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|  | | CPG15(15)084 Annex IV-09 |
| Norway, Bergen, 14th - 18th September 2015 | | |  |
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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 (FSS) 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):

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;

(…)

# CEPT position

CEPT supports new primary worldwide FSS allocations of 2x100 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:

The allocation is limited to geostationary FSS networks.

FSS space station emissions in the band 7150-7235 MHz shall comply with the e.i.r.p. density mask described in Method A of the CPM text on this Agenda Item. In the case that the e.i.r.p. density mask is considered not sufficient to ensure the desired level of protection of an SRS deep space mission when operated in the near-Earth region, a procedure for operational consultation between FSS and SRS system operators in the 7 150-7 190 MHz band is contained in a Resolution aiming to address these cases. Such a Resolution is proposed in the ECP approved at CPG in June 2015. However, CEPT will be open to discussions during WRC-15 on alternative and simpler proposals.

FSS earth stations in the band 7 150-7 235 MHz shall not claim protection from, nor constrain the use and development of earth stations in the space research service (Earth-to-space) allocated worldwide, and the space operation service (Earth-to-space) allocated in the Russian Federation under No. 5.459. Furthermore, Nos. 5.43A and 22.2 do not apply.

FSS Earth stations in the band 8400-8500 MHz shall be limited to specific earth stations operating at specified fixed points with a minimum antenna diameter of 3.5 m. Coordination under Nos. 9.17 and 9.17A and notification under No. 11.2 will apply.

FSS space stations in the band 8 400-8 500 MHz shall not claim protection from space stations in the space research service. Nos. 5.43A and 22.2 do not apply.

FSS earth stations in the band 8 400-8 500 MHz shall not constrain the use and development of earth stations in the space research service.

# 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 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 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 group 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 CPM text on A.I. 1.9.1 as well as in Preliminary Draft New Report ITU-R S.[FSS 7/8GHz COMPATIBILITY].

During the June 2015 meeting of ITU-R Working Party 4A, no consensus was reached on the new contributions dealing with sharing between FSS (space-to-Earth) and SRS (deep-space and near-Earth); therefore, the abovementioned Preliminary Draft New Report was neither upgraded nor modified from its previous version approved in July 2014. This Preliminary Draft New Report will remain as an annex to the WP4A chairman’s report.

### 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 adjacent 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 also ensure the protection of the FS systems in the 7 150-7 250 MHz frequency band.

The studies show that separation distances, assuming flat terrain between FS stations and FSS Earth stations in the band 8 400-8 500 MHz are around 100 km (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, the 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 84 to 540 km for the SRS Earth stations. Such large coordination distances 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 provide the 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 SRS receiving antennas go up to 2 377 km for a 0 dBi SRS antenna, 5 322 km for the 7 dBi SRS low gain antenna, 18 884 km for an SRS medium gain antenna and to 597 179 km for the SRS high gain antenna non off-pointed from Earth. The maximum FSS space station e.i.r.p. density considered is -26 dBW/Hz.

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.

In order to achieve compatibility between SRS spacecraft and FSS satellites, including during transitional phases of SRS missions, the following e.i.r.p density mask shall apply to the FSS satellite emissions.

dBW/Hz for 0 ≤ φ ≤ 8

46 dBW/Hz for 8 < φ ≤ 19.6

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.

With this mitigation technique, compatibility with the SRS would be ensured in all the cases analysed. A new resolution is proposed to describe operational coordination between FSS and SRS notifying Administrations to address the potential remaining cases where this mask would not be considered sufficient to protect SRS space stations, e.g. future SRS missions for which the spacecraft might pass close to the GSO arc with the high gain antenna potentially pointing towards the FSS satellites.

Static analyses indicated that the minimum orbital separation between FSS and GSO SRS satellites should be greater than 0.5 degrees. Taking into account the e.i.r.p. density mask, the orbital separation is reduced to 0.1 deg. Therefore, sharing can be achieved through 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/I total > 20 dB would be met for the required time percentage. Aggregated interference from 72 GSO FSS simultaneously transmitting spacecraft would result in meeting the protection criterion in all modes of SOS systems operation except for the mode involving 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 is feasible.

### 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 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

R12-CPM15.02-R-0001 - Report of the CPM on operational and regulatory/procedural matters to the World Radiocommunication Conference 2015 – Chapter 4 Satellite services - Agenda item 1.9.1

4A/669 Annex 2, 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).

# Actions to be taken

* none

# Relevant information from outside CEPT

## European Union (date of proposal)

## Regional telecommunication organisations:

APT (July 2015)

APT has adopted a PAPC NOC on this agenda item.

ATU (July 2015)

Not in favour of the allocation of this band because of the heavy usage in Africa of terrestrial services in this band.

ASMG (July 2015)

Does not support 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 heavy use of Fixed Terrestrial Services in these two bands.

CITEL (August 2015)

An IAP NOC has been adopted by CITEL.

RCC (September 2015)

The RCC Administrations oppose the allocation of the frequency bands 7 150-7 250 MHz (space-to-Earth) and 8 400-8 500 MHz (Earth-to-space) to FSS since the ITU-R studies have shown that it does not seem possible to provide the compatibility with the existing and being planned space services without imposing additional restrictions upon these services. Complies with Method C (NOC of the RR) of CPM Report.

## International organisations

IATA (date of proposal); ICAO (date of proposal); IMO (date of proposal)

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WMO (March 2015)

WMO considers that studies under WRC-15 Agenda item 1.9.1 should not have negative effect on a new EESS (Earth-to-space) allocation in 7-8 GHz frequency band under Agenda item 1.11.

NATO (June 2015)

Based on the results of sharing studies, NATO supports additional allocations to the FSS in the bands 7 150-7 250 MHz and 8 400-8 500 MHz noting that, in the latter band FSS systems will be limited to operations from a fixed, known location not encompassing small VSAT-like FSS earth stations.

SFCG (March 2015)

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 (May 2015)

Aligned to SFCG

Eurocontrol (date of proposal)

CRAF (June 2015)

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.

CRAF approves methods A, B and C developed in the CPM text for WRC-15 Agenda item 1.9.1.