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| Summary:  |
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| Proposal: |
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DRAFT CEPT BRIEF ON AGENDA ITEM 1.6

1.6 to consider the development of a regulatory framework for non-GSO FSS satellite systems that may operate in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), in accordance with Resolution 159 (WRC-15).

# ISSUE

According to Resolution 159 (WRC‑15) “Studies of technical, operational issues and regulatory provisions for non-geostationary fixed-satellite services satellite systems in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space)” to conduct:

1. studies of technical and operational issues and regulatory provisions for the operation of non-GSO FSS satellite systems in the frequency bands 37.5-42.5 GHz (space-to-Earth) and 47.2-48.9 GHz (limited to feeder links only), 48.9-50.2 GHz and 50.4-51.4 GHz (all Earth-to-space), while ensuring protection of GSO satellite networks in the FSS, MSS and BSS, without limiting or unduly constraining the future development of GSO networks across those bands, and without modifying the provisions of RR Article 21;
2. studies carried out under resolves to invite ITU-R 1 shall focus exclusively on the development of equivalent power flux-density limits produced at any point in the GSO by emissions from all the earth stations of a non-GSO system in the fixed-satellite service or into any geostationary FSS earth station, as appropriate;
3. studies and development of sharing conditions between non-GSO FSS systems operating in the frequency bands listed in resolves to invite ITU-R 1 above;
4. studies of possible necessary revisions to Resolution 750 (Rev.WRC-15) to ensure protection of the EESS (passive) in the frequency bands 36-37 GHz and 50.2-50.4 GHz from non-GSO FSS transmission, taking into account recognizing i) above, including study of aggregate FSS interference effects from networks and systems operating or planned to operate in the frequency bands described in resolves to invite ITU-R 1 above;
5. studies towards ensuring protection of the radio astronomy frequency bands 42.5-43.5 GHz, 48.94-49.04 GHz and 51.4-54.25 GHz from non-GSO FSS transmissions, taking into account recognizing i) above, including study of aggregate FSS interference effects from networks and systems operating or planned to operate in the frequency bands described in resolves to invite ITU-R 1 above.

# Preliminary CEPT position

CEPT considers that studies for the development of regulatory provisions and technical and operational conditions shall ensure protection for GSO satellite networks and stations of other existing services including passive services in the adjacent frequency bands. To ensure the protection of the EESS (passive) and RAS CEPT supports to study the effects of aggregate FSS interference from GSO satellite networks and NGSO systems operating in the relevant bands.

CEPT considers that the criteria based on Recommendation ITU-R S.1323 or other new possible ITU-R Recommendation shall be used while developing the aggregate epfd limits for protection of GSO networks. CEPT supports a methodology of interference assessment that takes into account the correlation between a fading event attenuating both the wanted signal and interfering signals in the frequency bands 40/50 GHz.

CEPT supports further studies on methodology of interference assessment applicable to frequency bands above 30 GHz to verify compliance with the criteria in Recommendation ITU-R S.1323.

# Background

Article 22 of the Radio Regulations contains provisions to ensure compatibility of non-GSO FSS operations with GSO networks for the 14/11 GHz and 30/20 GHz bands. Among these provisions are uplink and downlink equivalent power flux density (epfd↑ and epfd↓) limits to protect GSO networks from unacceptable interference pursuant to RR No. 22.2. There are currently no regulatory provisions for sharing between non-GSO systems and GSO networks in the 50/40 GHz frequency bands. Furthermore, there are currently no ITU-R defined protection requirements for 50/40 GHz band GSO networks.

Latest WP 4A meeting (28 September – 06 October 2016, Geneva) received a number of contributions, which included some proposals on GSO networks protection criteria and technical characteristics of GSO FSS.

Protection of FSS networks for frequency bands below 30 GHz is addressed in Recommendation ITU-R S.1323. WP 4A has requested the support of Working Party 3M in the work to update Recommendation ITU-R S.1323-2 to extend its applicability to frequencies above 30 GHz.  Specifically, guidance is sought with regard to propagation impairments, in addition to rain effects, to be taken into account to estimate fading at the frequency ranges of 50/40 GHz.  In addition, WP 4A has requested support on a methodology to compute the joint probability distribution functions of having fading impacting several different paths from space to a location on earth, that of the various interfering signals and the one of the wanted signal.

WP 4A meeting considered contributions with regard to protection of EESS (passive) in 36-37 GHz, 50.2-50.4 GHz and RAS in 42.5-43.5 GHz from non-GSO FSS. It was noted these studies require additional considerations.

WP 4A also received system characteristics and protection criteria for MSS GSO network from WP 4C due to the fact that MSS allocations overlap with AI 1.6 frequency ranges.

As a result WP 4A updated:

* Working Document [towards a Preliminary Draft New Report/Recommendation] on sharing between 50/40 GHz GSO and non-GSO FSS systems;
* Working Document [towards a Preliminary Draft New Report] on the protection of EESS (passive) and RAS systems from non-GSO satellite systems operating in the 37.5-42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz frequency bands;
* Work plan for WRC-19 agenda item 1.6.

In addition, WP 4A sent LS to WP 7D seeking guidance regarding the use of Recommendation ITU-R RA.769-2 in the bands 48.94-49.04 GHz and 51.4-54.25 GHz; reply LSs to WP 7C and WP 4C.

WP 7D sent the reply LS to WP 4A (doc. 4A/201) which contained information about RAS protection criteria.

# List of relevant documents

ITU-Documentation:

* Annex 9 to Document 4A/196 – Working Document [towards a preliminary draft new report/recommendation] on sharing between 50/40 GHz GSO and Non-GSO systems ITU-R S.[NGSO\_50/40 GHz]
* Annex 8 to Document 4A/196 – Working document [towards a preliminary draft new report] on the protection of EESS (passive) and RAS systems from non‑GSO satellite systems operating in the 37.5-42.5 GHz, 47.2‑50.2 GHz and 50.4-51.4 GHz frequency bands under WRC-19 agenda Item 1.6
* Annex 4 to Document 4A/196 – Working document towards a preliminary draft revision of Recommendation ITU-R S.1323-2 - 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 co-directional FSS networks operating in frequency bands below 52.4 GHz
* Annex 28 to Document 4A/196 – Work plan for WRC-19 agenda item 1.6
* 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.1325 – Simulation methodologies for determining statistics of short-term interference between co-frequency, codirectional non-geostationary-satellite orbit fixed-satellite service systems in circular orbits and other non-geostationary fixed-satellite service systems in circular orbits or geostationary-satellite orbit fixed-satellite service networks;
* Recommendation ITU-R S.1328 – Satellite system characteristics to be considered in frequency sharing analyses within the fixed-satellite service
* Recommendation ITU-R S.1529 – Frequency sharing of the bands 19.7-20.2 GHz and 29.5-30.0 GHz between systems in the mobile-satellite service and systems in the fixed-satellite service
* Recommendation ITU-R S.1557 – Operational requirements and characteristics of fixed-satellite service systems operating in the 50/40 GHz bands for use in sharing studies between the fixed-satellite service and the fixed service
* Recommendation ITU-R RS.515 – Frequency bands and bandwidths used for satellite passive remote sensing
* Recommendation ITU-R RS.1259 – Feasibility of sharing between space borne passive sensors and the fixed service from 50 to 60 GHz
* Recommendation ITU-R RS.1803 – Technical and operational characteristics for passive sensors in the Earth exploration-satellite (passive) service to facilitate sharing of the 10.6-10.68 GHz and 36-37 GHz bands with the fixed and mobile services
* Recommendation ITU-R RS.1813 – Reference antenna pattern for passive sensors operating in the Earth exploration-satellite service (passive) to be used in compatibility analyses in the frequency range 1.4-100 GHz
* Recommendation ITU-R RS.1861 – Typical technical and operational characteristics of Earth exploration-satellite service (passive) systems using allocations between 1.4 and 275 GHz
* Recommendation ITU-R RS.2017 – Performance and interference criteria for satellite passive remote sensing
* Recommendation ITU-R RS.2064 – Typical technical and operating characteristics and frequency bands used by space research service (passive) observation systems
* Recommendation ITU-R SM.1542– The protection of passive services from unwanted emissions
* Recommendation ITU-R SM.1633 – Compatibility analysis between a passive service and an active service allocated in adjacent and nearby bands
* Report ITU-R SM.2092 – Studies related to the impact of active services allocated in adjacent or nearby bands on Earth exploration-satellite service (passive)
* Report ITU-R SM.2091 – Studies related to the impact of active services allocated in adjacent or nearby bands on radio astronomy service
* Report ITU-R RS.2095 – Sharing of the 36-37 GHz band by the fixed and mobile services and the Earth exploration-satellite service (passive)
* Recommendation [ITU-R RA.314](http://www.itu.int/rec/R-REC-RA.1513/en) – Preferred frequency bands for radio astronomical measurements
* Recommendation [ITU-R RA.517](http://www.itu.int/rec/R-REC-RA.1513/en) – Protection of the radio astronomy service from transmitters operating in adjacent bands
* Recommendation [ITU-R RA.611](http://www.itu.int/rec/R-REC-RA.1513/en) – Protection of the radio astronomy service from spurious emissions
* Recommendation [ITU-R RA.769-2](http://www.itu.int/rec/R-REC-RA.769/en) – Protection criteria used for radio astronomical measurements
* Recommendation [ITU-R RA.1031](http://www.itu.int/rec/R-REC-RA.1513/en) – Protection of the radio astronomy service in frequency bands shared with other services
* Recommendation [ITU-R RA.1513](http://www.itu.int/rec/R-REC-RA.1513/en) – Levels of data loss to radio astronomy observations and percentage-of-time criteria resulting from degradation by interference for frequency bands allocated to the radio astronomy service on a primary basis
* Recommendation [ITU-R RA.1631](http://www.itu.int/rec/R-REC-RA.1513/en) – Reference radio astronomy antenna pattern to be used for compatibility analyses between non-GSO systems and radio astronomy service stations based on the epfd concept
* Recommendation [ITU-R S.1586-1](http://www.itu.int/rec/R-REC-S.1586/en) – Calculation of unwanted emission levels produced by a non-geostationary fixed-satellite service system at radio astronomy sites
* Recommendation ITU-R SA.1396 – Protection criteria for the space research service in the 37-38 and 40-40.5 GHz bands
* Recommendation ITU-R SA.2079 – Frequency sharing between SRS and FSS (space-to-Earth) systems in the 37.5-38 GHz band Report ITU-R RA.2126 – Techniques for mitigation of radio frequency interference in radio astronomy
* Report ITU-R RA.2131 – Supplementary information on the detrimental threshold levels of interference to radio astronomy observations in Recommendation ITU-R RA.769
* Report ITU-R RA.2188 – Power flux-density and e.i.r.p. levels potentially damaging to radio astronomy receivers

CEPT and/or ECC Documentation:

* ERC/DEC/(00)02 ERC Decision of 27 March 2000 on the use of the band 37.5 - 40.5 GHz by the fixed service and Earth stations of the fixed - satellite service (space-to-Earth)
* ECC/DEC/(05)08 The availability of frequency bands for high density applications in the Fixed-Satellite Service (space-to-Earth and Earth-to-space). Approved 24 June 2005/ Amended 8 March 2013
* [ECC/DEC/(02)04 The use of the band 40.5 – 42.5 GHz by terrestrial (fixed service/ broadcasting service) systems and uncoordinated Earth stations in the fixed satellite service and broadcasting-satellite service (space to Earth)](http://www.efis.dk/documents/15427)
* ERC/REC 12-11 Radio frequency channel arrangements for Fixed Service systems operation in the bands 48.5-50.2 / 50.9-52.6 GHz

# Actions to be taken

To identify technical characteristics of potential non-GSO and GSO FSS systems, which may operate in the frequency bands 37.5‑39.5 GHz, 39.5‑42.5 GHz, 47.2-50.2 GHz and 50.4-51.4 GHz and to encourage contributions relating to services in the bands and adjacent bands to facilitate the studies toward coexistence of services

To prepare proposals to preliminary draft new Report ITU-R S.[NGSO\_50/40 GHz]

To consider aggregate interference effect on EESS (passive) from FSS GSO satellite networks and NGSO systems operating in the adjacent bands

To consider aggregate interference effect on RAS from FSS GSO satellite networks and NGSO systems operating in the relevant bands

To consider technical, operational and regulatory provisions that would take into account the effect of aggregate interference into incumbent services

To prepare proposals to preliminary draft new Report protection of EESS (passive) and RAS systems from non‑GSO satellite systems operating in the 37.5-42.5 GHz, 47.2‑50.2 GHz and 50.4-51.4 GHz frequency bands

To prepare proposals to revise, if and as appropriate, Resolution 750 (Rev.WRC-15), based on studies of aggregate FSS interference effects from GSO satellite networks and NGSO systems operating in the adjacent bands

To prepare proposals to Working document towards a preliminary draft revision of Recommendation ITU-R S.1323-2 - 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 co-directional FSS networks operating in frequency bands below 52.4 GHz

To carry out studies and development of sharing conditions between non-GSO FSS systems operating in the frequency bands 37.5-42.5 GHz (space-to-Earth) and 47.2-48.9 GHz (limited to feeder links only), 48.9-50.2 GHz and 50.4-51.4 GHz (all Earth-to-space)

To carry out studies towards ensuring protection of the Space research service in the frequency band 37/38 GHz (space-to-Earth) from non-GSO FSS LEO and MEO transmissions;

To take into account that studies in the bands 37-43.5 GHz, 45.5-50.2 GHz, 50.4-52.6 GHz may be carried out under WRC-19 AI 1.13

To take into account that studies in the bands 38-39.5 GHz may be carried out under WRC-19 AI 1.14

To prepare proposals to the draft CPM Report

# Relevant information from outside CEPT (examples of these are below)

## European Union (date of proposal)

## Regional telecommunication organisations

APT (date of proposal)

ATU (date of proposal)

Arab Group (April 2017)

Protect the fixed-satellite service systems in GSO either by adequate epfd levels or any other methodologies or according to wave propagation models in the frequency bands above 30 GHz.

Consult the satellite operators of the team to determine the epfd value that ensures the protection of the satellite networks in the geostationary orbital positions and the opinion for the proposed mechanism.

CITEL (July 2017l)

Canada supports the studies under Resolution 159 (WRC-15) to develop a regulatory framework for new non-GSO FSS satellite systems. For the band 36-37 GHz: Canada is of the view that based on the results of studies, EESS (passive) systems operating in the 36- 37 GHz band and non-GSO FSS systems are compatible and no regulatory measures are required to address the compatibility between these two services. For the band 50.2-50.4 GHz: Canada is of the view that based on the results of studies, mitigation techniques and/or regulatory measures may be required to ensure compatibility between EESS (passive) systems operating in the band 50.2-50.4 GHz and non-GSO FSS systems.

The United States supports studies under WRC-19 Agenda Item 1.6 regarding the development of a regulatory framework for non-GSO satellite systems in the existing FSS allocations in the 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) frequency bands under the terms of Resolution 159 (WRC-15) and to take appropriate action based on the results of these studies.

RCC (14 April, 2017)

The RCC Administrations consider that studies on technical and operational issues and regulatory provisions in order to ensure operation of non-GSO FSS satellite systems in the frequency bands 37.5-42.5 GHz (space-to-Earth), 47.2-48.9 GHz (limited to feeder links), 48.9-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) shall ensure protection to GSO satellite networks in FSS, MSS and BSS, and also to stations of other existing services in the same and adjacent frequency bands.

The RCC Administrations consider that technical conditions and regulatory provisions should be developed to ensure sharing of the considered frequency bands between non-GSO FSS systems.

The RCC Administrations consider that when conducting studies, protection shall be ensured to EESS (passive) in the frequency bands 36-37 GHz, 47.5-48.5 GHz and 50.2-50.4 GHz, and also to the radio astronomy service in the frequency bands 42.5-43.5 GHz, 48.94-49.04 GHz and 51.4-54.25 GHz from non-GSO FSS transmissions.

The RCC Administrations find it reasonable to study the impact of aggregate interference from non-GSO FSS networks and systems operated or planned to be operated in the frequency bands 37.5-42.5 GHz (space-to-Earth), 47.2-48.9 GHz (limited to feeder links), 48.9-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) with the purpose of possible revision of Resolution 750 (Rev. WRC-15) "Compatibility between the Earth exploration-satellite service (passive) and relevant active services".

The RCC Administrations consider it reasonable to study modification of interference assessment methodology specified in the Recommendation ITU-R S.1323 (Methodology A) with the purpose to broaden applicability of this recommendation in the frequency bands above 30 GHz.

## International organisations

IATA (date of proposal)

ICAO (date of proposal)

IMO (date of proposal)

SFCG, ESA (June, 2016)

SFCG supports studies to consider a review of the regulatory framework for non-GSO FSS satellites systems addressed under WRC-19 AI 1.6. However, SFCG does not support revisions to the existing regulatory framework for non-GSO FSS systems unless studies conclude the existing protection of space science services, including passive sensing, will be preserved. This may result in possible necessary revisions to Resolution 750 (Rev.WRC-15) to ensure protection of the EESS (passive) in the frequency bands 36-37 GHz and 50.2-50.4 GHz from non-GSO FSS transmissions.

WMO and EUMETNET (February 2017)

EUMETNET:

No opposition to the development of a regulatory framework for non-GSO FSS satellite systems in the 37.5-51.4 GHz range provided that protection of EESS (Earth-to-space), EESS (passive) and ground-based radiometers is ensured.

WMO

WMO supports the development of a regulatory framework (including revisions to Resolution 750 (Rev.WRC-15) for non-GSO FSS satellite systems in the 37.5-51.4 GHz range provided that protection of EESS (Earth-to-space) in the band 40-40.5 GHz and EESS (passive) in the bands 36-37 GHz and 50.2-50.4 GHz is ensured by including appropriate unwanted emission limits in Resolution 750 (rev. WRC-15).

WMO would appreciate the development of a solution to ensure the effective operation of the ground-based radiometers in the 50.4-51.4 GHz frequency band.

## Regional organisations

Eurocontrol (date of proposal)

NATO (23 June, 2017)

This NATO military assessment summary is a common military assessment of the NATO Nations on the potential impacts and benefits of Agenda Item 1.6. It does not constitute a common position of the NATO Nations.

There does not seem to be any impact on military capabilities at this stage.

## OTHER INTERNATIONAL AND REGIONAL ORGANISATIONS

EBU (date of proposal)

GSMA (date of proposal)

CRAF (March 2017)

CRAF supports the protection of existing RAS and EESS (passive) allocations in the 42.5 - 43.5 GHz, 48.94 - 49.04 GHz, and 50.2 - 50.4 GHz. No changes should be made to the RR unless acceptable sharing and compatibility criteria are developed with the RAS and EESS (passive).