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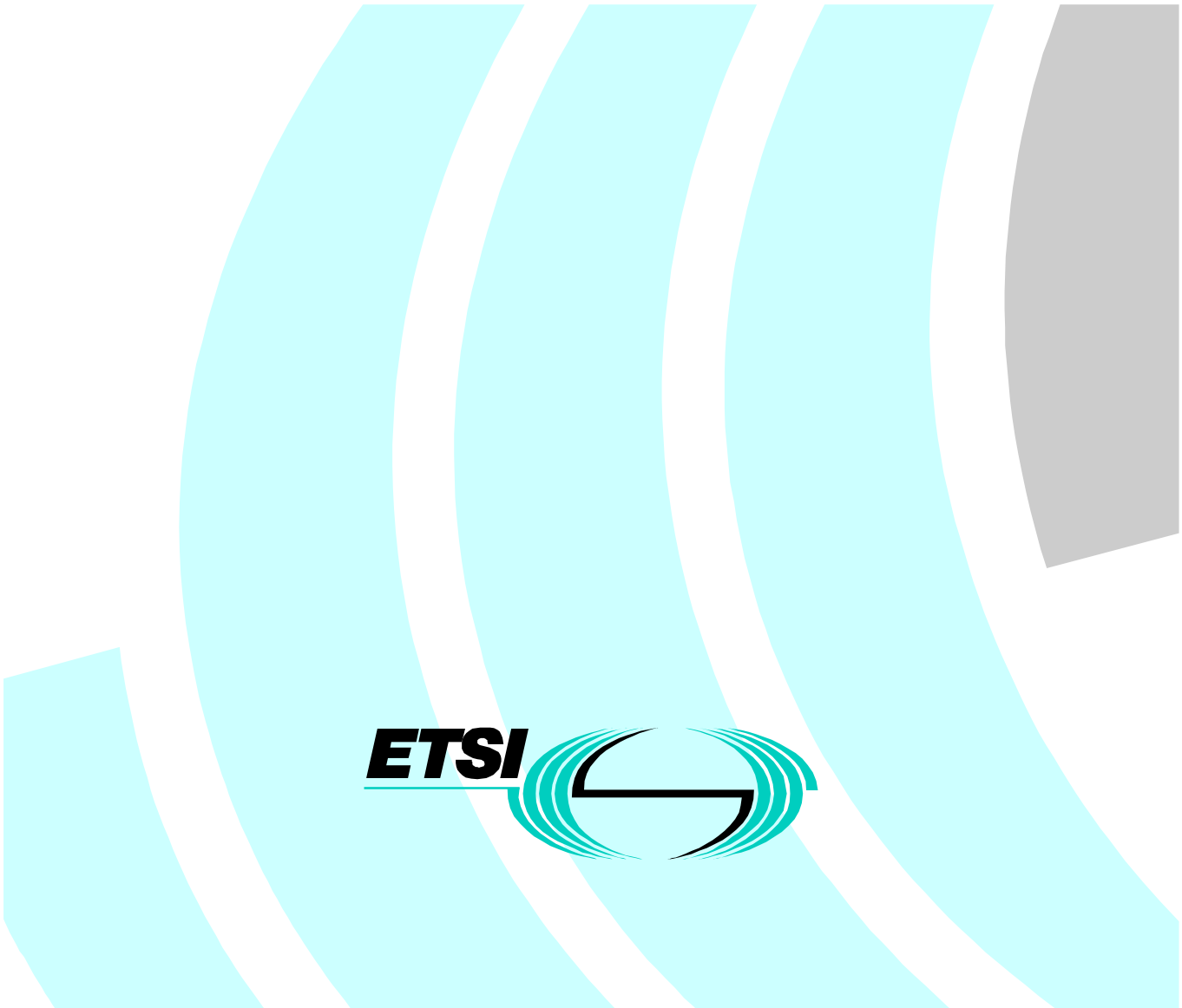
European Standard (Telecommunications series)

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



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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 ETSI standards One-step Approval Procedure.

The present document contains the minimum technical requirements to ensure compatibility of products and conformance with radio regulations across ETSI member states. Radio terminals from different manufacturers are not required 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 and associated interfaces.

The present document is part 2 of a multi-part deliverable covering the 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, as identified below:

Part 1: "Basic parameters";

Part 2: "Frequency Division Multiple Access (FDMA) methods";

Part 3: "Time Division Multiple Access (TDMA) methods";

Part 4: "Direct Sequence Code Division Multiple Access (DS-CDMA) methods";

Part 5: "Multi-Carrier Time Division Multiple Access (TDMA) methods".

The former title of the present document was: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Point-to-multipoint DRRS 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".

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

1 Scope

Point-to-Multipoint (P-MP) Radio Relay Systems may use different access methods. As some technical parameters are different for the various access methods, the standard is divided in four parts.

A basic description of the different access methods and a comparison among them is provided in TR 101 274 [2].

The present document (Time Division Multiple Access Methods, TDMA) is to be used in conjunction with part 1, describing the basic parameters common to all access methods.

The present document specifies the minimum requirements for system parameters of Time Division Multiple Access (TDMA) Point-to-Multipoint (P-MP) Radio Systems in the terrestrial fixed services operating in the band 24,5 GHz to 29,5 GHz (see CEPT Recommendation T/R 13-02 [3]). Only clauses specific to TDMA are described in respect to the clauses stated in EN 301 213-1 [1].

Time Division Multiple Access (TDMA) is an alternative to FDMA and CDMA covered in other parts of the present document. In TDMA point-to-Multipoint (P-MP) systems, a central station broadcasts information to terminal stations in a continuous Time Division Multiplex (TDM) or in a burst TDMA mode. The Terminal stations transmit in TDMA mode. The users may have access to the spectrum by sharing it through time multiplexing.

The version V.1.2.1 mod 1 contains a revision from version V 1.1.1 mod 1 in the areas of:

- introduction of System types codes for regulatory unique reference to the various system types detailed in the present document, refer to new annex A (normative) and related categorization into equipment classes of spectral efficiency;
- introduction of an additional system type C;
- introduction of an additional set of spectrum masks applicable to systems radiating more than one carrier per channel;
- introduction of specifications for discrete CW components which exceed the spectrum masks.

The present version V.1.3.1 mod 1 contains a revision from V.1.2.1 mod 1 in the area of:

- introduction of an additional system type HC (High Coexistence).

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.

[1] ETSI EN 301 213-1: "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 1: Basic parameters".

[2] ETSI TR 101 274: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Point-to-multipoint DRRS in the access network: Overview of different access techniques".

[3] CEPT Recommendation T/R 13-02: "Preferred channel arrangements for fixed services in the range 22.0-29.5 GHz".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document the terms and definitions given in EN 301 213-1 [1] and the following apply:

Gross bit rate: transmission bit rate over the air
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.

3.2 Symbols

For the purposes of the present document the symbols given in EN 301 213-1 [1] apply.

3.3 Abbreviations

For the purposes of the present document the abbreviations given in EN 301 213-1 [1] and the following apply:

CSmin	Minimum practical channel separation (for a given radio-frequency channel arrangement)
DRRS	Digital Radio Relay Systems
HC	High Coexistence

4 General characteristics

4.1 General System Architecture

Refer to EN 301 213-1 [1], clause 4.1.

4.2 Frequency bands and channel arrangements

4.2.1 Channel plan

Bands allocated to the Fixed Service in the range 24,5 GHz to 29,5 GHz shall be used according to CEPT Recommendation T/R 13-02 [3] annexes B and C.

Regulatory bodies may choose appropriate parts of the above mentioned frequency bands for the application for point-to-multipoint systems.

4.2.2 Channel arrangements

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

Table 1: Channel arrangement

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

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 and Type HC 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.

NOTE 3: The present document defines four System Types A, B C and HC. 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);
- HC: lower complexity modulation formats as System Type A (e.g. 4 states or equivalent), but with higher requirements for receiver sensitivity and tolerance to interference;
- B: medium complexity modulation formats (e.g. 16 states or equivalent);
- C: higher complexity modulation formats (e.g. 64 states or equivalent).

NOTE 4: For regulatory purposes in national procedures for licensing radio equipments according to the present document, the above system types shall be identified by the "system type codes" reported in annex A.

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 only in timeslots allocated by control signals from the CS, or on a fixed basis. The TS transmission direction is defined as "upstream". TS may transmit in a TDMA basis. 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.

4.3 Compatibility requirements

Refer to EN 301 213-1 [1], clause 4.3.

4.4 Environmental conditions

Refer to EN 301 213-1 [1], clause 4.4.

4.5 Power supply

Refer to EN 301 213-1 [1], clause 4.5.

4.6 Electromagnetic compatibility conditions

Refer to EN 301 213-1 [1], clause 4.6.

4.7 TMN interfaces

Refer to EN 301 213-1 [1], clause 4.7.

4.8 Synchronization of interface bit rates

Refer to EN 301 213-1 [1], clause 4.8.

4.9 Branching/feeder/antenna requirements

Refer to EN 301 213-1 [1], clause 4.9.

5 System parameters for TDMA P-MP systems

NOTE: Where a reference is made to the number of states of a modulation scheme or to the system type class, an equivalent modulation scheme may be applied, provided the system parameters are met.

5.1 System capacity

Refer to EN 301 213-1 [1], clause 5.1.

5.2 Round trip delay

Refer to EN 301 213-1 [1], clause 5.2.

5.3 Transparency

Refer to EN 301 213-1 [1], clause 5.3.

5.4 Voice coding methods

Refer to EN 301 213-1 [1], clause 5.4.

5.5 Transmitter characteristics

Refer to EN 301 213-1 [1], clause 5.5.

5.5.1 Transmitter output power

Refer to EN 301 213-1 [1], clause 5.5.1.

The maximum mean transmitter output power (average, for CRS, RS and TS) for system type HC shall not exceed +27 dBm.

5.5.2 Transmitter nominal output power

Refer to EN 301 213-1 [1], clause 5.5.2.

The power output of the transmitter at point C and C' (see figure 2 of EN 301 213-1 [1]) shall be appropriate to the mode of use.

a) CRS, or TS "broadcast mode". The power output shall be in conformance with EN 301 213-1 [1];

b) CRS, or TS operating in TDMA burst mode. The power output during a burst shall be in conformance with EN 301 213-1 [1]. The power may be controlled by ATPC;

c) The power setting shall have a maximum tolerance of ±2dB for environmentally protected locations, ±3dB for equipment in non-protected locations and shall not exceed the maximum allowed transmitter output power.

5.5.3 Transmitter power and frequency control

Refer to EN 301 213-1 [1], clause 5.5.3.

5.5.4 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.

5.5.4.1 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.

For systems which radiate a single carrier per channel, the RF spectrum masks shown in figures 1 and 2 and table 2 apply.

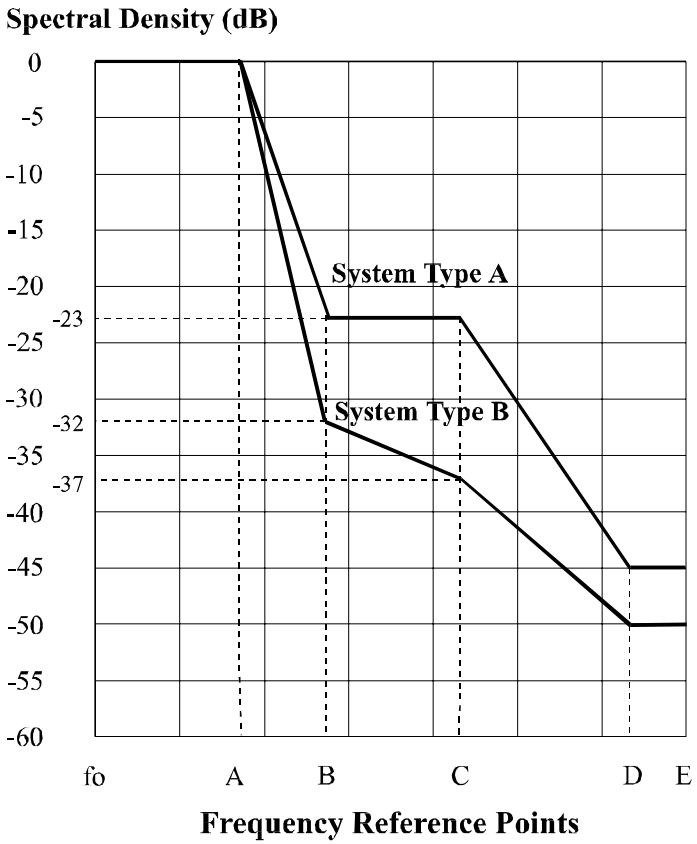


Figure 1: Spectrum masks, types A and B, single carrier (fo = actual carrier frequency)

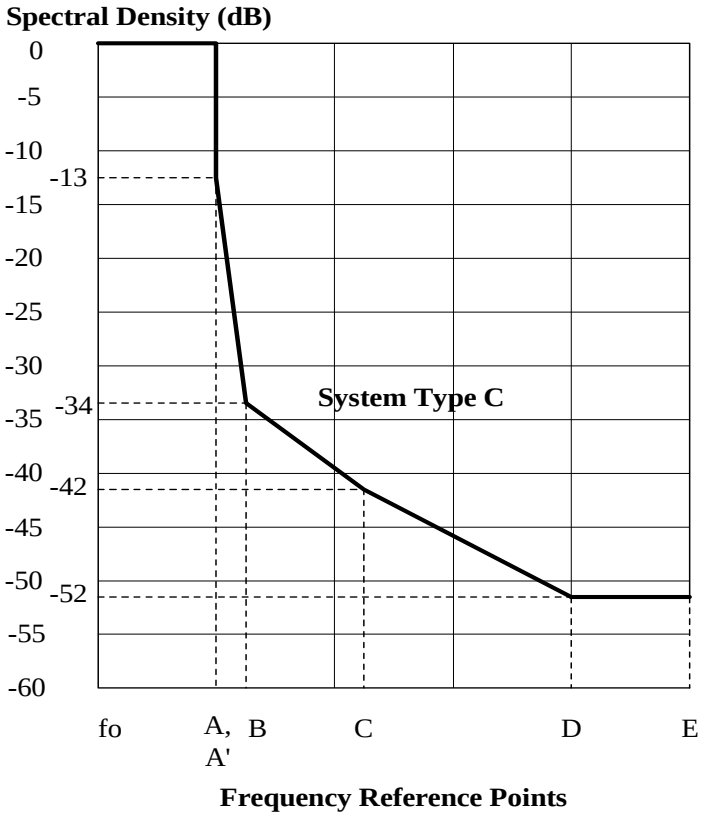


Figure 2: Spectrum mask, type C, single carrier (fo = actual carrier frequency)

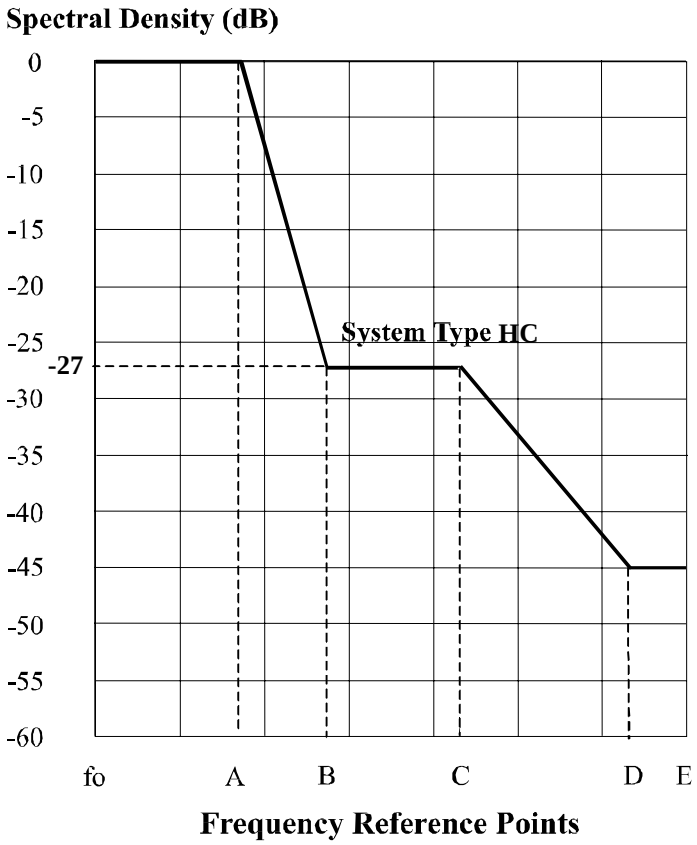


Figure 3: Spectrum mask, type HC, single carrier (fo = actual carrier frequency)

Table 2: Spectrum masks, single carrier

System Type A						
Co-polar channel spacing Points in figure 1	**0 dB Point A [MHz]**		**-23 dB Point B [MHz]**	**-23 dB Point C [MHz]**	**-45 dB Point D [MHz]**	**-45 dB Point E [MHz]**
3,5 MHz	1,5		2,8	3,7	7	8,75
7 MHz	2,8		5,6	7	14	17,5
14 MHz	5,6		11,2	14	28	35
28 MHz	11,2		22,4	28	56	70
56 MHz	22,5		45	56	112	140
112 MHz	45		90	112	224	280
System Type B						
Co-polar channel spacing Points in figure 1	**0 dB Point A [MHz]**		**-32 dB Point B [MHz]**	**-37 dB Point C [MHz]**	**-50 dB Point D [MHz]**	**-50 dB Point E [MHz]**
3,5 MHz	1,5		2,8	3,7	7	8,75
7 MHz	2,8		5,6	7	14	17,5
14 MHz	5,6		11,2	14	28	35
28 MHz	11,2		22,4	28	56	70
56 MHz	22,5		45	56	112	140
112 MHz	45		90	112	224	280
System Type C						
Co-polar channel spacing Points in figure 2	**0 dB Point A [MHz]**	**-13 dB Point A' [MHz]**	**-34 dB Point B [MHz]**	**-42 dB Point C [MHz]**	**-52 dB Point D [MHz]**	**-52 dB Point E [MHz]**
3,5 MHz	1,75	1,75	2,8	3,7	7	8,75
7 MHz	3,5	3,5	5,6	7	14	17,5
14 MHz	7	7	11,2	14	28	35
28 MHz	14	14	22,4	28	56	70
56 MHz	28	28	45	56	112	140
112 MHz	56	56	90	112	224	280
System Type HC						
Co-polar channel spacing Points in figure 3	**0 dB Point A [MHz]**		**-27 dB Point B [MHz]**	**-27 dB Point C [MHz]**	**-45 dB Point D [MHz]**	**-45 dB Point E [MHz]**
3,5 MHz	1,5		2,8	3,7	7	8,75
7 MHz	2,8		5,6	7	14	17,5
14 MHz	5,6		11,2	14	28	35
28 MHz	11,2		22,4	28	56	70
56 MHz	22,5		45	56	112	140
112 MHz	45		90	112	224	280

For systems where more than one identically modulated carrier is radiated from the same transmitter within each channel, the RF spectrum masks shown in figure 3 and table 3 apply.

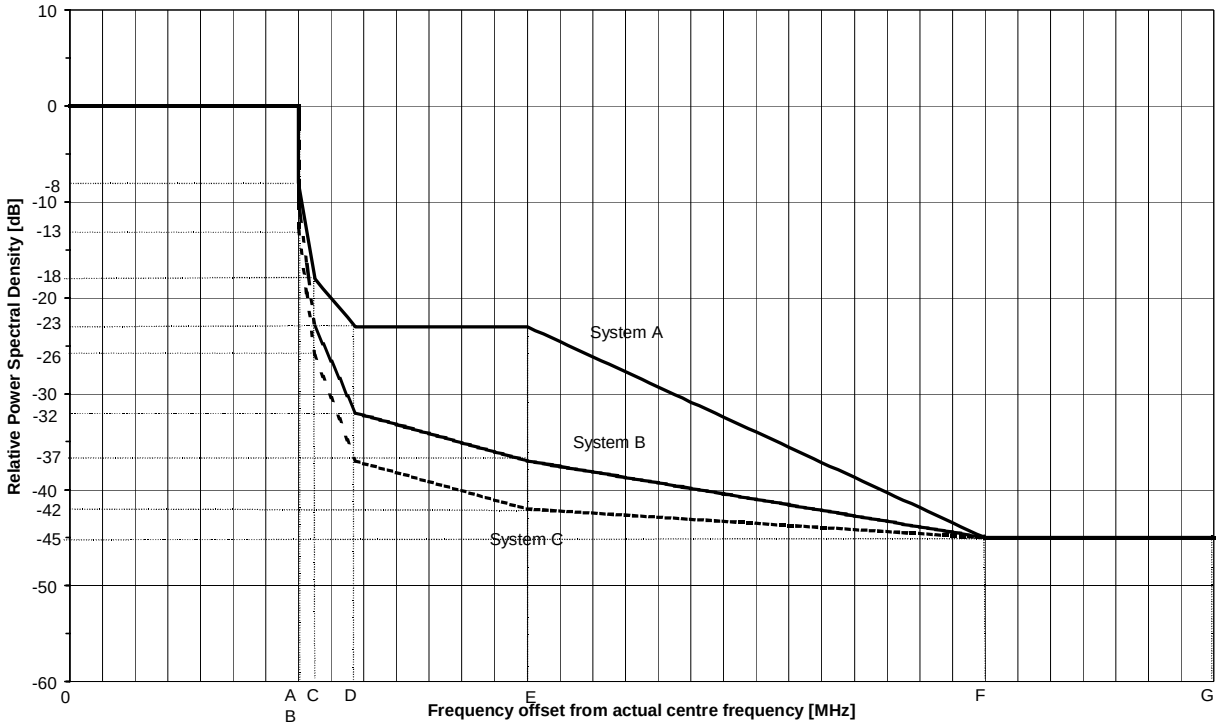


Figure 4: Spectrum masks, multiple carrier per channel (fo = channel centre frequency)

Table 3: Spectrum masks, multiple carrier per channel

System Type A							
Co-polar channel spacing Points in figure 3	**0 dB Point A [MHz]**	**-8 dB Point B [MHz]**	**-18 dB Point C [MHz]**	**-23 dB Point D [MHz]**	**-23 dB Point E [MHz]**	**-45 dB Point F [MHz]**	**-45 dB Point G [MHz]**
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
System Type B							
Co-polar channel spacing Points in figure 3	**0 dB Point A [MHz]**	**-10 dB Point B [MHz]**	**-23 dB Point C [MHz]**	**-32 dB Point D [MHz]**	**-37 dB Point E [MHz]**	**-45 dB Point F [MHz]**	**-45 dB Point G [MHz]**
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
System Type C							
Co-polar channel spacing Points in figure 3	**0 dB Point A [MHz]**	**-13 dB Point B [MHz]**	**-26 dB Point C [MHz]**	**-37 dB Point D [MHz]**	**-42 dB Point E [MHz]**	**-45 dB Point F [MHz]**	**-45 dB Point G [MHz]**
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

The spectrum analyser settings for measuring the RF-spectrum masks are listed in table 4.

Table 4: Spectrum analyser settings for RF power spectrum measurement

	Central Stations (CRS) and Repeater Stations						Terminal Stations
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: 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 ≈ 50 us the recommended settings are IF bandwidth ≈ 30 kHz and video bandwidth ≈ 10 kHz.
For other burst durations, the recommended settings are as following:
- if bandwidth ≈ 30 kHz x 50 us/(burst duration in us);
- video bandwidth ≈ 10 kHz x 50 us/(burst duration in us).

The manufacturer shall declare the burst duration and agree the spectrum analyser settings with the administration concerned.

5.5.4.2 RF-spectrum density mask for the terminal station and the repeater station

The RF spectrum masks for the TS and RS shall comply with the spectrum mask of the CRS (see figures 1, 2, and 3).

5.5.4.3 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:

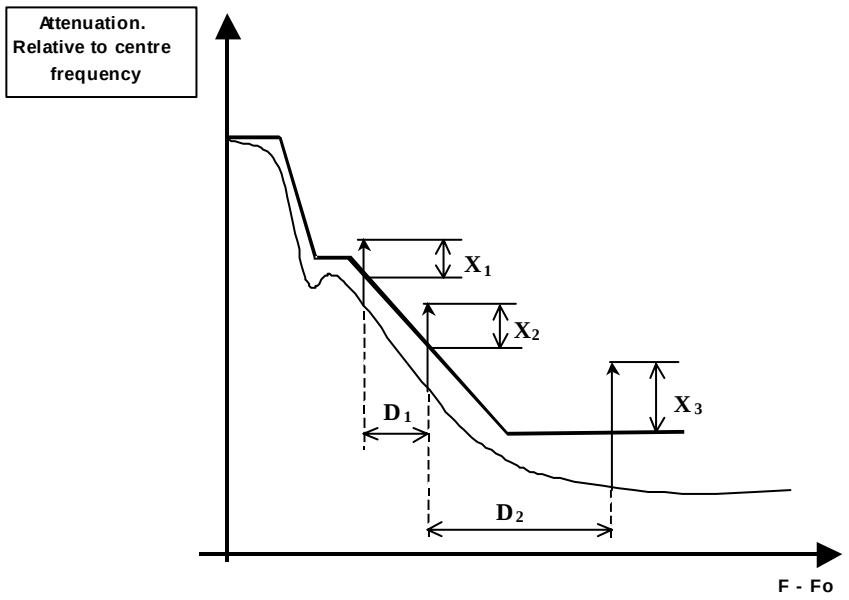
- exceed the mask by a factor more than {10 log (CSmin/IFbw) - 10} dB;
- be spaced each other in frequency by less than CSmin.

Where:

- CSmin is the minimum practical channel separation for the given radio-frequency channel arrangement;
- CSmin = 1 750 kHz for both 26 GHz and 28 GHz bands.

IFbw is the recommended resolution IF bandwidth, expressed in kHz, reported in table 4.

Figure 5 shows a typical example of this requirement.



X_1, X_2, X_3 [dB] $\leq 10\log(CSmin/IFbw) - 10$

$D_1, D_2 \geq CSmin$

Figure 5: CW lines exceeding the spectrum mask (typical example)

5.5.5 Tx local oscillator frequency arrangements

Refer to EN 301 213-1 [1], clause 5.5.5.

5.5.6 Spurious emissions (external)

Refer to EN 301 213-1 [1], clause 5.5.6.

5.5.7 Radio frequency tolerance

Refer to EN 301 213-1 [1], clause 5.5.7.

5.6 Receiver characteristics

Refer to EN 301 213-1 [1], clause 5.6.

5.6.1 Rx local oscillator frequency arrangements

Refer to EN 301 213-1 [1], clause 5.6.1.

5.6.2 Spurious emissions (external)

Refer to EN 301 213-1 [1], clause 5.6.2.

5.6.3 Receiver IF

Refer to EN 301 213-1 [1], clause 5.6.3.

5.7 System performance

All parameters are referred to reference points B or C of figure 2 of EN 301 213-1 [1]. All measurements shall be carried out with the test signals defined in clause 5.5 of EN 301 213-1 [1] and under full load conditions and, when applicable, with full load on all carriers transmitted by the same equipment.

5.7.1 Dynamic level range

The BER shall be less than 10^{-3} for a dynamic level range which shall exceed 50 dB. The dynamic level range shall be declared by the manufacturer.

5.7.2 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 the table 5. 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 5: BER Performance thresholds

System Type A						
Co-polar channel spacing	3,5 MHz	7 MHz	14 MHz	28 MHz	56 MHz	112 MHz
Channel bit rate (Mbit/s)	4 Mbit/s	8 Mbit/s	16 Mbit/s	32 Mbit/s	64 Mbit/s	128 Mbit/s
$1x10^{-3}$	-83 dBm	-80 dBm	-77 dBm	-74 dBm	-71 dBm	-68 dBm
$1x10^{-6}$	-79 dBm	-76 dBm	-73 dBm	-70 dBm	-67 dBm	-64 dBm
System Type B						
Co-polar channel spacing	3,5 MHz	7 MHz	14 MHz	28 MHz	56 MHz	112 MHz
Channel bit rate (Mbit/s)	8 Mbit/s	16 Mbit/s	32 Mbit/s	64 Mbit/s	128 Mbit/s	256 Mbit/s
$1x10^{-3}$	-75 dBm	-72 dBm	-69 dBm	-66 dBm	-63 dBm	-60 dBm
$1x10^{-6}$	-71 dBm	-68 dBm	-65 dBm	-62 dBm	-59 dBm	-56 dBm
System Type C						
Co-polar channel spacing	3,5 MHz	7MHz	14 MHz	28 MHz	56 MHz	112 MHz
Channel bit rate (Mbit/s)	12 Mbit/s	24 Mbit/s	48 Mbit/s	96 Mbit/s	192 Mbit/s	384 Mbit/s
$1x10^{-3}$	-68 dBm	-65 dBm	-62 dBm	-59 dBm	-56 dBm	-53 dBm
$1x10^{-6}$	-65 dBm	-62 dBm	-59 dBm	-56 dBm	-53 dBm	-50 dBm
System Type HC						
Co-polar channel spacing	3.5 MHz	7 MHz	14 MHz	28 MHz	56 MHz	112 MHz
Channel bit rate (Mbit/s)	4 Mbit/s	8 Mbit/s	16 Mbit/s	32 Mbit/s	64 Mbit/s	128 Mbit/s
1x10E-3	-88 dBm	-85 dBm	-82 dBm	-79 dBm	-76 dBm	-73 dBm
1x10E-6	-85 dBm	-82 dBm	-79 dBm	-76 dBm	-73 dBm	-70 dBm

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

NOTE: For (1+1) HSB systems the thresholds above for system type HC must be degraded by 3 dB.

5.7.3 Equipment residual BER (RBER)

See EN 301 213-1 [1], clause 5.7.3.

5.7.4 Interference sensitivity

5.7.4.1 Co-channel interference (external)

The limits of co-channel interference (external) shall be as in table 6, 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 6: Co-channel interference sensitivity

Description	BER = 10^{-6}	
Threshold degradation	1 dB	3 dB
Signal to Interference level	S/I [dB]	S/I [dB]
System Type A	23	19
System Type B	30	26,5
System Type C	36	32,5
System Type HC	19	16

5.7.4.2 Adjacent channel interference (external)

The limits of adjacent channel interference (external) shall be as given in table 7 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 7: Adjacent channel interference sensitivity

Description	BER = 10^{-6}	
Threshold degradation	1 dB	3 dB
Signal to Interference level	S/I [dB]	S/I [dB]
System Type A	0	-4
System Type B	0	-4
System Type C	0	-4
System Type HC	-10	-13

5.7.4.3 CW interference

See EN 301 213-1 [1], clause 5.7.4.3.

5.7.5 Distortion sensitivity

See EN 301 213-1 [1], clause 5.7.5.

6 Types of interfaces at the user equipment and the network node

See EN 301 213-1 [1], clause 6.

Annex A (normative): System type codes for regulatory procedures

System types reported in the present document shall be identified with the codes reported in table A.1.

Table A.1: System type codes for radio equipments reported in EN 301 213-3, relevant to regulatory procedures for national licensing

System type ↓	Channel spacing [MHz] ↓	CRS Bit-rate [Mbit/s] ↓	Frequency band (note) ↓	System type codes ↓
A	3,5	4	B1	01
			B2	02
	7	8	B1	03
			B2	04
	14	16	B1	05
			B2	06
	28	32	B1	07
			B2	08
	56	64	B1	09
			B2	10
	112	128	B1	11
			B2	12
B	3,5	8	B1	13
			B2	14
	7	16	B1	15
			B2	16
	14	32	B1	17
			B2	18
	28	64	B1	19
			B2	20
	56	128	B1	21
			B2	22
	112	256	B1	23
			B2	24
C	3,5	12	B1	25
			B2	26
	7	24	B1	27
			B2	28
	14	48	B1	29
			B2	30
	28	96	B1	31
			B2	32
	56	192	B1	33
			B2	34
	112	384	B1	35
			B2	36
HC	3,5	4	B1	37
			B2	38
	7	8	B1	39
			B2	40
	14	16	B1	41
			B2	42
	28	32	B1	43
			B2	44
	56	64	B1	45
			B2	46
	112	128	B1	47
			B2	48

NOTE: Option B1 refers to systems operating in frequency band 24 500 MHz to 26 500 MHz (ERC Recommendation T/R 13-02 [3] annex B).
Option B2 refers to systems operating in frequency band 27 500 MHz to 29 500 MHz (ERC Recommendation T/R 13-02 [3] annex C).

Annex B (informative): Bibliography

- ETSI ETS 300 019: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".
- ETSI 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".
- ETSI ETS 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".
- ETSI EN 301 021: "Fixed Radio Systems; Point-to-multipoint equipment; Time division Multiple access (TDMA); Point-to-Multipoint digital radio systems bands in the range 3 GHz to 11 GHz"
- ETSI EN 301 132: "Integrated Services Digital Network (ISDN); Security tools (SET) for use within telecommunication services".
- ETSI EN 301 215: "Fixed Radio Systems; Point to Multipoint Antennas; Antennas for point-to-multipoint fixed radio systems in the 11 GHz to 60 GHz band".
- 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".
- 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".
- IEC 60154-2: "Flanges for waveguides. Part 2: Relevant specifications for flanges for ordinary rectangular waveguides".
- ITU-R Recommendation F.1249-1: "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".
- ITU-T Recommendation G.131: "Control of talker echo".
- ITU-T Recommendation G.711: "Pulse code modulation (PCM) of voice frequencies".
- ITU-T Recommendation G.726: "40, 32, 24, 16 kbit/s adaptive differential pulse code modulation (ADPCM)".
- ITU-T Recommendation G.728: "Coding of speech at 16 kbit/s using low-delay code excited linear prediction".
- ITU-T Recommendation G.729 Annex A: "C source code and test vectors for implementation verification of the G.729 reduced complexity 8 kbit/s CS-ACELP speech coder".
- ITU-T Recommendation G.773: "Protocol suites for Q-interfaces for management of transmission systems".
- ITU-T Recommendation G.810: "Definitions and terminology for synchronization networks".
- ITU-T Recommendation G.812: "Timing requirements of slave clocks suitable for use as node clocks in synchronization networks".
- ITU-T Recommendation G.813: "Timing characteristics of SDH equipment slave clocks (SEC)".
- ITU-T Recommendation G.823: "The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy".
- ITU-T Recommendation G.825: "The control of jitter and wander within digital networks which are based on the synchronous digital hierarchy (SDH)".

- ITU-T Recommendation O.151: "Error performance measuring equipment operating at the primary rate and above".
- ITU-T Recommendation O.181: "Equipment to assess error performance on STM-N interfaces".

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