

RECOMMENDATION ITU-R M.1181

**MINIMUM PERFORMANCE OBJECTIVES FOR NARROW-BAND DIGITAL CHANNELS
USING GEOSTATIONARY SATELLITES TO SERVE TRANSPORTABLE AND
VEHICULAR MOBILE EARTH STATIONS IN THE 1-3 GHz RANGE,
NOT FORMING PART OF THE ISDN**

(Question ITU-R 112/8)

(1995)

Summary

This Recommendation concerns the minimum bit-error ratio performance objectives for voice mode and data mode of geostationary-satellite orbit (GSO) mobile-satellite service (MSS) systems.

The ITU Radiocommunication Assembly,

considering

- a) that performance objectives for digital mobile-satellite channels using narrow-band modulation and geostationary satellites should include an allowance for interference levels among and within systems operating in the 1-3 GHz range, as well as comply with user requirements for performance;
- b) that "general purpose" digital mobile-satellite channels may be used by land, maritime and aeronautical mobile earth stations, are designed to alternatively operate in data or voice transmission modes, or in-band signalling modes using the same frequencies during the same communications session;
- c) that reception of signals transmitted to and from mobile earth stations at most locations may be substantially degraded by location and orientation dependant signal propagation impairments which determine spatial performance;
- d) that "store and forward" messaging digital mobile-satellite channels using geostationary satellites are generally not sensitive to delay, and therefore are able to use near perfect interleaving in mitigating channel bit-error bursts, arising from multipath and light shadowing effects and thus can be operated within the performance objectives specified herein;
- e) that digital mobile-satellite channels may be used in global or spot coverage beams as part of a worldwide MSS, in which case stringent satellite power constraints are expected, combined with a minimum elevation angle to the satellite as low as 5°,

recommends

- 1 that in both directions of transmission through the service and feeder links, the combined radio-link minimum performance objectives for digital channels used by geostationary satellites to serve transportable or vehicular mobile earth stations in the MSS are as follows:
 - 1.1 for "general purpose" digital mobile-satellite channel (user rates up to 9.6 kbit/s):
 - 1.1.1 provisionally a channel bit-error ratio (BER) of better than 4×10^{-2} in the voice mode for not less than 90% of the available time;
 - 1.1.2 provisionally a BER of better than 1×10^{-5} in the data and signalling mode after error correction for not less than 90% of the available time;
 - 1.2 for transportable digital mobile-satellite channel (user rates up to 16 kbit/s);

- 1.2.1 a channel BER of better than 1×10^{-2} in the voice mode for not less than 95% of the available time;
- 1.2.2 a BER of better than 1×10^{-5} in the data and signalling modes after error correction for not less than 95% of the available time;
- 1.3 for “store and forward”, messaging digital mobile-satellite channels (up to 600 bit/s user rates):
- a BER of better than 4×10^{-5} after error correction for not less than 95% of the available time;

where available time is the total time for which the radio link is allocated and available to the user;

2 that the individual uplinks and downlinks may be so designed that the overall percentage of time for which the link is available is to a large extent determined by the service link. One method of allocating the overall percentage of time between the service and feeder links is described in Annex 2 as a guidance for the system designer;

3 that the additional conditions specified in the following Notes are part of the performance objectives specified in § 1 and 2.

NOTE 1 – Annexes 1 and 2 provide the basis of the performance objectives specified above.

NOTE 2 – For “general purpose” digital mobile-satellite channels used by vehicular land mobile earth stations, temporal availability is generally more critical than spatial availability because severe signal propagation impairments generally are eliminated when the mobile earth station antenna is moved a small distance. The specified signal quality and temporal availability levels are associated with mobile earth station operations in areas that are devoid of persistent heavy shadowing.

NOTE 3 – Sporadic, moderate shadowing of the signal to or from a geostationary satellite occurs with land mobile earth stations in most areas outside urban areas. These sporadic degradations can be effectively mitigated.

NOTE 4 – For voice communications, error control techniques may be provided as an integral part of the voice coder/decoder (codec) processing algorithm, but may also be incorporated in the modulator/demodulator (modem) module, or alternatively be partitioned between the modem and codec modules. Therefore, the performance objectives for voice communications should take into account the BER at the codec input.

NOTE 5 – Performance objectives and performance criteria for voice communications are likely to evolve with codec techniques becoming more efficient and with lower transmission rates. Therefore, voice performance objectives in future Recommendations may be stated in terms of actual voice quality (e.g. mean opinion score). Further study is needed on how to define the voice grade, and on selecting an evaluation method for low rate voice codecs.

NOTE 6 – For data communications, error control techniques are generally provided as an integral part of the modem. Additional end-to-end error control measures may be implemented to enhance performance for specific user applications. However, for the purpose of this Recommendation, the effects of these user application techniques are not included in the performance objectives.

NOTE 7 – Spatial performance is defined as the cumulative probability of link availability arising from the joint distribution of location and orientation dependent random losses in the link. Percentage of available time reflects the fraction of time the channel is not faded due to multipath and rain attenuation.

NOTE 8 – The Recommendation for performance objectives of the aeronautical mobile-satellite (R) service channels is described in Recommendation ITU-R M.1037.

NOTE 9 – In the case of backup using a previous generation satellite the BER performance objectives given in § 1 might be achieved for a lower percentage of the time.

NOTE 10 – The effects of aggregate interference from other systems and services should be taken into account in ensuring that the overall performance objectives of the digital MSS channel are met.

NOTE 11 – Further study is required for the necessity of short-term performance criteria to define the associated BER thresholds and percentages of time.