

RECOMMENDATION ITU-R F.1518*

**Spectrum requirement methodology for fixed wireless access and mobile
wireless access networks using the same type of equipment,
when coexisting in the same frequency band**

(Questions ITU-R 215/8 and ITU-R 140/9)

(2001)

The ITU Radiocommunication Assembly,

considering

- a) that use of wireless access systems is expanding for both fixed and mobile applications;
- b) that, for easy implementation, some wireless access systems use dynamic RF channel assignment;
- c) that fixed and mobile wireless access (FWA and MWA) systems operated in the same band may use the same type of equipment;
- d) that shared use of a limited spectrum by different access systems may reduce the traffic handling capability of each system;
- e) that the traffic handling capacity of a wireless system is a basic parameter of the engineering of the radio network;
- f) that a methodology to assess the traffic handling capability of a FWA system in a frequency band shared with other wireless access systems, fixed and/or mobile, is necessary,

recommends

- 1 that the methodology to be followed to assess the traffic capability should consider:
 - the cell deployment schemes of the different systems;
 - the access methods of the systems;
 - the transmission of the interfering signal towards the victim system;
 - the relative level of wanted and unwanted signals;
 - the statistical distribution of activity of the systems involved;
 - the interference mitigation techniques developed by the victim system;
- 2 that the calculation methodology in Annex 1 could be used to assess frequency spectrum requirement and traffic handling capability for coexisting MWA system and FWA system using the same type of equipment.

* This Recommendation was jointly developed by Radiocommunication Study Groups 3 (WP 8A) and 9 (WP 9B) and any further revision should be undertaken jointly.

ANNEX 1

A methodology to assess frequency spectrum requirements and traffic handling capability for coexisting of MWA system and FWA system in the same band using the same type of equipment, based on time division multiple access (TDMA) and/or frequency division multiple access (FDMA) technology

1 Introduction

Recommendation ITU-R F.1402 presents the frequency sharing between a MWA system and a FWA system on condition that the interference to each other should be less than a certain level. The basic idea behind the sharing is that the FWA system and MWA system have different service areas and the examination was done to find the separation distance between both systems.

In the practical operation, however, the service areas for the FWA system and MWA system sometimes overlap and there arises a need to coexist in part of their areas. Such coexistence is possible for the system in which the radio resource assignment is done autonomously, each equipment avoiding on-going interference.

Particularly, in some cases, the MWA system and FWA system have basically different service areas and share the same frequency band only in a small portion at the edge of each area, where the traffic for each system is rather small. In this situation, it is advisable in respect of the efficient use of frequencies, that the MWA system and FWA system use the same frequency band and coexist only in a small part where the service area overlaps, instead of each system using a different frequency band.

Considering the above, this Annex describes the technical conditions concerning the MWA system and FWA system using the same equipment as the MWA system and accessing the same frequency band at the same area.

2 Scope

In this methodology, the MWA system and the FWA system use the same type of equipment based on TDMA and/or FDMA technology, where the equipment chooses autonomously an unused radio channel within the frequency band. Coexistence conditions for such MWA and FWA systems when they use the same frequency band at the same area are examined.

The method described in this Annex can be applied to a wide range of frequency bands by applying a propagation formula suitable for the target frequency.

3 References

Recommendation ITU-R F.1399 – Vocabulary of terms for wireless access.

Recommendation ITU-R F.1402 – Frequency sharing criteria between a land mobile wireless access system and a fixed wireless access system using the same equipment as the mobile wireless access system.

Recommendation ITU-R M.1390 – Methodology for the calculation of IMT-2000 terrestrial spectrum requirements.

4 Analysis of frequency spectrum requirement

4.1 Assumed system

In this methodology, both the MWA and FWA systems are assumed to use the same TDMA/FDMA technology and in these systems the radio channel resource assignment is not controlled by the system as a whole, but each radio base station (MWA system) or cell station (FWA system) chooses the available resource autonomously from the candidate channels within the frequency band. It is possible that the channel being used receives interference, and in this case the system activates the interference avoidance process. It is assumed that the two systems have the same functions.

When the service areas of the MWA system and FWA system overlap, they can coexist in the same frequency band because the frequency assignments are done autonomously at call set up.

On the other hand, when one system uses a radio channel, the other system cannot use the channel, and in order to maintain the same call loss probability, it is necessary to assign additional frequency bandwidth.

If the systems employ an autonomous frequency control method, it may be possible that different types of systems can coexist. However, the interference conditions are much more complicated in this case.

4.2 Calculation of required frequency bandwidth when using the same frequency in the same service area

Generally speaking, when considering the introduction of a MWA or FWA system, the frequency bandwidth necessary for the system is calculated, assuming a traffic model and arrangement of base stations or cell stations for the serving area.

When considering the coexistence of a MWA system with a FWA system, the frequency bandwidth necessary to maintain the call loss probability is calculated in the same manner, and the possibility of coexistence is judged. The method for such an examination is shown in Appendix 1 to this Annex.

A calculation example about the coexistence of mobile PHS and PHS-FWA systems in rural areas is shown in Appendix 2 to this Annex.

4.3 Techniques for the efficient frequency use

It is possible to minimize the increase in the required bandwidth and extend the possibility of coexistence by employing the techniques given below.

4.3.1 Use of directional antenna

It is possible to reduce the interference by using a directional antenna, not only for base stations or cell stations but also for terminal stations in the FWA applications. Several types of directional antenna, such as tilt antenna, sector antenna, array antenna, can be used. By using directional antennas, the cluster shape and size explained in Appendix 1 to this Annex will be improved.

4.3.2 Frame synchronization of radio signals

Two steps of synchronization are possible for the radio signal frame synchronization for coexistence conditions. They are explained in the following paragraphs.



4.3.2.1 Frame synchronization within a system

By using frame synchronization within the MWA system or within the FWA system, communication on one time slot generates interference within the system during that time slot only. Therefore, the frequency bandwidth necessary for one communication channel will be improved in non-coexistence areas when compared with the unsynchronized case.

Moreover, in a TDD system, by achieving synchronization within a system, the possibility for interference is limited to the same conditions as for the FDD system (see Recommendation ITU-R F.1402). This means that the interference between base stations, which is the most problematic, is eliminated and the coexistence conditions are much improved. In the calculation method described in Appendix 1 to this Annex, the cluster size and spectrum requirement will become smaller than in an unsynchronized system.

4.3.2.2 Mutual frame synchronization among the systems

Without mutual frame synchronization, significant interference may occur between unsynchronized systems, especially if base stations or cell stations are in line-of-sight of one another. In general, mutual frame synchronization will be very difficult if different technologies are used for MWA and FWA systems.

By achieving mutual frame synchronization between a MWA system and a FWA system, communication on one time slot creates interference to primarily only that time slot, though it depends on how precise synchronization is achieved. Therefore, the frequency bandwidth necessary for one communication channel will be improved in all cases compared to the unsynchronized case.

Moreover, in the TDD system, by achieving synchronization among the systems, the possibilities for interference are limited to the same conditions as for the FDD system (see Recommendation ITU-R F.1402). In the calculation method described in Appendix 1 to this Annex, the cluster size and spectrum requirement will become smaller in all cases.

5 Traffic handling capability

The simulation process in Appendix 3 assesses the traffic handling capability for coexistence of the MWA system and FWA system using the same DECT type of equipment in an allocated frequency band.

6 Acronyms

DCA	dynamic channel allocation
DECT	digital enhanced cordless telecommunications
FDD	frequency division duplex
FDMA	frequency division multiple access
FWA	fixed wireless access
MWA	mobile wireless access

PHS	personal handy-phone system
PSTN	public switched telephone network
TDD	time division duplex
TDMA	time division multiple access

APPENDIX 1

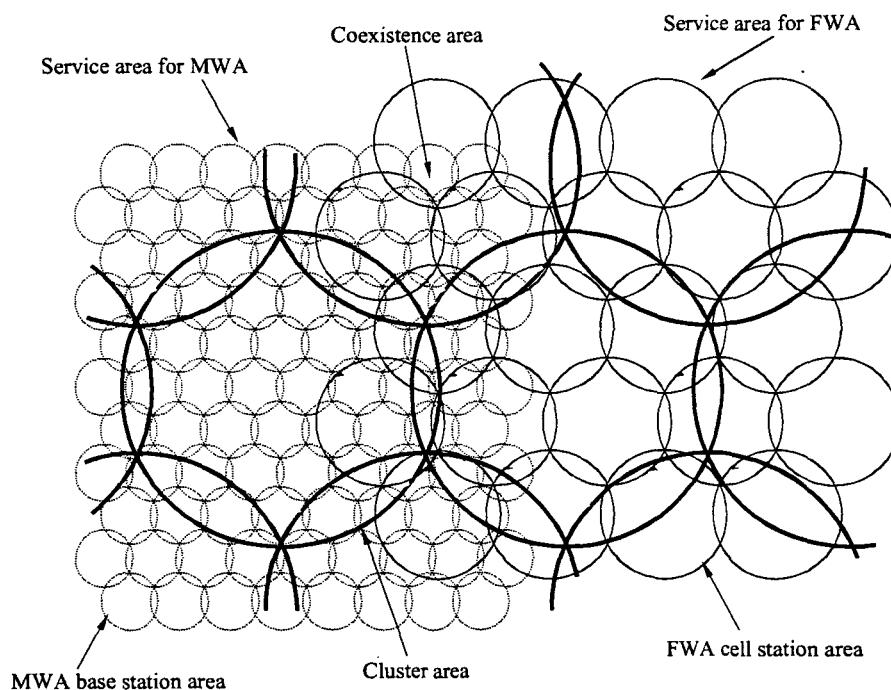
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Calculation method

1 Coexistence model

In calculating the necessary frequency bandwidth, the coexistence model shown in Fig. 1 is assumed.

FIGURE 1
Coexistence model



Note 1 – The service areas for the two systems may be identical.

Note 2 – Cluster radius for the two systems may be different.