KEYSIGHT

Impact of Using OMAouter to Calculate TDECQ

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AGENDA

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2. Experimental Data – 100GBaud “SSPRQ” Captures
3. OOMA Calculations for a Transmitter with Equalizable ISI
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Introduction

- The CRG adopted a change to use OMAouter as defined in clause 180.9.5 for the power penalty calculation (TDECQ)

TDECQ is given by Equation (180–12).

$$\mathrm{TDECQ} = 10\log_{10}\left(\frac{\mathrm{OMA}_{\mathrm{outer}}}{6} \times \frac{1}{Q_t R}\right) \qquad (180\text{–}12)$$

where

$\mathrm{OMA}_{\mathrm{outer}}$	is measured as defined in 180.9.5
Q_t	is 3.428, consistent with the target symbol error ratio for Gray mapped PAM4, and can be calculated according to Equation (180–27)

IEEE P802.3dj Draft 2.2 – Clause 180.9.7

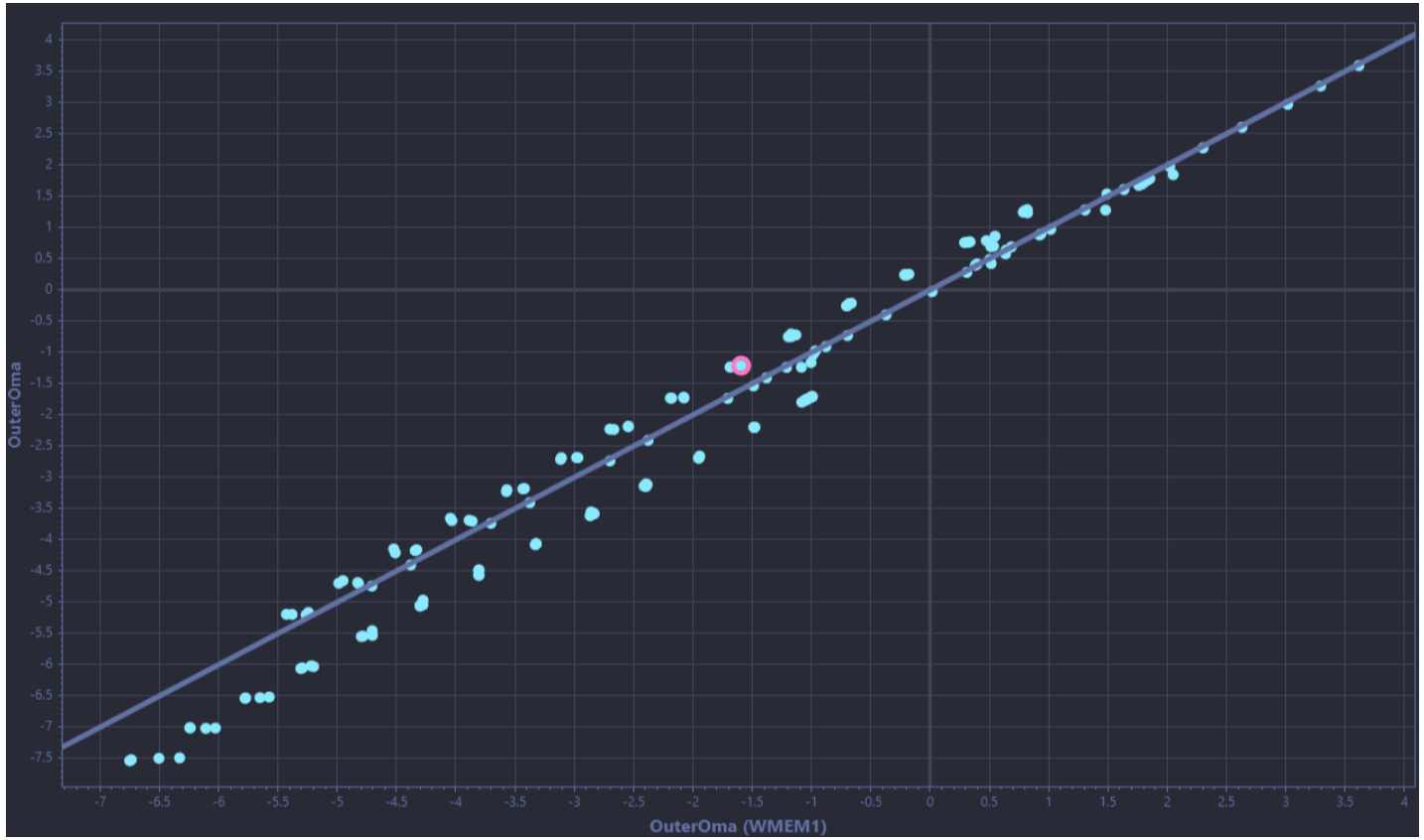
- This presentation provides experimental data showing the impact of the adopted change on TDECQ

Experimental Data - 100GBaud “SSPRQ” Captures

Comparing OOMA measured at the output of FFE vs OOMA measured at the input of FFE

Test Setup:

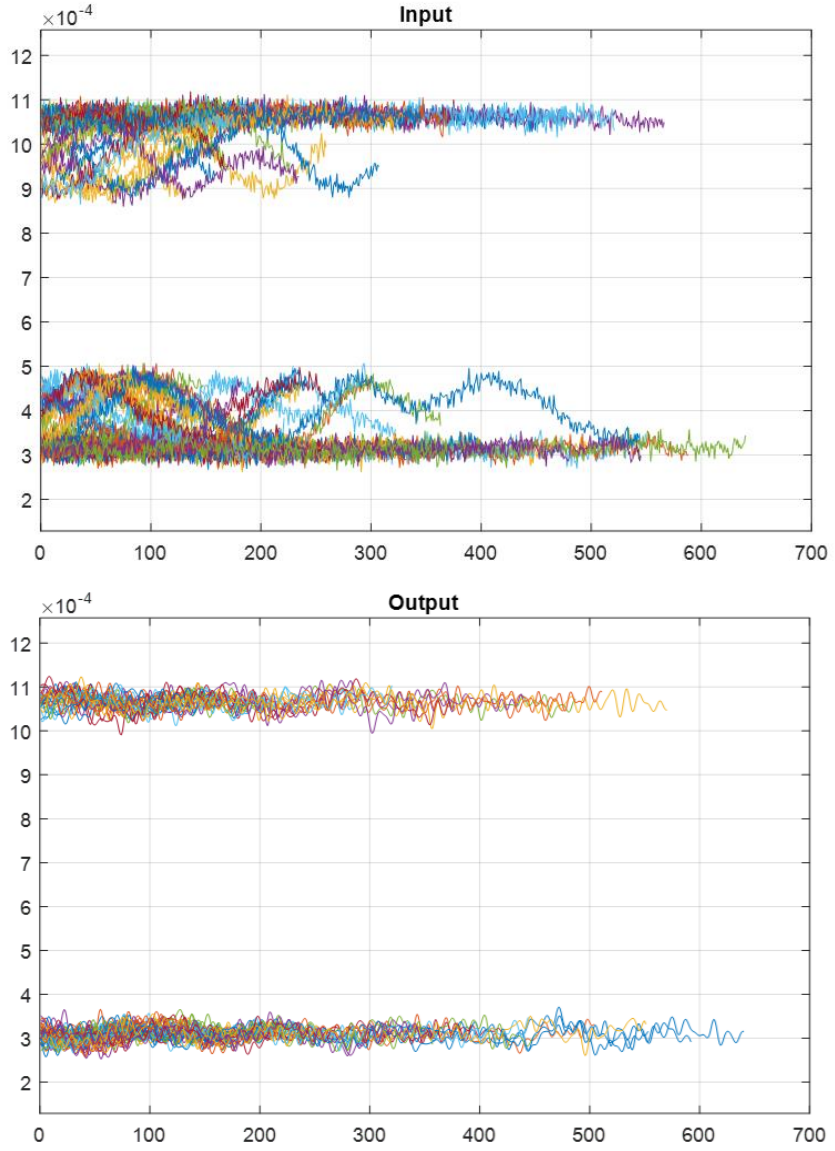
- Outer Optical Modulation Amplitude (OOMA) of various 200G-per-lane devices was measured at the output (y-axis) and the input (x-axis) of a 15-tap FFE equalizer.
- For the highlighted waveform, OOMA measured at the output of the 15-tap FFE is higher than the OOMA measured at the input of the FFE equalizer.
- OOMA calculations for the highlighted waveform are compared at input and the output of a 15-tap FFE equalizer in the next slide.



OOMA(dBm) at FFE Output vs. OOMA (dBm) at FFE Input

OOMA Calculations for a Transmitter with Equalizable ISI

- The waveform values used to make OMA measurements for the highlighted point in the previous slide are plotted for the input and output waveforms.
- OOMA is calculated using all runs of 0's and 3's that meet the minimum CID requirement in the SSPRQ pattern.
- The average level of each run is calculated. These values are averaged as 0 or 3 levels.
- The unequalized waveform (input) shows a bouncing effect that reduce the OOMA measured compared to the OOMA value measured at the equalized waveform (output).
- The TDECQ value calculated using the input waveform will go down.

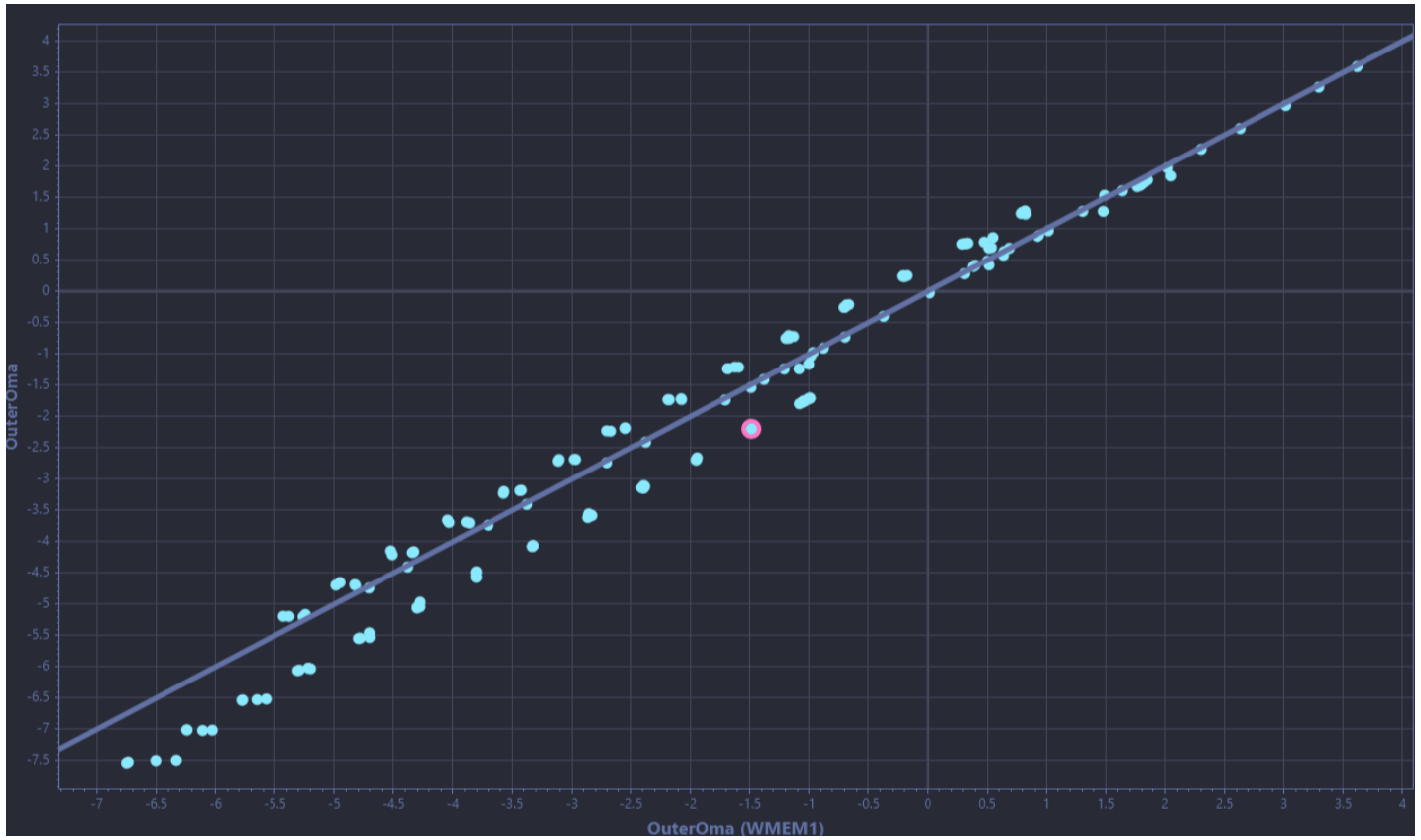


100GBaud “SSPRQ” Captures

Comparing OOMA measured at the output of FFE vs OOMA measured at the input of FFE

Test Setup:

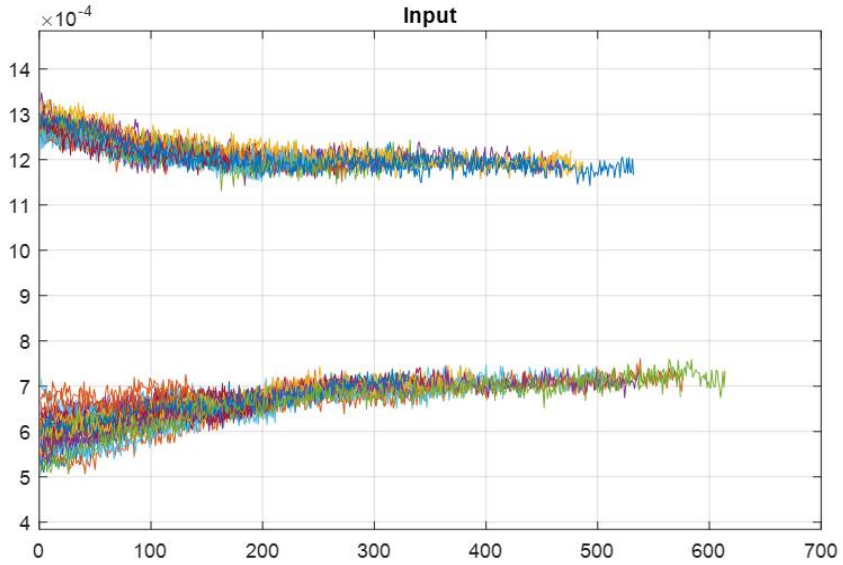
- Outer Optical Modulation Amplitude (OOMA) of various 200G-per-lane devices was measured at the output (y-axis) and the input (x-axis) of a 15-tap FFE equalizer.
- For the highlighted waveform, OOMA measured at the output of the 15-tap FFE is lower than the OOMA measured at the input of the FFE equalizer.
- OOMA calculations for the highlighted waveform are compared at input and the output of a 15-tap FFE equalizer in the next slide.

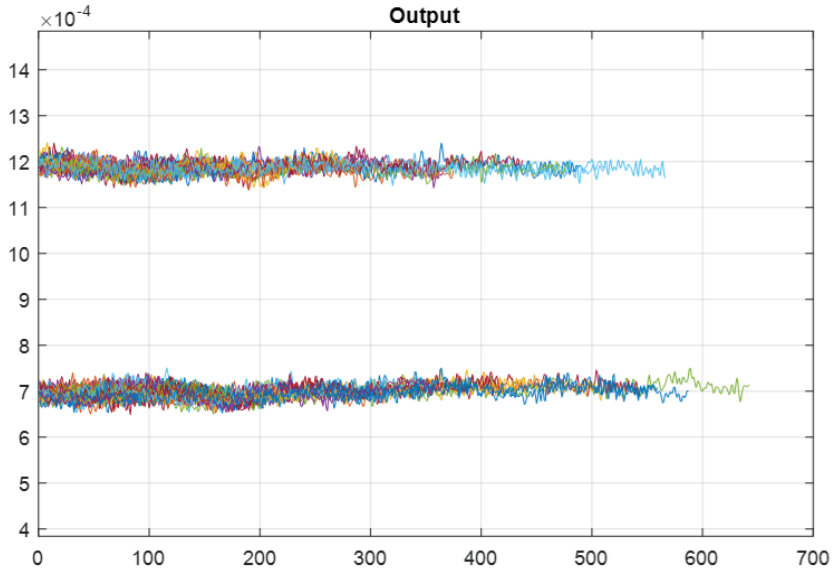


OOMA(dBm) at FFE Output vs. OOMA (dBm) at FFE Input

OOMA Calculations for a Transmitter with Overshoot

- The waveform values used to make OMA measurements for the highlighted point in the previous slide are plotted for the input and output waveforms.
- OOMA is calculated using all runs of 0's and 3's that meet the minimum CID requirement in the SSPRQ pattern.
- The average level of each run is calculated. These values are averaged as 0 or 3 levels.
- The unequalized waveform (input) shows an overshoot and a long tails effect that overestimates the OOMA measured compared to the OOMA value measured at the equalized waveform (output).
- The TDECQ value calculated using the input waveform will go up.





Summary

- The CRG adopted a change to use OMAouter as defined in clause 180.9.5 for the power penalty calculation (TDECQ)
- The adopted change will impact the TDECQ value calculated for an optical transmitter. The new TDECQ value could be higher or lower depending on the characteristics of the waveform.
- This presentation provides experimental data showing the impact of the adopted change on TDECQ for various 200G-per-lane optical transmitters.
- The adopted change seems to be penalizing transmitters with overshoot and a long tail which was not captured by the former TDECQ definition (using OOMA measured at the output of the reference equalizer).

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Thank you