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SERIES G: TRANSMISSION SYSTEMS AND MEDIA

Digital transmission systems – Digital networks – Design
objectives for digital networks

Definitions and terminology for synchronization networks

ITU-T Recommendation G.810

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION G.810

DEFINITIONS AND TERMINOLOGY FOR SYNCHRONIZATION NETWORKS

Summary

This Recommendation provides definitions and abbreviations used in timing and synchronization Recommendations.

Source

ITU-T Recommendation G.810 was revised by ITU-T Study Group 13 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 27th of August 1996.

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FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Recommendation G.810

DEFINITIONS AND TERMINOLOGY FOR SYNCHRONIZATION NETWORKS

(Melbourne, 1980; revised in 1996)

1 Scope

This Recommendation provides definitions and abbreviations used in timing and synchronization Recommendations. It also provides background information on the need to limit phase variation and the impairments on digital systems.

2 References

The following Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. All Recommendations are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

- [1] ITU-T Recommendation G.707 (1996), *Network node interface for the Synchronous Digital Hierarchy (SDH)*.
- [2] CCITT Recommendation G.811 (1988), *Timing requirements at the outputs of primary reference clocks suitable for plesiochronous operation of international digital links*.
- [3] CCITT Recommendation G.812 (1988), *Timing requirements at the outputs of slave clocks suitable for plesiochronous operation of international digital links*.
- [4] ITU-T Recommendation G.813 (1996), *Timing characteristics for SDH equipment slave clocks (SEC)*.
- [5] CCITT Recommendation G.822 (1988), *Controlled slip rate objectives on an international digital connection*.
- [6] ITU-T Recommendation G.823 (1993), *The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy*.
- [7] ITU-T Recommendation G.824 (1993), *The control of jitter and wander within digital networks which are based on the 1544 kbit/s hierarchy*.
- [8] ITU-T Recommendation G.825 (1993), *The control of jitter and wander within digital networks which are based on the Synchronous Digital Hierarchy (SDH)*.

3 Abbreviations

For the purposes of timing and synchronization Recommendations, the following abbreviations apply:

ADEV	Allan Deviation
AIS	Alarm Indication Signal
AP	Access Point
CUT	Clock Under Test
FFM	Flicker Frequency Modulation
FPM	Flicker Phase Modulation

MC	Master Clock
MDEV	Modified Allan Deviation
MRTIE	Maximum Relative Time Interval Error
MST	Multiplex Section Terminal
MTIE	Maximum Time Interval Error
NE	Network Element
PDH	Plesiochronous Digital Hierarchy
PRC	Primary Reference Clock
PSTN	Public Switched Telephone Network
RWFM	Random Walk Frequency Modulation
SASE	Stand Alone Synchronization Equipment
SC	Slave Clock
SDH	Synchronous Digital Hierarchy
SE	Synchronization Element
SEC	SDH Equipment Clock
SETS	SDH Equipment Timing Source
STM	Synchronous Transport Module
SSU	Synchronization Supply Unit
TDEV	Time Deviation
TIE	Time Interval Error
TIErms	root mean square Time Interval Error
TVAR	Time Variance
UI	Unit Interval
UIp-p	Unit Interval peak-to-peak
UTC	Coordinated Universal Time
WFM	White Frequency Modulation
WPM	White Phase Modulation

4 Definitions

For the purposes of timing and synchronization Recommendations, the following definitions apply.

4.1 General definitions

4.1.1 alignment jitter: The short-term variations between the optimum sampling instants of a digital signal and sampling clock derived from it.

4.1.2 bilateral: A synchronization link where the corrective action to maintain locking is active at both ends of the link.

4.1.3 frequency departure: An underlying offset in the long-term frequency of a timing signal from its ideal frequency.

4.1.4 network synchronization: A generic concept that depicts the way of distributing a common time and/or frequency to all elements in a network.

4.1.5 single ended synchronization: A method of synchronizing a specified synchronization node with respect to another synchronization node, in which synchronization information at the specified node is derived from the phase difference between the local clock and the incoming digital signal from the other node.

4.1.6 synchronization chain: An active interconnection of synchronization nodes and links.

4.1.7 synchronization reference chain: A specific synchronization chain to form the basis for simulations of jitter and wander in the synchronization network.

4.1.8 slip: The repetition or deletion of a block of bits in a synchronous or plesiochronous bit stream due to a discrepancy in the read and write rates at a buffer.

4.1.9 standard frequency: A frequency with a known relationship to a frequency standard.

4.1.10 time: Time is used to specify an instant (time of the day) or as a measure of time interval.

NOTE – The words time or timing, when used to describe synchronization networks, usually refer to the frequency signals used for synchronization or measurement.

4.1.11 time scale: A system of unambiguous ordering of events.

NOTE – This could be a succession of equal time intervals, with accurate references of the limits of these time intervals, which follow each other without any interruption since a well-defined origin. A time scale allows to date any event. For example, calendars are time scales. A frequency signal is not a time scale (every period is not marked and dated). For this reason "UTC frequency" must be used instead of "UTC".

4.1.12 (timing) jitter: The short-term variations of the significant instants of a timing signal from their ideal positions in time (where short-term implies that these variations are of frequency greater than or equal to 10 Hz).

4.1.13 unilateral: A synchronization link where the corrective action to maintain locking is only active at one end of the link.

4.1.14 UTC: The time scale, maintained by the *Bureau International des Poids et Mesures (BIPM)* and the International Earth Rotation Service (IERS), which forms the basis of a coordinated dissemination of standard frequencies and time signal.

NOTE – The reference frequency for network synchronization is the frequency which generates the UTC time scale. It is therefore preferable to use the words "UTC frequency" instead of "UTC".

4.1.15 wander: The long-term variations of the significant instants of a digital signal from their ideal position in time (where long-term implies that these variations are of frequency less than 10 Hz).

NOTE – For the purposes of this Recommendation and related Recommendations, this definition does not include wander caused by frequency offsets and drifts.

4.2 Definitions related to clock equipments

4.2.1 clock: An equipment that provides a timing signal.

NOTE – The word "clock" generally means, when used for synchronization networks, the generator of the frequencies which will be used to synchronize the network.

4.2.2 frequency standard: A generator, the output of which is used as a frequency reference.

4.2.3 master clock: A generator which generates an accurate frequency signal for the control of other generators.

4.2.4 node clock: A clock distributing synchronization to one or more synchronized equipment.