SLOVENSKI STANDARD
SIST EN 300 431 V1.3.1:2003

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Fiksni radijski sistemi ï Oprema tipa toļ ka-toļ ka ï Parametri radijskih sistemov za prenos digitalnih signalov,ki delujejo v frekvenļ nem obmoļ ju od 24,50 GHz do 29,50 GHz

Fixed Radio Systems; Point-to-point equipment; Parameters for radio system for the transmission of digital signals operating in the frequency range 24,50 GHz to 29,50 GHz

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Fixed Radio Systems; Point-to-point equipment; Parameters for radio system for the transmission of digital signals operating in the frequency range 24,50 GHz to 29,50 GHz

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Foreword

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

The clauses containing essential requirements for EC Council Directive 89/336 (EMC Directive) are reported in annex B.

The former title of the present document was: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Point-to-point DRRS operating in the frequency range 24,25 GHz to 29,50 GHz".

National transposition dates	
Date of adoption of this EN:	16 February 2001
Date of latest announcement of this EN (doa):	31 May 2001
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 November 2001
Date of withdrawal of any conflicting National Standard (dow):	30 November 2001

1 Scope

The present document specifies the minimum performance parameters for terrestrial fixed service radio communications equipments operating in the frequency range 24,50 GHz to 29,50 GHz and contains a revision from the previous version, in the areas of:

- introduction of unique system type codes for regulatory reference to the various system types detailed in the present document, refer to new annex C and related categories of equipment classes of spectral efficiency;
- additional systems with higher spectrum efficiency in the new class 4 systems;
- change of spectrum mask and adjacent channel selectivity of STM-0 systems in 28 MHz channel spacing to align to EN 300 639 [34];
- introduction of new spectrum efficiency class 5 for STM-1 capacity for 28 MHz Adjacent Channel Alternate-Polarization (ACAP as class 5a) and Adjacent Channel Co-Polarization (ACCP as class 5b), see examples of the spectrum usage in figures 1.1a and 1.1b;

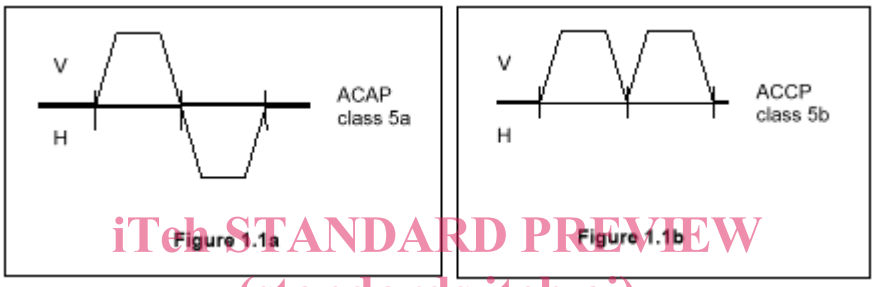

Figure 1.1a Figure 1.1b

- change to spectrum mask for class 4 (140 Mbit/s to 155 Mbit/s) at "f5" to align with the mask used in the 23 GHz and 38 GHz standards;

- technical specifications relevant to the EMC Directive, detailed in annex B.

NOTE: In a previous version (ETS 300 431), there was provision for:

- further options for Grade A digital radio systems (with 112 MHz Channel separation);
- specific antenna radiation patterns (now superseded by EN 300 833 [3]).

These options are not reprinted in the present document as they are considered to be no longer of interest for ETSI members. However, for regulatory purposes, they may still be referenced from ETS 300 431.

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 the Synchronous Transport Module, level 1 (STM-1).

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 either:
   - to separate antennas; or
   - to separate polarizations of the same antenna.

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, STM-0 and STM-1 Synchronous Digital Hierarchy (SDH) transmission systems. Antenna/feeder system requirements are covered in EN 300 833 [3].

For digital systems, with capacities up to 34 Mbit/s, for class 2 equipment there are also two types of equipment specified:

- grade A equipment, intended for applications where moderate frequency congestion is envisaged;
- the deployment of Grade A equipment in new links will be limited and stopped over a period of time. Therefore, it is likely that provision for Grade A equipment will be removed from the present document during the next revision;
- grade B equipment, intended for applications where higher nodal capacity is required.

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 [2].

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

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);

class 5: equipment spectral efficiency based on typically 64 or 128-states modulation scheme (e.g. 64-QAM, 128-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 will not be considered in the present document. However compliance to EN 60950 [35] will be required to comply with Directive 1999/5/EC [36] (R&TTE).

Technical background for most of the parameters and requirements referred in the present document may be found in TR 101 036-1 [21].

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 Recommendation T/R 13-02: "Preferred channel arrangements for fixed services in the range 22,0 GHZ to 29,5 GHz".

[2] ETSI EN 301 126-1: "Fixed Radio Systems; Conformance testing; Part 1: Point-to-point equipment - Definitions, general requirements and test procedures".

[3] 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".

[4] ITU-R Recommendation F.748-3: "Radio-frequency channel arrangements for radio-relay systems operating in the 25, 26 and 28 GHz bands".

[5] ETSI EN 300 645: "Telecommunications Management Network (TMN); Synchronous Digital Hierarchy (SDH) radio relay equipment; Information model for use on Q interfaces".

[6] ETSI ETS 300 019 (all parts): "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".

[7] ETSI ETS 300 132-1 (all parts): "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".

[8] ETSI ETS 300 132-2 (all parts): "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)".

[9] ETSI EN 300 385: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for fixed radio links and ancillary equipment".

[10] ETSI ETS 300 635: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); Radio specific functional blocks for transmission of Mx STM-N".

[11] ETSI ETS 300 785: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); Radio specific functional blocks for transmission of M x sub-STM-1".

[12] ITU-R Recommendation F.750-3: "Architectures and functional aspects of radio-relay systems for SDH-based networks".

[13] ITU-R Recommendation F.751-2: "Transmission characteristics and performance requirements of radio-relay systems for synchronous digital hierarchy SDH-based networks".

[14] ITU-R Recommendation F.1102: "Characteristics of radio-relay systems operating in frequency bands above about 17 GHz".

[15] ITU-R Recommendation F.1189-1: "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".

[16] ITU-R Recommendation F.1191-1: "Bandwidths and unwanted emissions of digital radio-relay systems".

[17] ITU-R Recommendation P.530-8: "Propagation data and prediction methods required for the design of terrestrial line-of-sight systems".

[18] ITU-T Recommendation G.703 (1991): "Physical/electrical characteristics of hierarchical digital interfaces".

[19] ITU-T Recommendation G.707 (1996): "Network node interface for the synchronous digital hierarchy (SDH)".

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

[21] ETSI TR 101 036-1: "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".

[22] IEC 60154-2: "Flanges for waveguides; Part 2: Relevant specifications for flanges for ordinary rectangular waveguides".

[23] ITU-T Recommendation G.783 (1994): "Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks".

[24] ITU-T Recommendation G.784 (1994): "Synchronous digital hierarchy (SDH) management".

[25] ITU-T Recommendation G.826 (1993): "Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate".

[26] ITU-T Recommendation G.708: "Sub STM-0 network node interface for the synchronous digital hierarchy (SDH)".

[27] ITU-T Recommendation G.957 (1995): "Optical interfaces for equipments and systems relating to the synchronous digital hierarchy".

[28] ITU-T Recommendation O.151 (1992): "Error performance measuring equipment operating at the primary rate and above".

[29] ITU-T Recommendation O.181 (1996): "Equipment to assess error performance on STM-N interfaces".

[30] IEC 60153-2: "Hollow metallic waveguides. Part 2: Relevant specifications for ordinary rectangular waveguides".

[31] CEPT/ERC Recommendation 74-01: "Spurious Emissions".

[32] ETSI TR 101 035 (V1.1.3): "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH) aspects regarding Digital Radio Relay Systems (DRRS)".

[33] Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility.

[34] ETSI EN 300 639: "Fixed Radio Systems; Point-to-point equipment; Sub-STM-1 digital radio systems operating in the 13 GHz, 15 GHz and 18 GHz frequency bands with about 28 MHz co-polar and 14 MHz cross-polar channel spacing".

[35] EN 60950: "Safety of information technology equipment including electrical business equipment".

[36] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.

3 Symbols and abbreviations

3.1 Symbols

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

dB	decibel
dBm	decibel relative to 1 milliWatt
GHz	GigaHertz
kHz	kiloHertz
Mbit/s	Megabits per second
MHz	MegaHertz
n.a.	Not Applicable
ppm	parts per million

3.2 Abbreviations

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

ac	alternating current
ACAP	Adjacent Channel Alternate Polarization
ACCP	Adjacent Channel Co-Polarization
ATPC	Automatic Transmit Power Control
AU	Administrative Unit
BB	Base Band
BBER	Background Block Error Rate
BER	Bit Error Rate
C/I	Carrier to Interference ratio
CMI	Coded Mark Inversion
CSmin	minimum practical Channel Separation (for a given radio-frequency channel arrangement)
CW	Continuous Wave
dc	direct current
DRRS	Digital Radio Relay Systems
EIRP	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
ESR	Errored Second Ratio
FSK	Frequency-Shift Keying (modulation)
IF	Intermediate Frequency
IPI	Inter-Port Isolation
LO	Local Oscillator
PDH	Plesiochronous Digital Hierarchy
PRBS	Pseudo Random Binary Sequence
QAM	Quadrature Amplitude Modulation
RBER	Residual BER
RF	Radio Frequency
RFC	Remote Frequency Control
RSL	Receive Signal Level
RTPC	Remote Transmit Power Control
Rx	Receiver
SDH	Synchronous Digital Hierarchy
SOH	Section OverHead
STM-0	medium capacity SDH radio Transport Module 51,840 Mbit/s AU-3 equivalent
STM-N	Synchronous Transport Module, level N
sub-STM-0	low capacity SDH radio Transport Module (n times VC-12 or VC2 equivalent)
TMN	Telecommunications Management Network
Tx	Transmitter
VC	Virtual Container
XPD	cross-Polar Discrimination

4 General characteristics

4.1 Frequency bands and channel arrangements

4.1.1 Channel arrangements

The frequency range is 24,50 GHz to 29,50 GHz. The channel plan shall be in accordance with CEPT Recommendation T/R 13-02 [1] or ITU-R Recommendation F.748-3 [4].

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

4.1.2 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).

NOTE: According to systems characteristics the equipment can be connected either to separate antennas or on a separate polarization to the same antenna.

Table 1: Digital systems channel spacings for various bit rates

	Payload Bit Rate [Mbit/s]⇒	2	2 × 2	8	2 × 8	34	51	140 and 155
Channel Spacings [MHz]	Class 2 equipments	3,5	3,5	7	14	28	56	
	Class 4 equipments			3,5	7	14	14/28	56
	Class 5 equipments							28

NOTE: n × 2 Mbit/s and n × 34 Mbit/s bit rates may be used where appropriate.
n × 2 Mbit/s mapped into SDH VC12 transport bit rates
(sub-STM-0 defined by ITU-T Recommendation G.708 [26]) may be used where appropriate
(e.g. three or four times VC12 into an 8 Mbit/s channel spacing).
The class 2, 2 Mbit/s in 3,5 MHz and the class 4 in 28 MHz reflects equipment more typical to a class 1 (2 Mbit/s) and class 3 (STM-0) system and as a result the adjacent channel interference parameters are more stringent.

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 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 polarization of the same antenna;
- there may be a requirement to multiplex different manufacturers equipment on different polarization of the same antenna. This will not apply to systems with integral 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.

4.3 Performance and availability requirements

Digital equipment shall be designed in order to meet network performance and availability requirements foreseen by ITU-T Recommendation G.826 [25], following the criteria defined in ITU-R Recommendation F.1189-1 [15] for the national portion of the digital connection.

The implication of the link design on the performance is recognized and the general design criteria reported in ITU-R Recommendations P.530-8 [17] and F.1102 [14] shall be applied.

4.4 Environmental conditions

The equipment shall be required to meet the environmental conditions set out in ETS 300 019 [6] which defines weather protected and non-weather protected locations, classes and test severity.

The manufacturer shall state which class the equipment is designed to withstand.