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| **US Radiocommunication Sector****FACT SHEET** |
| **Study Group:** USWP 7B | **Document No:** US7B\_27\_003\_R02 |
| **Reference:** RES **256 (WRC-23)** | **Date:** 17 January 2024 |
| **Document Title:** Proposed liaison statement to WP 5Ddocumenting characteristics of EESS, METSAT, and SRS systems in the frequency range 7 125 – 8 400 MHz for use in studies under WRC-27 agenda item 1.7 |
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| **Purpose:** To begin development of a detailed liaison statement containing the characteristics of SRS, METSAT, and EESS systems in the frequency range 7 125 – 8 400 MHz for use in studies under agenda item 1.7 (WRC-27)  |
| **Abstract:** WRC-27 agenda item 1.7 calls for the performance and consideration of sharing and compatibility studies to develop technical conditions for the use of International Mobile Telecommunications (IMT) in the frequency bands 4 400-4 800 MHz, 7 125-8 400 MHz (or parts thereof), and 14.8-15.35 GHz taking into account existing primary services operating in these, and adjacent, frequency bands. The space research service (SRS) is allocated on a primary basis in the (E-s) direction in the band 7 145 – 7 235 MHz. This includes an allocation in the 7 145 – 7 190 MHz portion of this band specifically for SRS (deep space) uplinks. The earth exploration-satellite service (EESS) is also allocated in the (E-s) direction in the 7 190 - 7 250 MHz band. Additionally, the EESS is allocated in the (s-E) direction in the band 8 025 – 8 400 MHz. Also, the METSAT service is allocated on a primary basis in the 7 450 – 7 550 MHz and 7 750 – 7 900 MHz bands in the (space-to-Earth) direction. This contribution is intended to initiate the work to develop a series of Recommendations to document the characteristics of EESS and SRS systems in these bands for use in sharing studies under WRC-27 agenda item 1.7.  |
| **Fact Sheet Preparer:** James Brase, Peraton for NASA |

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| **Radiocommunication Study Groups** | Logo  Description automatically generated |
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| Source: Subject: Agenda item 1.7 (WRC-27) | **Document 7B/x3** |
| **xx March 2024** |
| **English only** |
| United States of AmericaLIAISON STATEMENT TO WORKING PARTY 5D DOCUMENTING SRS, EESS, AND METSAT CHARACTERISTICS FOR AI 1.7 STUDIES |
| Characteristics of space research, Earth exploration-satellite, and meteorological-satellite service systems in the frequency ranges under consideration for Agenda item 1.7 (WRC-27) |

Working Party 7B (WP 7B) recognizes that the frequency ranges identified for study as part of Agenda item 1.7 (WRC-27) encompass a number of bands which are allocated to the science services for which it is the expert group. These include bands allocated to the space research service (both for near-Earth and deep space applications), the Earth exploration-satellite service, and th meteorological satellite service. These allocations apply in the (space-to-Earth), (Earth-to-space), and (space-to-space) directions.

In the attachment below, information on the technical and operational characteristics of these systems and the applicable protection criteria are compiled for use in sharing and compatibility studies.

Working Party 7B looks forward to close coordination with WP 5D to support studies under agenda item 1.7.

**Attachment 1**

**Characteristics of SRS, EESS, and METSAT systems in the frequency ranges 7 125 – 8 400 MHz and 14.8 – 15.35 GHz**

1. **Introduction**

The sections below provide information needed for sharing and compatibility studies under Agenda item 1.7 (WRC-27) for each of the science service allocations in the relevant frequency ranges. This information includes pointers to relevant sections of existing ITU-R Recommendations and Reports as well as other, additional data needed for studies.

1. **Space research service (deep space) (Earth-to-space) in the band 7 145 – 7 190 MHz**

**Applicable Recommendations hand Reports:**

* Recommendation ITU-R SA.1157: *Protection criteria for deep-space research*
* Recommendation ITU-R SA.509: *Space research earth station and radio astronomy reference antenna radiation pattern for use in interference calculations, including coordination procedures, for frequencies less than 30 GHz*
* Recommendation ITU-R SA.1014: *Radiocommunication requirements for manned and unmanned deep space research*
* Recommendation ITU-R SA.1015: *Bandwidth requirements for deep-space research*
* Recommendation ITU-R SA.1016: *Sharing considerations relating to space research service (deep space)*
* Recommendation ITU-R SA.1157: *Protection criteria for deep-space research*

**Additional information / characteristics**

TBP

1. **Space research service (Earth-to-space) in the band 7 190 – 7 235 MHz**

**Applicable Recommendations hand Reports:**

* Recommendation ITU-R SA.364: *Preferred frequencies and bandwidths for manned and unmanned near-Earth satellites of the space research service*
* Recommendation ITU-R SA.509: *Space research earth station and radio astronomy reference antenna radiation pattern for use in interference calculations, including coordination procedures, for frequencies less than 30 GHz*
* Recommendation ITU-R SA.609: *Protection criteria for radiocommunication links for manned and unmanned near-Earth research satellites*

**Additional information / characteristics**

TBP

1. **Earth exploration-satellite service (Earth-to-space) in the band 7 190 – 7 250 MHz**

**Applicable Recommendations hand Reports:**

* Recommendation ITU-R SA.1020: *Hypothetical reference system for the Earth exploration-satellite and meteorological satellite services*
* Recommendation ITU-R SA.1159: *Performance criteria for data transmission systems in the Earth exploration-satellite service and meteorological-satellite service*
* Recommendation ITU-R SA.1021: *Methodology for determining performance objectives for systems in the Earth exploration-satellite and meteorological-satellite services*

**Additional information / characteristics**

TBP

1. **Meteorological-satellite service (space-to-Earth) in the band 7 450 – 7 550 MHz**

**Applicable Recommendations hand Reports:**

* Report ITU-R SA.2488-0: *Characteristics to be used for assessing interference to systems operating in the Earth exploration-satellite and meteorological-satellite services, and for conducting sharing studies*
* Recommendation ITU-R SA.1020: *Hypothetical reference system for the Earth exploration-satellite and meteorological satellite services*
* Recommendation ITU-R SA.1159: *Performance criteria for data transmission systems in the Earth exploration-satellite service and meteorological-satellite service*
* Recommendation ITU-R SA.1021: *Methodology for determining performance objectives for systems in the Earth exploration-satellite and meteorological-satellite services*
* Recommendation ITU-R SA.1022: Methodology for determining interference criteria for systems in the Earth exploration-satellite and meteorological-satellite services
* Recommendation ITU-R SA.1023: *Methodology for determining sharing and coordination criteria for systems in the Earth exploration-satellite and meteorological-satellite services*
* Recommendation ITU-R SA.1026: *Aggregate interference criteria for space-to-Earth data transmission systems operating in the Earth exploration-satellite and meteorological-satellite services using satellites in low-Earth orbit*
* Recommendation ITU-R SA.1027: Sharing criteria for space-to-Earth data transmission systems in the Earth exploration-satellite and meteorological-satellite services using satellites in low-Earth orbit
* Recommendation ITU-R SA.514: *Interference criteria for command and data transmission systems operating in the Earth exploration-satellite and meteorological-satellite services*

**Additional information / characteristics**

TBP

1. **Meteorological-satellite service (space-to-Earth) in the band 7 750 – 7 900 MHz**

**Applicable Recommendations hand Reports:**

* Report ITU-R SA.2488-0: *Characteristics to be used for assessing interference to systems operating in the Earth exploration-satellite and meteorological-satellite services, and for conducting sharing studies*
* Recommendation ITU-R SA.1020: *Hypothetical reference system for the Earth exploration-satellite and meteorological satellite services*
* Recommendation ITU-R SA.1159: *Performance criteria for data transmission systems in the Earth exploration-satellite service and meteorological-satellite service*
* Recommendation ITU-R SA.1021: *Methodology for determining performance objectives for systems in the Earth exploration-satellite and meteorological-satellite services*
* Recommendation ITU-R SA.1022: *Methodology for determining interference criteria for systems in the Earth exploration-satellite and meteorological-satellite services*
* Recommendation ITU-R SA.1023: *Methodology for determining sharing and coordination criteria for systems in the Earth exploration-satellite and meteorological-satellite services*
* Recommendation ITU-R SA.1026: *Aggregate interference criteria for space-to-Earth data transmission systems operating in the Earth exploration-satellite and meteorological-satellite services using satellites in low-Earth orbit*
* Recommendation ITU-R SA.1027: Sharing criteria for space-to-Earth data transmission systems in the Earth exploration-satellite and meteorological-satellite services using satellites in low-Earth orbit
* Recommendation ITU-R SA.514: *Interference criteria for command and data transmission systems operating in the Earth exploration-satellite and meteorological-satellite services*

**Additional information / characteristics**

Table 6-1 provides the key technical characteristics of one representative system operating in the 7 750 – 7 900 MHz band. These characteristics are captured in Recommendation ITU-R SA.2488. The characteristics in Table 6-2 are for a follow-on to this system and are intended to be incorporated into Recommendation ITU-R SA.2488 in an upcoming revision.

Table 6-1. JPSS-1, Space-to-Earth Link, High-rate Data, METSAT

|  |  |
| --- | --- |
| **Parameter** | **Value and Unit** |
| Satellite | JPSS-1 |
| Orbital Altitude  | 824 km |
| Inclination Angle | 98.7 degrees |
| Orbit Type | Sun-synchronous |
| Local Time of Ascending Node (LTAN) | 13:25:00 |
| Center Frequency | 7812 MHz |
| Necessary Bandwidth | 30 MHz |
| Satellite Transmit Power  | 9.6 dBW |
| Satellite Antenna Maximum Gain | 9.4 dBi |
| Satellite Antenna Pattern | Isoflux |
| Satellite Antenna Polarization | RHCP |
| Ground Station Maximum Antenna Gain | 44.9 dBi |
| Ground Station Antenna Beamwidth | 0.8 degrees |
| Ground Station Antenna Pattern | Rec. ITU-R S.465-6 |
| Ground Station Antenna Polarization | RHCP |
| Ground Station Minimum Elevation | 5 degrees |
| Ground Station Receiver Noise Temperature | 343 K |

Table 6-2. JPSS-2 (and 3, 4), Space-to-Earth Link, High-rate Data, METSAT

|  |  |
| --- | --- |
| **Parameter** | **Value and Unit** |
| Satellite | JPSS-2 (and 3,4) |
| Orbital Altitude  | 824 km |
| Inclination Angle | 98.7 degrees |
| Orbit Type | Sun-synchronous |
| Local Time of Ascending Node (LTAN) | 13:25:00 |
| Center Frequency | 7812 MHz |
| Necessary Bandwidth | 50 MHz |
| Satellite Transmit Power  | 11.7 dBW |
| Satellite Antenna Maximum Gain | 6 dBi |
| Satellite Antenna Pattern | Isoflux |
| Satellite Antenna Polarization | RHCP |
| Ground Station Maximum Antenna Gain | 44.9 dBi |
| Ground Station Antenna Beamwidth | 0.8 degrees |
| Ground Station Antenna Pattern | Rec. ITU-R S.465-6 |
| Ground Station Antenna Polarization | RHCP |
| Ground Station Minimum Elevation | 5 degrees |
| Ground Station Receiver Noise Temperature | 343 K |

1. **Earth exploration-satellite service (space-to-Earth) in the band 8 025 – 8 400 MHz**
* **Applicable Recommendations hand Reports:**
* Report ITU-R SA.2488-0: *Characteristics to be used for assessing interference to systems operating in the Earth exploration-satellite and meteorological-satellite services, and for conducting sharing studies*
* Recommendation ITU-R SA.1810-1: *System design guidelines for Earth exploration-satellites operating in the band 8 025-8 400 MHz*
* Recommendation ITU-R SA.1020: *Hypothetical reference system for the Earth exploration-satellite and meteorological satellite services*
* Recommendation ITU-R SA.1159: *Performance criteria for data transmission systems in the Earth exploration-satellite service and meteorological-satellite service*
* Recommendation ITU-R SA.1021: *Methodology for determining performance objectives for systems in the Earth exploration-satellite and meteorological-satellite services*
* Recommendation ITU-R SA.1022: *Methodology for determining interference criteria for systems in the Earth exploration-satellite and meteorological-satellite services*
* Recommendation ITU-R SA.1023: *Methodology for determining sharing and coordination criteria for systems in the Earth exploration-satellite and meteorological-satellite services*
* Recommendation ITU-R SA.1024: *Necessary bandwidths and preferred frequency bands for data transmission from Earth exploration satellites (not including meteorological satellites)*
* Recommendation ITU-R SA.1026: *Aggregate interference criteria for space-to-Earth data transmission systems operating in the Earth exploration-satellite and meteorological-satellite services using satellites in low-Earth orbit*
* Recommendation ITU-R SA.1027: Sharing criteria for space-to-Earth data transmission systems in the Earth exploration-satellite and meteorological-satellite services using satellites in low-Earth orbit
* Recommendation ITU-R SA.1277: *Sharing in the 8 025-8 400 MHz frequency band between the Earth exploration-satellite service and the fixed, fixed-satellite, meteorological-satellite and mobile services in Regions 1, 2 and 3*
* Recommendation ITU-R SA.1810: *System design guidelines for Earth exploration-satellites operating in the band 8 025-8 400 MHz*
* Recommendation ITU-R SA.514: *Interference criteria for command and data transmission systems operating in the Earth exploration-satellite and meteorological-satellite services*

**Additional information / characteristics**

Recommendation ITU-R SA.2488-0 provides characteristics for three types of EESS Earth stations operating in the 8 025 – 8 400 band. These include Direct readout, Stored mission data, and Hybrid direct readout and stored mission data types. The characteristics of these types oof EESS systems are given in Table 11 of the document.

Table 7-1 and Table 7-2 below provide detailed characteristics of two EESS missions operating in this band. These systems are included in Recommendation ITU-R SA.2488; however, the some of the parameter values reflected below vary slightly from the Recommendation because the data is based on ITU filings. The information in the Recommendation will be revised to reflect these values when the Recommendation is updated.

Table 7-3 and Table 7-4 provide the characteristics of EESS systems in the 8 025 – 8 400 MHz band which are not currently included in Recommendation ITU-R SA.2488. The information given below is based on data in ITU filings.

Table 7-1. JASON-CS A (and B) (Sentinel-6A, 6B), Space-to-Earth Link, Payload Science Data, EESS

|  |  |
| --- | --- |
| **Parameter** | **Value and Unit** |
| Satellites | JASON-CS A (and B) |
| Orbital Altitude  | 1336 km |
| Inclination Angle | 66 degrees |
| Orbit Type | Non sun-synchronous |
| Center Frequency | 8090 MHz |
| Necessary Bandwidth | 120 MHz |
| Satellite Transmit Power  | 16.2 dBW |
| Satellite Antenna Maximum Gain | 6 dBi |
| Satellite Antenna Pattern | ND-SPACE |
| Satellite Antenna Polarization | RHCP |
| Ground Station Maximum Antenna Gain | 58.6 dBi |
| Ground Station Antenna Beamwidth | 0.2 degrees |
| Ground Station Antenna Pattern | Rec. ITU-R S.465-6 |
| Ground Station Antenna Polarization | RHCP |
| Ground Station Minimum Elevation | 5 |
| Ground Station Receiver Noise Temperature | 120 K |

Table 7-2. GOES-R Series, Space-to-Earth Link, Raw Sensor Data, EESS

|  |  |
| --- | --- |
| **Parameter** | **Value and Unit** |
| Satellites | GOES-R Series |
| Orbit Type | Geostationary |
| Center Frequency | 8220 MHz |
| Necessary Bandwidth | 130 MHz |
| Satellite Transmit Power  | 10 dBW |
| Satellite Antenna Maximum Gain | 35.9 dBi |
| Satellite Antenna Beamwidth | 3.1 degrees |
| Satellite Antenna Polarization | Mixed |
| Ground Station Maximum Antenna Gain | 61 dBi |
| Ground Station Antenna Beamwidth | 0.15 degrees |
| Ground Station Antenna Pattern | Rec. ITU-R S.465-6 |
| Ground Station Antenna Polarization | Mixed |
| Ground Station Antenna Pointing Angle | Fixed Pointing |
| Ground Station Receiver Noise Temperature | 150 K |

Table 7-3. OceanSat-3 (EOS-6), Space-to-Earth Link, Payload Science Data, EESS

|  |  |
| --- | --- |
| **Parameter** | **Value and Unit** |
| Satellite | OceanSat-3 (EOS-6) |
| Orbital Altitude  | 738 km |
| Inclination Angle | 98.3 degrees |
| Orbit Type | Sun-synchronous |
| Local Time of Ascending Node (LTAN) | 0:00:00 |
| Center Frequency | 8275 MHz |
| Necessary Bandwidth | 160 MHz |
| Satellite Transmit Power  | 13 dBW |
| Satellite Antenna Maximum Gain | 5 dBi |
| Ground Station Maximum Antenna Gain | 57.8 dBi |
| Ground Station Antenna Beamwidth | 0.2 degrees |
| Ground Station Antenna Pattern | Rec. ITU-R S.465-6 |
| Ground Station Minimum Elevation | 5 degrees |
| Ground Station Receiver Noise Temperature | 121 K |

Table 7-4. GOES-R Series, Earth-to-Space Link, GRB, (EESS)

|  |  |
| --- | --- |
| **Parameter** | **Value and Unit** |
| Satellites | GOES-R Series |
| Orbit Type | Geostationary |
| Center Frequency | 7216.6 MHz |
| Necessary Bandwidth | 10.9 MHz |
| Satellite Antenna Maximum Gain | 35.3 dBi |
| Satellite Antenna Beamwidth | 3.3 degrees |
| Satellite Antenna Polarization | Mixed |
| Satellite Receiver Noise Temperature | 1073 K |
| Ground Station Transmit Power  | 21.8 dBW |
| Ground Station Maximum Antenna Gain | 59 dBi |
| Ground Station Antenna Beamwidth | 0.18 degrees |
| Ground Station Antenna Pattern | Rec. ITU-R S.465-6 |
| Ground Station Antenna Polarization | Mixed |
| Ground Station Antenna Pointing Angle | Fixed Pointing |

1. **Meteorological-satellite service (Earth to-space) in the band 8 175 – 8 215 MHz**

**Applicable Recommendations hand Reports:**

* Recommendation ITU-R SA.1020: *Hypothetical reference system for the Earth exploration-satellite and meteorological satellite services*
* Recommendation ITU-R SA.1159: *Performance criteria for data transmission systems in the Earth exploration-satellite service and meteorological-satellite service*
* Recommendation ITU-R SA.1021: *Methodology for determining performance objectives for systems in the Earth exploration-satellite and meteorological-satellite services*

**Additional information / characteristics**

TBP

1. **Space research service (Earth-to-space) (space-to-Earth) (space-to-space) in the band 14.8 – 15.35 GHz**

**Applicable Recommendations hand Reports:**

* Recommendation ITU-R SA.2141: *Characteristics of space research service systems in the frequency range 14.8-15.35 GHz*
* Recommendation ITU-R SA.1414-2: Characteristics of data relay satellite systems
* Recommendation ITU-R SA.510: *Feasibility of frequency sharing between the space research service and other services in bands near 14 and 15 GHz - Potential interference from data relay satellite systems*
* Recommendation ITU-R SA.509: *Space research earth station and radio astronomy reference antenna radiation pattern for use in interference calculations, including coordination procedures, for frequencies less than 30 GHz*
* Recommendation ITU-R SA.609: *Protection criteria for radiocommunication links for manned and unmanned near-Earth research satellites*
* Recommendation ITU-R SA.1018: *Hypothetical reference system for networks/systems comprising data relay satellites in the geostationary orbit and their user spacecraft in low-Earth orbits*
* Recommendation ITU-R SA.1019: *Frequency bands and transmission directions for data relay satellite networks/systems*
* Recommendation ITU-R SA.1155: *Protection criteria related to the operation of data relay satellite systems*
* Recommendation ITU-R SA.1626-1: Feasibility of sharing between the space research service (space-to-Earth) and the fixed and mobile services in the band 14.8-15.35 GHz
* Recommendation ITU-R SA.364: *Preferred frequencies and bandwidths for manned and unmanned near-Earth satellites of the space research service*
* Recommendation ITU-R SA.1275: *Orbital locations of data relay satellites to be protected from the emissions of fixed service systems operating in the band 2 200-2 290 MHz*

**Additional information / characteristics**

This band is used by the data relay satellite systems operating in the SRS for two functions:

* Intersatellite (space-to-space) links from an NGSO DRS user satellite to a GSO DRS satellite.
* Feeder uplinks from DRS Earth stations to GSO DRS satellites