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Prenos in multipleksiranje (TM) ï Sinhrona digitalna hierarhija (SDH) ï Zakupljeni vodi v SDH ï Priključ itvene znaľ ilnosti

Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); SDH leased lines; Connection characteristics

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Foreword

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

National transposition dates	
Date of adoption of this EN:	16 April 1999
Date of latest announcement of this EN (doa):	31 July 1999
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 January 2000
Date of withdrawal of any conflicting National Standard (dow):	31 January 2000

1 Scope

The present document specifies the technical requirements and test principles for bi-directional and symmetrical leased line connections of SDH virtual containers, i.e. VC-4, VC-3, VC-2 and VC-12. Signals transmitted across the leased line connections are subject to restrictions (e.g. to the payload independent path overhead) and impairments (e.g. transfer delay, jitter, wander, errors, etc.).

A connection is presented via interfaces at Network Termination Points (NTPs) and includes any equipment that may provide the NTP. Together with the companion standard, EN 301 165 [4] defining the network and terminal interface presentation, the present document describes the technical characteristics of the leased line service offered to the user.

The present document is applicable for leased lines, including part time leased lines, for which the establishment or release does not require any protocol exchange or other intervention at the NTP.

The present document specifies compliance tests for the connection requirements. The present document does not include details concerning the implementation of tests, nor does it include information of any relevant regulations.

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] EN 300 417-2-1: "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".

[2] EN 300 417-3-1: "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 3-1: Synchronous Transport Module-N (STM-N) regenerator and multiplex section layer functions".

[3] EN 300 417-4-1: "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 4-1: Synchronous Digital Hierarchy (SDH) path layer functions".

[4] EN 301 165: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH): SDH leased lines; Network and terminal interface presentation".

[5] ITU-T Recommendation G.826 (1996): "Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate".

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

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

[8] ITU-T Recommendation M.2100 (1995): "Performance limits for bringing-into-service and maintenance of international digital paths, sections and transmission systems".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

layer: concept used to allow the transport network functionality to be described hierarchically as successive levels; each layer being solely concerned with the generation and transfer of its "characteristic information"

client/server layer: any two adjacent network layers are associated in a client/server relationship. Each transport network layer provides transport to the layer above and uses transport from the layers below. The layer providing transport is termed a "server", the layer using transport is termed "client"

Remote Defect Indication (RDI): signal which conveys the defect status of the characteristic information received by the Trail Termination sink function back to the network element which contains the characteristic information originating trail termination source function

Remote Error Indication (REI): signal which conveys either the exact or truncated number of error detection code violations within the characteristic information (as detected by the trail termination sink function) back to the network element which contains the characteristic information originating trail termination source function

AU-4-AIS: STM-N signal in which the entire capacity of an Administrative Unit 4 (AU-4) is set to logic "1"

TU-m-AIS: STM-N signal in which the entire capacity of a TU-m is set to logic "1"

Characteristic Information (CI): signal of specific rate and format which is transferred within and between "sub-networks", and presented to an "adaptation" function for "transport" by the server layer network

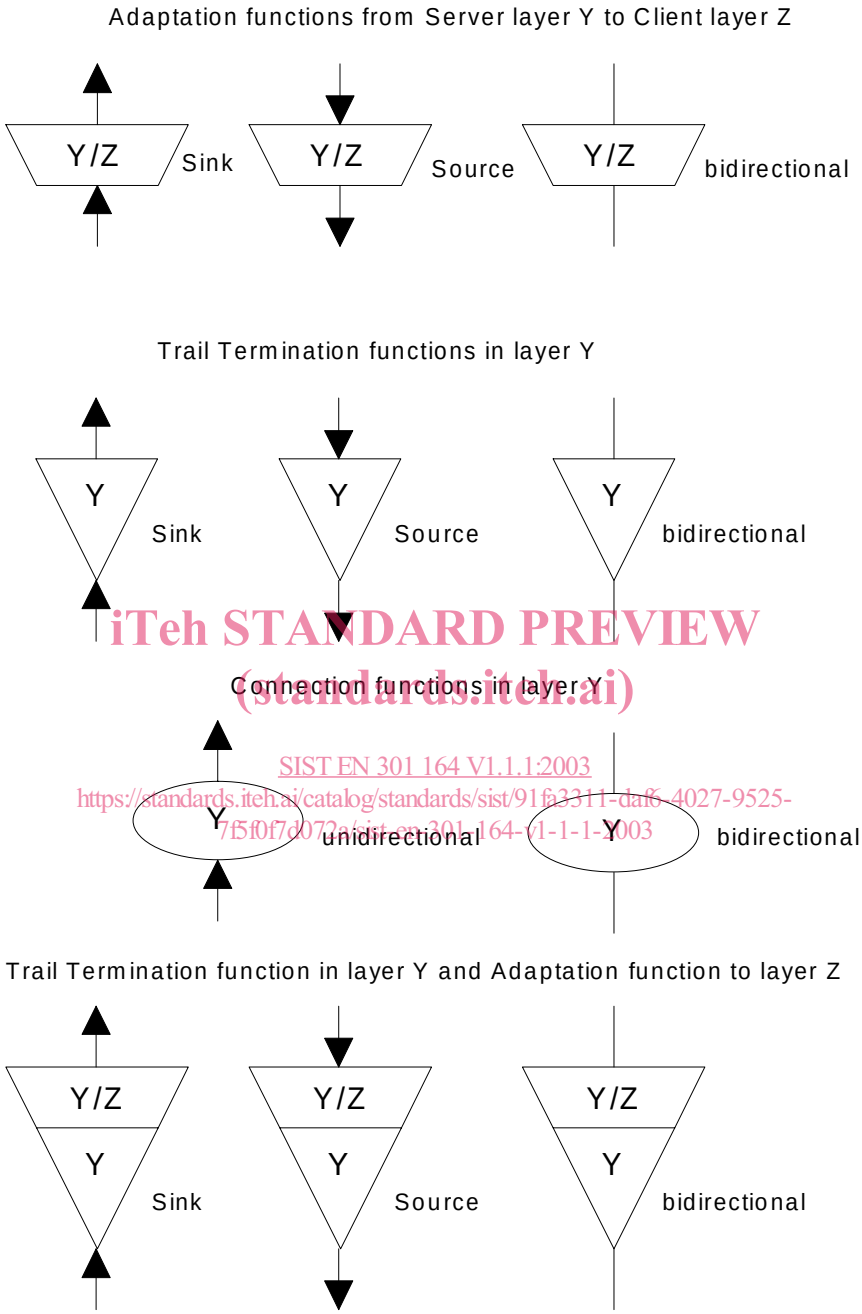
Connection Point (CP): "reference point" where the output of a "trail termination source" or a "connection" is bound to the input of another "connection", or where the output of a "connection" is bound to the input of a "trail termination sink". The "connection point" is characterized by the information which passes across it. A bi-directional "connection point" is formed by the association of a contra-directional pair

Termination Connection Point (TCP): special case of a "connection point" where a "trail termination" function is bound to an "adaptation" function or a "connection" function

defect: density of anomalies has reached a level where the ability to perform a required function has been interrupted. Defects are used as input for PERFORMANCE MANAGEMENT, the control of consequent actions, and the determination of fault cause

3.2 Symbols

The diagrammatic conventions and nomenclature used in the present document for adaptation, termination and connection functions (used to describe the atomic functions) are taken from EN 300 417-1-1 [6] and are shown in figure 1.



NOTE: If the above symbols are used for generic figures, i.e. not for specific layers, the layer references Y and Z may be omitted. Alternatively, the references may be to the type of function or layer, e.g. supervision, protection.

Figure 1: Symbols and diagrammatic conventions

3.3 Abbreviations

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

A	Adaptation function
AI	Adapted Information
AIS	Alarm Indication Signal
AU	Administrative Unit
AU-n	Administrative Unit, level n
BBE	Background Block Error
BBER	Background Block Error Ratio
BIP	Bit Interleaved Parity
BIP-N	Bit Interleaved Parity, width N
C	Connection function
CI	Characteristic Information
CP	Connection Point
EMC	Electromagnetic Compatibility
ES	Errored Second
ES1	STM-1 Electrical Section
LOF	Loss Of Frame
LOM	Loss Of Multiframe
LOP	Loss Of Pointer
LOS	Loss Of Signal
MS	Multiplex Section
MS1	STM-1 Multiplex Section
MS4	STM-4 Multiplex Section
NE	Network Element
NNI	Network Node Interface
NT	Network Termination
NTP	Network Termination Point
OS	Optical Section
OS1	STM-1 Optical Section
OS4	STM-4 Optical Section
PDH	Plesiochronous Digital Hierarchy
PLM	PayLoad Mismatch
RDI	Remote Defect Indication
REI	Remote Error Indication
RI	Remote Information
RX	Receive
S12	VC-12 path layer
S2	VC-2 path layer
S3	VC-3 path layer
S4	VC-4 path layer
SDH	Synchronous Digital Hierarchy
SES	Severely Errored Second
SF	Signal Fail
Sk	Sink
So	Source
SSF	Server Signal Fail
STM	Synchronous Transport Module
STM-N	Synchronous Transport Module, level N
TCP	Terminal Connection Point
TE	Terminal Equipment
TIM	Trace Identifier Mismatch
TSF	Trail Signal Fail
TSS	Test Signal Structure
TSSx	Test Signal Structure 1, 3 or 4
TT	Trail Termination function
TTP	Trail Termination Point
TU	Tributary Unit

TU-m	Tributary Unit, level m
TX	Transmit
UNEQ	Unequipped
UTC	Universal Time Co-ordinated
VC	Virtual Container
VC-n	Virtual Container, level n

4 Characteristics of VC-4, VC-3, VC-2 and VC-12 leased line connections

4.1 Tolerance of Virtual Container (VC) timing

Requirement: The leased line connection shall carry user timing with a tolerance of ±4,6 ppm.

NOTE: For optimum jitter and wander performance of Plesiochronous Digital Hierarchy (PDH) signal carried over a end to end Virtual Container (VC), it is recommended to generate VC timing at the nominal frequency. The recommended method of Synchronous Digital Hierarchy (SDH) synchronization is specified in EN 300 462-2 [7]. It should be noted that a systematic offset of the VC timing from the nominal VC frequency will result in periodic pointer adjustments at the output of the VC leased line connection. The SDH section signal which is transmitted from the Network Termination (NT) is carrying, under normal condition, the timing of the leased line network and may be used to generate the VC timing at the terminal interface.

4.2 Transfer delay

Requirement: The requirement depends upon whether satellite connection is involved in the connection or not:

– for connection where satellite transmission is not involved, the one way end-to-end delay shall be less than (10 + 0,01 G) ms, where G is the geographical distance in kilometres; or

– for connection where satellite transmission is involved, the one way end-to-end delay shall be less than 350 ms.

4.3 Jitter

The leased line connection shall operate as specified when the jitter at the leased line input is within the limits given in the companion standard EN 301 165 [4].

NOTE 1: The jitter and wander requirements of the Synchronous Transport Module, level N (STM-N) section layers are given at the associated Physical Section Layer to Regenerator Section Layer adaptation functions as specified in EN 300 417-2-1 [1].

NOTE 2: Jitter requirements of the VC-4 path are specified by the requirements for AU-4 pointer justification events of the Multiplex Section Layer to VC-4 path Layer adaptation function which is specified in EN 300 417-3-1 [2].

NOTE 3: Jitter requirements of the lower order VC paths are specified by the requirements for TU-3/2/12 pointer justification events of the "VC-4 Layer to VC-3, VC-2 and VC-12 Layer Adaptation functions, S4/Sx_A" which are specified EN 300 417-4-1 [3].

NOTE 4: Wander at the section layer may create pointer justification at VC path layers. Existing ETSs for leased line connection characteristics consider wander is irrelevant for a single leased line connection. That approach might be unacceptable for SDH leased lines.