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INTERFERENCE FROM UNWANTED EMISSIONS OF MOBILE EARTH STATIONS IN S-PCN SYSTEMS OPERATING IN THE BAND 1610 - 1626.5 MHz INTO GSO MSS SATELLITES OPERATING ABOVE 1626.5 MHz

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1 INTRODUCTION

This report studies the potential interference into geostationary (GSO) Mobile-Satellite Service (MSS) satellites from unwanted emissions of Satellite Personal Communication Networks (S-PCN) Mobile Earth Stations (MES) operating in the band 1610 - 1626.5 MHz, where the MES conform to the unwanted emission limits given in ETS 300 733[1]. The GSO MSS satellites studied were Inmarsat-2 and Inmarsat-3.

Interference was calculated both from the point of view of total noise increase and in terms of return link loading and C-band (4 GHz) feederlink power robbing.

It should be noted that this study does not consider the impact of unwanted emissions from S-PCN satellites.

2 MES UNWANTED EMISSIONS

Tables 2 and 3 of ETS 300 733 give limits for the unwanted emissions of MES operating in S-PCN systems in the band 1610 - 1626.5 MHz. An S-PCN system was assumed to be operating in the band 1621.5-1626.5 MHz. The system was assumed to have 120 equally spaced RF channels in the 5 MHz system bandwidth, i.e. the channel spacing is 41.67 kHz. The *nominated bandwidth* was assumed to be the maximum permitted by the definition, as shown in Table 1. The interfering EIRP in a 5 kHz and a 15 kHz channel just above the band edge 1626.5 MHz was calculated based on the unwanted emission mask of ETS 300 733. The results are given in Table 1.

The interfering EIRP of the MES's was reduced by 4 dB to take account of voice activation and by 2 dB to take account of power control.

3 INTERFERENCE ANALYSIS

3.1 C/I analysis

To compute the aggregate interference from a population of MES spread across the Earth's surface, the field of view of the GSO MSS satellites was divided into a number of concentric rings. The interference power (I) into the Inmarsat-2 global beam and into the Inmarsat-3 (assumed sub-satellite) spot beam was then calculated from the following equation:

$$I = 10\log\left\{\sum_{i=1}^{n} 10^{\left(EIRP+10\log(ni)-Li+Gi\right)}\right\}$$

where

- EIRP is the unwanted EIRP from each MES in dBW in the relevant bandwidth;
- n_i is the number of MES in ring i;
- L_i is the free space propagation loss from the inner edge of ring i in dB;
- G_i is the satellite receiving antenna gain at the corresponding off-axis angle in dBi.

The average MES interfering EIRP as given in Table 1 was used. This corresponds to a uniform distribution of MES, both geographically and in frequency.

The resulting C/I_0 values for an Inmarsat-3 spot beam and for an Inmarsat-2 global beam are given in Tables 2 and 3 respectively.

[1] The version approved for public vote at the Edinburgh SES meeting, Nov. 1996.

3.2 Power robbing analysis

Next, the equivalent C-band EIRP was calculated:

$$EIRP_C = I - G_{EOC} + G_{tr}$$

where

- G_{EOC} is the satellite receiving antenna gain at edge of coverage;
- G_{tr} is the satellite transponder gain.

The "power robbing" was then calculated, i.e. the percentage of the available C-band EIRP that would be used up by the interference. The power robbing is about 0.01% in all cases, assuming a total available C-band EIRP of 30 dBW in 17 MHz (assumed feederlink bandwidth used).

4 CONCLUSIONS

The calculations have shown that the likely interference impact of TDMA S-PCN terminals operating below 1626.5 MHz on GSO MSS satellites in the adjacent band above 1626.5 MHz will be acceptable with the unwanted emission limits of ETS 300 733. Thus, ETS 300 733 should provide sufficient protection for GSO MSS systems operating in the band 1626.5 - 1660.5 MHz, at least in the case where a TDMA S-PCN system is operating adjacent to the GSO MSS system.

Channel no.	Nominated bandwidth	Interfering EIRP in a 5 kHz channel	Interfering EIRP in a 15 kHz channel
1	41.67 kHz	-42.78 dBW	-38.01 dBW
2	125 kHz	-42.78 dBW	-38.01 dBW
3-6	166.67 kHz	-42.78 dBW	-38.01 dBW
7	166.67 kHz	-44.40 dBW	-39.89 dBW
10	166.67 kHz	-47.66 dBW	-42.96 dBW
15	166.67 kHz	-50.84 dBW	-46.15 dBW
19-35	166.67 kHz	-52.78 dBW	-48.01 dBW
36	166.67 kHz	-61.01 dBW	-56.27 dBW
46-120	166.67 kHz	-63.78 dBW	-59.01 dBW
Average of all channels		-52.91 dBW	-48.18 dBW
Average of all channels except 1		-53.26 dBW	-48.53 dBW
Average of all channels except 1,2		-53.65 dBW	-48.93 dBW
Average of all channels except 1,2,3		-54.09 dBW	-49.37 dBW

Table 1: Unwanted EIRP from different MES channels

CARRIER	MIN EIRP (dBW)	OCCUPIED BANDWITH (kHz)	RECEIVER ANTENNA GAIN (dBi)	PROP LOSS (dB)	RANDOM LOSS (dB)	C (dBW)	C/Io (dB)	THRESHOLD C/No+Io (dBHz)	THRESHOLD C/Io (dB)	MARGIN (dB)
INM-B VOICE	22.8	15	23	189.11	5	-148.31	78.77	46.9	69.1	9.67
INM-M(M) VOICE	17.9	5	23	189.11	5	-153.21	73.57	42	64.2	9.37
INM-M(L) VOICE	17.9	5	23	189.11	5	-153.21	73.57	42	64.2	9.37
INM-ML(F) VOICE	17.9	5	23	189.11	5	-153.21	73.57	42	64.2	9.37
INM-C DATA	4.6	0.75	23	189.11	3.2	-164.71	62.07	32.3	54.5	7.57

Table 2: C/I_0 calculation for Inmarsat-3 spot beam

CARRIER	MIN EIRP (dBW)	OCCUPIED BANDWITH (kHz)	RECEIVER ANTENNA GAIN (dBi)	PROP LOSS (dB)	RANDOM LOSS (dB)	C (dBW)	C/Io (dB)	THRESHOLD C/No+Io (dBHz)	THRESHOLD C/Io (dB)	MARGIN (dB)
INM-B VOICE	30.7	15	16	189.11	5	-147.41	79.71	46.9	69.1	10.61
INM-M(M) VOICE	25.8	5	16	189.11	5	-152.31	74.51	42	64.2	10.31
INM-M(L) VOICE	25.8	5	16	189.11	5	-152.31	74.51	42	64.2	10.31

Table 3: C/I_0 calculation for Inmarsat-2 global beam