

Efficient Use of Spectrum/Orbit

- Small things can help, too -

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BR/SSD/SSC
(BR Workshop, Geneva, 6 May 2009)

... **views** from the side, not from inside...
i.e. of authors, not necessarily of the BR

All that follows: non-planned, GSO

Some statistics first...

(from BR's SRS database)

Carrier Power

Transponder Power

Off-axis EIRP Density

Recording under No. 11.41

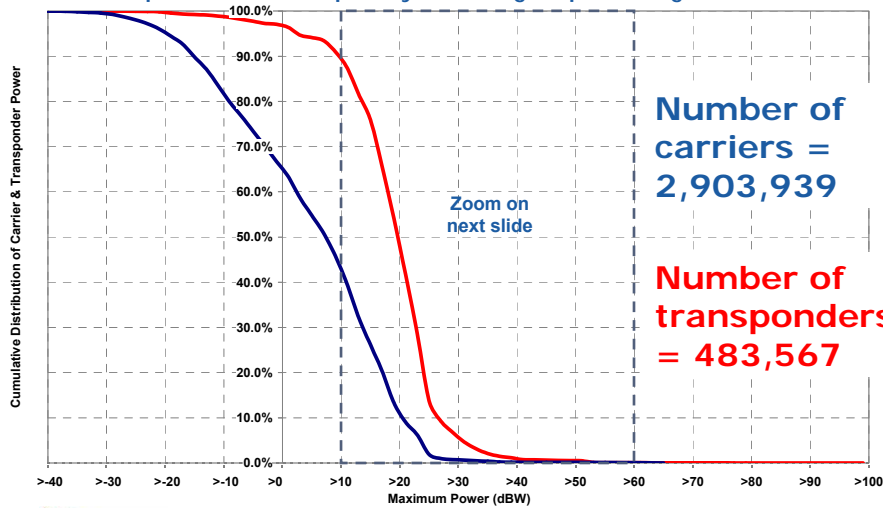
Who are the mightiest in Space?

Carrier: 64 dBW (2.5 Mega-Watts)
into satellite antenna

Transponder: 99 dBW (7.9 Giga-Watts)
can be pushed into satellite antenna

Carrier & Transponder Power

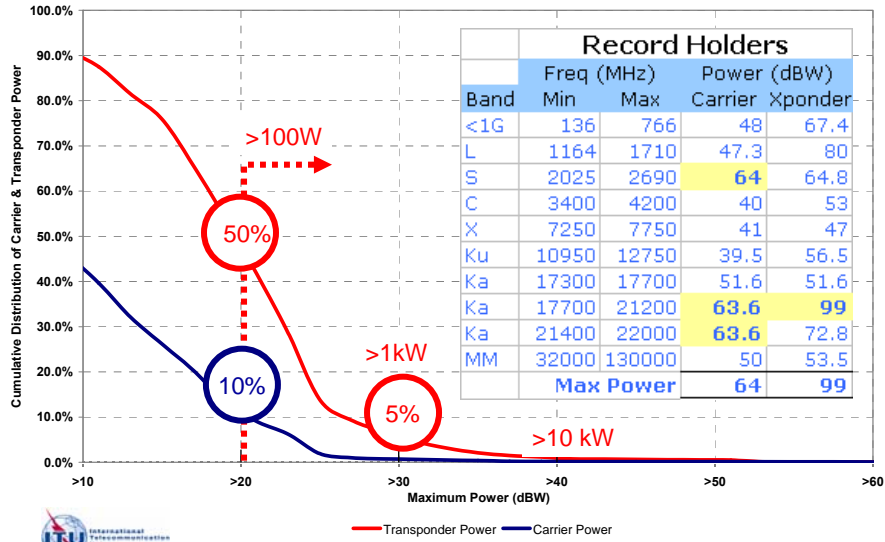
Carrier = 1 emission on 1 frequency with 1 Class of Station
Transponder = 1 frequency from a group of assignments + AB



Number of
carriers =
2,903,939

Number of
transponders
= 483,567

Carrier & Transponder Power



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Carrier & Transponder

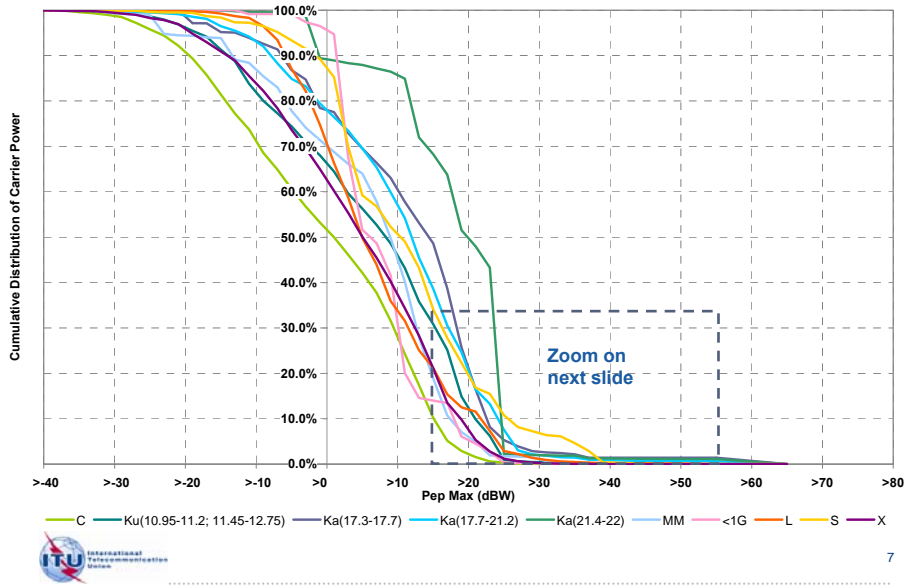
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Total: **2,903,939** carriers **483,567** transponders

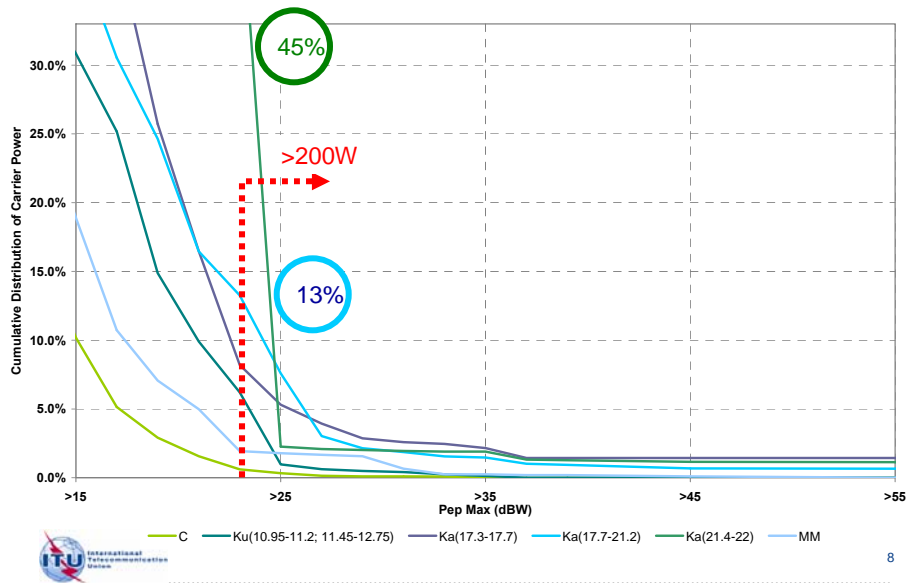
Band	Frequency (MHz)	Carriers	Xponders
<1G	136 - 766	40,696	14,012
L	1164 - 1710	36,296	14,094
S	2025 - 2690	30,292	5,851
C	3400 - 4200	795,785	113,779
X	7250 - 7750	98,490	22,937
Ku	10950 - 12750	1,359,017	197,763
Ka	17300 - 17700	27,066	12,528
Ka	17700 - 21200	400,116	78,836
Ka	21400 - 22000	53,471	10,099
MM	32000 - 130000	62,710	13,668

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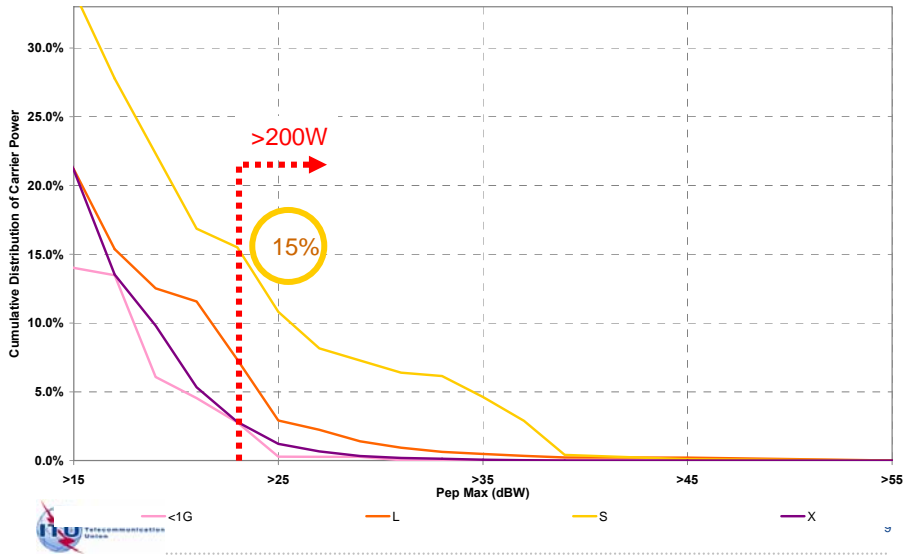
Carrier Power



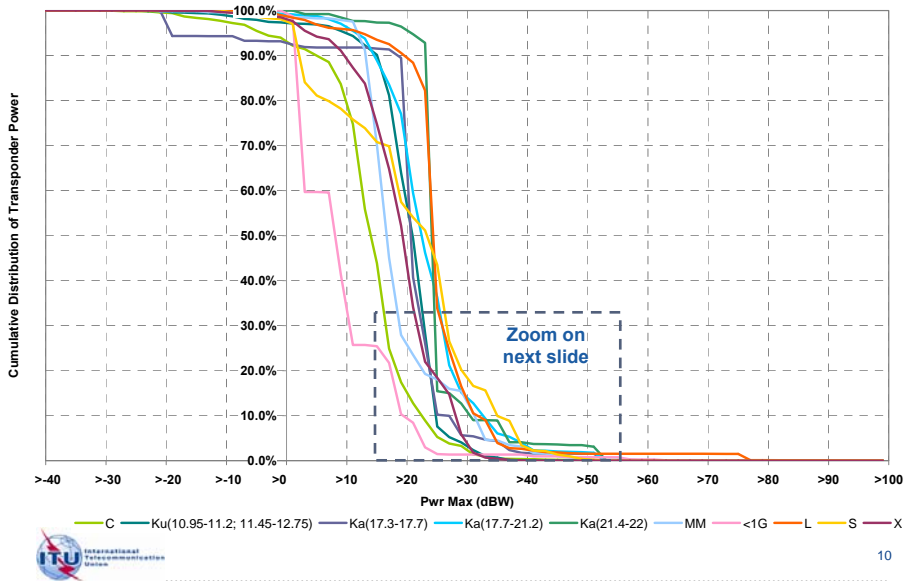
Carrier Power



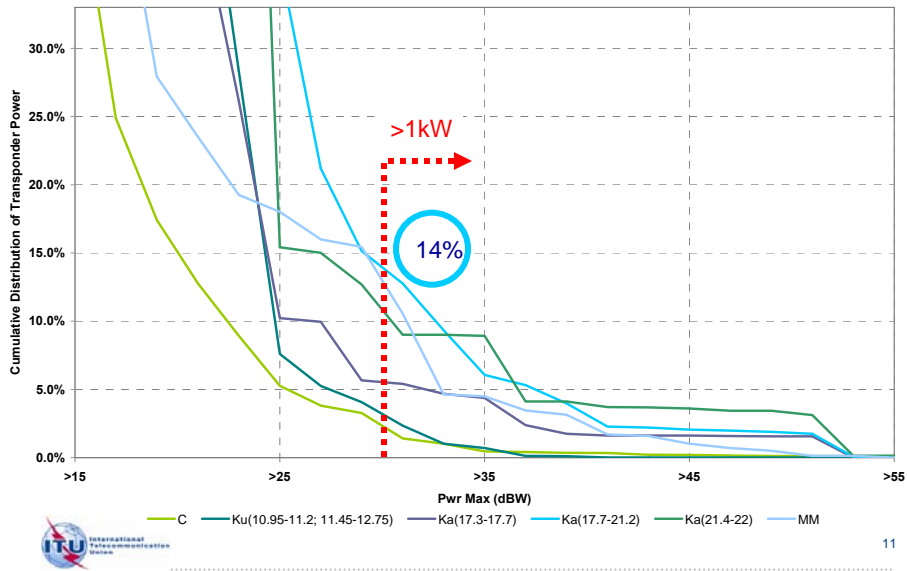
Carrier Power



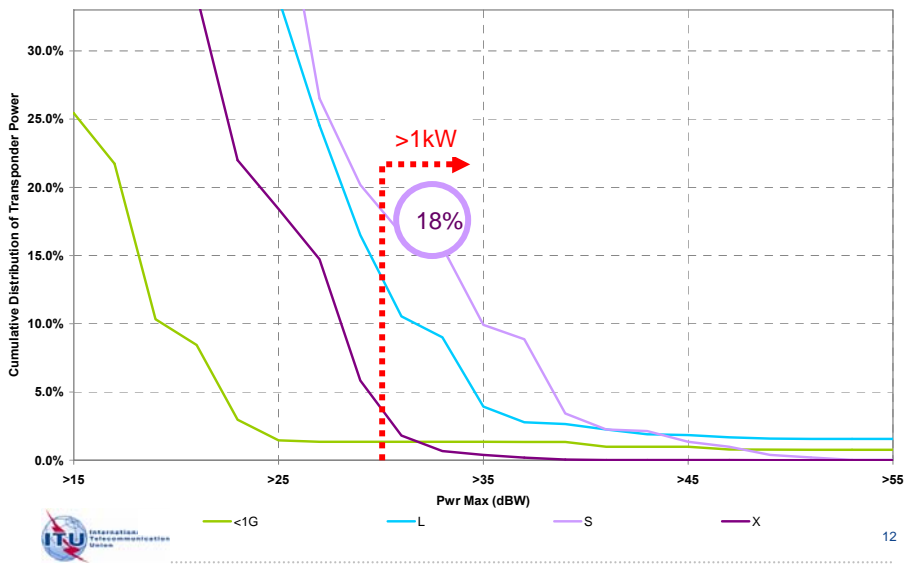
Transponder Power



Transponder Power



Transponder Power



...Carrier and Transponder Power...

...Carrier Power is used in C/I calculation and Transponder Power (and BW) is used to fill the BW of the wanted carrier with as many interfering carriers as can fit within their transponder BW and power...

Therefore:

...Higher than realistic notified power makes Coordination between Admins more difficult, leads to unnecessary unfavourable finding under No. 11.32A and recording under 11.41

- At higher end, may need to be made more realistic

...Carrier and Transponder Power...

...At higher end, may need to be made more realistic...

Change of RR needed?

Not necessarily, if Administrations voluntarily adjust notified POWER to more realistic values.

Enforcement? - Maybe MOD RR to, e.g. restrict POWER per Carrier and Transponder [specific per frequency band, current, future]

...Off-axis EIRP Density...

"I Commit!" (☑A.16.a, Appendix 4)

Compliance with **EIPR Density Limits of Section VI, Article 22**



But...

...Off-axis EIRP Density...

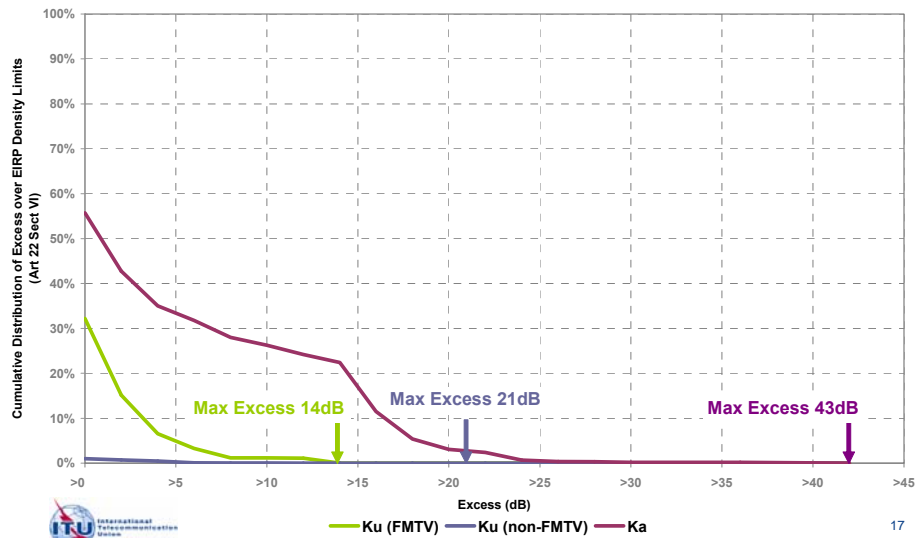
"I Commit!" (☑A.16.a, Appendix 4)

Excess over EIPR Density Limits of Section VI, Article 22

Frequency Band (GHz)	Non-FMTV	FMTV	All	Max Excess	Total assigns
Ku 13.75 - 14.5	1%	32.2%	4.3%	>21/14 dB	698444
Ka 29.5 - 30.0			55.7%	>43 dB	77187
% of assignments > Limit Overall			9.4%		775631

Pattern used=29-25logθ EC only

Excess over EIRP density limits of Art. 22 Sect. VI



ITU International Telecommunication Union

...Off-axis EIRP Density...

“I Commit!” (☑A.16.a, Appendix 4)

Excess over EIPR Density Limits of Section VI, Article 22

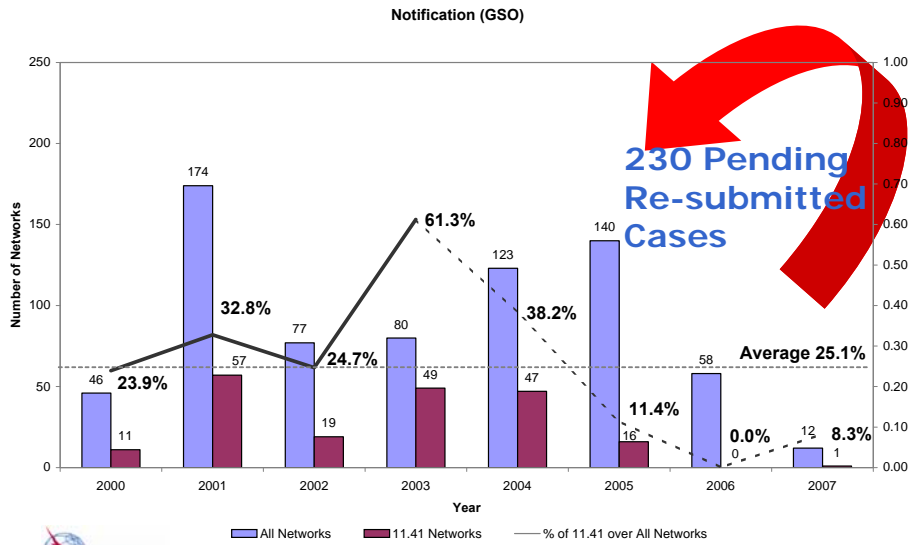
Is commitment in this case a good approach?

Maybe remove A.16.a and make Off-axis EIRP Density subject to simple calculation by Administrations and BR, necessary elements are anyway provided (antenna pattern, max power density and emission bandwidth)

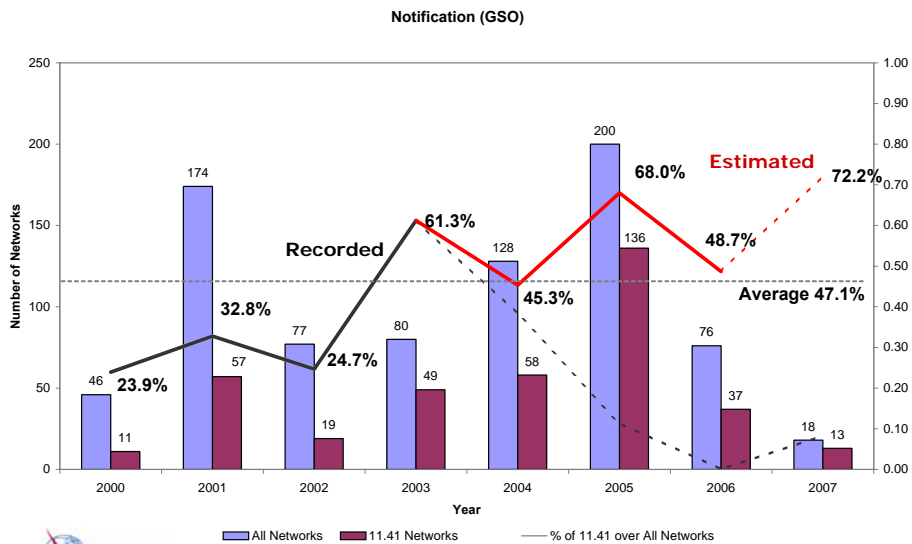
How about Off-axis EIRP Density Limits in other bands?
Its importance in sharing cannot be overstressed – its well known.

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Committed to connecting the world

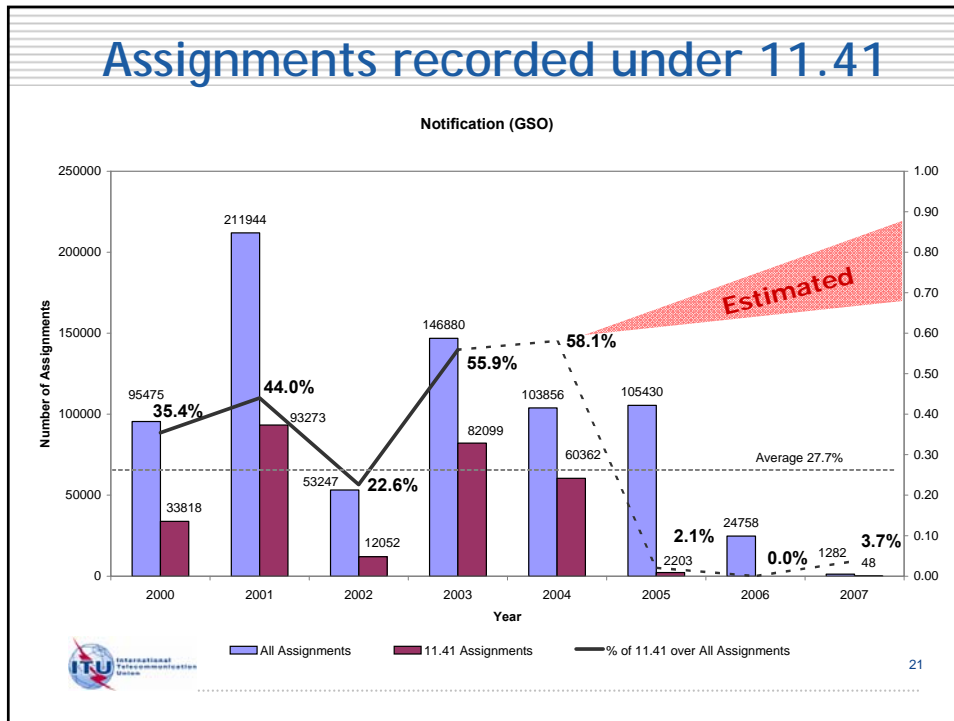
Networks recorded under 11.41



Networks recorded under 11.41



Assignments recorded under 11.41



...Recording in MIFR under 11.41...

... With the current high and growing proportion,

is the interference storm coming?

If so, serious measures are needed NOW !!!

(But which ?)

However, in view of the current high proportion of assignments recorded under No. 11.41, the number of reported interference cases is surprisingly low, practically almost nonexistent



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...Recording in MIFR under 11.41...

... With the current high and growing proportion,

is the interference storm coming?

If the storm is not coming, it indicates that the recorded characteristics are more interference “aggressive” than those used in operation and this makes Coordination between Administrations more difficult without good reason, therefore:

To make more room for others, bring recorded characteristics close(r) to operational values

Satellite Beams

Why stop at -20 dBr gain contour for high gain beams?
Why not go down to e.g. $-G_{max} \text{ (dBr)} = 0 \text{ dBi}$? MOD Ap4?

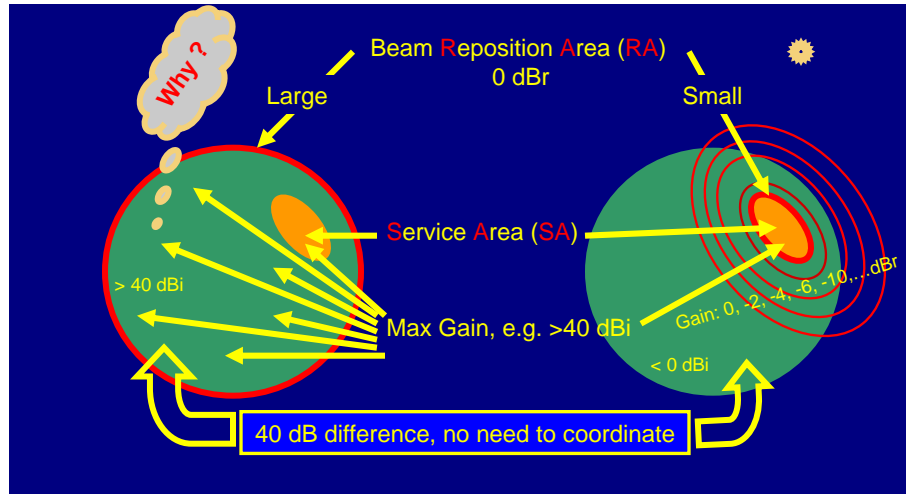
The importance of Off-axis EIRP Density in sharing cannot be overestimated – it’s well known.
How about Off-Service Area EIRP Density Limits or Gain roll-off requirement (if only the SA was a disk!).
Maybe a case for SG4 to study? E.g. 1° off-SA, -5dBr...

Repositionable Beams, generally

Notify more realistic Service Area(s) and Beam Reposition Area(s), or (as an ultimate measure) eliminate Repositionable Beams altogether at Notification

Repositionable Beams

-Small **Service Area**, Large **Reposition Area**-



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Repositionable Beams

-Small **SA**, Large **RA**-

Holder's benefit: Coordinated interference from and to its satellite everywhere, but not from and to earth stations outside SA (they do not exist there); so, it is in fact **only half-coordinated**. If a new SA is added within 7 years, the other half needs new coordination with the new 2D-date and must be brought into use within those 7 years.

7 years after API: Coordinated part lapses, the original CRC is no more a valid basis for Notification; so, any newly added SA needs full coordination with the new 2D-date.

No benefit after 7 years.

BLOCKING OTHERS is not a benefit recognized by the RR !

To enforce: ? MOD Ap4 of RR - RA must be within the SA !

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7 Years after API

Once a satellite network is recorded in MIFR (and 7 years from API have gone), **CRC data can be eliminated from the SRS database, provided...** (this would NOT be a SUP of CRC special section which must be preserved as the regulatory basis for recording!).

CRC is no more valid for any further Notification (it can thence be done only as a MOD of recorded assignments under No. 11.43A and if that MOD needs coordination, a fresh CRC is required with the 2D-date of the MOD).

CRC carries just one, but very essential, element that does not exist with recorded assignments – the “priority” date, 2D-date of CRC. Transfer it to assignments recorded in MIFR, and they can continue their regulatory life in MIFR beyond 7 years **without CRC** and enjoy the same “protection” as if CRC data were still there! SRS database of today supports such transfer and once it is done, **CRC data can be safely removed from SRS.**

Benefit: A) Fewer and easier coordination requirements for later comers – recorded characteristics are generally less coordination demanding!

b) Smaller SRS database, easier to handle, analyze...



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7 Years after API

Similar thing goes for API data.

If the date of receipt that starts the regulatory clock (or the 7-year deadline) and the original GSO orbital position are copied from API to the recorded network (and SRS database of today supports this) **API data can be safely removed from SRS database** without detriment to recorded assignments or application of the Radio Regulations provisions.

(As with CRC, this would NOT be a SUP of API special section which must be preserved as the regulatory basis for recording!).



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Reinforce Res. 49

Due Diligence Information (as the name says) is supposed to be provided before events.

But why not move it to [e.g. up to one month] after the events, after the launch of a satellite? It would become much easier for Administrations to verify the information provided!

Maybe make it part of data concerning the confirmation of the date of bringing into use?

Possible Effects

If each one of the mentioned measures had a potential to increase the

Efficiency of Use of Spectrum/Orbit
by just 1%, there would be room for
[10...15] new satellite networks!

**Thank you very much
for your attention**