and the version or issue number;

4 that, where a mandatory reference to an ITU-R Recommendation, or parts thereof, is included in the *resolves* of a WRC Resolution, which is itself cited in a provision or footnote of the Radio Regulations using mandatory language (i.e. “shall”), the ITU-R Recommendation or parts thereof shall also be considered as incorporated by reference;

5 that texts which are of a non-mandatory nature or which refer to other texts of a non-mandatory nature shall not be considered for incorporation by reference;

6 that, when considering the introduction of new cases of incorporation by reference, such incorporation shall be kept to a minimum and made by applying the following criteria:

6.1 only texts which are relevant to a specific WRC agenda item may be considered;

6.2 where the relevant texts are brief, the referenced material should be placed in the body of the Radio Regulations rather than using incorporation by reference;

6.3 the guidance contained in Annex 1 to this Resolution shall be applied in order to ensure that the correct method of reference for the intended purpose is employed;

7 that the text to be incorporated by reference shall be submitted for adoption by a competent WRC and the procedure described in Annex 2 to this Resolution shall be applied for approving the incorporation by reference of ITU-R Recommendations or parts thereof;

8 that existing references to ITU-R Recommendations shall be reviewed to clarify whether the reference is mandatory or non-mandatory in accordance with Annex 1 to this Resolution;

9 that ITU-R Recommendations, or parts thereof, incorporated by reference at the conclusion of each WRC, and a cross-reference list of the regulatory provisions, including footnotes and Resolutions, incorporating such ITU-R Recommendations by reference, shall be collated and published in a volume of the Radio Regulations (see Annex 2 to this Resolution);

10 that if, between WRCs, a text incorporated by reference (e.g. an ITU-R Recommendation) is updated, the reference in the Radio Regulations shall continue to apply to the earlier version incorporated by reference until such time as a competent WRC agrees to incorporate the new version; the mechanism for considering such a step is given in the *further resolves* part of this Resolution,

further resolves

1 that each RA shall communicate to the next WRC a list of the ITU-R Recommendations containing text incorporated by reference in the Radio Regulations which have been revised and approved during the elapsed study period;

2 that, on this basis, WRC is invited to examine those revised ITU-R Recommendations, and decide whether or not to update the corresponding references in the Radio Regulations;

3 that, if WRC decides not to update the corresponding references, the currently referenced version shall be maintained in the Radio Regulations;

4 to invite future WRCs to include a standing agenda item on examination of the revised ITU-R Recommendations in accordance with *further resolves* 1 and 2 of this Resolution,

instructs the Director of the Radiocommunication Bureau

1 to bring this Resolution to the attention of RA and the radiocommunication study groups;

2 to identify the provisions and footnotes of the Radio Regulations containing references to ITU-R Recommendations and make suggestions on any further action to the second session of the Conference Preparatory Meeting (CPM) for its consideration and inclusion in the CPM Report;

3 to identify the provisions and footnotes of the Radio Regulations containing references to WRC Resolutions that contain references to ITU-R Recommendations, and make suggestions on any further action to the second session of CPM for its consideration and inclusion in the CPM Report;

4 to provide the second session of CPM with a list, for inclusion in the CPM Report, of those ITU-R Recommendations containing texts incorporated by reference that have been revised or approved since the previous WRC, or that may be revised in time for the next WRC,

invites administrations

1 to submit proposals to future conferences, taking into account the CPM Report, in order to clarify the status of references, where ambiguities remain regarding the mandatory or non-mandatory status of the references in question, with a view to amending those references:

- i) that appear to be of a mandatory nature, identifying such references as being incorporated by reference by using clear linking language in accordance with Annex 1 to this Resolution;
- ii) that are of a non-mandatory character, so as to refer to “the most recent version” of the Recommendations;

2 to participate actively in the work of the radiocommunication study groups and the RA on revision of those Recommendations to which mandatory references are made in the Radio Regulations;

3 to examine any indicated revisions of ITU-R Recommendations containing text incorporated by reference and to prepare proposals on possible updating of relevant references in the Radio Regulations.

ANNEX 1 TO RESOLUTION 27 (REV.WRC-19)

Application of incorporation by reference

When introducing new cases of incorporation by reference in the provisions of the Radio Regulations or reviewing existing cases of incorporation by reference, administrations and ITU-R should address the following factors in order to ensure that the correct method of reference is employed for the intended purpose, according to whether each reference is mandatory (i.e. incorporated by reference) or non-mandatory:

Mandatory references

- 1 Mandatory references shall use clear linking language, i.e. “shall”.
- 2 Mandatory references shall be explicitly and specifically identified, e.g. “Recommendation ITU-R M.541-8”.
- 3 If the intended reference material is, as a whole, unsuitable as treaty-status text, the reference shall be limited to just those portions of the material in question which are of a suitable nature, e.g. “Annex A to Recommendation ITU-R Z.123-4”.

Non-mandatory references

- 4 Non-mandatory references or ambiguous references that are determined to be of a non-mandatory character (i.e. not incorporated by reference) shall use appropriate language, such as “should” or “may”. This appropriate language may refer to “the most recent version” of a Recommendation. Any appropriate language may be changed at any future WRC.

ANNEX 2 TO RESOLUTION 27 (REV.WRC-19)

Procedures applicable by WRC for approving the incorporation by reference of ITU-R Recommendations or parts thereof

During the course of each WRC, a list of the ITU-R Recommendations incorporated by reference, and a cross-reference list of the regulatory provisions, including footnotes and Resolutions, incorporating such ITU-R Recommendations by reference, shall be developed and maintained by the committees. These lists shall be published as a conference document in line with developments during the conference.

Following the end of each WRC, the Radiocommunication Bureau and the General Secretariat will update the volume of the Radio Regulations which serves as the repository of ITU-R Recommendations incorporated by reference in line with developments at the conference as recorded in the above-mentioned document.

RESOLUTION 32 (REV.WRC-23)

Regulatory procedures for frequency assignments to non-geostationary-satellite networks or systems identified as short-duration mission not subject to the application of Section II of Article 9

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that some non-geostationary (non-GSO) satellites with short-duration missions have, to date, been operating for their entire mission duration without being notified or recorded;
- b)* that successful and timely development and operation of non-GSO networks or systems with short-duration missions may require regulatory procedures which take account of the short development cycle, short lifetimes and typical missions of such satellites, and therefore the application of certain provisions of Articles 9 and 11 may need to be adapted to take account of the nature of these satellites;
- c)* that these satellites typically have a short (one to two years) development time and are low cost, often using off-the-shelf components;
- d)* that the operational lifetime of these satellites generally ranges from several weeks up to not more than three years;
- e)* that non-GSO satellites with short-duration missions utilize low-Earth orbits;
- f)* that non-GSO satellites with short-duration missions are being used for a wide variety of applications, including remote sensing, space weather research, upper atmosphere research, astronomy, communications, technology demonstration and education, and therefore may operate under various radiocommunication services;
- g)* that advances in the field of satellite technology have resulted in non-GSO satellites with short-duration missions becoming a means for developing countries to become involved in space activities,

considering further

- a)* that the application of provisions of Articles 9 and 11 to frequency assignments to non-GSO networks or systems identified as short-duration mission as prescribed in this Resolution should not adversely or otherwise affect the regulatory treatment of other systems;
- b)* that the application of any modified regulatory procedure should not change the sharing status with respect to networks and systems not applying the modified regulatory procedure, both terrestrial and space, in frequency bands which may be used by non-GSO systems with short-duration missions,

recognizing

- a) that Resolution ITU-R 68 seeks to improve awareness and increase knowledge on existing regulatory procedures for small satellites;
- b) that non-GSO networks or systems operating in frequency bands not subject to Section II of Article 9 are, irrespective of the period of validity of their associated frequency assignments, subject to Nos. 9.3 and 9.4;
- c) that non-GSO systems with short-duration missions are not to be used for safety-of-life services,

noting

- a) Report ITU-R SA.2312, on characteristics, definitions and spectrum requirements of nanosatellites and picosatellites, as well as systems composed of such satellites;
- b) that No. 22.1 states that “Space stations shall be fitted with devices to ensure immediate cessation of their radio emissions by telecommand, whenever such cessation is required under the provisions of these Regulations” (see also Appendix 4 data item A.24.a),

resolves

1 that this Resolution shall apply only to non-GSO networks or systems identified by the notifying administration as effecting short-duration missions and corresponding to the following criteria:

1.1 the network or system shall operate under any space radiocommunication service on frequency assignments that are not subject to the application of Section II of Article 9;

1.2 the maximum period of operation and validity of frequency assignments of a non-GSO network or system identified as short-duration mission shall not exceed three years from the date of bringing into use of the frequency assignments (see the Annex to this Resolution for the definition of date of bringing into use for such networks or systems), without any possibility of extension, after which the recorded assignments shall be cancelled;

1.3 the total number of satellites in a non-GSO network or system identified as short-duration mission shall not exceed 10 satellites¹;

2 that non-GSO networks or systems corresponding to *resolves* 1 of this Resolution shall comply with the conditions for use of the frequency band that is allocated to the service within which they operate;

3 that non-GSO networks or systems identified as short-duration mission using spectrum allocated to the amateur-satellite service shall operate in accordance with the definition of the amateur-satellite service as contained in Article 25;

¹ The typical mass of each satellite should not normally exceed 100 kg.

4 that non-GSO networks or systems with short-duration missions shall have the capability to cease transmitting immediately in order to eliminate harmful interference;

5 that, for the purpose of this Resolution, a non-GSO network or system identified as short-duration mission shall have a single launch date associated with the first launch (in the case of systems with multiple launches) and that launch date shall be defined as the date on which the first satellite of the non-GSO network or system with a short-duration mission is placed into its notified orbital plane,

instructs the Director of the Radiocommunication Bureau

1 to expedite the online publication of notices “as received” for such networks or systems, in addition to the normal publication of notices;

2 to provide the necessary assistance to administrations in the implementation of this Resolution,

invites administrations

1 to avoid heavily used frequency bands when assigning frequencies to a non-GSO network or system with a short-duration mission;

2 to exchange information associated with non-GSO networks or systems identified as short-duration mission and to make every possible effort to resolve interference that may be unacceptable to existing or planned satellite networks or systems, including those with short-duration missions;

3 to provide their comments on the application of No. 9.3, upon receipt of the International Frequency Information Circular of the Radiocommunication Bureau (BR IFIC) containing information published under No. 9.2B, as soon as possible within a period of four months from the date of publication of the BR IFIC, and to communicate to the notifying administration, with a copy to the Bureau, these comments on the particulars of the potential interference to its existing or planned systems.

ANNEX TO RESOLUTION 32 (REV.WRC-23)

Application of the provisions of Articles 9 and 11 for non-geostationary-satellite networks and systems identified as short-duration mission

1 The general provisions of the Radio Regulations shall apply to non-geostationary-satellite (non-GSO) networks or systems identified as short-duration mission with the following exceptions/additions/amendments.

2 When submitting advance publication information under No. 9.1, administrations shall submit the orbital characteristics (Appendix 4 data item A.4.b.4) planned at the early development stage of the satellite project.

3 In the application of No. **9.1**, the notification information cannot be communicated to the Radiocommunication Bureau (BR) at the same time, and can only be submitted after the launch of a satellite in the case of a network or of the first satellite in the case of a system with multiple launches.

4 Notices relating to notification for the recording of frequency assignments to non-GSO networks or systems identified as short-duration mission shall be communicated to BR only after the launch of a satellite in the case of a satellite network or of the first satellite in the case of a system requiring multiple launches, and not later than two months after the date of bringing into use. This provision applies instead of No. **11.25** for frequency assignments to non-GSO networks or systems with short-duration missions (see also the Rules of Procedure associated with this Resolution). Irrespective of the date of receipt of the notified characteristics of the non-GSO network or system with a short-duration mission under this Resolution, the maximum period of validity of frequency assignments of the system shall not exceed the time-limit in *resolves* 1.2 of this Resolution. At the expiry date of the period of validity, as described in *resolves* 1.2 of this Resolution, BR shall publish a suppression of the related Special Section.

5 Any frequency assignments to non-GSO networks or systems identified as short-duration mission for which the notice referred to in § 4 reaches the Bureau more than two months after the date of bringing into use shall bear a remark in the Master Register to indicate that they are not in conformity with § 4 of the Annex to Resolution **32 (Rev.WRC-23)**.

6 In addition to the application of No. **11.36**, BR shall publish the characteristics of the system together with the findings under No. **11.31** in its International Frequency Information Circular (BR IFIC) and on its website within no more than four months from the date of receipt of complete information under No. **11.28**. When BR is not in a position to comply with the time-limit referred to above, it shall periodically so inform the notifying administration, giving the reasons therefor.

7 In the application of No. **11.44**, the date of bringing into use of a non-GSO network or system identified as short-duration mission shall be defined as the launch date of a satellite in the case of a non-GSO network or of the first satellite in the case of a non-GSO system requiring multiple launches (see *resolves* 5 of this Resolution).

8 Nos. **11.43A**, **11.43B** and **11.49** shall not apply to frequency assignments to non-GSO networks or systems identified as short-duration mission.

RESOLUTION 34 (REV.WRC-19)

**Establishment of the broadcasting-satellite service in Region 3
in the frequency band 12.5-12.75 GHz and sharing with space and
terrestrial services in Regions 1, 2 and 3**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

that WARC-79 allocated the frequency band 12.5-12.75 GHz to the broadcasting-satellite service (BSS) for community reception in Region 3,

recognizing

that, under Resolution **507 (Rev.WRC-19)**, the ITU Council may wish to empower a future competent radiocommunication conference to establish a plan for the BSS in the frequency band 12.5-12.75 GHz in Region 3,

resolves

1 that, until such time as a plan may be established for the BSS in the frequency band 12.5-12.75 GHz in Region 3, the relevant provisions of Article 9 shall continue to apply to coordination between stations in the BSS in Region 3 and:

- a) space stations in the BSS and the fixed-satellite service (FSS) in Regions 1, 2 and 3;
- b) terrestrial stations in Regions 1, 2 and 3;

2 that the ITU Radiocommunication Sector (ITU-R) shall study urgently the technical provisions which may be appropriate for sharing between stations in the BSS in Region 3 and:

- a) space stations in the BSS and FSS in Regions 1 and 2;
- b) terrestrial stations in Regions 1 and 2;

3 that, until such time as technical provisions are developed by ITU-R and accepted by administrations concerned under Resolution **703 (Rev.WRC-07)**, sharing between space stations in the BSS in Region 3 and terrestrial services in Regions 1, 2 and 3 shall be based on the following criteria, as appropriate:

- a) the power flux-density at the Earth's surface produced by emissions from a space station in the BSS in Region 3 for all conditions and for all methods of modulation shall not exceed the limits given in Annex 5 of Appendix **30**;
- b) in addition to *resolves 3 a)* above, the provisions of Article **21** (Table **21-4**) shall apply in the countries mentioned in Nos. **5.494** and **5.496**;
- c) the limits given in *resolves 3 a)* and *b)* above may be exceeded on the territory of any country provided the administration of that country has so agreed.

RESOLUTION 35 (REV.WRC-23)

**A milestone-based approach for the implementation of frequency assignments
to space stations in a non-geostationary-satellite system
in specific frequency bands and services**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that filings for frequency assignments to non-geostationary-satellite (non-GSO) systems composed of hundreds to thousands of non-GSO satellites have been received by ITU since 2011, in particular in frequency bands allocated to the fixed-satellite service (FSS) or the mobile-satellite service (MSS);
- b)* that design considerations, availability of launch vehicles to support multiple satellite launches and other factors mean that notifying administrations may require longer than the regulatory period stipulated in No. **11.44** to complete implementation of the non-GSO systems referred to in *considering a)*;
- c)* that any discrepancies between the deployed number of orbital planes/satellites per orbital plane of a non-GSO system and the Master International Frequency Register (Master Register) have, to date, not significantly impinged upon the efficient use of the orbit/spectrum resource in any frequency band used by non-GSO systems;
- d)* that the bringing into use and recording in the Master Register of frequency assignments to space stations in non-GSO systems by the end of the seven-year regulatory period referred to in No. **11.44** do not require confirmation by the notifying administration of the deployment of all the satellites associated with these frequency assignments;
- e)* that ITU Radiocommunication Sector studies on the issue have shown that the adoption of a milestone-based approach will provide a regulatory mechanism to help ensure that the Master Register reasonably reflects the actual deployment of such non-GSO systems in certain frequency bands and services, and improve the efficient use of the orbit/spectrum resource in those frequency bands and services;
- f)* that, in defining the timeline and objective criteria for the milestone-based approach, there is a need to seek a balance between the prevention of spectrum warehousing, the proper functioning of coordination mechanisms and the operational requirements related to the deployment of a non-GSO system;
- g)* that adherence to fixed milestone periods is desirable, as this creates certainty with respect to the deployment of non-GSO systems,

recognizing

- a) that the bringing into use of frequency assignments to non-GSO systems is addressed in Article 11;
- b) that any regulatory mechanism for management of frequency assignments to non-GSO systems in the Master Register should not impose an unnecessary burden;
- c) that the number of orbital planes in a non-GSO system (item A.4.b.1) and the number of satellites in each orbital plane (item A.4.b.4.b) are among the notified required characteristics as specified in Appendix 4;
- d) that No. 13.6 is applicable to non-GSO systems with frequency assignments that were confirmed to have been brought into use prior to 1 January 2021 in the frequency bands and services to which this Resolution applies;
- e) that, for frequency assignments to non-GSO systems brought into use and having reached the end of the period referred to in No. 11.44 prior to 1 January 2021 in the frequency bands and services to which this Resolution applies, affected notifying administrations should be given either the opportunity to confirm completion of the deployment of satellites in accordance with the Appendix 4 characteristics of their recorded frequency assignments or sufficient time to complete deployment in accordance with this Resolution;
- f) that No. 11.49 addresses the suspension of recorded frequency assignments to a space station of a satellite network or to space stations of a non-GSO system,

recognizing further

that this Resolution relates to those aspects of non-GSO systems to which *resolves* 1 applies with regard to the notified required characteristics as specified in Appendix 4, and the conformity of the notified required characteristics of the non-GSO systems, other than those referred to in *recognizing c)* above, is outside the scope of this Resolution,

noting

that for the purpose of this Resolution:

- the term “frequency assignments” is understood to refer to frequency assignments to a space station of a non-GSO system;
- the term “notified orbital plane” means an orbital plane of the non-GSO system, as provided to the Radiocommunication Bureau (BR) in the most recent notification information for the system’s frequency assignments, that possesses the general characteristics of items:
 - A.4.b.4.a, the inclination of the orbital plane of the space station;
 - A.4.b.4.d, the altitude of the apogee of the space station;
 - A.4.b.4.e, the altitude of the perigee of the space station; and
 - A.4.b.4.i, the argument of the perigee of the orbit of the space station (only for orbits whose altitudes of the apogee and perigee are different)

in Table A of Annex 2 to Appendix 4;

- the term “total number of satellites” is understood to mean the sum of the various values of Appendix 4 data item A.4.b.4.b associated with the notified orbital planes in the most recent notification information submitted to BR,

resolves

- 1 that this Resolution applies to frequency assignments to non-GSO systems brought into use in accordance with Nos. **11.44** and **11.44C**, in the frequency bands and for the services listed in the Table below:

TABLE
Frequency bands and services for application of the milestone-based approach

Frequency bands (GHz)	Space radiocommunication services		
	Region 1	Region 2	Region 3
10.70-11.70	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)	FIXED-SATELLITE (space-to-Earth)	
11.70-12.50	FIXED-SATELLITE (space-to-Earth)		
12.50-12.70	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)	FIXED-SATELLITE (space-to-Earth)	BROADCASTING-SATELLITE FIXED-SATELLITE (space-to-Earth)
12.70-12.75	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)	FIXED-SATELLITE (Earth-to-space)	BROADCASTING-SATELLITE FIXED-SATELLITE (space-to-Earth)
12.75-13.25	FIXED-SATELLITE (Earth-to-space)		
13.75-14.50	FIXED-SATELLITE (Earth-to-space)		
17.30-17.70	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)	None	FIXED-SATELLITE (Earth-to-space)
17.70-17.80	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)	FIXED-SATELLITE (space-to-Earth)	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)
17.80-18.10	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)		
18.10-19.30	FIXED-SATELLITE (space-to-Earth)		
19.30-19.60	FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space)		
19.60-19.70	FIXED-SATELLITE (space-to-Earth) (Earth-to-space)		

Frequency bands (GHz)	Space radiocommunication services		
	Region 1	Region 2	Region 3
19.70-20.10	FIXED-SATELLITE (space-to-Earth) Mobile-satellite (space-to-Earth)	FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth)	FIXED-SATELLITE (space-to-Earth) Mobile-satellite (space-to-Earth)
20.10-20.20	FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth)		
27.00-27.50		FIXED-SATELLITE (Earth-to-space)	
27.50-29.50	FIXED-SATELLITE (Earth-to-space)		
29.50-29.90	FIXED-SATELLITE (Earth-to-space) Mobile-satellite (Earth-to-space)	FIXED-SATELLITE (Earth-to-space) MOBILE-SATELLITE (Earth-to-space)	FIXED-SATELLITE (Earth-to-space) Mobile-satellite (Earth-to-space)
29.90-30.00	FIXED-SATELLITE (Earth-to-space) MOBILE-SATELLITE (Earth-to-space)		
37.50-38.00	FIXED-SATELLITE (space-to-Earth)		
38.00-39.50	FIXED-SATELLITE (space-to-Earth)		
39.50-40.50	FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth)		
40.50-42.50	FIXED-SATELLITE (space-to-Earth) BROADCASTING-SATELLITE		
47.20-50.20	FIXED-SATELLITE (Earth-to-space)		
50.40-51.40	FIXED-SATELLITE (Earth-to-space)		

2 that, for frequency assignments to which *resolves* 1 applies, and for which the end of the seven-year regulatory period specified in No. **11.44** is on or after 1 January 2021, the notifying administration shall communicate to BR the required deployment information in accordance with Annex 1 to this Resolution no later than 30 days after the end of the regulatory period specified in No. **11.44** or 30 days after the end of the bringing-into-use period in No. **11.44C**, whichever comes later;

3 that, for frequency assignments to which *resolves* 1 applies, and for which the end of the seven-year regulatory period specified in No. **11.44** has expired prior to 1 January 2021, the notifying administration shall communicate to BR the required deployment information in accordance with Annex 1 to this Resolution no later than 1 February 2021;

4 that, for the purposes of this Resolution, all references to 100% of the total number of satellites indicated in the latest notification information shall mean either 100% of the filed satellites (counting the number of satellites in each notified orbital plane), or 100% of the filed satellites minus one satellite;

5 that, upon receipt of the required deployment information submitted in accordance with *resolves* 2 or 3 above, BR shall:

a) promptly make this information available “as received” on the ITU website;

- b) add a remark to the Master Register entry, if available, or to the latest notification information, as appropriate, stating that the assignments are subject to the application of *resolves* 7 to 18 of this Resolution if the number of satellites communicated to BR under *resolves* 2 or 3 above is less than 100% of the total number of satellites indicated in the latest notification information published in its International Frequency Information Circular (BR IFIC) (Part I-S) or in the latest notification information received by BR, as appropriate, for the frequency assignments; and
- c) publish the results of action taken pursuant to *resolves* 5b) above in the BR IFIC and on the ITU website;

6 that, if the number of satellites communicated to BR under *resolves* 2 or 3 above is 100% of the total number of satellites indicated in the Master Register in Part II-S of the BR IFIC, if available, or in the latest notification information published in the BR IFIC (Part I-S) for the frequency assignments, *resolves* 7 to 18 of this Resolution are not applicable;

7 that, for the frequency assignments to which *resolves* 2 applies, the notifying administration shall communicate to BR the required deployment information in accordance with Annex 1 to this Resolution as of the expiry of the milestone periods mentioned in subsections a) through c) below (see also *resolves* 9):

- a) no later than 30 days after the expiry of the two-year period after the end of the seven-year regulatory period referred to in No. **11.44**;
- b) no later than 30 days after the expiry of the five-year period after the end of the seven-year regulatory period referred to in No. **11.44**;
- c) no later than 30 days after the expiry of the seven-year period after the end of the seven-year regulatory period referred to in No. **11.44**;

8 that, for frequency assignments to which *resolves* 3 applies, the notifying administration shall communicate to BR the complete deployment information in accordance with Annex 1 to this Resolution as of 1 January of the years mentioned in subsections a) through c) below (see also *resolves* 9):

- a) no later than 1 February 2023 (corresponding to 30 days after the expiry of the two-year period after 1 January 2021);
- b) no later than 1 February 2026 (corresponding to 30 days after the expiry of the five-year period after 1 January 2021);
- c) no later than 1 February 2028 (corresponding to 30 days after the expiry of the seven-year period after 1 January 2021);

9 that, for purposes of *resolves* 7 and 8:

- a) BR shall process the deployment information required to be submitted under *resolves* 7a)/8a) or 7b)/8b), as appropriate, at any point during the relevant period, if the notifying administration reports that the total number of satellites required to be deployed as of the end of that milestone period has been achieved;

- b) BR shall process, at any time, a report from the notifying administration stating that the total number of satellites deployed as a part of the system is 100% of the total number of satellites indicated in the Master Register in Part II-S of the BR IFIC, if available, or in the latest notification information published in the BR IFIC (Part I-S) for the frequency assignments;
 - c) if the total number of satellites deployed as part of the system during any relevant milestone period is greater than the number of satellites that remain deployed as part of the system as of the expiry of the relevant milestone period, BR shall take into account the total number of satellites deployed during the period that has been reported by the notifying administration if:
 - i) the notifying administration includes a detailed explanation of the circumstances which led to having the reduced number of satellites deployed as of the expiry of that milestone period with the complete deployment information in accordance with Annex 1 to this Resolution; and
 - ii) the notifying administration provides an indication of whether any of the satellites no longer counted as of the expiry of the relevant milestone period have been or will be used to satisfy milestone obligations associated with frequency assignment(s) of any other non-GSO system(s) subject to this Resolution and, if so, how many satellites and the identity of the non-GSO system(s) in question;
 - d) the notifying administration shall provide with its reporting under *resolves* 7 or 8, as appropriate, an indication of whether any of the satellites counted as of the expiry of the relevant milestone period have been used to satisfy milestone obligations associated with frequency assignment(s) of any other non-GSO system(s) subject to this Resolution and, if so, how many satellites and the identity of the non-GSO system(s) in question;
- 10 that, upon receipt of the required deployment information submitted in accordance with *resolves* 7 or 8, BR shall:
- a) promptly make this information available “as received” on the ITU website;
 - b) conduct an examination of the information provided for compliance with the minimum number of satellites to be deployed as prescribed for each period in *resolves* 11a), 11b) or 11c), as appropriate;
 - c) modify the Master Register entry, if available, or the latest notification information, as appropriate, for the frequency assignments to the system to remove the remark added in accordance with *resolves* 5b), stating that the assignments are subject to the application of this Resolution if the number communicated to BR under *resolves* 7 or 8 is 100% of the total number of satellites indicated in the Master Register entry for the non-GSO system;
 - d) publish this information and its findings in the BR IFIC and make that information available on the ITU website as soon as possible;

11 that the notifying administration shall also submit to BR, no later than 90 days after the expiry of each of the milestone periods referred to in *resolves* 7 or 8, as appropriate, the modifications to the characteristics of the notified or recorded frequency assignments if the number of space stations declared as deployed:

- a) under *resolves* 7a) or 8a), as appropriate, is less than 10% of the total number of satellites (rounded down to the lower integer) indicated in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments; in this case, the modified total number of satellites shall not be greater than 10 times the number of space stations declared as deployed under *resolves* 7a) or 8a);
- b) under *resolves* 7b) or 8b), as appropriate, is less than 50% of the total number of satellites (rounded down to the lower integer) indicated in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments; in this case, the modified total number of satellites shall not be greater than two times the number of space stations declared as deployed under *resolves* 7b) or 8b);
- c) under *resolves* 7c) or 8c), as appropriate, is less than 100% of the total number of satellites indicated in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments; in this case, the modified total number of satellites shall not be greater than the number of space stations declared as deployed under *resolves* 7c) or 8c);

12 that *resolves* 11a) shall not apply for frequency assignments for which the end of the seven-year regulatory period in No. **11.44** is before 28 November 2022, provided that the notifying administration submits the complete information listed in Annex 2 to this Resolution to BR by 1 March 2023, and a favourable determination is made by the Radio Regulations Board (RRB) or WRC-23;

13 that BR shall, no later than 45 days before any deadline for submission by a notifying administration under *resolves* 2, 3, 7a), 7b), 7c), 8a), 8b), 8c), 19, 20 or 21 send a reminder to the notifying administration to provide the information required;

14 that, upon receipt of the modifications to the characteristics of the notified or recorded frequency assignments as referred to in *resolves* 11 or 21:

- a) BR shall promptly make this information available “as received” on the ITU website;
- b) BR shall conduct an examination for compliance with the maximum number of satellites as per *resolves* 11a), 11b) or 11c) and Nos. **11.43A/11.43B**, as appropriate;
- c) BR, for the purpose of No. **11.43B**, shall retain the original dates of entry of the frequency assignments in the Master Register if:
 - i) BR reaches a favourable finding under No. **11.31**; and

- ii) the modifications are limited to reduction of the number of orbital planes (Appendix 4 data item A.4.b.2) and modifications to the longitude of the ascending node (Appendix 4 data item A.4.b.4.j) associated with the remaining orbital planes, or reduction of the number of space stations per plane (Appendix 4 data item A.4.b.4.b) and modifications of the initial phase angle of the space stations (Appendix 4 data item A.4.b.4.h) within planes; and
 - iii) the notifying administration provides a commitment stating that the characteristics as modified will not cause more interference or require more protection than the characteristics provided in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments (see Appendix 4 data item A.23.a);
- d) for modifications submitted under *resolves* 11, BR shall ensure the remark stating that the assignments are subject to the application of this Resolution as defined in *resolves* 7 or 8 is retained until the milestone process in *resolves* 7 to 18 of this Resolution is complete;
- e) BR shall publish the information provided and its findings in the BR IFIC;
- 15 that, if a notifying administration fails to communicate the information required under *resolves* 2, 3, 7a), 7b), 7c), 8a), 8b), 8c), 11a), 11b), 11c), 19, 20 or 21, as appropriate, BR shall promptly send to the notifying administration a reminder asking the administration to provide the required information within 30 days from the date of this reminder from BR;
- 16 that, if a notifying administration fails to provide information after the reminder sent under *resolves* 15, BR shall send to the notifying administration a second reminder asking it to provide the required information within 15 days from the date of the second reminder;
- 17 that, if a notifying administration fails to provide the required information:
- a) under *resolves* 2 or 3, as appropriate, following the reminders under *resolves* 15 and 16, BR shall continue to take the entry in the Master Register into account when conducting its examinations until the decision is made by RRB to cancel the entry;
 - b) under *resolves* 7a), 7b), 7c), 8a), 8b), 8c), 11a), 11b), 11c), 19, 20 or 21, as appropriate, following the reminders under *resolves* 15 and 16, BR shall:
 - i) modify the entry by suppressing the notified orbital parameters of all satellites not listed in the last complete deployment information submitted under *resolves* 2, 3, 7, 8, 19 or 20, as appropriate; and
 - ii) no longer consider the frequency assignments under subsequent examinations under Nos. **9.36**, **11.32** or **11.32A**, and inform administrations having frequency assignments subject to subsection IA of Article 9 that those assignments shall not cause harmful interference to, or claim protection from, other frequency assignments recorded in the Master Register with a favourable finding under No. **11.31**;

18 that the suspension of the use of frequency assignments in accordance with No. **11.49** at any point prior to the end of a milestone period as specified in *resolves* 7a), 7b), 7c), 8a), 8b) or 8c) of this Resolution, as applicable, shall not alter or reduce the requirements associated with any of the remaining milestones as derived from *resolves* 7a), 7b), 7c), 8a), 8b) or 8c), as appropriate;

19 that the notifying administration for a non-GSO system that has completed the milestone process described in this Resolution, including application of *resolves* 10c) by BR, and for systems to which *resolves* 6 applies, shall communicate to BR the required deployment information in accordance with Annex 1 to this Resolution no later than 30 days after the expiry of the 11-year period after the end of the seven-year regulatory period referred to in No. **11.44** (for frequency assignments to which *resolves* 2 applies) or no later than 1 February 2032 (corresponding to 30 days after the expiry of the 11-year period after 1 January 2021) (for frequency assignments to which *resolves* 3 applies);

20 that the notifying administration for a non-GSO system that has provided deployment information under *resolves* 19 shall, no later than 30 days after the expiry of a four-year period from the due date of the submission under *resolves* 19, and every four years thereafter, communicate to BR the required deployment information in accordance with Annex 1 to this Resolution;

21 that, if the number of satellites reported pursuant to *resolves* 19 or 20 is less than:

$$X = N \cdot 50\% \quad \text{for} \quad N \leq 340$$

$$X = N - 67 \cdot \log(N) \quad \text{for} \quad 340 < N \leq 4\,950$$

$$X = N \cdot 95\% \quad \text{for} \quad N > 4\,950$$

where N is the total number of satellites in the non-GSO system indicated in the Master Register in Part II-S of the BR IFIC, if available, or in the latest notification information published in the BR IFIC (Part I-S) for the frequency assignments, and if the number of satellites deployed remains less than X in the formula above on the due date of the subsequent report under *resolves* 20, the notifying administration shall submit modifications to the characteristics of the notified or recorded frequency assignments to align with the number of space stations declared as deployed no later than 90 days after the due date of the subsequent report;

22 that, for a non-GSO system that has completed the milestone process described in this Resolution, including application of *resolves* 10c) by BR, and for systems to which *resolves* 6 applies, if the number of satellites considered as part of the system falls below the total number of satellites indicated in the Master Register in Part II-S of the BR IFIC, if available, or in the latest notification information published in the BR IFIC (Part I-S) for the frequency assignments, the notifying administration shall, for information purposes only:

- a) provide a report to BR, on an annual basis as of the completion of the milestone process, within 30 days of the anniversary, containing the date when this event, or events, began, and a general explanation of the event(s) for each affected satellite;

- b) provide to BR, either as part of the annual report under *resolves 22a*), or with the next report under *resolves 19* or *20*, whichever comes first, the date or dates on which each affected satellite was restored to operational status or replaced;

23 that BR shall:

- a) make any information reported under *resolves 22a*) and *22b*) available on its website; and
- b) include a report of its activities and data gathered under *resolves 22* to the relevant ITU-R study group and a future competent conference(s),

further resolves

to apply *resolves 19* to *23* above on a provisional basis as of 1 January 2025 pending review by a future competent conference,

instructs the Radiocommunication Bureau

- 1 to take the necessary actions to implement this Resolution;
- 2 to report any difficulties it encounters in the implementation of this Resolution to future competent world radiocommunication conferences;
- 3 to continue to identify and report on specific frequency bands in specific services for which there may be a problem similar to that which resulted in the creation of this Resolution, as early as possible, but not later than the penultimate meeting of the responsible group prior to the second session of the conference preparatory meeting,

invites the ITU Radiocommunication Sector

to continue studies with a view to confirming the suitability and regulatory implementation of the post-milestone procedure set out in *resolves 19* to *21* above, and to recommend appropriate action under Resolution **86 (Rev.WRC-07)**.

ANNEX 1 TO RESOLUTION 35 (REV.WRC-23)

Information to be submitted about the deployed space stations

A Satellite system information

- 1) Name of the satellite system
- 2) Name of the notifying administration
- 3) Country symbol
- 4) Reference to the advance publication information or the request for coordination, or the notification information, if available

- 5) Total number of space stations deployed into each notified orbital plane of the satellite system with the capability of transmitting or receiving the frequency assignments
- 6) Orbital plane number indicated in the latest notification information published in Part I-S of the BR IFIC for the frequency assignments into which each space station is deployed.

B Launch information to be provided for each deployed space station

- 1) Name of the launch vehicle provider
- 2) Name of the launch vehicle
- 3) Name and location of the launch facility
- 4) Launch date.

C Space station characteristics for each space station deployed

- 1) Frequency bands from the notification information in which the space station can transmit or receive
- 2) Orbital characteristics of the space station (altitude of the apogee and perigee, inclination, and argument of the perigee)
- 3) Name of the space station.

ANNEX 2 TO RESOLUTION 35 (REV.WRC-23)

**Information to be provided by the notifying administration pursuant to
*resolves 12***

- 1) Reference to notification information already submitted
- 2) Current deployment and operational information
- 3) Report indicating efforts made and detailing status of coordination with systems or networks
- 4) Clear evidence of a binding agreement for the manufacture or procurement of a sufficient number of satellites to meet the milestone obligation in *resolves 7b)* or *8b)*, as appropriate
- 5) Clear evidence of a binding agreement to launch a sufficient number of satellites to meet the milestone obligation in *resolves 7b)* or *8b)*, as appropriate.

NOTE – The manufacturing or procurement agreement should identify the contract milestones leading to the completion of manufacture or procurement of satellites required, and the launch agreement should identify the launch window, launch site and launch service provider.

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The information required under this Annex shall be submitted in the form of a written commitment by the responsible administration, including manufacturer or launch provider letters or declarations, and evidence of guaranteed funding arrangements for the implementation of the project, where possible.

The notifying administration is responsible for authenticating the evidence of agreement.

RESOLUTION 40 (REV.WRC-19)

Use of one space station to bring frequency assignments to geostationary-satellite networks at different orbital locations into use within a short period of time

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that the use of the same space station to bring frequency assignments to geostationary-satellite (GSO) networks located at different orbital locations into use within a short period of time could lead to inefficient use of spectrum/orbit resources;
- b)* that there are legitimate reasons why a notifying administration may need to move a space station from one orbital position to a new orbital position, and this should not be constrained,

noting

- a)* that WRC-12 recognized that the issue of using one space station to bring frequency assignments at different orbital locations into use within a short period of time was not the intent for its adoption of Nos. **11.44**, **11.44.1**, **11.44B** and **11.49**;
- b)* that, with respect to cases where an administration brings into use frequency assignments at a given orbital location using an already in-orbit satellite, and pending completion of ITU Radiocommunication Sector studies, WRC-12 requested the Radiocommunication Bureau (BR) to make an enquiry to that administration as to the last previous orbital location/frequency assignments brought into use with that satellite and make such information available;
- c)* that the procedures of Article **14** are available to administrations in cases where information required under *resolves* below may not be available to the notifying administration,

recognizing

- a)* that administrations may bring into use or bring back into use a frequency assignment to a GSO network using one of its own space stations or a space station under the responsibility of another administration;
- b)* that the absence of a GSO space station capable of transmitting and receiving the frequency assignments at a notified orbital position, due to the relocation of an in-orbit satellite to a new orbital position, can lead to either the suspension or the cancellation of those frequency assignments in some cases,

resolves

1 that, when informing BR of the bringing into use, or bringing back into use after suspension, of a frequency assignment to a space station in a GSO network, the notifying administration shall indicate to BR whether or not this action has been accomplished with a space station that has previously been used to bring into use, or resume the use of, frequency assignments at a different orbital location within the three years prior to the date of submission of this information;

2 that, in cases where a notifying administration informs BR, pursuant to *resolves* 1 above, that it has brought into use, or resumed the use after suspension of, a frequency assignment to a space station in a GSO network with a space station that has previously been used to bring into use, or resume the use of, frequency assignments at a different orbital location within three years prior to the date of submission of this information, the notifying administration shall also indicate, for that same three-year period:

- i) the last orbital location where the space station was used to bring into use, or resume the use of, frequency assignments;
- ii) the satellite network(s) with which the frequency assignments in *resolves* 2i) above were associated;
- iii) the date on which the space station was no longer maintained at the orbital location in *resolves* 2i) above;

3 that, if the information is not provided by the notifying administration under *resolves* 1 and 2 above, as appropriate, BR shall consult the notifying administration requesting the missing information;

4 that, if the notifying administration fails to provide the missing information within 30 days from BR's request under *resolves* 3 above, BR shall immediately send a reminder requesting the missing information;

5 that, from 1 January 2018, if the notifying administration fails to provide the missing information within 15 days after BR's reminder under *resolves* 4 above, BR shall consider that the frequency assignments to the GSO network have not been brought into use, or brought back into use, and shall so inform the notifying administration,

instructs the Radiocommunication Bureau

to make available the information provided in *resolves* 1 and 2 on the ITU website¹ within 30 days of its receipt.

¹ https://www.itu.int/net/ITU-R/space/snl/sat_relocation/index.asp.

RESOLUTION 42 (REV.WRC-19)

Use of interim systems in Region 2 in the broadcasting-satellite and fixed-satellite (feeder-link) services in Region 2 for the frequency bands covered by Appendices 30 and 30A

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that the Regional Administrative Conference for the Planning of the Broadcasting-Satellite Service in Region 2 (Geneva, 1983) prepared a Plan for the broadcasting-satellite service in the frequency band 12.2-12.7 GHz and a Plan for the associated feeder links in the frequency band 17.3-17.8 GHz with provisions for implementing interim systems in accordance with Resolution 2 (Sat-R2);
- b)* that, in the implementation of their assignments in the Plans, administrations of Region 2 may find it more appropriate to adopt a phased approach and initially use characteristics different from those appearing in the appropriate Region 2 Plan;
- c)* that some administrations of Region 2 may cooperate in the joint development of a space system with a view to covering two or more service areas from the same orbital position or to using a beam which would encompass two or more service areas;
- d)* that some administrations of Region 2 may cooperate in the joint development of a space system with a view to covering two or more feeder-link service areas from the same orbital position or to using a beam which encompasses two or more feeder-link service areas;
- e)* that interim systems shall not adversely affect the Plans nor hamper the implementation and evolution of the Plans;
- f)* that the number of assignments to be used in an interim system shall not in any case exceed the number of assignments appearing in the Region 2 Plan which are to be suspended;
- g)* that the interim systems shall not in any case use orbital positions that are not in the Region 2 Plan;
- h)* that an interim system shall not be introduced without the agreement of all administrations whose space and terrestrial services are considered to be affected;
- i)* that WRC-2000 revised the Regions 1 and 3 downlink and feeder-link Plans and established Lists together with regulatory procedures, protection criteria and calculation methods for sharing between services in the frequency bands of Appendices 30 and 30A;
- j)* that WRC-03 modified the regulatory procedures, protection criteria and calculation methods for sharing between services in the frequency bands of Appendices 30 and 30A,

resolves

that administrations and the Radiocommunication Bureau shall apply the procedure contained in the Annex to this Resolution, so long as Appendices 30 and 30A remain in force.

ANNEX TO RESOLUTION 42 (REV.WRC-19)

1 An administration or a group of administrations in Region 2 may, after successful application of the procedure contained in this Annex and with the agreement of the affected administrations, use an interim system during a specified period not exceeding ten years in order:

1.1 For an interim system in the broadcasting-satellite service

- a)* to use an increased equivalent isotropically radiated power (e.i.r.p.) in any direction relative to that appearing in the Region 2 Plan provided that the power flux-density (pfd) does not exceed the limits given in Annex 5 to Appendix 30;
- b)* to use modulation characteristics¹ different from those appearing in the Annexes to the Region 2 Plan and resulting in an increased probability of harmful interference or in a wider assigned bandwidth;
- c)* to change the coverage area by displacing the boresight, or by increasing the major or minor axis, or by rotating them from an orbital position which shall be one of the corresponding orbital positions appearing in the Region 2 Plan;
- d)* to use a coverage area appearing in the Region 2 Plan or a coverage area encompassing two or more coverage areas appearing in the Region 2 Plan from an orbital position which shall be one of the corresponding positions appearing in the Region 2 Plan;
- e)* to use a polarization different from that in the Region 2 Plan.

1.2 For an interim feeder-link system

- a)* to use an increased e.i.r.p. in any direction relative to that appearing in the Region 2 feeder-link Plan;
- b)* to use modulation characteristics¹ different from those appearing in the Annexes to the Plan and resulting in an increased probability of harmful interference or in a wider assigned bandwidth;
- c)* to change the feeder-link beam area by displacing the boresight, or by increasing the major or minor axis, or by rotating them in relation to an orbital position which shall be one of the corresponding orbital positions appearing in the Region 2 feeder-link Plan;
- d)* to use a feeder-link beam area appearing in the Region 2 feeder-link Plan or a feeder-link beam area encompassing two or more feeder-link beam areas appearing in the Region 2 feeder-link Plan in relation to an orbital position which shall be one of the corresponding orbital positions appearing in the Region 2 feeder-link Plan;
- e)* to use a polarization different from that in the Region 2 feeder-link Plan.

¹ For example, modulation with sound channels frequency-multiplexed within the bandwidth of a television channel, digital modulation of sound and television signals, or other pre-emphasis characteristics.

2 In all cases, an interim system shall correspond to assignments in the appropriate Region 2 Plan; the number of assignments to be used in an interim system shall not in any case exceed the number of assignments appearing in the Region 2 Plan which are to be suspended. During the use of an interim system, the use of the corresponding assignments in the Region 2 Plan is suspended; they shall not be brought into use before the cessation of the use of the interim system. However, the suspended assignments, but not the interim system's assignments, of an administration shall be taken into account when other administrations apply the procedure of Article 4 of Appendix **30** or of Article 4 of Appendix **30A**, as appropriate, in order to modify the Region 2 Plan or to include new or modified assignments in the Regions 1 and 3 List, or the procedure of this Annex in order to bring an interim system into use. The assignments of interim systems shall not be taken into account in applying the procedure of Article 6 or Article 7 of Appendix **30** and the procedure of Article 6 or Article 7 of Appendix **30A**.

3 As a specific consequence of § 2 above, Region 2 interim system assignments shall not obtain protection from, or cause harmful interference to, new or modified assignments appearing in the Regions 1 and 3 List following the successful application of the procedure of Article 4 of Appendix **30** or of Article 4 of Appendix **30A**, as appropriate, even if the assignment modification procedure is concluded and the assignments become operational within the time-limits specified in § 4 a).

4 When an administration proposes to use an assignment in accordance with § 1, it shall communicate to the Radiocommunication Bureau (BR) the information listed in Appendix **4** not earlier than eight years but, preferably, not later than two years before the date of bringing into use. An assignment shall lapse if it is not brought into use by that date. The administration shall also indicate:

- a) the maximum specified period during which the interim assignment is intended to remain in use;
- b) the assignments in the Region 2 Plans the use of which will remain suspended for the duration of the use of the corresponding interim assignment;
- c) the names of the administrations with which an agreement for the use of the interim assignment has been reached, together with any comment relating to the period of use so agreed and the names of administrations with which an agreement may be required but has not yet been reached.

5 Administrations are considered to be affected as follows:

5.1 For an interim system in the broadcasting-satellite service

- a) an administration of Region 2 is considered to be affected if any overall equivalent protection margin of one of its assignments in the Region 2 Plan, calculated in accordance with Annex 5 to Appendix **30** including the cumulative effect of all interim uses during the maximum specified period of use of the interim system, but excluding the corresponding suspended assignments (§ 4 b)), becomes negative or a former negative value is made more negative;

- b) an administration of Region 1 or 3 is considered to be affected if it has an assignment which is in conformity with the Regions 1 and 3 Plan contained in Appendix **30** or with the List or in respect of which proposed new or modified assignments have been received by BR in accordance with the provisions of Article 4 of that Appendix with a necessary bandwidth which falls within the necessary bandwidth of the proposed interim assignment and the appropriate limits of § 3 of Annex 1 to Appendix **30** are exceeded;
- c) an administration of Region 1 or 3 is considered to be affected if it has a frequency assignment in the fixed-satellite service which is recorded in the Master Register or which has been coordinated or is being coordinated under the provisions of No. **9.7** or under Article 7 of Appendix **30** or which has been published in accordance with No. **9.2B** and the appropriate limits of § 6 of Annex 1 to Appendix **30** are exceeded;
- d) an administration of Region 1 or 3 is considered to be affected if, although having no frequency assignment in the appropriate Regions 1 and 3 Plan or List in the channel concerned, it nevertheless would receive on its territory a power flux-density value which exceeds the limits given in § 4 of Annex 1 to Appendix **30** as a result of the proposed interim assignment, or if it has such an assignment for which its associated service area does not cover the whole of the territory of the administration, and in its territory outside that service area the pfd from the interim system space station exceeds the above-mentioned limits;
- e) an administration of Region 2 is considered to be affected if, although having no frequency assignment in the appropriate Region 2 Plan in the channel concerned, it nevertheless would receive on its territory a pfd value which exceeds the limits given in § 4 of Annex 1 to Appendix **30** as a result of the proposed interim assignment, or if it has such an assignment for which its associated service area does not cover the whole of the territory of the administration, and in its territory outside that service area the power flux-density from the interim system space station exceeds the above-mentioned limits;
- f) an administration of Region 3 is considered to be affected if it has a frequency assignment to a space station in the broadcasting-satellite service in the frequency band 12.5-12.7 GHz with a necessary bandwidth any portion of which falls within the necessary bandwidth of the proposed assignment, and which:
 - is recorded in the Master Register; *or*
 - has been coordinated or is being coordinated under the provisions of Articles **9** to **14**; *or*
 - appears in a Region 3 Plan to be adopted at a future radiocommunication conference, taking account of modifications which may be introduced subsequently in accordance with the Final Acts of that conference,

and the limits of § 3, Annex 1 to Appendix **30** are exceeded.

5.2 For interim feeder-link systems

- a) an administration of Region 2 is considered to be affected if any overall equivalent protection margin of one of its assignments in the Plan, calculated in accordance with Annex 3 to Appendix **30A** including the cumulative effect of all interim uses during the maximum specified period of use of the interim system, but excluding the corresponding suspended assignment(s) (§ 4 b)), becomes negative or a former negative value is made more negative;

b) an administration in Region 1 or 3 is considered to be affected if it has an assignment for feeder links in the fixed-satellite service (Earth-to-space), any portion of the necessary bandwidth of which falls within the necessary bandwidth of the proposed assignment, which is in conformity with the feeder-link Plan or List for Regions 1 and 3, or in respect of which proposed new or modified assignments in the List have already been received by BR in accordance with the provisions of Article 4 of Appendix 30A and for which the limits set out in § 5 of Annex 1 to Appendix 30A are exceeded.

6 BR shall publish in a Special Section of its International Frequency Information Circular (BR IFIC) the information received under § 4, together with the names of the administrations which BR has identified in applying § 5.

7 When BR finds that the suspended assignment of an administration having an interim system is not affected, it shall examine the projected interim system with respect to the interim system of that administration and if there is an incompatibility, it shall request the two administrations concerned to adopt any measures that may enable the new interim system to be operated.

8 BR shall send a telegram to the administrations listed in the Special Section of the BR IFIC, drawing their attention to the information it contains and shall send them the results of its calculations.

9 Any administration not listed in the special section which considers that its planned interim assignment may be affected shall so inform the administration responsible for the interim system and BR, and the two administrations shall endeavour to resolve the difficulty before the proposed date of bringing the interim assignment into use.

10 An administration which has not sent its comments either to the administration seeking agreement or to BR within a period of four months following the date of the BR IFIC referred to in § 6 shall be understood as having agreed to the proposed interim use.

11 On the expiry of four months following the date of publication of the BR IFIC referred to in § 6, BR shall review the matter, and, depending on the results obtained, shall inform the administration proposing the interim assignment that:

- a) it may notify its proposed use under Article 5 of Appendix 30 or Article 5 of Appendix 30A, as appropriate, if no agreement is required or the required agreement has been obtained from the administrations concerned. In this case BR shall update the Interim List;
- b) it may not bring into use its interim system before having obtained the agreement of the administrations affected, either directly or by applying the procedure described in Article 4 of Appendix 30 or Article 4 of Appendix 30A, as appropriate, as a means of obtaining that agreement.

12 BR shall include all the interim assignments in an Interim List in two parts, one each for the broadcasting-satellite service and the feeder-link assignments, and shall update it in accordance with this Annex. The Interim List shall be published together with the Region 2 Plans but does not constitute part of them.

13 One year prior to the expiry of the interim period, BR shall draw the attention of the administration concerned to this fact and request it to notify in due time the deletion of the assignment from the Master Register and the Interim List.

14 If, notwithstanding the reminders by BR, an administration does not reply to its request sent in application of § 13, BR shall, at the termination of the interim period:

- a) enter a symbol in the Remarks Column of the Master Register to indicate the lack of response and that the entry is for information only;
- b) not take that assignment into account in the Interim List;
- c) inform the administrations concerned and affected of its action.

15 When an administration confirms the termination of the use of the interim assignment, BR shall delete the assignment concerned from the Interim List and the Master Register. Any corresponding assignment in the Plan(s), suspended earlier, may then be brought into use.

16 An administration which considers that its interim system may continue to be used after the expiry of the interim period may extend it by not more than four years and to this effect shall apply the procedure described in this Annex.

17 When an administration applies the procedure in accordance with § 16, but is unable to obtain the agreement of one or more affected administrations, BR shall indicate this situation by inserting an appropriate symbol in the Master Register. Upon receipt of a complaint of harmful interference, the administration shall immediately cease operation of the interim assignment.

18 When an administration, having been informed of a complaint of harmful interference, does not cease transmission within a period of thirty days after the receipt of complaint, BR shall apply the provisions of § 14.

RESOLUTION 49¹ (REV.WRC-23)**Administrative due diligence applicable to some
satellite radiocommunication services**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that Resolution 18 (Kyoto, 1994) of the Plenipotentiary Conference instructed the Director of the Radiocommunication Bureau (BR) to initiate a review of some important issues concerning international satellite network coordination and to make a preliminary report to WRC-95 and a final report to WRC-97;
- b)* that the Director of BR provided a comprehensive report to WRC-97, including a number of recommendations for action as soon as possible and for identifying areas requiring further study;
- c)* that one of the recommendations in the Director's report to WRC-97 was that administrative due diligence should be adopted as a means of addressing the problem of reservation of orbit and spectrum capacity without actual use;
- d)* that experience may need to be gained in the application of the administrative due diligence procedures adopted by WRC-97, and that several years may be needed to see whether administrative due diligence measures produce satisfactory results;
- e)* that new regulatory approaches may need to be carefully considered in order to avoid adverse effects on networks already going through the different phases of the procedures;
- f)* that Article 44 of the ITU Constitution sets out the basic principles for the use of the radio-frequency spectrum and the geostationary-satellite and other satellite orbits, taking into account the needs of developing countries,

considering further

- a)* that WRC-97 decided to reduce the regulatory time-frame for bringing a satellite network into use;
- b)* that WRC-2000 considered the results of the implementation of the administrative due diligence procedures and prepared a report to the 2002 Plenipotentiary Conference in response to Resolution 85 (Minneapolis, 1998) of the Plenipotentiary Conference,

¹ This Resolution does not apply to satellite networks or satellite systems of the broadcasting-satellite service in the frequency band 21.4-22 GHz in Regions 1 and 3.

resolves

that the administrative due diligence procedure contained in Annex 1 to this Resolution shall be applied for a satellite network or satellite system of the fixed-satellite service, mobile-satellite service or broadcasting-satellite service for which the request for coordination under No. **9.30**, or for which the request for modifications of the Region 2 Plan under Article 4, § 4.2.1 *b*) of Appendices **30** and **30A** that involve the addition of new frequencies or orbital positions, or for which the request for modifications of the Region 2 Plan under Article 4, § 4.2.1 *a*) of Appendices **30** and **30A** that extend the service area to another country or countries in addition to the existing service area, or for which the request for additional uses in Regions 1 and 3 under § 4.1 of Article 4 of Appendices **30** and **30A**, or for which the submission under Appendix **30B** is received, with the exception of submissions of new Member States seeking the acquisition of their respective national allotments² for inclusion in the Appendix **30B** Plan,

further resolves

that the procedures in this Resolution are in addition to the provisions under Article **9** or **11** of the Radio Regulations or Appendix **30**, **30A** or **30B**, as applicable, and, in particular, do not affect the requirement to coordinate under those provisions (Appendices **30** and **30A**) in respect of extending the service area to another country or countries in addition to the existing service area,

instructs the Director of the Radiocommunication Bureau

to report to future competent world radiocommunication conferences on the results of the implementation of the administrative due diligence procedure.

ANNEX 1 TO RESOLUTION 49 (REV.WRC-23)

1 Any satellite network or satellite system of the fixed-satellite service, mobile-satellite service or broadcasting-satellite service with frequency assignments that are subject to coordination under Nos. **9.7**, **9.11**, **9.12**, **9.12A** and **9.13** shall be subject to these procedures.

2 Any request for modifications of the Region 2 Plan under the relevant provisions of Article 4 of Appendices **30** and **30A** that involve the addition of new frequencies or orbital positions or for modifications of the Region 2 Plan under the relevant provisions of Article 4 of Appendices **30** and **30A** that extend the service area to another country or countries in addition to the existing service area or request for additional uses in Regions 1 and 3 under the relevant provisions of Article 4 of Appendices **30** and **30A** shall be subject to these procedures.

3 Any submission of information under Article 6 of Appendix **30B**, with the exception of submissions of new Member States seeking the acquisition of their respective national allotments³ for inclusion in the Appendix **30B** Plan, shall be subject to these procedures.

² See § 2.3 of Appendix **30B**.

³ See § 2.3 of Appendix **30B**.

4 For any satellite network subject to § 1 above, administrations shall send to the Radiocommunication Bureau (BR) no later than 30 days following the end of the period established as a limit to bringing into use in No. **11.44**, the due diligence information relating to the identity of the satellite network, the spacecraft manufacturer and the launch service provider specified in Annex 2 to this Resolution.

5 An administration requesting a modification of the Region 2 Plan or additional uses in Regions 1 and 3 under Appendices **30** and **30A** under § 2 above shall send to BR no later than 30 days following the end of the period established as a limit to bringing into use in accordance with the relevant provisions of Article 4 of Appendix **30** and the relevant provisions of Article 4 of Appendix **30A**, the due diligence information relating to the identity of the satellite network, the spacecraft manufacturer and the launch service provider specified in Annex 2 to this Resolution.

6 An administration applying Article 6 of Appendix **30B** under § 3 above shall send to BR no later than 30 days following the end of the period established as a limit to bringing into use in § 6.1 of that Article, the due diligence information relating to the identity of the satellite network, the spacecraft manufacturer and the launch service provider specified in Annex 2 to this Resolution.

7 The information to be submitted in accordance with § 4, 5 or 6 above shall be signed by an authorized official of the notifying administration or of an administration that is acting on behalf of a group of named administrations.

8 On receipt of the due diligence information under § 4, 5 or 6 above, BR shall promptly examine that information for completeness. If the information is found to be complete, BR shall publish the complete information in a special section of its International Frequency Information Circular (BR IFIC) within 30 days.

9 If the information is found to be incomplete, BR shall immediately request the administration to submit the missing information. In all cases, the complete due diligence information shall be received by BR within the appropriate time period specified in § 4, 5 or 6 above.

10 Six months before expiry of the period specified in § 4, 5 or 6 above and if the administration responsible for the satellite network has not submitted the due diligence information under § 4, 5 or 6 above, BR shall send a reminder to the responsible administration.

11 If the complete due diligence information is not received by BR within the time limits specified in § 4, 5 or 6, as appropriate, the networks covered by § 1, 2 or 3 above shall be cancelled by BR. The provisional recording in the Master International Frequency Register shall be deleted by BR after it has informed the concerned administration. BR shall publish this information in the BR IFIC.

With respect to the request for modification of the Region 2 Plan or for additional uses in Regions 1 and 3 under Appendices **30** and **30A** under § 2 above, the modification shall lapse if the complete due diligence information is not submitted in accordance with § 5.

With respect to the request for application of Article 6 of Appendix **30B** under § 3 above, the network shall also be deleted from the Appendix **30B** List if the complete due diligence information is not submitted in accordance with § 6. When an allotment under Appendix **30B** is converted into an assignment, the assignment shall be reinstated in the Plan in accordance with § 6.33 c) of Article 6 of Appendix **30B**.

12 When an administration has completely fulfilled the due diligence procedure but has not completed coordination, this does not preclude the application of No. **11.41** by that administration.

ANNEX 2 TO RESOLUTION 49 (REV.WRC-23)

A Identity of the satellite network

- a)* Identity of the satellite network
- b)* Name of the administration
- c)* Country symbol
- d)* Reference to the request for modification of the Region 2 Plan or for additional uses in Regions 1 and 3 under Appendices **30** and **30A**; or reference to the information processed under Article 6 of Appendix **30B**
- e)* Reference to the request for coordination (not applicable for Appendices **30**, **30A** and **30B**)
- f)* Frequency band(s)
- g)* Name of the operator
- h)* Name of the satellite
- i)* Orbital characteristics.

B Spacecraft manufacturer*

- a)* Name of the spacecraft manufacturer
- b)* Date of execution of the contract
- c)* Contractual “delivery window”
- d)* Number of satellites procured.

C Launch services provider

- a)* Name of the launch vehicle provider
- b)* Date of execution of the contract
- c)* Launch or in-orbit delivery window
- d)* Name of the launch vehicle
- e)* Name and location of the launch facility.

* NOTE – In cases where a contract for satellite procurement covers more than one satellite, the relevant information shall be submitted for each satellite.

RESOLUTION 55 (REV.WRC-23)

Electronic submission of, and communications on, notice forms for satellite networks, earth stations and radio astronomy stations and reports of harmful interference affecting space services

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that submission of notices for all satellite networks, earth stations and radio astronomy stations in electronic format would further facilitate the tasks of the Radiocommunication Bureau (BR) and of administrations, and would accelerate the processing of these notices;
- b)* that the volume of advance publication information, coordination requests, notifications and filings under Appendices **30**, **30A** and **30B** for satellite networks or systems has been steadily increasing in recent years;
- c)* that a significant amount of effort is required to maintain the relevant databases;
- d)* that a paperless electronic approach to the submission of satellite network filings and comments, if required, would make this information readily accessible to all and would limit the workload for administrations and BR in the processing of these filings;
- e)* that the use of electronic means of communication in an integrated online platform for administrative correspondence related to advance publication, coordination and notification of satellite networks, earth stations and radio astronomy stations would facilitate the tasks of BR and of administrations, with the potential to improve efficiency and the coordination and notification process by reducing the amount of duplicated correspondence,

recognizing

- a)* that, should the processing delays related to the coordination and notification procedures extend beyond the periods specified in Articles **9** and **11**, as well as in Appendices **30**, **30A** and **30B**, administrations may be faced with a shortened time window in which to effect coordination;
- b)* that administrations could use the time freed by a reduction in administrative correspondence to effect coordination;
- c)* that BR has successfully implemented the ITU online e-Communications and e-Submission of Satellite Network Filings platforms in response to Resolutions of previous world radiocommunication conferences;
- d)* that, since 1 August 2018, all satellite network filings are submitted to BR through the e-Submission of Satellite Network Filings platform;

e) that, since 23 October 2019, all correspondence relating to the submission of, and commenting on, satellite network filings has been able to be communicated through the e-Communications platform;

f) that, since 1 September 2018, reports of harmful interference affecting space services have been submitted by administrations through the ITU Satellite Interference Reporting and Resolution System (SIRRS) implemented by BR for this purpose,

resolves

1 that, as from 3 June 2000, all notices (AP4/II and AP4/III), radio astronomy notices (AP4/IV) and API (AP4/V and AP4/VI) and due diligence information (Resolution **49 (Rev.WRC-23)**) for satellite networks and earth stations submitted to BR pursuant to Articles **9** and **11** shall be submitted in electronic format compatible with the BR electronic notice form capture software (SpaceCap);

2 that, as from 17 November 2007, all notices for satellite networks, earth stations and radio astronomy stations submitted to BR pursuant to Articles **9** and **11**, as well as to Appendices **30** and **30A** and Resolution **49 (Rev.WRC-23)**, shall be submitted in electronic format compatible with the BR electronic notice form capture software (SpaceCap and SpaceCom);

3 that, as from 1 June 2008, all notices for satellite networks and earth stations submitted to BR pursuant to Appendix **30B** shall be submitted in electronic format compatible with the BR electronic notice form capture software (SpaceCap);

4 that, as from 1 July 2009, comments/objections submitted to BR in accordance with Nos. **9.3** and **9.52** with respect to Nos. **9.11** to **9.14** and **9.21** of Article **9**, or in accordance with § 4.2.10, 4.2.13 or 4.2.14 of Appendices **30** and **30A** with respect to modification to the Region 2 Plan and use of the guardbands under Article 2A of those Appendices in Region 2, shall be submitted in electronic format compatible with the BR electronic notice form capture software (SpaceCom);

5 that, as from 18 February 2012, all requests for inclusion or exclusion submitted to BR under No. **9.41** of Article **9** shall be submitted in electronic format compatible with the BR electronic notice form capture software (SpaceCom);

6 that, since 3 June 2000, all graphical data associated with the submissions addressed in *resolves* 1, 2 and 3 should be submitted in graphics data format compatible with BR's data capture software (graphical interference management system (GIMS));

7 that all information indicated in *resolves* 1 to 6 above, in Annexes 1 and 2 to Resolution **35 (Rev.WRC-23)**, in Annex 2 to Resolution **552 (Rev.WRC-23)** and in the Attachment to Resolution **553 (Rev.WRC-23)** under §§ 8 and 9 shall be submitted to BR, using the e-Submission of Satellite Network Filings platform;

8 that administrative correspondence between administrations and BR related to the advance publication, coordination, notification and recording processes, including correspondence related to Appendices **30**, **30A** and **30B**, for satellite networks, earth stations and radio astronomy stations shall be communicated, whenever possible, using the e-Communications platform;

9 that reports of harmful interference affecting space services and associated correspondence exchanged between administrations and BR in accordance with Article **15** and No. **13.2** shall be submitted, whenever possible, using the SIRRS platform and following the guidance provided in the most recent version of Recommendation ITU-R SM.2149;

10 that, wherever the words “telegram”, “telex” or “fax” are inserted in provisions related to the advance publication, coordination, notification and recording processes for satellite systems or networks, earth stations and radio astronomy stations, including the provisions contained in Appendices **30**, **30A** and **30B** and related Resolutions, the e-Communications platform shall be used instead;

11 that other, traditional means of communication can be used in the case of difficulty encountered in applying *resolves* 8, 9 and 10,

instructs the Radiocommunication Bureau

1 to make available coordination requests and notifications referred to in *resolves* 1 “as received” within 30 days of receipt on its website;

2 to provide administrations with the latest versions of the capture and validation software and any necessary technical means, training and manuals, along with any assistance requested by administrations to enable them to comply with *resolves* 1 to 4 above;

3 to integrate the validation software with the capture software to the extent practicable;

4 to continue to develop and improve the e-Submission of Satellite Network Filings, e-Communications and SIRRS platforms to meet the needs of the Radio Regulations with respect to the submission of, and commenting on, satellite network filings, as well as the associated correspondence.

RESOLUTION 63 (REV.WRC-12)

Protection of radiocommunication services against interference caused by radiation from industrial, scientific and medical (ISM) equipment

The World Radiocommunication Conference (Geneva, 2012),

considering

- a)* that ISM applications are defined under RR No. **1.15** as “operation of equipment or appliances designed to generate and use locally radio-frequency energy for industrial, scientific, medical, domestic or similar purposes, excluding applications in the field of *telecommunications*”;
- b)* that ISM equipment may be situated in locations where outward radiation cannot always be avoided;
- c)* that there is an increasing amount of ISM equipment working on various frequencies throughout the spectrum;
- d)* that in some cases a considerable part of the energy may be radiated by ISM equipment outside its working frequency;
- e)* that Recommendation ITU-R SM.1056 recommends to administrations the use of International Special Committee on Radio Interference (CISPR) Publication 11 as a guide for ISM equipment to protect radiocommunication services, but that CISPR 11 does not yet fully specify radiation limits for all frequency bands;
- f)* that Report ITU-R SM.2180 introduces the interference analysis method and the radiation limits of ISM equipment developed by CISPR, and that the emission limits, which have been developed to protect analogue radiocommunication systems, may not provide protection to digital radiocommunication systems;
- g)* that certain digital radiocommunication systems use receivers that may be more sensitive to interference from ISM equipment;
- h)* that some radio systems, especially those using low field strengths, may suffer interference caused by radiation from ISM equipment, a risk which is unacceptable particularly in the case of systems belonging to radionavigation or other safety services;
- i)* that, in order to limit the risks of interference to specified parts of the spectrum:
 - the preceding Radio Conferences of Atlantic City, 1947, and Geneva, 1959, designated some frequency bands within which the radiocommunication services must accept harmful interference produced by ISM equipment;
 - WARC-79 accepted an increase in the number of bands to be designated for ISM equipment, but only on the condition that limits of radiation from such equipment be specified within the bands newly designated for worldwide use and outside all the bands designated for ISM equipment;

j) that the variety and evolution of digital technologies used in digital radiocommunication systems suggest a need for continuous review of CISPR Publication 11,

resolves

that, to ensure that radiocommunication services are adequately protected, studies are required on the limits to be imposed on the radiation from ISM equipment, within and outside the frequency bands designated in the Radio Regulations for this use,

invites ITU-R

1 to provide the necessary characteristics and protection criteria for relevant digital radiocommunication systems in order to enable CISPR to review and update, as needed, the limits on radiation from ISM equipment;

2 to continue, in collaboration with CISPR, its studies relating to radiation from ISM equipment, within and outside the frequency bands designated in the Radio Regulations for this use, in order to ensure adequate protection of radiocommunication services, including digital radiocommunication systems, with priority being given to the completion of studies which would permit CISPR to define limits in Publication CISPR 11 on radiation from ISM equipment inside all the bands designated in the Radio Regulations for the use of such equipment,

instructs the Director of the Radiocommunication Bureau

to bring this Resolution to the attention of CISPR.

RESOLUTION 72 (REV.WRC-19)

World and regional preparations for world radiocommunication conferences

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that the regional telecommunication organizations continue to coordinate their preparations for world radiocommunication conferences (WRCs);
- b) that many common proposals have been submitted to previous WRCs from administrations participating in the preparations of regional telecommunication organizations;
- c) that this consolidation of views at regional level, together with the opportunity for interregional discussions prior to WRCs, has eased the task of reaching a common understanding and saved time during past WRCs;
- d) that the burden of preparation for future WRCs is likely to increase;
- e) that there is consequently great benefit to the Member States of coordination of preparations at world level and at regional level;
- f) that the success of future WRCs will depend on greater efficiency of regional coordination and interaction at interregional level prior to future WRCs, including possible face-to-face meetings between regional telecommunication organizations;
- g) that there is a need for overall coordination of the interregional consultations,

recognizing

- a) *resolves* 2 of Resolution 80 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference;
- b) *resolves* 3 of Resolution 80 (Rev. Marrakesh, 2002):

“to encourage both formal and informal collaboration in the interval between conferences with a view to resolving differences on items already on the agenda of a conference or new items”,

noting

that the plenipotentiary conferences have resolved that the Union should continue to develop stronger relations with regional telecommunication organizations,

resolves to invite the regional telecommunication organizations

- 1 to continue their preparations for WRCs, including the possible convening of joint meetings of regional telecommunication organizations formally and informally;
- 2 to provide the Radiocommunication Bureau with a document containing the latest version of their views, positions and/or proposals under the agendas of WRCs at the earliest stage after each regional meeting in order to be published on the website of the related WRC,

invites administrations

to participate actively in the preparations of their regional telecommunication organizations for WRCs and join, to the extent possible, the regional common proposals,

instructs the Director of the Radiocommunication Bureau

1 to publish the documents mentioned in *resolves to invite the regional telecommunication organizations* 2 on the website of each WRC immediately after receiving such documents;

2 to continue consulting the regional telecommunication organizations on the means by which assistance can be given to their preparations for future WRCs in the following areas:

- organization of regional preparatory meetings;
 - organization of information sessions, preferably before and after the second session of the Conference Preparatory Meeting (CPM), including presentation of the chapters of the CPM Report;
 - identification of major issues to be resolved by the forthcoming WRC;
 - facilitation of regional and interregional formal and informal meetings, with the objective of reaching a possible convergence of interregional views on major issues;
- 3 to submit a report on the results of such consultations to each WRC,

invites the Director of the Telecommunication Development Bureau

to collaborate with the Director of the Radiocommunication Bureau in implementing this Resolution.

RESOLUTION 74 (REV.WRC-03)

Process to keep the technical bases of Appendix 7 current

The World Radiocommunication Conference (Geneva, 2003),

considering

- a) that Appendix 7 provides the method for the determination of the coordination area of an earth station, and the assumed technical coordination parameters for unknown terrestrial stations or earth stations;
- b) that the technical coordination parameters are contained in Tables 7, 8 and 9 of Annex 7 to Appendix 7;
- c) that the technical coordination parameter tables are based on Recommendation ITU-R SM.1448;
- d) that ITU-R studies on methods for the determination of the coordination area of an earth station are continuing, and the conclusions of these studies could lead to revision of Appendix 7; these methods under study are:
 - methods considering the cumulative impact in determining the coordination areas for high-density earth stations (fixed and mobile);
 - methods to address the modelling of VHF/UHF frequencies for percentages of time less than 1%;
 - methods to address propagation mode (1) water vapour density for both radio climatic Zones B and C;
 - refinements to propagation mode (2) to address elevation angle dependency and the displacement of the centre of the propagation mode (2) contour from the coordinating earth station;
- e) that the technical coordination parameter tables may also need to be modified when changes are made to the Table of Frequency Allocations at future world radiocommunication conferences (WRCs), or due to changes in technology or in applications;
- f) that the technical coordination parameter tables do not include values for all the necessary parameters of certain space radiocommunication services and terrestrial radiocommunication services sharing frequency bands with equal rights,

recognizing

- a) that Recommendation ITU-R SM.1448 was developed by ITU-R as a basis for the revision of Appendix 7;
- b) that there is a need for future WRCs to keep Appendix 7 current with the latest techniques and to ensure protection of other radiocommunication services sharing the same frequency bands with equal rights, particularly through revision of the tables of technical coordination parameters,

invites ITU-R

- 1 to continue its study, as required, of the technical bases used for determination of the coordination area of an earth station, including recommended values for the missing entries in the tables of technical coordination parameters (Annex 7 to Appendix 7);
- 2 to maintain the relevant ITU-R texts in a format which would facilitate the future revision of Appendix 7;
- 3 to assess the significance of changes to the technical bases,

resolves

- 1 that when ITU-R concludes, based on its studies of the methods in *considering d)* for determination of the coordination area of an earth station and/or the values of technical coordination parameters, that a revision of Appendix 7 is warranted, the matter shall be brought to the attention of the Radiocommunication Assembly;
- 2 that, if the Radiocommunication Assembly confirms the improvements of the methods in *considering d)* for determination of the coordination area of an earth station and/or the values of technical coordination parameters which have been presented by ITU-R, the Director of the Radiocommunication Bureau shall identify the matter in the Director's report to the following WRC,

invites

- 1 WRCs, when presented with any significant changes through the Director's report, to consider the revision of Appendix 7 in light of the recommendation of the Radiocommunication Assembly, pursuant to *resolves* 1 and 2 above;
- 2 each WRC, when modifying the Table of Frequency Allocations, to consider any consequential changes that may be required to the technical coordination parameters of Annex 7 to Appendix 7 and, if necessary, request ITU-R to study the matter.

RESOLUTION 76 (REV.WRC-23)

Protection of geostationary fixed-satellite service and geostationary broadcasting-satellite service networks from the maximum aggregate equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems in frequency bands where equivalent power flux-density limits have been adopted

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that WRC-97 adopted, in Article 22, provisional equivalent power flux-density (epfd) limits to be met by non-geostationary (non-GSO) fixed-satellite service (FSS) systems in order to protect geostationary-satellite (GSO) FSS and GSO broadcasting-satellite service (BSS) networks in parts of the frequency range 10.7-30 GHz;
- b)* that WRC-2000 revised Article 22 to ensure the limits contained therein provide adequate protection to GSO networks without placing undue constraints on any of the systems and services sharing these frequency bands;
- c)* that WRC-2000 decided that a combination of single-entry validation, single-entry operational and, for certain antenna sizes, single-entry additional operational epfd limits, contained in Article 22, along with the aggregate limits in Tables 1A to 1D as contained in Annex 1 to this Resolution, which apply to non-GSO FSS systems, protects GSO networks in these frequency bands;
- d)* that these single-entry validation limits have been derived from aggregate epfd masks contained in Tables 1A to 1D, assuming a maximum effective number of non-GSO FSS systems of 3.5;
- e)* that the aggregate interference caused by all co-frequency non-GSO FSS systems in these frequency bands into GSO FSS networks should not exceed the aggregate epfd limits in Tables 1A to 1D;
- f)* that to achieve the objective in *considering e)*, administrations of non-GSO FSS systems would need to establish collaboration through consultation meetings;
- g)* that WRC-97 decided, and WRC-2000 confirmed, that non-GSO FSS systems in the frequency bands in question are to mutually coordinate the use of frequencies in these frequency bands under the provisions of No. 9.12;
- h)* that the orbital characteristics of such systems are likely to be inhomogeneous;

i) that, as a result of this likely inhomogeneity, the aggregate epfd levels from multiple non-GSO FSS systems will not be directly related to the actual number of systems sharing a frequency band, and the number of such systems operating co-frequency is likely to be small;

j) that the possible misapplication of single-entry limits should be avoided,

recognizing

a) that non-GSO FSS systems are likely to need to implement interference mitigation techniques to mutually share frequencies;

b) that, on account of the use of such interference mitigation techniques, it is likely that the number of non-GSO systems will remain small, as will the aggregate interference caused by non-GSO FSS systems into GSO networks;

c) that, notwithstanding *considering d) and e) and recognizing b)*, there may be instances where the aggregate interference from non-GSO systems could exceed the interference levels given in Tables 1A to 1D;

d) that administrations operating GSO networks may wish to ensure that the aggregate epfd produced by all operating co-frequency non-GSO FSS systems in the frequency bands referred to in *considering a)* above into GSO FSS and/or GSO BSS networks does not exceed the aggregate interference levels given in Tables 1A to 1D,

noting

a) that Recommendation ITU-R S.1588 provides methodologies for calculating aggregate downlink epfd produced by multiple non-GSO FSS systems into a GSO FSS network;

b) that, given *considering j)*, some non-GSO FSS systems use multiple filings, which may be submitted by more than one administration,

resolves

1 that administrations operating or planning to operate non-GSO FSS systems, for which coordination or notification information, as appropriate, was received after 21 November 1997, in the frequency bands referred to in *considering a)* above, individually or in collaboration, shall take all possible steps, including, if necessary, by means of appropriate modifications to their systems, to ensure that the aggregate interference into GSO FSS and GSO BSS networks caused by such systems operating co-frequency in these frequency bands does not cause the aggregate power levels given in Tables 1A to 1D to be exceeded (see No. **22.5K**);

2 that, in the event that the aggregate interference levels in Tables 1A to 1D are exceeded, administrations operating non-GSO FSS systems in these frequency bands shall take all necessary measures expeditiously to reduce the aggregate epfd levels to the limits given in Tables 1A to 1D, or to higher levels where those levels are acceptable to the affected GSO administration (see No. **22.5K**);

3 that, in order to fulfil the requirements in *resolves* 1, administrations operating or planning to operate non-GSO FSS systems shall, on a regular basis (e.g. yearly), hold a consultation meeting to determine the level of aggregate interference caused to GSO FSS or GSO BSS networks from non-GSO FSS systems and determine the necessary measures to ensure compliance with the required level for protecting GSO FSS and GSO BSS networks;

4 that administrations engaged in consultation meetings, when developing agreements to carry out their obligations under *resolves* 1 and 2 above, shall establish mechanisms to ensure that all administrations are given full visibility of the process and its outcome and the aggregate interference allowance into GSO FSS or GSO BSS networks is shared fairly among non-GSO FSS systems;

5 that those administrations participating in the consultation meeting shall designate one administration that shall communicate to the Radiocommunication Bureau the results of any technical or operational amendment to the relevant non-GSO FSS systems following the application of *resolves* 2 above;

6 that consultation meetings to achieve the objective of *resolves* 1 and 2 shall be held after the ITU Radiocommunication Sector (ITU-R) adopts the Recommendation specified in *invites the ITU Radiocommunication Sector* 1 below, with the exception of meetings for the purpose of organizing the functioning of the consultation meetings and establishing preliminary terms of reference;

7 that administrations, when evaluating the aggregate interference into GSO FSS or GSO BSS networks under *resolves* 1, shall take into account the submission of appropriate notification information under No. **11.2** for non-GSO FSS systems and the submission of the information referred to in Resolution **35 (Rev.WRC-23)** for non-GSO FSS systems, along with the relevant information provided to the consultation meetings referred to in *considering f)*;

8 that the aggregate epfd calculations performed within the scope of the consultation meeting referred to in *resolves* 3 shall involve two assessments, one considering only the operational space stations of non-GSO FSS systems and another for information only, if needed, considering also non-GSO FSS space stations planned to be deployed before the next consultation meeting;

9 that any amendment to the relevant non-GSO FSS systems mentioned in *resolves* 7 above shall not affect the regulatory status of the affected non-GSO FSS systems, including following any modifications to their published characteristics,

invites the ITU Radiocommunication Sector

1 to continue its studies on the subject and develop, as a matter of urgency and preferably before 30 July 2027, and taking into account existing and relevant ITU-R Recommendations, a Recommendation on a suitable methodology for calculating the aggregate co-frequency epfd produced by non-GSO FSS systems and accurately modelling non-GSO FSS operations in the frequency bands referred to in *considering a)* above into GSO FSS and GSO BSS networks, which may be used to determine whether the systems are in compliance with the aggregate power levels given in Tables 1A to 1D, taking into account relevant elements of Recommendations ITU-R S.1588 and ITU-R S.1503, as appropriate;

2 to develop, as a matter of urgency and preferably before 30 July 2027, a Recommendation on a suitable methodology to adapt the operation of co-frequency non-GSO FSS systems in the frequency bands referred to in *considering a)* above to ensure that the aggregate power levels given in Tables 1A to 1D are met;

3 to continue to verify, as a matter of urgency, the effectiveness of the provisions defined in this Resolution and, if needed, to study and analyse possible amendments to those provisions,

instructs the Director of the Radiocommunication Bureau

1 to participate in the consultation meetings mentioned in *resolves* 3 to 9 and to observe carefully the results of the epfd calculation mentioned in *resolves* 3;

2 to publish in the Radiocommunication Bureau International Frequency Information Circular the information referred to in *resolves* 5 and *instructs the Director of the Radiocommunication Bureau* 1;

3 to report to WRC-27, and to subsequent world radiocommunication conferences, on the implementation of this Resolution;

4 to examine the possibility, if needed, of developing software that can be used to calculate the epfd level mentioned under *resolves* 1,

invites the 2027 world radiocommunication conference

to review the report on the implementation of this Resolution and to take any necessary action, as appropriate,

invites administrations

1 to participate in the discussions and determinations mentioned under *resolves* 5, as appropriate;

2 to provide to the Bureau, and to all participants in the consultation meetings, access to software developed, taking into consideration the methodology referred to in *invites the ITU Radiocommunication Sector* 1, to calculate the epfd level mentioned under *resolves* 2.

ANNEX 1 TO RESOLUTION 76 (REV.WRC-23)

TABLE 1A^{1, 2, 3}Limits on aggregate $\text{epfd}_{\downarrow}$ radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	$\text{epfd}_{\downarrow}$ (dB(W/m ²))	Percentage of time during which $\text{epfd}_{\downarrow}$ may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern ⁴
10.7-11.7 in all Regions	-170	0	40	60 cm
11.7-12.2 in Region 2	-168.6	90		Recommendation ITU-R S.1428
12.2-12.5 in Region 3	-165.3	99		
12.5-12.75 in Regions 1 and 3	-160.4	99.97		
	-160	99.99		
	-160	100		
	-176.5	0	40	1.2 m
	-173	99.5		Recommendation ITU-R S.1428
	-164	99.84		
	-161.6	99.945		
	-161.4	99.97		
	-160.8	99.99		
	-160.5	99.99		
	-160	99.9975		
	-160	100		
	-185	0	40	3 m ⁵
	-184	90		Recommendation ITU-R S.1428
	-182	99.5		
	-168	99.9		
	-164	99.96		
	-162	99.982		
	-160	99.997		
	-160	100		
	-190	0	40	10 m ⁵
	-190	99		Recommendation ITU-R S.1428
	-166	99.99		
	-160	99.998		
	-160	100		

¹ For certain GSO FSS receive earth stations, see also Nos. 9.7A and 9.7B.² In addition to the limits shown in Table 1A, the following aggregate $\text{epfd}_{\downarrow}$ limits apply to all antenna sizes greater than 60 cm in the frequency bands listed in Table 1A:

100% of the time $\text{epfd}_{\downarrow}$ (dB(W/(m ² · 40 kHz)))	Latitude (North or South) (degrees)
-160	0 ≤ Latitude ≤ 57.5
$-160 + 3.4(57.5 - Latitude)/4$	57.5 < Latitude ≤ 63.75
-165.3	63.75 < Latitude

³ For each reference antenna diameter, the limit consists of the complete curve on a plot which is linear in decibels for the $\text{epfd}_{\downarrow}$ levels and logarithmic for the time percentages, with straight lines joining the data points.⁴ For this Table, reference patterns in Recommendation ITU-R S.1428 shall be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.⁵ The values for the 3 m and 10 m antennas are applicable only for the methodology referred to *invites the ITU Radiocommunication Sector* 1.

TABLE 1B^{1, 2, 3}Limits on aggregate epdf_↓ radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	epfd _↓ (dB(W/m ²))	Percentage of time during which epdf _↓ may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern ⁴
17.8-18.6	-170	0	40	1 m Recommendation ITU-R S.1428
	-170	90		
	-164	99.9		
	-164	100		
	-156	0	1 000	2 m Recommendation ITU-R S.1428
	-156	90		
	-150	99.9		
	-150	100		
	-173	0	40	5 m Recommendation ITU-R S.1428
	-173	99.4		
	-166	99.9		
	-164	99.92		
	-164	100		5 m Recommendation ITU-R S.1428
	-159	0	1 000	
	-159	99.4		
	-152	99.9		
	-150	99.92		
	-150	100		
	-180	0	40	5 m Recommendation ITU-R S.1428
	-180	99.8		
	-172	99.8		
	-164	99.992		
	-164	100		5 m Recommendation ITU-R S.1428
	-166	0	1 000	
	-166	99.8		
	-158	99.8		
	-150	99.992		
	-150	100		

¹ For certain GSO FSS receive earth stations, see also Nos. 9.7A and 9.7B.² For each reference antenna diameter, the limit consists of the complete curve on a plot which is linear in decibels for the epdf_↓ levels and logarithmic for the time percentages, with straight lines joining the data points.³ A non-GSO system shall meet the limits of this Table in both the 40 kHz and the 1 MHz reference bandwidths.⁴ For this Table, reference patterns in Recommendation ITU-R S.1428 shall be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.

TABLE 1C^{1, 2, 3}Limits on aggregate epdf_↓ radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	epfd _↓ (dB(W/m ²))	Percentage of time during which epdf _↓ may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern ⁴
19.7-20.2	-182 -172 -154 -154	0 90 99.94 100	40	70 cm Recommendation ITU-R S.1428
	-168 -158 -140 -140	0 90 99.94 100	1 000	
	-185 -176 -165 -160 -154 -154	0 91 99.8 99.8 99.99 100	40	90 cm Recommendation ITU-R S.1428
	-171 -162 -151 -146 -140 -140	0 91 99.8 99.8 99.99 100	1 000	
	-191 -162 -154 -154	0 99.933 99.998 100	40	2.5 m Recommendation ITU-R S.1428
	-177 -148 -140 -140	0 99.933 99.998 100	1 000	
	-195 -184 -175 -161 -154 -154	0 90 99.6 99.984 99.9992 100	40	5 m Recommendation ITU-R S.1428
	-181 -170 -161 -147 -140 -140	0 90 99.6 99.984 99.9992 100	1 000	

¹ For certain GSO FSS receive earth stations, see also Nos. 9.7A and 9.7B.² For each reference antenna diameter, the limit consists of the complete curve on a plot which is linear in decibels for the epdf_↓ levels and logarithmic for the time percentages, with straight lines joining the data points.³ A non-GSO system shall meet the limits of this Table in both the 40 kHz and the 1 MHz reference bandwidths.⁴ For this Table, reference patterns in Recommendation ITU-R S.1428 shall be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.

TABLE 1D^{1,2}

Limits on aggregate epdf↓ radiated by non-GSO FSS systems in certain frequency bands
into 30 cm, 45 cm, 60 cm, 90 cm, 120 cm, 180 cm, 240 cm and 300 cm BSS antennas

Frequency band (GHz)	epfd↓ (dB(W/m ²))	Percentage of time during which epdf↓ may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern ³
11.7-12.5 in Region 1 11.7-12.2 and 12.5-12.75 in Region 3 12.2-12.7 in Region 2	-160.4	0	40	30 cm Recommendation ITU-R BO.1443, Annex 1
	-160.1	25		
	-158.6	96		
	-158.6	98		
	-158.33	98		
	-158.33	100		
	-170	0	40	45 cm Recommendation ITU-R BO.1443, Annex 1
	-167	66		
	-164	97.75		
	-160.75	99.33		
	-160	99.95		
	-160	100		
	-171	0	40	60 cm Recommendation ITU-R BO.1443, Annex 1
	-168.75	90		
	-167.75	97.8		
	-162	99.6		
	-161	99.8		
	-160.2	99.9		
	-160	99.99		
	-160	100		
	-173.75	0	40	90 cm Recommendation ITU-R BO.1443, Annex 1
	-173	33		
	-171	98		
	-165.5	99.1		
	-163	99.5		
	-161	99.8		
	-160	99.97		
	-160	100		
	-177	0	40	120 cm Recommendation ITU-R BO.1443, Annex 1
	-175.25	90		
	-173.75	98.9		
	-173	98.9		
	-169.5	99.5		
	-167.8	99.7		
	-164	99.82		
	-161.9	99.9		
	-161	99.965		
	-160.4	99.993		
	-160	100		

TABLE 1D^{1, 2} (end)

Frequency band (GHz)	epfd↓ (dB(W/m ²))	Percentage of time during which epfd↓ may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern ³
11.7-12.5 in Region 1 11.7-12.2 and 12.5-12.75 in Region 3 12.2-12.7 in Region 2	-179.5	0	40	180 cm Recommendation ITU-R BO.1443, Annex 1
	-178.66	33		
	-176.25	98.5		
	-163.25	99.81		
	-161.5	99.91		
	-160.35	99.975		
	-160	99.995		
	-160	100		
	-182	0	40	240 cm Recommendation ITU-R BO.1443, Annex 1
	-180.9	33		
	-178	99.25		
	-164.4	99.85		
	-161.9	99.94		
	-160.5	99.98		
	-160	99.995		
	-160	100		
	-186.5	0	40	300 cm Recommendation ITU-R BO.1443, Annex 1
	-184	33		
	-180.5	99.5		
	-173	99.7		
	-167	99.83		
	-162	99.94		
	-160	99.97		
	-160	100		

¹ For BSS antenna diameters of 180 cm, 240 cm and 300 cm, in addition to the aggregate limits shown in Table 1D, the following aggregate 100% of the time epfd↓ limits also apply:

100% of the time epfd↓ (dB(W/(m ² · 40 kHz)))	Latitude (North or South) (degrees)
-160	0 ≤ Latitude ≤ 57.5
-160 + 3.4(57.5 - Latitude)/4	57.5 < Latitude ≤ 63.75
-165.3	63.75 < Latitude

² For each reference antenna diameter, the limit consists of the complete curve on a plot which is linear in decibels for the epfd↓ levels and logarithmic for the time percentages, with straight lines joining the data points. For BSS antenna of diameter 240 cm, in addition to the above aggregate 100% of the time epfd↓ limit, a -167 dB(W/(m² · 40 kHz)) aggregate 100% of the time operational epfd↓ limit also applies to receive antennas located in Region 2, west of 140° W, north of 60° N, pointing toward GSO BSS satellites at 91° W, 101° W, 110° W, 119° W and 148° W with elevation angles greater than 5°. This limit is implemented during a transition period of 15 years.

³ For this Table, reference patterns in the Annex 1 to Recommendation ITU-R BO.1443 shall be used only for the calculation of interference from non-GSO FSS systems into GSO BSS systems.

RESOLUTION 80 (REV.WRC-07)

Due diligence in applying the principles embodied in the Constitution

The World Radiocommunication Conference (Geneva, 2007),

considering

- a) that Articles 12 and 44 of the Constitution lay down the basic principles for the use of the radio-frequency spectrum and the geostationary-satellite and other satellite orbits;
- b) that those principles have been included in the Radio Regulations;
- c) that Article I of the Agreement between the United Nations and the International Telecommunication Union provides that “the United Nations recognizes the International Telecommunication Union (hereinafter called “the Union”) as the specialized agency responsible for taking such action as may be appropriate under its basic instrument for the accomplishment of the purposes set forth therein”;
- d) that, in accordance with Nos. **11.30**, **11.31** and **11.31.2**, notices shall be examined with respect to the provisions of the Radio Regulations, including the provision relating to the basic principles, appropriate rules of procedure being developed for the purpose;
- e) that WRC-97 instructed the Radio Regulations Board (RRB) to develop, within the framework of Nos. **11.30**, **11.31** and **11.31.2**, rules of procedure to be followed in order to be in compliance with the principles in No. **0.3** of the Preamble to the Radio Regulations;
- f) that the Board, in accordance with Resolution **80 (WRC-97)**, submitted a report to WRC-2000 suggesting possible solutions and stating that, after examining the Radio Regulations, it had concluded that there are no provisions currently in the Radio Regulations that link the formal notification or coordination procedures with the principles stated in No. **0.3** of the Preamble to the Radio Regulations;
- g) that the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space of the United Nations General Assembly has drawn up recommendations in this respect,

noting

- a) that, in accordance with the provisions of No. 127 of the Convention, the Conference may give instructions to the Sectors of the Union;
- b) that, according to No. 160C of the Convention, the Radiocommunication Advisory Group (RAG) shall review any matter as directed by a conference;
- c) the RRB report to WRC-2000 (see Annex 1);
- d) the RRB report to WRC-03 (see Annex 2);
- e) that some of the issues identified in the report referred to in *noting c)* have been resolved before WRC-07,

resolves

1 to instruct the Radiocommunication Sector, in accordance with No. 1 of Article 12 of the Constitution, to carry out studies on procedures for measurement and analysis of the application of the basic principles contained in Article 44 of the Constitution;

2 to instruct the RRB to consider and review possible draft recommendations and draft provisions linking the formal notification, coordination and registration procedures with the principles contained in Article 44 of the Constitution and No. 0.3 of the Preamble to the Radio Regulations, and to report to each future World Radiocommunication Conference with regard to this Resolution;

3 to instruct the Director of the Radiocommunication Bureau to submit to each future World Radiocommunication Conference a detailed progress report on the action taken on this Resolution,

invites

1 the other organs of the Radiocommunication Sector, in particular the RAG, to make relevant contributions to the Director of the Radiocommunication Bureau for inclusion in his report to each future World Radiocommunication Conference;

2 administrations to contribute to the studies referred to in *resolves* 1 and to the work of the RRB as detailed in *resolves* 2.

ANNEX 1 TO RESOLUTION 80 (REV.WRC-07)

RRB Report to WRC-2000

In the RRB Report to WRC-2000¹, several members of the Board noted some difficulties likely to be experienced by administrations, particularly administrations of developing countries, as follows:

- the “first-come first-served” concept restricts and sometimes prevents access to and use of certain frequency bands and orbit positions;
- a relative disadvantage for developing countries in coordination negotiations due to various reasons such as a lack of resources and expertise;
- perceived differences in consistency of application of the Radio Regulations;
- the submitting of “paper” satellites that restricts access options;
- the growing use of the bands of the Plans of Appendices 30 and 30A by regional, multichannel systems, which may modify the main purpose of these Plans to provide equitable access to all countries;

¹ This Report can be found in Document 29 to WRC-2000.

- the considerable processing delays in the Radiocommunication Bureau are due to the very complex procedures required and the large number of filings submitted; these delays contribute to a coordination backlog of 18 months which could extend to three years and creates uncertain regulatory situations, additional delay in the coordination process that cannot be overcome by administrations, and the possible loss of the assignment because the allotted time is exceeded;
- satellite systems may already be in orbit before completion of coordination;
- statutory time-frames, such as those in No. **11.48**, may often be insufficient for developing countries to be able to complete the regulatory requirements as well as the design, construction and launch of satellite systems;
- no provisions for international monitoring to confirm the bringing into use of satellite networks (assignments and orbits).

ANNEX 2 TO RESOLUTION 80 (REV.WRC-07)

RRB Report to WRC-03

In the RRB Report to WRC-03², concepts to satisfy *resolves* 2 of Resolution **80 (WRC-2000)** were provided, as follows:

- special measures for countries submitting their first satellite filing:
 - on an exceptional basis, special consideration could be given to countries submitting their first filing for a satellite system, taking into account the special needs of developing countries;
 - such consideration should take into account the following:
 - impact on other administrations;
 - satellite service of the system (i.e. FSS, MSS, BSS);
 - frequency band covered by the filing;
 - system is intended to meet the direct needs of the country(s) concerned;
- extension of the regulatory time-limit for bringing into use:
 - conditions could be specified under which extensions might be granted on an exceptional basis to developing countries when they are not able to complete the regulatory date requirements, so that sufficient time for design, construction and launch of satellite systems is made available;
 - the conditions created under the previous paragraph should be included in the Radio Regulations as provisions that would allow the Radiocommunication Bureau to grant the extension.

² This Report can be found in Addendum 5 to Document 4 to WRC-03.

RESOLUTION 81 (REV.WRC-15)

Evaluation of the administrative due diligence procedure for satellite networks

The World Radiocommunication Conference (Geneva, 2015),

considering

- a)* that WRC-97 adopted Resolution **49 (WRC-97)*** establishing administrative due diligence procedure applicable to some satellite radiocommunication services with effect from 22 November 1997;
- b)* that the Plenipotentiary Conference adopted Resolution 85 (Minneapolis, 1998) on evaluation of the administrative due diligence procedure for satellite networks;
- c)* that Resolution 85 (Minneapolis, 1998) instructs the Director of the Radiocommunication Bureau to inform WRC-2000 about the effectiveness of the administrative due diligence procedure, in accordance with Resolution **49 (WRC-97)***;
- d)* that Resolution 85 (Minneapolis, 1998) resolves that WRC-2000 shall evaluate the results of the implementation of the administrative due diligence procedure and shall inform the next Plenipotentiary Conference, in 2002, of its conclusions in that regard;
- e)* the report of the Director of the Radiocommunication Bureau on the administrative due diligence procedure applicable to some satellite networks;
- f)* the proposals made to this Conference to strengthen the administrative due diligence procedure, and to adopt financial due diligence procedures,

noting

- a)* that the Bureau has not encountered any administrative difficulty in applying the provisions and in gathering and publishing information;
- b)* that the Bureau has taken action pursuant to *resolves* 6 of Resolution **49 (WRC-97)*** to cancel the submissions, and accordingly publish the related special sections, in respect of 36 satellite networks;
- c)* that, for all of these cancellations, the maximum (nine-year) period for bringing into use pursuant to *resolves* 1 and 2 of Resolution **51 (WRC-97)**** and No. **11.44** had been reached and hence the submissions would have been cancelled in any event;
- d)* that, when requested to provide due diligence information (triggered by the original date of bringing into use of their satellite networks), administrations have generally requested, wherever possible, extensions of the regulatory period for bringing into use up to the maximum limit authorized by the Radio Regulations;

* *Note by the Secretariat:* This Resolution was revised by WRC-07, WRC-12, WRC-15, WRC-19 and WRC-23.

** *Note by the Secretariat:* This Resolution was abrogated by WRC-15.

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e) that the effect of the administrative due diligence procedure may not, therefore, be fully apparent until at least 21 November 2003,

recognizing

that the administrative due diligence procedure has not yet had any impact on the problem of reservation of orbit and spectrum capacity without actual use,

resolves

1 that further experience is needed in the application of the administrative due diligence procedures adopted by WRC-97, and that several years may be needed to see whether the procedure produces satisfactory results;

2 that it is premature to consider the adoption, among other procedures, of any financial due diligence procedures.

RESOLUTION 85 (REV.WRC-23)

**Application of Article 22 of the Radio Regulations for the protection of
geostationary fixed-satellite service and broadcasting-satellite service networks
from non-geostationary fixed-satellite service systems**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that WRC-2000 adopted, in Article **22**, single-entry limits applicable to non-geostationary (non-GSO) fixed-satellite service (FSS) systems in certain parts of the frequency range 10.7-30 GHz to protect geostationary-satellite (GSO) networks operating in the same frequency bands;
- b)* that, taking into account Nos. **22.5H** and **22.5I**, wherever the limits referred to in *considering a)* are exceeded by a non-GSO FSS system to which the limits apply without the agreement of the concerned administrations, this constitutes a violation of the obligations under No. **22.2**;
- c)* that Recommendation ITU-R S.1503 provides a functional description to be used in developing software tools for determining the conformity of non-GSO FSS networks with limits contained in Article **22**;
- d)* that there was no software tool available to the Radiocommunication Bureau for equivalent power flux-density (epfd) examinations until the publication of the Circular Letter CR/414 on 6 December 2016 informing administrations of the availability of software for implementing Recommendation ITU-R S.1503-2;
- e)* that the software may not adequately model certain non-GSO FSS systems and further improvements to Recommendation ITU-R S.1503 may be necessary;
- f)* that, before the availability of the epfd validation software, the Bureau had requested commitments from the notifying administrations that they will meet the epfd limits in Tables **22-1A**, **22-1B**, **22-1C**, **22-1D**, **22-1E**, **22-2** and **22-3**, and that under these commitments the Bureau gave qualified favourable findings to their systems;
- g)* that the epfd validation software based on Recommendation ITU-R S.1503-2 does not allow the Bureau to perform examinations in relation to Nos. **9.7A** and **9.7B** when earth stations communicate with GSO space stations in inclined orbits and, thus, Recommendation ITU-R S.1714 was revised to assist the Bureau with this task;

h) that, during the examination under Nos. **9.35** and **11.31**, the Bureau examines non-GSO FSS systems to ensure their compliance with the single-entry epfd limits given in Tables **22-1A**, **22-1B**, **22-1C**, **22-1D**, **22-1E**, **22-2** and **22-3**,

recognizing

that some non-GSO FSS systems are pending review of the qualified favourable findings despite the availability of epfd validation software,

resolves

1 that when the Bureau is unable to examine non-GSO FSS systems subject to Nos. **22.5C**, **22.5D** and **22.5F** under Nos. **9.35** and/or **11.31**, the notifying administration shall send to the Bureau a commitment that the non-GSO FSS system complies with the limits given in Tables **22-1A**, **22-1B**, **22-1C**, **22-1D**, **22-1E**, **22-2** and **22-3** in addition to the information submitted under Nos. **9.30** and **11.15**; a detailed technical description including the results of epfd calculations using existing epfd validation software, the results of epfd calculations using simulation software with adequate modelling of the non-GSO satellite FSS system, and identification of particular areas of the most recent version of Recommendation ITU-R S.1503 that fail to adequately model the non-GSO system shall also be provided;

1 bis that the Bureau shall promptly make available on the ITU website the information referred to in *resolves* 1 that it has received from the administration of the non-GSO satellite system, and publish it in the Radiocommunication Bureau International Frequency Information Circular (BR IFIC);

2 that the Bureau shall issue either a qualified favourable finding under No. **9.35** or a favourable finding with a date of review under No. **11.31** with respect to the limits contained in Tables **22-1A**, **22-1B**, **22-1C**, **22-1D**, **22-1E**, **22-2** and **22-3**, if *resolves* 1 is satisfied, otherwise the non-GSO FSS system will receive a definitive unfavourable finding;

3 that, if an administration believes that a non-GSO FSS system, for which the commitment referred to in *resolves* 1 was sent, has the potential to exceed the limits given in Tables **22-1A**, **22-1B**, **22-1C**, **22-1D**, **22-1E**, **22-2** and **22-3**, it may request from the notifying administration additional information with regard to the compliance with the limits mentioned above; both administrations shall cooperate to resolve any difficulties, with the assistance of the Bureau, if so requested by either of the parties, and may exchange any additional relevant information that may be available;

4 that the Bureau shall determine coordination requirements between GSO FSS earth stations and non-GSO FSS systems under Nos. **9.7A** and **9.7B** based on bandwidth overlap, GSO FSS earth station antenna maximum isotropic gain, *G/T* and emission bandwidth;

5 that *resolves* 1 to 4 shall no longer be applied since, as per *considering d)*, the Bureau has communicated to all administrations via a circular letter that the epfd validation software is available and the Bureau is able to verify compliance with the limits in Tables **22-1A**, **22-1B**, **22-1C**, **22-1D**, **22-1E**, **22-2** and **22-3** and, as per *considering g)*, Recommendation ITU-R S.1714 has been revised and allows the Bureau to determine the coordination requirements between GSO FSS earth stations and non-GSO FSS systems under Nos. **9.7A** and **9.7B** based on all the conditions and criteria specified in Table 5-1 of Appendix 5;

6 that notwithstanding *resolves* 5:

6.1 the course of actions described in *resolves* 2 and 3 (without the need to satisfy *resolves* 1) and *resolves* 4 shall continue to apply for non-GSO systems that can be adequately modelled using the existing version of the epfd validation software tool, notified after the publication of the circular letter referred to in *considering d)*, until the review of all the non-GSO FSS systems with qualified favourable findings is completed; and

6.2 *resolves* 1 to 3 and *resolves* 4, as appropriate, shall continue to apply to non-GSO systems that cannot be adequately modelled by the version of the software available until a new version of the software which adequately models the non-GSO system is made available,

invites the ITU Radiocommunication Sector

1 to amend, as a matter of urgency and taking into account the information referred to in *resolves* 1, as appropriate, the algorithm of Recommendation ITU-R S.1503 to ensure that the epfd validation software available to the Bureau for epfd examinations can adequately model non-GSO satellite FSS systems while maintaining the level of protection for GSO satellite networks in Article **22**;

2 to conduct studies, as a matter of urgency, to ensure that an indefinite application of a qualified favourable finding for a given non-GSO FSS system is avoided,

instructs the Director of the Radiocommunication Bureau

1 to encourage administrations to develop the epfd validation software;

2 to continue to review, using the available epfd validation software, the qualified favourable findings made in accordance with Nos. **9.35** and **11.31**;

3 to review, once a version of the epfd validation software that adequately models the non-GSO systems to which *resolves* 1 applies is available, the qualified favourable findings made in accordance with Nos. **9.35** and **11.31**;

4 to take the necessary actions to implement this Resolution.

RESOLUTION 86 (REV.WRC-07)

**Implementation of Resolution 86 (Rev. Marrakesh, 2002) of
the Plenipotentiary Conference**

The World Radiocommunication Conference (Geneva, 2007),

considering

a) that the Plenipotentiary Conference (Marrakesh, 2002) discussed the application of Resolution 86 (Minneapolis, 1998) and decided to request WRC-03 to determine the scope and criteria to be used by future world radiocommunication conferences (WRCs) in the application of Resolution 86 (Rev. Marrakesh, 2002);

b) that the Plenipotentiary Conference (Antalya, 2006) invited WRC-07 to consider Resolution 86 (Marrakesh, 2002) and to report the results to the 2010 Plenipotentiary Conference,

recognizing

that the Radio Regulations Board makes suggestions to transform the content of the Rules of Procedure into a regulatory text in accordance with Nos. **13.0.1** and **13.0.2** of Article **13** of the Radio Regulations,

noting

that administrations may also wish to make proposals to transform the content of the Rules of Procedure into a regulatory text for possible inclusion in the Radio Regulations,

resolves to invite future world radiocommunication conferences

1 to consider any proposals which deal with deficiencies and improvements in the advance publication, coordination, notification and recording procedures of the Radio Regulations for frequency assignments pertaining to space services which have either been identified by the Board and included in the Rules of Procedure or which have been identified by administrations or by the Radiocommunication Bureau, as appropriate;

2 to ensure that these procedures, and the related appendices of the Radio Regulations reflect the latest technologies, as far as possible,

invites administrations

to consider, in preparing for PP-10, appropriate action with regard to Resolution 86 (Rev. Marrakesh, 2002).

RESOLUTION 95 (REV.WRC-19)

General review of the Resolutions and Recommendations of world administrative radio conferences and world radiocommunication conferences

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that it is important to keep the Resolutions and Recommendations of past world administrative radio conferences (WARCs) and world radiocommunication conferences (WRCs) under constant review, in order to keep them up to date;
- b)* that the reports of the Director of the Radiocommunication Bureau submitted to previous conferences provided a useful basis for a general review of the Resolutions and Recommendations of past conferences;
- c)* that some principles and guidelines are necessary for future conferences to treat the Resolutions and Recommendations of previous conferences which are not explicitly related to the agenda of the conference,

resolves

that recommended agendas for future WRCs should include a standing agenda item to review the Resolutions and Recommendations of previous conferences that are not related to any other agenda item of the conference with a view to:

- abrogating those Resolutions and Recommendations that have served their purpose or have become no longer necessary;
- reviewing the need for those Resolutions and Recommendations, or parts thereof, requesting ITU Radiocommunication Sector (ITU-R) studies on which no progress has been made during the last two periods between conferences;
- updating and modifying Resolutions and Recommendations, or parts thereof, that have become out of date, and to correct obvious omissions, inconsistencies, ambiguities or editorial errors and effect any necessary alignment,

invites future competent world radiocommunication conferences

1 to review the Resolutions and Recommendations of previous conferences that are related to the agenda items of the conference, other than the standing agenda item mentioned in *resolves*, under those specific agenda items, with a view to their possible revision, replacement or abrogation, and to take appropriate action;

2 at the beginning of the conference, to determine which committee within the conference has the primary responsibility to review each of the Resolutions and Recommendations of previous conferences,

instructs the Director of the Radiocommunication Bureau

1 to conduct a general review of the Resolutions and Recommendations of previous conferences and, after consultation with the Radiocommunication Advisory Group and the chairmen and vice-chairmen of the radiocommunication study groups, submit a report to the second session of the Conference Preparatory Meeting (CPM) in respect of *resolves* and *invites future competent world radiocommunication conferences* 1, including an indication of any associated agenda items;

2 to include in the above report, with the cooperation of the chairmen of the radiocommunication study groups, the progress reports of ITU-R studies on the issues which have been requested by Resolutions and Recommendations of previous conferences but which are not placed on the agendas of the forthcoming two conferences,

invites administrations

to submit contributions on the implementation of this Resolution to the second session of CPM and the conference,

invites the Conference Preparatory Meeting

to include, in its Report, the results of the general review of the Resolutions and Recommendations of previous conferences, based on the contributions by administrations to the second session of CPM and the above-mentioned Report of the Director, in order to facilitate the follow-up by the conference.

RESOLUTION 99 (REV.WRC-23)

**Provisional application of certain provisions of the Radio Regulations
as revised by the 2023 World Radiocommunication Conference
and abrogation of certain Resolutions and Recommendations**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that this conference has, in accordance with its terms of reference, adopted a partial revision to the Radio Regulations (RR), which will enter into force on 1 January 2025;
- b)* that some of the provisions, as amended by this conference, need to apply provisionally before that date;
- c)* that, as a general rule, new and revised Resolutions and Recommendations enter into force at the time of the signing of the Final Acts of a conference;
- d)* that, as a general rule, Resolutions and Recommendations which a world radiocommunication conference has decided to suppress are abrogated at the time of the signing of the Final Acts of a conference,

resolves

1 that the date of entry into force of the frequency bands 1 614.4225-1 618.725 MHz or 1 616.3-1 620.38 MHz and 2 483.59-2 499.91 MHz, Nos. **5.368**, **5.372A**, **33.50**, **33.53**, as well as Appendix **15** for the frequency bands 1 614.4225-1 618.725 MHz or 1 616.3-1 620.38 MHz and 2 483.59-2 499.91 MHz is stipulated in *resolves 6* of Resolution **365 (WRC-23)**;

2 that, as of 16 December 2023, the following provisions of the Radio Regulations shall provisionally apply:

- Appendix **30**: 4.1.10d; 4.1.13bis; 4.1.13ter; 4.1.30; 4.1.31; 4.1.32; 5.1.6bis;
- Appendix **30A**: 4.1.10d; 4.1.13bis; 4.1.13ter; 4.1.34; 4.1.35; 4.1.36; 5.1.10bis;
- Appendix **30B**: 6.4bis; 6.15; 6.15quat; 6.15quin; 6.27bis; 6.29bis; 6.29ter; 8.10bis; 8.10ter,

further resolves

to abrogate the following Resolutions as of 16 December 2023:

Resolution **75 (Rev.WRC-12)**

Resolution **160 (WRC-15)**

Resolution **161 (WRC-15)**

Resolution **171 (WRC-19)**

Resolution **428 (WRC-19)**

Resolution **429 (WRC-19)**

Resolution **430 (WRC-19)**

Resolution **656 (Rev.WRC-19)**

Resolution **172 (WRC-19)**

Resolution **173 (WRC-19)**

Resolution **174 (WRC-19)**

Resolution **175 (WRC-19)**

Resolution **177 (WRC-19)**

Resolution **178 (WRC-19)**

Resolution **245 (WRC-19)**

Resolution **246 (WRC-19)**

Resolution **247 (WRC-19)**

Resolution **248 (WRC-19)**

Resolution **250 (WRC-19)**

Resolution **361 (Rev.WRC-19)**

Resolution **427 (WRC-19)**

Resolution **657 (Rev.WRC-19)**

Resolution **661 (WRC-19)**

Resolution **662 (WRC-19)**

Resolution **772 (WRC-19)**

Resolution **773 (WRC-19)**

Resolution **774 (WRC-19)**

Resolution **776 (WRC-19)**

Resolution **811 (WRC-19)**

Resolution **812 (WRC-19)**

Resolution **904 (WRC-07)**

Resolution **907 (Rev.WRC-15)**

Resolution **908 (Rev.WRC-15)**

RESOLUTION 111 (ORB-88)

**Planning of the fixed-satellite service in the bands 18.1-18.3 GHz,
18.3-20.2 GHz and 27-30 GHz¹**

The World Administrative Radio Conference on the Use of the Geostationary-Satellite Orbit and the Planning of Space Services Utilizing It (Second Session – Geneva, 1988),

considering

a) that WARC Orb-85 in its Report to WARC Orb-88, requested the ITU-R to study the technical characteristics of the fixed-satellite service in the bands 18.1-18.3 GHz, 18.3-20.2 GHz and 27-30 GHz with a view to a decision on the future planning of these bands for the fixed-satellite service being taken by a future competent conference;

b) that the ITU-R concluded that it would be extremely unwise for these bands to be subject to planning at this time and that further study would be necessary,

recognizing

1 that these bands have not been exploited extensively due to technical and economic reasons, although they potentially have great capacity;

2 that the required satellite orbital spacing may be reduced, thus resulting in easier coordination between satellite networks because narrower satellite antenna beamwidths can be achieved than in the lower frequency bands;

3 that different performance criteria may well be necessary from those which currently exist for frequency bands below 15 GHz, since the propagation characteristics are different,

resolves

that the bands 18.1-18.3 GHz, 18.3-20.2 GHz and 27-30 GHz shall not be included in frequency bands identified for planning at this time,

invites the ITU-R

to continue its studies into the technical characteristics of the bands 18.1-18.3 GHz, 18.3-20.2 GHz and 27-30 GHz until a decision is taken by a future competent conference.

¹ WRC-97 made editorial amendments to this Resolution.

RESOLUTION 114 (REV.WRC-15)

**Compatibility between the aeronautical radionavigation service and the
fixed-satellite service (Earth-to-space) (limited to feeder links of the
non-geostationary mobile-satellite systems in the mobile-satellite service)
in the frequency band 5 091-5 150 MHz**

The World Radiocommunication Conference (Geneva, 2015),

considering

- a) the current allocation of the frequency band 5 000-5 250 MHz to the aeronautical radionavigation service;
- b) the requirements of both the aeronautical radionavigation and the fixed-satellite (FSS) (Earth-to-space) (limited to feeder links of non-geostationary satellite (non-GSO) systems in the mobile-satellite service (MSS)) services in the above-mentioned band,

recognizing

- a) that priority must be given to the microwave landing system (MLS) in accordance with No. 5.444 and to other international standard systems of the aeronautical radionavigation service in the frequency band 5 030-5 091 MHz;
- b) that, in accordance with Annex 10 of the Convention of the International Civil Aviation Organization (ICAO) on international civil aviation, it may be necessary to use the frequency band 5 091-5 150 MHz for the MLS if its requirements cannot be satisfied in the frequency band 5 030-5 091 MHz;
- c) that the FSS providing feeder links for non-GSO systems in the MSS will need continuing access to the frequency band 5 091-5 150 MHz,

noting

- a) that Recommendation ITU-R S.1342 describes a method for determining coordination distances between international standard MLS stations operating in the frequency band 5 030-5 091 MHz and FSS earth stations providing Earth-to-space feeder links in the frequency band 5 091-5 150 MHz;
- b) the small number of FSS stations to be considered,

resolves

that administrations authorizing stations providing feeder links for non-GSO systems in the MSS in the frequency band 5 091-5 150 MHz shall ensure that they do not cause harmful interference to stations of the aeronautical radionavigation service,

invites administrations

when assigning frequencies in the frequency band 5 091-5 150 MHz to stations of the aeronautical radionavigation service or to earth stations of the FSS providing feeder links of the non-GSO systems in the MSS (Earth-to-space), to take all practicable steps to avoid mutual interference between them,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO.

RESOLUTION 121 (WRC-23)

**Use of the frequency band 12.75-13.25 GHz by earth stations in motion
on aircraft and vessels communicating with geostationary
space stations in the fixed-satellite service**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that WARC Orb-88 established an Allotment Plan for the use of the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz by the fixed-satellite service (FSS);
- b)* that WRC-07 revised the regulatory regime governing the use of the frequency bands referred to in *considering a)* above;
- c)* that the objective of providing broadband mobile-satellite communications may also be met by allowing earth stations in motion (ESIMs), on aircraft (A-ESIMs) and vessels (M-ESIMs), to communicate with geostationary space stations of an FSS network in the frequency bands 12.75-13.25 GHz (Earth-to-space) and the associated downlink frequency bands of that satellite; thus, for example, the frequency bands 10.70-10.95 GHz and 11.20-11.45 GHz of Appendix **30B** may be used;
- d)* that the frequency band 12.75-13.25 GHz is currently allocated on a primary basis to the FSS (Earth-to-space), fixed and mobile services and on a secondary basis to the space research service (space-to-Earth);
- e)* that the operation of services to which the frequency band 12.75-13.25 GHz is allocated and of services in adjacent bands needs to be protected from A-ESIMs and M-ESIMs;
- f)* that the frequency band 12.75-13.25 GHz (Earth-to-space) is used in the geostationary-satellite orbit (GSO) by FSS networks in accordance with the provisions of Appendix **30B** (No. **5.441**) and that there are many existing GSO FSS satellite networks operating in that frequency band;
- g)* that the objective of the procedures in Appendix **30B** is to guarantee, for all countries, equitable access to the GSO in the frequency bands of the FSS covered by that Appendix;
- h)* that regulatory provisions and interference-management mechanisms, including necessary mitigation measures and associated techniques, are required for the operation of A-ESIMs and M-ESIMs in the frequency band 12.75-13.25 GHz (Earth-to-space) to protect other services with allocations in that frequency band and adjacent frequency bands and without adversely affecting those services and their future development, taking into account the provisions of Appendix **30B** (see also *further resolves 2* on responsibilities);

i) that, in Appendix **30B**, the frequency bands in the space-to-Earth direction corresponding to the frequency band 12.75-13.25 GHz (Earth-to-space) are 10.70-10.95 GHz and 11.20-11.45 GHz, which may be used by A-ESIMs and M-ESIMs, subject to not claiming protection from other services and applications of the FSS and other radiocommunication services to which the frequency band is allocated;

j) that there is no publicly available information on coordination agreements reached among administrations regarding GSO FSS satellite networks, except on whether coordination has been completed, which is provided to the Radiocommunication Bureau;

k) that the operation of A-ESIMs and M-ESIMs requires the establishment of one or more gateway earth station facilities in one or several countries that are within the service area of the associated satellite network and that are authorized by the administration of the territory where such earth stations are located,

considering further

a) that A-ESIMs and M-ESIMs operating within the agreed service area of the satellite network with which they communicate may provide services within the territories under the jurisdiction of multiple administrations;

b) that the operation of ESIMs within the territory under the jurisdiction of administrations mentioned in *considering further a)* above is subject to obtaining authorization from those administrations,

recognizing

a) that Article 44 of the ITU Constitution contains the basic principles for the use of the radio-frequency spectrum and the GSO and other satellite orbits, taking into account the needs of developing countries;

b) that administrations intending to authorize A-ESIMs and M-ESIMs, when establishing national licensing rules, may consider adopting other interference management procedures and/or mitigation measures than those contained in this Resolution, as long as the provisions in Annex 2 are unchanged in cross border applications;

c) that, pursuant to the relevant provisions in Appendix **30B**, the operation of ESIMs in the frequency band 12.75-13.25 GHz may only be within the service area of the Appendix **30B** network for which the explicit agreement of any administration whose territory is partially or wholly included in that service area has been obtained;

d) that § 6.16 of Article 6 of Appendix **30B** provides the opportunity to any administration at any time to request that its territory be excluded from the service area of any assignment governed by Appendix **30B**;

e) that the operation of an A-ESIM or M-ESIM associated and communicating with a space station of a given satellite network needs the earth station to be within the coordinated and agreed service area of the satellite network under the relevant provisions of Appendix **30B**;

f) that, based on the available information in the Bureau's database in May 2022, there is no contiguous regional or worldwide coordinated and agreed service area for any satellite network using the Appendix **30B** frequency band 12.75-13.25 GHz recorded in the Master International Frequency Register (MIFR);

g) that, in order for A-ESIMs and M-ESIMs to operate in the Appendix **30B** frequency band 12.75-13.25 GHz (Earth-to-space) in an efficient and operationally viable manner, having a contiguous regional or worldwide coordinated and agreed service area is an important issue to be taken into account;

h) that the administration authorizing ESIMs on the territory under its jurisdiction has the right to require that the ESIMs referred to above only use those assignments associated with GSO FSS networks which have been successfully coordinated, notified, brought into use and recorded in the MIFR with a favourable finding under § 8.11 of Article 8 of Appendix **30B**, except those arising from the application of § 6.25 of Appendix **30B**;

i) that Resolution **170 (Rev.WRC-23)** provides the procedure to enhance equitable access to frequency bands under Appendix **30B** by developing countries;

j) that the protection of current usage and future development of Appendix **30B** in the frequency band 12.75-13.25 GHz (Earth-to-space) is a fundamental issue without any adverse effect thereto;

k) that the availability of the methodology to examine conformity with the power flux-density (pfd) limits as contained in Annex 2 to this Resolution is a fundamental and crucial element;

l) that there is a need to establish regulatory, technical and recording procedures for the usage of these types of ESIM that may differ from the current FSS Appendix **30B** Plan and List recording procedures;

m) that successful implementation of this Resolution does not oblige any administration to authorize/license A-ESIMs and M-ESIMs communicating with GSO space stations in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space) to operate on the territory under its jurisdiction (see *resolves* 7);

n) that, in accordance with Appendix **30B**, the examination by the Bureau of the frequency assignments in the frequency band 12.75-13.25 GHz (Earth-to-space) is limited to the test-points on land; it is necessary to examine the compatibility of A-ESIMs and M-ESIMs using grid points generated within the entire service area of A-ESIMs and M-ESIMs submitted under Appendix **4** (see Annex 1 to this Resolution);

o) that any administration retains its right to regulate and exercise its authority within its jurisdiction, recalling the Preamble to the Constitution,

recognizing further

a) that, under *resolves* 1.1.4 below, frequency assignments to GSO A-ESIMs and M-ESIMs need to be notified to the Bureau;

b) that, for the operation of GSO A-ESIMs and M-ESIMs, notification of any frequency assignment under Annex 1 to this Resolution shall only be made by one single administration, which is the notifying administration for the GSO FSS network with which the ESIMs communicate;

- c) that an administration authorizing the operation of GSO A-ESIMs and M-ESIMs within the territory under its jurisdiction may modify and/or withdraw that authorization at any time;
- d) that the three elements consisting of the interference management mechanism, switching facility for on/off function and the function of the network control and monitoring centre (NCMC) and their relations with each other and sequence of actions, together with estimated time for that action/function, are needed for the proper and effective operation of GSO A-ESIMs and M-ESIMs;
- e) that the operation of A-ESIMs and M-ESIMs shall comply with the provisions of No. **5.340**;
- f) that, when the Appendix **30B** GSO FSS satellite network with which A-ESIMs and M-ESIMs communicate transmits in the frequency bands 10.70-10.95 GHz and 11.20-11.45 GHz, it shall operate under the levels that were coordinated and included in the List, and that these Appendix **30B** satellite transmissions shall not change to accommodate A-ESIMs and M-ESIMs,

resolves

1 that, for any A-ESIM or M-ESIM communicating with a GSO FSS space station within the frequency band 12.75-13.25 GHz (Earth-to-space) or parts thereof, the following conditions shall apply:

- 1.1 with respect to space services in the frequency band 12.75-13.25 GHz and adjacent bands, A-ESIMs and M-ESIMs shall comply with the following conditions:
 - 1.1.1 the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by A-ESIMs and M-ESIMs shall not result in any changes or restrictions to allotments in the Plan, assignments in the List of Appendix **30B**, and assignments recorded in the MIFR, including the assignments arising from the implementation of Resolution **170 (Rev.WRC-23)**;
 - 1.1.2 with respect to satellite networks of other administrations, the characteristics of A-ESIMs and M-ESIMs shall remain within the envelope of typical characteristics of notified earth stations associated with the satellite networks with which these earth stations communicate, as published by the Bureau and included in its relevant International Frequency Information Circular (BR IFIC), and Annex 1 to this Resolution applies;
 - 1.1.3 the use of A-ESIMs and M-ESIMs shall not cause any interference to Appendix **30B** allotments, assignments received by the Bureau under Article 6 either in process or yet to be processed, assignments in the List, assignments notified under Article 8 of that Appendix, and assignments recorded in the MIFR, as well as submissions under Appendix **30B**, beyond that specified in the relevant Annexes to that Appendix;
 - 1.1.4 for the implementation of *resolves* 1.1.1, 1.1.2 and 1.1.3 above, the notifying administration for the GSO FSS network with which the above-mentioned A-ESIMs and M-ESIMs communicate shall follow the procedure in Annex 1 to this Resolution, together with the commitment that the operation of ESIMs shall be in conformity with the Radio Regulations, including this Resolution;

- 1.1.5 upon receipt of the notification information referred to in *resolves* 1.1.4 above, the Bureau shall process the submission in accordance with Annex 1 to this Resolution;
- 1.1.6 for the protection of non-GSO FSS systems operating in the frequency band 12.75-13.25 GHz, the above-mentioned A-ESIMs and M-ESIMs communicating with GSO FSS networks referred to above shall comply with the provisions contained in Annex 3 to this Resolution;
- 1.1.7 the notifying administration for the GSO FSS network with which the above-mentioned A-ESIMs and M-ESIMs communicate shall ensure that the operation of the A-ESIMs and M-ESIMs complies with the coordination agreements for the frequency assignments to the earth station of that GSO FSS satellite network of Appendix **30B** obtained under the relevant provisions of that Appendix;
- 1.1.8 the receiving part of the above-mentioned A-ESIMs and M-ESIMs in their associated frequency band shall not adversely affect the allotments in the Plan or the assignments in the List and shall not claim protection from other applications of the FSS or other radiocommunication services to which the frequency band is allocated;
- 1.2 with respect to the protection of terrestrial services to which the frequency band 12.75-13.25 GHz is allocated and that operate in accordance with the Radio Regulations, A-ESIMs and M-ESIMs shall comply with the following conditions:
 - 1.2.1 transmitting GSO A-ESIMs and M-ESIMs in the frequency band 12.75-13.25 GHz (Earth-to-space) shall not cause unacceptable interference to terrestrial services to which that frequency band is allocated and that operate in accordance with the Radio Regulations, and Annex 2 to this Resolution shall apply;
 - 1.2.2 the receiving part of the above-mentioned GSO A-ESIMs and M-ESIMs operating in the frequency bands mentioned in *recognizing further f)* shall not claim protection from terrestrial services to which those frequency bands are allocated and that are operating in accordance with the Radio Regulations;
 - 1.2.3 the requirement not to cause unacceptable interference to terrestrial services to which the frequency band 12.75-13.25 GHz is allocated and that operate in accordance with the Radio Regulations shall be respected, irrespective of compliance with Annex 2 (see *further resolves 7)*;
 - 1.2.4 for the application of Part II of Annex 2 as referred to in *resolves* 1.2.1 above, the Bureau shall examine the characteristics of A-ESIMs with respect to conformity with the pfd limits at any point on the Earth's surface specified in Part II of Annex 2, in accordance with the methodology described in Annex 4 to this Resolution, and publish the results of such examination in the BR IFIC; in the event of non-compliance with the pfd limits set out in Part II of Annex 2, the Bureau shall formulate an unfavourable finding and return the notice to the notifying administration;
 - 1.2.5 if an administration authorizing A-ESIMs agrees to pfd levels higher than the limits contained in Part II of Annex 2 within the territory under its jurisdiction, such agreement shall in no way affect other administrations that are not party to that agreement;

1.3 A-ESIMs and M-ESIMs communicating with GSO FSS networks shall not cause unacceptable interference to the aeronautical radionavigation service (ARNS) operating in accordance with the Radio Regulations in the frequency band 13.25-13.40 GHz;

2 that only frequency assignments of Appendix **30B** recorded in the List may be used as supporting assignments for A-ESIMs and M-ESIMs communicating with GSO FSS networks in the frequency band 12.75-13.25 GHz (Earth-to-space), if those assignments are recorded in the MIFR with a favourable finding under § 8.11 of Article 8 of Appendix **30B**;

2.1 if assignments to GSO FSS networks notified under § 6.25 of Appendix **30B** are used for the operation of the above-mentioned A-ESIMs and M-ESIMs, those assignments may be used for GSO A-ESIMs and M-ESIMs only in accordance with §§ 6.26 and 6.29 of Appendix **30B**;

2.2 for the implementation of *resolves* 2.1 above, the notifying administration for the GSO FSS network with which GSO A-ESIMs and M-ESIMs communicate shall send the Bureau a commitment that the operation shall be in conformity with *resolves* 2.1 and *further resolves* 2, 2.1 and 2.2 below;

3 that the operation of A-ESIMs and M-ESIMs communicating with GSO FSS space stations in the frequency band 12.75-13.25 GHz (Earth-to-space) shall be within the coordinated and notified service area of the GSO FSS network;

4 that, for the implementation of *resolves* 3 above, the notifying administration for the GSO FSS network with which the A-ESIMs and M-ESIMs communicate shall ensure that the necessary arrangements and switching facilities are built into the A-ESIMs and M-ESIMs to cease emissions once approaching the territory under the jurisdiction of those administrations which either are not within the notified and coordinated service area of the subject space station or have not authorized operation over their territories;

5 that any course of action taken under this Resolution have no impact on the original date of receipt of the frequency assignments of the GSO FSS satellite network with which A-ESIMs and M-ESIMs communicate, or on the coordination requirements of that satellite network;

6 that A-ESIMs and M-ESIMs shall not be used or relied upon for safety-of-life applications;

7 that the operation of A-ESIMs and M-ESIMs within territorial waters and/or airspace under the jurisdiction of another administration shall be carried out only if a licence under No. **18.1**, or the authorization of that administration, is obtained;

8 that gateway earth station facilities for A-ESIMs and M-ESIMs shall be within the service area of the satellite network associated with that gateway;

9 that, in the event that unacceptable interference caused by A-ESIMs and/or M-ESIMs is reported:

9.1 the notifying administration for the GSO FSS network with which the A-ESIMs and M-ESIMs communicate be responsible for eliminating the case of unacceptable interference; consequently, no other administration shall be held responsible for eliminating cases of unacceptable interference (see also *resolves* 9.2 below);

9.2 any authorizing administration, subject to its explicit agreement and to the extent of its ability, provide any available information that may help eliminate the case of unacceptable interference;

9.3 the administration responsible for the aircraft or vessel on which an ESIM operates shall provide, when requested, the affected administration with a point of contact to assist in identifying the notifying administration for the satellite with which the ESIM communicates, which is responsible for eliminating the case of unacceptable interference (see *resolves* 9.1 and 9.2);

10 that the notifying administration for the GSO FSS satellite network with which the GSO A-ESIMs and M-ESIMs communicate shall ensure that:

10.1 A-ESIMs and M-ESIMs employ the minimum requirements specified in Annex 5 to this Resolution;

10.2 for the operation of A-ESIMs and M-ESIMs, techniques are employed to maintain adequate pointing accuracy of the antenna towards the associated GSO FSS satellite to avoid inadvertently tracking an adjacent GSO satellite;

10.3 all necessary measures shall be taken so that A-ESIMs and M-ESIMs are subject to permanent monitoring and control by an NCMC or equivalent facility in order to comply with the provisions of this Resolution, and are capable of receiving and immediately acting upon, *inter alia*, “enable transmission” and “disable transmission” commands from the NCMC;

10.4 measures are taken so that the A-ESIMs and/or M-ESIMs do not transmit on territory under the jurisdiction of an administration, including its territorial waters and national airspace, that either is not in the coordinated and notified service area of the GSO satellite network or has not authorized their use on its territory;

10.5 a permanent point of contact shall be provided in the Appendix 4 submission under Annex 1 of this Resolution and published in the special section by the notifying administration for the GSO FSS network for the purpose of tracing any suspected cases of unacceptable interference from A-ESIMs and M-ESIMs and to immediately respond to such requests;

11 that the operation of GSO A-ESIMs and M-ESIMs, including operation of the NCMC, interference management system, and mechanism and functioning of switching facilities, be subject to the availability of the ITU-R Recommendation referred to in *invites the ITU Radiocommunication Sector* below, with the understanding that, in the meantime, *further resolves* 2, 2.1 and 2.2 strictly apply;

12 that the operation of GSO A-ESIMs and M-ESIMs under frequency assignments recorded under § 6.25 of Appendix **30B**, including operation of the NCMC, interference management system, and mechanism and functioning of switching facilities, be subject to the availability of the ITU-R Recommendation referred to in *invites the ITU Radiocommunication Sector* below, with the understanding that, in the meantime, *further resolves* 2, 2.1 and 2.2 strictly apply,

further resolves

1 that compliance with this Resolution in no way whatsoever release the notifying administration(s) from its/their obligation not to cause unacceptable interference to, or claim protection from, the incumbent services as referred to in this Resolution;

2 that the notifying administration for the GSO network, when submitting Appendix 4 information/data elements, shall send a firm, objective, actionable, measurable and enforceable commitment that, in the event of unacceptable interference being reported, it undertakes to immediately eliminate the interference or reduce it to an acceptable level;

2.1 in case of no action being taken with regard to the obligation referred to in *further resolves* 2 above, the Bureau shall send a reminder and request the notifying administration for the GSO network to comply with the requirements referred to in the commitment;

2.2 should the interference persist 30 days after the dispatch date of the above-mentioned reminder, the Bureau shall submit the case to the subsequent meeting of the Radio Regulations Board (RRB) for review and necessary actions (including suppression of the frequency assignment to the ESIM concerned), as appropriate;

3 that frequency assignments in the frequency band 12.75-13.25 GHz (Earth-to-space) used by A-ESIMs and M-ESIMs communicating with geostationary space stations in the FSS shall be notified to the Bureau under Annex 1 to this Resolution by the notifying administration for the satellite network with which the ESIMs communicate;

4 that the notifying administration for the satellite network shall ensure that A-ESIMs and M-ESIMs operate only in the territory under the jurisdiction of administrations from which authorization has been obtained, taking into account *recognizing further c)* above;

5 that, in accordance with *instructs the Director of the Radiocommunication Bureau* 4 below, the notifying administration for the Appendix **30B** FSS satellite network operating A-ESIMs and M-ESIMs, upon request by the Bureau regarding cases of unacceptable interference reported by affected administrations, shall provide the Bureau with the list of administrations that have authorized ESIM operations to communicate with that satellite network and that are potentially related to a reported case of unacceptable interference;

6 that, for the implementation of *further resolves* 2, the notifying administration responsible for the operation of GSO A-ESIMs and M-ESIMs shall also be responsible for observing and complying with all relevant regulatory and administrative provisions applicable to the operation of the above-mentioned GSO A-ESIMs and M-ESIMs, as contained in this Resolution and in the Radio Regulations;

7 that the authorization for a GSO A-ESIM or M-ESIM to operate in the territory under the jurisdiction of an administration shall in no way release the notifying administration for the satellite network with which the ESIM communicates from the obligation to comply with the provisions contained in this Resolution and in the Radio Regulations,

instructs the Director of the Radiocommunication Bureau

1 to take all necessary actions to facilitate the implementation of this Resolution;

2 to report to future world radiocommunication conferences on any difficulties or inconsistencies encountered in the implementation of this Resolution, including on whether or not the responsibilities relating to the operation of GSO A-ESIMs and M-ESIMs have been properly addressed;

3 to accelerate, to the maximum extent possible, the development and availability of the software required for implementation of the methodology contained in Annex 4 to this Resolution to examine compliance with the pfd limits in Part II of Annex 2 to this Resolution;

4 in the event of unacceptable interference:

4.1 based on information provided by the affected administration, to request the notifying administrations for satellite networks communicating with A-ESIMs and M-ESIMs that could potentially be causing unacceptable interference to promptly provide the relevant list of administrations that have authorized such ESIM operations to the affected administration;

4.2 to provide the affected administration with the list of networks potentially related to the reported case of unacceptable interference;

4.3 if a notifying administration fails to provide the information required under *instructs the Director of the Radiocommunication Bureau* 4.1 above within 45 days from the date of dispatch of the Bureau's request referred to in *instructs the Director of the Radiocommunication Bureau* 4.1, to send the notifying administration a reminder to provide the required list within 15 days from the date of that reminder;

4.4 if a notifying administration fails to provide the required information following the reminder under *instructs the Director of the Radiocommunication Bureau* 4.3 above and if the affected administration has not confirmed to the Bureau that the case of unacceptable interference has been resolved, to submit the case to the subsequent meeting of RRB for review and the necessary actions, as appropriate,

invites the ITU Radiocommunication Sector

to study, as a matter of urgency, with the objective of preparing a Recommendation to be adopted and approved in accordance with Resolution ITU-R 1, the functionalities and implementation of NCMC for ESIMs,

instructs the Secretary-General

1 to bring this Resolution to the attention of the International Maritime Organization and the International Civil Aviation Organization;

2 to bring this Resolution to the attention of the ITU Council with a view to its considering whether cost recovery should be applied to GSO A-ESIMs and M-ESIMs.

ANNEX 1 TO RESOLUTION 121 (WRC-23)

PART I

Procedure to be followed by the administrations and the Bureau for submission of the earth stations in motion on aircraft and vessels operating in the frequency band 12.75-13.25 GHz (Earth-to-space) and for the protection of allotments in the Plan, assignments in the Appendix 30B List and those submitted under Articles 6 and 7 of Appendix 30B as well as under Resolution 170 (Rev.WRC-23)

Section A – Procedure for entering assignments to earth stations in motion on aircraft and vessels in the Appendix 30B ESIM List¹

1 When an administration, or one acting on behalf of a group of named administrations, intends to use as a supporting frequency assignment one or more Appendix **30B** assignments already included in the List and the Master international Frequency Register (MIFR) in support of the operation of earth stations in motion on aircraft (A-ESIMs) and earth stations in motion on vessels (M-ESIMs) in the frequency band 12.75-13.25 GHz, it shall send to the Radiocommunication Bureau, not earlier than eight years but preferably not later than two years before the operation of A-ESIMs and M-ESIMs, the information specified in Appendix **42**.

An assignment in the Appendix **30B** ESIM List shall lapse if it is not brought into use within eight years of the date of receipt by the Bureau of the relevant complete information specified above. A proposed assignment not included in the Appendix **30B** ESIM List within eight years after the date of receipt by the Bureau of the relevant complete information shall also lapse.

2 If the information received by the Bureau under § 1 is found to be incomplete, the Bureau shall immediately seek any clarification required and information not provided from the administration concerned.

3 Upon receipt of a complete notice under § 1, the Bureau shall examine it with respect to its conformity with:

- a) the Table of Frequency Allocations and other provisions³ of the Radio Regulations, except those provisions relating to conformity with the FSS Plan and the coordination procedures;

¹ The List of assignments for earth stations in motion (ESIMs) in the frequency band 12.75-13.25 GHz in Appendix **30B**.

² Submissions may include only the frequency band 12.75-13.0 GHz or 13.0-13.25 GHz.

³ The “other provisions” shall be identified and included in the Rules of Procedure.

- b) Annex 3 to Appendix **30B**;
- c) the on-axis equivalent isotropically radiated power (e.i.r.p.) density and off-axis e.i.r.p. density of the supporting Appendix **30B** assignment(s);
- d) the service area of the supporting Appendix **30B** assignment(s) in respect of explicit agreements of those administrations whose territories are included in the service area⁴; and
- e) the frequency band of the supporting Appendix **30B** assignment(s) in the List in the frequency band 12.75-13.25 GHz.

4 When the examination with respect to § 3 leads to an unfavourable finding, the relevant part of the notice shall be returned to the notifying administration with an indication of the appropriate action.

5 When the examination with respect to § 3 leads to a favourable finding, the Bureau shall use the method of Annex 4 to Appendix **30B** (see § 23) to determine administrations whose:

- a) allotments in the Plan;
- b) assignments which appear in the List; or
- c) assignments which the Bureau has previously examined under § 6.5 of Article 6 of Appendix **30B** after receiving complete information in accordance with § 6.1 of that Article

are considered as being affected and receiving more interference than that produced by the supporting Appendix **30B** assignment(s).

6 The Bureau shall publish, in a special section of its International Frequency Information Circular (BR IFIC), the complete information received under § 1, and examined under § 5, together with the names of the affected administrations, the corresponding allotments in the Plan, assignments in the List and assignments for which the Bureau has previously received complete information in accordance with § 6.1 of Article 6 of Appendix **30B** and which it has examined under § 6.5 of that Article.

7 The Bureau shall immediately inform the administration proposing the assignment in the Appendix **30B** ESIM List, drawing its attention to the information contained in the relevant BR IFIC and the requirement to seek and obtain the agreement of those affected administrations.

8 The Bureau shall also inform each administration listed in the special section of the BR IFIC published under § 6, drawing its attention to the information it contains.

⁴ The service area may be reduced by excluding certain countries for which explicit agreement was obtained.

9 An administration that has not notified its comments either to the administration seeking agreement or to the Bureau within a period of four months following the date of the BR IFIC referred to in § 6 shall be deemed to have not agreed to the proposed assignment in respect of its allotment in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, submission in accordance with Resolution **170 (Rev.WRC-23)**, as appropriate, where the absence of reply/comments shall be construed as its disagreement to the request for coordination. This time-limit shall be extended for an administration that has requested the assistance of the Bureau by up to 30 days following the date on which the Bureau communicated the result of its action. In respect of its frequency assignments under Article 6 of Appendix **30B** other than those mentioned above, the same course of action outlined in § 6.10 of that Article shall apply.

10 Unless coordination is no longer required, the administration responsible for the notice published under § 6 shall seek and obtain the explicit agreement of the relevant affected administrations contained in the special section published under § 6 in respect of allotments in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, an Article 7 request transferred to Article 6, a submission in accordance with Resolution **170 (Rev.WRC-23)**, as appropriate. In this specific case of explicit agreement, any request for the assistance of the Bureau shall not change it to implicit/tacit agreement.

11 If agreements have been reached in accordance with §§ 9 and 10 with administrations published under § 6, the administration responsible for the notice published under § 6 may request the Bureau to have the assignment entered into the Appendix **30B** ESIM List, indicating the final characteristics of the notice⁵ together with the names of the administrations with which agreement has been reached.

12 In submitting such information, noting the requirement of § 1 of Section B, the administration may also request the Bureau to examine the submission in respect of notification under Section B.

13 If the information received by the Bureau under §§ 11 and 12 is found to be incomplete, the Bureau shall immediately seek any clarification required and information not provided from the administration concerned. The Bureau may also provide additional information in order to assist the notifying administration in complying with requirements under §§ 14, 16 and 17.

14 Upon receipt of a complete notice under § 11, the Bureau shall examine each assignment in the notice with respect to its conformity with:

- a) the Table of Frequency Allocations and other provisions⁶ of the Radio Regulations, except those provisions relating to conformity with the FSS Plan and the procedures for coordination;
- b) Annex 3 to Appendix **30B**;
- c) the service area published under § 6;

⁵ Submissions may include only the frequency band 12.75-13.0 GHz or 13.0-13.25 GHz.

⁶ The “other provisions” shall be identified and included in the Rules of Procedure.

- d) the on-axis e.i.r.p. density and off-axis e.i.r.p. density of the assignments published under § 6; and
- e) the frequency band of the assignments published under § 6.

15 When the examination with respect to § 14 of an assignment received under § 11 leads to an unfavourable finding, the notice shall be returned to the notifying administration with an indication that subsequent resubmission under § 11 will be considered with a new date of receipt.

16 When the examination with respect to § 14 of an assignment received under § 11 leads to a favourable finding, the Bureau shall use the method described in Annex 4 to Appendix **30B** to examine if there is any administration and corresponding:

- a) allotment in the Plan;
- b) assignment which appears in the List at the date of receipt of the examined notice submitted under § 1;
- c) assignments which the Bureau has previously examined under § 6.5 of Article 6 of Appendix **30B** after receiving complete information in accordance with § 6.1 of that Article at the date of receipt of the examined notice submitted under § 17,

considered as being affected and receiving more interference than that produced by the supporting Appendix **30B** assignment(s) and whose agreement has not been provided under § 11.

17 The Bureau shall determine if the cumulative interference is caused to an allotment in the Plan or an assignment in the List or an assignment for which the Bureau has received complete information in accordance with Article 6 of Appendix **30B** before the date of receipt of the complete notice under § 11. The cumulative interference shall be calculated based on Appendix 1 to Annex 4 of Appendix **30B**, taking into account assignments in the Appendix **30B** ESIM List together with assignments submitted under § 11. The cumulative interference is considered as being caused when the overall aggregate $(C/I)_{\text{aggregate}}$ value is less than that resulting from the supporting Appendix **30B** assignment(s) with a tolerance of 0.25 dB (inclusive of the 0.05 dB computational precision), except for an allotment in the Plan, an assignment stemming from the conversion of an allotment into an assignment without modification, or when the modification is within the envelope characteristics of the initial allotment, as well as assignments relating to application of Article 7 of Appendix **30B** for which the 0.05 dB computational precision is applicable.

18 In the event of a favourable finding under §§ 16 and 17, the Bureau shall enter the proposed assignment in the Appendix **30B** ESIM List and publish in a special section of the BR IFIC the characteristics of the assignment received under § 11, together with the names of administrations with which the provisions of this procedure have been successfully applied.

⁷ Similar course of action as prescribed in footnote 7bis of § 6.21 of Article 6 of Appendix **30B** applies.

19 When the examination under § 16 or § 17 leads to an unfavourable finding with respect to allotments in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, an Article 7 request transferred to Article 6, or a submission in accordance with Resolution **170 (Rev.WRC-23)**, the Bureau shall return the notice to the notifying administration. In this case, the notifying administration undertakes not to bring into use the frequency assignments until the finding with respect to allotments in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, an Article 7 request transferred to Article 6, or a submission in accordance with Resolution **170 (Rev.WRC-23)**, is favourable. The Bureau, in returning the notice to the notifying administration, shall indicate that the subsequent resubmission under § 11 will be considered with a new date of receipt.

20 When the examination under § 16 or § 17 leads to a favourable finding with respect to allotments in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, an Article 7 request transferred to Article 6, a submission in accordance with Resolution **170 (Rev.WRC-23)**, but an unfavourable finding with respect to others, and if the notifying administration insists that the proposed assignment be included in the Appendix **30B** ESIM List, the Bureau shall enter the assignment provisionally in the Appendix **30B** ESIM List with an indication of those administrations whose assignments were the basis of the unfavourable finding. To this effect, the notifying administration shall include a signed commitment, indicating that the use of an assignment provisionally recorded in the Appendix **30B** ESIM List shall not cause unacceptable interference to, or claim protection from, those assignments for which agreement still needs to be obtained. The entry in the Appendix **30B** ESIM List shall be changed from provisional to definitive only if the Bureau is informed that all required agreements have been obtained.

21 Should the assignments that were the basis of the unfavourable finding not be brought into use within the period specified in § 6.1 of Article 6 of Appendix **30B** or within the extension period under § 6.31*bis* of Article 6 of Appendix **30B**, the status of the assignment in the Appendix **30B** ESIM List shall be reviewed accordingly.

22 Should unacceptable interference be caused by an assignment entered in the Appendix **30B** ESIM List under § 20 to any assignment in the List which was the basis of the disagreement, the notifying administration of the assignment entered in the Appendix **30B** ESIM List under § 20 shall, upon receipt of advice thereof, immediately eliminate this unacceptable interference.

23 For the examinations referred to in Part I and Part II, the Bureau shall generate a set of uplink grid points everywhere within the service area of the relevant assignments to A-ESIMs and M-ESIMs, assuming that A-ESIMs and M-ESIMs are located at these uplink grid points.

Section B – Procedure for notification and recording in the Master International Frequency Register of assignments to earth stations in motion on aircraft and vessels dealt with under this Resolution

1 Any assignment in the ESIM List for which the relevant procedure of Section A and Part II of this Annex has been successfully applied shall be notified to the Bureau using the relevant characteristics listed in Appendix 4, not earlier than three years before the assignment is brought into use.

2 If the first notice referred to in § 1 has not been received by the Bureau within the required period mentioned in § 1 of Section A, the assignments in the Appendix **30B** ESIM List shall be cancelled by the Bureau after having informed the administration at least three months before the expiry of this period.

3 Notices not containing those characteristics specified in Appendix 4 as mandatory or required shall be returned with comments to help the notifying administration to complete and resubmit them, unless the information not provided is immediately forthcoming in response to an inquiry by the Bureau.

4 Complete notices shall be marked by the Bureau with their date of receipt and shall be examined in the order of their dates of receipt. Following receipt of a complete notice, the Bureau shall, as soon as possible after the date of entry of the corresponding assignment into the Appendix **30B** ESIM List or within not more than two months if the corresponding assignment has already been entered in the Appendix **30B** ESIM List, publish its contents, with any diagrams and maps and the date of receipt, in the BR IFIC, which shall constitute the acknowledgement to the notifying administration of receipt of its notice. When the Bureau is not in a position to comply with the time-limit referred to above, it shall periodically so inform the administrations, giving the reasons therefor.

5 The Bureau shall not postpone the formulation of a finding on a complete notice unless it lacks sufficient data to reach a conclusion thereon.

6 Each notice shall be examined:

6.1 with respect to its conformity with the Table of Frequency Allocations and other provisions⁸ of the Radio Regulations, except those provisions relating to conformity with the FSS Plan and the procedures for coordination, which are the subject of the following subparagraph; and

⁸ The “other provisions” shall be identified and included in the Rules of Procedure.

6.2 with respect to its conformity with the FSS Plan, the procedures for coordination and the associated provisions⁹.

7 When the examination with respect to § 6.1 leads to a favourable finding, the assignment shall be examined further with respect to § 6.2; otherwise, the notice shall be returned with an indication of the appropriate action.

8 When the examination with respect to § 6.2 leads to a favourable finding, the ESIM assignment shall be recorded in the MIFR. When the finding is unfavourable, the notice shall be returned to the notifying administration, with an indication of the appropriate action.

9 In every case when a new ESIM assignment is recorded in the MIFR it shall, in accordance with the provisions of this Resolution, include an indication of the finding reflecting the status of the assignment. This information shall also be published in the BR IFIC.

10 A notice of a change in the characteristics of the ESIM assignment already recorded, as specified in Appendix 4, shall be examined by the Bureau under §§ 6.1 and 6.2, as appropriate. Any changes to the characteristics of an assignment that has been recorded and confirmed as having been brought into use shall be brought into use within eight years from the date of the notification of the modification. Any changes to the characteristics of an assignment that has been recorded but not yet brought into use shall be brought into use within the period provided for in § 1 of Section A.

11 In applying the provisions of this Section, any resubmitted notice which is received by the Bureau more than six months after the date on which the original notice was returned by the Bureau shall be considered to be a new notice.

12 All frequency assignments notified in advance of their being brought into use shall be entered provisionally in the MIFR. Any frequency assignment provisionally recorded under this provision shall be brought into use no later than the end of the period provided for in § 1 of Section A. Unless the Bureau has been informed by the notifying administration of the bringing into use of the assignment, it shall, no later than 15 days before the end of the regulatory period established under § 1 of Section A, send a reminder requesting confirmation that the assignment has been brought into use within the regulatory period. If the Bureau does not receive that confirmation within 30 days following the period provided for under § 1 of Section A, it shall cancel the entry in the MIFR and the corresponding assignment in the Appendix 30B ESIM List.

⁹ When an administration notifies any assignment with characteristics different from those entered in the Appendix 30B ESIM List through successful application of the relevant procedure of Section A and Part II of this Annex, the Bureau shall undertake calculations to determine if the proposed new characteristics increase the interference level caused to other allotments in the Plan, assignments in the List, an assignment for which the Bureau has received complete information in accordance with § 6.1 of Article 6 of Appendix 30B before the date of receipt of this notification, assignments in the Appendix 30B ESIM List and an assignment for which the Bureau has received complete information in accordance with § 1 of Section A before the date of receipt of this notification. The increase of the interference due to characteristics different from those entered in the Appendix 30B ESIM List will be checked by comparing the *C/I* ratios of these other allotments and assignments, which result from the use of the proposed new characteristics of the subject assignment on the one hand, and those obtained with the characteristics of the subject assignment in the Appendix 30B ESIM List, on the other hand. This *C/I* calculation is performed under the same technical assumptions and conditions.

13 When the Bureau has received confirmation that the assignment in the Appendix **30B** ESIM List has been brought into use, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC.

14 Wherever the use of a frequency assignment in the Appendix **30B** ESIM List is suspended for a period exceeding six months, the notifying administration shall inform the Bureau of the date on which such use was suspended. When that assignment is brought back into use, the notifying administration shall so inform the Bureau, as soon as possible. On receipt of the information sent under this provision, the Bureau shall make that information available on the ITU website as soon as possible and shall publish it in the BR IFIC. The date on which the assignment is brought back into use shall be no later than three years from the date on which the use of the frequency assignment was suspended, provided that the notifying administration informs the Bureau of the suspension within six months from the date on which the use was suspended. If the notifying administration informs the Bureau of the suspension more than six months after the date on which the use of the frequency assignment was suspended, this three-year time period shall be reduced. In this case, the amount by which the three-year period shall be reduced shall be equal to the amount of time that has elapsed between the end of the six-month period and the date that the Bureau is informed of the suspension. If the notifying administration informs the Bureau of the suspension more than 21 months after the date on which the use of the frequency assignment was suspended, the frequency assignment shall be removed from the MIFR and the Appendix **30B** ESIM List.

15 If the supporting Appendix **30B** assignment(s) is removed from the List, the corresponding ESIM assignment shall also be removed from the Appendix **30B** ESIM List and the MIFR, as appropriate.

PART II

Procedure to be followed by administrations and the Bureau for examination and protection of one earth station in motion (ESIM) with respect to other ESIMs

1 In the publication of the special section referred to in § 6 of Section A, the Bureau shall also include the names of the affected administrations, the corresponding assignments in the Appendix **30B** ESIM List and assignments for which the Bureau has previously received complete information in accordance with § 1 of Section A and which it has examined under § 5 of Section A, as appropriate.

2 In determining administrations whose assignments in the Appendix **30B** ESIM List or assignments for which the Bureau has previously received complete information in accordance with § 1 of Section A and which it has examined under § 5 of Section A are considered as being affected, the Bureau shall apply the principle of Annex 4 to Appendix **30B** and the following criteria:

- a) orbital spacing as specified in § 1.2 of Annex 4;
- b) Earth-to-space single-entry carrier-to-interference as specified in § 2.1 of Annex 4 or Earth-to-space single-entry carrier-to-interference (C/I) derived from the supporting Appendix **30B** assignment(s), whichever is the lowest;

c) the Earth-to-space power flux-density as specified in § 2.2 of Annex 4.

3 An administration that has not notified its comments either to the administration seeking agreement or to the Bureau within a period of four months following the date of the BR IFIC referred to in § 6 of Section A shall be deemed to have agreed to the proposed assignment. This time-limit shall be extended for an administration that has requested the assistance of the Bureau by up to 30 days following the date on which the Bureau communicated the result of its action.

4 Unless coordination is no longer required, taking into account the final characteristics of the notice in § 11 of Section A, should harmful interference be caused by an assignment included in Appendix **30B** ESIM List to any assignment in Appendix **30B** ESIM List identified in § 1 for which agreement has not been obtained, the notifying administration shall, upon receipt of advice thereof, immediately eliminate this harmful interference.

ANNEX 2 TO RESOLUTION 121 (WRC-23)

Provisions for earth stations in motion on aircraft and vessels to protect terrestrial services in the frequency band 12.75-13.25 GHz

1 The parts below contain provisions to ensure that earth stations in motion on aircraft (A-ESIMs) and earth stations in motion on vessels (M-ESIMs) do not cause unacceptable interference to terrestrial service operations when A-ESIMs and M-ESIMs operate in frequency bands overlapping with those used at any time by terrestrial services to which the frequency band 12.75-13.25 GHz is allocated and operating in accordance with the Radio Regulations (see also *resolves* 1.2 of this Resolution).

PART I

M-ESIMs

2 The notifying administration for the geostationary-satellite (GSO) network in the fixed-satellite service (FSS) with which an M-ESIM communicates shall ensure compliance of the M-ESIM operating within the frequency band 12.75-13.25 GHz, or parts thereof, with both of the following conditions for the protection of terrestrial services to which the frequency band is allocated within a coastal State:

2.1 The minimum distance from the low-water mark as officially recognized by the coastal State beyond which an M-ESIM can operate without the prior agreement of any administration is 158 km in the frequency band 12.75-13.25 GHz. Any transmissions from an M-ESIM within the minimum distance shall be subject to the prior agreement of the coastal State concerned.

2.2 The maximum M-ESIM equivalent isotropically radiated power (e.i.r.p.) spectral density towards the horizon shall be limited to 12.5 dB(W/MHz). Transmissions from an M-ESIM with higher e.i.r.p. spectral density levels towards the territory of any coastal State shall be subject to the prior agreement of the coastal State concerned.

PART II

A-ESIMs

3 The notifying administration of the GSO FSS satellite network with which an A-ESIM communicates shall ensure compliance of the A-ESIM operating within the frequency band 12.75-13.25 GHz, or parts thereof, with all of the following conditions for the protection of terrestrial services to which the frequency band is allocated:

POWER FLUX-DENSITY MASK

3.1 When within line-of-sight of the territory of an administration, and above an altitude of 3 km, the maximum power flux-density (pfd) produced at the surface of the Earth on the territory of an administration by emissions from a single A-ESIM shall not exceed:

$\text{pfd}(\theta) = -112$	$\text{dB(W/(m}^2 \cdot 14 \text{ MHz))}$	for	$\theta \leq 5^\circ$
$\text{pfd}(\theta) = -117.5 + \theta$	$\text{dB(W/(m}^2 \cdot 14 \text{ MHz))}$	for	$5^\circ < \theta \leq 40^\circ$
$\text{pfd}(\theta) = -77$	$\text{dB(W/(m}^2 \cdot 14 \text{ MHz))}$	for	$40^\circ < \theta \leq 90^\circ$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

3.2 When within line-of-sight of the territory of an administration, and up to an altitude of 3 km, the maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single A-ESIM shall not exceed:

$\text{pfd}(\theta) = -123.5$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$\theta \leq 5^\circ$
$\text{pfd}(\theta) = -128.5 + \theta$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$5^\circ < \theta \leq 40^\circ$
$\text{pfd}(\theta) = -88.5$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$40^\circ < \theta \leq 90^\circ$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

4 The maximum power in the out-of-band domain should be attenuated below the maximum output power of the A-ESIM transmitter as described in the most recent version of Recommendation ITU-R SM.1541.

5 Higher pfd levels than those provided for in §§ 3.1 and 3.2 above, produced by an A-ESIM at any point on the surface of the Earth within the territory of another administration, shall be subject to the prior agreement of that administration (see also *resolves* 1.2.5 of this Resolution).

ANNEX 3 TO RESOLUTION 121 (WRC-23)

**Provisions for earth stations in motion on aircraft and vessels to protect
non-geostationary-satellite systems in the fixed-satellite service
in the frequency band 12.75-13.25 GHz**

1 In order to protect the non-geostationary-satellite (non-GSO) systems in the fixed-satellite service (FSS) referred to in *resolves* 1.1.6 of this Resolution in the frequency band 12.75-13.25 GHz, earth stations in motion on aircraft (A-ESIMs) and earth stations in motion on vessels (M-ESIMs) communicating with geostationary-satellite (GSO) FSS satellite networks shall not exceed the following operational limits:

- a) on-axis equivalent isotropically radiated power (e.i.r.p.) density of 49 dB(W/1 MHz) for a GSO A-ESIM and M-ESIM with an antenna maximum gain lower than 38.5 dBi;
- b) on-axis e.i.r.p. density of 54 dB(W/1 MHz) for a GSO A-ESIM and M-ESIM with an antenna maximum gain equal to or greater than 38.5 dBi but lower than 45 dBi;
- c) on-axis e.i.r.p. density of 57.5 dB(W/1 MHz) for a GSO A-ESIM and M-ESIM with an antenna maximum gain equal to or greater than 45 dBi;
- d) e.i.r.p. density for any off-axis angle ϕ which is 3° or more off the main-lobe axis of a GSO A-ESIM and M-ESIM antenna and outside 3° of the GSO arc:

<i>Off-axis angle</i>	<i>Maximum e.i.r.p. density</i>
$3^\circ \leq \phi \leq 31.6^\circ$	$37 - 25 \log \phi$ dB(W/40 kHz)
$31.6^\circ < \phi \leq 180^\circ$	-0.5 dB(W/40 kHz)

2 The above levels are operational and are not examined by the Radiocommunication Bureau.

ANNEX 4 TO RESOLUTION 121 (WRC-23)

**Methodology for examining the compliance of earth stations in motion on
aircraft communicating with geostationary space stations in
the fixed-satellite service in the frequency band 12.75-13.25 GHz
with the set of power flux-density limits pre-established in Part II of Annex 2 to
this Resolution at the Earth's surface**

1 Overview

The methodology below is a functional description of how to conduct an examination of earth stations in motion on aircraft (A-ESIMs) operating with geostationary-satellite (GSO) networks and their conformity with the power flux-density (pfd) limits specified in Part II of Annex 2 to this Resolution.

2 A-ESIM parameters required for examination

To conduct the relevant examination of an A-ESIM and its conformity with respect to the pfd limits, the following parameters are required:

- satellite network name;
- GSO satellite longitude;
- GSO service area latitude bounds;
- GSO service area longitude bounds;
- A-ESIM peak antenna gain;
- A-ESIM minimum elevation;
- A-ESIM power density and bandwidth as given in Table 1; and
- fuselage attenuation mask expressed as a function of the angle below the horizon of the A-ESIM.

3 Examination methodology

3.1 Introduction

An A-ESIM can operate at different locations defined by latitude, longitude and altitude. This methodology determines the maximum allowable power P_j for an A-ESIM transmitter communicating with a GSO satellite network in the fixed-satellite service (FSS) to ensure compliance with the pre-established pfd limits to protect terrestrial services, at all positions, for a defined set of altitude ranges. The methodology derives P_j , taking into account the relevant loss and attenuation in the geometry considered.

The methodology then compares the computed P_j with the range of notified power for the A-ESIM emission. The minimum and maximum power values for emissions from the A-ESIM, $P_{\min\_emission,j}$ and $P_{\max\_emission,j}$, are calculated from the data included in the Appendix 4 notification information for the GSO satellite network with which the A-ESIM communicates and from the A-ESIM characteristics.

A-ESIMs are evaluated over a number of predefined altitude ranges in order to establish a number of P_j levels.

An examination by the Radiocommunication Bureau should apply this methodology for the defined altitude range, to determine whether an A-ESIM operating under a given GSO satellite network complies with the pre-established pfd limits to protect terrestrial services.

3.2 Parameters and geometry

Considering a hypothetical GSO FSS network, Table 1 below provides an example of emissions that are included in one group transmitting in the frequency band 12.75-13.25 GHz. Tables 2 to 4 provide additional assumptions and Figure 1 illustrates the geometry involved in the examination.

TABLE 1

Example of a group of A-ESIM emissions
(with reference to relevant Appendix 4 data fields)

Emission No.	C.7.a Designation of emission	BW _{emission} MHz	C.8.a.3 Minimum power density dB(W/Hz)	C.8.a.2 Maximum power density dB(W/Hz)
1	6M00G7W--	6.0	−69.7	−66.0

TABLE 2

Additional example assumptions

ID	Parameter	Notation	Value	Unit
1	Frequency assignment	f	13	GHz
2	Reference bandwidth of pfd mask	BW_{Ref}	1.0 or 14.0, depending on the altitude under examination	MHz
3	A-ESIM antenna peak gain	G_{max}	36	dBi
4	A-ESIM antenna gain pattern	-	As per Rec. ITU-R S.580 (see C.10.d.5.a)	

TABLE 3

Additional assumptions defined in the methodology

ID	Parameter	Notation	Value	Unit
1	A-ESIM minimum elevation angle towards GSO satellite	ε	Appendix 4, C.10.d.10	degrees
2	Atmospheric attenuation	L_{atm}	Computed with Rec. ITU-R P.676 (see NOTE below)	dB
3	Angle of arrival of the incident wave on the Earth's surface	δ	Specified in the pre- established sets of pfd limits, variable from 0° to 90°	degrees
4	Minimum examination altitude	H_{min}	0.01	km
5	Maximum examination altitude	H_{max}	15.0	km
6	Examination altitude spacing ¹	H_{step}	1.0	km
7	Fuselage attenuation	L_f	Use Table 4 if no ITU-R Recommendation provided in Appendix 4, C.10.d.11	dB

¹ The fourth altitude value (H_4) computed in accordance with this H_{step} is adjusted to 2.99 km to facilitate the examination of compliance with the two sets of predefined pfd values indicated in Table 5A and Table 5B.

NOTE: The atmospheric attenuation is computed using the most recent version of Recommendation ITU-R P.676, with the mean annual global reference atmosphere as defined in the most recent version of Recommendation ITU-R P.835.

FIGURE 1

Geometry for examination of compliance for two different A-ESIM altitudes

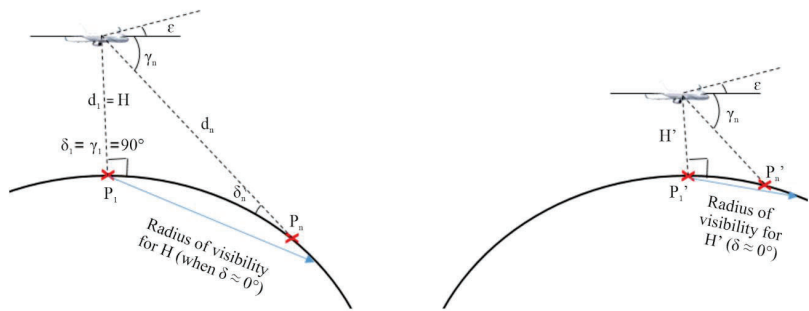


TABLE 4

Fuselage attenuation model based on Report ITU-R M.2221-0

$L_{fuse}(\gamma) = 3.5 + 0.25 \cdot \gamma$	dB	for	$0^\circ \leq \gamma \leq 10^\circ$
$L_{fuse}(\gamma) = -2 + 0.79 \cdot \gamma$	dB	for	$10^\circ < \gamma \leq 34^\circ$
$L_{fuse}(\gamma) = 3.75 + 0.625 \cdot \gamma$	dB	for	$34^\circ < \gamma \leq 50^\circ$
$L_{fuse}(\gamma) = 35$	dB	for	$50^\circ < \gamma \leq 90^\circ$

Notes:

- This fuselage attenuation model is based on measurements made at 14.2 GHz (see Fig. 3.6-14 in Report ITU-R M.2221-0).
- Table 5A and Table 5B are taken from Part II of Annex 2 to this Resolution. The reference bandwidth for the sets of pfd limits included in Table 5A and Table 5B are 1 MHz and 14 MHz, respectively.

TABLE 5A

Required conformance pfd mask for altitudes up to 3 km

$\text{pfd}(\theta) = -123.5$	dB(W/(m ² · MHz))	for	$\theta \leq 5^\circ$
$\text{pfd}(\theta) = -128.5 + \theta$	dB(W/(m ² · MHz))	for	$5^\circ < \theta \leq 40^\circ$
$\text{pfd}(\theta) = -88.5$	dB(W/(m ² · MHz))	for	$40^\circ < \theta \leq 90^\circ$

TABLE 5B

Required conformance pfd mask for altitudes above 3 km

$\text{pfd}(\theta) = -112$	dB(W/(m ² · 14 MHz))	for	$\theta \leq 5^\circ$
$\text{pfd}(\theta) = -117 + \theta$	dB(W/(m ² · 14 MHz))	for	$5^\circ < \theta \leq 40^\circ$
$\text{pfd}(\theta) = -77$	dB(W/(m ² · 14 MHz))	for	$40^\circ < \theta \leq 90^\circ$

3.3 Calculation algorithm

This section includes a step-by-step description of how the examination methodology would be implemented.

START

- i) For each A-ESIM altitude, it is necessary to generate as many δ_n angles (angle of arrival of the incident wave) as required in order to test full compliance with the applicable set of pfd limits. The N angles δ_n must be between 0° and 90° and have a resolution compatible with the granularity of the pre-established pfd limits. Each of the N angles δ_n will correspond to as many N points on the ground.

- ii) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \dots, H_{max}$:

- a) set the altitude of the A-ESIM to H_j
 b) compute the angles below the horizon $\gamma_{j,n}$ as seen from the A-ESIM for each of the N angles δ_n generated in i) using the following equation:

$$\gamma_{j,n} = \arccos \left(\frac{R_e \cdot \cos(\delta_n)}{(R_e + H_j)} \right) \quad (1)$$

where R_e is the mean earth radius.

- c) Compute the distance $D_{j,n}$, in km, for $n = 1, \dots, N$ between the A-ESIM and the tested point on the ground:

$$D_{j,n} = \sqrt{R_e^2 + (R_e + H_j)^2 - 2R_e(R_e + H_j)\cos(\gamma_n - \delta_n)} \quad (2)$$

- d) Compute the fuselage attenuation $L_{f,j,n}$ (dB) with $n = 1, \dots, N$ applicable to each of the angles $\gamma_{j,n}$ computed in b) above.
 e) Compute the gaseous absorption $L_{atm,j,n}$ (dB) with $n = 1, \dots, N$ applicable to each of the distances $D_{j,n}$, computed in c) above, using the applicable sections of the most recent version of Recommendation ITU-R P.676.

- iii) a) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \dots, H_{max}$, and each angle below the horizon $\gamma_{j,n}$, compute the maximum emission power in the reference bandwidth $P_{j,n}(\delta_n, \gamma_{j,n})$ for which the pfd limits are met using the following algorithm:

$$P_{j,n}(\delta_n, \gamma_{j,n}) = pdf(\delta_n) + 10 \log_{10} \left(4\pi (D_{j,n} \cdot 1000)^2 \right) + L_{f,j,n} + L_{atm,j,n} - Gtx(\gamma_{j,n} + \varepsilon)$$

with $Gtx(\gamma_{j,n} + \varepsilon)$ being the transmit antenna gain with the off-axis angle from the boresight, consisting of the summation of both angles $\gamma_{j,n}$ and minimum elevation angle ε as defined in Table 3.

- b) Compute the minimum P_j across all values calculated at the previous step:

$$P_j = \text{Min} \left(P_{j,n}(\delta_n, \gamma_{j,n}) \right)$$

The output of this step is the maximum power in the reference bandwidth that can be used by the A-ESIM to ensure it complies with the pfd limits indicated in Table 5A or Table 5B, as applicable, with respect to all angles δ_n at the altitude H_j , and the elevation indicated in Table 3. There will be one P_j for each of the H_j altitudes considered.

The output of step *b*) is summarized in Table 6 below:

TABLE 6

Computed P_j values

H_j (Altitude) (km)	P_j (Maximum power in the reference bandwidth that can be used at minimum elevation) dB(W/BW)
0.01	<i>TBD</i>
1.0	<i>TBD</i>
2.0	<i>TBD</i>
2.99	<i>TBD</i>
4.0	<i>TBD</i>
5.0	<i>TBD</i>
6.0	<i>TBD</i>
7.0	<i>TBD</i>
8.0	<i>TBD</i>
9.0	<i>TBD</i>
10.0	<i>TBD</i>
11.0	<i>TBD</i>
12.0	<i>TBD</i>
13.0	<i>TBD</i>
14.0	<i>TBD</i>
15.0	<i>TBD</i>

- c) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \dots, H_{max}$, and each emission in each group of emissions under examination, compute the minimum and the maximum powers of the emission in the reference bandwidth:

$$P_{\min\_emission,j} = \text{minimum power density}(emission, dBW / Hz) + 10 * \log_{10}(BW)$$

$$P_{\max\_emission,j} = \text{maximum power density}(emission, dBW / Hz) + 10 * \log_{10}(BW)$$

BW in Hz is:

$$BW_{Ref} \text{ if } BW_{Ref} = 1 \text{ MHz}$$

$$BW_{Ref} \text{ if } BW_{Ref} = 14 \text{ MHz and } BW_{emission} \geq BW_{Ref}$$

$$BW_{emission} \text{ if } BW_{Ref} = 14 \text{ MHz and } BW_{emission} < BW_{Ref}$$

The methodology assumes that only one emission within the reference bandwidth of 14 MHz is transmitted by A-ESIM.

- d) For each emission in each group of emissions under examination, check if there is at least one altitude H_j for which:

$$P_{\max\_emission,j} > P_j > P_{\min\_emission,j}$$

The results of this check are illustrated in Table 7 below.

TABLE 7

Example comparison between P_j and $(P_{\min\_emission,j}, P_{\max\_emission,j})$

Emission No.	C.7.a Designation of emission	$BW_{emission}$ MHz	C.8.a.3 Minimum power density dB(W/Hz)	C.8.a.2 Maximum power density dB(W/Hz)	Lowest altitude H_j (km) for which $P_{\max\_emission,j}$ > P_j > $P_{\min\_emission,j}$
1	6M00G7W--	6.0	-69.7	-66.0	TBD

- e) Based on the test detailed in iii) d) above applied to all emissions in the group under examination, the results of the Bureau's examination for that group is favourable, after removing emissions that have failed the examination; otherwise, it is unfavourable (i.e. all emissions have failed).

- iv) The output of this methodology should, at a minimum, include:

- the resulting parameters as contained in Table 6;
- the examination results for each group;
- for those cases when some emissions successfully pass and some do not, the examination results for the resulting new group that includes only the emission(s) which successfully passed the examination.

END

ANNEX 5 TO RESOLUTION 121 (WRC-23)

**Required capabilities of earth stations in motion communicating
with geostationary-satellite networks (in accordance
with *resolves* 10.1 of this Resolution)**

This Annex provides the minimum requirements for earth stations in motion (ESIMs) communicating with geostationary-satellite (GSO) networks subject to this Resolution, as shown in Table 8 below.

TABLE 8

GSO ESIM minimum requirements

Requirement	Associated provision(s)
Ability to monitor and control pointing of main beam in direction of satellite with which ESIM communicates	<i>Resolves</i> 10.2
Geolocation capability	<i>Resolves</i> 10.4
Ability of ESIM to receive information and execute commands from network control and monitoring centre (NCCM)	<i>Resolves</i> 10.3 <i>Resolves</i> 10.4
Ability to send information to NCCM	<i>Resolves</i> 10.4
Ability to monitor and control transmission power and frequency	<i>Resolves</i> 10.4
Ability to enable/disable ESIM transmission	<i>Resolves</i> 10.3

RESOLUTION 122 (REV.WRC-19)

**Use of the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz
by high-altitude platform stations in the fixed service**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that the frequency band 47.2-50.2 GHz is allocated to the fixed service, the mobile service and the fixed-satellite service (FSS) on a co-primary basis;
- b)* that WRC-97 made provision for the operation of high-altitude platform stations (HAPS), also known as stratospheric repeaters, within the fixed service in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz;
- c)* that establishing a stable technical and regulatory environment will promote the use of all co-primary services in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz;
- d)* that Recommendation ITU-R F.1500 contains the characteristics of systems in the fixed service using HAPS in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz;
- e)* that, while the decision to deploy HAPS can be taken on a national basis, such deployment may affect the territory of other administrations and operators of co-primary services;
- f)* that the ITU Radiocommunication Sector (ITU-R) has completed studies dealing with sharing between systems using HAPS in the fixed service and other types of systems in the fixed service in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz;
- g)* that ITU-R has conducted studies dealing with compatibility between systems using HAPS and existing services in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz, leading to Report ITU-R F.2476;
- h)* that No. **5.552** urges administrations to take all practicable steps to reserve FSS use of the frequency band 47.2-49.2 GHz for feeder links for the broadcasting-satellite service (BSS) operating in the frequency band 40.5-42.5 GHz, and that ITU-R studies indicate that HAPS in the fixed service may share with such feeder links;
- i)* that the technical characteristics of expected BSS feeder links and FSS gateway-type stations are similar;
- j)* that ITU-R has updated studies on sharing between HAPS ground stations in the fixed service and the FSS, noting the negligible contribution to interference from HAPS stations to FSS space receivers,

recognizing

- a)* that Recommendation ITU-R SF.1843 provides information on the feasibility of HAPS systems in the fixed service sharing with the FSS;
- b)* that ITU-R studies have established specific power flux-density (pfd) values to be met at international borders to facilitate sharing conditions for HAPS with other types of fixed-service systems in a neighbouring country;

c) that FSS networks and systems with earth station antenna diameters of 2.5 metres or larger operating as a gateway-type station are capable of sharing with HAPS ground stations;

d) that, during periods of rain, the equivalent isotropically radiated power (e.i.r.p.) of the beam of the HAPS system suffering rain fade may be increased by a level commensurate with the level of rain fade, by up to 20 dB above the e.i.r.p. under clear-sky conditions indicated in Appendix 4,

resolves

1 that to facilitate sharing with the FSS (Earth-to-space), the maximum transmit e.i.r.p. density of a HAPS ground station shall not exceed the following levels under clear-sky conditions:

$$6.4 \quad \text{dB(W/MHz)} \quad \text{for} \quad 30^\circ < \theta \leq 90^\circ$$

$$22.57 \quad \text{dB(W/MHz)} \quad \text{for} \quad 15^\circ < \theta \leq 30^\circ$$

$$28 \quad \text{dB(W/MHz)} \quad \text{for} \quad 5^\circ < \theta \leq 15^\circ$$

where θ is the HAPS ground station elevation angle in degrees (angle of arrival above the horizontal plane);

2 that the ground station antenna patterns of HAPS operating in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz shall meet the following antenna beam patterns:

$$G(\varphi) = G_{\max} - 2.5 \times 10^{-3} \left(\frac{D}{\lambda} \varphi \right)^2 \quad \text{for} \quad 0^\circ < \varphi < \varphi_m$$

$$G(\varphi) = 39 - 5 \log(D/\lambda) - 25 \log \varphi \quad \text{for} \quad \varphi_m \leq \varphi < 48^\circ$$

$$G(\varphi) = -3 - 5 \log(D/\lambda) \quad \text{for} \quad 48^\circ \leq \varphi \leq 180^\circ$$

where:

$G_{\max}$: maximum antenna gain (dBi)

$G(\varphi)$: gain (dBi) relative to an isotropic antenna

φ : off-axis angle (degrees)

D : antenna diameter
 λ : wavelength } expressed in the same units

$$\varphi_m = \frac{20 \lambda}{D} \sqrt{G_{\max} - G_1} \text{ degrees}$$

G_1 : gain of the first side lobe

$$= 2 + 15 \log(D/\lambda) \text{ (dBi);}$$

3 that, for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz, the pfd level per HAPS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, developed for clear-sky conditions, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

-141	dB(W/(m ² · MHz))	for	0° ≤ θ < 3°
-141 + 2(θ - 3)	dB(W/(m ² · MHz))	for	3° ≤ θ ≤ 13°
-121	dB(W/(m ² · MHz))	for	13° < θ ≤ 90°

where θ is the angle of the arrival of the incident wave above the horizontal plane, in degrees;

4 that, for the purpose of protecting mobile-service systems in the territory of other administrations in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz, the pfd level per HAPS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, developed for clear-sky conditions, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

-106	dB(W/(m ² · MHz))	for	0° ≤ θ ≤ 4°
-106 + 1.2 (θ - 4)	dB(W/(m ² · MHz))	for	4° < θ ≤ 11.5°
-97	dB(W/(m ² · MHz))	for	11.5° < θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees.

The limits above take into account the 3 dB aggregate loss due to polarization mismatch, and body loss was not taken into account;

5 that, to protect radio astronomy stations operating in the frequency band 48.94-49.04 GHz from unwanted emissions of HAPS operating in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz, the separation distance between the radio astronomy station and the nadir of a HAPS platform shall exceed 50 km;

6 that administrations planning to implement a HAPS system in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz shall notify the frequency assignments by submitting all mandatory elements of Appendix 4 to the Radiocommunication Bureau for the examination of compliance with respect to this Resolution with a view to their registration in the Master International Frequency Register,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

RESOLUTION 123 (WRC-23)

Use of the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by aeronautical and maritime earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service

The World Radiocommunication Conference (Dubai, 2023),

recalling

the Preamble to the ITU Constitution,

considering

a) that there is some interest in global broadband satellite communications, and that some of this need could be met by allowing aeronautical and maritime earth stations in motion (A-ESIMs and M-ESIMs, respectively) to communicate with non-geostationary-satellite (non-GSO) fixed-satellite service (FSS) systems operating in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth), and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space);

b) that the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) are allocated to space services, and that the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz, and 27.5-29.1 GHz are allocated to terrestrial services on a primary basis worldwide;

c) that, in the countries identified in No. 5.524, the frequency band 19.7-20.2 GHz is allocated to the fixed and mobile services on a primary basis; and that, in the countries identified in No. 5.542, the frequency band 29.5-30 GHz is allocated to the fixed and mobile services on a secondary basis;

d) that the frequency bands in *considering a)* above are used by a variety of different systems and that these existing services and their future development need to be protected without being adversely affected by the operation of non- GSO earth stations in motion (ESIMs)¹;

e) that the frequency band 18.6-18.8 GHz is allocated to the Earth exploration-satellite service (EESS) (passive) and space research service (SRS) (passive) and that these services need to be protected from the operation of those systems with which non-GSO ESIMs communicate;

f) that there is no regulatory procedure in the Radio Regulations for the coordination of non-GSO ESIMs relating to terrestrial assignments pertaining to a station of these services;

¹ Throughout this Resolution, aeronautical and maritime non-GSO ESIMs are referred to as non-GSO A-ESIMs and non-GSO M-ESIMs, respectively.

g) that regulatory procedures and interference management mechanisms, including necessary mitigation measures, are required for the operation of non-GSO ESIMs to protect other space and terrestrial services to which the frequency bands referred to in *considering a)* are allocated,

considering further

a) that there is no publicly available information on the conditions stipulated in coordination agreements reached among administrations with respect to non-GSO FSS satellite systems;

b) that, in order to enable sharing between transmitting non-GSO ESIMs and its terrestrial services, an administration intending to authorize the operation of non-GSO ESIMs on the territory under its jurisdiction, including territorial waters and national airspace, may consider adopting interference management procedures and/or mitigation measures different from those contained in this Resolution, as long as the provisions of this Resolution apply with respect to any other administration;

c) that the service area of the non-GSO FSS systems with which non-GSO ESIMs communicate may cover territories under the jurisdiction of multiple administrations;

d) that this Resolution in no way establishes or addresses any technical or regulatory provisions for the operation and use of land non-GSO ESIMs communicating with non-GSO FSS systems, and that any authorization of land non-GSO ESIMs is outside the scope of this Resolution (see *recalling* above),

recognizing

a) that an administration authorizing non-GSO ESIMs on the territory under its jurisdiction, including territorial waters and national airspace, has the right to require that the non-GSO ESIMs referred to above use only those assignments associated with non-GSO FSS systems that have been successfully coordinated, notified, brought into use and recorded in the Master International Frequency Register (MIFR) with a favourable finding under Articles 9 and 11, including No. 11.31, 11.32 or 11.32A, where applicable, with the exception of No. 11.41;

b) that, where assignments to non-GSO FSS systems recorded under No. 11.41 will be used for the operation of non-GSO ESIMs in the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-28.6 GHz and 29.5-30 GHz (Earth-to-space), such assignments may be used for non-GSO FSS ESIMs only in accordance with No. 11.42;

c) that for cases of incomplete coordination under No. 9.7B of the non-GSO FSS system with which non-GSO ESIMs communicate, the operation of non-GSO ESIMs in the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz (space-to-Earth) needs to be in accordance with the provisions of No. 11.42 with respect to any recorded frequency assignment which was the basis of an unfavourable finding under No. 11.38;

d) that the provisions of No. 22.2 apply to non-GSO FSS systems with which non-GSO ESIMs operate in the frequency band 17.7-17.8 GHz (space-to-Earth) with respect to geostationary-satellite (GSO) FSS and GSO broadcasting-satellite service (BSS) networks;

e) that, under the provisions of No. **22.2**, in the frequency bands 27.5-28.6 GHz and 29.5-30 GHz (Earth-to-space) non-GSO ESIMs shall not cause unacceptable interference to GSO FSS and BSS networks operating in accordance with the Radio Regulations, and shall not claim protection from them in the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz (space-to-Earth), and No. **5.43A** does not apply in this case;

f) that a non-GSO FSS system operating in the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-28.6 GHz and 29.5-30 GHz (Earth-to-space) in compliance with the provisions and equivalent power flux-density (epfd) limits set out in Nos. **22.5C**, **22.5D** and **22.5F** is considered as having fulfilled its obligations under No. **22.2** with respect to not causing unacceptable interference to any GSO network, provided that the operational limits given in Table **22-4B** are also met by the non-GSO FSS system;

g) that the use of the frequency bands 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) by non-GSO FSS systems is subject to No. **9.11A** (i.e. the provisions of Nos. **9.12** to **9.16** apply), and No. **22.2** does not apply in this case;

h) that, for the use of the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by non-GSO systems, No. **9.12** applies;

i) that, with respect to GSO FSS networks, in the frequency bands 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) Nos. **9.12A** and **9.13** apply, and No. **22.2** does not apply;

j) that there is no obligation for any administration to authorize any non-GSO ESIMs to operate within the territory under its jurisdiction, including territorial waters and national airspace,

recognizing further

a) that frequency assignments to non-GSO ESIMs need to be notified to the Radiocommunication Bureau;

b) that the notification by different administrations of frequency assignments to be used by the same non-GSO satellite system could create difficulties to identify the responsible administration in case of unacceptable interference;

c) that an administration authorizing the operation of non-GSO ESIMs within the territory under its jurisdiction may modify or withdraw that authorization at any time,

resolves

1 that, before using non-GSO A-ESIMs and non-GSO M-ESIMs in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space), the notifying administration for the non-GSO FSS system in which the non-GSO ESIM is to be used shall send the Bureau the relevant Appendix 4 notification information relating to the characteristics of the non-GSO ESIM intended to communicate with the non-GSO FSS system, together with a commitment to operate the non-GSO ESIM in conformity with the Radio Regulations, including this Resolution;

1.1 that, upon receipt of the notification information and commitment referred to in *resolves* 1 above, the Bureau shall examine them to check conformity with Article 11, taking into account *recognizing a) and b)*, and with the provisions of this Resolution, and publish the results of its examination in its International Frequency Information Circular (BR IFIC);

2 that the characteristics of non-GSO ESIMs shall remain within the envelope characteristics, including any applicable coordination agreement, of typical earth stations associated with the non-GSO FSS system with which the ESIMs communicate;

3 that, with respect to space services in the frequency bands referred to in *resolves* 1 above, or portions thereof, non-GSO ESIMs shall comply with the following conditions:

3.1 non-GSO ESIMs communicating with space stations of a non-GSO FSS system shall not cause more interference or claim more protection than what is applicable to typical earth stations of that same non-GSO FSS system;

3.2 the notifying administration for the non-GSO FSS system with which a non-GSO ESIM communicates, together with the administration authorizing the use of that non-GSO ESIM within the territory under its jurisdiction, including territorial waters and national airspace, shall ensure that the operation of that ESIM complies with *resolves* 3.1 above and with the coordination agreements for the frequency assignments of the typical earth station of that non-GSO FSS system obtained under the provisions of Article 9, taking into account *recognizing a)* above;

3.3 taking into account *recognizing f)* above, the notifying administration for the non-GSO FSS system with which ESIMs communicate shall ensure that non-GSO ESIMs comply with the provisions and epfd limits set out in Nos. 22.5C, 22.5D and 22.5F, as well as the operational limits given in Table 22-4B;

3.4 non-GSO ESIMs shall not claim protection from BSS feeder-link earth stations operating in accordance with the Radio Regulations in the frequency band 17.7-18.4 GHz;

3.5 with respect to the protection of EESS (passive) operating in the frequency band 18.6-18.8 GHz, any non-GSO FSS system with an orbital apogee of less than 20 000 km operating in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz with which non-GSO A-ESIMs and/or non-GSO M-ESIMs communicate and for which the complete notification information has been received by the Bureau after 1 January 2025 shall comply with the provisions indicated in Annex 3 to this Resolution;

3.6 for the implementation of *resolves* 3.5 above, the notifying administration for the non-GSO FSS system with which non-GSO ESIMs communicate shall send the Bureau the relevant Appendix 4 notification information, including a commitment that operation shall be in conformity with *resolves* 3.5 above and *further resolves* 1, 2, 3 and 4 below;

3.7 where the operation of the ESIM referred to in *resolves* 1 uses assignments to non-GSO FSS systems recorded under No. 11.41, such assignments may be used for non-GSO ESIMs only in accordance with No. 11.42;

3.7.1 for the implementation of *resolves* 3.7 above, the notifying administration for the non-GSO FSS system with which non-GSO ESIMs communicate shall send the Bureau a commitment that operation shall be in conformity with *resolves* 3.7 above and *further resolves* 1, 2, 3 and 4 below;

4 that, with respect to terrestrial services that operate in accordance with the Radio Regulations in the frequency bands referred to in *resolves* 1 above, or portions thereof, non-GSO ESIMs shall comply with the following conditions:

4.1 receiving non-GSO ESIMs in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (see No. **5.524**) shall not claim protection from assignments in the terrestrial services to which those frequency bands are allocated;

4.2 transmitting non-GSO ESIMs in the frequency band 27.5-29.1 GHz shall not cause unacceptable interference to terrestrial services to which the frequency band is allocated, and Annex 1 to this Resolution shall apply;

4.3 transmitting non-GSO ESIMs in the frequency band 29.5-30 GHz shall not adversely affect the operations of terrestrial services to which that frequency band is allocated on a secondary basis, and the limits in Annex 1 to this Resolution shall apply with respect to those administrations mentioned in No. **5.542**;

4.4 the provisions in this Resolution, including Annex 1, set conditions for the purpose of protecting terrestrial services from unacceptable interference from non-GSO A-ESIMs and non-GSO M-ESIMs, in accordance with the provisions included in *resolves* 4.2 and 4.3 above; however, the requirement not to cause unacceptable interference to, or claim protection from, terrestrial services to which the frequency bands are allocated and that are operating in accordance with the Radio Regulations remains valid;

4.5 should an administration authorizing non-GSO A-ESIMs and/or non-GSO M-ESIMs agree to limits less stringent than those contained in Annex 1 to this Resolution within the territory under its jurisdiction, including territorial waters and national airspace, such agreement shall not adversely affect other countries that are not party to that agreement;

5 that the Bureau shall examine, in accordance with the provisions included in *resolves* 4.2 and 4.3 above and with the methodology included in Annex 2 to this Resolution, the characteristics of non-GSO A-ESIMs with respect to conformity with the power flux-density (pfd) limits at the Earth's surface specified in Part 2 of Annex 1 to this Resolution and publish the results of such examination in the BR IFIC;

5.1 should the results of the examination by the Bureau with respect to this Resolution, including *resolves* 5 above, be satisfactory, the assignments in question shall be published in the appropriate special section of the BR IFIC and recorded in the MIFR with a favourable finding; otherwise, the assignments in question shall be returned to the notifying administration with the reasons therefor;

6 that, in the event that unacceptable interference caused by non-GSO A-ESIMs and/or non-GSO M-ESIMs is reported:

6.1 the notifying administration for the non-GSO FSS system with which ESIMs communicate is responsible for eliminating the case of unacceptable interference; consequently, no other administration shall be held responsible for eliminating cases of unacceptable interference (see also *resolves* 6.3 below);

6.1.1 for the implementation of *resolves* 6.1 above, the system shall employ the minimum requirements specified in Annex 4 to this Resolution;

6.2 in the event that there is more than one administration involved in the notification of frequency assignments to the same operating non-GSO satellite system with which ESIMs communicate, those administrations shall nominate one administration as the notifying administration responsible to act on their behalf to eliminate any unacceptable interference cases, and inform the Bureau accordingly;

6.3 any authorizing administration, subject to its explicit agreement and to the extent of its ability, provide any available information that may help eliminate the case of unacceptable interference;

6.4 the administration responsible for the aircraft or vessel on which the ESIM operates shall, when requested, provide the affected administration with a point of contact to assist in identifying the notifying administration for the satellite with which the ESIM communicates, which is responsible for eliminating the case of unacceptable interference (see *resolves* 6.1 and 6.2 above);

7 that the notifying administration for the non-GSO FSS system with which non-GSO ESIMs communicate shall ensure that:

7.1 for the operation of non-GSO ESIMs, techniques are employed to maintain adequate antenna-pointing accuracy towards the associated non-GSO FSS satellite to avoid inadvertently tracking non-GSO satellites other than the associated non-GSO satellite;

7.2 measures are taken so that non-GSO ESIMs are subject to permanent monitoring and control by a network control and monitoring centre (NCMC) in order to comply with the provisions in this Resolution, including the minimum requirements specified in Annex 4;

7.3 measures are taken so that non-GSO A-ESIMs and non-GSO M-ESIMs do not transmit from territory, including territorial waters and national airspace, under the jurisdiction of an administration situated inside the service area of the non-GSO FSS system with which those non-GSO A-ESIMs and non-GSO M-ESIMs communicate that has not authorized their use within its territory;

7.4 non-GSO ESIMs operate only in the territory, including territorial waters and national airspace, under the jurisdiction of administrations from which an authorization has been obtained, taking into account *recognizing further c)*;

7.5 a point of contact is designated and provided in the Appendix 4 submission by the notifying administration for the non-GSO FSS systems with which the non-GSO ESIMs communicate for the purpose of tracing any cases of unacceptable interference from non-GSO ESIMs and to respond immediately to requests from the focal point of the affected administration;

- 8 that non-GSO ESIMs shall not be used or relied upon for safety-of-life applications;
- 9 that the application of this Resolution does not provide regulatory status to non-GSO ESIMs different from that derived from the non-GSO FSS system with which they communicate, taking into account the provisions referred to in this Resolution (see *recognizing a) and b)*);
- 10 that any course of action taken under this Resolution has no impact on the original date of receipt of the frequency assignments to space and earth stations of the non-GSO FSS system with which non-GSO ESIMs communicate or on the coordination requirements of that system;
- 11 that compliance with this Resolution by non-GSO ESIMs does not, in any way whatsoever, release the notifying administration(s) from its/their obligation not to cause unacceptable interference to, or claim protection from, the incumbent services, as referred to in this Resolution;
- 12 that the operation of non-GSO A-ESIMs and M-ESIMs, including operation of the NCMC, the interference management system, and the mechanism and functioning of switching facilities, is subject to the availability of the ITU-R Recommendation referred to in *invites the ITU Radiocommunication Sector* below; in the meantime, *further resolves* 1, 2 and 3 shall strictly apply;
- 13 that the operation of non-GSO A-ESIMs and M-ESIMs using frequency assignments recorded under No. **11.41**, including operation of the NCMC, the interference management system, and the mechanism and functioning of switching facilities, is subject to the availability of the ITU-R Recommendation referred to in *invites the ITU Radiocommunication Sector* below, with the understanding that, in the meantime, *further resolves* 1, 2 and 3 strictly apply,

further resolves

- 1 that the notifying administration for the non-GSO system with which ESIMs communicate, when submitting Appendix 4 information, shall send a firm, objective, actionable, measurable and enforceable commitment that, in the event of unacceptable interference being reported, it undertakes to immediately eliminate the interference or reduce it to an acceptable level;
- 2 that, in the case of no action being taken with regard to the obligation referred to in *further resolves* 1 above, the Bureau shall send a reminder and request the notifying administration for the non-GSO system with which ESIMs communicate to comply with the requirements referred to in the commitment;
- 3 that, should the interference persist 30 days after the dispatch date of the above-mentioned reminder, the Bureau shall submit the case to the subsequent meeting of the Radio Regulations Board (RRB) for review and the necessary actions (including suppression of the frequency assignment in question), as appropriate;
- 4 that, for the implementation of *further resolves* 1 above, the notifying administration responsible for the operation of non-GSO A-ESIMs and non-GSO M-ESIMs shall also be responsible for observing and complying with all relevant regulatory and administrative provisions applicable to the operation of the ESIMs included in this Resolution or contained in the Radio Regulations;

5 that, in accordance with *instructs the Director of the Radiocommunication Bureau* 4 below, any notifying administration for a non-GSO system operating non-GSO A-ESIMs and non-GSO M-ESIMs, upon request by the Bureau regarding cases of unacceptable interference reported by an affected administration, shall provide the Bureau with a list of the administrations that have authorized non-GSO ESIM operations to communicate with that non-GSO FSS system and that are potentially related to a reported case of unacceptable interference,

instructs the Director of the Radiocommunication Bureau

1 to take all necessary actions to facilitate the implementation of this Resolution;

2 to report to future world radiocommunication conferences on any difficulties or inconsistencies encountered in the implementation of this Resolution, in particular with respect to the verification of compliance with the efd limits specified in Article 22;

3 not to examine, under No. 11.31, the conformity of non-GSO FSS systems with the provisions of *resolves* 3.5 of this Resolution with respect to the EESS (passive);

4 in the case of unacceptable interference:

4.1 based on information provided by the affected administration, to request the notifying administrations for non-GSO FSS systems with which non-GSO ESIMs communicate that could potentially be causing unacceptable interference to provide the affected administration promptly with the relevant list of administrations that have authorized non-GSO ESIM operations;

4.2 to provide the affected administration with a list of non-GSO FSS systems potentially related to the reported case of unacceptable interference;

4.3 if a notifying administration fails to provide the information required under *instructs the Director of the Radiocommunication Bureau* 4.1 above within 45 days from the date of dispatch of the Bureau's request as referred to in *instructs the Director of the Radiocommunication Bureau* 4.1, to send the notifying administration a reminder to provide the required list within 15 days from the date of that reminder;

4.4 if a notifying administration fails to provide the required information following the reminder under *instructs the Director of the Radiocommunication Bureau* 4.3 above, and if the affected administration has not confirmed to the Bureau that the case of unacceptable interference has been resolved, to submit the case to the subsequent meeting of the RRB for review and the necessary actions, as appropriate,

invites the ITU Radiocommunication Sector

to study, as a matter of urgency, with the objective of preparing a Recommendation to be adopted and approved in accordance with Resolution ITU-R 1, the functionalities and implementation of NCMCs for ESIMs,

instructs the Secretary-General

1 to bring this Resolution to the attention of the International Maritime Organization and the International Civil Aviation Organization;

2 to bring this Resolution to the attention of the ITU Council with a view to its considering whether cost recovery should be applied to non-GSO A-ESIMs and non-GSO M-ESIMs.

ANNEX 1 TO RESOLUTION 123 (WRC-23)

Provisions for maritime and aeronautical earth stations in motion communicating with non-geostationary-satellite systems to protect terrestrial services operating in the frequency band 27.5-29.1 GHz and for the frequency band 29.5-30 GHz with respect to administrations mentioned in No. 5.542

1 The parts below contain provisions to ensure that maritime and aeronautical earth stations in motion (ESIMs) communicating with non-geostationary-satellite (non-GSO) systems in the fixed-satellite service (FSS) do not cause unacceptable interference at any time in neighbouring countries to terrestrial service operations when such non-GSO ESIMs are operating in frequencies overlapping with those used by terrestrial services to which the frequency band 27.5-29.1 GHz is allocated and operating in accordance with the Radio Regulations. The provisions specified below also apply in the frequency band 29.5-30 GHz with respect to administrations mentioned in No. 5.542 (see *resolves* 4.2 and 4.3).

Part 1: Non-GSO maritime ESIMs

2 The notifying administration for the non-GSO FSS system with which maritime ESIMs (M-ESIMs) communicate shall ensure compliance of the non-GSO M-ESIM operating within the frequency bands, or parts thereof, indicated in § 1 above with the following conditions for the protection of terrestrial services to which the frequency bands are allocated within a coastal State:

2.1 The minimum distance from the low-water mark as officially recognized by the coastal State beyond which non-GSO M-ESIMs can operate without the prior agreement of any administration is 70 km within the frequency bands 27.5-29.1 GHz and 29.5-30 GHz. Any transmissions from non-GSO M-ESIMs within the minimum distance shall be subject to the prior agreement of the coastal State(s) concerned.

2.2 The maximum non-GSO M-ESIM equivalent isotropically radiated power (e.i.r.p.) spectral density towards the territory of any coastal State will be limited to 24.44 dBW in a reference bandwidth of 14 MHz. Transmissions from non-GSO M-ESIMs with higher e.i.r.p. spectral density levels towards the territory of any coastal state shall be subject to the prior agreement of the coastal State(s) concerned.

Part 2: Non-GSO aeronautical ESIMs

3 The notifying administration for the non-GSO FSS system with which a non-GSO aeronautical ESIM (A-ESIM) communicates shall ensure compliance of the non-GSO A-ESIM operating within the frequency bands, or parts thereof, indicated in § 1 above with all of the following conditions for the protection of terrestrial services to which the frequency band is allocated:

3.1 When within line-of-sight of the territory of an administration, and above an altitude of 3 km, the maximum power flux-density (pfd) produced at the surface of the Earth on the territory of an administration by emissions from a single non-GSO A-ESIM shall not exceed:

$\text{pfd}(\theta) = -124.7$	$\text{dB(W/(m}^2 \cdot 14 \text{ MHz))}$	for $0^\circ \leq \theta \leq 0.01^\circ$
$\text{pfd}(\theta) = -120.9 + 1.9 \cdot \log\theta$	$\text{dB(W/(m}^2 \cdot 14 \text{ MHz))}$	for $0.01^\circ < \theta \leq 0.3^\circ$
$\text{pfd}(\theta) = -116.2 + 11 \cdot \log\theta$	$\text{dB(W/(m}^2 \cdot 14 \text{ MHz))}$	for $0.3^\circ < \theta \leq 1^\circ$
$\text{pfd}(\theta) = -116.2 + 18 \cdot \log\theta$	$\text{dB(W/(m}^2 \cdot 14 \text{ MHz))}$	for $1^\circ < \theta \leq 2^\circ$
$\text{pfd}(\theta) = -117.9 + 23.7 \cdot \log\theta$	$\text{dB(W/(m}^2 \cdot 14 \text{ MHz))}$	for $2^\circ < \theta \leq 8^\circ$
$\text{pfd}(\theta) = -96.5$	$\text{dB(W/(m}^2 \cdot 14 \text{ MHz))}$	for $8^\circ < \theta \leq 90.0^\circ$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

3.2 When within line-of-sight of the territory of an administration, and up to an altitude of 3 km, the maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single non-GSO A-ESIM shall not exceed:

$\text{pfd}(\theta) = -136.2$	$\text{dB(W/(m}^2 \cdot 1 \text{ MHz))}$	for $0^\circ \leq \theta \leq 0.01^\circ$
$\text{pfd}(\theta) = -132.4 + 1.9 \cdot \log\theta$	$\text{dB(W/(m}^2 \cdot 1 \text{ MHz))}$	for $0.01^\circ < \theta \leq 0.3^\circ$
$\text{pfd}(\theta) = -127.7 + 11 \cdot \log\theta$	$\text{dB(W/(m}^2 \cdot 1 \text{ MHz))}$	for $0.3^\circ < \theta \leq 1^\circ$
$\text{pfd}(\theta) = -127.7 + 18 \cdot \log\theta$	$\text{dB(W/(m}^2 \cdot 1 \text{ MHz))}$	for $1^\circ < \theta \leq 12.4^\circ$
$\text{pfd}(\theta) = -108$	$\text{dB(W/(m}^2 \cdot 1 \text{ MHz))}$	for $12.4^\circ < \theta \leq 90.0^\circ$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

3.3 A non-GSO A-ESIM operating within the frequency bands, or parts thereof, indicated in § 1 above within the territory of an administration that has authorized fixed-service and/or mobile-service operation in the same frequency bands shall not transmit in these frequency bands without the prior agreement of that administration (see also *resolves* 4.5).

3.4 The maximum power in the out-of-band domain should be attenuated below the maximum output power of the A-ESIM transmitter as described in the most recent version of Recommendation ITU-R SM.1541.

3.5 Higher pfd levels than those specified in §§ 3.1 and 3.2 above produced by A-ESIMs at the surface of the Earth in an area under the jurisdiction of any administration shall be subject to the prior agreement of that administration (see also *resolves* 4.5).

ANNEX 2 TO RESOLUTION 123 (WRC-23)

**Methodology and procedure to examine power flux-density
at the Earth's surface produced by aeronautical earth stations in motion
communicating with non-geostationary satellites in the fixed-satellite service
and conformity with power flux-density limits**

1 Overview

The methodology below is a functional description to conduct examination of aeronautical earth stations in motion (A-ESIMs) communicating with non-geostationary satellite (non-GSO) systems and their conformity with the power flux-density (pfd) limits specified in Part 2 of Annex 1 to this Resolution (see *resolves* 5).

2 A-ESIM parameters required for examination

To conduct the relevant examination of A-ESIMs and their conformity with respect to the pfd limits established in Part 2 of Annex 1, the following parameters are required:

- satellite system name;
- A-ESIM peak antenna gain;
- A-ESIM power density and bandwidth as given in Table 1; and
- fuselage attenuation mask expressed as a function of the angle below the horizon of the A-ESIM.

3 Examination methodology

3.1 Introduction

An A-ESIM can operate at different locations defined by latitude, longitude and altitude. This methodology determines the maximum allowable power P_j for an A-ESIM transmitter communicating with a non-GSO satellite system in the fixed-satellite service (FSS) to ensure compliance with the pre-established pfd limits to protect terrestrial services, at all positions, for a defined set of altitude ranges. The methodology derives P_j , taking into account the relevant loss and attenuation in the geometry considered.

The methodology then compares the computed P_j with the range of notified power for the A-ESIM emission. The minimum and maximum power values for emissions from the A-ESIM, $P_{min\_emission,j}$ and $P_{max\_emission,j}$, are calculated from the data included in the Appendix 4 notification information for the non-GSO FSS system with which the A-ESIM communicates and from the A-ESIM characteristics.

A-ESIMs are evaluated over a number of predefined altitude ranges in order to establish a number of P_j levels.

An examination by the Radiocommunication Bureau should apply this methodology for the defined altitude range to determine whether an A-ESIM operating under a given non-GSO satellite system complies with the pre-established pfd limits to protect terrestrial services.

3.2 Parameters and geometry

Considering a hypothetical non-GSO FSS system, Table 1 below provides an example of emissions that are included in one group associated with the A-ESIM non-GSO FSS class of earth station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz. Tables 2 to 4 provide additional assumptions and Figure 1 illustrates the geometry involved in the examination.

TABLE 1

**Example of a group of A-ESIM emissions
(with reference to relevant Appendix 4 data fields)**

Emission No.	C.7.a Designation of emission	$BW_{emission}$ MHz	C.8.c.3 Minimum power density dB(W/Hz)	C.8.a.2/C.8.b.2 Maximum power density dB(W/Hz)
1	6M00G7W--	6.0	-69.7	-66.0
2	6M00G7W--	6.0	-64.7	-61.0
3	6M00G7W--	6.0	-59.7	-56.0

TABLE 2

Additional example assumptions

ID	Parameter	Notation	Value	Unit
1	Frequency assignment	f	29.1	GHz
2	Reference bandwidth of pfd mask	BW_{Ref}	1.0 or 14.0, depending on the altitude under examination	MHz
3	A-ESIM antenna peak gain	G_{max}	37.5	dBi
4	A-ESIM antenna gain pattern	-	As per Rec. ITU-R S.580 (see C.10.d.5.a)	

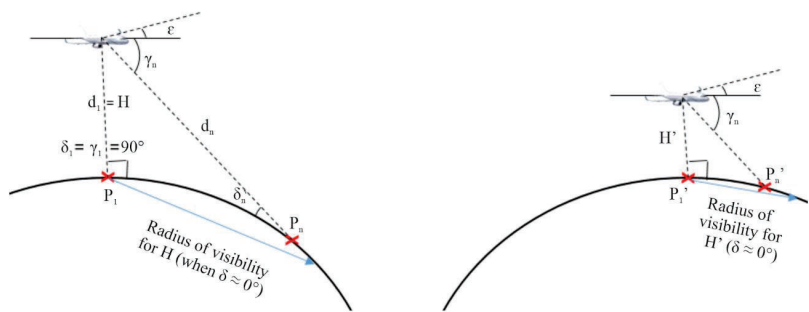
TABLE 3
Characteristics defined in the methodology

ID	Parameter	Notation	Value	Unit
1	A-ESIM minimum elevation angle towards non-GSO FSS system	ε	Appendix 4, data item A.36.a	degrees
2	Atmospheric attenuation	L_{atm}	Computed with Rec. ITU-R P.676 (see NOTE below)	dB
3	Angle of arrival of the incident wave on the Earth's surface	δ	Specified in the pre-established sets of pfd limits in Part 2 of Annex 1, variable from 0° to 90°	degrees
4	Minimum examination altitude	H_{min}	0.01	km
5	Maximum examination altitude	H_{max}	15.0	km
6	Examination altitude spacing ²	H_{step}	1.0	km
7	Fuselage attenuation	L_f	Use Table 4 if no ITU-R Recommendation provided in Appendix 4 (see data item A.36.b)	dB

NOTE: The atmospheric attenuation is computed using the most recent version of Recommendation ITU-R P.676, with the mean annual global reference atmosphere as defined in the most recent version of Recommendation ITU-R P.835.

FIGURE 1

Geometry for examination of compliance for two different A-ESIM altitudes



² The fourth altitude value (H_4) computed in accordance with this H_{step} is adjusted to 2.99 km to facilitate the examination of compliance with the two sets of pfd values indicated in Part 2 of Annex 1 to this Resolution.

TABLE 4

Fuselage attenuation model based on Report ITU-R M.2221-0

$L_{fuse}(\gamma) = 3.5 + 0.25 \cdot \gamma$	dB	for	$0^\circ \leq \gamma \leq 10^\circ$
$L_{fuse}(\gamma) = -2 + 0.79 \cdot \gamma$	dB	for	$10^\circ < \gamma \leq 34^\circ$
$L_{fuse}(\gamma) = 3.75 + 0.625 \cdot \gamma$	dB	for	$34^\circ < \gamma \leq 50^\circ$
$L_{fuse}(\gamma) = 35$	dB	for	$50^\circ < \gamma \leq 90^\circ$

NOTE: This fuselage attenuation model is based on measurements made at 14.2 GHz (see Figure 3.6-14 in Report ITU-R M.2221-0).

3.3 Calculation algorithm

This section includes a step-by-step description of how the examination methodology would be implemented.

START

- i) For each A-ESIM altitude, it is necessary to generate as many δ_n angles (angle of arrival of the incident wave) as required in order to test full compliance with the applicable set of pfd limits. The N angles δ_n must be between 0° and 90° and have a resolution compatible with the granularity of the pre-established pfd limits. Each of the N angles δ_n will correspond to as many N points on the ground.

- ii) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \dots, H_{max}$:

- a) Set the altitude of the A-ESIM to H_j
b) Compute the angle below the horizon $\gamma_{j,n}$ as seen from the A-ESIM for each of the N angles δ_n generated in i) using the following equation:

$$\gamma_{j,n} = \arccos \left(\frac{R_e \cdot \cos(\delta_n)}{(R_e + H_j)} \right) \quad (1)$$

where R_e is the mean Earth radius.

- c) Compute the distance $D_{j,n}$, in km, for $n = 1, \dots, N$ between the A-ESIM and the tested point on the ground:

$$D_{j,n} = \sqrt{R_e^2 + (R_e + H_j)^2 - 2R_e(R_e + H_j)\cos(\gamma_n - \delta_n)} \quad (2)$$

- d) Compute the fuselage attenuation $L_{f,j,n}$ (dB) with $n = 1, \dots, N$ applicable to each of the angles $\gamma_{j,n}$ computed in b) above.
e) Compute the gaseous absorption $L_{atm,j,n}$ (dB) with $n = 1, \dots, N$ applicable to each of the distances $D_{j,n}$ computed in c) above, using the applicable sections of the most recent version of Recommendation ITU-R P.676.

- iii)

- a) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \dots, H_{max}$, and each angle below the horizon $\gamma_{j,n}$, compute the maximum emission power in the reference bandwidth $P_{j,n}(\delta_n, \gamma_{j,n})$ for which the pfd limits are met using the following algorithm:

$$P_{j,n}(\delta_n, \gamma_{j,n}) = pfd(\delta_n) + 10 \log_{10} \left(4\pi (D_{j,n} \cdot 1000)^2 \right) + L_{f,j,n} + L_{atm,j,n} - Gtx(\gamma_{j,n} + \varepsilon)$$

With $G_{tx}(\gamma_{j,n} + \varepsilon)$ being the transmit antenna gain with the off-axis angle from the boresight, consisting of the summation of both angles $\gamma_{j,n}$ and minimum elevation angle ε as defined in Table 3.

- b) Compute the minimum P_j across all values calculated at the previous step:

$$P_j = \text{Min}\left(P_{j,n}\left(\delta_n, \gamma_{j,n}\right)\right)$$

The output of this step is the maximum power in the reference bandwidth that can be used by the A-ESIM to ensure it complies with the pfd limits in Part 2 of Annex 1, with respect to all angles δ_n at the altitude H_j , and the elevation indicated in Table 3. There will be one P_j for each of the H_j altitudes considered.

The output of step b) is summarized in Table 5 below:

TABLE 5
Computed P_j values

H_j (Altitude) (km)	P_j (Maximum power in the reference bandwidth that can be used at minimum elevation) dB(W/BW)
0.01	TBD
1.0	TBD
2.0	TBD
2.99	TBD
4.0	TBD
5.0	TBD
6.0	TBD
7.0	TBD
8.0	TBD
9.0	TBD
10.0	TBD
11.0	TBD
12.0	TBD
13.0	TBD
14.0	TBD
15.0	TBD

- c) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \dots, H_{max}$, and each emission in each group of emissions under examination, compute the minimum and the maximum powers of the emission in the reference bandwidth:

$$P_{\min\_emission,j} = \text{minimum power density}(\text{emission, dBW / Hz}) + 10 * \log_{10}(BW)$$

$$P_{\max\_emission,j} = \text{maximum power density}(\text{emission, dBW / Hz}) + 10 * \log_{10}(BW)$$

BW in Hz is:

$$BW_{Ref} \text{ if } BW_{Ref} = 1 \text{ MHz}$$

$$BW_{Ref} \text{ if } BW_{Ref} = 14 \text{ MHz and } BW_{emission} \geq BW_{Ref}$$

$$BW_{emission} \text{ if } BW_{Ref} = 14 \text{ MHz and } BW_{emission} < BW_{Ref}$$

- d) For each emission in each group of emissions under examination check if there is at least one altitude H_j for which:

$$P_{\max\_emission,j} > P_j > P_{\min\_emission,j}$$

The results of this check are illustrated in Table 6 below:

TABLE 6

Example comparison between P_j and $(P_{\min\_emission,j}, P_{\max\_emission,j})$

Emission No.	C.7.a Designation of emission	$BW_{emission}$ MHz	C.8.c.3 Minimum power density dB(W/Hz)	C.8.a.2/C.8.b.2 Maximum power density dB(W/Hz)	Lowest altitude H_j (km) for which $P_{\max\_emission,j} > P_j > P_{\min\_emission,j}$
1	6M00G7W--	6.0	-69.7	-66.0	TBD
2	6M00G7W--	6.0	-64.7	-61.0	TBD
3	6M00G7W--	6.0	-59.7	-56.0	TBD

- e) Based on the test detailed in iii) d) above applied to all emissions in the group under examination, the results of the Bureau's examination for that group is favourable, after removing emissions that have failed the examination; otherwise, it is unfavourable (i.e. all emissions have failed).

- iv) The output of this methodology should, at a minimum, include:

- the resulting parameters as contained in Table 5;
- the examination results for each group;
- for those cases when some emissions successfully pass and some do not, the examination results for the resulting new group that includes only the emission(s) which successfully passed the examination.

END

ANNEX 3 TO RESOLUTION 123 (WRC-23)

**Provisions for non-geostationary-satellite fixed-satellite service systems³
transmitting to aeronautical and/or maritime earth stations in motion
operating in or over an ocean in the frequency bands
18.3-18.6 GHz and 18.8-19.1 GHz with respect to the Earth exploration-satellite
service (passive) operating in the frequency band 18.6-18.8 GHz
(in accordance with *resolves* 3.5 of this Resolution)**

Non-geostationary-satellite (non-GSO) space stations operating with an orbit apogee of more than 2 000 km and less than 20 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz, when communicating with an aeronautical or maritime earth station in motion (A-ESIM and M-ESIM, respectively), shall not exceed a power flux-density (pfd) of $-118 \text{ dB(W/(m}^2 \cdot 200 \text{ MHz))}$ produced at the surface of the oceans across the 200 MHz of the frequency band 18.6-18.8 GHz.

Non-GSO space stations operating with an orbit apogee less than or equal to 2 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz, when communicating with an A-ESIM or M-ESIM, shall not exceed a pfd of $-110 \text{ dB(W/(m}^2 \cdot 200 \text{ MHz))}$ produced at the surface of the oceans across the 200 MHz of the frequency band 18.6-18.8 GHz.

ANNEX 4 TO RESOLUTION 123 (WRC-23)

**Required capabilities of earth stations in motion communicating
with non-geostationary-satellite systems
(in accordance with *resolves* 6.1.1 of this Resolution)**

This Annex provides the minimum requirements for earth stations in motion (ESIMs) communicating with non-geostationary-satellite (non-GSO) systems subject to this Resolution, as shown in Table A4-1 below.

³ These provisions do not apply to non-GSO systems using orbits with an apogee less than 2 000 km that employ a frequency reuse factor of at least 3.

TABLE A4-1

Non-GSO ESIM minimum requirements

Requirement	Associated provision(s)
Ability to monitor and control pointing of main beam in direction of satellite with which ESIM communicates	<i>Resolves 7.1</i>
Geolocation capability	<i>Resolves 7.3</i> <i>Resolves 7.4</i>
Ability of ESIM to receive information and execute commands from network control and monitoring centre (NCCM)	<i>Resolves 7.2</i> <i>Resolves 7.3</i> <i>Resolves 7.4</i>
Ability to send information to NCCM	<i>Resolves 7.3</i>
Ability to monitor and control transmission power and frequency	<i>Resolves 7.3</i>
Ability to enable/disable ESIM transmission	<i>Resolves 7.3</i> <i>Resolves 7.4</i>

RESOLUTION 125 (REV.WRC-12)

**Frequency sharing in the bands 1 610.6-1 613.8 MHz and 1 660-1 660.5 MHz
between the mobile-satellite service and the radio astronomy service**

The World Radiocommunication Conference (Geneva, 2012),

with a view

to enabling the mobile-satellite service (MSS) and the radio astronomy service to make the most efficient use of frequency bands allocated to them, having due regard to the other services to which those bands are also allocated,

considering

a) that the bands 1 610.6-1 613.8 MHz and 1 660-1 660.5 MHz are allocated to the radio astronomy service and the MSS (Earth-to-space) on a co-primary basis;

b) that No. **5.372** states that “Harmful interference shall not be caused to stations of the radio astronomy service using the band 1 610.6-1 613.8 MHz by stations of the radiodetermination-satellite and mobile-satellite services (No. **29.13** applies)”; and that Article **29** also points out that emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service;

c) that the nature of objects studied by the radio astronomy service in the bands 1 610.6-1 613.8 MHz and 1 660-1 660.5 MHz demands maximum flexibility in the planning of observation frequencies;

d) that, in the bands 1 610.6-1 613.8 MHz and 1 660-1 660.5 MHz, which are shared between the radio astronomy service and the MSS, operational constraints are necessary for MSS mobile earth stations;

e) that a former ITU-R Recommendation relating to sharing between the MSS and the radio astronomy service in the band 1 660-1 660.5 MHz noted that further studies were required, particularly in the areas of propagation models and assumptions used for the determination of separation distances;

f) that Recommendation ITU-R M.1316 may be used in order to facilitate coordination between mobile earth stations and radio astronomy stations in the bands 1 610.6-1 613.8 MHz and 1 660-1 660.5 MHz;

g) that no experience has been gained up to now with the use of the Recommendation mentioned in *considering f)*;

h) that the threshold levels of interference detrimental to the radio astronomy service are given in Recommendation ITU-R RA.769,

resolves

that a future competent conference should evaluate frequency sharing in the bands 1 610.6-1 613.8 MHz and 1 660-1 660.5 MHz between the MSS and the radio astronomy service, based upon the experience gained with the use of ITU-R M.1316 and other relevant ITU-R Recommendations,

invites ITU-R

to continue studies to evaluate the effectiveness of Recommendations aiming to facilitate sharing between the MSS and the radio astronomy service,

instructs the Director of the Radiocommunication Bureau

to provide the results of the studies in the Report of the Director to a future competent conference,

urges administrations

to participate actively in this evaluation.

RESOLUTION 126 (WRC-23)

Temporary regulatory measures in Appendix 30B to improve the reference situation of severely impacted national allotments

The World Radiocommunication Conference (Dubai, 2023),

considering

- a) that some national allotments, especially those of developing countries, have low overall aggregate carrier-to-interference values in Appendix **30B**;
- b) that implementation of a national allotment with a low overall aggregate carrier-to-interference value could be difficult,

recognizing

- a) that the special procedure outlined in this Resolution may be difficult to implement when the territory of the administration responsible for an affected national allotment, deemed to have implicitly agreed to the assignment in the List, is neighbouring the territories included in the service area of that assignment (see § 6.15 of Appendix **30B** of the 2020 version of the Radio Regulations);
- b) that Article 44 of the ITU Constitution stipulates that: “In using frequency bands for radio services, Member States shall bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of developing countries and the geographical situation of particular countries”;
- c) that the administration of an assignment in the List which applied § 6.15 of Appendix **30B** with regard to a national allotment can sign an agreement under § 6.15*quat* of Appendix **30B** (WRC-23),

resolves

1 that the special procedure outlined in this Resolution shall only be applied by administrations of assignments in the List and administrations of national allotments for which § 6.15 of Appendix **30B** of the 2020 version of the Radio Regulations was applied;

2 that, when agreements under § 6.15*quat* of Appendix **30B** are received by the Radiocommunication Bureau in accordance with *recognizing c)*, the Bureau shall immediately apply § 6.15*quin* and § 6.27*bis* of Appendix **30B** (WRC-23) and update the reference situation without reviewing the previous examinations;

3 to request the notifying administrations of assignments for which the procedures of Article 6 of Appendix **30B** have not yet been completed and which have been examined by the Bureau before its application of *resolves* 2 to make their utmost efforts to take into account the new reference situations of national allotments with respect to which the special procedure of this Resolution has been applied when submitting their notice under § 6.17 or § 6.25 of Appendix **30B**,

instructs the Director of the Radiocommunication Bureau

1 to take the necessary actions to implement this Resolution, including drawing the attention of notifying administrations to *resolves* 3 and providing necessary assistance to notifying administrations for the implementation of *resolves* 3;

2 to report to the relevant meetings of the Radio Regulations Board on the efforts undertaken by the notifying administrations in implementing *resolves* 3 for further consideration;

3 to report to a future world radiocommunication conference on the implementation of this Resolution.

RESOLUTION 129 (WRC-23)

**Studies on possible revisions of sharing conditions in the frequency band
13.75-14 GHz to allow the use of uplink fixed-satellite service
earth stations with smaller antenna sizes**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that WARC-92 added an allocation to the fixed-satellite service (FSS) (Earth-to-space) in the frequency band 13.75-14 GHz;
- b)* that WRC-03 introduced changes to Nos. **5.502** and **5.503** that made it possible to use earth station antennas in the range of 1.2 to 4.5 metres for the geostationary fixed-satellite service (FSS) networks with limits on power flux-density (pfd) and equivalent isotropically radiated power (e.i.r.p.) density;
- c)* that WRC-03 did not introduce any changes in Nos. **5.502** and **5.503** in regard to earth stations for non-geostationary-satellite orbit (non-GSO) systems;
- d)* that there is congestion in the geostationary orbit (GSO);
- e)* that many new satellite systems are being introduced into non-GSO;
- f)* that it is necessary to guarantee that orbit and spectrum resources are used efficiently and rationally to facilitate the introduction of new satellite networks;
- g)* that there is a requirement for more uplink spectrum in the frequency range 13-15 GHz, which could be used worldwide by smaller earth station antennas, to complement the downlink capacity in the frequency range 10-13 GHz;
- h)* that the frequency band 13.75-14 GHz is allocated worldwide on a primary basis to the radiolocation service (RLS);
- i)* that the frequency band 13.75-14 GHz is shared with the RLS on the basis of the conditions set forth in No. **5.502**;
- j)* that the sharing conditions in No. **5.502** impose technical limitations on both the RLS and FSS to balance the operational needs of the two services;
- k)* that WRC-03 decided that a reduction in the FSS earth station's antenna size required the application of a pfd limit applied at the low-water mark and at national land borders to ensure continued protection of the RLS;

l) that the enhancement of operating conditions of the earth stations in the frequency band 13.75-14 GHz would help to meet the evolving needs of FSS applications and facilitate an efficient and rational use of the Earth-to-space and space-to-Earth frequency bands corresponding to the frequency ranges 13-15 GHz and 10-13 GHz;

m) that space research service (SRS) systems continue to operate in the frequency band 13.75-14 GHz, including on a primary basis under No. **5.503**,

noting

a) that the SRS is allocated to this band on a secondary basis;

b) that the geostationary space stations of the SRS for which the Bureau has received information for advance publication before 31 January 1992 shall be operating on an equal footing with the stations in the FSS; after that date, the new geostationary space stations of the SRS shall operate on a secondary basis;

c) that, until the geostationary space stations of the SRS for which the Bureau has received information for advance publication before 31 January 1992 stop operating in that frequency band, the frequency band 13.77-13.78 GHz shall be shared with the SRS under the conditions set forth in No. **5.503**;

d) that, in the Master International Frequency Register, there is currently only a very limited number of earth stations and satellite networks of the SRS in the frequency band 13.77-13.78 GHz for which advance publication information was received before 31 January 1992;

e) that the usage of the FSS and other services that share this band may have evolved;

f) that the service objectives, geographical areas of operations, and protection requirements of the RLS are described in Recommendation ITU-R M.1644;

g) that, in some countries, the band is also allocated to the fixed service and the mobile service (Nos. **5.499** and **5.500**) and to the radionavigation service (RNS) (No. **5.501**),

recognizing

a) that the possible use of the frequency band 13.75-14 GHz by uplink FSS earth stations with smaller antenna sizes requires studies to support possible regulatory changes while continuing to ensure the protection of the RLS and SRS, as addressed in Nos. **5.502** and **5.503**;

b) that it is necessary to study possible revised coexistence conditions between the primary services that share this band with their current characteristics and applications and uplink FSS earth stations with smaller antenna sizes, in particular noting Nos. **5.502** and **5.503**;

c) that these studies need to take into account that current SRS systems have been developed and operate in the current sharing environment in accordance with Nos. **5.502** and **5.503**, and changes to these regulations may change this sharing environment;

d) that there is a need to ensure the continued operations of the RLS in the frequency band 13.75-14 GHz;

e) that the pfd limits at the low-water mark and at the border of national territories in No. **5.502** are critical to ensure the protection of the RLS;

f) that the power limitations applicable to stations in the RLS and RNS stated in No. **5.502** shall remain unchanged;

g) that frequency assignments to ship and mobile stations of the RLS cannot be notified under No. **11.14**, and as such the coordination procedure as stipulated in Section II of Article **9** cannot apply as a method for resolving interference issues between FSS earth stations and mobile stations of the RLS;

h) that the protection of the RLS in the frequency band 13.75-14 GHz and SRS in the frequency band 13.77-13.78 GHz relies on the application of a combination of FSS antenna size limitation and of pfd limits at the low-water mark and at the border of national territories,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 studies on the technical and operational limitations regarding the minimum antenna size and associated power limitations of GSO and non-GSO FSS earth stations in the frequency band 13.75-14 GHz (Earth-to-space), while ensuring the protection of the services stipulated in Nos. **5.502** and **5.503**;

2 studies on possible changes to Nos. **5.502** and **5.503** and possible associated regulatory measures,

invites administrations

to participate actively in the studies and provide the information required for the studies listed under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* by submitting contributions to the ITU Radiocommunication Sector,

invites the 2027 world radiocommunication conference

to consider, based on the results of the above studies, the minimum antenna size and associated power limitations of GSO and non-GSO FSS earth stations in the frequency band 13.75-14 GHz (Earth-to-space), possible changes to Nos. **5.502** and **5.503**, and consequential regulatory measures.

RESOLUTION 130 (WRC-23)

Studies relating to the use of the frequency band 51.4-52.4 GHz to enable its use by gateway earth stations transmitting to non-geostationary-satellite orbit systems in the fixed-satellite service (Earth-to-space)

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that satellite systems are increasingly being used to deliver broadband services and can help enable universal broadband access;
- b)* that next-generation fixed-satellite service (FSS) technologies for broadband will increase speeds, with faster rates expected in the near future;
- c)* that technological developments such as advances in spot-beam technologies and frequency reuse are used by the FSS in frequency bands above 30 GHz to increase the efficient use of spectrum;
- d)* that fixed-satellite applications in frequency bands above 30 GHz, such as feeder links, may be easier to share with other radiocommunication services than high-density FSS (HDFSS) applications;
- e)* that the current frequency allocations to the FSS in the frequency band 51.4-52.4 GHz do not enable its use by non-geostationary-satellite orbit (non-GSO) gateway operations, and as such do not meet the expected needs of such systems;
- f)* that the protection of the Earth exploration-satellite service (EESS) (passive) in the adjacent frequency bands 50.2-50.4 GHz and 52.6-54.25 GHz is vital to weather prediction and disaster management,

recognizing

- a)* the need to protect existing services when considering frequency bands for possible additional allocations to any service;
- b)* that the conditions in No. **5.555C** with respect to geostationary-satellite orbit (GSO) networks should not be changed;
- c)* that the frequency band 51.4-52.4 GHz is allocated to the fixed and mobile services, which will need to be protected, and is available for high-density applications in the fixed service, as indicated in No. **5.547**;
- d)* that No. **5.340** applies to the frequency bands 50.2-50.4 GHz and 52.6-54.25 GHz;

- e) that in the frequency band 51.4-54.25 GHz, radio astronomy observations are carried out under national arrangements, as indicated in No. **5.556**, and that appropriate measures may have to be defined to protect the radio astronomy service;
- f) that Report ITU-R S.2461 identifies the spectrum needs in the frequency band 51.4-52.4 GHz for additional FSS spectrum (Earth-to-space) for both GSO networks and non-GSO systems;
- g) that the use of the frequency band 51.4-52.4 GHz by the FSS (Earth-to-space) is limited only to GSO networks and associated gateway earth stations with a minimum antenna diameter of 2.4 metres, in accordance with No. **5.555C**, as a result of WRC-19 studies;
- h) that, in the frequency band 51.4-52.4 GHz, Resolution **750 (Rev.WRC-19)** applies as indicated in No. **5.338A**;
- i) that the frequency band 50.2-50.4 GHz is also allocated to the EESS (passive) with the applicable non-GSO FSS unwanted emission limits provided in Resolution **750 (Rev.WRC-19)**;
- j) that the frequency band 52.6-54.25 GHz is allocated to the EESS (passive), which needs to be protected, as indicated in No. **5.340**, through revision of Resolution **750 (Rev.WRC-19)**, with a view to including the non-GSO FSS unwanted emission limit for the frequency band 52.6-54.25 GHz together with possible modification of the GSO FSS unwanted emission limit for the frequency band 52.6-54.25 GHz, subject to the result of the studies, taking into account the aggregation of interference into EESS (passive);
- k) that the existing limits for GSO FSS networks to protect EESS (passive) operating in the frequency band 52.6-54.25 GHz established in Resolution **750 (Rev.WRC-19)** continue to apply for those GSO FSS networks that were notified/brought into use before a date to be defined at WRC-27;
- l) that Report ITU-R S.2462 contains studies on sharing and compatibility between GSO FSS networks and non-GSO FSS systems in the frequency bands 37.5-42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz;
- m) that, although the studies prior to WRC-19 were conducted only for GSO FSS earth stations, as noted in Report ITU-R S.2463, spectrum needs for both GSO and non-GSO FSS earth stations in the frequency band 51.4-52.4 GHz were ultimately identified, as indicated in *recognizing f*);
- n) that the need for additional uplink spectrum in the 50 GHz frequency range for non-GSO FSS gateway earth station use continues,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 sharing and compatibility studies with existing services, including in adjacent bands, including protection of the fixed and mobile services, and studies relating to the suitability of revising conditions associated with the primary allocation to the FSS in the frequency band 51.4-52.4 GHz (Earth-to-space) to enable its use by gateway earth stations of non-GSO FSS systems (Earth-to-space), and the relevant regulatory studies;

2 compatibility studies between non-GSO FSS gateway operation in the frequency band 51.4-52.4 GHz and the existing primary passive services operating in the frequency band 52.6-54.25 GHz in order to review and revise Resolution **750 (Rev.WRC-19)** to protect the EESS (passive), considering the aggregated interference from GSO gateway earth stations and non-GSO FSS gateway earth stations and taking into account that the existing limits for GSO FSS networks to protect the EESS (passive) operating in the frequency band 52.6-54.25 GHz established in Resolution **750 (Rev.WRC-19)** continue to apply for those GSO FSS networks that were notified/brought into use before a date to be defined at WRC-27;

3 studies on sharing and compatibility between non-GSO FSS gateway operation in the frequency band 51.4-52.4 GHz and the radio astronomy observations carried out in the frequency band 51.4-54.25 GHz in conformity with No. **5.556**, in order to determine the conditions to ensure the protection of these observations;

4 studies regarding the protection of GSO FSS space stations from the emissions of non-GSO FSS gateway earth stations, including possible associated regulatory actions and possible inclusion of the frequency band 51.4-52.4 GHz in the scope of Resolutions **769 (WRC-19)** and **770 (Rev.WRC-23)**,

invites administrations

to participate actively in the studies and provide the information required for the studies listed under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* by submitting contributions to the ITU Radiocommunication Sector (ITU-R),

invites the 2027 world radiocommunication conference

to consider, based on the results of the ITU-R studies, the possible revision of the conditions related to allocations to the FSS in the frequency band 51.4-52.4 GHz to enable its use by non-GSO FSS gateway earth stations on a primary basis and any other related regulatory provisions.

RESOLUTION 131 (WRC-23)

Consideration of technical and regulatory measures for fixed-satellite service satellite networks/systems in the frequency bands 37.5-42.5 GHz (space-to-Earth), 42.5-43.5 GHz (Earth-to-space), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) for equitable access to these frequency bands

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that, in the frequency ranges at 4/6/10/11/12/13/14/17/20/30/40/50 GHz, there are allocations to the fixed-satellite service (FSS) and/or broadcasting-satellite service (BSS) on a primary basis;
- b)* that a portion of radio-frequency spectrum in the frequency ranges at 4/6/10/11/12/13/14/17 GHz has been used to develop planned space services as contained in Appendices **30**, **30A** and **30B**;
- c)* the additional regulatory measures for the enhancement of equitable access are included in Resolution **553 (Rev.WRC-23)** in the BSS in the frequency band 21.4-22 GHz in Regions 1 and 3;
- d)* that all countries have equal rights with respect to the use of both the radio frequencies allocated to various space radiocommunication services and geostationary-satellite orbits (GSO) and non-geostationary-satellite orbits (non-GSO) for these services in accordance with the Radio Regulations;
- e)* that, accordingly, a country or a group of countries having satellite filings in the FSS in the frequency ranges at 30/40/50 GHz can take practical measures to facilitate the use of new space systems by other countries or groups of countries;
- f)* that the Plenipotentiary Conference 2022 adopted Resolution 219 (Bucharest, 2022), on sustainability of the radio-frequency spectrum and associated satellite-orbit resources used by space services;
- g)* that No. **5.550B**, which identifies the 37-43.5 GHz band for IMT, notes that potential deployment of FSS earth stations within the frequency range 37.5-42.5 GHz and high-density applications in the FSS in the frequency bands 39.5-40 GHz in Region 1, 40-40.5 GHz in all Regions and 40.5-42 GHz in Region 2 (see No. **5.516B**); administrations should further take into account potential constraints to IMT in these frequency bands, as appropriate,

considering further

that planning for FSS networks, as was done in the Appendices **30**, **30A** and **30B** in the C- and Ku-bands, resulted in undesired consequences such as a lack of flexibility to adapt to new technologies, and that lessons learned should be taken into account in the consideration of the frequency bands 37.5-42.5 GHz (space-to-Earth), 42.5-43.5 GHz (Earth-to-space), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) for equitable access,

recognizing

- a) that Articles 12 and 44 of the ITU Constitution lay down the basic principles for the use of the radio-frequency spectrum and the GSO and non-GSO systems, taking into account the needs of developing countries;
- b) that the “first-come, first-served” concept in Articles **9** and **11** can result in difficulties for future access to limited spectrum and orbits resources for later filed systems;
- c) the relative disadvantage for developing countries in coordination negotiations due to reasons such as a lack of resources and expertise;
- d) that Resolution **2 (Rev.WRC-03)** resolves that “the registration with the Radiocommunication Bureau of frequency assignments for space radiocommunication services and their use do not provide any permanent priority for any individual country or groups of countries and do not create an obstacle to the establishment of space systems by other countries”;
- e) that Resolution ITU-R 74 resolves to continue activities in the scope of the ITU Radiocommunication Sector (ITU-R) with a focus on equitable, efficient and economical use of the radio-frequency spectrum taking into account the special needs of developing countries,

recognizing further

- a) that there is a need to have additional technical and regulatory measures to ensure equitable access to the frequency ranges at 30/40/50 GHz in the FSS;
- b) that there are many GSO FSS submissions in the frequency ranges at 30/40/50 GHz, which can prevent access to these frequency bands by developing countries,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

to study the technical and regulatory measures for FSS satellite networks/systems in the frequency bands 37.5-42.5 GHz (space-to-Earth), 42.5-43.5 GHz (Earth-to-space), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), or portions thereof, for equitable access, while ensuring the protection of existing primary services to which the band is allocated in the same and adjacent bands, taking into account the specific needs of developing countries:

- without adversely affecting those services, specifically the operation of the satellite networks and systems in the bands;
- without changing measures to protect terrestrial services from unacceptable interference,

invites the 2027 world radiocommunication conference

to review the results of the studies in accordance with *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* above and take appropriate action on the usage of the frequency bands 37.5-42.5 GHz (space-to-Earth), 42.5-43.5 GHz (Earth-to-space), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) for equitable access to these frequency bands by FSS satellite networks/systems,

invites administrations

to participate actively in the studies by submitting contributions to ITU-R.

RESOLUTION 133 (WRC-23)

Study of the possible use of the frequency band 12.75-13.25 GHz by aeronautical and maritime earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service (Earth-to-space)

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the frequency band 12.75-13.25 GHz is currently allocated, on a primary basis, to fixed service, mobile service and fixed-satellite service (FSS) (Earth-to-space) and, on a secondary basis, to the deep-space research service (space-to-Earth) worldwide;
- b)* that the frequency band 12.75-13.25 GHz is used in the FSS by geostationary-satellite networks (GSO) in conformity with the provisions of Appendix **30B** (No. **5.441**) and that there are GSO satellite networks in the FSS that are operating in this frequency band;
- c)* that the frequency band 12.75-13.25 GHz is used in the FSS by non-geostationary-satellite (non-GSO) systems in conformity with No. **5.441**;
- d)* that the demand for aeronautical and maritime connectivity could be partially met by allowing aeronautical earth stations in motion (A-ESIMs) and maritime earth stations in motion (M-ESIMs) to communicate with non-GSO space stations in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space);
- e)* that advances in technology, including the use of antenna tracking techniques, allow A-ESIMs and M-ESIMs to operate within the characteristics of fixed earth stations in the FSS;
- f)* that the use of the frequency band 12.75-13.25 GHz for A-ESIMs and M-ESIMs operating with non-GSO FSS could contribute, as an additional use of the spectrum, to improving broadband communications for passengers;
- g)* that A-ESIMs and M-ESIMs referred to in the present Resolution are not to be used for safety-of-life applications;
- h)* that the frequency band 10.6-10.7 GHz is used for the Earth exploration-satellite service (EESS) (passive) in line with Recommendation ITU-R RS.1861;
- i)* that all emissions are prohibited in the frequency band 10.68-10.7 GHz according to No. **5.340**,

noting

- a) that Resolution **156 (Rev.WRC-23)** addresses the use of earth stations in motion (ESIMs) communicating with GSO space stations in the FSS in the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz;
- b) that Resolution **169 (Rev.WRC-23)** addresses the use of ESIMs communicating with GSO space stations in the FSS in the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz;
- c) that this conference has adopted Resolution **123 (WRC-23)** which contains the technical operational and regulatory provisions for ESIMs communicating with non-GSO space stations in the FSS in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth), and the frequency bands 27.5-29.1 GHz and 29.5-30.0 GHz (Earth-to-space);
- d) that this conference has adopted Resolution **121 (WRC-23)**, which contains the technical operational and regulatory provisions for the use of A-ESIMs and M-ESIMs communicating with GSO space stations in the FSS in the frequency band 12.75-13.25 GHz;
- e) that the use of non-GSO space stations in the FSS may introduce more complicated sharing scenarios,

recognizing

- a) that, in conformity with No. **5.441**, non-GSO systems shall not claim protection from GSO networks operating in conformity with the Radio Regulations and shall operate in such a way that any unacceptable interference that might occur due to their operation is immediately eliminated;
- b) that, in conformity with No. **5.441**, the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by a non-GSO satellite system in the FSS is subject to the application of the provisions of No. **9.12** for coordination with other non-GSO satellite systems in the FSS;
- c) that Article **21** contains the power flux-density limits at the Earth's surface produced by emissions from non-GSO FSS systems in the space-to-Earth direction to protect fixed and mobile services;
- d) that Article **22** contains the equivalent power flux-density limits for non-GSO FSS systems in the frequency band 12.75-13.25 GHz (Earth-to-space) that guarantee the protection of GSO networks;
- e) that non-GSO FSS systems that operate in the frequency band 12.75-13.25 GHz (Earth-to-space) may also operate in the frequency band 10.7-10.95 GHz (space-to-Earth) in accordance with No. **5.441**;
- f) that the potential interference impact from unwanted emissions produced by non-GSO FSS systems communicating with A-ESIMs and M-ESIMs in the frequency band 10.7-10.95 GHz (space-to-Earth) in accordance with No. **5.441**, into passive sensors of the EESS operating in the adjacent frequency band 10.6-10.7 GHz, should be studied to ensure protection of existing and future use of the frequency band by the EESS (passive);

g) that the current use and future development of existing services in the frequency band should be protected from unacceptable interference caused by operation of A-ESIMs and M-ESIMs communicating with non-GSO space stations in the frequency band;

h) that interference management mechanisms, including necessary mitigation measures, are required for the operation of non-GSO ESIMs to protect other space and terrestrial services to which the frequency band referred to in *considering a)* are allocated,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference

1 studies on the technical and operational characteristics of A-ESIMs and M-ESIMs planning to communicate with the non-GSO space stations in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space);

2 studies on sharing and compatibility between A-ESIMs and M-ESIMs communicating with non-GSO space stations in the FSS and the current and planned stations of existing services with allocations in the frequency band 12.75-13.25 GHz, ensuring that ESIMs will not call for further protection or cause more interference than existing typical earth stations;

3 the development of the technical conditions and regulatory provisions for the operation of A-ESIMs and M-ESIMs communicating with non-GSO space stations in the FSS that operate in the frequency band 12.75-13.25 GHz (Earth-to-space), taking into account the results of the studies outlined in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* 1 and 2, while ensuring the protection of incumbent services;

4 sharing and compatibility studies for communications between non-GSO space stations in the FSS and ESIMs with respect to the EESS (passive) allocated in the adjacent frequency band referred to in *recognizing f)*;

5 studies on the development of a new Recommendation for the network control and monitoring centre functionality for ESIM operation;

6 studies on the responsibility of the entities involved in the operation of the A-ESIMs and M-ESIMs addressed by this Resolution,

invites administrations

to participate actively in the studies by sending their contributions to the ITU Radiocommunication Sector,

invites the 2031 world radiocommunication conference

to consider the results of the above-mentioned studies and to adopt the necessary measures accordingly.

RESOLUTION 140 (REV.WRC-23)

Measures and studies associated with the equivalent power flux-density (epfd) limits in the frequency band 19.7-20.2 GHz

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that, after several years of study, WRC-2000 adopted epfd limits in a number of frequency bands to give practical effect to No. **22.2**, in order to facilitate non-geostationary-orbit (non-GSO) systems in the fixed-satellite service (FSS) to operate while still ensuring protection of GSO FSS networks from unacceptable interference;
- b)* that in Resolution **76 (WRC-2000)***, WRC-2000 also adopted aggregate epfd↓ limits in the same frequency bands for the protection of GSO FSS systems;
- c)* that a small number of systems based on constellations of satellites in highly elliptical orbits (HEOs), in certain FSS bands, have been operating for many years;
- d)* that since the late 1990s, especially after WRC-2000, there has been a growing interest in HEOs in a number of frequency bands and for several space services, predominantly in the FSS allocations below 30 GHz;
- e)* that ITU-R studies reported to WRC-03 considered HEO systems to be a sub-category of non-GSO systems and characterized their operational features;
- f)* that in the period between WRC-2000 and WRC-03, ITU-R developed Recommendations concerning frequency sharing between HEO FSS systems and other systems, including GSO, low Earth orbit (LEO), medium Earth orbit (MEO) and HEO systems;
- g)* that certain types of HEO system would have difficulty in meeting the long-term portion of epfd↓ limits in force in the frequency band 19.7-20.2 GHz,

noting

- a)* that, in the long-term portion, the epfd↓ limits in the frequency band 19.7-20.2 GHz are considerably more stringent than those in the 17.8-18.6 GHz frequency band;
- b)* that Nos. **9.7A** and **9.7B** apply in this frequency band;

* *Note by the Secretariat:* This Resolution was revised by WRC-15 and WRC-23.

- c) that the frequency band 19.7-20.2 GHz is one of the few bands identified by WRC-03 on a global basis for high-density applications in the fixed-satellite service;
- d) that Recommendation ITU-R S.1715 provides guidelines to protect GSO FSS networks in the frequency band 19.7-20.2 GHz,

resolves to invite administrations

to consider using the relevant ITU-R Recommendations regarding the protection of GSO FSS satellite networks from interference by non-GSO FSS systems as a guideline for consultation between administrations, to fulfil their obligations under No. **22.2** in the frequency band 19.7-20.2 GHz, and in the case where an administration responsible for a non-GSO FSS system requests the application of No. **22.5CA**,

instructs the Radiocommunication Bureau

in cases where an administration responsible for a non-GSO FSS system indicates in its coordination request its wish to apply No. **22.5CA** with respect to the $\text{epfd}_{\downarrow}$ limits in Table **22-1C** in the frequency band 19.7-20.2 GHz but has not yet reached the necessary agreements, to make a qualified favourable finding with respect to this provision. This provisional finding regarding compliance with $\text{epfd}_{\downarrow}$ limits shall be changed to a definitive favourable finding at the notification stage, only if all explicit agreements from administrations for which epfd limits are exceeded are obtained and an indication thereof is provided to the Bureau within two years from the date of receipt of the coordination request. Otherwise, this provisional finding shall be changed to a definitive unfavourable finding.

RESOLUTION 143 (REV.WRC-19)

Guidelines for the implementation of high-density applications in the fixed-satellite service in frequency bands identified for these applications

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that demand has been increasing steadily for global broadband communication services throughout the world, such as those provided by high-density applications in the fixed-satellite service (HDFSS);
- b) that HDFSS systems are characterized by flexible, rapid and ubiquitous deployment of large numbers of cost-optimized earth stations employing small antennas and having common technical characteristics;
- c) that HDFSS is an advanced broadband communication application concept that will provide access to a wide range of broadband telecommunication applications supported by fixed telecommunication networks (including the Internet), and thus will complement other telecommunication systems;
- d) that, as with other fixed-satellite service (FSS) systems, HDFSS offers great potential to establish telecommunication infrastructure rapidly;
- e) that HDFSS applications can be provided by satellites of any orbital type;
- f) that interference mitigation techniques have been and continue to be studied in the ITU Radiocommunication Sector (ITU-R) to facilitate sharing between HDFSS earth stations and terrestrial services;
- g) that, to date, studies have not concluded on the practicability of implementation of interference mitigation techniques for all HDFSS earth stations,

noting

- a) that No. **5.516B** identifies frequency bands for HDFSS;
- b) that, in some of these frequency bands, the FSS allocations are co-primary with fixed- and mobile-service allocations as well as other services;
- c) that this identification does not preclude the use of these frequency bands by other services or by other FSS applications, and does not establish priority in these Radio Regulations among users of the frequency bands;
- d) that, in the frequency band 18.6-18.8 GHz, the FSS allocation is co-primary with the Earth exploration-satellite service (EESS) (passive) with the restrictions of Nos. **5.522A** and **5.522B**;
- e) that radio astronomy observations are carried out in the frequency band 48.94-49.04 GHz, and that such observations require protection at notified radio astronomy stations;

- f) that co-frequency sharing between transmitting HDFSS earth stations and terrestrial services is difficult in the same geographical area;
- g) that co-frequency sharing between receiving HDFSS earth stations and terrestrial stations in the same geographical area may be facilitated through the implementation of interference mitigation techniques, if practicable;
- h) that many FSS systems with other types of earth stations and characteristics have already been brought into use or are planned to be brought into use in some of the frequency bands identified for HDFSS in No. **5.516B**;
- i) that HDFSS stations in these frequency bands are expected to be deployed in large numbers over urban, suburban and rural areas of large geographical extent;
- j) that the frequency band 50.2-50.4 GHz, adjacent to the frequency band 48.2-50.2 GHz (Earth-to-space) identified for HDFSS in Region 2, is allocated to the EESS (passive),

recognizing

- a) that in cases where FSS earth stations use frequency bands that are shared on a co-primary basis with terrestrial services, the Radio Regulations stipulate that earth stations of the FSS shall be individually notified to the Radiocommunication Bureau when their coordination contours extend into the territory of another administration;
- b) that, as a consequence of their general characteristics, it is expected that the coordination of HDFSS earth stations with fixed-service stations on an individual site-by-site basis between administrations will be a difficult and long process;
- c) that, to minimize the burden for administrations, simplified coordination procedures and provisions can be agreed by administrations for large numbers of similar HDFSS earth stations associated with a given satellite system;
- d) that harmonized worldwide frequency bands for HDFSS would facilitate the implementation of HDFSS, thereby helping to maximize global access and economies of scale,

recognizing further

that HDFSS applications implemented on FSS networks and systems are subject to all provisions of the Radio Regulations applicable to the FSS, such as coordination and notification pursuant to Articles 9 and 11, including any requirements to coordinate with terrestrial services of other countries, and the provisions of Articles 21 and 22,

resolves

that administrations which implement HDFSS should consider the following guidelines:

- a) make some or all of the frequency bands identified in No. **5.516B** available for HDFSS applications;

- b) in making frequency bands available under *resolves a)*, take into account:
- that HDFSS deployment will be simplified in frequency bands that are not shared with terrestrial services;
 - in frequency bands shared with terrestrial services, the impact that the further deployment of terrestrial stations would have on the existing and future development of HDFSS, and the further deployment of HDFSS earth stations would have on the existing and future development of terrestrial services;
- c) take into account the relevant technical characteristics applicable to HDFSS, as identified by ITU-R Recommendations (e.g. the most recent versions of Recommendations ITU-R S.524, ITU-R S.1594 and ITU-R S.1783);
- d) take into account other existing and planned FSS systems, having different characteristics, in frequency bands where HDFSS is implemented in accordance with *resolves a)* above, and the conditions specified in No. **5.516B**,

invites administrations

1 to give due consideration to the benefits of harmonized utilization of the spectrum for HDFSS on a global basis, taking into account the use and planned use of these frequency bands by all other services to which they are allocated, as well as other types of FSS applications;

2 to consider implementing simplified procedures and provisions that facilitate the deployment of HDFSS systems in some or all of the frequency bands identified in No. **5.516B**;

3 when considering the deployment of HDFSS systems in the upper portion of the frequency band 48.2-50.2 GHz, to take into account as appropriate the potential impact such deployment may have on the satellite passive services in the adjacent frequency band 50.2-50.4 GHz, and to participate in ITU-R studies on the compatibility between these services, taking into account No. **5.340**;

4 to consider, given *invites administrations* 3 above, and where practicable, starting the deployment of HDFSS earth stations in the lower part of the frequency band 48.2-50.2 GHz.

RESOLUTION 144 (REV.WRC-15)

Special requirements of geographically small or narrow countries operating earth stations in the fixed-satellite service in the frequency band 13.75-14 GHz

The World Radiocommunication Conference (Geneva, 2015),

considering

- a) that WARC-92 made an additional allocation to the fixed-satellite service (FSS) (Earth-to-space) in the frequency band 13.75-14 GHz;
- b) that this frequency band is shared with the radiolocation and radionavigation services;
- c) that, following a decision by WRC-2000 and the completion of ITU-R studies, WRC-03 reviewed and revised the sharing conditions for the services in this frequency band and adopted new regulations which govern sharing between the FSS, radiolocation and radionavigation services (see No. **5.502**);
- d) that these revised sharing conditions additionally permit the operation of geostationary FSS earth stations in the frequency band 13.75-14 GHz with antennas having diameters between 1.2 m and 4.5 m,

recognizing

- a) that these sharing conditions of No. **5.502** will mean that countries which are geographically small or narrow will have significant difficulties deploying geostationary FSS earth stations in this frequency band with antennas having diameters between 1.2 m and 4.5 m;
- b) that in order to further facilitate sharing between the FSS and the maritime radiolocation systems operating in the radiolocation service, there may be a need to develop technical and operational methods;
- c) that these technical and operational methods may be used to allow a greater deployment of FSS earth stations in the frequency band 13.75-14 GHz in conformity with No. **5.502** while protecting the radiolocation service,

noting

Recommendation ITU-R S.1712 “Methodologies for determining whether an FSS earth station at a given location could transmit in the frequency band 13.75-14 GHz without exceeding the pfd limits in No. **5.502** of the Radio Regulations, and guidelines to mitigate excesses”,

resolves

that the administrations of geographically small or narrow countries may exceed the limitations on FSS earth station power flux-density at the low-water mark in No. **5.502** if such operation is in conformance with bilateral agreements with administrations deploying maritime radiolocation systems in the frequency band 13.75-14 GHz, this being in order to provide due consideration to administrations of geographically small or narrow countries,

encourages

administrations deploying maritime and land mobile radiolocation systems in the frequency band 13.75-14 GHz to rapidly reach bilateral agreements relating to the operation of FSS earth stations in this frequency band with administrations of those geographically small or narrow countries deploying these FSS earth stations, this being in order to provide due consideration to administrations of geographically small or narrow countries.

RESOLUTION 145 (REV.WRC-19)

**Use of the frequency band 27.9-28.2 GHz by
high-altitude platform stations in the fixed service**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that WRC-97 made provision for the operation of high-altitude platform stations (HAPS), also known as stratospheric repeaters, within a 2×300 MHz portion of the fixed-service allocation in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz;
- b) that No. **4.23** specifies that transmissions to or from HAPS shall be limited to the frequency bands specifically identified in Article 5;
- c) that, at WRC-2000, several countries in Region 3 and one country in Region 1 expressed a need for a lower frequency band for HAPS due to the excessive rain attenuation that occurs at 47 GHz in these countries;
- d) that some countries in Region 2 have also expressed an interest in using a frequency range lower than those referred to in *considering a*);
- e) that, in order to accommodate the need expressed by the countries referred to in *considering c*), WRC-2000 adopted Nos. **5.537A** and **5.543A**, which were modified at WRC-03 and then again at WRC-07 to permit the use of HAPS in the fixed service in the frequency band 27.9-28.2 GHz and in the frequency band 31-31.3 GHz in certain Region 1 and 3 countries on a non-harmful interference, non-protection basis;
- f) that the frequency band 27.9-28.2 GHz is already heavily used or planned to be used by a number of different services and a number of other types of applications in the fixed service;
- g) that while the decision to deploy HAPS can be taken on a national basis, such deployment may affect neighbouring administrations, particularly in small countries;
- h) that the ITU Radiocommunication Sector (ITU-R) has conducted studies dealing with sharing between systems using HAPS in the fixed service and other types of systems in the fixed service in the frequency band 27.9-28.2 GHz, leading to Recommendation ITU-R F.1609;
- i) that results of some ITU-R studies indicate that, in the frequency band 27.9-28.2 GHz, sharing between fixed-service systems using HAPS and other conventional fixed-service systems in the same area will require appropriate interference mitigation techniques to be developed and implemented;
- j) that ITU-R has produced Recommendation ITU-R SF.1601 containing methodologies for evaluating interference from fixed-service systems using HAPS into geostationary-satellite systems in the fixed-satellite service in the frequency band 27.9-28.2 GHz;

k) that HAPS technical issues could continue to be studied in order to determine appropriate measures for protecting the fixed service and other co-primary services in the frequency band 27.9-28.2 GHz,

resolves

1 that, notwithstanding No. 4.23, in Region 2 the use of HAPS within the fixed-service allocations in the frequency band 27.9-28.2 GHz shall not cause harmful interference to, or claim protection from, other stations of services operating in accordance with the Table of Frequency Allocations of Article 5, and, further, that the development of these other services shall proceed without constraints by HAPS operating pursuant to this Resolution;

2 that any use by HAPS of the fixed-service allocation at 27.9-28.2 GHz pursuant to *resolves* 1 above shall be limited to operation in the HAPS-to-ground direction;

3 that the administrations listed in No. 5.537A which intend to implement systems using HAPS in the fixed service in the frequency band 27.9-28.2 GHz shall seek explicit agreement of concerned administrations with regard to their stations of primary services to ensure that the conditions in No. 5.537A are met, and those administrations in Region 2 which intend to implement systems using HAPS in the fixed service in these frequency bands shall seek explicit agreement of concerned administrations with regard to their stations of services operating in accordance with the Table of Frequency Allocations of Article 5 to ensure that the conditions in *resolves* 1 are met;

4 that administrations planning to implement a HAPS system pursuant to *resolves* 1 above shall notify the frequency assignment(s) by submitting all mandatory elements of Appendix 4 to the Radiocommunication Bureau for the examination of compliance with *resolves* 3 above,

invites the ITU Radiocommunication Sector

1 to continue to carry out studies on the appropriate interference mitigation techniques for the situations referred to in *considering* i);

2 to develop protection criteria for the mobile service having primary allocations in the frequency band 27.9-28.2 GHz from HAPS in the fixed service and include the results of these studies in existing or new ITU-R Reports/Recommendations, as appropriate.

RESOLUTION 147 (WRC-07)

Power flux-density limits for certain systems in the fixed-satellite service using highly-inclined orbits having an apogee altitude greater than 18 000 km and an orbital inclination between 35° and 145° in the band 17.7-19.7 GHz

The World Radiocommunication Conference (Geneva, 2007),

considering

- a)* that the band 17.7-19.7 GHz is heavily used in many countries for fixed service (FS) applications including mobile communication network infrastructure;
- b)* that in the band 17.7-19.7 GHz, there are planned or existing non-geostationary (non-GSO) fixed-satellite service (FSS) systems using satellites with highly-inclined orbits having an apogee altitude greater than 18 000 km and an orbital inclination between 35° and 145°;
- c)* that in this frequency band, ITU-R has conducted studies of the impact on FS stations of the pfd produced or to be produced by non-GSO FSS systems of the types described in *considering b)*;
- d)* that one of the types of systems referred to in *considering b)* under the ITU filing name USCSID-P, was notified and brought into use under the applicable power flux-density (pfd) levels for the 17.7-19.7 GHz band in Table 21-4:

-115	dB(W/(m ² · MHz))	for	0° ≤ δ < 5°
-115 + 0.5(δ - 5)	dB(W/(m ² · MHz))	for	5° ≤ δ ≤ 25°
-105	dB(W/(m ² · MHz))	for	25° < δ ≤ 90°

where δ is the angle of arrival above the horizontal plane in degrees,

recognizing

- 1 that studies carried out in ITU-R of the systems described in *considering b)*, demonstrated that the system described in *considering d)* did not cause harmful interference to the fixed service in the 17.7-19.7 GHz band;
- 2 that one FSS system of the type described in *considering d)* has been operating since 1995 at the -115/-105 dB(W/(m² · MHz)) levels and there has been no complaint of harmful interference to any station in the fixed service of any administration,

resolves

that in the band 17.7-19.7 GHz, FSS space stations currently operating in a system of the type described in *considering d)* and for which advance publication information was received by the Radiocommunication Bureau before 5 July 2003, as well as space stations with the same parameters in a future notice for a replacement system, shall continue to be subject to the power flux-density limits:

-115	dB(W/(m ² · MHz))	for	0° ≤ δ < 5°
-115 + 0.5(δ - 5)	dB(W/(m ² · MHz))	for	5° ≤ δ ≤ 25°
-105	dB(W/(m ² · MHz))	for	25° < δ ≤ 90°

where δ is the angle of arrival above the horizontal plane in degrees.

RESOLUTION 148 (REV.WRC-15)

**Satellite systems formerly listed in Part B of the Plan of Appendix 30B
(WARC Orb-88)**

The World Radiocommunication Conference (Geneva, 2015),

considering

a) that WARC Orb-88 adopted a Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz contained in Appendix **30B (WARC Orb-88)**;

b) that, when the Plan was adopted, some satellite systems in the same frequency bands were under coordination or had been recorded in the Master International Frequency Register (MIFR), or had information relating to advance publication that was received by the Radiocommunication Bureau before 8 August 1985, and which in all cases were listed in Part B of the Plan at WARC Orb-88;

c) that in the original provisions of Appendix **30B (WARC Orb-88)**, the satellite systems mentioned in *considering b)* above were referred to as “existing systems”;

d) that satellite systems identified in *considering b)* have either been included in the List of Appendix **30B** or cancelled, and thus Part B of the Plan is empty;

e) that, therefore, WRC-07 suppressed Part B of the Plan in Appendix **30B**,

recognizing

a) that § 9.2 of Appendix **30B (WARC Orb-88)** indicates that “The existing systems listed in Part B of the Plan may continue in operation for a maximum period of 20 years from the date of entry into force of this Appendix”, and consequently the period of operation of satellite systems in Part B of the Plan expires after 16 March 2010;

b) that some administrations expressed their wish to continue operation of these systems after the deadline mentioned in *recognizing a)*;

c) that satellite systems referred to in *considering b)* are compatible with satellite networks in Appendix **30B**,

resolves

that an administration wishing to further extend the notified period of validity of assignments to “existing system(s)” as referred to in *considering c)* shall inform the Bureau accordingly more than three years before the expiry of the notified period of validity and, if the characteristics of that assignment remain unchanged, the Bureau shall amend, as requested, the notified period of validity and publish that information in a special section of the Bureau’s International Frequency Information Circular (BR IFIC),

instructs the Radiocommunication Bureau

- 1 to cancel from the Master Register and the List assignments to “existing system(s)” as referred to in *considering c)* upon expiry of their notified period of validity;
- 2 to calculate aggregate *C/I* of the “existing systems” as referred to in *considering c)* without taking into account the interference between these systems;
- 3 to take the appropriate actions in accordance with *resolves* above.

RESOLUTION 149 (REV.WRC-12)

**Submissions from new Member States of the Union relating
to Appendix 30B of the Radio Regulations**

The World Radiocommunication Conference (Geneva, 2012),

considering

a) that WARC Orb-88 adopted a Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz as contained in Appendix **30B (WARC Orb-88)**;

b) that WRC-07 revised the Appendix **30B** Plan and the associated regulatory procedures;

c) that WRC-07 decided that the principle of guaranteed access to spectrum resources for all Members of the Union must be maintained and, as a consequence, the highest priority should be given to submissions from countries not having a national allotment in the Plan or an assignment in the List stemming from the conversion of an allotment;

d) that under the regulatory provisions adopted by WARC Orb-88 and revised by subsequent conferences, submissions from Member States not having a national allotment in the Plan or an assignment in the List stemming from the conversion of an allotment are processed in order of receipt together with other submissions,

recognizing

that some countries that have joined, or may join, the Union as a Member State do not have a national allotment or an assignment in the List stemming from the conversion of an allotment,

resolves

1 that an administration of a country which has joined the Union as a Member State and does not have a national allotment in the Plan or an assignment in the List stemming from the conversion of an allotment shall have the right to request the Bureau to exclude its territory from the service area of an allotment or an assignment, whereupon the Bureau shall exclude the territory accordingly without adversely affecting the rest of the service area and subsequently recalculate the new reference situation for the Appendix **30B** Plan and List;

2 to urge administrations¹ to make utmost efforts to accommodate submissions received from new Member States of ITU.

¹ Those administrations which are the basis of unfavourable findings with respect to submissions from new Member States.

RESOLUTION 150 (WRC-12)

**Use of the bands 6 440-6 520 MHz and 6 560-6 640 MHz by gateway links
for high-altitude platform stations in the fixed service**

The World Radiocommunication Conference (Geneva, 2012),

considering

- a)* that ITU has among its purposes “to promote the extension of the benefit of the new telecommunication technologies to all the world’s inhabitants” (No. 6 of the Constitution);
- b)* that systems based on new technologies using high-altitude platform stations (HAPS) can potentially be used for various applications such as the provision of high-capacity services to urban and rural areas;
- c)* that provision has been made in the Radio Regulations for the deployment of HAPS in specific bands, including as base stations to serve IMT networks;
- d)* that at WRC-07, a need for provision for gateway links to serve HAPS operations was expressed;
- e)* that WRC-07 invited ITU-R to conduct sharing studies, with a view to identifying two channels of 80 MHz each for gateway links for HAPS in the range from 5 850 to 7 075 MHz, in bands already allocated to the fixed service, while ensuring the protection of existing services;
- f)* that for the purpose of protecting the operations of the Earth exploration-satellite service (EESS) (passive) in the band 6 425-7 075 MHz, No. **5.458** applies;
- g)* that for the purpose of protecting the radio astronomy service in the band 6 650-6 675.2 MHz, No. **5.149** applies;
- h)* that the range 5 850-7 075 MHz is already heavily used or planned to be used by a number of different services and a number of other types of applications in the fixed service;
- i)* that in order to accommodate the need stated in *considering d)*, WRC-12 adopted No. **5.457** to permit the use of HAPS gateway links in the fixed service in the bands 6 440-6 520 MHz and 6 560-6 640 MHz in the limited number of countries listed in the footnote;
- j)* that compatibility between HAPS and affected services will largely depend on the number of administrations deploying HAPS and the total number of such systems;
- k)* that while the deployment of HAPS gateway links in the bands 6 440-6 520 MHz and 6 560-6 640 MHz is taken on a national basis, such deployment would affect other administrations;
- l)* that Appendix 4 does not contain all the necessary data elements pertaining to HAPS gateway links,

recognizing

- a) that ITU-R has studied technical and operational characteristics of HAPS gateway links in the fixed service in the range 5 850-7 075 MHz resulting in Recommendation ITU-R F.1891;
- b) that Recommendation ITU-R F.2011 contains a methodology to evaluate interference from HAPS gateway downlinks in the fixed service to conventional fixed wireless systems in the range 5 850-7 075 MHz;
- c) that Report ITU-R F.2240 contains the results of interference analyses between HAPS gateway links in the fixed service and other systems/services in the range 5 850-7 075 MHz;
- d) that the World Summit on the Information Society has encouraged the development and application of emerging technologies to facilitate infrastructure and network development worldwide with special focus on under-served regions and areas,

resolves

- 1 that the antenna pattern for both the HAPS platform and the HAPS gateway station in the bands 6 440-6 520 MHz and 6 560-6 640 MHz shall meet the following antenna beam patterns:

$$\begin{aligned}
 G(\psi) &= G_m - 3(\psi/\psi_b)^2 & \text{dBi} & \quad \text{for} & \quad 0^\circ \leq \psi \leq \psi_1 \\
 G(\psi) &= G_m + L_N & \text{dBi} & \quad \text{for} & \quad \psi_1 < \psi \leq \psi_2 \\
 G(\psi) &= X - 60 \log(\psi) & \text{dBi} & \quad \text{for} & \quad \psi_2 < \psi \leq \psi_3 \\
 G(\psi) &= L_F & \text{dBi} & \quad \text{for} & \quad \psi_3 < \psi \leq 90^\circ
 \end{aligned}$$

where:

$G(\psi)$: gain at the angle ψ from the main beam direction (dBi)

G_m : maximum gain in the main lobe (dBi)

ψ_b : one-half of the 3 dB beamwidth in the plane considered (3 dB below G_m) (degrees)

L_N : near side-lobe level (dB) relative to the peak gain required by the system design, and has a maximum value of -25 dB

L_F : far side-lobe level, $G_m - 73$ dBi.

$$\psi_1 = \psi_b \sqrt{-L_N/3} \quad \text{degrees}$$

$$\psi_2 = 3.745 \psi_b \quad \text{degrees}$$

$$X = G_m + L_N + 60 \log(\psi_2) \quad \text{dBi}$$

$$\psi_3 = 10^{(X-L_F)/60} \quad \text{degrees}$$

$$\psi_b = \sqrt{7 \cdot 442 / (10^{0.1 G_m})} \quad \text{degrees;}$$

2 that the maximum angle of deviation of the HAPS airborne antenna from the nadir for gateway links shall be limited to 60 degrees corresponding to the urban area coverage of the HAPS; and the maximum number of gateway stations operating with a single platform shall not exceed 5;

3 that the minimum antenna elevation angle of HAPS gateway stations on the ground shall be 30 degrees;

4 that for the purpose of protecting the fixed satellite service (Earth-to-space), the aggregate pfd of HAPS uplinks shall be limited to a maximum of -183.9 dBW/m^2 in 4 kHz at any point in the geostationary arc. To meet this aggregate pfd criterion, the maximum e.i.r.p. value of a single HAPS gateway link towards the geostationary arc shall not exceed -59.9 dBW/4 kHz in any direction within ± 5 degrees of the geostationary arc;

5 that for the purpose of protecting the fixed wireless systems in other administrations in the band 6 440-6 520 MHz, the e.i.r.p. of the HAPS downlink shall be limited to a maximum of -0.5 dBW/10 MHz for all off-axis angles from the nadir to 60 degrees from the nadir;

6 that for the purpose of protecting EESS passive operations over oceans, HAPS gateway stations shall maintain a minimum distance of 100 kilometres for a single HAPS gateway station and 150 kilometres for several HAPS gateway stations from coast lines;

7 that administrations planning to implement HAPS gateway links in the notification to the Bureau of the frequency assignment(s) shall submit all mandatory parameters for the examination by the Bureau for compliance with respect to *resolves* 1 to 6 above, and also the explicit agreement obtained pursuant to No. **5.457**,

invites

administrations to consult with the Director of the Radiocommunication Bureau to determine the data elements of HAPS gateway stations necessary for notification and examination of frequency assignments in accordance with the provisions of Article 11 and Appendix 4,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution.

RESOLUTION 154 (REV.WRC-15)

Consideration of technical and regulatory actions in order to support existing and future operation of fixed-satellite service earth stations within the frequency band 3 400-4 200 MHz, as an aid to the safe operation of aircraft and reliable distribution of meteorological information in some countries in Region 1

The World Radiocommunication Conference (Geneva, 2015),

considering

- a)* that the frequency band 3 400-4 200 MHz is allocated worldwide to the fixed-satellite service (FSS) in the space-to-Earth direction and to the fixed service on a primary basis;
- b)* that the frequency band 3 400-3 600 MHz is allocated on a primary basis to the mobile, except aeronautical mobile, service and identified for International Mobile Telecommunications (IMT) in Region 1 countries as specified in Article 5 of the Radio Regulations;
- c)* that in Region 1, the allocation to the mobile, except aeronautical mobile, service in the frequency band 3 400-3 600 MHz is subject to technical and regulatory conditions aimed at ensuring compatibility with co-primary services of neighbouring countries;
- d)* that a number of developing countries rely, to a great extent, on FSS systems using very small aperture terminals (VSAT) in the frequency band 3 400-4 200 MHz for the provision of communications as an aid to safe operation of aircraft and reliable distribution of meteorological information;
- e)* that, in some cases, where an adequate terrestrial communication infrastructure is not available, VSAT networks referred to in *considering d)* above are the only viable option to augment the communication infrastructure in order to satisfy the overall communications infrastructure requirements of the International Civil Aviation Organization (ICAO) and to ensure distribution of meteorological information under the auspices of the World Meteorological Organization (WMO);
- f)* that the relevant ITU Radiocommunication Sector (ITU-R) studies showed a potential for interference from fixed wireless access and IMT stations into FSS receiving earth stations at distances from less than one kilometre up to hundreds of kilometres, depending on the parameters and deployment of stations of these services;
- g)* that WRC-12, taking into account the studies mentioned in *considering f)* above, decided to study technical and regulatory measures to support the FSS earth stations referred to in *considering e)* above,

noting

- a) that, by the date of this conference, several cases of harmful interference to the FSS VSATs used for aeronautical safety communications from fixed wireless access or IMT stations were reported;
- b) that these reported cases of interference indicated difficulties that some administrations have encountered in the coordination of frequencies between the fixed wireless access or IMT systems and frequency assignments for VSATs used for aeronautical and meteorological purposes;
- c) that, in many countries, FSS VSAT earth stations are not subject to individual licensing and not registered as specific stations in their national frequency databases and in the ITU Master International Frequency Register (MIFR) due to the considerable administrative work involved;
- d) that knowledge of the location and operational frequencies of VSAT stations used for communications as an aid to the safe operation of aircraft and/or distribution of meteorological information is critically important for ensuring compatibility with applications of other services,

recognizing

- a) that ITU-R conducted comprehensive studies of compatibility between FSS on the one hand and fixed wireless access systems and IMT applications on the other hand in the frequency band 3 400-4 200 MHz, and summarized the results of the studies in Recommendation ITU-R SF.1486 as well as Reports ITU-R S.2199, ITU-R M.2109 and ITU-R S.2368;
- b) that the Recommendation and Reports identified in *recognizing a)* offer a set of mitigation techniques that could be employed for international coordination and at a national level and to facilitate coexistence of FSS, fixed service and mobile service systems;
- c) that Recommendation ITU-R S.1856 contains methodologies for verification of compliance with the relevant power flux-density (pfd) limit set forth in the Radio Regulations,

resolves

1 to recommend that administrations in countries where the frequency band 3 400-3 600 MHz is allocated on a primary basis to the mobile, except aeronautical mobile, service in Region 1 and identified for IMT in Region 1 ensure compliance of IMT stations with the relevant provisions set forth in the Radio Regulations and apply the relevant coordination procedures before bringing these applications into use;

2 to urge administrations in Region 1, when planning and/or licensing fixed point-to-point, fixed wireless access and IMT systems in frequency bands referred to in *considering b)* above, to take into account the protection needs of existing and planned FSS earth stations within the frequency band 3 400-4 200 MHz, as an aid to the safe operation of aircraft and reliable distribution of meteorological information in some countries in Region 1;

3 to invite administrations in Region 1, taking into account the number of earth stations involved for this particular type of usage, to consider the possibility of licensing the FSS earth stations used for communications as an aid to the safe operation of aircraft and/or distribution of meteorological information on an individual basis and registering them in the MIFR as specific earth stations;

4 to encourage administrations in Region 1 to employ the appropriate mitigation techniques described in the ITU-R publications referred to in *recognizing a)* above;

5 to invite administrations to ensure that the application of these technical and regulatory measures to FSS and the mobile service does not limit the use of the frequency band 3 400-4 200 MHz by other existing and planned systems and services in other countries,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO and WMO.

RESOLUTION 155 (REV.WRC-19)

Regulatory provisions related to earth stations on board unmanned aircraft which operate with geostationary-satellite networks in the fixed-satellite service in certain frequency bands not subject to a Plan of Appendices 30, 30A and 30B for the control and non-payload communications of unmanned aircraft systems in non-segregated airspaces*

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that the operation of unmanned aircraft systems (UAS) requires reliable control and non-payload communication (CNPC) links, in particular to relay air traffic control communications and for the remote pilot to control the flight;
- b) that satellite networks may be used to provide CNPC links of UAS beyond the line-of-sight, as shown in Annex 1 to this Resolution;
- c) that CNPC links between space stations and stations on board unmanned aircraft (UA) are proposed to be operated under this Resolution in the primary fixed-satellite service (FSS) in frequency bands shared with other primary services, including terrestrial services, however that would not preclude the use of other available allocations to accommodate this application,

considering further

that UAS CNPC links relate to the safe operation of UAS and have to comply with certain technical, operational and regulatory requirements,

noting

- a) that WRC-15 adopted Resolution **156 (WRC-15)**** on the use of earth stations in motion communicating with geostationary FSS space stations in the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz;
- b) that Report ITU-R M.2171 provides information on characteristics of UAS and spectrum requirements to support their safe operation in non-segregated airspace,

recognizing

- a) that the UAS CNPC links will operate in accordance with international standards and recommended practices (SARPs) and procedures established in accordance with the Convention on International Civil Aviation;

* May also be used consistent with international standards and practices approved by the responsible civil aviation authority.

** *Note by the Secretariat:* This Resolution was revised by WRC-23.

b) that, in this Resolution, conditions are provided for operations of CNPC links without prejudging whether the International Civil Aviation Organization (ICAO) would be able to develop SARPs to ensure safe operation of UAS under these conditions,

resolves

1 that assignments to stations of GSO FSS networks operating in the frequency bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.5 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Regions 1 and 3 and 19.7-20.2 GHz (space-to-Earth), and in the frequency bands 14-14.47 GHz (Earth-to-space) and 29.5-30.0 GHz (Earth-to-space), may be used for UAS CNPC links in non-segregated airspace*, provided that the conditions specified in *resolves* below are met;

2 that earth stations in motion on board UA may communicate with the space station of a GSO FSS network operating in the frequency bands listed in *resolves* 1 above, provided that the class of the earth station in motion on board UA is matched with the class of the space station and that other conditions of this Resolution are met (see also *instructs the Director of the Radiocommunication Bureau* 3 below);

3 that the frequency bands specified in *resolves* 1 shall not be used for the UAS CNPC links before the adoption of the relevant international aeronautical SARPs consistent with Article 37 of the Convention on International Civil Aviation, taking into account *instructs the Director of the Radiocommunication Bureau* 4;

4 that administrations responsible for an FSS network providing UA CNPC links shall apply the relevant provisions of Articles 9 (necessary provisions need to be identified or developed) and 11 for the relevant assignments, including, as appropriate, assignments to the corresponding space station, specific and typical earth station and earth station in motion on board UA, including the request for publication in the International Frequency Information Circular (BR IFIC) of items referred to in *resolves* 2 and the course of actions identified in that *resolves* in order to obtain international rights and recognition as specified in Article 8;

5 that earth stations of UAS CNPC links shall operate within the notified and recorded technical parameters of the associated satellite network, including specific or typical earth stations of the GSO FSS network(s) as published by the Radiocommunication Bureau (BR);

6 that earth stations of UAS CNPC links shall not cause more interference to, or claim more protection from, other satellite networks and systems than specific or typical earth stations as indicated in *resolves* 5 as published by BR;

* May also be used consistent with international standards and practices approved by the responsible civil aviation authority.

7 that, in order to apply *resolves* 6 above, administrations responsible for the FSS network to be used for UAS CNPC links shall provide the level of interference for the reference assignments of the network used for CNPC links upon request by an administration authorizing the use of UAS CNPC links within its territory;

8 that earth stations of UAS CNPC links of a particular FSS network shall not cause more interference to, or claim more protection from, stations of terrestrial services than specific or typical earth stations of that FSS network as indicated in *resolves* 5 that have been previously coordinated and/or notified under relevant provisions of Articles 9 and 11;

9 that the use of assignments of an FSS satellite network for UAS CNPC links shall not constrain other FSS networks during the application of the provisions of Articles 9 and 11;

10 that the introduction of UAS CNPC links shall not result in additional coordination constraints on terrestrial services under Articles 9 and 11;

11 that earth stations on board UA shall be designed and operated so as to be able to accept the interference caused by terrestrial services operating in conformity with the Radio Regulations in the frequency bands listed in *resolves* 1 without complaints under Article 15;

12 that earth stations on board UA shall be designed and operated so as to be able to operate with interference caused by other satellite networks resulting from application of Articles 9 and 11;

13 that, in order to ensure safety-of-flight operation of UAS, administrations responsible for operating UAS CNPC links shall:

- ensure that the use of UAS CNPC links be in accordance with international SARPs consistent with Article 37 of the Convention on International Civil Aviation;
- take the required measures, consistent with No. 4.10, to ensure freedom from harmful interference to earth stations on board UA operated in accordance with this Resolution;
- act immediately when their attention is drawn to any such harmful interference, as freedom from harmful interference to UAS CNPC links is imperative to ensure their safe operation, taking into account *resolves* 11;
- use assignments associated with the FSS networks for UAS CNPC links (see Figure 1 in Annex 1), including assignments to space stations, specific or typical earth stations and earth stations on board UA (see *resolves* 2), that have been successfully coordinated under Article 9 (including provisions identified in *resolves* 4) and recorded in the Master International Frequency Register with a favourable finding under Article 11, including Nos. 11.31, 11.32 or 11.32A where applicable, and except those assignments that have not successfully completed coordination procedures under No. 11.32 by applying Appendix 5 § 6.d.i;

– ensure that real-time interference monitoring, estimation and prediction of interference risks and planning solutions for potential interference scenarios are addressed by FSS operators and UAS operators with guidance from aviation authorities;

14 that, unless otherwise agreed between the administrations concerned, UA CNPC earth stations shall not cause harmful interference to terrestrial services of other administrations (see also Annex 2 to this Resolution);

15 that, in order to implement *resolves* 14 above, power flux-density (pfd) hard limits need to be developed for UAS CNPC links; possible examples of such provisional limits to protect the fixed service are provided in Annex 2; subject to agreement between the administrations concerned, that annex may be used for the implementation of this Resolution;

16 that the pfd hard limits provided in Annex 2 shall be reviewed and, if necessary, revised by WRC-23¹;

17 that, in order to protect the radio astronomy service in the frequency band 14.47-14.5 GHz, administrations operating UAS in accordance with this Resolution in the frequency band 14-14.47 GHz within line-of-sight of radio astronomy stations are urged to take all practicable steps to ensure that the emissions from the UA in the frequency band 14.47-14.5 GHz do not exceed the levels and percentage of data loss given in the most recent versions of Recommendations ITU-R RA.769 and ITU-R RA.1513;

18 to consider the progress obtained by ICAO in the process of preparation of SARPs for UAS CNPC links, to review this Resolution at WRC-23, taking into account the results of the implementation of Resolution **156 (WRC-15)***, and to take necessary actions as appropriate;

19 that the ITU Radiocommunication Sector (ITU-R) studies on technical, operational and regulatory aspects in relation to the implementation of this Resolution shall be completed, together with the adoption of relevant ITU-R Recommendations defining the technical characteristics of CNPC links and conditions of sharing with other services,

encourages administrations

1 to provide the relevant information where available in order to facilitate the application of *resolves* 6;

2 to participate actively in the studies referred to in *invites the ITU Radiocommunication Sector* by submitting contributions to ITU-R,

¹ WRC-19 received a proposal from one regional organization regarding protection of the fixed service using a revised pfd mask as contained in Annex 2 section b). ITU-R is invited, in continuing its study on the implementation of this Resolution, to consider this mask and take necessary action as appropriate.

* *Note by the Secretariat:* This Resolution was revised by WRC-23.

invites the 2023 World Radiocommunication Conference

to consider the results of the above studies referred to in this Resolution with a view to reviewing and, if necessary, revising this Resolution, and take necessary actions, as appropriate,

invites the ITU Radiocommunication Sector

to conduct, as a matter of urgency, relevant studies of technical, operational and regulatory aspects in relation to the implementation of this Resolution¹,

instructs the Director of the Radiocommunication Bureau

1 to examine the relevant part of this Resolution requiring actions to be taken by administrations to implement this Resolution, with a view to sending it to administrations and posting it on the ITU website;

2 to present to subsequent WRCs a progress report relating to the implementation of this Resolution;

3 to define a new class of station in order to be able to process satellite network filings submitted by administrations for earth stations providing UA CNPC links, after the Resolution is implemented, in accordance with this Resolution, and publish the information as referred to in *resolves* 4;

4 not to process satellite network filing submissions by administrations with a new class of a station for earth stations providing UA CNPC links before *resolves* 1-12 and 14-19 of this Resolution are implemented;

5 to report to subsequent WRCs on the progress made by ICAO on the development of SARPs for UAS CNPC links,

instructs the Secretary-General

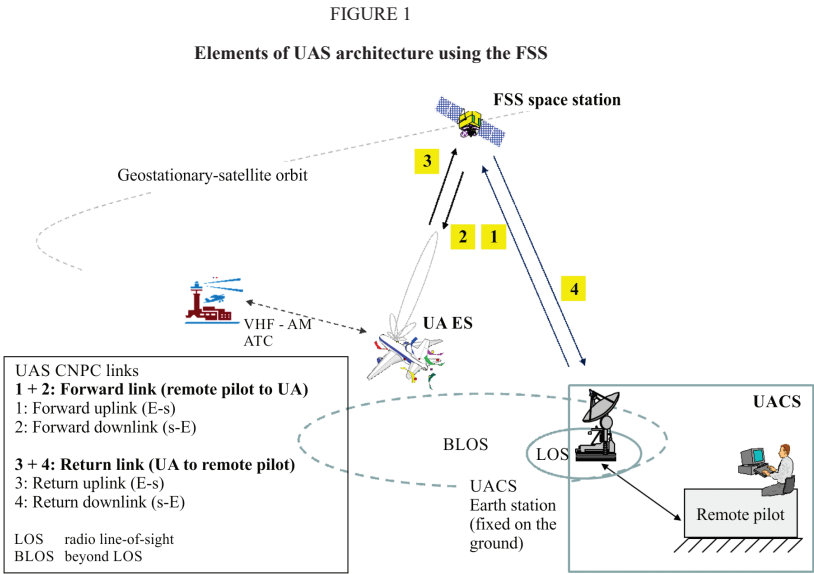
to bring this Resolution to the attention of the Secretary General of ICAO,

invites the International Civil Aviation Organization

to provide to the Director of BR, in time for WRC-23, information on ICAO efforts regarding implementation of UAS CNPC links, including the information related to the development of SARPs for UAS CNPC links.

ANNEX 1 TO RESOLUTION 155 (REV.WRC-19)

UAS CNPC links



RES155_Annex1-01

ANNEX 2 TO RESOLUTION 155 (REV.WRC-19)

Protection of the fixed service from UAS CNPC emissions

a) Example provided to WRC-15

The fixed service is allocated by table entries and footnotes in several countries with co-primary status with FSS. Conditions of UA using CNPC shall be such that the fixed service is protected from any harmful interference as follows:

An earth station on board UA in the frequency band 14.0-14.47 GHz shall comply with provisional power flux-density (pfd) limits described below:

$-132 + 0.5 \cdot \theta$	dB(W/(m ² · MHz))	for	$0^\circ \leq \theta \leq 40^\circ$
-112	dB(W/(m ² · MHz))	for	$40^\circ < \theta \leq 90^\circ$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizontal).

NOTE – The aforementioned limits relate to the pfd and angles of arrival that would be obtained under free-space propagation conditions.

b) Example provided to WRC-19

An earth station on board UA in the frequency band 14.0-14.3 GHz shall comply with the pfd limits described below, on the territory of countries listed in No. **5.505**:

$$15 \log(\theta + 0.9) - 124 \text{ dB} \left(\text{W} / \left(\text{m}^2 \cdot \text{MHz} \right) \right) \quad \text{for } 0^\circ \leq \theta \leq 90^\circ$$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizontal).

An earth station on board UA:

- in the frequency band 14.25-14.3 GHz on the territory of countries listed in No. **5.508**;
- in the frequency band 14.3-14.4 GHz in Regions 1 and 3;
- in the frequency band 14.4-14.47 GHz worldwide,

shall comply with the pfd limits described below:

$$15 \log(\theta + 0.9) - 133.5 \text{ dB} \left(\text{W} / \left(\text{m}^2 \cdot \text{MHz} \right) \right) \quad \text{for } 0^\circ \leq \theta \leq 90^\circ$$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizontal).

NOTE – The aforementioned limits relate to the pfd and angles of arrival that would be obtained under free-space propagation conditions.

RESOLUTION 156 (REV.WRC-23)

Use of the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz by earth stations in motion communicating with geostationary space stations in the fixed-satellite service¹

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that there is some regulatory ambiguity in the current No. **5.526** with respect to its scope of application;
- b)* that there is a need for global broadband mobile-satellite communications, and that some of this need could be met by allowing earth stations in motion (ESIMs) to communicate with space stations of the fixed-satellite service (FSS);
- c)* that the ITU Radiocommunication Sector (ITU-R) has studied certain aspects of the technical and operational use of ESIMs and that the result of these studies is contained in Reports ITU-R S.2223 and ITU-R S.2357;
- d)* that appropriate technical, regulatory and operational procedures are required for ESIMs;
- e)* that current regulatory provisions and their associated Rules of Procedure provide the possibility that an earth station operate within the envelope of coordination agreements established for the corresponding satellite network;
- f)* that there may be a need to clarify that ESIMs as referred to in this Resolution are not intended to be used or to be relied upon for the provision of safety-of-life applications,

recognizing

- a)* that the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz are globally allocated on a primary basis to the FSS and are used by geostationary-satellite orbit (GSO) FSS networks;
- b)* that, in the frequency band 29.5-30.0 GHz, there is an allocation to the fixed and mobile services on a secondary basis in a number of countries (see No. **5.542**) and, in the frequency band 19.7-20.2 GHz, there is an allocation to the fixed and mobile services on a primary basis in a number of countries (see No. **5.524**);
- c)* that there is a need to take actions to eliminate harmful interference which may be caused to terrestrial services of those administrations listed in No. **5.542**;

¹ As referred to in the Table of Frequency Allocations.

d) that, currently, there is no specific regulatory procedure for the coordination of ESIMs with regard to terrestrial services;

e) that WRC-15 adopted No. **5.527A** to clarify that ESIMs can communicate with GSO FSS space stations in the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz under certain conditions specified in *resolves* 1-4 below;

f) that a class of station is defined in the Preface to the International Frequency Information Circular of the Radiocommunication Bureau (BR IFIC) for ESIMs communicating with GSO FSS space stations for the application of the provisions of No. **5.527A** for satellite network filings under Articles **9** and **11**;

g) that successful coordination does not in any way imply licensing authorization to provide a service within the territory of a Member State (see also *recognizing b*) of Resolution **25 (Rev.WRC-23)**),

resolves

1 that ESIMs communicating with the GSO FSS shall operate under the following conditions:

- 1.1 with respect to satellite networks of other administrations, the earth station shall remain within the envelope of the coordination agreements of the satellite networks with which this earth station is associated or, in the absence of such agreements, comply with the off-axis equivalent isotropically radiated power (e.i.r.p.) density levels given in the Annex;
- 1.2 with respect to terrestrial services of other administrations mentioned in No. **5.524**, the ESIM shall not claim protection from, or impose constraints on the development of, these services operating in the frequency band 19.7-20.1 GHz in Regions 1 and 3;
- 1.3 with respect to any terrestrial systems operating in the frequency band 29.5-29.9 GHz in Regions 1 and 3 in the countries listed in No. **5.542**, the notifying administrations operating maritime ESIMs operating in international waters and aeronautical ESIMs operating in international airspace shall ensure that such operations do not cause unacceptable interference;
- 1.4 in the case of interference, the administration responsible for the satellite network shall, upon receipt of a report of harmful interference with respect to any terrestrial systems operating in the countries listed in No. **5.542**, immediately cease the interference or reduce it to an acceptable level;
- 1.5 to this effect, that administration shall submit to the Bureau a commitment for implementation of *resolves* 1.4 above;
- 1.6 that these earth stations are to be subject to permanent monitoring and control by a network control and monitoring centre (NCMC) or equivalent facility and capable of receiving and acting upon at least “enable transmission” and “disable transmission” commands from the NCMC;
- 1.7 that these earth stations are not to be used or relied upon for safety-of-life applications;

2 that the administration responsible for the satellite network shall ensure that the ESIMs employ techniques to track the associated GSO FSS satellite and that they are resistant to capturing and tracking adjacent GSO satellites;

3 that the notifying administration for the satellite network within which the ESIMs operate by means of fixed, mobile or transportable terminals shall ensure that they have the capability to limit operations of such earth stations to the territory or territories of administrations having authorized those earth stations and to comply with Article 18;

4 that administrations authorizing ESIMs shall require the operators to provide a point of contact for the purpose of tracing any suspected cases of interference from ESIMs.

ANNEX TO RESOLUTION 156 (REV.WRC-23)

Off axis e.i.r.p. density levels for earth stations in motion communicating with geostationary space stations of the fixed-satellite service in the frequency band 29.5-30.0 GHz²

This annex provides a set of off-axis e.i.r.p. levels for earth stations in motion (ESIMs) operating in the frequency band 29.5-30.0 GHz.

ESIMs operating and communicating with geostationary space stations in the fixed-satellite service transmitting in the frequency band 29.5-30.0 GHz shall be designed in such a manner that at any angle, θ , which is 2° or more from the vector from the earth station antenna to the associated satellite (see Figure 1 below for the reference geometry of an ESIMs compared to an earth station at a fixed location), the e.i.r.p. density in any direction within 3° of the GSO, shall not exceed the following values:

Angle θ	Maximum e.i.r.p. per 40 kHz*
$2 \leq \theta \leq 7^\circ$	$(19 - 25 \log \theta)$ dB(W/40 kHz)
$7 < \theta \leq 9.2^\circ$	-2 dB(W/40 kHz)
$9.2 < \theta \leq 48^\circ$	$(22 - 25 \log \theta)$ dB(W/40 kHz)
$48 < \theta \leq 180^\circ$	-10 dB(W/40 kHz)

* Other levels may be coordinated and mutually agreed between affected administrations (see also *resolves* 1.1).

NOTE 1 – The values above are maximal values under clear-sky conditions. In the case of networks employing uplink power control, these levels should include any additional margins above the minimum clear-sky level necessary for the implementation of uplink power control. When attenuation by rain occurs and uplink power control is used, the levels stated above may be exceeded to compensate for that attenuation. When uplink power control is not used and the e.i.r.p. density levels given above are not met, different values could be used in compliance with the values agreed to through bilateral coordination of GSO FSS satellite networks.

² See also Report ITU-R S.2357 for ease of reference.

NOTE 2 – The e.i.r.p. density levels for angles of θ less than 2° may be determined from GSO FSS coordination agreements taking into account the specific parameters of the two GSO FSS satellite networks.

NOTE 3 – For geostationary space stations in the fixed-satellite service employing code division multiple access (CDMA) with which the ESIMs are expected to transmit simultaneously in the same 40 kHz band, the maximum e.i.r.p. density values should be decreased by $10 \log(N)$ dB, where N is the number of ESIMs that are in the receive satellite beam of the associated satellite and that are expected to transmit simultaneously on the same frequency. Alternative methods may be used if agreed between affected administrations.

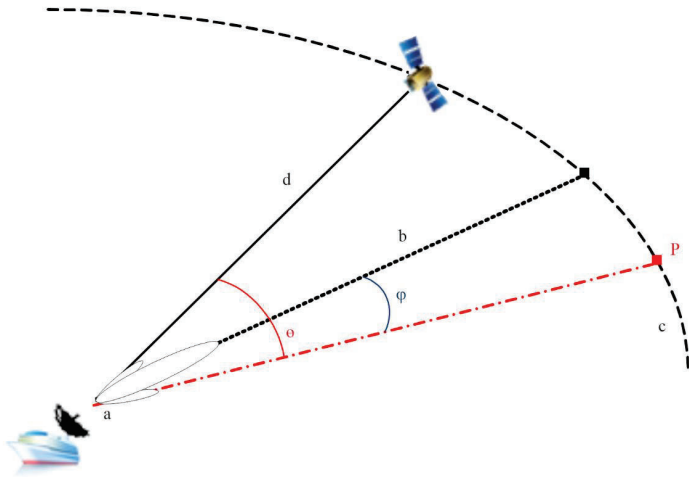
NOTE 4 – Potential aggregate interference from ESIMs operating within the fixed-satellite service using multi-spot frequency reuse technologies should be taken into account in coordination with respect to other GSO satellite networks.

NOTE 5 – ESIMs operating in the frequency band 29.5-30.0 GHz with low elevation angles to the GSO will require higher e.i.r.p. levels relative to the same terminals at high elevation angles to achieve the same power flux-densities (pfd) at the GSO due to the combined effect of increased distance and atmospheric absorption. Earth stations with low elevation angles may exceed the above levels by the following amount:

Elevation angle to GSO (ϵ)	Increase in e.i.r.p. spectral density (dB)
$\epsilon \leq 5^\circ$	2.5
$5^\circ < \epsilon \leq 30^\circ$	$3 - 0.1 \epsilon$

Figure 1 below illustrates the definition of angle θ^3 .

FIGURE 1



³ In Figure 1 proportions are illustrative and not to scale.

where:

- a represents the ESIM;
- b represents the boresight of the earth station antenna;
- c represents the geostationary-satellite orbit (GSO);
- d represents the vector from the ESIM to the associated GSO FSS satellite;
- φ represents the angle between the boresight of the earth station antenna and a point P on the GSO arc;
- θ represents the angle between the vector d and point P on the GSO arc;
- P represents a generic point on the GSO arc which angles θ and φ are referred to.

RESOLUTION 163 (WRC-15)

Deployment of earth stations in some Regions 1 and 2 countries in the frequency band 14.5-14.75 GHz in the fixed-satellite service (Earth-to-space) not for feeder links for the broadcasting-satellite service

The World Radiocommunication Conference (Geneva, 2015),

considering

- a)* that there is a demand for satellite communication services, particularly for the Earth-to-space direction in the frequency range 13-17 GHz;
- b)* that some of this demand may be met by earth stations operating in the frequency band 14.5-14.8 GHz without requiring this use to be subject to the Appendix **30A** Plan or List;
- c)* that certain conditions would be required in order to ensure the protection and future use of assignments subject to the Appendix **30A** Plan and List;
- d)* that, in order to ensure the protection of current and future use of other services to which this frequency band is allocated, earth stations would need to operate under certain technical and operational limitations (see Nos. **5.509B**, **5.509C**, **5.509D**, **5.509E** and **5.509F**);
- e)* that some administrations may not be in a position to ascertain the potential future use of this frequency band in their territory,

resolves

that earth stations in Regions 1 and 2 in the frequency band 14.5-14.75 GHz in the fixed-satellite service (Earth-to-space) not for feeder links for the broadcasting-satellite service shall be operated only in the following countries: Algeria, Saudi Arabia, Argentina, Armenia, Azerbaijan, Bahrain, Belarus, Brazil, Bulgaria, Cuba, Egypt, El Salvador, the Russian Federation, Iraq, Jordan, Kazakhstan, Kuwait, Mauritania, Mexico, Morocco, Nicaragua, Norway, Oman, Uzbekistan, Qatar, Türkiye, Kyrgyzstan, Sudan, Uruguay and Venezuela; such operation is subject to the technical and operational limitations contained in Nos. **5.509B**, **5.509C**, **5.509D**, **5.509E** and **5.509F**.

RESOLUTION 164 (WRC-15)

Deployment of earth stations in some Region 3 countries in the frequency band 14.5-14.8 GHz in the fixed-satellite service (Earth-to-space) not for feeder links for the broadcasting-satellite service

The World Radiocommunication Conference (Geneva, 2015),

considering

- a)* that there is a demand for satellite communication services, particularly for the Earth-to-space direction in the frequency range 13-17 GHz;
- b)* that some of this demand may be met by earth stations operating in the frequency band 14.5-14.8 GHz without requiring this use to be subject to the Appendix **30A** Plan or List;
- c)* that certain conditions would be required in order to ensure the protection and future use of assignments subject to the Appendix **30A** Plan and List;
- d)* that, in order to ensure the protection of current and future use of other services to which this frequency band is allocated, earth stations would need to operate under certain technical and operational limitations (see Nos. **5.509B**, **5.509C**, **5.509D**, **5.509E** and **5.509F**);
- e)* that some administrations may not be in a position to ascertain the potential future use of this frequency band in their territory,

resolves

that earth stations in Region 3 in the frequency band 14.5-14.8 GHz in the fixed-satellite service (Earth-to-space) not for feeder links for the broadcasting-satellite service shall be operated only in the following countries: Australia, Cambodia, China, Japan, Lao P.D.R., Pakistan, Papua New Guinea, Thailand and Viet Nam; such operation is subject to the technical and operational limitations contained in Nos. **5.509B**, **5.509C**, **5.509D**, **5.509E** and **5.509F**.

RESOLUTION 165 (REV.WRC-23)

**Use of the frequency band 21.4-22 GHz by high-altitude platform
stations in the fixed service in Region 2**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that there is a need for greater broadband connectivity in underserved communities and in rural and remote areas;
- b)* that WRC-15 invited the ITU Radiocommunication Sector (ITU-R) to study additional spectrum needs for fixed high-altitude platform station (HAPS) links to provide broadband connectivity and to facilitate the use of HAPS links on a global or regional basis, recognizing that the existing HAPS identifications were established without reference to today's broadband capabilities;
- c)* that HAPS can provide broadband connectivity with minimal ground network infrastructure;
- d)* that ITU-R has conducted studies dealing with compatibility between systems using HAPS and existing services in the frequency band 21.4-22 GHz in Region 2, leading to Report ITU-R F.2471,

considering further

that current technologies can be used to deliver broadband applications by HAPS, which can provide broadband connectivity and disaster-recovery communications with minimal ground network infrastructure,

recognizing

- a)* that a HAPS is defined in No. **1.66A** as a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth, and is subject to No. **4.23**;
- b)* that the aeronautical mobile service (AMS) within the mobile service operates in the frequency range 21.2-21.5 GHz on a primary basis within Region 2,

noting

- a)* that limits to be met at the border by HAPS transmitters may not be appropriate for frameworks for the introduction of HAPS nationally;
- b)* that Reports ITU-R F.2438 and ITU-R F.2439 provide information relevant to the development of a framework for the introduction of HAPS by administrations,

resolves

1 that, for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency band 21.4-22 GHz, the power flux-density (pfd) level per HAPS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, developed for clear-sky conditions, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

0.7 θ – 135	dB(W/(m ² · MHz))	for	0° ≤ θ < 10°
2.4 θ – 152	dB(W/(m ² · MHz))	for	10° ≤ θ < 20°
0.45 θ – 113	dB(W/(m ² · MHz))	for	20° ≤ θ < 60°
–86	dB(W/(m ² · MHz))	for	60° ≤ θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

during periods of rain, the equivalent isotropically radiated power (e.i.r.p.) of the beam suffering rain fade may be increased by a level commensurate with the level of rain fade, by up to 20 dB above the e.i.r.p. associated with the above pfd mask at the surface of the Earth;

2 that, for the purpose of protecting the Earth exploration-satellite service (passive) in the frequency bands 21.2-21.4 GHz and 22.21-22.5 GHz, the e.i.r.p. density in the frequency bands 21.2-21.4 GHz and 22.21-22.5 GHz per HAPS operating in the frequency band 21.4-22 GHz shall not exceed:

–0.76 θ – 9.5	dB(W/100 MHz)	for	–4.53° ≤ θ < 35.5°
–36.5	dB(W/100 MHz)	for	35.5° ≤ θ ≤ 90°

where θ is the elevation angle in degrees at the platform height;

3 that, in order to ensure the protection of the radio astronomy service (RAS), the pfd level produced by unwanted emissions from HAPS downlink transmissions in the frequency band 21.4-22 GHz shall not exceed –176 dB(W/(m² · 290 MHz)) for continuum observations and –192 dB(W/(m² · 250 kHz)) for spectral line observations in the frequency band 22.21-22.5 GHz at an RAS station location at a height of 50 m; this limit relates to the pfd which would be obtained using a time percentage of 2% in the relevant propagation model;

to verify compliance, the following formula shall be used:

$$pfd = e.i.r.p._{nominal\ clear\ sky}(Az, \theta) + Att_{618p=2\%} - 10 \log(4\pi d^2) - GasAtt(\theta)$$

where:

e.i.r.p._nominal clear sky: nominal unwanted emission e.i.r.p. density towards the RAS station at which the HAPS operates under clear-sky conditions in dB(W/290 MHz) for continuum observations and in dB(W/250 kHz) for spectral line observations in the frequency band 22.21-22.5 GHz

Az: azimuth in degrees from the HAPS towards the RAS station

θ : elevation angle in degrees at the HAPS towards the RAS station

*Att*_{618p=2%}: attenuation in dB from the most recent version of Recommendation ITU R P.618 corresponding to $p = 2\%$ of the time at the radio astronomy location

d: separation distance in metres between the HAPS and the RAS station

GasAtt(θ): gaseous attenuation for an elevation angle of θ (see the most recent version of Recommendation ITU-R SF.1395);

4 that *resolves* 3 applies at any radio astronomy station that was in operation prior to 22 November 2019 and has been notified to the Radiocommunication Bureau in the frequency band 22.21-22.5 GHz before 22 May 2020, or at any radio astronomy station that was notified before the date of receipt of the complete Appendix 4 information for notification, for the HAPS system to which *resolves* 3 applies; radio astronomy stations notified after this date may seek an agreement with administrations that have authorized HAPS;

5 that, for the purpose of protecting the AMS operating in the frequency band 21.2-21.5 GHz, the e.i.r.p. per HAPS shall not exceed 17.5 dB(W/100 MHz) in the frequency range 21.4-21.5 GHz;

6 that administrations planning to implement a HAPS system in the frequency band 21.4-22 GHz shall notify the frequency assignments by submitting all mandatory elements of Appendix 4 to the Bureau for the examination of compliance with respect to this Resolution with a view to their registration in the Master International Frequency Register,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

RESOLUTION 166 (REV.WRC-23)

Use of the frequency band 24.25-27.5 GHz by high-altitude platform stations in the fixed service in Region 2

The World Radiocommunication Conference (Dubai, 2023),

considering

- a) that there is a need for greater broadband connectivity in underserved communities and in rural and remote areas;
- b) that WRC-15 invited the ITU Radiocommunication Sector (ITU-R) to study additional spectrum needs for fixed high-altitude platform station (HAPS) links to provide broadband connectivity and to facilitate the use of HAPS links on a global or regional basis, recognizing that the existing HAPS identifications were established without reference to today's broadband capabilities;
- c) that HAPS can provide broadband connectivity with minimal ground network infrastructure;
- d) that ITU-R has conducted studies dealing with compatibility between HAPS systems and systems in existing services in the frequency band 24.25-27.5 GHz and in the adjacent band in Region 2, leading to Report ITU-R F.2472-0,

considering further

that current technologies can be used to deliver broadband applications by HAPS, which can provide broadband connectivity and disaster-recovery communications with minimal ground network infrastructure,

recognizing

that, in the frequency bands 24.75-25.25 GHz and 27.0-27.5 GHz, with respect to earth stations in the fixed-satellite service (FSS) (Earth-to-space) and HAPS ground station receivers which operate in the fixed service, No. **9.17** applies,

resolves

1 that, for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency band 27-27.5 GHz, the power flux-density (pfd) level per HAPS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, developed for clear-sky conditions, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

0.39 θ – 132.12	dB(W/(m ² · MHz))	for	0° ≤ θ < 13°
2.715 θ – 162.3	dB(W/(m ² · MHz))	for	13° ≤ θ < 20°
0.45 θ – 117	dB(W/(m ² · MHz))	for	20° ≤ θ < 60°
–90	dB(W/(m ² · MHz))	for	60° ≤ θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

during periods of rain, the equivalent isotropically radiated power (e.i.r.p.) of the beam suffering rain fade may be increased by a level commensurate with the level of rain fade, by up to 20 dB above the e.i.r.p. associated with the above pfd mask at the surface of the Earth;

2 that, for the purpose of protecting mobile-service systems in the territory of other administrations in the frequency band 24.25-25.25 GHz, the pfd level per HAPS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, developed for clear-sky conditions, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

-110.3	dB(W/(m ² · MHz))	for	0° ≤ θ ≤ 4°
-110.3 + 1.2 (θ - 4)	dB(W/(m ² · MHz))	for	4° < θ ≤ 9°
-104.3	dB(W/(m ² · MHz))	for	9° < θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

the limits above take into account the 3 dB aggregate loss due to polarization mismatch, and body loss was not taken into account;

during periods of rain, the e.i.r.p. of the beam suffering rain fade may be increased by a level commensurate with the level of rain fade, by up to 20 dB above the e.i.r.p. associated with the above pfd mask at the surface of the Earth;

3 that, for the purpose of protecting mobile-service systems in the territory of other administrations in the frequency band 27-27.5 GHz, the pfd level per HAPS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, developed for clear-sky conditions, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

0.95 θ - 114	dB(W/(m ² · MHz))	for	0° ≤ θ < 5.7°
0.6 θ - 112	dB(W/(m ² · MHz))	for	5.7° ≤ θ < 20°
-100	dB(W/(m ² · MHz))	for	20° ≤ θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

the limits above take into account the 3 dB aggregate loss due to polarization mismatch, and body loss was not taken into account;

during periods of rain, the e.i.r.p. of the beam suffering rain fade may be increased by a level commensurate with the level of rain fade, by up to 20 dB above the e.i.r.p. associated with the above pfd mask at the surface of the Earth;

4 that, for the purpose of protecting mobile-service systems operating in the frequency band 25.25-27 GHz in the territory of neighbouring administrations, coordination of a transmitting HAPS ground station is required when the pfd in dB(W/(m² · MHz)) at the border of a neighbouring administration exceeds a pfd limit of -110.3 dB(W/(m² · MHz)), and the pfd values shall be verified considering a percentage of time of 1% using the most recent version of Recommendation ITU-R P.452 and a mobile-station antenna height of 20 m;

5 that, for the purpose of protecting the inter-satellite service (ISS) and the FSS, the e.i.r.p. density per HAPS in the frequency band 27-27.5 GHz shall not exceed -10.7 dB(W/MHz) for off-nadir angles higher than 85.5° ;

6 that, for the purpose of protecting the ISS, the e.i.r.p. density per HAPS in the frequency band 24.45-24.75 GHz shall not exceed -19.9 dB(W/MHz) for off-nadir angles higher than 85.5° ;

7 that, for the purpose of protecting non-geostationary space stations of the ISS, the e.i.r.p. density per HAPS ground station in the frequency band 25.25-27 GHz shall not exceed 12.3 dB(W/MHz) under clear-sky conditions;

in addition, for the purpose of protecting geostationary space stations of the ISS, the maximum e.i.r.p. density in the frequency band 25.25-27 GHz of HAPS ground stations shall not exceed 0.5 dB(W/MHz) in the direction of the geostationary arc under clear-sky conditions; it is also necessary to take into account a possible orbit inclination of GSO space stations of between -5° and 5° ;

automatic power control may be used to increase the e.i.r.p. density only to the level to compensate rain fade, by up to 20 dB;

8 that, for the purpose of protecting the FSS, the e.i.r.p. density per HAPS in the frequency band 24.75-25.25 GHz shall not exceed -9.1 dB(W/MHz) for off-nadir angles higher than 85.5° ;

9 that, for the purpose of protecting the Earth exploration-satellite service (EESS) (passive) in the frequency band 23.6-24 GHz, the e.i.r.p. density in the frequency band 23.6-24 GHz per HAPS operating in the frequency band 24.25-25.25 GHz shall not exceed:

$$\begin{array}{llll} -0.7714 \theta - 16.5 & \text{dB(W/200 MHz)} & \text{for} & -4.53^\circ \leq \theta < 35^\circ \\ -43.5 & \text{dB(W/200 MHz)} & \text{for} & 35^\circ \leq \theta \leq 90^\circ \end{array}$$

where θ is the elevation angle in degrees at the platform height;

10 that, in order to ensure the protection of in-band space research service (SRS)/EESS in the territory of other administrations from the HAPS gateway in the frequency band 25.5-27.0 GHz, the pfd shall not exceed the threshold values given below at the SRS/EESS earth stations at a height of 20 m above ground level; if the pfd threshold values below are exceeded, then HAPS shall coordinate in accordance with No. **9.18**, taking into account the parameters of the relevant systems; these limits relate to the pfd which would be obtained under assumed propagation conditions predicted by the most recent version of Recommendation ITU-R P.452 using the following time percentages: 0.001% for SRS, 0.005% for EESS non-GSO and 20% for EESS GSO:

SRS: $\text{pfd} = -121 \text{ dB(W/(m}^2 \cdot \text{MHz))}$

EESS non-GSO: $\text{pfd} = -97 \text{ dB(W/(m}^2 \cdot \text{MHz))}$

EESS GSO: $\text{pfd} = -129 \text{ dB(W/(m}^2 \cdot \text{MHz))};$

11 that, in order to ensure the protection of the radio astronomy service (RAS), the pfd level produced by unwanted emissions from HAPS downlink transmissions in the frequency band 24.25-25.25 GHz shall not exceed $-177 \text{ dB(W/(m}^2 \cdot 400 \text{ MHz))}$ for continuum observations and $-191 \text{ dB(W/(m}^2 \cdot 250 \text{ kHz))}$ for spectral line observations in the frequency band 23.6-24 GHz at an RAS station location at a height of 50 m; this limit relates to the pfd which would be obtained using a time percentage of 2% in the relevant propagation model;

to verify compliance, the following formula shall be used:

$$pfd = e.i.r.p.\text{-nominal clear sky}(Az, \theta) + Att_{618p=2\%} - 10 \log(4\pi d^2) - GasAtt(\theta)$$

where:

e.i.r.p.-nominal clear sky: nominal unwanted emission e.i.r.p. density towards the RAS station at which the HAPS operates under clear-sky conditions in dB(W/400 MHz) for continuum observations and in dB(W/250 kHz) for spectral line observations in the frequency band 23.6-24 GHz

Az: azimuth in degrees from the HAPS towards the RAS station

θ : elevation angle in degrees at the HAPS towards the RAS station

Att_{618p=2%}: attenuation in dB from the most recent version of Recommendation ITU-R P.618 corresponding to $p = 2\%$ of the time at the radio astronomy location

d: separation distance in metres between the HAPS and the RAS station

pfd: pfd at the Earth's surface per HAPS in dB(W/(m² · 400 MHz)) for continuum observations and in dB(W/(m² · 250 kHz)) for spectral line observations in the frequency band 23.6-24 GHz

GasAtt(θ): gaseous attenuation for an elevation angle of θ (see the most recent version of Recommendation ITU-R SF.1395);

12 that *resolves* 11 applies at any radio astronomy station that was in operation prior to 22 November 2019 and has been notified to the Radiocommunication Bureau in the frequency band 23.6-24 GHz before 22 May 2020, or at any radio astronomy station that was notified before the date of receipt of the complete Appendix 4 information for notification, for the HAPS system to which *resolves* 11 applies; radio astronomy stations notified after this date may seek an agreement with administrations that have authorized HAPS;

13 that administrations planning to implement a HAPS system in the frequency band 24.25-27.5 GHz shall notify the frequency assignments by submitting all mandatory elements of Appendix 4 to the Bureau for the examination of compliance with respect to this Resolution with a view to their registration in the Master International Frequency Register,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

RESOLUTION 167 (REV.WRC-23)

**Use of the frequency band 31-31.3 GHz by high-altitude platform
stations in the fixed service**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that there is a need for greater broadband connectivity in underserved communities and in rural and remote areas;
- b)* that WRC-15 invited the ITU Radiocommunication Sector (ITU-R) to study additional spectrum needs for fixed high-altitude platform station (HAPS) links to provide broadband connectivity and to facilitate the use of HAPS links on a global or regional basis, recognizing that the existing HAPS identifications were established without reference to today's broadband capabilities;
- c)* that ITU-R has conducted studies dealing with compatibility between systems using HAPS and passive services in the frequency band 31.3-31.8 GHz, leading to Report ITU-R F.2473;
- d)* that Report ITU-R F.2439 provides deployment and technical characteristics of broadband HAPS systems;
- e)* that Report ITU-R F.2438 contains worldwide spectrum needs of HAPS systems;
- f)* that ITU-R has conducted studies dealing with sharing between systems using HAPS in the fixed service and other types of systems in the fixed service in the frequency band 31-31.3 GHz, leading to Report ITU-R F.2473,

considering further

that current technologies, such as HAPS, can be used to deliver broadband applications for broadband connectivity and disaster-recovery communications with minimal ground network infrastructure,

recognizing

that, during periods of rain, the equivalent isotropically radiated power (e.i.r.p.) of the HAPS beam suffering rain fade may be increased by a level commensurate with the level of rain fade, by up to 20 dB above the e.i.r.p. under clear-sky conditions indicated in Appendix 4,

noting

- a)* that WRC-2000 adopted No. **5.543A**, which was modified at WRC-03 and then again at WRC-07, to permit the use of HAPS in the fixed service in the frequency band 31-31.3 GHz in certain Region 1 and 3 countries on a non-harmful interference, non-protection basis;

- b) that the frequency band 31-31.3 GHz is widely used or planned to be used by a number of different services and a number of other types of applications in the fixed service;
- c) that, while the decision to deploy HAPS can be taken on a national basis, such deployment may affect neighbouring administrations, particularly in small countries;
- d) that results of some ITU-R studies indicate that, in the frequency band 31-31.3 GHz, sharing between fixed-service systems using HAPS and other conventional fixed-service systems in the same area is subject to appropriate interference mitigation techniques to be developed and implemented,

resolves

1 that, for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency band 31-31.3 GHz, the power flux-density (pfd) level per HAPS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, developed for clear-sky conditions, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

$0.875 \theta - 143$	dB(W/(m ² · MHz))	for	$0^\circ \leq \theta < 8^\circ$
$2.58 \theta - 156.6$	dB(W/(m ² · MHz))	for	$8^\circ \leq \theta < 20^\circ$
$0.375 \theta - 112.5$	dB(W/(m ² · MHz))	for	$20^\circ \leq \theta < 60^\circ$
-90	dB(W/(m ² · MHz))	for	$60^\circ \leq \theta \leq 90^\circ$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

2 that, with regard to the protection of fixed-service stations with pointing elevation beyond 5°, an administration believing that unacceptable interference may still be caused shall, within four months of the date of publication of the relevant International Frequency Information Circular of the Radiocommunication Bureau (BR IFIC), provide its comments with the relevant justification to the notifying administration;

3 that, in order to ensure the protection of the Earth-exploration satellite service (EESS) (passive), the level of unwanted power density in the frequency band 31.3-31.8 GHz into the antenna of a HAPS ground station operating in the frequency band 31-31.3 GHz shall be limited to -83 dB(W/200 MHz) under clear-sky conditions, and may be increased under rainy conditions to mitigate fading due to rain, provided that the effective impact on the passive satellite does not exceed the impact under clear-sky conditions;

4 that, in order to ensure the protection of the EESS (passive), the level of unwanted emission e.i.r.p. density per HAPS transmitter operating in the frequency band 31-31.3 GHz into the frequency band 31.3-31.8 GHz shall be limited to:

$-\theta - 13.1$	dB(W/200 MHz)	for	$-4.53^\circ \leq \theta < 22^\circ$
-35.1	dB(W/200 MHz)	for	$22^\circ \leq \theta < 90^\circ$

where θ is the elevation angle in degrees at the platform height;

5 that, in order to ensure the protection of the radio astronomy service (RAS), the pfd level produced by any HAPS ground station operating in the frequency band 31-31.3 GHz at RAS station locations at a height of 50 m shall not exceed $-141 \text{ dB(W/(m}^2 \cdot 500 \text{ MHz))}$ in the frequency band 31.3-31.8 GHz; this limit relates to the pfd which would be obtained under assumed propagation conditions predicted by the most recent version of Recommendation ITU-R P.452 using a time percentage of 2%;

6 that, in order to ensure the protection of the RAS, the pfd level produced by unwanted emissions from HAPS downlink transmissions in the frequency band 31-31.3 GHz shall not exceed $-171 \text{ dB(W/(m}^2 \cdot 500 \text{ MHz))}$ for continuum observations in the frequency band 31.3-31.8 GHz at an RAS station location at a height of 50 m; this limit relates to the pfd which would be obtained using a time percentage of 2% in the relevant propagation model;

to verify compliance, the following formula shall be used:

$$pfd(\theta) = e.i.r.p._{nominal \text{ clear sky}}(Az, \theta) + Att_{618 \text{ } p=2\%} - 10 \log(4\pi d^2) - GasAtt(\theta)$$

where:

e.i.r.p._nominal clear sky: nominal unwanted emission e.i.r.p. density towards the RAS station at which the HAPS operates under clear-sky conditions in dB(W/500 MHz) in the RAS frequency band

Az: azimuth in degrees from the HAPS towards the RAS station

θ : elevation angle in degrees at the HAPS towards the RAS station

Att_{618 p=2%}: attenuation in dB from the most recent version of Recommendation ITU-R P.618 corresponding to $p = 2\%$ of the time at the radio astronomy location

d: separation distance in metres between the HAPS and the RAS station

pfd(θ): pfd at the Earth's surface per HAPS station in $\text{dB(W/(m}^2 \cdot 500 \text{ MHz))}$

GasAtt(θ): gaseous attenuation for an elevation angle of θ (see the most recent version of Recommendation ITU-R SF.1395);

7 that resolves 5 and 6 apply at any radio astronomy station that was in operation prior to 22 November 2019 and has been notified to the Bureau in the frequency band 31.3-31.8 GHz before 22 May 2020, or at any radio astronomy station that was notified before the date of receipt of the complete Appendix 4 information for notification, for the HAPS system to which resolves 5 and 6 apply; radio astronomy stations notified after this date may seek an agreement with administrations that have authorized HAPS;

8 that administrations planning to implement a HAPS system in the frequency band 31-31.3 GHz shall notify the frequency assignments by submitting all mandatory elements under Appendix 4 to the Bureau for the examination of compliance with respect to this Resolution with a view to their registration in the Master International Frequency Register,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

RESOLUTION 168 (REV.WRC-23)

Use of the frequency band 38-39.5 GHz by high-altitude platform stations in the fixed service

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that there is a need for greater broadband connectivity in underserved communities and in rural and remote areas;
- b)* that WRC-15 invited the ITU Radiocommunication Sector (ITU-R) to study additional spectrum needs for fixed high-altitude platform station (HAPS) links to provide broadband connectivity and to facilitate the use of HAPS links on a global or regional basis, recognizing that the existing HAPS identifications were established without reference to today's broadband capabilities;
- c)* that Report ITU-R F.2439 provides updated deployment and technical characteristics of broadband HAPS systems;
- d)* that Report ITU-R F.2438 contains worldwide spectrum needs of HAPS systems;
- e)* that ITU-R has conducted studies dealing with compatibility between systems using HAPS and existing services in the frequency band 38-39.5 GHz, leading to Report ITU-R F.2475,

considering further

that current technologies, such as HAPS, can be used to deliver broadband applications for broadband connectivity and disaster-recovery communications with minimal ground network infrastructure,

recognizing

- a)* that, during periods of rain, the equivalent isotropically radiated power (e.i.r.p.) of the HAPS beam suffering rain fade may be increased by a level commensurate with the level of rain fade, by up to 20 dB above the e.i.r.p. under clear-sky conditions indicated in Appendix 4;
- b)* that existing services shall be protected from HAPS operations, and no undue constraints shall be imposed on the future development of existing services by HAPS,

resolves

1 that, for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency band 38-39.5 GHz, the power flux-density (pfd) level per HAPS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, developed for clear-sky conditions, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

−137	dB(W/(m ² · MHz))	for	0° ≤ θ ≤ 13°
−137 + 3.125 (θ − 13)	dB(W/(m ² · MHz))	for	13° < θ ≤ 25°
−99.5 + 0.5 (θ − 25)	dB(W/(m ² · MHz))	for	25° < θ ≤ 50°
−87	dB(W/(m ² · MHz))	for	50° < θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

2 that, with regard to the protection of fixed-service stations with pointing elevation beyond 15°, an administration believing that unacceptable interference may still be caused shall, within four months of the date of publication of the relevant International Frequency Information Circular of the Radiocommunication Bureau (BR IFIC), provide its comments with relevant justification to the notifying administration;

3 that, for the purpose of protecting mobile-service systems in the territory of other administrations in the frequency band 38-39.5 GHz, the power flux-density (pfd) level per HAPS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, developed for clear-sky conditions, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

−107.8	dB(W/(m ² · MHz))	for	0° ≤ θ ≤ 4°
−107.8 + 1.5 (θ − 4)	dB(W/(m ² · MHz))	for	4° < θ ≤ 10°
−98.8	dB(W/(m ² · MHz))	for	10° < θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

the limits above take into account the 3 dB aggregate loss due to polarization mismatch, and body loss was not taken into account;

4 that, for the purpose of protecting mobile-service systems operating in the frequency band 38-39.5 GHz in the territory of neighbouring administrations, coordination of a transmitting HAPS ground station is required when the pfd in dB(W/(m² · MHz)) at the border of a neighbouring administration exceeds a pfd limit of −110.8 dB(W/(m² · MHz)), and the pfd values shall be verified considering a percentage of time of 1% in the relevant propagation model of the most recent version of Recommendation ITU-R P.452 and a mobile-station antenna height of 20 m;

5 that, for the purpose of protecting earth stations in the geostationary-satellite (GSO) fixed-satellite service (FSS) (space-to-Earth) in the territory of other administrations, the pfd in the territory of other neighbouring administrations shall not exceed the following values, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

$-169.9 + 1954 \alpha^2$	dB(W/(m ² · MHz))	for	$0^\circ \leq \alpha < 0.136^\circ$
-133.9	dB(W/(m ² · MHz))	for	$0.136^\circ \leq \alpha < 1^\circ$
$-133.9 + 25 \log \alpha$	dB(W/(m ² · MHz))	for	$1^\circ \leq \alpha < 47.9^\circ$
-91.9	dB(W/(m ² · MHz))	for	$47.9^\circ \leq \alpha \leq 180^\circ$

where α is the minimum angle between the line to the HAPS (taking into account the HAPS location tolerance) and the lines to the GSO arc, in degrees, at any point on the territory of other administrations;

to calculate the pfd produced by a HAPS platform, the following equation shall be used:

$$pfd = e.i.r.p. - 10 \log(4\pi d^2) - Att_{gaz}$$

where:

d : distance in metres between the HAPS and the GSO FSS earth station

Att_{gaz} : attenuation in dB due to atmospheric gases on the HAPS-to-GSO FSS earth station path (see the most recent version of Recommendation ITU-R P.676)

$e.i.r.p.$: maximum HAPS e.i.r.p. spectral density in the direction of the GSO FSS earth station in dB(W/MHz);

6 that, for the purpose of protecting non-geostationary-satellite (non-GSO) systems in the FSS (space-to-Earth) in the territory of other administrations from HAPS interference, administrations implementing HAPS shall seek explicit agreement with any other administration when the distance between the HAPS nadir point and any point on such other administration's border is less than the distance calculated by the following formula, where the minimum earth station elevation angle is 10 degrees; this does not preclude lower elevation angles being used for the operation of earth stations; and this distance can be decreased by explicit agreement of affected administrations on a case-by-case basis:

$$d = \frac{\pi R}{180} \left(90 - \theta - \arcsin \left(\frac{R}{R+h} \cos \theta \right) \right)$$

where:

R : Earth's radius (6 371 km)

θ : minimum elevation angle at the non-GSO FSS earth station (10°)

h : HAPS altitude (km);

7 that, in making assignments to HAPS systems (HAPS ground stations and HAPS) in the fixed service in the frequency band 38-39.5 GHz, administrations shall protect the space research service (SRS) (space-to-Earth) in the frequency band 37-38 GHz from harmful interference by unwanted emissions, taking into account the SRS (space-to-Earth) protection level of -217 dB(W/Hz) at the input of the SRS receiver with 0.001% exceedance due to atmospheric and precipitation effects, as referred to in the relevant ITU-R Recommendations;

8 that, for the purpose of protecting earth stations in the GSO and non-GSO FSS (space to-Earth) in the territory of neighbouring administrations, coordination of a transmitting HAPS ground station is required when the pfd in $\text{dB(W/(m}^2 \cdot \text{MHz))}$ at the border of a neighbouring administration exceeds a pfd limit of $-111.3 \text{ dB(W/(m}^2 \cdot \text{MHz))}$ for non-GSO operations and $-108.9 \text{ dB(W/(m}^2 \cdot \text{MHz))}$ for GSO operations, and the pfd values shall be verified considering a percentage of time of 20% in the relevant propagation model of the most recent version of Recommendation ITU-R P.452 and an FSS earth station antenna height of 10 m;

9 that the notifying administration for the HAPS system shall send to the Bureau a commitment that the HAPS operation shall be in conformity with the Radio Regulations, including this Resolution;

10 that administrations planning to implement a HAPS system in the frequency band 38-39.5 GHz shall notify the frequency assignments by submitting all mandatory elements of Appendix 4 to the Bureau for the examination of compliance with respect to this Resolution with a view to their registration in the Master International Frequency Register;

11 that the notifying administration for the HAPS system shall send to the Bureau a commitment that, upon receiving an unacceptable interference report with relevant justification on exceedance of the limits set in this Resolution, the notifying administration for the HAPS system shall take the required action to eliminate interference or reduce it to an acceptable level,

further resolves

that, should an administration operating HAPS agree, with its neighbouring administrations, to levels higher than the limits contained in this Resolution, such agreement shall not affect other administrations that are not party to that agreement,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution,

invites the ITU Radiocommunication Sector

to develop a Recommendation to provide technical guidance to facilitate the implementation of HAPS operations while ensuring the protection of non-GSO FSS earth stations.

RESOLUTION 169 (REV.WRC-23)

**Use of the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz
by earth stations in motion communicating with geostationary space stations
in the fixed-satellite service**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that there is a need for global broadband mobile-satellite communications, and that some of this need could be met by allowing earth stations in motion (ESIMs) to communicate with space stations of the geostationary-satellite orbit (GSO) fixed-satellite service (FSS) operating in the frequency bands 17.7-19.7 GHz (space-to-Earth) and 27.5-29.5 GHz (Earth-to-space);
- b)* that appropriate regulatory and interference-management mechanisms are necessary for the operation of ESIMs;
- c)* that the frequency bands 17.7-19.7 GHz (space-to-Earth) and 27.5-29.5 GHz (Earth-to-space) are also allocated to terrestrial and space services used by a variety of different systems, and these existing services and their future development need to be protected, without the imposition of undue constraints, from the operation of ESIMs;
- d)* that the ITU Radiocommunication Sector has studied whether aeronautical ESIMs are capable of protecting non-geostationary (non-GSO) mobile-satellite service (MSS) feeder-link satellite receivers in the frequency band 29.1-29.5 GHz,

recognizing

- a)* that the administration authorizing ESIMs on territory under its jurisdiction has the right to require that the ESIMs referred to above only use those assignments associated with GSO FSS networks which have been successfully coordinated, notified, brought into use and recorded in the Master International Frequency Register with a favourable finding under Article 11, including Nos. 11.31, 11.32 or 11.32A, where applicable;
- b)* that, for cases of incomplete coordination under No. 9.7 of the GSO FSS network with assignments to be used by ESIMs, the operation of ESIMs on those assignments in the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz needs to be in accordance with the provisions of No. 11.42 with respect to any recorded frequency assignment which was the basis of the unfavourable finding under No. 11.38;
- c)* that any course of action taken under this Resolution has no impact on the original date of receipt of the frequency assignments of the GSO FSS satellite network with which ESIMs communicate or on the coordination requirements of that satellite network;

d) that successful compliance with this Resolution does not oblige any administration to authorize/license any ESIM to operate within the territory under its jurisdiction,

resolves

1 that, for any ESIM communicating with a GSO FSS space station within the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz, or parts thereof, the following conditions shall apply:

1.1 with respect to space services in the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz, ESIMs shall comply with the following conditions:

1.1.1 with respect to satellite networks or systems of other administrations, ESIM characteristics shall remain within the envelope characteristics of typical earth stations associated with the satellite network with which the ESIMs communicate;

1.1.2 the use of ESIMs shall not cause more interference and shall not claim more protection than for typical earth stations in this GSO FSS network;

1.1.3 the notifying administration of the GSO FSS network with which the ESIMs communicate shall ensure that the operation of ESIMs complies with the coordination agreements for the frequency assignments of the typical earth station of this GSO FSS network obtained under the relevant provisions of the Radio Regulations, taking into account *recognizing b)* above;

1.1.4 for the implementation of *resolves* 1.1.1 above, the notifying administration for the GSO FSS network with which the ESIMs communicate shall, in accordance with this Resolution, send to the Radiocommunication Bureau (BR) the relevant Appendix 4 notification information related to the characteristics of the ESIMs intended to communicate with that GSO FSS network, together with the commitment that the ESIM operation shall be in conformity with the Radio Regulations, including this Resolution;

1.1.5 upon receipt of the notification information referred to in *resolves* 1.1.4 above, BR shall examine it with respect to the provisions referred to in *resolves* 1.1.1 above and publish the result of such examination in its International Frequency Information Circular (BR IFIC);

1.1.6 for the protection of non-GSO FSS systems operating in the frequency band 27.5-28.6 GHz, ESIMs communicating with GSO FSS networks shall comply with the provisions contained in Annex 1 to this Resolution;

1.1.7 for the protection of non-GSO MSS feeder links of non-GSO systems for which complete coordination information was received before, and for which feeder-link earth stations were in service as of, 28 October 2019 in the frequency band 29.1-29.5 GHz, ESIMs communicating with GSO FSS networks should consider Annex 2 to this Resolution;

1.1.8 ESIMs shall not claim protection from non-GSO FSS systems operating in the frequency band 17.8-18.6 GHz in accordance with the Radio Regulations, including No. **22.5C**;

1.1.9 ESIMs shall not claim protection from broadcasting-satellite service feeder-link earth stations operating in the frequency band 17.7-18.4 GHz in accordance with the Radio Regulations;

1.2 with respect to the protection of terrestrial services to which the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz are allocated and which are operating in accordance with the Radio Regulations, ESIMs shall comply with the following conditions:

1.2.1 receiving ESIMs in the frequency band 17.7-19.7 GHz shall not claim protection from terrestrial services to which the frequency band is allocated and which are operating in accordance with the Radio Regulations;

1.2.2 transmitting aeronautical and maritime ESIMs in the frequency band 27.5-29.5 GHz shall not cause unacceptable interference to terrestrial services to which the frequency band is allocated and which are operating in accordance with the Radio Regulations, and Annex 3 to this Resolution shall apply;

1.2.3 transmitting land ESIMs in the frequency band 27.5-29.5 GHz shall not cause unacceptable interference to terrestrial services in neighbouring countries to which the frequency band is allocated and which are operating in accordance with the Radio Regulations (see *resolves* 3);

1.2.4 the provisions in this Resolution, including Annex 3, set the conditions for the purpose of protecting terrestrial services from unacceptable interference from aeronautical and maritime ESIMs in neighbouring countries in the frequency band 27.5-29.5 GHz; however, the requirement not to cause unacceptable interference to, or claim protection from, terrestrial services to which the frequency band is allocated and which are operating in accordance with the Radio Regulations remains valid (see *resolves* 4);

1.2.5 for the application of Part II of Annex 3 as referred to in *resolves* 1.2.2 and 1.2.4 above, BR shall examine the characteristics of aeronautical ESIMs with respect to the conformity with the power flux-density (pfd) limits on the Earth's surface specified in Part II of Annex 3 and publish the results of such examination in the BR IFIC;

1.2.6 the notifying administration for the GSO FSS network with which the ESIMs communicate shall send to BR a commitment that, upon receiving a report of unacceptable interference, the notifying administration for the GSO FSS network with which the ESIMs communicate shall follow the procedures in *resolves* 4;

2 that ESIMs shall not be used or relied upon for safety-of-life applications;

3 that the operation of ESIMs within the territory, including territorial waters and territorial airspace, of an administration shall be carried out only if authorized by that administration;

4 that, in the case of unacceptable interference caused by any type of ESIM:

4.1 the administration of the country in which the ESIM is authorized shall cooperate with an investigation on the matter and provide, to the extent of its ability, any required information on the operation of the ESIM and a point of contact to provide such information;

4.2 the administration of the country in which the ESIM is authorized and the notifying administration of the GSO FSS network with which the ESIM communicates shall, jointly or individually, as the case may be, upon receipt of a report of unacceptable interference, take required action to eliminate the interference or reduce it to an acceptable level;

5 that the administration responsible for the GSO FSS satellite network with which ESIMs communicate shall ensure that:

5.1 for the operation of ESIMs, techniques to maintain pointing accuracy with the associated GSO FSS satellite, without inadvertently tracking adjacent GSO satellites, are employed;

5.2 all necessary measures are taken so that ESIMs are subject to permanent monitoring and control by a network control and monitoring centre (NCMC) or equivalent facility in order to comply with the provisions in this Resolution, and are capable of receiving and acting upon at least “enable transmission” and “disable transmission” commands from the NCMC or equivalent facility;

5.3 measures, when required, are taken to limit the operation of ESIMs in the territory, including territorial waters and territorial airspace, under the jurisdiction of the administrations authorizing ESIMs;

5.4 a permanent point of contact is provided for the purpose of tracing any suspected cases of unacceptable interference from ESIMs and to immediately respond to requests from the focal point of the authorizing administration;

6 that the application of this Resolution does not provide regulatory status to ESIMs different from that derived from the GSO FSS network with which they communicate, taking into account the provisions referred to in this Resolution (see *recognizing b*) above);

7 that, if BR is unable to examine, in accordance with *resolves* 1.2.5 above, aeronautical ESIMs with respect to conformity with the pfd limits on the Earth’s surface specified in Part II of Annex 3, the notifying administration shall send to BR a commitment that the aeronautical ESIMs comply with those limits;

8 that BR shall formulate a qualified favourable finding under No. **11.31** with respect to the limits contained in Part II of Annex 3, if *resolves* 7 is applied successfully, otherwise it shall formulate an unfavourable finding,

further resolves

that, should an administration authorizing ESIMs agree to pfd levels higher than the limits contained in Part II of Annex 3 within the territory under its jurisdiction, such agreement shall not affect other countries that are not party to that agreement,

instructs the Director of the Radiocommunication Bureau

1 to take all necessary actions to facilitate the implementation of this Resolution, together with providing any assistance for the resolution of interference, when required;

2 to report to future world radiocommunication conferences any difficulties or inconsistencies encountered in the implementation of this Resolution, including whether or not the responsibilities relating to the operation of ESIMs have been properly addressed;

3 to review, if necessary, once the methodology to examine the characteristics of aeronautical ESIMs with respect to conformity with the pfd limits on the Earth's surface specified in Part II of Annex 3 is available, its findings made in accordance with No. **11.31**,

invites administrations

to collaborate for the implementation of this Resolution, in particular for resolving interference, if any,

invites the ITU Radiocommunication Sector

to conduct, as a matter of urgency, relevant studies to determine a methodology with respect to the examination referred to in *resolves* 1.2.5 above,

instructs the Secretary-General

to bring this Resolution to the attention of the Secretary-General of the International Maritime Organization and of the Secretary General of the International Civil Aviation Organization.

ANNEX 1 TO RESOLUTION 169 (REV.WRC-23)

Provisions for earth stations in motion to protect non-geostationary fixed-satellite service systems in the frequency band 27.5-28.6 GHz

1 In order to protect the non-geostationary (non-GSO) fixed-satellite service (FSS) systems referred to in *resolves* 1.1.6 of this Resolution in the frequency band 27.5-28.6 GHz, earth stations in motion (ESIMs) shall comply with the following provisions:

- a) the level of equivalent isotropically radiated power (e.i.r.p.) density emitted by an ESIM in a geostationary (GSO) network in the frequency band 27.5-28.6 GHz shall not exceed the following values for any off-axis angle ϕ which is 3° or more off the main-lobe axis of an ESIM antenna and outside 3° of the GSO arc:

<i>Off-axis angle</i>	<i>Maximum e.i.r.p. density</i>
$3^\circ \leq \phi \leq 7^\circ$	$28 - 25 \log \phi$ dB(W/40 kHz)
$7^\circ < \phi \leq 9.2^\circ$	7 dB(W/40 kHz)
$9.2^\circ < \phi \leq 48^\circ$	$31 - 25 \log \phi$ dB(W/40 kHz)
$48^\circ < \phi \leq 180^\circ$	-1 dB(W/40 kHz)

- b) for any ESIM operating in the frequency band 27.5-28.6 GHz that does not meet condition a) above, outside of 3° of the GSO arc, the maximum ESIM on-axis e.i.r.p. shall not exceed 55 dBW for emission bandwidths up to and including 100 MHz. For emission bandwidths larger than 100 MHz, the maximum ESIM on-axis e.i.r.p. may be increased proportionately.

ANNEX 2 TO RESOLUTION 169 (REV.WRC-23)

Protection of non-geostationary mobile-satellite service feeder links in the frequency band 29.1-29.5 GHz from earth stations in motion

With regard to the non-geostationary (non-GSO) mobile-satellite service (MSS) feeder links referred to in *resolves* 1.1.7 of this Resolution, administrations should consider the provisions in Part A, Part B or Part C below, as appropriate:

A. If an earth station in motion (ESIM) communicating with a geostationary (GSO) fixed-satellite service (FSS) network complies with each of the parameters or operating conditions listed in Table 1 below, coordination may be used to ensure compatibility between the affected non-GSO MSS feeder-link systems in the frequency band 29.1-29.5 GHz and the GSO FSS network with which the ESIM is associated.

TABLE 1

ESIM operational characteristics and parameters

E.i.r.p. density per carrier (single per ESIM)	≤ 35.5 dBW/MHz
Off-axis e.i.r.p. density	as per No. 22.32
Average carrier burst duty cycle	≤ 10% (averaged over 30 seconds)
Number of transmitting ESIMs in a single satellite beam in a 15 MHz channel	≤ 6

B. If an ESIM communicating with a GSO FSS network does not comply with each of the parameters or operating conditions listed in Table 1 above, but complies with each of the parameters or operating conditions listed in Table 2 below, coordination may be used to ensure compatibility between the affected non-GSO MSS feeder-link systems in the frequency band 29.1-29.5 GHz and the GSO FSS network with which the ESIM is associated. However, depending on the values of these parameters and characteristics in combination, there may need to be an exclusion zone or other constraint(s) on ESIMs developed by the parties and included in the agreement. Until such time as an agreement on coordination is reached, it may be appropriate for administrations to restrict ESIMs from operating within 500 km of a non-GSO MSS feeder-link earth station in any portion of the frequency band 29.1-29.5 GHz used by non-GSO MSS feeder-link earth stations, and to require that ESIMs operate subject to the condition that they do not cause harmful interference.

TABLE 2

ESIM operational characteristics and parameters

E.i.r.p. density per carrier (single per ESIM)	≤ 50 dBW/MHz
Off-axis e.i.r.p. density	as per No. 22.32
Average carrier burst duty cycle	100% (averaged over 4 hours)
Number of transmitting ESIMs in a single satellite beam in a 15 MHz channel	≤ 12

C. If an ESIM communicating with a GSO FSS network does not comply with each of the parameters or operating conditions listed in Table 1 or Table 2 above, it may be appropriate for administrations to restrict ESIMs from operating within 725 km of the non-GSO MSS feeder-link earth station in any portion of the frequency band 29.1-29.5 GHz used by non-GSO MSS feeder-link earth stations, and to require that any ESIM operations within between 725 and 1 450 km of a non-GSO MSS feeder-link earth station in any portion of the frequency band 29.1-29.5 GHz used by non-GSO MSS feeder-link earth stations be subject to the condition that the ESIMs do not cause harmful interference.

ANNEX 3 TO RESOLUTION 169 (REV.WRC-23)**Provisions for maritime and aeronautical earth stations in motion to protect terrestrial services in the frequency band 27.5-29.5 GHz**

1 The parts below contain provisions to ensure that maritime and aeronautical earth stations in motion (ESIMs) do not cause unacceptable interference in neighbouring countries to terrestrial service operations when ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency band 27.5-29.5 GHz is allocated and operating in accordance with the Radio Regulations (see also *resolves* 3 of this Resolution).

Part I: Maritime ESIMs

2 The notifying administration of the geostationary (GSO) fixed-satellite service (FSS) network with which a maritime ESIM communicates shall ensure compliance of the maritime ESIM operating within the frequency band 27.5-29.5 GHz, or parts thereof, with both of the following conditions for the protection of terrestrial services to which the frequency band is allocated within a coastal State:

2.1 The minimum distance from the low-water mark as officially recognized by the coastal State beyond which maritime ESIMs can operate without the prior agreement of any administration is 70 km in the frequency band 27.5-29.5 GHz. Any transmissions from maritime ESIMs within the minimum distance shall be subject to the prior agreement of the coastal State concerned.

2.2 The maximum maritime ESIM equivalent isotropically radiated power (e.i.r.p.) spectral density towards the horizon shall be limited to 24.44 dB(W/14 MHz). Transmissions from maritime ESIMs with higher e.i.r.p. spectral density levels towards the territory of any coastal State shall be subject to the prior agreement of the coastal State concerned.

Part II: Aeronautical ESIMs

3 The notifying administration of the GSO FSS satellite network with which an aeronautical ESIM communicates shall ensure compliance of the aeronautical ESIM operating within the frequency band 27.5-29.5 GHz, or parts thereof, with all of the following conditions for the protection of terrestrial services to which the frequency band is allocated:

3.1 When within line-of-sight of the territory of an administration, and above an altitude of 3 km, the maximum power flux-density (pfd) produced at the surface of the Earth on the territory of an administration by emissions from a single aeronautical ESIM shall not exceed:

$$\begin{aligned}
 \text{pfd}(\theta) &= -124.7 & (\text{dB(W/(m}^2 \cdot 14 \text{ MHz}))) & \text{ for } 0^\circ \leq \theta \leq 0.01^\circ \\
 \text{pfd}(\theta) &= -120.9 + 1.9 \cdot \log\theta & (\text{dB(W/(m}^2 \cdot 14 \text{ MHz}))) & \text{ for } 0.01^\circ < \theta \leq 0.3^\circ \\
 \text{pfd}(\theta) &= -116.2 + 11 \cdot \log\theta & (\text{dB(W/(m}^2 \cdot 14 \text{ MHz}))) & \text{ for } 0.3^\circ < \theta \leq 1^\circ \\
 \text{pfd}(\theta) &= -116.2 + 18 \cdot \log\theta & (\text{dB(W/(m}^2 \cdot 14 \text{ MHz}))) & \text{ for } 1^\circ < \theta \leq 2^\circ \\
 \text{pfd}(\theta) &= -117.9 + 23.7 \cdot \log\theta & (\text{dB(W/(m}^2 \cdot 14 \text{ MHz}))) & \text{ for } 2^\circ < \theta \leq 8^\circ \\
 \text{pfd}(\theta) &= -96.5 & (\text{dB(W/(m}^2 \cdot 14 \text{ MHz}))) & \text{ for } 8^\circ < \theta \leq 90.0^\circ
 \end{aligned}$$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

3.2 When within line-of-sight of the territory of an administration, and up to an altitude of 3 km, the maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single aeronautical ESIM shall not exceed:

$$\begin{aligned}
 \text{pfd}(\theta) &= -136.2 & (\text{dB(W/(m}^2 \cdot 1 \text{ MHz}))) & \text{ for } 0^\circ \leq \theta \leq 0.01^\circ \\
 \text{pfd}(\theta) &= -132.4 + 1.9 \cdot \log\theta & (\text{dB(W/(m}^2 \cdot 1 \text{ MHz}))) & \text{ for } 0.01^\circ < \theta \leq 0.3^\circ \\
 \text{pfd}(\theta) &= -127.7 + 11 \cdot \log\theta & (\text{dB(W/(m}^2 \cdot 1 \text{ MHz}))) & \text{ for } 0.3^\circ < \theta \leq 1^\circ \\
 \text{pfd}(\theta) &= -127.7 + 18 \cdot \log\theta & (\text{dB(W/(m}^2 \cdot 1 \text{ MHz}))) & \text{ for } 1^\circ < \theta \leq 12.4^\circ \\
 \text{pfd}(\theta) &= -108 & (\text{dB(W/(m}^2 \cdot 1 \text{ MHz}))) & \text{ for } 12.4^\circ < \theta \leq 90^\circ
 \end{aligned}$$

where θ is the angle of arrival of the radio-frequency wave (degrees above the horizon).

3.3 An aeronautical ESIM operating within the territory of an administration that has authorized fixed-service and/or mobile-service operation in the same frequency bands shall not transmit in these frequency bands without prior agreement of that administration (see also *resolves* 3 of this Resolution).

4 The maximum power in the out-of-band domain should be attenuated below the maximum output power of the aeronautical ESIM transmitter as described in the most recent version of Recommendation ITU-R SM.1541.

5 Higher pfd levels than those provided in 3.1 and 3.2 above produced by aeronautical ESIMs on the surface of the Earth within an administration shall be subject to the prior agreement of that administration (see also *further resolves* of this Resolution).

RESOLUTION 170 (REV.WRC-23)

**Additional measures for satellite networks in the fixed-satellite service
in frequency bands subject to Appendix 30B for the enhancement
of equitable access to these frequency bands**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a) that WARC Orb-88 created an allotment Plan for the use of the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz;
- b) that WRC-07 revised the regulatory regime governing the use of the frequency bands mentioned in *considering a)* above,

considering further

- a) the additional regulatory measures for the enhancement of equitable access included in Resolution **553 (WRC-15)** *;
- b) that the Rule of Procedure on No. **9.6** states that “the intent of Nos. **9.6 (9.7 to 9.21)**, **9.27** and Appendix **5** is to identify to which administrations a request for coordination is to be addressed, and not to state an order of priorities for rights to a particular orbital position”,

recognizing

- a) that Article 44 of the ITU Constitution lays down the basic principles for the use of the radio-frequency spectrum and the geostationary-satellite and other satellite orbits, taking into account the needs of developing countries;
- b) that the “first-come first-served” concept can restrict and sometimes prevent access to and use of certain frequency bands and orbital positions;
- c) the relative disadvantage for developing countries in coordination negotiations for various reasons such as a lack of resources and expertise;
- d) that Resolution **2 (Rev.WRC-03)** resolves that “the registration with the Radiocommunication Bureau of frequency assignments for space radiocommunication services and their use do not provide any permanent priority for any individual country or groups of countries and do not create an obstacle to the establishment of space systems by other countries”,

* *Note by the Secretariat:* This Resolution was revised by WRC-23.

recognizing further

a) that information provided by the Radiocommunication Bureau (BR) in ITU Radiocommunication Sector studies indicates that a very significant number of Appendix 30B submissions have been received by BR in the time period 1 January 2009 to 22 November 2019, and that the table below summarizes the data provided by BR into those studies (see also Attachment 2 to this Resolution) and shows the variations for the number of networks at the various stages;

	Request for conversion without change of initial allotment (national service area)	Request for conversion with changes within the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (supra national service area)	Request for additional use (national service area)	Request for additional use (supra national service area and global coverage ^{**})	Suppression
2009 Q1 + Q2	0	0	0	1	3	11	0
2009 Q3 + Q4	0	0	0	0	0	6	15
2010 Q1 + Q2	1	0	0	0	1	14	2
2010 Q3 + Q4	0	0	0	0	1	19	1
2011 Q1 + Q2	1	0	0	0	2	18	1
2011 Q3 + Q4	1	0	0	0	2	20	23
2012 Q1 + Q2	0	0	0	0	3	20	1
2012 Q3 + Q4	1	0	2	0	2	23	4
2013 Q1 + Q2	1	0	0	0	4	27	7
2013 Q3 + Q4	1	0	0	0	0	17	12
2014 Q1 + Q2	1	0	0	0	2	30	42
2014 Q3 + Q4	0	0	0	0	7	20	0
2015 Q1 + Q2	0	0	1	0	1	30	11
2015 Q3 + Q4	0	0	0	0	0	26	7
2016 Q1 + Q2	0	1	0	0	0	23	8
2016 Q3 + Q4	0	0	0	0	1	24	4
2017 Q1 + Q2	0	0	0	0	4	34	1

	Request for conversion without change of initial allotment (national service area)	Request for conversion with changes within the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (supra national service area)	Request for additional use (national service area)	Request for additional use (supra national service area and global coverage ^{**})	Suppression
2017 Q3 + Q4	0	1	0	0	0	25	7
2018 Q1 + Q2	0	0	0	0	6	20	9
2018 Q3 + Q4	0	0	0	0	0	10	15
2019 Q1 + Q2	1	1	0	0	0	4	17
2019 Q3	0	0	0	0	1	3	6

^{**} Notices for additional use with service area and coverage beyond the national territory of the notifying administration.

b) that the number of Appendix **30B** submissions made by some administrations is large, which may not be realistic;

c) that the use of certain combinations of technical parameters in submissions (e.g. high-gain receiving space station antennas) can make systems/submissions overly sensitive to interference, in such a way that subsequent submissions for conversion from allotment into assignments with changes would cause interference to those systems,

taking into account

that the majority of submissions under § 6.1 of Appendix **30B** have a global coverage and service area, which is typically changed to limited service area with a considerably wider coverage area at the time of submission under § 6.17, notwithstanding the Note to Appendix **4** data item B.3.b.1, which states “Taking due account of applicable technical restrictions and allowing some reasonable degree of flexibility for satellite operations, administrations should, to the extent practicable, align the areas the satellite steerable beams could cover with the service area of their networks with due regard to their service objectives”, and this is complicating coordination for administrations attempting to convert their national allotments into assignments or introducing an additional system for national use in a technically and economically viable manner, or for administrations acting on behalf of a group of named administrations introducing an additional system for their national use in a technically and economically viable manner,

resolves

that, as of 23 November 2019, the special procedure described in Attachment 1 to this Resolution shall be applied for the processing of submissions received by BR under Article 6 of Appendix **30B** for conversion of the allotment of an administration into an assignment with modifications outside the envelope of the initial allotment while restricted to providing service to its national territory, designated by test points as contained in the corresponding allotment, a submission by an administration of an additional system the service area of which is limited to its national territory, designated by test points as contained in the allotment, or a submission by an administration acting on behalf of a group of named administrations of an additional system the service area of which is limited to the national territories of the group of named administrations, designated by test points as contained in the allotments, in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz, if requested by an administration or one acting on behalf of a group of named administrations in respect of its submission, as specified in Attachment 1 to this Resolution; additional test points may be submitted inside the national territory of each participating administration provided that they are located on land and within the corresponding national territory, and that the total number of test points, per national territory, including those of the associated allotment, shall not exceed 20,

further resolves

that, when coordinating networks submitted under these additional measures, administrations, in particular those having satellite networks in process or included in the List with global coverage, exercise the utmost goodwill, and endeavour to overcome any difficulties encountered by the incoming network, in order to accommodate the incoming submission while respecting the underlying principles of No. **9.6** and its associated Rule of Procedure¹, which would apply by analogy to Article 6 of Appendix **30B**; in addressing, in particular, difficulties encountered in coordination due to the issue of potential Earth-to-space harmful interference caused by an incoming network which originates outside the service area of other potentially affected networks, administrations having potentially affected networks with global coverage shall implement, to the maximum extent possible, means to accommodate the incoming network, taking into account actual operating characteristics of the potentially affected networks,

instructs the Director of the Radiocommunication Bureau

to provide assistance, if requested by an administration, in the generation of a minimum ellipse as called for in § 3 c) of Attachment 1 to this Resolution.

¹ “in the application of Article **9** no administration obtains any particular priority as a result of being the first to start either the advance publication phase (Section I of Article **9**) or the request for coordination procedure (Section II of Article **9**).”

ATTACHMENT 1 TO
RESOLUTION 170 (REV.WRC-23)

**Additional measures for satellite networks in the fixed-satellite service in
frequency bands subject to Appendix 30B for the enhancement
of equitable access to these frequency bands**

1 The special procedure described in this Attachment can only be applied once by an administration, or one acting on behalf of a group of named administrations², having no assignment in the List of Appendix **30B** or assignment submitted under § 6.1 of Appendix **30B**.

2 With regard to the latter case, in order to benefit from application of the special procedure, the submitting administration may either withdraw or modify its submission previously sent to the Radiocommunication Bureau (BR) under § 6.1 of Appendix **30B** or submit its submission under § 6.17 of Appendix **30B** to meet the criteria of this special procedure. Whenever an administration acts on behalf of a group of named administrations, all members of that group shall withdraw their submissions, if any, previously sent to BR under § 6.1 of Appendix **30B**.

3 Administrations, or ones acting on behalf of a group of named administrations, seeking to apply this special procedure shall submit their request to BR, with the information specified in § 6.1 of Appendix **30B**. Specifically, this information shall contain:

- a) in the cover letter to BR, the information that the administration, or one acting on behalf of a group of named administrations, requests the use of this special procedure;
- b) for an administration acting on its own behalf, a service area limited to the territory as contained in its national allotment, or as submitted in the case that a new Member State of the Union does not have an allotment in the Plan and has not submitted a request under § 7.2 of Article 7 of Appendix **30B**, or, in the case of submission of an additional system by an administration acting on behalf of a group of named administrations, a service area limited to the national territories of the named administrations;

² Whenever, under this Resolution, an administration acts on behalf of a group of named administrations, all members of that group can no longer apply this procedure or take part in another group of named administrations that requests to apply this procedure. Furthermore, all members of that group shall have no assignment in the List of Appendix **30B** or assignment submitted under § 6.1 of Appendix **30B**.

- c) a minimum ellipse for an administration acting on its own behalf, or a beam formed by combining all individual minimum ellipses for a group of named administrations, determined by a set of test points, as specified in the *resolves* part of this Resolution for each participating administration, using the relevant BR software application. An administration, or one acting on behalf of a group of named administrations, may request BR to create such a diagram (see the *resolves* section of this Resolution).

4 If the information submitted under § 3 above is found to be incomplete, BR shall immediately seek from the administration concerned any clarification required and information not provided.

5 An administration, or one acting on behalf of a group of named administrations, using this special procedure shall effect coordination with other administrations as required in § 6 below before:

- i) submitting a request under § 6.17³ of Appendix **30B** to have the satellite network entered in the Appendix **30B** List; and
- ii) bringing into use a frequency assignment.

6 Following the successful application of §§ 1 to 4 above, BR shall, ahead of submissions not yet processed under § 6.3 of Appendix **30B**, promptly:

- a) examine the information with respect to its conformity with § 6.3 of Appendix **30B**;
- b) identify, in accordance with Appendix 1 to this Attachment, any administration with which coordination may need to be effected^{4, 5};
- c) include their names in the publication under d) below;
- d) publish⁶, as appropriate, the complete information in its International Frequency Information Circular (BR IFIC) within the time-limit as specified in Appendix **30B**;

³ During the coordination with an administration identified as affected, the notifying administration may change the beam to a shaped beam. Therefore, BR shall accept submissions of satellite networks applying this Resolution and containing a shaped beam under § 6.17 of Appendix **30B**, if the characteristics of the submission under § 6.17 of Appendix **30B** are within the envelope of the characteristics of the submission under § 6.1 of Appendix **30B**.

⁴ BR shall also identify the specific satellite networks with which coordination needs to be effected.

⁵ Whenever an administration acts on behalf of a group of named administrations, all members of that group retain the right to respond in respect of their own allotments or assignments.

⁶ If the payments are not received in accordance with the provisions of ITU Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, BR shall cancel the publication, after informing the administration concerned. BR shall inform all administrations of such action and that the network specified in the publication in question no longer has to be taken into consideration by BR and other administrations. BR shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with above-mentioned Council Decision 482 unless the payment has already been received.

- e) inform the administrations concerned of its actions and communicate the results of its calculations, drawing attention to the relevant BR IFIC.

7 In applying §§ 6.5, 6.12, 6.14, 6.21 and 6.22 of Appendix **30B**, the criteria in Annex 4 to Appendix **30B** shall be replaced by those given in Appendix 1 to this Attachment.

8 Administrations identified under § 6*b*) above, especially with a global coverage in uplink and limited service area, are required to apply all practical measures to overcome coordination difficulties encountered by the incoming network, in accordance with *further resolves* above.

9 If there is still continuing disagreement, the notifying administration may seek the assistance of BR.

10 If there is still continuing disagreement, the notifying administration can resubmit the notice under § 6.25 of Appendix **30B** and insist upon its reconsideration; BR, on the condition of a favourable finding under § 6.21 and § 6.22 of Appendix **30B** with respect to allotments in the Plan, shall enter the assignment provisionally in the List.

11 The administration responsible for the assignment which was the basis of the provisional entry under § 6.25 of Appendix **30B** shall be deemed to have agreed to the proposed assignment if BR is informed that the new assignment in the List has been in use, together with the assignment which was the basis for the disagreement, for at least four months without any complaint of harmful interference being made, and § 6.29 does not apply⁷.

12 The start of the four-month period referred to in § 11 above and the conditions for the operation to verify no harmful interference during this period shall be agreed by both administrations. If there is no agreement between administrations, any administration may seek the assistance of BR.

13 If there is no reply under § 8 or § 12 above from the notifying administration of the existing network to the request for collaboration of the notifying administration of the incoming network, or if there are problems in communication between the two administrations, the notifying administration of the incoming network may seek the assistance of BR. In this event, BR shall forthwith send a telefax to the notifying administration of the existing network which has failed to reply, requesting an immediate beginning of collaboration with the notifying administration of the incoming network.

⁷ Should harmful interference be caused at any later time by an assignment submitted under the provisions of this Resolution and for which § 14 has not been applied and which is entered in the List under § 6.25 of Appendix **30B** to any assignment in the List in respect of which § 6.25 of Appendix **30B** was applied, the administrations shall exercise the utmost goodwill and efforts to overcome any difficulties encountered by the incoming network, and the interfered-with administration shall identify appropriate remedial measures to be implemented, taking into account actual operations and cooperation with the incoming network.

14 If there is no acknowledgement of receipt within 30 days after BR's action under § 13 above, BR shall immediately send a reminder providing an additional 15-day period for response. In the absence of such an acknowledgement within 15 days, it shall be deemed that the notifying administration of the existing network which has failed to acknowledge receipt has undertaken that no complaint will be made in respect of any harmful interference affecting its own assignments which may be caused by the assignment of the notifying administration of the incoming network for which coordination was requested.

15 The calculation of the reference situation (*C/I*) of an assignment with which agreement has been deemed to have been obtained under § 11 above shall not take into account the interference produced by the assignment for which the provisions of § 6.25 of Appendix **30B** have been applied until an explicit agreement has been reached.

16 The provisions in this Attachment are supplementary to the provisions of Article 6 of Appendix **30B**.

APPENDIX 1 TO ATTACHMENT 1 TO RESOLUTION 170 (REV.WRC-23)

Criteria for determining whether an assignment is considered to be affected by networks submitted under Appendix 30B pursuant to this Resolution

The criteria as contained in Annex 4 to Appendix **30B** continue to apply in order to determine if a proposed new assignment applying the procedures of this Attachment affects:

- a) national allotments in the Plan;
- b) an assignment stemming from the conversion of an allotment into an assignment without modification or with modification within the envelope of the allotment;
- c) an allotment requested under Article 7 of Appendix **30B** by a new Member State of the Union which has received unfavourable findings under Article 7 and has been subsequently treated as a submission under § 6.1 of Appendix **30B**;
- d) assignments stemming from the application of § 6.35 of Appendix **30B**;
- e) assignments for which the procedures of this Resolution have been previously applied;
- f) assignments recorded in the List until 22 November 2019 with a service area limited to the national territories.

An assignment which appears in the List with a service area beyond national territories or which BR has previously examined after receiving complete information and published under § 6.7 of Appendix **30B**, which does not fall into any of the above categories and that is not applying the procedures of this Attachment, is considered as being affected by a proposed new assignment that is applying the procedures of this Attachment:

- 1) if the orbital spacing between its orbital position and the orbital position of the proposed new assignment is equal to or less than:
 - 1.1) 7° in the frequency bands 4 500-4 800 MHz (space-to-Earth) and 6 725-7 025 MHz (Earth-to-space);

- 1.2) 6° in the frequency bands 10.70-10.95 GHz (space-to-Earth), 11.20-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space);
- 2) however, an administration is considered as not being affected by a proposed new assignment that is applying the procedures of this Attachment if the conditions listed in 2.1 or 2.2 are satisfied:
- 2.1) the calculated⁸ Earth-to-space single-entry carrier-to-interference $(C/I)_u$ value at each test point associated with the assignment under consideration is greater than or equal to a reference value of 27 dB, or $(C/N)_u + 6$ dB⁹, or any already accepted Earth-to-space single entry (C/I) , whichever is the lowest, and the calculated⁸ space-to-Earth single-entry $(C/I)_d$ value everywhere within the service area of the assignment under consideration is greater than or equal to a reference value¹⁰ of 23.65 dB, or $(C/N)_d + 8.65$ dB¹¹, or any already accepted value, whichever is the lowest, and the calculated⁸ overall aggregate $(C/I)_{agg}$ value at each test point associated with the assignment under consideration is greater than or equal to a reference value of 21 dB, or $(C/N)_t + 7$ dB¹², or any already accepted overall aggregate $(C/I)_{agg}$ value, whichever is the lowest, with a tolerance of 0.45 dB¹³ in the case of assignments not stemming from the conversion of an allotment into an assignment without modification, or when the modification is within the envelope characteristics of the initial allotment;
- 2.2) in the frequency band 4 500-4 800 MHz (space-to-Earth), the power flux-density (pfd) produced under assumed free-space propagation conditions does not exceed the threshold values shown below, anywhere within the service area of the potentially affected assignment:

$0 \leq \theta \leq 0.09$	-240.5	dB(W/(m ² · Hz))
$0.09 < \theta \leq 3$	$-240.5 + 20\log(\theta/0.09)$	dB(W/(m ² · Hz))
$3 < \theta \leq 5.5$	$-216.79 + 0.75 \cdot \theta^2$	dB(W/(m ² · Hz))
$5.5 < \theta \leq 7$	$-194.1 + 25\log(\theta/5.5)$	dB(W/(m ² · Hz))

where θ denotes nominal geocentric separation (degrees) between interfering and interfered with satellite networks;

⁸ Including a computational precision of 0.05 dB.

⁹ $(C/N)_u$ is calculated as in Appendix 2 to Annex 4 to Appendix 30B.

¹⁰ The reference values within the service area are interpolated from the reference values at the test points.

¹¹ $(C/N)_d$ is calculated as in Appendix 2 to Annex 4 to Appendix 30B.

¹² $(C/N)_t$ is calculated as in Appendix 2 to Annex 4 to Appendix 30B.

¹³ Inclusive of the 0.05 dB computational precision.

in the frequency band 6 725-7 025 MHz (Earth-to-space), the pfd produced at the location in the geostationary-satellite orbit (GSO) of the potentially affected assignment under assumed free-space propagation conditions does not exceed $-201.0 - G_{Rx}$ dB(W/(m² · Hz)), where G_{Rx} is the relative space station uplink receive antenna gain of the potentially affected assignment at the location of the interfering earth station;

in the frequency bands 10.7-10.95 and 11.2-11.45 GHz (space-to-Earth), the pfd produced under assumed free-space propagation conditions does not exceed the threshold values shown below, anywhere within the service area of the potentially affected assignment:

$0 \leq \theta \leq 0.05$	-235.0	dB(W/(m ² · Hz))
$0.05 < \theta \leq 3$	$-235.0 + 20\log(\theta/0.05)$	dB(W/(m ² · Hz))
$3 < \theta \leq 5$	$-207.98 + 0.95 \cdot \theta^2$	dB(W/(m ² · Hz))
$5 < \theta \leq 6$	$-184.23 + 25\log(\theta/5)$	dB(W/(m ² · Hz))

where θ denotes nominal geocentric separation (degrees) between interfering and interfered with satellite networks;

in the frequency band 12.75-13.25 GHz (Earth-to-space), the pfd produced at the location in the GSO of the potentially affected assignment under assumed free-space propagation conditions does not exceed $-205.0 - G_{Rx}$ dB(W/(m² · Hz)), where G_{Rx} is the relative space station uplink receive antenna gain of the potentially affected assignment at the location of the interfering earth station.

APPENDIX 2 TO ATTACHMENT 1 TO RESOLUTION 170 (REV.WRC-23)

Protection criteria for a new incoming network

Incoming network	Allotments or assignments to be protected	Protection criteria
Assignment applying the special procedure or allotment proposed under Article 7 of Appendix 30B	Allotment in the Plan	Annex 4 to Appendix 30B
	Assignment converted from allotment without modification	Annex 4 to Appendix 30B
	Assignment converted from allotment with modification within the envelope of the allotment	Annex 4 to Appendix 30B
	Assignment converted from allotment with modification outside the envelope of the allotment and the special procedure applied	Annex 4 to Appendix 30B
	Assignment converted from allotment with modification outside the envelope of the allotment and the special procedure NOT applied	New criteria specified in this Resolution
	Former existing system	Annex 4 to Appendix 30B
	Additional system for which the special procedure applied	Annex 4 to Appendix 30B
	Additional system with frequency assignments recorded in the List until 22 November 2019 with service area limited to national territories for which the special procedure NOT applied	Annex 4 to Appendix 30B
	Additional system with frequency assignments submitted under item 6.1 of Appendix 30B with service area limited to national territories for which the special procedure NOT applied	New criteria specified in this Resolution
	Additional system with frequency assignments with service area beyond national territories for which the special procedure NOT applied	New criteria specified in this Resolution
	Request under Article 7 but transferred to Article 6	Annex 4 to Appendix 30B
	New allotment through the application of § 6.35	Annex 4 to Appendix 30B
Conversion of allotment or new additional system for which the special procedure NOT applied	All	Annex 4 to Appendix 30B

ATTACHMENT 2 TO RESOLUTION 170 (REV.WRC-23)

**Number of Appendix 30B submissions that have been received by the
Radiocommunication Bureau**

Number of new submissions

	Request for conversion without change of initial allotment (national service area)	Request for conversion with changes within the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (supra national service area)	Request for additional use (national service area)	Request for additional use (with supra national service area and global coverage)	Total
F						103	103
HOL						33	33
RUS/IK						29	29
E						28	28
PNG						28	28
IND					12	14	26
CHN					8	15	23
G						21	21
UAE						19	19
ISR						17	17
RUS					9	7	16
QAT						12	12
ARS/ARB						10	10
LUX						10	10
S						8	8
B			2		2	3	7
D						6	6
INS					3	3	6
J						6	6
USA				1		5	6
BLR	1					4	5
CYP						5	5
BGD	1					3	4

	Request for conversion without change of initial allotment (national service area)	Request for conversion with changes within the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (national service area)	Request for conversion with changes outside the envelope of initial allotment (supra national service area)	Request for additional use (national service area)	Request for additional use (with supra national service area and global coverage)	Total
IRN		1				3	4
MCO						4	4
MEX	1				3		4
MLA					1	3	4
TUR						4	4
CAN			1			2	3
KAZ						3	3
BUL	1					1	2
HNG						2	2
LAO						2	2
NCG						2	2
NPL		1			1		2
VTN					1	1	2
ALG						1	1
ARM						1	1
BOL		1					1
CBG						1	1
ETH						1	1
GRC						1	1
IRQ						1	1
MNE	1						1
MNG	1						1
NOR						1	1
PAK						1	1
ROU	1						1
SDN	1						1
Total:	8	3	3	1	40	424	479

Number of suppressions

	2009-2019	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019*
ARS/ARB	11						3	1	1	1	2	3
BLR	1										1	
BUL	1					1						
CAN	2						1	1				
CHN	16						15					1
E	1											1
F	14						2	1			6	5
F/EUT	38	15	3	16	2	1			1			
G	9				1			6		1		1
HOL	5								3			2
IND	8			1				6	1			
ISR	4										2	2
KOR	10					10						
LBY	1			1								
LUX	26			1		4	13		2	5	1	
MCO	1					1						
MLA	1								1			
NOR	2						1	1				
PNG	6			3						1	1	1
RUS	12			2	1	1	5	1	2			
RUS/IK	9										6	3
S	4						2		1		1	
SDN	1											1
TUR	2										2	
UAE	4										1	3
USA	2					1		1				
VTN	2				1						1	
Total	193	15	3	24	5	19	42	18	12	8	24	23

* In 2019, the statistics stop at 30 September.

RESOLUTION 176 (REV.WRC-23)

Studies on the use of the frequency bands 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), or parts thereof, by aeronautical and maritime earth stations in motion in the fixed-satellite service

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the frequency bands 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) are globally allocated on a primary basis to the fixed-satellite service (FSS);
- b)* that there is an increasing need for mobile communications, including global broadband satellite services, and that some of this need can be met by allowing aeronautical and maritime earth stations in motion (ESIMs) to communicate with FSS space stations operating in the frequency bands mentioned in *considering a)*;
- c)* that in the FSS, there are geostationary-satellite (GSO) networks and non-geostationary (non-GSO) systems operating and/or planned for near-term operation in the frequency bands mentioned in *considering a)* that are allocated to the FSS;
- d)* that some administrations have already deployed, and plan to expand their use of, ESIMs with operational and future FSS GSO networks and non-GSO systems;
- e)* that the space stations mentioned in *considering c)* in the frequency bands mentioned in *considering a)* are required to be coordinated and notified in accordance with the provisions of Articles 9 and 11;
- f)* that the frequency bands in *considering a)* are also allocated to several other services on a primary basis, the allocated services are used by a variety of different systems in many administrations, and these existing services and their future development should be protected without undue constraints;
- g)* the need to encourage the development and implementation of new technologies in the FSS at frequencies above 30 GHz;
- h)* that advances in technology, including the use of tracking techniques, allow ESIMs to operate within the characteristics of fixed earth stations of the FSS;
- i)* that the operation of ESIMs within the territory, including territorial waters and territorial airspace, of an administration shall be carried out only if authorized by that administration,

noting

- a) that Article **21** contains power flux-density (pfd) limits for the space stations mentioned in *considering c*);
- b) that WRC-15 adopted No. **5.527A** and Resolution **156 (WRC-15)*** with respect to ESIMs communicating with GSO FSS networks in the frequency bands 19.7-20.2 GHz and 29.5-30.0 GHz;
- c) that WRC-19 adopted No. **5.517A** and Resolution **169 (WRC-19)**** with respect to ESIMs communicating with GSO FSS networks in the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz;
- d) that this conference has adopted Resolution **121 (WRC-23)** with respect to aeronautical ESIMs (A-ESIMs) and maritime ESIMs (M-ESIMs) communicating with GSO space stations in the FSS in the frequency band 12.75-13.25 GHz;
- e) that the ESIMs addressed by this Resolution are not to be used for safety-of-life applications;
- f) that the frequency band 48.2-50.2 GHz (Earth-to-space) in Region 2 is identified for use by high-density applications in the FSS (No. **5.516B**);
- g) that the provisions of No. **5.550B** apply;
- h) that administrations are urged to take all practicable steps to reserve the frequency band 47.2-49.2 GHz for feeder links for the broadcasting-satellite service (BSS) operating in the frequency band 40.5-42.5 GHz (No. **5.552**);
- i) that the use of the frequency bands 47.5-47.9 GHz, 48.2-48.54 GHz and 49.44-50.2 GHz by the FSS (space-to-Earth) is limited to GSO satellites (No. **5.554A**);
- j) that the pfd in the frequency band 48.94-49.04 GHz produced by any GSO space station in the FSS (space-to-Earth) operating in the frequency bands 48.2-48.54 GHz and 49.44-50.2 GHz shall not exceed $-151.8 \text{ dB(W/m}^2\text{)}$ in any 500 kHz band at the site of any radio astronomy station (No. **5.555B**);
- k) that the frequency band 48.94-49.04 GHz is also allocated to the radio astronomy service (RAS) on a primary basis (No. **5.555**);
- l) that, in the frequency bands 49.7-50.2 GHz, 50.4-50.9 GHz and 51.4-52.6 GHz, Resolution **750 (Rev.WRC-19)** applies, and Nos. **5.338A**, **5.340** and **5.340.1**, among other provisions of the Radio Regulations, apply;
- m) that the fixed and mobile services are allocated on a primary basis in the frequency band 48.2-50.2 GHz on a global basis;
- n) that the frequency band 50.2-50.4 GHz is allocated on a primary basis to the Earth exploration-satellite service (EESS) (passive) and space research service (SRS) (passive);
- o) that the RAS is extremely susceptible to interference from space and airborne transmitters (see No. **29.12**);

* *Note by the Secretariat:* This Resolution was revised by WRC-23.

** *Note by the Secretariat:* This Resolution was revised by WRC-23.

p) that in the frequency band 48.94-49.04 GHz, administrations are urged to take all practicable steps to protect the RAS from harmful interference, in accordance with No. 5.149,

recognizing

a) that the protection of the primary incumbent services in these frequency bands should be studied;

b) that the authorization of land ESIMs remains the prerogative of each administration and, as such, it is not within the scope of this Resolution;

c) that the frequency bands used for reception by A-ESIMs and M-ESIMs shall not impose constraints on other allocated services or claim protection from allocated services operating in accordance with the Radio Regulations,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 studies on the spectrum needs and technical and operational characteristics of A-ESIMs and M-ESIMs that plan to operate within FSS allocations in the frequency bands mentioned in *considering a)*, or parts thereof;

2 studies on sharing and compatibility between A-ESIMs and M-ESIMs communicating with space stations in the FSS in the frequency bands mentioned in *considering a)*, or parts thereof, and the stations of primary services allocated in these frequency bands and in adjacent frequency bands, including passive services in adjacent and near-adjacent frequency bands, in order to ensure protection of, and not impose undue constraints on, those services;

3 the development, for M-ESIMs and A-ESIMs, of the technical conditions for their operation, taking into account the results of the studies above;

4 the development, for M-ESIMs and A-ESIMs communicating with GSO networks and non-GSO systems, of regulatory provisions for their operation, taking into account the results of the studies above;

5 consideration of the results of studies within the ITU Radiocommunication Sector (ITU-R) for the development of a new Recommendation for the network control and monitoring centre for ESIM operations;

6 studies on the responsibility of the administrations involved in the operations of the A-ESIMs and M-ESIMs addressed by this Resolution,

invites the 2027 world radiocommunication conference

to consider the results of the above studies and take the necessary actions for GSO and non-GSO ESIMs, as appropriate, provided that the results of the studies referred to in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* are complete and agreed by the ITU-R study groups.

RESOLUTION 205 (REV.WRC-19)

Protection of systems operating in the mobile-satellite service in the frequency band 406-406.1 MHz

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that WARC-79 allocated the frequency band 406-406.1 MHz to the mobile-satellite service (MSS) in the Earth-to-space direction;
- b)* that No. **5.266** limits the use of the frequency band 406-406.1 MHz to low-power satellite emergency position-indicating radiobeacons (EPIRBs);
- c)* that WARC Mob-83 made provision in the Radio Regulations for the introduction and development of a global distress and safety system;
- d)* that the use of satellite EPIRBs is an essential element of this system;
- e)* that, like any frequency band reserved for a distress and safety system, the frequency band 406-406.1 MHz is entitled to full protection against all harmful interference;
- f)* that Nos. **5.267** and **4.22** and Appendix **15** (Table **15-2**) require the protection of the MSS within the frequency band 406-406.1 MHz from all emissions of systems, including systems operating in the lower and upper adjacent frequency bands;
- g)* that Recommendation ITU-R M.1478 provides protection requirements for the various types of instruments mounted on board operational satellites receiving EPIRB signals in the frequency band 406-406.1 MHz against both broadband out-of-band emissions and narrowband spurious emissions;
- h)* that Report ITU-R M.2359 provides the results of studies covering various scenarios between the MSS and other relevant active services operating in the frequency bands 390-406 MHz and 406.1-420 MHz or in separate parts of these frequency bands;
- i)* that unwanted emissions from services outside the frequency band 406-406.1 MHz have the potential to cause interference to MSS receivers within 406-406.1 MHz;
- j)* that long-term protection against harmful interference of the Cospas-Sarsat satellite system operating in the MSS in the frequency band 406-406.1 MHz is vital to the response times of emergency services;
- k)* that, in most cases, the frequency bands adjacent or near to those used by Cospas-Sarsat will continue to be used for various applications in the services to which they are allocated,

considering further

- a) that some administrations have initially developed and implemented an operational low-altitude, near-polar orbiting satellite system (Cospas-Sarsat) operating in the frequency band 406-406.1 MHz to provide alerting and to aid in the locating of distress incidents;
- b) that thousands of human lives have been saved through the use of spaceborne distress-beacon detection instruments, initially on 121.5 MHz and 243 MHz, and subsequently in the frequency band 406-406.1 MHz;
- c) that the 406 MHz distress transmissions are relayed through many instruments mounted on geostationary, low-Earth and medium-Earth satellite orbits;
- d) that the digital processing of these emissions provides accurate, timely and reliable distress alert and location data to help search and rescue authorities assist persons in distress;
- e) that the International Maritime Organization has decided that satellite EPIRBs operating in the Cospas-Sarsat system form part of the Global Maritime Distress and Safety System (GMDSS);
- f) that observations of the use of frequencies in the frequency band 406-406.1 MHz show that they are being used by stations other than those authorized by No. **5.266**, and that these stations have caused harmful interference to the MSS, and particularly to the reception of satellite EPIRB signals by the Cospas-Sarsat system;
- g) that the results of spectrum monitoring and ITU Radiocommunication Sector (ITU-R) studies contained in Report ITU-R M.2359 indicate that emissions from stations operating in the frequency bands 405.9-406 MHz and 406.1-406.2 MHz have the potential to severely impact the performance of MSS systems in the frequency band 406-406.1 MHz;
- h) that the results of ITU-R studies indicate that increased deployment of land mobile systems operating in the vicinity of the frequency band 406-406.1 MHz may degrade the receiver performance of mobile-satellite systems operating in the frequency band 406-406.1 MHz;
- i) that the maximum permissible level of interference to the MSS in the frequency band 406-406.1 MHz may be exceeded due to frequency drift of the radiosondes operating above 405 MHz,

recognizing

- a) that it is essential for the protection of human life and property that frequency bands allocated exclusively to a service for distress and safety purposes be kept free from harmful interference;
- b) that the deployment of mobile systems near the frequency band 406-406.1 MHz is ongoing and more such systems are envisaged;
- c) that this increased deployment raises significant concerns on the reliability of future distress and safety communications due to the increases in the noise level measured in many areas of the world for the frequency band 406-406.1 MHz;

d) that it is essential to preserve the MSS frequency band 406-406.1 MHz free from out-of-band emissions that would degrade the operation of the 406 MHz satellite transponders and receivers, with the risk that satellite EPIRB signals would go undetected,

noting

a) that the 406 MHz search and rescue system will be enhanced by placing 406-406.1 MHz transponders on global navigation satellite systems such as Galileo, GLONASS and GPS, relaying search and rescue emissions at 406 MHz, in addition to already-operational and future low-Earth orbiting and geostationary satellites, thus providing a large constellation of satellites relaying search and rescue messages;

b) that this enhanced constellation of spaceborne search and rescue instruments was designed to improve geographic coverage and reduce distress-alert transmission delays by means of larger uplink footprints, an increased number of satellites and improvement in the accuracy of the location of the distress signal;

c) that the characteristics of these spacecraft with larger footprints, and the low power available from satellite EPIRB transmitters, means that aggregate levels of electromagnetic noise, including noise from transmissions in adjacent frequency bands, may present a risk of satellite EPIRB transmissions being undetected, or delayed in reception, or lead to reduced accuracy of the calculated locations, thereby putting lives at risk;

d) that Recommendation ITU-R SM.1051 provides a methodology to monitor the electromagnetic environment in the adjacent frequency bands 405.9-406 MHz and 406.1-406.2 MHz,

noting further

a) that the MSS systems contributing to the Cospas-Sarsat emergency location system provide a worldwide emergency location system to the benefit of all countries, even if those mobile-satellite systems are not operated by their country;

b) that many Cospas-Sarsat satellites implement efficient out-of-band filtering, which would be further improved in upcoming satellites,

resolves

1 to request administrations not to make new frequency assignments within the frequency bands 405.9-406.0 MHz and 406.1-406.2 MHz under the mobile and fixed services;

2 that administrations take into account frequency drift characteristics of radiosondes when selecting their operating frequencies above 405 MHz to avoid transmitting in the 406-406.1 MHz frequency band and take all practical steps to avoid frequency drifting close to 406 MHz,

instructs the Director of the Radiocommunication Bureau

1 to continue to organize monitoring programmes in the frequency band 406-406.1 MHz in order to identify the source of any unauthorized emission in that frequency band;

2 to organize monitoring programmes on the impact of unwanted emissions from systems operating in the frequency bands 405.9-406 MHz and 406.1-406.2 MHz on MSS reception in the frequency band 406-406.1 MHz in order to assess the effectiveness of this Resolution, and to report to subsequent world radiocommunication conferences,

encourages administrations

to take measures such as authorizing new assignments to stations in the fixed and mobile services with priority given to selecting channels with greater frequency separation from the frequency band 406 to 406.1 MHz and ensuring that the equivalent isotropically radiated power of new fixed and mobile systems at all but low elevation angles is kept to the minimum required level,

urges administrations

1 to take part in monitoring programmes referred to in *instructs the Director of the Radiocommunication Bureau* above;

2 to ensure that stations other than those operated under No. **5.266** abstain from using frequencies in the frequency band 406-406.1 MHz;

3 to take the appropriate measures to eliminate harmful interference caused to the distress and safety system;

4 when designing Cospas-Sarsat satellite receiver payloads in the frequency band 406-406.1 MHz, to improve, to the extent possible, out-of-band filtering of such receivers, in order to reduce constraints on adjacent services while preserving the ability of the Cospas-Sarsat system to detect all kinds of emergency beacons and to maintain an acceptable rate of detection, which is vital to search and rescue missions;

5 to take all practical steps to limit the levels of unwanted emissions of stations operating within the frequency ranges 403-406 MHz and 406.1-410 MHz in order not to cause harmful interference to mobile-satellite systems operating in the frequency band 406-406.1 MHz;

6 to actively cooperate with the administrations participating in the monitoring programme and the Radiocommunication Bureau to resolve reported cases of interference to the Cospas-Sarsat system.

RESOLUTION 207 (REV.WRC-15)

Measures to address unauthorized use of and interference to frequencies in the frequency bands allocated to the maritime mobile service and to the aeronautical mobile (R) service

The World Radiocommunication Conference (Geneva, 2015),

considering

- a)* that the HF frequencies currently used by the aeronautical and maritime mobile services for distress, safety and other communications, including allotted operational frequencies, suffer from harmful interference and are often subject to difficult propagation conditions;
- b)* that WRC-97 considered some aspects of the use of the HF bands for distress and safety communications in the context of the Global Maritime Distress and Safety System (GMDSS), especially with regard to regulatory measures;
- c)* that unauthorized operations using maritime and aeronautical frequencies in the HF bands are continuing to increase and are already a serious risk to HF distress, safety and other communications;
- d)* that some administrations have resorted to, for example, transmitting warning messages on operational HF channels as a means of deterring unauthorized users;
- e)* that provisions of the Radio Regulations prohibit the unauthorized use of certain safety frequencies for communications other than those related to safety;
- f)* that enforcing compliance with these regulatory provisions is becoming increasingly difficult with the availability of low-cost HF single side-band (SSB) transceivers;
- g)* that monitoring observations of the use of frequencies in the frequency band 2 170-2 194 kHz and in the frequency bands allocated exclusively to the maritime mobile service between 4 063 kHz and 27 500 kHz and to the aeronautical mobile (R) service between 2 850 kHz and 22 000 kHz show that a number of frequencies in these frequency bands are still being used by stations of other services, many of which are operating in contravention of No. **23.2**;
- h)* that, in certain situations, HF radio is the sole means of communication for the maritime mobile service and that certain frequencies in the frequency bands mentioned in *considering g)* are reserved for distress and safety purposes;
- i)* that, in certain situations, HF radio is the sole means of communication for the aeronautical mobile (R) service and that this is a safety service;
- j)* that WRC-2000 and subsequent conferences have reviewed the use of the HF bands by the aeronautical mobile (R) and maritime mobile services with a view to protecting operational, distress and safety communications;

k) that this Resolution identifies several interference mitigation techniques that can be employed by administrations on a non-mandatory basis,

considering in particular

a) that it is of paramount importance that the distress and safety channels of the maritime mobile service be kept free from harmful interference, since they are essential for the protection of the safety of life and property;

b) that it is also of paramount importance that channels directly concerned with the safe and regular conduct of aircraft operations be kept free from harmful interference, since they are essential for the safety of life and property,

resolves to invite ITU-R and ITU-D, as appropriate

to increase regional awareness of appropriate practices in order to help mitigate interference in the HF bands, especially on distress and safety channels,

invites administrations

1 to ensure that stations of services other than the maritime mobile service abstain from using frequencies in distress and safety channels and their guardbands and in the frequency bands allocated exclusively to that service, except under the conditions expressly specified in Nos. **4.4**, **5.128**, **5.137** and **4.13** to **4.15**; and to ensure that stations of services other than the aeronautical mobile (R) service abstain from using frequencies allocated to that service except under the conditions expressly specified in Nos. **4.4** and **4.13**;

2 to make every effort to identify and locate the source of any unauthorized emission capable of endangering human life or property and the safe and regular conduct of aircraft operations, and to communicate their findings to the Radiocommunication Bureau;

3 to participate, in accordance with item 4 in the Annex, in any monitoring programmes organized by the Bureau or administrations, if so agreed among those administrations, without adversely affecting the rights of other administrations or conflicting with any provisions of the Radio Regulations;

4 to make every effort to prevent unauthorized transmissions in frequency bands allocated to the maritime mobile service and the aeronautical mobile (R) service;

5 to request their competent authorities to take, within their respective jurisdiction, such legislative or regulatory measures which they consider necessary or appropriate in order to prevent stations from unauthorized use of distress and safety channels or from operating in contravention of No. **23.2**;

6 to take all necessary steps in such cases of contravention of No. **23.2** to ensure the cessation of any transmissions contravening the provisions of the Radio Regulations on the frequencies or in the frequency bands referred to in this Resolution;

7 to employ as many of the interference mitigation techniques referred to in the Annex as are appropriate for the maritime mobile and aeronautical mobile (R) services,

instructs the Radiocommunication Bureau

- 1 to seek the cooperation of administrations in identifying the sources of those emissions by all available means and in securing the cessation of those emissions;
- 2 when the station of another service transmitting in a frequency band allocated to the maritime mobile service or to the aeronautical mobile (R) service has been identified, to inform the administration concerned;
- 3 to include the problem of interference to maritime and aeronautical distress and safety channels on the agenda of relevant regional radiocommunication seminars,

instructs the Secretary-General

to bring this Resolution to the attention of the International Maritime Organization and the International Civil Aviation Organization for such actions as they may consider appropriate.

ANNEX TO RESOLUTION 207 (REV.WRC-15)

Interference mitigation techniques

This Annex lists several possible HF interference mitigation techniques that may be used, either in combination or singly, depending on the resources of administrations. Use of any or all of these techniques is not mandatory.

1 Alternative modulation methods

The use of digitally modulated emissions, such as QPSK, to replace or supplement analogue SSB voice (J3E) and data (J2B) emissions. This initiative would need to be adopted internationally to allow the interoperability of equipment. For example, ICAO has adopted an HF data-link standard to provide packet data communications using automated link establishment and adaptive frequency control techniques as a supplement to analogue SSB voice communications (see ICAO Convention, Annex 10).

2 Passive and active/adaptive antenna systems

Use of passive and active/adaptive antenna systems to reject unwanted signals.

3 Channel barring

Administrations should ensure through their licensing, equipment standardization and inspection arrangements that, in compliance with No. **43.1**, HF radio equipment cannot transmit on frequencies exclusively allocated to the aeronautical mobile (R) service, as detailed in Appendix **27**, except for frequencies allocated for worldwide use and shared with the aeronautical mobile (OR) service (see Appendix **26/3.4**).

4 Regional HF monitoring and direction-finding facilities

Collaboration and cooperation between regional administrations to coordinate the use of monitoring and direction-finding facilities.

5 Transmission of warning messages

Transmission of multilanguage warning messages on specific channels affected by strong or persistent interference. Such transmissions should be conducted after coordination with the users of the affected services and the administration(s) or competent authorities concerned.

6 Education and publicity initiatives

Administrations should provide education and publicity initiatives on the proper use of the radio-frequency spectrum in these frequency bands.

RESOLUTION 212 (REV.WRC-23)

Implementation of International Mobile Telecommunications in the frequency bands 1 885-2 025 MHz and 2 110-2 200 MHz

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that Resolution ITU-R 56 defines the naming for International Mobile Telecommunications (IMT);
- b)* that the ITU Radiocommunication Sector (ITU-R), for WRC-97, recommended approximately 230 MHz for use by the terrestrial and satellite components of IMT;
- c)* that ITU-R studies forecast that additional spectrum may be required to support the future services of IMT and to accommodate future user requirements and network deployments;
- d)* that ITU-R has recognized that the satellite component is an integral part of IMT;
- e)* that, in No. **5.388**, WARC-92 identified frequency bands to accommodate certain mobile applications defined as IMT,

noting

- a)* that both the terrestrial and satellite components of IMT have already been deployed or are being considered for deployment within the frequency bands 1 885-2 025 MHz and 2 110-2 200 MHz;
- b)* that the availability of the satellite component of IMT in the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz simultaneously with the terrestrial component of IMT in the frequency bands identified in No. **5.388** would improve the overall use of IMT,

noting further

- a)* that co-coverage, co-frequency deployment of independent satellite and terrestrial IMT components is not feasible unless techniques, such as the use of an appropriate guardband or other mitigation techniques, are applied to ensure coexistence and compatibility between the terrestrial and satellite components of IMT, but that co-coverage, co-frequency deployment of terrestrial and satellite components of IMT could be feasible if deployed as integrated networks supported by a system providing the management of frequency utilization by both components;
- b)* that, when the satellite and terrestrial components of IMT are deployed in the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz, technical or operational measures may need to be implemented to avoid harmful interference,

resolves

- 1 that administrations which implement IMT:
 - a) should make the necessary frequencies available for system development;
 - b) should use those frequencies when IMT is implemented;
 - c) should use the relevant international technical characteristics, as identified by Recommendations of ITU-R and of the ITU Telecommunication Standardization Sector;
- 2 that administrations should take the technical and operational measures, such as those found in the Annex to this Resolution, to facilitate coexistence and compatibility between the terrestrial and satellite components of IMT in the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz;
- 3 that, in the event of harmful interference, the concerned administrations should investigate and take technical and operational measures, as appropriate, to reduce interference to an acceptable level,

invites the ITU Radiocommunication Sector

to study possible technical and operational measures to improve co-existence and compatibility between the terrestrial and satellite components of IMT in the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz where those frequency bands are shared by the mobile service and the mobile-satellite service in different countries, in particular for the deployment of independent satellite and terrestrial components of IMT and to facilitate development of both the satellite and terrestrial components of IMT,

invites administrations

- 1 to give due consideration to the accommodation of other services currently operating in these frequency bands when implementing IMT;
- 2 to facilitate coexistence of the satellite component of IMT with the terrestrial component of IMT in the frequency band 1 980-2 010 MHz, by the concerned administrations, as appropriate, considering the following:
 - a) to apply an uplink direction from user equipment to IMT base stations as provided in the most recent version of Recommendation ITU-R M.1036, for the user equipment belonging to the terrestrial component of IMT in the frequency band 1 980-2 010 MHz (see the Annex to this Resolution);
 - b) that, in the event of harmful interference to the satellite component of the IMT space station, the concerned administrations may take additional steps to facilitate the reduction of harmful interference to an acceptable level;
- 3 to facilitate coexistence of the terrestrial component of IMT stations with the satellite component of IMT in the frequency band 2 170-2 200 MHz, by the concerned administrations, as appropriate, considering the following:
 - a) to apply an appropriate power flux-density value to the IMT space stations in the frequency band 2 170-2 200 MHz (see the Annex to this Resolution);
 - b) that, in the event of harmful interference to the terrestrial component of IMT, the concerned administrations may take additional steps to facilitate the reduction of harmful interference to an acceptable level.

ANNEX TO RESOLUTION 212 (REV.WRC-23)

**Guidance on the implementation of technical and operational measures to
facilitate coexistence between terrestrial and satellite components of
International Mobile Telecommunications in the frequency
bands 1 980-2 010 MHz and 2 170-2 200 MHz**

This Annex provides guidance to concerned administrations on the following technical, operational and other applicable measures in the deployment of terrestrial and satellite components of International Mobile Telecommunications (IMT) for reducing the potential of harmful interference between the terrestrial and satellite components of IMT in the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz for the interference scenarios indicated in the table below, noting the applicability of any relevant Article 9 coordination procedures for scenarios A2, B1 and B2. The identified measures may be applicable for some scenarios and may not be applicable to other scenarios, and may or may not be implementable in satellite and terrestrial IMT system designs.

Interference scenarios

Scenario	From	To
A1	Terrestrial IMT base station or mobile station	Satellite IMT space station
A2	Terrestrial IMT base station	Satellite IMT mobile earth station
B1	Satellite IMT mobile earth station	Terrestrial IMT base station or user equipment
B2	Satellite IMT space station	Terrestrial IMT user equipment

- 1) Measures for the terrestrial component of IMT:
 - a) Use base station antennas with improved sidelobe performance as shown in relevant ITU-R Recommendations and Reports (e.g. improved antenna patterns compared with those contained in the most recent version of Recommendation ITU-R F.1336).
 - b) Consider the orientation in elevation and/or in azimuth of the IMT base station antenna pointing in the coexistence analysis with a view to reducing the interference level from the IMT base station above the horizon.
 - c) Consider the impact of the actual deployment scenario, including the activity factor values of the terrestrial component of IMT, on the coexistence.
 - d) Consider attenuation from terrain and clutter taking into account the deployment environments and propagation effects in the coexistence analysis.
 - e) Consider reducing the equivalent isotropically radiated power in the frequency band 1 980-2 010 MHz to a level sufficient for coexistence, for example, nominally to -10 dB(W/5 MHz)¹.

¹ See user terminal characteristics in Report ITU-R M.2292.

- f) Set the transmission direction for the use of the frequency band 1 980-2 010 MHz with regard to the IMT base station to operate in receive mode as found in relevant ITU-R Recommendations.
- g) Implement other applicable interference mitigation techniques.
- 2) Measures for the satellite component of IMT:
 - a) Use narrower spot beams and steeper roll-off from the boresight of the satellite antenna (i.e. not only reducing the interference level from the antenna sidelobe but also increasing frequency reuse and resilience to interference).
 - b) Antenna steering, where such capability exists in the satellite design.
 - c) Beamforming and/or beam nulling of the satellite antenna (e.g. digital processing of multi-element beamforming technique, which has the capability to suppress received interference from regions on the Earth).
 - d) Dynamic frequency management paired with geographical separation (e.g. monitoring interference in real time and dynamically assigning channels and/or beams).
 - e) Consider reducing the power flux-density to a level sufficient for coexistence, for example to nominally -122 dBW/m^2 for 1 MHz² for the protection of some base stations or nominally -108.8 dBW/m^2 for 1 MHz for the protection of some user equipment on the Earth's surface on the territories of other administrations using this frequency band for the terrestrial IMT component.
 - f) Consider an appropriate elevation angle model of an earth station and handover method by a satellite control system in the coexistence analysis.
 - g) Consider actual activity factor values, which may result in a reduction of interference.
 - h) Apply a polarization of the satellite antenna different from that of the terrestrial station receiver (for example, use of linear polarization by the terrestrial station receivers and circular polarization by the satellite may provide some benefit).
 - i) Implement other applicable interference mitigation techniques.

² See Resolution 539 (Rev.WRC-19) for the frequency band 2 605-2 655 MHz.

RESOLUTION 213 (WRC-23)

**Use of high-altitude platform stations as International Mobile
Telecommunications base stations in the frequency
band 694-960 MHz, or portions thereof¹**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the favourable propagation characteristics of the frequency band 694-960 MHz are beneficial to provide cost-effective solutions for coverage, including for large areas of low population density;
- b)* that the operation of high-altitude platform stations (HAPS) as International Mobile Telecommunications (IMT) base stations (HIBS) in the same geographical area with existing services may create compatibility issues;
- c)* that it is necessary to adequately protect existing services in this frequency band;
- d)* that there is growing demand for access to mobile broadband, requiring more flexibility in approaches to expanding the capacity and coverage provided by IMT systems;
- e)* that HIBS would be used as part of terrestrial IMT networks and may use the same frequency bands as ground-based IMT base stations in order to provide mobile-broadband connectivity to underserved communities, and in rural and remote areas;
- f)* that HIBS would offer a new means of providing IMT services with minimal network infrastructure, as they are capable of providing service to a large footprint together with a dense coverage;
- g)* that the use of HIBS is optional for administrations, and that such use should not have any priority over other terrestrial IMT use;
- h)* that the mobile station to be served, whether by HIBS or ground-based IMT base stations, is the same, and currently supports a variety of the frequency bands identified for IMT;
- i)* that, under certain deployment scenarios, platform transmissions in the frequency band 694-960 MHz may occur at altitudes down to 18 km, and some sensitivity studies have shown that the difference of interference at this altitude would be negligible;

¹ HIBS: High-altitude platform station as IMT base station. The conditions in this Resolution refer to these platforms operating between 18 km and 25 km.

j) that the ITU Radiocommunication Sector (ITU-R) has addressed sharing and compatibility between HIBS and existing systems of primary allocated services in the frequency band 694-960 MHz, and services in the adjacent bands,

recognizing

a) that, in Article 5, the frequency band 694-960 MHz, or parts thereof, is allocated on a primary basis to various services;

b) that the use of the frequency band 470-862 MHz by the broadcasting service and other primary services in Region 1 (except Mongolia) and the Islamic Republic of Iran is covered by the GE06 Agreement;

c) that a HAPS is defined in No. 1.66A as a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth;

d) that the frequency band 694-960 MHz, or parts thereof, are identified for IMT in accordance with Nos. 5.313A and 5.317A;

e) that these frequency bands are allocated to the fixed and mobile services on a co-primary basis,

emphasizing

that the requirements of the different services to which the frequency band is allocated, including the mobile, aeronautical radionavigation (in accordance with Nos. 5.312 and 5.323), fixed and broadcasting services, shall be taken into account,

resolves

1 that use of the frequency band 694-960 MHz in accordance with Nos. 5.312B and 5.314A is subject to agreement obtained under No. 9.21 with respect to the affected aeronautical radionavigation service (ARNS) in countries listed in Nos. 5.312 and 5.323 based on the criteria contained in Annex 1 to this Resolution;

2 that HIBS operating in the frequency band 694/698-862 MHz shall not cause harmful interference to, nor claim protection from, the broadcasting service; where the GE06 Agreement applies, the power flux-density (pfd) level per HIBS shall not exceed $-135.8 \text{ dB(W/(m}^2 \cdot \text{MHz))}$, produced in the territory of other administrations, at a height of 10 metres unless explicit agreement of the affected administration is provided at the time of the notification of HIBS;

3 that, where the GE06 Agreement does not apply, the use of the frequency band 694/698-862 MHz by HIBS is subject to agreement obtained under No. 9.21 with respect to the broadcasting service in the territory of other administrations; the coordination threshold of a pfd level of $-135.8 \text{ dB(W/(m}^2 \cdot \text{MHz))}$, produced in the territory of other administrations, per HIBS shall be used at a height of 10 metres;

4 that administrations wishing to implement HIBS shall comply with the following:

4.1 for the purpose of protecting the mobile service, including IMT terrestrial systems, in the territory of neighbouring administrations in the frequency band 694-960 MHz, the following limits shall apply:

- the pfd level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit for the protection of IMT mobile stations, unless explicit agreement of the affected administration is provided:

$$-114 \quad \text{dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 0^\circ < \theta \leq 90^\circ$$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

- the pfd level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit for the protection of IMT base stations, unless explicit agreement of the affected administration is provided:

$$-136 + 0.21 (\theta)^2 \quad \text{dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 0^\circ \leq \theta \leq 8.3^\circ$$

$$-121.8 + 0.08 (\theta) \quad \text{dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 8.3^\circ < \theta \leq 90^\circ$$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees²;

4.2 for the purpose of protecting mobile services including IMT terrestrial systems in the territory of Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Mongolia, Uzbekistan, Kyrgyzstan, the Democratic People's Republic of Korea, Tajikistan and Turkmenistan in the frequency band 694-960 MHz, the pfd level per HIBS produced at the surface of the Earth in the territory of the countries listed above in this *resolves* shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

$$-150 \quad \text{dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 0^\circ \leq \theta < 11^\circ$$

$$-150 + 0.3912 (\theta - 11) \quad \text{dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 11^\circ \leq \theta < 80^\circ$$

$$-123 \quad \text{dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 80^\circ \leq \theta \leq 90^\circ$$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

4.3 for the purpose of protecting fixed services in the territory of Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Mongolia, Uzbekistan, Kyrgyzstan, the Democratic People's Republic of Korea, Tajikistan and Turkmenistan in the frequency band 694-960 MHz, the pfd level per HIBS produced at the surface of the Earth in the territory of the countries listed above in this *resolves* shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

$$-150 \quad \text{dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 0^\circ \leq \theta < 11^\circ$$

$$-150 + 0.3912 (\theta - 11) \quad \text{dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 11^\circ \leq \theta < 80^\circ$$

$$-123 \quad \text{dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 80^\circ \leq \theta \leq 90^\circ$$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

² The pfd levels to protect IMT base stations will apply unless the affected administration informs the Radiocommunication Bureau that only terminal stations need to be protected.

5 that administrations intending to implement HIBS systems shall notify, in accordance with Article 11, the frequency assignments to transmitting and receiving HIBS by submitting all mandatory elements of Appendix 4 to the Radiocommunication Bureau for the examination of compliance with the conditions specified in the *resolves* above;

6 that the notifying administration of HIBS at the time of submission of the Appendix 4 information shall provide a firm, objective, actionable, measurable and enforceable commitment to the Bureau to immediately eliminate unacceptable interference to existing primary services or reduce it to an acceptable level should such interference occur,

invites administrations

1 to adopt appropriate frequency arrangements for HIBS in order to consider the benefits of harmonized utilization of the spectrum for HIBS and protection of existing services and systems operating on a primary basis taking into account the *resolves* above and the relevant ITU-R Recommendations and Reports;

2 to review their entries for the broadcasting service in the Master International Frequency Register in the frequency band above 694 MHz and to remove those no longer required according to Article 8,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

ANNEX 1 TO RESOLUTION 213 (WRC-23)

Criteria for identifying potentially affected administrations with respect to the aeronautical radionavigation service in countries listed in Nos. 5.312 and 5.323

To identify potentially affected administrations when applying the procedure for seeking agreement under No. 9.21 for HIBS in the mobile service with respect to the aeronautical radionavigation service (ARNS) station operating in countries mentioned in Nos. 5.312 and 5.323, the coordination distances (between a HIBS in the mobile service and a potentially affected ARNS station) indicated below should be used.

When applying the procedure for seeking agreement under No. **9.21**, notifying administrations may indicate in the notice sent to the Radiocommunication Bureau the list of administrations with which a bilateral agreement has already been reached. The Bureau shall take this into account in determining the administrations with which coordination under No. **9.21** is required.

Coordination distances for transmitting HIBS of MS (km)	Coordination distances for receiving HIBS of MS (km)
$4.1(\sqrt{h_1} + \sqrt{h_2})$	$4.1(\sqrt{h_1} + \sqrt{h_3}) + R$

h_1 is ARNS stations height (10 000 m).

h_2 is HIBS stations height (between 18 000 and 25 000 m).

h_3 is IMT mobile stations height (1.5 m).

R is radius of HIBS service area in km.

RESOLUTION 215 (REV.WRC-12)

Coordination process among mobile-satellite systems and efficient use of the allocations to the mobile-satellite service in the 1-3 GHz range

The World Radiocommunication Conference (Geneva, 2012),

considering

- a)* that space-to-Earth transmissions of mobile-satellite systems are constrained to limit their power flux-density over areas where the frequency band is shared with terrestrial systems;
- b)* that a number of proposed mobile-satellite systems can provide a good service to users within the power flux-density limits given in Annex 1 to Appendix 5 to the Radio Regulations;
- c)* that when maximum communication capacity is achieved by systems in the mobile-satellite service (MSS) a major portion of the interference into each of these systems will come from the other mobile-satellite systems sharing the frequency band, and, consequently, if one system starts to transmit at higher power, all others need to do the same in order to overcome mutual interference;
- d)* that ITU-R is studying the efficient use of the radio spectrum and frequency sharing within the MSS, that Recommendations ITU-R M.1186 and ITU-R M.1187 are a basis for further study, and that additional preliminary texts are available or can be provided by administrations on this matter;
- e)* that, in a codirectional, co-frequency and co-coverage sharing environment, capacities of systems using spread-spectrum multiple-access techniques are affected by technical and operational characteristics of other MSS systems using similar multiple-access techniques;
- f)* that in many parts of the world and in certain frequency bands in the 1-3 GHz range, significant congestion already exists due to use by other terrestrial and space services;
- g)* the need to make most efficient use of frequencies in the MSS allocations,

recognizing

that, as a means to ensure that the frequency bands allocated to the MSS can be used in an efficient manner, there is an urgent demand for:

- a)* criteria to be established by ITU-R to be used in determining the need to coordinate between mobile-satellite systems; and
- b)* detailed methods of interference calculation to be used by administrations in the coordination process;
- c)* ITU-R studies which should not impede the timely deployment of any MSS systems,

resolves to invite ITU-R

1 to continue its studies on this subject and develop, as a matter of urgency, criteria for determining the need to coordinate and calculation methods for determining levels of interference, as well as the required protection ratios between MSS networks;

2 to study, as a matter of urgency, the use of technically and operationally feasible techniques to allow for improvements in spectrum efficiency in MSS systems,

further resolves

1 that ITU-R studies should be focused on the technical and operational characteristics of systems using spread-spectrum multiple-access techniques that can allow co-frequency, co-coverage, codirectional sharing but which involve cooperation among systems' operators to maximize the efficient use of spectrum by multiple MSS systems using such access techniques;

2 that administrations responsible for the introduction of mobile-satellite systems are urged to implement, as practicable, the latest available technologies to improve spectrum efficiency consistent with the requirement to offer viable MSS services;

3 to recommend that administrations be encouraged to use the most advanced technology available when preparing to implement their global MSS systems in the 1-3 GHz range so that they may operate, if necessary, in different frequency bands in different regions, in accordance with the MSS allocations in the 1-3 GHz range decided by WRC-97.

RESOLUTION 217 (REV.WRC-23)

Implementation of wind profiler radars

The World Radiocommunication Conference (Dubai, 2023),

having noted

a request to ITU from the Secretary-General of the World Meteorological Organization (WMO), in May 1989, for advice and assistance in the identification of appropriate frequencies near 50 MHz, 400 MHz and 1 000 MHz in order to accommodate allocations and assignments for wind profiler radars,

considering

- a)* that wind profiler radars are vertically-directed Doppler radars exhibiting characteristics similar to radiolocation systems;
- b)* that wind profiler radars are important meteorological systems used to measure wind direction and speed as a function of altitude;
- c)* that it is necessary to use frequencies in different ranges in order to have options for different performance and technical characteristics;
- d)* that, in order to conduct measurements up to a height of 30 km, it is necessary to allocate frequency bands for these radars in the general vicinity of 50 MHz (3 to 30 km), 400 MHz (500 m to about 10 km) and 1 000 MHz (100 m to 3 km);
- e)* that some administrations have either already deployed, or plan to expand their use of, wind profiler radars in operational networks for studies of the atmosphere and to support weather monitoring, forecasting and warning programmes;
- f)* that the Radiocommunication Study Groups have studied the technical and sharing considerations between wind profiler radars and other services allocated in bands near 50 MHz, 400 MHz and 1 000 MHz,

considering further

- a)* that some administrations have addressed this matter nationally by assigning frequencies for use by wind profiler radars in existing radiolocation bands or on a non-interference basis in other bands;
- b)* the work of the Voluntary Group of Experts on the Allocation and Improved Use of the Radio-Frequency Spectrum and Simplification of the Radio Regulations supports increased flexibility in the allocation of frequency spectrum,

noting in particular

- a) that wind profiler radars operating in the meteorological aids service in the frequency band 400.15-406 MHz interfere with satellite emergency position-indicating radio beacons operating in the mobile-satellite service in the frequency band 406-406.1 MHz under No. **5.266**;
- b) that in accordance with No. **5.267**, any emission capable of causing harmful interference to the authorized uses of the frequency band 406-406.1 MHz is prohibited,

resolves

1 to urge administrations to implement wind profiler radars as radiolocation service systems in the following bands, having due regard to the potential for incompatibility with other services and assignments to stations in these services, thereby taking due account of the principle of geographical separation, in particular with regard to neighbouring countries, and keeping in mind the category of service of each of these services:

46-68 MHz in accordance with No. **5.162A**

440-450 MHz

470-494 MHz in accordance with No. **5.291A**

904-928 MHz in Region 2 only

1 270-1 295 MHz

1 300-1 375 MHz;

2 that, in case compatibility between wind profiler radars and other radio applications operating in the frequency band 440-450 MHz or 470-494 MHz cannot be achieved, the frequency bands 420-435 MHz or 438-440 MHz could be considered for use;

3 to urge administrations to implement wind profiler radars in accordance with the most recent versions of Recommendations ITU-R M.1226, ITU-R M.1085 and ITU-R M.1227 for the frequency bands around 50 MHz, 400 MHz and 1 000 MHz, respectively;

4 to urge administrations not to implement wind profiler radars in the frequency band 400.15-406 MHz;

5 to urge administrations currently operating wind profiler radars in the frequency band 400.15-406 MHz to discontinue them as soon as possible,

instructs the Secretary-General

to bring this Resolution to the attention of the International Civil Aviation Organization, International Maritime Organization and WMO.

RESOLUTION 218 (WRC-23)

**Use of high-altitude platform stations as International Mobile
Telecommunications base stations in the frequency
band 2 500-2 690 MHz, or portions thereof¹**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that there is growing demand for access to mobile broadband, requiring more flexibility in the approaches to expand the capacity and coverage provided by International Mobile Telecommunications (IMT) systems;
- b)* that high-altitude platform stations (HAPS) as IMT base stations (HIBS) would be used as part of terrestrial IMT networks and may use the same frequency bands as ground-based IMT base stations in order to provide mobile-broadband connectivity to underserved communities, and in rural and remote areas;
- c)* that HIBS would offer a new means of providing IMT services with minimal network infrastructure, as they are capable of providing service to a large footprint together with a dense coverage;
- d)* that the use of HIBS is optional for administrations, and that such use should not have any priority over other terrestrial IMT use;
- e)* that the mobile station to be served, whether by HIBS or ground-based IMT base stations, is the same, and currently supports a variety of the frequency bands identified for IMT;
- f)* that, under certain deployment scenarios, platform transmissions in the frequency band 2 500-2 690 MHz may occur at altitudes down to 18 km, and some sensitivity studies have shown that the difference of interference at this altitude would be negligible;
- g)* that the ITU Radiocommunication Sector (ITU-R) has addressed sharing and compatibility between HIBS and existing systems of primary allocated services in the frequency band 2 500-2 690 MHz and services in the adjacent bands;

¹ HIBS: High-altitude platform station as IMT base station. The conditions in this Resolution refer to these platforms operating between 18 km and 25 km.

h) that the frequency band 2 690-2 700 MHz is allocated to the Earth exploration-satellite service (passive), the space research service (passive) and the radio astronomy service, and that No. **5.340** applies in this frequency band,

recognizing

a) that a HAPS is defined in No. **1.66A** as a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth;

b) that, in Regions 1 and 2, the frequency band 2 500-2 690 MHz (the frequency band 2 500-2 510 MHz is limited to reception by HIBS in Regions 1 and 2), and, in Region 3, the frequency band 2 500-2 655 MHz (the frequency band 2 500-2 535 MHz is limited to reception by HIBS in Region 3) are included in No. **5.409A** for the use of HIBS;

c) that the frequency band 2 500-2 690 MHz, or parts thereof, is identified for IMT in accordance with No. **5.384A**;

d) that this frequency band is allocated to the fixed and mobile services on a co-primary basis;

e) that, in the frequency band 2 700-2 900 MHz, ground-based meteorological radar stations under the radiolocation service are authorized to operate on a basis of equality with stations of the aeronautical radionavigation service, according to No. **5.423**,

resolves

1 that administrations wishing to implement HIBS shall comply with the following:

1.1 for the purpose of protecting the mobile service, including IMT terrestrial systems in the territory of other administrations in the frequency band 2 500-2 690 MHz, the power flux-density (pfd) level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits:

– the pfd level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit for the protection of IMT mobile stations, unless explicit agreement of the affected administration is provided:

$$-109 \quad \text{dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 0^\circ < \theta \leq 90^\circ$$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

– the pfd level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits for the protection of IMT base stations, unless explicit agreement of the affected administration is provided:

$$-144.55 \quad \text{dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 0^\circ \leq \theta < 11^\circ$$

$$-144.55 + 0.45 (\theta - 11) \quad \text{dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 11^\circ \leq \theta < 80^\circ$$

$$-113.55 \quad \text{dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 80^\circ \leq \theta \leq 90^\circ$$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees²;

² The pfd levels to protect IMT base stations will apply unless the affected administration informs the Radiocommunication Bureau that only terminal stations need to be protected.

1.2 for the purpose of protecting the mobile service including IMT terrestrial systems in the territories of Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Mongolia, Uzbekistan, Kyrgyzstan, the Democratic People's Republic of Korea, Tajikistan and Turkmenistan in the frequency band 2 500-2 690 MHz, the pfd level per HIBS produced at the surface of the Earth in the territories of the countries listed above in this *resolves* shall not exceed the following limits, unless explicit agreement is received from the administration affected:

-147	dB(W/(m ² · MHz))	for	0° ≤ θ < 11°
-147 + 0.45 (θ - 11)	dB(W/(m ² · MHz))	for	11° ≤ θ < 80°
-116	dB(W/(m ² · MHz))	for	80° ≤ θ < 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.3 for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency band 2 500-2 690 MHz, the pfd level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

-148	dB(W/(m ² · MHz))	for	0° < θ ≤ 2°
-148 + 0.71 (θ - 2)	dB(W/(m ² · MHz))	for	2° < θ ≤ 47°
-116	dB(W/(m ² · MHz))	for	47° < θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.4 for the purpose of protecting the broadcasting-satellite service (BSS) in the territory of other administrations in the frequency band 2 520-2 630 MHz, the pfd level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement is received from the administration affected:

-130.5	dB(W/(m ² · MHz))	for	0° < θ ≤ 20°
-139.8	dB(W/(m ² · MHz))	for	20° < θ < 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.4.1 in addition, in Region 3, in the frequency band 2 520-2 630 MHz, the use of HIBS shall not cause unacceptable interference to, nor claim protection from, the BSS operating in Region 3;

1.5 for the purpose of protecting aeronautical-radionavigation service systems in the territory of other administrations in the frequency band 2 700-2 900 MHz, the pfd level per HIBS operating in the frequency band 2 500-2 690 MHz produced at the surface of the Earth in the territory of other administrations shall not exceed the following unwanted emissions limits, unless explicit agreement of the affected administration is provided:

-156.2	dB(W/(m ² · MHz))	for	θ ≤ 7°
-163 + 15 · log ₁₀ (θ - 4)	dB(W/(m ² · MHz))	for	7° < θ < 30.5°
-141 + 2.7 · log ₁₀ (θ - 4)	dB(W/(m ² · MHz))	for	θ = 30.5°
-157 + 14 · log ₁₀ (θ - 4)	dB(W/(m ² · MHz))	for	30.5° < θ ≤ 40.5°
-101.5	dB(W/(m ² · MHz))	for	θ > 40.5°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.6 for the purpose of protecting radiolocation service systems in the territory of other administrations, in particular those systems operating in accordance with No. **5.423** in the frequency band 2 700-2 900 MHz, the pfd level per HIBS operating in the frequency band 2 500-2 690 MHz produced at the surface of the Earth in the territory of other administrations shall not exceed the following unwanted emissions limits, unless explicit agreement of the affected administration is provided:

-165.6	dB(W/(m ² · MHz))	for	$\theta \leq 37^\circ$
$-165.6 + 5.5 (\theta - 37)$	dB(W/(m ² · MHz))	for	$37^\circ < \theta < 45^\circ$
$-121.6 + (\theta - 45) / 3$	dB(W/(m ² · MHz))	for	$45^\circ < \theta \leq 90^\circ$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.7 for the purpose of protecting radio astronomy service stations in the frequency band 2 690-2 700 MHz, the pfd level of HIBS operating in the frequency band 2 500-2 690 MHz produced at any radio astronomy observatory site shall not exceed the following unwanted emissions limit, unless explicit agreement of the affected administration is provided:

$$-177 \quad \text{dB(W/(m}^2 \cdot 10 \text{ MHz))};$$

1.8 *resolves* 1.7 applies at any radio astronomy station that was in operation prior to 15 December 2023 and has been notified to the Radiocommunication Bureau in the frequency band 2 690-2 700 MHz before 17 May 2024, or at any radio astronomy station that was notified before the date of receipt of the complete Appendix 4 information for notification, for the HIBS system to which *resolves* 1.6 applies; for radio astronomy stations notified after these dates an agreement needs to be sought with administrations that have notified HIBS;

1.9 for the purpose of protecting the mobile-satellite service (MSS) (space-to-Earth) and radiodetermination-satellite service (space-to-Earth) in the frequency band 2 483.5-2 500 MHz, the use of HIBS in the frequency band 2 500-2 690 MHz shall comply with an unwanted emission limit of -30 dBm/MHz in the frequency band 2 483.5-2 500 MHz;

1.10 for the purpose of protecting MSS (Earth-to-space) in the frequency band 2 655-2 690 MHz in Region 3, the notifying administration of HIBS shall ensure an enforceable commitment that, in case of causing unacceptable interference, it undertakes to immediately cease emission or reduce the interference to an acceptable level;

2 that administrations intending to implement HIBS systems shall notify, in accordance with Article 11, the frequency assignments to transmitting and receiving HIBS stations by submitting all mandatory elements of Appendix 4 to the Bureau for the examination of compliance with the conditions specified in the *resolves* above;

3 that the notifying administration of HIBS at the time of submission of the Appendix 4 information shall provide a firm, objective, actionable, measurable and enforceable commitment to the Bureau to immediately eliminate unacceptable interference to existing primary services or reduce it to an acceptable level should such interference occur,

invites administrations

to adopt appropriate frequency arrangements for HIBS in order to consider the benefits of harmonized utilization of the spectrum for HIBS and protection of existing services and systems operating on a primary basis taking into account the *resolves* above and the relevant ITU-R Recommendations and Reports,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

RESOLUTION 219 (WRC-23)

**Terrestrial component of International Mobile Telecommunications
in the frequency band 10-10.5 GHz in Region 2**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that International Mobile Telecommunications (IMT), including IMT-2000, IMT-Advanced and IMT-2020, is intended to provide telecommunication services on a worldwide scale, regardless of location and type of network or terminal;
- b)* that adequate and timely availability of spectrum and supporting regulatory provisions are essential to realize the objectives set out in Recommendation ITU-R M.2083;
- c)* that there is a need to continually take advantage of technological developments in order to increase the efficient use of spectrum and facilitate spectrum access;
- d)* that IMT systems are now evolving to cover diverse usage scenarios and applications, such as enhanced mobile broadband, massive machine-type communications and ultra-reliable and low-latency communications,

recognizing

- a)* that timely availability of wide and contiguous blocks of spectrum is important to support the development of IMT;
- b)* that the frequency band 10.6-10.68 GHz is allocated on a primary basis to both active and passive services with the specific conditions outlined in Resolution **751 (WRC-07)**, based on the conclusions of the studies contained in Report ITU-R RS.2096, which allow for sharing with the Earth exploration-satellite service (EESS) (passive);
- c)* that the frequency band 10.68-10.7 GHz is globally allocated to passive services, including the radio astronomy service, and No. **5.340** applies;
- d)* that the frequency band 10-10.4 GHz is allocated to the EEES (active), whose capability to perform very high-resolution cloud-free imaging offers a multitude of benefits to society, such as topographic and cadastral mapping, urban planning, emergency management, climate change monitoring and enhanced maritime monitoring;
- e)* that the use of the frequency band 10-10.5 GHz for IMT is only intended for microcell base stations,

resolves

- 1 that administrations wishing to implement IMT consider use of the frequency band 10-10.5 GHz identified for IMT in No. **5.480A** in countries in Region 2, taking into account the most recent versions of relevant ITU-R Recommendations;

2 that administrations shall take practical measures to ensure that transmitting antennas of outdoor base stations are normally pointing below the horizon when deploying IMT base stations within the frequency band 10-10.5 GHz; the mechanical pointing needs to be at or below the horizon;

3 that the maximum equivalent isotropically radiated power (e.i.r.p.) per base station shall not exceed 30 dB(W/100 MHz) and that the maximum e.i.r.p. per base station for elevation angles higher than 34 degrees shall not exceed 0.5 dB(W/100 MHz);

4 that, for the purposes of protecting the EESS (passive), and considering the conditions under *resolves* 3, the total radiated power (TRP)¹ produced per IMT base station operating in the frequency band 10-10.5 GHz shall not exceed -37.9 dB(W/100 MHz) in the frequency band 10.6-10.7 GHz;

5 that, for the purposes of protecting the EESS (passive), the TRP produced by IMT user equipment operating in the frequency band 10-10.5 GHz shall not exceed -39 dB(W/100 MHz) in the frequency band 10.6-10.7 GHz;

6 that IMT stations within the frequency range 10-10.5 GHz shall be used only for applications of the land mobile service,

invites the ITU Radiocommunication Sector

1 to develop harmonized frequency arrangements to facilitate IMT deployment in the frequency band 10-10.5 GHz, taking into account the results of sharing and compatibility studies conducted in preparation for WRC-23;

2 to continue providing guidance to ensure that IMT can meet the telecommunication needs of developing countries;

3 to develop an ITU Radiocommunication Sector (ITU-R) Report and/or Recommendation on methodologies for calculating coordination zones around radio astronomy stations operating in the frequency band 10.6-10.7 GHz in order to avoid harmful interference from IMT systems operating in the frequency band 10-10.5 GHz;

4 to review existing ITU-R Recommendations/Reports and, as appropriate, to update them or develop new ITU-R Recommendations to provide information and assistance to the administrations concerned regarding possible coordination measures for fixed-service stations with IMT stations in the frequency band 10-10.5 GHz,

instructs the Director of the Radiocommunication Bureau

to bring this Resolution to the attention of relevant international organizations.

¹ The TRP is to be understood here as the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere.

RESOLUTION 220 (WRC-23)

**Terrestrial component of International Mobile Telecommunications (IMT)
within the frequency band 6 425-7 125 MHz**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that International Mobile Telecommunications (IMT), including IMT-2000, IMT-Advanced and IMT-2020, is the ITU vision for global mobile access, and is intended to provide telecommunication services on a worldwide scale, regardless of location and type of network or terminal;
- b)* that harmonized worldwide frequency bands for IMT are desirable in order to achieve global roaming and the benefits of economies of scale;
- c)* that identification of frequency bands allocated to the mobile service for IMT may change the sharing situation regarding applications of services to which the frequency band is already allocated, and may require regulatory actions;
- d)* that it is assumed that only a very limited number of IMT base stations will be communicating with a positive elevation angle towards IMT indoor mobile stations;
- e)* that the frequency band 6 425-7 125 MHz, or parts thereof, is allocated on a primary basis to the fixed, mobile, fixed-satellite (Earth-to-space) (space-to-Earth) and space operation services (Earth-to-space);
- f)* that, in the frequency band 6 650-6 675.2 MHz, radio astronomy observations are carried out under No. **5.149** for measurement of methanol spectral lines;
- g)* that No. **5.458** states that, in the band 6 425-7 075 MHz, “passive microwave sensor measurements are carried out over the oceans. In the band 7 075-7 250 MHz, passive microwave sensor measurements are carried out. Administrations should bear in mind the needs of the Earth exploration-satellite (passive) and space research (passive) services in their future planning of the bands 6 425-7 075 MHz and 7 075-7 250 MHz”;
- h)* that existing satellite networks of the fixed-satellite service (FSS) (Earth-to-space) are used within the frequency band 6 425-7 075 MHz, or parts thereof, and their characteristics may evolve in the future;
- i)* that the frequency band 6 425-7 125 MHz, or parts thereof, is also used by other applications in the mobile service;
- j)* that the frequency band 7 100-7 155 MHz is allocated on a primary basis to the space operation services (Earth-to-space) in the Russian Federation, in accordance with No. **5.459**;
- k)* that the frequency band 7 145-7 190 MHz is allocated on a primary basis to the space research service (SRS) (deep space);

l) that the frequency band 6 725-7 025 MHz is included in Appendix **30B** and used to provide a plan to guarantee in practice, for all countries, equitable access to the geostationary satellite orbit (GSO) in the frequency bands of the FSS;

m) that expected equivalent isotropically radiated power (e.i.r.p.) limits have been established which require assessment for compliance in equipment conformance tests;

n) that the frequency band 6 700-7 075 MHz (space-to-Earth) is used for feeder links of non-geostationary satellite systems of the mobile-satellite service (MSS), in accordance with No. **5.458B**;

o) that the frequency band 6 425-7 075 MHz in the FSS can be used to provide feeder links in the MSS;

p) that the FSS is currently used to provide feeder links in the MSS to enhance maritime services within the frequency band 6 425-6 575 MHz,

noting

a) Resolutions **223 (Rev.WRC-23)**, **224 (Rev.WRC-23)**, **225 (Rev.WRC-23)**, **241 (Rev.WRC-23)**, **242 (Rev.WRC-23)** and **243 (Rev.WRC-23)**, which also relate to IMT;

b) that the IMT terrestrial radio interfaces as defined in Recommendations ITU-R M.1457, ITU-R M.2012 and ITU-R M.2150 are expected to evolve within the framework of the ITU Radiocommunication Sector (ITU-R) beyond those initially specified, to provide enhanced services and services beyond those envisaged in the initial implementation;

c) that Recommendation ITU-R M.2160 outlines the framework and overall objectives of the future development of IMT for 2030 and beyond;

d) that Recommendation ITU-R M.2083 provides the IMT Vision – Framework and overall objectives of the future development of IMT for 2020 and beyond,

recognizing

a) that the identification of a frequency band for IMT does not establish priority in the Radio Regulations and does not preclude the use of the frequency band by any application of the services to which it is allocated;

b) that studies have shown that the protection of feeder links for the non-GSO FSS (space-to-Earth) requires the determination of protection distances ranging between a few kilometres to tens of kilometres; these protection distances are site-specific and depend on several elements, such as the propagation parameters, local terrain topography, and station and orbital parameters of the feeder links for the non-GSO FSS (space-to-Earth);

c) that studies have shown that co-channel coexistence between IMT and the fixed service can be achieved but may require cross-border coordination between countries;

d) that studies have shown that co-channel coexistence between IMT and the fixed service can be achieved but would require site-by-site coordination if IMT and the fixed service are deployed in the same or adjacent geographical areas;

e) that a later deployment of IMT may be considered by those administrations wishing to migrate the fixed service to other frequency bands,

resolves

1 that administrations wishing to implement IMT in accordance with Nos. **5.457D**, **5.457E**, and **5.457F** consider use of the frequency bands referred to in those footnotes, taking into account the most recent versions of the relevant ITU-R Recommendations;

2 that, in order to ensure protection for the FSS (Earth-to-space), and taking into account *considering d)*, the level of expected e.i.r.p. spectral density emitted by an IMT base station as a function of the vertical angle above the horizon shall not exceed the following values (No. **21.5** does not apply):

Vertical angle range $\theta_L \leq \theta < \theta_H$ (vertical angle θ above horizon)	Expected e.i.r.p. (dBm/MHz) (See NOTES 1, 2 and 3)
$0^\circ \leq \theta < 5^\circ$	27
$5^\circ \leq \theta < 10^\circ$	23
$10^\circ \leq \theta < 15^\circ$	19
$15^\circ \leq \theta < 20^\circ$	18
$20^\circ \leq \theta < 30^\circ$	16
$30^\circ \leq \theta < 60^\circ$	15
$60^\circ \leq \theta \leq 90^\circ$	15

NOTE 1: The expected e.i.r.p. is defined as the average value of the e.i.r.p., with the averaging being performed:

- over horizontal angles from -180° to $+180^\circ$, with the IMT base station beamforming in a specific direction within its horizontal and vertical steering range,
- over different beamforming directions within the IMT base station horizontal and vertical steering range, and
- over the specified vertical angle range $\theta_L \leq \theta < \theta_H$.

NOTE 2: An IMT base station shall comply with the specified limits on expected e.i.r.p. spectral density for all mechanical tilts with which it can be deployed, taking into account *considering m)*.

NOTE 3: See the Annex to this Resolution for additional details on how the expected e.i.r.p. can be calculated for this frequency band.

3 that administrations wishing to implement IMT in the frequency band 6 700-7 075 MHz shall ensure the protection, continued use and future development of FSS (space-to-Earth) stations through the adoption of site-specific coordination,

invites administrations

1 to take into account the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT;

2 to ensure that provisions for the implementation of IMT do not adversely affect the operation of FSS earth stations and their future development;

3 to take all practical steps to protect the radio astronomy service (RAS) from harmful interference in the frequency band 6 650-6 675.2 MHz, which covers spectral lines of importance for current astronomical investigations, in accordance with No. 5.149,

invites the ITU Radiocommunication Sector

1 to develop harmonized frequency arrangements to facilitate IMT deployment within the frequency band 6 425-7 125 MHz;

2 to continue providing guidance to ensure that IMT can meet the telecommunication needs of developing countries;

3 to develop a Recommendation to address methods for the determination of the protection area around a non-GSO earth station in the frequency band 6 700-7 075 MHz from an IMT base station;

4 to update existing ITU-R Recommendations/Reports or develop new ITU-R Recommendations/Reports, as appropriate, to provide information and assistance to the administrations concerned on possible coordination of stations in the fixed service with IMT stations in the frequency band 6 425-7 125 MHz;

5 to regularly review, as appropriate, the impact of evolving technical and operational characteristics of IMT systems (including base-station density) on sharing and compatibility with space services, and to take into account the results of these reviews in the development and/or revision of ITU-R Recommendations/Reports addressing, *inter alia*, if necessary, applicable measures to mitigate the risk of interference into space services;

6 to develop an ITU-R Recommendation to address methods for the determination of the protection area around existing RAS stations from IMT stations in the frequency band 6 650-6 675.2 MHz;

7 to update existing ITU-R Recommendations/Reports or develop new ITU-R Recommendations/Reports, as appropriate, to provide information and assistance to the administrations concerned on possible coordination of SRS (deep space) stations operating in the band 7 145-7 190 MHz with IMT stations operating in the frequency band 6 425-7 125 MHz,

instructs the Director of the Radiocommunication Bureau

to bring this Resolution to the attention of relevant international organizations.

ANNEX TO RESOLUTION 220 (WRC-23)

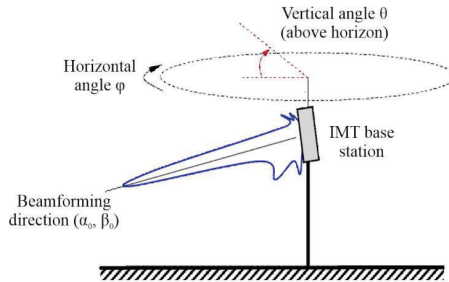
Details for the calculation of the expected equivalent isotropically radiated power of an International Mobile Telecommunications base station operating within the frequency band 6 425-7 125 MHz

This annex outlines the theoretical calculation of the expected equivalent isotropically radiated power (e.i.r.p.) of an International Mobile Telecommunications (IMT) base station for assessing the compliance of IMT base station equipment with the limit on expected e.i.r.p.

The e.i.r.p. of an IMT base station in the horizontal (azimuth) direction $-\pi \leq \varphi \leq \pi$ and vertical (elevation) direction $0 \leq \theta \leq \pi/2$ above the horizon can be written as $P(\theta, \varphi; \alpha, \beta)$. The parameters α and β are the horizontal and vertical beamforming directions, i.e. the angles towards which the base station electronically steers a beam. These are illustrated in Figure 1 below.

FIGURE 1

Illustration of horizontal (azimuth) angle, vertical (elevation) angle and beamforming directions



The expected e.i.r.p. $\bar{P}_{\theta_L \theta_H}$ of an IMT base station within a vertical angle range $\theta_L \leq \theta < \theta_H$ can be calculated by averaging the e.i.r.p. $P(\theta, \varphi; \alpha, \beta)$ of the base station as follows:

- 1) **Averaging over beamforming directions for a given vertical angle θ_0 and horizontal angle φ_0 : for an AAS base station within a given horizontal and vertical steering range**, a sufficient sampling of N beamforming directions (α_n, β_n) $n = 1 \dots N$ is necessary to allow an accurate averaging of the expected e.i.r.p.

The beamforming directions (α_n, β_n) have a uniform statistical angular distribution within the steering range of the IMT base station. In other words:

$$P_1(\theta_0, \varphi_0) = \sum_{n=1}^N w_n P(\theta_0, \varphi_0; \alpha_n, \beta_n)$$

where w_n refers to the weight for the n^{th} beamforming direction, i.e. the fraction of the steering range represented by the n^{th} beamforming direction. For example, $w_n = 1/N$ in the case that N uniform equispaced beams are assumed in the azimuth and elevation, respectively, and where each beam covers an equal range of angles.

The set of base station configurations over which the base station complies with the limits on expected e.i.r.p. (for example, power of steering range as one of the parameters) shall be declared and the BS shall be used within one of these configurations.

The set of e.i.r.p. values used to calculate the expected e.i.r.p. for each vertical angle range shall be a mathematical summation of both polarization states of the IMT base station antenna with no polarization discrimination.

For a non-AAS base station, $P_1(\theta_0, \varphi_0) = P(\theta_0, \varphi_0; \alpha_1, \beta_1)$ where $\alpha_1 = 0$ and β_1 is the electrical tilt.

It is noted that the compliance with the limits on expected e.i.r.p. should be limited to a defined range of electrical tilts.

- 2) **Averaging over horizontal and vertical angles:** the expected e.i.r.p. is then calculated by averaging the results of step 1 over horizontal angles φ from $-\pi$ to $+\pi$ with respect to the base station horizontal boresight, and vertical angles θ within vertical angle range $\theta_L \leq \theta < \theta_H$ with respect to the horizon. In other words:

$$\bar{P}_{\theta_L \theta_H} = \frac{1}{2\pi(\sin \theta_H - \sin \theta_L)} \int_{\theta_L}^{\theta_H} \int_{-\pi}^{\pi} P_1(\theta, \varphi) \cos(\theta) d\varphi d\theta$$

The averaging processes in steps 1 and 2 shall allow for accurate averaging of the expected e.i.r.p. (e.g. to the confidence interval of 95%).

RESOLUTION 221 (REV.WRC-23)

**Use of high altitude platform stations as International Mobile
Telecommunications base stations in the frequency bands 1 710-1 980 MHz,
2 010-2 025 MHz and 2 110-2 170 MHz¹**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that there is growing demand for access to mobile broadband, requiring more flexibility in approaches to expanding the capacity and coverage provided by International Mobile Telecommunications (IMT) systems;
- b)* that high-altitude platform stations (HAPS) as IMT base stations (HIBS) would be used as part of terrestrial IMT networks and may use the same frequency bands as ground-based IMT base stations in order to provide mobile-broadband connectivity to underserved communities, and in rural and remote areas;
- c)* that HIBS would offer a new means of providing IMT services with minimal network infrastructure as they are capable of providing service to a large footprint together with a dense coverage;
- d)* that the use of HIBS is optional for administrations, and that such use should not have any priority over other terrestrial IMT use;
- e)* that the mobile station to be served, whether by HIBS or ground-based IMT base stations, is the same, and currently supports a variety of the frequency bands identified for IMT;
- f)* that, under certain deployment scenarios, platform transmissions in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz may occur at altitudes down to 18 km, and some sensitivity studies have shown that the difference of interference at this altitude would be negligible;
- g)* that the ITU Radiocommunication Sector (ITU-R) has addressed sharing and compatibility between HIBS and existing systems of primary allocated services in the frequency bands 1 710-2 025 MHz and 2 110-2 200 MHz and services in the adjacent bands;

¹ HIBS: High-altitude platform station as IMT base station. The conditions in this Resolution refer to these platforms operating between 18 km and 25 km.

h) that the conclusion of the compatibility studies between HIBS operating above 1 710 MHz and meteorological-satellite service (MetSat) operations in the adjacent frequency band 1 670-1 710 MHz has assumed that the use of HIBS in the frequency band 1 710-1 785 MHz is limited to reception by HIBS;

i) that the conclusion of the compatibility studies between HIBS operating above 2 110 MHz and space research service (SRS)/space operation service/Earth exploration-satellite service operations in the adjacent frequency band 2 025-2 110 MHz and the conclusion of the sharing studies between HIBS and SRS in the frequency band 2 110-2 120 MHz have both assumed that the use of HIBS in the frequency band 2 110-2 170 MHz is limited to transmission from HIBS,

recognizing

a) that a HAPS is defined in No. **1.66A** as a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth;

b) that, in Regions 1 and 3, the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz and, in Region 2, the frequency bands 1 710-1 980 MHz and 2 110-2 160 MHz are included in No. **5.388A** for the use of HIBS;

c) that the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, or parts thereof, are identified for IMT in accordance with Nos. **5.384A** and **5.388**;

d) that these frequency bands are allocated to the fixed and mobile services on a co-primary basis,

resolves

1 that administrations wishing to implement HIBS shall comply with the following:

1.1 for the purpose of protecting the mobile service, including IMT terrestrial systems, in the territory of neighbouring administrations in the frequency band 1 710-1 885 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the following limits on power flux-density (pfd) shall apply:

– the pfd level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit for the protection of IMT mobile stations, unless explicit agreement of the affected administration is provided:

$$-111 \qquad \text{dB(W/(m}^2 \cdot \text{MHz))} \qquad \text{for} \qquad 0^\circ < \theta \leq 90^\circ$$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

- the pfd level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit for the protection of IMT base stations, unless explicit agreement of the affected administration is provided:

–144.55	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$0^\circ \leq \theta < 11^\circ$
$-144.55 + 0.45 (\theta - 11)$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$11^\circ \leq \theta < 80^\circ$
–113.55	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$80^\circ \leq \theta \leq 90^\circ$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees².

1.2 for the purpose of protecting mobile service systems including IMT terrestrial systems in the territories of Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Mongolia, Uzbekistan, Kyrgyzstan, the Democratic People's Republic of Korea, Tajikistan and Turkmenistan, in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the pfd level per HIBS produced at the surface of the Earth in the territories of the countries listed above in this *resolves* shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

–145	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$0^\circ \leq \theta < 11^\circ$
$-145 + 0.4347 (\theta - 11)$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$11^\circ \leq \theta < 80^\circ$
–115	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$80^\circ \leq \theta < 90^\circ$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.3 for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the pfd level per HIBS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

–150	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$0^\circ < \theta \leq 2^\circ$
$-150 + 1.78 (\theta - 2)$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$2^\circ < \theta \leq 20^\circ$
$-118 + 0.215 (\theta - 20)$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$20^\circ < \theta \leq 48^\circ$
–112	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$48^\circ < \theta \leq 90^\circ$

² The pfd levels to protect IMT base stations will apply unless the affected administration informs the Radiocommunication Bureau that only terminal stations need to be protected.

1.4 for the purpose of protecting fixed-service systems in the territories of Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Mongolia, Uzbekistan, Kyrgyzstan, the Democratic People's Republic of Korea, Tajikistan and Turkmenistan in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, the pfd level per HIBS produced at the surface of the Earth in the territories of the countries listed above in this *resolves* shall not exceed the following limits, unless explicit agreement of the affected administration is provided:

–165	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$0^\circ < \theta \leq 5^\circ$
$-165 + 1.75 (\theta - 5)$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$5^\circ < \theta \leq 25^\circ$
–130	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$25^\circ < \theta \leq 90^\circ$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.5 in order to protect fixed-service systems in Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Mongolia, Uzbekistan, Kyrgyzstan, Tajikistan and Turkmenistan from interference, a HIBS shall not exceed the following limits on out-of-band pfd at the surface of the Earth in the territories of the countries listed above in this *resolves* in the frequency band 2 025-2 110 MHz:

–165	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$0^\circ < \theta \leq 5^\circ$
$-165 + 1.75 (\theta - 5)$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$5^\circ < \theta \leq 25^\circ$
–130	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$25^\circ < \theta \leq 90^\circ$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees;

1.6 for the purpose of protecting mobile earth stations operating in the territory of other administrations in the frequency bands 2 160-2 200 MHz in Region 2 and 2 170-2 200 MHz in Regions 1 and 3, the pfd of the unwanted emissions per HIBS operating in the frequency bands 2 110-2 160 MHz in Region 2 and 2 110-2 170 MHz in Regions 1 and 3 produced at the surface of the Earth in the territory of other administrations shall not exceed the following limit:

–165	$\text{dB(W/(m}^2 \cdot 4 \text{ kHz))};$

1.7 for the protection of aeronautical mobile service systems operating in the frequency band 1 780-1 850 MHz from harmful interference, administrations planning to implement HIBS operating within 1 135 km of the border of the territory of other administrations in this frequency band shall obtain agreement with all affected administrations prior to implementation of HIBS unless otherwise agreed between the administrations concerned; this condition does not apply in the countries within the African Broadcasting Area, as described in Nos. **5.10**, **5.11**, **5.12** and **5.13**, and Algeria, Egypt, Libya and Morocco in Region 1;

2 that administrations intending to implement HIBS systems shall notify, in accordance with Article **11**, the frequency assignments to transmitting and receiving HIBS stations by submitting all mandatory elements of Appendix **4** to the Radiocommunication Bureau for the examination of compliance with the conditions specified in the *resolves* above;

3 the notifying administration of HIBS at the time of submission of the Appendix 4 information shall provide a firm, objective, actionable, measurable, and enforceable commitment to the Bureau to immediately eliminate unacceptable interference to existing primary services or reduce it to an acceptable level should such interference occur,

invites administrations

to adopt appropriate frequency arrangements for HIBS in order to consider the benefits of harmonized utilization of the spectrum for HIBS and protection of existing services and systems operating on a primary basis taking into account the *resolves* above and the relevant ITU-R Recommendations and Reports,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

RESOLUTION 222 (REV.WRC-23)

**Use of the frequency bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz
by the mobile-satellite service, and procedures to ensure long-term
spectrum access for the aeronautical mobile-satellite (R) service**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that prior to WRC-97, the frequency bands 1 530-1 544 MHz (space-to-Earth) and 1 626.5-1 645.5 MHz (Earth-to-space) were allocated to the maritime mobile-satellite service and the frequency bands 1 545-1 555 MHz (space-to-Earth) and 1 646.5-1 656.5 MHz (Earth-to-space) were allocated on an exclusive basis to the aeronautical mobile-satellite (R) service (AMS(R)S) in most countries;
- b)* that WRC-97 allocated the frequency bands 1 525-1 559 MHz (space-to-Earth) and 1 626.5-1 660.5 MHz (Earth-to-space) to the mobile-satellite service (MSS) to facilitate the assignment of spectrum to multiple MSS systems in a flexible and efficient manner;
- c)* that WRC-97 adopted No. **5.353A** giving priority to accommodating spectrum requirements for, and protecting from unacceptable interference, distress, urgency and safety communications of the global maritime distress and safety system (GMDSS) in the frequency bands 1 530-1 544 MHz and 1 626.5-1 645.5 MHz and No. **5.357A** giving priority to accommodating spectrum requirements for, and protecting from unacceptable interference, AMS(R)S communications as defined within priority categories 1 to 6 in Article **44** for the frequency bands 1 545-1 555 MHz and 1 646.5-1 656.5 MHz;
- d)* that AMS(R)S systems are an essential element of the International Civil Aviation Organization (ICAO) standardized communication infrastructure used in air traffic management for the provision of safety and regularity of flight in civil aviation;
- e)* that currently some MSS systems provide distress, emergency and safety communications under the MSS allocations in the frequency bands 1 525-1 559 MHz (space-to-Earth) and 1 626.5-1 660.5 MHz (Earth-to-space);
- f)* that it is necessary to ensure the long-term availability of the spectrum for AMS(R)S;
- g)* that it is necessary to retain unchanged the generic allocation for the MSS in the frequency bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz without placing undue constraints on the existing systems operating in accordance with the Radio Regulations,

further considering

- a) that frequency coordination between satellite networks is required on a bilateral basis in accordance with the Radio Regulations, and that, in the frequency bands 1 525-1 559 MHz (space-to-Earth) and 1 626.5-1 660.5 MHz (Earth-to-space), frequency coordination is partially assisted by regional multilateral meetings;
- b) that, in these frequency bands, geostationary mobile-satellite system operators currently use a capacity-planning approach at frequency coordination meetings, with the guidance and support of their administrations, to periodically coordinate access to the spectrum needed to accommodate their requirements;
- c) that spectrum requirements for MSS networks, including the GMDSS and AMS(R)S, are currently accommodated through the capacity-planning approach and that, in the frequency bands to which Nos. **5.353A** or **5.357A** apply, this approach, supplemented, in the case of AMS(R)S, by additional procedures contained in the Annex to this Resolution, may assist in accommodating the long-term spectrum requirements for GMDSS and AMS(R)S;
- d) that Report ITU-R M.2073 has concluded that prioritization and inter-system pre-emption between different mobile-satellite systems is not practical and, without a significant advance in technology, is unlikely to be feasible for technical, operational and economic reasons;
- e) that there is existing and increasing demand for spectrum for AMS(R)S and non-AMS(R)S by several mobile satellite systems in the frequency bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz, and that the application of this Resolution may impact the provision of services by non-AMS(R)S systems in the MSS;
- f) that according to the ITU-R studies, the long-term AMS(R)S spectrum requirements for communications within priority categories 1 to 6 of Article **44** have been estimated, at the year 2025, to be less than the available 2×10 MHz identified by No. **5.357A**;

- g) that future requirements for GMDSS spectrum may require additional allocations,

recognizing

- a) that Article 40 of the ITU Constitution establishes the priority of telecommunications concerning safety of life;
- b) that ICAO has adopted standards and recommended practices addressing satellite communications with aircraft in accordance with the Convention on International Civil Aviation;
- c) that all air traffic communications as defined in Annex 10 to the Convention on International Civil Aviation fall within priority categories 1 to 6 of Article **44**;
- d) that Table 15-2 of Appendix **15** identifies the frequency bands 1 530-1 544 MHz (space-to-Earth) and 1 626.5-1 645.5 MHz (Earth-to-space) for distress and safety purposes in the maritime mobile-satellite service as well as for routine non-safety purposes;

e) that any administration having difficulty in applying the procedures of Articles 9 and 11 with respect to No. 5.357A and this Resolution may at any time request assistance from the Radiocommunication Bureau and the Board under the relevant provisions of the Radio Regulations, including Article 7, the relevant provisions of Articles 9 and 11, as well as Articles 13 and 14;

f) that ICAO has knowledge of aviation communication requirements,

noting

that, since spectrum resources are limited, there is a need to use them in the most efficient manner within and amongst various MSS systems, including GMDSS and AMS(R)S,

resolves

1 that, in frequency coordination of MSS networks in the frequency bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz, the notifying administrations of mobile-satellite networks shall ensure that the spectrum needed for distress, urgency and safety communications of GMDSS, as elaborated in Articles 32 and 33, in the frequency bands where No. 5.353A applies, and for the AMS(R)S communications within priority categories 1 to 6 of Article 44 in the frequency bands where No. 5.357A applies, is accommodated;

2 that notifying administrations of mobile-satellite networks shall ensure the use of the latest technical advances in their mobile-satellite systems, in order to achieve the most flexible, efficient and practical use of the generic allocations;

3 that the notifying administrations of mobile-satellite networks shall ensure that, in the event that the spectrum requirements of MSS, including AMS(R)S, networks are decreasing relative to the previous frequency coordination meeting, the corresponding unused spectrum resources shall be released to facilitate efficient use of spectrum;

4 that the notifying administrations of mobile-satellite networks shall ensure that MSS operators carrying non-safety-related traffic yield capacity, as and when necessary, to accommodate the spectrum requirements for distress, urgency and safety communication of GMDSS communications, as elaborated in Articles 32 and 33, and for AMS(R)S communications within priority categories 1 to 6 of Article 44; this could be achieved in advance through the coordination process in *resolves* 1, and in the case of AMS(R)S the procedures contained in the Annex to this Resolution shall apply,

invites

1 administrations, if they so desire, to have their AMS(R)S traffic requirements submitted to ICAO before the frequency coordination meeting;

2 ICAO to evaluate and, as appropriate, comment on the AMS(R)S traffic requirements received from individual administrations, on the basis of the known global and regional aviation traffic requirements, including the time-scale of regional and global communication requirements,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO.

ANNEX TO RESOLUTION 222 (REV.WRC-23)

**Procedures to implement No. 5.357A and
Resolution 222 (Rev.WRC-23)**

1 The notifying administrations of planned MSS, including AMS(R)S, networks shall submit to the Radiocommunication Bureau (BR) the required technical characteristics and other relevant information of their MSS networks in accordance with Appendix 4. Coordination of these MSS networks with other affected satellite networks operating in the frequency bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz shall proceed in accordance with Articles 9 and 11 and other relevant provisions of the Radio Regulations, as appropriate.

2 To further facilitate coordination under Articles 9 and 11, the notifying administrations of MSS, including AMS(R)S, networks may authorize their respective MSS satellite operators, including AMS(R)S satellite operators, to enter into bilateral and multilateral coordination processes to obtain operator agreements on access to spectrum for their satellite networks.

3 At frequency coordination meetings, including operator meetings as referred to in 2 above, the notifying administration of each AMS(R)S network claiming priority under No. 5.357A, or its respective satellite operator, shall present the spectrum requirements of each AMS(R)S network translated from their traffic requirements in accordance with an agreed methodology that considers the most recent version of Recommendation ITU-R M.2091 and was developed in response to Resolution 422 (WRC-12), and accompanied with the information justifying such requirements.

The participants to the frequency coordination meeting then collectively validate the requirements.

The notifying administrations or their authorized MSS operators shall accommodate validated AMS(R)S spectrum requirements in accordance with No. 5.357A without placing undue constraints on the existing systems operating in accordance with the Radio Regulations.

4 The notifying administrations of MSS networks, including AMS(R)S, have responsibility to ensure that their respective assignments are compatible in the relevant bilateral or multilateral frequency coordination meetings (in particular when those networks span various geographic area(s)).

5 The notifying administrations shall inform BR about the total amount of spectrum assigned to AMS(R)S systems after each coordination meeting where the total AMS(R)S assignments are affected.

6 If a notifying AMS(R)S administration is of the opinion that its spectrum requirements have not been met in the frequency coordination process as per No. 5.357A, the notifying administration may notify the Director of BR of this and request that a Reassessment Meeting be called.

7 If the Bureau receives an announcement from an administration that their AMS(R)S spectrum requirements have not been met, the Director of the Bureau shall invite the notifying administrations of mobile-satellite networks involved in step 2 for a Reassessment Meeting to be held normally within three months. The Reassessment Meeting shall limit its task to consideration of the application of No. **5.357A** and shall not enter into specific coordination activities for the modification of the assignments to individual operators. The Reassessment Meeting shall be attended by the notifying administrations. These administrations may decide to invite other parties or BR in an advisory role if agreed by all notifying administrations.

8 If the Reassessment Meeting concludes that the AMS(R)S spectrum requirements of the concerned system have not been met, the Reassessment Meeting may call for an additional specific frequency coordination meeting of the notifying administrations of mobile-satellite networks involved in step 2 and their representative MSS operators, which is requested to adapt the coordination agreement, taking due account of the advice of the Reassessment Meeting. This frequency coordination meeting should take place as soon as possible and preferably immediately following the Reassessment Meeting.

9 At the conclusion of the Reassessment Meeting, a report containing information about the issue discussed and the conclusions shall be prepared by the participating notifying administrations and submitted to BR for publication.

10 If the matter remains unresolved at the administrations' frequency coordination meeting referred to in 8 above, the notifying AMS(R)S administration shall seek the assistance of the Radiocommunication Bureau pursuant to Articles **7** and **13** and notify the respective administrations indicating that its AMS(R)S requirements have not been satisfied. The Radiocommunication Bureau shall provide a report and assistance in accordance with No. **13.3**.

11 If the matter remains unresolved after the Bureau has communicated its conclusions to the notifying AMS(R)S administration involved, the notifying AMS(R)S administration may request review of the decision of the Bureau in accordance with Article **14**.

RESOLUTION 223 (REV.WRC-23)

Additional frequency bands identified for International Mobile Telecommunications

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that International Mobile Telecommunications (IMT), including IMT-2000, IMT-Advanced and IMT-2020, is the ITU vision of global mobile access;
- b)* that IMT systems provide telecommunication services on a worldwide scale regardless of location, network or terminal used;
- c)* that IMT provides access to a wide range of telecommunication services supported by fixed telecommunication networks (e.g. public switched telephone network (PSTN)/integrated services digital network (ISDN), high bit rate Internet access), and to other services which are specific to mobile users;
- d)* that the technical characteristics of IMT are specified in ITU Radiocommunication Sector (ITU-R) and ITU Telecommunication Standardization Sector (ITU-T) Recommendations, including Recommendations ITU-R M.1457 and ITU-R M.2012, which contain the detailed specifications of the terrestrial radio interfaces of IMT;
- e)* that the evolution of IMT is being studied within ITU-R;
- f)* that the review of IMT-2000 spectrum requirements at WRC-2000 concentrated on the frequency bands below 3 GHz;
- g)* that at WARC-92, 230 MHz of spectrum was identified for IMT-2000 in the frequency bands 1 885-2 025 MHz and 2 110-2 200 MHz, including the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz for the satellite component of IMT-2000, in No. **5.388** and under the provisions of Resolution **212 (Rev.WRC-23)**;
- h)* that since WARC-92 there has been a tremendous growth in mobile communications including an increasing demand for broadband multimedia capability;
- i)* that the frequency bands identified for IMT are currently used by mobile systems or applications of other radiocommunication services;
- j)* that Recommendation ITU-R M.1308 addresses the evolution of existing mobile communication systems to IMT-2000, and that Recommendation ITU-R M.1645 addresses the evolution of the IMT systems and maps out their future development;
- k)* that harmonized worldwide frequency bands for IMT are desirable in order to achieve global roaming and the benefits of economies of scale;

- l)* that the frequency bands 1 710-1 885 MHz, 2 500-2 690 MHz and 3 300-3 400 MHz are allocated to a variety of services in accordance with the relevant provisions of the Radio Regulations;
- m)* that the frequency band 2 300-2 400 MHz is allocated to the mobile service on a co-primary basis in the three ITU Regions;
- n)* that the frequency band 2 300-2 400 MHz, or portions thereof, is used extensively in a number of administrations by other services including the aeronautical mobile service (AMS) for telemetry in accordance with the relevant provisions in the Radio Regulations;
- o)* that IMT has already been deployed or is being considered for deployment in some countries in the frequency bands 1 710-1 885 MHz, 2 300-2 400 MHz and 2 500-2 690 MHz and equipment is readily available;
- p)* that the frequency bands 1 710-1 885 MHz, 2 300-2 400 MHz and 2 500-2 690 MHz, or parts thereof, are identified for use by administrations wishing to implement IMT;
- q)* that technological advancement and user needs will promote innovation and accelerate the delivery of advanced communication applications to consumers;
- r)* that changes in technology may lead to the further development of communication applications, including IMT;
- s)* that timely availability of spectrum is important to support future applications;
- t)* that IMT systems are envisaged to provide increased peak data rates and capacity that may require a larger bandwidth;
- u)* that ITU-R studies forecasted that additional spectrum may be required to support the future services of IMT and to accommodate future user requirements and network deployments;
- v)* that the frequency band 1 427-1 429 MHz is allocated to the mobile, except aeronautical mobile, service in all three Regions on a primary basis;
- w)* that the frequency band 1 429-1 525 MHz is allocated to the mobile service in Regions 2 and 3 and to the mobile, except aeronautical mobile, service in Region 1 on a primary basis;
- x)* that the frequency band 1 518-1 559 MHz is allocated in all three Regions to the mobile-satellite service (MSS) on a primary basis¹;
- y)* that WRC-15 identified the frequency band 1 427-1 518 MHz for use by administrations wishing to implement terrestrial IMT systems;
- z)* that there is a need to ensure the continued operations of the MSS in the frequency band 1 518-1 525 MHz;

¹ See Table 21-4 for applicable pfd limits.

aa) that appropriate technical measures to facilitate adjacent frequency band compatibility between the MSS in the frequency band 1 518-1 525 MHz and IMT in the frequency band 1 492-1 518 MHz need to be studied;

ab) Report ITU-R RA.2332, on compatibility and sharing studies between the radio astronomy service and IMT systems in the frequency bands 608-614 MHz, 1 330-1 400 MHz, 1 400-1 427 MHz, 1 610.6-1 613.8 MHz, 1 660-1 670 MHz, 2 690-2 700 MHz, 4 800-4 990 MHz and 4 990-5 000 MHz;

ac) that WRC-15, WRC-19 and this conference have identified the frequency band 3 300-3 400 MHz for use by administrations wishing to implement terrestrial IMT systems in Nos. **5.429B**, **5.429D** and **5.429F**;

ad) that the frequency band 3 100-3 400 MHz is allocated worldwide on a primary basis to the radiolocation service;

ae) that a number of administrations use the frequency band 3 300-3 400 MHz, or portions thereof, which is allocated to the fixed and mobile services on a primary basis in No. **5.429**;

af) that the frequency band 4 800-4 990 MHz is allocated worldwide to the mobile and fixed services on a primary basis;

ag) that the frequency band 4 800-4 990 MHz is identified for use by administrations wishing to implement terrestrial IMT systems in countries listed in Nos. **5.441A** and **5.441B**;

ah) that appropriate technical measures may be considered by administrations at a national level to facilitate adjacent frequency band compatibility between radio astronomy receivers in the frequency band 4 990-5 000 MHz and IMT systems in the frequency band 4 800-4 990 MHz;

ai) that Report ITU-R M.2481 addresses in-band and adjacent-band coexistence and compatibility studies between IMT systems in the frequency band 3 300-3 400 MHz and radiolocation systems in the frequency band 3 100-3 400 MHz, and that further studies were carried out in preparation for this conference;

aj) that the development of new ITU-R Recommendations and/or Reports could provide guidance to support administrations planning to implement IMT, to ensure co-existence with the radiolocation service operating in neighbouring countries in the frequency band 3 300-3 400 MHz,

emphasizing

a) that flexibility must be afforded to administrations:

- to determine, at a national level, how much spectrum to make available for IMT from within the identified frequency bands;
- to develop their own transition plans, if necessary, tailored to meet their specific deployment of existing systems;
- to have the ability for the identified frequency bands to be used by all services having allocations in those frequency bands;

- to determine the timing of availability and use of the frequency bands identified for IMT, in order to meet particular user demand and other national considerations;
- b) that the particular needs of developing countries must be met;
- c) that Recommendation ITU-R M.819 describes the objectives to be met by IMT-2000 in order to meet the needs of developing countries,

noting

- a) Resolutions **224 (Rev.WRC-23)** and **225 (Rev.WRC-23)**, which also relate to IMT;
- b) that the sharing implications between services sharing the frequency bands identified for IMT in No. **5.384A**, as relevant, will need further study in ITU-R;
- c) that studies regarding the availability of the frequency band 2 300-2 400 MHz for IMT are being conducted in many countries, the results of which could have implications for the use of those frequency bands in those countries;
- d) that, due to differing requirements, not all administrations may need all of the IMT frequency bands identified at WRC-07, or, due to the usage by and investment in existing services, may not be able to implement IMT in all of those frequency bands;
- e) that the spectrum for IMT identified by WRC-07 may not completely satisfy the expected requirements of some administrations;
- f) that currently operating mobile communication systems may evolve to IMT in their existing frequency bands;
- g) that services such as the fixed service, the mobile service (second-generation systems), the space operation service, the space research service and the AMS are in operation or planned in the frequency band 1 710-1 885 MHz, or portions thereof;
- h) that in the frequency band 2 300-2 400 MHz, or portions thereof, there are services such as the fixed, mobile, amateur and radiolocation services which are currently in operation or planned to be in operation in the future;
- i) that services such as the broadcasting-satellite service (BSS), the BSS (sound), the MSS (in Region 3) and the fixed service (including multipoint distribution/communication systems) are in operation or planned in the frequency band 2 500-2 690 MHz, or portions thereof;
- j) that the identification of several frequency bands for IMT allows administrations to choose the best frequency band or parts thereof for their circumstances;

- k)* that further study of the technical and operational measures regarding adjacent frequency band compatibility between IMT systems operating below 3 400 MHz and fixed-satellite service earth stations operating above 3 400 MHz may be required;
- l)* that ITU-R has identified additional work to address further developments in IMT;
- m)* that the IMT terrestrial radio interfaces as defined in Recommendations ITU-R M.1457 and ITU-R M.2012 are expected to evolve within the framework of ITU-R beyond those initially specified, in order to provide enhanced services and services beyond those envisaged in the initial implementation;
- n)* that the identification of a frequency band for IMT does not establish priority in the Radio Regulations and does not preclude the use of the frequency band for any application of the services to which it is allocated;
- o)* that the provisions of Nos. **5.317A**, **5.384A**, **5.388**, **5.429B**, **5.429D**, **5.429F**, **5.441A** and **5.441B** do not prevent administrations from having the choice to implement other technologies in the frequency bands identified for IMT, based on national requirements,

recognizing

that, for some administrations, the only way of implementing IMT would be spectrum refarming, requiring significant financial investment,

resolves

- 1 to invite administrations planning to implement IMT to make available, based on user demand and other national considerations, additional frequency bands or portions of the frequency bands above 1 GHz identified in Nos. **5.341B**, **5.384A**, **5.429B**, **5.429D**, **5.429F**, **5.441A** and **5.441B** for the terrestrial component of IMT; due consideration should be given to the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT, taking into account the services to which the frequency band is currently allocated;
- 2 to acknowledge that the differences in the texts of Nos. **5.341B**, **5.384A** and **5.388** do not confer differences in regulatory status;
- 3 that, in the frequency bands 4 800-4 825 MHz and 4 835-4 950 MHz, in order to identify potentially affected administrations when applying the procedure for seeking agreement under No. **9.21** for IMT stations in relation to aircraft stations, a coordination distance from an IMT station to the border of another country equal to 300 km (for land path)/450 km (for sea path) applies;
- 4 that in the frequency band 4 800-4 990 MHz, in order to identify potentially affected administrations when applying the procedure for seeking agreement under No. **9.21** for IMT stations in relation to fixed-service stations or other ground-based stations of the mobile service, a coordination distance from an IMT station to the border of another country equal to 70 km applies;

5 that the power flux-density (pfd) limits in No. **5.441B** shall not apply to the following countries: Armenia, Brazil, Cambodia, China, Russian Federation, Kazakhstan, Lao P.D.R., Uzbekistan, South Africa, Viet Nam and Zimbabwe,

invites the ITU Radiocommunication Sector

1 to continue providing guidance to ensure that IMT can meet the telecommunication needs of developing countries and rural areas;

2 to continue providing guidance to administrations planning to facilitate the implementation of IMT in the frequency band 3 300-3 400 MHz, taking into account *considering aj*;

3 to include the results of the studies mentioned in *invites the ITU Radiocommunication Sector* above in one or more ITU-R Recommendations and Reports, as appropriate.

RESOLUTION 224 (REV.WRC-23)

**Frequency bands for the terrestrial component of International
Mobile Telecommunications below 1 GHz**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that International Mobile Telecommunications (IMT) is the root name that encompasses IMT-2000, IMT-Advanced and IMT-2020 collectively (see Resolution ITU-R 56);
- b)* that IMT systems are intended to provide telecommunication services on a worldwide scale, regardless of location, network or terminal used;
- c)* that parts of the frequency band 790-960 MHz are extensively used in the three Regions by mobile systems;
- d)* that IMT systems have already been deployed in the frequency band 694/698-960 MHz in some countries of the three Regions;
- e)* that some administrations of Regions 2 and 3 are planning to use the frequency band 470-694/698 MHz, or part of that frequency band, for IMT;
- f)* that the frequency band 450-470 MHz is allocated to the mobile service on a primary basis in the three Regions and that IMT systems have already been deployed in some countries of the three Regions;
- g)* that results of the sharing studies for the frequency band 450-470 MHz are contained in Report ITU-R M.2110;
- h)* that cellular-mobile systems in the three Regions in the frequency bands below 1 GHz operate using various frequency arrangements;
- i)* that, where cost considerations warrant the installation of fewer base stations, such as in rural and/or sparsely populated areas, frequency bands below 1 GHz are generally suitable for implementing mobile systems, including IMT;
- j)* that frequency bands below 1 GHz are important, especially for some developing countries and countries with large areas where economic solutions for low population density areas are necessary;
- k)* that Recommendation ITU-R M.819 describes the objectives to be met by IMT-2000 in order to meet the needs of developing countries, and in order to assist them to “bridge the gap” between their communication capabilities and those of developed countries;
- l)* that Recommendation ITU-R M.1645 also describes the coverage objectives of IMT,

recognizing

- a) that the evolution of cellular-based mobile networks to IMT can be facilitated if they are permitted to evolve within their current frequency bands;
- b) that some of the frequency bands or parts of the frequency bands identified for IMT below 1 GHz are used extensively in many countries by various other terrestrial mobile systems and applications, including public protection and disaster relief radiocommunications (see Resolution **646 (Rev.WRC-19)**);
- c) that there is a need, in many developing countries and countries with large areas of low population density, for the cost-effective implementation of IMT, and that the propagation characteristics of frequency bands below 1 GHz identified in Nos. **5.286AA**, **5.295**, **5.308A** and **5.317A** result in larger cells;
- d) that the frequency band 450-470 MHz, or parts thereof, is also allocated to services other than the mobile service;
- e) that the frequency band 460-470 MHz is also allocated to the meteorological-satellite service in accordance with No. **5.290**;
- f) that the frequency band 470-890 MHz, except the frequency band 608-614 MHz in Region 2, is allocated to the broadcasting service on a primary basis in all three Regions as contained in Article 5 of the Radio Regulations, and parts of this frequency band are used predominantly by this service;
- g) that, in the frequency band 470-862 MHz, the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in the Islamic Republic of Iran, and that this Agreement contains provisions for the terrestrial broadcasting service and other primary terrestrial services, a Plan for digital television, and a list of stations of other primary terrestrial services;
- h) that the transition from analogue to digital television is expected to result in situations where the frequency band 470-806/862 MHz will be used extensively for both analogue and digital terrestrial transmission, and the demand for spectrum during the transition period may be even greater than the standalone usage of analogue broadcasting systems;
- i) that the time-frame and transition period for analogue to digital television switchover may not be the same for all countries;
- j) that, after analogue to digital television switchover, some administrations may decide to use all or parts of the frequency band 470-806/862 MHz for other services to which the frequency band is allocated on a primary basis, in particular the mobile service for the implementation of IMT, while in other countries the broadcasting service will continue to operate in that frequency band;
- k) that in the frequency band 470-890 MHz, or parts thereof, there is an allocation on a primary basis for the fixed service;

l) that, in some countries, the frequency band 470-862 MHz, or parts thereof, for Regions 2 and 3 and the frequency band 694-862 MHz in Region 1 are allocated to the mobile service on a primary basis;

m) that the frequency band 645-862 MHz is allocated on a primary basis to the aeronautical radionavigation service in the countries listed in No. 5.312;

n) that Recommendation ITU-R M.1036 provides frequency arrangements for implementation of the terrestrial component of IMT in the frequency bands identified for IMT in the Radio Regulations;

o) that Reports ITU-R M.2241, ITU-R BT.2215, ITU-R BT.2247, ITU-R BT.2248, ITU-R BT.2265, ITU-R BT.2301, ITU-R BT.2337 and ITU-R BT.2339 contain material relevant to compatibility studies between IMT and other services;

p) that Report ITU-R BT.2338 describes the implications of a co-primary allocation to the mobile service in the frequency band 694-790 MHz in Region 1 for the use of that frequency band by applications ancillary to broadcasting and programme-making,

emphasizing

a) that in all administrations terrestrial broadcasting is a vital part of the communication and information infrastructure;

b) that flexibility must be afforded to administrations:

- to determine, at a national level, how much spectrum to make available for IMT from within the identified frequency bands, taking into account current uses of the spectrum and the needs of other applications;
- to develop their own transition plans, if necessary, tailored to meet their specific deployment of existing systems;
- to have the ability for the identified frequency bands to be used by all services having allocations in those frequency bands;
- to determine the timing of availability and use of the frequency bands identified for IMT, in order to meet particular market demand and other national considerations;

c) that the particular needs and national conditions and circumstances of developing countries, including least-developed countries, highly-indebted poor countries with economies in transition, and countries with large territories and territories with a low subscriber density, must be met;

d) that due consideration should be given to the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT, taking into account the current and planned use of these frequency bands by all services to which these frequency bands are allocated;

e) that the use of frequency bands below 1 GHz for IMT also helps to “bridge the gap” between sparsely-populated areas and densely-populated areas in various countries;

- f) that the identification of a frequency band for IMT does not preclude the use of this frequency band by other services or applications to which it is allocated;
- g) that the use of the frequency band 470-862 MHz by the broadcasting service and other primary services is also covered by the GE06 Agreement;
- h) that the requirements of the different services to which the frequency band is allocated, including the mobile and broadcasting services, need to be taken into account,

resolves

- 1 that administrations which are implementing or planning to implement IMT consider the use of frequency bands identified for IMT below 1 GHz and the possibility of cellular-based mobile network evolution to IMT, in the frequency band identified in Nos. **5.286AA**, **5.317A**, and in some countries of Regions 2 and 3, the frequency band(s) identified in Nos. **5.295**, **5.296A** and **5.308A**, and in some countries of Region 1 in the frequency band identified in No. **5.307A**, based on user demand and other considerations;
- 2 to encourage administrations to take into account results of the existing relevant ITU Radiocommunication Sector studies, when implementing IMT applications/systems in the frequency bands 694-862 MHz in Region 1, in the frequency band 470-806 MHz in Region 2, in the frequency band 790-862 MHz in Region 3, in the frequency band 470-698 MHz, or portions thereof, for those administrations mentioned in No. **5.296A**, in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**, and in the frequency band 614-694 MHz, for those administrations mentioned in No. **5.307A**;
- 3 that administrations should take into account the need to protect existing and future broadcasting stations, both analogue and digital, except analogue in the GE06 planning area, in the frequency band 470-806/862 MHz, as well as other primary terrestrial services;
- 4 that administrations planning to implement IMT in the frequency bands mentioned in *resolves 2* shall effect coordination, as required, with all neighbouring administrations prior to implementation;
- 5 that in Region 1 (excluding Mongolia) and in the Islamic Republic of Iran, the implementation of stations in the mobile service shall be subject to the applications of procedures contained in the GE06 Agreement; in so doing:
 - a) administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not cause unacceptable interference to, nor claim protection from, stations of the broadcasting service of administrations operating in conformity with the GE06 Agreement; this should include a signed commitment as required under § 5.2.6 of the GE06 Agreement;

b) administrations which deploy stations in the mobile service for which coordination was not required, or without having obtained the prior consent of those administrations that may be affected, shall not object to nor prevent the entry into the GE06 plan or recording in the MIFR of additional future broadcasting allotments or assignments of any other administration in the GE06 Plan with reference to those stations;

6 that, in Region 2, implementation of IMT shall be subject to the decision of each administration on the transition from analogue to digital television,

invites the Director of the Telecommunication Development Bureau

to draw the attention of the ITU Telecommunication Development Sector to this Resolution.

RESOLUTION 225 (REV.WRC-23)

Use of additional frequency bands for the satellite component of IMT

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz are identified for use by the satellite component of International Mobile Telecommunications (IMT) through No. **5.388** and Resolution **212 (Rev.WRC-23)**;

b) Resolutions **212 (Rev.WRC-23)**, **223 (Rev.WRC-23)** and **224 (Rev.WRC-23)** on the implementation of the terrestrial and satellite components of IMT;

c) that the bands 1 518-1 544 MHz, 1 545-1 559 MHz, 1 610-1 626.5 MHz, 1 626.5-1 645.5 MHz, 1 646.5-1 660.5 MHz, 1 668-1 675 MHz and 2 483.5-2 500 MHz are allocated on a co-primary basis to the mobile-satellite service and other services in accordance with the Radio Regulations;

d) that, in Region 3, the bands 2 500-2 520 MHz and 2 670-2 690 MHz are allocated on a co-primary basis to the mobile-satellite service and other services in accordance with the Radio Regulations;

e) that distress, urgency and safety communications of the Global Maritime Distress and Safety System and the aeronautical mobile-satellite (R) service have priority over all other mobile-satellite service communications in accordance with Nos. **5.353A** and **5.357A**,

recognizing

a) that services such as broadcasting-satellite, broadcasting-satellite (sound), mobile-satellite, fixed (including point-to-multipoint distribution/communication systems) and mobile are in operation or planned in the band 2 500-2 690 MHz, or in portions of that band;

b) that other services such as the mobile service, the radio astronomy service and radiodetermination-satellite service are in operation or planned, in accordance with the Table of Frequency Allocations, in the bands 1 518-1 559/1 626.5-1 660.5 MHz, 1 610-1 626.5/2 483.5-2 500 MHz and 1 668-1 670 MHz, or in portions of those bands, and that those bands, or portions thereof, are intensively used in some countries by applications other than the IMT satellite component, and the sharing studies within ITU-R are not finished;

c) that studies of potential sharing and coordination between the satellite component of IMT and the terrestrial component of IMT, mobile-satellite service applications and other high-density applications in other services such as point-to-multipoint communication/distribution systems in the bands 2 500-2 520 MHz and 2 670-2 690 MHz are not finished;

d) that the bands 2 520-2 535 MHz and 2 655-2 670 MHz are allocated to the mobile-satellite, except aeronautical mobile-satellite, service for operation limited to within national boundaries pursuant to Nos. **5.403** and **5.420**;

e) Resolution ITU-R 47 on studies under way on satellite radio transmission technologies for IMT,

resolves

1 that, in addition to the frequency bands indicated in *considering a)* and *resolves 2*, the frequency bands 1 518-1 544 MHz, 1 545-1 559 MHz, 1 610-1 626.5 MHz, 1 626.5-1 645.5 MHz, 1 646.5-1 660.5 MHz, 1 668-1 675 MHz and 2 483.5-2 500 MHz may be used by administrations wishing to implement the satellite component of IMT, subject to the regulatory provisions related to the mobile-satellite service in these frequency bands;

2 that the bands 2 500-2 520 MHz and 2 670-2 690 MHz as identified for IMT in No. **5.384A** and allocated to the mobile-satellite service in Region 3 may be used by administrations in that Region wishing to implement the satellite component of IMT; however, depending on user demand, it may be possible in the longer term that the administrations decide to use these bands for the terrestrial component of IMT (see the Preamble of the ITU Constitution);

3 that this identification of frequency bands for the satellite component of IMT does not preclude the use of these bands by any applications of the services to which they are allocated and does not establish priority in the Radio Regulations,

invites the ITU Radiocommunication Sector

1 to study the sharing and coordination issues in the above bands related to use of the mobile-satellite service allocations for the satellite component of IMT and the use of this spectrum by the other allocated services, including the radiodetermination-satellite service;

2 to report the results of these studies to a future world radiocommunication conference,

invites the Director of the Telecommunication Development Bureau

to draw the attention of the ITU Telecommunication Development Sector to this Resolution.

RESOLUTION 229 (REV.WRC-23)

**Use of the frequency bands 5 150-5 250 MHz, 5 250-5 350 MHz and
5 470-5 725 MHz by the mobile service for the implementation of
wireless access systems including radio local area networks**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that WRC-03 allocated the frequency bands 5 150-5 350 MHz and 5 470-5 725 MHz on a primary basis to the mobile service for the implementation of wireless access systems (WAS), including radio local area networks (RLANs);
- b)* that WRC-03 decided to make an additional primary allocation for the Earth exploration-satellite service (EESS) (active) in the frequency band 5 460-5 570 MHz and the space research service (SRS) (active) in the frequency band 5 350-5 570 MHz;
- c)* that WRC-03 decided to upgrade the radiolocation service to a primary status in the frequency band 5 350-5 650 MHz;
- d)* that the frequency band 5 150-5 250 MHz is allocated worldwide on a primary basis to the fixed-satellite service (FSS) (Earth-to-space), this allocation being limited to feeder links of non-geostationary-satellite (non-GSO) systems in the mobile-satellite service (MSS) (No. **5.447A**);
- e)* that the frequency band 5 150-5 250 MHz is also allocated to the mobile service, on a primary basis, in some countries (No. **5.447**) subject to agreement obtained under No. **9.21**;
- f)* that the frequency band 5 250-5 460 MHz is allocated to the EESS (active) and the frequency band 5 250-5 350 MHz to the SRS (active) on a primary basis;
- g)* that the frequency band 5 250-5 725 MHz is allocated on a primary basis to the radiodetermination service;
- h)* that there is a need to protect the existing primary services in the frequency bands 5 150-5 350 MHz and 5 470-5 725 MHz;
- i)* that results of studies in the ITU Radiocommunication Sector (ITU-R) indicate that sharing in the frequency band 5 150-5 250 MHz between WAS, including RLANs, and the FSS is feasible under specified conditions;
- j)* that studies have shown that sharing between the radiodetermination and mobile services in the frequency bands 5 250-5 350 MHz and 5 470-5 725 MHz is only possible with the application of mitigation techniques such as dynamic frequency selection;

- k)* that there is a need to specify an appropriate equivalent isotropically radiated power (e.i.r.p.) limit and, where necessary, operational restrictions for WAS, including RLANs, in the mobile service in the frequency bands 5 250-5 350 MHz and 5 470-5 570 MHz in order to protect systems in the EESS (active) and SRS (active);
- l)* that the deployment density of WAS, including RLANs, will depend on a number of factors including intrasystem interference and the availability of other competing technologies and services;
- m)* that the means to measure or calculate the aggregate power flux-density (pfd) level at FSS satellite receivers specified in Recommendation ITU-R S.1426 are currently under study;
- n)* that certain parameters contained in Recommendation ITU-R M.1454 related to the calculation of the number of RLANs tolerable by FSS satellite receivers operating in the frequency band 5 150-5 250 MHz require further study;
- o)* that an aggregate pfd level has been developed in Recommendation ITU-R S.1426 for the protection of FSS satellite receivers in the frequency band 5 150-5 250 MHz;
- p)* that the attenuation offered by the car and train hulls, when WAS including RLANs are located inside automobiles and trains, could facilitate a level of protection to incumbent services from WAS including RLANs,

considering further

- a)* that the interference from a single WAS, including RLANs, complying with the operational restrictions under *resolves* 2 will not on its own cause any unacceptable interference to FSS receivers on board satellites in the frequency band 5 150-5 250 MHz;
- b)* that such FSS satellite receivers may experience an unacceptable effect due to the aggregate interference from these WAS, including RLANs, especially in the case of a prolific growth in the number of these systems;
- c)* that the aggregate effect on FSS satellite receivers will be due to the global deployment of WAS, including RLANs, and it may not be possible for administrations to determine the location of the source of the interference and the number of WAS, including RLANs, in operation simultaneously,

noting

- a)* that, prior to WRC-03, a number of administrations developed regulations to permit indoor and outdoor WAS, including RLANs, to operate in the various frequency bands under consideration in this Resolution;

b) that, in response to Resolution 229 (WRC-03)*, ¹, ITU-R developed Report ITU-R M.2115, which provides testing procedures for implementation of dynamic frequency selection,

recognizing

a) that in the frequency band 5 600-5 650 MHz, ground-based meteorological radars are extensively deployed and support critical national weather services, according to footnote No. 5.452;

b) that the performance and interference criteria of spaceborne active sensors in the EESS (active) are given in Recommendation ITU-R RS.1166;

c) that a mitigation technique to protect radiodetermination systems is given in Recommendation ITU-R M.1652;

d) that Recommendation ITU-R RS.1632 identifies a suitable set of constraints for WAS, including RLANs, in order to protect the EESS (active) in the frequency band 5 250-5 350 MHz;

e) that Recommendation ITU-R M.1653 identifies the conditions for sharing between WAS, including RLANs, and the EESS (active) in the frequency band 5 470-5 570 MHz;

f) that the stations in the mobile service should also be designed to provide, on average, a near-uniform spread of the loading of the spectrum used by stations across the frequency band or bands in use to improve sharing with satellite services;

g) that WAS, including RLANs, provide effective broadband solutions;

h) that the demand for WAS/RLAN, including outdoor services, has increased since WRC-03;

i) that there is a need for administrations to ensure that WAS, including RLANs, meet the required mitigation techniques, for example, through equipment or standards compliance procedures;

j) that some sharing studies submitted to ITU-R between WAS/RLANs and the FSS for non-GSO MSS feeder uplinks, in the frequency band 5 150-5 250 MHz, have shown that WAS/RLAN outdoor relaxation up to 3 per cent of the total number of WAS/RLANs can be feasible;

k) that measures to control the number of outdoor WAS/RLANs, in the frequency band 5 150-5 250 MHz, can include: authorization approach, registration procedures, domestic notification, limited application, limitation to fixed WAS/RLAN access points, etc.,

resolves

1 that the use of these frequency bands by the mobile service is for the implementation of WAS, including RLANs, as described in the most recent version of Recommendation ITU-R M.1450;

* *Note by the Secretariat:* This Resolution was revised by WRC-12, WRC-19 and WRC-23.

¹ Reference to Resolution 229 (WRC-03) is provided as background information.

2 that, in the frequency band 5 150-5 250 MHz, stations in the mobile service shall be restricted to indoor use, including inside trains, with a maximum mean e.i.r.p.² of 200 mW and a maximum mean e.i.r.p. density of 10 mW/MHz in any 1 MHz band or equivalently 0.25 mW/25 kHz in any 25 kHz band; mobile stations inside automobiles shall operate with a maximum e.i.r.p. of 40 mW;

3 that in the frequency band 5 150-5 250 MHz, administrations may exercise some flexibility by taking appropriate measures that would allow controlled and/or limited outdoor usage with a maximum mean e.i.r.p.² of 200 mW; administrations have a further option to permit stations in the mobile service, for indoor or controlled outdoor use, to operate up to a maximum mean e.i.r.p. of 30 dBm; in the case of indoor or controlled outdoor use, administrations are requested to either ensure that the maximum e.i.r.p. at any elevation angle above 5 degrees as measured from the horizon shall not exceed 200 mW (23 dBm), or to ensure that the maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon shall not exceed 125 mW (21 dBm) or to apply the emission mask described in *resolves* 5 below to maintain protection to the incumbent services; in that case, administrations shall take all appropriate measures, such as those described in *recognizing k*), to control the number of these higher power outdoor WAS/RLAN stations up to 2 per cent of the estimated total amount of WAS/RLAN stations; if the maximum e.i.r.p. is raised above 200 mW, unwanted emissions shall not increase above the existing levels already authorized within administrations for the existing systems that operate with an in-band e.i.r.p. of not greater than 200 mW; in all cases, administrations are requested to maintain protection to the other primary services;

4 that administrations may monitor whether the aggregate pfd levels given in Recommendation ITU-R S.1426³ are exceeded as a consequence of a prolific growth in the number of WAS/RLANs;

5 that, in the frequency band 5 250-5 350 MHz, stations in the mobile service shall be limited to a maximum mean e.i.r.p. of 200 mW and a maximum mean e.i.r.p. density of 10 mW/MHz in any 1 MHz band; administrations are requested to take appropriate measures that will result in the predominant number of stations in the mobile service being operated in an indoor environment; furthermore, stations in the mobile service that are permitted to be used either indoors or outdoors may operate up to a maximum mean e.i.r.p. of 1 W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1 MHz band, and, when operating above a mean e.i.r.p. of 200 mW, these stations shall comply with the following e.i.r.p. elevation angle mask, where θ is the angle above the local horizontal plane (of the Earth):

² In the context of this Resolution, “mean e.i.r.p.” refers to the e.i.r.p. during the transmission burst which corresponds to the highest power, if power control is implemented.

³ $-124 - 20 \log(h_{SAT}/1\,414) \text{ dB(W/(m}^2 \cdot 1 \text{ MHz))}$, or equivalently, $-140 - 20 \log(h_{SAT}/1\,414) \text{ dB(W/(m}^2 \cdot 25 \text{ kHz))}$, at the FSS satellite orbit, where h_{SAT} is the altitude of the satellite (km).

-13 dB(W/MHz)	for $0^\circ \leq \theta < 8^\circ$
$-13 - 0.716(\theta - 8) \text{ dB(W/MHz)}$	for $8^\circ \leq \theta < 40^\circ$
$-35.9 - 1.22(\theta - 40) \text{ dB(W/MHz)}$	for $40^\circ \leq \theta \leq 45^\circ$
-42 dB(W/MHz)	for $45^\circ < \theta$;

6 that administrations may exercise some flexibility in adopting other mitigation techniques, provided that they develop national regulations to meet their obligations to achieve an equivalent level of protection to the EESS (active) and the SRS (active) based on their system characteristics and interference criteria as stated in Recommendation ITU-R RS.1632;

7 that, in the frequency band 5 470-5 725 MHz, stations in the mobile service shall be restricted to a maximum transmitter power of 250 mW⁴ with a maximum mean e.i.r.p. of 1 W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1 MHz band;

8 that, in the frequency bands 5 250-5 350 MHz and 5 470-5 725 MHz, systems in the mobile service shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB;

9 that, in the frequency bands 5 250-5 350 MHz and 5 470-5 725 MHz, the mitigation measures for systems in the mobile service found in Annex 1 to Recommendation ITU-R M.1652-1 as well as the characteristics and interference criteria for systems in the radiolocation service stated in Annex 5 to Recommendation ITU-R M.1652-1 shall be used by systems in the mobile service to ensure compatible operation with radiodetermination systems,

invites administrations

1 to consider appropriate measures, when allowing the operation of stations in the mobile service using the e.i.r.p. elevation angle mask referred in *resolves* 5 above, to ensure the equipment is operated in compliance with this mask;

2 to take appropriate measures, such as the examples in *recognizing k)*, to control the number of outdoor stations in the frequency band 5 150-5 250 MHz, if implementing *resolves* 3 above, in order to ensure the protection of incumbent services.

⁴ Administrations with existing regulations prior to WRC-03 may exercise some flexibility in determining transmitter power limits.

RESOLUTION 235 (REV.WRC-23)

**Review of the spectrum use of the frequency band 470-694 MHz
or parts thereof for some countries in Region 1**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the favourable propagation characteristics in the frequency bands below 1 GHz are beneficial in providing cost-effective solutions for coverage;
- b)* that there is a need to continually take advantage of technological developments in order to increase the efficient use of the spectrum and facilitate spectrum access;
- c)* that the frequency band 470-694 MHz is a harmonized band used to provide terrestrial television broadcasting services on a worldwide scale;
- d)* that, in many countries, there is a sovereign national obligation on the provision of broadcasting services;
- e)* that terrestrial broadcasting networks have a long life cycle and a stable regulatory environment is necessary to provide protection of investment and future development;
- f)* that there is a need for investment in the next decade in broadcasting service development within the frequency band 470-694 MHz and for the implementation of new-generation broadcasting technologies and new applications (e.g. ultra-high definition (UHD), 5G Broadcast);
- g)* that there are countries where terrestrial broadcasting is the only viable means of delivery of broadcasting services;
- h)* that there are countries with decreasing use of digital terrestrial television broadcasting (DTTB) due to the evolution, broader availability and increased use of alternative media distribution platforms;
- i)* that International Mobile Telecommunications (IMT) systems utilize, among others, the frequency band 614-694 MHz to provide telecommunication services in some countries;
- j)* that, in accordance with No. **5.296**, there are countries where applications ancillary to broadcasting and programme-making are operating under the land mobile service (LMS) on a secondary basis and will continue to operate in the frequency band 470-694 MHz or in parts of that frequency band, but that the availability of spectrum for these applications will be affected by the implementation of other applications of the mobile service;
- k)* that the frequency band 645-862 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS) in the countries listed in No. **5.312**;

l) that, in some countries, parts of the frequency band are also allocated to the radiolocation service on a secondary basis, limited to the operation of wind profiler radars (No. **5.291A**);

m) that, in the African Broadcasting Area (see Nos. **5.10** to **5.13**), the frequency band 606-614 MHz is allocated to the radio astronomy service (RAS) on a primary basis (No. **5.304**), and in the rest of Region 1 the frequency band 608-614 MHz is allocated to the RAS on a secondary basis (No. **5.306**);

n) that this conference has allocated the frequency band 470-694 MHz in some countries in Region 1 to the mobile/mobile, except aeronautical mobile, services on a secondary basis by a footnote, which enables some countries to implement mobile-based applications in order to address their national needs and interests;

o) that this conference has allocated the frequency band 614-694 MHz in some countries in Region 1 to the mobile, except aeronautical mobile, service on a primary basis by a footnote, which enables some countries to implement mobile-based applications in order to address their national needs and interests;

p) that in the Russian Federation and Kazakhstan, the frequency band 625-650 MHz is used for the space operation service (space-to-Earth), under No. **4.4**,

recognizing

a) that the GE06 Agreement applies in all Region 1 countries, except Mongolia, and in Iran (Islamic Republic of), in particular for the frequency band 470-862 MHz;

b) that the GE06 Agreement contains provisions for the terrestrial broadcasting service and other primary terrestrial services, a Plan for digital television and a list of stations of other primary terrestrial services;

c) that a digital entry in the GE06 Plan may also be used for transmissions in a service other than the broadcasting service under the conditions set out in § 5.1.3 of the GE06 Agreement ;

d) that the sharing and compatibility studies carried out in preparation for this conference and previous relevant world radiocommunication conferences may need to be updated for applications already considered, in cases of significantly changed technical characteristics;

e) that there may be some changes over the coming years in the spectrum use and needs of broadcasting and mobile services;

f) that No. **5.149** urges administrations to take all practicable steps to protect the radio astronomy service from harmful interference in the frequency band 608-614 MHz;

g) the ongoing needs of the LMS with allocations on a secondary basis used for applications ancillary to broadcasting and programme-making in No. **5.296** in the frequency band 470-694 MHz, and that stations in the LMS in the countries listed in this footnote shall not cause harmful interference to other existing or planned stations, considering the need to assess the demand of these applications in various administrations,

noting

- a) the ongoing development of new applications and technologies of both the broadcasting and mobile services;
- b) the studies regarding spectrum use and spectrum needs of existing services within the frequency band 470-960 MHz in Region 1, in particular the spectrum requirements of the broadcasting and mobile, except aeronautical mobile, services, carried out in preparation for this conference and relevant previous world radiocommunication conferences;
- c) that the ITU Radiocommunication Sector (ITU-R) is studying possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)¹ in accordance with Resolution ITU-R 59, to facilitate services ancillary to broadcasting (SAB)/services ancillary to programme-making (SAP) operations;
- d) that coexistence between applications of existing secondary services (e.g. SAB/SAP, radio astronomy and wind profiler radars) and other applications of the mobile service requires suitable sharing methods,

resolves to invite the ITU Radiocommunication Sector after this conference and in time for the 2031 world radiocommunication conference

- 1 to review spectrum use and needs of applications of broadcasting and mobile services, taking into account *recognizing g*), within the frequency band 470-694 MHz or parts thereof for countries listed in No. **5.295A**;
- 2 based on the review referred to in *resolves to invite the ITU Radiocommunication Sector, after this conference and in time for the 2031 world radiocommunication conference* 1, to update sharing and compatibility studies for coexistence conditions and develop new studies, as appropriate, taking into account existing primary and secondary services and No. **5.295A**, and to propose technical and regulatory conditions,

encourages administrations

- 1 to participate actively in the studies by submitting contributions to ITU-R;
- 2 to consider making spectrum available for continued SAB/SAP operation, taking into account Resolution ITU-R 59;
- 3 to take appropriate measures for the protection of stations in the RAS (see Nos. **5.304** and **5.306**) from stations in the mobile service, in accordance with the Radio Regulations,

¹ ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting and programme-making, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

invites the 2031 world radiocommunication conference

to consider, based on the results of ITU-R studies:

- a) possible regulatory actions, including a review of the allocation of the frequency band 614-694 MHz to the mobile service for countries listed in No. **5.295A**;
- b) and then also, a possible regulatory action to protect the RAS to which the frequency band 608-614 MHz is allocated in some countries in Region 1, taking into account the outcomes of *invites the 2031 world radiocommunication conference a)* above,

further invites the ITU Radiocommunication Sector

to ensure intersectoral collaboration with the ITU Telecommunication Development Sector in the implementation of this Resolution.

RESOLUTION 240 (WRC-19)

Spectrum harmonization for railway radiocommunication systems between train and trackside within the existing mobile-service allocations

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that railway transportation contributes to global economic and social development, especially for developing countries;
- b) that the term “railway radiocommunication systems between train and trackside” (RSTT) refers to radiocommunication systems providing improved railway traffic control, passenger safety and improved security for train operations;
- c) that the main categories of RSTT applications are train radio, train positioning information, train remote and train surveillance;
- d) that spectrum harmonization of the train radio application of RSTT may have priority among the four categories of RSTT applications, because the train radio application provides for train dispatching, train control and other important railway services which are used to ensure the safety of passengers and train operations and require high reliability and high quality of services;
- e) that there may be a need to integrate different technologies across multiple bands in order to facilitate various functions, for instance dispatching commands, operating control and data transmission, into railway train and trackside systems to also meet the needs of a high-speed railway environment;
- f) that the technologies for RSTT are evolving, and international or regional organizations, such as the 3rd Generation Partnership Project (3GPP), the International Union of Railways (UIC), the European Telecommunications Standards Institute (ETSI), the European Union Agency for Railways (ERA), etc., are developing specifications for technologies and new functions to evolve RSTT;
- g) that the implementation of evolving RSTT needs to take account of the development of the railway industry;
- h) that some administrations wish to facilitate RSTT interoperability, in particular for cross-border operations, to ensure spectrum resources are used effectively and to minimize the risk of interference;
- i) that deployment of RSTT requires significant long-term investment and a stable radio regulatory environment;
- j) that international standards and harmonized spectrum could facilitate deployment of RSTT and provide economies of scale for the railway industry;

k) that the harmonization of frequency bands for RSTT does not preclude the use of these frequency bands by any other application of services to which they are allocated,

recognizing

a) that Report ITU-R M.2418 provides the generic architecture, main applications, current technologies and generic operating scenarios of RSTT;

b) that Report ITU-R M.2442 provides detailed technical and operational characteristics of RSTT and also provides spectrum usage of current and planned RSTT in some countries;

c) that devices used for the train positioning information application of RSTT may be based on short-range devices, using some frequency bands contained in the most recent version of Recommendation ITU-R SM.1896;

d) that, as indicated in Report ITU-R M.2442, most of the current radiocommunication systems for train radio and train remote applications are widely deployed in the frequency bands below 1 GHz, and higher frequency bands such as millimetric bands are used for train radio and train surveillance applications of RSTT in some countries;

e) that the ITU Radiocommunication Sector (ITU-R) is developing an ITU-R Recommendation to facilitate the spectrum harmonization of current and evolving RSTT within the existing mobile-service allocations,

noting

a) that Report ITU-R M.2442 indicates that several particular frequency bands are in common use for train radio applications of RSTT by some administrations;

b) that administrations have flexibility to determine how much spectrum to make available for RSTT as well as the conditions for usage at the national level in order to meet their particular national and/or regional requirements,

resolves

to encourage administrations, when planning for their RSTT, to consider the study results as per *invites the ITU Radiocommunication Sector* 1, as well as other relevant ITU-R Recommendations/Reports, with a view to facilitating spectrum harmonization for RSTT, in particular for train radio applications,

invites the ITU Radiocommunication Sector

1 to continue development of the ITU-R Recommendation referred in *recognizing e)* addressing spectrum harmonization for RSTT in a timely manner;

2 to further develop and update ITU-R Recommendations/Reports concerning the technical and operational implementation of RSTT, as appropriate,

instructs the Director of the Radiocommunication Bureau

to support administrations in their work towards the harmonization of spectrum for RSTT pursuant to *resolves* above,

invites administrations

to encourage railway agencies and organizations to utilize relevant ITU-R publications in implementing technologies and systems supporting RSTT,

invites Member States, Sector Members, Associates and Academia

to participate actively in the study by submitting contributions to ITU-R,

instructs the Secretary-General

to bring this Resolution to the attention of UIC, 3GPP and other relevant international and regional organizations.

RESOLUTION 241 (REV.WRC-23)

**Use of the frequency band 66-71 GHz for International Mobile
Telecommunications and coexistence with
other applications of the mobile service**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that International Mobile Telecommunications (IMT), including IMT-2000, IMT-Advanced and IMT-2020, and other wireless access systems are intended to provide telecommunication services on a worldwide scale regardless of location and type of network or terminal;
- b)* that the evolution of IMT is being studied within the ITU Radiocommunication Sector (ITU-R);
- c)* that harmonized worldwide frequency bands and harmonized frequency arrangements are highly desirable in order to achieve global roaming and the benefits of economies of scale;
- d)* that adequate and timely availability of spectrum for IMT and supporting regulatory provisions are essential to realize the objectives in Recommendation ITU-R M.2083;
- e)* that IMT systems are envisaged to provide increased peak data rates and capacity that may require a larger bandwidth;
- f)* that there is a need to protect existing services and to allow for their continued development,

noting

- a)* Recommendation ITU-R M.2083, on the IMT Vision – framework and overall objectives of the future development of IMT for 2020 and beyond;
- b)* Recommendation ITU-R M.2003, on multiple gigabit wireless systems in frequencies around 60 GHz;
- c)* Report ITU-R M.2227, on the use of multiple gigabit wireless systems in frequencies around 60 GHz,

recognizing

Resolutions 176 (Rev. Bucharest, 2022) and 203 (Rev. Bucharest, 2022) of the Plenipotentiary Conference,

resolves

1 that administrations wishing to implement IMT make available the frequency band 66-71 GHz identified in No. **5.559AA** for use by the terrestrial component of IMT;

2 that administrations wishing to implement IMT in the frequency band 66-71 GHz, identified for IMT under the provisions in No. **5.559AA**, which also wish to implement other applications of the mobile service, including other wireless access systems in the same frequency band, consider coexistence between IMT and these applications,

invites the ITU Radiocommunication Sector

1 to develop ITU-R Recommendations and/or Reports, as appropriate, to assist administrations in ensuring the efficient use of the frequency band through coexistence mechanisms between IMT and other applications of the mobile service, including other wireless access systems, as well as between the mobile service and other services;

2 to regularly review, as appropriate, the impact of evolving technical and operational characteristics of IMT systems (including base-station density) and those of systems of space services on sharing and compatibility, and to take into account the results of these reviews in the development and/or revision of ITU-R Recommendations/Reports addressing, *inter alia*, if necessary, applicable measures to mitigate the risk of interference into space receivers,

instructs the Director of the Radiocommunication Bureau

to bring this Resolution to the attention of relevant international organizations.

RESOLUTION 242 (REV.WRC-23)

**Terrestrial component of International Mobile Telecommunications
in the frequency band 24.25-27.5 GHz**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that International Mobile Telecommunications (IMT), including IMT-2000, IMT-Advanced and IMT-2020, is the ITU vision of global mobile access and is intended to provide telecommunication services on a worldwide scale, regardless of location and type of network or terminal;
- b)* that the evolution of IMT is being studied within the ITU Radiocommunication Sector (ITU-R);
- c)* that harmonized worldwide frequency bands for IMT are desirable in order to achieve global roaming and the benefits of economies of scale;
- d)* that IMT systems are now being evolved to support diverse usage scenarios such as enhanced mobile broadband, massive machine-type communications and ultra-reliable and low-latency communications;
- e)* that ultra-low latency and very high bit-rate applications of IMT will require larger contiguous blocks of spectrum than those available in frequency bands that are currently identified for use by administrations wishing to implement IMT;
- f)* that the properties of higher frequency bands, such as shorter wavelength, would better enable the use of advanced antenna systems, including multiple input, multiple output (MIMO) and beam-forming techniques, in supporting enhanced broadband;
- g)* that identification of frequency bands allocated to the mobile service for IMT may change the sharing situation regarding applications of services to which the frequency band is already allocated, and may require regulatory actions;
- h)* that there is a need to protect existing services and to allow for their continued development;
- i)* that ITU-R has studied, in preparation for WRC-19, sharing and compatibility with services allocated in the frequency band 24.25-27.5 GHz and its adjacent band, based on characteristics available at that time, and results may change if these characteristics change;

j) that it is assumed that a very limited number of IMT base stations will be communicating with a positive elevation angle towards IMT indoor mobile stations;

k) that the allocations of frequency bands to the Earth exploration-satellite service (EESS) (passive) are defined solely by the fundamental properties of the Earth and its atmosphere, and related measurements are beneficial and used globally and extensively in meteorology, climatology and other scientific purposes for the protection of human life and natural resources; and although EESS (passive) satellites and sensors are operated by few countries, they benefit the whole international community and are hence to be protected on a worldwide basis;

l) that sharing studies were conducted considering applications in the land mobile service,

noting

a) that Recommendation ITU-R M.2083 provides the framework and overall objectives of the future development of IMT for 2020 and beyond;

b) that Recommendation ITU-R SA.2142 provides the methodologies for calculating coordination areas around EESS and space research service (SRS) earth stations to avoid harmful interference from IMT-2020 systems in the frequency bands 25.5-27 GHz and 37-38 GHz;

c) that Recommendation ITU-R M.2161 provides guidelines to assist administrations to mitigate in-band interference from FSS earth stations operating in the frequency bands 24.65-25.25 GHz, 27-27.5 GHz, 42.5-43.5 GHz and 47.2-48.2 GHz into IMT stations,

recognizing

a) that the identification of a frequency band for IMT does not establish priority in the Radio Regulations and does not preclude the use of the frequency band by any application of the services to which it is allocated;

b) Resolutions 176 (Rev. Bucharest, 2022) and 203 (Rev. Bucharest, 2022) of the Plenipotentiary Conference;

c) that Resolution **750 (Rev.WRC-19)** establishes limits on unwanted emissions in the frequency band 23.6-24 GHz from IMT base stations and IMT mobile stations within the frequency band 24.25-27.5 GHz;

d) that the spurious emission limits of Recommendation ITU-R SM.329 Category B (−60 dB(W/MHz)) are sufficient to protect the EESS (passive) in the frequency bands 50.2-50.4 GHz and 52.6-54.25 GHz from the second harmonic of IMT base station emissions in the frequency band 24.25-27.5 GHz;

e) that ITU-R has conducted sharing studies between IMT and the inter-satellite service (ISS)/fixed-satellite service (FSS) (Earth-to-space) in the frequency band 24.25-27.5 GHz based on a number of baseline assumptions, (e.g. equivalent isotropically radiated power (e.i.r.p.) of 18 dB(W/200 MHz), base station densities of 1 200 per 10 000 km² and other deployment scenarios), as well as sensitivity analysis for some of them, and these baseline assumptions, as well as other assumptions, influence the sharing study results;

f) that the frequency bands immediately below the passive frequency band 23.6-24 GHz are not intended to be used for high-density mobile applications,

resolves

1 that administrations wishing to implement IMT consider use of the frequency band 24.25-27.5 GHz identified for IMT in No. **5.532AB**, and the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT, taking into account the latest relevant ITU-R Recommendations;

2 that administrations shall apply the following conditions for the frequency band 24.25-27.5 GHz:

2.1 take practical measures to ensure the transmitting antennas of outdoor base stations are normally pointing below the horizon, when deploying IMT base stations within the frequency band 24.25-27.5 GHz; the mechanical pointing needs to be at or below the horizon;

2.2 as far as practicable, sites for IMT base stations within the frequency band 24.45-27.5 GHz employing values of e.i.r.p. per beam exceeding 30 dB(W/200 MHz) should be selected so that the direction of maximum radiation of any antenna will be separated from the geostationary-satellite orbit, within line-of-sight of the IMT base station, by ± 7.5 degrees;

3 that protection of EESS/SRS earth stations in the frequency band 25.5-27 GHz and radio astronomy service (RAS) stations in the frequency band 23.6-24 GHz and coexistence between FSS earth stations in the frequency bands 24.65-25.25 GHz and 27-27.5 GHz and IMT stations should be facilitated through bilateral agreements for cross-border coordination as necessary;

4 that the operation of IMT within the frequency band 24.25-27.5 GHz shall protect existing and future EESS (passive) systems in the frequency band 23.6-24 GHz;

5 that IMT stations within the frequency range 24.25-27.5 GHz are used for applications of the land mobile service,

encourages administrations

1 to ensure that provisions for the implementation of IMT allow for the continued use of EESS, SRS and FSS earth stations and their future development;

2 to keep the antenna pattern of IMT base stations within the limits of the approximation envelope according to the most recent version of Recommendation ITU-R M.2101;

3 to apply the spurious emission limits of Recommendation ITU-R SM.329 Category B for the frequency bands 50.2-50.4 GHz and 52.6-54.25 GHz when making the frequency band 24.25-27.5 GHz available for IMT;

4 that for the future development of EESS (passive) in the frequency band 23.6-24 GHz, administrations should consider additional mitigation techniques (e.g. guardbands) beyond the limits specified in Resolution **750 (Rev.WRC-19)**, as appropriate,

invites the ITU Radiocommunication Sector

1 to update existing ITU-R Recommendations or develop a new ITU-R Recommendation, as appropriate, to provide information and assistance to the concerned administrations on possible coordination and protection measures for the RAS in the frequency band 23.6-24 GHz from IMT deployment;

2 to regularly review, as appropriate, the impact of evolving technical and operational characteristics of IMT systems (including base-station density) and those of systems of space services on sharing and compatibility, and to take into account the results of these reviews in the development and/or revision of ITU-R Recommendations/Reports addressing, *inter alia*, if necessary, applicable measures to mitigate the risk of interference into space receivers,

instructs the Director of the Radiocommunication Bureau

to bring this Resolution to the attention of relevant international organizations.

RESOLUTION 243 (REV.WRC-23)

**Terrestrial component of International Mobile Telecommunications
in the frequency bands 37-43.5 GHz and 47.2-48.2 GHz**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that International Mobile Telecommunications (IMT), including IMT-2000, IMT-Advanced and IMT-2020, is intended to provide telecommunication services on a worldwide scale, regardless of location and type of network or terminal;
- b)* that adequate and timely availability of spectrum and supporting regulatory provisions are essential to realize the objectives in Recommendation ITU-R M.2083;
- c)* that there is a need to continually take advantage of technological developments in order to increase the efficient use of spectrum and facilitate spectrum access;
- d)* that IMT systems are now being evolved to provide diverse usage scenarios and applications such as enhanced mobile broadband, massive machine-type communications and ultra-reliable and low-latency communications;
- e)* that ultra-low latency and very high bit-rate applications of IMT will require larger contiguous blocks of spectrum than those available in frequency bands that are currently identified for use by administrations wishing to implement IMT;
- f)* that the properties of higher frequency bands, such as shorter wavelength, would better enable the use of advanced antenna systems, including multiple-input and multiple-output (MIMO) and beam-forming techniques, in supporting enhanced broadband;
- g)* that harmonized worldwide frequency bands for IMT are desirable in order to achieve global roaming and the benefits of economies of scale;
- h)* that the ITU Radiocommunication Sector (ITU-R) has studied, in preparation for WRC-19, sharing and compatibility with services allocated in the frequency ranges 37-43.5 GHz and 47.2-48.2 GHz and their adjacent frequency bands, based on the characteristics available at that time, and the results may change if these characteristics change;
- i)* that identification of frequency bands allocated to the mobile service for IMT may change the sharing situation regarding applications of services to which the frequency band is already allocated, and may require regulatory actions;
- j)* that there is a need to protect existing services and to allow for their continued development;

k) that it is assumed that a very limited number of IMT base stations will be communicating with a positive elevation angle towards IMT indoor mobile stations;

l) that the use of this frequency band by the mobile service for IMT is intended for land mobile service use and sharing studies were conducted based on that assumption,

noting

a) that Recommendation ITU-R M.2083 provides the framework and overall objectives of the future development of IMT for 2020 and beyond;

b) that Report ITU-R M.2320 addresses future technology trends of terrestrial IMT systems;

c) that Report ITU-R M.2370 addresses trends impacting future IMT traffic growth beyond the year 2020 and estimates global traffic demand for the period 2020 to 2030;

d) that Resolution **143 (Rev.WRC-19)** establishes the guidelines for the implementation of high-density applications in the fixed-satellite service (HDFSS) in frequency bands identified for these applications;

e) that Recommendation ITU-R SA.2142 addresses the methodologies for calculating coordination areas around Earth exploration-satellite service (EESS) and space research service (SRS) earth stations to avoid harmful interference from IMT-2020 systems in the frequency bands 25.5-27 GHz and 37-38 GHz;

f) that Recommendation ITU-R M.2161 provides guidelines to assist administrations to mitigate in-band interference from FSS earth stations operating in the frequency bands 24.65-25.25 GHz, 27-27.5 GHz, 42.5-43.5 GHz and 47.2-48.2 GHz into IMT stations,

recognizing

a) that timely availability of wide and contiguous blocks of spectrum is important to support the development of IMT;

b) Resolutions 176 (Rev. Bucharest, 2022) and 203 (Rev. Bucharest, 2022) of the Plenipotentiary Conference;

c) the identification of HDFSS in the space-to-Earth direction in the frequency bands 39.5-40 GHz in Region 1, 40-40.5 GHz in all Regions, 40.5-42 GHz in Region 2 and 47.5-47.9 GHz in Region 1 (see No. **5.516B**);

d) that No. **5.149** applies for the purpose of protecting the radio astronomy service (RAS) in the frequency band 42.5-43.5 GHz, which is allocated on a primary basis;

e) that the frequency band 47.2-48.2 GHz is allocated to the fixed, mobile and fixed-satellite services, including planned non-geostationary-satellite (non-GSO) uplinks,

resolves

1 that administrations wishing to implement IMT consider use of the frequency band 37-43.5 GHz, or portions thereof, and the frequency band 47.2-48.2 GHz, identified for IMT in No. **5.550B** and No. **5.553B**, and the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT taking into account the latest relevant ITU-R Recommendations;

2 that, in order to ensure coexistence between IMT in the frequency bands 37-43.5 GHz and 47.2-48.2 GHz as identified by WRC-19 in Article **5** and other services to which the frequency band is allocated, including the protection of these other services, administrations shall apply the following condition(s):

2.1 in order to protect the EESS (passive) in the frequency band 36-37 GHz, the following unwanted emissions of IMT stations operating in the frequency band 37-40.5 GHz apply as specified in Table 1 below:

TABLE 1

Frequency band for the EESS (passive)	Frequency band for IMT stations	Unwanted emission mean power for IMT stations ¹	Recommended limits for IMT stations ¹
36-37 GHz	37-40.5 GHz	-43 dB(W/MHz) and -23 dB(W/GHz) within the frequency band 36-37 GHz	-30 dB(W/GHz)

¹ The unwanted emission power level is considered in terms of total radiated power (TRP). The TRP is to be understood here as the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere.

2.2 protection of SRS earth stations in the frequency band 37-38 GHz and RAS stations in the frequency band 42.5-43.5 GHz from IMT stations should be facilitated through bilateral agreements for cross-border coordination as necessary;

2.3 protection of and coexistence with fixed-satellite service (FSS) earth stations within the frequency ranges 37.5-43.5 GHz and 47.2-48.2 GHz should be facilitated through bilateral agreements for cross-border coordination as necessary;

2.4 take practical measures to ensure the transmitting antennas of outdoor base stations are normally pointing below the horizon, when deploying IMT base stations within the frequency bands 42.5-43.5 GHz and 47.2-48.2 GHz; the mechanical pointing needs to be at or below the horizon;

2.5 as far as practicable, sites for IMT base stations in the frequency bands 42.5-43.5 GHz and 47.2-48.2 GHz employing values of equivalent isotropically radiated power (e.i.r.p.) per beam exceeding 30 dB(W/200 MHz) should be selected so that the direction of maximum radiation of any antenna will be separated from the geostationary-satellite orbit, within line-of-sight of the IMT base station, by ± 7.5 degrees;

3 that IMT stations within the frequency ranges 37-43.5 GHz and 47.2-48.2 GHz are used for applications of the land mobile service,

invites administrations

to ensure that, when considering the spectrum to be used for IMT, due attention is paid to the need for spectrum for ubiquitous earth stations at unspecified points, as well as those used for gateways, taking into account spectrum identified in the frequency bands 39.5-40 GHz in Region 1, 40-40.5 GHz in all Regions, 40.5-42 GHz in Region 2 and 47.5-47.9 GHz in Region 1 for the HDFSS, in accordance with No. **5.516B**,

encourages administrations

1 to ensure that provisions for the implementation of IMT allow for the continued development of EESS, SRS, FSS and broadcasting-satellite service (BSS) earth stations and RAS stations and their future development;

2 to keep the antenna pattern of IMT base stations within the limits of the approximation envelope according to the most recent version of Recommendation ITU-R M.2101,

encourages administrations of Region 1

to consider implementing IMT in the frequency band 40.5-43.5 GHz in order to better accommodate the needs of other services below 40.5 GHz, taking into account protection of the FSS within the frequency band 37.5-40.5 GHz in Region 1,

invites the ITU Radiocommunication Sector

1 to continue providing guidance to ensure that IMT can meet the telecommunication needs of the developing countries;

2 to develop ITU-R Reports and Recommendations, as appropriate, to assist administrations in ensuring coexistence between IMT and BSS and FSS, including HDFSS in accordance with No. **5.516B**, within the frequency ranges 37-43.5 GHz and 47.2-48.2 GHz, as appropriate;

3 to develop a new ITU-R Recommendation, as appropriate, to provide information and assistance to the concerned administrations on possible coordination and protection measures for the RAS in the frequency band 42.5-43.5 GHz from IMT deployment;

4 to regularly review, as appropriate, the impact of evolving technical and operational characteristics of IMT systems (including base-station density) and those of systems of space services on sharing and compatibility, and to take into account the results of these reviews in the development and/or revision of ITU-R Recommendations/Reports addressing, *inter alia*, if necessary, applicable measures to mitigate the risk of interference into space receivers,

instructs the Director of the Radiocommunication Bureau

to bring this Resolution to the attention of relevant international organizations.

RESOLUTION 244 (REV.WRC-23)

**International Mobile Telecommunications
in the frequency band 45.5-47 GHz**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that International Mobile Telecommunications (IMT), including IMT-2000, IMT-Advanced and IMT-2020, is intended to provide telecommunication services on a worldwide scale, regardless of location and type of network or terminal;
- b)* that the evolution of IMT is being studied within the ITU Radiocommunication Sector (ITU-R);
- c)* that adequate and timely availability of spectrum and supporting regulatory provisions are essential to realize the objectives in Recommendation ITU-R M.2083;
- d)* that there is a need to continually take advantage of technological developments in order to increase the efficient use of spectrum and facilitate spectrum access;
- e)* that IMT systems are now being evolved to provide diverse usage scenarios and applications such as enhanced mobile broadband, massive machine-type communications and ultra-reliable and low-latency communications;
- f)* that ultra-low latency and very high bit-rate applications of IMT will require larger contiguous blocks of spectrum than those available in frequency bands that are currently identified for use by administrations wishing to implement IMT;
- g)* that the properties of higher frequency bands, such as shorter wavelength, would better enable the use of advanced antenna systems, including multiple-input and multiple-output (MIMO) and beam-forming techniques, in supporting enhanced broadband;
- h)* that harmonized worldwide frequency bands for IMT are desirable in order to achieve global roaming and the benefits of economies of scale,

noting

that Recommendation ITU-R M.2083 provides the framework and overall objectives of the future development of IMT for 2020 and beyond,

recognizing

that the identification of a frequency band for IMT does not establish priority in the Radio Regulations and does not preclude the use of the frequency band by any application of the services to which it is allocated,

resolves

that administrations wishing to implement IMT consider use of the frequency band 45.5-47 GHz, identified for IMT in No. **5.553A**, and the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT taking into account the latest relevant ITU-R Recommendations,

invites the ITU Radiocommunication Sector

to continue providing guidance to ensure that IMT can meet the telecommunication needs of the developing countries in the context of the studies referred to above.

RESOLUTION 249 (REV.WRC-23)

**Study of technical and operational issues and regulatory provisions
for space-to-space transmissions in the frequency bands 1 518-1 544 MHz,
1 545-1 559 MHz, 1 610-1 645.5 MHz, 1 646.5-1 660 MHz, 1 670-1 675 MHz
and 2 483.5-2 500 MHz**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that many non-geostationary-satellite orbit (non-GSO) satellites operate with limited and non-real-time connectivity to earth stations;
- b)* that, by utilizing space-to-space communication between such non-GSO satellites and mobile-satellite service (MSS) satellites operating at higher orbital altitudes, including in the geostationary-satellite orbit (GSO), to relay data to or from the ground, data can be made available in near-real time, enhancing the availability and value of instrument data for low latency applications;
- c)* that all MSS allocations in the frequency bands 1 518.0-1 544.0 MHz, 1 545.0-1 559.0 MHz, 1 610.0-1 645.5 MHz, 1 646.5-1 660.0 MHz, 1 670.0-1 675.0 MHz and 2 483.5-2 500.0 MHz include a space-to-Earth or Earth-to-space direction indicator but do not include a space-to-space direction indicator;
- d)* that the ITU Radiocommunication Sector (ITU-R) has begun preliminary studies on the technical and operational issues associated with the operation of space-to-space links between non-GSO MSS satellites and GSO MSS satellites in some of the above frequency bands, but no studies have been conducted on the technical and operational issues associated with the operation of space-to-space links between non-GSO MSS satellites and non-GSO MSS satellites in the above frequency bands to determine whether space-to-space operations are compatible;
- e)* that it is technically feasible for a lower orbital altitude non-GSO space station to transmit data to and receive data from a higher orbital altitude non-GSO or GSO space station when passing within the satellite antenna coverage beam that is directed towards the Earth;
- f)* that several satellite systems operate space-to-space transmissions in some of the above frequency bands under No. 4.4, without defined regulatory protection mechanisms, subject to the application of No. 8.5;

g) that there is growing interest for utilizing space-to-space satellite links for a variety of applications;

h) that a precedent for space-to-space links sharing with Earth-to-space links or space-to-Earth links exists for other space services, for example, the space operation, Earth exploration-satellite, and space research services in the frequency bands 2 025-2 110 MHz and 2 200-2 290 MHz through the inclusion of a space-to-space direction indicator,

recognizing

a) that it is necessary to study the impact on, and to protect, other services, including Earth-to-space and space-to-Earth operation within the MSS, from the operation of space-to-space links in the above frequency bands, taking into account applicable footnotes to the Table of Frequency Allocations, to ensure compatibility with all primary allocated services in these frequency bands and the adjacent frequency bands and avoid harmful interference;

b) that there should be no additional regulatory or technical constraints imposed on primary services to which the frequency bands and adjacent frequency bands are currently allocated;

c) that it is necessary to study whether space-to-Earth direction transmissions from space stations at higher orbital altitudes, including GSO, can be successfully received by lower orbital altitude non-GSO satellites, without imposing any additional constraints on all allocated services in these frequency bands;

d) that the sharing scenarios may vary widely because of the wide variety of orbital characteristics of the non-GSO MSS space stations;

e) that out-of-band emissions, signals due to antenna pattern sidelobes, and in-band unintentional radiation due to Doppler shifts may impact services operating in the same and adjacent or nearby frequency bands,

recognizing further

a) that the use of frequency bands by the MSS in the frequency range 1-3 GHz is subject to existing Resolutions, coordination requirements and country footnotes taking into account, in particular, the protection of safety services and aeronautical mobile-satellite (R) services, and of the Global Maritime Distress and Safety System (GMDSS);

b) that the fixed and mobile services are allocated on a primary basis in the frequency bands 2 483.5-2 500 MHz on a global basis and that the fixed service is also allocated on a primary basis in the frequency band 1 525-1 530 MHz in Regions 1 and 3;

c) that the radionavigation-satellite service is allocated on a primary basis in the frequency band 1 559-1 610 MHz for both space-to-Earth and space-to-space use;

- d)* that No. **5.356** states that the use of the frequency band 1 544-1 545 MHz by the MSS (space-to-Earth) is limited to distress and safety communications (see Article **31**);
- e)* that Nos. **5.357A** and **5.362A** provide priority for accommodating the spectrum requirements of the aeronautical mobile-satellite (R) service in the frequency bands 1 545-1 555 MHz and 1 646.5-1 656.5 MHz, and 1 555-1 559 MHz and 1 656.5-1 660.5 MHz, respectively;
- f)* that No. **5.353A** provides priority for distress, urgency and safety communications of the GMDSS in the frequency bands 1 530-1 544 MHz and 1 626.5-1 645.5 MHz;
- g)* that the radio astronomy service is allocated on a primary basis in the frequency bands 1 610.6-1 613.8 MHz and 1 660-1 670 MHz, and No. **5.149** applies;
- h)* that according to No. **5.366** the frequency band 1 610-1 626.5 MHz is reserved on a worldwide basis for the use and development of airborne electronic aids to air navigation and any directly associated ground-based or satellite-borne facilities, and such satellite use is subject to agreement obtained under No. **9.21**;
- i)* that, according to No. **5.368**, the provisions of No. **4.10** do not apply with respect to the radiodetermination-satellite and mobile-satellite services in the frequency band 1 610-1 626.5 MHz; however, No. **4.10** applies in the frequency band 1 610-1 626.5 MHz with respect to the aeronautical radionavigation-satellite service when operating in accordance with No. **5.366**, the aeronautical mobile satellite (R) service when operating in accordance with No. **5.367**, and in the frequency band 1 621.35-1 626.5 MHz with respect to the maritime mobile-satellite service when used for GMDSS;
- j)* that according to No. **5.343** in Region 2, the frequency band 1 435-1 525 MHz is used by the aeronautical mobile service for telemetry;
- k)* that, in the frequency band 1 518-1 525 MHz, Nos. **5.348**, **5.348A** and **5.348B** provide that the MSS shall not claim protection from the fixed service, stations in the mobile service in the territory of Japan, and aeronautical mobile telemetry stations in the mobile service in the territory of the United States;
- l)* that Resolution **744 (Rev.WRC-23)** applies to use of the frequency band 1 670-1 675 MHz by the mobile-satellite service;
- m)* that the meteorological aids and meteorological-satellite (space-to-Earth) services are allocated on a primary basis in the frequency band 1 670-1 675 MHz,

noting

that section 3.1.3.2 of the Director's Report to WRC-19 highlighted that the Radiocommunication Bureau has received an increased number of Advance Publication Information (API) submissions for non-GSO networks in frequency bands which are not allocated by Article **5** for the type of service foreseen, including satellite network filings for inter-satellite links in frequency bands allocated to MSS only in the Earth-to-space or space-to-Earth directions,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 studies of the technical and operational characteristics of different types of non-GSO space stations that operate or plan to operate space-to-space links with GSO networks in the following frequency bands, with the limitation that these space-to-space links only operate in the same direction as the existing MSS allocations:

- a) Earth-to-space direction in the frequency bands 1 626.5-1 645.5 MHz and 1 646.5-1 660 MHz; and
- b) space-to-Earth direction in the frequency bands 1 525-1 544 MHz and 1 545-1 559 MHz;

2 studies of the technical and operational characteristics of different types of non-GSO space stations that operate or plan to operate space-to-space links with non-GSO systems or GSO networks in the following frequency bands, with the limitation that these space-to-space links only operate in the same direction as the existing MSS allocations:

- a) Earth-to-space direction in the frequency bands 1 610-1 626.5 MHz and 1 670-1 675 MHz; and
- b) space-to-Earth direction in the frequency bands 1 518-1 525 MHz, 1 613.8-1 626.5 MHz and 2 483.5-2 500 MHz;

3 studies of sharing and compatibility between space-to-space links in the cases described in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 1 and 2 and

- current and planned stations of the MSS, taking into account, in particular, *recognizing further e) and f)*;
- other existing primary services allocated in the same frequency bands;
- other existing primary services allocated in adjacent frequency bands; and
- existing passive services allocated in adjacent frequency bands;

in order to ensure protection of other MSS operations and other services allocated in those frequency bands and in adjacent frequency bands, taking into account *recognizing further a) to m)*;

4 development of technical conditions and regulatory provisions for the operation of space-to-space links in these frequency bands, including MSS (space-to-space) allocations or the addition of inter-satellite service (ISS) allocations, in all or parts of the frequency bands identified in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 1 and 2 above, with the condition that stations operating in an MSS (space-to-space) or ISS allocation shall not cause harmful interference to, or claim protection from, the MSS (space-to-Earth) or MSS (Earth-to-space), while ensuring the protection of other services allocated in those and adjacent frequency bands, taking into account the results of the studies called for in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 1, 2, and 3 above,

invites administrations

to participate in the studies by submitting contributions to ITU-R,

invites the 2027 world radiocommunication conference

to consider the results of the above studies and take necessary regulatory actions, as appropriate.

RESOLUTION 251 (REV.WRC-23)

Studies to consider a possible primary allocation in the frequency bands [694-960 MHz, or parts thereof, in Region 1], 890-942 MHz, or parts thereof, in Region 2, and [3 400-3 700 MHz, or parts thereof, in Region 3] to the aeronautical mobile service for the use of International Mobile Telecommunications (IMT) user equipment in terrestrial IMT networks by non-safety applications*

The World Radiocommunication Conference (Dubai, 2023),

considering

- a) that there is a demand for greater connectivity for passengers and aeronautical communications of aeronautical vehicles;
- b) that current and future International Mobile Telecommunications (IMT) networks can provide connectivity services to helicopters, small aircraft, commercial aircraft and unmanned aircraft systems (UAS);
- c) that current and future IMT networks may provide communication functions for the beyond visual line-of-sight operation of UAS;
- d) that future IMT networks may provide connectivity services to commercial airplanes with specific equipment on board airplanes;
- e) that the IMT network capacities identified in the *considering* paragraphs above have been considered by several studies and are being developed by standards development organizations,

noting

- a) that ITU Radiocommunication Sector (ITU-R) sharing and compatibility studies supporting the identification of specific frequency bands for IMT did not consider the use cases described in *considering b) to e)*;
- b) that the frequency band 694-960 MHz is allocated on a primary basis to the mobile, except aeronautical mobile, service in Region 1;
- c) that the frequency bands 890-902 MHz and 928-942 MHz are allocated on a primary basis to the mobile, except aeronautical mobile, service in Region 2 and that the frequency band 902-928 MHz is allocated on a secondary basis to the mobile, except aeronautical mobile, service in Region 2;

* The appearance of square brackets around certain frequency bands in this Resolution is understood to mean that WRC-27 will consider and review the inclusion of these frequency bands with square brackets and decide, as appropriate.

- d) that Nos. **5.312** and **5.323** allocate the frequency band 645-960 MHz, or parts thereof, to the aeronautical radionavigation service on a primary basis in several countries of Region 1;
- e) that the frequency band 694-960 MHz is allocated on a primary basis to the broadcasting service in Region 1;
- f) that Resolution **224 (Rev.WRC-23)** addresses frequency bands for the terrestrial component of IMT below 1 GHz;
- g) that Resolution **749 (Rev.WRC-23)** addresses the use of the frequency band 790-862 MHz in countries of Region 1 and the Islamic Republic of Iran by mobile applications and by other services;
- h) that Resolution **760 (Rev.WRC-23)** addresses provisions relating to the use of the frequency band 694-790 MHz in Region 1 by the mobile, except aeronautical mobile, service and by other services;
- i) that the frequency bands under consideration are identified for use by IMT in accordance with No. **5.317A**;
- j) that, for countries listed in No. **5.318**, the frequency bands 849-851 MHz and 894-896 MHz are also allocated to the aeronautical mobile service (AMS) on a primary basis, for public correspondence with aircraft; the use of the frequency band 894-896 MHz is limited to transmissions from aircraft stations;
- k) that, for one country listed in No. **5.325**, the frequency bands 890-902 MHz and 928-942 MHz are allocated to the radiolocation service on a primary basis;
- l) that the frequency band 3 500-3 600 MHz is identified for use by IMT in some countries in accordance with No. **5.433A**;
- m) that the frequency bands 3 400-3 500 MHz, 3 500-3 600 MHz and 3 600-3 700 MHz are also allocated to the fixed, fixed-satellite (space-to-Earth) and mobile, except aeronautical mobile, services on a primary basis and that those allocations are used by a variety of incumbent systems in many administrations;
- n) that, under Nos. **5.432** and **5.432B**, the frequency band 3 400-3 500 MHz is allocated on a primary basis to the mobile, except aeronautical mobile, service and identified for use by IMT in some countries in Region 3;
- o) that Report ITU-R M.2282 addresses systems for public mobile communications with aircraft,

recognizing

that new primary allocations to the AMS in the frequency bands proposed may enable the unified use of these allocations by airborne user equipment in terrestrial IMT networks throughout the Regions,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference

- 1 assessment of relevant AMS scenarios for connectivity for airborne user equipment in IMT networks to be addressed in compatibility and sharing studies;
- 2 identification of the relevant technical parameters associated with the aeronautical mobile systems to be used for studies;
- 3 sharing and compatibility studies with existing incumbent services, including in-band and adjacent frequency bands and between neighbouring Regions, to determine the suitability of new primary allocations of the following frequency bands to the AMS, in the countries for which there is an IMT identification, for the use of IMT user equipment by non-safety applications:

- [694-960 MHz, or parts thereof, in Region 1];
- 890-942 MHz, or parts thereof, in Region 2;
- [3 400-3 700 MHz, or parts thereof, in Region 3],

invites administrations

to participate actively in the studies and provide the information required for the studies listed under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* by submitting contributions to ITU-R,

invites the 2031 world radiocommunication conference

to consider, based on results of studies, possible allocations on a primary basis of all or part of the frequency bands listed in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* 3 to the AMS, in the countries for which there is an IMT identification, for the use of IMT user equipment in terrestrial IMT networks by non-safety applications, and/or any other regulatory provisions.

RESOLUTION 252 (WRC-23)

Studies on potential new allocations to, and regulatory actions for, the mobile-satellite service in the frequency bands 1 427-1 432 MHz (space-to-Earth), 1 645.5-1 646.5 MHz (space-to-Earth) (Earth-to-space), 1 880-1 920 MHz (space-to-Earth) (Earth-to-space) and 2 010-2 025 MHz (space-to-Earth) (Earth-to-space) required for the future development of low-data-rate non-geostationary mobile-satellite systems

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that low-data-rate mobile-satellite service (MSS) systems, in the context of this Resolution, refer to non-geostationary (non-GSO) systems not delivering telephony that transmit data in bursts and can therefore operate with periodic or intermittent data transmission and maintain a service while experiencing packet loss;
- b)* that there is a need for low-data-rate MSS systems for the purpose of developing the Internet of Things;
- c)* that there are insufficient spectrum opportunities for new non-voice low-data-rate non-GSO MSS systems to operate in existing MSS frequency bands below 5 000 MHz;
- d)* that the number of mobile-satellite systems using small satellites is growing and the spectrum demand for suitable MSS allocations is increasing,

noting

- a)* that the frequency band 1 427-1 429 MHz is currently allocated to the space operations (Earth-to-space), fixed, and mobile, except aeronautical mobile, services on a primary basis;
- b)* that the frequency band 1 429-1 452 MHz is currently allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis in Region 1, and to the fixed and mobile services on a primary basis in Regions 2 and 3;
- c)* that the frequency band 1 400-1 427 MHz is currently allocated to the Earth exploration-satellite (passive), radio astronomy and space research (passive) services on a primary basis;
- d)* that the frequency band 1 645.5-1 646.5 MHz is currently allocated to the MSS (Earth-to-space) on a primary basis;
- e)* that the frequency band 1 880-1 920 MHz is currently allocated to the fixed and mobile services on a primary basis;

- f) that the frequency band 2 010-2 025 MHz is currently allocated to the fixed and mobile services on a primary basis;
- g) that the frequency band 2 010-2 025 MHz is currently allocated to the MSS on a primary basis in Region 2 only;
- h) that in Regions 1 and 3, the frequency band 2 010-2 025 MHz may be used by high-altitude platform stations as base stations to provide International Mobile Telecommunications (IMT), in accordance with No. **5.388A**;
- i) that the frequency band 1 427-1 432 MHz is identified for IMT globally, in accordance with Resolution **223 (Rev.WRC-23)**;
- j) that the frequency bands 1 880-1 920 MHz and 2 010-2 025 MHz are identified for IMT globally in accordance with Resolution **212 (Rev.WRC-23)** and are included in arrangement B1 for implementation of IMT in Recommendation ITU-R M.1036;
- k) that Report ITU-R SA.2312 provides technical characteristics and benefits of some low-data-rate MSS satellites and suggests that MSS frequency bands already allocated above 5 000 MHz are not suited to the inherent size, weight and power restrictions of small satellites (usually having a mass of less than 100 kg);
- l) the need for regulatory certainty regarding the available spectrum for both satellite and earth station design and planning purposes,

recognizing

- a) that the frequency bands 1 427-1 432 MHz, 1 645.5-1 646.5 MHz, 1 880-1 920 MHz and 2 010-2 025 MHz, and adjacent frequency bands, are also allocated to other radiocommunication services on a primary basis and that those allocations are used by a variety of incumbent systems in many administrations, and that the protection of these services should be studied;
- b) that, for the determination of the incumbent services, the relevant provisions of the Radio Regulations in force apply;
- c) that low-data-rate MSS systems in non-GSO orbits should, in the context of this Resolution have the following properties:
- not including telephony;
 - transmitting data in bursts;
 - capable of operating with periodic or intermittent data transmission;
 - capable of maintaining a service while experiencing packet loss;
- d) that MSS systems use different modes of operation and employ interference-mitigating measures to facilitate spectrum sharing and compatibility between systems and other services;
- e) that new allocations for MSS systems are needed,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 studies on spectrum requirements, technical and operational characteristics and conditions for non-GSO low-data-rate MSS systems, including mitigation techniques, that allow coexistence of these systems in the same frequency bands;

2 studies on sharing and compatibility between the non-GSO low-data-rate MSS systems and the existing primary services operating in the frequency bands 1 427-1 432 MHz (space-to-Earth), 1 645.5-1 646.5 MHz (space-to-Earth) (Earth-to-space), 1 880-1 920 MHz (space-to-Earth) (Earth-to-space) and 2 010-2 025 MHz (space-to-Earth) (Earth-to-space) and in the relevant adjacent frequency bands, in order to ensure protection of existing services,

invites administrations

to participate actively in the studies and provide the information required for the studies listed under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* by submitting contributions to the ITU Radiocommunication Sector,

invites the 2027 world radiocommunication conference

to consider, based on the results of studies, possible allocations to the MSS and possible regulatory actions in the frequency bands referred to in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference*.

RESOLUTION 253 (WRC-23)

Studies on possible new allocations to the mobile-satellite service for direct connectivity between space stations and International Mobile Telecommunications (IMT) user equipment to complement terrestrial IMT network coverage

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that International Mobile Telecommunications (IMT) systems support terrestrial and satellite components, including the capability to enable direct communication to IMT user equipment;
- b)* that the mobile-satellite system may provide alternative network resilience and mobile connectivity to underserved communities and in rural and remote areas, in particular in the event of network failures of terrestrial IMT and natural disasters;
- c)* that the expected usage of the mobile-satellite service (MSS) in IMT frequency bands in specific service areas is based on the authorization by administrations within the territory under their jurisdiction,

noting

- a)* that Report ITU-R M.2077-0 indicated a shortfall of spectrum available for the satellite component of IMT and systems beyond IMT-2000 of more than 144 MHz (space-to-Earth) and more than 19 MHz (Earth-to-space);
- b)* that Report ITU-R M.2218-0 estimated the spectrum requirement in the frequency range 4-16 GHz for MSS broadband applications between 240 MHz and 355 MHz;
- c)* that Report ITU-R M.2514-0, on vision, requirements and evaluation guidelines for satellite radio interfaces of IMT-2020, defined the minimum technical requirements for satellite systems which can be part of the IMT-2020 ecosystem, including bandwidth requirements;
- d)* that Report ITU-R M.2041-0 addressed sharing and adjacent band compatibility in the 2.5 GHz band between the terrestrial and satellite components of IMT-2000;
- e)* that Recommendation ITU-R M.1182-1 considered the integration of terrestrial and satellite mobile communication systems;
- f)* that Recommendation ITU-R M.1036-6 addressed frequency arrangements for the implementation of the terrestrial component of IMT in the bands identified for IMT in the Radio Regulations;

- g) that Recommendation ITU-R RA.769-2 contains the protection criteria used for radio astronomical measurements;
- h) that Recommendation ITU-R RA.1513-2 provides the acceptable levels of data loss to radio astronomy observations and percentage-of-time criteria resulting from degradation by interference for frequency bands allocated to the radio astronomy service (RAS) on a primary basis;
- i) that Recommendation ITU-R M.1808-1 also applies for the studies of frequency bands allocated for the mobile service below 960 MHz;
- j) that Resolution **646 (Rev.WRC-19)** also applies in frequency bands below 960 MHz;
- k) that the GE06 Agreement applies for countries in Region 1, except Mongolia, and including the Islamic Republic of Iran,

recognizing

- a) that the growth in demand for mobile-satellite systems is making it difficult to sustain MSS services on a long-term basis in the existing bands;
- b) that MSS systems may provide direct connectivity between space stations and IMT user equipment to complement terrestrial IMT network coverage;
- c) that new allocations to the MSS would be consistent with the International Telecommunication Union's objective of promoting access to telecommunication services, particularly in remote and rural areas;
- d) that there is a need to concentrate the studies on the frequency bands allocated to the mobile service on a primary basis and used for IMT or identified for IMT by country footnotes or on a regional or multi-regional basis;
- e) that for the determination of the incumbent services, the relevant provisions of the Radio Regulations in force apply;
- f) that unwanted emissions in the spurious domain may be considered regarding RAS frequency allocations,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 studies on possible allocations to the MSS in the frequency range between 694/698 MHz and 2.7 GHz, taking into account the IMT frequency arrangements addressed in the most recent version of Recommendation ITU-R M.1036;

2 studies on spectrum requirements and on technical, operational and regulatory matters related to the implementation of the mobile-satellite service for direct connectivity to the IMT user equipment to complement the terrestrial IMT network coverage,

further resolves

1 to conduct studies on sharing and compatibility between incumbent services, including in adjacent frequency bands, ensuring the protection of incumbent services in accordance with the Radio Regulations;

2 to study possible technical and operational measures to ensure that the stations in the MSS do not cause harmful interference to, or claim protection from, stations operating in the mobile service,

invites administrations

to participate actively in the studies and provide the information required for the studies listed in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* by submitting contributions to the ITU Radiocommunication Sector,

invites the 2027 world radiocommunication conference

to consider, based on the results of studies, the appropriate regulatory actions, including possible new allocations to the MSS for direct connectivity between space stations and IMT user equipment to complement terrestrial IMT network coverage.

RESOLUTION 254 (WRC-23)

**Studies on possible new frequency allocations to the mobile-satellite service
in the frequency bands 2 010-2 025 MHz (Earth-to-space) and 2 160-2 170 MHz
(space-to-Earth) in Regions 1 and 3 and 2 120-2 160 MHz (space-to-Earth)
in all Regions**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that demand for mobility communications has driven an increasing demand for mobile-satellite service and connectivity anywhere;
- b)* that the range of mobile-satellite service applications has expanded manifold since the last mobile-satellite service (MSS) allocations were made, and the number of MSS systems is growing and the spectrum demand for suitable MSS allocations is increasing;
- c)* that MSS systems implementing various applications, including data applications, are a proven, practical and cost-effective method of providing telecommunication service that contributes to global economic and social development especially in remote and underserved areas;
- d)* that recent advances in technology and the development of external standards are facilitating the integration of mobile-satellite solutions to address connectivity, which increases the range of potential users of the MSS;
- e)* that MSS systems play a part in reducing the digital divide;
- f)* that MSS systems have the capability of overcoming practical and logistical difficulties associated with terrestrial infrastructure;
- g)* that contiguous spectrum for the MSS would enable efficiencies in spectrum management;
- h)* the need for regulatory certainty regarding the available spectrum for both satellite and earth station design and planning purposes;
- i)* that new MSS allocations in the frequency bands 2 010-2 025 MHz (Earth-to-space) and 2 160-2 170 MHz (space-to-Earth) in Regions 1 and 3 and 2 120-2 160 MHz (Earth-to-space) in all Regions may help to address MSS spectrum demands;
- j)* that it may be possible to provide additional MSS capacity by amending some existing secondary MSS allocations to primary,

noting

- a) that MSS characteristics can be found in ITU-R Recommendations and Reports, such as Recommendation ITU-R M.1184;
- b) that Report ITU-R M.2514, “Vision, requirements and evaluation guidelines for satellite radio interface(s) of IMT-2020”, has been approved;
- c) that the frequency band 2 010-2 025 MHz is allocated to the MSS on a primary basis for Earth-to-space operations in Region 2;
- d) that the frequency bands 2 025-2 110 MHz and 2 200-2 290 MHz are allocated to the fixed and mobile services on a primary basis;
- e) that the frequency band 2 120-2 160 MHz is allocated to the MSS on a secondary basis for space-to-Earth operations in Region 2;
- f) that the frequency band 2 160-2 170 MHz is allocated to the MSS on a primary basis for space-to-Earth operations in Region 2;
- g) that the frequency bands 2 010-2 025 MHz, 2 160-2 170 MHz and 2 200-2 215 MHz are adjacent to bands that are allocated to the MSS on a primary basis and identified for the satellite component of IMT-2020;
- h) that the frequency bands 2 010-2 025 MHz, 2 120-2 160 MHz and 2 160-2 170 MHz are adjacent to bands allocated to the MSS on a primary basis globally or in Region 2;
- i) that, under Recommendation ITU-R M.1036, the frequency bands 1 920-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz are included as arrangements B1, B4, B5 and B7 for the implementation of IMT; some administrations have used these bands in Regions 1, 2 and 3, and terrestrial mobile operators have deployed IMT systems, and also in some countries portions of these bands have been implemented for railway control and dispatching systems, which are critical for the safety of railway operations; the frequency band 2 110-2 170 MHz is used for downlink transmission from terrestrial IMT base stations; and IMT systems in the frequency range 2 010-2 025 MHz are operated in time-division duplex (TDD) mode;
- j) that, in accordance with No. **5.388**, the frequency bands 1 885-2 025 MHz and 2 110-2 200 MHz are intended for use, on a worldwide basis, by administrations wishing to implement IMT; such use does not preclude the use of these frequency bands by other services to which they are allocated; these frequency bands should be made available for IMT in accordance with Resolution **212 (Rev.WRC-23)**;
- k) that, in accordance with Resolution **212 (Rev.WRC-23)**, both the terrestrial and the satellite components of IMT have already been deployed or are being planned for deployment within the frequency bands 1 885-2 025 MHz and 2 110-2 200 MHz, and that the availability of the satellite component of IMT in the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz simultaneously with the terrestrial component of IMT in the frequency bands identified in No. **5.388** could improve the overall use of IMT;

l) that the frequency bands 2 025-2 110 MHz and 2 200-2 290 MHz are allocated to the space operation, Earth-exploration satellite and space research services on a primary basis in the Earth-to-space, space-to-Earth and space-to-space directions and are currently heavily used by most satellite systems for telecommand, telemetry and precision tracking, as well as by launchers and manned or unmanned space research missions,

recognizing

- a) that some existing satellite allocations may be adapted to provide further MSS capacity;
- b) that the introduction of applications of the possible new allocation to the MSS should not adversely affect existing primary services allocated in the frequency bands being considered and adjacent frequency bands that operate in accordance with the Radio Regulations,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 studies on relevant spectrum requirements and technical, operational and regulatory matters for the MSS in connection with possible new allocations to the MSS in the frequency bands 2 010-2 025 MHz (Earth-to-space) and 2 160-2 170 MHz (space-to-Earth) in Regions 1 and 3 and 2 120-2 160 MHz (space-to-Earth) in all Regions;

2 studies on sharing and compatibility of possible new allocations to the MSS in the frequency bands being studied to ensure the protection of existing services allocated on a primary basis, and also in adjacent frequency bands, without adversely affecting those services;

3 studies on possible technical, operational and regulatory measures that ensure the protection of existing services and their continued operation and future development without imposing additional regulatory or technical constraints on those services, while ensuring their protection from harmful interference, when considering possible additional allocations to the MSS,

invites administrations

to participate actively in the studies and provide the information required for the studies referred to in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* by submitting contributions to the ITU Radiocommunication Sector,

invites the 2027 world radiocommunication conference

to consider, based on results of studies conducted under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference*, possible new allocations and associated regulatory conditions for the MSS, while ensuring the protection of existing primary services.

RESOLUTION 255 (WRC-23)

Studies on frequency-related matters for International Mobile Telecommunications (IMT) identification in the frequency bands [102-109.5 GHz, 151.5-164 GHz, 167-174.8 GHz, 209-226 GHz and 252-275 GHz] for the future development of IMT*

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that International Mobile Telecommunications (IMT) is intended to provide telecommunication services on a worldwide scale, regardless of location and type of network or terminal;
- b)* that IMT systems have contributed to global economic and social development;
- c)* that IMT systems are now evolving to provide diverse usage scenarios and applications, such as enhanced mobile broadband, massive machine-type communications and ultra-reliable and low-latency communications;
- d)* that ultra-low latency and very high bit-rate applications of IMT will require larger contiguous blocks of spectrum than those available in frequency bands that are currently identified for use by administrations wishing to implement IMT;
- e)* that it may be suitable to examine higher frequency bands for these larger blocks of spectrum;
- f)* that there is a need to continually take advantage of technological developments in order to increase the efficient use of spectrum and facilitate spectrum access;
- g)* that the properties of higher frequency bands, such as shorter wavelength, would better enable the use of advanced antenna systems, including multiple input, multiple output (MIMO) and beam-forming techniques in supporting enhanced broadband;
- h)* that harmonized worldwide bands and harmonized frequency arrangements for IMT are highly desirable in order to achieve global roaming and the benefits of economies of scale;
- i)* that identification of frequency bands allocated to the mobile service for IMT may change the sharing situation regarding applications of services to which the frequency band is already allocated and may require additional regulatory actions,

* The appearance of square brackets around certain frequency bands in this Resolution is understood to mean that WRC-27 will consider and review the inclusion of these frequency bands with square brackets and decide, as appropriate.

noting

- a) that IMT encompasses IMT-2000, IMT-Advanced, IMT-2020, IMT-2030 and future generations of IMT collectively;
- b) that Report ITU-R M.2516 addresses future technology trends of terrestrial systems for IMT for 2030 and beyond;
- c) that there are ongoing studies within the ITU Radiocommunication Sector (ITU-R) on propagation characteristics for mobile systems in higher frequency bands,

recognizing

- a) that there is a lead time between the allocation of frequency bands by world radiocommunication conferences and the deployment of systems in those bands, and that timely availability of wide and contiguous blocks of spectrum is therefore important to support the development of IMT;
- b) that any identification of frequency bands for IMT should take into account the use of the frequency bands by other services and the evolving needs of those services, including the space research service (passive) in frequency bands 105-109.5 GHz and 217-226 GHz;
- c) that there should be no additional regulatory or technical constraints imposed on services to which the frequency band is currently allocated on a primary basis;
- d) that frequency bands adjacent to those listed in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference 2* below are allocated to passive services and that No. **5.340** applies in many of those adjacent frequency bands,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference

1 the appropriate studies to determine the spectrum needs for the terrestrial component of IMT in the frequency bands listed in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference 2*, taking into account:

- technical and operational characteristics of terrestrial IMT systems that would operate in those frequency bands, including the evolution of IMT through advances in technology and spectrally efficient techniques;
- the deployment scenarios envisaged for IMT-2030 systems and the related requirements of high data traffic, such as in dense urban areas and/or at peak times; and
- the needs of developing countries and the time-frame in which spectrum would be needed;

2 the appropriate sharing and compatibility¹ studies, taking into account the protection of services to which the frequency band is allocated on a primary basis for the following frequency bands:

– [102-109.5 GHz, 151.5-164 GHz, 167-174.8 GHz, 209-226 GHz and 252-275 GHz],

invites administrations

to participate actively in the studies and provide the information required for the studies listed under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* by submitting contributions to ITU-R,

invites the 2031 world radiocommunication conference

to consider, based on the results of studies, the identification of frequency bands for the terrestrial component of IMT; the frequency bands to be considered being limited to part or all of the frequency bands listed in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* 2.

¹ Including studies with respect to services in adjacent bands, as appropriate.

RESOLUTION 256 (WRC-23)

**Sharing and compatibility studies and development of technical conditions
for the use of International Mobile Telecommunications (IMT) in the frequency
bands 4 400-4 800 MHz, 7 125-8 400 MHz (or parts thereof), and 14.8-15.35 GHz
for the terrestrial component of IMT**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that International Mobile Telecommunications (IMT) is intended to provide telecommunication services on a worldwide scale, regardless of location and type of network or terminal;
- b)* that the continuous development of IMT and other mobile broadband systems contribute to global economic and social development by providing diverse usage scenarios and a wide range of applications;
- c)* that ultra-low latency and very high bit-rate applications of IMT will require contiguous blocks of spectrum for use by administrations wishing to implement IMT;
- d)* that there continues to be an increase in the data-traffic demand for mobile communications beyond 2030 to satisfy numerous connections and user experience, especially in areas of high user density;
- e)* that the ITU Radiocommunication Sector (ITU-R) is working on the development of IMT-2030 and beyond;
- f)* that the appropriate choices of contiguous frequency bands to provide coverage, capacity and performance are necessary and are important to the cost-effective implementation of future systems, taking into account the radio-wave propagation characteristics and implementation complexity and cost factors;
- g)* that harmonized worldwide/regional frequency bands and frequency arrangements for IMT are highly desirable in order to achieve global roaming and the benefits of economies of scale;
- h)* that the implementation of IMT may differ among administrations in different frequency bands identified for IMT;
- i)* the need to protect existing services and to allow for their continued development when considering frequency bands for possible additional allocations to any service;
- j)* that continuation of studies regarding additional spectrum identification for IMT is needed in order to provide proper conditions for use of IMT, which provides sharing and compatibility with other incumbent applications, and then to give flexibility for administrations to select the frequency bands among those bands identified for IMT;

noting

- a) that relevant information relating to terrestrial IMT technology and previous sharing studies are contained in Recommendations ITU-R M.2083, ITU-R M.2150, ITU-R M.2160, ITU-R M.2101 and ITU-R M.2116 and Reports ITU-R M.2410, ITU-R M.2320, ITU-R M.2516, ITU-R M.2370 and ITU-R M.2376;
- b) that Resolution ITU-R 65 addresses the principles for the process of development of IMT-2020 and IMT-2030;
- c) that IMT encompasses IMT-2000, IMT-Advanced, IMT-2020 and IMT-2030 collectively, as described in Resolution ITU-R 56;
- d) that Question ITU-R 77/5 considers the needs of developing countries in the development and implementation of IMT;
- e) that Question ITU-R 229/5 seeks to address the further development of IMT;
- f) that Question ITU-R 262/5 addresses the study of usage of IMT systems for specific applications;
- g) that relevant ITU-R Recommendations provide information on propagation models that may be relevant to the studies,

recognizing

- a) that there is a lead time between the allocation of frequency bands by WRCs and the deployment of systems in those bands, and that timely availability of wide and contiguous blocks of spectrum is therefore important to support the development of IMT;
- b) that, in order to ensure the future development of IMT, it is important to ensure the timely identification of additional spectrum;
- c) that any identification of frequency bands for IMT should take into account the use of the frequency band(s) and adjacent frequency bands by other services and the evolving needs of these services;
- d) that administrations may have different spectrum requirements for IMT depending on national conditions and particular circumstances;
- e) that the frequency bands 4 400-4 800 MHz, 7 125-8 400 MHz (or parts thereof), and 14.8-15.35 GHz are also allocated to the radiocommunication services on a primary basis and that those allocations are used by a variety of incumbent systems in many administrations;
- f) that No. **5.457D** identifies the frequency band 6 425-7 025 MHz for IMT for certain countries of Region 3, and that some other countries in Region 3 could propose adding their names to this footnote in accordance with Resolution **26 (Rev.WRC-23)**,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 the appropriate studies of technical, operational and regulatory issues pertaining to the possible use of the terrestrial component of IMT in the frequency bands listed in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 2, taking into account:

- evolving needs to meet emerging demand for IMT;
- technical and operational characteristics of terrestrial IMT systems that would operate in these specific frequency bands, including the evolution of IMT through advances in technology and spectrally efficient techniques;
- the deployment scenarios envisaged for IMT systems and the related requirements of balanced coverage and capacity;
- the needs of developing countries; and
- the time-frame in which spectrum would be needed;

2 sharing and compatibility studies, with a view to ensuring the protection of services to which the frequency band is allocated on a primary basis, including protection of stations operating in international waters or airspace which cannot be registered in the MIFR, without imposing additional regulatory or technical constraints on those services, and also on services in adjacent bands, for the frequency bands:

- 4 400-4 800 MHz;
- 7 125-8 400 MHz; and
- 14.8-15.35 GHz,

invites administrations

to participate actively in the studies and provide the information required for the studies listed under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* by submitting contributions to ITU-R,

invites the 2027 world radiocommunication conference

to consider, based on results of studies, the identification of frequency band(s):

- 4 400-4 800 MHz, or parts thereof, in Region 1 and Region 3;
- 7 125-8 400 MHz, or parts thereof, in Region 2 and Region 3;
- 7 125-7 250 MHz and 7 750-8 400 MHz, or parts thereof, in Region 1;
- 14.8-15.35 GHz,

for the terrestrial component of IMT.

RESOLUTION 331 (REV.WRC-12)

Operation of the Global Maritime Distress and Safety System

The World Radiocommunication Conference (Geneva, 2012),

noting

that all ships subject to the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, are required to be fitted for the Global Maritime Distress and Safety System (GMDSS),

noting further

- a) that a number of administrations have taken steps to implement the GMDSS also for classes of vessels not subject to SOLAS, 1974, as amended;
- b) that an increasing number of vessels not subject to SOLAS, 1974, as amended, are making use of the techniques and frequencies of the GMDSS prescribed in Chapter **VII**;
- c) that Chapter **VII** provides for maintaining interoperability between ships fitted for GMDSS and ships not yet fully equipped for GMDSS;
- d) that the International Maritime Organization (IMO) is of the view that SOLAS ships, while at sea, should be required to keep a listening watch on VHF channel 16, for the foreseeable future, with a view to providing:
 - a distress alerting and communication channel for non-SOLAS ships; and
 - bridge-to-bridge communications;
- e) that IMO has urged administrations to require all seagoing vessels under national legislation, and encourage all vessels voluntarily carrying VHF radio equipment to be fitted with facilities for transmitting and receiving distress alerts by digital selective calling (DSC) on VHF channel 70;
- f) that separate provisions in the existing Radio Regulations allow VHF channel 16 and 2 182 kHz to be used for general calling by radiotelephony;
- g) that several administrations have established Vessel Traffic Service (VTS) systems and require their vessels to keep watch on local VTS channels;
- h) that ships that are required by SOLAS to carry a radio station have been equipped with DSC, and many vessels subject to national carriage requirements are also being equipped with DSC, but the majority of vessels that carry a radio station on a voluntary basis might not yet have DSC equipment;
- i) that many administrations have established distress and safety service based on DSC watchkeeping, but the majority of port stations, pilot stations and other operational coast stations might not yet have been equipped with DSC facilities;
- j) that ships not required by international agreement to carry GMDSS equipment can do so for safety purposes,

recognizing

- a) that stations in the maritime mobile service are increasingly making use of the frequencies and techniques of GMDSS;
- b) that there may be a need to maintain existing shore-based distress and safety services for reception of distress, urgency and safety calling by voice on VHF channel 16 for some years after this Conference so that ships whose ability to participate in GMDSS is limited to VHF channel 16 will be able to attract attention and obtain assistance from these services,

resolves

- 1 to urge all administrations to assist in enhancing safety at sea by:
- encouraging, where appropriate, establishment of shore-based facilities for GMDSS, either on an individual basis or in cooperation with other relevant parties in the area;
 - encouraging the implementation of GMDSS techniques and frequencies on non-SOLAS vessels including national ships;
 - encouraging all vessels carrying maritime VHF equipment to be fitted with DSC on VHF channel 70 as soon as possible, taking into account the relevant decisions of IMO;
 - encouraging vessels to limit their use of VHF channel 16 and the frequency 2 182 kHz for calling to the minimum necessary, noting the provisions of No. 52.239;
- 2 that coast stations that form part of shore-based arrangements for reception of distress calling by radiotelephony on VHF channel 16 should maintain an efficient watch on VHF channel 16. Such watch shall be indicated in the List of Coast Stations and Special Service Stations;
- 3 that administrations may release their coast stations from the listening watch on VHF channel 16 in respect of distress, urgency and safety calling by voice, in accordance with relevant decisions of IMO and ITU on aural watch-keeping requirements on channel 16, taking into account the GMDSS radio systems available in the area concerned;

when doing so, administrations should:

- inform IMO of their decisions and submit to IMO details on the area concerned;
- inform the Secretary-General of the necessary details for inclusion in the List of Coast Stations and Special Service Stations,

resolves further

that the Secretary-General should ensure that such arrangements and details regarding the area concerned be indicated in relevant maritime publications,

invites ITU-R

to monitor the development of and changes to the GMDSS, and to continue to develop techniques and systems relevant for the GMDSS,

instructs the Secretary-General

to bring this Resolution to the attention of IMO, the International Civil Aviation Organization (ICAO) and the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA).

RESOLUTION 339 (REV.WRC-07)

Coordination of NAVTEX services

The World Radiocommunication Conference (Geneva, 2007),

considering

- a)* that the International Maritime Organization (IMO) has established a Coordinating Panel on NAVTEX to, *inter alia*, coordinate the operational aspects of NAVTEX services, such as allocation of transmitter identification character (B1) and time schedules, in the planning stages for transmissions on the frequencies 490 kHz, 518 kHz or 4 209.5 kHz;
- b)* that coordination in the frequencies 490 kHz, 518 kHz and 4 209.5 kHz is essentially operational;
- c)* that the frequency band around 518 kHz is also allocated to the aeronautical radionavigation service on a primary basis,

resolves

to invite administrations to apply the procedures established by IMO, taking into account the IMO NAVTEX Manual, for coordinating the use of the frequencies 490 kHz, 518 kHz and 4 209.5 kHz,

instructs the Secretary-General

to invite IMO to provide ITU with information on a regular basis on operational coordination for NAVTEX services on the frequencies 490 kHz, 518 kHz and 4 209.5 kHz,

instructs the Director of the Radiocommunication Bureau

to publish this information in the *List of Coast Stations and Special Service Stations* (List IV) (see No. 20.7).

RESOLUTION 343 (REV.WRC-12)

**Maritime certification for personnel of ship stations and ship earth stations
for which a radio installation is not compulsory**

The World Radiocommunication Conference (Geneva, 2012),

considering

- a)* that WRC-97 considered the question of certification for personnel of ship stations and ship earth stations within the Global Maritime Distress and Safety System (GMDSS);
- b)* that GMDSS was fully implemented on 1 February 1999 by vessels subject to an international agreement;
- c)* that vessels not subject to an international agreement have adopted GMDSS systems and techniques;
- d)* that use of GMDSS equipment should be accompanied by appropriate training and certification;
- e)* that the Radio Regulations stipulate that the service of every ship radio station working on frequencies assigned for international use shall be performed by operators holding a certificate;
- f)* that WRC-07 suppressed Appendix **13** to the Radio Regulations, which specified distress communications and operator's certificates by radiotelephones, and that, in order to incorporate provisions for non-GMDSS certificates, WRC-12 has further modified Article **47**,

noting

that a number of administrations currently issue radio operator certificates specially designed for the non-compulsory sector,

resolves

that administrations wishing to implement special certification for the non-compulsory sector should implement the certificates contained in the Annex to this Resolution,

invites ITU-R

to develop a Recommendation describing these certificates,

instructs the Secretary-General

to bring this Resolution to the attention of the International Maritime Organization (IMO).

ANNEX TO RESOLUTION 343 (REV.WRC-12)

Examination syllabus for radio operator's certificates appropriate to vessels using the frequencies and techniques of the Global Maritime Distress and Safety System on a non-compulsory basis**Introduction**

The introduction of the Global Maritime Distress and Safety System (GMDSS) in February 1992 made it necessary to harmonize the examination requirements for certificates for professional radio operators. Harmonized examination procedures for the general operator's Certificate and restricted operator's Certificate, based on the syllabuses described in Article 47, have already been introduced for maritime radio operators performing radiocommunication duties on board vessels subject to the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended. The GMDSS was fully implemented on 1 February 1999 for vessels subject to SOLAS, 1974, as amended.

For vessels not subject to SOLAS, 1974, as amended, and which install radiocommunication equipment on a voluntary basis, there are significant advantages to also using the GMDSS. However, it was foreseen by some administrations that such vessels would use some, but not all, of the frequencies and techniques of the GMDSS and that radio personnel on board such vessels would not need the same level of certification as radio personnel on board vessels which use all of the frequencies and techniques of the GMDSS on a compulsory basis. A syllabus has been developed which provides the flexibility for a depth of study, level of knowledge, and length of course appropriate to meet the certification requirements of radio personnel on board vessels which use some of the frequencies and techniques of the GMDSS on a non-compulsory basis. The syllabus also provides for certification in the use of satellite equipment where appropriate.

This Annex describes the syllabus developed to meet the certification requirements referred to above, and which are implemented in a number of countries under the title "Long Range Certificate" and "Short Range Certificate". The Short Range Certificate should at least contain those elements of the syllabus which are relevant to sea area A1.

Examination syllabus

The examination should consist of theoretical and practical tests and should include at least:

A General knowledge of radiocommunications in the maritime mobile service

A.1 The general principles and basic features of the maritime mobile service.

B Detailed practical knowledge and ability to use radio equipment

B.1 The VHF radio installation. Use of VHF equipment in practice.

B.2 The MF/HF radio installation. Use of MF/HF equipment in practice.

B.3 Purpose and use of digital selective calling facilities and techniques.

C Operational procedures of the GMDSS and detailed practical operation of GMDSS subsystems and equipment

- C.1 Basic introduction to GMDSS procedures.
- C.2 Distress, urgency and safety communication procedures in the GMDSS.
- C.3 Distress, urgency and safety communication procedures by radiotelephony in the old distress and safety system.
- C.4 Protection of distress frequencies.
- C.5 Maritime safety information (MSI) systems in the GMDSS.
- C.6 Alerting and locating signals in the GMDSS.
- C.7 Procedures for cancelling an inadvertent false alert transmission.

D Operational procedures and regulations for radiotelephone communications

- D.1 Ability to exchange communications relevant to the safety of life at sea.
- D.2 Regulations, obligatory procedures and practices.
- D.3 Practical and theoretical knowledge of radiotelephone procedures.
- D.4 Use of the international phonetic alphabet and, where appropriate, parts of the IMO Standard Marine Communication Phrases.

E Optional examination module for the maritime mobile-satellite service for vessels not subject to a compulsory fit

- E.1 The general principles and basic features of the maritime mobile-satellite service.
- E.2 Operational procedures and detailed practical operation of ship earth stations in the GMDSS.

RESOLUTION 344 (REV.WRC-19)

Management of the maritime identity numbering resource

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

noting

- a)* that the installation of digital selective calling (DSC) equipment and some Inmarsat ship earth station equipment on ships participating in the Global Maritime Distress and Safety System (GMDSS) on a mandatory or voluntary basis requires the assignment of a unique nine-digit maritime mobile service identity (MMSI);
- b)* that such equipment offers the possibility to connect with public telecommunication networks;
- c)* that only mobile-satellite systems have been able to resolve the various billing, routing, charging and signalling requirements needed to provide full two-way automatic connectivity between ships and the international public correspondence service;
- d)* that the automatic identification system (AIS) and its related systems require MMSI or other maritime identities;
- e)* that radios capable of DSC and intended to be used on non-SOLAS ships require maritime identities;
- f)* that the first three digits of a ship station MMSI form the maritime identification digits (MID), which denote the ship's administration,

considering

- a)* that DSC distress alerts require valid identities recognizable by search and rescue authorities in order to ensure a timely response;
- b)* that AIS and its related systems require valid identities recognizable by other ships and authorities for safety of navigation and search and rescue operations;
- c)* that Recommendation ITU-R M.585 contains guidance for the assignment and use of maritime identities, such as MMSIs and other maritime identities,

recognizing

- a)* that even domestic ships which install the present generation of ship earth stations will require the assignment of MMSI numbers from those numbers originally intended for ships communicating worldwide, further depleting the resource;
- b)* that mobile-satellite systems offering access to public telecommunication networks and participating in the GMDSS employ a free-form numbering system that need not include any part of the MMSI;
- c)* that future growth of AIS and its related systems will require further resources of MMSI and other maritime identities,

noting further

- a) that the ITU Radiocommunication Sector (ITU-R) is solely responsible for managing the MMSI and MID numbering resources;
- b) that ITU-R can monitor the status of the MMSI resource, through regular reviews of the spare capacity available within the MIDs already in use, and the availability of spare MIDs, taking account of regional variations;
- c) that ITU-R, as a part of the review of MMSI numbering resources, adopted a revision of Recommendation ITU-R M.585 in 2019, removing a provision within the MMSI numbering scheme that set aside three trailing zeros for some categories of mobile-satellite service systems participating in the GMDSS to facilitate the shore-to-ship routing of calls; the provision is no longer necessary and its removal has allowed for the release of reserved MMSI numbering resources,

resolves to instruct the Director of the Radiocommunication Bureau

1 to manage allotment and distribution of the MID resource within the MMSI and other maritime identity numbering formats, taking into account:

- Sections II, V and VI of Article 19;
- regional variations in MMSI use;
- spare capacity within the MID resource; and
- the assignment, management and conservation of maritime identities contained in the most recent version of Recommendation ITU-R M.585, in particular as regards the reuse of MMSIs;

2 to report to each world radiocommunication conference on the use and status of the MMSI resource, noting in particular the anticipated reserve capacity and any indications of rapid exhaustion of the resource,

invites the ITU Radiocommunication Sector

to keep under review the Recommendations for assigning MMSIs and other maritime identities, with a view to:

- improving the management of the MID, MMSI and other maritime identity resources; and
- identifying alternative resources if there is an indication of rapid exhaustion of these resources,

instructs the Secretary-General

to communicate this Resolution to the International Maritime Organization.

RESOLUTION 349 (REV.WRC-23)

Operational procedures for cancelling false distress alerts in the global maritime distress and safety system

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the 1974 International Convention for the Safety of Life at Sea (SOLAS), as amended, prescribes that ships subject to that Convention shall be fitted with global maritime distress and safety system (GMDSS) equipment as appropriate;
- b)* that non-SOLAS vessels are also being equipped with GMDSS equipment;
- c)* that the transmission and relay of false distress alerts is a significant problem within the GMDSS,

noting

that the International Maritime Organization (IMO) refers to this operational procedure for cancelling false distress alerts in its documentation,

resolves

- 1 to urge administrations to take all necessary measures to avoid false distress alerts and to minimize the unnecessary burden on rescue organizations which occurs;
- 2 to urge administrations to encourage the correct use of GMDSS equipment, with particular attention to appropriate training;
- 3 to urge administrations to implement the operational procedures contained in the Annex to this Resolution;
- 4 that administrations should take any consequential appropriate action in this respect,

instructs the Secretary-General

to bring this Resolution to the attention of IMO.

ANNEX TO RESOLUTION 349 (REV.WRC-23)

Cancelling of false distress alerts

If a distress alert is inadvertently transmitted, the following steps shall be taken to cancel the distress alert.

1 VHF digital selective calling

- 1) Follow the instructions on the radio screen, if applicable, or
Switch off and switch on after 10 seconds, and follow the instructions on the radio screen, if applicable;
- 2) If the digital selective-calling (DSC) equipment is capable of cancellation, start the distress self-cancel operation in accordance with the most recent version of Recommendation ITU-R M.493;
- 3) Set to channel 16; and
- 4) Transmit a broadcast message to “All Stations” giving the ship’s name, call sign and maritime mobile service identity (MMSI), and cancel the false distress alert.

Example of message:

- the words “ALL STATIONS”, spoken three times;
- the words “THIS IS”;
- the name of the vessel, spoken three times;
- the call sign or other identification;
- the MMSI;
- the words “PLEASE CANCEL MY DISTRESS ALERT OF” followed by the time in UTC.

2 MF digital selective calling

- 1) Follow the instructions on the radio screen, if applicable, or
Switch off and switch on after 10 seconds, and follow the instructions on the radio screen, if applicable;
- 2) If the DSC equipment is capable of cancellation, start the distress self-cancel operation in accordance with the most recent version of Recommendation ITU-R M.493;
- 3) Tune for radiotelephony transmission on 2 182 kHz; and
- 4) Transmit a broadcast message to “All Stations” giving the ship’s name, call sign and MMSI, and cancel the false alert;

For example of message see section 1.

3 HF digital selective calling

- 1) Follow the instructions on the radio screen, if applicable; or
Switch off and switch on after 10 seconds, and follow the instructions on the radio screen, if applicable;
- 2) If the DSC equipment is capable of cancellation, start the distress self-cancel operation in accordance with the most recent version of Recommendation ITU-R M.493;
- 3) Tune for radiotelephony on the distress and safety frequency in each frequency band in which a false distress alert was transmitted (see Appendix 15); and
- 4) Transmit a broadcast message to “All Stations” giving the ship’s name, call sign and MMSI, and cancel the false alert on the distress and safety frequency in each frequency band in which the false distress alert was transmitted;

For example of message see section 1.

4 Ship earth station

Notify the appropriate rescue coordination centre that the alert is cancelled by sending a distress priority message. Provide ship name, call sign and ship earth station identity with the cancelled alert message.

Example of message by telegraphy:

- NAME, CALL SIGN, IDENTITY NUMBER, POSITION;
- Cancel my distress;
- Alert of DATE, TIME UTC;
- =Master+.

Example of message by radiotelephony:

- the words “ALL STATIONS”, spoken three times;
- the words “THIS IS”;
- the name of the vessel, spoken three times;
- the call sign or other identification;
- the identity number/MMSI;
- the words “PLEASE CANCEL MY DISTRESS ALERT OF” followed by the time in UTC.

5 Satellite emergency position indicating radiobeacon (EPIRB)

If for any reason a satellite emergency position indicating radiobeacon (EPIRB) is activated inadvertently or accidentally, immediately stop the inadvertent transmission and contact the appropriate rescue coordination centre through a coast station or land earth station and cancel the distress alert.

6 General

Notwithstanding the above, ships may use additional appropriate means available to them to inform the appropriate authorities that a false distress alert has been transmitted and should be cancelled.

No action will normally be taken against any ship or mariner for reporting and cancelling a false distress alert. However, in view of the serious consequences of false alerts, and the strict ban on their transmission, authorities may take actions in cases of repeated violation.

RESOLUTION 352 (WRC-03)

Use of the carrier frequencies 12 290 kHz and 16 420 kHz for safety-related calling to and from rescue coordination centres

The World Radiocommunication Conference (Geneva, 2003),

considering

- a)* that this Conference modified No. **52.221A** to allow safety-related calling to and from rescue coordination centres on the carrier frequencies 12 290 kHz and 16 420 kHz;
- b)* that this limited safety-related calling function on these carrier frequencies will enhance the capability of those search and rescue organizations which maintain watch on these distress and safety frequencies to call vessels not utilizing the Global Maritime Distress and Safety System (GMDSS),

noting

- a)* that regulation IV/4.8 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, requires that SOLAS ships, while at sea, be capable of transmitting and receiving general radiocommunications to and from shore-based radio systems or networks;
- b)* that general communications may include safety-related communications necessary for the safe operation of vessels,

further noting

that safety-related communications require adequate, effective and immediate access and protection,

recognizing

- a)* that the International Maritime Organization (IMO) notes that distress, urgency and safety radiocommunications include, but are not limited to:
 - transmissions of maritime safety information;
 - distress calls and traffic;
 - acknowledgment and relaying of distress calls;
 - search and rescue coordination communications;
 - ship movement service communications;
 - communications related to the safe operation of ships;
 - communications related to navigation;
 - meteorological warnings;
 - meteorological observations;
 - ship position reports; and
 - medical emergencies (e.g. MEDICO/MEDIVAC);
- b)* that distress, urgency and safety communications are defined in Articles **32** and **33**,

resolves

1 that the carrier frequencies 12 290 kHz and 16 420 kHz be used only for distress, urgency and safety communications, and safety-related calling limited to that to and from rescue coordination centres;

2 that safety-related calling be initiated only after determination that other communications are not present on these frequencies;

3 that safety-related calling be minimized and not cause interference to distress, urgency and safety communications,

invites administrations

to encourage the coast and ship stations under their jurisdiction to use digital selective calling techniques,

instructs the Secretary-General

to bring this Resolution to the attention of the IMO.

RESOLUTION 354 (REV.WRC-23)

Distress and safety radiotelephony procedures for 2 182 kHz

The World Radiocommunication Conference (Dubai, 2023),

noting

a) that all ships subject to the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, are required to be fitted for the global maritime distress and safety system (GMDSS);

b) that some vessels not subject to SOLAS, 1974, as amended, may not be making use of the techniques and frequencies of GMDSS prescribed in Chapter VII and may wish to continue using radiotelephony procedures for distress and safety communications on 2 182 kHz until such time as they are able to participate in the GMDSS;

c) that some administrations may have a need to maintain shore-based radiotelephony distress and safety services on 2 182 kHz so that vessels not subject to SOLAS, 1974, as amended, and not yet using the techniques and frequencies of GMDSS will be able to obtain assistance from these services until such time as they are able to participate in GMDSS,

considering

that there needs to be some recognized guidance for the use of radiotelephony on 2 182 kHz for distress and safety communications,

resolves

1 that ships, when in distress or when engaged in urgency or safety-related communications on 2 182 kHz, use the radiotelephony procedures contained in the Annex to this Resolution;

2 that coast stations, in order to maintain communication with non-GMDSS ships that are in distress or engaged in urgency or safety related communications on 2 182 kHz, use the radiotelephony procedures contained in the Annex to this Resolution.

ANNEX TO RESOLUTION 354 (REV.WRC-23)

Distress and safety radiotelephony procedures for 2 182 kHz*

PART A1 – GENERAL

§ 1 The frequencies and techniques specified in this Resolution may be used in the maritime mobile service for stations¹ not required by national or international regulation to fit GMDSS equipment and for communications between those stations and aircraft. However, stations of the maritime mobile service, when additionally fitted with any of the equipment used by stations operating in conformity with the provisions specified in Chapter VII, should, when using that equipment, comply with the appropriate provisions of that Chapter.

§ 2 1) No provision of this Resolution prevents the use by a mobile station or mobile earth station in distress of any means at its disposal to attract attention, make known its position, and obtain help.

2) No provision of this Resolution prevents the use by stations on board aircraft or ships engaged in search and rescue operations, in exceptional circumstances, of any means at their disposal to assist a mobile station or mobile earth station in distress.

3) No provision of this Resolution prevents the use by a land station or coast earth station, in exceptional circumstances, of any means at its disposal to assist a mobile station or mobile earth station in distress (see also No. 4.16).

§ 3 In cases of distress, urgency or safety, communications by radiotelephony should be made slowly and distinctly, each word being clearly pronounced to facilitate transcription.

§ 4 The abbreviations and signals of Recommendation ITU-R M.1172 and the Phonetic Alphabet and Figure Code in Appendix 14 should be used where applicable².

§ 5 Distress, urgency and safety communications may also be made using digital selective calling and satellite techniques, in accordance with the provisions specified in Chapter VII and relevant ITU-R Recommendations.

* Distress and safety communications include distress, urgency and safety calls and messages.

¹ These stations may include rescue coordination centres. The term “Rescue Coordination Centre” as defined in the International Convention on Maritime Search and Rescue (1979) refers to a unit responsible for promoting the efficient organization of search and rescue services and for coordinating the conduct of search and rescue operations within a search and rescue region.

² The use of the Standard Marine Communication Phrases (SMCP) and, where language difficulties exist, the International Code of Signals, both published by the International Maritime Organization, is also recommended. It should be noted that the pronunciations for figures in Appendix 14 and IMO SMCP are different.

§ 6 Mobile stations³ of the maritime mobile service may communicate for safety purposes with stations of the aeronautical mobile service. Such communications shall normally be made on the frequencies authorized, and under the conditions specified, in Section I of Part A2 (see also § 2 1)).

§ 7 Mobile stations of the aeronautical mobile service may communicate for distress and safety purposes with stations of the maritime mobile service in conformity with the provisions of this Resolution.

§ 8 Any aircraft required by national or international regulations to communicate for distress, urgency or safety purposes with stations of the maritime mobile service shall be capable of transmitting and receiving class J3E emissions when using the carrier frequency 2 182 kHz or the carrier frequency 4 125 kHz.

PART A2 – FREQUENCIES FOR DISTRESS AND SAFETY

Section I – Availability of frequencies

A – 2 182 kHz

§ 1 1) The carrier frequency 2 182 kHz is an international distress frequency for radiotelephony; it may be used by ship, aircraft and survival craft stations when requesting assistance from the maritime services. It is used for distress calls and distress traffic, for the urgency signal and urgency messages and for the safety signal. Safety messages should be transmitted, when practicable, on a working frequency, after a preliminary announcement on 2 182 kHz. The class of emission to be used for radiotelephony on the frequency 2 182 kHz shall be J3E. Distress traffic on 2 182 kHz following the reception of a distress call using digital selective calling should take into account that some shipping in the vicinity may not be able to receive this traffic.

2) If a distress message on the carrier frequency 2 182 kHz has not been acknowledged, the distress call and message may be transmitted again on a carrier frequency of 4 125 kHz or 6 215 kHz, as appropriate.

3) However, ship stations and aircraft which cannot transmit either on the carrier frequency 2 182 kHz or on the carrier frequencies 4 125 kHz or 6 215 kHz may use any other available frequency on which attention might be attracted.

4) Coast stations using the carrier frequency 2 182 kHz for distress purposes and to send navigational warnings may transmit an audible alarm signal⁴ of short duration for the purpose of attracting attention to the message which follows.

³ Mobile stations communicating with the stations of the aeronautical mobile (R) service in bands allocated to the aeronautical mobile (R) service shall conform to the provisions of the Regulations which relate to that service and, as appropriate, any special arrangements between the governments concerned by which the aeronautical mobile (R) service is regulated.

⁴ Alarm signals may consist of transmissions of sinusoidal audio frequency tones 1 300 Hz, 2 200 Hz, or both. Different tone generation patterns may be used to signal the type of message which follows, and an alarm signal ending in a 10-second continuous tone could be used to identify a transmission by a coast station.

B – 4 125 kHz

§ 2 1) The carrier frequency 4 125 kHz is used to supplement the carrier frequency 2 182 kHz for distress and safety purposes and for call and reply. This frequency is also used for distress and safety traffic by radiotelephony.

2) The carrier frequency 4 125 kHz may be used by aircraft to communicate with stations of the maritime mobile service for distress and safety purposes, including search and rescue.

C – 6 215 kHz

§ 3 The carrier frequency 6 215 kHz is used to supplement the carrier frequency 2 182 kHz for distress and safety purposes and for call and reply. This frequency is also used for distress and safety traffic by radiotelephony.

Section II – Protection of distress and safety frequencies

A – General

§ 4 Test transmissions on any of the distress and safety frequencies described above shall be kept to a minimum and, wherever practicable, be carried out on artificial antennas or with reduced power.

§ 5 Before transmitting on any of the frequencies identified for distress and safety communications, a station shall listen on the frequency concerned to make sure that no distress transmission is being sent (see Recommendation ITU-R M.1171). This does not apply to stations in distress.

B – 2 182 kHz

§ 6 1) Except for transmissions authorized on the carrier frequency 2 182 kHz and on the frequencies 2 174.5 kHz, 2 177 kHz, 2 187.5 kHz and 2 189.5 kHz, all transmissions on the frequencies between 2 173.5 kHz and 2 190.5 kHz are forbidden (see also No. **5.110** for 2 174.5 kHz, Nos. **52.130** to **52.136** for 2 177 kHz and 2 189.5 kHz and Appendix **15** for 2 182 kHz and 2 187.5 kHz).

2) To facilitate the reception of distress calls, all transmissions on 2 182 kHz should be kept to a minimum.

Section III – Watch on distress frequencies

A – 2 182 kHz

§ 7 1) Coast stations may maintain a watch on the carrier frequency 2 182 kHz if so directed by their Administration. Such assignments should be indicated in the List of Coast Stations and Special Service Stations.

2) Ship stations not fitted with equipment compatible with the GMDSS are encouraged to keep the maximum watch practicable on the carrier frequency 2 182 kHz.

B – 4 125 kHz, 6 215 kHz

§ 8 Coast stations may maintain additional watch, as permitted, on the carrier frequencies 4 125 kHz and 6 215 kHz. Such assignments should be indicated in the List of Coast Stations and Special Service Stations.

PART A3 – DISTRESS COMMUNICATIONS

Section I – General

§ 1 The general provisions for distress communications are found in Section I of Article 32 (see Nos. 32.1, 32.3, and 32.4).

Section II – Distress signal, call and message

§ 2 The radiotelephone distress signal, call and message are described in Section II of Article 32 (see Nos. 32.13BA, 32.9, 32.13B, 32.13C, and 32.13D).

Section III – Procedures

§ 3 After the transmission by radiotelephony of its distress message, the mobile station may be requested to transmit suitable signals, followed by its call sign or other identification, to permit direction-finding stations to determine its position. This request may be repeated at frequent intervals if necessary.

§ 4 1) The distress message, preceded by the distress call, shall be repeated at intervals until an answer is received.

2) The intervals shall be sufficiently long to allow time for replying stations, in their preparations, to start their sending apparatus.

§ 5 When the mobile station in distress receives no answer to a distress message sent on the distress frequency, the message may be repeated on any other available frequency on which attention might be attracted.

Section IV – Transmission of a distress relay message by a station not itself in distress

§ 6 The radiotelephone procedures for the transmission of a distress relay message by a station not itself in distress are found in Section II of Article 32 (see Nos. 32.16 to 32.19A and 32.19D to 32.19F).

Section V – Receipt and acknowledgement of a distress message

§ 7 The procedures relating to the receipt and acknowledgement of a distress message are found in Section II of Article **32** (see Nos. **32.23**, **32.26**, **32.28**, **32.29**, **32.30** and **32.35**).

Section VI – Distress traffic

§ 8 The radiotelephone procedures relating to the distress traffic are found in Section III of Article **32** (see Nos. **32.39** to **32.42**, **32.45** to **32.47**, **32.49** to **32.52** and **32.54** to **32.59**).

§ 9 1) Every mobile station acknowledging receipt of a distress message shall, on the order of the person responsible for the ship, aircraft or other vehicle, transmit the following information in the order shown as soon as possible:

- its name;
- its position;
- the speed at which it is proceeding towards, and the approximate time it will take to reach, the mobile station in distress;
- additionally, if the position of the ship in distress appears doubtful, ship stations should also transmit, when available, the true bearing of the ship in distress.

2) Before transmitting the message specified in § 9 1), the station shall ensure that it will not interfere with the emissions of other stations better situated to render immediate assistance to the station in distress.

PART A4 – URGENCY AND SAFETY COMMUNICATIONS

Section I – Urgency communications

§ 1 The radiotelephone procedures for urgency communications are found in Sections I and II of Article **33** (see Nos. **33.1** to **33.7** and **33.8**, **33.8B** to **33.9A** and **33.11** to **33.16**).

Section II – Safety communications

§ 2 The radiotelephone procedures for safety communications are found in Sections I and IV of Article **33** (see Nos. **33.31**, **33.31C**, **33.32**, **33.34** to **33.35** and **33.38B**).

RESOLUTION 356 (REV.WRC-19)

ITU maritime service information registration

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

noting

a) that the provisions of No. **20.16** of Article **20** require administrations to notify the Radiocommunication Bureau (BR) of any changes in the operational information contained in the List of Coast Stations and Special Service Stations (List IV) and the List of Ship Stations and Maritime Mobile Service Identity Assignments (List V);

b) that WRC-07 modified Article **19** to provide for the assignment of a maritime mobile service identity (MMSI) to search and rescue aircraft, automatic identification system (AIS) aids to navigation, and craft associated with a parent ship;

c) that the provisions of No. **20.15**, however, give BR authority to change the content and form of this information in consultation with administrations;

d) that the International Maritime Organization (IMO) has already identified, in Resolution A.887(21) adopted on 25 November 1999, information to be included in search and rescue databases, including:

- vessel identification number (IMO number or national registration number);
- maritime mobile service identity (MMSI);
- radio call sign;
- name, address and telephone number and, if applicable, telefax number of emergency contact person ashore;
- alternative 24-hour emergency telephone number;
- capacity for persons on board (passengers and crew),

resolves to instruct the Director of the Radiocommunication Bureau

to maintain online information systems to allow rescue coordination centres to have immediate access to this information on a 24-hour per day, 7-day per week basis,

invites the ITU Radiocommunication Sector

to consult on a regular basis with administrations, IMO, the International Civil Aviation Organization (ICAO), the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) and the International Hydrographic Organization (IHO) to identify elements for incorporation in ITU online information systems,

instructs the Secretary-General

to communicate this Resolution to IMO, ICAO, IALA and IHO.

RESOLUTION 363 (REV.WRC-23)

Improving the utilization of the VHF maritime mobile band

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the ITU Radiocommunication Sector (ITU-R) is conducting ongoing studies on improving efficiency in the use of the VHF maritime mobile band, including the use of digital technologies to respond to the emerging demands for new maritime uses and to ease congestion;
- b)* that transitional arrangements from analogue voice to digital voice VHF radios may take a long time and needs effective transitional solutions;
- c)* that use of existing maritime mobile service (MMS) allocations, where practicable, for ship and port security and enhanced maritime safety would be preferable, particularly where international interoperability is required;
- d)* that any changes made in Appendix 18 should not prejudice the future use of these frequencies or the capabilities of systems or new applications required for use by the MMS;
- e)* that ensuring resilient positioning, navigation and timing (PNT) data is particularly important for safe navigation at sea;
- f)* that ranging mode (R-Mode), which uses VHF data exchange system (VDES), is a maritime radionavigation system that provides independent resilient terrestrial PNT data,

recognizing

- a)* that Appendix 18 identifies frequencies to be used for distress and safety communications and other maritime communications on an international basis;
- b)* that some frequencies in the bands used by the MMS in Appendix 18 are allocated to the fixed and mobile services on a co-primary basis;
- c)* that a need exists to protect existing and planned in-band and adjacent-band services with no additional regulatory or technical constraints on these co-primary incumbent services when considering any potential modifications to MMS channelling arrangements;
- d)* that it is desirable to enhance maritime safety and ship and port security via spectrum-dependent systems;

e) that ITU and relevant international organizations have initiated related studies on the use of digital technologies for maritime safety and ship and port security;

f) that studies will be required to provide a basis for considering possible regulatory provisions to improve maritime safety and ship and port security, which may need access to spectrum for experimental use;

g) that administrations' and some relevant international organizations' efforts to continue the development of R-Mode to support the implementation of e-navigation may require a review of the Radio Regulations,

noting

a) that WRC-12, WRC-15 and WRC-19 reviewed Appendix 18 to improve use and efficiency for data communication using digital systems, e.g. for the introduction of VDES;

b) that maritime on-board communication systems have implemented digital technologies for voice communication as described in Recommendation ITU-R M.1174 to improve efficient use of the frequency band 450-470 MHz;

c) that digital systems have been implemented in the land mobile service,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference

1 studies on sharing and compatibility with incumbent services that are allocated on a primary basis in the same and adjacent frequency bands and studies on spectrum needs, transitional arrangements and possible changes to the VHF maritime mobile band, in order to advance digital voice and data technologies in the MMS, taking into account *recognizing b) and c)*;

2 compatibility studies, limited to frequencies identified in Appendix 18 for VDES, for a new allocation of the maritime radio navigation service under Article 5 and within the existing MMS to implement R-Mode,

invites administrations

to participate actively in the studies as described in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* and provide the information required for the studies by submitting contributions to ITU-R,

invites the 2031 world radiocommunication conference

1 to consider, based on the results of studies, and within the Radio Regulations, excluding new allocations under Article 5, possible regulatory changes to advance digital voice and data technologies in the MMS within the VHF maritime mobile band;

2 to consider, based on the results of studies, possible revisions to the Radio Regulations, including new allocations under Article 5, limited to frequencies identified in Appendix 18 for VDES, for implementation of R-Mode as a new maritime radionavigation service,

invites relevant international organizations

to participate actively in the studies by providing requirements and information that should be taken into account in ITU-R studies,

instructs the Secretary-General

to bring this Resolution to the attention of the International Maritime Organization, International Association of Marine Aids to Navigation and Lighthouse Authorities, Comité International Radio-Maritime and other concerned international and regional organizations.

RESOLUTION 364 (WRC-23)

Coordination of services provided by the NAVDAT system

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that the International Maritime Organization (IMO) coordinates the operational aspects of services provided by the NAVDAT system, such as allocation of transmitter identification and time schedules, in the planning stages for transmissions on the frequencies 500 kHz and/or 4 226 kHz and other frequencies which are specified in No. **5.79** and Appendix **15**;

b) that coordination in the frequencies 500 kHz and/or 4 226 kHz, and other frequencies which are specified in No. **5.79** and Appendix **15**, is essentially operational,

resolves

to invite administrations to apply the procedures established by IMO, taking into account the IMO NAVDAT manual, for coordinating the use of the frequencies 500 kHz and/or 4 226 kHz, and other frequencies which are specified in No. **5.79** and Appendix **15**,

instructs the Secretary-General

to invite IMO to provide ITU with information on a regular basis on operational coordination for services provided by the NAVDAT system on the frequencies 500 kHz and/or 4 226 kHz, and other frequencies which are specified in No. **5.79** and Appendix **15**,

instructs the Director of the Radiocommunication Bureau

to publish this information in the *List of Coast Stations and Special Service Stations* (List IV) (see No. **20.7**).

RESOLUTION 365 (WRC-23)

**Provisional application of the Radio Regulations for the introduction
of new geostationary satellite networks into the global maritime distress
and safety system**

The World Radiocommunication Conference (Dubai, 2023),

considering

a) the growing demand for global maritime distress and safety system (GMDSS) communications capabilities to enhance maritime safety;

b) that the Maritime Safety Committee (MSC) of the International Maritime Organization (IMO), in its resolution MSC.529(106), recognized a new geostationary (GSO) mobile satellite communication system¹ for the use of a regional messaging system in the GMDSS limited to the service area within 75°E to 135°E longitude and 10°N to 55°N latitude, hereinafter referred to as “the GSO Networks”; and that it is necessary for the coordination process to be completed before the GSO system commences GMDSS services;

c) that this conference considered a revised radio regulatory framework for reflecting the frequencies for GMDSS on a provisional basis in Appendix 15 and Articles 5 and 33 of the Radio Regulations,

considering further

a) that the GSO Networks currently operate using frequency assignments recorded in the Master International Frequency Register under No. 11.41 (see Annex 1);

b) that the primary mobile-satellite service (MSS) allocations in the frequency bands 1 614.4225-1 618.725 MHz or 1 616.3-1 620.38 MHz and 2 483.59-2 499.91 MHz are also used by non-GSO MSS systems and radiodetermination-satellite service (RDSS) systems operating in the same recognized service area, and that further coordination is required with these notified satellite systems and networks as identified in accordance with No. 9.27;

c) the potential impact of coordination outcomes and technological advancements on the identification of frequencies for GMDSS safety services by the GSO Networks,

¹ The system described here refers to BeiDou Message Service System as recognized by IMO for use in GMDSS.

noting

- a) that regulatory provisions for the frequency coordination and notification of any satellite network and system are contained in Articles **9** and **11**;
- b) that several other satellite systems have satisfied the provisions of Articles **9** and **11** and operate in the same frequency bands;
- c) the ongoing coordination being conducted by the GSO Networks and relevant non-GSO systems, in accordance with Article **9** and relevant Rules of Procedure;
- d) that it is necessary for the notifying administration of the GSO Networks to address issues with respect to related assignments identified under No. **9.27** before the commencement of the GMDSS service (i.e. to achieve compatibility between relevant systems and resolve identified harmful interference issues),

recognizing

- a) that the GSO Networks need to be coordinated under Nos. **9.7** and **9.11A**;
- b) that the GSO Networks shall not cause harmful interference to, or claim protection from, the frequency assignments which are the basis of unfavourable findings until frequency coordination and notification is completed;
- c) that non-GSO systems with an earlier date of protection and operating in the same frequency bands as the GSO Networks are experiencing harmful interference as reported in ITU2023-63161 (received on 17.08.2023), USA2023-63567 (received on 14.09.2023), F2023-63644 (received on 25.09.2023), USA2023-64675 (received on 15.11.2023), F2023-64822 (received on 23.11.2023), and F2023-64912 (received on 30.11.2023),

recognizing further

- a) that successful completion of coordination with all necessary satellite systems ensures reliable operation of a GMDSS service;
- b) that systems in the GMDSS should be protected from harmful interference to ensure safety of life at sea,

resolves

- 1 that the provisions of this Resolution apply only to the GSO Networks as recognized for use in the GMDSS system identified in *considering b*);
- 2 that any identified harmful interference shall be eliminated;
- 3 that the GSO Networks shall successfully complete coordination of their frequency assignments with the relevant non-GSO systems in *considering further b*) in accordance with Articles **9** and **11** prior to the commencement of GMDSS services;
- 4 that the coordination of frequency assignments used for GMDSS services by the GSO Networks shall only be considered as completed after the corresponding remarks and indication relating to assignments for which an unfavourable finding had led to its recording under No. **11.41** are removed according to No. **11.41B**;

5 that a review of the frequency bands in Nos. **5.368**, **5.372A**, Article **33** and Appendix **15** in the Earth-to-space direction for GMDSS shall be conducted at the first world radiocommunication conference following the completion of coordination as referenced in *resolves* 3 to determine the relevant frequency band;

6 that the regulatory provisions referred to in *considering c)* shall enter into force as of the date of successful completion and fulfilment of *resolves* 1 to 5 above,

urges the administrations responsible for the respective satellite filings

1 to make the utmost effort to eliminate any harmful interference and engage in frequency coordination with other administrations concerned, in order to complete coordination before WRC-27;

2 to submit reports on the resolution of any identified harmful interference and on frequency coordination progress to the Radiocommunication Bureau before WRC-27;

3 to cooperate to address any potential issues related to the coordination of RDSS in the frequency band 2 483.5-2 500 MHz,

instructs the Director of the Radiocommunication Bureau

1 to report to WRC-27 the status of the implementation of this Resolution and any potential difficulties;

2 to follow, to the extent practical, the progress of frequency coordination between the administrations involved and to take appropriate measures within the mandate of the Bureau in order to assist in the implementation of this Resolution;

3 to publish ITU circular letters to confirm that frequency coordination has completed between all relevant administrations in accordance with *resolves* 3,

instructs the Secretary-General

to bring this Resolution to the attention of the IMO and other relevant international and regional organizations.

ANNEX 1 TO RESOLUTION 365 (WRC-23)

List of geostationary satellite network filings associated with the GSO networks

Orbital position	Satellite network	Special section (the service link of BDMS)
58.75° E	COMPASS-58.75E	CR/C/798 MOD-1 CR/C/798 MOD-2 Part II-S
80° E	CHINASAT-31	AR11/C/2674 Part II-S
	COMPASS-80E	CR/C/799 MOD-5 Part II-S
110.5° E	CHINASAT-33	AR11/C/2676 Part II-S
	COMPASS-110.5E	CR/C/800 MOD-1 CR/C/800 MOD-2 Part II-S
140° E	CHINASAT-32	AR11/C/2675 Part II-S
	COMPASS-140E	CR/C/801 MOD-1 CR/C/801 MOD-2 Part II-S
160° E	COMPASS-160E	CR/C/1526 MOD-1 CR/C/1526 MOD-2 Part II-S

RESOLUTION 366 (WRC-23)

**Improving the utilization and channelization of maritime radiocommunication
in the MF and HF bands, including potential revisions
to Article 52 and Appendix 17**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the ITU Radiocommunication Sector (ITU-R) has finalized studies to remove narrowband direct-printing (NBDP) frequencies for distress and safety communications from Article 5 and Appendices 15 and 17;
- b)* that the International Maritime Organization (IMO) decided to remove NBDP for distress and safety communications from the Global Maritime Distress and Safety System (GMDSS) in MF and HF bands;
- c)* that ITU-R has finalized studies on the implementation of the automatic connection system (ACS) using digital selective calling (DSC) in MF and HF maritime mobile frequency bands;
- d)* that the implementation of the ACS will ensure simple and reliable access to the required radio links for ship stations;
- e)* that IMO has implemented the ACS in performance standards for shipborne MF and MF/HF radio installations for GMDSS,

recognizing

- a)* that Article 52 identifies frequencies and channelling arrangements in the MF band in some Regions;
- b)* that Appendix 17 identifies frequencies and channelling arrangements in the HF bands for the maritime mobile service (MMS);
- c)* that some HF bands lack channels in Appendix 17 for inter-ship operation;
- d)* that the implementation of the ACS may require revision of Article 52 and Appendix 17 channel plans for more working channels on an international basis,

noting

- a)* that this conference reviewed MF and HF bands in Article 5 and Appendices 15 and 17 to remove NBDP frequencies for distress and safety communications;

b) that this conference reviewed MF and HF bands in Article 5 and Appendix 17 to introduce the ACS;

c) that there is no global inter-ship channel in the MF band, and some HF bands lack channels for inter-ship operation in Appendix 17,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference

studies on possible revisions to the Article 52 and Appendix 17 channel plans to identify additional working channels on an international basis to improve the use of maritime radiocommunication in the MF and HF bands,

invites the 2031 world radiocommunication conference

to consider, based on the results of studies, possible revisions to the Article 52 and Appendix 17 channel plans in the maritime mobile MF and HF bands to improve use and efficiency,

invites administrations

to participate actively in the studies described in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* and provide the information required for the studies by submitting contributions to ITU-R,

invites relevant international organizations

to participate actively in the studies by providing requirements and information that should be taken into account in ITU-R studies,

instructs the Secretary-General

to bring this Resolution to the attention of IMO and other international and regional organizations concerned.

RESOLUTION 405

Relating to the use of frequencies of the aeronautical mobile (R) service¹

The World Administrative Radio Conference (Geneva, 1979),

considering

- a)* that WARC-Aer2 adopted and developed a new Frequency Allotment Plan for the use of HF channels for the aeronautical mobile (R) service (Appendix 27);
- b)* that air operations are subject to continuous changes;
- c)* that these changes require attention by the administrations concerned; but
- d)* that, in seeking to satisfy new communication requirements, no decision should be taken that will prevent or handicap the coordinated utilization of those high frequency aeronautical mobile (R) band allotments as prescribed in the Plan;
- e)* that the families of frequencies allotted to the major world air route areas (MWARAs), regional and domestic air route areas (RDARAs) and sub-areas and VOLMET areas have been chosen considering propagation conditions which allow for the selection of the most suitable frequencies for the distances involved;
- f)* that specific steps should be taken to ensure that the correct order of frequency is used;
- g)* that it is essential to distribute the communication traffic load as uniformly as possible over the frequencies available;
- h)* that frequencies have been allotted for worldwide use,

resolves

that administrations, individually or in collaboration, take the necessary steps:

- 1 to make as great a use as possible of higher frequencies in order to lessen the load on the HF aeronautical mobile (R) bands;
- 2 to make as great a use as possible of antennas of appropriate directivity and efficiency in order to minimize the possibilities of mutual interference within an area or between areas;
- 3 to coordinate the use of families of frequencies necessary for a given route segment in accordance with the technical principles in Appendix 27 and in the light of the propagation data available, to ensure that the most appropriate frequencies are used with an aircraft at a given distance from the aeronautical station providing service over the route segment concerned;
- 4 to improve operating techniques and procedures and to use equipment which will make it possible to attain the highest possible efficiency in handling air-ground HF communications;

¹ WRC-97 made editorial amendments to this Resolution.

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5 to collect precise data on the operation of their HF communication systems, particularly data having a bearing on technical and operating standards, so as to facilitate re-examination of the Plan;

6 to establish, through regional arrangements, the best method of providing the communications required for any new long-distance international or regional air operation which is not or cannot be accommodated within the system of MWARA and RDARA, in such a manner as not to cause harmful interference to the utilization of frequencies as prescribed in the Plan.

RESOLUTION 406 (WRC-23)

**Use of the frequency band 117.975-137 MHz by
the aeronautical mobile-satellite (R) service**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the optimization of air traffic management (ATM) over oceanic and remote areas necessitates appropriate aeronautical surveillance and communication means, in order to meet the required communication performance for reduced separation minima;
- b)* that the allocation of the frequency band 117.975-137 MHz to the aeronautical mobile-satellite (R) service (AMS(R)S) is intended for the relay via satellite of VHF communications under the aeronautical mobile (R) service (AM(R)S), in order to complement terrestrial communication infrastructures when aircraft are operating in oceanic and remote areas;
- c)* that the AM(R)S VHF channels have become congested in some areas and AMS(R)S systems need to operate in such a manner as not to constrain AM(R)S VHF systems, without modification to aircraft equipment,

noting

- a)* that there are Standards and Recommended Practices (SARPs) developed by the International Civil Aviation Organization (ICAO) detailing frequency assignment planning criteria for AM(R)S VHF communication systems;
- b)* that frequency assignment planning between stations operated under the AM(R)S allocation in the frequency band 117.975-137 MHz is performed by competent organizations under ICAO provisions;
- c)* that the development of compatibility criteria between AMS(R)S systems proposed for operations under *considering b)* and ICAO-standardized aeronautical systems in the frequency band 117.975-137 MHz is the responsibility of ICAO;
- d)* that feeder links of AMS(R)S systems are not planned to be operated in the frequency band 117.975-137 MHz,

recognizing

- a)* that the frequency band 117.975-137 MHz is allocated on a primary basis to the AM(R)S and is used by air-ground, air-air and ground-air systems operated in accordance with ICAO SARPs, providing critical voice and data communications for ATM on a global basis;

b) that Annex 10 to the Convention on International Civil Aviation contains SARPs for safety aeronautical radionavigation and radiocommunication systems used by international civil aviation,

resolves

1 that the notifying administration for the AMS(R)S satellite system authorizing the use of the frequency band 117.975-137 MHz by that system shall take into account relevant ICAO frequency assignment planning procedures in relation to *noting b*);

2 that, taking into account *resolves* 1, the frequency band 117.975-137 MHz may also be used by AMS(R)S experimental systems during the period of time that the relevant SARPs are being developed and before operational deployment;

3 that the interference from out-of-band emissions of the AMS(R)S space station operating in the frequency band 117.975-137 MHz to adjacent channels of the AM(R)S airborne receiving stations shall not be more than the interference from out-of-band emissions of AM(R)S aircraft stations;

4 that, in accordance with ICAO frequency assignment planning procedures, the identification or selection of channels for use by the AMS(R)S shall:

- take into account the operational deployment of stations operating in the AM(R)S and, when available, the aeronautical mobile (OR) service (AM(OR)S);
- not adversely affect the potential future modifications of AM(R)S channel planning when required;

5 that, in assigning frequencies to stations in the AM(OR)S, the administration needs to take into account the frequencies assigned to the AMS(R)S for which coordination under Nos. **9.14** and **9.15** has been agreed to between both administrations involved in the coordination process;

6 that space stations operating in the frequency band 117.975-137 MHz in the AMS(R)S shall not have out-of-band emissions into the frequency band 137-138 MHz that exceed a power flux-density of $-170 \text{ dB(W/(m}^2 \cdot 14 \text{ kHz))}$ at the Earth's surface;

7 that, in the frequency band 136.8-137 MHz, AMS(R)S space station receivers shall be designed to be resilient to the interference environment resulting from satellite systems operating in the frequency band 137-138 MHz; the power level(s) contained in the Annex to this Resolution and associated percentage(s) of time are to be taken into account in the development of relevant ICAO SARPs,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO and the International Maritime Organization,

invites the International Civil Aviation Organization

to take into account this Resolution in the course of developing SARPs for the AMS(R)S and planning the AM(R)S and AMS(R)S in the frequency band 117.975-137 MHz.

ANNEX TO RESOLUTION 406 (WRC-23)

The following table provides the power levels for several percentages of time for the AMS(R)S space station channel centre frequency between 136.8 and 136.975 MHz:

Power level (dBW/25 kHz)		AMS(R)S space station channel centre frequency (MHz)							
		136.8	136.825	136.85	136.875	136.9	136.925	136.95	136.975
% of time	50	−207	−205	−203	−201	−195.75	−190.5	−185.25	−180
	10	−184	−182	−180	−178	−172.75	−167.5	−162.25	−157
	1	−175	−173	−171	−169	−163.75	−158.5	−153.25	−148
	0.1	−167	−165	−163	−161	−155.75	−150.5	−145.25	−140
	0.01	−161	−159	−157	−155	−149.75	−144.5	−139.25	−134
	0.001	−155	−153	−151	−149	−143.75	−138.5	−133.25	−128
	0.0001	−152	−150	−148	−146	−140.75	−135.5	−130.25	−125

RESOLUTION 411 (WRC-23)

**Consideration of appropriate regulatory actions to update Appendix 26
in support of modernization of high-frequency spectrum
use in the aeronautical mobile (OR) service**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that digital aeronautical high-frequency (HF) systems need to coexist with existing aeronautical analogue voice and data HF systems without causing harmful interference;
- b)* that characteristics of HF propagation enable long distance communication for aircraft;
- c)* that aeronautical analogue voice and narrowband digital HF systems are some of the current means of communication with aircraft in remote and oceanic areas;
- d)* that there exist modern HF systems that can enhance the HF communication capability of aircraft,

recognizing

- a)* that the modernization of aeronautical HF communications will not require any changes to Article 5;
- b)* that the frequencies 3 023 kHz and 5 680 kHz are designated for search and rescue in Appendix 15;
- c)* that for the purpose of this Resolution, the term “wideband” in HF communications may refer to a combination of emissions wider than 3 kHz channels;
- d)* that wideband operation can be achieved by single- or multi-carrier emissions;
- e)* that wideband operation may be achieved by contiguous or non-contiguous channel aggregation for multi-carrier emissions;
- f)* that the use of existing frequency and area allotments in the frequency bands allocated to the aeronautical mobile (OR) service between 3 025 kHz and 18 030 kHz is governed by the provisions of Appendix 26,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 studies on the introduction of new technologies that enhance performance, including, but not limited to, new classes of emission, wideband systems (see *recognizing c), d) and e)*), etc., to the aeronautical mobile (OR) service systems in the frequency ranges considered in Appendix 26;

2 in order to undertake *resolves to invite ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 1, the definition of the relevant technical and operational characteristics and conduct sharing and compatibility studies with existing aeronautical mobile (OR) service systems and with other incumbent services that are allocated on a primary basis in the same or adjacent frequency bands;

3 based on ITU Radiocommunication Sector (ITU-R) studies, the identification of any potential modifications to Appendix 26, without modifying the existing area allotments in *recognizing f)*, and while taking into account that the current use of the narrowband systems shall remain unchanged and shall not be impacted nor precluded by the revision of Appendix 26,

invites administrations

to participate actively in the studies and provide the information required for the studies listed in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* by submitting contributions to ITU-R,

invites the 2027 world radiocommunication conference

to consider necessary changes, as appropriate, to Appendix 26, on the basis of the studies conducted under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* above.

RESOLUTION 413 (REV.WRC-23)

**Use of the frequency band 108-117.975 MHz
by the aeronautical mobile (R) service**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* the current allocation of the frequency band 108-117.975 MHz to the aeronautical radionavigation service (ARNS);
- b)* the current requirements of FM broadcasting systems operating in the frequency band 87-108 MHz;
- c)* that digital sound broadcasting systems are capable of operating in the frequency band at about 87-108 MHz as described in Recommendation ITU-R BS.1114;
- d)* the need for the aeronautical community to provide additional services by enhancing navigation systems through a radiocommunication data link;
- e)* the need for the broadcasting community to provide digital terrestrial sound broadcasting services;
- f)* that this allocation was made by WRC-07 in the knowledge that studies are ongoing with respect to the technical characteristics, sharing criteria and sharing capabilities;
- g)* the need for the aeronautical community to provide additional services for radiocommunications, relating to safety and regularity of flight, in the band 112-117.975 MHz;
- h)* that WRC-07 modified the allocation of the band 112-117.975 MHz to the aeronautical mobile (R) service (AM(R)S) in order to make available this frequency band for new AM(R)S systems, and in doing so enabled further technical developments, investments and deployment;
- i)* that the frequency band 117.975-137 MHz currently allocated to the AM(R)S is reaching saturation in certain areas of the world;
- j)* that this new allocation is intended to support the introduction of applications and concepts in air traffic management which are data intensive, and which could support data links that carry safety-critical aeronautical data;
- k)* that additional information is needed about the new technologies which will be used, the amount of spectrum required, the characteristics and sharing capabilities/conditions, and that therefore studies are urgently required on which AM(R)S systems will be used, the amount of spectrum required, the characteristics and the conditions for sharing with ARNS systems,

recognizing

- a) that precedence must be given to the ARNS operating in the frequency band 108-117.975 MHz;
- b) that, in accordance with Annex 10 to the Convention on International Civil Aviation, all aeronautical systems must meet standards and recommended practices (SARPs) requirements;
- c) that within ITU-R, compatibility criteria between FM broadcasting systems operating in the frequency band 87-108 MHz and the ARNS operating in the frequency band 108-117.975 MHz already exist, as indicated in the most recent version of Recommendation ITU-R SM.1009;
- d) that all compatibility issues between FM broadcasting systems and International Civil Aviation Organization (ICAO) standard ground-based systems for the transmission of radionavigation-satellite differential correction signals have been addressed,

noting

- a) that aeronautical systems are converging towards a radiocommunication data link environment to support aeronautical navigation and surveillance functions, which need to be accommodated in existing radio spectrum;
- b) that some administrations are planning to introduce digital sound broadcasting systems in the frequency band at about 87-108 MHz;
- c) that no compatibility criteria currently exist between FM broadcasting systems operating in the frequency band 87-108 MHz and the planned additional aeronautical systems in the adjacent band 108-117.975 MHz using aircraft transmission;
- d) that no compatibility criteria currently exist between digital sound broadcasting systems capable of operating in the frequency band at about 87-108 MHz and aeronautical services in the band 108-117.975 MHz,

resolves

- 1 that any aeronautical mobile (R) service systems operating in the band 108-117.975 MHz shall not cause harmful interference to, nor claim protection from ARNS systems operating in accordance with international aeronautical standards;
- 2 that any AM(R)S systems planned to operate in the frequency band 108-117.975 MHz shall, as a minimum, meet the FM broadcasting immunity requirements contained in Annex 10 to the Convention on International Civil Aviation for existing aeronautical radionavigation systems operating in this frequency band;
- 3 that AM(R)S systems operating in the band 108-117.975 MHz shall place no additional constraints on the broadcasting service or cause harmful interference to stations operating in the bands allocated to the broadcasting service in the frequency band 87-108 MHz and No. 5.43 does not apply to systems identified in *recognizing d)*;

4 that frequencies below 112 MHz shall not be used for AM(R)S systems excluding the ICAO systems identified in *recognizing d*);

5 that any AM(R)S operating in the frequency band 108-117.975 MHz shall meet SARPs requirements published in Annex 10 to the Convention on International Civil Aviation,

invites the ITU Radiocommunication Sector

to study any compatibility issues between the broadcasting service and AM(R)S in the frequency band 108-117.975 MHz that may arise from the introduction of appropriate digital sound broadcasting systems, described in the most recent version of Recommendation ITU-R BS.1114, and to develop new or revised ITU-R Recommendations as appropriate,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO.

RESOLUTION 416 (WRC-07)

Use of the bands 4 400-4 940 MHz and 5 925-6 700 MHz by an aeronautical mobile telemetry application in the mobile service

The World Radiocommunication Conference (Geneva, 2007),

considering

- a) that there is a need to provide global spectrum to the mobile service for wideband aeronautical mobile telemetry (AMT) systems;
- b) that studies have been conducted within ITU-R concerning the sharing and compatibility of AMT for flight testing with other services in the bands 4 400-4 940 MHz and 5 925-6 700 MHz;
- c) that based on the results of these studies, in the bands 4 400-4 940 MHz and 5 925-6 700 MHz, technical and operational measures applied to AMT for flight testing purposes facilitate sharing with other services and applications in these bands;
- d) that spectrum efficiency is enhanced in situations where new applications can be implemented compatibly in bands that are heavily occupied;
- e) that there is extensive deployment of fixed-satellite service (FSS) earth stations in the band 5 925-6 425 MHz and to a lesser extent in the band 6 425-6 700 MHz;
- f) that there is extensive deployment of fixed service stations in the bands 4 400-4 940 MHz and 5 925-6 700 MHz;
- g) that in certain locations, availability of spectrum will be limited due to its extensive use by the various services while in other locations, this may not be the case;
- h) that there are various techniques which can enhance sharing between co-primary services such as frequency or geographic separation;
- i) that WRC-07 has adopted Nos. **5.440A** and **5.457C**,

recognizing

- a) that the bands 4 400-4 500 MHz and 4 800-4 940 MHz are allocated to the fixed and mobile services on a primary basis;
- b) that the band 4 500-4 800 MHz is allocated to the fixed, fixed-satellite (space-to-Earth), and mobile services on a co-primary basis;
- c) that the band 4 800-4 990 MHz is allocated to the radio astronomy service on a secondary basis worldwide and that No. **5.149** applies;
- d) that the band 4 825-4 835 MHz referred to in *recognizing c)* is allocated on a primary basis to radio astronomy in Argentina, Australia and Canada (see No. **5.443**);
- e) that No. **5.442** applies to AMT for flight testing operations in the band 4 825-4 835 MHz;

f) that the band 5 925-6 700 MHz is allocated to the fixed, fixed-satellite (Earth-to-space), and mobile services on a co-primary basis;

g) that the use of the band 4 500-4 800 MHz (space-to-Earth) by the FSS shall be in accordance with the provisions of Appendix **30B (Rev.WRC-07)** (see No. **5.441**);

h) that provisions for the coordination of terrestrial and space services exist in the Radio Regulations,

resolves

1 that, in the bands 4 400-4 940 MHz and 5 925-6 700 MHz, administrations authorizing AMT for flight test purposes per Nos **5.440A**, **5.442** and **5.457C** shall utilize the criteria set forth below:

- emissions limited to transmission from aircraft stations only, see No. **1.83**;
- in these bands, AMT in the aeronautical mobile service is not considered an application of a safety service as per No. **1.59**;
- the peak e.i.r.p. density of a telemetry transmitter antenna shall not exceed -2.2 dB(W/MHz);
- transmissions limited to designated flight test areas, where flight test areas are airspace designated by administrations for flight testing;
- if operation of AMT aircraft stations is planned within 500 km of the territory of an administration in which the band 4 825-4 835 MHz is allocated to radio astronomy on a primary basis (see No. **5.443**), consult with that administration to determine whether any special measures are needed to prevent interference to their radio astronomy observations;
- in the bands 4 400-4 940 MHz and 5 925-6 700 MHz, bilateral coordination of transmitting AMT aircraft stations with respect to receiving fixed or mobile stations must be effected if the AMT aircraft station will operate within 450 km of the receiving fixed or mobile stations of another administration. The following procedure should be used to establish whether a fixed or mobile service receiver within 450 km of the flight test area will receive an acceptable level of interference:
 - determine if the receiving fixed or mobile station's antenna main-beam axis, out to a distance of 450 km, passes within 12 km of the designated area used by transmitting AMT aircraft stations, where this distance is measured orthogonally from the main-beam axis projection on the Earth's surface to the nearest boundary of the projection of the flight test area on the Earth's surface;
 - if the main-beam axis does not intersect the flight test area or any point within the 12 km offset, the interference could be accepted. Otherwise, further bilateral coordination discussions would be needed;

2 that administrations authorizing AMT per Nos **5.440A**, **5.442** and **5.457C** in the bands 4 400-4 940 MHz and 5 925-6 700 MHz require the use of technical and/or operational measures on AMT where appropriate to facilitate sharing with other services and applications in these bands.

RESOLUTION 417 (REV.WRC-15)

Use of the frequency band 960-1 164 MHz by the aeronautical mobile (R) service

The World Radiocommunication Conference (Geneva, 2015),

considering

- a)* that WRC-07 allocated the frequency band 960-1 164 MHz to the aeronautical mobile (R) service (AM(R)S) in order to make available this frequency band for AM(R)S systems, and in doing so enabled further technical developments, investments and deployment;
- b)* that the frequency band 960-1 164 MHz is currently allocated to the aeronautical radionavigation service (ARNS);
- c)* that new technologies are being developed to support communications and air navigation, including airborne and ground surveillance applications;
- d)* that the allocation of the frequency band 960-1 164 MHz to the aeronautical mobile (R) service is intended to support the introduction of applications and concepts in air traffic management which are data intensive and which could support data links that carry safety critical aeronautical data;
- e)* that in Armenia, Azerbaijan, Belarus, Bulgaria, China, the Russian Federation, Kazakhstan, Mongolia, Uzbekistan, Kyrgyzstan, Tajikistan and Ukraine, the frequency band 960-1 164 MHz is also used by systems in the ARNS for which standards and recommended practices (SARPs) have not been developed nor published by the International Civil Aviation Organization (ICAO);
- f)* that, furthermore, the frequency band 960-1 164 MHz is also used by a non-ICAO system operating in the ARNS that has characteristics similar to those of ICAO standard distance measuring equipment,

recognizing

- a)* that Annex 10 to the Convention on International Civil Aviation contains SARPs for aeronautical radionavigation and radiocommunication systems used by international civil aviation;
- b)* that all compatibility issues between the ICAO Standard Universal Access Transceiver (UAT) operating under the AM(R)S allocation and other systems which operate in the same frequency range, excluding the system identified in *considering e)*, have been addressed;
- c)* that in the frequency band 1 024-1 164 MHz the sharing conditions are more complex than in the frequency band 960-1 024 MHz,

noting

- a)* that the development of compatibility criteria between AM(R)S systems proposed for operations in the frequency band 960-1 164 MHz and ICAO-standardized aeronautical systems in this frequency band is the responsibility of ICAO;

b) that the development of compatibility criteria between AM(R)S systems operating in the frequency band 960-1 164 MHz and radionavigation-satellite service (RNSS) receivers on the same aircraft is the responsibility of ICAO;

c) that practical operational measures should be developed to facilitate the coordination between AM(R)S systems and non-ICAO ARNS systems,

resolves

1 that any AM(R)S system operating in the frequency band 960-1 164 MHz shall meet SARP requirements published in Annex 10 to the Convention on International Civil Aviation;

2 that, with the exception of the system described in *recognizing b)*, any operation of AM(R)S systems in the frequency band 960-1 164 MHz with aircraft stations operating within 934 km or/and ground stations operating within 465 km from the border of the territory of Armenia, Azerbaijan, Belarus, Bulgaria, China, the Russian Federation, Kazakhstan, Mongolia, Uzbekistan, Kyrgyzstan, Tajikistan and Ukraine is subject to coordination with the concerned administrations of the countries listed above for the protection of aeronautical radionavigation systems (see *considering e)*) operating in the same frequency band in these countries. An administration not responding within a four-month period after receiving a request to seek agreement shall be regarded as unaffected;

3 the system described in *recognizing b)* shall not cause harmful interference to, or claim protection from, the systems described in *considering e)*;

4 that administrations authorizing AM(R)S systems in the frequency band 960-1 164 MHz shall ensure compatibility with systems indicated under *considering f)* whose characteristics are described in Annex 1 of Recommendation ITU-R M.2013-0;

5 that such compatibility between any AM(R)S systems in the frequency band 960-1 164 MHz and systems in *considering f)* is a matter to be dealt with in ICAO;

6 that administrations intending to implement AM(R)S in the frequency band 960-1 164 MHz, in order not to cause harmful interference to the RNSS in the frequency band 1 164-1 215 MHz, shall utilize the criteria set forth below:

- any ground station operating under the AM(R)S allocation in the frequency band 960-1 164 MHz shall limit its maximum equivalent isotropically radiated power (e.i.r.p.) to the values presented in the following table:

Emissions in the frequency band 960-1 164 MHz (Maximum allowable e.i.r.p. in the frequency band 960-1 164 MHz as a function of the carrier central frequency) for non-pulsed AM(R)S ground station transmissions				Emissions in the frequency band 1 164-1 215 MHz	
AM(R)S centre frequency < 1 091 MHz	AM(R)S centre frequency 1 091- 1 119 MHz	AM(R)S centre frequency 1 119- 1 135 MHz	AM(R)S centre frequency 1 135- 1 164 MHz	1 164-1 197.6 MHz	1 197.6-1 215 MHz
51.6 dBW	Linearly decreasing from 51.6 to 23.6 dBW	Linearly decreasing from 23.6 to –2.4 dBW	Linearly decreasing from –2.4 to –68.4 dBW	–90.8 dBW in any 1 MHz of the frequency band 1 164-1 197.6 MHz	–90.8 dBW in any 1 MHz of the frequency band 1 197.6-1 215 MHz

- any airborne station operating under the AM(R)S allocation in the frequency band 960-1 164 MHz shall limit its maximum e.i.r.p. to the values presented in the following table:

Emissions in the frequency band 960-1 164 MHz (Maximum allowable e.i.r.p. in the frequency band 960-1 164 MHz as a function of the carrier central frequency) for non-pulsed AM(R)S airborne station transmissions				Emissions in the frequency band 1 164-1 215 MHz	
AM(R)S centre frequency < 1 091 MHz	AM(R)S centre frequency 1 091- 1 119 MHz	AM(R)S centre frequency 1 119- 1 135 MHz	AM(R)S centre frequency 1 135- 1 164 MHz	1 164-1 197.6 MHz	1 197.6-1 215 MHz
55.3 dBW	Linearly decreasing from 55.3 to 27.3 dBW	Linearly decreasing from 27.3 to –1.3 dBW	Linearly decreasing from –1.3 to –64.7 dBW	–84 dBW in any 1 MHz of the frequency band 1 164-1 197.6 MHz	–92.4 dBW in any 1 MHz of the frequency band 1 197.6-1 215 MHz

7 that future AM(R)S systems operating in the frequency band 960-1 164 MHz with pulsed emissions shall demonstrate that they limit AM(R)S ground and airborne station emission characteristics in order to provide protection to RNSS systems equivalent to the protection provided by non-pulsed emission AM(R)S ground and airborne stations operating in the 960-1 164 MHz frequency band at the maximum e.i.r.p. levels in *resolves* 6 above,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO.

RESOLUTION 418 (REV.WRC-19)

Use of the frequency band 5 091-5 250 MHz by the aeronautical mobile service for telemetry applications

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that there is a need to provide global spectrum to the mobile service for wideband aeronautical telemetry systems;
- b)* that the operation of aircraft stations is subject to national and international rules and regulations;
- c)* that the frequency band 5 030-5 150 MHz is allocated to the aeronautical radionavigation service on a primary basis;
- d)* that the allocation of the frequency band 5 091-5 250 MHz to the fixed-satellite service (FSS) (Earth-to-space) is limited to feeder links of non-geostationary-satellite systems in the mobile-satellite service;
- e)* that the frequency band 5 091-5 150 MHz is also allocated to the aeronautical mobile-satellite (R) service on a primary basis, subject to agreement obtained under No. **9.21**;
- f)* that WRC-07 allocated the frequency band 5 091-5 150 MHz to the aeronautical mobile service (AMS) on a primary basis subject to No. **5.444B**;
- g)* that the frequency band 5 150-5 250 MHz is also allocated to the mobile, except aeronautical mobile, service on a primary basis;
- h)* that WRC-07 additionally allocated the frequency band 5 150-5 250 MHz to the AMS on a primary basis, subject to No. **5.446C**;
- i)* that aeronautical mobile telemetry (AMT) in the AMS is not considered an application of a safety service as defined in No. **1.59**,

noting

- a)* that results of studies show the feasibility of using the frequency band 5 091-5 250 MHz for the AMS on a primary basis, limited to transmissions of telemetry for flight testing, under certain conditions and arrangements as provided in Recommendation ITU-R M.2122;
- b)* that the identification by ITU Radiocommunication Sector (ITU-R) of technical and operational requirements for aircraft stations operating in the frequency band 5 091-5 250 MHz should prevent unacceptable interference to other services;
- c)* that the frequency band 5 091-5 150 MHz is to be used for the operation of international standard microwave landing system (MLS) for precision approach and landing;
- d)* that MLS can be protected through the implementation of an adequate separation distance between an AMS transmitter to support telemetry and MLS receivers;

e) that ITU-R studies have generated methods, described in Report ITU-R M.2118, for ensuring compatibility and sharing between the AMS and the FSS operating in the frequency band 5 091-5 250 MHz, which result in interference of no more than 1% $\Delta T_{\text{satellite}}/T_{\text{satellite}}$ from AMT aircraft station transmissions to FSS spacecraft receivers;

f) that a method to facilitate sharing between MLS and the AMS is contained in Recommendation ITU-R M.1829;

g) that Recommendation ITU-R M.1828 provides the technical and operational requirements for aircraft stations of the AMS, limited to transmissions of telemetry for flight testing;

h) that ITU-R compatibility studies have been performed for AMT, limited to flight testing, such application being for the testing of aircraft during non-commercial flights for the purpose of development, evaluation and/or certification of aircraft in airspace designated by administrations for this purpose,

recognizing

a) that priority is to be given to MLS in accordance with No. **5.444** in the frequency band 5 030-5 091 MHz;

b) that studies have been performed within ITU-R concerning the sharing and compatibility of AMT for flight testing with other services in the frequency band 5 091-5 250 MHz;

c) that Resolution **748 (Rev.WRC-19)** also provides guidance on the use of the frequency band 5 091-5 150 MHz by the AMS,

resolves

1 that administrations choosing to implement AMT shall limit AMT applications to those identified in *noting h)* in the frequency band 5 091-5 250 MHz, and shall utilize the criteria set forth in the Annex to this Resolution;

2 that the power flux-density limits in §§ 3 and 4 of the Annex to this Resolution which protect terrestrial services may be exceeded on the territory of any country whose administration has so agreed.

ANNEX TO RESOLUTION 418 (REV.WRC-19)

1 In implementing aeronautical mobile telemetry (AMT), administrations shall utilize the following criteria:

- limit transmissions to those from aircraft stations only (see No. **1.83**);
- the operation of aeronautical telemetry systems within the frequency band 5 091-5 150 MHz shall be coordinated with administrations operating microwave landing systems (MLS) and whose territory is located within a distance D of the AMT flight area, where D is determined by the following equation:

$$D = 43 + 10^{(127.55 - 20 \log(f) + E)/20}$$

where:

D : separation distance (km) triggering the coordination

f : minimum frequency (MHz) used by the AMT system

E : peak equivalent isotropically radiated power density (dBW in 150 kHz) of the aircraft transmitter.

2 For the protection of the fixed-satellite service (FSS), a telemetry aircraft station in the frequency band 5 091-5 250 MHz shall be operated in such a manner that one aircraft station transmitter power flux-density (pfd) be limited to $-198.9 \text{ dB(W/(m}^2 \cdot \text{Hz))}$ at the FSS satellite orbit for spacecraft using Earth coverage receive antennas. Such pfd limit per aircraft transmitter has been derived under the assumptions that the FSS satellite orbit is at 1 414 km altitude and that a total of 21 co-frequency AMT transmitters operate concurrently within the field of view of the FSS satellite. In case of fewer than 21 AMT co-frequency transmitters operating simultaneously in view of the satellite, the transmitter power can be adjusted so as not to exceed an aggregate pfd at the satellite of $-185.7 \text{ dB(W/(m}^2 \cdot \text{Hz))}$, which corresponds to a $\Delta T_{\text{satellite}}/T_{\text{satellite}}$ of 1%.

3 For the protection of the mobile service in the frequency band 5 150-5 250 MHz, the maximum pfd produced at the surface of the Earth by emissions from an aircraft station of an aeronautical mobile service (AMS) system, limited to transmissions of telemetry for flight testing, shall not exceed: $-79.4 \text{ dB(W/(m}^2 \cdot 20 \text{ MHz))} - G_r(\theta)$.

$G_r(\theta)$ represents the mobile service receiver antenna gain versus elevation angle θ and is defined as follows:

Wireless access system elevation antenna pattern

Elevation angle, θ (degrees)	Gain $G_r(\theta)$ (dBi)
$45 < \theta \leq 90$	-4
$35 < \theta \leq 45$	-3
$0 < \theta \leq 35$	0
$-15 < \theta \leq 0$	-1
$-30 < \theta \leq -15$	-4
$-60 < \theta \leq -30$	-6
$-90 < \theta \leq -60$	-5

4 For the protection of the aeronautical mobile (R) service (AM(R)S) in the frequency band 5 091-5 150 MHz, the maximum pfd produced at the surface of the Earth, where AM(R)S may be deployed in accordance with No. **5.444B**, by emissions from an aircraft station of an AMS system, limited to transmissions of telemetry for flight testing, shall not exceed: $-89.4 \text{ dB(W/(m}^2 \cdot 20 \text{ MHz))} - G_r(\theta)$.

$G_r(\theta)$ represents the mobile -service receiver antenna gain versus elevation angle θ and is defined as follows:

$$G_r(\theta) = \max[G_1(\theta), G_2(\theta)]$$

$$G_1(\theta) = 6 - 12 \left(\frac{\theta}{27} \right)^2$$

$$G_2(\theta) = -6 + 10 \log \left[\left(\max \left\{ \frac{|\theta|}{27}, 1 \right\} \right)^{-1.5} + 0.7 \right]$$

where:

$G(\theta)$: gain relative to an isotropic antenna (dBi)

(θ) : absolute value of the elevation angle relative to the angle of maximum gain (degrees).

RESOLUTION 422 (WRC-12)

Development of methodology to calculate aeronautical mobile-satellite (R) service spectrum requirements within the frequency bands 1 545-1 555 MHz (space-to-Earth) and 1 646.5-1 656.5 MHz (Earth-to-space)

The World Radiocommunication Conference (Geneva, 2012),

considering

- a)* that coordination between satellite networks is required on a bilateral basis in accordance with the Radio Regulations, and that, in the frequency bands 1 525-1 559 MHz (space-to-Earth) and 1 626.5-1 660.5 MHz (Earth-to-space), coordination is partially assisted by regional multilateral meetings;
- b)* that, in these frequency bands, geostationary mobile-satellite system operators currently use a capacity-planning approach at multilateral coordination meetings, with the guidance and support of their administrations, to periodically coordinate access to the spectrum needed to accommodate their requirements, including aeronautical mobile-satellite (R) service (AMS(R)S) spectrum requirements;
- c)* that within ITU-R, there is no agreed methodology for calculating AMS(R)S spectrum requirements related to the priority categories 1 to 6 of Article 44;
- d)* that within ITU-R, some administrations have expressed a desire to develop an agreed methodology for calculating AMS(R)S spectrum requirements on an ongoing basis for purposes of bilateral and multilateral mobile-satellite service (MSS) coordinations conducted pursuant to Article 9 of the Radio Regulations;
- e)* that, since spectrum resources are limited, there is a need to use them in the most efficient manner within and amongst various MSS networks,

recognizing

- a)* that WRC-97 allocated the frequency bands 1 525-1 559 MHz (space-to-Earth) and 1 626.5-1 660.5 MHz (Earth-to-space) to the MSS to facilitate the assignment of spectrum to multiple MSS networks in a flexible and efficient manner;
- b)* that WRC-97 adopted No. 5.357A giving priority to accommodating spectrum requirements for, and protecting from unacceptable interference, the AMS(R)S providing transmission of messages with priority categories 1 to 6 in Article 44 in the frequency bands 1 545-1 555 MHz and 1 646.5-1 656.5 MHz,

noting

that AMS(R)S systems are an essential element of the International Civil Aviation Organization (ICAO) standardized communications infrastructure used in air traffic management for the provision of safety and regularity of flight in civil aviation,

resolves to invite ITU-R

to conduct studies on, and develop in one or more ITU-R Recommendations, a methodology, including clear definitions of input parameters and assumptions to be used, to calculate spectrum requirements within the frequency bands 1 545-1 555 MHz (space-to-Earth) and 1 646.5-1 656.5 MHz (Earth-to-space) for AMS(R)S communications related to the priority categories 1 to 6 of Article 44, and to take into account *considering b)* in conducting these studies,

invites

ICAO, the International Air Transport Association (IATA), administrations and other concerned organizations to participate in the studies identified in *resolves* above,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO.

RESOLUTION 424 (REV.WRC-23)

**Use of Wireless Avionics Intra-Communications in the
frequency band 4 200-4 400 MHz**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that aircraft are designed to enhance their efficiency, reliability and safety, as well as to be more environmentally friendly;
- b)* that Wireless Avionics Intra-Communications (WAIC) systems provide radiocommunications between two or more aircraft stations integrated into or installed on a single aircraft, supporting the safe operation of the aircraft;
- c)* that WAIC systems do not provide radiocommunications between an aircraft and the ground, another aircraft or a satellite;
- d)* that WAIC systems operate in a manner that ensures the safe operation of an aircraft;
- e)* that WAIC systems operate during all phases of flight, including on the ground;
- f)* that aircraft equipped with WAIC systems operate globally;
- g)* that WAIC systems operating inside an aircraft receive the benefits of fuselage attenuation to facilitate sharing with other services;
- h)* that Recommendation ITU-R M.2067 provides technical characteristics and operational objectives for WAIC systems,

recognizing

that Annex 10 to the International Civil Aviation Organization (ICAO) Convention on International Civil Aviation contains Standards and Recommended Practices (SARPs) for safety aeronautical radionavigation and radiocommunication systems used by international civil aviation,

resolves

- 1 that WAIC is defined as radiocommunication between two or more aircraft stations located on board a single aircraft, supporting the safe operation of the aircraft;
- 2 that WAIC systems operating in the frequency band 4 200-4 400 MHz shall not cause harmful interference to, nor claim protection from, systems of the aeronautical radionavigation service operating in this frequency band;

RES424-2

3 that WAIC systems operating in the frequency band 4 200-4 400 MHz shall comply with the Standards and Recommended Practices published in Annex 10 to the Convention on International Civil Aviation;

4 that No. **43.1** shall not apply for WAIC systems,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO,

invites the International Civil Aviation Organization

to take into account the most recent version of Recommendation ITU-R M.2085 in the course of development of SARPs for WAIC systems.

RESOLUTION 425 (REV.WRC-19)

Use of the frequency band 1 087.7-1 092.3 MHz by the aeronautical mobile-satellite (R) service (Earth-to-space) to facilitate global flight tracking for civil aviation

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that Resolution 185 (Busan, 2014) of the Plenipotentiary Conference instructed WRC-15, pursuant to No. 119 of the ITU Convention, to include in its agenda, as a matter of urgency, the consideration of global flight tracking, including, if appropriate, and consistent with ITU practices, various aspects of the matter, taking into account ITU Radiocommunication Sector (ITU-R) studies;
- b)* that the frequency band 960-1 164 MHz is allocated to the aeronautical radionavigation service and the aeronautical mobile (R) service;
- c)* that the frequency band 960-1 164 MHz is used by International Civil Aviation Organization (ICAO) standardized and non-ICAO systems, thus creating a complex interference environment;
- d)* that Automatic Dependent Surveillance-Broadcast (ADS-B) is defined by ICAO, and involves aircraft transmission of data such as identification and position;
- e)* that the frequency band 1 087.7-1 092.3 MHz is currently utilized for terrestrial transmission and reception of ADS-B signals in accordance with ICAO standards, involving transmissions from aircraft to terrestrial stations on the ground within line-of-sight;
- f)* that WRC-15 allocated the frequency band 1 087.7-1 092.3 MHz to the aeronautical mobile-satellite (R) service (AMS(R)S) in the Earth-to-space direction, limited to the space station reception of ADS-B emissions from aircraft transmitters that operate in accordance with recognized international aeronautical standards;
- g)* that the allocation of the frequency band 1 087.7-1 092.3 MHz to the AMS(R)S is to extend reception of currently transmitted ADS-B signals beyond terrestrial line-of-sight, to facilitate reporting the position of ADS-B equipped aircraft located anywhere in the world;
- h)* that, taking into account *considering c)*, use of the frequency band 1 087.7-1 092.3 MHz requires some administrations to control all users to ensure proper operation of all terrestrial systems,

recognizing

- a)* that ICAO develops standards and recommended practices (SARPs) for systems enabling position determination and tracking of aircraft;
- b)* that Annex 10 to the Convention on International Civil Aviation contains SARPs for terrestrial ADS-B usage of the frequency band 1 087.7-1 092.3 MHz,

noting

a) that the development of performance criteria for space station reception of ADS-B operating under the provisions of No. **5.328AA**, including whether such criteria would require modifications to ICAO standard ADS-B equipment, is the responsibility of ICAO;

b) that Report ITU-R M.2396 provides information on use of mobile-satellite systems for flight tracking, including through reception of ADS-B in the frequency band 1 087.7-1 092.3 MHz,

resolves

1 that the use of the frequency band 1 087.7-1 092.3 MHz by AMS(R)S systems shall be in accordance with recognized international aeronautical standards;

2 that AMS(R)S systems (Earth-to-space) in the frequency band 1 087.7-1 092.3 MHz shall be designed so that they can operate in the interference environment as described in *considering c*);

3 that, taking into account *resolves 2*, AMS(R)S use of the frequency band 1 087.7-1 092.3 MHz shall not constrain administrations which have responsibilities as referred to in *considering h*),

instructs the Secretary-General

to bring this Resolution to the attention of ICAO.

RESOLUTION 506 (REV.WRC-97)

Use by space stations in the broadcasting-satellite service operating in the 12 GHz frequency bands allocated to the broadcasting-satellite service of the geostationary-satellite orbit and no other

The World Radiocommunication Conference (Geneva, 1997),

considering

- a)* that a Plan designating frequency assignments in the above-mentioned frequency bands and positions in the geostationary-satellite orbit was adopted by WARC SAT-77 for Regions 1 and 3;
- b)* that a similar Plan for Region 2 was adopted by the Regional Administrative Conference for the Planning of the Broadcasting-Satellite Service in Region 2 (Geneva, 1983);
- c)* that the Plans referred to in *considering a)* and *b)* above were consolidated in Appendix **30** at WARC Orb-85;
- d)* that the Plans in Appendices **30** and **30A** for Regions 1 and 3 have been modified by this Conference;
- e)* that the operation of the broadcasting-satellite service in the frequency bands concerned in orbits other than the geostationary-satellite orbit might be incompatible with the Plans referred to in *considering a), b)* and *d)* above,

resolves

that administrations shall ensure that their space stations in the broadcasting-satellite service in these frequency bands are operated in the geostationary-satellite orbit and no other.

RESOLUTION 507 (REV.WRC-19)

**Establishment of agreements and associated plans for
the broadcasting-satellite service¹**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that it is important to make the best possible use of the geostationary-satellite orbit (GSO) and of the frequency bands allocated to the broadcasting-satellite service (BSS);
- b)* that the great number of receiving installations using such directional antennas as could be set up for a BSS may be an obstacle to changing the location of space stations in that service on the GSO, as of the date of their being brought into use;
- c)* that satellite broadcasts may create harmful interference over a large area of the Earth's surface;
- d)* that the other services with allocations in the same frequency band need to use the frequency band before the BSS is set up,

resolves

1 that stations in the BSS shall be established and operated in accordance with agreements and associated plans adopted by world (WRCs) or regional (RRCs) radiocommunication conferences, as the case may be, in which all the administrations concerned and the administrations whose services are liable to be affected may participate;

2 that, during the period before the entry into force of such agreements and associated plans, the administrations and the Radiocommunication Bureau shall apply the procedure contained in Articles 9 to 14,

invites the ITU Council

to keep under review the question of WRCs, and/or RRCs, as required, with a view to fixing suitable dates, places and agendas.

¹ This Resolution does not apply to the frequency band 21.4-22 GHz.

RESOLUTION 517 (REV.WRC-19)

Introduction of digitally modulated emissions in the high-frequency bands between 3 200 kHz and 26 100 kHz allocated to the broadcasting service

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that digital techniques are being introduced into many existing services;
- b) that digital techniques allow more effective utilization of the frequency spectrum than double-sideband (DSB) techniques;
- c) that digital techniques enable reception quality to be improved;
- d) the relevant parts of Appendix 11 concerning the digital system specification in the high-frequency (HF) broadcasting services;
- e) that the ITU Radiocommunication Sector (ITU-R), in its Recommendation ITU-R BS.1514, has recommended system characteristics for digital sound broadcasts in the broadcasting frequency bands below 30 MHz;
- f) that digital modulation techniques are expected to provide the means to achieve the optimum balance between sound quality, circuit reliability and bandwidth;
- g) that digitally modulated emissions can, in general, provide more efficient coverage than amplitude-modulated transmissions by using fewer simultaneous frequencies and less power;
- h) that it may be economically attractive, using current technology, to convert modern conventional DSB broadcasting systems to digital operation in accordance with *considering d*);
- i) that some DSB transmitters have been used with digital modulation techniques without transmitter modifications;
- j) that ITU-R is carrying out further studies on the development of broadcasting using digitally modulated emissions in the frequency bands allocated to the broadcasting service below 30 MHz;
- k) that a long period could be needed for the introduction of digital broadcasting, taking into account the cost impact of replacement of transmitters and receivers,

resolves

- 1 that the early introduction of digitally modulated emissions as recommended by ITU-R in the HF bands between 3 200 kHz and 26 100 kHz allocated to the broadcasting service is to be encouraged;
- 2 that digitally modulated emissions shall comply with the characteristics specified in the relevant parts of Appendix 11;

3 that whenever an administration replaces a DSB emission by an emission using digital modulation techniques, it shall ensure that the level of interference is not greater than that caused by the original DSB emission, and shall use the RF protection values specified in Resolution **543 (Rev.WRC-19)**;

4 that the continued use of DSB emissions may be reviewed by a future competent world radiocommunication conference (WRCs) based on administrations' experience with the introduction of digital HF broadcasting services,

instructs the Director of the Radiocommunication Bureau

to compile and provide to the future competent WRC referred to in *resolves* 4 the latest available complete statistics on the worldwide distribution of digital HF broadcasting receivers and transmitters,

invites the ITU Radiocommunication Sector

to continue its studies on digital techniques in HF broadcasting with a view to assisting in the development of this technology for future use,

invites administrations

to encourage the inclusion in all new HF broadcasting transmitters put into service after 1 January 2004 of the capability to offer digital modulation,

further invites administrations

1 to assist the Director of the Radiocommunication Bureau by providing the relevant statistical data and to participate in ITU-R studies on matters relating to the development and introduction of digitally modulated emissions in the HF bands between 3 200 kHz and 26 100 kHz allocated to the broadcasting service;

2 to bring to the notice of transmitter and receiver manufacturers the recent results of relevant ITU-R studies on spectrum-efficient modulation techniques suitable for use at HF as well as the information referred to in *considering d)* and *e)*, and encourage the availability of affordable low-cost digital receivers.

RESOLUTION 526 (REV.WRC-12)

Future adoption of procedures to ensure flexibility in the use of the frequency band allocated to the broadcasting-satellite service (BSS) for wide RF-band high-definition television (HDTV) and to the associated feeder links

The World Radiocommunication Conference (Geneva, 2012),

considering

- a)* that WARC-92 has added an allocation to the BSS in the band 17.3-17.8 GHz in Region 2 for use by wide RF-band HDTV;
- b)* that in the longer term regulatory provisions designed to ensure flexible and equitable use of the BSS (HDTV) and associated feeder-link allocations will be necessary,

resolves to invite ITU-R

to study the development of future regulatory provisions for BSS (HDTV) to ensure flexibility in the use of the band 17.3-17.8 GHz in Region 2, having regard to the interests of all countries and the state of technical development of this new service,

instructs the Secretary-General

to bring this Resolution to the attention of the Council with a view to placing an appropriate item on the agenda of a future world radiocommunication conference.

RESOLUTION 528 (REV.WRC-19)

Introduction of broadcasting-satellite service (sound) systems and complementary terrestrial broadcasting in the frequency bands allocated to these services within the frequency range 1-3 GHz

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that WARC-92 made frequency allocations to the broadcasting-satellite service (BSS) (sound) and complementary terrestrial broadcasting;
- b)* that it is necessary to ensure that the introduction of the BSS (sound) and complementary terrestrial broadcasting proceeds in a flexible and equitable manner;
- c)* that efficient use of the spectrum will be enhanced by a worldwide allocation;
- d)* that a worldwide allocation may cause difficulties to some countries in relation to their existing services;
- e)* that future planning may limit the effect on other services,

resolves

- 1 that a competent conference should be convened for the planning of the BSS (sound) in the frequency bands allocated to this service in the frequency range 1-3 GHz and the development of procedures for the coordinated use of complementary terrestrial broadcasting;
- 2 that that conference should review criteria for sharing with other services;
- 3 that, in the interim period, broadcasting-satellite systems may only be introduced within the upper 25 MHz of the appropriate frequency band in accordance with the procedures contained in Articles 9 to 14, as appropriate; the complementary terrestrial service may be introduced during this interim period subject to coordination with administrations whose services may be affected;
- 4 that the calculation methods and the interference criteria to be employed in evaluating the interference should be based upon relevant ITU-R Recommendations agreed by the administrations concerned as a result of Resolution 703 (Rev.WRC-07) or otherwise,

invites the ITU Radiocommunication Sector

to conduct the necessary studies prior to the conference,

instructs the Secretary-General

to bring this Resolution to the attention of the ITU Council to consider including in the agenda of a radiocommunication conference the matters addressed above.

RESOLUTION 535 (REV.WRC-23)

Information needed for the application of Article 12 of the Radio Regulations

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that WRC-97 adopted Article **12** as a simple and flexible seasonal planning procedure for high-frequency broadcasting (HFBC) based on coordination;
- b)* that, for the purpose of the application of Article **12**, the Radiocommunication Bureau developed the software of which administrations were informed through circular letters,

resolves to instruct the Director of the Radiocommunication Bureau

to consider improvements to the established arrangements for the preparation, publication and dissemination of the information relating to the application of Article **12**, in consultation with administrations and regional coordination groups,

invites administrations

to submit their schedules in a common electronic format,

instructs the Secretary-General

to consider provision of the necessary funding to enable developing countries to participate fully in the application of Article **12** and relevant radiocommunication seminars.

ANNEX TO RESOLUTION 535 (REV.WRC-23)

This Annex responds to the need for information in the application of Article **12**; the flowchart in Description 2 provides an overview of the Procedure.

Software modules**Data capture of requirements**

A new module will be required that permits the capture of all data elements detailed in Description 3. This module should also contain validation routines that prevent inconsistent data being captured and sent to the Radiocommunication Bureau for processing.

Propagation calculation

This new module should calculate the field strength and other necessary data at all relevant test points as described in Descriptions 1 and 4.

It should also include an option that allows administrations to select the optimum frequency bands for their requirements.

The output format of the data and the medium should be such as to allow easy publication and distribution of the results to all administrations.

The results of these calculations should be displayable in a graphical format.

Compatibility analysis

This module should use the output of the propagation calculation to provide a technical analysis of a requirement both alone and in the presence of other requirements as in Description 4. This analysis would be used in the coordination process.

The values for the parameters given in Description 4 should be user selectable, but in the absence of other values the recommended default values should be used.

The results of this analysis should be capable of being displayed in a graphical format for a defined service area as in Description 4.

Data query

This module should enable the user to perform typical data query functions.

DESCRIPTION 1

Selection of suitable frequency band(s)

General

In order to assist broadcasters and administrations in the preparation of their HF broadcasting requirements, the Bureau will prepare and distribute suitable computer software. This should be easy to use and the output should be easy to understand.

User input data

The user should be able to enter:

- the name of the transmitting station (for reference purposes);
- the geographic coordinates of the transmitting station;
- the transmitter power;
- the frequency bands which are available for use;
- hours of transmission;
- sunspot number;
- months during which a service is required;
- the available antenna types, together with the relevant directions of maximum radiation;
- the required coverage area specified as a set of CIRAF zones and quadrants (or by means of relevant geographic information).

It is desirable that the software should be able to store the above information, once it has been entered correctly, and provide the user with an easy means of recalling any previously entered information.

Methodology and data

The software should use:

- Recommendation ITU-R BS.705 for the calculation of antenna patterns;
- Recommendation ITU-R P.533 for the prediction of wanted field-strength values;
- Recommendation ITU-R P.842 for the calculation of reliability values.

The set of 911 test points (agreed at WARC HFBC-87) should be used, supplemented where necessary with test points based on a geographic grid.

The software should calculate the field-strength values and the fading margins at each test point inside the required service area for each of the frequency bands declared to be available, taking account of the relevant transmitting antenna characteristics for each frequency band. The desired RF signal-to-noise ratio should be user selectable with a default value of 34 dB in the case of double sideband (DSB) or as provided in the most recent version of Recommendation ITU-R BS.1615, as appropriate, in the case of digital emissions.

The dates for which calculations are made should be user selectable, the default values being:

- 0.5 month after the start of the season;
- mid-point of the season;
- 0.5 month before the end of the season.

The times for which calculations are made should be user selectable, the default values being:

- 30 min past the hour in which the requirement starts;
- 30 min past each successive hour until the hour in which the requirement stops.

Software output data

For rapid assessment of suitable frequency bands, the software should calculate:

- the basic service reliability for each available frequency band and for the relevant test points from the set of 911 test points;
- the basic area reliability for each available frequency band and for the relevant test points from the set of 911 test points.

In order to provide information about the geographic distribution of wanted signal values within the required service area, additional results should be available from the software:

- a listing should be available giving, for each of the available frequency bands, the basic circuit reliability (BCR) for each of the test points (from the set of 911 test points) inside the required service area.

In some cases, a graphical display of the BCR values throughout the required service area may be desirable. These values should be calculated at test points at 2° intervals of latitude and longitude throughout the required service area.

The BCR values should be displayed graphically as a set of coloured or hatched “pixels” scaled in steps of 10%. It should be noted that:

- reliability values relate to the use of a single frequency band;
- reliability values are a function of the desired RF signal-to-noise ratio (user selectable);
- the field-strength values should be calculated by the supplied software on the user’s own computer hardware. The software supplied should calculate the relevant reliability values based on these field-strength values and the user-supplied desired RF signal-to-noise values.

DESCRIPTION 2

Time sequence for the Procedure

In the sequence outlined below, the start date for a given schedule period is defined as D and the end date for the same schedule period is defined as E.

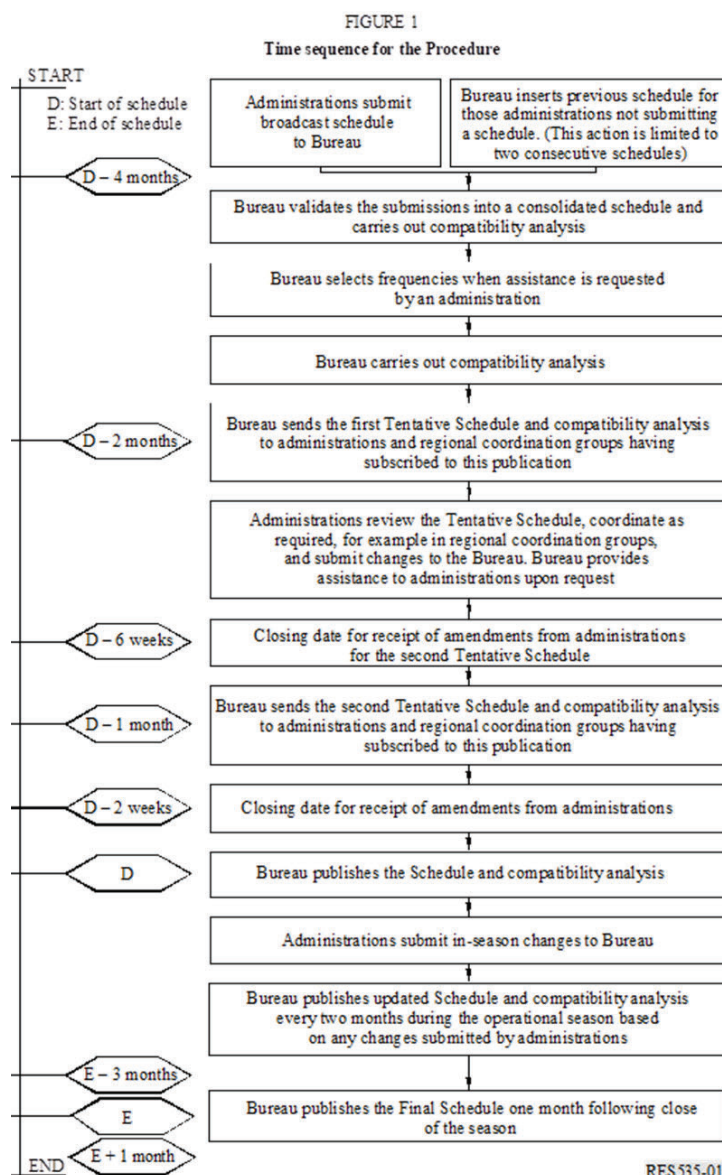
Date	Action
D – 4 months	Closing date for administrations to send their schedules ¹ to the Radiocommunication Bureau (Bureau), preferably by electronic means. Schedule data will be made available via TIES as soon as it has been processed.
D – 2 months	Bureau to send to administrations a consolidated schedule (the first Tentative Schedule) together with a complete compatibility analysis ² .
D – 6 weeks	Closing date for receipt of amendments from administrations to correct errors and other changes resulting from the coordination process to ensure that this information appears in the second Tentative Schedule for D – 1 month.
D – 1 month	Bureau to send to administrations a consolidated schedule (the second Tentative Schedule) together with a complete compatibility analysis ² .
D – 2 weeks	Closing date for receipt of amendments from administrations to correct errors and other changes resulting from the coordination process to ensure that this information appears in the Schedule for date D.
D	Bureau to issue the High Frequency Broadcasting Schedule and compatibility analysis.

¹ See Description 3.

² See Description 4. The schedules and the results of the analyses should be available on CD-ROM and in TIES.

Date	Action
D to E – 3 months	Administrations to correct errors and coordinate in-season changes of requirements, sending information to the Bureau as it becomes available. Bureau to issue updates of the Schedule and compatibility analysis at intervals of two months.
E	Closing date for receipt of final operational schedules from administrations to Bureau. No input is needed if there have been no changes to the information previously sent.
E + 1 month	Bureau to send to administrations the final consolidated schedule (the Final Schedule) together with a compatibility analysis.

Figure 1 shows, in flow chart form, the time sequence for the Procedure.



DESCRIPTION 3

Specification of input data for a requirement

The fields needed for a given requirement and their specifications are:

- frequency in kHz, up to 5-digit integer;
- start time, as 4-digit integer;
- stop time, as 4-digit integer;
- target service area, as a set of up to 12 CIRAF zones and quadrants up to a maximum of 30 characters;
- site code, a 3-character code from a list of codes, or a site name and its geographic coordinates;
- power in kW, up to 4-digit integer;
- azimuth of maximum radiation;
- slew angle, up to 2-digit integer representing the difference between the azimuth of maximum radiation and the direction of unslewed radiation;
- antenna code, up to 3-digit integer from a list of values, or a full antenna description, as given in Recommendation ITU-R BS.705;
- days of operation;
- start date, in the case that the requirement starts after the start of the schedule;
- stop date, in the case that the requirement stops before the end of the schedule;
- modulation choice, to specify if the requirement is to use DSB, single-side band (SSB) or digital emission (for the latter, see Recommendation ITU-R BS.1514). This field may be used to identify any other type of modulation when this has been defined for use by HFBC in an ITU-R Recommendation;
- administration code;
- broadcasting organization code;
- identification number;
- identification of synchronization with other requirements.

DESCRIPTION 4

Compatibility analysis**General**

In order to assess the performance of each requirement in the presence of noise and of the potential interference from other requirements using the same or adjacent channels, it is necessary to calculate the relevant reliability values. To this end, the Bureau will prepare suitable software, taking account of user requirements in terms of desired signal-to-noise and signal-to-interference ratios.

Input data

The schedule for a given season – this may be either an initial consolidated schedule (to permit assessment of those requirements which need coordination) or the High Frequency Broadcasting Schedule (to permit assessment of the likely performance of requirements during the relevant season).

Methodology and data

The software should use:

- Recommendation ITU-R BS.705 for the calculation of antenna patterns;
- Recommendation ITU-R P.533 for the prediction of the wanted field-strength values at each test point for each wanted requirement;
- Recommendation ITU-R P.533 for the prediction of the potentially interfering field-strength values from all other co-channel or adjacent channel requirements at each test point for each wanted requirement;
- Recommendation ITU-R BS.560 for adjacent channel RF protection ratios;
- Recommendation ITU-R P.842 for the calculation of reliability values.

The set of 911 test points (agreed at WARC HFBC-87) should be used, supplemented where necessary with test points based on a geographic grid.

The software should calculate the wanted and unwanted field-strength values and the fading margins at each test point inside the required service area.

The desired RF signal-to-noise and RF protection ratios should be user selectable, the default values being 34 dB and 17 dB (DSB-to-DSB co-channel case), respectively. In the case of digital emissions, the desired RF signal-to-noise ratios are as provided in the most recent version of Recommendation ITU-R BS.1615. The default values of RF protection ratio to be used by the Bureau for its compatibility analyses are given in Section 1 of the Annex to Resolution **543 (Rev.WRC-19)**.

The dates for which a compatibility analysis is made should be user selectable, the default values being:

- 0.5 month after the start of the season;

- mid-point of the season;
- 0.5 month before the end of the season.

These default values should be used by the Bureau for its compatibility analyses.

The times for which a compatibility analysis is made should be user selectable, the default values being:

- 30 min past the hour in which the requirement starts;
- 30 min past each successive hour until the hour in which the requirement ends.

These default values should be used by the Bureau for its compatibility analyses.

Software output data

For rapid assessment of the performance of a requirement, the software should calculate:

- the overall service reliability for the relevant test points from the set of 911 test points;
- the overall area reliability for the relevant test points from the set of 911 test points.

In order to provide information about the geographic distribution of wanted and unwanted signal values for a given requirement, additional results should be available from the software:

- a listing should be available giving the overall circuit reliability for each of the relevant test points from the set of 911 test points.

In some cases, a graphical display of the coverage achieved throughout a required service area may be desirable. These values will need to be calculated by the user (with the supplied software and on the user's own computer hardware) at test points at 2° intervals of latitude and longitude throughout the required service area. The values should be displayed graphically as a set of coloured or hatched pixels in steps of 10%. It should be noted that:

- reliability values relate to the use of a single frequency;
- reliability values are a function of the desired RF signal-to-noise and RF protection ratios (both user selectable);
- the field-strength values for the test points (from the set of 911 test points) inside the required service area should be calculated by the Bureau. The software supplied should calculate the relevant reliability values based on these pre-calculated field-strength values and the user-supplied desired signal-to-noise and signal-to-interference values;
- the field-strength values for the test points at 2° intervals should be calculated using the supplied software on the user's own computer hardware. The software supplied should calculate the relevant reliability values based on these field-strength values and the user-supplied desired signal-to-noise and signal-to-interference values.

RESOLUTION 536 (WRC-97)

Operation of broadcasting satellites serving other countries

The World Radiocommunication Conference (Geneva, 1997),

considering

- a) the institutional nature of the ITU which is founded on an agreement between its Member States;
- b) the treaty status of the Plans in Appendices **30** and **30A**;
- c) that these Plans were established on the basis of planning principles which included, *inter alia*, that the Plans should be based mainly on national coverage;
- d) the increasing number of applications under Article 4 of Appendices **30** and **30A** for modifications to the Plans, leading to many multinational systems;
- e) that No. **23.13** requires that “In devising the characteristics of a space station in the broadcasting-satellite service, all technical means available shall be used to reduce, to the maximum, the radiation over the territory of other countries unless an agreement has been previously reached with such countries”,

recognizing

- a) that current technology provides opportunities to implement broadcasting-satellite systems with service areas that exceed national coverage;
- b) that several such systems have been implemented and others are being planned;
- c) that successful Appendices **30** and **30A** Article 4 coordination of such systems does not in any way imply licensing authorization to provide a service within the territory of a Member States,

resolves

that, in addition to observing No. **23.13**, and before providing satellite broadcasting services to other administrations, administrations originating the services should obtain the agreement of those other administrations.

RESOLUTION 539 (REV.WRC-19)

**Use of the frequency band 2 605-2 655 MHz in certain Region 3 countries
by non-geostationary-satellite systems in the
broadcasting-satellite service (sound)**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that the frequency band 2 535-2 655 MHz is allocated under No. **5.418** to the broadcasting-satellite service (BSS) (sound) in certain Region 3 countries;
- b) that the provisions of Resolution **528 (Rev.WRC-19)** currently limit the use of this frequency band by systems in the BSS (sound) to the upper 25 MHz of the frequency band;
- c) that, prior to WRC-2000, there were no coordination procedures applicable to non-geostationary (non-GSO) BSS (sound) systems in this frequency band in relation to other non-GSO or GSO networks;
- d) that satellite technology has now advanced to the stage where non-GSO systems in the BSS (sound) are technically and economically feasible when operated with high elevation angles and that there are practical designs available to ensure that the radiation of the non-GSO satellite in the BSS (sound) outside the main beam is kept at low levels;
- e) that satellite systems in the BSS as described in *considering d)* can be used for the delivery of high-quality, spectrally efficient BSS (sound) to portable and mobile terminals;
- f) that non-GSO systems in the BSS (sound) in the frequency band 2 630-2 655 MHz in Region 3 have been notified to ITU and are expected to be brought into use in the near future;
- g) that, prior to WRC-2000, the protection of existing terrestrial services was addressed through the coordination procedures of No. **9.11**;
- h) that the provision cited in *considering g)* may be inadequate to ensure the future deployment of terrestrial services in this frequency band;
- i) that a regulatory procedure is required in order to meet the dual objectives of providing adequate long-term protection to existing and planned terrestrial services while not placing undue constraints on the development and implementation of non-GSO BSS (sound) systems;
- j) that there are non-GSO systems being planned for operation in the BSS (sound) in the frequency band 2 605-2 655 MHz in Region 3 that have highly elliptical orbits;
- k) that the ITU Radiocommunication Sector (ITU-R) has undertaken studies of the likely aggregate interference from a number of co-frequency broadcasting-satellite systems sharing with the terrestrial services on a co-primary basis;
- l) that ITU-R has undertaken studies that assumed there is only one satellite active at any time in a non-GSO system operating in a highly elliptical orbit,

invites

1 administrations planning to operate non-GSO BSS (sound) systems in accordance with this Resolution to take measures to design the system to minimize interference to terrestrial services outside the non-GSO BSS (sound) service area, for example as in *considering d)* above;

2 administrations whose territory is geographically close to the territory of an administration planning to operate a non-GSO BSS (sound) system in accordance with this Resolution, and for which there is a correspondingly high elevation angle to the active satellite, to take measures to facilitate the operation of non-GSO BSS (sound) systems,

resolves

1 that any BSS (sound) system using non-GSO orbits brought into operation in the frequency band 2 605-2 655 MHz in Region 3 shall be operated such that the minimum elevation angle over the service area is not less than 55°, for the purposes of sharing with terrestrial services;

2 that, before an administration notifies to the Radiocommunication Bureau (BR) or brings into use a frequency assignment for a BSS (sound) system using non-GSO satellites in the frequency band 2 630-2 655 MHz for which complete Appendix 4 coordination information or notification information has been received after 2 June 2000, and in the frequency band 2 605-2 630 MHz for which complete Appendix 4 coordination information or notification information has been received after 4 July 2003, the following regulatory arrangements shall apply:

The following mask of power flux-density (pfd) values at the Earth's surface produced by emissions from a space station for all conditions and for all methods of modulation shall be used as the basis of the regulatory procedures of this Resolution:

-130	dB(W/(m ² · MHz))	for	0° ≤ θ ≤ 5°
-130 + 0.4 (θ - 5)	dB(W/(m ² · MHz))	for	5° < θ ≤ 25°
-122	dB(W/(m ² · MHz))	for	25° < θ ≤ 45°
-122 + 0.2 (θ - 45)	dB(W/(m ² · MHz))	for	45° < θ ≤ 65°
-118 + 0.09 (θ - 65)	dB(W/(m ² · MHz))	for	65° < θ ≤ 76°
-117	dB(W/(m ² · MHz))	for	76° < θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees.

These values relate to the pfd and angles of arrival which would be obtained under free-space propagation conditions.

Furthermore:

- for angles of arrival of less than 76° in the pfd mask above, if the limits are exceeded, the notifying administration shall obtain explicit agreement from any administration identified by BR in its examination below;
- for angles of arrival from 76° to 90° in the pfd mask above, the coordination procedure with respect to those administrations identified by BR in its examination below will be that of No. 9.11;

3 that systems in the BSS (sound) using non-GSO satellites shall be limited to national services unless agreement has been reached to include the territories of other administrations in the service area;

4 that, within the context of this Resolution, an administration listed in No. **5.418** shall not have simultaneously two overlapping frequency assignments, one under that provision, and the other one under No. **5.416**;

5 that, as from 5 July 2003, BR and administrations shall apply the provisions of Articles **9** and **11** taking into account Nos. **5.418**, **5.418A**, **5.418B**, **5.418C** and this Resolution, as revised by WRC-03,

instructs the Radiocommunication Bureau

1 when applying *resolves* 2, to use the pfd mask in *resolves* 2; and

- for angles of arrival of less than 76°, identify the affected administrations which have a primary allocation to terrestrial services in the same frequency band and on whose territory the pfd is exceeded, and inform both the notifying and the affected administrations; at the notification stage, the lack of any necessary agreement is considered as non-conformity with No. **11.31**;
- for angles of arrival from 76° to 90°, identify the affected administrations which have a primary allocation to terrestrial services in the same frequency band and on whose territory the pfd is exceeded; and inform both the notifying and the affected administrations; at the notification stage, each notice shall be examined in the application of No. **11.32** and, if appropriate, under No. **11.32A** with respect to the probability of harmful interference that may be caused to assignments for which coordination could not be successfully completed;

2 as from 5 July 2003, to apply *resolves* 5 in its examination of requests for coordination and notifications for any BSS (sound) systems using non-GSO satellites in the frequency band 2 630-2 655 MHz for which complete Appendix 4 coordination information or notification information has been received after 2 June 2000.

RESOLUTION 543 (REV.WRC-19)

Provisional RF protection ratio values for analogue and digitally modulated emissions in the high-frequency broadcasting service

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that this conference has resolved to encourage the introduction of digitally modulated emissions in the high-frequency (HF) broadcasting bands allocated to the broadcasting service and has revised Resolution **517** accordingly;
- b)* that the current use of the spectrum is based on the use of double-sideband (DSB) emissions;
- c)* that Appendix **11** gives details of the system parameters and the emission characteristics of the digitally modulated emissions;
- d)* that the ITU Radiocommunication Sector (ITU-R) is carrying out further studies on the development of HF broadcasting using digitally modulated emissions in the frequency bands allocated to the broadcasting service below 30 MHz;
- e)* that RF co-channel and adjacent channel protection ratios are among the fundamental parameters when determining compatibility;
- f)* that the currently available values of RF protection ratios may need to be updated in the light of future ITU-R studies;
- g)* that Annex 1 to Recommendation ITU-R BS.1514 describes a digital system suitable for broadcasting in the frequency bands below 30 MHz;
- h)* that there is a need to compile and maintain statistics on administrations' capability to introduce digital modulation systems for their HF broadcasting services,

resolves

- 1 that digital modulation in accordance with Resolution **517 (Rev.WRC-19)** may be used in any of the HF bands allocated to the broadcasting service; this accommodation has to be made with the appropriate amounts of protection given to both analogue and digital emissions as described in the Annex to this Resolution;
- 2 that the protection ratio values described in the Annex be used in the coordination process under Article **12** on a provisional basis;
- 3 to invite a future competent conference to revise these provisional protection ratio values, as appropriate,

invites the ITU Radiocommunication Sector

to continue studies on digital techniques in HF broadcasting with the purpose of revising the RF protection ratio values for analogue and digitally modulated emissions in the HF broadcasting service as described in the Annex to this Resolution.

ANNEX TO RESOLUTION 543 (REV.WRC-19)

Section 1 – Standard RF protection ratio values

RF protection ratio values to be used for seasonal planning under the provisions of Article 12 are contained in Table 1 in this Section.

The values are consistent with those in Recommendation ITU-R BS.1615.

The characteristics of the digital emission are based on the 64-QAM modulation system, protection level No. 1, robustness mode B, spectrum occupancy type 3 (as contained in Recommendation ITU-R BS.1514), which will be used extensively for HF sky-wave broadcasting in 10 kHz channels.

The characteristics of the analogue emission are based on double-sideband modulation as summarized in Part A of Appendix 11, with 53% modulation depth.

TABLE 1

Relative RF protection ratios (dB) associated with digitally modulated emissions
in the HF bands allocated to the broadcasting service

Wanted signal	Unwanted signal	Frequency separation $f_{unwanted} - f_{wanted}$ (kHz)								
		–20	–15	–10	–5	0	5	10	15	20
Amplitude modulation	Digital	–47	–42	–32	3	6	3	–32	–42	–47
Digital	Amplitude modulation	–54	–48	–40	–3	0	–3	–40	–48	–54
Digital	Digital	–53	–47	–38	–3	0	–3	–38	–47	–53

In the case of an amplitude modulation (AM) signal interfered with by a digital signal, the protection ratios are determined by adding 17 dB (audio-frequency protection ratio) to the relative RF protection ratios in Table 1.

In the case of a digital signal interfered with by an AM signal, the protection ratios are determined by adding 7 dB (signal-to-interference ratio for a bit error ratio (BER) of 10^{-4}) to the relative RF protection ratios in Table 1.

In the case of a digital signal interfered with by a digital signal, the protection ratios are determined by adding 16 dB (signal-to-interference ratio for a BER of 10^{-4}) to the RF relative protection ratios in Table 1.

Section 2 – Correction values of RF protection ratios

Correction values of RF protection ratios for different wanted signal conditions such as AM modulation depths, AM quality grades and digital modulation modes are provided in this Section.

1 AM modulation depth

RF protection ratios for a wanted AM signal interfered with by a digital signal depend on the AM modulation depth. A modulation depth of 53% is used as a default value in this Annex. If a different modulation depth is used, a correction value for RF protection ratio is required. Table 2 provides correction values for typical modulation depths.

TABLE 2

Correction values (dB) to be used for other AM modulation depths in respect of wanted AM signal

Modulation depth (%)	30	38	53	m
Correction value (dB)	5	3	0	$20 \log (53/m)$

2 AM audio quality

RF protection ratios for a wanted AM signal interfered with by a digital signal depend on the required audio quality grade. If another quality grade is used, correction values of RF protection ratios as in Table 3 shall be added.

TABLE 3

Correction values (dB) to be used for other audio quality grades in respect of wanted AM signal

Audio quality grade	3	3.5	4
Correction value (dB)	0	7	12

3 Digital modulation scheme, protection level number and robustness mode

RF protection ratios for a wanted digital signal interfered with by an analogue or digital signal depend on the digital modulation scheme and mode. If any combination different from the default value in Section 1 is used, correction values of RF protection ratios as in Table 4 shall be added.

TABLE 4

Correction values (dB) to be used for other combinations
of digital modulation scheme, protection level number and
robustness mode in respect of wanted digital signal

Modulation scheme	Protection level number	Robustness mode		
		B	C	D
16-QAM	0	-7	-6	-6
	1	-5	-4	-4
64-QAM	0	-1	-1	0
	1	0	0	1

NOTE – 10 kHz nominal bandwidth.

Protection levels Nos. 2 and 3 and robustness mode A are not recommended for use in HF and are therefore not described here.

Section 3 – Explanatory examples

- a) In Table 1, first row <AM interfered with by Digital>: with the AF protection ratio = 17 dB, all values of relative protection ratios entered in that row of the Table must be increased by 17 dB in order to determine the absolute value of the RF protection ratio (RF PR). As examples:
- For co-channel interference (0 kHz separation) the RF PR would be $6 + 17 = 23$ dB.
 - For adjacent channel interference (± 10 kHz separation) the RF PR would be $-32 + 17 = -15$ dB.
 - For the case of modulation depth = 38% and audio quality grade = 4, a correction factor of 15 dB ($= 3 + 12$) is added to the RF PR values described above.
- b) In Table 1, second row <Digital interfered with by AM>: all values of relative protection ratios entered in that row of the Table must be increased by 7 dB in order to determine the absolute value of the RF PR. As examples:
- For co-channel interference (0 kHz separation) the RF PR would be $0 + 7 = 7$ dB.
 - For adjacent channel interference (± 10 kHz separation) the RF PR would be $-40 + 7 = -33$ dB.
- c) In Table 1, third row <Digital interfered with by Digital>: all values of relative protection ratios entered in that row of the Table must be increased by 16 dB in order to determine the absolute value of the RF protection ratio. As examples:
- For co-channel interference (0 kHz separation) the RF PR would be $0 + 16 = 16$ dB.
 - For adjacent channel interference (± 10 kHz separation) the RF PR would be $-38 + 16 = -22$ dB.

RESOLUTION 548 (REV.WRC-12)

**Application of the grouping concept in Appendices 30 and 30A
in Regions 1 and 3¹**

The World Radiocommunication Conference (Geneva, 2012),

considering

- a) that the grouping concept as it is applied in Appendices **30** and **30A** with respect to Regions 1 and 3 was considered by WRC-03;
- b) that the protection of assignments in the Plan and the List in Appendices **30** and **30A** is based upon an equivalent protection margin criterion;
- c) that concerns have been raised that the use of the grouping concept by one administration may reduce access to spectrum resources by others;
- d) that coordination of one network² in a group shall not lead to a reduction of coordination requirements for other networks in the same group;
- e) that WRC-2000 accepted grouping in the Regions 1 and 3 List for some networks which are separated by up to 0.2° in the geostationary arc according to their respective nominal orbital locations,

noting

- a) that the 2002 Conference Preparatory Meeting considered a proposed solution in which there is a limit to the number of assignments in a group or number of groups in one orbital location;
- b) that the Radio Regulations Board has developed Rules of Procedure with respect to the application of the grouping concept,

resolves

- 1 that a grouping of networks with an overall separation of not more than 0.4° in the geostationary arc, in accordance with their respective nominal orbital locations, is regarded as a grouping at the same orbital location;
- 2 that the limitations referred to in *resolves* 4 do not apply to grouping of networks before the inclusion of the assignments in the List;
- 3 that the limitations in *resolves* 4 do not apply to grouping within one network;

¹ It is noted that the application of the grouping concept in Region 2 does not require any change. Therefore, the Radiocommunication Bureau shall continue to apply the grouping concept in Region 2 as it has applied it prior to WRC-03.

² In the application of this Resolution, a network is understood as being a submission by one administration, or one administration acting on behalf of a group of administrations, to the Bureau of a set of assignments, received on the same date, with the same name for the satellite network and at the same orbital location.

4 that under Appendices **30** and **30A** in Regions 1 and 3 the following principles with respect to the application of the grouping concept between networks at the same orbital location shall apply:

- a) these limitations apply for networks with overlapping frequency bands;
- b) for networks for which a submission is received by the Bureau under § 4.1.3 of Appendix **30** or **30A** after 4 July 2003, not more than three networks within the same overlapping frequency bandwidth can be in a group in the List;
- c) for networks for which a submission was received by the Bureau under § 4.1.3 of Appendix **30** or **30A** before 5 July 2003, not more than five networks within the same overlapping frequency bandwidth can be in a group in the List;
- d) if the number of networks in a group in the List reaches the maximum limit specified above, no new networks can be entered into the List in this group without removal of another overlapping part of a network from the List;

5 that, as from 5 July 2003, in the processing and publication by the Bureau of submissions relating to Regions 1 and 3 under Article 4 of Appendix **30** or **30A** received after 2 June 2000 and the identification of affected administrations in accordance with § 4.1.5, each network in a group is examined separately, without taking into account the other networks in the group³.

³ In applying § 4.1.11, the application of the new methodology in this *resolves* to networks received before 3 June 2000 shall not result in additional coordination requirements for those networks.

RESOLUTION 550 (REV.WRC-19)

Information relating to the high-frequency broadcasting service

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that this conference reviewed the case for relieving congestion in certain of the high-frequency (HF) bands allocated to the broadcasting service;
- b)* that this conference decided to maintain the present Table of Frequency Allocations in the HF bands, in view of the rapid development and use of the frequency bands by all services;
- c)* that, as part of a general transition away from analogue transmission systems, digital modulation is being introduced into the HF broadcasting bands;
- d)* that, in common with the other services using the HF bands, the broadcasting service has an ongoing need to review the effectiveness of its use of spectrum,

noting

that Resolution **517 (Rev.WRC-19)** deals with the introduction of digitally modulated emissions in the HF bands allocated to the broadcasting service,

noting further

that the ITU Radiocommunication Sector (ITU-R) has prepared a wide-ranging report, namely Report ITU-R BS.2105, on information relating to the HF broadcasting service,

resolves to invite the ITU Radiocommunication Sector

to continue studies on HF broadcasting, taking into account:

- technical and operational factors;
- digital transmissions, including how the introduction of these emissions will affect HF broadcasting requirements and operations,

invites administrations and Sector Members

to participate actively in the aforementioned studies by submitting contributions to ITU-R.

RESOLUTION 552 (REV.WRC-23)

**Long-term access to and development in the frequency band
21.4-22 GHz in Regions 1 and 3**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that WARC-92 allocated the frequency band 21.4-22 GHz in Regions 1 and 3 to the broadcasting-satellite service (BSS) to be implemented after 1 April 2007;
- b)* that the use of the frequency band since 1992 was subject to an interim procedure in accordance with Resolution **525 (WARC-92, Rev.WRC-03 and Rev.WRC-07)*, 1**;
- c)* that Article 44 of the ITU Constitution sets out the basic principles for the use of the radio-frequency spectrum and the geostationary-satellite (GSO) and other satellite orbits, taking into account the needs of developing countries;
- d)* that a due diligence process was first adopted by WRC-97 with a view to providing, as early as possible, information on the industrial project behind a satellite network submitted to ITU;
- e)* that providing information required under this due diligence process was a prerequisite to qualifying for a two-year extension of the regulatory period to bring into use a satellite network in non-planned bands;
- f)* that WRC-03 decided to remove the two-year extension by setting the regulatory period to bring into use a satellite network in non-planned bands at seven years;
- g)* that data concerning the manufacturer, launch service provider and launch date of a satellite will be more accurate and useful if submitted after the launch of the satellite,

resolves

- 1 that this Resolution applies to GSO networks in the BSS in the frequency band 21.4-22 GHz;
- 2 that, for frequency assignments to satellite networks as described in *resolves* 1 for which confirmation of the date of bringing into use under the provisions of Article **11** was not received by the Radiocommunication Bureau before 18 February 2012 or which were suspended under No. **11.49** at that date, the procedure contained in Annex 1 to this Resolution shall be applied at the time of first bringing into use or when resuming use after a suspension, as appropriate;

* *Note by the Secretariat:* This Resolution was abrogated by WRC-12.

1 Reference to Resolution **525 (WARC-92, Rev.WRC-03 and Rev.WRC-07)** is provided as background information.

3 that, for frequency assignments to satellite networks as described in *resolves* 1 for which confirmation of the date of bringing into use under the provisions of Article 11 was received by the Bureau before 18 February 2012, the provisions of §§ 5 to 8 of Annex 1 to this Resolution shall be applied, as appropriate,

further resolves

that the procedures in this Resolution are in addition to the provisions under Articles 9 and 11,

instructs the Director of the Radiocommunication Bureau

to include in his report to future competent world radiocommunication conferences the results of the implementation of this Resolution.

ANNEX 1 TO RESOLUTION 552 (REV.WRC-23)

1 Within 30 days after the actual commencement, or resumption, of use of the frequency assignments to a satellite network subject to these procedures, the notifying administration shall send to the Radiocommunication Bureau (BR) the information specified in Annex 2 to this Resolution.

2 The information to be submitted in accordance with § 1 above shall be signed by an authorized official of the notifying administration.

3 If the spacecraft is used for the first time under this Resolution, the due diligence information to be submitted in accordance with § 1 above could be supplemented by a copy of the contract with the launch service provider.

4 On receipt of the information under § 1 above, BR shall promptly examine its completeness. If the information is found to be complete, BR shall publish the complete information in a special section of its International Frequency Information Circular (BR IFIC) within two months. If the information is found to be incomplete, BR shall request the notifying administration to submit the missing information within 30 days.

5 The information submitted in accordance with § 1 above shall be updated and resubmitted to BR by the notifying administration not later than 30 days after the end of life or the relocation of the spacecraft associated with the submission under § 1 above. In the case of end of life of a spacecraft, the corresponding ITU ID number associated with such a spacecraft shall no longer be used.

6 On receipt of the information under § 5 above, BR shall promptly examine its completeness. If the information is found to be complete, BR shall publish the complete information in a special section of the BR IFIC within two months. If the information is found to be incomplete, BR shall request the notifying administration to submit the missing information within 30 days.

7 If the complete information specified in § 1 and 5 above is not received by BR within the time-limits specified in § 1, 4, 5 and 6 above, BR shall immediately inform the notifying administration and take appropriate measures under § 8, if required.

8 Within 30 days after the end of the seven-year period following the date of receipt by BR of the relevant complete information under No. **9.30**, and after the end of the three-year period following the date of suspension under No. **11.49**, if the complete information under this Resolution is not yet received by BR, the corresponding frequency assignments shall be cancelled by BR, which subsequently informs the administration accordingly.

ANNEX 2 TO RESOLUTION 552 (REV.WRC-23)

Information to be submitted

- 1 Identity of the satellite network
 - a)* Identity of the satellite network
 - b)* Name of the notifying administration
 - c)* Orbital characteristics
 - d)* Reference to the request for coordination
 - e)* Reference to the notification, when available
 - f)* Frequency band(s) included in the relevant special sections of the satellite network
 - g)* First date of bringing into use²
 - h)* Regulatory status
 - Satellite network under operation (only data listed in § 2 shall be provided) or
 - Satellite network suspended (only data listed in § 3 shall be provided)
- 2 Identity of the spacecraft³ (if satellite network filing is under operation)
 - a)* ITU ID number or
 - b)* Spacecraft manufacturer
 - Name of the spacecraft manufacturer
 - Date of execution of the contract
 - Delivery date

² This information has already been provided by the administration under the provisions of Article **11** and will be inserted by BR.

³ If data about the spacecraft are submitted for the first time under this Resolution, items “Spacecraft manufacturer”, “Launch service provider” and “Frequency band(s) present on board the spacecraft” shall be provided. Otherwise, if data about the spacecraft were already submitted under this Resolution, the ID number (based on the ITU filing number) given by BR to this spacecraft at that time shall be indicated.

- c)* Launch service provider
 - Name of the launch vehicle provider
 - Date of execution of the contract
 - Name of the launch vehicle
 - Name and location of the launch facility
 - Launch date
 - d)* Frequency band(s) present on board the spacecraft (i.e. frequency bands for each transponder that are able to be transmitted by a transponder located on board the spacecraft within the frequency band 21.4-22 GHz)
- 3 Suspension information (if satellite network filing is suspended)
- a)* Date of suspension⁴
 - b)* Reason for suspension:
 - Spacecraft moved to another orbital position, or
 - In-orbit failure of the spacecraft, or
 - Spacecraft de-orbited,
 - Other reasons (to be specified).

⁴ This information has already been provided by the administration under the provisions of Article 11 and will be inserted by BR.

RESOLUTION 553 (REV.WRC-23)

**Additional regulatory measures for broadcasting-satellite networks
in the frequency band 21.4-22 GHz in Regions 1 and 3 for the
enhancement of equitable access to this frequency band**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that WARC-92 allocated the frequency band 21.4-22 GHz in Regions 1 and 3 to the broadcasting-satellite service (BSS) to be implemented after 1 April 2007;
- b)* that the use of the frequency band since 1992 was subject to an interim procedure in accordance with Resolution **525 (WARC-92, Rev.WRC-03 and Rev.WRC-07)***;
- c)* that the frequency band 21.4-22 GHz in Regions 1 and 3 for the BSS was subject to Resolution **507 (Rev.WRC-12)****,

considering further

- a)* that *a priori* planning for BSS networks in the frequency band 21.4-22 GHz in Regions 1 and 3 is not necessary and should be avoided as it freezes access according to technological assumptions at the time of planning and then prevents flexible use taking account of real world demand and technical developments;
- b)* that WRC-12 established definitive arrangements for the use of the frequency band 21.4-22 GHz;
- c)* that Articles 12 and 44 of the ITU Constitution lay down the basic principles for the use of the radio-frequency spectrum and the geostationary-satellite and other satellite orbits, taking into account the needs of developing countries;
- d)* that those principles have been included in the Radio Regulations;
- e)* that all countries have equal rights in the use of both the radio frequencies allocated to various space radiocommunication services and geostationary-satellite orbit and other satellite orbits for these services;
- f)* that, accordingly, a country or a group of countries having frequency assignments for the BSS in the frequency band 21.4-22 GHz need to take all practical measures to facilitate the use of new space systems by other countries or groups of countries;

* *Note by the Secretariat:* This Resolution was abrogated by WRC-12.

** *Note by the Secretariat:* This Resolution was revised by WRC-15 and WRC-19.

g) that, according to No. **23.13**, in devising the characteristics of a space station in the BSS, all technical means available shall be used to reduce, to the maximum, the radiation over the territory of other countries unless an agreement has been previously reached with such countries,

recognizing

a) that the “first-come, first-served” concept can restrict and sometimes prevents access to and use of certain frequency bands and orbital positions;

b) the relative disadvantage for developing countries in coordination negotiations due to various reasons such as a lack of resources and expertise;

c) the perceived differences in consistency of application of the Radio Regulations,

recognizing further

a) that WRC-12 received information provided by the Bureau or the various submissions received by the Bureau which include assignments in the BSS for Regions 1 or 3 in the frequency band 21.4-22 GHz up until December 2011 and that the table below summarizes the data provided by the Bureau and shows the variations for the number of networks at the various stages;

	Advance publication information	Coordination request	Notification submission	Networks in MIFR	Resolution 49	Confirmed brought into use
October 2008	605	115	21	2	18	
September 2009	599	158	24	9	22	18
March 2010	558	199	22	11	20	19
June 2010	664	229	22	12	23	19
January 2011	703	242	20	7	18	14
December 2011	890	291	13	8*	16	10*

* Clarification is awaited for one network. One network is suspended under No. **11.49**.

b) that the number of submissions made by some administrations as contained in the above table in this frequency band is large, which may not be realistic and may be difficult to implement within the regulatory time-limit under Article **11**;

c) that the number of submissions as shown in *recognizing further a)* above, is complicating coordination of BSS systems already submitted or planned to be submitted by other administrations,

resolves

that, as of 18 February 2012, the special procedure outlined in the Attachment to this Resolution for processing of coordination requests for BSS frequency assignments in Regions 1 and 3 in the frequency band 21.4-22 GHz shall be applied in respect of submissions of administrations meeting the specified requirements in the Attachment.

ATTACHMENT TO RESOLUTION 553 (REV.WRC-23)

Special procedure to be applied for an assignment for a broadcasting-satellite service system in the frequency band 21.4-22 GHz in Regions 1 and 3

1 The special procedure described in this attachment can only be applied to one network at a time (except as described in § 4 below) by an administration or an administration acting on behalf of a group of named administrations when, for the frequency band 21.4-22 GHz, none of those administrations have:

- a network in the Master International Frequency Register (MIFR), notified under Article 11; or
- more than one network successfully examined under No. 9.34 and published under No. 9.38 at the same orbital position as the one of the network subject to this special procedure; or
- a network successfully examined under No. 9.34 and published under No. 9.38 at an orbital position different from the one of the network subject to this special procedure.

In the case of countries complying with § 4 below, the special procedure described in this Attachment can also be applied¹ by an administration when the administration has networks in the MIFR, notified under Article 11, or more than one network successfully examined under No. 9.34 and published under No. 9.38 at the same orbital position as the one of the network subject to this special procedure, or a network successfully examined under No. 9.34 and published under No. 9.38 at an orbital position different from the one of the network subject to this special procedure for the frequency band 21.4-22 GHz, but which, combined, do not include its entire territory in the service area. Each one of the administrations in a group will lose its right to apply this special procedure individually or as a member of another group.

2 In the case that an administration that has already made a submission under this special procedure, either individually or as a part of a group (except as described in § 4 below), at a later stage submits a new submission, this new submission cannot benefit from this special procedure except where the network associated with the previous submission under this special procedure has not been notified prior to the regulatory deadline.

¹ The number of submissions shall not exceed the number of orbital locations for national assignments in the Appendix 30 Plan, reduced by the number of orbit locations of that administration for networks in the MIFR, submissions notified under Article 11 and submissions successfully examined under No. 9.34 and published under No. 9.38.

3 In order to benefit from the application of this special procedure, the submitting administration may either withdraw or modify its submission previously sent to the Bureau under the normal procedure and successfully examined under No. 9.34 and published under No. 9.38. In the case of modification, such modification shall remain within the envelope characteristics of the previous submission in order to retain the original date of receipt. If the previous assignment includes several frequency bands, the modification can be applied to the frequency band 21.4-22 GHz to be separated as an independent submission under the special procedure.

4 In order to meet the concerns of some countries with a large territory or dispersed territories that cannot be covered from one orbital location, under this procedure the requirement of such countries having large territory would be met by allowing them to apply this special procedure for submissions to cover their territories from an absolute minimum number of orbital locations² that enable them to cover the entire territory in question.

5 Administrations seeking to apply this special procedure shall submit their request to the Bureau, with the following information:

- a) the geographical coordinates of not more than 20 points for determining the minimal ellipse³ to cover its/their national territory⁴;
- b) the height above sea level of each of its points;
- c) any special requirement which is to be taken into account, to the extent practicable.

6 In submitting their request under § 5 above, administrations may seek the assistance of the Bureau to suggest candidate orbital locations for a submission.

7 Upon receipt of the complete information (mentioned in § 5 above) from an administration seeking the assistance of the Bureau under § 6, the Bureau shall expeditiously generate the minimum coverage ellipse and candidate orbital locations (if requested by the administration) for a prospective submission. The Bureau shall send this information to the requesting administration.

8 Before an administration notifies to the Bureau or brings into use a frequency assignment subject to this special procedure, it shall effect coordination with other administrations as required in § 11 below.

² The number of orbital locations shall not exceed the number of orbital locations for national assignments in the Appendix 30 Plan.

³ In some cases, use of composite beams may be necessary to provide required coverage while reducing undesired coverage of adjacent geographical areas.

⁴ Countries requiring more than one orbital location to cover their national territory (see § 4 above) shall submit points for different orbital locations such that the polygons drawn between the points do not overlap with those from other orbital locations of the same administration.

9 Upon receipt of the information under § 7 above, administrations seeking assistance in applying this special procedure shall submit a request for coordination together with the appropriate information listed in Appendix 4.

10 Administrations not seeking the assistance of the Bureau may submit a request for coordination together with the appropriate information listed in Appendix 4 at the same time as submitting the information under § 5 above.

11 On receipt of the complete information sent under § 9 or § 10 above, the Bureau shall, ahead of submissions not yet processed under No. **9.34**, promptly:

- a)* examine the information with respect to conformity with Annex 1 to this Attachment and §§ 1 to 4 above;
- b)* examine the information with respect to its conformity with No. **11.31**;
- c)* identify, in accordance with Annex 2 to this Attachment, any administration with which coordination may need to be effected⁵;
- d)* include their names in the publication under *e)* below;
- e)* publish⁶, as appropriate, the complete information in its International Frequency Information Circular (BR IFIC) within four months. Where the Bureau is not in a position to comply with the time-limit referred to above, it shall periodically so inform the administrations, giving the reasons therefor;
- f)* inform the administrations concerned of its actions and communicate the results of its calculations, drawing attention to the relevant BR IFIC.

12 If the information is found to be incomplete, the Bureau shall immediately seek from the administration concerned any clarification required and information not provided.

13 The provisions in this Resolution are in addition to the provisions of Articles 9 and 11.

⁵ The Bureau shall also identify the specific satellite networks with which coordination needs to be effected.

⁶ If the payments are not received in accordance with the provisions of Council Decision 482, as amended, on the implementation of cost recovery for satellite network filings, the Bureau shall cancel the publication, after informing the administration concerned. The Bureau shall inform all administrations of such action and that the network specified in the publication in question no longer has to be taken into consideration by the Bureau and other administrations. The Bureau shall send a reminder to the notifying administration not later than two months prior to the deadline for the payment in accordance with the above-mentioned Council Decision 482 unless the payment has already been received. (WRC-12)

ANNEX 1

TO

ATTACHMENT TO RESOLUTION 553 (REV.WRC-23)

**Technical parameters to be used for submissions for Regions 1 and 3
broadcasting-satellite service networks under the special procedure
of this Resolution**

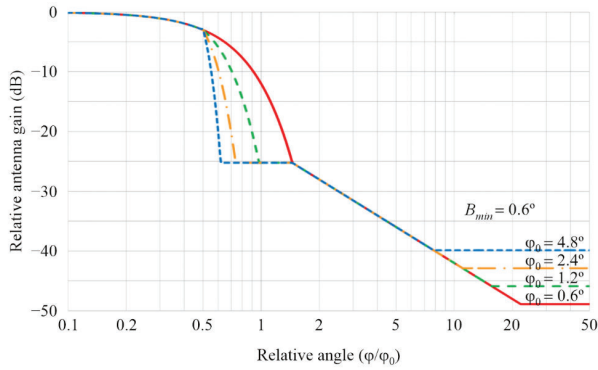
- a)* The receiving earth station antenna diameter should be in the range 45-120 cm. The radiation pattern of the receiving terminal antenna should comply with Recommendation ITU-R BO.1900.
- b)* The noise temperature of the receiving earth station should be in the range 145-200 K.
- c)* The transmitting equivalent isotropically radiated power (e.i.r.p.) of the space station shall be in the range from 43.2 dBW/MHz to 58.2 dBW/MHz⁷.
- d)* The service area shall be limited by the national borders of the country and the minimum coverage ellipse generated by the Bureau.
- e)* In the case of an administration with a large territory or dispersed territories, requiring more than one orbit location to cover the territory of their country, the polygons drawn between the points submitted under § 5 above for each submitted orbital location shall not overlap each other and shall not overlap with service areas of networks of this administration successfully examined under No. **9.34** and published under No. **9.38**.
- f)* The minimum coverage ellipse, generated from not more than 20 points with associated geographical coordinates⁸.
- g)* The reference pattern of the transmitting space station shall be in compliance with Figure 1 below.
- h)* The maximum pointing error of the transmitting space station antenna shall be 0.1° in any direction.
- i)* The maximum rotational error of the transmitting space station antenna shall be ±1°.

⁷ The maximum pfd produced at high elevation angles at the Earth's surface under free-space conditions shall not exceed -105 dB(W/(m² · MHz)).

⁸ In some cases use of composite beams may be necessary to provide required coverage while reducing undesired coverage of adjacent geographical areas.

FIGURE 1* (WRC-12)

**Reference patterns for satellite antennas
with fast roll-off in the main beam**



$$G_{max} = 44.45 - 10 \log (\varphi_{01} \cdot \varphi_{02}) \quad \text{dBi} \quad (\text{WRC-12})$$

Curve A: dB relative to main beam gain

$$-12 (\varphi/\varphi_0)^2$$

$$\text{for } 0 \leq (\varphi/\varphi_0) \leq 0.5$$

$$-12 \left[\frac{(\varphi/\varphi_0) - x}{B_{min}/\varphi_0} \right]^2$$

$$\text{for } 0.5 < (\varphi/\varphi_0) \leq \left(\frac{1.45 B_{min}}{\varphi_0} + x \right)$$

$$-25.23$$

$$\text{for } \left(\frac{1.45 B_{min}}{\varphi_0} + x \right) < (\varphi/\varphi_0) \leq 1.45$$

$$-(22 + 20 \log (\varphi/\varphi_0))$$

$$\text{for } (\varphi/\varphi_0) > 1.45$$

after intersection with Curve B: Curve B.

Curve B: Minus the on-axis gain (Curve B represents examples of four antennas having different values of φ_0 as labelled in Fig. 1. The on-axis gains of these antennas are approximately 39.9, 42.9, 45.9 and 48.9 dBi, respectively) (WRC-12)

where:

φ : off-axis angle (degrees)

φ_0 : cross-sectional half-power beamwidth in the direction of interest (degrees)

$\varphi_{01}, \varphi_{02}$: major and minor axis half-power beamwidth, respectively, of elliptical beam (degrees) (WRC-12)

$$x = 0.5 \left(1 - \frac{B_{min}}{\varphi_0} \right)$$

where:

$$B_{min} = 0.6^\circ$$

* Figure 1 represents patterns for some values of φ_0 . (WRC-12)

ANNEX 2

TO

ATTACHMENT TO RESOLUTION 553 (REV.WRC-23)

**Technical criteria to determine coordination requirements for submissions
under the special procedure to be applied for an assignment for a
broadcasting-satellite service system in the frequency band
21.4-22 GHz in Regions 1 and 3**

Coordination of assignments for a broadcasting-satellite service (BSS) space station with respect to other BSS networks is not required if the power flux-density (pfd) produced under assumed free space propagation conditions does not exceed the threshold values shown below, anywhere within the service area of the potentially affected assignment:

- a) this mask shall be applied for frequency assignments subject to this Resolution with regard to frequency assignments not subject to this Resolution for which:
- notification is not submitted under Article 11; and
 - complete information under Resolution **552 (Rev.WRC-23)** is not received by the Bureau,

at the date of receipt of complete information under § 9 and 10 of the Attachment to this Resolution,

–146.88	dB(W/(m ² · MHz))	for	0° ≤ θ < 0.6°
–150.2 + 9.3 θ ²	dB(W/(m ² · MHz))	for	0.6° ≤ θ < 1.05°
–140.5 + 27.2 log θ	dB(W/(m ² · MHz))	for	1.05° ≤ θ < 2.65°
–138.1 + 1.3 θ ²	dB(W/(m ² · MHz))	for	2.65° ≤ θ < 4.35°
–130.2 + 26.1 log θ	dB(W/(m ² · MHz))	for	4.35° ≤ θ < 9.1°
–105	dB(W/(m ² · MHz))	for	9.1° ≤ θ

where θ is the minimum nominal geocentric orbital separation, in degrees, between the wanted and interfering space stations, taking into account the respective east-west station-keeping accuracies;

- b) this mask shall be applied for frequency assignment subject to this Resolution with regard to:
- frequency assignments subject to this Resolution; or
 - frequency assignments not subject to this Resolution for which:
 - notification is submitted under Article 11; or
 - complete information under Resolution **552 (Rev.WRC-23)** is received by the Bureau,

at the date of receipt of complete information under § 9 and 10 of the Attachment to this Resolution,

-149.88	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$0^\circ \leq \theta < 0.6^\circ$
$-153.2 + 9.3 \theta^2$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$0.6^\circ \leq \theta < 1.05^\circ$
$-143.5 + 27.2 \log \theta$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$1.05^\circ \leq \theta < 2.65^\circ$
$-141.1 + 1.3 \theta^2$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$2.65^\circ \leq \theta < 4.35^\circ$
$-133.2 + 26.1 \log \theta$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$4.35^\circ \leq \theta < 12^\circ$
-105	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for	$12^\circ \leq \theta$

where θ is the minimum nominal geocentric orbital separation, in degrees, between the wanted and interfering space stations, taking into account the respective east-west station-keeping accuracies.

RESOLUTION 554 (WRC-12)

Application of pfd masks to coordination under No. 9.7 for broadcasting-satellite service networks in the band 21.4-22 GHz in Regions 1 and 3

The World Radiocommunication Conference (Geneva, 2012),

considering

- a) that more precise criteria to apply No. 9.7 have the potential to reduce undue protection requirements for assignments in respect of incoming assignments in their vicinity;
- b) that reduction of undue protection requirements will facilitate coordination of submissions of new networks;
- c) that the use of pfd thresholds to identify coordination requirements will encourage use of more homogeneous technical parameters and support efficient spectrum usage,

resolves

1 that coordination of assignments for a broadcasting-satellite service (BSS) space station in Regions 1 and 3 in the 21.4-22 GHz band with respect to other BSS networks is not required if the pfd produced under assumed free space propagation conditions, does not exceed the threshold values shown below, anywhere within the service area of the potentially affected assignment:

-149.88	dB(W/(m ² · MHz))	for	0° ≤ θ < 0.6°
-153.2 + 9.3 θ ²	dB(W/(m ² · MHz))	for	0.6° ≤ θ < 1.05°
-143.5 + 27.2 log θ	dB(W/(m ² · MHz))	for	1.05° ≤ θ < 2.65°
-141.1 + 1.3 θ ²	dB(W/(m ² · MHz))	for	2.65° ≤ θ < 4.35°
-133.2 + 26.1 log θ	dB(W/(m ² · MHz))	for	4.35° ≤ θ < 12°
-105	dB(W/(m ² · MHz))	for	12° ≤ θ

where θ is the minimum nominal geocentric orbital separation, in degrees, between the wanted and interfering space stations, taking into account the respective East-West station-keeping accuracies;

2 that when the Bureau, under No. 11.32, conducts its examination of notifications of satellite networks in respect of compliance with the coordination procedures, it shall base its findings on the coordination requirements set by No. 9.7 in Table 5-1 of Appendix 5 as revised by WRC-12 for those networks received under No. 9.30 before 18 February 2012.

RESOLUTION 558 (WRC-19)

Protection of implemented broadcasting-satellite service networks in the orbital arc of the geostationary-satellite orbit between 37.2° W and 10° E in the frequency band 11.7-12.2 GHz

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that the provisions applying to the broadcasting-satellite service (BSS) in the frequency bands 11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3 are contained in Appendix **30**;
- b)* that systems in the fixed-satellite service (FSS) and the BSS share the frequency band 11.7-12.2 GHz;
- c)* that this conference suppressed the limitation in Section 3 of Annex 7 to Appendix **30 (Rev.WRC-15)** which determined allowable portions of the orbital arc between 37.2° W and 10° E for new or modified assignments in the frequency band 11.7-12.2 GHz in the Regions 1 and 3 List;
- d)* that Section 1 of Annex 1 to Appendix **30** provides criteria used for determining coordination requirements for frequency assignments of the Regions 1 and 3 Plan and List;
- e)* that power flux-density mask values in Section 1 of Annex 1 to Appendix **30** are based on the parameters adopted by WRC-2000, based on a minimum earth station receiving antenna diameter of 60 cm;
- f)* that the use of this frequency band by the BSS is subject to the coordination procedure of Article 4 of Appendix **30**,

noting

- a)* that the ITU Radiocommunication Sector has carried out a significant amount of studies in preparation for conferences on BSS planning, and has developed a number of Reports and Recommendations;
- b)* that, within the orbital arc of the geostationary-satellite orbit (GSO) between 37.2° W and 10° E, prior to this conference there were limitations on the use of some orbital positions for any proposed new or modified assignment in the Regions 1 and 3 List of additional uses in the frequency band 11.7-12.2 GHz;
- c)* that some networks with an earth station receiving antenna diameter smaller than 60 cm were successfully implemented within the orbital arc mentioned in *noting b)*, in view of protection due to the presence of limitations on the use of orbital positions in this orbital arc;
- d)* that, with the deletion of orbital position limitations, the protection of satellite assignments mentioned in *noting c)* shall be ensured;
- e)* that the GSO between 37.2° W and 10° E is widely used by Region 1 BSS and Region 2 FSS networks;

f) that equitable access to and efficient use of the 12 GHz frequency range should be encouraged,

resolves

1 that this Resolution is applicable only to implemented¹ networks with an earth station receiving antenna diameter smaller than 60 cm (40 cm and 45 cm) as outlined in Annex 1 to this Resolution;

2 that frequency assignments associated with an earth station receiving antenna diameter of 40 cm or 45 cm in the networks mentioned in *resolves* 1 above are considered by the Radiocommunication Bureau (BR) as being affected by a proposed new or modified assignment in the List filed at the GSO orbital positions mentioned in Annex 1 to this Resolution, only if the following conditions specified in Annex 1 to Appendix 30 are met:

- the minimum orbital spacing between the wanted and interfering space stations, under worst-case station-keeping conditions, is less than 9°;
- the reference equivalent downlink protection margin corresponding to at least one of the test points of that wanted assignment, including the cumulative effect of any previous modification to the List or any previous agreement, falls more than 0.45 dB below 0 dB, or, if already negative, more than 0.45 dB below that reference equivalent protection margin value;

3 that, for cases when a proposed new assignment in the List is filed within the GSO orbital arc between 37.2° W and 10° E in orbital arc segments that differ from those in Annex 1 to this Resolution, appropriate provisions of Annex 1 to Appendix 30 to determine the need for coordination continue to be applied with respect to relevant frequency assignments of the satellite networks mentioned in *resolves* 1.

¹ For the avoidance of doubt, the “implemented” networks referred to are related to Regions 1 and 3 BSS networks in the orbital arc 37.2° W and 10° E:

- for which complete Appendix 4 information had been received by BR under § 4.1.3 of Appendix 30 (Rev.WRC-15) prior to 28 November 2015, and
- for which complete Appendix 4 information had been received by BR under § 4.1.12 of Appendix 30 (Rev.WRC-15) prior to 23 November 2019, and
- for which the complete due diligence information, in accordance with Annex 2 to Resolution 49 (Rev.WRC-15), had been received by BR prior to 23 November 2019, and
- for which complete Appendix 4 information had been received by BR under § 5.1.2 of Appendix 30 (Rev.WRC-15) prior to 23 November 2019, and
- brought into use, and for which the date of bringing into use has been confirmed to BR before 23 November 2019.

ANNEX 1 TO RESOLUTION 558 (WRC-19)

**Satellite networks in the frequency band 11.7-12.2 GHz and orbital arc segments
for which this Resolution is applicable**

Satellite networks for which this Resolution applies					Orbital arc segments where the conditions specified in <i>resolves 2</i> of this Resolution apply
Orbital position	Earth station antenna diameter, cm	Satellite network	Date of receipt of Part A submission	Notice ID Part II	
30.0° W	45	HISPASAT-1	08.02.2000	99500256	34.92° W $\leq \theta < 33.5^\circ$ W; 32.5° W $< \theta \leq 31.78^\circ$ W; 28.22° W $\leq \theta < 26.0^\circ$ W.
		HISPASAT-37A	19.11.2014	117560019	
4.8° E	40	SIRIUS-N-BSS	17.11.2014	118560003	0° $< \theta \leq 2.93^\circ$ E; 6.67° E $\leq \theta < 9.0^\circ$ E; 9° E $< \theta \leq 10^\circ$ E.

Where θ is the orbital position within the orbital segment defined in the table above.

RESOLUTION 559 (WRC-19)

Additional temporary regulatory measures following the deletion of part of Annex 7 to Appendix 30 (Rev.WRC-15) by WRC-19

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that some national assignments, especially those of developing countries in the Regions 1 and 3 Plan, have equivalent downlink protection margin (EPM) values in Appendix 30 (Rev.WRC-15) equal to or below -10 dB;
- b) that implementation of a national assignment in the Regions 1 and 3 Plan with an EPM equal to or below -10 dB would be difficult;
- c) that any modification of orbital position and other parameters of a national assignment in the Appendix 30 Plan would require a corresponding modification of the orbital position and other parameters in the Appendix 30A feeder-link Plan,

recognizing

- a) that Article 44 of the ITU Constitution stipulates that: “In using frequency bands for radio services, Member States shall bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies taking account the special needs of the developing countries and the geographical situation of particular countries”;
- b) that Resolution 71 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference includes the ITU strategic plan for 2020-2023, which contains, as one of the strategic objectives of the ITU Radiocommunication Sector: “Meet, in a rational, equitable, efficient, economical and timely way, the ITU membership’s requirements for radio-frequency spectrum and satellite-orbit resources, while avoiding harmful interference”,

resolves

1 that, as of 23 March 2020 and for a period until 21 May 2020, the special procedure outlined in the Attachment to this Resolution shall be applied in respect of submissions of Region 1 and 3 administrations under § 4.1.3 of Appendices 30 and 30A in Regions 1 and 3 meeting the specified requirements in § 1 of the Attachment to this Resolution at an orbital position within orbital arcs for which the Annex 7 to Appendix 30 (Rev.WRC-15) limitations were suppressed by this conference; and those submissions sent before 23 March 2020 shall be returned to the administration;

2 that submissions received by the Radiocommunication Bureau (BR) in accordance with *resolves* 1 shall be considered as received by BR on 21 May 2020;

3 that, as of 23 November 2019 and for a period until 21 May 2020, all submissions under § 4.1.3 of Appendices **30** and **30A** in Regions 1 and 3 not meeting the specified requirements in § 1 of the Attachment to this Resolution at an orbital position within orbital arcs for which the Annex 7 to Appendix **30 (Rev.WRC-15)** limitations were suppressed by this conference shall be considered as received by BR on 22 May 2020,

instructs the Director of the Radiocommunication Bureau

1 to identify the administrations that meet the conditions of § 1 of the Attachment to this Resolution and inform these administrations accordingly;

2 at the request of administrations identified in *instructs the Director of the Radiocommunication Bureau* 1 which have the intention to apply the procedure indicated in this Resolution, to assist and advise them in complying with the conditions described in the Attachment to this Resolution, including the identification of appropriate new orbital positions and frequency channels.

ATTACHMENT TO RESOLUTION 559 (WRC-19)

Additional temporary regulatory measures following the deletion of part of Annex 7 to Appendix 30 (Rev.WRC-15) by WRC-19

1 The special procedure described in this Attachment can only be applied once by an administration with:

- a) no frequency assignments submitted on its own behalf and either included in the List or for which complete Appendix **4** information has been received by the Radiocommunication Bureau (BR) in accordance with the provisions of § 4.1.3 of Appendix **30**; and
- b) an assignment in the Regions 1 and 3 Plan of Appendix **30** when the equivalent downlink protection margin (EPM) value corresponding to a test point of its national assignment in the Regions 1 and 3 Plan is equal to or below -10 dB for at least 50% of the total number of EPM values of the assignment in the Regions 1 and 3 Plan in Appendix **30**.

2 Administrations seeking to apply this special procedure shall submit their request to BR, with the information specified in § 4.1.3 of Appendices **30** and **30A**, which shall include, in particular:

- a) in the cover letter to BR, the information that the administration requests the use of this special procedure together with the name of the Plan assignments for which the conditions defined in § 1 above are met;
- b) a service area limited to the national territory as defined in the relevant BR software application;
- c) a set of a maximum of 20 test points inside the national territory;
- d) a minimal ellipse determined by the set of test points submitted in c) above using the relevant BR software application. An administration may request BR to create such a diagram;

- e)¹ a maximum ten² consecutive odd or even channels with standard Appendix **30** assigned frequencies in the same polarization for a Region 1 administration or twelve consecutive odd or even channels with standard Appendix **30** assigned frequencies in the same polarization for a Region 3 administration with a bandwidth of 27 MHz;
- f) a corresponding submission for the Appendix **30A** feeder-link Plan in compliance with the principles defined in items b), c), d) and e) above.

3 Upon receipt of the complete information from an administration sent under § 2 above, BR shall process the submissions in date order in accordance with Article 4 of Appendices **30** and **30A**.

4 The notifying administration shall request subsequent world radiocommunication conferences to consider the inclusion of these assignments in the Appendices **30** and **30A** Plans as a replacement of its national assignments appearing in the Plans, pursuant to § 4.1.27 of Article 4 of Appendices **30** and **30A**. Under this Resolution, footnotes 10 and 12 associated with § 4.1.27 of Article 4 of Appendices **30** and **30A**, respectively, are not applicable.

¹ In case of a submission for the Appendix **30A** feeder-link Plan in the 14 GHz frequency band, the maximum of ten² channels for a Region 1 administration or twelve² channels for a Region 3 administration with a bandwidth of 27 MHz could be in different polarizations.

² This maximum number of channels shall not be greater than the number of channels contained in the assignment referred in § 1 of the Attachment to this Resolution.

RESOLUTION 608 (REV.WRC-19)

Use of the frequency band 1 215-1 300 MHz by systems of the radionavigation-satellite service (space-to-Earth)

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that WRC-2000 introduced a new allocation for the radionavigation-satellite service (RNSS) in the frequency band 1 260-1 300 MHz;
- b)* that the frequency bands 1 215-1 240 MHz and 1 240-1 260 MHz were already allocated to the RNSS;
- c)* that, in the frequency band 1 215-1 260 MHz, RNSS (space-to-Earth) systems have been successfully operating for more than 20 years without any reports of interference to the radars which operate in this frequency band;
- d)* the importance of the continuing need for protection for the radiodetermination systems operating in the frequency band 1 215-1 300 MHz,

noting

- a)* Recommendation ITU-R M.1902, on characteristics and protection criteria for receiving earth stations in the RNSS (space-to-Earth) operating in the frequency band 1 215-1 300 MHz;
- b)* Report ITU-R M.2284, on compatibility of RNSS (space-to-Earth) systems and radars operating in the frequency band 1 215-1 300 MHz,

noting further

that the provisions of No. **5.329** as adopted by WRC-03 will provide for operation of the RNSS (space-to-Earth) in the frequency band 1 215-1 300 MHz and will protect the radiolocation systems operating in that frequency band, in addition to the protection already provided to radionavigation service systems operating in the countries listed in No. **5.331**,

recognizing

- a)* that the ITU Radiocommunication Bureau (ITU-R) carried out studies related to the protection of the radiodetermination systems operating in the frequency band 1 215-1 300 MHz and that these studies should continue pursuant to relevant ITU-R Questions, such as Questions ITU-R 62/5 and ITU-R 217/4, so as to prepare, as appropriate, ITU-R Recommendations;

b) that, up to the end of WRC-2000, use of the RNSS in the frequency band 1 215-1 260 MHz was subject only to the constraint that no harmful interference was caused to the radionavigation service in Algeria, Germany, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Burundi, Cameroon, China, Croatia, Denmark, United Arab Emirates, France, Greece, India, Iran (Islamic Republic of), Iraq, Kenya, Liechtenstein, Luxembourg, North Macedonia, Mali, Mauritania, Norway, Oman, Pakistan, Netherlands, Portugal, Qatar, Türkiye, Serbia and Montenegro*, Senegal, Slovenia, Somalia, Sudan**, Sri Lanka, Sweden and Switzerland, and, furthermore, that No. 5.43 was applied,

resolves

that no constraints in addition to those in place prior to WRC-2000 (see *recognizing b)*) shall be placed on the use of RNSS (space-to-Earth) frequency assignments in the frequency band 1 215-1 260 MHz brought into use until 2 June 2000,

instructs the Secretary-General

to communicate the contents of this Resolution to the International Civil Aviation Organization (ICAO) for such actions as it may consider appropriate, and to invite ICAO to participate actively in the study activity identified under *recognizing a)*.

* *Note by the Secretariat:* Serbia and Montenegro became independent States in 2006.

** *Note by the Secretariat:* Sudan was partitioned into two independent States in 2011 (Sudan and South Sudan).

RESOLUTION 609 (REV.WRC-07)

Protection of aeronautical radionavigation service systems from the equivalent power flux-density produced by radionavigation-satellite service networks and systems in the 1 164-1 215 MHz frequency band

The World Radiocommunication Conference (Geneva, 2007),

considering

- a) that the band 960-1 215 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS) in all Regions;
- b) that the band 1 164-1 215 MHz is also allocated on a primary basis to the radionavigation-satellite service (RNSS), subject to the condition in No. **5.328A** that operation of RNSS systems shall be in accordance with this Resolution;
- c) that WRC-2000 provided for implementation of a provisional aggregate power flux-density (pfd) limit during the period between WRC-2000 and WRC-03, and requested ITU-R studies on the need for an aggregate pfd limit, and revision, if necessary, of the provisional pfd limit given in No. **5.328A**;
- d) that WRC-03 determined that protection of the ARNS from harmful interference can be achieved if the value of the equivalent pfd (epfd) produced by all the space stations of all RNSS (space-to-Earth) systems in the 1 164-1 215 MHz band does not exceed the level of $-121.5 \text{ dB(W/m}^2\text{)}$ in any 1 MHz band;
- e) that only a limited number of RNSS systems are expected to be deployed in the 1 164-1 215 MHz band, and only a few of these systems at most would have overlapping frequencies;
- f) that ARNS systems can be protected without placing undue constraints on the development and operation of RNSS systems in this band;
- g) that to achieve the objectives in *considering f)*, administrations operating or planning to operate RNSS systems will need to agree cooperatively through consultation meetings to equitably share the aggregate epfd in a manner to achieve the level of protection for ARNS systems that is stated in *considering d)*;
- h) that it may be appropriate for representatives of administrations operating or planning to operate ARNS systems to be involved in determinations made pursuant to *considering g)*;
- i) that WRC-03 decided to apply the coordination provisions of Nos. **9.12**, **9.12A** and **9.13** to RNSS systems and networks for which complete coordination or notification information, as appropriate, is received by the Bureau after 1 January 2005,

noting

- a) that WRC-2000 invited ITU-R to conduct the appropriate technical, operational and regulatory studies on the overall compatibility between the RNSS and the ARNS in the band 960-1 215 MHz;
- b) that WRC-2000 resolved to recommend that WRC-03 review the results of the studies,

recognizing

that under No. 7.5, interested administrations have the ability, at any time, to request the assistance of the Bureau with respect to Articles 9 and 11 and associated procedures,

resolves

1 that in order to protect ARNS systems, administrations shall ensure, pursuant to this Resolution, that the epfd level produced by all space stations of all RNSS systems does not exceed the level $-121.5 \text{ dB(W/m}^2\text{)}$ in any 1 MHz band;

2 that administrations operating or planning to operate in the 1 164-1 215 MHz frequency band RNSS systems or networks shall, in collaboration, take all necessary steps, including, if necessary, by means of appropriate modifications to their systems or networks, to ensure that the aggregate interference into ARNS systems caused by such RNSS systems or networks operating co-frequency in these frequency bands is shared equitably among the systems identified in *resolves* 3 and does not exceed the level of the aggregate protection criterion given in *resolves* 1 above;

3 that administrations, in carrying out their obligations under *resolves* 1 and 2 above, shall take into account only those RNSS systems with frequency assignments in the band 1 164-1 215 MHz that have met the criteria listed in the Annex to this Resolution through appropriate information provided to the consultation meetings referred to in *considering* g);

4 that administrations, in developing agreements to carry out their obligations under *resolves* 1 and 2 above, shall establish mechanisms to ensure that all potential RNSS system operators and administrations are given full visibility of the process;

5 that in order to allow multiple RNSS systems to operate in the frequency band 1 164-1 215 MHz, no single RNSS system shall be permitted to use up the entire interference allowance specified in *resolves* 1 above in any 1 MHz of the 1 164-1 215 MHz band (see Recommendation 608 (Rev.WRC-07));

6 that to achieve the objectives in *resolves* 1 and 2 above, administrations operating or planning to operate RNSS systems will need to agree cooperatively through consultation meetings to achieve the level of protection for ARNS systems that is stated in *resolves* 1;

7 that administrations participating in this process of epfd calculation should hold consultation meetings on a regular basis (e.g. yearly);

8 the administrations participating in the consultation meeting shall designate one administration that shall communicate to the Bureau the results of any aggregate sharing determinations made in application of *resolves* 2 above, without regard to whether such determinations result in any modifications to the published characteristics of their respective systems or networks (see Recommendation 608 (Rev.WRC-07));

9 that administrations operating or planning to operate ARNS systems in the 1 164-1 215 MHz band should participate, as appropriate, in discussions and determinations relating to the *resolves* above;

10 that the methodology and the reference worst-case ARNS system antenna contained in Recommendation ITU-R M.1642-2 shall be used by administrations for calculating the aggregate epfd produced by all the space stations within all RNSS systems in the band 1 164-1 215 MHz,

instructs the Radiocommunication Bureau

- 1 to participate in consultation meetings mentioned under *resolves* 6 and to observe carefully results of the epfd calculation mentioned in *resolves* 1;
- 2 to determine whether the pfd level in *recommends* 1 of Recommendation **608 (Rev.WRC-07)** is exceeded by any subject space station, and to report the findings of this determination to the participants in the consultation meeting;
- 3 to publish in the International Frequency Information Circular (BR IFIC), the information referred to in *resolves* 8 and *instructs the Radiocommunication Bureau* 2,

invites the Radiocommunication Bureau

to examine the possibility, if needed, of developing software that can be used to calculate the epfd level mentioned under *resolves* 1,

invites administrations

- 1 to deal with RNSS intersystem matters, as required, as early as possible;
- 2 to provide the Bureau and all participants in the consultation meeting with access to appropriate software used to calculate the epfd level mentioned under *resolves* 1.

ANNEX TO RESOLUTION 609 (REV.WRC-07)

Criteria for application of Resolution 609 (Rev.WRC-07)

- 1 Submission of appropriate Advance Publication information.
- 2 Entry into satellite manufacturing or procurement agreement, and entry into satellite launch agreement.

The RNSS system or network operator should possess:

- i) clear evidence of a binding agreement for the manufacture or procurement of its satellites; and
- ii) clear evidence of a binding agreement to launch its satellites.

The manufacturing or procurement agreement should identify the contract milestones leading to the completion of manufacture or procurement of satellites required for the service provision, and the launch agreement should identify the launch date, launch site and launch service provider. The notifying administration is responsible for authenticating the evidence of agreement.

The information required under this criterion may be submitted in the form of a written commitment by the responsible administration.

- 3 As an alternative to satellite manufacturing or procurement and launch agreements, clear evidence of guaranteed funding arrangements for the implementation of the project would be accepted. The notifying administration is responsible for authenticating the evidence of these arrangements and for providing such evidence to other interested administrations in furtherance of its obligations under this Resolution.

RESOLUTION 610 (REV.WRC-19)

**Coordination and bilateral resolution of technical compatibility issues for
radionavigation-satellite service networks and systems in the frequency bands
1 164-1 300 MHz, 1 559-1 610 MHz and 5 010-5 030 MHz**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that WRC-2000 decided to allocate the frequency bands 1 164-1 215 MHz, 1 260-1 300 MHz and 5 010-5 030 MHz to the radionavigation-satellite service (RNSS) (space-to-Earth) (space-to-space) in addition to the frequency bands 1 215-1 260 MHz and 1 559-1 610 MHz that have already been allocated to the RNSS;
- b) that this conference established conditions for the protection of the aeronautical radionavigation service from RNSS systems in the frequency band 1 164-1 215 MHz, for the protection of radiodetermination services from RNSS systems in the frequency band 1 215-1 300 MHz, and for the protection of the radio astronomy service in the frequency band 4 990-5 000 MHz from RNSS systems in the frequency band 5 010-5 030 MHz;
- c) that, to date, RNSS systems have been able to resolve intersystem technical compatibility issues on a bilateral basis under Section I of Article 9, without the need for imposition of the coordination procedures of Section II of Article 9, however, in recent years, there has been an increase in the number of RNSS systems and networks filed with the Radiocommunication Bureau (BR);
- d) that this conference has decided to apply, in the frequency bands mentioned in *considering a)*, the coordination provisions of Nos. 9.12, 9.12A and 9.13 to RNSS systems and networks for which complete coordination or notification information, as appropriate, is received by BR after 1 January 2005, and the provisions of No. 9.7 already apply to geostationary-satellite networks in the RNSS;
- e) that it is necessary to have a basis for administrations with RNSS systems that are not subject to Nos. 9.12, 9.12A and 9.13 to engage in bilateral coordinations to resolve intersystem technical compatibility issues within the RNSS;
- f) that it is desirable, in order to reduce burdens on administrations operating or planning RNSS systems or networks, to conduct bilateral coordinations between RNSS systems and networks that are either in operation or that are actually in the process of being implemented,

resolves

- 1 that, for administrations planning to operate RNSS systems subject to coordination under Nos. 9.7, 9.12, 9.12A and/or 9.13 in the frequency bands mentioned in *considering a)*, if an administration with which coordination is requested responds to the request under No. 9.52, the requesting administration shall, during the process of coordination and upon request by the responding administration, inform the responding administration (with a copy to BR) whether it has met the criteria listed in the Annex to this Resolution with respect to the subject network or system;

2 that administrations responding under No. **9.52** to a request for coordination under Nos. **9.7**, **9.12**, **9.12A** and/or **9.13** in the frequency bands mentioned in *considering a)*, shall, during the process of coordination mentioned in *resolves 1* and upon request by the requesting administration, inform the requesting administration (with a copy to BR) whether it has met the criteria listed in the Annex to this Resolution with respect to the subject network or system;

3 that administrations operating or planning to operate RNSS systems in the frequency bands mentioned in *considering a)*, which systems are not subject to coordination under Section II of Article **9**, shall take all practicable steps to resolve issues of intersystem compatibility on a bilateral basis;

4 that, in undertaking the obligations under *resolves 3* above, administrations operating or planning to operate RNSS systems or networks should first address intersystem compatibility between RNSS systems or networks that are actually in operation or are in the process of being implemented;

5 that, for the application of *resolves 4* above, an RNSS system or network that has satisfied the criteria listed in the Annex to this Resolution with respect to the subject network or system would be considered to be actually in the process of being implemented;

6 that when notifying BR under No. **11.47** that a frequency assignment to station(s) in the RNSS in the frequency bands mentioned in *considering a)* has been brought into use, the notifying administration, if it has not already done so, shall inform BR whether it has met the criteria listed in the Annex to this Resolution;

7 that implementation of this Resolution shall be conducted in such a way as to promote the principle of equality and fairness in ensuring access for RNSS operators and planned RNSS systems in the above-referenced frequency bands,

instructs the Radiocommunication Bureau

to provide, on request, assistance to administrations operating or planning to operate RNSS systems in the frequency bands mentioned in *considering a)* above, which systems are not subject to coordination under Section II of Article **9**, in securing bilateral agreements with other RNSS systems as early as possible.

ANNEX TO RESOLUTION 610 (REV.WRC-19)

Criteria for the application of Resolution 610 (Rev.WRC-19)

- 1 Submission of appropriate Coordination Request information.
- 2 Entry into satellite manufacturing or procurement agreement, and entry into satellite launch agreement.

The RNSS system or network operator should possess:

- i) clear evidence of a binding agreement for the manufacture or procurement of its satellites; and
- ii) clear evidence of a binding agreement to launch its satellites.

The manufacturing or procurement agreement should identify the contract milestones leading to the completion of manufacture or procurement of satellites required for the service provision, and the launch agreement should identify the launch date, launch site and launch service provider. The notifying administration is responsible for authenticating the evidence of agreement.

The information required under this criterion may be submitted in the form of a written commitment by the responsible administration.

- 3 As an alternative to satellite manufacturing or procurement and launch agreements, clear evidence of guaranteed funding arrangements for the implementation of the project would be accepted. The notifying administration is responsible for authenticating the evidence of these arrangements.

RESOLUTION 612 (REV.WRC-12)

**Use of the radiolocation service between 3 and 50 MHz to
support oceanographic radar operations**

The World Radiocommunication Conference (Geneva, 2012),

considering

- a)* that there is increasing interest, on a global basis, in the operation of oceanographic radars for measurement of coastal sea surface conditions to support environmental, oceanographic, meteorological, climatological, maritime and disaster mitigation operations;
- b)* that oceanographic radars are also known in parts of the world as HF ocean radars, HF wave height sensing radars or HF surface wave radars;
- c)* that oceanographic radars operate through the use of ground-waves intended to propagate over the sea;
- d)* that oceanographic radar technology has applications in global maritime domain awareness by allowing the long-range sensing of surface vessels, which provides a benefit to the global safety and security of shipping and ports;
- e)* that operation of oceanographic radars provides benefits to society through environmental protection, disaster preparedness, public health protection, improved meteorological operations, increased coastal and maritime safety and enhancement of national economies;
- f)* that oceanographic radars have been operated on an experimental basis around the world, providing an understanding of spectrum needs and spectrum sharing considerations, as well as an understanding of the benefits these systems provide;
- g)* that performance and data requirements dictate the regions of spectrum that can be used by oceanographic radar systems for ocean observations;
- h)* that below approximately 30 MHz, unintended skywave propagation from oceanographic radar may occur when appropriate propagation conditions exist,

recognizing

- a)* that oceanographic radars have been operated under provision No. 4.4 since the 1970s by several administrations;
- b)* that developers of the systems in *recognizing a)* have implemented techniques to make the most efficient use of the spectrum and mitigate interference to other radio services;

c) that protection of stations of existing services from interference caused by oceanographic radars could be ensured if the interfering signal at the receiving antenna location, assuming rural and quiet rural man-made and natural noise characteristics as defined in Recommendation ITU-R P.372-10, does not result in an I/N ratio of more than -6 dB, and if this value was used to calculate the minimum separation distances for coordination between an oceanographic radar and a potentially affected country;

d) that for the purpose of protecting existing services from harmful interference, the impact of oceanographic radars via ground-wave propagation can be checked by Report ITU-R M.2234, based on Recommendation ITU-R P.368-9,

resolves

1 that, when oceanographic radars are brought into use after 17 February 2012 and notified to the Bureau, the notification shall be in accordance with No. **11.2** of the Radio Regulations and shall contain the station identification (call sign);

2 that the peak e.i.r.p. of an oceanographic radar shall not exceed 25 dBW;

3 that each oceanographic radar station shall transmit a station identification (call sign) on the assigned frequency, in international Morse code at manual speed, at the end of each data acquisition cycle, but at an interval of no more than 20 minutes;

4 that oceanographic radars should, where applicable, use techniques that allow multiples of such radars to operate on the same frequency, reducing to a minimum the spectral occupancy of a regional or global deployment of radars;

5 that oceanographic radars should use directional antennas, where applicable and as required, to facilitate sharing, thereby reducing the e.i.r.p. in the direction of the transmit antenna backlobe;

6 that the separation distances between an oceanographic radar and the border of other countries shall be greater than the distances specified in the following table, unless prior explicit agreements from affected administrations are obtained:

Frequency (MHz)	Land path (km)		Sea or mixed path (km)	
	Rural	Quiet rural	Rural	Quiet rural
5 (± 1 MHz)	120	170	790	920
9 (± 1 MHz)	100	130	590	670
13 (± 1 MHz)	100	110	480	520
16 (± 1 MHz)	80	100	390	450
25 (± 3 MHz)	80	100	280	320
42 (± 3 MHz)	80	100	200	230

RESOLUTION 642

**Relating to the bringing into use of earth stations in
the amateur-satellite service**

The World Administrative Radio Conference (Geneva, 1979),

recognizing

that the procedures of Articles **9** and **11** are applicable to the amateur-satellite service,

recognizing further

- a)* that the characteristics of earth stations in the amateur-satellite service vary widely;
- b)* that space stations in the amateur-satellite service are intended for multiple access by amateur earth stations in all countries;
- c)* that coordination among stations in the amateur and amateur-satellite services is accomplished without the need for formal procedures;
- d)* that the burden of terminating any harmful interference is placed upon the administration authorizing a space station in the amateur-satellite service pursuant to the provisions of No. **25.11**,

notes

that certain information specified in Appendix **4** cannot reasonably be provided for earth stations in the amateur-satellite service,

resolves

1 that when an administration (or one acting on behalf of a group of named administrations) intends to establish a satellite system in the amateur-satellite service and wishes to publish information with respect to earth stations in that system it may:

1.1 communicate to the Radiocommunication Bureau all or part of the information listed in Appendix **4**; the Bureau shall publish such information in a Special Section of its BR IFIC requesting comments to be communicated within a period of four months after the date of publication;

1.2 notify under Nos. **11.2** to **11.8** all or part of the information listed in Appendix **4**; the Bureau shall record it in a special list;

2 that this information shall include at least the characteristics of a typical amateur earth station in the amateur-satellite service having the facility to transmit signals to the space station to initiate, modify, or terminate the functions of the space station.

RESOLUTION 646 (REV.WRC-19)

Public protection and disaster relief

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that the term “public protection radiocommunication” refers to radiocommunications used by agencies and organizations responsible for the maintenance of law and order, protection of life and property and emergency situations;
- b)* that the term “disaster relief radiocommunication” refers to radiocommunications used by agencies and organizations dealing with a serious disruption of the functioning of society, posing a significant widespread threat to human life, health, property or the environment, whether caused by accident, natural phenomena or human activity, and whether developing suddenly or as a result of complex, long-term processes;
- c)* the growing telecommunication and radiocommunication needs of public protection agencies and organizations, including those dealing with emergency situations and disaster relief, that are vital to the maintenance of law and order, protection of life and property, disaster relief and emergency response;
- d)* that many administrations wish to promote interoperability and interworking between systems used for public protection and disaster relief (PPDR), both nationally and for cross-border operations in emergency situations and for disaster relief;
- e)* that existing systems for PPDR applications mainly support narrowband/wideband voice and data applications;
- f)* that, although narrowband and wideband systems will continue to be used to meet PPDR requirements, there is a growing need for broadband applications to support improved data and multimedia capabilities, which require higher data rates and higher capacity, and appropriate spectrum may need to be made available on a national basis to meet these growing needs;
- g)* that new technologies for broadband PPDR applications are being developed in various standards organizations, e.g. International Mobile Telecommunications (IMT) technologies that support higher data rates and higher capacity for PPDR applications, and these technologies are also being used to meet the needs of PPDR agencies and organizations;
- h)* that continuing development of new technologies and systems, such as IMT and intelligent transportation systems (ITS), may be able to further support or supplement advanced PPDR applications;
- i)* that some commercial terrestrial and satellite systems are complementing the dedicated systems in support of PPDR, and that the use of commercial solutions will be in response to technology development and market demands;

j) that administrations may have different operational needs and spectrum requirements for PPDR applications depending on the circumstances;

k) that an approach based on global and/or regional frequency ranges¹ may enable administrations to benefit from harmonization while continuing to meet national planning requirements,

recognizing

a) the benefits of spectrum harmonization such as:

- increased potential for interoperability;
- clear guidance for standardization;
- increased volume of equipment resulting in economies of scale, more cost-efficient equipment and expanded equipment availability;
- improved spectrum management and planning;
- more effective international aid during disasters and major events; and
- enhanced cross-border coordination and circulation of equipment;

b) that the organizational distinction between public protection activities and disaster relief activities are matters for administrations to determine at the national level;

c) that national spectrum planning for PPDR needs to have regard to cooperation and bilateral consultation with other concerned administrations, which should be facilitated by greater levels of spectrum harmonization;

d) that the Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations (Tampere, 1998), an international treaty deposited with the United Nations Secretary-General, and related United Nations General Assembly resolutions and reports are also relevant in this regard;

e) that Resolution 36 (Rev. Guadalajara, 2010) of the Plenipotentiary Conference urges Member States Parties to the Tampere Convention to take all practical steps for the application of the Tampere Convention and to work closely with the operational coordinator as provided for therein;

f) that Recommendation ITU-R M.1637 offers guidance to facilitate the global cross-border circulation of radiocommunication equipment in emergency and disaster relief situations;

g) that Recommendation ITU R M.2009 identifies radio interface standards applicable to PPDR operations;

h) that Report ITU-R M.2291 provides details of the capabilities of IMT technologies to meet the requirements of applications supporting broadband PPDR operations;

¹ In the context of this Resolution, the term “frequency range” means a range of frequencies over which radio equipment is envisaged to be capable of operating but limited to specific frequency band(s) according to national conditions and requirements.

- i)* that Report ITU-R M.2377 provides details of systems and applications supporting PPDR operations in narrowband, wideband and broadband use;
- j)* that PPDR agencies and organizations have an initial set of requirements, including but not limited to interoperability, secure and reliable communications, sufficient capacity to respond to emergencies, priority access in the use of non-dedicated systems, fast response times, ability to handle multiple group calls and the ability to cover large areas, as described in Reports ITU-R M.2377 and ITU-R M.2291;
- k)* that Report ITU-R BT.2299 provides a compilation of supporting evidence to the effect that terrestrial broadcasting plays an important role in disseminating information to the public in times of emergencies;
- l)* that Recommendation ITU-R M.2015 contains regionally harmonized PPDR frequency arrangements, as well as frequency arrangements of individual administrations²;
- m)* that in times of disasters, if most terrestrial-based networks are destroyed or impaired, amateur, satellite and other non-ground-based networks may be available to provide communication services to assist in PPDR efforts;
- n)* that the amount of spectrum needed for public protection on a daily basis differs significantly between countries, and that certain amounts of spectrum are already in use in various countries for PPDR applications;
- o)* that, in response to a disaster or emergency, access to additional spectrum on a temporary basis may be required for PPDR operations;
- p)* that not all frequencies within an identified common frequency range will be available for PPDR use within each country;
- q)* that the identification of common frequency ranges within which equipment could operate may ease interoperability and/or interworking, with mutual cooperation and consultation, especially in national, regional and cross-border emergency situations and disaster relief operations;
- r)* that when a disaster occurs, the PPDR agencies and organizations are usually the first responders on the scene using their day-to-day communication systems and, additionally, other agencies and organizations may also become involved in disaster relief operations;
- s)* that some countries in Region 1 have identified certain parts of the frequency range 694-791 MHz for broadband PPDR deployment;
- t)* that some countries in Region 1 have identified certain parts of the frequency range 790-862 MHz for broadband PPDR deployment;

² For example, as of November 2015 some countries in Region 3 had adopted parts of the frequency ranges 138-174 MHz, 351-370 MHz and 380-400 MHz for narrowband PPDR applications and the frequency ranges 174-205 MHz and 1 447-1 467 MHz for broadband PPDR applications.

- u) the provisions contained in Nos. 5.266 and 5.267, and Resolution 205 (Rev.WRC-19);
- v) that the meteorological aids and meteorological-satellite services operate on a globally harmonized basis in the frequency band 400.15-406 MHz;
- w) that the radio astronomy service operates on a primary basis in the frequency band 406.1-410 MHz and there may be PPDR operations adjacent to that frequency band,

noting

- a) that many administrations will continue to use different frequency bands below 1 GHz for narrowband systems and applications supporting PPDR and may decide to use the same range for future PPDR systems;
- b) that some administrations also use certain frequency bands above 1 GHz for broadband PPDR applications;
- c) that applications requiring large coverage areas and providing good signal availability would generally be accommodated in lower frequency bands;
- d) that many administrations have made significant investments in PPDR systems;
- e) that flexibility allows disaster relief agencies and organizations to use current and future radiocommunications, so as to facilitate their humanitarian operations;
- f) that disasters and emergency events require response not only from PPDR agencies and organizations but also from humanitarian agencies and organizations;
- g) that broadband PPDR can be realized and deployed in the frequency bands identified for IMT;
- h) the benefits of cooperation between countries for the provision of effective and appropriate humanitarian assistance in case of disasters, particularly in view of the special operational requirements of such activities involving multinational response;
- i) the needs of countries, particularly the developing countries³, for cost-efficient communication equipment;
- j) that the use of technologies based on Internet protocols is well established,

emphasizing

- a) that the frequency ranges that are covered by the *resolves* part of this Resolution are allocated to a variety of services in accordance with the relevant provisions of the Radio Regulations and are currently used intensively by the fixed, mobile, mobile-satellite and broadcasting services;

³ Taking into account, for example, the latest version of the ITU Telecommunication Development Sector (ITU-D) Handbook on disaster relief.

- b) that PPDR applications in the ranges listed in *resolves* 2 and 3 are intended to operate in the mobile service allocated on a primary basis according to the provisions of the Radio Regulations;
- c) that flexibility must be afforded to administrations to determine:
- how much spectrum to make available at a national level for PPDR from the ranges in the *resolves* part of this Resolution in order to meet their particular national requirements;
 - the need and timing of availability as well as the conditions of usage of the frequency bands used for PPDR, including those covered in this Resolution and Recommendation ITU-R M.2015, in order to meet specific regional or national situations⁴;
- d) that the provisions of Nos. **1.59** and **4.10** of the Radio Regulations do not apply to PPDR;
- e) that administrations can adopt their frequency arrangements for the terrestrial component of IMT from those detailed in Recommendation ITU-R M.1036,

resolves

- 1 to encourage administrations to use harmonized frequency ranges for PPDR to the maximum extent possible, taking into account the national and regional requirements and also having regard to any needed consultation and cooperation with other concerned countries;
- 2 to encourage administrations to consider parts of the frequency range 694-894 MHz, as described in the most recent version of Recommendation ITU-R M.2015, when undertaking their national planning for their PPDR applications, in particular broadband, in order to achieve harmonization, taking into account *emphasizing c) and e)* above;
- 3 to further encourage administrations to also consider parts of the following regionally harmonized frequency ranges for their PPDR applications:
- in Region 1: 380-470 MHz;
 - in Region 3: 406.1-430 MHz, 440-470 MHz and 4 940-4 990 MHz;
- 4 that PPDR frequency arrangements within the frequency ranges specified in *resolves* 2 and 3, as well as countries' frequency arrangements for PPDR, should be included in Recommendation ITU-R M.2015;
- 5 that the use of the frequency ranges for PPDR in *resolves* 2 and 3 above, as well as the use of the countries' frequency arrangements for PPDR, as described in the most recent version of Recommendation ITU-R M.2015, must not cause unacceptable interference, nor constrain the use of these frequency ranges by applications of the services to which they are allocated in the Radio Regulations;

⁴ For example, some countries in Region 1 have identified certain parts of the frequency range 694-862 MHz for broadband PPDR applications.

6 to encourage administrations, in emergency and disaster relief situations, to satisfy temporary needs for frequencies in addition to what may be normally provided for in agreements with the concerned administrations;

7 to encourage administrations to facilitate cross-border circulation of radiocommunication equipment intended for use in emergency and disaster relief situations through mutual cooperation and consultation without hindering national legislation;

8 that administrations encourage PPDR agencies and organizations to utilize relevant ITU Radiocommunication Sector (ITU-R) Recommendations in planning spectrum use and implementing technology and systems supporting PPDR;

9 to encourage administrations to continue to work closely with their PPDR community to further refine the operational requirements for PPDR activities,

invites the ITU Radiocommunication Sector

1 to continue its technical studies and to make recommendations concerning technical and operational implementation, as necessary, to meet the needs of PPDR radiocommunication applications, taking into account the capabilities, evolution and any resulting transition requirements of the existing systems, particularly those of many developing countries, for national and international operations;

2 to review and revise Recommendation ITU-R M.2015 and other relevant ITU-R Recommendations and Reports, as appropriate.

RESOLUTION 647 (REV.WRC-19)

**Radiocommunication aspects, including spectrum-management guidelines,
for early warning, disaster prediction, detection, mitigation and
relief operations relating to emergencies and disasters**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that natural disasters have underscored the importance of utilizing effective measures to mitigate their effects, including prediction, detection and alerting through coordinated and effective use of the radio-frequency spectrum;
- b) ITU's comprehensive role in emergency communications, not only in the field of radiocommunications, but also in the area of technical standards to facilitate interconnection and interoperability of networks for monitoring and management at the onset of and during emergency and disaster situations, and as an integral part of the telecommunication development agenda through the Buenos Aires Action Plan;
- c) that administrations have been urged to take all practical steps to facilitate the rapid deployment and effective use of telecommunication resources for early warning, emergency, disaster mitigation and relief operations by reducing and, where possible, removing regulatory barriers and strengthening global, regional and transborder cooperation between States;
- d) that effective use of telecommunications/information and communication technologies (ICTs) at the onset of and during critical emergencies is essential for disaster forecasting and prediction, timely detection, early warning, mitigation, management, relief strategies and operations, and plays a vital role in the safety and security of relief workers in the field;
- e) the particular needs of developing countries and the special requirements of the inhabitants of high-risk areas exposed to disasters, as well as those living in remote areas;
- f) the work carried out by the ITU Telecommunication Standardization Sector in standardizing the common alerting protocol (CAP), through the approval of the relevant CAP Recommendation,

recognizing

- a) that the Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations (Tampere, 1998)¹, an international treaty deposited with the United Nations Secretary-General, calls on the States Parties, when possible, and in conformity with their national law, to develop and implement measures to facilitate the availability of telecommunication resources for such operations;

¹ However, a number of countries have not ratified the Tampere Convention.

- b) Article 40 of the ITU Constitution, on priority of telecommunications concerning safety of life;
- c) Article 46 of the Constitution, on distress calls and messages;
- d) Resolution 34 (Rev. Buenos Aires, 2017) of the World Telecommunication Development Conference, on the role of telecommunications/ICTs in disaster preparedness, early warning, rescue, mitigation, relief and response, as well as ITU Telecommunication Development Sector Question 5/2, on utilizing telecommunications/ICTs for disaster risk reduction and management;
- e) Resolution 36 (Rev. Guadalajara, 2010) of the Plenipotentiary Conference, on telecommunications/ICTs in the service of humanitarian assistance;
- f) Resolution 136 (Rev. Dubai, 2018) of the Plenipotentiary Conference, on the use of telecommunications/ICTs for monitoring and management in emergency and disaster situations for early warning, prevention, mitigation and relief;
- g) Resolution ITU-R 55, on the ITU Radiocommunication Sector (ITU-R) studies of disaster prediction, detection, mitigation and relief;
- h) that Resolution **646 (Rev.WRC-19)** addresses the broader category of public protection and disaster relief (PPDR), as well as the harmonization of frequency bands/ranges for PPDR solutions²;
- i) that some administrations may have different operational needs and spectrum requirements for emergency and disaster-relief applications, depending on their circumstances;
- j) that the immediate availability of spectrum to support emergency radiocommunication equipment and administration contact information on disaster-relief issues are important for successful telecommunications in the very early stages of humanitarian assistance intervention for disaster relief,

aware

of the progress made in regional organizations around the world, and in particular in regional telecommunication organizations, on matters related to emergency communications planning and response,

² Resolution **646 (Rev.WRC-19)** includes *considering* paragraphs to the effect that the term “public protection radiocommunication” refers to radiocommunications used by agencies and organizations responsible for the maintenance of law and order, protection of life and property and emergency situations, and that the term “disaster relief radiocommunication” refers to radiocommunications used by agencies and organizations dealing with a serious disruption of the functioning of society, posing a significant widespread threat to human life, health, property or the environment, whether caused by accident, natural phenomena or human activity, and whether developing suddenly or as a result of complex, long-term processes.

recognizing further

that ITU-R has developed a Handbook on Emergency and Disaster Relief as well as various Reports and Recommendations relating to emergency and disaster-relief operations and radiocommunication resources³,

noting

- a) the close relationship between this Resolution and Resolution **646 (Rev.WRC-19)**, on PPDR;
- b) that, when a disaster occurs, the disaster-relief agencies are usually the first on the scene using their day-to-day communication systems, but that in most cases other agencies and organizations may also be involved in disaster-relief operations;
- c) that there is a critical requirement to perform immediate spectrum-management actions, including frequency coordination, sharing and spectrum reuse, within a disaster area;
- d) that national spectrum planning for emergency and disaster relief should take into account the need for cooperation and bilateral consultation with other concerned administrations, which can be facilitated by spectrum harmonization, as well as agreed spectrum-management guidelines pertaining to disaster relief and emergency planning;
- e) that, in times of disasters, radiocommunication facilities may be destroyed or impaired and the national regulatory authorities may not be able to provide the necessary spectrum-management services for the deployment of radio systems for relief operations;
- f) that availability of information, such as the identification of administration disaster-relief contact information, frequency availability within individual administrations within which equipment could operate and any relevant instructions or procedures, may ease interoperability and/or interworking, with mutual cooperation and consultation, especially in national, regional and cross-border emergency situations and disaster-relief activities,

noting further

- a) that flexibility must be afforded to disaster-relief agencies and organizations to use current and future radiocommunications, so as to facilitate their humanitarian operations;
- b) that it is in the interest of administrations and disaster-relief agencies and organizations to have access to updated information on national spectrum planning for emergency and disaster relief,

taking into account

that the Radiocommunication Bureau (BR) has established and maintains a database³ containing administration contact information, available frequencies/frequency bands for use by terrestrial and space services, and any additional information or instructions relevant to emergency situations within these administrations,

³ <http://itu.int/go/ITU-R/emergency>

resolves

1 that ITU-R continue through its study groups to study those aspects of radiocommunications/ICTs that are relevant to early warning, disaster prediction, detection, mitigation and relief operations, taking into account Resolution ITU-R 55;

2 to encourage administrations to communicate to BR the relevant up-to-date administration contact information and, where available, the frequencies or frequency bands for use in emergency and disaster-relief operations;

3 to reiterate to administrations the importance of having up-to-date information referred to in *resolves* 2 above available for use in the very early stages of humanitarian assistance intervention for disaster relief,

instructs the Director of the Radiocommunication Bureau

1 to support administrations in their work towards the implementation of Resolution 136 (Rev. Dubai, 2018), as well as the Tampere Convention;

2 to coordinate activities between this Resolution and Resolution **646 (Rev.WRC-19)** in order to minimize possible overlap;

3 to continue to assist Member States with their emergency communication preparedness activities by maintaining the database³ of information from administrations for use in emergency situations, which includes contact information and optionally includes available frequencies;

4 to facilitate online access to the database by administrations, national regulatory authorities, disaster-relief agencies and organizations, in particular the United Nations Emergency Relief Coordinator, in accordance with the operating procedures developed for disaster situations;

5 to collaborate with the United Nations Office for the Coordination of Humanitarian Affairs and other organizations, as appropriate, in the development and dissemination of standard operating procedures and relevant spectrum-management practices for use in the event of a disaster situation;

6 to collaborate, as appropriate, with the United Nations Working Group on Emergency Telecommunications (WGET) and the radio frequency and radio standards group under the UN Emergency Telecommunications Cluster (ETC) for which the World Food Programme (WFP) is the cluster lead;

7 to take into consideration, and collaborate in, as appropriate, all relevant activities in ITU's other two Sectors and General Secretariat;

8 to report on progress on this Resolution to subsequent world radiocommunication conferences,

invites the ITU Radiocommunication Sector

to continue conducting studies as necessary, in accordance with *resolves* 1 and in support of developing and maintaining appropriate spectrum-management guidelines applicable in emergency and disaster-relief operations,

invites the Director of the Telecommunication Standardization Bureau and the Director of the Telecommunication Development Bureau

to collaborate closely with the Director of the Radiocommunication Bureau (BR) to ensure that a consistent and coherent approach is adopted in the development of strategies in response to emergency and disaster situations,

urges administrations

to participate in the emergency communication preparedness activities described above and to provide to BR their information and, in particular, up-to-date contact information related to emergency and disaster-relief radiocommunications for inclusion in the database, taking into account Resolution ITU-R 55.

RESOLUTION 655 (REV.WRC-23)

Definition of time scale and dissemination of time signals via radiocommunication systems

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the ITU Radiocommunication Sector (ITU-R) is responsible for setting standards for the content and structure of time signals to be disseminated via radiocommunication systems, including the standard frequency and time signal service (SFTS) and the standard frequency and time signal-satellite service (SFTSS);
- b)* that the International Bureau of Weights and Measures (BIPM) is responsible for establishing and maintaining the second of the International System of Units (SI) and the reference time scale UTC with the SI second as its scale unit;
- c)* that the definition of reference time scale and dissemination of time signals via radiocommunication systems are important for applications and equipment that require a time traceable to the reference time,

considering further

- a)* that ITU-R has a liaison with the Consultative Committee for Time and Frequency (CCTF) and participates in the General Conference on Weights and Measures (CGPM) as an observer;
- b)* that BIPM is a Sector Member of ITU-R and participates in the relevant activities of ITU-R,

noting

- a)* that the international reference time scale UTC is the legal basis for timekeeping for many countries and is the time scale used in the majority of countries;
- b)* that disseminated time signals are used not only in telecommunications but also in many industries and practically all areas of human activities;
- c)* that time signals are disseminated by both wired communications covered by Recommendations of the ITU Telecommunication Standardization Sector (ITU-T) and by systems of different radiocommunication services (space and terrestrial), including the standard frequency and time signal service for which ITU-R is responsible,

realizing

that, in BIPM, a Task Group has been created to prepare a draft resolution for CGPM in 2026 related to the new maximum value of the difference between UT1 and UTC, and, in the spirit of close collaboration with ITU, the ITU-R group in charge of the subject has been invited to participate in this Task Group,

recognizing

- a) that No. **26.1** states that: “Attention should be given to the extension of this service to those areas of the world not adequately served”;
- b) that No. **26.6** states that: “In selecting the technical characteristics of standard frequency and time signal transmissions, administrations shall be guided by the relevant ITU-R Recommendations”;
- c) that the original definition of the international reference time scale UTC resulted from work completed in 1970 by the International Radio Consultative Committee (CCIR) of ITU, in full cooperation with CGPM;
- d) that WARC-79 included UTC in the Radio Regulations, and since then UTC, as “strongly endorsed” in Resolution 5 of CGPM (1975), has been used as the main time scale for telecommunication networks (wired and wireless) and for other time-related applications and equipment;
- e) that, in 2020, a Memorandum of Understanding was signed between BIPM and ITU concerning the expertise of each organization;
- f) that Resolution 2 of the 26th meeting of the CGPM (2018) provides the definition of UTC and confirms that UTC produced by BIPM is the only recommended time scale for international reference and the basis of civil time in most countries;
- g) that, in Resolution 4 on the use and future development of UTC, the 27th meeting of the CGPM (2022) decided that the maximum value for the difference allowed between UT1 and UTC will be increased in, or before, 2035;
- h) that the various aspects of current and potential future reference time scales, including their impacts and applications, are covered by Report ITU-R TF.2511;
- i) that a change in approach to the formation of the continuous UTC time scale will have positive operational and, consequently, economic implications;
- j) that implementing a new tolerance ($UT1 - UTC$) will require a transitional period of up to 15 years, in accordance with Report ITU-R TF.2511, the length of which shall take into account the planned lifetime of equipment and the implementation of backward compatibility for some categories of user;
- k) that the maximum value for the difference between UT1 and UTC should be no less than 100 seconds, taking into account the constraints of the technological systems expected to be used to disseminate this value,

resolves to invite the ITU Radiocommunication Sector

1 to continue the cooperation with BIPM, the International Committee for Weights and Measures (CIPM) and CGPM, as well as other relevant organizations, concerned industries and groups, and to maintain a dialogue concerning the expertise of each organization;

2 to further study the content and structure of time signals to be disseminated by radiocommunication systems, including wired technologies, using the combined expertise of the relevant organizations,

resolves

1 that, until the implementation of continuous UTC (see *recognizing g*)), UTC as described in Recommendation ITU-R TF.460-6 shall continue to apply;

2 that ITU-R cooperate further with BIPM, CIPM and CGPM in response to the consultation in *realizing*, to define a new maximum value for the difference between UT1 and UTC and on the implementation date for continuous UTC, possibly in 2035;

3 that ITU-R conduct studies, as appropriate, related to actions consequential upon *resolves* 1 and 2 to provide new and revised ITU-R Reports and Recommendations, such as, but not limited to, a revision to Recommendation ITU-R TF.460-6;

4 to establish a transition period for implementation and allow for the possibility to disseminate the increased difference between UT1 and UTC via radiocommunication system until 2035, but no later than 2040, in cases where existing equipment cannot be replaced earlier;

5 to maintain the name “UTC” as contained in Recommendation ITU-R TF.460-6 when it is revised,

instructs the Director of the Radiocommunication Bureau

to report on the progress of this Resolution to WRC-27,

invites administrations

to participate in the studies by submitting contributions to ITU-R,

instructs the Secretary-General

to bring this Resolution to the attention of the International Maritime Organization, the International Civil Aviation Organization, CGPM, CCTF, CIPM, BIPM, the International Earth Rotation and Reference Systems Service, the International Union of Geodesy and Geophysics, the International Union of Radio Science (URSI), the International Organization for Standardization (ISO), the World Meteorological Organization, the International Astronomical Union, the Institute of Electrical and Electronics Engineers and the Internet Engineering Task Force.

RESOLUTION 660 (WRC-19)

Use of the frequency band 137-138 MHz by non-geostationary satellites with short-duration missions in the space operation service

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that the term “short-duration mission” is used in accordance with Resolution **32 (WRC-19)***;
- b) that non-geostationary-satellite orbit (non-GSO) systems identified as short-duration mission are constrained in terms of low on-board power and low antenna gain;
- c) that the studies in Report ITU-R SA.2427 have indicated that the frequency bands 150.05-174 MHz and 400.15-420 MHz are not suitable for non-GSO systems in the space operation service (SOS) with short-duration missions;
- d) that the overall occupied bandwidth of any emission should be maintained completely within the frequency band allocated to the application identified in the SOS with short-duration missions, including any offsets such as Doppler shift or frequency tolerances;
- e) that, due to operational restrictions, only one non-GSO short-duration mission satellite is transmitting per channel at a given time in the same geographic area;
- f) that Report ITU-R SA.2425 provides studies related to the spectrum requirements for telemetry, tracking and command (TT&C) in the SOS for non-GSO systems with short-duration missions,

recognizing

- a) that the frequency range 108-137 MHz is allocated to the aeronautical mobile (R) service and is used for critical safety-of-life air-ground communications to ensure the safe operation of aircraft;
- b) that the technical characteristics for TT&C in the SOS below 1 GHz for non-GSO systems with short-duration missions are found in Report ITU-R SA.2426,

resolves

- 1 that the use of the SOS (space-to-Earth) for non-GSO systems with short-duration missions in the frequency range 137-138 MHz shall be limited to the frequency band 137.025-138 MHz;
- 2 that, in the frequency band 137.025-138 MHz, the power flux-density at any point on the Earth's surface produced by a space station of non-GSO SOS systems used for short-duration missions in accordance with Appendix 4 shall not exceed $-140 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$;

* *Note by the Secretariat:* This Resolution was revised by WRC-23.

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3 that administrations wishing to implement the SOS (space-to-Earth) in the frequency band 137.025-138 MHz by means of non-GSO systems for short-duration missions shall ensure compliance with *considering d)*,

invites the ITU Radiocommunication Sector

to conduct, as a matter of urgency, relevant studies of technical, operational and regulatory aspects in relation to the implementation of this Resolution,

instructs the Director of the Radiocommunication Bureau

to present to the next world radiocommunication conference a progress report relating to the implementation of this Resolution.

RESOLUTION 663 (REV.WRC-23)

Studies on possible new additional allocations to the radiolocation service on a primary basis in the frequency range 231.5-275 GHz, and possible new identifications for radiolocation service applications in frequency bands within the frequency range 275-700 GHz

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that all millimetric and sub-millimetric wave systems and applications in the radiolocation service (RLS) to be considered by this Resolution fall under the categories of ranging, imaging (including material analysis) and localization;
- b)* that those systems and applications are typically designed in two main configurations: active (radars) and receive-only (radiometers);
- c)* that those RLS systems and applications:
 - have been recognized by scientific communities and governmental organizations as well suited for stand-off detection of concealed objects in the imaging category;
 - will make a significant contribution to public safety, such as counterterrorism and the security of high-risk/high-value assets or areas in the imaging and localization categories;
 - will significantly contribute to improving transportation safety in the near ranges around vehicles and in the Intelligent Transport Systems (ITS) context in general in the ranging, localization and imaging categories;
- d)* that the RLS systems and applications are divided into:
 - active use, which may require a frequency bandwidth up to 30 GHz to achieve range resolutions in the order of half a centimetre;
 - receive-only use, which will detect the extremely weak power that is naturally radiated by objects and require a much wider frequency bandwidth than active systems to collect enough power for detection;
- e)* that globally harmonized spectrum for those millimetric and sub-millimetric wave RLS systems and applications is highly desirable for achieving economies of scale;
- f)* that the optimal frequency range for the operation of those active millimetric and sub-millimetric wave RLS systems is 231.5-320 GHz, where the atmospheric absorption is relatively low;

g) that there are some narrower existing allocations to the RLS in the frequency range 217-275 GHz in the three ITU Regions, which however may not support the bandwidth required for these millimetric and sub-millimetric wave RLS systems and applications;

h) that those RLS systems and applications in:

- the imaging category will operate at low transmit powers, in ranges up to 300 metres, and are limited in space and in time;
- the ranging category are expected to be ubiquitously deployed specifically in the near ranges around vehicles, while the category localization is used in general in the ITS context;
- all categories may be severely affected by other power sources operating in the same frequency band;

i) that the technical and operational characteristics for those receive-only and active millimetric and sub-millimetric wave systems and applications in the different categories need to be described, including protection criteria in particular for receive-only systems and applications;

j) that the combination of chosen transmitting power and bandwidth for some of the applications listed in *considering c)* within the regulatory framework depends on the operational requirements in the frequency band(s) used,

noting

a) that No. **5.563A** applies in the frequency bands 235-238 GHz, 250-252 GHz and 265-275 GHz, identifying these frequency bands for use by ground-based passive atmospheric sensing;

b) that No. **5.340** applies in the frequency band 250-252 GHz, prohibiting all emissions in this frequency band;

c) that consideration of receive-only imaging systems and the naturally compatible Earth exploration-satellite service (EESS) (passive) and radio astronomy service (RAS) might be possible when making common assignments in order to improve the overall spectrum usage efficiency;

d) that No. **5.565** states that the use of the frequency range 275-1 000 GHz by the passive services does not preclude use of this frequency range by active services;

e) that No. **5.564A** identifies the frequency range 275-450 GHz for the use by administrations for the implementation of land mobile and fixed service applications with certain limitations to protect the EEES (passive) in the frequency bands 296-306 GHz, 313-318 GHz and 333-356 GHz and to protect the RAS in general, in accordance with Resolution **731 (Rev.WRC-23)**,

recognizing

a) that the frequency ranges 231.5-275 GHz and 275-700 GHz are also allocated to other radiocommunication services and that those allocations are used by a variety of incumbent systems in many administrations, and that the protection of these services, including adjacent services, should be studied;

b) that, for the determination of the incumbent services, the relevant provisions of the Radio Regulations in force apply;

c) that administrations wishing to make frequencies available in the frequency range 275-1 000 GHz for active service applications are urged to take all practicable steps to protect the passive services from harmful interference until the date when the Table of Frequency Allocations is established for the relevant frequencies,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 the description of the technical and operational characteristics, including required protection criteria, for those receive-only and active millimetric and sub-millimetric wave RLS systems and applications in the categories listed in *recognizing a*);

2 studies on globally harmonized spectrum for the RLS, in particular for those millimetric and sub-millimetric wave RLS systems and applications above 231.5 GHz;

3 sharing and compatibility studies (in-band and adjacent bands) for active millimetric and sub-millimetric wave RLS systems and applications with other services in the frequency range 231.5-275 GHz, while ensuring protection for the current use and further development of the incumbent services allocated to this frequency range;

4 sharing and compatibility studies (in-band and adjacent bands) for RLS applications with EESS (passive), space research service (passive) and RAS applications in the frequency range 275-700 GHz, while maintaining protection for the passive service applications identified in No. **5.565**;

5 sharing and compatibility studies (in-band and adjacent bands) for RLS applications with fixed service and land mobile service applications in the frequency range 275-450 GHz, as identified in No. **5.564A**,

invites the 2027 world radiocommunication conference

1 to determine, based on the results of the ITU-R studies described in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference*, possible new allocations to the RLS in the frequency range 231.5-275 GHz on a primary basis, considering required regulatory measures, while taking into account and ensuring the protection of the current use and further development of existing services in the frequency bands considered and in adjacent frequency bands;

2 to determine, based on the results of the ITU-R studies described in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference*, possible identifications of frequency bands in the frequency range 275-700 GHz for use by RLS applications, considering required regulatory measures, while ensuring the protection of the applications identified in Nos. **5.564A** and **5.565** in the frequency bands considered and, as appropriate, in adjacent frequency bands.

RESOLUTION 664 (REV.WRC-23)

Studies on a possible new primary allocation to the Earth exploration-satellite service (Earth-to-space) in the frequency band 22.55-23.15 GHz

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the frequency band 25.5-27 GHz, allocated worldwide to the Earth exploration-satellite service (EESS) (space-to-Earth) on a primary basis currently does not have a paired band for potential associated Earth-to-space links;
- b)* that an EESS (Earth-to-space) allocation in the frequency band 22.55-23.15 GHz would allow for uplinks and downlinks on the same transponder, increasing efficiency and reducing satellite complexity;
- c)* that an EESS (Earth-to-space) allocation in the frequency band 22.55-23.15 GHz would allow for its use for satellite tracking, telemetry and command (TT&C) in combination with the existing EESS (space-to-Earth) allocation referred to in *considering a)*,

noting

- a)* that the frequency band 22.55-23.15 GHz is allocated to the fixed, inter-satellite and mobile services on a primary basis;
- b)* that the frequency band 22.55-23.15 GHz is also allocated to the space research service (SRS) (Earth-to-space) on a primary basis, paired with the space research service (SRS) (space-to-Earth) allocation in the frequency band 25.5-27 GHz;
- c)* that the frequency band 22.21-22.5 GHz is allocated to the radio astronomy service (RAS) and EESS (passive) on a primary basis;
- d)* that, for the RAS in the frequency bands 22.81-22.86 GHz and 23.07-23.12 GHz, No. **5.149** applies;
- e)* that the frequency band 23.6-24 GHz is allocated to the EESS (passive) and RAS on a primary basis (No. **5.340** applies),

recognizing

- a)* that the possible development of the EESS (Earth-to-space) in the frequency band 22.55-23.15 GHz should not constrain the use and development of the EESS (passive) operating in the frequency band 23.6-24 GHz;
- b)* that protection of the RAS sites operating in the frequency bands indicated in *noting c)*, *d)* and *e)* may be achieved through sufficient geographic separation from EESS earth stations,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference

studies on spectrum requirements and studies on sharing and compatibility between EESS (Earth-to-space) and the existing services, taking into account *noting a) to e)*, while ensuring the protection of these services, using relevant technical and operational parameters of their current and planned use,

invites administrations

to participate actively in ITU Radiocommunication Sector (ITU-R) studies and provide the technical and operational characteristics of the systems involved by submitting contributions to ITU-R,

invites the 2031 world radiocommunication conference

to consider, based on the results of the studies under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference*, a new worldwide primary allocation to the EESS (Earth-to-space) in the frequency band 22.55-23.15 GHz,

invites the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

RESOLUTION 673 (REV.WRC-23)

The importance of Earth observation radiocommunication applications

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the collection and exchange of Earth observation data are essential for maintaining and improving the accuracy of weather forecasts, which contribute to the protection of life and preservation of property throughout the world;
- b)* that Earth observation data are also essential for monitoring and predicting climate changes, for disaster prediction, monitoring and mitigation, for increasing the understanding, modelling and verification of all aspects of climate change, and for related policy-making;
- c)* that Earth observations are also used to obtain pertinent data regarding natural resources, this being particularly crucial for the benefit of developing countries;
- d)* that observations of the Earth's surface are also used for a large variety of other applications (e.g. urban developments, utilities deployments, agriculture, security);
- e)* that many observations are performed over the entire world which require spectrum-related issues to be considered on a worldwide basis;
- f)* that the importance of Earth observation radiocommunication applications has been stressed by a number of international bodies such as the World Meteorological Organization (WMO), the Intergovernmental Panel on Climate Change and the Group on Earth Observation, and that ITU-R collaboration with these bodies is essential;
- g)* that, although meteorological and Earth observation satellites are currently operated by only a limited number of countries, the data and/or related analyses resulting from their operation are distributed and used globally, in particular by national weather services in developed and developing countries and by climate change-related organizations;
- h)* that Earth observations are performed for the benefit of the whole international community and the data are generally made available at no cost,

recalling

- a)* the Plan of Action of the World Summit on the Information Society (Geneva, 2003), on e-environment, calling for the establishment of monitoring systems, using information and communication technologies (ICTs), to forecast and monitor the impact of natural and man-made disasters, particularly in developing countries, least developed countries and small economies;

b) Resolution 136 (Rev. Bucharest, 2022) of the Plenipotentiary Conference, on the use of telecommunications/ICTs for humanitarian assistance and for monitoring and management in emergency and disaster situations, including health-related emergencies, for early warning, prevention, mitigation and relief;

c) Resolution 182 (Rev. Bucharest, 2022) of the Plenipotentiary Conference, on the role of telecommunications/ICTs in regard to climate change and the protection of the environment,

recognizing

a) Recommendations ITU-R RS.1859, on use of remote sensing systems for data collection to be used in the event of natural disasters and similar emergencies, and ITU-R RS.1883, on use of remote sensing systems in the study of climate change and the effects thereof;

b) the Report on Question ITU-D 22/2, on utilization of ICTs for disaster management, resources and active and passive space-based sensing systems as they apply to disaster and emergency relief situations;

c) the joint WMO-ITU Handbook *Use of Radio Spectrum for Meteorology: Weather, Water and Climate Monitoring and Prediction* and the ITU-R Handbook *Earth Exploration-Satellite Service*,

recognizing further

Report ITU-R RS.2178, on the essential role and global importance of radio spectrum use for Earth observations and for related applications,

noting

a) that *in situ* and remote Earth observation capabilities depend on the availability of radio frequencies under a number of radio services, allowing for a wide range of passive and active applications on satellite- or ground-based platforms (see Report ITU-R RS.2178);

b) that, according to the United Nations Framework Convention on Climate Change, more than 90 per cent of natural disasters are climate- or weather-related;

c) that for certain Earth observation applications, long-term consistency of measurements is essential (e.g. climate change);

d) that certain frequency bands used by Earth observation applications have unique physical characteristics (e.g. spectral lines), so that migration to alternative frequency bands is not possible;

e) that ground-based radiometer measurements at the frequencies of water vapour absorption lines are essential for weather prediction and climate monitoring;

f) that some essential passive frequency bands are covered by No. **5.340** of the Radio Regulations;

g) that some essential passive Earth observation sensors could suffer from interference resulting in erroneous data or even complete loss of data,

resolves

- 1 to continue to recognize that the use of spectrum by Earth observation applications has a considerable societal and economic value;
- 2 to urge administrations to take into account Earth observation radio-frequency requirements and in particular protection of the Earth observation systems in the related frequency bands;
- 3 to encourage administrations to consider the importance of the use and availability of spectrum for Earth observation applications prior to taking decisions that would negatively impact the operation of these applications.

RESOLUTION 674 (WRC-23)

**Studies on possible allocations to the Earth exploration-satellite service (passive)
in the bands 4 200-4 400 MHz and 8 400-8 500 MHz**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the frequency band 6 425-7 250 MHz has been used by the Earth exploration-satellite service (EESS) (passive) to perform sea surface temperature (SST) measurements;
- b)* that SST measurements are important for detecting and forecasting meteorological events that drastically impact the safety and security of administrations and the populations of their countries;
- c)* that SST data sets are an essential resource for monitoring and understanding climate variability and climate change;
- d)* that SST measurement by satellite, in the microwave domain, remains the only measurement enabling daily and global measurement of SST, independently of meteorological conditions (i.e. the presence of clouds);
- e)* that SST measurement over different frequency channels might improve radio-frequency interference mitigation;
- f)* that certain frequency bands used for SST measurement have unique physical characteristics, so complementary frequency bands need to be carefully studied,

noting

that, under No. **5.458**, passive microwave sensor measurements are carried out over the oceans in the frequency band 6 425-7 075 MHz and planned to be carried out over the oceans in the frequency band 8 400-8 500 MHz, and passive microwave sensor measurements are carried out in the frequency band 7 075-7 250 MHz,

recognizing

- a)* that some complementary bands need to be determined in order to ensure continuity of SST measurement by the EESS (passive);
- b)* that, due to the sensitivity of the brightness temperature of the sea surface with regard to frequency, it is appropriate to perform SST measurements in frequency bands within the range 4-9 GHz,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

sharing and compatibility studies to determine the possibility of a future allocation to the EESS (passive) in the frequency bands 4 200-4 400 MHz and 8 400-8 500 MHz,

invites administrations

to participate actively in the studies and provide the information required for the studies listed in *resolves to invite ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* by submitting contributions to ITU-R,

invites the 2027 world radiocommunication conference

to examine the results of these studies with a view to considering a new primary allocation in all Regions to the EESS (passive) in the frequency bands 4 200-4 400 MHz and 8 400-8 500 MHz, without protection from existing services in these frequency bands and in adjacent bands.

RESOLUTION 675 (WRC-23)

Importance of meteorological aids service (space weather) applications

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the collection and exchange of space weather data are important for detecting solar activity events, including solar flares and high energetic particles and their relevant consequences for the Earth's geomagnetic and ionospheric conditions, and other space weather phenomena that impact services critical to the economy, safety and security of administrations and the populations of their countries;
- b)* that space weather data is critical for forecasting and providing alerts of space weather events and important to understanding the physical processes to develop prediction models for space weather events and their impacts on societal-infrastructure services;
- c)* that space weather data is important in understanding the physical process to provide prediction models for space weather events and their impacts;
- d)* that spectrum-reliant space weather sensor technology has been developed and operational systems have been deployed without much regard for domestic or international spectrum regulations, or for the potential need for protection from interference;
- e)* that spectrum-reliant space weather sensors may be vulnerable to interference from both terrestrial and spaceborne systems;
- f)* that some space weather sensors operate by receiving signals of low-level natural phenomena, mainly originating from solar activity and occurring beyond the major portion of the Earth's atmosphere, that impact the Earth's environment, and that they may therefore suffer harmful interference at levels which could be tolerated by other radiocommunication applications;
- g)* that the importance of space weather radiocommunication applications has been stressed by a number of international bodies, such as the World Meteorological Organization, the Intergovernmental Panel on Climate Change, the United Nations Office for Disaster Risk Reduction (UNDRR), the International Civil Aviation Organization (ICAO) and the United Nations Committee on the Peaceful Uses of Outer Space, and that ITU Radiocommunication Sector (ITU-R) collaboration with these bodies is essential;
- h)* that space weather data collection is performed for the benefit of the whole international community and the data is generally made freely available to users,

recalling

- a) the Plan of Action of the World Summit on the Information Society (Geneva, 2003), on e-environment, calling for the establishment of monitoring systems, using information and communication technologies (ICTs), to forecast and monitor the impact of natural and man-made disasters, particularly in developing countries, least developed countries and small economies;
- b) Resolution 136 (Rev. Bucharest, 2022) of the ITU Plenipotentiary Conference, on the use of telecommunications/ICTs for humanitarian assistance and for monitoring and management in emergency and disaster situations, including health-related emergencies, for early warning, prevention, mitigation and relief;
- c) Resolution 182 (Rev. Bucharest, 2022) of the Plenipotentiary Conference, on the role of telecommunications/ICTs in regard to climate change and the protection of the environment;
- d) the Global Framework for Climate Services as identified at the eighteenth session of the World Meteorological Congress (Geneva, June 2019), which provides information to help society adapt to climate variability and change;
- e) that UNDRR and the International Science Council identified hazards related to space weather in the initial list of the hazards for disaster risk management in 2021 under the Sendai Framework for Disaster Risk Reduction 2015-2030;
- f) United Nations General Assembly Resolution 76/3 of 25 October 2021, on the ‘Space2030’ Agenda: space as a driver of sustainable development, objective 3.8: increase awareness of the risks of adverse space weather and mitigate those risks, in order to ensure increased global resilience against space weather effects, and improve the international coordination of space weather-related activities, including outreach, communication and capacity-building, as well as the establishment of an international mechanism to promote increased high-level coordination in relation to space weather and increased global resilience against space weather effects;
- g) Amendment 78 to Annex 3 to the Convention on International Civil Aviation (International Standards and Recommended Practices, Meteorological Service for International Air Navigation), adopted on 7 March 2018 at the 213th session of the ICAO Council, which has introduced space weather advisory information services on space weather phenomena expected to affect aeronautical radiocommunication and radionavigation systems,

recognizing

- a) that Report ITU-R RS.2456, on space weather sensor systems using radio spectrum, contains:
 - a summary of spectrum-reliant space weather sensors; and
 - the documentation of the systems used for operational space weather monitoring, prediction and early warning deployed globally;
- b) that the ITU-R *Handbook on Radio Astronomy* contains further information on space weather observations;

c) that existing services and their systems and applications should be protected in the frequency bands used for space weather observations and no undue constraints should be imposed on the future development of these services,

noting

a) that *in situ* (local) and remote-sensing space weather observation capabilities depend on the availability of radio frequencies;

b) that, according to the United Nations Office for Outer Space Affairs, society is becoming increasingly dependent on space-based systems and it is vital to understand how space weather could affect space systems and human space flight, electric power transmission, high-frequency radiocommunications, and global navigation satellite system (GNSS) signals;

c) that certain frequency bands used by space weather applications have unique physical characteristics, so that migration to alternative frequency bands is not possible;

d) the need to include within the agenda of a world radiocommunication conference (WRC) an item for studies to be conducted on compatibility and frequency sharing for space weather sensors with incumbent radiocommunication services and for possible allocations for the meteorological aids service (MetAids) (space weather), on the basis of the outcomes of ITU-R studies,

resolves

1 that the following definition for space weather shall be used:

space weather: natural phenomena, mainly originating from solar activity and occurring beyond the major portion of the Earth's atmosphere, that impact Earth's environment and human activities;

2 that space weather sensor systems may operate under MetAids (space weather) allocations;

3 that an active space weather sensor is a system in the MetAids (space weather) by means of which information is obtained by transmission and reception of radio waves;

4 that a receive-only space weather sensor is a system in the MetAids (space weather) by means of which information is obtained by reception of radio waves of natural origin, or by the opportunistic reception of transmissions of other specific radiocommunication services;

5 to recognize the importance of spectrum usage by space weather applications for monitoring space weather phenomena and events that impact services critical to the economy, safety and security of administrations and the populations of their countries;

6 to urge administrations to take into account space weather radio-frequency requirements and in particular protection of the related frequency bands;

7 to encourage administrations to consider the importance of the use and availability of spectrum for space weather applications prior to taking decisions that would negatively impact their operations;

8 that no notification of frequency assignments to a station used for space weather observation be made by administrations under the existing MetAids allocations until a future competent WRC introduces the corresponding allocations to MetAids (space weather) in Article 5,

instructs the Director of the Radiocommunication Bureau

to consider any frequency assignments to space weather sensors that are notified within existing MetAids allocations prior to such a decision being taken by a competent WRC in accordance with *resolves* 8 above as being not in conformity with No. **11.31**.

RESOLUTION 676 (WRC-23)

Prevention and mitigation of harmful interference to the radionavigation-satellite service in the frequency bands 1 164-1 215 MHz and 1 559-1 610 MHz

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the radionavigation-satellite service (RNSS) in the frequency bands 1 164-1 215 MHz and 1 559-1 610 MHz is used in several aeronautical and maritime communication, navigation and surveillance safety-of-life systems;
- b)* that the RNSS is used for safety-of-life applications, for scientific applications and in many applications and devices around the world and across all sectors of the global economy, as described in Report ITU-R M.2458;
- c)* that harmful interference to the RNSS has potential consequences for safety systems used by aeronautical and maritime applications, and for the regularity and efficiency of civil aviation operations;
- d)* that the International Civil Aviation Organization (ICAO) has taken action to reinforce the resilience to interference of aeronautical positioning, navigation and timing (PNT) systems (see ICAO Assembly Resolution 41-8, Appendix C);
- e)* that ICAO has established a strategy for retaining essential conventional PNT infrastructure for contingency support in the case of RNSS outages, and for developing mitigation techniques for loss of services (see Convention on International Civil Aviation, Annex 10, Vol. I, Att. H); however, such infrastructure and mitigation techniques may not be available in some areas (e.g. over the high seas);
- f)* that the International Maritime Organization (IMO) through its Maritime Safety Committee (MSC), despite actions taken to mitigate the impact of harmful interference on the RNSS and its applications, has recognized that harmful interference impacting the RNSS poses a substantial risk to the safety of navigation, the safety of life and property, and the protection of the marine environment (see MSC.1/Circ. 1644);
- g)* that harmful interference to the RNSS may be difficult to detect and trace to origin,

recognizing

- a)* that disruption to the RNSS has been identified globally by the aeronautical community and the maritime community;
- b)* that there are different types of activities, notably the use of unauthorized transmitters, which may cause disruption;

c) that ICAO decided at its 40th Assembly in October 2019 to take measures to prevent and avoid interference to the RNSS;

d) that the Radiocommunication Bureau, in response to a decision of the Radio Regulations Board, issued Circular Letter CR/488, containing recommendations to Member States concerning mitigation of harmful interference to the RNSS;

e) that Article 45 of the ITU Constitution states that “All stations, whatever their purpose, must be established and operated in such a manner as not to cause harmful interference to the radio services or communications of other Member States or of recognized operating agencies, or of other duly authorized operating agencies which carry on a radio service, and which operate in accordance with the provisions of the Radio Regulations”;

f) that Article 47 of the Constitution states that “Member States agree to take the steps required to prevent the transmission or circulation of false or deceptive distress, urgency, safety or identification signals, and to collaborate in locating and identifying stations under their jurisdiction transmitting such signals”;

g) that No. **4.10** states that “the safety aspects of radionavigation and other safety services require special measures to ensure their freedom from harmful interference”;

h) that No. **5.328A** states that “Stations in the radionavigation-satellite service in the band 1 164-1 215 MHz shall operate in accordance with the provisions of Resolution **609 (Rev.WRC-07)** and shall not claim protection from stations in the aeronautical radionavigation service in the band 960-1 215 MHz. No. **5.43A** does not apply. The provisions of No. **21.18** shall apply”;

i) that prevention, identification, reporting and handling of cases of harmful interference, are subject to the provisions of Article **15**;

j) that there are other RNSS applications in the frequency bands 1 164-1 215 MHz and 1 559-1 610 MHz and that there are other RNSS applications operating in other frequency bands that need to be protected and that are not within the scope of this Resolution,

resolves to urge administrations

1 to apply necessary measures to avoid the proliferation, circulation and operation of unauthorized transmitters that cause, or have the potential to cause, harmful interference to RNSS systems and networks operating in the frequency bands 1 164-1 215 MHz and 1 559-1 610 MHz, including possible measures that might need to be taken with respect to *recognizing j*);

2 to take the following actions to prevent and mitigate harmful interference affecting the RNSS operating in the frequency bands 1 164-1 215 MHz and 1 559-1 610 MHz without prejudice to the right of administrations to deny access to the RNSS, for security or defence purposes:

2.1 to encourage collaboration between spectrum regulators, enforcement authorities and RNSS stakeholders, in particular in the aeronautical and maritime domains;

2.2 to encourage cooperation between aeronautical, maritime and security authorities, as well as spectrum regulators, as appropriate, to address interference risks to RNSS systems that may stem from the activities of these security authorities;

3 to report cases, as the affected administration deems appropriate, of harmful interference to the RNSS, in accordance with Article 15,

instructs the Director of the Radiocommunication Bureau

to provide, on request, assistance to administrations in accordance with No. 13.2,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO and IMO.

RESOLUTION 677 (WRC-23)

Use of the frequency range 40-50 MHz allocated to the Earth exploration-satellite service (active) for spaceborne radar sounders

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that spaceborne active sensors operating in the Earth exploration-satellite service (EESS) (active), described in Recommendation ITU-R RS.2042, can provide unique information on the physical properties of the Earth, such as characteristics of polar ice sheets and subterranean fossil aquifers in desertic environments;
- b)* that spaceborne active remote sensing requires specific frequency ranges depending on the physical phenomena to be observed;
- c)* that worldwide, periodic measurements of subsurface water/ice deposits require the use of spaceborne radar sounder active sensors;
- d)* that the measurement of reflectivity from subsurface scattering layers as deep as 10-100 metres for shallow aquifers and groundwater conduits, and on the order of 5 km for basal interface topography and ice-sheet thickness, is necessary;
- e)* that spaceborne radar sounders operating in the EESS (active) are intended to be operated from polar orbits, only in either uninhabited, sparsely populated or remote areas, with particular focus on deserts and polar ice fields;
- f)* that the 40-50 MHz frequency range is preferable to satisfy all operational requirements for such spaceborne radar sounder active sensors,

recognizing

- a)* that, given the complexity of the EESS (active) instrument implementation in these low frequencies and the high investment costs associated with these observation missions, very few such platforms are expected to be in orbit at the same time; consequently, aggregate interference from multiple spaceborne radar sounders into incumbent services is not anticipated and could be mitigated by coordination between the operators of such instruments;
- b)* that measurements by these radar sounders are only possible when the total electron content of the ionosphere is near its daily minimum, which normally occurs in a window of a few hours, centred at approximately 4 a.m. local time;
- c)* that No. **21.16.8** provides the equation to determine mean power flux-density (pfd) values for the EESS (active);

d) that wind profiler radars in the VHF band are addressed in Resolution **217 (Rev.WRC-23)** and are ideally suited for meteorological measurements (wind, atmospheric turbulence, tropopause height) up to high altitudes of 20-25 km that cannot be accommodated in other frequency bands;

e) that coordination between operators of EESS (active) systems and operators of wind profiler radars in the 40-50 MHz band may be needed on a case-by-case basis to ensure coexistence between the corresponding stations, acknowledging that there is no compatibility issue between those stations when they operate in adjacent bands;

f) that, at a pfd level of $-189 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$, EESS (active) systems are not functional or are in mute mode,

resolves

1 that the use of the frequency band 40-50 MHz by the EESS (active) is limited to spaceborne radar sounders, as described in the most recent version of Recommendation ITU-R RS.2042;

2 that, for the purpose of protecting in-band and adjacent-band services, the following conditions outlined in *resolves* 2.1 to 2.4 shall apply to the EESS (active) in the frequency band 40-50 MHz when the subsatellite¹ point is located within any of the following areas:

- a)* the spherical cap formed by latitudes between 72 and 90 degrees North;
- b)* the spherical cap formed by latitudes between 60 and 90 degrees South;
- c)* the quadrangle formed by latitudes between 59 and 72 degrees North and longitudes between 25 and 55 degrees West;

2.1 stations operating in the EESS (active) shall transmit within the areas defined in *resolves* 2 for no more than a total of 90 minutes within a 24-hour period;

2.2 the mean pfd level per spaceborne radar sounder produced at any given point on the surface of the Earth shall not exceed $-147 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$, under clear sky propagation conditions, for more than 0.05% of the time within a 24-hour period;

2.3 the mean pfd level per spaceborne radar sounder produced at any given point on the surface of the Earth shall not exceed $-136 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$, under clear sky propagation conditions;

¹ The subsatellite point is defined as the location of the projection of the satellite's nadir-pointing vector onto the Earth's surface.

2.4 if more than one spaceborne radar sounder is in operation:

- administrations shall ensure collectively that the pfd limit in *resolves* 2.2 is not exceeded for more than 0.1% of the time and shall have consultations accordingly;
- until such consultations enable to ensure compliance with that pfd limit, each system will have to ensure that the limit in *resolves* 2.2 is not exceeded for more than $0.1/N\%$ of the time, where N is the number of spaceborne radar sounders;

3 that, for the purpose of protecting in-band and adjacent-band services, the following conditions shall apply when the subsatellite point is located outside the areas provided in *resolves* 2;

3.1 in order to ensure that the spaceborne radar sounder is not operational or is in mute mode, the peak pfd level per spaceborne radar sounder produced at the surface of the Earth shall not exceed $-189 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$, under free-space propagation conditions;

3.2 for the use of the frequency band 40-50 MHz by the EESS (active) for operation of spaceborne radar sounders outside the areas defined in *resolves* 2, if the pfd level of $-189 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$ per spaceborne radar sounder produced at the surface of the Earth over the territory of any administration is exceeded, this exceedance is only permitted subject to an explicit agreement obtained;

3.3 stations operating in the EESS (active) in the 40-50 MHz frequency band shall not claim protection from stations operating in the radiolocation service in the frequency bands 42-42.5 MHz in Region 1, 41-44 MHz in countries included in No. **5.161**, and 46-50 MHz in countries included in No. **5.162A**; No. **5.43A** does not apply,

invites the ITU Radiocommunication Sector

to regularly review the number and characteristics of spaceborne radar sounders and the application of *resolves* 2.4 by Member States concerned,

instructs the Radiocommunication Bureau

to ensure the examination of the maximum pfd level given in *resolves* 2.3,

instructs the Director of the Radiocommunication Bureau

to report to future competent world radiocommunication conferences on the number of EESS satellites in operation in the frequency band 40-50 MHz and on the application of *resolves* 2.4 above.

RESOLUTION 678 (WRC-23)

**Use of the frequency band 14.8-15.35 GHz by the space research service
(space-to-space) (Earth-to-space) (space-to-Earth)
and associated transitional measures**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that there is a need for broadband communication downlinks in the space research service (SRS) for the purpose of transmitting future scientific data at high data transmission speeds;
- b)* that SRS operators need more stable regulatory certainty in order to be able to ensure long-term operation of systems in this service of public interest, and that operating on the basis of a secondary allocation conflicts with this objective;
- c)* that the frequency band 15.35-15.4 GHz is currently allocated to the radio astronomy service (RAS) on a primary basis;
- d)* that the frequency band 14.8-15.35 GHz is currently allocated to the fixed and mobile services on a primary basis;
- e)* that some applications in the aeronautical mobile service in the frequency band 14.8-15.35 GHz are non-commercial applications that need high flexibility of operations in order to achieve their mission;
- f)* that the helicopter television transmission system is used to transmit real-time television signals and data from a helicopter to the receiving stations on the ground or a ship, operated in the aeronautical mobile service in the frequency band 14.8-15.35 GHz,

noting

- a)* that Recommendations ITU-R F.758, ITU-R M.2068 and ITU-R M.2089 contain characteristics of, and protection criteria for, systems operating in the fixed, land and aeronautical mobile services, respectively, in the frequency range 14.5-15.35 GHz;
- b)* that Recommendations ITU-R RA.769, ITU-R RA.1513 and ITU-R RA.1631 contain protection criteria used for radio astronomical measurements in the frequency range 15.35-15.4 GHz, including percentage-of-time criteria, and reference radio astronomy antenna pattern to be used for compatibility analyses between non-geostationary orbit (non-GSO) systems and RAS stations based on the equivalent power flux-density (epfd) concept, respectively;
- c)* that Recommendation ITU-R SA.2141 provides technical and operational system characteristics for the SRS in the frequency range 14.8-15.35 GHz,

recognizing

- a) that the frequency band 14.8-15.35 GHz is currently used by data relay satellites in inter-satellite links, which permits the establishment of communications with satellites in non-GSO, including manned flights in the SRS;
- b) that the frequency band 14.8-15.35 GHz is planned for use by high-speed data links from non-GSO satellites within the SRS;
- c) that the use of the frequency band 14.8-15.35 GHz by the SRS should not cause harmful interference to stations of the RAS in the frequency band 15.35-15.4 GHz,

resolves

1 that, for the purpose of protecting in-band and adjacent-band services, the following conditions outlined in *resolves* 1.1 to 1.6 shall apply to the SRS in the frequency band 14.8-15.35 GHz:

1.1 any earth station in the SRS operating in the frequency band 14.8-15.35 GHz shall not exceed the power flux-density (pfd) level of $-156 \text{ dB(W/m}^2\text{)}$ for more than 2% of the time in a 50 MHz bandwidth in the frequency band 15.35-15.4 GHz, at any radio astronomy site observing in the frequency band 15.35-15.4 GHz;

1.2 the pfd produced in the frequency band 15.35-15.40 GHz by a space station of a GSO satellite network in the SRS (space-to-Earth) (space-to-space) shall not exceed the protection criteria specified in Recommendation ITU-R RA.769-2 for more than 2% of the time, at any radio astronomy site observing in the frequency band 15.35-15.4 GHz;

1.3 the epfd produced in the frequency band 15.35-15.40 GHz by all space stations of a non-GSO satellite system in the SRS (space-to-Earth) (space-to-space) shall not exceed $-240 \text{ dB(W/m}^2\text{)}$ for more than 2% of the time in a 50 MHz bandwidth in the frequency band 15.35-15.4 GHz at any radio astronomy site observing in the frequency band 15.35-15.4 GHz; the above limit shall be evaluated in accordance with Recommendation ITU-R RA.1513-2;

1.4 space stations in the SRS, operating in the space-to-space and Earth-to-space directions, shall not claim protection from stations in the fixed service; No. **5.43A** does not apply;

1.5 the pfd produced by a space station in the SRS at any point on the Earth's surface shall not exceed:

$-124 \text{ dB(W/(m}^2 \cdot \text{MHz))}$ for space-to-space links;

$-145.6 \text{ dB(W/(m}^2 \cdot \text{MHz))}$ for space-to-space links for more than 1% of time within a 24-hour period and

$-138 \text{ dB(W/(m}^2 \cdot \text{MHz))}$ for space-to-Earth links;

1.6 receiving earth stations in the SRS shall not claim protection from stations in the aeronautical mobile service operating in the frequency band 14.8-15.35 GHz within the respective border(s) of neighbouring countries, unless otherwise agreed between the administrations; No. **9.18** does not apply to stations in the aeronautical mobile service,

instructs the Director of the Radiocommunication Bureau

that, in reviewing the findings under No. **11.50** of the frequency assignments to a station in the space research service (space-to-space) (Earth-to-space) (space-to-Earth) in the frequency band 14.8-15.35 GHz, recorded in the Master International Frequency Register (MIFR) prior to 16 December 2023, the Bureau shall review as follows:

- a)* the original date of receipt of the recorded assignment in the MIFR shall be kept;
- b)* the Bureau shall examine each frequency assignment recorded in the MIFR in accordance with No. **11.31**;
- c)* when the examination with respect to No. **11.31** leads to a favourable finding, the assignment shall be upgraded to a primary status;
- d)* when the finding with respect to No. **11.31** is unfavourable, the assignment shall be modified in the MIFR to “for information purposes” and subject to application of No. **8.5**, only if the administration undertakes that it will be operated in accordance with No. **4.4**; otherwise the assignment shall be removed from the MIFR.

RESOLUTION 679 (WRC-23)

**Use of the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz
and 27.5-30 GHz by the inter-satellite service**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that there is a need for non-geostationary-satellite orbit (non-GSO) space stations to be able to relay data to the Earth, and that part of this need could be met by allowing such non-GSO space stations to communicate with inter-satellite service (ISS) space stations operating in the geostationary-satellite orbit (GSO) and in the non-GSO in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof;
- b)* that the administration responsible for the notification of non-GSO space stations communicating with GSO or non-GSO space stations in the ISS at higher altitude does not need to be the same administration that has already notified assignments in the ISS;
- c)* that imposing the hard limits necessary to protect other services would provide regulatory certainty for notifying administrations both of non-GSO space stations communicating with ISS space stations and of potentially impacted services;
- d)* that there is growing interest in utilizing satellite-to-satellite links for a variety of applications;
- e)* that the ITU Radiocommunication Sector (ITU-R) has carried out studies on sharing and compatibility between incumbent services in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz and adjacent bands and satellite-to-satellite transmissions in the ISS;
- f)* that these studies were based on certain principles, including the limitation of the use of frequency bands to a specific direction, in accordance with the existing fixed-satellite service (FSS) allocations in these frequency bands, the use of power control and antenna steering capabilities, and compliance with applicable equivalent power flux-density (epfd), power flux-density (pfd) and off-axis equivalent isotropically radiated power (e.i.r.p.) limits to protect incumbent services;
- g)* that the frequency bands 18.1-18.6 GHz (space-to-Earth), 18.8-20.2 GHz (space-to-Earth) and 27.5-30 GHz (Earth-to-space) are also allocated to terrestrial and space services used by a variety of different systems, and these existing services and their future development need to be protected, without the imposition of additional constraints, from the operation of satellite-to-satellite links in the ISS;

h) that there are no protection criteria for evaluation of time-varying interference into non-GSO satellite systems established in ITU-R; therefore, the following protection criteria were used as a basis for sharing studies involving links between two non-GSO space stations and interfered-with non-GSO FSS systems: I/N of 0 dB not to be exceeded more than 0.02% of the time, –6 dB no more than 0.6% of the time and –10.5 dB no more than 20% of the time,

recognizing

a) that any course of action taken under this Resolution has no impact on the original date of receipt of the frequency assignments of the GSO FSS satellite network or the non-GSO FSS system with which non-GSO space stations communicate or on the coordination requirements of that satellite network;

b) that the protection of frequency assignments to GSO FSS satellite networks in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or parts thereof, is a fundamental and important issue due to the fact that those frequency bands are used for the telecommunication/information and communication technology (ICT) infrastructure of many countries, in particular developing countries,

resolves

1 that, for a non-GSO space station subject to this Resolution communicating with a GSO or non-GSO ISS space station within the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz, and 27.5-30 GHz, or parts thereof, the following conditions shall apply:

1.1 the non-GSO ISS space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz, or parts thereof, shall only operate inter-satellite links when its apogee altitude¹ is lower than the minimum operational altitude² of the GSO or non-GSO space station with which it communicates and when the off-nadir angle between that GSO or non-GSO space station and the non-GSO space station with which it communicates is less than or equal to θ_{Max} (as defined in Annex 1 to this Resolution);

1.2 the GSO or non-GSO space station receiving in the frequency band 27.5-30 GHz and transmitting in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz, or parts thereof, shall only operate inter-satellite links when its minimum operational altitude is higher than the apogee altitude of the non-GSO space station with which it communicates;

1.3 that the use of inter-satellite links by GSO or non-GSO space stations transmitting in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz and receiving in the frequency band 27.5-30 GHz is limited to those with recorded assignments in the relevant FSS (space-to-Earth) and (Earth-to-space) allocations in those frequency bands;

¹ See item A.4.b.4.d of Appendix 4.

² See item A.4.b.4.f of Appendix 4.

2 that, for a non-GSO ISS space station transmitting in the frequency band 27.5-30 GHz, the following conditions shall apply:

2.1 this non-GSO ISS space station shall transmit only when within the cone whose apex is the GSO or non-GSO receiving space station and whose angle is θ_{Max} (as defined in Annex 1 to this Resolution);

2.2 the emissions of this non-GSO ISS space station shall remain within the envelope of the recorded characteristics of the associated transmitting FSS earth stations of the GSO FSS network or non-GSO FSS system with which it communicates;

2.3 this non-GSO space station shall comply with the limits contained in Article 21, Table 21-4, taking into account the provisions in Annex 2 to this Resolution for protection of terrestrial services in the frequency band 27.5-29.5 GHz and shall not cause unacceptable interference to or otherwise impose constraints on the operation or the development of terrestrial services; in the frequency band 29.5-30 GHz, with respect to the terrestrial services on the territory of administrations listed in footnote No. 5.542, the operation of inter-satellite links in the frequency band 29.5-30 GHz should not adversely impact the required protection of terrestrial services operated by the administrations listed in footnote No. 5.542;

2.4 the requirement not to cause unacceptable interference to terrestrial services shall not release the notifying administration from its obligation as contained in *resolves* 2.3 above;

2.5 this non-GSO space station shall not cause unacceptable interference to, or otherwise impose constraints on, the operation or the development of non-GSO FSS systems and shall comply with the provisions contained in Annex 4 to this Resolution;

2.6 this non-GSO space station shall not cause unacceptable interference to, or otherwise impose constraints on, the operation or development of FSS feeder links to non-GSO mobile-satellite service (MSS) systems operating in the frequency band 29.1-29.5 GHz; the conditions in section b) of Annex 4 to this Resolution shall apply;

2.7 the emission of this non-GSO space station shall not produce a pfd at any point in the GSO arc greater than the pfd produced by earth stations associated with the satellite network/system with which they communicate, and Annex 5 to this Resolution shall apply;

3 that for a space station transmitting in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz or parts thereof, the following conditions shall apply:

3.1 this non-GSO or GSO space station shall transmit only when the non-GSO ISS receiving space station is within the cone whose apex is the GSO or non-GSO transmitting space station and whose angle is θ_{Max} (as defined in Annex 1 to this Resolution);

3.2 the transmissions shall remain within the envelope of the recorded characteristics of the transmitting GSO FSS or non-GSO FSS space station towards its associated FSS earth stations;

3.3 with respect to the Earth exploration-satellite service (EESS) (passive) operating in the frequency band 18.6-18.8 GHz, any non-GSO FSS system with an altitude of apogee of less than 20 000 km communicating with lower-orbiting non-GSO space stations in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz and for which complete notification information has been received by the Radiocommunication Bureau after 1 January 2025 shall comply with the provisions indicated in Annex 3 to this Resolution;

4 that non-GSO ISS space stations receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz, or parts thereof, shall not claim protection from FSS and MSS networks and systems or meteorological-satellite service networks, or from terrestrial services operating in conformity with the Radio Regulations;

5 that the notifying administration for a non-GSO FSS system communicating with a non-GSO space station in the frequency bands 18.1-18.6 GHz, 19.7-20.2 GHz, 27.5-28.6 GHz and 29.5-30 GHz shall ensure that the epfd produced by the emissions from all combined operations of inter-satellite links in the ISS and Earth-to-space and space-to-Earth links in the FSS comply with the epfd limits contained in Article 22, Tables 22-1B, 22-1C and 22-2;

6 that the notifying administration for a non-GSO ISS system communicating with a non-GSO space station in the frequency bands 18.1-18.6 GHz and 19.7-20.2 GHz and receiving in the frequency bands 27.5-28.6 GHz and 29.5-30 GHz shall ensure that the epfd produced by the emissions from operations of inter-satellite links in the ISS comply with the epfd limits contained in Article 22, Tables 22-1B, 22-1C and 22-2;

7 that space stations receiving inter-satellite transmissions in the frequency band 27.5-30 GHz from non-GSO space stations shall not claim protection for inter-satellite links from FSS and MSS networks and systems or from terrestrial services operating in conformity with the Radio Regulations;

8 that assignments to inter-satellite links in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz shall not cause unacceptable interference to, or claim protection from, GSO FSS services operating in the frequency band allocated to the FSS,

further resolves

1 that, subject to this Resolution:

- a) the notifying administration for the non-GSO system choosing to operate inter-satellite links and receiving in the frequency bands 27.5-28.6 GHz and 29.5-30 GHz shall indicate to the Bureau its commitment that the epfd produced at any point in the GSO by emissions from all combined operations of inter-satellite links and associated earth station transmissions shall not exceed the limits given in Article 22, Table 22-2;
- b) the notifying administration for a non-GSO ISS space station transmitting in the frequency band 27.5-30 GHz towards a GSO network and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall send the Bureau the relevant Appendix 4 advance publication information containing the characteristics of the non-GSO ISS space station and the name of the associated notified GSO FSS network with which it intends to communicate;

- c) the notifying administration for a non-GSO ISS space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz towards a non-GSO system and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall send the Bureau the relevant Appendix 4 advance publication information containing the characteristics of the non-GSO ISS space station and the name of the associated notified non-GSO FSS system(s) with which it intends to communicate;
 - d) the notifying administration for a non-GSO system operating inter-satellite links and receiving in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz or of a GSO network operating inter-satellite links and receiving in the frequency band 27.5-30 GHz is responsible for eliminating any case of unacceptable interference;
- 2 that the notifying administration for a GSO network/non-GSO system receiving in the frequency band 27.5-30 GHz shall submit, with the Appendix 4 data, a firm, objective, actionable, measurable and enforceable commitment that, in the event of reported unacceptable interference, it undertakes to immediately eliminate the interference or reduce it to an acceptable level, following the procedures in *further resolves* 3:
- a) that in case no action is taken with regard to the obligation referred to in *further resolves* 2 above, the Bureau shall send a reminder requesting the notifying administration for the GSO network/non-GSO system to comply with the requirements referred to in the commitment;
 - b) should the interference persist 30 days after the dispatch date of the above-mentioned reminder, the Bureau shall submit the case to the subsequent meeting of the Radio Regulations Board for review and the necessary actions (including suppression of the frequency assignment in question), as appropriate;
- 3 that in the event of unacceptable interference caused by a non-GSO ISS space station transmitting in the frequency band 27.5-30 GHz or parts thereof:
- a) the notifying administration for that non-GSO ISS space station shall cooperate with an investigation into the matter and provide the information on the operation of the transmitting space station needed to assess the interference and a point of contact to provide such information;
 - b) the notifying administration for the non-GSO ISS space station transmitting in the frequency band 27.5-30 GHz and the notifying administration for the GSO or non-GSO network or system with which the non-GSO transmitting space station communicates shall, jointly or individually, as the case may be, upon receipt of a report of unacceptable interference, take the required actions to eliminate or reduce the interference to an acceptable level;
- 4 that the notifying administration for the GSO or non-GSO FSS space station receiving inter-satellite transmissions in the frequency band 27.5-30 GHz shall ensure that:
- a) the non-GSO ISS space stations transmitting in this frequency band employ techniques to maintain pointing accuracy with the associated receiving space station and to avoid inadvertently tracking an adjacent GSO space station of any other notifying administration or a space station in a non-GSO system of any other notifying administration;

- b) all necessary measures are taken so that non-GSO ISS space stations transmitting in this frequency band are subject to permanent monitoring and control by a network Control and Monitoring Centre (NCMC) or equivalent facility and are capable of receiving and acting upon at least “enable transmission” and “disable transmission” commands from the NCMC or equivalent facility; and
- c) a permanent point of contact is provided for the purpose of tracing any cases of unacceptable interference from non-GSO ISS space stations transmitting in this frequency band and responding immediately to requests from the focal point;

5 that, upon examination of the information submitted by the notifying administration under *further resolves* 1b) or 1c), if no recorded frequency assignments with typical earth stations for the relevant frequency bands can be identified for the GSO FSS network or non-GSO FSS system with which the notifying administration for the non-GSO ISS space station intends to communicate, the Bureau shall return the information to the notifying administration,

invites the ITU Radiocommunication Sector

1 to develop a suitable methodology for calculating the epfd produced by the emissions from operations of all ISS links in the frequency bands 27.5-28.6 GHz and 29.5-30 GHz, within a given non-GSO ISS system, for use by the Bureau in examining whether the system is in compliance with the epfd limits contained in Article 22, Table 22-2;

2 to develop a suitable methodology for calculating the epfd produced by the emissions from operations of all ISS links in the frequency bands 18.1-18.6 GHz and 19.7-20.2 GHz, within a given non-GSO ISS system, for use by the Bureau in examining whether the system is in compliance with the epfd limits contained in Article 22, Tables 22-1B and 22-1C,

instructs the Director of the Radiocommunication Bureau

1 to take all necessary actions to facilitate the implementation of this Resolution, together with providing any assistance for the resolving of interference, if and when required;

2 to report to future world radiocommunication conferences on any difficulties or inconsistencies encountered in the implementation of this Resolution;

3 to use the methodology given in Annex 2 to this Resolution when assessing compliance with the pfd limits in Article 21, Table 21-4;

4 to use the methodology given in Appendices 1 to 3 to Annex 5 to this Resolution when assessing compliance with Annex 5;

5 not to examine, under No. 11.31, the conformity of non-GSO ISS systems with the provisions of *resolves* 3.3 of this Resolution in view of the fact that the detailed characteristics of non-GSO ISS system transmitters are not available;

6 that, until the methodology is developed according to *invites the ITU Radiocommunication Sector* 1 and 2 above, the Bureau shall issue a qualified favourable finding for examination under No. 11.31; when the methodology is available, the Bureau shall review its finding under No. 11.31.

ANNEX 1 TO RESOLUTION 679 (WRC-23)

Determination of the off-nadir angle

1 A non-geostationary (non-GSO) inter-satellite service (ISS) space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall communicate with a non-GSO space station only when the off-nadir angle between this non-GSO space station and the non-GSO space station with which it communicates is equal to or smaller than:

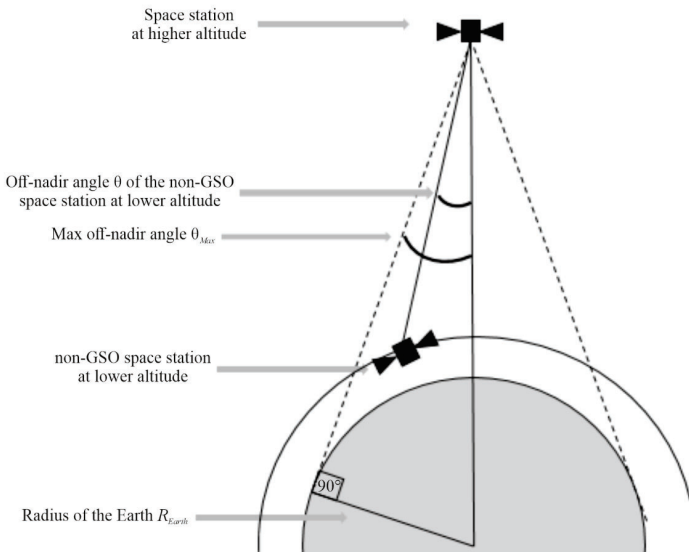
$$\theta_{Max} = \sin^{-1} \left(\frac{R_{Earth}}{R_{Earth} + Alt_{Higher}} \right)$$

where:

$$R_{Earth} = 6\,378 \text{ km}$$

Alt_{Higher} = altitude of the non-GSO space station at a higher orbital altitude in km.

FIGURE 1



2 A non-GSO ISS space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz shall communicate with a geostationary (GSO) space station only when the off-nadir angle between this GSO space station and the non-GSO space station with which it communicates is equal to or smaller than:

- if the altitude of the non-GSO space station is less than 2 000 km:

$$\theta_{Max} = \sin^{-1} \left(\frac{R_{Earth} + Alt_{non-GSO}}{R_{Earth} + Alt_{GSO}} \right)$$

- if the altitude of the non-GSO space station is greater than or equal to 2 000 km:

$$\theta_{Max} = \sin^{-1} \left(\frac{R_{Earth}}{R_{Earth} + Alt_{GSO}} \right)$$

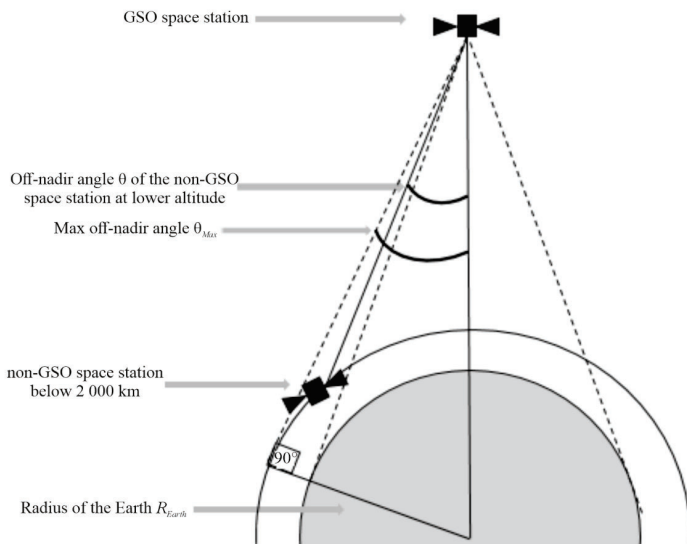
where:

$R_{Earth} = 6\,378$ km

Alt_{GSO} = altitude of the GSO space station in km

$Alt_{non-GSO}$ = altitude of the non-GSO space station in km.

FIGURE 2



3 If the altitude of the non-GSO space station transmitting in the frequency band 27.5-30 GHz and receiving in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz is less than 2 000 km, the angle between the vector from this space station to the centre of the Earth and the vector between this space station and the GSO space station shall be at least 90°.

4 Where the notified service area of the GSO or non-GSO network/system at a higher orbital altitude is not global, the maximum off-nadir angle θ_{Max} will vary at each azimuth according to the notified service area and there will be a specific maximum off-nadir angle associated with each azimuth, based on the position in space of the FSS network/system at higher orbital altitude and the geographical coordinates (latitude, longitude) of the border of the notified service area at each azimuth, which are extracted from the Graphical Interference Management System (GIMS) database container that was submitted to the Bureau when notifying a specific non-global service area:

$$\theta_{Max} = \cos^{-1} \left(\frac{\left(R_{Earth} + Alt_{Higher} \right)^2 + dist^2 - R_{Earth}^2}{2 \times \left(R_{Earth} + Alt_{Higher} \right) \times dist} \right)$$

with:

$$dist = \sqrt{(X_E - X_S)^2 + (Y_E - Y_S)^2 + (Z_E - Z_S)^2}$$

$$X_E = R_{Earth} \times \cos(lat_{sab}(\varphi)) \times \cos(lon_{sab}(\varphi))$$

$$Y_E = R_{Earth} \times \cos(lat_{sab}(\varphi)) \times \sin(lon_{sab}(\varphi))$$

$$Z_E = R_{Earth} \times \sin(lat_{sab}(\varphi))$$

$$X_S = (R_{Earth} + Alt_{Higher}) \times \cos(lat_{SS}) \times \cos(lon_{SS})$$

$$Y_S = (R_{Earth} + Alt_{Higher}) \times \cos(lat_{SS}) \times \sin(lon_{SS})$$

$$Z_S = (R_{Earth} + Alt_{SS}) \times \sin(lat_{Higher})$$

where:

$lat_{sab}(\varphi)$ = latitude of the service area border for the azimuth φ

$lon_{sab}(\varphi)$ = longitude of the service area border for the azimuth φ

lat_{SS} = latitude of the sub-satellite point of the GSO/non-GSO space station

lon_{SS} = longitude of the sub-satellite point of the GSO/non-GSO space station.

ANNEX 2 TO RESOLUTION 679 (WRC-23)

**Provisions for non-GSO ISS space stations transmitting in the
frequency band 27.5-30 GHz to protect terrestrial services
in the frequency band 27.5-30 GHz**

To check the compliance of non-geostationary-satellite (non-GSO) inter-satellite service (ISS) emissions with the power flux-density (pfd) mask described in Table 21-4, the following procedures shall be followed:

- 1 Parameter a is the orbital altitude (km) of the non-GSO ISS system identified in *further resolves 1b*) or in *further resolves 1c*) of this Resolution. PSD is the power spectral density in the reference bandwidth associated with the pfd limit. Compute the off-axis gain pattern $Gtx(\varphi)$, with φ being the off-axis angle in the direction of the terrestrial receiver. Assume the Earth is a sphere whose radius, R_e , is 6 378 km.
- 2 Compute the angle, as seen from the non-GSO ISS system transmitting in the frequency band 27.5-30 GHz (the user space station), between the centre of the Earth and the geostationary-satellite (GSO) network or non-GSO systems receiving in the frequency band 27.5-30 GHz (the service provider space station), assuming that the user is at the edge of the cone of coverage with the formula:

$$\delta = \arcsin \left(\frac{R_e}{R_e + a} \right)$$

- 3 Sweep the angle of arrival to the terrestrial station, θ , from 0° to 90° in 0.1° increments.
- 4 Compute the satellite angle $\gamma = \arcsin \left(\frac{\sin(90 + \theta)}{R_e + a} * R_e \right)$.
- 5 Compute the off-axis angle $\varphi = 180 - \delta - \gamma$.
- 6 Compute the gain Gtx in dBi towards the Earth point for each of the angles from Step 5, using the user space station transmit antenna pattern.
- 7 Compute the slant range $d = (R_e + a) \frac{\sin(90 - \gamma - \theta)}{\sin(90 + \theta)}$.
- 8 Compute the PFD on the ground:

$$PFD = PSD + Gtx(\theta) - 10 \times \log_{10} \left(4\pi d^2 \right)$$

ANNEX 3 TO RESOLUTION 679 (WRC-23)

**Provisions for non-GSO space station³ links in the frequency bands
18.3-18.6 GHz and 18.8-19.1 GHz towards non-GSO space stations
with respect to the Earth exploration-satellite service (passive)
in the frequency band 18.6-18.8 GHz**

Non-geostationary (non-GSO) space stations operating with an altitude of apogee of more than 2 000 km and less than 20 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz, when communicating with a non-GSO inter-satellite service space station as described in *resolves* 1 of this Resolution, shall not exceed a power flux-density (pfd) produced at the surface of the oceans across the 200 MHz of the 18.6-18.8 GHz band of $-118 \text{ dB(W/(m}^2 \cdot 200 \text{ MHz))}$.

Non-GSO space stations operating with an altitude of apogee of less than 2 000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz, when communicating with a non-GSO space station as described in *resolves* 1 of this Resolution, shall not exceed a pfd produced at the surface of the oceans across the 200 MHz of the 18.6-18.8 GHz band of $-110 \text{ dB(W/(m}^2 \cdot 200 \text{ MHz))}$.

ANNEX 4 TO RESOLUTION 679 (WRC-23)

**Provisions for non-GSO inter-satellite links in the frequency band
27.5-30 GHz to protect non-GSO space stations**

The following conditions for non-geostationary (non-GSO) inter-satellite service (ISS) space stations transmitting in the frequency band 27.5-30 GHz shall apply for the protection of non-GSO space stations:

a) The emissions from any non-GSO ISS space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a geostationary-satellite (GSO) fixed-satellite service (FSS) network shall not exceed the following on-axis equivalent isotropically radiated power (e.i.r.p.) spectral density limits:

- for non-GSO space station transmit on-axis antenna gains greater than or equal to 40.6 dBi: 52.5 dBW/10 MHz;
- for non-GSO space station transmit on-axis antenna gains less than 40.6 dBi: $52.5 - (40.6 - X) \text{ dBW/10 MHz}$;

where X is the on-axis gain of the non-GSO space station antenna in dBi, where the 10 MHz reference bandwidth is in any 10 MHz (e.g. adjacent but non-overlapping).

³ These provisions do not apply to non-GSO systems using orbits with an altitude of apogee of less than 2 000 km that employ a frequency reuse factor of at least 3.

b) To protect FSS feeder links to non-GSO mobile-satellite service systems, the following conditions for non-GSO space stations and systems transmitting in the frequency band 29.1-29.5 GHz shall apply:

- emissions from any non-GSO space station communicating with a GSO network shall not exceed a maximum power spectral density of -66 dBW/Hz at the input of the antenna of the non-GSO space station;
- any non-GSO space station communicating with a GSO network shall have a minimum antenna diameter of 0.3 m whose gain shall not exceed the gain envelope in the most recent version of Recommendation ITU-R S.580;
- non-GSO space stations communicating with a GSO network shall operate only in orbits with inclination between 75° and 105° ;
- non-GSO systems communicating with a GSO network shall not contain more than 100 satellites.

c) The emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO system with a minimum operational altitude higher than or equal to 2 000 km shall not exceed an on-axis e.i.r.p. spectral density of -20 dBW/Hz, and the total e.i.r.p. from any non-GSO space station shall not exceed:

Transmitting non-GSO space station operational altitude (km)	Maximum total e.i.r.p. (dBW) (brought into use on or before 31 December 2036)	Maximum total e.i.r.p. (dBW) (brought into use after 31 December 2036)
altitude < 450	63	66
$450 \leq \text{altitude} < 600$	61	64
$600 \leq \text{altitude} < 750$	58	58
$750 \leq \text{altitude} < 900$	55	55
$900 \leq \text{altitude} < 1\,350$	25	44
altitude $\geq 1\,350$	Not applicable	Not applicable

d) The emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO system with a minimum operational altitude lower than 2 000 km shall not exceed an on-axis e.i.r.p. spectral density of -28 dBW/Hz, and the total e.i.r.p. from any non-GSO space station shall not exceed:

Transmitting non-GSO space station operational altitude (km)	Maximum total e.i.r.p. (dBW) (brought into use on or before 31 December 2036)	Maximum total e.i.r.p. (dBW) (brought into use after 31 December 2036)
altitude < 375	61	64
375 ≤ altitude < 450	60	63
450 ≤ altitude < 600	58	61
600 ≤ altitude < 750	55	55
750 ≤ altitude < 900	53	53
900 ≤ altitude < 1 350	25	44
altitude ≥ 1 350	Not applicable	Not applicable

e) For off-axis angles greater than 3.5°, the off-axis e.i.r.p. emissions of a non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO system with a minimum operational altitude higher than or equal to 2 000 km shall not exceed the envelope generated by the combination of an input power spectral density at the antenna flange of -62 dBW/Hz coupled with the following off-axis gain:

- 29-25 log(φ) dBi for angles between 3.5° and 4.9°;
- 11.71 dBi for angles between 4.9° and 9.5°;
- 43-32log(φ) dBi for angles between 9.5° and 20°.

ANNEX 5 TO RESOLUTION 679 (WRC-23)

Provisions for non-GSO inter-satellite links in the frequency band 27.5-30 GHz bands to protect GSO space stations

1 In the frequency band 27.5-30 GHz, when a non-geostationary-satellite (non-GSO) system, as identified in *further resolves 1b*) of this Resolution, identifies an associated geostationary-satellite (GSO) network, as described in *further resolves 1b*), to operate inter-satellite links, the Radiocommunication Bureau shall perform the examination described in Appendix 1 to this Annex.

2 The notifying administration for the GSO network identified in § 1 above shall respect all coordination agreements that have already been recorded, noting the provisions of *further resolves 3* and 4 of this Resolution.

3 The notifying administration for the GSO network identified in § 2 above shall provide, upon any request from the notifying administration of a GSO network involved in the coordination agreements referred to above, additional information on how the relevant coordination agreements will be respected with regard to protection from inter-satellite links. This information shall be provided within 90 days after the receipt of the request.

4 In the frequency bands 27.5-29.1 GHz and 29.5-30 GHz, when a non-GSO system, as identified in *further resolves 1c*) of this Resolution, identifies a non-GSO system, as described in *further resolves 1c*), to operate inter-satellite links, the Bureau shall perform the examination described in Appendix 2 to this Annex.

5 The notifying administration for the receiving non-GSO network identified in § 3 above shall respect all coordination agreements that have already been recorded, noting the provisions of *further resolves 3* and 4 of this Resolution.

6 In the frequency bands 27.5-28.6 GHz and 29.5-30 GHz, the power flux-density (pfd) produced at any point in the geostationary-satellite orbit by a non-GSO space station, as mentioned in *further resolves 1c*), shall not exceed a pfd of -164 dB(W/m²) in any 40 kHz band. A computation methodology is provided in Appendix 3 to this Annex.

7 In cases where all of the conditions identified in Appendix 4 to this Annex are met, the notifying administration for frequency assignments to the GSO inter-satellite service (ISS) space stations shall seek agreement from the notifying administration for the GSO fixed-satellite service (FSS) or mobile-satellite service (MSS) network. In the absence of agreement, frequency assignments to the ISS space station shall operate under the express condition that the ISS space station does not cause harmful interference to, or claim protection from, frequency assignments to the GSO FSS or MSS network operating in accordance with the Radio Regulations.

7.1 The Bureau shall not perform an examination under § 7 of this Annex.

7.2 In the event of the harmful interference actually being caused by an ISS space station under § 7 of this Annex, for the case of ISS links between a non-GSO space station and a GSO space station, to any GSO FSS or MSS with recorded frequency assignments operating in accordance with the Radio Regulations, the notifying administration for the GSO ISS space station shall, upon receipt of a report providing the particulars relating to the harmful interference given in the form indicated in Appendix 10, immediately eliminate this harmful interference.

7.3 In the case of unresolved harmful interference under § 7 of this Annex, the Bureau shall submit the case to the subsequent meeting of the Radio Regulations Board for review and the necessary actions (including suppression of the frequency assignment in question), as appropriate.

7.4 The notifying administration for the GSO ISS space station shall inform the notifying administration for the non-GSO ISS space station of the status of the agreement being sought under § 7 of this Annex.

APPENDIX 1 TO ANNEX 5

The aim of this Appendix is to provide a method to be used by the Radiocommunication Bureau to assess whether the emissions from a non-geostationary (non-GSO) space station operating inter-satellite links with a geostationary (GSO) space station are within the envelope of the typical earth stations of the GSO network.

Step 1: For each group of the transmitting non-GSO notification.

Step 2: For each of the receiving GSO networks, as listed in *further resolves 1b*) of this Resolution.

Step 3: For each beam in the Earth-to-space direction of the receiving GSO network notification, compute the maximum equivalent isotropically radiated power (e.i.r.p.) produced in one hertz (*EIRPSD*).

Step 4: Compute the reduction in free-space loss at the altitude of the user using:

$$\Delta FSL = 20 \log_{10} \left(\frac{GSO_{alt}}{GSO_{alt} - NGSO_{alt}} \right)$$

where $NGSO_{alt}$ is the altitude of the transmitting non-GSO system space stations and $GSO_{alt} = 35\,786$ km. It should be noted that, if several altitudes are included in the notification, each altitude shall be tested.

Step 5: Compute the reduced e.i.r.p. spectral density as $EIRPSD_{reduced} = EIRPSD - \Delta FSL$.

Step 6: For all beams in the non-GSO system notification with a class of station ES, the e.i.r.p. spectral density mask is given in Appendix 4, data item A.27.e.

Step 7: For all emissions in the GSO network notification, compute the e.i.r.p. spectral density mask for all off-axis angles between 0° and 80°, with a step of 1°, and reduce it by ΔFSL . The e.i.r.p. spectral density mask computation should assume that the maximum gain is for an off-axis angle of 0°.

Step 8: Frequency assignments to non-GSO systems shall receive a favourable finding with respect to Annex 5 if, for all beams:

- the maximum value of the e.i.r.p. spectral density mask from Step 6 does not exceed the $EIRPSD_{reduced}$ quantity, computed at the same altitude; and
- the e.i.r.p. spectral density mask of the transmitting non-GSO space station from Step 6 is less than the reduced e.i.r.p. spectral density mask, compared in one hertz, from Step 7 for all angles for at least one emission in the GSO network notification.

Otherwise, the assignments shall receive an unfavourable finding.

APPENDIX 2 TO ANNEX 5

The aim of this Appendix is to provide a method to be used by the Radiocommunication Bureau to assess whether the emissions from a non-geostationary (non-GSO) space station operating inter-satellite links with a non-GSO space station are within the envelope of the typical earth stations of the non-GSO system.

Step 1: For each group of the transmitting non-GSO notification.

Step 2: For each of the receiving non-GSO systems, as listed in *further resolves 1c)* of this Resolution.

Step 3: For each beam in the Earth-to-space direction of the receiving non-GSO system notification, compute the maximum equivalent isotropically radiated power (e.i.r.p.) produced in one hertz (*EIRPSD*).

Step 4: Compute the reduction in free-space loss at the altitude of the user using:

$$\Delta FSL = 20 \log_{10} \left(\frac{GSO_{alt}}{GSO_{alt} - NGSO_{alt}} \right)$$

where $NGSO_{alt}$ is the altitude of the transmitting non-GSO system space stations and $GSO_{alt} = 35\,786$ km. It should be noted that if several altitudes are included in the notification, each altitude shall be tested.

Step 5: Compute the reduced e.i.r.p. spectral density as $EIRPSD_{reduced} = EIRPSD - \Delta FSL$.

Step 6: For all beams in the non-GSO system notification with a class of station ES, the e.i.r.p. spectral density mask is given in Appendix 4, data item A.27.e.

Step 7: For all emissions in the receiving non-GSO network notification, compute the e.i.r.p. spectral density mask for all off-axis angles between 0° and 80° , with a step of 1° , and reduce it by ΔFSL . The e.i.r.p. spectral density mask computation should assume that the maximum gain is for an off-axis angle of 0° .

Step 8: Frequency assignments to non-GSO systems shall receive a favourable finding with respect to Annex 5 if, for all beams:

- the maximum value of the mask from Step 6 does not exceed the $EIRPSD_{reduced}$ quantity, computed at the same altitude; and
- the e.i.r.p. spectral density mask of the transmitting non-GSO space station from Step 6 is less than the reduced e.i.r.p. spectral density mask from Step 7 for all angles.

Otherwise, the assignments shall receive an unfavourable finding.

APPENDIX 3 TO ANNEX 5

To check the compliance of non-geostationary-satellite (non-GSO) emissions with the power flux-density (pfd) limit given in Annex 5, § 6, the following procedure shall be followed.

Step 1: For each of the latitudes in the equivalent isotropically radiated power (e.i.r.p.) spectral density mask given in Appendix 4 data item A.27.e, select the corresponding value to the geostationary-satellite (GSO) arc avoidance and denote it as $eirpa$. If the mask is non-monotonic, select the largest value in the e.i.r.p. mask considering all angles greater than or equal to the GSO arc avoidance angle as given in Appendix 4, data item A.27.d.

Step 2a: compute the slant distance to the GSO arc as:

$$d = \sqrt{(6378 + alt)^2 + 42164^2 - 2 \times (6378 + alt) \times 42164 \times \cos(latitude)}$$

where alt is the altitude of the transmitting non-GSO space station, in km, and latitude is at the nadir of the non-GSO space station.

Step 2b: Compute the *PFD* on the GSO arc using:

$$PFD = eirp_{\alpha} - 10 \log \left(4\pi (d \times 1000)^2 \right)$$

Step 3: Frequency assignments to non-GSO systems shall receive a favourable finding with respect to Annex 5, § 6, if all pfd values calculated in Step 2b are below the threshold given in Annex 5, § 6.

APPENDIX 4 TO ANNEX 5

§ 7 of this Annex applies when all of the following conditions are met between frequency assignments for the notifying administration for a geostationary-satellite (GSO) fixed-satellite service (FSS) or mobile-satellite service (MSS) network and frequency assignments to the GSO inter-satellite service (ISS) space station receiving in the frequency band 27.5-30 GHz and transmitting in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz:

- the date of receipt under No. **9.6** of the frequency assignments to the GSO FSS or MSS network is before the date of recording of the ISS frequency assignments in the Master International Frequency Register, and
- frequency overlap, and
- orbital separation of less than or equal to 2°, and
- the maximum off-axis equivalent isotropically radiated power (e.i.r.p.) spectral density of the non-GSO ISS space station towards the affected GSO FSS or MSS space station exceeds $-65 + 29 - 25 * \log(\theta)$ dBW/Hz, where θ is the topocentric angular separation between the notified affected GSO FSS or MSS space station and the notified GSO ISS space station, and
- the service area of the potentially affected GSO FSS or MSS network includes the territory of its notifying administration.

RESOLUTION 680 (WRC-23)

**Studies on frequency-related matters, including possible new
or modified space research service (space-to-space) allocations,
for future development of communications on the lunar surface
and between lunar orbit and the lunar surface**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that there is increased interest in conducting scientific discovery and space exploration activities in lunar orbit and on the lunar surface;
- b)* that wireless communication technology is well-developed and widely deployed on the Earth and could be applied to lunar communications;
- c)* that point-to-multipoint systems on the lunar surface used for scientific or technological research purposes could operate in the space research service (SRS) (space-to-space) currently;
- d)* that lunar missions may require signals for accurate Positioning, Navigation and Timing (PNT) in the lunar region originating from Moon-orbiting satellites;
- e)* that the lunar environment has unique atmospheric, soil and topographic conditions;
- f)* that the shielded zone of the Moon (SZM) and the absence of appreciable water vapour and oxygen in the lunar atmosphere allow for radioastronomical observations which are not possible on Earth;
- g)* that the interests of scientific discovery and space exploration are of a global nature;
- h)* that lunar scientific and exploration activities can advance the development of potential future space activities beyond space research, which may in the future include other relevant radiocommunication services for lunar communications,

noting

- a)* that Section V of Article 22 addresses protection of radio astronomy in the SZM;
- b)* that Recommendation ITU-R RA.479-5 relates to the protection of frequencies for radioastronomical measurements in the SZM, with a view to preserving the unique radioastronomical capabilities in this zone;
- c)* that the impact of unintended electromagnetic radiation from electrical and electronic systems into radio astronomy receivers should be assessed (see Question ITU-R 243/1);

recognizing

- a) that studies on sharing and compatibility between potential systems on the Moon's surface and systems orbiting the Moon would need to take into account any existing SRS applications and other affected services in the same or, as appropriate, adjacent bands;
- b) that frequencies for communications between the Earth and the Moon are provided through the existing allocations to the SRS;
- c) that frequencies for communications between satellites orbiting the Moon can operate in existing frequency allocations to the SRS (space-to-space) and the inter-satellite service;
- d) that existing allocations to the amateur radio service have also been used for communications between the Earth and the Moon, and Earth-to-Earth via passive reflection from the Moon;
- e) that dedicated frequencies are needed in the lunar vicinity for local communications between systems operating on the lunar surface and between systems in lunar orbit and systems on the lunar surface;
- f) that future development of communications on the lunar surface and between lunar orbit and the lunar surface should take into account the need to maintain the opportunities for radio astronomy observations and the operation of space research sensors, including active and passive sensors on the Moon;
- g) that the frequency bands 7 190-7 235 MHz (Earth-to-space) and 8 450-8 500 MHz (space-to-Earth) are allocated to the SRS on a primary basis;
- h) that the frequency band 5 250-5 570 MHz is allocated to the SRS (active) on a primary basis;
- i) that the frequency bands 3 500-3 800 MHz (space-to-Earth) and 5 725-5 925 MHz (Earth-to-space) are allocated to the fixed-satellite service on a primary basis;
- j) that the frequency band 25.25-27.5 GHz is allocated to the inter-satellite service on a primary basis, limited to space research and Earth exploration-satellite applications, and also transmissions of data originating from industrial and medical activities in space, as stipulated in No. **5.536**;
- k) that the fixed and mobile (in some bands mobile, except aeronautical mobile) services are allocated on a primary basis within the frequency ranges 390-399.9 MHz, 400.05-401 MHz by No. **5.262**, 420-430 MHz, 440-450 MHz, 2 400-2 690 MHz, 3 500-3 800 MHz, 5 650-5 850 MHz by No. **5.453**, 7 190-7 235 MHz, 8 450-8 500 MHz and 25.25-28.35 GHz;
- l) that the mobile, except aeronautical mobile, service is allocated on a primary basis in the frequency ranges 5 150-5 350 MHz and 5 470-5 725 MHz, the aeronautical mobile service is allocated on a primary basis under Nos. **5.446C** and **5.446D** in the frequency band 5 150-5 250 MHz, the fixed service is allocated on a primary basis under No. **5.447E** in the frequency band 5 250-5 350 MHz and the fixed service is allocated on a primary basis in the frequency band 5 670-5 850 MHz in No. **5.455**;

m) that the aeronautical radionavigation service is allocated on a primary basis in the frequency bands 5 150-5 250 MHz and 5 350-5 460 MHz and by No. **5.450** in the frequency band 5 470-5 650 MHz, the radionavigation service is allocated on a primary basis in the frequency band 2 450-2 500 MHz (Regions 2 and 3), in the frequency band 5 250-5 350 by No. **5.448** and in the frequency band 5 460-5 470 MHz, the maritime radionavigation is allocated on a primary basis in the frequency range 5 470-5 650 MHz, the radiolocation service (RLS) is allocated on a primary basis in the frequency range 5 250-5 850 MHz, and the RLS is allocated on a primary basis under No. **5.269** in the frequency bands 420-430 MHz and 440-450 MHz,

n) that the broadcasting-satellite service (BSS) is allocated on a primary basis in the frequency range 2 520-2 670 MHz, and the BSS (sound) and complementary terrestrial sound broadcasting service are allocated on a primary basis under No. **5.418** in the frequency band 2 535-2 565 MHz;

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 studies of the spectrum needs of systems in the SRS which may operate on the lunar surface, or systems in lunar orbit communicating with systems on the lunar surface, in the following frequency ranges or portions thereof, taking into account *noting a), b) and c)*:

- 390-406.1 MHz, 420-430 MHz and 440-450 MHz, limited to outside the SZM
- 2 400-2 690 MHz, 3 500-3 800 MHz, 5 150-5 570 MHz, 5 570-5 725 MHz, 5 775-5 925 MHz, 7 190-7 235 MHz, 8 450-8 500 MHz and 25.25-28.35 GHz;

2 studies of the technical and operational characteristics, as well as protection criteria, of systems in the SRS that are planned for operation in the frequency bands in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 1, as well as protection criteria to be applied for the protection of the radio astronomy service (RAS) and SRS active and passive sensors on the lunar surface and lunar orbit;

3 studies of the propagation considerations for lunar surface systems and lunar-orbiting systems operating in the frequency ranges in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 1;

4 studies of sharing and compatibility related to systems in the SRS that are planned for operation in the frequency ranges identified in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 1 to ensure protection of:

- radiocommunication services, as specified in *recognizing g) to n)*, and
- the RAS on the Earth and in the SZM in the same, adjacent or nearby bands;

5 studies of potential new or modified frequency allocations and/or identifications to the SRS with appropriate regulatory provisions, for communications on the lunar surface or in lunar orbit communicating with systems on the lunar surface,

invites the ITU Radiocommunication Sector

1 to begin studying, taking into account *considering h)*, future spectrum needs for lunar communications and systems, beyond those identified in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference 1*, which may be needed for communications between the Earth, lunar-orbiting spacecraft and the lunar surface;

2 to study whether future radiocommunications in the vicinity of the Moon, as described in *considering h)*, can be accommodated within existing space radiocommunication services and whether the regulatory provisions described in the Radio Regulations are sufficient,

invites administrations

to participate in the studies by submitting contributions to the ITU Radiocommunication Sector,

invites the 2027 world radiocommunication conference

to consider, based on the results of the studies referred to in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference 1* to 5, new or modified allocations and/or identifications in the SRS in the frequency ranges in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference 1* above, or portions thereof, for use in the vicinity of the Moon,

instructs the Director of the Radiocommunication Bureau

to report to WRC-27 on the progress of the studies referred to in *invites the ITU Radiocommunication Sector 1* and 2 above,

invites a future competent world radiocommunication conference after WRC-27

to consider, if necessary, appropriate regulatory actions based upon the studies called for in *invites the ITU Radiocommunication Sector 1* and 2 above.

RESOLUTION 681 (WRC-23)

Studies of technical and regulatory provisions necessary to protect radio astronomy operating in specific Radio Quiet Zones and, in radio astronomy service primary allocated frequency bands globally, from aggregate radio-frequency interference caused by systems in the non-geostationary-satellite orbit

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that radio astronomy is a pivotal scientific discipline that plays a crucial role in unravelling the mysteries of the cosmos;
- b)* that the number of non-geostationary-satellite orbit (non-GSO) satellite launches has increased in recent years and even more launches are planned for the next decade;
- c)* that for the purpose of this Resolution, a Radio Quiet Zone (RQZ) is any recognized geographic area within which the usual spectrum management procedures are modified for the specific purpose of reducing or avoiding interference with radio telescopes, thereby maintaining the required standards for quality and availability of observational data, as defined in Report ITU-R RA.2259;
- d)* that aggregate emissions from single and multiple non-GSO satellite systems may cause interference to the radio astronomy service (RAS), even in RQZs, which may be challenging to resolve with only national regulation;
- e)* that non-GSO satellite systems are being considered for future use as part of terrestrial networks under the mobile-satellite service (MSS);
- f)* that a number of administrations have implemented regulations to establish RQZs which may not be applicable to satellite operations;
- g)* that the 2023 Radiocommunication Assembly instructed ITU Radiocommunication Sector (ITU-R) Study Group 7 to facilitate information sharing to enable better coordination between satellite operators and RAS sites, including, for example, the creation of a database of RQZs;
- h)* that the potential impact of non-GSO satellite systems on astronomy has been recognized and is currently being discussed in the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) under the name “Dark and Quiet Skies”;
- i)* that the impact of non-GSO satellite systems on radio astronomy has been recognized by the International Astronomical Union by creating the Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference;

j) that a small number of remote RAS stations are of the utmost importance as they are designed to make observations of significance, resulting in new knowledge of astronomical phenomena, which may require observations of objects not previously studied, or observing objects with increased precision;

k) that, for the purpose of this Resolution, the facilities which fall into the category defined in *considering j)* are:

- the Square Kilometre Array Observatory in South Africa;
- the Atacama Large Millimeter/submillimeter Array (ALMA) in Chile;

l) that the RAS stations in *considering k)* must be able to operate in much larger frequency ranges than those currently allocated to the RAS in order to meet their scientific goals;

m) that the RAS stations in *considering k)* are afforded a national RQZ, while only a small fraction of other RAS stations are surrounded by RQZs;

n) that current approaches and procedures may not be sufficient to ensure protection of the RAS from emissions produced by the increasing number of non-GSO satellite systems,

noting

a) that Recommendation ITU-R RA.769 provides thresholds for the non-GSO satellite interference received through the far side lobes of radio astronomy telescopes;

b) that Recommendation ITU-R RA.1031 addresses the protection of radio astronomy in shared bands;

c) that Recommendation ITU-R RA.1513 provides the acceptable levels of data loss to radio astronomy observations and percentage-of-time criteria resulting from degradation by interference for frequency bands allocated to the RAS on a primary basis;

d) that Recommendation ITU-R M.1583 provides the calculations for interference between non-GSO MSS or radio navigation-satellite service (RNSS) and radio astronomy telescope sites;

e) that Recommendation ITU-R S.1586 provides the method for calculating unwanted emission levels produced by a non-GSO FSS at radio astronomy sites;

f) that Report ITU-R RA.2259 contains characteristics of national RQZs and measures to establish them,

recognizing

a) that No. **29.12** highlights the susceptibility of radio astronomy to harmful interference from space-borne transmitters;

b) that the spectrum requirements for radio astronomy stations in *considering k)* are fulfilled by the primary and secondary allocations, as well as by national arrangements;

- c) that there are no examinations currently performed by the Bureau with regard to RAS protection from satellite systems under Articles 9 or 11;
- d) that the compatibility issues between the RAS and non-GSO systems may be addressed by technical mitigation measures before satellites are launched and operational;
- e) that for non-GSO systems the equivalent power flux density (epfd) method, which is developed in Recommendations ITU-R M.1583 and ITU-R S.1586, provides a sufficiently accurate estimate of the total power that is introduced into RAS receivers and can be used to incorporate the effects of other technical parameters;
- f) that national regulations for radio astronomy in the RQZ may be different for each administration, leading to varying protection measures;
- g) that some non-GSO systems currently operate in frequency bands adjacent to RAS primary allocations;
- h) that the specific protection measures for the RAS agreed between administrations are outside the scope of this Resolution,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

- 1 studies on how the interference from unwanted emissions from a single non-GSO satellite system operating in the adjacent and nearby frequency bands in Table 1 affects the operation of RAS stations in frequency bands allocated to the RAS on a primary basis in Table 1;
- 2 studies on how the aggregate interference from unwanted emissions from multiple non-GSO satellite systems operating in the adjacent and nearby frequency bands in Table 1 affect the operation of RAS stations in frequency bands allocated to the RAS on a primary basis in Table 1;
- 3 studies on the possible recognition of the RQZs specified in *considering k)* above, based on their characteristics and existing ITU-R studies;
- 4 studies on how the aggregate interference from single and multiple non-GSO satellite systems affects the operation of RAS stations in the RQZs specified in *considering k)*;
- 5 studies on new coexistence measures between non-GSO satellite systems and RAS stations in the RQZs specified in *considering k)*;
- 6 studies of methods to calculate the necessary separation distances between gateways of non-GSO systems operating in bands adjacent to or near RAS allocations and RAS stations protected by the RQZs specified in *considering k)*,

invites administrations

to participate actively in the studies and provide the technical and operational characteristics of the systems involved and other information required for the studies by submitting contributions to the ITU-R,

invites the 2027 world radiocommunication conference

- 1 to consider appropriate technical and/or regulatory measures based on the results of the studies mentioned in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference 1*;
- 2 to consider, if deemed appropriate, based on the studies mentioned in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference 3, 4, 5 and 6*, potential solutions to characterize the RQZs in *considering k*) in the Radio Regulations and/or in a WRC Resolution,

instructs the Secretary-General

to bring this Resolution to the attention of COPUOS and other international and regional organizations concerned.

TABLE 1

RAS frequency bands to be studied and corresponding active services to be included

Radio astronomy frequency band	Active space service operating in adjacent or nearby frequency band	Active space service (space-to-Earth)	Scope
10.6-10.7 GHz	10.7-10.95 GHz	FSS	<i>Resolves etc. 1 and 2</i>
42.5-43.5 GHz	42-42.5 GHz	FSS	<i>Resolves etc. 2</i>
76-77.5 GHz	74-76 GHz	FSS, MSS	<i>Resolves etc. 2</i>
94.1-95 GHz	95-100 GHz	RNSS, MSS	<i>Resolves etc. 2</i>
100-102 GHz	95-100 GHz	RNSS, MSS	<i>Resolves etc. 1 and 2</i>
114.25-116 GHz	116-119.98 GHz	ISS	<i>Resolves etc. 1 and 2</i>
130-134 GHz	123-130 GHz	FSS, MSS, RNSS	<i>Resolves etc. 2</i>

RESOLUTION 682 (WRC-23)

**Consideration of regulatory provisions and potential primary allocations
to the meteorological aids service (space weather) to accommodate receive-only
space weather sensor applications in the Radio Regulations**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that space weather data is important to understanding the physical process of providing prediction models for space weather events and their impacts on services critical to the economy, safety and security of administrations and the population of their countries as:
 - space weather observations are important for detecting natural phenomena, mainly originating from solar activity and occurring beyond the major portion of the Earth's atmosphere;
 - the collection and exchange of space weather data are important to understanding the origin of these phenomena and the physical processes;
- b)* that the importance of space weather radiocommunication applications has been stressed by a number of international bodies, such as the World Meteorological Organization, the Intergovernmental Panel on Climate Change, the United Nations Office for Disaster Risk Reduction, the International Civil Aviation Organization, the United Nations Office for Outer Space Affairs and the United Nations Committee on the Peaceful Uses of Outer Space, and that ITU Radiocommunication Sector (ITU-R) collaboration with these bodies is essential;
- c)* that these observations could be made from space- and ground-based systems, and guidance in the design of those systems is necessary;
- d)* that the observational frequencies used by these space weather sensors have been chosen based on the physical properties of the observed phenomena;
- e)* that some receive-only sensors operate by receiving low-level emissions, including, but not limited to, emissions from the Sun, the Earth's atmosphere and other celestial bodies, and may therefore suffer harmful interference in the future;
- f)* that radio regulatory protection is needed for space weather observation systems that are used operationally in the production of forecasts and warnings of space weather events that can cause harm to important sectors of national economies and security, as well as human welfare;
- g)* that the bandwidth requirement for observations by receive-only space weather sensors may typically encompass a minimum continuous bandwidth,

noting

- a) that Resolution **675 (WRC-23)**:
 - defines space weather;
 - designates space weather sensors to the meteorological aids service (MetAids) in the subset MetAids (space weather);
- b) that Report ITU-R RS.2456, on space weather sensor systems using radio-frequency spectrum, contains:
 - a summary of spectrum-reliant space weather sensors; and
 - a description of the systems for operational space weather monitoring, prediction and warnings deployed globally;
- c) that, within ITU-R, work is ongoing to determine the spectrum requirements of receive-only space weather sensors and their protection criteria in response to Question ITU-R 256/7;
- d) that Resolution 136 (Rev. Bucharest, 2022) of the Plenipotentiary Conference highlights the use of telecommunications/information and communication technologies for monitoring and management in emergency and disaster situations for early warning, prevention, mitigation and relief,

recognizing

- a) that no frequency bands have been documented in any manner in the Radio Regulations for space weather sensor applications;
- b) that, while data products are used for forecasts and warnings related to public safety, among other purposes, the provisions of Nos. **1.59** and **4.10** do not apply to spectrum-reliant space weather sensors;
- c) that some receive-only space weather sensors in operation utilize bands not currently allocated to the MetAids service, and some of them need to continue their current operation;
- d) that the current provisions of Article **11** do not allow an administration to notify a frequency assignment to a receive-only terrestrial radio station, except for certain types of station (see Nos. **11.2**, **11.9** and **11.12**), and that therefore no procedure for notifying receive-only MetAids (space weather) stations is provided;
- e) that receive-only space weather sensors are considered in the studies under this Resolution on the understanding that these sensors will be deployed only at a limited number of specific locations and not in a ubiquitous manner,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

- 1 studies on spectrum needs and appropriate protection criteria for receive-only space weather sensors, as well as system characteristics, as appropriate, taking into account *noting a*);

2 sharing and compatibility studies pertaining to potential new primary allocations to MetAids (space weather) in the following frequency bands for receive-only sensors, taking into account *further resolves* 2:

- 27.5-28.0 MHz;
- 29.7-30.2 MHz;
- 32.2-32.6 MHz;
- 37.5-38.325 MHz;
- 73.0-74.6 MHz;
- 608-614 MHz;

3 studies on possible regulatory provisions of the Radio Regulations to accommodate the possibility for an administration that desires to notify a receive-only space weather sensor station to be included in the Master International Frequency Register,

further resolves

1 that no notification of frequency assignments to a station used for space weather observation be made by administrations under MetAids (space weather) until WRC-27 introduces the corresponding allocations in Article 5;

2 that any possible new primary MetAids (space weather) allocations to be made under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 2 shall not claim protection from, or constrain the future development of, incumbent services in these frequency bands or in adjacent bands,

invites administrations

to participate actively in the studies and provide the information required for the studies listed under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* by submitting contributions to ITU-R,

invites the 2027 world radiocommunication conference

to take appropriate actions, including potential new primary receive-only MetAids (space weather) allocations, based on the results of the studies under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference*, taking into account *further resolves* 2,

invites relevant international organizations

to participate actively in the relevant ITU-R studies by providing information that should be taken into account in ITU-R studies,

instructs the Secretary-General

to bring this Resolution to the attention of the relevant international organizations.

RESOLUTION 683 (WRC-23)

Study of technical and operational issues and regulatory provisions to support inter-satellite service transmissions in the frequency bands 3 700-4 200 MHz and 5 925-6 425 MHz for non-geostationary-satellite space stations communicating with geostationary-satellite space stations¹

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that many non-geostationary-satellite orbit (non-GSO) satellites operate with limited and non-real-time connectivity to earth stations;
- b)* that inter-satellite service (ISS) communications between such non-GSO satellites and geostationary-satellite orbit (GSO) satellites would enhance the efficiency of operations and that the effective reuse of some frequency bands allocated to the fixed-satellite service (FSS) for transmissions between such space stations may increase the efficiency of use of those frequency bands;
- c)* that there is growing interest in utilizing ISS links for a variety of applications and that there have been expressions of interest by some administrations in using the frequency bands 3 700-4 200 MHz and 5 925-6 425 MHz for ISS transmissions between space stations in those frequency bands,

noting

- a)* that the use of frequency bands by the FSS in the frequency bands 3 700-4 200 MHz and 5 925-6 425 MHz is subject to existing Resolutions, coordination requirements and country footnotes, taking into account, in particular, the protection of incumbent services;
- b)* that the frequency band 3 700-4 200 MHz is allocated to the fixed and mobile services on a primary basis in Regions 2 and 3;
- [*c*)* that, in Region 1, the frequency band 3 700-4 200 MHz is allocated to the fixed service on a primary basis and the frequency band 3 700-3 800 MHz is allocated to the mobile service on a primary basis;]

¹ *Note by the Secretariat:* The square brackets appearing in this Resolution have been kept with the understanding that this Resolution, which is on the WRC-31 preliminary agenda (see Resolution **814 (WRC-23)**), should be considered at WRC-27.

[* This Region 1 allocation for fixed and mobile services is pending the WRC-23 outcome, and this *noting* should be revised or removed based on the conclusion of WRC-23 agenda item 1.2/1.3.]

[d]** that, in Region 2, the frequency band 3 600-3 700 MHz is identified on a regional basis for International Mobile Telecommunications (IMT) and the frequency band 3 700-3 800 MHz is identified for IMT via No. **5.435B**;

e) that any future use of the ISS in the frequency band 3 700-4 200 MHz shall not claim protection from terrestrial services operating in conformity with the Radio Regulations;

f) that the FSS and fixed and mobile services are allocated globally on a co-primary basis in the frequency band 5 925-6 425 MHz;

g) that the use of the frequency bands 3 700-4 200 MHz and 5 925-6 425 MHz by the non-GSO FSS is subject to the application of the provisions of Nos. **22.5C** and **22.5D**;

h) that the frequency band 5 925-6 425 MHz may be used for the FSS (Earth-to-space) for the provision of earth stations located on board vessels, subject to Nos. **5.457A** and **5.457B**;

i) that the use of the frequency band 5 925-6 425 MHz for aeronautical mobile telemetry is subject to the application of the provisions of No. **5.457C**,

noting further

that sharing and compatibility studies were performed between ISS links intending to operate between space stations in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz and current and planned stations of the FSS and other existing services allocated in the same frequency bands and adjacent frequency bands, including passive services, with a view to ensuring protection of the primary services,

recognizing

a) that the frequency bands 3 700-4 200 MHz and 5 925-6 425 MHz are also allocated to other radiocommunication services on a primary basis, that those allocations are used by a variety of incumbent systems in many administrations and that the protection of those services should be studied;

b) that, for the determination of the incumbent services, the relevant provisions of the Radio Regulations in force apply,

recognizing further

a) that any future ISS use in the frequency band 3 700-4 200 MHz shall not claim protection from terrestrial services or other FSS applications operating consistent with the Radio Regulations;

b) that sharing scenarios may vary because of the wide variety of orbital characteristics of non-GSO FSS space stations,

[** These Region 2 identifications for IMT are pending the WRC-23 outcome, and this *noting* should be revised or removed based on the conclusion of WRC-23 agenda item 1.2.]

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference

1 studies on spectrum requirements, technical and operational characteristics and sharing and compatibility, with incumbent [* **; including secondary,] services, taking into account *noting a) to i)*, for non-GSO space stations that operate or plan to operate ISS links with GSO FSS networks in the following frequency bands:

- a) in the Earth-to-space direction in the frequency band 5 925-6 425 MHz, for transmissions from non-GSO user space stations operating at lower orbital altitudes, in communication with GSO FSS service provider space stations; and
- b) in the space-to-Earth direction in the frequency band 3 700-4 200 MHz, for transmissions from GSO FSS service provider space stations, towards non-GSO user space stations;

2 to develop technical conditions and regulatory provisions to ensure protection of other services allocated in those frequency bands for the operation of ISS links taking into account the results of the studies called for in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* 1 above,

invites administrations

to participate actively in the studies and provide the information required for the studies listed under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* by submitting contributions to the ITU Radiocommunication Sector (ITU-R),

invites the 2031 world radiocommunication conference

to consider, based on the results of ITU-R studies, to support ISS allocations in the frequency bands 3 700-4 200 MHz and 5 925-6 425 MHz, and associated regulatory provisions, to enable links between non-GSO and GSO satellites.

RESOLUTION 684 (WRC-23)

**Studies on possible new allocations to the radionavigation-satellite service
(space-to-Earth) in the frequency bands [5 030-5 150 MHz and
5 150-5 250 MHz] or parts thereof***

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that radionavigation-satellite service (RNSS) systems and networks are intended to provide accurate information for many positioning, navigation and timing applications;
- b)* that, with growing user demands and technology improvement, the current RNSS allocations might not be sufficient to respond to requirements for higher positioning accuracy, network availability and robustness in the future;
- c)* that the frequency band 5 010-5 030 MHz is allocated worldwide to the RNSS (space-to-Earth) on a primary basis;
- d)* that the frequency band 5 150-5 216 MHz is allocated to the radiodetermination-satellite service (RDSS) (space-to-Earth) under the provisions described in No. **5.446**,

noting

- a)* that the frequency band 5 030-5 091 MHz is allocated to the aeronautical mobile (R) service (AM(R)S) (see No. **5.443C**), aeronautical mobile-satellite (R) service (AMS(R)S) (see No. **5.443D**) and aeronautical radionavigation service (ARNS) (see No. **5.444**) on a primary basis;
- b)* that the frequency band 5 091-5 150 MHz is allocated to the fixed-satellite service (FSS) (Earth-to-space) (see No. **5.444A**), aeronautical mobile service (see No. **5.444B**), AMS(R)S (see No. **5.443AA**) and ARNS (see No. **5.444**) on a primary basis;
- c)* that the frequency band 5 150-5 250 MHz is allocated to the FSS (Earth-to-space), the mobile, except aeronautical mobile, service subject to No. **5.446A** and the ARNS (see No. **5.444**) on a primary basis;
- d)* that the frequency band 5 250-5 350 MHz is allocated to the Earth exploration-satellite (active), mobile, except aeronautical mobile, (see Nos. **5.446A** and **5.447F**), radiolocation and space research (active) (see No. **5.447D**) services on a primary basis;

* The appearance of square brackets around certain frequency bands in this Resolution is understood to mean that WRC-27 will consider and review the inclusion of these frequency bands with square brackets and decide, as appropriate.

e) that the frequency bands 5 150-5 250 MHz and 5 250-5 350 MHz are used by wireless access systems, including radio local area networks, under the mobile service and their operation is subject to Resolution **229 (Rev.WRC-23)**;

f) that the AM(R)S in the frequency band 5 091-5 150 MHz is limited to surface applications at airports and operated in accordance with standards and recommended practices (SARPs) in Annex 10 to the Convention on International Civil Aviation;

g) that the ARNS in the frequency band 5 030-5 091 MHz is operated in accordance with SARPs in Annex 10 to the Convention on International Civil Aviation, and that SARPs are under development for the AM(R)S and AMS(R)S in this band,

recognizing

a) that the possible addition of the RNSS (space-to-Earth) in the frequency bands [5 030-5 150 MHz and 5 150-5 250 MHz], or parts thereof, shall ensure protection of, and not impose constraints on, the development of incumbent services in the same and adjacent bands;

b) that the use of the frequency band 5 150-5 216 MHz by the RDSS is limited to feeder links in conjunction with the RDSS operating in the frequency bands 1 610-1 626.5 MHz and/or 2 483.5-2 500 MHz, and that the total power flux-density (pfd) at the Earth's surface shall in no case exceed $-159 \text{ dB(W/m}^2\text{)}$ in any 4 kHz band for all angles of arrival (see No. **5.446**);

c) that the characteristics and protection criteria for the receiving earth stations and also the transmitting space stations of RNSS in the frequency band 5 010-5 030 MHz are presented in Recommendation ITU-R M.2031;

d) that, in order not to cause harmful interference to the microwave landing system operating above 5 030 MHz, the aggregate pfd produced at the Earth's surface in the frequency band 5 030-5 150 MHz by all the space stations within any RNSS system (space-to-Earth) operating in the frequency band 5 010-5 030 MHz shall not exceed $-124.5 \text{ dB(W/m}^2\text{)}$ in a 150 kHz band (see No. **5.443B**);

e) that, in order not to cause harmful interference to the radio astronomy service (RAS) in the frequency band 4 990-5 000 MHz, RNSS systems operating in the frequency band 5 010-5 030 MHz shall comply with the limits in the frequency band 4 990-5 000 MHz defined in Resolution **741 (Rev.WRC-15)** (see No. **5.443B**);

f) that Recommendation ITU-R SM.1535 provides information on the protection of safety services from unwanted emissions,

resolves to invite the ITU Radiocommunication Sector to conduct and complete in time for the 2031 world radiocommunication conference

1 studies on spectrum requirements and technical and operational characteristics for the RNSS, in particular in the space-to-Earth direction between [5 030 and 5 250 MHz];

2 studies on sharing and compatibility between RNSS and the incumbent services allocated in the frequency range [5 030-5 250 MHz] and the adjacent-band services and studies related to the protection of the RAS in the frequency band 4 990-5 000 MHz, taking into account *recognizing a*),

invites the 2031 world radiocommunication conference

to consider, based on the results of studies, possible allocations to the RNSS (space-to-Earth) in the frequency bands [5 030-5 150 MHz and 5 150-5 250 MHz] or parts thereof,

invites administrations

to participate actively in ITU Radiocommunication Sector (ITU-R) studies and provide the technical and operational characteristics of the systems involved by submitting contributions to ITU-R,

instructs the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

RESOLUTION 685 (WRC-23)

Studies towards frequency allocations for the Earth exploration-satellite service (space-to-Earth) within the frequency range [37.5-52.4 GHz]*

The World Radiocommunication Conference (Dubai, 2023),

considering

- a) that the frequency band 40-40.5 GHz is allocated worldwide to the Earth exploration-satellite service (EESS) (Earth-to-space) on a primary basis;
- b) that a frequency allocation to the EESS (space-to-Earth) above 37.5 GHz would allow its use for payload data transmissions in combination with the existing EESS (Earth-to-space) allocation referred to in *considering a*);
- c) that a frequency allocation to the EESS (space-to-Earth) above 37.5 GHz would allow for uplinks and downlinks on the same transponder, increasing efficiency and reducing satellite complexity,

noting

- a) that the frequency band 37.5-40.5 GHz is allocated worldwide to the EESS (space-to-Earth) on a secondary basis;
- b) that the frequency band 37.5-40.5 GHz is allocated to a number of services on a primary basis,

recognizing

- a) the importance of the appropriate regulatory status and certainty to accommodate the requirements of future Earth observation missions;
- b) that, in order to meet those requirements, primary allocation to the EESS (space-to-Earth) in certain frequency bands above 37.5 GHz might be required,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference

1 the review of the existing allocation to the EESS (space-to-Earth) in the frequency band [37.5-40.5 GHz], and sharing and compatibility studies as necessary, in order to determine the feasibility of upgrading this frequency allocation to primary status while ensuring the protection of the primary services;

* The appearance of square brackets around certain frequency bands in this Resolution is understood to mean that WRC-27 will consider and review the inclusion of these frequency bands with square brackets and decide, as appropriate.

2 the identification of frequency bands within the frequency range [40.5-52.4 GHz], and sharing and compatibility studies as necessary, in order to determine the feasibility of creating new primary allocations to the EESS (space-to-Earth) in these bands, while ensuring the protection of the primary services,

invites administrations

to participate actively in the studies by submitting contributions to the ITU Radiocommunication Sector,

invites the 2031 world radiocommunication conference

to consider, based on the results of studies, an upgrade of the secondary allocation to the EESS (space-to-Earth) in the frequency band [37.5-40.5 GHz] or possible new worldwide allocations on a primary basis to the EESS (space-to-Earth) in certain frequency bands within the frequency range [40.5-52.4 GHz],

instructs the Secretary-General

to bring this Resolution to the attention of international and regional organizations concerned.

RESOLUTION 686 (WRC-23)

Possible secondary allocation to the Earth exploration-satellite service (active) in the frequency bands [3 000-3 100 MHz] and [3 300-3 400 MHz]*

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that spaceborne active radio-frequency sensors can provide unique information on the physical properties of the Earth;
- b)* that spaceborne active remote sensing requires specific frequency ranges, depending on the physical phenomena to be observed;
- c)* that there is an interest in using active spaceborne sensors in the 3 GHz frequency range primarily for measurement of ice boundaries, type and age, ocean wave structure, ocean wind speed and direction and mapping of ocean circulation (currents and eddies);
- d)* that the frequency band 3 100-3 300 MHz is already allocated to the Earth exploration-satellite service (EESS) (active) on a secondary basis and is currently being used for altimeters and synthetic aperture radars (SARs);
- e)* that a frequency band of at least 400 MHz is preferable to satisfy the requirements for high-resolution SARs;
- f)* that SARs in the 3 GHz frequency range are not intended to be operated in populated areas of the globe, but primarily over oceans and seas,

recognizing

- a)* that the frequency band 3 000-3 100 MHz is allocated to the radiolocation service (RLS) and radionavigation service on a primary basis;
- b)* that the frequency band 3 300-3 400 MHz is allocated to the RLS on a primary basis;
- c)* that the frequency band 3 300-3 400 MHz is also allocated to the amateur service on a secondary basis in Regions 2 and 3;
- d)* that the frequency band 3 300-3 400 MHz is also allocated to the fixed and mobile services on a secondary basis in Region 2;
- e)* that the frequency band 3 300-3 400 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis in certain countries under Nos. **5.429A**, **5.429C** and **5.429E**;

* The appearance of square brackets around certain frequency bands in this Resolution is understood to mean that WRC-27 will consider and review the inclusion of these frequency bands with square brackets and decide, as appropriate.

f) that the frequency band 3 300-3 400 MHz is identified for the implementation of International Mobile Telecommunications in certain countries in Regions 1 and 2 under Nos. **5.429B** and **5.429D**;

g) that, in accordance with No. **5.149**, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference in the frequency bands 3 332-3 339 MHz and 3 345.8-3 352.5 MHz,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference

studies on spectrum needs and studies on the possibility of sharing between the EESS (active) and incumbent radio services in the frequency bands [3 000-3 100 MHz] and [3 300-3 400 MHz],

invites the 2031 world radiocommunication conference

to consider the results of studies for a possible new secondary allocation to the EESS (active) for spaceborne SARs in the frequency bands [3 000-3 100 MHz] and [3 300-3 400 MHz], taking into account the protection of incumbent services, and take appropriate action,

invites administrations

to participate actively in the studies by submitting contributions to the ITU Radiocommunication Sector.

RESOLUTION 703 (REV.WRC-07)

Calculation methods and interference criteria recommended by ITU-R for sharing frequency bands between space radiocommunication and terrestrial radiocommunication services or between space radiocommunication services

The World Radiocommunication Conference (Geneva, 2007),

considering

- a) that, in frequency bands shared with equal rights by space radiocommunication and terrestrial radiocommunication services, it is necessary to impose certain technical limitations and coordination procedures on each of the sharing services for the purpose of limiting mutual interference;
- b) that, in frequency bands shared by space stations located on geostationary satellites, it is necessary to impose coordination procedures for the purpose of limiting mutual interference;
- c) that the calculation methods and interference criteria relating to coordination procedures referred to in *considering a)* and *b)* are based upon ITU-R Recommendations;
- d) that, in recognition of the successful sharing of the frequency bands by space radiocommunication and terrestrial radiocommunication services, and the continuing improvements in space technology and that of the Earth segment, each Radiocommunication Assembly has improved upon some of the technical criteria recommended by the preceding Assembly;
- e) that the ITU Radiocommunication Assembly has approved a procedure for approving Recommendations between Radiocommunication Assemblies;
- f) that the Constitution recognizes the right of Member States to make special arrangements on telecommunication matters; however, such arrangements shall not be in conflict with the terms of the Constitution, Convention or of the Regulations annexed thereto as far as harmful interference to the radio services of other countries is concerned;
- g) that the use of this Resolution may reduce the need for incorporation by reference of some ITU-R Recommendations,

is of the opinion

- a) that future decisions of ITU-R are likely to make further changes in the recommended calculation methods and interference criteria;
- b) that the administrations should whenever possible apply the current ITU-R Recommendations on sharing criteria when planning systems for use in frequency bands shared with equal rights between space radiocommunication and terrestrial radiocommunication services, or between space radiocommunication services,

invites administrations

to submit contributions to the Radiocommunication Study Groups, providing information on practical results and experience of sharing between terrestrial and space radiocommunication services or between space services, which help to bring about significant improvements in coordination procedures, calculation methods and harmful interference thresholds, and thereby to optimize the available orbit/spectrum resources,

resolves

1 that the Director of the Radiocommunication Bureau, in consultation with Study Group Chairmen, shall annually prepare a list identifying the relevant newly approved ITU-R Recommendations relating to sharing between space radiocommunication and terrestrial radiocommunication services, or between space radiocommunication services;

2 that the Director of the Radiocommunication Bureau shall, once a year, publish this list electronically for the information of all administrations.

RESOLUTION 705 (REV.WRC-15)

Mutual protection of radio services operating in the frequency band 70-130 kHz

The World Radiocommunication Conference (Geneva,2015),

considering

- a)* that various radio services, including radionavigation systems used by maritime and aeronautical services, operate in frequency bands between 70 and 130 kHz;
- b)* that, radionavigation being a safety service, all practical steps consistent with the Radio Regulations should be taken to prevent harmful interference to any radionavigation system;
- c)* that the ITU-R has noted that users of phased pulse radionavigation systems in the frequency band 90-110 kHz receive no protection outside the frequency band, yet may receive benefit from their signals outside the occupied bandwidth,

noting

that ITU-R studies show:

- that for continuous wave radionavigation systems in the frequency bands 70-90 kHz and 110-130 kHz, the protection ratio should be 15 dB within the receiver passband of ± 7 Hz at 3 dB;
- that phased pulse radionavigation systems require a 15 dB protection ratio within the frequency band 90-110 kHz;
- that these pulse radionavigation systems would be aided by protection ratios of 5 dB and 0 dB for frequency separations between wanted and interfering signal of 10-15 kHz and 15-20 kHz, respectively,

further noting

that the ITU-R has recommended the exchange of information between authorities operating radionavigation systems in the frequency band 90-110 kHz and those operating other systems in the frequency band 70-130 kHz employing emissions of very high stability,

recognizing

- a)* that radio services other than radionavigation operating in the frequency bands 70-90 kHz and 110-130 kHz fulfil essential functions that may be affected;
- b)* the provisions of Nos. **4.5**, **4.10**, **5.60** and **5.62**,

resolves that administrations

1 in assigning frequencies to services in the frequency bands 70-90 kHz, 90-110 kHz and 110-130 kHz, consider the potential mutual impairment to other stations operating in accordance with the Table of Frequency Allocations and apply protective measures;

RES705-2

2 use the relevant ITU-R Recommendations and encourage the exchange of information between authorities operating radionavigation systems in the frequency band 90-110 kHz and those operating other systems in the frequency band 70-130 kHz employing emissions of very high stability, to assist in preventing potential interference problems;

3 encourage consultation, both nationally and internationally, between operators of radionavigation systems using the frequency band 90-110 kHz and of other systems using the frequency band 70-130 kHz,

requests the ITU-R

to continue studies in this matter, particularly the development of technical criteria and standards to permit compatible operations within the allocated frequency bands.

RESOLUTION 712 (WRC-23)

Studies on compatibility between the Earth exploration-satellite service (passive), the radio astronomy service in certain bands above 76 GHz, and active services in adjacent and nearby frequency bands

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that WRC-2000 made a number of different allocation changes to the frequency bands above 71 GHz, including primary allocations to the Earth exploration-satellite service (EESS) (passive) subject to No. **5.340**, based on the requirements known at the time of that conference;
- b)* that primary allocations have been made to various active services in frequency bands adjacent to frequency bands above 86 GHz allocated to the EESS (passive) subject to No. **5.340**;
- c)* that primary service allocations have been made, in adjacent or nearby frequency bands, to the radio astronomy service (RAS) and to various space services, such as the fixed-satellite service (FSS), mobile-satellite service (MSS), broadcasting-satellite service (BSS) and radionavigation-satellite service (RNSS), hereinafter referred to as “active satellite services”, in frequency bands above 76 GHz;
- d)* that unwanted emissions from active services have the potential to cause unacceptable interference to the EESS (passive) and the RAS;
- e)* that, in many cases, the frequencies used by EESS (passive) sensors and stations of the RAS are chosen to study natural phenomena producing radio emissions at frequencies fixed by the laws of nature, and therefore shifting frequency to avoid or mitigate interference problems is not possible;
- f)* that the current regulatory provisions and procedures may require review to ensure protection of the EESS (passive) and the RAS from harmful interference produced by active services as listed in Tables 1 and 2 below,

noting

- a)* that Resolution **750 (Rev.WRC-19)** deals with compatibility between the EESS (passive) and some active services;
- b)* that Resolution **750 (Rev.WRC-19)** already contains provisions to protect the EESS (passive) in the frequency band 86-92 GHz from emissions of the fixed service in the frequency bands 81-86 GHz and 92-94 GHz and that there is no intention to change these provisions;

- c) that there is no intention to change the existing allocations or status of allocations in Article 5 for the frequency bands above 86 GHz;
- d) that interference criteria for EESS (passive) sensors have been developed and are given in Recommendation ITU-R RS.2017;
- e) that typical technical and operational characteristics of EESS (passive) systems are given in Recommendation ITU-R RS.1861;
- f) that the allocation to the inter-satellite service in the frequency band 116-119.98 GHz is subject to No. 5.562C;
- g) that Resolution 739 (Rev.WRC-19) applies under No. 5.208B for the frequency bands listed in the Annex to that Resolution;
- h) that, according to *resolves* 3 of Resolution 739 (Rev.WRC-19), in case the unwanted emissions from the space station or satellite system cannot meet the values given in the Annex to that Resolution, the concerned administrations enter into a consultation process in order to achieve a mutually acceptable solution;
- i) that Resolution 739 (Rev.WRC-19) defines thresholds to be met by any geostationary space station (Table 1 of Annex to Resolution 739 (Rev.WRC-19) or by any single network of non-geostationary-satellite orbit (non-GSO) space stations (Table 2 of Annex to Resolution 739 (Rev.WRC-19)) in order to protect radio astronomy stations;
- j) that Recommendation ITU-R RA.769 provides, in Annex 1, the general consideration and assumptions used in the calculation of interference levels;
- k) that Recommendation ITU-R RA.769 provides, in Table 1 and Table 2, the threshold levels for interference detrimental to radio astronomy observations in some radio astronomy bands;
- l) that Recommendation ITU-R RA.1631 provides the typical maximum RAS antenna gains in order to derive the equivalent power flux-density (epfd) resulting from unwanted emission levels produced by a non-GSO system at radio astronomy stations,

recognizing

- a) that Resolution 739 (Rev.WRC-19) contains no power flux-density (pfd)/epfd threshold for unwanted emission from any geostationary-satellite orbit (GSO)/non-GSO space station in the bands listed in Table 2 to this Resolution;
- b) that the current values provided in Resolution 739 (Rev.WRC-19) are derived from Recommendations ITU-R RA.769 and ITU-R RA.1631,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 compatibility studies between the EESS (passive) and the corresponding active services in adjacent frequency bands as listed in Table 1 below:

TABLE 1

EESS (passive) frequency bands to be studied and corresponding active services to be included

EESS (passive) frequency band	Active service frequency band	Active service
86-92 GHz	81-86 GHz	Fixed-satellite service (FSS) (Earth-to-space), mobile service (MS)
	92-94 GHz	MS, radiolocation service (RLS)
114.25-116 GHz	111.8-114.25 GHz	Fixed service (FS), MS
164-167 GHz	158.5-164 GHz	FS, FSS (space-to-Earth), MS, mobile-satellite service (MSS) (space-to-Earth)
	167-174.5 GHz	FS, FSS (space-to-Earth), inter-satellite service (ISS), MS
200-209 GHz	191.8-200 GHz	FS, ISS, MS, MSS, radionavigation service (RNS), radionavigation-satellite service (RNSS)
	209-217 GHz	FS, FSS (Earth-to-space), MS

2 compatibility studies between the RAS and the active satellite services in certain adjacent and nearby frequency bands listed in Table 2 below with a view to setting the relevant threshold levels for unwanted emissions from any GSO and non-GSO space stations and revising and updating Resolution 739 (Rev.WRC-19) accordingly:

TABLE 2

RAS frequency bands to be studied and corresponding active services to be included

Radio astronomy frequency band	Active satellite service frequency band	Active satellite service (space-to-Earth)
76-81 GHz	71-76 GHz	Fixed-satellite service (FSS), mobile-satellite service (MSS), broadcasting-satellite service (BSS)
130-134 GHz	123-130 GHz	FSS, MSS, radionavigation-satellite service (RNSS)
164-167 GHz	167-174.5 GHz	FSS
226-231.5 GHz	232-235 GHz	FSS

invites administrations

to participate actively in the studies and provide the technical and operational characteristics of the systems involved by submitting contributions to the ITU Radiocommunication Sector,

invites the 2027 world radiocommunication conference

1 to determine, based on the results of studies, any required regulatory measures regarding the protection of the EESS (passive) in the frequency bands listed in Table 1 above from unwanted emissions of active services and update Resolution **750 (Rev.WRC-19)** accordingly;

2 to determine, based on the results of studies, any required regulatory measures regarding the protection of the RAS in the frequency bands listed in Table 2 above and update Resolution **739 (Rev.WRC-19)** accordingly,

instructs the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

RESOLUTION 716 (REV.WRC-23)

**Use of the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz in
all three Regions and 2 010-2 025 MHz and 2 160-2 170 MHz in
Region 2 by the fixed and mobile-satellite services
and associated transition arrangements**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that WARC-92 allocated the bands 1 980-2 010 MHz and 2 170-2 200 MHz for the mobile-satellite service (MSS) with a date of entry into force of 1 January 2005, these allocations being co-primary with fixed and mobile service allocations;
- b)* that the use of the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz in all three Regions and 2 010-2 025 MHz and 2 160-2 170 MHz in Region 2 by the MSS, in accordance with the provisions of Nos. **5.389A** and **5.389C** of the Radio Regulations, as adopted by WRC-95 and WRC-97, is subject to a date of entry into force of 1 January 2000, 1 January 2002 (for Region 2) or 1 January 2005;
- c)* that these bands are shared with the fixed and mobile¹ services on a primary basis and that they are widely used by the fixed service in many countries;
- d)* that the studies made have shown that, while sharing of the MSS with the fixed service in the short to medium term would be generally feasible, in the long term sharing will be complex and difficult in both bands, so that it would be advisable to transfer the fixed service stations operating in the bands in question to other segments of the spectrum;
- e)* that for many developing countries, the use of the 2 GHz band offers a substantial advantage for their radiocommunication networks and that it is not attractive to transfer these systems to higher frequency bands because of the economic consequences that this would entail;
- f)* that ITU-R has developed a new frequency plan for the fixed service in the 2 GHz band, set out in Recommendation ITU-R F.1098 which will facilitate the introduction of new fixed service systems in band segments that do not overlap with the above-mentioned MSS allocations at 2 GHz;
- g)* that sharing between fixed service systems using tropospheric scatter and Earth-to-space links in the MSS in the same frequency band segments is generally not feasible;
- h)* that some countries utilize these bands in application of Article 48 of the ITU Constitution,

¹ This Resolution does not apply to the mobile service. In this respect, the use of these bands by the MSS is subject to coordination with the mobile service under the provisions of No. **9.11A**, where applicable.

recognizing

a) that the bands 1 885-2 025 MHz and 2 110-2 200 MHz have been identified for worldwide use by International Mobile Telecommunications (IMT), the satellite component being limited to the bands 1 980-2 010 MHz and 2 170-2 200 MHz, and that the development of IMT can offer great potential in helping the developing countries develop more rapidly their telecommunication infrastructure;

b) that WARC-92 resolved to request the Telecommunication Development Bureau, when formulating its immediate plans for assistance to the developing countries, to consider the introduction of specific modifications in the radiocommunication networks of the developing countries and that a future world development conference should examine the needs of developing countries and should assist them with the resources needed to implement the required modifications to their radiocommunication networks,

noting

that in response to Resolution **716 (WRC-95)***², ITU-R developed Recommendation ITU-R F.1335, which provides planning tools necessary to assist those administrations considering replanning of their terrestrial networks to accommodate the MSS in the 2 GHz bands,

resolves

1 to request administrations to notify to the Radiocommunication Bureau the basic characteristics of frequency assignments to existing or planned fixed stations requiring protection, or those typical³ of existing and planned fixed stations brought into use before 1 January 2000 in the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz in all three Regions and 2 010-2 025 MHz and 2 160-2 170 MHz in Region 2;

2 that administrations proposing to bring an MSS system into service must take account of the fact that, when coordinating their system with administrations having terrestrial services, such administrations may have existing or planned installations covered by Article 48 of the Constitution;

3 that in respect of stations of the fixed service taken into account in the application of No. **9.11A**, administrations responsible for MSS networks operating in the bands 1 980-2 010 MHz and 2 170-2 200 MHz in all three Regions and 2 010-2 025 MHz and 2 160-2 170 MHz in Region 2 shall ensure that unacceptable interference is not caused to fixed service stations notified and brought into use before 1 January 2000;

* *Note by the Secretariat:* This Resolution was revised by WRC-12 and WRC-23.

2 Reference to Resolution **716 (WRC-95)** is provided as background information.

3 With respect to the notification of frequency assignments to stations in the fixed and mobile services, it was possible to notify the characteristics of typical stations in the fixed service in accordance with No. **11.17** without restriction up until 1 January 2000.

4 that to facilitate the introduction and future use of the 2 GHz bands by the MSS:

4.1 administrations are urged to ensure that frequency assignments to new fixed service systems, to be brought into operation after 1 January 2000, do not overlap with the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz in all three Regions and 2 010-2 025 MHz and 2 160-2 170 MHz in Region 2 MSS allocations, for example by using the channel plans of the most recent version of Recommendation ITU-R F.1098;

4.2 administrations are urged to take all practicable steps to phase out troposcatter systems operating in the band 1 980-2 010 MHz in all three Regions and 2 010-2 025 MHz in Region 2 by 1 January 2000. New troposcatter systems shall not be brought into operation in these bands;

4.3 administrations are encouraged, where practicable, to draw up plans for the gradual transfer of the frequency assignments to their fixed service stations in the bands 1 980-2 010 MHz and 2 170-2 200 MHz in all three Regions and 2 010-2 025 MHz and 2 160-2 170 MHz in Region 2 to non-overlapping bands, giving priority to the transfer of their frequency assignments in the band 1 980-2 010 MHz in all three Regions and 2 010-2 025 MHz in Region 2, considering the technical, operational and economical aspects;

5 that administrations responsible for the introduction of mobile-satellite systems should take into account and address the concerns of affected countries, especially developing countries, to minimize the possible economic impact of transition measures in respect to existing systems;

6 to invite the Telecommunication Development Bureau to provide assistance to developing countries requesting it for the introduction of specific modifications to their radiocommunication networks that will facilitate their access to the new technologies being developed in the 2 GHz band as well as in all coordination activities;

7 that administrations responsible for the introduction of mobile-satellite systems urge their mobile-satellite system operators to participate in the protection of terrestrial fixed services especially in the least developed countries,

invites the ITU Radiocommunication Sector

to conduct, as a matter of urgency, further studies, in conjunction with the Bureau, to develop and provide to administrations the necessary tools in a timely manner to assess the impact of interference in the detailed coordination of mobile-satellite systems,

invites the ITU Telecommunication Development Sector

to evaluate, as a matter of urgency, the financial and economic impact on the developing countries of the transfer of fixed services, and to present its results to a future competent world radiocommunication conference and/or world telecommunication development conference,

RES716-4

invites the Director of the Telecommunication Development Bureau

to implement *invites the ITU Telecommunication Development Sector* by encouraging joint activities between the relevant study groups of both ITU-D and ITU-R,

instructs the Director of the Radiocommunication Bureau

to submit a report on the implementation of this Resolution to world radiocommunication conferences.

RESOLUTION 721 (WRC-23)

Studies on potential new allocations to fixed, mobile, radiolocation, amateur, amateur-satellite, radio astronomy, Earth exploration-satellite (passive and active) and space research (passive) services in the frequency range 275-325 GHz with the consequential update of Nos. 5.149, 5.340, 5.564A and 5.565

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that technologies above 275 GHz are considered as emerging enablers to enhance the radio interface to support high-capacity transmission and scientific research;
- b)* that sub-terahertz and terahertz spectrum have been discussed for use by various active service applications;
- c)* that there have been radio observatories and passive remote sensing satellites operating above 275 GHz;
- d)* that studies on technical and operational characteristics of fixed service and land mobile service (LMS) applications operating in the frequency range 275-450 GHz have been carried out by the ITU Radiocommunication Sector (ITU-R) and resulted in No. **5.564A** being added by WRC-19;
- e)* that amateur and amateur satellite service applications have been utilized in the frequency range 275-450 GHz in a number of countries;
- f)* that Recommendation ITU-R RS.2017 provides performance and interference criteria for satellite passive remote sensing up to 1 000 GHz;
- g)* that protection criteria for the radio astronomy service (RAS) above 275 GHz is included in Report ITU-R RA.2189;
- h)* that frequency bands above 275 GHz in which emissions are prohibited are not specified by a provision of the Radio Regulations;
- i)* that propagation characteristics of frequencies above 275 GHz are being studied by ITU-R Study Group 3;
- j)* that international standards are being developed for equipment operating in the frequency range 275-450 GHz;

k) that it is appropriate to ensure that any frequency allocations above 275 GHz to the fixed, land mobile, radiolocation, amateur, amateur-satellite, radio astronomy and Earth exploration-satellite (passive and active), space research (passive) and any other radiocommunication services should correspond to up-to-date technical and operational characteristics for those applications and take into account compatibility between these services,

noting

- a)* that Nos. **5.564A** and **5.565** apply to the frequency range 275-450 GHz;
- b)* that Reports ITU-R F.2416, ITU-R M.2417 and ITU-R RS.2431 provide technical and operational characteristics of fixed service, LMS and Earth exploration-satellite service (EESS) (passive) applications in the frequency range 275-450 GHz, respectively;
- c)* that Report ITU-R SM.2352 contains technology trends of active services in the frequency range 275-3 000 GHz;
- d)* that Report ITU-R SM.2540 provides sharing and compatibility study results between land mobile, fixed and passive services in the frequency range 275-450 GHz;
- e)* that Report ITU-R RS.2194 contains passive bands of scientific interest to the EEES/space research service (SRS) from 275 to 3 000 GHz,

recognizing

- a)* that the frequency range 275-325 GHz is also identified for other radiocommunication services and that those identifications are used by a variety of incumbent systems in many administrations, and that the protection of these services, including adjacent services, should be studied;
- b)* that for the determination of the incumbent services, the relevant provisions of the Radio Regulations in force apply;
- c)* that identifications do not preclude the use of the frequency bands by any application of the services to which the frequency bands are identified and do not establish priority over any other applications of radiocommunication services;
- d)* that the frequency bands 296-306 GHz, 313-318 GHz and 333-356 GHz may only be used by fixed and land mobile service applications when specific conditions to ensure the protection of EEES) (passive) applications are determined in accordance with Resolution **731 (Rev.WRC-23)**;
- e)* that in the frequency bands 275-323 GHz, 327-371 GHz, 388-424 GHz and 426-442 GHz, where radio astronomy applications are used, specific conditions (e.g. minimum separation distances and/or avoidance angles) may be necessary to ensure protection of radio astronomy sites from land mobile and/or fixed service applications, on a case-by-case basis in accordance with Resolution **731 (Rev.WRC-23)**,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference

1 studies on the spectrum needs for the fixed, mobile, radiolocation, amateur, amateur-satellite, radio astronomy, Earth exploration-satellite (passive and active) and space research (passive) services in the frequency range 275-325 GHz;

2 studies on sharing and compatibility between services referenced in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* 1;

3 studies on possible new allocations to services referenced in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* 1, while ensuring the protection of passive services in the frequency range 275-325 GHz and adjacent frequency bands, taking into account the frequency bands identified in Nos. **5.564A** and **5.565**, and the results of the studies under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* 1 and 2,

invites the 2031 world radiocommunication conference

based on the results of the studies, to consider potential new allocations in the frequency range 275-325 GHz for radiocommunication services referenced in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* 1 and update Nos. **5.149**, **5.340**, **5.564A** and **5.565**, as appropriate,

encourages administrations

to participate actively in the studies and provide the information required for the studies listed under *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference* by submitting contributions to the ITU Radiocommunication Sector,

instructs the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

RESOLUTION 722 (WRC-23)

**Studies on the coexistence between spaceborne synthetic aperture
radars operating in the Earth exploration-satellite service (active)
and radiodetermination service in the frequency band
[9 200-10 400 MHz]***

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the Earth exploration-satellite service (EESS) (active) is used for various active spaceborne sensor applications, among which synthetic aperture radar (SAR) is the most widely used application;
- b)* that, following the decisions of WRC-07 and WRC-15, the allocation of the EESS (active) was extended from the frequency band 9 500-9 800 MHz to 9 200-10 400 MHz, which is shared with the radiodetermination service, including radiolocation and radionavigation services;
- c)* that ITU Radiocommunication Sector (ITU-R) studies had concluded that the percentage of time of exceedance of the protection criteria of the radiodetermination service due to SAR emissions of space stations would be low and even lower when taking the processing gain of radar systems into account;
- d)* that, since 2015, the number of advance publication information and coordination requests for SAR application satellite networks/systems in the frequency band 9 200-10 400 MHz has increased;
- e)* that the growing usage of spaceborne SAR transmitters, as described in *considering d)*, may increase the probability of interference between radiodetermination radars and SAR satellites,

noting

- a)* that No. **5.474A** stipulates that the use of the frequency bands 9 200-9 300 MHz and 9 900-10 400 MHz by the EESS (active) is subject to agreement to be obtained under No. **9.21** from a number of administrations;
- b)* that No. **21.16** provides the power flux-density limit at the Earth's surface produced by emissions from the EESS (active) in the frequency band 9 900-10 400 MHz with respect to the protection of the fixed service;
- c)* that Recommendations ITU-R M.1796 and ITU-R M.1849 contain the technical characteristics and protection criteria for radars operating in the radiodetermination service in the frequency range 8 500-10 680 MHz;

* The appearance of square brackets around certain frequency bands in this Resolution is understood to mean that WRC-27 will consider and review the inclusion of these frequency bands with square brackets and decide, as appropriate.

d) that Report ITU-R RS.2313 contains sharing analyses of wideband EESS (active) transmissions with stations in the radio determination service operating in the frequency bands 8 700-9 300 MHz and 9 900-10 500 MHz,

recognizing

a) the importance of the continuing operation of SAR satellites and the need for protection for the radiodetermination systems operating in the frequency band 9 200-10 400 MHz;

b) that No. **5.476A** states that in the frequency band 9 300-9 800 MHz, stations in the Earth exploration-satellite service (active) and space research service (active) shall not cause harmful interference to, or claim protection from, stations of the radionavigation and radiolocation services;

c) that No. **5.474D** states that stations in the Earth exploration-satellite service (active) shall not cause harmful interference to, or claim protection from, stations of the maritime radionavigation and radiolocation services in the frequency band 9 200-9 300 MHz, the radionavigation and radiolocation services in the frequency band 9 900-10 000 MHz and the radiolocation service in the frequency band 10.0-10.4 GHz;

d) that the aeronautical radionavigation service (ARNS) operating in the frequency band 9 000-9 200 MHz and the maritime radionavigation service operating in the frequency band 9 200-9 500 MHz are used by safety service systems, in accordance with Nos. **1.59** and **4.10**;

e) that Recommendation ITU-R M.1796 contains the technical characteristics and protection criteria for radars operating in the radiodetermination service in the frequency range 8 500-10 680 MHz,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference

1 studies on the technical and operational characteristics of SARs in the EESS (active) in the frequency band 9 200-10 400 MHz;

2 studies on the coexistence between SARs operating in the EESS (active) and the radiodetermination service in the frequency band 9 200-10 400 MHz,

invites administrations

to participate actively in the studies and provide the information required for the studies listed in *resolves to invite ITU-R to complete in time for the 2031 world radiocommunication conference* by submitting contributions to ITU-R,

resolves to invite the 2031 world radiocommunication conference

to consider the results of the above ITU-R studies and take actions, as appropriate.

RESOLUTION 726 (WRC-23)

Possible new primary allocation to the fixed-satellite service (space-to-Earth) in the frequency band 17.3-17.7 GHz and possible new primary allocation to the broadcasting-satellite service (space-to-Earth) in the frequency band 17.3-17.8 GHz in Region 3, and consideration of equivalent power flux-density limits to be applied in Regions 1 and 3 to non-geostationary-satellite systems in the fixed-satellite service (space-to-Earth) in the frequency band 17.3-17.7 GHz

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* the need to encourage the development and implementation of new technologies in the fixed-satellite service (FSS) for broadband applications and in the broadcasting-satellite service (BSS) for ultra-high-definition television (UHDTV) applications;
- b)* that FSS systems based on the use of new technologies associated with geostationary-satellite orbit (GSO) and non-geostationary-satellite orbit (non-GSO) systems are capable of providing high-capacity and low-cost means of broadband communication even to the most isolated regions of the world, and BSS systems are capable of providing high-quality and low-cost means of wideband broadcasting;
- c)* that, due to the orbital characteristics of non-GSO satellite systems, the constellations are capable of providing services globally, and there is therefore a need for harmonized Radio Regulations;
- d)* that the Radio Regulations should enable the introduction of new applications of radiocommunication technology to ensure the operation of as many systems as possible in order to ensure efficient use of the spectrum;
- e)* that there is a mismatch in usable downlink bandwidth in the FSS in Region 3 in the frequency range 17-20 GHz associated with the uplink frequency range of 27-30 GHz;
- f)* that, in Region 3, the frequency band 17.3-18.1 GHz is allocated on a primary basis to the FSS (Earth-to-space), subject to the application of No. **5.516**;
- g)* that there are no relevant provisions applying to the non-GSO FSS in the frequency band 17.7-17.8 GHz;
- h)* that, under the present Resolution, the equivalent power flux-density (epfd) limits in *noting e)* are to be considered as a reference, without the intent of a modification at WRC-27 for Region 2;

noting

- a) that technology has been developed to provide more efficient use of the spectrum and to enable both bidirectional and same-directional sharing;
- b) that bidirectional sharing between the FSS (Earth-to-space) and the FSS (space-to-Earth) is already considered in Regions 1 and 2 for the frequency band 17.3-17.7 GHz;
- c) that extending the FSS (space-to-Earth) allocation in the frequency band 17.3-17.7 GHz and the BSS (space-to-Earth) allocation in the frequency band 17.3-17.8 GHz to Region 3 will contribute to global harmonization;
- d) that there are other primary services, including the fixed and mobile services, in the band 17.7-17.8 GHz in Region 3;
- e) that Article 22 (Tables 22-1B, 22-3 and 22-4B) contains epfd limits to ensure the protection of GSO satellite networks from non-GSO FSS satellite systems in the frequency band 17.3-17.7 GHz in Region 2,

resolves

that the studies referred to in *invites the ITU Radiocommunication Sector to conduct and complete in time for the 2027 world radiocommunication conference* below shall protect radiocommunication services to which the frequency band is allocated on a primary basis, including the fixed and mobile services, in particular assignments to the BSS feeder links contained in Appendix 30A,

invites the ITU Radiocommunication Sector to conduct and complete in time for the 2027 world radiocommunication conference

1 studies on sharing and compatibility between the FSS (space-to-Earth), the BSS (space-to-Earth) and the FSS (Earth-to-space) designated by No. 5.516 in order to consider a possible new primary allocation to the FSS (space-to-Earth) in the frequency band 17.3-17.7 GHz for Region 3 and to the BSS (space-to-Earth) in the frequency band 17.3-17.8 GHz for Region 3, while ensuring the protection of existing primary allocations in the same and adjacent frequency bands, and without adversely affecting the existing allocations to the FSS (Earth-to-space) designated by No. 5.516, including assignments to the BSS feeder links contained in Appendix 30A;

2 consideration of the applicability of Region 2 non-GSO FSS epfd limits (see *noting e)*) pertaining to the frequency band 17.3-17.7 GHz to Regions 1 and 3, so as to ensure the protection of GSO networks,

invites the 2027 world radiocommunication conference

to consider the results of the above ITU Radiocommunication Sector (ITU-R) studies and take necessary actions, as appropriate, with respect to the following issues:

- 1) a possible new primary allocation to the FSS (space-to-Earth) in the frequency band 17.3-17.7 GHz for Region 3;
- 2) a possible new primary allocation to the BSS (space-to-Earth) in the frequency band 17.3-17.8 GHz for Region 3;

- 3) ensuring the protection of existing primary allocations in the same and adjacent frequency bands, without adversely affecting the existing allocations to the fixed and mobile services in the frequency band 17.7-17.8 GHz and to the FSS (Earth-to-space) as designated by No. **5.516**, including assignments to the BSS feeder links contained in Appendix **30A**;
- 4) the application of Region 2 epfd limits to non-GSO FSS systems (as given in *noting e*)) operating in the frequency band 17.3-17.7 GHz in Regions 1 and 3,

invites administrations

to participate actively in the studies described in *resolves to invite the ITU Radiocommunication Sector to conduct and complete in time for the 2027 world radiocommunication conference* and provide the technical and operational characteristics of the systems involved by submitting contributions to ITU-R.

RESOLUTION 729 (REV.WRC-07)

Use of frequency adaptive systems in the MF and HF bands*

The World Radiocommunication Conference (Geneva, 2007),

considering

- a)* that the efficiency of spectrum use will be improved by the use of frequency adaptive systems in the MF and HF bands shared by the fixed and the mobile services;
- b)* that trials and deployment of frequency adaptive systems have been under way during the past 30 years and have demonstrated the effectiveness of such systems and improved spectrum efficiency;
- c)* that such improved efficiency is attained through:
 - shorter call set-up and improved transmission quality by selection of the most suitable assigned channels;
 - reduced channel occupancy, permitting the same channels to be used by different networks, yet decreasing the probability of harmful interference;
 - minimization of the transmitter power required for each transmission;
 - continued optimization of the emissions owing to the sophistication of the systems;
 - simple operation by the use of intelligent peripheral equipment;
 - reduced need for skilled radio operators;
- d)* that following WRC-95, the Radiocommunication Bureau no longer undertakes examination with respect to the probability of harmful interference caused by new assignments recorded in the Master International Frequency Register (MIFR) in the non-planned bands below 28 MHz;
- e)* that WRC-97 introduced a means for notification of block assignments;
- f)* that frequency adaptive systems will actively contribute to the avoidance of interference since, when other signals are observed on the channel, the frequency adaptive system will move to another frequency,

resolves

- 1 that, in authorizing the operation of frequency adaptive systems in the fixed and mobile services for the MF and HF bands, administrations shall:
 - 1.1 not make assignments in those bands:
 - governed by the Appendix 25 frequency allotment Plan for the maritime mobile service or the Appendix 27 frequency allotment Plan for the aeronautical mobile (R) service;

* This Resolution should be brought to the attention of ITU-D Study Group 2.

- shared on a co-primary basis with the broadcasting service, radiodetermination service or the amateur services;
 - allocated to the radio astronomy service;
- 1.2 avoid use which may affect frequency assignments involving safety services made in accordance with Nos. **5.155**, **5.155A** and **5.155B**;
- 1.3 take into account any footnotes applicable to the proposed bands and the implications regarding compatibility;
- 2 that frequency adaptive systems shall automatically limit simultaneous use of frequencies to the minimum necessary for communication requirements;
- 3 that, with a view to avoiding harmful interference, frequency adaptive systems should evaluate the channel occupancy prior to and during operation;
- 4 that assignments for frequency adaptive systems shall be notified to the Bureau in accordance with the provisions of Article **11** and Appendix **4**.

RESOLUTION 731 (REV.WRC-23)

**Consideration of sharing and adjacent-band compatibility
between passive and active services above 71 GHz**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the changes made to the Table of Frequency Allocations by WRC-2000 in frequency bands above 71 GHz were based on the requirements known at the time of that conference;
- b)* that the passive service spectrum requirements above 71 GHz are based on physical phenomena and therefore are well known, and are reflected in the changes made to the Table of Frequency Allocations by that conference;
- c)* that several frequency bands above 71 GHz are already used by the Earth exploration-satellite service (EESS) (passive) and space research service (passive) because they are unique bands for the measurement of specific atmospheric parameters;
- d)* that frequency bands in the frequency range 275-1 000 GHz are identified for use by administrations for passive service applications in No. **5.565**, without precluding the use of this frequency range by active service applications, and urging administrations to take all practicable steps to protect the passive service applications from harmful interference;
- e)* that there is currently only limited knowledge of requirements and implementation plans for the active services that will operate in frequency bands above 71 GHz;
- f)* that, in the past, technological developments have led to viable communication systems operating at increasingly higher frequencies, and that this can be expected to continue so as to make communication technology available in the future in the frequency bands above 71 GHz;
- g)* that, in the future, alternative spectrum needs for the active and passive services should be accommodated when the new technologies become available;
- h)* that, following the revisions to the Table of Frequency Allocations by WRC-2000, sharing studies may still be required for services in some frequency bands above 71 GHz;
- i)* that interference criteria for passive sensors have been developed and are given in Recommendation ITU-R RS.2017;
- j)* that protection criteria for radio astronomy have been developed and are given in Recommendations ITU-R RA.769 and ITU-R RA.1513 and Report ITU-R RA.2189;

k) that several satellite downlink allocations have been made in frequency bands adjacent to those allocated to the radio astronomy service;

l) that sharing criteria for active and passive services in frequency bands above 71 GHz have not yet been fully developed within the ITU Radiocommunication Sector (ITU-R),

recognizing

a) that several frequency bands above 71 GHz are subject to No. **5.340**, and all emissions are prohibited in these bands;

b) that, to the extent practicable, the burden of sharing among active and passive services should be equitably distributed among the services to which allocations are made,

resolves

to invite a future competent world radiocommunication conference to consider the results of ITU-R studies referred to in *invites the ITU Radiocommunication Sector* below with a view to taking the necessary action, as appropriate, in order to accommodate the emerging requirements of active services, taking into account the requirements of the passive services, in frequency bands above 71 GHz,

urges administrations

to note the possibility of changes to Article **5** to accommodate emerging requirements for active services, as indicated in this Resolution, and to take this into account in the development of national policies and regulations,

invites the ITU Radiocommunication Sector

1 to continue its studies to determine if and under what conditions sharing is possible between active and passive services in the frequency bands above 71 GHz, such as, but not limited to, 116-122.25 GHz, 174.8-182 GHz, 185-190 GHz and 235-238 GHz;

2 to study under what conditions passive services operating in allocated frequency bands 100-102 GHz, 148.5-151.5 GHz, 182-185 GHz, 190-191.8 GHz and 226-231.5 GHz are compatible with active services allocated to adjacent bands;

3 to conduct studies to determine the specific conditions to be applied to the land-mobile and fixed-service applications to ensure the protection of EESS (passive) applications in the frequency bands 296-306 GHz, 313-318 GHz and 333-356 GHz;

4 to study means of avoiding adjacent-band interference from space services (downlinks) into radio astronomy frequency bands above 71 GHz;

5 to take into account the principles of burden-sharing to the extent practicable in their studies;

6 to complete the necessary studies when the technical characteristics of the active services in these frequency bands are known;

7 to develop Recommendations specifying sharing criteria for those frequency bands where sharing is feasible,

instructs the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

RESOLUTION 732 (REV.WRC-12)

Consideration of sharing between active services above 71 GHz

The World Radiocommunication Conference (Geneva, 2012),

considering

- a)* that the World Radiocommunication Conference (Istanbul, 2000) has made changes to the Table of Frequency Allocations above 71 GHz, following consideration of science service issues;
- b)* that there are several co-primary active services in some bands above 71 GHz in the Table of Frequency Allocations as revised by the World Radiocommunication Conference (Istanbul, 2000);
- c)* that there is still limited knowledge of characteristics of active services that may be developed to operate in bands above 71 GHz;
- d)* that sharing criteria for sharing between active services in bands above 71 GHz have not yet been fully developed within ITU-R;
- e)* that sharing between multiple co-primary active services may hinder the development of each active service in bands above 71 GHz;
- f)* that the technology for some active services may be commercially available earlier than for some other active services;
- g)* that adequate spectrum should be available for the active services for which the technology is available at a later time,

noting

that sharing criteria need to be developed and included in ITU-R Recommendations, which may be used by a future competent conference, for determining to what extent sharing between multiple co-primary active services is possible in each of the bands,

resolves

- 1 that appropriate measures should be taken to meet the spectrum requirements for active services for which the technology will be commercially available at a later time;
- 2 that sharing criteria be developed for co-primary active services in bands above 71 GHz;
- 3 that the sharing criteria developed should form the basis for a review of active service allocations above 71 GHz at a future competent conference, if necessary,

urges administrations

to note the possibility of changes to Article 5 to accommodate emerging requirements for active services, as indicated in this Resolution, and to take this into account in the development of national policies and regulations,

invites ITU-R

to complete the necessary studies and develop ITU-R Recommendation(s) with a view to presenting, at the appropriate time, the technical information likely to be required as a basis for the work of a future competent conference,

instructs the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

RESOLUTION 739 (REV.WRC-19)

Compatibility between the radio astronomy service and the active space services in certain adjacent and nearby frequency bands

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that adjacent or nearby primary service allocations have been made to the radio astronomy service (RAS), and to various space services, such as the fixed-satellite service (FSS), radionavigation-satellite service (RNSS), mobile-satellite service (MSS) and broadcasting-satellite service (BSS), hereafter referred to as “active space services”;
- b) that, in many cases, the frequencies used by the RAS are chosen to study natural phenomena producing radio emissions at frequencies fixed by the laws of nature, so shifting frequency to avoid or mitigate interference problems may not be possible;
- c) that Report ITU-R SM.2091 provides a methodology for conducting, and a framework for documenting the results of, compatibility studies between active space service and RAS band pairs;
- d) that Report ITU-R SM.2091 also provides the results of compatibility studies between the RAS and an active space service in certain adjacent and nearby frequency bands;
- e) that appropriate consultation between administrations has the potential to lead to the development of innovative solutions and to the rapid deployment of systems;
- f) that, for technical or operational reasons, more stringent spurious emission limits than the general limits in Appendix 3 may be required to protect the RAS from active services in specific frequency bands,

noting

- a) that the additional burden of undertaking any technical examination should not be placed on the Radiocommunication Bureau (BR);
- b) that a consultation procedure, as contained in this Resolution, would not place an additional burden on BR;
- c) that Recommendation ITU-R M.1583 provides a methodology based on the equivalent power flux-density (epfd) concept for calculation of interference resulting from unwanted emissions from non-geostationary-satellite (non-GSO) systems of the MSS or RNSS into radio astronomy stations;
- d) that Recommendation ITU-R S.1586 provides a methodology based on the epfd concept for calculation of interference resulting from unwanted emissions from non-GSO systems of the FSS into radio astronomy stations;

- e) that the methodology described in these Recommendations may also be used to study the case of non-GSO systems in the BSS;
- f) that Recommendation ITU-R RA.1631 provides antenna patterns to be used for compatibility analyses between non-GSO systems and RAS stations, based on the epfd concept;
- g) that Recommendation ITU-R RA.1513 provides acceptable levels of data loss to radio astronomy observations, stating in particular that the percentage of data loss caused by any system should be lower than 2%;
- h) that some of the results documented in Report ITU-R SM.2091 may be used as threshold levels to initiate the consultation procedure;
- i) that the results of successful consultation between concerned administrations would ensure that the interests of both the active services and the RAS are considered;
- j) that measures taken by active space services to protect radio astronomy stations from interference may result in increased costs and/or reduced capabilities for those services;
- k) that, conversely, not taking such measures may result in additional operating costs and reduced operational effectiveness for the radio astronomy stations concerned;
- l) that the implementation of additional interference mitigation measures at the radio astronomy station may increase operating costs and reduce observational effectiveness;
- m) that, conversely, not implementing such measures may impose upon the active space services an additional cost burden and reduction in service capability,

recognizing

- a) that unwanted emissions produced by stations of the active space services may cause unacceptable interference to stations of the RAS;
- b) that, although some unwanted emissions from transmitters on space stations can be controlled through careful design methods and appropriate testing procedures, other unwanted emissions, such as narrowband spurious emissions, generated by uncontrollable and/or unpredictable physical mechanisms, may only be detected after the spacecraft is launched;
- c) that there is an uncertainty in the pre-launch assessment of the levels of unwanted emissions;
- d) that it is necessary to ensure equitable burden-sharing for achieving compatibility between the active space services and the RAS;
- e) that, for those cases where difficulties are encountered in meeting the values in the Annex to this Resolution, a consultation procedure could be used to resolve the difficulties,

resolves

1 that an administration take all reasonable steps to ensure that any space station or satellite system being designed and constructed to operate in the frequency bands in the Annex to this Resolution meets the values given therein at any radio astronomy station operating in the corresponding frequency bands identified in that Annex;

2 that in the event that during construction and prior to launch it is determined that, after having considered all reasonable means, the unwanted emissions from the space station or satellite system cannot meet the values given in the Annex, the administration that notified the space station or satellite system contact, as soon as possible, the administration operating the radio astronomy station to confirm that *resolves* 1 has been fulfilled, and the concerned administrations enter into a consultation process in order to achieve a mutually acceptable solution;

3 that in the event that, following the space station launch, an administration operating a radio astronomy station determines that, due to unexpected circumstances, a space station or satellite system does not meet the values for unwanted emissions given in the Annex at that radio astronomy station, it contact the administration that notified the space station or satellite system for the latter administration to confirm that *resolves* 1 has been fulfilled, and the concerned administrations enter into a consultation process in order to identify further steps with a view to achieving a mutually acceptable solution;

4 that the radio astronomy stations to be taken into account in applying *resolves* 1, 2 and 3 are those which are operating in the frequency band(s) identified in the Annex and which are notified before the date of receipt of the advance publication information (API) of the space station or satellite system to which this Resolution applies;

5 that the space stations or satellite systems to be considered in the application of *resolves* 1 to 4 above are those designed to operate in the space service frequency bands listed in the tables in the Annex for which API is received by BR following the entry into force of the Final Acts of the appropriate conference, as specified in those tables;

6 that the objective of the consultation process in *resolves* 1, 2 and 3 is to achieve a mutually acceptable solution, using as guidance Report ITU-R SM.2091 and any other ITU Radiocommunication Sector Recommendations deemed relevant by the concerned administrations;

7 that BR shall make no examination or finding with respect to this Resolution under either Article 9 or 11,

invites administrations

1 to take all appropriate and practicable steps, from the design phase onward, to ensure that unwanted emissions are minimized from space stations that are planned to operate in one or more space service allocations, in order to avoid exceeding the threshold levels of unwanted emissions identified in the Annex at any radio astronomy station;

2 to take all practicable steps, from the design phase onward, to minimize the sensitivity of radio astronomy stations to interference and to take into account the need to implement interference mitigation measures.

ANNEX TO RESOLUTION 739 (REV.WRC-19)

Unwanted emission threshold levels

The unwanted emission threshold levels applicable to geostationary space stations are given in Table 1 in terms of power flux-density (pfd) in a reference bandwidth produced at a radio astronomy station.

In Table 1, the unwanted emission threshold levels given in the fourth, sixth and eighth columns (associated with the reference bandwidth contained in the adjacent columns) should be met by any GSO space station operating in the frequency bands indicated in the second column at the radio astronomy station operating in the frequency band mentioned in the third column.

The unwanted emission threshold levels applicable to space stations of a non-geostationary-satellite (non-GSO) system are given in Table 2 in terms of the equivalent power flux-density (epfd) produced at a radio astronomy station in a reference bandwidth by all the space stations in a non-GSO system that are visible to the radio astronomy station considered, not to be exceeded during a given percentage of time, over the whole sky.

In Table 2, the epfd value given in the fourth, sixth and eighth columns (associated with the reference bandwidths contained in the adjacent column) should be met by all the space stations of a non-GSO system operating in the frequency bands indicated in the second column at the radio astronomy station operating in the frequency band mentioned in the third column. The epfd value at a given radio astronomy station shall be evaluated by using the antenna pattern and the radio astronomy service maximum antenna gain given in Recommendation ITU-R RA.1631-0. Guidance on the calculation of epfd can be found in Recommendations ITU-R S.1586 and ITU-R M.1583. The elevation angles of the radio astronomy stations to be taken into account in the epfd calculation are those higher than the minimum elevation angle θ_{min} of the radio telescope. In the absence of such information, a value of 5° shall be taken. The percentage of time during which the epfd level shall not be exceeded is mentioned in Note ⁽¹⁾ to Table 2.

Some sections of Report ITU-R SM.2091 indicate levels of unwanted emissions in radio astronomy frequency bands that certain satellite systems, by design, do not exceed.

TABLE 1
pfd thresholds for unwanted emissions from any GSO space station
at a radio astronomy station

Space service	Space service frequency band (MHz)	Radio astronomy frequency band (MHz)	Single dish, continuum observations		Single dish, spectral line observations		VLBI		Condition of application: the API is received by BR following the entry into force of the Final Acts of:
			pfd ⁽¹⁾ (dB(W/m ²))	Reference bandwidth (MHz)	pfd ⁽¹⁾ (dB(W/m ²))	Reference bandwidth (kHz)	pfd ⁽¹⁾ (dB(W/m ²))	Reference bandwidth (kHz)	
MSS (space-to-Earth)	387-390	322-328.6	-189	6.6	-204	10	-177	10	WRC-07
BSS	1 452-1 492	1 400-1 427	-180	27	-196	20	-166	20	WRC-03
MSS (space-to-Earth)	1 525-1 559								
MSS (space-to-Earth)	1 525-1 559	1 610.6-1 613.8	NA	NA	-194	20	-166	20	WRC-03
MSS (space-to-Earth)	1 613.8-1 626.5								
RNSS (space-to-Earth)	1 559-1 610	1 610.6-1 613.8	NA	NA	-194	20	-166	20	WRC-07
BSS	2 655-2 670	2 690-2 700	-177	10	NA	NA	-161	20	WRC-03
FSS (space-to-Earth)									
FSS (space-to-Earth)	2 670-2 690	2 690-2 700 (m Regions 1 and 3)	-177	10	NA	NA	-161	20	WRC-03
			-	-	-	-	-	-	WRC-03 for VLBI, and WRC-07 for other types of observation
BSS	21.4-22.0	22.21-22.5	-146	290	-162	250	-128	250	

NA: Not applicable, measurements of this type are not made in this frequency band.

⁽¹⁾ Integrated over the reference bandwidth with an integration time of 2 000 s.

TABLE 2
epfd thresholds⁽¹⁾ for unwanted emissions from all space stations of a non-GSO satellite system
at a radio astronomy station

Space service	Space service frequency band (MHz)	Radio astronomy frequency band (MHz)	Single dish, continuum observations		Single dish, spectral line observations		VLBI		Condition of application: the API is received by BR following the entry into force of the Final Acts of:
			epfd ⁽²⁾ (dB(W/m ²))	Reference bandwidth (MHz)	epfd ⁽²⁾ (dB(W/m ²))	Reference bandwidth (kHz)	epfd ⁽²⁾ (dB(W/m ²))	Reference bandwidth (kHz)	
MSS (space-to-Earth)	137-138	150.05-153	-238	2.95	NA	NA	NA	NA	WRC-07
MMSS (space-to-Earth)	157.1875-157.3375	150.05-153	-238	2.95	NA	NA	NA	NA	WRC-19
	161.7875-161.9375		-238	2.95	NA	NA	NA	NA	WRC-19
MMSS (space-to-Earth)	157.1875-157.3375	322-328.6	-240	6.6	-255	10	-228	10	WRC-19
	161.7875-161.9375		-240	6.6	-255	10	-228	10	WRC-07
MSS (space-to-Earth)	387-390	322-328.6	-240	6.6	-255	10	-228	10	WRC-07
MSS (space-to-Earth)	400.15-401	406.1-410	-242	3.9	NA	NA	NA	NA	WRC-07
MSS (space-to-Earth)	1 525-1 559	1 400-1 427	-243	27	-259	20	-229	20	WRC-07
RNSS (space-to-Earth) ⁽³⁾	1 559-1 610	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-07
MSS (space-to-Earth)	1 525-1 559	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-07

NA: Not applicable, measurements of this type are not made in this frequency band.

⁽¹⁾ These epfd thresholds should not be exceeded for more than 2% of time.

⁽²⁾ Integrated over the reference bandwidth with an integration time of 2 000 s.

⁽³⁾ This Resolution does not apply to current and future assignments of the radionavigation-satellite system GLONASS/GLONASS-M in the frequency band 1 559-1 610 MHz, irrespective of the date of receipt of the related coordination or notification information, as appropriate. The protection of the radio astronomy service in the frequency band 1 610.6-1 613.8 MHz is ensured and will continue to be in accordance with the bilateral agreement between the Russian Federation, the notifying administration of the GLONASS/GLONASS-M system, and IUCAF, and with subsequent bilateral agreements with other administrations.

RESOLUTION 741 (REV.WRC-15)

**Protection of the radio astronomy service in the frequency band
4 990-5 000 MHz from unwanted emissions of the radionavigation-satellite
service (space-to-Earth) operating in the frequency band 5 010-5 030 MHz**

The World Radiocommunication Conference (Geneva, 2015),

considering

- a)* that unwanted emissions from space stations of the radionavigation-satellite service (RNSS) operating in the frequency band 5 010-5 030 MHz may cause interference to the radio astronomy service (RAS) in the frequency band 4 990-5 000 MHz;
- b)* that WRC-2000 decided to introduce a provisional power flux-density (pfd) limit in the frequency band 4 990-5 000 MHz to protect the RAS, and invited ITU-R to conduct studies to review this limit;
- c)* that protection requirements for the RAS are given in Recommendations ITU-R RA.769 and ITU-R RA.1513, and are different for geostationary (GSO) and non-GSO satellite systems,

noting

- a)* that Recommendation ITU-R M.1583 provides a methodology based on the equivalent pfd (epfd) concept for calculation of interference resulting from unwanted emissions from non-GSO systems of the mobile-satellite service or RNSS into radio astronomy stations;
- b)* that Recommendation ITU-R RA.1631 provides antenna patterns and maximum antenna gain to be used for compatibility analyses between non-GSO systems and RAS stations based on the epfd concept;
- c)* that Recommendation ITU-R RA.1513 recommends acceptable levels of data loss to radio astronomy observations, stating in particular that the percentage of data loss caused by any system should be lower than 2%;
- d)* that as from the end of WRC-03, the Radiocommunication Bureau reviewed all RNSS systems for which complete coordination or notification information, as appropriate, had been received for the frequency band 5 010-5 030 MHz, and revised its findings regarding compliance with No. **5.443B**, taking into account additional information received under *resolves* 4,

resolves

- 1 that in order not to cause harmful interference to the RAS in the frequency band 4 990-5 000 MHz, the pfd produced in this frequency band by any GSO RNSS network operating in the 5 010-5 030 MHz frequency band shall not exceed $-171 \text{ dB(W/m}^2\text{)}$ in a 10 MHz frequency band at any radio astronomy station;

2 that in order not to cause harmful interference to the RAS in the frequency band 4 990-5 000 MHz, over the whole sky, for elevations higher than the minimum operating elevation angle θ_{min} ¹ specified for the radio telescope, the epfd produced in this frequency band by all space stations within any non-GSO RNSS system operating in the 5 010-5 030 MHz frequency band shall not exceed $-245 \text{ dB(W/m}^2\text{)}$ in a 10 MHz frequency band at any radio astronomy station for more than 2% of the time, using the methodology in Recommendation ITU-R M.1583-1 and a reference antenna with a radiation pattern and maximum antenna gain given in Recommendation ITU-R RA.1631-0;

3 that the limits referred to in *resolves* 1 and 2 shall apply to RNSS systems as from 3 June 2000;

4 that administrations planning to operate a GSO or a non-GSO RNSS system in the frequency band 5 010-5 030 MHz, for which complete coordination or notification information, as appropriate, has been received by the Bureau after 2 June 2000, shall send to the Bureau the value of the maximum level of pfd as referred to in *resolves* 1 or the value of the maximum level of epfd as referred to in *resolves* 2, as appropriate.

¹ Until adoption of a definition of θ_{min} by ITU-R, and publication of notified radio astronomy observatory data, a value of 5° should be assumed in appropriate calculations.

RESOLUTION 743 (WRC-03)

**Protection of single-dish radio astronomy stations in Region 2
in the 42.5-43.5 GHz band**

The World Radiocommunication Conference (Geneva, 2003),

considering

- a)* that the band 42.5-43.5 GHz is allocated to the radio astronomy service (RAS) on a primary basis, and that both continuum and spectral line observations are conducted in this band;
- b)* that there are primary allocations to the fixed-satellite service (FSS) (space-to-Earth) and to the broadcasting-satellite service (BSS) in the 42-42.5 GHz band;
- c)* that a geostationary (GSO) FSS or BSS satellite operating in the 42-42.5 GHz band could encounter great difficulty in meeting the values given in No. **5.551I** for single-dish radio telescope observations in the 42.5-43.5 GHz band for 100% of the time;
- d)* that an FSS or BSS satellite or system operating in the 42-42.5 GHz band would encounter great difficulty in meeting the power flux-density (pfd) level of $-153 \text{ dB(W/m}^2\text{)}$ in any 500 kHz for GSO satellites or the equivalent pfd (epfd) level of $-246 \text{ dB(W/m}^2\text{)}$ in any 500 kHz for any non-GSO system for single-dish radio telescope spectral-line observations near the 42.5 GHz band edge of the 42.5-43.5 GHz band, even when all practicable technical or operational measures to reduce the potential for interference detrimental to the RAS stations are employed;
- e)* that because there are relatively few RAS stations operating single-dish telescopes in the band 42.5-43.5 GHz, and because there are expected to be relatively few FSS or BSS earth stations operating in the 42-42.5 GHz band, it may be feasible for both services to employ technical or operational measures, including but not limited to such interference mitigation techniques as geographical isolation, time sharing, etc., in order to reduce the potential for interference detrimental to the RAS stations operating in this band;
- f)* that, taking into account the above *considerings*, it should be feasible to rely on arrangements between concerned RAS and FSS/BSS administrations to ensure that the unwanted emissions from FSS or BSS satellites and systems in the 42-42.5 GHz band do not cause interference detrimental to RAS stations in Region 2 conducting spectral-line observations in the 42.5-42.77 GHz band,

resolves

- 1 that a GSO FSS or BSS satellite in the band 42-42.5 GHz shall not exceed the values given in No. **5.551I** for more than 2% of the time at any radio astronomy station in Region 2 registered as a single-dish radio telescope in the 42.5-43.5 GHz band;

2 that an administration that plans to operate a GSO FSS or BSS satellite or a non-GSO FSS or BSS system in the 42-42.5 GHz band shall take all practicable steps to avoid exceeding the pfd value of $-153 \text{ dB(W/m}^2\text{)}$ in any 500 kHz for a GSO satellite, and the epfd value of $-246 \text{ dB(W/m}^2\text{)}$ in any 500 kHz for any non-GSO system in the 42.5-42.77 GHz band, for more than 2% of the time, at the site of a radio astronomy station registered as a single-dish radio telescope in Region 2;

3 that in the event that an administration planning to operate a GSO FSS or BSS satellite or a non-GSO FSS or BSS system in the band 42-42.5 GHz has taken all practicable steps to avoid exceeding the values and percentage of time criterion in *resolves* 2 in the 42.5-42.77 GHz band, but that nevertheless would not meet them, the administration planning to operate such a satellite or systems shall enter into discussions with the administration operating the affected radio astronomy station in Region 2 to arrive at a mutually satisfactory arrangement with respect to the unwanted emissions produced into the band 42.5-42.77 GHz;

4 that *resolves* 1, 2 and 3 shall apply with respect to any radio astronomy station in Region 2 registered as a single-dish radio telescope in the band 42.5-43.5 GHz that was in operation prior to 5 July 2003 and that has been notified to the Radiocommunication Bureau before 4 January 2004, or that was notified before the date of receipt of the complete Appendix 4 information for coordination or notification, as appropriate, for an FSS or BSS satellite or system to which this Resolution applies (see Note 1);

5 that an administration notifying a radio astronomy station in Region 2 as a single-dish radio telescope after the dates provided in *resolves* 4 may seek an agreement with administrations that have authorized FSS or BSS satellites or systems to which this Resolution applies,

invites ITU-R

to conduct studies and develop Recommendations to establish the appropriate balance between the percentage of time that GSO satellites operating in the 42-42.5 GHz band exceed the single-dish values in No. **5.551I** at the site of a radio astronomy station and the associated impact on radio astronomy observations.

NOTE 1 – For purposes of No. **5.551H**, No. **5.551I** and *resolves* 4 of this Resolution, the radio astronomy stations currently under construction in Sierra Negra, Mexico, $18^\circ 59' \text{ N}/97^\circ 18' \text{ W}$ (station Volcan Sierra Negra) and San Pedro de Atacama, Chile, $23^\circ 20' \text{ S}/67^\circ 44' \text{ W}$ (station Atacama Large Millimeter Array) to conduct observations in the 42.5-43.5 GHz band, shall be considered to have been in operation prior to 5 July 2003 if they are notified to the Radiocommunication Bureau before 1 January 2005.

RESOLUTION 744 (REV.WRC-23)

Sharing between the mobile-satellite service (Earth-to-space) and the fixed and mobile services in the frequency band 1 668.4-1 675 MHz

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that WRC-03 made a global allocation to the mobile-satellite service (MSS) (Earth-to-space) in the band 1 668-1 675 MHz and a global allocation to the MSS (space-to-Earth) in the band 1 518-1 525 MHz;
- b)* that the band 1 668.4-1 675 MHz is also allocated to the fixed and mobile services;
- c)* that due to sharing conditions between MSS (space-to-Earth) and the aeronautical mobile service for telemetry in the band 1 518-1 525 MHz (see No. **5.348B**), MSS operation in the United States of America is unlikely to be feasible;
- d)* that the above constraints on the MSS in the band 1 518-1 525 MHz therefore limit the possible use of the band 1 668-1 675 MHz by the MSS in the United States of America;
- e)* that the band 1 670-1 675 MHz is used in Canada and the United States of America for the fixed and mobile services;
- f)* that some administrations operate transportable radio-relay systems in the band 1 668.4-1 675 MHz which could operate as part of the fixed or mobile service allocations;
- g)* that sharing between the mobile service and the mobile-satellite service (Earth-to-space) in the band 1 668.4-1 675 MHz has been studied in Recommendation ITU-R M.1799,

resolves

- 1 that the use of the band 1 668.4-1 675 MHz by systems in the mobile service is limited to transportable radio-relay systems;
- 2 that administrations operating transportable radio-relay systems should take into account the most recent version of Recommendation ITU-R M.1799, which states that, to adequately protect MSS networks, the e.i.r.p. of transportable radio-relay stations should not exceed -27 dB(W/4 kHz) in the frequency band 1 668.4-1 675 MHz in the direction of the geostationary orbit;
- 3 that from 1 January 2015 administrations operating such systems in the mobile service shall limit the e.i.r.p. spectral density radiated in the direction of the geostationary orbit by these systems to -27 dB(W/4 kHz) in the band 1 668.4-1 675 MHz;

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4 that, in the band 1 670-1 675 MHz, stations in the MSS shall not claim protection from stations in the fixed and mobile services operating in Canada and the United States of America;

5 that *resolves* 1, 2 and 3 do not apply to stations in the fixed and mobile services operating in Canada and the United States of America.

RESOLUTION 748 (REV.WRC-19)

Compatibility between the aeronautical mobile (R) service and the fixed-satellite service (Earth-to-space) in the frequency band 5 091-5 150 MHz

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that the allocation of the frequency band 5 091-5 150 MHz to the fixed-satellite service (FSS) (Earth-to-space) is limited to feeder links of non-geostationary-satellite (non-GSO) systems in the mobile-satellite service (MSS);
- b)* that the frequency band 5 000-5 150 MHz is currently allocated to the aeronautical mobile-satellite (R) service (AMS(R)S), subject to agreement obtained under No. **9.21**, and to the aeronautical radionavigation service (ARNS);
- c)* that WRC-07 allocated the frequency band 5 091-5 150 MHz to the aeronautical mobile service (AMS) on a primary basis subject to No. **5.444B**;
- d)* that the International Civil Aviation Organization (ICAO) is in the process of identifying the technical and operating characteristics of new systems operating in the AM(R)S in the frequency band 5 091-5 150 MHz;
- e)* that the compatibility of one AM(R)S system, to be used by aircraft operating on the airport surface, and the FSS has been demonstrated in the frequency band 5 091-5 150 MHz;
- f)* that ITU Radiocommunication Sector (ITU-R) studies have examined potential sharing among the separate AMS applications and the FSS in the frequency band 5 091-5 150 MHz;
- g)* that the frequency band 117.975-137 MHz currently allocated to the AM(R)S is reaching saturation in certain areas of the world, and therefore that frequency band would not be available to support additional surface applications at airports;
- h)* that this new allocation is intended to support the introduction of applications and concepts in air traffic management which are data intensive, and which will support data links that carry safety-critical aeronautical data,

recognizing

- a)* that in the frequency band 5 030-5 091 MHz priority is to be given to the microwave landing system (MLS) in accordance with No. **5.444**;
- b)* that ICAO publishes recognized international aeronautical standards and recommended practices (SARPs) for AM(R)S systems;
- c)* that Resolution **114 (Rev.WRC-15)** applies to the sharing conditions between the FSS and ARNS in the frequency band 5 091-5 150 MHz,

noting

- a) that the number of FSS transmitting earth stations required may be limited;
- b) that the use of the frequency band 5 091-5 150 MHz by the AM(R)S needs to ensure protection of the current or planned use of this frequency band by the FSS (Earth-to-space);
- c) that ITU-R studies describe methods for ensuring compatibility between the AM(R)S and FSS operating in the frequency band 5 091-5 150 MHz, and compatibility has been demonstrated for the AM(R)S system referred to in *considering e*),

resolves

- 1 that any AM(R)S systems operating in the frequency band 5 091-5 150 MHz shall not cause harmful interference to, nor claim protection from, systems operating in the ARNS;
- 2 that any AM(R)S systems operating in the frequency band 5 091-5 150 MHz shall meet the SARPs requirements published in Annex 10 of the ICAO Convention on International Civil Aviation and the requirements of Recommendation ITU-R M.1827-1, to ensure compatibility with FSS systems operating in that frequency band;
- 3 that, in part to meet the provisions of No. **4.10**, the coordination distance with respect to stations in the FSS operating in the frequency band 5 091-5 150 MHz shall be based on ensuring that the signal received at the AM(R)S station from the FSS transmitter does not exceed –143 dB(W/MHz), where the required basic transmission loss shall be determined using the methods described in Recommendations ITU-R P.525-4 and ITU-R P.526-15,

invites

- 1 administrations to supply technical and operational criteria necessary for sharing studies for the AM(R)S, and to participate actively in such studies;
- 2 ICAO and other organizations to participate actively in such studies,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO.

RESOLUTION 749 (REV.WRC-23)

**Use of the frequency band 790-862 MHz in countries of Region 1
and the Islamic Republic of Iran by mobile applications
and by other services**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the favourable propagation characteristics of the frequency band 470-862 MHz are beneficial in providing cost-effective solutions for coverage, including of large areas of low population density;
- b)* that the operation of broadcasting stations and base stations of the mobile service in the same geographical area may create incompatibility issues;
- c)* that many communities are particularly underserved compared to urban centres;
- d)* that applications ancillary to broadcasting are sharing the frequency band 470-862 MHz with the broadcasting service in all three Regions, and are expected to continue their operations in this frequency band;
- e)* that it is necessary to adequately protect, *inter alia*, terrestrial television broadcasting and other systems in this frequency band,

recognizing

- a)* that, in Article 5, the frequency band 790-862 MHz, or parts thereof, is allocated, and is used on a primary basis, for various services including broadcasting;
- b)* that the GE06 Agreement applies in all Region 1 countries except Mongolia and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;
- c)* that the transition from analogue to digital television is expected to result in situations where the frequency band 790-862 MHz will be used for both analogue and digital terrestrial transmission; and the demand for spectrum during the transition period may be even greater than the standalone usage of analogue broadcasting systems;
- d)* that the switchover to digital may result in spectrum opportunities for new applications;
- e)* that the timing of the switchover to digital is likely to vary from country to country;
- f)* that the use of spectrum for different services should take into account the need for sharing studies;

g) that the Radio Regulations provide that the identification of a given frequency band for International Mobile Telecommunications (IMT) does not preclude the use of that frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations;

h) that the GE06 Agreement contains provisions for the terrestrial broadcasting service and other terrestrial services, a Plan for digital TV, and the List of other primary terrestrial services;

i) that the GE06 Agreement established, for the frequency band 470-862 MHz, 16 June 2015 as the date when the transition period ended, meaning that the assignments that were in the analogue Plan are no longer protected and shall not cause unacceptable interference in countries which are Contracting Members to the Agreement;

j) that the studies carried out by the ITU Radiocommunication Sector (ITU-R) pursuant to Resolution **749 (WRC-07)***,¹ showed that the potential impact of the cumulative effect of interference from base stations, which individually did not trigger the need for coordination with broadcasting, could be significant; on the other hand, the potential impact of cumulative interference might be less significant in practice;

k) that ITU-R initiated studies with a view to developing and completing comprehensive Recommendations and Reports, in accordance with Resolution **224 (Rev.WRC-19)****, which need to take into account the cumulative effect of interference,

recognizing further

a) that the frequency band 790-862 MHz, as part of a wider frequency band, has been allocated to the mobile service in Region 3 (including the Islamic Republic of Iran) since 1971 (prior to WRC-07);

b) that the GE06 Agreement, in its relevant Annexes, establishes the relationship between digital terrestrial broadcasting, on the one hand, and other primary terrestrial services, including the aeronautical radionavigation service (ARNS) in the countries mentioned in No. **5.312**, on the other;

c) that WRC-07, under No. **5.316B**, allocated the frequency band 790-862 MHz in Region 1 to the mobile, except aeronautical mobile, service on a primary basis, and that this allocation shall come into effect as of 17 June 2015 and shall be subject to agreement obtained under No. **9.21** with respect to the ARNS in countries mentioned in No. **5.312**;

d) that the frequency band 790-862 MHz in Region 1 and the frequency band 790-806 MHz in Region 3 were identified by WRC-07 for use by administrations wishing to implement IMT, whereas the frequency band 806-960 MHz in Region 3 was identified for IMT in WRC-2000;

e) that for Contracting Members to the GE06 Agreement, the use of stations of the mobile service in relation to the broadcasting service is also subject to successful application of the procedures of the GE06 Agreement;

* *Note by the Secretariat:* This Resolution was revised by WRC-12, WRC-15, WRC-19 and WRC-23.

¹ Reference to Resolution **749 (WRC-07)** is provided as background information.

** *Note by the Secretariat:* This Resolution was revised by WRC-23.

f) that the coordination between terrestrial services (fixed, mobile and broadcasting) in the frequency band 790-862 MHz between the Islamic Republic of Iran, on the one hand, and the other countries of Region 3, on the other, is a matter to be left to the administrations concerned, based on bilateral or multilateral negotiations, if it is mutually agreed by those administrations,

noting

a) that Resolution ITU-R 57 provides principles for the process of development of IMT-Advanced and that this process had already started after WRC-07;

b) that in the frequency band 790-862 MHz, Resolution **224 (Rev.WRC-23)** applies,

emphasizing

a) that the use of the frequency band 470-862 MHz by broadcasting and other primary services is also covered by the GE06 Agreement;

b) that the requirements of the different services to which the frequency band is allocated, including the mobile service, the ARNS (in accordance with No. **5.312**), the fixed service and the broadcasting service, shall be taken into account,

taking into account

that the results of the studies carried out by ITU-R pursuant to Resolution **749 (WRC-07)*, 2** indicate that there is a need to protect other primary terrestrial services from the mobile service in Region 1,

resolves

1 that, in Region 1:

in accordance with No. **5.316B**, and based on the criteria contained in the Annex to this Resolution, administrations implementing the mobile service in Region 1 shall seek agreement under No. **9.21** with respect to the ARNS in the countries mentioned in No. **5.312**;

2 that for Region 1 and the Islamic Republic of Iran:

2.1 when coordination between administrations is being effected, the protection ratios applicable to the generic case NB contained in the GE06 Agreement for the protection of the broadcasting service shall be used only for mobile systems with a bandwidth of 25 kHz; if another bandwidth is used, the relevant protection ratios are to be found in the most recent version of Recommendations ITU-R BT.1368 and ITU-R BT.2033;

2.2 administrations are invited to take into account, *inter alia*, the results of the sharing studies conducted by ITU-R in response to Resolution **749 (WRC-07)*, 2**;

* *Note by the Secretariat:* This Resolution was revised by WRC-12, WRC-15, WRC-19 and WRC-23.

² Reference to Resolution **749 (WRC-07)** is provided as background information.

3 that, with respect to adjacent channel interference within the frequency band 790-862 MHz:

3.1 adjacent channel interference within a given country is a national matter and needs to be dealt with by each administration as a national matter;

3.2 adjacent channel interference should be treated among administrations concerned, using mutually agreed criteria or those contained in relevant ITU-R Recommendations (see also the most recent versions of Recommendations ITU-R BT.1368, ITU-R BT.1895 and ITU-R BT.2033 when sharing with the broadcasting service is concerned), as appropriate,

invites administrations

to contribute further to the studies conducted by ITU-R in accordance with *recognizing k)* above,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

ANNEX TO RESOLUTION 749 (REV.WRC-23)

Criteria for identifying potentially affected administrations with respect to the aeronautical radionavigation service in countries listed in No. 5.312

To identify potentially affected administrations when applying the procedure for seeking agreement under No. 9.21 by the mobile service with respect to the aeronautical radionavigation service (ARNS) operating in countries mentioned in No. 5.312, as stipulated in No. 5.316B, the coordination distances (between a base station in the mobile service and a potentially affected ARNS station) indicated below should be used.

When applying No. 5.316B, notifying administrations may indicate in the notice sent to the Radiocommunication Bureau (BR) the list of administrations with which bilateral agreement has already been reached. BR shall take this into account in determining the administrations with which coordination under No. 9.21 is required.

1 Case where the mobile service is operated according to the frequency arrangement where the base stations transmit only in the frequency band 791-821 MHz and receive only in the frequency band 832-862 MHz

ARNS station	System type code	Coordination distances for receiving MS base stations (km)	Coordination distances for transmitting MS base stations (km)
RSBN (ground receiver)	AA8	—	70/125/175**
RLS 2 (Type 2) (aircraft receiver)	BC	70/150*	—
RLS 1 (Types 1 and 2) (ground receiver)	AB	70/125/175**	—

* The first value should be used when the notifying administration indicates in the notice form that the aggregate equivalent isotropically radiated power (e.i.r.p.) value of all user equipment operating simultaneously with the notified base station is assumed not to exceed 21 dBm in 1 MHz. The second value should be used in other cases.

** 90% ≤ land path ≤ 100% / 50% ≤ land path < 90% / 0% ≤ land path < 50%.

2 Other cases

ARNS station	System type code	Coordination distances for MS receiving base stations (km)	Coordination distances for MS transmitting base stations (km)
RSBN	AA8	50	125/175*
RLS 2 (Type 1) (aircraft receiver)	BD	410	432
RLS 2 (Type 1) (ground receiver)	BA	50	250/275*
RLS 2 (Type 2) (aircraft receiver)	BC	150	432
RLS 2 (Type 2) (ground receiver)	AA2	50/75*	300/325*
RLS 1 (Types 1 and 2) (ground receiver)	AB	125/175*	400/450*
Other types of ARNS terrestrial station	Not applicable	125/175*	400/450*
Other types of ARNS airborne station	Not applicable	410	432

* 50% ≤ land path ≤ 100% / 0% ≤ land path < 50%.

RESOLUTION 750 (REV.WRC-19)

**Compatibility between the Earth exploration-satellite service (passive)
and relevant active services**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that primary allocations have been made to various space services such as the fixed-satellite service (Earth-to-space), the space operation service (Earth-to-space) and the inter-satellite service and/or to terrestrial services such as the fixed service, the mobile service and the radiolocation service, hereinafter referred to as “active services”, in frequency bands adjacent or nearby to frequency bands allocated to the Earth exploration-satellite service (EESS) (passive), subject to No. 5.340;
- b) that unwanted emissions from active services have the potential to cause unacceptable interference to EESS (passive) sensors;
- c) that, for technical or operational reasons, the general limits in Appendix 3 may be insufficient in protecting the EESS (passive) in specific frequency bands;
- d) that, in many cases, the frequencies used by EESS (passive) sensors are chosen to study natural phenomena producing radio emissions at frequencies fixed by the laws of nature, and therefore shifting frequency to avoid or mitigate interference problems is not possible;
- e) that the frequency band 1 400-1 427 MHz is used for measuring soil moisture, and also for measuring sea-surface salinity and vegetation biomass;
- f) that long-term protection of the EESS in the frequency bands 23.6-24 GHz, 31.3-31.5 GHz, 50.2-50.4 GHz, 52.6-54.25 GHz and 86-92 GHz is vital to weather prediction and disaster management, and measurements at several frequencies must be made simultaneously in order to isolate and retrieve each individual contribution;
- g) that, in many cases, the frequency bands adjacent to or nearby passive service frequency bands are used and will continue to be used for various active service applications;
- h) that it is necessary to ensure equitable burden-sharing for achieving compatibility between active and passive services operating in adjacent or nearby frequency bands,

noting

- a) that some of the compatibility studies between relevant active and passive services operating in adjacent and nearby frequency bands are documented in Report ITU-R SM.2092 and in Report ITU-R S.2463;
- b) that the compatibility studies between International Mobile Telecommunications (IMT) systems in the frequency bands 1 375-1 400 MHz and 1 427-1 452 MHz and EESS (passive) systems in the frequency band 1 400-1 427 MHz are documented in Report ITU-R RS.2336;

c) that Report ITU-R F.2239 provides the results of studies covering various scenarios between the fixed service, operating in the frequency bands 81-86 GHz and/or 92-94 GHz, and the EESS (passive), operating in the frequency band 86-92 GHz;

d) that Recommendation ITU-R RS.2017 provides the interference criteria for satellite passive remote sensing,

noting further

that, for the purpose of this Resolution:

- point-to-point communication is defined as radiocommunication provided by a link, for example a radio-relay link, between two stations located at specified fixed points;
- point-to-multipoint communication is defined as radiocommunication provided by links between a single station located at a specified fixed point (also called “hub station”) and a number of stations located at specified fixed points (also called “customer stations”),

recognizing

a) that studies documented in Report ITU-R SM.2092 do not consider point-to-multipoint communication links in the fixed service in the frequency bands 1 350-1 400 MHz and 1 427-1 452 MHz;

b) that, in the frequency band 1 427-1 452 MHz, mitigation measures, such as channel arrangements, improved filters and/or guardbands, may be necessary in order to meet the unwanted emission limits for IMT stations in the mobile service specified in Table 1 of this Resolution;

c) that, in the frequency band 1 427-1 452 MHz, IMT mobile stations typically perform better than the equipment specifications as stated by relevant standards organizations, which may be taken into account in meeting the limits specified in Table 1 (see also sections 4 and 5 of Report ITU-R RS.2336),

resolves

1 that unwanted emissions of stations brought into use in the frequency bands and services listed in Table 1 below shall not exceed the corresponding limits in that table, subject to the specified conditions;

2 to urge administrations to take all reasonable steps to ensure that unwanted emissions of active service stations in the frequency bands and services listed in Table 2 below do not exceed the recommended maximum levels contained in that table, noting that EESS (passive) sensors provide worldwide measurements that benefit all countries, even if these sensors are not operated by their country;

3 that the Radiocommunication Bureau shall not make any examination or finding with respect to compliance with this Resolution under either Article 9 or 11.

TABLE 1

EESS (passive) frequency band	Active service frequency band	Active service	Limits of unwanted emission power from active service stations in a specified bandwidth within the EESS (passive) frequency band ¹
1 400-1 427 MHz	1 427-1 452 MHz	Mobile	–72 dBW in the 27 MHz of the EESS (passive) band for IMT base stations –62 dBW in the 27 MHz of the EESS (passive) band for IMT mobile stations^{2, 3}
23.6-24.0 GHz	22.55-23.55 GHz	Inter-satellite	–36 dBW in any 200 MHz of the EESS (passive) band for non-GSO inter-satellite service (ISS) systems for which complete advance publication information (API) is received by BR before 1 January 2020, and –46 dBW in any 200 MHz of the EESS (passive) band for non-GSO ISS systems for which complete API is received by BR on or after 1 January 2020
	24.25-27.5 GHz	Mobile	–33 dBW^a in any 200 MHz of the EESS (passive) band for IMT base stations⁵ –29 dBW^b in any 200 MHz of the EESS (passive) band for IMT mobile stations⁵
31.3-31.5 GHz	31-31.3 GHz	Fixed (excluding HAPS)	For stations brought into use after 1 January 2012: –38 dBW in any 100 MHz of the EESS (passive) band. This limit does not apply to stations that have been authorized prior to 1 January 2012
50.2-50.4 GHz	49.7-50.2 GHz	Fixed-satellite (E-to-s) ⁴	For GSO earth stations brought into use after the date of entry into force of the Final Acts of WRC-07 and prior to 1 January 2024: –10 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi –20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBi For GSO earth stations with antenna gain greater than or equal to 57 dBi brought into use on or after 1 January 2024: –25 dBW into the 200 MHz of the EESS (passive) band for earth stations having an elevation angle below 80° –45 dBW into the 200 MHz of the EESS (passive) band for earth stations having an elevation angle equal or above 80° For GSO earth stations with antenna gain less than 57 dBi brought into use on or after 1 January 2024: –30 dBW into the 200 MHz of the EESS (passive) band for earth stations having an elevation angle below 80° –45 dBW into the 200 MHz of the EESS (passive) band for earth stations having an elevation angle equal or above 80°

EESS (passive) frequency band	Active service frequency band	Active service	Limits of unwanted emission power from active service stations in a specified bandwidth within the EESS (passive) frequency band ¹
			For non-GSO earth stations brought into use after the date of entry into force of the Final Acts of WRC-07 and before the date of entry into force of the Final Acts of WRC-19: –10 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi –20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBi For non-GSO earth stations brought into use after the date of entry into force of the Final Acts of WRC-19⁶: –42 dBW into the 200 MHz of the EESS (passive) band for earth stations not employing uplink power control –42 dBW into the 200 MHz of the EESS (passive) band at zenith increasing to a maximum level of –35 dBW into the 200 MHz of the EESS (passive) band at a minimum elevation angle of 15° for earth stations employing uplink power control
50.2-50.4 GHz	50.4-50.9 GHz	Fixed-satellite (E-to-s) ⁴	For GSO earth stations brought into use after the date of entry into force of the Final Acts of WRC-07 and prior to 1 January 2024: –10 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi –20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBi For GSO earth stations with antenna gain greater than or equal to 57 dBi brought into use on or after 1 January 2024: –25 dBW into the 200 MHz of the EESS (passive) band for earth stations having an elevation angle below 80° –45 dBW into the 200 MHz of the EESS (passive) band for earth stations having an elevation angle equal or above 80° For GSO earth stations with antenna gain less than 57 dBi brought into use on or after 1 January 2024: –30 dBW into the 200 MHz of the EESS (passive) band for earth stations having an elevation angle below 80° –45 dBW into the 200 MHz of the EESS (passive) band for earth stations having an elevation angle equal or above 80°

EESS (passive) frequency band	Active service frequency band	Active service	Limits of unwanted emission power from active service stations in a specified bandwidth within the EESS (passive) frequency band ¹
			For non-GSO earth stations brought into use after the date of entry into force of the Final Acts of WRC-07 and before the date of entry into force of the Final Acts of WRC-19: –10 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi –20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBi For non-GSO earth stations brought into use after the date of entry into force of the Final Acts of WRC-19⁶: –42 dBW into the 200 MHz of the EESS (passive) band for earth stations not employing uplink power control –42 dBW into the 200 MHz of the EESS (passive) band at zenith increasing to a maximum level of –35 dBW into the 200 MHz of the EESS (passive) band at a minimum elevation angle of 15° for earth stations employing uplink power control
52.6-54.25 GHz	51.4-52.4 GHz	Fixed-satellite (E-to-s) ⁴	For earth stations operating in GSO FSS networks, in order to protect non-GSO EESS (passive) space stations: –37 dBW in any 100 MHz of the EESS (passive) band for FSS earth stations with elevation angles lower than 75° –52 dBW in any 100 MHz of the EESS (passive) band for FSS earth stations with elevation angles equal to or higher than 75° For earth stations operating with a GSO FSS space station whose nominal geocentric orbital separation Δ is equal to or smaller than 2.5° from any GSO EESS (passive) space station from the time of its notification in accordance with No. 11.44 with nominal orbital positions: 0°, 9.5° E, 76° E, 79° E, 99.5° E, 105° E, 123.5° E, 133° E, 165.8° E, 14.5° W and 137.2° W: –84 + 200 Δ dBW for $0^\circ \leq \Delta < 0.1^\circ$ –67 + 22.8 Δ dBW for $0.1^\circ \leq \Delta < 0.5^\circ$ –61 + 11.3 Δ dBW for $0.5^\circ \leq \Delta < 1.9^\circ$ –47 + 4 Δ dBW for $1.9^\circ \leq \Delta \leq 2.5^\circ$ in any 100 MHz of the EESS (passive) band
52.6-54.25 GHz	51.4-52.6 GHz	Fixed	For stations brought into use after the date of entry into force of the Final Acts of WRC-07: –33 dBW in any 100 MHz of the EESS (passive) band

Notes to Table 1:

- ¹ The unwanted emission power level is to be understood here as the level measured at the antenna port, unless it is specified in terms of total radiated power (TRP).
- ² This limit does not apply to mobile stations in the IMT systems for which the notification information has been received by BR by 28 November 2015. For those systems, -60 dBW/27 MHz applies as the recommended value.
- ³ The unwanted emission power level is to be understood here as the level measured with the mobile station transmitting at an average output power of 15 dBm.
- ⁴ The limits apply under clear-sky conditions. During fading conditions, the limits may be exceeded by earth stations when using uplink power control.
- ⁵ The unwanted emission power level is considered in terms of TRP. The TRP is to be understood here as the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere.
- ^a A limit of -39 dB(W/200 MHz) will apply to IMT base stations brought into use after 1 September 2027. This limit will not apply to IMT base stations which have been brought into use prior to this date. For those IMT base stations, the limit of -33 dB(W/200 MHz) will continue to apply after this date.
- ^b A limit of -35 dB(W/200 MHz) will apply to IMT mobile stations brought into use after 1 September 2027. This limit will not apply to IMT mobile stations which have been brought into use prior to this date. For those IMT mobile stations, the limit of -29 dB(W/200 MHz) will continue to apply after this date.
- ⁶ Compliance with these limits may include the consideration of additional mitigation techniques, which require further studies by ITU-R.

TABLE 2

EESS (passive) frequency band	Active service frequency band	Active service	Recommended maximum level of unwanted emission power from active service stations in a specified bandwidth within the EESS (passive) frequency band ¹
1 400-1 427 MHz	1 350-1 400 MHz	Radiolocation ²	–29 dBW in the 27 MHz of the EESS (passive) band
		Fixed	–45 dBW in the 27 MHz of the EESS (passive) band for point-to-point
		Mobile	–60 dBW in the 27 MHz of the EESS (passive) band for mobile-service stations except transportable radio-relay stations –45 dBW in the 27 MHz of the EESS (passive) band for transportable radio-relay stations
	1 427-1 429 MHz	Space operation (E-to-s)	–36 dBW in the 27 MHz of the EESS (passive) band
	1 427-1 429 MHz	Mobile except aeronautical mobile	–60 dBW in the 27 MHz of the EESS (passive) band for mobile-service stations except IMT stations and transportable radio-relay stations ³ –45 dBW in the 27 MHz of the EESS (passive) band for transportable radio-relay stations
		Fixed	–45 dBW in the 27 MHz of the EESS (passive) band for point-to-point
	1 429-1 452 MHz	Mobile	–60 dBW in the 27 MHz of the EESS (passive) band for mobile-service stations except IMT stations, transportable radio-relay stations and aeronautical telemetry stations –45 dBW in the 27 MHz of the EESS (passive) band for transportable radio-relay stations –28 dBW in the 27 MHz of the EESS (passive) band for aeronautical telemetry stations ³
		Fixed	–45 dBW in the 27 MHz of the EESS (passive) band for point-to-point
31.3-31.5 GHz	30.0-31.0 GHz	Fixed-satellite (E-to-s) ⁴	–9 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 56 dBi –20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 56 dBi
86-92 GHz ⁵	81-86 GHz	Fixed	–41 – 14(f – 86) dBW/100 MHz for $86.05 \leq f \leq 87$ GHz –55 dBW/100 MHz for $87 \leq f \leq 91.95$ GHz where f is the centre frequency of the 100 MHz reference bandwidth expressed in GHz
	92-94 GHz	Fixed	–41 – 14(92 – f) dBW/100 MHz for $91 \leq f \leq 91.95$ GHz –55 dBW/100 MHz for $86.05 \leq f \leq 91$ GHz where f is the centre frequency of the 100 MHz reference bandwidth expressed in GHz

Notes to Table 2:

- ¹ The unwanted emission power level is to be understood here as the level measured at the antenna port.
- ² The mean power is to be understood here as the total power measured at the antenna port (or an equivalent thereof) in the frequency band 1 400-1 427 MHz, averaged over a period of the order of 5 s.
- ³ The frequency band 1 429-1 435 MHz is also allocated to the aeronautical mobile service in eight Region 1 administrations on a primary basis exclusively for the purposes of aeronautical telemetry within their national territory (No. **5.342**).
- ⁴ The recommended maximum levels apply under clear-sky conditions. During fading conditions, these levels may be exceeded by earth stations when using uplink power control.
- ⁵ Other maximum unwanted emission levels may be developed based on different scenarios provided in Report ITU-R F.2239 for the frequency band 86-92 GHz.

RESOLUTION 751 (WRC-07)

Use of the frequency band 10.6-10.68 GHz

The World Radiocommunication Conference (Geneva, 2007),

considering

- a)* that the frequency band 10.6-10.7 GHz is allocated to the Earth exploration-satellite service (EESS) (passive) and to the space research service (passive) on a primary basis;
- b)* that the band 10.6-10.7 GHz is of primary interest for the measurement of rain, snow, sea state, ocean wind and soil moisture;
- c)* that this frequency band is used by passive sensors to study natural phenomena producing radio emissions at frequencies fixed by the laws of nature, and therefore shifting frequency to avoid or mitigate interference problems may not be possible;
- d)* that any limitation of the operation of passive sensors in the band 10.68-10.7 GHz covered by No. **5.340** would degrade the sensitivity of those sensors;
- e)* that the frequency band 10.6-10.68 GHz is also allocated to the mobile, except aeronautical mobile, and the fixed services on a primary basis;
- f)* that experience has shown that EESS (passive) sensors currently operating in the band 10.6-10.68 GHz are facing high interference levels from the emissions of systems of active services in some parts of the world;
- g)* that studies have concluded that appropriate sharing criteria applicable to both passive and active services would reduce this interference to a level that would permit passive sensors to operate successfully, while allowing continuing operation of active services in the same band,

noting

that, for the purpose of this Resolution:

- point-to-point communication is defined as radiocommunication provided by a link, for example a radio-relay link, between two stations located at specified fixed points;
- point-to-multipoint communication is defined as radiocommunication provided by links between a single station located at a specified fixed point (also called “hub station”) and a number of stations located at specified fixed points (also called “customer stations”);
- automatic transmit-power control (ATPC) is a technique in which the output power of a microwave transmitter is automatically varied to compensate for path propagation conditions; in normal propagation conditions, ATPC maintains the transmitter output power at a reduced level; ATPC is characterized by its range, which is defined as the difference between the maximum and minimum values of transmitted power, and has no impact on the design of the related link,

resolves

- 1 to urge administrations to take all reasonable steps to comply with the sharing criteria in Tables 1 to 4 contained in Annex 1 to this Resolution when bringing into use stations in the Earth exploration-satellite service (passive), the fixed service and the mobile, except aeronautical mobile, service, noting that EESS (passive) sensors provide worldwide measurements that benefit all countries, even if these sensors are not operated by their country;
- 2 that the Radiocommunication Bureau shall not make any examination or finding with respect to compliance with this Resolution under either Article 9 or 11.

ANNEX 1 TO RESOLUTION 751 (WRC-07)

Sharing criteria in the band 10.6-10.68 GHz

TABLE 1

Earth exploration-satellite service (passive)

Parameter	Value
Incidence angle (defined as the angle at the Earth's surface between the local vertical and the direction of the passive sensor)	$\leq 60^\circ$
Spatial resolution (defined as the maximum cross-section of the passive sensor -3 dB contour on the Earth's surface)	≤ 50 km (See Note 1)
Main-beam efficiency (defined as the energy of main and cross-polarization components within 2.5 times the -3 dB beamwidth region, relative to the total energy within all angles)	$\geq 85\%$ (See Note 1)

NOTE 1 – These parameters only apply to real-aperture EESS (passive) systems.

TABLE 2

Stations of point-to-point systems in the fixed service

Parameter	Value
Maximum elevation angle	20°
Maximum transmitter power at the antenna port	-15 dBW (See Notes 2 and 3)

NOTE 2 – In the case of point-to-point systems using ATPC, the maximum transmitter power at the antenna port may be increased by a value corresponding to the ATPC range, up to a maximum of -3 dBW.

NOTE 3 – In the case of point-to-point fixed service used for unidirectional transmissions for broadcasting applications, the maximum transmitter power at the antenna port may be increased up to -3 dBW. For such applications, administrations are urged to limit the off-axis e.i.r.p. above 20° elevation to a level of -10 dBW.

TABLE 3

Stations of point-to-multipoint systems in the fixed service

Parameter	Value
Hub stations (See Note 4)	
Maximum transmitter power at the antenna port	−7 dBW
Maximum off-axis e.i.r.p. above 20° from the horizontal plane	−6 dBW
Maximum off-axis e.i.r.p. above 45° from the horizontal plane	−11 dBW
Maximum off-axis e.i.r.p. at 90° from the horizontal plane	−13 dBW
Customer stations (See Note 4)	
Maximum elevation angle	20°
Maximum transmitter power at the antenna port	−8 dBW
Maximum off-axis e.i.r.p. above 45° from the horizontal plane	−18 dBW (See Note 5)

NOTE 4 – Administrations planning point-to-multipoint deployment in the band 10.6-10.68 GHz, paired with another frequency band, are encouraged to only deploy return links (i.e. emissions from customer stations) in the 10.6-10.68 GHz band.

NOTE 5 – In the case of point-to-multipoint systems using ATPC, the maximum transmitter power at the antenna port may be increased by a value corresponding to the ATPC range, up to a maximum of −3 dBW.

TABLE 4

Stations in the mobile service

Parameter	Value
Maximum transmitter power at the antenna port	−17 dBW (See Note 6)

NOTE 6 – In the case of mobile service systems used for broadcasting applications, the maximum transmitter power at the antenna port may be increased up to −3 dBW. For such applications, administrations are urged to limit the off-axis e.i.r.p. above 20° elevation to a level of −10 dBW.

RESOLUTION 752 (WRC-07)

Use of the frequency band 36-37 GHz

The World Radiocommunication Conference (Geneva, 2007),

considering

- a)* that the frequency band 36-37 GHz is allocated to the Earth exploration-satellite service (EESS) (passive) and to the space research service (passive) on a primary basis;
- b)* that the band 36-37 GHz is of primary interest for the measurement of rain, snow, ocean ice and water vapour;
- c)* that this frequency band is used by passive sensors to study natural phenomena producing radio emissions at frequencies fixed by the laws of nature, and therefore shifting frequency to avoid or mitigate interference problems may not be possible;
- d)* that the frequency band 36-37 GHz is also allocated to the fixed service and to the mobile service on a primary basis;
- e)* that the EESS (passive) operating in the band 36-37 GHz may suffer from interference from the emissions of systems of active services;
- f)* that studies have concluded that appropriate sharing criteria applicable to both passive and active services would reduce this interference to a level that would permit passive sensors to operate successfully in this band, while allowing continuing operation of active services in the same band,

noting

that, for the purpose of this Resolution:

- point-to-point communication is defined as radiocommunication provided by a link, for example a radio-relay link, between two stations located at specified fixed points;
- point-to-multipoint communication is defined as radiocommunication provided by links between a single station located at a specified fixed point (also called “hub station”) and a number of stations located at specified fixed points (also called “customer stations”);
- automatic transmit-power control (ATPC) is a technique in which the output power of a microwave transmitter is automatically varied to compensate for path propagation conditions; in normal propagation conditions, ATPC maintains the transmitter output power at a reduced level; ATPC is characterized by its range, which is defined as the difference between the maximum and minimum values of transmitted power,

resolves

- 1 that, in order to facilitate sharing between active and passive services in the band 36-37 GHz, EESS (passive) stations brought into use after the date of entry into force of the Final Acts of WRC-07 shall comply with the sharing criteria contained in Table 1 of Annex 1 to this Resolution;
- 2 that, in order to facilitate sharing between active and passive services in the band 36-37 GHz, stations of point-to-point systems in the fixed service brought into use after 1 January 2012 shall comply with the sharing criteria contained in Table 2 of Annex 1 to this Resolution;
- 3 that, in order to facilitate sharing between active and passive services in the band 36-37 GHz, stations of point-to-multipoint systems in the fixed service brought into use after the date of entry into force of Final Acts of WRC-07 shall comply with the sharing criteria contained in Table 2 of Annex 1 to this Resolution;
- 4 that, in order to facilitate sharing between active and passive services in the band 36-37 GHz, stations in the mobile service brought into use after the date of entry into force of the Final Acts of WRC-07 shall comply with the sharing criteria contained in Table 3 of Annex 1 to this Resolution;
- 5 that the Radiocommunication Bureau shall not make any examination or finding with respect to compliance with this Resolution under either Article 9 or 11.

ANNEX 1 TO RESOLUTION 752 (WRC-07)

Sharing criteria in the band 36-37 GHz

TABLE 1

Earth exploration-satellite service (passive)

Parameter	Value
Incidence angle (defined as the angle at the Earth's surface between the local vertical and the direction of the passive sensor)	$\leq 60^\circ$
Spatial resolution (defined as the maximum cross-section of the passive sensor -3 dB contour on the Earth's surface)	≤ 50 km (See Note 1)
Main-beam efficiency (defined as the energy of main and cross-polarization components within 2.5 times the -3 dB beamwidth region, relative to the total energy within all angles)	$\geq 92\%$ (See Note 1)

NOTE 1 – These parameters only apply to real-aperture EESS (passive) systems.

TABLE 2

Fixed service

Parameter	Value
Maximum elevation angle	20°
Point-to-point systems	
Maximum transmitter power at the antenna port	-10 dBW (See Note 2)
Point-to-multipoint systems	
Maximum transmitter power at the antenna port of hub stations	-5 dBW
Maximum transmitter power at the antenna port of customer stations	-10 dBW (See Note 2)

NOTE 2 – In the case of fixed service systems using ATPC, the maximum transmitter power at the antenna port may be increased by a value corresponding to the ATPC range, up to a maximum of -7 dBW.

TABLE 3

Mobile service

Parameter	Value
Maximum transmitter power at the antenna port	-10 dBW (See Note 3)

NOTE 3 – The maximum transmitter power at the antenna port may be increased up to -3 dBW for stations used for public safety and disaster management.

RESOLUTION 759 (WRC-15)

**Technical studies on the coexistence of the radiolocation service and
the amateur, amateur-satellite and radio astronomy services
in the frequency band 76-81 GHz**

The World Radiocommunication Conference (Geneva, 2015),

considering

- a)* that the frequency band 77.5-78 GHz is allocated to the amateur and amateur-satellite services on a primary basis;
- b)* that the frequency band 77.5-78 GHz is allocated to the radio astronomy service (RAS) on a secondary basis;
- c)* that this conference has allocated the frequency band 77.5-78 GHz to the radiolocation service on a primary basis;
- d)* that under No. **5.149**, administrations, in making assignments to stations of services other than radio astronomy to which the frequency band 76-86 GHz is allocated, are urged to take all practicable steps to protect the RAS from harmful interference,

noting

- a)* that the allocation of the frequency band 76-81 GHz to the radiolocation service is used by radar applications and that a radar station may use the entire frequency band 76-81 GHz;
- b)* that technical parameters of radars for automotive applications are contained in Recommendation ITU-R M.2057;
- c)* that sharing studies between the amateur, amateur-satellite and radio astronomy services and the radiolocation service are limited to automotive radars as described in Report ITU-R M.2322,

recognizing

- a)* that administrations may benefit from the availability of studies and guidelines about the protection of the RAS in the frequency band 76-81 GHz;
- b)* that the protection of the RAS, in accordance with *considering d)*, may require additional measures in some countries, such as the definition of specific exclusion zones around RAS sites,

resolves to invite the ITU Radiocommunication Sector

to perform studies to assist administrations in ensuring compatibility between applications of the amateur, amateur-satellite and radio astronomy services and radiolocation service applications in the frequency band 76-81 GHz, taking into account those already completed in Report ITU-R M.2322, and develop ITU-R Recommendations and Reports, as appropriate.

RESOLUTION 760 (REV.WRC-23)

Provisions relating to the use of the frequency band 694-790 MHz in Region 1 by the mobile, except aeronautical mobile, service and by other services

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the favourable propagation characteristics of the frequency band 694-790 MHz are beneficial in providing cost-effective solutions for coverage;
- b)* that the ITU Radiocommunication Sector (ITU-R) carried out studies, in accordance with Resolution **232 (WRC-12)***¹, on compatibility between the mobile service and other services currently allocated in the frequency band 694-790 MHz;
- c)* that it is necessary to adequately protect all primary services in the frequency band 694-790 MHz and in adjacent frequency bands;
- d)* that Report ITU-R BT.2339 provides elements on co-channel sharing and compatibility between digital terrestrial television broadcasting and International Mobile Telecommunications (IMT) in the frequency band 694-790 MHz in the GE06 planning area, which administrations can use in the development of their bilateral agreements;
- e)* that the frequency band 645-862 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS) in the countries listed in No. **5.312**;
- f)* that, in some countries, applications ancillary to broadcasting and programme-making are operating in the frequency band 470-862 MHz or in parts of that frequency band and are expected to continue such operations;
- g)* that, in some countries, the implementation of IMT in the frequency band 694-790 MHz may affect the availability of frequencies for applications ancillary to broadcasting and programme-making,

recognizing

- a)* that, in Article **5**, the frequency band 694-790 MHz, or parts of that frequency band, is allocated, and is used on a primary basis, for various services;
- b)* that the GE06 Agreement applies in all Region 1 countries except Mongolia and in the Islamic Republic of Iran in the frequency bands 174-230/470-862 MHz;
- c)* that, in the frequency band 694-790 MHz, Resolution **224 (Rev.WRC-23)** applies;

* *Note by the Secretariat:* This Resolution was abrogated by WRC-15.

¹ Reference to Resolution **232 (WRC-12)** is provided as background information.

- d) that WRC-12, through Resolution **232 (WRC-12)*, 2**, allocated the frequency band 694-790 MHz in Region 1 to the mobile, except aeronautical mobile, service on a primary basis, subject to agreement obtained under No. **9.21** with respect to the ARNS in countries listed in No. **5.312**, and requested WRC-15 to specify technical and regulatory conditions applicable to the mobile-service allocation, as appropriate, taking into account the ITU-R studies;
- e) that the identification of a given frequency band for IMT in the Radio Regulations does not preclude the use of that band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations;
- f) that interference generated and received within a given country is a national matter and needs to be dealt with by each administration as a national matter;
- g) that adjacent-channel interference generated in one country and affecting a neighbouring country needs to be mutually considered;
- h) that Recommendation ITU-R M.2090 provides specific unwanted emission limits of IMT mobile stations operating in the frequency band 694-790 MHz in order to facilitate protection of existing services in the frequency band 470-694 MHz in Region 1;
- i) that Recommendation ITU-R M.1036 provides frequency arrangements for implementation of the terrestrial component of IMT in the frequency bands identified for IMT in the Radio Regulations, and provides frequency arrangements in the frequency band 694-960 MHz;
- j) that the studies carried out by ITU-R pursuant to Resolution **232 (WRC-12)*, 2** showed that the potential impact of the cumulative effect of interference from base stations, which individually did not trigger the need for coordination with broadcasting, could be significant; on the other hand, the potential impact of cumulative interference might be less significant in practice;
- k) that bilateral coordination agreements have already been reached and will be used by administrations as an agreement obtained under No. **9.21** with respect to ARNS in countries listed in No. **5.312**;
- l) that, in Region 1, a number of countries have deployments of applications ancillary to broadcasting and programme-making which provide tools for daily content production for the broadcasting service,

noting

- a) that, while some administrations may decide to use all or part of the frequency band 694-790 MHz for IMT, other countries may continue to operate other services to which the frequency band is also allocated;

* *Note by the Secretariat:* This Resolution was abrogated by WRC-15.

2 Reference to Resolution **232 (WRC-12)** is provided as background information.

- b) that the timing of the deployment of IMT in the frequency band 694-790 MHz is likely to vary from country to country;
- c) that parts of Region 1 have successfully completed or committed to completing modification of the GE06 Digital Plan in the frequency band 470-790 MHz in order to harmonize the use of the frequency band 694-790 MHz for IMT, while other parts of Region 1 have not started;
- d) that a digital entry in the GE06 Plan may also be used for transmissions in the mobile service under the conditions set out in § 5.1.3 of the GE06 Agreement;
- e) that, in some countries, applications ancillary to broadcasting and programme-making may be operated in parts of the frequency band 694-790 MHz;
- f) that ITU-R studies regarding possible solutions for global/regional harmonization of frequency bands and tuning ranges for electronic news gathering (ENG)³ are needed and Resolution ITU-R 59 provides the framework for such studies,

resolves

1 that use of the frequency band 694-790 MHz in Region 1 by the mobile, except aeronautical mobile, service is subject to agreement obtained under No. 9.21 with respect to ARNS in countries listed in No. 5.312, in which regard the criteria for identifying affected administrations under No. 9.21 for the mobile service with respect to the ARNS in the frequency band 694-790 MHz are set out in the Annex to this Resolution;

2 that, for Region 1 and the Islamic Republic of Iran:

2.1 when coordination between administrations is being effected, the protection ratios applicable to the generic case NB contained in the GE06 Regional Agreement for the protection of the broadcasting service shall be used only for mobile systems with a bandwidth of 25 kHz; if another bandwidth is used, the relevant protection ratios are to be found in the most recent versions of Recommendations ITU-R BT.1368 and ITU-R BT.2033;

2.2 administrations are invited to take into account, *inter alia*, the results of the sharing studies conducted by ITU-R;

3 that, with respect to adjacent-channel interference between the mobile service in the frequency band 694-790 MHz and the broadcasting service in the frequency band 470-694 MHz:

3.1 adjacent-channel interference within a given country is a national matter and needs to be dealt with by each administration as a national matter;

3.2 adjacent-channel interference should be treated among administrations concerned, using mutually agreed criteria or those contained in relevant ITU-R Recommendations (see also the most recent versions of Recommendations ITU-R BT.1368, ITU-R BT.1895 and ITU-R BT.2033, as well as ITU-R M.2090 when sharing with the broadcasting service is concerned), as appropriate,

³ ENG within Resolution ITU-R 59 represents all applications ancillary to broadcasting, such as terrestrial electronic news gathering, electronic field production, TV outside broadcast, wireless radio microphones and radio outside production and broadcast.

invites the ITU Radiocommunication Sector

1 to consider the information received about the implementation of IMT in the frequency band 694-790 MHz and develop ITU-R Reports, as appropriate;

2 to pursue studies on the implementation of applications ancillary to broadcasting and programme-making on the basis of Resolution ITU-R 59,

invites the Director of the Radiocommunication Bureau

to work, in cooperation with the Director of the Telecommunication Development Bureau, to bring assistance to developing countries wishing to implement the new mobile allocation in order to help these administrations to determine the modifications of the GE06 entries according to their needs,

invites administrations

1 to provide information to ITU-R about the implementation of IMT in the frequency band 694-790 MHz, including, for example, implementation of measures for interference mitigation;

2 to communicate on a bilateral basis in order to eliminate possible cumulative interference, as appropriate;

3 to consider the use of applications ancillary to broadcasting and programme-making in those parts of the frequency band 694-790 MHz that are not used for other applications in the mobile service or other primary services,

instructs the Director of the Radiocommunication Bureau

to implement this Resolution and to take appropriate actions.

ANNEX TO RESOLUTION 760 (REV.WRC-23)

Criteria for identifying potentially affected administrations in the frequency band 694-790 MHz with respect to the aeronautical radionavigation service for countries listed in No. 5.312

To identify affected administrations when applying the procedure for seeking agreement under No. 9.21 by the mobile service with respect to the aeronautical radionavigation service (ARNS) operating in countries mentioned in No. 5.312, the coordination distances (between a base station in the mobile service and a potentially affected ARNS station) indicated below should be used.

Notifying administrations may indicate in the notice sent to the Radiocommunication Bureau (BR) the list of administrations with which bilateral agreement has already been reached. BR shall take this into account in determining the administrations with which coordination under No. 9.21 is required.

1 Case of mobile-service usage under the frequency allocation plans when base stations transmit only in the frequency band 758-788 MHz and receive signals only in the frequency band 703-733 MHz

TABLE 1

ARNS station	System type code	Coordination distances for the receiving MS base stations (km)	Coordination distances for the transmitting MS base stations (km)
RSBN (ground receiver)	AA8	-	70/125/175*

* $90\% \leq \text{land path} \leq 100\%$ / $50\% \leq \text{land path} < 90\%$ / $0\% \leq \text{land path} < 50\%$.

2 Other cases

TABLE 2

ARNS station	System type code	Coordination distances for the receiving MS base stations (km)**	Coordination distances for the transmitting MS base stations (km)
RSBN	AA8	50	125/175*
RLS 2 (type 1) (airborne receiver)	BD	410	432
RLS 2 (type 1) (ground receiver)	BA	50	250/275*
RLS 2 (type 2) (airborne receiver)	BC	150	432
RLS 2 (type 2) (ground receiver)	AA2	50/75*	300/325*
RLS 1 (types 1 and 2) (ground receiver)	AB	125/175*	400/450*
Other ARNS ground stations	Not applied	125/175*	400/450*
Other ARNS airborne stations	Not applied	410	432

* $50\% \leq \text{land path} \leq 100\%$ / $0\% \leq \text{land path} < 50\%$.

** Coordination distances for the receiving MS base stations are based on protection of ARNS stations from the stations in the mobile service and do not ensure protection for receiving MS base stations from ARNS stations.

RESOLUTION 761 (REV.WRC-19)

**Coexistence of International Mobile Telecommunications and the
broadcasting-satellite service (sound) in the frequency band
1 452-1 492 MHz in Regions 1 and 3**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

noting

a) Recommendation ITU-R M.1459, on protection criteria for telemetry systems in the aeronautical mobile service and mitigation techniques to facilitate sharing with geostationary broadcasting-satellite (BSS) and mobile-satellite services in the frequency bands 1 452-1 525 MHz and 2 310-2 360 MHz;

b) that ITU Radiocommunication Sector (ITU-R) studies provide useful information on the power flux-density (pfd) level to protect BSS earth stations that could be used for coordination purposes,

recognizing

a) that the frequency band 1 452-1 492 MHz is allocated to the BSS (sound) and the mobile service on a primary basis;

b) that both the mobile service and the BSS (sound) have already been deployed or are being considered for deployment within the frequency band 1 452-1 492 MHz in Regions 1 and 3,

resolves

taking into account Nos. **5.346** and **5.346A**,

1 that the pfd at the Earth's surface produced by emissions from a geostationary space station in the BSS (sound) in the frequency band 1 452-1 492 MHz shall not exceed $-107 \text{ dB(W/(m}^2 \cdot \text{MHz))}$ on the territory of any other country in Regions 1 and 3 (except for the territories of the countries listed in No. **5.342**);

2 that the limit in *resolves* 1 may be exceeded on the territory of any country in Region 1 or 3 whose administration has so agreed;

3 that the pfd limit defined in *resolves* 1 does not apply to frequency assignments to the BSS (sound) in the frequency band 1 452-1 492 MHz for which complete Appendix 4 coordination or notification information was received prior to 28 October 2019 and for which the date of bringing into use or bringing back into use is prior to 1 January 2024 or the regulatory time-limit as specified in Nos. **11.44** and **11.49**, as appropriate, whichever comes earlier;

4 that, in the territories of countries listed in No. **5.342**, the pfd limit defined in *resolves* 1 and pfd coordination threshold in *resolves* 5 do not apply and the BSS (sound) is subject to coordination under No. **9.11**;

5 that, as an exception to No. 9.6.3, No. 9.11 shall apply, in addition to the pfd limit set forth in *resolves* 1, with respect to the territories of those countries of Region 3 and those listed in No. 5.346 which use frequency assignments with the nature of service “IM”, and the following pfd coordination threshold values shall be used:

–131.3 dB(W/m²) in 1 MHz for angles of arrival $0^\circ \leq \delta \leq 5^\circ$ above the horizontal plane;

–131.3 + 16/20($\delta - 5$) dB(W/m²) in 1 MHz for angles of arrival $5^\circ \leq \delta \leq 25^\circ$ above the horizontal plane;

–115.3 dB(W/m²) in 1 MHz for angles of arrival $25^\circ \leq \delta \leq 90^\circ$ above the horizontal plane;

6 that the Radiocommunication Bureau (BR) shall apply the coordination threshold identified in *resolves* 5 above in the application of No. 9.11 to identify potentially affected administrations for frequency assignments to stations in the BSS (sound) in the frequency band 1 452-1 492 MHz in Regions 1 and 3 for which complete Appendix 4 coordination information is considered as having been received after 23 November 2019;

7 that, before an administration in Region 1 or 3 brings into use an International Mobile Telecommunications (IMT) system in the frequency band 1 452-1 492 MHz, the administration shall ensure that the pfd produced by any IMT transmitting station which uses frequency assignments with the nature of service “IM” at 3 m above the ground for any point at the border of the territory of the notifying administration of a BSS (sound) network in this frequency band does not exceed –154 dB(W/(m² · 4 kHz)) for more than 20 per cent of the time, unless otherwise agreed between the administrations, No. 9.19 also applies;

8 that, for the territories of the countries listed in No. 5.342, the pfd limit defined in *resolves* 7 does not apply and the frequency assignments with the nature of service “IM” are subject to coordination under No. 9.21,

instructs the Director of the Radiocommunication Bureau

1 not to examine the pfd limit set forth in *resolves* 1 under No. 9.35 and issue a qualified favourable finding with respect to No. 9.35, but to perform the full regulatory examination under No. 11.31, including the review of any qualified favourable findings;

2 in applying *resolves* 5 at the coordination stage, to check conformity with the pfd value contained herein during the examination under No. 9.36:

- if the value is met on the territory of countries which use frequency assignments with the nature of service “IM”, BR shall not identify such administrations with which coordination may need to be effected;
- if the value is exceeded, BR shall identify such administrations with which coordination may need to be effected and in such cases publish the administrations with an additional remark “IM” under No. 9.11;

3 to assist administrations notifying frequency assignments to the BSS (sound) by informing each administration where coordination is required and to inform them that coordination is requested under No. 9.11 and that No. 9.52C applies in the application of *resolves* 5;

4 to investigate under No. **13.6** the technical characteristics and operational parameters of assignments to the BSS (sound) in the frequency band 1 452-1 492 MHz for which the notification information was submitted before 23 November 2019 and which were brought into use by that date;

5 to investigate under No. **13.6** the technical characteristics and operational parameters of assignments to base stations in the frequency band 1 452-1 492 MHz identified for IMT in the country submitting the notice with the nature of service “IM” in Regions 1 and 3 for which the notification information was submitted and which were brought into use before 23 November 2019.

RESOLUTION 762 (WRC-15)

Application of power flux-density criteria to assess the potential for harmful interference under No. 11.32A for fixed-satellite and broadcasting-satellite service networks in the 6 GHz and 10/11/12/14 GHz frequency bands not subject to a Plan

The World Radiocommunication Conference (Geneva, 2015),

considering

- a)* that the 6 GHz and 10/11/12/14 GHz frequency bands, not subject to a Plan, are extensively used with operational satellites about every 2-3° around the geostationary-satellite orbit;
- b)* that there are currently a very large number of satellite networks submitted to the ITU Radiocommunication Sector for these frequency bands;
- c)* that the above factors have led to significant difficulties for administrations to introduce new satellite networks;
- d)* that more precise criteria to assess the probability of harmful interference under No. **11.32A** have the potential to reduce undue protection requirements for assignments in respect of incoming assignments;
- e)* that due to the congestion in these frequency bands as well as advances in technology and applications in these frequency bands, practical satellite implementations are seen in practice to use relatively homogeneous technical parameters;
- f)* that use of more homogeneous technical parameters will facilitate efficient spectrum usage and support the introduction of new networks;
- g)* that the use of power flux-density (pfd) thresholds will encourage use of more homogeneous technical parameters and support efficient spectrum usage,

resolves

1 that, for satellite networks operating in the frequency bands 5 725-5 850 MHz (Region 1), 5 850-6 725 MHz and 7 025-7 075 MHz (Earth-to-space) having a nominal orbital separation in the geostationary-satellite orbit of more than 7°, assignments for a fixed-satellite service (FSS) satellite network with respect to other FSS networks do not have the potential to cause harmful interference if the pfd produced at the location in the geostationary-satellite orbit of the other FSS network under assumed free-space propagation conditions does not exceed $-204.0 \text{ dB(W/(m}^2 \cdot \text{Hz))}^*$;

2 that, in the frequency bands 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz (Region 2), 12.2-12.5 GHz (Region 3), 12.5-12.7 GHz (Regions 1 and 3) and 12.7-12.75 GHz (space-to-Earth), assignments for an FSS or broadcasting-satellite service (BSS) satellite network not subject to a Plan with respect to other FSS or BSS networks not subject to a Plan having a nominal orbital separation in the geostationary-satellite orbit of more than 6° do not have the potential to cause harmful interference if the pfd produced under assumed free-space propagation conditions does not exceed the threshold values shown below*, anywhere within the service area of the potentially affected assignment:

$$\begin{array}{lll} 5.8^\circ < \theta \leq 20.9^\circ & -187.2 + 25\log(\theta/5) & \text{dB(W/(m}^2 \cdot \text{Hz))} \\ 20.9^\circ < \theta & -171.67 & \text{dB(W/(m}^2 \cdot \text{Hz))} \end{array}$$

where θ is the minimum orbital separation in the geostationary-satellite orbit, in degrees, between the wanted and interfering space stations, taking into account the longitudinal station-keeping tolerance;

* NOTE – The pfd thresholds were derived from the parameters shown below.

Downlink		10/11/12 GHz
Earth station antenna diameter	N/A	0.45-11 m
Earth station antenna diagram	N/A	Main lobe: According to Appendix 8, Section III Sidelobes: $29-25\log\theta$ dBi (Recommendation ITU-R BO.1213, which implements these main and sidelobe characteristics, was used in deriving the pfd threshold)
Earth station noise temperature	N/A	125 K
Earth station antenna efficiency	N/A	70%
Equivalent $\Delta T/T$	N/A	6%
Uplink	6 GHz	14 GHz
Maximum satellite G/T	0 dB/K	11 dB/K
Equivalent $\Delta T/T$	6%	6%

3 that, for satellite networks operating in the frequency band 13.75-14.5 GHz (Earth-to-space) having a nominal orbital separation in the geostationary-satellite orbit of more than 6°, assignments for an FSS satellite network with respect to other FSS satellite networks do not have the potential to cause harmful interference if the pfd produced at the location in the geostationary-satellite orbit of the other FSS satellite network under assumed free-space propagation conditions does not exceed $-208 \text{ dB(W/(m}^2 \cdot \text{Hz))}^*$,

4 that as of 1 January 2017 the Bureau and administrations shall apply this Resolution,

instructs the Director of the Radiocommunication Bureau

to include in his report, for consideration by WRC-19, the results and any potential difficulties relating to the implementation of this Resolution.

RESOLUTION 768 (WRC-19)

Need for coordination of Region 2 fixed-satellite service networks in the frequency band 11.7-12.2 GHz with respect to the Region 1 broadcasting-satellite service assignments located further west than 37.2° W and of Region 1 fixed-satellite service networks in the frequency band 12.5-12.7 GHz with respect to the Region 2 broadcasting-satellite service assignments located further east than 54° W

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that WRC-15 decided to conduct studies on, review, and identify possible revisions to, if necessary, the limitations mentioned in Annex 7 to Appendix **30 (Rev.WRC-15)**, while ensuring the protection of, and without imposing additional constraints on, assignments in the Plan and in the List and the future of broadcasting-satellite service (BSS) networks and existing fixed-satellite service (FSS) networks;
- b)* that the provisions applying to the BSS frequency assignments in the frequency bands 11.7-12.5 GHz in Region 1 and 12.2-12.7 GHz in Region 2 are contained in Appendix **30**;
- c)* that the FSS has primary allocations in the frequency bands 12.5-12.75 GHz in Region 1 and 11.7-12.2 GHz in Region 2;
- d)* that the BSS has primary allocations in the frequency bands 11.7-12.5 GHz in Region 1 and 12.2-12.7 GHz in Region 2;
- e)* that this conference has suppressed the limitation in Annex 7 to Appendix **30 (Rev.WRC-15)** that prevented broadcasting satellites serving an area in Region 1 and using frequency assignments in the frequency band 11.7-12.2 GHz at orbital positions further west than 37.2° W;
- f)* that this conference has suppressed the limitation in Annex 7 to Appendix **30 (Rev.WRC-15)** that prevented broadcasting satellites serving an area in Region 2 and using frequency assignments in the frequency band 12.5-12.7 GHz at orbital positions further east than 54° W;
- g)* that the result of those suppressions shall ensure the protection of, and cannot impose additional constraints on, assignments in the Plan and the List and the future development of the BSS within the Plan, and existing and planned FSS networks,

recognizing

- a)* that existing FSS networks operating in the frequency bands mentioned in *considering c)* and BSS frequency assignments in the Plan and List implemented in accordance with the provisions of Annex 7 to Appendix **30 (Rev.WRC-15)** prior to this conference shall continue to be protected;

b) that the frequency bands 11.7-12.5 GHz in Region 1 and 12.2-12.7 GHz in Region 2 are widely used by BSS networks, subject to the provisions of Annex 7 to Appendix **30 (Rev.WRC-15)** prior to this conference;

c) that the frequency bands 12.5-12.75 GHz in Region 1 and 11.7-12.2 GHz in Region 2 are widely used by FSS networks,

resolves

1 that, in the frequency band 11.7-12.2 GHz, with respect to §§ 7.1 a), 7.2.1 a), 7.2.1 b) and 7.2.1 c) of Article 7 of Appendix **30**, in determining the need for coordination of a transmitting space station in the FSS in Region 2 with a transmitting space station in the BSS in Region 1 at an orbital position further west than 37.2° W, and with minimum geocentric orbital separation of less than 4.2 degrees between the FSS and BSS space stations, the conditions in Annex 1 to this Resolution apply instead of those contained in Annex 4 to Appendix **30**;

2 that, in the frequency band 12.5-12.7 GHz, with respect to §§ 7.1 a), 7.2.1 a) and 7.2.1 c) of Article 7 of Appendix **30**, in determining the need for coordination of a transmitting space station in the FSS in Region 1 with a transmitting space station in the BSS in Region 2 at an orbital position further east than 54° W and not within its clusters in the Region 2 Plan of Appendix **30**, and with a minimum geocentric orbital separation less than 4.2 degrees between FSS and BSS space stations, the conditions in Annex 2 to this Resolution apply instead of those contained in Annex 4 to Appendix **30**;

3 that, except the cases specified in *resolves* 1 and 2, the conditions in Annex 4 to Appendix **30** continue to apply.

ANNEX 1 TO RESOLUTION 768 (WRC-19)

With respect to §§ 7.1 a), 7.2.1 a), 7.2.1 b) and 7.2.1 c) of Article 7 of Appendix **30**, coordination of a transmitting space station in the fixed-satellite service (FSS) (space-to-Earth) in Region 2 is required with a broadcasting-satellite (BSS) station serving an area in Region 1 and using a frequency assignment in the frequency band 11.7-12.2 GHz with a nominal orbital position further west than 37.2° W when, under assumed free-space propagation conditions, the power flux-density at any test point within the service area of the overlapping frequency assignments in the BSS exceeds the following values:

-147	dB(W/(m ² · 27 MHz))	for	0° ≤ θ < 0.23°
-135.7 + 17.74 log θ	dB(W/(m ² · 27 MHz))	for	0.23° ≤ θ < 2.0°
-136.7 + 1.66 θ ²	dB(W/(m ² · 27 MHz))	for	2.0° ≤ θ < 3.59°
-129.2 + 25 log θ	dB(W/(m ² · 27 MHz))	for	3.59° ≤ θ < 4.2°

where θ is the minimum geocentric orbital separation in degrees between the wanted and interfering space stations, taking into account the respective east-west station-keeping accuracies.

ANNEX 2 TO RESOLUTION 768 (WRC-19)

With respect to §§ 7.1 *a)*, 7.2.1 *a)* and 7.2.1 *c)* of Article 7 of Appendix **30**, coordination of a transmitting space station in the fixed-satellite service (FSS) (space-to-Earth) in Region 1 is required with a broadcasting-satellite (BSS) station serving an area in Region 2 and using a frequency assignment in the frequency band 12.5-12.7 GHz with a nominal orbital position further east than 54° W and not within its clusters in the Region 2 Plan of Appendix **30** when, under assumed free-space propagation conditions, the power flux-density at any test point within the service area of the overlapping frequency assignments in the BSS exceeds the following values:

$$-147 \quad \text{dB(W/(m}^2 \cdot 27 \text{ MHz))} \quad \text{for} \quad 0^\circ \leq \theta < 0.23^\circ$$

$$-135.7 + 17.74 \log \theta \quad \text{dB(W/(m}^2 \cdot 27 \text{ MHz))} \quad \text{for} \quad 0.23^\circ \leq \theta < 1.8^\circ$$

$$-134.0 + 0.89 \theta^2 \quad \text{dB(W/(m}^2 \cdot 27 \text{ MHz))} \quad \text{for} \quad 1.8^\circ \leq \theta < 4.2^\circ$$

where θ is the minimum geocentric orbital separation in degrees between the wanted and interfering space stations, taking into account the respective east-west station-keeping accuracies.

RESOLUTION 769 (WRC-19)

Protection of geostationary fixed-satellite service, broadcasting-satellite service and mobile-satellite service networks from the aggregate interference produced by multiple non-geostationary fixed-satellite service systems in the frequency bands 37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) are allocated, *inter alia*, on a primary basis to the fixed-satellite service (FSS);
- b)* that the frequency bands 40.5-41 GHz and 41-42.5 GHz are allocated on a primary basis to the broadcasting-satellite service (BSS);
- c)* that the frequency bands 39.5-40 GHz (space-to-Earth) and 40-40.5 GHz (space-to-Earth) are allocated on a primary basis to the mobile-satellite service (MSS);
- d)* that Article 22 contains regulatory and technical provisions on sharing between geostationary-satellite (GSO) and non-geostationary-satellite (non-GSO) FSS systems in the frequency bands referred to in *considering a)*;
- e)* that, in accordance with No. 22.2, non-GSO systems shall not cause unacceptable interference to GSO FSS and GSO BSS networks and, unless otherwise specified in the Radio Regulations, shall not claim protection from GSO FSS and GSO BSS networks;
- f)* that administrations planning to operate non-GSO FSS systems require quantification of the technical regulatory measures required for protection of GSO FSS, GSO MSS and GSO BSS networks operating in the frequency bands referred to in *considering a), b) and c)* above;
- g)* that the operating parameters and orbital characteristics of non-GSO FSS systems are usually inhomogeneous;
- h)* that the time allowance for the C/N value specified in the short-term performance objective associated with the shortest percentage of time (lowest C/N) or decrease of the long-term throughput (spectral efficiency) caused to reference GSO FSS, GSO MSS and GSO BSS links by non-GSO FSS systems is likely to vary according to the parameters of such systems;
- i)* that the aggregate interference from multiple non-GSO FSS systems will be related to the actual number of systems sharing a frequency band based on the single-entry operational use of each system;
- j)* that, to protect GSO FSS, GSO MSS and GSO BSS networks in the frequency bands listed in *considering a), b) and c)* from unacceptable interference, the aggregate impact of interference caused by all co-frequency non-GSO FSS systems shall not exceed the aggregate impact limit specified in No. 22.5M;
- k)* that the aggregate levels are likely to be the summation of worst-case single-entry levels of interference caused by non-GSO FSS systems,

noting

- a) that Resolution **770 (WRC-19)*** contains the methodology for determining conformity to the single-entry limits to protect the GSO networks;
- b) that Recommendation ITU-R S.1503 provides guidance on how to compute the equivalent power flux-density (epfd) levels from a non-GSO system into GSO earth stations and satellites;
- c) that Resolution **770 (WRC-19)*** contains GSO system characteristics to be used in non-GSO/GSO frequency sharing analyses in the frequency bands 37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz,

recognizing

- a) that non-GSO FSS systems may need to implement interference mitigation techniques, such as avoidance angles, Earth station site diversity and GSO arc avoidance, to facilitate sharing frequencies among non-GSO FSS systems and to protect GSO FSS, GSO MSS and GSO BSS networks;
- b) that administrations operating or planning to operate non-GSO FSS systems will need to agree cooperatively through consultation meetings to share the aggregate interference allowance for all non-GSO FSS systems sharing the frequency bands listed in *considering a)* in order to achieve the desired level of protection for GSO FSS, GSO MSS and GSO BSS networks that is stated in No. **22.5M**;
- c) that administrations operating or planning to operate GSO FSS, GSO MSS or GSO BSS networks are invited to participate and be involved in the consultation meetings mentioned in *recognizing b)* above, especially as the aggregate interference level approaches the limits specified in No. **22.5M**;
- d) that, taking into account the single-entry allowance in No. **22.5L**, the aggregated worst-case impact of all non-GSO FSS systems can be computed without the need for specialized software tools, based on the results of the assessment of single-entry levels of interference caused by each system;
- e) that, in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), signals experience high levels of attenuation due to atmospheric effects such as rain, cloud cover and gaseous absorption;
- f) that, given these expected high levels of fading, it is desirable for GSO networks and non-GSO FSS systems to implement fade countermeasures such as automatic level control, power control and adaptive coding and modulation,

resolves

- 1 that administrations operating or planning to operate non-GSO FSS systems in the frequency bands referred to in *considering a)* above shall jointly take all necessary steps, including, if necessary, appropriate modifications to the operational characteristics of their systems or networks, to ensure that the aggregate interference impact to GSO FSS, GSO MSS and GSO BSS networks caused by such systems operating co-frequency in these frequency bands does not exceed the aggregate limits specified in No. **22.5M**;

* *Note by the Secretariat:* This Resolution was revised by WRC-23.

2 that, to carry out the obligations in *resolves* 1 above, administrations operating or planning to operate non-GSO FSS systems shall agree cooperatively through the regular consultation discussions referred to in *recognizing b)* to ensure that operations of all non-GSO FSS networks do not exceed the aggregate level of protection for GSO networks;

3 that, taking into account *resolves* 2, failure by a responsible administration operating or planning to operate non-GSO FSS systems to participate in the consultation process does not relieve that administration of obligations under *resolves* 1 above, nor does it remove their systems from consideration in any aggregate calculations by the consultation group;

4 that *resolves* 2 and 3 above begin to apply when a second non-GSO FSS system with frequency assignments in the frequency bands referred to in *considering a)* meets the criteria listed in Annex 2 to this Resolution;

5 that, to carry out the obligations in *resolves* 1 above, administrations shall use the generic GSO reference links listed in Resolution **770 (WRC-19)*** and validated supplemental GSO links associated with notified and brought-into-use frequency assignments submitted to the Radiocommunication Bureau (BR) by administrations to determine the results of the aggregate impact on GSO networks;

6 that administrations (including representatives of administrations operating GSO FSS, GSO MSS and GSO BSS networks) participating in a consultation meeting are allowed to use their own software in conjunction with any software tools used by BR for the calculation and verification of the aggregate limits, subject to the agreement of the consultation meeting;

7 that administrations, in carrying out their obligations under *resolves* 1 above, shall take into account only those non-GSO FSS systems with frequency assignments in the frequency bands referred to in *considering a)* above that have met the criteria listed in Annex 2 to this Resolution through appropriate information provided in the course of the consultation discussions referred to in *resolves* 2;

8 that administrations, in developing agreements to carry out their obligations under *resolves* 1, shall establish mechanisms to ensure that all notifying administrations and operators that are planning to operate FSS, BSS and MSS systems and networks are given full visibility of, and the opportunity to participate in, the consultation process, either in person or remotely, regardless of the stage of development and deployment of these systems and networks;

9 that, taking into account *resolves* 2, a responsible administration operating or planning to operate non-GSO FSS systems that is unable to participate in the consultation process, either in person or remotely, is still responsible for meeting its obligations under *resolves* 1 above and for providing information on its systems so that they may be included in the aggregate calculations by the consultation group;

10 that each administration, in the absence of an agreement reached at consultation meetings referred to in *resolves* 2, shall ensure that each of its non-GSO FSS systems subject to this Resolution are operated in accordance with reduced single-entry interference impact allowances, calculated by an amount proportional to their single-entry contribution to the aggregate, so as to ensure that the aggregate allowance in No. **22.5M** is not exceeded;

11 that the administrations participating in the consultation discussion referred to in *resolves* 2 shall designate one convener to be responsible for communicating to BR the results of the aggregate non-GSO system operational calculation and sharing determinations made in application of *resolves* 1, 3 and 9 above, without regard to whether such determinations result in any modifications to the published characteristics of their respective systems, providing a draft record of each consultation meeting, and providing BR with the approved record, as specified in Annex 1 to this Resolution,

invites administrations

to submit to BR, as necessary, supplemental GSO links, in a format consistent with the generic links in Annex 1 to Resolution **770 (WRC-19)***, and in the frequency bands listed in *considering a)*, that are associated with GSO networks,

invites the Radiocommunication Bureau

to participate in the consultation meetings in *resolves* 2 as an observer,

invites the ITU Radiocommunication Sector

1 to carry out studies and develop, as a matter of urgency, a suitable methodology, considering a range of input values and assumptions, including both best and worst case, for calculating the aggregate interference produced by all non-GSO FSS and as appropriate non-GSO MSS systems operating or planning to operate in the frequency bands referred to above co-frequency with GSO FSS, GSO MSS and GSO BSS networks, which may be used to determine whether the systems are in compliance with the aggregate limits specified in No. **22.5M**;

2 to carry out studies and develop, as a matter of urgency a methodology to validate supplemental GSO links;

3 to study the selection and use of *C/N* objectives, and the necessity of specifying one or more *C/N* objective points at associated percentages of time, with regard to the GSO link performance;

4 to report back to a future world radiocommunication conference, as appropriate, under Resolution **86 (Rev.WRC-07)**,

instructs the Radiocommunication Bureau

1 to collect and, once a methodology is available, evaluate for validation purposes and provide for information the supplemental GSO links submitted by administrations for frequency assignments associated with GSO networks;

2 to provide the consultation meeting, for use in the aggregate calculations, with the validated supplemental GSO links associated with networks brought into use;

3 to make available on the ITU website within one month from the closing date of any consultation meeting all information, such as that in Annex 2, referred to in *resolves* 11;

4 to exclude the aggregate calculations given in No. **22.5M** as part of a satellite network examination under No. **11.31**.

ANNEX 1 TO RESOLUTION 769 (WRC-19)

List of geostationary-satellite network characteristics and format of the result of the aggregate calculation to be provided to the Radiocommunication Bureau for publication for information

I GSO FSS and GSO BSS network characteristics to be used in the calculation of aggregate emissions from non-GSO FSS systems

I-1 GSO FSS, GSO MSS and GSO BSS network characteristics

The GSO network characteristics to be considered in the aggregate calculation are the:

- generic links contained in Annex 1 to Resolution 770 (WRC-19)*.

I-2 Non-GSO FSS system constellation parameters

For each non-GSO system, the following parameters should be provided to BR for publication in the aggregate calculation:

- notifying administration;
- number of space stations used in aggregate calculations;
- single-entry contribution to the aggregate of each non-GSO FSS system.

II Results of the aggregate efd calculation

- summary record of the meeting;
- single-entry contribution of each non-GSO FSS system;
- detailed description of methodology used to calculate the aggregate interference;
- the aggregate assessment of the non-GSO systems on the generic and validated supplemental GSO links, if any;
- all input materials submitted to the meeting; and
- studies conducted prior to or at the meeting as well as any other materials deemed necessary for demonstrating compliance with No. 22.5M.

* *Note by the Secretariat:* This Resolution was revised by WRC-23.

ANNEX 2 TO RESOLUTION 769 (WRC-19)

List of criteria for the application of *resolves* 7

1 Submission of appropriate coordination and/or notification information for non-GSO FSS systems.

2 Entry into satellite manufacturing or procurement agreement, and entry into satellite launch agreement.

The non-geostationary FSS system operator should possess:

- i) evidence of a binding agreement for the manufacture or procurement of its satellites; and
- ii) evidence of a binding agreement to launch its satellites.

The manufacturing or procurement agreement should identify the contract milestones leading to the completion of manufacture or procurement of satellites required for the service provision, and the launch agreement should identify the launch date, launch site and launch service provider. The notifying administration is responsible for authenticating the evidence of an agreement.

The information required under this criterion may be submitted in the form of a written commitment by the responsible administration.

3 As an alternative to satellite manufacturing or procurement and launch agreements, evidence of guaranteed funding arrangements for the implementation of the project would be accepted. The notifying administration is responsible for authenticating the evidence of these arrangements and for providing such evidence to other interested administrations in furtherance of its obligations under this Resolution.

RESOLUTION 770 (REV.WRC-23)

**Application of Article 22 of the Radio Regulations to the protection of
geostationary fixed-satellite service and broadcasting-satellite service networks
from non-geostationary fixed-satellite service systems in the frequency bands
37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz**

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that geostationary-satellite (GSO) and non-geostationary-satellite (non-GSO) fixed-satellite service (FSS) networks may operate in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space);

b) that WRC-19 adopted Nos. **22.5L** and **22.5M**, which contain single-entry and aggregate limits for non-GSO FSS systems in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) to protect GSO networks operating in the same frequency bands;

c) that the ITU Radiocommunication Sector (ITU-R) has developed a methodology, contained in Recommendation ITU-R S.1503, that results in the equivalent power flux-density (epfd) generated by any one non-GSO FSS system considered and a GSO location that corresponds to the worst-case geometry that generates the highest levels of epfd into potentially affected GSO earth stations and satellites,

recognizing

a) that, in accordance with calculations utilizing Recommendation ITU-R S.1503, verification of the worldwide epfd interference of any one non-GSO system can be carried out by a set of generic GSO reference link budgets having characteristics that encompass global GSO network deployments that are independent of any specific geographical locations;

b) that Resolution **769 (WRC-19)** addresses the protection of GSO networks from aggregate emissions from non-GSO systems,

resolves

1 that, during the examination under Nos. **9.35** and **11.31**, as applicable, of a non-GSO FSS satellite system with frequency assignments in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), compliance with No. **22.5L** shall be verified using the technical characteristics of generic GSO reference links contained in Annex 1 to this Resolution and Recommendation ITU-R S.2157-0;

2 that frequency assignments to non-GSO FSS systems referred to in *resolves* 1 shall receive a favourable finding with respect to the single-entry provision given in No. **22.5L** if compliance with No. **22.5L** is established under *resolves* 1, otherwise the assignments shall receive an unfavourable finding;

3 that, if the Radiocommunication Bureau (BR) is unable to examine non-GSO FSS systems subject to the single-entry provision given in No. **22.5L** due to a lack of available software, the notifying administration shall provide all necessary information sufficient to demonstrate compliance with No. **22.5L** and send BR a commitment that the non-GSO FSS system complies with the limits given in No. **22.5L**;

4 that frequency assignments to non-GSO FSS systems that cannot be assessed under *resolves* 1 shall receive a qualified favourable finding under Nos. **9.35** and **11.31** with respect to No. **22.5L** if *resolves* 3 is satisfied, otherwise the assignments shall receive an unfavourable finding;

5 that, if an administration believes that a non-GSO FSS system for which the commitment referred to in *resolves* 3 was sent has the potential to exceed the limits given in No. **22.5L**, it may request additional information from the notifying administration with regard to compliance with these limits and No. **22.2**, and both administrations shall cooperate to resolve any difficulties, with the assistance of BR, if so requested by either of the parties;

6 that *resolves* 3, 4 and 5 shall no longer be applied after BR has communicated to all administrations via a circular letter that validation software is available and BR is able to verify compliance with the limits in No. **22.5L**,

invites the ITU Radiocommunication Sector

1 to study and, as appropriate, develop a functional description that could be used to develop software for the procedures outlined in *resolves* 1 above;

2 to review and, as appropriate, provide updates to the generic GSO reference links in Annex 1 to this Resolution under Resolution **86 (Rev.WRC-07)**,

instructs the Director of the Radiocommunication Bureau

1 to take all necessary measures to facilitate the implementation of this Resolution, in particular to accelerate the development of the validation software;

2 to send, once the validation software as described in *resolves* 3 above is available, a letter to administrations having submitted coordination requests and/or notification information for frequency assignments to non-GSO FSS satellite systems for which a qualified favourable finding has been issued under *resolves* 4, to offer the possibility to modify, within 90 days following publication of the circular letter referred to in *resolves* 6, their associated Appendix 4 parameters, limited to items listed under A.4.b.6*bis*, A.4.b.6.a, A.4.b.7 and A.14, and to retain the protection date of the initial frequency assignments, provided that the modified frequency assignments receive a favourable finding under No. **9.35** or No. **11.31**, as applicable, with respect to No. **22.5L**;

3 to review, once the validation software referred to in *resolves* 3 is available, BR's findings made in accordance with Nos. **9.35** and **11.31** under *resolves* 4.

ANNEX 1 TO RESOLUTION 770 (REV.WRC-23)

Generic GSO reference links for evaluation of compliance with single-entry requirements for non-GSO systems

The data in this Annex are to be regarded as a generic range of representative technical characteristics of geostationary-satellite (GSO) network deployments that are independent of any specific geographical location, to be used only for establishing the interference impact of a non-geostationary-satellite (non-GSO) system into GSO networks and not as a basis for coordination between satellite networks.

TABLE 1

Parameters of generic GSO reference links to be used in examination of the downlink (space-to-Earth) impact from any one non-GSO system

1	Generic GSO reference link parameters - service					Parameters
	Link type	User #1	User #2	User #3	Gateway	
1.1	E.i.r.p. density (dBW/MHz)	44	44	40	36	$eirp$
1.2	Equivalent antenna diameter (m)	0.45	0.6	2	9	D_m
1.3	Bandwidth (MHz)	1	1	1	1	B_{MHz}
1.4	ES antenna gain pattern	S.1428	S.1428	S.1428	S.1428	

1	Generic GSO reference link parameters - service					Parameters
1.5	Additional link losses (dB) This field includes non-precipitation impairments	3	3	3	3	L_o
1.6	Additional noise contribution including margin for inter-system interference (dB)	2	2	2	2	M_{0inter}
1.7	Additional noise contribution including margin for intra-system interference (dB) and non-time varying sources	1	1	1	1	M_{0intra}

2	Generic GSO reference link parameters - parametric analysis	Parametric cases for evaluation						
2.1	E.i.r.p. density variation	−3, 0, +3 dB from value in 1.1						$\Delta eirp$
2.2	Elevation angle (deg)	20			55		90	ε
2.3	Rain height (m) for specified latitude in item 2.4	5 000	3 950	1 650	5 000	3 950	5 000	h_{rain}
2.4	Latitude* (deg. N)	0	±30	±61.8	0	±30	0	Lat
2.5	ES noise temperature (K)	340						T
2.6	0.01% rain rate (mm/hr)	10, 50, 100						$R_{0.01}$
2.7	Height of ES above mean sea level (m)	0, 500, 1 000						h_{ES}
2.8	Threshold C/N (dB)	−2.5, 2.5, 5, 10						$\left(\frac{C}{N}\right)_{Thr,i}$
2.9	Probability of non-zero rain attenuation	10						p_{max} (%)

NOTE – For items 2.2, 2.3 and 2.4, these three groups of data are to be considered as unique sets of data to be used in the larger, overall set of total possible permutations. For example, 20 degrees of elevation angle will consider three different latitudes of 0, 30 and 61.8 degrees while 90 degrees of elevation will only consider a latitude of 0 degrees and one possible rain height 5 km. The above parameters are chosen as representative propagation parameters for purposes of calculations of precipitation fade statistics. These precipitation fades are representative of other geographic locations.

* Latitude is evaluated as a single value representing the absolute value of the latitude

TABLE 2

Parameters of generic GSO reference links to be used in examination of the uplink (Earth-to-space) impact from any one non-GSO system

1	Generic GSO reference link parameters - service					
	Link type	Link #1	Link #2	Link #3	Gateway	
1.1	ES e.i.r.p. density (dBW/MHz)	49	49	49	60	$eirp$
1.2	Bandwidth (MHz)	1	1	1	1	B_{MHz}
1.3	Half-power beamwidth (deg)	0.2	0.3	1.5	0.3	
1.4	ITU-R S.672 sidelobe level (dB)	−25	−25	−25	−25	
1.5	Satellite antenna peak gain (dBi)	58.5	54.9	38.5	54.9	G_{max}
1.6	Additional link losses (dB) This field includes non-precipitation impairments	4.5	4.5	4.5	4.5	L_o
1.7	Additional noise contribution including margin for inter-system interference (dB)	2	2	2	2	M_{0inter}
1.8	Additional noise contribution including margin for intra-system interference (dB) and non-time varying sources	1	1	1	1	M_{0intra}

2	Generic GSO reference link parameters - parametric analysis	Parametric cases for evaluation						
2.1	E.i.r.p. density variation	−6, 0, +6 dB from value in 1.1						$\Delta eirp$
2.2	Elevation angle (deg)	20			55		90	ε
2.3	Rain height (m) for specified latitude in item 2.4	5 000	3 950	1 650	5 000	3 950	5 000	h_{rain}
2.4	Latitude* (deg. N)	0	± 30	± 61.8	0	± 30	0	Lat
2.5	0.01% rain rate (mm/hr)	10, 50, 100						$R_{0.01}$

2	Generic GSO reference link parameters - parametric analysis	Parametric cases for evaluation	
2.6	Height of ES above mean sea level (m)	0, 500, 1 000	h_{ES}
2.7	Satellite noise temperature (K)	500, 1 600	T
2.8	Threshold C/N (dB)	-2.5, 2.5, 5, 10	$\left(\frac{C}{N}\right)_{Thr,i}$
2.9	Probability of non-zero rain attenuation	10	p_{max} (%)

NOTE – For items 2.2, 2.3 and 2.4, these three groups of data are be considered as unique sets of data to be used in the larger, overall set of total possible permutations. For example, 20 degrees of elevation angle will consider three different latitudes of 0, 30 and 61.8 degrees while 90 degrees of elevation will only consider a latitude of 0 degrees and one possible rain height 5 km. The above parameters are chosen as representative propagation parameters for purposes of calculations of precipitation fade statistics. These precipitation fades are representative of other geographic locations.

* Latitude is evaluated as a single value representing the absolute value of the latitude

RESOLUTION 771 (WRC-19)

Use of the frequency bands 37.5-42.5 GHz (space-to-Earth) and 47.2-48.9 GHz, 48.9-50.2 GHz and 50.4-51.4 GHz (Earth-to-space) by non-geostationary-satellite systems in the fixed-satellite service and 39.5-40.5 GHz (space-to-Earth) by non-geostationary-satellite systems in the mobile-satellite service

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that this conference has adopted regulatory provisions for the operation of non-geostationary-satellite (non-GSO) fixed-satellite service (FSS) systems in the frequency bands 37.5-42.5 GHz (space-to-Earth) and 47.2-48.9 GHz, 48.9-50.2 GHz and 50.4-51.4 GHz (Earth-to-space) and non-GSO mobile-satellite service (MSS) systems in the frequency bands 39.5-40.5 GHz (space-to-Earth);
- b)* that this conference has introduced a new coordination procedure associated with the use of these frequency bands by these space services;
- c)* that there are already several frequency assignments to non-GSO FSS/MSS satellite systems that have been notified or recorded in the Master International Frequency Register prior to 23 November 2019,

resolves

1 that frequency assignments to non-GSO networks or systems for which the complete notification information has been received by the Radiocommunication Bureau before 23 November 2019 shall be brought into use before 23 November 2022 or the end of the regulatory period set forth in No. **11.44**, whichever date comes earlier;

2 that frequency assignments to which *resolves* 1 applies and that are not brought into use before 23 November 2022 or the end of the regulatory period set forth in No. **11.44**, whichever date comes earlier, shall be suppressed,

instructs the Radiocommunication Bureau

to take the necessary actions to implement this Resolution.

RESOLUTION 775 (REV.WRC-23)

**Power flux-density and equivalent isotropically radiated power limits
for inclusion in Article 21 for the fixed-satellite, mobile-satellite
and broadcasting-satellite services to protect the fixed and mobile services
in the frequency bands 71-76 GHz and 81-86 GHz**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that WRC-2000 made a number of different allocation changes to the frequency bands 71-76 GHz and 81-86 GHz based on the requirements known at the time;
- b)* that sharing conditions between the fixed service, mobile service and satellite services in the frequency bands 71-76 GHz and 81-86 GHz could not be fully developed at WRC-2000 due to lack of available information on these services at the time;
- c)* that, in the last two decades, there have been a number of significant technology advances and changes in network requirements in the fixed and mobile services, and the frequency bands 71-76 GHz and 81-86 GHz have become strategically important frequency bands for high-capacity fixed-service links, including backhaul for future mobile networks;
- d)* that there is now much more information available in the ITU Radiocommunication Sector (ITU-R) on the characteristics and deployment of fixed-service systems;
- e)* that there are an increasing number of satellite filings in the frequency bands 71-76 GHz and 81-86 GHz and some satellites are equipped with payload ready to utilize these bands,

noting

- a)* that the frequency band 81-86 GHz is allocated to the radio astronomy service on a primary basis, and that No. **5.149** applies;
- b)* that WRC-12 already addressed sharing and compatibility issues between the fixed and passive services in the frequency bands 71-76 GHz and 81-86 GHz and relevant adjacent frequency bands,

recognizing

- a)* that the frequency bands 71-76 GHz and 81-86 GHz are also allocated to other radiocommunication services and that those allocations are used by a variety of incumbent systems in many administrations, and that the protection of these services should be studied;
- b)* that for the determination of the incumbent services, the relevant provisions of the Radio Regulations in force apply;

c) that Article **21** and other provisions of the Radio Regulations currently do not contain the necessary technical and regulatory provisions to protect fixed and mobile service use in the frequency bands 71-76 GHz and 81-86 GHz;

d) that Resolution **750 (Rev.WRC-19)** already contains necessary provisions to protect passive services in the frequency bands and adjacent frequency bands from emissions of the fixed service in the frequency bands 71-76 GHz and 81-86 GHz, and there is no intention to change these provisions;

e) that there is no intention to remove the existing allocations or change the primary status of those allocations in Article **5** for the frequency bands 71-76 GHz and 81-86 GHz,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

the appropriate studies to determine power flux-density (pfd) and equivalent isotropically radiated power (e.i.r.p.) limits to be included in Article **21** for satellite services (fixed-satellite service (FSS), mobile-satellite service (MSS) and broadcasting-satellite service (BSS)) to protect the current and planned fixed and mobile services in the frequency bands 71-76 GHz and 81-86 GHz,

invites administrations

to participate actively in the studies by submitting contributions to ITU-R,

invites the 2027 world radiocommunication conference

to consider, based on the results of studies, the inclusion of pfd and e.i.r.p. limits in Article **21** for the FSS, MSS and BSS to protect the current and planned fixed and mobile services in the frequency bands 71-76 GHz and 81-86 GHz.

RESOLUTION 804 (REV.WRC-23)

Principles for establishing agendas for world radiocommunication conferences

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that, in accordance with No. 118 of the ITU Convention, the general scope of the agendas for world radiocommunication conferences (WRCs) should be established four to six years in advance;
- b)* Article 13 of the ITU Constitution relating to the competence and scheduling of WRCs and Article 7 of the Convention relating to their agendas;
- c)* that No. 92 of the Constitution and Nos. 488 and 489 of the Convention require conferences to be fiscally responsible;
- d)* that, in Resolution 71 (Rev. Marrakesh, 2002), concerning the strategic plan of the Union, the Plenipotentiary Conference noted the increasingly complex and lengthy agendas for WRCs;
- e)* that Resolution 80 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference and Resolution **72 (Rev.WRC-19)** recognize the positive contribution of regional telecommunication organizations and informal groups and the need for improved efficiency and fiscal prudence;
- f)* the relevant Resolutions of previous WRCs;
- g)* that Resolution ITU-R 2-8 describes the principles of the organization of the work of the Conference Preparatory Meeting (CPM), including the reporting of contributions concerning future agenda items for information,

recognizing

- a)* that the number of issues addressed in agendas for future WRCs has been growing, and that, in the past, several issues could not be addressed adequately in the time allotted to WRCs, including WRC preparations;
- b)* that some agenda items may have a greater impact on the future of radiocommunications than others;
- c)* that the human and financial resources of administrations, Sector Members and ITU are limited;
- d)* that agendas of future WRCs include standing items, some of which could be addressed under more than one regular agenda item;

e) that there is a need to limit the agenda of WRCs and the amount of preparatory work to a manageable level for administrations and the ITU Radiocommunication Sector (ITU-R), taking account of the needs of developing countries, in a manner that allows the issues to be dealt with equitably and efficiently;

f) that, in accordance with No. 90 of the Constitution, the interval between WRCs should normally be three to four years, to ensure that changes in technology and requirements of Member States are adequately reflected in WRC agendas;

g) that administrations and regional telecommunication organizations need sufficient time to coordinate, evaluate and examine the potential consequences of proposed new items for inclusion in the agendas of future WRCs;

h) that during the study cycle for preparation of a WRC, the ITU-R studies identified in Resolutions associated with the agenda of that WRC should be carried out within ITU-R, and not by other international organizations,

resolves

1 that recommended agendas for future WRCs shall include a standing agenda item for the establishment of preliminary agendas for subsequent WRCs;

2 that the course of action outlined in this Resolution needs to be taken into account in the preparation of and decision on the agenda of future WRCs;

3 that the principles in Annex 1 to this Resolution need to be taken into account when developing agendas for future WRCs;

4 that the guidance given in Annex 2 to this Resolution needs to be used in developing agenda items for future WRCs and their supporting resolutions;

5 to encourage administrations and regional telecommunication organizations to submit, to the extent practicable, information on possible items/topics for the agenda of future WRCs under the WRC standing agenda item mentioned in *resolves* 1 to the second session of CPM,

invites administrations

1 to use the guidance in Annex 2 to this Resolution in developing agenda items for future WRCs and their supporting resolutions;

2 to use the template in Annex 3 to this Resolution in proposing agenda items for future WRCs,

further invites administrations

to participate in regional activities for the preparation of agendas for future WRCs,

invites the Radiocommunication Bureau

to review and provide feedback, to the extent possible, when consulted by administrations on the development of items for the agendas of future WRCs, seeking consistency with relevant provisions of the Radio Regulations and practices of the Bureau.

ANNEX 1 TO RESOLUTION 804 (REV.WRC-23)

Principles for establishing agendas for future radiocommunication conferences

- 1 An agenda of a world radiocommunication conference (WRC) shall include:
 - 1.1 items assigned to it by the ITU Plenipotentiary Conference;
 - 1.2 items on which the Director of the Radiocommunication Bureau (BR) has been requested to report;
 - 1.3 items concerning instructions to the Radio Regulations Board and BR regarding their activities and concerning the review of those activities.
- 2 In general, a WRC may decide to include on the agenda of a future WRC an item proposed by a group of administrations or an administration, if all the following conditions are met:
 - 2.1 it addresses issues of a worldwide or regional character;
 - 2.2 it is expected that changes in the Radio Regulations, including WRC Resolutions and Recommendations, may be necessary;
 - 2.3 it addresses issues that cannot be resolved through the regular activities of the ITU Radiocommunication Sector (ITU-R) or under WRC standing agenda items;
 - 2.4 it is expected that required studies can be completed (e.g. that appropriate ITU-R Recommendations will be approved) prior to that WRC;
 - 2.5 resources associated with the subject are kept within a range which is manageable for Member States and Sector Members, BR and ITU-R study groups and the Conference Preparatory Meeting;
- 3 Items that meet the requirements specified in section 2 of this Annex shall be included in the future WRC agenda as standalone items, and shall not be included as separate issues under the agenda item on which the Director of BR reports on ITU-R activities since the last WRC.
- 4 To the extent possible, agenda items arising from previous WRCs, normally reflected in Resolutions, and which have been considered by two successive WRCs, should not be considered, unless justified.
- 5 Inclusion of an identical topic on the agenda of two future subsequent WRCs shall strictly be avoided.
- 6 Issues that could be addressed through actions undertaken by a radiocommunication assembly, particularly those not involving amendments to the Radio Regulations, shall not be included in the agenda.

- 7 In developing agenda items for future WRCs, efforts need to be made to:
- a) encourage regional and interregional coordination on the subjects to be considered in the preparatory process for WRCs, in accordance with Resolution 72 (**Rev.WRC-19**) and Resolution 80 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference, with a view to addressing potentially difficult issues well before a WRC;
 - b) include, to the extent possible, agenda items that are prepared within regional telecommunication organizations, taking into account the equal right of individual administrations to submit proposals for agenda items;
 - c) ensure that proposals are submitted with an indication of priority and any accompanying reasons for the indicated priority (see also Annex 3 to this Resolution);
 - d) include in proposals an assessment of their financial and other resource implications (with the assistance of BR) to ensure that they are within the agreed budgetary limits for ITU-R (see also Annex 3 to this Resolution);
 - e) ensure that the objectives and scope of proposed agenda items are complete and unambiguous (see guidance in Annex 2 to this Resolution);
 - f) take into account the status of ITU-R studies related to the potential agenda items before considering them as possible candidates for future agendas;
 - g) distinguish between items intended to result in changes to the Radio Regulations and those dealing solely with the progress of studies;
 - h) arrange items on the agenda by subject to the extent possible.

ANNEX 2 TO RESOLUTION 804 (REV.WRC-23)

Guidance for the development of Resolutions related to agenda items of world radiocommunication conferences

The guidance in this Annex is provided for developing the text of an agenda item of a future world radiocommunication conference (WRC) and a related supporting resolution which should contain the following sections:

- Preambular part (information/background)
 - *considering*
 - *noting*
 - *recognizing*
- Operative part (actions/tasks)
 - *resolves*
 - *instructs*
 - *invites.*

In developing the text of an agenda item of a future WRC and its supporting resolution, the following should be taken into account:

- a) the text of the agenda item, the title of its supporting resolution and the operative part of that resolution should be unambiguous and consistent;
- b) in selecting the terms and wording of the supporting resolution, in particular the operative part, efforts need to be made to be unambiguous, meaningful and clear;
- c) in developing a supporting resolution, terms such as “constraints”, “due constraints”, “undue constraints”, “additional constraints” and “regulatory actions” and the ambiguous use of “as appropriate”, which are not quantifiable and have no regulatory consequence in the ITU Radio Regulations, should be avoided;
- d) there needs to be conformity between the subject issue referred to in the preambular part of the supporting resolution and the actions required in the operative part of that resolution;
- e) the preambular part of the supporting resolution needs to be kept to the minimum necessary to justify the operative part;
- f) reference to the protection of incumbent services needs to be clearly specified in the supporting resolution;
- g) repetition of text across different sections of the supporting resolution should be kept to a minimum, while references to existing provisions of the Radio Regulations and/or other sections of the supporting resolution should be used to the extent possible.

The below guidance in the form of a draft new Resolution provides an example addressing the study of the introduction of new service allocations and/or systems. In order to address different situations, variations of the guidance should be considered.

Below, guidance is provided in the form of NOTES for each section.

DRAFT NEW RESOLUTION [A10-Y.YY] (WRC-ZZ)

Title of the Resolution^(NOTES 1 and 2)

The World Radiocommunication Conference (PLACE, YEAR),

considering^(NOTES 3, 5 and 7)

(...),

considering further^(NOTES 4, 5 and 7)

(...),

noting^(NOTES 6, 7 and 9)

(...),

noting further^(NOTES 7, 8 and 9)

(...),

recognizing^(NOTES 7, 10 and 12)

a) that {the frequency bands/ranges under consideration} are also allocated to other radiocommunication services {on a primary basis} and that those allocations are used by a variety of incumbent systems in many administrations {throughout Region X}, {and that the protection of these services should be studied};

b) that for the determination of the incumbent services, the relevant provisions of the Radio Regulations in force apply;

c) (...),

recognizing further^(NOTES 7, 11 and 12)

(...),

resolves to invite the ITU Radiocommunication Sector to complete in time for the ZZZZ world radiocommunication conference^(NOTE 15)

1 studies on {relevant} spectrum requirements and technical and operational characteristics, for the {new entrant};

2 (...),^(NOTES 13 and 14)

invites administrations

to participate actively in the studies and provide the information required for the studies listed under *resolves to invite the ITU Radiocommunication Sector to complete in time for the ZZZZ world radiocommunication conference* by submitting contributions to ITU-R,

invites the ZZZZ world radiocommunication conference^(NOTE 16)

to ..., based on results of studies, ...,

invites relevant international organizations^(NOTES 17 and 20)

to participate actively in the relevant ITU-R studies by providing information that should be taken into account in ITU-R studies,

instructs the Director of the Radiocommunication Bureau^(NOTES 17, 18, 20 and 21)

(...),

instructs the Secretary-General^(NOTES 17, 19, 20 and 21)

(...).^(NOTE 22)

- NOTE 1 The title of the Resolution related to an agenda item Y.YY should refer to the desired objective of that WRC-ZZ agenda item, with the same wording as listed in section Y.YY of the Resolution containing the agenda of that future WRC-ZZ.
- NOTE 2 The title may start “Studies on/Consideration of ...” to bridge to the objective of the agenda item, emphasizing that the Resolution primarily relates to the studies to be provided by ITU-R to the competent WRC as a basis for the relevant decision.
- NOTE 3 The content of the *considering* section should primarily aim to qualify the demand/objective under consideration and thus provide the baseline justification for approving a WRC agenda item and tasking ITU-R to perform the studies under *resolves to invite the ITU Radiocommunication Sector to complete in time for the ZZZZ world radiocommunication conference*. This may include an indication of the need for studies to support addressing the demand, the description of the {new entrant/revised service} or its applications. The section should also contain various general background information giving the reasons for the agenda item, including the allocations in the frequency band(s)/range(s) under consideration. Specific factual elements on current and planned usage may also be included here, as requested by the interested administrations.
- NOTE 4 If there is a need to highlight any content of the *considering* section, that content could be listed in this section.
- NOTE 5 Each *considering* should start with “that” and end with a semicolon “;” and be numbered *a),...z), aa)...*; the last *considering* ends with a comma “,”.
- NOTE 6 The content of the noting section should aim to provide factual/relevant regulatory information through statement of existing RR Article 5 frequency allocations, regulatory references (RR No., WRC Resolution, etc.), as well as ITU-R deliverables (Recommendation, Report, Question, etc.) of relevance to the topic, including information on any relevant sharing and compatibility studies so far carried out in previous cycles, to avoid repeating studies previously performed and specific usages and use cases (e.g. secondary services and/or identification/designations in RR footnotes) in the frequency bands/ranges under consideration, as requested by administrations.
- NOTE 7 The information in this section cannot be expected to be exhaustive; an omission should not have an impact on proceedings.
- NOTE 8 If there is a need to highlight any content of the *noting* section, that content could be listed in this section.
- NOTE 9 Each *noting* should start with “that” and end with a semicolon “;” and be numbered *a),...z), aa)...*; the last *noting* ends with a comma “,”.
- NOTE 10 The content of the recognizing section should aim to set a framework for studies/future use, through recognizing assumptions or objectives for the studies to be performed by ITU-R under *resolves to invite the ITU Radiocommunication Sector to complete in time for the ZZZZ world radiocommunication conference*.
- NOTE 11 If there is a need to highlight any content of the *recognizing* section, that content could be listed in this section.
- NOTE 12 Each *recognizing* should start with “that” and end with a semicolon “;” and be numbered *a),...z), aa)...*; the last *recognizing* ends with a comma “,”.
- NOTE 13 This section should indicate study tasks for ITU-R – regulatory, technical, operational and/or procedural, including the necessary sharing and compatibility studies, as required, to ensure the protection of incumbent primary services. This section should be complete and provide the fundamental elements necessary for WRC action.

- NOTE 14 The development of the Resolution should consider, on request by administrations, the following:
- passive services,
 - secondary services,
 - services and their specific conditions of use as outlined in footnotes to the Table of Frequency Allocations and/or designation of specific frequency bands for specific applications.
- NOTE 15 Each *resolves to invite etc.* should end with a semicolon “;” and be numbered 1, 2, 3, etc.; the last *resolves to invite etc.* ends with a comma “,”.
- NOTE 16 The *invites the ZZZZ world radiocommunication conference* section shall express the desired objective of the relevant agenda item in concise and unambiguous wording – the same wording shall be listed in section Y.YY of the Resolution containing the agenda of WRC-ZZ.
- NOTE 17 This section is optional.
- NOTE 18 This section contains instructions for performing any further required ITU-R internal actions or steps or addressing non-self-standing issues for a WRC.
- NOTE 19 This section may contain instructions on the presentation of the agenda item or a related topic in the framework of the United Nations principal organs, related organizations or specialized agencies, within the United Nations system, as necessary.
- NOTE 20 The instructions should be limited to the minimum necessary and are considered an optional, non-standing part of the Resolution.
- NOTE 21 Each item in this section should start with “to” and end with a semicolon “;” and be numbered 1, 2, 3, etc. the last item ends with a comma “,”.
- NOTE 22 The Resolution ends with a full stop “.”.

ANNEX 3 TO RESOLUTION 804 (REV.WRC-23)

Template for the submission of proposals for agenda items of future world radiocommunication conferences

Subject: {The main purpose/objective/topic of the proposed new agenda item needs to be provided here with clear concise wording.}

Origin:

Proposal: {The exact text of the proposed agenda item for future WRCs should be provided here in a clear and unambiguous wording with a reference to its supporting resolution(s).}

Supporting resolution: {The title of the draft supporting resolution for the proposed agenda item needs to be provided here.}

Background/reason:

{The reason and justification for the proposal should be clearly provided, taking into account 7c) of Annex 1 to this Resolution.}

Radiocommunication services concerned:

Indication of possible difficulties:

Previous/ongoing studies on the issue:

Studies to be carried out by:

with the participation of:

ITU-R study groups concerned:

ITU resource implications, including financial implications (refer to CV126):

Common regional proposal: Yes/No

Multicountry proposal: Yes/No

Number of countries:

Remarks

RESOLUTION 813 (WRC-23)

Agenda for the 2027 world radiocommunication conference

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that, in accordance with No. 118 of the ITU Convention, the general scope of the agenda for a world radiocommunication conference (WRC) should be established four to six years in advance and that a final agenda shall be established by the ITU Council two years before the conference;
- b)* Article 13 of the ITU Constitution, relating to the competence and scheduling of WRCs, and Article 7 of the Convention, relating to their agendas;
- c)* the relevant resolutions and recommendations of previous world administrative radio conferences (WARCs) and WRCs,

recognizing

- a)* that this conference has identified a number of urgent issues requiring further examination by WRC-27;
- b)* that in preparing this agenda, some items proposed by administrations could not be included and have had to be deferred to future conference agendas,

resolves

to recommend to the Council that a WRC be held in 2027 for a period of four weeks, with the following agenda:

1 on the basis of proposals from administrations, taking into account of the results of WRC-23 and the Report of the Conference Preparatory Meeting, and with due regard to the requirements of existing and future services in the frequency bands under consideration, to consider and take appropriate action in respect of the following items:

1.1 to consider the technical and operational conditions for the use of the frequency bands 47.2-50.2 GHz and 50.4-51.4 GHz (Earth-to-space), or parts thereof, by aeronautical and maritime earth stations in motion communicating with space stations in the fixed-satellite service and develop regulatory measures, as appropriate, to facilitate the use of the frequency bands 47.2-50.2 GHz and 50.4-51.4 GHz (Earth-to-space), or parts thereof, by aeronautical and maritime earth stations in motion communicating with geostationary space stations and non-geostationary space stations in the fixed-satellite service, in accordance with Resolution 176 (Rev.WRC-23);

1.2 to consider possible revisions of sharing conditions in the frequency band 13.75-14 GHz to allow the use of uplink fixed-satellite service earth stations with smaller antenna sizes, in accordance with Resolution **129 (WRC-23)**;

1.3 to consider studies relating to the use of the frequency band 51.4-52.4 GHz to enable use by gateway earth stations transmitting to non-geostationary-satellite orbit systems in the fixed-satellite service (Earth-to-space), in accordance with Resolution **130 (WRC-23)**;

1.4 to consider a possible new primary allocation to the fixed-satellite service (space-to-Earth) in the frequency band 17.3-17.7 GHz and a possible new primary allocation to the broadcasting-satellite service (space-to-Earth) in the frequency band 17.3-17.8 GHz in Region 3, while ensuring the protection of existing primary allocations in the same and adjacent frequency bands, and to consider equivalent power flux-density limits to be applied in Regions 1 and 3 to non-geostationary-satellite systems in the fixed-satellite service (space-to-Earth) in the frequency band 17.3-17.7 GHz, in accordance with Resolution **726 (WRC-23)**;

1.5 to consider regulatory measures, and implementability thereof, to limit the unauthorized operations of non-geostationary-satellite orbit earth stations in the fixed-satellite and mobile-satellite services and associated issues related to the service area of non-geostationary-satellite orbit satellite systems in the fixed-satellite and mobile-satellite services, in accordance with Resolution **14 (WRC-23)**;

1.6 to consider technical and regulatory measures for fixed-satellite service satellite networks/systems in the frequency bands 37.5-42.5 GHz (space-to-Earth), 42.5-43.5 GHz (Earth-to-space), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) for equitable access to these frequency bands, in accordance with Resolution **131 (WRC-23)**;

1.7 to consider studies on sharing and compatibility and develop technical conditions for the use of International Mobile Telecommunications (IMT) in the frequency bands 4 400-4 800 MHz and 7 125-8 400 MHz (or parts thereof), and 14.8-15.35 GHz taking into account existing primary services operating in these, and adjacent, frequency bands, in accordance with Resolution **256 (WRC-23)**;

1.8 to consider possible additional spectrum allocations to the radiolocation service on a primary basis in the frequency range 231.5-275 GHz and possible new identifications for radiolocation service applications in frequency bands within the frequency range 275-700 GHz for millimetric and sub-millimetric wave imaging systems, in accordance with Resolution **663 (Rev.WRC-23)**;

1.9 to consider appropriate regulatory actions to update Appendix **26** to the Radio Regulations in support of aeronautical mobile (OR) high frequency modernization, in accordance with Resolution **411 (WRC-23)**;

1.10 to consider developing power flux-density and equivalent isotropically radiated power limits for inclusion in Article **21** of the Radio Regulations for the fixed-satellite, mobile-satellite and broadcasting-satellite services to protect the fixed and mobile services in the frequency bands 71-76 GHz and 81-86 GHz, in accordance with Resolution **775 (Rev.WRC-23)**;

1.11 to consider the technical and operational issues, and regulatory provisions, for space-to-space links among non-geostationary and geostationary satellites in the frequency bands 1 518-1 544 MHz, 1 545-1 559 MHz, 1 610-1 645.5 MHz, 1 646.5-1 660 MHz, 1 670-1 675 MHz and 2 483.5-2 500 MHz allocated to the mobile-satellite service, in accordance with Resolution **249 (Rev.WRC-23)**;

1.12 to consider, based on the results of studies, possible new allocations to the mobile-satellite service and possible regulatory actions in the frequency bands 1 427-1 432 MHz (space-to-Earth), 1 645.5-1 646.5 MHz (space-to-Earth) (Earth-to-space), 1 880-1 920 MHz (space-to-Earth) (Earth-to-space) and 2 010-2 025 MHz (space-to-Earth) (Earth-to-space) required for the future development of low-data-rate non-geostationary mobile-satellite systems, in accordance with Resolution **252 (WRC-23)**;

1.13 to consider studies on possible new allocations to the mobile-satellite service for direct connectivity between space stations and International Mobile Telecommunications (IMT) user equipment to complement terrestrial IMT network coverage, in accordance with Resolution **253 (WRC-23)**;

1.14 to consider possible additional allocations to the mobile-satellite service, in accordance with Resolution **254 (WRC-23)**;

1.15 to consider studies on frequency-related matters, including possible new or modified space research service (space-to-space) allocations, for future development of communications on the lunar surface and between lunar orbit and the lunar surface, in accordance with Resolution **680 (WRC-23)**;

1.16 to consider studies on the technical and regulatory provisions necessary to protect radio astronomy operating in specific Radio Quiet Zones, and in frequency bands allocated to the radio astronomy service on a primary basis globally, from aggregate radio-frequency interference caused by non-geostationary-satellite orbit systems, in accordance with Resolution **681 (WRC-23)**;

1.17 to consider regulatory provisions for receive-only space weather sensors and their protection in the Radio Regulations, taking into account the results of ITU Radiocommunication Sector studies, in accordance with Resolution **682 (WRC-23)**;

1.18 to consider, based on the results of ITU Radiocommunication Sector studies, possible regulatory measures regarding the protection of the Earth exploration-satellite service (passive) and the radio astronomy service in certain frequency bands above 76 GHz from unwanted emissions of active services, in accordance with Resolution **712 (WRC-23)**;

1.19 to consider possible primary allocations in all Regions to the Earth exploration-satellite service (passive) in the frequency bands 4 200-4 400 MHz and 8 400-8 500 MHz, in accordance with Resolution **674 (WRC-23)**;

2 to examine the revised ITU Radiocommunication Sector Recommendations incorporated by reference in the Radio Regulations communicated by the Radiocommunication Assembly, in accordance with *further resolves* of Resolution **27 (Rev.WRC-19)**, and to decide whether or not to update the corresponding references in the Radio Regulations, in accordance with the principles contained in *resolves* of that Resolution;

3 to consider such consequential changes and amendments to the Radio Regulations as may be necessitated by the decisions of the conference;

4 in accordance with Resolution **95 (Rev.WRC-19)**, to review the resolutions and recommendations of previous conferences with a view to their possible revision, replacement or abrogation;

5 to review, and take appropriate action on, the Report from the Radiocommunication Assembly submitted in accordance with Nos. 135 and 136 of the ITU Convention;

6 to identify those items requiring urgent action by the radiocommunication study groups in preparation for the next world radiocommunication conference;

7 to consider possible changes, in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference, on advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks, in accordance with Resolution **86 (Rev.WRC-07)**, in order to facilitate the rational, efficient and economical use of radio frequencies and any associated orbits, including the geostationary-satellite orbit;

8 to consider and take appropriate action on requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, taking into account Resolution **26 (Rev.WRC-23)**;

9 to consider and approve the Report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the ITU Convention:

9.1 on the activities of the ITU Radiocommunication Sector since WRC-23¹;

9.2 on any difficulties or inconsistencies encountered in the application of the Radio Regulations²; and

¹ This WRC's standing agenda sub-item is strictly limited to the Report of the Director on ITU-R activities since the last WRC; and any topics outside 1.1-1.19 as listed above shall be strictly avoided, particularly those topics which require any changes/amendments to the Radio Regulations.

² This WRC's standing agenda sub-item is strictly limited to the Report of the Director on any difficulties or inconsistencies encountered in the application of the Radio Regulations and the comments from administrations. Administrations are invited to inform the Director of the Radiocommunication Bureau of any difficulties or inconsistencies encountered in the Radio Regulations.

9.3 on action in response to Resolution **80 (Rev.WRC-07)**;

10 to recommend to the ITU Council items for inclusion in the agenda for the next world radiocommunication conference, and items for the preliminary agenda of future conferences, in accordance with Article 7 of the ITU Convention and Resolution **804 (Rev.WRC-23)**,

further resolves

to activate the Conference Preparatory Meeting (CPM),

invites the ITU Council

to finalize the agenda and arrange for the convening of WRC-27, and to initiate as soon as possible the necessary consultations with Member States,

instructs the Director of the Radiocommunication Bureau

1 to make the necessary arrangements to convene meetings of the CPM and to prepare a report to WRC-27;

2 to submit a draft report on any difficulties or inconsistencies encountered in the application of the Radio Regulations, as referred to in agenda item 9.2, to the second session of the CPM and to submit the final report at least five months before the next WRC,

instructs the Secretary-General

to communicate this Resolution to international and regional organizations concerned.

RESOLUTION 814 (WRC-23)

Preliminary agenda for the 2031 world radiocommunication conference*

The World Radiocommunication Conference (Dubai, 2023),

considering

- a) that, in accordance with No. 118 of the ITU Convention, the general scope of the agenda for WRC-31 should be established four to six years in advance;
- b) Article 13 of the ITU Constitution, relating to the competence and scheduling of world radiocommunication conferences (WRCs), and Article 7 of the Convention, relating to their agendas;
- c) the relevant resolutions and recommendations of previous world administrative radio conferences (WARCs) and WRCs,

resolves to give the view

that the following items should be included in the preliminary agenda for WRC-31:

- 1 to take appropriate action in respect of those urgent issues that were specifically requested by WRC-27;
- 2 on the basis of proposals from administrations and the Report of the Conference Preparatory Meeting, and taking account of the results of WRC-27, to consider and take appropriate action in respect of the following items:
 - 2.1 to consider potential new allocations to the fixed, mobile, radiolocation, amateur, amateur-satellite, radio astronomy, Earth exploration-satellite (passive and active) and space research (passive) services in the frequency range 275-325 GHz in the Table of Frequency Allocations of the Radio Regulations, with the consequential update of Nos. **5.149**, **5.340**, **5.564A** and **5.565**, in accordance with Resolution **721 (WRC-23)**;
 - 2.2 [to consider the possible [frequency bands] for [non-beam and beam] wireless power transmission to avoid harmful interference to the radiocommunication services caused by wireless power transmission, in accordance with Resolution **910 (WRC-23)**];
 - 2.3 to consider the use of aeronautical and maritime earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service (Earth-to-space) in the frequency band 12.75-13.25 GHz, in accordance with Resolution **133 (WRC-23)**;

* For further consideration at WRC-27, given the divergent views regarding the frequency bands to be studied and the means to ensure the full protection of all incumbent services concerned.

2.4 to consider, based on the results of ITU Radiocommunication Sector studies, support for inter-satellite service allocations in the frequency bands 3 700-4 200 MHz and 5 925-6 425 MHz, and associated regulatory provisions, to enable links between non-geostationary orbit satellites and geostationary orbit satellites, in accordance with Resolution **683 (WRC-23)**;

2.5 to consider a possible primary allocation in the frequency bands [694-960 MHz, or parts thereof, in Region 1], 890-942 MHz, or parts thereof, in Region 2, and [3 400-3 700 MHz, or parts thereof, in Region 3] to the aeronautical mobile service for the use of International Mobile Telecommunications (IMT) user equipment in terrestrial IMT networks by non-safety applications, in accordance with Resolution **251 (Rev.WRC-23)**;

2.6 to consider the identification of the frequency bands [102-109.5 GHz, 151.5-164 GHz, 167-174.8 GHz, 209-226 GHz and 252-275 GHz] for International Mobile Telecommunications, in accordance with Resolution **255 (WRC-23)**;

2.7 to consider improving the utilization of VHF maritime radiocommunication, in accordance with Resolution **363 (Rev.WRC-23)**;

2.8 to consider improving the utilization and channelization of maritime radiocommunication in the MF and HF bands, including potential revisions of Article **52** and Appendix **17**, in accordance with Resolution **366 (WRC-23)**;

2.9 to consider possible new allocations to the radionavigation-satellite service (space-to-Earth) in the frequency bands [5 030-5 150 MHz and 5 150-5 250 MHz] or parts thereof, in accordance with Resolution **684 (WRC-23)**;

2.10 to consider a possible new primary allocation to the Earth exploration-satellite service (Earth-to-space) in the frequency band 22.55-23.15 GHz, in accordance with Resolution **664 (Rev.WRC-23)**;

2.11 to consider an upgrade of the secondary allocation to the Earth exploration-satellite service (space-to-Earth) in the frequency band [37.5-40.5 GHz] or possible new worldwide frequency allocations on a primary basis to the Earth exploration-satellite service (space-to-Earth) in certain frequency bands within the frequency range [40.5-52.4 GHz], in accordance with Resolution **685 (WRC-23)**;

2.12 to consider possible new allocations to the Earth exploration-satellite service (active) in the frequency bands [3 000-3 100 MHz] and [3 300-3 400 MHz] on a secondary basis, in accordance with Resolution **686 (WRC-23)**;

2.13 to consider studies on coexistence between spaceborne synthetic aperture radars operating in the Earth exploration-satellite service (active) and the radiodetermination service in the frequency band 9 200-10 400 MHz, with possible actions as appropriate, in accordance with Resolution **722 (WRC-23)**;

2.14 to review spectrum use and needs of applications of broadcasting and mobile services and consider possible regulatory actions in the frequency band 470-694 MHz or parts thereof, in accordance with Resolution **235 (Rev.WRC-23)**;

3 to examine the revised ITU Radiocommunication Sector Recommendations incorporated by reference in the Radio Regulations communicated by the Radiocommunication Assembly, in accordance with *further resolves* of Resolution **27 (Rev.WRC-19)**, and to decide whether or not to update the corresponding references in the Radio Regulations, in accordance with the principles contained in *resolves* of that Resolution;

4 to consider such consequential changes and amendments to the Radio Regulations as may be necessitated by the decisions of the conference;

5 in accordance with Resolution **95 (Rev.WRC-19)**, to review the Resolutions and Recommendations of previous conferences with a view to their possible revision, replacement or abrogation;

6 to review, and take appropriate action on, the Report from the Radiocommunication Assembly submitted in accordance with Nos. 135 and 136 of the ITU Convention;

7 to identify those items requiring urgent action by the radiocommunication study groups;

8 to consider possible changes, in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference, on advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks, in accordance with Resolution **86 (Rev.WRC-07)**, in order to facilitate the rational, efficient and economical use of radio frequencies and any associated orbits, including the geostationary-satellite orbit;

9 to consider and take appropriate action on requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, taking into account Resolution **26 (Rev.WRC-23)**;

10 to consider and approve the Report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the ITU Convention:

10.1 on the activities of the Radiocommunication Sector since WRC-27¹;

10.2 on any difficulties or inconsistencies encountered in the application of the Radio Regulations²; and

10.3 on action in response to Resolution **80 (Rev.WRC-07)**;

¹ This WRC's standing sub-item is strictly limited to the Report of the Director on ITU-R activities since the last WRC; and any topics outside 2.1-2.14 as listed above shall be strictly avoided, particularly those topics which require any changes/amendments to the Radio Regulations.

² This agenda sub-item is strictly limited to the Report of the Director on any difficulties or inconsistencies encountered in the application of the Radio Regulations and the comments from administrations. Administrations are invited to inform the Director of the Radiocommunication Bureau of any difficulties or inconsistencies encountered in the Radio Regulations.

RES814-4

11 to recommend to the ITU Council items for inclusion in the agenda for the next world radiocommunication conference, and items for the preliminary agenda of future conferences, in accordance with Article 7 of the ITU Convention and Resolution **804 (Rev.WRC-23)**,

invites the ITU Council

to finalize the agenda and arrange for the convening of WRC-31, and to initiate as soon as possible the necessary consultations with Member States,

instructs the Director of the Radiocommunication Bureau

1 to make the necessary arrangements to convene meetings of the Conference Preparatory Meeting (CPM) and to prepare a report to WRC-31;

2 to submit a draft Report on any difficulties or inconsistencies encountered in the application of the Radio Regulations, as referred to in agenda item 10.2, to the second session of the CPM and to submit the final Report at least five months before the next WRC,

instructs the Secretary-General

to communicate this Resolution to international and regional organizations concerned.

RESOLUTION 901 (REV.WRC-15)

**Determination of the orbital arc separation for which coordination
would be required between two satellite networks operating
in a space service not subject to a Plan**

The World Radiocommunication Conference (Geneva, 2015),

considering

- a) that WRC-2000 adopted a coordination arc concept in Appendix 5 to simplify the coordination between fixed-satellite service (FSS) networks in certain frequency bands between 3.4 GHz and 30 GHz;
- b) that in frequency bands below 3.4 GHz, mobile-satellite service (MSS) satellite networks normally have to coordinate with other networks with overlapping service areas operating anywhere in the visible arc;
- c) that the application of such a concept was limited to the frequency ranges where very large numbers of FSS satellite filings had been received by ITU-R;
- d) that many satellite networks and systems are now proposing to use higher frequency bands for which the coordination arc does not yet apply;
- e) that the Radio Regulations Board (RRB) adopted a Rule of Procedure on No. 9.36 that extended the coordination arc concept to the FSS and broadcasting-satellite service (BSS), not subject to a Plan, and in all frequency bands above 3.4 GHz until a review by WRC-03;
- f) that the use of the coordination arc considerably reduces the volume of data that needs to be supplied to the Radiocommunication Bureau under Section D of Annex 2 to Appendix 4;
- g) that application of the coordination arc concept has the potential to reduce the workload of the Bureau in identifying affected administrations;
- h) that the coordination arc concept may be valid for all geostationary space stations operating in any space radiocommunication service above 3.4 GHz that is not subject to a Plan, but may require different values for different services and frequency bands;
- i) that the ITU-R studies for other services and for frequency bands above 17.3 GHz, except for the 17.7-20.2 GHz and 29.5-30 GHz ranges for the FSS, have not been completed;
- j) that application of the coordination arc concept could facilitate the introduction of satellite services above 17.3 GHz after the studies conclude on the appropriate value(s) of the coordination arc,

recognizing

that there have been no difficulties resulting from the application of the coordination arc concept in the frequency bands where it applies,

noting

Recommendation ITU-R S.1780 “Coordination between geostationary-satellite orbit fixed-satellite service networks and broadcasting-satellite service networks in the frequency band 17.3-17.8 GHz”,

further noting

that WRC-07 incorporated part of the Rule of Procedure referred to in *considering e*) and extended the coordination arc of $\pm 8^\circ$ for the FSS in frequency bands above 17.3 GHz on a provisional basis, and has adopted an alternative value of $\pm 16^\circ$ on a provisional basis for the coordination arc applicable for the BSS in these frequency bands in Table 5-1 of Appendix 5,

resolves

to recommend that a future competent conference review the results of ITU-R studies on the application of the coordination arc value(s) to other frequency bands and other services, as applicable, and consider their inclusion in Appendix 5,

invites ITU-R

1 to conduct studies on the applicability of the coordination arc concept for space radiocommunication services not yet covered by these Regulations;

2 to recommend, as appropriate, the orbital separation required for triggering inter-service and intra-service coordination concerning the satellite services in frequency bands above 3.4 GHz for geostationary-satellite (GSO) networks not subject to a Plan and not already covered by the coordination arc concept specified in No. 9.7 (GSO/GSO) of Table 5-1 (Appendix 5), under items 1) to 8) of the frequency band column, and subject to Section II of Article 9,

instructs the Director of the Radiocommunication Bureau

to report the results of these studies to the RRB once Recommendations are approved, and to the next competent conference.

RESOLUTION 902 (REV.WRC-23)

**Provisions relating to earth stations located on board vessels which operate
in fixed-satellite service networks in the uplink frequency bands
5 925-6 425 MHz and 14-14.5 GHz**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a) that there is a demand for global wideband satellite communication services on vessels;
- b) that the technology exists that enables earth stations on board vessels (ESVs) to use fixed-satellite service (FSS) networks operating in the uplink bands 5 925-6 425 MHz and 14-14.5 GHz;
- c) that ESVs are currently operating through FSS networks in the frequency bands 3 700-4 200 MHz, 5 925-6 425 MHz, 10.7-12.75 GHz and 14-14.5 GHz under No. 4.4;
- d) that ESVs have the potential to cause unacceptable interference to other services in the frequency bands 5 925-6 425 MHz and 14-14.5 GHz;
- e) that, with respect to the frequency bands considered in this Resolution, global coverage is only available in the frequency band 5 925-6 425 MHz and that only a limited number of geostationary FSS systems can provide such global coverage;
- f) that, without special regulatory provisions, ESVs could place a heavy coordination burden on some administrations, especially those in developing countries;
- g) that, in order to ensure the protection and future growth of other services, ESVs need to operate under certain technical and operational limitations;
- h) that, within ITU-R studies, based on agreed technical assumptions, minimum distances from the low-water mark as officially recognized by the coastal State have been calculated, beyond which an ESV will not have the potential to cause unacceptable interference to other services in the frequency bands 5 925-6 425 MHz and 14-14.5 GHz;
- i) that, in order to limit the interference into other networks in the FSS, it is necessary to establish maximum off-axis e.i.r.p. density limits on ESV emissions;
- j) that establishing a minimum antenna diameter for ESVs has an impact on the number of ESVs that will ultimately be deployed, hence it will reduce interference into the fixed service,

noting

- a) that ESVs may be assigned frequencies to operate in FSS networks in the frequency bands 3 700-4 200 MHz, 5 925-6 425 MHz, 10.7-12.75 GHz and 14-14.5 GHz pursuant to No. 4.4 and shall not claim protection from, or cause interference to, other services having allocations in these bands;
- b) that the regulatory procedures of Article 9 apply for ESVs operating at specified fixed points,

resolves

that ESVs transmitting in the frequency bands 5 925-6 425 MHz and 14-14.5 GHz shall operate under the regulatory and operational provisions contained in Annex 1 and the technical limitations in Annex 2 of this Resolution,

encourages concerned administrations

to cooperate with administrations which license ESVs while seeking agreement under the above-mentioned provisions, taking into consideration the provisions of Recommendation 37 (Rev.WRC-23),

instructs the Secretary-General

to bring this Resolution to the attention of the Secretary-General of the International Maritime Organization.

ANNEX 1 TO RESOLUTION 902 (REV.WRC-23)

Regulatory and operational provisions for ESVs transmitting in the frequency bands 5 925-6 425 MHz and 14-14.5 GHz

1 The administration that issues the licence for the use of earth stations on board vessels (ESVs) in these frequency bands (licensing administration) shall ensure that such stations follow the provisions of this Annex and thus do not present any potential to cause unacceptable interference to the services of other concerned administrations.

2 ESV service providers shall comply with the technical limitations listed in Annex 2 and, when operating within the minimum distances as identified in § 4 below, with the additional limitations agreed by the licensing and other concerned administrations.

3 In the frequency band 3 700-4 200 MHz and frequency range 10.7-12.75 GHz range, ESVs in motion shall not claim protection from transmissions of terrestrial services operating in accordance with the Radio Regulations.

4 The minimum distances from the low-water mark as officially recognized by the coastal State beyond which ESVs can operate without the prior agreement of any administration are 300 km in the frequency band 5 925-6 425 MHz and 125 km in the frequency band 14-14.5 GHz, taking into account the technical limitations in Annex 2. Any transmissions from ESVs within the minimum distances shall be subject to the prior agreement of the concerned administration(s).

5 The potentially concerned administrations referred to in § 4 above are those where fixed or mobile services are allocated on a primary basis in the Table of Frequency Allocations of the Radio Regulations:

Frequency bands	Potentially concerned administrations
5 925-6 425 MHz	All three Regions
14-14.25 GHz	Countries listed in No. 5.505 , except those listed in No. 5.506B
14.25-14.3 GHz	Countries listed in Nos. 5.505 , 5.508 and 5.509 , except those listed in No. 5.506B
14.3-14.4 GHz	Regions 1 and 3, except countries listed in No. 5.506B
14.4-14.5 GHz	All three Regions, except countries listed in No. 5.506B

6 The ESV system shall include means of identification and mechanisms to immediately cease emissions, whenever the station does not operate in compliance with the provisions of §§ 2 and 4 above.

7 Cessation of emissions as referred to in § 6 above shall be implemented in such a way that the corresponding mechanisms cannot be bypassed on board the vessel, except under the provisions of No. **4.9**.

8 ESVs shall be equipped so as to:

- enable the licensing administration under the provisions of Article **18** to verify earth station performance; and
- enable the cessation of ESV emissions immediately upon request by an administration whose services may be affected.

9 Each licence-holder shall provide a point of contact to the administration with which agreements have been reached for the purpose of reporting unacceptable interference caused by the ESV.

10 When ESVs operating beyond the territorial sea but within the minimum distance (as referred to in § 4 above) fail to comply with the terms required by the concerned administration pursuant to §§ 2 and 4, then that administration may:

- request the ESV to comply with such terms or cease operation immediately; or
- request the licensing administration to require such compliance or immediate cessation of the operation.

ANNEX 2 TO RESOLUTION 902 (REV.WRC-23)

Technical limitations applicable to ESVs transmitting
in the frequency bands 5 925-6 425 MHz and 14-14.5 GHz

	5 925-6 425 MHz	14-14.5 GHz
Minimum diameter of ESV antenna	2.4 m	1.2 m ¹
Tracking accuracy of ESV antenna	±0.2° (peak)	±0.2° (peak)
Maximum ESV e.i.r.p. spectral density towards the horizon	17 dB(W/MHz)	12.5 dB(W/MHz)
Maximum ESV e.i.r.p. towards the horizon	20.8 dBW	16.3 dBW
Maximum off-axis e.i.r.p. density ²	See below	See below

¹ While operations within the minimum distances are subject to specific agreement with concerned administrations, licensing administrations may authorize the deployment of smaller antenna sizes down to 0.6 m at 14 GHz provided that the interference to the terrestrial services is no greater than that which would be caused with an antenna size of 1.2 m, taking into account the most recent version of Recommendation ITU-R SF.1650. In any case, the use of smaller antenna size shall be in compliance with the tracking accuracy of ESV antenna, maximum ESV e.i.r.p. spectral density towards the horizon, maximum ESV e.i.r.p. towards the horizon and maximum off-axis e.i.r.p. density limits in the Table above and the protection requirements of the FSS intersystem coordination agreements.

² In any case, the e.i.r.p. off-axis limits shall be compliant with the FSS intersystem coordination agreements that may agree to more stringent off-axis e.i.r.p. levels.

Off-axis limits

For earth stations on board vessels (ESVs) operating in the 5 925-6 425 MHz band, at any angle φ specified below, off the main-lobe axis of an earth-station antenna, the maximum equivalent isotropically radiated power (e.i.r.p.) in any direction within 3° of the geostationary-satellite orbit (GSO) shall not exceed the following values:

5 925-6 425 MHz

<i>Angle off-axis</i>	<i>Maximum e.i.r.p. per 4 kHz band</i>
2.5° ≤ φ ≤ 7°	(32 – 25 log φ) dB(W/4 kHz)
7° < φ ≤ 9.2°	11 dB(W/4 kHz)
9.2° < φ ≤ 48°	(35 – 25 log φ) dB(W/4 kHz)
48° < φ ≤ 180°	–7 dB(W/4 kHz)

For ESV operating in the 14-14.5 GHz band, at any angle ϕ specified below, off the main-lobe axis of an earth station antenna, the maximum e.i.r.p. in any direction within 3° of the GSO shall not exceed the following values:

14.0-14.5 GHz

<i>Angle off-axis</i>		<i>Maximum e.i.r.p. per 40 kHz band</i>	
2°	$\leq \phi \leq 7^\circ$	$(33 - 25 \log \phi)$	dB(W/40 kHz)
7°	$< \phi \leq 9.2^\circ$	12	dB(W/40 kHz)
9.2°	$< \phi \leq 48^\circ$	$(36 - 25 \log \phi)$	dB(W/40 kHz)
48°	$< \phi \leq 180^\circ$	-6	dB(W/40 kHz)

RESOLUTION 903 (REV.WRC-19)

Transitional measures for certain broadcasting-satellite/fixed-satellite service systems in the frequency band 2 500-2 690 MHz

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that WRC-07 revised the limits of power flux-density (pfd) from space stations in Article 21, Table 21-4 for the frequency band 2 500-2 690 MHz;
- b) that use of the frequency bands 2 500-2 690 MHz in Region 2 and 2 500-2 535 MHz and 2 655-2 690 MHz in Region 3 by the fixed-satellite service (FSS) is limited to national and regional systems, subject to agreement obtained under No. 9.21 (see Nos. 5.415 and No. 5.2.1);
- c) that in the frequency band 2 520-2 670 MHz, the broadcasting-satellite service (BSS) is limited to national and regional systems, subject to agreement obtained under No. 9.21 (see Nos. 5.416 and No. 5.2.1);
- d) that, in No. 5.384A, the frequency band 2 500-2 690 MHz is identified as one of the frequency bands for use by administrations wishing to implement International Mobile Telecommunications (IMT) in accordance with Resolution 223 (Rev.WRC-19)*;
- e) that, due to the specific national and regional allocation status applied to the space services mentioned above, and the identification for use by administrations wishing to implement IMT, it is advantageous to apply the revised Article 21, Table 21-4 limits in the frequency band 2 500-2 690 MHz at an early date;
- f) that agenda item 1.9 of WRC-07 mentioned a requirement to not place undue constraints on the services to which the frequency band is allocated,

resolves

- 1 that, in the frequency band 2 500-2 690 MHz, space stations of satellite networks listed in the Annex to this Resolution shall not exceed the following pfd values:

$-152 \text{ dB(W/m}^2\text{)}$	for	$\delta < 5^\circ$
$-152 + 0.75 (\delta - 5) \text{ dB(W/m}^2\text{)}$	for	$5^\circ \leq \delta \leq 25^\circ$
$-137 \text{ dB(W/m}^2\text{)}$	for	$\delta > 25^\circ$

in any 4 kHz band, where δ is the angle of arrival above the horizontal plane; the limits in Table 21-4 do not apply;

* *Note by the Secretariat:* This Resolution was revised by WRC-23.

2 that, for systems other than those addressed in *resolves* 1, No. **5.418** and Resolution **539 (Rev.WRC-19)**, the Radiocommunication Bureau (BR) shall examine any coordination and notification information with respect to the provisions Nos. **9.35** and **11.31** (respectively) for frequency assignments in the FSS or BSS received by BR after 14 November 2007 using the pfd limits for the frequency band 2 500-2 690 MHz in Table **21-4** of Article **21**,

instructs the Radiocommunication Bureau

to implement *resolves* 1 and *resolves* 2.

ANNEX TO RESOLUTION 903 (REV.WRC-19)

Notifying administration	Name of space station	Orbital position	Coordination request Special Section	Date of receipt of Advance Publication Information
IND	INSAT-2(74)	74.00 E	CR/C/1311 and CR/C/1311 M1	07.08.85
IND	INSAT-2(83)	83.00 E	CR/C/1312 and CR/C/1312 M1	07.08.85
IND	INSAT-2(93.5)	93.50 E	CR/C/1313 and CR/C/1313 M1	07.08.85

RESOLUTION 906 (REV.WRC-15)

**Electronic submission of notices for terrestrial services
to the Radiocommunication Bureau and exchange of
data between administrations**

The World Radiocommunication Conference (Geneva, 2015),

considering

- a) that the electronic format for submission of notifications concerning terrestrial services under Article **11** and Plans annexed to Regional Agreements has been used by the Radiocommunication Bureau since September 1994;
- b) that, since 8 December 1998, submission of high-frequency broadcasting schedule requirements under Article **12** has been in electronic format only;
- c) that, since 3 June 2001 for space services, all notices and related information submitted to the Radiocommunication Bureau pursuant to Articles **9** and **11** have been submitted in electronic format only;
- d) that, since January 2009, the submission of notices for terrestrial services is done in electronic format only, using the secured ITU web interface WISFAT (Web Interface for the Submission of Frequency Assignments/Allotments to Terrestrial Services) in accordance with Circular Letter CR/297;
- e) that RRC-06 decided that all submissions in the application of Articles 4 and 5 of the GE06 Regional Agreement shall be in electronic format only;
- f) that preparation of notices for terrestrial services in electronic format allows administrations to validate the data prior to submission using Radiocommunication Bureau software tools;
- g) that submission of notices for terrestrial services in electronic format removes the need for the Radiocommunication Bureau to transcribe the data, avoids the potential for the introduction of errors and reduces the data processing effort required by the Radiocommunication Bureau;
- h) that the submission of notices for terrestrial services in electronic format only may require appropriate training on the Radiocommunication Bureau's software tools, especially in developing and least-developed countries;
- i) that, for some administrations, the submission of notices for terrestrial services in electronic format only may require the adaptation of their national procedures and the development of appropriate electronic facilities;
- j) that information in electronic format could be used to fulfil administrations' database requirements and facilitate the exchange of information between administrations and with the Radiocommunication Bureau;
- k) that administrations have the sovereign right to establish bilateral agreements pertaining to cross-border coordination issues, including the definition of the format for the mutual exchange of information;

l) that administrations recognize the importance and requirement of electronic submission of notices for terrestrial services to the Radiocommunication Bureau,

further considering

a) that the use of an electronic format for the submission of notices for terrestrial services to the Radiocommunication Bureau tends to reduce its costs and allows a better publication of data;

b) that the Radiocommunication Bureau makes available free of charge to administrations terrestrial notification software (TerRaNotices) through the distribution of its BR International Frequency Information Circular (BR IFIC) for terrestrial services;

c) that in its Resolution 9 (Rev. Dubai, 2014), on the participation of countries, particularly developing countries, in spectrum management, the World Telecommunication Development Conference 2014 (WTDC-14) recognizes the importance of facilitating access to radiocommunication-related documentation in order to facilitate the task of radio-frequency spectrum managers;

d) that in its Decision 12 (Rev. Busan, 2014), on free online access to ITU publications, the Plenipotentiary Conference instructed the Secretary-General of ITU to prepare a report on an ongoing basis on sales of ITU software and databases, and to present this report to the Council, which will decide on further policies for improving access to ITU publications, software and databases;

e) that an automated spectrum management system would, among other things, facilitate national spectrum management and monitoring, coordination among administrations and notification to the Radiocommunication Bureau;

f) that Recommendation ITU-R SM.1370 provides design guidelines for developing automated spectrum management systems at the national level;

g) that data elements used in national spectrum management for international coordination and notification have been reflected in Appendix 4 of the Radio Regulations and in Recommendation ITU-R SM.1413;

h) that the Radiocommunication Advisory Group has established a task group to review the Radiocommunication Bureau's information systems used for the submission and treatment of notices for terrestrial and space services;

i) the difficulty faced by many countries, particularly developing and least-developed countries, in participating in the activities of ITU-R world radiocommunication seminars and study group meetings dealing with terrestrial services,

resolves

1 that administrations are encouraged to accelerate migration to the use of an electronic format and electronic facilities for the submission of notices to the Bureau and for the exchange of coordination data between administrations;

2 that the format established by ITU-R for electronic notices be considered by administrations for the exchange of information,

instructs the Director of the Radiocommunication Bureau

- 1 to refine, as required, the specification of the electronic format and related software to be used for the submission of notices for terrestrial services;
- 2 to provide assistance, as required, to any administration in the use of the electronic format for the submission of notices for terrestrial services;
- 3 to support developing and least-developed countries while deploying electronic facilities for the submission of electronic notices to the Bureau and for the exchange of coordination data between administrations;
- 4 to include in radiocommunication seminars and regional workshops appropriate training in the use of the electronic format and related software for the submission of notices for terrestrial services.

RESOLUTION 910 (WRC-23)

[Studies on the possible [frequency bands] for [non-beam and beam] wireless power transmission (WPT) to avoid harmful interference to the radiocommunication services caused by WPT]¹

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that wireless power transmission (WPT) is defined as the transmission of power from a power source to an electrical load wirelessly using an electromagnetic field, excluding transmission for radiocommunications;
- b)* that a wide variety of technologies and applications of WPT are evolving, planned, or have already been partly put on the market;
- c)* that such [beam and non-beam] WPT technologies may be useful in a variety of applications, including electric vehicles, Internet of Things (IoT) devices, and wireless charging of mobile or portable devices,

noting

- a)* that ITU Radiocommunication Sector (ITU-R) Study Group 1 is studying, based on Question ITU-R 210/1, the technical and operational requirements to ensure that radiocommunication services are protected from harmful interference caused by WPT operations, and what kind of applications and electric apparatus WPT are considered to be;
- b)* that ITU-R Recommendations on frequency ranges for WPT (Recommendations ITU-R SM.2110, ITU-R SM.2129, and ITU-R SM.2151) have been approved, and further studies on a variety of WPT applications and technologies are ongoing in ITU-R;
- c)* that, according to Nos. **15.12.1** and **15.13.1**, in order to provide protection to radiocommunication services called for in *recognizing c)* administrations should be guided by the latest relevant ITU-R Recommendations;
- d)* that ITU-R Recommendations provide guidance to administrations,

recognizing

- a)* that WPT is not a defined radio service in the Radio Regulations;
- b)* that there are no international regulations to regulate radiation from WPT;

¹ Further discussion is needed on the scope of this agenda item.

- c) that, under Nos. **15.12** and **15.13**, administrations shall take all practicable and necessary steps to ensure that the operation of electrical apparatus or installations, including those for WPT, does not cause harmful interference to a radiocommunication service and, in particular, to a radionavigation or any other safety service;
- d) that some administrations regard WPT as an industrial, scientific and medical (ISM) application defined by the Radio Regulations, and that they apply their current regulations to the ISM applications and equipment;
- e) that some administrations regard WPT equipment as short-range radiocommunication Devices (SRD), and that they apply their current SRD regulations, although SRD is not defined by the Radio Regulations, but it is discussed in some ITU-R Recommendations and Reports;
- f) that, in order not to cause harmful interference to the radiocommunication services, some administrations classify certain applications of WPT as a radio service that is not defined in the Radio Regulations,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2031 world radiocommunication conference

1 technical, operational and impact studies, taking into account the results of already available studies, to consider suitable frequency ranges for harmonized WPT operations;

2 consideration of spectrum matters necessary to ensure the protection of radiocommunication services and the radio astronomy service to which the frequency bands are allocated on a primary and secondary basis, as well as services in the adjacent bands, and those affected by the harmonics,

invites Member States, Sector Members, Academia, and Associates

to participate in the studies by submitting contributions to ITU-R,

invites the 2031 world radiocommunication conference

to consider, based on the results of ITU-R studies, the possible frequency bands for WPT on the basis of avoiding harmful interference to the radiocommunication services caused by WPT.

RECOMMENDATIONS

RECOMMENDATION 7 (REV.WRC-97)

Adoption of standard forms for ship station and ship earth station licences and aircraft station and aircraft earth station licences¹

The World Radiocommunication Conference (Geneva, 1997),

considering

- a)* that the standardization of the licence forms issued to stations installed on board ships and aircraft making international voyages and flights would greatly facilitate the task of inspection of such stations;
- b)* that standard licence forms for ship stations and for aircraft stations would serve as a useful guide to those administrations desiring to improve their existing national licences;
- c)* that standard licence forms could be advantageously used by these administrations as the form of certification specified in No. **18.8**,

considering further

that the Administrative Radio Conference (Geneva, 1959), formulated:

- a)* a set of principles for the draft of a standard licence form (see Annex 1);
- b)* specimens of a ship station licence and of an aircraft station licence (see Annexes 2 and 3),

considering also

changes in radio systems and shipborne radiocommunication equipment introduced in connection with the implementation of the Global Maritime Distress and Safety System (GMDSS),

recommends

- 1 that administrations which find these forms practicable and acceptable should adopt them for international use;
- 2 that administrations should, as far as possible, endeavour to bring their national licence forms into line with these standard forms.

¹ Throughout this Recommendation, references to ship stations may include references to ship earth stations and references to aircraft stations may include references to aircraft earth stations.

ANNEX 1 TO RECOMMENDATION 7 (REV.WRC-97)

Principles for the formulation of standard ship and aircraft station licences

The Administrative Radio Conference (Geneva, 1959), considered that, in formulating standard ship and aircraft station licences, the following set of principles should be applied:

- 1 The licence should, as far as possible, be prepared in tabular form, and each line and column of the table clearly numbered or lettered.
- 2 The licence for ship stations and the licences for aircraft stations should be as similar as possible.
- 3 The size of the licence should be international standard A4.
- 4 The licence should be designed in a form which facilitates its display on board a ship or an aircraft.
- 5 The licence should be printed in Latin characters in the national language of the country which issues it. Those countries whose national language cannot be written in Latin characters should use their national language and, in addition, English, Spanish or French.
- 6 The title “Ship Station Licence” or “Aircraft Station Licence” should appear at the top of the licence in the national language as well as in English, Spanish and French.

These principles were used in formulating the two standard forms which are given in Annexes 2 and 3.

ANNEX 2 TO RECOMMENDATION 7 (REV.WRC-97)

(Full name of the authority issuing the licence, in the national language)

.....*

SHIP STATION LICENCE
LICENCE DE STATION DE NAVIRE
LICENCIA DE ESTACIÓN DE BARCO

No.

Period of validity

In accordance with (*Title of the National Regulation*) and with the Radio Regulations which complement the Constitution and the Convention of the International Telecommunication Union now in force, this authorization is herewith issued for the installation and for the use of the radio equipment described below:

1	2			3	4
Name of ship	Identification of the ship station			Holder of licence	Accounting authority identification code, or additional information including accounting information if required
	Call sign	MMSI	Other identification (optional)		

	Equipment	Type or description of equipment	Frequencies
5	Transmitters		**
6	Other equipment (optional)		

For the Issuing Authority:

.....

Place Date Authentication

* The words “Ship Station Licence” written in the national language, if this is not English, Spanish or French.

** Specifically or by reference to List V, columns 8 and 9.

ANNEX 3 TO RECOMMENDATION 7 (REV.WRC-97)

(Full name of the authority issuing the licence, in the national language)

.....*

AIRCRAFT STATION LICENCE
LICENCE DE STATION D’AÉRONEF
LICENCIA DE ESTACIÓN DE AERONAVE

No.
Period of validity

In accordance with *(Title of the National Regulation)* and with the Radio Regulations which complement the Constitution and the Convention of the International Telecommunication Union now in force, this authorization is herewith issued for the installation and for the use of the radio equipment described below:

1	2	3	4
Nationality and registration mark of the aircraft	Call sign or other identification	Type of aircraft	Owner of aircraft

		a	b	c	d
	Equipment	Type	Power (W)	Class of emission	Frequency bands or assigned frequencies
5	Transmitters				**
6	Survival craft transmitters <i>(when applicable)</i>				**
7	Other equipment	<i>(Optional)</i>			

For the Issuing Authority:

.....
Place Date Authentication

* The words “Aircraft Station Licence” written in the national language, if this is not English, Spanish or French.
** Specifically or by reference.

RECOMMENDATION 8

Relating to automatic identification of stations

The World Administrative Radio Conference (Geneva, 1979),

considering

- a)* Article **19** which allows, where practicable, automatic identification of stations in appropriate services, and under certain circumstances;
- b)* that it is not always feasible or convenient to give manual identification;
- c)* that sources of harmful interference often remain unidentified for long periods, with consequential delay in measures that might be taken to minimize the interference;
- d)* that automatic identification procedures, where appropriate, may help overcome some of the disadvantages of manual identification;
- e)* that automatic transmission of a call sign or other signals may provide a means of identifying some stations for which identification is not always possible, e.g. radio relay and space systems;
- f)* the desirability of fostering a common automatic identification method to facilitate effective implementation of the provisions of Article **19**, as an alternative to the proliferation of many different systems and modulation techniques that might be used for this purpose,

recommends

that the ITU-R study the matter of automatic identification of stations with a view to recommending technical characteristics and methods of implementing a common universal system, including standard modulation techniques, for application in accordance with Article **19**, with due consideration to the needs of the different services and types of stations.

RECOMMENDATION 9

Relating to the measures to be taken to prevent the operation of broadcasting stations on board ships or aircraft outside national territories¹

The World Administrative Radio Conference (Geneva, 1979),

considering

- a)* that the operation of broadcasting stations on board ships or aircraft outside national territories is in conflict with the provisions of Nos. **23.2** and **42.4**;
- b)* that such operation is contrary to the orderly use of the radio-frequency spectrum and may result in chaotic conditions;
- c)* that the operation of such broadcasting stations may take place outside the jurisdiction of Member States, thereby making the direct application of national laws difficult;
- d)* that a particularly difficult legal situation arises when such broadcasting stations are operated on board ships or aircraft not duly registered in any country,

recommends

- 1 that administrations ask their governments to study possible means, direct or indirect, to prevent or suspend such operations and, where appropriate, take the necessary action;
- 2 that administrations inform the Secretary-General of the results of these studies and submit any other information which may be of general interest, so that the Secretary-General can inform Member States accordingly.

¹ WRC-97 made editorial amendments to this Recommendation.

RECOMMENDATION 16 (REV.WRC-19)

Interference management for stations that may operate under more than one terrestrial radiocommunication service

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that radiocommunication services and spectrum allocation aim at achieving international uniformity in spectrum usage in order to simplify interference management rules and promote equitable spectrum access;
- b)* that the principles behind radiocommunication services and spectrum allocation have been adopted since the first Radio Telegraph Conference of Berlin in 1906, where frequency bands were allocated to the maritime service;
- c)* that technological, market and regulatory developments are resulting in significant changes to the radiocommunication environment, especially in bands below 6 GHz;
- d)* that these changes to the radiocommunication environment, and in particular the convergence of services, will make the classification of certain radio stations under existing radiocommunication services increasingly difficult;
- e)* that the issues raised by the convergence of services may not always be addressed through the redefinition of radiocommunication services;
- f)* that previous world radiocommunication conferences (WRCs) have considered the possibility of enhancing the international spectrum regulatory framework in the light of the changing radiocommunication environment;
- g)* that ITU-R studies to enhance the international spectrum management framework have so far been carried out under the traditional framework of radiocommunication services and spectrum allocation only;
- h)* that administrations have adopted, or are in the process of adopting, approaches to spectrum management on a national basis that are not based on the above traditional framework, with a view to improving flexibility and to catering for the changing radiocommunication environment;
- i)* that in order to obtain the required degree of flexibility at national level while not causing harmful interference at international level, these administrations may use No. 4.4 of the Radio Regulations;
- j)* that through the application of No. 4.4, administrations having adopted national spectrum management that is not based on the above traditional framework and that is in derogation of the Table of Frequency Allocations and of the provisions of the Radio Regulations cannot claim protection for their radio stations from cross-border harmful interference, or cause harmful interference to stations operated in conformance with the Radio Regulations by other administrations,

recognizing

- a) that improvement of the international spectrum management framework is a continuous process;
- b) that Article 42 of the Constitution provides that administrations reserve for themselves the right to make special arrangements on telecommunications matters which do not concern Member States in general, so far as this is not in conflict with the provisions of the Constitution, the Convention or the Administrative Regulations, so far as concerns harmful interference which their operation might cause to the radio operations of other Member States,

recommends

that ITU-R study all aspects of interference management resulting from the impact of technical convergence on the radio regulatory environment, involving stations that may operate under more than one terrestrial radiocommunication service, particularly cross-border interference cases, to ensure harmful interference is not caused to stations of other Member States,

invites administrations

to participate actively in the studies by submitting contributions to ITU-R.

RECOMMENDATION 34 (REV.WRC-23)

Principles for the allocation of frequency bands

The World Radiocommunication Conference (Dubai,2023),

considering

- a)* that the Radio Regulations contain an international Table of Frequency Allocations covering the radio-frequency spectrum;
- b)* that it may be desirable, in certain cases, to allocate frequency bands to the most broadly defined services of Article 1 in order to improve flexibility of use but without detriment to other services;
- c)* that the development of common worldwide allocations is desirable in order to improve and harmonize utilization of the radio-frequency spectrum;
- d)* that adherence to these principles for the allocation of spectrum will allow the Table of Frequency Allocations to focus on matters of regulatory significance while enabling greater flexibility in national spectrum use;
- e)* that technological developments occur at a rapid pace and administrations desire to take advantage of such developments to increase spectrum efficiency and facilitate spectrum access;
- f)* that the needs of developing countries need to be taken into account;
- g)* that Recommendation ITU-R SM.1133 provides a guide to the use of broadly-defined services;
- h)* that radiocommunications play a significant role in achieving national, as well as regional and global, priorities, including those found in relevant resolutions of plenipotentiary conferences and world radiocommunication conferences (WRCs),

recognizing

that Resolution **26 (Rev.WRC-23)** provides guidelines for the use of footnotes, including additions, modifications or deletions,

recommends that future world radiocommunication conferences

- 1 should, wherever possible, allocate frequency bands to the most broadly defined services with a view to providing the maximum flexibility to administrations in spectrum use, taking into account safety, technical, operational, economic and other relevant factors;
- 2 should, wherever possible, allocate frequency bands on a worldwide basis (aligned services, categories of service and frequency band limits) taking into account safety, technical, operational, economic and other relevant factors;

3 should, wherever possible, keep the number of footnotes in Article 5 to a minimum when allocating frequency bands through footnotes, in line with Resolution 26 (Rev.WRC-23);

4 should take into account relevant studies by the ITU Radiocommunication Sector (ITU-R) and report(s) of the relevant Conference Preparatory Meeting(s) (CPM), as appropriate, considering also contributions by members, including technical and operational developments, forecasts and usages as per the agenda of the WRC,

recommends administrations

in making proposals to world radiocommunication conferences, to take into account *recommends that future world radiocommunication conferences 1 to 4 and considering a) to g),*

invites administrations

to actively participate in ITU-R studies, providing their technical and operational developments, forecasts and usages,

instructs the Director of the Radiocommunication Bureau and requests the ITU Radiocommunication Sector study groups

1 when carrying out technical studies relating to a frequency band, to examine the compatibility of broadly defined services with the existing utilizations and the possibility of aligning allocations on a worldwide basis, having regard to *considering a) to g) and recommends that future world radiocommunication conferences 1 to 4 above;*

2 to conduct the studies with the participation of the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO), the World Meteorological Organization (WMO) and other international organizations concerned, where appropriate;

3 to submit a report to future world radiocommunication conferences containing the results of these studies,

invites the ITU Radiocommunication Sector

to identify areas for study and to undertake the studies necessary to determine the impact on existing services of those agenda items of future world radiocommunication conferences which involve broadening the scope of existing service allocations,

instructs the Secretary-General

to communicate this Recommendation to ICAO, IMO, WMO and other international organizations concerned, where appropriate,

invites the Director of the Radiocommunication Bureau

to bring this Recommendation to the attention of the ITU Telecommunication Standardization and Telecommunication Development Sectors.

RECOMMENDATION 36 (REV.WRC-19)

**Role of international monitoring in reducing apparent congestion
in the use of orbit and spectrum resources**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that the geostationary-satellite orbit and the radio-frequency spectrum are limited natural resources and are being increasingly utilized by space services;
- b)* the desirability of achieving a more effective use of the geostationary-satellite orbit and radio-frequency spectrum in order to assist administrations in satisfying their requirements and, to that end, the desirability of taking steps to make the Master International Frequency Register reflect more accurately the actual use being made of these resources;
- c)* that monitoring information should assist ITU-R in discharging this function;
- d)* that facilities for monitoring of emissions originating from space stations are expensive,

recognizing

that an international monitoring system cannot be fully effective unless it covers all areas of the world,

invites ITU-R

to study and make recommendations concerning the facilities required to provide adequate coverage of the world with a view to ensuring efficient use of resources,

invites administrations

- 1 to make every effort to provide monitoring facilities as envisaged in Article 16;
- 2 to inform ITU-R of the extent to which they are prepared to cooperate in such monitoring programmes as may be requested by ITU-R;
- 3 to consider the various aspects of monitoring emissions originating from space stations to enable the provisions of Articles 21 and 22 to be applied.

RECOMMENDATION 37 (REV.WRC-23)

Operational procedures for earth stations on board vessels (ESVs) use

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that under the provisions of Resolution **902 (Rev.WRC-23)** transmissions from ESVs within the distances defined in item 4 of Annex 1 of Resolution **902 (Rev.WRC-23)** should be based upon prior agreement of concerned administrations;
- b)* that it is desirable to provide guidance on activities to achieve such prior agreement with concerned administrations;
- c)* that such guidance should include the operational procedures for ESV use,

recommends

that operation of ESVs follow the procedures set forth in the Annex.

ANNEX 1 TO RECOMMENDATION 37 (REV.WRC-23)

Operational procedures for earth stations on board vessels (ESV) use**A Initiation of contact**

The ESV licensing administration or the licence-holder should contact, in advance of ESV operations within the minimum distances, the concerned administration(s) to obtain agreements that will establish the technical bases for avoiding unacceptable interference to the terrestrial facilities of the concerned administration or administrations.

The minimum distances and concerned administrations are defined in items 4 and 5 of Annex 1 of Resolution **902 (Rev.WRC-23)**, respectively.

B Recommended actions of licensing administrations, licence-holders and concerned administrations

- The licensing administration or the licence-holder should provide the technical and operational parameters required by the concerned administration, among them, if required, information on the movement of the ship(s) equipped with ESVs within the minimum distances.

- Concerned administrations that wish to permit the operation of ESVs should determine if they have terrestrial stations that could be affected by ESV operations with a view to identifying possible frequencies for ESV use that would avoid potential interference.

C Frequency use arrangements

National practices, as well as applicable Recommendations of ITU-R (such as ITU-R S.1587, ITU-R SF.1585, ITU-R SF.1648, ITU-R SF.1649, ITU-R SF.1650), may be used in reaching frequency usage arrangements.

D Avoidance of unacceptable interference

According to Annex 1 of Resolution **902 (Rev.WRC-23)** the ESV licensing administration shall ensure that such stations do not cause unacceptable interference to the services of other concerned administrations. In the event that unacceptable interference occurs, the licence-holder must eliminate the source of any interference from its station immediately upon being advised of such interference. Additionally, the licence-holder shall immediately terminate transmissions at the request of either the concerned administration or the ESV licensing administration if either administration determines that the ESV is causing unacceptable interference or is otherwise not being operated in compliance with the operating agreement.

RECOMMENDATION 63 (REV.WRC-19)

**Relating to the provision of formulae and examples for
the calculation of necessary bandwidths**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that Appendix 1, Section I requires that the necessary bandwidth be part of the full designation of emissions;
- b)* that Recommendation ITU-R SM.1138, gives a partial list of examples and formulae for the calculation of the necessary bandwidth of some typical emissions;
- c)* that sufficient information is not available for the determination of the *K*-factors used throughout the table of examples of the necessary bandwidth in Recommendation ITU-R SM.1138;
- d)* that, especially with regard to the efficient utilization of the radio-frequency spectrum, monitoring and the notification of emissions, it is required that necessary bandwidths for the individual classes of emission be known;
- e)* that for reasons of simplification and international uniformity it is desirable that measurements for determining the necessary bandwidth be made as seldom as possible,

recommends that ITU-R

- 1 provide, from time to time, additional formulae for the determination of necessary bandwidth for common classes of emission, as well as examples to supplement those given in Recommendation ITU-R SM.1138;
- 2 study and provide values of supplementary *K*-factors required for the calculation of the necessary bandwidth for common classes of emission,

invites the Radiocommunication Bureau

to publish examples of such calculations in the Preface to the International Frequency Information Circular (BR IFIC).

RECOMMENDATION 71

Relating to the standardization of the technical and operational characteristics of radio equipment¹

The World Administrative Radio Conference (Geneva, 1979),

considers

- a) that administrations are confronted with the necessity of allocating increasing resources to the regulation of radio equipment performance;
- b) that administrations, and in particular those in developing countries, often have difficulty in providing such resources;
- c) that it would be of advantage to apply, as far as practicable, any mutually agreed standards and associated type approvals;
- d) that a number of international bodies including the ITU-R, International Civil Aviation Organization (ICAO), International Maritime Organization (IMO), International Special Committee on Radio Interference (CISPR) and the International Electrotechnical Commission (IEC) already provide recommendations and standards for technical and operating characteristics applicable to equipment performance and its measurement;
- e) that in this context the specific requirements of developing countries have not always been taken fully into account,

recommends

- 1 that administrations endeavour to cooperate with a view to establishing international performance specifications and associated measuring methods that could be used as models for domestic standards for radio equipment;
- 2 that such international performance specifications and associated measuring methods respond to widely representative conditions including specific requirements of developing countries;
- 3 that, when such international performance specifications for radio equipment exist, administrations, as far as practicable, adopt these specifications as a basis for their national standards;
- 4 that administrations consider as far as practicable mutual acceptance for the type approval of equipment which conforms to such performance specifications.

¹ WRC-97 made editorial amendments to this Recommendation.

RECOMMENDATION 75 (REV.WRC-15)

Study of the boundary between the out-of-band and spurious domains of primary radars using magnetrons

The World Radiocommunication Conference (Geneva, 2015),

considering

- a)* that the principal objective of Appendix 3 is to specify the maximum permitted level of unwanted emissions in the spurious domain;
- b)* that the out-of-band and spurious domains of an emission are defined in Article 1;
- c)* that Recommendation ITU-R SM.1541 specifies the boundary between the out-of-band and spurious domains for primary radars, and that the boundary is related to the emission mask based on the –40 dB bandwidth;
- d)* that Appendix 3 refers to Recommendation ITU-R SM.1541;
- e)* that Recommendation ITU-R M.1177 describes the techniques for measurement of unwanted emissions of radars,

recognizing

that there is a possibility that calculated values for the –40 dB bandwidth related to unwanted emissions of primary radars using magnetrons underestimate the actual bandwidth,

recommends

that ITU-R study calculation methods for the –40 dB bandwidth necessary for the determination of the boundary between the spurious and out-of-band domains of primary radars using magnetrons,

invites administrations

to participate actively in the above studies by submitting contributions to ITU-R.

RECOMMENDATION 76 (WRC-12)

Deployment and use of cognitive radio systems

The World Radiocommunication Conference (Geneva, 2012),

considering

- a)* that a cognitive radio system (CRS) is defined as *a radio system employing technology that allows the system to obtain knowledge of its operational and geographical environment, established policies and its internal state; to dynamically and autonomously adjust its operational parameters and protocols according to its obtained knowledge in order to achieve predefined objectives; and to learn from the results obtained* (Report ITU-R SM.2152);
- b)* that a method of spectrum management to be used for aiding frequency assignment for terrestrial services in border areas can be found in Recommendation ITU-R SM.1049;
- c)* that ITU-R is studying the implementation and use of CRS in accordance with Resolution ITU-R 58;
- d)* that studies on regulatory measures related to the implementation of CRS are outside the scope of Resolution ITU-R 58;
- e)* that there are plans to deploy CRS in some radiocommunication services,

recognizing

- a)* that any radio system implementing CRS technology needs to operate in accordance with the provisions of the Radio Regulations;
- b)* that the use of CRS does not exempt administrations from their obligations with regard to the protection of stations of other administrations operating in accordance with the Radio Regulations;
- c)* that CRSs are expected to provide flexibility and improved efficiency to overall spectrum use,

recommends

that administrations participate actively in the ITU-R studies conducted under Resolution ITU-R 58, taking into account *recognizing a) and b)*.

RECOMMENDATION 100 (REV.WRC-03)

Preferred frequency bands for systems using tropospheric scatter

The World Radiocommunication Conference (Geneva, 2003),

considering

- a)* the technical and operational difficulties pointed out by Recommendation ITU-R F.698 in the frequency bands shared by tropospheric scatter systems, space systems and other terrestrial systems;
- b)* the additional allocation of frequency bands made by WARC-79 and WARC-92 for the space services in view of their increasing development;
- c)* that the Radiocommunication Bureau requires administrations to supply specific information on systems using tropospheric scatter in order to verify compliance with certain provisions of the Radio Regulations (such as Nos. **5.410** and **21.16.3**),

recognizing nevertheless

that, to meet certain telecommunication requirements, administrations will wish to continue using tropospheric scatter systems,

noting

that the proliferation of such systems in all frequency bands and particularly in those shared with space systems is bound to aggravate an already difficult situation,

recommends that administrations

- 1 for the assignment of frequencies to new stations in systems using tropospheric scatter, take into account the latest information prepared by ITU-R to ensure that systems established in the future use a limited number of certain frequency bands;
- 2 in frequency assignment notifications to the Bureau, indicate expressly whether they relate to stations of tropospheric scatter systems.

RECOMMENDATION 206 (REV.WRC-23)

**Studies on the possible use of integrated mobile-satellite service
and ground component systems in the frequency bands 1 525-1 544 MHz,
1 545-1 559 MHz, 1 626.5-1 645.5 MHz and 1 646.5-1 660.5 MHz**

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that mobile-satellite service (MSS) systems may provide service to a wide area;
- b)* that integrated MSS systems employ a satellite component and a ground component where the ground component is complementary to the satellite component and operates as, and is, an integral part of the MSS system. In such systems, the ground component is controlled by the satellite resource and network management system. Further, the ground component uses the same portions of MSS frequency bands as the associated operational mobile-satellite system;
- c)* that MSS systems have a limited capacity for providing reliable radiocommunication services in urban areas on account of natural or man-made obstacles and that the ground component of an integrated MSS system can mitigate blockage areas, as well as allow for indoor service coverage;
- d)* that MSS systems can improve coverage of rural areas, thus being one element that can bridge the digital divide in terms of geography;
- e)* that MSS systems are suitable for public protection and disaster relief communications, as stated in Resolution **646 (Rev.WRC-19)**;
- f)* that the frequency bands 1 525-1 544 MHz, 1 545-1 559 MHz, 1 626.5-1 645.5 MHz and 1 646.5-1 660.5 MHz are allocated on a primary basis to the mobile-satellite service and to other services but that none of these bands are allocated to the mobile service on a primary basis except by country footnote;
- g)* that within their territories in some of the frequency bands identified in *considering f)*, some administrations have authorized or plan to authorize integrated MSS systems;
- h)* that ITU-R has performed frequency sharing studies and has determined that the coexistence between independent systems in the MSS and systems in the mobile services in the same spectrum without harmful interference is not feasible in the same or adjacent geographical area,

recognizing

- a)* that ITU-R has not performed studies on sharing, technical or regulatory issues with regard to integrated MSS systems, but that some administrations have performed such studies;

b) that the radionavigation-satellite service in the 1 559-1 610 MHz band and the radio astronomy service in the frequency bands 1 610.6-1 613.8 MHz and 1 660-1 670 MHz need to be protected from harmful interference;

c) that the MSS in the 1 525-1 559 MHz and 1 626.5-1 660.5 MHz bands needs to be protected from harmful interference that may be caused due to co-channel and/or adjacent channel operation of the ground component of integrated MSS systems;

d) that Nos. **5.353A** and **5.357A** are applicable to MSS systems in different portions of the frequency bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz with respect to the spectrum requirements and prioritization of communications for the Global Maritime Distress and Safety System and the aeronautical mobile-satellite (R) service;

e) that, subject to satisfactory measures being taken to protect RNSS systems, integrated MSS systems may be deployed in the 1 980-2 010 MHz, 2 170-2 200 MHz, 2 483.5-2 500 MHz bands in all three Regions and also in the 2 010-2 025 MHz band in Region 2, all of which bands are allocated both to the MSS and MS services, without the need for ITU-R studies,

noting

a) that the combined wide-area and urban coverage capabilities of integrated MSS systems may contribute to meeting the particular needs of developing countries;

b) that some administrations that are planning to implement or are implementing integrated systems within their national territories have imposed limitations, in rules and authorization actions, on the e.i.r.p. density that the ground component of such systems may produce into bands allocated to the radionavigation-satellite service;

c) that there are a limited number of frequency bands allocated to the MSS, that these bands are already congested, and that the introduction of integrated ground components may in some instances make spectrum access for other MSS systems more difficult;

d) that administrations implementing integrated MSS systems may provide, in bilateral consultations of administrations, information on system characteristics of the ground component,

recommends

to invite ITU-R to conduct studies on the possible use of integrated MSS systems in the frequency bands 1 525-1 544 MHz, 1 545-1 559 MHz, 1 626.5-1 645.5 MHz and 1 646.5-1 660.5 MHz, as appropriate, taking into account the need to protect existing and planned systems, as well as the above *considering, recognizing and noting*, and in particular *recognizing a), b) and c)*,

invites administrations

to participate as necessary in the ITU-R studies taking into account *recognizing a)*.

RECOMMENDATION 207 (REV.WRC-19)

Future IMT systems

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that the future development of IMT is being studied by ITU-R in accordance with Recommendations ITU-R M.1645 and ITU-R M.2083, and further Recommendations are to be developed for IMT;
- b)* that the future development of IMT for 2020 and beyond is foreseen to address the need for higher data rates, corresponding to user needs, as appropriate, than those of currently deployed IMT systems;
- c)* the need to define the requirements associated with ongoing enhancement of future IMT systems,

noting

- a)* the ongoing relevant studies by ITU-R on IMT-2020, in particular the outputs from Question ITU-R 229/5;
- b)* the need to take into consideration requirements of applications of other services,

recommends

to invite ITU-R to study as necessary technical, operational and spectrum related issues to meet the objectives of future development of IMT systems.

RECOMMENDATION 208 (WRC-19)

**Harmonization of frequency bands for evolving
Intelligent Transport Systems applications
under mobile-service allocations**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that information and communication technologies are integrated in a vehicle system to provide evolving Intelligent Transport Systems (ITS) communication applications for the purpose of improving traffic management and assisting safer driving;
- b)* that there is a need for consideration of spectrum harmonization for evolving ITS applications, which are being used globally or regionally;
- c)* that there is a need to integrate various technologies, including radiocommunications, into land transportation systems;
- d)* that many new connected vehicles use intelligent technologies in the vehicles' combined advanced traffic-management, advanced traveller-information, advanced public transportation-management and/or advanced fleet-management systems to improve traffic management;
- e)* that future vehicular radiocommunication technologies and ITS broadcast systems are emerging;
- f)* that some frequency bands harmonized for ITS are also allocated to the fixed-satellite service (FSS) (Earth-to-space), which under certain circumstances may cause potential interference to ITS stations while in close proximity,

recognizing

- a)* that harmonized spectrum and international standards facilitate worldwide deployment of evolving ITS radiocommunications and provide for economies of scale in bringing evolving ITS equipment and services to the public;
- b)* that the use of frequency bands harmonized for evolving ITS, or parts thereof, does not preclude the use of these bands/frequencies by any other application of the services to which they are allocated and does not establish priority in the Radio Regulations;
- c)* that in those harmonized frequency bands or parts thereof for evolving ITS, there are existing services whose protection needs to be ensured;
- d)* that evolving ITS also becomes important in helping to reduce road traffic problems such as congestion and accidents;
- e)* that ITU-R studies on evolving ITS technologies are meant to address road safety and efficiency-related matters,

noting

- a) that the ITU-R Recommendations on ITS are Recommendations ITU-R M.1452, M.1453, M.1890, M.2057, M.2084 and M.2121;
- b) that the ITU-R Reports on ITS are Reports ITU-R M.2228, M.2322, M.2444 and M.2445;
- c) that some administrations have deployed or are considering deployment of radiocommunication local area networks in some frequency bands recommended for evolving ITS,

recommends

- 1 that administrations consider using globally or regionally harmonized frequency bands, or parts thereof, as described in the most recent versions of Recommendations (e.g. ITU-R M.2121), when planning and deploying evolving ITS applications, taking into account *recognizing b)* above;
- 2 that administrations take into account, if necessary, coexistence issues between ITS stations and stations of existing services (e.g. FSS earth stations), taking into account *considering f)*,

invites Member States and Sector Members

to participate actively in and to contribute to ITU-R studies on aspects of ITS and evolving ITS (e.g. connected vehicles, autonomous vehicles, adaptive driver assistance systems), through the ITU-R study groups,

instructs the Secretary-General

to bring this Recommendation to the attention of relevant international and regional organizations, in particular standards development organizations, dealing with ITS.

RECOMMENDATION 316 (REV.WRC-19)

**Use of ship earth stations within harbours and other waters
under national jurisdiction**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

recognizing

that permitting the use of ship earth stations within harbours and other waters under national jurisdiction belongs to the sovereign right of countries concerned,

recalling

that a number of frequency bands have been allocated to the mobile-satellite service and maritime mobile-satellite service and can be used for maritime-related communications via ship earth stations,

considering

a) that the maritime mobile-satellite service, which is at present in operation worldwide, has improved maritime communications greatly and has contributed much to the safety and efficiency of ship navigation, and that fostering and developing the use of that service in future will contribute further to their improvement;

b) that the maritime mobile-satellite service plays an important role in the Global Maritime Distress and Safety System (GMDSS),

recommends

that all administrations should permit, to the extent possible, ship earth stations to operate within harbours and other waters under national jurisdiction, in the frequency bands used for the GMDSS.

RECOMMENDATION 401

Relating to the efficient use of aeronautical mobile (R) worldwide frequencies

The World Administrative Radio Conference (Geneva, 1979),

considering

that WARC-Aer2 allotted a limited number of worldwide frequencies for exercising control over regularity of flight and for safety of aircraft,

recommends to administrations

1 that the number of HF aeronautical stations on the worldwide channels should be kept to a minimum consistent with the economic and efficient use of frequencies;

2 that, if possible and practicable, one such station should serve aircraft operating agencies in adjacent countries and there should not normally be more than one station per country.

RECOMMENDATION 503 (REV.WRC-19)

High-frequency broadcasting

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) the congestion in the HF broadcasting bands;
- b) the extent of co-channel and adjacent-channel interference;
- c) that AM reception quality is relatively poor compared with FM broadcast or CD quality;
- d) that new digital techniques have enabled significant improvements in reception quality to be obtained in other broadcasting bands;
- e) that the introduction of digital modulation systems in the broadcasting bands below 30 MHz has been shown to be feasible using low bit-rate coding;
- f) that Resolution **517 (Rev.WRC-19)** invites ITU-R to continue its studies on digital techniques in HF broadcasting, with a view to assisting the development of this technology for future use;
- g) that studies on this subject are currently being carried out by ITU-R, with a view to issuing a relevant Recommendation,

recognizing

- a) that the implementation of an ITU-recommended worldwide system for digital sound in the HF bands would be extremely beneficial, particularly for developing countries, since it allows for:
 - mass-scale production resulting in receivers as economical as possible;
 - more economical analogue-to-digital conversion of existing transmitting infrastructures;
- b) that the above system would result in digital receivers having a number of advanced features such as assisted tuning, improved audio quality and robustness to co-channel and adjacent-channel interference, which would greatly contribute to a better spectrum utilization,

recommends administrations

- 1 to draw the attention of manufacturers to this matter, in order to ensure that future digital receivers take full advantage of the advanced technology while maintaining low cost;
- 2 to encourage manufacturers to monitor closely the development of the studies carried out by ITU-R, with a view to starting mass production of new low-cost digital receivers as soon as possible after the approval of relevant ITU-R Recommendation(s).

RECOMMENDATION 506

**Relating to the harmonics of the fundamental frequency of
broadcasting-satellite stations¹**

The World Administrative Radio Conference (Geneva, 1979),

considering

- a)* that the frequency band 23.6-24 GHz is allocated to the radio astronomy service on a primary basis;
- b)* that the second harmonic of the fundamental frequency of broadcasting-satellite stations operating within the band 11.8-12 GHz may seriously disturb radio astronomy observations in the band 23.6-24 GHz if effective steps are not taken to reduce the level of this harmonic,

in view of

the provisions of No. **3.8**,

recommends

that, when defining the characteristics of their space stations operating in the broadcasting-satellite service, particularly within the band 11.8-12 GHz, administrations take all necessary steps to reduce the level of the second harmonic below the values indicated in the relevant ITU-R Recommendations.

¹ WRC-97 made editorial amendments to this Recommendation.

RECOMMENDATION 520 (WARC-92)

Elimination of HF broadcasting on frequencies outside the HF bands allocated to the broadcasting service

The World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum (Malaga-Torremolinos, 1992),

considering

- a)* that there is an increasing number of HF broadcasting stations operating on frequencies outside the bands allocated to the broadcasting service;
- b)* that the common use of the HF bands by the broadcasting and other services, without the relevant allocations or detailed regulations, results in inefficient use of the frequency spectrum;
- c)* that such use has led to harmful interference;
- d)* that this Conference has allocated additional spectrum to the broadcasting service in the HF bands,

recommends

that administrations shall take practicable steps to eliminate HF broadcasting outside the HF bands allocated to the broadcasting service.

RECOMMENDATION 522 (WRC-97)

Coordination of high-frequency broadcasting schedules in the bands allocated to the broadcasting service between 5 900 kHz and 26 100 kHz

The World Radiocommunication Conference (Geneva, 1997),

considering

- a)* that Article 12 establishes the principles and the procedure for use of the frequency bands allocated to the HF broadcasting service between 5 900 kHz and 26 100 kHz;
- b)* that the aforementioned principles stipulate, *inter alia*, that the procedure should promote the development of a voluntary coordination process among administrations to resolve incompatibilities;
- c)* that the procedure itself encourages administrations to coordinate their schedules with other administrations as far as possible prior to submission;
- d)* that the development of coordination among administrations with the assistance of the Radiocommunication Bureau, when requested, would result in better use of the spectrum allocated to the HF broadcasting service between 5 900 kHz and 26 100 kHz,

recognizing

- a)* that the participation of broadcasting organizations in this coordination process would make the task of resolving incompatibilities easier;
- b)* that multilateral coordination of the use of the HF broadcasting bands is already practised on an informal basis in various regional coordination groups¹,

recommends administrations

to promote, as far as possible, regular coordination of their broadcasting schedules within appropriate regional coordination groups of administrations or broadcasting organizations in order to resolve or reduce incompatibilities, through bilateral or multilateral meetings or by correspondence (telephone, facsimile, e-mail, etc.).

¹ Not related to the ITU Regions.

RECOMMENDATION 608 (REV.WRC-07)

**Guidelines for consultation meetings established in
Resolution 609 (Rev.WRC-07)**

The World Radiocommunication Conference (Geneva, 2007),

considering

- a)* that in accordance with the Radio Regulations (RR), the band 960-1 215 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS) in all the ITU Regions;
- b)* that WRC-2000 introduced a co-primary allocation for the radionavigation-satellite service (RNSS) in the frequency band 1 164-1 215 MHz (subject to the conditions specified under No. **5.328A**), with a provisional limit on the aggregate power flux-density (pfd) produced by all the space stations within all radionavigation-satellite systems at the Earth's surface of $-115 \text{ dB(W/m}^2\text{)}$ in any 1 MHz band for all angles of arrival;
- c)* that WRC-03 revised this provisional limit and decided that the level of $-121.5 \text{ dB(W/m}^2\text{)}$ in any 1 MHz for the aggregate equivalent pfd (epfd) applying for all the space stations within all RNSS systems, taking into account the reference worst-case ARNS system antenna characteristics described in Annex 2 of Recommendation ITU-R M.1642-2, is adequate to ensure the protection of the ARNS in the band 1 164-1 215 MHz;
- d)* that WRC-03 decided that to achieve the objectives in *resolves* 1 and 2 of Resolution **609 (Rev.WRC-07)**, administrations operating or planning to operate RNSS systems will need to agree cooperatively through consultation meetings to achieve the level of protection for ARNS systems, and shall establish mechanisms to ensure that all potential RNSS system operators are given full visibility of the process but that only real systems are taken into account in the calculation of the aggregate epfd,

recommends

- 1 that in the implementation of *resolves* 5 of Resolution **609 (Rev.WRC-07)**, in the frequency band 1 164-1 215 MHz, the maximum pfd produced at the surface of the Earth by emissions from a space station in the RNSS, for all angles of arrival, should not exceed $-129 \text{ dB(W/m}^2\text{)}$ in any 1 MHz band under free space propagation conditions;
- 2 that the RNSS characteristics listed in the Annex 1, used when applying the methodology contained in Recommendation ITU-R M.1642-2, as well as the calculated aggregate epfd in $\text{dB(W/m}^2\text{)}$ in each 1 MHz in the range 1 164-1 215 MHz, should be made available in electronic format by the consultation meetings.

ANNEX 1 TO RECOMMENDATION 608 (REV.WRC-07)

**List of RNSS system characteristics and format of the result of the aggregate
epfd calculation to be provided to the Radiocommunication Bureau
for publication for information**

I RNSS systems characteristics**I-1 RNSS ITU publication reference**

RNSS network name	Network ID	ITU Publication reference	IFIC
		AR11/A/...	
		API/A/...	
		AR11/C/...	
		CR/C/...	

I-2 Non-GSO satellite system constellation parameters

For each non-GSO satellite system, the following constellation parameters should be provided to the Bureau for publication for information:

- N : number of space stations of the non-GSO system
- K : number of orbital planes
- h : satellite altitude above the Earth (km)
- I : inclination angle of the orbital plane above the Equator (degrees).

Satellite index I	RAAN Ω_{i0} (degrees)	Argument of latitude E_{i0} (degrees)
1	...	...
2	...	...
...	...	...
N	...	...

I-3 GSO satellite system longitude

For each GSO satellite network, the satellite longitude should be provided to the Bureau for publication for information, as follows:

- LonGSO _{i} : longitude of each of the GSO satellites (degrees).

I-4 Maximum non-GSO space station pfd versus the elevation angle at the Earth's surface (worst 1 MHz)

For the non-GSO satellite system space stations, the maximum pfd in the worst 1 MHz versus elevation angle should be provided to the Bureau for publication for information in a table format as follows:

Elevation angle (each 1°)	pfd (dB(W/(m ² · MHz)))
−4	pfd (−4°)
−3	pfd (−3°)
...	...
...	...
90	pfd (−90°)

I-5 Maximum GSO space station pfd versus latitude and longitude at the Earth's surface (worst 1 MHz)

For each GSO satellite network space station, the maximum pfd in the worst 1 MHz, defined as the 1 MHz in which the pfd of the signal is maximum versus latitude and longitude should be provided to the Bureau for publication for information in a table format as follows:

Longitude (each 1°)	0	1	...	360
Latitude (each 1°)	Maximum pfd dB(W/m ²) in worst 1 MHz			
−90	pfd (0, −90)	...	...	...
−89	...	...	...	...
...	...	...	...	...
...	...	...	...	...
90	...	...	...	pfd (360, 90)

I-6 Spectrum for GSO satellite networks or non-GSO satellite systems

For each GSO satellite network or non-GSO satellite system, the level of spectrum emission in each 1 MHz relative to the spectrum value at the worst 1 MHz of the whole band (1 164-1 215 MHz) should also be provided to the Bureau for publication for information.

II Results of the aggregate epfd calculation in the worst 1 MHz of the 1 164-1 215 MHz band

Maximum aggregate epfd in dB(W/m²) in the worst-case megahertz in the range 1 164-1 215 MHz.

RECOMMENDATION 622 (WRC-97)

**Use of the frequency bands 2 025-2 110 MHz and 2 200-2 290 MHz
by the space research, space operation, Earth exploration-satellite,
fixed and mobile services**

The World Radiocommunication Conference (Geneva, 1997),

considering

- a)* that the bands 2 025-2 110 MHz and 2 200-2 290 MHz are allocated on a primary basis to the space research, space operation, Earth exploration-satellite, fixed and mobile services;
- b)* that, in response to Resolutions from the 1992 Conference (WARC-92), studies have resulted in a number of ITU-R Recommendations, which, when adhered to by the services, will result in a stable, long-term sharing environment (Recommendations ITU-R SA.364, ITU-R SA.1019, ITU-R F.1098, ITU-R SA.1154, ITU-R F.1247, ITU-R F.1248, ITU-R SA.1273, ITU-R SA.1274 and ITU-R SA.1275);
- c)* that this Conference adopted No. **5.391** which states that high-density mobile systems shall not be introduced in these frequency bands,

considering further

that enhancements in technology may enable the services mentioned in *considering a)* to minimize the total bandwidth requirement in these frequency bands,

noting

that WARC-92 considered that it is desirable to review the present and planned use of the frequency bands 2 025-2 110 MHz and 2 200-2 290 MHz, with the intent, where practicable, of satisfying some space mission requirements in bands above 20 GHz,

recognizing

that there are increasing requirements for emerging communication systems which need to be satisfied in the frequency range below 3 GHz,

recommends

that administrations planning to introduce new systems in the space research, space operation, earth exploration-satellite, fixed or mobile services in the bands 2 025-2 110 MHz and 2 200-2 290 MHz take into account the ITU-R Recommendations referred to in *considering b)* above when making assignments to these services, and implement enhancements in technology as early as practicable with a view to minimizing the total bandwidth required by systems of each service.

RECOMMENDATION 707 (REV.WRC-23)

Relating to the use of the frequency band 32.3-33 GHz shared between the inter-satellite service and the radionavigation service

The World Radiocommunication Conference (Dubai, 2023),

considering

- a)* that the band 32.3-33 GHz is allocated to the inter-satellite service and the radionavigation service;
- b)* that there are safety aspects associated with the radionavigation service;
- c)* that No. **5.548** has been incorporated into Article **5**;
- d)* that Recommendation ITU-R S.1151 provides the criteria for sharing between the inter-satellite service and the radionavigation service at 33 GHz,

recommends

that a future competent world radiocommunication conference consider the result of the ITU-R studies referred to in *considering d)* above with a view to the inclusion of such sharing criteria in Article **21**.

RECOMMENDATION 724 (WRC-07)

**Use by civil aviation of frequency allocations on a primary basis
to the fixed-satellite service**

The World Radiocommunication Conference (Geneva, 2007),

considering

- a)* that remote and rural areas often still lack a terrestrial communication infrastructure that meets the evolving requirements of modern civil aviation;
- b)* that the cost of providing and maintaining such an infrastructure could be expensive, particularly in remote regions;
- c)* that satellite communication systems operating in the fixed-satellite service (FSS) may be the only medium to satisfy the requirements of the International Civil Aviation Organization's (ICAO) communication, navigation, surveillance and air traffic management (CNS/ATM) systems, where an adequate terrestrial communication infrastructure is not available;
- d)* that the use of VSAT systems, operating in the FSS and being deployed on a large scale in aeronautical communications, has the potential to significantly enhance communications between air traffic control centres as well as with remote aeronautical stations;
- e)* that establishing and utilizing satellite communication systems for civil aviation would also bring benefits for developing countries and countries with remote and rural areas by enabling the use of VSAT systems for non-aeronautical communications;
- f)* that in the cases identified in *considering e)* it is necessary to draw attention to the importance of aeronautical communications as opposed to non-aeronautical communications,

noting

- a)* that the FSS is not a safety service;
- b)* that Resolution **20 (Rev.WRC-03)** resolves to instruct the Secretary-General "to encourage ICAO to continue its assistance to developing countries which are endeavouring to improve their aeronautical telecommunications ...",

recommends

- 1 that administrations, in particular in developing countries and in countries with remote and rural areas, recognize the importance of VSAT operations to the modernization of civil aviation telecommunications systems and encourage the implementation of VSAT systems that could support both aeronautical and other communication requirements;
- 2 that administrations in developing countries be encouraged, to the maximum extent possible and as necessary, to expedite the authorization process to enable aeronautical communications using VSAT technology;

3 that arrangements should be made to provide for urgent service restoration or alternative routing in case of a disruption of a VSAT link associated with the aeronautical communications;

4 that administrations implementing VSAT systems in accordance with *recommends* 1 to 3 should do so in satellite networks operating in frequency bands with a primary allocation to the satellite services;

5 to invite ICAO, noting Resolution **20 (Rev.WRC-03)**, to continue its assistance to developing countries to improve their aeronautical telecommunications, including interoperability of VSAT networks, and provide guidance to developing countries on how they could best use VSAT technology for this purpose,

requests the Secretary-General

to bring this Recommendation to the attention of ICAO.

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