

Effects of Additional FIR Taps to the CDAUI-8 Chip-to-Chip (C2C) Link Performance

For IEEE 802.3bs

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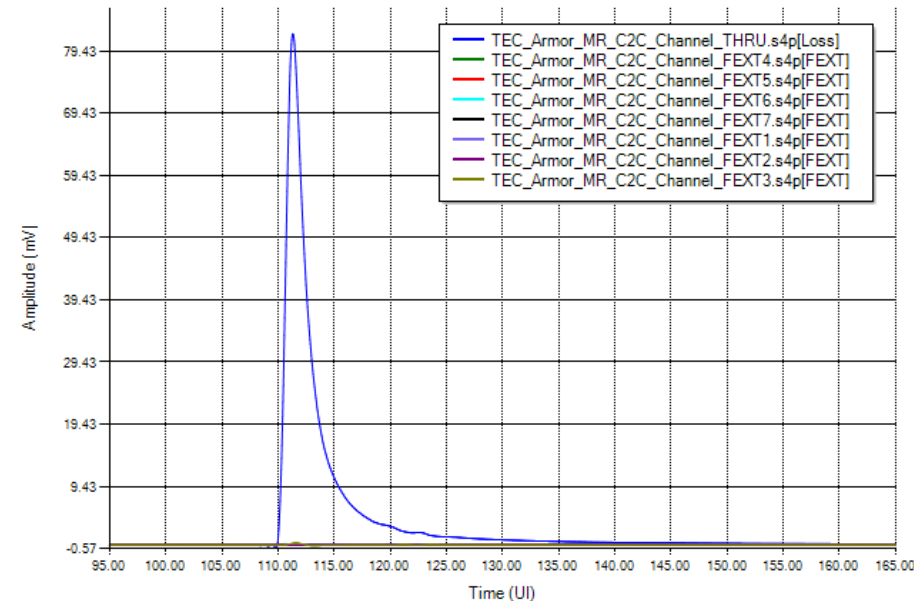
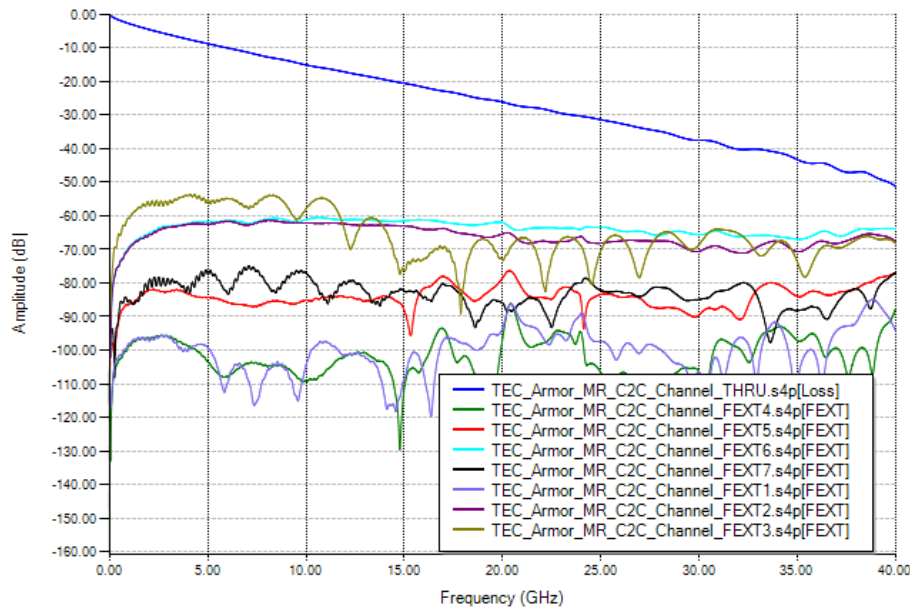
Channel Characteristics

TEC_Armor_MR_C2C_Channel_THRU/FEXTn.s4p

(<http://www.ieee802.org/3/bs/public/channel/index.shtml>)

JNEye Channel Viewer: [1] FR: Sdd21

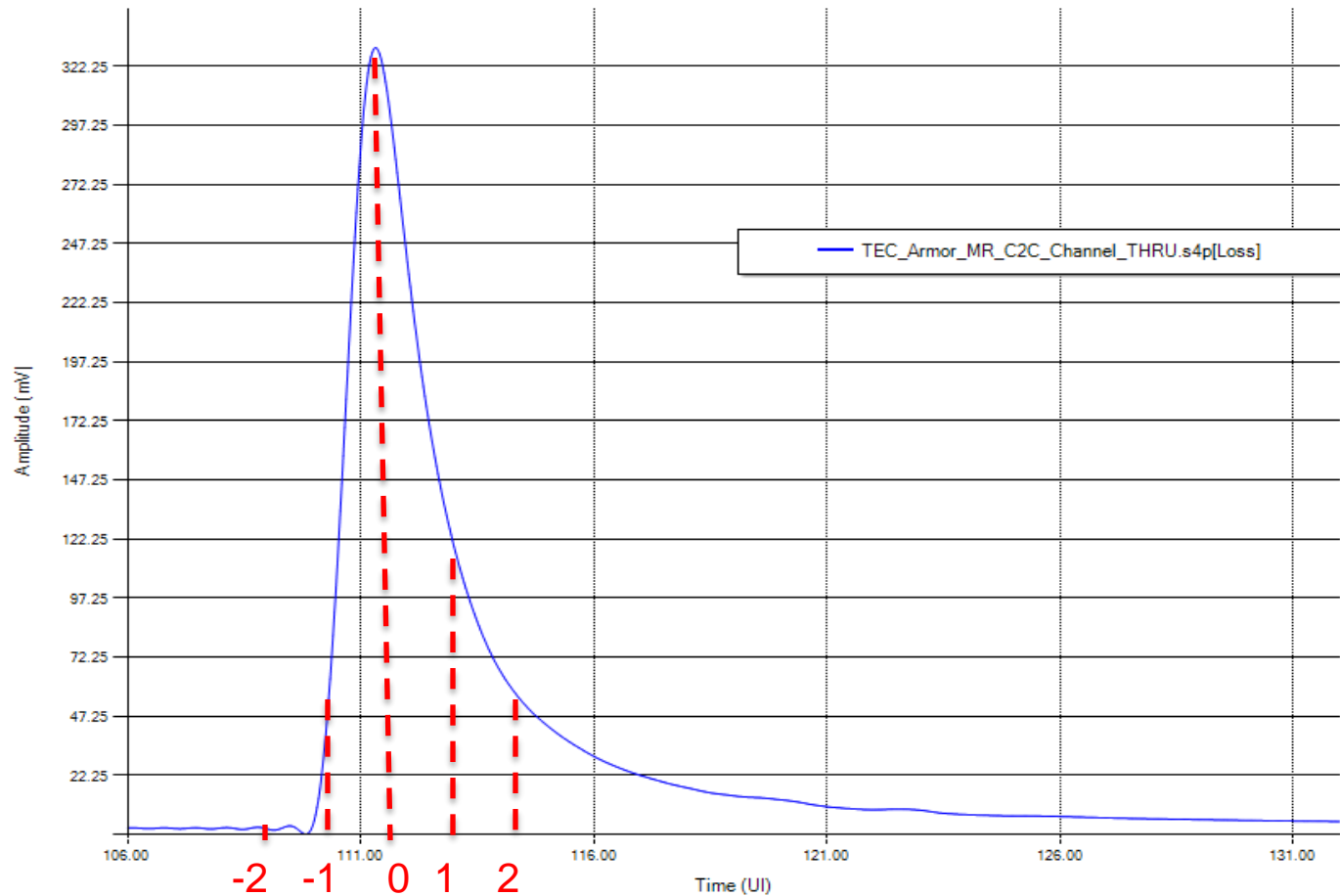
JNEye Channel Viewer: [2] SBR: Sdd21



Note:

- IL at 13 GHz = -18.3 dB, PSXT = -56.9 dB at 13 GHz
- Shown good channel characteristics in frequency and time domain.
- Thru channel: shown slight causality violation

Channel Single Bit Response (SBR) Zoom-in



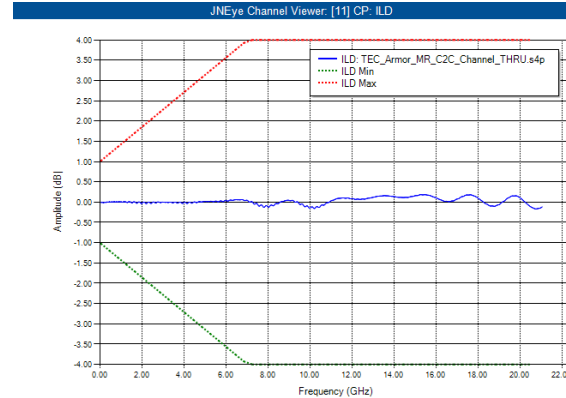
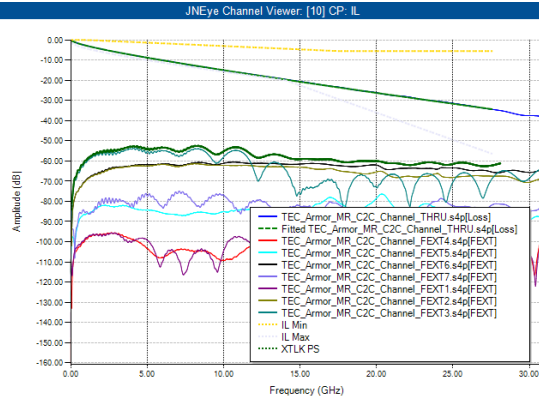
Note:

- Channel is slightly non-causal
- There is no true dispersion/ISI at C-2 location

Channel Characteristics (cont.)

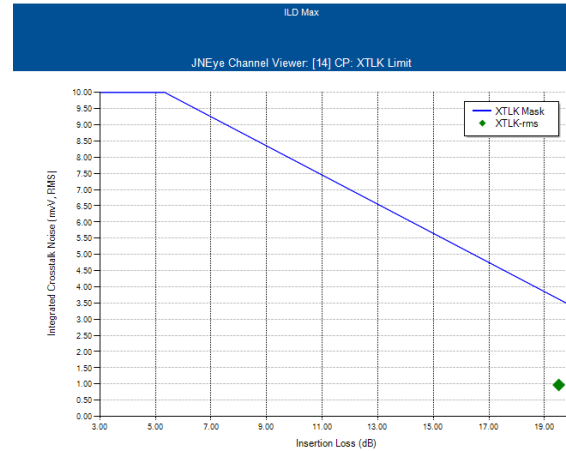
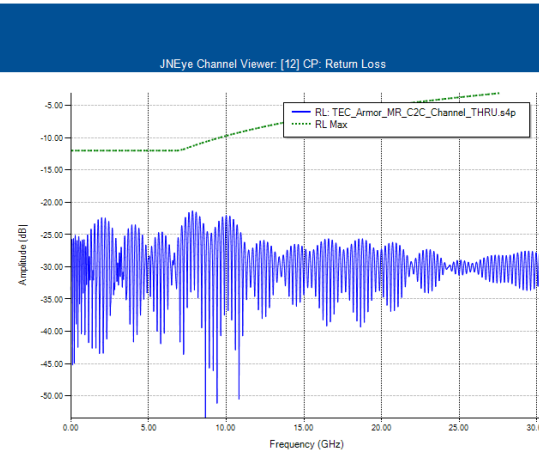
TEC_Armor_MR_C2C_Channel_THRU/FEXTn.s4p

Insertion Loss



ILD

Return Loss



ICN

OIF-CEI-28G-MR Channel Compliance Check

- Pass all checks

IL at 13 GHz = -18.3 dB, ILD <= +/- 0.19 dB, ICN = 0.97 mV rms

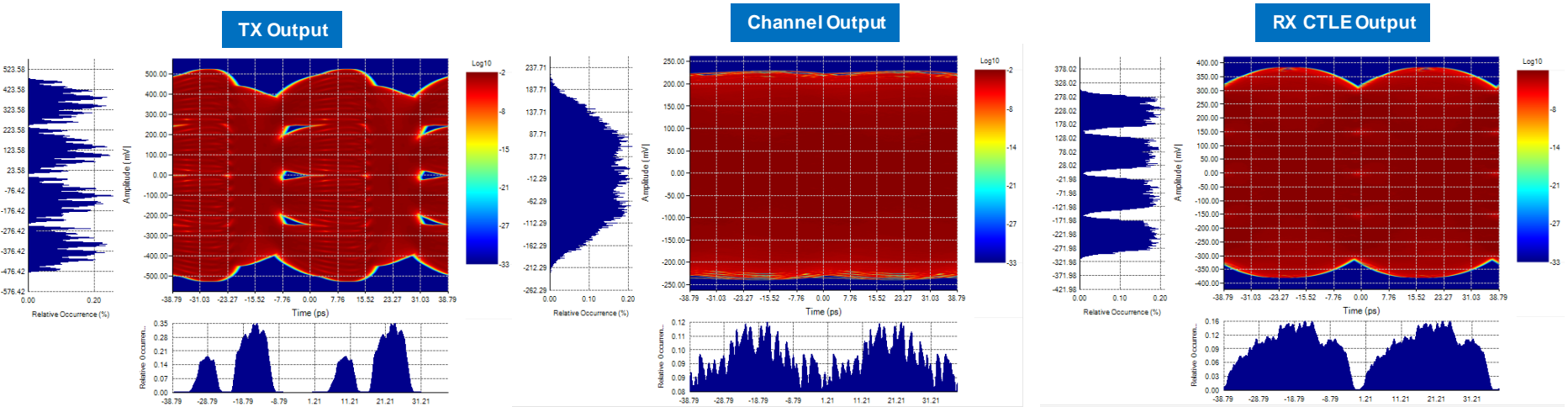


Link Configuration and Parameter Settings

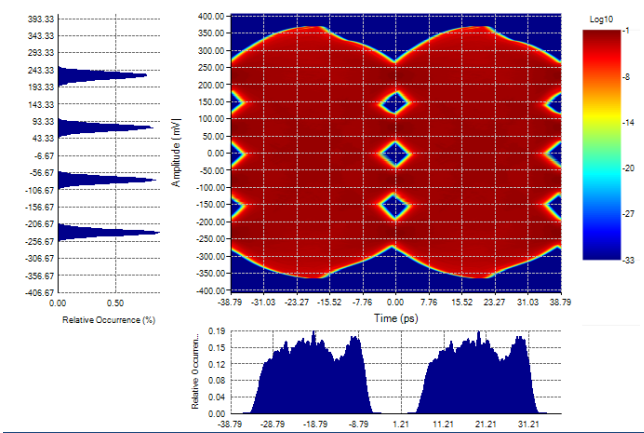
- ◀ Data Rate: 51.56 Gbps
- ◀ Signaling: PAM-4
- ◀ Test pattern: PRBS 2^{31} + PAM-4
- ◀ BER: 10^{-6}
- ◀ Channel: TE C2C channels
 - with 7 FEXT
- ◀ TX:
 - 3-tap FIR (base: pre-tap1+main-tap+post-tap1), base+pre-tap2, base+post-tap2
 - Vdiff: 1.15V
 - Tf: 14.7 ps
 - Noise: 0.5 mV-rms
 - Jitter:
 - ◀ DCD 0.014 UI, BUJ: 0.033 UI, RJ: 0.211 ps-rms
- ◀ RX:
 - CTLE, 5- Tap DFE

3-Tap FIR (Base) Simulation Results

Data Rate: 51.56 Gbps /PAM-4 /TX (3-Tap FIR)/RX (CTLE + 5-Tap DFE)



RX w/ 5-Tap DFE Output



DFE (5-Tap) Output

BER 1e-6: EW = 0.197 UI (7.64 ps), EH = 72.2 mV

4-Tap FIR (Base+Pre-tap2) Simulation Results

Data Rate: 51.56 Gbps / PAM-4 / TX (4-Tap FIR) / RX (CTLE + 5-Tap DFE)

C-2	C-1	C0	C+1	C+2	EW (1e-6) (UI)	EH (1e-6) (mv)	delta EW (UI)	delta EH (mv)
0	-0.09	1	-0.28	0	0.197	72.2	0	0
0.024	-0.09	1	-0.28	0	0.202	80.9	0.005	8.7
0.047	-0.09	1	-0.28	0	0.194	67.3	-0.003	-4.9
0.073	-0.09	1	-0.28	0	0.168	52.8	-0.029	-19.4
0.1	-0.09	1	-0.28	0	NA	NA		
-0.024	-0.09	1	-0.28	0	0.183	66.7	-0.014	-5.5
-0.047	-0.09	1	-0.28	0	0.159	58.9	-0.038	-13.3
-0.073	-0.09	1	-0.28	0	0.132	44.8	-0.065	-27.4
-0.1	-0.09	1	-0.28	0	NA	NA		

- Pre-tap2 improvement is small (EW: 2.5%, EH: 12%)
- Possibly due to the slight over-equalizing by pre-tap1 due to the tap resolution limitation

4-Tap FIR (Base+Post-tap2) Simulation Results

Data Rate: 51.56 Gbps / PAM-4 / TX (4-Tap FIR) / RX (CTLE + 5-Tap DFE)

C-2	C-1	C0	C+1	C+2	EW (1e-6) (UI)	EH (1e-6) (mv)	delta EW (UI)	delta EH (mv)
0	-0.09	1	-0.28	0.024	0.195	69.2	-0.002	-3
0	-0.09	1	-0.28	0.047	0.164	54.8	-0.033	-17.4
0	-0.09	1	-0.28	0.073	0.117	38.8	-0.08	-33.4
0	-0.09	1	-0.28	0.1	0.0723	21.2	-0.1247	-51
0	-0.09	1	-0.28	0.128	0.0156	1.44	-0.1814	-70.76
0	-0.09	1	-0.28	-0.024	0.197	64.5	0	-7.7
0	-0.09	1	-0.28	-0.047	NA	NA		

Post-tap2 provides **NO** improvement

Summary

- ▶ A study of additional pre-tap2 and post-tap2 effects to the CDAUI-8 C2C link performance using the TC channel^[1] has been carried out
- ▶ For the additional pre-tap2, we have found insignificant performance improvement (2.5% EW, and 12% EH) over the base FIR
- ▶ For the additional post-tap2, we have found **NO** performance improvement over the base FIR
- ▶ We plan to do further studies with more CDAUI-8 C2C channels

References

- [1] <http://www.ieee802.org/3/bs/public/channel/index.shtml>
(TE channel data)