End to End COM Estimates for 100G Linear Interface with 30 Meters of OM3

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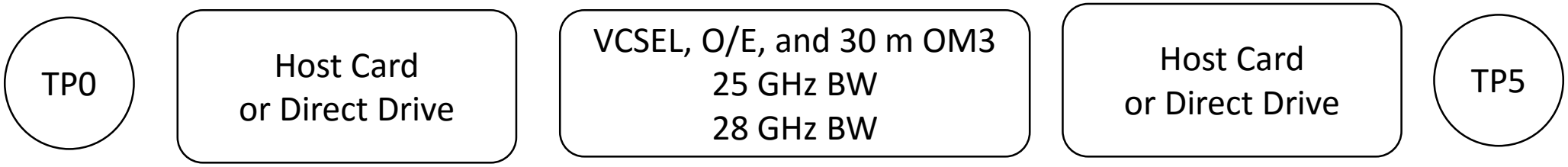
Follow up to “In Support of Linear Interface: Updated Measurements / Simulations”

- Ryan Latchman, Macom
- http://www.ieee802.org/3/db/public/adhoc/presentations/latchman_3db_adhoc_01_101520.pdf
- Illustrate how much working margin that .3ck 100G KR devices could have using a COM end to end analysis.

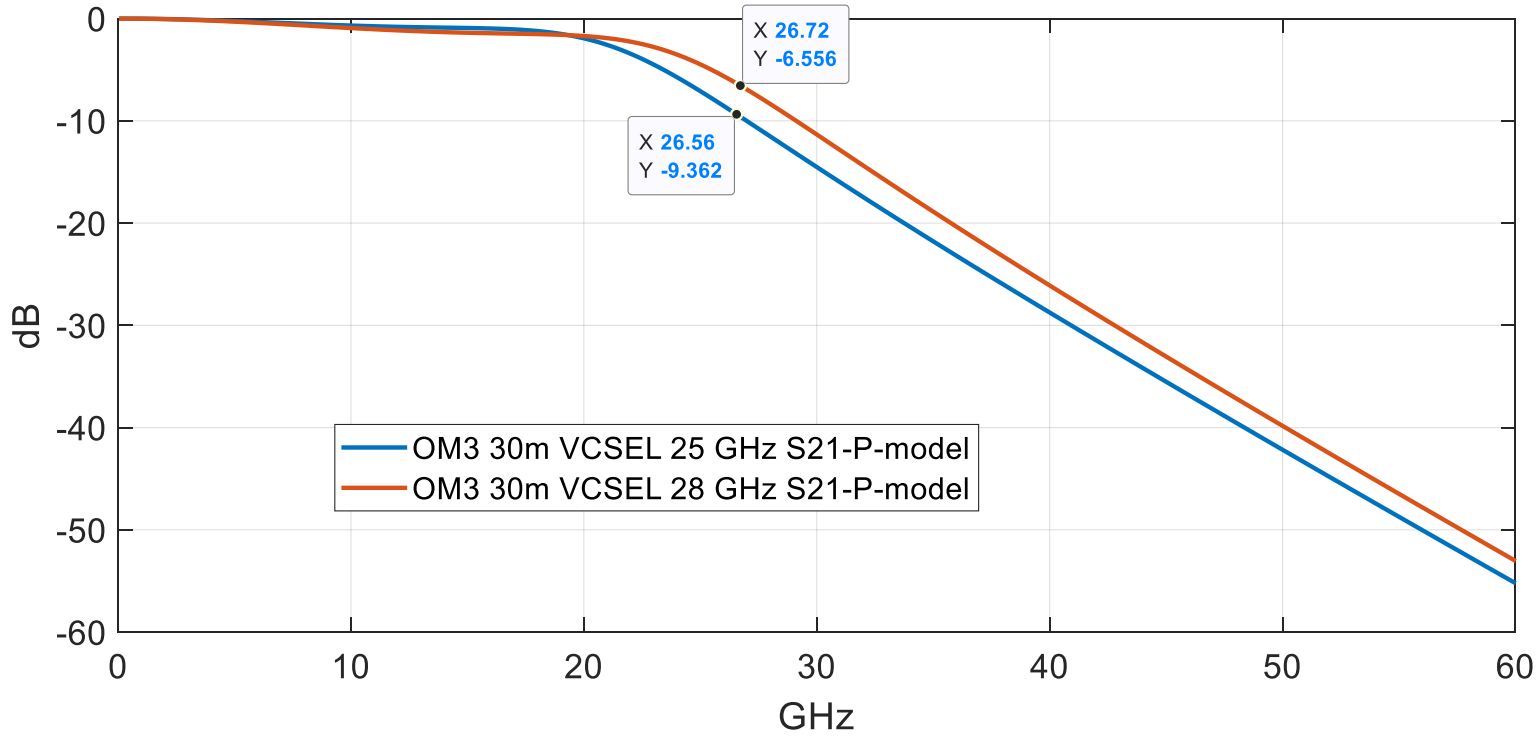
COM End to End Topology



- ❑ Electricals channels
  - 3 short channels from Jane Lim (2”,3” and 4”)
  - 400 mm cabled host
  - 85 mm direct drive die to die
- ❑ Optics
  - 30 m OM3
  - 25 GHz and 28 GHz VCSEL bandwidths

VCSEL 25 GHz and 28 GHz Contribution

- Contribution from Jose Castro, Panduit
- VCSEL, O/E, and 30 meter of OM3 converted to S-parameters

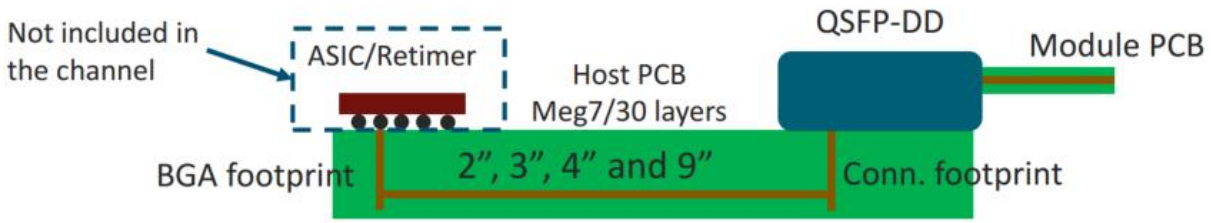


Electrical Channels: Short Host Channels

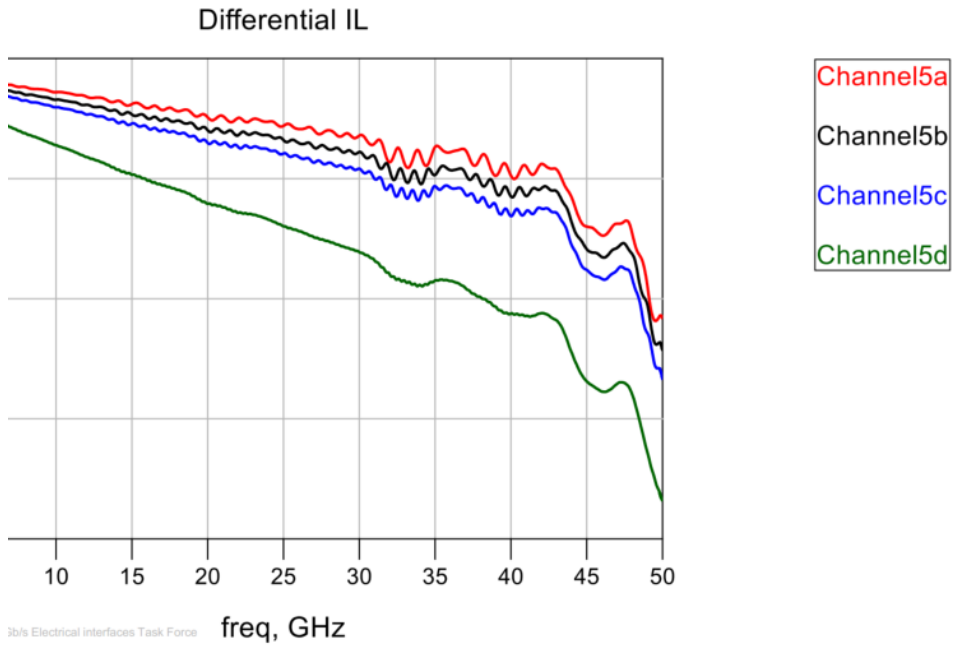
- http://www.ieee802.org/3/ck/public/adhoc/aug14_19/lim_3ck_adhoc_01_073119.pdf

Model Overview

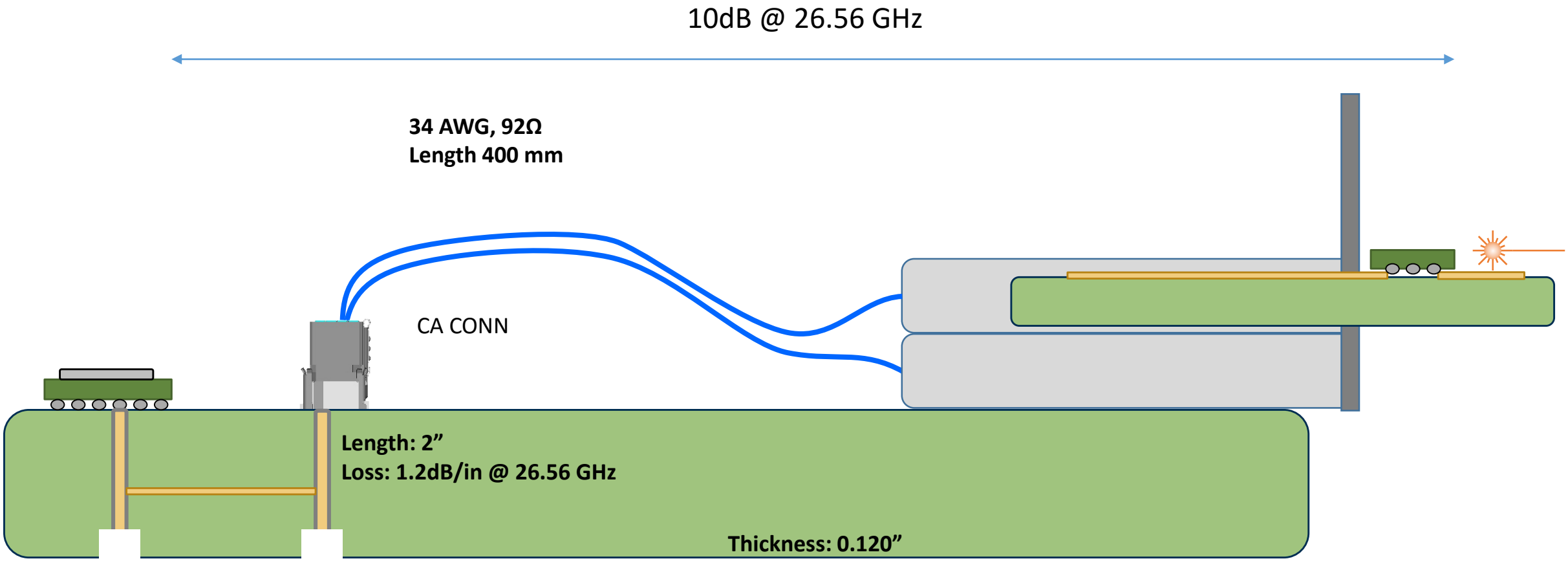
- 16 pairs (8 Tx, 8 Rx) QSFP-DD SMT Connector and host PCB footprint are solved as one piece in HFSS
  - QSFP-DD is the latest updated 112G simulation model
- PCB stackup is 30 layers, 150mil thick, with Meg7 material
- PCB via stub length is modelled as 10mil
- Diff pair trace width/spacing is 4.5mil/8.5mil
- ASIC and retimer footprint are simulated with actual BGA ball-out using the same PCB stackup



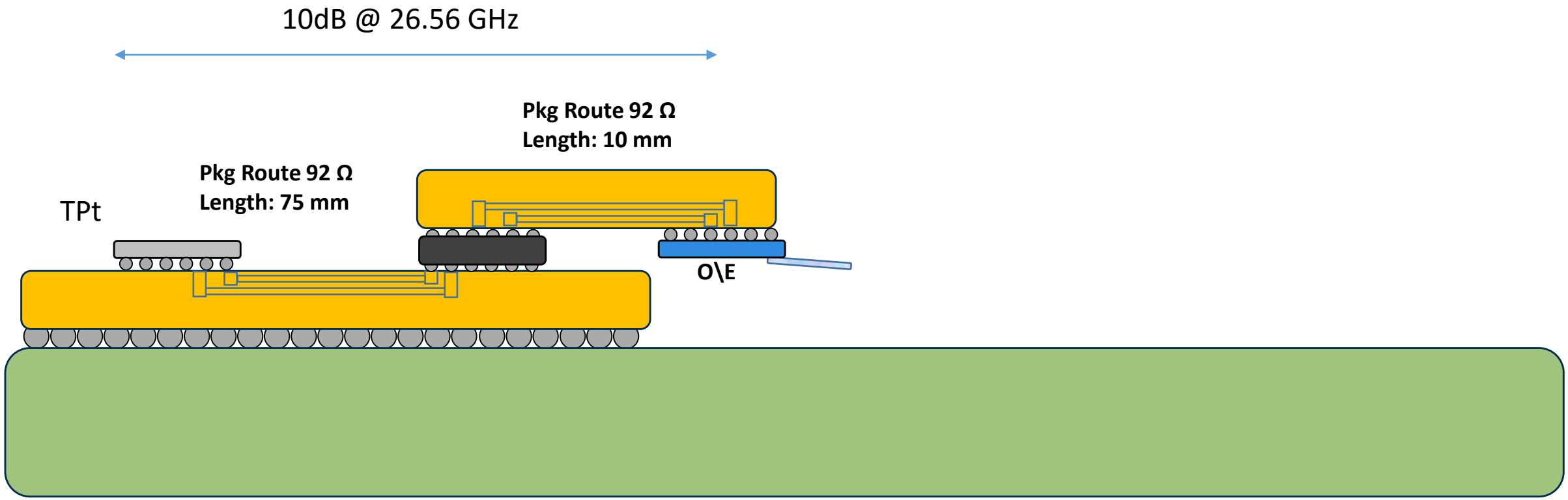
Differential Insertion Loss



FQSFPDD NVAC--DD800Host 400mm Electrical Channel

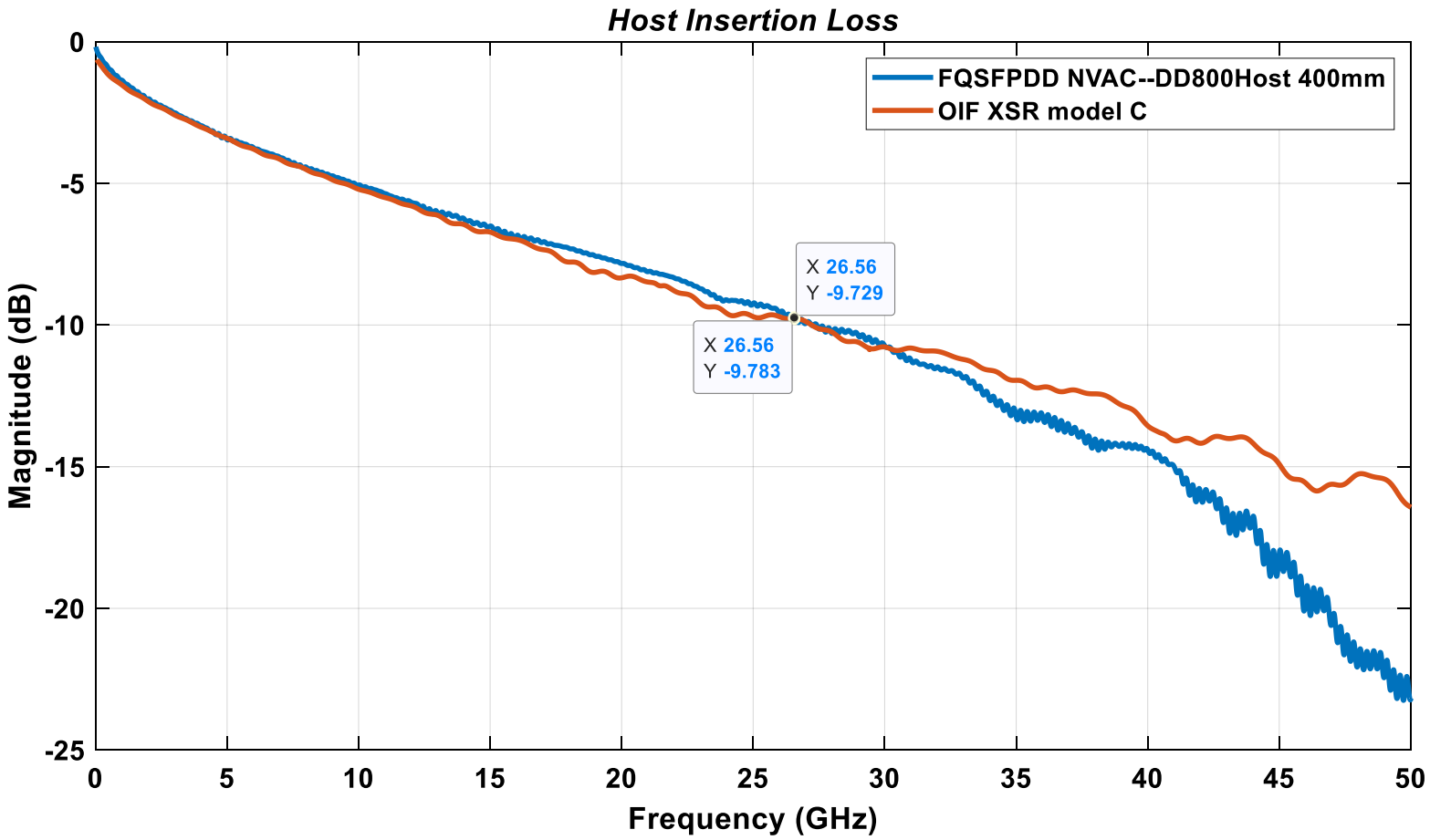


OIF XSR Model C Electrical Channel



OIF (XSR die to die use model C)

FQSPDD 800 and XSR Insertion Loss



COM Computation Example

- COM KR table for P802.3ck D1.3
- COM version 2.95
- No crosstalk
- TP0 to TP5 used
  - Synthesized optic and electrical
- 3 dB is normally required for COM
- Consider
  - This is a first feasibility step in COM modeling
  - Additional feasibility results has been shared in earlier P802.3dB presentations
  - Figure that 4 dB COM would be required to account for extra noise and crosstalk

COM Results

Channel	Host type	COM (dB) 25 GHz VCSEL	COM (dB) 28 GHz VCSEL	HOST IL (dB) @ 25.56 GHz
Lim--Channel5_thru_small_pad_2inch_w_OM3_Length_30m	Front Panel	4.1	4.7	5.7
Lim--Channel5_thru_small_pad_3inch_w_OM3_Length_30m	Front Panel	4.5	4.9	6.9
Lim--Channel5_thru_small_pad_4inch_w_OM3_Length_30m	Front Panel	4.3	4.9	8.2
FQSFPDD_NVAC--DD800Host_400mm_OM3_Length_30m	Front Panel	5.2	5.5	9.8
XSR_Model_C_OM3_Length_30m	XSR - OIF	6.2	6.5	9.8

- Plenty of margin for crosstalk and additional noise

Summary

- End to end channels with 30 meter of OM3 fiber pass COM with wide margin
- There may be more details to consider:
  - Additional noise, linearity, etc.
  - Including these factors not expected to delay SR standardization
- COM margin suggests we are within striking distance
  - Good enough for an objective

Thank You!

BACKUP

COM table for 0.3ck D1.3 (COM 2.95)

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	[1 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)	0.3		
b_min(2..N_b)	[0.05 -0.03*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	

I/O control		
DIAGNOSTICS	1	logical
DISPLAY_WINDOW	1	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_CONTRIBUTION	0	logical
Operational		
COM Pass threshold	3	dB
ERL Pass threshold	8	dB
DER_0	0.0001	
T_r	0.0075	ns
FORCE_TR	1	logical
Local Search	2	
BREAD_CRUMBS	1	logical
SAVE_CONFIG2MAT	1	logical
TDR and ERL options		
TDR	1	logical
ERL	1	logical
ERL_ONLY	0	logical
TR_TDR	0.01	ns
N	3500	
beta_x	0	
rho_x	0.618	
fixture delay time	[0 0]	[port1 port2]
TDR_W_TXPKG	0	
N_bx	21	UI
Tukey_Window	1	logical
Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	UI
eta_0	8.20E-09	V^2/GHz
SNR_TX	33	dB
R_LM	0.95	

Table 93A–3 parameters		
Parameter	**Setting**	**Units**
package_tl_gamma0_a1_a2	[0 0.0009909 0.0002772]	
package_tl_tau	0.006141	ns/mm
package_Z_c	[87.5 87.5 ; 92.5 92.5]	Ohm
Table 92–12 parameters		
Parameter	**Setting**	
board_tl_gamma0_a1_a2	*[0 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	**0**	**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	0.594	*Fb
f_f	0.594	*Fb
f_n	0.594	*Fb
f_2	40.000	GHz
A_ft	0.600	V
A_nt	**0.600**	V
Receiver testing		
RX_CALIBRATION	0	logical
Sigma BBN step	5.00E-03	V