Eta_0 & SNR Tx Impact on Copper Cables

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EVERY CONNECTION COUNTS

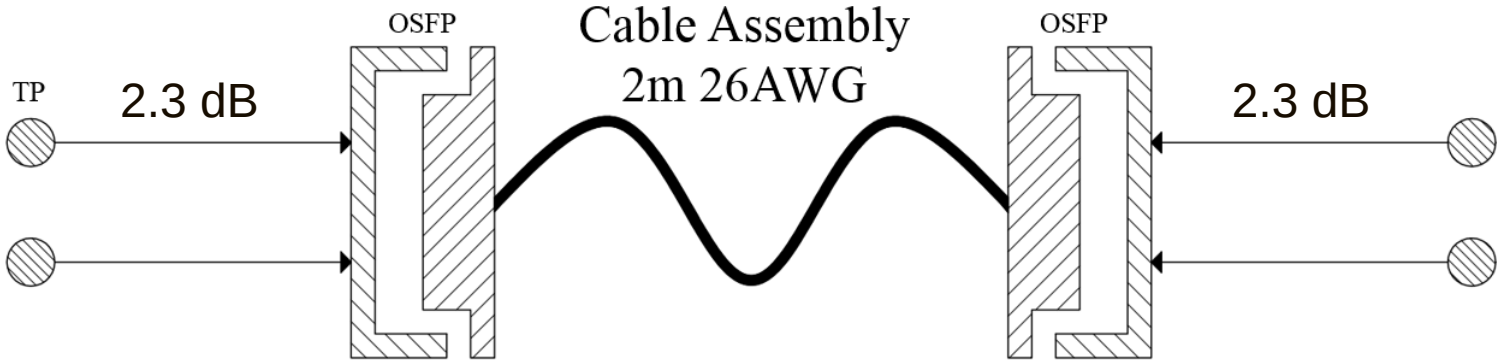
Overview

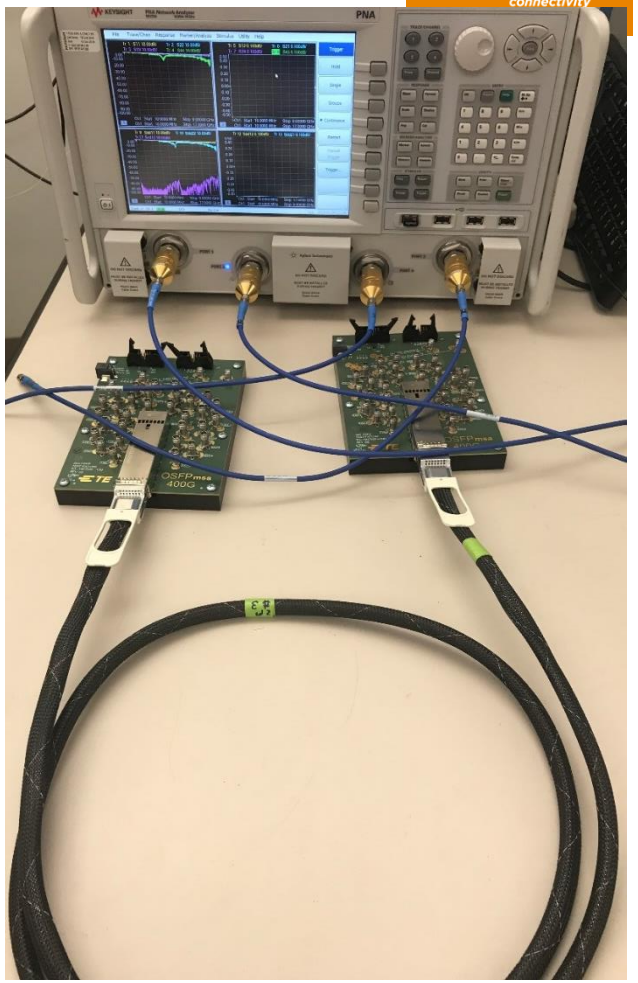
- Description of new work being shared
- Results of copper cable measurements using various COM settings in addition to recommended settings
- Summary

New Work Being Shared

- Various OSFP cable assemblies have been built
- Tested with prototype OSFP MCBs and connectors
- MCB trace loss is per the draft specification, 2.3 dB at 26.56 GHz
- Measurement results were then analyzed using various COM settings specifically in regard to eta_0 and SNR Tx

Test Set-up



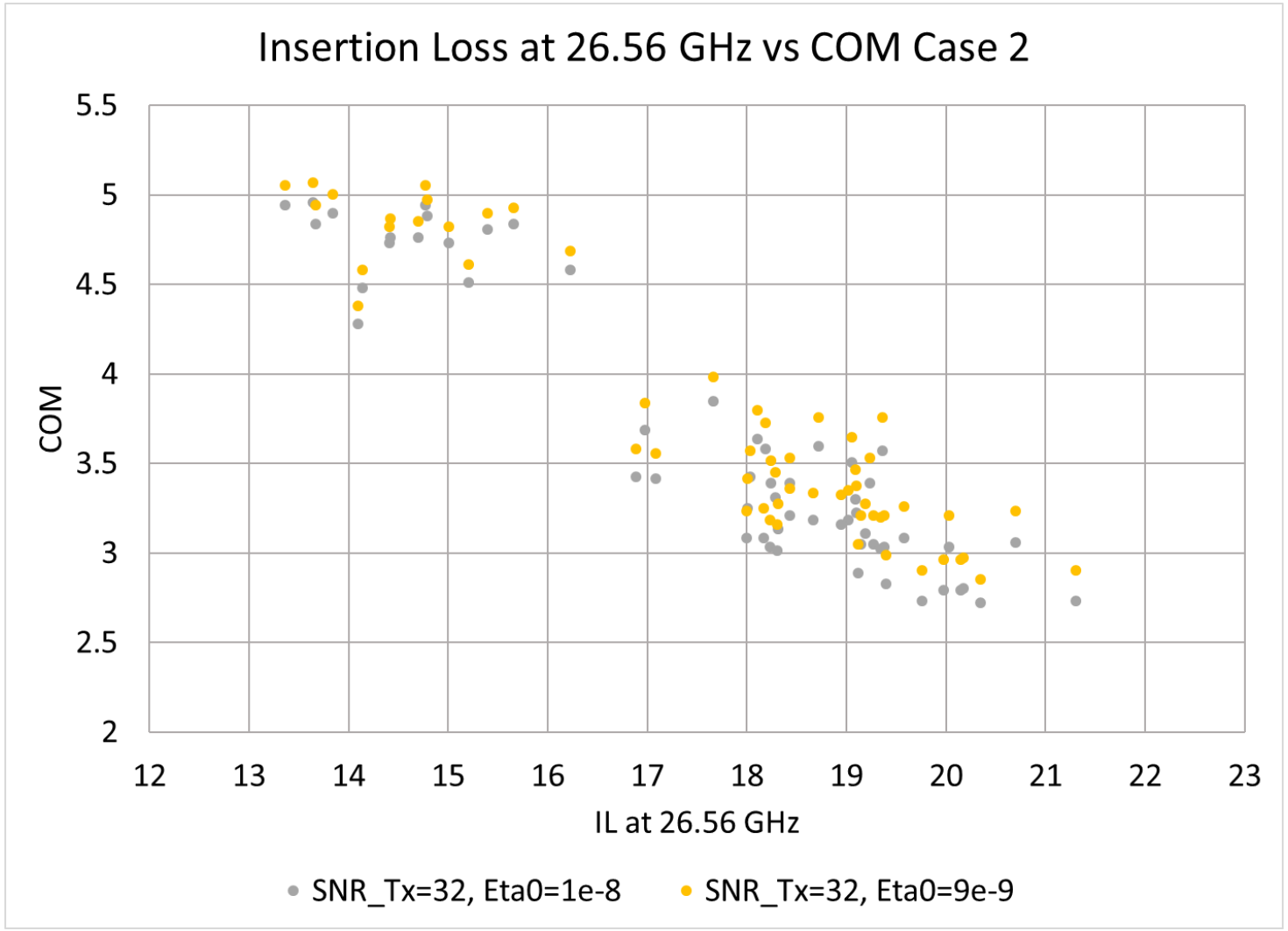


OSFP Pin Map

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

COM vs IL using Varying Eta_0 Values

- Past data shown recommends eta_0 should be 9.0e-9 V^2/GHz
  - lim_3ck_01a_1119
  - mellitz_3ck_03a_1119
- Spec is currently at 1e-8 V^2/GHz
- Plot on right shows IL vs COM for 60 channels using two different eta_0 values
- Average Δ between COM values = 0.15 dB
- 0.15 dB of COM is significant when approaching the Tp1-Tp4 IL target of -19.75 dB as shown in plot
- Adjusting eta_0 back to 9e-9 is recommended to achieve the desired 2m copper reach



COM vs IL using Varying Eta_0 & SNR_Tx Values

- In addition to evaluating Eta_0 impact on COM we also evaluated SNR_Tx
- Plot on right compares
  - Two different SNR_Tx values
  - Two different Eta_0 values
- Latest 2.93 COM setting file has SNR_Tx listed as 32.5, but 32 has also been mentioned in discussions and past contributions
- Keeping SNR_Tx set at 32.5 as listed in latest COM setting file is recommended in order for 2m copper channels to reliably pass specification limits

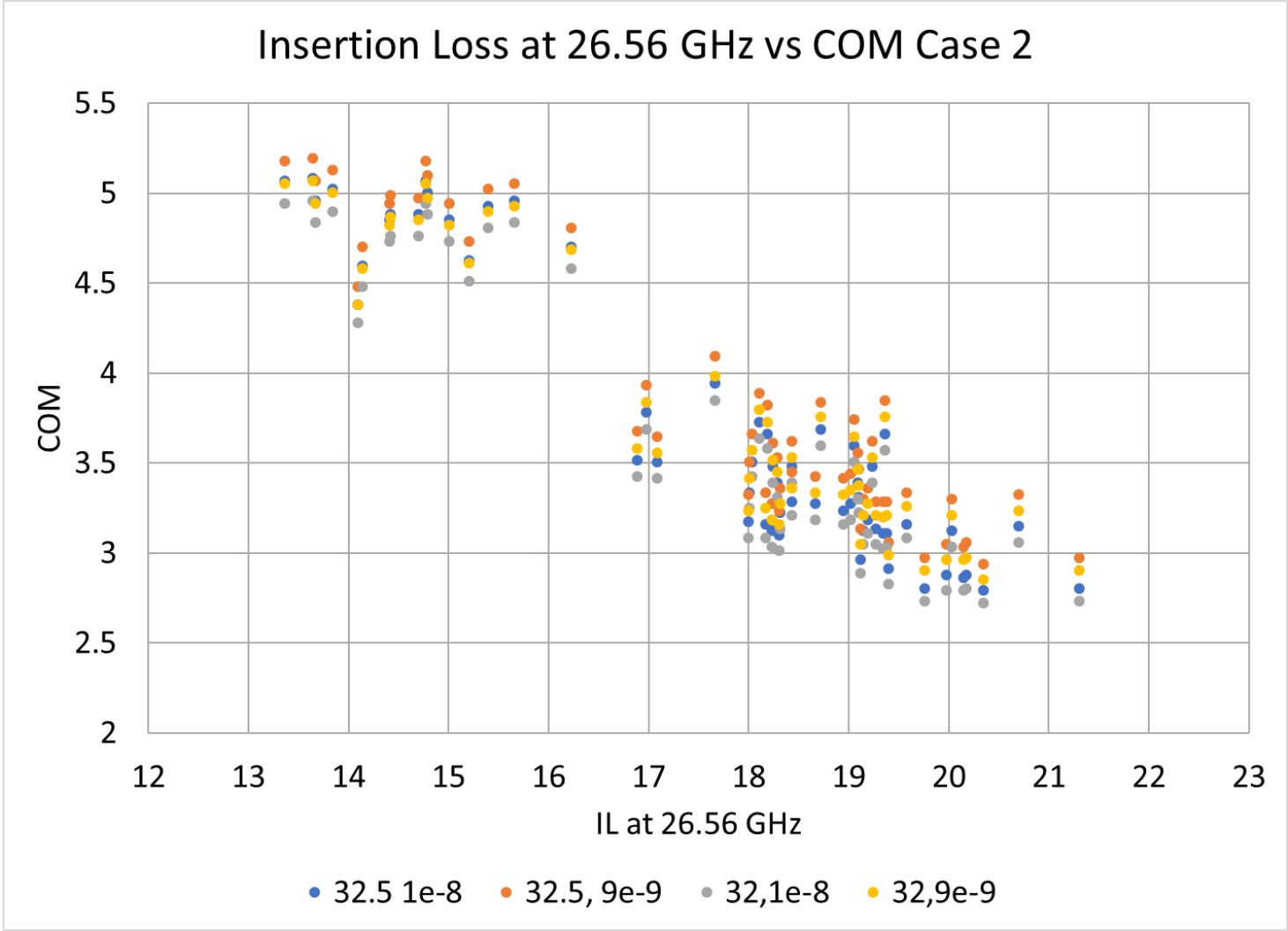


Table 93A-1 parameters			
Parameter	**Setting**	**Units**	**Information**
f_b	53.125	GBd	
f_min	0.05	GHz	
Delta_f	0.01	GHz	
C_d	[1.2e-4 1.2e-4]	nF	[TX RX]
L_s	[0.12, 0.12]	nH	[TX RX]
C_b	[0.3e-4 0.3e-4]	nF	[TX RX]
z_p select	[2]		[test cases to run]
z_p (TX)	[12 31; 1.8 1.8]	mm	[test cases]
z_p (NEXT)	[12 29; 1.8 1.8]	mm	[test cases]
z_p (FEXT)	[12 31; 1.8 1.8]	mm	[test cases]
z_p (RX)	[12 29; 1.8 1.8]	mm	[test cases]
C_p	[0.87e-4 0.87e-4]	nF	[TX RX]
R_0	50	Ohm	
R_d	[50 50]	Ohm	[TX RX]
A_v	0.413	V	
A_fe	0.413	V	
A_ne	0.608	V	
L	4		
M	32		
filter and Eq			
f_r	0.75	*fb	
c(0)	0.54		min
c(-1)	[-0.34:0.02:0]		[min:step:max]
c(-2)	[0:0.02:0.12]		[min:step:max]
c(-3)	[-0.06:0.02: 0]		[min:step:max]
c(1)	[-0.2:0.05:0]		[min:step:max]
N_b	12	UI	
b_max(1)	0.85		
b_max(2..N_b)	[0.3 0.2*ones(1,10)]		
b_min(1)	**-0.85**		
b_min(2..N_b)	**[0.3 0.2*ones(1,10)]**		
g_DC	[-20:1:0]	dB	[min:step:max]
f_z	21.25	GHz	
f_p1	21.25	GHz	
f_p2	53.125	GHz	
g_DC_HP	[-6:1:0]		[min:step:max]
f_HP_PZ	0.6640625	GHz	
GDC_MIN	**0**	**dB**	**l is and ingnore**

I/O control		
DIAGNOSTICS	0	logical
DISPLAY_WINDOW	0	logical
CSV_REPORT	1	logical
RESULT_DIR	.\results\100GEL_KR_{date}\	
SAVE_FIGURES	0	logical
Port Order	[1 3 2 4]	
RUNTAG	KR_eval_	
COM_CONTRIBUTIO	0	logical
Operational		
COM Pass threshold	3	dB
ERL Pass threshold	**10.5**	dB
DER_0	1.00E-04	
T_r	**0.00616071**	ns
FORCE_TR	1	logical
Local Search	**2**	
TDR and ERL options		
TDR	1	logical
ERL	1	logical
ERL_ONLY	0	logical
TR_TDR	**0.01**	ns
N	7000	
beta_x	0.0000E+00	
rho_x	0.618	
fixture delay time	[0.6e-9 0.6e-9]	[port1 port2]
TDR_W_TXPKG	0	
N_bx	**21**	UI
Receiver testing		
RX_CALIBRATION	0	logical
Sigma BBN step	5.00E-03	V
Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	UI
eta_0	9.00E-09	V^2/GHz
SNR_TX	**32.5**	dB
R_LM	0.95	

Table 93A-3 parameters		
Parameter	**Setting**	**Units**
ckage_tl_gamma0_a1	**0.0009909 0.0002772]**	
package_tl_tau	**6.141E-03**	**ns/mm**
package_Z_c	**37.5 87.5 ; 92.5 92.5**	**Ohm**
benartsi_3ck_01_0119 & mellitz_3ck_01_0119		
Table 92-12 parameters		
Parameter	Setting	
board_tl_gamma0_a1_a2	*[3.8206e-04 9.5909e-05]*	
board_tl_tau	*5.790E-03*	ns/mm
board_Z_c	100	Ohm
z_bp (TX)	*110.3*	mm
z_bp (NEXT)	*110.3*	mm
z_bp (FEXT)	*110.3*	mm
z_bp (RX)	*110.3*	mm
C_0	[0.29e-4]	nF
C_1	[0.19e-4]	nF
Include PCB	**1**	**logical**
Floating Tap Control		
N_bg	3	0 1 2 or 3 groups
N_bf	3	taps per group
N_f	40	UI span for floating taps
bmaxg	0.05	max DFE value for floating taps
B_float_RSS_MAX	0.02	rss tail tap limit
N_tail_start	25	(UI) start of tail taps limit
ICN parameters		
f_v	0.723	*Fb
f_f	0.723	*Fb
f_n	0.723	*Fb
f_2	39.844	GHz
A_ft	0.600	V
A_nt	**0.600**	V

TBD in document	**under consideration**
new	

Summary

- TP1 to TP4 OSFP cable assembly measured results have been presented
- Eta_0 settings currently in the draft will make it extremely difficult, if not impossible, to consistently produce copper cable assemblies in compliance with the ck specification
- Recommend to change eta_0 values to 9.0e-9
    - These results are based on OSFP, early indications are showing QSFP-DD will have even less margin to the COM limit and these settings will have more impact
- Recommend to set SNR_Tx at 32.5