

Refinement to XLAUI/CAUI Electrical Specifications

IEEE P802.3ba
Vancouver

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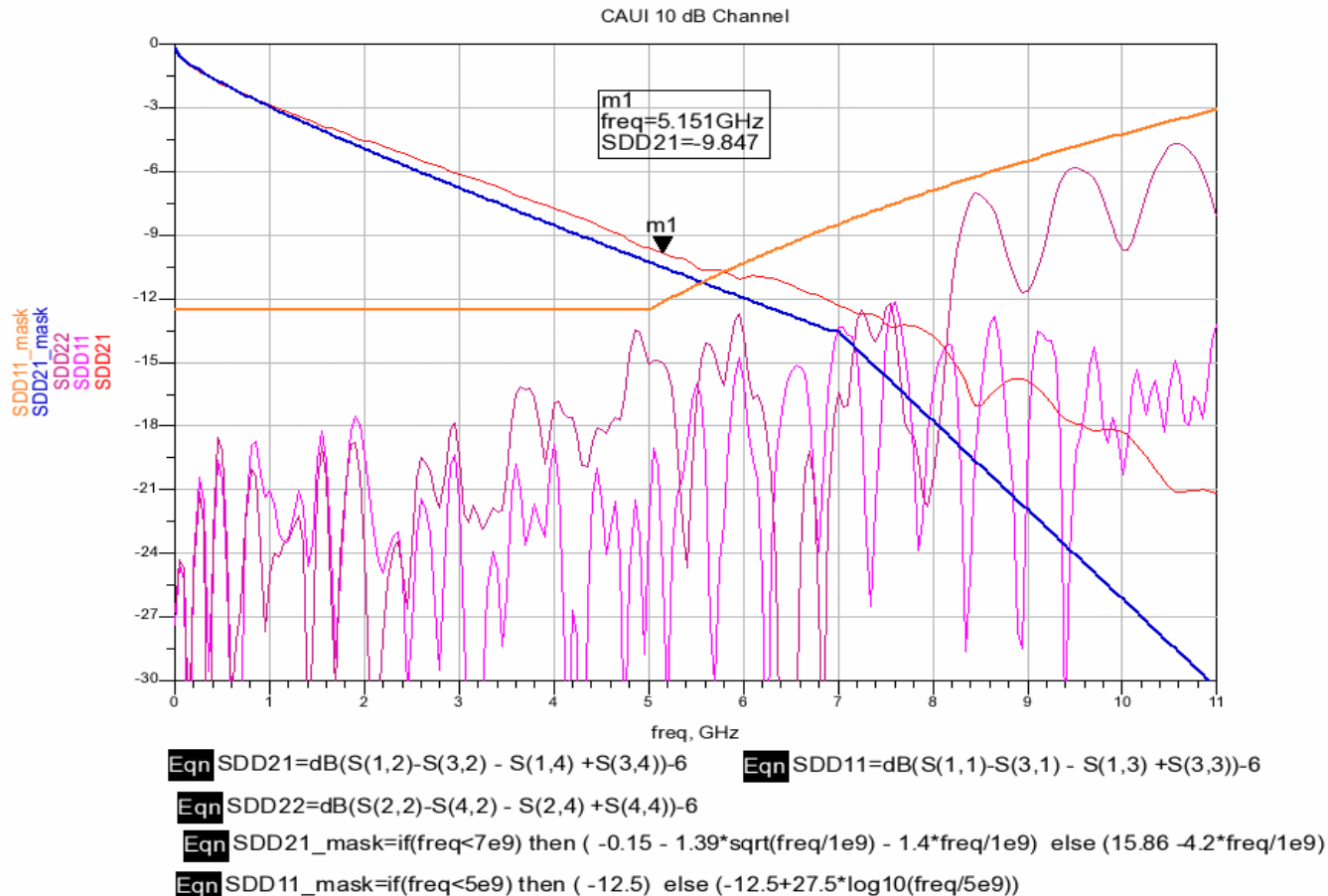
Ali Ghiasi
Broadcom Corporation
aghiasi@broadcom.com

Summary

- **Update to nAUI channel SDD21 and ripple**
- **Defining nAUI compliance point**
- **Updating module and host return loss based cascaded effect of connector and chip**
- **Shifting nAUI compliance from chip ball to 1 dB loss point**
- **Verifying far end compliance for several corner cases**

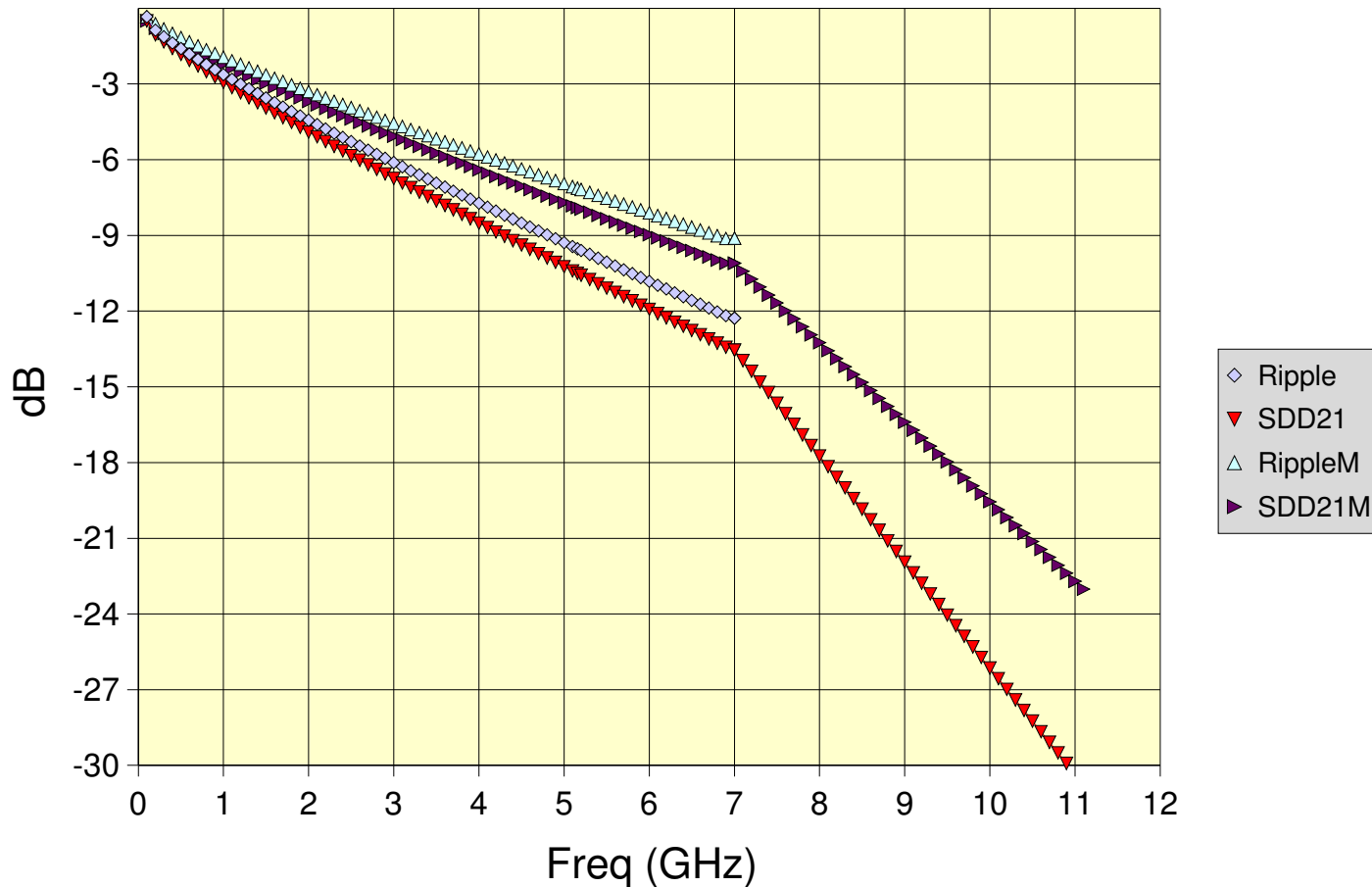
XLAUI/CAUI Channel with 10 dB Loss

- This is improved version over ghiasi_01_0708 which had some undesirable ripple
 - The 10 dB channel was created by cascading 2nd PCB with 2 dB loss at Nyquist with the 8" Fr4-8 channel which is adding some ripple.



nAUI Channel Loss and Ripple

- SDD21 and ripple for nAUI chip to chip and chip to module

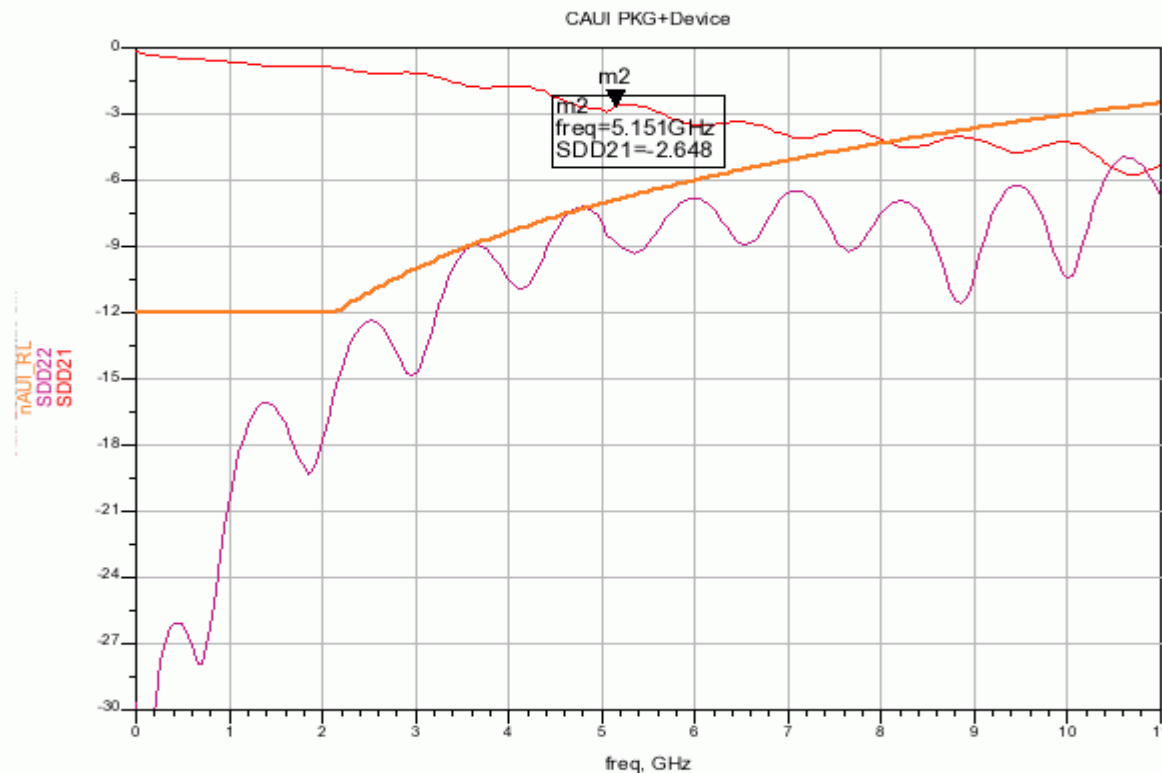


nAUI Channel Loss and Ripple cont.

- **Chip to chip loss SDD21=10.5 dB@5.15GHz (already in D1.2)**
 - SDD21(dB)= $-0.15 - 1.39\text{Sqrt}(f) - 1.4*f$ from 0.25 to 7 GHz
 - SDD21(dB) = $15.86 - 4.2 * f$ from 7 to 11.1 Ghz
- **Chip to chip Ripple (need to be added)**
 - Ripple(dB) = $\text{SDD21}(\text{dB}) * (0.15 + 0.16*f)$ from 0.5 to 7 GHz
- **Chip to module channel SDD21=7.9 dB@5.15GHz (detail missing)**
 - SDD21(dB) = $-0.111 - 1.046*\text{Sqrt}(f) - 1.05*f$ from 0.25 to 7 GHz
 - SDD21(dB) = $11.95 - 3.15 * f$ from 7 to 11.1 Ghz
- **Chip to module Ripple (need to be added)**
 - Ripple(dB) = $\text{SDD21}(\text{dB}) * (0.15 + 0.12*f)$ from 0.5 to 7 GHz

Creating nAUI Compliance Output

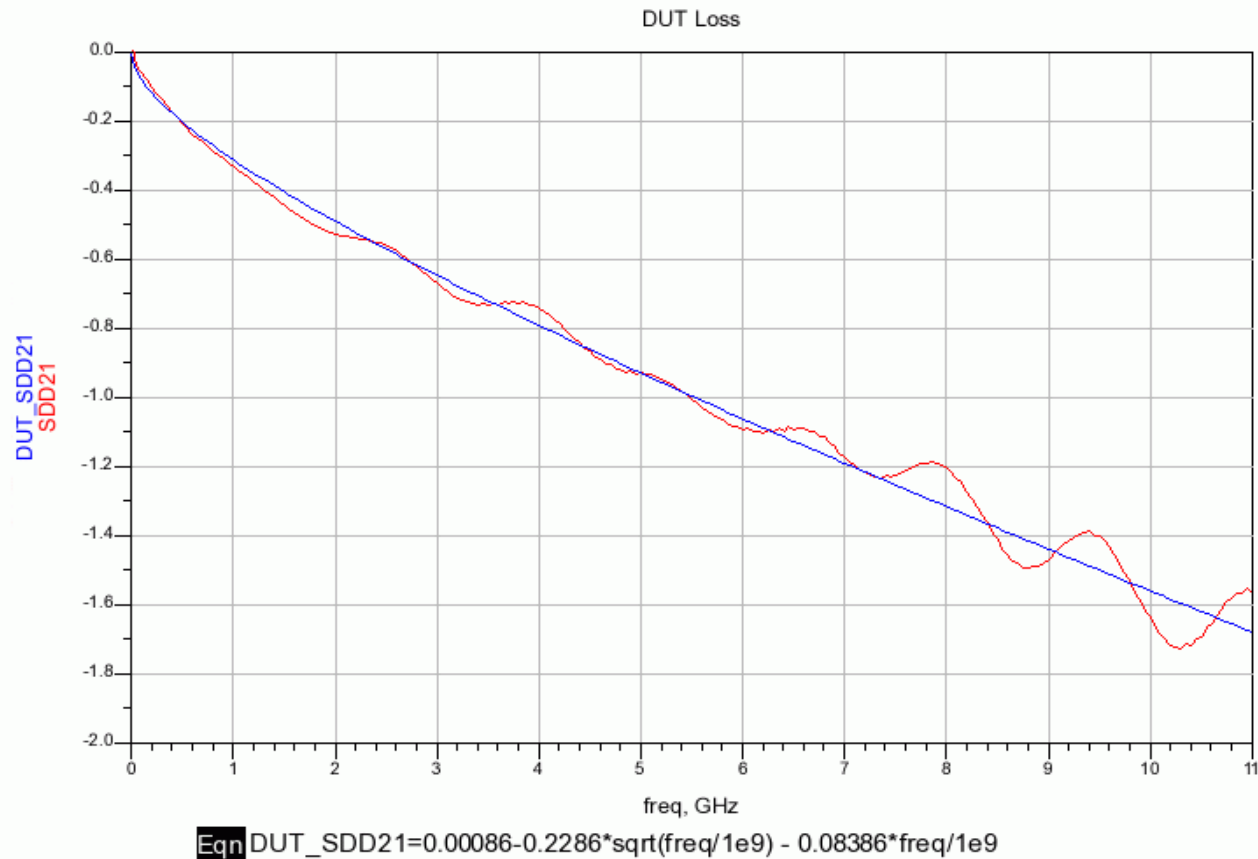
- SerDes with worst case return loss + channel with 1 dB loss at Nyquist
 - No need to make any changes to the host chip RL



$$\text{Eqn } \text{nAUI_RL} = \text{if}(\text{freq} < 2.125\text{e}9) \text{ then } (-12) \text{ else } (-6.5 + 13.33 * \log_{10}(\text{freq}/5.5\text{e}9))$$

Loss from Chip Ball to Compliance Point

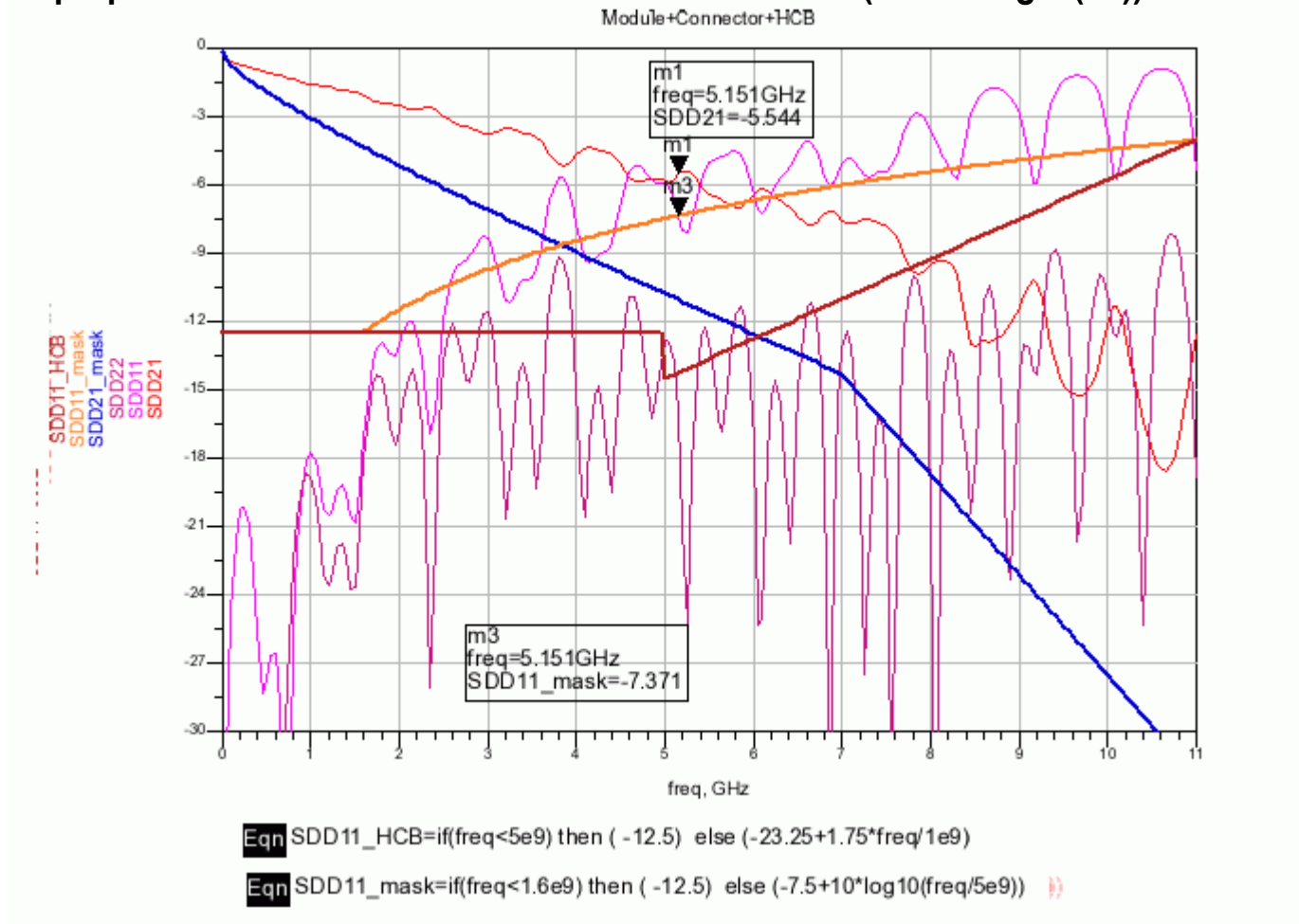
- Current value in the draft are 0.7 dB, this was scaled to 1 dB at 5.5 GHz for easier PCB routing and channel availability



Host Return Loss

- Current limit would fail

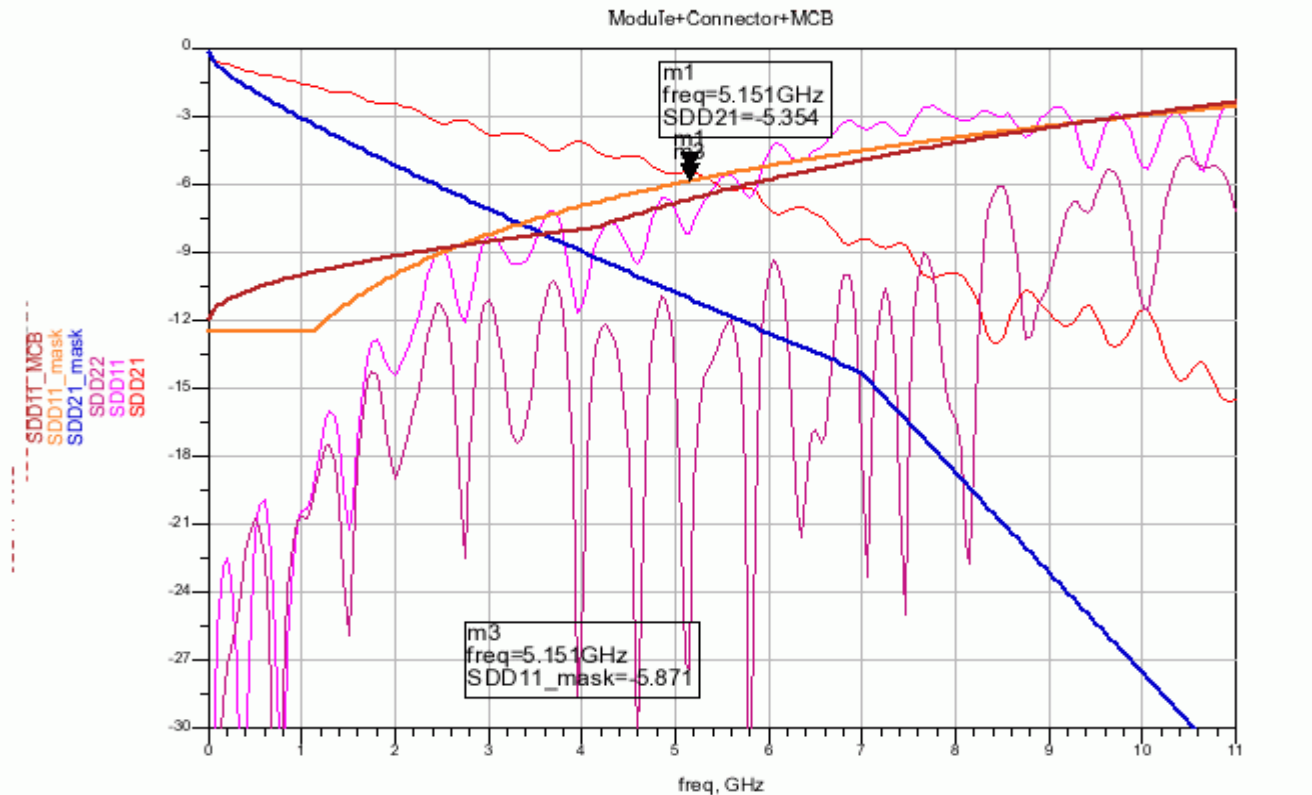
- The proposed limit is -12.5 dB from 0.01 to 1.6 GHz and $(-7.5+10\log_{10}(f/5))$ f from 1.6 to 11.1 GHz.



Module Return Loss

- Current limit would fail

- The proposed limit is -12.5 dB from 0.01 to 1.15 GHz and $(-6+10\log_{10}(f/5))$ f from 1.15 to 11.1 GHz.

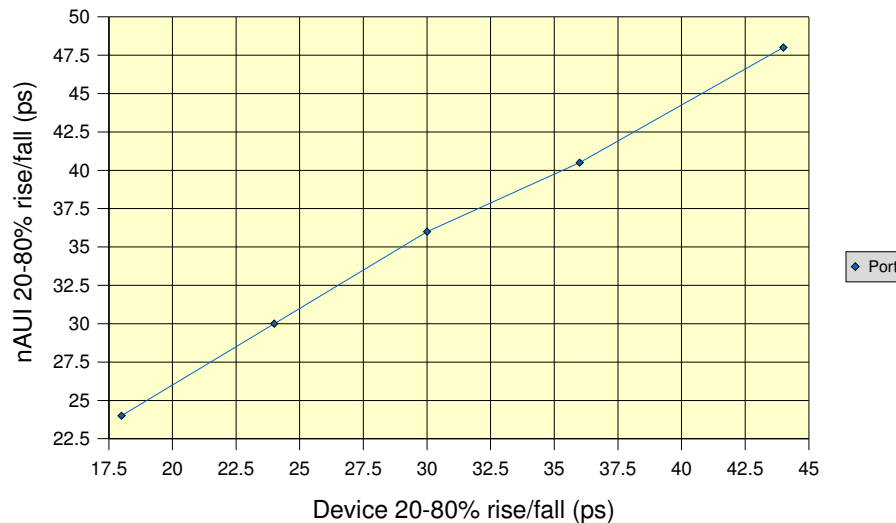


Eqn SDD11_MCB=if(freq<4.11e9) then (-12+2*sqrt(freq/1e9)) else (-6.3+13*log10(freq/5.5e9))

Eqn SDD11_mask=if(freq<1.15e9) then (-12.5) else (-6.+10*log10(freq/5e9))

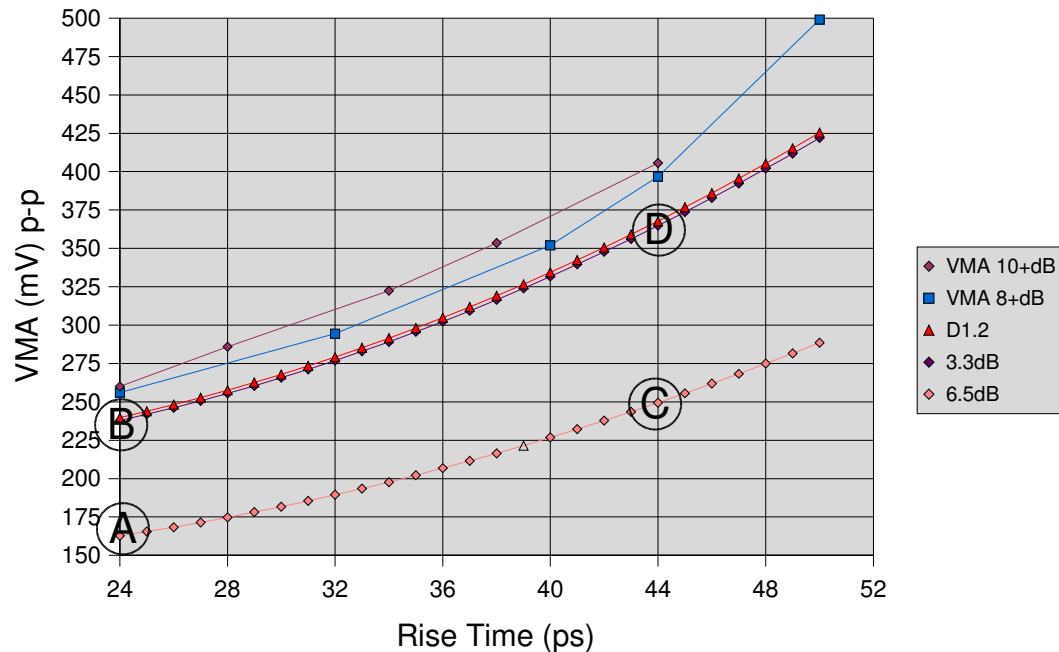
nAUI Compliance Output

- **Impact of nAUI PKG+1d B loss channel on de-emphasis**
 - Requires 1.5 dB de-emphasis
 - min de-emphasis 4.8 dB becomes 3.2 dB
 - max de-emphasis of 7.5 dB becomes 6 dB
- **Impact of rise/fall time at nAUI compliance point**
 - Approximate device and nAUI near end port output shown below:



Translating Device Setting to nAUI Compliance Output

- Vtx-demph was adjusted to give same value as in D1.2 with 3.3 dB de-emphasis since 1.5 dB is part of the near end measurement.
 - $V_{tx-demph} = (234.64 - 2.13 \cdot x + 0.13 \cdot x^2) \cdot 1.32 \cdot (10^{y/20})$
- Next investigate 4 corner cases A, B, C, and D for far end compliance

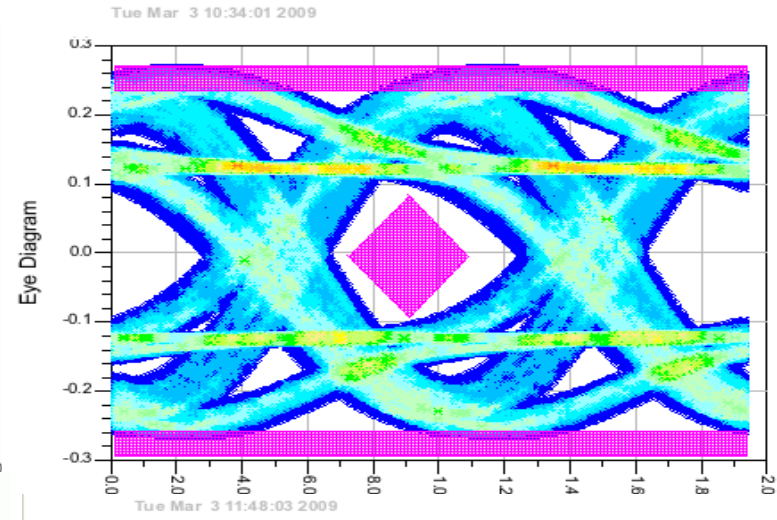
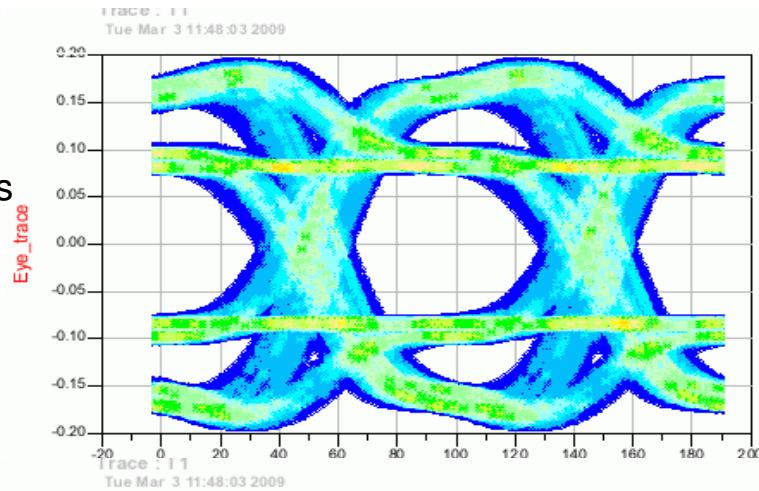


Near End and Far End Eyes

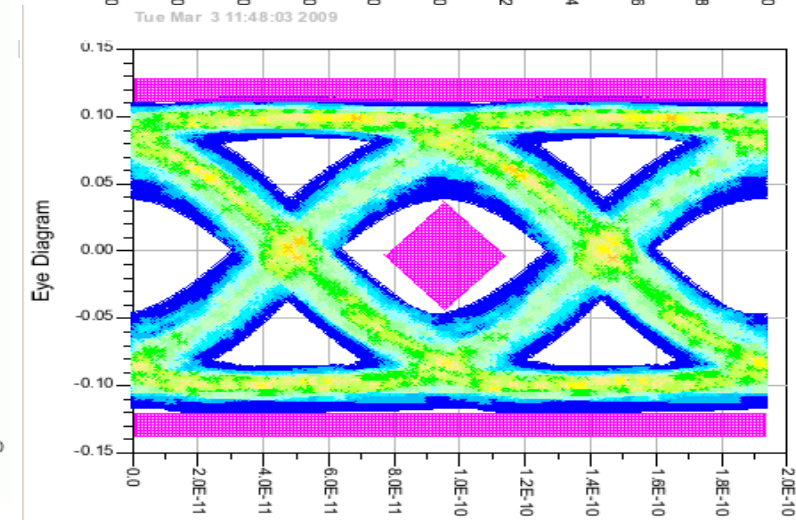
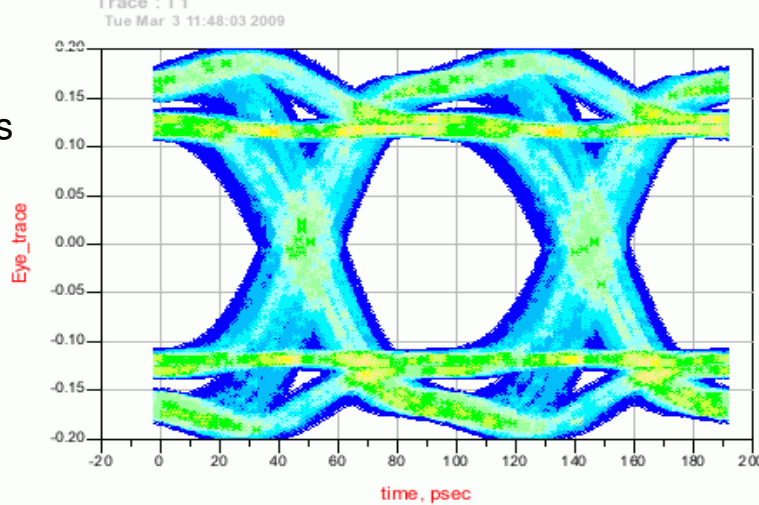
nAUI Near

nAUI Far

Case A
5.2 dB
Tr=24 ps

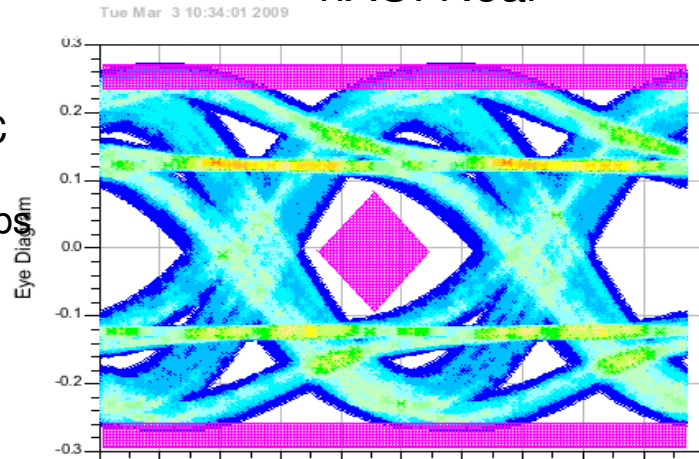


Case B
3.3 dB
Tr=24 ps

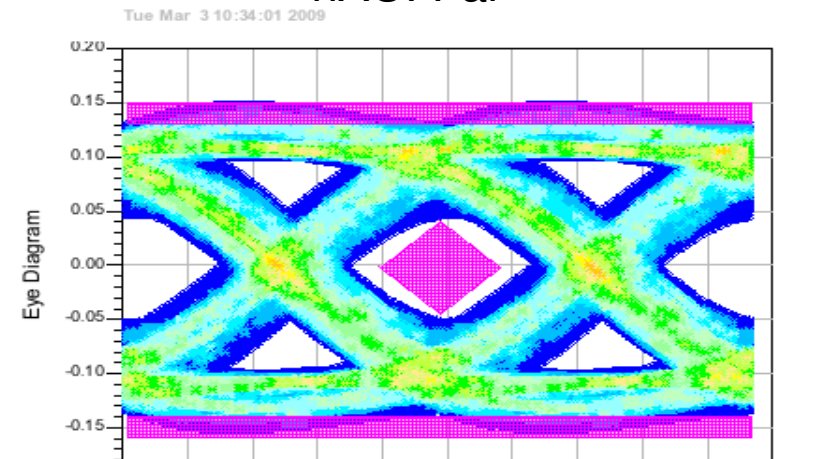


Near End and Far End Eyes

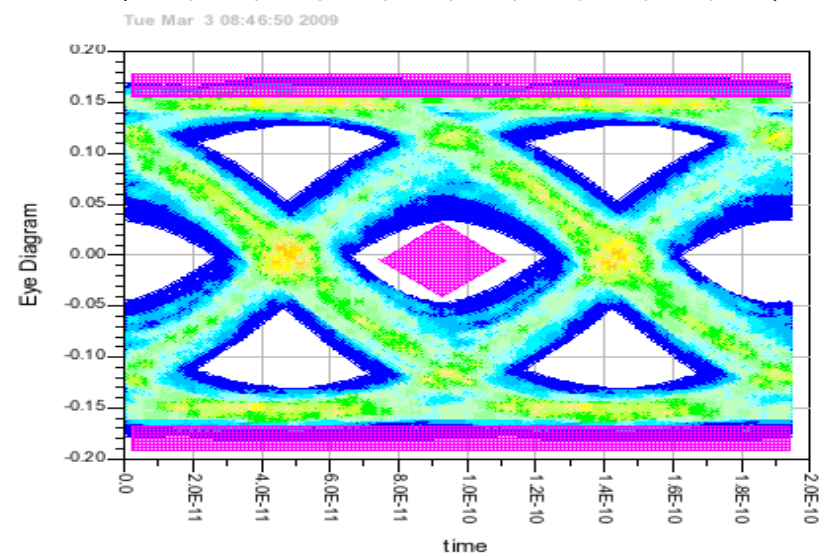
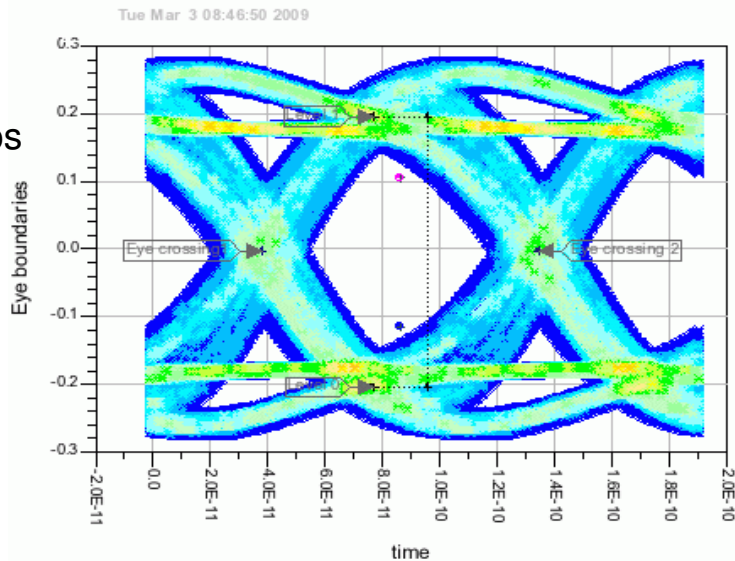
nAUI Near



nAUI Far



Case D
3.3 dB
Tr=44 ps



Summary

- **Proposed to define nAUI compliance at 1 dB loss at Nyquist instead of 0.7 dB due to availability of traces (SFP+ MCB cal trace) and for routing flexibility**
- **The de-emphasis, rise time, and Vtx-demph are shifted to the nAUI TX/RX compliance point.**
 - **The combination of package and 1 dB channel required about 1.5 dB de-emphasis and reduced the max de-emphasis from 4.8 dB to 3.2 dB.**
- **Module and Host return loss was adjusted based on channel with 4.2 dB loss at Nyquist instead of (2.1 dB module+0.5 dB connector+1 dB MCB loss=3.6 dB).**
- **Proposed de-emphasis, Tr/Tf, and Vtx-demph gurantee far end compliance.**
 - **CL83B still need to be verified current value are place holder.**