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| **34 MEETING OF PERMANENT**  **CONSULTATIVE COMMITTEE II:**  **RADIOCOMMUNICATIONS**  **August 12 to 16, 2019**  **Ottawa, Ontario, Canada** | | **OEA/Ser.L/XVII.4.2.34**  **CCP.II-RADIO/doc. /19**  **19 July 2019**  **Original: English** | |
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|  | **PRELIMINARY PROPOSAL FOR WRC-19 ON AGENDA ITEM 10: Inter-satellite Links** | |
|  | **(Item on the Agenda: 3.1)** | |
|  | **(Document submitted by the delegation of the United States of America)** | |

**Introduction**

WRC-19 agenda item 10, recommends to Council items to include in the agenda for the next WRC, and to give its views on the preliminary agenda for the subsequent conference and on possible items for future conferences, in accordance with Article 7 of the Convention. For this agenda item, the United States offers to CITEL PCC.II the included preliminary proposal for the WRC-23 agenda to consider, on the basis of ITU-R studies, to identify the cases and regulatory conditions under which space-to-space transmissions in the same direction (Earth-to-space or space-to-Earth) as the current satellite service allocations, between non-geostationary orbit (non-GSO) space stations at different orbital altitudes or between non-GSO and geostationary orbit (GSO) space stations may be accommodated by new inter-satellite service (ISS) allocations in certain frequency bands currently allocated to the fixed-satellite service and mobile-satellite service, while ensuring the protection of existing services and their future development.

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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 24 to Document xxx-E** |
|  | **19 July 2019** |
|  | **Original: English** |
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| United States of America | |
| Proposals for the work of the conference | |
|  | |
| Agenda item 10 | |

10to recommend to the Council items for inclusion in the agenda for the next WRC, and to give its views on the preliminary agenda for the subsequent conference and on possible agenda items for future conferences, in accordance with Article 7 of the Convention,

**BACKGROUND INFORMATION**:

Space station operations in low-Earth orbit are increasing at a rapid rate for scientific, academic and commercial purposes from the many civil space agencies around the World to commercial entities and academic institutions. They vary in size from as large as the International Space Station to as small as single unit cubesats and have widely ranging data requirements. All of these systems have one thing in common, however, the need to get data down to Earth in an efficient and cost-effective manner and similarly to receive telecommand information in an equal manner. Telecommunications satellites offer a ready means to fulfill this need as preliminary studies in Working Parties 4A and 4C have shown. What is lacking, however, is the regulatory recognition for the inter-satellite links (ISL) that would allow telecommunications satellites to fill that need. Regulatory recognition for these ISL’s could be achieved through the adoption of an inter-satellite service (ISS) allocation within existing satellite service allocations such as with the fixed-satellite service (FSS) and mobile-satellite service (MSS). Currently such support in FSS and MSS allocations is only possible under No. **4.4**.

Article **1** of the Radio Regulations defines the inter-satellite service as follows:

**1.22** *Inter-satellite service:* A *radiocommunication service* providing links between artificial *satellites*.

The possibility for inter-satellite links seems particularly reasonable for links between a non-GSO space station and a geostationary orbit space station or between two non-geostationary orbit (non-GSO) space stations at different orbital altitudes, where the inter-satellite link is being transmitted in the same general direction (e.g., Earth-to-space or space-to-Earth) within the receive or transmit beam of the higher orbital altitude space station, and the lower orbital altitude space station operates with technical parameters that make its operation identical, or substantially similar, to earth stations (or mobile earth stations) operating within the higher orbital altitude space station receive or transmit beam for either FSS or MSS.

**PROPOSAL:**

Because frequency bands allocated to the FSS and MSS are used for links between space stations and earth stations (or mobile earth stations), it is necessary to analyze the use of the same bands for satellite-to-satellite links to ensure compatibility and avoid harmful interference to existing services. The sharing scenario is likely to differ as the orbital characteristics of the linked satellites vary.

**Proposals:**

**MOD USA/10/[ISL-1]**

RESOLUTION 810 (WRC‑19)

**Agenda for the 2023 World Radiocommunication Conference**

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

\* \* \*

*resolves to give the view*

that the following items should be included in the agenda for WRC-23:

\* \* \*

2 on the basis of proposals from administrations and the Report of the Conference Preparatory Meeting, and taking account of the results of WRC-19, to consider and take appropriate action in respect of the following items:

\* \* \*

* 1. to consider additional allocations and regulatory conditions for the inter-satellite service (ISS), under which space-to-space transmissions in the same direction (Earth-to-space or space-to-Earth) as the current fixed and mobile satellite service allocations, between non-geostationary orbit (non-GSO) space stations at different orbital altitudes or between non-GSO and geostationary orbit (GSO) space stations may be accommodated, in accordance with Resolution [**A10-ISL] (WRC-19)**;

\* \* \*

**ADD USA/10/[ISL-2]**

draft new RESOLUTION [A10-FSS-ISL] (WRC‑19)

**Study of technical, operational issues, and regulatory provisions for additional inter-satellite service allocations for the transmissions between non-geostationary orbit space stations and non-geostationary or geostationary orbit space stations at different orbital altitudes in the frequency range 1 525 MHz – 50.2 GHz**

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

*considering*

*a)* that the definition of inter-satellite service (ISS) in No. **1.22** of the Radio Regulations includes only links between space stations;

*b)* that of using the frequency bands allocated to the FSS (Earth-to-space) and MSS (Earth-to-space) for transmissions in the Earth-to-space direction from non-geostationary orbit (non-GSO) satellites toward FSS satellites operating in higher orbital altitudes including geostationary orbit (GSO) may increase spectral efficiency in these frequency bands;

*c)* that using frequency bands allocated to the FSS (space-to-Earth) and MSS (space-to-Earth)for transmissions in the space-to-Earth direction from FSS satellites operating in higher orbital altitudes including the GSO toward non-GSO satellites may increase spectral efficiency in these frequency bands ;

*d)* that most allocations to the fixed-satellite and mobile satellite service include a space-to-Earth or Earth-to-space direction indicator,

*e)* that it is technically feasible for a lower orbital altitude non-GSO satellite station to transmit data to and receive data from a higher orbital altitude non-GSO or GSO satellite when passing within the satellite antenna coverage beam that is directed toward the Earth,

*recognizing*

*a)* that it is necessary to study the potential impact to other services in the frequency bands allocated to the fixed-satellite and mobile satellite service , taking into account applicable footnotes, for transmissions in the Earth-to-space direction from non-GSO satellites toward GSO space stations and non-GSO space stations at higher orbital altitudes, to ensure compatibility with all allocated services in these bands and avoid harmful interference;

*b)* that it is necessary to study whether space-to-Earth direction transmissions from space stations in higher orbital altitudes, including GSO satellites, can be successfully received by lower orbital altitude non-GSO satellites, without imposing any additional constraints on all allocated services in these bands;

*c)* that the sharing scenario is likely to vary widely because of the wide variety of orbital characteristics of the non-GSO satellites;

*d)* that out-of-band emissions, signals due to antenna pattern sidelobes, reflections from receiving space stations, and in-band unintentional radiation due to doppler shifts, may impact services operating in the same and adjacent bands,

*e)* that No. **22.2** applies to the 19.7-20.2 GHz and 29.5-30 GHz bands, in which the mobile-satellite service (MSS) has a co-primary allocation in Region 2 and in the 20.1-20.2 GHz and 29.9-30 GHz portions of the bands in Regions 1 and 3;

*f)* that the use by a non-allocated space service of frequency bands allocated to another space service under No. **4.4** of the Radio Regulations, without recognition and on a non-harmful interference/non-protected basis, is being made today,

*recognizing further*

*a)* that use of bands by the mobile-satellite service in the frequency range 1-3 GHz are subject to existing Resolutions, coordination requirements and country footnotes taking into account, in particular, the protection of safety and aeronautical mobile-satellite (R) services, and of the Global Maritime Distress and Safety System;

*b)* that the use of the frequency bands 27.5-28.6 GHz and 29.5-30 GHz by the non-GSO FSS is subject to the application of the provisions of Nos. **5.484A**, **22.5C** and **22.5I**;

*c)* that use of the frequency band 28.6-29.1 GHz by geostationary and non-geostationary fixed-satellite service networks is subject to the application of the provisions of No. **9.11A**, and No. **22.2** does not apply (see No. **5.523A**);

*d)* that use of the frequency band 29.1-29.5 GHz (Earth-to-space) by the fixed-satellite

service is limited to geostationary-satellite systems and feeder links to non-geostationary satellite

systems in the mobile-satellite service, and that such use is subject to the application of the provisions of No. **9.11A**, but not subject to the provisions of No. **22.2**, except as indicated in Nos. **5.523C** and **5.523E**, where such use is not subject to the provisions of No. **9.11A** and shall continue to be subject to Articles **9** (except No. **9.11A**) and **11** procedures, and to the provisions of No. **22.2** (see No. **5.535A**);

*e)* that the frequency band 27.5-30 GHz may be used by the fixed-satellite service (Earth-to-space) for the provision of feeder links for the broadcasting-satellite service (see No. **5.539**);

*f)* that feeder links of non-geostationary networks in the mobile-satellite service and

geostationary networks in the fixed-satellite service operating in the frequency band 29.1-29.5 GHz (Earth-to-space) shall employ uplink adaptive power control or other methods of fade compensation, such that the earth station transmissions shall be conducted at the power level required to meet the desired link performance while reducing the level of mutual interference between both networks (see No. **5.541A**);

*g)* that the fixed and mobile services are allocated on a primary basis in the frequency bands 27.5-30 GHz, 47.2 – 50.2 GHz, and 50.4 – 51.4 GHz on a global basis;

*h)* that the frequency band 48.94-49.04 GHz is allocated to the radio astronomy service on a primary basis and that RR **5.340** specifies that all emissions are prohibited in this band from airborne stations;

*i*) that the frequency band 50.2-50.4 GHz is allocated to the Earth exploration-satellite service (passive) and space research service (passive) on a primary basis with relevant provision RR No. **5.340, 5.340.1**, and the conditions to protect the EESS (passive) from existing and planned fixed-satellite service operations are described in Resolution **750** (Rev. WRC-15);

*j)* that the frequency band 29.5-30 GHz (Earth-to-space) is also allocated to the mobile-satellite service on a primary basis in 29.5-30 GHz in Region 2, on a primary basis in 29.9-30 GHz in Regions 1 and 3, and on a secondary basis in Regions 1 and 3 in 29.5-29.9 GHz;

*k)* that use of bands 17.7-20.2 GHz, and 37.5-42 GHz by the fixed-satellite service are subject to existing RR footnotes, Resolutions, coordination requirements and country footnotes,

*resolves to invite ITU-R*

1 to conduct the appropriate studies to determine the spectrum needs for additional inter-satellite service allocations in the frequency bands given in *resolves* 2, taking into account various scenarios envisaged for these space-to-space transmissions and the related data traffic requirements;

2 to conduct and complete in time for WRC-23, the appropriate sharing and compatibility studies, taking into account the protection of services to which the band is allocated on a primary basis, for inter-satellite service operations in the same directionality (see *considering d*) ) as existing satellite services for the frequency bands:

* 1525-1544 MHz, 1545-1559 MHz, 1610-1660.5 MHz, 2483.5-2500 MHz, 17.7-20.2 GHz, 28.6-30 GHz, 40-42 GHz, and 48.2-50.2 GHz;

3 to develop, for different types of non-GSO space stations and different portions of the

frequency bands studied, technical conditions and regulatory provisions for their operation in the frequency bands studied under *resolves* 2, including possible new inter-satellite service allocations to potentially accommodate directional space-to-space use, as appropriate, taking into account the results of the studies above,

*invites administrations*

to participate in the studies and to provide input contributions,

*resolves to invite the 2023 World Radiocommunication Conference*

to consider the results of the above studies and take necessary regulatory actions, as appropriate.

**ATTACHMENT**

**PROPOSAL FOR FUTURE AGENDA ITEM FOR WRC-23**

**Subject:** Proposed Future WRC Agenda Item for WRC-2023 to consider additional allocations to the inter-satellite service based on the results of studies on the compatibility of lower orbital altitude non-GSO satellite-to-higher orbital altitude non-GSO and GSO satellite links, in the Earth-to-space and space-to Earth directions, and with other services allocated to the bands.

**Origin**: United States of America

***Proposal:***

To consider additional allocations and regulatory conditions for the inter-satellite service (ISS), under which space-to-space transmissions in the same direction (Earth-to-space or space-to-Earth) as the current fixed and mobile satellite service allocations, between non-geostationary orbit (non-GSO) space stations at different orbital altitudes or between non-GSO and geostationary orbit (GSO) space stations may be accommodated, in accordance with Resolution [A10-ISL] (WRC-19).

***Background/reason:***

To provide a means for recognizing in the Radio Regulations space-to-space transmissions in the Earth-to-space and space-to-Earth directions between non-GSO space stations, and non-GSO and geostationary orbit space stations, at different orbital altitudes in specified frequency bands allocated to the fixed-satellite service and mobile-satellite service where conditions of avoiding interference with existing systems are met.

***Radiocommunication services concerned:***

Aeronautical Radionavigation, Broadcasting-Satellite, Earth Exploration Satellite, Fixed, Fixed-Satellite, Meteorological Aids, Meteorological-Satellite, Mobile, Mobile Satellite, Radio Astronomy, Radiodetermination-Satellite, Radionavigation-Satellite, Radiolocation, Space Operation, Space Research.

***Indication of possible difficulties:***  None foreseen

***Previous/ongoing studies on the issue:*** Studies have been initiated in Working Party 4A and WP4C during the 2016-2019 ITU-R Study Cycle

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| ***Studies to be carried out by:*** ITU-R Study Group 4 | *with the participation of:*  SGs 5 and 7 |

***ITU-R Study Groups concerned:*** SG 5 and SG 7

***ITU resource implications, including financial implications (refer to CV126):*** Minimal

***Common regional proposal:*** Yes/No ***Multicountry proposal:*** Yes/No

*Number of countries:*

***Remarks***