

C2M TP4 and Farend Eye Verification

Ali Ghiasi – Ghiasi Quantum
Kumaran Krishnasamy – Broadcom Ltd

IEEE 802.3bs Electrical Adhoc

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Background

- ❑ **The P802.3bs group focus has been 200GAUI-4/400GAUI-8 compliance at TP1a and Far-end eye (host ASIC input)**
- ❑ **The test vehicle for this analysis was a measured mated QSFP28 board**
- ❑ **This contribution determine far-end eye for a range of CTLE setting and pre-emphasis**
 - As the result show a set of transmitter pre/post cursor combined with CTLE equalization produce the minimum eye height and eye width
 - This simulation show for the above configuration good selection of transmit FFE with RX CTLE are available to meet the 30 mV EH and 0.2 UI EW at far end
 - The next step was to use the setting that just about meet far-end EH of 30 mV without changing transmitter setting observe the TP4 output (150 mm channel removed) for EH and EW
 - Our result indicate TP4 EH and EW could increase slightly as TP4 limit as stand easily will be passed but far-end more likely to fail.

Module Output Specification

□ Specification at TP4 and far-end

- For a set of condition producing far-end eye of 30 mV, the goal was to determine how well simulated result for far-end EW, TP4 EH, and TP4 EW correlate with parameters in table below.

Table 120E–3—200GAUI-4 and 400GAUI-8 C2M module output characteristics (at TP4)

Parameter	Reference	Value	Units
Signaling rate per lane (range)	120E.3.1.1	26.5625 ± 100 ppm	GBd
AC common-mode output voltage (max, RMS)	120E.3.1.2	17.5	mV
Differential peak-to-peak output voltage (max)	120E.3.1.2	900	mV
Near-end ESMW (Eye symmetry mask width)	120E.4.2	0.265	UI
Near-end Eye height, differential (min)	120E.4.2	70	mV
Far-end ESMW (Eye symmetry mask width)	120E.4.2	0.2	UI
Far-end Eye height, differential (min)	120E.4.2	30	mV

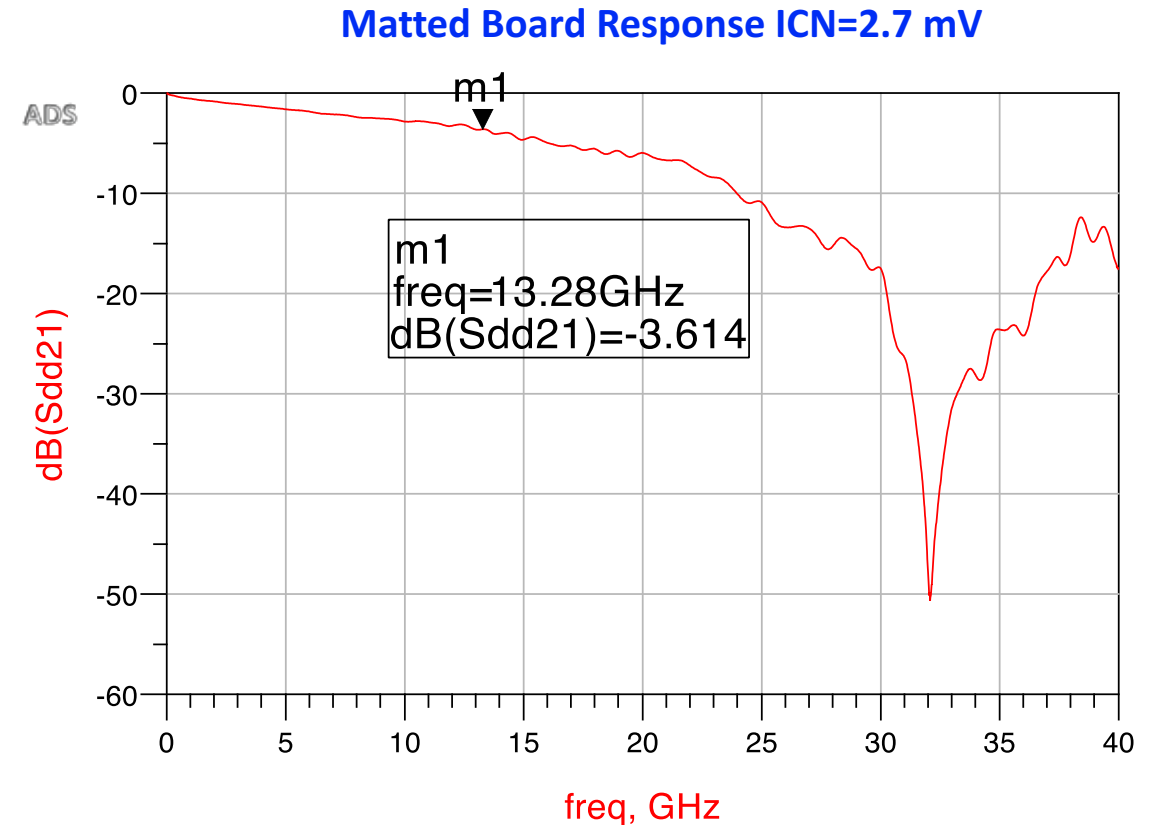
Link Configuration Setting

❑ Transmitter parameters

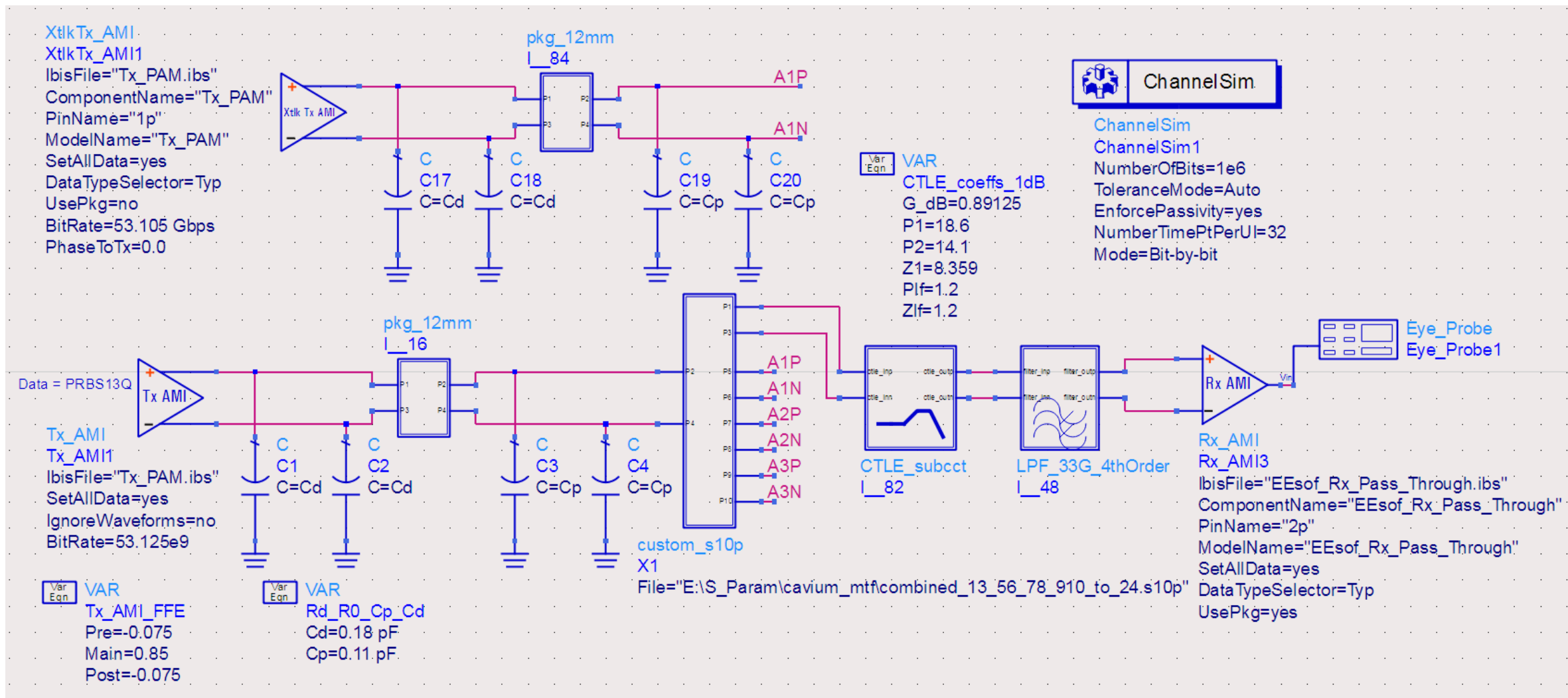
- 12 mm package for module CDR with $C_d=0.18$ pf, $C_p=0.11$ pf, $Z_c=90 \Omega$
- Jitter $\sigma_{RJ}=0.01$ UI, $A_{dd}=0.02$ UI

❑ Mated board ICN calibrated to 4.4 mV RMS for additional detail on the mated board see

- http://www.ieee802.org/3/bs/public/17_03/dudek_3bs_01_0317.pdf



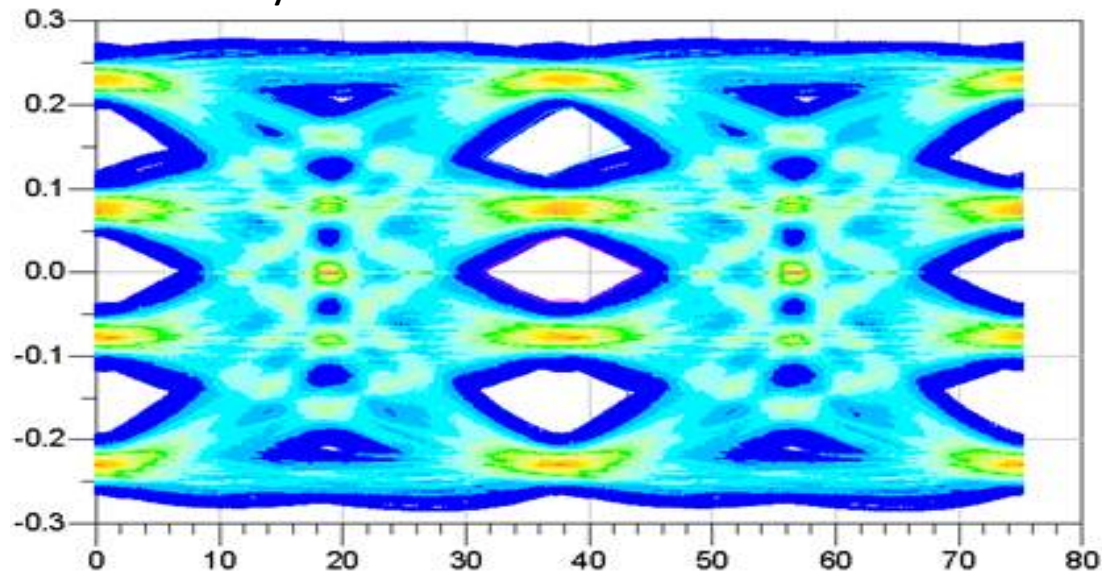
ADS Configuration



Typical TP4 and Farend Eye

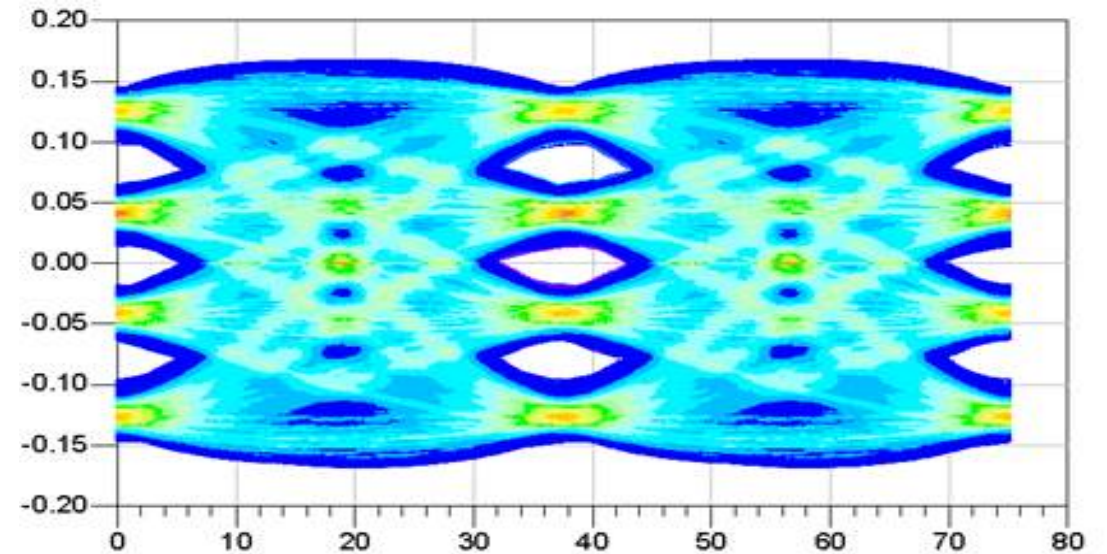
- CDR package assumed 12 mm

TP4 eye with Pre=Post=-0.075 and 1 dB CTLE



measurement	time, psec	Summary
WidthAtBER0		1.242E-11
WidthAtBER1		1.299E-11
WidthAtBER2		1.148E-11
HeightAtBER0		0.079
HeightAtBER1		0.076
HeightAtBER2		0.078

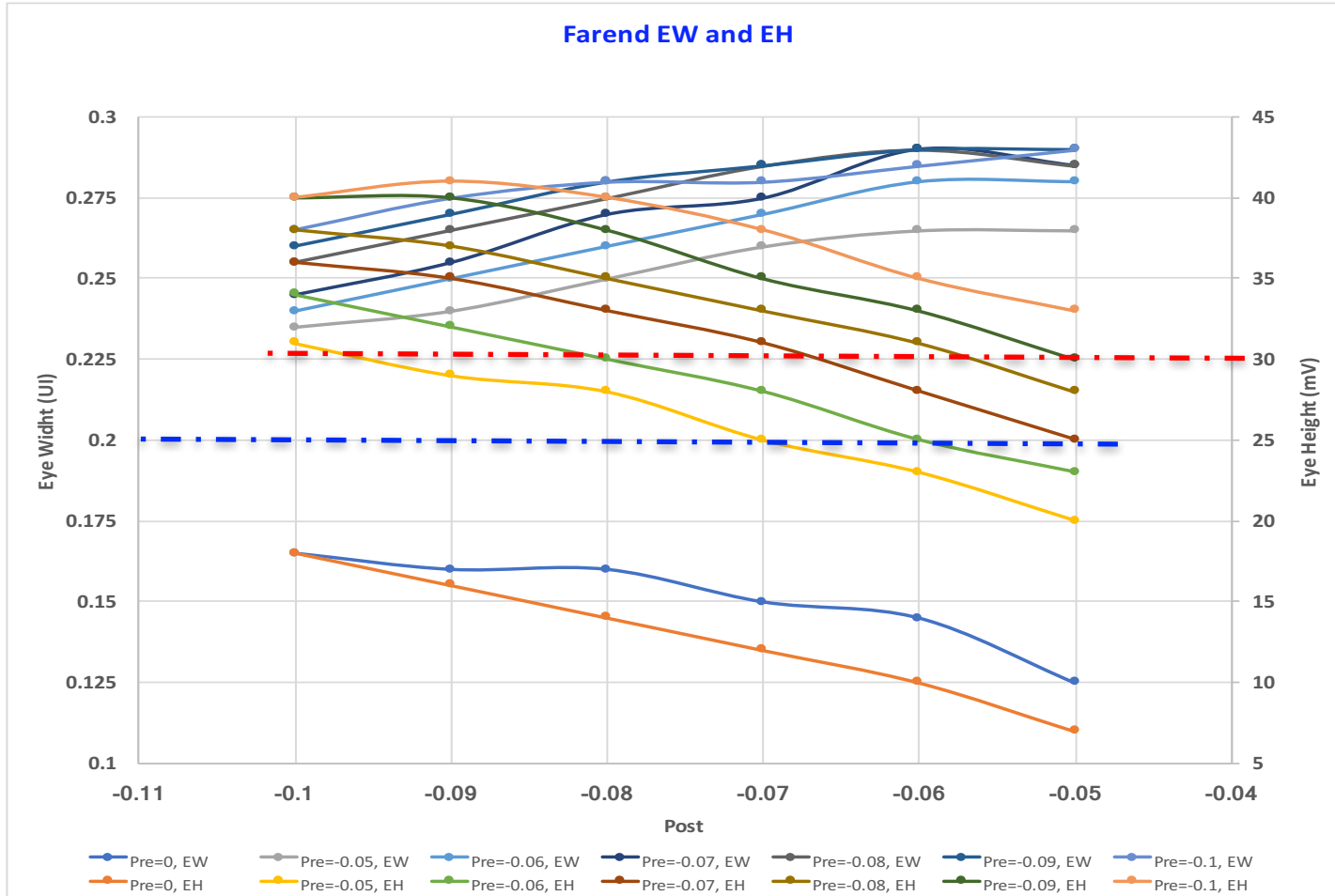
Farend eye with Pre=Post=-0.075 and 6 dB CTLE



measurement	time, psec	Summary
WidthAtBER0		1.035E-11
WidthAtBER1		1.073E-11
WidthAtBER2		1.073E-11
HeightAtBER0		0.037
HeightAtBER1		0.033
HeightAtBER2		0.034

TP4 and Farend Sweep

- For several transmit pre/post cursor farend resulted are plotted and for setting producing farend of ~30 mV TP4 EH and EW are listed in the table to the right.



TP4 Result for setting producing ~30 mV Farend Eye

Post	Pre=-0.05, EW UI	Pre=-0.05, EH mV
-0.09	0.30	77
	Pre=-0.06, EW UI	Pre=-0.06, EH mV
-0.08	0.30	78
	Pre=-0.07, EW UI	Pre=-0.07, EH mV
-0.07	0.30	79
	Pre=-0.08, EW UI	Pre=-0.08, EH mV
-0.06	0.30	80
	Pre=-0.09, EW UI	Pre=-0.09, EH mV
-0.05	0.31	80

Summary

- ❑ **Sweep of transmitter parameters that just meet farend EH of 30 mV and simultaneously meet TP4 EH=70 mV and EW=0.26 UI indicate validity of parameters in 802.3bs D 3.1 clause 120.e**
- ❑ **The sweep of transmit parameters offers possibility of some further tweak if we choose so**
 - Meeting EH and EW at TP4 likely farend EH and EW will not be met
 - An EH~75 mV with EW of ~0.28 would be better indicator that far end will be met
 - Another way of thinking is to say the required parameters are at Farend, TP4 parameters are there more to indicate some min opening, min VECP, and min EW
 - At least for board considered here it appear that we could tighten EW at TP4 by 0.01-0.02 UI, also increasing Farend EW by the same amount, and relaxing the jitter tolerance of the host
- ❑ **Even if we choose not make these tweaks the specification as stand is sound given that Farend and TP4 specification both must be met.**