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| **Radiocommunication Study Groups** |  |
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| Source: Documents [7B/170](https://www.itu.int/md/R15-WP7B-C-0170/en) (Annex 1), [7B/195](https://www.itu.int/md/R15-WP7B-C-0195/en) and [7B/219](https://www.itu.int/md/R15-WP7B-C-0219/en) | **Annex 1 to Document 7B/238-E** |
| **6 November 2017** |
| **English only** |
| Annex 1 to Working Party 7B Chairman's Report | |
| Draft CPM Text on WRC-19 Agenda Item 1.2 | |
| Agenda item 1.2 | |

*1.2 to consider in-band power limits for earth stations operating in the mobile-satellite service, meteorological-satellite service and Earth exploration-satellite service in the frequency bands 401-403 MHz and 399.9-400.05 MHz, in accordance with Resolution****765 (WRC‑15)****;*

Resolution **765 (WRC‑15)**: Establishment of in-band power limits for earth stations operating in mobile-satellite service, the meteorological-satellite service and the Earth exploration-satellite service in the frequency bands 401-403 MHz and 399.9-400.05 MHz.

# 4/1.2/1 Executive summary

Taking into account the results of ITU-R studies, the objective of WRC-19 agenda item 1.2 is to establish, within the Radio Regulation, in-band power limits applicable to earth stations in the frequency bands 399.9-400.05 MHz and 401-403 MHz in order to ensure the operation of existing and future systems that usually implement low or moderate output powers for MSS, EESS and MetSat systems.

A working document toward a preliminary draft new Report ITU-R SA.[400 MHz-LIMITS] is in development which compiles elements related to background on WRC-19 agenda item 1.2 as well as technical considerations on MSS, EESS and METSAT in the frequency ranges of 399.9‑400.05 MHz and 401-403 MHz bands. This PDN Report includes an analysis section providing a method to derive the relevant power/e.i.r.p. limits under this agenda item.

# 4/1.2/2 Background

Two frequency bands: 399.9-400.05 MHz for mobile - satellite service (MSS) (Earth-to-space), 401-403 MHz for Earth exploration-satellite service (EESS) (Earth-to-space) and Meteorological Satellite Service MetSat (Earth-to-space) are under the scope of this agenda item. Earth exploration-satellite service (EESS), meteorological satellite service (MetSat) and mobile-satellite service (MSS) systems in these frequency bands are currently used for data collection systems (DCS) that implement moderate/low power levels. In these bands, earth stations, also called platforms, are deployed and send specific information to dedicated satellites which collect the corresponding data when the platforms are in the satellite footprint. Most of these platforms are active all the time. It is to be noted that very often, customers tend to use very low powers to ensure extended life time of the platforms.

This agenda item was created as a result in the significant recent increase in use of the frequency bands 401-403 MHz and 399.9-400.05 MHz for telemetry, tracking and command (TT&C) purposes. This increase is largely attributable to increased interest by educational institutions and especially by private and commercial entities seeking to operate large fleets and constellations of satellites. A large number of these satellite networks are already filed in both bands and as can be seen from filed parameters in the ITU-R database (i.e. large uplink transmit gains for example), plan to use the frequency bands 401-403 MHz and 399.9-400.05 MHz for telecommand (see No. **1.135**) (Earth-to-space) purposes under the EESS, MetSat or MSS allocations. The proliferation of such TT&C usage is most likely to have a significant impact upon the large number of existing lower power data collection system (DCS) stations communicating to sensitive receivers on GSO and non-GSO satellites. The output power levels of the earth stations referred to these telecommand links (Earth-to-space) can be much higher than the power levels used for the operation of DCS systems in these frequency bands.

In the 401-403 MHz band an overall of tens thousands of DCS stations communicating with GSO and non-GSO are deployed worldwide for the purpose of collecting essential weather and climate data. The Data Collection Platform Systems (DCP) gather information activity related to the Earth, the environment and scientific application, weather, environment observation: meteorological and oceanographic, seismic observation, volcanology, geodesy and geodynamics, fishing vessel monitoring, wildlife tracking, homeland security, law enforcement, test/evaluation, monitoring shipments of dangerous goods, humanitarian applications, managing water resources or tsunami warning system, etc. The data which are collected by DCPs, are sent and received by satellites in visibility of these platforms, that retransmit the retrieved information to dedicated earth stations.

In the 399.9-400.05 MHz band, several large constellations under development are planning to operate under the MSS allocation.

# 4/1.2/3 Summary and Analysis of the results of ITU-R studies

Relevant ITU-R Recommendations: ITU-R SA.2044, ITU-R SA.1163, ITU-R SA.1164, ITU-R SA.1627, ITU-R SA.1159, ITU-R SA.2045, and ITU-R M.2046.

New relevant ITU-R Report: ITU-R SA.[400 MHZ-LIMITS].

In the frequency band 401-403 MHz, according to on-going ITU-R studies, in practice, for non-GSO satellite networks, the values of output power range from –3 dBW (bandwidth of 800 Hz) up to 7 dBW (bandwidth of 6400 Hz). In some applications, the power may decrease down to –25 dBW using specific techniques such as Spread Spectrum Multiple Access. For specific bands within 401-403 MHz satellite uplink e.i.r.p. for DCS LEO systems could reach 12 dBW for existing non-GSO MetSat system (i.e. Meteor-3M, operating in the band 401.899-402.001 MHz). The maximum value of the corresponding antenna gain is below 3 dBi, and in practice the antenna gain does not exceed 0 dBi. The antennas are most of time omnidirectional and whip antennas are used.

Thus, any additional use, other than for DCS, of this limited and unique spectrum resource for DCS systems would have to blend in with appropriate power levels such that the reception of signals from data collection platforms at the satellite receivers is not interfered.

For GSO networks, it can be noted that the International Data Collection System (IDCS) of the DCP is based on the usage of GSO satellites, and the e.i.r.p. at the antenna output shall not exceed 22 dBW under any combination of operational conditions. The transmitted radio frequency shall use the 11 IDCS channels (with centre frequencies spaced 3 kHz apart), from 402.034-402.067 MHz regardless of the GSO spacecraft. Other GSO channels are reserved for DCP, and there are various types of DCP transmitters in operation generally ranging from 5 W, 10 W and 20 W output power with a directional antenna, or 40 W or even higher output power with an omnidirectional antenna. The resulting uplink equivalent isotropically radiated power (e.i.r.p.) is between 6 to 22 dBW. HEO DCS systems are based on the orbits with apogee of 40 000 km, which makes their characteristics similar to characteristic of the GSO DCP. For DCP’s operating with HEO satellites (ARCTICA-M), uplink e.i.r.p. would not exceed 16-18 dBW.

Given the significant difference in the power level ranges of non-GSO data collection platforms compared to platforms communicating to GSO MetSat and EESS satellites, as outline above, the establishment of power/e.i.r.p. limits will have to differentiate between NGSO (LEO/MEO) and GSO/HEO DCS in the 401-403 MHz frequency band.

To this respect, the establishment of an appropriate set of in-band power/e.i.r.p. limits in the 401 - 403 MHz band will have to take into account the framework set forth by the general partitioning in Recommendation ITU-R SA.2045 to ensure the protection of existing and future use of meteorological operations (MetSat and EESS (Earth-to-space)) in the 401-403 MHz frequency band for both non-GSO (LEO/MEO) and GSO/HEO DCS systems.

Report ITU-R SA.[400 MHZ-LIMITS] contains the technical characteristics and results of current ITU-R studies for in-band power limits applicable to the earth stations in the mobile-satellite service in the frequency band 399.9-400.05 MHz, the meteorological-satellite service and the Earth exploration-satellite service in the frequency band 401-403 MHz. The Report shows that the power limits for the earth stations operating in the EESS and MetSat services in the frequency band 401-403 MHz are based on two categories: GSO/HEO and non-GSO (LEO and MEO). Regarding the MSS in the frequency band 399.9-400.05 MHz, since this band is limited to non-GSO, just one set of limits is necessary.

The conclusion of PDN REPORT SA.[400 MHz-LIMITS] are that the earth station maximum e.i.r.p. in the mobile-satellite service in the frequency band 399.9-400.05 MHz, the meteorological-satellite service and the Earth exploration-satellite service in the frequency band 401-403 MHz, shall comply with the following conditions:

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| --- | --- |
| Frequency band | Maximum e.i.r.p. of the Earth stations |
| 399.9 – 400.05 MHz | 5 dBW |

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| Frequency band | Maximum e.i.r.p. of the Earth stations | |
| 401 – 403 MHz | GSO/HEO | 22 dBW |
| non-GSO (MEO and LEO) | 7 dBW(1) |
| (1) For the band 401.899-402.001 MHz, the maximum e.i.r.p for existing non-GSO MetSat system can be increased up to 12 dBW. | | |

*[Editor’s note : the information in the above footnote (1) will need further consideration]*

[This report also includes some specific transitional measures in band 399.9-400.05 MHz and 401-403 MHz.]

# 4/1.2/4 Methods to satisfy the agenda item

## 4/1.2/4.1 Method A

The proposed method is to include in RR the relevant e.i.r.p limits given in section 4/1.2/3 by adding a new footnote in the bands 399.9-400.05 MHz and 401-403 MHz in the Table of Frequency Allocations in RR Article **5**.

Advantages

– The in-band power limits applicable to earth stations would ensure the operation of existing and future systems that usually implement low or moderate output powers for MSS, EESS, and MetSat systems.

– Provide long-term security and assurance of the global network for the protection of stations of data collection system of MSS, EESS, and MetSat services.

– Retains the quality of meteorological and environmental data supporting safety of life services including public weather warnings and alerts, operational decision support for dams, locks and maritime operations on coasts and within inland waterways, emergency response and management for flood scenarios, relay of wildfire weather conditions for wildfire firefighters and other critical uses, and the possibility of disaster risk reduction.

Disadvantages

None

# 4/1.2/5 Regulatory and procedural considerations

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

MOD

|  |  |  |
| --- | --- | --- |
| 335.4-410 MHz | | |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 399.9-400.05 MOBILE-SATELLITE (Earth-to-space) 5.209 5.220 ADD 5.A1.2 | | |
| 400.05-400.15 STANDARD FREQUENCY AND TIME SIGNAL- SATELLITE (400.1 MHz)  5.261 5.262 | | |
| 400.15-401 METEOROLOGICAL AIDS  METEOROLOGICAL-SATELLITE (space-to-Earth)  MOBILE-SATELLITE (space-to-Earth) 5.208A 5.208B 5.209  SPACE RESEARCH (space-to-Earth) 5.263  Space operation (space-to-Earth)  5.262 5.264 | | |
| 401-402 METEOROLOGICAL AIDS  SPACE OPERATION (space-to-Earth)  EARTH EXPLORATION-SATELLITE (Earth-to-space) ADD 5.B1.2  METEOROLOGICAL-SATELLITE (Earth-to-space) ADD 5.B1.2  Fixed  Mobile except aeronautical mobile | | |
| 402-403 METEOROLOGICAL AIDS  EARTH EXPLORATION-SATELLITE (Earth-to-space) ADD 5.B1.2  METEOROLOGICAL-SATELLITE (Earth-to-space) ADD 5.B1.2  Fixed  Mobile except aeronautical mobile | | |

ADD

5.A1.2 In the frequency band 399.9-400.05 MHz, the maximum e.i.r.p. of earth stations in the mobile-satellite service shall not exceed 5 dBW,

5.B1.2 In the frequency band 401-403 MHz, the maximum e.i.r.p. of earth stations in the meteorological-satellite service and the Earth exploration-satellite service shall not exceed 22 dBW for geostationary systems and non-geostationary systems with an orbit of apogee equal or greater than 35 786 km and 7 dBW for non-geostationary systems with an orbit of apogee lower than 35 786 km. In the frequency band 401.899-402.001 MHz, non-geostationary meteorological satellite service systems, notified before [XXX], can operate associated earth stations with the maximum e.i.r.p 12 dBW.

*[Editor’s note: The information in the last sentence of 5.B1.2 will need further consideration]*