Some 50 Gb/s PAM4 VCSEL results

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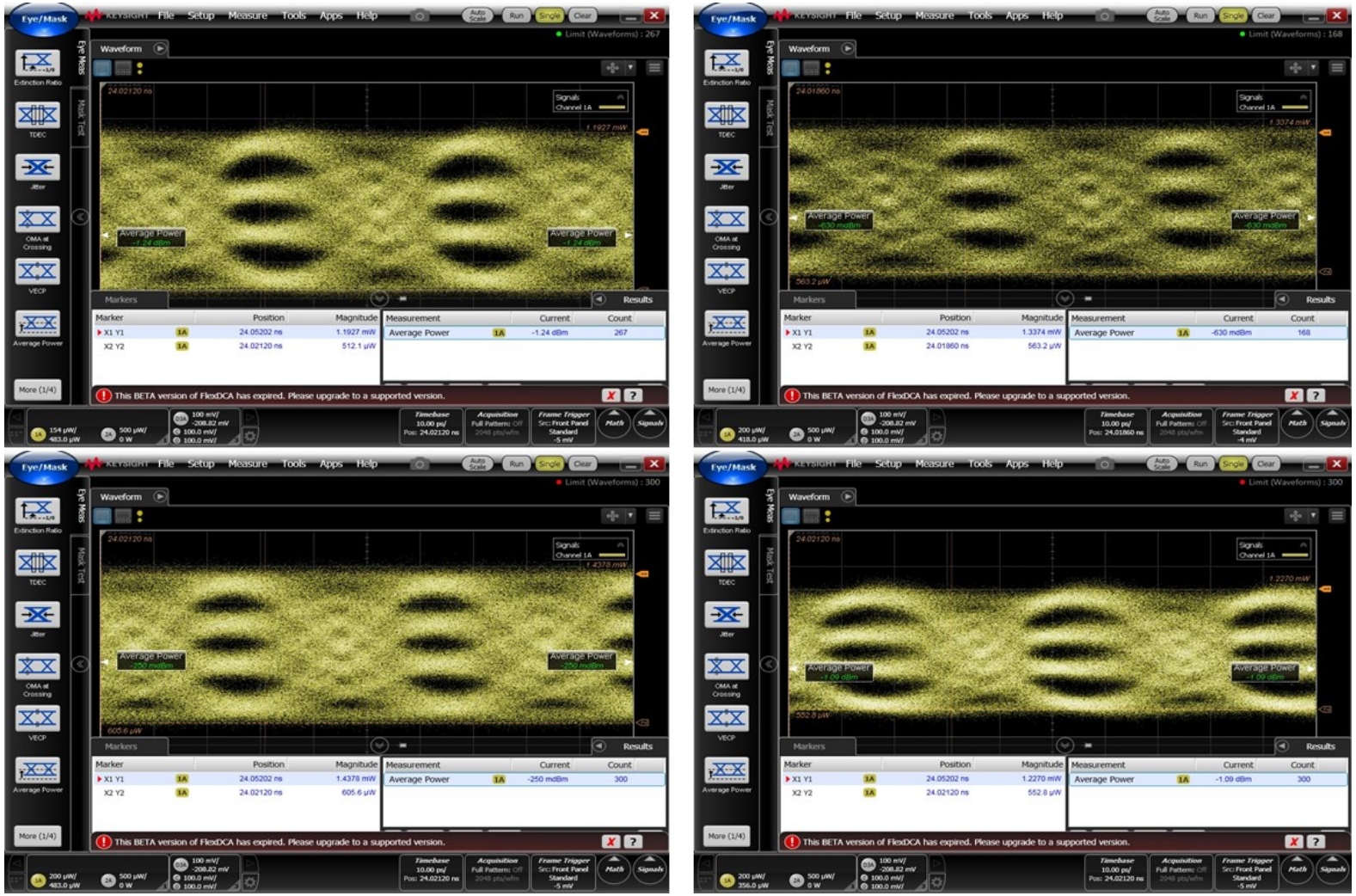
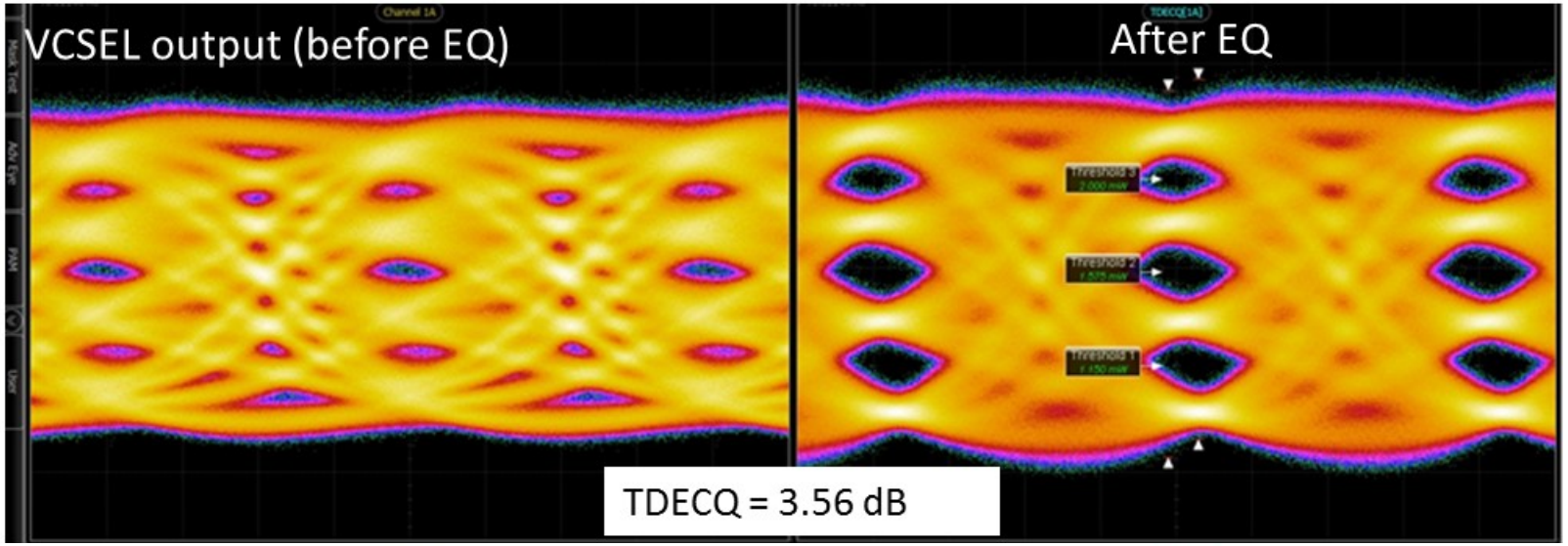
PAM4 VCSEL samples: eyes at 53.1 Gb/s -1

- Evaluation board mounted commercial drivers and test-board mounted 50Gb/s PAM4 VCSELs
  - PRBS15
- Open eyes, with reasonable timing window

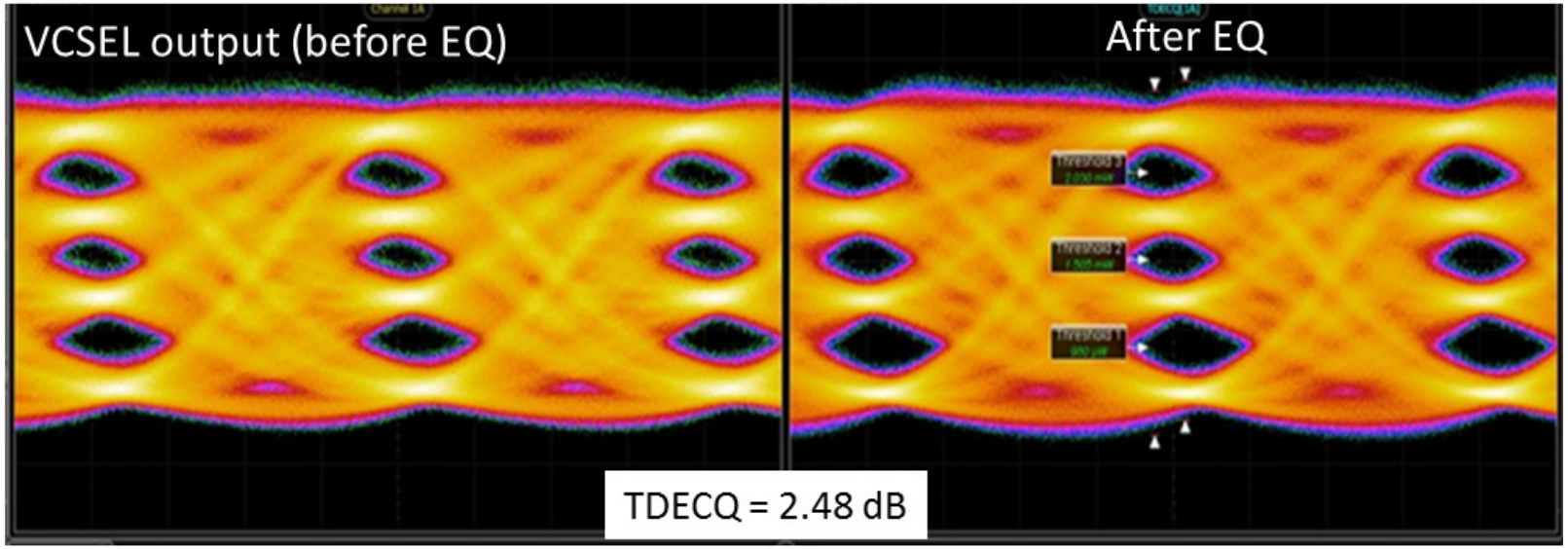


PAM4 VCSEL samples eyes and TDECQ at 53.1 Gb/s -2

- VCSEL driver without pre-emphasis
  - Unequal eye heights
- **SECQ = 3.6 dB**
  - PRBS15
  - ER_{outer} = 5.0 dB



- VCSEL driver with pre-emphasis representative of 'real' driver
- **SECQ = 2.5 dB**
  - PRBS15
  - ER_{outer} = 3.8 dB

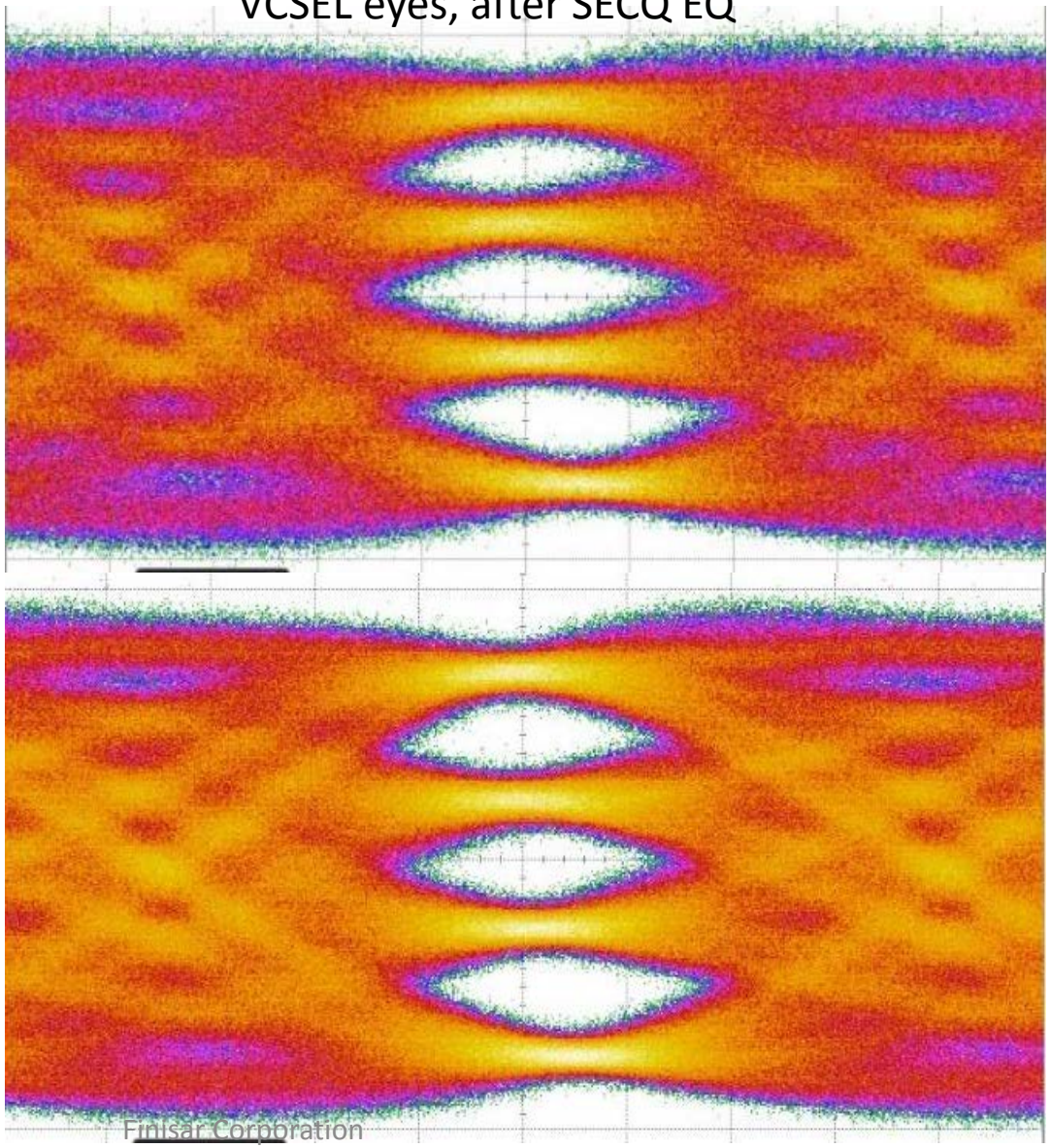


PAM4 VCSEL samples: eyes at 53.1 Gb/s and TDECQ - 2

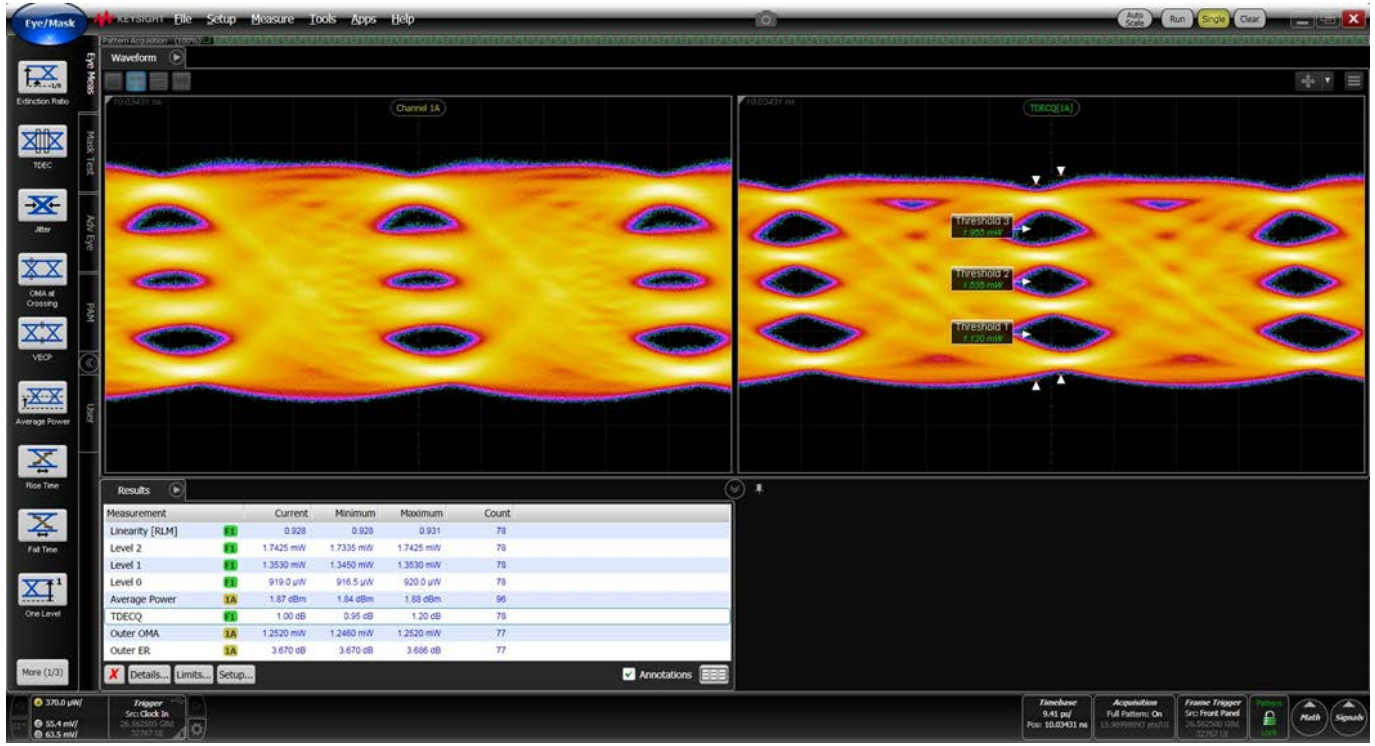
- VCSEL driven without pre-emphasis
  - Unequal eye heights
- **SECQ = 3.6 dB**
  - PRBS15
  - ER_{outer} = 3.5 dB

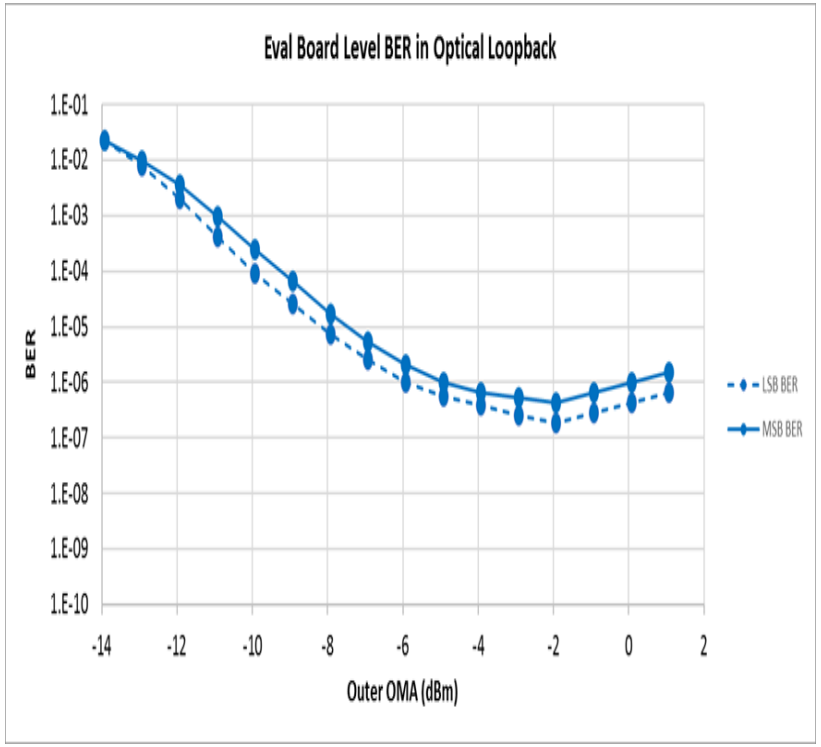
- VCSEL driven with pre-emphasis
  - Equal eye heights
- **SECQ = 2.0 dB**
  - PRBS15
  - ER_{outer} = 3.4 dB

VCSEL eyes, after SECQ EQ



Recent evaluation board level integration of 56 Gb/s PAM4 driver, VCSEL, and receiver/TIA and EQ/CDR





- SECQ = 1.0 dB; back-to-back sensitivity ~-10 dBm (for 1.0 dB SECQ Tx)

Summary

- 50 Gb/s PAM4 VCSELs samples
- 3 commercial driver chips on evaluation board assemblies
  - Each has ability to shape the VCSEL driver waveform to give substantially equal height sub-eyes
- Encouraging results - open eyes, reasonable SECQ and receiver sensitivity measurements – consistent with the 802.3cd D3.0 specs and perhaps some margin for manufacturing…
  - … with caveats: these results don't use SSPRQ test pattern; SECQ was measured (not TDECQ); nominal temperature, lab measurements
- More results coming soon