



**SLOVENSKI STANDARD**  
**SIST EN 301 128 V1.2.1:2003**  
**01-december-2003**

: ]\_gb]fUX]g\_]g]ghYa ]E`CdfYa U]hdU]c \_U]c \_UE`D`Yn]c\ fcbUX][ ]H]bU\ ]YfU\ ]U  
fD8 <L`E`8 ][ ]H]b]fUX]g\_]g]ghYa ]n`b]n\_c ]b`gfYXb`c`na c[ `]j cg]h`z\_]XYi `Y`c`j  
ZY\_j Yb b]`dUgcj ]`%` ; <nž`%` ; <n]b`%` ; <n

Fixed Radio Systems; Point-to-point equipment; Plesiochronous Digital Hierarchy (PDH);  
Low and medium capacity digital radio systems operating in the 13 GHz, 15 GHz and 18  
GHz frequency bands

**iteh STANDARD PREVIEW**  
**(standards.iteh.ai)**

<https://standards.iteh.ai/catalog/standards/sist/78073cb7-3a35-4c99-ae5d-ab58a31b297d/sist-en-301-128-v1-2-1-2003>

**Ta slovenski standard je istoveten z: EN 301 128 Version 1.2.1**

**ICS:**

33.040.20	Prenosni sistem	Transmission systems
33.060.30	Radiorelejni in fiksni satelitski komunikacijski sistemi	Radio relay and fixed satellite communications systems

**SIST EN 301 128 V1.2.1:2003**                      **en**

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 301 128 V1.2.1:2003](https://standards.iteh.ai/catalog/standards/sist/78073cb7-3a35-4c99-aefd-ab58a31b297d/sist-en-301-128-v1-2-1-2003)

<https://standards.iteh.ai/catalog/standards/sist/78073cb7-3a35-4c99-aefd-ab58a31b297d/sist-en-301-128-v1-2-1-2003>

# ETSI EN 301 128 V1.2.1 (2001-02)

---

*European Standard (Telecommunications series)*

**Fixed Radio Systems;  
Point-to-point equipment;  
Plesiochronous Digital Hierarchy (PDH);  
Low and medium capacity digital radio systems operating  
in the 13 GHz, 15 GHz and 18 GHz frequency bands**

---

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 301 128 V1.2.1:2003](https://standards.iteh.ai/catalog/standards/sist/78073cb7-3a35-4c99-aefd-ab58a31b297d/sist-en-301-128-v1-2-1-2003)

<https://standards.iteh.ai/catalog/standards/sist/78073cb7-3a35-4c99-aefd-ab58a31b297d/sist-en-301-128-v1-2-1-2003>



---

**Reference**

REN/TM-04111-15

---

**Keywords**

DRRS, PDH, radio, transmission

**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° 7803/88

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN 301 128 V1.2.1:2003

<https://standards.iteh.ai/catalog/standards/sist/78073cb7-3a35-4c99-ae6d-ab58a31b297d/sist-en-301-128-v1-2-1-2003>

---

**Important notice**

Individual copies of the present document can be downloaded from:

<http://www.etsi.org>

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at <http://www.etsi.org/tb/status/>

If you find errors in the present document, send your comment to:  
editor@etsi.fr

---

**Copyright Notification**

No part may be reproduced except as authorized by written permission.  
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2001.  
All rights reserved.

# Contents

Intellectual Property Rights .....	5
Foreword.....	5
1 Scope.....	6
2 References.....	6
3 Symbols and abbreviations.....	8
3.1 Symbols .....	8
3.2 Abbreviations.....	8
4 General characteristics .....	8
4.1 Frequency bands and channel arrangements.....	8
4.1.1 Channel plans .....	8
4.1.2 Channel Spacing (CS).....	9
4.2 Compatibility requirements between systems .....	9
4.3 Performance and availability requirements.....	9
4.4 Environmental conditions .....	9
4.4.1 Equipment within weather protected locations (indoor locations).....	9
4.4.2 Equipment for non-weather protected locations (outdoor locations).....	10
4.5 Electromagnetic compatibility conditions.....	10
4.6 Power supply.....	10
4.7 Telecommunications Management Network (TMN) requirements.....	10
4.8 Block diagram.....	11
4.9 Mechanical specifications for Radio Frequency (RF) interfaces.....	11
5 Baseband characteristics .....	11
5.1 Plesiochronous Digital Hierarchy (PDH) interfaces.....	11
6 Transmitter characteristics .....	12
6.1 Output power .....	12
6.1.1 Automatic Transmit Power Control (ATPC).....	12
6.2 RF spectrum masks .....	12
6.3 Discrete CW components exceeding the spectrum mask limit.....	14
6.3.1 Spectral lines at the symbol rate .....	14
6.3.2 Other spectral lines .....	14
6.4 Spurious emissions.....	15
6.4.1 Spurious emissions-external .....	15
6.4.2 Spurious emissions-internal.....	15
6.5 Radio frequency tolerance .....	15
6.6 Return loss .....	16
7 Receiver characteristics.....	16
7.1 Receiver spurious emissions .....	16
7.1.1 Spurious emissions-external .....	16
7.1.2 Spurious emissions-internal.....	16
7.2 Input level range.....	16
7.3 Return loss .....	17
8 System characteristics without diversity.....	17
8.1 BER as a function of receiver input level .....	17
8.2 Equipment background bit errors .....	18
8.3 Interference sensitivity .....	18
8.3.1 Co-channel external interference .....	18
8.3.2 Adjacent channel interference .....	19
8.3.3 Front-end non-linearity requirements (two-tone Continuous Wave (CW) interference).....	19
8.3.4 CW interference.....	20
8.4 Distortion sensitivity .....	20

<b>Annex A (informative):</b>	<b>Additional information</b> .....	<b>21</b>
A.1	Automatic Transmit Power Control (ATPC) .....	21
A.2	Spectrum masks .....	21
A.3	Lightning protection .....	21
A.4	Generic mechanical requirements .....	21
History	.....	22

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 301 128 V1.2.1:2003](https://standards.iteh.ai/catalog/standards/sist/78073cb7-3a35-4c99-aefd-ab58a31b297d/sist-en-301-128-v1-2-1-2003)

<https://standards.iteh.ai/catalog/standards/sist/78073cb7-3a35-4c99-aefd-ab58a31b297d/sist-en-301-128-v1-2-1-2003>

---

## Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<http://www.etsi.org/ipr>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

---

## 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); Plesiochronous Digital Hierarchy (PDH); Low and medium capacity DRRS operating in the 13 GHz, 15 GHz and 18 GHz frequency bands".

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 digital radio communications equipments operating in the 13 GHz, 15 GHz and 18 GHz frequency bands.

Digital Radio Relay Systems (DRRS) are used for point-to-point connections in local, regional and national networks at data rates between 2 Mbit/s and 34 Mbit/s.

As harmonized channel spacings lower than 13,75 MHz are not available in the 18 GHz frequency band at the drafting date of the present document, capacities lower than 2 x 8 Mbit/s are consequently not considered in this frequency band. However the present document can be considered as a guideline when national frequency plans based on a 3,5 MHz channel spacing exist.

Systems considered in the present document are able to respect ITU-R Recommendation national or international grade performance objectives, i.e. ITU-R Recommendations F.1189-1 [9] for national, ITU-R Recommendation F.1092-1 [8] for international and ITU-T Recommendation G.826 [11]. Maximum hop lengths of about 35 km are normally achievable according to the considered frequency bands.

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 and medium capacity Plesiochronous Digital Hierarchy (PDH) transmission. Antenna/feeder system requirements are covered in EN 300 833 [18].

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

Class 1: equipment based on a minimum 4-state modulation scheme (e.g. 4-FSK, 4-QAM, or equivalent).

Class 2: equipment based on a minimum 16-state modulation scheme (e.g. 16-QAM, or equivalent).

Safety aspects are outside the mandate of ETSI and they are not considered in the present document.

---

# 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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

- [1] ITU-R Recommendation F.497-6: "Radio-frequency channel arrangements for radio-relay systems operating in the 13 GHz frequency band".
- [2] ITU-R Recommendation F.636-3: "Radio-frequency channel for radio-relay systems operating in the 15 GHz band".
- [3] ITU-R Recommendation F.595-6: "Radio-frequency channel arrangements for radio-relay systems operating in the 18 GHz frequency band".



- [4] ETSI ETS 300 019-1-2: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-2: Classification of environmental conditions; Transportation".
- [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] ITU-T Recommendation G.703 (1988): "Physical/electrical characteristics of hierarchical digital interfaces".
- [8] ITU-R Recommendation F.1092-1: "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".
- [9] 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".
- [10] ITU-T Recommendation G.773 (1993): "Protocol suites for Q-interfaces for management of transmission systems".
- [11] ITU-T Recommendation G.826 (1999): "Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate".
- [12] ETSI EN 300 385: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for fixed radio links and ancillary equipment".
- [13] ITU-R Recommendation F.1101: "Characteristics of digital radio-relay systems below about 17 GHz".
- [14] ITU-R Recommendation F.1102: "Characteristics of radio-relay systems operating in frequency bands above about 17 GHz".
- [15] CEPT/ERC Recommendation T/R 12-02: "Harmonised radio frequency channel arrangements for analogue and digital terrestrial fixed systems operating in the band 12.75 GHz to 13.25 GHz".
- [16] CEPT/ERC Recommendation T/R 12-07: "Harmonised radio frequency channel arrangements for digital terrestrial fixed systems operating in the band 15.23 to 15.35 GHz".
- [17] CEPT/ERC Recommendation T/R 12-03: "Harmonised radio frequency channel arrangements for digital terrestrial fixed systems operating in the band 17.7 GHz to 19.7 GHz".
- [18] 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".
- [19] ITU-R Recommendation SM.329-7: "Spurious emissions".
- [20] ITU-R Recommendation F.1191-1: "Bandwidths and unwanted emissions of digital radio-relay systems".
- [21] ITU-R Recommendation F.758-1: "Considerations in the development of criteria for sharing between the terrestrial fixed service and other services".
- [22] IEC 60154: "Flanges for waveguides".
- [23] 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
kg	kilogramme
kHz	kiloHertz
km	kilometre
Mbit/s	Mega-bits per second
MHz	MegaHertz
ppm	parts per million
ns	nanosecond

### 3.2 Abbreviations

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

ATPC	Automatic Transmit Power Control
BBER	Background Bit Error Rate
BER	Bit Error Rate
C/I	Carrier to Interference ratio
CS	Channel Separation
CSmin	minimum practical Channel Separation (for a given radio-frequency channel arrangement)
CW	Continuous Wave
F <sub>c</sub>	cut-off Frequency
FSK	Frequency Shift Keying
IF	Intermediate Frequency
NFD	Net Filter Discrimination
PDH	Plesiochronous Digital Hierarchy
QAM	Quadrature Amplitude Modulation
RF	Radio Frequency
RSL	Receive Signal Level
TMN	Telecommunications Management Network
TX	Transmit

---

## 4 General characteristics

### 4.1 Frequency bands and channel arrangements

#### 4.1.1 Channel plans

The systems are required to operate in the 13 GHz, 15 GHz or 18 GHz frequency bands.

These channel plans based on a 3,5 MHz homogeneous channel pattern using vertical and horizontal polarizations shall be in accordance with the ITU-R Recommendations F.497-6 [1], F.636-3 [2], F.595-6 [3] and the CEPT/ERC Recommendations T/R 12-02 [15], T/R 12-07 [16] and T/R 12-03 [17].

All the GO channels shall be in one frequency half band and all the RETURN channels in the other half band.

## 4.1.2 Channel Spacing (CS)

For systems operating on different antennas or different polarization of the same antenna, on the same route.

**Table 1a: Channel spacings: 13 GHz & 15 GHz frequency bands**

	Bit rate Mbit/s	2 Mbit/s	2 x 2 Mbit/s	8 Mbit/s	2 x 8 Mbit/s	34 Mbit/s	2 x 34 Mbit/s
Channel	Class 1	1,75 MHz	3,5 MHz	7 MHz	14 MHz	28 MHz	-
Spacing	Class 2	-	1,75 MHz	3,5 MHz	7 MHz	14 MHz	28 MHz

NOTE: n x 2 Mbit/s and n x 8 Mbit/s bit rates may be used where appropriate.

**Table 1b: Channel spacings: 18 GHz frequency band**

	Bit Rate Mbit/s	2 x 8 Mbit/s	34 Mbit/s	2 x 34 Mbit/s
Channel	Class 1	13,75 MHz	27,5 MHz	-
Spacing	Class 2	-	13,75 MHz	27,5 MHz

NOTE: n x 2 Mbit/s and n x 8 Mbit/s bit rates may be used where appropriate.

## 4.2 Compatibility requirements between systems

There shall be no requirement to operate transmitting equipment from one manufacturer with receiving equipment from another.

Different manufacturer equipment may be used on different polarization of one antenna but there shall be no requirement to multiplex different manufacturer's equipment on the same polarization of the same antenna.

(standards.iteh.ai)

## 4.3 Performance and availability requirements

Equipments shall be designed in order to meet network performance and availability requirements foreseen by ITU-T Recommendation G.826 [11], following the criteria reported in ITU-R Recommendations F.1092-1 [8] and F.1189-1 [9] for international and national portions 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 F.1101 [13] and F.1102 [14] shall be applied.

## 4.4 Environmental conditions

Both indoor and partially outdoor installations are considered.

The equipment shall be required to meet the environmental conditions set out in ETS 300 019-1-2 [4] 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.

### 4.4.1 Equipment within weather protected locations (indoor locations)

Equipment intended for operation within temperature controlled locations or partially temperature controlled locations shall meet the requirements of ETS 300 019-1-2 [4] classes 3.1 and 3.2, respectively.

Optionally, the more stringent requirements of ETS 300 019-1-2 [4] classes 3.3 (non-temperature controlled locations), 3.4 (sites with heat trap) and 3.5 (sheltered locations) may be applied.