Radio Regulations

Resolutions and Recommendations

3

Edition of 2020

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Disclaimer

The designations employed and the presentation of material in this Publication do not imply the expression of any opinion whatsoever on the part of ITU and of the Secretariat of the ITU concerning the legal status of the countries, territories, cities or areas or their authorities, or concerning the delimitation of their frontiers or boundaries.

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 Radiocommunication Conferences of 1995 (WRC-95), 1997 (WRC-97), 2000 (WRC-2000), 2003 (WRC-03), 2007 (WRC-07), 2012 (WRC-12), 2015 (WRC-15) and 2019 (WRC-19). The majority of the provisions of these Regulations shall enter into force as from 1 January 2021; 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 2020, the Secretariat corrected the typographical errors that were drawn to the attention of WRC-19 and which were approved by WRC-19.

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)" or "(WRC-19)"). 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-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-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)" or "WRC-19)"), 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-19)**") if not explicitly described in the text (e.g. Appendix **4** as modified by WRC-19). In the texts of Appendices that were partially modified by WRC-19, the provisions that were modified by WRC-19 are indicated with the abbreviation "(WRC-19)" 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, 2023[1]

[1] The date of this conference has not been finalized.

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RESOLUTIONS

RESOLUTION 1 (REV.WRC-97)

Notification of frequency assignments[1]

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 orbits[1]

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 station[2] 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 station[2] 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 station[2], 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 station[2] 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 prejudge in any way the decisions of future radiocommunication conferences,

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[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-15)

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

The World Radiocommunication Conference (Geneva, 2015),

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 Union of National Radio and Television Organizations of Africa (URTNA)* 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;

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.

* *Note by the Secretariat*: In 2006, this Union was transformed into a new Union, under the name "The African Union of Broadcasting (AUB)".

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 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-19)

Assistance and support to Palestine

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

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. 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 rebuilding its telecommunication networks;

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. 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. 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. Dubai, 2018), 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,

mindful

of the fundamental principles contained in the Constitution,

noting with concern

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

welcomes

1 the bilateral agreement elaborated through the Joint Technical Committee (JTC) by concerned parties on 24 October 2019, which included:

i) establishing a subcommittee dedicated to reviewing and assessing the present and future needs of Palestine for the next five years, which will establish a work plan containing an outline of future steps towards addressing the requirements presented by the Palestinians, including, after six months, steps with respect to the identification, designation and allocation of adequate frequencies for the operation of 4G and 5G networks;

ii) identifying, designating and allocating adequate frequencies for the operation of 3G, 4G and 5G networks and for microwave links in Palestine for the existing Palestinian operators and another new potential operator, based on the Palestinian requirements as submitted to the last JTC meeting held on 24 October 2019;

iii) supporting the timely implementation in Palestine of new technologies in accordance with the agreed outcomes of the meeting of 24 October 2019 elaborated through JTC;

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 continue implementing 3G technology in Gaza through support and technical assistance, consistent with the bilateral agreement signed on 19 November 2015;

3 to enable Palestine to modernize its telecommunication networks, including building and operating 4G and 5G networks, through support and technical assistance,

urges concerned parties

to facilitate the import and deployment of equipment and, in the next JTC meeting (expected either December 2019 or January 2020), to start establishing a clear and reasonable time-frame for allocation of adequate frequencies of 4G and 5G for the Palestinian operators,

instructs the Director of the Radiocommunication Bureau

1 to take appropriate measures within the mandate of the Radiocommunication Bureau 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,

instructs the Secretary-General

to ensure that this Resolution is implemented.

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 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-15)

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 (Geneva, 2015),

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 and, if available on board ships and aircraft, by the addition of the single group "NNN" in radiotelegraphy; 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;

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,

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 (WRC-19)

Measures to limit unauthorized uplink transmissions from earth stations

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

considering

a) that, in accordance with Resolution **958 (WRC-15)*** and Resolution ITU-R 64 (Geneva, 2015) 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;

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

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

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-03)

Operation of global satellite systems for personal communications

The World Radiocommunication Conference (Geneva, 2003),

considering

a) that, in accordance with No. 6 of its Constitution (Geneva, 1992), 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-19)

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

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

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 required;

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.

ANNEX 1 TO RESOLUTION 26 (REV.WRC-19)

Previous WRCs have recognized that the scope of the standing agenda item 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.

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 in the committees responsible under the relevant agenda items, as appropriate.

Administrations are invited to submit their proposals under relevant agenda items.

Proposals for additions which do not fall within the categories referred to in *further resolves* 1 of this Resolution may be considered by the WRC committee responsible for proposals submitted 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 (WRC-19)

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 (Sharm el-Sheikh, 2019),

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 satellites[1];

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**;

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;

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

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;

3 to report to WRC-23 on 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 (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 copy to the Radiocommunication Bureau, these comments on the particulars of the potential interference to its existing or planned systems.

ANNEX TO RESOLUTION 32 (WRC-19)

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 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. 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 period of validity, as described in *resolves* 1.2 of this Resolution, BR shall publish a suppression of the related Special Section.

5 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 the 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.

6 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).

7 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 (WRC-19)

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 (Sharm el-Sheikh, 2019),

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.5.c, 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)		
19.70-20.10	FIXED-SATELLITE (space-to-Earth)	FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth)	FIXED-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)		

Frequency bands (GHz)	Space radiocommunication services		
	Region 1	Region 2	Region 3
29.50-29.90	FIXED-SATELLITE (Earth-to-space)	FIXED-SATELLITE (Earth-to-space) MOBILE-SATELLITE (Earth-to-space)	FIXED-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 the 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* 5*b)* 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* 7*a)*/8*a)* or 7*b)*/8*b),* 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* 11*a)*, 11*b)* or 11*c)*, 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* 5*b)*, 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* 7*a)* or 8*a),* 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* 7*a)* or 8*a)*;

b) under *resolves* 7*b)* or 8*b),* 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* 7*b)* or 8*b)*;

c) under *resolves* 7*c)* or 8*c),* 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* 7*c)* or 8*c)*;

12 that *resolves* 11*a)* 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, as described below:

a) upon receipt of this complete information, BR shall report it to RRB as soon as possible, but no later than 1 April 2023, in order to enable comments from administrations and consideration by RRB at its second meeting in 2023, at the latest;

b) RRB shall consider the information provided under this *resolves* and provide a report with its conclusions or recommendations to WRC-23, including any cases where RRB is not in a position to conclude favourably;

13 that BR shall, no later than 45 days before any deadline for submission by a notifying administration under *resolves* 2, 3, 7*a)*, *b)* or *c)* and 8*a)*, *b)* or *c)*, 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:

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* 11*a)*, *b)* or *c)* 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.1) and modifications to the right ascension of the ascending node of each plane (Appendix **4** data item A.4.b.5.a/A.4.b.4.g), the longitude of the ascending node (Appendix **4** data item A.4.b.6.g) and its date and time (Appendix **4** data items A.4.b.6.h and A.4.b.6.i.a) 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.5.b/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) 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, 7*a)*, *b)* or *c)*, 8*a)*, *b)* or *c)* or 11*a)*, *b)* or *c)*, 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* 7*a)*, *b)* or *c)*, 8*a)*, *b)* or *c)*, or 11*a)*, *b)* or *c)*, 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 or 8, 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, nor 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* 7*a)*, *b)* or *c)* or 8*a)*, *b)* or *c)* of this Resolution, as applicable, shall not alter or reduce the requirements associated with any of the remaining milestones as derived from *resolves* 7*a)*, *b)* or *c)* or 8*a)*, *b)* or *c)*, as appropriate;

19 that, for a non-GSO system that has completed the milestone process described in this Resolution, including application of *resolves* 10*c)* by BR, and for systems to which *resolves* 6 applies, if the number of satellites capable of transmitting or receiving the frequency assignments deployed in that system subsequently falls below 95% (rounded down to the lower integer) of the total number of satellites indicated in the Master Register entry minus one satellite for six continuous months, the notifying administration shall inform BR of the date when this event began, for information purposes only, as soon as possible thereafter; if appropriate and applicable, the notifying administration should also inform BR, as soon as possible thereafter, of the date on which the deployment of the total number of satellites was resumed; BR shall make the information received under this *resolves* available on its website,

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 WRC-23;

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,

instructs the Radio Regulations Board

to provide a report to WRC-23 as called for in *resolves* 12*b),*

invites the 2023 World Radiocommunication Conference

to consider the RRB report submitted in response to *resolves* 12*b)* and take necessary action, as appropriate.

ANNEX 1 TO RESOLUTION 35 (WRC-19)

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 (WRC-19)

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* 7*b)* or 8*b)*, as appropriate

5) Clear evidence of a binding agreement to launch a sufficient number of satellites to meet the milestone obligation in *resolves* 7*b)* or 8*b)*, 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.

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 website[1] 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 characteristics[1] 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 characteristics[1] 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.

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[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 49[1] (REV.WRC-19)

Administrative due diligence applicable to some satellite radiocommunication services

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

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,

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[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 advance publication information under Nos. **9.1A** or **9.2B**, 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 orbit 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 allotments[2] 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 Appendices **30**, **30A** or **30B**, as applicable, and, in particular, do not affect the requirement to coordinate under those provisions (Appendices **30**, **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-19)

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 orbit 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 (Rev.WRC-19)**, with the exception of submissions of new Member States seeking the acquisition of their respective national allotments[3] for inclusion in the Appendix **30B** Plan, shall be subject to these procedures.

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2 See § 2.3 of Appendix **30B (Rev.WRC-19)**.

3 See § 2.3 of Appendix **30B (Rev.WRC-19)**.

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 (Rev.WRC-19)** 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 the 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 MIFR 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 (Rev.WRC-19)** 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 (Rev.WRC-19)**.

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-19)

A Identity of the satellite network

a) Identity of the satellite network

b) Name of the administration

c) Country symbol

d) Reference to the advance publication information or 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 (Rev.WRC-19)**

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-19)

Electronic submission of notice forms for satellite networks, earth stations and radio astronomy stations

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

considering

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,

recognizing

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,

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-19)**) 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 Appendices **30** and **30A** and Resolution **49 (Rev.WRC-19)**, 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 § 4.1.7, 4.1.9, 4.1.10, 4.2.10, 4.2.13 or 4.2.14 of Appendices **30** and **30A** with respect to modification to the Region 2 Plan or to additional uses in Regions 1 and 3 under Article 4 and use of the guardbands under Article 2A of those Appendices, 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)),

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.

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 75 (REV.WRC-12)

Development of the technical basis for determining the coordination area for coordination of a receiving earth station in the space research service (deep space) with transmitting stations of high-density applications in the fixed service in the 31.8-32.3 GHz and 37-38 GHz bands

The World Radiocommunication Conference (Geneva, 2012),

considering

a) that the band 31.8-32.3 GHz is allocated to the space research service for deep space operations only, the band 37-38 GHz is allocated to the space research service (space-to-Earth), and both bands are allocated to the fixed service for the use of high-density applications and to other services on a primary basis;

b) that the 31.8-32.3 GHz band offers unique advantages in support of deep-space missions;

c) that space research service earth stations operating in these bands employ very high-gain antennas and very low-noise amplifiers in order to receive weak signals from deep space;

d) that fixed-service stations in these bands are expected to be deployed in large numbers over urban areas of large geographical extent;

e) that studies are being initiated to characterize short-term (of the order of 0.001% of the time, commensurate with the protection criteria given in Recommendations ITU-R SA.1396 and ITU-R SA.1157) anomalous propagation from transmitting stations dispersed over a large geographical area to a single receiving earth station (area-to-point propagation);

f) that preliminary ITU-R studies have indicated that the coordination distance between a space research service (deep space) earth station and a single urban area may be of the order of 250 km;

g) that there are currently three space research service (deep space) earth stations in operation or planned for operation near Goldstone (United States of America), Madrid (Spain) and Canberra (Australia), and there are up to ten more earth stations planned in the future,

noting

a) that Resolution **74 (Rev.WRC-03)** provides a mechanism to update Appendix **7** as required;

b) that Recommendations ITU-R F.1760 and ITU-R F.1765 provide methodologies to derive the aggregate equivalent isotropically radiated power (a.e.i.r.p.) for transmitting stations of high-density applications in the fixed service in bands above 30 GHz, which may be used to assess the potential interference from these stations to other services,

resolves to invite ITU-R

to develop, as a matter of urgency, the technical basis for determining the coordination area for coordination of a receiving earth station in the space research service (deep space) with transmitting stations of high-density systems in the fixed service in the 31.8-32.3 GHz and 37-38 GHz bands,

urges administrations

to participate actively in the aforementioned studies by submitting contributions to ITU-R.

RESOLUTION 76 (REV.WRC-15)

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 (Geneva, 2015),

considering

a) that WRC-97 adopted, in Article **22**, provisional equivalent power flux-density (epfd) limits to be met by non-geostationary fixed-satellite service (non-GSO FSS) systems in order to protect 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 systems 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 systems should not exceed the aggregate epfd levels in Tables 1A to 1D;

f) 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**;

g) that the orbital characteristics of such systems are likely to be inhomogeneous;

h) 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;

i) 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 systems;

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 systems 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

Recommendation ITU-R S.1588 "Methodologies for calculating aggregate downlink equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems into a geostationary fixed-satellite service network",

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 those given in Tables 1A to 1D, or to higher levels where those levels are acceptable to the affected GSO administration (see No. **22.5K**),

invites the ITU Radiocommunication Sector

1 to continue its studies and to develop , as appropriate, a suitable methodology for calculating the aggregate epfd produced by all non-GSO FSS systems operating or planning to operate co-frequency 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;

2 to continue its studies and to develop a Recommendation on the accurate modelling of interference from non-GSO FSS systems into GSO FSS and GSO BSS networks in the frequency bands referred to in *considering a)* above, in order to assist administrations planning or operating non-GSO FSS systems in their efforts to limit the aggregate epfd levels produced by their systems into GSO networks, and to provide guidance to GSO network designers on the maximum epfd↓ levels expected to be produced by all non-GSO FSS systems when accurate modelling assumptions are used;

3 to develop a Recommendation containing procedures to be used among administrations in order to ensure that the aggregate epfd limits given in Tables 1A to 1D are not exceeded by operators of non-GSO FSS systems;

4 to attempt to develop measurement techniques to identify the interference levels from non-GSO systems in excess of the aggregate limits given in Tables 1A to 1D, and to confirm compliance with these limits,

instructs the Director of the Radiocommunication Bureau

1 to assist in the development of the methodology referred to in *invites the ITU Radiocommunication Sector* 1 above;

2 to report to a future competent conference on the results of studies in *invites the ITU Radiocommunication Sector* 1 and 3 above.

ANNEX 1 TO RESOLUTION 76 (REV.WRC-15)

TABLE 1A[1, 2, 3]

Limits on aggregate epfd↓ radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	epfd↓ (dB(W/m²))	Percentage of time during which epfd↓ may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern[4]
10.7-11.7 in all Regions 11.7-12.2 in Region 2 12.2-12.5 in Region 3 12.5-12.75 in Regions 1 and 3	−170 −168.6 −165.3 −160.4 −160 −160	0 90 99 99.97 99.99 100	40	60 cm Recommendation ITU-R S.1428
	−176.5 −173 −164 −161.6 −161.4 −160.8 −160.5 −160 −160	0 99.5 99.84 99.945 99.97 99.99 99.99 99.9975 100	40	1.2 m Recommendation ITU-R S.1428
	−185 −184 −182 −168 −164 −162 −160 −160	0 90 99.5 99.9 99.96 99.982 99.997 100	40	3 m [5] Recommendation ITU-R S.1428
	−190 −190 −166 −160 −160	0 99 99.99 99.998 100	40	10 m [5] Recommendation ITU-R S.1428

[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 epfd↓ limits apply to all antenna sizes greater than 60 cm in the frequency bands listed in Table 1A:

100% of the time epfd↓ (dB(W/(m² · 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 epfd↓ 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 epfd↓ radiated by non-GSO FSS systems in certain frequency bands

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[4]
17.8-18.6	−170 −170 −164 −164	0 90 99.9 100	40	1 m Recommendation ITU-R S.1428
	−156 −156 −150 −150	0 90 99.9 100	1 000	
	−173 −173 −166 −164 −164	0 99.4 99.9 99.92 100	40	2 m Recommendation ITU-R S.1428
	−159 −159 −152 −150 −150	0 99.4 99.9 99.92 100	1 000	
	−180 −180 −172 −164 −164	0 99.8 99.8 99.992 100	40	5 m Recommendation ITU-R S.1428
	−166 −166 −158 −150 −150	0 99.8 99.8 99.992 100	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 epfd↓ 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 epfd↓ radiated by non-GSO FSS systems in certain frequency bands

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[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 epfd↓ 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 epfd↓ 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 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	−160.4 −160.1 −158.6 −158.6 −158.33 −158.33	0 25 96 98 98 100	40	30 cm Recommendation ITU-R BO.1443, Annex 1
	−170 −167 −164 −160.75 −160 −160	0 66 97.75 99.33 99.95 100	40	45 cm Recommendation ITU-R BO.1443, Annex 1
	−171 −168.75 −167.75 −162 −161 −160.2 −160 −160	0 90 97.8 99.6 99.8 99.9 99.99 100	40	60 cm Recommendation ITU-R BO.1443, Annex 1
	−173.75 −173 −171 −165.5 −163 −161 −160 −160	0 33 98 99.1 99.5 99.8 99.97 100	40	90 cm Recommendation ITU-R BO.1443, Annex 1
	−177 −175.25 −173.75 −173 −169.5 −167.8 −164 −161.9 −161 −160.4 −160	0 90 98.9 98.9 99.5 99.7 99.82 99.9 99.965 99.993 100	40	120 cm Recommendation ITU-R BO.1443, Annex 1

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 −178.66 −176.25 −163.25 −161.5 −160.35 −160 −160	0 33 98.5 99.81 99.91 99.975 99.995 100	40	180 cm Recommendation ITU-R BO.1443, Annex 1
	−182 −180.9 −178 −164.4 −161.9 −160.5 −160 −160	0 33 99.25 99.85 99.94 99.98 99.995 100	40	240 cm Recommendation ITU-R BO.1443, Annex 1
	−186.5 −184 −180.5 −173 −167 −162 −160 −160	0 33 99.5 99.7 99.83 99.94 99.97 100	40	300 cm Recommendation ITU-R BO.1443, Annex 1

[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/(m^2 · 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-2000[1], 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-03[2], 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;

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

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

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 (WRC-03)

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

The World Radiocommunication Conference (Geneva, 2003),

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 ITU-R has developed Recommendation ITU-R S.1503 to provide 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 is currently no software tool available to the Radiocommunication Bureau for epfd examinations;

e) that the Bureau has issued Circular Letters CR/176 and CR/182, which request additional information from non-GSO systems in order to examine them for compliance with the Article **22** epfd limits;

f) that, since no epfd validation software is available, the Bureau has 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 gives qualified favourable findings to their systems;

g) that the Bureau is not in a position to perform its duties in relation to Nos. **9.7A** and **9.7B** due to the lack of epfd validation software;

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**,

resolves

1 that since 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**;

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, and GSO FSS earth station antenna maximum isotropic gain, G/T and emission bandwidth;

5 that this Resolution shall no longer be applied after 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 to determine the coordination requirements under Nos. **9.7A** and **9.7B**,

further resolves

that those provisions of the Radio Regulations that have been amended by this Conference and that are referred to in *resolves* 5 shall provisionally apply as from 5 July 2003,

instructs the Director of the Radiocommunication Bureau

1 to encourage administrations to develop the epfd validation software;

2 to review, once the epfd validation software is available, its findings made in accordance with Nos. **9.35** and **11.31**;

3 to review, once the epfd validation software is available, the coordination requirements under Nos. **9.7A** and **9.7B**.

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-19)

Provisional application of certain provisions of the Radio Regulations as revised by the 2019 World Radiocommunication Conference and abrogation of certain Resolutions and Recommendations

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

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 2021;

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, as of 23 November 2019, the following provisions of the RR, as revised or established by this conference, shall provisionally apply: Table of Frequency Allocations 1 621.35-1 626.5 MHz, Nos. **5.260A**, **5.260B**, **5.264A**, **5.264B**, **5.368**, **5.372**, **5.373**, **5.373A**, **5.441B**, **5.550C**, **5.550E**, **9.35**, **9.35.1**, **22.5L**, **22.5L.1**, **22.5M**, **33.50**, **33.53**, Table **21-4** (frequency band 40-40.5 GHz) as well as all provisions of Appendices **4**, **5**, **15**, **30**, **30A** and **30B**;

2 that, as of 1 July 2020, the following provisions of the RR, as revised or established by this conference, shall provisionally apply: No. **5.517A**,

further resolves

to abrogate the following Resolutions as of 23 November 2019:

Resolution **28 (Rev.WRC-15)**
Resolution **31 (WRC-15)**
Resolution **33 (Rev.WRC-15)**
Resolution **157 (WRC-15)**
Resolution **158 (WRC-15)**
Resolution **159 (WRC-15)**
Resolution **162 (WRC-15)**
Resolution **236 (WRC-15)**
Resolution **237 (WRC-15)**
Resolution **238 (WRC-15)**
Resolution **239 (WRC-15)**
Resolution **359 (WRC-15)**
Resolution **360 (Rev.WRC-15)**
Resolution **362 (WRC-15)**
Resolution **426 (WRC-15)**
Resolution **549 (WRC-07)**
Resolution **555 (Rev.WRC-15)**
Resolution **556 (WRC-15)**
Resolution **557 (WRC-15)**
Resolution **641 (Rev.HFBC-87)**
Resolution **658 (WRC-15)**
Resolution **659 (WRC-15)**
Resolution **763 (WRC-15)**
Resolution **764 (WRC-15)**
Resolution **765 (WRC-15)**
Resolution **766 (WRC-15)**
Resolution **767 (WRC-15)**
Resolution **809 (WRC-15)**
Resolution **810 (WRC-15)**
Resolution **958 (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 GHz[1]

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.

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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 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	dB(W/MHz)	for	$30° < \theta \leq 90°$
22.57	dB(W/MHz)	for	$15° < \theta \leq 30°$
28	dB(W/MHz)	for	$5° < \theta \leq 15°$

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:

$$G(\varphi) = G_{max} - 2.5 \times 10^{-3} \left(\frac{D}{\lambda} \varphi \right)^2 \quad \text{for} \quad 0° < \varphi < \varphi_m$$

$$G(\varphi) = 39 - 5 \log (D/\lambda) - 25 \log \varphi \quad \text{for} \quad \varphi_m \leq \varphi < 48°$$

$$G(\varphi) = -3 - 5 \log (D/\lambda) \quad \text{for} \quad 48° \leq \varphi \leq 180°$$

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

$= 2 + 15 \log (D/\lambda)$ (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	$0° \le \theta < 3°$
$-141 + 2(\theta - 3)$	dB(W/(m^2 · MHz))	for	$3° \le \theta \le 13°$
-121	dB(W/(m^2 · MHz))	for	$13° < \theta \le 90°$

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	$0° \le \theta \le 4°$
$-106 + 1.2\ (\theta - 4)$	dB(W/(m^2 · MHz))	for	$4° < \theta \le 11.5°$
-97	dB(W/(m^2 · MHz))	for	$11.5° < \theta \le 90°$

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 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 140 (REV.WRC-15)

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 (Geneva, 2015),

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;

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;

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[*] *Note by the Secretariat:* This Resolution was revised by WRC-15.

d) Recommendation ITU-R S.1715 "Guidelines developed in response to the studies requested in Resolution **140 (WRC-03)***",

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 epfd↓ 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 epfd↓ 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.

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

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/(m^2 · 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 administrations[1] 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:

$$G(\psi) = G_m - 3(\psi/\psi_b)^2 \quad \text{dBi} \quad \text{for} \quad 0° \le \psi \le \psi_1$$

$$G(\psi) = G_m + L_N \quad \text{dBi} \quad \text{for} \quad \psi_1 < \psi \le \psi_2$$

$$G(\psi) = X - 60 \log(\psi) \quad \text{dBi} \quad \text{for} \quad \psi_2 < \psi \le \psi_3$$

$$G(\psi) = L_F \quad \text{dBi} \quad \text{for} \quad \psi_3 < \psi \le 90°$$

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.

$$\psi_1 = \psi_b \sqrt{-L_N / 3} \quad \text{degrees}$$

$$\psi_2 = 3.745\ \psi_b \quad \text{degrees}$$

$$X = G_m + L_N + 60 \log(\psi_2) \quad \text{dBi}$$

$$\psi_3 = 10^{(X - L_F)/60} \quad \text{degrees}$$

$$\psi_b = \sqrt{7\ 442 / (10^{0.1 G_m})} \quad \text{degrees;}$$

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.

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;

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;

* May also be used consistent with international standards and practices approved by the responsible civil aviation authority.

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-23[1];

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,

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 Resolution[1],

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[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.

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

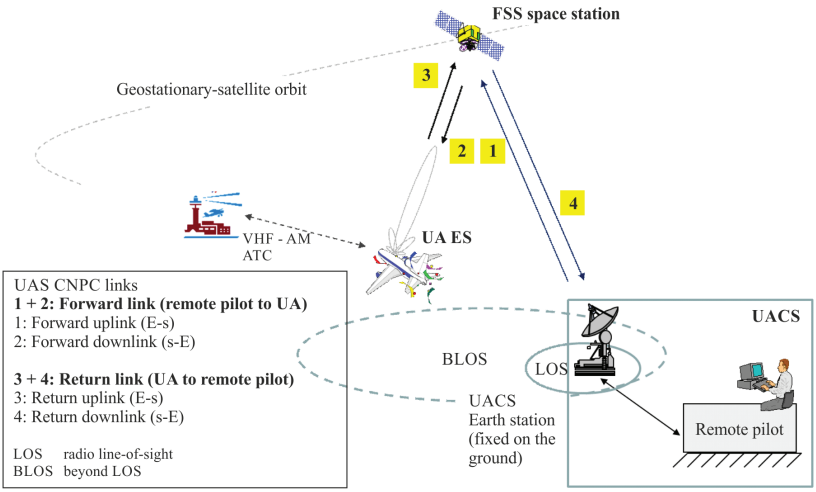
to provide to the Director of BR, in time for WRC-23, information on ICAO efforts regarding implementation of UAS CNPC links, including the information related to the development of SARPs for UAS CNPC links.

ANNEX 1 TO RESOLUTION 155 (REV.WRC-19)

UAS CNPC links

FIGURE 1

Elements of UAS architecture using the FSS



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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:

$$-132 + 0.5 \cdot \theta \quad \text{dB}(\text{W}/(\text{m}^2 \cdot \text{MHz})) \quad \text{for} \quad 0° \leq \theta \leq 40°$$

$$-112 \quad \text{dB}(\text{W}/(\text{m}^2 \cdot \text{MHz})) \quad \text{for} \quad 40° < \theta \leq 90°$$

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**:

$$15\log(\theta+0.9)-124\ \text{dB}\left(\text{W}/\left(\text{m}^2\cdot\text{MHz}\right)\right) \quad \text{for } 0^\circ \le \theta \le 90^\circ$$

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:

$$15\log(\theta+0.9)-133.5\,\text{dB}\left(\text{W}/\left(\text{m}^2\cdot\text{MHz}\right)\right) \quad \text{for } 0^\circ \le \theta \le 90^\circ$$

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 (WRC-15)

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 service[1]

The World Radiocommunication Conference (Geneva, 2015),

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 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 earth stations in motion 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 earth stations in motion;

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 earth stations in motion as referred to in this Resolution are not intended to be used nor 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**;

d) that, currently, there is no specific regulatory procedure for the coordination of the earth stations in motion with regard to terrestrial services;

e) that the UC class of station is used for earth stations in motion communicating with the FSS when using the provisions of No. **5.526** for satellite network filings under Articles **9** and **11**;

---

[1] As referred to in the Table of Frequency Allocations.

f) that this conference has adopted No. **5.527A** to clarify that earth stations in motion 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 the *resolves* 1-4 below;

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-03)**),

resolves

1 that earth stations in motion 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 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 earth station in motion shall not claim protection 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 earth stations in motion operating in international waters and aeronautical earth stations in motion operating in international airspace shall ensure that such operations do not cause unacceptable interference;

1.4 in 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 or reduce the interference to the 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 be subject to permanent monitoring and control by a Network Control and Monitoring Centre (NCMC) or equivalent facility and be capable of receiving and acting upon at least “enable transmission” and “disable transmission” commands from the NCMC;

1.7 that these earth stations not be used or relied upon for safety-of-life applications;

2 that the administration responsible for the satellite network shall ensure that the earth stations in motion 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 earth stations in motion 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 earth stations in motion shall require the operators to provide a point of contact for the purpose of tracing any suspected cases of interference from earth stations in motion.

ANNEX TO RESOLUTION 156 (WRC-15)

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 GHz[2]

This annex provides a set of off-axis e.i.r.p. levels for earth stations in motion operating in the frequency band 29.5-30.0 GHz.

Earth stations in motion 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 earth station in motion 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*
$2° \le \theta \le 7°$	$(19 - 25 \log \theta)$ dB(W/40 kHz)
$7° < \theta \le 9.2°$	−2 dB(W/40 kHz)
$9.2° < \theta \le 48°$	$(22 - 25 \log \theta)$ dB(W/40 kHz)
$48° < \theta \le 180°$	−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.

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 earth stations in motion 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 earth stations in motion 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 earth stations in motion 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.

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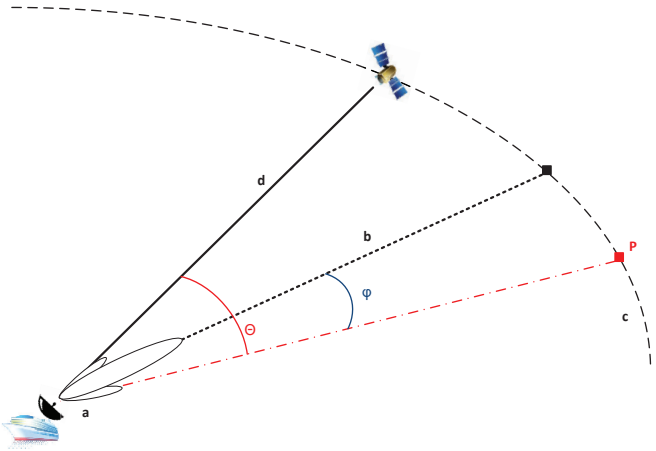
2 See also Report ITU-R S.2357 for ease of reference.

NOTE 5 – Earth stations in motion 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)**
$\varepsilon \leq 5°$	2.5
$5° < \varepsilon \leq 30°$	$3 - 0.1\ \varepsilon$

Figure 1 below illustrates the definition of angle θ[3].

FIGURE 1



where:

a represents the earth station in motion

b represents the boresight of the earth station antenna

c represents the geostationary-satellite orbit (GSO)

d represents the vector from the earth station in motion 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.

[3] In Figure 1 proportions are illustrative and not to scale.

RESOLUTION 160 (WRC-15)

Facilitating access to broadband applications delivered by high-altitude platform stations

The World Radiocommunication Conference (Geneva, 2015),

considering

a) that there is a need for greater broadband connectivity and telecommunication services in underserved communities and in rural and remote areas;

b) that current technologies can be used for broadband applications delivered by base stations operating at high altitudes;

c) that high-altitude platform stations (HAPS) are one possible means for providing fixed broadband connectivity that would enable wireless broadband deployment in remote areas, including mountainous, coastal and sandy desert areas;

d) that HAPS using inter-HAPS links can provide broadband connectivity with minimal ground network infrastructure;

e) that HAPS may also be used for disaster recovery communications;

f) that some new entities are currently testing the delivery of broadband over lightweight, solar-powered aircraft and airships at an altitude of 20-50 kilometres for several months at a nominal fixed point relative to the ground below,

recognizing

a) that existing services and their applications shall be protected from HAPS applications, and no undue constraints shall be imposed on the future development of existing services by HAPS;

b) that HAPS is defined in No. **1.66A** of the Radio Regulations as a station located on an object at an altitude of 20-50 km and at a specified, nominal, fixed point relative to the Earth, and is subject to No. **4.23**;

c) that WRC-97 added a global identification for HAPS in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz, that WRC-2000 agreed, because of concerns with rain fade in that frequency range, on a HAPS identification for the frequency band 27.9-28.2 GHz (fixed downlink), paired with the frequency band 31.0-31.3 GHz (fixed uplink), outside Region 2, and that at WRC-12 five countries joined footnote **5.457** for a HAPS designation in the fixed service for frequency bands 6 440-6 520 MHz (HAPS-to-ground) and 6 560-6 640 MHz (ground-to-HAPS);

d) that WRC-2000 decided on additional spectrum identifications for HAPS links under No. **5.388A** and No. **5.388B** in some countries;

e) that the existing HAPS identifications were established without reference to today's broadband capabilities;

f) that Recommendation **34 (Rev.WRC-12)** noted that the development of common worldwide allocations is desirable in order to improve and harmonize utilization of the radio-frequency spectrum;

g) that, since WRC-12, the evolution of technology through advances in solar panel efficiency, battery energy density, lightweight composite materials, autonomous avionics and antenna technology may improve HAPS viability;

h) that the allotments of the Appendix **30B** Plan, assignments in the Plans and the List subject to Appendix **30** and **30A** and assignments in the Appendix **30B** List shall be protected,

resolves to invite ITU-R

1 to study additional spectrum needs for gateway and fixed terminal links for HAPS to provide broadband connectivity in the fixed service taking into account:

– the existing identifications and deployments of HAPS systems;

– the deployment scenarios envisioned for HAPS broadband systems and related requirements such as in remote areas;

– the technical and operational characteristics of HAPS systems, including the evolution of HAPS through advances in technology and spectrally-efficient techniques, and their deployment;

2 to study the suitability of using the existing identifications in *recognizing c)*, on a global or regional level, taking into account the regulatory provisions, such as geographical and technical restrictions associated with existing HAPS identifications based on the study performed in *resolves to invite ITU-R* 1;

3 to study appropriate modifications to the existing footnotes and associated resolutions in the identifications in *recognizing c)* in order to facilitate the use of HAPS links on a global or regional level, limited to the currently identified frequency bands and, where the use of an identification is not technically feasible for HAPS use, the possible removal of the unsuitable identification;

4 to study, in order to meet any spectrum needs which could not be satisfied under *resolves to invite ITU-R* 2 and 3, for the use of gateway and fixed terminal links for HAPS, the following frequency bands already allocated to the fixed service on a primary basis, not subject to Appendices **30**, **30A**, and **30B** in any region:

– on a global level: 38-39.5 GHz, and

– on a regional level: in Region 2, 21.4-22 GHz and 24.25-27.5 GHz,

further resolves

1 that the studies referred to in *resolves to invite ITU-R* 3 and 4 include sharing and compatibility studies to ensure protection of existing services allocated in the frequency ranges identified and, as appropriate, adjacent band studies, taking into account studies already performed in ITU-R;

2 that modifications studied under *resolves to invite ITU-R* 3 shall not consider the use of HAPS links in the frequency bands subject to Appendix **30B**;

3 to develop ITU-R Recommendations and Reports, as appropriate, on the basis of the studies called for in *resolves to invite ITU-R* 1, 2, 3, and 4 above,

invites administrations

to participate in the studies and to provide input contributions,

resolves to invite the 2019 World Radiocommunication Conference

to consider the results of the above studies and take necessary regulatory actions, as appropriate, provided that the results referred to in *resolves to invite ITU-R* are complete and agreed by ITU-R study groups.

RESOLUTION 161 (WRC-15)

Studies relating to spectrum needs and possible allocation of the frequency band 37.5-39.5 GHz to the fixed-satellite service

The World Radiocommunication Conference (Geneva, 2015),

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 technologies for broadband will increase speeds (45 Mbps is already available), with faster rates expected in the near future;

c) that technological developments such as advances in spot-beam technologies and frequency re-use are used by the fixed-satellite service (FSS) in spectrum above 30 GHz to increase the efficient use of spectrum;

d) that fixed-satellite applications in spectrum above 30 GHz, such as gateways, should be easier to share with other radiocommunication services than high-density fixed-satellite service (HDFSS) applications;

e) that FSS systems based on the use of new technologies above 30 GHz and associated with both geostationary (GSO) and non-geostationary (non-GSO) satellite constellations are capable of providing high-capacity and economically feasible communications even to the most isolated regions of the world;

f) that the frequency band 36-37 GHz is allocated on a primary basis to the Earth exploration-satellite service (EESS) (passive) and the space research service (SRS) (passive), which must be adequately protected,

considering further

a) that Recommendations ITU-R S.1323, S.1325, S.1328, S.1529 and S.1557 provide information on system characteristics, operational requirements and protection criteria to be used in sharing studies;

b) that it may be technically feasible to have a new FSS allocation in the frequency band 37.5-39.5 GHz (Earth-to-space) for operations of gateway earth stations, depending on the results of technical studies,

noting

a) that filing information for GSO satellite networks in the frequency band 37.5-42.5 GHz (space-to-Earth) has been communicated to the Radiocommunication Bureau;

b) that some of these GSO satellite networks are in operation and others will be operated in the near future;

c) that the frequency band 37.5-38 GHz is allocated to SRS on a primary basis in the space-to-Earth direction;

d) that the frequency band 37.5-39.5 GHz is allocated to EESS on a secondary basis in the space-to-Earth direction,

recognizing

the need to protect existing services when considering frequency bands for possible additional allocations to any service,

resolves to invite ITU-R

to conduct, and complete in time for WRC-23:

1 studies considering additional spectrum needs for development of the fixed-satellite service, taking into account the frequency bands currently allocated to FSS, the technical conditions of their use and the possibility of optimizing the use of these frequency bands with a view to increasing spectrum efficiency;

2 sharing and compatibility studies with existing services, on primary and secondary basis, including in adjacent bands as appropriate, to determine the suitability of new primary allocations to the FSS in the frequency band 37.5-39.5 GHz (Earth-to-space, limited to FSS feeder links only) for both GSO and non-GSO orbit use;

3 studies towards possible revision of Resolution **750 (Rev.WRC-15)**[*] so that systems operating in the passive frequency band 36-37 GHz are protected,

further resolves

to invite WRC-23 to consider the results of the above studies and take appropriate actions,

invites administrations

to participate actively in these studies by submitting contributions to ITU-R.

[*] *Note by the Secretariat:* This Resolution was revised by WRC-19.

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, Kyrgyzstan, Sudan, Turkey, 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 (WRC-19)

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 (Sharm el-Sheikh, 2019),

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:

$0.7\,\theta - 135$	dB(W/(m² · MHz))	for	$0° \le \theta < 10°$
$2.4\,\theta - 152$	dB(W/(m² · MHz))	for	$10° \le \theta < 20°$
$0.45\,\theta - 113$	dB(W/(m² · MHz))	for	$20° \le \theta < 60°$
-86	dB(W/(m² · MHz))	for	$60° \le \theta \le 90°$

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 (EESS) (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:

$-0.76\,\theta - 9.5$	dB(W/100 MHz)	for	$-4.53° \le \theta < 35.5°$
-36.5	dB(W/100 MHz)	for	$35.5° \le \theta \le 90°$

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/(m^2 · 290 MHz)) for continuum observations and −192 dB(W/(m^2 · 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:

$$pfd = e.i.r.p._{nominal\ clear\ sky}(Az,\theta) + Att_{618_{p=2\%}} - 10\log\left(4\pi d^2\right) - GasAtt(\theta)$$

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 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

$GasAtt(\theta)$: gaseous attenuation for an elevation angle of θ (see 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 (BR) 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 BR 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 (WRC-19)

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 (Sharm el-Sheikh, 2019),

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:

$0.39\,\theta - 132.12$	dB(W/(m^2 · MHz))	for	$0° \le \theta < 13°$
$2.715\,\theta - 162.3$	dB(W/(m^2 · MHz))	for	$13° \le \theta < 20°$
$0.45\,\theta - 117$	dB(W/(m^2 · MHz))	for	$20° \le \theta < 60°$
-90	dB(W/(m^2 · MHz))	for	$60° \le \theta \le 90°$

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	$0° \le \theta \le 4°$
$-110.3 + 1.2\,(\theta - 4)$	dB(W/(m^2 · MHz))	for	$4° < \theta \le 9°$
-104.3	dB(W/(m^2 · MHz))	for	$9° < \theta \le 90°$

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:

$0.95\,\theta - 114$	dB(W/(m^2 · MHz))	for	$0° \le \theta < 5.7°$
$0.6\,\theta - 112$	dB(W/(m^2 · MHz))	for	$5.7° \le \theta < 20°$
-100	dB(W/(m^2 · MHz))	for	$20° \le \theta \le 90°$

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/(m^2 · MHz)) at the border of a neighbouring administration exceeds a pfd limit of -110.3 dB(W/(m^2 · 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 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 inter-satellite service, 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 inter-satellite service, 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 inter-satellite service, 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 geostationary arc under clear-sky conditions. It is also needed 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:

$$-0.7714\,\theta - 16.5 \quad \text{dB(W/200 MHz)} \quad \text{for} \quad -4.53° \le \theta < 35°$$

$$-43.5 \quad \text{dB(W/200 MHz)} \quad \text{for} \quad 35° \le \theta \le 90°$$

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 the 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 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 dB(W/(m² · 400 MHz)) for continuum observations and −191 dB(W/(m² · 250 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:

$$pfd = e.i.r.p._{nominal\ clear\ sky}(Az, \theta) + Att_{618_{p=2\%}} - 10\log\left(4\pi d^2\right) - GasAtt(\theta)$$

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 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/(m^2 · 400 MHz)) for continuum observations and in dB(W/(m^2 · 250 kHz)) for spectral line observations in the frequency band 23.6-24 GHz

$GasAtt(\theta)$: gaseous attenuation for an elevation angle of θ (see 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 (BR) 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 BR 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 (WRC-19)

Use of the frequency band 31-31.3 GHz by high-altitude platform stations in the fixed service

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

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/(m² · MHz))	for	$0° \le \theta < 8°$
$2.58\,\theta - 156.6$	dB(W/(m² · MHz))	for	$8° \le \theta < 20°$
$0.375\,\theta - 112.5$	dB(W/(m² · MHz))	for	$20° \le \theta < 60°$
–90	dB(W/(m² · MHz))	for	$60° \le \theta \le 90°$

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 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 (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	$-4.53° \le \theta < 22°$
−35.1	dB(W/200 MHz)	for	$22° \le \theta < 90°$

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 dB(W/(m^2 · 500 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 dB(W/(m² · 500 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:

$$pfd(\theta) = e.i.r.p._{nominal\ clear\ sky}(Az, \theta) + Att_{618\,p=2\%} - 10\log\left(4\pi d^2\right) - GassAtt(\theta)$$

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

$Att_{618p=2\%}$: attenuation in dB from 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

$pfd(\theta)$: pfd at the Earth's surface per HAPS station in dB(W/(m² · 500 MHz))

$GasAtt(\theta)$: gaseous attenuation for an elevation angle of θ (see 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 Radiocommunication Bureau (BR) 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 BR 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 (WRC-19)

Use of the frequency band 38-39.5 GHz by high-altitude platform stations in the fixed service

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

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/(m² · MHz))	for	$0° \le \theta \le 13°$
$-137 + 3.125\ (\theta - 13)$	dB(W/(m² · MHz))	for	$13° < \theta \le 25°$

$-99.5 + 0.5\ (\theta - 25)$	dB(W/(m² · MHz))	for	$25° < \theta \leq 50°$
-87	dB(W/(m² · MHz))	for	$50° < \theta \leq 90°$

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 (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/(m² · MHz))	for	$0° \leq \theta \leq 4°$
$-107.8 + 1.5\ (\theta - 4)$	dB(W/(m² · MHz))	for	$4° < \theta \leq 10°$
-98.8	dB(W/(m² · MHz))	for	$10° < \theta \leq 90°$

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/(m² · MHz))	for	$0° \leq \alpha < 0.136°$
-133.9	dB(W/(m² · MHz))	for	$0.136° \leq \alpha < 1°$
$-133.9 + 25 \log \alpha$	dB(W/(m² · MHz))	for	$1° \leq \alpha < 47.9°$
-91.9	dB(W/(m² · MHz))	for	$47.9° \leq \alpha \leq 180°$

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:

$$pfd = e.i.r.p. - 10\log\left(4\pi d^2\right) - Att_{gaz}$$

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 (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:

$$d = \frac{\pi R}{180}\left(90 - \theta - \operatorname{asin}\left(\frac{R}{R+h}\cos\theta\right)\right)$$

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 dB(W/(m² · MHz)) at the border of a neighbouring administration exceeds a pfd limit of −111.3 dB(W/(m² · MHz)) for non-GSO operations and −108.9 dB(W/(m² · 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 Radiocommunication Bureau (BR) 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 BR 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 BR 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 or reduce interference to an acceptable level,

resolves further

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 (WRC-19)

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 (Sharm el-Sheikh, 2019),

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, the 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 the 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 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 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 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 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 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 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 or reduce interference 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,

resolves further

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 (WRC-19)

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-GSO FSS systems referred to in *resolves* 1.1.6 of this Resolution in the frequency band 27.5-28.6 GHz, 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 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:

Off-axis angle	*Maximum e.i.r.p. density*
$3° \le \varphi \le 7°$	$28 - 25 \log\varphi$ dB(W/40 kHz)
$7° < \varphi \le 9.2°$	7 dB(W/40 kHz)
$9.2° < \varphi \le 48°$	$31 - 25 \log\varphi$ dB(W/40 kHz)
$48° < \varphi \le 180°$	−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 (WRC-19)

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 non-GSO 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 ESIM communicating with a GSO 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 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 (WRC-19)

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 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 GSO 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 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 pfd produced at the surface of the Earth on the territory of an administration by emissions from a single aeronautical ESIM shall not exceed:

$$\begin{aligned}
&pfd(\theta) = -124.7 && (dB(W/(m^2 \cdot 14\ MHz))) && \text{for} && 0° \le \theta \le 0.01° \\
&pfd(\theta) = -120.9 + 1.9 \cdot \log\theta && (dB(W/(m^2 \cdot 14\ MHz))) && \text{for} && 0.01° < \theta \le 0.3° \\
&pfd(\theta) = -116.2 + 11 \cdot \log\theta && (dB(W/(m^2 \cdot 14\ MHz))) && \text{for} && 0.3° < \theta \le 1° \\
&pfd(\theta) = -116.2 + 18 \cdot \log\theta && (dB(W/(m^2 \cdot 14\ MHz))) && \text{for} && 1° < \theta \le 2° \\
&pfd(\theta) = -117.9 + 23.7 \cdot \log\theta && (dB(W/(m^2 \cdot 14\ MHz))) && \text{for} && 2° < \theta \le 8° \\
&pfd(\theta) = -96.5 && (dB(W/(m^2 \cdot 14\ MHz))) && \text{for} && 8° < \theta \le 90.0°
\end{aligned}$$

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:

$$\begin{aligned}
&pfd(\theta) = -136.2 && (dB(W/(m^2 \cdot 1\ MHz))) && \text{for} && 0° \le \theta \le 0.01° \\
&pfd(\theta) = -132.4 + 1.9 \cdot \log\theta && (dB(W/(m^2 \cdot 1\ MHz))) && \text{for} && 0.01° < \theta \le 0.3° \\
&pfd(\theta) = -127.7 + 11 \cdot \log\theta && (dB(W/(m^2 \cdot 1\ MHz))) && \text{for} && 0.3° < \theta \le 1° \\
&pfd(\theta) = -127.7 + 18 \cdot \log\theta && (dB(W/(m^2 \cdot 1\ MHz))) && \text{for} && 1° < \theta \le 12.4° \\
&pfd(\theta) = -108 && (dB(W/(m^2 \cdot 1\ MHz))) && \text{for} && 12.4° < \theta \le 90°
\end{aligned}$$

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 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 *resolves further* of this Resolution).

RESOLUTION 170 (WRC-19)

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 (Sharm el-Sheikh, 2019),

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",

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
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,

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 Procedure[1] 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,

[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**)."

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.

ATTACHMENT 1 TO RESOLUTION 170 (WRC-19)

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 administrations[2], 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 the same set of test points contained in the Appendix **30B** Plan from each 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 § 6.17[3] of Appendix **30B** to have the satellite network entered into 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) publish[6], as appropriate, the complete information in the International Frequency Information Circular (BR IFIC) within the time-limit as specified in Appendix **30B**;

e) inform the administrations concerned of its actions and communicate the results of its calculations, drawing attention to the relevant BR IFIC.

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[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.

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 apply[7].

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.

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.

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[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.

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 (WRC-19)

Criteria for determining whether an assignment is considered to be affected by networks submitted to Appendix 30B under 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 calculated[8] 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 dB[9], or any already accepted Earth-to-space single entry (C/I), whichever is the lowest, and the calculated[8] 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 value[10] of 23.65 dB, or $(C/N)_d$ + 8.65 dB[11], or any already accepted value, whichever is the lowest, and the calculated[8] 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 dB[12], or any already accepted overall aggregate $(C/I)_{agg}$ value, whichever is the lowest, with a tolerance of 0.45 dB[13] 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;

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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/(m^2 · 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/(m^2 · 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 addition to the above, and as a consequence of the reduced coordination arc in 1) above as compared to that in Annex 3 to Appendix **30B**, the following limits shall be applied, instead of the limits contained in Annex 3 to Appendix **30B**, for submissions made under this Resolution.

Under assumed free-space propagation conditions, the pfd (space-to-Earth) of a proposed new allotment or assignment produced on any portion of the surface of the Earth shall not exceed:

– -131.4 dB(W/(m^2 · MHz)) in the frequency band 4 500-4 800 MHz; and

– -118.4 dB(W/(m^2 · MHz)) in the frequency bands 10.70-10.95 GHz and 11.20-11.45 GHz.

Under assumed free-space propagation conditions, the pfd (Earth-to-space) of a proposed new allotment or assignment shall not exceed:

– -140.0 dB(W/(m^2 · MHz)) towards any location in the GSO located more than 7° from the proposed orbital position in the frequency band 6 725-7 025 MHz; and

– -133.0 dB(W/(m^2 · MHz)) towards any location in the GSO located more than 6° from the proposed orbital position in the frequency band 12.75-13.25 GHz.

APPENDIX 2 TO ATTACHMENT 1 TO
RESOLUTION 170 (WRC-19)

Protection criteria for a new incoming network

Incoming network	Allotments or assignments to be protected	Protection criteria
Assignment applying the special procedure	Allotment in the Plan	Annex 4
	Assignment converted from allotment without modification	Annex 4
	Assignment converted from allotment with modification within the envelope of the allotment	Annex 4
	Assignment converted from allotment with modification outside the envelope of the allotment and the special procedure applied	Annex 4
	Assignment converted from allotment with modification outside the envelope of the allotment and the special procedure NOT applied	New criteria
	Former existing system	Annex 4
	Additional system for which the special procedure applied	Annex 4
	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
	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
	Additional system with frequency assignments with service area beyond national territories for which the special procedure NOT applied	New criteria
	Request under Article 7 but transferred to Article 6	Annex 4
	New allotment through the application of § 6.35	Annex 4
Conversion of allotment or new additional system for which the special procedure NOT applied	All	Annex 4

ATTACHMENT 2 TO RESOLUTION 170 (WRC-19)

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
IRN		1				3	4
MCO						4	4
MEX	1				3		4
MLA					1	3	4
TUR						4	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
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 171 (WRC-19)

Review and possible revision of Resolution 155 (Rev.WRC-19) and No. 5.484B in the frequency bands to which they apply

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, and that satellite networks may be used to provide these CNPC links beyond line-of-sight;

b) that UAS CNPC links relate to the safe operation of UAS and have to comply with certain technical and regulatory requirements, and will operate in accordance with international Standards and Recommended Practices (SARPs) and procedures established in accordance with the Convention on International Civil Aviation;

c) that the International Civil Aviation Organization (ICAO) is developing SARPs to ensure the technical aspects of using fixed-satellite service (FSS) satellites to support safe and reliable UAS CNPC links;

d) that there is urgency to conclude on the feasibility of use of the FSS frequency bands identified by Resolution **155 (Rev.WRC-19)** to support the safe implementation of UAS CNPC links in non-segregated airspace;

e) that the ITU Radiocommunication Sector (ITU-R) has made substantive progress on studies of technical, operational and regulatory aspects in relation to the implementation of Resolution **155 (Rev.WRC-19)**,

recognizing

a) that *invites the 2023 World Radiocommunication Conference* in Resolution **155 (Rev.WRC-19)** requests the 2023 World Radiocommunication Conference to consider the results of ITU-R studies referred to in Resolution **155 (Rev.WRC-19)** with a view to reviewing and, if necessary, revising Resolution **155 (Rev.WRC-19)**, and take necessary actions, as appropriate;

b) that, under No. **5.484B** adopted at WRC-15, reference is made to Resolution **155 (WRC-15)** in the Table of Frequency Allocations;

c) that the technical, operational and coordination conditions and processes for operation within FSS networks are to be maintained in any modifications of Resolution **155 (Rev.WRC-19)**;

d) that ICAO is responsible for defining the appropriate criteria and mitigation techniques, taking into account the safety-of-life aspects of the CNPC links, in order to operate UAS under the FSS in non-segregated airspace,

resolves to invite the ITU Radiocommunication Sector

1 to continue and complete in time for WRC-23 relevant studies of the technical, operational and regulatory aspects, based on the frequency bands mentioned in *resolves* 1 of Resolution **155 (Rev.WRC-19)**, in relation to the implementation of Resolution **155 (Rev.WRC-19)**, taking into account the progress obtained by ICAO in the completion of SARPs on use of the FSS for the UAS CNPC links;

2 to review No. **5.484B** and Resolution **155 (Rev.WRC-19)** taking into account the results of the above studies,

invites the 2023 World Radiocommunication Conference

to revise, if necessary, No. **5.484B** and Resolution **155 (Rev.WRC-19)** and take other necessary actions, as appropriate, on the basis of the studies conducted under Resolution **155 (Rev.WRC-19)** and *resolves to invite the ITU Radiocommunication Sector* above,

instructs the Secretary-General

to bring this Resolution to the attention of the Secretary-General of ICAO.

RESOLUTION 172 (WRC-19)

Operation of earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service in the frequency band 12.75-13.25 GHz (Earth-to-space)

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

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 referred to in *considering a)* above;

c) that the frequency band 12.75-13.25 GHz is currently allocated on a primary basis to the fixed, fixed-satellite (FSS) (Earth-to-space) and mobile services, and on a secondary basis to the space research (deep space) (space-to-Earth) service globally;

d) that the frequency band 12.75-13.25 GHz is used by the geostationary-satellite (GSO) FSS in accordance with the provisions of Appendix **30B** (No. **5.441**) and there are many existing GSO FSS satellite networks operating in this frequency band;

e) that the frequency bands in the space-to-Earth direction corresponding to the frequency band referred to in *considering d)* are the frequency bands 10.7-10.95 GHz and 11.2-11.45 GHz, which may be used by earth stations on aircraft and vessels, subject to not claiming protection from other applications of the FSS as well as other radiocommunication services to which the frequency band is allocated;

f) that the frequency band 10.6-10.7 GHz is allocated to the Earth exploration-satellite service (EESS) (passive);

g) that the availability of the frequency band 12.75-13.25 GHz (Earth-to-space) for earth stations on aircraft and vessels could provide administrations with more flexibility to use their allotments in the Appendix **30B** Plan, restricted to national territory;

h) that there is an increased need for in-flight and maritime connectivity which can be partially satisfied by allowing earth stations on aircraft and vessels to communicate with GSO space stations in the FSS, including in the frequency band 12.75-13.25 GHz (Earth-to-space);

i) that advances in technology, including the use of tracking techniques, allow earth stations on aircraft and vessels to operate within the characteristics of fixed earth stations of the FSS;

j) that the use of the frequency band 12.75-13.25 GHz (Earth-to-space) for links of earth stations on aircraft and vessels operating to GSO FSS satellite networks could contribute as an additional use of the spectrum and enhance broadband communications for passengers, and is not to be used or relied upon for safety-of-life applications,

considering further

a) that there is no methodology on how to protect neighbouring space stations of Appendix **30B** from earth stations on aircraft and vessels communicating with a GSO FSS space station;

b) that there is no information on coordination agreements reached among administrations regarding GSO FSS satellite networks;

c) that there is no established and agreed interference management procedure to address the potential interference arising from the use of earth stations on aircraft and vessels referred to in this Resolution, and the responsibility of the entities involved in this operation is not defined,

noting

a) that Resolution **156 (WRC-15)** 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 **158 (WRC-15)**[*] calls for studies for 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 **169 (WRC-19)**, which contains the regulatory conditions regarding ESIMs communicating with GSO FSS networks in the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz under conditions contained in that Resolution;

d) that this conference has adopted Resolution **170 (WRC-19)**, which provides the procedure to ensure equitable access to frequency bands under Appendix **30B** by developing countries,

recognizing

a) that the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by earth stations on aircraft and vessels shall not result in any changes or restrictions to the existing Plan allotments and List assignments made under the Appendix **30B**;

b) that the technical characteristics of earth stations on aircraft and vessels communicating with a GSO space station in the FSS shall comply with the envelope defined in Appendix **30B** and/or with the coordination agreements reached between administrations;

c) that the current usage and future development of the allocated services in the frequency band 12.75-13.25 GHz (Earth-to-space) shall be protected without imposing additional constraints on them;

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[*] *Note by the Secretariat*: This Resolution was abrogated by WRC-19.

d) that, in the frequency bands referred to in *considering e)*, use by earth stations on aircraft and vessels would be for reception and therefore not cause interference;

e) that for the frequency bands referred to in *considering e)*, earth stations on aircraft and vessels shall not impose constraints on other allocated services nor claim protection from allocated services operating in accordance with the Radio Regulations;

f) that the transmitting GSO space station communicating with earth stations on aircraft and vessels should protect the adjacent EESS (passive) operations referred to in *considering f)* in accordance with No. **5.340**;

g) that administrations intending to operate earth stations on aircraft and vessels in Appendix **30B** frequency bands shall submit a commitment to ITU to undertake to immediately eliminate unacceptable interference or reduce it to an acceptable level should such interference be caused to terrestrial services;

h) that a worldwide harmonized approach for earth stations on aircraft and vessels would benefit the administrations as well as industries;

i) that Appendix **30B** requires the notifying administration to obtain the specific agreement of other administrations via Article 6 (§§ 6.6 and 6.16) regarding the inclusion of their territory in the service area of the satellite network;

j) that there are established criteria in Annex 4 to Appendix **30B** comprising single-entry and aggregate values to protect Appendix **30B** assignments;

k) that Article 44 of the ITU Constitution lays down 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;

l) that the "first-come first-served" concept can restrict and sometimes prevent access to and use of certain frequency bands and orbital positions;

m) 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",

recognizing further

that information provided by the Radiocommunication Bureau (BR) in ITU Radiocommunication Sector (ITU-R) studies indicates that a very significant number of Appendix **30B** submissions have been received by BR in the time period 1 January 2013 until 22 November 2019 and that the table provided in *recognizing further a)* of Resolution **170 (WRC-19)** summarizes the data provided by BR into those studies and shows the variations for the number of networks at the various stages,

resolves

that earth stations on aircraft and vessels addressed by this Resolution:

a) shall not be used or relied upon for safety-of-life applications;

b) shall not result in changes or restrictions to the existing Plan allotments and List assignments made under the Appendix **30B**, and their future development,

invites the ITU Radiocommunication Sector

1 to study the technical and operational characteristics and user requirements of earth stations on aircraft and vessels that communicate or plan to communicate with GSO space stations in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space) under the envelope of Appendix **30B** Article 6 recorded in the List or the Master International Frequency Register (MIFR) with favourable finding only, and to examine related existing regulatory provisions, subject to *recognizing a)*;

2 to study the sharing and compatibility issues between earth stations on aircraft and vessels communicating with GSO space stations in the FSS and current and planned stations of existing services referred to in *considering c)* as well as services in adjacent frequency bands, to ensure protection of, and not impose undue constraints on, those services and their future development, taking into account the provisions of Appendix **30B**;

3 to study the responsibility of the entities involved in the operation of the earth stations on aircraft and vessels addressed by this Resolution;

4 to develop the criteria to ensure that earth stations on aircraft and vessels, as a new FSS application in this frequency band, shall not claim more protection or cause more interference than filed earth stations in Appendix **30B**;

5 to develop the technical conditions and regulatory provisions for the harmonized operation of earth stations on aircraft and vessels communicating with GSO space stations in the FSS operating in the frequency band 12.75-13.25 GHz (Earth-to-space), considering the results of the studies outlined in *invites the ITU Radiocommunication Sector* 1 and 2, and in particular without affecting the Appendix **30B** Plan;

6 to ensure that the operation of earth stations on aircraft and vessels in the frequency band 12.75-13.25 GHz under Appendix **30B** shall not adversely affect the criteria referred to in *recognizing j)*, including the cumulative effect of multiple earth stations on aircraft and vessels;

7 to ensure that the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by earth stations on aircraft and vessels shall not limit the access of other administrations to their national resources in Appendix **30B** as well as implementation of Resolution **170 (WRC-19)**;

8 to ensure that the use of earth stations on aircraft and vessels addressed by this Resolution would not result in any additional status than that of the GSO network with which these stations communicate;

9 to ensure that the results of ITU-R studies are agreed by Member States taking into account the required consensus on this matter;

10 to complete studies in time for WRC-23,

invites the 2023 World Radiocommunication Conference

to consider the results of the above studies in *invites the ITU Radiocommunication Sector* and take necessary actions, as appropriate,

invites administrations

to participate actively in the studies by submitting contributions to ITU-R.

RESOLUTION 173 (WRC-19)

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 earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service

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

considering

a) 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 globally allocated on a co-primary basis to the fixed-satellite service (FSS), and that there are a number of non-geostationary-satellite systems (non-GSO) operating or planned to operate in these frequency bands;

b) that the fixed and mobile services are allocated on a primary basis in the frequency bands 17.7-17.8 GHz, 18.1-19.7 GHz and 27.5-29.5 GHz on a global basis* and the fixed service is also allocated on a primary basis in the frequency band 17.8-18.1 GHz on a global basis;

c) that the frequency band 28.5-30 GHz (Earth-to-space) is allocated to the Earth exploration-satellite service (EESS) on a secondary basis, and no additional constraints should be imposed on the EESS;

d) that the frequency band 29.95-30 GHz may be used for space-to-space links in the EESS on a secondary basis, and no additional constraints should be imposed on the EESS;

e) that there are existing and planned non-GSO satellite constellations in the frequency bands 17.7-20.2 GHz (space-to-Earth) and 27.5-30 GHz (Earth-to-space) and that these constellations are designed to serve the growing need for access to broadband connectivity, regardless of location;

f) that existing regulatory and technical procedures apply in the segments of the frequency bands listed in *considering a)* between geostationary-satellite (GSO) FSS networks and non-GSO FSS systems;

g) that the frequency bands listed in *considering a)* are also allocated to several other services on a primary basis, that those services are used by a variety of different systems in many administrations and that these existing services and their future development should be protected without undue constraints;

h) that, in accordance with the relevant provisions of Articles **9** and **11**, non-GSO FSS networks intending to operate in the frequency bands detailed in *considering a)* should be coordinated and notified;

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* *Note by the Secretariat*: The band 17.7-17.8 GHz is allocated to the mobile service on a secondary basis in Region 2.

i) that there is a need for mobile-satellite communications, including global satellite broadband, and that part of this need can be met by allowing earth stations in motion (ESIMs) to communicate with FSS space stations operating in the frequency bands detailed in *considering a)*;

j) that a consistent approach to the deployment of these ESIMs will support important and growing global communication requirements and provide adequate protection to other services in the frequency bands;

k) that, currently, there is no specific regulatory procedure for the coordination of ESIMs relative to terrestrial stations for these services,

considering further

a) that there is no methodology on how to protect GSO FSS space stations from ESIMs communicating with non-GSO FSS systems;

b) that there is no information on the coordination agreements reached among administrations between GSO FSS satellite networks and non-GSO FSS systems in those frequency bands where No. **5.523A** applies;

c) that there is no established and agreed interference management procedure to address the potential interference arising from the use of ESIMs communicating with non-GSO FSS systems referred to in this Resolution, and the responsibility of the entities involved in this operation is not defined;

d) that ESIMs communicating with non-GSO FSS systems should be operated within the envelope of the characteristics and envelope of coordination of specific and/or typical earth stations of the non-GSO FSS systems initially published and included in the International Frequency Information Circular (BR IFIC);

e) that there is no established methodology to calculate the equivalent power flux-density (epfd) from the use of multiple non-GSO FSS systems in the frequency bands detailed in *considering a)*,

noting

a) that Resolution **156 (WRC-15)** addresses the use of 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 **158 (WRC-15)*** calls for studies for 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 **169 (WRC-19)**, which contains the technical, operational and regulatory provisions for ESIMs communicating with GSO FSS networks in the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz, under the conditions contained in that Resolution,

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

recognizing

a) that technical and operational requirements for ESIMs, which prior to WRC-15 were referred to as earth stations on mobile platforms ("ESOMPs") operating with non-GSO FSS systems in the frequency bands detailed in *considering a)* above have been discussed in the ITU Radiocommunication Sector (ITU-R) and are reflected in the Report ITU-R S.2261;

b) that Article **21** determines power flux-density (pfd) limits applicable to non-GSO FSS systems to protect fixed and mobile land stations;

c) that Article **22** contains epfd limits for non-GSO FSS systems in the frequency bands 17.8-18.6 GHz, 19.7-20.2 GHz (space-to-Earth), 27.5-28.6 GHz (Earth-to-space), 29.5-30 GHz (Earth-to-space) and 17.8-18.4 GHz (inter-satellite);

d) that the use of the frequency band 19.3-19.6 GHz (Earth-to-space) by the FSS is limited to GSO systems and feeder links to non-GSO systems in the mobile-satellite service (MSS), in accordance with No. **5.523D**;

e) that the use of the frequency band 29.1-29.5 GHz (Earth-to-space) by the FSS is limited to GSO systems and feeder links to non-GSO systems in the MSS, in accordance with No. **5.535A**;

f) that WRC-15 adopted No. **5.527A** and Resolution **156 (WRC-15)** related to ESIMs that communicate with GSO satellites;

g) that advances in technology, including the use of tracing techniques, allow ESIMs to operate according to the characteristics of typical FSS earth stations;

h) that these earth stations are not be used or relied upon for safety-of-life applications;

i) that the frequency band 18.6-18.8 GHz is allocated to the EESS (passive) and space research service (SRS) (passive),

recognizing further

a) that segments of the frequency band 17.7-18.1 GHz are used by feeder links for the broadcasting-satellite service (BSS), subject to Appendix **30A** (No. **5.516**);

b) that the frequency bands 18.3-19.3 GHz (Region 2), 19.7-20.2 GHz (all regions), 27.5-27.82 GHz (Region 1), 28.35-28.45 GHz (Region 2), 28.45-28.94 GHz (all regions), 28.94-29.1 GHz (Regions 2 and 3), 29.25-29.46 GHz (Region 2) and 29.465-30.0 GHz (all regions) have been identified for use in high-density applications in the FSS (No. **5.516B**);

c) that the use of the frequency band 18.1-18.4 GHz by the FSS (Earth-to-space) is limited to feeder links of GSO BSS systems (No. **5.520**);

d) that the use of the frequency bands 17.8-18.6 GHz, 19.7-20.2 GHz, 27.5-28.6 GHz and 29.5-30.0 GHz by non-GSO FSS systems is subject to the applicable provisions of Nos. **5.484A**, **22.5C** and **22.5I**;

e) that the use of the frequency bands 18.8-19.3 GHz and 28.6-29.1 GHz by GSO and non-GSO FSS networks is subject to the applicable provisions of No. **9.11A**, while No. **22.2** does not apply (No. **5.523A**);

f) that the use of the frequency band 19.3-19.7 GHz by GSO FSS systems and feeder links of non-GSO MSS systems is subject to the applicable provisions of No. **9.11A**, but not to the provisions of No. **22.2**; in addition, the use of this frequency band by other non-GSO FSS systems or for the cases indicated in Nos. **5.523C** and **5.523E** is not subject to the provisions of No. **9.11A**, and shall continue to be subject to the procedures of Article **9** (except No. **9.11A**) and Article **11**, and to the provisions of No. **22.2** (No. **5.523D**);

g) that the frequency bands 27.5-29.1 GHz and 29.5-30.0 GHz may be used by the FSS (Earth-to-space) to provide feeder links in the BSS (No. **5.539**);

h) that all allocated services in the frequency bands referred to in *considering a)* to *e)* should be taken into account when conducting sharing and compatibility studies;

i) that the notifying administrations of those non-GSO FSS systems with which ESIMs in the frequency bands detailed in *considering a)* above are intended to operate should submit a commitment to ITU to undertake to immediately eliminate unacceptable interference or reduce it to an acceptable level should such interference be caused to terrestrial services;

j) 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",

resolves to invite the ITU Radiocommunication Sector

1 to study the technical and operational characteristics and user requirements of the different types of ESIMs that plan to operate within non-GSO FSS systems 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), or parts thereof;

2 to study sharing and compatibility between ESIMs operating with non-GSO FSS systems and current and planned stations of primary services allocated 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), or parts thereof, to ensure protection of, and not impose additional constraints on, GSO systems and other services, including terrestrial services, in those frequency bands and in adjacent frequency bands, including passive services;

3 to develop the technical and regulatory provisions for the operation of aeronautical and maritime ESIMs with non-GSO FSS systems, taking into account the results of studies under *resolves to invite the ITU Radiocommunication Sector* 1 and 2;

4 to ensure that the technical and operational measures and the possible regulatory changes established in accordance with this Resolution shall not affect the relevant provisions related to the protection of GSO networks from non-GSO FSS systems;

5 to ensure that the results of ITU-R studies are agreed by Member States by consensus;

6 to complete the studies in time for WRC-23,

invites the 2023 World Radiocommunication Conference

to review the results of these studies and take appropriate action.

RESOLUTION 174 (WRC-19)

Primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2

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

considering

a) the need to encourage the development and implementation of new technologies in the fixed-satellite service (FSS) for broadband applications;

b) that FSS systems based on the use of new technologies associated with geostationary-satellite systems are capable of providing high-capacity and low-cost means of broadband communication even to the most isolated regions of the world;

c) 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;

d) that the frequency band 17.3-17.7 GHz is allocated in Region 2 on a primary basis to the broadcasting-satellite service (BSS) (space-to-Earth) and to the FSS (Earth-to-space), subject to the application of No. **5.516**,

recognizing

the need to preserve and protect frequencies subject to the application of Appendix **30A**,

noting

a) that technology has been developed to provide more efficient use of the spectrum;

b) that sharing of FSS (Earth-to-space) and FSS (space-to-Earth) is already considered in Region 1 for the frequency band 17.3-17.7 GHz;

c) that there is no other primary service in the frequency band 17.3-17.7 GHz apart from the FSS and the BSS,

resolves

that the studies referred in *invites the ITU Radiocommunication Sector* below shall protect radiocommunication services to which the frequency band is allocated on primary basis, in particular assignments contained in Appendix **30A**,

invites the ITU Radiocommunication Sector

to conduct, and complete in time for WRC-23, sharing and compatibility studies between the FSS (space-to-Earth) and the BSS (space-to-Earth) and between the FSS (space-to-Earth) and the FSS (Earth-to-space), 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 2, while ensuring the protection of existing primary allocations in the same and adjacent frequency bands, as appropriate, and without imposing any additional constraints on existing allocations to the BSS (space-to-Earth) and the FSS (Earth-to-space),

invites the 2023 World Radiocommunication Conference

to consider the results of the above studies and take necessary actions, as appropriate,

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.

RESOLUTION 175 (WRC-19)

Use of International Mobile Telecommunications systems for fixed wireless broadband in the frequency bands allocated to the fixed service on a primary basis

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

considering

a) that the use of harmonized frequency bands for International Mobile Telecommunications (IMT) systems is desirable in order to achieve the benefits of economies of scale worldwide;

b) that the use of IMT systems for fixed broadband can assist in meeting global demands to bridge the digital divide, support the broadband agenda in developing countries and provide cost-effective broadband services to rural and underserved areas,

recognizing

a) that Resolution 139 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference calls for bridging the digital divide worldwide through the use of telecommunications/information and communication technologies to bridge the digital divide and build an inclusive information society;

b) that Resolution 37 (Rev. Buenos Aires, 2017) of the World Telecommunication Development Conference calls for bridging the digital divide;

c) that the ITU Radiocommunication Sector (ITU-R) Handbook on fixed wireless access addresses the use of IMT systems for fixed wireless access, and Recommendation ITU-R M.819 contains specific requirements pertaining to fixed wireless access,

resolves to invite the ITU Radiocommunication Sector

to conduct any necessary studies on the use of IMT systems for fixed wireless broadband in the frequency bands allocated to the fixed service on primary basis, taking into account the relevant ITU-R studies, Handbooks, Recommendations and Reports,

instructs the Director of the Radiocommunication Bureau

to report to WRC-23 on the results of these studies,

invites administrations

to participate in these studies in the process of preparation for WRC-23.

RESOLUTION 176 (WRC-19)

Use of the frequency bands 37.5-39.5 GHz (space-to-Earth), 40.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) by aeronautical and maritime earth stations in motion communicating with geostationary space stations in the fixed-satellite service

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 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 37.5-40.5 GHz (space-to-Earth), 40.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space);

c) that in the FSS, there are geostationary-satellite (GSO) networks operating and/or planned for near-term operation in the frequency bands allocated to the FSS in the frequency range 37.5-51.4 GHz;

d) that some administrations have already deployed, and plan to expand their use of, ESIMs with operational and future GSO FSS networks;

e) that GSO FSS networks in the frequency bands 37.5-39.5 GHz (space-to-Earth), 40.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) are required to be coordinated and notified in accordance with the provisions of Articles **9** and **11**;

f) that the frequency bands 37.5-39.5 GHz, 40.5-42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz 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,

recognizing

a) that Article **21** contains power flux-density (pfd) limits for GSO FSS;

b) that advances in technology, including the use of tracking techniques, allow ESIMs to operate within the characteristics of fixed earth stations of the FSS;

c) that WRC-15 adopted No. **5.527A** and Resolution **156 (WRC-15)** related to ESIMs;

d) that ESIMs addressed by this Resolution are not to be used for safety-of-life applications;

e) that the frequency bands 40.5-42 GHz (space-to-Earth) in Region 2, 47.5-47.9 GHz (space-to-Earth) in Region 1, 48.2-48.54 GHz (space-to-Earth) in Region 1, 49.44-50.2 GHz (space-to-Earth) in Region 1 and 48.2-50.2 GHz (Earth-to-space) in Region 2 are identified for use by high-density applications in the FSS (No. **5.516B**);

f) that the frequency bands 37-40 GHz, 40.5-43.5 GHz are available for high-density applications in the fixed service (No. **5.547**);

g) that the pfd in the frequency band 42.5-43.5 GHz produced by any GSO space station in the FSS (space-to-Earth) or the broadcasting-satellite service (BSS) operating in the frequency band 42-42.5 GHz shall not exceed, at the site of any radio astronomy station, the values listed in No. **5.551I**;

h) that the allocation of the spectrum for the FSS in the frequency bands 42.5-43.5 GHz and 47.2-50.2 GHz for Earth-to-space transmission is greater than that in the frequency band 37.5-39.5 GHz for space-to-Earth transmission in order to accommodate feeder links to broadcasting satellites, and administrations are urged to take all practicable steps to reserve the frequency band 47.2-49.2 GHz for feeder links for the BSS operating in the frequency band 40.5-42.5 GHz (No. **5.552**);

i) that the allocation to the fixed service in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz is designated for use by high-altitude platform stations, and the use of the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz is subject to the provisions of Resolution **122 (Rev.WRC-19)** (No. **5.552A**);

j) 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**);

k) 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 dB(W/m^2) in any 500 kHz band at the site of any radio astronomy station (No. **5.555B**);

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** apply among other provisions of the Radio Regulations;

m) that the fixed and mobile services are allocated on a primary basis in the frequency bands 37.5-42.5 GHz and 47.2-50.2 GHz on a global basis;

n) that the frequency band 37.5-38 GHz is allocated to the space research service (SRS) (deep space) in the space-to-Earth direction and the frequency band 40.0-40.5 GHz is allocated to the SRS and the Earth exploration-satellite service (EESS) in the Earth-to-space direction on a primary basis;

o) that the frequency bands 37.5-40.5 GHz and 38-39.5 GHz are also allocated to the EESS in the space-to-Earth direction on a secondary basis;

p) that the frequency band 50.2-50.4 GHz is allocated on a primary basis to the EESS (passive) and SRS (passive), which need to be adequately protected;

q) that all allocated services in these frequency bands should be taken into account,

resolves to invite the ITU Radiocommunication Sector

1 to study the technical and operational characteristics of aeronautical and maritime ESIMs that plan to operate within GSO FSS allocations in the frequency bands 37.5-39.5 GHz, 40.5-42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz;

2 to study sharing and compatibility between aeronautical and maritime ESIMs operating with GSO FSS networks in the frequency bands 37.5-39.5 GHz, 40.5-42.5 GHz, 47.2-50.2 GHz[*] and 50.4-51.4 GHz[*] and current and planned stations of existing services allocated in these frequency bands and, where appropriate, in adjacent frequency bands, in order to ensure protection of, and not impose undue constraints on, those services;

3 to develop, for different types of ESIM, technical conditions and regulatory provisions for their operation, taking into account the results of the studies above,

invites the 2027 World Radiocommunication Conference

to consider the results of the above studies and take necessary actions, as appropriate, provided that the results of the studies referred to in *resolves to invite the ITU Radiocommunication Sector* are complete and agreed by the radiocommunication study groups.

[*] For the frequency bands 47.2-50.2 GHz and 50.4-51.4 GHz, sharing and compatibility studies for aeronautical ESIM should take into account all necessary steps to protect the terrestrial services to which the frequency band is allocated to.

RESOLUTION 177 (WRC-19)

Studies relating to spectrum needs and possible allocation of the frequency band 43.5-45.5 GHz to the fixed-satellite service

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

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 (45 Mbit/s is already available), 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 spectrum above 30 GHz to increase the efficient use of spectrum;

d) that fixed-satellite applications in spectrum above 30 GHz, such as gateways, should be easier to share with other radiocommunication services than high-density fixed-satellite service applications;

e) that FSS systems based on the use of new technologies above 30 GHz and associated with both geostationary and non-geostationary satellite constellations are capable of providing high-capacity and economically feasible communications even to the most isolated regions of the world,

noting

that the frequency band 43.5-45.5 GHz is allocated to the mobile, mobile-satellite, radionavigation and radionavigation-satellite services on a primary basis,

recognizing

the need to protect existing services when considering frequency bands for possible additional allocations to any service,

resolves to invite the ITU Radiocommunication Sector

to conduct, and complete in time for WRC-27:

1 studies considering additional spectrum needs for development of the FSS, taking into account the frequency bands currently allocated to the FSS, the technical conditions of their use and the possibility of optimizing the use of these frequency bands with a view to increasing spectrum efficiency;

2 sharing and compatibility studies with existing services allocated on a primary basis, to determine the suitability of new primary allocations to the FSS in the frequency band 43.5-45.5 GHz,

invites the 2027 World Radiocommunication Conference

to consider the results of studies in *resolves to invite the ITU Radiocommunication Sector* 1 above and take appropriate actions, if necessary,

invites administrations

to participate actively in these studies by submitting contributions to the ITU Radiocommunication Sector.

RESOLUTION 178 (WRC-19)

Studies of technical and operational issues and regulatory provisions for non-geostationary fixed-satellite service satellite system feeder links in the frequency bands 71-76 GHz (space-to-Earth and proposed new Earth-to-space) and 81-86 GHz (Earth-to-space)

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

considering

a) that satellite systems are increasingly being used to deliver broadband services and are part of the solutions to enable broadband access;

b) that next-generation fixed-satellite service (FSS) technologies are required to deliver multi-terabit speeds to support demanding real-time applications, which can be delivered by large-constellation non-geostationary-satellite (non-GSO) FSS systems;

c) that the particular characteristics of such high-capacity feeder links for large-constellation non-GSO FSS systems involve highly directional antennas on both the satellites and the earth stations and, as such, may be conducive to frequency-sharing arrangements including, but not limited to, consideration of reverse-band operation in certain situations, and consideration of whether No. **22.2** can be replaced by another sharing mechanism between geostationary-satellite (GSO) and non-GSO systems in some or all of the frequency bands 71-76 GHz and 81-86 GHz;

d) that GSO networks are operating or planned to operate in these frequency bands and that some administrations are considering deploying high-density fixed-service links in these frequency bands;

e) that studies are required in order to ascertain the feasibility of, and conditions for, non-GSO FSS satellite system feeder links sharing the frequency bands 71-76 GHz (space-to-Earth) and 81-86 GHz (Earth-to-space) with GSO links and with other non-GSO FSS satellite systems;

f) that studies are required to ascertain the feasibility of, and conditions for, a possible new allocation to the FSS (Earth-to-space), for reverse-band feeder links for non-GSO FSS satellite systems in the frequency band 71-76 GHz;

g) that the frequency bands 71-76 GHz and 81-86 GHz are allocated to various services,

considering further

a) that Recommendations ITU-R S.1323, ITU-R S.1325, ITU-R S.1328, ITU-R S.1526 and ITU-R S.1529 provide information on non-GSO and GSO FSS system characteristics, operational requirements and protection criteria that may be used in sharing studies;

b) that Recommendation ITU-R F.2006 provides information on radio-frequency channel and block arrangements for fixed wireless systems operating in the frequency bands 71-76 GHz and 81-86 GHz;

c) that Recommendation ITU-R M.2057 provides information on system characteristics of automotive radars operating in the frequency band 76-81 GHz for intelligent transport system applications;

d) that the ITU Radiocommunication Sector (ITU-R) expert group is currently developing FSS characteristics in the frequency bands 71-76 GHz and 81-86 GHz to provide additional system characteristics of planned high millimetre-wave FSS networks and systems,

noting

a) that filing information for GSO and non-GSO FSS satellite networks in the frequency bands 71-76 GHz (space-to-Earth) and 81-86 GHz (Earth-to-space) has recently been communicated to the Radiocommunication Bureau;

b) that the frequency band 71-76 GHz is also allocated to the fixed and mobile services on a primary basis and is extensively used for applications in the fixed service;

c) that the frequency band 74-76 GHz is also allocated to the broadcasting service and the broadcasting-satellite service (BSS) on a primary basis, as well as the space research service (SRS) in the space-to-Earth direction on a secondary basis;

d) that, in the frequency band 74-76 GHz, the fixed, mobile and broadcasting services shall not cause harmful interference to stations of the FSS in accordance with No. **5.561**;

e) that the frequency band 81-86 GHz is also allocated to the fixed and mobile services and the radio astronomy service (RAS) on a primary basis, as well as the SRS in the space-to-Earth direction on a secondary basis;

f) that Resolution **750 (Rev.WRC-19)** applies in the frequency band 81-86 GHz in accordance with No. **5.338A**;

g) that the frequency band 81-84 GHz is also allocated to the mobile-satellite service (MSS) in the Earth-to-space direction on a primary basis;

h) that the frequency band 81-81.5 GHz is also allocated to the amateur and amateur-satellite services on a secondary basis;

i) that the frequency band 76-81 GHz is also allocated to the radiolocation service on a primary basis,

recognizing

a) that No. **21.16** does not contain power flux-density limits applicable to FSS satellites to protect fixed and mobile services with allocations in the frequency band 71-76 GHz;

b) that the frequency band 86-92 GHz is allocated on a primary basis to the Earth exploration-satellite service (EESS) (passive), the RAS and the SRS (passive), which must be protected, and in accordance with No. **5.340** all emissions are prohibited in the frequency band;

c) that No. **5.149** indicates that radio astronomy observations are carried out in the frequency band 76-86 GHz and that mitigation measures may have to be defined in this regard,

resolves to invite the ITU Radiocommunication Sector

to conduct, and complete in time for WRC-27:

1 studies considering additional spectrum needs for the development of non-GSO FSS satellite systems in the frequency bands 71-76 GHz and 81-86 GHz, the technical conditions for their use, and the possibility of optimizing the use of these frequency bands with a view to increasing spectrum efficiency;

2 studies of technical and operational issues for the operation of feeder links for non-GSO FSS satellite systems in the frequency bands 71-76 GHz (space-to-Earth and the feasibility of a possible new allocation for reverse-band feeder operation in the Earth-to-space direction) and 81-86 GHz (Earth-to-space), as well as consideration of regulatory provisions in some or all of these frequency bands for non-GSO systems coordinating and sharing with both GSO and other non-GSO systems in the FSS, MSS and BSS, and their specific earth stations, taking into account the future growth of these uses and the need to ensure their protection;

3 sharing and compatibility studies between non-GSO FSS satellite system feeder links in the frequency bands 71-76 GHz (space-to-Earth and a possible new allocation for non-GSO FSS in the Earth-to-space direction) and 81-86 GHz (Earth-to-space) and other existing co-primary services, including the fixed and mobile services, in those frequency bands and in adjacent frequency bands, taking into account the need to ensure the protection of these services;

4 studies of possible necessary provisions of the Radio Regulations to ensure protection of the EESS (passive) and SRS (passive) in the frequency band 86-92 GHz from non-GSO FSS transmissions, including study of aggregate FSS interference;

5 studies towards ensuring protection of the RAS operating in the frequency bands 76-86 GHz and 86-92 GHz from non-GSO FSS transmissions, taking into account *recognizing b)* above, including study of aggregate FSS interference effects from networks and systems operating or planned to operate in the frequency bands described in *resolves to invite the ITU Radiocommunication Sector* 2 above,

invites the 2027 World Radiocommunication Conference

to consider the results of the above studies and take appropriate action,

invites administrations

to participate in the studies by submitting contributions to ITU-R.

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-19)

Implementation of International Mobile Telecommunications in the frequency bands 1 885-2 025 MHz and 2 110-2 200 MHz

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

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 latest 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-19)

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 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 MHz[2] 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.

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2 See Resolution **539 (Rev.WRC-19)** for the frequency band 2 605-2 655 MHz.

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 (WRC-97)

Implementation of wind profiler radars

The World Radiocommunication Conference (Geneva, 1997),

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 band 400.15-406 MHz interfere with satellite emergency position-indicating radio beacons operating in the mobile-satellite service in the 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 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 band 440-450 MHz or 470-494 MHz cannot be achieved, the 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 Recommendations ITU-R M.1226, ITU-R M.1085-1 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 band 400.15-406 MHz;

5 to urge administrations currently operating wind profiler radars in the 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 (ICAO), International Maritime Organization (IMO) and WMO.

RESOLUTION 221 (REV.WRC-07)

Use of high altitude platform stations providing IMT in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2

The World Radiocommunication Conference (Geneva, 2007),

considering

a) that the bands 1 885-2 025 MHz and 2 110-2 200 MHz are identified in No. **5.388** as intended for use on a worldwide basis for IMT, including the bands 1 980-2 010 MHz and 2 170-2 200 MHz for the terrestrial and satellite components of IMT;

b) that a high altitude platform station (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";

c) that HAPS may 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 HAPS as base stations within the terrestrial component of IMT is optional for administrations, and that such use should not have any priority over other terrestrial IMT use;

e) that, in accordance with No. **5.388** and Resolution **212 (Rev.WRC-07)**[*], administrations may use the bands identified for IMT, including the bands referred to in this Resolution, for stations of other primary services to which they are allocated;

f) that these bands are allocated to the fixed and mobile services on a co-primary basis;

g) that, in accordance with No. **5.388A**, HAPS may be used as base stations within the terrestrial component of IMT in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2. Their use by IMT applications using HAPS as base stations does not preclude the use of these bands by any station in the services to which they are allocated and does not establish priority in the Radio Regulations;

h) that ITU-R has studied sharing and coordination between HAPS and other stations within IMT, has considered compatibility of HAPS within IMT with some services having allocations in the adjacent bands, and has approved Recommendation ITU-R M.1456;

i) that radio interfaces of IMT HAPS are compliant with Recommendation ITU-R M.1457;

j) that ITU-R has addressed sharing between systems using HAPS and some existing systems, particularly PCS (personal communications system), MMDS (multichannel multipoint distribution system) and systems in the fixed service, which are currently operating in some countries in the bands 1 885-2 025 MHz and 2 110-2 200 MHz;

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[*] *Note by the Secretariat:* This Resolution was revised by WRC-15 and WRC-19.

k) that HAPS stations are intended to transmit in the band 2 110-2 170 MHz in Regions 1 and 3 and in the band 2 110-2 160 MHz in Region 2;

l) that administrations planning to implement a HAPS as an IMT base station may need to exchange information, on a bilateral basis, with other concerned administrations, including data items describing the HAPS characteristics in a more detailed manner than the data items currently included in Annex 1 of Appendix **4**, as indicated in the Annex to this Resolution,

resolves

1 that:

1.1 for the purpose of protecting IMT mobile stations in neighbouring countries from co-channel interference, a HAPS operating as an IMT base station shall not exceed a co-channel power flux-density (pfd) of −117 dB(W/(m^2 · MHz)) at the Earth's surface outside a country's borders unless explicit agreement of the affected administration is provided at the time of the notification of HAPS;

1.2 a HAPS operating as an IMT base station shall not transmit outside the frequency bands 2 110-2 170 MHz in Regions 1 and 3 and 2 110-2 160 MHz in Region 2;

1.3 in Region 2, for the purpose of protecting MMDS stations in some neighbouring countries in the band 2 150-2 160 MHz from co-channel interference, a HAPS operating as an IMT base station shall not exceed the following co-channel pfd at the Earth's surface outside a country's borders unless explicit agreement of the affected administration is provided at the time of the notification of the HAPS;

– −127 dB(W/(m^2 · MHz)) for angles of arrival (θ) less than 7° above the horizontal plane;

– −127 + 0.666 (θ − 7) dB(W/(m^2 · MHz)) for angles of arrival between 7° and 22° above the horizontal plane; and

– −117 dB(W/(m^2 · MHz)) for angles of arrival between 22° and 90° above the horizontal plane;

1.4 in some countries (see No. **5.388B**), for the purpose of protecting fixed and mobile services, including IMT mobile stations, in their territories from co-channel interference caused by a HAPS operating as an IMT base station in accordance with No. **5.388A** in neighbouring countries, the limits of **5.388B** shall apply;

2 that the limits referred to in this Resolution shall apply to all HAPS operating in accordance with No. **5.388A**;

3 that administrations wishing to implement HAPS within a terrestrial IMT system shall comply with the following:

3.1 for the purpose of protecting IMT stations operating in neighbouring countries from co-channel interference, a HAPS operating as a base station within IMT shall use antennas that comply with the following antenna pattern:

$G(\psi) = G_m - 3(\psi/\psi_b)^2$ dBi for $0° \le \psi \le \psi_1$

$G(\psi) = G_m + L_N$ dBi for $\psi_1 < \psi \le \psi_2$

$G(\psi) = X - 60 \log(\psi)$ dBi for $\psi_2 < \psi \le \psi_3$

$G(\psi) = L_F$ dBi for $\psi_3 < \psi \le 90°$

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

$$\psi_1 = \psi_b \sqrt{-L_N / 3} \quad \text{degrees}$$

$$\psi_2 = 3.745\ \psi_b \quad \text{degrees}$$

$$X = G_m + L_N + 60 \log (\psi_2) \quad \text{dBi}$$

$$\psi_3 = 10^{(X - L_F)/60} \quad \text{degrees}$$

The 3 dB beamwidth ($2\psi_b$) is estimated by:

$$(\psi_b)^2 = 7\,442/(10^{0.1 G_m}) \quad \text{degrees}^2;$$

3.2 for the purpose of protecting mobile earth stations within the satellite component of IMT from interference, a HAPS operating as an IMT base station, shall not exceed an out-of-band pfd of −165 dB(W/(m^2 · 4 kHz)) at the Earth's surface in the bands 2 160-2 200 MHz in Region 2 and 2 170-2 200 MHz in Regions 1 and 3;

3.3 a HAPS operating as an IMT base station, in order to protect fixed stations from interference, shall not exceed the following limits of out-of-band power flux-density (pfd) at the Earth's surface in the bands 2 025-2 110 MHz:

– −165 dB(W/(m^2 · MHz)) for angles of arrival (θ) less than 5° above the horizontal plane;

– −165 + 1.75 (θ − 5) dB(W/(m^2 · MHz)) for angles of arrival between 5° and 25° above the horizontal plane; and

– −130 dB(W/(m^2 · MHz)) for angles of arrival between 25° and 90° above the horizontal plane;

4 that, for facilitating consultations between administrations, administrations planning to implement a HAPS as an IMT base station shall furnish to the concerned administrations the additional data elements listed in the Annex to this Resolution, if so requested;

5 that administrations planning to implement a HAPS as an IMT base station 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* 1.1, 1.3 and 1.4 above;

6 that, since 5 July 2003, the Bureau and administrations provisionally apply Nos. **5.388A** and **5.388B** as revised by WRC-03 for the frequency assignments to HAPS referred to in this Resolution, including those received before this date but not yet processed by the Bureau,

invites ITU-R

to develop, as a matter of urgency, an ITU-R Recommendation providing technical guidance to facilitate consultations with neighbouring administrations.

ANNEX TO RESOLUTION 221 (REV.WRC-07)

Characteristics of a HAPS operating as an IMT base station in the frequency bands given in Resolution 221 (Rev.WRC-07)

A General characteristics to be provided for the station

A.1 Identity of the station

a) Identity of the station

b) Country

A.2 Date of bringing into use

The date (actual or foreseen, as appropriate) of bringing the frequency assignment (new or modified) into use.

A.3 Administration or operating agency

Symbols for the administration or operating agency and for the address of the administration to which communication should be sent on urgent matters regarding interference, quality of emissions and questions referring to the technical operation of the station (see Article **15**).

A.4 Position information of the HAPS

a) The nominal geographical longitude for the HAPS

b) The nominal geographical latitude for the HAPS

c) The nominal altitude for the HAPS

d) The planned longitudinal and latitudinal tolerance for the HAPS

e) The planned tolerance of altitude for the HAPS

A.5 Agreements

If appropriate, the country symbol of any administration or administration representing a group of administrations with which agreement has been reached, including where the agreement is to exceed the limits prescribed in Resolution **221 (Rev.WRC-07)**.

B Characteristics to be provided for each antenna beam

B.1 HAPS antenna characteristics

a) The maximum isotropic gain (dBi).

b) HAPS antenna gain contours plotted on a map of the Earth's surface.

C Characteristics to be provided for each frequency assignment for HAPS antenna beam

C.1 Frequency range

C.2 Power density characteristics of the transmission

The maximum value of the maximum power density (dB(W/MHz)), averaged over the worst 1 MHz supplied to the input of the antenna.

D Calculated pfd limit produced over any country in visibility of HAPS

The maximum pfd calculated at the Earth's surface within each administration's territory over which the HAPS may be visible and over which these calculated pfd levels exceed the limits indicated in *resolves* 1.1, 1.3 and 1.4 of Resolution **221 (Rev.WRC-07)**.

RESOLUTION 222 (REV.WRC-12)

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 (Geneva, 2012),

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-12)

Procedures to implement No. 5.357A and Resolution 222 (Rev.WRC-12)

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 until such time as an ITU-R Recommendation is available pursuant 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-19)

Additional frequency bands identified for International Mobile Telecommunications

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

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-19)**;

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 basis[1];

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;

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;

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[1] See Table **21-4** for applicable pfd limits.

ac) that WRC-15 and this conference 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 3 300-3 400 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 WRC-15 and this conference identified the frequency band 4 800-4 990 MHz 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,

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-19)** and **225 (Rev.WRC-12)**, 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, 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** by 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** by 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**, which is subject to review at WRC-23, 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 conduct compatibility studies in order to provide technical measures to ensure coexistence between the MSS in the frequency band 1 518-1 525 MHz and IMT in the frequency band 1 492-1 518 MHz, including guidance on the implementation of frequency arrangements for IMT deployment in the frequency band 1 427-1 518 MHz, taking into account the results of these studies;

2 to study the technical and regulatory conditions for the protection of stations of the AMS and the maritime mobile service (MMS) located in international airspace or waters (i.e. outside national territories) and operated in the frequency band 4 800-4 990 MHz;

3 to continue providing guidance to ensure that IMT can meet the telecommunication needs of developing countries and rural areas;

4 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,

invites the 2023 World Radiocommunication Conference

to consider, based on the results of the studies referred to in *invites the ITU Radiocommunication Sector* above, possible measures to address, in the frequency band 4 800-4 990 MHz, protection of stations of the AMS and MMS located in international airspace and waters from other stations located within national territories and to review the pfd criteria in No. **5.441B**.

RESOLUTION 224 (REV.WRC-19)

Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz

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

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**, 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**, and in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**;

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-12)

Use of additional frequency bands for the satellite component of IMT

The World Radiocommunication Conference (Geneva, 2012),

considering

a) that the 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-07)***;

b) Resolutions **212 (Rev.WRC-07)***, **223 (Rev.WRC-12)*** and **224 (Rev.WRC-12)*** 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 bands 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**;

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

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 ITU-R

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 Telecommunication Development Sector to this Resolution.

RESOLUTION 229 (REV.WRC-19)

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 (Sharm el-Sheikh, 2019),

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)**[*], 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**;

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[*] *Note by the Secretariat:* This Resolution was revised by WRC-12 and WRC-19.

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;

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.[1] 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;

[1] 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 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.[1] 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.1426[2] 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):

-13 dB(W/MHz)	for	$0° \le \theta < 8°$
$-13 - 0.716(\theta - 8)$ dB(W/MHz)	for	$8° \le \theta < 40°$
$-35.9 - 1.22(\theta - 40)$ dB(W/MHz)	for	$40° \le \theta \le 45°$
-42 dB(W/MHz)	for	$45° < \theta$;

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;

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[2] $-124 - 20 \log (h_{SAT}/1\,414)$ dB(W/(m^2 · 1 MHz)), or equivalently, $-140 - 20 \log (h_{SAT}/1\,414)$ dB(W/(m^2 · 25 kHz)), at the FSS satellite orbit, where h_{SAT} is the altitude of the satellite (km).

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 mW[3] 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,

invites the ITU Radiocommunication Sector

1 to continue studies on mitigation techniques to provide protection of EESS from stations in the mobile service;

2 to continue studies on suitable test methods and procedures for the implementation of dynamic frequency selection, taking into account practical experience.

[3] Administrations with existing regulations prior to WRC-03 may exercise some flexibility in determining transmitter power limits.

RESOLUTION 235 (WRC-15)

Review of the spectrum use of the frequency band 470-960 MHz in Region 1

The World Radiocommunication Conference (Geneva, 2015),

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 470-862 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 obligation to provide 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, in many countries, there is a need for investment in the next decade for the migration of broadcasting into the frequency band below 694 MHz and for the implementation of new-generation broadcasting technologies, in order to take advantage of technological developments to increase the efficient use of the spectrum;

g) that in many developing countries terrestrial broadcasting is the only viable means of delivery of broadcast services;

h) that the technology trend in digital terrestrial television (DTT) is towards high-definition television which requires a higher bit rate than standard-definition television;

i) that it is necessary to adequately protect all primary services in the frequency band 470-694 MHz and in adjacent frequency bands;

j) that International Mobile Telecommunications (IMT) systems, utilizing some parts of the frequency band 694/698-960 MHz, are intended to provide telecommunication services on a worldwide scale, regardless of location, network or terminal used;

k) that, for countries listed in No. **5.296**, an additional allocation to the land-mobile service on a secondary basis is in place, intended for applications ancillary to broadcasting and programme-making;

l) 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**;

m) 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**), and also to the radio astronomy service on a secondary basis (No. **5.306**), and, according to No. **5.149**, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference when making assignments to stations of other services,

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 and the provisions of No. **4.4** of the Radio Regulations;

d) that information on implementation of the digital dividend and on the transition to digital television and its technological evolution is needed and may not be available before 2019,

noting

the ongoing development of new applications and technologies of both the broadcasting and mobile services,

resolves to invite ITU-R, after the 2019 World Radiocommunication Conference and in time for the 2023 World Radiocommunication Conference

1 to review the spectrum use and study the 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, taking into account the relevant ITU Radiocommunication Sector (ITU-R) studies, Recommendations and Reports;

2 to carry out sharing and compatibility studies, as appropriate, in the frequency band 470-694 MHz in Region 1 between the broadcasting and mobile, except aeronautical mobile, services, taking into account relevant ITU-R studies, Recommendations and Reports;

3 to conduct sharing and compatibility studies, as appropriate, in order to provide relevant protection of systems of other existing services,

invites administrations

to participate actively in the studies by submitting contributions to ITU-R,

resolves to invite the 2023 World Radiocommunication Conference

to consider, based on the results of studies above, provided that these studies are completed and approved by ITU-R, possible regulatory actions in the frequency band 470-694 MHz in Region 1, as appropriate,

further invites ITU-R

to ensure intersectoral collaboration with the ITU Telecommunication Development Sector (ITU-D) 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 (WRC-19)

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 (Sharm el-Sheikh, 2019),

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, which provides 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. Dubai, 2018) and 203 (Rev. Dubai, 2018) 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 harmonized frequency arrangements for the implementation of the terrestrial component of IMT in the frequency band 66-71 GHz;

2 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;

3 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 (WRC-19)

Terrestrial component of International Mobile Telecommunications in the frequency band 24.25-27.5 GHz

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

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 of 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

Recommendation ITU-R M.2083, which 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) Resolutions 176 (Rev. Dubai, 2018) and 203 (Rev. Dubai, 2018) 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 km^2 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/space research service (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 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 develop harmonized frequency arrangements to facilitate IMT deployment in the frequency band 24.25-27.5 GHz, taking into account the results of sharing and compatibility studies conducted in preparation for WRC-19;

2 to develop an ITU-R Recommendation on methodologies for calculating coordination zones around EESS/SRS earth stations in order to avoid harmful interference from IMT systems in the frequency band 25.5-27 GHz;

3 to develop ITU-R Recommendation(s) to assist administrations to mitigate interference from FSS earth stations into IMT stations operating in the frequency bands 24.65-25.25 GHz and 27-27.5 GHz;

4 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;

5 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 (WRC-19)

Terrestrial component of International Mobile Telecommunications in the frequency bands 37-43.5 GHz and 47.2-48.2 GHz

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

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) Recommendation ITU-R M.2083, which provides the "IMT Vision – 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,

recognizing

a) that timely availability of wide and contiguous blocks of spectrum is important to support the development of IMT;

b) Resolutions 176 (Rev. Dubai, 2018) and 203 (Rev. Dubai, 2018) 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 this conference 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 Earth exploration satellite service (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 space research service (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 as per 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 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 develop harmonized frequency arrangements to facilitate IMT deployment in the frequency bands 37-43.5 GHz and 47.2-48.2 GHz, taking into account the results of sharing and compatibility studies conducted in preparation for WRC-19;

2 to continue providing guidance to ensure that IMT can meet the telecommunication needs of the developing countries;

3 to develop an ITU-R Recommendation on methodologies for calculating coordination zones around SRS earth stations in order to avoid harmful interference from IMT systems in the frequency band 37-38 GHz;

4 to develop ITU-R Reports and Recommendations, as appropriate, to assist administrations in ensuring coexistence between IMT and BSS and FSS, including HDFSS as per No. **5.516B**, within the frequency ranges 37-43.5 GHz and 47.2-48.2 GHz, as appropriate;

5 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;

6 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 (WRC-19)

International Mobile Telecommunications in the frequency band 45.5-47 GHz

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

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

Recommendation ITU-R M.2083, which provides the “IMT Vision – 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

1 to develop harmonized frequency arrangements to facilitate IMT deployment in the frequency band 45.5-47 GHz;

2 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 245 (WRC-19)

Studies on frequency-related matters for the terrestrial component of International Mobile Telecommunications identification in the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz

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

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 being evolved to provide diverse usage scenarios such as enhanced mobile broadband, massive machine-type communications and ultra-reliable and low-latency communications, and applications including fixed broadband;

d) 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;

e) that, compared with lower and higher frequency bands, the mid-band spectrum can provide better balance for meeting needs for both coverage and capacity;

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 short 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 the ITU Telecommunication Standardization Sector has been working on network standardization for IMT-2020 and beyond;

i) that adequate and timely availability of spectrum and corresponding regulatory provisions are essential to support the future development of IMT;

j) that harmonized worldwide frequency bands and harmonized frequency arrangements for IMT are highly desirable in order to achieve global roaming and the benefits of economies of scale;

k) that identification of frequency bands as in *considering e)* for IMT may change the sharing situation regarding applications of all services to which the frequency band is already allocated, and may require additional regulatory actions;

l) the need to protect existing services and to allow for their continued development when considering frequency bands for possible additional allocations to any service,

noting

a) that Resolution ITU-R 65 addresses the principles for the process of development of IMT for 2020 and beyond;

b) that IMT encompasses IMT-2000, IMT-Advanced and IMT-2020 collectively, as described in Resolution ITU-R 56-2;

c) that Question ITU-R 77-8/5 considers the needs of developing countries in the development and implementation of IMT;

d) that Question ITU-R 229/5 seeks to address the further development of IMT;

e) that Question ITU-R 262/5 addresses the study of usage of IMT systems for specific applications;

f) Recommendation ITU-R M.2083, on the framework and objectives of the future development of IMT for 2020 and beyond;

g) Recommendation ITU-R M.2101, on modelling and simulation of IMT networks and systems for use in sharing and compatibility studies;

h) Recommendation ITU-R P.2108, on prediction of clutter loss;

i) that Report ITU-R M.2320 addresses future technology trends of terrestrial IMT systems;

j) that Report ITU-R M.2370 analyses trends impacting future IMT traffic growth beyond the year 2020 and estimates global traffic demand for the period 2020 to 2030;

k) Report ITU-R M.2376, on technical feasibility of IMT in the frequency bands above 6 GHz;

l) Report ITU-R M.2410, on minimum requirements related to technical performance for IMT-2020 radio interface(s);

m) Report ITU-R M.2481, on 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,

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 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 bands by other services and the evolving needs of these services,

resolves to invite the ITU Radiocommunication Sector

1 to conduct and complete in time for WRC-23 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* 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;

– the time-frame in which spectrum would be needed;

2 to conduct and complete in time for WRC-23 the sharing and compatibility studies[1], with a view to ensuring the protection of services to which the frequency band is allocated on a primary basis, without imposing additional regulatory or technical constraints on those services, and also, as appropriate, on services in adjacent bands, for the frequency bands:

– 3 600-3 800 MHz and 3 300-3 400 MHz (Region 2);

– 3 300-3 400 MHz (amend footnote in Region 1);

– 7 025-7 125 MHz (globally);

– 6 425-7 025 MHz (Region 1);

– 10.0-10.5 GHz (Region 2),

resolves

1 to invite the first session of the Conference Preparatory Meeting for WRC-23 to define the date by which technical and operational characteristics needed for sharing and compatibility studies are to be available to ensure that studies referred to in *resolves to invite the ITU Radiocommunication Sector* can be completed in time for consideration at WRC-23;

2 to invite WRC-23 to consider, based on the results of the above studies, additional spectrum allocations to the mobile service on a primary basis and to consider 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* 2,

invites administrations

to participate actively in these studies by submitting contributions to the ITU Radiocommunication Sector.

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1 Including studies with respect to services in adjacent bands, as appropriate.

RESOLUTION 246 (WRC-19)

Studies to consider possible allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis within Region 1

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

considering

a) that the frequency band 3 600-3 800 MHz is allocated to the fixed and fixed-satellite services on a primary basis in all three Regions and is also allocated to the mobile, except aeronautical mobile, service on a primary basis within Regions 2 and 3;

b) that the frequency band 3 600-3 800 MHz is allocated to the mobile service on a secondary basis within Region 1;

c) that terrestrial systems of the mobile service are intended to provide telecommunication services on a worldwide scale, regardless of location;

d) that some administrations in Region 1 are currently using the frequency band 3 600-3 800 MHz, or part of that frequency band, for the mobile service (for example International Mobile Telecommunications (IMT) implementation);

e) the need to protect existing services when considering possible additional allocation to any service in any frequency band;

f) that the systems operating in the new allocation should not impose constraints on the existing systems of primary services, including in adjacent frequency bands,

recognizing

a) that there is a need in many countries to identify additional harmonized spectrum resources for cost-effective implementation of mobile systems;

b) that the ITU Radiocommunication Sector (ITU-R) performed studies in the frequency band 3 400-4 200 MHz between the fixed-satellite service (FSS) and IMT during previous study cycles (for example Reports ITU-R S.2368 and ITU-R M.2109);

c) that for African countries, especially those in tropical areas, the operations of FSS systems are more reliable for use in at C-band frequencies (3 400-4 200 MHz), rather than in higher frequency bands,

resolves to invite the ITU Radiocommunication Sector

to conduct sharing and compatibility studies in time for WRC-23 between the mobile service and other services allocated on a primary basis within the frequency band 3 600-3 800 MHz and adjacent frequency bands in Region 1, as appropriate, to ensure protection of those services to which the frequency band is allocated on a primary basis and not impose undue constraints on the existing services and their future development,

invites the 2023 World Radiocommunication Conference

based on the results of studies in *resolves to invite the ITU Radiocommunication Sector*, to consider possible upgrade of the allocation of the frequency band 3 600-3 800 MHz to the mobile, except aeronautical mobile, service on a primary basis within Region 1, and to take appropriate regulatory actions,

invites administrations

to participate in these studies in the process of preparation for WRC-23.

RESOLUTION 247 (WRC-19)

Facilitating mobile connectivity in certain frequency bands below 2.7 GHz using high-altitude platform stations as International Mobile Telecommunications base stations

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

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 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 IMT systems have evolved significantly in terms of spectrum identification, network deployment and radio access technology, with the standardization of IMT-Advanced and IMT-2020;

d) that studies of new IMT network topologies may provide increased spectrum efficiency for the frequency bands already identified for IMT;

e) that HIBS may be used as a part of terrestrial IMT networks to provide mobile connectivity to underserved communities and in rural and remote areas, with the ability to utilize a large footprint at low latency;

f) that recent technological advances in battery and solar-panel technologies provide further support for the deployment of HIBS;

g) that the user equipment 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;

h) that mobile connectivity is becoming widespread, connecting not only people but also objects (e.g. IoT: Internet of Things, IoE: Internet of Everything), based on IMT technologies (e.g. eMTC: enhanced machine-type communication, NB-IoT: narrowband IoT) which are expected to be used widely, including in unpopulated areas;

i) that the use of HIBS within the terrestrial component of IMT should not have any priority, and shall not cause any undue constraints which result in regulatory changes to the existing IMT identifications in the Radio Regulations;

j) that studies must be performed to demonstrate that sharing with existing services in the frequency band, including other IMT uses, is feasible, and that those existing services are protected with no new regulatory constraints on those existing uses and planned development;

k) that any potential new regulatory procedural considerations resulting from potential HIBS identifications should not apply to existing IMT identifications in the Radio Regulations;

l) that studies should be limited to sharing and compatibility between HIBS and other existing services and applications;

m) that the frequency bands identified for IMT below 2.7 GHz are used extensively to provide mobile-broadband services using ground-based IMT systems,

noting

that Recommendations ITU-R M.1456 and ITU-R M.1641 provide technical characteristics and operational conditions, as well as a methodology for the studies between HIBS and ground-based IMT systems in certain frequency bands around 1.9/2.1 GHz,

recognizing

a) that high-altitude platform station 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 the frequency bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3 and the frequency bands 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2 are included in No. **5.388A** for the use of HIBS, in accordance with the provisions of Resolution **221 (Rev.WRC-07)**;

c) that Nos. **5.388A** and **5.388B** and Resolution **221 (Rev.WRC-07)** stipulate technical conditions for high-altitude IMT necessary for the protection of ground-based IMT stations in neighbouring countries and other services, based on the sharing and compatibility studies with IMT-2000;

d) that some frequency bands below 2.7 GHz are globally or regionally identified for IMT in accordance with Nos. **5.286AA**, **5.317A**, **5.341A**, **5.341B, 5.341C, 5.346**, **5.346A**, **5.384A** and **5.388**;

e) that the ITU Radiocommunication Sector (ITU-R) is conducting co-channel sharing analysis involving IMT-Advanced systems using HIBS;

f) that some geostationary-satellite mobile-satellite service (MSS) networks in Region 3 have reported harmful interference affecting their uplinks in the frequency band 2 655-2 690 MHz from terrestrial IMT stations operating in some countries in Region 3 and Region 1, and ITU-R is conducting sharing and coexistence studies between the MSS and terrestrial IMT systems in the frequency band 2 655-2 690 MHz;

g) that the frequency bands 2 520-2 670 MHz and 2 700-2 900 MHz are allocated on a primary basis to the broadcasting-satellite service and the aeronautical radionavigation service, respectively,

resolves to invite the ITU Radiocommunication Sector

1 to study spectrum needs, as appropriate, for HIBS to provide mobile connectivity in the mobile service, taking into account:

– the existing identification in *recognizing b)*;

– the usage and deployment scenario envisioned for HIBS as complementary for terrestrial IMT networks;

– the technical and operational characteristics and requirements of HIBS;

2 to conduct and complete in time for WRC-23, taking into account the results of studies already performed and those in progress within ITU-R, sharing and compatibility studies to ensure the protection of services, without imposing any additional technical or regulatory constraints in their deployment, to which the frequency band is allocated on a primary basis, including other IMT uses, existing systems and the planned development of primary allocated services, and adjacent services, as appropriate, for certain frequency bands below 2.7 GHz, or portions thereof, globally or regionally harmonized for IMT, i.e.:

– 694-960 MHz;

– 1 710-1 885 MHz (1 710-1 815 MHz to be used for uplink only in Region 3);

– 2 500-2 690 MHz (2 500-2 535 MHz to be used for uplink only in Region 3, except 2 655-2 690 MHz in Region 3);

3 to study appropriate modifications to the existing footnote and associated resolution in the identification referred to in *recognizing b)* in order to facilitate the use of HIBS with the latest radio interface technologies of IMT;

4 to study the definition of HIBS, including possible modifications to the provisions of the Radio Regulations, as appropriate;

5 to develop ITU-R Recommendations and Reports, as appropriate, taking into account *resolves to invite the ITU Radiocommunication Sector* 1, 2, 3 and 4 above,

invites the 2023 World Radiocommunication Conference

to consider, based on the results of the above studies, the use of HIBS in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level, and take necessary regulatory actions, as appropriate, taking into account that changes to the footnotes referred to in *recognizing d)* are outside the scope and there should be no additional regulatory or technical constraints imposed on the deployment of ground-based IMT systems in the frequency bands referred to in those footnotes,

invites administrations

to participate actively in these studies by submitting contributions to ITU-R.

RESOLUTION 248 (WRC-19)

Studies relating to spectrum needs and potential new allocations to the mobile-satellite service in the frequency bands 1 695-1 710 MHz, 2 010-2 025 MHz, 3 300-3 315 MHz and 3 385-3 400 MHz for future development of narrowband mobile-satellite systems

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

considering

a) that a preliminary assessment of the spectrum requirements would suggest that a pairing of no more than 5 MHz in the uplink and 5 MHz in the downlink may suffice for the applications of low data-rate systems for the collection of data from, and management of, terrestrial devices in the mobile-satellite service (MSS);

b) that the frequency bands under consideration, namely 1 695-1 710 MHz, 2 010-2 025 MHz, 3 300-3 315 MHz and 3 385-3 400 MHz, are allocated on a primary or secondary basis to the mobile service, fixed service, mobile-satellite service (MSS), amateur service, radiolocation service and meteorological services, among others;

c) that previous studies only addressed spectrum requirements for the satellite component of International Mobile Telecommunications (IMT) - IMT-2000 and systems beyond IMT-2000 (Report ITU-R M.2077), and spectrum requirements for new broadband MSS applications in the 4-16 GHz frequency range (Reports ITU-R M.2218 and ITU-R M.2221);

d) that Report ITU-R M.2218 suggests that the operational characteristics of incumbent MSS systems may constrain and effectively hamper the sharing of existing MSS spectrum, resulting in a requirement for additional spectrum for new applications;

e) that Report ITU-R SA.2312 suggests that MSS frequency bands already allocated above 5 GHz are not suited to the inherent size, weight and power restrictions of small satellites (usually having a mass of less than 100 kg);

f) that earth and space stations used for the applications of the systems referred to in *considering a)* may include a combination of low power and intermittent transmissions to facilitate spectrum sharing and spectrum requirements,

noting

a) the existing MSS allocation and current use of the frequency band 2 010-2 025 MHz, in particular in Region 2;

b) that the number of mobile-satellite systems using small satellites for the systems described in *considering a)* is growing and the spectrum demand for suitable MSS allocations is increasing;

c) the examples, technical characteristics and benefits of such satellites given in Report ITU-R SA.2312;

d) the contribution of the applications described in *considering a)*, delivering actionable information, to the promotion of human welfare;

e) the insufficient spectrum opportunities for new applications described in *considering a)* to operate in MSS frequency bands below 5 GHz;

f) that Recommendation ITU-R SA.1158-3 summarized that narrowband short-duration types of data transmissions in the MSS (Earth-to-space) may feasibly share the frequency band 1 670-1 710 MHz with the meteorological-satellite service (space-to-Earth),

recognizing

a) that the existing primary allocated services in the frequency bands considered and adjacent frequency bands shall be protected;

b) the need for regulatory certainty regarding the available spectrum for both satellite and earth station design and planning purposes;

c) that the studies envisaged under *resolves to invite the ITU Radiocommunication Sector* in this Resolution are to be limited to those systems with space stations that have a maximum equivalent isotropically radiated power (e.i.r.p.) of 27 dBW or less, with a beamwidth of no more than 120 degrees, and earth stations that individually communicate no more than once every 15 minutes, for no more than 4 seconds at a time, with a maximum e.i.r.p. of 7 dBW;

d) that some of the frequency bands listed in *resolves to invite the ITU Radiocommunication Sector* 2 are identified for IMT in accordance with No. **5.429D**;

e) that the introduction of the applications of the possible new MSS allocation should not impose constraints on other existing allocated primary services in the frequency bands under consideration and adjacent frequency bands operating in accordance with the Radio Regulations,

resolves to invite the ITU Radiocommunication Sector

1 to conduct studies on spectrum and operational requirements as well as system characteristics of low data-rate systems for the collection of data from, and management of, terrestrial devices in the MSS as described in *considering a)* and limited to the basic characteristics in *recognizing c)*;

2 to conduct sharing and compatibility studies with existing primary services to determine the suitability of new allocations to the MSS, with a view to protecting the primary services, in the following frequency bands and adjacent frequency bands:

- 1 695-1 710 MHz in Region 2,
- 2 010-2 025 MHz in Region 1,
- 3 300-3 315 MHz and 3 385-3 400 MHz in Region 2;

3 to consider possible new primary or secondary allocations, with the necessary technical limitations, taking into account the characteristics described in *recognizing c),* to the MSS for non-geostationary satellites operating low data-rate systems for the collection of data from, and management of, terrestrial devices, based on the results of sharing and compatibility studies, while ensuring the protection of existing primary services in those frequency bands and adjacent frequency bands, without causing undue constraints on their further development,

invites the 2023 World Radiocommunication Conference

to determine, on the basis of the studies conducted under *resolves to invite the ITU Radiocommunication Sector* above, appropriate regulatory actions,

invites administrations

to participate in the studies by submitting contributions to the ITU Radiocommunication Sector.

RESOLUTION 249 (WRC-19)

Study of technical and operational issues and regulatory provisions for space-to-space transmissions in the Earth-to-space direction in the frequency bands [1 610-1 645.5 and 1 646.5-1 660.5 MHz] and the space-to-Earth direction in the frequency bands [1 525-1 544 MHz], [1 545-1 559 MHz], [1 613.8-1 626.5 MHz] and [2 483.5-2 500 MHz] among non-geostationary and geostationary satellites operating in the mobile-satellite service*

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

considering

a) that the definition of mobile-satellite service (MSS) in No. **1.25** includes communication between space stations;

b) that the definition of inter-satellite service (ISS) in No. **1.22** includes only links between space stations, and that the term *inter-satellite link* in this resolution is taken to mean a radiocommunication service link between artificial satellites;

c) that many non-geostationary-satellite orbit (non-GSO) satellites operate with limited and non-real-time connectivity to earth stations;

d) that space-to-space communication between such non-GSO satellites and geostationary-satellite orbit (GSO) MSS satellites would enhance the security and efficiency of operations;

e) that MSS satellites operating in the frequency bands 1 525-1 544 MHz, 1 545-1 559 MHz, 1 610-1 645.5 MHz, 1 646.5-1 660.5 MHz and 2 483.5-2 500 MHz can support these types of operation;

f) that using the frequency bands 1 610-1 645.5 MHz and 1 646.5-1 660.5 MHz allocated to the MSS (Earth-to-space) for transmissions in the Earth-to-space direction from non-GSO MSS space stations towards MSS space stations operating at higher orbital altitudes, including GSO, may increase spectral efficiency in these frequency bands;

g) that using the frequency bands 1 525-1 544 MHz, 1 545-1 559 MHz, 1 613.8-1 626.5 MHz and 2 483.5-2 500 MHz allocated to the MSS (space-to-Earth) for transmissions in the space-to-Earth direction from MSS space stations operating at higher orbital altitudes, including GSO, towards non-GSO MSS satellites, may increase spectral efficiency in these frequency bands;

h) that all MSS allocations in the above frequency bands include a space-to-Earth or Earth-to-space direction indicator, but do not include a space-to-space direction indicator;

* The appearance of square brackets around certain frequency bands in this Resolution is understood to mean that WRC-23 will consider and review the inclusion of these frequency bands with square brackets and decide, as appropriate.

i) 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 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;

j) 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;

k) that several satellite systems have been relying on satellite-to-satellite communication in existing satellite frequency bands under No. **4.4**, and such reliance on No. **4.4** does not provide a sound basis for continued development of such systems nor the confidence in commercial viability and availability of the service to the end users;

l) that there is growing interest for utilizing space-to-space satellite links for a variety of applications;

m) that a precedent for space-to-space links sharing with Earth-to-space and space-to-Earth exists for 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 allocation,

recognizing

a) that it is necessary to study the impact on other services, as well as Earth-to-space and space-to-Earth operation within the MSS, of the operation of inter-satellite 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 band 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, reflections from receiving space stations and in-band unintentional radiation due to Doppler shifts may impact services operating in the same and adjacent or nearby frequency bands;

f) that currently the only option for MSS space stations in the frequency bands 1 525-1 544 MHz, 1 545-1 559 MHz, 1 610-1 645.5 MHz, 1 646-1 660.5 MHz and 2 483.5-2 500 MHz needing to communicate with other orbital space stations is to operate under No. **4.4**, without recognition and on a non-harmful interference/non-protected basis in frequency bands allocated to another space service,

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;

b) that the fixed and mobile services are allocated on a primary basis in the frequency band 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,

noting

a) that section 3.1.3.2 of the Director's Report to this conference highlights 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 applications in frequency bands allocated only in the Earth-to-space or space-to-Earth directions;

b) that the Director's Report concludes that, in view of recent technical developments and the increasing number of submissions of inter-satellite links in frequency bands not allocated to the ISS or to a space service in the space-to-space direction, this conference may wish to consider means to give recognition to these uses based on the conditions derived from studies by ITU-R Working Parties 4A and 4C in order to avoid interfering with existing systems operating in the same frequency bands,

resolves to invite the ITU Radiocommunication Sector

1 to study the technical and operational characteristics of different types of non-GSO MSS space stations that operate or plan to operate space-to-space links with GSO MSS networks in the following frequency bands:

a) Earth-to-space direction in the frequency bands [1 626.5-1 645 5 MHz and 1 646.5-1 660.5 MHz]; and

b) space-to-Earth direction in the frequency bands [1 525-1 544 MHz and 1 545-1 559 MHz];

2 to study the technical and operational characteristics of different types of non-GSO MSS space stations that operate or plan to operate space-to-space links with non-GSO and GSO MSS networks in the following frequency bands:

a) Earth-to-space direction in the frequency band [1 610-1 626.5 MHz]; and

b) space-to-Earth direction in the frequency bands [1 613.8-1 626.5 MHz and 2 483.5-2 500 MHz];

3 to study sharing and compatibility between space-to-space links in the cases described in *resolves to invite the ITU Radiocommunication Sector* 1 and 2 and

– current and planned stations of the MSS;

– other existing services allocated in the same frequency bands; and

– other existing services allocated in adjacent frequency bands,

in order to ensure protection of, and not impose undue constraints on, other MSS operations and other services allocated in those frequency bands and in adjacent frequency bands, taking into account *recognizing further a)* to *c)*;

4 to develop technical conditions and regulatory provisions for the operation of space-to-space links in these frequency bands, including new or revised MSS allocations or the addition of ISS allocations, on a secondary basis, while ensuring the protection of, and without imposing additional constraints on, other MSS operations or 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* 1, 2, and 3 above;

5 to complete these studies by WRC-27,

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 250 (WRC-19)

Studies on possible allocations to the land mobile service (excluding International Mobile Telecommunications) in the frequency band 1 300-1 350 MHz for use by administrations for the future development of terrestrial mobile-service applications

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

considering

a) that mobile connectivity contributes to global economic and social development;

b) that demand has been increasing steadily for mobile communication services throughout the world;

c) that mobile services play a large and increasing role in connecting users to the Internet;

d) that technological advancement and user needs will promote innovation and accelerate the further development of communication applications;

e) that timely availability of spectrum is important to support future applications;

f) that all studies leading up to WRC-15 between radars and International Mobile Telecommunications (IMT) in the frequency range 1 300-1 350 MHz concluded, based on the parameters provided at that time, that within the same geographical area co-frequency operation of mobile-broadband systems and radar was not feasible;

g) that there is widespread usage of this frequency range in some countries for radar;

h) that WRC-15 noted that in countries where the frequency band is not fully used by these systems, studies were undertaken in the ITU Radiocommunication Sector that showed sharing may be feasible in those countries, subject to various mitigation and coordination measures, however no conclusions were drawn as to their applicability, complexity, practicability or achievability;

i) that some administrations are considering the feasibility of spectrum refarming/relocating some services operating in portions of the frequency band 1 300-1 350 MHz for the land mobile service (LMS), which requires a significant investment;

j) that advanced spectrum sharing techniques are under development that could facilitate additional utilization of spectrum by a number of different services in operation;

k) the need to protect existing services when considering frequency bands for possible additional allocations to any service,

recognizing

a) that the frequency band 1 300-1 350 MHz is allocated to the radiolocation service, the aeronautical radionavigation service and the radionavigation-satellite service (RNSS) on a primary basis;

b) that the RNSS (space-to-Earth) (space-to-space) is allocated, among others, on a primary basis in the adjacent frequency band 1 240-1 300 MHz;

c) that No. **5.149** calls for administrations to take all practicable steps to protect the radio astronomy service from harmful interference in the frequency band 1 330-1 400 MHz, which includes spectral lines of importance for current astronomical investigations,

resolves to invite the ITU Radiocommunication Sector

1 to develop technical and operational characteristics of LMS systems in the frequency band 1 300-1 350 MHz;

2 to conduct sharing and compatibility studies to ensure protection of those services to which the frequency band is allocated on a primary basis, and adjacent frequency bands as appropriate, taking into account *considering f),* for the frequency band 1 300-1 350 MHz;

3 to complete these studies by WRC-27,

invites the 2027 World Radiocommunication Conference

to consider, on the basis of the studies conducted under *resolves to invite the ITU Radiocommunication Sector* above, possible allocations to the LMS.

RESOLUTION 251 (WRC-19)

Removal of the limitation regarding aeronautical mobile in the frequency range 694-960 MHz for the use of International Mobile Telecommunications user equipment by non-safety applications

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

considering

a) that there is a need for greater connectivity of aeronautical vehicles to address existing demand and future requirements from the aeronautical community;

b) that current and future International Mobile Telecommunications (IMT) networks can provide connectivity services to helicopters, small 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 support direct air-ground connectivity services to commercial airplanes with specific equipment on board airplanes;

e) that the IMT capacities identified in the *considering* paragraphs above have been demonstrated to be feasible by several studies and are currently being developed by standards development organizations,

noting

a) that ITU Radiocommunication Sector 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;

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-19)** addresses frequency bands for the terrestrial component of IMT below 1 GHz;

g) that Resolution **749 (Rev.WRC-19)** 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-19)** 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,

recognizing

that the removal of the limitation regarding aeronautical mobile in the proposed frequency bands would enable the unified use of the IMT identifications by aeronautical user equipment throughout the Regions,

resolves to invite the ITU Radiocommunication Sector

1 to assess relevant aeronautical mobile service scenarios for air-ground and ground-air connectivity for airborne user equipment in IMT networks to be addressed in compatibility and sharing studies;

2 to identify relevant technical parameters associated with the aeronautical mobile systems;

3 to conduct sharing and compatibility studies with existing services, including in adjacent frequency bands;

4 to determine the possibility of removing the aeronautical mobile service exception or other suitable regulatory measures in the frequency ranges 694-960 MHz in Region 1 and 890-942 MHz in Region 2, based on the results of studies,

invites the 2027 World Radiocommunication Conference

to consider the results of the above studies and take appropriate actions.

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-19)

Operational procedures for cancelling false distress alerts in the Global Maritime Distress and Safety System

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

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) has developed similar operational procedures to cancel false distress alerts,

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-19)

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) Reset the equipment immediately;

2) If the DSC equipment is capable of cancellation, cancel the alert 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.

2 MF digital selective calling

1) Reset the equipment immediately;

2) If the DSC equipment is capable of cancellation, cancel the alert 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.

3 HF digital selective calling

1) Reset the equipment immediately;

2) If the DSC equipment is capable of cancellation, cancel the alert 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.

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.

5 Emergency position indicating radiobeacon (EPIRB)

If for any reason an EPIRB is activated inadvertently, 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.

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 (WRC-07)

Distress and safety radiotelephony procedures for 2 182 kHz

The World Radiocommunication Conference (Geneva, 2007),

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 (WRC-07)

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 stations[1] 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 applicable[2].

§ 5 Distress, urgency and safety communications may also be made using digital selective calling and satellite techniques and/or direct-printing telegraphy, in accordance with the provisions specified in Chapter **VII** and relevant ITU-R Recommendations.

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* 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 and, where language difficulties exist, the International Code of Signals, both published by the International Maritime Organization, is also recommended.

§ 6 Mobile stations[3] 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 signal[4] of short duration for the purpose of attracting attention to the message which follows.

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[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 Appendix **15**).

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 361 (REV.WRC-19)

Consideration of possible regulatory actions to support modernization of the Global Maritime Distress and Safety System and the implementation of e-navigation

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

considering

a) that there is a continuing need in the Global Maritime Distress and Safety System (GMDSS), on a global basis, for improved communications to enhance maritime capabilities;

b) that the International Maritime Organization (IMO) is considering GMDSS modernization;

c) that advanced maritime MF/HF/VHF data systems and satellite communication systems may be used to deliver maritime safety information (MSI) and other GMDSS communications;

d) that IMO is considering additional global and regional GMDSS satellite service providers;

e) that this conference has commenced regulatory actions in regard to modernization of the GMDSS;

f) that IMO is in the process of implementing e-navigation, defined as the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth-to-berth navigation and related services for safety and security at sea and protection of the marine environment;

g) that GMDSS may be influenced by the development of e-navigation in the future,

noting

a) that WRC-12 reviewed Appendix **17** and Appendix **18** to improve efficiency and introduce frequency bands for new digital technology;

b) that WRC-12 reviewed the regulatory provisions and spectrum allocations for use by maritime safety systems for ships and ports;

c) that IMO may evaluate new applications to recognize satellite systems as new GMDSS satellite providers during the WRC-23 study cycle, and that this may also need to be addressed, as appropriate,

noting further

that WRC-12, WRC-15 and this conference have reviewed Appendix **18** to improve efficiency and introduce frequency bands for new digital technology for data communications,

recognizing

a) that advanced maritime communication systems may support GMDSS modernization and the implementation of e-navigation;

b) that IMO efforts to modernize the GMDSS and implement e-navigation may require a review of the Radio Regulations to accommodate advanced maritime communication systems;

c) that, due to the importance of these radio links in ensuring the safe operation of shipping and commerce and safety at sea, they must be resilient to interference;

d) that IMO is evaluating an application to recognize the existing geostationary-satellite system operating on 1 610-1 626.5 MHz (Earth-to-space) and 2 483.5-2 500 MHz (space-to-Earth) as a new GMDSS satellite provider,

resolves to invite the 2023 World Radiocommunication Conference

1 to consider possible regulatory actions, based on ITU Radiocommunication Sector (ITU-R) studies, taking into consideration the activities of IMO, as well as information and requirements provided by IMO, to support GMDSS modernization;

2 to consider possible regulatory actions, including spectrum allocations based on ITU-R studies, for the maritime mobile service, supporting e-navigation;

3 to consider regulatory provisions, if any, based on the results of ITU-R studies referred to in *invites the ITU Radiocommunication Sector* below, to support the introduction of additional satellite systems into the GMDSS,

invites the ITU Radiocommunication Sector

to conduct studies, taking into consideration the activities of IMO and other relevant international organizations, in order to determine spectrum needs and regulatory actions to support GMDSS modernization and the implementation of e-navigation, including the introduction of additional satellite systems into the GMDSS,

instructs the Secretary-General

to bring this Resolution to the attention of IMO and other international and regional organizations concerned.

RESOLUTION 363 (WRC-19)

Considerations to improve utilization of the VHF maritime frequencies in Appendix 18

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

considering

a) that Appendix **18** identifies frequencies to be used for distress and safety communications and other maritime communications on an international basis;

b) that congestion on Appendix **18** frequencies requires consideration of efficient new technologies;

c) that the ITU Radiocommunication Sector (ITU-R) is conducting ongoing studies on improving efficiency in the use of Appendix **18**;

d) that the use of digital technologies will make it possible to respond to the emerging demand for new uses and ease congestion;

e) 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;

f) that 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;

g) that the International Maritime Organization (IMO) has initiated a regulatory scoping exercise for the use of maritime autonomous surface ships (MASS);

h) that the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) is developing ranging mode (R-Mode), which is a radionavigation system that is intended to provide a contingency system in case of temporary global navigation satellite system (GNSS) disruption, to support e-navigation,

recognizing

a) that it is desirable to enhance maritime safety and ship and port security via spectrum-dependent systems;

b) that ITU and relevant international organizations have initiated related studies on the use of digital technologies for maritime safety and ship and port security;

c) 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;

d) that, in order to provide worldwide interoperability of equipment on ships, there should be harmonized technologies, or interoperable technologies, implemented under Appendix **18**;

e) 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 this conference have reviewed Appendix **18** to improve use and efficiency for data communication using digital systems;

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,

noting further

that WRC-12, WRC-15 and this conference have reviewed Appendix **18** to improve efficiency and introduce frequency bands for new digital technology for data communication, e.g. for the introduction of the VHF data exchange system (VDES),

resolves to invite the 2027 World Radiocommunication Conference

1 to consider possible changes to Appendix **18** in order to enable use in the MMS for future implementation of new technologies, for improving efficient use of the maritime frequency bands;

2 to consider possible changes to the Radio Regulations 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,

invites the ITU Radiocommunication Sector

to conduct studies to determine the necessary regulatory provisions and spectrum needs according to *resolves to invite the 2027 World Radiocommunication Conference*,

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) service[1]

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;

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[1] WRC-97 made editorial amendments to this Resolution.

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 413 (REV.WRC-12)

Use of the band 108-117.975 MHz by the aeronautical mobile (R) service

The World Radiocommunication Conference (Geneva, 2012),

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 ITU-R

to study any compatibility issues between the broadcasting service and AM(R)S in the band 108-117.975 MHz that may arise from the introduction of appropriate digital sound broadcasting systems, described in 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 SARPs 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% $\Delta T_{satellite}/T_{satellite}$ 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 dB(W/(m^2 · 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 dB(W/(m^2 · Hz)), which corresponds to a $\Delta T_{satellite}/T_{satellite}$ 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 dB(W/(m^2 · 20 MHz)) − G_r (θ).

G_r(θ) 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(θ) (dBi)**
45 < θ ≤ 90	−4
35 < θ ≤ 45	−3
0 < θ ≤ 35	0
−15 < θ ≤ 0	−1
−30 < θ ≤ −15	−4
−60 < θ ≤ −30	−6
−90 < θ ≤ −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 dB(W/(m^2 · 20 MHz)) − G_r (θ).

$G_r(\theta)$ represents the mobile -service receiver antenna gain versus elevation angle θ and is defined as follows:

$$G_r(\theta) = \max\left[G_1(\theta),\, G_2(\theta)\right]$$

$$G_1(\theta) = 6 - 12\left(\frac{\theta}{27}\right)^2$$

$$G_2(\theta) = -6 + 10\log\left[\left(\max\left\{\frac{|\theta|}{27}.1\right\}\right)^{-1.5} + 0.7\right]$$

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 (WRC-15)

Use of Wireless Avionics Intra-Communications in the frequency band 4 200-4 400 MHz

The World Radiocommunication Conference (Geneva, 2015),

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;

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 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 427 (WRC-19)

Updating provisions related to aeronautical services in the Radio Regulations

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

considering

a) that provisions contained in the Radio Regulations should be continually assessed and reviewed to reflect the current utilization of various radio applications;

b) that some modes of operation of aeronautical radio applications employed in the past are no longer in use, due to the introduction of new aviation technologies;

c) that some provisions of the Radio Regulations refer to outdated types of equipment,

recognizing

that the Radio Regulations may not fully reflect current aeronautical operational practices as defined by the International Civil Aviation Organization (ICAO),

resolves to invite the ITU Radiocommunication Sector

to study the Articles, limited to Chapters IV, V, VI and VIII of Volume I, of the Radio Regulations and their associated Appendices, as appropriate, in order to identify outdated aeronautical provisions with respect to ICAO standards and recommended practices and to develop examples of regulatory texts for updating these provisions, while ensuring that potential changes to such provisions will not impact any other systems or services operating in accordance with the Radio Regulations,

invites administrations and Sector Members

to participate actively in the studies by submitting contributions to the ITU Radiocommunication Sector (ITU-R),

instructs the Director of the Radiocommunication Bureau

to include in the Report of the Director to WRC-23 the progress on the ITU-R studies referred to in *resolves to invite the ITU Radiocommunication Sector*,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO.

RESOLUTION 428 (WRC-19)

Studies on a possible new allocation to the aeronautical mobile-satellite (R) service within the frequency band 117.975-137 MHz in order to support aeronautical VHF communications in the Earth-to-space and space-to-Earth directions

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

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, without modification to aircraft equipment;

b) that the availability of appropriate communication means is still an issue over oceanic and remote areas, where there is currently no suitable solution to provide aeronautical VHF services;

c) that, to meet the evolving requirements of modern civil aviation, satellite systems may be used for the relay of VHF communications compliant with International Civil Aviation Organization (ICAO) standards, operating 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;

d) that the VHF channels have become congested in some areas and the new aeronautical mobile-satellite (R) service (AMS(R)S) system would need to operate in such a manner as not to constrain existing systems;

e) that the frequency band 1 087.7-1 092.3 MHz was allocated to the AMS(R)S (Earth-to-space) on a primary basis in order to extend reception of Automatic Dependent Surveillance-Broadcast (ADS-B) signals beyond terrestrial line-of-sight, thereby facilitating the availability of surveillance means anywhere in the world;

f) that aeronautical VHF communications, when available in geographically remote and oceanic areas, may be used in combination with satellite ADS-B to support radar-like separation of aircraft, thus greatly improving airspace capacity, efficiency and safety,

recognizing

a) that the frequency band 108-117.975 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS), and to the AM(R)S in accordance with Resolution **413 (Rev.WRC-12)**;

b) 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 Standards and Recommended Practices (SARPs), providing critical voice and data communications for ATM on a global basis;

c) that under Nos. **5.201** and **5.202**, the frequency bands 132-136 MHz and 136-137 MHz are also allocated in several countries to the aeronautical mobile (OR) service on a primary basis;

d) that the AM(R)S VHF frequency band (117.975-137 MHz) is currently used by air traffic communication and airline operational communication;

e) that the frequency band 117.975-137 MHz is only used by systems that operate in accordance with recognized international aeronautical standards,

noting

a) that Annex 10 to the Convention on International Civil Aviation contains SARPs for safety aeronautical radionavigation and radiocommunication systems used by international civil aviation;

b) that the development of compatibility criteria between new AMS(R)S systems proposed for operations in the frequency band 117.975-137 MHz and ICAO-standardized aeronautical systems in this frequency band is the responsibility of ICAO;

c) that there are SARPs developed by ICAO detailing frequency assignment planning criteria for VHF air-ground communication systems;

d) that feeder links of AMS(R)S systems may be accommodated in the fixed-satellite service,

resolves to invite the ITU Radiocommunication Sector

1 to define the relevant technical characteristics and to study, taking into account *considering c)* and taking into account No. **5.200**, compatibility between potential new AMS(R)S systems that operate within the frequency band 117.975-137 MHz in the Earth-to-space and space-to-Earth directions and existing primary services in that frequency band and in adjacent frequency bands, while ensuring the protection of systems using existing primary services in those frequency bands and not constraining planned usage of those systems;

2 to take into account the results of the studies to provide technical and regulatory recommendations relative to a possible new AMS(R)S allocation within the frequency band 117.975-137 MHz, taking into consideration the responsibility of ICAO referred to in *noting b)*,

invites the 2023 World Radiocommunication Conference

to consider the results of the studies and take appropriate actions, including a possible primary allocation to the AMS(R)S within the frequency band 117.975-137 MHz,

invites Member States and Sector Members

to participate actively in the studies and to submit the characteristics of any current and planned systems to be studied, as appropriate,

invites the International Civil Aviation Organization

to participate in the studies by providing aeronautical operational requirements and relevant available technical characteristics to be taken into account in ITU Radiocommunication Sector (ITU-R) studies and to take into account the sharing and compatibility conclusions reached at ITU-R in the SARPs to be developed for the AMS(R)S,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO.

RESOLUTION 429 (WRC-19)

Consideration of regulatory provisions for updating Appendix 27 of the Radio Regulations in support of aeronautical HF modernization

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

considering

a) that for the purpose of this Resolution, the term "wideband" in HF communications may refer to a combination of multiple 3 kHz channels to provide improved data rates;

b) that, with the availability of advanced digital technologies and the demonstrated capabilities of aeronautical wideband HF, including contiguous or non-contiguous channel aggregation, faster data rates and better voice communications are possible;

c) that digital aeronautical HF must coexist with existing aeronautical analogue voice and data HF systems;

d) that desirable properties of HF propagation enable global coverage for aircraft;

e) that aeronautical analogue voice and narrowband digital HF systems are the primary means for international and domestic aviation to communicate with aircraft in remote and oceanic areas;

f) that there is an operational need for the modernization of data link services in the HF band for messages related to the safety and regularity of flight for use by international civil aviation;

g) that current aeronautical HF systems are limited by the available technology, and are insufficient to meet many modern aircraft information requirements without being augmented by aeronautical safety satellite communications;

h) that use of the frequencies in the frequency bands allocated to the aeronautical mobile (R) service (AM(R)S) in the frequency bands between 2 850 and 22 000 kHz is governed by the provisions of Appendix **27**,

recognizing

a) the need for improving aeronautical HF performance in support of internationally recognized aviation performance standards as defined by the International Civil Aviation Organization (ICAO);

b) that Annex 10 (Volume III) to the Convention on International Civil Aviation is a part of the international Standards and Recommended Practices (SARPs) for the current aeronautical narrowband HF communication systems used by international civil aviation;

c) that the modernization of aeronautical HF communications will not require any changes to Article **5** of the Radio Regulations;

d) that the frequencies 3 023 kHz and 5 680 kHz are designated for search and rescue in Appendix **15** of the Radio Regulations;

e) that any channel aggregation needs to be performed in a manner that protects other primary services operating in band and in adjacent frequency bands,

noting

a) the special arrangements clause in Appendix **27** for classes of emission other than J3E or H2B;

b) that the existing regional frequency allotments are detailed in Appendix **27** for aeronautical HF in the AM(R)S;

c) that Appendix **27** provides international and regional allotments for HF channels within the AM(R)S;

d) that the current aeronautical HF narrowband digital communications are detailed in Recommendation ITU-R M.1458;

e) that inter-system compatibility between internationally standardized aeronautical equipment is the responsibility of ICAO;

f) that new HF contiguous or non-contiguous channel aggregation technology allows for variable bandwidths greater than 3 kHz,

resolves to invite the ITU Radiocommunication Sector

1 to identify any necessary modifications to Appendix **27** for the AM(R)S between 2 850 and 22 000 kHz, noting *recognizing c)*;

2 to identify any necessary transition arrangements for the introduction of new digital aeronautical wideband HF systems and any consequential changes to Appendix **27**;

3 to recommend how new digital aeronautical wideband HF systems can be introduced while ensuring compliance with safety requirements and with *recognizing e)*;

4 to define the relevant technical characteristics and to conduct any necessary sharing and compatibility studies, taking into account *noting e),* with incumbent services that are allocated on a primary basis in the same or adjacent frequency bands to avoid harmful interference in accordance with *recognizing e)*;

5 to complete the studies in time for WRC-23,

invites the 2023 World Radiocommunication Conference

to consider necessary changes to Appendix **27**, on the basis of the studies conducted under *resolves to invite the ITU Radiocommunication Sector* above,

instructs the Secretary-General

to bring this Resolution to the attention of the ICAO,

invites the International Civil Aviation Organization

to participate actively by providing aeronautical operational requirements and relevant available technical characteristics to be taken into account in ITU Radiocommunication Sector studies.

RESOLUTION 430 (WRC-19)

Studies on frequency-related matters, including possible additional allocations, for the possible introduction of new non-safety aeronautical mobile applications

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

considering

a) that the number of aircraft equipped with sensors has grown significantly in the past 20 years;

b) that the need for bidirectional low to high data rate communications between aeronautical stations and aircraft stations, or between aircraft stations, is consequently increasing;

c) that the frequency bands to be considered should preferably be chosen close to frequency bands already used by aeronautical communication systems, in order to enable extended tuning ranges for such new aeronautical communication systems;

d) that these new aeronautical communications are not related to safety of flights;

e) that there is no clear identification of the frequency bands in which these new aeronautical communication systems may be developed with a sufficient level of confidence for long-term investment by industry;

f) that the decisions of previous conferences have introduced some restrictions on the use and imposed constraints on the development of these communication systems within several existing mobile allocations traditionally used by aeronautical mobile applications;

g) that the existing mobile allocations which can be used by these communication systems have some limitations due to coexistence with other services in the frequency band;

h) that in Region 1 there are allocations to the mobile, except aeronautical mobile, service in some frequency bands which are allocated to the mobile service in Regions 2 and 3;

i) that harmonized worldwide allocation would facilitate the implementation of these new aeronautical communication systems;

j) that an adaptation of the regulatory framework for further visibility, protection and development of non-safety aeronautical mobile applications may be required,

recognizing

a) that the use of innovative sharing methods may be considered to ensure the protection of existing services while offering the possibility to have access to new frequency bands;

b) that the introduction of the new aeronautical mobile systems in the possible new allocations should not impose constraints on existing and planned systems of primary services,

noting

a) that the frequency band 15.4-15.7 GHz is allocated on a primary basis to the radiolocation service, the aeronautical radionavigation service and, in part, the fixed-satellite service (Earth-to-space);

b) that the frequency band 22-22.21 GHz is allocated on a primary basis to the mobile, except aeronautical mobile, service;

c) that the frequency band 15.4-15.7 GHz is adjacent to the frequency band 15.35-15.4 GHz which is allocated to the radio astronomy service (RAS) on a primary basis;

d) that frequency band 22.01-22.21 GHz is adjacent to the frequency band 22.21-22.5 GHz which is allocated to the RAS, the Earth exploration-satellite service (passive) and the space research service (passive) on a primary basis;

e) that the frequency bands 22.01-22.21 GHz and 22.21-22.5 GHz are covered by No. **5.149**,

resolves to invite the ITU Radiocommunication Sector

to conduct, and complete in time for WRC-23:

1 studies on spectrum needs for new non-safety aeronautical mobile applications for air-air, ground-air and air-ground communications of aircraft systems;

2 sharing and compatibility studies in the frequency band 22-22.21 GHz, already allocated on a primary basis to the mobile, except aeronautical mobile, service, in order to evaluate the possible revision or deletion of the “except aeronautical mobile” restriction, while ensuring the protection of primary services in the frequency bands considered and, as appropriate, in adjacent frequency bands;

3 sharing and compatibility studies on possible new primary allocations to the aeronautical mobile service (AMS) for non-safety aeronautical applications in the frequency band 15.4-15.7 GHz, while ensuring the protection of primary services in the frequency bands considered and, as appropriate, in adjacent frequency bands;

4 definition of appropriate protection for the passive services and the RAS allocated in adjacent frequency bands from unwanted emissions of the AMS,

invites the 2023 World Radiocommunication Conference

to review the results of the ITU Radiocommunication Sector (ITU-R) studies and take appropriate actions,

invites administrations

to participate actively in the studies by submitting contributions to ITU-R.

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 service[1]

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.

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[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-19)

Information needed for the application of Article 12 of the Radio Regulations

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

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-19)

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.
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.

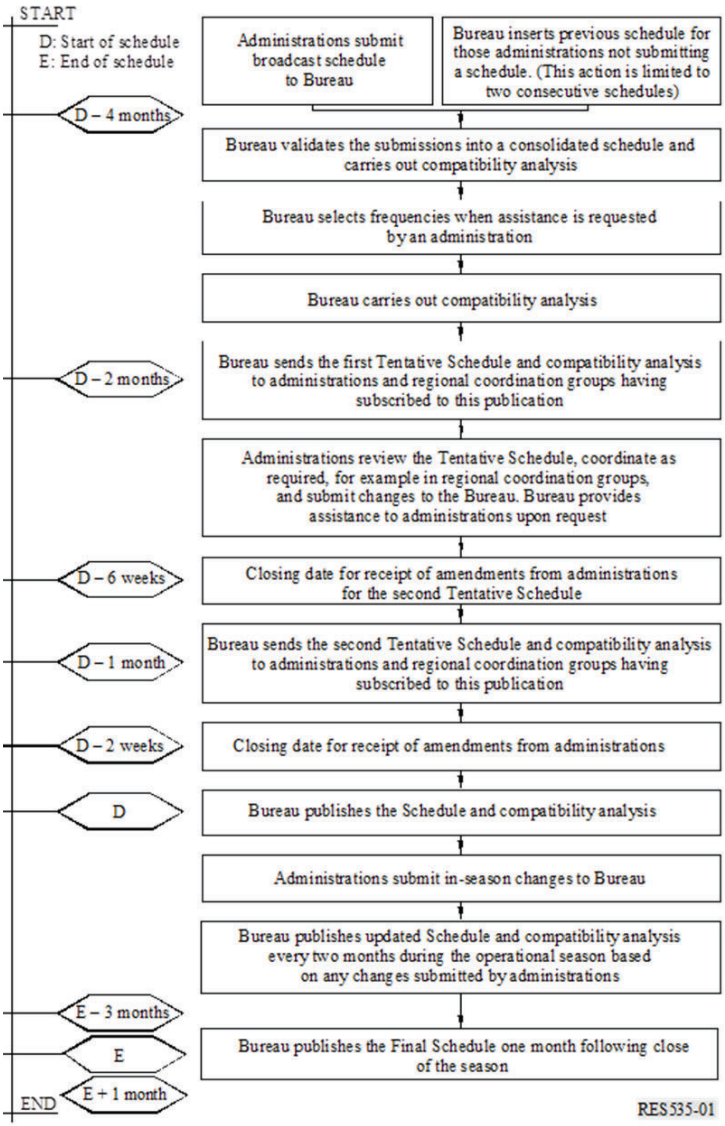
[1] See Description 3.

[2] See Description 4. The schedules and the results of the analyses should be available on CD-ROM and in TIES.

Figure 1 shows, in flow chart form, the time sequence for the Procedure.

FIGURE 1

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) (see Recommendation ITU-R BS.640) or digital emission (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 $0° \le \theta \le 5°$
$-130 + 0.4\,(\theta - 5)$	dB(W/(m^2 · MHz))	for $5° < \theta \le 25°$
-122	dB(W/(m^2 · MHz))	for $25° < \theta \le 45°$
$-122 + 0.2\,(\theta - 45)$	dB(W/(m^2 · MHz))	for $45° < \theta \le 65°$
$-118 + 0.09\,(\theta - 65)$	dB(W/(m^2 · MHz))	for $65° < \theta \le 76°$
-117	dB(W/(m^2 · MHz))	for $76° < \theta \le 90°$

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 3[1]

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 network[2] 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;

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[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 group[3].

[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-19)

Long-term access to and development in the frequency band 21.4-22 GHz in Regions 1 and 3

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

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 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 (BR) 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;

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 BR before 18 February 2012, the provisions of §§ 5 to 8 of Annex 1 to this Resolution shall be applied, as appropriate,

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[*] *Note by the Secretariat*: This Resolution was abrogated by WRC-12.

further resolves

that the procedures in this Resolution are in addition to the provisions under Articles **9** and **11** of the Radio Regulations,

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-19)

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 services 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 the 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 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 the Bureau 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 Nos. **9.1A** or **9.2C**, as appropriate, 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-19)

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 advance publication information

e) Reference to the request for coordination

f) Reference to the notification, when available

g) Frequency band(s) included in the relevant special sections of the satellite network

h) First date of bringing into use[1]

i) 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 spacecraft[2] (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

c) Launch services 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)

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[1] This information has already been provided by the administration under the provisions of Article **11** and will be inserted by the Radiocommunication Bureau (BR).

[2] If data about the spacecraft are submitted for the first time under this Resolution, items “Spacecraft manufacturer”, “Launch services 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.

3 Suspension information (if satellite network filing is suspended)

a) Date of suspension[3]

b) Reason of suspension:

– Spacecraft moved to another orbital position, or

– In-orbit failure of the spacecraft, or

– Spacecraft de-orbited,

– Other reasons (to be specified).

[3] 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-15)

Additional regulatory measures for broadcasting-satellite networks in the frequency band and 21.4-22 GHz in Regions 1 and 3 for the enhancement of equitable access to this frequency band

The World Radiocommunication Conference (Geneva, 2015),

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;

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,

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[*] *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.

recognizing

a) that the "first-come first-served" concept can restrict and sometimes prevents access to and use of certain frequency bands and orbit 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-15)

Special procedure to be applied for an assignment for a BSS 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 once (except as described in § 3 below) by an administration or an administration acting on behalf of a group of named administrations when none of those administrations have a network in the MIFR, notified under Article **11** or successfully examined under No. **9.34** and published under No. **9.38** for the frequency band 21.4-22 GHz. In case of countries complying with § 3 below, the special procedures described in this attachment can also be applied[1] by an administration when this administration has networks in the MIFR, notified under Article **11** or successfully examined under No. **9.34** and published under No. **9.38** 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 procedures 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 § 3 below), at a later stage submits a new submission, this new submission cannot benefit from this special procedure.

3 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 locations[2] that enable them to cover the entire territory in question.

4 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 ellipse[3] to cover its/their national territory[4];

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.

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[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**.

[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 § 3 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.

5 In submitting their request under § 4 above, administrations may seek the assistance of the Bureau to suggest candidate orbital locations for a submission.

6 Upon receipt of the complete information (mentioned in § 4 above) from an administration seeking the assistance of the Bureau under § 5, 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.

7 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 § 10 below.

8 Upon receipt of the information under § 6 above, administrations seeking assistance in applying this special procedure shall submit advance publication information and a request for coordination together with the appropriate information listed in Appendix **4** to these Regulations[5].

9 Administrations not seeking the assistance of the Bureau may submit advance publication information and a request for coordination together with the appropriate information listed in Appendix **4** to these Regulations[5] at the same time as submitting the information under § 4.

10 On receipt of the complete information sent under § 8 or § 9 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 and § 1 to 3;

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 effected[6];

d) include their names in the publication under *e)* below;

e) publish[7], as appropriate, the complete information in the 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.

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5 For submissions under this special procedure, the coordination information is receivable at the same date as that of the advance publication information.

6 The Bureau shall also identify the specific satellite networks with which coordination needs to be effected.

7 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)

11 If the information is found to be incomplete, the Bureau shall immediately seek from the administration concerned any clarification required and information not provided.

12 The provisions in this Resolution are in addition to the provisions of Articles **9** and **11** of the Radio Regulations.

ANNEX 1

TO

ATTACHMENT TO RESOLUTION 553 (REV.WRC-15)

Technical parameters to be used for submissions for Regions 1 and 3 BSS 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 e.i.r.p. of the space station shall be in the range from 43.2 dBW/MHz to 58.2 dBW/MHz[8].

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 § 4 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 coordinates[9].

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°.

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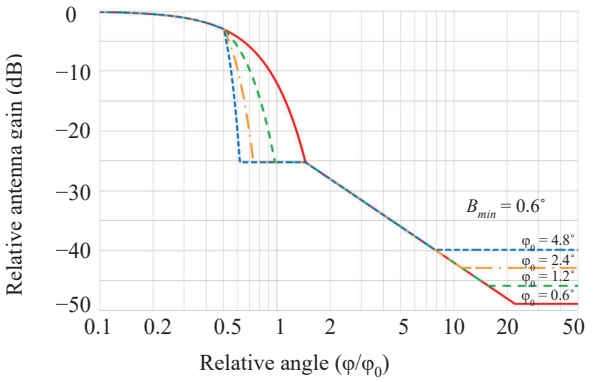
[8] The maximum pfd produced at high elevation angles at the Earth's surface under free-space conditions shall not exceed −105 dB(W/(m^2 · MHz)).

[9] 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

$-12\,(\varphi/\varphi_0)^2$ for $0 \le (\varphi/\varphi_0) \le 0.5$

$$-12\left[\frac{(\varphi/\varphi_0)-x}{B_{min}/\varphi_0}\right]^2 \quad \text{for } 0.5 < (\varphi/\varphi_0) \le \left(\frac{1.45B_{min}}{\varphi_0}+x\right)$$

-25.23 for $\left(\frac{1.45\,B_{min}}{\varphi_0}+x\right) < (\varphi/\varphi_0) \le 1.45$

$-(22 + 20 \log (\varphi/\varphi_0))$ 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)

φ_{01}, φ_{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:

$B_{min} = 0.6°$

* Figure 1 represents patterns for some values of φ_0. (WRC-12)

ANNEX 2

TO

ATTACHMENT TO RESOLUTION 553 (REV.WRC-15)

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 BSS space station 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:

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-15)*** is not received by the Bureau,

at the date of receipt of complete information under § 8 and 9 of the Attachment to this Resolution,

-146.88	dB(W/(m^2 · MHz))	for $0° \le \theta < 0.6°$
$-150.2 + 9.3\ \theta^2$	dB(W/(m^2 · MHz))	for $0.6° \le \theta < 1.05°$
$-140.5 + 27.2 \log \theta$	dB(W/(m^2 · MHz))	for $1.05° \le \theta < 2.65°$
$-138.1 + 1.3\ \theta^2$	dB(W/(m^2 · MHz))	for $2.65° \le \theta < 4.35°$
$-130.2 + 26.1 \log \theta$	dB(W/(m^2 · MHz))	for $4.35° \le \theta < 9.1°$
-105	dB(W/(m^2 · MHz))	for $9.1° \le \theta$

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;

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-15)*** is received by the Bureau,

* *Note by the Secretariat:* This Resolution was revised by WRC-19.

at the date of receipt of complete information under § 8 and 9 of the Attachment to this Resolution,

-149.88	dB(W/(m^2 · MHz))	for	$0° \le \theta < 0.6°$
$-153.2 + 9.3\ \theta^2$	dB(W/(m^2 · MHz))	for	$0.6° \le \theta < 1.05°$
$-143.5 + 27.2 \log \theta$	dB(W/(m^2 · MHz))	for	$1.05° \le \theta < 2.65°$
$-141.1 + 1.3\ \theta^2$	dB(W/(m^2 · MHz))	for	$2.65° \le \theta < 4.35°$
$-133.2 + 26.1 \log \theta$	dB(W/(m^2 · MHz))	for	$4.35° \le \theta < 12°$
-105	dB(W/(m^2 · MHz))	for	$12° \le \theta$

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	$0° \le \theta < 0.6°$
$-153.2 + 9.3\ \theta^2$	dB(W/(m^2 · MHz))	for	$0.6° \le \theta < 1.05°$
$-143.5 + 27.2 \log \theta$	dB(W/(m^2 · MHz))	for	$1.05° \le \theta < 2.65°$
$-141.1 + 1.3\ \theta^2$	dB(W/(m^2 · MHz))	for	$2.65° \le \theta < 4.35°$
$-133.2 + 26.1 \log \theta$	dB(W/(m^2 · MHz))	for	$4.35° \le \theta < 12°$
-105	dB(W/(m^2 · MHz))	for	$12° \le \theta$

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;

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 implemented[1] 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.

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[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 *resolves* 2 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 ≤ θ < 33.5° W; 32.5° W < θ ≤ 31.78° W; 28.22° W ≤ θ < 26.0° W.
		HISPASAT-37A	19.11.2014	117560019	
4.8° E	40	SIRIUS-N-BSS	17.11.2014	118560003	0° < θ ≤ 2.93° E; 6.67° E ≤ θ < 9.0° E; 9° E < θ ≤ 10° 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 ten[2] 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.

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[1] In case of a submission for the Appendix **30A** feeder-link Plan in the 14 GHz frequency band, the maximum of ten[2] channels for a Region 1 administration or twelve[2] 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, Serbia and Montenegro*, Senegal, Slovenia, Somalia, Sudan**, Sri Lanka, Sweden, Switzerland and Turkey, 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)*.

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* *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 dB(W/m^2) 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 dB(W/m^2) 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 band1 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 ranges[1] 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;

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[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 administrations[2];

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;

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[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 countries[3], 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 *resolve*s 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 situations[4];

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 solutions[2];

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,

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[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 resources[3],

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 database[3] 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,

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[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 database[3] 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 (WRC-15)

Definition of time scale and dissemination of time signals via radiocommunication systems

The World Radiocommunication Conference (Geneva, 2015),

considering

a) that the ITU Radiocommunication Sector (ITU-R) is responsible for defining the standard frequency and time signal service and the standard frequency and time signal-satellite service for the dissemination of time signals via radiocommunication;

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 its dissemination through the reference time scale;

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 is an organization member of 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 is the legal basis for time-keeping for many countries, and *de facto* 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,

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 current 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 the ITU World Administrative Radio Conference 1979 (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,

resolves to invite the ITU Radiocommunication Sector

1 to strengthen the cooperation between ITU-R and BIPM, the International Committee for Weights and Measures (CIPM), CGPM, as well as other relevant organizations, and to carry out a dialogue concerning the expertise of each organization;

2 to further and more widely study in cooperation with the relevant international organizations, concerned industries and user groups, through the participation of the membership, the various aspects of current and potential future reference time scales, including their impacts and applications;

3 to provide advice on the content and structure of time signals to be disseminated by radiocommunication systems, using the combined expertise of the relevant organizations;

4 to prepare one or more reports containing the results of studies that should include one or more proposals to determine the reference time scale and address other issues mentioned in 1, 2 and 3 above,

resolves

that until WRC-23, UTC as described in Recommendation ITU-R TF.460-6 shall continue to apply, and for most practical purposes associated with the Radio Regulations, UTC is equivalent to mean solar time at the prime meridian (0° longitude), formerly expressed in GMT,

instructs the Director of the Radiocommunication Bureau

1 to invite the relevant international organizations such as the International Maritime Organization (IMO), the International Civil Aviation Organization (ICAO), CGPM, CIPM, BIPM, the International Earth Rotation and Reference Systems Service (IERS), the International Union of Geodesy and Geophysics (IUGG), the International Union of Radio Science (URSI), the International Organization for Standardization (ISO), the World Meteorological Organization (WMO) and the International Astronomical Union (IAU) to participate in the work mentioned in *resolves to invite the ITU Radiocommunication Sector*;

2 to report on the progress of this Resolution to WRC-23,

invites the Director of the Telecommunication Development Bureau

to assist the participation of developing countries in meetings, within approved budgetary resources,

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 IMO, ICAO, CGPM, CIPM, BIPM, IERS, IUGG, URSI, ISO, WMO and IAU.

RESOLUTION 656 (REV.WRC-19)

Possible secondary allocation to the Earth exploration-satellite service (active) for spaceborne radar sounders in the range of frequencies around 45 MHz

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

considering

a) that spaceborne active radio-frequency sensors can provide unique information on physical properties of the Earth and other planets;

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 vicinity of the frequency range 40-50 MHz for measurements of the Earth's subsurface to provide radar maps of subsurface scattering layers with the intent to locate water/ice/deposits;

d) that worldwide, periodic measurements of subsurface water deposits require the use of spaceborne active sensors;

e) that the frequency range 40-50 MHz is preferable to satisfy all requirements for spaceborne radar sounders;

f) that spaceborne radars are intended to be operated only in either uninhabited or sparsely populated areas of the globe, with particular focus on deserts and polar ice fields, and only at night-time from 3 a.m. to 6 a.m. locally,

recognizing

a) that the frequency range 40-50 MHz is allocated to the fixed, mobile and broadcasting services on a primary basis;

b) that the frequency range 40.98 to 41.015 MHz is used by the space research service on a secondary basis;

c) that country footnotes in the Table of Frequency Allocations for the frequency range 40-50 MHz provide primary allocations for the aeronautical radionavigation and radiolocation services in certain parts of the world;

d) that Recommendation ITU-R RS.2042-1 provides typical technical and operating characteristics for spaceborne radar sounder systems using the frequency range 40-50 MHz that should be used for interference and compatibility studies;

e) that Report ITU-R RS.2455-0 provides preliminary results of sharing studies between a 45 MHz radar sounder and incumbent fixed, mobile, broadcasting and space research services operating in the frequency range 40-50 MHz,

resolves to invite the 2023 world radiocommunication conference

to consider the results of studies on spectrum needs for a possible new secondary allocation to the Earth exploration-satellite (active) service for spaceborne radar sounders within the range of frequencies around 45 MHz, taking into account the protection of incumbent services, and take appropriate action,

invites the ITU Radiocommunication Sector

to conduct studies on spectrum needs and sharing studies between the Earth exploration-satellite (active) service and the radiolocation, fixed, mobile, broadcasting, amateur and space research services in the frequency range 40-50 MHz and in adjacent bands,

invites administrations

to participate actively in the studies by submitting contributions to the ITU Radiocommunication Sector,

instructs the Secretary-General

to bring this Resolution to the attention of international and regional organizations concerned.

RESOLUTION 657 (REV.WRC-19)

Protection of radio spectrum-reliant space weather sensors used for global prediction and warnings

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

considering

a) that space weather observations are important for detecting solar activity events that impact services critical to the economy, safety and security of administrations and their population;

b) that these observations are made from ground-based and space-based systems;

c) that some of the sensors operate by receiving signals of opportunity, including, but not limited to, low-level natural emissions of the Sun, Earth's atmosphere and other celestial bodies, and therefore may suffer harmful interference at levels which could be tolerated by other radio systems;

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 a wide variety of spectrum-reliant space weather sensors currently operate relatively free of harmful interference; however, the radio interference environment could change as a result of changes made to the Radio Regulations;

f) that spectrum-reliant space weather sensors may be vulnerable to interference from both terrestrial and spaceborne systems;

g) that, while all spectrum-reliant space weather observation systems are important, the most critical need for radio regulatory protection is for those 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, human welfare and national security;

h) that frequency use is not consistent across the limited number of operational systems,

recognizing

a) that no frequency bands have been documented in any manner in the Radio Regulations for space weather sensor applications;

b) that Report ITU-R RS.2456-0, on space weather sensor systems using radio spectrum, contains a summary of spectrum-reliant space weather sensors and identifies the most critical operational systems (hereafter referred to as operational systems);

c) that the systems used for operational space weather monitoring, prediction and warnings documented in Report ITU-R RS.2456-0 are deployed globally;

d) that, while the number of systems is currently limited, the interest in and the importance of data from space weather monitoring systems is growing with time;

e) that certain, receive-only space weather applications may operate in a manner consistent with the definition of the meteorological aids (Metaids) service, but for scientific reasons observations cannot be conducted in frequency bands currently allocated to the Metaids service;

f) that the ITU Radiocommunication Sector (ITU-R) has a study Question ITU-R 256/7 to study the technical and operational characteristics, frequency requirements and appropriate radio service designation for space weather sensors,

noting

a) that any regulatory action associated with space weather sensor applications should take into account incumbent services that are already operating in the frequency bands of interest;

b) that ITU-R studies may show the protection of some systems to be a strictly national matter rather than requiring WRC action;

c) that, while data products are used for forecast 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,

resolves to invite the ITU Radiocommunication Sector

1 to identify, in time for WRC-23, and based on existing and possible further ITU-R studies on the technical and operational characteristics, specific space weather sensors which need to be protected by appropriate regulation, including:

– to determine if receive-only space weather sensors shall be designated as applications of the Metaids service;

– to determine the appropriate radiocommunication service, if any, for cases where it is determined that receive-only space weather sensors do not fall under the Metaids service;

2 to conduct, in time for WRC-23, any necessary sharing studies with incumbent systems operating in frequency bands used by space weather sensors with the objective of determining potential regulatory provisions that can be provided to receive-only operational space weather sensors for their appropriate recognition in the Radio Regulations, while not placing additional constraints on incumbent services;

3 to develop potential solutions to describe in the Radio Regulations, in Articles **1** and **4**, and/or as a WRC resolution, if deemed appropriate, for consideration by WRC-23, space weather sensor systems and their corresponding usage, as well as protection requirements for receive-only space weather sensors;

4 to conduct studies, in time for WRC-23, on the technical and operational characteristics of active space weather sensors and conduct necessary sharing studies with incumbent systems operating in frequency bands used by active space weather sensors, with the objective of determining the appropriate radiocommunication service for those sensors,

instructs the Director of the Radiocommunication Bureau

to report on the results of the ITU-R studies to WRC-23,

invites administrations

to participate actively in the 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 World Meteorological Organization and other international and regional organizations concerned.

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 dB(W/(m^2 · 4 kHz));

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 661 (WRC-19)

Examination of a possible upgrade to primary status of the secondary allocation to the space research service in the frequency band 14.8-15.35 GHz

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

considering

a) that the frequency band 14.8-15.35 GHz is currently allocated to the fixed and mobile services on a primary basis;

b) that the frequency band 14.8-15.35 GHz is currently allocated to the space research service (SRS) on a secondary basis;

c) that the frequency band 15.2-15.35 GHz is currently allocated to the Earth exploration-satellite service (EESS) (passive) and SRS (passive) on a secondary basis;

d) that the frequency band 15.35-15.4 GHz is currently allocated to the EESS (passive), the radio astronomy service and the SRS (passive) on a primary basis;

e) that there is a need for broadband communication downlinks in the SRS for the purpose of transmitting future scientific data at high data transmission speeds;

f) that a number of space agencies are already considering the possibility of using this frequency band for next-generation SRS satellites;

g) that, due to the small number of expected SRS earth stations that will be deployed worldwide (10-40 stations), coordination between fixed and land mobile communication systems and SRS stations will not impose excessive restrictions on any of the services;

h) that modern modulation methods together with the use of filters in high-speed data transmission links allow a significant reduction in out-of-band emissions, thereby minimizing possible interference for passive services in adjacent frequency bands;

i) that SRS operators must have 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;

j) that these space programmes represent long-term effort and investment that span across decades, from the time when the programme is officially decided, through the development period and the launch phase to the time when the corresponding satellites are in operation;

k) that space agencies are investing resources in the continuation of these programmes, providing subsequent satellites and payloads,

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-geostationary orbits (non-GSO), including manned flights in the SRS;

b) that the frequency band 14.8-15.35 GHz is also used by existing high-speed data links from non-GSO satellites within the SRS and is planned for use in future systems;

c) that these satellites are needed for the operation of telescopes and/or other passive instruments used for measuring such phenomena as the Earth's magnetosphere and solar flares;

d) that upgrading to primary status the allocation of the frequency band 14.8-15.35 GHz for the SRS will provide certainty for administrations and space agencies participating in satellite space programmes;

e) that upgrading to primary status the allocation of the frequency band 14.8-15.35 GHz for the SRS should not impose constraints on existing systems of primary services in the frequency band 14.8-15.35 GHz;

f) that the allocation to passive services mentioned in *considering c)* should be taken into account for protection,

noting

a) that Recommendations ITU-R M.2068 and ITU-R M.2089 contain characteristics of and protection criteria for systems operating in the land and aeronautical mobile services, respectively, in the frequency range 14.5-15.35 GHz;

b) that Recommendation ITU-R SA.1626 sets out the conditions for frequency sharing between the SRS (space-to-Earth) and the fixed and mobile services in the frequency band 14.8-15.35 GHz, including power flux-density (pfd) limits for the SRS;

c) that Recommendation ITU-R SA.510 sets out the conditions for frequency sharing between data relay systems operating in the SRS (space-to-space) and the fixed and mobile services in the frequency band 14.8-15.35 GHz, including pfd limits for the SRS,

resolves to invite the ITU Radiocommunication Sector

1 to investigate and identify all relevant scenarios mentioned in *recognizing a)* to *c)* that need to be considered in compatibility and sharing studies, taking into account the latest relevant ITU Radiocommunication Sector (ITU-R) Recommendations;

2 to conduct and complete in time for WRC-23 sharing and compatibility studies in order to determine the feasibility of upgrading the SRS allocation to primary status in the frequency band 14.8-15.35 GHz, with a view to ensuring protection of the primary services referred to in *considering a)* and *d)* and taking into account *recognizing e)*;

3 to determine the technical and regulatory conditions according to the results of the studies mentioned in *resolves to invite the ITU Radiocommunication Sector* 2,

invites administrations

to participate actively in the studies and provide the technical and operational characteristics of the systems involved by submitting contributions to ITU-R,

invites the 2023 World Radiocommunication Conference

to examine, on the basis of the results of studies by the ITU-R, the possibility of upgrading the secondary status of the allocation to the SRS to primary status in the frequency band 14.8-15.35 GHz, taking into account the studies referred to in *resolves to invite the ITU Radiocommunication Sector* 2 and the considerations in *resolves to invite the ITU Radiocommunication Sector* 3.

RESOLUTION 662 (WRC-19)

Review of frequency allocations for the Earth exploration-satellite service (passive) in the frequency range 231.5-252 GHz and consideration of possible adjustment according to observation requirements of passive microwave sensors

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

considering

a) that, within the frequency range 231.5-252 GHz, the frequency bands 235-238 GHz and 250-252 GHz are allocated to the Earth exploration-satellite service (EESS) (passive) for the use of passive microwave remote sensing systems;

b) that these allocations were agreed at WRC-2000, under agenda item 1.16 relating to Resolution **723 (WRC-97)**;

c) that scientific and technology developments for passive microwave sensor measurements have evolved over the last 20 years;

d) that it is appropriate to ensure that the frequency allocations to the EESS (passive) agreed in 2000 correspond to up-to-date observation requirements for passive microwave sensing,

recognizing

a) that some passive sensor systems under development plan to operate on some channels in the frequency range 239-248 GHz, given the specific characteristics of this frequency band for ice-cloud analysis;

b) that, as a result, it may be necessary to consider some adjustment/extension of the EESS (passive) allocations within the frequency range 231.5-252 GHz;

c) that the effect on the other primary services in the frequency range 231.5-252 GHz would have to be studied and the EESS (passive) allocations possibly adjusted,

resolves to invite the ITU Radiocommunication Sector

1 to review the existing primary allocations to the EESS (passive) in the frequency range 231.5-252 GHz in order to analyse if these allocations are aligned with the observation requirements of passive microwave sensors;

2 to study the impact that any change to the EESS (passive) allocations in the frequency range 231.5-252 GHz might have on the other primary services in these frequency bands;

3 to study, as appropriate, possible adjustments to the EESS (passive) allocations in the frequency range 231.5-252 GHz, taking into account the results under *resolves to invite the ITU Radiocommunication Sector* 1 above,

invites the 2023 World Radiocommunication Conference

to review the results of these studies with a view to adjusting existing allocations or adding possible new allocations, as appropriate, to the EESS (passive) in the frequency range 231.5-252 GHz without unduly constraining the other primary services currently allocated in this frequency range,

invites administrations

to participate actively in the studies 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 663 (WRC-19)

New allocations for the radiolocation service in the frequency band 231.5-275 GHz, and a new identification for radiolocation service applications in frequency bands in the frequency range 275-700 GHz

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

considering

a) that millimetre and sub-millimetre wave frequencies have been recognized by scientific communities and governmental organizations as well suited for stand-off detection of concealed objects;

b) that millimetre and sub-millimetre wave imaging systems will provide a significant contribution to public safety, counterterrorism and the security of high-risk/high-value assets or areas;

c) that millimetre and sub-millimetre wave imaging systems are typically designed in two main configurations: active (radars) and receive-only (radiometers);

d) that active millimetre and sub-millimetre wave imaging systems require a frequency bandwidth wider than 30 GHz to achieve range resolutions in the order of one centimetre;

e) that receive-only millimetre and sub-millimetre wave imaging systems 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;

f) that globally harmonized spectrum for the millimetre and sub-millimetre wave imaging systems is required;

g) that the optimal frequency range for the operation of the active millimetre and sub-millimetre wave imaging systems is between 231.5 GHz and 320 GHz, where the atmospheric absorption is relatively low;

h) that there are some narrower existing allocations to the radiolocation service (RLS) in the frequency range 217-275 GHz in the three ITU Regions, which however do not support the bandwidth required for these systems;

i) that, for the receive-only millimetre and sub-millimetre wave imagers, an identification in the frequency range 275-700 GHz is envisaged;

j) that the frequency bands 235-238 GHz and 250-252 GHz are allocated to the Earth exploration-satellite service (EESS) (passive) on a primary basis;

k) that the frequency bands 241-248 GHz and 250-275 GHz are allocated to the radio astronomy service (RAS) on a primary basis;

l) that a number of frequency bands in the frequency range 275-1 000 GHz are identified for use by passive services, such as the RAS, the EESS (passive) and the space research service (SRS) (passive);

m) 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;

n) 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,

noting

a) that active millimetre and sub-millimetre wave imaging systems operate at very low transmit powers (a few milliwatts typically) and short ranges (up to 300 metres);

b) that millimetre and sub-millimetre wave imaging systems may be severely affected by other power sources operating in the same frequency band;

c) that the technical and operational characteristics for millimetre and sub-millimetre wave imaging systems need to be defined, including protection criteria in particular for receive-only systems,

resolves to invite the ITU Radiocommunication Sector

1 to study the future requirements for globally harmonized spectrum for the RLS, in particular for millimetre and sub-millimetre wave imaging applications above 231.5 GHz, as referred to in *considering a)* and *b)*;

2 to define technical and operational characteristics, including required protection criteria, for millimetre and sub-millimetre wave imaging systems;

3 to study sharing and compatibility of active millimetre and sub-millimetre wave imaging applications with other systems in the frequency range between 231.5 GHz and 275 GHz, while ensuring that the EESS (passive), SRS (passive) and RAS allocated in this frequency range are protected;

4 to conduct sharing and compatibility studies between RLS applications and EESS (passive), SRS (passive) and RAS applications operating in the frequency range 275-700 GHz, while maintaining protection of the passive service applications identified in No. **5.565**;

5 to study sharing and compatibility of receive-only millimetre and sub-millimetre wave imaging applications with other systems in the frequency range between 275 GHz and 700 GHz;

6 to study possible new allocations to the RLS on a co-primary basis in the frequency range between 231.5 GHz and 275 GHz, while ensuring the protection of existing services in the frequency bands considered and, as appropriate, adjacent frequency bands;

7 to study a possible identification of frequency bands in the frequency range 275-700 GHz for use by RLS applications;

8 to review studies under *resolves to invite the ITU Radiocommunication Sector* 1 to 7, and elaborate regulatory measures for the possible introduction of millimetre and sub-millimetre wave imaging systems;

9 to complete the studies in time for WRC-27,

invites the 2027 World Radiocommunication Conference

to review the results of these studies and take appropriate actions,

invites administrations

to participate actively in the studies by submitting contributions to the ITU Radiocommunication Sector.

RESOLUTION 664 (WRC-19)

Use of the frequency band 22.55-23.15 GHz by the Earth exploration-satellite service (Earth-to-space)

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

considering

a) that the frequency band 25.5-27 GHz is allocated worldwide on a primary basis to the Earth exploration-satellite service (EESS) (space-to-Earth);

b) that an EESS (Earth-to-space) allocation in the frequency range 22.55-23.15 GHz would allow its use for satellite tracking, telemetry and control (TT&C) in combination with the existing EESS (space-to-Earth) allocation referred to in *considering a)*;

c) that an EESS (Earth-to-space) allocation in the 23 GHz frequency range would allow for uplinks and downlinks on the same transponder, increasing efficiency and reducing satellite complexity,

recognizing

a) that the frequency band 22.55-23.55 GHz is allocated to the fixed, inter-satellite and mobile services;

b) that the frequency band 22.55-23.15 GHz is also allocated to the space research service (SRS) (Earth-to-space);

c) that the SRS (Earth-to-space) allocation in the frequency band 22.55-23.15 GHz is paired with the SRS (space-to-Earth) allocation in the frequency band 25.5-27 GHz;

d) 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 SRS (Earth-to-space) in this frequency band,

resolves to invite the ITU Radiocommunication Sector

1 to conduct sharing and compatibility studies between EESS (Earth-to-space) systems and the existing services mentioned in *recognizing a)* and *b)*, while ensuring the protection of, and not imposing undue constraints on, all services and future development of existing services, in the frequency band 22.55-23.15 GHz;

2 to complete the studies, taking into account the present use of the allocated frequency band, with a view to presenting, at the appropriate time, the technical basis for the work of WRC-27,

invites the 2027 World Radiocommunication Conference

to review the results of these studies with a view to providing a worldwide primary allocation to the EESS (Earth-to-space) in the frequency band 22.55-23.15 GHz,

invites administrations

to participate actively in the studies by submitting contributions to the ITU Radiocommunication Sector,

invites the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

RESOLUTION 673 (REV.WRC-12)

The importance of Earth observation radiocommunication applications

The World Radiocommunication Conference (Geneva, 2012),

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 (IPCC) and the Group on Earth Observation (GEO), 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 (ICT), 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. Guadalajara, 2010) of the Plenipotentiary Conference, on the use of telecommunications/information and communication technologies for monitoring and management in emergency and disaster situations for early warning, prevention, mitigation and relief;

c) Resolution 182 (Guadalajara, 2010) of the Plenipotentiary Conference, on the role of telecommunications/information and communication technologies on climate change and the protection of the environment,

recognizing

a) Recommendations ITU-R RS.1859 "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 "Use of remote sensing systems in the study of climate change and the effects thereof";

b) the Report on Question ITU-D 22/2 "Utilization of ICT for disaster management, resources and active and passive space-based sensing systems as they apply to disaster and emergency relief situations";

c) joint WMO-ITU Handbook on "Use of Radio Spectrum for Meteorology: Weather, Water and Climate Monitoring and Prediction" and ITU-R Handbook on "Earth exploration-satellite service",

further recognizing

Report ITU-R RS.2178 "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 (UNFCCC), 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 some essential passive frequency bands are covered by No. **5.340** of the Radio Regulations;

f) 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 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;

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 716 (REV.WRC-12)

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 (Geneva, 2012),

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 mobile[1] 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 Constitution (Geneva, 1992),

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[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)***, 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 typical[2] 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;

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 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 Recommendation ITU-R F.1098;

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* *Note by the Secretariat:* This Resolution was revised by WRC-12.

2 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.

4.2 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 ITU-R

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 ITU-D

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,

invites the Director of the Telecommunication Development Bureau

to implement *invites ITU-D* 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 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;

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* 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-19)

Consideration of sharing and adjacent-band compatibility between passive and active services above 71 GHz

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

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

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, 100-102 GHz, 116-122.25 GHz, 148.5-151.5 GHz, 174.8-191.8 GHz, 226-231.5 GHz and 235-238 GHz;

2 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;

3 to study means of avoiding adjacent-band interference from space services (downlinks) into radio astronomy frequency bands above 71 GHz;

4 to take into account the principles of burden-sharing to the extent practicable in their studies;

5 to complete the necessary studies when the technical characteristics of the active services in these frequency bands are known;

6 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	Radio astronomy frequency band	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]	Reference bandwidth	pfd[1]	Reference bandwidth	pfd[1]	Reference bandwidth	
	(MHz)	(MHz)	(dB(W/m^2))	(MHz)	(dB(W/m^2))	(kHz)	(dB(W/m^2))	(kHz)	
MSS (space-to-Earth)	387-390	322-328.6	−189	6.6	−204	10	−177	10	WRC-07
BSS MSS (space-to-Earth)	1 452-1 492 1 525-1 559	1 400-1 427	−180	27	−196	20	−166	20	WRC-03
MSS (space-to-Earth) MSS (space-to-Earth)	1 525-1 559 1 613.8-1 626.5	1 610.6-1 613.8	NA	NA	−194	20	−166	20	WRC-03
RNSS (space-to-Earth)	1 559-1 610	1 610.6-1 613.8	NA	NA	−194	20	−166	20	WRC-07
BSS FSS (space-to-Earth)	2 655-2 670	2 690-2 700	−177	10	NA	NA	−161	20	WRC-03
FSS (space-to-Earth)	2 670-2 690	2 690-2 700 (in Regions 1 and 3)	−177	10	NA	NA	−161	20	WRC-03
	(GHz)	(GHz)	–	–	–	–	–	–	
BSS	21.4-22.0	22.21-22.5	−146	290	−162	250	−128	250	WRC-03 for VLBI, and WRC-07 for other types of observation

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	Radio astronomy frequency band	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]	Reference bandwidth	epfd[2]	Reference bandwidth	epfd[2]	Reference bandwidth	
	(MHz)	(MHz)	(dB(W/m^2))	(MHz)	(dB(W/m^2))	(kHz)	(dB(W/m^2))	(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 161.7875-161.9375	150.05-153	−238	2.95	NA	NA	NA	NA	WRC-19
MMSS (space-to-Earth)	157.1875-157.3375 161.7875-161.9375	322-328.6	−240	6.6	−255	10	−228	10	WRC-19
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 dB(W/m^2) 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 dB(W/m^2) 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 dB(W/m^2) in any 500 kHz for GSO satellites or the equivalent pfd (epfd) level of −246 dB(W/m^2) 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 dB(W/m^2) in any 500 kHz for a GSO satellite, and the epfd value of −246 dB(W/m^2) 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° 59′ N/97° 18′ W (station Volcan Sierra Negra) and San Pedro de Atacama, Chile, 23° 20′ S/67° 44′ 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-07)

Sharing between the mobile-satellite service (Earth-to-space) and the fixed and mobile services in the band 1 668.4-1 675 MHz

The World Radiocommunication Conference (Geneva, 2007),

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 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 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;

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-19)

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 (Sharm el-Sheikh, 2019),

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)**[*] 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;

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

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-19)** 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)**[*] 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 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**)[*];

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;

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

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-19)

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 stations[5] −29 dBW[b] in any 200 MHz of the EESS (passive) band for IMT mobile stations[5]
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-19[6]: −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-19[6]: −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: $-84 + 200\,\Delta$ dBW for $0° \le \Delta < 0.1°$ $-67 + 22.8\,\Delta$ dBW for $0.1° \le \Delta < 0.5°$ $-61 + 11.3\,\Delta$ dBW for $0.5° \le \Delta < 1.9°$ $-47 + 4\,\Delta$ dBW for $1.9° \le \Delta \le 2.5°$ 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)	≤ 60°
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)	≥ 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)	≤ 60°
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)	≥ 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 Maximum transmitter power at the antenna port of customer stations	 −5 dBW −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-19)

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 (Sharm el-Sheikh, 2019),

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)**[*], 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-19)** applies;

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

d) that WRC-12, through Resolution **232 (WRC-12)***, 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 this conference 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)*** 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;

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;

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

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)[1] 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 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 **232 (WRC-12)**[*];

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,

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[1] 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.

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

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-19)

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% ≤ land path ≤ 100% / 50% ≤ land path < 90% / 0% ≤ 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% ≤ land path ≤ 100% / 0% ≤ 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 dB(W/(m^2 · 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/m^2) in 1 MHz for angles of arrival $0° \le \delta \le 5°$ above the horizontal plane;

$-131.3 + 16/20(\delta - 5)$ dB(W/m^2) in 1 MHz for angles of arrival $5° \le \delta \le 25°$ above the horizontal plane;

-115.3 dB(W/m^2) in 1 MHz for angles of arrival $25° \le \delta \le 90°$ 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/(m^2 · 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 dB(W/(m^2 · 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:

5.8°	<	θ	≤ 20.9°	−187.2 + 25log(θ/5)	dB(W/(m^2 · Hz))
20.9°	<	θ		−171.67	dB(W/(m^2 · Hz))

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: 29–25logθ 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 Δ*T*/*T*	N/A	6%
Uplink	**6 GHz**	**14 GHz**
Maximum satellite G/T	0 dB/K	11 dB/K
Equivalent Δ*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 dB(W/(m^2 · 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	$0° \le \theta < 0.23°$
$-135.7 + 17.74 \log \theta$	dB(W/(m^2 · 27 MHz))	for	$0.23° \le \theta < 2.0°$
$-136.7 + 1.66\ \theta^2$	dB(W/(m^2 · 27 MHz))	for	$2.0° \le \theta < 3.59°$
$-129.2 + 25 \log \theta$	dB(W/(m^2 · 27 MHz))	for	$3.59° \le \theta < 4.2°$

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	dB(W/(m^2 · 27 MHz))	for	$0° \le \theta < 0.23°$
$-135.7 + 17.74 \log \theta$	dB(W/(m^2 · 27 MHz))	for	$0.23° \le \theta < 1.8°$
$-134.0 + 0.89\ \theta^2$	dB(W/(m^2 · 27 MHz))	for	$1.8° \le \theta < 4.2°$

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.

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**;

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 epfd 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**.

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 (WRC-19)

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 (Sharm el-Sheikh, 2019),

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 this conference has 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 geographic 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), the technical characteristics of generic GSO reference links contained in Annex 1 to this Resolution shall be used in conjunction with the methodology in Annex 2 to this Resolution to determine compliance with No. **22.5L**;

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 No. **9.35** 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

to review, once the validation software as described in *resolves* 3 is available, BR's findings made in accordance with Nos. **9.35** and **11.31**.

ANNEX 1 TO RESOLUTION 770 (WRC-19)

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 GSO network deployments that are independent of any specific geographic location, to be used only for establishing the interference impact of a 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	
1.5	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						Δ*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						$\left(\frac{C}{N}\right)_{Thr,i}$

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

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						$R_{0.01}$
2.6	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						$\left(\frac{C}{N}\right)_{Thr,i}$

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

ANNEX 2 TO RESOLUTION 770 (WRC-19)

Description of parameters and procedures for the evaluation of interference from any one non-GSO system into a global set of generic GSO reference links

This Annex provides an overview of the process to validate compliance with the single-entry permissible interference of a non-GSO system into GSO networks using the generic GSO reference link parameters in Annex 1 and the interference impact using the latest version of Recommendation ITU-R S.1503. The procedure to determine compliance with the single-entry permissible interference relies on the following principles.

Principle 1: The two time-varying sources of link performance degradation considered in the verification are link fading (from rain) using the characteristics of the generic GSO reference link and interference from a non-GSO system. The total C/N in the reference bandwidth for a given carrier is:

$$C/N = C/(N_T + I) \quad (1)$$

where:

C: wanted signal power (W) in the reference bandwidth, which varies as a function of fades and also as a function of transmission configuration

N_T: total system noise power (W) in the reference bandwidth

I: time-varying interference power (W) in the reference bandwidth generated by other networks.

Principle 2: The calculation of spectral efficiency is focused on satellite systems utilizing adaptive coding and modulation (ACM) by calculating the throughput degradation as a function of C/N, which varies depending on the propagation and interference impacts on the satellite link over the long term.

Principle 3: During a fading event in the downlink direction the interfering carrier is attenuated by the same amount as the wanted carrier. This principle results in slight underestimation of the impact of the downlink interference.

Implementation of verification algorithm

The generic GSO reference link parameters described in Annex 1 should be used as described in the following algorithm to determine if a non-GSO FSS network is compliant with No. **22.5L**.

Within the parametric analysis there are a range of values for each of the following parameters in Section 2 of Tables 1 and 2:

– e.i.r.p. density variation

– elevation angle (degree)

– rain height (m)

– latitude (degree)

– 0.01% rain rate (mm/hr)

– height of ES (m)

– ES noise temperature (K) or satellite noise temperature (K), as appropriate.

A set of generic GSO reference links should be created using one per service case identified in Section 1 of Tables 1 and 2 and one value from each of the parametric analysis parameters in Section 2 of Tables 1 and 2. Then, with this set of generic GSO reference links, the following process should be undertaken:

Determine the frequency that should be used in the analysis, f_{GHz}, by applying the methodology in Recommendation ITU-R S.1503 to the non-GSO system filed frequencies and the frequency bands for which No. ***22.5L*** *applies*

For each of the generic GSO reference links

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Step 0: Determine if this generic GSO reference link is valid and select the appropriate threshold

If the generic GSO reference link is valid, then

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Step 1: Derive the probability density function (PDF) of the rain fade to use in the convolution

Step 2: Recommendation ITU-R S.1503 should be used to derive the PDF of the EPFD from the non-GSO FSS system

Step 3: Perform a modified convolution (space-to-Earth) or convolution (Earth-to-space) with the PDF of the rain fade and the PDF of the EPFD. This convolution yields a PDF of C/N and C/(N+I)

Step 4: Use the C/N and C/(N+I) PDFs to determine compliance with No. ***22.5L***

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}

If the non-GSO system under examination is found to comply with No. ***22.5L*** *with respect to all generic GSO reference links, then the result of the evaluation is pass otherwise it is an unfavourable finding.*

Each of these steps are described further in Appendices **1** and **2** to this Annex for the space-to-Earth and Earth-to-space procedures, respectively.

APPENDIX 1 TO ANNEX 2 TO RESOLUTION 770 (WRC-19)

Algorithm steps to be applied in the space-to-Earth direction to determine compliance with No. 22.5L

By applying the following steps, the single-entry interference impact from a non-GSO system on the availability and spectral efficiency of a generic GSO reference link is determined. The generic GSO reference link parameters of Annex 1 to this Resolution are used, considering all possible parametric permutations, in conjunction with the worst-case geometry ("WCG") epfd output of the latest version of Recommendation ITU-R S.1503. The output of Recommendation ITU-R S.1503 is a set of interference statistics that a non-GSO system creates. These interference statistics are then used to determine the effect of the interference into each generic GSO reference link.

Step 0: Verification of the generic GSO reference link and selection of *C*/*N* threshold

The following steps should be used to determine if the generic GSO reference link is valid and if so, which of the thresholds $\left(\frac{C}{N}\right)_{Thr,i}$ should be used. It is assumed that R_s = 6 378.137 km, R_{geo} = 42 164 km and k_{dB} = −228.6 dB(J/K). Note that the term "cumulative distribution function" is meant to include the concept of the complementary cumulative distribution function depending upon context.

1) Calculate the peak gain of the ES in dBi using:

for $20 \le D/\lambda \le 100$

$$G_{max} = 20 \log\left(\frac{D}{\lambda}\right) + 7.7 \qquad \text{dBi}$$

for $D/\lambda > 100$

$$G_{max} = 20 \log\left(\frac{D}{\lambda}\right) + 8.4 \qquad \text{dBi}$$

2) Calculate the slant distance in km using:

$$d_{km} = R_S\left(\sqrt{\frac{R_{geo}^2}{R_s^2} - \cos^2(\varepsilon)} - \sin(\varepsilon)\right)$$

3) Calculate the free-space path loss in dB using:

$$L_{fs} = 92.45 + 20\log(f_{GHz}) + 20\log(d_{km})$$

4) Calculate the wanted signal power in the reference bandwidth in dBW accounting for additional link losses:

$$C = eirp + \Delta eirp - L_{fs} + G_{max} - L_o$$

5) Calculate the total noise power in the reference bandwidth in dBW/MHz using:

$$N_T = 10\log(T \cdot B_{MHz} \cdot 10^6) + k_{dB} + M_{ointra} + M_{ointer}$$

6) For each threshold $(C/N)_{Thr,i}$, derive the margin available for precipitation for that case in dB:

$$A_{rain,i} = C - N_T - \left(\frac{C}{N}\right)_{Thr,i}$$

7) If for each threshold $(C/N)_{Thr,i}$ the margin $A_{rain,i} \leq A_{min}$, then this generic GSO reference link is not valid.

8) For each of the thresholds $(C/N)_{Thr,i}$ for which $A_{rain,i} > A_{min}$, undertake step 9:

9) Using the precipitation model in Recommendation ITU-R P.618 together with the selected rain rate, ES height, rain height, ES latitude, elevation angle, frequency, calculated rain fade margin and an assumed polarization of vertical, calculate the associated percentage of time, $p_{rain,i}$.

10) If for each threshold $(C/N)_{Thr,i}$ the associated percentage of time is not within the range:

$$0.001\% \leq p_{rain,i} \leq 10\%$$

then this generic GSO reference link is not valid.

11) If at least one threshold meets the criteria in steps 7 and 10, then the lowest threshold, $(C/N)_{Thr}$ that meets these criteria is used in the analysis.

NOTE – A_{min} is 3 dB.

Step 1: Generation of precipitation fade PDF

The precipitation fade PDF should be generated using Recommendation ITU-R P.618 from the selected rain rate, ES height, ES latitude, rain height, elevation angle, frequency and an assumed polarization of vertical as follows:

1) Calculate the maximum fade depth A_{max} using $p = 0.001\%$

2) Create a set of 0.1 dB bins of precipitation fade A_{rain} between 0 dB and A_{max}

3) For each of the bins, determine the associate probability p to create a cumulative distribution function (CDF) of A_{rain}

4) For each of the bins, convert this CDF into a PDF of A_{rain}

When using Recommendation ITU-R P.618, the precipitation attenuation should be 0 dB for time percentages above p_{max} where p_{max} is the minimum value of a) 10% and b) the probability of rain attenuation on a slant path calculated from § 2.2.1.2. of Recommendation ITU-R P.618-13.

A bin size of 0.1 dB should be used to ensure consistency with the output from Recommendation ITU-R S.1503. Each bin of the CDF contains the probability that the precipitation fade is at least A_{rain} dB. Each bin of the PDF contains the probability that the precipitation fade is between A_{rain} and A_{rain} + 0.1 dB. During implementation, the array of bins can be capped at the minimum of A_{max} and the fade for which the resulting C/N would lead to the link being unavailable or have zero throughput.

Step 2: Generation of epfd PDF

Recommendation ITU-R S.1503 should be used to determine the epfd CDF from the non-GSO FSS parameters and the frequency, dish size and ES gain pattern. The epfd CDF will be calculated at the worst-case geometry from Recommendation ITU-R S.1503.

The epfd CDF should then be converted into a PDF.

Step 3: Creation of *C*/*N* and *C*/(*N*+*I*) CDFs by modified convolution of precipitation fade PDF with epfd PDF

For the selected generic GSO reference link, the *C*/*N* and *C*/(*N*+*I*) PDFs should be generated using the following steps to undertake the modified discrete convolution:

Initialize the C/N and C/(N+I) distributions with bin size of 0.1 dB

Calculate the effective area of an isotropic antenna at wavelength λ using:

$$A_{ISO} = 10\log\left(\frac{\lambda^2}{4\pi}\right)$$

Calculate the wanted signal power accounting for additional link losses and gain at edge of coverage:

$$C = eirp + \Delta eirp - L_{fs} + G_{max} - L_o$$

Calculate the system noise power using:

$$N_T = 10\log(T \cdot B_{MHz} \cdot 10^6) + k_{dB} + M_{ointra}$$

For each value A_{rain} in the precipitation fade PDF

{

Calculate the faded wanted signal power using:

$$C_f = C - A_{rain}$$

Calculate the C/N using:

$$\frac{C}{N} = C_f - N_T$$

Update the C/N distribution with this C/N and the probability associated with this A_{rain}

For each value EPFD in the EPFD PDF

{

Calculate the interference from the EPFD taking into account the precipitation fading using:

$$I = EPFD + G_{peak} + A_{iso} - A_{rain}$$

Calculate the noise plus interference using:

$$(N_T + I) = 10\log\left(10^{N_T/10} + 10^{I/10}\right)$$

Calculate the C/(N+I) using:

$$\frac{C}{N+I} = C_f - (N_T + I)$$

Identify the relevant C/(N+I) bin for this C/(N+I) value

Increment this bin's probability with the product of the probabilities of this precipitation fade and EPFD

}

}

Step 4: Use of *C*/*N* and *C*/(*N*+*I*) distributions with the criteria in No. 22.5L

The *C*/*N* and *C*/(*N*+*I*) distributions should then be used to check against the availability and spectral efficiency criteria in No. **22.5L** as follows:

Step 4A: Check on unavailability increase

Using the selected threshold $\left(\frac{C}{N}\right)_{Thr}$ for the generic GSO reference link, determine the following:

U_R = Sum of the probabilities from all bins for which $C/N < \left(\frac{C}{N}\right)_{Thr}$

U_{RI} = Sum of the probabilities from all bins for which $C/(N+I) < \left(\frac{C}{N}\right)_{Thr}$

Then the condition to be verified for compliance is:

$$U_{RI} \leq 1.03 \times U_R$$

Step 4B: Check on the time-weighted average spectral efficiency decrease

Determine the long-term time-weighted average spectral efficiency, SE_R, assuming precipitation only by:

Set $SE_R = 0$

For all bins in the C/N PDF above the threshold $\left(\frac{C}{N}\right)_{Thr}$

{

Equation 3 of Recommendation ITU-R S.2131-0 should be used to convert the C/N to a spectral efficiency

Increment SE_R *by the spectral efficiency multiplied by the probability associated with this C/N*

}

Determine the long-term time-weighted average spectral efficiency, SE_{RI}, assuming precipitation and interference by:

Set $SE_{RI} = 0$

For all bins in the C/(N+I) PDF above the threshold $\left(\frac{C}{N}\right)_{Thr}$

{

Equation 3 of Recommendation ITU-R S.2131-0 should be used to convert the C/(N+I) to a spectral efficiency

Increment SE_{RI} *by the spectral efficiency multiplied by the probability associated with this C/(N+I)*

}

Then the condition to be verified for compliance is:

$SE_{RI} >= SE_R*(1 - 0.03)$

APPENDIX 2 TO ANNEX 2 TO RESOLUTION 770 (WRC-19)

Algorithm steps to be applied in the Earth-to-space direction to determine compliance with No. 22.5L

By applying the following steps, the single-entry interference impact from a non-GSO system on the availability and spectral efficiency of a generic GSO reference link is determined. The generic GSO reference link parameters of Annex 1 to this Resolution are used, considering all possible parametric permutations, in conjunction with the worst-case geometry ("WCG") epfd output of the latest version of Recommendation ITU-R S.1503. The output of Recommendation ITU-R S.1503 is a set of interference statistics that a non-GSO system creates. These interference statistics are then used to determine the effect of the interference into each generic GSO reference link.

Step 0: Verification of the generic GSO reference link and selection of *C*/*N* threshold

The following steps should be used to determine if the generic GSO reference link is valid and if so, which of the thresholds $\left(\frac{C}{N}\right)_{Thr,i}$ should be used. It is assumed that $R_s = 6\,378.137$ km, $R_{geo} = 42\,164$ km and $k_{dB} = -228.6$ dB(J/K). Note that the term cumulative distribution function is meant to include the concept of the complementary cumulative distribution function depending upon context.

1) Calculate the slant distance in km using:

$$d_{km} = R_s \left(\sqrt{\frac{R_{geo}^2}{R_s^2} - \cos^2(\varepsilon)} - \sin(\varepsilon) \right)$$

2) Calculate the free-space path loss in dB using:

$$L_{fs} = 92.45 + 20\log(f_{GHz}) + 20\log(d_{km})$$

3) Calculate the wanted signal power in the reference bandwidth in dBW accounting for additional link losses and gain at edge of coverage:

$$C = eirp + \Delta eirp - L_{fs} + G_{max} - L_o + G_{rel}$$

4) Calculate the total noise power in the reference bandwidth in dBW/MHz using:

$$N_T = 10\log(T \cdot B_{MHz} \cdot 10^6) + k_{dB} + M_{ointra} + M_{ointer}$$

5) For each threshold $(C/N)_{Thr,i}$, derive the precipitation margin for that case in dB:

$$A_{rain,i} = C - N_T - \left(\frac{C}{N}\right)_{Thr,i}$$

6) If for each threshold $(C/N)_{Thr,i}$ the margin $A_{rain,i} \leq A_{min}$, then this generic GSO reference link is not valid.

7) For each of the thresholds $(C/N)_{Thr,i}$ for which $A_{rain,i} > A_{min}$, undertake step 8:

8) Using the precipitation model in Recommendation ITU-R P.618 together with the selected rain rate, ES height, rain height, ES latitude, elevation angle, frequency, calculated precipitation fade margin and an assumed polarization of vertical, calculate the associated percentage of time, $p_{rain,i}$.

9) If for each threshold $(C/N)_{Thr,i}$ the associated percentage of time is not within the range:

$$0.001\% \leq p_{rain,i} \leq 10\%$$

then this generic GSO reference link is not valid.

10) If at least one threshold meets the criteria in steps 6 and 9, then the lowest threshold, $(C/N)_{Thr}$ that meets these criteria should be used in the analysis.

NOTE – A_{min} is 3 dB and the gain relative to peak towards the ES, $G_{rel} = -3$ dB.

Step 1: Generation of precipitation fade PDF

The precipitation fade PDF should be generated using Recommendation ITU-R P.618 from the selected rain rate, ES height, ES latitude, rain height, elevation angle, frequency and an assumed polarization of vertical as follows:

1) Calculate the maximum fade depth A_{max} using $p = 0.001\%$

2) Create a set of 0.1 dB bins between 0 dB and A_{max}

3) For each of the bins, determine the associate probability p to create a cumulative distribution function (CDF) of A_{rain}

4) For each of the bins, convert this CDF into a PDF of A_{rain}

When using Recommendation ITU-R P.618, the precipitation attenuation should be 0 dB for time percentages above p_{max} where p_{max} is the minimum value of a) 10% and b) the probability of rain attenuation on a slant path calculated from § 2.2.1.2. of Recommendation ITU-R P.618-13.

A bin size of 0.1 dB should be used to ensure consistency with the output from Recommendation ITU-R S.1503. Each bin of the CDF contains the probability that the precipitation fade is at least A_{rain} dB. Each bin of the PDF contains the probability that the precipitation fade is between A_{rain} and A_{rain} + 0.1 dB. During implementation, the array of bins can be capped at the minimum of A_{max} and the fade for which the resulting *C*/*N* would lead to the link being unavailable or have zero throughput.

Step 2: Generation of epfd PDF

Recommendation ITU-R S.1503 should be used to determine the epfd CDF from the non-GSO FSS parameters and the frequency, dish size and ES gain pattern. The epfd CDF will be calculated at the worst-case geometry from Recommendation ITU-R S.1503.

The epfd CDF should then be converted into a PDF.

Step 3: Creation of *C*/*N* and *C*/(*N*+*I*) CDFs by convolution of precipitation fade PDF with epfd PDF

For the selected generic GSO reference link, the *C*/*N* and *C*/(*N*+*I*) PDFs should be generated using the following steps to undertake the discrete convolution:

Initialize the C/N and C/(N+I) distributions with bin size of 0.1 dB

Calculate the effective area of an isotropic antenna at wavelength λ using:

$$A_{ISO} = 10\log\left(\frac{\lambda^2}{4\pi}\right)$$

Calculate the wanted signal power accounting for additional link losses and gain at edge of coverage:

$$C = eirp + \Delta eirp - L_{fs} + G_{max} - L_o + G_{rel}$$

Calculate the system noise power using:

$$N_T = 10\log(T \cdot B_{MHz} \cdot 10^6) + k_{dB} + M_{ointra}$$

For each value A_{rain} in the precipitation fade PDF

{

Calculate the faded wanted signal power using:

$$C_f = C - A_{rain}$$

Calculate the C/N using:

$$\frac{C}{N} = C_f - N_T$$

Update the C/N distribution with this C/N and the probability associated with this A_{rain}

For each value EPFD in the EPFD PDF

{

Calculate the interference from the EPFD:

$$I = EPFD + G_{peak} + A_{iso}$$

Calculate the noise plus interference using:

$$(N_T + I) = 10\log\left(10^{N_T/10} + 10^{I/10}\right)$$

Calculate the C/(N+I) using:

$$\frac{C}{N+I} = C_f - (N_T + I)$$

Identify the relevant C/(N+I) bin for this C/(N+I) value

Increment this bin's probability with the product of the probabilities of this precipitation fade and EPFD

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}

Step 4: Use of *C*/*N* and *C*/(*N*+*I*) distributions with the criteria in No. 22.5L

The *C*/*N* and *C*/(*N*+*I*) distributions should then be used to check against the availability and spectral efficiency criteria in No. **22.5L** as follows:

Step 4A: Check on unavailability increase

Using the selected threshold $\left(\frac{C}{N}\right)_{Thr}$ for the generic GSO reference link, determine the following:

U_R = Sum of the probabilities from all bins for which $C/N < \left(\frac{C}{N}\right)_{Thr}$

U_{RI} = Sum of the probabilities from all bins for which $C/(N+I) < \left(\frac{C}{N}\right)_{Thr}$

Then the conditions to be verified for compliance are:

$$U_{RI} \leq 1.03 \times U_R$$

Step 4B: Check on the time-weighted average spectral efficiency decrease

Determine the long-term time-weighted average spectral efficiency, SE_R, assuming precipitation only by:

Set $SE_R = 0$

For all bins in the C/N PDF above the threshold $\left(\frac{C}{N}\right)_{Thr}$

{

Equation 3 of Recommendation ITU-R S.2131-0 should be used to convert the C/N to a spectral efficiency

Increment SE_R *by the spectral efficiency multiplied by the probability associated with this C/N*

}

Determine the long-term time-weighted average spectral efficiency, SE_{RI}, assuming precipitation and interference by:

Set $SE_{RI} = 0$

For all bins in the C/(N+I) PDF above the threshold $\left(\frac{C}{N}\right)_{Thr}$

{

Equation 3 of Recommendation ITU-R S.2131-0 should be used to convert the C/(N+I) to a spectral efficiency

Increment SE_{RI} *by the spectral efficiency multiplied by the probability associated with this C/(N+I)*

}

Then the conditions to be verified for compliance are:

$$SE_{RI} \geq SE_R * (1 - 0.03)$$

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 772 (WRC-19)

Consideration of regulatory provisions to facilitate the introduction of sub-orbital vehicles

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

considering

a) that sub-orbital vehicles are being developed which are intended to operate at higher altitudes than conventional aircraft, with a sub-orbital trajectory;

b) that sub-orbital vehicles are also being developed to fly through the lower levels of the atmosphere, where they are expected to operate in the same airspace as conventional aircraft;

c) that sub-orbital vehicles may perform various missions (e.g. conducting scientific research or providing transportation) and then return to the Earth's surface without completing a full orbital flight around the Earth;

d) that stations on board sub-orbital vehicles have a need for voice/data communications, navigation, surveillance and telemetry, tracking and command (TT&C);

e) that sub-orbital vehicles must be safely accommodated into airspace used by conventional aircraft during certain phases of flight;

f) that there is a need to ensure that equipment installed on such vehicles can communicate with air traffic management systems and relevant ground control facilities;

g) that vehicles operating at the boundary of space and the atmosphere or re-entering the atmosphere may generate a plasma sheath that may envelop all or most of the vehicle;

h) that the plasma-sheath attenuation does not allow for radiocommunications directly to either ground or space stations,

recognizing

a) that there is no internationally agreed legal demarcation between the Earth's atmosphere and the space domain;

b) that there is no formal definition of sub-orbital flight, although it has been assumed in Report ITU-R M.2477 to be an intentional flight of a vehicle expected to reach the upper atmosphere with a portion of its flight path that may occur in space without completing a full orbit around the Earth before returning back to the surface of the Earth;

c) that stations on board sub-orbital vehicles may use systems operating under space and/or terrestrial services;

d) that the current regulatory provisions and procedures for terrestrial and space services may not be adequate for international use of relevant frequency assignments by stations on board sub-orbital vehicles;

e) that Annex 10 to the Convention on International Civil Aviation contains Standards and Recommended Practices for aeronautical radionavigation and radiocommunication systems used by international civil aviation;

f) that the studies on spectrum requirements for voice/data communications, navigation, surveillance and TT&C on stations on board sub-orbital vehicles have not been completed;

g) that some space launch systems may include components or items not reaching orbital trajectories, and that some of these components or items may be developed as reusable items operating on sub-orbital trajectories;

h) that conventional space launch systems currently have a radiocommunication regulatory framework that may differ from the future radiocommunication framework of sub-orbital vehicles,

noting

a) Question ITU-R 259/5, on operational and radio regulatory aspects for planes operating in the upper level of the atmosphere;

b) that Report ITU-R M.2477 provides information on the current understanding of radiocommunications for sub-orbital vehicles, including a description of the flight trajectory, categories of sub-orbital vehicles, technical studies related to possible avionics systems used by sub-orbital vehicles, and service allocations of those systems;

c) that the provisions of No. **4.10** may apply to certain aspects of these operations;

d) that the development of compatibility criteria between International Civil Aviation Organization (ICAO) standardized aeronautical systems is the responsibility of ICAO;

e) that the definitions and future applicable radiocommunication services for sub-orbital vehicles should be clarified by the ITU Radiocommunication Sector (ITU-R), with necessary coordination with ICAO,

resolves to invite the ITU Radiocommunication Sector

1 to study spectrum needs for communications between stations on board sub-orbital vehicles and terrestrial/space stations providing functions such as, *inter alia*, voice/data communications, navigation, surveillance and TT&C;

2 to study appropriate modification, if any, to the Radio Regulations, excluding any new allocations or changes to the existing allocations in Article **5**, to accommodate stations on board sub-orbital vehicles, whilst avoiding any impact on conventional space launch systems, with the following objectives:

– to determine the status of stations on sub-orbital vehicles, and study corresponding regulatory provisions to determine which existing radiocommunication services can be used by stations on sub-orbital vehicles, if necessary;

– to determine the technical and regulatory conditions to allow some stations on board sub-orbital vehicles to operate under the aeronautical regulation and to be considered as earth stations or terrestrial stations even if a part of the flight occurs in space;

– to facilitate radiocommunications that support aviation to safely integrate sub-orbital vehicles into airspace and ensure interoperability with international civil aviation;

– to define the relevant technical characteristics and protection criteria for the studies to be undertaken in accordance with the bullet point below;

– to conduct sharing and compatibility studies with incumbent services that are allocated on a primary basis in the same and adjacent frequency bands in order to avoid harmful interference to other radiocommunication services and to existing applications of the same service in which stations on board sub-orbital vehicles operate, having regard to the sub-orbital flight application scenarios;

3 to identify, as a result of the studies above, whether there is a need for access to additional spectrum that should be addressed after WRC-23 by a future competent conference,

invites the International Civil Aviation Organization

to participate in the studies and provide to ITU the relevant technical characteristics required for the studies called for in *resolves to invite the ITU Radiocommunication Sector*,

invites the 2023 World Radiocommunication Conference

to consider the results of the studies above and take the appropriate action,

instructs the Director of the Radiocommunication Bureau

to bring this Resolution to the attention of the relevant ITU-R study groups,

invites administrations

to participate actively in the studies by submitting contributions to ITU-R,

instructs the Secretary-General

to bring this Resolution to the attention of the United Nations Committee on the Peaceful Uses of Outer Space and ICAO and other international and regional organizations concerned.

RESOLUTION 773 (WRC-19)

Study of technical and operational issues and regulatory provisions for satellite-to-satellite links in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz

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

considering

a) that the definition of fixed-satellite service (FSS) in No. **1.21** includes the possibility, in some cases, of satellite-to-satellite links, which may also be operated in the inter-satellite service (ISS);

b) that the definition of ISS in No. **1.22** includes only links between space stations, and that the term *inter-satellite link* in this Resolution is taken to mean a radiocommunication service link between artificial satellites;

c) that frequency bands allocated to the FSS are used for links between earth stations and space stations, and that such links may not be operated in the ISS;

d) that using some frequency bands allocated to the FSS for transmissions between space stations may increase spectral efficiency in those frequency bands;

e) that there is growing interest for utilizing satellite-to-satellite links for a variety of applications and that there have been expressions of interest by some administrations in using the FSS frequency bands 27.5-30 GHz (Earth-to-space) and 11.7-12.7 GHz, 18.1-18.6 GHz and 18.8-20.2 GHz (space-to-Earth) for links between space stations;

f) that all FSS allocations include a space-to-Earth or Earth-to-space direction indicator;

g) that the ITU Radiocommunication Sector (ITU-R) has begun preliminary studies on the technical and operational issues associated with the use of non-geostationary (non-GSO) satellites transmitting towards the geostationary-satellite orbit (GSO) in the FSS frequency band 27.5-30 GHz, and that such studies are expected to continue in this frequency band and other frequency bands after this conference,

recognizing

a) that it is necessary to study the compatibility of satellite-to-satellite transmissions with other primary services in the frequency bands taking into account applicable footnotes, and the need to protect the primary services in the frequency bands referred to in *considering e)*;

b) that the use of the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz and 18.8-20.2 GHz (space-to-Earth) and 27.5-30 GHz (Earth-to-space) for transmissions between space stations should ensure compatibility with, and impose no additional regulatory or technical constraints on, services to which the frequency band is currently allocated on a primary basis and services using adjacent frequency bands allocated on a primary basis;

c) that it is necessary to study whether space-to-Earth direction transmissions from space stations at higher orbital altitudes, including GSO satellites, 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 are likely to differ as the orbital characteristics of the non-GSO satellites vary;

e) that out-of-band emissions, signals due to antenna pattern sidelobes, reflections from receiving space stations and in-band unintentional radiation due to Doppler shifts may impact services operating in the same and adjacent frequency bands;

f) that some administrations have authorized these satellite-to-satellite transmission links under Article **4**, No. **4.4**, without recognition and on a non-harmful interference/non-protected basis,

recognizing further

a) that a precedent for satellite-to-satellite links sharing with Earth-to-space and space-to-Earth exists for the space operation (SOS), Earth exploration-satellite (EESS) and space research (SRS) services in the frequency bands 2 025-2 110 MHz and 2 200-2 290 MHz through the inclusion of a space-to-space allocation;

b) that the use of the frequency bands 27.5-28.6 GHz and 29.5-30 GHz by the non-GSO FSS is subject to the application of the provisions of Nos. **5.484A**, **22.5D** and **22.5I**;

c) that the use of the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz by the non-GSO FSS is subject to the application of the provisions of Nos. **5.484A**, **22.5C** and **22.5I**;

d) that use of the frequency band 28.6-29.1 GHz by GSO and non-GSO FSS networks is subject to the application of the provisions of No. **9.11A**, and No. **22.2** does not apply (see No. **5.523A**);

e) that No. **22.2** applies to the frequency bands 19.7-20.2 GHz and 29.5-30 GHz, in which the mobile-satellite service (MSS) has a co-primary allocation in Region 2 and in the 20.1-20.2 GHz and 29.9-30 GHz portions of the frequency bands in Regions 1 and 3;

f) that use of the frequency band 29.1-29.5 GHz (Earth-to-space) by the FSS is limited to GSO systems and feeder links to non-GSO systems in the MSS, and that such use is subject to the application of the provisions of No. **9.11A**, but not subject to the provisions of No. **22.2**, except as indicated in Nos. **5.523C** and **5.523E**, where such use is not subject to the provisions of No. **9.11A** and shall continue to be subject to Article **9** (except No. **9.11A**) and **11** procedures, and to the provisions of No. **22.2** (see No. **5.535A**);

g) that the frequency band 27.5-30 GHz may be used by the FSS (Earth-to-space) for the provision of feeder links for the broadcasting-satellite service (BSS) (see No. **5.539**);

h) that feeder links of non-GSO MSS networks and GSO FSS networks operating in the frequency band 29.1-29.5 GHz (Earth-to-space) shall employ uplink adaptive power control or other methods of fade compensation, such that the earth station transmissions shall be conducted at the power level required to meet the desired link performance while reducing the level of mutual interference between both networks (see No. **5.541A**);

i) that the fixed and mobile services are allocated on a primary basis in the frequency bands 10.7-11.7 GHz, 17.7-17.8 GHz, 18.1-19.7 GHz and 27.5-29.5 GHz on a global basis, in the frequency band 17.7-17.8 GHz in Regions 1 and 3, in the frequency band 12.2-12.7 GHz in Regions 2 and 3 and in the frequency band 11.7-12.5 GHz in Regions 1 and 3, and the fixed service is also primary in the frequency band 17.8-18.1 GHz globally and in the frequency band 11.7-12.1 GHz in Region 2;

j) that the frequency band 28.5-29.5 GHz (Earth-to-space) is also allocated to the EESS on a secondary basis, and no additional constraints should be imposed on the EESS, and the conditions of FSS operation are described in Resolution **750 (Rev.WRC-19)**;

k) that the allotments of the Appendix **30B** Plan, assignments in the Plans and the List subject to Appendix **30** and **30A** and assignments in the Appendix **30B** List must be protected;

l) that the frequency band 29.5-30 GHz (Earth-to-space) is also allocated to the MSS on a primary basis in the frequency band 29.5-30 GHz in Region 2, on a primary basis in the frequency band 29.9-30 GHz in Regions 1 and 3, and on a secondary basis in the frequency band 29.5-29.9 GHz in Regions 1 and 3;

m) that use of the frequency band 18.1-18.4 GHz by the FSS (Earth-to-space) is limited to GSO BSS feeder links (No. **5.520**);

n) that the use of the frequency band 17.8-18.4 GHz is subject to the application of No. **22.5F** and $epfd_{is}$ limits,

resolves to invite the ITU Radiocommunication Sector

1 to develop the technical and operational characteristics of different types of space stations that plan satellite-to-satellite transmissions in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, taking into account *considering e)* above;

2 to study the technical and operational characteristics, including spectrum requirements, off-axis equivalent isotropically radiated power (e.i.r.p.) values and out-of-band emission limits, for transmissions between space stations in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz;

3 to study sharing and compatibility between satellite-to-satellite links intending to operate between space stations in the frequency bands 11.7-12.7 GHz, 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 same frequency bands and adjacent frequency bands, including passive services, with a view to ensuring protection of the primary services referred to in *recognizing further i)*;

4 to develop, for different types of space stations, the technical conditions and regulatory provisions for satellite-to-satellite operations in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or portions thereof, including new ISS allocations, as appropriate, taking into account the results of the studies above,

invites administrations

to participate in the studies and to provide input contributions,

invites the 2023 World Radiocommunication Conference

to consider the results of the above studies and take necessary regulatory actions, as appropriate.

RESOLUTION 774 (WRC-19)

Studies on technical and operational measures to be applied in the frequency band 1 240-1 300 MHz to ensure the protection of the radionavigation-satellite service (space-to-Earth)

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

considering

a) that the frequency band 1 240-1 300 MHz is allocated worldwide to the amateur service on a secondary basis;

b) that the amateur-satellite service (Earth-to-space) may operate in the frequency band 1 260-1 270 MHz under No. **5.282**;

c) that the frequency band 1 240-1 300 MHz is important for the amateur community and has been used for many years for a range of applications;

d) that the frequency band 1 240-1 300 MHz is also allocated worldwide to the radionavigation-satellite service (RNSS) in the space-to-Earth direction on a primary basis;

e) that RNSS systems using the frequency band 1 240-1 300 MHz are operational, or becoming operational, in various parts of the world, with the aim of supporting a wide range of new satellite positioning services, for example enhanced accuracy and position authentication,

noting

a) that Recommendation ITU-R M.1732 contains the characteristics of systems operating in the amateur and amateur-satellite services for use in sharing studies;

b) that Recommendation ITU-R M.1044 should be used as a guide in studies of compatibility between systems operating in the amateur and amateur-satellite services and systems operating in other services;

c) that Recommendation ITU-R M.1787 contains the description of RNSS systems and the technical characteristics of space stations operating in the frequency band 1 240-1 300 MHz;

d) that Recommendation ITU-R M.1902 contains the characteristics and protection criteria for RNSS (space-to-Earth) receivers operating in the frequency band 1 240-1 300 MHz,

recognizing

a) that some cases of harmful interference caused by emissions in the amateur service into RNSS (space-to-Earth) receivers have occurred, and resulted in investigations and in instructions to the operator of the interfering station to cease transmissions;

b) that the number of RNSS receivers in the frequency band 1 240-1 300 MHz is currently limited in certain regions, but will increase dramatically in the near future with the ubiquitous deployment of receivers used in mass-market applications;

c) that, in accordance with No. **5.29**, stations of a secondary service shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date;

d) that administrations will benefit from the availability of studies and guidelines on protection of the RNSS (space-to-Earth) by the amateur and amateur-satellite services in the frequency band 1 240-1 300 MHz;

e) that some RNSS receivers in the frequency band 1 240-1 300 MHz may be equipped with pulse-blanking, which may facilitate sharing with certain amateur-service applications;

f) that the amateur service in the frequency band 1 240-1 300 MHz is currently used for amateur voice, data and image transmission in several countries in Europe and around the globe, and may transmit a variety of emission types including wideband, continuous and/or high equivalent isotropically radiated power (e.i.r.p.) transmissions,

resolves to invite the ITU Radiocommunication Sector

1 to perform a detailed review of the different systems and applications used in the amateur service and amateur-satellite service allocations in the frequency band 1 240-1 300 MHz;

2 taking into account the results of the above review, to study possible technical and operational measures to ensure the protection of RNSS (space-to-Earth) receivers from the amateur and amateur-satellite services in the frequency band 1 240-1 300 MHz, without considering the removal of these amateur and amateur-satellite service allocations,

instructs the Director of the Radiocommunication Bureau

to include the results of these studies in his Report to WRC-23 for the purpose of considering appropriate actions in response to *resolves to invite the ITU Radiocommunication Sector* above.

RESOLUTION 775 (WRC-19)

Sharing between stations in the fixed service and satellite services in the frequency bands 71-76 GHz and 81-86 GHz

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

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 the frequency bands 71-76 GHz and 81-86 GHz are allocated on a primary basis, among other services, to the fixed service globally;

c) that the frequency band 71-76 GHz is also allocated to the fixed-satellite service (FSS) (space-to-Earth) and the mobile-satellite service (MSS) (space-to-Earth) and the frequency band 74-76 GHz is allocated to the broadcasting-satellite service;

d) that the frequency band 81-86 GHz is also allocated to the FSS and MSS (Earth-to-space);

e) that sharing conditions between the fixed 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;

f) that now, nearly 20 years on, there have been a number of significant technology advances and changes in network requirements in the fixed service, 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;

g) that WRC-12 already addressed sharing and compatibility issues between the fixed service and passive services in the frequency bands 71-76 GHz and 81-86 GHz and relevant adjacent frequency bands,

recognizing

a) that there is now much more information available in the ITU Radiocommunication Sector (ITU-R) on the characteristics and deployment of fixed-service systems;

b) that there are an increasing number of satellite filings in the frequency bands 71-76 GHz and 81-86 GHz;

c) that Article **21** and other provisions of the Radio Regulations currently do not contain the necessary technical and regulatory provisions to protect the fixed-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 change the existing allocations or status of those allocations in Article **5** of the Radio Regulations for the frequency bands 71-76 GHz and 81-86 GHz,

resolves to invite the ITU Radiocommunication Sector

to conduct, as a matter of urgency and in time for WRC-27, the appropriate studies to determine power flux-density and equivalent isotropically radiated power limits in Article **21** for satellite services to protect the fixed service in the frequency bands 71-76 GHz and 81-86 GHz without unduly constraining satellite systems,

invites the 2027 World Radiocommunication Conference

to consider the results of studies and take necessary action,

invites administrations

to participate actively in the studies by submitting contributions to ITU-R.

RESOLUTION 776 (WRC-19)

Conditions for the use of the frequency bands 71-76 GHz and 81-86 GHz by stations in the satellite services to ensure compatibility with passive services

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

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 the frequency band 71-76 GHz is also allocated to the fixed-satellite service (FSS) (space-to-Earth) and the mobile-satellite service (MSS) (space-to-Earth) and the frequency band 74-76 GHz is allocated to the broadcasting-satellite service;

c) that the frequency band 81-86 GHz is also allocated to the FSS and MSS (Earth-to-space);

d) that the frequency bands 76-77.5 GHz, 79-81 GHz and 81-86 GHz are allocated to the radio astronomy service (RAS) on a primary basis;

e) that the frequency band 86-92 GHz is allocated to the Earth exploration-satellite service (EESS) (passive), the space research service (SRS) (passive) and the RAS, and that No. **5.340** applies in this frequency band;

f) that compatibility conditions between satellite services in the frequency bands 71-76 GHz and 81-86 GHz and passive services in the frequency bands and in adjacent frequency bands could not be fully developed at WRC-2000 due to lack of available information on satellite services at the time;

g) that WRC-12 already addressed sharing and compatibility issues between the fixed service and passive services in the frequency bands 71-76 GHz and 81-86 GHz and relevant adjacent frequency bands;

h) that Resolution **750 (Rev.WRC-19)** contains no provisions to protect the EESS (passive) in the frequency band 86-92 GHz from emissions of the space services in the frequency band 81-86 GHz;

i) that Resolution **739 (Rev.WRC-19)** contains no provisions to protect the RAS in adjacent frequency bands from emissions of the space services in the frequency bands 71-76 GHz and 81-86 GHz,

recognizing

a) that there are an increasing number of satellite filings in the frequency bands 71-76 GHz and 81-86 GHz;

b) that Resolution **731 (Rev.WRC-19)** calls for consideration of sharing and adjacent-band compatibility between passive and active services above 71 GHz;

c) 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;

d) that there is no intention to change the existing allocations or status of those allocations in Article **5** of the Radio Regulations for the frequency bands 71-76 GHz and 81-86 GHz,

resolves to invite the ITU Radiocommunication Sector

to conduct the appropriate studies to determine the technical conditions for satellite services in the frequency band 81-86 GHz in order to protect the EESS (passive) and the SRS (passive) in the frequency band 86-92 GHz and the RAS in the frequency bands mentioned in *considering d)* and *e)* without unduly constraining satellite systems,

invites the 2027 World Radiocommunication Conference

to consider the results of studies and take necessary action,

invites administrations

to participate actively in the studies by submitting contributions to the ITU Radiocommunication Sector.

RESOLUTION 804 (REV.WRC-19)

Principles for establishing agendas for world radiocommunication conferences

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

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 world radiocommunication conferences;

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,

noting

a) that the number of issues addressed in agendas for WRCs has been growing, and that some issues could not be resolved adequately in the time allotted to the conference, including conference 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 ITU are limited;

d) that there is a need to limit the agenda of conferences, taking account of the needs of developing countries, in a manner that allows the major issues to be dealt with equitably and efficiently;

e) 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 conference agendas;

f) that administrations and regional telecommunication organizations need sufficient time to evaluate and examine the potential consequences of proposed new items for inclusion in the agendas of future WRCs,

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 principles in Annex 1 to this Resolution should be used when developing future WRC agendas;

3 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 template in Annex 2 to this Resolution in proposing agenda items for WRCs;

2 to participate in regional activities for the preparation of future WRC agendas.

ANNEX 1 TO RESOLUTION 804 (REV.WRC-19)

Principles for establishing agendas for world radiocommunication conferences

1 A conference agenda 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 conference may include on a future conference agenda 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 is expected that required studies can be completed (e.g. that appropriate ITU Radiocommunication Sector (ITU-R) Recommendations will be approved) prior to that conference;

2.4 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 CPM.

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 conferences, normally reflected in Resolutions, and which have been considered by two successive conferences, should not be considered, unless justified.

5 In addition, where possible, issues that could be addressed through actions undertaken by a Radiocommunication Assembly, particularly those not involving amendments to the Radio Regulations, should not be included in the agenda.

6 In developing the conference agenda, efforts should be made to:

a) encourage regional and interregional coordination on the subjects to be considered in the preparatory process for the WRC, 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;

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;

e) ensure that the objectives and scope of proposed agenda items are complete and unambiguous;

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-19)

Template for the submission of proposals for agenda items

Subject:

Origin:

***Proposal*:**

***Background/reason*:**

***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 811 (WRC-19)

Agenda for the 2023 world radiocommunication conference

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

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-23;

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 2023 for a maximum period of four weeks, with the following agenda:

1 on the basis of proposals from administrations, taking account of the results of WRC-19 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, based on the results of ITU-R studies, possible measures to address, in the frequency band 4 800-4 990 MHz, protection of stations of the aeronautical and maritime mobile services located in international airspace and waters from other stations located within national territories, and to review the power flux-density criteria in No. **5.441B** in accordance with Resolution **223 (Rev.WRC-19)**;

1.2 to consider identification of the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution **245 (WRC-19)**;

1.3 to consider primary allocation of the frequency band 3 600-3 800 MHz to the mobile service in Region 1 and take appropriate regulatory actions, in accordance with Resolution **246 (WRC-19)**;

1.4 to consider, in accordance with Resolution **247 (WRC-19)**, the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level;

1.5 to review the spectrum use and spectrum needs of existing services in the frequency band 470-960 MHz in Region 1 and consider possible regulatory actions in the frequency band 470-694 MHz in Region 1 on the basis of the review, in accordance with Resolution **235 (WRC-15)**;

1.6 to consider, in accordance with Resolution **772 (WRC-19)**, regulatory provisions to facilitate radiocommunications for sub-orbital vehicles;

1.7 to consider a new aeronautical mobile-satellite (R) service allocation in accordance with Resolution **428 (WRC-19)** for both the Earth-to-space and space-to-Earth directions of aeronautical VHF communications in all or part of the frequency band 117.975-137 MHz, while preventing any undue constraints on existing VHF systems operating in the aeronautical mobile (R) service, in the aeronautical radionavigation service, and in adjacent frequency bands;

1.8 to consider, on the basis of ITU-R studies in accordance with Resolution **171 (WRC-19)**, appropriate regulatory actions, with a view to reviewing and, if necessary, revising Resolution **155 (Rev.WRC-19)** and No. **5.484B** to accommodate the use of fixed-satellite service networks by control and non-payload communications of unmanned aircraft systems;

1.9 to review Appendix **27** of the Radio Regulations and consider appropriate regulatory actions and updates based on ITU-R studies, in order to accommodate digital technologies for commercial aviation safety-of-life applications in existing HF bands allocated to the aeronautical mobile (R) service and ensure coexistence of current HF systems alongside modernized HF systems, in accordance with Resolution **429 (WRC-19)**;

1.10 to conduct studies on spectrum needs, coexistence with radiocommunication services and regulatory measures for possible new allocations for the aeronautical mobile service for the use of non-safety aeronautical mobile applications, in accordance with Resolution **430 (WRC-19)**;

1.11 to consider possible regulatory actions to support the modernization of the Global Maritime Distress and Safety System (GMDSS) and the implementation of e-navigation, in accordance with Resolution **361 (Rev.WRC-19)**;

1.12 to conduct, and complete in time for WRC-23, studies for a possible new secondary allocation to the Earth exploration-satellite service (active) for spaceborne radar sounders within the range of frequencies around 45 MHz, taking into account the protection of incumbent services, including in adjacent bands, in accordance with Resolution **656 (Rev.WRC-19)**;

1.13 to consider a possible upgrade of the allocation of the frequency band 14.8-15.35 GHz to the space research service, in accordance with Resolution **661 (WRC-19)**;

1.14 to review and consider possible adjustments of the existing frequency allocations or possible new primary frequency allocations to the Earth exploration-satellite service (passive) in the frequency range 231.5-252 GHz, to ensure alignment with more up-to-date remote-sensing observation requirements, in accordance with Resolution **662 (WRC-19)**;

1.15 to harmonize the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service globally, in accordance with Resolution **172 (WRC-19)**;

1.16 to study and develop technical, operational and regulatory measures, as appropriate, to facilitate the 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 non-geostationary fixed-satellite service earth stations in motion, while ensuring due protection of existing services in those frequency bands, in accordance with Resolution **173 (WRC-19)**;

1.17 to determine and carry out, on the basis of ITU-R studies in accordance with Resolution **773 (WRC-19)**, the appropriate regulatory actions for the provision of inter-satellite links in specific frequency bands, or portions thereof, by adding an inter-satellite service allocation where appropriate;

1.18 to consider studies relating to spectrum needs and potential new allocations to the mobile-satellite service for future development of narrowband mobile-satellite systems, in accordance with Resolution **248 (WRC-19)**;

1.19 to consider a new primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2, while protecting existing primary services in the band, in accordance with Resolution **174 (WRC-19)**;

2 to examine the revised ITU-R 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-19)**;

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-19:

– In accordance with Resolution **657 (Rev.WRC-19)**, review the results of studies relating to the technical and operational characteristics, spectrum requirements and appropriate radio service designations for space weather sensors with a view to describing appropriate recognition and protection in the Radio Regulations without placing additional constraints on incumbent services;

– Review the amateur service and the amateur-satellite service allocations in the frequency band 1 240-1 300 MHz to determine if additional measures are required to ensure protection of the radionavigation-satellite service (space-to-Earth) operating in the same band in accordance with Resolution **774 (WRC-19)**;

– Study the use of International Mobile Telecommunication systems for fixed wireless broadband in the frequency bands allocated to the fixed service on a primary basis, in accordance with Resolution **175 (WRC-19)**;

9.2 on any difficulties or inconsistencies encountered in the application of the Radio Regulations;[1] and

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-19)**,

invites the ITU Council

to finalize the agenda and arrange for the convening of WRC-23, 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-23;

2 to submit a draft report on any difficulties or inconsistencies encountered in the application of the Radio Regulations referred 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.

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[1] 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.

RESOLUTION 812 (WRC-19)

Preliminary agenda for the 2027 World Radiocommunication Conference*

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

considering

a) that, in accordance with No. 118 of the ITU Convention, the general scope of the agenda for WRC-27 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-27:

1 to take appropriate action in respect of those urgent issues that were specifically requested by WRC-23;

2 on the basis of proposals from administrations and the Report of the Conference Preparatory Meeting, and taking account of the results of WRC-23, to consider and take appropriate action in respect of the following items:

2.1 to consider, in accordance with Resolution **663 (WRC-19)**, additional spectrum allocations to the radiolocation service on a co-primary basis in the frequency band 231.5-275 GHz and an identification for radiolocation applications in frequency bands in the frequency range 275-700 GHz for millimetre and sub-millimetre wave imaging systems;

2.2 to study and develop technical, operational and regulatory measures, as appropriate, to facilitate the use of the frequency bands 37.5-39.5 GHz (space-to-Earth), 40.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) by aeronautical and maritime earth stations in motion communicating with geostationary space stations in the fixed-satellite service, in accordance with Resolution **176 (WRC-19)**;

2.3 to consider the allocation of all or part of the frequency band [43.5-45.5 GHz] to the fixed-satellite service, in accordance with Resolution **177 (WRC-19)**;

2.4 the introduction of power flux-density (pfd) and equivalent isotropically radiated power (e.i.r.p.) limits in Article **21** for the frequency bands 71-76 GHz and 81-86 GHz in accordance with Resolution **775 (WRC-19)**;

2.5 the conditions for the use of the frequency bands 71-76 GHz and 81-86 GHz by stations in the satellite services to ensure compatibility with passive services in accordance with Resolution **776 (WRC-19)**;

* The appearance of square brackets around certain frequency bands in this Resolution is understood to mean that WRC-23 will consider and review the inclusion of these frequency bands with square brackets and decide, as appropriate.

2.6 to consider regulatory provisions for appropriate recognition of space weather sensors and their protection in the Radio Regulations, taking into account the results of ITU Radiocommunication Sector studies reported to WRC-23 under agenda item 9.1 and its corresponding Resolution **657 (Rev.WRC-19)**;

2.7 to consider the development of regulatory provisions for non-geostationary fixed-satellite system feeder links in the frequency bands 71-76 GHz (space-to-Earth and proposed new Earth-to-space) and 81-86 GHz (Earth-to-space), in accordance with Resolution **178 (WRC-19)**;

2.8 to study the technical and operational matters, and regulatory provisions, for space-to-space links in the frequency bands [1 525-1 544 MHz], [1 545-1 559 MHz], [1 610-1 645.5 MHz], [1 646.5-1 660.5 MHz] and [2 483.5-2 500 MHz] among non-geostationary and geostationary satellites operating in the mobile-satellite service, in accordance with Resolution **249 (WRC-19)**;

2.9 to consider possible additional spectrum allocations to the mobile service in the frequency band 1 300-1 350 MHz to facilitate the future development of mobile-service applications, in accordance with Resolution **250 (WRC-19)**;

2.10 to consider improving the utilization of the VHF maritime frequencies in Appendix **18**, in accordance with Resolution **363 (WRC-19)**;

2.11 to consider a new Earth exploration-satellite service (Earth-to-space) allocation in the frequency band 22.55-23.15 GHz, in accordance with Resolution **664 (WRC-19)**;

2.12 to consider the use of existing International Mobile Telecommunications (IMT) identifications in the frequency range 694-960 MHz, by consideration of the possible removal of the limitation regarding aeronautical mobile in IMT for the use of IMT user equipment by non-safety applications, where appropriate, in accordance with Resolution **251 (WRC-19)**;

2.13 to consider a possible worldwide allocation to the mobile-satellite service for the future development of narrowband mobile-satellite systems in frequency bands within the frequency range [1.5-5 GHz], in accordance with Resolution **248 (WRC-19)**;

3 to examine the revised ITU-R 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-19)**;

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-23;

10.2 on any difficulties or inconsistencies encountered in the application of the Radio Regulations[1]; and

10.3 on action in response to Resolution **80 (Rev.WRC-07)**;

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-19)**,

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 Conference Preparatory Meeting (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 in agenda item 10.2 to the second session of 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.

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[1] 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.

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 ±8° for the FSS in frequency bands above 17.3 GHz on a provisional basis, and has adopted an alternative value of ±16° 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 (WRC-03)

Provisions relating to earth stations located on board vessels which operate in fixed-satellite service networks in the uplink bands 5 925-6 425 MHz and 14-14.5 GHz

The World Radiocommunication Conference (Geneva, 2003),

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 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 bands 5 925-6 425 MHz and 14-14.5 GHz;

e) that, with respect to the bands considered in this Resolution, global coverage is only available in the 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 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 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, nor 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 5 925-6 425 MHz and 14-14.5 GHz bands 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 (WRC-03)**,

instructs the Secretary-General

to bring this Resolution to the attention of the Secretary-General of the International Maritime Organization (IMO).

ANNEX 1 TO RESOLUTION 902 (WRC-03)

Regulatory and operational provisions for ESVs transmitting in the 5 925-6 425 MHz and 14-14.5 GHz bands

1 The administration that issues the licence for the use of ESVs in these 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 item 4 below, with the additional limitations agreed by the licensing and other concerned administrations.

3 In the 3 700-4 200 MHz band and 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 5 925-6 425 MHz band and 125 km in the 14-14.5 GHz band, 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 the previous item 4 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 items 2 and 4 above.

7 Cessation of emissions as referred to in item 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 item 4 above) fail to comply with the terms required by the concerned administration pursuant to items 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 (WRC-03)

Technical limitations applicable to ESVs transmitting in the 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 toward 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 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 toward 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 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 e.i.r.p. in any direction within 3° of the GSO shall not exceed the following values:

5 925-6 425 MHz

Angle off-axis	*Maximum e.i.r.p. per 4 kHz band*
$2.5° \leq \varphi \leq 7°$	$(32 - 25 \log \varphi)$ dB(W/4 kHz)
$7° < \varphi \leq 9.2°$	11 dB(W/4 kHz)
$9.2° < \varphi \leq 48°$	$(35 - 25 \log \varphi)$ dB(W/4 kHz)
$48° < \varphi \leq 180°$	−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

Angle off-axis	*Maximum e.i.r.p. per 40 kHz band*
$2° \leq \varphi \leq 7°$	$(33 - 25 \log \varphi)$ dB(W/40 kHz)
$7° < \varphi \leq 9.2°$	12 dB(W/40 kHz)
$9.2° < \varphi \leq 48°$	$(36 - 25 \log \varphi)$ dB(W/40 kHz)
$48° < \varphi \leq 180°$	−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 dB(W/m^2)	for	$\delta < 5°$
$-152 + 0.75\,(\delta - 5)$ dB(W/m^2)	for	$5° \leq \delta \leq 25°$
-137 dB(W/m^2)	for	$\delta > 25°$

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;

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 904 (WRC-07)

Transitional measures for coordination between the mobile-satellite service (Earth-to-space) and the space research (passive) service in the band 1 668-1 668.4 MHz for a specific case

The World Radiocommunication Conference (Geneva, 2007),

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 1 660.5-1 668.4 MHz is allocated to the space research (passive) service;

c) that in the band 1 668-1 668.4 MHz, mobile earth stations and space research (passive) stations are subject to coordination under No. **9.11A**;

d) that the relevant coordination threshold condition is given in Appendix **5**;

e) that before WRC-07, Appendix **4** did not contain the relevant information for the request for coordination for passive services;

f) that before WRC-07, Appendix **4** contained all necessary data for request for coordination for MSS systems, and coordination information was submitted after WRC-03 for some MSS systems;

g) that there is one satellite system (SPECTR-R) in the space research (passive) service in the band 1 668-1 668.4 MHz for which relevant advance publication information has been communicated to the Bureau prior to WRC-07, and that it is necessary to provide some transitional measures for the treatment of this information by the Bureau,

noting

a) that Report ITU-R M.2124 contains an assessment of sharing between the mobile-satellite service and space research (passive) service in the band 1 668-1 668.4 MHz;

b) that the satellite system SPECTR-R is associated with the RADIOASTRON project, which is an international project for a space very long baseline interferometry system,

resolves

that, in the band 1 668-1 668.4 MHz, mobile-satellite service systems that exceed the relevant coordination threshold condition shall be coordinated with the SPECTR-R system operating in the space research service (passive), for which advance publication information was received by the Bureau on 7 December 2005[1], provided that the complete coordination information is received by the Bureau within the time-limit mentioned in No. **9.5D**.

[1] API/A/3957 dated 24 January 2006.

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 907 (REV.WRC-15)

Use of modern electronic means of communication for administrative correspondence related to advance publication, coordination and notification of satellite networks including that related to Appendices 30, 30A and 30B, earth stations and radio astronomy stations

The World Radiocommunication Conference (Geneva, 2015),

considering

that the use of electronic means of communication for administrative correspondence related to advance publication, coordination and notification of satellite networks, earth stations and radio astronomy stations would facilitate the tasks of the Radiocommunication Bureau and of administrations and has the potential to improve the coordination and notification process by reducing the amount of duplicated correspondence,

noting

that Decision 5 (Rev. Busan, 2014) of the Plenipotentiary Conference includes, in its Annex 2, paragraph 28, which proposes to "*discontinue to the greatest extent possible communications by fax and traditional postal mail between the Union and Member States and replace it with modern electronic communication methods*",

recognizing

that administrations could use the time freed by a reduction of administrative correspondence to effect coordination,

resolves

1 that modern electronic means of communication shall be used whenever possible in the administrative correspondence between administrations and the Radiocommunication Bureau 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;

2 that, wherever the words "telegram", "telex" or "fax" are inserted in provisions related to the advance publication, coordination, notification and recording processes of satellite networks, earth stations and radio astronomy stations, including the provisions contained in Appendices **30**, **30A** and **30B**, modern electronic means shall be used, to the greatest extent possible;

3 that other traditional means of communication shall continue to be used unless the administration informs the Bureau of its willingness to discontinue such use,

instructs the Radiocommunication Bureau

1 to provide administrations with the necessary technical means to ensure that the modern electronic correspondence between administrations and the Radiocommunication Bureau is secure;

2 to inform administrations of the availability of such means and of the associated schedule of implementation;

3 to automatically acknowledge receipt of all electronic correspondence;

4 to report to the next world radiocommunication conference on the experience gained in the application of this Resolution, with a view to making any necessary consequential amendments to the Radio Regulations,

urges administrations

to use, to the extent possible, modern electronic means of communication in the administrative correspondence between themselves related to advance publication, coordination and notification of satellite networks, including that related to Appendices **30**, **30A** and **30B**, and to earth stations and radio astronomy stations, recognizing that other means of communication may still be used if necessary (see also *resolves* 3).

RESOLUTION 908 (REV.WRC-15)

Electronic submission and publication of satellite network filings

The World Radiocommunication Conference (Geneva, 2015),

considering

a) that the volume of advance publication information (API), coordination requests (CR/C), notifications and filings under Appendices **30**, **30A** and **30B** for satellite networks or systems has been steadily increasing in recent years;

b) that a significant amount of effort is required to maintain the relevant databases;

c) that a paperless electronic approach for 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 the Bureau in the processing of these filings,

noting

a) that, through Circular Letters CR/363 and CR/376, the Bureau informed administrations that a web-based application (SpaceWISC) is available as of 1 March 2015 for the submission and publication of API notices for satellite networks or systems subject to coordination and of administrations' associated comments;

b) that, through Circular Letter CR/360, the Bureau informed administrations that web-based online distribution of the International Frequency Information Circular BR IFIC (Space services) on DVD-ROM in ISO format has been developed, allowing the data to be available without delay on the BR IFIC publication date and enabling administrations to obtain a secure local reproduction of the BR IFIC (Space services) DVD-ROM,

resolves

that administrations shall submit all satellite network filings and comments, if required, using a secure paperless electronic approach upon being advised that the means for such electronic submission of a satellite network filing for satellite networks or systems has been implemented and upon receiving assurances that such means are indeed secure,

instructs the Director of the Radiocommunication Bureau

1 to implement a secure paperless electronic approach for the electronic submission and publication of satellite network filings and comments, if required, for satellite networks or systems, taking into account the conditions mentioned in the *resolves* of this Resolution;

2 to study and implement, as appropriate, a consolidated approach for the electronic submission of both satellite network filings and their related correspondence.

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 licences[1]

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.

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[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
	Identification of the ship station				
Name of ship	Call sign	MMSI	Other identification *(optional)*	Holder of licence	Accounting authority identification code, or additional information including accounting information if required

	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 *(when applicable)*				**
7	Other equipment	*(Optional)*			

For the Issuing Authority:

.....

Place Date Authentication

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* 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 territories[1]

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.

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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-12)

Principles for the allocation of frequency bands

The World Radiocommunication Conference (Geneva, 2012),

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 ITU Plenipotentiary Conference and WRC Resolutions,

recognizing

that Resolution **26 (Rev.WRC-07)*** 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-07)***;

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* *Note by the Secretariat:* This Resolution was revised by WRC-19.

4 should take into account relevant studies by the Radiocommunication Sector 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 account of *recommends* 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-R 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 *considerings a)* to *g)* and *recommends* 1 to 4 above;

2 to conduct these 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 ITU-R

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 ITU-T and ITU-D.

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 (WRC-03)

Operational procedures for earth stations on board vessels (ESVs) use

The World Radiocommunication Conference (Geneva, 2003),

considering

a) that under the provisions of Resolution **902 (WRC-03)** transmissions from ESVs within the distances defined in item 4 of Annex 1 of Resolution **902 (WRC-03)** 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 (WRC-03)

Operational procedures for 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 (WRC-03)**, 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 (WRC-03)** 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 equipment[1]

The World Administrative Radio Conference (Geneva, 1979),

considering

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.

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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-19)

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 (Sharm el-Sheikh, 2019),

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 such as is noted in Resolution **212 (Rev.WRC-07)***;

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)*.

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

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 stations[1]

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 groups[1],

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.).

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[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 dB(W/m^2) 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 dB(W/m^2) 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 dB(W/m^2) 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 dB(W/m^2) 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 $\Omega_{i,0}$ (degrees)	Argument of latitude $E_{i,0}$ (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/m^2) 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

Relating to the use of the frequency band 32-33 GHz shared between the inter-satellite service and the radionavigation service[1]

The World Administrative Radio Conference (Geneva, 1979),

considering

a) that the band 32-33 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**,

recommends

that, as a matter of urgency, studies should be made of the sharing criteria for these two services in the frequency band listed above,

requests the ITU-R

to carry out these studies,

recommends further

that a future competent world radiocommunication conference review the ITU-R Recommendations with a view to the inclusion of such sharing criteria in Article **21**.

[1] WRC-97 made editorial amendments to this Recommendation.

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.

ISBN 978-92-61-30301-3 SAP id 43513

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Published in Switzerland
Geneva, 2020