# National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service (NOAA/NESDIS) Comments

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Re: International Bureau Seeks Comment on Recommendations Approved by World Radiocommunication Conference Advisory Committee, IB Docket No. 16-185

General Comments Follow;

## Agenda Item 1.2

Studies conducted by NOAA/NESDIS from the end of World Radio Conference-15 until now have shown that interference from high power telecommand signals are incompatible with NOAA Data Collection System (DCS) operations conducted by geostationary (GSO) and non-geostationary (non-GSO) NOAA/NESDIS systems. NOAA/NESDIS DCS currently has tens of thousands of operational transmitters deployed. No comprehensive studies have been conducted to identify feasible mitigation techniques for telecommand signals to protect DCS operations.

***NOAA/NESDIS supports*** ***Method C in the WRC-19 CPM-2 Report for the 399.9-400.05 MHz band and Method E in the WRC-19 CPM-2 Report for the 401-403 MHz band since these are the only method to ensure long-term continuity for the operation of DCS. Noting that NOAA/NESDIS DCS operations have been operational for decades, and Smallsat TT&C operations are relatively recent, and a new application in the subject bands.***

1. The inclusion of a Resolution by FCC is not adequate to protect NOAA DCS systems.
2. The use of telecommand operations within the designated GSO DCS spectrum would make the GSO DCS systems more susceptible to interference from telecommand operations and cause operational failures as GSO satellite have much larger footprints than non-GSO systems and aggregate interference will occur over 1/3 of the Earth.
3. The mitigation technique proposed in the Resolution was not completely or comprehensively studied in the ITU-R Report SA.2430. See summary section C.4 of Annex C of the aforementioned report.
4. The mitigation technique was not agreed by ITU-R Working Party 7B (WP7B). The effectiveness of the mitigation techniques is inconclusive. See ITU-R Report SA.2430 Section 8.3.
5. The Draft New Resolution is not a regulatory proposal to protect the GSO DCS systems, as is the intent of this agenda item, and may be outside the scope of agenda item 1.2. How could it be implemented or enforced? Important technical points:
   1. This 401-403 MHz band is different from Ka band where pencil beams can be used to do arc avoidance.
   2. There isn’t an agreement on whether this is a practical solution when considering aggregate interference.
   3. The example antenna patterns reference in Figures 4 and 5 of ITU-R Report SA.2430 is not recognized in any ITU-R Recommendation. Therefore, this antenna is a specialized case, rather than a typical case to base regulatory standards.
6. The only mitigation technique studied is the use of combined high-gain antenna and orbit avoidance. The only study that considered more than one telecommand Earth station showed that this still does not meet the aggregate interference protection for DCS. See Annex D of ITU-R Report SA.2430.
7. Telecommand operations are violating the DCS protection criteria in Recommendations ITU-R SA.1163-3 and SA.1164-3. The SA.1163-3 has the aggregate interference criteria, showing the protection levels when considering all sources of interference. The interferer needs to proportion the interference criteria, not only within its own network/system but also with other operator’s network/system. Noting there may be thousands of smallsats in orbit contributing to the aggregate interference. Recommendation ITU-R SA.1164-3 contains DCS sharing and coordination protection criteria.
8. Applying limits to most uses of the 401-403 MHz frequency band while allowing telecommand use to continue without limits, using unproven mitigation techniques, may render the 401-403 MHz band unusable for those DCS operations which are subject to the limits. This solution creates an imbalance that was intended to be fixed under agenda item 1.2. The Draft New Resolution proposal takes Agenda Item 1.2 in a direction that may be out of scope of Resolution 765 (WRC-15) and lead to a conclusion that is the opposite of the original intent of this agenda item.

## Specific comments on the WAC proposed AI 1.2 document:

**Document WAC/086 (11.03.19)**

**United States of America**

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.2

**Agenda Item 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)***

**BACKGROUND**: Resolution **765 (WRC-15)** resolves to invite the WRC-19 to take into account the results of ITU-R studies and consider the possibility of establishing in-band power limits for Earth stations in the Earth exploration-satellite service (EESS) and meteorological-satellite service (MetSat) in the frequency bands 401- 403 MHz and in the mobile-satellite service (MSS) frequency band 399.9-400.05 MHz.

Earth stations operating in the EESS and MetSat in the frequency band 401-403 MHz and in the MSS in the frequency band 399.9-400.05 MHz are used for data collection systems (DCS) uplinks. These DCS usually operate most efficiently together by using moderate to low equivalent isotropic radiated power (e.i.r.p) levels, resulting in small link margins.

Recommendation ITU-R SA.2045 provides information on the performance and interference criteria for relevant geostationary-satellite orbit (GSO) and non-geostationary satellite (non-GSO) DCS in the frequency band 401-403 MHz. Recommendation ITU-R SA.2044 provides information on the current and future usage of non-GSO DCS in the frequency band 401-403 MHz and the portioning of the frequency band to allow all DCS equal access to the spectrum. Recommendation ITU-R M.2046 provides a description, and the corresponding protection criteria for broadband noise and narrowband interference, of one MSS system that uses the frequency band 399.9-400.05 MHz (Earth-to-space).

DCS stations are deployed worldwide and communicate with GSO and non-GSO satellites are deployed worldwide for the purpose of collecting essential weather and climate data. The Data Collection Platforms (DCP) gather information activity related to the Earth, environmental and scientific applications, 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. The data collected by DCPs are transmitted to satellites that relay the retrieved information to dedicated earth stations. EESS, MetSat, and MSS systems are necessary for monitoring and predicting climate change and monitoring oceans, weather, and water resources.

There is a growing interest in using these frequency bands for critical satellite telecommand purposes under the EESS, MetSat, and MSS allocations. The output power levels of these Earth stations at the antenna port for telecommand links (Earth-to-space) may be much higher than the typical moderate to low power levels traditionally used for the operation of EESS, MetSat, and MSS DCS systems in the frequency bands 401-403 MHz and 399.9-400.05 MHz.

ITU-R studies are considering (i) in-band power limits for earth stations operating in the frequency ranges 399.9-400.05 MHz in the MSS and 401-403 MHz in the EESS and MetSat services and (ii) potential mitigation measures that, if employed, would allow some satellite telecommand operations to continue indefinitely in both frequency bands.

Proposal:

ARTICLE 5

**Frequency allocations**

**Section IV – Table of Frequency Allocations**

(See No. **2.1**)

**MOD**  **USA/AI 1.2/1**

|  |  |  |
| --- | --- | --- |
| **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.A102 | | |
| **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.B102  5.C102 5.D102  METEOROLOGICAL-SATELLITE (Earth-to-space) ADD 5.B102  5.C102 5.D102  Fixed  Mobile except aeronautical mobile | | |
| **402-403**  METEOROLOGICAL AIDS  EARTH EXPLORATION-SATELLITE (Earth-to-space) ADD 5.B102  5.C102 5.D102  METEOROLOGICAL-SATELLITE (Earth-to-space) ADD 5.B102  5.C102 5.D102  Fixed  Mobile except aeronautical mobile | | |

**Reasons:** Studies have shown that to protect the existing and future operation of DCS in the MSS, EESS, and MetSat services new regulatory provisions are needed to address (i) in-band power limits applicable to Earth stations and (ii) mitigation measures that will allow some satellite telecommand operations continue indefinitely.

**ADD USA/AI 1.2/2**

**5.A102** In the frequency band 399.9-400.03 MHz, the maximum e.i.r.p. transmission at the input of the antenna from any Earth stations (Earth-to-space) in the mobile-satellite service shall not exceed 5 dBW. This limit shall apply after 22 November 2024 for which complete notification information is received by the Radiocommunication Bureau before 22 November 2019. Administrations are encouraged to take all efforts to comply with the maximum e.i.r.p limit in the frequency band 399.9-400.03 MHz prior to 22 November 2024.

**Reason:** Establishes Earth station maximum e.i.r.p. limit to ensure the continued operations of non-GSO data collection systems in the frequency band and permits continued satellite telecommand operations in the 400.03-400.05 MHz segment of the band while protecting DCS.

**USA/AI 1.2/3**

**ADD**

**5.B102** In the frequency band 401-403 MHz, the maximum e.i.r.p. transmission at the input of the antenna from any Earth stations (Earth-to-space) in themeteorological-satellite service and the Earth exploration-satellite service shall not exceed 22 dBW for geostationary-satellite orbit systems and non-geostationary-satellite orbit systems with an orbital apogee equal to or greater than 35 786 km and 7 dBW for non-geostationary-satellite orbit systems with an orbital apogee lower than 35 786 km.

After 22 November 2024, these limits shall apply to all systems, except telecommand systems for which complete notification information has been received by the Radiocommunication Bureau before 22 November 2019 and brought into use before 22 November 2019, in the meteorological-satellite service and the Earth exploration-satellite service operating in this frequency band.

Administrations are encouraged to take all efforts to comply with the maximum e.i.r.p limits in the frequency band 401-403 MHz prior to 22 November 2024.

**Reasons:** Establishes Earth station maximum e.i.r.p. limit to ensure the continued operations of DCS in the frequency band and permits some continued satellite telecommand in the frequency band while protecting DCS.

**ADD USA/AI 1.2/4**

**5.C102** Operations for telecommand in the band 401-403 MHz after 22 November 2024 shall comply with DRAFT NEW RESOLUTION [TBD] (WRC-19).     (WRC‑19)

**Reason:** Provides a new WRC Resolution that would permit some continued satellite telecommand operations in the frequency band while protecting DCS.

**ADD USA/AI 1.2/5**

**5.D102** In the frequency band 401.898-402.522 MHz, the maximum e.i.r.p. transmission at the input of the antenna from Earth stations (Earth-to-space)of associated satellite system for which complete notification information was received by the Radiocommunication Bureau on 28 April 2007 may continue to be used at that permitted level.

**Reasons:** This provision provides flexibility to existing Earth station(s) of the associated non-GSO system, and it ensures the continued operation of this non-GSO DCS.

**ADD USA/AI 1.2/6**

DRAFT NEW RESOLUTION [TBD] (WRC-19)

**Transitional measures for existing satellite networks and systems of the meteorological-satellite service (Earth-to-space) and the Earth exploration-satellite service (Earth-to-space) in the**

**frequency band 401-403 MHz**

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

*considering*

1. that data collection systems (DCS) operate on geostationary and non-geostationary orbits in the meteorological-satellite service (MetSat) and the Earth exploration-satellite service (EESS) (Earth-to-space) systems in the frequency band 401-403 MHz;
2. that DCS are essential for monitoring and predicting climate change, monitoring oceans, and water resources, weather forecasting and assisting in protecting biodiversity and improving maritime security;
3. that the frequency band 401-403 MHz is also used for the uplink of critical mission and telemetry data for meteorological and Earth exploration purposes;
4. that the World Radiocommunication Conference 2019 (WRC-19) has created a 7 dBW eirp limit for all systems in the frequency band 401-403 MHz after 22 November 2024 in No. **5.B102** to provide protection of existing and future DCS;

*noting*

1. that several EESS and MetSat satellite networks and systems in the frequency band 401-403 MHz were notified and brought into use before 22 November 2019;
2. that some of these EESS and MetSat satellite networks and systems, completing operations in *considering c)*, above may not meet the eirp limit in *considering d)*;

*resolves*

that the frequency assignment of MetSat (Earth-to-space) and EESS (Earth-to-space) satellite network in the frequency band 401-403 MHz for which complete notification information was received by the Radiocommunication Bureau prior to the end of WRC-19 and which space stations do not meet the eirp limits stated in No. **5.B102** shall be used on a primary basis with respect to the DCS after 22 November 2024 as stipulated in the Annex to this Resolution;

*instructs the Director of the Radiocommunication Bureau*

for the frequency assignment of MetSat (Earth-to-space) and EESS (Earth-to-space) satellite network for which complete notification information was received by the Radiocommunication Bureau prior to the end of WRC-19, the Bureau shall review the finding under No. **11.50** without proposal to the administration that it submit a new assignment to replace the previous one. The original date of such assignment in the Master International Frequency Register (MIFR) shall be kept.

ANNEX TO draft new   
RESOLUTION [TBD] (WRC-19)

**Transitional measures for existing satellite networks and systems of the meteorological-satellite service (Earth-to-space) and the Earth exploration-satellite service (Earth-to-space) in the**

**frequency band 401-403 MHz**

1 EESS and MetSat satellite networks and systems, falling under *noting b)*, shall implement the following mitigation measures to maintain operations after 22 November 2024.

2 EESS and MetSat satellite networks and systems, falling under *noting b)*, shall only operate in the GSO-only DCS segments of the frequency band 401-403 MHz as outlined in Recommendation ITU-R SA.2045. These segments are 401.2-401.3 MHz, 401.7-401.899 MHz, and 402.067-402.850 MHz.

3 EESS and MetSat satellite networks and systems, falling under *noting b)*, shall employ earth stations with antenna patterns with relative antenna gain pattern masks that achieve compliance with Recommendation ITU-R SA.1163. The earth stations shall avoid pointing at GSO DCS satellites sufficient for the antenna off-axis loss to reduce levels into the GSO DCS receivers to meet the relevant ITU-R thresholds for interference exceedance in Recommendation ITU-R SA.1163. Example antenna patterns are referenced in Figures 4 and 5 in Report ITU-R SA.2430.

**Reasons:** Allows continuation of some satellite telecommand operations in the EESS and MetSat frequency bands, with protection to all DCP operations, after 22 November 2024.

**SUP USA/AI 1.2/7**

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**

**Reasons**: Consequential actions to establishing in-band power limits for Earth stations operating in the mobile-satellite service, the meteorological-satellite service and the Earth-exploration-satellite service in the frequency bands 399.9-400.05 MHz and 401-403 MHz.

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## Agenda Item 1.3

NOAA/NESDIS position is NOC (No Change to Radio Regulations). The GOES networks comply with the US FCC pfd limits, however, they do not meet the proposed ITU-R limits. The non-GSO systems have a significant difference between the spreading loss and non-GSO antenna gain towards earth stations with elevation angles of 0 degrees and 90 degrees, whereas the GSO systems have much less of a difference. The EESS service for both GSO and non-GSO is currently a secondary service.

## Agenda Item 1.13

Document 172A1 states that “The FCC also seeks comment on the attached draft proposals that have been provided by the WAC for information as they did not reach full consensus by the membership (Attachment B),” however, Attachment A also contains text for Agenda Item 1.13 where full consensus was not reached for the 43.5 - 47.2 GHz and 50.4 – 52.6 GHz bands.

On page 38 of Document DA-19-172A2, View A for the 50.4-52.6 GHz band suggests that RR 5.340.1 means no protection for EESS (passive) is necessary, however, “should not impose undue constraints” does not mean that no protection should be provided to the EESS (passive) services. Additionally, there is no current IMT identification in the 50.4-52.6 GHz band. Although page 38 states, “With respect to the EESS (passive), Radio Regulations No. 5.340.1 applies,” it may not apply with respect to IMT-2020, which is a new application in the band.

NOAA/NESDIS cannot overstate the importance of the adjacent passive sensing bands between 52.6-55.78 GHz for its mission to protect lives and livelihoods. Current assets in orbit – constituting tens of billions of dollars in taxpayer investment -- use exceedingly sensitive instrumentation that can easily be inundated with out-of-band emissions. These instruments sense physical phenomena and are not capable of relocating to other spectrum equities.

NOAA/NESDIS supports View B, with respect to the concern for the EESS (passive) protection and NOC with respect to this frequency range.

## Agenda Item 9.1.9

Page 24 contains updates to Resolution 750 Table 1-1, however, it does not include the entire 51.4-52.4 GHz band. No studies were conducted to assess whether the limit should only apply to 52.1-52.4 GHz band, the nearest 300 MHz.

## General Comments

Several of the edits to the Radio Regulations are not shown with track changes.

Page 19 of Attachment A, Appendix 5 contains blank MS Word equation boxes.

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