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| Riga, Latvia 25th - 28th March 2014 |  |
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| Subject:  | Draft CEPT Brief on WRC-15 Agenda Item 1.9.1 |
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| Summary:  |
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| Proposal: |
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DRAFT CEPT BRIEF ON AGENDA ITEM 1.9.1

1.9 to consider, in accordance with Resolution 758 (WRC‑12):

1.9.1 possible new allocations to the fixed-satellite service in the frequency bands 7 150-7 250 MHz (space-to-Earth) and 8 400-8 500 MHz (Earth-to-space), subject to appropriate sharing conditions;

(…)

# ISSUE

1.9 to consider, in accordance with Resolution 758 (WRC‑12):

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(…)

# Preliminary CEPT position

CEPT supports new primary worldwide FSS allocations of 2\*100 MHz in the bands 7 150-7 250 MHz (space-to-Earth) and 8 400‑8 500 MHz (Earth-to-space) under the following conditions:

* Their use is limited to geostationary FSS satellites.
* FSS space stations in the band 7150-7235 shall comply with an e.i.r.p mask such as proposed in section 3.1.3 below.
* FSS Earth stations in the band 8400-8500 MHz shall operate at specified fixed points with a minimum antenna diameter of 3.5 m and shall be subject to coordination under Nos. 9.17 and 9.17A in accordance with Resolution 758 (WRC-12).
* FSS space stations in the band 8 400-8 500 MHz and FSS earth stations in the band 7 150-7 250 MHz shall not claim protection from SRS. No. 5.43A does not apply.

# Background

The frequency bands 7 250-7 750 MHz (space-to-Earth) and 7 900-8 400 MHz (Earth-to-space) are currently allocated worldwide to the fixed-satellite service (FSS) on a primary basis. Regarding the FSS, some administrations have reported a shortfall of spectrum available for their current and future applications in these bands. FSS additional bandwidth requirements for data transmission on the next-generation satellites are estimated to be around a maximum of 100 MHz.

WRC-15 Agenda Item 1.9.1 and Resolution 758 (WRC-12) invite ITU-R to conduct technical and regulatory studies on possible new allocations to the FSS in the frequency bands 7 150-7 250 MHz (s-E) and 8 400-8 500 MHz (E-s).

CEPT was the proponent of this agenda item, under the understanding that the requirements for additional allocations were to expand the core X band usage with a limited number of FSS Earth stations operating at known locations.

Working Party 4A has been identified by the Conference Preparatory Meeting as the responsible ITU-R groups for the studies on WRC-15 agenda item 1.9.1.. Taking into account the received parameters from different Working Parties, technical studies have been carried out and the associated results are described in the draft CPM text on A.I. 1.9.1 as well as in Preliminary Draft New Report ITU-R S.[FSS 7/8GHz COMPATIBILITY].Sharing with FS in the bands 7 150 – 7 250 MHz and 8 400-8 500 MHz.

### Sharing with FS in the bands 7 150 – 7 250 MHz and 8 400-8 500 MHz

Compatibility studies between FSS(s-E) and FS stations in the frequency band 7 150–7 250 MHz have shown that pfd limits or thresholds would be required to reduce interference to FS receivers. The existing pfd mask contained in RR Article 21 applicable to the band 7 250-7 900 MHz which is -152 dBW/m2/4kHz (angles below 5 deg.) rising to -142 dBW/m2/4kHz (angles above 25 deg.) is adequate to ensure the protection of the FS service.

The studies show that separation distances assuming flat terrain between FS systems and FSS Earth stations in the band 8 400-8 500 MHz are around 100km (83.5 to 120km) to meet long-term protection criterion and between 211.5 and 426 km to meet short-term protection criterion. Noting that this 426 km distance was computed under the assumption of an antenna diameter of 1.5 m, these distances will be reduced when considering real terrain elevation and earth station antenna diameter greater than 3.5 m. Sharing between FSS (Earth-to-space) and FS can be achieved through coordination under RR No. 9.17 applying the methods of RR Appendix 7.

### Sharing with MS in the bands 7 150 – 7 250 MHz and 8 400-8 500 MHz

Since MS stations characteristics in the band 7 250-7 750 MHz do not differ from those in the band 7 150-7 250 MHz, no additional sharing conditions are required considering that the pfd limit given in RR No. 21.16 will also apply to a space station in the FSS in the band 7 150-7 250 MHz.

Working Party 4A was not provided with any characteristics of mobile applications in the band 8 400-8 500 MHz. Consequently, sharing studies between FSS and MS in the quoted band have not been carried out. As for FS, sharing between FSS (Earth-to-space) and mobile service in the band 8 400-8 500 MHz will be achieved through coordination under RR No. 9.17 applying the methods of RR Appendix 7.

### Sharing with SRS in the bands 7 150 – 7 235 MHz (E-s) and 8 400-8 500 MHz (s-E)

Under Nos. 5.460 and 5.465, use of SRS allocations in the bands 7 145-7 190 MHz (E-s) and 8 400-8 450 MHz (s-E) is limited to deep-space, while the bands 7 190-7 235 MHz (E-s) and 8 450-8 500 MHz (s-E) are reserved for SRS near-Earth missions. The proposed FSS allocation overlaps with the SRS allocations in the reverse direction, which can create a potential for interference between FSS and SRS earth stations, and between FSS and SRS space stations.

The potential for interference is of great concern due to the high sensitivity of SRS earth stations and spacecraft. An interference free environment is needed to protect the vital near-Earth as well as deep-space communications especially during specific transitional phases which represent mission critical events such as launch-and-early-orbit (LEOP), trajectory correction manoeuvers, planetary orbit insertion, entry-decent-and-landing (EDL), flybys, and emergency communications. Disruption in communications during these transitional phases could lead to spacecraft failure and even possible loss of the spacecraft, or failure to achieve primary mission science objectives.

The protection of receiving SRS Earth stations in the band 8 400-8 500 MHz may be achieved through coordination under 9.17A. WP 7B has evaluated the coordination distances that would be required, which are quite large in view of the high sensitivity of the SRS Earths station, and range from 84to 675 km for the SRS Earth stations. Such large coordination distance prevent the ubiquitous deployment of VSAT-like earth stations in large areas, but may allow for the operation of larger FSS earth stations at specified fixed points.

 The static studies give the critical separation distances between the space stations of FSS and SRS in the band 7 150-7 235 MHz, below which the received interference would exceed the protection criterion of the SRS. These separation distances, calculated for main beam coupling between the FSS transmitting antenna and different kinds of SRS receiving antennas, range from 2 377 km to 597 179 km while considering -26 dBW/Hz FSS as the maximum FSS space station e.i.r.p. spectral density.

In addition, dynamic analyses have been performed in order to evaluate the level and duration of FSS interference into SRS spacecraft receiver in the band 7 150-7 235 MHz during transitional phases such as launch-and-early orbit (LEOP), Earth flybys, and sample return..

Considering the results obtained with dynamic analysis, sharing in the 7 150-7 235 MHz band between SRS and FSS is feasible, including during transitional phases of SRS missions, by applying the e.i.r.p mask given below to the FSS emissions. With this mitigation technique, such emissions become compliant with both near-Earth and deep space SRS protection criteria.

E.i.r.p spectral density mask:

$ -26-3×\left(\frac{φ}{3.10}\right)^{2}$ dBW/Hz for 0 ≤ φ ≤ 8

$-$46 dBW/Hz for 8 < φ ≤ 19.6

$-46-25×log\_{10}\left(\frac{φ}{19.6}\right)$ dBW/Hz for 19.6 < φ ≤ 64.9

$-$59 dBW/Hz for 64.9 < φ ≤ 180

Where φ is the off-axis angle in degrees of the antenna.

Although there is no existing case of GSO SRS space station operating today, a proposal is considered in ITU-R in order the ensure a minimum separation of 0.6 degree between GSO FSS and GSO SRS space stations in 7190-7235 MHz. However, with the application of the proposed e.i.r.p mask to FSS emissions, the required minimum separation decreases down to less than 0.2 degree. Sharing in this case should therefore be left to coordination under No. 9.7.

### Sharing with SOS (Earth-to-space) in the bands 7 150 – 7 155 MHz and 7 190 – 7 235 MHz

The conducted studies in feasibility of sharing between FSS (space-to-Earth) and SOS (Earth-to-space) in 7 GHz band showed that the ratio of useful signal power to that of single interfering GSO FSS space station would be from 32 dB to 42 dB at the front end of SOS space station receiver depending on its operation mode. The margin for aggregate interference caused by emissions from 36 GSO FSS spacecraft (separated by 10º) would vary from 0.6 dB to 11 dB depending on SOS station operating mode. The protection criterion of C/Itotal > 20 dB would be met for the specified time percentage. Aggregated interference from 72 GSO FSS concurrently transmitting spacecraft would result in meeting the protection criterion in all modes of SOS systems operation except of the mode related to wide beam antenna of the space station in a typical low-Earth circular orbit (2.5 dB deficit). Considering, that the conducted studies were based on the worst case scenario of interference effect, sharing between FSS (space-to-Earth) and SOS (space-to-Earth) in 7 GHz band seems attainable.

### Sharing with EESS (Earth-to-space) in the band 7 190-7 250 MHz sought under AI 1.11

Sharing between FSS (space-to-Earth) and EESS (Earth-to-space) can be achieved through coordination under RR No. 9.17A. The coordination distance, calculated based on the TVG methodology (described in Annex 6 to RR Appendix 7) and flat terrain, reaches up to 350 km in the worst case scenario. When taking into account real terrain elevation, the studies show that the coordination distance is reduced by 60% to 90% for the considered stations.

# List of relevant documents

4A/468 Annex 27 - Working document - Draft CPM text for WRC-15 Agenda item 1.9.1

4A/468 Annex 26 - Working document towards a preliminary draft new Report ITU-R S.[FSS 7/8 GHz COMPATIBILITY] - Compatibility studies between the fixed-satellite service and the terrestrial and other space services in the frequency bands 7 150-7 250 MHz (space-to-Earth) and 8 400-8 500 MHz (Earth-to-space)

7B/154 Annex 17 - Working document towards a preliminary draft new Report ITU-R SA.[1.9.1VS1.11-7GHz] - Sharing between the potential EESS (Earth-to-space) and FSS allocations in the 7-8 GHz range

# Actions to be taken

* [Text by France on request of the chair]
* Finalise draft CPM text and Preliminary Draft New Report ITU-R S.[FSS 7/8GHz COMPATIBILITY].
* Finalise ECP

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

## European Union (date of proposal)

## Regional telecommunication organisations:

APT (July 2013)

APT Members support technical and regulatory studies in ITU-R on the possible new allocations to the fixed-satellite service (FSS) in the frequency bands 7 150-7 250 MHz (space-to-Earth) and 8 400-8 500 MHz (Earth-to-space), ensuring sharing and compatibility with existing services.

APT Members also have a view that the possible new allocation should be limited to FSS systems not including small VSAT-like FSS earth stations in order to enable appropriate compatibility with systems of other services.

ATU (date of proposal)

Arab Group (December 2013)

Not Supporting the new allocations to the fixed-satellite service in the frequency bands 7 150-7 250 MHz and the band 8400-8500 MHz because of the use of Fixed Terrestrial Services in these two bands.

Following up the current studies

Prepare proposal to WP 4A to include NOC method

CITEL (April 2013)

CAN/USA/MEX

If ITU-R studies demonstrate compatibility with incumbent services and if due consideration is given to a potential allocation to EESS under Agenda Item 1.11, these administrations will consider supporting allocations to the FSS in the bands 7 150 – 7 250 MHz and 8 400 – 8 500 MHz, or portions thereof, limited to FSS systems operated from a fixed, known location not encompassing small VSAT-like FSS earth stations.

RCC (April 2013)

The RCC administrations do not object to the allocation of 7 150-7 250 MHz band (space-to-Earth) and 8 400-8 500 MHz band (Earth-to-space) to the FSS subject to compatibility with existing terrestrial and space services without imposing additional constraints on these services.

## International organisations

IATA (date of proposal)

ICAO (date of proposal)

IMO (date of proposal)

NATO (December 2013)

Preliminary NATO Military Position as of December 2013:

If ITU-R studies demonstrate compatibility with incumbent Services, NATO will support additional allocations to the FSS in the bands 7 150-7 250 MHz and 8 400-8 500 MHz, or portions thereof, limited to FSS systems operated from a fixed, known location not encompassing small VSAT-like FSS earth stations.

SFCG (July.2013)

SFCG supports the protection of the science services in all frequency bands as indicated above. No new allocations to the FSS should be made in these frequency bands unless acceptable solutions are found to the following issues:

Large coordination zones to be imposed around current and future SRS earth stations;

Mechanisms to ensure full protection of SRS (deep space and near Earth) spacecraft as well as SOS links.

## Regional organisations

ESA (July 2013)

Same as SFCG

Eurocontrol (date of proposal)

CRAF (January 2013)

CRAF supports the protection of the SRS allocation at 8 400-8 500 MHz. No new allocations to the FSS should be made in this frequency band unless acceptable sharing criteria with SRS in 8 400-8 500 MHz are developed and included in appropriate regulations.

Eurocontrol (date of proposal)