



Recommendation ITU-R F.1489
(05/2000)

**A methodology for assessing the level
of operational compatibility between fixed
wireless access and radiolocation systems
when sharing the band 3.4-3.7 GHz**

F Series
Fixed service

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 F.1489*,**

**A METHODOLOGY FOR ASSESSING THE LEVEL OF OPERATIONAL COMPATIBILITY
BETWEEN FIXED WIRELESS ACCESS AND RADIOLOCATION
SYSTEMS WHEN SHARING THE BAND 3.4-3.7 GHz**

(Question ITU-R 215/5)

(2000)

Scope

This Recommendation provides a methodology to assess the level of operational compatibility between fixed wireless access (FWA) and radiolocation systems when they are sharing the frequency band 3 400-3 700 MHz. The methodology may be applied to determine whether or not intended FWA operations are sufficiently distant from the operating areas of radiolocation systems, so as not to receive unacceptable interference, and/or to determine suitable mitigation techniques that could be implemented.

The ITU Radiocommunication Assembly,

considering

- a) that the frequency band 3 400-3 700 MHz is allocated on a primary basis to the fixed service (FS) and the fixed-satellite service (FSS), amongst other services;
- b) that this band, amongst others, is used for terrestrial systems operating in the FS for providing fixed wireless access (FWA) in a variety of situations, and that this use is growing rapidly in many countries, in particular developing countries;
- c) that the characteristics of FWA and radiolocation systems can make compatibility difficult to achieve,

noting

- a) that there is interest in harmonizing the use of FWA systems in this band;
- b) that the radiolocation service is allocated on a primary basis in Regions 2 and 3 and on a secondary basis in Region 1 in the band 3 400-3 700 MHz;
- c) that generally FWA applications use multipoint architectures, comprising a multiplicity of base and user terminals over an area;
- d) that there is a need to protect co-primary services and to assess further the sharing conditions between FWA systems and these services;
- e) that Recommendation ITU-R M.1461 provides calculation procedures which may be used when performing sharing studies between FWA and radiolocation systems,

recommends

- 1** that when performing frequency sharing studies between FWA and radiolocation systems, the methodology contained in Annex 1 should be considered;
- 2** that the information gathered from studies performed using this methodology may be applied to determine whether or not intended FWA operations are sufficiently distant from routine or frequent operating areas of radiolocation systems, so as to not receive interference, and/or to determine suitable mitigation techniques that could be implemented (see Note 1);
- 3** that administrations should make the relevant studies, including those that used other methodologies, available to the appropriate Radiocommunication Study Groups whenever possible;

* This Recommendation should be brought to the attention of Radiocommunication Study Group 4.

** Study Group 5 made editorial amendments to this Recommendation in December 2009.

4 that sharing criteria needed to ensure compatible operation between FWA and radiolocation systems should be developed, taking into account available mitigation techniques and the results of assessment methodologies, such as in Annex 1.

NOTE 1 – Mitigation options for ensuring the compatibility between digital radio-relay systems and radar systems are given in Recommendation ITU-R F.1097.

ANNEX 1

Methodologies for assessing the level of compatibility between FWA and radiolocation systems

1 Introduction

The use of FWA systems to improve teledensity and variety of services throughout the world has increased and continues to gain acceptance in a variety of situations, including developing countries. To determine compatibility between FWA and radiolocation systems in a specific band, sharing studies should be conducted and where practical, actual measurements should be made. This Annex outlines the steps for performing these sharing studies. The results of studies performed in this manner should be carefully analysed to determine if the particular sharing scenario is feasible for any combination of FWA system and appropriate radiolocation systems operating in the same band.

2 Methodology

The study should be performed in accordance with the following:

- a) Characterize those FWA system parameters that are considered to be critical to ensuring compatibility, and define acceptable performance in terms of threshold of acceptable service degradation. This involves the following receiver and other system characteristics. It should be noted that in all cases both base stations and user terminals should be considered:
 - sensitivity,
 - receiver noise floor,
 - selectivity,
 - error detection and correction of corrupted/missing data bits (techniques and parameter values such as bit-error ratio (BER)),
 - co- and adjacent-channel/s interference rejection,
 - spurious responses,
 - recovery time,
 - automatic gain control (AGC)/limiter response time,
 - receiver saturation level,
 - non-recoverable degradation,
 - receiver intermodulation,
 - modulation scheme/s, bandwidths and data rates with associated bit or byte error rate requirements,
 - antenna gain patterns or side-lobe levels,
 - typical antenna heights and base-station siting (hilltop, low point, etc.).
- b) Establish the radiolocation system characteristics (transmit power, pulse duration and duty cycle etc., using, for example, Recommendation ITU-R M.1465 – Characteristics of, and protection criteria for, radars operating in the radiodetermination service in the frequency band 3 100-3 700 MHz). For solid-state radar transmitters it should be noted that transmitter pulse lengths and duty cycles are expected to be of the order of 1 ms and 25% respectively in the foreseeable future.
- c) Analyse the effects of radiolocation systems on FWA installations. For the anticipated range of radiolocation emission parameters, determine the tolerable I/N or C/I ratios by analysis (see Notes 1 and 2). Deterministic

or probabilistic (closed-form) modelling techniques might be suitable with respect to some degradation forms, but simulation or Monte Carlo techniques should be used when necessary for other degradation measures.

- d) Using the resulting I/N and/or C/I criteria, assess the impact of radar emissions on FWA systems by means of interference-level/coupling computations in accordance with Recommendation ITU-R M.1461 – Procedures for determining the potential for interference between radars operating in the radiodetermination service and systems in other services.
- e) Verify that FWA equipment available for test is operating within its specifications as determined in a), with particular attention directed to the following items: selectivity; frequency response; noise figure or receiver noise temperature; dynamic range (saturation level); spurious responses; recovery time; BER with only desired signals present; cross-modulation; intermodulation.
- f) Characterize the performance degradations of the FWA receiver system from various undesired signal sources by means of bench testing. The undesired sources should be coupled into the FWA system along with the desired signal(s). A full range of undesired signal parameters should be used, including various pulse widths and pulse-repetition rates. The desired and undesired signal levels will be varied and measures of performance (as defined in a)) will be measured and recorded. The results may be presented in terms of signal-to-interference, S/I , ratio, and should be compared to those obtained from the analysis in c).
- g) Characterize the antenna frequency response and radiation pattern in a frequency range determined as necessary from the above analyses, which should include at minimum the range 3 400 to 3 700 MHz band.
- h) Calculate the effects of radiolocation emissions on FWA system deployments. Develop the findings in the form of frequency-distance separation curves.
- i) Install, where necessary, a representative FWA system adjacent to identified radiolocation systems and measure interference effects of radiolocation emitters to FWA receivers through field testing. The data obtained from the measurements should be used to validate the radiolocation system to FWA system analysis results.
- j) Determine those FWA system parameters, including transmitter power, antenna gains, side-lobe levels, antenna heights, and siting practice, that are critical to ensuring compatibility.
- k) Calculate the aggregated impact of representative, complete FWA system deployments on radiolocation systems, using the radar $(I + N)/N$ criterion and interference-level/coupling computations as described in Recommendation ITU-R M.1461. The specific multiple-access technique, with a realistic multiplicity of users, may need to be reflected in the models and/or simulations.
- l) Evaluate the possible variations in likely FWA system deployments and their illumination by radiolocation systems, and vice versa, with a view to undertaking possible additional measurements and/or calculations on the aggregated effects.
- m) If appropriate, summarize the final results in the form of frequency-distance separation curves and/or any other appropriate forms.

NOTE 1 – Examples of tolerable I/N for unwanted emissions from radar systems are given in Recommendation ITU-R F.1190.

NOTE 2 – General guidance for sharing criteria for the FS is given in Recommendation ITU-R F.758.
