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Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 2-1: Synchronous Digital Hierarchy (SDH) and Plesiochronous Digital Hierarchy (PDH) physical section layer functions

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Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 2-1: Synchronous Digital Hierarchy (SDH) and Plesiochronous Digital Hierarchy (PDH) physical section layer functions

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Foreword

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

The present document is one of a family of documents that has been produced in order to provide inter-vendor and inter-operator compatibility of Synchronous Digital Hierarchy (SDH) equipment.

The present document is part 2, sub-part 1 of a multi-part deliverable covering the Generic requirements of transport functionality of equipment, as identified below:

Part 1-1: "Generic processes and performance";

Part 1-2: "General information about Implementation Conformance Statement (ICS) proforma";

Part 2-1: "Synchronous Digital Hierarchy (SDH) and Plesiochronous Digital Hierarchy (PDH) physical section layer functions";

Part 2-2: "Synchronous Digital Hierarchy (SDH) and Plesiochronous Digital Hierarchy (PDH) physical section layer functions; Implementation Conformance Statement (ICS) proforma specification";

Part 3-1: "Synchronous Transport Module-N (STM-N) regenerator and multiplex section layer functions";

Part 3-2: "Synchronous Transport Module-N (STM-N) regenerator and multiplex section layer functions; Implementation Conformance Statement (ICS) proforma specification";

Part 4-1: "Synchronous Digital Hierarchy (SDH) path layer functions";

Part 4-2: "Synchronous Digital Hierarchy (SDH) path layer functions; Implementation Conformance Statement (ICS) proforma specification";

Part 5-1: "Plesiochronous Digital Hierarchy (PDH) path layer functions";

Part 5-2: "Plesiochronous Digital Hierarchy (PDH) path layer functions; Implementation Conformance Statement (ICS) proforma specification";

Part 6-1: "Synchronization layer functions";

Part 6-2: "Synchronization layer functions; Implementation Conformance Statement (ICS) proforma specification";

Part 7-1: "Equipment management and auxiliary layer functions";

Part 9-1: "Synchronous Digital Hierarchy (SDH) concatenated path layer functions; Requirements".

Parts 2 to 7 specify the layers and their atomic functions.

NOTE: The SDH radio equipment functional blocks are addressed by ETSI WG TM4.Various of the above parts have previously been published as parts of EN 300 417.

They have been converted to parts of EN 300 417 without technical changes, but some editorial changes have been necessary (e.g. references). In particular:

- Parts 2-1 and 3-2 have been modified to take account of editorial errors present in edition 1.
- Part 1-1 has had its title change of to align with other parts published at a later date.

Also note that in the meantime parts 8-1, 8-2 and 8-3 have been stopped.

National transposition dates	
Date of adoption of this EN:	12 October 2001
Date of latest announcement of this EN (doa):	31 January 2002
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 July 2002
Date of withdrawal of any conflicting National Standard (dow):	31 July 2002

1 Scope

The present document specifies a library of basic building blocks and a set of rules by which they are combined in order to describe transport functionality of equipment. The library comprises the functional building blocks needed to completely specify the generic functional structure of the European transmission hierarchies. Equipment which is compliant with the present document needs to be describable as an interconnection of a subset of these functional blocks contained within the present document. The interconnections of these blocks need to obey the combination rules given. The generic functionality is described in the EN 300 417-1-1 [8].

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, the latest version applies.

[1] ANSI T1.102: "Digital Hierarchy; Electrical Interfaces".

[2] ANSI T1.107: "Digital Hierarchy; Formats Specifications".

[3] ETSI EN 300 147: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); Multiplexing structure".

[4] ETSI EN 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".

[5] ETSI EN 300 167: "Transmission and Multiplexing (TM); Functional characteristics of 2 048 kbit/s interfaces".

[6] ITU-T Recommendation G.957 (1999): "Optical interfaces for equipments and systems relating to the synchronous digital hierarchy".

NOTE: The former version of G.957 was modified and published under ETSI ETS 300 236 (1996). As no revision is ongoing, the ITU Reference is preferred.

[7] ETSI ETS 300 337: "Transmission and Multiplexing (TM); Generic frame structures for the transport of various signals (including Asynchronous Transfer Mode (ATM) cells and Synchronous Digital Hierarchy (SDH) elements) at the ITU-T Recommendation G.702 hierarchical rates of 2 048 kbit/s, 34 368 kbit/s and 139 264 kbit/s".

[8] ETSI EN 300 417-1-1: "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 1-1: Generic processes and performance".

[9] ETSI EN 300 417–6–1: "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 6-1: Synchronization layer functions".

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

[11] ITU-T Recommendation G.706: "Frame alignment and cyclic redundancy check (CRC) procedures relating to basic frame structures defined in Recommendation G.704".

[12] ITU-T Recommendation G.742 (1988): "Second order digital multiplex equipment operating at 8 448 kbit/s and using positive justification".

[13] ITU-T Recommendation G.751 (1988): "Digital multiplex equipments operating at the third order bit rate of 34 368 kbit/s and the fourth order bit rate of 139 264 kbit/s and using positive justification".

[14] ITU-T Recommendation G.775: "Loss of Signal (LOS), Alarm Indication Signal (AIS) and Remote Defect Indication (RDI) defect detection and clearance criteria for PDH signals".

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

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

[17] Void.

[18] ITU-T Recommendation G.691: "Optical interfaces for single-channel SDH systems with Optical Amplifiers, and STM-64 systems".

[19] ETSI ETS 300 232: "Transmission and Multiplexing (TM); Optical interfaces for equipments and systems relating to the Synchronous Digital Hierarchy [ITU-T Recommendation G.957 (1993), modified]".

3 Definitions, abbreviations and symbols

3.1 Definitions

The functional definitions are described in EN 300 417-1-1 [8].

3.2 Abbreviations

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

A	Adaptation function
AI	Adapted Information
AIS	Alarm Indication Signal
ALS	Automatic Laser Shutdown
ANSI	American National Standards Institute
AP	Access Point
ATM	Asynchronous Transfer Mode
AU	Administrative Unit
BBE	Background Block Error
BER	Bit Error Rate
BFA	Basic Frame Alignment
BIP	Bit Interleaved Parity
C	Connection function
CH	CHannel
CI	Characteristic Information
CID	Consecutive Identical Digits
CK	ClocK
CM	Connection Matrix
CMI	Coded Mark Inversion
Co	Connection
CP	Connection Point
CRC	Cyclic Redundancy Check
D	Data
DEC	DECrement
DEG	DEGraded
DL	Data Link
E0	Electrical interface signal 64 kbit/s

E11	Electrical interface signal 1 544 kbit/s
E12	Electrical interface signal 2 048 kbit/s
E22	Electrical interface signal 8 448 kbit/s
E31	Electrical interface signal 34 368 kbit/s
E32	Electrical interface signal 44 736 kbit/s
E4	Electrical interface signal 139 264 kbit/s
EBC	Errored Block Count
ECC	Embedded Communications Channel
EDC	Error Detection Code
EQ	EQuipment
ES	Electrical Section
ES	Errored Second
ESR	Errored Seconds Rate
Ex	ITU-T Recommendation G.703 [10] type electrical signal, bit rate order x
F_B	Far-end Block
F_SES	Far-end Severely Errored Second
FAS	Frame Alignment Signal
FO	Frame Offset information
FS	Frame Start signal
HDB3	High Density Bipolar of order 3
HO	Higher Order
ID	IDentifier
IF	In Frame state
INC	INCrement
IS	Intermediate System
ITU-T	International Telecommunications Union - Telecommunications Sector
LC	Link Connection
LO	Lower Order
LOF	Loss Of Frame
LOM	Loss Of Multiframe
LOP	Loss Of Pointer
LOS	Loss Of Signal
LOT	Loss of Octet Timing
LT	Line Termination
MC	Matrix Connection
MFP	MultiFrame Present
MI	Management Information
MO	Managed Object
MON	MONitored
MS	Multiplex Section
MS1	STM-1 Multiplex Section
MSP	Multiplex Section Protection
N_B	Near-end Block
N_SES	Near-end Severely Errored Second
NC	Network Connection
NCI	No CRC-4 to CRC-4 Interworking
NE	Network Element
NNI	Network Node Interface
NRZ	Non-Return to Zero
NU	National Use (bits, bytes)
OOF	Out Of Frame state
OS	Optical Section
OW	Order Wire
P	Protection
P0s	synchronous 64 kbit/s layer
P11x	1 544 kbit/s layer (transparent)
P12s	2 048 kbit/s PDH path layer with synchronous 125 µs frame structure according to EN 300 167 [5]
P12x	2 048 kbit/s layer (transparent)
P22e	8 448 kbit/s PDH path layer with 4 plesiochronous 2 048 kbit/s
P22x	8 448 kbit/s layer (transparent)
P31e	34 368 kbit/s PDH path layer with 4 plesiochronous 8 448 kbit/s

P31s	34 368 kbit/s PDH path layer with synchronous 125 µs frame structure according to ETS 300 337 [7]
P31x	34 368 kbit/s layer (transparent)
P32x	44 736 kbit/s layer (transparent)
P4e	139 264 kbit/s PDH path layer with 4 plesiochronous 34 368 kbit/s
P4s	139 264 kbit/s PDH path layer with synchronous 125 µs frame structure according to ETS 300 337 [7]
P4x	139 264 kbit/s layer (transparent)
PDH	Plesiochronous Digital Hierarchy
PS	Protection Switching
RI	Remote Information
RLT	Regenerated Line Termination
RS	Regenerator Section
RS1	STM-1 Regenerator Section
RS16	STM-16 Regenerator Section
RS4	STM-4 Regenerator Section
S2	VC-2 path layer
S3	VC-3 path layer
S4	VC-4 path layer
SD	Synchronization Distribution layer, Signal Degrade
SDH	Synchronous Digital Hierarchy
SES	Severely Errored Second
SF	Signal Fail
SHR	Self Healing Ring
Sk	Sink
SNC	Sub-Network Connection
So	Source
SOH	Section OverHead
SSF	Server Signal Fail
STM	Synchronous Transport Module
STM-N	Synchronous Transport Module, level N
T12	2 048 kHz signal
TD	Transmit Degrade
TF	Transmit Fail
TG	Timing Generator
TI	Timing Information
TM	Transmission_Medium
TP	Timing Point
TR	Threshold Report
TS	Time Slot
TSF	Trail Signal Fail
TT	Trail Termination function
TU	Tributary Unit
TUG	Tributary Unit Group
UAT	UnAvailable Time
UAT_cmd	UnAvailable Time command
UI	Unit Interval
UNI	User to Network Interface
VC	Virtual Container
W	Working

3.3 Symbols and diagrammatic conventions

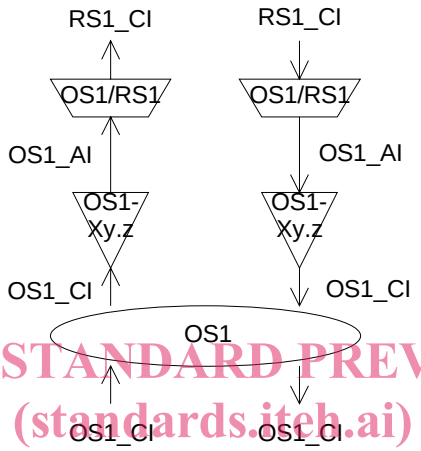
The symbols and diagrammatic conventions are described in EN 300 417-1-1 [8].

3.4 Introduction

The atomic functions defining the physical interface section layers are described below. They describe the physical and logical characteristics of the optical and electrical interfaces used in SDH equipments also with their adaptation functionality of PDH multiplex equipments described in the CCITT Recommendations G.751 [13] and G.742 [12] for signal hierarchies P4, P31 and P22, and adaptation functionality for SDH over PDH specified by ETS 300 337 [7] for signal hierarchies P4s and P31s and EN 300 167 [5] for P12s layer signals.

The physical interface layers are defined for each of the synchronous and plesiochronous rates as defined in EN 300 147 [3] and EN 300 166 [4]. References to the signal structure are mentioned in the appropriate text clauses.

4 STM-1 Optical Section Layer Functions



NOTE: Xy.z will be one value out of the set: {I1, S1.1, S1.2, L1.1, L1.2, L1.3}.

Figure 1: STM-1 Optical Section atomic functions

STM-1 Optical Section Layer CP

Characteristic Information OS1_CI of the optical layer CP (see figure 2) is a digital, optical signal of defined power, bit rate, pulse width and wavelength. A range of such characteristic signals for different optical power budgets is defined in ETS 300 232 [19].

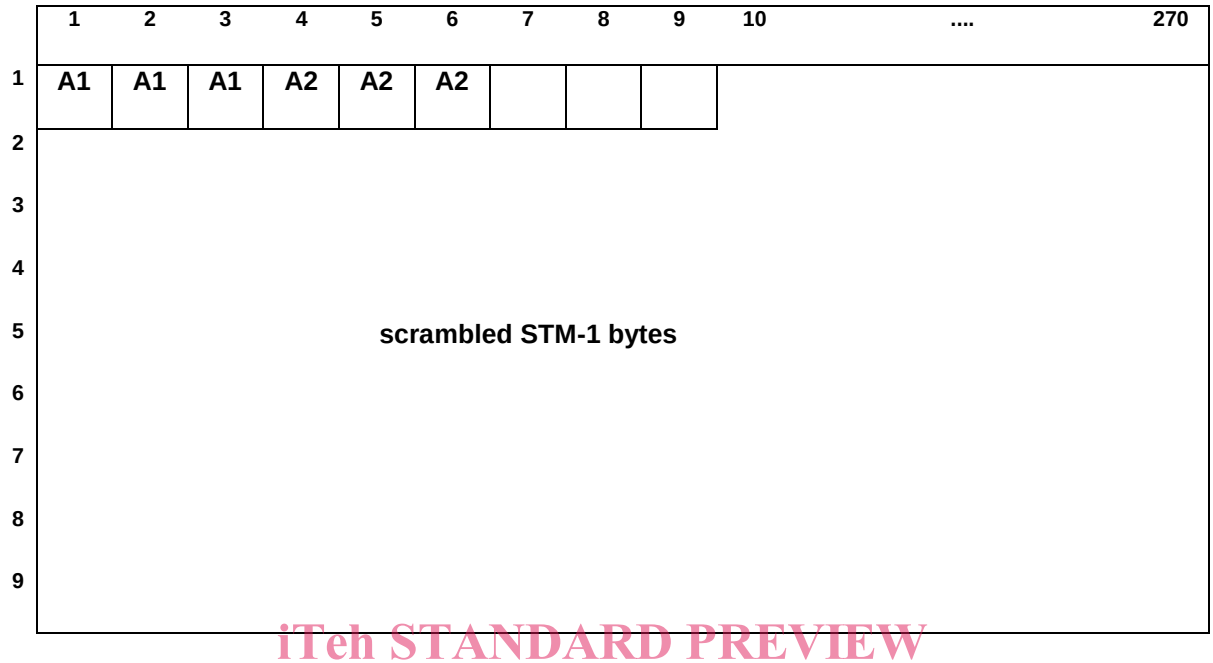


Figure 2: OS1 characteristic information OS1_CI (optical) and adapted information OS1_AI (electrical)

STM-1 Optical Section Layer AP

The information passing across the OS1_AP takes the form of a scrambled, digital bitstream (including a block frame character at 125 µs intervals) with co-directional bit timing (see figure 2). Frame characters and the synchronous, scrambling polynomial are defined in EN 300 147 [3].

4.1 Optical Section Connection functions

For further study.

4.2 Optical Section Trail Termination functions

4.2.1 Optical Section Trail Termination Source OS1-Xy.z_TT_So

NOTE: Xy.z will be one value out of the set: {I1, S1.1, S1.2, L1.1, L1.2, L1.3}.