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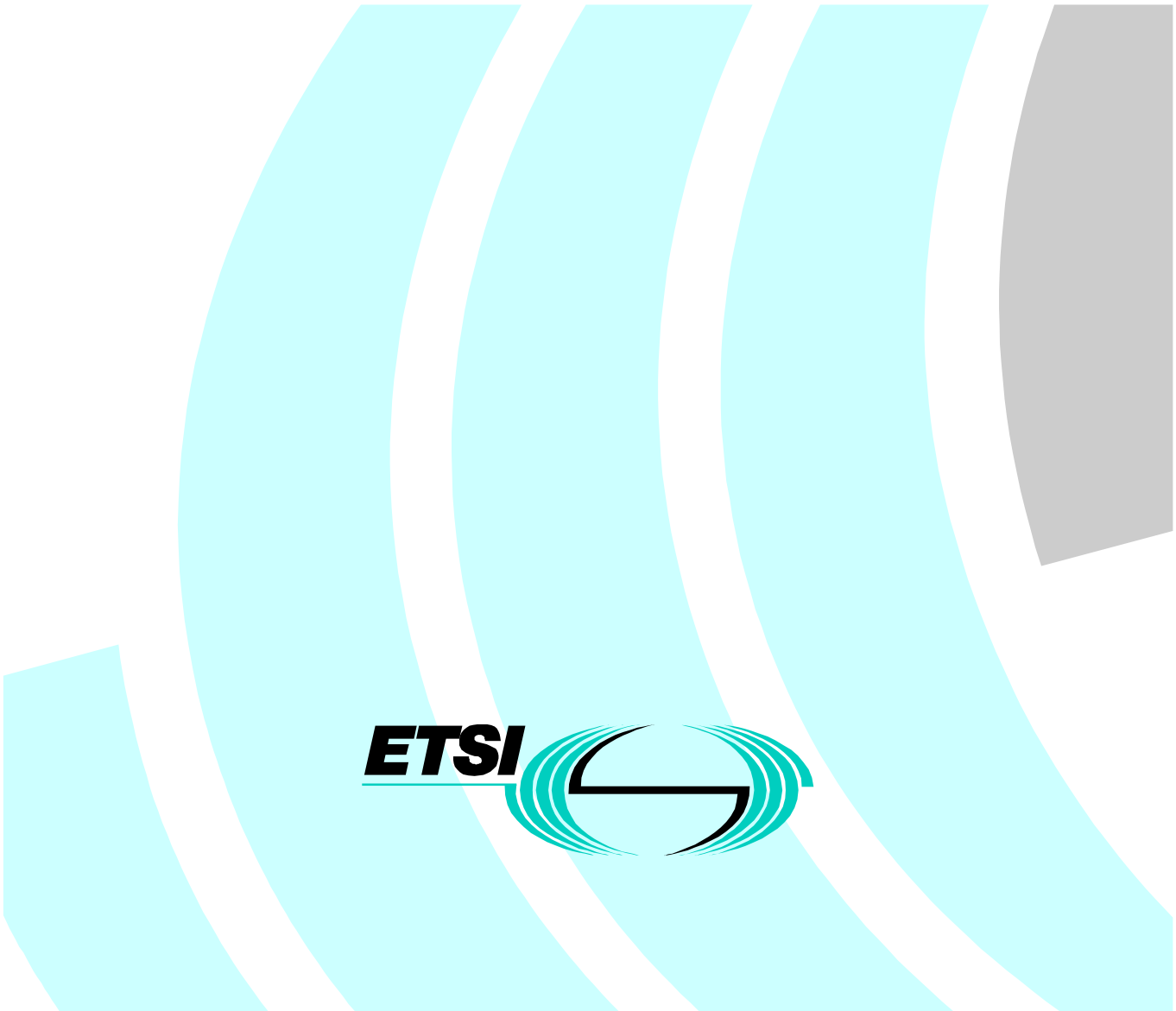
European Standard (Telecommunications series)

Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Point-to-multipoint DRRS in frequency bands in the range 24,25 GHz to 29,5 GHz using different access methods; Part 1: Basic parameters



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ETSI

Postal address
F-06921 Sophia Antipolis Cedex - FRANCE

Office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - 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

Internet
secretariat@etsi.fr
http://www.etsi.fr
http://www.etsi.org

Contents

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Foreword

This European Standard (Telecommunication series) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

The present document contains the minimum technical requirements to ensure compatibility of products and conformance with radio regulations across ETSI member states. Radio equipment from different manufacturers are not required to inter-work at radio frequency (i.e. no common air interface).

The present document defines the requirements for radio-relay equipment and associated interfaces.

The present document is intended to cover a variety of systems designed for a variety of services, applications, performance objectives and deployment conditions. Therefore it is necessary if applicable to include in the present document different sets of system parameters. In the present document these set of parameters are referred to as "system types".

The present document is part 1 of a multi-part European Standard covering the point-to-multipoint digital radio systems in the band 24,5 GHz to 29,5 GHz with different access methods, as identified below:

Part 1: "Basic parameters";

Part 2: "Frequency Division Multiple Access Methods (FDMA)" (EN 301 213-2 [2]);

Part 3: "Direct Sequence Code Division Multiple Access Methods (DS CDMA)" (EN 301 213-3 [3]);

Part 4: "Time Division Multiple Access Methods (TDMA)" (EN 301 213-4 [4]).

Parts 2 to 4 are intended to be used in conjunction with the present document, describing the basic parameters common to all access methods.

A basic description of the different access methods and a comparison among them are provided in TR 101 274 [5].

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

Introduction

The main field of application of Point-to-Multipoint (P-MP) systems using the Fixed Service (FS) is to provide access to both public and private networks (PSTN, PDN, etc.). By means of P-MP systems the network service area may cover scattered subscriber locations. The systems may be applied to build new access networks by means of a multi cellular architecture, covering both suburban, urban and regional areas.

Subscribers are offered the full range of services by the particular public or private network. Subscribers have access to these services by means of the various standardized user network interfaces (e.g. 2-wire loop and ISDN ranging from basic rate to n x primary rate).

Point-to-multipoint systems provide standard network interfaces and transparently connect subscribers to the appropriate network node. These systems allow a service to be connected to a number of subscribers ranging from a few to several thousand, and over a wide range of distances.

P-MP systems are generally configured as Pre-Assigned Multiple Access Systems (PAMA) or as Demand Assigned Multiple Access (DAMA) Radio Systems.

The essential features of a typical P-MP Radio Systems are:

- efficient use of the radio spectrum;
- concentration;
- transparency.

Radio is often the ideal way of obtaining communications at low cost and almost independent of distance, and difficult topography. Moreover, a small number of sites are required for these installations, thus facilitating rapid implementation and minimizing maintenance requirements of the systems.

Concentration means that m subscribers can share n radio channels (m being larger than n), allowing a better use to made of the available frequency spectrum and at a lower equipment cost. The term "multi-access" derives from the fact that every subscriber has access to every channel (instead of a fixed assignment as in most multiplex systems). When a call is initiated one of the available channels is allocated to it. When the call is terminated, the channel is released for another call.

Concentration requires the use of distributed intelligent control which in turn allows many other operation and maintenance functions to be added.

Transparency means that the exchange (service node) and the subscriber equipment communicates with each other without being aware of the radio link.

1 Scope

The present document specifies the minimum requirements for system parameters of Point-to-Multipoint (P-MP) Radio Systems in the terrestrial Fixed Services (FS) operating in the bands 24,25 GHz to 29,5 GHz.

Point-to-Multipoint (P-MP) Radio-Relay Systems use in principle three different access methods, taking into account the basic physical parameters of the frequency, the code and the time. This leads to the three basic access methods of:

- Frequency Division Multiple Access (FDMA);
- Code Division Multiple Access (CDMA);
- Time Division Multiple Access (TDMA).

The P-MP system in the band 24,5 GHz to 29,5 GHz (CEPT Recommendation T/R 13-02[1]) will provide access to both public and private networks (PSTN, PDN, etc.) by means of the various standardized network interfaces (e.g. 2-wire loop and ISDN ranging from basic rate to n × 2 Mbit/s as well as local area to wide area data networks interfaces).

The system may be applied to build new access networks by means of a multi cellular architecture, covering urban, including suburban areas.

P-MP systems are generally configured as Pre-Assigned Multiple Access (PAMA) or as Demand Assigned Multiple Access (DAMA) Radio Systems.

The present document covers the following P-MP applications:

- The transmission of
  - voice;
  - fax;
  - voice band data;
  - telex;
- related to analogue interfaces and
  - 64 kbit/s;
  - ISDN;
  - digital video;
  - digital audio;
- related to digital interfaces.

Further applications like ATM, Frame Relay, LAN, WAN may also be provided.

The equipment covered by EN 301 213 should be designed to be able to meet the network performance requirements foreseen by ITU-R Recommendations F.696 [6], F.697 [7], for medium, local grade or ITU-Recommendation F.1189 [8] national portion (access or short haul) of the digital connection following the criteria defined in ITU-T Recommendation(s) G.821 [9] and/or G.826 [10].

The availability requirements are under further study by the relevant bodies.

Network operators may choose different performance and availability requirements in order to extend the possible area of application thus fitting to their network needs.

Radio terminals from different manufacturers are not intended to interwork at radio frequency (i.e. no common air interface).

Regulatory bodies should take into account the inband coexistence between P-MP systems using differing access methods.

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

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] CEPT Recommendation T/R 13-02: "Preferred channel arrangements for the Fixed Services in the range 22,0 - 29,5 GHz".

[2] EN 301 213-2: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Point-to-multipoint DRRS in frequency bands in the range 24,25 GHz to 29,5 GHz using different access methods; Part 2: Frequency Division Multiple Access (FDMA) methods".

[3] EN 301 213-3: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Point-to-multipoint DRRS in frequency bands in the range 24,25 GHz to 29,5 GHz using different access methods; Part 3: Direct Sequence Code Division Multiple Access methods (DS-CDMA)".

[4] EN 301 213-4: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Point-to-multipoint DRRS in frequency bands in the range 24,25 GHz to 29,5 GHz using different access methods; Part 4: Time Division Multiple Access methods (TDMA)".

[5] TR 101 274: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Point-to-multipoint DRRS in the access network: Overview of different access techniques".

[6] ITU-R Recommendation F.696: "Error performance and availability objectives for hypothetical reference digital sections forming part or all of the medium- grade portion of an ISDN connection at a bit rate below the primary rate utilizing digital radio relay systems".

[7] ITU-R Recommendation F. 697: "Error performance and availability objectives for the local grade portion at each end of an ISDN connection a bit rate below the primary rate utilizing digital radio relay systems".

[8] ITU-R Recommendation F.1189: "Error-Performance Objectives for constant bit rate digital paths at or above the primary rate carrier by digital radio-relay systems which may form part or all the national portion of a 27 500 km hypothetical reference path".

[9] 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".

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

[11] ITU-T Recommendation G.861: "Principles and Guidelines for Integration of Satellite and Radio Systems in the SDH Network".

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

[13] EN 301 132: "Integrated Services Digital Network (ISDN); Security tools (SET) for use within telecommunication services".

[14] ETS 300 385: "Radio Equipment and Systems (RES); ElectroMagnetic Compatibility (EMC) standard for digital fixed radio links and ancillary equipment with data rates at around 2 Mbit/s and above".

[15] EN 300 339: "Electromagnetic compatibility and Radio spectrum Matters (ERM); General ElectroMagnetic Compatibility (EMC) for radio communications equipment".

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

[17] ITU-T Recommendation G.810: "Definitions and terminology for synchronization networks".

[18] ITU-T Recommendation G.812: "Timing requirements at the output of slave clocks suitable for plesiochronous operation of international digital links".

[19] ITU-T Recommendation G.823: "The control of jitter and wander within digital networks which are based on the 2 048 kbit/s hierarchy".

[20] ITU-T Recommendation G.813: "Timing characteristics of SDH equipment slave clocks (SEC)".

[21] ITU-T Recommendation G.825: "The control of jitter and wander within digital networks which are based on the synchronous digital hierarchy".

[22] ETS 300 833: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Antennas used in point-to-point DRRS operating in the frequency band 3 to 60 GHz".

[23] EN 301 215: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Antennas for use in point-to-multipoint DRRS in the 11 GHz to 60 GHz band".

[24] IEC Publication 154-2: " Flanges for wave guides, rectangular".

[25] ITU-T Recommendation G.703: "Physical/electrical characteristics of hierarchical digital interfaces".

[26] ITU-T Recommendation G.131: "Stability and echo".

[27] ITU-T Recommendation G.711: "Pulse code modulation (PCM) of voice frequencies".

[28] ITU-T Recommendation G.726: "40, 32, 24, 16 kbit/s adaptive differential pulse code modulation (ADPCM)".

[29] ITU-T Recommendation G.728: "Coding of speech at 16 kbit/s using low-delay code excited linear prediction".

[30] ITU-T Recommendation G.729: "Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear prediction".

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

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

[33] ITU-R Recommendation F.[AD/9D]: "Maximum equivalent isotropically radiated power of transmitting stations in the Fixed Service operating in the frequency band 25,25 - 27,5 GHz shared with the Inter-Satellite Service".

[34] DEN/TM-04040: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Spurious emissions and receiver immunity at equipment antenna ports of DRRS".

[35] ITU-T Recommendation Q.552: "Transmission characteristics at 2-wire analogue interfaces of digital exchanges".

[36] ITU-T Recommendation Q.553: "Transmission characteristics at 4-wire analogue interfaces of digital exchanges".

[37] ITU-T Recommendation R.20: "Telegraph modem for subscriber lines".

[38] ITU-T Recommendation V series: "Data communication over the telephone network".

[39] ITU-T Recommendation X series: "Data networks and open system communication".

[40] ITU-T Recommendation G.961: "Digital transmission system on metallic local lines for the ISDN basic rate access".

[41] ETS 300 012: "Integrated Services Digital Network (ISDN); Basic user-network interface; Layer 1 specification and test principles".

[42] ETS 300 011: "Integrated Services Digital Network (ISDN); Primary rate user-network interface; Layer 1 specification and test principles".

[43] ITU-T Recommendation G.962: "Access digital line section for ISDN primary rate at 2 048 kbit/s".

[44] ITU-T Recommendation G.707: "Network node interface for the synchronous digital hierarchy".

[45] ITU-T Recommendation G.964: "V-Interfaces at the digital local exchange (LE) - V5.1-interface (based on 2 048 kbit/s) for the support of access network (AN)".

[46] ITU-T Recommendation G. 965: "V-Interfaces at the digital local exchange (LE) - V5.2-interface (based on 2 048 kbit/s) for the support of access network (AN)".

[47] ITU-T Recommendation G.957: "Optical interfaces for equipment and systems relating to synchronous digital hierarchy".

[48] ETS 300 324: "Signalling Protocols and Switching (SPS); V interfaces at the digital Local Exchange (LE); V5.1 interface for the support of Access Network (AN)".

[49] ETS 300 347: "Signalling Protocols and Switching (SPS); V interfaces at the digital Local Exchange (LE); V5.2 interface for the support of Access Network (AN)".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

round trip delay: the round trip delay is defined as the sum of the delay between point F to G plus G to F in figure 1 including any repeaters as appropriate.

Full Capacity Load (FCL): full capacity load is defined by the maximum number of 64 kbit/s signals or the equivalent which can be transmitted and received by a single CRS within a specified RF-bandwidth, fulfilling a given performance and availability objectives in respect to fading conditions.

3.2 Symbols

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

dB	decibel
dBm	decibel relative to 1 mW
GHz	GigaHertz
kbit/s	kilobit per second
km	kilometre
Mbit/s	Megabit per second
MHz	MegaHertz
ms	millisecond
ns	nanosecond
ppm	parts per million

3.3 Abbreviations

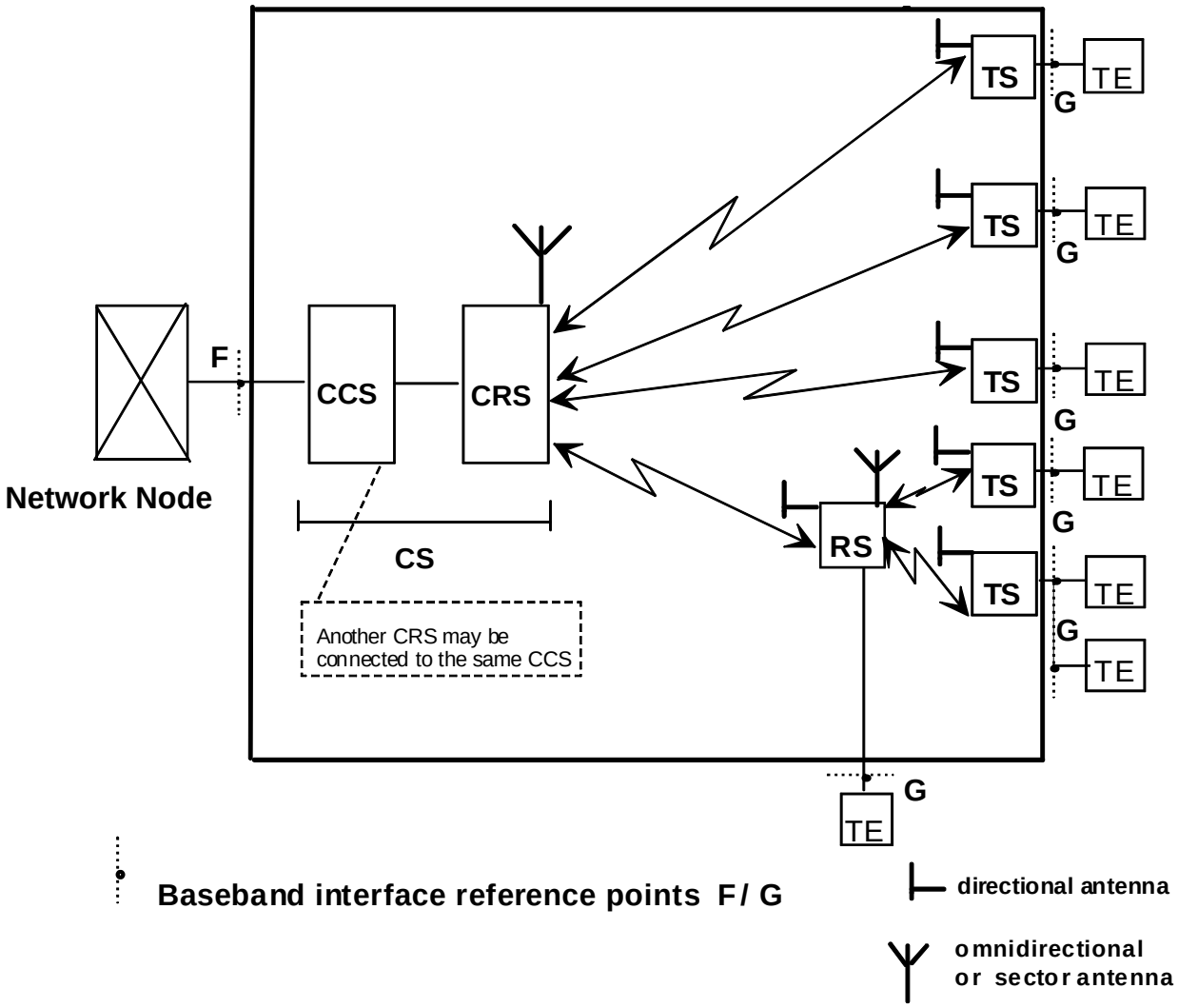
For the purposes of present document the following abbreviations apply:

ADPCM	Adaptive Differential Pulse Code Modulation
ATPC	Automatic Transmit Power Control
ATM	Asynchronous Transfer Mode
BB	Base Band
BER	Bit Error Ratio
CDMA	Code Division Multiple Access
CEPT	La Conférence Européenne des Administrations des Postes et Télécommunications
CCS	Central Controller Station
CRS	Central Radio Station
CS	Central Station
CW	Continuous Wave
DAMA	Demand Assigned Multiple Access
DS CDMA	Direct Sequence Code Division Multiple Access
EMC	Electromagnetic Compatibility
FCL	Full Capacity Load
FDMA	Frequency Division Multiple Access
F_0	Centre frequency of the RF-channel
f_S	RF channel spacing
FS	Fixed Service
IF	Intermediate Frequency
ISDN	Integrated Service Digital Network
IF/RF	Intermediate Frequency/Radio Frequency
LAN	Local Area Network
LO	Local Oscillator
NNI	Network Node Interface
PAMA	Pre-Assigned Multiple Access
PDN	Public Data Network
P-MP	Point-to-Multipoint
PP	Point to Point Radio-Relay System
PRBS	Pseudo-Random Binary Sequence
PSTN	Public Switched Telephone Network
RF	Radio Frequency
RFC	Radio Frequency Channel
RS	Repeater Station

RSL	Receiver Signal Level
RTPC	Remote Trasmit Power Control
SDH	Synchronous Digital Hierarchy
SRL	Spectrum Reference Level
STM-1	Synchronous Transport Module level 1
STM-0	Synchronous Transfer Module level 0 (see [11])
TDMA	Time Division Multiple Access
FDMA	Frequency Division Multiple Access
TE	Terminal Equipment
TM	Transmission and Multiplex
TMN	Telecommunications Management Network
TS	Terminal Station
Tx	Transmitter
Rx	Receiver
WAN	Wide Area Network

4 General characteristics

4.1 General System Architecture



CS: Central Station which may be subdivided in to two units.
CCS: Central Controller Station which provides the interface to the network node.
CRS: Central Radio Station which is the central base station containing at least the radio transceiver equipment providing the interface to the terminal station via the air. Each transceiver is connected to a separate antenna. This is used e.g. if sectored cells are applied to increase the capacity of each cell.
TS: Terminal station which provides the interfaces to the subscriber equipment.
RS: Repeater Station which may also provide the interfaces to the subscriber, if applicable. A RS may serve one or more TSs.
F: Point of connection to the Network Node.
G: Point(s) of connection to the subscriber equipment.
TE: Terminal (Subscriber) Equipment.

NOTE 1: Central Controller Station (CCS) may control more than one Central Radio Station (CRS).
NOTE 2: A TS may serve more than one TE.

Figure 1: General System Architecture

The Central Station (CS) performs the interconnection with the network node (local exchange) carrying out a concentration function by sharing the total number of available channels in the system. The central station is linked by microwave transmission paths to each Terminal Station (TS) either directly or via one or more Repeater Stations (RS).

Whenever an existing digital transmission link is available, the network implementation can be optimized by separating the CCS, installed at the exchange site, and the CRS.

4.2 Frequency bands and channel arrangements

4.2.1 Channel plan

Bands allocated to the Fixed Service in the range 24,5 GHz to 29,5 GHz shall be used according to CEPT Recommendation T/R 13-02 [1] annex B and annex C. The Tx/Rx spacing shall be 1 008 MHz.

Regulatory bodies may choose appropriate parts of the above mentioned frequency bands for the application for P-MP systems. The manufacturer shall declare the particular sub-band for which the system was designed.

4.2.2 Channel arrangements

The system shall operate on one or more of the channel spacing 3,5 MHz, 7 MHz, 14 MHz, 28 MHz, 56 MHz and 112 MHz.

The minimum transport capacities achievable within the above channel spacing with each of the different access methods are defined in the relevant parts of EN 301 213-2 [2], EN 301 213-3 [3], EN 301 213-4 [4].
The channel spacing appropriate to the P-MP system envisaged, depends on the necessary customer transport capacity, the overall number of customers connected to one CS in a serving area and the access method used. Details are given in the parts of EN 301 213-2 [2], EN 301 213-3 [3], EN 301 213-4 [4], addressing the access methods applied.

4.3 Compatibility requirements

There is no requirement to operate the CRS from one manufacturer with the TS and RS from an other manufacturer.

4.4 Environmental Conditions

The equipment shall be required to meet the environmental conditions set out in ETS 300 019 [12] 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)

The equipment intended for operation within temperature controlled locations or partially temperature controlled locations shall meet the requirements of ETS 300 019 [12] classes 3.1 and 3.2 respectively.

Optionally, the more stringent requirements of ETS 300 019 [12] classes 3.3 (Non-temperature controlled locations), 3.4 (Sites with heat trap) and 3.5 (Sheltered locations) may be applied.

4.4.2 Equipment for non-weather protected locations (outdoor locations)

Equipment intended for operation within non-weather protected locations shall meet the requirements of ETS 300 019 [12] class 4.1 or 4.1E.

Class 4.1 applies to many European countries and class 4.1E applies to all European countries.

For systems supplied within a specific radio cabinets which gives full protection against precipitation, wind, etc. the ETS 300 019 [12] classes 3.3, 3.4 and 3.5 may be applied also for equipment intended for operation in non-weather protected locations.

4.5 Power Supply

The power supply interface shall be in accordance with the characteristics of one or more of the secondary voltages foreseen in parts 1 and 2 of EN 301 132 [13].

NOTE: Some applications may require a power supply voltage range that is not covered by EN 301 132 [13].

4.6 Electromagnetic compatibility conditions

Fixed Services equipment with capacity of about 2 Mbit/s and above shall operate under the conditions specified in ETS 300 385 [14]. For lower capacities the subject is under study, however EN 300 339 [15] shall apply and the performance criteria for the immunity of the equipment shall be specified by the supplier for conformance testing purposes.

Two different locations, the CS and the TS location have to be considered with respect to the characteristics of the severity parameters related to EMC. The RS will be regarded as a TS if not co-located with other CRS.

4.7 TMN interfaces

TMN interface, if any, should be in accordance with ITU-T Recommendation G.773 [16].

4.8 Synchronization of interface bit rates

Systems employing digital interfaces shall include methods enabling internal and external synchronization to the network. The principles for synchronization shall be met according to ITU-T Recommendation G.810 [17]. Tolerances shall be in accordance to ITU-T Recommendations G.812 [18] and G.823 [19] for systems providing PDH interfaces and/or ITU-T Recommendations G.813 [20] and G.825 [21] for systems providing SDH interfaces.

4.9 Branching/feeder/antenna requirements

If high gain antennas are required for the Terminal Stations to cover longer hop length they shall comply with ETS 300 833 [22]. For other hop lengths the antennas for the TS shall comply with EN 301 215 [23].

Different types of antennas are envisaged for the CRS depending on the cell structure of the radio cell covered by the CS. Those antennas shall also comply with EN 301 215 [23].

4.9.1 Wave guide flanges

If flanges (or other connector types) are required at reference point(s) B, B', C, C' of the RF-System block diagram (figure 2) the following types according to IEC Publication 154-2 [24] shall be used:

- UBR/PBR/CBR 260, for the complete frequency range 24,5 GHz to 29,5 GHz;
- UBR/PBR/CBR 220, for the lower part of the frequency range;
- UBR/PBR/CBR 320, for the higher part of the frequency range.

The upper frequency limit for wave guide R 220 is 26,5 GHz, according to IEC Publication 154-2 [24].

The lower frequency limit for wave guide R 320 is 26,5 GHz, according to IEC Publication 154-2 [24].

4.9.2 Return loss

Where antennas are an integral part of the TS, RS and the CRS radio equipment, there are no requirements to be defined at reference point C'/C in the direction to the transceiver of the CRS, TS and RS respectively. When separate antennas are used the return loss referred to C'/C shall be better than 18 dB.

4.9.3 Intermodulation products

No requirement are necessary to be defined because P-MP Systems do not generally use RF branching networks at the same antenna.

5 System parameters

NOTE: Where a reference is made to the number of states of a modulation scheme, an equivalent modulation scheme may be applied, provided that the system parameters are met.

5.1 System Capacity

The system capacity considered in the present document is the transmission capacity of the CRS, which consists of the maximum number of TSs simultaneously connected to the CRS and transporting their maximum payload bit rate each utilizing interfaces according to table 3 in clause 6.

The maximum number of TSs simultaneously connected to a CRS shall be declared by the manufacturer.

The minimum number of simultaneously transmitted 64 kbit/s signals will be defined in the parts relevant for the different access methods (see EN 301 213-2 [2], EN 301 213-3 [3], EN 301 213-4 [4]).

5.2 Round Trip Delay

The round trip delay for a 64 kbit/s traffic channel shall not exceed 20 ms.

Longer round trip delays may result at other bit rates and when using speech coding at rates lower than 64 kbit/s. In order to guarantee that the delay, introduced by the system into the transmission network does not degrade the quality of the telephone communication, compliance to ITU-T Recommendation G.131 [26] shall be ensured.

5.3 Transparency

The system shall be fully transparent. The network node and the subscriber equipment (points F and G in figure 1) communicate with each other without being aware of the radio link.

5.4 Voice Coding methods

One of the following coding methods should be used:

- 64 kbit/s ITU-T Recommendation G.711 [27];
- 32 kbit/s ITU-T Recommendation G.726 [28];
- 16 kbit/s ITU-T Recommendation G.728 [29];
- 8 kbit/s ITU-T Recommendation G.729 [30].

Other voice coding methods may be employed if the quality for voice transmission is adequate. The used coding method shall be declared by the manufacturer.

5.5 Transmitter characteristics

All Transmitter characteristics are referred to a system under any load conditions.

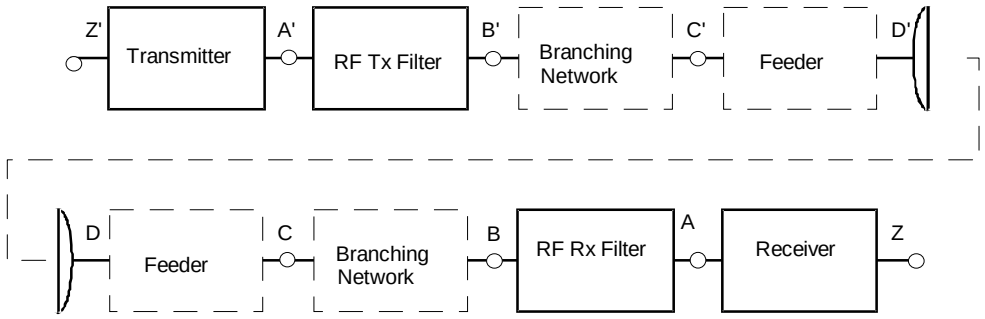
The values and measurements are referred to point B' or C' of figure 2.

Measurements shall be made when the CRS (at least one transceiver equipment) is under full load conditions, to be declared by the manufacturer.

A BER lower than or equal to 10^{-6} shall be achieved at a receive level stated in subclause 5.7.2.

The specified transmitter characteristics shall be met with the appropriate input signals applied at point A or B of figure 1. For the PDH interface this shall be in accordance with ITU-T Recommendation O.151 [31]. and for SDH interfaces in accordance with ITU-T Recommendation O.181 [32].

The RF-System block diagram shows the point to point connection of the P-MP transceiver between the CRS and one TS and vice versa, as illustrated in figure 2.



NOTE: The points shown above are reference points only; points B, C and D, B', C' and D' may coincide.

Figure 2: RF system block diagram

5.5.1 Transmitter output power

The maximum mean transmitter output power (average, for CRS, RS and TS) shall not exceed +35 dBm. Care shall be taken that the system EIRP defined in the Radio Regulations is not exceeded and ITU-R Recommendation F.[AD/9D] [33] is fulfilled.

5.5.2 Transmitter nominal output power

The transmitter nominal mean output power shall be in the range +5 dBm to +33 dBm. The nominal value shall be declared by the manufacturer.

A capability for output power level adjustment may be required for regulatory purposes, in which case the range of adjustment, either by fixed or automatic attenuators, should be in increments of 5 dB or less.

5.5.3 Transmit power and frequency control

5.5.3.1 Automatic Transmit Power Control (ATPC)

ATPC is an optional feature. The use of the ATPC may depend on the access scheme. Equipment with ATPC will be subject to manufacturer declaration of the ATPC ranges and related tolerances. Testing shall be carried out with output power level corresponding to:

- ATPC set manually to a fixed value for System performance;
- ATPC set at maximum provided output power for Tx performance.

5.5.3.2 Remote Transmit Power Control (RTPC)

RTPC is an optional feature. The use of the RTPC may depend on the access scheme. Equipment with RTPC will be subject to manufacturer declaration of the RTPC ranges and related tolerances. Testing shall be carried out with output power level corresponding to:

- RTPC set manually to the maximum and to the minimum values for System performance;
- RTPC set at maximum provided output power for Tx performance;
- RF spectrum mask shall be verified at three points (lower, medium, and upper part of the frequency band envisaged), if applicable. Tx power control shall be set to the maximum value.

5.5.3.3 Remote Frequency Control (RFC)

RFC is an optional feature. The use of the RFC may depend on the access scheme. Equipment with RFC will be subject to manufacturer declaration of the RFC ranges and related tolerances. Testing shall be carried out including:

- RFC setting procedure at least for three frequencies in the lower, centre and higher part of the covered frequency range, if applicable;
- RFC setting procedure shall not produce emissions outside the spectrum mask.

5.5.4 RF spectrum mask

The 0 dB level shown on the spectrum masks is the maximum of the modulated spectrum disregarding residual carriers.

The masks do not include frequency tolerance.

The spectrum masks used for the different access methods and the spectrum analyzer settings for measuring the RF spectrum mask are detailed in EN 301 213-2 [2], FDMA access method, EN 301 213-3 [3], DS CDMA access method and EN 301 213-4 [4], TDMA access method respectively.

5.5.5 Tx Local Oscillator frequency arrangements

There shall be no requirement on LO frequency arrangement.

5.5.6 Spurious emissions (external)

According to DEN/TM-04040 [34] transmitter external spurious emissions are defined as emissions at frequencies which are ±250 % of the relevant channel spacing f_S outside the nominal carrier frequency. The limits on spurious emissions for radio equipment are applicable to the range 9 kHz to 300 GHz. However, for practical measurement purpose only, the frequency range of spurious emissions may be restricted. As guidance for practical purposes, the following measurement range from 30 MHz to 2^{nd} harmonic is normally recommended for the spurious emissions taking into account the fundamental frequency range of equipment described in the present document.

NOTE: When waveguide is used between reference point A' and D', which length is higher than twice the free space wavelength of cut-off frequency (Fc), the lower limit of measurement will be increased to 0,7 Fc and to 0,9 Fc when the length is higher than four times the same wavelength.

5.5.6.1 Within plus or minus 250 % of the relevant RF channel spacing f_S

The emission in this range includes only wanted and out of band emissions which shall be in accordance with the spectrum masks and the limits required by subclause 5.5.4 in the relevant parts for the different access methods (see EN 301 213-2 [2], EN 301 213-3 [3], EN 301 213-4 [4]).

5.5.6.2 Outside the band of plus or minus 250 % of the relevant RF channel spacing f_S

For the purpose of the spectrum analyser measurement, the start (or the stop) frequency at the exclusion bandwidth edges shall be higher (or lower) than the edges frequency by an amount equal to BWe/2.

The limit values referenced at point C' of figure 2 are defined as follows:

- in the band 30 MHz < f < 21,2 GHz:

  -50 dBm for CRS (see note 1);

  -40 dBm for TS (see note 1);

- above 21,2 GHz:

  -30 dBm for all systems (see note 1).

For "noise-like" emissions, the limits are intended not to be exceeded in any elementary reference bandwidth.

The relevant reference bandwidths for the above limits values are:

- 100 kHz for spurious emissions from 30 MHz to 1 GHz;
- 1 MHz, apart from the exception stated in table 1 and in figure 3, for spurious emissions above 1 GHz.

The relevant reference bandwidths for the above limits values are stated in table 1.

Table 1: Reference bandwidth

Fundamental Emission Frequency	Channel Spacing (f_S) [MHz]	Typical Symbol Frequency [Mbit/s]	Ref. BW 100 kHz Fd [MHz]
Above 21,2 GHz (All stations)	$1 \leq f_S < 10$	Fs ≅ 0,6 to 8	70
	$f_S \geq 10$	Fs ≥ 6	-

NOTE 1: RS are considered as Terminal stations when they are intended for use only in remote stations not co-located with any other Fixed radio equipment classified as CRS. In other cases RS are considered as CRS.

NOTE 2: It is recognized that, depending on the characteristic of the emissions, the actual power density relative to the ETSI mask at the ±250 % boundary, when evaluated in the reference bandwidth table 1 may be lower than the spurious emission limit itself. In such cases this step is not applicable and the first applicable spurious emission reference bandwidth step which corresponds to a power density equal or lower than that evaluated with the ETSI mask in the same reference bandwidth should be extended back to the ±250 %.

NOTE 3: When burst transmission is used, the mean power of any spurious emissions are measured using power averaging during the burst duration.

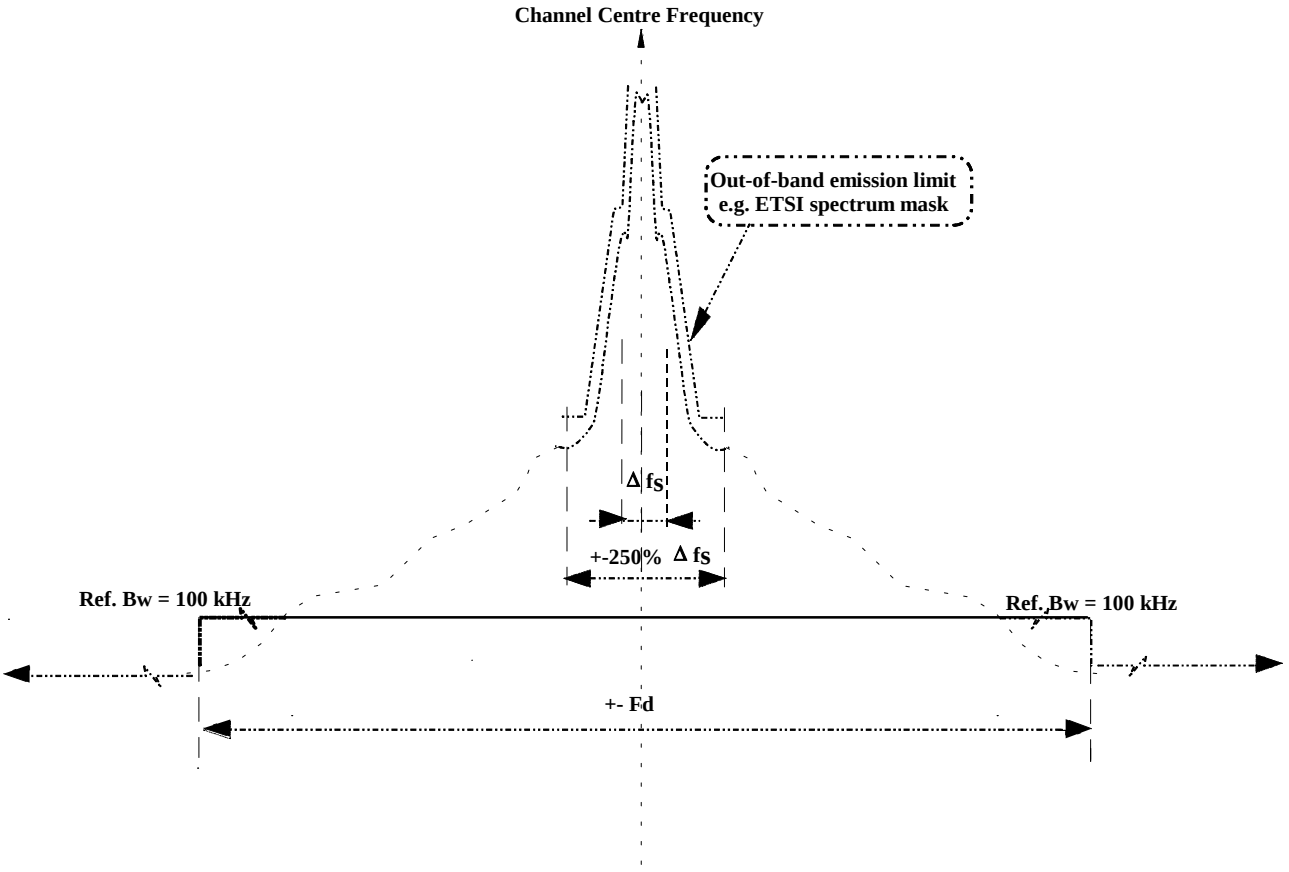


Figure 3: Generic Spurious emission limits mask (see table 1)

5.5.7 Radio frequency tolerance

Radio frequency tolerance shall not exceed ±15 ppm. This limit includes both short-term factors and long-term ageing effects. For the purpose of type testing the manufacturer shall state the guaranteed short-term part and the expected ageing part.

5.6 Receiver characteristics

5.6.1 Rx Local Oscillator frequency arrangements

There shall be no requirement on LO frequency arrangement.

5.6.2 Spurious emissions

Receiver spurious emissions shall not be higher than the limits and procedures prescribed for the transmitters in subclause 5.5.6.2, provided that limits apply also at all frequencies without any exclusion such as the ±250 % of the f_s provided by subclause 5.5.6.1. However for practical reasons spurious emissions should be measured only up to the 2nd harmonic of the fundamental receiving frequency.

NOTE: When waveguide is used between reference point A' and D', which length is higher than twice the free space wavelength of cut-off frequency (Fc), the lower limit of measurement will be increased to 0,7 Fc and to 0,9 Fc when the length is higher than four times the same wavelength.

5.6.3 Receiver IF

No IF interfaces are required.

5.7 System performance

The parameters stated below shall be met under any system load condition.

All parameters are referred to reference point B or C of the R-system block diagram (figure 2).

5.7.1 Dynamic level range

The dynamic level range may depend on the access method utilized. Detailed parameters are given in the parts dealing with the access methods.

5.7.2 BER as a function of receiver input signal level RSL

The BER as functions of the input levels are defined in the parts relevant to the various access methods.

5.7.3 Equipment Background BER

The Equipment Background BER under simulated operating conditions shall be measured with a signal level which is 6 dB above the specified level for BER = 10^{-6} in subclause 5.7.2 taking into account the actual test load conditions.

For different payload bit rates the measurement time and the maximum number of errors allowed are given in table 2.

Table 2: Max. number of errors allowed, measuring the Equipment Background BER

Payload bit rate (kbit/s)	Recording time (h)	Max. number of errors
≤ 64	20	5
≥ 2 048	15	10

5.7.4 Interference sensitivity

All receive signal levels and S/I measurements are defined in the parts relevant to the various access methods.

5.7.4.1 Co-channel interference sensitivity (external)

The limits of co-channel interference (external) shall be as defined in the parts relevant to the various access methods.

5.7.4.2 Adjacent channel interference

The limits of adjacent channel interference shall be as defined in the parts relevant to the various access methods.

5.7.4.3 CW interference

For a receiver operating at the RSL specified in subclause 5.7.2 for 10^{-6} BER threshold, the introduction of a CW interferrer at a level of +30 dB (provisional), with respect to the wanted signal and at any frequency up to 60 GHz, excluding frequencies either side of the centre frequency of the wanted RF channel by up to 500 % of the co-polar channel spacing, shall not cause a degradation of more than 1 dB of the BER threshold as specified in subclause 5.7.2.

This test is designed to identify specific frequencies at which the receiver may have a spurious response, e.g. image frequency, harmonics of the receive filter, etc. The actual test range should be adjusted accordingly. The test is not intended to imply a relaxed specification at all out of band frequencies elsewhere specified in the present document.

5.7.5 Distortion sensitivity

Outage from multipath phenomena is not considered relevant to the systems subject to the present document.

6 Types of interfaces at the subscriber equipment and the network exchange.

Table 3 lists a range of interfaces for various voice and data services.

The equipment covered by the present document shall use one or more of the standardized interfaces (ITU/ETSI), the more common of which are listed in table 3.

Table 3: Types of interfaces

Interface	Proposed Standards
Subscriber Equipment Interfaces	
Analogue (2 wires)	ITU-T Recommendation Q.552 [35]
Analogue (4 W + E & M)	ITU-T Recommendation Q.553 [36]
Telex	ITU-T Recommendation R.20 [37] and V series [38]
Digital data port (electrical)	ITU-T Recommendation G.703 [25], X [39] and V series [38]
ISDN basic rate U; S	ITU-T Recommendation G.961 [40]; ETS 300 012-1 [41]
ISDN primary rate U; S	ITU-T Recommendation G.962 [43]; ETS 300 011-1 [42]
SDH interfaces	ITU-T Recommendation G.707 [44]
Network Interfaces	
2 Mbit/s	ITU-T Recommendation G.703 [25]
Analogue (2 wires)	ITU-T Recommendation Q.552 [35]
Analogue (4 W + E & M)	ITU-T Recommendation Q. 553 [36]
Telex	ITU-T Recommendation R.20 [37] and V series [38]
Digital data port (electrical)	ITU-T Recommendation G.703 [25], X [39] and V series[38]
Digital data port (optical)	ITU-T Recommendation G.957 [47]
ISDN + Analogue subscribers + Leased lines 2 Mbit/s Interface	ITU-T Recommendation G.703 [25] ITU-T Recommendation G.964 V5.1 [45] ITU-T Recommendation G.965 V5.2 [46] ETS 300 324 [48] ETS 300 347 [49]
ISDN U interface	ITU-T Recommendation G.961 [40]
PDH/SDH interfaces	ITU-T Recommendations G.703 [25]; G.707 [44] and G.957 [47]

NOTE: Further ITU/ETSI standardized interfaces may be implemented. The usage of interfaces not standardized by ITU/ETSI are outside the scope of the present document.

History

Document history				
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