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| Summary: | | |
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| Proposal: | | |
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DRAFT CEPT BRIEF ON AGENDA ITEM 1.11

1.11 to consider a primary allocation for the Earth exploration-satellite service (Earth-to-space) in the 7-8 GHz range, in accordance with Resolution 650 (WRC-12)

# ISSUE

This agenda item considers the provision of a new primary allocation to the Earth exploration-satellite service EESS (Earth-to-space) in the 7-8 GHz range in order to complement telemetry operations of Earth exploration-satellite service (space-to-Earth) in the 8 025-8 400 MHz band.

Resolution 650 (WRC-12), “Allocation for the Earth exploration satellite service (Earth to space) in the 7/8 GHz range”, resolves to invite ITU-R:

1. to study spectrum requirements in the 7-8 GHz range for EESS (Earth-to-space) telecommand operations in order to complement telemetry operations of EESS (space-to-Earth) in the 8 025-8 400 MHz band;
2. to conduct compatibility studies between EESS (Earth-to-space) systems and existing services, with priority to the band 7 145-7 235 MHz, and then within other portions of the 7-8 GHz range only if the band 7 145-7 235 MHz is found not to be suitable;
3. to complete the studies as a matter of urgency, taking into account the present use of the allocated band, with a view to presenting, at the appropriate time, the technical basis for the work of WRC-15,

Resolution 650 (WRC-12) also invites WRC-15 to review the results of these studies with a view to providing a worldwide primary allocation to EESS (Earth-to-space) in the range 7-8 GHz with priority to the band 7 145 -7 235 MHz.

# Preliminary CEPT position

CEPT supports the allocation of the frequency band 7190-7250 MHz on a primary basis to the Earth exploration-satellite service (Earth-to-space).

The space operation services (SOS) allocated in the Russian Federation in the band 7190-7235 MHz needs to be protected and the sharing studies EESS-SOS need to be finalised.

CEPT recognizes that EESS (E-s) cannot share with SRS (deep space) in 7145-7190 MHz band.

# Background

The high concentration of satellites (several hundreds) using the band 2025-2110 MHz (E-s) and 2200-2290 MHz (s-E) for Tracking, Telemetry and Control (TT&C) is making the satellites coordination in these bands rather difficult.

Among the various satellite services using this band, the Earth exploration-satellite service (EESS) currently can only use the allocation at 2 025-2 110 MHz for the Earth-to-space transmissions, because no other Earth-to-space allocations are available at higher frequencies. The EESS (s-E) allocations at higher frequencies (8025-8400 MHz and 25.5-27 GHz) do not have any corresponding EESS (E-s) allocation and therefore in practice can be used only for payload data transmission and not for TT&C.

An EESS (E-s) allocation in the 7-8 GHz range would allow its use for TT&C in combination with the existing EESS (s-E) allocation in the band 8 025-8 400 MHz, thereby alleviating the congestion problem in S-Band, mitigating the frequency coordination problem, and eventually leading to a simplified on-board architecture and operational concept for future EESS missions. By this way some EESS new missions that already have to use the 8025-8400 MHz band for payload downlink, may use this band at these higher frequencies also for TT&C. It is to be noted that only some EESS missions may be able to migrate to the higher frequency for TT&C. And also these ones may still need using the bands 2025 – 2110 MHz and 2200-2290 MHz during LEOP (Launch and Early Orbital Phase) and in case of emergency, as other satellite systems using the space operation allocation in this band.. Nevertheless a new EESS allocation would allow limiting the use of these very congested bands at 2 GHz in a way similar to what is done for many telecommunications satellites.

The frequency range 7145-7235 MHz was identified at the WRC 12 as the most promising frequency range for this potential new EESS (E-s) allocation. This range is sufficiently close to the existing EESS (s-E) allocation at 8025-8400 MHz and has been shared for more than 15 years between the SRS (E-s) worldwide and furthermore with the Space Operation Service (E-s) in the Russian Federation, and systems of the Fixed/Mobile services with no specific sharing problems being reported.

The technical characteristics of potential new EESS (E-s) systems operating in the 7-8 GHz frequency range would be similar to those of SRS near Earth systems, but with lower transmit power requirements and smaller antenna size limited to a diameter between 11 and 15 m. Since the EESS (E-s) station will operate in a similar manner to the SRS stations but will require power levels typically much lower than the ones used by SRS in this band, sharing with terrestrial services in principle should be feasible.

* **Estimation of bandwidth requirements for EESS (E-s) in the 7-8 GHz range**

The results of spectrum requirement studies are summarised in a draft new Report ITU-R SA.[SPECTRUM REQ] “Spectrum requirements for future EESS missions operating under a potential new EESS uplink allocation in the 7/8 GHz range” (see [Doc. 7/32 Rev.2](http://www.itu.int/md/R12-SG07-C-0032/en)). The DNR comes to the conclusion that the allocation to the EESS (E-s) in the 7/8 GHz band would need approximately 56 MHz, considering that most likely the EESS would be sharing the whole or part of the allocated band with other satellite services.

* **Sharing between EESS (E-s) and Space Research Service (SRS) in the band 7 145-7 235 MHz**

The results of studies related to this issue are summarized in a preliminary draft new Report ITU-R SA.[EESS-SPACE-7GHZ] “Compatibility between EESS (Earth-to-space) and the space research service or the space operation service in the band 7 100-7 235 MHz” (see Annex 2 to Doc. 7B/226). All studies come to the same conclusion that in the band 7 190-7 235 MHz (SRS E-s near-Earth) interference levels from EESS uplinks into SRS uplinks are below the relevant ITU-R protection criterion, so this type of operation is compatible without any additional special mitigation techniques.

Studies have shown that there may be interference from SRS uplinks into EESS uplinks in some particular cases. These situations could be resolved, as currently done in S-Band, by consultation.

On the contrary, the band 7 145-7 190 MHz (SRS E-s deep-space) has to be excluded from consideration for future EESS Earth-to-space links since EESS uplinks may interfere with SRS deep space spaceborne receivers. Additionally, SRS Earth station emissions would have the potential to saturate and damage the EESS spaceborne receivers.

* **Sharing EESS (E-s) and Space Operations Service (SOS) in the bands 7 100-7 155 MHz and 7 190-7 235 MHz**

Two studies (7B/198 and 7B/209) have been conducted independently to perform a dynamic sharing of the interference from the newly proposed EESS system into the existing SOS system. These studies were discussed at the ITU-R 7B meeting in September 2013. The assumptions considered in both studies need to be reviewed, in particular several parameters of the SOS systems as noted in Table 3 of the PDN Report ITU-R SA.[ EESS-SPACE-7GHZ] (See Annex 2 to Doc. 7B/226). Based on the consolidated assumptions, the sharing analysis and conclusions about compatibility of EESS and SOS uplink systems will have to be reassessed in time for the next WP-7B meeting in May 2014.

* **Sharing EESS (E-s) and Fixed Service (FS) in the 7 – 8 GHz range**

The results of studies between EESS (E-s) and FS are summarised in a preliminary draft new Report ITU-R SA.[EESS-FS-7GHz] “Sharing between the EESS (Earth-to-space) and the fixed service in the 7‑8 GHz range” (see Doc. 7/55 Rev 1 ). The analysis shows that the coordination area around EESS earth stations where coordination would be required with the FS will depend on the location of the station, its characteristics and the orbit of the EESS satellite. The TVG contour leads to maximum coordination distances of 74 km for an EESS earth station located in Kiruna (Sweden), 103 km for an EESS earth station in Villafranca (Spain) and 156 km for a station in Kourou (French Guyana). This coordination distance drops rapidly down to 3 km when the FS station does not point directly towards the EESS earth station, which would likely be the case when dealing with cross border coordination.

WP 5C agreed that based on the results of study results to date, compatibility with the fixed service could be achieved through coordination under 9.17, as already done for the SRS in the band 7 145–7 235 MHz. Similarly to what is happening for these SRS earth stations, for each individual EESS satellite mission and earth station a specific uplink licence will have to be obtained from the relevant administration.

Concerning the impact of the FS stations into the EESS space stations, no harmful interference is expected in the EESS satellite receivers due to impact of a deployment of FS links. The analysis is considering the number of links FS deployed in the whole range 7.1-8.5 GHz.

Working Party 5C has agreed that, based on study results to date, compatibility between EESS (Earth-to-space) and the fixed service could be achieved through coordination under 9.17, as already done for the space research service in the band 7 145–7 235 MHz (see Doc 7B/94, Nov 2013).

* **Sharing EESS (E-s) and Mobile Service (MS) in the 7 – 8 GHz range**

WP 5A, which is the group responsible for mobile service in ITU-R, indicated that at this stage, it was not aware of any ITU-R deliverable providing the requested information for the mobile service regarding the 7-8 GHz frequency range, apart from ENG/OB applications operating below 7125 MHz for which characteristics are given in Recommendation ITU-R M.1824.

* **Sharing EESS (E-s) and Fixed Satellite Service (FSS) in the band 7 150-7 250 MHz**

WRC-15 Agenda item 1.9.1 considers possible new allocations to the Fixed Satellite Service (FSS), amongst others in the frequency band 7 150-7 250 MHz (s-E), as by Res 758. Similar bands are being considered under WRC-15 Agenda items 1.9.1 (for FSS) and 1.11 (for EESS), therefore the conditions of compatibility between potential stations of both services needs to be studied.

The impact of such EESS (Earth-to-space) earth stations into the new potential Fixed Satellite Service earth stations has been studied in a working document toward a PDN Report ITU-R SA.[ 1.9.1VS1.11 -7GHz] (see [Annex 17](http://www.itu.int/md/dologin_md.asp?lang=en&id=R12-WP7B-C-0154!N17!MSW-E) to Doc. 7B/154). The analysis applies the time-variant gain (TVG) methodology to assess the coordination area around EESS earth stations where coordination would be required with FSS, and leads to a maximum coordination distance of approximately 350 km for an EESS earth station located in Sweden (high latitudes), 230 km for an EESS earth station located in medium latitudes and around 290 km for low latitude and this, only with the consideration that the FSS station is pointing directly towards the EESS earth station.. These previous results take into account a flat terrain (the sea or the ocean and flat soil space). When taking into account real terrain elevation, on a site-by-site basis, the coordination distance would be much more reduced.

The studies show that interference levels from one single FSS spacecraft into EESS satellite receivers in the band 7 190-7 235 MHz are compliant with the applicable ITU criterion and this type of operation is compatible without the need of any special mitigation techniques (see Annex 16 to 4A/343).

* **Draft CPM Text for AI 1.11**

The draft CPM text revised at the ITU-R 7B meeting in Sept.13 (see Annex 1 to Doc 7B/226) contains a single method to make a primary worldwide allocation to the EESS in the band 7 190-7 250 MHz in the Table of Frequency Allocations in RR Article 5. Future work on this draft CPM text will require the inclusion of the conclusions of the sharing of the EESS with space operation services (SOS) and to review and possibly refine the regulatory and procedural considerations for this single method to satisfy the agenda item.

The preparatory work for AI 1.11 progresses as expected in the WP 7B work plan (Doc. [7B/27](http://www.itu.int/md/meetingdoc.asp?lang=en&parent=R12-WP7B-C-0027)), although the sharing analysis and conclusions about compatibility of EESS and SOS uplink systems will have to be reassessed in time for the next WP-7B meeting in May 2014.. Next milestone for the 4th meeting May 2014 is as follows;

* Completion of WP 7B EESS-SOS sharing studies and conclusions, final liaison to concerned WPs.
* Completion of all necessary Reports and Recommendations.
* CPM and regulatory matters text agreed.

# List of relevant documents

Recommendation ITU-R SA.609-2 “Protection criteria for radiocommunication links for manned and unmanned near-Earth research satellites”

Recommendation ITU-R SA.1157-1 “Protection criteria for deep-space research”

Recommendation ITU-R SA 514-3 “Interference criteria for command and data transmission systems operating in the Earth exploration satellite and meteorological satellite services”

Recommendation ITU-R F.758-3 “Considerations in the development of criteria for sharing between the terrestrial fixed service and other services”

**ITU Reports**

Draft new Report ITU-R SA.[SPECTRUM REQU]. (see Doc 7/32 Rev 2).

Preliminary draft new Report ITU-R SA.[EESS-SPACE-7GHZ] “Compatibility between EESS (Earth-to-space) and the space research service or the space operation service in the band 7 100-7 235 MHz” (see Annex 2 to Doc. 7B/226).

Draft new Report ITU-R SA.[EESS-FS-7GHz] “Sharing between the EESS (Earth-to-space) and the fixed service in the 7‑8 GHz range” (see Doc. 7/55 Rev 1)

Working document toward a PDN 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” (see [Annex 17](http://www.itu.int/md/dologin_md.asp?lang=en&id=R12-WP7B-C-0154!N17!MSW-E) to Doc. 7B/154)

**DRAFT CPM TEXT** FOR WRC-15 AGENDA ITEM 1.11. (see Annex 1 to Doc 7B/226).

Latest versions ITU-R preliminary draft new report are available at:

<http://www.itu.int/ITU-R/go/rcpm-wrc-15-studies>

# Actions to be taken

* to prepare proposals to ITU Working document towards a preliminary draft new Report or Recommendation. The following areas should be covered as part of this action:

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| **Areas to be studied** | **Status** |
| (a) Determination of technical and operational characteristics of EESS earth stations transmitting in the band 7-8 GHz, with particular focus on the band 7145-7235 MHz | **COMPLETED** |
| (b) Determination of technical and operational characteristics FS, MS, FSS, SOS and SRS systems operating in the band 7-8 GHz | **COMPLETED** |
| (c ) Analyse the potential for interference to the existing and planned FS, SOS, MS, FSS and SRS systems and determine the appropriate sharing criteria | ON GOING  (pending consolidation of EESS-SOS sharing analysis) |
| (d) Definition of spectrum requirements of new EESS systems | **COMPLETED** |
| (e) Examination of possible regulatory actions to satisfy the spectrum requirements of the new EESS systems. | ON GOING |
| (f) Analyse the potential for sharing between the EESS (E-s) and FSS (s-E) considering WRC15 AI 1.9.1 proposal for an allocation to the FSS (s-E) in the 7-8 GHz range once the FSS (s-E) parameters are defined. These parameters should come from ITU WP 4A documentation. | ON GOING |

* to prepare proposals to ECP
* 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 (December 2013)

At the Asia-Pacific Telecommunity (APT), the Working Group WG-2 is responsible for AI 1.11.

APT Members support the current sharing studies in the ITU-R in accordance with Resolution 650 (WRC-12).

APT Members are of the view that the band 7 145-7190 MHz (deep-space SRS band) should be excluded for further considerations under this agenda item taking into account the current study results of the ITU-R WP7B.

APT Members are also of the view that the existing services in this band should be adequately protected from potential interference due to the possible new allocation to the Earth exploration-satellite service (Earth-to-space), in accordance with resolution 650, and no constraints are placed on these services.

(source: 1st ITU inter-regional workshop)

ATU (March 2013)

The Africa Telecommunication Union (ATU) held the first WRC-15 Preparatory meeting on 18-20 March 2013 in Dakar (Senegal).

The meeting report does not provide a common ATU position about AI 1.11, and only the preliminary view of one Administration is presented. “Sudan support not to allocate a primary allocation to the Earth exploration-satellite service (Earth-to-space) in the 7-8 GHz range. Reason: To protect the current services. Action: Continue following the current studies”.

No position was presented at the 1st ITU inter-regional workshop.

Website: <http://atu-uat.org>

Arab Spectrum Management Group (December 2013)

Not supporting a primary allocation for the Earth exploration satellite service (Earth-to-space) in the 7-8GHz range in order to protect the existing services because of heavy use of terrestrial fixed services in this band.

Follow up the studies in WP 7B

Prepare proposal to WP 7B to include NOC method.

(source: 1st ITU inter-regional workshop)

CITEL (December 2013)

CITEL Preparation for WRC is under responsibility of the PCC.II. The group SGT-3 is responsible for AI 1.11. Draft Inter-American Proposals

Position of Canada/United States

MOD Article 5 to add EESS (Earth-to-space) in the 7 190-7 250 MHz band and divide the Table of Frequency Allocation at 7 190 MHz to clarify the allocation of services within the Table.

MOD No. **5.460** - consequential to dividing the Table at 7 190 MHz

MOD Article **21** Tables **21-2** and **21-3** - consequential

MOD Appendix **7** Table **7b** - consequential

SUP Resolution 650 (WRC-12)

(source: 1st ITU inter-regional workshop)

RCC (December 2013)

The RCC administrations do not object to allocation of frequency band 7190-7250 MHz on a primary basis to the Earth exploration-satellite service (Earth-to-space) provided the compatibility with systems of SOS, SRS, FS and MS is ensured.

Compatibility conditions between EESS (Earth-to-space) and other existing services in the range of 7-8 GHz shall be incorporated in the RR.

(source: 1st ITU inter-regional workshop)

## International organisations

IATA (date of proposal)

ICAO (December 2013)

ICAO preliminary position is to oppose any new Earth exploration-satellite service allocation, unless it has been demonstrated through agreed studies that there will be no impact on aviation use in the frequency band 8 750 – 8 850 MHz.

(source: 1st ITU inter-regional workshop)

IMO (December 2013)

(IMO did not present any specific position for this agenda item at the 1st ITU inter-regional workshop)

NATO (December 2013)

Preliminary NATO military position: NATO supports adequate allocations to the EESS (active) (E-s), if studies demonstrate compatibility with incumbent services.

SFCG (December 2013)

SFCG supports an allocation to EESS (E-s) in the band 7190-7250 MHz that would satisfy the spectrum requirements identified.

The frequency range 7235-7250 MHz would be used for those cases of EESS spacecraft links presenting a difficult sharing scenario with SRS spacecraft and SOS links in the frequency range 7190-7235 MHz.

SFCG recognizes that EESS (E-s) is not compatible with SRS (deep space) in 7145-7190 MHz band.

WMO (December 2013)

WMO supports a new EESS (Earth-to-space) allocation in the 7-8 GHz frequency band, provided that compatibility with meteorological-satellite systems operating in the bands 7 450-7 550 MHz and 7 750-7 900 MHz is ensured.

(source: 1st ITU inter-regional workshop) .

## Regional organisations

ESA (June 2013)

As SFCG

EUMETNET (January 2013)

EUMETNET supports a new allocation to EESS (Earth-to-space) in the 7-8 GHz frequency range, provided that compatibility with meteorological applications is ensured.

(source: Eumetnet input to CPG-2)

CRAF (January 2013)

CRAF supports the protection of the SRS (passive). The lower frequency range 7190 – 7235 MHz is favoured for new allocations.

Eurocontrol (date of proposal)

## OTHER INTERNATIONAL AND REGIONAL ORGANISATIONS

EBU (date of proposal)

GSMA (date of proposa)