

## RECOMMENDATION ITU-R SA.1021

**METHODOLOGY FOR DETERMINING PERFORMANCE OBJECTIVES FOR SYSTEMS IN THE EARTH EXPLORATION-SATELLITE AND METEOROLOGICAL-SATELLITE SERVICES**

(Question ITU-R 138/7)

(1994)

The ITU Radiocommunication Assembly,

*considering*

- a) that permissible levels of interference for systems operating in the Earth exploration-satellite and meteorological-satellite services should be based on performance objectives for those services;
- b) that the hypothetical reference system (Recommendation ITU-R SA.1020) defines several radiocommunication functions of the Earth exploration-satellite and meteorological-satellite services, each of which may have particular performance objectives;
- c) that, although specific systems may have performance objectives that differ from those recommended for the service, all systems operating in the Earth exploration-satellite and meteorological-satellite services should accommodate interference at levels greater than or equal to the permissible levels of interference that are recommended for the service;
- d) that the methodology used to develop performance objectives for the Earth exploration-satellite and meteorological-satellite services may be applied to specific systems;
- e) that for remote sensors, systematic degradation of data from the same locations is a particularly severe type of interference,

*recommends*

- 1. that the methodology of Annex 1 be used for the development of performance objectives for the Earth exploration-satellite and meteorological-satellite services;
- 2. that the methodology of Annex 1 be used for the development of performance objectives for specific systems.

## ANNEX 1

**Methodology for determining performance objectives****1. Form of performance objectives**

Performance objectives should be specified for a particular function, even though the data associated with the function may be multiplexed with other data that are associated with other functions and performance objectives. In order to provide a basis for performance analyses and for derivation of permissible levels of interference, the performance objectives should denote the threshold(s) of required signal quality (e.g. bit error ratio (BER) or signal-to-noise ratio ( $S/N$ )) and associated percentage(s) of time or locations for which the threshold(s) should be met. Table 1 lists the form in which performance objectives typically are specified. In addition, special operating conditions associated with the performance threshold should be specified, such as minimum elevation angles, antenna standards, or the nature of the media being remotely observed (by active or passive sensors).

TABLE 1

**Form of performance objectives**

Service function	Type of performance threshold	Form of probability specification	
		Percentage of time	Percentage of locations
Data collection	BER or $S/N$ of baseband signal	yes	yes
Data dissemination	BER or $S/N$ of baseband signal	yes	no
Data collection platform interrogation	Data block error rate or $S/N$ of baseband signal	yes	yes
Passive sensing	Percentage loss of sensitivity <sup>(1)</sup>	yes	yes
Active sensing	Percentage loss of data <sup>(1)</sup>	yes	yes
Direct data readout	BER or $S/N$ of baseband signal	yes	no
Recorded data acquisition	BER or $S/N$ of baseband signal	yes	no

<sup>(1)</sup> Performance objectives are different in the case of loss which occurs randomly and in the case of loss which is systematic (see § e)).

## 2. Steps for determining performance objectives

### Step 1

Determine the performance objectives of the ultimate users of the data. It will be necessary to consider the objectives for the accuracy, availability, resolution and reliability. For passive sensors that use the radio spectrum, it is also necessary to determine the dynamic range and precision of the physical measurement which will be derived from the sensor data. This information must be transformed into the equivalent range and sensitivity of microwave temperature measurements made by the sensor. Similar objectives can be formulated for other operational functions.

### Step 2

Define one or more representative systems which include the satellite, earth station, and as appropriate, sensors, and systems for data collection, data relay and data dissemination. The relevant transmission and operating characteristics must be considered.

### Step 3

Evaluate the degradation in performance of the representative system caused by intra-system factors (e.g. fading of the desired signal).

### Step 4

Taking intra-system degradation into account, assess the performance achievable with the representative system.

### Step 5

If necessary, repeat steps 2, 3 and 4 until either the performance objectives determined in step 1 are satisfied or the performance objectives are modified to be harmonized with achievable performance when intra-system degradation is taken into account.