

RECOMMENDATION ITU-R SA.1023

**METHODOLOGY FOR DETERMINING SHARING AND COORDINATION CRITERIA
FOR SYSTEMS IN THE EARTH EXPLORATION-SATELLITE AND
METEOROLOGICAL-SATELLITE SERVICES**

(Question ITU-R 138/7)

(1994)

The ITU Radiocommunication Assembly,

considering

- a) that frequency bands allocated to the Earth exploration-satellite and meteorological-satellite services may be shared by several systems, including systems operating in other services;
- b) that sharing and coordination criteria for the Earth exploration-satellite and meteorological-satellite services should relate to the minimum level of interference that can be accepted from an individual interferer;
- 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 sharing and coordination criteria for the Earth exploration-satellite and meteorological-satellite services may be applied to specific systems in order to determine acceptable single entry levels of interference that are greater than or equal to the permissible levels,

recommends

- 1. that the methodology of Annex 1 be used for the development of sharing criteria for the Earth exploration-satellite and meteorological-satellite services and for specific systems operating in these services;
- 2. that the sharing criteria determined in accordance with § 1 be considered in the development of coordination criteria for the Earth exploration-satellite and meteorological-satellite services and for the specific systems operating in these services.

ANNEX 1

Initial division of interference criteria

In cases involving Earth exploration- or meteorological-satellite space-to-Earth transmissions, it is useful to initially divide the permissible level of total interfering signal power (i.e., interference criteria) between interference via terrestrial signal paths (i.e. for earth and terrestrial station transmissions) and space-to-Earth signal paths (including meteorological-satellite and earth exploration-satellite) because the assumed number of interferers and the associated interference statistics usually differ between these two categories of interfering services. In other cases, this initial division is unnecessary. The initial division is accomplished using the following equations:

$$i_s(20) = i(20) \times (A_s/100) \quad (1a)$$

$$i_t(20) = i(20) - i_s(20) \quad (1b)$$

$$i_s(p_s) = i(p) - i_t(20) \quad (2a)$$

$$i_t(p_t) = i(p) - i_s(20) \quad (2b)$$

$$p_s = p \times (a_s/100) \quad (2c)$$

$$p_t = p - p_s \quad (2d)$$

where:

- $i(20)$: permissible level of total interfering signal power (W) to be exceeded for no more than 20% of the time (i.e., long-term interference criteria)
- $i_s(20), i_s(p_s)$: interfering signal power (W) level budgeted for space-to-Earth signals that is to be exceeded for no more than 20% and $p_s\%$ of the time, respectively
- $i_t(20), i_t(p_t)$: interfering signal power (W) level budgeted for terrestrial signal paths that is to be exceeded for no more than 20% and $p_t\%$ of the time, respectively
- A_s : percentage of permissible level of total interfering signal power (W) allotted for interference from space-to-Earth signals
- $i(p)$: permissible level of total interfering signal power (W) to be exceeded for no more than $p\%$ of the time (i.e., short-term interference criteria)
- p : percentage of time associated with the short-term interference criteria
- p_s : percentage of time that space-to-Earth signals may exceed the interference threshold
- p_t : percentage of time that signals propagated over terrestrial paths may exceed the interference threshold
- a_s : portion (percentage) of the percentage of time p allotted to interference from space-to-Earth signals.

In equation (1), the long-term interference criteria are divided on a power basis among interference categories. This is because long-term space-to-Earth and terrestrial interference levels are expected to be present simultaneously.

The short-term interference criteria are divided, in equation (2), among space-to-Earth and terrestrial interference categories. Short-term enhanced levels of interference are not likely to occur simultaneously. However, interference from space-to-Earth paths at their long-term level must be considered when the short-term interference budget is established for terrestrial interfering signal paths, and *vice versa*.

Values for the parameters A_s and a_s should be selected to correspond with the relative levels of interference expected from space and terrestrial services. These parameter values are estimated from the allocations, interfering service characteristics, and anticipated usage of the subject frequency band.

Determination of permissible single entry interference levels

Equations (3) and (4) accomplish subdivision of the interference budgeted to space-to-Earth signal paths (and terrestrial signal paths, where applicable) in order to establish an appropriate permissible level of interfering signal power from individual transmitters (i.e., single entry interference).

$$i'(20) = i(20) / n \quad (3)$$

$$i'(p') = i(p) / yn - (i(20) \times (1 - y)) \quad (4a)$$

$$p' = p / n \quad (4b)$$

where primed (') parameters denote the permissible level of single entry interfering signal power (i.e., sharing criteria) and:

- $i'(20)$: permissible level of interfering signal power (W) for individual space or terrestrial interferers (depending on value of $i(20)$ that is used) to be exceeded for no more than 20% of the time
- $i(20)$: permissible level of total interfering signal power (W) for space or terrestrial interferers to be exceeded for no more than 20% of the time
- p : percentage of time associated with the short-term interference criteria (equals p_s or p_t in cases where the initial subdivision of interference is made)
- p' : percentage of time calculated for use in specifying short-term single entry sharing criteria
- n : equivalent number of space or terrestrial interferers
- $i'(p')$: permissible level of interfering signal power (W) for individual space or terrestrial interferers (depending on value of $i(p)$ that is used) to be exceeded for no more than p' % of the time
- $i(p)$: permissible level of total interfering signal power (W) for space or terrestrial interferers to be exceeded for no more than p % of the time
- y : fraction of space or terrestrial interferers producing interference at enhanced levels ($0 < y < 1$), (y is analogous to a correlation coefficient and is usually equal to $1/n$, i.e. interference entries are mutually uncorrelated).

Equations (3) and (4) are similar in nature to equations (1) and (2). Long-term interference allowances are subdivided on a power basis and short-term interference allowances are subdivided on a percentage of time basis. In equation (4), only some of the interferers are assumed to be enhanced to their short-term levels because they are uncorrelated. While these interference entries are enhanced, all other entries are assumed to be at their long-term levels.
