

**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**



Reference

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Postal address

F-06921 Sophia Antipolis Cedex - FRANCE

Office address650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16
Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Internetsecretariat@etsi.fr
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Contents

Intellectual Property Rights.....	5
Foreword	5
1 Scope.....	6
2 References.....	6
3 Definitions, symbols and abbreviations	7
3.1 Definitions.....	7
3.2 Symbols.....	7
3.3 Abbreviations.....	7
4 General characteristics	7
4.1 General System Architecture.....	7
4.2 Frequency bands and channel arrangements	7
4.2.1 Channel plan.....	7
4.2.2 Channel arrangements	7
4.3 Compatibility requirements.....	8
4.4 Environmental conditions	8
4.5 Power supply.....	8
4.6 Electromagnetic compatibility conditions.....	8
4.7 TMN interfaces	8
4.8 Synchronization of interface bit rates.....	8
4.9 Branching/feeder/antenna requirements.....	8
5 System parameters for TDMA P-MP systems	9
5.1 System capacity.....	9
5.2 Round trip delay.....	9
5.3 Transparency.....	9
5.4 Voice coding methods.....	9
5.5 Transmitter characteristics	9
5.5.1 Transmitter output power	9
5.5.2 Transmitter nominal output power	9
5.5.3 Transmitter power and frequency control.....	9
5.5.4 RF spectrum mask	10
5.5.4.1 RF spectrum mask for the central radio station	10
5.5.4.2 RF-spectrum mask for the terminal station and the repeater station	14
5.5.5 Tx local oscillator frequency arrangements.....	14
5.5.6 Spurious emissions (external).....	14
5.5.7 Radio frequency tolerance	14
5.6 Receiver characteristics.....	14
5.6.1 Rx local oscillator frequency arrangements.....	14
5.6.2 Spurious emissions (external).....	14
5.6.3 Receiver IF.....	15
5.7 System performance	15
5.7.1 Dynamic level range.....	15
5.7.2 BER as a function of Receiver input Signal Level (RSL).....	15
5.7.3 Equipment residual BER (RBER)	15
5.7.4 Interference sensitivity	15
5.7.4.1 Co-channel interference (external)	15
5.7.4.2 Adjacent channel interference (external).....	16
5.7.4.3 CW interference	16
5.7.5 Distortion sensitivity.....	16

6	Types of interfaces at the user equipment and the network node	16
Annex A (normative):	System type codes for regulatory procedures.....	17
	Bibliography	18
	History	20

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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 European Standard 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
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Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

1 Scope

Point-to-Multipoint Radio Relay Systems (P-MP) 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 sections specific to TDMA are described in respect to the paragraphs 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 present 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.

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, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, subsequent revisions do apply.
- 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] 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 the fixed services in the range 22,0 GHz to 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] apply.

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] apply.

4 General characteristics

4.1 General System Architecture

Refer to EN 301 213-1 [1] subclause 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

NOTE 1: The minimum bit rate for transmission and reception is defined as the gross bit rate. The gross bit rate is defined as the 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 an unique relation to the symbol rate through the implemented modulation format.

NOTE 2: Systems may offer a combination of Type A, Type B, and 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.

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.

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] subclause 4.3.

4.4 Environmental conditions

Refer to EN 301 213-1 [1] subclause 4.4.

4.5 Power supply

Refer to EN 301 213-1 [1] subclause 4.5.

4.6 Electromagnetic compatibility conditions

Refer to EN 301 213-1 [1] subclause 4.6.

4.7 TMN interfaces

Refer to EN 301 213-1 [1] subclause 4.7.

4.8 Synchronization of interface bit rates

Refer to EN 301 213-1 [1] subclause 4.8.

4.9 Branching/feeder/antenna requirements

Refer to EN 301 213-1 [1] subclause 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] subclause 5.1.

5.2 Round trip delay

Refer to EN 301 213-1 [1] subclause 5.2.

5.3 Transparency

Refer to EN 301 213-1 [1] subclause 5.3.

5.4 Voice coding methods

Refer to EN 301 213-1 [1] subclause 5.4.

5.5 Transmitter characteristics

Refer to EN 301 213-1 [1] subclause 5.5.

5.5.1 Transmitter output power

Refer to EN 301 213-1 [1] subclause 5.5.1.

5.5.2 Transmitter nominal output power

Refer to EN 301 213-1 [1] subclause 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 ± 2 dB for environmentally protected locations, ± 3 dB 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] subclause 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 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 below apply:

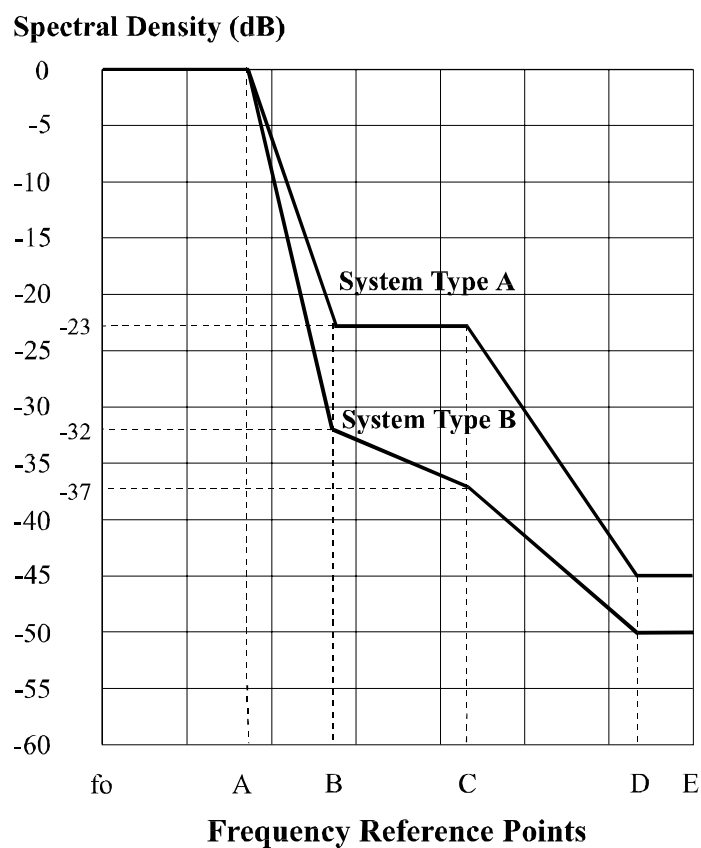


Figure 1: Spectrum masks, types A and B, single carrier (f_0 = actual carrier frequency)

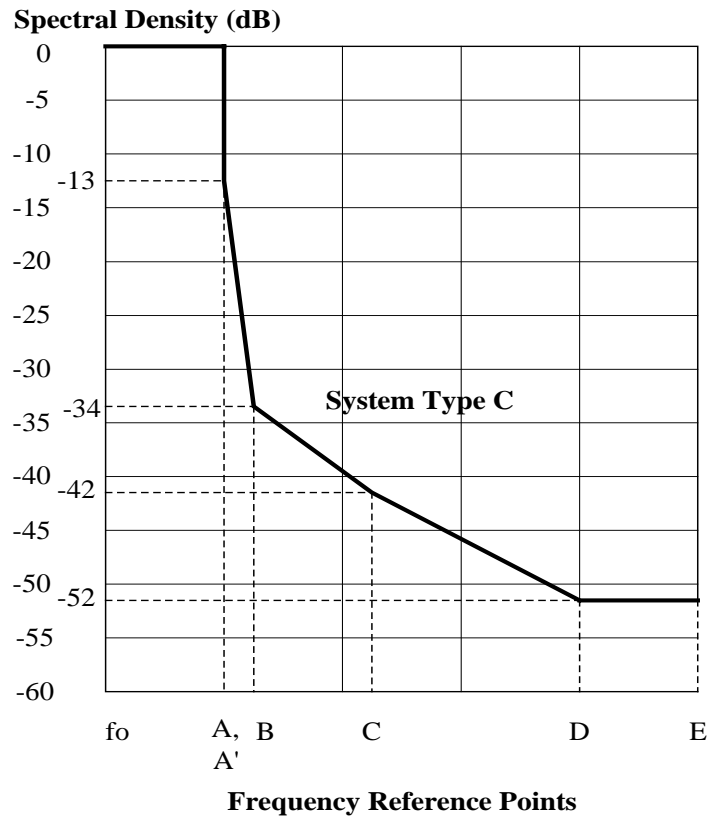


Figure 2: Spectrum mask, type C, single carrier (f_0 = actual carrier frequency)

Table 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 MHz		19 MHz	25 MHz	45 MHz	70 MHz
56 MHz	18 MHz		32 MHz	40 MHz	70 MHz	140 MHz
112 MHz	36 MHz		64 MHz	80 MHz	140 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

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.

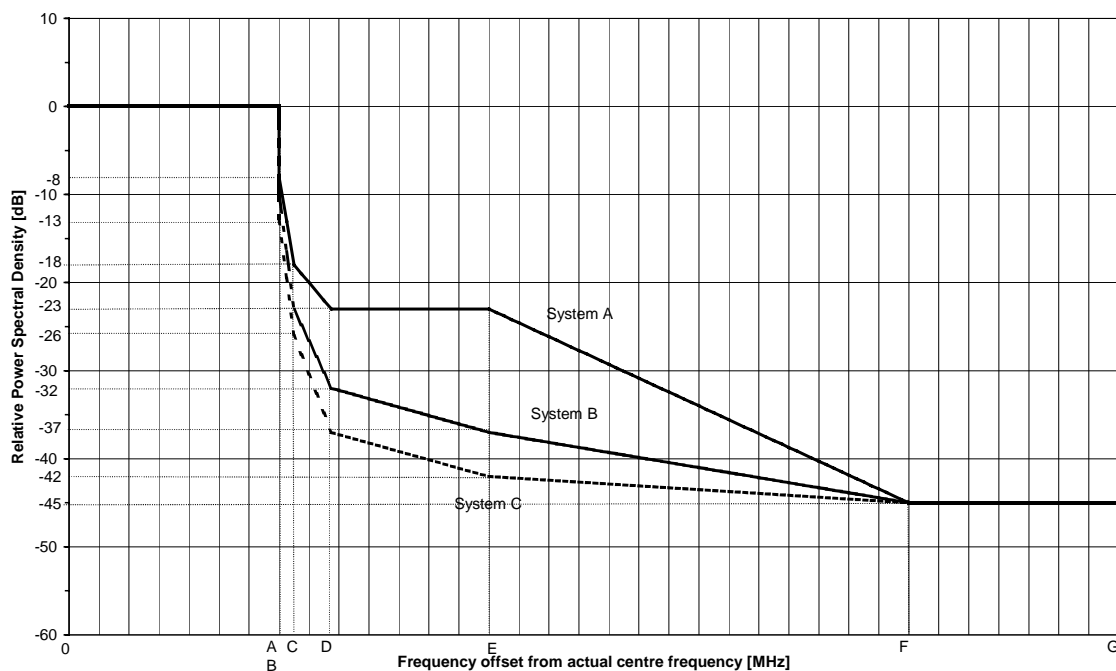


Figure 3: Spectrum masks, multiple carrier per channel (f_o = channel centre frequency)

Table 3: Spectrum masks, multiple carrier per channel

System Type A							
Co-polar chan. 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 chan. 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 chan. 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

RF channel spacing. (MHz)	3,5	7	14	28	56	112
Centre frequency	actual	actual	actual	Actual	Actual	actual
Sweep width (MHz)	20	40	80	160	320	640
Scan time	auto	auto	auto	Auto	Auto	auto
IF bandwidth (kHz)	30	30	30	100	100	300
Video bandwidth (kHz)	0,1	0,3	0,3	0,3	0,3	1,0

5.5.4.2 RF-spectrum 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).

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 pulse durations, the recommended settings are as following:

- if bandwidth ≈ 30 kHz x 50us/(pulse duration in us);
- video bandwidth ≈ 10 kHz x 50us/(pulse duration in us);
- the supplier has to declare the settings.

5.5.5 Tx local oscillator frequency arrangements

Refer to EN 301 213-1 [1] subclause 5.5.5.

5.5.6 Spurious emissions (external)

Refer to EN 301 213-1 [1] subclause 5.5.6.

5.5.7 Radio frequency tolerance

Refer to EN 301 213-1 [1] subclause 5.5.7.

5.6 Receiver characteristics

Refer to EN 301 213-1 [1] subclause 5.6.

5.6.1 Rx local oscillator frequency arrangements

Refer to EN 301 213-1 [1] subclause 5.6.1.

5.6.2 Spurious emissions (external)

Refer to EN 301 213-1 [1] subclause 5.6.2.

5.6.3 Receiver IF

Refer to EN 301 213-1 [1] subclause 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 subclause 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
1×10^{-3}	-83 dBm	-80 dBm	-77 dBm	-74 dBm	-71 dBm	-68 dBm
1×10^{-6}	-79 dBm	-76 dBm	-73 dBm	-70 dBm	-67 dBm	-64 dBm
System Type B						
Co-polar channel spacing	3,5 MHz	7MHz	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
1×10^{-3}	-75 dBm	-72 dBm	-69 dBm	-66 dBm	-63 dBm	-60 dBm
1×10^{-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
1×10^{-3}	-68 dBm	-65 dBm	-62 dBm	-59 dBm	-56 dBm	-53 dBm
1×10^{-6}	-65 dBm	-62 dBm	-59 dBm	-56 dBm	-53 dBm	-50 dBm

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

5.7.3 Equipment residual BER (RBER)

See EN 301 213-1 [1] subclause 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 subclause 5.7.2.

Table 6: Co-channel interference sensitivity

Description	BER = 10 ⁻⁶	
	1 dB	3 dB
Threshold degradation		
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

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 subclause 5.7.2.

Table 7: Adjacent channel interference sensitivity

Description	BER = 10 ⁻⁶	
	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

5.7.4.3 CW interference

See EN 301 213-1 [1] subclause 5.7.4.3.

5.7.5 Distortion sensitivity

See EN 301 213-1 [1] subclause 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 1) ↓	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

NOTE: Option B1 refers to systems operating in frequency band 24500-26500 MHz (ERC Recommendation, T/R 13-02 [3] annex B.

Option B2 refers to systems operating in frequency band 27500-29500 MHz (ERC Recommendation, T/R 13-02 [3] annex C.

Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

- ETSI ETS 300 019: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".
- ETSI EN 300 339: "Electromagnetic compatibility and Radio spectrum Matters (ERM); General ElectroMagnetic Compatibility (EMC) for radio communications 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: "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".
- 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".
- IEC 60154-2: "Flanges for waveguides. Part 2: Relevant specifications for flanges for ordinary rectangular waveguides".
- 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".
- ITU-T Recommendation G.131: "Control of talker echo".
- ITU-T Recommendation G.711: "Pulse code modulation (PCM) of voice frequencies".
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- ITU-T Recommendation G.729: "C source code and test vectors for implementation verification of the G.729 8 kbit/s CS-ACELP speech coder".
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- 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".
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- ITU-T Recommendation G.823: "The control of jitter and wander within digital networks which are based on the 2 048 kbit/s hierarchy".
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- 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".
- 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".

History

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