



Recommendation ITU-R M.1472-1
(01/2010)

**Methodology to evaluate the impact of
interference from time division multiple
access/frequency division multiple access
(TDMA/FDMA) mobile-satellite service (MSS)
space-to-Earth transmissions on baseband
performance in frequency division
multiplexing-frequency modulation
(FDM-FM) analogue line-of-sight (LoS)
fixed service receivers in the
frequency range 1-3 GHz**

M Series
**Mobile, radiodetermination, amateur
and related satellite services**



International
Telecommunication
Union
Documents
Document Sharing Hub

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.

Policy on Intellectual Property Right (IPR)

ITU-R policy on IPR is described in the Common Patent Policy for ITU-T/ITU-R/ISO/IEC referenced in Annex 1 of Resolution ITU-R 1. Forms to be used for the submission of patent statements and licensing declarations by patent holders are available from <http://www.itu.int/ITU-R/go/patents/en> where the Guidelines for Implementation of the Common Patent Policy for ITU-T/ITU-R/ISO/IEC and the ITU-R patent information database can also be found.

Series of ITU-R Recommendations

(Also available online at <http://www.itu.int/publ/R-REC/en>)

Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
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.

Electronic Publication
Geneva, 2010

© ITU 2010

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without written permission of ITU.

RECOMMENDATION ITU-R M.1472-1*

Methodology to evaluate the impact of interference from time division multiple access/frequency division multiple access (TDMA/FDMA) mobile-satellite service (MSS) space-to-Earth transmissions on baseband performance in frequency division multiplexing-frequency modulation (FDM-FM) analogue line-of-sight (LoS) fixed service receivers in the frequency range 1-3 GHz

(Questions ITU-R 201/4 and ITU-R 118/5)

(2000-2010)

Scope

This Recommendation provides a methodology to assess the impact of interference from TDMA/FDMA mobile-satellite service (MSS) space-to-Earth transmissions on baseband performance in FDM-FM analogue line-of-sight (LoS) fixed service (FS) receivers in the frequency range 1-3 GHz. This methodology may also be used in detailed MSS/FS coordination to further refine the results obtained implementing the methodology described in Recommendation ITU-R M.1319.

The ITU Radiocommunication Assembly,

considering

- a) that the frequency band 1 518-1 525 MHz is allocated to the mobile-satellite service (MSS) (space-to-Earth) and the fixed service (FS) on a co-primary basis in all Regions;
- b) that the frequency band 1 525-1 559 MHz is also allocated to the MSS (space-to-Earth) on a primary basis in all Regions;
- c) that the frequency band 1 525-1 530 MHz is also allocated to the fixed service on a primary basis in Regions 1 and 3 and the frequency band 1 550-1 559 MHz is also allocated to the fixed service on a primary basis in some countries;
- d) that the frequency bands 2 170-2 200 MHz in all Regions and 2 160-2 170 MHz in Region 2 are allocated to the MSS (space-to-Earth) and the fixed service on a co-primary basis;
- e) that transmissions from mobile satellites could cause interference to line-of-sight (LoS) receivers operating in these bands;
- f) that such interference involves time-varying phenomena such as interference geometry, propagation conditions, and MSS traffic;
- g) that computer simulation usually is the only way to accurately evaluate such interference;
- h) that the output of such simulations is typically in the form of C/I , C/N and $C/(N + I)$ statistics into the given fixed service systems;

* This is a joint Radiocommunication Study Groups 4 and 5 Recommendation, and any revision shall be undertaken jointly.

j) that the impact and acceptability of such interference in most cases can be assessed in detailed bilateral coordination by studying via computer simulation the radio frequency C/N , C/I and $C/(N + I)$ statistics as described in Recommendation ITU-R M.1319;

k) that, in some critical cases, there may be a need during detailed bilateral coordination to evaluate via computer simulation the interference impact on analogue FDM-FM fixed service baseband performance objectives,

recommends

1 that the methodology in Annex 1 may be used in detailed bilateral coordination between concerned parties for detailed assessment of the impact of interference from TDMA/FDMA MSS satellites in the 1-3 GHz MSS allocations on baseband performance in analogue FDM-FM LoS fixed service receivers, in cases where the results obtained by the methodology described in Recommendation ITU-R M.1319 needs further refinement (see Notes 1, 2 and 3).

NOTE 1 – The application of the methodology in this Recommendation will require the development of algorithms or calculation procedures to address the implementation of the considerations described. The use or adaptation of these algorithms or procedures in any bilateral coordination would be subject to agreement by the concerned parties.

NOTE 2 – In countries where a large number of fixed service systems are in operation, it may be sufficient to apply the analysis to a representative set of existing fixed service systems, using actual fixed service parameters, especially taking into account those fixed service systems that are likely to be most sensitive to interference. The most sensitive fixed service systems are usually those oriented close to the worst-case azimuth direction; this direction can be established based on the orbital characteristics of the MSS system. However, this is a matter that will require agreement between the concerned parties.

NOTE 3 – In the case of GSO MSS systems the calculations are significantly simplified, since there is no need to simulate the orbital mechanics of the MSS constellation, however the potential of interference from multiple GSO MSS satellites may need to be considered when evaluating the impact of interference.

Annex 1

Methodology to evaluate the impact of interference from TDMA/FDMA MSS systems on baseband performance in FDM-FM analogue LoS fixed service receivers operating in the frequency range 1-3 GHz

1 Introduction

Sharing between MSS and fixed service involves time varying phenomena such as interference geometry, propagation conditions, etc. Simulation is usually the only way to accurately evaluate interference between MSS and fixed service systems. The output of such simulations is typically in the form of radio-frequency C/I , C/N and $C/(N + I)$ statistics presented usually as a cumulative distribution function.

Recommendation ITU-R M.1319 provides a methodology whereby *inter alia* baseband performance objectives for analogue FDM-FM and TV-FM fixed service systems provided in Recommendation ITU-R F.393¹ and Recommendation ITU-R F.555² can be translated into equivalent radio-frequency $C/(N + I)$ requirements for an associated percentage of time, with if necessary appropriate scaling to address actual fixed service routes of shorter length than the reference circuits. These equivalent radio-frequency performance objectives are plotted on the cumulative distribution plots of $C/(N + I)$ in order to determine if the interference from MSS satellites is acceptable.

The method described in Recommendation ITU-R M.1319 although it requires extensive computer simulation is relatively straightforward to implement in software, since all calculations and comparisons are undertaken in the radio-frequency domain. The methodology of Recommendation ITU-R M.1319 should be used in the detailed coordination phase between administrations, when coordination is formally required and triggered in application of the Radio Regulation (RR), in order to determine if interference is acceptable or not, when considered in the context of actual fixed service system information and the relevant ITU-R performance and availability objectives.

In some cases during the bilateral coordination phase, it may be necessary for the parties concerned to further examine the impact of MSS interference on the performance objectives of analogue fixed service systems. This could be the case where the results of the simulation method described in Recommendation ITU-R M.1319 above are not sufficiently definitive to enable the conclusion of frequency coordination.

The objective of this annex is to present methodologies to evaluate the baseband performance impairments more accurately for FDM-FM analogue fixed service carriers taking into account the effects of varying frequency separations that would exist for multiple narrow-band interfering carriers, recognizing that the interference reduction factor or *B*-factor and the protection ratio requirements of Recommendation ITU-R SF.766 indicate a strong dependence on frequency separation between the wanted and the interfering carriers.

The methodology presented in this annex necessarily involves more sophisticated simulation tools than those described in Recommendation ITU-R M.1319 and is expected to require considerably more computer resources to execute.

2 Methodology for FDM-FM fixed service systems

2.1 Reference FDM-FM fixed service system for simulation

In the detailed coordination phase, it is expected that actual analogue fixed service route parameters will be available in order to assess the impact of MSS interference. It is noted that in the 1-3 GHz range, the intermediate fixed service stations in a fixed service modem section are usually equipped with IF repeaters. Demodulation to the baseband takes place at the terminal station. Since demodulation to baseband does not take place at the intermediate repeaters, it is only necessary to calculate the baseband interference at the last/terminal repeater in the modem section or actual fixed service route.

¹ Recommendation ITU-R F.393 was suppressed in 2007. However some fixed systems may continue to exist for which this Recommendation would be applicable.

² Recommendation ITU-R F.555 was suppressed in 2007. However some fixed systems may continue to exist for which this Recommendation would be applicable.