



100 Gbps Copper Cable Measurement and S-Parameter File

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Supporters

Agenda

- Review of prior presentations and data
- Presentation of measured 2m, 26 AWG OSFP cable assembly data
- S-Parameter file review
- Conclusions

Measured Cable Assembly Analysis, & Simulations: Work Done To Date

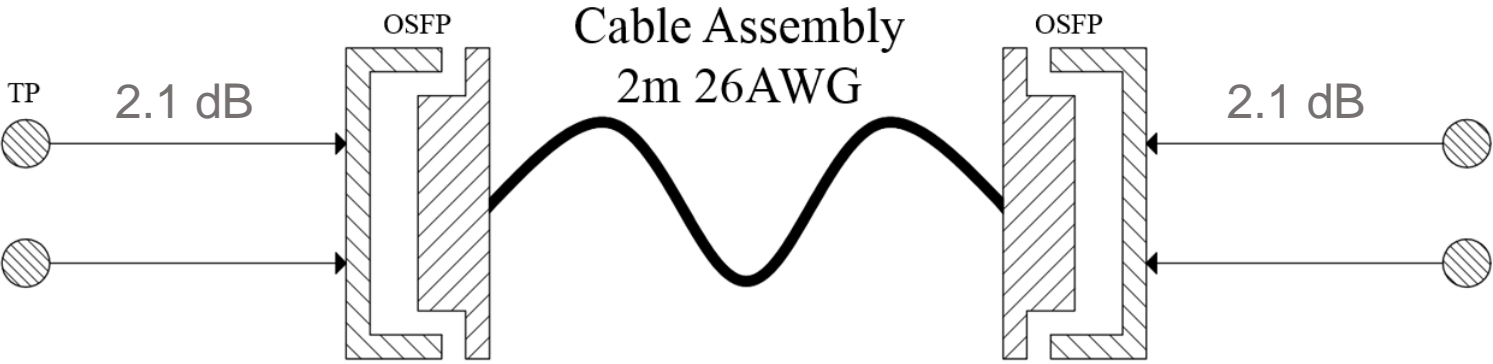
TE has presented cable assembly simulation and measured data previously as our development results have progressed

- tracy_100GEL_01a_0318, recommends 30dB loss budget
- tracy_3ck_02a_1118, suggests there is going to be an issue with the 28dB 2m goal
- February 27, 2019 P802.3ck ad hoc, provided simulation and measured results for a number of cables and configurations, projecting a 19.4 to 20.4 dB loss range of loss for 2m cable assemblies
- tracy_3ck_01a_0319, March 2019, presented some of the Feb 27, 2019 data and contributed two new cable assembly channel S-Parameter simulations for a 1.5m 28AWG cable assembly and a 2m 28AWG cable assembly for working group analysis

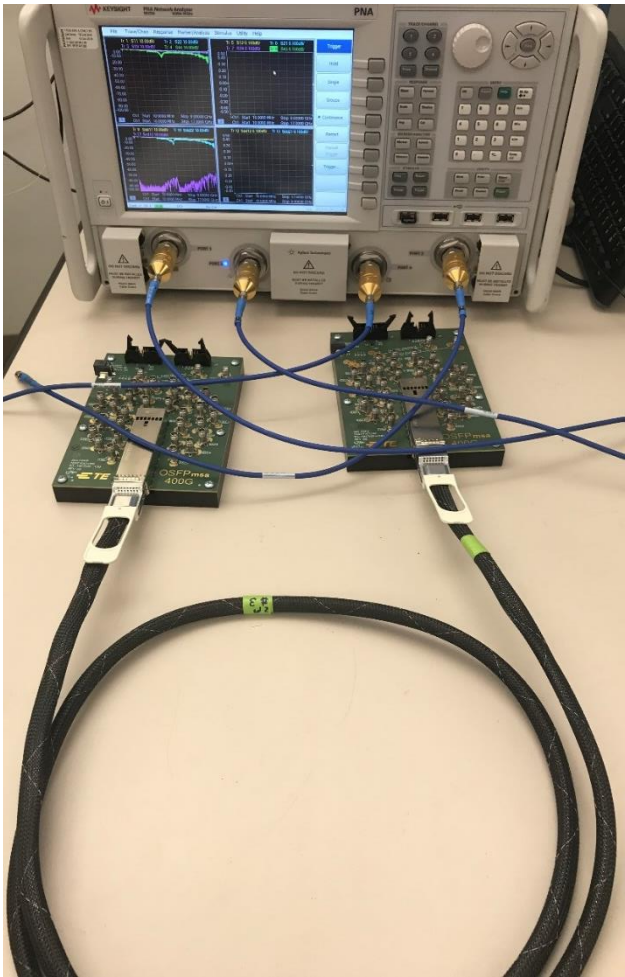
New Work Being Shared

- 2m, 26 AWG OSFP cable assemblies have been built
- Tested with prototype OSFP MCBs and connectors
- MCB trace loss is slightly below draft specification and is approx. 2.1 dB instead of the draft spec. 2.3 dB
 - Slide 7 shows per channel loss limit adjusted by 0.4 dB to 19.6 dB (vs. proposed 20dB) due to MCB loss being low (2 x 0.2 dB)
 - All S-Parameter data is raw measurement and is not adjusted
- S-Parameter files have been contributed as tracy_3ck_02_0719

2m, 26AWG OSFP Cable: TP1-TP4 Test Data



- Data taken from TP1 to TP4
- 10 MHz to 50 GHz
- All Thru files and all XT collected



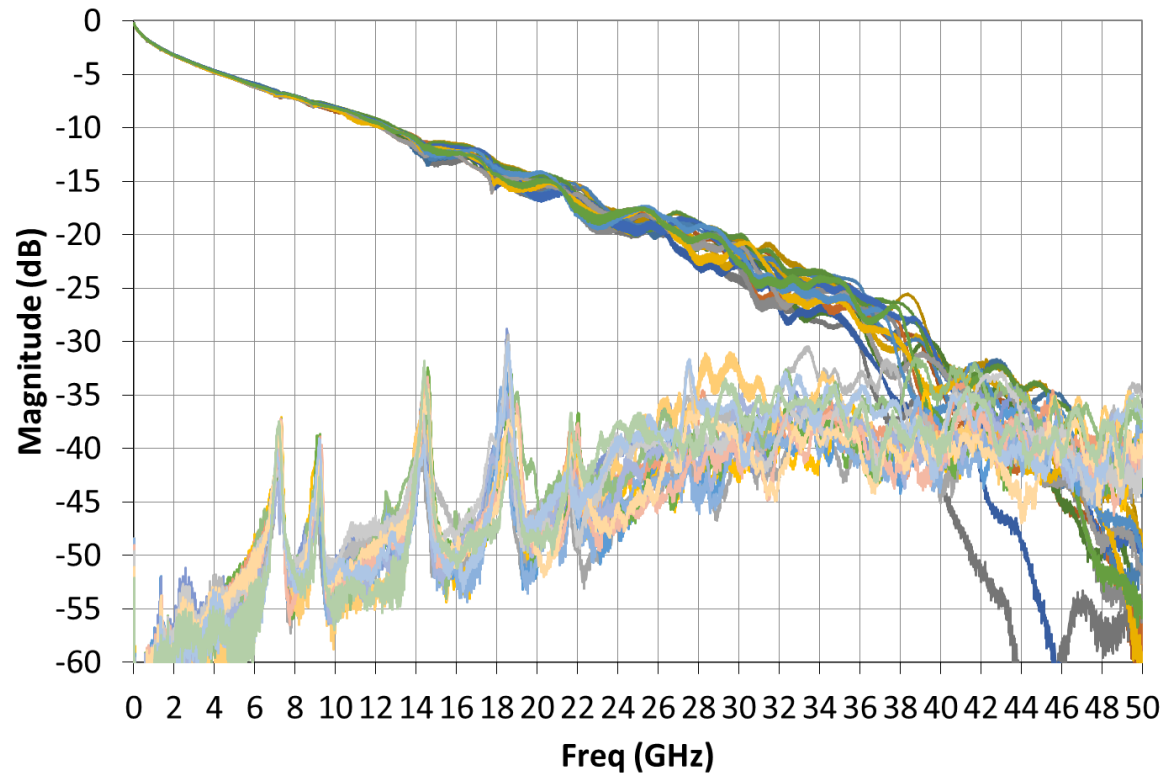
OSFP Pin Map

Pin #	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
	G	Tx1+	Tx1-	G	Tx3+	Tx3-	G	Tx5+	Tx5-	G	Tx7+	Tx7-	G	SB	SB	SB	SB	G	Rx8-	Rx8+	G	Rx6-	Rx6+	G	Rx4-	Rx4+	G	Rx2-	Rx2+	G
	G	Tx2+	Tx2-	G	Tx4+	Tx4-	G	Tx6+	Tx6-	G	Tx8+	Tx8-	G	SB	SB	SB	SB	G	Rx7-	Rxy+	G	Rx5-	Rx5+	G	Rx3-	Rx3+	G	Rx1-	Rx1+	G
Pin #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

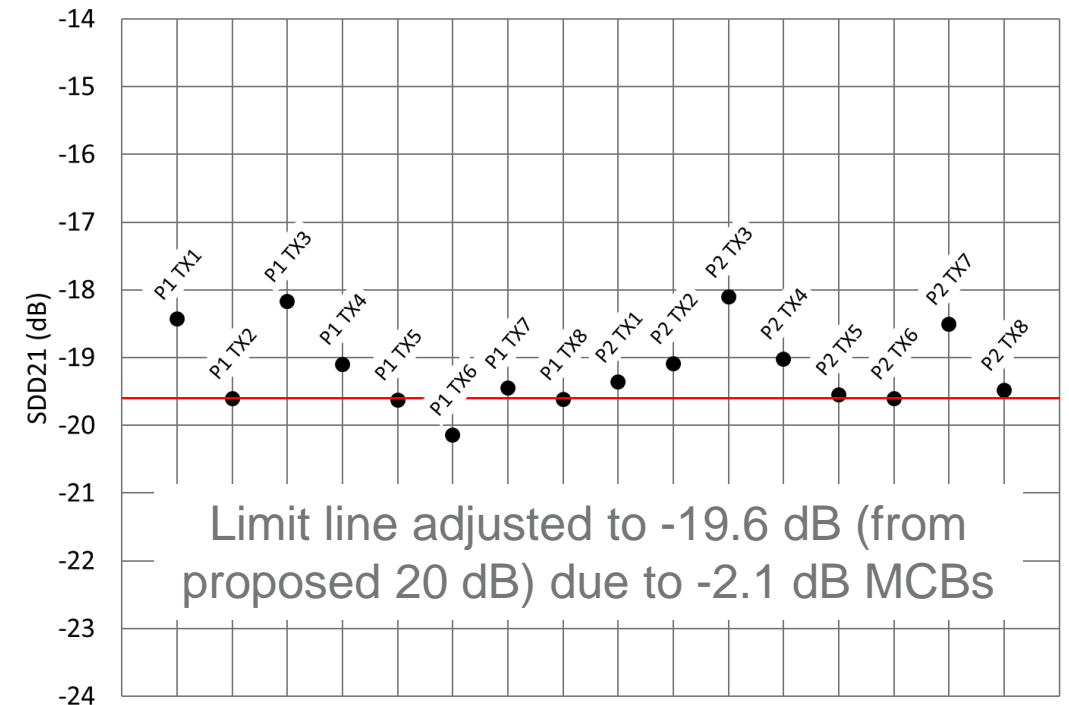
2m, 26AWG OSFP Cable: TP1-TP4 Test Data

- Test data taken using 2.1dB MCBs (Chart on bottom right compensated for this by adjusting limit line by 0.4 dB)
- PSXT includes all aggressors (7 FEXT & 8 NEXT)
- Resonances in crosstalk are from receptacle connector (improvements in development)

SDD21/PSXT of 2m 26AWG OSFP, Tp1-Tp4



Insertion Loss at 26.56 GHz



Used COM 2.70 script
 Config file shown later

- Cd = 120 fF
- Ls = 120 pH
- Cb = 30 fF
- 16 fixed taps with 2 banks of 4 up to 80 UI

PCB Length = 102.7 mm*
 * Improvements expected with less PCB trace

Case 1

- z_p (Tx) = 12mm
- z_p (Rx) = 12mm

Case 2

- z_p (Tx) = 31mm
- z_p (Rx) = 29mm

	IL at 26.56 GHz	COM Case 1	COM Case 2	ERL 11	ERL 22
P1_Tx1	-18.432	4.408	3.363	10.084	9.824
P1_Tx2	-19.602	3.688	2.569	9.040	9.846
P1_Tx3	-18.171	4.731	3.768	10.586	11.172
P1_Tx4	-19.097	4.524	3.453	8.610	9.889
P1_Tx5	-19.622	3.795	2.890	10.955	10.701
P1_Tx6	-20.143	4.237	3.086	9.556	10.383
P1_Tx7	-19.452	3.904	2.938	10.437	8.804
P1_Tx8	-19.619	3.890	2.902	9.314	10.089
P2_Tx1	-19.359	4.867	3.728	10.867	10.949
P2_Tx2	-19.086	4.510	3.440	10.153	10.478
P2_Tx3	-18.107	4.852	3.863	10.533	11.116
P2_Tx4	-19.017	4.408	3.440	9.562	10.100
P2_Tx5	-19.548	3.688	2.865	10.612	9.458
P2_Tx6	-19.607	3.999	3.086	10.604	11.060
P2_Tx7	-18.508	3.768	2.938	10.449	9.696
P2_Tx8	-19.479	3.836	2.950	9.854	10.117

Data is not adjusted for low MCB loss. IL is “as measured”
 and COM / ERL is calculated based on measured data

COM Settings

Table 93A-1 parameters				I/O control			Table 93A-3 parameters		
Parameter	Setting	Units	Information				Parameter	Setting	Units
f_b	53.125	GBd		DIAGNOSTICS	0	logical	package_tl_gamma0_a1_a2	[0 0.0009909 0.0002772]	
f_min	0.05	GHz		DISPLAY_WINDOW	0	logical	package_tl_tau	6.141E-03	ns/mm
Delta_f	0.01	GHz		CSV_REPORT	0	logical	package_Z_c	[87.5 87.5 ; 92.5 92.5]	Ohm
C_d	[1.2e-4 1.2e-4]	nF	[TX RX]	RESULT_DIR	.\results\100GEL_KR_{date}\				
L_s	[0.12, 0.12]	nH	[TX RX]	SAVE_FIGURES	1	logical			
C_b	[0.3e-4 0.3e-4]	nF	[TX RX]	Port Order	[1 3 2 4]		Table 92-12 parameters 5.2dB at 26.56GHz		
z_p select	[1 2]		[test cases to run]	RUNTAG	KR_eval_		Parameter	Setting	
z_p (TX)	[12 31; 1.8 1.8]	mm	[test cases]	COM_CONTRIBUTION	0	logical	board_tl_gamma0_a1_a2	[0 0.000599 0.0001022]	1.286 dB/in or 0.0506 dB/mm at 100 ohms
z_p (NEXT)	[12 29; 1.8 1.8]	mm	[test cases]	Operational			board_tl_tau	6.200E-03	ns/mm
z_p (FEXT)	[12 31; 1.8 1.8]	mm	[test cases]	COM Pass threshold	3	dB	board_Z_c	90	Ohm
z_p (RX)	[12 29; 1.8 1.8]	mm	[test cases]	ERL Pass threshold	10	dB	z_bp (TX)	102.7	mm
C_p	[0.87e-4 0.87e-4]	nF	[TX RX]	DER_0	1.00E-04		z_bp (NEXT)	102.7	mm
R_0	50	Ohm		T_r	6.16E-03	ns	z_bp (FEXT)	102.7	mm
R_d	[45 45]	Ohm	[TX RX]	FORCE_TR	1	logical	z_bp (RX)	102.7	mm
A_v	0.39	V	vp/vf=.694	Include PCB	1	logical			
A_fe	0.39	V	vp/vf=.694	TDR and ERL options			Floating Tap Control		
A_ne	0.578	V		TDR	1	logical	N_bg	2	0 1 2 or 3 groups
L	4			ERL	1	logical	N_bf	4	taps per group
M	32			ERL_ONLY	0	logical	N_f	80	UI span for floating taps
filter and Eq				TR_TDR	0.01	ns	bmaxg	0.1	max DFE value for floating taps
f_r	0.75	*fb		N	3000				
c(0)	0.5		min	beta_x	2.53E+09				
c(-1)	[-0.3:0.02:0]		[min:step:max]	rho_x	0.25				
c(-2)	[0:0.02:0.12]		[min:step:max]	fixture delay time	0	s			
c(-3)	[-0.06:0.02: 0]		[min:step:max]	TDR_W_TXPKG	0				
c(1)	[-0.2:0.05:0]		[min:step:max]	N_bx	24	UI			
N_b	16	UI		Receiver testing					
b_max(1)	0.85			RX_CALIBRATION	0	logical			
b_max(2..N_b)	0.3			Sigma BBN step	5.00E-03	V			
g_DC	[-20:1:0]	dB	[min:step:max]	Noise, jitter					
f_z	21.25	GHz		sigma_RJ	0.01	UI			
f_p1	21.25	GHz		A_DD	0.02	UI			
f_p2	53.125	GHz		eta_0	8.20E-09	V^2/GHz			
g_DC_HP	[-6:1:0]		[min:step:max]	SNR_TX	33	dB			
f_HP_PZ	0.6640625	GHz		R_LM	0.95				

yellow indicates WIP

Comments on *tracy_3ck_02_0719* S-Parameter File

S4P files

Data is TP1 to TP4

10MHz to 50 GHz

All thru files and all cross talk included

Included “Read Me” file provides port identification guidance

Pin #	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
	G	Tx1+	Tx1-	G	Tx3+	Tx3-	G	Tx5+	Tx5-	G	Tx7+	Tx7-	G	SB	SB	SB	SB	G	Rx8-	Rx8+	G	Rx6-	Rx6+	G	Rx4-	Rx4+	G	Rx2-	Rx2+	G
	G	Tx2+	Tx2-	G	Tx4+	Tx4-	G	Tx6+	Tx6-	G	Tx8+	Tx8-	G	SB	SB	SB	SB	G	Rx7-	Rxy+	G	Rx5-	Rx5+	G	Rx3-	Rx3+	G	Rx1-	Rx1+	G
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Summary

2m, 26 AWG, TP1 to TP4 OSFP cable assembly measured results have been presented and contributed

Based on multiple cables built, we believe this demonstrates performance that is consistent with the inclusion of manufacturing variations

Supports 20dB loss for TP1 to TP4

Aligns with 29dB for end to end link, TP0 to TP5

Further performance improvements will be required, but we have time

S-Parameter files included for working group analysis

Recommendation: use this contributed file to get COM configuration narrowed down