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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 2: Frequency Division Multiple Access (FDMA) methods**



Reference

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Foreword

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

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 radio-relay equipment and associated interfaces.

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

Part 1: "Basic parameters";

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

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".

Parts 2 to 4 are intended to be used in conjunction with part 1, describing the basic parameters common to all access methods.

A basic description of the different access methods and a comparison among them are provided in TR 101 274 [3].

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 2: Frequency Division Multiple Access (FDMA) methods".

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Date of adoption of this EN:	25 August 2000
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1 Scope

The present document specifies the minimum requirements for system parameters of Frequency Division Multiple Access (FDMA) Point-to-Multipoint (P-MP) Radio Systems in the terrestrial fixed services operating in the band 24,5 GHz - 29,5 GHz (CEPT Recommendation T/R 13-02[4]). Only sections specific to FDMA are described in respect to the clauses stated in EN 301 213-1[1].

The FDMA P-MP system will transmit a RF-signal from the customer site to the Central Radio Station (CRS) only utilizing a spectral bandwidth corresponding to that capacity which is requested from and assigned to the customer by Preassigned Multiple Access or by Demand Assigned Multiple Access. The Central Radio Station receives from each customer site a single modulated carrier being processed independently within the CRS. Thus the CRS is receiving a FDMA P-MP signal.

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] 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] EN 301 213-4: "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 4: Direct Sequence Code Division Multiple Access (DS-CDMA) methods".
- [3] 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".
- [4] CEPT Recommendation T/R 13-02: "Preferred channel arrangements for the Fixed Services in the range 22,0 - 29,5 GHz".
- [5] ITU-R Recommendation F.[AD/9D]: "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".

3 Definitions, symbols and abbreviations

See EN 301 213-1 [1], clause 3.

4 General characteristics

4.1 General System Architecture

See EN 301 213-1 [1], 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 [4] annexes B and C. The transmit/receive spacing shall be 1 008 MHz.

Regulatory bodies may choose appropriate parts of the above mentioned frequency bands for the application for P-MP systems.

4.2.2 Channel arrangements

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

Table 1: Channel arrangement

Channel spacing (MHz)	3,5	7	14	28	56	112
Min. CRS transmission capacity (kbit/s) 4 state modulation (or equivalent)	42 × 64	84 × 64; 4 × 2 048	8 × 2 048	16 × 2 048	32 × 2 048	64 × 2 048 or STM-1
Min. CRS transmission capacity (kbit/s) 8 state modulation (or equivalent)	62 × 64	5 × 2 048	10 × 2 048	20 × 2 048	40 × 2 048	80 × 2 048
Min. CRS transmission capacity (kbit/s) 16 state modulation (or equivalent)	84 × 64; 4 × 2 048	8 × 2 048	16 × 2 048	32 × 2 048	64 × 2 048 or STM-1	128 × 2 048 or 2 × STM-1
Min. CRS transmission capacity (kbit/s) 64 state modulation (or equivalent)	6 × 2 048	12 × 2 048	24 × 2 048	48 × 2 048	96 × 2 048 or STM-1	192 × 2 048 or 2 × 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 42 × 64 kbit/s a capacity of 21 × 128 kbit/s can be transmitted.						

4.3 Compatibility requirements

See EN 301 213-1 [1], 4.3.

4.4 Environmental Conditions

See EN 301 213-1 [1], 4.4.

4.5 Power Supply

See EN 301 213-1 [1], 4.5.

4.6 Electromagnetic compatibility conditions

See EN 301 213-1 [1], 4.6.

4.7 TMN interfaces

See EN 301 213-1 [1], 4.7.

4.8 Synchronization of interface bit rates

See EN 301 213-1 [1], 4.8.

4.9 Branching/feeder/antenna requirement

See EN 301 213-1 [1], 4.9.

5 System parameters for FDMA P-MP systems

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

5.1 System Capacity

See EN 301 213-1 [1], 5.1.

5.2 Round Trip Delay

See EN 301 213-1 [1], 5.2.

5.3 Transparency

See EN 301 213-1 [1], 5.3.

5.4 Voice Coding methods

See EN 301 213-1 [1], 5.4.

5.5 Transmitter characteristics

See EN 301 213-1 [1], 5.5.

5.5.1 Transmitter output power

See EN 301 213-1 [1], 5.5.1.

5.5.2 Transmitter nominal output power

See EN 301 213-1 [1], 5.5.2.

5.5.3 Transmitter power and frequency control

See EN 301 213-1 [1], 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.

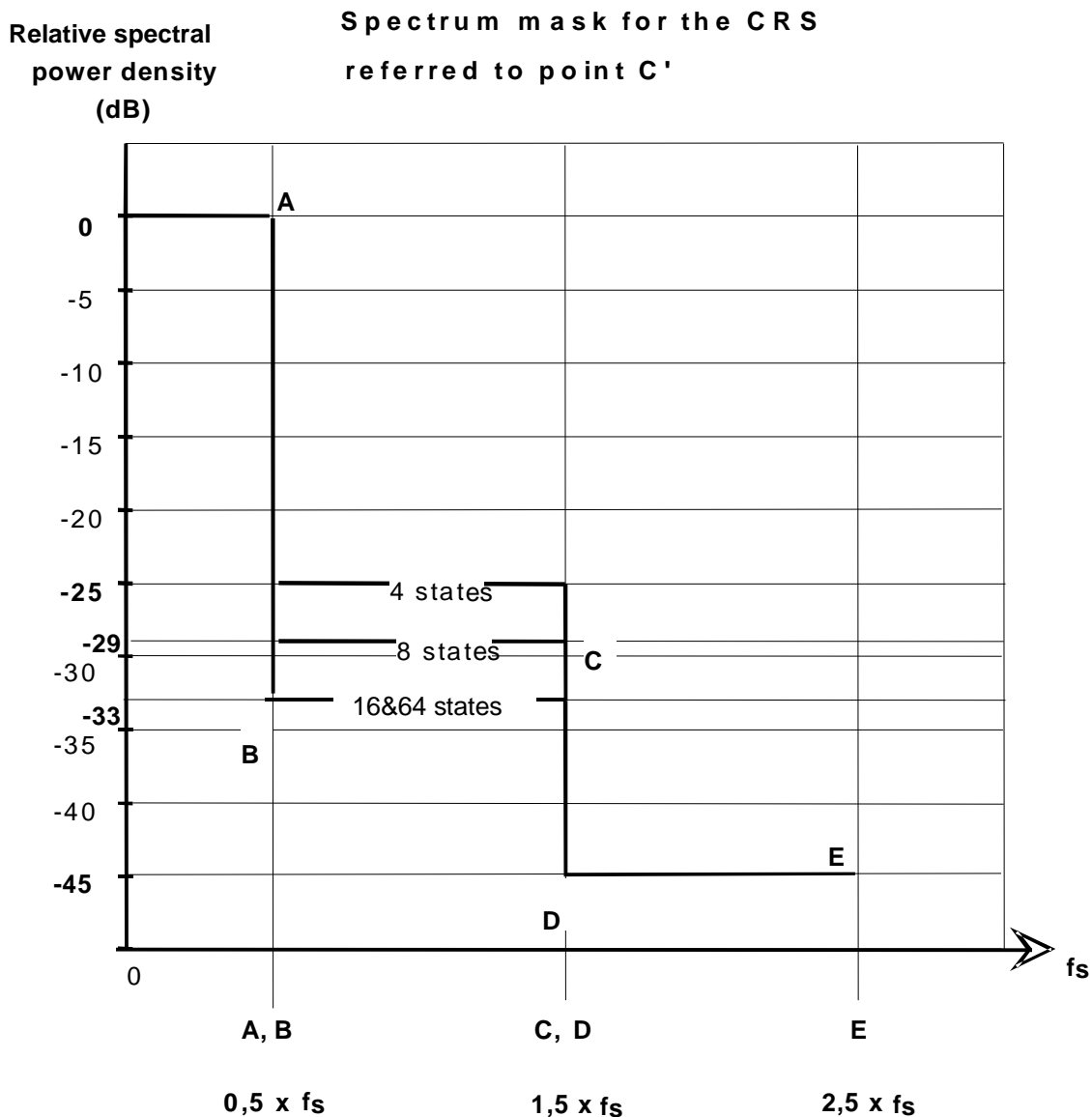
5.5.4.1 RF spectrum mask for the Central Radio Station

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

- 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 of EN 301 213-1 [1]) declared by the manufacturer. The input signal shall be in accordance to the interfaces stated in table 3 of EN 301 213-1 [1].
- 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 +35 dBm is not exceeded and/or ITU-R Recommendation F. [AD/9D] [5] is fulfilled.

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



NOTE 1: f_s : RF channel spacing

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

Figure 1: Spectrum Mask for the CRS

The spectrum analyser settings for measuring the RF-spectrum masks are listed in table 2.

Table 2: Spectrum Analyser Settings for RF Power Spectrum Measurement

RF channelspacing f_s (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	100
Video bandwidth (kHz)	0,3	0,3	0,3	0,3	0,3	0,3

5.5.4.2 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 1) of the CRS.

5.5.5 Tx Local Oscillator frequency arrangements

See EN 301 213-1 [1], 5.5.5.

5.5.6 Spurious emissions (external)

See EN 301 213-1 [1], 5.5.6.

5.5.7 Radio frequency tolerance

See EN 301 213-1 [1], 5.5.7.

5.6 Receiver characteristics

See EN 301 213-1 [1], 5.6.

5.6.1 Rx Local Oscillator frequency arrangements

See EN 301 213-1 [1], 5.6.1.

5.6.2 Spurious emissions (external)

See EN 301 213-1 [1], 5.6.2.

5.6.3 Receiver IF

See EN 301 213-1 [1], 5.6.3.

5.7 System performance

All parameters are referred to reference points B or C of figure 2 (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.

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 along with the modulation level at which this dynamic range is achieved.

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

Table 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	64	4	8	16	64
-95	-94	-89	-83	-92,5	-91,5	-86,5	-80,5

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})) = $-89,5 + 10 \times \log_{10} b$
- 64-state modulation schemes:
 - RSL (dBm(for BER 10^{-3})) = $-86 + 10 \times \log_{10} b$
 - RSL (dBm(for BER 10^{-6})) = $-83,5 + 10 \times \log_{10} b$

NOTE: b = bit rate (Mbit/s).

5.7.3 Equipment Background BER

See EN 301 213-1 [1], 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 4, 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 4: Co-channel Interference Sensitivity

Description	BER = 10^{-6}	
	1 dB	3 dB
Threshold degradation	1 dB	3 dB
Signal to Interference level	S/I [dB]	S/I [dB]
4 state modulation	17,5	13,5
8 state modulation	19,5	15,5
16 state modulation	26,5	22,5
64 state modulation	38	34

5.7.4.2 Adjacent channel interference (external)

The limits of adjacent channel interference (external) shall be as given in table 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 subclause 5.7.2.

Table 5: Adjacent Channel Interference Sensitivity

Description	BER = 10^{-6}	
	1 dB	3 dB
Threshold degradation	1 dB	3 dB
Signal to Interference level	S/I [dB]	S/I [dB]
4 state modulation	-15,5	-19,5
8 state modulation	-13,5	-17,5
16 state modulation	-6,5	-10,5
64 state modulation	0	-4

5.7.4.3 CW interference

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

5.7.5 Distortion sensitivity

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

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

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

Bibliography

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

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".

History

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