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Transmission and Multiplexing (TM); Generic requirements for synchronization networks;
Part 2-1: Synchronization network architecture

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Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 2-1: Synchronization network architecture

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Foreword

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

The present document has been produced to provide requirements for synchronization networks that are compatible with the performance requirements of digital networks. It is one of a family of documents covering various aspects of synchronization networks:

- Part 1-1: "Definitions and terminology for synchronization networks";
- Part 2-1: "Synchronization network architecture";**
- Part 3-1: "The control of jitter and wander within synchronization networks";
- Part 4-1: "Timing characteristics of slave clocks suitable for synchronization supply to Synchronous Digital Hierarchy (SDH) and Plesiochronous Digital Hierarchy (PDH) equipment";
- Part 4-2: "Timing characteristics of slave clocks suitable for synchronization supply to Synchronous Digital Hierarchy (SDH) and Plesiochronous Digital Hierarchy (PDH) equipment Implementation Conformance (ICS) Statement";
- Part 5-1: "Timing characteristics of slave clocks suitable for operation in Synchronous Digital Hierarchy (SDH) equipment";
- Part 6-1: "Timing characteristics of primary reference clocks";
- Part 6-2: "Timing characteristics of primary reference clocks Implementation Conformance (ICS) Statement";
- Part 7-1: "Timing characteristics of slave clocks suitable for synchronization supply to equipment in local node applications".

Parts 1-1, 2-1, 3-1 and 5-1 have previously been published as ETS 300 462 Parts 1, 2, 3 and 5, respectively.

Additionally, parts 4-1 and 6-1 completed the Voting phase of the Two Step Approval procedure as ETS 300 462 Parts 4 and 6, respectively.

It was decided to prepare ICS proformas for several of the parts and this necessitated a re-numbering of the individual document parts. It was also decided to create a new part 7-1.

This in turn led to a need to re-publish new versions of all six parts of the original ETS. At the same time, the opportunity was taken to convert the document type to EN.

This has involved no technical change to any of the documents. However part 5-1 has been modified, due to editorial errors which appeared in ETS 300 462-5.

Transposition dates	
Date of adoption of this ETS:	16 August 1996
Date of latest announcement of this ETS (doa):	31 December 1996
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	30 June 1997
Date of withdrawal of any conflicting National Standard (dow):	30 June 1997

NOTE: The above transposition table is the original table from ETS 300 462-2 (September 1996, see History).

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1 Scope

This European Standard (Telecommunications series) specifies the architectural principles that should be applied for the design of synchronization networks that are suitable for the synchronization of Synchronous Digital Hierarchy (SDH) and Plesiochronous Digital Hierarchy (PDH) networks. It supports the construction of synchronization networks that support both the short term stability requirements of SDH networks and the long term stability requirements of PDH networks. It applies to the design of new synchronization networks. It does not characterize existing PDH synchronization networks.

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, subsequent revisions do apply.
- 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 300 462-1-1: "Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 1-1: Definitions and terminology for synchronization networks".
- [2] EN 300 462-3-1: "Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 3-1: The control of jitter and wander within synchronization networks".
- [3] ETS 300 147 (1995): "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH) Multiplexing structure".
- [4] EN 300 462-5-1: "Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 5-1: Timing characteristics of slave clocks suitable for operation in Synchronous Digital Hierarchy (SDH) equipment".
- [5] EN 300 462-6-1: "Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 6-1: Timing characteristics of primary reference clocks".
- [6] ITU-T Recommendation G.783 (1994): "Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks".
- [7] EN 300 462-4-1: "Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 4-1: Timing characteristics of slave clocks suitable for synchronization supply to Synchronous Digital Hierarchy (SDH) and Plesiochronous Digital Hierarchy (PDH) equipment".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the definitions given in EN 300 462-1-1 [1] apply:

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in EN 300 462-1-1 [1], together with the following, apply:

AIS	Alarm Indication Signal
NE	Network Element
PDH	Plesiochronous Digital Hierarchy
ppm	parts per million
PRC	Primary Reference Clock
PSTN	Public Switched Telephone Network
SASE	Stand-Alone Synchronization Equipment
SDH	Synchronous Digital Hierarchy
SEC	SDH Equipment Clock
SETS	SDH Equipment Timing Source
SSU	Synchronization Supply Unit
STM-N	Synchronous Transport Module N
TU	Tributary Unit

4 Synchronization methods

There are two fundamental methods of synchronizing nodal clocks. These are identified in EN 300 462-1-1 [1]:

- master-slave synchronization;
- mutual synchronization.

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4.1 Master-slave synchronization

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Master-slave synchronization is appropriate for synchronizing SDH networks and the following material offers guidance on using this method.

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Master-slave synchronization uses a hierarchy of clocks in which each level of the hierarchy is synchronized with reference to a higher level. There are four qualities of clock in the synchronization hierarchy shown below:

- Primary Reference Clock (PRC): see EN 300 462-6-1 [5];
- slave clock (transit node): see EN 300 462-4-1 [7];
- slave clock (local node): see EN 300 462-4-1 [7];
- SDH Equipment Clock (SEC): see EN 300 462-5-1 [4].

The PRC is the highest quality hierarchical clock and the SEC is the lowest quality clock. Higher quality clocks must not be synchronised by lower quality clocks in holdover mode, but clocks in holdover mode can be used to synchronise clocks of the same quality. There are limits on the number of clocks which can be connected in a synchronization distribution trail (see clause 8). Clock reference signals are distributed between levels of the hierarchy via a distribution network which may use the facilities of the transport network. The transport network may contain SECs. The distribution of timing between hierarchical node clocks shall be performed using a method which avoids intermediate pointer processing. Two possible methods are as follows:

- recover timing from a received Synchronous Transport Module N (STM-N) signal (this avoids the unpredictable effect of a pointer adjustment on the downstream slave clock);
- derive timing from a synchronization trail that is not supported by a SDH network.

The master-slave method uses a single-ended synchronization technique with the slave clock determining the synchronization trail to be used as its reference and changing to an alternative if the original trail fails. This is a unilateral control scheme.