Concerns with stressed input tests in Annex 120E D3p2 (Direct reference from Annex 135G)

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Two Issues

- Achieving specified aggressor transition times
- Difficulty obtaining specified eye width of stressed input test pattern

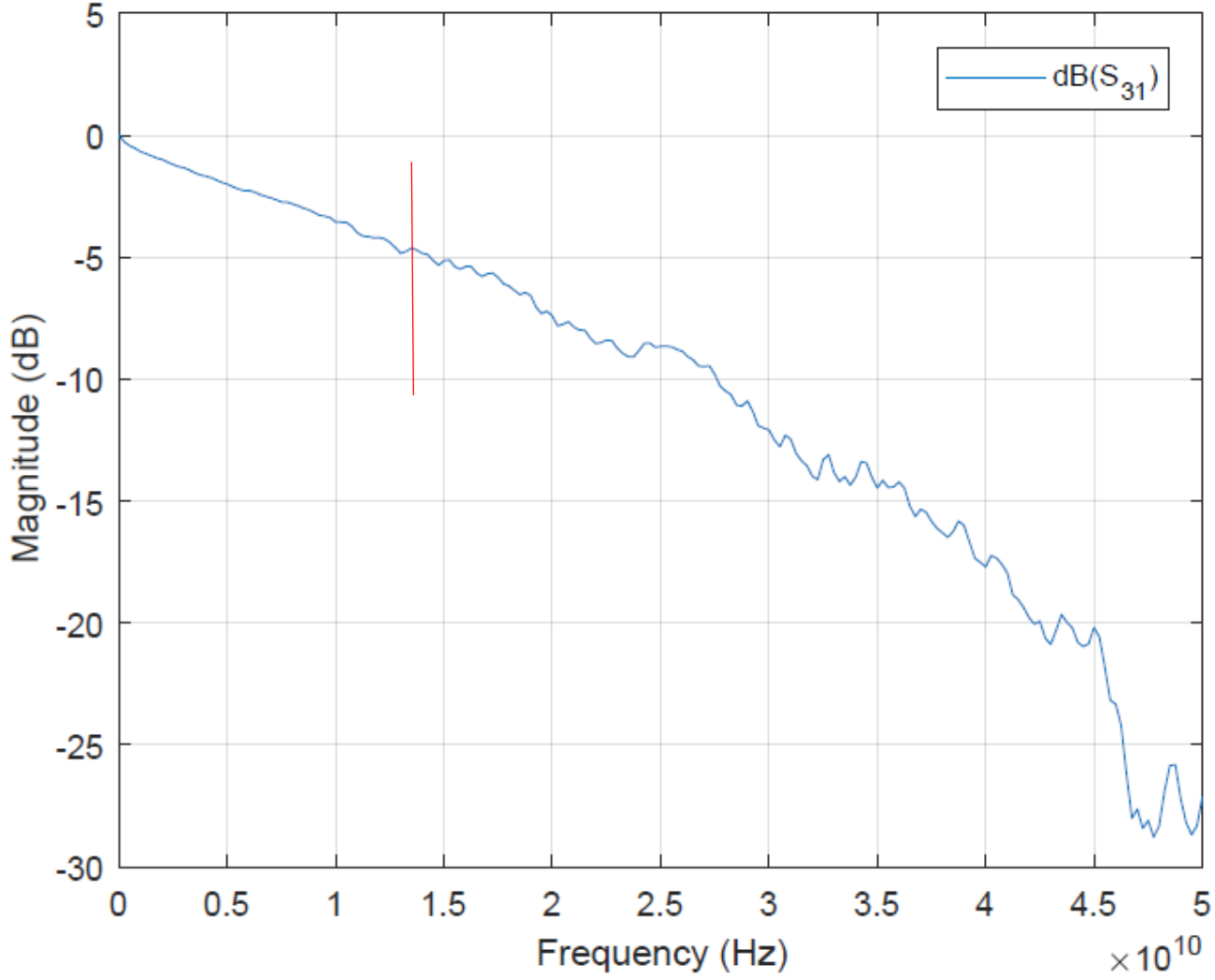
Crosstalk Aggressor Transition Time

- Specified transition time is too fast (12 ps) when measured with specified BW scope and through specified channel

The counter propagating crosstalk channels during calibration of the stressed signal are asynchronous with target amplitude of 880 mV peak-to-peak differential and 20% to 80% target transition time of 12 ps as measured at TP1a. The crosstalk signal transition time is calibrated with PRBS13Q. The pattern may be changed to a valid 400GBASE-R signal for amplitude calibration and the stressed input test. The PRBS13Q pattern is described in 120.5.11.2.1. For the case where the PRBS13Q pattern is used with a common clock, there is at least 31 UI delay between the PRBS13Q patterns on one lane and any other lane, so that the symbols on each lane are not correlated within the PMD. Any one of these patterns is sufficient as a crosstalk aggressor with all lanes active during the stressed input test.

- Should equate to the minimum allowed Tx output transition time
  - One point to note – measurement methods are different (CTLE is not used for measuring aggressor transition time)

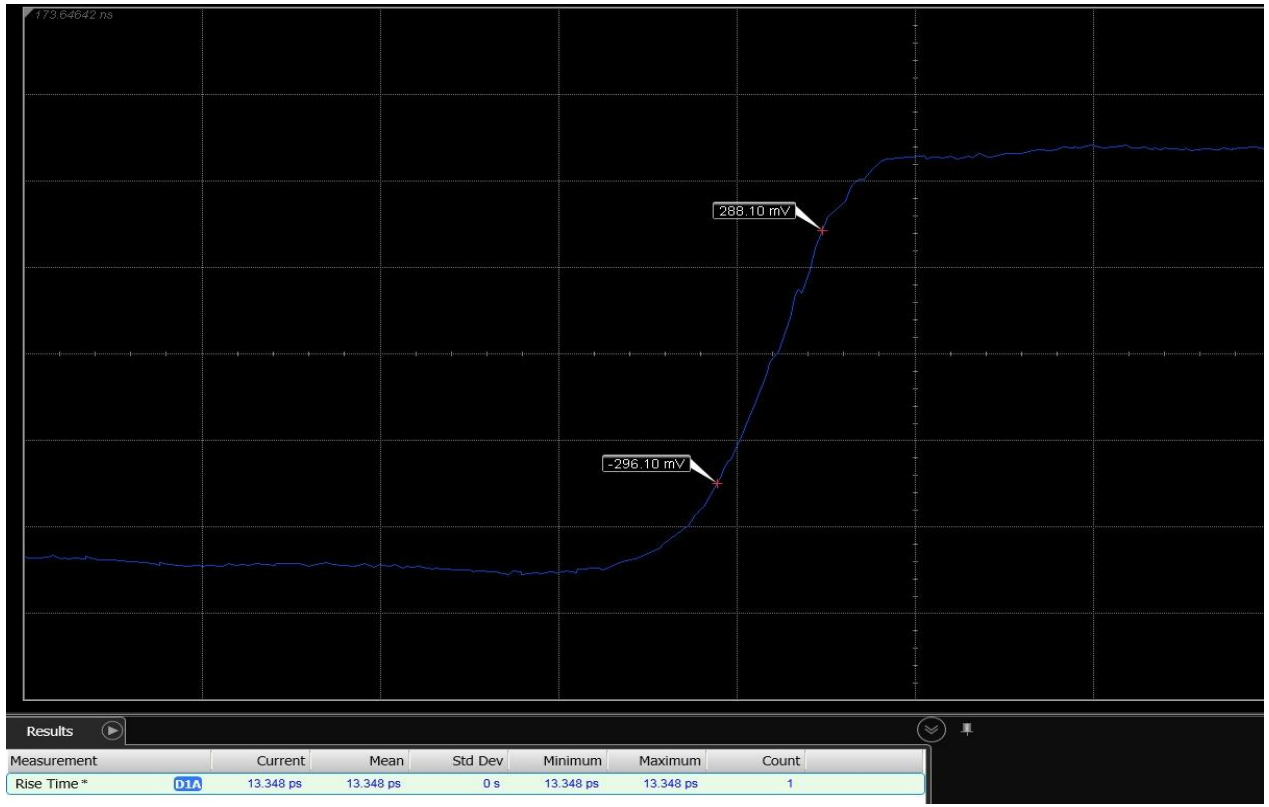
Test channel used



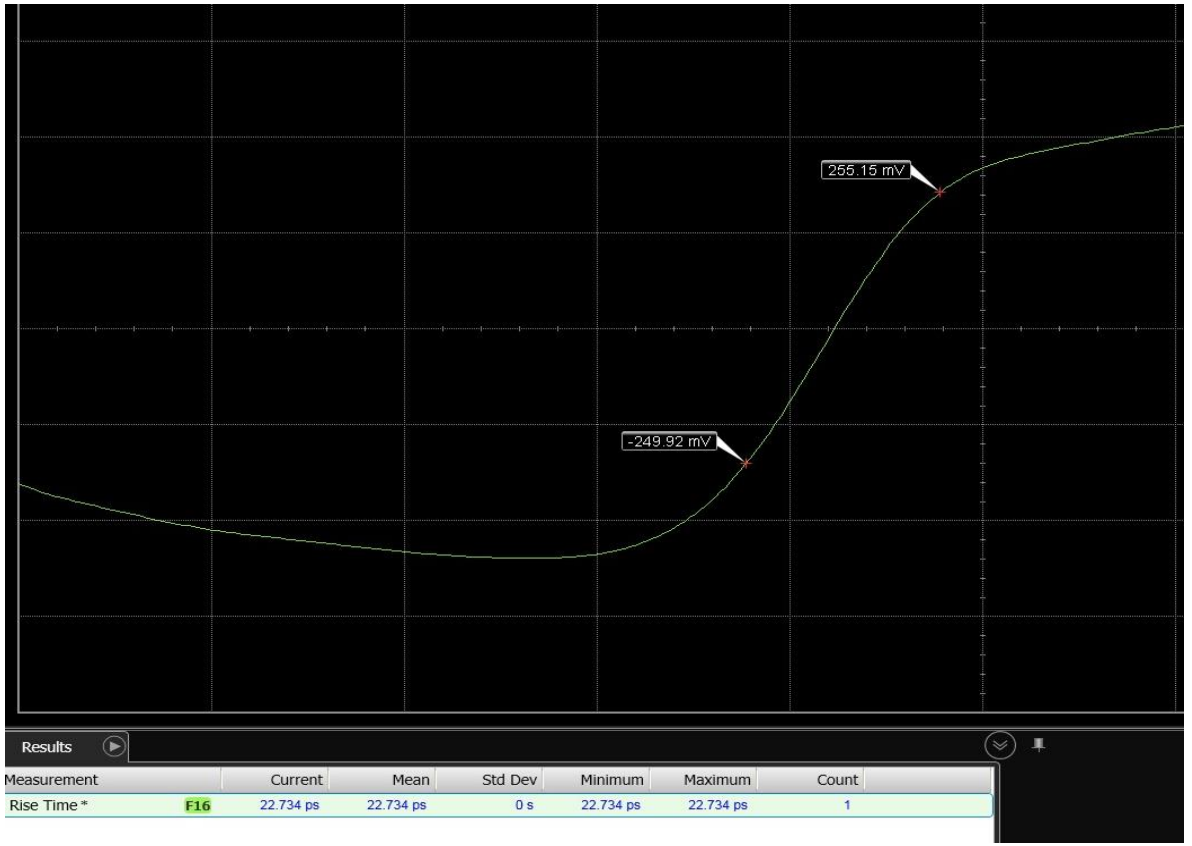
Step response, without and with channel

(With specified oscilloscope BW (33 GHz through 4th order BT)

PG output: ≈12 ps De-Emphasis is used, but has little effect after channel



Tr (20-80%) = 13.48 ps



Tr (20-80%) = 22.73 ps

Conclusions

- Channel loss combined with measurement instrument BW considerably slow transition
- 12 ps measured as above would equate to an unrealistically fast host or module driver output
- Aggressor transition time when measured as specified using practical test equipment is nearly twice the specified value

- Recommend changing parameter limit to value that more accurately equates to actual host or module driver
  -or- add text stating that practical test equipment will likely not achieve specified transition time

Difficulty achieving specified eye width

- Preliminary work shows eye width is narrower than specified (0.20 UI) for stressed host and module input tests when measured through compliance channel

- Residual jitter is not the issue – it's mostly all loss in the test channel (HCB / MCB)

Test setup values, host input test

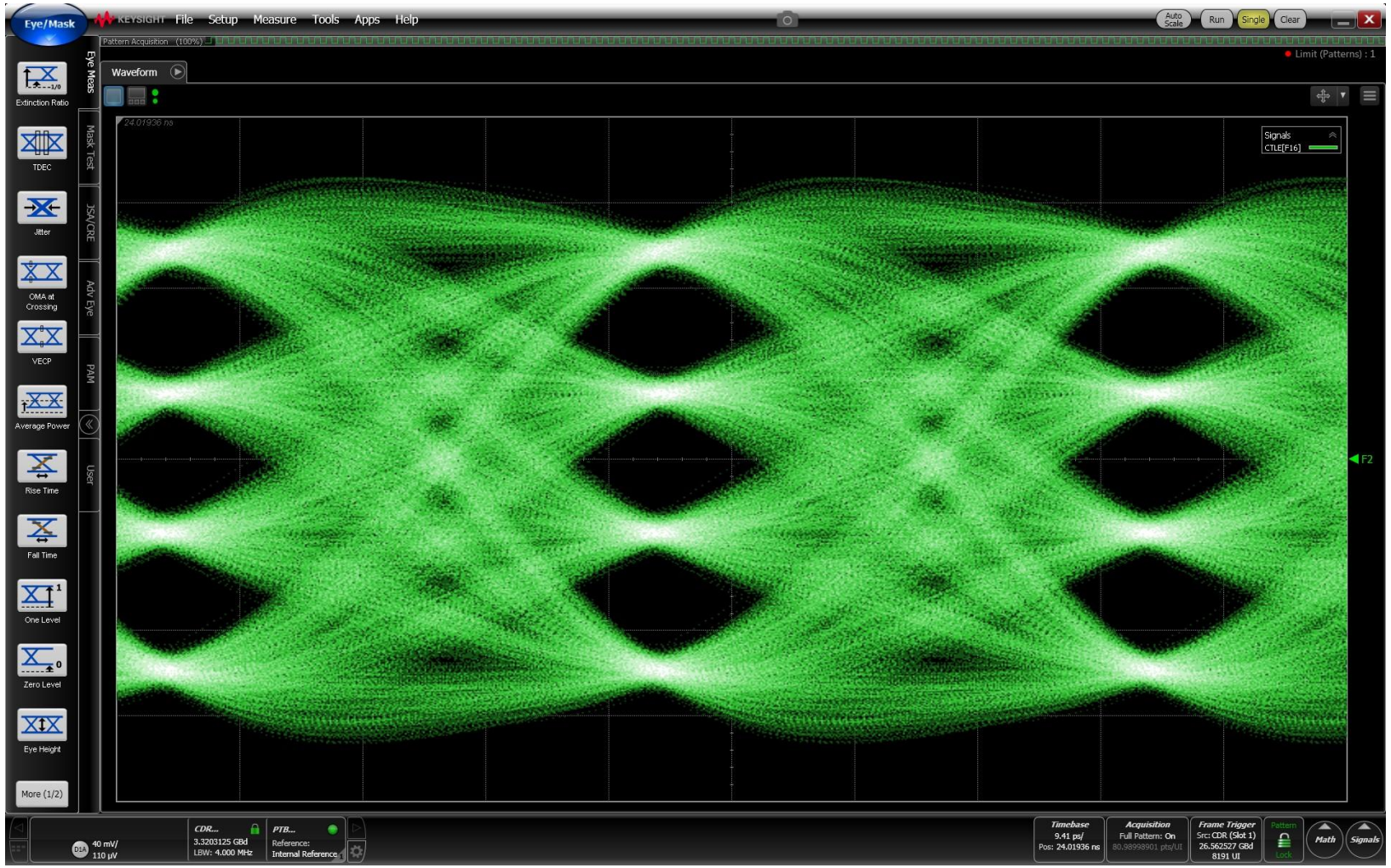
- Channel: -7 dB @ Nyquist

- Settings for optimum eye width and height

- Reference receiver CTLE: 2.5 dB
- PG De-emphasis: Pre-cursor: 0.13; Post-cursor: 0.10

Eye , with aggressor

(Although adding aggressor does not significantly close eye)



Eye Measurements

Src: F2 Rate: 26.562527 GBd Pat. Length: 8191

Measurement	Eye 0/1	Eye 1/2	Eye 2/3
Eye Width (1.0E-5)	131 mUI	160 mUI	164 mUI
Eye Height (1.0E-5)	12.90 mV	13.35 mV	16.90 mV
Eye Skew	4 mUI	-6 mUI	11 mUI
TJ (1.0E-5)	870 mUI	840 mUI	840 mUI
DJ (δ - δ)	640 mUI	620 mUI	600 mUI
RJ (rms)	30 mUI	30 mUI	30 mUI
BUJ (δ - δ)	30 mUI	30 mUI	30 mUI
DDJ (p-p)	696 mUI	684 mUI	666 mUI

Conclusions and questions

- Using specified test setup with high performance commercially available test equipment, stressed test pattern eye width and eye height fail to meet requirement
- CTLE (in reference receiver) peaked at Nyquist provides little boost for 3rd harmonic. This generates a sinusoidal eye – OK for NRZ, but provides inadequate opening for upper and lower eyes in PAM4.

  Question – is using a reference receiver CTLE peaked at Nyquist really similar to actual receiver BW and CTLE response?