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Fixed Radio Systems; Point-to-multipoint equipment; Time Division Multiple Access (TDMA); Point-to-multipoint digital radio systems in frequency bands in the range 3 GHz to 11 GHz

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# ETSI EN 301 021 V1.6.1 (2003-07)

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*European Standard (Telecommunications series)*

**Fixed Radio Systems;  
Point-to-multipoint equipment;  
Time Division Multiple Access (TDMA);  
Point-to-multipoint digital radio systems  
in frequency bands in the range 3 GHz to 11 GHz**

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## Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM).

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Date of adoption of this EN:	4 July 2003
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## Introduction

The main field of application of Point-to-Multipoint (P-MP) systems is to provide access to both public and private networks (Public Switched Telephone Networks (PSTN), Private Data Networks (PDN)). By means of P-MP systems the network service area may be extended to cover both distant and scattered user locations and the systems may be applied to build new access networks covering both urban and rural areas.

Users are offered the full range of services by the particular public or private network. Users have access to these services by means of the various standardized user network interfaces (2 wire loop, new data services and Integrated Services Digital Network (ISDN) ranging from basic rate to  $n \times$  primary rate).

P-MP systems provide standard network interfaces and transparently connect users to the appropriate network node. These systems allow a service to be connected to a number of users ranging from a few to several thousands and over a wide range of distances.

P-MP systems are generally configured as Pre-Assigned Multiple Access (PAMA) radio systems or as Demand Assigned Multiple Access (DAMA) radio systems.

The essential features of a typical P-MP radio system are:

- efficient use of the radio spectrum;
- concentration;
- transparency.

Radio is often the ideal way of obtaining communications at low cost and almost independent of distance, and over difficult topography. Moreover, a small number of sites are required for these installations, thus facilitating rapid implementation and minimizing maintenance requirements of the systems.

Concentration means that "m" users can share "n" radio channels (m being larger than n), allowing a better use to be made of the available frequency spectrum and at a lower equipment cost. The term "multi-access" derives from the fact that every user has access to every channel (instead of a fixed assignment as in most multiplex systems). When a demand arises an available channel (or channels) is allocated to it. When the demand is terminated, the channel is released for other use.

Concentration requires the use of distributed intelligent control, which in turn allows many other operation and maintenance functions to be added.

Transparency means that the network node and the user terminal communicate with each other without being aware of the radio path.

Efficient use of the radio spectrum is generally achieved by reusing frequency sets at base stations in a cellular pattern.

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# 1 Scope

The present document covers equipment, which may operate in frequency bands that have paired frequencies, which can be used by either equipment employing Frequency Division Duplex (FDD) or Time Division Duplex (TDD) techniques. For use with Time Division Duplex only one frequency of the frequency pair will be used and for the purpose of the present document the tx/rx separation will be zero. The channel spacing is intended to be the same in downlink and uplink directions.

This revision extends the scope to cover systems employing basically TDMA multi-access but which also allows for additional methods (such as OFDMA) combined with TDMA, to be used to provide another dimension of multiple access.

## 1.1 Applications

The present document specifies the minimum and optional requirements for system parameters of Time Division Multiple Access (TDMA) Point-to-Multipoint (P-MP) Radio Systems in the terrestrial Fixed Service operating in frequency bands in the range 3 GHz to 11 GHz.

The present document covers the following typical Point-to-MultiPoint (P-MP) applications:

- voice;
- fax;
- voice-band data;
- telex, related to analogue interfaces;
- data up to 64 kbit/s or beyond with optional interfaces;
- ISDN;
- digital video;
- digital audio, related to digital interfaces.

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Radio terminals from different manufacturers are not intended to inter-work at radio frequency (i.e. no common air interface).

The present document defines the requirements of radio terminal and radio-relay equipment including the interfaces. The requirements for multiplex, network management and antenna/feeder equipment may be addressed elsewhere.

Testing to the present document will be undertaken with the guidance of a generic test methods document EN 301 126-2-1 [22], EN 301 126-2-3 [23] and EN 301 126-3-2 [24].

## 1.2 Frequencies

The present document covers fixed P-MP services operating in the 3,5 GHz, 3,7 GHz and 10,5 GHz bands, having the frequency plans as given in CEPT/ERC Recommendations 14-03 [7], 12-08 [25], 12-05 [8] and in ITU-R Recommendation F.1491 [34].

## 1.3 Access method

The present document covers Time Division Multiple Access (TDMA) systems. Optionally, for certain of the system types defined in the present document, other access methods (e.g. Orthogonal Frequency Division Multiple Access (OFDMA)) may be used in conjunction with TDMA to provide another dimension of multiple access.

## 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

- [1] ETSI EN 300 012-1: " Integrated Services Digital Network (ISDN); Basic User-Network Interface (UNI); Part 1: Layer 1 specification".
- [2] ITU-T Recommendation G.703: "Physical/electrical characteristics of hierarchical digital interfaces".
- [3] ITU-T Recommendation Q.553: "Transmission characteristics at 4-wire analogue interfaces of digital exchanges".
- [4] ITU-T Recommendation Q.552: "Transmission characteristics at 2-wire analogue interfaces of digital exchanges".
- [5] ITU-T Recommendation G.821: "Error performance of an international digital connection operating at a bit rate below the primary rate and forming part of an integrated services digital network".
- [6] ITU-T Recommendation R.20: "Telegraph modem for subscriber lines".
- [7] CEPT/ERC Recommendation 14-03: "Harmonised radio frequency channel arrangements for low and medium capacity systems in the band 3400 MHz to 3600 MHz".
- [8] CEPT/ERC Recommendation 12-05: "Harmonised radio frequency channel arrangements for digital terrestrial fixed systems operating in the band 10,0 - 10,68 GHz".
- [9] ETSI EN 300 019-1: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Sub-parts 1-1 to 1-7: Classification of environmental conditions".
- [10] ETSI EN 300 019-2: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Sub-parts 2-1 to 2-7: Specification of environmental tests".
- [11] ETSI ETS 300 132 (Parts 1 and 2): "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 1: Operated by alternating current (ac) derived from direct current (dc) sources; Part 2: Operated by direct current (dc)".
- [12] ETSI EN 301 489-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".
- [13] ETSI EN 301 489-4: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 4: Specific conditions for fixed radio links and ancillary equipment and services".
- [14] ETSI EN 300 385: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for fixed radio links and ancillary equipment".
- [15] ITU-T Recommendation G.726: "40, 32, 24, 16 kbit/s adaptive differential pulse code modulation (ADPCM)".

- [16] ITU-T Recommendation G.728: "Coding of speech at 16 kbit/s using low-delay code excited linear prediction".
- [17] ITU-R Recommendation F.697: "Error performance and availability objectives for the local-grade portion at each end of an ISDN connection at a bit rate below the primary rate utilizing digital radio-relay systems".
- [18] ITU-T Recommendation G.729: "Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear-prediction (CS-ACELP)".
- [19] ETSI EN 300 324-1: "V interfaces at the digital Local Exchange (LE); V5.1 interface for the support of Access Network (AN); Part 1: V5.1 interface specification".
- [20] ETSI ETS 300 347-1: "V interfaces at the digital Local Exchange (LE); V5.2 interface for the support of Access Network (AN); Part 1: V5.2 interface specification".
- [21] ITU-R Recommendation F.1191: "Bandwidths and unwanted emissions of digital fixed service systems".
- [22] ETSI EN 301 126-2-1: "Fixed Radio Systems; Conformance testing; Part 2-1: Point-to-Multipoint equipment; Definitions and general requirements".
- [23] ETSI EN 301 126-2-3: "Fixed Radio Systems; Conformance testing; Part 2-3: Point-to-Multipoint equipment; Test procedures for TDMA systems".
- [24] ETSI EN 301 126-3-2: "Fixed Radio Systems; Conformance testing; Part 3-2: Point-to-Multipoint antennas - Definitions, general requirements and test procedures".
- [25] CEPT/ERC Recommendation 12-08: "Harmonised radio frequency channel arrangements and blocks allocations for low, medium and high capacity systems in the band 3600 MHz to 4200 MHz".
- [26] ITU-T Recommendation G.131: "Control of talker echo".
- [27] ETSI EN 300 011-1: "Integrated Services Digital Network (ISDN); Primary rate User Network Interface (UNI); Part 1: Layer 1 specification".
- [28] ISO/IEC 8802-3: "Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications".
- [29] CEPT/ERC Recommendation 74-01: "Spurious emissions".
- [30] ITU-R Recommendation SM.329: "Unwanted emissions in the spurious domain".
- [31] ITU-R Recommendation F.1488: "Frequency block arrangements for fixed wireless access systems in the range 3 400-3 800 MHz".
- [32] ITU-T Recommendation G.826: "End-to-end error performance parameters and objectives for international, constant bit-rate digital paths and connections".
- [33] ITU-T Recommendation G.827: "Availability parameters and objectives for path elements of international constant bit-rate digital paths at or above the primary rate".
- [34] ITU-R Recommendation F.1491: "Error performance objectives for real digital radio links used in the national portion of a 27 500 km hypothetical reference path at or above the primary rate".
- [35] ITU-R Recommendation F.557: "Availability objective for radio-relay systems over a hypothetical reference circuit and a hypothetical reference digital path".
- [36] ITU-T Recommendation G.723: "Dual rate speech coder for multimedia communications transmitting at 5,3 and 6,3 kbit/s".
- [37] ETSI EG 202 306 (V1.2.1): "Transmission and Multiplexing (TM); Access networks for residential customers".

- [38] ITU-T Recommendation G.711: "Pulse code modulation (PCM) of voice frequencies".
- [39] ITU-T Recommendation G.957: "Optical interfaces for equipments and systems relating to the synchronous digital hierarchy".
- [40] ITU-R Radio Regulations, Article S5.482: "Frequency allocations".

## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**gross bit rate:** defined as the transmission bit rate over the air

NOTE: In case of a transmitter working in burst mode the gross bit rate is the instantaneous maximum transmission bit rate during the burst. The gross bit rate has a unique relationship to the symbol rate through the implemented modulation format. In the case of OFDMA this relationship is unique when all OFDMA sub carriers are in use. Gross bit rate for TDMA/OFDMA systems is the aggregate bit rate of all OFDMA sub carriers transmitting simultaneously.

**OFDM-sub-carrier:** physical sub-division of the channel as determined by the manufacturer for OFDM and OFDMA systems

NOTE: The complete set of discrete sub-carriers is distributed throughout the assigned channel. With OFDM (and OFDMA), individual symbols are represented by all (or some) of the sub-carriers operating in concert rather than by individual sub-carriers.

**Orthogonal Frequency Division Multiplexing (OFDM):** transmission method where the transmitted signal is composed of multiple narrow band OFDM-sub-carriers, all modulated in parallel

**Orthogonal Frequency Division Multiple Access (OFDMA):** variant of OFDM where only a subset of the OFDM-sub-carriers are used by any single transmitter, allowing multiple transmitters to transmit at the same time on disjoint sets of OFDM-sub-carriers

NOTE: When used in conjunction with TDMA this applies burst by burst.

**OFDMA-sub-channel:** logical channel for transmission or control purposes, comprising a set of physical OFDM sub-carriers

NOTE: The specific sub-carriers associated with a particular sub-channel are usually dynamically distributed throughout the whole channel bandwidth. The minimum number of sub-carriers that may comprise a sub-channel is dependent on the system design.

### 3.2 Symbols

For the purposes of the present document, the following symbols apply:

$\Delta F$	Channel Spacing
dB	deciBel
dBm	deciBel relative to 1 milliwatt
GHz	GigaHertz
Hz	Hertz
kbit/s	kilobits per second
kHz	kiloHertz
Mbit/s	Megabits per second
MHz	MegaHertz
ms	millisecond
Pr	interpolated Power level
s	number of states