SIST

SLOVENSKI STANDARD

SIST EN 300 462-3-1 V1.1.1:2003

01-december-2003

Prenos in multipleksiranje (TM) ï Generiļ ne zahteve za sinhronizacijska omreģja ï 3-1. del: Obvladovanje trepetanja in zdrsavanja v sinhronizacijskih omreģjih

Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 3-1: The control of jitter and wander within synchronization networks

Ta slovenski standard je istoveten z: EN 300 462-3-1 Version 1.1.1

ICS:

33.040.20	Prenosni sistem	Transmission systems

SIST EN 300 462-3-1 V1.1.1:2003 en

EN 300 462-3-1 V1.1.1 (1998-05)

European Standard (Telecommunications series)

Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 3-1: The control of jitter and wander within synchronization networks

Reference

REN/TM-03017-3-1 (4a0r9ico.PDF)

Keywords

Synchronization, transmission, network

ETSI

Postal address

F-06921 Sophia Antipolis Cedex - FRANCE

Office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16
Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Internet

secretariat@etsi.fr
http://www.etsi.fr
http://www.etsi.org

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETR 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available **free of charge** from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://www.etsi.fr/ipr or http://www.etsi.org/ipr).

Pursuant to the ETSI Interim IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETR 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

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	3 January 1997
Date of latest announcement of this ETS (doa):	30 April 1997
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	31 October 1997
Date of withdrawal of any conflicting National Standard (dow):	31 October 1997

NOTE: The above transposition table is the original table from ETS 300 462-3 (January 1997, see History).

1 Scope

The present document outlines requirements for the control of jitter and wander within synchronization Networks that are constructed according to the architectural principles described in EN 300 462-2-1 [2]. A synchronization network that complies with the network limits for jitter and wander specified in the present document will be suitable for the synchronization of Synchronous Digital Hierarchy (SDH) and Public Switched Telephone Network (PSTN) networks. It combines the short term stability requirements of SDH networks with the long term stability requirements of the PSTN. The values specified in the present document refer to the design of new synchronization networks. They do not necessarily represent the performance of existing PSTN synchronization networks.

The network limits specified in the present document form the network requirements from which the clock specifications in EN 300 462-4-1 [3], EN 300 462-5-1 [4] and EN 300 462-6-1 [5] have been derived.

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

[3] 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".

[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.822: "Controlled slip rate objectives on an international digital connection".

[7] ITU-T Recommendation G.823: "The control of jitter and wander within digital networks which are based on the 2 048 kbit/s hierarchy".

[8] ITU-T Recommendation O.171: "Timing jitter measuring equipment for digital systems".

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

3 Definitions, symbols 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 Symbols

For the purposes of the present document the symbols and diagrammatic conventions described in EN 300 462-1-1 [1] apply.

3.3 Abbreviations

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

MTIE	Maximum Time Interval Error
PDH	Plesiochronous Digital Hierarchy
PSTN	Public Switched Telephone Network
PRC	Primary Reference Clock
SDH	Synchronous Digital Hierarchy
SEC	SDH Equipment Clock
SSU	Synchronization Supply Unit
STM-N	Synchronous Transport Module, level N
TDEV	Time DEViation
UTC	Universal Time Co-ordinated

4 Basic philosophy for the control of jitter and wander

The present multi-part document describes the synchronization network as a logically distinct network layer with its own planning rules and performance requirements. The philosophy for the control of jitter and wander in the synchronization network layer is the same as applied to the payload carrying layers of the transport network, which can be found in ITU-T Recommendation G.823 [7]. It is based on the need to recommend a maximum network limit that should not be exceeded at any synchronization interface. This network limit represents the worst case accumulation of jitter and wander within the synchronization network reference chain shown in figure 5 of EN 300 462-2-1 [2]. The main purpose for defining a network limit is that it provides the maximum amount of jitter and wander that any synchronization element in the network may experience at its input, since the network limit should not be exceeded at the output of a synchronization element anywhere in the network. The network limits therefore provide indirectly the requirements for the lower limit of maximum tolerable jitter and wander at the input of synchronization elements.

The wander tolerance of the large installed base of 64 kbit/s digital switches, i.e. the differential wander that a switch will tolerate before giving rise to controlled slip, together with the slip performance objectives stated in ITU-T Recommendation G.822 [6], have to be respected when introducing new transport technologies in the network. This differential wander is the cumulative effect of wander in the synchronization network and the wander that the transport of the data between switches may introduce. In the case of SDH, in most implementations, the latter is dependent on the wander that the SDH network elements experience at their synchronization inputs. The wander in a synchronization network that is also suitable for the synchronization of SDH therefore needs to be controlled to a level that is compatible with the slip performance objectives of the 64 kbit/s switched network.

It should be noted that the implication of the network limit definition is, that in practical networks the jitter and wander values at most synchronization interfaces should be well within the network limits, because the network limits will only appear at the end of a synchronization chain that is as long as the reference chain.

5 Synchronization interfaces

The synchronization interfaces that are specified in the present document are depicted in figure 1. This figure is an expanded version of figure 6 of EN 300 462-2-1 [2] showing examples of actual physical interfaces that may appear in synchronization networks. Universal Time Co-ordinated (UTC) is indicated in the figure as the reference relative to which all network limits are specified. Because of the way it is defined, there is no physical entity or interface associated with UTC. Two alternative synchronization distribution methods may be used between Synchronization Supply Unit (SSUs), and between Primary Reference Clock (PRC) and SSUs. SDH distribution makes use of the SDH section layer and may be a cascade of sections with at most 20 intermediate SDH network elements, each containing an SDH Equipment Clock (SEC). Plesiochronous Digital Hierarchy (PDH) distribution makes use of a 2 Mbit/s PDH path that may be traversing a number of intermediate PDH multiplexing stages and PDH line systems. These are not shown explicitly, because they do not contain clocks that are subject to the present document.

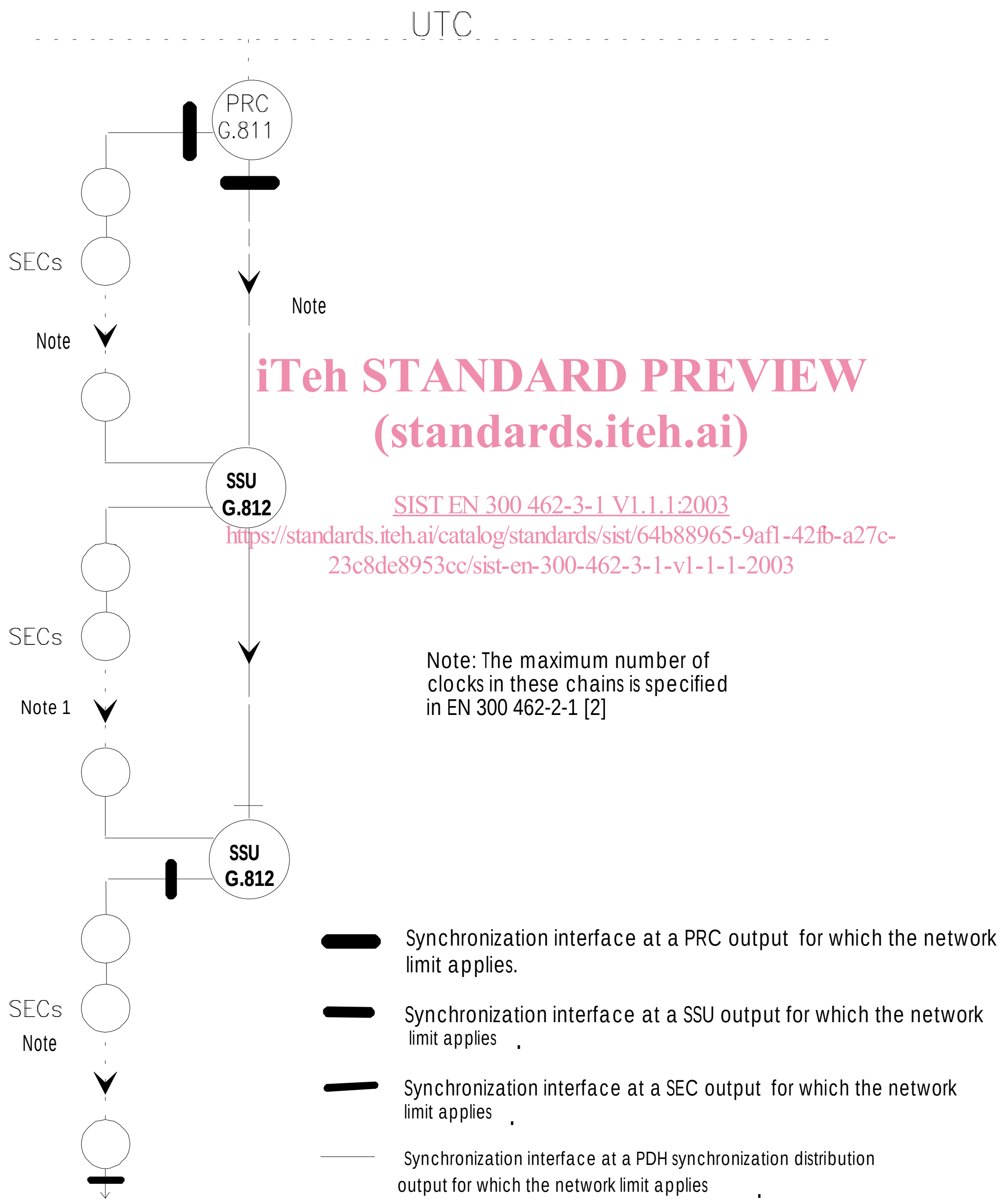

Figure 1: Synchronization reference chain showing where the network limits apply

Figure 1 shows that four types of synchronization interfaces can be distinguished in the synchronization network:

- synchronization interfaces at PRC outputs;

- synchronization interfaces at SSU outputs;
- synchronization interfaces at SEC outputs;
- synchronization interfaces at PDH distribution outputs.

The present document therefore provides four sets of network limit requirements, one for each type of interface.

6 Synchronization reference network

The synchronization reference chain defined in figure 5 of EN 300 462-2-1 [2] has to support not only a homogeneous SDH transport network, to which the transport network will evolve sooner or later, but also the evolution towards an all SDH transport network. In the transitional period, a mixed situation will exist where data paths may traverse both PDH and SDH sub-networks. The additional PDH/SDH mappings give rise to an increase of the wander that the data path is experiencing because the wander that appears at the output of one SDH island is passed on transparently through subsequent islands via the asynchronous mapping process. It is therefore the transitional period which puts the most stringent requirements on the performance of the synchronization network.

To provide for consistency between the specifications of the individual synchronization elements and the network limits an iterative process has been followed. The accumulation of wander in the synchronization reference network has been calculated based on a set of assumptions on:

- the number and performance of individual synchronization elements;
- the number and size of transients in the synchronization network;
- the level of diurnal wander.

The resulting quality of the synchronization network has then been applied to a reference model for the data path of four synchronous islands. Subsequently, the set of assumptions has been varied until a combination was found that met the requirement for the average differential wander experienced by a slip buffer terminated equipment (e.g. a 64 kbit/s exchange) of less than 18 µs measured over one day. The assumptions that were found to meet this requirement are documented in annex B.

It is stressed however that many other combinations of assumptions are conceivable that will comply with the network limits resulting from the set given in annex B. These are elaborated in this informative annex for guidance only. Provided these assumptions are fulfilled, the 18 µs wander limit will be met also across multiple operator domains.

A network operator may use a different set of rules, e.g. with a different number of SSUs and other assumptions about the transients in the synchronization chain, provided the synchronization network limits for jitter and wander specified in the present document are adhered to.

7 Network limits for jitter and wander at synchronization interfaces

The specification of network limits for synchronization interfaces is primarily intended to reflect the results of a theoretical analysis of the worst case accumulation of jitter and wander in a synchronization network. These values then serve to specify tolerance requirements for synchronization equipment. It should, however, also be possible to verify through measurements in a real network that a particular interface does not exceed the specified limits. The location of the interface in the synchronization chain of that network determines what margin may be expected with reference to the network limits.

As shown in figure 1, an SSU may receive its timing via SDH or PDH distribution. The network limit at the output of these distribution chains represents the amount of jitter and wander that an SSU may experience at its input. Since there is more jitter allowed at PDH interfaces than at SDH Synchronous Transport Module, level N (STM-N) interfaces, the network limit for the PDH distribution outputs represents the worst case that the SSU should tolerate at its inputs. The jitter and wander tolerance of a SEC should be (at least) the amount of jitter at the input of the last SEC of a synchronization chain. Since the contribution of the last SEC in the chain to the network limit at SEC outputs- that is the