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Fixed Radio Systems; Point-to-point equipment; High capacity digital radio systems transmitting STM-4 or 4 x STM-1 in a 40 MHz radio frequency channel using Co-Channel Dual Polarized (CCDP) operation

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European Standard (Telecommunications series)

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or 4 x STM-1 in a 40 MHz radio frequency channel using
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Foreword

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

The former title of the present document was: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); High capacity DRRS transmitting STM-4 or 4 x STM-1 in a 40 MHz radio frequency channel using Co-Channel Dual Polarized (CCDP) operation".

National transposition dates	
Date of adoption of this EN:	21 January 2000
Date of latest announcement of this EN (doa):	30 April 2000
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 October 2000
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1 Scope

The present document defines technical parameters for a high capacity Digital Radio Relay System (DRRS) operating in frequency bands with 40 MHz channel spacing e.g. the 4 GHz, 5 GHz, U 6 GHz and 11 GHz bands. The capacity should be STM-4 or $4 \times$ STM-1 per 40 MHz RF-channel by using both polarizations in the co-channel dual polarized (CCDP) mode of operation.

The area of application of these DRRS is foreseen to be in regional and trunk networks forming part of a SDH-network including STM-4 rings.

Systems considered in the present document should be able to respect ITU-R high grade performance objectives.

The systems considered should operate in these networks having regard for existing hop length, which are considered to be normally up to about 30 km to 40 km for regional and about 60 km for trunk networks, respectively. Hop lengths greater than this latter length are used in special applications.

For information about compatibility with other systems see clause A.3.

The parameters 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.

NOTE: Equipment supplied by different manufacturers on the same path or existing radio-relay systems operate on different frequencies.

- b) Parameters defining the transmission quality of the proposed system.

The standardization deals with baseband and RF characteristics relevant to SDH. Antenna/feeder system requirements are also considered.

Baseband interfaces have to be considered for STM-1 signals and STM-4 signals in accordance with ITU-T Recommendations G.707 [6] and G.957 [21] respectively.

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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] ITU-R Recommendation F.384-6 (1995): "Radio-frequency channel arrangements for medium and high capacity analogue or digital radio-relay systems operating in the upper 6 GHz band".
- [2] ITU-R Recommendation F.387-7 (1995): "Radio-frequency channel arrangements for radio-relay systems operating in the 11 GHz band".
- [3] ITU-R Recommendation F.635-4 (1997): "Radio-frequency channel arrangements based on a homogeneous pattern for radio-relay systems operating in the 4 GHz band".
- [4] ITU-R Recommendation F.750-3 (1997): "Architectures and functional aspects of radio-relay systems for SDH-based networks".

- [5] ITU-R Recommendation F.1099-2 (1997): "Radio-frequency channel arrangements for high-capacity digital radio-relay systems in the 5 GHz (4 400 MHz to 5 000 MHz) band".
- [6] ITU-T Recommendation G.707 (1996): "Network node interface for the synchronous digital hierarchy (SDH)".
- [7] ITU-R Recommendation SM.329-7 (1997): "Spurious Emissions".
- [8] ITU-T Recommendation G.773 (1993): "Protocol suites for Q-interfaces for management of transmission systems".
- [9] ITU-T Recommendation G.784 (1999): "Synchronous digital hierarchy (SDH) management".
- [10] ETS 300 019 (all parts): "Equipment engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".
- [11] ETS 300 119 (all parts): "Equipment engineering (EE); European telecommunication standard for equipment practice".
- [12] EN 300 385: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for fixed radio links and ancillary equipment".
- [13] ETS 300 132 (all parts): "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment".
- [14] ETS 300 635: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); Radio specific functional blocks for transmission of M x STM-N".
- [15] 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".
- [16] ITU-T Recommendation G.703 (1991): "Physical/electrical characteristics of hierarchical digital interfaces".
- [17] ITU-R Recommendation F.1191-1 (1997): "Bandwidths and unwanted emissions of digital radio-relay systems".
- [18] ITU-T Recommendation O.151 (1992): "Error performance measuring equipment operating at the primary rate and above".
- [19] ITU-T Recommendation O.181 (1996): "Equipment to assess error performance on STM-N interfaces".
- [20] ITU-T Recommendation G.783 (1997): "Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks".
- [21] ITU-T Recommendation G.957 (1995): "Optical interfaces for equipments and systems relating to the synchronous digital hierarchy".
- [22] TR 101 035: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH) aspects regarding Digital Radio Relay Systems (DRRS)".
- [23] ITU-R Recommendation F.695 (1990): "Availability objectives for real digital radio-relay links forming part of a high-grade circuit within an integrated services digital network".
- [24] ITU-R Recommendation F.1092-1 (1997): "Error performance objectives for constant bit rate digital path at or above the primary rate carried by digital radio-relay systems which may form part of the international portion of a 27 500 km hypothetical reference path".
- [25] ITU-R Recommendation F.1189-1 (1997): "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".
- [26] ITU-R Recommendation F.557-4 (1997): "Availability objective for radio-relay systems over a hypothetical reference circuit and a hypothetical reference digital path".

- [27] ITU-T Recommendation G.826 (1996): "Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate".
- [28] ITU-T Recommendation G.827 (1996): "Availability parameters and objectives for path elements of international constant bit-rate digital paths at or above the primary rate".
- [29] ITU-R Recommendation F.752-1 (1993): "Diversity techniques for radio-relay systems".
- [30] ITU-R Recommendation F.1093-1 (1997): "Effects of multipath propagation on the design and operation of line-of-sight digital radio-relay systems".
- [31] ITU-R Recommendation F.1101 (1993): "Characteristics of digital radio-relay systems below about 17 GHz".
- [32] EN 301 127: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Synchronous Digital Hierarchy (SDH); High capacity DRRS carrying SDH signals (2 x STM-1) in frequency bands with about 30 MHz channel spacing and using Co-Channel Dual Polarized (CCDP) operation".
- [33] CEPT/ERC Recommendation 12-08: "Harmonized radio frequency channel arrangements and block allocations for low, medium and high capacity systems in the band 3 600 MHz to 4 200 MHz".
- [34] CEPT/ERC Recommendation 14-02: "Radio-frequency channel arrangements for medium and high capacity analogue or high capacity digital radio-relay systems operating in the band 6 425 MHz to 7 125 MHz".
- [35] CEPT/ERC Recommendation 12-06: "Harmonized radio frequency channel arrangements for digital terrestrial fixed systems operating in the band 10,7 GHz to 11,7 GHz".
- [36] ETR 019: "Transmission and Multiplexing (TM); Specification of new generation high-capacity digital radio systems carrying 2 x STM-1 Synchronous Digital Hierarchy (SDH) signals in frequency bands with 40 MHz channel spacing".
- [37] TR 101 127: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Synchronous Digital Hierarchy (SDH); High capacity DRRS carrying SDH signals (1 x STM-1) in frequency bands with about 30 MHz channel spacing and using Co-Channel Dual Polarized (CCDP) operation".
- [38] CEPT/ERC Recommendation 74-01: "Spurious emissions".

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 mW
GHz	GigaHertz
km	kilometre
Mbit/s	Mega-bit per second
MHz	MegaHertz
m/s	metres per second
ppm	parts per million
ns	nanosecond
W/m ²	Watts per square metre

3.2 Abbreviations

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

ATPC	Automatic Transmit Power Control
BER	Bit Error Rate
C/I	Carrier to Interference ratio
CCDP	Co-Channel Dual Polarized
IF	Intermediate Frequency
NFD	Net Filter Discrimination
PDH	Plesiochronous Digital Hierachy
QAM	Qadrature Amplitude Modulation
RCSOH	Radio Complementary Sectra OverHeat
RF	Radio Frequency
RFCOH	Radio Frame Complementary OverHeat
RX	Receiver
SDH	Synchronous Digital Hierarchy
SOH	Section OverHead
STM-1	Synchronous Transport Module Level 1 (155,52 Mbit/s)
STM-4	Synchronous Transport Module Level 4 (622 Mbit/s)
TMN	Telecommunication Management Network
TX	Transmitter
U6	Upper 6 (GHz frequency band)
XIF	Cross polarization improvement factor due to XPIC operation
XPD	Cross Polar Discrimination
XPI	Cross Polar Interference
XPIC	Cross Polar Interference Canceller

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4 General characteristics

4.1 Frequency bands and channel arrangements

The system shall be required to operate in the following frequency bands, according to the specified CEPT and ITU-R Recommendations on the quoted channel spacings.

4 GHz

CEPT/ERC Recommendation 12-08 [33], annex A, Part 1 with 40 MHz channel spacing ITU-T Recommendation G.826 [27] and ITU-R Recommendation F.635-4 [3] with 40 MHz channel spacing. The centre gap between transmitters and receivers in ITU-R Recommendation F.635-4 [3] is 80 MHz.

5 GHz

ITU-R Recommendation F.1099-2 [5] with 40 MHz channel spacing. The centre gap between transmitters and receivers in ITU-R Recommendation F.1099-2 [5] is 60 MHz.

U 6 GHz

CEPT/ERC Recommendation 14-02 [34] and ITU-R Recommendation F.384-6 [1] with 40 MHz channel spacing. The centre gap between transmitters and receivers in ITU-R Recommendation F.384-6 [1] is 60 MHz.

11 GHz

CEPT/ERC Recommendation 12-06 [35] and ITU-R Recommendation F.387-7 [2] with 40 MHz channel spacing. The centre gap between transmitters and receivers in ITU-R Recommendation F.387-7 [2] is 130 MHz.