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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 1-1 of a multi-part EN covering the generic requirements of transport functionality of equipment, as identified below:

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

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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".

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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; Implementaion 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.

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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 will 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.

National transposition dates	
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 may be combined in order to describe a digital transmission equipment. The library comprises the functional building blocks needed to specify completely the generic functional structure of the European digital transmission hierarchy. In order to be compliant with the present document, equipment needs to be describable as an interconnection of a subset of these functional blocks contained within the present document. The interconnections of these blocks should obey the combination rules given.

The present document specifies both the components and the methodology that should be used in order to specify SDH equipment; it does not specify an individual SDH equipment as such.

The specification method is based on functional decomposition of the equipment into atomic, compound and major compound functions. The equipment is then described by its Equipment Functional Specification (EFS) which lists the constituent atomic and compound functions, their interconnection, and any overall performance objectives (e.g. transfer delay, availability, etc.). The concept is illustrated in figure 1.

The internal structure of the implementation of this functionality (equipment design) need not be identical to the structure of the functional model, as long as all the details of the externally observable behaviour comply with the EFS.

The equipment functionality is consistent with the SDH multiplexing structure given in ETS 300 147 [1].

Equipment developed prior to the production of the present document may not comply in all details with the present document.

Equipment which is normally stated to be compliant with the present document may not fulfil all the requirements in the case that it is interworking with old equipment that is not compliant with the present document.

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The structure of the present document envisages the addition of new layers, atomic functions and (major) compound functions. For example, Asynchronous Transfer Mode (ATM), Integrated Services Digital Network (ISDN) and n x 64 kbit/s layers could be added as new complete parts while corresponding adaptation functions are added to existing layers. "SDH interworking" functionality can be added as new layers in part 5. This approach allows for short development times for standards describing new functionality.

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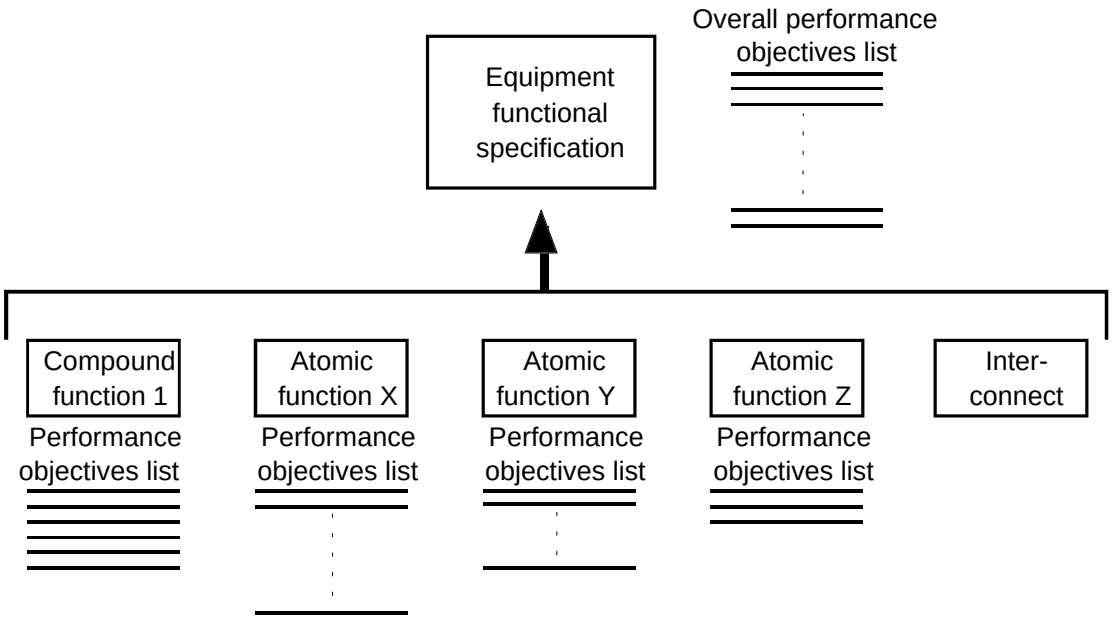

Figure 1: Composition of equipment functional specification

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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] ETS 300 147 (1995): "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); Multiplexing structure".

[2] 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] ETS 300 304: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); SDH information model for the Network Element (NE) view".

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

[5] EN 300 462-2-1: "Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 2-1: Synchronization network architecture".

[6] ITU-T Recommendation G.803 (1993): "Architecture of transport networks based on the synchronous digital hierarchy (SDH)".

[7] CCITT Recommendation G.703 (1991): "Physical / electrical characteristics of hierarchical digital interfaces".

[8] ITU-T Recommendation G.704 (1995): "Synchronous frame structures used at 1 544, 6 312, 2 048, 8 488 and 44 736 kbit/s hierarchical levels".

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

[10] 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".

[11] ITU-T Recommendation G.957 (1995): "Optical interfaces for equipments and systems relating to the synchronous digital hierarchy".

[12] ITU-T Recommendation G.783 (1994): "Characteristics of Synchronous Digital Hierarchy (SDH) equipment functional blocks".

[13] ITU-T Recommendation G.811 (1988): "Timing requirements at the outputs of primary reference clocks suitable for plesiochronous operation of international digital links".

[14] CCITT Recommendation G.821 (1988): "Error performance of an international digital connection forming part of an integrated services digital network".

[15] CCITT Recommendation G.823 (1988) modified according COM XVIII - R. report: "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 (1993): "The control of jitter and wander within digital networks which are based on the synchronous digital hierarchy (SDH)".

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[17] ITU-T Recommendation G.826 (1993): "Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate".

[18] ITU-T Recommendation G.958 (1994): "Digital line systems based on the synchronous digital hierarchy for use on optical cables".

[19] ITU-T Recommendation G.911 (1993): "Parameters and calculation methodologies for reliability and availability of fibre optic systems".

[20] CCITT Recommendation E.862 (1992): "Dependability planning of telecommunication networks".

[21] CCITT Recommendation X.721 (1992): "Information technology - Open Systems Interconnection - Structure of Management Information: Definition of management information".

[22] ITU-T Recommendation G.707 (1996): "Network node interface for the Synchronous Digital Hierarchy (SDH)".

[23] CCITT Recommendation M.20 (1992): "Maintenance philosophy for telecommunications networks".

[24] CCITT Recommendation M.2120 (1992): "Digital path, section and transmission system fault detection and localization procedures".

[25] ITU-T Recommendation G.784 (1994): "Synchronous Digital Hierarchy (SDH) management".

[26] EN 300 462-5-1: "Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 5: Timing characteristics of slave clocks suitable for operation in Synchronous Digital Hierarchy (SDH) equipment".

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3 Abbreviations, definitions, naming and numbering conventions

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3.1 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
AP	Access Point
APId	Access Point Identifier
APS	Automatic Protection Switch
ATM	Asynchronous Transfer Mode
AU	Administrative Unit
AU-n	Administrative Unit, level n
AUG	Administrative Unit Group
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

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C	Connection function
Cs	supervisory-unequipped Connection function
CH	Channel
CI	Characteristic Information
CK	Clock
CM	Connection Matrix
CMI	Coded Mark Inversion
Ctrl	Control
Co	Connection
CP	Connection Point
CRC	Cyclic Redundancy Check
CRC-N	Cyclic Redundancy Check, width N
CSES	Consecutive Severely Errored Seconds
CTF	Compound Timing Function
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	Errored Second
ES	Electrical Section
ESR	Errored seconds Ratio
Ex	CCITT Recommendation G.703 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

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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
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
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
MS4	STM-4 Multiplex Section
MS16	STM-16 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
N.C.	Not Connected
NCM	No CRC-4 Multiframe alignment signal
NDF	New Data Flag
NE	Network Element

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