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| A close up of a sign  Description automatically generated | **World Radiocommunication Conference (WRC-23)Dubai, 20 November - 15 December 2023** |  |
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| PLENARY MEETING | **Addendum 4 toDocument 44(Add.27)-E** |
|  | **13 October 2023** |
|  | **Original: English** |
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| Member States of the Inter-American Telecommunication Commission (CITEL) |
| PROPOSALS FOR THE WORK OF THE CONFERENCE |
|  |
| Agenda item 10 |

10to recommend to the ITU Council items for inclusion in the agenda for the next world radiocommunication conference, and items for the preliminary agenda of future conferences, in accordance with Article 7 of the ITU Convention and Resolution **804 (Rev.WRC‑19)**,

Part 4

Background

Recently, non-geostationary-satellite orbit (non-GSO) systems in frequency bands below 30 GHz have been deployed and are providing connectivity across the globe. They are capable of providing high speed, low latency broadband connectivity worldwide, including to locations where access to the internet was previously unreliable, or entirely unavailable. Publicly available data shows that non-GSO fixed-satellite service (FSS) systems serve well over one million users worldwide as of 2022 and are projected to serve at least tens of millions of users by 2030, resulting in enormous benefits to the global community. These unprecedented developments have dramatically changed the paradigm in satellite telecommunications.

GSO networks and non-GSO systems rely entirely on shared spectrum to provide service, and efficient use of shared spectrum resources is one of the ITU pillars. To realize the full benefits and potential of non-GSO FSS systems, the ITU must ensure spectrally efficient access to co‑frequency spectrum resources for non-GSO systems and GSO networks, in accordance with the Radio Regulations (RR) including No. **22.2**, while also increasing the efficiency of intra-service spectrum sharing through careful consideration of the ITU’s regulatory provisions.

RR Article **22** and Resolution **76 (Rev.WRC‑15)** contain provisions that aim, in principle, to protect GSO FSS and GSO broadcasting satellite service (BSS) networks. Among these provisions are the uplink and downlink equivalent power flux-density (epfd↑ and epfd↓) limits that were adopted in 1997 and 2000. Non-GSO systems and GSO networks today have evolved in design and operational capabilities than the systems that were considered when developing the Article **22** epfd limits nearly twenty-five years ago. Since WRC‑2000, next-generation non-GSO systems have also taken advantage of technological improvements such as adaptive coding and modulation schemes, on-board processing, phased-array antennas and adaptive power control. Additionally, our knowledge about how non-GSO systems operate in practice has advanced significantly since that time.

BSS GSO networks have not seen the need to implement adaptive coding and modulation schemes. epfd limits were developed based on characteristics of the victim system that required protection. However, studies to the ITU‑R have shown that it is difficult to define one epfd mask that would allow all non-GSO systems (in LEO and MEO) to operate and meet the protection criteria given in Recommendation ITU‑R S.1323. If an epfd mask were developed for the operation of one particular non-GSO FSS system, with specific technical parameters and orbital characteristics, another non-GSO FSS system may have difficulty meeting the requirements of that mask, while still protecting GSO. This results in the inefficient use of spectrum resources. Different non-GSO FSS systems (i.e. LEO versus MEO orbit) will lead to different interference profiles into the GSO links. It is for this reason that it is important to ensure that the characteristics of interfering non-GSO systems be considered when studying and defining both single-entry and aggregate interference protection criteria.

Some of these technologies are currently the subject of studies within ITU‑R. A major development since WRC‑2000 is the much higher number of non-GSO system filings and the number of satellites per filing these contain. The impact related to the apportionment of non-GSO aggregate interference to GSO networks has also been the subject of studies in ITU‑R and has not yet been resolved.

With regard to compliance with current limits, the recent increase in the number of non-GSO FSS, especially large constellations, has caused difficulties for the Radiocommunication Bureau to examine compliance with the single-entry limits in RR Article **22** due to issues of modeling these constellations. Additionally, often non-GSO FSS systems rely on multiple ITU filings, so examination of individual filings does not fully capture the complete non-GSO FSS system or its impact on GSO networks. Moreover, the lack of methodologies, including one to accurately model non-GSO systems, has led to a situation where consultation meetings called for in Resolution **76 (Rev.WRC‑15)** to ensure compliance with the aggregate epfd limits to protect GSO networks have not been held. This situation has raised uncertainty on the protection of GSO networks.

Given the importance of both GSO and non-GSO for FSS implementations to the delivery of numerous types of services and applications, including the delivery of high-speed broadband services to rural and remote areas, it is imperative to ascertain whether existing RR Article **22** epfd limits are suitable to allow for the efficient use of the orbit and spectrum resources in the frequency bands 14/11 GHz and 30/20 GHz while maintaining the obligations stipulated in RR No. **22.2**.

The proposal below seeks a WRC‑27 agenda item to study the regulatory provisions for frequency bands below 30 GHz in which RR Article **22** epfd limits apply, with the goal of ensuring protection from unacceptable interference to GSO FSS and BSS networks from non-GSO FSS systems in the most spectrally efficient manner and establishing means to ensure that that non-GSO FSS systems meet the single entry and aggregate limits.

Changes to RR No. **22.2** are beyond the scope of the proposed new agenda item.

Proposal

CITEL proposes to conduct, and complete in time for WRC‑27, studies of the current regulatory provisions, including epfd limits, for non-GSO FSS systems to protect GSO FSS and BSS networks from unacceptable interference in the portions of the frequency bands 3 700‑4 200 MHz, 5 925‑6 725 MHz, 10.7-14.5 GHz, 17.3-20.2 GHz and 27.5-30 GHz where RR Article **22** epfd limits apply, including evaluation by administrations of the aggregate epfd limits in Resolution **76 (Rev.WRC-15)**, and the implementation of those regulatory provisions, without modifying the requirements or conditions for coordination under RR Nos. **9.7A** and **9.7B**, with the objective of protecting GSO networks in accordance with RR No. **22.2** and improving efficient use of the spectrum resource. Based on the results of the studies, and as appropriate, potential modifications could be developed to the regulatory provisions, including epfd limits, for non-GSO FSS systems to protect GSO FSS and BSS networks from unacceptable interference in the portions of the frequency bands 3 700‑4 200 MHz, 5 925‑6 725 MHz, 10.7‑14.5 GHz, 17.3‑20.2 GHz and 27.5‑30 GHz where RR Article **22** epfd limits apply, or replacement of the epfd framework with another approach and development of associated limits, without modification to RR No. **22.2**.

ADD IAP/44A27A4/1

Draft New Resolution [iap-10-2027] (WRC-23)

Agenda for the 2027 World Radiocommunication Conference

The World Radiocommunication Conference (Dubai, 2023),

considering

*a)* that, in accordance with No. 118 of the ITU Convention, the general scope of the agenda for a world radiocommunication conference (WRC) should be established four to six years in advance and that a final agenda shall be established by the ITU Council two years before the conference;

*b)* Article 13 of the ITU Constitution relating to the competence and scheduling of WRCs and Article 7 of the Convention relating to their agendas;

*c)* the relevant resolutions and recommendations of previous world administrative radio conferences (WARCs) and WRCs,

recognizing

*a)* that this conference has identified a number of urgent issues requiring further examination by WRC‑27;

*b)* that, in preparing this agenda, some items proposed by administrations could not be included and have had to be deferred to future conference agendas,

resolves

to recommend to the Council that a WRC be held in 2027 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‑23 and the Report of the Conference Preparatory Meeting, and with due regard to the requirements of existing and future services in the frequency bands under consideration, to consider and take appropriate action in respect of the following items:

1.x to study, review, and update or replace, as appropriate, the regulatory provisions for the protection of GSO fixed-satellite service (FSS) and broadcasting-satellite service (BSS) networks from unacceptable interference from non-GSO FSS systems in portions of the frequency bands 3 700-4 200 MHz, 5 925-6 725 MHz, 10.7-14.5 GHz, 17.3-20.2 GHz and 27.5-30 GHz in which Article **22** epfd limits apply, and implementation of those provisions, in accordance with Resolution **[AI-10-EPFD REVISION] (WRC-23)**,

invites the ITU Council

to finalize the agenda and arrange for the convening of WRC‑27, and to initiate as soon as possible the necessary consultations with Member States,

instructs the Director of the Radiocommunication Bureau

1 to make the necessary arrangements to convene meetings of the Conference Preparatory Meeting (CPM) and to prepare a report to WRC‑27;

2 to submit a draft report on any difficulties or inconsistencies encountered in the application of the Radio Regulations referred in agenda item 9.2 to the second session of the CPM and to submit the final report at least five months before the next WRC,

instructs the Secretary-General

to communicate this Resolution to international and regional organizations concerned.

**Reasons:** To provide for studies to review and possibly revise, as appropriate, the regulatory provisions for protection of GSO FSS and BSS networks from unacceptable interference from non-GSO FSS systems in the frequency bands below 30 GHz in which RR Article **22** epfd limits apply, and the implementation of those provisions.

ADD IAP/44A27A4/2

Draft New Resolution [AI-10-EPFD REVISION] (WRC-23)

Study of regulatory provisions for protection of GSO FSS and BSS networks from unacceptable interference from non-GSO FSS systems in portions of the frequency bands 3 700-4 200 MHz, 5 925-6 725 MHz, 10.7-14.5 GHz, 17.3‑20.2 GHz and 27.5-30 GHz in which Article 22 epfd limits apply

The World Radiocommunication Conference (Dubai, 2023),

considering

*a)* that systems based on the use of new technologies associated with both geostationary-satellite orbit (GSO) fixed-satellite service (FSS) and broadcasting-satellite service (BSS) networks and non-geostationary-satellite orbit (non-GSO) FSS constellations in frequency bands below 30 GHz in which Article **22** equivalent power flux-density (epfd) limits apply are capable of providing high-capacity means of communication to rural and remote regions of the world;

*b)* that both non-GSO FSS systems and GSO FSS networks are more technologically advanced than the systems that were considered in the development of Article **22** epfd limits in WRC‑1997 and WRC‑2000;

*c)* that GSO links used in the derivation of epfd limits for WRC‑97 may not reflect the operations of modern GSO networks;

*d)* that the GSO orbit and its associated spectrum are a valuable resource that is heavily utilized around the world;

*e)* that non-GSO satellite orbit systems have been deployed recently in the bands referred to in *considering a)* above;

*f)* that the epfd limits applicable to non-GSO FSS systems in the frequency bands below 30 GHz in which Article **22** epfd limits apply may not accurately reflect the protection required by GSO FSS and BSS networks;

*g)* that there is a need to encourage the development and implementation of both GSO and non-GSO technologies to meet the growing demand for satellite services globally;

*h)* the need to encourage the development and implementation of both GSO and non-GSO technologies in the frequency bands below 30 GHz, in accordance with No. **5.484A**;

*i)* that there is a need to ensure efficient use of co-frequency spectrum resources for non‑GSO FSS systems and GSO FSS and BSS networks;

*j)* that the certainty of the interference environment provided by epfd limits has enabled technological advancements to date and appropriate limits will be critical for continued innovation in GSO and non-GSO networks and services;

*k)* that non-GSO FSS systems could be based on multiple filings for the same frequency bands;

*l)* that currently the Radiocommunication Bureau (Bureau) assesses compliance with the single-entry Article **22** limits based on individual filings;

*m)* that GSO and non-GSO FSS systems may benefit from an updated review of the implementation of Article **22** epfd limits consistent with No. **22.2**,

noting

that Recommendations ITU‑R S.1323, ITU‑R S.1325, ITU‑R S.1328, ITU‑R S.1529, ITU‑R S.1557, ITU‑R S.2131, among others, provide information on system characteristics, operational requirements and protection criteria that may be used in sharing studies,

recognizing

*a)* that according to No. **22.2**, non-GSO systems shall not cause unacceptable interference to, and shall not claim protection from geostationary orbit satellite networks in the FSS and the BSS;

*b)* that the Article **22** and Resolution **76 (Rev.WRC-15)** epfd limits apply to non-GSO FSS systems to protect GSO FSS and BSS satellite networks from unacceptable interreference from non-GSO FSS satellite systems;

*c)* that WRC‑2000 adopted provisions, including epfd limits in relevant provisions of No.**22.5** to quantify No. **22.2** in order to protect GSO FSS and BSS satellite networks from non-GSO FSS satellite systems in the frequency bands below 30 GHz in which the Article **22** epfd limits apply;

*d)* that Article **22** and Resolution **76 (Rev.WRC-15)** of the Radio Regulations contains provisions that include uplink, downlink and inter-satellite equivalent power flux-density (epfd↑, epfd↓, and epfdis) limits; and that an administration operating a non-GSO FSS system in compliance with these limits is considered as having fulfilled its obligations under No. **22.2**;

*e)* that any revision to Article **22** epfd limits must protect GSO FSS and BSS satellite networks consistent with No. **22.2**;

*f)* that WRC‑2000 agreed that additional protection above that provided by the epfd↓ limits in the portions of the 30/20 GHz frequency bands in which Article **22** epfd limits apply is required for certain GSO FSS networks with specific receive earth stations with very large antennas and that, in order to provide this additional protection, WRC‑2000 adopted a procedure for identifying the need for coordination under Nos. **9.7A** and **9.7B**;

*g)* that the procedure for identifying the need for coordination under Nos. **9.7A** and **9.7B** is based on bandwidth overlap and the conditions specified in Appendix **5** for the GSO FSS earth station antenna maximum isotropic gain, *G*/*T* and emission bandwidth and the epfd↓ radiated by the non-GSO FSS satellite system into the earth station employing the very large antenna;

*h)* that Recommendation ITU‑R S.1323 provides information on operational requirements and protection criteria that may be used in epfd sharing studies;

*i)* that Article **22** and Resolution **76 (Rev.WRC‑15)** epfd limits were derived taking into account only a short-term protection criterion;

*j)* that WRC‑19 adopted No. **22.5L** and No. **22.5M** for the 50/40 GHz bands, which is an alternative protection framework for GSO FSS networks;

*k)* that the approach for the 50/40 GHz bands referred to *recognizing j),* or other approaches to resolve specific issues identified with the current epfd limits, including modifying the existing epfd limits, could be considered in studies to ensure the protection of GSO FSS and BSS networks from unacceptable interference as required by No. **22.2**;

*l)* that there are currently both GSO FSS and BSS networks and non-GSO FSS systems filed and operating in the frequency bands subject to Article **22** epfd limits and any change to this framework may require transitional measures in order not to disrupt these services and to take due regard of the requirements of these existing and planned GSO networks;

*m)* that Resolution **76 (Rev.WRC‑15)** contains aggregate epfd limits not to be exceeded by non-GSO FSS systems that apply to operational non-GSO FSS systems to protect GSO FSS and BSS satellite networks from unacceptable interference from all co-frequency operational non-GSO FSS systems;

*n)* that Resolution **76 (Rev.WRC‑15)** aggregate epfd limits are not examined by the Bureau as they are considered operational limits, however there are no agreed methodologies to compute the aggregate interference or how to address cases where the aggregate epfd limits are exceeded and this results in uncertainty for GSO networks;

*o)* that there may be a need to improve the ability to measure non-GSO operational parameters that ensure the protection of GSO networks;

*p)* that GSO networks have limited capability to avoid interference from non-GSO systems;

*q)* that Article **22** contains provisions for the protection of GSO BSS and FSS networks from non-GSO FSS systems in both the short-term and long-term,

recognizing further

*a)* that the Article **21** limits apply for protection of terrestrial services;

*b)* that there have been difficulties experienced regarding examination of compliance with the single-entry epfd limits due to issues of modelling complex non-GSO constellations and reliance on multiple ITU filings by one non-GSO system,

resolves to invite ITU‑R

1 to conduct, and complete in time for WRC‑27, studies of the current regulatory provisions, including epfd limits, for non-GSO FSS systems to protect GSO FSS and BSS networks from unacceptable interference in the portions of the frequency bands 3 700-4 200 MHz, 5 925‑6 725 MHz, 10.7-14.5 GHz, 17.3-20.2 GHz and 27.5-30 GHz where Article **22** epfd limits apply, including evaluation by administrations of the aggregate epfd limits in Resolution **76 (Rev.WRC‑15)**, and the implementation of those regulatory provisions, without modifying the requirements or conditions for coordination under Nos. **9.7A** and **9.7B**, with the objective of protecting GSO networks in accordance with No. **22.2** and improving efficient use of the spectrum resource;

2 to develop, based on the results of the studies referred to in *resolves* 1, and as appropriate, potential modifications to the regulatory provisions, including epfd limits, for non-GSO FSS systems to protect GSO FSS and BSS networks from unacceptable interference in the portions of the frequency bands 3 700-4 200 MHz, 5 925-6 725 MHz, 10.7-14.5 GHz, 17.3-20.2 GHz and 27.5-30 GHz where Article **22** epfd limits apply, or replacement of the epfd framework with another approach and development of associated limits, without modification to No. **22.2**;

3 to identify any other consequential changes to the Radio Regulations resulting from any modification under *resolves to invite ITU‑R*2 to ensure that continuity of operations of existing and planned GSO networks and non-GSO systems is not disrupted, in accordance with No. **22.2**, through developing transitional measures as needed;

4 to ensure the protection of GSO networks as required by the ITU Radio Regulations;

5 to complete by WRC‑27, development of a suitable methodology for accurately modelling non-GSO systems and calculating the applicable aggregate limits produced by all non-GSO FSS systems operating or planning to operate co-frequency with GSO FSS and BSS networks and other necessary elements required for administrations to hold consultation meetings to confirm compliance with the applicable aggregate limits;

6 to develop, based on the results of the studies referred to in *resolves* *to invite ITU‑R* 1 and 2, procedures to be used by administrations to confirm compliance with the applicable aggregate limits;

7 to develop a suitable methodology to ensure compliance with the applicable aggregate limits, in case these limits are exceeded;

8 to develop as soon as possible, based on the results of studies in *resolves* *to invite ITU‑R*1 and 2 any additional methodologies or tools that may be required for the Bureau to examine non-GSO system filings for compliance with single entry epfd limits;

9 to study and identify means to ensure that single-entry limits to protect GSO networks are applied per complete system and not per individual filing,

invites the 2027 World Radiocommunication Conference

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

**Reasons:** To provide for studies in frequency bands below 30 GHz where RR Article **22** epfd limits apply of the regulatory provisions, including epfd limits, applicable to non-GSO FSS systems for the protection of GSO FSS and BSS networks from unacceptable interference and for potential modification of those provisions, while ensuring the protection from unacceptable interference of incumbent and planned GSO networks as required by the ITU Radio Regulations and develop as needed transitional measures, such as grandfathering, to ensure continuity of operations of existing and planned GSO networks and non-GSO systems are not disrupted.

ANNEX

Proposal for future agenda item to study regulatory provisions for protection of GSO FSS and BSS networks from unacceptable interference from non-GSO FSS systems in portions of the frequency bands 3 700-4 200 MHz, 5 925‑6 725 MHz, 10.7-14.5 GHz, 17.3-20.2 GHz and 27.5-30 GHz in which Article 22 epfd limits apply

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| **Subject:** Proposed future WRC‑27 agenda item to study regulatory provisions for protection of GSO FSS and BSS networks from non-GSO systems in frequency bands below 30 GHz in which RR Article **22** epfd limits apply, and the implementation of those provisions |
| **Origin:** CITEL |
| ***Proposal*:**To study and update, as appropriate, regulatory provisions for sharing between non-GSO systems and GSO networks in the portions of the frequency bands below 30 GHz in which RR Article **22** epfd limits apply, and the implementation of those provisions. |
| ***Background/reason:***Non-GSO and GSO networks today have evolved in design and operational capabilities from the systems that were considered when developing the RR Article **22** epfd limits nearly twenty-five years ago. Equally important the tools and methodologies for examination of single-entry and aggregate epfd limits to protect GSO networks are not fully available. Thus a comprehensive study is needed to determine if updates to the protection levels are required, and make changes as appropriate to ensure maximum spectral efficiency to meet the growing demand for satellite services globally. |
| ***Radiocommunication services concerned*:**Fixed-satellite service (FSS), mobile-satellite service (MSS), broadcasting-satellite service (BSS), Earth exploration-satellite service (EESS), radio astronomy and other services. |
| ***Indication of possible difficulties*:** |
| ***Previous/ongoing studies on the issue*:**N/A |
| ***Studies to be carried out by*:**ITU‑R Working Party 4A | ***with the participation of*:**Administrations and Sector members of the ITU‑R |
| ***ITU‑R study groups concerned*:**ITU‑R Study Group 4 |
| ***ITU resource implications, including financial implications (refer to CV126)*:**This proposed agenda item will be studied within the normal ITU‑R procedures and planned budget. |
| ***Common regional proposal*:** Yes/No | ***Multicountry proposal*:** Yes/No***Number of countries*:**  |
| ***Remarks*** |

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