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| Summary:  |
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| Proposal: |
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1. The following pages are intended to be compiled in one CEPT Brief on AI 9

DRAFT CEPT BRIEF ON AGENDA ITEM 9.1 Issue 9.1.3

9 to consider and approve the Report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the Convention:

9.1 on the activities of the Radiocommunication Sector since WRC‑15.

# ISSUE

Resolution 157 (WRC‑15) “Study of technical and operational issues and regulatory provisions for new non-geostationary-satellite orbit systems in the 3 700-4 200 MHz, 4 500-4 800 MHz, 5 925-6 425 MHz and 6 725-7 025 MHz frequency bands allocated to the fixed-satellite service”

resolves to invite the ITU Radiocommunication Sector

to study the following issues relating to non-GSO systems in the following frequency bands allocated to the FSS:

* 1. in the frequency band 3 700-4 200 MHz (space-to-Earth), identification of possible revision of Article 21, Table 21-4 for non-GSO FSS satellites, with a view to enabling new non-GSO systems to operate in these FSS frequency bands, while ensuring that existing primary services, i.e. the mobile service and fixed service, are protected and maintaining the existing Article 21 pfd limits for GSO networks;
	2. in the frequency bands 3 700-4 200 MHz (space-to-Earth) and 5 925-6 425 MHz (Earth‑to‑space), the Article 22 epfd↓ limits and epfd↑ limits applicable to non-GSO systems with a view to enabling additional non-GSO systems to operate in these frequency bands, while ensuring that GSO networks are protected from unacceptable interference pursuant to No 22.2 and existing protection criteria;
	3. in the frequency bands 4 500-4 800 MHz (space-to-Earth) and 6 725-7 025 MHz (Earth‑to‑space), the possible development of Article 22 epfd↓ and epfd↑ limits similar to those in other FSS frequency bands with a view to enabling non-GSO systems to operate in these frequency bands, while ensuring that GSO networks are protected from unacceptable interference pursuant to No 22.2 and existing protection criteria;
	4. in the frequency band 6 700-7 025 MHz, the protection of feeder links for MSS systems operating in the space-to-Earth direction from unacceptable interference, pursuant to existing criteria, from non-GSO FSS system earth stations operating in the Earth-to-space direction;
	5. in the frequency band 4 500-4 800 MHz (space-to-Earth), the development of appropriate regulatory provisions for non-GSO FSS systems to protect terrestrial services;
	6. in the frequency bands 4 500-4 800 MHz (space-to-Earth) and 5 925-6 425 MHz (Earth‑to‑space), the development of regulatory provisions to clarify that Nos 5.440A and 5.457C would apply in a manner to ensure that non-GSO FSS systems do not cause harmful interference to, or claim protection from, AMT (aeronautical mobile telemetry) for flight testing by aircraft stations,

further resolves

1. that the results of studies referred to in the resolves above shall:

in no way change the protection criteria and protection levels defined in those criteria for the GSO FSS, the fixed service and the mobile service;

ensure protection of the existing non-GSO FSS systems with highly-elliptical orbits,

1. that new non-GSO systems that operate in FSS bands subject to the provisions of Appendix 30B shall ensure that the allotments appearing in the Plan and the assignments of the List of Appendix 30B will be fully protected,

# Preliminary CEPT position

CEPT supports no changes to the provisions of RR Article 21 and Article 22 in the frequency bands 3 700 - 4 200 MHz, 4 500-4 800 MHz, 5 925-6 425 MHz and 6 725-7 025 MHz.

CEPT is considering the introduction of a coordination procedure under RR No. 9.12 in order to address coordination between non-GSO FSS systems in the frequency bands 3 700−4 200 MHz and 5 925−6 425 MHz.

# Background

Article 21 power flux-density (pfd) limits and Article 22 equivalent power flux-density (epfd↓) limits in the frequency band 3 700-4 200 MHz (space-to-Earth) and the Article 22 epfd↑ limits in the frequency band 5 925-6 725 MHz (Earth-to-space) were developed at WRC-03.

Article 22 does not contain epfd↓ and epfd↑ limits for non-GSO systems in the frequency bands 4 500-4 800 MHz (space-to-Earth) and 6 725-7 025 MHz (Earth-to-space) allocated to the FSS, the use of which is subject to the provisions of Appendix 30B.

Working Party 4A has been identified by the Conference Preparatory Meeting as the responsible ITU-R group for the studies on WRC-15 Agenda item 9.1, issue 9.1.3. At the first meeting, the group sent liaison statements to gather technical characteristics and protection criteria needed to perform the appropriate sharing studies with existing services. WP 4A also established work plans for the studies as well as for the development of the draft CPM text and started the development of working documents.

### Sharing with FS in the bands 3 700-4 200 MHz and 5 925-6 425 MHz

[TBD]

### Sharing with MS in the bands 3 700-4 200 MHz and 5 925-6 425 MHz

It should be noted that in accordance with resolves a) of the Resolution 157 (WRC‑15) possible revision of Article 21, Table 21-4 in the frequency band 3 700-4 200 MHz (space-to-Earth) should ensure the protection of the existing primary services.

### Sharing with FSS in the bands 3 700-4 200 MHz and 5 925-6 425 MHz

Sharing with GSO FSS

One study (see Annex 17 to Document 4A/364) indicated that operations of a circular-orbit non-GSO FSS system intended to provide global broadband services in the 6/4 GHz band could result in large exceedances as much as 40 dB of the GSO protection criteria and concluded that it would be very difficult to operate a system for such purposes. The application of mitigation techniques considered in the study did little to prevent the exceedance of the protection criteria. Another study (Document 4A/487) presented to WP 4A suggested a regulatory approach by which the current limits of Article 21 and 22, which are specified as single-entry values, would not be reviewed as such. Rather, this approach would envisage the establishment of corresponding aggregate epfd limits to be collectively met by the non-GSO FSS network operators and which would be verified through multilateral meetings.

The latter study on the regulatory approach was not discussed in substance at the WP 4A meeting of 17 - 27 October 2017. It considered that further studies would be required to demonstrate the feasibility of the non- GSO systems being able to take advantage of this approach.

At the WP 4A meeting of 13 February - 2 March 2018, some administrations expressed the view that further studies are needed on whether the transformation of the compliance with the single entry epfd limits into a compliance with aggregate of epfd limits (the aggregate values would be 8.5 dB higher than single entry levels) is workable to protect GSO satellite networks.

It was also expressed by some administrations at this meeting that it is not clear how the resulted interference could adequately protect the services to which the bands are currently allocated. To respond on this, some other administrations explained that the services to which the bands are currently allocated would be equally protected as they are now in that the current limits in Article 22 are basis for deriving epfd limits as per the study.

The WP4A meeting of 3-14 July 2018 produced draft CPM text (Annex 44 to Document 4A/826) which reflects a reduction in the number of options to satisfy the agenda item. The draft CPM text summarises two studies. One study indicates that circular-orbit non-GSO FSS systems could result in large exceedances of the GSO protection criteria and concludes that it would be very difficult to operate a non-GSO circular-orbit system for the purposes of a global broadband network in the 6/4 GHz frequency bands. A second study offers to establish coordination procedure between non-GSO FSS systems under RR No. 9.12. This study finds that there is no need to review the values of the existing limits presented in Article 22 (epfd) and Article 21 (pfd) of the Radio Regulations for the 3 700-4 200 MHz, 4 500-4 800 MHz, 5 925-6 425 MHz, and 6 725-7 025 MHz frequency bands.

Sharing with non- GSO FSS

In the frequency bands 3 700-4 200 MHz and 5 925-6 425 MHz there are no coordination procedures on operation of the non-GSO FSS systems in the case of sharing with other services. The hard limits are intended to protect the GSO FSS and terrestrial services.

There are no regulatory procedures for shared operation of non-GSO FSS systems in the considered bands.

Regarding the protection of the HEO systems, direct simulation of the two systems (a victim HEO system and interfered new LEO system with a circular orbit) is one of the approaches to estimate compatibility and the operational limits for such compatibility.

However, for a number of objective reasons this approach cannot be applied by the Bureau at the stage of the filing examination.

At the same time, such an approach can be applied for coordination subject to No 9.12. In this case, Administrations can provide the detailed characteristics of the systems, and conduct joint calculations.

However, the studies carried out in ITU-R (WRC-2000) have shown that there are no coordination criteria and protection mitigation techniques between non-GSO FSS systems with high elliptical and circular orbits.

Therefore, during the current study period it is required to define the approaches for providing shared operation, to determine the coordination criteria and interference mitigation technics for the non-GSO FSS systems to ensure that non-GSO FSS systems with highly-elliptical orbits will be protected.

At the WP 4A meeting of 13 February - 2 March 2018, one study (document 4A/569) suggested to establish coordination procedure in the frequency bands 3 700−4 200 MHz and 5 925−6 425 MHz between non-GSO FSS systems under RR No. 9.12. This study finds that there is no need to review the values of the existing limits presented in Article 22 epfd and Article 21 pfd of the Radio Regulations for the 3 700‑4 200 MHz, 4 500-4 800 MHz, 5 925-6 425 MHz, and 6 725-7 025 MHz frequency bands.

### Sharing with FS in the bands 4 500-4 800 MHz and 6 725-7 025 MHz

[TBD]

### Sharing with MS in the bands 4 500-4 800 MHz and 6 725-7 025 MHz

[TBD]

### Sharing with FSS in the bands 4 500 – 4 800 MHz and 6 725-7 025 MHz

Sharing with FSS, the use of which is subject to the provisions of Appendix 30B

1. It should be noted that according to No 5.441, the use of the bands 4 500‑4 800 MHz (space-to-Earth) and 6 725-7 025 MHz (Earth-to-space) by the fixed satellite service shall be in accordance with the provisions of Appendix 30B, which is limited to the geostationary-satellite of the fixed-satellite service.

[TBD]

### Sharing with FSS (s-E), the use of which is limited to feeder links for non-geostationary satellite systems of the mobile-satellite service

Spacecraft-to-spacecraft interference

[TBD]

Earth station-to-earth station interference

The long-term and short-term analysis were made to estimate distances required for ensuring shared operation of FSS transmitting ES and receiving ES limited to feeder links of MSS systems in the frequency band 6 725-7 025 MHz.

For long-term analysis, Lb (20%) the separation distance for protection of gateway ES can range from [26 km to 53.2 km] depending on the FSS ES interfering transmitter power.

For short term analysis, Lb (0.0017%) the coordination distances range from 169 km up to 389 km when flat terrain is used and depending on the FSS ES interfering transmitter power.

Annex 7 of Appendix 7 provides information on the parameters required for the determination of coordination distances for transmitting earth stations in bands shared directionally with receiving earth stations.

# List of relevant documents

ITU-Documentation

* Annex 44 to Document 4A/826 - Draft CPM text for WRC-19 agenda item 9.1, issue 9.1.3
* Annex 50 to Document 4A/675 - Working document towards draft CPM Text for WRC-19 agenda item 9.1, issue 9.1.3
* Annex 49 to Document 4A/675 - Work plan for WRC-19 agenda item 9.1, issue 9.1.3
* Annex 20 to Document 4A/675 – Working document [towards a Preliminary Draft New Report ITU-R S.[NGSO\_6/4-GHz] - Technical and Regulatory Studies for 6/4 GHz Non-GSO FSS sharing
* Annex 16 to Document 4A/364 – Working document towards a Preliminary Draft New Report ITU-R S.[NGSO FSS 6/4 GHz SHARING]
* Recommendation ITU-R S.1323 – Maximum permissible levels of interference in a satellite network (GSO/FSS; non-GSO/FSS; non-GSO/MSS feeder links) in the fixed-satellite service caused by other codirectional FSS networks below 30 GHz
* Recommendation ITU-R S.672-4 – Satellite antenna radiation pattern for use as a design objective in the fixed-satellite service employing geostationary satellites
* Recommendation ITU-R S.1328 – Satellite system characteristics to be considered in frequency sharing analyses within the fixed-satellite service
* Recommendation ITU-R F.1108 – Determination of the criteria to protect fixed service receivers from the emissions of space stations operating in non-geostationary orbits in shared frequency bands
* Recommendation ITU-R F.758 – System parameters and considerations in the development of criteria for sharing or compatibility between digital fixed wireless systems in the fixed service and systems in other services and other sources of interference
* Recommendation ITU-R F.1336 – Reference radiation patterns of omnidirectional, sectoral and other antennas in point-to-multipoint systems for use in sharing studies in the frequency range from 1 GHz to about 70 GHz
* Recommendation ITU-R M.1459 – Protection criteria for telemetry systems in the aeronautical mobile service and mitigation techniques to facilitate sharing with geostationary broadcasting-satellite and mobile-satellite services in the frequency bands 1 452-1 525 MHz and 2 310‑2 360 MHz
* Annex 13 to Document 5B/71 – WDPDN Rec. ITU-R M.[AMS 4.4-5GHz] – Technical characteristics of, and protection criteria for aeronautical mobile systems operating in the frequency band 4 400-4 990 MHz
* Report ITU-R M.2119 – Sharing between aeronautical mobile telemetry systems for flight testing and other systems operating in the 4 400-4 940 and 5 925-6 700 MHz bands
* Report ITU-R M.2109 – Sharing studies between IMT‑Advanced systems and geostationary satellite networks in the fixed-satellite service in the 3 400-4 200 and 4 500-4 800 MHz frequency bands
* Report ITU-R S.2368 – Sharing studies between International Mobile Telecommunication-Advanced systems and geostationary satellite networks in the fixed-satellite service in the 3 400-4 200 MHz and 4 500-4 800 MHz frequency bands in the WRC study cycle leading to WRC-15

CEPT and/or ECC Documentation (Decisions, Recommendations, Reports)

* [ECC/DEC/(05)09 The free circulation and use of Earth Stations on board Vessels operating in Fixed Satellite service networks in the frequency bands 5925-6425 MHz (Earth-to-space) and 3700-4200 MHz (space-to-Earth)](http://www.efis.dk/documents/240)
* [Commission Decision 2008/411/EC on the harmonisation of the 3400-3800 MHz frequency band for terrestrial systems](http://www.efis.dk/documents/12)
* [ECC/DEC/(11)06 Harmonised frequency arrangements for mobile/fixed communications networks (MFCN) operating in the bands 3400-3600 MHz and 3600-3800 MHz](http://www.efis.dk/documents/14636)
* [CEPT Report 49: Technical conditions regarding spectrum harmonisation for terrestrial wireless systems in the 3400-3800 MHz frequency band](http://www.efis.dk/documents/38021)
* ECC/DEC/(18)06 on the withdrawal of [ECC Decision (07)02](https://www.ecodocdb.dk/document/408) on availability of frequency bands between 3400-3800 MHz for the harmonised implementation of Broadband Wireless Access systems (BWA)
* [ECC Report 100 on Compatibility studies in the band 3400-3800 MHz between BWA systems and other services](http://www.efis.dk/documents/11399)
* [ERC/REC 12-08 Harmonised radio frequency channel arrangements and block allocations for low, medium and high capacity systems in the band 3600 MHz to 4200 MHz](http://www.efis.dk/documents/3289)
* [EN 302 217 Characteristics and requirements for point-to-point equipment and antennas](http://www.efis.dk/documents/14677)
* CEPT Report 67 on the Review of the harmonised technical conditions applicable to the 3.4-3.8 GHz ('3.6 GHz') frequency band, to develop harmonised technical conditions for spectrum use in support of the introduction of next-generation (5G) terrestrial wireless systems in the Union

# Actions to be taken

Explore further the development of a coordination procedure under RR No 9.12 in order to address coordination between non-GSO FSS systems in the frequency bands 3 700−4 200 MHz and 5 925−6 425 MHz.

To develop a draft ECP, noting that from a regulatory provision standpoint, the ECP would be NOC as regards to RR Articles 21 and 22.

# Relevant information from outside CEPT

## European Union (date of proposal)

## Regional telecommunication organisations

APT (March 2018)

APT Preliminary View(s)

APT Members support no change (NOC) to the Radio Regulations to satisfy agenda item 9.1, issue 9.1.3 based on study progress of ITU-R for new non-GSO systems in the 3 700-4 200 MHz, 4 500-4 800 MHz, 5 925-6 425 MHz and 6 725-7 025 MHz frequency bands under the terms of Resolution 157 (WRC-15).

ATU (September, 2017)

The APM19-2 agreed to:

1. Note that ITU-R studies so far show that it would be difficult to operate non-GSO circular orbit system for the purposes of global broadband network in the 6/4 GHz frequency bands.

2. Encourage administrations to review studies conducted on the issue in time, and make proposals during the next ITU-R Study Group 4 approval process of the studies.

Arab Group (April 2018)

ASMG Preliminary Position

The preliminary position agreed at the 7-11 April 2018 meeting of the ASMG is to support no change to Radio Regulations.

CITEL (July 2018)

Inter-American Proposal

Brazil, Canada, Guatemala, Nicaragua, Uruguay, USA:

No change to Articles 21 and 22 of the Radio Regulations and suppression of Resolution 157 (WRC-15)

Reason: ITU-R studies show that it would be very difficult to operate a non-GSO circular-orbit system for the purposes of a global broadband network in the 6/4 GHz frequency bands. Therefore, CITEL Administrations support no revision to Article 21, Table 21-4 for non-GSO FSS satellites in the frequency band 3700-4200 MHz (space-to-Earth) and no modifications to Article 22 epfd limits applicable to non-GSO systems in the bands 3700-4200 MHz (space-to-Earth) and 5925-6425 MHz (Earth-to-Space). Similarly, CITEL Administrations propose no change to the bands 4500-4800 MHz (space-to-Earth) and 6725-7025 MHz (Earth-to-space).

RCC (March 2018)

The RCC Administrations do not oppose possible revision of Article 21, Table 21-4 for non-GSO FSS satellites, with a view to enabling new non-GSO systems to operate in these FSS frequency bands, while ensuring that existing primary services, including the mobile and fixed services, are protected, and subject to maintaining the existing Article 21 pfd limits for GSO networks in the frequency bands 3700−4200 MHz and 4500−4800 MHz (space-to-Earth).

The RCC Administrations consider that when reviewing RR Article 22 epfd↓ and epfd↑ limits for new non-GSO systems in the frequency bands 3700−4200 MHz (space-to-Earth), 5925−6425 MHz (Earth-to-space), 4500−4800 MHz (space-to-Earth) and 6725−7025 MHz (Earth-to-space), it is necessary to ensure protection of GSO FSS networks, including allotments in the Plan and assignments in the Appendix 30В List, without modification of their protection criteria.

The RCC Administrations consider that when determining operation conditions for new non-GSO FSS systems in the frequency bands:

* 3700−4200 MHz (space-to-Earth), 5925−6425 MHz (Earth-to-space), it is necessary to protect existing non-GSO FSS systems in highly elliptical orbits.
* 4 500−4 800 MHz (space-to-Earth), 5 925−6 425 MHz (Earth-to-space) and 6 725 7 075 MHz (Earth-to-space), it is necessary to protect existing terrestrial services.

## International organisations

IATA (date of proposal)

ICAO (July, 2017)

To oppose any new or changes to existing regulatory provisions in Article 21 of the ITU Radio Regulations for the frequency bands 3 700 – 4 200 MHz and 5 925-6 425 MHz unless it has been demonstrated through agreed ITU-R studies that there will be no impact from the potential introduction of new non-geostationary-satellites on aviation use in those bands.

To oppose introduction of new non-geostationary-satellites in frequency bands near to the frequency band 4 200 – 4 400 MHz unless aviation use of that band is ensured through agreed ITU-R studies.

IMO (25 August, 2016)

Non-GSO systems shall not cause harmful interference to or claim protection from GSO FSS networks.

SFCG (date of proposal)

WMO and EUMETNET (date of proposal)

## Regional organisations

ESA (date of proposal)

Eurocontrol (date of proposal)

NATO (June 2018)

NATO military assessment

At the moment, it is not clear if NATO could benefit from non-GSO systems to operate in these bands allocated to FSS. But the existing military applications are relying on large portions of the bands under study. The risk that possible changes to the RR could downgrade military capabilities is high at the moment. Furthermore consistency in C-band (4 - 8 GHz) epfd requirements and limits with respect to Ku (12 - 18 GHz) and Ka (26.5 - 40 GHz) bands should be ensured.

NATO preliminary position

NATO will not oppose the update of conditions applicable to NGSO systems in the FSS bands under consideration, if studies clearly demonstrate, that there is no impact to existing services in the NJFA bands, in particular 4.5-4.8 GHz, and no additional constraints are applied to existing users of these bands.

## OTHER INTERNATIONAL AND REGIONAL ORGANISATIONS

EBU (date of proposal)

GSMA (date of proposal)

CRAF (date of proposal)