

**Transmission and Multiplexing (TM);
Terms and definitions in transport networks;
Part 2: Access networks**



Reference

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM).

The present document is part 2 of a multi-part deliverable covering the terms and definitions in transport networks, as identified below:

Part 1: "Core networks";

Part 2: "Access Networks";

Part 3: "Radio systems".

1 Scope

The present document lists the definitions and abbreviations relevant to access network standardization, found in publicly available documents prepared by ETSI working groups TM6 and former working group TM3, working party A.

For each of the ETSI documents shown in clause 2, the definitions and abbreviations have been extracted and placed in the present document. If there are any amendments to a document, the definitions, symbols and abbreviations used in this amendment are listed under the subclause referring to the main document

Following this, the definitions, symbols and abbreviations have each been sorted in alphabetical order and exact duplications have been deleted. Definitions of general terms, re-defined in one document in a specific way for the purpose of the present document have been written in a more generic form, possible restrictions concerning to this specific document however, have been added.

If the same acronym is used for different terms used in different environments, both of the acronyms are printed in **bold** letters. All organizational abbreviations (e.g. CENELEC, ITU) have been removed.

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] ETSI ETR 300 119: "Network Aspects (NA); Open Network Provision (ONP) study on possible new interfaces at the network side of the NT1".
- [2] ETSI ETR 248: "Transmission and Multiplexing (TM); Use of single-mode fibre in the access network".
- [3] ETSI ETR 300 326: "Transmission and Multiplexing (TM); Broadband Integrated Services Digital Network (B-ISDN) access".
- [4] ETSI ETR 328: "Transmission and Multiplexing (TM); Asymmetric Digital Subscriber Line (ADSL); Requirements and performance".
- [5] ETSI EN 300 011-1: "Integrated Services Digital Network (ISDN); Primary rate User-Network Interface (UNI); Part 1: Layer 1 specification".
- [6] ETSI ETS 300 011-2: "Integrated Services Digital Network (ISDN); Primary rate User-Network Interface (UNI); Part 2: Conformance test specification for interface IA and IB".
- [7] ETSI ETS 300 011-3: "Integrated Services Digital Network (ISDN); Primary rate User-Network Interface (UNI); Part 3: Implementation Conformance Statement (ICS) and Implementation eXtra Information for Testing (IXIT) proforma specification for interface IA and IB".
- [8] ETSI EN 300 012-1: "Integrated Services Digital Network (ISDN); Basic User-Network Interface (UNI); Part 1: Layer 1 specification".
- [9] ETSI ETS 300 012-2: "Integrated Services Digital Network (ISDN); Basic User-Network Interface (UNI); Part 2: Implementation Conformance Statement (ICS) and Implementation eXtra Information for Testing (IXIT) specification for interface IA".

- [10] ETSI ETS 300 012-3: "Integrated Services Digital Network (ISDN); Basic User-Network Interface (UNI); Part 3: Implementation Conformance Statement (ICS) and Implementation eXtra Information for Testing (IXIT) specification for interface IB".
- [11] ETSI ETS 300 012-4: "Integrated Services Digital Network (ISDN); Basic User-Network Interface (UNI); Part 4: Conformance test specification for interface IA".
- [12] ETSI ETS 300 012-5: "Integrated Services Digital Network (ISDN); Basic User-Network Interface (UNI); Part 5: Conformance test specification for interface IB".
- [13] ETSI ETS 300 012-6: "Integrated Services Digital Network (ISDN); Basic User-Network Interface (UNI); Part 6: Abstract Test Suite (ATS) specification for interface IA".
- [14] ETSI ETS 300 012-7: "Integrated Services Digital Network (ISDN); Basic User-Network Interface (UNI); Part 7: Abstract Test Suite (ATS) specification for interface IB".
- [15] ETSI ETS 300 166: "Transmission and Multiplexing (TM); Physical and electrical characteristics of hierarchical digital interfaces for equipment using the 2 048 kbit/s –based plesiochronous or synchronous digital hierarchies".
- [16] ETSI ETS 300 167: "Transmission and Multiplexing (TM); Functional characteristics of 2 048 kbit/s interfaces".
- [17] ETSI ETS 300 233: "Integrated Services Digital Network (ISDN); Access digital section for ISDN primary rate".
- [18] ETSI ETS 300 297: "Integrated Services Digital Network (ISDN); Access digital section for ISDN basic access".
- [19] ETSI EN 300 299: "Broadband Integrated Services Digital Network (B-ISDN); Cell based user network access for 155 520 kbit/s and 622 080 kbit/s; Physical layer interfaces for B-ISDN applications".
- [20] ETSI ETS 300 300: "Broadband Integrated Services Digital Network (B-ISDN); Synchronous Digital Hierarchy (SDH) based user network access; Physical layer User Network Interfaces (UNI) for 155 520 kbit/s and 622 080 kbit/s Asynchronous Transfer Mode (ATM) B-ISDN applications".
- [21] ETSI EN 300 463: "Transmission and Multiplexing (TM); Requirements of passive Optical Access Networks (OANs) to provide services up to 2 Mbit/s bearer capacity".
- [22] ETSI ETS 300 742: "Transmission and Multiplexing (TM); Physical layer User Network Interface (UNI) for 2 048 kbit/s Asynchronous Transfer Mode (ATM) signals".
- [23] ETSI I-ETS 300 811: "Broadband Integrated Services Digital Network (B-ISDN); Transmission Convergence (TC) and Physical Media Dependent (PMD) sublayers for the SB reference point at a bit-rate of 25,6 Mbit/s over twisted pair cable".
- [24] ETSI TS 101 135: "Transmission and Multiplexing (TM); High bit-rate Digital Subscriber Line (HDSL) transmission system on metallic local lines; HDSL core specification and applications for 2 048 kbit/s based access digital sections".
- [25] ETSI TS 101 270-1: "Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Very high speed Digital Subscriber Line (VDSL); Part 1: Functional requirements".
- [26] ETSI TS 101 270-2: "Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Very high speed Digital Subscriber Line (VDSL); Part 2: Transceiver specification".
- [27] ETSI TS 102 080: "Transmission and Multiplexing (TM); Integrated Services Digital Network (ISDN) basic rate access; Digital transmission system on metallic local lines".
- [28] ETSI TS 101 388: "Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Asymmetrical Digital Subscriber Line (ADSL) - European specific requirements [ANSI T1.413 - 1998, modified]".

- [29] ETSI ETR 001: "Integrated Services Digital Network (ISDN); Customer access maintenance".
- [30] ITU-T Recommendation I.604: "Application of maintenance principles to ISDN primary rate access".
- [31] CCITT Recommendation X.200 (1988): "Information technology - Open Systems Interconnection - Basic reference model: The basic model".
- [32] ITU-T Recommendation G.652: "Characteristics of a single-mode optical fibre cable".
- [33] ITU-T Recommendation I.430: "Basic user - network interface - Layer 1 specification".
- [34] ISO/IEC 9646-1: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".
- [35] ITU-T Recommendation G.960: "Access digital section for ISDN basic rate access".
- [36] ITU-T Recommendation I.411: "ISDN user-network interfaces - Reference configurations".
- [37] ITU-T Recommendation I.412: "ISDN user-network interfaces - Interface structures and access capabilities".
- [38] ITU-T Recommendation I.113: "Vocabulary of terms for broadband aspects of ISDN".
- [39] ITU-T Recommendation Q.2931: "Broadband Integrated Services Digital Network (B-ISDN) - Digital Subscriber Signalling System No. 2 (DSS 2) - User-Network Interface (UNI) - Layer 3 specification for basic call/connection control".
- [40] ITU-T Recommendation I.112: "Vocabulary of terms for ISDNs".
- [41] ITU-T Recommendation I.414: "Overview of Recommendations on Layer 1 for ISDN and B-ISDN customer accesses".
- [42] ITU-T Recommendation I.432.1: "B-ISDN user-network interface - Physical layer specification: General characteristics".
- [43] ITU-T Recommendation I.432.2: "B-ISDN user-network interface - Physical layer specification: 155 520 kbit/s and 622 080 kbit/s operation".
- [44] ITU-T Recommendation I.432.3: "B-ISDN user-network interface - Physical layer specification: 1544 kbit/s and 2048 kbit/s operation".
- [45] ITU-T Recommendation I.432.4: "B-ISDN user-network interface - Physical layer specification: 51 840 kbit/s operation".
- [46] ETSI ETR 257: "V interfaces at the digital Service Node (SN); Identification of the applicability of existing protocol specifications for a VB5 reference point in an access arrangement with Access Networks (ANs)".
- [47] Void.
- [48] ETS 300 324: "V interfaces at the digital Local Exchange (LE); V5.1 interface for the support of Access Network (AN)".
- [49] ETS 300 347: "V interfaces at the digital Local Exchange (LE); V5.2 interface for the support of Access Network (AN)".
- [50] ITU-T Recommendation I.610: "B-ISDN operation and maintenance principles and functions".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of TM6 documents, the following terms and definitions are used:

2M1: classification of an ADSL system capable of transporting 6 144 kbit/s downstream towards the ADSL Network Termination (ANT)

2M2: classification of an ADSL system capable of transporting 4 096 kbit/s downstream towards the ANT

2M3: classification of an ADSL system capable of transporting 2 048 kbit/s downstream towards the ANT

Abstract Test Case: complete and independent specification of the actions required to achieve a specific test purpose, defined at the level of abstraction of a particular Abstract Test Method, starting in a stable testing state and ending in a stable testing state. This specification may involve one or more consecutive or concurrent connections. (ISO/IEC 9646-1 [34])

Abstract Test Suite (ATS): test suite composed of abstract test cases. (ISO/IEC 9646-1 [34])

Access: set of equipment at a point of the network where a user connects to it. This includes the user equipment and the equipment in the network to which the user connects, i. e. the exchange termination, network termination and terminal equipment (ITU-T Recommendation Q.2931 [39]).

NOTE 1: The ISDN customer access as defined in ITU-T Recommendation G.960 [35], annex B consists of the ET, the access digital section and the terminal equipment.

Access digital section: whole of the means of digital transmission of a digital signal of specified rate between two consecutive reference points. The term should be qualified by the type of access supported, or by a prefix denoting the V interface at the digital section boundaries. For example:

- basic access digital section;
- primary rate access digital section;
- V_x digital section.

Access link: whole of transmission means between a given network interface and a single user interface. The concept of access link is used in order to allow a functional and procedural description and a definition of the network requirements.

NOTE 2: The user-side and the network-side of the access link are not identical and therefore the access link is not symmetrical.

Activation/Deactivation: layer 1 provides the signalling capability and the necessary procedures to enable customer TEs and/or NTs to be deactivated when required and reactivated when required. The activation and deactivation procedures are defined in subclause 7.2 of ETS 300 012-1 [8]

Adaptation Unit (AU): AU provides adaptation functions between the Optical Network Unit (ONU) and the user side

Aggregate bit rate: data rate transmitted by a (VDSL) system in one direction. The aggregate data rate includes both net data rate and overhead used by the system for cyclic redundancy checks, the embedded operations channel, synchronization of the various data streams, and fixed indicator bits for operations administration and maintenance. The aggregate data rate does not include forward error correction code redundancy

Alternate Mark Inversion (AMI): line code where ONEs are represented by alternate positive and negative pulses, and ZEROs by spaces

asymmetric: mode characterized by that the bit rate supported in one transmission direction exceeds the bit rate supported in the opposite direction. Typically, asymmetric implies that the downstream bit rate exceeds the upstream bit rate

ATM cell: digital information block of fixed length (53 octets) identified by a label at the asynchronous transfer mode level

Available bit rate: ATM service whose bit rate varies between upper and lower limits and is characterized by an average bit rate. The minimum, maximum, and average bit rates may vary while a connection is established

Basic access: user-network access arrangement that corresponds to the interface structure composed of two B-channels and one D-channel. The bit rate of the D-channel for this type of access is 16 kbit/s

B-channel: B-channels provide for the bidirectional transmission of independent B-channel signals each having a bit rate of 64 kbit/s

Bearer service: type of telecommunication service that provides the capability for the transmission of signals between user-network interfaces.

NOTE 3: The ISDN connection type used to support a bearer service may be identical to that used to support other types of telecommunication service.

Bridged taps: sections of unterminated twisted-pair cable connected in parallel across the cable under consideration

Broad band: service or system that supports data using one or more frequency bands above the POTS band. Broad band typically implies transmission of bit rates greater than 100 kbit/s

Broadband Access Digital Link (B-ADL): B-ADL corresponds to the ATM End-to-End (EtoE) Virtual Path Connection (VPC) (End-to End VP Trail) between the Broadband User Network Interface (B-UNI) at the T_B reference point, as defined in ITU-T Recommendations I.432.1 [42], I.432.2 [43], I.432.3 [44] and I.432.4 [45] (also under study in TM3 - see annex B), and the first ATM switching element (service node) at the V_B reference point, as defined in ETR 257 [46]. This definition implies that the AN does not include Virtual Channel (VC) Cross-Connect (XC) functions but can include VP XC functions.

The definition of the B-ADL as a set of ATM VC Links (VC Link Connections) between the B-TE and the B-ET (in order to match the case in which the AN includes also VC XC functions), is left for further study.

The definition of the B-ADL, being based only on ATM layer functions, ensures independence from the underlying physical layer. Its applicability is then independent from the definition of B-UNI physical layer: the aim is just to define functions, associated with the B-ADL, which will remain valid independently from the evolution of the B-UNI physical layer

Broadband Access Digital Section (B-ADS): section between the user-network interface (B-UNI) at reference point T_B and the reference point V_{B1} (ITU-T Recommendation I.414 [41]).

When the access network (AN) contains ATM elements, the B-ADS corresponds to the section between the UNI at the reference point T_B and the first ATM element in the AN at V_{B1} reference point. When the AN does not include ATM elements, the first ATM element corresponds to the B-ET.

Cell : *block* of fixed length. It is identified by a label at the asynchronous transfer mode layer of the B-ISDN protocol reference model (from ITU-T Recommendation I.113 [38])

Cell delineation: identification of cell boundaries in a cell stream (from ITU-T Recommendation I.113 [38])

Clear channel: transparent bit or byte pipe

Conformance Test Adaptor (CTA): device which is either a local exchange with adaption functions providing access to the required functions or an adaptor able to provide these functions and to simulate the required functionality of the local exchange

Connection management entity: entity for the purpose of management of resources that have an impact on an individual data link connection

Constant bit rate: ATM service characterized by a deterministic bit rate that remains constant over time

Crest factor: peak to RMS voltage ratio

D-channel: this channel provides for bidirectional transmission of one D-channel signal at a bit rate of 16 kbit/s

D-channel access: layer 1 provides the signalling capability and the necessary procedures to allow TEs to gain access to the common resource of the D-channel in an orderly fashion while meeting the performance requirements of the D-channel signalling system. These D-channel access control procedures are defined in subclause 7.1 of ETS 300 012-1 [8]

Designated terminal: terminal which is permitted to draw power from power source 1 under both normal and restricted power conditions

Diplex working: bidirectional communication using a different wavelength for each direction of transmission over a single fibre

Downstream: transmission in the direction of LT (or ONU) towards NT (network to customer premise)

Duplex working: bidirectional communication using the same wavelength for both directions of transmission over a single fibre

Dynamic range: ratio between the largest and smallest usable signals that meet the requirements defined in a specification

Errored second: one second interval of received signal containing one or more bit errors

Fast channel: channel with low latency but higher BER in comparison to a slow channel

Fibre: medium used for the transport of optical signals according to ITU Recommendation G.652 [32]

Field Replaceable Unit (FRU): FRU is the lowest level of maintenance spare and will typically be a plug-in card. The modules of an Optical Line Termination (OLT) and ONU should be FRUs

Filter: device for the selection of electrical or optical signals at specific frequencies or optical wavelengths

Frame alignment: this function provides information to enable the TE or NT to recover the time-division multiplexed channels

FTTCab: this term is used to define the situation when LT transceivers are located physically at a node (normally the Cabinet or PCP) in the periphery of the access network

FTTEx: this term is used to define the situation when LT transceivers are located physically at the serving Local Exchange

Full access: given no other connections, any slot on one side of the concentrator may be connected to any slot on the other side of the concentrator

Full activation: activation of the access in order to establish a layer 2 service between the user and the network

Head end: that part of the line terminal realization that terminates the optical functions of the access (TV distribution)

High-Density Bipolar 3 (HDB3): is a modified AMI code. An exception occurs for blocks of 4 successive ZEROs. Each block of 4 successive ZEROs is replaced by 000V or B00V where B represents an inserted pulse conforming to the AMI and V represents an AMI violation. The choice of 000V or B00V is made so that the number of B pulses between consecutive V pulses is odd. In other words, successive V pulses are of alternate polarity so that no direct current (dc) component is introduced

Implementation Conformance Statement (ICS): statement made by the supplier of an Open Systems Interconnection (OSI) implementation or system, stating which capabilities have been implemented for a given system (ISO/IEC 9646-1 [34])

Implementation Under Test (IUT): implementation of functions related to interfaces as:

- the user side interface (T), i.e. NT1; and
- the exchange side interface (V), i.e. LT

or access connection elements (see also ITU-T Recommendation I.430 [33], annex E, clause E.1 definition 109)

Impulse noise: short-duration noise source characterized by sharp rise and fall times and a large amplitude

Integrated Services Digital Network (ISDN): network that provides or supports a range of different telecommunications services and provides digital connections between user-network interfaces

Interface: ETS 300 012-1 [8] defines the layer 1 characteristics of the UNI to be applied at the S or T reference points for the basic interface structure defined in CCITT Recommendation I.412 [37]. The reference configuration for the interface is defined in ITU-T Recommendation I.411 [36] and is reproduced in figure 1.

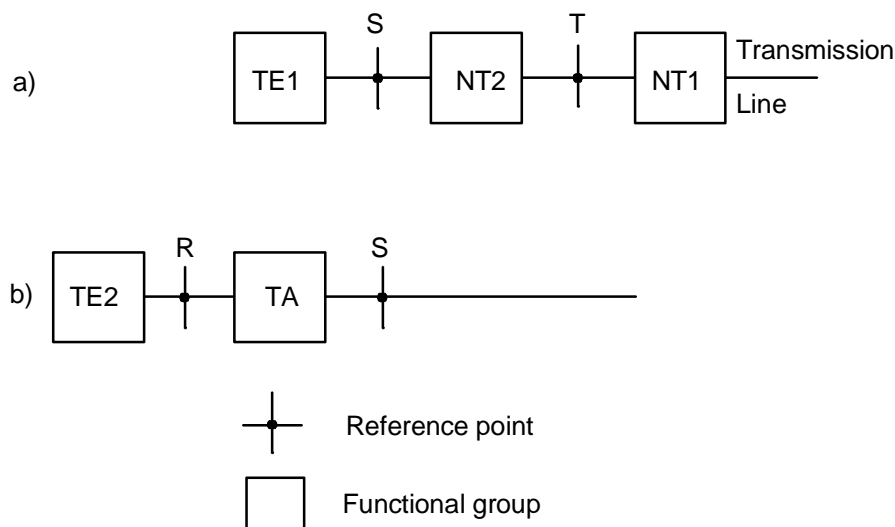


Figure 1: Definition of reference points according to the ISDN reference configuration

Interface I_A: user side of the ISDN user-network interface

Interface I_B: network side of the ISDN user-network interface

Invalid cell: cell where the header is declared by the header error control process to contain errors (from ITU-T Recommendation I.113 [38])

Item under test (IUT): implementation of functions related to interfaces as:

- the user side interface (T), i.e. NT1; and
- the exchange side interface (V), i.e. LT

or access connection elements (see also ITU-T Recommendation I.430 [33], annex E, clause E.1 definition 109).

NOTE 4: This definition is identical to Implementation Under Test and should not be used in the future.

Line rate: total bit rate supported by a connection in one direction. Line rate is the sum of the payload bit rate and all bit rate overhead required for forward error correction, synchronization, cyclic redundancy checks the embedded operations channel, the (xDSL) overhead channel, and fixed indicator bits for operations, administration and maintenance

Line Termination (LT): functional group containing at least the transmit and receive functions terminating one end of a digital transmission system (ITU-T Recommendation I.112 [40])

Lower Tester (LT): representation of the means of providing, during test execution, indirect control and observation of the lower service boundary of the IUT via the underlying service-provider. (ISO/IEC 9646-1 [34])

Maintenance: layer 1 provides the signalling capability, procedures and necessary functions at layer 1 to enable maintenance functions to be performed

Multiplexing (dynamic): system of multiplexing where the relationship between the position of the tributaries to the multiplexed format (channels) is flexible. It also allows for tributaries to be aggregated where there are more tributaries than available channels and the possibility to vary the bandwidth to n times the capacity of the channels

Multiplexing (static): system of multiplexing where the relationship between the position of the tributaries to the multiplexed format (channels) is predetermined and fixed

Network option 1: digital link between interface at the T and V reference point does not provide a CRC-4 processing, i.e. the CRC-4 is terminated in the TE and the ET. This digital link is called to be "without CRC processing" (see subclause 7.2.2.2 of ETS 300 011-1 [5])

NOTE 5: This option is not provided by the public ISDN at the T reference point. However it might be used for Private Telecommunications Network Exchange (PTNX) interconnection using unstructured 2 048 kbit/s leased lines.

Network option 2: digital link between interface at the T and V reference point provides CRC-4 processing in the NT1 and the ET according ETR 001 [29]. Therefore the combinations of CRC-4 error information and Remote Alarm Indication (RAI) indicate the fault condition; FC1 or FC4 (see subclause 7.2.2.1 of ETS 300 011-1 [5]).

NOTE 6: This option is not provided by the public ISDN at the T reference point. However it might be used for PTNX interconnection using unstructured 2 048 kbit/s leased lines.

Network side: NT1, LT and ET functional groups in case of an interface at the T reference point; or relevant parts of the NT2 functional group in case of an interface at the S reference point

Network Termination (NT): term NT is used to indicate network terminating layer 1 aspects of NT1, NT2 and PS1 (if applicable) functional groups unless otherwise indicated. The term NT is also used to indicate the layer 1 network side of the basic- or primary rate access interface.

NOTE 7: The NT is providing an I_B interface.

Network Termination Type 1 (NT1): this functional group includes functions broadly equivalent to layer 1 (physical) of the Open System Interconnection (OSI) reference model as defined in CCITT Recommendation X.200 [31]. These functions are associated with the proper physical and electromagnetic termination of the network. NT1 functions are:

- line transmission termination;
- layer 1 maintenance functions and performance monitoring;
- timing;
- layer 1 multiplexing;
- interface termination.

Network Termination Type 2 (NT2): this functional group includes functions broadly equivalent to layer 1 and higher layers of the Open System Interconnection (OSI) reference model as defined in CCITT Recommendation X.200 [31]. Private Telecommunication Network Exchanges (PTNXs), local area networks and terminal controllers are examples of equipment or combinations of equipment that provide NT2 functions. NT2 functions include:

- layer 2 and layer 3 protocol handling;
- layer 2 and layer 3 multiplexing;
- switching;
- concentration;
- maintenance functions;
- interface termination and other layer 1 functions.

Non-blocking: any allowable connection may be made at any time, regardless of the order in which connections are established or removed. (An allowable connection assumes that the respective slots are free)

Non-designated terminal: terminal which is only permitted to draw power from power source 1 under normal power conditions

Normal power condition: condition indicated by the normal polarity of the phantom voltage at the access leads, i.e. where the voltage of the transmit leads c and d on the TE is positive with respect to the voltage on the receive leads e and f

Optical Access Network (OAN): set of access links sharing the same network-side interfaces and supported by optical access transmission systems.

NOTE 8: The OAN may include a number of ODNs connected to the same OLT.

Optical Distribution Network (ODN): ODN provides the optical transmission means from the OLT towards the users, and vice versa

Optical filter: device for the selection of optical signals at optical specific wavelengths

Optical Line Termination (OLT): functional group containing at least the transmit and receive functions terminating one end of an optical transmission system. An OLT provides the network-side interface of the OAN and is connected to one or more ODNs

Optical Network Unit (ONU): ONU provides (directly or remotely) the user-side interface of the OAN and is connected to the ODN

Optical (power) splitter: device that has n inputs with k outputs, where $n = 1$ to k and $k \geq 2$

Partial activation: partial activation of the access digital section under control from the ET. No signal shall be sent from the NT1 to the interface at the T reference point, but signals can be received for the activation from the user side

Passive component: component part of the optical digital network that does not require external power and has reciprocal properties in both directions. i.e. fibre, splitter, filter

Passive Optical Network (PON): PON is a subset of an ODN and refers to a point-to-multipoint option

Payload bit rate: total data rate that is available to user data in any one direction

PICS Proforma: document, in the form of a questionnaire, designed by the protocol specifier or the conformance test suite specifier, which when completed for an OSI implementation or system becomes the PICS (ISO/IEC 9646-1 [34])

Point of Control and Observation (PCO): point within a testing environment where the occurrence of test events is to be controlled and observed, as defined in an Abstract Test Method. (ISO/IEC 9646-1 [34])

NOTE 9: A PCO is characterized by the set of ASPs and / or PDUs that can occur, according to the ATS, at the PCO.

Point-to-multipoint: transmission system which can have one input or output at one end with multiple inputs or outputs at the other end

Point-to-multipoint operation: this mode of operation at layer 1 allows more than one TE (source and sink pair) to be simultaneously active at an S or T reference point. (The multipoint mode of operation may be accommodated, as discussed in clause 5 of ETS 300 012-1 [8], with point-to-point or point-to-multipoint wiring configurations)

Point-to-point operation: this mode of operation at layer 1 implies that only one source (transmitter) and one sink (receiver) are active at any one time in each direction of transmission at an S or T reference point. (Such operation is independent of the number of interfaces which may be provided on a particular wiring configurations - see clause 5 of ETS 300 012-1 [8])

Power Source 1 (PS1): power source for the provision of remote power feeding of TE via a phantom circuit of the interface wires

Primary rate access Digital Section (DS): the provision to transmit a digital signal of specified rate between two consecutive reference points. The term should be qualified by the type of access supported, or by a prefix denoting the V interface at the digital section boundaries. For example:

- basic rate access digital section;
- primary rate access digital section;
- V 5 digital section.

Primitives: represent, in an abstract way, the logical exchange of information and control between layer 1 and other entities. They neither specify nor constrain the implementation of entities or interfaces

Private Network Termination (PNT): remote unit of equipment which terminates a transmission system employed between the PTNX and the interface I_b and the S reference point

Private Telecommunication Network eXchange (PTNX): nodal identity in a private telecommunication network which provides autonomous and automatic switching and call handling functions used for the provision of telecommunication services which are based on the definitions for those of the public ISDN

Protocol Implementation Conformance Statement (PICS): statement made by the supplier of an Open Systems Interconnection (OSI) implementation or system, stating which capabilities have been implemented for a given OSI protocol (ISO/IEC 9646-1 [34])

Quality of service: set of parameters characterizing the success or failure of an end-to-end connection to meet the service contract negotiated for the transfer of ATM cells

R (Receive) reference point: point on the optical fibre just before the Optical Line Terminal (OLT) optical connection point (i.e. optical connector or optical splice).

NOTE 10: This definition applies only to ETR 300 248 [2].

Restricted power condition: condition indicated by the reversed polarity of the phantom voltage at the access leads, i.e. where the voltage of the receive leads e and f on the TE is positive with respect to the voltage on the transmit leads c and d

Rx (Receiver): interface signal receiver of IUT or simulator

S (Send) reference point: point on the optical fibre just after the Optical Line Terminal (OLT) optical connection point (i.e. optical connector or optical splice).

NOTE 11: This definition applies only to ETR 300 248 [2].

Serial number: reference number assigned to an object, component, etc.

Service channel: each bearer service is allocated a service channel in the PON systems. e.g. a 64 kbit/s channel to support the Public Switched Telephone Network (PSTN)

Services provided to layer 2: layer 1 provides the following services to layer 2 and the management entity.

- transmission capability;
- activation/deactivation;
- D-channel access;
- maintenance status indication.

NOTE 12: This definition applies to ETS 300 012-1 [8] only.

Services required from the physical medium: layer 1 of this interface requires a balanced metallic transmission medium, for each direction of transmission, capable of supporting 192 kbit/s

Service Unit (SU): FRU that supports service interface (Service Unit (SU)) function(s)

Simplex working: communication which uses a different fibre or wire pair for each direction of transmission

Simulator (terminal equipment or network): device generating a stimulus signal to bring the IUT into the required operational state and monitoring the receive signal from the IUT. It can either be a simulator for the user side or the network side of the interface

Slow channel: channel with high latency but lower BER in comparison with the fast channel

Space Division Multiplexing (SDM): bi-directional multiplexing using different fibres for up and downstream signals

Splitter: low-pass/high-pass pair of filters that separate high-frequency (e.g. VDSL or ADSL) and low-frequency (e.g. POTS, ISDN-BA) signals

State F1 (INACTIVE): in this inactive (powered-off) state, the TE is not transmitting and cannot detect the presence of any input signals. In the case of locally powered TEs which cannot detect the appearance/disappearance of power source 1 or 2, this state is entered when local power is not present. For TEs which can detect power source 1 or power source 2, this state is entered whenever loss of power (required to support all TEI functions) is detected, or when the absence of power from source 1 or 2, whichever power source is used for determining the connection status, is detected

State F2 (SENSING): this state is entered after the TE has been powered on but has not determined the type of signal (if any) that the TE is receiving. When in this state, a TE may go to a low-power consumption mode as specified in subclause 6.1.8

State F3 (DEACTIVATED): this is the deactivated state of the physical protocol. Neither the NT nor the TE is transmitting. When in this state, a TE may go to a low-power consumption mode as specified in subclause 6.1.8

State F4 (AWAITING Signal): when the TE is requested to initiate activation by means of a PH-ACTIVATE REQUEST primitive, it transmits a signal (INFO 1) and waits for a response from the NT

State F5 (IDENTIFYING Input): at the first receipt of any signal from the NT, the TE ceases to transmit INFO 1 and awaits identification of signal INFO 2 or INFO 4

State F6 (SYNCHRONIZED): when the TE receives an activation signal (INFO 2) from the NT, it responds with a signal (INFO 3) and waits for normal frames (INFO 4) from the NT

State F7 (ACTIVATED): state F7 is the only state where B and D channel contain operational data. This is the normal activate state with the protocol activated in both directions

State F8 (LOST Framing): this is the condition when the TE has lost frame synchronization and is awaiting re-synchronization by receipt of INFO 2 or INFO 4 or deactivation by receipt of INFO 0

State G1 (DEACTIVATED): in this deactivated state, the NT is not transmitting. When in this state, an NT may go to a low-power consumption mode as specified in subclause 6.1.8

State G2 (PENDING Activation): in this partially active state the NT sends INFO 2 while waiting for INFO 3. This state will be entered on request by higher layers, by means of a PH-ACTIVATE REQUEST primitive, or on the receipt of INFO 0 or lost framing while in the active state (G3). The choice to eventually deactivate is up to higher layers at the network side

State G3 (ACTIVE): this is the normal active state where the NT and TE are active with INFO 4 and INFO 3, respectively. A deactivation may be initiated by the NT system management, by means of an MPH-DEACTIVATE REQUEST primitive, or the NT may be the active state all the time, under non-fault conditions

State G4 (PENDING Deactivation): when the NT wishes to deactivate, it may wait for a timer to expire before returning to the deactive state

Static conformance review: review of the extent to which the static conformance requirements are met by the Implementation Under Test (IUT), accomplished by comparing the PICS with the static conformance requirements expressed in the relevant standard(s)

Status indication: layer 1 provides an indication to the higher layers of the status of layer 1

Sub Carrier Multiplexing (SCM): multiplexing multiple electrical frequencies onto a single fibre at a single wavelength to provide an individual frequency to each multipoint to point path

Sub-channel: frequency band used by a DMT transceiver. Using an inverse discrete Fourier transformation (IDFT), the total system bandwidth is partitioned into a set of orthogonal, independent sub-channels

Subscriber premise: location at which the remote transceiver resides. it is presumed that the remote transceiver may be located either inside or outside the subscriber premise

Superframe: set of successive DMT symbols, some of which support upstream transmission, and others which support downstream transmission. Superframes also contain silent intervals whose duration may or may not be integer multiples of a symbol period (this definition applies to VDSL only)

symmetric: condition occurring when the same bit rate is supported in both transmission directions

Synchronized discrete multi-tone: implementation of DMT that requires transmission of all VTU-Os in a common binder to be time synchronized

System Under Test (SUT): real open system in which the IUT resides. (ISO/IEC 9646-1 [34])

Terminal Adapter (TA): equipment with interface I_A and one or more auxiliary interfaces that allow non-ISDN terminals to be served by an ISDN user-network interface (see also ITU-T Recommendation I.411 [36])

Terminal Equipment (TE): term TE is used to indicate terminal terminating layer 1 aspects of TE1, TA and NT2 functional groups, unless otherwise indicated. The term TE is also used to indicate the layer 1 terminal side of the basic- or primary rate access interface.

NOTE12: The TE is providing an I_A interface.

Terminal Equipment Type 1 (TE1): this functional group includes functions belonging to the functional group TE, and with an interface that complies with the ISDN user-network interface standard

Time Compression Multiplexing (TCM): bi-directional multiplexing using different time slots for up and downstream signals

Time Division Multiplexing (TDM): multiplexing information onto fixed time ranges

Transmission capability: layer 1 provides the transmission capability, by means of appropriately encoded bit streams, for the B- and D-channels and the related timing and synchronization functions

Tributary Unit (TU): TU is a FRU with one or more tributary interface functions

Tx (Transmitter): interface signal transmitter of IUT or simulator

Unspecified bit rate: "best effort" ATM service for which no traffic parameters are specified and no level of performance is guaranteed

Upper Tester (UT): representation of the means of providing, during test execution, control and observation of the upper service boundary of the IUT, as defined by the chosen Abstract Test Method. (ISO/IEC 9646-1 [34])

Upstream: transmission in the direction of NT towards LT (customer premise to network)

User side: terminal terminating layer 1 aspects of TE1, Terminal Adapter (TA) and NT2 functional groups

Valid cell: cell where the header is declared by the header error control process to be free of errors (from ITU-T Recommendation I.113 [38])

Variable bit rate: ATM service whose bit rate is characterized by the average and peak bit rates. These parameters remain constant for the duration of a connection

Wavelength Division Multiplexing (WDM): bi-directional multiplexing using different optical wavelength for up and downstream signals

3.2 Symbols

For the purposes of TM6 documents, the following symbols are used:

C'	capacitance nanoFarads per km (nF/km)
F4	maintenance flow for the VP layer (see ITU-T Recommendation I.610 [50])
F5	maintenance flow for the VC layer (see ITU-T Recommendation I.610 [50])
fh	Upper frequency limit of the VDSL operating band
fh'	Upper frequency -3 dB point of the VDSL signal
fi	Upper frequency limit of the passband for existing narrow-band transmission systems
fl	Lower frequency limit of the VDSL operating band
fl'	Lower frequency -3 dB point of the VDSL signal
ft	Test loop calibration frequency for setting the insertion loss of the loop
G'	leakance Siemens per km (S/km)
L'	inductance microHenries per km (μH/km)
μs	micro second
ONE	Binary "1"
ppm	parts per million
<i>p.p.m</i>	<i>part per million</i>
R'	resistance Ohms per km (Ω/km)
Rv	VDSL source/load design impedance (purely resistive)
TB	reference point at B-UNI;
V5.1	reference point defined in ETS 300 324 [48];
V5.2	reference point defined in ETS 300 347 [49];

VB	reference point between service node and AN for B-ISDN;
VB1	reference point on the network side, delimiting the B-ADS;
VB5.1	reference point between the service node and the multi-customer AN (under study in SPS3 - see annex B).
Z0	Characteristic impedance of the test loop
ZERO	Binary "0"
Zm	Compromise reference impedance for the VDSL splitter (usually complex)

3.3 Abbreviations

For the purposes of TM6 documents, the abbreviations listed below are used.

NOTE: If two or more different acronyms for one term have been used in the past they are contained in the list. The acronym to be used in future is written in normal characters. Acronyms written in italic characters however, shall not be used any longer.

If the same acronym is used for different terms used in different contexts, both of the acronyms are printed in **bold** letters.

2B1Q	2 Binary 1 Quaternary [line code; 4-PAM]
4B3T	4 Binary 3 Ternary [Alternative line code for the ISDN-BA with higher frequency spectrum than 2B1Q]
A/D	Analogue to Digital (conversion)
AAL1	ATM Adaptation Layer 1
ac	Alternating current
<i>AC</i>	<i>Alternating Current</i>
ADC	Analogue to Digital Converter
ADL	Access Digital Link
ADSL	Asymmetric Digital Subscriber Line
AI	Action Indicator
AIB	Alarm Indicator Bit
AIS	Alarm Indication Signal
ALT	ADSL Line Termination
AM	Amplitude Modulation
AMI	Alternate Mark Inversion
AN	Access Network
ANT	ADSL Network Termination
A-PON	Access network PON
APS	Auxiliary Power Source
ASN.1	Abstract Syntax Notation
ASP	Abstract Service Primitive
ATM	Asynchronous Transfer Mode
ATM	Abstract Test Method
ATM XC	ATM cross Connect
ATS	Abstract Test Suite
ATU-C	ADSL Terminal Unit-Central office (same as ALT)
ATU-R	ADSL Terminal Unit-Remote (same as ANT)
AU	Adaptation Unit
AU	Administrative Unit
AUXP	AUXiliary Pattern
BA	Basic Access [THIS ACRONYM IS TO BE USED ONLY IN CONJUNCTIN WITH ISDN AS ISDN-BA]
B-ADL	Broadband Access Digital Link
B-ADS	Broadband Access Digital Section
BCC	Bearer Channel Control
BER	Bit Error Rate
BERTS	Bit Error Rate Test Set
B-ET	Broadband Exchange Termination
BIP	Bit Interleaved Parity
B-ISDN	Broadband Integrated Services Digital Network
B-NT	Broadband Network Termination

B-NT2	Broadband Network Termination type 2
B-OLT	Broadband Optical Line Termination
B-ONU	Broadband Optical network Unit
BRA	Basic Rate Access [THIS TERM SHALL NOT BE USED IN FUTURE; IT IS TO BE REPLACED BY ISDN-BA]
BT	Bridged Tap [an unterminated twisted pair section bridged across the line]
B-TA	Broadband ISDN (B-ISDN) Terminal Adapter
B-TE	Broadband ISDN (B-ISDN) Terminal Equipment
B-UNI	Broadband ISDN (B-ISDN) User Network Interface
CAP	Carrierless Amplitude Phase modulation
CATV	CABLE TeleVision
CCP	Cross Connection Point
CEC	Cell Error Control
CER	ATM Cell Error Ratio
CF	Crest Factor
CLP	Cell Loss Priority
CMI	Coded Mark Inversion
CO	Central Office (Local Exchange)
CPE	Customer Premise Equipment
CRC	Cyclic Redundancy Check (CRC might be extended by a number like CRC-4 indicating the number of bits used for the test)
CSO	Cold-Start-Only
CTA	Conformance Test Adaptor
D/A	Digital to Analogue (conversion)
D/S	Downstream (Network to Customer direction)
D2048S	2 048 kbit/s digital structured ONP leased line
D2048U	2 048 kbit/s digital unstructured ONP leased line
dBm	deciBel referred to 1 milliwatt
dc	direct current
<i>DC</i>	<i>Direct Current</i>
<i>Dc</i>	<i>direct current</i>
DLL	Digital Local Line
DPS	Dynamic Power Saving
DS	Distributive Services
DS	access Digital Section
DSL	Digital Subscriber Line
DSS	Distributed Sample Scrambler
DTS	Digital Transmission System
DXC	Digital cross Connect
EC	Echo Cancellor
ECH	Echo Cancellation Hybrid
EDC	Error Detection Code
EM	Element Manager
EMC	Electro-Magnetic Compatibility
EMI	ElectroMagnetic Interference
eoc	embedded operations channel
<i>EOC</i>	<i>Embedded Operations Channel</i>
ET	Exchange Termination
EtoE	End to End
ETR	ETSI Technical Report
ETS	European Telecommunication Standard
ExTS	Executable Test Suite
FAS	Frame Alignment Signal
FAW	Frame Alignment Word
FC	Fault Condition
FC4	Failure Condition
FDD	Frequency Division Duplex
FDM	Frequency Division Multiplexing
FE	Function Element
FE	Failure Element
FEBE	Far End Block Error
FEC	Forward Error Correction

FEXT	Far-end crosstalk
FITL	Fibre In The Loop
FRAU	Field Replaceable Unit
FSAN	Full Services Access Network
FTTA	Fibre To The Apartment
FTTB	Fibre To The Building
FTTC	Fibre To The Curb
FTTCab	Fibre To The Cabinet
FTTEx	Fibre to the Exchange
FTTH	Fibre To The Home
FTTO	Fibre To The Office
FW	Frame Word
HAPI	Hypothetical Application Independent Interface
HDB3	High Density Bipolar 3
HDLC	High level Data Link Control
HDSL	High bit rate Digital Subscriber Line
HEC	Header Error Control
HOH	HDSL OverHead
HOPT	Higher Order Path Termination
I	Informative
I _A	Interface point A
I _B	Interface point B
ICS	Implementation Conformance Statement
IDFT	Inverse Discrete Fourier Transform
IFW	Inverted Frame Word
IL	Insertion Loss
INFO	Information element defined at the user-network interface
IS	Interactive Services
ISDN	Integrated Services Digital Network
ISDN-BA	ISDN-Basic Access
ISDN-PRA	ISDN Primary Rate Access
ISN	Impedance Stabilisation Network
ITSEC	Information Technology Security Criteria
IUT	Implementation Under Test
IXIT	Implementation eXtra Information for Testing
kbps	kilo bits per second (1 kbps = 1 000 bits per second = 1 kbit/s)
LAN	Local Area Network
LCD	Loss of Cell Delineation
LCL	Longitudinal Conversion Loss
LCTL	Longitudinal Conversion Transfer Loss
LEx	Local Exchange or Central Office
LFA	Loss of Frame Alignment
LOF	Loss Of Frame
LOM	Loss Of Maintenance cell
LOP	Loss Of Pointer
LOS	Loss Of Signal
LSB	Least Significant Bit
<i>lsb</i>	<i>least significant bit</i>
LT	Line Termination
LT	Lower Tester
LTU	Line Termination Unit
LUP	Logical User Port
MA	Medium Adapter
Mbps	Mega bits per second (1 Mbps = 1 000 kbps = 1000 kbit/s)
MBS	Monitoring Block Size
MDF	Main Distribution Frame
MF	Multiframe
MFAS	Multiframe Alignment Signal
MMS	Modified Monitoring State
MOT	Means Of Testing
MPH	Management (entity) - PPhysical (layer) [primitive used for the communication between Management and Physical layer]

MPH	Management Physical Header
MPH-AI	MPH - Activate Indication
MPH-DI	MPH – Deactivation Indication
MPH-EI	MPH - Error Indication
MSB	Most Significant Bit
<i>msb</i>	<i>most significant bit</i>
MST	Multiplex Section Termination
MTBF	Mean Time Between Failures
MTIE	Maximum Time Interval Error
MTTR	Mean Time To Repair
N	Normative
N/R	Not Relevant
NE	Network Element
NEXT	Near End Crosstalk
NF	Normal Frame
NIB	Network Indicator Bit
NIC	Number of Included Cells
N-ISDN	Narrowband ISDN
NMB	Number of Monitored Blocks
NNI	Network Node Interface
NNI	Network to Network Interface
NOF	Normal Operational Frames
NPC	Network Parameter Control
NRZ	Non Return to Zero
NT	Network Termination
NT1	Network Termination type 1
NTM	NT1 Test Mode
NTR	Network Timing Reference
NTU	Network Termination Unit
O&M	Operation and Maintenance
OAM	Operation Administration and Maintenance
OAN	Optical Access Network
OCD	Out of Cell Delineation
ODN	Optical Distribution Network
OLT	Optical Line Termination
ONP	Open Network Provision
ONU	Optical Network Unit
OS	Operations System
OSI	Open Systems Interconnection
OTDR	Optical Time Domain Reflectometer
P-AIS	Path Alarm Indication Signal
PAM	Pulse Amplitude Modulation
PCM	Pulse Code Modulation
PCN	Personal Communications Network
PCO	Point of Control and Observation
PCTR	Protocol Conformance Test Report
PDH	Plesiochronous Digital Hierarchy
PDU	Protocol Data Unit
PE	Poly-Ethylene
<i>PE</i>	<i>PolyEthylene</i>
PEP	Peak Envelope Power
PH	PHysical (layer) [primitive used for the communication between data link layer and physical layer]
PH	Packet Handler
PH	Physical Header
PH-AI	PH - Activate Indication
PH-DI	PH - Deactivate Indication
PICS	Protocol Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
PL O&M	Physical Layer Operation & Maintenance
PLOAM	Physical Layer Operations, Administration and Maintenance
PM	Physical Medium
PMD	Physical Medium Dependent

PMDA	Physical Medium Dependent Adaptation
PMS	Physical Media Specific
PMS-TC	Physical Media Specific-Transmission Convergence
PNT	Private Network Termination
POH	Path Overhead
PON	Passive Optical Network
POTS	Plain Old Telephony Service
PRA	Primary Rate Access [THIS TERM SHALL BE USED ONLY IN CONJUNCTION WITH ISDN AS ISDN-PRA]
PRBS	Pseudo-Random Binary Sequence
PRC	Primary Reference Clock
PRC	Payload Rate Change
P-REI	Path Remote Error Indication
PRU	Pseudo-Random Upstream
PS1	Power Source 1
PS2	Power Source 2
PSD	Power Spectral Density [usually quoted in dBm/Hz]
PSL	Power Sum Loss
PSN	Physical layer Sequence Number
PSTN	Public Switched Telephone Network
PTI	Payload Type Identifier
PTN	Private Telecommunications Network
PTNX	Private Telecommunications Network Exchange
PTR	Pointer
PVC	Poly Vinyl Chloride
Q AN	Q interface for the Access Network
QoS	Quality of Service
RAI	Remote Alarm Indication
RDI	Remote Defect Indication
REG	Regenerator
REG-C	NTU side of the regenerator
REG-R	LTU side of the regenerator
REI	Remote Error Indication
RF	Radio Frequency
RFI	Radio Frequency Interference
rms	root mean square
<i>RMS</i>	<i>Root Mean Square</i>
RSE	Remote Single layer Embedded
RST	Regenerator Section Termination
Rx	signal Receiver
SAI	S/T-interface-Activity Indicator
SCM	Sub Carrier Multiplexing
SCMA	Sub Carrier Multiple Access
SCS	System Conformance Statement
SCTR	System Conformance Test Report
SDB	Switched Digital Broadcast
SDH	Synchronous Digital Hierarchy
SDM	Space Division Multiplexing
SDP	Subscriber Distribution Point
SELV	Subscriber Extra Low Voltage
SIG	Signal between LT and NT1
SMF	Sub-MultiFrame
SNI	Service Node Interface
SNR	Signal to Noise Ratio
SOH	Section Overhead
SPF	Signalling Processing Function
SSU	Synchronization Supply Unit
STI	Surface Transfer Impedance
STM	Synchronous Transport Module
STM	Synchronous Transfer Mode
SU	Service Unit
SUT	System Under Test

SVC	Signalling Virtual Channel
SW	Short Wave
TA	Terminal Adapter
TBD	To Be Determined (Defined)
TC	Transmission Convergence
TC	Trellis Coding
TCM	Time Compression Multiplexing
TCP	Test Co-ordination Procedures
TDD	Time Division Duplex
TDM	Time Division Multiplexing
TDMA	Time Division Multiple Access
TE	Terminal Equipment
TEI	Terminal Endpoint Identifier
TELE	Telephone port for the VDSL splitter
TFV	Terminal Failure Voltage
TMN	Telecommunication Management Network
TNV	Telecommunication Network Voltage
TP	Test Purpose
TPS	Transmission Protocol Specific
TPS-TC	Transmission Protocol Specific-Transmission Convergence
TS	Time Slot
TS	Technical Specification
TSS&TP	Test Suite Structure and Test Purposes
TTCN	Tree and Tabular Combined Notation
TTP	Trail Termination Point
TU	Tributary Unit
TU-12	Tributary Unit-12
TV	Television
Tx	signal Transmitter
U/S	Upstream (Customer to Network direction)
UI	Unit Interval
Uipp	Unit Intervals peak to peak
UNA	User-Network Access
UNI	User Network Interface
UOA	DLL-Only-Activation
UPC	User Parameter Control
UPF	User Port Function
UTC	Unable To Comply
VC	Virtual Container
VC	Virtual Channel
VC-12	Virtual Container-12
VCC	Virtual Channel Connection
VCI	Virtual Channel Identifier
VCR	Video Cassette Recorder
VDSL	Very high speed Digital Subscriber Line
VF	Voice Frequency
VP	Virtual Path
VP XC	Virtual Path Cross Connect
VPC	Virtual Path Connection
VPI	Virtual Path Identifier
VSB/AM	Vestigial Side-Band/Amplitude Modulation
WDM	Wavelength Division Multiplexer
XC	Cross Connect
xDSL	Generic term covering the family of all DSL technologies, e.g. HDSL, ADSL, VDSL

History

Document history		
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