Resolving SNDR

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SNDR is challenges for PAM4

- The fitted peak voltage should divided by 3 or noise should be multiplied by 3

No change in the way Vf is found or σ_e

- $SNDR = \dfrac{Vpeak/3}{\sqrt{\sigma_e{}^2 + \sigma_n{}^2}}$

IEEE Std 802.3bj-2014
AMENDMENT TO IEEE Std 802.3-2012: Ethernet

Table 94–13—Summary of transmitter characteristics at TP0a

Parameter	Subclause reference	Value	Units
Signaling rate	94.3.12.2	13.59375 ± 100 ppm	GBd
Differential peak-to-peak output voltage (max.) Transmitter disabled Transmitter enabled	94.3.12.3	 30 1200	 mV mV
DC common-mode output voltage (max.)	94.3.12.3	1.9	V
DC common-mode output voltage (min.)	94.3.12.3	0	V
AC common-mode output voltage (RMS, max.)	94.3.12.3	30	mV
Differential output return loss (min.)	94.3.12.4	Equation (94–7)	dB
Common-mode output return loss (min.)	94.3.12.4	Equation (94–8)	dB
Output waveform Level separation mismatch ratio, R_{LM} (min.) Steady-state voltage v_f (max.) Steady-state voltage v_f (min.) Linear fit pulse peak (min.) Normalized coefficient step size (min.) Normalized coefficient step size (max.) Pre-cursor full-scale range (min.) Post-cursor full-scale range (min.)	 94.3.12.5.1 94.3.12.5.3 94.3.12.5.3 94.3.12.5.3 94.3.12.5.5 94.3.12.5.5 94.3.12.5.6 94.3.12.5.6	 0.92 0.6 0.4 $0.85 \times v_f$ 0.0083 0.05 1.54 4	 — V V V — — — —
Output jitter and linearity Clock random jitter, RMS (max.) Clock deterministic jitter, peak-to-peak (max.) Even-odd jitter (max.) Signal-to-noise-and-distortion ratio (min.)	 94.3.12.6.1 94.3.12.6.1 94.3.12.6.2 94.3.12.7	 0.005 0.05 0.019 31	 UI UI UI dB

30 mm package

Available signal, As

IEEE P802.3bs 400 Gb/s Ethernet Task Force
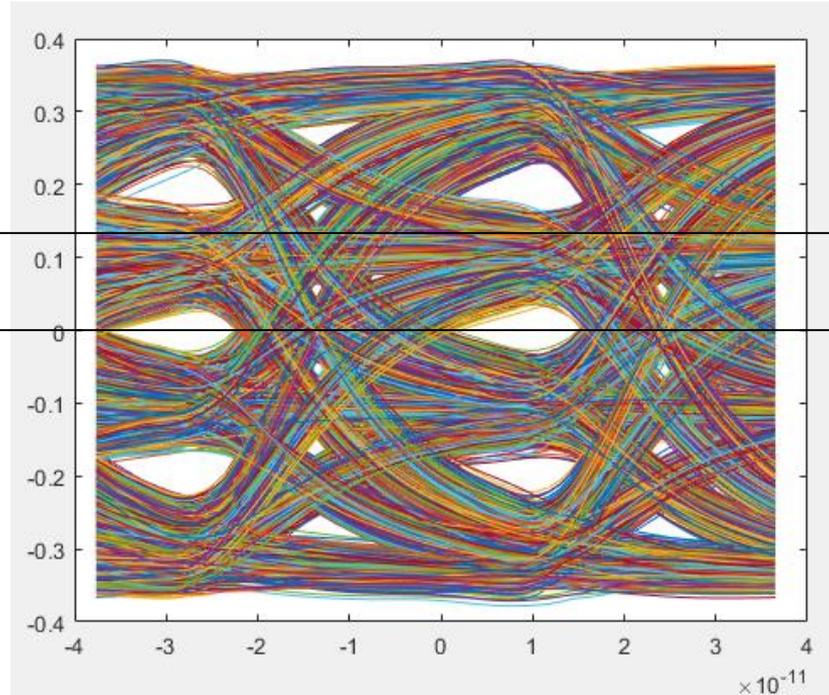
30 mm package with CTLE Gdc=-6dB

IEEE P802.3bs 400 Gb/s Ethernet Task Force
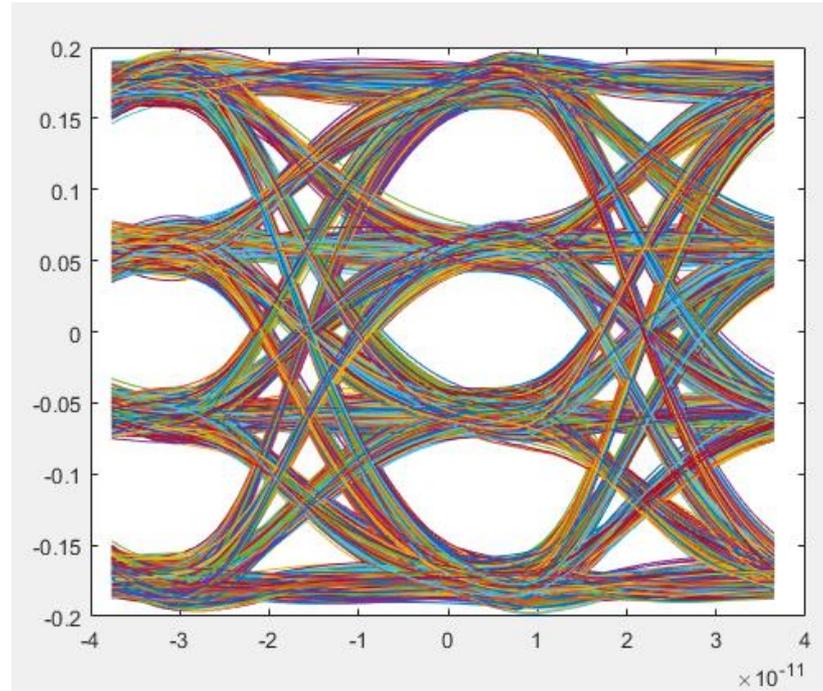
Measurement vs fit and error plots
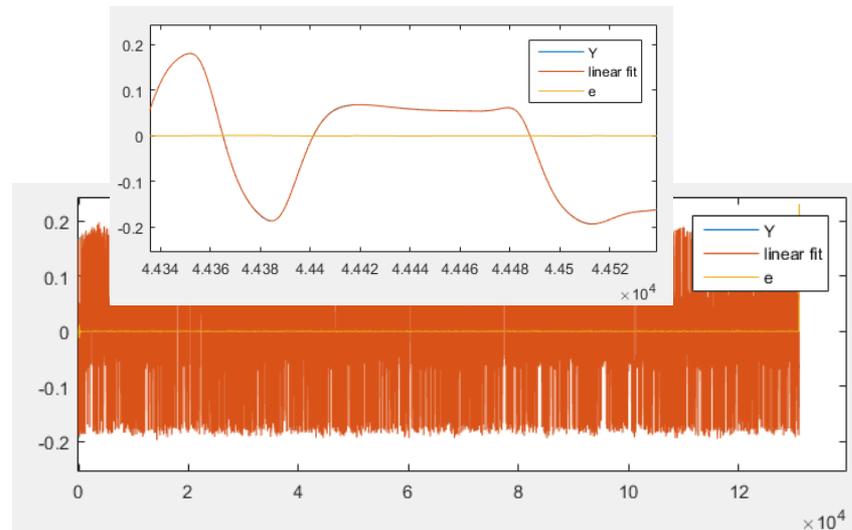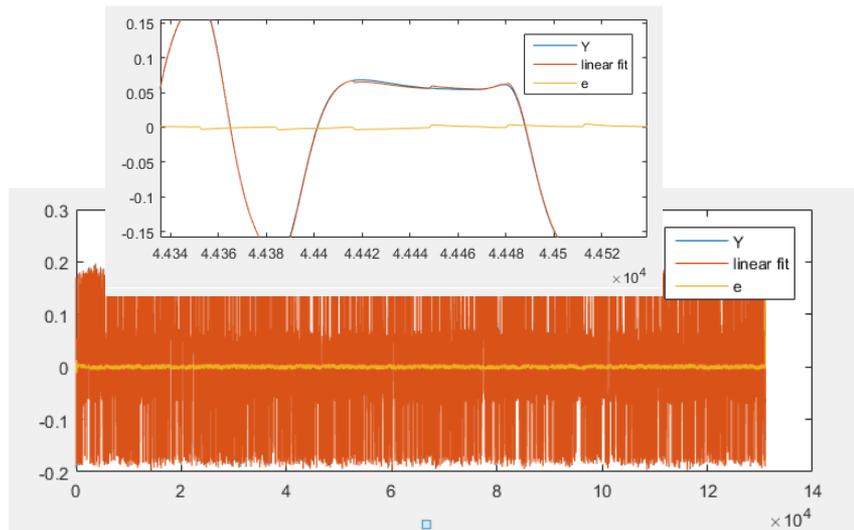
Fit length: 13 UI

Fit length: 67 UI

Suggestion to compensate for reference equalization in COM computation

- Find best Vf for any tx ffe setting
  - Fit over 67 UI
  - Use this setting
- Find CTLE setting which yields best SNDR using a fit over 67 UI
  - vpeak/vf is loss spec
  - remember these g_{dc1}, σ_{e1}
- Perform fit for ndfe+1+dp with CTLE using g_{dc1}
  - Determine σ_{e2}
  - $\sigma_e = \sqrt{\sigma_{e2}^2 - \sigma_{e1}^2}$

- $SNDR = \dfrac{Vpeak/3}{\sqrt{\sigma_e^2 + \sigma_n^2}}$