# Alternate 3CK C2M Reference receiver proposal

Karthik Gopalakrishnan, Basel Alnabulsi, Jamal Riani, Ilya Lyubomirsky

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# CK C2M Reference receiver

- Significant work has gone into CK for comparing reference receiver topologies -
  - 4Tap DFE
  - 5Tap FFE
  - 5Tap FFE + 1Tap DFE (No Pre)

- Recent discussions have listed the need for additional TX Precursors - C(-3)
  - Questions still linger on the method to adapt these taps
  - Possible solutions may involve system level approaches

- The reference receiver also impacts TP1a compliance testing
  - Per channel TX tuning should be avoided, etc

- Primary inquiry "Can a RX FFE (5Tap with n Pre) + 1-Tap DFE provide similar performance as some of the better performing options (4Tap DFE, Etc) ?"
  - Simplify system level tests and compliance

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# Channels and Setup

- **Channels considered**
  - Lim 16dB C2M Channels 2, 4, 6 (lim_3ck_01_0319)
  - Lim 16dB C2M (lim_3ck_01_0918)
  - Tracy Micro via case (tracy_100GEL_06_0118)

- **Setup**
  - Cascaded 30mm and 3.6mm Packages for host and module side
  - PKG shows ~3.5dB Loss at Nyq (host side) and ~1.5dB module
  - Cascaded die model for either ends of the link (Cd=110fF)

- **Time-domain MATLAB simulator incorporating circuit data**
  - Noise, BW, Timing loop, etc
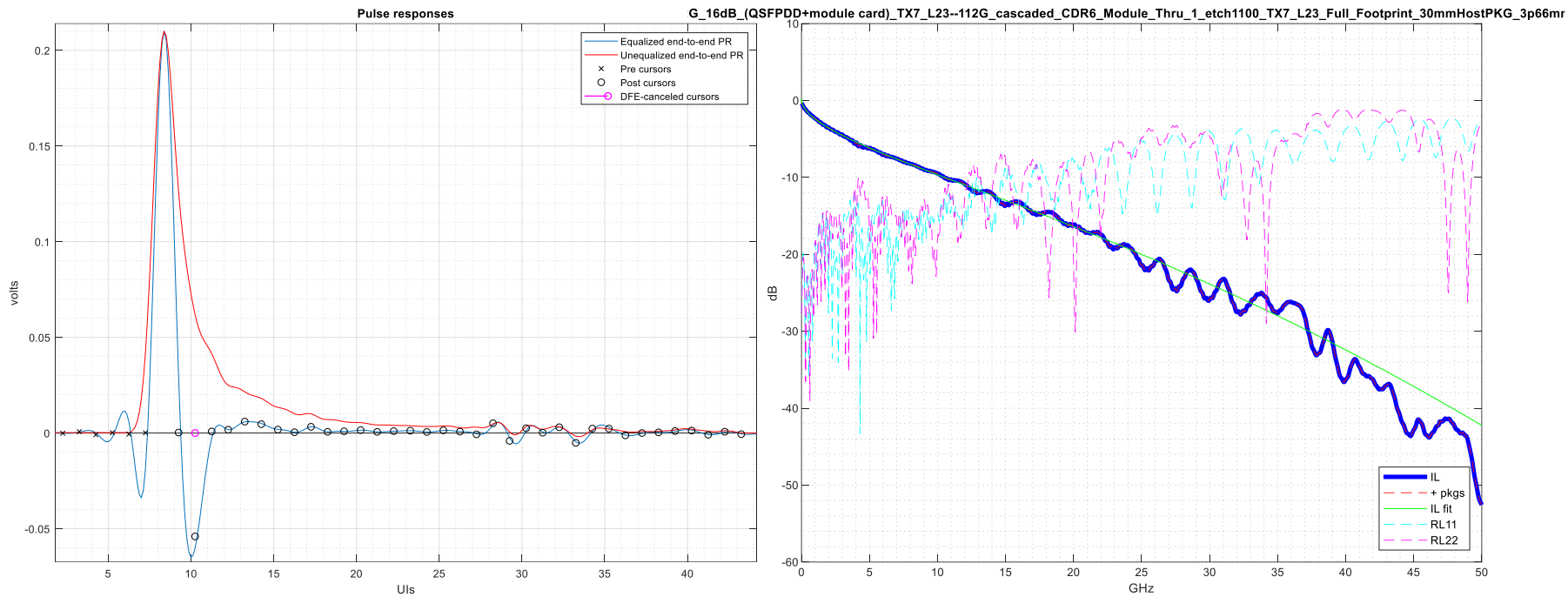  - Fully adaptive FFE, DFE, Timing loop
  - TX FIR (Coarse sweep), CTLE

# Channel: Lim Ch 2

- **112G_cascaded_CDR6_Module_Thru_1_etch1100_TX7_L23_Full_Footprint**
  - Insertion Loss at Nyquist = 23.2dB
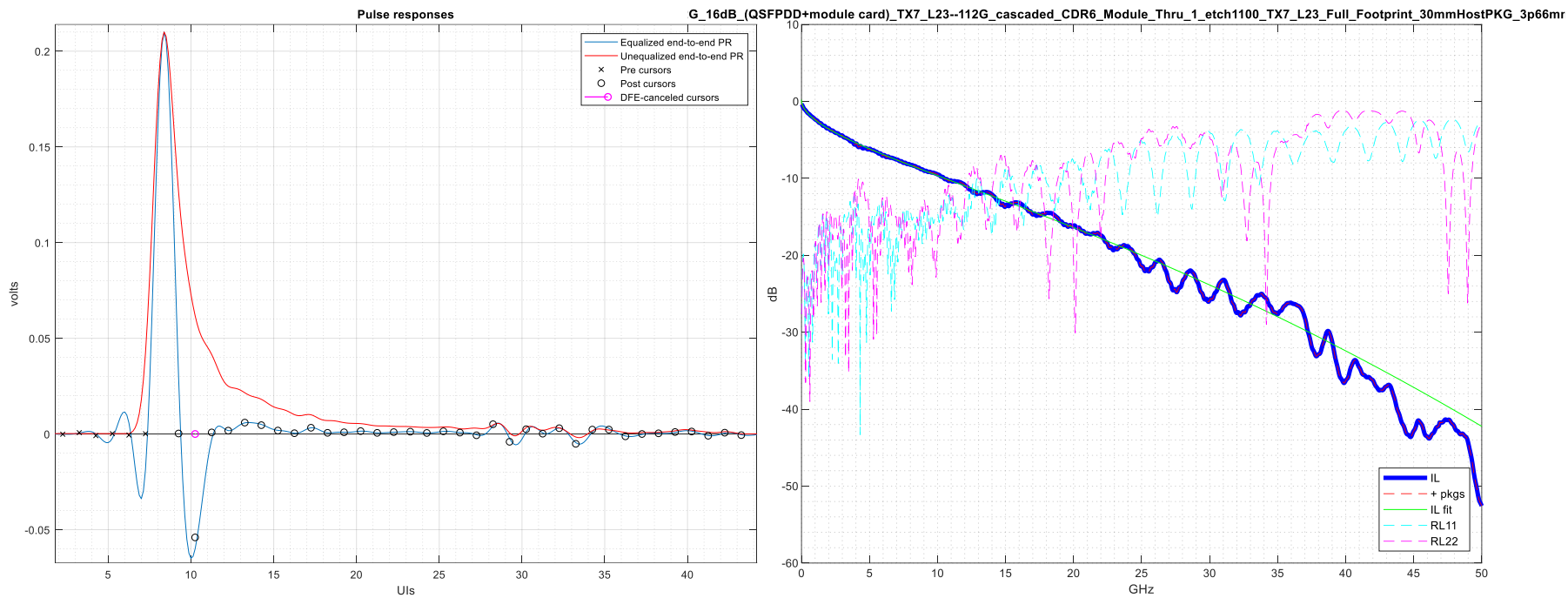
# Channel: Lim Ch 6

■ 112G_cascaded_CDR6_Module_Thru_1_etch1100_TX3_Asic_Footprint

— Insertion Loss at Nyquist = 25.5dB

# Simulation results summary

- ■ We studied the difference in performance with a 5Tap FFE
  - — Assumed a 4Tap TX FFE
  - — 1Tap DFE follows the last FFE Tap

| | Lim Ch - 2 (SNR dB) | | | | Lim Ch - 4 (SNR dB) | | | | Lim Ch - 6 (SNR dB) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RX Configuration | | | | RX Configuration | | | | RX Configuration | | | |
| | 5T | 5T-1Pre | 5T-2Pre | 5T-3Pre | 5T | 5T-1Pre | 5T-2Pre | 5T-3Pre | 5T | 5T-1Pre | 5T-2Pre | 5T-3Pre |
| No DFE | 20.96 | 20.60 | 19.13 | 17.71 | 20.45 | 19.97 | 19.66 | 17.57 | 19.79 | 19.80 | 19.38 | 17.21 |
| 1Tap DFE | 22.20 | 20.69 | 20.24 | 22.11 | 23.09 | 20.63 | 21.58 | 22.19 | 22.94 | 20.53 | 21.05 | 22.05 |

| | Lim Ch - 16dB Spokane (SNR dB) | | | | Tracy_06_0118 (SNR dB) | | | |
|---|---|---|---|---|---|---|---|---|
| | RX Configuration | | | | RX Configuration | | | |
| | 5T | 5T-1Pre | 5T-2Pre | 5T-3Pre | 5T | 5T-1Pre | 5T-2Pre | 5T-3Pre |
| No DFE | 18.31 | 18.78 | 18.13 | 17.66 | 18.80 | 18.43 | 18.11 | 16.69 |
| 1Tap DFE | 21.85 | 18.43 | 20.29 | 21.85 | 21.13 | 19.18 | 18.89 | 20.62 |

Note:
Tracy and Lim Spokane channels used
Cd=130fF

- ■ The precursors on the RX FFE are effective if a 1T-DFE can be added

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# Summary

- **RX FFE with pre-cursors enables a simpler system**
  - Set and forget TX, simplified TP1a compliance tests, etc
  - Any channel or transmitter variation over voltage and temperature is tracked on the receiver
  - sub-optimal SI on customer boards require significant tuning / optimization effort for TP compliance and this effort can be minimized

- **5Tap FFE is already adopted on the optical side for TDECQ and is built into scopes already**
  - Adding precursors or 1Tap DFE should be trivial