World Radiocommunication Conference (WRC-23)
Dubai, 20 November - 15 December 2023

PLENARY MEETING

Addendum 15 to
Document 6216-E
9 October 2023
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African Common Proposals

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.15

1.15 to harmonize the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service globally, in accordance with Resolution **172 (WRC-19)**;

Introduction

This proposal presents the African common proposals (AfCP) from the African group on this agenda item. Essentially, ATU supports Method B if the following conditions are fulfilled:

1. Ensuring protection to the existing services within the frequency band 12.75-13.25 GHz, and those in the adjacent bands, taking into account the need to protect Appendix **30B** of the Radio Regulations (RR) and the operation of such earth stations on aircraft and vessels should not impact the usability of the allotments in the Plan and assignments in the List under RR Appendix **30B** and not limit the access of other administrations to their national resources in RR Appendix **30B** as well as implementation of Resolution **170 (WRC-19)**.
2. Aeronautical or maritime earth stations in the frequency band 12.75-13.25 GHz need to have the capability to restrict operations in territories of those administrations where agreement under § 6.6 of RR Appendix **30B** has been obtained.
3. Support that the operation of aeronautical and maritime earth stations in motion (A-ESIM and M-ESIM) within territorial waters and/or airspace under the jurisdiction of an administration shall be carried out only if authorization of that administration is obtained.
4. Administrations responsible for notice to use an Appendix **30B** assignment in the List in support of the operation of earth stations on aircraft and vessels in the frequency band 12.75-13.25 GHz, to seek the explicit agreement of all the affected administrations from such use.
5. BR to publish the list of assignments in the Appendix **30B** ESIM brought into use with information about its service area and countries authorizing such use to assist affected administration to identify source of interference.

6. Usage of 133/150 km as a minimum distance from the low-water mark as officially recognized by the coastal State for protection of terrestrial services from the M-ESIM transmission.
7. Notifying administration of the satellite network is the only administration that has the responsibility to notify the ESIMs that will communicate with that network and to resolve any interference incident.
8. Receiving part of the ESIM in their associated frequency band shall not adversely affect the allotments in the Plan nor the assignments in the List and not claim protection from other applications of the FSS as well as other radiocommunication services to which the frequency band is allocated. ATU prefer such measures to be included in resolves part.
9. Completion of the interference management mechanism and definition the role of the Network Monitoring and Control Center (NCMC), to deal with the interference that occurs from the operation of A-ESIM/M-ESIM of other administrations.
10. Development of a methodology to assist the Radiocommunication Bureau in examining the conformity of earth stations on board aircraft and vessels in the event that an appropriate flux density is used to protect terrestrial services from moving earth stations, with the need to agree on such a methodology before end of the conference.
11. Review which frequency assignments that entered in the List under § 6.17 of RR Appendix **30B** can be used as supporting assignments by ESIM.
12. Need to review any cost associated with the possible implementation of the draft new Resolution under WRC-23 agenda item (AI) 1.15.
13. Studies under this agenda item need to equally consider the effect of aggregated interference from ESIMs to ensure long term protection of the fixed and mobile services.

ARTICLE 5

Frequency allocations

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

MOD AFCP/6216A15/1

11.7-13.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
12.75-13.25	FIXED FIXED-SATELLITE (Earth-to-space) 5.441 ADD 5.A115 MOBILE Space research (deep space) (space-to-Earth)	

ADD AFCP/6216A15/2

5.A115 The operation of earth stations in motion on board aircraft and vessels communicating with geostationary space stations in the fixed-satellite service in the frequency band 12.75-13.25 GHz (Earth-to-space) shall be subject to the application of Resolution **[AFCP-A115] (WRC-23)**. (WRC-23)

ADD AFCP/6216A15/3

DRAFT NEW RESOLUTION [AFCP-A115] (WRC-23)

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

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that WARC Orb-88 established an Allotment Plan for the use of the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz;

b) that WRC-07 revised the regulatory regime governing the use of the frequency bands referred to in *considering a)* above;

c) that the objective of providing broadband mobile satellite communications may also be met by allowing earth stations in motion (ESIMs), on aircraft (A-ESIMs) and vessels (M-ESIMs), to communicate with the geostationary space stations of a fixed-satellite service network in the frequency bands 12.75-13.25 GHz (Earth-to-space) and the associated downlink frequency bands of that satellite, thus for example the frequency bands 10.70-10.95 GHz and 11.20-11.45 GHz of Appendix **30B** may be used;

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

e) that the operation of services to which the frequency band 12.75-13.25 GHz is allocated and those in adjacent bands needs to be protected from A-ESIM and M-ESIM;

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

g) that the objective of the procedures in Appendix **30B** is to guarantee, for all countries, equitable access to the GSO in the frequency bands of the FSS covered by this Appendix;

h) that appropriate regulatory and interference-management mechanisms, including necessary mitigation measures and associated techniques, are required for the operation of A-ESIM and M-ESIM in the frequency band 12.75-13.25 GHz (Earth-to-space) to protect other space and terrestrial services in this frequency band as well as services in adjacent frequency bands and without adversely affecting those services and their future development, taking into account the provisions of Appendix **30B** (see also *resolves further* 1 to 5 on responsibilities);

i) that, in Appendix **30B**, the frequency bands in the space-to-Earth direction corresponding to the frequency band 12.75-13.25 GHz (Earth-to-space) are 10.7-10.95 GHz and 11.2-11.45 GHz, which may be used by A-ESIM and M-ESIM, subject to not claiming protection from other services and applications of the FSS and other radiocommunication services to which the frequency band is allocated;

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

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

considering further

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

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

recognizing

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

b) that administrations intending to authorize A-ESIMs and M-ESIMs, when establishing national licensing rules, may consider adopting other interference management procedures and/or mitigation measures than those contained in this Resolution;

c) that, pursuant to the relevant paragraph in Appendix **30B**, the operation of ESIM in the frequency band 12.75-13.25 GHz could be only within the service area of the Appendix **30B**

network for which the explicit agreement of any administration whose territory is partially or wholly included in this service area has been obtained;

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

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

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

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

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

h) that Resolution **170 (WRC-19)** provides the procedure to enhance equitable access to frequency bands under Appendix **30B** by developing countries;

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

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

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

l) that successful compliance with this Resolution does not oblige any administration to authorize/license A-ESIM and M-ESIM communicating with geostationary space stations in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space) to operate within the territory under its jurisdiction (see *resolves* 7);

m) that administration experiencing unacceptable interference from an ESIM may contact any administration involved in the operation of ESIM; however, the responsibility for resolving the case of unacceptable interference is remain under notifying administration of the GSO FSS network with which ESIMs communicate;

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

recognizing further

a) that, under *resolves* 1.1.3 of this Resolution, frequency assignments to ESIMs need to be notified to the BR;

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

c) that an administration authorizing the operation of ESIMs within the territory under its jurisdiction may modify and/or withdraw that authorization at any time;

d) that the three elements consisting of interference management mechanism, switching facility for on/off function and the function of NCMC and their relations with each other and sequence of actions together with estimated time for that action/function are needed for the proper and factual operation of the ESIM;

e) the operation of A-ESIM and M-ESIM shall comply with provision No. **5.340**;

f) when the Appendix **30B** GSO FSS satellite network with which A-ESIM and M-ESIM communicate transmits in the frequency bands 10.7-10.95 GHz and 11.2-11.45 GHz, it shall operate under the levels that were coordinated and included in the List, and these Appendix **30B** satellite transmissions will not change to accommodate A-ESIM and M-ESIM;

resolves

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

1.1 with respect to space services in the frequency band 12.75-13.25 GHz and adjacent bands, A-ESIM and M-ESIM shall comply with the following conditions:

1.1.1 the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by A-ESIM and M-ESIM shall not result in any changes or restrictions to the allotment in the Plan, assignments in the List of Appendix **30B**, and those recorded in the MIFR, including the assignments arising from the implementation of Resolution **170 (WRC-19)**;

1.1.2 with respect to satellite networks or systems of other administrations, the characteristics of A-ESIM and M-ESIM shall remain within the envelope of typical characteristics of notified earth stations associated with the satellite networks with which these earth stations communicate, as published by the Bureau and included in relevant International Frequency Information Circular (BR IFIC), and Annex 1 applies;

1.1.2*bis* the use of A-ESIM and M-ESIM shall not cause any interference to Appendix **30B** allotments, assignments received by the Bureau under Article 6 either in process or yet to be processed, assignments in the List, assignments notified under Article 8 of that Appendix, and assignments recorded in the MIFR as well as submission under Appendix **30B** beyond that specified in the relevant Annexes to that Appendix;

1.1.3 for the implementation of *resolves* 1.1.1, 1.1.2 and 1.1.2*bis* above, the notifying administration for the GSO FSS network with which the above-mentioned A-ESIM and M-ESIM communicate shall follow the procedure in Annex 1 of this Resolution, together with the commitment that the operation of ESIM shall be in conformity with the Radio Regulations, including this Resolution;

1.1.4 upon receipt of the notification information referred to in *resolves* 1.1.3 above, the BR shall process the submission in accordance with Annex 1 of this Resolution;

1.1.5 for the protection of non-GSO FSS systems operating in the frequency band 12.75-13.25 GHz, the above-mentioned A-ESIM and M-ESIM communicating with GSO FSS networks referred to above shall comply with the provisions contained in Annex 3 of this Resolution;

1.1.6 the notifying administration of the GSO FSS network with which the above-mentioned earth stations communicate shall ensure that the operation of these A-ESIM and M-ESIM complies with the coordination agreements for the frequency assignments of the earth station of this GSO FSS satellite network of Appendix **30B** obtained under the relevant provisions of that Appendix;

1.1.9 the receiving part of the above-mentioned ESIM in their associated frequency band shall not adversely affect the allotments in the Plan nor the assignments in the List and not claim protection from other applications of the FSS as well as other radiocommunication services to which the frequency band is allocated;

1.2 with respect to the protection of terrestrial services to which the frequency band 12.75-13.25 GHz is allocated and that operate in accordance with the Radio Regulations, A-ESIM and M-ESIM shall comply with the following conditions:

1.2.1 transmitting A-ESIM and M-ESIM in the frequency band 12.75-13.25 GHz (Earth-to-space) shall not cause unacceptable interference to terrestrial services to which this frequency band is allocated and that operate in accordance with the Radio Regulations, and Annex 2 to this Resolution shall apply;

1.2.2 the receiving part of the above-mentioned ESIM in their associated frequency band shall not claim protection from terrestrial services to which this frequency band is allocated and that operate in accordance with the Radio Regulations;

1.2.3 the requirement to not cause unacceptable interference to terrestrial services to which the frequency band 12.75-13.25 GHz is allocated and that operate in accordance with the Radio Regulations shall be respected, irrespective of compliance with Annex 2 (see resolves 7);

1.2.4 for the application of Part II of Annex 2 as referred to in resolves 1.2.1 above, the BR shall examine the characteristics of A-ESIM with respect to the conformity with the pfd limits on the Earth's surface specified in Part II of Annex 2, and publish the results of such examination in the BR IFIC;

1.2.5 the compliance with the technical conditions in Annex 2 does not release the notifying administration of the A-ESIM and M-ESIM with respect to discharging its responsibility that such earth station shall not cause unacceptable interference and any interrelated receiving part shall not claim protection from the terrestrial stations;

1.2.6 if administrations authorizing A-ESIM agree to pfd levels higher than the limits contained in Part II of Annex 2 within the territory under its jurisdiction, such agreement shall in no way affect other countries that are not party to that agreement;

1.2.7 the notifying administration for the GSO FSS network with which the A-ESIM and M-ESIM will communicate, taking into account the *resolves further* below, shall send to the BR, together with submission of the Appendix **4** information for the above-mentioned earth station, a commitment undertaking that, upon receiving a report of unacceptable interference, it shall immediately take all appropriate measures to eliminate that interference or reduce it to an acceptable level and follow the procedures in *resolves* 9;

1.3 with respect to the aeronautical radionavigation systems operating in the frequency band 13.25-13.4 GHz, A-ESIM and M-ESIM communicating with GSO FSS networks shall not cause

unacceptable interference to the aeronautical radionavigation service (ARNS) operating in accordance with the Radio Regulations in the frequency band 13.25-13.40 GHz;

Option 1:

2 that, for assignments of Appendix **30B** recorded in the List, only frequency assignments entered in the List under § 6.17 can be used as supporting assignments by earth stations on aircraft and vessels communicating with GSO networks in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space), if those assignments are recorded in the MIFR with a favourable finding under § 8.11 of Article 8 of Appendix **30B**, except assignments recorded under § 6.25 of Article 6 of the Appendix;

Option 2:

2 that only frequency assignments of Appendix **30B** recorded in the List can be used as supporting assignments by A-ESIMs and M-ESIMs communicating with GSO networks in the FSS in the frequency band 12.75-13.25 GHz (Earth-to-space), if those assignments are recorded in the MIFR with a favourable finding under § 8.11 of Article 8 of Appendix **30B** provided that assignments recorded under § 6.25 of Article 6 used for A-ESIM and M-ESIM operations shall not cause unacceptable interference or claim protection from those assignments for which agreement was not obtained;

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

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

5 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 A-ESIM and M-ESIM communicate, or on the coordination requirements of that satellite network;

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

7 that the operation of A-ESIM and M-ESIM within territorial waters and/or airspace under the jurisdiction of an administration shall be carried out only if a licence according to No. 18.1 of the Radio Regulations/authorization of that administration is obtained;

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

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

9.1 only the notifying administration of the GSO FSS network/non-GSO FSS systems with which ESIMs communicate is responsible for resolving the case of unacceptable interference;

9.2 the notifying administration of the GSO FSS network with which the ESIMs communicate shall immediately take the required action to eliminate or reduce interference to an acceptable level;

9.3 the affected administration(s) may assist, to the extent of its ability in resolving or provide information that would facilitate resolving the case of unacceptable interference;

9.4 the administration authorizing the operation of A-ESIM and M-ESIM on the territory under its jurisdiction may, subject to its explicit agreement and to the extent of its ability, cooperate to assist in the resolution of unacceptable interference;

9.5 an administration that the territory of which is situated inside the service area of a satellite and has provided explicit authorization to receive the service/to be served by any type of ESIM has no obligation nor any mandate, whatsoever, to be involved directly or indirectly in detection, identification, reporting, resolution of any interference caused by the operation of the ESIM the operation of which was authorized;

9.6 the administration responsible for the aircraft or vessel on which the ESIM operates shall provide a point of contact to assist identifying the notifying administration of the satellite with which the ESIM communicates;

10 that the notifying administration of the GSO FSS satellite network with which the ESIM communicates shall ensure that:

10.1 for the operation of A-ESIM and M-ESIM, techniques are employed to maintain adequate 10 pointing accuracy with the associated GSO/non-GSO FSS satellite;

10.2 all necessary measures shall be taken so that A-ESIM and M-ESIM are subject to permanent monitoring and control by a Network Control and Monitoring Centre (NCMC) in order to comply with the provisions in this Resolution, and are capable of receiving and immediately acting upon, *inter alia*, “enable transmission” and “disable transmission” commands from the NCMC;

10.3 measures are taken so that the A-ESIM and/or M-ESIM do not transmit on the territory, under the jurisdiction of an administration, including its territorial waters and its national airspace, that is neither in the service area of the GSO satellite network and/or has not authorized its use on its territory;

10.4 a permanent point of contact shall be provided, in the Appendix **4** submission under Annex 1 of this Resolution and published in the special section, by the notifying administration of the GSO FSS network for the purpose of tracing any suspected cases of unacceptable interference from earth stations on aircraft and vessels and to immediately respond to such requests;

NOTE: *resolves* 11 in the CPM Report was not kept under the condition that all the existence of various uncertainties in the implementation of several courses of action referred to in the potential Resolution associated with Method B is properly addressed and concluded.

resolves further

1 that ESIMs shall not cause unacceptable interference to nor claim protection from other services as referred to in *resolves* 1.2.1 and 1.2.2;

2 that the notifying administration for the ESIMs shall send to the BR, when submitting the relevant Appendix **4** data, a commitment (as stipulated in *resolves* 1.2.7) that, upon receiving a report of unacceptable interference, the notifying administration for the GSO satellite network with which ESIMs communicate shall remove such interference;

3 that the commitment referred to in *resolves further* 2 shall be objective, measurable and enforceable;

4 that, in case of continued unacceptable interference despite of the commitment referred to in *resolves further* 2, the assignment causing interference shall be submitted to the Radio Regulations Board for review;

5 that compliance with the provisions contained in Annex 2 does not release the notifying administration of the GSO satellite network with which ESIMs communicate of its obligations mentioned in *resolves further* 1 above (see *resolves* 1.2.3);

6 that frequency assignments in the frequency band 12.75-13.25 GHz (Earth-to-space) by A-ESIM and M-ESIM communicating with geostationary space stations in the FSS shall be notified by the notifying administration of the satellite network with which the ESIM communicates;

7 that the notifying administration of the satellite network shall ensure that ESIMs operate only in the territory under the jurisdiction of an administration from which an authorization has been obtained, taking into account *recognizing further c)* above;

8 that the notifying administration of the satellite network shall provide to the BR the list of administrations that authorize the use of the Appendix **30B** ESIM.

9 that, for the implementation of *resolves further* 2 above, the notifying administration of the satellite network with which ESIMs communicate shall ensure that ESIMs are designed and operate so as to cease transmission in the territory of any administration from which authorization has not been obtained;

9*bis* that, for the implementation of *resolves further* 7 and 9 above, the system shall employ the minimum capabilities listed in Annex 5;

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

11 that the authorization for an ESIM to operate in the territory under the jurisdiction of an administration shall in no way release the notifying administration of the satellite network with which the ESIM communicates from the obligation to comply with the provisions included in this Resolution and those contained in the Radio Regulations,

instructs the Director of the Radiocommunication Bureau

1 to take all necessary actions to facilitate the implementation of this Resolution, together with providing any assistance for the resolution of interference, when required;

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

3 to review, if necessary, once the methodology to examine the characteristics of A-ESIMs with respect to conformity with the pfd limits on the Earth’s surface specified in Part II of Annex 2 is available;

4 to publish the list of assignments in the Appendix **30B** ESIM brought into use with information about its service area and countries authorize such use if any; this information shall be updated regularly,

instructs the Secretary-General

1 to bring this Resolution to the attention of the Council with a view to consider if cost recovery should be applied to ESIM;

2 to bring this Resolution to the attention of the Secretary-General of the International Maritime Organization and of the Secretary General of the International Civil Aviation Organization.

ANNEX 1 TO DRAFT NEW RESOLUTION [AFCP-A115] (WRC-23)

PART I

Procedure to be followed by the administrations and the Bureau for submission of the earth stations in motion on aircraft and vessels operating in the frequency band 12.75-13.25 GHz (Earth-to-space) and for the protection of allotments in the Plan, assignments in the Appendix 30B List and those submitted under Articles 6 and 7 of Appendix 30B as well as under Resolution 170 (WRC-19)

Section A – Procedure for entering assignments to earth stations in motion on aircraft and vessels in the Appendix 30B ESIM List[1]

1 When an administration, or one acting on behalf of a group of named administrations, intends to use one or more Appendix **30B** assignments already included in the List and MIFR in support of the operation of A-ESIMs and M-ESIMs in the frequency band 12.75-13.25 GHz, it shall send to the Bureau, not earlier than 8 years but preferably not later than 2 years before the operation of A-ESIMs and M-ESIMs, the information specified in Appendix **4**[2].

An assignment in the Appendix **30B** ESIM List shall lapse if it is not brought into use within 8 years after the date of receipt by the Bureau of the relevant complete information specified above. A proposed assignment not included in the Appendix **30B** ESIM List within 8 years after the date of receipt by the Bureau of the relevant complete information shall also lapse.

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

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

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

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[1] The List of assignments for earth station in motion (ESIM) in the frequency band 12.75-13.25 GHz in Appendix **30B**.

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

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

b) Annex 3 to Appendix **30B**;

c) the on-axis e.i.r.p. density and off-axis e.i.r.p. density of the supporting Appendix **30B** assignment(s);

d) the service area of the supporting Appendix **30B** assignment(s) in respect of explicit agreements of those administrations whose territories are included in the service area4;

e) the frequency band of the supporting Appendix **30B** assignment(s) in the List in the frequency band 12.75-13.25 GHz.

3 When the examination with respect to § 2 leads to an unfavourable finding, the relevant part of the notice shall be returned to the notifying administration with an indication of the appropriate action.

4 When the examination with respect to § 2 leads to a favourable finding, the Bureau shall use the method of Annex 4 to Appendix **30B** to determine administrations whose:

a) allotments in the Plan; or

b) assignments which appear in the List; or

c) assignments which the Bureau has previously examined under § 6.5 of Article 6 of Appendix **30B** after receiving complete information in accordance with § 6.1 of that Article,

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

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

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

6 The Bureau shall also inform each administration listed in the Special Section of the BR IFIC published under § 5, drawing its attention to the information it contains.

7 An administration that has not notified its comments either to the administration seeking agreement or to the Bureau within a period of four months following the date of the BR IFIC referred to in § 5 shall be deemed to have not agreed to the proposed assignment in respect of its allotment in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, submission in accordance with Resolution **170 (WRC-19)**, according to the case for which absence of reply/comments shall construe their disagreement to the request for coordination. This time-limit shall be extended for an administration that has requested the assistance of the Bureau by up to thirty days following the date on which the Bureau communicated the result of its action. In respect of its frequency assignments under Article 6 of Appendix **30B** other than those mentioned above, the same course of action outlined in § 6.10 of that Article shall apply.

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

8 Unless coordination is no longer required, the administration responsible for the notice published under § 5 shall seek and obtain the explicit agreement of the relevant affected administrations contained in the Special Section published under § 5 in respect of allotment in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, submission in accordance with Resolution **170 (WRC-19)**, as appropriate. In this specific case of explicit agreement, any request for the assistance of the Bureau shall not change it to implicit/tacit agreement.

9 If agreements have been reached in accordance with §§ 7 and 8 with administrations published under § 5, the administration responsible for the notice published under § 5 may request the Bureau to have the assignment entered into the Appendix **30B** ESIM List, indicating the final characteristics of the notice[5] together with the names of the administrations with which agreement has been reached.

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

9*ter* If the information received by the Bureau under §§ 9 and 9*bis* is found to be incomplete, the Bureau shall immediately seek any clarification required and information not provided from the administration concerned. The Bureau may also provide additional information in order to assist the notifying administration in complying with requirements under §§ 10, 12 and 13.

10 Upon receipt of a complete notice under § 9, the Bureau shall examine each assignment in the notice with respect to its conformity with:

a) the Table of Frequency Allocations and the other provisions[6] of the Radio Regulations, except those provisions relating to conformity with the FSS Plan and the procedures for obtaining coordination;

b) Annex 3 to Appendix **30B**;

c) the service area published under § 5;

d) the on-axis e.i.r.p. density and off-axis e.i.r.p. density of the assignments published under § 5, and

e) frequency band of the assignments published under § 5.

11 When the examination with respect to § 10 of an assignment received under § 9 leads to an unfavourable finding, the notice shall be returned to the notifying administration with an indication that subsequent resubmission under § 9 will be considered with a new date of receipt.

12 When the examination with respect to § 10 of an assignment received under § 9 leads to a favourable finding, the Bureau shall use the method of Annex 4 to examine if there is any administration and the corresponding:

a) allotment in the Plan;

b) assignment which appears in the List at the date of receipt of the examined notice submitted under § 1;

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

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

c) assignments which the Bureau has previously examined under § 6.5 of Article 6 of Appendix **30B** after receiving complete information in accordance with § 6.1 of that Article at the date of receipt of the examined notice submitted under § 1[7],

considered as being affected and receiving more interference than that produced by the supporting Appendix **30B** assignment(s) and whose agreement has not been provided under § 9.

13 The Bureau shall determine if the cumulative interference is caused to an allotment in the Plan or an assignment in the List or an assignment for which the Bureau has received complete information in accordance with Article 6 of Appendix **30B** before the date of receipt of the complete notice under § 9. The cumulative interference shall be calculated based on Appendix 1 to Annex 4 of Appendix **30B**, taking into account assignments in the Appendix **30B** ESIM List together with assignments submitted under § 9. The cumulative interference is considered as being caused when the overall aggregate $(C/I)_{aggregate}$ value is less than that resulting from the supporting Appendix **30B** assignment(s) with a tolerance of 0.25 dB (inclusive of the 0.05 dB computational precision), except for an allotment in the Plan, an assignment stemming from the conversion of an allotment into an assignment without modification, or when the modification is within the envelope characteristics of the initial allotment, as well as assignments relating to application of Article 7 of Appendix **30B** for which the 0.05 dB computational precision is applicable.

14 In the event of a favourable finding under §§ 12 and 13, the Bureau shall enter the proposed assignment in the Appendix **30B** ESIM List and publish in a Special Section of its BR IFIC the characteristics of the assignment received under § 9, together with the names of administrations with which the provisions of this procedure have been successfully applied.

15 When the examination under § 12 or § 13 leads to an unfavourable finding with respect to allotments in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, or submission in accordance with Resolution **170 (WRC-19)**, the Bureau shall return the notice to the notifying administration. In this case, the notifying administration undertakes not to bring into use the frequency assignments until the finding with respect to allotments in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, or submission in accordance with Resolution **170 (WRC-19)**, is favourable. The Bureau, in returning the notice to the notifying administration, shall indicate that the subsequent resubmission under § 9 will be considered with a new date of receipt.

15*bis* When the examination under § 12 or § 13 leads to a favourable finding with respect to allotments in the Plan, conversion of an allotment into an assignment without modification or with a modification which is within the envelope characteristics of the initial allotment, Article 7 request transferred to Article 6, submission in accordance with Resolution **170 (WRC-19)**, but an unfavourable finding with respect to others, and if the notifying administration insists that the proposed assignment be included in the Appendix **30B** ESIM List, the Bureau shall enter the assignment provisionally in the Appendix **30B** ESIM List with an indication of those administrations whose assignments were the basis of the unfavourable finding. To this effect, the notifying administration shall include a signed commitment, indicating that use of an assignment provisionally recorded in the Appendix **30B** ESIM List shall not cause unacceptable interference to, nor claim protection from, those assignments for which agreement still needs to be obtained. The

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

entry in the Appendix **30B** ESIM List shall be changed from provisional to definitive only if the Bureau is informed that all required agreements have been obtained.

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

16 Should unacceptable interference be caused by an assignment entered in the Appendix **30B** ESIM List under § 15*bis* to any assignment in the List which was the basis of the disagreement, the notifying administration of the assignment entered in the Appendix **30B** ESIM List under § 15*bis* shall, upon receipt of advice thereof, immediately eliminate this unacceptable interference.

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

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

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

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

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

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

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

6 Each notice shall be examined:

6.1 with respect to its conformity with the Table of Frequency Allocations and the other provisions[8] of these Regulations, except those provisions relating to conformity with the FSS Plan and the procedures for obtaining coordination, which are the subject of the following subparagraph;

6.2 with respect to its conformity with the FSS Plan, the procedures for obtaining coordination and the associated provisions[9].

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

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

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

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

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

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

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[8] The "other provisions" shall be identified and included in the Rules of Procedure.

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

within 30 days following the period provided under § 1 of Section A, it shall cancel the entry in the Master Register and the corresponding assignment in the Appendix **30B** ESIM List.

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

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

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

PART II

Procedure to be followed by the administrations and the Bureau for examination and protection of one ESIM with respect to the other ESIMs

1 In the publication of the Special Section referred to in § 5 of Section A, the Bureau shall also include the names of the affected administrations, the corresponding assignments in the Appendix **30B** ESIM List and assignments for which the Bureau has previously received complete information in accordance with § 1 of Section A and which it has examined under § 4 of Section A, as appropriate.

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

a) orbital spacing as specified in paragraph 1.2 of Annex 4;

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

c) the Earth-to-space pfd as specified in paragraph 2.2 of Annex 4.

3 An administration that has not notified its comments either to the administration seeking agreement or to the Bureau within a period of four months following the date of the BR IFIC referred to in § 5 of Section A shall be deemed to have agreed to the proposed assignment. This time-limit shall be extended for an administration that has requested the assistance of the Bureau by up to thirty days following the date on which the Bureau communicated the result of its action.

4 Unless coordination is no longer required, taking into account the final characteristics of the notice in § 9 of Section A, should harmful interference be caused by an assignment included in Appendix **30B** ESIM List to any assignment in Appendix **30B** ESIM List identified in § 1 for which agreement has not been obtained, the notifying administration shall, upon receipt of advice thereof, immediately eliminate this harmful interference.

ANNEX 2 TO DRAFT NEW RESOLUTION [AFCP-A115] (WRC-23)

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

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

PART I

Earth stations on vessels

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

2.1 The minimum distance from the low-water mark as officially recognized by the coastal State beyond which an M-ESIM can operate without the prior agreement of any administration is 133/150 km in the frequency band 12.75-13.25 GHz. Any transmissions from an M-ESIM within the minimum distance shall be subject to the prior agreement of the coastal State concerned.

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

PART II

Earth stations on aircraft

3 The notifying administration of the GSO FSS satellite network with which an A-ESIM communicates shall ensure compliance of the A-ESIM operating within the frequency band 12.75-

13.25 GHz, or parts thereof, with all of the following conditions for the protection of terrestrial services to which the frequency band is allocated:

PFD MASK

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

$$pfd(\theta) = -112 \quad (dB(W/(m^2 \cdot 14\ MHz))) \quad for \quad \theta \leq 5°$$
$$pfd(\theta) = -117 + \theta \quad (dB(W/(m^2 \cdot 14\ MHz))) \quad for \quad 5° < \theta \leq 40°$$
$$pfd(\theta) = -77 \quad (dB(W/(m^2 \cdot 14\ MHz))) \quad for \quad 40° < \theta \leq 90°$$

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

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

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

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

2 The maximum power in the out-of-band domain should be attenuated below the maximum output power of the aeronautical ESIM transmitter as described in Recommendation ITU-R SM.1541.

ANNEX 3 TO DRAFT NEW RESOLUTION [AFCP-A115] (WRC-23)

Provisions for earth stations in motion on aircraft and vessels to protect non-GSO FSS in the frequency band 12.75-13.25 GHz

1 In order to protect the non-GSO FSS systems referred to in *resolves* 1.1.5 of this Resolution in the frequency band 12.75-13.25 GHz, ESIMs shall not exceed the following operational limits:

a) on-axis e.i.r.p. density of 49 dB(W/1 MHz) for an ESIM with an antenna maximum gain lower than 38.5 dBi;

b) on-axis e.i.r.p. density of 54 dB(W/1 MHz) for an ESIM with an antenna maximum gain equal to or greater than 38.5 dBi but lower than 45 dBi;

c) on-axis e.i.r.p. density of 57.5 dB(W/1 MHz) for an ESIM with an antenna maximum gain equal to or greater than 45 dBi;

d) e.i.r.p. density for any off-axis angle φ which is 3° or more off the main-lobe axis of an ESIM antenna and outside 3° of the GSO arc:

Off-axis angle	*Maximum e.i.r.p. density*
$3° \leq \varphi \leq 31.6°$	$37 - 2.$ dB(W/40 kHz)
$31.6° < \varphi \leq 180°$	dB(W/40 kHz)

2 the Radiocommunication Bureau shall not make any examination or finding with respect to compliance with this Annex under either Article 9 or 11.

ANNEX 4 TO DRAFT NEW RESOLUTION [AFCP-A115] (WRC-23)

NOTE: This methodology has been developed based on the discussions in Working Party 4A regarding the draft new Recommendation ITU-R S.[RES.169_METH] which contains a methodology for assessing compliance of A-ESIM communicating with GSO FSS satellites to meet the obligations to protect terrestrial services in Resolution 169 (WRC-19). Proposals to WRC-23 on agenda item may need to take into account any further progress/updates to this draft new Recommendation when considering a methodology for assessing compliance with Part 2 of Annex 1 of Resolution [A115] (WRC-23) for A-ESIM communicating with GSO FSS satellites. However, it should be emphasized that the discussion in the CG would lead to a satisfactory conclusion on the matter and there is no certainty that the work of the CG will be agreed at WP 4A and SG4. Consequently, actions referred to in CPM should not be based on other actions that may not be conclusive.

Methodology with respect to the examination of compliance of A-ESIM with pfd limits in Part II of Annex 2

1 Overview of the methodology

This methodology determines the off-axis e.i.r.p. spectral density ("$EIRP_C$") towards the ground for an A-ESIM transmitter communicating with a GSO FSS satellite that would ensure compliance with a set of pre-established pfd limits defined on the Earth's surface. This methodology may also be used for guidance by administrations when considering authorizing the operation of ESIMs in their territories.

The methodology then compares the computed $EIRP_C$ with a metric introduced here and named Reference off-axis e.i.r.p. towards the ground ("$EIRP_R$") of the A-ESIM. For the emission in each group of a GSO satellite network, $EIRP_R$ will be calculated by using the Appendix **4** data for that network as well as other input parameters that shall be provided by the notifying administration for that network.

Specifically, for an emission of the GSO FSS satellite network associated with an A-ESIM class of station, the $EIRP_R$ is the algebraic summation (in logarithmic terms) of the maximum input power to the antenna flange (item C.8.a.1 of Appendix **4**), the peak gain of the A-ESIM antenna (item C.10.d.3 of Appendix **4**), the maximum achievable off-axis gain isolation towards the ground of the A-ESIM antenna in the service area of the GSO network under examination and a parameter that would compensate for any difference between the emission bandwidth and the reference bandwidth of the pre-established set of pfd limits.

The operations of A-ESIM shall be evaluated over multiple predefined altitude ranges in order to establish as many $EIRP_C$ levels for comparison with $EIRP_R$.

This comparison is at the basis of the methodology and examination that are described more in detail in the following section.

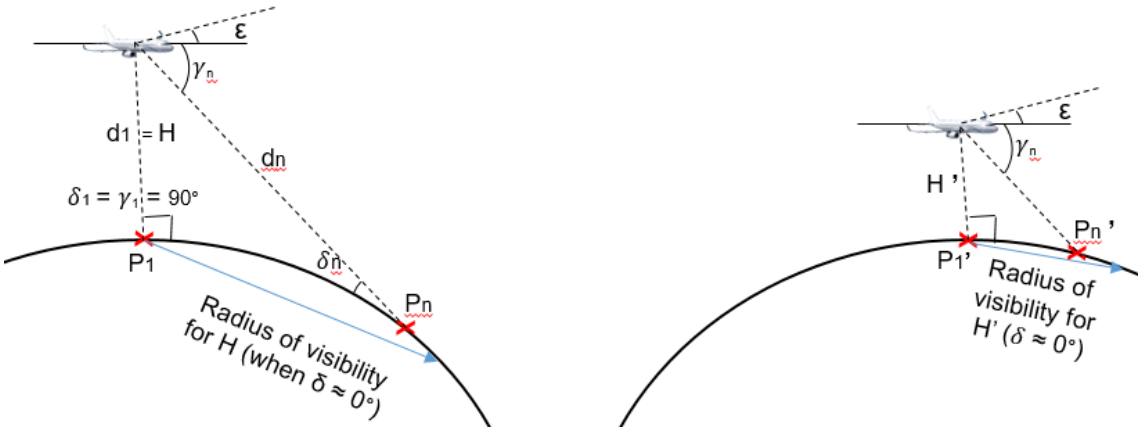
2 Parameters and geometry

Figure A4-1 provides a description of the geometry considered under this methodology. The figure shows an A-ESIM flying at two different altitudes and also some of the parameters used for the

calculation. The model is agnostic to GSO ESIM geographical locations on Earth and assumes a spherical Earth model with a fixed radius for the calculation.

FIGURE A4-1

Geometry for the examination of compliance for two different ESIM altitudes



All the parameters required by the Bureau to carry out the examination process are listed and briefly described in Table A4-1. Additional considerations are further elaborated in section 3.

TABLE A4-1

Relevant parameters for pfd compliance examination

Parameter	Symbol	Type of parameter	Observation
Aeronautical GSO ESIM altitude	H	Established by the methodology as H_{min}= [0.02] km, H_{max}= [15] km, H_{step}= [1] km	The altitudes at which the examination is carried out range from H_{min} to H_{max} at H_{step} intervals
Angle of arrival of the incident wave on the Earth's surface	δ	Specified by the pre-established set(s) of pfd limits, variable from 0° to 90°	Pre-established set(s) of pfd should cover incident angles from 0° to 90°
Angle below the horizontal plane of the ESIM corresponding to the angle of arrival δ under examination	γ	Calculated from the geometry	This angle is calculated considering the GSO ESIM altitude H_j examined and angle of arrival δ under examination (see Fig. A.4-1)
Distance between the ESIM and the point on the ground under examination	D	Calculated from the geometry	This distance is a function of the A-ESIM altitude and the angles δ and γ
Frequency	f	Established by the methodology	To evaluate the propagation loss either at the central frequency or at the upper and lower limits of the frequency range
Atmospheric loss	L_{atm}	Calculated and established by the methodology	Based on Recommendation ITU-R P.676

Parameter	Symbol	Type of parameter	Observation
Polarization loss	L_{Pol}	Fixed value	0 dB proposed as a conservative approach for the polarization loss between the polarization of A-ESIM antenna and the one used by terrestrial services
Fuselage attenuation	L_f	Report ITU-R M.2221 or other model supported by ITU-R studies (e.g. Reports and/or Recommendations)	The attenuation depends on the angle (γ) below the horizontal plane of the GSO ESIM. The value(s) could come from ITU-R studies (e.g. Reports and/or Recommendations) based on: measurements simulations
A-ESIM antenna peak gain and off-axis gain pattern	G_{max}, $G(\theta)$	Taken from the Appendix **4** data (items C.10.d.3 and C.10.d.5.a.1, respectively) of the GSO network under examination	The A-ESIM antenna gain is used to compute $EIRP_R$
Emission bandwidth	$BW_{Emission}$	Taken from the Appendix **4** data (as part of item C.7.a) of the GSO network under examination	These two bandwidths shall be compared, and a correcting factor needs to be included in the computation of $EIRP_R$ in case $BW_{Emission} < BW_{Ref}$
Reference bandwidth	BW_{Ref}	Taken from the set(s) of pre-established pfd limits	
Effective isotropic radiated power required for compliance with the pfd limits in a reference bandwidth	$EIRP_C$	$EIRP_C$ is the result of the calculation; it depends on the ESIM altitude and the angle of arrival (δ) of the incident wave on the Earth's surface	For each of the altitudes H_j, the e.i.r.p. for compliance is calculated for the different incident angles (δ) considered to cover all the range of the pfd limits to be established by WRC-23. This leads to a number of values of $EIRP_C$ associated with a given altitude H_j; for each altitude H_j, the lowest *EIRP* value is the one to be retained and compared with $EIRP_R$ (see section 3)
A set of pre-established pfd limits on the Earth's surface	$pfd(\delta)$	A possible outcome of the studies carried out under WRC-23 AI 1.15	The pfd limits, expressed in dB(W/m^2/BW_{Ref}), are a function of the angle of arrival δ

3 Calculation procedure

This section includes a step-to-step description of how the examination methodology would be implemented for a given group associated to the class of earth station for A-ESIM.

START

i) For the emission of the Group under consideration, compute the reference e.i.r.p. ($EIRP_R$, dB(W)) as:

$$EIRP_R = G_{Max} - G_{Isol_{Max}} + P_{Max} + 10\log_{10}(BW) \quad (1)$$

where:

G_{Max} is the A-ESIM antenna peak gain in dBi

$G_{Isol_{Max}}$ is the maximum achievable gain isolation of the A-ESIM antenna towards the ground in dB, taking into account the pointing of the A-ESIM towards the GSO satellite within the GSO network service area

P_{Max} is the maximum power density at the A-ESIM antenna flange in dB(W/Hz).

BW in Hz is:

BW_{Ref} if $BW_{emission} > BW_{Ref}$

$BW_{emission}$ if $BW_{emission} < BW_{Ref}$

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

iii) For each altitude $H_j = H_{min}, H_{min} + H_{step}, \ldots, H_{max}$, compute $EIRP_{C\_j}$ using the following algorithm:

a) Set the altitude of the A-ESIM to H_j.

b) Compute the angle below the horizon $\gamma_{j,n}$ as seen from the A-ESIM for each of the N angles δ_n generated in ii) using the following equation:

$$\gamma_{j,n} = \arccos\left(\frac{R_e \cdot \cos(\delta_n)}{(R_e + H_j)}\right) \quad (2)$$

where R_e is the mean earth radius.

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

$$D_{j,n} = \sqrt{R_e^2 + (R_e + H_j)^2 - 2R_e(R_e + H_j)\cos(\gamma_n - \delta_n)} \quad (3)$$

d) Compute the fuselage attenuation $L_{fj,n}$ (dB) applicable to each of the angles $\gamma_{j,n}$ computed in b) above.

e) Compute the atmospheric loss $L_{atm\_j,n}$ (dB) applicable to each of the distances $D_{j,n}$ computed in c) above.

f) Compute the $EIRP_{C\_j,n}$ (dB(W/BW_{Ref})), that is the maximum e.i.r.p. that can be radiated in the pfd mask's reference bandwidth by the A-ESIM towards each of the N points to be compliant with the set(s) of pre-established pfd limits, as per the following equation:

$$EIRP_{C\_j,n}(\delta_n, \gamma_n) = pfd(\delta_n) + 10\log_{10}\left(4\pi\left(D_{j,n} \cdot 1\,000\right)^2\right) + L_{f\,j,n} + L_{atm\_j,n} + L_{pol} \quad (4)$$

g) Compute the minimum $EIRP_{C\_j}$ across all values calculated at the previous step, $EIRP_{C\_j}$ = Min ($EIRP_{C\_j,n}$ (δ_n, γ_n)). The output of this last step is the maximum $EIRP_C$ that can be radiated by the A-ESIM to ensure it complies with the set(s) of pre-established pfd limits with respect to all angles δ_n at the altitude H_j. There will be one $EIRP_{C\_j}$ for each of the H_j altitudes considered.

iv) For the emissions, check whether there is at least one j for which $EIRP_{C\_j} > EIRP_R$. If the emission of the Group under examination passes the test above, the result of the Bureau's examination for that Group is ***favourable***, otherwise it is ***unfavourable***.

v) The Bureau publishes:

The finding (*favourable* or *unfavourable*) for each Group of emissions of the GSO network examined.

4 Example application of the methodology

Table A4-2 below describes the emissions included in one Group of a fictitious satellite network that are associated to the class of A-ESIM transmitting in the frequency band 12.75-13.25 GHz.

TABLE A4-2

Example A-ESIM emissions in the Group examined

Emission No.	C7a Designation of emi	C8a2/C8b2 Maximum power d dB(W/Hz)	C8c3 Minimum power de (not used in method dB(W/Hz)	C8e1 *C*/*N* objective (total – clear sk (not used in method dB
1	6MD7W--	−70	−80	−5.0

Table A4-3 below includes additional assumptions needed for the application of the methodology described in section 3.

TABLE A4-3

Additional assumptions

Parameter	Notatic	Value	Unit
Test frequency	F	13.25	GHz
GSO orbital longitude	GSO_l	13.0	deg
GSO service area latitude bounds	-	from 23.55 to 63.55	deg
GSO service area longitude bounds	-	from −9.72 to 30.28	deg
A-ESIM antenna peak gain	G_{max}	32.7	dBi
Antenna gain pattern	-	APEREC015V01	
\Polarization loss	L_{Pol}	0.0	dB
Fuselage attenuation model	L_f	See Table A4-4	
Atmospheric loss	L_{atm}	Recommendation ITU-R P.676	
Minimum examination altitude range	H_{min}	0.02	km
Maximum examination altitude range	H_{max}	15.0	km
Examination altitude range spacing	H_{step}	1.0	km

TABLE A4-4

Fuselage attenuation model from Report ITU-R M.2221

$L_{fuse}(\gamma) = 3.5 + 0.25 \cdot \gamma$	d	fo	$0° \leq \gamma \leq 10°$
$L_{fuse}(\gamma) = -2 + 0.79 \cdot \gamma$	d	fo	$10° < \gamma \leq 34°$
$L_{fuse}(\gamma) = 3.75 + 0.625 \cdot \gamma$	d	fo	$34° < \gamma \leq 50°$
$L_{fuse}(\gamma) = 35$	d	fo	$50° < \gamma \leq 90°$

TABLE A4-5

Tested pfd limits on the ground

The maximum pfd produced at the surface of the Earth on the territory of an administration by emissions from a single earth station on aircraft shall not exceed:

−123.5	dB(W/(m^2 · MHz))	for	$\theta \leq 5°$
−128.5 + θ	dB(W/(m^2 · MHz))	for	$5° < \theta \leq 40°$
−88.5	dB(W/(m^2 · MHz))	for	$40° < \theta \leq 90°$

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

The paragraphs below represent the step-by-step application of the calculation methodology described in section 3.

START

i) For the emission in Table A4-2, the reference e.i.r.p. ($EIRP_R$, dBW) is computed and the relevant results are included in Table A4-6 below:

TABLE A4-6

Computed values of $EIRP_R$ for the Group under consideration

Emission	G_{Max}, dBi	$G_{Isol_{Max}}$ dB	P_{Max}, dB(W/H	BW, MHz	$EIRP_R$, dBV
1	32.7	35.2	−70	6.0 − 12.5	−12.5

ii) Generate δ_n angles compatible with the pfd limits described in Table A4-5:

δ_n = 0°, 0.01°, 0.02°, …, 0.3°, 0.4°,…, 12.3°, 12.4°,…, 13°, 14°,…, 90°.

iii) For each altitude $H_j = H_{min}$, $H_{min} + H_{step}$, …, H_{max}, compute $EIRP_{C\_j}$. The output of this step is summarized in Table A4-7 below:

TABLE A4-7

Computed $EIRP_{C\_j}$ values (see embedded file for full results)

j	H_j	$EIRP_{C\_j,n}$ (δ_n, γ_n) dB(W/BW$_{Ref}$)				$EIRP_{C\_j}$
–	(km)	δ = 0°	δ = 0.01	…	δ = 90°	dB(W/BW$_{Ref}$)
1	0.02	Table A.2.9_1.15.xlsx				−40.62
2	1.00					−26.84
3	2.00					−20.77
…	…					…
16	15.00					−3.27

iv) For the emission, check whether there is at least one altitude for which $EIRP_{C\_j} > EIRP_R$. The result of this step is summarized in Table A4-8 below:

TABLE A4-8

Comparison between $EIRP_{C\_j}$ and $EIRP_R$

Emission	***EIRP*$_R$ dB(W)**	**Smallest *j* for which $EIRP_{C\_j} > EIRP_R$**	**$EIRP_{C\_j} > EIRP$**
1	−12.5	5	Yes

v) Since the emission among those included in the Group under examination passes the test detailed in iv) above, the results of the Bureau's examination for this Group are ***favourable***.

vi) The Bureau publishes:

The finding (here, favourable) for the Group of the GSO network examined.

ANNEX 5 TO DRAFT NEW RESOLUTION [AFCP-A115] (WRC-23)

Required ESIM capabilities

In order to enable the ESIM to cease transmission when the conditions described are met, the ESIM network shall be designed with appropriate capabilities. The table below describes applicable minimum capabilities, with a justification for their requirement.

it is also important to note that the NCMC has a database of allowed power spectral density limits per angles (azimuth, elevation and skew), altitude and attitude that are critical to ensure pfd limits are met. The NCMC draws upon this comprehensive and detailed database of allowed levels and continually monitors feedback from the terminal to ensure emissions are fully compliant with regulatory limits.

For each ESIM, the NCMC should have a record of the location, the latitude, longitude and altitude, the transmit frequency, channel bandwidth and satellite system with which the ESIM communicates. This data can be made available to an administration or authorized agency for the purposes of detecting and resolving interference events.

TABLE A5-1

Minimum ESIM capabilities and justification

Capability	Justification
GNSS (or other geolocation capabilities)	Required to assess ESIM's geographic location so ESIM is aware when entering the administration's territory that has not given authorization and feedback to software to cease transmissions accordingly.
Monitor loss of frequency lock	Required to anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band.
Monitor loss of LO signal	Required to anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band.
Monitor and control of the transmission frequency	Required to anticipate an error in transmission frequency, which could potentially lead to interference out of assigned transmission band.
Internal power off/on/reset	Required for the ESIM to have the ability to self-power down after experiencing a fault condition, then restart or power back on when fault is resolved.
Disable/enable transmission and level adjustment	Required to cease, adjust and re-enable transmissions as necessary to mitigate interference or unauthorized transmissions.
Receive and execute commands from NCMC	Required to receive commands to enable/disable transmission from NCMC or other commands as necessary to mitigate interference or unauthorized transmissions.