

## RECOMMENDATION ITU-R F.1094-1

**MAXIMUM ALLOWABLE ERROR PERFORMANCE AND AVAILABILITY DEGRADATIONS  
TO DIGITAL RADIO-RELAY SYSTEMS ARISING FROM INTERFERENCE FROM  
EMISSIONS AND RADIATIONS FROM OTHER SOURCES**

(Question ITU-R 127/9)

(1994-1995)

The ITU Radiocommunication Assembly,

*considering*

- a) that emissions/radiations of radio services may cause interferences to victim receivers of the terrestrial fixed service;
- b) that increasing use of the radio spectrum requires definition of the maximum allowable error performance and availability degradations to radio-relay systems due to various sources of interference;
- c) that for digital radio-relay systems (DRRS) the error performance and availability objectives are given in one or more of Recommendations ITU-R F.634, ITU-R F.695, ITU-R F.696 and ITU-R F.697;
- d) that the maximum allowable values of interference (error performance and availability degradation) from the fixed-satellite service (FSS) into terrestrial DRRS which may form part of an ISDN and share the same frequency bands below 15 GHz are given in Recommendation ITU-R SF.615;
- e) that the basic considerations on the development of criteria for sharing between the terrestrial fixed service and other services are given in Recommendation ITU-R F.758,

*recommends*

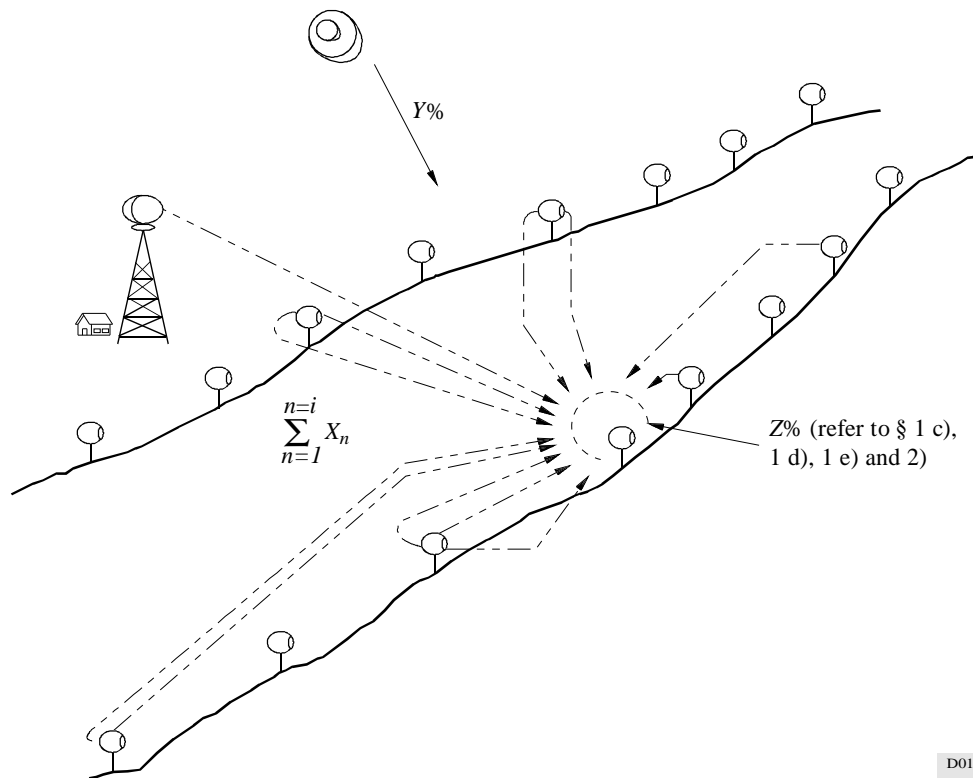
- 1** that all necessary precautions should be taken in establishing digital radio-relay links and networks so that degradations caused by interferers (see subclauses a) to e)) in periods of heavy fading should not cause a violation of the error performance and availability objectives (network performance objective (NPO)) defined by the ITU-R (see Recommendations ITU-R F.634, ITU-R F.695, ITU-R F.696 and ITU-R F.697):
- a) Emissions\* from radio-relay systems operating in the same band (see Fig. 1);
  - b) Emissions\* from other radio services which share frequency allocations on a primary basis (see Fig. 1);
  - c) Emissions\* from radio services which share frequency\* allocations on a non-primary basis;
  - d) Unwanted emissions\* (i.e. out-of-band and spurious emissions such as energy spread from radio systems, etc.) in non-shared bands\*\*;
  - e) Unwanted radiations (e.g. ISM applications);

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\* The term emission is defined in the Radio Regulations as radiation produced, or the production of radiation, by a radio transmitting station.

\*\* Spurious emissions of radio-relay systems are dealt with in Recommendation ITU-R F.1191 and Report 937 (Düsseldorf, 1990).

FIGURE 1  
RF interference sources



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**2** that, when required by the sharing conditions, the maximum allowable value of error performance degradation defined by the NPO should be divided into an element  $X\%$  for the fixed service portion (see § 1 a)) ( $X\%$  includes degradations due to equipment imperfections),  $Y\%$  is for frequency sharing on a primary basis (see § 1 b)) and  $Z\%$  is for all other sources of interference (see § 1 c), 1 d) and 1 e)) causing error performance degradation taking into account the effect of fading;

**3** that the sum of  $X\% + Y\% + Z\%$  should not cause the violation of error performance objectives given in Recommendations ITU-R F.634, ITU-R F.696 and ITU-R F.697.

Values of  $X, Y, Z$  are  $X = 89, Y = 10$  and  $Z = 1$  (see Notes 1 and 2);

**4** that the sum of  $X\% + Y\% + Z\%$  should not cause the violation of the unavailability objectives defined in Recommendations ITU-R F.695, ITU-R F.696 and ITU-R F.697. The value of  $X\%$  includes all non-interference causes mentioned in these Recommendations.

Values of  $X, Y, Z$  are  $X = 89, Y = 10$  and  $Z = 1$  (see Notes 1, 2 and 3);

**5** that Annex 1 should be referred to for additional guidance for the application of this Recommendation.

NOTE 1 – The values of  $X, Y$  and  $Z$  are subject to further study.

NOTE 2 – There may be a further sub-division of the  $X\%$  allowance to suit the grade of service.

NOTE 3 - Interference from emissions and radiations from other services is not expected to significantly affect the availability of digital radio-relay systems as defined by Recommendation ITU-R F.557. For frequency bands below about 10 GHz it will be possible, in actual situations, to consider that *recommends 4* will be complied with, if *recommends 3* is met.

## ANNEX 1

**Basic considerations related to the maximum allowable error performance and availability degradations to digital radio-relay systems arising from interference from emissions and radiations from other sources**

## **1 Introduction**

This Annex lays the foundation for the apportionment of the error performance and availability degradations of digital radio-relay systems arising from sources of interference that may be received via an antenna system (see Fig. 1). A particular point to note is that an interference source (say a transmitter), may affect more than one hop of a system.

## **2 Error performance and availability degradations due to frequency sharing on a primary basis**

Error performance and availability degradations due to emissions from the fixed-satellite service which shares bands with the fixed service on equal basis are given in Recommendation ITU-R SF.615 for the HRDP which covers the high grade case.

Error performance and availability degradations due to interference from other radio services are under study.

## **3 Error performance and availability degradations due to frequency sharing on a non-primary basis**

Under study.

## **4 Error performance and availability degradations due to unwanted emissions**

Two types of error performance degradations are possible due to interference from services in adjacent bands:

- In one type, the victim receiver of the system is so broad in bandwidth that error performance degradation is caused, even when the energy of the interfering signal is totally contained in its assigned band.

In general, a system should be so provisioned that its error performance is not degraded by this type of interference.

- Another type of error performance degradation is that caused by unwanted emissions which fall in or near the occupied band of the signal which is suffering from interference.

## **5 General considerations on allowable error performance and availability degradations due to interference**

It will be necessary to consider allowable degradations to high grade, medium grade and local grade error performance and availability objectives. It will also be necessary to consider how to apportion these degradations within the reference models (HRDPs, HRDS, etc.). Some provisional information on this last point can be found in Recommendation ITU-R F.634.

Sharing criteria have been established concerning the frequency bands which are allocated to the fixed service and the fixed-satellite service on a primary basis. Basic principles underlying such criteria can be summarized as follows:

- In cases where digital radio-relay systems are interfered with, the interfering radiation should not degrade the error performance (DM, SES, ES) or the availability by more than one-tenth of the percentage of time allowed for the overall error performance degradation or unavailability of the radio-relay systems (see Recommendation ITU-R SF.615).

This approach, however, may not be applicable to interference which comes from emissions generated by systems of services which share frequency bands on a non-primary basis or which are due to unwanted emissions or radiations from services in other bands. It seems reasonable that the sum of the interferences from such emissions should produce degradations which are much smaller than that from systems sharing the same frequency band on a primary basis.

It is difficult to draw a definite conclusion at this stage. One proposal for the maximum allowable degradation of the fixed service from services in other bands is to adopt one-hundredth, or some other value near that, instead of one-tenth which is applicable to the interference from systems sharing frequency bands.

The date of introduction of different services also needs to be taken into account. It seems necessary to determine whether the criteria for the case where an interfering system is introduced after the victim system is operational can also be applied to the case where the victim system is the last to be brought into operation. When a radio-relay system is to be brought into operation, it should be prepared to accept already existing interferences provided that the interferences are known and within acceptable limits.

Detailed considerations in the development of criteria for sharing between the terrestrial fixed service and other services are dealt with at length in Recommendation ITU-R F.758.

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