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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 | | **Revision 1 to**  **Document 158-E** | |
|  | | **13 November 2023** | |
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| Burundi (Republic of)/Cameroon (Republic of)/Central African Republic/Congo (Republic of the)/Gabonese Republic/Equatorial Guinea (Republic of)/Madagascar (Republic of)/Nigeria (Federal Republic of)/Democratic Republic of the Congo/Sao Tome and Principe (Democratic Republic of)/ Chad (Republic of) | | | |
| PROPOSALS FOR THE WORK OF THE CONFERENCE | | | |
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| 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)**,

Introduction

Non-geostationary (“non-GSO”) fixed-satellite service (FSS) satellite systems in the low-Earth orbit (LEO) in the Ku and Ka bands have recently become critical to provide broadband connectivity on a global basis, with low latency, high speed and high-capacity. LEO systems are essential to bridging the digital divide and achieving universal connectivity.

Article **22** (Space services) of the Radio Regulations (RR) contain a number of provisions to ensure compatibility of non-GSO FSS operations with co-primary systems and services. Among these provisions are equivalent power flux-density (epfd) and aggregate epfd limits to be met by non-GSO FSS systems operating in certain frequency bands to protect GSO FSS and broadcasting-satellite service (BSS) operations from unacceptable interference. However, the epfd limits set forth in RR Article **22** represent outdated regulations that restrict the operations of non-GSO broadband services and increase costs for their operations. The epfd limits are technologically outdated as they are based on the technical and operational characteristics of envisioned non-GSO FSS systems and other services from an era prior to WRC-2000. None of the non-GSO systems used to derive the epfd limits have ever been placed in operation. The epfd limits also represent outdated spectrum management techniques and principles, as the studies used to derive the limits depended on GSO protection criteria that did not account for modern technological evolution or ITU-R protection requirements in satellite designs such as long-term protection criteria, which is a principal in GSO protections today. In particular, the sharing studies that led to the epfd limits currently in RR Article**22** fail to consider technological changes of the past 25 years and new spectrum management techniques for both non-GSO and GSO systems such as smaller, steerable spot beams of satellite systems, improved antenna technology, long-term protection criteria, adaptive coding and modulation etc. Furthermore, the non-GSO FSS power level limits included in RR Article **22** to ensure compatibility with GSO FSS operations differ substantially across various FSS bands, even though the protection criteria used to evaluate and derive the epfd limits are identical. The failure to consider technological innovation and modern spectrum management techniques such as protection requirements in RR Article **22** sharing framework and the inconsistencies in power level limits across frequency bands results in inefficient spectrum sharing between non-GSO and GSO FSS systems.

Discussion

Under WRC-19 agenda Item 1.6, extensive study was undertaken to evaluate the manner in which epfd limits were developed during the 2000 time period. Although the focus of that agenda item at WRC-19 was on the Q/V band, Report ITU-R **S.2462**, studied and concluded that for bands below 30 GHz the methodology used to derive the epfd limits results in spectrum inefficiencies and inaccuracies. The studies in Report ITU-R **S.2462** indicated that “*sharing methodologies between non-GSO and GSO FSS systems based on epfd limits masks as was done in frequency bands below 30 GHz are extremely system dependent*” and “*this situation can result in spectrum inefficiencies*”. It further indicated that the “*Optimal use of orbit and spectrum resources in the 50/40 GHz requires a more equitable regulatory environment between GSO networks and non-GSO FSS systems than has been established in bands below 30 GHz in order to take advantage of next generation satellite technology to provide high capacity broadband services, while utilizing benefits of both non-GSO and GSO satellite orbits*”. Given that the studies have already identified spectrum inefficiencies and inaccuracies issues below 30 GHz and that WRC-19 has adopted an improved regulatory framework applicable to bands above 30 GHz, it is clear that studies and regulatory solutions are necessary to develop possible remedies for spectrum sharing between non-GSO FSS and GSO networks in frequencies below 30 GHz.

RR No. **22.2** ensures the protection of GSO networks and states that “*Non-geostationary-satellite systems* ***shall*** *not cause unacceptable interference to and, unless otherwise specified in these Regulations, shall not claim protection from geostationary-satellite networks in the fixed-satellite service and the broadcasting-satellite service operating in accordance with these Regulations…”*. The underlying principles of the studies and regulatory solutions during the study cycle will be to ensure that RR No. **22.2** shall continue to apply and no modification is sought to RR No. **22.2**.

Efficient use of shared spectrum resources is one of ITU's core goals. Resolution 219 (Bucharest, 2022) of the ITU Plenipotentiary Conference *instructs* “*the Radiocommunication Assembly, as a* ***matter of urgency****, to perform the necessary studies through relevant ITU Radiocommunication Sector (ITU-R) study groups on the issue of the increasing use of radio-frequency spectrum and associated orbit resources in non-GSO orbits, as well as on equitable access to, and rational and compatible use of, the GSO and non-GSO orbit and spectrum resources, consistent with the objectives of Article 44 of the Constitution*”.

According to the ITU, some 2.7 billion people worldwide remain totally offline, with universal connectivity still a distant prospect in least developed countries (LDCs) and landlocked developing countries (LLDCs), where, on average, only 36 per cent of the population is online. Figure 1 below shows the internet penetration around the world, as per the ITU Global Connectivity Report 2022. Africa has only 33% of the population online. In the LDCs, only 27% of the population use the Internet and in the LLDCs, the share is 35 per cent. These low rates fall far short of Target 9.c of the Sustainable Development Goals (SDGs) 2030 that called for significantly increased access to information and communication technologies and for universal and affordable access to the Internet in least developed countries by 2020.

Figure 1

Internet penetration around the world (ITU Global Connectivity Report 2022)

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The ITU World Telecommunication Development Conference (WTDC) Declaration 2022, declared that “(2) …In the digital era, universal, secure and ***affordable broadband connectivity is indispensable*** and provides opportunities for boosting productivity and efficiency, ending poverty, improving livelihoods and ensuring that sustainable development becomes a reality for all…”. With just seven years left to achieve the Sustainable Development Goals (SDGs) 2030 and given the importance of LEO systems in bridging the digital divide and the impact of efficient spectrum sharing on the affordability of broadband connectivity, it is crucial that WRC-23 adopt a regulatory mechanism through a WRC-27 agenda item, to allow for any necessary regulatory changes to the RR Article **22** provisions, subject to the outcome of the ITU-R studies. Any further delay to address the identified spectrum inefficiencies will not only adversely affect the ability to realize the full benefit of global non-GSO FSS systems to provide additional capacity in order to help provide broadband and associated service applications to those that need it most but also affect administrations’ ability to achieve the SDGs 2030. These are particularly important for Africa, LDCs and LLDCs that are already falling short of some of the targets.

Proposal

The cosignatory administrations of this contribution propose that WRC-23 adopt a new Resolution inviting the ITU-R to **urgently** study in time for WRC-27 the possible update to the regulatory provisions, including epfd limits, for non-GSO FSS systems to protect GSO FSS and BSS networks from unacceptable interference in the frequency bands below 30 GHz in which RR Article **22** epfd limits apply.

The underlying and guiding principles during the four years study cycle will be that regardless of the solution that will be found, GSO FSS and BSS satellite networks will continue to be protected as mandated under RR No. **22.2** and without any modification to RR No. **22.2**.

The study should include the development of procedures for notifying administrations of non-GSO FSS systems to ensure compliance with the aggregate epfd limits in Resolution **76 (Rev.WRC-15)**. These studies must not modify the requirements or conditions for coordination under Nos. **9.7A** and **9.7B**.

**Reasons:** Africa remains the least connected continent on the planet. In line with the objectives of the UN SDGs 2030, bridging the digital divide is one of the priorities of countries across Africa. To enable more spectral efficiency and operational flexibility for the design and operation of non-GSO systems, while ensuring protection of GSO networks, all within a set time frame so that any regulatory changes to RR Article **22** provisions, as identified by the outcome of studies, can be done at WRC-27 to urgently meet the SDGs 2030.

ADD BDI/CME/CAF/COG/GAB/GNE/MDG/NIG/COD/STP/TCD/158/1

Draft New Resolution [BDI/CME/CAF/COG/GAB/GNE/MDG/NIG/COD/STP/TCD-WRC-27 Agenda] (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, as appropriate, regulatory provisions for the protection of GSO FSS and BSS networks from unacceptable interference from non-GSO FSS systems in the frequency bands below 30 GHz in which Article **22** epfd limits apply, and implementation of those provisions, in accordance with Resolution **[BDI/CME/CAF/COG/GAB/GNE/MDG/NIG/COD/STP/TCD-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 urgent studies to review and 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 Article **22** epfd limits apply.

ADD BDI/CME/CAF/COG/GAB/GNE/MDG/NIG/COD/STP/TCD/158/2

Draft New Resolution [BDI/CME/CAF/COG/GAB/GNE/MDG/NIG/COD/STP/TCD-EPFD   
REVISION] (WRC-23)]

Review and update the regulatory provisions for the protection of GSO FSS and BSS networks from unacceptable interference from non-GSO FSS systems in the frequency bands below 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 in order to provide connectivity to those regions;

*b)* that GSO and non-GSO satellite orbits and associated spectrum are valuable resources and equitable access to these resources should be protected for the benefit of all countries in the world;

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

*d)* the need to ensure efficient use of co-frequency spectrum resources for non‑GSO FSS systems and GSO FSS and BSS networks;

*e)* that Article **22** contains provisions that are intended to ensure compatibility between non-GSO FSS operations and GSO FSS and BSS networks for the frequency bands below 30 GHz, including the provisions for uplink, downlink and inter-satellite equivalent power flux-density (epfd↑, epfd↓, and epfdis) limits; and

*f)* that Resolution 219 (Bucharest, 2022) of the ITU Plenipotentiary Conference instructs, as a matter of urgency, the relevant ITU Radiocommunication Sector (ITU-R) study groups to perform studies on the issue of the increasing use of radio-frequency spectrum and associated orbit resources in non-GSO orbits, as well as on equitable access to, and rational and compatible use of, the GSO and non-GSO orbit and spectrum resources, consistent with the objectives of Article 44 of the Constitution;

*g)* that according to the ITU, some 2.7 billion people worldwide remain totally offline, with universal connectivity still a distant prospect in least developed countries and landlocked developing countries, where, on average, only 36 per cent of the population is online;

*h)* that there is only seven years left to meet the Sustainable Development Goals (SDGs) 2030;

*i)* that non‑GSO FSS systems would benefit from an updated review and specification of measures required to protect GSO FSS and BSS satellite networks under No. **22.2**,

noting

that Recommendations ITU‑R S.1432, 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 fixed satellite services and the broadcasting satellite service;

*b)* that 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 Article **22** epfd limits apply;

*d)* that Article **22** and Resolution **76 (WRC‑19)** contains provisions that include uplink, downlink and inter-satellite 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 non-GSO FSS systems and GSO FSS and BSS networks are vastly different today than the systems that were considered in developing Article **22** epfd limits in 1997 and 2000, and the knowledge about how these systems operate in practice has advanced significantly since then;

*f)* that WRC‑2000 agreed that additional protection above that provided by the epfd↓ limits in the portions of the frequency bands below 30 GHz 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, 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**;

*h)* that the earth stations registered under Nos. **9.7A** and **9.7B** are associated with GSO satellite networks that have been filed, and are operating with, non-zero inclination;

*i)* 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;

*j)* that WRC‑2000 indicated that the results of the coordination examination under Nos. **9.7A** and **9.7B** would have no impact on the determination of whether a non-GSO system met the epfd limits in the portions of the frequency bands below 30 GHz in which the Article **22** limits apply;

*k)* that Recommendation ITU‑R S.1503 provides a specification for a software simulation tool for calculating epfd↓ as a function of time, however this Recommendation does not take into account the inclination of a GSO satellite for determining the need for coordination under Nos. **9.7A** and **9.7B**;

*l)* that in accordance with *recognizing f)-j)*, Recommendation ITU‑R S.1714 provides a static methodology for calculating epfd↓ to facilitate identifying the need for coordination of very large antennas under Nos. **9.7A** and **9.7B**;

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

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

*o)* that the epfd limits applicable to frequency bands below 30 GHz non-GSO FSS systems result in interference levels well below the long-term protection required by GSO FSS and BSS networks, and this can unnecessarily constrain non-GSO FSS systems;

*p)* that the issues linked to *recognizing n)*, in view of *recognizing o)*, were identified and addressed in WRC‑19 for the Q/V bands, leading to an alternative protection framework for GSO FSS networks for those bands and the development of provisions No. **22.5L** and No. **22.5M**;

*q)* 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** and that it may be necessary to provide some transitional measures for the epfd examination of non-GSO FSS coordination and notification information by the Bureau;

*r)* 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;

*s)* 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;

*t)* 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;

*u)* that administrations intending to develop non-GSO systems shall ensure that the assignments appearing in the Plan of Appendices **30** and **30B** will be protected from unacceptable interference as per No. **22.2**,

recognizing further

that the Article **22** epfd limits for non-GSO FSS systems operating in portions of the frequency bands below 30 GHz were designed solely to protect GSO FSS and BSS satellite networks, as Article **21** limits apply for terrestrial services,

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 frequency bands below 30 GHz in which 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 frequency bands below 30 GHz in which 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 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;

4 to develop procedures to be used by administrations to confirm compliance with the applicable aggregate limits;

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

6 to develop as soon as possible, based on the results of studies in *resolves* 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;

7 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 urgent studies in the frequency range below 30 GHz to review and revise, as appropriate the epfd limits applicable to non-GSO FSS systems and associated regulatory provisions.

ATTACHMENT

Proposal for future agenda item for [Review and update regulatory provisions for sharing between non-GSO systems and GSO networks in frequency bands below 30 GHz in which Article 22 epfd limits apply]

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| **Subject:** Proposed future WRC‑2027 agenda item to study regulatory provisions for sharing between non-GSO systems and GSO networks in the frequency bands below 30 GHz in which Article 22 epfd limits apply, and the implementation of those provisions; | |
| **Origin:** [AGL/BDI/CME/CAF/TCD/COD/GNE/GAB/MDG/COG/RRW/STP] | |
| ***Proposal*:** [To study and update, as appropriate, regulatory provisions for sharing between non-GSO systems and GSO networks in 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 are vastly different in design and operational capabilities than the systems that were considered when developing the 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 WRC‑27 agenda item that leads to a comprehensive study is needed to evaluate if updates to the protection levels are required, and make changes as appropriate in the Radio Regulations to ensure maximum spectral efficiency to meet the growing demand for satellite services globally. | |
| ***Radiocommunication services concerned*:**  Fixed Satellite Service, Mobile Satellite Service, BSS, EESS, Radio Astronomy and other services] | |
| ***Indication of possible difficulties*:** | |
| ***Previous/ongoing studies on the issue*:**  Old WRC‑19 agenda item 1.6 at demonstrated that sharing methodologies between non-GSO and GSO FSS systems based on defining epfd limit masks as was done in frequency bands below 30 GHz are extremely system dependent. The work was summarized in the ITU‑R Report [S.2462-0 (07/2019)](https://www.itu.int/pub/publications.aspx?lang=en&parent=R-REP-S.2462-2019) | |
| ***Studies to be carried out by*:**  WP 4A | ***with the participation of*:**  Administrations and Sector members of the ITU‑R |
| ***ITU‑R study groups concerned*:**  SG 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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