# UNITED STATES OF AMERICA

# DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

**AGENDA ITEM 1.5**: *to consider the use of the frequency bands 17.7-19.7 GHz (space-to-Earth) and 27.5‑29.5 GHz (Earth-to-space) by earth stations in motion communicating with geostationary space stations in the fixed-satellite service and take appropriate action, in accordance with Resolution* ***158 (WRC-15)***

**BACKGROUND INFORMATION**:

Advances in satellite manufacturing and directional earth station technology, particularly the development of multi-axis stabilized earth station antennas capable of maintaining a high degree of pointing accuracy from stationary or on rapidly moving platforms to GSO FSS space stations. Satellite network operators are designing, coordinating, and bringing into use GSO FSS networks that can offer both stationary and moving broadband services using a single stabilized directional antenna within existing GSO FSS technical parameters.

The ITU-R has been studying deployment of earth stations in motion (ESIM) communicating with GSO FSS space stations for a number of years. WRC-15 adopted provisions for operating ESIM communicating with GSO FSS space stations in the 29.5-30 GHz and 19.7-20.2 GHz bands under No. **5.527A** and Resolution **156 (WRC-15)**, and prior Conferences adopted provisions for operation of Earth Stations on Vessels (ESVs) on maritime vessels communicating with GSO FSS space stations portions of the C- and Ku-bands.

WRC-19 Agenda Item 1.5 provides for consideration of the 27.5-29.5 GHz and 17.7-19.7 GHz bands for ESIM. The 17.7-19.4 GHz and 19.6-19.7 GHz bands are considered separately from the 29.5-30 GHz and 19.7-20.2 GHz bands considered at WRC-15 due to the fact that the allocations, use, interference mechanisms, and required protection of incumbent services are significantly different in the 27.5-29.5 GHz and 17.7-19.7 GHz bands proposed for analysis by WRC-19.[[1]](#footnote-1) Further, in some administrations and regions, portions of the 27.5-29.5 GHz band are either not available for high-density FSS applications, or ESIM are expressly prohibited in certain bands.[[2]](#footnote-2)

The sharing cases requiring study in the 27.5-29.5 GHz and 17.7-19.4 GHz and 19.6-19.7 GHz bands are set out in Resolution **158 (WRC-15)** for the broadcasting-satellite service, the fixed-satellite service (geostationary and non-geostationary), the fixed-satellite service limited to feeder links for non-geostationary satellite systems in the mobile-satellite service, feeder links for the broadcasting satellite service, the mobile service, the fixed service, and the earth exploration-satellite service.

ITU-R studies leading to the conditions necessary for such protection have been identified or are nearing conclusion.

The proposal below will augment the 500 MHz + 500 MHz identified for ESIM at WRC-15, by providing additional spectrum, to support ESIM deployments. As well, specific protection mechanisms for non-geostationary mobile-satellite service feeder links are proposed in a Resolution to be incorporated by reference into the Radio Regulations.

Proposals

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations  
(See No. 2.1)

MOD USA/1.5/1

|  |  |  |
| --- | --- | --- |
| 15.4-18.4 GHz | | |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 17.7-18.1  FIXED  FIXED-SATELLITE (space-to-Earth) 5.484A ADD5.A15  (Earth-to-space) 5.516  MOBILE | 17.7-17.8  FIXED  FIXED-SATELLITE (space-to-Earth) 5.517 ADD5.A15 (Earth-to-space) 5.516  BROADCASTING-SATELLITE  Mobile  5.515 | 17.7-18.1  FIXED  FIXED-SATELLITE (space-to-Earth) 5.484A ADD5.A15  (Earth-to-space) 5.516  MOBILE |
|  | 17.8-18.1  FIXED  FIXED-SATELLITE (space-to-Earth) 5.484A ADD5.A15  (Earth-to-space) 5.516  MOBILE  5.519 |  |
| 18.1-18.4 FIXED  FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B ADD5.A15  (Earth-to-space) 5.520  MOBILE  5.519 5.521 | | |

MOD USA/1.5/2

|  |  |  |
| --- | --- | --- |
| 18.4-22 GHz | | |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 18.4-18.6 FIXED  FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B ADD5.A15  MOBILE | | |
| 18.6-18.8  EARTH EXPLORATION-SATELLITE (passive)  FIXED  FIXED-SATELLITE (space-to-Earth) 5.522B ADD5.A15  MOBILE except aeronautical mobile  Space research (passive) | 18.6-18.8  EARTH EXPLORATION- SATELLITE (passive)  FIXED  FIXED-SATELLITE (space-to-Earth) 5.516B 5.522B ADD5.A15  MOBILE except aeronautical mobile  SPACE RESEARCH (passive) | 18.6-18.8  EARTH EXPLORATION-SATELLITE (passive)  FIXED  FIXED-SATELLITE (space-to-Earth) 5.522B ADD5.A15  MOBILE except aeronautical mobile  Space research (passive) |
| 5.522A 5.522C | 5.522A | 5.522A |
| 18.8-19.3 FIXED  FIXED-SATELLITE (space-to-Earth) 5.516B 5.523A ADD5.A15  MOBILE | | |
| 19.3-19.7 FIXED  FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 5.523B 5.523C 5.523D 5.523E ADD5.A15 MOBILE | | |

|  |  |  |
| --- | --- | --- |
| MOD USA/1.5/3  24.75-29.9 GHz | | |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 27.5-28.5 FIXED 5.537A  FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 ADD5.A15  MOBILE  5.538 5.540 | | |
| 28.5-29.1 FIXED  FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.523A 5.539 ADD5.A15  MOBILE  Earth exploration-satellite (Earth-to-space) 5.541  5.540 | | |
| 29.1-29.5 FIXED  FIXED-SATELLITE (Earth-to-space) 5.516B 5.523C 5.523E 5.535A 5.539 5.541A ADD5.A15  MOBILE  Earth exploration-satellite (Earth-to-space) 5.541  5.540 | | |

ADD USA/1.5/4

**5.A15** The operation of earth stations in motion communicating with geostationary FSS space stations in the bands 17.7-19.4 GHz and 19.6-19.7 GHz (space-to-Earth), and 29.4525-29.5 GHz (Earth-to-Space) [shall be in accordance with shall/be subject to] Resolution **[A15] (WRC-19)**.

**Reasons:** Adoption of these proposals would provide the availability of additional spectrum in the above-referenced bands in both the FSS uplink and downlink directions to support ESIM deployment. The bands proposed above differ from the Resolution **158 (WRC-15)** bands referenced for study because ESIM are either expressly excluded from operation in a Region, or portions of the Resolution **158 (WRC-15)** reference spectrum is not available in an administration. Spectrum not encumbered as described above and also harmonized across all three Regions is proposed in USA/1.5/4.

ADD USA/1.5/5

draft new RESOLUTION [A15] (WRC-19)

Use of the frequency bands 17.7-19.4 GHz and 19.6-19.7 GHz and 27.5-29.1 GHz and 29.4525-29.5 GHz by earth stations in motion (ESIM) communicating with geostationary space stations  
in the fixed-satellite service1

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 ESIM to communicate with space stations of geostationary-satellite orbit (GSO) fixed-satellite service (FSS) operating in the frequency bands 17.7-19.4 GHz and 19.6-19.7 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.4525-29.5 GHz (Earth-to-space);

*b)* that appropriate regulatory and interference management mechanisms are necessary for the operation of ESIM;

*c)* that the frequency bands 17.7-19.4 GHz and 19.6-19.7 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.4525-29.5 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 from the operation of ESIM,

recognizing

*a)* that the administration authorising ESIM on territory under its jurisdiction has the right to require that ESIM referred to above only use those assignments associated with GSO FSS networks which have been successfully coordinated, notified, brought into use and recorded in the MIFR with a favourable finding under 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 ESIM, the operation of ESIM on those assignments 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 ESIM communicate or on the coordination requirements of that satellite network,

*further recognizing*

1. that non-GSO MSS feeder link systems using the frequency band 19.3-19.7 GHz (space-to-Earth) are not subject to the provisions of RR No. **22.2**.;
2. that the use of this frequency band for other non-geostationary fixed-satellite service systems, or for the cases indicated in RR Nos. **5.523C** and **5.523E**, is not subject to the provisions of No. **9.11A**, but is subject to Articles **9** (except No. **9.11A**) and **11** procedures, and to the provisions of No. **22.2** (No. **5.523D);**
3. that ECC Decision 13 (01)] prohibits ESIM use of – among other bands – the band 29.1-29.4525; (*see, ECC Decision (ECC/DEC/(13)01) on the harmonized use, free circulation and exemption from individual licensing of Earth Stations on Mobile Platforms (ESOMPs) within the frequency bands 17.3-20.2 GHz and 27.5-30.0 GHz (approved March 8, 2013))*;
4. that in the United States, the use of the bands 19.4-19.6 GHz and 29.1-29.25 GHz by the fixed-satellite service is limited to feeder links for non-geostationary-satellite systems in the mobile-satellite service; (*see, 47 CFR 2.106, NG166)*;
5. that the band 29.1-29.25 GHz is not available for use by high density fixed-satellite service applications; (*see, ITU Radio Regulations, No. 5.516B* (2016 ed.));

resolves

1 that for any ESIM communicating with a GSO FSS space station in the frequency bands 17.7-19.4 GHz and 19.6-19.7 GHz and 27.5-29.1 GHz and 29.4525-29.5 GHz, or portions thereof, the following conditions shall apply:

1.1 with respect to space services in the 17.7-19.4 GHz and 19.6-19.7 GHz and 27.5-29.1 GHz and 29.4525-29.5 GHz bands, ESIM shall comply with the following conditions:

1.1.1 with respect to satellite networks or systems of other administrations, ESIM shall remain within the envelope of the satellite network with which these ESIM communicate;

1.1*.*2 for the implementation of *resolves* 1.1.1 above, the notifying administration of the GSO FSS network with which ESIM communicate shall send to the Bureau under this Resolutionthe relevant Appendix **4** information related to the characteristics of the ESIM intended to communicate with the space station of that GSO FSS network, including a commitment that the ESIM operation would be in conformity with the Radio Regulations and this Resolution (including its annexes, as applicable);

1.1.3 upon receipt of the information provided in accordance with *resolves* 1.1.2 above, the Bureau shall examine it in relation to the requirements referred to in *resolves* 1.1.1 based on the complete information submitted to the Bureau under No. **11.2,** and complying with No. **11.28,** for the satellite network of the GSO FSS space station with which the ESIM is intended to communicate;]

1.1.4 If, following the examination referred to in *resolves* 1.1.3 above, the Bureau concludes that the ESIM characteristics are within the envelope of the satellite network, it shall publish the results in a Special Section annexed to the BR IFIC, and retain the original date of protection for the assignment being modified where the information is presented as a modification of an existing notice;]

1.1.5 if, following the examination referred to in *resolves* 1.1.3 above, the Bureau concludes that the ESIM characteristics are not within the envelope of the satellite network, the information shall be returned to the notifying administration;

1.1.6 for the protection of non-GSO FSS systems operating in the band 27.5-28.6/29.1 GHz, ESIM 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 operating in the band 29.4525-29.5 GHz, ESIM communicating with GSO FSS networks shall comply with the provisions of Annex 1B to this Resolution;

1.1.8 ESIM shall not claim protection from non-GSO MSS feeder link earth stations operating in the frequency bands 17.7-19.4 GHz and 19.6-19.7 GHz (space-to-Earth), and 29.4525-29.5 GHz (Earth-to-Space) in accordance with the Radio Regulations and shall not affect their future development;

[Note: renumber below]

1.1.7 ESIM 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**;

1.1.8 ESIM shall not claim protection from BSS feeder link earth stations operating in the frequency band 17.7-18.4 GHz in accordance with the Radio Regulations and shall not affect their future development;

1.2 with respect to terrestrial services in the 17.7-19.4 GHz and 19.6-19.7 GHz and 27.5-29.1 GHz and 29.4525-29.5 GHz frequency bands ESIM shall comply with the following conditions:

1.2.1 the receiving ESIM in the 17.7-19.4 GHz and 19.6-19.7 frequency band shall not claim protection from any stations in the terrestrial services in this band operating in accordance with the Radio Regulations and shall not affect the future development of these services;

1.2.2 the transmitting aeronautical and maritime ESIM in the 27.5-29.1 GHz and 29.4525-29.5 GHz frequency band shall not cause unacceptable interference to any stations in the terrestrial services in this band operating in accordance with the Radio Regulations and shall not affect the future development of these services, and Annex 2 applies;

1.2.3 the transmitting land ESIM in the 27.5-29.1 GHz and 29.4525-29.5 GHz frequency band shall not cause interference to any stations in the terrestrial services in this band operating in accordance with the Radio Regulations and shall not affect the future development of these services, and Annex 3 applies;

1.2.4 for the implementation of *resolves* 1.2.2 and 1.2.3 above, the notifying administration responsible for the GSO FSS satellite network with which ESIM communicate shall, in making the commitment referred to in *resolves* 1.1.2 above, be deemed to have committed that it shall, upon receipt of a report of unacceptable interference (in the case of aeronautical or maritime ESIM) or interference (in the case of land ESIM), take necessary action to immediately cease or reduce interference to an acceptable level;

1.2.5 any transmitting aeronautical or maritime ESIM that conforms to the requirements in Annex 2 to this Resolution shall be deemed to have met its obligation to terrestrial stations under *resolves* 1.2.2 above;

2 that ESIM shall not be used or relied upon for safety-of-life applications;

3 that for the implementation of this Resolution, administrations may consider relevant parts of Annex 3 when considering to authorise ESIM as well as in their bi-lateral or multi-lateral negotiations;

4  that, in addition to *resolves* 3, administrations authorizing land ESIM shall ensure that land ESIM operating in their territory do not cause unacceptable interference to terrestrial services of other countries operating in accordance with the Radio Regulations

5 that the administration responsible for the GSO FSS satellite network with which the ESIM communicate shall ensure that:

5.1 ESIM employ techniques to track the associated GSO FSS satellite without inadvertently tracking adjacent GSO satellites;

5.2 the ESIM network operator puts in place all necessary measures so that its ESIM are subject to permanent monitoring and control by a Network Control and Monitoring Centre (NCMC) or equivalent facility and are capable of receiving and acting upon at least “enable transmission” and “disable transmission” commands from the NCMC or equivalent facility (see also Annex 3);

6 that the application of this Resolution does not provide regulatory status to ESIM different from that derived from the GSO FSS network with which they communicate taking into account the provisions referred to in this Resolution,

instructs the Director of the Radiocommunication Bureau

1 to take any necessary actions for the implementation of this Resolution;

2 to take any necessary actions to assist in resolving any potential and actual interference issues;

3 to report to WRC-23 any difficulties or inconsistencies encountered in the implementation of this Resolution;

invites administrations

to collaborate, to the maximum extent practicable, for the implementation of this Resolution, in particular for resolving any potential interference.

Annex 1a to draft new Resolution [A15] (WRC-19)

Provisions for ESIM to protect non-GSO FSS systems in the frequency band 27.5-28.6 GHz

1 In order to protect those non-GSO FSS referred to in *resolves* 1.1.6 of this Resolution, ESIM shall comply with the following provisions:

a. The level of equivalent isotropically radiated power (e.i.r.p.) density emitted by an ESIM in a geostationary-satellite network in the 27.5-28.6 GHz frequency band 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:

|  |  |  |
| --- | --- | --- |
| *Off-axis angle* |  | *Maximum e.i.r.p. density* |
| 3    7 |  | 28 – 25 log dB(W/40 kHz) |
| 7    9.2 |  | 7 dB(W/40 kHz) |
| 9.2    48 |  | 31 – 25 log dB(W/40 kHz) |
| 48    180 |  | 1 dB(W/40 kHz) |

b. For any ESIM that does not meet Condition 1.a above, outside of 3 deg of the GSO, 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 1B to draft new Resolution [A15] (WRC-19)

Provisions for ESIM to protect non-GSO MSS feeder link systems in the frequency band 29.4525-29.5GHz

1 In order to protect non-GSO MSS feeder link systems referred to in *resolves* 1.1.7 of this Resolution, ESIM shall comply with the following provisions:

1. The level of equivalent isotropically radiated power (e.i.r.p.) density emitted by an ESIM in a geostationary-satellite network in the 29.1-29.5 GHz frequency band shall not exceed the following values for any off-axis angle ϕ off the main-lobe axis of an ESIM antenna:

|  |  |  |
| --- | --- | --- |
| *Off-axis angle* |  | *Maximum e.i.r.p. density* |
| *0* |  | 28.5 dB(W/40kHz) |
| *0.04* *<*  |  | 28.5 – 25 log (30dB(W/40kHz) |
| 0.3  0.5 |  | -3.5 dB(W/40kHz) |
|    1 |  | 20.5 - 25 log (30dB(W/40kHz) |
| 1  3.9 |  | -17.5dB(W/40 kHz) |
| 3.9   6.5 |  |  25 log  dB(W/40 kHz) |
| 6.5 <  |  | dB(W/40 kHz) |
| 10  |  | log dB(W/40 kHz) |
|  |  | dB(W/40 kHz) |

1. For any ESIM that does not meet the conditions 1.a. above, it shall not transmit within 2,179 km of any current or future non-GSO MSS feeder link earth station with parameters as described in Attachment 1 to this Annex.

ATTACHMENT 1 TO ANNEX 1B

**Analysis for ESIM exclusion zones to protect non-GSO MSS feeder link systems**

Agenda Item 1.5 compatibility studies between ESIMs and feeder links for the non-GSO MSS have not been finalized and need further study due to the complexity of the dynamic interference environment and disagreement on parameters used for the studies to determine the full potential for interference. Reference to these ongoing studies can be found in Annex 15 to Document 4A/826 (Working Document Towards a Preliminary Draft New Report ITU-R S.[ESIM]). Table 1 below provides a static analysis that demonstrates the potential interference that an ESIM can cause to a representative non-GSO MSS feeder link system.

Table 1: Static ESIM interference analysis



ESIM parameters have been duplicated from the ongoing described in the Working Document referenced above. ESIM uplink transmissions have the potential to generate interference levels that exceed non-GSO MSS feeder link satellite receiver noise floor by over 38 dB. Thus, 38.4 dB of antenna discrimination is required just to reduce the amount of interference to the level of the satellite receiver noise floor. This antenna discrimination could be applied to the ESIM antenna (if not pointing directly at the non-GSO MSS satellite) and/or the non-GSO MSS satellite antenna. A simplified example of this is shown in Figure 1.

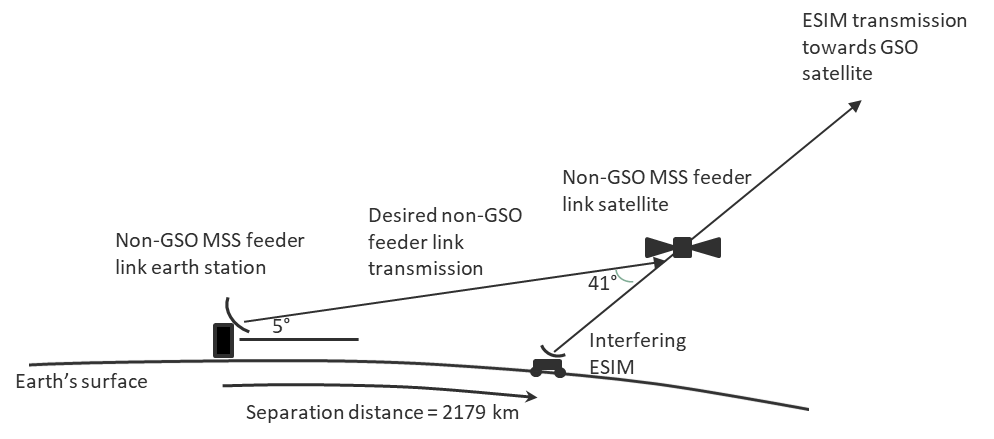


Figure 1: ESIM interference to non-GSO satellite feeder link geometry

Since there can always be a scenario in which the non-GSO MSS satellite moves through the main beam of an ESIM transmission, the antenna discrimination applied to the ESIM antenna for this case is 0 dBi, leaving all of the 38.4 dB of discrimination to be applied to the non-GSO MSS satellite receive antenna. Again referencing the above Working Document study, the HIBLEO-2FL satellite receive antenna pattern is modeled using Recommendation ITU-R S.465-5, which assumes an off-axis gain described by the following equation:

*G = 32 – 25 log ϕ dBi, for ϕmin ≤ ϕ < 48°.*

For the peak satellite antenna gain of 30.1 dBi, an antenna discrimination of 38.4 dBi results in an absolute off-axis antenna gain, *G*, of -8.3 dBi. From the equation above, to meet this value of *G*, the off-axis angle, *ϕ,* is found to be equal to 41 degrees. As shown in Figure 1, for the HIBLEO-2FL satellite at its minimum elevation angle of 5 degrees, and for an ESIM near the Earth’s surface, the ESIM would need to be 2179 km from the HIBLEO-2FL feeder link earth station and be at the 41 degree off-axis angle from the perspective of the HIBLEO-2FL satellite antenna. For the ESIM parameters assumed above, this is the maximum distance at which an ESIM could be from the HIBLEO-2FL feeder link earth station and produce an interference level equal to the satellite receiver noise floor (I/N = 0 dB). The particular geometry for this scenario could exist at high latitude regions in which both the HIBLEO-2FL feeder link is at its minimum elevation angle and in alignment with the ESIM link to a geostationary satellite low on the horizon.

This static analysis does not consider likelihood of interference events or percentage of time that interference levels thresholds are exceeded. Factors that would impact this result include specific locations of the non-GSO MSS feeder link earth station, ESIM and GSO satellite, the number of ESIMs transmitting near the feeder link earth station, the transmission parameters of these ESIMs including the duty cycles at which they transmit, and the specific non-GSO MSS feeder link protection criteria. However, since these factors are still being considered and debated within ITU-R Working Party 4A, a static analysis as provided above is needed to bound the ESIM interference problem. As a comparison, it’s worth noting that the referenced Working Document includes a simulated analysis, for a different geographic location and for a protection criterion I/N value slightly different than the I/N = 0 dB case considered here. That analysis yields a worst-case separation distance of 1455 km.

The static analysis provided here indicates that harmful interference from ESIMs to non-GSO MSS feeder link communications could occur even at separation distances greater than 2,000 km. Simulated results based on non-GSO MSS feeder link geographic locations and ESIM-supported GSO networks could produce different separation distances, but no resolution of those simulation parameters has been agreed at this time.

Annex 2 to draft new Resolution [A15] (WRC-19)

Part 1:

Provisions for maritime ESIM to protect terrestrial services operating in the frequency band 27.5-29.1 GHz and 29.4525-29.5 GHz for the implementation of resolves 1.2.2

Part 2:

Provisions for aeronautical ESIM to protect terrestrial services operating in the frequency band 27.5-29.1 GHz and 29.4525-29.5 GHz for the implementation of resolves 1.2.2

Part 1: Maritime ESIM

1 Maritime ESIM shall comply with items 1.1 and 1.2 below:

1.1 The minimum distance from the low-water mark as officially recognized by the coastal State beyond which maritime ESIM can operate without the prior agreement of any administration is 60 km in the 27.5-29.1 GHz and 29.4525-29.5 GHz frequency band. Any transmissions from maritime ESIM within the minimum distance shall be subject to the prior agreement of the concerned coastal State.

1.2 The maximum maritime ESIM e.i.r.p. spectral density towards the territory of any coastal State will be limited to 24.44 dBW in reference bandwidth of 14 MHz. Transmissions from maritime ESIM with higher e.i.r.p. spectral density levels towards the territory of any coastal state shall be subject to the prior agreement of the concerned coastal State.

Part 2: Aeronautical ESIM

1 Aeronautical ESIM communicating with GSO FSS networks shall comply with the provisions of items 1.1 and 1.2 below:

1.1 When within line-of-sight of the territory of an administration, the maximum pfd produced (in a reference bandwidth of 14 MHz) at the surface of the Earth within the territory of that administration by emissions from a single aeronautical ESIM shall not exceed:

PFD(δ)=-124.7 (dBW/m2/14 MHz) for 0°≤δ≤0.01°

PFD(δ)=-120.9+1.9∙log10(δ) (dBW/m2/14 MHz) for 0.01°≤ δ≤0.3°

PFD(δ)=-124.7 (dBW/m2/14 MHz) for 0°≤δ≤0.01°

PFD(δ)=-120.9+1.9∙log10(δ) (dBW/m2/14 MHz) for 0.01°≤ δ≤0.3°

PFD(δ)=-116.2+11∙log10(δ) (dBW/m2/14 MHz) for 0.3°<δ≤1°

PFD(δ)=-116.2+18∙log10(δ) (dBW/m2/14 MHz) for 1°<δ≤2°

PFD(δ)=-117.9+23.7∙log10(δ) (dBW/m2/14 MHz) for 2°<δ≤8°

PFD(δ)=-96.5 (dBW/m2/14 MHz) for 8°<δ≤90.0°

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

1.2 Higher pfd levels than provided in 1.1 above produced by aeronautical ESIM on surface of the Earth within the territory of an administration that is within line-of-sight of the aeronautical ESIM shall be subject to the prior agreement of that administration.

NOTE 1 – When calculating whether an ESIM meets the pfd levels specified in provision 1.1 above, free-space propagation, atmospheric absorption, and any attenuation due to the aircraft fuselage should be considered.

Annex 3 to draft new Resolution [A15] (WRC-19)

Guidelines to assist administrations to authorize ESIM   
in the frequency band 27.5-29.1 GHz and 29.4525-29.5 GHz

The following guidelines are provided for administrations involved in the authorization and operation of ESIM in the 27.5-29.1 GHz and 29.4525-29.5 GHz and 17.7-19.4 GHz and 19.6-19.7 frequency bands:

1. With regard to Land ESIM (L-ESIM), the administration authorizing L-ESIM may require: :

1.1 that L-ESIM operate within the territory under the jurisdiction of an administration only if authorised by that administration;

1.2 the operator of any ESIM network within which the L-ESIM operate to confirm that such L-ESIM have the capability to limit operations to the territory of administrations having authorized those L-ESIM;

1.3 The operator of the ESIM network within which the L-ESIM operate provide a point of contact for the purpose of tracing any suspected cases of interference from L-ESIM.

2. With regard to Maritime ESIM (M-ESIM), the administration authorizing M-ESIM may require: :

2.1 that M-ESIM operate within the territorial waters under the jurisdiction of an administration only if authorised by that administration.

2.2. the operator of any ESIM network within which the M-ESIM operate to confirm that such M-ESIM have the capability to limit operations to the territorial waters of administrations having authorized those M-ESIM.

2.3 The operator of the ESIM network within which the M-ESIM operate provide a point of contact for the purpose of tracing any suspected cases of interference from M-ESIM.

3. With regard to Aeronautical ESIM (A-ESIM), the administration authorizing A-ESIM may require:

3.1 that A-ESIM operate within the territorial airspace under the jurisdiction of an administration only if authorized by that administration;

3.2 the operator of any ESIM network within which the A-ESIM operate to confirm that such A-ESIM have the capability to limit operations to the territorial airspace of administrations having authorized those A-ESIM.

3.3 The operator of the ESIM network within which the A-ESIM operate provide a point of contact for the purpose of tracing any suspected cases of interference from A-ESIM.

**Reasons:** to provide guidelines for authorizing ESIM..

MOD USA/1.5/6

APPENDIX 4 (REV.WRC‑15)

Consolidated list and tables of characteristics for use in the  
application of the procedures of Chapter III

ANNEX 2

Characteristics of satellite networks, earth stations  
or radio astronomy stations2    (Rev.WRC‑12)

Footnotes to Tables A, B, C and D

MOD

TABLE A

Table of characteristics to be submitted for space andradio astronomy services   
(Rev.WRC ‑12)

| Items in Appendix | *A \_ GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK,  EARTH STATION OR RADIO ASTRONOMY STATION* | *Advance publication of a geostationary- satellite network* | *Advance publication of a non-geostationary-satellite network subject to coordination under Section II  of Article 9* | *Advance publication of a non-geostationary-satellite network not subject to coordination under Section II  of Article 9* | *Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)* | *Notification or coordination of a non-geostationary-satellite network* | *Notification or coordination of an earth station (including notification under  Appendices 30A or 30B)* | *Notice for a satellite network in the broadcasting-satellite service under  Appendix 30 (Articles 4 and 5)* | *Notice for a satellite network  (feeder-link) under Appendix 30A  (Articles 4 and 5)* | *Notice for a satellite network in the fixed- satellite service under Appendix 30B  (Articles 6 and 8)* | *Items in Appendix* | *Radio astronomy* |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| \* \* \* | **\* \* \*** |  |  |  |  |  |  |  |  |  | \* \* \* |  |
| **A.18** | **COMPLIANCE WITH NOTIFICATION OF AIRCRAFT EARTH STATION(S)** |  |  |  |  |  |  |  |  |  |  |  |
| A.18.a | a commitment that the characteristics of the aircraft earth station (AES) in the aeronautical mobile-satellite service are within the characteristics of the specific and/or typical earth station published by the Bureau for the space station to which the AES is associated  Required only for the band 14-14.5 GHz, when an aircraft earth station in the aeronautical mobile-satellite service communicates with a space station in the fixed-satellite service |  |  |  | **+** | **+** |  |  |  |  | A.18.a |  |
| **A.19** | **COMPLIANCE WITH § 6.26 OF ARTICLE 6 OF APPENDIX 30B** |  |  |  |  |  |  |  |  |  | **A.19** |  |
| A.19.a | a commitment that the use of the assignment shall not cause unacceptable interference to, nor claim protection from, those assignments for which agreement still needs to be obtained  Required if the notice is submitted under § 6.25 of Article 6 of Appendix **30B** |  |  |  |  |  |  |  |  | **+** | A.19.a |  |
| **A.20** | **COMPLIANCE WITH *Resolves* 1.1.2 of Resolution [AI 1.5/XXX] (WRC-19)** |  |  |  |  |  |  |  |  |  | **A.20** |  |
| A.20.a | indicator (yes) if an assignment for the 27.5-29.1 GHz and 29.4525-29.5 GHz and/or 17.7-19.4 GHz and 19.6-19.7 GHz17.7-19.4 GHz and 19.6-19.7 GHz band in the satellite network will be used by ESIM |  |  |  |  |  | **O** |  |  |  | A.20.a |  |
| A.20.b | if yes under A.20.a, a commitment that the ESIM operation would be in conformity with the Radio Regulations and Resolution **[AI1.5/XXX] (WRC-19)** (including its annexes) |  |  |  |  |  | **+** |  |  |  | A.20.b |  |

Reasons: This Appendix **4** element is needed to implement *resolves* 1.1.2 of Draft New Resolution **[A1.5] (WRC-19).**

**SUP USA/1.5/7**

RESOLUTION 158 (WRC‑15)

Use of the frequency bands 17.7-19.7 GHz (space-to-Earth) and 27.5-29.5 GHz (Earth-to-space) by earth stations in motion communicating with  
geostationary space stations in the fixed-satellite service

Reasons: Consequential.

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1. For example, MSS allocations in the 29.5-30 GHz and 19.7-20.2 GHz bands have been available for use for many years. Effectively, ESIM are MSS, and in the 29.5-30 GHz and 19.7-20.2 GHz bands could have deployed as FSS delivered MSS without any WRC action. [↑](#footnote-ref-1)
2. ITU Radio Regulations, No. 5.516B (2016 ed.); 47 CFR 2.106, NG166; ECC Decision (ECC/DEC/(13)01) on the harmonized use, free circulation and exemption from individual licensing of Earth Stations on Mobile Platforms (ESOMPs) within the frequency bands 17.3-20.2 GHz and 27.5-30.0 GHz (approved March 8, 2013). [↑](#footnote-ref-2)