T10/07-001r1

Proposal for 6G SAS Phy Specification

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Preview

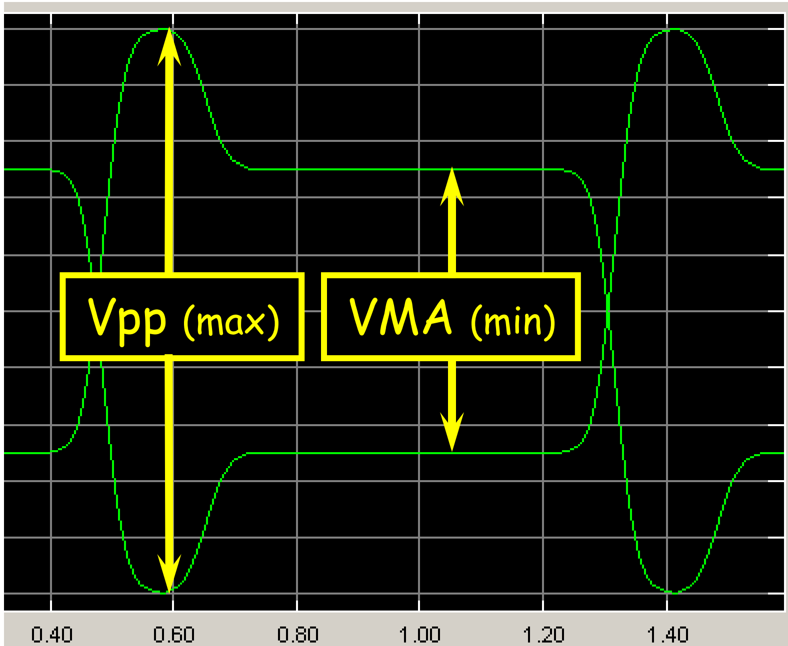
- This presentation references T10/06-496r2, generally identifying proposal elements which differ from that presentation in red.
- Primary difference from T10/06-496r2 is in method of specifying TX compliance.

TX Spec Proposal
(ref T10/06-496r2, slide 6)

Transmitter	Min	Nominal	Max	Units
Bit Rate		6000		MBps
Differential Voltage	**(see following slide)**			mV
Transition Time (20%-80%)	0.25		**---**	UI
Tx De-Emphasis	**(not directly specified)**			
DC Differential Impedance	**(covered by SDD22)**			
DC Impedance Mismatch			5	ohm
DC Common Mode Impedance	**(covered by SCC22)**			
Dif'l Return Loss (SDD22)	(see Plot)			dB
CM Return Loss (SCC22)	(see Plot)			dB
Max. Intra-Pair Skew 15 ps				
Max. Tx Output Imbalance			10	%
**Common Mode Generation			50	mVpp
Random Jitter			0.15**??**	UI
Deterministic Jitter			0.15**??**	UI
Total Jitter			0.3 **??**	UI
AC Coupling Cap			12	nF

TX Spec Proposal: Dif'l Voltage

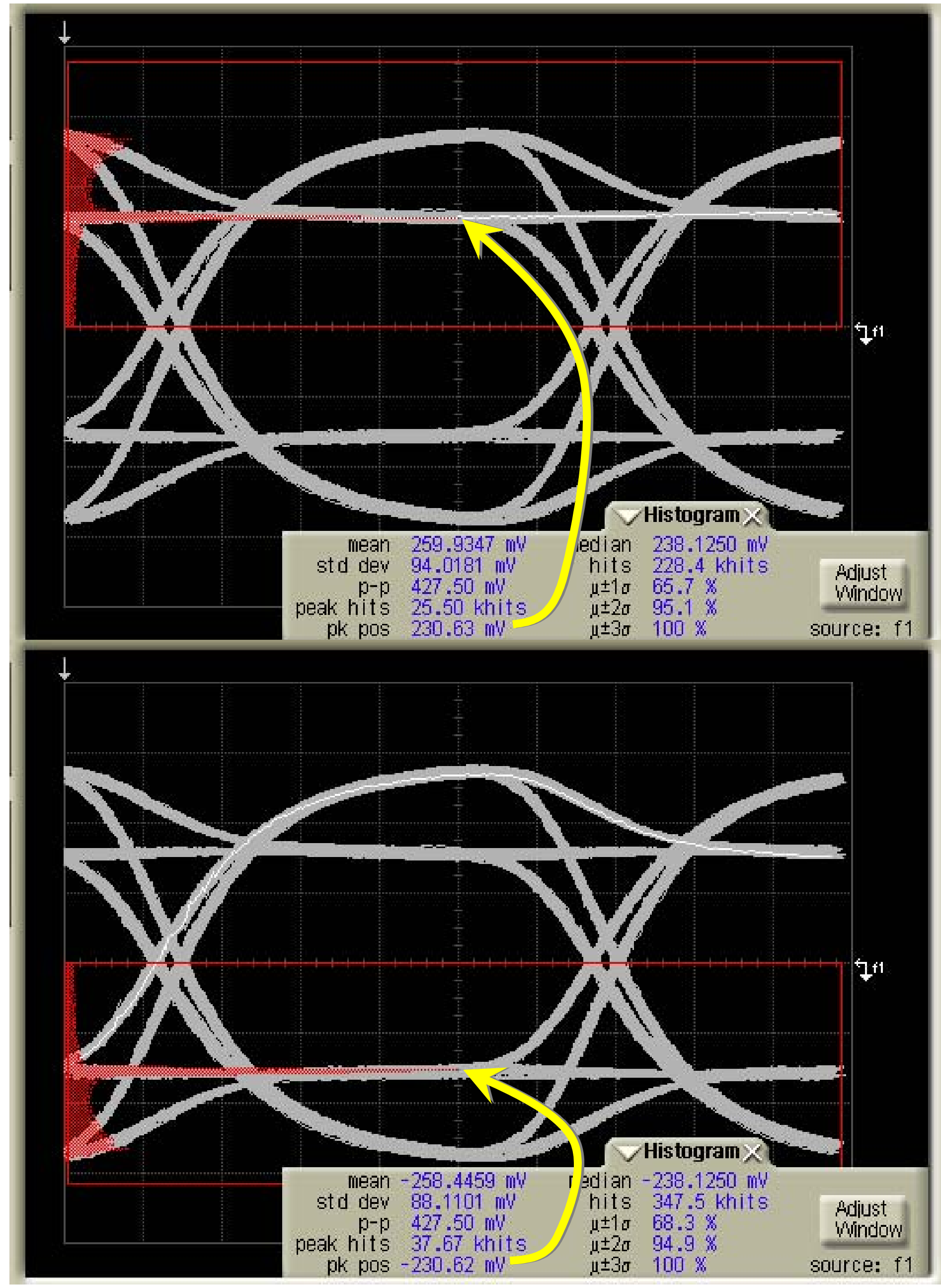
- Max amplitude to protect RX
  - **1200 mVppd**
  - Same as T10/06-496r2
- Min de-emphasized amplitude ("VMA")
  - **400 mVppd**
  - Same as 800 mVppd min peak voltage with 6dB de-emphasis
  - Enables low-swing mode



Measurement of Vpp & VMA

1. Two vertical histogram spanning an integral number of UI using a defined data pattern. 1st covers zero volts to above waveform, & 2nd covers zero to below wfm.
2. VMA is "peak position" of 1st histogram minus 2nd histogram
3. Vpp is peak-peak of 1st plus 2nd.

Using example at right:
- VMA = 230.63 – (-230.62)
  = 461.25 mVppd
- Vpp = 427.50 + 427.50
  = 955.00 mVppd



Reasons not to Specify TX De-emphasis

- Mandates a high EMI TX waveform, even if it isn't needed
- RX equalization (DFE) is equal or better performance compared to TX emphasis
- Details of waveform depend on details of TX-to-compliance point path
  - 1dB @ 3GHz for 2-3" PCB trace, taking a compliant TX out of compliance

TX Spec Proposal: Return Loss

(same as T10/06-496r2, slide 10)

50 MHz < f < 4.5 GHz:

SCC22 = max{-6, -5.9+13.3*log10(f/4.25 GHz)}
= max{-6, -7.9+13.3*log10(f/3.0 GHz)}

SDD22 = max{-10, -5.9+13.3*log10(f/4.25 GHz)}
= max{-10, -7.9+13.3*log10(f/3.0 GHz)}

TX Spec Proposal: Interoperability
(from OIF CEI 2.0, "Method D")

2.4.3 Transmitter Interoperability

The following step shall be made to identify which transmitters are to be considered compliant.

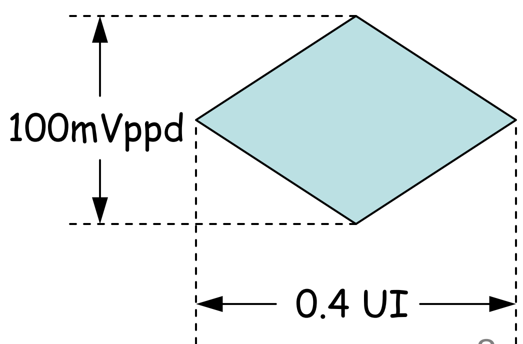
1. It shall be verified that the measured eye is equal or better than the calculated eye for the given measurement probability Q (see Appendix 2.E.3 for a suggested method of calculating Q given a measurement population), given:

   — A "compliance" channel as per 2.4.2 that required at least half the maximum transmit emphasis with no receiver filtering to give an open eye.

   — Using this channel the transmitter shall be then optimally adjusted and the resulting eye measured (see Appendix 2.D.7 for a suggested method).

   — Using this channel the statistical eye shall then be calculated, as per Annex 2.C.5, using the maximum defined transmit jitter and the actual transmitter's amplitude and emphasis.

- 10 meter iPass cable (possibly plus 1-2 dB of fixture loss) satisfies this "compliance" channel definition.
- Proposed TX eye mask after compliance channel and simulated DFE equalization is 100mVppd x 0.4UI (R_Y1=50mV and R_X1=0.3)



RX Spec Proposal
(ref T10/06-496r2, slide 11)

Receiver	Min	Nom	Max	Units
DC Differential Impedance	**(covered by SDD11)**			
DC Common Mode Impedance	**(covered by SCC11)**			
Dif'l Return Loss (SDD11)	(same as SDD22)			
CM Return Loss (SCC11)	**(same as SCC22)**			
DC Impedance Mismatch			**5**	**ohm**
CM Tolerance (2-200MHz)	150			mVpp
Max Operational Input	1200			mVpp
Max Non-Operational Input	2000			mVpp

Reference Devices

- Reference TX & RX are used primarily to set requirements for compliant channels.
- Numerous presentations have shown that the following reference TX (one post cursor tap) & RX (two DFE taps) establish all the submitted channels as compliant.
- More elaborate reference TX and/or RX will declare more difficult (but yet unknown) channels as compliant.

Reference Devices: TX

(ref T10/06-496r2, slide 5)

Ref TX		Units
Ref Tx # of taps	**2 (note 1)**	
Ref Tx de-emphasis	**0 to 6**	dB
Ref Tx swing ("VMA")	**400**	mVpp
Ref Tx dif'l resistance	**100**	ohms
Ref Tx dif'l capacitance	**0.47**	pF

Note 1: If more accuracy is required, one additional TX tap (precursor) provides far more margin than adding a 3rd RX tap. (Ref: T10/06-049r1)

Reference Devices: RX
(ref T10/06-496r2, slide 5)

Ref RX		Units
Ref RX # of taps	**2**	
Ref RX tap spacing	**1**	UI
Ref RX tap weight limit	**(see below)**	
Ref Tx dif'l resistance	**100**	ohms
Ref Tx dif'l capacitance	**0.47**	pF

Note: DFE tap weights are constrained to be positive (in the sense defined in OIF CEI 2.0, so that fractions of preceding decisions are *subtracted* from the present input). This precludes DFE supplying a low pass characteristic to compensate for excess de-emphasis.