# UNITED STATES OF AMERICA

# DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

**AGENDA ITEM 1.6**: *to consider the development of a regulatory framework for non-GSO FSS satellite systems that may operate in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space‑to‑Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), in accordance with Resolution* ***159 (WRC-15);***

**BACKGROUND INFORMATION**:

Article **22** of the Radio Regulations contains provisions to ensure compatibility of non-GSO FSS operations with GSO networks. There are currently no defined technical provisions for sharing between non-GSO systems and GSO networks in the 50/40 GHz frequency bands. Moreover, there are no existing mechanisms in the RR establishing coordination procedures applicable to non-GSO systems operating within the FSS allocations in frequency bands in the 37.5 to 51.4 GHz range, such as application of RR No. **9.12**. This also contributes to uncertainty among potential operators of non-GSO satellite systems in these bands.

To address these issues, WRC-15 established agenda item 1.6 for WRC-19: “to consider the development of a regulatory framework for non-GSO FSS satellite systems that may operate in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space),in accordance with Resolution **159 (WRC-15)**” which invites the ITU-R membership to contribute to “Studies of technical, operational issues and regulatory provisions for non-GSO fixed-satellite services satellite systems in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space).”

Non-GSO FSS systems in the 50/40 GHz band can be utilized to unlock a new and promising source of global broadband communications. Recent advances in satellite design, launch service capabilities and user terminal technology make it feasible to provide global satellite broadband services. Thanks to these recent technological advances, next-generation non-GSO satellite systems are currently being developed. These systems can greatly enhance the efficient use of existing FSS spectrum by using next-generation satellite and earth station technology. The benefits of such non-GSO satellite systems include providing worldwide connectivity and high-quality communication services to users in all geographic settings, be they urban, rural or remote, and offer tools for definitively addressing the longstanding broadband gap. Developing a regulatory framework in the 50/40 GHz band will provide regulatory certainty to allow non-GSO satellite systems to efficiently operate in these existing FSS frequency bands.

ITU-R studies have concluded that sharing between non-GSO and GSO FSS systems is possible in these frequency bands. ITU-R Working Party 4A has also been working on the development of a new Recommendation to identify means and a methodology to define a protection criteria for sharing by FSS systems in the 50/40 GHz bands. The methodology in this Recommendation and proposed protection criteria considers both the short term performance objectives and long term time-average bandwidth efficiency to enable use of these frequency bands by non-GSO FSS systems that will ensure protection of GSO FSS networks. ITU-R studies have confirmed that the application of the procedures in the new Recommendation allows for flexibility in the design and operation of non-GSO systems, while fully protecting GSO operations, therefore significantly enhancing spectrum efficiency for FSS networks in the 50/40 GHz bands.

During its meeting in July, 2018, WP4A finalized four methods in the CPM report as a potential solution for WRC-19 AI 1.6. All four methods propose a similar approach to address issues related to non-GSO and GSO sharing including a regulatory framework based upon a single entry and aggregate allowance of unavailability and time-average bandwidth efficiency and a resolution to track aggregate effects from multiple NGSO system to ensure GSO protections. All four methods also propose a modification to Article 9 to address coordination for NGSO systems in the 50/40 GHz bands. Regarding protections of EESS (passive) and modifications to Resolution **750 (Rev. WRC-15)**, the four methods present a range of options for protections of EESS (passive) systems in the 50.2-50.4 GHz bands.

This proposal presents a regulatory solution for providing certainty and technical provisions to allow for sharing between non-GSO and GSO systems and for protection of EESS (passive) systems under WRC-19 AI 1.6. This proposal has been developed based on sharing study results in ITU-R WP4A to identify a methodology to allow for maximum spectrum efficiency for both non-GSO and GSO FSS systems, while providing for protections for operations of GSO FSS systems from operations of non-GSO networks. Additionally, this proposal provides a regulatory solution to ensure that aggregate emissions from operating non-GSO networks do not exceed aggregate protection requirements of GSO FSS systems. This proposal tracks closely with Method A in the draft CPM report from the July, 2018 meeting of ITU-R WP4A as contained in Annex 29 of the WP4A chairman’s report (4A/826).

**Proposal:**

ARTICLE 5

**Frequency allocations**

**Section IV – Table of Frequency Allocations**

**MOD USA/1.6/1**

|  |  |  |
| --- | --- | --- |
| 34.2-40 GHz | | |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 37.5-38 FIXED  FIXED-SATELLITE (space-to-Earth) **ADD 5.A16**  MOBILE except aeronautical mobile  SPACE RESEARCH (space-to-Earth)  Earth exploration-satellite (space-to-Earth)  5.547 | | |
| 38-39.5 FIXED  FIXED-SATELLITE (space-to-Earth) **ADD 5.A16**  MOBILE  Earth exploration-satellite (space-to-Earth)  5.547 | | |
| 39.5-40 FIXED  FIXED-SATELLITE (space-to-Earth) 5.516B **ADD 5.A16**  MOBILE  MOBILE-SATELLITE (space-to-Earth) **ADD 5.B16**  Earth exploration-satellite (space-to-Earth)  5.547 | | |

|  |  |  |
| --- | --- | --- |
| 40-47.5 GHz | | |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 40-40.5 EARTH EXPLORATION-SATELLITE (Earth-to-space)  FIXED  FIXED-SATELLITE (space-to-Earth) 5.516B **ADD 5.A16**  MOBILE  MOBILE-SATELLITE (space-to-Earth) **ADD 5.B16**  SPACE RESEARCH (Earth-to-space)  Earth exploration-satellite (space-to-Earth) | | |
| 40.5-41  FIXED  FIXED-SATELLITE  (space-to-Earth) ADD 5.484A **ADD 5.A16**  BROADCASTING  BROADCASTING-SATELLITE  Mobile  5.547 | 40.5-41  FIXED  FIXED-SATELLITE  (space-to-Earth) 5.516B **ADD 5.A16**  BROADCASTING  BROADCASTING-SATELLITE  Mobile  Mobile-satellite (space-to-Earth)  5.547 | 40.5-41  FIXED  FIXED-SATELLITE  (space-to-Earth) **ADD 5.A16**  BROADCASTING  BROADCASTING-SATELLITE  Mobile  5.547 |
| 41-42.5 FIXED  FIXED-SATELLITE (space-to-Earth) 5.516B **ADD 5.A16**  BROADCASTING  BROADCASTING-SATELLITE  Mobile  5.547 5.551F 5.551H 5.551I | | |
| 47.2-47.5 FIXED  FIXED-SATELLITE (Earth-to-space) 5.552 **ADD 5.A16**  MOBILE  5.552A | | |

|  |  |  |
| --- | --- | --- |
| 47.5-51.4 GHz | | |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 47.5-47.9  FIXED  FIXED-SATELLITE (Earth-to-space) 5.552 **ADD 5.A16** (space-to-Earth) 5.516B 5.554A  MOBILE | 47.5-47.9  FIXED  FIXED-SATELLITE (Earth-to-space) 5.552 **ADD 5.A16**  MOBILE | |
| 47.9-48.2 FIXED  FIXED-SATELLITE (Earth-to-space) 5.552 **ADD 5.A16**  MOBILE  5.552A | | |
| 48.2-48.54  FIXED  FIXED-SATELLITE (Earth-to-space) 5.552 **ADD 5.A16** (space-to-Earth) 5.516B 5.554A 5.555B  MOBILE | 48.2-50.2  FIXED  FIXED-SATELLITE (Earth-to-space) 5.516B 5.338A 5.552 **ADD 5.A16**  MOBILE | |
| 48.54-49.44  FIXED  FIXED-SATELLITE (Earth-to-space) 5.552 **ADD 5.A16**  MOBILE  5.149 5.340 5.555 |  | |
| 49.44-50.2  FIXED  FIXED-SATELLITE (Earth-to-space) 5.338A 5.552 **ADD 5.A16** (space-to-Earth) 5.516B 5.554A 5.555B  MOBILE | 5.149 5.340 5.555 | |
| 50.4-51.4 FIXED  FIXED-SATELLITE (Earth-to-space) 5.338A **ADD 5.A16** MOBILE  Mobile-satellite (Earth-to-space) | | |

ADD

5.A16The use of the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space‑to‑Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) by a non‑geostationary‑satellite system in the fixed-satellite service is subject to the application of the provisions of No. **9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service, but not with non-geostationary systems in other services. Draft new Resolution **[A16] (WRC-19)** shall also apply, and No. **22.2** shall continue to apply.     (WRC-19)

ADD

5.B16The use of the frequency bands 39.5-40 and 40-40.5 GHz by the mobile-satellite service (space-to-Earth) and non‑geostationary-satellite systems in the fixed-satellite service (space-to-Earth) is subject to coordination under No. **9.11A**.     (WRC-19).

**Reasons:** To address coordination among non-GSO and mobile-satellite service (space-to-Earth) FSS systems in the 50/40 GHz bands

**ADD USA/1.6/2**

ARTICLE 22

**Space services**

**ADD**

**22.5L** 9) A non-geostationary-satellite system in the fixed-satellite service in the frequency bands 37.5-39.5, 39.5-42.5, 47.2-50.2, and 50.4-51.4 GHz shall not exceed a single-entry permissible allowance of 3% of time allowance for degradation in terms of C/N specified in the short term and long term performance objectives of reference GSO FSS networks. The calculation procedures given in Recommendation ITU‑R S.[50/40 GHz FSS sharing] and the GSO reference links contained in Recommendation ITU-R S.[50/40 GHz Reference Links] shall be used for the calculation . (WRC-19)

**ADD**

**22.5M** 10) Administrations operating or planning to operate non-geostationary-satellite systems in the fixed-satellite service in the frequency bands 37.5-39.5, 39.5-42.5, 47.2-50.2, and 50.4-51.4 GHz shall apply the provisions of Resolution **[A16] (WRC-19)** to ensure that the aggregate interference into geostationary fixed and broadcasting satellite service networks caused by all non-geostationary fixed-service satellite systems operating co-freqeuncy in these frequency bands shall not exceed 10% of the time allowance for degradation in terms of C/N specified in the short term and long term performance objectives of the geostationary reference links listed in Recommendation ITU-R S.[50/40 RFERENCE LINKS]. (WRC-19)

**Reasons:** Based on ITU-R studies, the detailed technical regulatory provisions presented above will introduce technical regulatory provisions into the Radio Regulations that will enable the introduction of non-GSO satellite systems that will protect GSO systems and provide for maximum spectral efficiency for FSS operations in the 50/40 GHz bands.

**MOD USA/1.6/3**

ARTICLE 9

Procedure for effecting coordination with or obtaining agreement of other administrations1, 2, 3, 4, 5, 6, 7, 8, 9    (WRC‑15)

**MOD**

**9.35** *a)* examine that information with respect to its conformity with No. **11.31MOD**19;

(WRC-2019)

MOD

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19 **9.35.1** The Bureau shall include the detailed results of its examination under No. **11.31** of compliance with the limits in Tables **22-1** to **22-3** and the single entry limits in No. **22.5L** of Article **22** in the publication under No. **9.38**. (WRC-2019)

**ADD USA/1.6/4**

draft new RESOLUTION [A16] (WRC‑19)

**Protection of geostationary satellite networks from the aggregate equivalent power flux-density produced by non-geostationary satellite networks and systems in the 37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz, and 50.4-51.4 GHz frequency bands**

The World Radiocommunication Conference (2019),

*considering*

*a)* that the frequency bands 37.5-39.5, 39.5-42.5, 47.2-50.2 (Earth-to-space), and 50.4-51.4 GHz are allocated, *inter alia*, on a primary basis to the fixed-satellite service (FSS) in all Regions;

*b)* that Article **22** contains regulatory and technical provisions on sharing between GSO and non-GSO FSS systems in these bands in *considering a)*;

*c)* that, in accordance with No. **22.2**, non-GSO systems shall not cause unacceptable

interference to GSO FSS and broadcasting-satellite service (BSS) networks and, unless otherwise

specified in the Radio Regulations, shall not claim protection from GSO FSS and BSS satellite

networks;

*d*) that non-GSO FSS systems would benefit from the certainty that would result from the

quantification of regulatory measures required to protect GSO FSS and BSS satellite networks under No. 22.2;

*e)* that the Radio Regulations should enable the introduction of new applications of radiocommunication technology to ensure the operation of as many systems as possible in order to ensure efficient use of spectrum;

*f)* that GSO FSS systems can be protected without placing undue constraints on non-GSO FSS systems in the bands in *considering a)*;

*g)* that single-entry and aggregate limits for the protection of GSO networks from non-geostationary FSS satellite systems are contained in Recommendation ITU-R S.[50/40 GHz sharing];

*h)* that this conference modified Article **22** to include single-entry and aggregate permissible time allowances for degradation in terms of C/N of GSO FSS networks in the bands in *considering a)*;

*i)* that, the aggregate epfd levels from multiple non‑geostationary FSS systems will be directly related to the actual number of systems sharing a frequency band based on the single-entry operational use of each system;

*j)* that the aggregate interference caused by all co-frequency non-GSO FSS systems into these bands into GSO FSS systems should not exceed the aggregate limits given in Recommendation ITU-R S.[50/40 GHz FSS Sharing Methodology] *recommends* 3;

*recognizing*

that non-geostationary FSS systems are likely to need to implement interference mitigation techniques, such as orbital avoidance angles, Earth station site diversity, and GSO arc avoidance, to mutually share frequencies and to protect GSO FSS networks;

*noting*

1. that Recommendation ITU‑R S.[50/40 GHz FSS sharing] contains the methodology for determining conformity to the single-entry and aggregate limits to protect the GSO networks;
2. that Recommendation ITU-R S.1503 provides recommendations on how to compute the EPFD from a non-GSO system into victim earth stations and satellites;
3. that administrations may use their own software in conjunction with any approved ITU‑R software tools for the calculation and verification of the aggregate limits given in Recommendation ITU-R S.[50/40 GHz sharing], noting that the aggregation of all systems can be performed from these results without a specialized software tool. They are invited to provide the Radiocommunication Bureau and all participants to the Consultation meetings with access to their software;
4. that Recommendation ITU-R S.[50/40 GHz FSS Reference Links] contains GSO satellite system characteristics to be considered in frequency sharing analyses within the fixed‑satellite service in the frequency bands 37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz and 50.4‑51.4 GHz;

*resolves*

1 that administrations operating or planning to operate non‑geostationary FSS systems in the frequency bands referred to in *considering a)* above, shall, in collaboration, take all necessary steps, including, if necessary, by means of appropriate modifications to their systems or networks, to ensure that the aggregate interference into geostationary FSS and BSS satellite networks caused by such systems operating co-frequency in these frequency bands does not exceed the aggregate protection limits as determined pursuant to No. **22.5M** of the Radio Regulations;

2 that to carry the obligations in *resolves*1 above, administrations operating or planning to operate non-geostationary FSS systems shall agree cooperatively through regular consultation discussions to ensure that operations of all non-GSO networks do not exceed the aggregate level of protection for geostationary satellite networks;

4 that to carry out the calculation of *resolves 2,* administrations shall take into account the GSO satellite characteristics listed in Recommendation ITU-R S.[50/40 GHz Reference Links] when applying the methodology contained in Recommendation ITU-R S.[50/40 GHz sharing methdology] and the epfd results calculated by a epfd validation software;

5 that administrations, in carrying out their obligations under *resolves*1, shall take into account only those non-geostationary FSS systems with frequency assignments in the frequency bands referred to in *considering a)* above that have met the criteria listed in Annex 2 to this Resolution through appropriate information provided to consultation discussions referred to in *resolves* 2;

6 that administrations, in developing agreements to carry out their obligations under *resolves*1, shall establish mechanisms to ensure that all potential FSS system and network notifying administrations and operators are given full visibility of and the opportunity to participate in the process;

7 that in the absence of an agreement reached at consultation discussions referred to in *resolves* 2, each non-geostationary FSS system shall be operated in accordance with single-entry limits calculated by the apportionment of the aggregate levels commensurate to the number of non-GSO systems operating so as to assure equitable sharing of the aggregate limit among all non-GSO systems in operation;

8 that the administrations participating at the consultation discussion referred to in *resolves 2* shall designate one convener to be responsible for communicating to the Bureau, such as shown in Annex 1 that the results of the aggregate non-GSO system operational calculation and sharing determinations made in application of *resolves*1 above, without regard to whether such determinations result in any modifications to the published characteristics of their respective systems, providing a draft record of each Consultation meeting, and posting the approved record;

*instructs the Radiocommunication Bureau*

1 to observe the results of the aggregate epfd calculation performed according to *resolves*1;

2 to publish in the International Frequency Information Circular (BR IFIC), the information referred to in *resolves*8,

ANNEX 1 TO RESOLUTION [AGG\_SHARING] (WRC-19)

List of GSO FSS system characteristics and format of the result of   
the aggregate calculation to be provided to BR for   
publication for information

# I GSO FSS, GSO BSS and Non-GSO system characteristics to be used in the calculation of aggregate emissions from non-GSO FSS systems

## **I-1 GSO FSS and GSO BSS Characteristics**

Recommendation ITU-R S.[Ref links]

## **I-2 Non-GSO satellite system constellation parameters**

For each non‑GSO satellite system, the following parameters should be provided to BR for publication in the aggregate calculation:

– System administration;

– Number of space stations used in aggregate calculation;

– Single entry use of each non-GSO FSS systems.

2. Results of the aggregate epfd calculation

ANNEX 2 TO RESOLUTION [AGG\_EPFD] (WRC-19)

**List of criteria for the application of *resolves* 3**

1 Submission of appropriate Notification Publication Information.

2 Entry into satellite manufacturing or procurement agreement, and entry into satellite launch agreement.

The non-geostationary FSS system operator should possess:

i) clear evidence of a binding agreement for the manufacture or procurement of its satellites; and

ii) clear evidence of a binding agreement to launch its satellites.

The manufacturing or procurement agreement should identify the contract milestones leading to the completion of manufacture or procurement of satellites required for the service provision, and the launch agreement should identify the launch date, launch site and launch service provider. The notifying administration is responsible for authenticating the evidence of agreement.

The information required under this criterion may be submitted in the form of a written commitment by the responsible administration.

3 As an alternative to satellite manufacturing or procurement and launch agreements, clear evidence of guaranteedfunding arrangements for the implementation of the project would be accepted. The notifying administration is responsible for authenticating the evidence of these arrangements and for providing such evidence to other interested administrations in furtherance of its obligations under this Resolution.

**Reasons:** To provide a methodology to ensure that aggregate GSO protection levels are never exceeded and to provide a mechanism to monitor the aggregate epfd limits from the operation of actual non-GSO systems

**MOD**

RESOLUTION 750 (Rev.WRC‑19)

Compatibility between the Earth exploration-satellite service (passive) and relevant active services

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

…

| EESS (passive) band | Active service band | Active service | Limits of unwanted emission power from active service stations in a specified bandwidth within the EESS (passive) band1 |
| --- | --- | --- | --- |
| 1 400- 1 427 MHz | 1 427- 1 452 MHz | Mobile | −72 dBW in the 27 MHz of the EESS (passive) band for IMT base stations  −62 dBW in the 27 MHz of the EESS (passive) band for IMT mobile stations2, 3 |
| 23.6-24.0 GHz | 22.55-23.55 GHz | Inter-satellite | −36 dBW in any 200 MHz of the EESS (passive) band for non-geostationary (non-GSO) inter-satellite service (ISS) systems for which complete advance publication information is received by the Bureau before 1 January 2020, and −46 dBW in any 200 MHz of the EESS (passive) band for non-GSO ISS systems for which complete advance publication information is received by the Bureau on or after 1 January 2020 |
| 31.3-31.5 GHz | 31-31.3 GHz | Fixed (excluding HAPS) | For stations brought into use after 1 January 2012: −38 dBW in any 100 MHz of the EESS (passive) band. This limit does not apply to stations that have been authorized prior to 1 January 2012 |
| 50.2-50.4 GHz | 49.7-50.2 GHz | Fixed-satellite (E‑to‑s)4 | For stations brought into use after the date of entry into force of the Final Acts of WRC‑07:  −10 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi  −20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBi |
| 50.2-50.4 GHz | 49.7-50.2 GHz | Fixed-satellite non-GSO (E‑to‑s)4 | For stations brought into use after the date of entry into force of the Final Acts of WRC‑19:  TBD |
| 50.2-50.4 GHz | 50.4-50.9 GHz | Fixed-satellite (E‑to‑s)4 | For stations brought into use after the date of entry into force of the Final Acts of WRC‑07:  −10 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi  −20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBi |
| 50.2-50.4 GHz | 50.4-50.9 GHz | Fixed-satellite non-GSO (E‑to‑s)4 | For stations brought into use after the date of entry into force of the Final Acts of WRC‑19:  TBD |
| 52.6-54.25 GHz | 51.4-52.6 GHz | Fixed | For stations brought into use after the date of entry into force of the Final Acts of WRC‑07:  −33 dBW in any 100 MHz of the EESS (passive) band |
| 1 The unwanted emission power level is to be understood here as the level measured at the antenna port.  2 This limit does not apply to mobile stations in the IMT systems for which the notification information has been received by the Radiocommunication Bureau by 28 November 2015. For those systems, −60 dBW/27 MHz applies as the recommended value.  3 The unwanted emission power level is to be understood here as the level measured with the mobile station transmitting at an average output power of 15 dBm.  4 The limits apply under clear-sky conditions. During fading conditions, the limits may be exceeded by earth stations when using uplink power control. | | | |

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