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| **World Radiocommunication Conference (WRC-19) Sharm el-Sheikh, Egypt, 28 October – 22 November 2019** |  |
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| PLENARY MEETING | **Addendum 2 to Document 47-E** |
|  | **4 October 2019** |
|  | **Original: English** |
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| Australia | |
| PROPOSALS FOR THE WORK OF THE CONFERENCE | |
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| 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)**;

# 1 Introduction

For WRC-19 agenda item 1.2, both Australia and the Asia-Pacific Telecommunity (APT) support the introduction of an EIRP limit of 5 dBW in the entire 399.9-400.05 MHz frequency band, as per Method C of the Conference Preparatory Meeting (CPM) Report. This document provides additional information underpinning Australia’s decision to support this method.

Resolution **765 (WRC-15)** considers that mobile-satellite service (MSS) systems in this frequency band are used for data collection for various scientific applications. One example MSS system is outlined in Recommendation ITU-R M.2046.

However, the Australian administration wishes to emphasize that there is also growing international demand for access to the 399.9-400.05 MHz band for MSS systems utilising direct-to-orbit satellite communications, with Internet-of-Things (IoT) applications that extend beyond scientific applications. Multiple MSS systems have been proposed to the ITU to use the 399.9-400.05 MHz band, and Australia anticipates the deployment of tens of millions of low-power IoT devices to use this band internationally.

Such large numbers of devices will only be possible by introducing an EIRP limit across the *entire* 150 kHz allocated bandwidth, since there are no alternative allocations that support low-power, direct-to-orbit satellite IoT applications.

# 2 Background

With respect to the 399.9-400.05 MHz frequency band, the objective of WRC-19 agenda item 1.2 is to consider establishing in-band power limits applicable to earth station transmissions to ensure the operation of existing and future systems that usually implement low output powers for the MSS.

The 399.9-400.05 MHz frequency band is used for data collection systems (DCS) and data collection platform systems (DCP), for applications commonly referred to as the Internet of Things (IoT). This agenda item was created as a result of the significant recent increase in use of the 399.9-400.05 MHz frequency band for telecommand purposes. The proliferation of such telecommand usage could impact on the planned usage of tens of millions of low power IoT devices communicating to sensitive receivers on non-GSO satellites. With the lack of international frequency allocations available for non-GSO satellite IoT systems to operate, it is important to protect the entire 150 kHz allocated bandwidth.

Direct-to-orbit satellite IoT

The global IoT market is forecast to be enormous due to the tremendous productivity gains promised for various applications across a range of industries. Of special interest are IoT services using IoT devices (also known as data collection platforms) that communicate directly with satellites in low Earth orbit, and do not require any other form of terrestrial hub or gateway. Such direct-to-orbit satellite IoT systems are especially important in regional and remote areas of the world which are unserved by cellular mobile networks. In these areas, low-power IoT devices can provide connections to objects and places of interest which are currently not possible or prohibitively expensive. Applications of direct-to-orbit satellite IoT include the following:

• Environment: Weather monitoring; water flow sensing; oceanography; soil monitoring; natural resource management.

• Agriculture: Water security; livestock tracking; sensor telemetry; soil moisture probes; weather stations; feral animal trapping.

• Resource sector: Asset tracking and monitoring; predictive maintenance; process optimisation.

• Utilities: Smart grid; meter reading; infrastructure management; remote alerts and control.

• Transport and Logistics: Asset tracking and monitoring; end-to-end freight; route planning and optimisation; intelligent transport.

Purpose of EIRP limit

Agenda item 1.2 proposes to introduce an EIRP limit to protect satellite services such as direct-to-orbit IoT from the impact of satellite telecommand using 399.9-400.05 MHz. IoT systems are able to utilise this frequency band with EIRP far less than that used by telecommand. An EIRP limit is required to enable non-GSO satellites to successfully receive low power signals from IoT devices without being affected by higher power terrestrial emissions, such as telecommand. The EIRP limit must be low to enable IoT systems to operate without suffering harmful interference from telecommand.

Benefits of low EIRP

IoT systems benefit when the EIRP limit is lower for several reasons, besides reducing the noise floor. Using a lower EIRP can reduce the size, cost, and complexity of IoT device design, which enables ubiquitous deployment, and provides greater opportunities of IoT applications. There are benefits to the IoT device when either the transmitter gain or power can be reduced.

Minimising transmit power increases battery life, which enables utilisation of a greater number of IoT applications and leads to simpler device design. IoT devices benefit from using minimal transmit power for the following reasons:

• Less requirement to replace batteries - Possible for IoT device to last years in the field without changing batteries.

• Smaller battery capacity requirements - Reduced form factor of IoT device.

• Avoids requirement for external power supply - Decreases complexity, and improves mobility of IoT device.

IoT devices benefit when using lower antenna gain for the following reasons:

• Lower gain requirement can enable smaller antenna to be integrated inside IoT device - Enables more IoT applications.

• Simple non-directional antenna rather than complicated directional antenna - Simplifies deployment.

Suggested EIRP limit 5 dBW

For the frequency range 399.9-400.05 MHz, an EIRP of 5 dBW is sufficient for an IoT device to communicate direct-to-orbit with a satellite below 600 km altitude, for all elevation angles above the horizon.

An EIRP greater than 5 dBW is unnecessary for direct-to-orbit communications in the 399.9-400.05 MHz frequency band for IoT devices. Using more than 5 dBW would unnecessarily decrease battery life of an IoT device, and would increase the noise floor in the 399.9-400.05 MHz frequency band.

399.9-400.05 MHz allocation ideal for satellite IoT

Under RR No. **5.209**, use of the 399.9-400.05 MHz frequency band is limited to non-GSO satellite systems only. As this eliminates the potential for interference from GSO MSS systems, this band is particularly desirable for non-GSO MSS use, such as direct-to-orbit IoT.

The 399.9-400.05 MHz band is one of only two international frequency allocations exclusively available to non-GSO MSS for Earth-to-space communications that is suitable for low-power direct-to-orbit IoT communications. Higher power uses such as TT&C have alternative frequency allocations available. As such, higher power purposes should be prevented, since alternatives are available.

EIRP limit for entire 150 kHz bandwidth

The 399.9-400.05 MHz frequency allocation is the only feasible option for low power IoT satellite systems, with only 150 kHz in total. This 150 kHz must satisfy the entire world’s needs, which is expected to be in the tens of millions of IoT devices. For many IoT applications, there is no alternative solution but employing low power direct-to-orbit satellite communications, therefore it is essential to provide as much bandwidth as available by protecting the entire 399.9-400.05 MHz allocation.

In 2014, there were 7 active ITU filings with MSS assignments over the 399.9-400.05 MHz range, and within five years it increased to 21 filings. This highlights the increase in demand for access to the 399.9-400.05 MHz band for MSS. Due to the lack of suitable international frequency allocations, demand will continue to grow, emphasising the importance of protecting the entire 150 kHz allocation of the scarce 399.9-400.05 MHz band. This is the world’s only spectrum resource for providing low power satellite IoT applications and can’t be compromised by telecommand operations that have other allocations available.

Australia supports Method C for agenda item 1.2, specifically to include an EIRP limit of 5 dBW by adding a new footnote in the band 399.9-400.05 MHz in the Table of Frequency Allocations in RR Article **5**, without breaking it into sub-bands.

# 3 Proposal

Australia proposes the following changes to the RR for this agenda item:

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations  
(See No. 2.1)

MOD AUS/47A2/1#50176

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.B12 | | |

ADD AUS/47A2/2#50177

5.B12 In the frequency band 399.9-400.05 MHz, the maximum e.i.r.p of any emission of the earth stations in the mobile-satellite service shall not exceed 5 dBW in any 4 kHz and maximum e.i.r.p. of each earth station in the mobile-satellite service shall not exceed 5 dBW in the whole 399.9-400.05 MHz frequency band. Until 22 November 2024, this limit shall not apply to satellite systems for which complete notification information has been received by the Radiocommunication Bureau by 22 November 2019 and that have been brought into use by that date. After 22 November 2024 these limits shall apply to all systems within mobile-satellite service operating in this frequency band.     (WRC‑19)

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