Refinement to XLAUI/CAUI Electrical Specifications

IEEE P802.3ba
New Orleans

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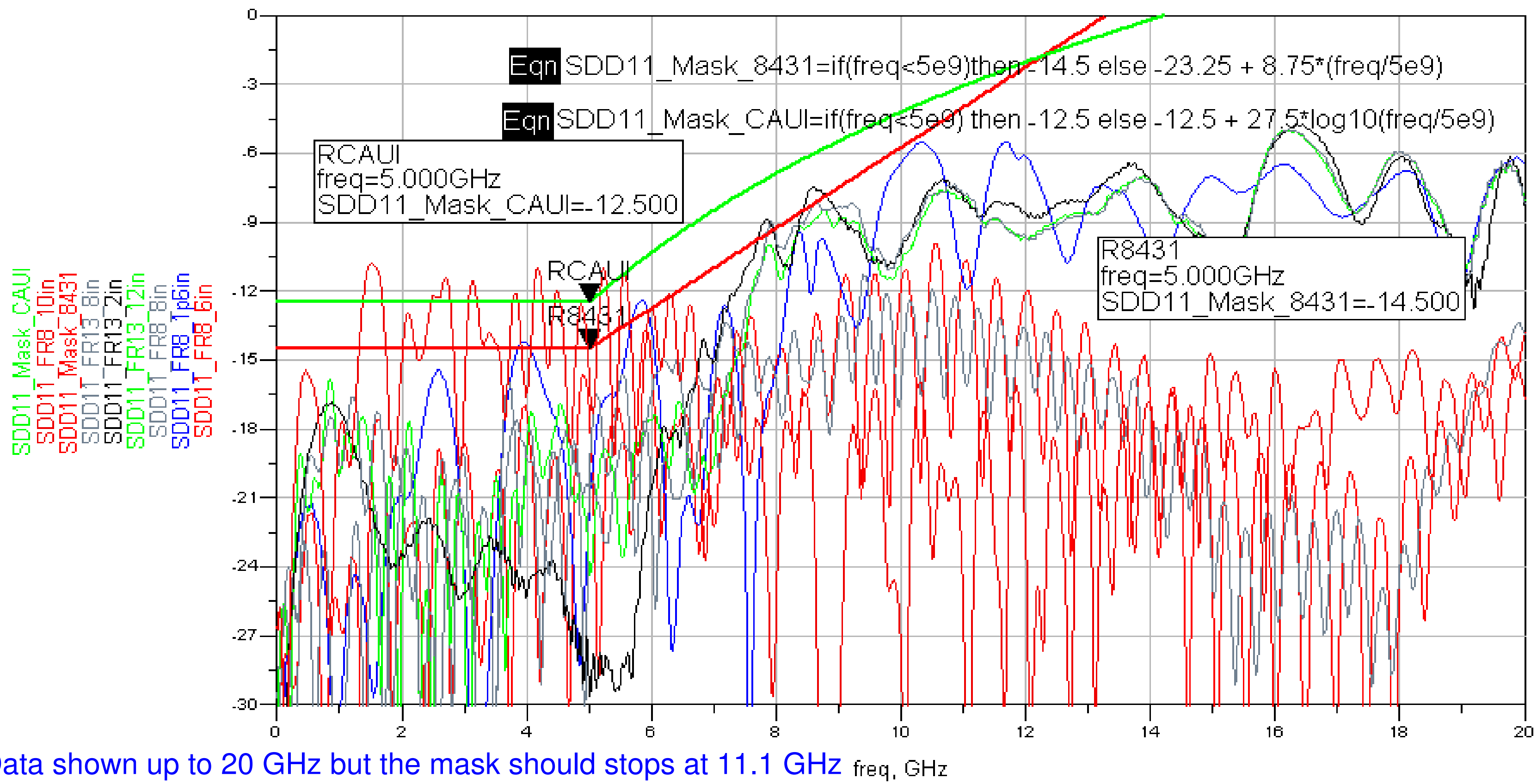
Summary

- **Addressing xAUI channel SDD21/SDD11**
- **How to define transmit de-emphasis**
- **How to guarantee near end mask will guarantee far end compliance over worst case xAUI channel**
- **Improvement in jitter methodology**
- **Method of meeting BER 1E-15 without increasing the test time**

XLAUI/CAUI Channel SDD11(Informative)

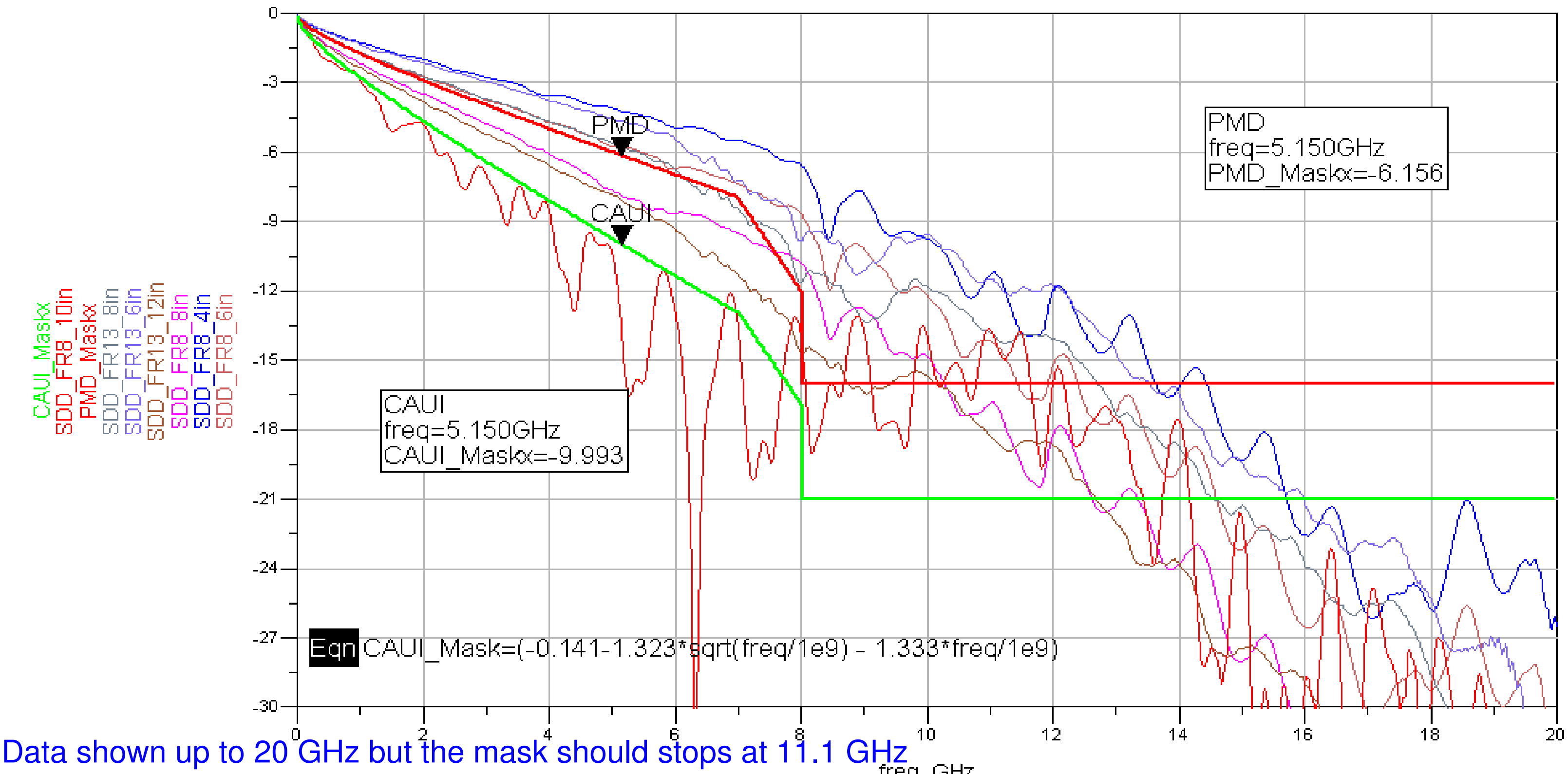
- **As shown in ghiasi_01_0708 include xAUI mask below per comment 49 and 61**
  - **The cascaded channel with 10+ dB loss at Nyquist its SDD11 is degrades about 3 dB.**



Data shown up to 20 GHz but the mask should stops at 11.1 GHz

XLAUI/CAUI Channel SDD21 (Informative)

- **As shown in ghiasi_01_0708 include xAUI mask below per comment 48**
  - **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.**

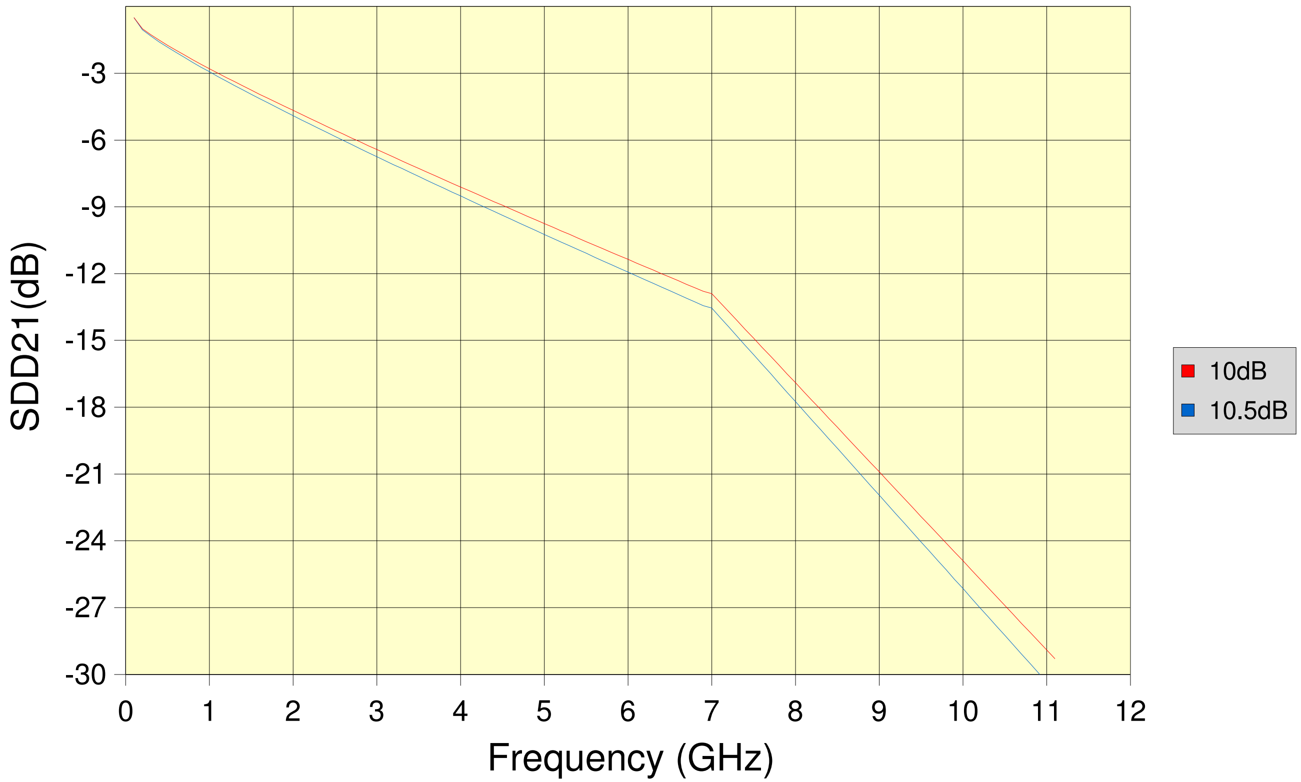


Data shown up to 20 GHz but the mask should stops at 11.1 GHz

Eqn CAUI_Maskx=if(freq<7e9) then (-0.141-1.323*sqrt(freq/1e9) - 1.33*freq/1e9) elseif (freq<=8e9) then 15.1-4.*freq/1e9 else -21 endif

Updated nAUI SDD21 Loss

- **Loss increased to 10.5 dB from 10 dB**
  - **SDD21(10.5 dB) = -0.15 – 1.39Sqrt(f) – 1.4*f from 0.25 to 7 GHz**
  - **SDD21(10.5 dB) = 15.86 -4.2 * f from 7 to 11.1 GHz**

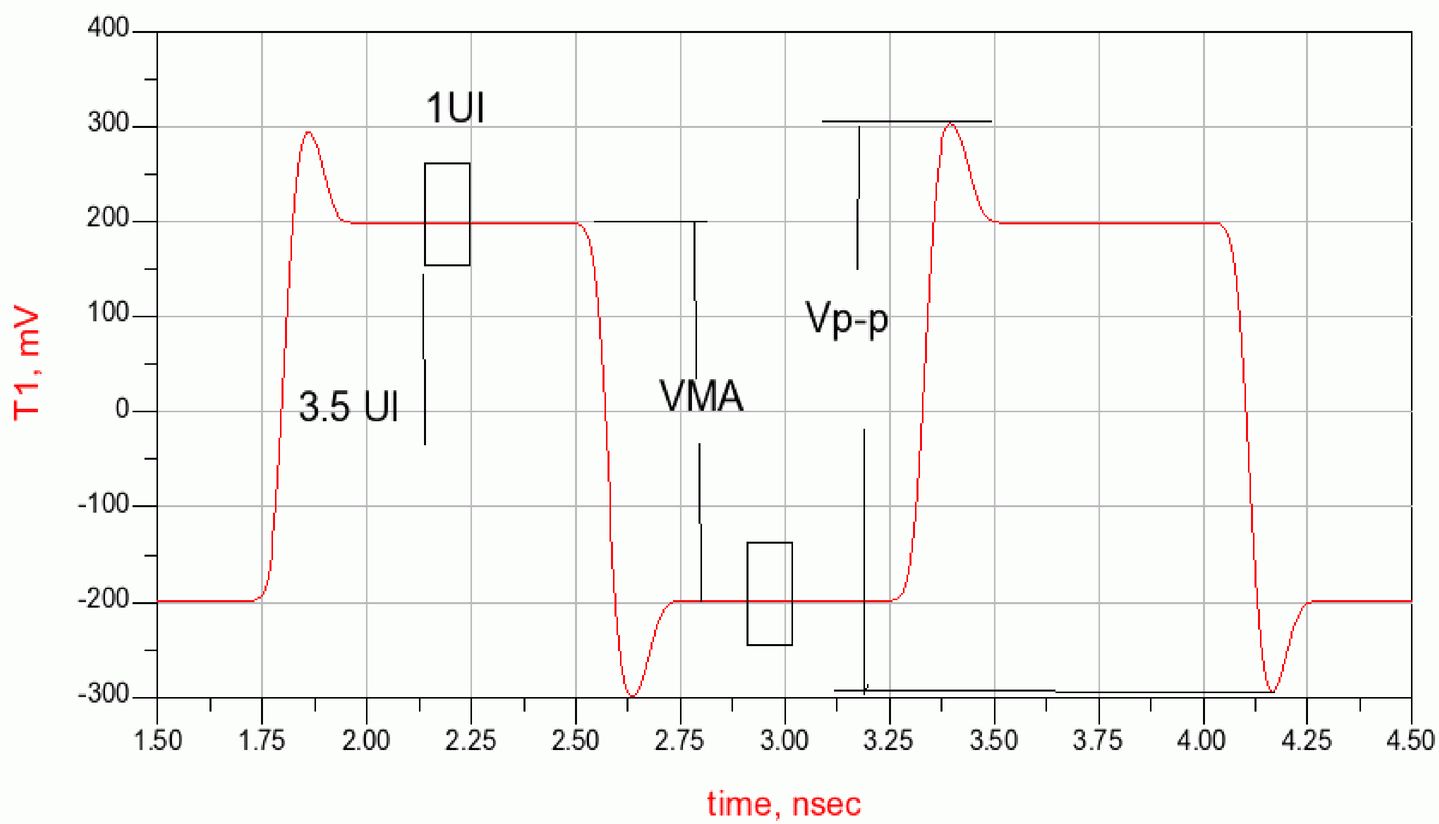


Simplified Approach to Test xAUI Transmitter (comment 50, 53, 54)

- **Define the following parameters**
  - **Transmit max output=760 mV p-p (already defined)**
  - **Min VMA = as function of rise and fall time**
  - **Min de-emphasis = 4.7 dB**
  - **Min Tr/Tf 20-80% = 24 ps (already defined)**
  - **Max Tr/Tf 20-80%= limited by the de-emphasis and max transmitter**
  - **At this point define transmitter jitter with de-emphasis off and continue to investigate better method.**

De-emphasis Definition and Measurement

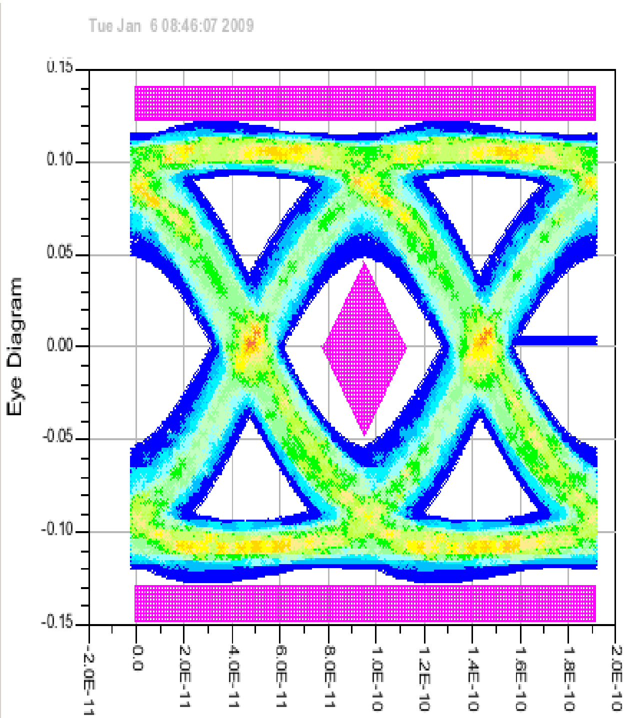
- Vp-p is the peak amplitude
- VMA is the peak to peak voltage when measured with 8 ones and 8 zero pattern over histogram window defined below. Use of PRBS9 is an acceptable alternative
- De-emphasis dB=20log10(Vp-p/VMA)



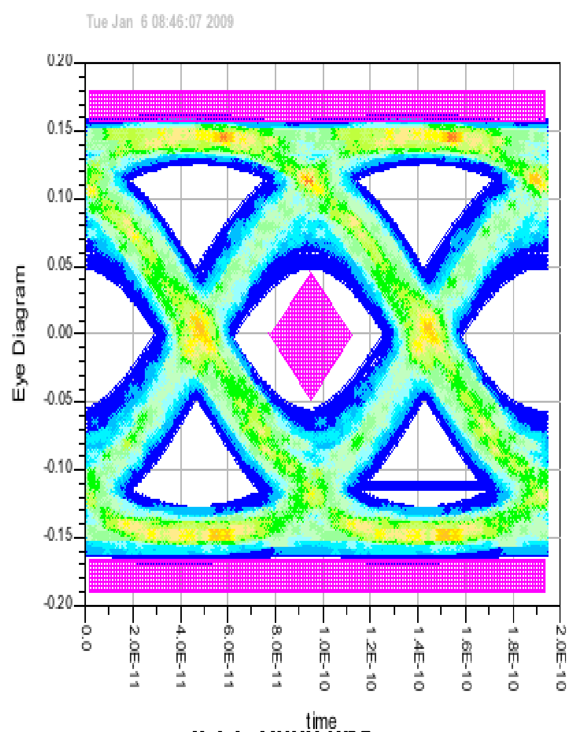
The Impact of Rise Time on Far End Compliance with 8+dB Channel

- **The 8+dB channel response is little better than xAUI channels**
  - **Include worst case xtalk from min loss channel.**

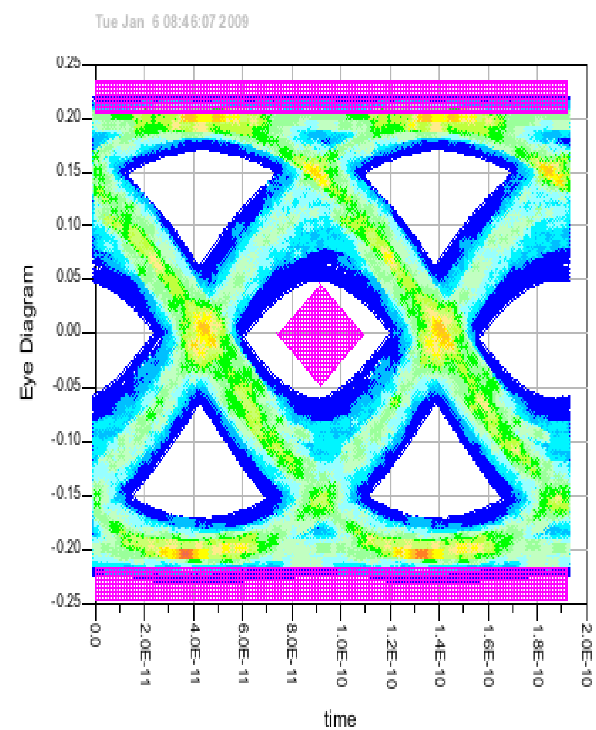
TX Ampl = 400 mV p-p
Tr=24 ps
de-emphasis=3.9 dB



TX Ampl = 550 mV p-p
Tr=40 ps
de-emphasis=3.9 dB



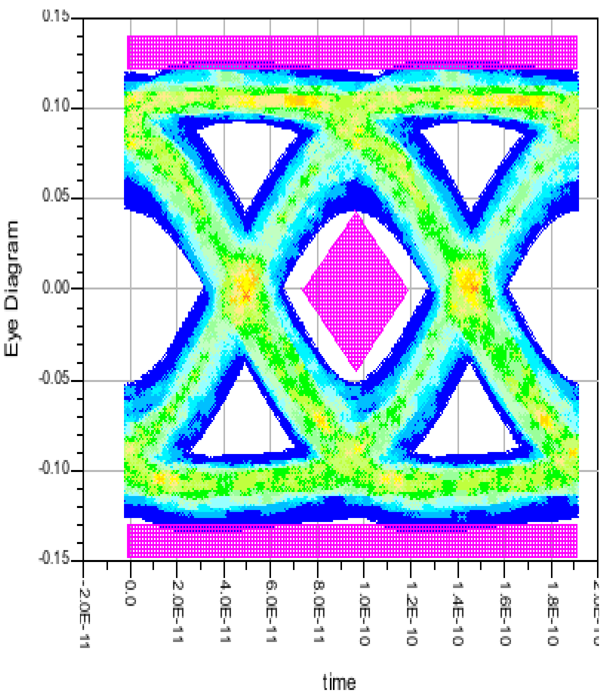
TX Ampl = 780 mV p-p
Tr=50 ps
de-emphasis=3.9 dB



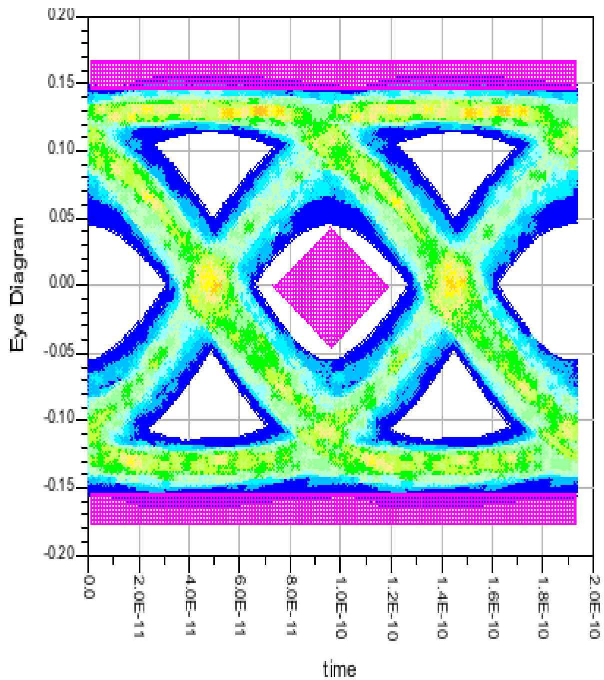
The Impact of Rise Time on Far End Compliance with 10+dB Channel

- **The 10+ dB loss channel has worse response than xAUI channels**
  - **Include worst case xtalk from min loss channel.**

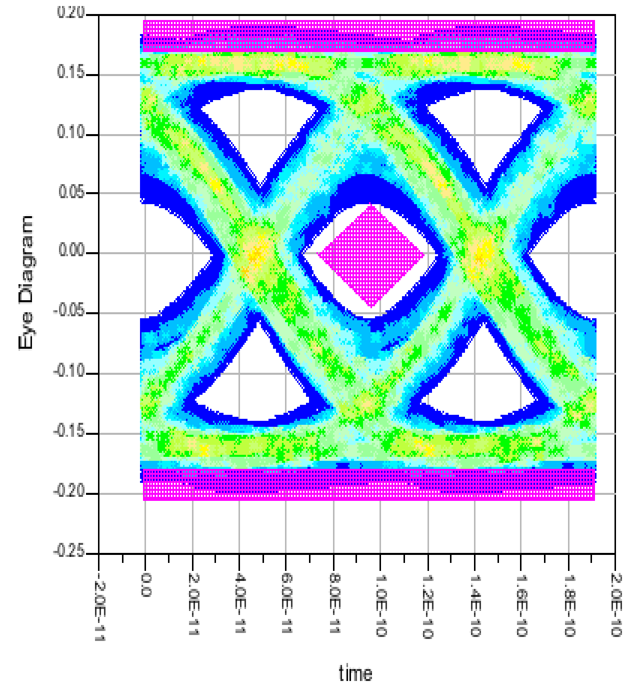
TX Ampl = 500 mV p-p
Tr=24 ps
de-emphasis=5.5 dB



TX Ampl = 620 mV p-p
Tr=34 ps
de-emphasis=5.5 dB



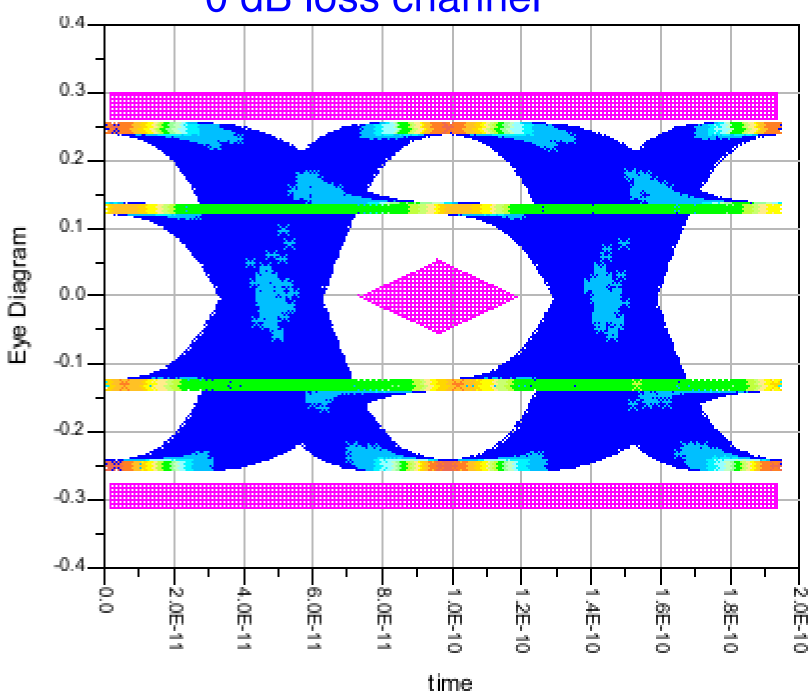
TX Ampl = 780 mV p-p
Tr=44 ps
de-emphasis=5.5 dB



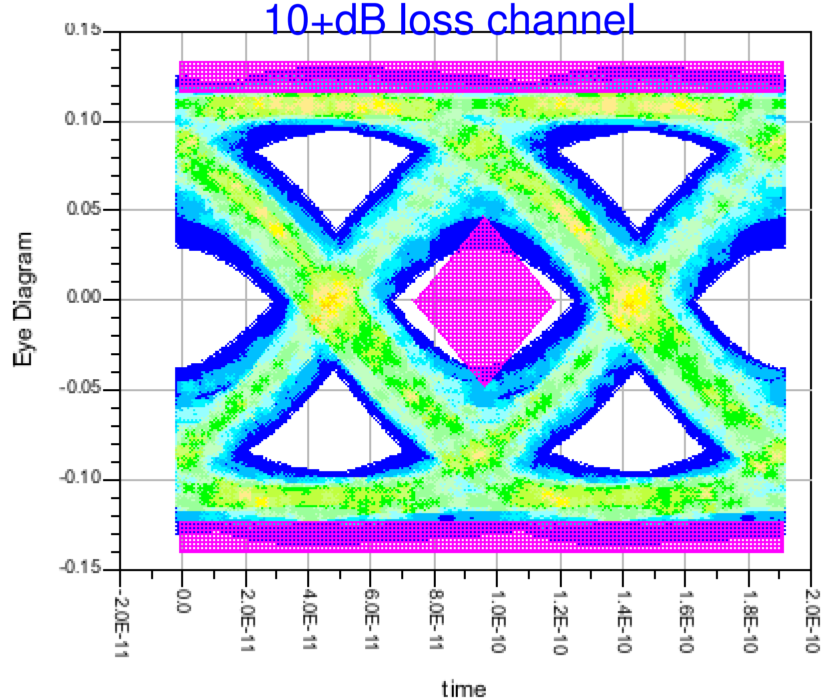
More xAUI Eye Diagrams

- **The combination of slow transmitter and low driver output fails the far end mask!**

TX Ampl = 500 mV p-p
Tr=24 ps
de-emphasis=5.5 dB
0 dB loss channel

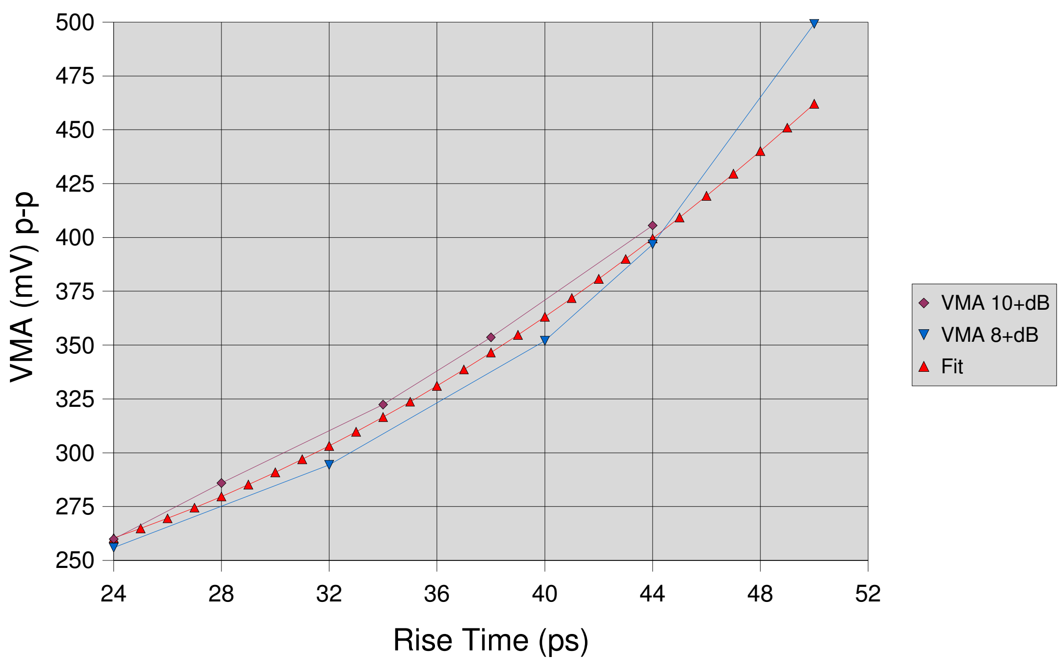


TX Ampl = 500 mV p-p
Tr=44 ps
de-emphasis=5.5 dB
10+dB loss channel



Proposed min VMA as Function of Transmitter Rise Time (comment 53)

- **The combination of slow transmitter with weak drive could result in failing the far end mask!**
- **TX VMA=(234.64 – 2.13*x + 0.13*x^2)*1.6(10^(-de-emp/20), x is max (tr,tf) 20-80%**
  - 10dB+ channel de-emph=5.5 dB (more stressful channel)
  - 8dB+ channel de-emph=3.9 dB (less stressful channel)
  - Propose min de-emph=4.8 dB (compromise value)

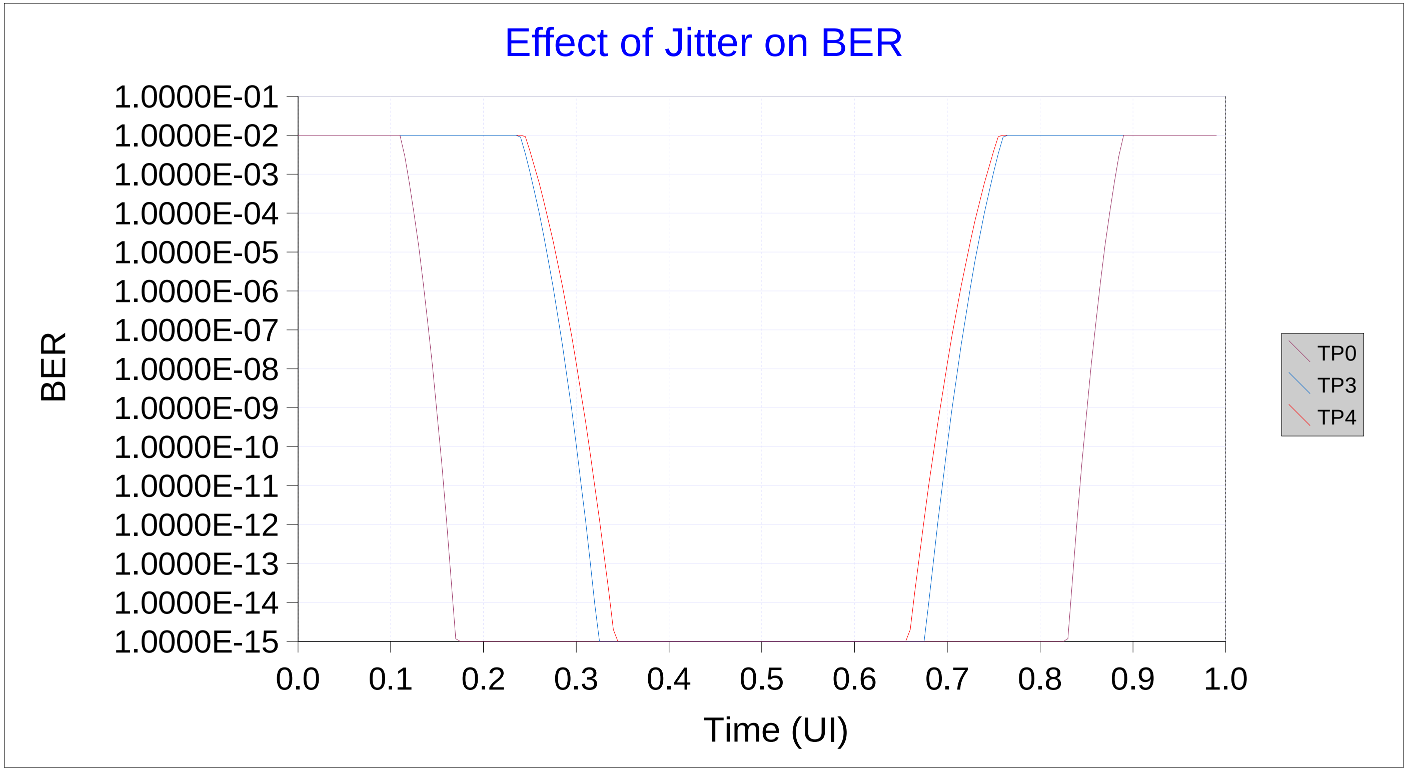


Improved Jitter Methodology (comments 52, 55, 56, 57, and 58)

- **Due to issue with dual-dirac methodology per MJSQ CL86 is moving to J2(eye opening at BER 1e-2), J9(eye opening at BER 1E-9), etc.**
  - **J2, J9, or J12 can be measured directly on the BERT without any jitter breakdown which may result in DJ reduction as RJ is increased.**
  - **J2 measures high probability jitter required for CDR robust locking**
  - **J12 guarantee target BER**
- **Table 83A-1 transmitter jitter**
  - **TJ=0.32 UI, DJ=0.17 UI resulting in J2=0.23 UI and J12=0.32 UI**
- **Table 83A-2 receiver jitter**
  - **TJ=0.62 UI, non-EQJ=0.42 UI resulting in J2=0.47 UI and J12=0.62 UI**

How to Offer BER of ~1E-15 without Test Time Complications

- **Limit the channel output jitter to J2=0.47 UI and J12=0.62 (TP3)**
- **Test receiver tolerance with J2=0.48 UI and J15=0.65 UI (TP4)**
  - **Jitter added to make up 0.65 UI assumed to be RJ for worst case BER of 1E-15.**



Impact of Larger TX RJ on the BER

- **Amount of TP3 RJ was increased and DJ reduced by 5 ps**
  - **J2=0.41 UI, J12=0.32 UI**
- **With practical amount of RJ increase**
  - **The BER varies from 1E-14 to 1E-16**