



**SLOVENSKI STANDARD**  
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Fixed Radio Systems; Point-to-point equipment; Parameters for digital radio systems for the transmission of digital signals operating at 52 GHz

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# ETSI EN 301 786 V1.1.2 (2001-05)

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*European Standard (Telecommunications series)*

**Fixed Radio Systems;  
Point-to-point equipment;  
Parameters for digital radio systems  
for the transmission of digital signals  
operating at 52 GHz**

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## Foreword

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

The present document specifies the minimum performance parameters for radio equipment operating in the frequency ranges as detailed in clause 4.1.1.

The former title of the present document was "Transmission and Multiplexing; Digital Radio Relay Systems; Parameters for the DRRS for the transmission of digital signals operating at 52 GHz".

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# 1 Scope

The present document specifies the minimum performance parameters for terrestrial digital fixed service radio communications equipments operating in the 52 GHz frequency band and provides for the following:

- introduction of unique system type codes for regulatory reference to the various system types detailed in the present document, refer to new annex C (normative) and related categories of equipment classes of spectral efficiency;
- payload capacities for spectrum efficiency classes 1 to 4;
- digital services operating in frequency division duplex (FDD) operation only;
- technical specifications relevant to the EMC Directive, detailed in annex B (normative);
- specific antenna radiation patterns as defined in EN 300 833 [11]).

As harmonized channel spacings lower than 14 MHz are not defined in the 52 GHz frequency band at the drafting date of the present document, channel spacings at 7 MHz and 3,5 MHz are shown for information purposes only.

However the present document can be considered as a guideline when national frequency plans based on 7 MHz and 3,5 MHz channel spacings exist.

Digital systems are intended to be used for point-to-point connections in local and regional networks at data rates between 2 Mbit/s and Synchronous Transport Module, level 1 (STM-1).

Digital systems considered in the present document will be able to meet the error performance objectives of the ITU-R national portion of the reference path, i.e. ITU-R Recommendation F.1189 [18] and the error performance objectives detailed in ITU-T Recommendation G.826 [25].

The parameters to be specified fall into two categories:

- a) those that are required to provide compatibility between channels from different sources of equipment on the same route, connected to separate antennas;
- b) parameters defining the transmission quality of the proposed system.

The present document deals with Radio Frequency (RF) and baseband characteristics relevant to low, medium and high capacity Plesiochronous Digital Hierarchy (PDH) transmission systems, and STM-0 and STM-1 Synchronous Digital Hierarchy (SDH) transmission systems. Antenna/feeder system requirements are covered in EN 300 833 [11].

The present document does not contain aspects related to test procedures and test conditions however they are to be found in EN 301 126-1 [3].

As the maximum transmission rate in a given bandwidth depends on system spectral efficiency, different equipment classes are defined:

- |          |   |
|----------|---|
| Class 1: | equipment spectral efficiency based on typically 2-states modulation scheme (e.g. 2-FSK, Gaussian Minimum Shift Keying (GMSK) with discriminator detection, or equivalent); |
| Class 2: | equipment spectral efficiency based on typically 4-states modulation scheme (e.g. 4-FSK, 4-QAM, or equivalent);   |
| Class 3: | equipment spectral efficiency based on typically 8-states modulation scheme (e.g. 8PSK, or equivalent);   |
| Class 4: | equipment spectral efficiency based on typically 16 or 32-states modulation scheme (e.g. 16-QAM, 32-QAM, or equivalent).  |

The above classes are indicative only and do not imply any constraint to the actual modulation format, provided that all the requirements in the present document are met.



Safety aspects are not be considered in the present document. However compliance to CENELEC EN 60950 [33] will be required to comply with the 1999/5/EC Directive (R&TTE).

Technical background for most of the parameters and requirements referred in the present document may be found in TR 101 036-1 [13]

## 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, 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] CEPT /ERC Recommendation 12-11 E (Luxembourg 1999): "Radio frequency channel arrangement for fixed service systems operating in the band 51.4 GHz - 52.6 GHz".
- [2] CEPT/ERC Recommendation 74-01: "Spurious emissions".
- [3] ETSI EN 301 126-1 (V1.1.2): "Fixed Radio Systems; Conformance testing; Part 1: Point-to-point equipment - Definitions, general requirements and test procedures".
- [4] ETSI ETS 300 019: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".
- [5] ETSI ETS 300 132-1: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 1: Operated by alternating current (ac) derived from direct current (dc) sources".
- [6] ETSI ETS 300 132-2: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)".
- [7] ETSI EN 300 385: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for fixed radio links and ancillary equipment".
- [8] ETSI ETS 300 635: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); Radio specific functional blocks for transmission of Mx STM-N".
- [9] ETSI EN 300 645: "Telecommunications Management Network (TMN); Synchronous Digital Hierarchy (SDH) radio relay equipment; Information model for use on Q interfaces".
- [10] ETSI ETS 300 785: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); Radio specific functional blocks for transmission of M x sub-STM-1".
- [11] ETSI EN 300 833: "Fixed Radio Systems; Point to Point Antennas; Antennas for point-to-point fixed radio systems operating in the frequency band 3 GHz to 60 GHz".
- [12] ETSI TR 101 035 (V1.1.3): "Transmission and multiplexing (TM); Synchronous Digital Hierarchy (SDH) aspects regarding Digital Radio Relay Systems (DRRS)".
- [13] ETSI TR 101 036-1 (V1.2.1): "Fixed Radio Systems; Point-to-point equipment; Generic wordings for standards on digital radio systems characteristics; Part 1: General aspects and point-to-point equipment parameters".
- [14] IEC 60154-2: "Flanges for waveguides. Part 2: Relevant specifications for flanges for ordinary rectangular waveguides".

- [15] ITU-R Recommendation F.750: "Architectures and functional aspects of radio-relay systems for SDH-based networks".
- [16] ITU-R Recommendation F.751: "Transmission characteristics and performance requirements of radio-relay systems for SDH-based networks".
- [17] ITU-R Recommendation F.1102: "Characteristics of radio-relay systems operating in frequency bands above about 17 GHz".
- [18] ITU-R Recommendation F.1189: "Error performance objectives for constant bit rate digital paths at or above the primary rate carried by digital radio-relay systems which may form part or all of the national portion of a 27 500 km hypothetical reference path".
- [19] ITU-R Recommendation F.1191: "Bandwidths and unwanted emissions of digital radio-relay systems".
- [20] ITU-T Recommendation G.703: "Physical/electrical characteristics of hierarchical digital interfaces".
- [21] ITU-T Recommendation G.707: "Network node interface for the synchronous digital hierarchy (SDH)".
- [22] ITU-T Recommendation G.773: "Protocol suites for Q-interfaces for management of transmission systems".
- [23] ITU-T Recommendation G.783: "Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks".
- [24] ITU-T Recommendation G.784: "Synchronous digital hierarchy (SDH) management".
- [25] ITU-T Recommendation G.826: "Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate".
- [26] ITU-T Recommendation G.828: "Error performance parameters and objectives for international synchronous digital paths".  
<https://standards.etsi.org/catalog/standards/sist/23b396c8-a454-402c-9931-1f3e269dbbe/sist-en-301-786-v1-1-2-2003>
- [27] ITU-T Recommendation G.861: "Principles and guidelines for the integration of satellite and radio systems in SDH transport networks".
- [28] ITU-T Recommendation G.957: "Optical interfaces for equipments and systems relating to the synchronous digital hierarchy".
- [29] ITU-T Recommendation O.151: "Error performance measuring equipment operating at the primary rate and above".
- [30] ITU-T Recommendation O.181: "Equipment to assess error performance on STM-N interfaces".
- [31] ITU-R Recommendation P.530-6: "Propagation data and prediction methods required for the design of terrestrial line-of-sight systems".
- [32] Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility.
- [33] CENELEC EN 60950: "Safety of information technology equipment".
- [34] ITU-R Recommendations SM.329-8: "Spurious emissions".

## 3 Symbols and abbreviations

### 3.1 Symbols

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

dB	decibel
dB <sub>i</sub>	decibel relative to isotropic radiator
dB <sub>m</sub>	decibel relative to 1 mW
dB <sub>u</sub>	decibel relative to 1 microVolt
dBW	decibel relative to 1 W
GHz	GigaHertz
kHz	kiloHertz
Mbit/s	Mega-bits per second
MHz	MegaHertz
ppm	parts per million
mW	milliWatt
Ω	Ohm

### 3.2 Abbreviations

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

ac	alternating current
ATPC	Automatic Transmit Power Control
AU	Administrative Unit
BBER	Background Block Error Rate
BER	Bit Error Rate
C/I	Carrier to Interference ratio
CMI	Coded Mark Inversion
CW	Continuous Wave
dc	direct current
DRRS	Digital Radio Relay Systems
EIRP	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
ESR	Errored Second Ratio
FDD	Frequency Division Duplex
FSK	Frequency-Shift Keying (modulation)
GMSK	Gaussian Minimum Shift Keying (modulation)
IEC	International Electrotechnical Committee
IF	Intermediate Frequency
IPI	Inter-Port Isolation
LO	Local Oscillator
n.a.	not applicable
PDH	Plesiochronous Digital Hierarchy
PRBS	Pseudo Random Binary Sequence
QAM	Quadrature Amplitude Modulation
RBER	Residual Bit Error Rate
RF	Radio Frequency
RFC	Remote Frequency Control
RL	Return Loss
RSL	Receive Signal Level
RTPC	Remote Transmit Power Control
SDH	Synchronous Digital Hierarchy
SOH	Section OverHead
STM-N	Synchronous Transport Module, level N
STM-0	medium capacity SDH radio transport module (51,840 Mbit/s AU-3 equivalent, also referred as STM-0 by ITU-T Recommendation G.861 [27])
TC	ETSI Technical Committee

TM ETSI TC-Transmission and Multiplexing  
 TMN Telecommunications Management Network  
 XPD cross-Polar Discrimination

## 4 General characteristics

### 4.1 Frequency bands and channel arrangements

#### 4.1.1 Channel arrangements

The equipment shall operate on one or more of the channels as defined below:

The frequency range shall be 51,4 GHz to 52,6 GHz. The channel arrangements shall be in accordance with CEPT/ERC Recommendation 12-11 E (Luxembourg 1999) [1].

Harmonized channel spacings below 14 MHz are not currently defined in the 52 GHz CEPT channel plan. Therefore channel spacings at 7 MHz and 3,5 MHz are shown for information purposes only although these can be considered as a guide for national frequency plans based on 7 MHz and 3,5 MHz channel spacings."

For reader convenience, the basic parameters of the CEPT Recommendation are shown in informative annex A.

#### 4.1.2 Co-polar channel spacing for systems operating on the same route

System bit rates and their relevant channel spacing in the present document are reported in table 1 (for the precise payload bit rates, see clause 5.1).

**Table 1: Digital systems channel spacing for various bit rates**

Channel Spacing [MHz]	Payload Bit Rate [Mbit/s]	2	2 x 2	8	2 x 8	34	51	140 and 155
	Class 1 equipments	7	7	7	14	28	56	
Class 2 equipments	3,5	3,5	3,5	7	14	28	56	
Class 3 equipment							28	
Class 4 equipment				3,5	7	14	14	56

NOTE: n x 2 Mbit/s and n x 34 Mbit/s bit rates may be used where appropriate.

For regulatory purposes in national procedures for licensing radio equipment according to the present document, the above system types shall be identified by the "system type codes" reported in normative annex C.

### 4.2 Compatibility requirements between systems

The compatibility requirements between systems are as follows:

- there shall be no requirement to operate transmitting equipment from one manufacturer with receiving equipment from another;
- there shall not be a requirement to multiplex different manufacturers equipment on the same or on different polarization of the same antenna;
- depending on the application, it shall be possible to operate the system in vertical and/or horizontal polarization, if required by the channel arrangement.