**WRC-19 Agenda Item 1.5**

IWG-3 members were not able to reach consensus on a proposal for WRC-19 Agenda Item 1.5 regarding 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, in accordance with Resolution **158 (WRC-15).** The views on the appropriate regulatory changes the FCC should support are provided.

View A is supported by: Inmarsat, Viasat, SES, Boeing, Thales

View B is supported by AT&T, CTIA, Ericsson, Global Mobile Suppliers Association (GSA), GSMA, Intel Corporation, Sprint Corporation, T-Mobile, and Verizon.

View C is supported by: Iridium

VIEW A

**View A:**

View A proposes to adopt regulatory and technical considerations for the use of earth stations in motion (ESIM) communicating with geostationary-satellite orbit (GSO) fixed-satellite service (FSS) space stations in the 17.7-19.7 GHz (space-to-Earth) and 27.5-29.5 GHz (Earth-to-space) frequency bands.

Although FSS traditionally involves communications between satellites in orbit and earth stations in fixed locations, the growing demand for broadband communications to vessels, land vehicles, and aircraft has resulted in increased use of FSS for mobility applications. ESIM in the 17.7-19.7 GHz and 27.5-29.5 GHz bands enable the provision of very high data rate broadband communications, navigation, situational awareness, and other services to mobile platforms that often cannot be served using other communications technologies. ESIM are used to deliver broadband to ships, vehicles, trains, and aircraft using the same frequency bands, hardware, satellites, transponder beams, and control stations used to serve earth stations at fixed locations.

At WRC-15, the ITU adopted regulatory and technical provisions for ESIM in the 29.5-30 GHz and 19.7-20.2 GHz frequency bands. Use of these bands by services other than the FSS is limited.

Resolution 158 (WRC-15) established a list of sharing and protection cases to be addressed under Agenda item 1.5. All of the required studies have been undertaken in the ITU-R during the 2015-2019 study cycle. Where provisions were shown to be required for the protection of existing services and applications – such as the mobile service, the fixed service, and non-GSO FSS systems in portions of the band subject to No. **22.2** – studies leading to the conditions necessary for such protection have been identified and are nearing conclusion. The ITU-R determined that a WRC Resolution containing the regulatory, technical, and operational conditions for ESIM operation on aircraft, maritime vessels, and land vehicles could be developed and effectively implemented to address this agenda item.

View A contains a series of proposals for establishment of ESIMs in the 17.7-19.7 GHz and 27.5-29.5 GHz bands:

The first element is a proposed footnote for Article 5 that authorizes ESIM and makes them subject to a new WRC resolution. This footnote tracks exactly the consensus version in the draft CPM Report for CPM19-2.

The second element is the draft WRC Resolution mentioned in the new footnote. This Resolution provides the regulatory mechanism for ESIM – which must operate within the envelope of existing or proposed fixed earth stations associated with the GSO FSS network with which the ESIM communicate – and sets up the examination required by the BR. The Resolution also provides specific provisions for protection of neighboring GSO FSS satellite networks, and for non-GSO FSS systems in the segments of the 27.5-29.5 GHz band where there is no coordination under RR No. 9.11A. No separate provisions for protection of non-GSO MSS feeder links in the 29.1-29.5 GHz band, or for non-GSO FSS systems in the 28.6-29.1 GHz band are included because these bands are subject to coordination under No. 9.11A; operation within the envelope (*resolves* 1.1.1 of the Resolution) assures compatible operation and no unacceptable interference. Protection of terrestrial services (fixed and mobile) from unacceptable interference is provided in *resolves* 1.2 through 1.2.5 of the draft Resolution. These provisions include specific provisions for protection of fixed and mobile services in Annex 2. A pfd mask –for protection of fixed and mobile systems from aeronautical ESIM in 27.5-29.5 GHz, and included as an option in the draft CPM Report – is proposed for Annex 2.

The final element of the proposal is a new entry in Appendix 4 of the Radio Regulations. This provides a commitment by administrations adding ESIM to their satellite networks that the ESIM operation would be in conformity with the Radio Regulations and the new draft Resolution (including the annexes).

The proponents of View A maintain that the proposals above – all of which are the result of intense ITU-R study and are reflected in the draft CPM Report, and are consistent with how the FCC has treated ESIM in the past – provide the complete and appropriate measures for successful governance of the operation of ESIM communicating with GSO FSS networks in the 17.7-19.7 GHz and 27.5-29.5 GHz bands. Existing services are protected from unacceptable interference, important guidance is provided to administrations seeking to implement ESIM, and the stage is set for a new and important tool for provision of broadband services to be established.

**ATTACHMENT TO VIEW A:**

**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**:

The global demand for broadband communications continues unabated and is not location specific. Such demand includes requirements of connectivity for users on vessels, aircraft and vehicles that operate at both fixed locations and while in motion, often in very remote parts of the globe. ITU for many years has and continues to address ways of meeting this important need. State of the art 30/20 GHz GSO FSS satellite networks and earth stations that employ advanced technology available today are capable of meeting the connectivity requirements of broadband users on vehicles and vessels, including high-throughput applications.

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 while stationary or on rapidly moving platforms, have made earth stations with very stable pointing characteristics both available and practical. These earth stations can operate in the same interference environment, and comply with same regulatory and technical constraints as typical GSO FSS earth 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 many years. WRC-15 adopted regulatory provisions for the operation of 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 ESIM on maritime vessels communicating with GSO FSS space stations in lower FSS bands.

The latest bands to be considered for ESIM communication with GSO FSS space stations are the 27.5-29.5 GHz and 17.7-19.7 GHz bands. These bands were considered separately from the “upper 500 MHz” of the 30/20 GHz band due to the fact that the upper bands are allocated predominantly to satellite services while the lower portions of the 30/20 GHz bands are shared on a global basis with the fixed and mobile services as well as other users.

The sharing cases requiring study in the 27.5-29.5 GHz and 17.7-19.7 GHz bands were set out in Resolution **158 (WRC-15)**. Where provisions were shown to be required for the protection of existing services and applications – such as the mobile service, the fixed service, and non-GSO FSS systems in portions of the band subject to No. **22.2** – studies leading to the conditions necessary for such protection have been identified or are nearing conclusion. The ITU-R determined that a resolution containing the regulatory, technical, and operational conditions for ESIM operation on aircraft, maritime vessels, and land vehicles could be developed and effectively implemented.

Adoption of the proposals below will provide up to 2000 megahertz, in each the uplink and downlink directions, to support these important and growing global broadband requirements, on an equal basis in all three Regions and result in rational and efficient use of the radio spectrum resource. Adoption of this proposal will also assure the protection of existing services.

**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 17.7-19.7 GHz and 27.5-29.5 GHz shall be subject to Resolution **[A15] (WRC-19)**.

**Reasons:** Adoption of these proposals would provide the availability of 2 GHz of additional spectrum in each the FSS uplink and downlink directions at 30/20 GHz to support important and growing global broadband communication requirements for users on ships, airplanes, and land vehicles, on an equal basis in all three Regions and result in rational and efficient use of the radio spectrum resource.

**ADD USA/1.5/5**

draft new RESOLUTION [A15] (WRC-19)

**Use of the frequency bands 17.7-19.7 GHz and 27.5-29.5 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 17.7-19.7 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 ESIM;

*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 from the operation of ESIM,

*d)* that ITU-R studies have shown that aeronautical ESIM are capable of operating without causing harmful interference interfering with non-GSO mobile-satellite service feeder link satellite receivers in the 29.1-29.5 GHz band,

*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,

*resolves*

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

1.1 with respect to space services in the 17.7-19.7 GHz and 27.5-29.5 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 GHz, ESIM communicating with GSO FSS networks shall comply with the provisions contained in Annex 1 to this Resolution;

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 constrain their future development;

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

1.2.1 the receiving ESIM in the 17.7-19.7 GHz 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 27.5-29.5 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 27.5-29.5 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 facilitate the implementation of this Resolution by administrations, including assisting in resolving any potential 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 1 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 2 to draft new Resolution [A15] (WRC-19)

**Provisions for maritime and aeronautical ESIM to protect terrestrial services operating in the frequency band 27.5-29.5 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 27.5-29.5 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 27.5-29.5 GHz**

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

1. With regard to Land ESIM (L-ESIM), the administration authorizing L-ESIM has the right to 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 must 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 has the right to 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 has the right to 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:** Adoption of this proposal would provide the availability of 2 GHz of additional spectrum in each the FSS uplink and downlink directions at 30/20 GHz to support important and growing global broadband communication requirements for users on ships, airplanes, and land vehicles, on an equal basis in all three Regions and result in rational and efficient use of the radio spectrum resource.

**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 27.5‑29.5 GHz and/or 17.7-19.7 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.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

VIEW B

**VIEW B:**

View B addresses WRC-19 agenda item 1.5 with an emphasis on the appropriate protection of the mobile service in the 28 GHz band. View B is supported by AT&T, CTIA, Ericsson, Global Mobile Suppliers Association (GSA), GSMA, Intel Corporation, Sprint Corporation, T-Mobile, and Verizon.

View B is based upon several important principles.

1. The benefits of a tuning range approach. Similar to the position the above-signed took with WRC-19 agenda item 1.13 for IMT, this proposal recognizes the benefits of a tuning range approach for ESIMS (when 5G is the victim service). We continue to believe the United States should propose a tuning range approach and that both agenda items 1.13 and 1.5 should be treated in the same manner. If the US decides to not support a tuning range approach for agenda item 1.13 (e.g. 37-43.5 GHz), then we would request that a similar approach be taken with agenda item 1.5 (i.e. segment the band and only propose ESIM operation in the upper part of the 28 GHz band consistent with US rules).
2. Ensuring appropriate protection of the mobile services. ITU-R Working Party 5A (WP5A), the expert group on mobile broadband, liaised characteristics of mobile broadband systems to ITU-R Working Party 4A for sharing and compatibility studies under WRC-19 agenda item 1.5. In particular, the liaison covered two mobile broadband systems. Consistent with long-time ITU procedures, it is crucial to ensure the protection of both systems. Currently, under agenda item 1.5, protection is being considered for only one of the systems provided by the expert group: this would create a precedence in the ITU where a service disregard protection of specific systems of other services. Furthermore, even for the protection being considered in some cases for the first system, the pfd mask that is being proposed is not adequate and does not cover all pointing angles. The mask in View B is a composite mask which utilizes the formula provided by WP5A as well as the technical characteristics for both mobile broadband systems provided by WP5A.
3. Compliance with the pfd values for the protection of mobile and fixed services can be done at the national and bilateral level, and there is no need to address any specific details for calculating the pfd values in the current regulations. Any reference for compliance procedure in the WRC Resolution will be an inappropriate precedence setting, noting that there are many instances in the Radio Regulations where pfd values for the terrestrial services are specified without mention of any specific parameters related to compliance e.g. in RR 5.430A “This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station) and with the assistance of the Bureau if so requested.”

Based upon these principles, the above signed companies support View B with respect to WRC-19 agenda item 1.5.

**ATTACHMENT TO VIEW B:**

**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**:

There is a need for mobile communications, including global broadband satellite services. Some of this need can be met by allowing earth stations in motion to communicate with space stations of the FSS operating in the frequency bands 17.7-19.7 GHz (space-to-Earth) and 27.5-29.5 GHz (Earth-to-space).

The ITU-R has been studying deployment of earth stations in motion (ESIM) communicating with GSO FSS space stations for many years. WRC-15 adopted regulatory provisions for the operation of 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)**. Resolution 156 *resolves 1.3* states that “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.”

WRC-19 agenda item 1.5 considers 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 (ESIM) communicating with geostationary space stations in the fixed-satellite service (FSS). This agenda item has studied three types of ESIM: aeronautical, maritime and land, depending on which vehicle they are installed.

The ITU-R examined sharing conditions between ESIM and terrestrial services in the 27.5‑29.5 GHz band and concluded that there would be potential interference to receiving stations of terrestrial services from ESIM transmitters. Therefore, aeronautical and maritime ESIM should operate under the specified technical, operational and regulatory conditions to avoid causing unacceptable interference to receiving stations of terrestrial services operating in accordance with the Radio Regulations.

This proposal provides a new footnote in Article 5 of the Radio Regulations for the operation of maritime and aeronautical earth stations in motion communicating with geostationary FSS space stations within the bands 17.7-19.7 GHz and 27.5-29.5 GHz, referencing a new WRC Resolution providing the conditions for the operation of ESIM and protection of the services to which the bands are allocated, and consequential suppression of Resolution **158 (WRC-15)**.

It should be noted that the conditions for the protection of the terrestrial services includes a composite pfd mask to protect both mobile systems provided by the ITU-R.

**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 17.7-19.7 GHz and 27.5-29.5 GHz, or portions thereof, shall be subject to Resolution **[A15] (WRC-19)**.

**Reasons:** Permitting the operation of earth stations in motion within these frequency bands would provide the additional spectrum to support broadband communication for users globally.

**ADD USA/1.5/5**

draft new RESOLUTION [A15] (WRC-19)

**Use of the frequency bands 17.7-19.7 GHz and 27.5-29.5 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 within 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 ESIM;

*c)* that the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz 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,

*d)* that ITU-R studies have shown that aeronautical ESIM are capable of operating without causing harmful interference interfering with non-GSO mobile-satellite service feeder link satellite receivers in the 29.1-29.5 GHz band,

*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,

*resolves*

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

1.1 with respect to space services in the 17.7-19.7 GHz and 27.5-29.5 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 GHz, ESIM communicating with GSO FSS networks shall comply with the provisions contained in Annex 1 to this Resolution;

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 17.7-19.7 GHz and 27.5-29.5 GHz frequency bands ESIM shall comply with the following conditions:

1.2.1 the receiving ESIM in the 17.7-19.7 GHz frequency band shall not claim protection from any stations in the terrestrial services or any assignments to stations of 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 27.5-29.5 GHz frequency band shall not cause unacceptable interference to any stations in the terrestrial services in this band or any assignments to stations of terrestrial services operating in accordance with the Radio Regulations and shall not affect the future development of these services;

1.2.3 the transmitting land ESIM in the 27.5-29.5 GHz frequency band shall not cause unacceptable interference to nor claim protection from any stations in the terrestrial services or any assignments to stations of terrestrial services in this band operating in accordance with the Radio Regulations and shall not affect the future development of these services;

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 submit to the Bureau together with the Appendix **4** data referred to in *resolves* 1.1.2 a commitment undertaking that in case of interference, upon receipt of a report of interference, take necessary action to immediately cease or reduce interference to an acceptable level;

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 Secretary General*

to bring this Resolution to the attention of the Secretary General of the International Maritime Organization (IMO) and of the Secretary General of the International Civil Aviation Organization (ICAO).

Annex 1 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 2 to draft new Resolution [A15] (WRC-19)

**Part 1:**

**Provisions for maritime ESIM to protect terrestrial services operating in the frequency band 27.5-29.5 GHz**

**Part 2:**

**Provisions for aeronautical ESIM to protect terrestrial services operating in the frequency band 27.5-29.5 GHz**

**Part 1: Maritime ESIM**

1 Maritime ESIM operating within the frequency band 27.5-29.5 Hz 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 within the 27.5-29.5 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 12.98 dBW in a reference bandwidth of 1 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 operating within the frequency band 27.5-29.5 GHz 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 1 MHz) at the surface of the Earth within the territory of that administration by emissions from aeronautical ESIM shall not exceed:

PFD(δ) = -122.6 (dBW/m2/1 MHz) for 0° ≤ δ ≤ 2°

PFD(δ) = -122.6 + 1.5 \* (δ - 2) (dBW/m2/1 MHz) for 2° < δ ≤ 13.6°

PFD(δ) = -105.2 (dBW/m2/1 MHz) for 13.6° < δ ≤ 90°

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.

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

**Guidelines to assist administrations regarding the authorization and operation of ESIM   
in the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz**

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

1. With regard to Land ESIM (L-ESIM), the administration authorizing L-ESIM has the right to 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 has the right to 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 has the right to 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:** This Resolution provides the conditions to protect services allocated on a primary basis while permitting the operation of earth stations in motion within these frequency bands.

**SUP USA/1.5/6**

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 suppression as the work related to Resolution 158 is completed.

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VIEW C

**View C:**

Supporters of View C maintain it is premature for the WAC to approve Document IWG-3/051 (“Doc. 051”) because ITU-R studies are incomplete and because the Doc. 051 proposes frequencies for ESIM use that is inconsistent with the United States and European frequency plans. Therefore, the WAC should not recommend Doc. 051 to the FCC to use as the basis for a draft United States proposal to the upcoming meeting of CITEL PCC.II (3-6 December 2018, Brasilia, Brazil).

However, if the FCC decides to move forward anyway, it should use Document IWG-3/057 (“Doc. 057”) as the basis for reconciling a proposal on AI 1.5 with the National Telecommunications and Information Administration and the Department of State. Doc. 057 provides for sufficient additional spectrum for ESIM use while protecting frequencies used by the View C proponent.

**Introduction**

The View C proposal addresses two deficiencies in Doc. 051:

* Incomplete compatibility studies concerning ESIM compatibility with non-Geostationary Mobile-satellite service feeder links (“NGSO MSS feeder links); and
* Inconsistency with United States frequency allocations and Europe’s European Economic Community (“ECC”) Decision 13(01) that specifies frequencies available for ESIM use.[[1]](#footnote-1)

**Discussion**

Incomplete Compatibility Studies. In proposed Draft New Resolution **[A15] WRC-19**, c*onsidering c)*, View A Doc. 051 states:

“*d)* that ITU-R studies have shown that aeronautical ESIM are capable of operating without causing harmful interference interfering with non-GSO mobile-satellite service feeder link satellite receivers in the 29.1-29.5 GHz band,”

The statement above is untrue.

Among other things, Resolution **158 (WRC-15)**[[2]](#footnote-2) resolves to invite the ITU-R to:

“to study the technical and operational characteristics and user requirements of different types of earth stations in motion that operate or plan to operate within geostationary FSS allocations in the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz, including the use of spectrum to provide the envisioned services to various types of earth station in motion and the degree to which flexible access to spectrum can facilitate sharing with services identified in *recognizing further a) to n)*;”

Recognizing further “*g)*” and “*h)* call for studies to facilitate sharing with NGSO MSS feeder links in the bands 19.3-19.7 GHz and 29.1-29.5 GHz respectively.

Resolution 158 also invites the 2019 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 ITU-R *are complete and agreed by ITU-R study groups.*” (*emphasis added*).

The studies regarding NGSO MSS feeder links are in process in ITU-R WP 4A (“WP 4A”), but are not complete. Currently, in WP 4A there exists Document 4A/826, Annex 15 (“Annex 15”),[[3]](#footnote-3) with the following editor’s note:

“*[Editor’s note: This document is a compilation of contributions received on this subject at the July 2018 meeting of WP 4A and its content is not agreed at this time].*”

The editor’s note is there because Annex 15 consists of a simple compilation of input contributions, with no analysis by WP 4A.

As part of the Annex 15 compilation there are example NGSO MSS protection analyses that have not been analyzed formally within WP 4A, nor agreed. Indeed, within USWP4A, the Department of State’s preparatory process for WP 4A, there remains an open debate (therefore, the U.S. position remains open and inconclusive on ESIM-NGSO MSS feeder link compatibility) on methodologies and parameters to use to determine whether ESIM are compatible with and can share spectrum use. Until studies are agreed among ESIM proponents and NGSO MSS feeder link users and agreed by ITU-R study groups as Resolution 158 dictates, the FCC should not advocate for a United States proposal on this matter.

Inconsistency with the United States and European Frequency Plans. The United States should not propose for others what it cannot use itself. That is, the United State should not support any Agenda Item 1.5 proposal that is contrary to the U.S. band plan embodied in the U.S. Table of Frequency Allocations (47 CFR 2.106). As described below, Doc. 051 fails in this respect by proposing for ESIM frequencies that are not available in the United States. It fails in Europe as well, by proposing frequencies Europe took off of the table back in 2013.

The View C proposal is consistent with the FCC’s United States non-federal Ka-band plan (“U.S. band plan”). The frequency bands identified by Resolution 158 for compatibility studies include the frequency bands 17.7-19.7 GHz (space-to-Earth) and 27.5-29.5 GHz (Earth-to-space). However, the U.S. band plan does not authorize GSO FSS satellite transmission in the 19.4-19.6 GHz band, nor does it authorize GSO FSS satellite reception in the 29.1-29.25 GHz band, as mandated by footnote NG166 in the U.S. Table of Frequency Allocations. Furthermore, the FCC’s NPRM and Draft Order on ESIMs does not propose the use of the 19.4-19.6 GHz and 29.1-29.25 GHz bands for ESIMs. Consequently, ESIM communicating with GSO FSS satellite systems cannot operate in these bands.[[4]](#footnote-4)

Europe’s plan for ESIM frequency use is in ECC Decision (13)01, approved March 09, 2013. Decides 2 Of ECC Decision (13)01 provides that CEPT administrations shall:

“b. Designate the frequency bands 17.3-19.7 GHz (space-to-Earth), 27.5-27.8285 GHz (Earth-to-space), 28.4445-28.8365 GHz (Earth-to-space), and 29.4525-29.5 GHz (Earth-to-space) for the operation of ESOMPs;”

Thus, for the bands considered under Agenda Item 1.5, in Europe in the Earth-to-space direction only the 29.4525 -29.5 GHz band is available. Consequently, taking account of the U.S. Table of Frequency Allocations restrictions, and the ESIM band availability specified in ECC Decision 13(01), the spectrum common to the U.S. and Europe that may be available for ESIM is as follows:

• 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).

The View A proposal in Doc. 051 is inconsistent with the above restrictions and exclusions.

The View C Proposal Provides Sufficient Spectrum for ESIM Use. The 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) bands form the basis of the View C proposal as the spectrum that should be common in all three Regions. Though this proposal does not protect the entirety of the 19.3-19.7 GHz and 29.1-29.5 GHz bands, as the View C proponent desires to ensure continued favorable conditions for current use and future deployment of NGSO MSS feeder links, at least, in the absence of conclusive studies, protects spectrum the View C proponent uses today.

The View C proposal provides for spectrum which should be more than sufficient for ESIM use. Combined with WRC-15’s identification of the 29.5-30 GHz and 19.7-20.2 GHz bands under No. 5.527A, the View C proposal, if adopted by WRC-19, results in 2.1475 GHz of spectrum in the Earth-to-space direction, and 2.7 GHz of spectrum in the space-to-Earth direction available for ESIM use.

**Summary:**

Doc. 051 fails to recognize that ITU-R studies concerning ESIM compatibility with NGSO MSS feeder links are incomplete. Thus Resolution 158 (WRC-15) is not satisfied. It also proposes to WRC-19 to identify frequency bands for ESIM use that is inconsistent with the Federal Communication Commission’s United States Non-Federal Ka-band frequency allocations codified in 47 CFR 2.106, and inconsistent with the availability of frequencies for ESIM in Europe, captured in ECC Decision 13 (01). Consequently, with these issues outstanding, the View C proponent believes the proposal in Doc. 051 is premature.

For these reasons, at this time the FCC should not move forward with any Agenda Item 1.5 draft proposal. If the FCC decides otherwise, it should use Document IWG-3/057 – which considers the View C proponent’s spectrum use, while providing sufficient additional spectrum for ESIM use – as the basis for reconciling a proposal on AI 1.5 with the National Telecommunications and Information Administration and the Department of State.

**Attachment to View C:**

**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.[[5]](#footnote-5) 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.[[6]](#footnote-6)

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 27.5-29.1 GHz 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.

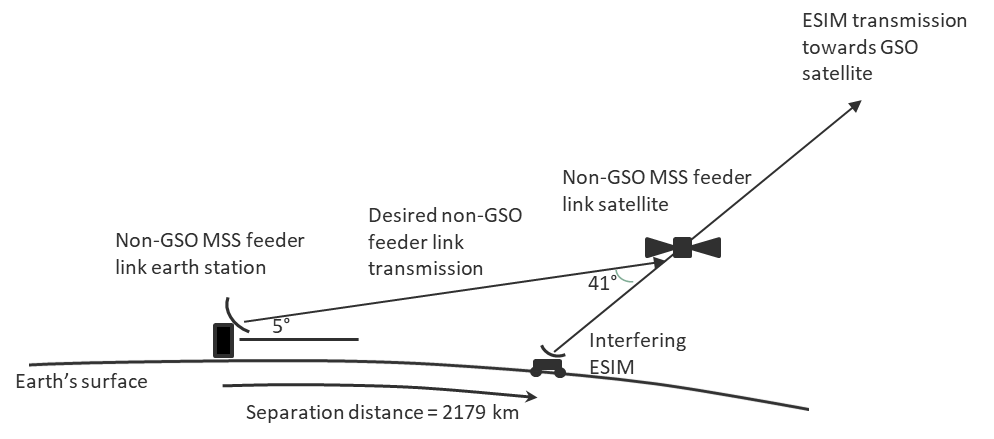


Figure 1: ESIM interference to non-GSO satellite feeder link geometry

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.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. 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-1)
2. ITU-R 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. [↑](#footnote-ref-2)
3. *See* ITU-R WP4A, *Earth stations in motion (ESIM) compatibility with non-GSO MSS feeder links in the bands 19.3-19.7 GHz and 29.1-29.5 GHz*, Document 4A/486, Annex 15 (July 23, 2018). [↑](#footnote-ref-3)
4. *See Amendment of Parts 2 and 25 of the Commission’s Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service*, Draft Report and Order and Further Notice of Proposed Rulemaking, FCC-CIRC1809-08, IB Docket No. 17-95 (circulated Sept. 5, 2018). [↑](#footnote-ref-4)
5. 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-5)
6. 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-6)