IEEE instrumentation & measurement society

TC-10
Waveform Generation, Measurement and Analysis

Proposal of an IEEE Standard on Jitter Measurement

June 30th, 2011

Orvieto, Italy

What is jitter?

- **Jitter is the time variation of a periodic signal in electronics and telecommunications, often in relation to a reference clock source** (Wikipedia!)
- Jitter may be observed in characteristics such as the frequency of successive pulses, the signal amplitude, or phase of periodic signals.

What is jitter for IEEE TC-10?

IEEE Std. 1057:2007

- **3.1.5 aperture uncertainty:** The standard deviation of the sample instan… instability; timing jitter;
- **3.1.100 trigg…** …n the trigger delay time ov… multiple records.

Mainly concerned with the effects of jitter on the sampling instants

IEEE Std. 1241:2010

- Similar approach as 1057

Jitter as per IEEE Std. 181:2003

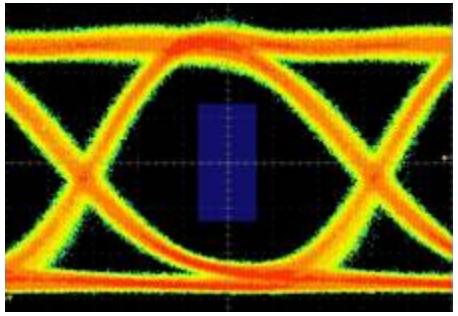
- **3.1.16 jitter:** The variation (dispersion) of a time parameter between successive cycles of a repetitive signal and/or between successively acquired waveforms of a repetitive signal for a given reference instant or duration. Unless otherwise specified by a mathematical adjective, rms jitter is assume
- **3.1.16.1 jitter,** specified reference level instants of signal.
- **3.1.16.2 jitter,** petitive signal or its waveform.
- **3.1.16.3 jitter, pulse duration:** The jitter in the pulse duration of a signal or its waveform.
- **3.1.16.4 jitter, trigger:** The jitter between a repetitive signal and the trigger event that is used to generate or measure that signal.

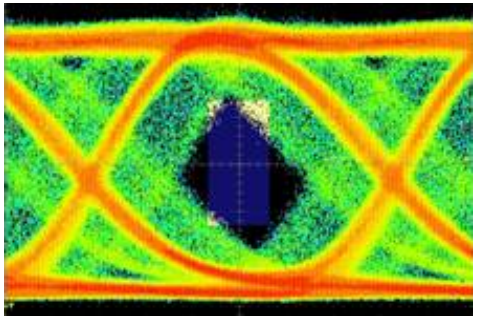
Mainly concerned with the characterics of the signal

Jitter in communications

- ITU-T Recommendation G.810 (08/1996): jitter is *"the short-term variations of the significant instants of a timing signal from their ideal positions in time (where "short-term*
- The jitter re
- Look at the eye:

Mainly concerned with the causes and effects of jitter on the symbol recovery





ITU-T Recommendations

O.xxx series about measurement instrumentation

Document #	Title
O.171	Timing jitter and wander measuring equipment for digital systems which are based on the Plesiochronous Digital Hierarchy (PDH).
O.172	Jitter and wander measuring equipment for digital systems which are based on the Synchronous Digital Hierarchy (SDH).
O.173 (draft)	Jitter measuring equipment for digital systems which are based on the Optical Transport Network (OTN)

What should a Standard on Jitter Measurement provide?

- Terminology: unambiguous, consistent, clear, harmonized with the existing standards
- Measurement methods
- Measurement setups
- Guidance to set-up specific measurement procedures

Strategic questions

Should the standard:

- focus on the effects of jitter or stay general on the signal characteristics?
- aim at the harmonization with the existing standards or propose a new approach to the matter?
- include specific procedures or general guidance to the uncertainty estimation and statement?

Tactical questions

Should we:

- try to order the list of definitions and figures of merit referring to the same physical quantity?
- use direct (timing or aperture jitter) or indirect figures (phase noise, frequency stability, SNR_j, …)?
- introduce a list of application-related definitions and measurement methods?

First step: the working group

- Working group composition
  - At least a chairman, a secretary, an editor, 10 to 25 members
  - Potential members: users, manufacturers, academic, …
- Enrolling of volunteers
- Work plan
- Assignments
- Time schedule

Next: Project Authorization Request

- A new PAR is used to initiate a project for the first time
- The PAR must be completed via IEEE myProject web site
- There is a precise timing for submission: not later than 60 days before the next New Standard Commission (NeSCom) of IEEE-SA

PAR contents (1/2)

- Scope of the standard: what will be done
- Purpose of the standard: why the standard will be done
- Need for the Project
- Stakeholders for the Standard

Purpose examples

IEEE Std. 1057:2007

- The main purpose of this standard is to ensure that manufactures and users of waveform recorders have a well-defined set of specifications and test methods so they can understand, describe, and compare the performance of these recorders using a common language.

IEEE Std. 181:2003

- The purpose of the standard is to facilitate accurate and precise communication concerning parameters of transition, pulse, and related waveforms and the techniques and procedures for measuring them. Because of the broad applicability of electrical pulse technology in the electronics industries (such as computer, telecommunication, and test instrumentation industries), the development of unambiguous definitions for pulse terms and the presentation of methods and/or algorithms for their calculation is important for communication between manufacturers and consumers within the electronics industry.

Scope examples

IEEE Std. 1057:2007

- This standard defines specifications and describes test methods for measuring the performance of electronic digitizing waveform recorders, waveform analyzers, and digitizing oscilloscopes with digital outputs. The standard is directed toward, but not restricted to, general-purpose waveform recorders and analyzers.

IEEE Std. 181:2003

- This standard provides definitions of terms pertaining to transitions, pulses, and related waveforms, and provides definitions and descriptions of techniques and procedures for measuring their parameters. The waveforms considered in this standard are those that make a number of transitions and that remain relatively constant in the time intervals between transitions.

Stakeholders

- **Academic** An educational institution or a person or entity affiliated with such institution, providing academic review of the standard being developed.
- **General Interest** A participant in standards activities that may benefit directly or indirectly, and may be affected by the standard being developed without being primarily a member of any of the other interest categories defined for this ballot.
- **Government/Military** A governmental entity or a person affiliated with such entity with direct interest in the standard being developed.
- **Producer** A person or entity that directly creates or that will create a conformant product, component, or service, for sale or distribution.
- **User** A person or entity that relies or will rely on the standard to define conformance of the product or service, and to create a common understanding of the operation of the product or service.

PAR contents (2/2)

- Existing standards: identify standards or projects of similar scopes within or outside of the IEEE
- International standard activities
  - Possibility that another organization adopts the standard (intact adoption)
  - Harmonization with other standards (adoption of parts of this standard)

PAR preparation

- Analysis of the existing standards
- Analysis of the jitter domains
- Definition of the jitter domains and the possible applications of the standard
- Timing: next deadlines July 29th or October 17th

Ideas? Opinions? Comments? Suggestions?

All interested people are welcome in the newborn IEEE TC-10 Subcommittee on Jitter Mesurement

Contacts: Tom Linnenbrink tom.linnenbrink@hittite.com
Sergio Rapuano rapuano@unisannio.it