

RECOMMENDATION ITU-R M.1475

**METHODOLOGY FOR DERIVATION OF PERFORMANCE OBJECTIVES
OF NON-GEOSTATIONARY MOBILE-SATELLITE SERVICE
SYSTEMS OPERATING IN THE 1-3 GHz BAND
NOT USING SATELLITE DIVERSITY**

(Question ITU-R 87/8)

(2000)

The ITU Radiocommunication Assembly,

considering

- a) that non-geostationary mobile-satellite service (non-GSO MSS) systems in the 1-3 GHz band are being planned for implementation or being implemented;
- b) that performance objectives would be specified for the hypothetical reference digital path (HRDP) given in Recommendation ITU-R M.827;
- c) that performance objectives are designated for GSO MSS systems in Recommendation ITU-R M.1181;
- d) that both regenerative and non-regenerative transponders may be used in non-GSO MSS systems;
- e) that the methodology for the derivation of performance objectives may be different for regenerative and non-regenerative transponders;
- f) that performance objectives for feeder links of non-GSO MSS systems should be determined based on end-to-end performance objectives;
- g) that performance objectives are useful for the basis of definition of interference criteria,

recommends

- 1 that for non-GSO MSS systems with non-regenerative transponders performance objectives should be defined for an end-to-end connection, from which performance objectives may be derived for feeder link and service link in such a way that 10% of unavailable time is allocated to the feeder link;
- 2 that the method presented in Annex 1 may be used to obtain performance objectives for non-GSO MSS systems with non-regenerative transponders;
- 3 that for non-GSO MSS systems with regenerative transponders performance objectives may be defined either for an end-to-end connection or for service link and feeder link separately, where Recommendation ITU-R S.614 or ITU-R S.1062 may provide guidance on performance objectives of feeder links.

Methodology for the derivation of performance objectives for non-GSO MSS systems with non-regenerative transponders

1 Derivation of performance objective

1.1 Definition of performance objective

A performance objective is defined by a threshold value of the end-to-end performance and an acceptable percentage of time as the following definition: “Percentage of time when the bit error ratio (BER) without forward error correction (FEC) is worse than BER_{th} shall be $X\%$ (e.g. 0.1%, 1%, 10%, etc.) or less”, where BER_{th} and $X(\%)$ are the end-to-end performance threshold BER and the percentage of unavailable time, respectively. This BER should be averaged over a period of Z s. (The quantity is for further study.)

1.2 Link threshold value of performance objectives

Recommendation ITU-R M.1181 which deals with availability of GSO-MSS stipulates the threshold value of performance BER_{th} , for mobile voice traffic, is 4×10^{-2} (without FEC). It should be noted that the threshold value of performance depends on the type of applications offered by the particular MSS system (e.g. voice, fax, data and for mobile, vehicular and semi-fixed).

1.3 Percentage of available and unavailable time

Due to inherent properties of MSS systems, which includes the time variant conditions of MSS service link shadowing and mobility of user terminals, it may be realistic to use the value given in Recommendation ITU-R M.1181 for GSO MSS systems, that is, available time percentages ($X\%$) between 90% to 95% for non-GSO MSS systems.

2 Basic concept and assumptions

2.1 Threshold C/N_T

The carrier-to-noise power ratio for the end-to-end link may be estimated from the performance objective defined by the BER_{th} . As an example, the end-to-end threshold $(C/N_T)_{th}$ (where “ th ” stands for threshold) for mobile voice traffic employing QPSK modulation is assumed to be 7 dB, for a threshold BER of 4×10^{-2} without FEC. It should be noted that the $(C/N_T)_{th}$ value of 7 dB is higher than the theoretical value to cope with various practical degradation (e.g. modem implementation margins). Furthermore, for other MSS, such as transportable data delivery service, the BER requirement is more stringent (see Recommendation ITU-R M.1181) leading to a $(C/N_T)_{th}$ requirement of at least 15 dB.

2.2 Degradation of C/N_T and service link and feeder-link margin

2.2.1 Definitions

The total carrier-to-noise power ratio is denoted by C/N_T . Hence, it is possible to write the end-to-end C/N_T of the non-GSO MSS system as:

$$C/N_T = \left\{ [(C/N_T)_s]^{-1} + [(C/N_T)_f]^{-1} \right\}^{-1} \quad (1)$$

where C is the receive carrier power and N_T is the sum of the noise power N (excluding interference) and the interference power, I , (i.e. $N_T = N + I$). The suffixes s and f indicate the service link and feeder link, respectively.