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Prenos in multipleksiranje (TM) ï Generiļ ne zahteve za prenosno funkcionalnost opreme ï 6-1. del: Funkcije sinhronizacijske plasti

Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 6-1: Synchronization layer functions

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Foreword

This European Telecommunication Standard (ETS) has been produced by the Transmission and Multiplexing (TM) Technical Committee of the European Telecommunications Standards Institute (ETSI).

This ETS has been produced in order to provide inter-vendor and inter-operator compatibility of Synchronous Digital Hierarchy (SDH) equipment.

This ETS consists of 8 parts as follows:

Part 1: "Generic processes and performance" (ETS 300 417-1-1 [1]);

Part 2: "SDH and PDH physical section layer functions" (ETS 300 417-2-1 [6]);

Part 3: "STM-N regenerator and multiplex section layer functions" (ETS 300 417-3-1 [7]);

Part 4: "SDH path layer functions" (ETS 300 417-4-1 [8]);

Part 5: "PDH path layer functions" (ETS 300 417-5-1 [9]);

Part 6: "Synchronization layer functions" (ETS 300 417-6-1);

Part 7: "Auxiliary layer functions" (ETS 300 417-7-1);

Part 8: "Compound and major compound functions" (ETS 300 417-8-1).

Transposition dates	
Date of adoption of this ETS:	24 July 1998
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1 Scope

This ETS specifies a library of basic Synchronization Distribution (SD) building blocks, referred to as "atomic functions" and a set of rules by which they are combined in order to describe a digital transmission equipment. The library defined in this ETS forms part of the set of libraries defined in ETS 300 417 series. The library comprises the functional building blocks needed to completely specify the generic functional structure of the European digital transmission hierarchy. Equipment that is compliant with this ETS should be describable as an interconnection of a subset of these functional blocks contained within this ETS. The interconnection of these blocks should obey the combination rules given in ETS 300 417. The generic functionality is described in ETS 300 417-1-1 [1].

This ETS assumes that there are only two types of Synchronization Supply Units (SSUs), transit and local, as currently defined in ITU-T Recommendation G.812 [18]. However, STC TM3 has approved in September 1996 a new SSU with enhanced characteristics. The inclusion of such an SSU in this ETS is for further study.

This ETS does not specify the atomic functions that are specific to SSU and Primary Reference Clock (PRC); the Synchronization Status Message (SSM) selection algorithm specified in the present document applies only to SEC's.

2 Normative references

This ETS incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references subsequent amendments to, or revisions of, any of these publications apply to this ETS only when incorporated in it by amendments or revisions. For undated references the latest edition of the publication referred to applies.

[1] ETS 300 417-1-1 (1996): "Transmission and Multiplexing (TM); Generic functional requirements for Synchronous Digital Hierarchy (SDH) equipment; Part 1-1: Generic processes and performance".

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

[3] 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".

[4] ITU-T Recommendation G.707 (1996): "Network node interface for the synchronous digital hierarchy (SDH)".

[5] ITU-T Recommendation G.783: "Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks".

[6] ETS 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".

[7] ETS 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".

[8] ETS 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".

[9] ETS 300 417-5-1: "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 5-1: Plesiochronous Digital Hierarchy (PDH) path layer functions".

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

[11] ETS 300 462-4: "Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 4: Timing characteristics of slave clocks suitable for synchronization supply to Synchronous Digital Hierarchy (SDH) and Plesiochronous Digital Hierarchy (PDH) equipment".

[12] ETS 300 462-5: "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".

[13] ETS 300 462-6: "Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 6: Timing characteristics of primary reference clocks".

[14] 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".

[15] ETS 300 337 (1996): "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".

[16] ETS 300 337 (1995): "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".

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

[18] ITU-T Recommendation G.812 (1988.): "Timing requirements at the outputs of slave clocks suitable for plesiochronous operation of international digital links".

[19] ITU-T Recommendation G.813 (1996): "Timing characteristics of SDH equipment slave clocks (SEC)".

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

[21] ETS 300 462-1: "Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 1: Definitions and terminology for synchronization networks".

3 Definitions, abbreviations and symbols

3.1 Definitions

For the purposes of this ETS, the following definition applies:

timing loop: This is a network condition where a slave clock providing synchronization becomes locked to its own timing signal. It is generally created when the slave clock Timing Information (TI) is looped back to its own input, either directly or via other network equipments. Timing loops should be prevented in networks by careful network design.

QL minimum: QL_minimum is a configurable parameter used in the squelching of clock output signals. If the Quality Level (QL) of the signal used to derive the output falls below QL_Minimum then the output will be squelched (cut-off or set to Alarm Indication Signal (AIS)).

Clock-Source Quality-Level: The clock-source quality-level of a SDH Equipment Clock (SEC) or Stand Alone Synchronization Equipment (SASE) is defined as the grade of clock to which it is ultimately traceable; i.e. the grade-of-clock to which it is synchronized directly or indirectly via a chain of SEC's, and SASE's however long this chain of clocks is. For example, the clock-source quality-level may be a PRC complying with ETS 300 462-6 [13], or it may be a Slave Clock in holdover-mode, complying with ETS 300 462-4 [11], or a ETS 300 462-5 [12] Clock in holdover or free-run.

The clock-source quality-level is essentially, therefore, an indication only of the long-term accuracy of the Network Element (NE) Clock.

Station Clock: This is a node clock as defined in ETS 300 462-1 [21].

The functional definitions are given in ETS 300 417-1-1 [1].

3.2 Abbreviations

For the purposes of this ETS, the following abbreviations apply:

AI	Adaptation Information
AIS	Alarm Indication Signal
AP	Access Point
CI	Characteristic Information
CK	timing information - Clock signal
CLR	Clear
CP	Connection Point
CS	timing information - Clock Source
CSid	Clock Source identifier
DNU	Do Not Use
ES1	STM-1 Electrical Section layer
EXTCMD	External Command
FS	timing information - Frame Start
FSw	Forced Switch
HO	Hold Over mode
HO	Hold Off time
ID	IDentifier
INVx	INValid x
LC	Layer Clock
LO	Lock Out
LO	Locked mode
LOS	Loss Of Signal
LSB	Least Significant Bit
LTI	Loss of Timing Information
MA	Maintenance and Adaptation
MI	Management Information
MON	MONitored
MFP	MultiFrame Present
MFS	MultiFrame Start
MS	Multiplex Section
MSB	Most Significant Bit
MSw	Manual Switch
MTIE	Maximum Time Interval Error
NE	Network Element
NS	Network Synchronization
NSUPP	Not supported
OSn	STM-N Optical Section layer
P12s	2 048 kbit/s PDH path layer with synchronous 125 µs frame structure according to ETS 300 167 [20]
P31s	34 368 kbit/s PDH path layer with synchronous 125 µs frame structure according to ETS 300 337 [15]
P4s	139 264 kbit/s PDH path layer with synchronous 125 µs frame structure according to ETS 300 337 [15]
PDH	Plesiochronous Digital Hierarchy
PRC	Primary Reference Clock

QL	Quality Level
RI	Remote Information
RSn	STM-N Regenerator Section layer
SASE	Stand Alone Synchronization Equipment
SD	Synchronization Distribution
SDH	Synchronous Digital Hierarchy
SDL	Specification and Description Language
SEC	SDH Equipment Clock
SF	Signal Fail
SQLCH	Squelch
SSF	Server Signal Fail
SSM	Synchronization Status Message
SSU	Synchronization Supply Unit
SSUL	Local SSU
SSUT	Transit SSU
STM-N	Synchronous Transport Module, level N
Sk	Sink
So	Source
TCP	Termination Connection Point
TDEV	Time DEViation
TI	Timing Information
TL	Transport Layer
TM	Timing Marker
TT	Trail Termination
TSF	Trail Signal Fail
UNC	UNConnected
VC-n	Virtual Container, level n
WTR	Wait to Restore

3.3 Symbols and diagrammatic conventions

The symbols and diagrammatic conventions are given in ETS 300 417-1-1 [1].

3.4 Introduction

This subclause defines the atomic functions that are part of the 2 synchronization layers, the SD layer and the Network Synchronization (NS) layer. It also defines some atomic functions, part of the Transport Layer (TL), which are related with synchronization.

These functions describe the synchronization of SDH NEs and how SDH NEs are involved in NS.

4 Synchronization principles

4.1 Network synchronization

Synchronization network architecture is specified in ETS 300 462-2 [10].

Synchronization information is transmitted through the network via synchronization network connections. These synchronization network connections can transport different synchronization levels. Each synchronization network connection is provided by one or more synchronization link connections, each supported by a synchronized primary or secondary rate Plesiochronous Digital Hierarchy (PDH) trail or SDH multiplex section trail (see clause 5 of ETS 300 462-2 [10]).

Some of these synchronized primary or secondary rate PDH trail or SDH multiplex section trail signals contain a communication channel, the SSM or the Timing Marker (TM) transporting a quality Identifier (ID). This QL ID can be used to select the highest synchronization level incoming reference signal from a set of nominated synchronization references available at the NE.

Synchronization network connections are uni-directional and generally point to multipoint. ETS 300 462-2 [10] specifies a master-slave synchronization technique for synchronizing SDH networks (see subclause 4.1 of ETS 300 462-2 [10]). Figures 1 to 4 illustrate the synchronization network connection model.

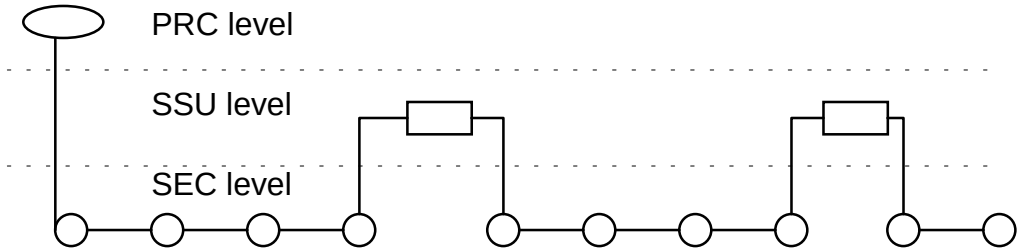

Figure 1: General representation of a synchronization network

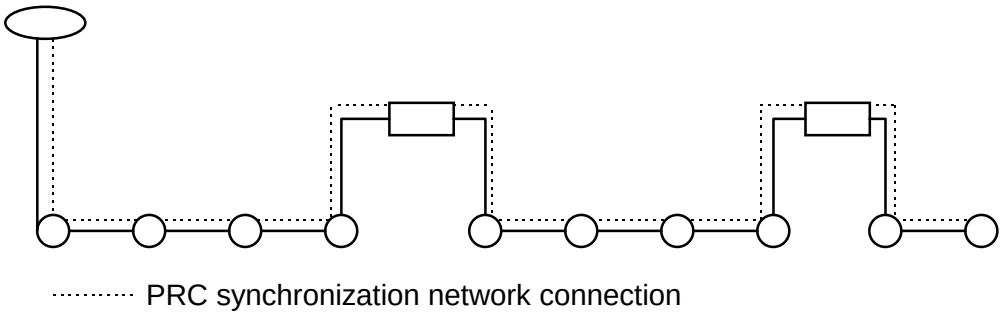

Figure 2: Representation of the PRC network connection

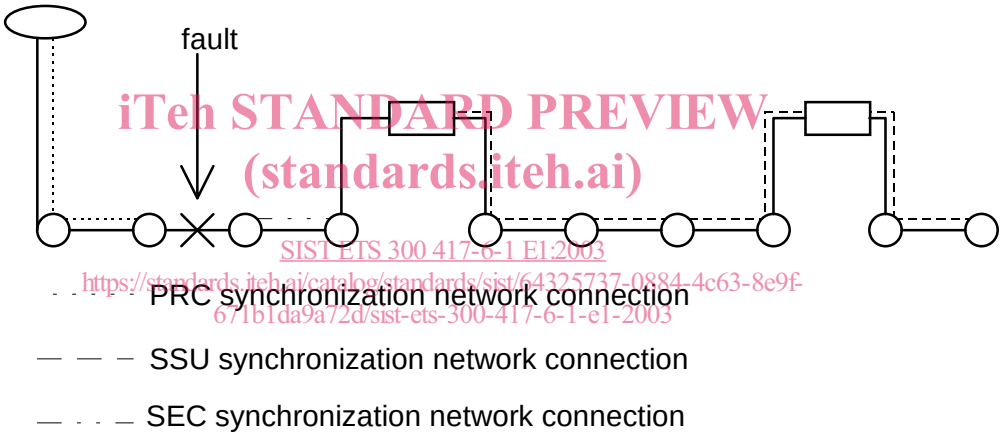

Figure 3: Representation of the synchronization network connection in case of failure

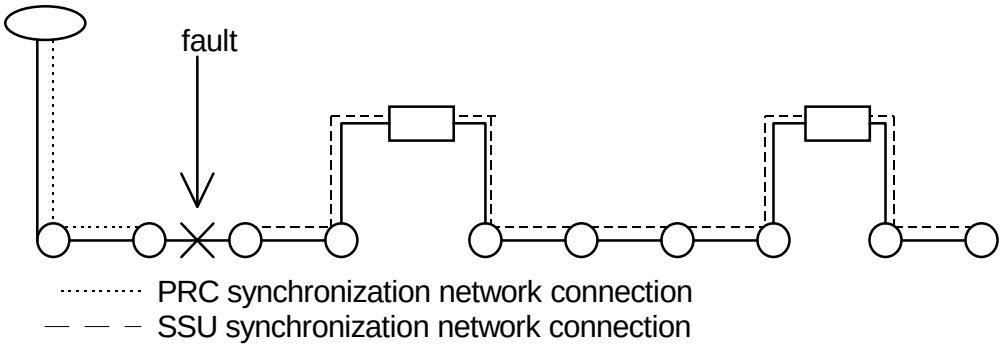

Figure 4: Example of restoration of the synchronization (see figure 7 of ETS 300 462-2 [10])