

RECOMMENDATION ITU-R BO.792***

**Interference protection ratios for the
broadcasting-satellite service (television)
in the 12 GHz band**

(1992)

The ITU Radiocommunication Assembly,

considering

- a) that the interference protection ratio is a primary parameter for the broadcasting-satellite service (BSS) (television);
- b) that certain values of protection ratios for television signals have already been used for planning purposes by the WARC-BS-77 and RARC SAT-83;
- c) that more accurate values of protection ratio required for frequency modulated television systems, using time domain multiplex for the video components, and digital techniques for associated sound and data, are now well established;
- d) that the existing Plans for the BSS in the 12 GHz band may be reconsidered in the future and that the planning will require protection ratio data for the types of wanted and interfering signals involved;
- e) that the selectivity characteristics of receiving equipment for the BSS (television) are designed taking into account these values,

recommends

- 1** that the protection ratio templates given in Annex 1 should be used for the planning of broadcasting-satellite systems using conventional frequency modulated TV signals;
- 2** that for satellite broadcasting using conventional frequency modulated TV and the channel spacings specified in Appendix 30 of the Radio Regulations, but with a different frequency deviation, the formulae given in Annex 2 could be used to obtain an estimation of the co-channel protection ratio PR_0 measured under the reference conditions described in Recommendation ITU-R BO.600. In these formulae, it is assumed that the modulation parameters of the wanted and unwanted signals are the same;
- 3** that to facilitate the coordination of MAC systems in the 12 GHz band, the values shown in Table 1 (D2-MAC), Table 2 (D-MAC) and Tables 3, 4 and 5 (B-MAC) of Annex 3 could be used as protection ratios.

NOTE 1 – Data applicable to new systems (for example HDTV analogue or digital) are not yet available, but will be included in future revisions of this Recommendation.

* *Note:* Report ITU-R BO.634-4 was used in preparing this Recommendation.

** Radiocommunication Study Group 6 made editorial amendments to this Recommendation in 2001 in accordance with Resolution ITU-R 44.

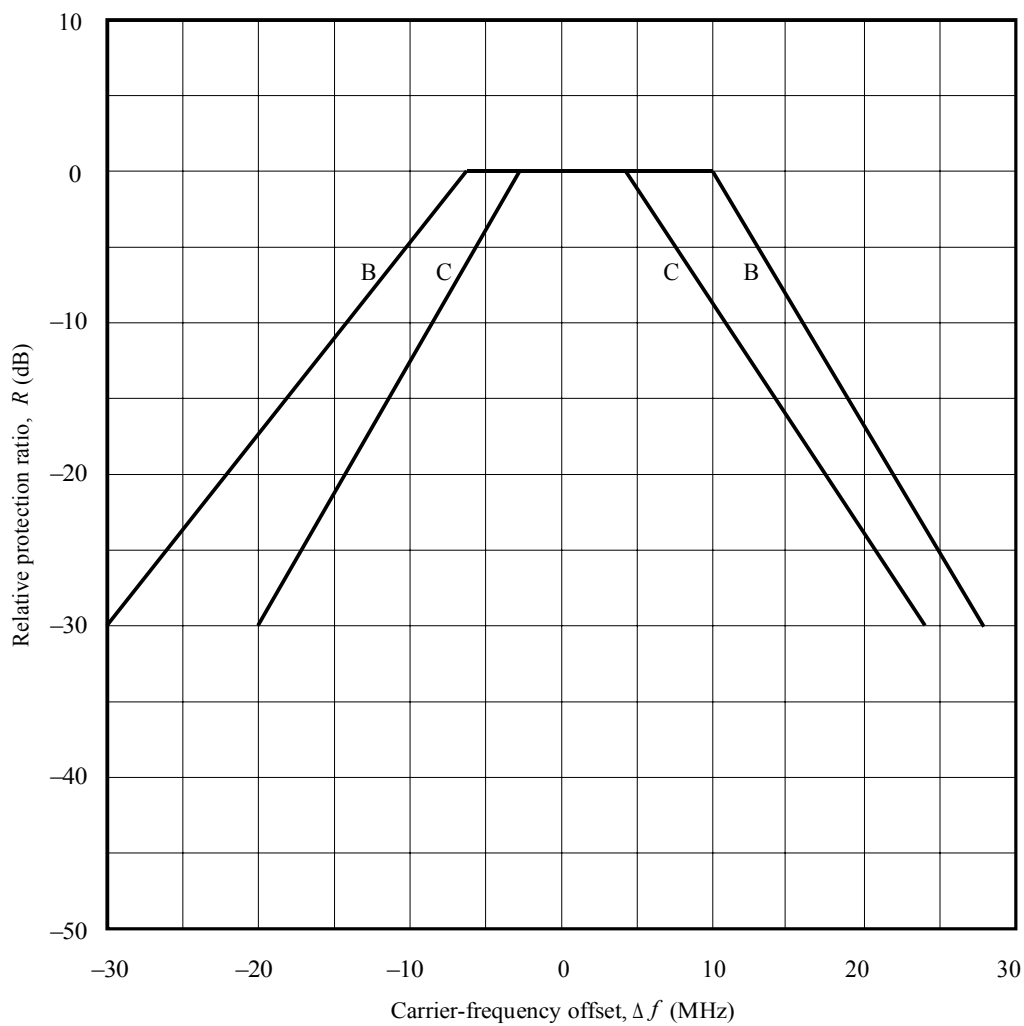
ANNEX 1

Protection ratios for satellite broadcasting of conventional frequency modulated television signals

1 For systems SECAM, PAL and NTSC (Regions 1 and 3) with deviation sensitivity 13.5 MHz and preemphasis for 625 lines (Region 1) and 525 lines (Region 3), use Fig. 1a.

FIGURE 1a

Reference case protection ratios relative to co-channel values



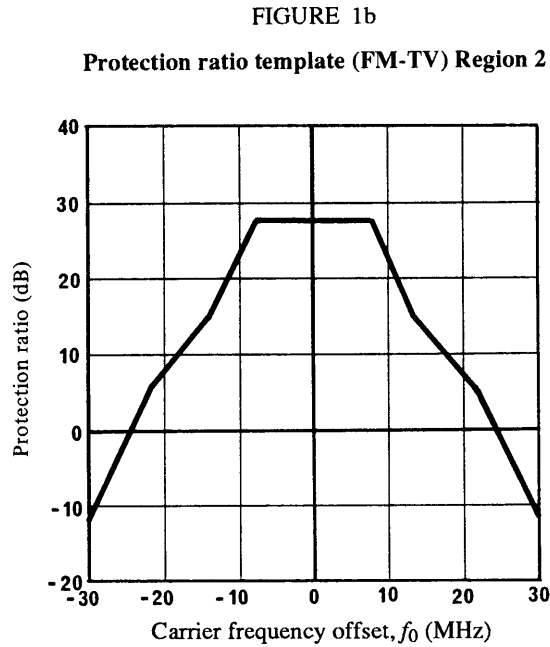
$$\Delta f = (f_{\text{interfering}} - f_{\text{wanted}})$$

Curves A: not used

B: television/frequency modulation-wanted, television/frequency modulation interfering, co-channel value: 30 dB (Regions 1 and 3)

C: television/frequency modulation-wanted, television/vestigial sideband modulation interfering, co-channel value: 30 dB (Regions 1, 2 and 3)

2 For system NTSC (Region 2) with deviation sensitivity 12 MHz, and pre-emphasis for 525 lines, use Fig. 1b.



Protection ratio (peak-to-peak frequency deviation $D_v = 12$ MHz):

28.0	dB	for	$ f_0 \leq 8.36$ MHz
$-2.762 f_0 + 51.09$	dB	for	$8.36 < f_0 \leq 12.87$ MHz
$-1.154 f_0 + 30.4$	dB	for	$12.87 < f_0 \leq 21.25$ MHz
$-2.00 f_0 + 48.38$	dB	for	$ f_0 > 21.25$ MHz

D02-sc

ANNEX 2

Formulae for estimating co-channel protection ratios for conventional frequency modulated TV

1 For all systems except 525-line M/NTSC:

$$PR_0 = C - 20 \log (D_v/12) - Q + 1,1 Q^2 \tag{1a}$$

where:

D_v : nominal peak-to-peak frequency deviation (MHz)

Q : the impairment grade, concerning the effect of interference only, measured on the 5-point scale recommended in Recommendation ITU-R BT.500

C : a constant depending on the television system which is:

12.5, for 625-line systems I/PAL, G/PAL, L/SECAM

18.5, for 625-line system K/SECAM.

2 For 525-line system M/NTSC:

$$PR_0 = 16,9 - 8,7 \log I_u - 20 \log (D_v/12) \quad (1b)$$

where:

$$I_u = \frac{5-Q}{Q-1} \quad \text{con } 1 < Q < 5$$

Equation (1b) is based on data obtained from measurements carried out in Canada and the United States of America using 525-line system M/NTSC. This equation was found to provide a reasonably good fit to these data over the full range of Q .

ANNEX 3

Protection ratios for MAC television signals

TABLE 1

Protection ratios between D2-MAC/packet and PAL/SECAM (WARC-BS-77)

Wanted signal	Interfering signal	C/I corresponding to the visibility threshold		
		Co-channel (dB)	Lower adjacent channel (dB)	Upper adjacent channel (dB)
D2-MAC/packet	D2-MAC/packet	20	11	12
PAL/SECAM (WARC-BS-77)	D2-MAC/packet	27	12	13

Deviation sensitivity for all signals at the cross-over frequency of the pre-emphasis network: 13.5 MHz/V.

RF channel bandwidth: 27 MHz.

Pre-emphasis parameters for D2-MAC: $A = 0.7071$, $f_1 = 0.84$ MHz, $f_2 = 1.50$ MHz.

Note 1 – The values given in this table were measured with a –3 dB bandwidth of 27 MHz using a 5th order Chebyshev IF filter.

TABLE 2

Protection ratios for the D-MAC/packet system using frequency modulation*

Wanted signal (1)	Interfering signal (1)	Co-channel	Lower adjacent channel	Upper adjacent channel
D-MAC/packet	D-MAC/packet continuous data (2)	17	3	1
D-MAC/packet	C-MAC/packet (3)	27	10	6
PAL system (WARC-BS-77)	D-MAC/packet continuous data (2)	22	7	6
PAL system	C-MAC/packet (3)	29	11	8

* Protection ratio required for just-perceptible interference on the wanted channel picture (dB).

Deviation sensitivity for all signals at the cross-over frequency of the pre-emphasis network: 13.5 MHz/V.

RF channel bandwidth: 27 MHz.

Pre-emphasis parameters for C-MAC and D-MAC: $A = 0.7071$, $f_1 = 0.84$ MHz, $f_2 = 1.50$ MHz.

Note 1 – The values given in this table were measured with a –3 dB bandwidth of 27 MHz using an LC type filter.

- (1) The wanted channel and interfering channel pictures were synchronized with a 1/2 line offset between each other.
- (2) Full-channel data signal.
- (3) The protection ratios in this row also apply when the interfering signal is a D-MAC/packet signal (data and vision). Note that the adjacent-channel interference is predominantly determined by the vision signal, not by the data part of the MAC/packet signal.

TABLE 3

Co-channel interference results for B-MAC (C/I (dB))

		Interfering signal	
		NTSC	B-MAC
Wanted signal	NTSC	MB = 24.3 CB = 26.1 Average = 25.2	MB = 24.4 CB = 26.2 Average = 25.3
	B-MAC	MB = 24.3 CB = 25.1 Average = 24.4	MB = 23.6 CB = 25.1 Average = 24.4

MB: multiburst video test signal

CB: 75% colour bar test signal

TABLE 4

Upper adjacent-channel interference results for B-MAC (C/I (dB))

		Interfering signal	
		NTSC	B-MAC
Wanted signal	NTSC	MB = 4.3 CB = 4.4 Average = 4.3	MB = 7.4 CB = 7.2 Average = 7.3
	B-MAC	MB = 4.2 CB = 2.4 Average = 3.3	MB = 6.1 CB = 6.8 Average = 6.5

MB: multiburst video test signal

CB: 75% colour bar test signal

TABLE 5

Lower adjacent-channel interference results for B-MAC (C/I (dB))

		Interfering signal	
		NTSC	B-MAC
Wanted signal	NTSC	MB = 5.5 CB = 2.9 Average = 4.2	MB = 7.2 CB = 5.1 Average = 6.2
	B-MAC	MB = 5.7 CB = 3.9 Average = 4.8	MB = 9.1 CB = 9.2 Average = 9.2

MB: multiburst video test signal

CB: 75% colour bar test signal

Pre-emphasis parameters for B-MAC: $A = 0.7071$, $f_1 = 1.87$ MHz, $f_2 = 3.74$ MHz.
