

ITUEvents

ITU World Radiocommunication Seminar 2018

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Geneva, Switzerland

www.itu.int/go/ITU-R/WRS-18



Coordination Request

PFD Hard/Trigger Limits &
Averaging Bandwidth

Hon Fai Ng
BR/Space Services Dept



UNION INTERNATIONALE DES TÉLÉCOMMUNICATIONS
BUREAU DES RADIOCOMMUNICATIONS

INTERNATIONAL TELECOMMUNICATION UNION
RADIOCOMMUNICATION BUREAU

UNIÓN INTERNACIONAL DE TELECOMUNICACIONES
OFICINA DE RADIOCOMUNICACIONES

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RÉSEAU À SATELLITE SATELLITE NETWORK RED DE SATÉLITE		GSAT-NS(93.5E)		SECTION SPÉCIALE N° SPECIAL SECTION No. SECCIÓN ESPECIAL N.º	CR/C/4091
STATION TERRIENNE EARTH STATION ESTACIÓN TERRENA		---		BR IFIC / DATE BR IFIC / DATE BR IFIC / FECHA	2832 / 08.11.2016
ADM. RESPONSABLE RESPONSIBLE ADM. ADM. RESPONSABLE	IND	LONGITUDE NOMINALE NOMINAL LONGITUDE LONGITUD NOMINAL	93.5 E	NUMÉRO D'IDENTIFICATION IDENTIFICATION NUMBER NÚMERO DE IDENTIFICACIÓN	116520121
RENSEIGNEMENTS REÇUS PAR LE BUREAU LE / INFORMATION RECEIVED BY THE BUREAU ON / INFORMACIÓN RECIBIDA POR LA OFICINA EL					12.05.2016

Cette demande de coordination, reçue par le Bureau des radiocommunications en vertu du numéro 9.30 du Règlement des radiocommunications, a été examinée au titre des numéros 9.35 et 9.36 et est publiée conformément au numéro 9.38. Elle est subordonnée au type de coordination indiqué dans la colonne de gauche par un X dans la case pertinente.

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.

Esta solicitud de coordinación, recibida por la Oficina de Radiocomunicaciones de conformidad con el punto N° 9.30 del Reglamento de Radiocomunicaciones, se ha examinado de conformidad con los N° 9.35 y 9.36 y se publica de conformidad con el N° 9.38. Está sujeta al formulario de coordinación indicado en la columna de la izquierda con una X en la casilla correspondiente.

Type de coordination mentionné dans le Tableau I / Form of coordination referred to in Table I / Forma de coordinación mencionada en el cuadro I					
<input checked="" type="checkbox"/>	9.7				
	9.7A				
	9.7B				
<input checked="" type="checkbox"/>	AP30#7.1	Conformément aux numéros 9.50 à 9.52 du Règlement des radiocommunications, les Administrations identifiées dans le Tableau I ci-après sont priées de communiquer leur décision à l'Administration responsable et au Bureau avant la date limite indiquée ci-dessous.	In accordance with Nos. 9.50-9.52 of the Radio Regulations, the Administrations identified in Table I below are requested to communicate their decision to the Responsible administration and the Bureau by the deadline indicated below.	De conformidad con los N° 9.50-9.52 del Reglamento de Radiocomunicaciones, se solicita a las administraciones señaladas en el cuadro I a continuación que comuniquen su decisión a la administración responsable y a la Oficina antes del plazo indicado más abajo.	
	AP30A#7.1				
	RS539				
	RS33#3				
Type de coordination mentionné dans le Tableau II / Form of coordination referred to in Table II / Formulario de coordinación remitido al cuadro II					
	9.11				
	9.11A	Les Administrations, énumérées ou non-énumérées dans le Tableau II ci-après, qui n'acceptent pas la demande de coordination au titre des numéros 9.11 à 9.14, 9.21 et RS33#2.1, sont priées de communiquer leurs observations à l'Administration responsable et au Bureau avant la date limite indiquée ci-dessous. Toute Administration qui ne réagira pas au titre du numéro 9.52 avant cette date limite sera considérée comme n'étant pas défavorablement influencée et, dans les cas couverts par les numéros 9.11 à 9.14 et RS33#2.1, les dispositions des numéros 9.48 et 9.49 s'appliqueront.	Administrations listed or not listed in Table II below, which do not agree to the request for coordination under Nos. 9.11 to 9.14, 9.21 and RS33#2.1 are requested to communicate their comments to the responsible administration and the Bureau by the deadline indicated below. Any administration not responding under No. 9.52 within this deadline shall be regarded as unaffected and, in the cases of Nos. 9.11 to 9.14 and RS33#2.1, the provisions of Nos. 9.48 and 9.49 shall apply.	Se invita a las administraciones, enumeradas o no en el cuadro II, que no estén de acuerdo con la solicitud de coordinación de conformidad con los N° 9.11 a 9.14, 9.21 y RS33#2.1 que comuniquen sus observaciones a la administración responsable y a la Oficina dentro del plazo indicado más abajo. Se considerará que toda administración que no responda de conformidad con el N° 9.52 dentro del plazo señalado, no está afectada y, en el caso de los N° 9.11 a 9.14 y RS33#2.1, se aplicarán las disposiciones de los N° 9.48 y 9.49.	
	9.12				
	9.12A				
	9.13				
	9.14				
	9.21/A				
	9.21/B				
	9.21/C				
	RS33#2.1				

DATE LIMITE POUR LA DÉCISION / EXPIRY DATE FOR DECISION / FECHA LÍMITE PARA LA DECISIÓN

08.03.2017

RADIOCOMMUNICATION	BUREAU
<u>COMMENTS</u>	

Relating to the Findings with respect to No. 11.31

Steerable beams KTR and KTR3S, frequency assignments 11.075, 11.575, 12.35, 12.625 GHz with maximum power density =-44 dBW/Hz and maximum peak power =-8 dBW, respectively

UNFAVOURABLE

The power flux density limits specified in No. 21.16 are exceeded.

There are no positions of the steerable beams where the applicable PFD limits are met.



How to avoid unfavourable findings?

3504
GSO Satellite
Networks



Operate in an
INTERFERENCE FREE
environment

**POTENTIAL FOR
INTERFERENCE**

690
Non-GSO Satellite
Systems

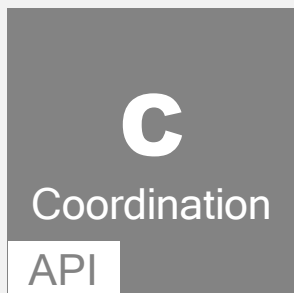


2.4 million
Terrestrial



Subject to coordination

Section II of Article 9 (GSO & Non-GSO)



Article 9

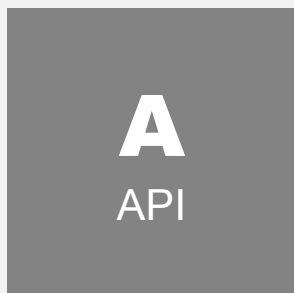


Article 11



NOT sub to coordination

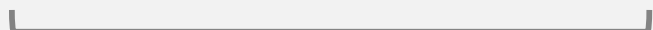
(Non-GSO)



Article 9



Article 11



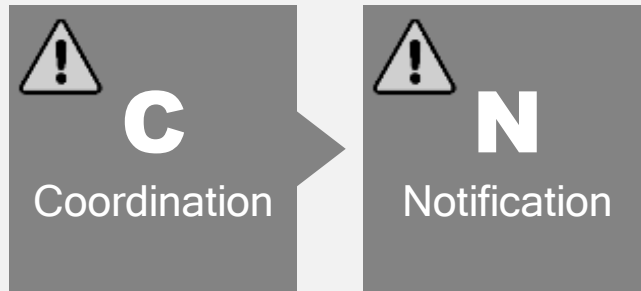
7y



“Right to international recognition ... to avoid harmful interference”
(No. 8.3)

Subject to coordination

Section II of Article 9 (GSO & Non-GSO)



NOT sub to coordination

(Non-GSO)



Nos. 9.35/11.31 CONFORMITY EXAM With Table of Frequency Allocations

Including footnotes & any referred Res. or Rec.
(Article 5)

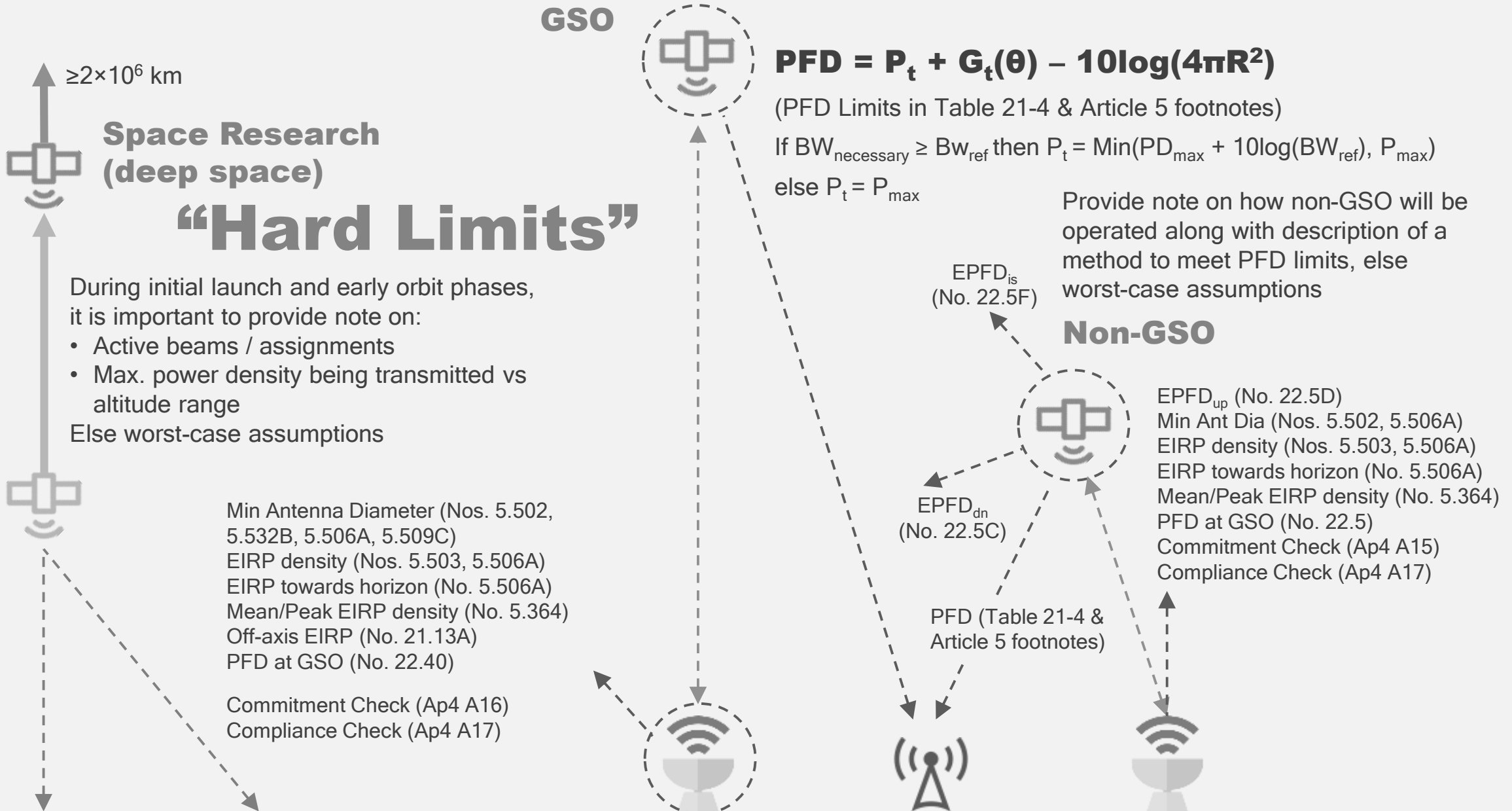
With other provisions

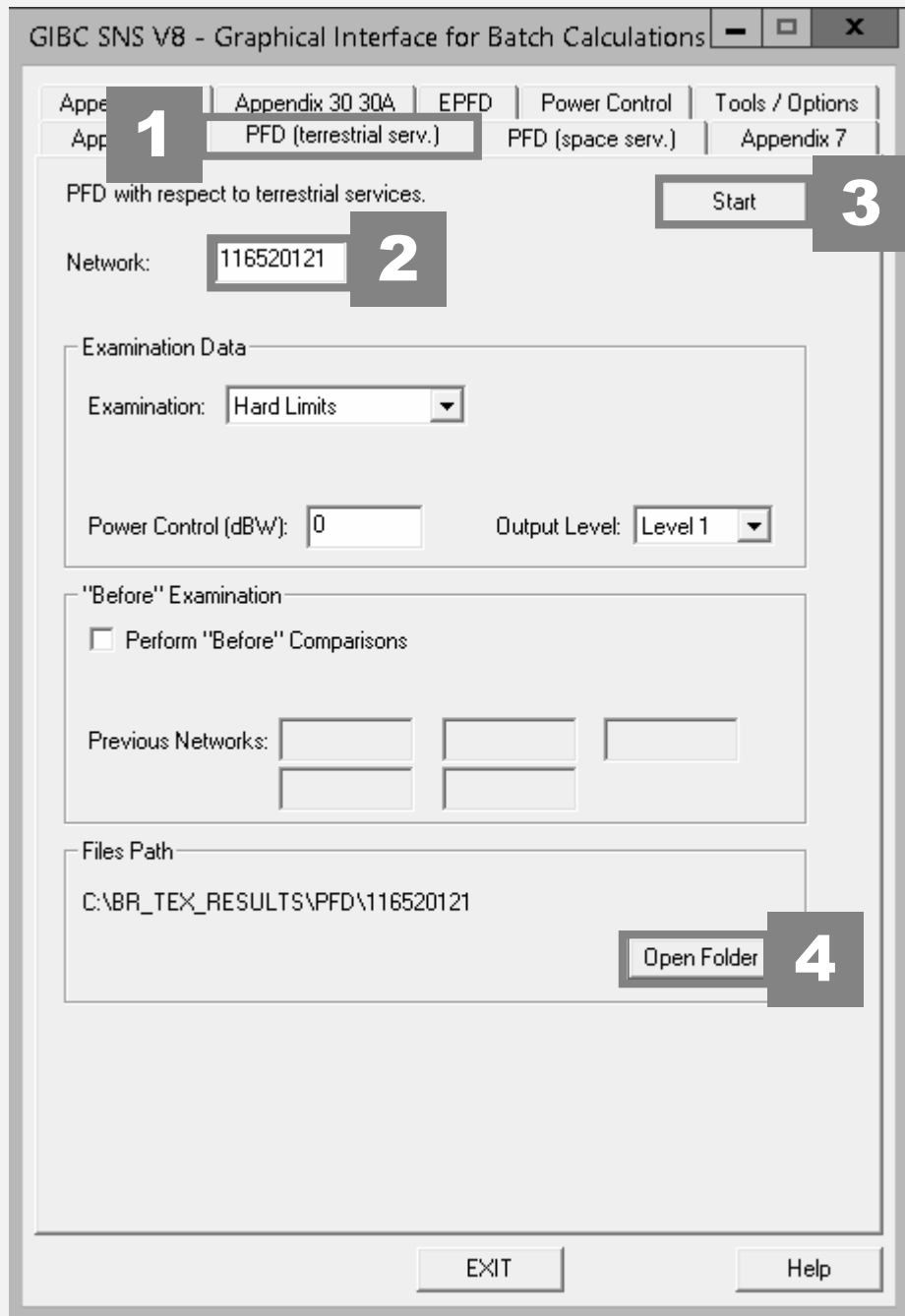
PFD, EIRP, Off-axis EIRP, PFD at GSO, EPFD
etc. - See RoP11.31 (Articles 21 & 22)



UNFAVOURABLE FINDINGS UNDER Nos. 9.35/11.31

- No status & no date of protection
- Record in Master Register for information only (No. 8.4)
- Cannot cause harmful interference & cannot claim protection (No. 4.4)
- New submission incurs cost recovery & new date of protection





GIBC/Hard Limits

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

(GSO only)

Does NOT calculate:

- Aggregate PFD
- PFD with % of time
- PFD in adjacent band
- EPFD
- Limits with commitment/compliance in Ap4*
- e.g. 5.379C, 5.443B, 5.502, 5.509D, 5.509E, 5.549A, 5.551I, RES609, RES741 etc.

*Except A.17.d (9900-10400 MHz EESS)

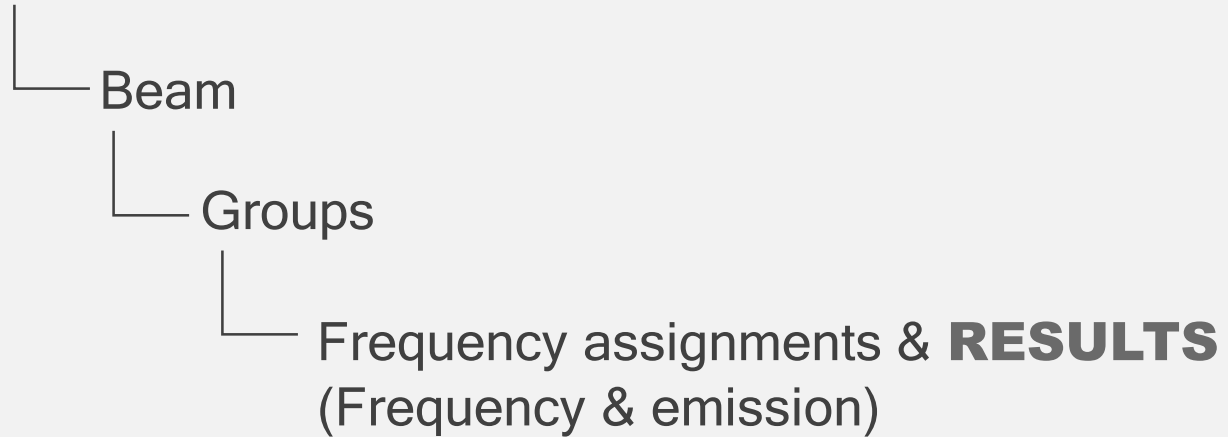
PFD.LST LOCATION

C:\BR_TEX_RESULTS\PFD\

Results only show frequency assignments that have exceeded applicable limits

PFD.LST STRUCTURE

Satellite Network



PFD.LST (HARD LIMITS) RESULTS

Beam name	Maximum Gain	Group ID
KTR	34.00 DB	116.520121
EK ER 250000 KHZ DR 12.05.16	POINTING ACC 0.10 DEG	N- 116.677596
11.07500 G 250000 KHZ 4K00N0N-- -8.00 DBW -44.00 DBW/HZ		N- 0001
(6) RR 21.16 ALL WORLD	FIXED-SATELLITE 159E5242 53N5410 RUS	REF. BW 0.004MHZ 34.00 -137.27 12.73 -150.00 N-
EK ER 250000 KHZ DR 12.05.16		N- 116.677597
11.57500 G 250000 KHZ 4K00N0N-- -8.00 DBW -44.00 DBW/HZ		N- 0001
(6) RR 21.16 ALL WORLD	FIXED-SATELLITE 159E5242 53N5410 RUS	REF. BW 0.004MHZ 34.00 -137.27 12.73 -150.00 N-
EK ER 250000 KHZ DR 12.05.16		N- 116.677598
12.62500 G 250000 KHZ 4K00N0N-- -8.00 DBW -44.00 DBW/HZ		N- 0001
(7) RR 21.16 REGION 1 CTYS OF 5.494 AND 5.496 AND REGION 3	FIXED-SATELLITE 017E1611 07N4932 TCD	REF. BW 0.004MHZ 34.00 -137.27 10.73 -148.00 N-

Ref. to applicable limits | Worst case location
e.g. 21.16, 5.503, 21.13A, 22.40 (WRC-15), 5.509C (WRC-15) etc.

Frequency assignment with excess Gain | PFD at worst case | Max Excess | PFD Limit | BW_{ref}.
(Frequency | Bandwidth | Emission | Total Peak Power | Maximum Power Density)

STEERABLE BEAMS

A satellite antenna beam that can be re-pointed



Favourable finding under No. 11.31 if

- **One position** where pfd limits are met without reduction of power density, and
- **Description of method** to meet pfd limits submitted by Administration e.g. RoP21.16 Annex 1

STEERABLE BEAMS

A satellite antenna beam that can be re-pointed

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



R is longer

R is shorter

Worst case
Most stringent

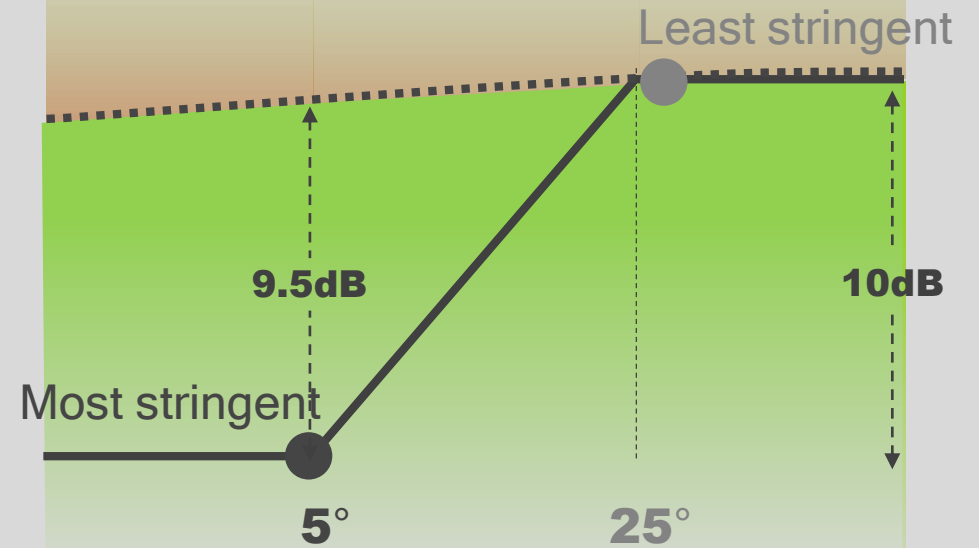
5°

Best case
Least stringent

~25°

Typical PFD Limits Curve

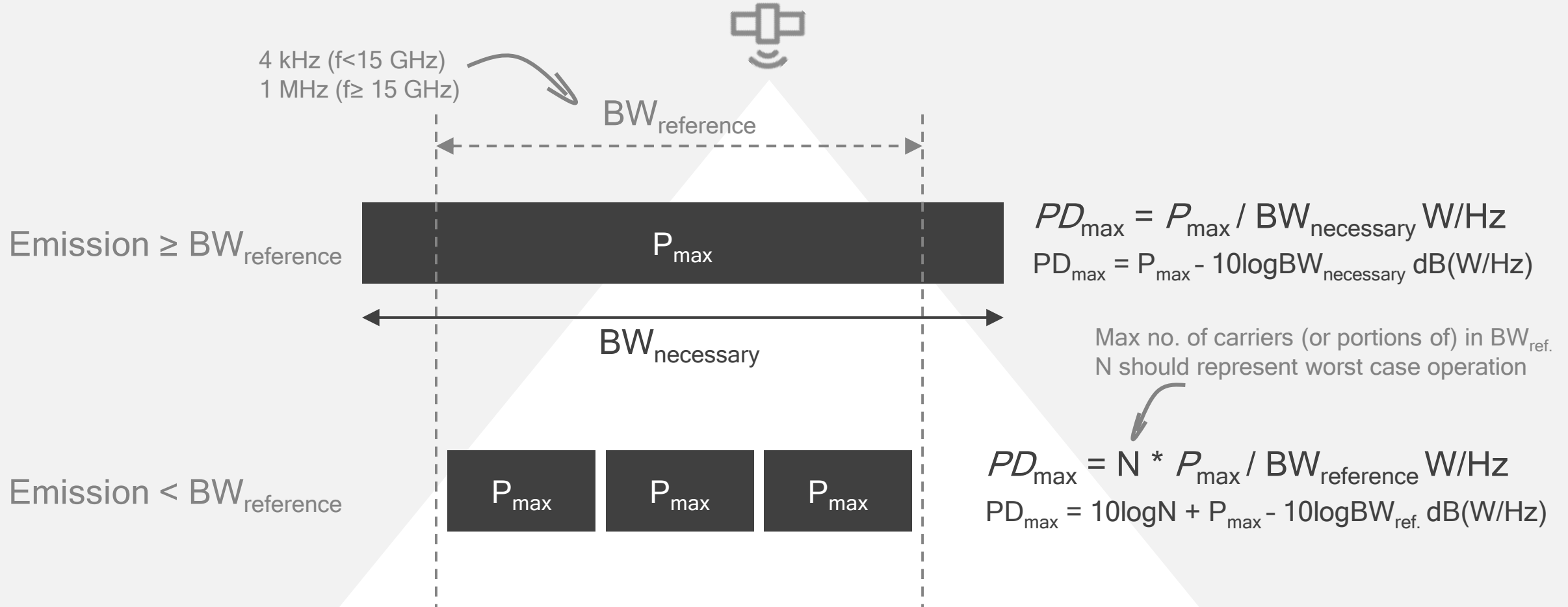
Table 21-4 of Article 21
e.g. C, Ku, Ka-bands FSS GSO



General Rule: For globally steerable beam with worst case location at 5° elevation, max tolerable excess is **9.5 dB**

HOW TO DEFINE MAX POWER DENSITY

By using averaging bandwidth (or reference bandwidth)



Source: Footnote 2 to Tables A, B, C, D of Annex 2 to Appendix 4

Rec ITU-R SF.675-4 (www.itu.int/rec/R-REC-SF.675/en)

Annex 13 to Doc. 4A/63 (www.itu.int/md/choice_md.asp?id=R15-WP4A-C-0063!N13!MSW-E&lang=en&type=sitems)

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, conditions apply)



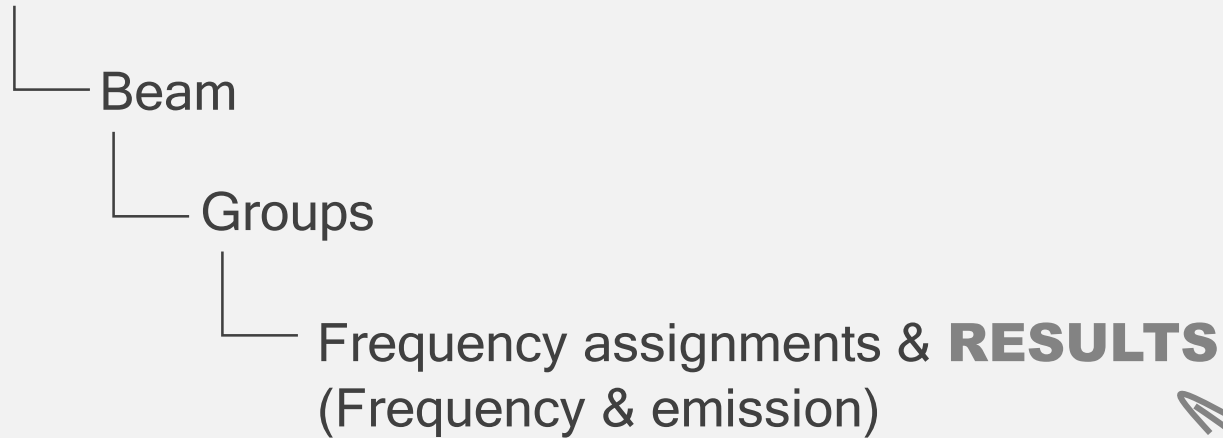
Excess = Coordination may be
required, Aff Adm needs to confirm



Provisions: 9.14, 9.11, 9.21/C

PFD.LST (TRIGGER) STRUCTURE

Satellite Network



Contains list of ALL countries where PFD trigger is exceeded

PFD.LST (TRIGGER) RESULTS

CLCR 42.0 DB POINTING ACC 0.20 DEG 116.520160
 EI 9500 KHZ DR 26.05.16 116.683385
 1529.75000 M 9500 KHZ 1K00N0N-- 4.0 DBW -26.0 DBW/HZ A- 0001

(51) RR 5.354 MOBILE-SATELLITE REF. BW 1.000MHZ
 REGIONS 1 AND 3 099E43 07N13 THA 38.0 -121.3 6.7 -128.0 N-

AFS	1.1	AGL	1.9	ALG	0.7	ARS	0.8	AUS/HMD	2.4	AUS/ICO	5.5	BDI	1.9
BEN	1.2	BFA	0.9	BGD	4.1	BOT	1.7	BRM	6.7	BTN	4.1	CAF	1.9
CBG	6.7	CHN	6.7	CME	1.9	COD	1.9	COG	1.9	COM	1.1	CTI	0.6
DJI	1.3	DNK/FRO	1.8	EGY	1.2	ERI	1.5	ETH	1.9	F /AMS	0.1	F /KER	0.4
F /MYT	0.8	F /REU	0.6	FIN	3.7	G	0.5	GAB	1.9	GHA	1.0	GNE	1.9
IND	6.5	INS	6.7	ISL	5.6	KAZ	5.2	KEN	1.9	KGZ	1.7	LAO	6.7
LBY	1.5	LSO	0.3	MDG	0.7	MLA	6.7	MLI	0.8	MNG	6.7	MOZ	1.9
MWI	1.9	NGR	1.9	NIG	1.9	NMB	1.8	NOR	6.7	NPL	2.5	POR/AZR	0.4
RRW	1.9	RUS	6.7	S	3.2	SDN	1.9	SEY	0.9	SNG	6.6	SOM	1.8
SSD	1.9	STP	1.9	SWZ	0.6	TCD	1.9	TGO	1.1	THA	6.7	TZA	1.9
UGA	1.9	VTN	6.7	XZZ/XBY	1.9	YEM	1.0	ZMB	1.9	ZWE	1.9		

List of ALL countries where PFD trigger is exceeded | PFD excess in the country

KEY POINTS



Run GIBC (Hard Limits) for GSO

Or manually calculate for non-GSO
Check what applicable limits are exceeded



Fix before submitting to BR

Modify parameters & submit correct Max Power Density
For steerable beams, check “B3b1b Method in An1 RoP21.16”
For non-GSO, provide note on how assignments will be operated
Check (manually) conformity with Table of Frequency Allocation



Eliminate Unfavourable Finding

To obtain date of protection