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| **The 5th Meeting of the APT Conference Preparatory Group for WRC-23 (APG23-5)** | **APG23-5/INP-xx** |
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Thailand (Kingdom of)

**preliminary views on WRC-23 agenda items 1.12, 1.13, 1.14,**

**9.1 Topic a and 9.1 Topic D**

**Agenda Item 1.12:**

*to conduct, and complete in time for WRC-23, studies for a possible new secondary allocation to the Earth exploration-satellite (active) service for spaceborne radar sounders within the range of frequencies around 45 MHz, taking into account the protection of incumbent services, including in adjacent bands, in accordance with Resolution 656 (Rev.WRC-19);*

**1. Background**

This agenda item seeks a new secondary allocation to the Earth exploration-satellite service (EESS) (active) for spaceborne radar sounders within a range of frequencies around 45 MHz while taking into account the protection of incumbent services including those in adjacent bands. Studies to support this agenda item have been developed in PDN Report ITU-R RS.[SPACEBORNE VHF RADAR SOUNDER]. Specifically, this Report contains the results of compatibility studies, based on the proposed EESS (active) radar characteristics provided in Recommendation ITU-R RS.2042 and the characteristics of the incumbent services as provided by the responsible Working Parties.

Five methods have been proposed in the draft CPM report:

* **Method A1** proposes to establish a new global secondary allocation to the EESS for active emissions. This new secondary allocation is proposed to be limited, through a dedicated footnote, to the operation of spaceborne radar sounder systems, over the frequency band 40-50 MHz, in the Table of Frequency Allocations of RR Article 5. This footnote would reference a proposed new WRC Resolution to protect incumbent services in the frequency band 40-50 MHz and in the adjacent frequency bands;
* **Method A2** proposes to establish a new global secondary allocation to the EESS for active emissions. This new secondary allocation is proposed to be limited, through a dedicated footnote, to the operation of spaceborne radar sounder systems, over the frequency band 40-50 MHz, in the Table of Frequency Allocations of RR Article 5. This footnote would also include relevant technical conditions, such as the power fluxdensity at the surface of the Earth, to address the protection of incumbent services in the frequency band 40-50 MHz;
* **Method B** proposes to establish a new global secondary allocation to the EESS for active emissions. This new secondary allocation is proposed to be limited, through a dedicated footnote, to the operation of spaceborne radar sounder systems, over the frequency band 40-50 MHz, in the Table of Frequency Allocations of RR Article 5.  
  In addition, this footnote would address the protection of the secondary radiolocation service in the frequency bands 42-42.5 MHz and 46-68 MHz;
* **Method C** proposes to establish a global secondary allocation to the EESS for active emissions over the frequency band 40-50 MHz in the Table of Frequency Allocations of RR Article 5;
* **Method D** proposes no change to RR (Articles and Appendices).

The five methods propose the suppression of Resolution **656 (WRC-19)**.

**2. Preliminary View**

Thailand is of the view that a new secondary allocation to the Earth exploration‐satellite service (active) for spaceborne radar sounders in the 40‐50 MHz band shall provide protection to and not adversely affect incumbent services in the 40-50 MHz and adjacent frequency bands.

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**Agenda Item 1.13:**

*to consider a possible upgrade of the allocation of the frequency band 14.8-15.35 GHz to the space research service, in accordance with Resolution* ***661 (WRC-19)****;*

**1. Background**

The frequency band 14.8-15.35 GHz is currently allocated on a primary basis to the fixed and mobile services, and on a secondary basis to the space research service (SRS). Within the SRS, the band is expected to be used for high-speed direct downlinks from space science missions to a limited number of earth stations located globally. Additionally, the band is also currently used in two capacities by Data Relay Satellite (DRS) systems operated by multiple administrations. These uses include forward feeder uplinks from DRS earth stations to relay satellites in GSO orbit, as well as inter-satellite return links to relay data from non-GSO space science spacecraft (including crewed space vehicles and stations) through DRS satellites to the Earth.

The space research satellite requirements for use of the band are expected to continue to increase in the coming years as a result of increasing numbers of robotic science satellites and crewed vehicles, limited bandwidth and/or increasing congestion in other SRS bands, and increasing science mission data transport needs.

The purpose of this agenda item is to explore the feasibility of establishing a regulatory framework to provide for the operation of SRS systems in this band on a primary basis, consistent with not causing harmful interference to nor constraining the operation of systems operating in other primary services in the band.

Resolution 661 (WRC-19) invites ITU-R to investigate and identify all relevant scenarios that need to be considered in assessment of a possible upgrade to the allocation to the space research service to primary status in the frequency band 14.8-15.35 GHz, and to conduct and complete such studies in time for WRC 23 so as to determine any associated technical and regulatory conditions to ensure protection of the current use and future development of the existing primary services. WRC 23 agenda item 1.13 calls for examination, on the basis of the results of studies by the ITU Radiocommunication Sector, of the possibility of upgrading the secondary status of the allocation to the space research service (SRS) to primary status.

Six methods have been proposed in the draft CPM report:

* **Method A** proposes no change to RR and maintains the status of the SRS allocation as secondary;
* **Method B** proposes to upgrade the status of the SRS allocation to primary, subject to conditions establishing protection of use and development of currently allocated services;
* **Method C** proposes to upgrade the status of the SRS allocation to primary, with provisions to avoid imposing constraints on the current use and future development of existing systems of primary services, including the aeronautical mobile service (AMS). It also provides further protection to the radio astronomy service (RAS). This method also avoids the usage of deep-space missions in that frequency band because the impact of those missions was not studied;
* **Method D** proposes to upgrade the status of the SRS allocation to primary, with provisions to avoid imposing constraints on the current use and future development of existing systems of primary services and provide further protection to them, including the fixed service (FS) and the mobile service (MS);
* **Method E** proposes to upgrade the status of the SRS allocation to primary, with provisions to provide further protection to existing systems of primary services, including the RAS;
* **Method F** proposes to upgrade the status of the SRS allocation to primary, with provisions to avoid imposing constraints on the current use and future development of existing systems of primary services, including the FS and MS.

All these methods support the suppression of Resolution 661 (WRC-19).

**2. Preliminary View**

Thailand is of the view that the upgrade of the SRS allocation from secondary to primary in the frequency band 14.8-15.35 GHz shall provide protection to and not adversely affect existing services in the frequency band 14.8-15.35 GHz and adjacent bands.

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**Agenda Item 1.14:**

*to review and consider possible adjustments of the existing or possible new primary frequency allocations to EESS (passive) in the frequency range 231.5-252 GHz, to ensure alignment with more up-to-date remote-sensing observation requirements, in accordance with Resolution* ***662 (WRC-19)****;*

**1. Background**

The objective of WRC-23 agenda item 1.14 is to review and consider possible adjustment of the existing or possible new primary frequency allocations to the Earth exploration-satellite service (EESS) (passive) in the frequency range 231.5-252 GHz, to ensure alignment with more up-to-date remote sensing observation requirements, ensure that the allocations to EESS (passive) within the considered frequency range correspond to the observation requirements for satellite passive microwave sensing without unduly constraining the operation of other primary services currently allocated in this frequency range, taken into account the possible effect on the other primary services in the considered frequency range.

EESS (passive) microwave sensing mainly includes Ice Cloud Measurements and atmosphere gases measurement. The Ice Cloud Imager (ICI) instrument which is a conical scanning millimeter/sub-millimeter wave radiometer, performs measurements cloud ice water paths and cirrus clouds operating in two symmetric spectral bands of 239.2-242.2 GHz and 244.2-247.2 GHz. The Microwave Limb Sounder (MLS) instrument continuously observes thermal emission from utilizing spectrometers of numerous channels within the frequency band 231.5-252 GHz to measure the chemical processes and compounds within Earth’s atmosphere.

Compatibility studies show that, in the frequency bands 239.2-242.2 GHz and 244.2-247.2 GHz, the sharing between the conical scanning passive sensors (like ICI) and systems of fixed service (FS)/mobile service (MS) is not feasible. Studies also show that limb sounding passive sensors are compatible with systems of FS/MS in the whole frequency range 231.5-252 GHz. Further, the sharing between the fixed-satellite service (FSS) (GSO, space-to-Earth) and EESS (passive) is feasible within the whole frequency range 232-240 GHz.

Three methods have been proposed in the draft CPM report:

* **Method A**: Addition of new primary allocations to the EESS (passive) in the frequency bands 239.2-242.2 GHz and 244.2-247.2 GHz, power limits to the FS and MS in the frequency band 239.2-241 GHz and no change to the current allocations in the frequency band 239.2-242.2 GHz.
* **Method B**: Addition of new primary allocations to the EESS (passive) in the frequency bands 239.2-242.2 GHz and 244.2-247.2 GHz, switch of the current FS and MS allocations in the frequency band 239.2-241 GHz to the frequency band 235-238 GHz.
* **Method C**: No change.

**2. Preliminary View**

Thailand supports possible adjustments to the existing or possible new primary frequency allocations to EESS (passive) in the frequency range 231.5-252 GHz. Any changes to the EESS (passive) allocations in the frequency range 231.5-252 GHz shall not adversely affect the operation of other primary services allocated in this frequency range.

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**Agenda Item 9.1 Topic A:**

*In accordance with Resolution* ***657 (Rev.WRC-19)****, review the results of studies relating to the technical and operational characteristics, spectrum requirements and appropriate radio service designations for space weather sensors with a view to describing appropriate recognition and protection in the Radio Regulations without placing additional constraints on incumbent services;*

**1. Background**

Space weather refers to the physical processes occurring in the space environment that ultimately affects human activities on Earth and in space. Space weather is influenced by the X-ray, Ultraviolet (UV), high energic particles and strong solar wind generated by Coronal Mass Ejection (CME). Space weather observations are important for detecting and forecasting solar activity events that impact services critical to the economy, safety and security of administrations and their population. These observations are made from ground-based and space-based systems. Some of the sensors operate by receiving signals of opportunity, including, but not limited to, low-level natural emissions of the Sun, Earth’s atmosphere and other celestial bodies, and therefore may suffer harmful interference at levels which could be tolerated by other radio systems. However, no frequency bands have been documented in any manner in RR for space weather sensor applications.

Agenda item 9.1 topic a was therefore established with a view to describing appropriate recognition and protection of space weather sensors in RR without placing additional constraints on incumbent services.

As a responsible group for this agenda item, ITU-R WP 7C submitted the draft CPM text in October 2022.

The draft CPM report provided the following:

* example of space weather definition;
* potential radio service designation for space weather;
* possible solution under RR Articles 1 and 4 that WRC-23 could implement;
* that the candidate frequency bands to be protected need to be finalized and that the sharing studies and identification of new allocations could be done at WRC-27; and
* potential new WRC-23 Resolution on the importance of space weather sensor systems.

**2. Preliminary View**

Thailand is of the view that the definition of space weather as specified in the draft CPM text and the designation of space weather observation as an application of the MetAids service could be supported.

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**Agenda Item 9.1 Topic D:**

*Protection of EESS (passive) in the frequency band 36-37 GHz from non GSO FSS space stations*

**1. Background**

Under the WRC-23 agenda item 9.1, topic d), which is a continuation of study matters that began but were not fully resolved under WRC-19 agenda item 1.6, there are two potential interference scenarios that were studied, while taking into account the fixed-satellite service (FSS) characteristics provided by the relevant ITU-R contributing group and the Earth exploration-satellite service (EESS) (passive) characteristics contained in Recommendation [ITU-R RS.1861-1](https://www.itu.int/rec/R-REC-RS.1861/en):

* Interference into the sensing channel of EESS (passive) from FSS non-GSO constellations operating in the frequency band 37.5-38 GHz at a lower altitude than EESS (passive) sensors.
* Interference into the cold calibration channel of EESS (passive) from FSS non-GSO constellations operating in the frequency band 37.5-38 GHz at a higher altitude than EESS (passive) sensors.

The draft CPM report and studies show the following:

* With regard to the first issue, the results of one study considering two different non-GSO FSS systems indicate that an unwanted emission power limit of ‑31 dBW/100 MHz in the frequency band 36-37 GHz would be needed. This would be applicable to non-GSO FSS constellations operating at altitudes below 970 km (maximum altitude of EESS (passive) sensors in this band). The results of another study considering one non-GSO FSS system shows that there is a minimum positive margin of 10-15 dB to the EESS (passive) protection criteria. Both studies consider a sidelobe level of 0 dBi, no additional satellite body blockage loss, and no apportionment of the EESS (passive) protection criterion. When considering an additional 30 dB attenuation provided by the FSS satellite body, all studies conclude that no specific unwanted emission limit would be needed to cover this scenario.
* With regard to the second issue, the results of two studies considering three different non-GSO FSS systems indicate that an unwanted emission power limit of -31 dBW/100 MHz in the band 36-37 GHz would be needed, without apportionment of the EESS (passive) protection criterion. This would be applicable to non‑GSO FSS constellations operating at altitudes above 407 km (minimum altitude of EESS (passive) sensors in this band). Another study that considers a different set of operational FSS characteristics has shown that there is a minimum positive margin of approximately 7 dB to the EESS (passive) protection criteria when only assessing interference from the particular constellation considered, and this study concludes that no specific unwanted emission limit would be needed to cover this scenario.

**2. Preliminary View**

Thailand supports the conditions for the protection of EESS (passive) sensors operating in the frequency band 36-37 GHz from non-GSO FSS systems operating in the frequency band 37.5-38 GHz in accordance with the results of the ITU-R studies under this agenda item.

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