Refinement to XLAUI/CAUI Electrical Specifications

IEEE Quebec City

May 4, 2009

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Summary

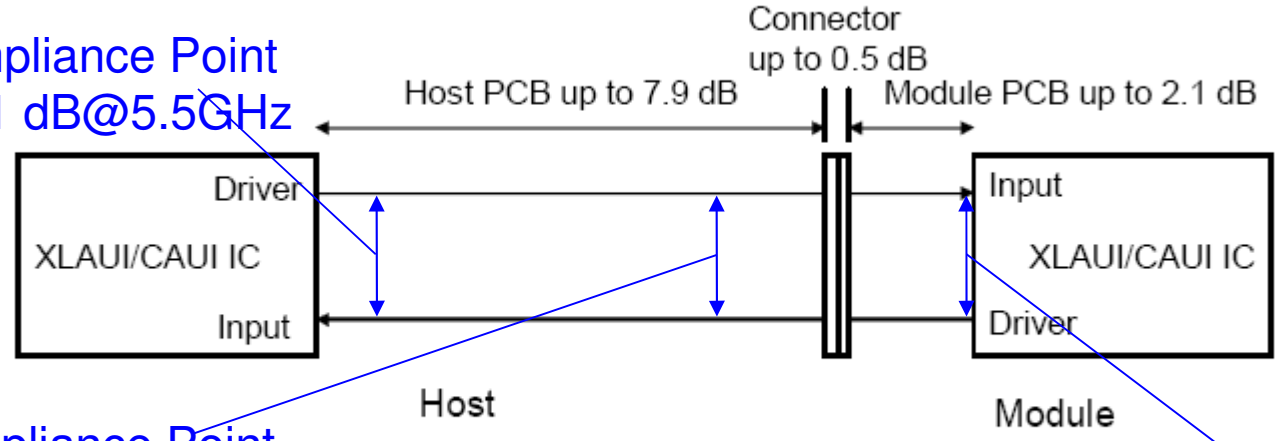
- **Update to nAUI channel SDD21**
- **Defining nAUI compliance point**
- **Updating module and host return loss based cascaded effect of connector and chip**
- **Shifting nAUI compliance from chip ball to 1 dB loss point**
- **Shifting nAUI compliance from the module by the MCB loss**
- **Verifying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

Addressing comments: 405, 407, 408, 409, 410, 411, 412, 419, 420

Where should MCB and HCB Measurement Point be?

- **Where should HCB reference point be?**
  - **Naturally it can be at the end of module PCB With 2.1 dB of loss**
- **Where should MCB reference point be?**
  - **At end of 7.9 dB channel**
    - **A short circuit at connector will have RL of 15.8 dB!**
  - **At minimum loss from the connector but physically implementable**
    - **Propose 1 dB at 5.5 GHz**

Chip Compliance Point
Propose 1 dB@5.5GHz



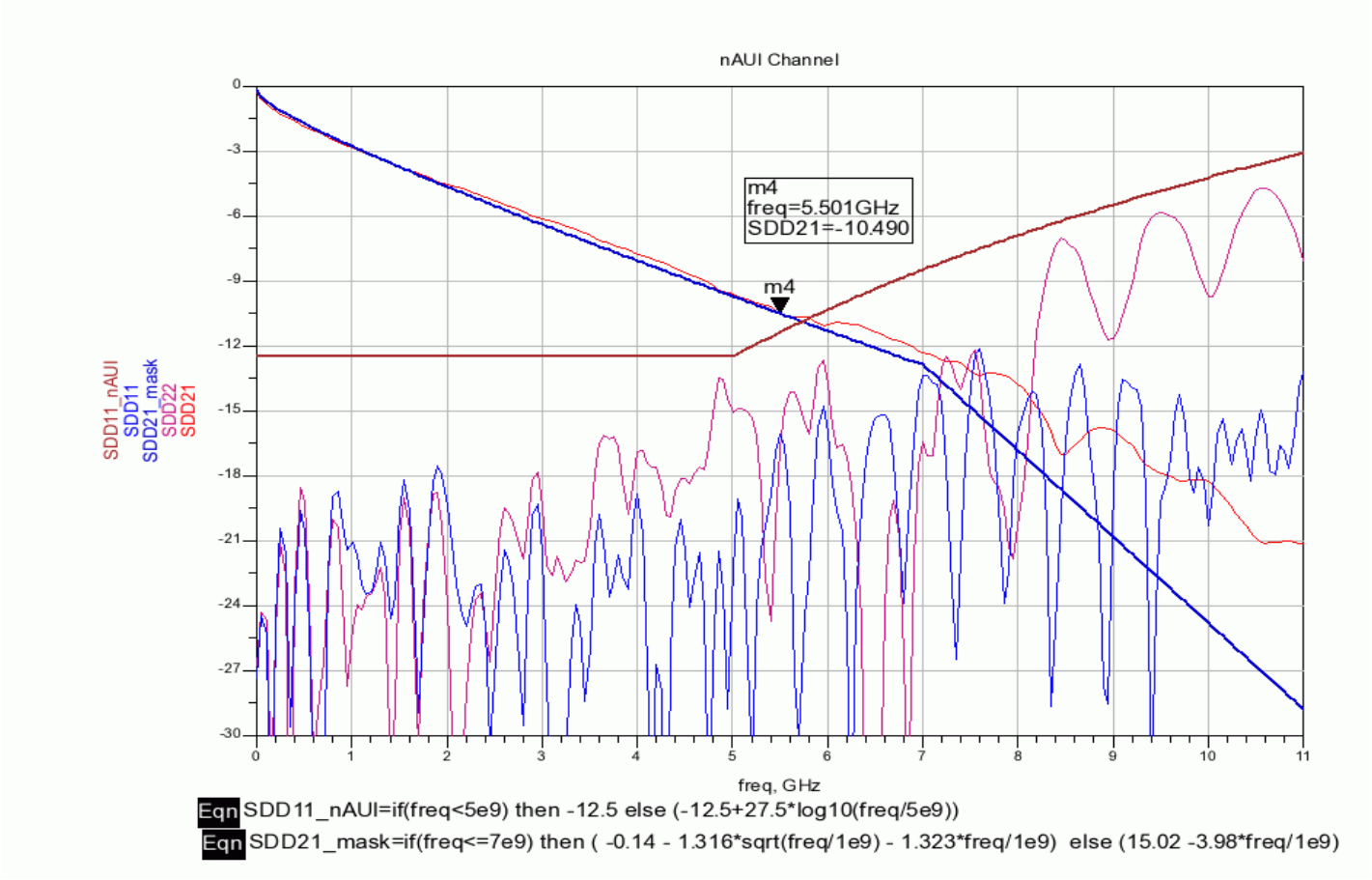
MCB Compliance Point
Propose 1dB@5.5 GHz

Figure 83B–1—Chip-module loss budget

HCB Compliance Point
Propose 2.1 dB@5.5GHz

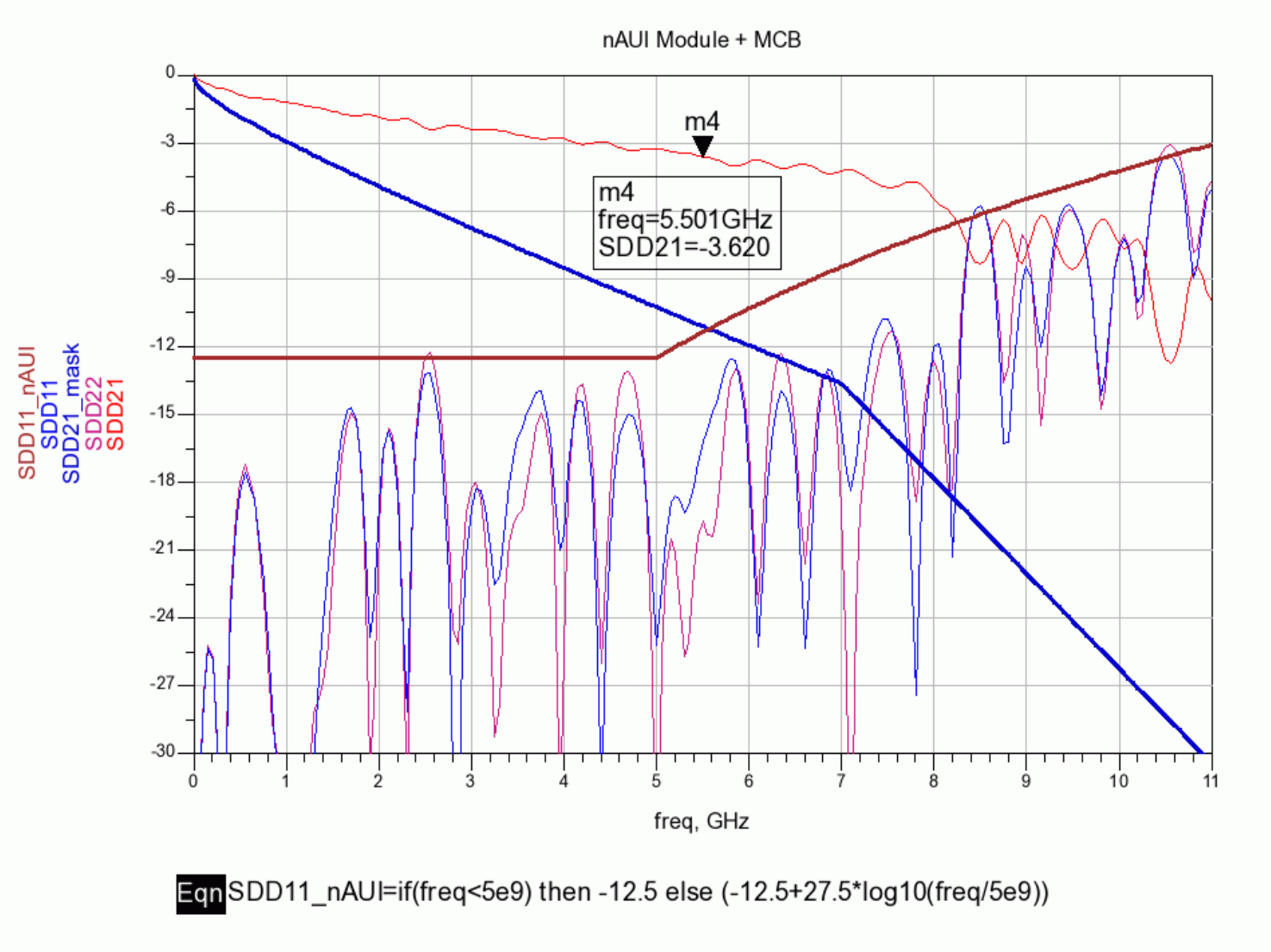
XLAUI/CAUI Channel with 10.5 dB Loss

- **This is an improved version over ghiasi_01_0708 which had some undesirable ripple and available from the http://www.ieee802.org/3/ba/public/channel.html**
  - **The 10.5 dB channel was created by cascading 2 dB loss PCB at Nyquist with the 8” Fr4-8 channel.**



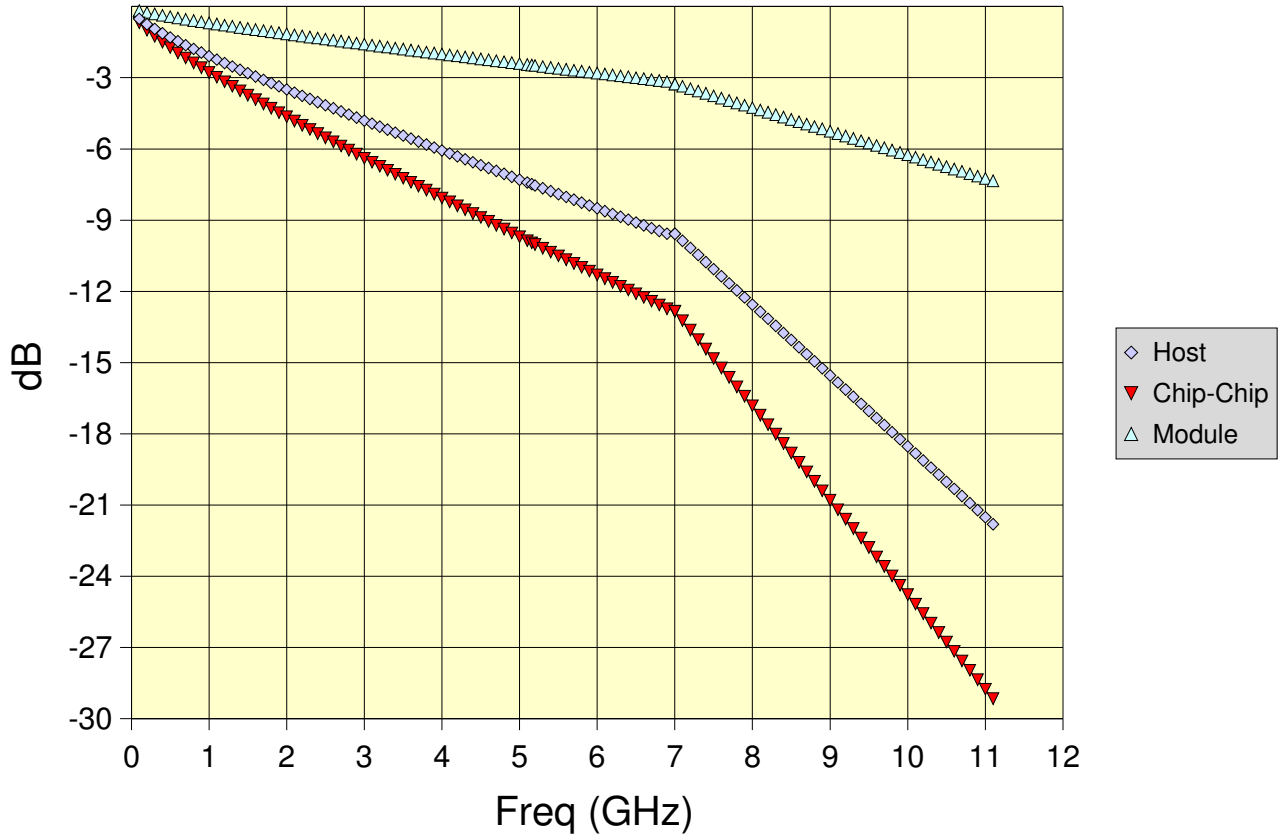
nAUI Module MCB with 3.6 dB Loss

- **S-parameters avilable from http://www.ieee802.org/3/ba/public/channel.html**



Bringing nAUI Channel Loss in Sync

- **Proposed SDD21 masks will make CL83A and CL83B in sync**

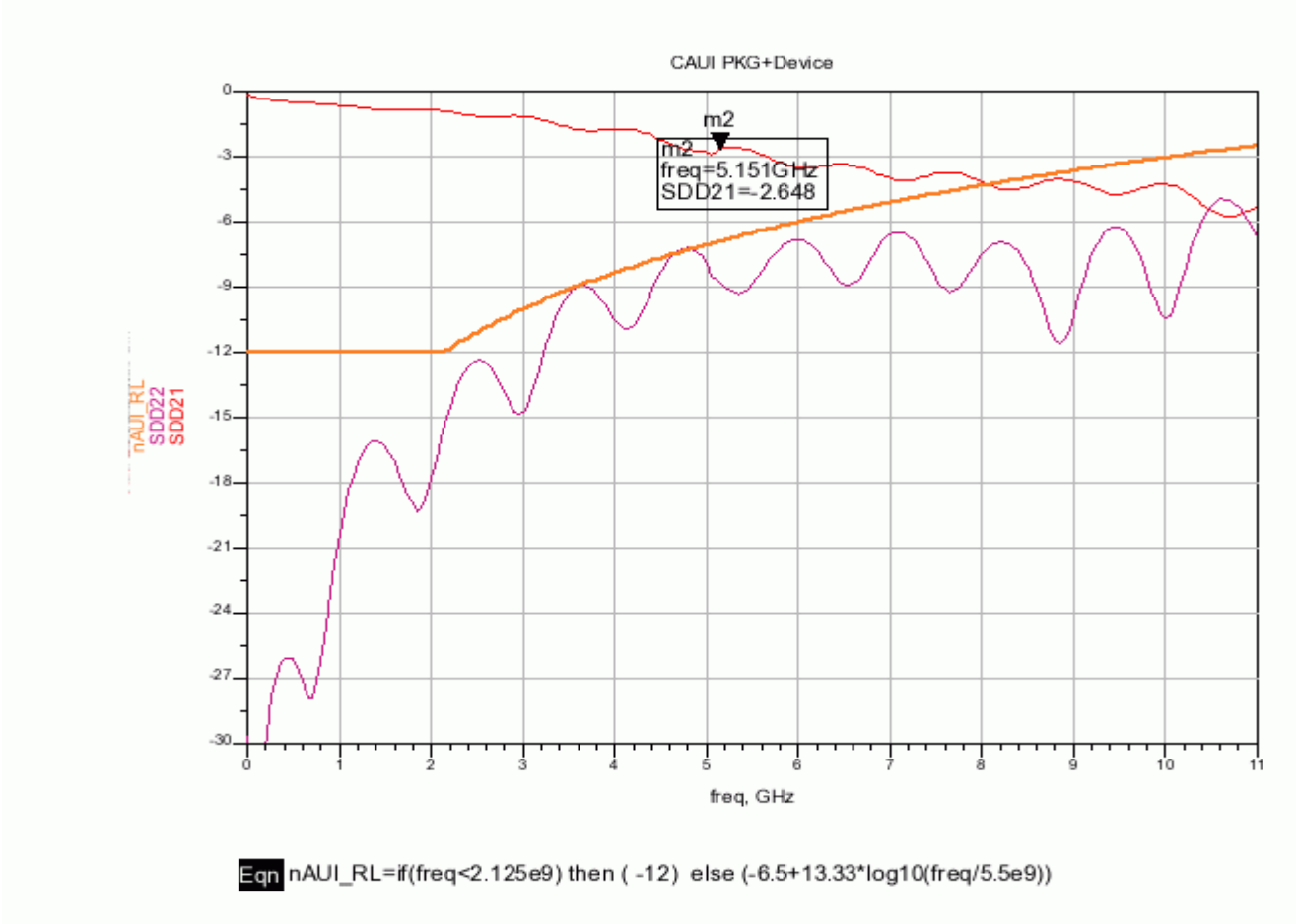


nAUI SDD21 Channel Loss cont.

- **Chip to chip loss SDD21=10.5 dB@5.5 GHz (already in D2.0)**
  - **SDD21(dB)= -0.140 – 1.32*sqrt(f) – 1.32*f from 0.25 to 7 GHz**
  - **SDD21(dB) = 15.02 -3.98 * f from 7 to 11.1 Ghz**
- **Chip to module channel SDD21=7.9 dB@5.5 GHz (detail missing)**
  - **SDD21(dB) = -0.11 – 0.99*Sqrt(f) – 1.00*f from 0.25 to 7 GHz**
  - **SDD21(dB) = 11.32 -2.99 * f from 7 to 11.1 Ghz**
- **Module PCB channel SDD21=2.1 dB@5.5 GHz (detail missing)**
  - **SDD21(dB) = -0.04 – 0.33*Sqrt(f) – 0.32*f from 0.25 to 7 GHz**
  - **SDD21(dB) = 3.72 - f from 7 to 11.1 Ghz**

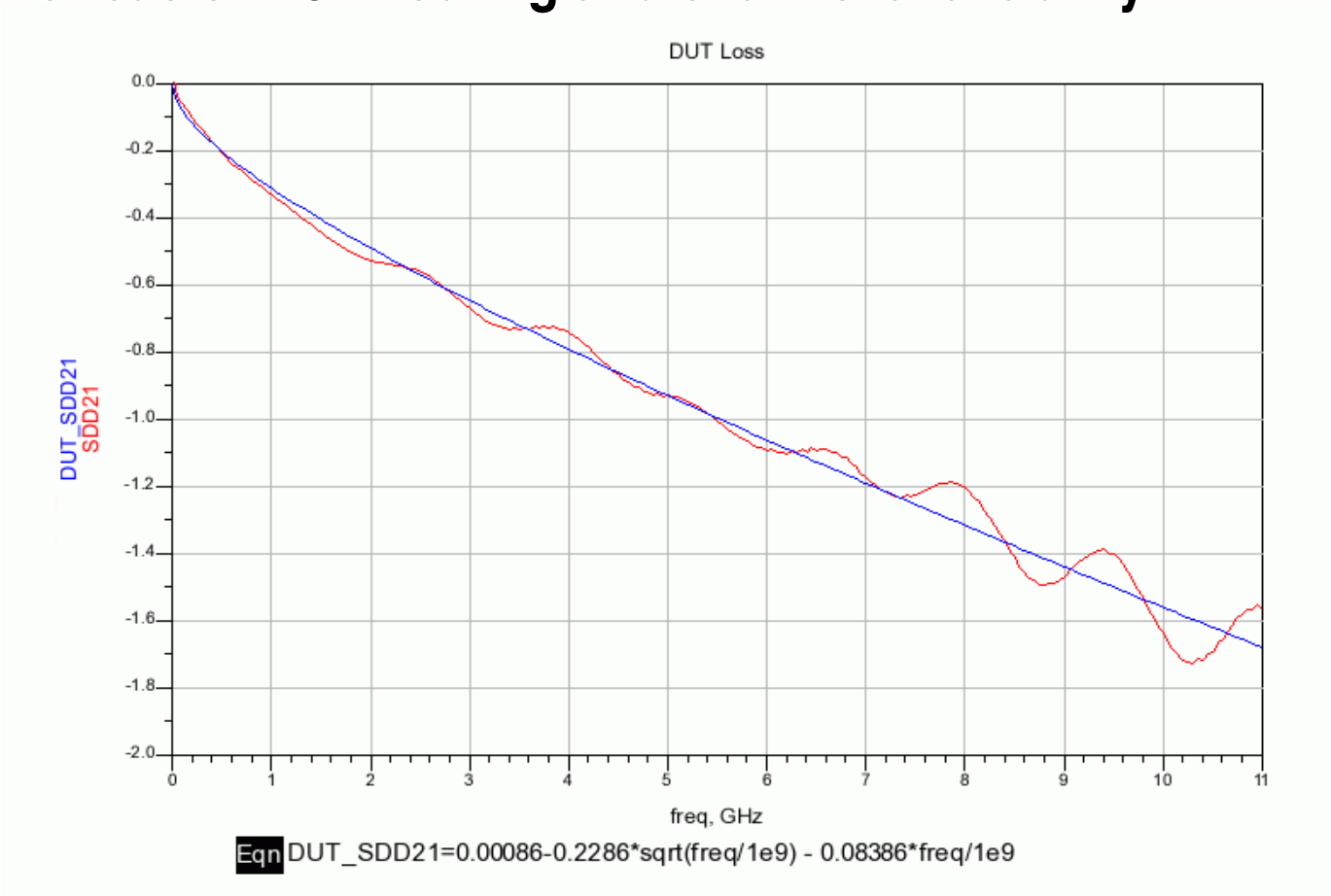
Creating nAUI Compliance Output

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



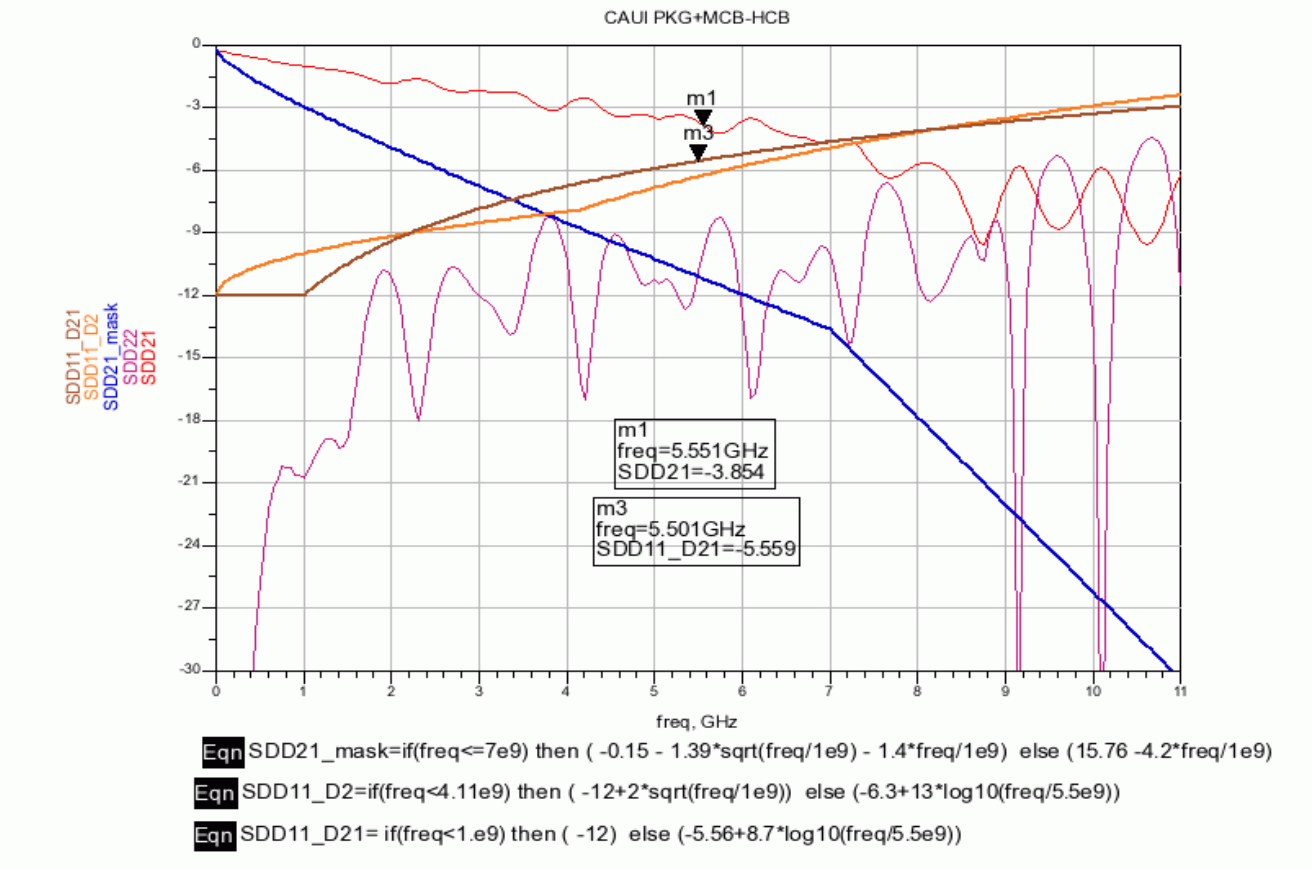
Loss from Chip Ball to Chip Compliance Point

- **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**



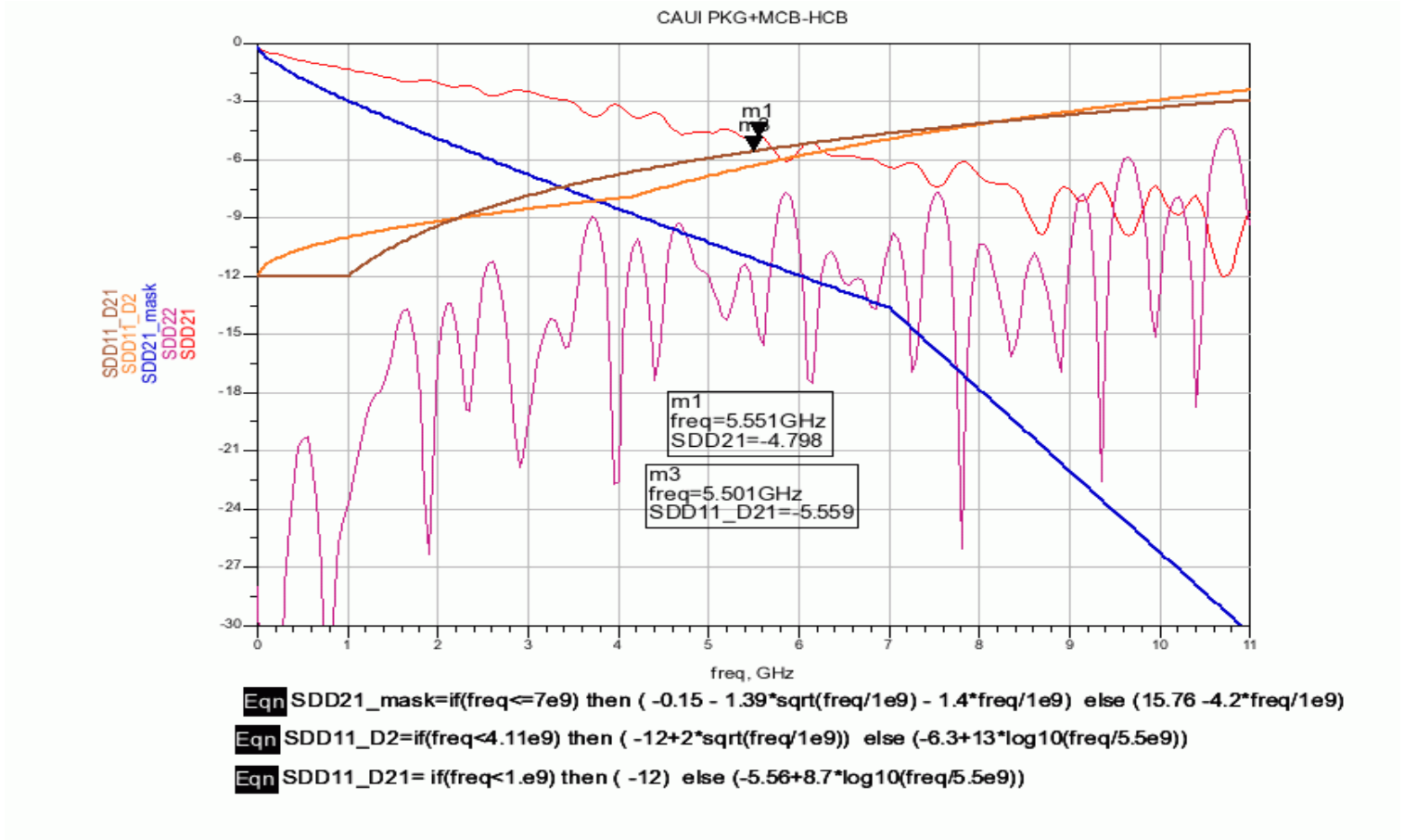
Module Return Loss

- **Current host & module limits from SFP+ limits are based on SerDes RL 2 dB better!**
  - **Current mask limit (SDD11_D2) almost touches the mask, propose limit is SDD11_D21**
    - **Assumes 0.5 dB PCB loss @5.5 Ghz and 1 dB for the MCB**



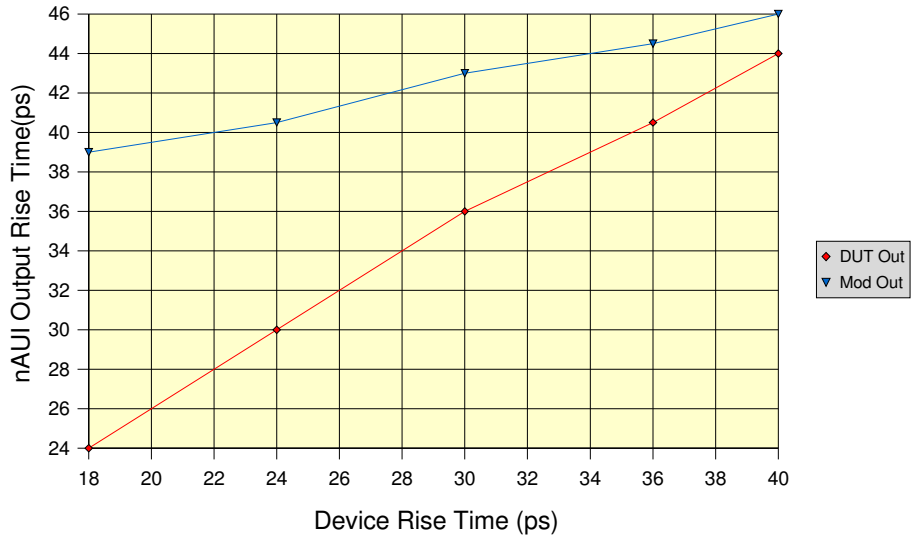
Host Return Loss

- **Current host & module limits from SFP+ limits are based on SerDes RL 2 dB better!**
  - **Current mask limit (SDD11_D2) not optimum for host mask, propose limit is SDD11_D21**
    - **Assumes min PCB loss of 0.5 dB@5.5 Ghz and 2 dB loss @5.5 Ghz for the HCB**



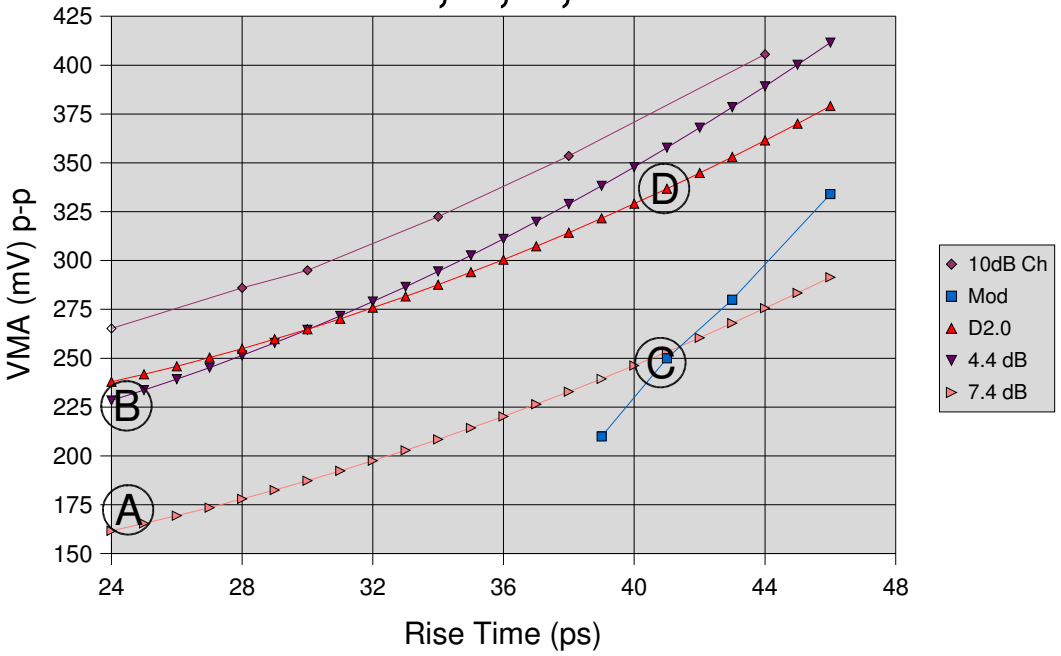
nAUI Compliance Output

- **Chip measured with 1 dB DUT board**
- **Module measured with 1 dB MCB board and assumed module PCB has 2.1 dB loss**
- **Impact of rise/fall time at nAUI compliance point illustrated below**
  - **Since the compliance measurement already has some PCB loss the minimum de-emphasis amount will be lower.**



Translating Device Setting to nAUI Device DUT Output

- **Vtx-demph was adjusted to give same far end eye opening for 10 dB channel then the output measured with 1 dB DUT board**
  - **Vtx-demph=(234.64 -2.13*x +0.18*x^2)*1.32*(10^y/20)**
    - **The de-emphasis range y is from 4.4 dB to 7.4 dB calibrated at DUT output**
      - The device de-emphasis was 7.5 dB
- **Next investigate 4 corner cases A, B, C, and D for far end compliance**

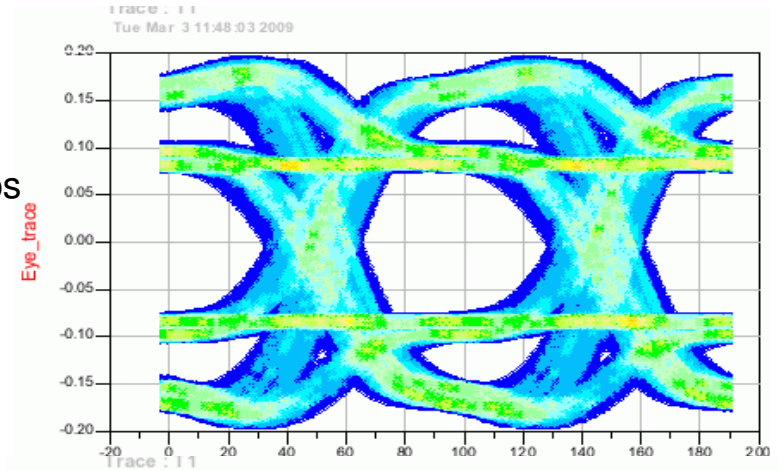


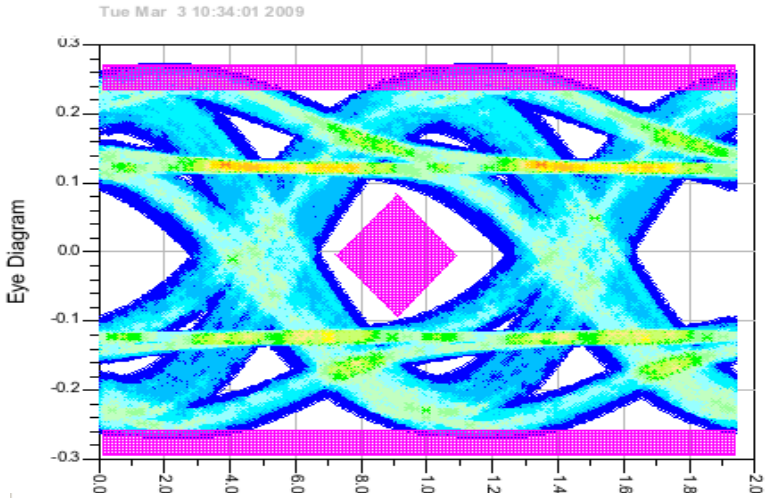
Near End and Far End Eyes

nAUI Near

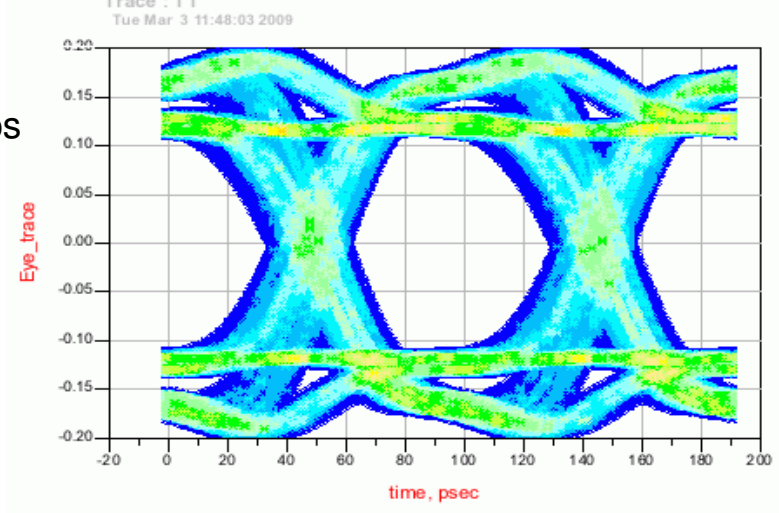
nAUI Far

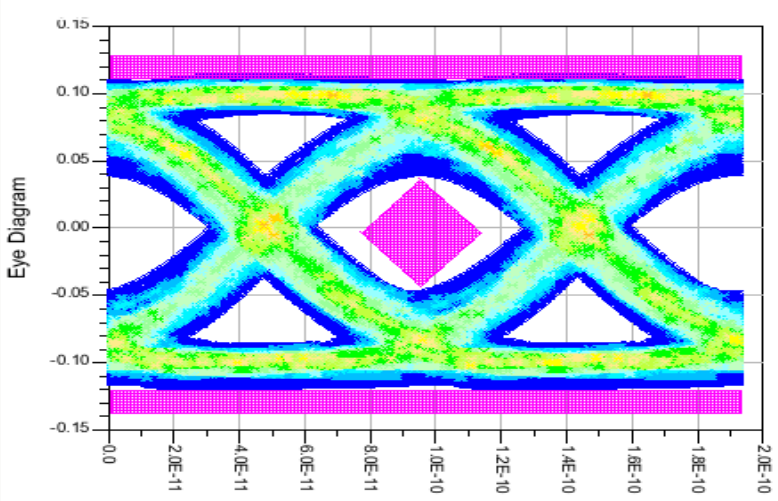
Case A
5.2 dB
Tr=24 ps





Case B
3.3 dB
Tr=24 ps



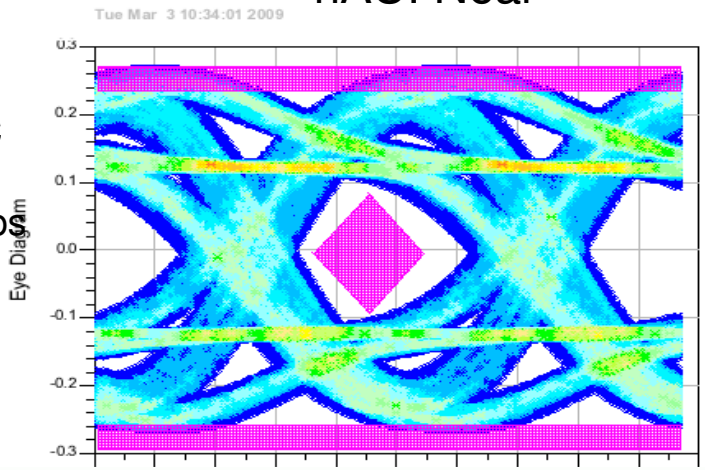


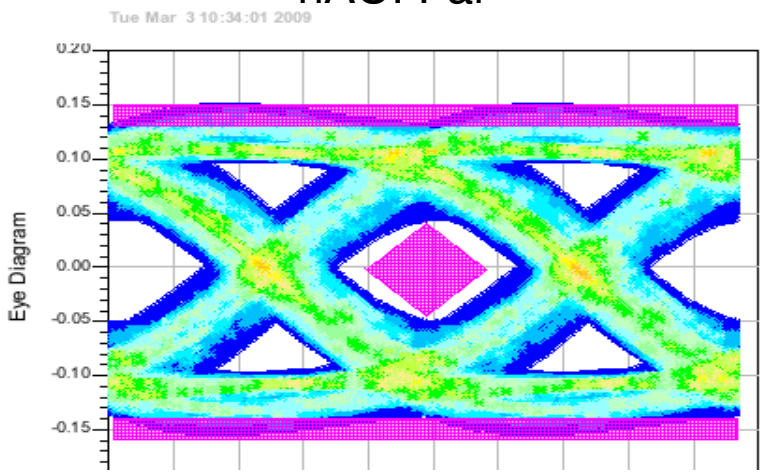
Near End and Far End Eyes

nAUI Near

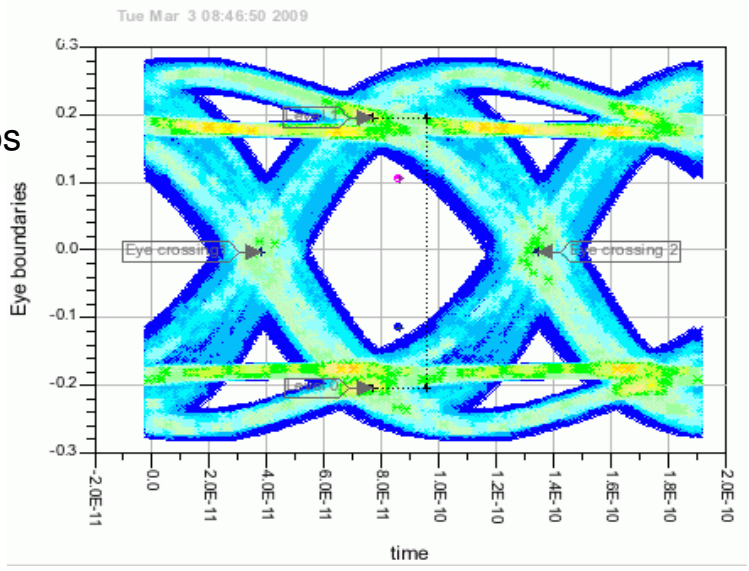
nAUI Far

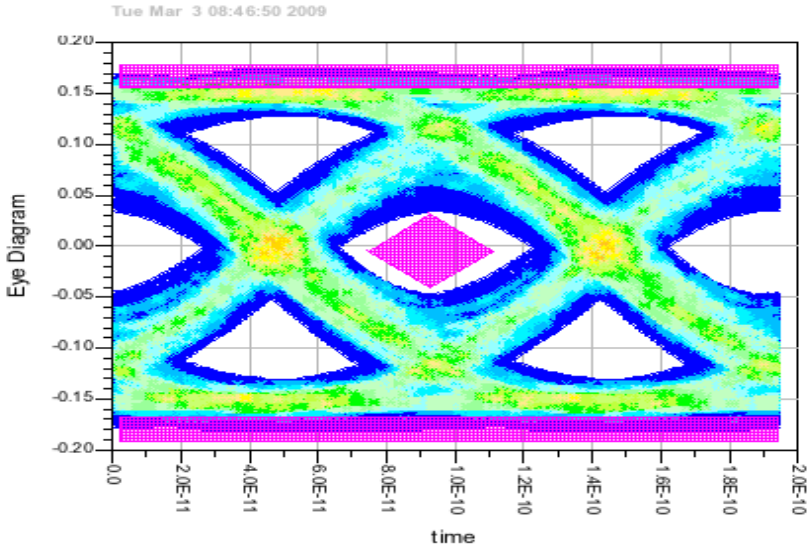
Case C
5.2 dB
Tr=44 ps





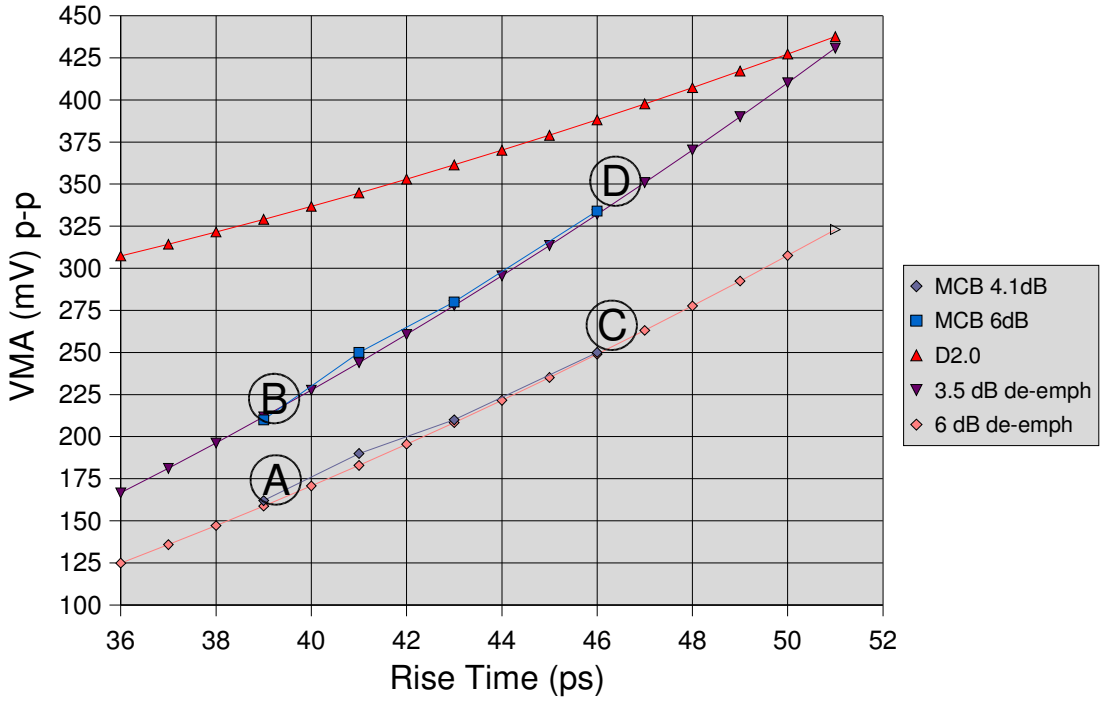
Case D
3.3 dB
Tr=44 ps





Translating Device Setting to nAUI Module MCB Output

- **Vtx-demph was adjusted to give same far end eye opening for 10 dB channel then the output measured with MCB**
  - **Vtx-demph=(-110 -2.13*x +0.32*x^2)*(10^y/20)**
    - **The de-emphasis range y varies from 3.5 dB to 6 dB calibrated at MCB output**
      - The device de-emphasis was 7.5 dB
- **Next investigate 4 corner cases A, B, C, and D for far end compliance**

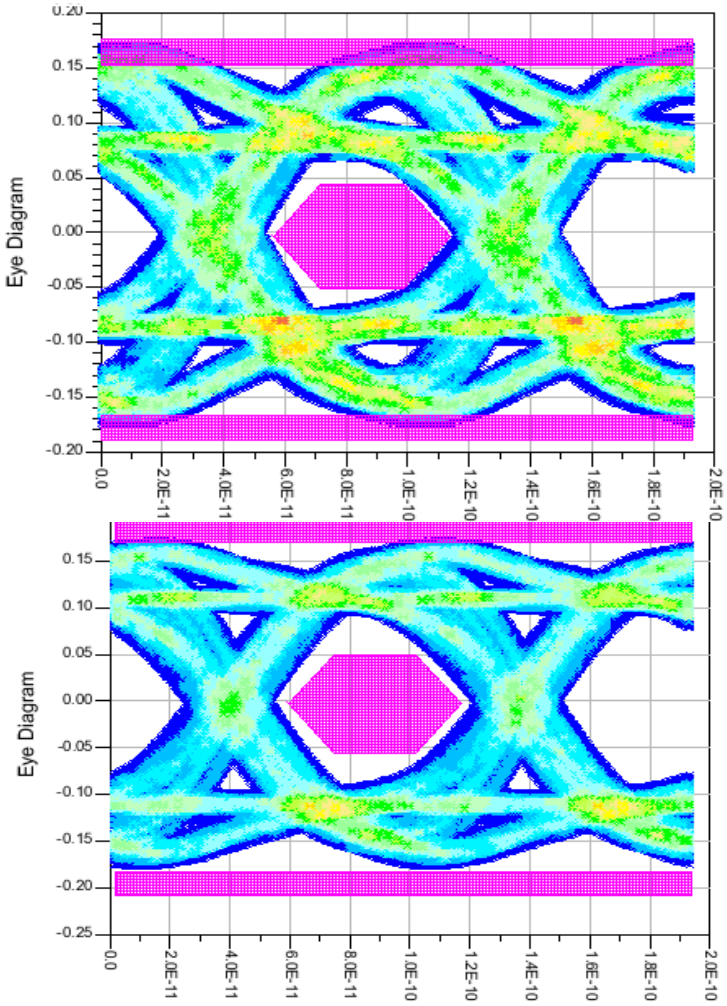


Near End and Far End Eyes

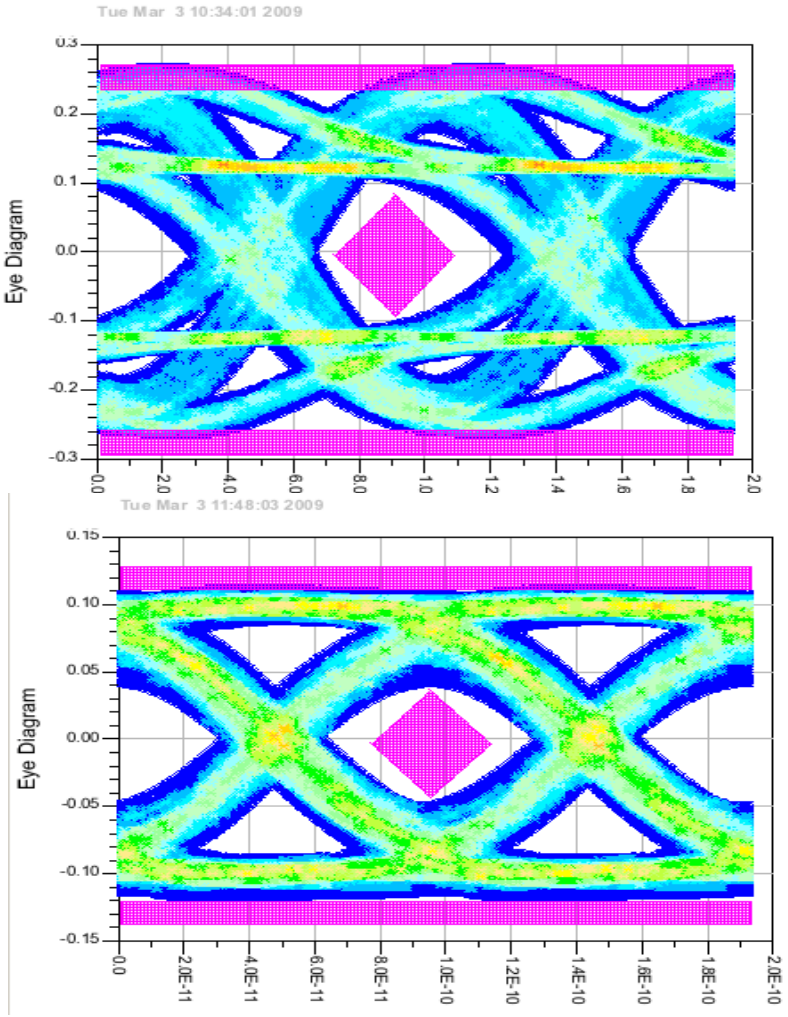
Case A
6 dB
Tr=39 ps

Case B
3.5 dB
Tr=39 ps

nAUI Near



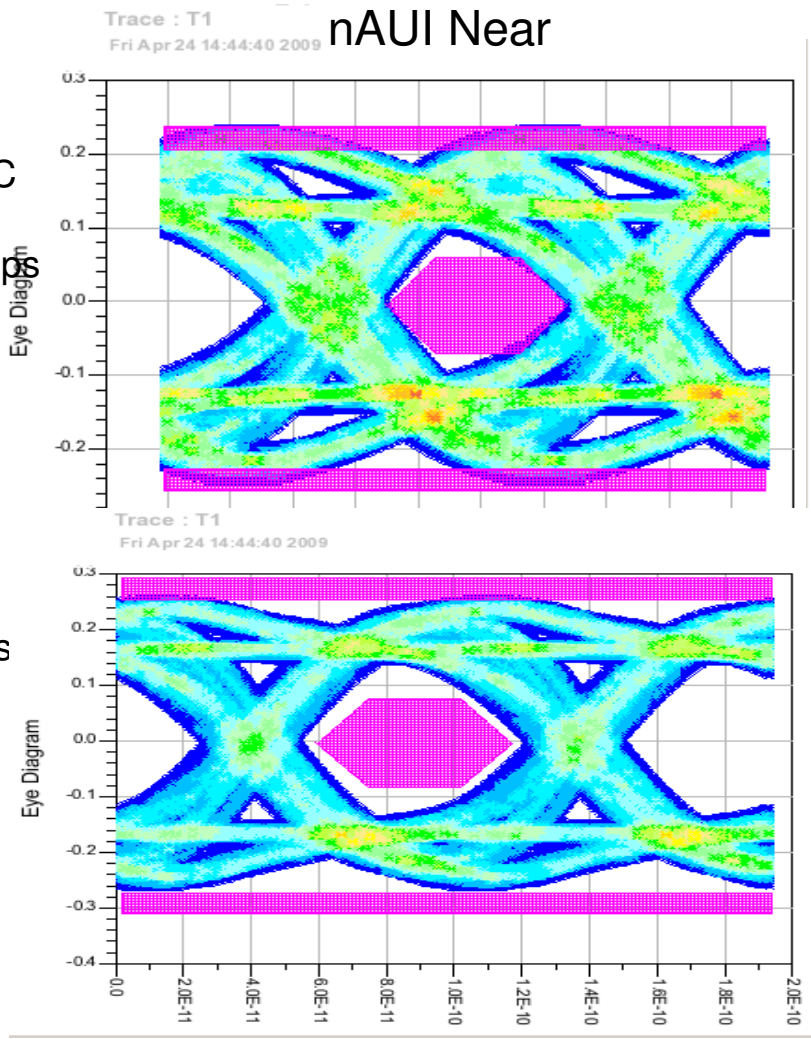
nAUI Far



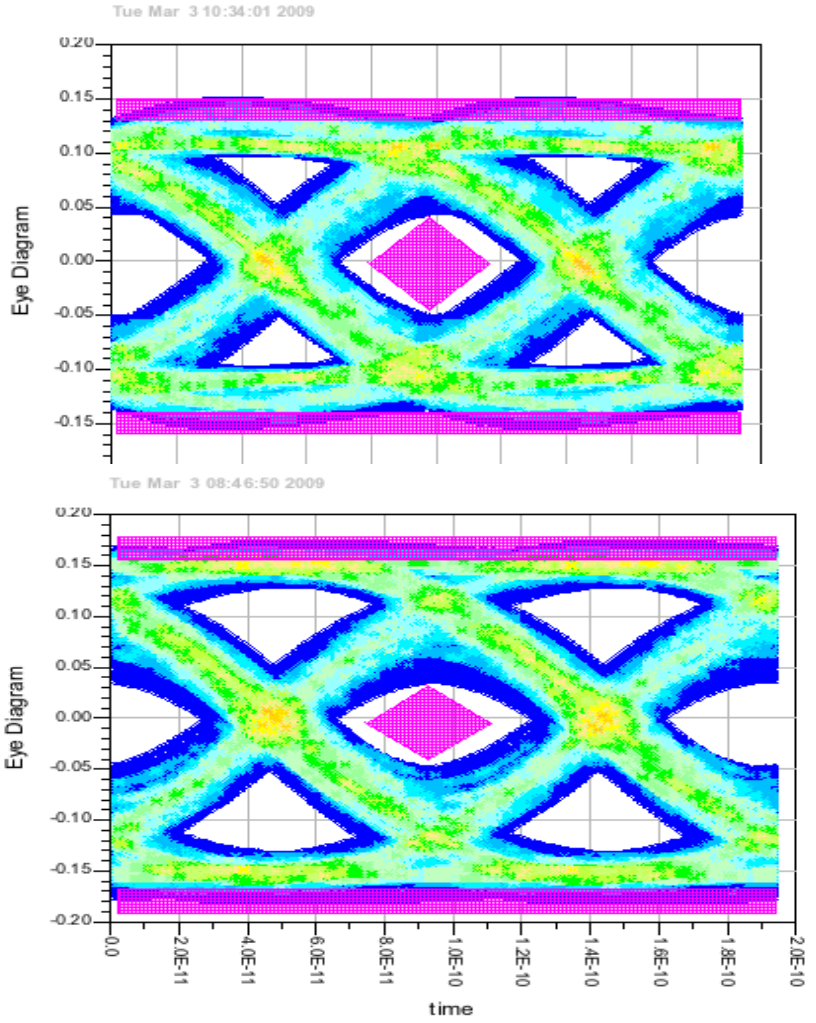
Near End and Far End Eyes

Case C
3.5 dB
Tr=46 ps

nAUI Near



nAUI Far

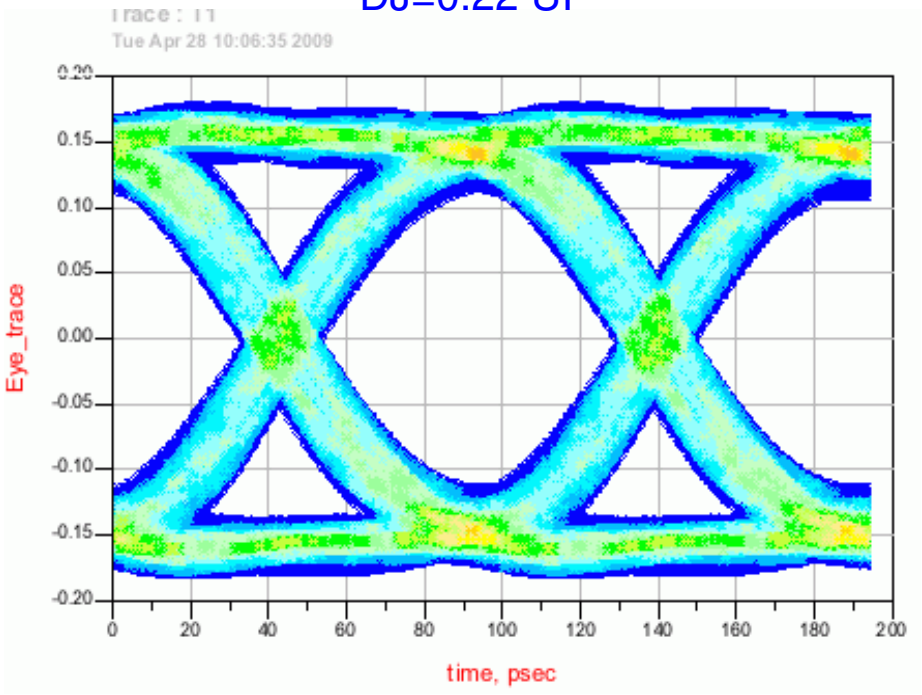


Case D
6 dB
Tr=46 ps

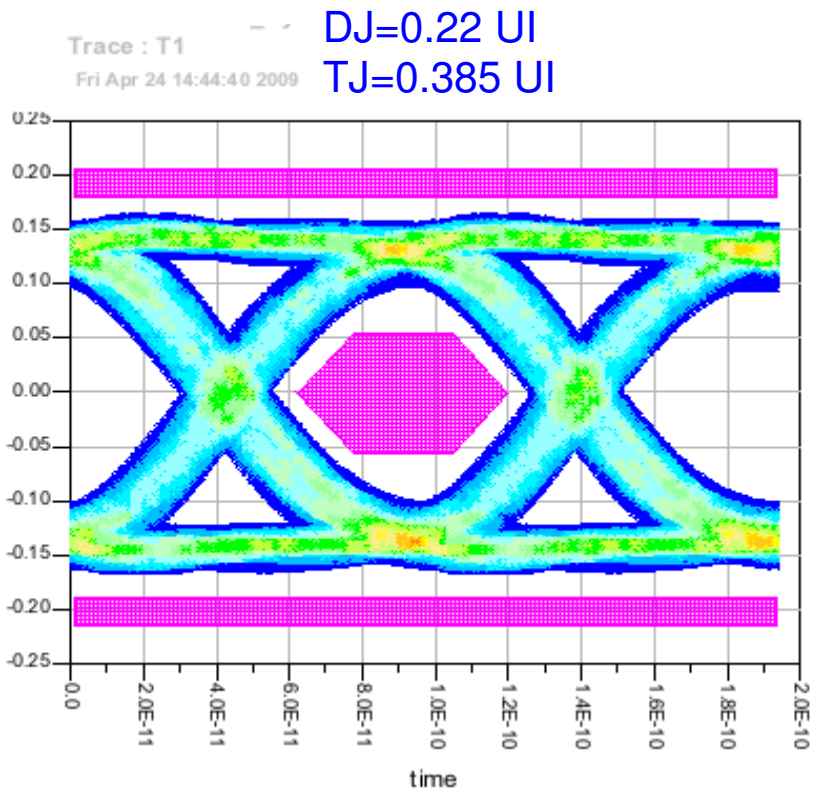
Verifying Module MCB Jitter Output

- **The current DJ and TJ values are in line with worst case MCB output**

DJ=0.22 UI



DJ=0.22 UI
TJ=0.385 UI



Summary

- Proposed to define nAUI compliance at 1 dB loss at Nyquist to allow practical PCB test board and breakout
- The de-emphasis, rise time, and Vtx-demph are shifted to the nAUI TX/RX compliance point.
  - Chip-Chip compliance point was move to 1 dB@5.5 Ghz
  - Module compliance point was moved to 3.6 dB@5.5 Ghz
  - The de-emphasis and rise/fall time were then adjusted based on the chip or module observable compliance point
- Module return loss adjusted assuming min channel and MCB loss
- Host return loss was adjusted based on HCB loss and with channel
- Proposed de-emphasis, Tr/Tf, and Vtx-demph guarantee far end compliance for CL83A and CL83B.