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Fixed Radio Systems; Point-to-point equipment; Parameters for radio systems for the transmission of STM-1 digital signals operating in the 18 GHz frequency band with channel spacing of 55 MHz and 27,5 MHz

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European Standard (Telecommunications series)

**Fixed Radio Systems;
Point-to-point equipment;
Parameters for radio systems for the transmission of STM-1
digital signals operating in the 18 GHz frequency band
with channel spacing of 55 MHz and 27,5 MHz**

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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 interwork at radio frequency (i.e. no common air interface). However, terminals may be combined with other manufacturers' equipment on a Radio Frequency (RF) branching network for operation on different polarizations.

The present document defines the requirements of radio terminal and radio relay equipment and associated interfaces. The requirements for multiplex, network management and antenna/feeder equipment may be addressed elsewhere.

The clauses containing essential requirements for Council Directive 89/336/EEC [30] (EMC Directive) are reported in annex B.

The former title of the present document was: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); High capacity DRRS carrying PDH and 1x Synchronous Transport Module level 1 (1 x STM-1) signals operating in the 18 GHz frequency band with channel spacing of 55 MHz and 27,5 MHz".

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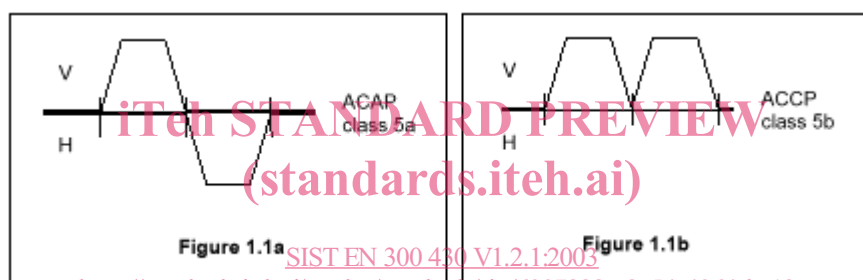
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1 Scope

The present document specifies parameters for high capacity STM-1 digital radio-relay systems designed to operate in the 17,7 GHz to 19,7 GHz band. The channel spacing between adjacent co-polar channels shall be 55 MHz or 27,5 MHz. Operation in the Adjacent Channel Co-Polarization (ACCP) mode for class 4 systems and class 5 systems as defined below with orthogonal polarizations or in the alternated cross-polar mode is foreseen. Additionally for class 4 systems, operation in the Co-Channel Dual Polarized (CCDP) mode with orthogonal polarization is also foreseen. The present document covers both single and multi-channel systems.

The present document specifies the minimum performance parameters for terrestrial fixed service radio communications equipment operating in the frequency range 17,7 GHz to 19,7 GHz and contains a revision from the previous version, in the area of:

- categorization of previously considered equipments into a new spectrum efficiency class 4;
- 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;
- new spectrum efficiency class 5 for STM-1 capacity for 27,5 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:



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Figure 1

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

The applications of these digital radio-relay systems are anticipated to be in the regional and access networks, at data rates of 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
 - separate polarizations of the same antenna; or
 - one polarization of one antenna at a frequency separation of 110 MHz or more, enabling, in addition for class 4 equipment only, interworking of different manufacturers equipment at the same Radio Frequency (RF) branching;
 - this category also includes parameters providing compatibility with the existing radio-relay network.
- b) parameters defining the transmission quality of the proposed system.

The standardization deals with RF and baseband characteristics. Antenna/feeder system requirements are covered in EN 300 833 [33].

Two possible baseband interfaces for SDH systems have to be considered: one for STM-1 and another for 140 Mbit/s signals.

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 [19].

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

- 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 [28] will be required to comply with Directive 1999/5/EC [29] (R&TTE).

Technical background for most of the parameters and requirements referred in the present document may be found in TR 101 036-1 [20].

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.
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- [1] CEPT Recommendation 12-03: "Harmonized radio frequency channel arrangements for digital terrestrial fixed systems operating in the band 17,7 GHz to 19,7 GHz".
 - [2] ITU-R Recommendation F.595-6: "Radio-frequency channel arrangements for radio-relay systems operating in the 18 GHz frequency band".
 - [3] ITU-R Recommendation F.634-4: "Error performance objectives for real digital radio-relay links forming part of the high-grade portion of international digital connections at a bit rate below the primary rate within an integrated services digital network".
 - [4] ITU-R Recommendation F.695: "Availability objectives for real digital radio-relay links forming part of a high-grade circuit within an integrated services digital network".
 - [5] ITU-R Recommendation F.750-3: "Architectures and functional aspects of radio-relay systems for SDH-based networks".
 - [6] ITU-R Recommendation F.751-2: "Transmission characteristics and performance requirements of radio-relay systems for SDH-based networks".
 - [7] ITU-R Recommendation F.1191-1: "Bandwidths and unwanted emissions of digital radio-relay systems".
 - [8] ETSI ETS 300 019-1: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1: Classification of environmental conditions".
 - [9] ETSI ETS 300 019-2: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2: Specification of environmental tests".
 - [10] 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".

- [11] ETSI ETS 300 132-2: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)".
- [12] ITU-T Recommendation G.703: "Physical/electrical characteristics of hierarchical digital interfaces".
- [13] ITU-T Recommendation G.773: "Protocol suites for Q-interfaces for management of transmission systems".
- [14] ITU-T Recommendation G.784: "Synchronous digital hierarchy (SDH) management".
- [15] ITU-T Recommendation G.821: "Error performance of an international digital connection operating at a bit rate below the primary rate and forming part of an integrated services digital network".
- [16] ITU-T Recommendation G.826: "Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate".
- [17] ITU-T Recommendation G.957: "Optical interfaces for equipments and systems relating to the synchronous digital hierarchy".
- [18] ETSI EN 301 489-4: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 4: Specific conditions for fixed radio links and ancillary equipment and services".
- [19] ETSI EN 301 126-1: "Fixed Radio Systems; Conformance testing; Part 1: Point-to-Point equipment - Definitions, general requirements and test procedures".
- [20] 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".
- [21] ETSI ETS 300 635: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); Radio specific functional blocks for transmission of M x STM-N".
- [22] ETSI EN 300 645: "Telecommunications Management Network (TMN); Synchronous Digital Hierarchy (SDH) radio relay equipment; Information model for use on Q interfaces".
- [23] CEPT/ERC Recommendation 74-01: "Spurious emissions".
- [24] ITU-T Recommendation O.151 (1992): "Error performance measuring equipment operating at the primary rate and above".
- [25] ITU-T Recommendation O.181 (1996): "Equipment to assess error performance on STM-N interfaces".
- [26] ETSI TR 101 035: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH) aspects regarding Digital Radio Relay Systems (DRRS)".
- [27] IEC 60154-2: "Flanges for waveguides; Part 2: Relevant specifications for flanges for ordinary rectangular waveguides".
- [28] EN 60950: "Safety of information technology equipment".
- [29] 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.
- [30] Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility.
- [31] ETSI ETS 300 785: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); Radio specific functional blocks for transmission of M x sub-STM-1".
- [32] CEPT Recommendation 13-02: "Preferred channel arrangements for fixed services in the range 22,0 GHz to 29,5 GHz".

- [33] 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".

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
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
CW	Continuous Wave
DRRS	Digital Radio Relay Systems
EMC	ElectroMagnetic Compatibility
ERC	European Radiocommunications Committee
ESR	Errored Seconds Ratio
IF	Intermediate Frequency
IPI	Inter-Port Isolation
LO	Local Oscillator
NFD	Net Filter Discrimination
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
SDH	Synchronous Digital Hierarchy
SOH	Section OverHead
STM-N	Synchronous Transport Module, level N
TMN	Telecommunications Management Network
XPD	cross-Polar Discrimination

4 General characteristics

4.1 Frequency bands and channel arrangements

4.1.1 Channel arrangements

The systems are required to operate in the 17,7 GHz to 19,7 GHz frequency band, with a channel spacing of 55 MHz or 27,5 MHz. The equipment shall be capable of operating to the channel plans specified in CEPT Recommendation 12-03 [1] or ITU-R Recommendation F.595-6 [2].

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 subclause 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]⇒	140 and 155
Channel Spacing [MHz]	Class 4 equipments	55
	Class 5 equipments	55/27,5

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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 annex C.

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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 may 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.

4.3 Performance and availability requirements

Systems considered in the present document shall be able to respect ITU-R high grade performance objectives, i.e. ITU-R Recommendations 634-4 [3] and 695 [4], ITU-T Recommendation G.821 [15] and the performance objectives derived from ITU-T Recommendation G.826 [16].

4.4 Environmental conditions

The equipment shall be required to meet the environmental conditions set out in ETS 300 019-1 [8] and ETS 300 019-2 [9] 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.