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Converging on ICN values for Mated compliance Test Fixtures in 802.3dj Annex 179B

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Supporters

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- John Calvin, Keysight

Intent

- Present measured data and contribute data set for establishing ICN values
- ICN is dominated by the module connector
 - Variance in coupling within module connector is controlled by connector vendor
- Not attempting to set ICN limit values in this contribution
 - Reviewed and Support contribution by Sam Kocsis proposing ICN limit values

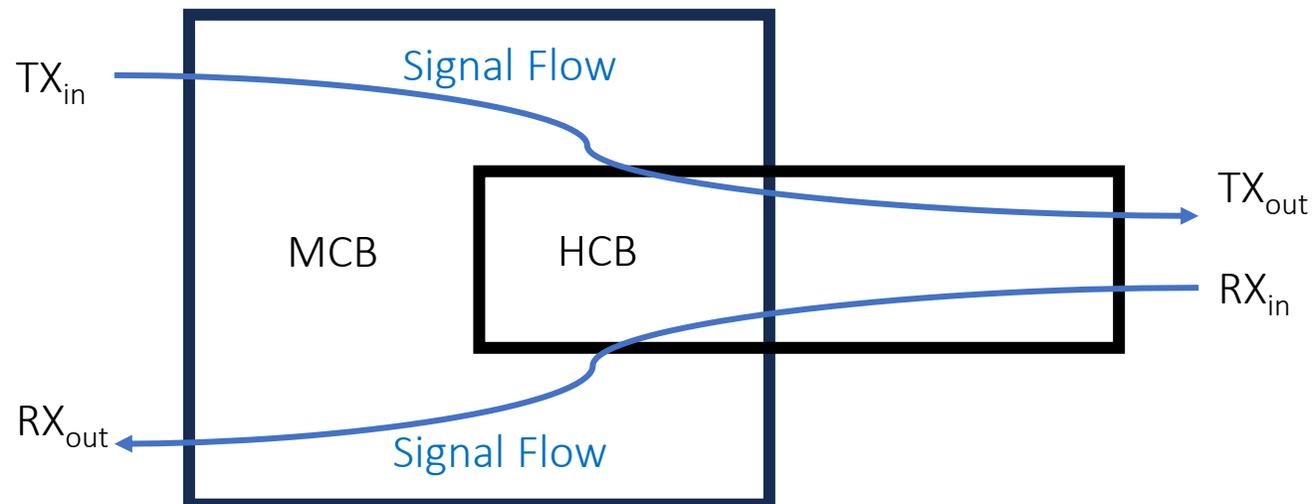
Notes & Caveats

- Measurements made from 'pre-compliance' HCB & MCB
 - Pre-compliance until Standard is published
- HCB & MCB are prototype fixtures
 - Known issues to be resolved in next turn
- Module connector – prototype second generation 1.6T OSFP

VNA Setup and Terminations

- IF Bandwidth: 1 kHz
- Power: -10 dBm
- Frequency Start: 10 MHz
- Frequency Stop: 110 GHz
- Frequency Step: 10 MHz
- 1.00 mm terminators are on aggressor and victim differential pairs.
- 1.85 mm terminators and 1.85 mm to 1.00 mm adapters on nearest neighbors relative to both the connector and test fixtures.

Measurement Set



NEXT Measurements:

Aggressor		Victim
TX_{MCB}	→	RX_{MCB}
RX_{HCB}	→	TX_{HCB}

FEXT Measurements:

Aggressor		Victim
RX_{HCB}	→	RX_{MCB}
TX_{MCB}	→	TX_{HCB}

Multiple Disturber and ICN Calculations

Equations below from the IEEE 802.3 specification 92-44 through 92-48

- $MDNEXT_{loss}(f) = -10\log_{10}(\sum_{i=0}^{i=7} 10^{-NL_i(f)/10})$
- $W_{nt}(f) = \left(\frac{A_{nt}^2}{f_b}\right) \text{sinc}^2\left(\frac{f}{f_b}\right) \left[1/\left(\left(1 + \frac{f}{f_{nt}}\right)^4\right)\right] \left[1/\left(\left(1 + \frac{f}{f_r}\right)^8\right)\right]$
 - Applies the same for ft
- $MDFEXT_{loss}(f) = -10\log_{10}(\sum_{i=0}^{i=6} 10^{-NL_i(f)/10})$
- $\sigma_{nx} = \left(2\Delta f \sum_n W_{nt}(f_n) 10^{\frac{MDNEXT_{loss}(f_n)}{10}}\right)^{1/2}$

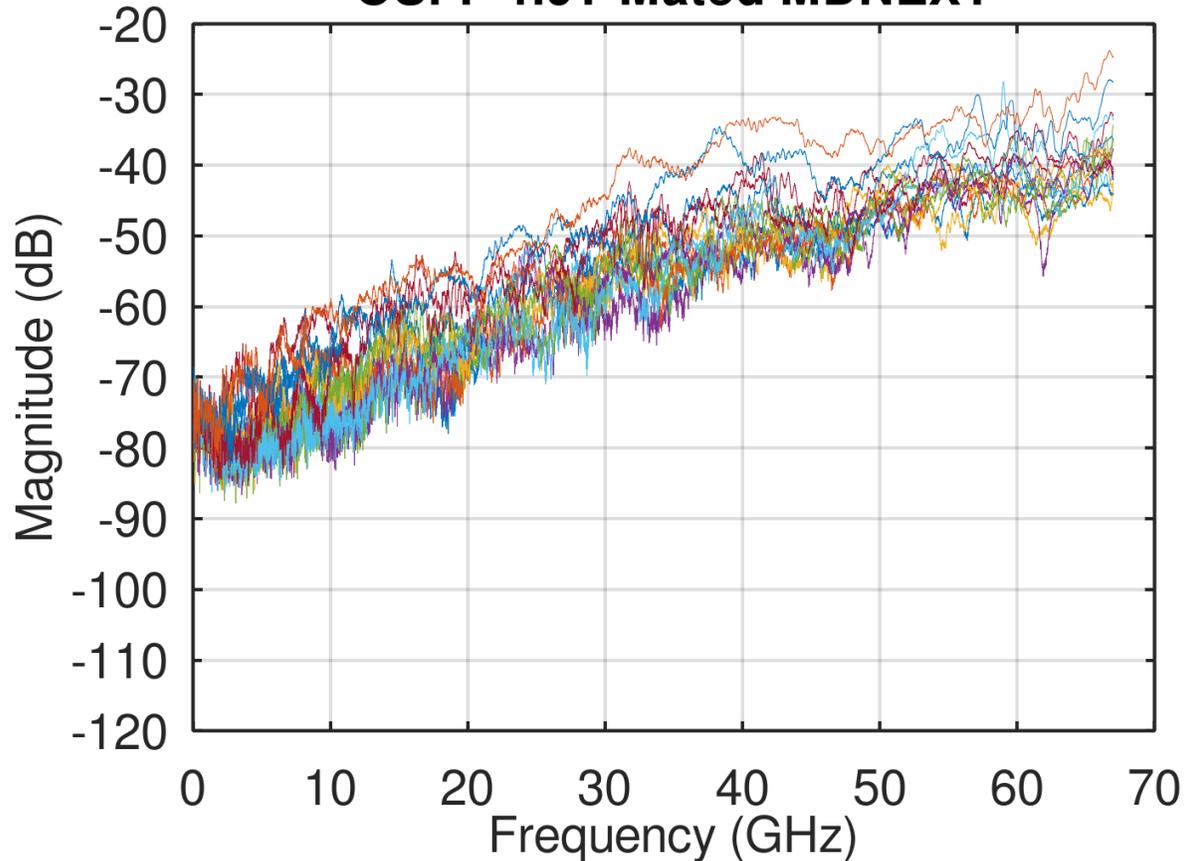
dj Parameters

$$\begin{aligned} f_b &= 106.25 \text{ GBd} & f_{start} &= 50 \text{ MHz} \\ f_r &= 58.4375 \text{ GHz} & f_{stop} &= 67 \text{ GHz} \\ A_{nt} &= 600 \text{ mV} \\ T_{nt} &= 4.25 \text{ ps} \end{aligned}$$

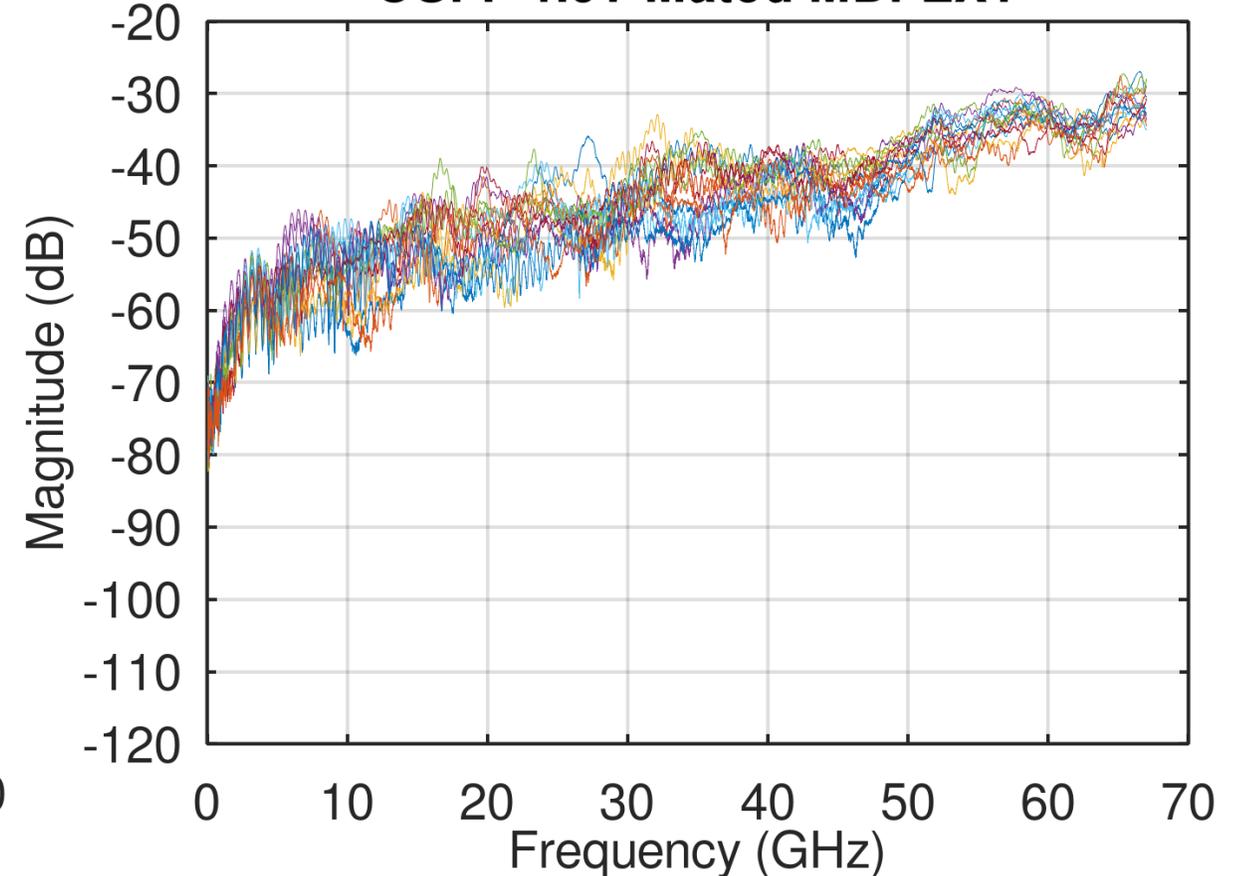
- $\sigma_x \rightarrow \sqrt{\sigma_{nx}^2 + \sigma_{fx}^2}$

Multiple Disturber Plotted Data

OSFP 1.6T Mated MDNEXT



OSFP 1.6T Mated MDFEXT



RX7 victim TX8 aggressor pair and RX8 victim TX7 aggressor pair have a known issue that affects the crosstalk. Disregard the associated MDNEXT for those victims.

ICN Table TX

ICN (mV) from TX FEXT	Victim (HCB) p=port3, n=port4							
Aggressor (MCB) p=port1, n=port2	TX1 (mV)	TX2 (mV)	TX3 (mV)	TX4 (mV)	TX5 (mV)	TX6 (mV)	TX7 (mV)	TX8 (mV)
TX1	NA	0.89399	2.91878	0.61252	1.16779	0.57247	0.59681	0.49867
TX2	0.93662	NA	0.82211	2.32051	0.93475	1.1069	0.69987	1.05754
TX3	2.90367	0.74016	NA	0.64297	1.60013	0.67711	1.68218	0.41602
TX4	0.67322	2.22693	0.97067	NA	1.10203	1.52836	0.79694	1.01853
TX5	0.94451	0.67708	1.77277	0.62022	NA	0.70987	2.36429	0.66731
TX6	0.63732	1.11211	0.8522	1.70869	1.253	NA	0.89427	2.23555
TX7	0.53731	0.52279	1.53513	0.40982	2.75232	0.58351	NA	0.68097
TX8	0.60304	0.69921	0.5729	0.81213	0.7904	1.65401	0.98784	NA
TX MDFEXT	3.42234	2.96035	4.08548	3.21016	3.9727	2.81558	3.41705	2.91277

ICN (mV) from TX NEXT	Victim (HCB) p=port3, n=port4							
Aggressor (HCB) p=port1, n=port2	TX1 (mV)	TX2 (mV)	TX3 (mV)	TX4 (mV)	TX5 (mV)	TX6 (mV)	TX7 (mV)	TX8 (mV)
RX1	0.27231	0.4611	0.25064	0.29884	0.30484	0.39879	0.29068	0.43309
RX2	0.39393	0.30732	0.33789	0.22175	0.33895	0.26839	0.40588	0.26694
RX3	0.25373	0.30892	0.19675	0.34619	0.22552	0.36962	0.27223	0.37657
RX4	0.35893	0.29057	0.31591	0.23319	0.44961	0.25557	0.41331	0.23791
RX5	0.23897	0.32178	0.21651	0.3897	0.27099	0.4107	0.22384	0.47118
RX6	0.27957	0.26808	0.36314	0.19763	0.31356	0.32638	0.65495	0.3716
RX7	0.22914	0.42352	0.23416	0.31719	0.33203	0.59135	0.36651	1.16564
RX8	0.4069	0.32233	0.29555	0.2475	0.59738	0.26964	1.48863	0.40199
TX MDNEXT	0.88084	0.97242	0.79777	0.81578	1.04866	1.0633	1.82307	1.52893

TX ICN total (mV)	3.53387	3.11597	4.16264	3.31219	4.10877	3.00967	3.87296	3.28966
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Worst case crosstalk noise is highlighted in yellow.

ICN Table RX

ICN (mV) from RX FEXT	Victim (MCB) p=port3, n=port4							
Aggressor (HCB) p=port1, n=port2	RX1 (mV)	RX2 (mV)	RX3 (mV)	RX4 (mV)	RX5 (mV)	RX6 (mV)	RX7 (mV)	RX8 (mV)
RX1	NA	0.97741	1.99896	0.7024	0.82472	0.40655	0.73334	0.49825
RX2	0.99623	NA	0.77902	2.00702	0.62951	1.14873	0.596977	0.52974
RX3	1.82529	0.65943	NA	0.8675	1.48435	0.64491	1.03095	0.55193
RX4	0.78967	1.95746	1.09763	NA	0.93584	1.96622	0.77152	1.34326
RX5	0.74244	0.46148	1.50627	0.66461	NA	0.61872	1.60427	0.58338
RX6	0.65828	1.18387	0.88502	2.11164	1.11363	NA	0.85787	2.08623
RX7	0.70338	0.38039	1.07805	0.5488	1.68423	0.70589	NA	0.62498
RX8	0.66211	0.62307	0.61114	1.31752	0.82654	2.13511	0.882	NA
RX MDFEXT	2.62019	2.71464	3.22417	3.49454	2.98589	3.34762	2.57678	2.77869

ICN (mV) from RX NEXT	Victim (MCB) p=port3, n=port4							
Aggressor (MCB) p=port1, n=port2	RX1 (mV)	RX2 (mV)	RX3 (mV)	RX4 (mV)	RX5 (mV)	RX6 (mV)	RX7 (mV)	RX8 (mV)
TX1	0.35357	0.47297	0.33803	0.40295	0.30959	0.29855	0.32563	0.41697
TX2	0.40599	0.36494	0.41286	0.31388	0.38712	0.27229	0.44926	0.38908
TX3	0.24047	0.49447	0.23165	0.374	0.24731	0.61804	0.22947	0.57002
TX4	0.3817	0.22472	0.34762	0.21721	0.82872	0.26639	0.44931	0.26621
TX5	0.25795	0.34524	0.26049	0.34508	0.26442	0.37032	0.27214	0.83282
TX6	0.31988	0.27291	0.46699	0.30165	0.57371	0.23216	0.82006	0.36133
TX7	0.33357	0.69497	0.24471	0.69872	0.31168	1.32232	0.38798	4.01134
TX8	0.46003	0.40847	0.55101	0.41619	0.91407	0.38886	2.86771	0.5564
RX MDNEXT	0.99253	1.22286	1.05292	1.14867	1.52492	1.64529	3.11179	4.23623
RX ICN total (mV)	2.80188	2.97735	3.39174	3.67849	3.35274	3.73008	4.04018	5.06624

Worst case crosstalk noise is highlighted in yellow.

RX7 victim TX8 aggressor pair and RX8 victim TX7 aggressor pair have a known issue that affects the crosstalk. Disregard these specific measurements, the associated RX MDNEXT, and the total ICN for those victims.

Conclusion

- Measured , presented and contributed crosstalk data from prototype HCB/MCB set with 2nd gen. OSFP connector
- ICN limit value for should account for module connector production variances
- Task force members affiliated with module connector vendors are presenting contributions recommending MTF ICN limit
 - Based on data available at the time, I support contribution by Sam Kocsis, Amphenol, suggesting ICN limit