
PLENARY MEETING

**Addendum 16 to
Document 6453(Add.24)-
E
10 September 2019
Original: English**

Member States of the Inter-American Telecommunication Commission (CITEL)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 10

{Temporary information note to be deleted before the submission via CPI of this document to the WRC-19 Secretariat: In accordance with Resolution 804 (Rev. WRC-12), Administrations are invited to use the template provided in Annex 2 to that Resolution (TIES-protected) when proposing agenda items for WRCs. This template may be filled out for each of the proposed WRC agenda item and annexed to this document.}

10 to 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

CITEL has identified a need for a WRC-23 agenda item to consider regulatory measures to enable inter-satellite links in various frequency bands.

The need for inter-satellite links has been identified to address two major issues.

Issue A:

Doc 5079

Inexpensive optical sensors can now capture imagery of extremely fine spatial and spectral resolution, while advances in synthetic aperture radar (SAR) enable satellites to image both at night and through cloud coverage. Both techniques can generate massive amounts of data with each pass. SAR satellites, for example, generate massive amounts of information, growing from 85 Mbps in

1995¹ to 1.5 Gbps today.² While their data rates are not as large as imaging satellites, satellites servicing tracking protocols like AIS, ADS-B, and GNSS-RO/R are more reliant on low-latency to deliver value to their stakeholders. These new capabilities of increased payload data intensity and very low latency data delivery presents a growing challenge for satellites.

Due to frequency crowding and the geographical constraints of where they can downlink, both imaging and tracking satellites struggle to offload their increasing volume of data in a punctual and efficient way. The resulting limited connectivity creates a downlink bottleneck that severely limits satellite utilization, handicapping operators' ability to provide truly actionable information to public and private stakeholders.

Inter-Satellite Links ("ISLs") ease this problem in addition to improving data delivery through network efficiencies. Allowing ISLs in bands already accommodating space-Earth downlinks would increase spectrum efficiency by streamlining data into continuous ground station access networks. Instead of relying on orbital timing to communicate with satellites, ISL-enabled operators could interface with their satellites and their tracking data instantaneously. Communications technology advancements in deployable high-gain antennas, computer miniaturization, and Software-defined Radio (SDR) proliferation have made ISLs a commercially viable method that entities are actively exploring. Even though ISLs are capable of improving data transfer and easing frequency crowding, there is a lack of allocations that allow ISL in bands below 12.2 GHz that could be used by satellites. The frequency bands below 12.2 GHz are specifically of interest to support ISL for small satellites, though it is understood that the spectrum is heavily used by other services.

In order to resolve how much spectrum may be required, it is important to comprehend the difference between cross-constellation data handover and inter-constellation data relays. The former relates to the handoff of data from one constellation focused on gathering data, say from earth imaging, to a second constellation that focuses on relaying the data to earth. Such a handoff may not require a large amount of spectrum due to the limited number of satellites offloading their data to a single satellite in the relay constellation. The handoff of data between existing networks is more likely to occur at lower frequency ranges while daisy-chaining that data through the relay network is more likely to occur at higher bandwidths due to the increased spectrum requirement.

Issue B:

doc 5045

As reported by the Director of the Radiocommunication Bureau to the final CPM for WRC-19, since 2014, there have been 27 submissions of advance publication information for non-GSO satellite systems under No. 4.4 of the Radio Regulations specifying use by a non-allocated space service of frequency bands allocated to another space service. See Document CPM19-2/017, at Section 3.1.3.2 (Preliminary Draft Report of the Director to WRC-19 on Activities of the Radiocommunication Sector). Notification information was subsequently filed for frequency assignments to 3 of these systems. The Director's draft report states that "[n]one of these frequency assignments was reported to the BR as causing harmful interference to any service of another administration." Document CPM19-2/017, at Section 3.1.3.2

¹ Alaska SAR Facility. RADARSAT-1 Standard Beam SAR Images - National Snow and Ice, Geophysical Institute - University of Alaska Fairbanks, 1999.

² Amelung F. NISAR Science Users' Handbook, National Aeronautics and Space Administration, 2018.

The challenge comes, as the Director of the Radiocommunication Bureau has acknowledged, in finding a path to recognition in the Radio Regulations for such uses, where possible, based on the technical conditions derived from ITU-R studies. Because frequency bands allocated to the fixed-satellite service and mobile-satellite service are used for links between space stations and 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. The sharing scenario is likely to differ compared to the current use of these bands for space-to-Earth and Earth-to-space transmissions.

Preliminary ITU-R studies conducted in Working Party 4A have identified factors to be considered in assessing the compatibility of non-GSO satellite-to-GSO satellite links, in the Earth-to-space direction in the 27.5 – 30 GHz frequency band and space-to-Earth in frequency bands 17.7-20.2 GHz, with other FSS operations and other services. Further, at least one satellite operator has sought to operate non-GSO satellite-to-GSO satellite links in the 47.2-50.2 GHz and 50.4-51.4 GHz frequency bands. Preliminary ITU-R studies conducted in Working Party 4C have identified factors to be considered in assessing the compatibility of non-geostationary satellites operating space-to-space links in MSS allocations in the 1-3 GHz range, with other MSS operations and other services. Continued development and completion of these studies to include non-GSO satellite-to-satellite links will permit the development of appropriate ITU-R regulatory text to define the cases in which such transmissions may be provided, and allow for a determination of whether the recognition of compatible links can be made via appropriate modifications to the studied FSS and MSS allocations in Article 5.

A broad ITU-R led reexamination of which bands could accommodate an additional ISL allocation would deliver regulatory efficiency and clarity.

ADD IAP/6453A24A16/1

DRAFT NEW RESOLUTION [IAP/10(P)-2023] (WRC-19)

Agenda for the 2023 World Radiocommunication Conference

The World Radiocommunication Conference (Geneva, 2015),

considering

- a) that, in accordance with No. 118 of the ITU Convention, the general scope of the agenda for a world radiocommunication conference should be established four to six years in advance and that a final agenda shall be established by the Council two years before the conference;
- b) Article 13 of the ITU Constitution relating to the competence and scheduling of world radiocommunication conferences and Article 7 of the Convention relating to their agendas;
- c) the relevant resolutions and recommendations of previous world administrative radio conferences (WARCs) and world radiocommunication conferences (WRCs),

resolves

to recommend to the Council that a world radiocommunication conference be held in 2023 for a maximum period of four weeks, with the following agenda:

1 on the basis of proposals from administrations, taking account of the results of WRC-19 and the Report of the Conference Preparatory Meeting, and with due regard to the requirements of existing and future services in the bands under consideration, to consider and take appropriate action in respect of the following items:

(...)

[Space-to-Space]]to determine and carry out, on the basis of the ITU-R studies in accordance with Resolution [IAP/10(P)/SAT-TO-SAT] (WRC-23), the appropriate regulatory actions for the provision of inter-satellite links in specific frequency bands, or portions thereof, either by adding a space-to-space directionality to an existing satellite service allocation, or by adding an inter-satellite service allocation where appropriate;

(...)

resolves further

to activate the Conference Preparatory Meeting,

invites the Council

to finalize the agenda and arrange for the convening of WRC-23, and to initiate as soon as possible the necessary consultations with Member States,

instructs the Director of the Radiocommunication Bureau

to make the necessary arrangements to convene meetings of the Conference Preparatory Meeting and to prepare a report to WRC-23,

instructs the Secretary-General

to communicate this Resolution to international and regional organizations concerned.

Reasons:

ADD IAP/6453A24A16/2

DRAFT NEW RESOLUTION [IAP/10(P)/SAT-TO-SAT] (WRC-19)

TBD

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

considering

- a) that 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 and MSS satellites operating in higher orbital altitudes, including geostationary orbit (GSO), may increase spectral efficiency in these frequency bands;
- b) 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 and MSS satellites operating in higher orbital altitudes, including the GSO, toward non-GSO satellites may increase spectral efficiency in these frequency bands ;
- c) that several satellite systems have been relying on satellite-to-satellite communication in existing satellite bands under RR No. 4.4 and such reliance on No. 4.4 does not provide a sound basis for continued development of such systems nor the confidence in commercial viability and availability of the service to the end users;
- d) that there is growing interest for utilizing space-to-space satellite links for a variety of applications,

recognizing

- a) that the ITU-R is currently studying space-to-space links in both the mobile satellite service and the fixed satellite service
- b) that the ITU-R has begun preliminary studies on the technical and operational issues associated with the potential use of non-GSO satellites transmitting toward the GSO in the 27.5-30 GHz FSS band, and that such studies are expected to continue after WRC-19
- c) that the ITU-R has begun preliminary studies on the technical and operational issues associated with the use of non-GSO satellites communicating with GSO MSS satellites in the bands 1 518-1 559 MHz, 1 610-1 626.5 MHz, 1 626.5-1 660.5 MHz, 1 668-1 675 MHz, and 2483.5-2500 MHz and that such studies are expected to continue in this band and other bands after WRC-19,
- 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 further

- a) 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 operating in the same bands;
- b) that the sharing scenario is likely to differ as the orbital characteristics of the non-GSO satellites vary;
- c) the need to protect existing services when considering frequency bands for possible allocations to any service;
- d) that precedent for space-to-space links sharing with Earth-to-space and space-to-Earth exists for Space Operation, Earth Exploration-Satellite and Space Research in the frequency bands 2 025-2 110 MHz, and 2 200-2 290 MHz through the inclusion of a space-to-space allocation,
- e) that the allotments of the Appendix 30B Plan, assignments in the Plans and the List subject to Appendix 30 and 30A and assignments in the Appendix 30B List must be protected;
- f) 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,
- g) 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;
- h) that the use of the frequency bands 27.5-28.6 GHz and 29.5-30 GHz by non-geostationary fixed-satellite service systems is subject to the application of the provisions of Nos. 5.484A, 22.5C and 22.5I;
- i) 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 (No. 5.523A);
- j) 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 (No. 5.535A);
- k) 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 (No. 5.539);
- l) 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 (No. 5.541A);

m) that the frequency band 28.5-29.5 GHz (Earth-to-space) is also allocated to the Earth exploration-satellite service on a secondary basis, and no additional constraints should be imposed on the EESS;

n) 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;

o) that the frequency bands 47.2-47.5 and 47.9-48.2 GHz are allocated on a primary basis to the fixed service and designated for use by high altitude platform stations, subject to the provisions of Resolution 122 (Rev. WRC-07);

p) that the frequency bands 47.2-50.2 GHz and 50.4-51.4 GHz are also allocated on a primary basis to the fixed and mobile services,

resolves to invite ITU-R

to conduct and complete in time for the 2023 World Radiocommunication Conference:

1 studies of the technical and operational characteristics and user requirements of different types of non-GSO space stations that plan transmissions to non-GSO FSS space stations, and to GSO FSS space stations in the same direction as existing satellite services in the frequency bands:

3 400-3 740, 4500 - 4800, 6 700-7 075 MHz, 10.7-12.2, 17.7-20.2, 27.5-30, 40-42, 47.2-50.2, and 50.4-51.4 GHz

2 the appropriate sharing and compatibility studies, taking into account the protection of services to which the band is allocated on a primary basis, between inter-satellite links described in *resolves 1* and existing services allocated in the same frequency bands as included in *resolves 1*

3 studies of the technical and operational characteristics and user requirements of different types of non-GSO space stations that plan transmissions to non-GSO MSS space stations, and to GSO MSS space stations in the same direction as existing satellite services, in the frequency bands:

1525-1559, 1610-1626.5, 1626.5-1660.5, 1668-1670, 2160-2200, 2483.5-2500 MHz

4 the appropriate sharing and compatibility studies, taking into account the protection of services to which the band is allocated on a primary basis, between inter-satellite links described in *resolves 3* and existing services allocated in the same frequency bands as included in *resolves 3*

5 studies of the technical and operational characteristics and user requirements of different types of non-GSO EESS or meteorological satellite service space stations that plan transmissions between non-GSO space stations in the frequency bands:

1670-1675, 1675-1710, 8025-8400 MHz

6 the appropriate sharing and compatibility studies, taking into account the protection of services to which the band is allocated on a primary basis, between inter-satellite links described in *resolves 5* and existing services allocated in the same frequency bands as included in *resolves 5*

7 to develop, based on the results of the studies above in the frequency bands, or portions thereof, technical conditions and regulatory provisions for operation of inter-satellite links, including the addition of a space-to-space direction indicator to existing satellite allocations or a new inter-satellite service allocation as appropriate;

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.

Reasons: