



Recommendation ITU-R F.757-4
(04/2011)

**Basic system requirements and performance
objectives for fixed wireless access using
mobile-derived technologies offering
telephony and data communication
services**

F Series
Fixed service



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, 2011

© ITU 2011

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

RECOMMENDATION ITU-R F.757-4

Basic system requirements and performance objectives for fixed wireless access using mobile-derived technologies offering telephony and data communication services

(Question ITU-R 215/5)

(1992-1997-1999-2003-2011)

Scope

This Recommendation provides basic system requirements and performance objectives for fixed wireless access (FWA) using mobile-derived technologies¹. Annex 1 describes applications of mobile technologies for use as FWA offering basic telephony services. Annex 2 describes FWA systems offering a data communication service.

The ITU Radiocommunication Assembly,

considering

- a) that mobile radiocommunication systems offering basic telephony services are already in wide use;
- b) that such systems are implemented both with analogue and digital technologies;
- c) that in some cases it may be desirable, for reasons of convenience and economy, to apply systems derived from mobile technologies for use as FWA (see Annex 2, § 5 for list of acronyms) in both rural and urban areas;
- d) that there is a need for fixed applications using mobile-derived technologies that provide an equivalent access function to metallic lines;
- e) that when used in fixed applications the radio links provided may form part of an international connection;
- f) that the introduction of FWA systems derived from digital mobile technologies will make it possible to offer various types of service including the local grade portion of an ISDN;
- g) that FWA applications using mobile-derived technologies may also operate in bands allocated to the fixed service,

recommends

- 1** that systems using mobile-derived technologies in fixed applications should provide services also available by metallic lines. These services include:
- individual customer telephone service;
 - pay-phone service of various kinds;

¹ The terrestrial radio interfaces supporting both mobile and FWA at user bit rates that include broadband capabilities covered in Recommendation ITU-R M.1457 – Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2000 (IMT-2000) are outside the scope of this Recommendation.

- 4-wire service with and without receive and send “E AND M” signalling;
 - the capability to carry voice-band data signals including facsimile and other telematic services up to a data rate of 9.6 kbit/s;
- 2 that digital systems using mobile-derived technologies in fixed applications should provide the same ISDN access as digital mobile systems;
- 3 that, since such systems used as FWA may form part of an international connection, the relevant G-Series ITU-T Recommendations should be met;
- 4 that, a service quality comparable to that already provided to fixed end-users in urban areas should be offered, e.g. a grade of service better than 1% and should be calculated employing Recommendations ITU-T E.506, ITU-T E.541 and Supplement No.1 to the E-Series Recommendations. Giving due regard to economical considerations, the grade of service (lost call probability) offered by such a system to an end-user should not normally be worse than 5%;
- 5 that the error performance and availability objectives of digital systems should generally be in accordance with Recommendations ITU-R F.697 and ITU-R F.1400;
- 6 that Annex 1 should be referred to for the application of mobile-derived technologies as FWA;
- 7 that Annex 2 should be referred to for characteristics of FWA systems based on mobile-derived technologies offering data communications.

Annex 1

Applications of mobile radiocommunication technologies for use as FWA offering basic telephony services

1 Introduction

Mobile radiocommunication systems are already in wide use. The technology for such systems is expanding rapidly.

It is technically feasible, and in some cases it may be desirable for reasons of convenience and economy, to apply mobile-derived radiocommunication systems for use as FWA. FWA systems using mobile technologies are useful in developing countries for reasons of convenience and economy. It is useful also in developed countries, especially where the existing mobile network has coverage and the fixed network needs enhancement (rural areas).

This annex describes basic system requirements for such applications. Some applications deal with the connection of end-users to the telephone exchange and thereby into the switched network. Other applications include fixed and mobile users in the same network.

For brevity, the application of mobile radiocommunication technologies for use as FWA will be called simply “mobile-derived FWA”.

2 General considerations

The service to be provided forms a permanent, integral part of a communications network.

A number of administrations have already implemented such systems, for the provision of basic telephony services in rural areas. It is important, therefore, to establish the basic system requirements (e.g. performance objectives, frequency bands, implementation process and maintenance aspects) which permit such integration as effectively as possible without degrading overall network performance.

The general goal in rural and remote areas is to establish an overall quality of service equal or better to that achieved by wire line systems in well-served urban areas. A minimum objective towards this goal is to achieve service quality at least comparable to that offered in these urban areas, as proposed in the ITU-T (ex-CCITT) Handbook on Rural Telecommunications (Geneva, 1985) and in Recommendations ITU-R F.1103 and ITU-R F.1400.

In some cases, it may be effective to use mobile-derived FWA systems not only in rural areas but also in urban areas, e.g. where the cable infrastructure is temporarily inadequate. The radio system has the advantage that it can be deployed rapidly compared with cable systems. Also it may be another attractive feature that the facilities can be easily converted for mobile use after the cable systems become available.

2.1 Basic approach

There are two basic approaches for mobile-derived FWA. One is to establish an entirely new mobile-derived FWA system, optimised for and dedicated to fixed use, and the other approach is to make minimum changes to the existing or planned mobile systems for adaptation to fixed use.

The former approach may be justified in some cases from the viewpoint of economic considerations. However, it should be taken into account that in many cases it may be desirable that a system can accommodate both mobile and fixed end-users. The latter approach seems preferable for these cases. It is therefore desirable that future mobile systems should include in their design considerations the possible application of the systems for FWA to satisfy its own performance criteria set by the mobile environment, and may well limit the performance achievable by the fixed station. For example, one administration operates mobile systems with a carrier to interference ratio of 18 dB at the edges of the cell. This provides an acceptable level of performance for a mobile system, but could result in unacceptable performance in the fixed service where the radio link is intended to be part of the telephone network and radio is used instead of wire or cable only for convenience and economy. Another factor is that mobile systems are normally optimised for low end-user traffic, 0.02 E, whereas fixed end-user traffic normally averages between 0.05 and 0.09 E.

2.2 Frequency bands

Frequency spectrum is a limited natural resource. Therefore, the frequency bands suitable for mobile communication should be primarily used for the mobile services or fixed applications complementing each other. For this reason, the application of mobile-derived systems for FWA may be justified mainly in rural areas where the demand for mobile communication is small and the provision of telecommunication services by means of wireline facilities is too costly. See also Recommendation ITU-R F.1401 – Considerations for the identification of possible frequency bands for fixed wireless access and related sharing studies.

If mobile systems are adapted for use as FWA, frequency bands should be the same as those for mobile systems.

Frequency bands commonly used for mobile radio are, for example, in the 400 MHz and 800/900 MHz band, generally below 3 GHz. Any of these bands are, in principle, also suitable for the provision of a fixed service; accordingly, the interference environment in any area where it is proposed to operate must now satisfy criteria for both the fixed service and the mobile service.

2.3 Operational aspects

As a matter of principle, all kinds of telecommunication services offered through wireline facilities could be made available through mobile-derived FWA systems. Most of the services are already provided by mobile systems. Among the services which are not usually provided by mobile systems is the pilot number service (multiple lines) which is essential for key telephones and private branch exchanges.

Some features of mobile systems are not necessary for mobile-derived FWA. Among them are roaming and handover capabilities. In addition, certain sub-systems of mobile systems may require modifications for adaptation to the FWA application. Most important are the numbering plan and charging sub-system. In particular, in cases where a system accommodates both mobile and mobile-derived FWA end-users, the numbering and charging sub-systems should be capable of handling the two categories of end-users, unless the regulation permits a common sub-system to be applicable to both mobile and mobile-derived FWA end-users.

One of the solutions for numbering and charging when mobile systems are introduced into an existing PSTN might be to adopt service control points with common channel signalling.

In providing telecommunications services, consideration must be given to the likely location of the end-user station. While it is possible to locate the end-user terminal at the customer's premises, this is not necessarily the best location for the radio antenna. In hilly terrain, houses are most often built in valleys or where some shielding is provided from the weather. This must be taken into account in the system design by, for example, adapting mobile equipment to feed a 650 Ω loop (including the telephone set) when used in the fixed service.

In some rural areas, the commercial alternating current power is either unavailable or is less reliable than that in urban or suburban areas. Substantial attention must be given to provide reliable power sources for the end-user units in rural areas. To equip a backup battery is one alternative.

2.4 Traffic capacity – grade of service

The grade of service or lost call probability is frequently designed to be of the order of 1%, but it is seldom as high as 5%, while some administrations set requirements in the range 0.1% to 0.5%, in order not to degrade the national network beyond the ITU-T recommended objective of 1%. Care must be taken to allow for appropriate growth in the number of end-users and the higher loss probability figures should, therefore, be avoided, since they will generally result in severe customer dissatisfaction. These probabilities are calculated in the usual manner, employing Recommendations ITU-T E.506, ITU-T E.541 and Supplement No. 1 to the E-Series Recommendations, as well as Recommendation ITU-R F.1103. Factors to consider include:

- the number of radio channels required;
- the number of end-users to be served;
- the traffic intensity per end-user.

Average traffic intensities of 0.05 to 0.09 E per end-user have been used frequently for rural end-users. The loss probability for up to 6 RF channels is shown in graphical form in the ITU-T (ex-CCITT) Handbook on Rural Telecommunications (Geneva, 1985), page 84, Fig. 7-4(III).

3 Requirements for digital systems

3.1 General

Today's widespread use of digital mobile technologies has provided cost-effective radio equipment for FWA. Such systems have the following features:

- high system availability and good speech quality;
- shorter installation time;
- low initial cost in rural and suburban areas;
- easy maintenance and management of facilities;
- flexible access network construction to respond to changing demand;
- immunity against disasters.

Making use of the above advantages, digital mobile-derived FWA systems have been extensively introduced in many countries. Services provided by mobile-derived FWA systems include 2-wire telephone, public telephone, facsimile and data transmission using modems (up to 9.6 kbit/s). Future provision of ISDN (2B + D) connection is taken into account.

3.2 System configuration

System configuration of a FWA system is shown in Fig. 1. The major components of the system are adapters (ADPs), cell stations (CSs) and end-user stations or subscriber stations (SSs). Cables or radio systems are used for connections between ADPs and CSs. ADPs are positioned between the service node (SN) and the CSs. ADPs function to implement concentration, authentication and so on.

