RECOMMENDATION ITU-R F.1094-2

Maximum allowable error performance and availability degradations to digital fixed wireless systems arising from radio interference from emissions and radiations from other sources

(Question ITU-R 127/9)

(1994-1995-2007)

Scope

This Recommendation defines maximum allowable error performance and availability degradations to digital fixed wireless systems (FWSs) arising from radio interference from emissions and radiations from other sources.

The ITU Radiocommunication Assembly,

considering

a) that emissions/radiations of radio services may cause interferences to victim receivers of the fixed service;

b) that increasing use of the radio spectrum requires definition of the maximum allowable error performance and availability degradations to fixed wireless systems (FWSs) due to various sources of interference;

c) that for digital FWSs the error performance and availability objectives are given in Recommendations ITU-R F.1668 and ITU-R F.1703, respectively;

d) that the maximum performance degradations due to interference from other services sharing the same frequency bands on a co-primary basis are given in Recommendation ITU-R F.1565;

e) that the basic considerations on the development of criteria for sharing between the 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 fixed wireless links and networks so that degradations caused by interferers (see subclauses a) to e)) should not exceed the error performance and availability objectives (network performance objective (NPO)) defined by the ITU-R (see Recommendations ITU-R F.1668 and ITU-R F.1703):

a) Emissions[1] from FWSs operating in the same band (see Fig. 1);

b) Emissions[1] from other radio services which share frequency allocations on a primary basis (see Fig. 1);

c) Emissions[1] from radio services which use frequency[1] allocations on a non-primary basis;

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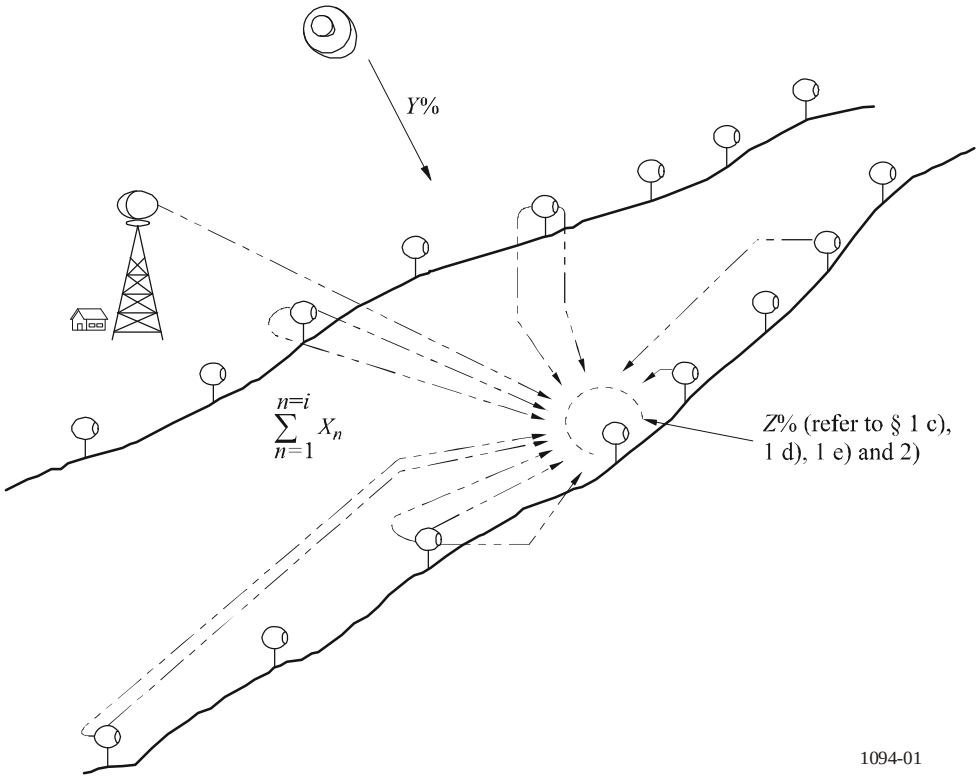
[1] The term *emission* is defined in the Radio Regulations (RR) as *radiation* produced, or the production of *radiation*, by a radio transmitting *station*.

d) Unwanted emissions[1] (i.e. out-of-band and spurious emission domains such as energy spread from radio systems, etc.) in non-shared bands[2];

e) Unwanted radiations (e.g. among others, UWB applications),

FIGURE 1
RF interference sources



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

3 that the sum of *X*% + *Y*% + *Z*% should not exceed error performance objectives given in Recommendation ITU-R F.1668.

Values of *X*, *Y*, *Z* are *X* = 89, *Y* = 10 and *Z* = 1 (see Note 1);

4 that the sum of *X*% + *Y*% + *Z*% should not exceed the unavailability objectives defined in Recommendation ITU-R F.1703. 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 and 2);

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[2] Spurious emissions of FWSs are dealt with in Recommendation ITU-R F.1191 and Recommendation ITU-R SM.329.

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

6 Notes 1 and 2 are considered as part of the Recommendation.

NOTE 1 – There may be a further sub-division of the *X*% allowance to provide for the degradations due to propagation effects and interference within the fixed service. Where appropriate, these degradations could include interference from high altitude platform stations (HAPS) transmitters operating within the fixed service.

NOTE 2 – Interference from emissions and radiations from other services is not expected to significantly affect the availability of digital FWSs as defined by Recommendation ITU-R F.1703. 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 FWSs arising from radio 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 FWSs 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 degradations due to emissions from other services that share with the fixed service on an equal basis are given in Recommendation ITU-R F.1565.

3 Error performance and availability degradations due to frequency use on a non-primary basis

Total error performance and availability degradations due to all unwanted radiations and emissions and emissions from radio services which use frequency allocations on a non-primary basis should not exceed Z = 1% of error performance and availability objectives.

4 Error performance and availability degradations due to unwanted emissions

Two types of error performance and availability 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 and availability 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 and availability is not degraded by this type of interference.

– Another type of error performance and availability 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

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

– In cases where digital FWS are interfered with, the interfering radiation should not degrade the error performance (SESR, ESR and BBER) or the availability performance (unavailability ratio (UR) and outage intensity (OI)) assigned to each parameter by more than one-tenth of the overall error performance or unavailability objectives of the FWSs (see Recommendation ITU-R F.1565).

This approach, however, may not be applicable to interference which comes from emissions generated by systems of services which use the same 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 on a co-primary basis. The extent to which it is necessary or possible to further subdivide this portion to account for the different types of emissions and radiations is a matter to be determined in specific cases for specific 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 FWS 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 fixed service and other services are dealt with at length in Recommendation ITU-R F.758.