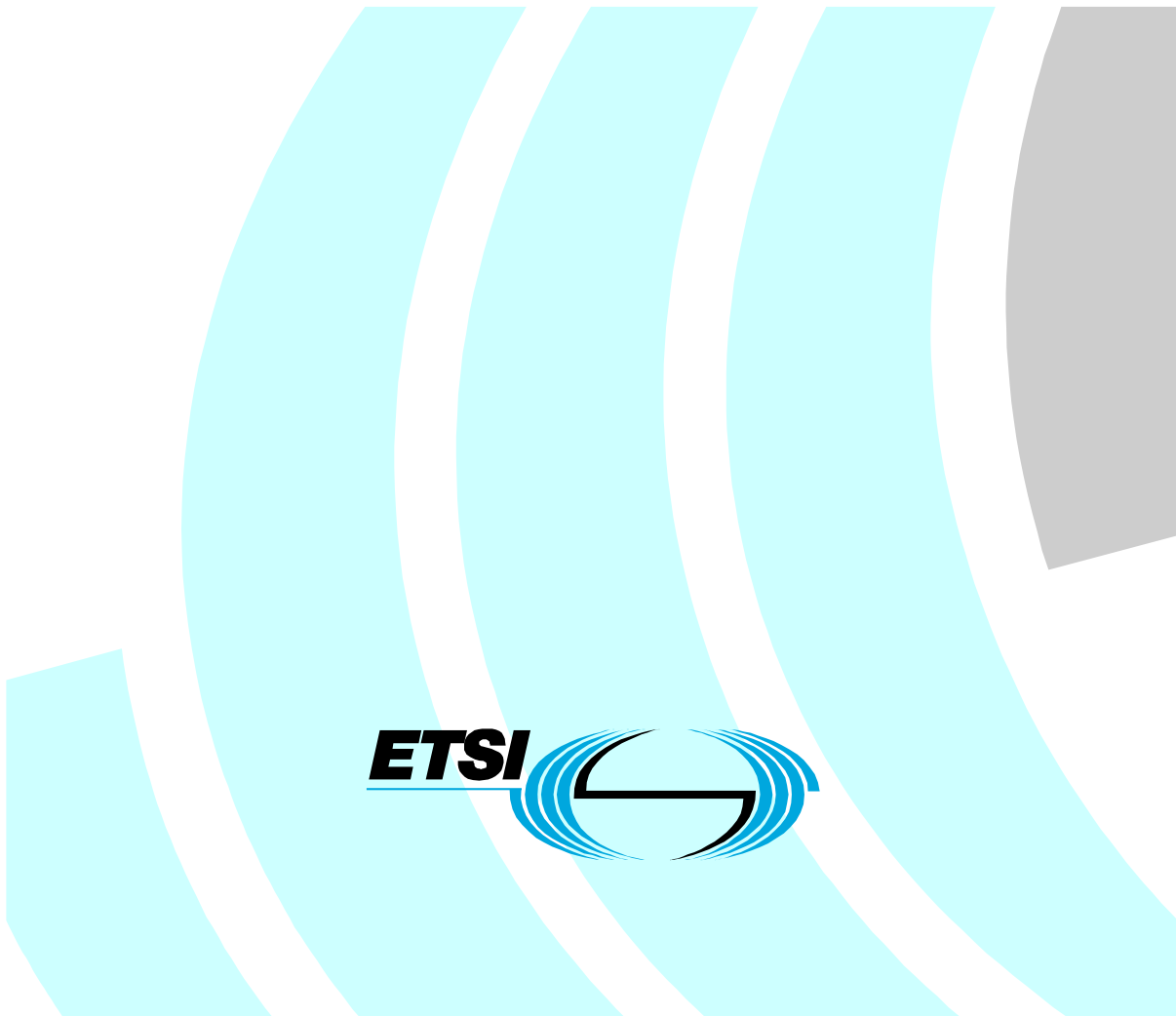


ETSI TS 101 270-2 V1.2.1 (2003-07)

Technical Specification

Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Very High Speed Digital Subscriber Line (VDSL); Part 2: Transceiver specification



Reference

RTS/TM-06023

Keywords

access, ATM, B-ISDN, IP, network, transmission,
VDSL, XDSL

ETSI

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

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

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

Important notice

Individual copies of the present document can be downloaded from:

<http://www.etsi.org>

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

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at

<http://portal.etsi.org/tb/status/status.asp>

If you find errors in the present document, send your comment to:

editor@etsi.org

Copyright Notification

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

© European Telecommunications Standards Institute 2003.
All rights reserved.

DECT™, **PLUGTESTS™** and **UMTS™** are Trade Marks of ETSI registered for the benefit of its Members.
TIPHON™ and the **TIPHON logo** are Trade Marks currently being registered by ETSI for the benefit of its Members.
3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

ETSI

Contents

Intellectual Property Rights	9
Foreword.....	9
1 Scope	9
2 References	10
3 Definitions and abbreviations.....	10
3.1 Definitions.....	10
3.2 Abbreviations	12
4 Reference models	14
4.1 Interface model.....	14
4.2 Protocol model	14
4.2.1 Protocol layer model.....	14
4.2.2 Functional decomposition.....	14
4.3 Reference points.....	15
4.3.1 V reference point	15
4.3.2 U reference points.....	15
4.3.3 S and T reference points	15
4.4 Deployment configurations	15
5 Physical Medium Dependent (PMD) layer	17
5.1 Multi-carrier PMD sub-layer specification.....	17
5.1.1 PMD functional model.....	17
5.1.2 VTU-O and VTU-R functional characteristics	18
5.1.2.1 Modulation	18
5.1.2.1.1 Sub-carriers	18
5.1.2.1.2 Data sub-carriers.....	18
5.1.2.1.3 Modulation by the Inverse Discrete Fourier Transform (IDFT).....	18
5.1.2.2 Cyclic extension.....	18
5.1.2.3 Synchronisation.....	19
5.1.2.3.1 Pilot tone.....	19
5.1.2.3.2 Loop timing	20
5.1.2.3.3 Timing advance	20
5.1.2.3.4 Synchronous mode (optional).....	20
5.1.2.4 Power back-off in the upstream direction	20
5.1.2.5 Constellation encoder.....	20
5.1.2.5.1 Even values of b	21
5.1.2.5.2 Odd values of b , $b = 1$ or $b = 3$	21
5.1.2.5.3 Odd values of b , $b > 3$	22
5.1.2.6 Gain scaling.....	23
5.1.2.7 Tone ordering.....	23
5.1.2.8 U_1 -interface characteristics	24
5.1.2.8.1 Egress	24
5.1.2.8.2 Power Spectral Density of all signals	24
5.1.2.8.3 Wideband launch power	24
5.2 Single carrier PMD sub-layer specification.....	24
5.2.1 Basic principles.....	24
5.2.1.1 Functional model.....	24
5.2.1.2 Timing.....	25
5.2.2 Transmit functionality.....	25
5.2.2.1 Frame splitting	25
5.2.2.2 Coding and modulation	27
5.2.2.2.1 Constellation encoder	27
5.2.2.2.2 Modulator	31
5.2.2.3 Carrier spectral shaping.....	32
5.2.3 Receive functionality	33

5.2.4	Interface specification.....	34
5.2.4.1	I-interface	34
5.2.4.2	U1-interface (Transmission Media Interface)	34
5.2.4.2.1	Transmit signal power	34
5.2.4.2.2	Transmit signal Power Spectral Density.....	34
5.2.4.2.3	Transmit PSD control	34
5.2.4.2.4	Return Loss.....	35
5.2.4.2.5	Output Signal Balance (OSB).....	35
5.2.5	Transmission profiles.....	36
5.2.5.1	Transmission profile specification	36
5.2.5.1.1	Profile code.....	36
5.2.5.1.2	Bit Rates	36
5.2.5.1.3	Spectral allocation of the Transmit Signal.....	37
5.2.5.2	Standard Transmission Profiles.....	37
5.2.5.2.1	Standard Transmission Profiles - VDSL Band Allocation	38
5.2.5.2.2	Standard Transmission Profiles - Optional Regional Specific Band Allocation	39
6	Transmission Convergence (TC) layer.....	40
6.1	TC layer functionality	40
6.1.1	Generic functional model.....	40
6.1.2	ATM transport	42
6.1.2.1	Functional model of ATM transport	42
6.1.2.2	Transport of ATM data	42
6.1.3	STM transport.....	43
6.1.3.1	Functional model of STM transport	43
6.1.3.2	Transport of STM data	43
6.1.4	Packets Transport Mode (PTM).....	44
6.1.4.1	Functional Model of PTM transport.....	44
6.1.4.2	Transport of PTM Data	44
6.1.5	Network timing reference transport	45
6.2	Transport Protocol Specific TC (TPS-TC) sub-layer	45
6.2.1	ATM Transport Protocol Specific TC (ATM_TC).....	45
6.2.1.1	Application interface description	45
6.2.1.1.1	Data flow	45
6.2.1.1.2	Synchronisation flow	46
6.2.1.1.3	Control flow	46
6.2.1.1.4	OAM flow	47
6.2.1.2	ATM_TC functionality	47
6.2.1.2.1	Cell rate de-coupling	47
6.2.1.2.2	HEC generation and verification	47
6.2.1.2.3	Cell payload randomisation and de-randomisation	47
6.2.1.2.4	Cell delineation.....	48
6.2.2	SDH Transport Protocol Specific TC (SDH_TC).....	48
6.2.2.1	Application interface description	48
6.2.2.1.1	Data flow	48
6.2.2.1.2	Synchronisation flow	48
6.2.2.1.3	OAM flow	48
6.2.2.2	SDH TPS-TC functionality	49
6.2.3	Overhead channel TPS-TC (OC_TC).....	49
6.2.3.1	Application interface description	49
6.2.3.1.1	Data flow	49
6.2.3.1.2	Synchronisation flow	49
6.2.3.2	Single Carrier OC_TC functionality	49
6.2.3.2.1	VOC and eoc multiplexing	50
6.2.3.2.2	De-multiplexing.....	50
6.2.4	PTM transport protocol specific TC (PTM-TC).....	50
6.2.4.1	Application Interface Description	50
6.2.4.1.1	Data Flow	51
6.2.4.1.2	Synchronization Flow.....	51
6.2.4.1.3	Control Flow.....	51
6.2.4.1.4	OAM Flow	52
6.2.4.2	PTM TPS-TC Functionality.....	52

6.2.4.2.1	Packet encapsulation	52
6.2.4.2.2	Frame structure	52
6.2.4.2.3	Octet transparency	53
6.2.4.2.4	Frame Check Sequence (FCS)	54
6.2.4.2.5	Packet error monitoring	54
6.2.4.3	Data rate decoupling	55
6.2.4.4	Frame delineation	55
6.3	Physical Medium-Specific TC (PMS-TC) sub-layer	55
6.3.1	Functional model	55
6.3.2	Interface specification	56
6.3.2.1	$\alpha(\beta)$ - Interface	56
6.3.2.1.1	Data flow	56
6.3.2.1.2	Synchronisation flow	56
6.3.2.1.3	OAM flow	57
6.3.2.2	I-Interface	57
6.3.2.2.1	Data flow	57
6.3.2.2.2	Synchronisation flow	58
6.4	PMS-TC functions for multi-carrier modulation	58
6.4.1	Scrambler	59
6.4.2	Forward error correction	59
6.4.3	Interleaving	59
6.4.3.1	General	59
6.4.3.2	Triangular implementation	60
6.4.4	Framing	60
6.4.4.1	Frame description	60
6.4.4.2	Payload adaptation	61
6.4.4.3	Reed-Solomon encoding	62
6.4.4.4	Superframe description and contents of fast and slow octets	63
6.4.4.4.1	Cyclic redundancy check	63
6.4.4.4.2	Synchronisation octet	63
6.4.4.4.3	Indicator bits (IB)	64
6.4.4.4.4	Network Timing Reference (NTR)	64
6.4.4.5	Convergence of fast and interleaved buffers	65
6.5	PMS-TC for single carrier modulation	65
6.5.1	Transmission frame format	65
6.5.1.1	Fast codeword structure	66
6.5.1.2	Slow codeword structure	66
6.5.1.3	Frame header octet definition	67
6.5.1.3.1	Syncword octets	67
6.5.1.3.2	Control 1 octet	68
6.5.1.3.3	Control 2 octet	68
6.5.1.3.4	Control 3 octet	69
6.5.1.3.5	CRC-bits	69
6.5.1.3.6	NTR transport and NTR marker generation	69
6.5.1.4	Frame transport classes	69
6.5.1.5	Frame delineation algorithm	70
6.5.2	Data randomisation and de-randomisation	70
6.5.3	Forward error correction	70
6.5.4	Interleaving	71
7	Operations and maintenance	72
7.1	OAM reference model	72
7.1.1	OAM framework	72
7.1.2	Components of the OAM framework	72
7.1.3	OAM functionality	73
7.1.4	Fault and performance monitoring process	74
7.2	OAM entities	75
7.2.1	OAM functional model	75
7.2.2	OAM communication channels	76
7.2.2.1	Indicator Bits (IB)	77
7.2.2.2	VDSL Overhead Control (VOC)	77
7.2.2.3	Embedded operation channel (eoc)	77

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.