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European Standard (Telecommunications series)

Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Time Division Multiple Access (TDMA) point-to-multipoint DRRS in Frequency Division Duplex (FDD) bands in the range 3 GHz to 11 GHz

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Contents

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM), and is now submitted for the Voting phase of the ETSI standards Two-step Approval Procedure.

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

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 x 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.

1 Scope

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 terrrestrial 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.

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 [22], which is under preparation.

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 and having the frequency plans as given in ERC Recommendations 14-03 [7], 12-08 [23] and 12-05 [8], respectively.

1.3 Access method

The present document covers Time Division Multiple Access (TDMA) systems.

2 Normative references

References may be made to either:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ETS 300 012 (1992): "Integrated Services Digital Network (ISDN); Basic user-network interface Layer 1 specification and test principles".

[2] ITU-T Recommendation G.703: "Physical/electrical characteristics of hierarchical digital interfaces".

[3] ITU-T Recommendation Q.553 (1994): "Transmission characteristics at 4-wire analogue interfaces of digital exchanges".

[4] ITU-T Recommendation Q.552 (1994): "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] ERC Recommendation 14-03: "Harmonized radio frequency channel arrangements for low and medium capacity systems in the band 3 400 MHz to 3 600 MHz".

[8] ERC Recommendation 12-05: "Harmonized radio frequency channel arrangements for digital terrestrial fixed systems operating in the band 10.0 - 10.68 GHz".

[9] ETS 300 019, Parts 1 and 2 (1994): "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; sub-parts 1-1 to 1-7: Classification of environmental conditions; sub-parts 2-1 to 2-7: Specification of environmental tests".

[10] ETS 300 132: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 1: Operated by alternating current (ac)derived from direct current sources; and Part 2: Operated by direct current (dc)".

[11] ITU-T Recommendation G.773 (1993): "Protocol suites for Q-interfaces for management of transmission systems".

[12] ETS 300 385: "Radio Equipment and Systems (RES); ElectroMagnetic Compatibility (EMC) standard for digital fixed radio links and ancillary equipment with data rates at around 2 Mbit/s and above".

[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-R Recommendation F.697-1: "Error performance and availability objectives for the local-grade portion at each end of an ISDN connection utilizing digital radio-relay systems".

[17] ETS 300 339: "Radio Equipment and Systems (RES); General Electro-Magnetic Compatibility (EMC) for radio equipment".

[18] ITU-T Recommendation G.729: "Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear-prediction".

[19] ETS 300 324 (1995): "Signalling Protocols and Switching (SPS); V interfaces at the digital Local Exchange (LE) V5.1 interface for the support of Access Network (AN); Part 1: V5.1 interface specification, Part 5: Structure and Test Purposes (TSS&TP) specification for the network layer (LE side) and Part 7: Structure and Test Purposes (TSS&TP) specification for the data link layer".

[20] ETS 300 347 (1994): "Signalling Protocols and Switching (SPS); V interfaces at the digital Local Exchange (LE) V5.2 interface for the support of Access Network (AN) Part 1: V5.2 interface specification and Part 2: Protocol Implementation Conformance Statement (PICS) proforma".

[21] ITU-R Recommendation F.1191: "Bandwidths and unwanted emissions of digital radio-relay systems".

[22] EN 301 126-1 and -2: "Conformance testing for Radio Relay Systems; Part 1: Point to Point Equipment Parameters; Part 2: Additional Parameters for P-MP Equipment".

[23] ERC Recommendation 12-08: "Harmonized radio frequency channel arrangements and blocks allocations for medium and high capacity systems in the band 3 600 MHz to 4 200 MHz".

[24] ITU-T Recommendation G.131: "Control of talker echo".

[25] ITU-T Recommendation G.962: "Access digital line section for ISDN primary rate at 2 048 kbit/s".

3 Symbols and abbreviations

3.1 Symbols

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

Hz	Hertz
kHz	kiloHertz
MHz	MegaHertz
GHz	GigaHertz
kbit/s	kilobits per second
Mbit/s	Megabits per second
ms	millisecond
dB	deciBel
dBm	deciBel relative to 1 milliwatt

3.2 Abbreviations

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

BER	Bit Error Ratio
CCS	Central Controller Station
CS	Central Station
CRS	Central Radio Station
EMC	Electromagnetic Compatibility
ERC	European Radiocommunications Committee
ISDN	Integrated Services Digital Network
PRBS	Pseudo-Random Binary Sequence
RS	Repeater Station
TDMA	Time Division Multiple Access
TMN	Telecommunications Management Network
TS	Terminal Station
LD CELP	Low Delay Code Excited Linear Prediction
MOS	Mean Opinion Score
QDU	Quantization Distortion Unit
TSH	Terminal Station High frequency
TSL	Terminal Station Low frequency
RS	Repeater Station
RSC	Repeater Station Crossband
TE	Terminal Equipment
TX	Transmitter

4 General system architecture

4.1 Sub-system types

A system could consist of several sub-systems as follows (see figure 1):

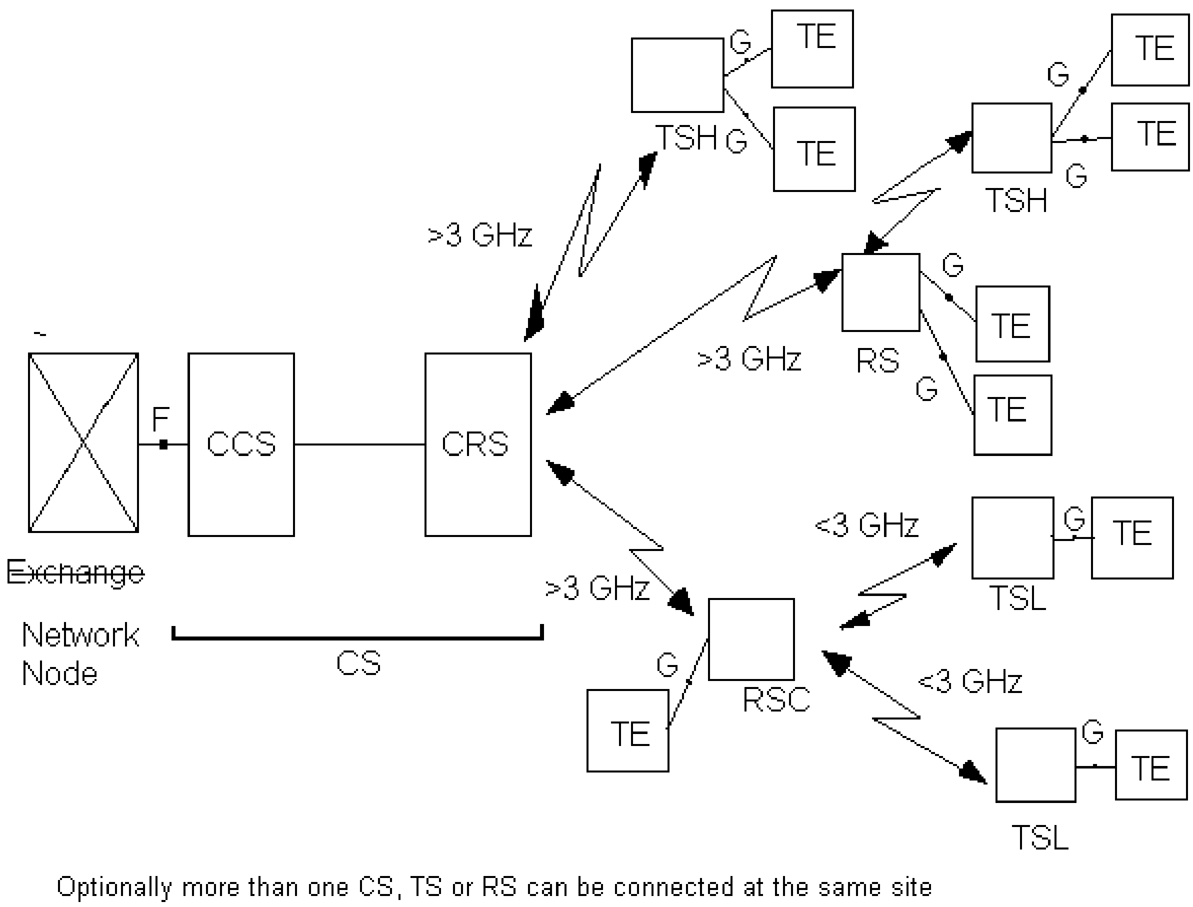


Figure 1: General system architecture

CS: The Central Station, which interfaces the network. It can be integrated or divided into two units:

i) the Central Controller Station (CCS);

ii) the Central Radio Station (CRS);

TS: The Terminal Station (outstations with user interfaces). These are sub-divided into two types:

i) **TSH:** (Terminal Station High frequency), i.e. > 3 GHz; and

ii) **TSL:** (Terminal Station Low frequency), i.e. < 3 GHz.

RS: The Repeater Station (radio repeater outstations with or without user interfaces). The repeater station can be divided into two types:

i) **RS:** (Repeater Station), > 3 GHz; and

ii) **RSC:** (Repeater Station with Crossband), i.e. the frequency is transformed to a frequency in another band which is below or above 3 GHz.

The central station performs the interconnection with the local switching exchange (network node) carrying out a concentration function by sharing the total number of available channels in the system. The central station is linked either directly to all Terminal Stations or via Repeater Stations (RS) by microwave transmission paths. Whenever an existing digital transmission link is available, the network implementation can be optimized by separating the CCS installed at the network node site and the CRS.

The general characteristics which are typical for P-MP systems are considered in the present document. These characteristics have been categories under four headings:

1) system characteristics;

2) radio characteristics;

3) type of services/user equipment and network interfaces;

4) power supply, mechanical and environmental characteristics.

4.2 System characteristics

The following characteristics shall be used:

4.2.1 System capacity

The system traffic carrying capacity shall be below 0,5 Mbit/s or n x 2 Mbit/s (n = 1or 2).

4.2.2 Transmission error performance

Equipment shall be designed in order to meet network performance and availability requirements specified by ITU-T Recommendation G.821 [5] following the criteria defined in ITU-R Recommendation F.697-1 [16] for the local grade portion of the digital connection.

4.2.3 Round trip delay

The round trip delay for a 64 kbit/s 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 with ITU-T Recommendation G.131 [24] shall be ensured.

4.2.4 Transparency

The system shall be fully transparent: the network node and the user equipment (points A and B in the Reference Model) communicate with each other without being aware of the radio link. The system shall be transparent to analogue or digital subscriber equipment signalling and to voiceband data signals. However, advantage may be taken of coding methods at rates lower than 64 kbit/s to conserve radio spectrum, provided that a means to maintain the above transparency is used.

At least one of the following standard coding methods could be employed:

64 kbit/s: according to ITU-T Recommendation G.711 [13], which will provide full transparency and permit a direct digital interface to digital switches;

32 kbit/s: according to ITU-T Recommendation G.726 [14];

16 kbit/s: according to ITU-T Recommendation G.728 [15] for Low Delay Code Excited Linear Prediction (LD CELP);

8 kbit/s: according to ITU-T Recommendation G.729 [18].

Other voice coding methods may be employed if the quality (measured for example in Quantization Distortion Units (QDU) or Mean Opinion Score (MOS)) shall be equivalent to the above.

4.2.5 TMN interface

TMN interface, if any, should be in accordance with ITU-T Recommendation G.773 [11].

4.2.6 Synchronization

Systems employing digital interfaces shall include methods enabling internal and external synchronization to the network. Synchronization tolerance should meet the requirements of ITU-T Recommendation G.703 [2].

5 Radio characteristics

5.1 Frequency bands

Bands allocated to the fixed service in the range 3 GHz to 11 GHz shall be used.

5.2 Proposed channel arrangement

Table 1 gives details of proposed bands and channel spacings which have been considered within CEPT and the European Radiocommunications Committee (ERC).

Table 1: Frequency bands

Frequency band	Band limits	Transmit/receive spacing (applies to channels/blocks)
3,5 GHz	3,4 GHz to 3,6 GHz	50 MHz or 100 MHz, ERC Recommendation 14-03 [7]
3,7 GHz	3,6 GHz to 3,8 GHZ	50 MHz or 100 MHz ERC Recommendation 12-08 [23]
10,5 GHz	10,15 GHz to 10,3 GHz paired with 10,5 GHz to 10,65 GHz	350 MHz, ERC Recommendation 12-05 [8]

Table 2: Channel spacing

Minimum Bit Rate (Mbit/s)	< 0,5	2	4
Channel spacing (MHz)	ERC Recommendations14-03 [7], 12-08 [23] and 12-05 [8]	1,75/2	3,5

5.3 Transmitter (TX) characteristics

5.3.1 TX power range

The maximum value of output power, referred to point C' of the RF block diagram in figure 2 shall not exceed 35 dBm.

If for proper operation of the system or for regulatory purposes, a reduced range of output power is required, then a built in or added means of adjustment shall be provided.

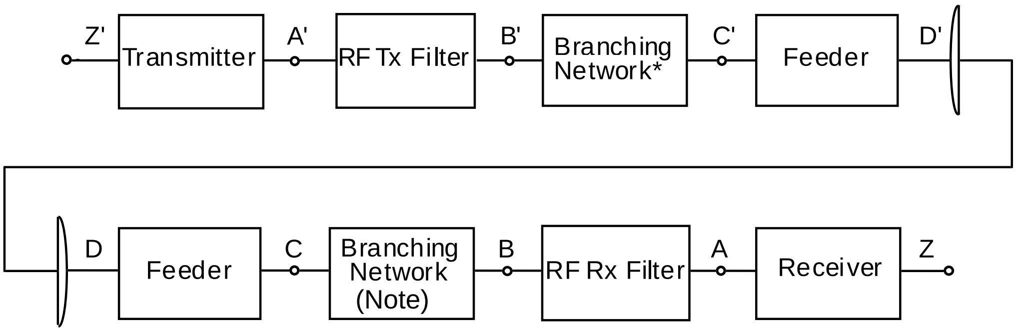
The tolerance value around the nominal or selected value of output power is ± 1 dB.

The transmitted output power means the value measured when the output is connected to a dummy load, i.e. power meter or spectrum analyser. The transmitted carrier shall be modulated with a signal representing the normal traffic, under all conditions of loading and services.

Two different measurement methods can be used:

1) spectrum analyser with resolution bandwidth and video bandwidth greater than 1 MHz; or

2) power meter.



NOTE: Points B and C and B' and C' will coincide if branching networks are not used.

Figure 2: Radio Frequency (RF) block diagram

5.3.2 Automatic Transmit Power Control (ATPC)

ATPC is considered to be 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 a fixed value for system performance;
- ATPC set at the nominal output power declared by the manufacturer.

5.3.3 Spectrum mask

Spectrum masks are given in figure 3.

The transmitted output power spectrum is defined as: the spectrum when modulated with a signal representing the normal traffic, under all conditions of loading and services.

The spectrum measurement at point C' of the system block diagram shall be performed with the "maximum hold" function selected on the spectrum analyser.

The reference level of the output spectrum means that the 0 dB level is the top of the modulated spectrum.

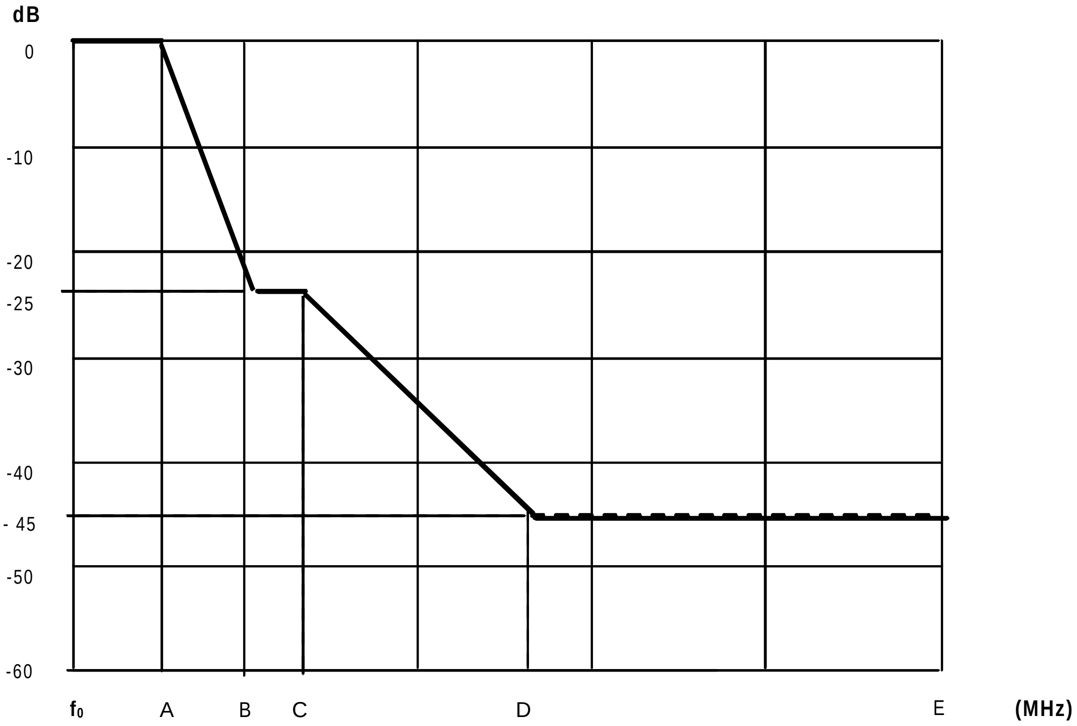


Figure 3: Power spectrum mask (fo = actual carrier frequency)

Table 3: Reference frequencies for spectrum mask

		Frequency offset (MHz)				
Minimum bitrate (Mbit/s)	**Channel spacing, (MHz)**	**A**	**B**	**C**	**D**	**E**
< 0,5	(note)	1,7 × Symbol Rate (Mbaud)	2,6 × Symbol Rate (Mbaud)	3,6 × Symbol Rate (Mbaud)	6,4 × Symbol Rate (Mbaud)	10 × Symbol Rate (Mbaud)
2	1,75	0,75	1,15	1,6	2,8	4,375
2	2	0,85	1,3	1,8	3,2	5,0
4	3,5	1,5	2,5	3,7	6,8	8,75

NOTE: TDMA systems with minimum bit rates below 0,5 Mbit/s may use various channel spacings within blocks of slots assigned to an operator according to ERC Recommendations 14-03 [7], 12-05 [8] or 12-08 [23]. The manufacturer should declare the system traffic bit rate, symbol rate and channel spacing, from which the break points A, B, C and D for the spectrum mask can be calculated.

Table 4: Spectrum analyser settings

Resolution bandwidth	Video bandwidth	Sweep time	Sweep width
30 kHz	300 Hz	10 s	10 MHz

5.3.4 Transmitter spurious emissions

Spurious emissions are defined as emissions at frequencies which are outside the bandwidth defined by nominal carrier frequency ± 2,5 times the relevant channel spacing as in ITU-R Recommendation F.1191 [21].

The levels of spurious emissions shall be expressed in terms of the mean power, supplied by the transmitter to the antenna feeder line at the frequencies of the spurious emission concerned, within a defined resolution bandwidth.

Consequently "noise like" emissions are intended not to exceed the limits in any elementary resolution bandwidth.

When burst emission is used, the mean power of any spurious emission is measured using power averaging over the burst duration.

The frequency range where limits of spurious emissions are defined is from 9 kHz (see nexr paragraph) to 110 GHz or the second harmonic if higher. However, for practical measurements, spurious emissions up to the fifth harmonic of the fundamental frequency should be measured, provided that this does not exceed 26 GHz. The limit values measured at point C' in figure 2 are defined below.

When waveguide is used between reference points A' and C' in figure 2, which length is higher than twice the free space wavelength of cut-off frequency (Fc), the lower limit of measurement will be increased to 0,7 Fc and, when the length is higher than four times the same wavelength, to 0,9 Fc. For the purpose of the spectrum analyzer measurement, the start (or the stop) frequency at the exclusion bandwidth edges shall be higher (or lower) than the edges frequency by an amount equal to BWe/2.

Maximum transmitter spurious emissions allowed for CRS, RS and TS.

A) Terminal stations (TS remote out-station with user interfaces):

-40 dBm: for spurious emissions falling from 9 kHz to 21,2 GHz;

-30 dBm: for spurious emissions falling from 21,2 GHz to 110 GHz or the second harmonic of fundamental emission if higher.

Repeater Stations (RS) of Point-to-multipoint systems will be considered as terminal stations when they are intended for use only in Remote stations not co-located with any other Fixed radio equipment classified as central station.

B) All other stations (master stations and P.P. stations) :

-50 dBm for spurious emissions falling between 9 kHz to 21,2 GHz;

-30 dBm for spurious emissions falling from 21,2 GHz to 110 GHz or the second harmonic of fundamental emission if higher.

The following reference bandwidths shall be used:

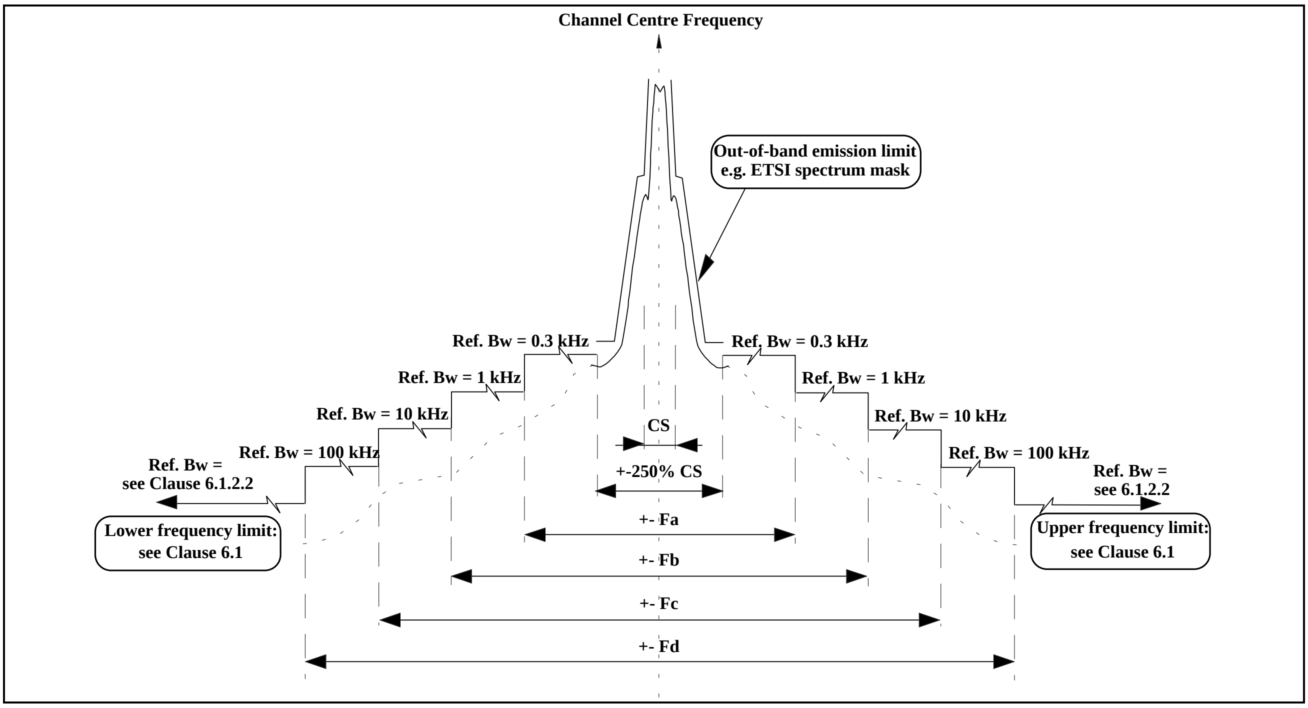
1 kHz for spurious emissions falling between 9 kHz and 150 kHz;

10 kHz for spurious emissions falling between 150 kHz and 30 MHz;

100 kHz for spurious emissions falling between 30 MHz and 1 GHz;

1 MHz for spurious emissions falling above 1 GHz.

However, because in some frequency bands and/or applications narrow band RF filters are not technically or economically feasible, it is necessary to provide one or more steps of reference bandwidth to produce suitable transition area for the spectral density to manage the required limit. Consequently, just outside the ± 250 % of the relevant Channel Spacing, the limit of spurious emissions are defined within the reference bandwidths detailed in the following figure 4 in a comprehensive form.



NOTE: ± Fd frequency steps are not applicable if lower than 1 GHz
± Fc frequency steps are not applicable if lower than 30 MHz
± Fb frequency steps are not applicable if lower than 150 kHz

Figure 4 : Generic Spurious emission limits mask (referred to table 5)

Table 5

Fundamental Emission	**Channel Spacing (CS)**	**Typical Symbol Rate**	**BWr 0,3 kHz**	**BWr 1 kHz**	**BWr 10 kHz**	**BWr 100 kHz**
Frequency	[MHz]	[~Mbaud/s]	Fa [MHz]	Fb [MHz]	Fc [MHz]	Fd [MHz]
Below 21,2 GHz (Terminal stations)	0.01≤CS<1	Fs≅0,06÷0,8	-	-	14	28
	1≤CS<10	Fs≅0,6÷8	-	-	28	56
	CS ≥10	Fs~>6	-	-	49 (*)	56 (*)
Below 21,2 GHz (Other stations)	0.01≤CS<1	Fs≅0,06÷0,8	3,5	7	14	28
	1≤CS<10	Fs≅0,6÷8	-	14 (*)	28	56
	CS ≥10	Fs~>6	-	-	49 (*)	56 (*)

(*): Not applicable where the 250 % of CS exceed these values

Systems with fundamental emissions from 1 GHz to 21,2 GHz

BWr shall be taken equal to 0,3 kHz:

- for CS < 1 MHz in the range from ±250 % of CS to ± 3,5 MHz.

NOTE: Not applicable to TS and RS remote out-stations.

BWr shall be taken equal to 1 kHz:

- for CS < 1 MHz in the range from ± 3,5 MHz to ± 7 MHz; and
- for 1 MHz ≤ CS < 5,6 MHz in the range from ± 250 % of channel spacing to ± 14 MHz.

BWr shall be taken equal to 10 kHz:

- for CS < 1 MHz in the range from ±7 MHz to ±14 MHz; and
- for 1 MHz ≤ CS < 5.6 MHz in the range from ±14 MHz to ±28 MHz; and

- for 5,6 MHz ≤ CS < 10 MHz in the range from ± 250 % of CS to ± 28 MHz; and
- for 10 MHz ≤ CS < 19,6 MHz in the range from ± 250 % of CS to ± 49 MHz; and

NOTE: not applicable to TS and RS remote out-stations.

- for 19,6 MHz ≤ CS < 22,4 MHz in the range from ± 250 % of CS to ± 56 MHz.

5.3.5 Radio frequency tolerance

Maximum radio frequency tolerance shall not exceed the values defined in table 6. These limits include both short-term factors (environmental effects) and long term ageing effects.

In the type test the manufacturer shall state the guaranteed short-term part and the expected ageing part.

Table 6: Permitted frequency tolerance

Frequency band (GHz)	Minimum bit rate (Mbit/s)	Frequency tolerance (kHz)
3,5/3,7	< 0,5	± 4
3,5/3,7	2	± 60
10,5	2	± 220

The equipment should be designed, manufactured, and maintained to ensure that the long term frequency tolerance remains within the limits above.

5.4 Receiver characteristics

5.4.1 Input level range

The input level range shall be greater than 40 dB above the threshold level for a BER of 10^{-3} referred to point C of the system block diagram (figure 2).

5.4.2 Spurious emissions

Spurious emissions are defined as emissions at frequencies which are outside the bandwidth defined by nominal receive frequency ± 2,5 times the relevant channel spacing as in ITU-R Recommendation F.1191 [21].

The frequency range where limits of spurious emissions are defined is from 9 kHz (see note) to 110 GHz or the second harmonic if higher. However, for practical measurements, spurious emissions up to the fifth harmonic of the fundamental frequency should be measured, provided that this does not exceed 26 GHz. The limit values measured at point C in figure 2 are defined in tables 8 and 9.

NOTE: When waveguide is used between reference point A and C, which length is higher than twice the free space wavelength of cut-off frequency (Fc), the lower limit of measurement will be increased to 0,7 Fc and to 0,9 Fc when the length is higher than four times the same wavelength.

The levels of spurious emissions shall be expressed in terms of the mean power, supplied by the receiver to the antenna feeder line at the frequencies of the spurious emission concerned, within a defined resolution bandwidth.

Consequently "noise like" emissions are intended not to exceed the limits in any elementary resolution bandwidth.

Table 7: CS Equipment, including RS Equipment without user interfaces

9 kHz < f <(5 x F_0) or 110 GHz whichever is the lowest	-50 dBm

Table 8: TS Equipment, including RS Equipment with user interfaces

9 kHz < f <(5 x F_0) or 110 GHz whichever is the lowest	-40 dBm

NOTE: Spurious emissions to be measured in a1MHz resolution bandwidth for emissions above 1GHz, in a 100 kHz resolution bandwidth for emissions falling between 30 MHz and 1GHz, in a 10 kHz resolution bandwidth for emissions falling between 150 kHz and 30 MHz and in a 1 kHz resolution bandwidth for emissions falling between 9 kHz and 150 kHz.

5.4.3 Bit Error Rate (BER) performance

BER versus receive signal power level, referred to point C of the system block diagram (figure 2) shall be equal to or better than the values in table 9.

Table 9: BER versus receiver signal level

Traffic Bit rate (Mbit/s)	BER 10^{-3} (dBm)	BER 10^{-6} (dBm)
< 0,5	(note)	(note)
2	-90	-86
4	-87	-83
NOTE: For these systems the reference levels may be calculated from the following formulas: For BER = 10^{-3}: (-93 + $10\log_{10}$[bit rate Mbit/s]) dBm; For BER = 10^{-6}: (-89 + $10\log_{10}$[bit rate Mbit/s]) dBm.		

5.4.4 Interference sensitivity

5.4.4.1 Adjacent channel interference

Adjacent channel sensitivity is defined as the ability of the receiver to receive a wanted signal in the presence of a like unwanted signal which is one channel away.

The two signal generators shall be connected to the receiver input via a combiner, so that the impedance is matched to the nominal impedance.

The wanted signal shall be tuned to the receiver's nominal frequency and be modulated with a Pseudo-Random Binary Sequence (PRBS) signal. The interfering signal shall be turned off while the wanted signal is adjusted to the level corresponding to BER = 10^{-6} as specified in table 9.

The interfering signal shall be tuned one channel away from the wanted signal and be modulated with a PRBS signal which is uncorrelated to the wanted signal.

The interfering signal shall be adjusted to the same level as the wanted signal. The BER shall not be greater than 10^{-5}.

Measurement on both sides of the nominal frequency shall be carried out.

5.4.4.2 Co-channel interference

Co-channel sensitivity is defined as the ability of the receiver to receive a wanted signal in the presence of a like unwanted signal on the same frequency.

The two signal generators shall be connected to the receiver input via a combiner, so that the impedance is in matched to the nominal impedance of the system.

The wanted signal shall be tuned to the receiver's nominal frequency and modulated with a PRBS signal.

The interfering signal shall be turned off while the wanted signal is adjusted to the level corresponding to BER = 10^{-6} as specified in table 9.

The interfering signal shall be tuned to the same frequency as the wanted signal and modulated with a PRBS signal which is uncorrelated to the wanted signal.

The interfering signal shall then be injected at a level which is 23 dB below the wanted signal.

The BER shall not be greater than 10^{-5}.

5.4.5 Image frequency rejection

If applicable image frequency (frequencies) rejection shall be greater than 75 dB.

5.5 Antenna port characteristics

5.5.1 RF interface

The RF interface at reference points C and C' of the system block diagram (figure 2) is to be declared by the manufacturer.

5.5.2 Return loss

The return loss at reference points C and C' of the system block diagram (figure 2) shall be more than 15 dB at the reference impedance for systems with separate antennas.

6 Types of user equipment and service node interfaces

Table 7 lists a range of interfaces for various voice and data services. At least one of these interfaces shall be implemented in a P-MP system covered by the present document.

Table 10: Types of interfaces

User equipment interfaces	
Analogue (2 wires)	ITU-T Recommendation Q.552 [4].
Analogue (4 W + E & M)	ITU-T Recommendation Q.553 [3].
Telex	ITU-T Recommendation R.20 [6]; plus the V series of ITU-T Recommendations.
Digital data port	ITU-T Recommendation G.703 [2]; the H series, he V series, and the X series of ITU-T Recommendations.
ISDN basic rate	ETS 300 012 [1] (note 1).
ISDN primary rate	ITU-T Recommendation G.962 [25]
Service Node Interfaces	
2 Mbit/s	ITU-T Recommendation G.703 [2].
Analogue (2 wires)	ITU-T Recommendation Q.552 [4].
Analogue (4 W + E & M)	ITU-T Recommendation Q.553 [3].
Telex	ITU-T Recommendation R.20 [6]; the V series of ITU-T recommendations.
Digital data port	ITU-T Recommendation G.703 [2]; the H series, the V series, and the X series of ITU-T Recommendations.
ISDN basic rate	ETS 300 012 [1] (note 2).
Digital data port (optical)	ITU-T Recommendation G.957
ISDN + analogue subscribers + leased lines 2 Mbit/s interface	V5.1: ETS 300 324 [19]; V5.2: ETS 300 347 [20]); ITU-T Recommendation G.703 [2].
NOTE 1: ETS 300 012 [1] defines the S ISDN interface which is a customer premises interface and may not be suitable as a terminal station interface. NOTE 2: As noted above, ETS 300 012 [1] is a customer premises interface and may not be suitable as a network interface. However, exchange line interfaces for ISDN basic rate are to be vendor - specific and no single standard interface is available.	

7 Power supply and environmental characteristics

7.1 Power supply

The equipment shall operate from one or more of the power supplies within the ranges specified in tables 11 and 12. The power supply interface shall be in accordance with the characteristics of one or more of the secondary voltages foreseen in ETS 300 132 [10].

Table 11: Power supplies - DC

Nominal voltage	Voltage range
12 V	10,8 V to 13,6 V
24 V	21,8 V to 28,1 V
48 V	40,5 V to 57 V (see ETS 300 132 [10])
60 V	50,0 V to 72 V (see ETS 300 132 [10])

Table 12: Power supplies - AC

For 110 V AC nominal	99 V to 121 V	60 Hz ± 2 Hz
For 230 V AC nominal	207 V to 253 V	50 Hz ± 2 Hz (see ETS 300 132 [10])

7.2 Environmental conditions

The equipment shall meet the environmental conditions set out in ETS 300 019 [9] which defines weather protected and non-weather protected locations classes and test severities.

7.2.1 Equipment within weather protected locations

Equipment intended for operation in temperature controlled locations or partially temperature controlled locations shall meet the requirements of ETS 300 019 [9] classes 3.1 and 3.2 respectively.

Optionally, the more stringent requirements of ETS 300 019 [9] classes 3.3 (non temperature controlled locations), 3.4 (sites with heat trap) and 3.5 (sheltered locations) may be applied.

7.2.2 Equipment for non-weather protected locations

Equipment intended for operation in non weather protected locations shall meet the requirements of ETS 300 019 [9], class 4.1 or 4.1E.

Class 4.1 applies to many European countries and class 4.1E applies to all European countries.

Weather protected equipment conforming to classes 3.3, 3.4 and 3.5 together with an enclosure or cabinet may fulfil the requirements for operating in a non weather protected environment but this is outside the scope of the present document.

7.3 ElectroMagnetic Compatibility (EMC) conditions

For those aspects of EMC not specified in the present document, the conditions of ETS 300 385 [12] shall apply to systems operating at rates of 2 Mbit/s and above. For systems operating below 2 Mbit/s, ETS 300 339 [17] shall apply.

History

Document history				
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