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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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# EN 300 417-2-1 V1.1.3 (1999-05)

*European Standard (Telecommunications series)*

## **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 2-1 of a multi-part EN 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: "Auxiliary layer functions".

Part 7-2: "Auxiliary layer functions; Implementation Conformance Statement (ICS) proforma specification".

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

NOTE 1: The present document does not currently address configuration management.

NOTE 2: The SDH radio equipment functional blocks are addressed by ETSI WG TM4.

Various of the above parts have previously been published as parts of ETS 300 417.



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

- Parts 2-1, 2-2 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 and 8-2 together with all parts x-3 (Abstract Test Suites) have been stopped.

This version of the present document has been published because the previous version had incorrect dates in the transposition table.

<b>National transposition dates</b>	
Date of latest announcement of this EN (doa):	31 August 1999
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	29 February 2000
Date of withdrawal of any conflicting National Standard (dow):	29 February 2000

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## 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.
- 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] ANSI T1.102 (1993): "Telecommunications; Digital Hierarchy; Electrical Interfaces".
- [2] ANSI T1.107 (1988): "Telecommunications; Digital Hierarchy; Formats Specifications".
- [3] ETS 300 147: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); Multiplexing structure".
- [4] ETS 300 166 (1993): "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] ETS 300 167: "Transmission and Multiplexing (TM); Functional characteristics of 2 048 kbit/s interfaces".
- [6] ETS 300 232 (1993): "Transmission and Multiplexing (TM); Optical interfaces for equipments and systems relating to the Synchronous Digital Hierarchy [ITU-T Recommendation G.957 (1993) modified]".
- [7] 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] EN 300 417-1-1: "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 1-1: Generic processes and performance".
- [9] EN 300 417-6-1: "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 6-1: Synchronization distribution layer functions".
- [10] CCITT Recommendation G.703 (1991): "Physical/electrical characteristics of hierarchical digital interfaces".
- [11] CCITT Recommendation G.742 (1988): "Second order digital multiplex equipment operating at 8 448 kbit/s and using positive justification".

- [12] CCITT 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".
- [13] ITU-T Recommendation G.775 (1994): "Loss of signal (LOS) and alarm indication signal (AIS) defect detection and clearance criteria".
- [14] ITU-T Recommendation G.823 (1993): "The control of jitter and wander within digital networks which are based on the 2 048 kbit/s hierarchy".
- [15] ITU-T Recommendation G.825: "The control of jitter and wander within digital networks which are based on the synchronous digital hierarchy (SDH)".
- [16] ITU-T Recommendation G.958 (1994): "Digital line systems based on the synchronous digital hierarchy for use on optical fibre cables".

## 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
AcSL	Accepted Signal Label
AcTI	Accepted Trace Identifier
ADM	Add-Drop Multiplexer
AI	Adapted Information
AIS	Alarm Indication Signal
ALS	Automatic Laser Shutdown
ANSI	American National Standards Institute
AP	Access Point
APId	Access Point Identifier
APS	Automatic Protection Switch
ATM	Asynchronous Transfer Mode
AU	Administrative Unit
AUG	Administrative Unit Group
AU-n	Administrative Unit, level n
BBE	Background Block Error
BBER	Background Block Error Ratio
BER	Bit Error Ratio
BFA	Basic Frame Alignment
BIP	Bit Interleaved Parity
BIP-N	Bit Interleaved Parity, width N
BITS	Building Integrated Timing Supply
BNF	Backus-Naur Form
BSHR	Bi-directional Self Healing Ring
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
CRC-N	Cyclic Redundancy Check, width N
Cs	supervisory-unequipped Connection function
CSES	Consecutive Severely Errored Seconds
CTF	Compound Timing Function
Ctrl	Control
D	Data
DCC	Data Communications Channel
DEC	DECrement
DEG	DEGraded
DEGTHR	DEGraded THReshold
DL	Data Link
DPRING	Dedicated Protection RING
DROP	Decreased Received Optical Power
DXC	Digital Cross Connect
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
ECC(x)	Embedded Communications Channel, layer x
EDC	Error Detection Code
EDCV	Error Detection Code Violation
EFS	Equipment Functional Specification
EMF	Equipment Management Function
EPS	Equipment Protection Switch
EQ	Equipment
ERS	Elementary Regenerator Section
ES	Electrical Section
ES	Errored Second
ESR	Errored Seconds Ratio
Ex	CCITT Recommendation G.703 [10] type electrical signal, bit rate order x
ExSL	Expected Signal Label
ExTI	Expected Trace Identifier
F_B	Far-end Block
F_BBE	Far-end Background Block Error
F_DS	Far-end Defect Second
F_EBC	Far-end Errored Block Count
F_ES	Far-end Errored Second
F_SES	Far-end Severely Errored Second
F_SESTHR	Far-end Severely Errored Second THReshold
F_UAT_cmd	Far-end UnAvailable Time command
FAS	Frame Alignment Signal
FEBE	Far End Block Error
FERF	Far End Receive Failure
FIFO	First In First Out
FIT	Failure In Time
FO	Frame Offset information
FOP	Failure Of Protocol
FS	Frame Start signal
HDB3	High Density Bipolar of order 3
HDLC	High-level Data Link Control procedure
HO	Higher Order
HOVC	Higher Order Virtual Container
HP	Higher order Path

ID	Identifier
IF	In Frame state
INC	INCRement
IOS	Intra-Office Section
IS	Intermediate System
ISDN	Integrated Services Digital Network
ISO	International Standardization Organization
ITU-T	International Telecommunications Union - Telecommunications Sector
LAN	Local Area Network
LBC	Laser Bias Current
LC	Link Connection
LLC	Logical Link Control
LMC	Laser Modulation Current
LO	Lower Order
LOA	Loss Of Alignment; generic for LOF, LOM, LOP
LOF	Loss Of Frame
LOM	Loss Of Multiframe
LOP	Loss Of Pointer
LOS	Loss Of Signal
LOT	Loss of Octet Timing
LOVC	Lower Order Virtual Container
LPx	Lower order Path for VC-x (x = 11, 12, 2, 3)
LT	Line Termination
M&CF	Management & Communication Function
MC	Matrix Connection
MCF	Message Communications Function
MDT	Mean Down Time
mei	maintenance event information
MI	Management Information
MO	Managed Object
MON	MONitored
MP	Management Point
MS	Multiplex Section
MS1	STM-1 Multiplex Section
MS16	STM-16 Multiplex Section
MS4	STM-4 Multiplex Section
MSB	Most Significant Bit
MSOH	Multiplex Section OverHead
MSP	Multiplex Section Protection
MSPG	Multiplex Section Protection Group
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
N_B	Near-end Block
N_BBE	Near-end Background Block Error
N_DS	Near-end Defect Second
N_EBC	Near-end Errored Block Count
N_ES	Near-end Errored Second
N_SES	Near-end Severely Errored Second
N_SESTHR	Near-end Severely Errored Second THReshold
N_UAT_cmd	Near-end UnAvailable Time command
NC	Network Connection
NCM	No CRC-4 Multiframe alignment signal
NDF	New Data Flag
NE	Network Element
NMON	Not MONitored
NNI	Network Node Interface
NPDU	Network Protocol Data Unit
NRZ	Non-Return to Zero
NRZI	Non-Return to Zero Inverted
NSAP	Network Service Access Point

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NU	National Use (bits, bytes)
NUx	National Use, bit rate order x
OAM	Operation, Administration and Management
OFS	Out of Frame Second
OOF	Out Of Frame state
OS	Optical Section
OSC	Oscillator
OSI(x)	Open Systems Interconnection, Layer x
OW	Order Wire
P	Protection
P_A	Protection Adaptation
P_C	Protection Connection
P_TT	Protection Trail Termination
P0_31c	1 984 kbit/s layer
P0s	synchronous 64 kbit/s layer
P11x	1 544 kbit/s layer (transparent)
P12s	2 048 kbit/s PDH path layer with synchronous 125 $\mu$ s frame structure according to ETS 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 $\mu$ s 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 $\mu$ s frame structure according to ETS 300 337 [7]
P4x	139 264 kbit/s layer (transparent)
PDC	Photo Diode Current
PDH	Plesiochronous Digital Hierarchy
PJE	Pointer Justification Event
PLM	PayLoad Mismatch
PM	Performance Monitoring
Pn	Plesiochronous signal, Level n
POH	Path OverHead
PRC	Primary Reference Clock
PS	Protection Switching
PSC	Protection Switch Count
PSV	Power Supply Voltage
PTR	PoinTeR
PU	PDH Unit
QOS	Quality Of Service
RDI	Remote Defect Indicator
REI	Remote Error Indicator
RI	Remote Information
RLT	Regenerated Line Termination
RP	Remote Point
RS	Regenerator Section
RS1	STM-1 Regenerator Section
RS16	STM-16 Regenerator Section
RS4	STM-4 Regenerator Section
RSOH	Regenerator Section OverHead
RTG	Regenerator Timing Generator
RTR	Reset Threshold Report
RxSL	Received Signal Label
RxTI	Received Trace identifier
S11	VC-11 path layer
S12	VC-12 path layer

S2	VC-2 path layer
S3	VC-3 path layer
S4	VC-4 path layer
SASE	Stand-Alone Synchronization Equipment
SD	Synchronization Distribution layer, Signal Degrade
SD-2	2 048 kbit/s based timing source reference
SDA	Synchronization Distribution Adaptation
SD-C	2 048 kHz based timing source reference
SDH	Synchronous Digital Hierarchy
SD-N	STM-N based timing source reference
SDT	Synchronization Distribution Termination
SEC	SDH Equipment Clock
SES	Severely Errored Second
SESR	Severely Errored Seconds Ratio
SF	Signal Fail
SHR	Self Healing Ring
Sk	Sink
SLM	Signal Label Mismatch
SMF	Sub-Multi Frame
SMUX	Synchronous MULTipleXer
SNC	Sub-Network Connection
SNC/I	Inherently monitored Sub-Network Connection protection
SNC/N	Non-intrusively monitored Sub-Network Connection protection
So	Source
SOH	Section OverHead
SPRING	Shared Protection RING
SSD	Server Signal Degrade
SSF	Server Signal Fail
SSM	Synchronization Status Message
SSU	Synchronization Supply Unit
STM	Synchronous Transport Module
STM-N	Synchronous Transport Module, level N
T12	2 048 kHz signal
TCA	Threshold Crossing Alert
TCF	Timing Connection Function
TCN	Threshold Crossing Notification
TCP	Termination Connection Point
TD	Transmit Degrade
TF	Transmit Fail
TFAS	trail Trace identifier Frame Alignment Signal
TG	Timing Generator
TI	Timing Information
TIM	Trace Identifier Mismatch
TM	Transmission_Medium
TMN	Telecommunications Management Network
TP	Timing Point
TPmode	Termination Point mode
TPS	Transmission Protection Switch
TR	Threshold Report
TS	Time Slot
TSD	Trail Signal Degrade
TSF	Trail Signal Fail
TSL	Trail Signal Label
TT	Trail Termination function
TTI	Trail Trace Identifier
TTP	Trail Termination Point
TTs	Trail Termination supervisory function
TU	Tributary Unit
TUG	Tributary Unit Group
TUG-m	Tributary Unit Group, level m