6G SAS Jitter Definitions T10/07-XXXr0

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SAS TX Jitter Parameters

The current Transmit Jitter parameters from T10/07-063r5 are:

- Random Jitter (1010 pattern, zero-length test load) 0.18 UI or 30 ps.
- Total Jitter (through reference channel, reference receiver, CJTPAT) 0.63 UI or 105 ps.
- Tx Equalization, the recomended TX device setting for interoperability of 2-4dB. (used for the reference transmitter device)

SAS RX Jitter Parameters

The current Receive Jitter parameters from T10/07-063r5 are:

- Applied sinusoidal jitter at IR or CR (1 UI).
- Deterministic Jitter (DJ) of 0.35 UI
- Total Jitter (TJ) of 0.65 UI.

SAS RX Reference Receiver

The current Reference Receiver parameter from T10/07-063r5 are:

- 2-Tap DFE with infinite precision taps and 1UI spacing.
- LMSE auto-adapting taps
- EQ inner EYE of 100mV vertical
- EQ inner EYE of 0.6 UI horizontal

SAS TX and RX jitter reconciliation

How to reconcile

- TX parameters RJ, TJ and EQ, with
- RX parameters SJ, DJ and TJ? and with
- with the Reference EQ DFE?

SPEC problems

The TX generation continues to the CR or IR points.

- TX output
- Compliant RX device, and
- Through some compliant channel,

to work in the system.

Jitter and EQ two parts of one problem

SAS relies on reference RX definition from MJSQ. This reference RX

- Provides a timebase to sample the data,
- Mimics RX CDR behavior,
- provides jitter budget relief for SSC closed jitter EYES.

SAS is proposing a DFE reference RX EQ. This reference EQ

- Provides an open EYE for sampling,
- Mimics RX EQ behavior, and
- provides jitter budget relief for amplitude closed jitter EYES.

Need to open the time and amplitude jitter simultaneously.

Combined/Unified signal specifications

A combined specification must include:

- A Reference RX CDR PLL definition,
- A Reference RX EQ definition - 2 TAP DFE (Enhanced TWDP), and
- A EYE MASK opening at 10^{-12} BER target.
- Further limits on TX and RX Return Loss to permit Channel budgeting and modeling.

A compliant SAS system is one that generates a signal within the specified generation limits, and tolerates a signal at least as large as the tolerance limits.

Why combine EQ and RX CDR?

The RX signal is inter-dependent.

- The reference EQ creates transitions,. . .
- The reference CDR derives a timebase from the transitions, and
- adaptation changes EQ parameters based on the sampled EYEs.

Thus the RX eye is inter-dependent on the EQ and CDR and adaptation results. This is obviously channel specific.

RX EQ analysis

Simple RX EQ analysis requires:

- A spectrally rich signal for the adaptation, (JTSPAT to CJTSPAT)
- A repetitive signal, (The deterministic signal found through averaging)

It creates a NORMALIZED EYE to a reference target. Simulation or software DFE can create any amplitude.

Combined/Unified Spec parameter table

Name	Description	Unit	value	(min/max)
VMA	Signal amplitude	Volts	XXX	min
Y1	normalized inner vertical EYE		XXX	min
X1	Horizontal EYE opening	UI	XXX	max

Combined/Unified Spec parameter table (cont)

With the signal measurements from:

- auto-adapted parameters from a scrambled pattern,
- EYE generated from the combined reference DFE + CDR.

Combined/Unified Spec parameter table (cont)

Additional table entries can be added to restrict the allowable signals further by adding parameters designed with a channel budget in mind:

Name	Description	Unit	value	(min/max)
TX-TJ	max TX jitter		XXX	max
S21	Nyquist rate channel loss	dB	XXX	max

In all cases the EYE measurement is the same, through a combined DFE+CDR reference EQ after the auto-adaption took place on a scrambled repetitive pattern.

Reference channel extensions

"Near end" measurements can be performed via

- A reference channel definition set,
- CDR+DFE analysis of the resulting EYE

Thus near and far end measurements are effectively measured "far end".

Conclusions

- Effects of Rj, Dj, Sj etc, are captured by the DFE+DCR and the mask.
- Effects of Channel, + TX EQ are captured by the DFE+CDR and the mask.
- A consistent measurement method has been proposed.
- Detailed interactions are captured by the "far end" analysis method.

Thank you for your time. I Wish I Was in Washington.