30TH WORLD RADIOCOMMUNICATION SEMINAR

24 – 28 October 2022
Geneva, Switzerland

Regulatory and Technical Examination

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Radiocommunication Bureau, ITU

www.itu.int/go/wrs-22

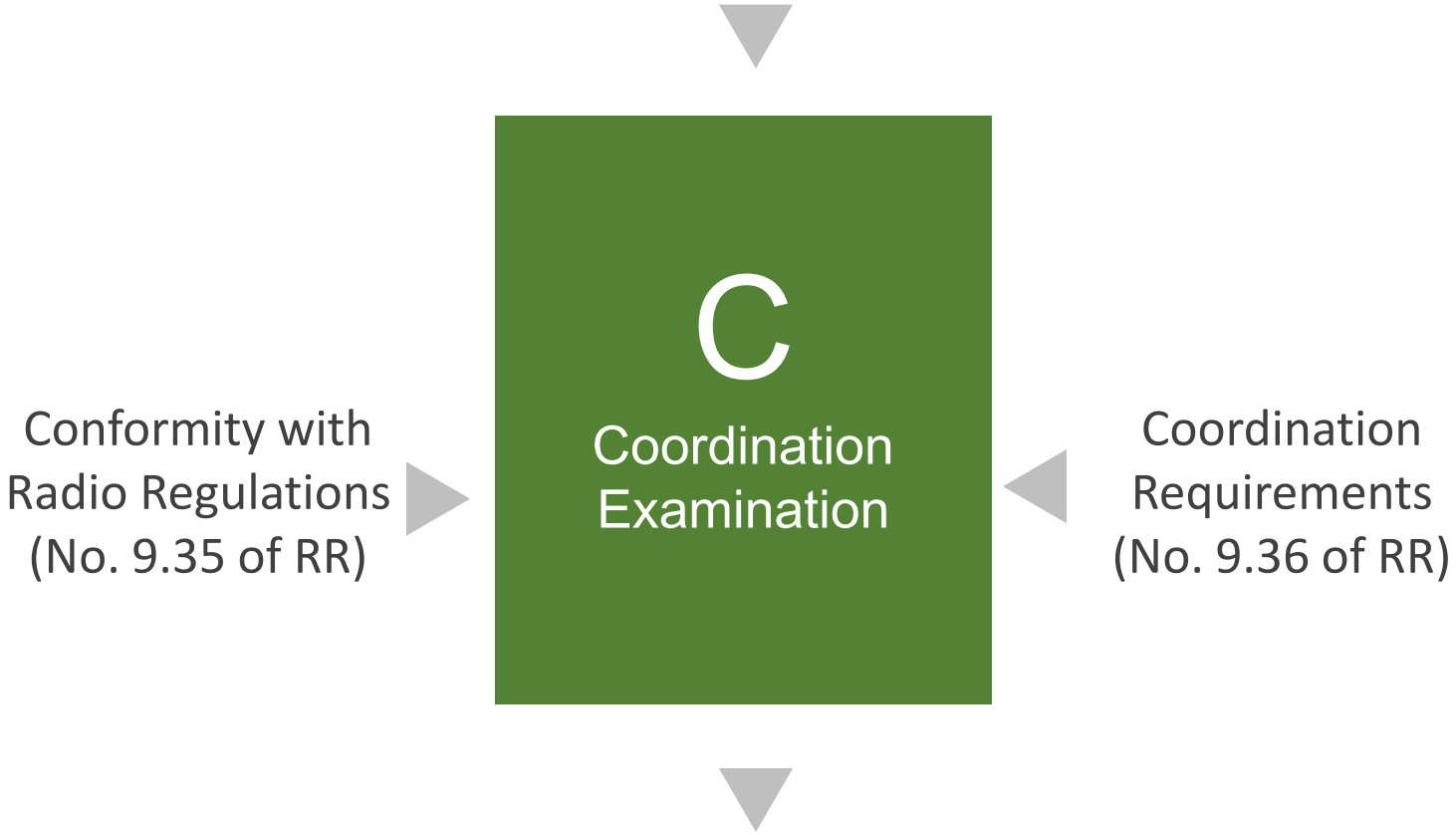
#ITUWRS

Regulatory and technical examination

General Overview

Cessy Karina

Completeness/Validation Process



Expectation

OBSERVATIONS DU BUREAU DES RADIOCOMMUNICATIONS

Relatives à la Conclusion conformément au Nº 11.31

FAVORABLE pour toutes les assignations de fréquence.

RADIOCOMMUNICATION BUREAU COMMENTS

Relating to the Findings with respect to No. 11.31

FAVOURABLE for all frequency assignments.

OBSERVACIONES DE LA OFICINA DE RADIOCOMUNICACIONES

Relativas a la Conclusión según N.º 11.31

FAVORABLE para todas las asignaciones de frecuencia.

无 线 电 通 信 局 的 意 见

根据第11.31款的审查结果

所有频率指配均**合格**。

ЗАМЕЧАНИЯ БЮРО РАДИОСВЯЗИ

Относительно Заключения по п. 11.31

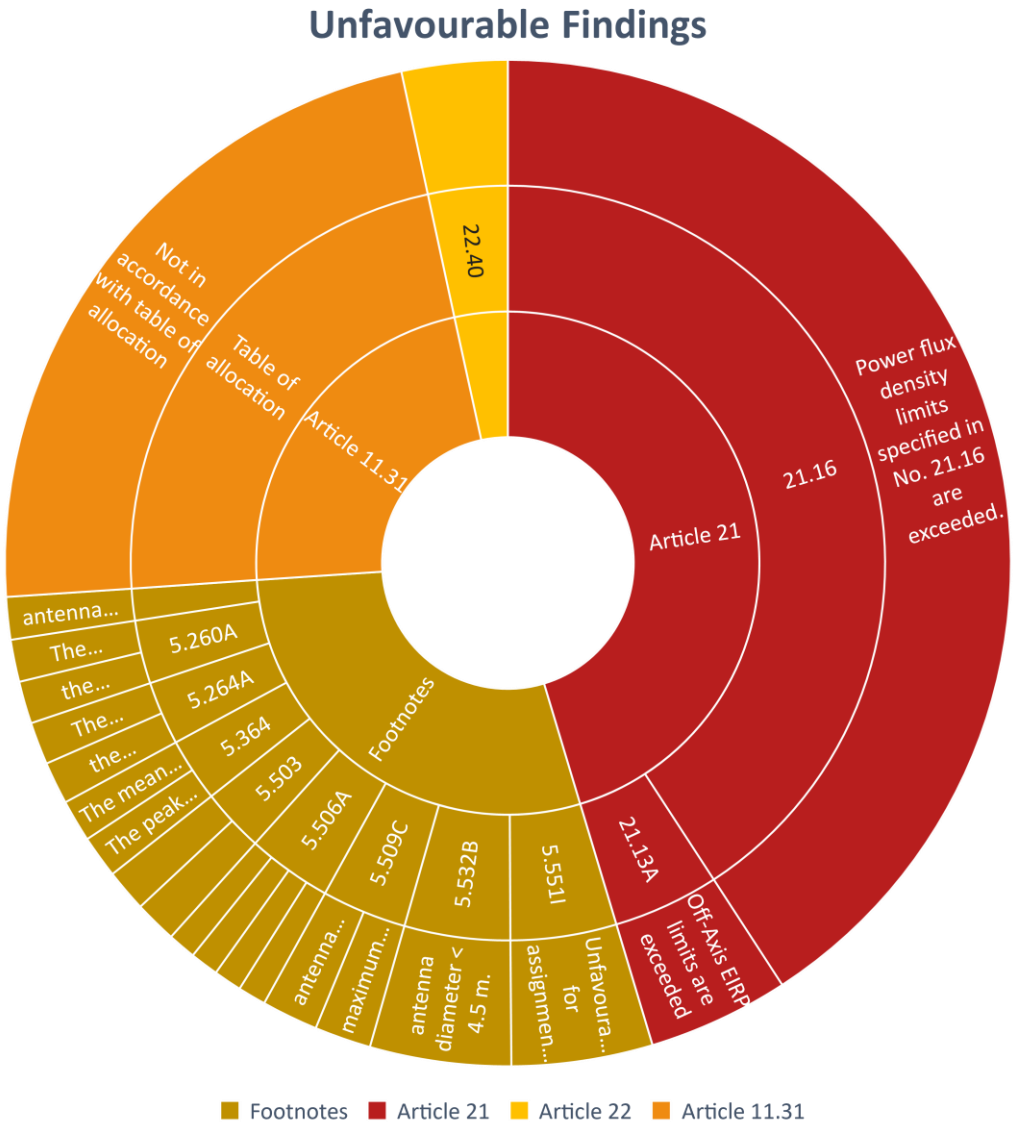
БЛАГОПРИЯТНОЕ для всех частотных присвоений.

تعليقات مكتب الاتصالات الراديوية

المتعلقة بالنتيجة وفقاً للرقم 31.11

مؤاتية لجميع تخصيصات التردد.

ITUWRS GENEVA2022



How to avoid unfavourable findings?

UNFAVOURABLE. No allocation to Aeronautical Mobile-Satellite (R) Service in Region 3 in the frequency bands 806-890 MHz and 942 – 960 MHz (No. 5.320 refers).

UNFAVOURABLE for all assignments in the Mobile-Satellite Service. Not in accordance with the Table of Frequency Allocation including Nos. 5.317, 5.319, 5.320, as appropriate.

Regarding the frequency assignments listed in Table-1, **UNFAVOURABLE** finding is given under No. 21.16 for assignments in Table-2.

There are no positions of the steerable beam(s) where the applicable PFD limits are met.

1

Conformity with Table of Frequency Allocation & other provisions (PFD/EIRP Limits etc.)

Nos. 9.35, 11.31 of RR, RoP11.31

Network Summary

E/R	Freq	BW	MinFreq	MaxFreq	ClsStn	SA No	Beam 1	Beam 2
E	848	84000	806	890	EI	SA No:1	A	A
E	951	18000	942	960	EI	SA No:1	A	A
E	1522	7000	1518	1525	EI	SA No:1	A	A
E	1535	19000	1525	1544	EI	SA No:1	A	A
E	1552	14000	1545	1559	EI	SA No:1	A	A
R	848	84000	806	890	EI	SA No:1	A	A
R	951	18000	942	960	EI	SA No:1	A	A
R	1618	16000	1610	1626	EI	SA No:1	A	A
R	1636	19000	1626.5	1645.5	EI	SA No:1	A	A
R	1654	14000	1646.5	1660.5	EI	SA No:1	A	A

Conformity with Radio Regulations (No. 9.35 of RR)

Network Summary

Frequency bands
Direction of transmission
Class of station/Services
Beams/Service area

E/R	Freq	BW	MinFreq	MaxFreq	ClsStn	SA No	Beam 1	Beam 2
E	848	84000	806	890	EI	SA No:1	A	A
E	951	18000	942	960	EI	SA No:1	A	A
E	1522	7000	1518	1525	EI	SA No:1	A	A
E	1535	19000	1525	1544	EI	SA No:1	A	A
E	1552	14000	1545	1559	EI	SA No:1	A	A
R	848	84000	806	890	EI	SA No:1	A	A
R	951	18000	942	960	EI	SA No:1	A	A
R	1618	16000	1610	1626	EI	SA No:1	A	A
R	1636	19000	1626.5	1645.5	EI	SA No:1	A	A
R	1654	14000	1646.5	1660.5	EI	SA No:1	A	A

Compare with Table of Frequency Allocation

(Article 5 of Radio Regulations)

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 518-1 525 FIXED MOBILE except aeronautical mobile MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341 5.342	**1 518-1 525** FIXED MOBILE 5.343 MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341 5.344	**1 518-1 525** FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341
1 525-1 530 SPACE OPERATION (space-to-Earth) FIXED MOBILE-SATELLITE (space-to-Earth) 5.208B 5.351A Earth exploration-satellite Mobile except aeronautical mobile 5.349 5.341 5.342 5.350 5.351 5.352A 5.354	**1 525-1 530** SPACE OPERATION (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) 5.208B 5.351A Earth exploration-satellite Fixed Mobile 5.343 5.341 5.351 5.354	**1 525-1 530** SPACE OPERATION (space-to-Earth) FIXED MOBILE-SATELLITE (space-to-Earth) 5.208B 5.351A Earth exploration-satellite Mobile 5.349 5.341 5.351 5.352A 5.354

Relevant footnotes

Conformity with RR (No. 9.35 of RR)

Table of Allocation

1 452-1 492 FIXED MOBILE except aeronautical mobile 5.346 BROADCASTING BROADCASTING-SATELLITE 5.208B 5.341 5.342 5.345	**1 452-1 492** FIXED MOBILE 5.341B 5.343 5.346A BROADCASTING BROADCASTING-SATELLITE 5.208B 5.341 5.344 5.345	
1 492-1 518 FIXED MOBILE except aeronautical mobile 5.341A 5.341 5.342	**1 492-1 518** FIXED MOBILE 5.341B 5.343 5.341 5.344	**1 492-1 518** FIXED MOBILE 5.341C 5.341
1 518-1 525 FIXED MOBILE except aeronautical mobile MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341 5.342	**1 518-1 525** FIXED MOBILE 5.343 MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341 5.344	**1 518-1 525** FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341

Footnote

5.344 *Alternative allocation:* in the United States, the band 1 452-1 525 MHz is allocated to the fixed and mobile services on a primary basis (see also No. **5.343**).

Article 21

1 518-1 525 MHz (Applicable to the territory of the United States in Region 2 between the longitudes 71° W and 125° W)	Mobile-satellite (space-to-Earth)	$0° \le \delta \le 4°$	$4° < \delta \le 20°$	$20° < \delta \le 60°$	$60° < \delta \le 90°$	4 kHz
		−181.0	−193.0 + 20 log δ	−213.3 + 35.6 log δ	−150.0	
1 518-1 525 MHz (Applicable to all other territory of the United States in Region 2)	Mobile-satellite (space-to-Earth)	$0° \le \delta \le 43.4°$	$43.4° < \delta \le 60°$		$60° < \delta \le 90°$	4 kHz
		−155.0	−213.3 + 35.6 log δ		−150.0	

E/R	Freq	BW	MinFreq	MaxFreq	ClsStn	SA No	Beam 1	Beam 2
E	848	84000	806	890	EI	SA No:1	A	A
E	951	18000	942	960	EI	SA No:1	A	A
E	1522	7000	1518	1525	EI	SA No:1	A	A
E	1535	19000	1525	1544	EI	SA No:1	A	A
E	1552	14000	1545	1559	EI	SA No:1	A	A
R	848	84000	806	890	EI	SA No:1	A	A
R	951	18000	942	960	EI	SA No:1	A	A
R	1618	16000	1610	1626	EI	SA No:1	A	A
R	1636	19000	1626.5	164				
R	1654	14000	1646.5	166				

460-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
790-862 FIXED MOBILE except aeronautical mobile 5.316B 5.317A BROADCASTING 5.312 5.319		**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
862-890 FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322	**806-890** FIXED MOBILE 5.317A BROADCASTING	
5.319 5.323	5.317 5.318	5.149 5.305 5.306 5.307 5.320

5.317 *Additional allocation*: in Region 2 (except Brazil, the United States and Mexico), the frequency band 806-890 MHz is also allocated to the mobile-satellite service on a primary basis, subject to agreement obtained under No. **9.21**. The use of this service is intended for operation within national boundaries. (WRC-15)

5.319 *Additional allocation*: in Belarus, the Russian Federation and Ukraine, the bands 806-840 MHz (Earth-to-space) and 856-890 MHz (space-to-Earth) are also allocated to the mobile-satellite, except aeronautical mobile-satellite (R), service. The use of these bands by this service shall not cause harmful interference to, or claim protection from, services in other countries operating in accordance with the Table of Frequency Allocations and is subject to special agreements between the administrations concerned.

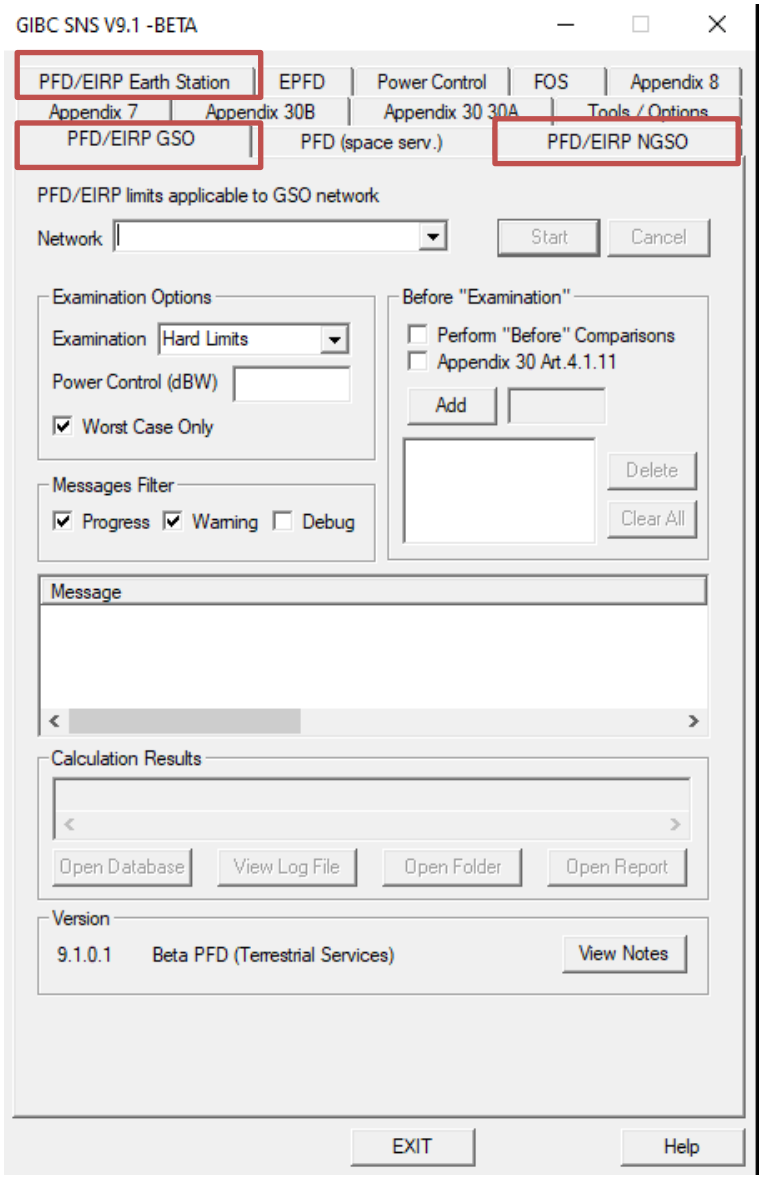
5.320 *Additional allocation*: in Region 3, the bands 806-890 MHz and 942-960 MHz are also allocated to the mobile-satellite, except aeronautical mobile-satellite (R), service on a primary basis, subject to agreement obtained under No. **9.21**. The use of this service is limited to operation within national boundaries. In seeking such agreement, appropriate protection shall be afforded to services operating in accordance with the Table, to ensure that no harmful interference is caused to such services.

Conformity with RR (No. 9.35 of RR)

Power-flux density limits (PFD)

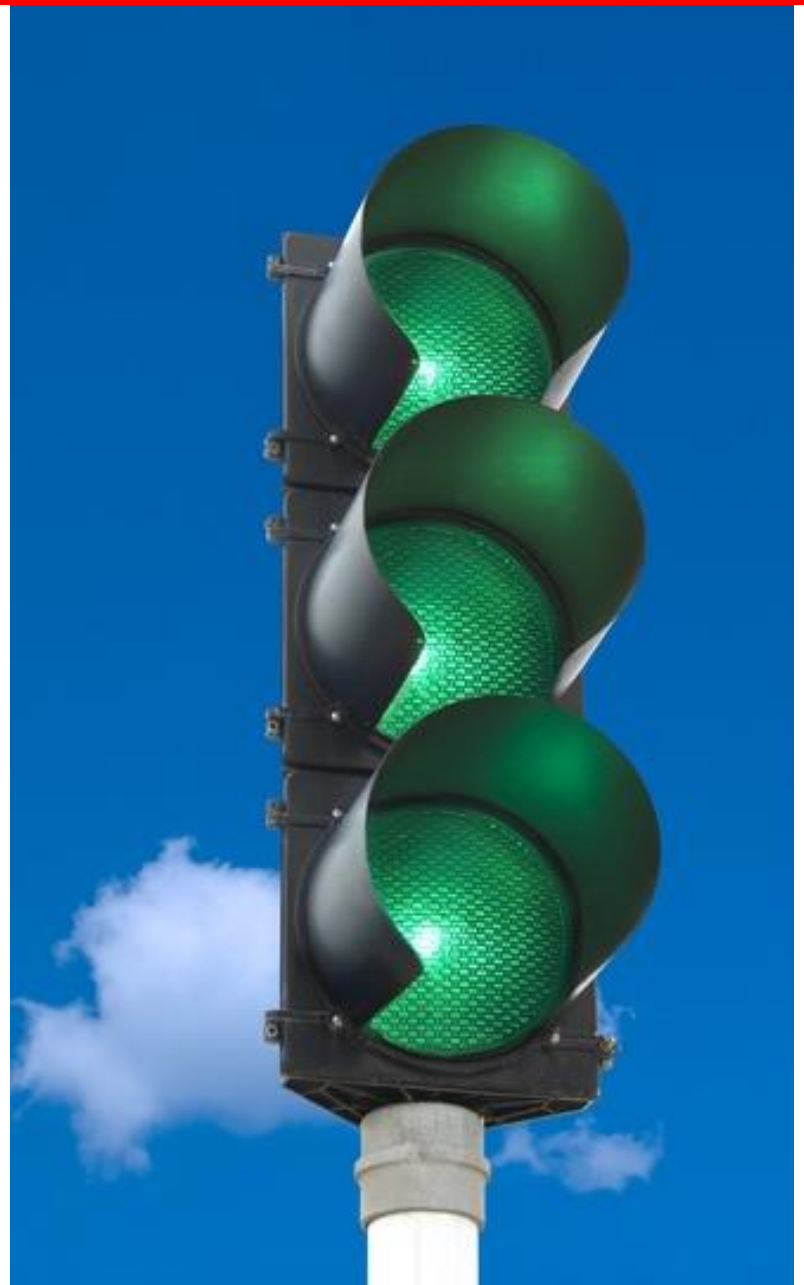
EIRP limits

GIBC Program v9.1 (Graphical Interface for Batch Calculations)



Conformity with RR (No. 9.35 of RR)

Only favourable frequency assignments will proceed …



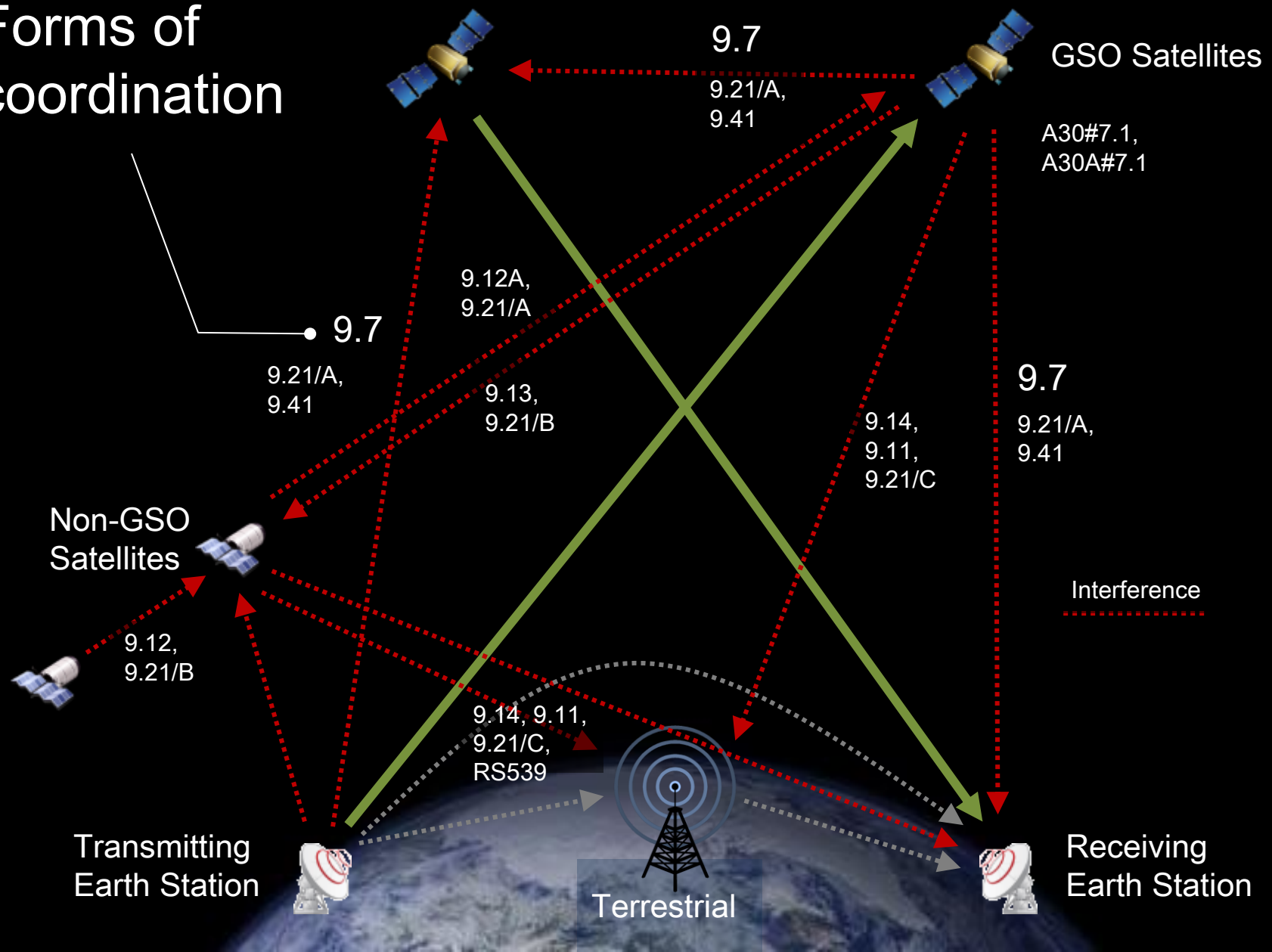
2

Identify any administration with which coordination may need to be effected

No. 9.36 of RR

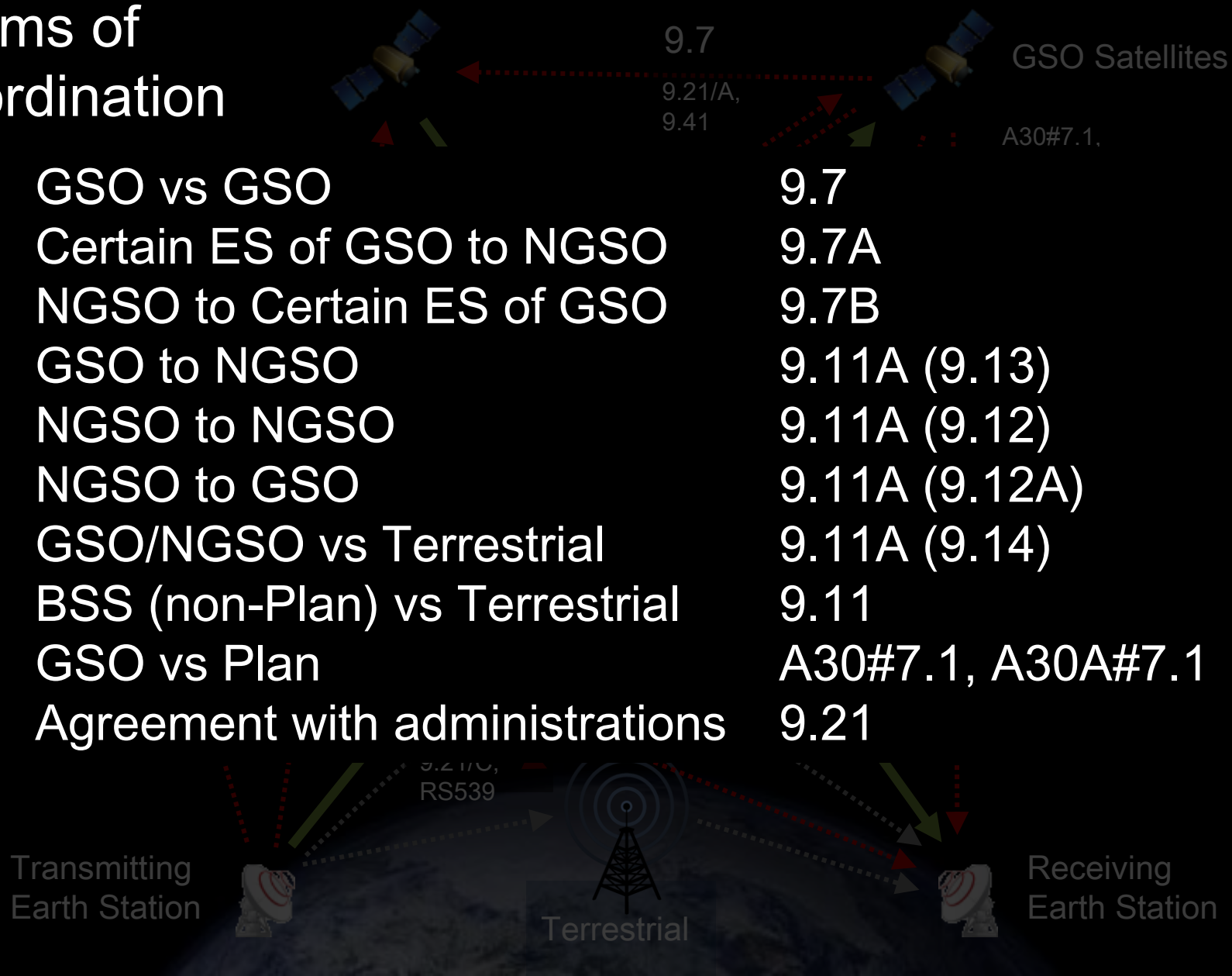
Coordination requirements (No. 9.36 of RR)

Forms of coordination



Forms of coordination

GSO vs GSO	9.7
Certain ES of GSO to NGSO	9.7A
NGSO to Certain ES of GSO	9.7B
GSO to NGSO	9.11A (9.13)
NGSO to NGSO	9.11A (9.12)
NGSO to GSO	9.11A (9.12A)
GSO/NGSO vs Terrestrial	9.11A (9.14)
BSS (non-Plan) vs Terrestrial	9.11
GSO vs Plan	A30#7.1, A30A#7.1
Agreement with administrations	9.21



Coordination requirements (No. 9.36 of RR)

UIT ITU

UNION INTERNATIONALE DES TÉLÉCOMMUNICATIONS
BUREAU DES RADIOCOMMUNICATIONS

INTERNATIONAL TELECOMMUNICATION UNION
RADIOCOMMUNICATION BUREAU

UNIÓN INTERNACIONAL DE TELECOMUNICACIONES
OFICINA DE RADIOCOMUNICACIONES

RÉSEAU À SATELLITE SATELLITE NETWORK RED DE SATÉLITE	SECTION SPÉCIALE N° SPECIAL SECTION No. SECCIÓN ESPECIAL N.º CR/C/
STATION TERRIENNE EARTH STATION ESTACIÓN TERRENA ---	BR IFIC / DATE BR IFIC / DATE BR IFIC / FECHA
ADM. RESPONSABLE RESPONSIBLE ADM. ADM. RESPONSABLE / LONGITUDE NOMINALE NOMINAL LONGITUDE LONGITUD NOMINAL	NUMÉRO D'IDENTIFICATION IDENTIFICATION NUMBER NÚMERO DE IDENTIFICACIÓN

...Y THE BUREAU ON / INFORMACIÓN RECIBIDA POR LA OFICINA EL

This request for coordination, received by the Radiocommunication Bureau pursuant to No. 9.30 of the Radio Regulations, has been examined under Nos. 9.35 and 9.36 and is published in accordance with No. 9.38. It is subject to the form of coordination indicated in the left-hand column by an X in the relevant box

...st for coordination, received by the Radiocommunication Bureau ... No. 9.30 of the Radio Regulations, has been examined under Nos. ...36 and is published in accordance with No. 9.38. It is subject to the ...rdination indicated in the left-hand column by an X in the relevant box

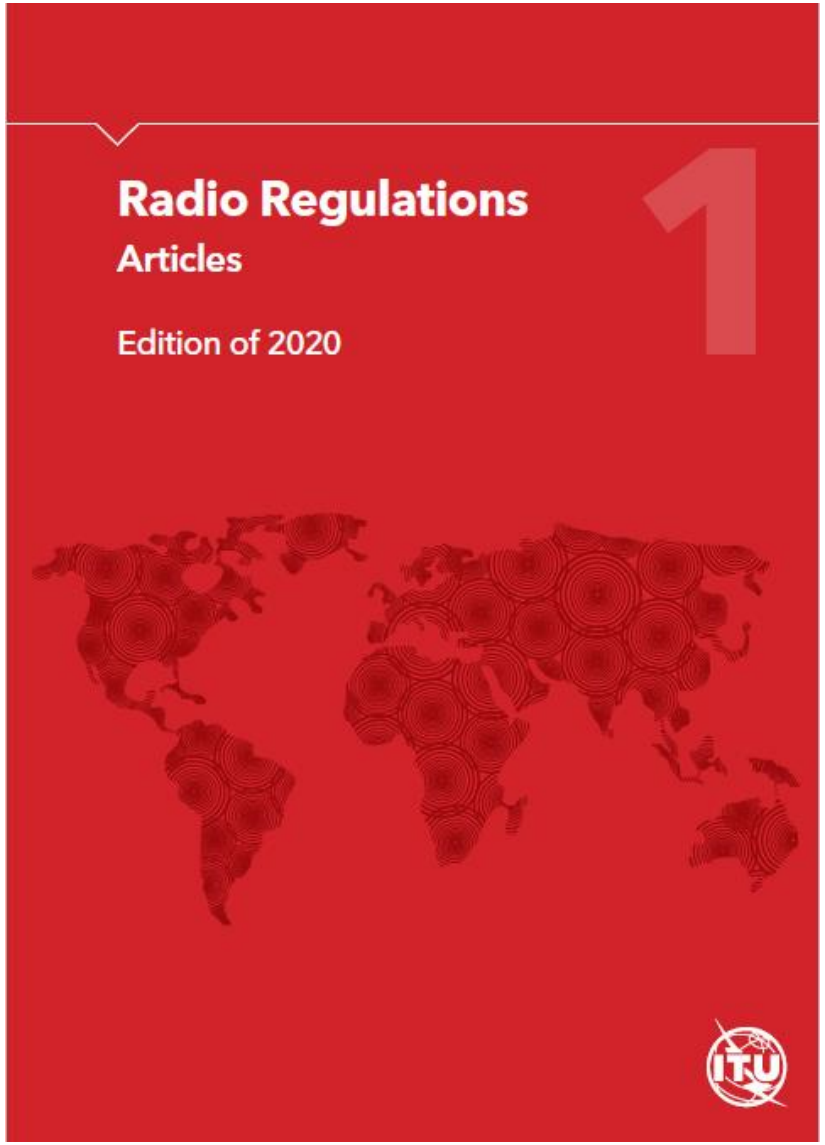
Esta solicitud de coordinación, recibida por la Oficina de Radiocomunicaciones de conformidad con el punto Nº 9.30 del Reglamento de Radiocomunicaciones, se ha examinado de conformidad con los Nos 9.35 y 9.36 y se publica de conformidad con el Nº 9.38. Está sujeta al formulario de coordinación indicado en la columna de la

Type de coordination mentionné dans le Tableau I	
X	9.7
	9.7A
	9.7B
X	AP30#7.1
X	AP30A#7.1
Type de coordination mentionné dans le Tableau II	
X	9.11
X	9.11A
	9.12
	9.12A
X	9.13
X	9.14
X	9.21/A
X	9.21/B
X	9.21/C

Identify forms of coordination

Article 9
Article 5 footnotes (9.21, 9.11A)
Rules of Procedure (9.11A)
Articles 7 of Appendices 30, 30A

Appendix 5 for criteria and methods for identification



Section II – Procedure for effecting coordination[13, 14]

Sub-Section IIA – Requirement and request for coordination

9.6 Before an administration[15, 16, 17] notifies to the Bureau or brings into use a frequency assignment in any of the cases listed below, it shall effect coordination, as required, with other administrations identified under No. **9.27**: (WRC-03)

9.7 *a)* for a station in a satellite network using the geostationary-satellite orbit, in any space radiocommunication service, in a frequency band and in a Region where this service is not subject to a plan, in respect of any other satellite network using that orbit, in any space radiocommunication service in a frequency band and in a Region where this service is not subject to a plan, with the exception of coordination between earth stations operating in the opposite direction of transmission.

9.7A *b)*[18, 19] for a specific earth station in a geostationary-satellite network in the fixed-satellite service in certain frequency bands, in respect of a non-geostationary-satellite system in the fixed-satellite service; (WRC-2000)

9.7B *c)* [18, 19] for a non-geostationary-satellite system in the fixed-satellite service in certain frequency bands, in respect of a specific earth station in a geostationary-satellite network in the fixed-satellite service. (WRC-2000)

9.11 *d)* for a space station in the broadcasting-satellite service in any band shared on an equal primary basis with terrestrial services and where the broadcasting-satellite service is not subject to a plan, in respect of terrestrial services;

9.11A *e)*
the
to **9.**

9.12 *f)*
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5.218 *Additional allocation:* the band 148-149.9 MHz is also allocated to the space operation service (Earth-to-space) on a primary basis, subject to agreement obtained under No. **9.21**. The bandwidth of any individual transmission shall not exceed ± 25 kHz.

5.219 The use of the band 148-149.9 MHz by the mobile-satellite service is subject to coordination under No. **9.11A**. The mobile-satellite service shall not constrain the development and use of the fixed, mobile and space operation services in the band 148-149.9 MHz.

5.220 The use of the frequency bands 149.9-150.05 MHz and 399.9-400.05 MHz by the mobile-satellite service is subject to coordination under No. **9.11A**. (WRC-15)

Radio Regulations

Appendices

2

Edition of 2020

ITU

ARTICLE 7 (REV.WRC-19)

Coordination, notification and recording in the Master International Frequency Register of frequency assignments to stations in the fixed-satellite service (space-to-Earth) in the bands 11.7-12.2 GHz (in Region 2), 12.2-12.7 GHz (in Region 3) and 12.5-12.7 GHz (in Region 1), and to stations in the broadcasting-satellite service in the band 12.5-12.7 GHz (in Region 3) when frequency assignments to broadcasting-satellite stations in the bands 11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3 are involved[22]

7.1 The provisions of No. **9.7** and the associated provisions under Articles **9** and **11** are applicable in respect of frequency assignments to broadcasting-satellite stations in the frequency bands 11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3:

a) to transmitting space stations in the fixed-satellite service in the frequency bands 11.7-12.2 GHz (in Region 2), 12.2-12.7 GHz (in Region 3) and 12.5-12.7 GHz (in Region 1); and

b) to transmitting space stations in the broadcasting-satellite service in the frequency band 12.5-12.7 GHz (in Region 3). (WRC-19)

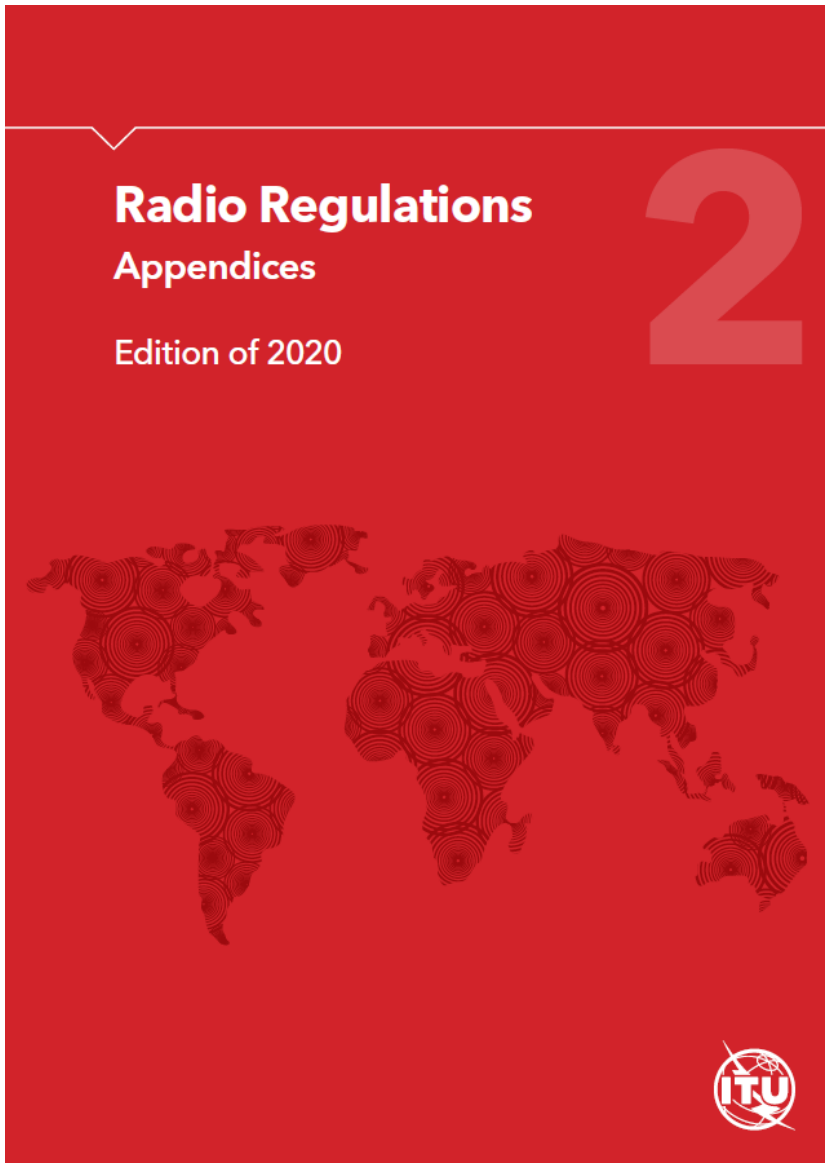
7.2 In applying the procedures referred to in § 7.1, the provisions of Appendix **5** are replaced by the following:

ARTICLE 7 (REV.WRC-19)

Coordination, notification and recording in the Master International Frequency Register of frequency assignments to stations in the fixed-satellite service (space-to-Earth) in Region 1 in the frequency band 17.3-18.1 GHz and in Regions 2 and 3 in the frequency band 17.7-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in Region 2 in the frequency bands 14.5-14.8 GHz and 17.8-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in countries listed in Resolution 163 (WRC-15) in the frequency band 14.5-14.75 GHz and in countries listed in Resolution 164 (WRC-15) in the frequency band 14.5-14.8 GHz where those stations are not for feeder links for the broadcasting-satellite service, and to stations in the broadcasting-satellite service in Region 2 in the frequency band 17.3-17.8 GHz when frequency assignments to feeder links for broadcasting-satellite stations in the frequency bands 14.5-14.8 GHz and 17.3-18.1 GHz in Regions 1 and 3 or in the frequency band 17.3-17.8 GHz in Region 2 are involved[28] (Rev.WRC-19)

Section I – Coordination of transmitting space or earth stations in the fixed-satellite service or transmitting space stations in the broadcasting-satellite service with assignments to broadcasting-satellite service feeder links

7.1 The provisions of No. **9.7** and the associated provisions under Articles **9** and **11** are applicable to transmitting space stations in the fixed-satellite service in Region 1 in the frequency band 17.3-18.1 GHz, to transmitting space stations in the fixed-satellite service in Regions 2 and 3 in the frequency band 17.7-18.1 GHz, to transmitting earth stations in the fixed-satellite service in Region 2 in the frequency bands 14.5-14.8 GHz and 17.8-18.1 GHz, to transmitting earth stations in the fixed-satellite service in countries listed in Resolution **163 (WRC-15)** in the frequency band 14.5-14.75 GHz and in countries listed in Resolution **164 (WRC-15)** in the frequency band 14.5-14.8 GHz where those stations are not for feeder links for the broadcasting-satellite service, and to transmitting space stations in the broadcasting-satellite service in Region 2 in the frequency band 17.3-17.8 GHz. (WRC-19)



Criteria and methods for identification

TABLE 5-1 (Rev.WRC-15)

Technical conditions for coordination
(see Article 9)

Reference of Article 9	Case	Frequency bands (and Region) of the service for which coordination is sought	Threshold/condition	Calculation method	Remarks
No. **9.7** GSO/GSO	A station in a satellite network using the geostationary-satellite orbit (GSO), in any space radiocommunication service, in a frequency band and in a Region where this service is not subject to a Plan, in respect of any other satellite network using that orbit, in any space radiocommunication service in a frequency band and in a Region where this service is not subject to a Plan, with the exception of the coordination between earth stations operating in the opposite direction of transmission	1) 3 400-4 200 MHz 5 725-5 850 MHz (Region 1) and 5 850-6 725 MHz 7 025-7 075 MHz 2) 10.95-11.2 GHz 11.45-11.7 GHz 11.7-12.2 GHz (Region 2) 12.2-12.5 GHz (Region 3) 12.5-12.75 GHz (Regions 1 and 3) 12.7-12.75 GHz (Region 2) and 13.75-14.8 GHz	i) Bandwidth overlap, and ii) any network in the fixed-satellite service (FSS) and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±7° of the nominal orbital position of a proposed network in the FSS i) Bandwidth overlap, and ii) any network in the FSS or broadcasting-satellite service (BSS), not subject to a Plan, and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±6° of the nominal orbital position of a proposed network in the FSS or BSS, not subject to a Plan iii) in the band 14.5-14.8 GHz any network in the space research service (SRS) or FSS not subject to a Plan and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±6° of the nominal orbital position of a proposed network in the SRS or FSS not subject to a Plan		With respect to the space services listed in the threshold/condition column in the frequency bands in 1), 2), 2*bis*), 3), 4), 5), 6), 7) and 8), an administration may request, pursuant to No. **9.41**, to be included in requests for coordination, indicating the networks for which the value of $\Delta T/T$ calculated by the method in § 2.2.1.2 and 3.2 of Appendix **8** exceeds 6%. When the Bureau, on request by an affected administration, studies this information pursuant to No. **9.42**, the calculation method given in § 2.2.1.2 and 3.2 of Appendix **8** shall be used
	opposite direction of transmission		power spectral density delivered to the mobile earth station antenna exceeds −10 dB(W/4 kHz)		
No. **9.14** Non-GSO/ terrestrial, GSO/ terrestrial	A space station in a satellite network in the frequency bands for which a footnote refers to No. **9.11A** or to No. **9.14**, in respect of stations of terrestrial services where threshold(s) is (are) exceeded	1) Frequency bands for which a footnote refers to No. **9.11A**; or 2) 11.7-12.2 GHz (Region 2 GSO FSS) 3) 5 030-5 091 MHz	1) See § 1 of Annex 1 to this Appendix; In the bands specified in No. **5.414A**, the detailed conditions for the application of No. **9.14** are provided in No. **5.414A** for MSS networks or 2) In the band 11.7-12.2 GHz (Region 2 GSO FSS): -124 dB(W/(m^2 · MHz)) for $0° \le \theta \le 5°$ $-124 + 0.5\,(\theta - 5)$ dB(W/(m^2 · MHz)) for $5° < \theta \le 25°$ -114 dB(W/(m^2 · MHz)) for $\theta > 25°$ where θ is the angle of arrival of the incident wave above the horizontal plane (degrees) 3) Bandwidth overlap	1) See § 1 of Annex 1 to this Appendix	

APPENDIX 8 (REV.WRC-15)

Method of calculation for determining if coordination is required between geostationary-satellite networks sharing the same frequency bands

1 Introduction

The method of calculation for determining if coordination is required under provision No. 9.7 is based on the concept that the noise temperature of a system subject to interference increases as the level of the interfering emission increases. It can, therefore, be applied irrespective of the modulation characteristics of these satellite networks, and of the precise frequencies used.

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ANNEX 1 (REV.WRC-19)

2

1 Coordination thresholds for sharing between MSS (space-to-Earth) and terrestrial services in the same frequency bands and between non-GSO MSS feeder links (space-to-Earth) and terrestrial services in the same frequency bands and between RDSS (space-to-Earth) and terrestrial services in the same frequency bands (WRC-12)

1.1 Below 1 GHz*

1.1.1 In the bands 137-138 MHz and 400.15-401 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to terrestrial services (except aeronautical mobile (OR) service networks operated by the administrations listed in Nos. **5.204** and **5.206** as of 1 November 1996) is required only if the pfd produced by this space station exceeds −125 dB(W/(m^2 · 4 kHz)) at the Earth's surface.

1.1.2 In the band 137-138 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to the aeronautical mobile (OR) service is required only if the pfd produced by this space station at the Earth's surface exceeds:

– −125 dB(W/(m^2 · 4 kHz)) for networks for which complete Appendix **3**** coordination information has been received by the Bureau prior to 1 November 1996;

– −140 dB(W/(m^2 · 4 kHz)) for networks for which complete Appendix **4**/**S4**/**3**** coordination information has been received by the Bureau after 1 November 1996 for the administrations referred to in § 1.1.1 above.

RESOLUTION 554 (WRC-12)

Application of pfd masks to coordination under No. 9.7 for broadcasting-satellite service networks in the band 21.4-22 GHz in Regions 1 and 3

The World Radiocommunication Conference (Geneva, 2012),

considering

ntial to reduce undue protection
their vicinity;

vill facilitate coordination of

uirements will encourage use of
um usage,

llite service (BSS) space station
S networks is not required if the
not exceed the threshold values
ected assignment:

$0° \le \theta < 0.6°$

$0.6° \le \theta < 1.05°$

$.05° \le \theta < 2.65°$

$.65° \le \theta < 4.35°$

$.35° \le \theta < 12°$

$12° \le \theta$

egrees, between the wanted and
est station-keeping accuracies;

examination of notifications of
cedures, it shall base its findings
pendix **5** as revised by WRC-12

ATTACHMENT TO RESOLUTION 553 (REV.WRC-15)

Technical criteria to determine coordination requirements for submissions under the special procedure to be applied for an assignment for a broadcasting-satellite service system in the frequency band 21.4-22 GHz in Regions 1 and 3

Coordination of assignments for a BSS space station with respect to other BSS networks is not required if the pfd produced under assumed free space propagation conditions does not exceed the threshold values shown below, anywhere within the service area of the potentially affected assignment:

a) this mask shall be applied for frequency assignments subject to this Resolution with regard to frequency assignments not subject to this Resolution for which:

– notification is not submitted under Article **11**; and

– complete information under Resolution **552 (Rev.WRC-15)*** is not received by the Bureau,

at the date of receipt of complete information under § 8 and 9 of the Attachment to this Resolution,

−146.88	dB(W/(m^2 · MHz))	for	$0° \le \theta < 0.6°$
$-150.2 + 9.3\ \theta^2$	dB(W/(m^2 · MHz))	for	$0.6° \le \theta < 1.05°$
$-140.5 + 27.2 \log \theta$	dB(W/(m^2 · MHz))	for	$1.05° \le \theta < 2.65°$
$-138.1 + 1.3\ \theta^2$	dB(W/(m^2 · MHz))	for	$2.65° \le \theta < 4.35°$
$-130.2 + 26.1 \log \theta$	dB(W/(m^2 · MHz))	for	$4.35° \le \theta < 9.1°$
−105	dB(W/(m^2 · MHz))	for	$9.1° \le \theta$

where θ is the minimum nominal geocentric orbital separation, in degrees, between the wanted and interfering space stations, taking into account the respective East-West station-keeping accuracies;

b) this mask shall be applied for frequency assignment subject to this Resolution with regard to:

– frequency assignments subject to this Resolution; or

– frequency assignments not subject to this Resolution for which:

  – notification is submitted under Article **11**; or

  – complete information under Resolution **552 (Rev.WRC-15)*** is received by the Bureau,

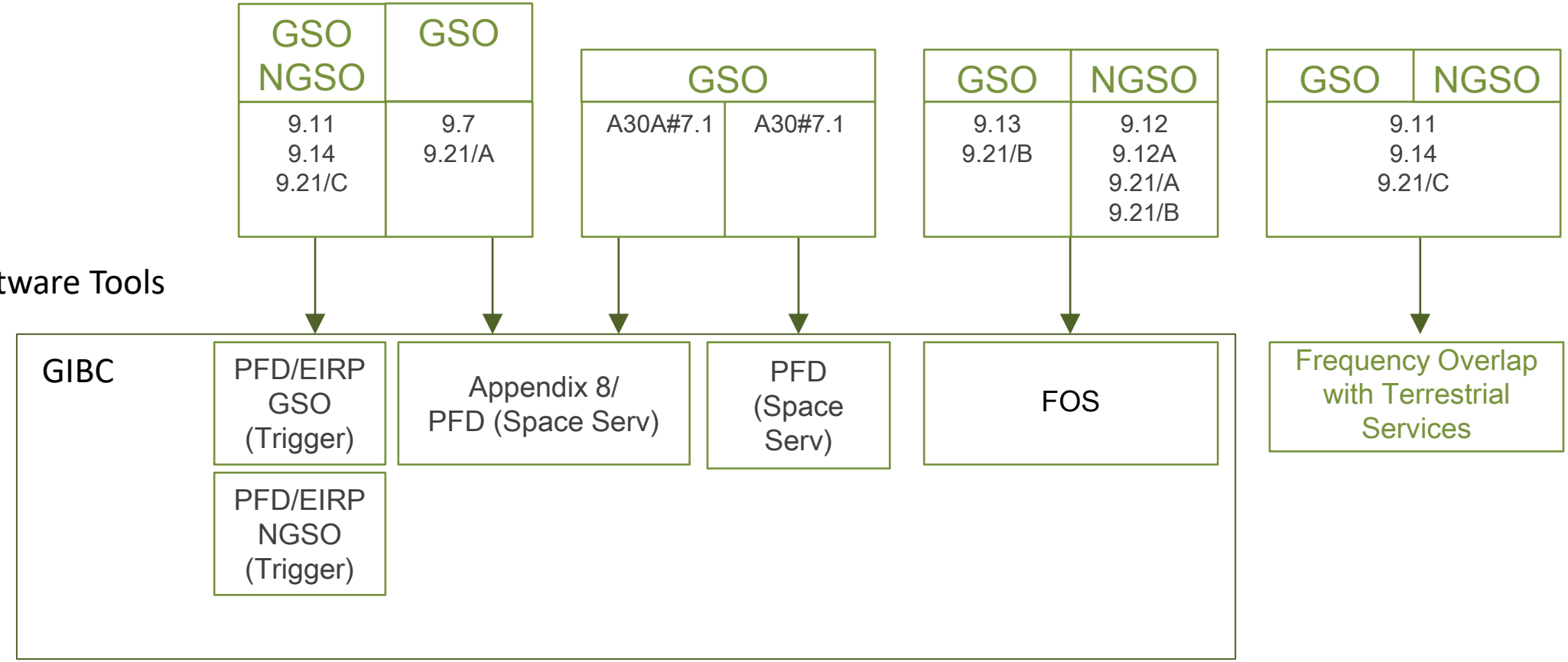
TABLE 9.11A-1

Applicability of the provisions of Nos. 9.11A-9.15 to stations of space services

1	2	3		4		5	6	7
Frequency band (GHz)	Footnote No. in Article 5	Space services mentioned in a footnote referring to Nos. **9.11A**, **9.12**, **9.12A**, **9.13** or **9.14**, as appropriate		Other space services or systems to which Nos. **9.12** to **9.14** provisions(s) apply equally, as appropriate		Applicable Nos. **9.12** to **9.14** provision(s), as appropriate	Terrestrial services in respect of which No. **9.14** apply equally	Notes
19.3-19.6	**5.523B**	FIXED-SATELLITE (limited to non-GSO MOBILE-SATELLITE SERVICE feeder links)	↑	---		**9.12, 9.12A, 9.13**	---	
	5.523D	FIXED-SATELLITE (GSO with coordination information received as of 18.11.1995 and non-GSO MOBILE-SATELLITE SERVICE feeder links) (see also No. **5.523C**)	↓					
19.6-19.7	**5.523D**	FIXED-SATELLITE (GSO with coordination information received as of 22.11.1997 and non-GSO MOBILE-SATELLITE SERVICE feeder links) (see also No. **5.523E**)	↓	FIXED-SATELLITE (GSO with coordination information received as of 22.11.1997 and non-GSO) (see also No. **5.523E**)	↑	**9.12, 9.12A, 9.13**	---	
19.7-20.1	**5.484A**	FIXED-SATELLITE (non-GSO)	↓	MOBILE-SATELLITE (Non-GSO) (Region 2)	↓	**9.12**	---	
20.1-20.2	**5.484A**	FIXED-SATELLITE (non-GSO)	↓	MOBILE-SATELLITE (Non-GSO)	↓	**9.12**	---	
27.5-28.6	**5.484A**	FIXED-SATELLITE (non-GSO)	↑	FIXED-SATELLITE (Non-GSO) in the band 27.5-27.501 GHz (**5.538**)	↓	**9.12**	---	
28.6-29.1	**5.523A**	FIXED-SATELLITE	↑	---		**9.12, 9.12A, 9.13**	---	
29.1-29.5	**5.536A**	FIXED-SATELLITE (GSO) (see also Nos. **5.523C** and **5.523E**) and non-GSO MOBILE-SATELLITE	↑	---		**9.12, 9.12A, 9.13**	---	

Coordination requirements (No. 9.36 of RR)

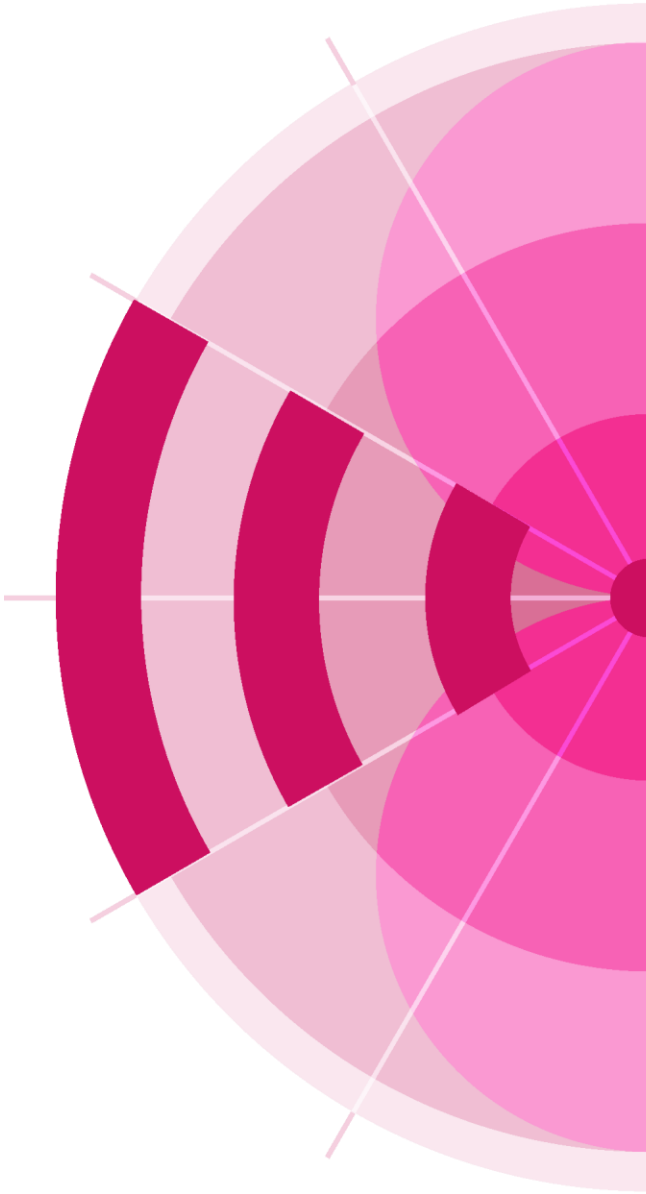
Forms of Coordination



Regulatory and technical examination

GIBC PFD/EIRP GSO

Hon Fai Ng



1) Conformity with RR
Check Freq Allocation &
"Hard Limits"

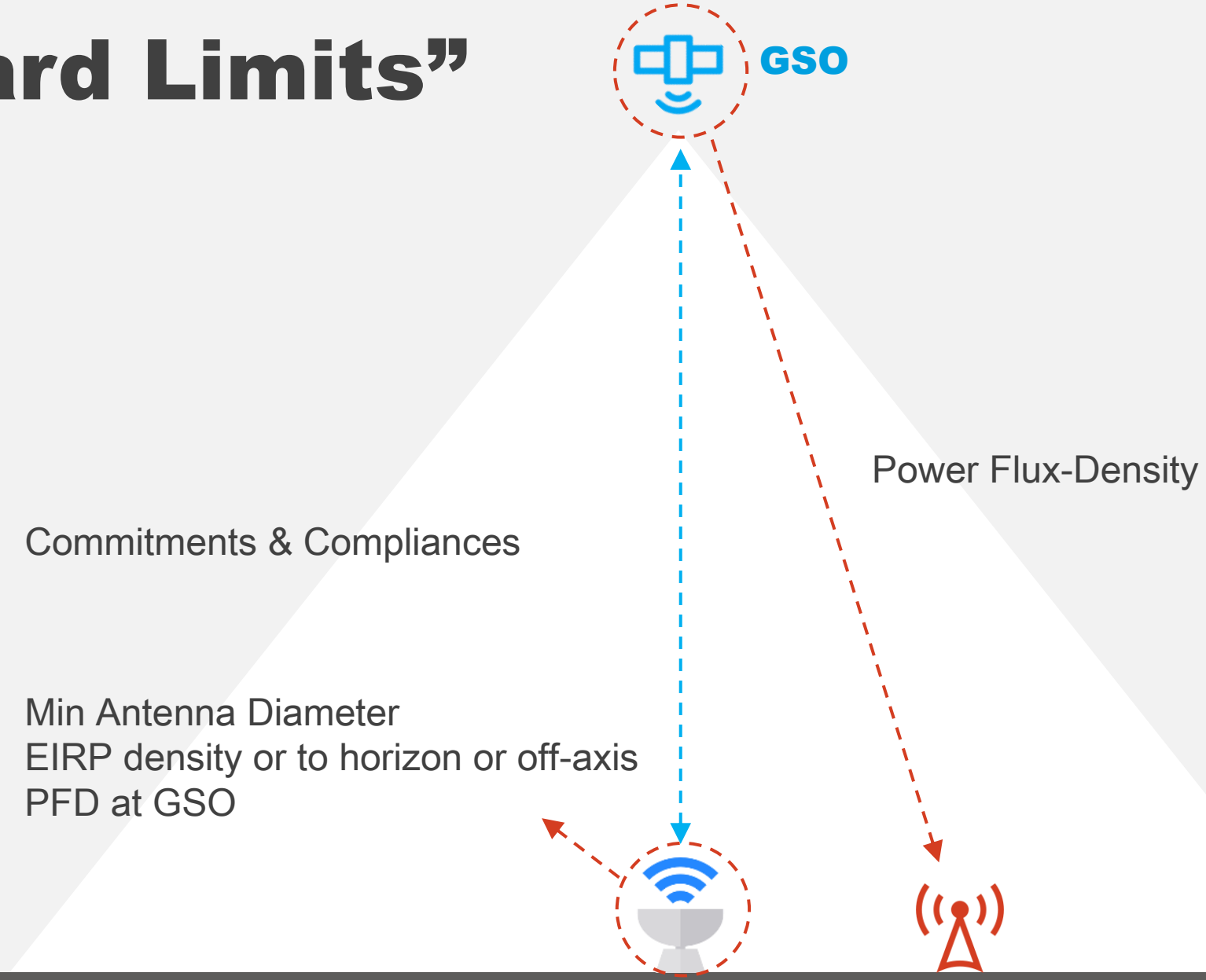
C

Coordination
Examination

2) Coordination Requirements
Establish affected administrations / networks

Reference: See Nos. 9.35, 11.31, 9.36 of Radio Regulations (RR)

“Hard Limits”



UNFAVOURABLE FINDING

Nos. 9.35 or 11.31

Consequence

No date of protection

Record for info only (No. 8.4)

No international recognition (No. 8.3)

Cannot cause or claim protection from harmful interference (No. 4.4)

Remedy

New Submission

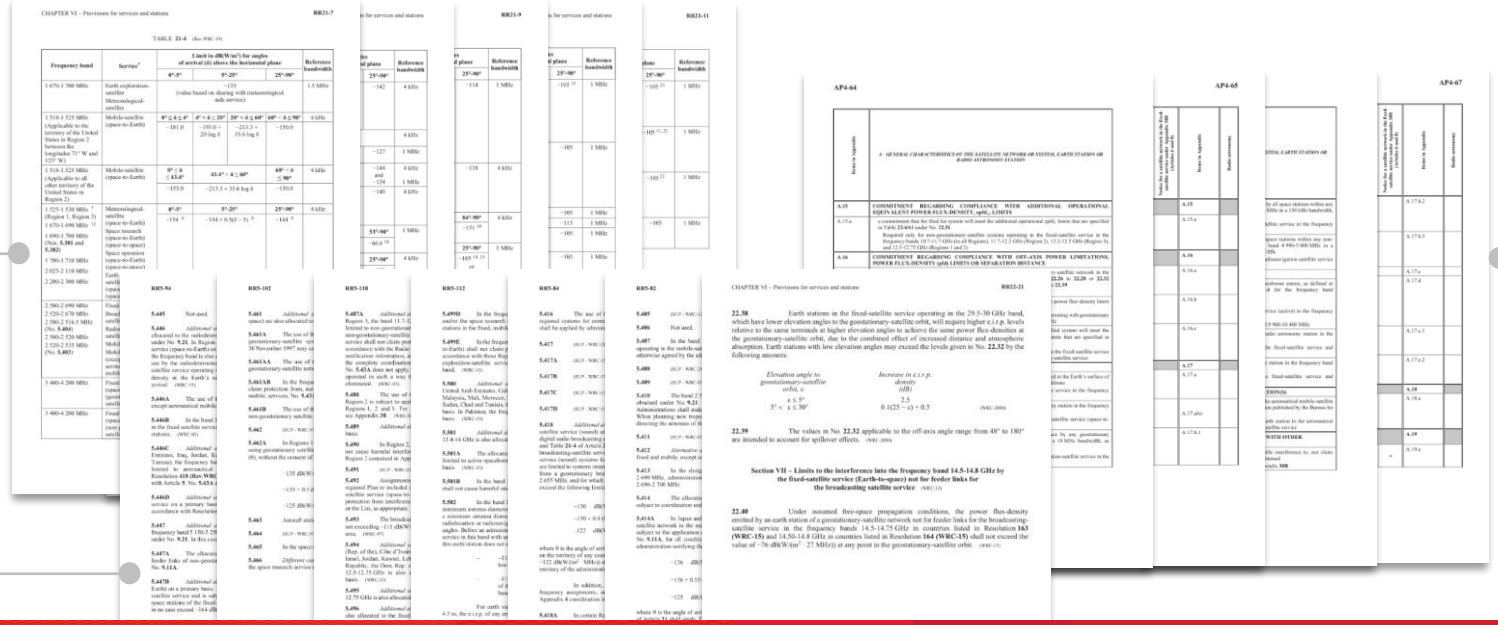
New Date of Receipt

New Cost Recovery Invoice

“Hard Limits” in Radio Regulations

PFD Limits
(Table 21-4)

Other limits
(Art5, 22 etc)



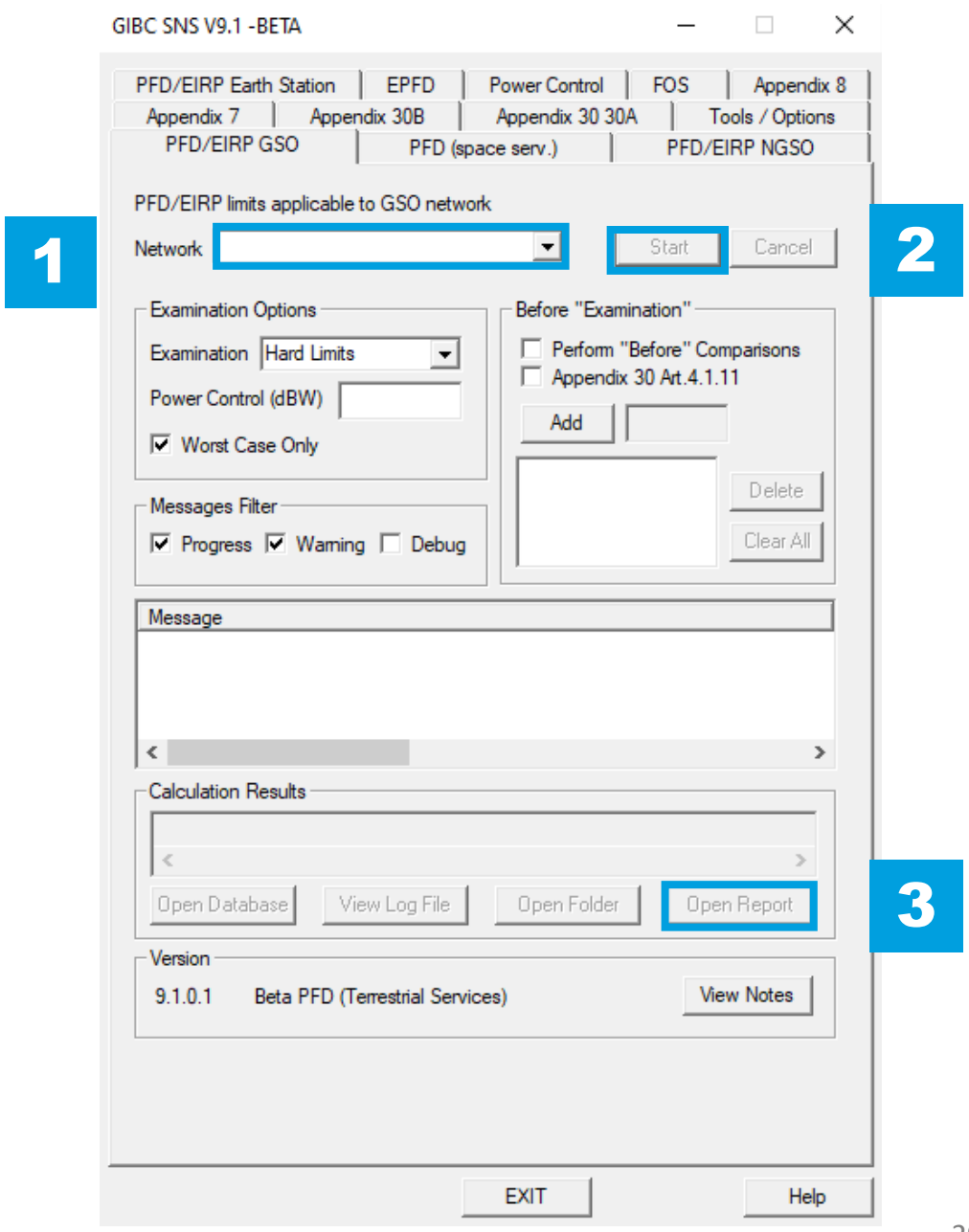
Commitments &
Compliances (Ap4)

Different
editions of RR

GIBC | PFD/EIRP GSO

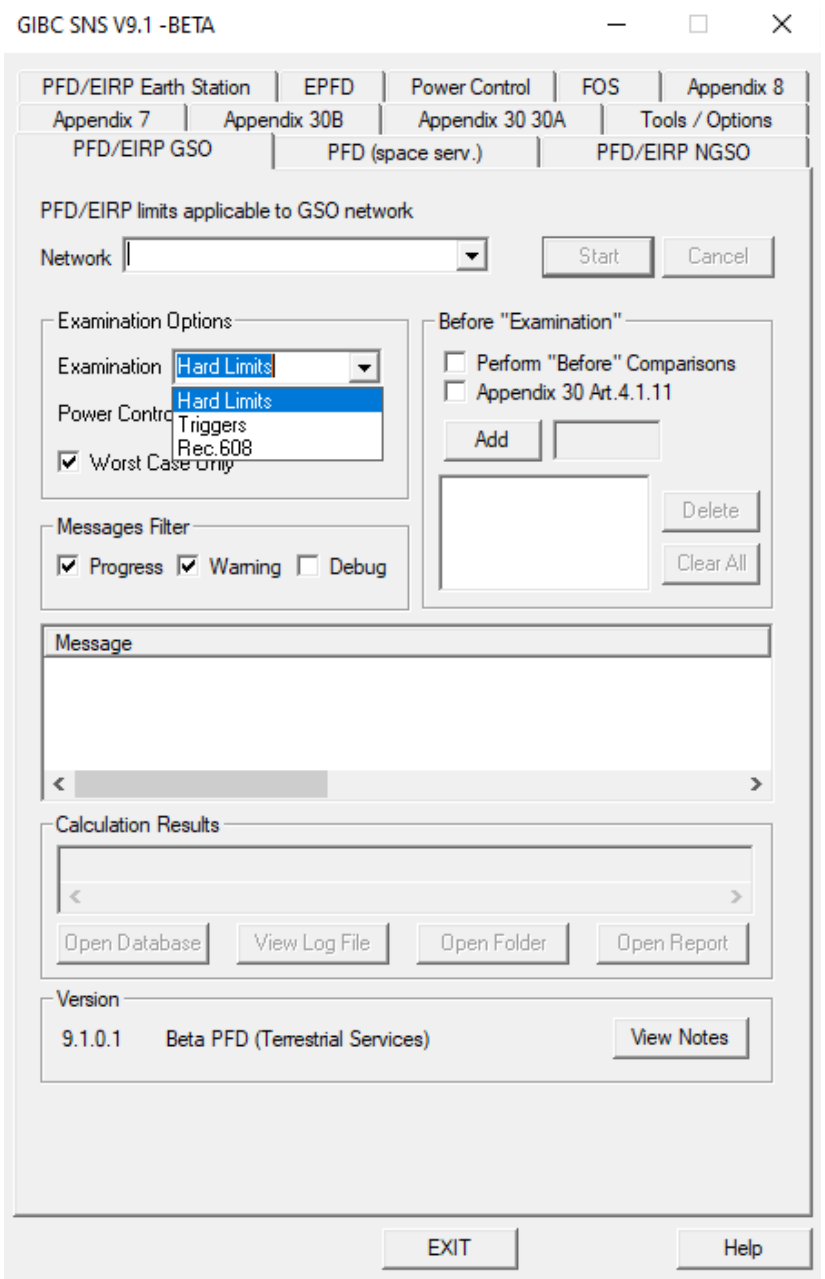
https://www.itu.int/en/ITU-R/software/Pages/gibc.aspx

Previously known as “PFD (terrestrial serv)”



Hard Limits

- GSO only
- PFD hard limits[1]
- EIRP density or to horizon or off-axis limits[2]
- PFD limit at GSO[3]
- Minimum antenna diameter[4]
- Commitment or Compliance checks[5]



[1] Table 21-4 of Art. 21, Nos. 5.268, 5.407, 5.418, 5.446, 5.462A, 5.493, 5.556A, 5.558A, 5.562C, 5.562H, Res903 (REV.WRC-19) & 761 (REV.WRC-19)

[2] Nos. 5.264A, 5.364, 5.503, 5.506A, 5.538, 21.8 (Warning), 21.13A, [Res169 (WRC-19)]

[3] No. 22.40

[4] Nos. 5.502, 5.532B, 5.506A, 5.509C, 5.555C

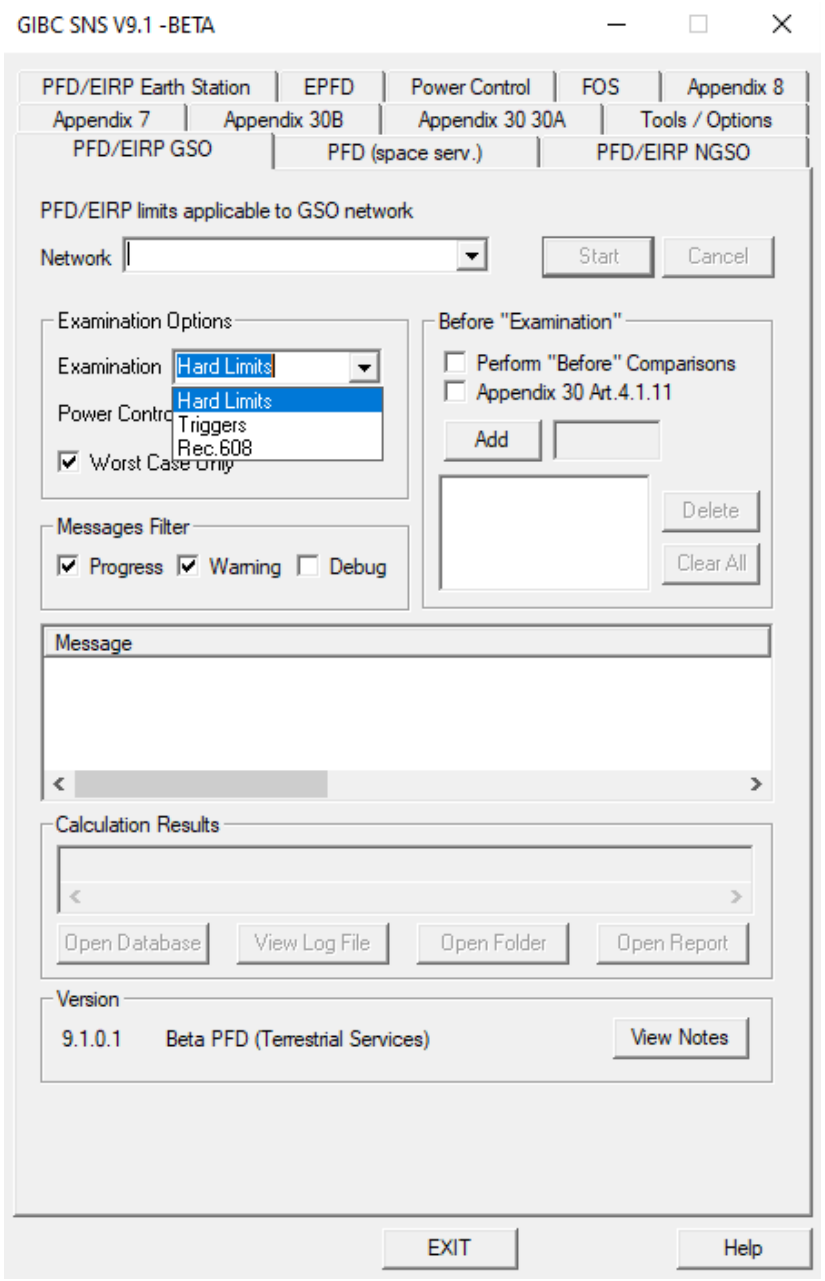
[5] Ap4 - A.16.a, A.16.c, A.17.a, A.17.b.1, A.17.b.2, A.17.d, A.17.e.2, A.18.a, A.19.b, [A.20.a, A.21.a, A.22.a – in v9.1]

Triggers

- GSO only
- No. 9.11 - BSS vs terrestrial stations
- No. 9.14 - GSO vs terrestrial stations
- No. 9.21/C - Seeking agreement wrt terrestrial stations

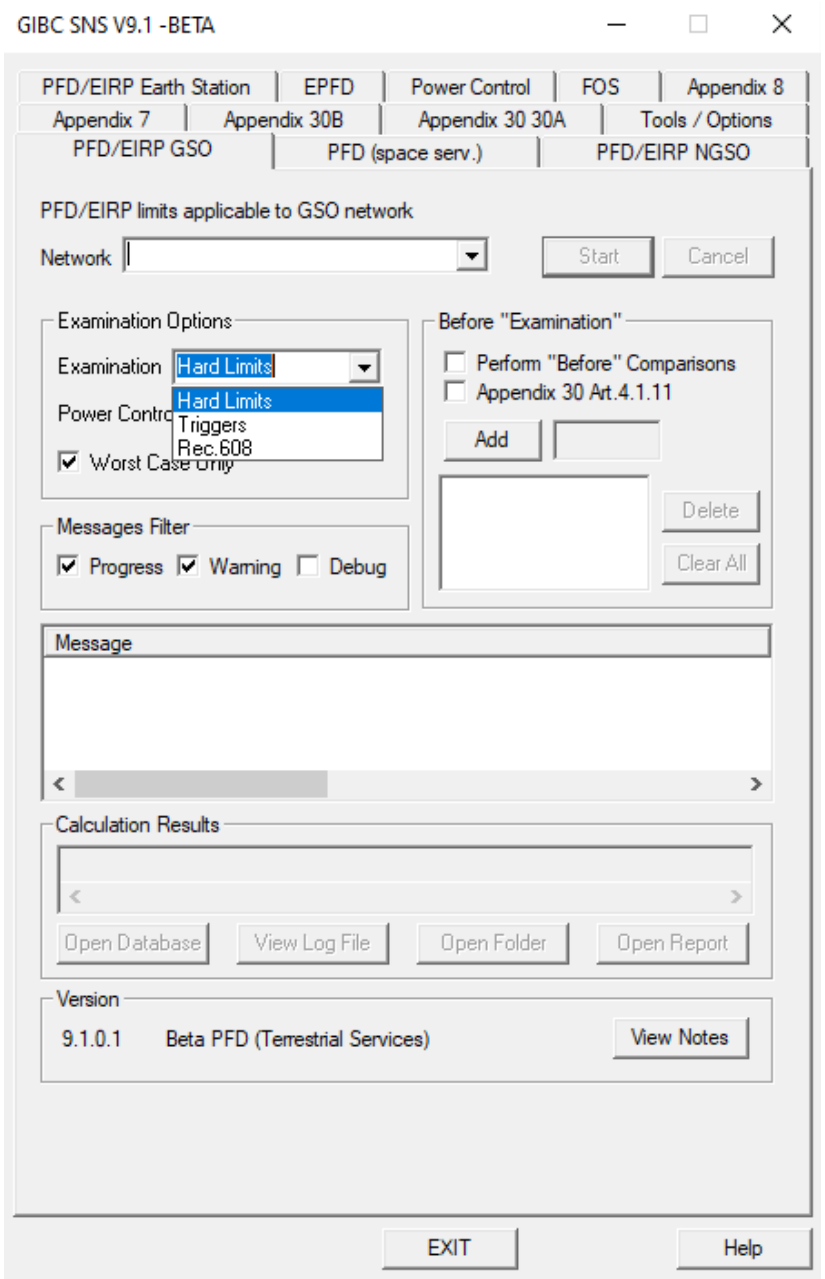
Rec. 608

- GSO only
- PFD limit of Rec. 608 (REV.WRC-07) for RNSS in 1164-1215 MHz



Does NOT verify

- Aggregate PFD or PFD with % of time[1]
- PFD in adjacent band[2]
- Limits already covered by commitment or compliance in Appendix 4[3]
- Station keeping & Pointing accuracy[4]
- Rules of Procedure on No. 21.16
- Table of Frequency Allocation[5]



[1] e.g. 5.379C, 5.443B, 5.502, 5.549A
[2] e.g. 5.443B, 5.551I, 5.555B
[3] e.g. 5.379C, 5.443B, 5.502, 5.509D, 5.509E, 5.549A, 5.551I, 22.26 to 22.28, 22.32, Res609, Res741 etc.except A.17.d (9900-10400 MHz EESS)
[4] e.g. Nos. 22.8, 22.13, 22.17 and 22.19
[5] Article 5

“HARD LIMITS” REPORT

Satellite Network

└ Beam(s)

└ Group(s)

└ Frequency assignment(s) & **RESULTS**
(Frequency & emission)

Contains assignments that **exceeded hard limits**

“HARD LIMITS” REPORT

Beam | Tx. Direction | Steerable or Fixed | Maximum Gain

Group ID | Class of Station | Bandwidth | Date of Protection

```
QT1        E   STEERABLE            GAIN MAX:   50.0 DBi  POINTING ACC.  0.10 DEG

120630210  EC                  1000000 KHZ   2D DATE:  15.01.2020 (DR)              N-
  38.00000 GHZ      1000000 KHZ   EMISS: 120MG2W--    PEP MAX:   34.7 DBW   PWR DS MAX: -45.9 DBW/HZ
    PROV:  (56) RR 21.16                 SRV: FSS                  PROT AREA: ALL WORLD                    REF.BW:  1.000 MHZ
    WORST CASE: 011E2038 02N0700/   5.0   GAB    GAIN:   44.0 DB   PFD: -105.2   PFDL: -127.0   PFDX:  21.8   FINDING: N-     X/21.16
```

Ref. to applicable limits | Service | Worst case location

e.g. 21.16, 5.503, 21.13A, 22.40, 5.509C etc.

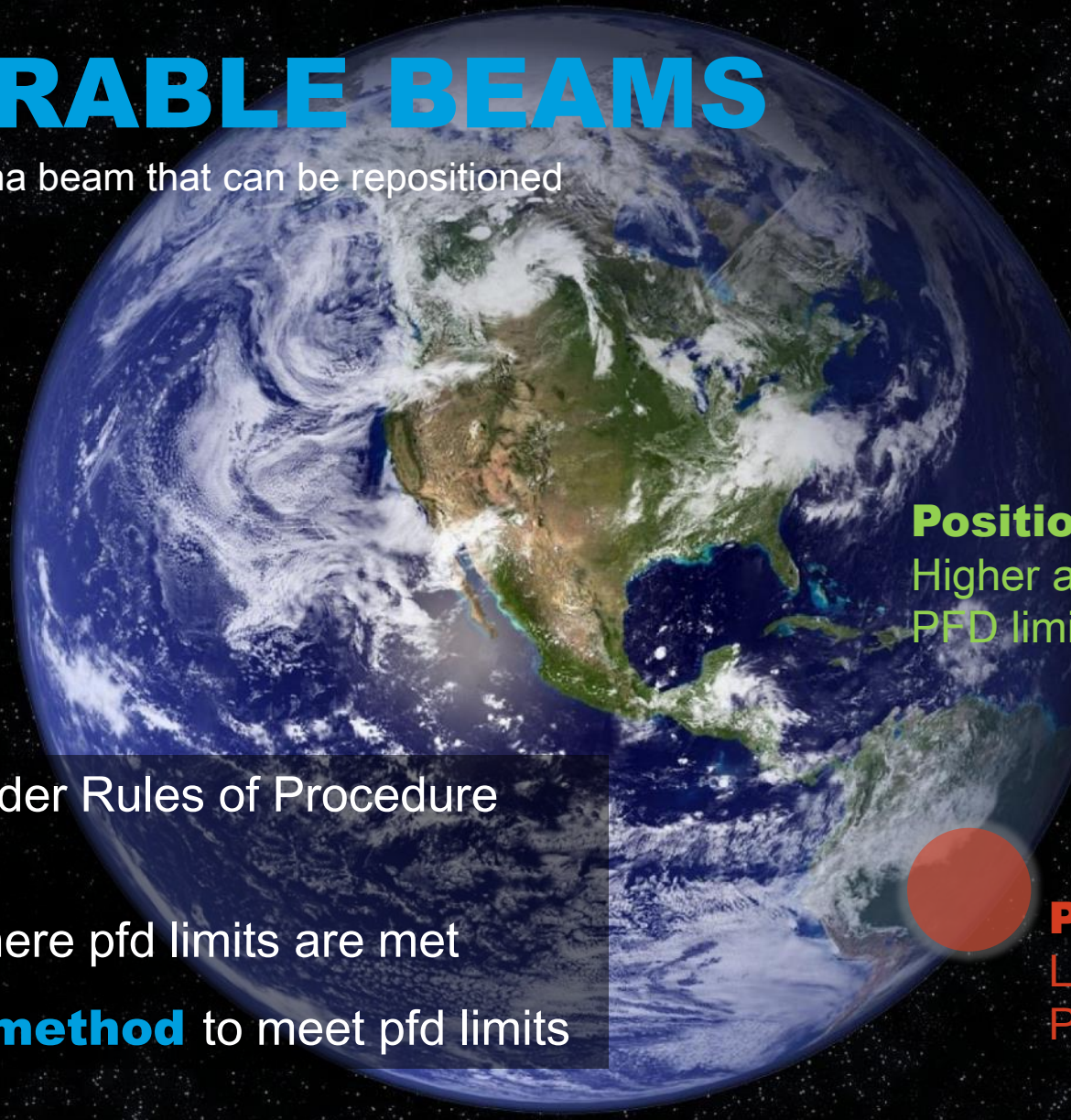
Frequency assignment with excess

(Frequency | Bandwidth | Emission | Total Peak Power | Maximum Power Density)

Gain | PFD at worst case | PFD Limit | **Max Excess** | Provision

STEERABLE BEAMS

A satellite antenna beam that can be repositioned



Position 2
Higher angle of arrival
PFD limits usually less stringent

Position 1
Low angle of arrival
PFD limits usually more stringent

Favourable finding under Rules of Procedure No. 21.16 if:

1. **One position** where pfd limits are met
2. **Description of method** to meet pfd limits

STEERABLE BEAMS

A satellite antenna beam that can be re-pointed

$$PFD = P_t + G_t(\theta) - 10\log(4\pi R^2)$$

R is longer

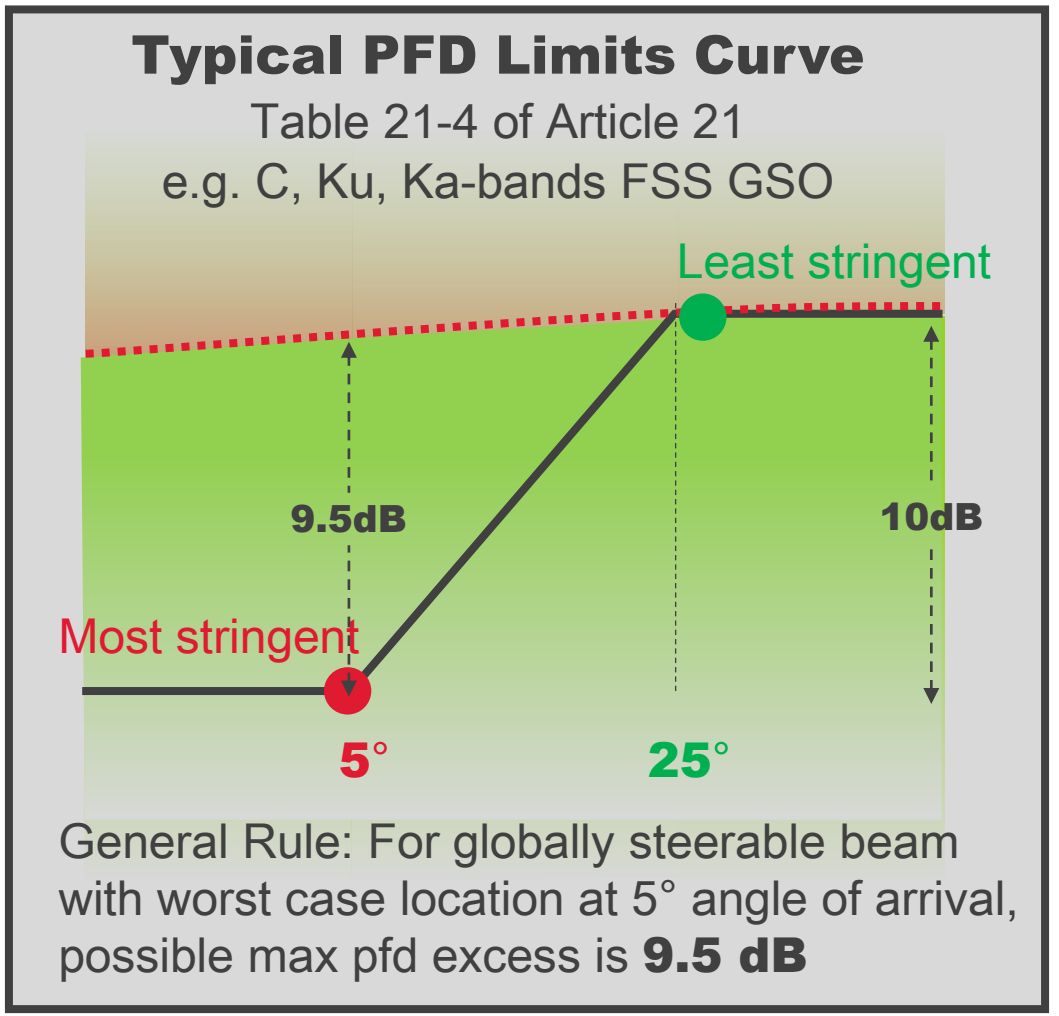
R is shorter

Worst case
Most stringent

5°

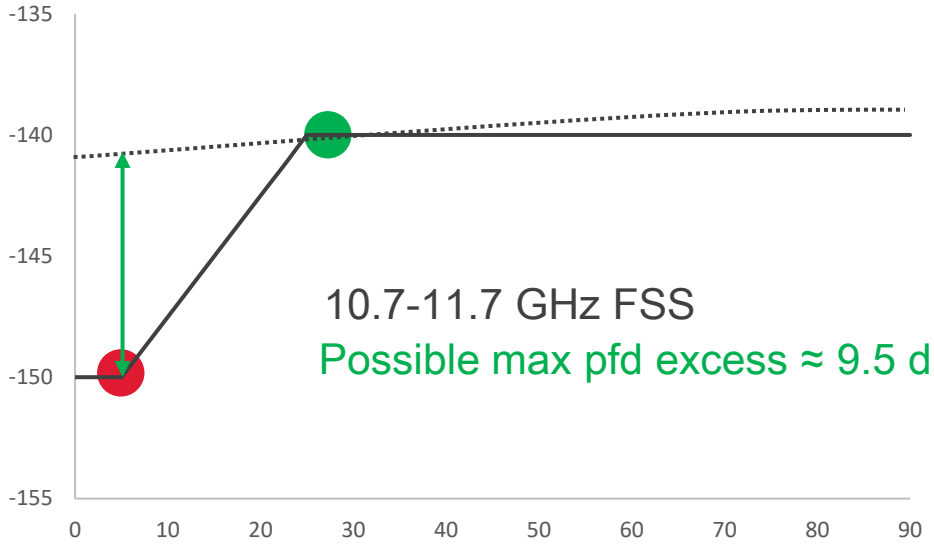
~25°

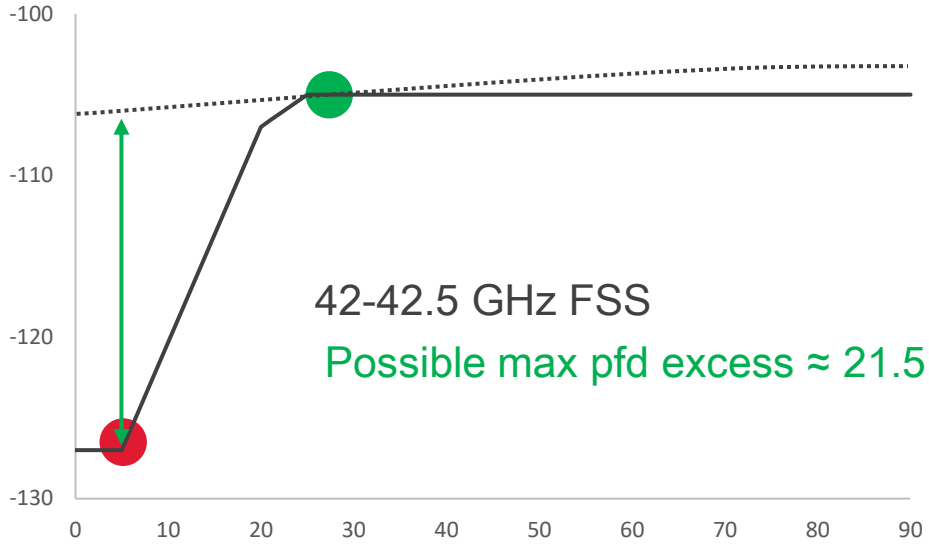
Best case
Least stringent

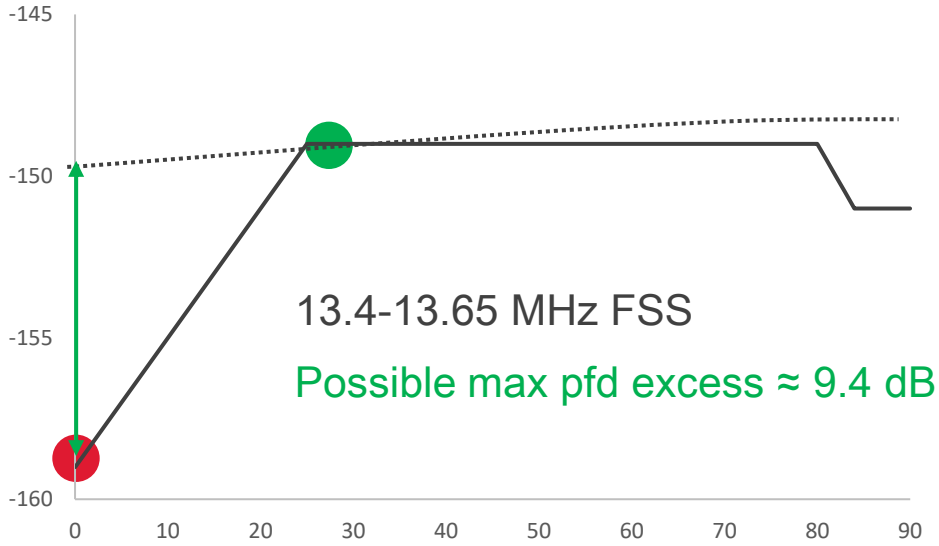


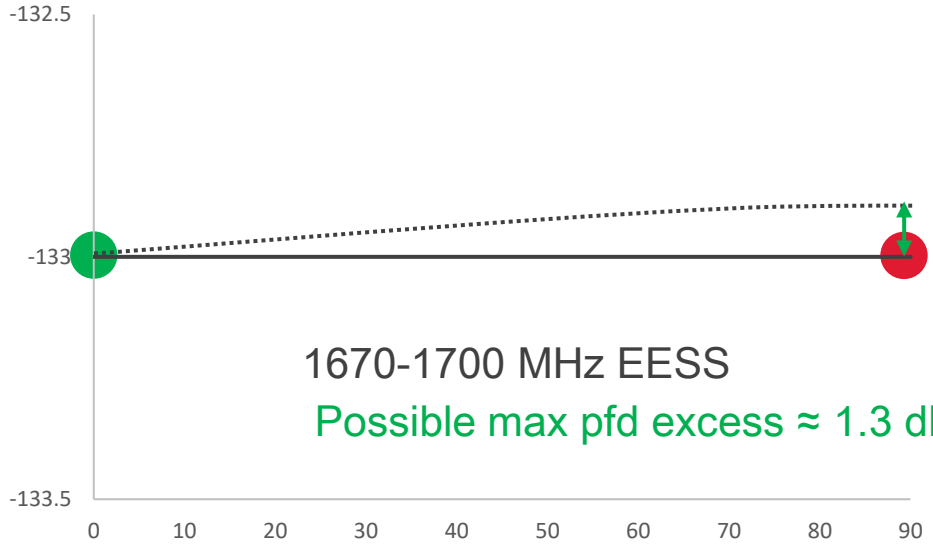
Examples - PFD Limits vs Angle of Arrival

Worst case Best case PFD Curve



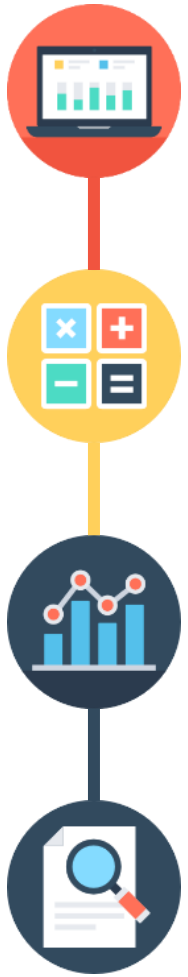






HARD LIMITS vs TRIGGER

GIBC “Hard Limits” option



GIBC “Trigger” option

To establish findings under Nos. 9.35/11.31

To identify coordination requirements under No. 9.36

Excess = Unfavourable (except for steerable beams under RoP21.16)

Excess = Coordination may be required, Aff Adm needs to confirm, CR/D

Provisions: 9.11, 9.14, 9.21/C

KEY POINTS

RUN

Run GIBC | PFD/EIRP GSO, check what “hard limits” are exceeded

FIX

Fix before submitting to BR e.g. total power, max power density, antenna diameter, commitment/compliance etc.
For steerable beams, select “B3b1b Method in An1 RoP21.16” in SpaceCap
Check (manually) with Table of Frequency Allocation

FAVOURABLE FINDINGS

Record in Master Register for international rights and recognition

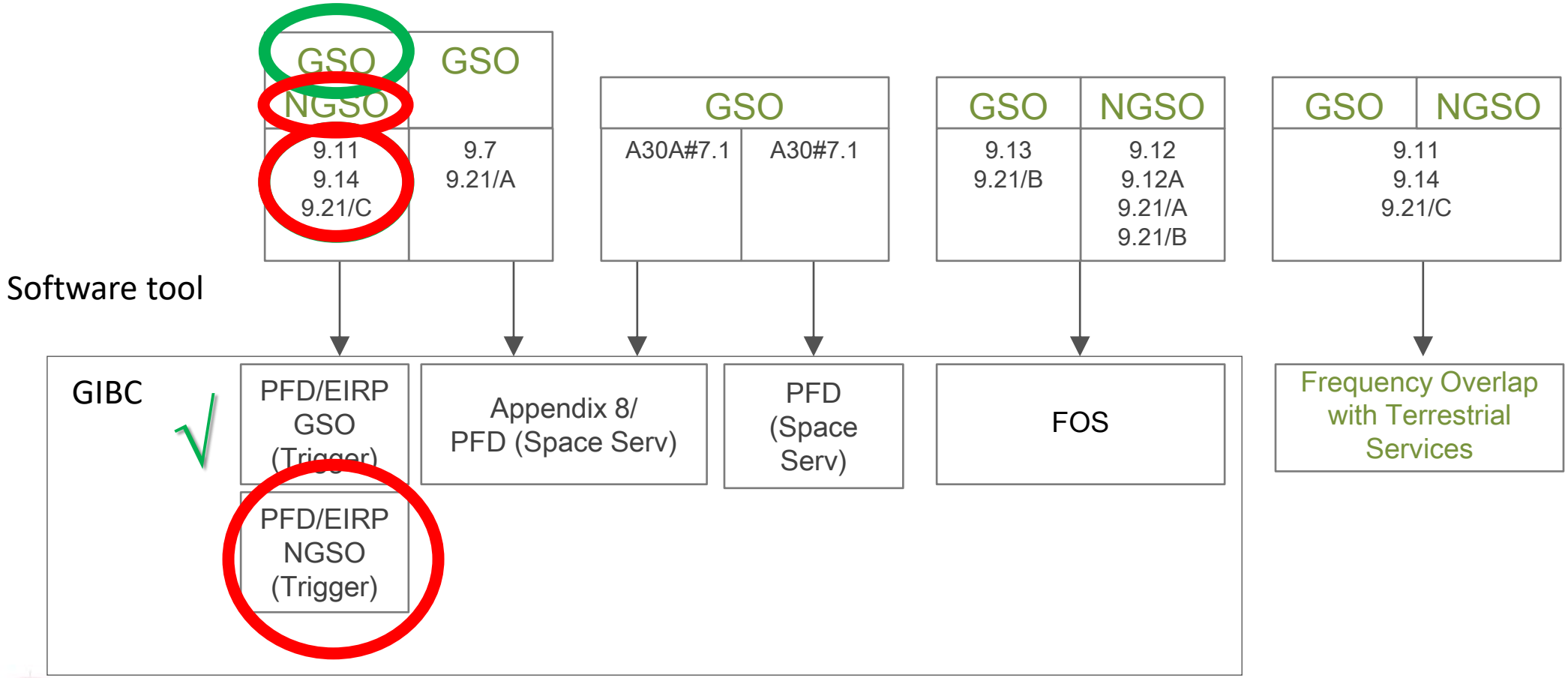
Regulatory and technical examination

GIBC PFD/EIRP NGSO

Belen Montenegro Villacieros

Coordination requirements (No. 9.36 of RR)

Forms of coordination



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GIBC PFD/EIRP NGSO

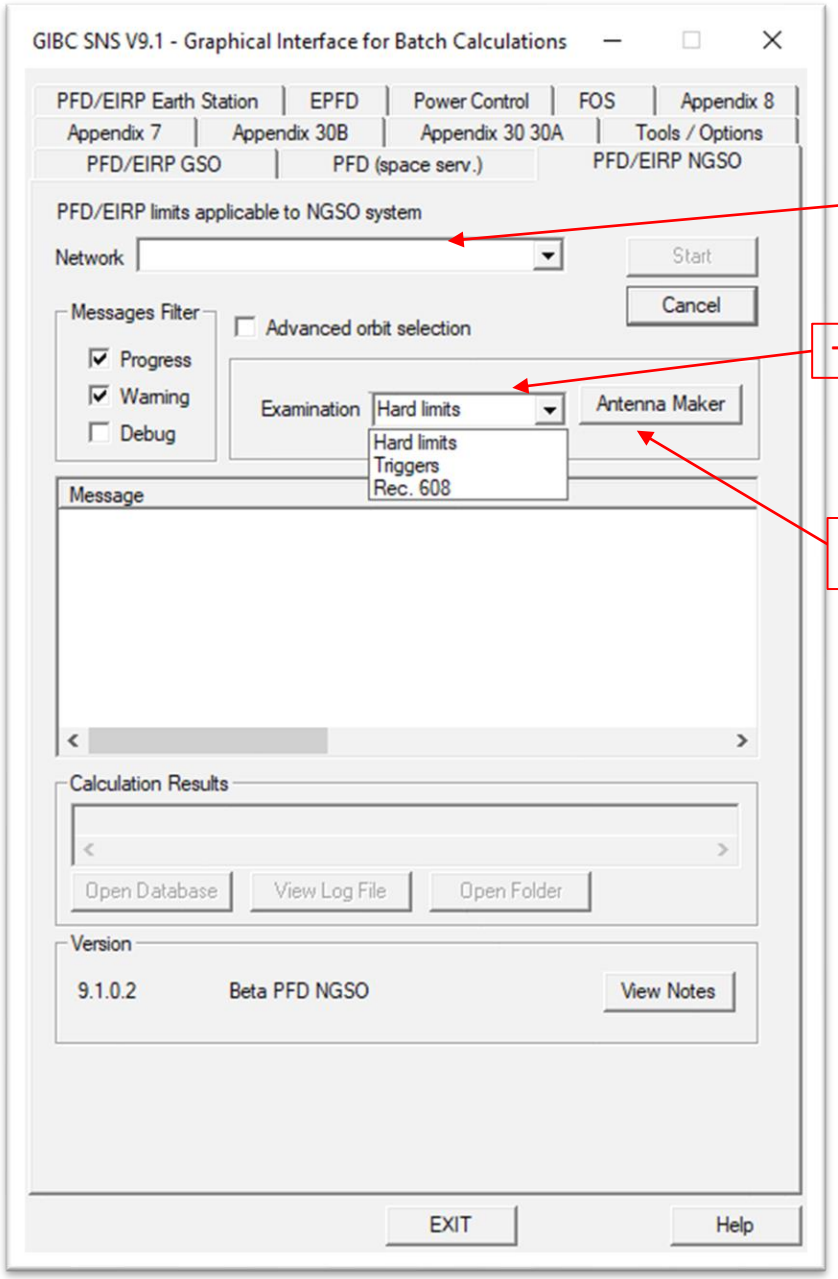
PFD: Power Flux Density at the surface of the Earth produced by emissions of a space station

EIRP: Equivalent Isotropic Radiated Power transmitted in any direction to the horizon by an Earth station

Types of examination:

- Hard limits
- Triggers
- Rec. 608

GIMS . customized antenna pattern



Notice_id

Type of examination

Antenna Maker

GIBC PFD/EIRP NGSO

Hard Limits

Where to find the limits in RR:

-PFD limits for space stations

- Table 21-4 of Art 21, Art 22.5
- Footnotes: 5.407, 5.493, 5.268, 5.447B, 5.446, 5.418
- Res 903 (REV.WRC-19) & 761 (REV.WRC-19)

-EIRP/ Minimum antenna diameter:

- Art 21 section III, Art. 21.8 (Warning)
- Footnotes: 5.364, 5.502, 5.503, 5.532B, 5.538 ,5.506A, 5.509C

-Commitment or Compliance checks: Res741, 5.443B, 5.549A, 5.551H, Art 22.5A

If Hard limit is exceeded:

-> **Unfavorable finding!!**

-> Exception: steerable beams if PFD limit is met in at least one position applying method RoP 21.16 or method proposed by the ADM -> **Favorable finding!!**

GIBC PFD/EIRP NGSO

Example

Allocation to services		
Region 1	**Region 2**	**Region 3**
2 500-2 520 FIXED 5.410 MOBILE except aeronautical mobile 5.384A 5.412	**2 500-2 520** FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A	**2 500-2 520** FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A MOBILE-SATELLITE (space-to-Earth) 5.351A 5.407 5.414 5.414A 5.404 5.415A

5.407 In the band 2 500-2 520 MHz, the power flux-density at the surface of the Earth from space stations operating in the mobile-satellite (space-to-Earth) service shall not exceed –152 dB(W/(m^2 · 4 kHz)) in Argentina, unless otherwise agreed by the administrations concerned.

TABLE **21-4** (Rev.WRC-19)

Frequency band	Service*	Limit in dB(W/m^2) for angles of arrival (δ) above the horizontal plane				Reference bandwidth
		0°-5°	**5°-25°**		**25°-90°**	
1 670-1 700 MHz	Earth exploration-satellite Meteorological-satellite	−133 (value based on sharing with meteorological aids service)				1.5 MHz
1 518-1 525 MHz (Applicable to the territory of the United States in Region 2 between the longitudes 71° W and 125° W)	Mobile-satellite (space-to-Earth)	**0° ≤ δ ≤ 4°**	**4° < δ ≤ 20°**	**20° < δ ≤ 60°**	**60° < δ ≤ 90°**	4 kHz
		−181.0	−193.0 + 20 log δ	−213.3 + 35.6 log δ	−150.0	
1 518-1 525 MHz (Applicable to all other territory of the United States in Region 2)	Mobile-satellite (space-to-Earth)	**0° ≤ δ ≤ 43.4°**	**43.4° < δ ≤ 60°**		**60° < δ ≤ 90°**	4 kHz
		−155.0	−213.3 + 35.6 log δ		−150.0	
1 525-1 530 MHz [7] (Region 1, Region 3) 1 670-1 690 MHz [12] 1 690-1 700 MHz (Nos. **5.381** and **5.382**) 1 700-1 710 MHz 2 025-2 110 MHz 2 200-2 300 MHz	Meteorological-satellite (space-to-Earth) Space research (space-to-Earth) (space-to-space) Space operation (space-to-Earth) (space-to-space) Earth exploration-satellite (space-to-Earth) (space-to-space)	**0°-5°**	**5°-25°**		**25°-90°**	4 kHz
		−154 [9]	−154 + 0.5(δ − 5) [9]		−144 [9]	
2 500-2 690 MHz 2 520-2 670 MHz 2 500-2 516.5 MHz (No. **5.404**) 2 500-2 520 MHz 2 520-2 535 MHz (No. **5.403**)	Fixed-satellite Broadcasting-satellite Radiodetermination-satellite Mobile-satellite Mobile-satellite (except aeronautical mobile-satellite)	−136 [10]	−136 + 11/20(δ − 5) [10]		−125 [10]	1 MHz
3 400-4 200 MHz	Fixed-satellite (space-to-Earth) (geostationary-satellite orbit)	−152	−152 + 0.5(δ − 5)		−142	4 kHz
3 400-4 200 MHz	Fixed-satellite (space-to-Earth) (non-geostationary-satellite orbit)	−138 − *Y* [22, 23]	−138 − *Y* + (12 + *Y*)(δ − 5)/20 [22, 23]		−126 [23]	1 MHz

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GIBC PFD/EIRP NGSO

Triggers

PFD threshold values to determine whether coordination under No. 9.11A is required.
Where to find the PFD threshold in RR:

- Table 5-2 and 1.3 of Appendix 5, footnote 5.348A

If PFD threshold is exceeded -> **Coordination needed!!**

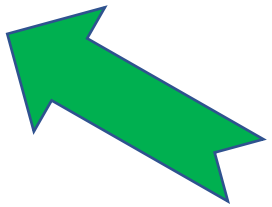
Recommendation 608

PFD Limits in footnote 5.328A- Recommendation 608/ RES609
Protection of ARNSS from RNSS in the frequency band 1164 – 1215 MHz:
PFD < -129dB(W/m^2) per 1MHz produced at the surface of the Earth by emissions from a space station in the RNSS
For information to the ADM

GIBC PFD/EIRP NGSO

PFD calculations methods:

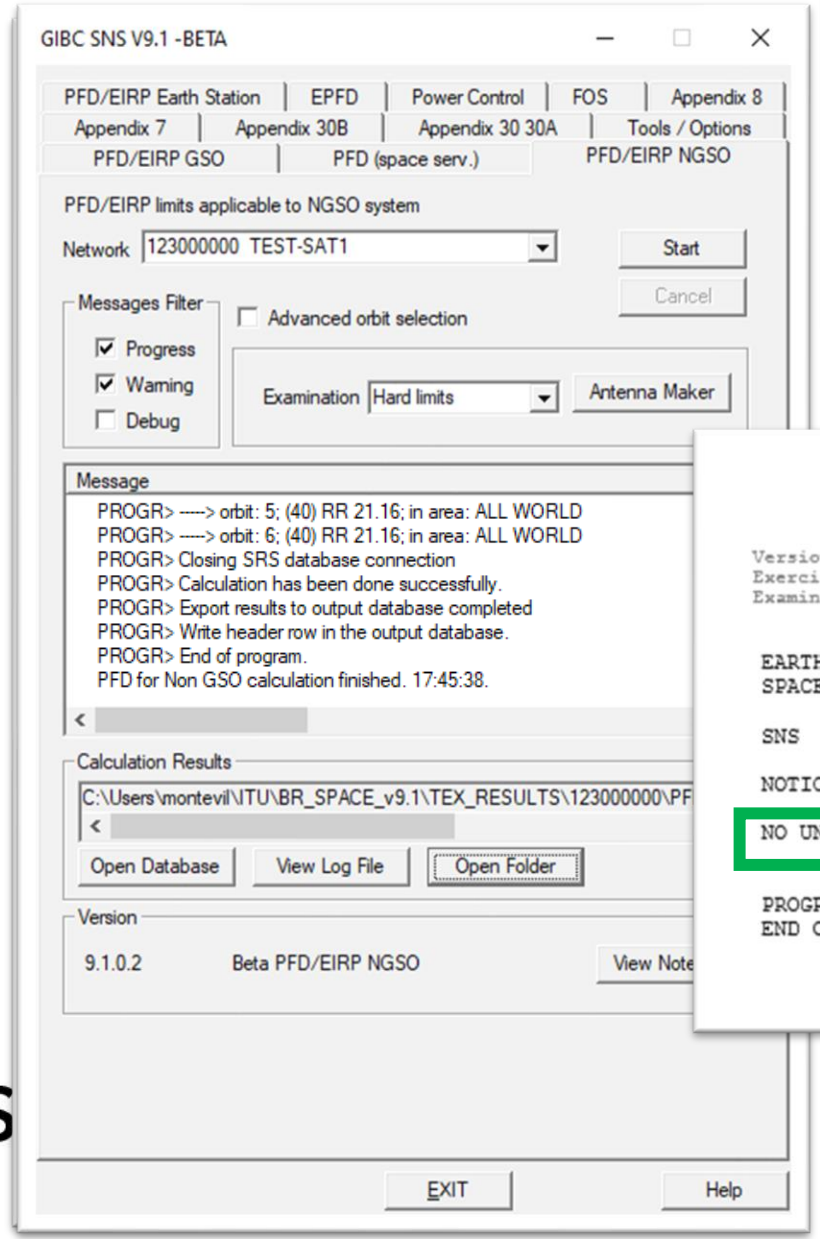
- Type of orbit: circular, elliptical
- Service area: global, region, list of countries
- Method in Annex 1 of RoP 21.16 (steerable beams & B.3.b.1)
- Antenna pattern
  - If not submitted by the ADM: Gmax for all off-axis angles
  - Standard patterns: ITU library(Antenna Patterns (itu.int))
  - Customize pattern:
    - Antenna Maker
    - GIMS

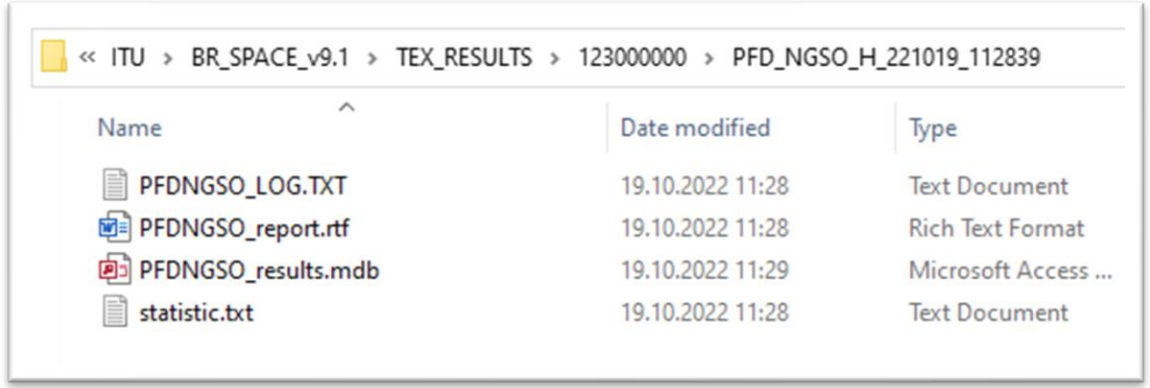


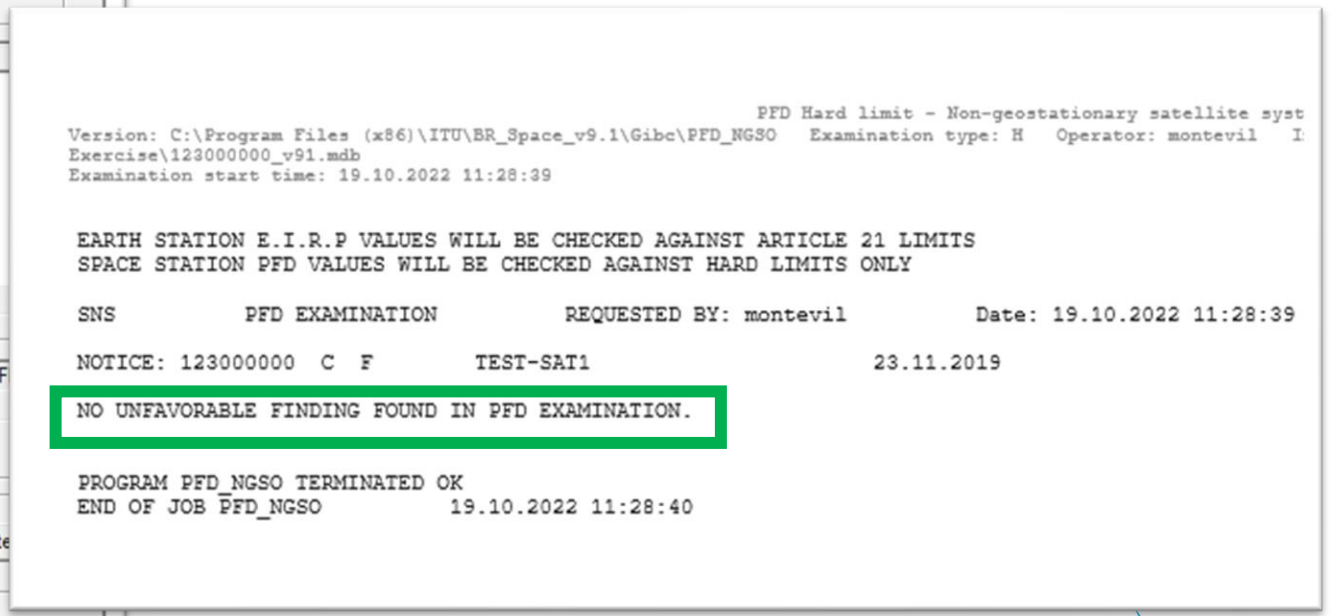
New!!!

GIBC PFD/EIRP NGSO

Example







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GIBC PFD/EIRP NGSO

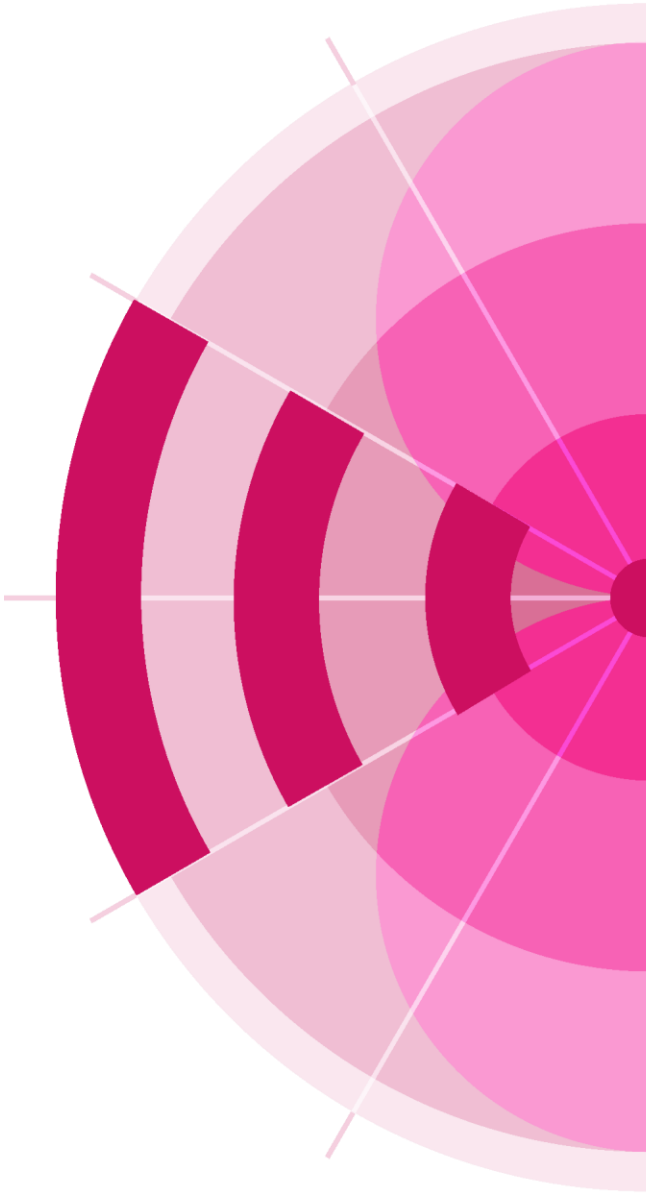
Conclusion

- Hard Limits exceeded -> **Unfavorable finding**, (exception RoP21.16)
- Triggers Limits exceeded -> **Coordination needed**
- Where to find Hard and Trigger limits in RR
- How to run GIBC/PFD NGSO SW
- Importance of capturing customized antenna pattern in GIMS

Regulatory and technical examination

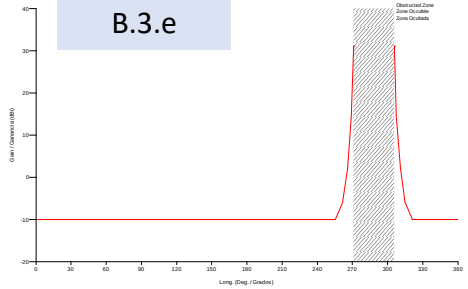
Graphical Interference Management System

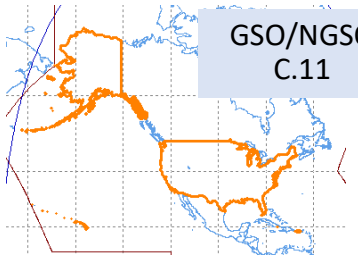
Olivier Evrard



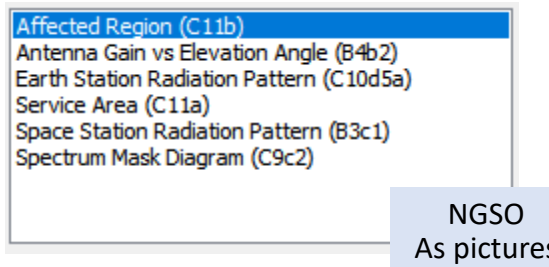
GIMS

GSO
B.3.e



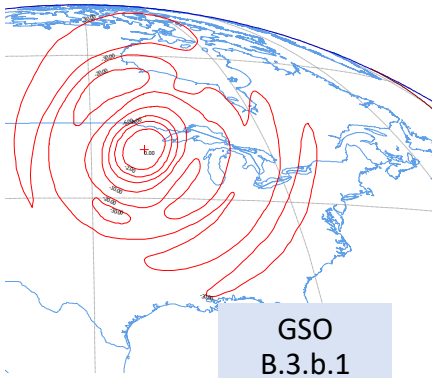


GSO/NGSO
C.11

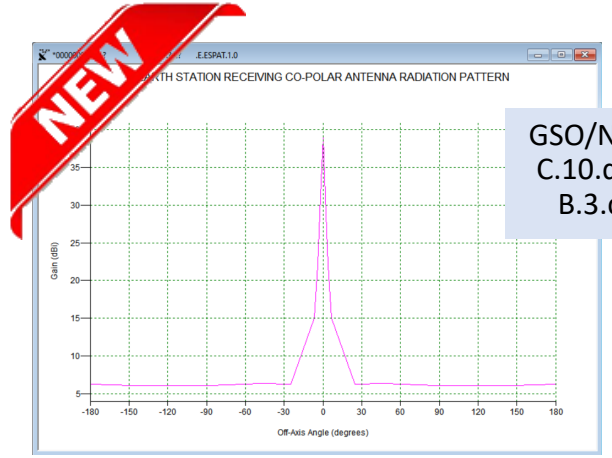


NGSO
As pictures

Help capturing AP4 graphical data



GSO
B.3.b.1



GSO/NGSO
C.10.d.5.a
B.3.c.1

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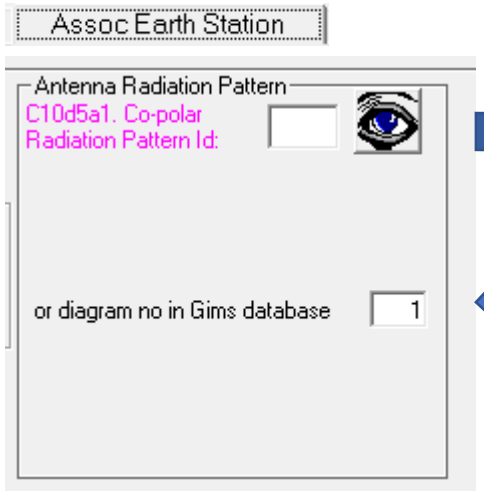
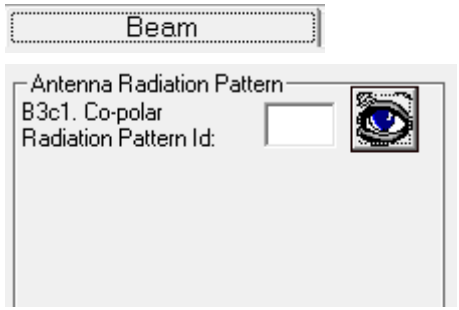
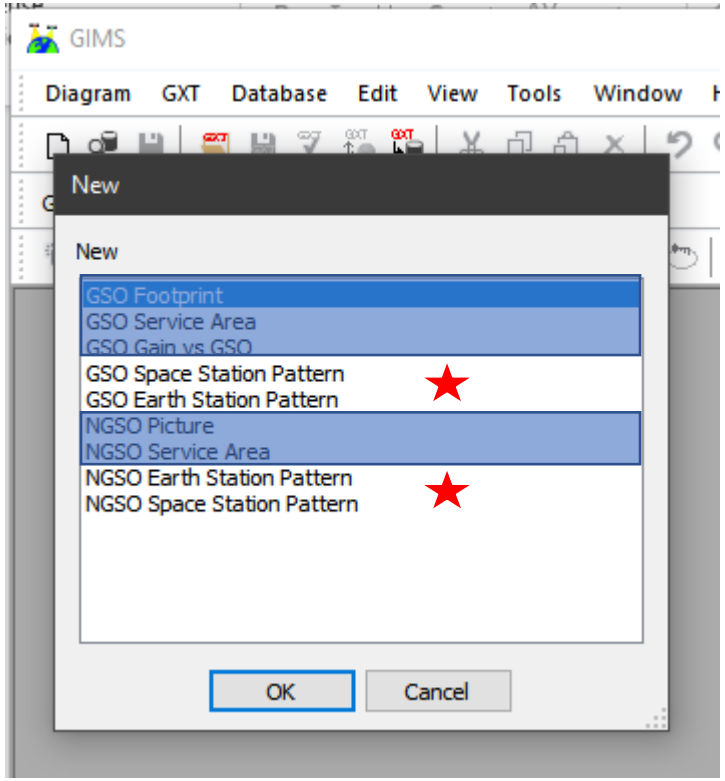
Antenna Pattern Diagram & SpaceCap



Optimized pattern
instead of pattern ID





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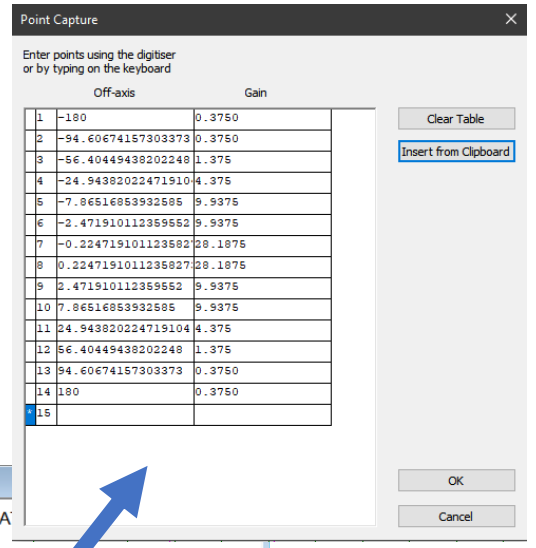
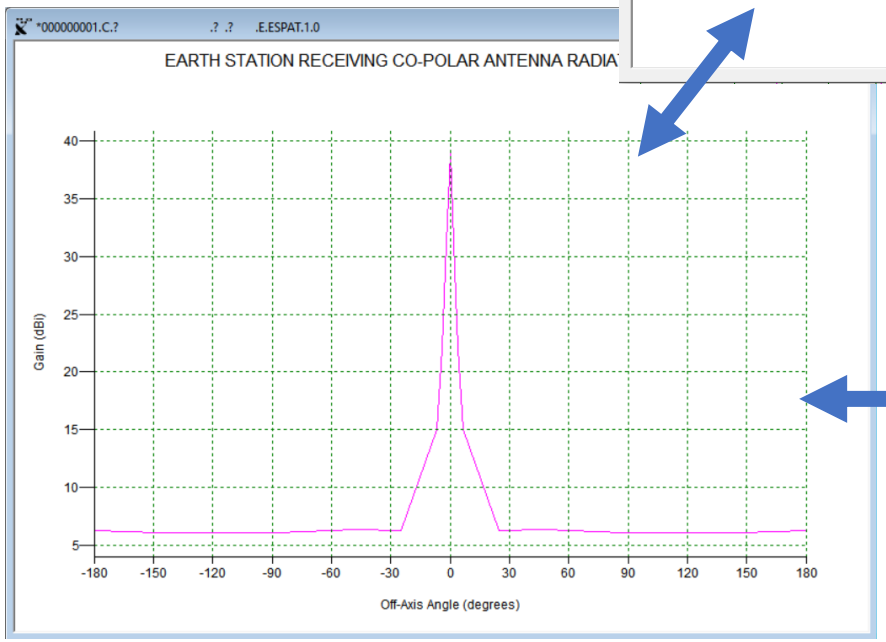
Capture

angle	gain
-180	6.2
-147.1	6.1
-87.6	6.1
-47.6	6.3
-25	6.2
-6.4	15
-4.2	22
-1.7	31.2
0	39
1.7	31.2
4.2	22
6.4	15
25	6.2
47.6	6.3
87.6	6.1
147.1	6.1
180	6.2





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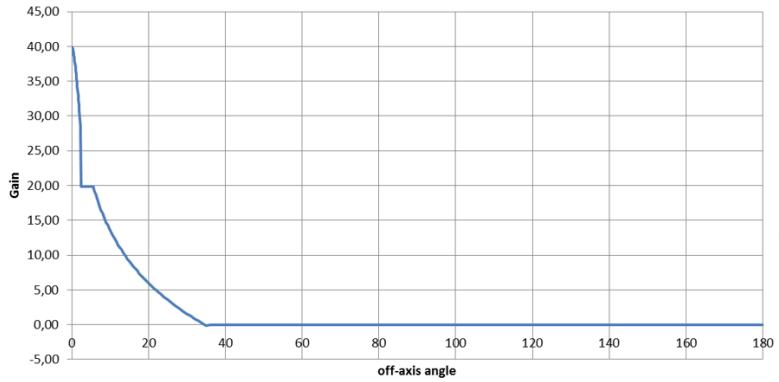
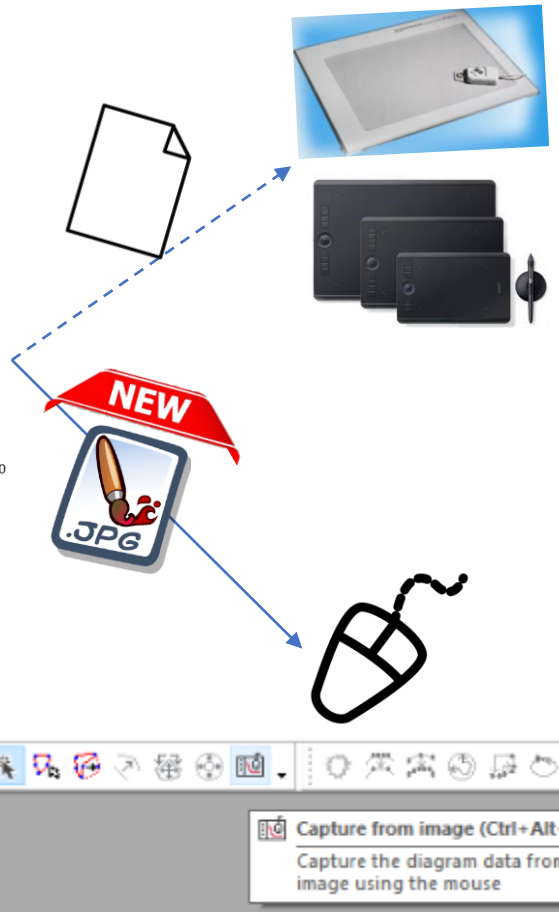
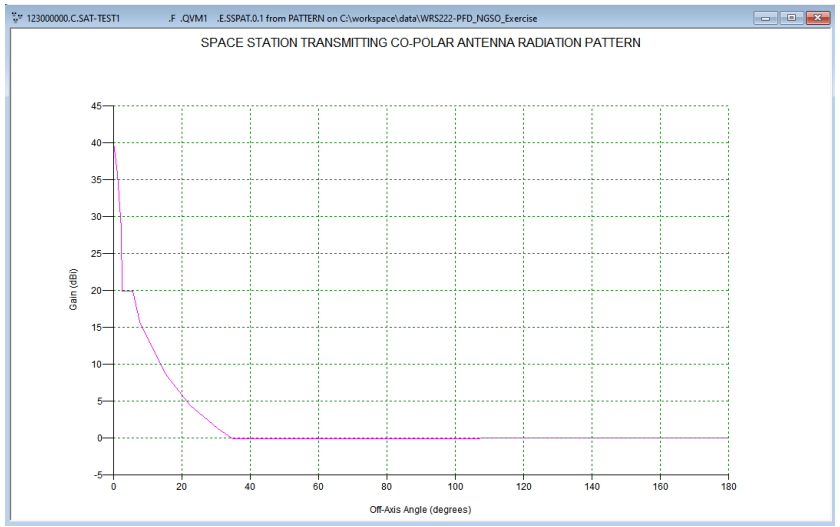
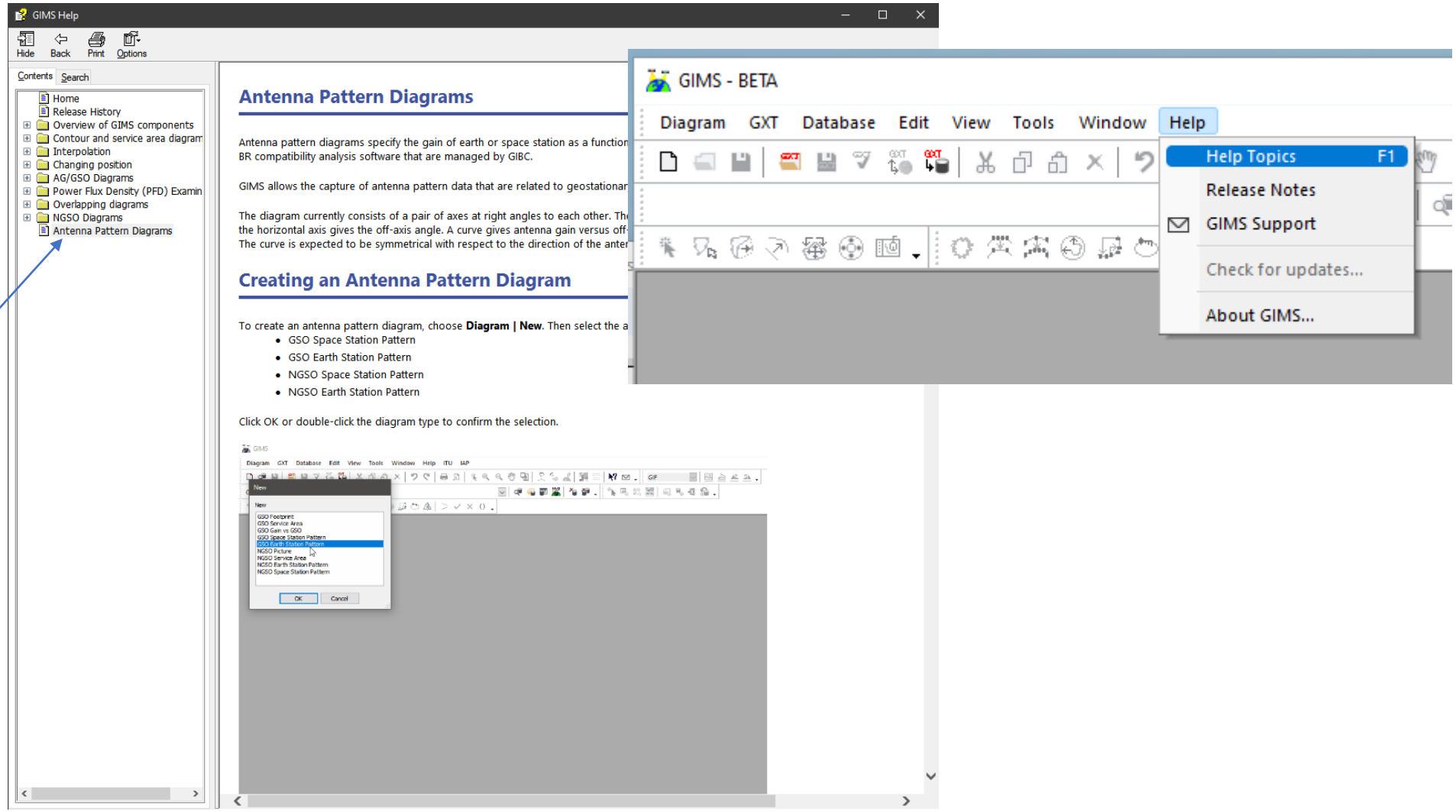
Capture from image







More Info



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Thank you!

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Questions to brmail@itu.int

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