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*European Standard (Telecommunications series)*

**Fixed Radio Systems;  
Multipoint equipment;  
Multipoint digital radio systems operating in the  
31,0 GHz to 33,4 GHz (32 GHz) frequency range**

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Reference

DEN/TM-04116

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Keywords

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# Contents

Intellectual Property Rights .....	5
Foreword.....	5
Introduction .....	5
1 Scope .....	6
2 References .....	6
3 Definitions, symbols and abbreviations .....	9
3.1 Definitions .....	9
3.2 Symbols.....	9
3.3 Abbreviations .....	9
4 General characteristics .....	10
4.1 General system architecture .....	10
4.2 Frequency bands and channel arrangements .....	11
4.2.1 Channel plan .....	11
4.2.2 Channel arrangements.....	11
4.2.3 Duplex methods .....	11
4.3 Compatibility requirements .....	11
4.4 Environmental conditions.....	12
4.4.1 Equipment within weather protected locations (indoor locations).....	12
4.4.2 Equipment for non-weather protected locations (outdoor locations) .....	12
4.5 Power supply .....	12
4.6 Electromagnetic compatibility conditions .....	12
4.7 TMN interfaces .....	12
4.8 Synchronization of interface bit rates.....	12
4.9 Branching/feeder/antenna requirements .....	13
4.9.1 Waveguide flanges.....	13
4.9.2 Return loss .....	13
4.9.3 Intermodulation products .....	13
5 System parameters.....	13
5.1 System capacity.....	13
5.2 Round trip delay .....	13
5.3 Transparency .....	13
5.4 Voice coding method.....	14
5.5 Transmitter characteristics.....	14
5.5.1 RF block diagram .....	14
5.5.2 Transmitter output power.....	14
5.5.3 Transmitter nominal output power.....	15
5.5.4 Transmit power and frequency control .....	15
5.5.4.1 Automatic Transmit Power Control (ATPC), uplink .....	15
5.5.4.2 Automatic Transmit Power Control (ATPC), downlink .....	15
5.5.4.3 Remote Transmit Power Control (RTPC) .....	15
5.5.4.4 Remote Frequency Control (RFC) .....	15
5.5.5 RF spectrum mask .....	15
5.5.6 Spurious emissions (external) .....	16
5.5.6.1 Within plus or minus 250 % of the relevant RF channel spacing fs.....	16
5.5.6.2 Outside the band of plus or minus 250 % of the relevant RF channel spacing fs .....	16
5.5.7 Radio frequency tolerance .....	16
5.6 Receiver characteristics .....	16
5.6.1 Rx local oscillator frequency arrangements.....	16
5.6.2 Spurious emissions .....	16
5.6.3 Receiver IF.....	16
5.6.4 Receiver selectivity.....	16
5.7 System performance .....	16
5.7.1 Dynamic level range .....	16

5.7.2	BER as a function of Receiver input Signal Level (RSL).....	16
5.7.3	Equipment background BER .....	17
5.7.4	Interference sensitivity.....	17
5.7.5	Distortion sensitivity.....	17
6	Types of interfaces at the subscriber equipment and the network exchange.....	17
<b>Annex A (normative): Specific parameters for TDMA-systems.....</b>		<b>19</b>
A.1	Channel arrangements .....	19
A.2	RF spectrum mask .....	19
A.3	BER as a function of Receiver input Signal Level (RSL).....	21
A.4	Interference sensitivity .....	22
A.4.1	Co-channel interference sensitivity (external).....	22
A.4.2	Adjacent channel interference .....	22
A.4.3	Continuous Wave (CW) interference .....	22
<b>Annex B (normative): Specific parameters for FDMA-systems .....</b>		<b>23</b>
B.1	Channel arrangements .....	23
B.2	RF spectrum mask .....	23
B.2.1	RF spectrum mask for the Central Radio Station .....	23
B.2.2	RF spectrum mask for the Terminal Station and the Repeater Station.....	24
B.3	BER as a function of Receiver input Signal Level (RSL).....	25
B.4	Interference sensitivity .....	25
B.4.1	Co-channel interference (external).....	25
B.4.2	Adjacent channel interference (external).....	26
B.4.3	CW interference .....	26
<b>Annex C (normative): Specific parameters for MC TDMA-systems .....</b>		<b>27</b>
C.1	Channel arrangements .....	27
C.2	Transmitter output power .....	28
C.3	RF spectrum masks .....	28
C.3.1	RF spectrum mask.....	28
C.3.1.1	RF spectrum density mask for the central radio station.....	28
C.3.1.2	RF-spectrum density mask for the terminal station .....	30
C.3.1.3	RF-spectrum density mask for the repeater station.....	30
C.3.1.4	Discrete CW components exceeding the spectrum density mask limit (all stations).....	31
C.4	System performance.....	31
C.4.1	BER as a function of Receiver input Signal Level (RSL) .....	31
C.4.2	Equipment Background BER .....	32
C.4.3	Interference sensitivity .....	32
C.4.3.1	Co-channel interference (external) .....	32
C.4.3.2	Adjacent channel interference (external) .....	33
C.4.3.3	CW interference.....	33
<b>Annex D (informative): Bibliography.....</b>		<b>34</b>
History .....		35

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## Foreword

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

<b>National transposition dates</b>	
Date of adoption of this EN:	24 January 2003
Date of latest announcement of this EN (doa):	30 April 2003
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## Introduction

Due to similarities between the frequency raster of the 26 GHz/28 GHz and the 32 GHz band (mainly 31,8 GHz to 33,4 GHz) consideration has been given to the same access methods as well as the respective system parameters in the 32 GHz as in the 26 GHz/28 GHz band. Therefore the main radio frequency parameters have been assumed to be the same as in EN 301 213 (all parts).

All emissions are prohibited in the band 31,3 GHz to 31,5 GHz (see footnote S5.340 of the Radio Regulations [17]), therefore this band is not available for FS systems.

At the drafting date of the present document, the levels of unwanted emissions from Fixed Service (FS) systems that may fall in the bands 31,3 GHz to 31,5 GHz and 31,5 GHz to 31,8 GHz are still discussed under Agenda Item 1.8.2 of WRC 03 (protection of passive services).

In the band 31,5 GHz to 31,8 GHz, there are sharing issues between the Fixed Services and the Passive Services (in particular, the EESS). National Administrations, using this band under the provision of footnote S5.546 of the Radio Regulations [17], should act appropriately when these issues arise. This issue will be addressed by ITU-R in the near future (see Question 232/7).

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# 1 Scope

The present document specifies the minimum requirements for FDD and TDD equipment and system parameters, including parameters necessary to plan co-existence, of broadband multipoint systems including Fixed Wireless Access (FWA) operating in the 31,0 GHz to 33,4 GHz frequency band (subsequently referred to as the 32 GHz frequency band). Multipoint systems include both point to multipoint (P-MP) and multipoint to multipoint (MP-MP). The 31,8 GHz to 33,4 GHz band has been identified and designated within CEPT with an ERC Recommendation CEPT/ERC/REC 01-02 [1] on the designation of the harmonized frequency band 31,8 GHz to 33,4 GHz for the introduction of Fixed Service (FS) including FWA and point-to-point radio relays.

The 31,0 GHz to 31,3 GHz band is available in some countries and included in the CEPT report 25. The present document therefore also covers the 31,0 GHz to 31,3 GHz band provided that the channel arrangement is based on the channel separation as stated in the CEPT/ECC/REC 02-02 [42].

The present document is applicable to system and equipment parameters required to be able to plan the radio inter-operator co-existence of a number of possible systems operating in the 32 GHz frequency band.

The following access methods are covered:

- FDMA;
- TDMA;
- MC-TDMA.

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# 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] CEPT/ERC/REC 01-02: "Preferred channel arrangement for digital fixed service systems operating in the frequency band 31.8 - 33.4 GHz".
- [2] ETSI EN 300 019 (all parts): "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".
- [3] ETSI ETS 300 132-1: "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".
- [4] ETSI ETS 300 132-2: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)".
- [5] ETSI EN 300 385: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for fixed radio links and ancillary equipment".
- [6] ITU-T Recommendation G.773: "Protocol suites for Q-interfaces for management of transmission systems".
- [7] ITU-T Recommendation G.810: "Definitions and terminology for synchronization networks".

- [8] ITU-T Recommendation G.812: "Timing requirements of slave clocks suitable for use as node clocks in synchronization networks".
- [9] ITU-T Recommendation G.813: "Timing characteristics of SDH equipment slave clocks (SEC)".
- [10] ITU-T Recommendation G.823: "The control of jitter and wander within digital networks which are based on the 2 048 kbit/s hierarchy".
- [11] ITU-T Recommendation G.825: "The control of jitter and wander within digital networks which are based on the synchronous digital hierarchy (SDH)".
- [12] ITU-T Recommendation G.131: "Control of talker echo".
- [13] ITU-T Recommendation G.711: "Pulse code modulation (PCM) of voice frequencies".
- [14] ITU-T Recommendation G.726: "40, 32, 24, 16 kbit/s adaptive differential pulse code modulation (ADPCM)".
- [15] ITU-T Recommendation G.728: "Coding of speech at 16 kbit/s using low-delay code excited linear prediction".
- [16] ITU-T Recommendation G.729: "Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear-prediction (CS-ACELP)".
- [17] ITU-R Radio Regulations.
- [18] ITU-R Recommendation F.1249: "Maximum equivalent isotropically radiated power of transmitting stations in the fixed service operating in the frequency band 25.25-27.5 GHz shared with the inter-satellite service".
- [19] ETSI EN 301 213-2: "Fixed Radio Systems; Point-to-multipoint equipment; Point-to-multipoint digital radio systems in frequency bands in the range 24,25 GHz to 29,5 GHz using different access methods; Part 2: Frequency Division Multiple Access (FDMA) methods".
- [20] ETSI EN 301 213-3: "Fixed Radio Systems; Point-to-multipoint equipment; Point-to-multipoint digital radio systems in frequency bands in the range 24,25 GHz to 29,5 GHz using different access methods; Part 3: Time Division Multiple Access (TDMA) methods".
- [21] CEPT/ERC/REC 74-01: "Spurious emissions".
- [22] ETSI EN 301 390: "Fixed Radio Systems; Point-to-point and Point-to-Multipoint Systems; Spurious emissions and receiver immunity at equipment/antenna port of Digital Fixed Radio Systems".
- [23] ITU-T Recommendation Q.552: "Transmission characteristics at 2-wire analogue interfaces of digital exchange".
- [24] ITU-T Recommendation Q.553: "Transmission characteristics at 4-wire analogue interfaces of digital exchanges".
- [25] ITU-T Recommendation G.703: "Physical/electrical characteristics of hierarchical digital interfaces".
- [26] ITU-T Recommendation G.957: "Optical interfaces for equipments and systems relating to the synchronous digital hierarchy".
- [27] ITU-T Recommendation G.964: "V-interfaces at the digital local exchange (LE) - V5.1 interface (based on 2 048 kbit/s) for the support of access network (AN)".
- [28] ITU-T Recommendation G.965: "V-interfaces at the digital local exchange (LE) - V5.2 interface (based on 2 048 kbit/s) for the support of access network (AN)".
- [29] ETSI EN 300 324 (all parts): "V interfaces at the digital Local Exchange (LE); V5.1 interface for the support of Access Network (AN)".

- [30] ETSI EN 300 347 (all parts): "V interfaces at the digital Local Exchange (LE); V5.2 interface for the support of Access Network (AN)".
- [31] ITU-T Recommendation G.961: "Digital transmission system on metallic local lines for ISDN basic rate access".
- [32] ITU-T Recommendation G.707: "Network node interface for the synchronous digital hierarchy (SDH)".
- [33] ETSI EN 300 833: "Fixed Radio Systems; Point-to-point Antennas; Antennas for point-to-point fixed radio systems operating in the frequency band 3 GHz to 60 GHz".
- [34] ETSI EN 301 215 (all parts): "Fixed Radio Systems; Point to Multipoint Antennas; Antennas for point-to-multipoint fixed radio systems in the 11 GHz to 60 GHz band".
- [35] IEC 60154-2: "Flanges for waveguides. Part 2: Relevant specifications for flanges for ordinary rectangular waveguides".
- [36] ITU-T Recommendation G.723.1: "Dual rate speech coder for multimedia communications transmitting at 5.3 and 6.3 kbit/s".
- [37] ETSI EN 301 213-5: "Fixed Radio Systems; Point-to-multipoint equipment; Point-to-multipoint digital radio systems in frequency bands in the range 24,25 GHz to 29,5 GHz using different access methods; Part 5: Multi-Carrier Time Division Multiple Access (MC-TDMA) methods".
- [38] ETSI EN 300 011-1: "Integrated Services Digital Network (ISDN); Primary rate User Network Interface (UNI); Part 1: Layer 1 specification".
- [39] ITU-T Recommendation G.962: "Access digital section for ISDN primary rate at 2 048 kbit/s".
- [40] ETSI ETS 300 012: "Integrated Services Digital Network (ISDN); Basic user-network interface; Layer 1 specification and test principles".
- [41] ITU-R Recommendation F.1520: "Radio-frequency arrangements for systems in the fixed service operating in the band 31.8-33.4 GHz".
- [42] CEPT/ECC/REC 02-02: "Channel arrangements for digital fixed service systems (point-to-point and point-to-multipoint) operating in the frequency band 31 - 31.3 GHz".
- [43] 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".
- [44] ATM User-Network Interface Specification V3.1.
- [45] 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".
- [46] 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".
- [47] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).



## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

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

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

NOTE: In the case of a transmitter working in burst mode, the gross bit rate is the instantaneous maximum bit rate during the burst. The gross bit rate has a unique relation to the symbol rate through the implemented modulation format.

**multi-carrier:** systems where more than one modulated sub-carrier is radiated from the same transmitter

NOTE 1: A system that uses several transmitters into a non-active antenna is not considered as a multi-carrier system. Systems using FDM/OFDM modulation formats are also not considered multi-carrier unless more than one separate FDM/OFDM signal set is transmitted from the same transmitter.

NOTE 2: FDMA systems are intrinsically multicarrier, because any single sub-carrier may be easily discriminated at RF level (unlike OFDM modulations) and activated according to the traffic requirements. However, for the purpose of the present document, a FDMA system are also considered as a whole (fully loaded) single signal set, unless more than one FDMA signal set is transmitted from the same transmitter.

### 3.2 Symbols

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

dB	decibel
dBm	decibel relative to 1 mW
GHz	Gigahertz
km	kilometre
Mbit/s	Megabit per second
MHz	Megahertz
ns	nanosecond
ppm	parts per million

### 3.3 Abbreviations

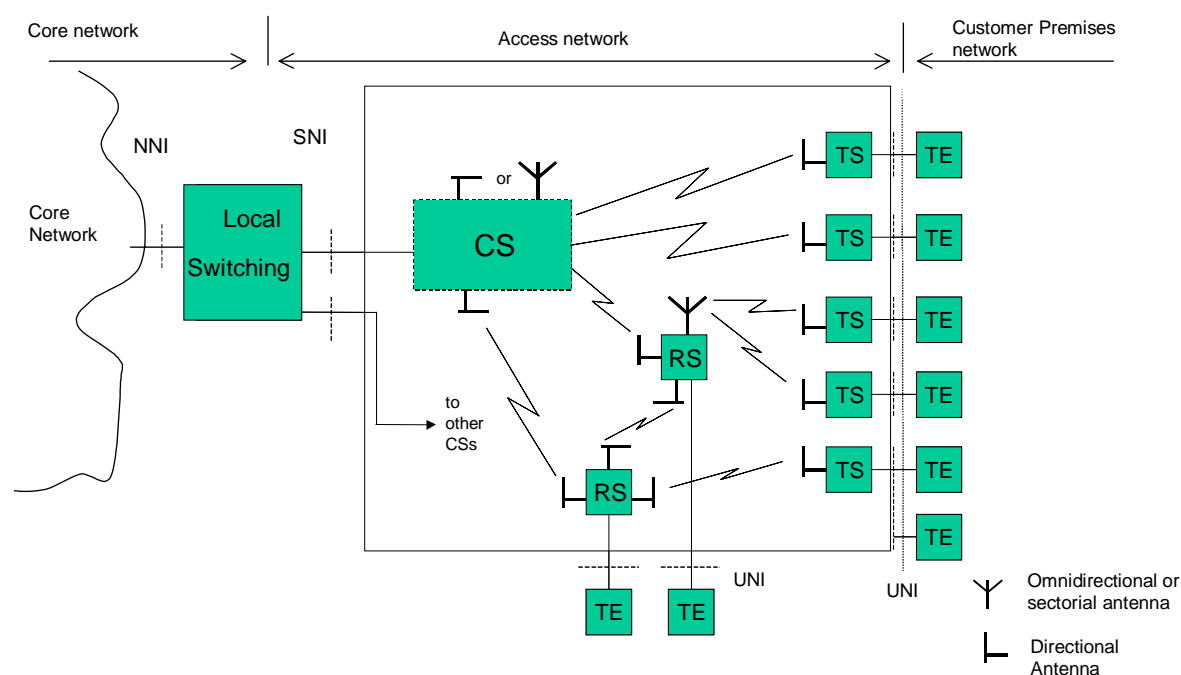
For the purposes of the present document, the following abbreviations apply:

AGC	Automatic Gain Control
ATPC	Automatic Transmit Power Control
BER	Bit Error Ratio
CBR	Constant Bit Rate
CCS	Central Controller Station
CEPT	Conférence des administrations Européennes des Postes et Télécommunications
CRS	Central Radio Station
CS	Central Station
CS-ACELP	Conjugate-Structure Algebraic Code-Excited Linear-Prediction
EIRP	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
FDD	Frequency Division Duplex
FDMA	Frequency Division Multiple Access
FS	Fixed Service
FWA	Fixed Wireless Access
IF	Intermediate Frequency
ISDN	Integrated Service Digital Network
ITU	International Telecommunications Union
LO	Local Oscillator

MC-TDMA	MultiCarrier TDMA
MP	MultiPoint
MP-MP	MultiPoint to MultiPoint
NNI	Network Node Interface
OJEC	Official Journal of the European Communities
PDH	Plesisynchronous Digital Hierarchy
P-MP	Point to Multipoint
RF	Radio Frequency
RS	Repeater Station
RSL	Receive Signal Level
Rx	Receiver
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TE	Terminal Equipment
TM	Transmission and Multiplex
TMN	Telecommunications Management Network
TS	Terminal Station
Tx	Transmitter

## 4 General characteristics

### 4.1 General system architecture



**Figure 1: Reference diagram**

- CS:** The Central Station, which interfaces the network. It can be integrated or divided into two units:
- the Central Controller Station (CCS);
  - the Central Radio Station (CRS) also called the radio unit, which is the central baseband/radio transceiver equipment. More than one CRS may be controlled by one CCS.
- TS:** The Terminal Station (outstations with subscriber interfaces). A TS may serve more than one Terminal Equipment (TE).

<b>RS:</b>	The Repeater Station (radio repeater outstations with or without subscriber interfaces). An RS may serve one or more TS or be connected to another RS.
<b>TE:</b>	Terminal Equipment.
<b>NNI:</b>	Network Node Interface.
<b>SNI:</b>	Service Node Interface (e.g. as described in EG 202 306).
<b>UNI:</b>	User Network Interface (e.g. as described in EG 202 306).

The diagram in figure 1 shows the most common and standardized approach for access network application; however when broadcast or private networks are concerned, different architectures are possible. For example, the CS may be directly connected to the Core Network by means of a NNI interface and the switching functionality may be implemented into CS (e.g. CS is an ATM switching into an ATM network) and, for private networks, the UNI interfaces may be substituted by custom interfaces.

The reference diagram includes the system elements and interfaces for different types of Multipoint system (both P-MP and MP-MP). Not all system elements are necessarily deployed in any particular network.

The numbers of each type of station in a real deployment can vary considerably. The diagram shows only each possible type of station and each possible type of connection between stations that may occur. While in P-MP applications there are typically few CS and RS connecting large number of TS, in a typical MP-MP system, there are many RS stations and a smaller number of TS stations associated with each central station (CS).

Although a single Central Station is possible, as shown, a typical system will deploy several Central Stations, each with connection to the SNI of the local switching centre or directly to the NNI of the core network(s). These interconnections may be by means of radio links, optical fibre or other means.

Subscriber to subscriber connections may also be provided in some networks, not routed via an external core network. The route from a network connection point to a user's terminal equipment interface may be via a single radio path (typical for P-MP systems) or via one or more radio repeaters (typical for MP-MP systems).

## 4.2 Frequency bands and channel arrangements

### 4.2.1 Channel plan

The following frequency band could be used:

- 31,8 GHz to 33,4 GHz according to CEPT/ERC/REC 01-02 [1] and ITU-R Recommendation F.1520 [41];
- 31,0 GHz to 31,3 GHz according to CEPT/ECC/REC 02-02 [42].

The band 31,5 GHz to 31,8 GHz might also be used on a national basis, taking into account the protection requirements of the allocated passive Services (in particular the Earth Exploration Satellite Service and the Space Research Service).

### 4.2.2 Channel arrangements

Refer to annexes A, B and C.

### 4.2.3 Duplex methods

FDD and TDD may be used.

## 4.3 Compatibility requirements

There is no requirement to operate the CS from one manufacturer with the TS and RS from another manufacturer.

## 4.4 Environmental conditions

The equipment shall be required to meet the environmental conditions set out in EN 300 019 [2] which defines weather protected and non-weather protected locations, classes and test severity.

The manufacturer shall state which class the equipment is designed to withstand.

### 4.4.1 Equipment within weather protected locations (indoor locations)

The equipment intended for operation within temperature controlled locations or partially temperature controlled locations shall meet the requirements of EN 300 019-1-3 [2] classes 3.1 and 3.2 respectively.

Optionally, the more stringent requirements of EN 300 019-1-3 [2] classes 3.3 (Non-temperature controlled locations), 3.4 (Sites with heat trap) and 3.5 (Sheltered locations) may be applied.

### 4.4.2 Equipment for non-weather protected locations (outdoor locations)

Equipment intended for operation within non-weather protected locations shall meet the requirements of EN 300 019-1-4 [2] class 4.1 or 4.1E. Class 4.1 applies to many European countries and class 4.1E applies to all European countries.

For systems supplied, within a specific radio cabinet, which gives full protection against precipitation, wind, etc. the EN 300 019-1-3 [2] classes 3.3, 3.4 and 3.5 may be applied also for equipment intended for operation in non-weather protected locations.

## 4.5 Power supply

The power supply interface shall be in accordance with the characteristics of one or more of the secondary voltages foreseen in ETS 300 132-1 [3] and ETS 300 132-2 [4].

NOTE: Some applications may require a power supply voltage range that is not covered by ETS 300 132-1 [3] and ETS 300 132-2 [4].

## 4.6 Electromagnetic compatibility conditions

Fixed Service equipment shall operate under the conditions specified in EN 301 489-1 [45] and EN 301 489-4 [46] of the EMC multipart harmonized standard or to the equivalent harmonized EN 300 385 [5], both are a basis for presumption of conformity to article 3.1b of the R&TTE Directive [47], however the latter will cease this role by the date reported in the OJEC.

## 4.7 TMN interfaces

TMN interface, if any, should be in accordance with ITU-T Recommendation G.773 [6].

## 4.8 Synchronization of interface bit rates

Certain digital services require the system to provide synchronized interfaces at terminal interface point. Such systems shall include methods enabling internal and external synchronization to the network. The principles for synchronization shall be met according to ITU-T Recommendation G.810 [7]. Tolerances shall be in accordance with ITU-T Recommendations G.812 [8] and G.823 [10] for systems providing PDH interfaces and/or ITU-T Recommendations G.813 [9] and G.825 [11] for systems providing SDH interfaces.

Services that may require external synchronization interfaces are for instance CBR (Constant Bit Rate) services such as  $n \times 2$  Mbit/s and  $n \times 64$  kbit/s, in particular when data interfaces are delivering tributaries coming from different sources.

## 4.9 Branching/feeder/antenna requirements

If high gain antennas are required for the Terminal Stations to cover longer hop length they shall comply with EN 300 833 [33]. For other hop lengths the antennas for the TS shall comply with EN 301 215 [34].

Different types of antennas are envisaged for the CS depending on the cell structure of the radio cell covered by the CS. Those antennas shall also comply with EN 301 215 [34].

### 4.9.1 Waveguide flanges

If flanges (or other connector types) are required at reference point(s) B, B', C, C' of the RF-system block diagram (figure 2) the following types according to IEC 60154-2 [35] shall be used:

UBR/PBR/CBR 320, for the complete frequency range 31,0 GHz to 33,4 GHz.

### 4.9.2 Return loss

Where antennas are an integral part of the TS, RS and the CS radio equipment, there are no requirements to be defined at reference point C'/C in the direction to the transceiver of the CS, TS and RS respectively. When separate antennas are used the return loss referred to C'/C measured in the direction of the equipment shall be better than 14 dB.

### 4.9.3 Intermodulation products

No requirements are necessary to be defined.

---

## 5 System parameters

### 5.1 System capacity

The system capacity considered in the present document for a P-MP system is the transmission capacity of the CS, which consists of the maximum number of TSs simultaneously connected to the CS and transporting their maximum payload bit rate each utilizing interfaces according to table 2.

The maximum number of TSs, simultaneously connected to a CS, shall be declared by the manufacturer. The minimum payload (expressed either as the number of 64 kbit/s signals or an aggregate bit rate), which a CS shall be capable of transporting, will be defined in the parts of the present document related to the different access methods.

Where the equipment can carry alternative traffic types (e.g. ISDN circuits or ATM cells) the CS shall be capable of carrying at least this minimum payload with at least one type of traffic.

In the case of an MP-MP system, the capacity is determined by the density of users in a given area that can each receive a given guaranteed transmission capacity, for a given number of radio channels available to the system.

### 5.2 Round trip delay

The round trip delay for 64 kbit/s telephony traffic channel shall not exceed 20 ms.

Longer round trip delays may result at other bit rates and when using speech coding at rates lower than 64 kbit/s. In order to guarantee that the delay introduced by the system into the transmission network does not degrade the quality of the telephone communication, compliance to ITU-T Recommendation G.131 [12] shall be ensured.

### 5.3 Transparency

The system shall be fully transparent. The network node and the subscriber equipment (points UNI and SNI in figure 1) communicate with each other without being aware of the radio link.

## 5.4 Voice coding method

If the system provides voice services, where the voice encoding/decoding is within the system, one or more of the following coding methods should be used:

- 64 kbit/s: ITU-T Recommendation G.711 [13];
- 32 kbit/s: ITU-T Recommendation G.726 [14];
- 16 kbit/s: ITU-T Recommendation G.728 [15];
- 8 kbit/s: ITU-T Recommendation G.729 [16];
- 5,3 kbit/s/6,3 kbit/s, dual rate: ITU-T Recommendation G.723.1 [36].

Other voice coding methods may be employed if the quality for voice transmission is adequate. The coding method used shall be declared by the manufacturer.

## 5.5 Transmitter characteristics

### 5.5.1 RF block diagram

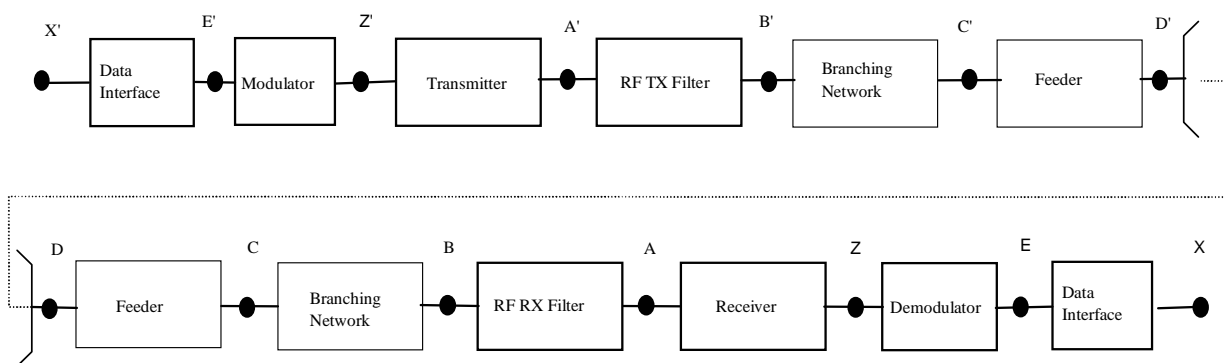
All Transmitter characteristics are referred to a system under any load condition.

The values and measurements are referred to point B' or C' of figure 2.

Measurements shall be made when the CS (at least one transceiver equipment) is under full load conditions, to be declared by the manufacturer.

The specified transmitter characteristics shall be met with the appropriate input signals applied at point E of figure 2 and measured at point E'.

The RF system block diagram in figure 2 shows the point to point connection of the P-MP transceiver between a CRS and one TS (or RS, or between an RS and TS or between an RS and another RS).



NOTE 1: The points shown above are reference points only; points B, C and D, B', C' and D' may coincide.

NOTE 2: The "DATA INTERFACE" block contains the mapping functionalities required for transforming from/to packet data protocols into/from raw data stream.

**Figure 2: RF block diagram**

### 5.5.2 Transmitter output power

The maximum mean transmitter output power (for CS, RS and TS) shall not exceed +30 dBm including tolerances. Care shall be taken that the system Equivalent Isotropically Radiated Power (EIRP) defined in the ITU-R Radio Regulations [17] is not exceeded.

### 5.5.3 Transmitter nominal output power

Refer to annexes A, B and C for requirements relevant to a particular access technique.

A capability for output power level adjustment may be required for regulatory purposes, in which case the range of adjustment, either by fixed or automatic attenuators, should be in increments of 5 dB or less.

### 5.5.4 Transmit power and frequency control

Refer to annexes A, B and C for requirements relevant to a particular access technique.

#### 5.5.4.1 Automatic Transmit Power Control (ATPC), uplink

ATPC is a mandatory feature in the uplink of P-MP systems that have maximum transmitter power density greater than 0,5 dBm/MHz, and in both direction of MP-MP links that have a maximum power density greater than 0,5 dBm/MHz. Equipment with ATPC will be subject to manufacturer declaration of the ATPC ranges and related tolerances. Testing shall be carried out with output power level corresponding to:

- ATPC set manually to a fixed value for system performance;
- ATPC set at maximum Tx output power for Tx parameters.

#### 5.5.4.2 Automatic Transmit Power Control (ATPC), downlink

ATPC in the downlink of a P-MP system is an optional feature. Equipment with ATPC will be subject to manufacturer declaration of the ATPC ranges and related tolerances. Testing shall be carried out with output power level corresponding to:

- ATPC set manually to the maximum and to the minimum values for system performance;
- ATPC set at maximum Tx output power for Tx parameters.

#### 5.5.4.3 Remote Transmit Power Control (RTPC)

RTPC is an optional feature. The use of the RTPC may depend on the access scheme. Equipment with RTPC will be subject to manufacturer declaration of the RTPC ranges and related tolerances. Testing shall be carried out with output power level corresponding to:

- RTPC set manually to the maximum and to the minimum values for system performance;
- RTPC set at maximum Tx output power for Tx parameters;
- RF spectrum mask shall be verified at three points (lower, medium, and upper part of the frequency band envisaged), if applicable. Tx power control shall be set to the maximum output power.

#### 5.5.4.4 Remote Frequency Control (RFC)

RFC is an optional feature. Equipment with RFC will be subject to manufacturer declaration of the RFC ranges and related tolerances. Testing shall be carried out including:

- RFC setting procedure at least for three frequencies in the lower, centre and higher part of the covered frequency range, if applicable;
- RFC setting procedure shall not produce emissions outside the spectrum mask.

### 5.5.5 RF spectrum mask

Refer to annexes A, B and C.

## 5.5.6 Spurious emissions (external)

### 5.5.6.1 Within plus or minus 250 % of the relevant RF channel spacing $f_s$

The emission in this range includes only wanted and out of band emissions which shall be in accordance with the spectrum masks and the limits required by clause 5.5.4 in the relevant parts for the different access methods (see EN 301 213-2 [19], EN 301 213-3 [20] and EN 301 213-5 [37]).

### 5.5.6.2 Outside the band of plus or minus 250 % of the relevant RF channel spacing $f_s$

Outside the frequency range  $\pm 250\%$  of the relevant channel spacing, across the nominal centre frequency, CEPT/ERC/REC 74-01 [21] shall apply.

In the frequency range 21,2 GHz to 43,5 GHz, EN 301 390 [22] shall apply.

## 5.5.7 Radio frequency tolerance

Radio frequency tolerance shall not exceed 15 ppm. This limit includes both short-term factors and long-term ageing effects. For the purpose of type testing the manufacturer shall state the guaranteed short-term part and the expected ageing part.

## 5.6 Receiver characteristics

### 5.6.1 Rx local oscillator frequency arrangements

There shall be no requirement on LO frequency arrangement.

### 5.6.2 Spurious emissions

CEPT/ERC/REC 74-01 [21] and EN 301 390 [22] shall apply.

### 5.6.3 Receiver IF

No IF interfaces are required.

### 5.6.4 Receiver selectivity

In order to facilitate interference calculations with other services both within and from outside the Fixed Service, the receiver selectivity should be declared by the manufacturer. However the definition and the method of measurement are under study within ETSI WG-TM4. Refer to work item TR 102 145.

## 5.7 System performance

The parameters stated below shall be met under any system load condition. All parameters are referred to reference point B or C of the RF system block diagram (see figure 2).

### 5.7.1 Dynamic level range

The BER shall be less than  $10^{-3}$  for a dynamic level range which shall exceed 50 dB including the ATPC and Automatic Gain Control (AGC) ranges if applicable. The dynamic level range shall be declared by the manufacturer.

### 5.7.2 BER as a function of Receiver input Signal Level (RSL)

Refer to annexes A, B and C.



### 5.7.3 Equipment background BER

Refer to annexes A, B and C for requirements relevant to a particular access technique.

The Equipment Background BER under simulated operating conditions shall be measured with a signal level which is 6 dB above the specified level for BER =  $10^{-6}$  in clause 5.7.2 taking into account the actual test load conditions.

For different payload bit rates the measurement time and the maximum number of errors allowed are given in table 1.

**Table 1: Max. number of errors allowed, measuring the equipment background BER**

Payload bit rate (kbit/s)	Recording time (h)	Max. number of errors
≤ 64	20	5
64 to 2 048	see note	see note
≥ 2 048	15	10

NOTE: For bit rates between 64 kbit/s to 2 048 kbit/s the values for the recording time and the max. number of errors shall be linearly derived from the value for ≥ 2 048 kbit/s in applying the next higher integer value.

### 5.7.4 Interference sensitivity

Refer to annexes A, B and C.

### 5.7.5 Distortion sensitivity

Outage from multipath phenomena is not considered relevant to the systems subject to the present document.

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## 6 Types of interfaces at the subscriber equipment and the network exchange

Table 2 lists a range of interfaces for various voice and data services.

The equipment covered by the present document shall use one or more of the ETSI, ITU or ISO/IEC (JTC1) standardized interfaces, the more common of which are listed in table 2.

Table 2: Types of interfaces

Interface	Subscriber Equipment Interfaces
<b>Proposed Standards</b>	
Ethernet 10baseT	ISO/IEC 8802-3 [43]
Ethernet 100baseT	ISO/IEC 8802-3 [43]
ATM-25	ATM User-Network Interface Specification V3.1 [44]
Analogue (2 wires) ITU	ITU-T Recommendation Q.552 [23]
Analogue (4 W + E & M) ITU	ITU-T Recommendation Q.553 [24]
Digital data port (electrical) ITU	ITU-T Recommendation G.703 [25] ITU-T Recommendation X series and ITU-T Recommendation V series
ISDN basic rate U; S ITU	ITU-T Recommendation G.961 [31]; ETS 300 012 [40]
ISDN primary rate U; S ITU	ITU-T Recommendation G.962 [39]; EN 300 011-1 [38]
SDH interfaces ITU	ITU-T Recommendation G.707 [32]
<b>Network Interfaces</b>	
Ethernet 100baseT	ISO/IEC 8802-3 [43]
Mbit/s ITU	ITU-T Recommendation G.703 [25]
Analogue (2 wires) ITU	ITU-T Recommendation Q.552 [23]
Analogue (4 W + E & M) ITU	ITU-T Recommendation Q.553 [24]
Digital data port (electrical) ITU	ITU-T Recommendation G.703 [25] ITU-T Recommendation X series and ITU-T Recommendation V series
Digital data port (optical) ITU	ITU-T Recommendation G.957 [26]
ISDN + Analogue subscribers + Leased lines 2 Mbit/s Interface	ITU-T Recommendation G.703 [25] ITU-T Recommendation G.964 [27] V5.1 ITU-T Recommendation G.965 [28] V5.2 EN 300 324 [29] EN 300 347 [30]
ISDN U interface ITU	ITU-T Recommendation G.961 [31]
PDH/SDH interfaces ITU	ITU-T Recommendations G.703 [25]; G.707 [32] and G.957 [26]
NOTE: Further ETSI, ITU or ISO/IEC standardized interfaces may be implemented.	

## Annex A (normative): Specific parameters for TDMA-systems

### A.1 Channel arrangements

The system shall operate on one or more of the channel spacing 3,5 MHz, 7 MHz, 14 MHz, 28 MHz and 56 MHz. The minimum transport capacities achievable within the above channel are given in table A.1.

**Table A.1: Channel arrangement**

Channel Spacing [MHz]		3,5 MHz	7 MHz	14 MHz	28 MHz	56 MHz
Minimum CRS gross bit rate for transmission and reception (Mbit/s)	System type A	4	8	16	32	64
	System type B	8	16	32	64	128
	System type C	12	24	48	96	192

NOTE 1: The minimum bit rate for transmission and reception is defined as the gross bit rate, defined in clause 3.1. The manufacturer shall declare the actual system traffic carrying capacity, the gross bit rate and the system type.

NOTE 2: Systems may offer a combination of Type A, Type B, Type C on a per Terminal Station basis, provided that such a system, when operating in mixed mode, complies with:

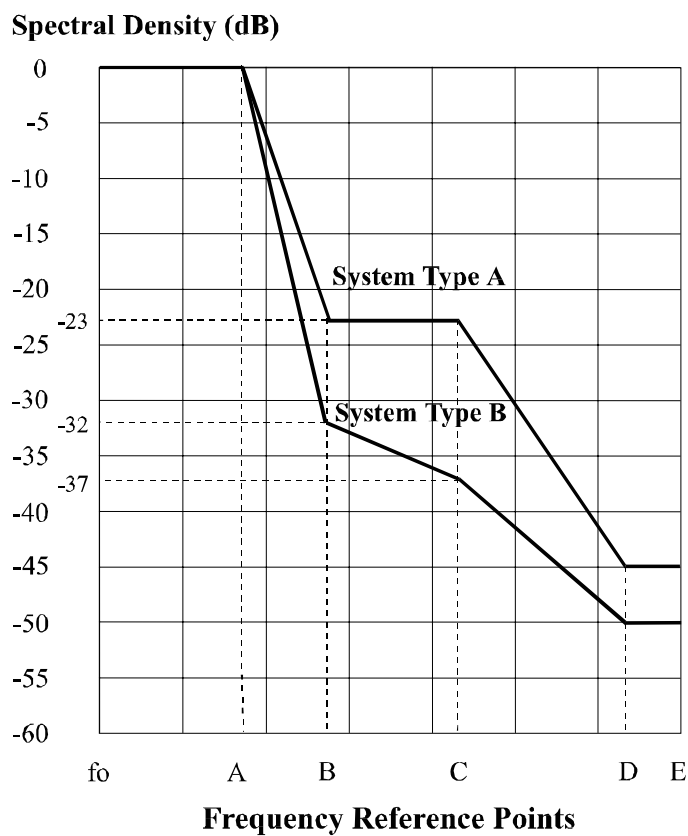
- the most stringent spectral mask for the types offered when co-ordination between different operators operating on adjacent channels is required.
- with one of the mask type A, B or C, declared by the manufacturer when co-ordination between different operators operating on adjacent channels is not required (i.e. when blocks of channels are assigned with guardbands in between).

NOTE 3: The present document defines three System Types A, B and C. These systems represent different spectral efficiency in term of gross-bit-rate/Hz; the gross bit rate, defined in clause 3.1, has a unique relation to the symbol rate through the implemented modulation format as follows:

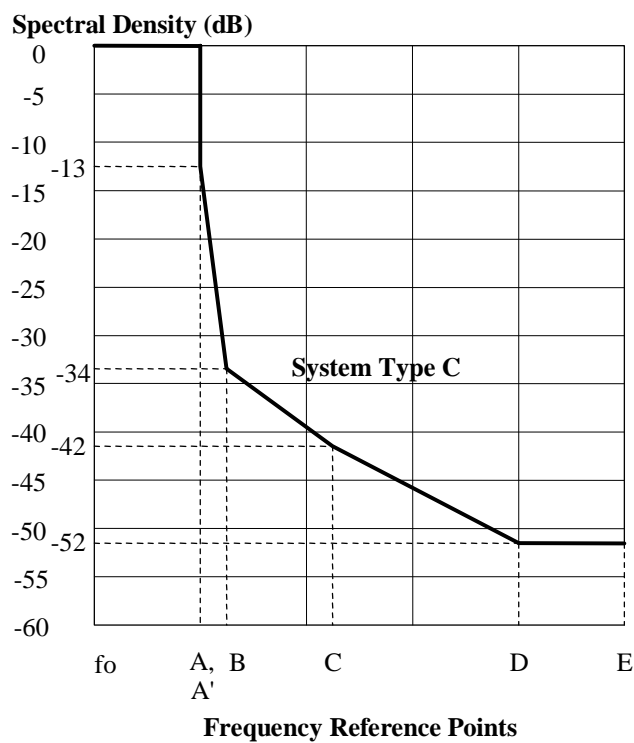
- A: lower complexity modulation formats (e.g. 4 states or equivalent).
- B: medium complexity modulation formats (e.g. 16 states or equivalent).
- C: higher complexity modulation formats (e.g. 64 states or equivalent).

### A.2 RF spectrum mask

The 0 dB level shown on the spectrum masks is the maximum of the modulated spectrum disregarding residual carriers. The masks do not include frequency tolerance.



**Figure A.1: Spectrum masks, types A and B**



**Figure A.2: Spectrum mask, type C**

Table A.2: Spectrum masks, single carrier

System Type A						
Co-polar channel spacing Points in figure 1	0 dB Point A		-23 dB Point B	-23 dB Point C	-45 dB Point D	-45 dB Point E
3,5 MHz	1,5 MHz		2,8 MHz	3,7 MHz	7 MHz	8,75 MHz
7 MHz	2,8 MHz		5,6 MHz	7 MHz	14 MHz	17,5 MHz
14 MHz	5,6 MHz		11,2 MHz	14 MHz	28 MHz	35 MHz
28 MHz	11,2 MHz		22,4 MHz	28 MHz	56 MHz	70 MHz
56 MHz	22,5 MHz		45 MHz	56 MHz	112 MHz	140 MHz
112 MHz	45 MHz		90 MHz	112 MHz	224 MHz	280 MHz
System Type B						
Co-polar channel spacing Points in figure 1	0 dB Point A		-32 dB Point B	-37 dB Point C	-50 dB Point D	-50 dB Point E
3,5 MHz	1,5 MHz		2,8 MHz	3,7 MHz	7 MHz	8,75 MHz
7 MHz	2,8 MHz		5,6 MHz	7 MHz	14 MHz	17,5 MHz
14 MHz	5,6 MHz		11,2 MHz	14 MHz	28 MHz	35 MHz
28 MHz	11,2 MHz		22,4 MHz	28 MHz	56 MHz	70 MHz
56 MHz	22,5 MHz		45 MHz	56 MHz	112 MHz	140 MHz
112 MHz	45 MHz		90 MHz	112 MHz	224 MHz	280 MHz
System Type C						
Co-polar channel spacing Points in figure 2	0 dB Point A	-13 dB Point A'	-34 dB Point B	-42 dB Point C	-52 dB Point D	-52 dB Point E
3,5 MHz	1,75 MHz	1,75 MHz	2,8 MHz	3,7 MHz	7 MHz	8,75 MHz
7 MHz	3,5 MHz	3,5 MHz	5,6 MHz	7 MHz	14 MHz	17,5 MHz
14 MHz	7 MHz	7 MHz	11,2 MHz	14 MHz	28 MHz	35 MHz
28 MHz	14 MHz	14 MHz	22,4 MHz	28 MHz	56 MHz	70 MHz
56 MHz	28 MHz	28 MHz	45 MHz	56 MHz	112 MHz	140 MHz
112 MHz	56 MHz	56 MHz	90 MHz	112 MHz	224 MHz	280 MHz

### A.3 BER as a function of Receiver input Signal Level (RSL)

The input signal level presented to the receiver under test is adjusted to the levels described in table A.3. The BER shall be less than or equal to the values defined in the table. For the purposes of testing, the transmitter is operated at its maximum rated power level.

Table A.3

Systems type A					
Co-polar channel spacing	3,5 MHz	7 MHz	14 MHz	28 MHz	56 MHz
Channel bit rate (Mbit/s)	4 Mbit/s	8 Mbit/s	16 Mbit/s	32 Mbit/s	64 Mbit/s
$1 \times 10^{-3}$	-83 dBm	-80 dBm	-77 dBm	-74 dBm	-71 dBm
$1 \times 10^{-6}$	-79 dBm]	-76 dBm	-73 dBm	-70 dBm	-67 dBm
Systems type B					
Co-polar channel spacing	3,5 MHz	7 MHz	14 MHz	28 MHz	56 MHz
Channel bit rate (Mbit/s)	8 Mbit/s	16 Mbit/s	32 Mbit/s	64 Mbit/s	128 Mbit/s
$1 \times 10^{-3}$	-75 dBm	-72 dBm	-69 dBm	-66 dBm	-63 dBm
$1 \times 10^{-6}$	-71 dBm	-68 dBm	-65 dBm	-62 dBm	-59 dBm
Systems type C					
Co-polar channel spacing	3,5 MHz	7 MHz	14 MHz	28 MHz	56 MHz
Channel bit rate (Mbit/s)	12 Mbit/s	24 Mbit/s	48 Mbit/s	96 Mbit/s	192 Mbit/s
$1 \times 10^{-3}$	-68 dBm	-65 dBm	-62 dBm	-59 dBm	-56 dBm
$1 \times 10^{-6}$	-65 dBm	-62 dBm	-59 dBm	-56 dBm	-53 dBm

NOTE: The channel bit rate is the minimum bit rate during a burst.

## A.4 Interference sensitivity

### A.4.1 Co-channel interference sensitivity (external)

The limits of co-channel interference (external) shall be as in table A.4, giving maximum S/I values for 1 dB and 3 dB degradation of the  $10^{-6}$  BER limits specified in clause 5.7.2.

**Table A.4: Co-channel interference sensitivity**

Description		BER = $10^{-6}$	
Threshold degradation dB		1	3
Signal to Interference level S/I [dB]	System type A	23	19
	System type B	30	26,5
	System type C	36	32,5

### A.4.2 Adjacent channel interference

The limits of adjacent channel interference (external) shall be as given in table A.5 for like modulated signals, giving maximum S/I values for 1 dB and 3 dB degradation of the  $10^{-6}$  BER limits specified in clause 5.7.2.

**Table A.5: Adjacent channel interference sensitivity**

Description		BER = $10^{-6}$	
Threshold degradation dB		1	3
Signal to Interference level S/I [dB]	System type A	0	-4
	System type B	0	-4
	System type C	0	-4

### A.4.3 Continuous Wave (CW) interference

For a receiver operating at the RSL specified in clause 5.7.2 for  $10^{-6}$  BER threshold, the introduction of a CW interferer at a level of +30 dB with respect to the wanted signal and at any frequency up to 60 GHz, excluding frequencies either side of the centre frequency of the wanted RF channel by up to 500 % of the co-polar channel spacing, shall not cause a degradation of more than 1 dB of the BER threshold as specified in clause 5.7.2.

This test is designed to identify specific frequencies at which the receiver may have a spurious response, e.g. imagefrequency, harmonics of the receive filter, etc. The actual test range should be adjusted accordingly. The test is not intended to imply a relaxed specification at all out of band frequencies elsewhere specified in the present document.

## Annex B (normative): Specific parameters for FDMA-systems

### B.1 Channel arrangements

The system shall meet one or more of the channel arrangements listed in table B.1.

**Table B.1: Channel arrangement**

Channel spacing		3,5 MHz	7 MHz	14 MHz	28 MHz	56 MHz
Min. CRS transmission capacity (kbit/s)	4 state modulation (or equivalent)	42 x 64	84 x 64; 4 x 2 048	8 x 2 048	16 x 2 048	32 x 2 048
	8 state modulation (or equivalent)	62 x 64	5 x 2 048	10 x 2 048	20 x 2 048	40 x 2 048
	16 state modulation (or equivalent)	84 x 64; 4 x 2 048	8 x 2 048	16 x 2 048	32 x 2 048	64 x 2 048 or STM-1
NOTE 1: "or equivalent" means: providing the same spectral efficiency and system performance regardless of the actual modulation scheme.						
NOTE 2: Allocated RF-channels may be occupied by systems using smaller RF-channel spacing as long as the spectrum mask for the allocated RF-channel is not exceeded.						
NOTE 3: Any other equivalent transmission capacity may be transported, e.g. instead of 8 x 2 048 kbit/s a capacity of 2 x 8 Mbit/s can be transmitted.						

### B.2 RF spectrum mask

The 0 dB level shown on the spectrum masks is the maximum of the modulated spectrum disregarding residual carriers.

The masks do not include frequency tolerances.

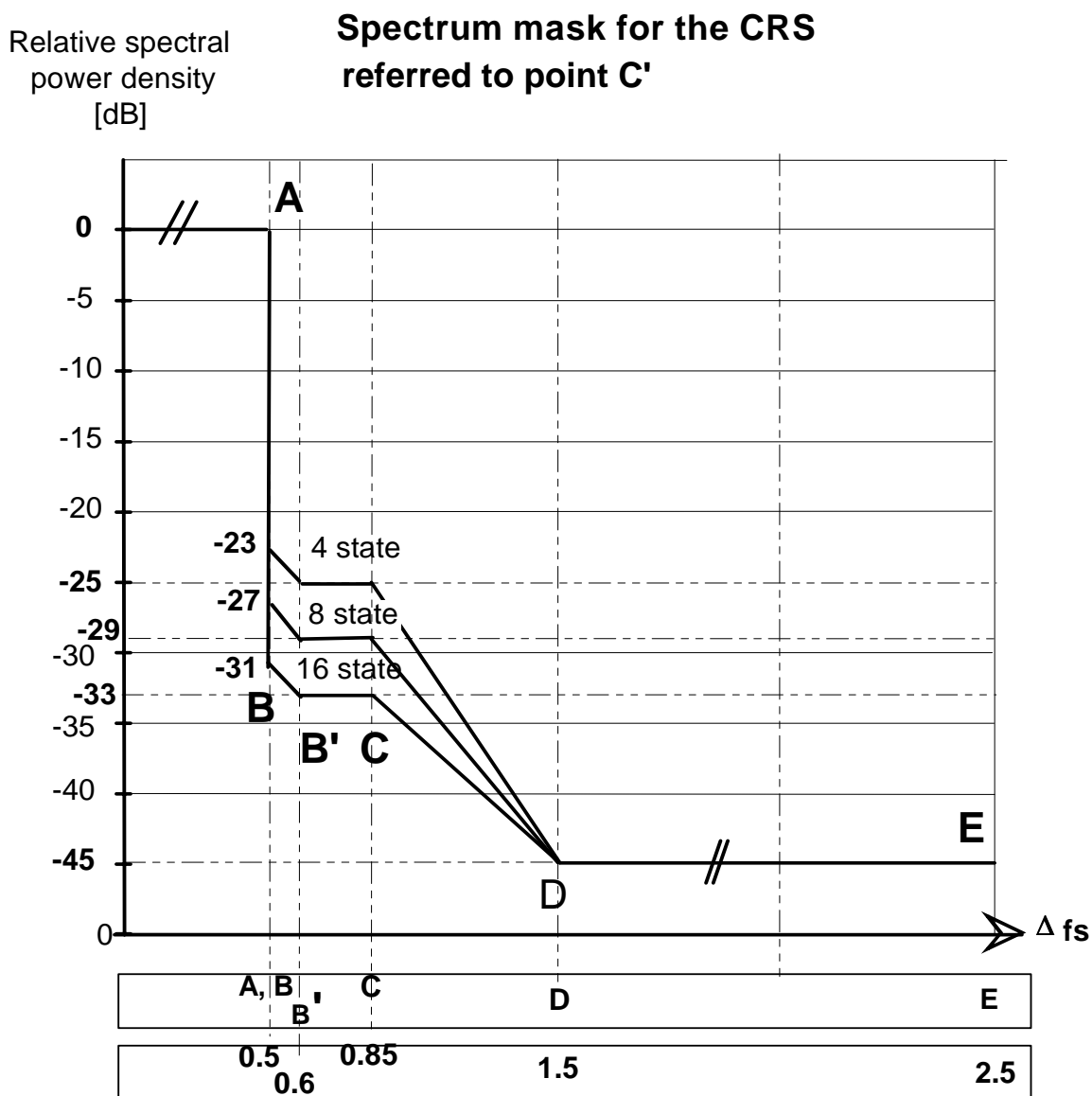
#### B.2.1 RF spectrum mask for the Central Radio Station

General test load conditions to measure the spectrum mask for the CRS transceiver:

- Number of carriers, N, transmitted over one CRS transceiver should correspond with the full capacity load of the measured CRS. The number shall be declared by the manufacturer.
- All carriers are modulated according to the input bit rate (referred to Z' in figure 2) declared by the manufacturer. The input signal shall be in accordance to the interfaces stated in table 2 of the main part of the present document.
- Nominal output power for each carrier: 1/N of the total nominal output power of the CRS referred to point C'.

NOTE: Under operational conditions the output power of some carriers may be greater than 1/N of the nominal output power provided that the maximum average output power of +27 dBm is not exceeded and/or ITU-R Recommendation F.1249 [18] is fulfilled.

The spectrum mask for the CRS transceiver is shown in figure B.1.



NOTE 1: fs: RF channel spacing.

NOTE 2: The different spectral power density levels at point C are related to different modulation schemes.

**Figure B.1: Spectrum mask for the CRS**

**Table B.2: Spectrum analyser settings for RF power spectrum measurement**

RF channel spacing, fs (MHz)	3,5	7	14	28	56
Centre Frequency	actual	actual	actual	actual	actual
Sweep width (MHz)	20	40	80	160	320
Scan time	auto	auto	auto	auto	auto
IF bandwidth (kHz)	30	30	30	100	100
Video bandwidth (kHz)	0,3	0,3	0,3	0,3	0,3

## B.2.2 RF spectrum mask for the Terminal Station and the Repeater Station

The RF spectrum mask for the TS and RS shall comply with the spectrum mask (see figure B.1) of the CRS.



## B.3 BER as a function of Receiver input Signal Level (RSL)

**Table B.3: BER performance thresholds for different modulation schemes for each 2 Mbit/s carrier for reference**

RSL (dBm) for BER $\leq 10^{-3}$			RSL (dBm) for BER $\leq 10^{-6}$		
Modulation states			Modulation states		
4	8	16	4	8	16
-95	-94	-89	-92,5	-91,5	-86,5

Applying other bit rates the relevant receive levels may be calculated according to the following formulas:

- 4-state modulation schemes:
  - RSL (dBm(for BER  $10^{-3}$ )) =  $-98 + 10 \times \log_{10} b$
  - RSL (dBm(for BER  $10^{-6}$ )) =  $-95,5 + 10 \times \log_{10} b$
- 8-state modulation schemes:
  - RSL (dBm(for BER  $10^{-3}$ )) =  $-97 + 10 \times \log_{10} b$
  - RSL (dBm(for BER  $10^{-6}$ )) =  $-94,5 + 10 \times \log_{10} b$
- 16-state modulation schemes:
  - RSL (dBm(for BER  $10^{-3}$ )) =  $-92 + 10 \times \log_{10} b$
  - RSL (dBm(for BER  $10^{-6}$ )) =  $-89,5 + 10 \times \log_{10} b$

b = bit rate (Mbit/s).

## B.4 Interference sensitivity

### B.4.1 Co-channel interference (external)

The limits of co-channel interference (external) shall be as in table B.4, giving maximum S/I values for 1 dB and 3 dB degradation of the  $10^{-6}$  BER limits specified in clause 5.7.2.

**Table B.4: Co-channel interference sensitivity**

Description		BER = $10^{-6}$	
Threshold degradation dB		1	3
Signal to Interference level S/I [dB]	4 state modulation	17,5	13,5
	8 state modulation	19,5	15,5
	16 state modulation	26,5	22,5

## B.4.2 Adjacent channel interference (external)

The limits of adjacent channel interference (external) shall be as given in table B.5 for like modulated signals, giving maximum S/I values for 1 dB and 3 dB degradation of the  $10^{-6}$  BER limits specified in clause 5.7.2.

**Table B.5: Adjacent channel interference sensitivity**

Description		BER = $10^{-6}$	
		1	3
Threshold degradation dB		1	3
Signal to Interference level S/I [dB]	4 state modulation	-15,5	-19,5
	8 state modulation	-13,5	-17,5
	16 state modulation	-6,5	-10,5

## B.4.3 CW interference

For a receiver operating at the RSL specified in clause B.3 for  $10^{-6}$  BER threshold, the introduction of a CW interferer at a level of +30 dB with respect to the wanted signal and at any frequency up to 60 GHz, excluding frequencies either side of the centre frequency of the wanted RF channel by up to 500 % of the co-polar channel spacing, shall not cause a degradation of more than 1 dB of the BER threshold as specified in clause B.3.

This test is designed to identify specific frequencies at which the receiver may have a spurious response, e.g. image frequency, harmonics of the receive filter, etc. The actual test range should be adjusted accordingly. The test is not intended to imply a relaxed specification at all out of band frequencies elsewhere specified in the present document.

# Annex C (normative): Specific parameters for MC TDMA-systems

## C.1 Channel arrangements

The system shall meet at least one or more of the channel arrangements listed in table C.1.

**Table C.1: Channel arrangement**

Channel Spacing		3,5 MHz	7 MHz	14 MHz	28 MHz	56 MHz	112 MHz
Minimum bit rate for transmission and reception (Mbit/s)	System Type A	4	8	16	32	64	128
	System Type B	8	16	32	64	128	256
	System Type C	12	24	48	96	192	384

NOTE 1: The minimum transmission bit rate is defined as the gross bit rate of the multi-carrier system assumed as sum of all sub-carriers gross bit rate. The sum of all upstream sub-carriers' transmission bit rates for a fully equipped system shall meet the requirements for the system type declared by the manufacturer as per table C.1. Where a different aggregate gross bit rate applies in each direction, the system type declared shall indicate this by giving the system type for the downstream followed by a hyphen and then the system type for the upstream. For example, a system conforming to type C in the downstream direction and type A in the upstream direction should be declared as a type C-A. Where the system type differs for upstream and downstream, the system shall meet all requirements for the declared system type for each direction.

NOTE 2: Systems may offer a combination of Type A, Type B, Type C on a per Terminal Station basis, provided that such a system, when operating in mixed mode, complies with:

- the most stringent spectral mask for the types offered when co-ordination between different operators operating on adjacent channels is required;
- with one of the masks type A, B or C, declared by the manufacturer when co-ordination between different operators operating on adjacent channels is not required (i.e. when blocks of channels are assigned with guardbands in between);
- A mix mode could consist of a system that operates with different system type on a per sub-carrier or time-slot basis or both.

NOTE 3: System Type A is primarily covering 4 state or equivalent modulation.  
System Type B is primarily covering 16 state or equivalent modulation.  
System Type C is primarily covering 64 state or equivalent modulation.  
"or equivalent" means providing the same spectral efficiency and system performance regardless of the actual modulation scheme.

NOTE 4: Allocated RF channels may be occupied by systems using any number of sub-carriers or size of sub-carrier bandwidth within a specific channel, as long as the spectrum mask for the allocated RF channel is not exceeded, for any configuration of sub-carriers.

NOTE 5: The CRS transmission, defined as the "downstream" direction, may be continuous, i.e. TDM (Time Division Multiplex). The CRS may transmit in the downstream direction even if there are no active calls, for the purpose of synchronization of the Terminal Stations.  
The Terminal Stations (TS) may transmit in timeslots allocated by control signals from the CS, or on a fixed basis. The TS transmission direction is defined as "upstream". A TS may transmit control, bandwidth requests or signalling information even during the absent of users activities. TS transmissions consist of bursts of fixed or variable duration, usually an integer multiple of a fundamental timeslot duration.

## C.2 Transmitter output power

In case of N similar sub-carriers, the nominal output power for each sub-carrier would be 1/N of the total nominal output power of the CRS referred to point C'.

In case of dissimilar sub-carriers the relative power of each sub-carrier would depend from the actual symbol frequencies (FS) and differ by a factor  $10\log(FS_1/FS_2)$ .

Therefore, under operational conditions, the output power of some sub-carriers may be greater than 1/N of the nominal output power provided that the maximum average output power is not exceeded and/or ITU-R Recommendation F.1249 [18] is fulfilled.

The RTPC function shall be common to all sub-carriers of the same transmitter (i.e. they are subject to the same attenuation).

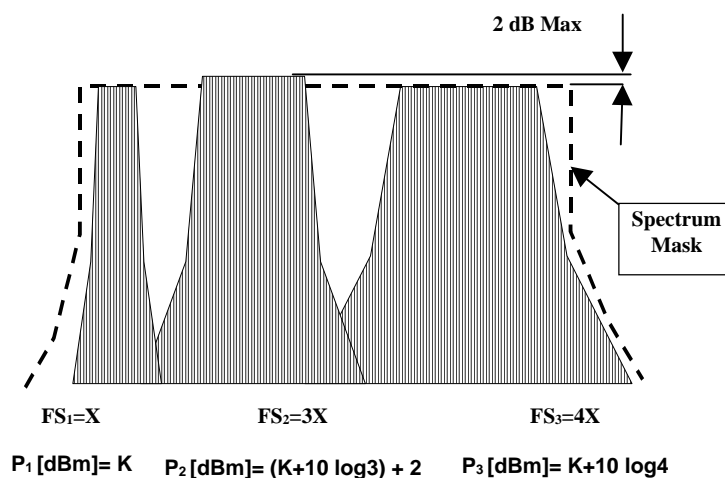
The ATPC function may be implemented on a common or on a single sub-carrier base; in all cases the spectrum mask of clause C.3 shall be met with the maximum provided output power of all sub-carriers.

## C.3 RF spectrum masks

### C.3.1 RF spectrum mask

The 0 dB level shown on the spectrum masks is relative to the maximum of the modulated spectrum of the sub-carrier with the lowest spectral density, disregarding residual carriers.

When applying the spectrum mask, the spectral density of all sub-carriers shall be within 0 to 2 dB relatively to the reference level; see a generic example in figure C.1.



**Figure C.1: Example of three sub-carrier system with different symbol frequency (FS)**

The masks do not include frequency tolerances.

#### C.3.1.1 RF spectrum density mask for the central radio station

General test load conditions to measure the spectrum mask for the CRS transceiver:

- The CRS transmitter shall work under full capacity load.
- The total output power level should be according to clause 5.5.2.
- All sub-carriers are modulated according to the input bit rate (referred to Z' in figure 2) declared by the manufacturer. The input signal shall be in accordance to the interfaces stated in table 2.

- For systems that use mix mode, refer to note 2 of clause C.1.
- The RF spectrum masks shown in figure C.2 and table C.2 apply for multi-carrier TDMA systems.

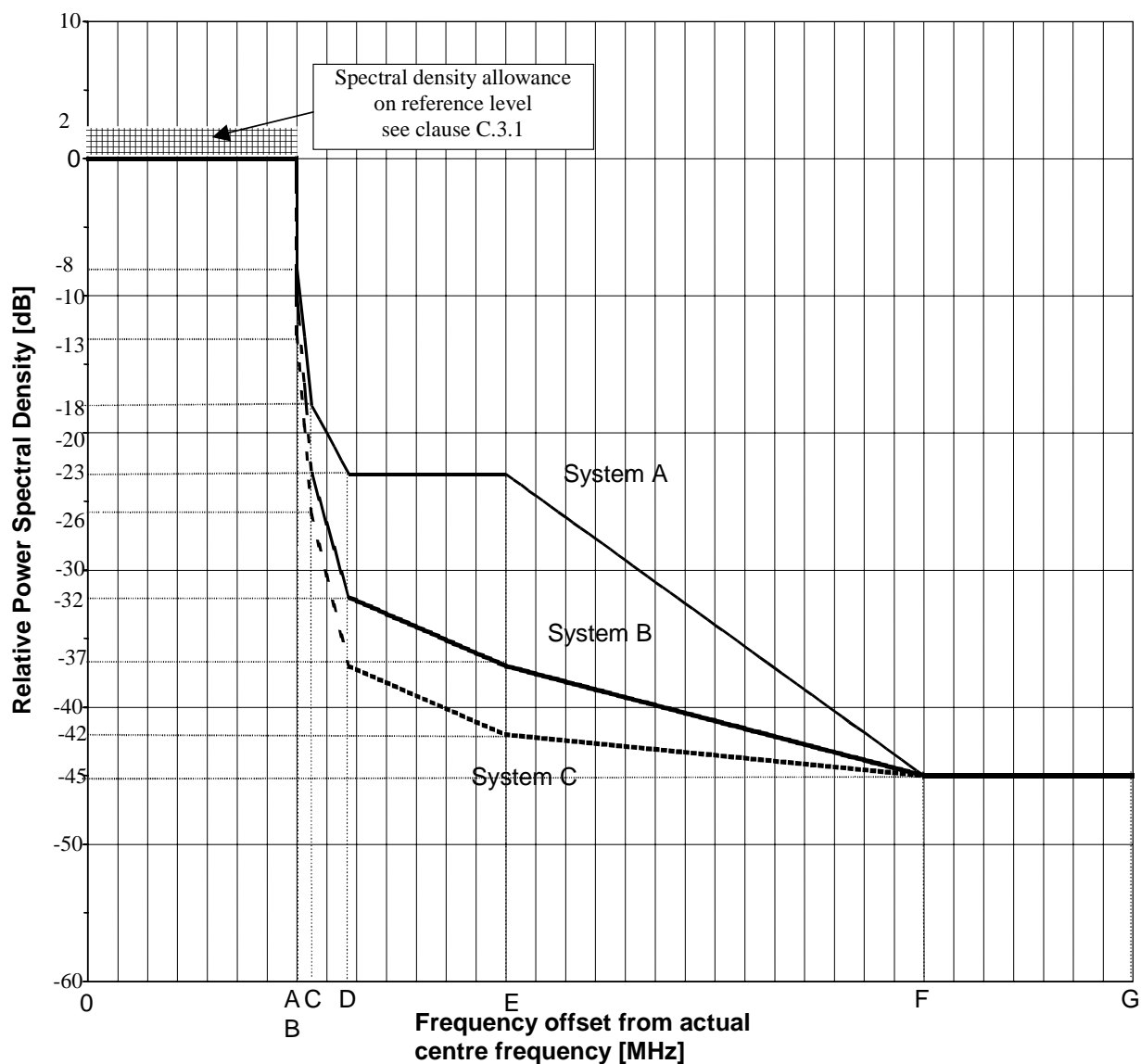


Figure C.2: Spectrum masks of the composite multi-carrier system ( $f_0$  = channel centre frequency)

Table C.2: Spectrum masks of the composite multi-carrier system

Co-polar channel spacing ↓	Points in figure C.2 (frequency) ↓						
	Point A [MHz]	Point B [MHz]	Point C [MHz]	Point D [MHz]	Point E [MHz]	Point F [MHz]	Point G [MHz]
3,5 MHz	1,75	1,75	2	2,25	3,5	7	8,75
7 MHz	3,5	3,5	3,75	4,5	7	14	17,5
14 MHz	7	7	7,5	8,75	14	28	35
28 MHz	14	14	15	17,5	28	56	70
56 MHz	28	28	30	35	56	112	140
112 MHz	56	56	60	70	112	224	280
	Points in figure C.2 (attenuation) ↓						
System Type A	0 dB	-8 dB	-18 dB	-23 dB	-23 dB	-45 dB	-45 dB
System Type B	0 dB	-10 dB	-23 dB	-32 dB	-37 dB	-45 dB	-45 dB
System Type C	0 dB	-13 dB	-26 dB	-37 dB	-42 dB	-45 dB	-45 dB

The spectrum analyser settings for measuring the RF-spectrum masks are listed in table C.3.

Table C.3: Spectrum analyser settings for RF power spectrum measurement

	Central Stations (CRS) and Repeater Stations (RS)						Terminal Stations (TS)
RF channel spacing. (MHz)	3,5	7	14	28	56	112	any
Centre frequency	actual	actual	actual	actual	actual	actual	actual
Sweep width (MHz)	20	40	80	160	320	640	see corresponding CRS
Scan time	auto	auto	auto	auto	auto	auto	auto
IF bandwidth (kHz)	30	30	30	100	100	300	see note
Video bandwidth (kHz)	0,1	0,3	0,3	0,3	0,3	1,0	
NOTE:	<p>The spectrum analyser settings for RF power Spectrum Measurement for TDMA Terminal Stations (TS) are depending on the burst duration. For a burst duration of <math>\approx 50 \mu\text{s}</math> the recommended settings are IF bandwidth <math>\approx 30 \text{ kHz}</math> and video bandwidth <math>\approx 10\text{kHz}</math>.</p> <p>For other burst durations, the recommended settings are as following:</p> <ul style="list-style-type: none"> <li>- IF bandwidth <math>\approx 30 \text{ kHz} \times 50 \mu\text{s}/(\text{burst duration in us})</math>;</li> <li>- Video bandwidth <math>\approx 10\text{kHz} \times 50 \mu\text{s}/(\text{burst duration in us})</math>.</li> </ul> <p>The supplier has to declare the burst duration.</p>						

### C.3.1.2 RF-spectrum density mask for the terminal station

The RF spectrum masks for the TS shall comply with the spectrum mask of the CRS in figure C.2, irrespective of the centre frequency of the TS sub-carrier.

### C.3.1.3 RF-spectrum density mask for the repeater station

The RF spectrum masks for the RS shall comply with the spectrum mask of the CRS in figure C.2, irrespective of the centre frequency of the RS sub-carriers.

### C.3.1.4 Discrete CW components exceeding the spectrum density mask limit (all stations)

In case some CW components exceed the spectrum mask, an additional allowance is given.

Those lines shall not:

- exceed the mask by a factor more than  $\{10 \log(\text{CSmin}/\text{IFbw}) - 10\}$  dB;
- be spaced each other in frequency by less than CSmin.

Where:

- CSmin is the minimum practical channel separation for the given radio-frequency channel arrangement.
- CSmin = 1 750 kHz.

IFbw is the recommended resolution IF bandwidth, expressed in kHz, reported in table C.3.

Figure C.3 shows a typical example of this requirement.

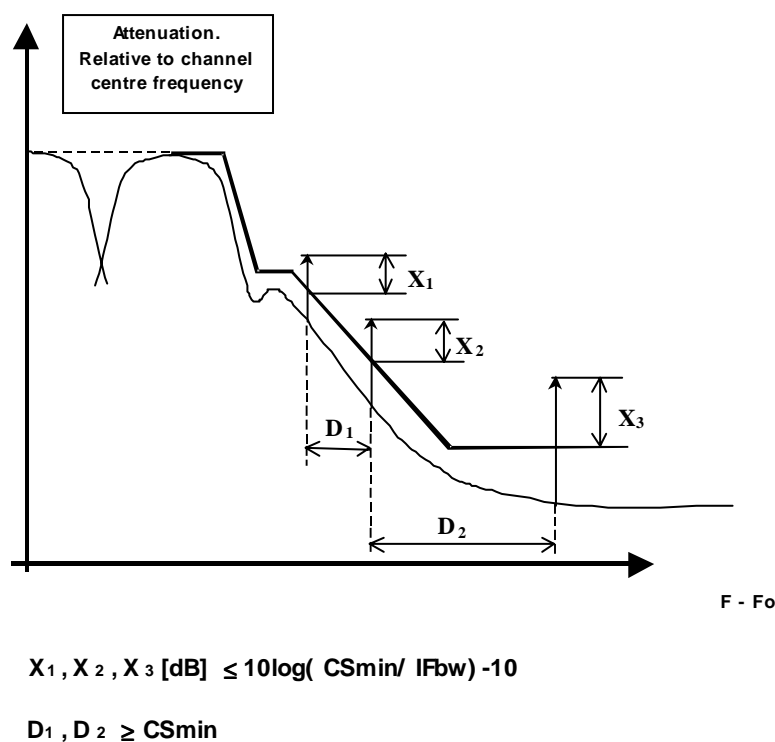


Figure C.3: CW lines exceeding the spectrum mask (typical example)

## C.4 System performance

### C.4.1 BER as a function of Receiver input Signal Level (RSL)

The input signal level of each sub-carrier presented to the receiver under test is adjusted to the levels calculated as described in the formulas below for the actual bit rate of the sub-carrier. The BER for each sub-carrier within a channel shall be less than or equal to the values defined in the formulas. For the purposes of testing, the transmitter is operated at its maximum rated power level declared by the manufacturer.

Based on the actual bit rates, the relevant receive levels of each sub-carrier shall be calculated according to the following formulas:

- System Type A:

$$RSL_{(\text{for BER } 10^{-3})} \text{ (dBm)} = -92 + 10 \times \log b$$

$$RSL_{(\text{for BER } 10^{-6})} \text{ (dBm)} = -88 + 10 \times \log b$$

- System Type B:

$$RSL_{(\text{for BER } 10^{-3})} \text{ (dBm)} = -87 + 10 \times \log b$$

$$RSL_{(\text{for BER } 10^{-6})} \text{ (dBm)} = -83 + 10 \times \log b$$

- System Type C:

$$RSL_{(\text{for BER } 10^{-3})} \text{ (dBm)} = -81,8 + 10 \times \log b$$

$$RSL_{(\text{for BER } 10^{-6})} \text{ (dBm)} = -78,8 + 10 \times \log b$$

$b$  = bit rate (Mbit/s) (actual gross bit rate of each sub-carrier)

The effect of differential attenuation of the sub-carriers, due to different rain intensity within the sector and/or ATPC, shall be taken into account. Therefore the above requirement shall be met with the adjacent sub-carrier transmitter(s) operating at the maximum declared power level and the adjacent sub-carrier(s) RSL set to the higher differential power, with respect to the sub-carrier under actual measurement, permitted by the system implementation, as declared by the supplier.

## C.4.2 Equipment Background BER

See clause 5.7.3. The requirement shall be met by each sub-carrier.

The effect of differential attenuation of the sub-carriers, due to different rain intensity within the sector and/or ATPC, shall be taken into account. Therefore the above requirement shall be met with the adjacent sub-carrier(s) RSL set to the higher differential power, with respect to the sub-carrier under actual measurement, permitted by the system implementation, as declared by the supplier.

## C.4.3 Interference sensitivity

### C.4.3.1 Co-channel interference (external)

The limits of co-channel interference (external from a like multi-carrier interfering signal) shall be as in table C.4, giving maximum S/I values for 1 dB and 3 dB degradation of the  $10^{-6}$  BER limits specified in clause C.4.1. Limits shall be met for each sub-carrier.

**Table C.4: Co-channel interference sensitivity**

Description		BER = $10^{-6}$	
Threshold degradation dB		1	3
Signal to Interference level S/I [dB]	System Type A	23	19
	System Type B	30	26,5
	System Type C	36	32,5



### C.4.3.2 Adjacent channel interference (external)

The limits of adjacent channel interference (external from a like multicarrier interfering signal) shall be as given in table C.5 for like modulated signals, giving maximum S/I values for 1 dB and 3 dB degradation of the  $10^{-6}$  BER limits specified in clause C.4.1. Limits shall be met for each sub-carrier.

The requirement shall be met for an interfering signal on either side of the multicarrier system centre frequency.

**Table C.5: Adjacent channel interference sensitivity**

Description		BER = $10^{-6}$	
Threshold degradation dB		1	3
Signal to Interference level S/I [dB]	System Type A	0	-4
	System Type B	0	-4
	System Type C	0	-4

### C.4.3.3 CW interference

For a receiver operating at the RSL specified in clause C.4.1 for  $10^{-6}$  BER threshold, the introduction of a CW interferer at a level of +30 dB with respect to the wanted signal and at any frequency up to 60 GHz, excluding frequencies either side of the centre frequency of the wanted RF channel by up to 500 % of the co-polar channel spacing, shall not cause a degradation of more than 1 dB of the BER threshold as specified in clause C.4.1.

This test is designed to identify specific frequencies at which the receiver may have a spurious response, e.g. image frequency, harmonics of the receive filter, etc. The actual test range should be adjusted accordingly. The test is not intended to imply a relaxed specification at all out of band frequencies elsewhere specified in the present document.

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## Annex D (informative): Bibliography

ETSI TR 102 145: "Fixed Radio Systems; Point-to-Multipoint equipment; Derivation of the Parameters for the Co-ordination of Point-to-Multipoint Fixed Service Systems".

ETSI EN 301 213 (all parts): "Fixed Radio Systems; Point-to-multipoint equipment; Point-to-multipoint digital radio systems in frequency bands in the range 24,25 GHz to 29,5 GHz using different access methods".

CEPT/ERC/REC 00-05: "Use of the band 24.5 - 26.5 GHz for fixed wireless access".

ETSI EG 202 306: "Transmission and Multiplexing (TM); Access networks for residential customers".

ITU-T Recommendation V series: "Data communication over the telephone network".

ITU-T Recommendation X series: "Data networks and open system communication".

CEPT/ERC Report 25: "The European table of frequency allocations and utilizations covering the frequency range 9 kHz to 275 GHz".

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## History

<b>Document history</b>			
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