

RECOMMENDATION ITU-R BO.790*, **

Characteristics of receiving equipment and calculation of receiver figure-of-merit (G/T) for the broadcasting-satellite service

(1992)

The ITU Radiocommunication Assembly,

considering

- a) that typical receiving equipment for individual reception is comprised of an antenna, a low-noise receiver front end, an indoor unit containing intermediate frequency stages, programme selector, demodulation or adaptor stages and a television monitor or television receiver;
- b) that the figure of merit, G/T , is a primary parameter in the system design and the evaluation of receiver performance;
- c) that the in-service performance of the receiving equipment in which operational factors are included should be used for a link budget calculation and that for this parameter, a term “usable G/T ” is given;
- d) that the parameter characterizing the intrinsic quality of a receiver is in wide use for evaluation of receiver performance and that for this parameter, a term “nominal G/T ” is given;
- e) that the standardization of factors to be taken into account for these two types of G/T is desirable;
- f) that receiving systems using a relatively small diameter antenna are now capable of offering the figure of merit and directivity established in the 12 GHz Plans because:
 - the noise figure of the low-noise front end has been improved far below the level previously expected at the WARC-BS-77;
 - the antenna efficiency has been enhanced from 55% to 70%; and
 - the side-lobe level has been markedly reduced through the use of the offset-feed type antenna;
- g) that for reception at 12 GHz the design will probably entail two frequency changes to ease problems of selectivity, image rejection and local oscillator radiation, but that installations with only one frequency change cannot be ruled out;

* *Note:* Report ITU-R BO.473-5 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.

- h) that in satellite broadcasting, the concept of signal reception, not only for individual reception but also for community receiving installations, has been established and that to this end it is necessary to use suitable reception and distribution techniques satisfying, as much as possible, the requirements of maximum commonality between individual and community receivers;
- j) that a potential source of unwanted radiation from BSS receiver terminals is the first local oscillator (LO),

recommends

- 1 that a distinction should be made between installations intended for community reception and for individual reception;
- 2 that the overall characteristics of receiving equipment should be specified by the figure of merit G/T which is the ratio expressed in $\text{dB}(\text{K}^{-1})$, between the gain of the receiving antenna (including losses) and the total noise temperature expressed in Kelvin, referred to the point of measurement of the antenna gain; the set of equations given in Annex 1 should be used to calculate the usable G/T and the nominal G/T ;
- 3 that when there is more than one frequency change, the first down-converter, equipped with a fixed frequency oscillator, should be placed close to, or on, the antenna. For 12 GHz reception, the first intermediate frequency should be chosen so as to avoid interference by terrestrial broadcasting transmitters or by other services using radio transmissions of significant power; the second intermediate frequency should be chosen so as to avoid interference by terrestrial broadcasting and other transmitters (see Annex 2);
- 4 that for individual reception at 12 GHz of sound-only broadcasts or of supplementary sound channels associated with television broadcasts, at least the same input stages as for the reception of television signals should be used;
- 5 that in order to avoid picture impairments due to interference problems, receiving equipment with a suitable well-screened construction and suitably designed components should be used; in particular the SHF converter (which should have a high gain but low intermodulation levels) and the down-lead conveying the signals at intermediate frequency;
- 6 that linearity requirements in the converter and IF amplifiers should take into account the number of television signals of significant amplitude that may be present within the first IF bandwidth.

ANNEX 1

1 Usable G/T

The usable G/T is defined by the following formula, which allows for pointing error, polarization effects and ageing:

$$G/T = \frac{\alpha \beta G_{\tau}}{\alpha T_a + (1 - \alpha) T_0 + (n - 1) T_0}$$