

ITU-R

Radiocommunication Sector of ITU

Recommendation ITU-R RA.1513-2
(03/2015)

**Levels of data loss to radio astronomy
observations and percentage-of-time
criteria resulting from degradation by
interference for frequency bands
allocated to the radio astronomy
service on a primary basis**

RA Series
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Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

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BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R RA.1513-2

Levels of data loss to radio astronomy observations and percentage-of-time criteria resulting from degradation by interference for frequency bands allocated to the radio astronomy service on a primary basis

(Question ITU-R 227/7)

(2001-2003-2015)

Scope

This Recommendation addresses the levels of data loss to radio astronomy observations and percentage-of-time criteria resulting from degradation by interference for frequency bands allocated to the radio astronomy service on a primary basis. It includes studies of sharing situations for terrestrial and space-based applications, as well as an extensive section on measurement of data loss from weak, pulsed interference.

The ITU Radiocommunication Assembly,

considering

- a) that research in radio astronomy depends critically upon the ability to make observations at the extreme limits of sensitivity and/or precision, and that the growing use of the radio spectrum increases the possibility of interference detrimental to the radio astronomy service (RAS);
- b) that for some radio astronomy observations, such as those involving the passage of a comet, an occultation by the moon, or a supernova explosion, a high probability of success is desirable because of the difficulty or impossibility of repeating them;
- c) that since interference to radio astronomy can result from unwanted emissions of services in adjacent, nearby, or harmonically related bands, interference from several services or systems may occur in any single radio astronomy band;
- d) that burden sharing may be necessary to facilitate the efficient use of the radio spectrum;
- e) that mitigation techniques are a part of burden sharing, and more advanced techniques are being developed for future implementation, to allow more efficient use of the radio spectrum;
- f) that threshold levels of interference (assuming 0 dBi antenna gain) detrimental to the RAS for 2000 s integration times are given in Recommendation ITU-R RA.769, but that no acceptable percentage of time has been established for interference from services with transmissions randomly distributed in time and either sharing a frequency band with the RAS, or producing unwanted emissions that fall within a radio astronomy band;
- g) that administrations may require criteria for evaluation of interference between the RAS and other services in shared, adjacent, nearby, or harmonically related bands;
- h) that methods (e.g. the Monte Carlo method) have been developed to determine the appropriate separation distance between radio astronomy sites and an aggregate of mobile earth stations, and that these methods require the specification of an acceptable percentage of time during which the aggregate interference power exceeds the threshold levels detrimental to the RAS;
- i) that studies of sharing scenarios and experience gained from long practice have led to values of tolerable time loss due to degradation of sensitivity, on time scales of a single observation, which are explained in more detail in Annex 1,

recommends

- 1 that, for evaluation of interference, a criterion of 5% be used for the aggregate data loss to the RAS due to interference from all networks, in any frequency band allocated to the RAS on a primary basis, noting that further studies of the apportionment between different networks are required;
- 2 that, for evaluation of interference, a criterion of 2% be used for data loss to the RAS due to interference from any one network, in any frequency band, which is allocated to the RAS on a primary basis;
- 3 that the percentage of data loss, in frequency bands allocated to the RAS on a primary basis be determined by using one of the following: (1) Recommendation ITU-R S.1586; (2) Recommendation ITU-R M.1583, or (3) the percentage of integration periods of 2000 s in which the average spectral pfd at the radio telescope exceeds the levels defined (assuming 0 dBi antenna gain) in Recommendation ITU-R RA.769, whichever is appropriate;
- 4 that the criteria described in § 3.3.2 of Annex 1 be used for evaluation of interference, in any frequency band allocated to the RAS on a primary basis, from unwanted emissions produced by any non-GSO satellite system at radio astronomy sites.

Annex 1

Data loss resulting from interference

	<i>Page</i>
1 Introduction	3
2 Data loss and sky blockage.....	4
3 Sharing situations	5
3.1 Interference due to variable propagation conditions	6
3.1.1 Terrestrial applications.....	6
3.1.2 Space-based applications	6
3.2 In-band sharing, where the transmission is variable in time and location.....	7
3.2.1 Terrestrial applications.....	7
3.2.2 Space-based applications	7
3.2.3 Space-based radio astronomy applications	7
3.3 Unwanted emissions into a radio astronomy frequency band, where the transmission is variable in time and/or direction of arrival	7
3.3.1 Terrestrial applications.....	7
3.3.2 Space-based applications	7
3.4 Measurement of data loss from weak, pulsed interference.....	9

3.4.1	Method	10
3.4.2	Effect of regular pulses	11
3.4.3	Long period pulses	12
3.4.4	Mitigation methods	12
3.4.5	Equivalence of rapid pulses and continuous emission.....	12
3.4.6	Summary	13
4	Conclusions	13

1 Introduction

An important parameter for all radiocommunication services is the percentage of time lost to interference. Administrations may need quantitative criteria relative to radio astronomy operations with active services operating in the same, adjacent, nearby, or harmonically related bands. For example, Recommendation ITU-R M.1316 uses this percentage of time lost to interference in the calculation of the separation distance by default between stations operating in the MSS (Earth-to-space) and a radio astronomy observatory, by using the Monte Carlo methodology.

Existing limits to the aggregate time losses tolerated by various other «science» services are given in Table 1, for comparison.

TABLE 1
Example of criteria for aggregate percentage of time of
data loss use for other science services

Earth exploration-satellite service (EESS) (passive sensors) (%) (Recommendation ITU-R SA.1029-2): – 3-D atmospheric sounding – All other sensors	0.01 1.0-5.0
Command and data transmission systems operating in the earth exploration-satellite and meteorological-satellite services (%) (Recommendation ITU-R SA.514-3)	0.1-1.0
EES and MetSat services using spacecraft in geostationary orbit (%) (Recommendation ITU-R SA.1161-1)	0.0025-0.1
Space operations systems $S/N > 20$ dB for $> 99\%$ of time (%) (Recommendation ITU-R SA.363-5)	1.0

Radio telescopes are designed to operate continuously, following a schedule of observing programs requested by astronomers. As a rule, access to radio telescopes is on a competitive basis, with research proposals often exceeding available telescope time by a factor of 2-3. Virtually all radio astronomy installations are operated out of public funds, and must be used very efficiently. Some loss of observing time resulting from maintenance or upgrading of hardware or software, however, cannot be avoided. Experience over many years of operation with major instruments by one