



European Radiocommunications Committee (ERC)
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**ANALYSIS OF SHARING BETWEEN TERRESTRIAL FIXED SERVICE
AND SPACE RESEARCH/EES (S-E) AT 38 GHz**

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1. **INTRODUCTION**

At WARC 92, new allocations for space research and earth exploration satellite services were introduced into the band 37 GHz - 40.5 GHz. At present (May 1992), it is stated in the Radio Regulations that the Power Flux Density (PFD) limits given in Nos. **2578/2584** apply in this frequency band. In addition, CEPT Recommendation T/R 12-01 E (Helsinki 1991) recommended that CEPT should develop necessary sharing criteria between the services authorised by the Radio Regulations. The object of the analysis is to assess the impact of using the currently specified PFD limits on the terrestrial fixed links.

2. **ANALYSIS**

The interfering signal from satellite to the fixed link station varies depending on the incident angle. Annex I works out the power received at the fixed link receiver input for incident angles between 0 and 50°, taking into account fixed link antenna radiation pattern envelope and system losses. The following calculation is based on a 2 Mbit/s system operating over a bandwidth of 7 MHz.

In order to assess the extent of the problem, the following assumptions are made and some of parameters are extracted from ETSI DE/TM-4001:

A co-channel interference case is considered:

Antenna Effective Aperture	0.125 m ²
Antenna Gain	44 dBi
Antenna Sidelobe Gain at an incident angle of 20°	6.7 dBi
Bit Rate	2 Mbit/s
Channel Spacing	7 MHz
Link Length	5 km
Availability	99.999%
UK Rain Zone	F
Rain Fade Margin, M	60 dB
The following satellite parameters are used:	
Incident Angle	20°
PFD in 1 MHz	-107.5 dB(W/m ²)

The interfering satellite signal after conversion to 7 MHz bandwidth equals to -99.05 dB(W/m²).

The interfering signal collected by a terrestrial receiving antenna of effective aperture of 0.125 m² is:
 $-99.05 \text{ dB(W/m}^2) + 10 \log 0.125$
 $= -108.08 \text{ dBW in 7 MHz bandwidth}$

The interfering signal power arriving at the receiver input is:
 Incident Power in 7 MHz – Discrimination at 20° – Fixed System Losses
 $= -108.08 \text{ dBW} - (44 - 6.7) \text{ dB} - 6 \text{ dB}$
 $= -151.38 \text{ dBW}$

Annex I shows a similar analysis for different bit rate systems with different incident angles.

Typical values of maximum long-term interference limits stated in CCIR Recommendation 758 for different bit rate systems are as follows:

2 Mbit/s	8 Mbit/s	34 Mbit/s	140 Mbit/s
-140 dBW	-134 dBW	-131 dBW	-124 dBW

Table 1

3. CONCLUSION

It can be seen from Annex I that, apart from the main beam direction (and this scenario is unlikely), all the interfering power arriving at the fixed link receiver input is below the limits specified in Table 1. This does indicate that sharing between Fixed Service (FS) and Space Research/EES at 38 GHz is feasible.

ANNEX 1

Incident Angle	PFD	RPE	Discrimination	2Mbit/s 7MHz	8Mbit/s 14MHz	34Mbit/s 28MHz	140/155Mb 140MHz
0	-115	44	0	-121.579	-118.569	-115.559	-108.569
1	-115	44	0	-121.579	-118.569	-115.559	-108.569
2	-115	44	0	-121.579	-118.569	-115.559	-108.569
3	-115	44	0	-121.579	-118.569	-115.559	-108.569
4	-115	44	0	-121.579	-118.569	-115.559	-108.569
5	-115	21.7	22.3	-143.879	-140.869	-137.859	-130.869
6	-114.5	20.36	23.64	-144.719	-141.709	-138.699	-131.709
7	-114	19.02	24.98	-145.559	-142.549	-139.539	-132.549
8	-113.5	17.68	26.32	-146.399	-143.389	-140.379	-133.389
9	-113	16.34	27.66	-147.239	-144.229	-141.219	-134.229
10	-112.5	15	29	-148.079	-145.069	-142.059	-135.069
11	-112	14.17	29.83	-148.409	-145.399	-142.389	-135.399
12	-111.5	13.34	30.66	-148.739	-145.729	-142.719	-135.729
13	-111	12.51	31.49	-149.069	-146.059	-143.049	-136.059
14	-110.5	11.68	32.32	-149.399	-146.389	-143.379	-136.389
15	-110	10.85	33.15	-149.729	-146.719	-143.709	-136.719
16	-109.5	10.02	33.98	-150.059	-147.049	-144.039	-137.049
17	-109	9.19	34.81	-150.389	-147.379	-144.369	-137.379
18	-108.5	8.36	35.64	-150.719	-147.709	-144.699	-137.709
19	-108	7.53	36.47	-151.049	-148.039	-145.029	-138.039
20	-107.5	6.7	37.3	-151.379	-148.369	-145.359	-138.369
21	-107	6.25	37.75	-151.329	-148.319	-145.309	-138.319
22	-106.5	5.8	38.2	-151.279	-148.269	-145.259	-138.269
23	-106	5.35	38.65	-151.229	-148.219	-145.209	-138.219
24	-105.5	4.9	39.1	-151.179	-148.169	-145.159	-138.169
25	-105	4.45	39.55	-151.129	-148.119	-145.109	-138.119
26	-105	4	40	-151.579	-148.569	-145.559	-138.569
27	-105	3.55	40.45	-152.029	-149.019	-146.009	-139.019
28	-105	3.1	40.9	-152.479	-149.469	-146.459	-139.469
29	-105	2.65	41.35	-152.929	-149.919	-146.909	-139.919
30	-105	2.2	41.8	-153.379	-150.369	-147.359	-140.369
31	-105	1.925	42.075	-153.654	-150.644	-147.634	-140.644
32	-105	1.65	42.35	-153.929	-150.919	-147.909	-140.919
33	-105	1.375	42.625	-154.204	-151.194	-148.184	-141.194
34	-105	1.1	42.9	-154.479	-151.469	-148.459	-141.469
35	-105	0.825	43.175	-154.754	-151.744	-148.734	-141.744
36	-105	0.55	43.45	-155.029	-152.019	-149.009	-142.019
37	-105	0.275	43.725	-155.304	-152.294	-149.284	-142.294
38	-105	4.4E-16	44	-155.579	-152.569	-149.559	-142.569
39	-105	-0.275	44.275	-155.854	-152.844	-149.834	-142.844
40	-105	-0.55	44.55	-156.129	-153.119	-150.109	-143.119
41	-105	-0.825	44.825	-156.404	-153.394	-150.384	-143.394
42	-105	-1.1	45.1	-156.679	-153.669	-150.659	-143.669
43	-105	-1.375	45.375	-156.954	-153.944	-150.934	-143.944
44	-105	-1.65	45.65	-157.229	-154.219	-151.209	-144.219
45	-105	-1.925	45.925	-157.504	-154.494	-151.484	-144.494
46	-105	-2.2	46.2	-157.779	-154.769	-151.759	-144.769
47	-105	-2.475	46.475	-158.054	-155.044	-152.034	-145.044
48	-105	-2.75	46.75	-158.329	-155.319	-152.309	-145.319
49	-105	-3.025	47.025	-158.604	-155.594	-152.584	-145.594
50	-105	-3.3	47.3	-158.879	-155.869	-152.859	-145.869