200G/Lane electrical interface jitter parameters

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Abstract

- Jitter and transition time is a trade off between performance and implementation power and cost. Jitter and transition time linearly scaled down from 100G/lane is challenging for massive 200G/lane productions given power and cost constraints.

- ran_3dj_elec_01a_231207 proposed to move the standard forward with some preliminary parameters. We investigated how to optimize σ_{RJ} and A_{DD} for broad implementation and reasonable performance.

Initial simulation conditions

- COM parameters (detail COM parameters in back up)
  - fb : 106.25 GBaud
  - Tx FIR : pre 2 taps, post 0 taps
  - Rx FFE : pre 6 taps, post 45 taps
  - DFE : 1 tap
  - No floating taps
  - DER_0 : 1E-4
  - η_0 : 4.0E-9
  - Tr : 4ps
  - σ_{RJ} : 10mUI
  - A_{DD} : 20mUI
  - Package A (case 2: zp=33mm)
    - ✓ Without MLSE
  - Package B (case 4: zp=45mm)
    - ✓ With MLSE

KR/CR Channels used for the study

- Selected 26 KR/CR channels from contribution to P802.3dj
  - For each data set, selected a few channels with die2die IL ≤ 40dB
    - ✓ If possible, selected with PKG B
    - ✓ If not possible with PKG B, selected with PKG A
  - With PKG A, all channels have die2die IL ≤ 40dB
    - ✓ All 26 channels are used for study with PKG A
  - With PKG B, only channels 1-9,12,16 have die2die IL ≤ 40dB
    - ✓ Only those 11 channels are used for study with PKG B

			CH IL	Fit CH IL	D2D IL	D2D IL	ILD	ERL	ICN	COM (dB) w/ PKG A		COM (dB) w/ PKG B		used for study	
CH#	data set	tag	(dB)	(dB)	PKGA(dB)	PKGB(dB)	(dB)	(dB)	(mV)	w/ MLSE	w/o MLSE	w/ MLSE	w/o MLSE	w/ PKG A	w/ PKG B
1	mellitz_3dj_02_elec_230504	CA 200mm, FO 100mm, PCB 75mm	22.7638	21.5792	32.7456	39.4515	0.20705	18.6363	0.94363	5.1718	4.1102	4.9269	2.9748	x	x
2		CA 200mm, FO 200mm, PCB 50mm	22.3229	21.3837	32.9123	39.2556	0.21796	17.9239	0.93516	4.9469	3.8088	4.2941	2.3837	x	x
3		CA 500mm, FO 100mm, PCB 50mm	22.2536	20.9543	32.9592	39.2247	0.22056	17.7278	0.97363	4.9214	3.7906	4.3284	2.4181	x	x
4		CA 1000mm, FO 100mm, PCB 25mm	21.8556	21.7501	33.0429	39.2081	0.22531	16.7368	0.8868	6.3565	5.0673	5.5984	3.5566	x	x
5	weaver_3dj_02_2305	host1 150mm, host2 150mm	21.7407	22.0272	33.0356	39.1232	0.095847	17.1272	1.2286	4.9157	3.7017	4.2864	2.2928	x	x
6		host1 150mm, host2 200mm	22.302	22.5379	33.4566	39.6155	0.088222	17.1397	1.2241	5.1304	3.6487	4.1698	2.1693	x	x
7		host1 150mm, host2 250mm	22.9027	23.0468	34.1459	40.249	0.08713	17.1585	1.2199	4.7737	3.4397	3.9583	1.9165	x	x
8	akinwale_3dj_01_2310	External 100mm	20.8348	20.5607	30.4362	37.305	0.13515	15.6556	1.127	5.9554	4.5797	5.329	3.2735	x	x
9		External 300mm	22.361	22.2294	31.9688	38.8317	0.13663	15.8851	1.0168	5.6418	4.1382	4.7348	2.6861	x	x
10		External 500mm	24.3314	23.9436	33.9163	40.7901	0.13558	16.0544	0.92529	5.3391	3.6619	3.98	1.9382	x	
11	shanbhag_3dj_02_2305	TP0-TP5 27.4dB	27.414	27.2668	39.7417	45.4115	0.05707	20.5098	0.15032	5.0721	3.5175	1.9905	0.052272	x	
12		TP0-TP5 19.3dB	19.2615	19.8094	31.3187	37.09	0.088295	18.5845	0.19937	6.703	5.7976	5.8174	4.0546	x	x
13		TP0-TP5 28.0dB	27.7126	28.2966	39.7106	45.5274	0.089873	20.5282	0.12077	5.7527	3.8493	2.1651	0.21991	x	
14	shanbhag_3dj_01_2305	TP0-TP5 23.5dB	23.5093	23.2555	35.423	41.351	0.16085	15.9775	0.86255	4.4951	3.6752	3.3999	1.5455	x	
15		TP0-TP5 25.9dB	25.9311	25.6616	37.7637	43.5927	0.15881	16.7607	0.77498	4.2497	3.1728	2.4709	0.57448	x	
16	weaver_3dj_elec_01_230622	host1 150mm, host2 150mm, room temp	21.7407	22.0272	33.0356	39.1232	0.095847	17.1272	0.94075	5.6358	4.437	4.7272	2.7335	x	x
17		host1 150mm, host2 150mm, high temp	24.3128	24.5487	35.5648	41.6778	0.096646	17.9171	0.90613	5.3181	3.7417	3.6152	1.5871	x	
18	weaver_3dj_02_2311	host1 HH, CA-A, host2 HN, vendor Y	23.4169	24.3217	34.729	40.8113	0.15852	16.6477	1.472	5.0421	3.6487	3.6152	1.5871	x	
19		host1 HH, CA-B, host2 HL, vendor Y	26.6144	27.6132	37.8587	43.9932	0.14939	16.1264	1.1745	4.2487	2.6507	-0.49792	-0.49792	x	
20		host1 HN, CA-B, host2 HN, vendor Y	25.1857	26.2401	36.4209	42.5509	0.15243	16.3062	1.2638	4.4788	3.0485	2.2955	0.3365	x	
21		host1 HN, CA-C, hosst2 HL, vendor Y	28.5224	29.5245	39.6505	45.8497	0.14894	16.409	1.0179	3.5853	1.7449	-2.0418	-2.0418	x	
22	kocsis_3dj_02_2305	config 3, host1 4dB, cable 1.5m, host2 4dB	26.6484	27.6629	37.9955	44.0577	0.16851	16.0875	1.3974	4.2955	2.4411	-0.48971	-0.48971	x	
23		config 4, host1 3dB, cable 1m, host2 9dB	26.7388	27.8445	37.956	44.0924	0.17463	15.2592	1.3913	4.2293	2.3609	-0.57143	-0.57143	x	
24		config 5, host1 9dB, cable 1m, host2 3dB	26.7388	27.8445	37.9603	44.0941	0.17463	15.2592	1.3913	4.1839	2.3154	-0.57143	-0.57143	x	
25	lim_3dj_03_230629	Design A	28.0458	28.4533	38.2284	44.8606	0.17267	18.5992	1.7018	3.5111	1.8196	-1.334	-1.334	x	
26	lim_3dj_04_230629	Design B	28.869	27.7792	38.8244	45.586	0.15683	18.2444	0.65531	3.0161	1.608	-1.3489	-1.3489	x	

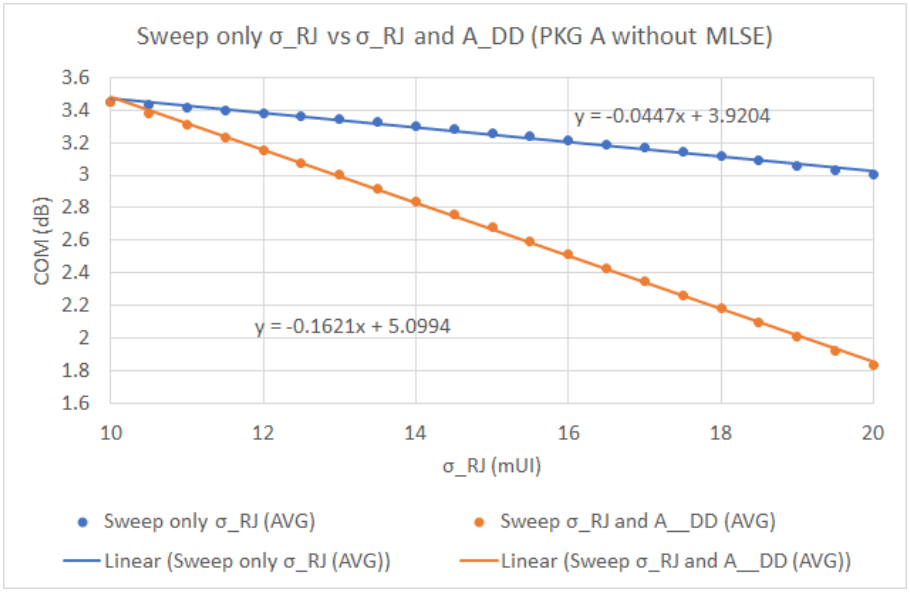
Sweep Conditions

- Sweep 1 : Sweep only σ_{RJ}
  - Sweep σ_{RJ} from 10 mUI to 20 mUI in 0.5 mUI step
  - Fix A_{DD} at 20 mUI

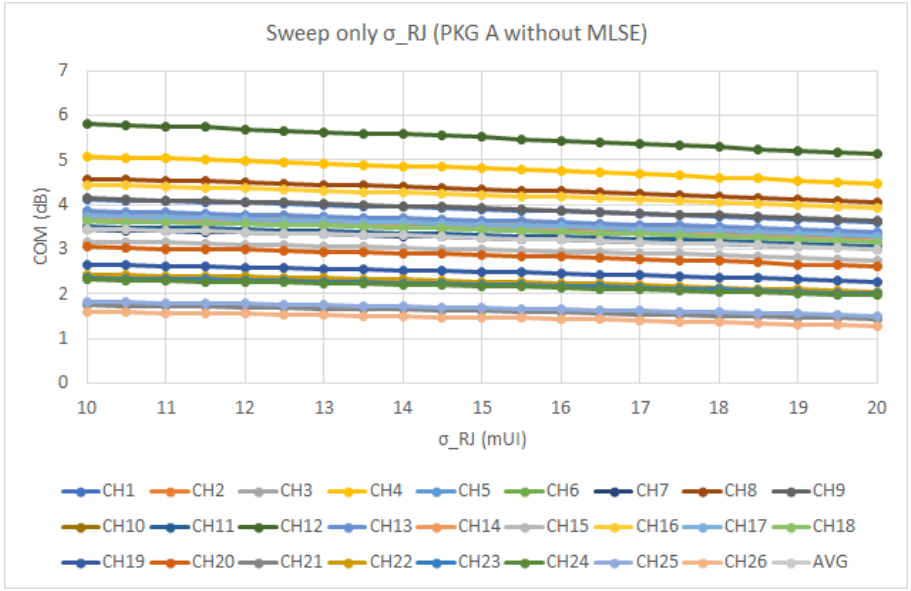
- Sweep 2 : Sweep σ_{RJ} and A_{DD} simultaneously with the same ratio
  - Sweep σ_{RJ} from 10 mUI to 20 mUI in 0.5 mUI step
  - Sweep A_{DD} from 20 mUI to 40 mUI in 1.0 mUI step

Results of Sweep 1&2 w/ PKG A (without MLSE)

- Sweeping only σ_{RJ} changes COM only moderately
- Sweeping σ_{RJ} and A_{DD} results in larger COM difference



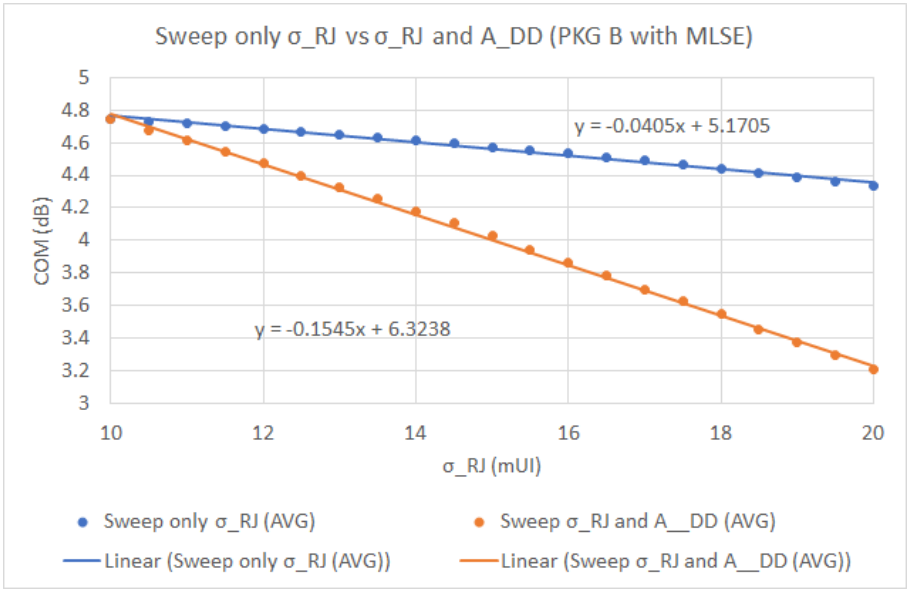
COM in average



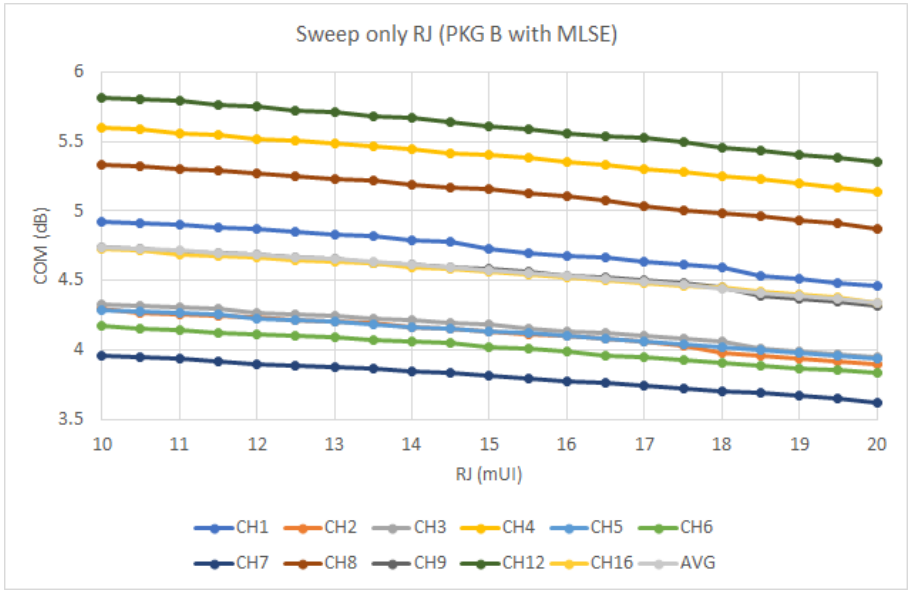
COM of each channel

Results of Sweep 1&2 w/ PKG B (with MLSE)

- Sweeping only σ_{RJ} changes COM only moderately
- Sweeping σ_{RJ} and A_{DD} results in larger COM difference



COM in average



COM of each channel

Summary of Results of Sweep 1 & 2

- COM difference for σ_{RJ} = 15.0mUI from 10mUI with A_{DD} = 20mUI is about 0.18dB

Sweep only σ_RJ

σ_RJ	A_DD	COM (dB)			dCOM		
mUI rms	mUI pk	PKG A w/o MLSE 26 CHs	PKG B w/ MLSE 11 CHs	AVG	PKG A w/o MLSE 26 CHs	PKG B w/ MLSE 11 CHs	AVG
10.0	20	3.452912	4.742791	4.097851	0	0	0
10.5	20	3.436073	4.729791	4.082932	-0.01684	-0.013	-0.01492
11.0	20	3.418831	4.715573	4.067202	-0.03408	-0.02722	-0.03065
11.5	20	3.402381	4.699636	4.051009	-0.05053	-0.04315	-0.04684
12.0	20	3.384735	4.682382	4.033558	-0.06818	-0.06041	-0.06429
12.5	20	3.366715	4.666073	4.016394	-0.0862	-0.07672	-0.08146
13.0	20	3.345092	4.651409	3.998251	-0.10782	-0.09138	-0.0996
13.5	20	3.325669	4.633582	3.979626	-0.12724	-0.10921	-0.11823
14.0	20	3.3056	4.614691	3.960145	-0.14731	-0.1281	-0.13771
14.5	20	3.283423	4.597264	3.940343	-0.16949	-0.14553	-0.15751
15.0	20	3.261904	4.574964	3.918434	-0.19101	-0.16783	-0.17942
15.5	20	3.239185	4.553818	3.896501	-0.21373	-0.18897	-0.20135
16.0	20	3.215796	4.532491	3.874144	-0.23712	-0.2103	-0.22371
16.5	20	3.191473	4.513882	3.852677	-0.26144	-0.22891	-0.24517
17.0	20	3.167681	4.491773	3.829727	-0.28523	-0.25102	-0.26812
17.5	20	3.141208	4.468509	3.804858	-0.3117	-0.27428	-0.29299
18.0	20	3.117088	4.441736	3.779412	-0.33582	-0.30105	-0.31844
18.5	20	3.088696	4.4111	3.749898	-0.36422	-0.33169	-0.34795
19.0	20	3.060958	4.388036	3.724497	-0.39195	-0.35475	-0.37335
19.5	20	3.034265	4.364873	3.699569	-0.41865	-0.37792	-0.39828
20.0	20	3.006127	4.338536	3.672332	-0.44678	-0.40425	-0.42552

Sweep σ_RJ and A_DD

σ_RJ	A_DD	COM (dB)			dCOM		
mUI rms	mUI pk	PKG A w/o MLSE 26 CHs	PKG B w/ MLSE 11 CHs	AVG	PKG A w/o MLSE 26 CHs	PKG B w/ MLSE 11 CHs	AVG
10.0	20	3.452912	4.742791	4.097851	0	0	0
10.5	21	3.380985	4.679218	4.030101	-0.07193	-0.06357	-0.06775
11.0	22	3.309512	4.613418	3.961465	-0.1434	-0.12937	-0.13639
11.5	23	3.234262	4.543964	3.889113	-0.21865	-0.19883	-0.20874
12.0	24	3.156638	4.473691	3.815165	-0.29627	-0.2691	-0.28269
12.5	25	3.077377	4.396055	3.736716	-0.37553	-0.34674	-0.36114
13.0	26	3.001277	4.326127	3.663702	-0.45163	-0.41666	-0.43415
13.5	27	2.919192	4.254045	3.586619	-0.53372	-0.48875	-0.51123
14.0	28	2.841219	4.179773	3.510496	-0.61169	-0.56302	-0.58736
14.5	29	2.762642	4.107482	3.435062	-0.69027	-0.63531	-0.66279
15.0	30	2.680096	4.026855	3.353475	-0.77282	-0.71594	-0.74438
15.5	31	2.597932	3.944682	3.271307	-0.85498	-0.79811	-0.82654
16.0	32	2.51553	3.859682	3.187606	-0.93738	-0.88311	-0.91025
16.5	33	2.432946	3.783682	3.108314	-1.01997	-0.95911	-0.98954
17.0	34	2.349994	3.700736	3.025365	-1.10292	-1.04205	-1.07249
17.5	35	2.267328	3.626527	2.946928	-1.18558	-1.11626	-1.15092
18.0	36	2.180478	3.545691	2.863084	-1.27243	-1.1971	-1.23477
18.5	37	2.093207	3.452073	2.77264	-1.3597	-1.29072	-1.32521
19.0	38	2.013534	3.376218	2.694876	-1.43938	-1.36657	-1.40298
19.5	39	1.926112	3.294264	2.610188	-1.5268	-1.44853	-1.48766
20.0	40	1.836115	3.208573	2.522344	-1.6168	-1.53422	-1.57551

σ_{RJ} and A_{DD} vs Calculated J_{RMS} and J_{3u}/J_{4u}

- If we keep A_{DD} 20mUI and compare the cases with 15 mUI and 10 mUI σ_{RJ}, the difference of J_{RMS} is 11.8%, J_{3u} is 30.4% and J_{4u} is 32.5%.

σ_{RJ} (mUI)	A_{DD} (mUI)	J_{RMS} (mUI)	J_{RMS} (ratio)	J_{3u} (mUI)	J_{3u} (ratio)	J_{4u} (mUI)	J_{4u} (ratio)
10.0	20	22.3607	100.000%	101.810	100.000%	114.385	100.000%
10.5	20	22.5887	101.020%	104.900	103.035%	118.104	103.251%
11.0	20	22.8254	102.078%	107.990	106.071%	121.823	106.503%
11.5	20	23.0705	103.175%	111.080	109.106%	125.542	109.754%
12.0	20	23.3238	104.307%	114.171	112.141%	129.261	113.005%
12.5	20	23.5850	105.475%	117.261	115.177%	132.980	116.257%
13.0	20	23.8537	106.677%	120.351	118.212%	136.699	119.508%
13.5	20	24.1299	107.912%	123.441	121.247%	140.418	122.759%
14.0	20	24.4131	109.179%	126.532	124.282%	144.137	126.010%
14.5	20	24.7032	110.476%	129.622	127.318%	147.856	129.262%
15.0	**20**	**25.0000**	**111.803%**	**132.712**	**130.353%**	**151.576**	**132.513%**

J_{RMS} and J_{3u}/J_{4u} in 100G spec

- Current jitter specs for 100G/L interfaces:

Interface	σ_{RJ} (mUI)	A_{DD} (mUI)	J_{RMS} (mUI)	J_{3u03} (mUI)	J_{3u} (mUI)	J_{4u03} (mUI)	J_{4u} (mUI)
CR (100G/L)	10	20	23	115	125		
KR (100G/L)	10	20	23	106	115		
C2C (100G/L)	10	20	23			118	128

J_{RMS} and J_{3u}/J_{4u} in 200G spec with 15mUI σ_{RJ}

- Compared to 100G spec, we can relax J_{RMS} by 11.8% in terms of UI, J_{3u} by 30.4% and J_{4u} by 32.5%.

Interface	σ_{RJ} (mUI)	A_{DD} (mUI)	J_{RMS} (mUI)	J_{3u03} (mUI)	J_{3u} (mUI)	J_{4u03} (mUI)	J_{4u} (mUI)
CR (200G/L)	15	20	25.7	150	163		
KR (200G/L)	15	20	25.7	138	150		
C2C (200G/L)	15	20	25.7			156	170

Note: The test point insertion loss (TP2 (CR) or TP0d (KR,C2C)) is assumed to be the same as 100G spec in this calculation but will certainly go up. For this increase of insertion loss, the J_{RMS} , J_{3u}, and J_{4u} specifications shall be relaxed further after the test point insertion loss specs are finalized.

Measurement Result of 212.5Gbps Instrument

- Measurement results of instrument-grade TX of 212.5Gbps at TP0d reported by John Calvin (calvin_3dj_elec_01a_240104) passes our proposal for KR (200G/L) spec, without much margin to cover PVT variations. It fails KR (100G/L) spec, if simply scaled from P802.3ck spec.

	Measured result (212.5Gbps)	KR (100G/L) 802.3ck spec	KR (200G/L) our proposal
Jrms	19.6 mUI	23 mUI	25.7 mUI
J3u03	112 mUI	106 mUI	138 mUI
J3u	133 mUI	115 mUI	150 mUI

calvin_3dj_elec_01a_240104, slide 5

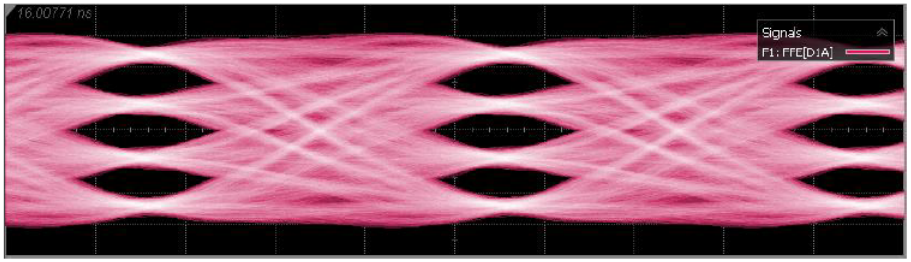
TP0d Instrument direct setup

Pattern Acquisition (0%)

Graphs | Output Jitter

Src: DN Rate: 106.25000 GBd Pat. Length: 8191

Measurement	To L0	To L1	To L2	To L3
J3u (All)	133 mUI			
J3u (R03/F30)	112 mUI			
From L3	109 mUI	115 mUI	132 mUI	--
From L2	115 mUI	131 mUI	--	145 mUI
From L1	142 mUI	--	136 mUI	114 mUI
From L0	--	145 mUI	117 mUI	115 mUI
Jrms (All)	19.6 mUI			
Jrms (R03/F30)	17.0 mUI			
From L3	16.5 mUI	17.5 mUI	20.4 mUI	--
From L2	17.6 mUI	19.8 mUI	--	22.3 mUI
From L1	21.4 mUI	--	20.7 mUI	17.4 mUI
From L0	--	22.2 mUI	17.9 mUI	17.5 mUI
EOJ (All)	19 mUI			
EOJ (R03/F30)	6 mUI			
From L3	1 mUI	9 mUI	14 mUI	--
From L2	4 mUI	1 mUI	--	19 mUI
From L1	2 mUI	--	12 mUI	0 UI
From L0	--	18 mUI	11 mUI	6 mUI



TP0d Conditions:
80GHz 4BT
Direct Measurement from outputs of generator's remote head
Explicit clocking (no CDR, results in slightly higher Jitter values)
Instrument grade TX with 700mV SE/ 1.4V Differential
7 TAP FFE (3 Pre)

Alternative Option: CDR bandwidth

- If linearly scaling jitter parameters are preferred, an alternative option to alleviate implementation challenge due to jitter is to raise CDR bandwidth.
  - TX jitter measurement is lower with higher-bandwidth CDR.
  - TX implementation cost is relaxed by raising CDR bandwidth from 4MHz to a higher value such as 8MHz to keep the same CDR bandwidth to Baud rate ratio.

- This is a viable option.
  - CDR loop SNR is maintained by keeping CDR bandwidth to Baud rate Ratio.
  - CDR circuit can run faster than previous generations.
  - 4MHz is quite low compared to other recent standards:
    - ✓ PCIe Gen5 (32Gbps, NRZ) specifies CDR bandwidth of 20MHz.
    - ✓ PCIe Gen6 (64Gbps, PAM4) specifies CDR bandwidth of 10MHz.

Summary

- Propose σ_{RJ} and A_{DD} to be 15mUI and 20mUI for 200G KR/CR COM analysis. The complete proposal with TX jitter parameters is in page 12.
  - TX J_{RMS} spec is 25.7mUI. TX J_{3u} spec is 163mUI for CR, and 150mUI for KR.
  - COM difference between 10mUI and 15mUI σ_{RJ} is only 0.18dB COM.

- An alternative option to effectively overcome TX jitter challenge is to raise CDR bandwidth to 8 MHz. It keeps jitter parameters the same in the standard and reduces residual jitters after tracking.

Back up

COM parameters for KR/CR channels (package A w/o MLSE)

Table 93A-1 parameters			
Parameter	**Setting**	**Units**	**Information**
f_b	106.25	GBd	
f_min	0.05	GHz	
Delta_f	0.01	GHz	
C_d	[0.4e-4 0.9e-4 1.1e-4 ;0.4e-4 0.9e-4 1.1e-4]	nF	[TX RX]
L_s	[0.13 0.15 0.14; 0.13 0.15 0.14]	nH	[TX RX]
C_b	[0.3e-4 0.3e-4]	nF	[TX RX]
R_0	50	Ohm	
R_d	[45 45]	Ohm	[TX RX]
A_v	0.386	V	vp/vf=
A_fe	0.386	V	vp/vf=
A_ne	0.6	V	
L	4		
M	32		
filter and Eq			
f_r	0.58	*fb	
c(0)	0.55		min
c(-1)	[-0.3:0.05:0]		[min:step:max]
c(-2)	[0:.05:0.1]		[min:step:max]
c(-3)	0		[min:step:max]
c(-4)	0		[min:step:max]
c(1)	0		[min:step:max]
N_b	1	UI	
b_max(1)	0.75		As/dffe1
b_max(2..N_b)	0.3		As/dfe2..N_b
b_min(1)	0		As/dffe1
b_min(2..N_b)	-0.15	S	As/dfe2..N_b
g_DC	[-15:1:-3]	dB	[min:step:max]
f_z	25.16	GHz	
f_p1	40.00	GHz	
f_p2	56.00	GHz	
g_DC_HP	[-5:1:0]		[min:step:max]
f_HP_PZ	1.328125	GHz	

I/O control		
DIAGNOSTICS	1	logical
DISPLAY_WINDOW	0	logical
CSV_REPORT	1	logical
RESULT_DIR	.\results\CACR_set1_{date}\	
SAVE_FIGURES	0	logical
Port Order	**[1 3 2 4]**	
RUNTAG	KR_set1_eval_	
COM_CONTRIBUTION	1	logical
TDR and ERL options		
TDR	1	logical
ERL	1	logical
ERL_ONLY	0	ns
TR_TDR	0.01	
N	4000	logical
TDR_Butterworth	1	
beta_x	0	
rho_x	0.618	
TDR_W_TXPKG	0	UI
N_bx	20	
fixture delay time	[0 0]	
Tukey_Window	1	
Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	V^2/GHz
eta_0	4.00E-09	dB
SNR_TX	33	
R_LM	0.95	
benartsi_3df_01a_2211		
mli_3df_02_220316		

Table 93A–3 parameters			
Parameter	**Setting**	**Units**	Information
package_tl_gamma0_a1_a2	[5e-4 8.9e-4 2e-4]		
package_tl_tau	0.006141	ns/mm	
package_Z_c	[87.5 87.5 ; 92.5 92.5; 100 100; 100 100]	Ohm	
z_p select	[2]		[test cases to run]
z_p (TX)	[12 33 ; 1.8 1.8 ; 0 0 ; 0 0]	mm	[test cases]
z_p (NEXT)	[12 31 ; 1.8 1.8 ; 0 0 ; 0 0]	mm	[test cases]
z_p (FEXT)	[12 33 ; 1.8 1.8 ; 0 0 ; 0 0]	mm	[test cases]
z_p (RX)	[12 31 ; 1.8 1.8 ; 0 0 ; 0 0]	mm	[test cases]
C_p	[0.4e-4 0.4e-4]	nF	[TX RX]
Filter: Rx FFE			
ffe_pre_tap_len	**6**	UI	
ffe_post_tap_len	45	UI	
ffe_tap_step_size	0		
ffe_main_cursor_min	0.7		
ffe_pre_tap1_max	0.7		
ffe_post_tap1_max	0.7		
ffe_tapn_max	0.7		
Operational			
ERL Pass threshold	10	dB	
COM Pass threshold	3	db	
DER_0	1.00E-04		
T_r	0.00400	ns	
FORCE_TR	1	logical	
PMD_type	C2C		
EW	1		
MLSE	0	logical	
ts_anchor	1		
sample_adjustment	[-8 8]		
Local Search	2		

SAVE_CONFIG2MAT	0	
Receiver testing		
RX_CALIBRATION	0	logical
Sigma BBN step	5.00E-03	V
ICN parameters		
f_v	0.278	Fb
f_f	0.278	Fb
f_n	0.278	Fb
f_2	61.625	GHz
A_ft	0.450	V
A_nt	0.450	V

Parameter	**Setting**	
board_tl_gamma0_a1_a2	*6.44084e-4 3.6036e-0*	1.4 db/in @ 53.125G
board_tl_tau	*5.790E-03*	ns/mm
board_Z_c	100	Ohm
z_bp (TX)	*32*	mm
z_bp (NEXT)	*32*	mm
z_bp (FEXT)	*32*	mm
z_bp (RX)	*32*	mm
C_0	[0.2e-4 0]	nF
C_1	[0.2e-4 0]	nF
Include PCB	**0**	**logical**
Seletions (rectangle, gaussian,dual_rayleigh,triangle		
Histogram_Window_Weight	gaussian	selection
Qr	*0.02*	UI
Floating Tap Control		
N_bg	**0**	0 1 2 or 3 groups
N_bf	4	taps per group
N_f	80	UI span for floating taps
bmaxg	0.2	max DFE value for floating taps
B_float_RSS_MAX	0.1	rss tail tap limit
N_tail_start	25	(UI) start of tail taps limit

COM parameters for KR/CR channels (package B w/ MLSE)

Table 93A-1 parameters			
Parameter	**Setting**	**Units**	**Information**
f_b	106.25	GBd	
f_min	0.05	GHz	
Delta_f	0.01	GHz	
C_d	[0.4e-4 0.9e-4 1.1e-4 ;0.4e-4 0.9e-4 1.1e-4]	nF	[TX RX]
L_s	[0.13 0.15 0.14; 0.13 0.15 0.14]	nH	[TX RX]
C_b	[0.3e-4 0.3e-4]	nF	[TX RX]
R_0	50	Ohm	
R_d	[45 45]	Ohm	[TX RX]
A_v	0.386	V	vp/vf=
A_fe	0.386	V	vp/vf=
A_ne	0.6	V	
L	4		
M	32		
filter and Eq			
f_r	0.58	*fb	
c(0)	0.55		min
c(-1)	[-0.3:0.05:0]		[min:step:max]
c(-2)	[0:.05:0.1]		[min:step:max]
c(-3)	0		[min:step:max]
c(-4)	0		[min:step:max]
c(1)	0		[min:step:max]
N_b	1	UI	
b_max(1)	0.75		As/dffe1
b_max(2..N_b)	0.3		As/dfe2..N_b
b_min(1)	0		As/dffe1
b_min(2..N_b)	-0.15	S	As/dfe2..N_b
g_DC	[-15:1:-3]	dB	[min:step:max]
f_z	25.16	GHz	
f_p1	40.00	GHz	
f_p2	56.00	GHz	
g_DC_HP	[-5:1:0]		[min:step:max]
f_HP_PZ	1.328125	GHz	

I/O control		
DIAGNOSTICS	1	logical
DISPLAY_WINDOW	0	logical
CSV_REPORT	1	logical
RESULT_DIR	.\results\CACR_set1_{date}\	
SAVE_FIGURES	0	logical
Port Order	**[1 3 2 4]**	
RUNTAG	KR_set1_eval_	
COM_CONTRIBUTION	1	logical
TDR and ERL options		
TDR	1	logical
ERL	1	logical
ERL_ONLY	0	ns
TR_TDR	0.01	
N	4000	logical
TDR_Butterworth	1	
beta_x	0	
rho_x	0.618	
TDR_W_TXPKG	0	UI
N_bx	20	
fixture delay time	[0 0]	
Tukey_Window	1	
Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	V^2/GHz
eta_0	4.00E-09	dB
SNR_TX	33	
R_LM	0.95	
benartsi_3df_01a_2211		
mli_3df_02_220316		

Table 93A–3 parameters			
Parameter	**Setting**	**Units**	Information
package_tl_gamma0_a1_a2	[5e-4 6.5e-4 3e-4]		
package_tl_tau	0.006141	ns/mm	
package_Z_c	[92 92 ; 70 70; 80 80; 100 100]	Ohm	
z_p select	[4]		[test cases to run]
z_p (TX)	[8 24 30 45 ; 1 1 1 1 ; 1 1 1 1 ; 0.5 0.5 0.5 0.5]	mm	[test cases]
z_p (NEXT)	[8 22 28 43 ; 1 1 1 1 ; 1 1 1 1 ; 0.5 0.5 0.5 0.5]	mm	[test cases]
z_p (FEXT)	[8 24 30 45 ; 1 1 1 1 ; 1 1 1 1 ; 0.5 0.5 0.5 0.5]	mm	[test cases]
z_p (RX)	[8 22 28 43 ; 1 1 1 1 ; 1 1 1 1 ; 0.5 0.5 0.5 0.5]	mm	[test cases]
C_p	[0.4e-4 0.4e-4]	nF	[TX RX]
Filter: Rx FFE			
ffe_pre_tap_len	**6**	UI	
ffe_post_tap_len	45	UI	
ffe_tap_step_size	0		
ffe_main_cursor_min	0.7		
ffe_pre_tap1_max	0.7		
ffe_post_tap1_max	0.7		
ffe_tapn_max	0.7		
Operational			
ERL Pass threshold	10	dB	
COM Pass threshold	3	db	
DER_0	1.00E-04		
T_r	0.00400	ns	
FORCE_TR	1	logical	
PMD_type	C2C		
EW	1		
MLSE	1	logical	
ts_anchor	1		
sample_adjustment	[-8 8]		
Local Search	2		

SAVE_CONFIG2MAT	0	
Receiver testing		
RX_CALIBRATION	0	logical
Sigma BBN step	5.00E-03	V
ICN parameters		
f_v	0.278	Fb
f_f	0.278	Fb
f_n	0.278	Fb
f_2	61.625	GHz
A_ft	0.450	V
A_nt	0.450	V

Parameter	**Setting**	
board_tl_gamma0_a1_a2	*6.44084e-4 3.6036e-0*	1.4 db/in @ 53.125G
board_tl_tau	*5.790E-03*	ns/mm
board_Z_c	100	Ohm
z_bp (TX)	*32*	mm
z_bp (NEXT)	*32*	mm
z_bp (FEXT)	*32*	mm
z_bp (RX)	*32*	mm
C_0	[0.2e-4 0]	nF
C_1	[0.2e-4 0]	nF
Include PCB	**0**	**logical**
Seletions (rectangle, gaussian,dual_rayleigh,triangle		
Histogram_Window_Weight	gaussian	selection
Qr	*0.02*	UI
Floating Tap Control		
N_bg	**0**	0 1 2 or 3 groups
N_bf	4	taps per group
N_f	80	UI span for floating taps
bmaxg	0.2	max DFE value for floating taps
B_float_RSS_MAX	0.1	rss tail tap limit
N_tail_start	25	(UI) start of tail taps limit

Detail Results of Sweep 1

- With PKG A (without MLSE)

Sweep only σ_RJ with PKG A

A_DD	σ_RJ	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12	CH13	CH14	CH15	CH16	CH17	CH18	CH19	CH20	CH21	CH22	CH23	CH24	CH25	CH26	AVG	dAVG
mUI pk	mUI rms	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB
20	10.0	4.1102	3.8088	3.7906	5.0673	3.7017	3.6487	3.4397	4.5797	4.1382	3.6619	3.5175	5.7976	3.8493	3.6752	3.1728	4.437	3.7417	3.6487	2.6507	3.0485	1.7449	2.4411	2.3609	2.3154	1.8196	1.608	3.452912	0
20	10.5	4.0963	3.7819	3.7648	5.0518	3.6884	3.6223	3.4139	4.5667	4.1242	3.6487	3.4915	5.7809	3.8358	3.6619	3.1603	4.4225	3.7284	3.6223	2.6389	3.0239	1.7343	2.4296	2.3381	2.3041	1.8089	1.5975	3.436073	-0.01684
20	11.0	4.0824	3.7685	3.7448	5.0362	3.6752	3.6091	3.4011	4.5408	4.0963	3.6355	3.4785	5.7476	3.8223	3.6355	3.1478	4.3937	3.7017	3.6091	2.6271	3.0116	1.7237	2.4066	2.3268	2.2928	1.7982	1.5767	3.418831	-0.03408
20	11.5	4.0546	3.7551	3.7316	5.0053	3.6487	3.596	3.3882	4.5279	4.0824	3.6091	3.4655	5.7311	3.8088	3.6223	3.1229	4.3793	3.6884	3.5828	2.6036	2.9993	1.7131	2.3952	2.3154	2.2815	1.7875	1.5663	3.402381	-0.05053
20	12.0	4.0408	3.7284	3.7051	4.9744	3.6355	3.5697	3.3754	4.5021	4.0546	3.596	3.4526	5.698	3.7819	3.596	3.1105	4.3649	3.6752	3.5697	2.5919	2.9871	1.7026	2.3837	2.3041	2.2702	1.7768	1.5559	3.384735	-0.06818
20	12.5	4.0132	3.7017	3.6919	4.959	3.6223	3.5566	3.3498	4.4764	4.0408	3.5828	3.4268	5.665	3.7685	3.5828	3.098	4.3362	3.6487	3.5436	2.5802	2.9626	1.692	2.3723	2.2928	2.2589	1.7662	1.5455	3.366715	-0.0862
20	13.0	3.9857	3.6884	3.6655	4.9283	3.596	3.5305	3.3371	4.4508	4.0132	3.5566	3.4139	5.6322	3.7417	3.5566	3.0733	4.3219	3.6355	3.5305	2.5569	2.9504	1.6709	2.3495	2.2702	2.2364	1.7556	1.5248	3.345092	-0.10782
20	13.5	3.9719	3.6619	3.6524	4.8978	3.5828	3.5045	3.3116	4.438	3.9994	3.5436	3.3882	5.5994	3.715	3.5305	3.0609	4.2934	3.6091	3.5045	2.5452	2.926	1.6604	2.3381	2.2589	2.2252	1.7343	1.5144	3.325669	-0.12724
20	14.0	3.9445	3.6487	3.6261	4.8673	3.5566	3.4915	3.2989	4.4125	3.9719	3.5175	3.3626	5.5831	3.7017	3.5175	3.0362	4.265	3.596	3.4785	2.5336	2.9139	1.6499	2.3154	2.2364	2.2028	1.7237	1.4938	3.3056	-0.14731
20	14.5	3.9172	3.6223	3.6	4.8369	3.5305	3.4655	3.2735	4.3871	3.9582	3.4915	3.3498	5.5506	3.6752	3.4915	3.0116	4.2366	3.5697	3.4655	2.5104	2.8896	1.6289	2.3041	2.2252	2.1916	1.7026	1.4834	3.283423	-0.16949
20	15.0	3.89	3.596	3.5869	4.8066	3.5175	3.4397	3.2609	4.3491	3.9309	3.4785	3.3243	5.5182	3.6487	3.4655	2.9993	4.2225	3.5436	3.4397	2.4872	2.8775	1.6184	2.2815	2.2028	2.1693	1.692	1.4629	3.261904	-0.19101
20	15.5	3.8764	3.5697	3.5609	4.7765	3.4915	3.4139	3.2356	4.3238	3.9036	3.4526	3.2989	5.4698	3.6355	3.4397	2.9748	4.1943	3.5175	3.4139	2.4756	2.8534	1.5975	2.2702	2.1916	2.1581	1.6709	1.4526	3.239185	-0.21373
20	16.0	3.8493	3.5436	3.5349	4.7464	3.4655	3.3882	3.2104	4.2986	3.8764	3.4268	3.2862	5.4377	3.6091	3.4139	2.9504	4.1662	3.5045	3.3882	2.4526	2.8293	1.5871	2.2477	2.1693	2.1359	1.6604	1.4321	3.215796	-0.23712
20	16.5	3.8223	3.5175	3.509	4.7165	3.4397	3.3754	3.1853	4.2735	3.8358	3.4011	3.2609	5.4057	3.5828	3.3882	2.926	4.1382	3.4785	3.3626	2.4296	2.8052	1.5663	2.2252	2.1581	2.1137	1.6394	1.4218	3.191473	-0.26144
20	17.0	3.7953	3.4915	3.4832	4.6866	3.4139	3.3498	3.1603	4.236	3.8088	3.3754	3.2356	5.3738	3.5566	3.3626	2.9139	4.1102	3.4526	3.3371	2.4181	2.7813	1.5455	2.2028	2.1359	2.1026	1.6289	1.4014	3.167681	-0.28523
20	17.5	3.7551	3.4655	3.4575	4.6569	3.3882	3.3243	3.1478	4.2111	3.7819	3.3498	3.2104	5.3262	3.5305	3.3371	2.8896	4.0824	3.4268	3.3116	2.3952	2.7574	1.5248	2.1581	2.1137	2.0805	1.608	1.381	3.141208	-0.3117
20	18.0	3.7284	3.4397	3.4318	4.6125	3.3754	3.2989	3.1229	4.1862	3.7551	3.3243	3.1853	5.2946	3.5045	3.3116	2.8654	4.0546	3.4011	3.2862	2.3723	2.7454	1.5144	2.1359	2.0915	2.0585	1.5871	1.3607	3.117088	-0.33582
20	18.5	3.7017	3.4139	3.4062	4.583	3.3371	3.2735	3.098	4.1491	3.7284	3.2989	3.1603	5.2475	3.4655	3.2735	2.8413	4.0132	3.3754	3.2482	2.3495	2.7217	1.4938	2.1137	2.0695	2.0365	1.5663	1.3404	3.088696	-0.36422
20	19.0	3.6752	3.3754	3.3807	4.5389	3.3116	3.2482	3.0733	4.1121	3.7017	3.2735	3.1353	5.2162	3.4397	3.2482	2.8172	3.9857	3.3371	3.223	2.3268	2.6624	1.4732	2.0915	2.0475	2.0145	1.5559	1.3201	3.060958	-0.39195
20	19.5	3.6487	3.3498	3.3426	4.5097	3.2862	3.2104	3.0485	4.0875	3.6752	3.2482	3.1105	5.1694	3.4139	3.223	2.7813	3.9582	3.3116	3.1979	2.3041	2.6389	1.4526	2.0695	2.0255	1.9927	1.5351	1.2999	3.034265	-0.41865
20	20.0	3.6091	3.3243	3.3172	4.466	3.2609	3.1853	3.0116	4.0508	3.6487	3.223	3.0733	5.1384	3.3882	3.1853	2.7574	3.9172	3.2862	3.1603	2.2815	2.6154	1.4321	2.0585	2.0036	1.9708	1.5144	1.2798	3.006127	-0.44678

- With PKG B (with MLSE)

Sweep only σ_RJ with PKG B

A_DD	σ_RJ	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH12	CH16	AVG	dAVG
mUI pk	mUI rms	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB
20	10.0	4.9269	4.2941	4.3284	5.5984	4.2864	4.1698	3.9583	5.329	4.7348	5.8174	4.7272	4.742791	0
20	10.5	4.9147	4.2713	4.317	5.5854	4.2751	4.1586	3.9475	5.3164	4.7229	5.8035	4.7153	4.729791	-0.013
20	11.0	4.9025	4.2599	4.3055	5.5593	4.2638	4.1475	3.9367	5.3038	4.7111	5.7897	4.6915	4.715573	-0.02722
20	11.5	4.8781	4.2485	4.2941	5.5463	4.2525	4.1253	3.919	5.2911	4.6993	5.7621	4.6797	4.699636	-0.04315
20	12.0	4.866	4.2371	4.2713	5.5203	4.23	4.1142	3.8975	5.266	4.6875	5.7484	4.6679	4.682382	-0.06041
20	12.5	4.8538	4.2145	4.2599	5.5074	4.2188	4.1031	3.8867	5.2534	4.664	5.7209	4.6443	4.666073	-0.07672
20	13.0	4.8296	4.2031	4.2485	5.4815	4.2076	4.0921	3.8828	5.2283	4.6523	5.7072	4.6325	4.651409	-0.09138
20	13.5	4.8175	4.1918	4.2258	5.4686	4.1852	4.07	3.8652	5.2158	4.6289	5.6799	4.6207	4.633582	-0.10921
20	14.0	4.7934	4.1693	4.2145	5.4429	4.1671	4.059	3.8438	5.1909	4.6172	5.6663	4.5972	4.614691	-0.1281
20	14.5	4.7813	4.158	4.1918	5.4172	4.156	4.048	3.8331	5.166	4.5939	5.6391	4.5855	4.597264	-0.14553
20	15.0	4.7226	4.1355	4.1805	5.4044	4.1337	4.026	3.8118	5.1536	4.5823	5.612	4.5622	4.574964	-0.16783
20	15.5	4.6986	4.1131	4.158	5.3789	4.1226	4.0081	3.8011	5.1288	4.559	5.585	4.5388	4.553818	-0.18897
20	16.0	4.6747	4.1019	4.1355	5.3534	4.1004	3.9863	3.7799	5.1041	4.5359	5.5581	4.5272	4.532491	-0.2103
20	16.5	4.6628	4.0796	4.1243	5.328	4.0783	3.9644	3.7693	5.0794	4.5243	5.5383	4.504	4.513882	-0.22891
20	17.0	4.639	4.0573	4.1019	5.3027	4.0672	3.9536	3.7481	5.0328	4.5012	5.5249	4.4808	4.491773	-0.25102
20	17.5	4.6152	4.0351	4.0796	5.2774	4.0452	3.9318	3.7269	5.0083	4.4782	5.4982	4.4577	4.468509	-0.27428
20	18.0	4.5916	3.9821	4.0573	5.2522	4.0232	3.9101	3.699	4.9838	4.4553	5.4583	4.4462	4.441736	-0.30105
20	18.5	4.5331	3.96	4.0113	5.2271	4.0012	3.8885	3.6953	4.9594	4.3913	5.4317	4.4232	4.4111	-0.33169
20	19.0	4.5095	3.9379	3.9891	5.2021	3.9794	3.8669	3.6743	4.9351	4.3686	5.4053	4.4002	4.388036	-0.35475
20	19.5	4.4861	3.9159	3.967	5.1647	3.9575	3.8561	3.6534	4.9108	4.3459	5.3789	4.3773	4.364873	-0.37792
20	20.0	4.4627	3.8939	3.9449	5.1398	3.9358	3.8346	3.6256	4.8745	4.3164	5.3526	4.3431	4.338536	-0.40425

Detail Results of Sweep 2

- With PKG A (without MLSE)

Sweep σ_RJ and A_DD with PKG A

A_DD	σ_RJ	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12	CH13	CH14	CH15	CH16	CH17	CH18	CH19	CH20	CH21	CH22	CH23	CH24	CH25	CH26	AVG	dAVG
mUI pk	mUI rms	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB
20	10.0	4.1102	3.8088	3.7906	5.0673	3.7017	3.6487	3.4397	4.5797	4.1382	3.6619	3.5175	5.7976	3.8493	3.6752	3.1728	4.437	3.7417	3.6487	2.6507	3.0485	1.7449	2.4411	2.3609	2.3154	1.8196	1.608	3.452912	N/A
21	10.5	4.0408	3.715	3.7183	4.9744	3.6355	3.5697	3.3626	4.5021	4.0546	3.596	3.4526	5.698	3.7685	3.596	3.098	4.3649	3.6752	3.5566	2.5919	2.9748	1.692	2.3837	2.2928	2.2589	1.7768	1.5559	3.380985	-0.07193
22	11.0	3.9445	3.6487	3.6392	4.8825	3.5566	3.5045	3.2989	4.4125	3.9857	3.5175	3.3754	5.5994	3.7017	3.5175	3.0362	4.2792	3.596	3.4915	2.5336	2.9139	1.6394	2.3268	2.2364	2.2028	1.7131	1.4938	3.309512	-0.1434
23	11.5	3.8764	3.5697	3.5609	4.7916	3.4915	3.4139	3.223	4.3238	3.89	3.4397	3.2989	5.4698	3.6223	3.4397	2.9626	4.1943	3.5175	3.4011	2.4641	2.8534	1.5871	2.2589	2.1804	2.147	1.6709	1.4423	3.234262	-0.21865
24	12.0	3.7819	3.4785	3.4832	4.6717	3.4139	3.3371	3.1603	4.236	3.8088	3.3754	3.223	5.3738	3.5305	3.3498	2.8896	4.1102	3.4397	3.3243	2.4066	2.7813	1.5351	2.1581	2.1137	2.0805	1.6184	1.3912	3.156638	-0.29627
25	12.5	3.7017	3.4011	3.3934	4.5683	3.3371	3.2609	3.0856	4.1491	3.715	3.2862	3.1478	5.2632	3.4526	3.2609	2.8293	4.0132	3.3626	3.2356	2.3381	2.6861	1.4732	2.1026	2.0475	2.0145	1.5559	1.3303	3.077377	-0.37553
26	13.0	3.6223	3.3243	3.3172	4.4794	3.2609	3.1728	3.0116	4.0508	3.6355	3.2104	3.0733	5.1539	3.3754	3.1853	2.7454	3.9309	3.2735	3.1603	2.2702	2.6154	1.4218	2.0365	1.9927	1.9599	1.4938	1.2597	3.001277	-0.45163
27	13.5	3.5175	3.2356	3.2292	4.3663	3.1853	3.098	2.926	3.9536	3.5436	3.1229	2.9993	5.046	3.2862	3.098	2.6743	3.8358	3.1979	3.0733	2.2028	2.5336	1.3607	1.9708	1.9165	1.8841	1.4321	1.2096	2.919192	-0.53372
28	14.0	3.4397	3.1603	3.1544	4.2684	3.0856	3.0239	2.8534	3.8695	3.4655	3.0485	2.9017	4.9394	3.1979	3.0116	2.5919	3.7417	3.1105	2.9993	2.1359	2.4641	1.2999	1.9165	1.8518	1.8196	1.3708	1.1499	2.841219	-0.61169
29	14.5	3.3498	3.0609	3.0803	4.158	3.0116	2.9504	2.7813	3.7442	3.3754	2.9626	2.8293	4.8342	3.1229	2.9382	2.522	3.6487	3.0362	2.9139	2.0585	2.3952	1.2396	1.8518	1.7875	1.7556	1.3201	1.1005	2.762642	-0.69027
30	15.0	3.2609	2.9993	2.9889	4.0624	2.926	2.8534	2.6979	3.661	3.2989	2.8896	2.7574	4.7006	3.0362	2.8534	2.4411	3.5566	2.9382	2.8293	1.9927	2.3154	1.1698	1.7662	1.7237	1.692	1.2496	1.022	2.680096	-0.77282
31	15.5	3.1478	2.9017	2.9061	3.9679	2.8534	2.7813	2.6154	3.567	3.2104	2.7932	2.6743	4.5977	2.9504	2.7574	2.3723	3.4655	2.8534	2.7217	1.9165	2.2477	1.1103	1.7131	1.6499	1.6184	1.1996	0.95384	2.597932	-0.85498
32	16.0	3.0733	2.8172	2.8241	3.848	2.7574	2.6979	2.5336	3.474	3.1229	2.7217	2.5919	4.4805	2.8654	2.6743	2.2815	3.3626	2.7693	2.6389	1.841	2.1581	1.0513	1.6499	1.5871	1.5559	1.1301	0.89587	2.51553	-0.93738
33	16.5	2.9871	2.7335	2.7198	3.7558	2.6743	2.6036	2.4526	3.382	3.0239	2.6389	2.5104	4.3793	2.7574	2.5919	2.214	3.2735	2.6861	2.5569	1.7768	2.0915	0.98297	1.5767	1.5144	1.4834	1.0611	0.82872	2.432946	-1.01997
34	17.0	2.8896	2.6389	2.6395	3.6386	2.5919	2.522	2.3837	3.2796	2.9504	2.5569	2.4181	4.2508	2.6743	2.5104	2.1359	3.1853	2.6036	2.4756	1.7026	2.0145	0.91515	1.5041	1.4423	1.4116	1.0024	0.76209	2.349994	-1.10292
35	17.5	2.8052	2.5569	2.5713	3.5486	2.522	2.4411	2.3041	3.1896	2.8413	2.4641	2.3381	4.1522	2.5802	2.4181	2.0475	3.098	2.5104	2.3837	1.6289	1.9382	0.84785	1.4218	1.3708	1.3404	0.92481	0.70538	2.267328	-1.18558
36	18.0	2.7098	2.4756	2.47	3.4469	2.4296	2.3609	2.214	3.1005	2.7574	2.3723	2.2589	4.0408	2.4988	2.3381	1.9817	2.9871	2.4296	2.3041	1.5455	1.8625	0.79058	1.3505	1.2496	1.2296	0.86703	0.62101	2.180478	-1.27243
37	18.5	2.6154	2.3837	2.392	3.3214	2.3495	2.2702	2.1359	2.9904	2.6743	2.2815	2.1693	3.9309	2.3837	2.2477	1.8841	2.9017	2.3381	2.214	1.4732	1.7768	0.71481	1.2697	1.1797	1.1598	0.80963	0.55594	2.093207	-1.3597
38	19.0	2.5336	2.3041	2.2927	3.2223	2.2702	2.1916	2.0585	2.9033	2.5919	2.2028	2.0805	3.8223	2.3041	2.1693	1.8089	2.8052	2.2477	2.1359	1.4014	1.692	0.64904	1.2096	1.1202	1.1005	0.73369	0.50056	2.013534	-1.43938
39	19.5	2.4181	2.214	2.2054	3.1242	2.1804	2.1026	1.9708	2.8064	2.4988	2.1137	2.0036	3.6884	2.214	2.0695	1.7237	2.7098	2.1581	2.0475	1.3201	1.608	0.58377	1.14	1.0513	1.0317	0.66778	0.42726	1.926112	-1.5268
40	20.0	2.3381	2.1026	2.1137	3.0239	2.0805	1.9599	1.8841	2.7211	2.3952	2.0255	1.9057	3.5828	2.1248	1.9817	1.6499	2.5802	2.0695	1.9599	1.2396	1.5351	0.50977	1.071	0.97325	0.96354	0.59306	0.35458	1.836115	-1.6168

- With PKG B (with MLSE)

Sweep σ_RJ and A_DD with PKG B

A_DD	σ_RJ	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH12	CH16	AVG	dAVG
mUI pk	mUI rms	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB
20	10.0	4.9269	4.2941	4.3284	5.5984	4.2864	4.1698	3.9583	5.329	4.7348	5.8174	4.7272	4.742791	0
21	10.5	4.866	4.2258	4.2713	5.5203	4.23	4.1142	3.8975	5.266	4.664	5.7484	4.6679	4.679218	-0.06357
22	11.0	4.7934	4.1693	4.2145	5.4429	4.1629	4.059	3.8438	5.1909	4.6055	5.6799	4.5855	4.613418	-0.12937
23	11.5	4.6866	4.1019	4.158	5.3661	4.1004	4.0041	3.7905	5.1164	4.5474	5.585	4.5272	4.543964	-0.19883
24	12.0	4.6271	4.0154	4.0908	5.29	4.0452	3.9427	3.7269	5.0205	4.4782	5.5045	4.4693	4.473691	-0.2691
25	12.5	4.5095	3.9379	4.0113	5.2146	3.9794	3.8777	3.6743	4.9472	4.3799	5.4246	4.4002	4.396055	-0.34674
26	13.0	4.451	3.883	3.9339	5.1275	3.9249	3.8132	3.6152	4.8625	4.312	5.3325	4.3317	4.326127	-0.41666
27	13.5	4.3696	3.8175	3.8681	5.0343	3.86	3.7492	3.5425	4.7905	4.2377	5.2613	4.2638	4.254045	-0.48875
28	14.0	4.3005	3.7417	3.8028	4.9488	3.7849	3.6856	3.4909	4.6954	4.1708	5.1709	4.1852	4.179773	-0.56302
29	14.5	4.2206	3.6773	3.738	4.8762	3.7141	3.6225	3.4226	4.6248	4.1044	5.0814	4.1004	4.107482	-0.63531
30	15.0	4.1413	3.6028	3.6666	4.7252	3.6402	3.553	3.3685	4.5432	4.0276	4.9928	4.0342	4.026855	-0.71594
31	15.5	4.074	3.5394	3.5112	4.6304	3.5878	3.4805	3.2809	4.4622	3.9515	4.9052	3.9684	3.944682	-0.79811
32	16.0	3.985	3.3852	3.427	4.5483	3.5149	3.4188	3.2208	4.3821	3.876	4.806	3.8924	3.859682	-0.88311
33	16.5	3.9079	3.3125	3.3644	4.467	3.4427	3.3474	3.1513	4.2958	3.7943	4.7202	3.817	3.783682	-0.95911
34	17.0	3.7786	3.2507	3.3022	4.375	3.3539	3.2696	3.0853	4.2059	3.7201	4.6352	3.7316	3.700736	-1.04205
35	17.5	3.7137	3.1791	3.2302	4.2952	3.293	3.1994	3.0265	4.1169	3.636	4.5511	3.6507	3.626527	-1.11626
36	18.0	3.6315	3.1011	3.1416	4.1981	3.2225	3.1297	2.9419	4.0398	3.5632	4.4559	3.5773	3.545691	-1.1971
37	18.5	3.5359	3.0206	3.0708	4.1087	3.1357	3.0537	2.8744	3.8447	3.4841	4.35	3.4942	3.452073	-1.29072
38	19.0	3.4622	2.9509	3.0007	4.0203	3.0763	2.9753	2.7911	3.7584	3.4022	4.2686	3.4324	3.376218	-1.36657
39	19.5	3.3788	2.8817	2.931	3.9328	2.9977	2.9073	2.7248	3.6416	3.3312	4.1764	3.3336	3.294264	-1.44853
40	20.0	3.3168	2.8059	2.8522	3.8462	2.9129	2.833	2.6496	3.5499	3.2539	4.0212	3.2527	3.208573	-1.53422

Results of sweep 1 with Av=0.413V, Rd=45ohm

- Average COM difference between σ_{RJ}=10mUI and 15mUI
  - 0.20028dB with PKG A without MLSE
  - 0.17787dB with PKG B with MLSE

- Detail results with PKG A (without MLSE)

Results with Av=0.413V for PKG A without MLSE

σ_RJ	A_DD		CH01	CH02	CH03	CH04	CH05	CH06	CH07	CH08	CH09	CH10	CH11	CH12	CH13	CH14	CH15	CH16	CH17	CH18	CH19	CH20	CH21	CH22	CH23	CH24	CH25	CH26	AVG
10mUI	20mUI	COM	4.2152	3.8685	3.8791	5.1968	3.9857	3.9445	3.7551	4.7486	4.3688	3.9172	3.8493	5.9451	4.1802	3.8764	3.4526	4.6866	4.0408	3.8493	2.9504	3.2989	2.0915	2.7217	2.6507	2.6154	2.0915	1.9927	3.698946
15mUI	20mUI	COM	3.986	3.6913	3.6797	4.9196	3.7819	3.7284	3.5697	4.5046	4.1507	3.715	3.6487	5.6485	3.9582	3.6619	3.2609	4.4515	3.8223	3.6355	2.7813	3.1229	1.9491	2.5569	2.4872	2.4526	1.9491	1.8518	3.498665
		dCOM	-0.2292	-0.1772	-0.1994	-0.2772	-0.2038	-0.2161	-0.1854	-0.244	-0.2181	-0.2022	-0.2006	-0.2966	-0.222	-0.2145	-0.1917	-0.2351	-0.2185	-0.2138	-0.1691	-0.176	-0.1424	-0.1648	-0.1635	-0.1628	-0.1424	-0.1409	-0.20028

- Detail results with PKG B (with MLSE)

Results with Av=0.413V for PKG B with MLSE

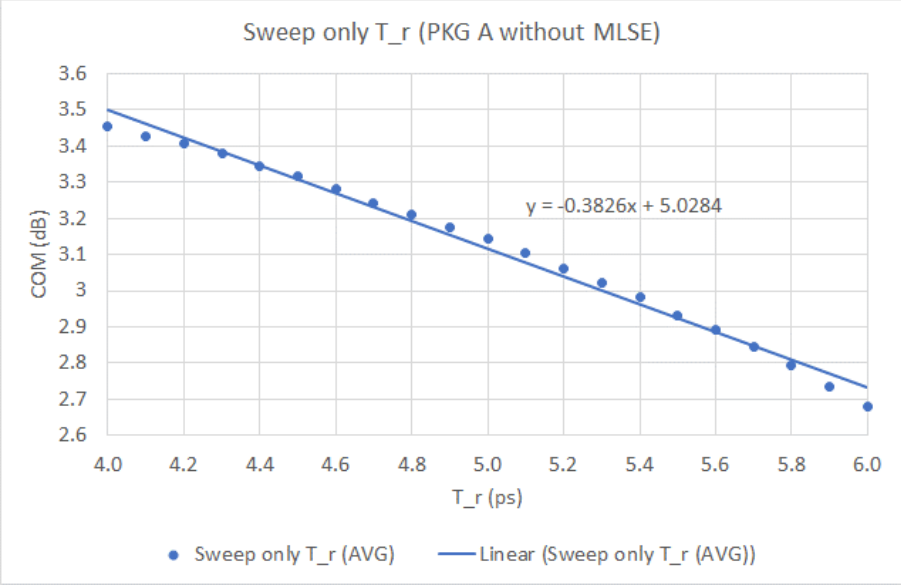
σ_RJ	A_DD		CH01	CH02	CH03	CH04	CH05	CH06	CH07	CH08	CH09	CH12	CH16	AVG
10mUI	20mUI	COM	5.1249	4.4556	4.4789	5.8034	4.6207	4.5294	4.3301	5.547	4.9694	6.049	5.0298	4.994382
15mUI	20mUI	COM	4.9044	4.2941	4.317	5.5984	4.4577	4.3728	4.1777	5.3544	4.801	5.8451	4.859	4.816509
		dCOM	-0.2205	-0.1615	-0.1619	-0.205	-0.163	-0.1566	-0.1524	-0.1926	-0.1684	-0.2039	-0.1708	-0.17787

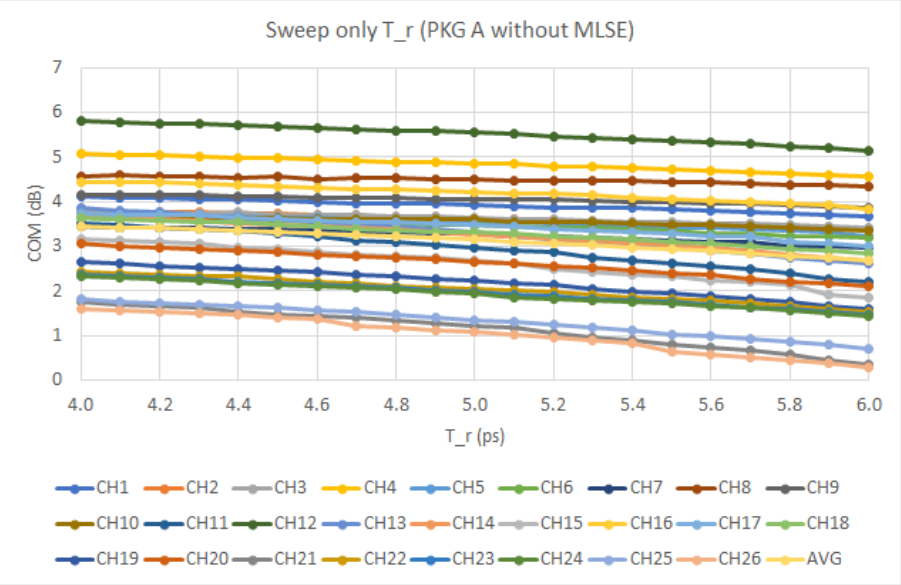
Additional Sweep Conditions

- Sweep 3 : Sweep only Tr
  - Sweep Tr from 4.0ps to 6.0ps in 0.1ps step

Results of Sweep 3 w/ PKG A (without MLSE)

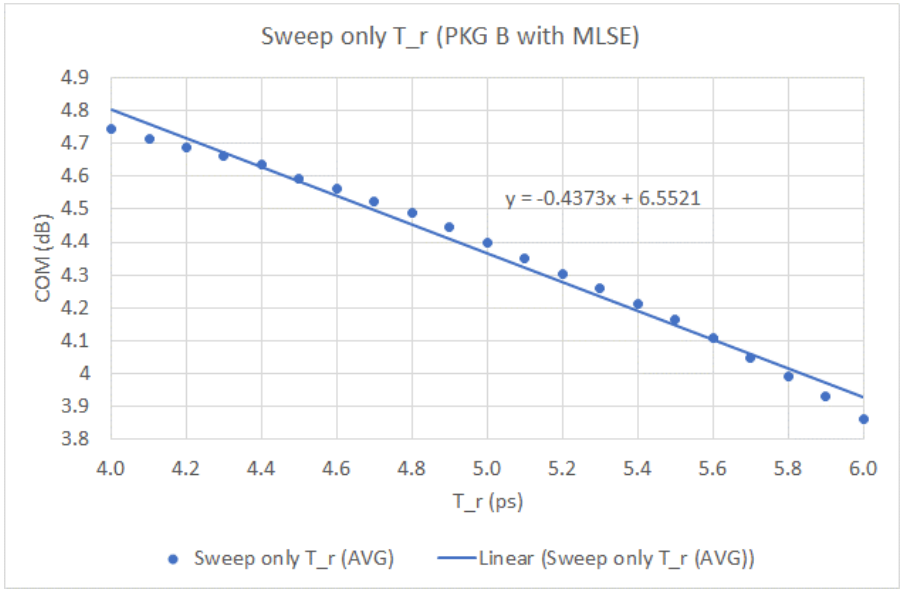
- Sweeping only Tr degrades COM rather significantly

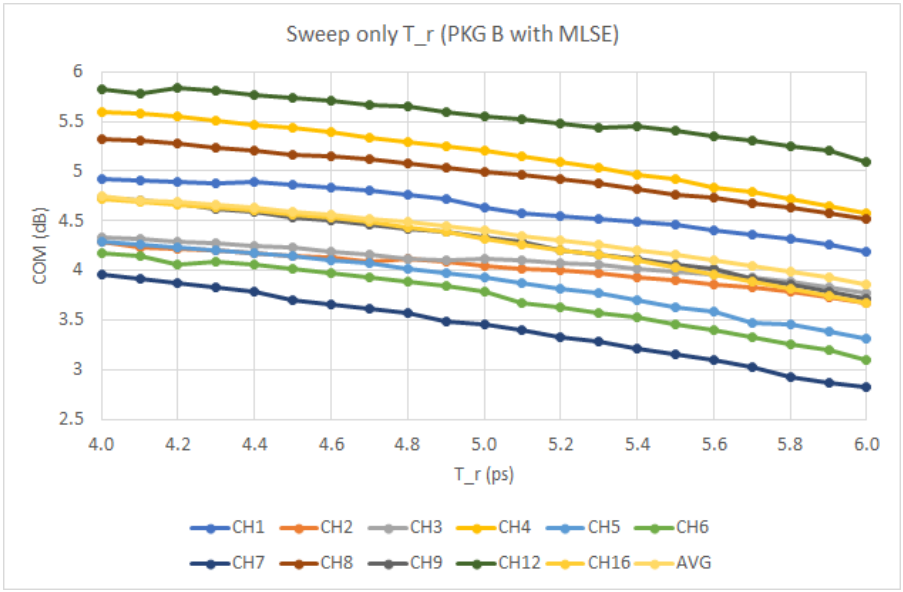




Results of Sweep 3 w/ PKG B (with MLSE)

- Sweeping only Tr degrades COM rather significantly





Summary of Results of Sweep 3

- More study is needed to determine Tr for 200G KR/CR COM analysis.
  - Changing Tr from 4ps to 4.6ps has a minor impact of 0.18dB COM.
  - Implementing Tr=4.6ps over PVT might still be a challenge.

Sweep only T_r

T_r	COM (dB)			dCOM		
ps	PKG A w/o MLSE 26 CHs	PKG B w/ MLSE 11 CHs	AVG	PKG A w/o MLSE 26 CHs	PKG B w/ MLSE 11 CHs	AVG
4.0	3.452912	4.742791	4.097851	0	0	0
4.1	3.426023	4.712482	4.069252	-0.02689	-0.03031	-0.0286
4.2	3.405231	4.688118	4.046674	-0.04768	-0.05467	-0.05118
4.3	3.377885	4.6612	4.019542	-0.07503	-0.08159	-0.07831
4.4	3.344554	4.633909	3.989231	-0.10836	-0.10888	-0.10862
4.5	3.315277	4.592536	3.953907	-0.13763	-0.15025	-0.14394
4.6	3.281058	4.562464	3.921761	-0.17185	-0.18033	-0.17609
4.7	3.243115	4.525191	3.884153	-0.2098	-0.2176	-0.2137
4.8	3.210946	4.486718	3.848832	-0.24197	-0.25607	-0.24902
4.9	3.176635	4.444527	3.810581	-0.27628	-0.29826	-0.28727
5.0	3.145323	4.399191	3.772257	-0.30759	-0.3436	-0.32559
5.1	3.104046	4.349836	3.726941	-0.34887	-0.39295	-0.37091
5.2	3.061775	4.302673	3.682224	-0.39114	-0.44012	-0.41563
5.3	3.023071	4.258155	3.640613	-0.42984	-0.48464	-0.45724
5.4	2.981498	4.211536	3.596517	-0.47141	-0.53125	-0.50133
5.5	2.932187	4.163745	3.547966	-0.52072	-0.57905	-0.54988
5.6	2.890078	4.109364	3.499721	-0.56283	-0.63343	-0.59813
5.7	2.84614	4.048673	3.447406	-0.60677	-0.69412	-0.65045
5.8	2.791844	3.991636	3.39174	-0.66107	-0.75115	-0.70611
5.9	2.736114	3.931245	3.33368	-0.7168	-0.81155	-0.76417
6.0	2.677969	3.860518	3.269244	-0.77494	-0.88227	-0.82861

Detail Results of Sweep 3

- With PKG A (without MLSE)

Sweep only T_r with PKG A

T_r	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12	CH13	CH14	CH15	CH16	CH17	CH18	CH19	CH20	CH21	CH22	CH23	CH24	CH25	CH26	AVG	dAVG
ps	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB
4.0	4.1102	3.8088	3.7906	5.0673	3.7017	3.6487	3.4397	4.5797	4.1382	3.6619	3.5175	5.7976	3.8493	3.6752	3.1728	4.437	3.7417	3.6487	2.6507	3.0485	1.7449	2.4411	2.3609	2.3154	1.8196	1.608	3.452912	0
4.1	4.0963	3.7819	3.7695	5.0518	3.6884	3.6223	3.4268	4.5898	4.1382	3.6619	3.4785	5.7783	3.8088	3.6487	3.1229	4.4225	3.715	3.6091	2.6036	3.0116	1.7026	2.4066	2.3268	2.2928	1.7556	1.5663	3.426023	-0.02689
4.2	4.0824	3.7819	3.7601	5.0362	3.7017	3.6091	3.4011	4.5597	4.1382	3.6752	3.4268	5.7578	3.7685	3.6223	3.0856	4.4225	3.715	3.5828	2.5685	2.9748	1.6604	2.3723	2.3041	2.2702	1.7237	1.5351	3.405231	-0.04768
4.3	4.0685	3.7685	3.7364	5.0207	3.6752	3.6091	3.4139	4.5678	4.1382	3.6487	3.3754	5.7302	3.715	3.5828	3.0485	4.3937	3.6884	3.5566	2.522	2.9382	1.6184	2.3381	2.2702	2.2252	1.6815	1.4938	3.377885	-0.07503
4.4	4.0408	3.7417	3.7509	4.9898	3.6619	3.596	3.3754	4.5483	4.1242	3.6355	3.3371	5.7134	3.6487	3.5175	2.9748	4.3793	3.6355	3.5305	2.4872	2.9017	1.5351	2.3154	2.214	2.1804	1.6604	1.4629	3.344554	-0.10836
4.5	4.027	3.7284	3.7114	4.9744	3.6355	3.5697	3.3754	4.5544	4.1102	3.6355	3.2735	5.6967	3.596	3.4785	2.926	4.3505	3.6223	3.4915	2.4526	2.8654	1.4834	2.2815	2.1804	2.147	1.6184	1.4116	3.315277	-0.13763
4.6	3.9994	3.7017	3.715	4.9437	3.6355	3.5436	3.3498	4.5158	4.0963	3.6223	3.223	5.6632	3.5436	3.4526	2.8775	4.3219	3.5828	3.4526	2.4181	2.8172	1.4321	2.1916	2.147	2.1137	1.5767	1.3708	3.281058	-0.17185
4.7	3.9719	3.6884	3.7017	4.9283	3.596	3.5436	3.3243	4.5415	4.0963	3.6091	3.1353	5.63	3.4915	3.4139	2.8172	4.2792	3.5566	3.3882	2.3609	2.7813	1.3912	2.1581	2.1026	2.0695	1.5248	1.2196	3.243115	-0.2098
4.8	3.9719	3.6487	3.6752	4.8978	3.5828	3.5175	3.3116	4.518	4.0824	3.6091	3.0856	5.5968	3.4397	3.3754	2.7813	4.265	3.5305	3.3626	2.3268	2.7335	1.3303	2.1137	2.0695	2.0365	1.4526	1.1698	3.210946	-0.24197
4.9	3.9445	3.6355	3.6619	4.8825	3.5566	3.4915	3.2989	4.5072	4.0685	3.596	3.0362	5.5803	3.3754	3.3243	2.7335	4.2366	3.5045	3.3116	2.2702	2.6979	1.2798	2.0695	2.0255	1.9927	1.3912	1.1202	3.176635	-0.27628
5.0	3.9309	3.6091	3.6355	4.8521	3.5566	3.4655	3.2735	4.4953	4.0546	3.596	2.9748	5.5473	3.3243	3.2609	2.6743	4.2225	3.4655	3.3116	2.2252	2.6507	1.2196	2.0585	1.9927	1.9599	1.3505	1.071	3.145323	-0.30759
5.1	3.89	3.596	3.6223	4.8369	3.5305	3.4526	3.2356	4.4824	4.0546	3.5566	2.9139	5.5145	3.223	3.223	2.6154	4.1943	3.4526	3.2735	2.1693	2.6036	1.1698	2.0145	1.9057	1.8625	1.2999	1.0122	3.104046	-0.34887
5.2	3.8628	3.5828	3.596	4.7916	3.5175	3.4268	3.223	4.4827	4.0408	3.5436	2.8654	5.4492	3.1728	3.1728	2.4872	4.1662	3.3882	3.2356	2.1248	2.5569	1.0415	1.9708	1.8841	1.8196	1.2496	0.95384	3.061775	-0.39114
5.3	3.8628	3.5566	3.5697	4.7916	3.4915	3.4139	3.1979	4.4821	4.027	3.5305	2.7454	5.4329	3.1105	3.1229	2.4296	4.1382	3.3498	3.1853	2.0475	2.5104	0.96354	1.9165	1.8303	1.7982	1.1897	0.9055	3.023071	-0.42984
5.4	3.8493	3.5305	3.5566	4.7614	3.4526	3.3882	3.1728	4.466	3.9857	3.5175	2.6743	5.4005	3.0485	3.0733	2.3723	4.0824	3.3116	3.1603	1.9927	2.4526	0.89587	1.8625	1.7875	1.7556	1.1301	0.83828	2.981498	-0.47141
5.5	3.8223	3.5045	3.5305	4.7314	3.4268	3.3498	3.1353	4.437	3.9857	3.4915	2.6154	5.3521	2.9871	3.0239	2.3154	4.0546	3.2735	3.098	1.9382	2.4066	0.80963	1.8089	1.7449	1.7131	1.0317	0.64904	2.932187	-0.52072
5.6	3.8088	3.4785	3.5045	4.7015	3.4011	3.2989	3.1105	4.4225	3.9582	3.4655	2.5452	5.3361	2.9139	2.9748	2.2477	4.027	3.2356	3.0485	1.8841	2.3495	0.73369	1.7768	1.692	1.6604	0.98297	0.58377	2.890078	-0.56283
5.7	3.7819	3.4526	3.5045	4.6717	3.3754	3.2735	3.0856	4.4081	3.9445	3.4397	2.4756	5.288	2.8293	2.9139	2.1916	3.9994	3.2104	2.9993	1.8196	2.2702	0.65841	1.7237	1.6394	1.6184	0.91515	0.50977	2.84614	-0.60677
5.8	3.7417	3.4526	3.4785	4.6272	3.3498	3.2356	2.9993	4.3793	3.9172	3.4139	2.4066	5.2403	2.7454	2.7932	2.1248	3.9719	3.1105	2.9504	1.7556	2.2028	0.57448	1.6709	1.5871	1.5559	0.85744	0.44553	2.791844	-0.66107
5.9	3.715	3.4139	3.4526	4.5977	3.3243	3.223	2.9993	4.3649	3.89	3.3882	2.2815	5.1927	2.6743	2.7454	1.9273	3.9309	3.0733	2.8896	1.6604	2.1581	0.43639	1.608	1.5248	1.5041	0.79058	0.37269	2.736114	-0.7168
6.0	3.6752	3.3882	3.4139	4.5536	3.223	3.1853	2.9748	4.3362	3.8764	3.3371	2.1916	5.1455	2.6036	2.6743	1.8625	3.8223	3.0116	2.8413	1.5975	2.0915	0.34553	1.5455	1.4732	1.4423	0.71481	0.30046	2.677969	-0.77494

- With PKG B (with MLSE)

Sweep only T_r with PKG B

T_r	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH12	CH16	AVG	dAVG
ps	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB
4.0	4.9269	4.2941	4.3284	5.5984	4.2864	4.1698	3.9583	5.329	4.7348	5.8174	4.7272	4.742791	0
4.1	4.9094	4.2319	4.3125	5.5792	4.2594	4.1433	3.9151	5.3038	4.7062	5.783	4.6935	4.712482	-0.03031
4.2	4.892	4.2162	4.2966	5.547	4.2326	4.0672	3.8721	5.2786	4.6758	5.8331	4.6581	4.688118	-0.05467
4.3	4.8746	4.2005	4.2694	5.5081	4.2059	4.0893	3.8331	5.2328	4.6172	5.8126	4.6297	4.6612	-0.08159
4.4	4.8866	4.1736	4.2536	5.4695	4.1793	4.0563	3.7905	5.2033	4.5939	5.765	4.6014	4.633909	-0.10888
4.5	4.8573	4.1468	4.2266	5.4309	4.146	4.0126	3.6958	5.166	4.5359	5.7383	4.5617	4.592536	-0.15025
4.6	4.8402	4.1313	4.1875	5.3926	4.1086	3.9731	3.6606	5.1536	4.5012	5.7047	4.5337	4.562464	-0.18033
4.7	4.806	4.0935	4.1607	5.3417	4.0824	3.9367	3.6187	5.1164	4.4553	5.6713	4.4944	4.525191	-0.2176
4.8	4.7585	4.1129	4.1228	5.2911	4.0235	3.8936	3.5736	5.0794	4.421	5.6451	4.4324	4.486718	-0.25607
4.9	4.7229	4.0866	4.1075	5.2534	3.98	3.8438	3.4875	5.0357	4.3868	5.5988	4.3868	4.444527	-0.29826
5.0	4.6325	4.0493	4.1226	5.2033	3.9298	3.7905	3.4533	4.9991	4.3346	5.5528	4.3233	4.399191	-0.3436
5.1	4.5807	4.0232	4.1004	5.1536	3.876	3.678	3.4022	4.9573	4.2895	5.5203	4.267	4.349836	-0.39295
5.2	4.5526	3.9972	4.07	5.0917	3.8225	3.636	3.3344	4.921	4.2111	5.4818	4.2111	4.302673	-0.44012
5.3	4.5247	3.9713	4.0549	5.0304	3.7693	3.5736	3.284	4.8728	4.1666	5.4366	4.1555	4.258155	-0.48464
5.4	4.4853	3.9348	4.0179	4.9626	3.7095	3.5253	3.2139	4.818	4.1113	5.448	4.1003	4.211536	-0.53125
5.5	4.4576	3.9092	3.992	4.921	3.636	3.4635	3.1642	4.7703	4.0563	5.4035	4.0276	4.163745	-0.57905
5.6	4.4072	3.8622	3.9554	4.8419	3.5839	3.4022	3.098	4.7348	4.0126	5.3465	3.9583	4.109364	-0.63343
5.7	4.3686	3.8263	3.9298	4.7891	3.4737	3.3344	3.0225	4.6826	3.919	5.3027	3.8867	4.048673	-0.69412
5.8	4.3189	3.7905	3.8828	4.718	3.4533	3.2639	2.9281	4.6289	3.8652	5.2466	3.8118	3.991636	-0.75115
5.9	4.2558	3.7269	3.8331	4.6475	3.392	3.194	2.8702	4.5823	3.7905	5.2033	3.7481	3.931245	-0.81155
6.0	4.1888	3.6743	3.7799	4.5706	3.3142	3.1079	2.8223	4.5243	3.7201	5.0958	3.6675	3.860518	-0.88227

COM parameters for C2M channels (No MLSE, host package A, module 8mm package)

Table 93A-1 parameters			
Parameter	**Setting**	**Units**	**Information**
f_b	106.25	GBd	
f_min	0.05	GHz	
Delta_f	0.01	GHz	
C_d	[0.4e-4 0.9e-4 1.1e-4 ;0.4e-4 0.9e-4 1.1e-4]	nF	[TX RX]
L_s	[0.13 0.15 0.14; 0.13 0.15 0.14]	nH	[TX RX]
C_b	[0.3e-4 0.3e-4]	nF	[TX RX]
R_0	50	Ohm	
R_d	[45 45]	Ohm	[TX RX]
A_v	0.386	V	vp/vf=
A_fe	0.386	V	vp/vf=
A_ne	0.6	V	
L	4		
M	32		
filter and Eq			
f_r	0.58	*fb	
c(0)	0.55		min
c(-1)	[-0.3:0.05:0]		[min:step:max]
c(-2)	[0:.05:0.1]		[min:step:max]
c(-3)	0		[min:step:max]
c(-4)	0		[min:step:max]
c(1)	0		[min:step:max]
N_b	1	UI	
b_max(1)	0.75		As/dffe1
b_max(2..N_b)	0.3		As/dfe2..N_b
b_min(1)	0		As/dffe1
b_min(2..N_b)	-0.15	S	As/dfe2..N_b
g_DC	[-15:1:-3]	dB	[min:step:max]
f_z	25.16	GHz	
f_p1	40.00	GHz	
f_p2	56.00	GHz	
g_DC_HP	[-5:1:0]		[min:step:max]
f_HP_PZ	1.328125	GHz	

I/O control		
DIAGNOSTICS	1	logical
DISPLAY_WINDOW	0	logical
CSV_REPORT	1	logical
RESULT_DIR	.\results\C2M_{date}\	
SAVE_FIGURES	0	logical
Port Order	**[1 3 2 4]**	
RUNTAG	C2M TP1a_COM_model	
COM_CONTRIBUTION	1	logical
TDR and ERL options		
TDR	1	logical
ERL	1	logical
ERL_ONLY	0	ns
TR_TDR	0.01	
N	3000	logical
TDR_Butterworth	1	
beta_x	0	
rho_x	0.618	
TDR_W_TXPKG	0	UI
N_bx	0	
fixture delay time	[0 0]	
Tukey_Window	1	
Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	UI
eta_0	6.00E-09	V^2/GHz
SNR_TX	33	dB
R_LM	0.95	

Table 93A–3 parameters			
Parameter	Setting	Units	Information
package_tl_gamma0_a1_a2	[5e-4 8.9e-4 2e-4]		
package_tl_tau	0.006141	ns/mm	
package_Z_c	[87.5 87.5 ; 92.5 92.5; 100 100; 100 100]	Ohm	
z_p select	[2]		[test cases to run]
z_p (TX)	[12 33 ; 1.8 1.8 ; 0 0 ; 0 0]	mm	[test cases]
z_p (NEXT)	[8 8 ; 0 0 ; 0 0 ; 0 0]	mm	[test cases]
z_p (FEXT)	[12 33 ; 1.8 1.8 ; 0 0 ; 0 0]	mm	[test cases]
z_p (RX)	[8 8 ; 0 0 ; 0 0 ; 0 0]	mm	[test cases]
C_p	[0.4e-4 0.4e-4]	nF	[TX RX]
Filter: Rx FFE			
ffe_pre_tap_len	**6**	UI	
ffe_post_tap_len	25	UI	
ffe_tap_step_size	0		
ffe_main_cursor_min	0.7		
ffe_pre_tap1_max	0.7		
ffe_post_tap1_max	0.7		
ffe_tapn_max	0.7		
Operational			
ERL Pass threshold	10	dB	
COM Pass threshold	3	db	
VEC Pass threshold	10	db	
DER_0	2.00E-05		
T_r	4.00E-03	ns	
FORCE_TR	1	logical	
Min_VEO_Test	0	mV	
PMD_type	C2C		
EH_min	5	Value	
EH_max	1000	Value	
T_O	50	mUI	
samples_for_C2M	100	samples/UI	
ts_anchor	1		
sample_adjustment	[-8 12]		
EW	1		
MLSE	0		
Local Search	2		

SAVE_CONFIG2MAT	0	
Receiver testing		
RX_CALIBRATION	0	logical
Sigma BBN step	5.00E-03	V
ICN parameters		
f_v	0.588	Fb
f_f	0.278	Fb
f_n	0.278	Fb
f_2	61.625	GHz
A_ft	0.450	V
A_nt	0.450	V

Parameter	**Setting**	
board_tl_gamma0_a1_a2	*[0 6.44084e-4 3.6036e-05]*	1.4 db/in @ 53.125G
board_tl_tau	*5.790E-03*	ns/mm
board_Z_c	100	Ohm
z_bp (TX)	*32*	mm
z_bp (NEXT)	*32*	mm
z_bp (FEXT)	*32*	mm
z_bp (RX)	*32*	mm
C_0	[0.2e-4 0]	nF
C_1	[0.2e-4 0]	nF
Include PCB	**0**	**logical**
Seletions (rectangle, gaussian,dual_rayleigh,triangle		
Histogram_Window_Weigh	gaussian	selection
Qr	*0.02*	UI
Floating Tap Control		
N_bg	**0**	0 1 2 or 3 groups
N_bf	4	taps per group
N_f	80	UI span for floating taps
bmaxg	0.2	max DFE value for floating taps
B_float_RSS_MAX	0.1	rss tail tap limit
N_tail_start	16	(UI) start of tail taps limit

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mli_3df_02_220316
ran_3dj_elec_02_230622

COM parameters for C2M channels (No MLSE, host package B, module 8mm package)

Table 93A-1 parameters			
Parameter	**Setting**	**Units**	**Information**
f_b	106.25	GBd	
f_min	0.05	GHz	
Delta_f	0.01	GHz	
C_d	[0.4e-4 0.9e-4 1.1e-4 ;0.4e-4 0.9e-4 1.1e-4]	nF	[TX RX]
L_s	[0.13 0.15 0.14; 0.13 0.15 0.14]	nH	[TX RX]
C_b	[0.3e-4 0.3e-4]	nF	[TX RX]
R_0	50	Ohm	
R_d	[45 45]	Ohm	[TX RX]
A_v	0.386	V	vp/vf=
A_fe	0.386	V	vp/vf=
A_ne	0.6	V	
L	4		
M	32		
filter and Eq			
f_r	0.58	*fb	
c(0)	0.55		min
c(-1)	[-0.3:0.05:0]		[min:step:max]
c(-2)	[0:.05:0.1]		[min:step:max]
c(-3)	0		[min:step:max]
c(-4)	0		[min:step:max]
c(1)	0		[min:step:max]
N_b	1	UI	
b_max(1)	0.75		As/dffe1
b_max(2..N_b)	0.3		As/dfe2..N_b
b_min(1)	0		As/dffe1
b_min(2..N_b)	-0.15	S	As/dfe2..N_b
g_DC	[-15:1:-3]	dB	[min:step:max]
f_z	25.16	GHz	
f_p1	40.00	GHz	
f_p2	56.00	GHz	
g_DC_HP	[-5:1:0]		[min:step:max]
f_HP_PZ	1.328125	GHz	

I/O control		
DIAGNOSTICS	1	logical
DISPLAY_WINDOW	0	logical
CSV_REPORT	1	logical
RESULT_DIR	.\results\C2M_{date}\	
SAVE_FIGURES	0	logical
Port Order	**[1 3 2 4]**	
RUNTAG	C2M TP1a_COM_model	
COM_CONTRIBUTION	1	logical
TDR and ERL options		
TDR	1	logical
ERL	1	logical
ERL_ONLY	0	ns
TR_TDR	0.01	
N	3000	logical
TDR_Butterworth	1	
beta_x	0	
rho_x	0.618	
TDR_W_TXPKG	0	UI
N_bx	0	
fixture delay time	[0 0]	
Tukey_Window	1	
Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	UI
eta_0	6.00E-09	V^2/GHz
SNR_TX	33	dB
R_LM	0.95	

Table 93A–3 parameters			
Parameter	Setting	Units	Information
package_tl_gamma0_a1_a2	[5e-4 6.5e-4 3e-4]		
package_tl_tau	0.006141	ns/mm	
package_Z_c	[92 92 ; 70 70; 80 80; 100 100]	Ohm	
z_p select	[4]		[test cases to run]
z_p (TX)	[8 24 30 45 ; 1 1 1 1 ; 1 1 1 1 ; 0.5 0.5 0.5 0.5]	mm	[test cases]
z_p (NEXT)	[8 8 8 8; 0 0 0 0 ; 0 0 0 0 ; 0 0 0 0]	mm	[test cases]
z_p (FEXT)	[8 24 30 45 ; 1 1 1 1 ; 1 1 1 1 ; 0.5 0.5 0.5 0.5]	mm	[test cases]
z_p (RX)	[8 8 8 8; 0 0 0 0 ; 0 0 0 0 ; 0 0 0 0]	mm	[test cases]
C_p	[0.4e-4 0.4e-4]	nF	[TX RX]
Filter: Rx FFE			
ffe_pre_tap_len	**6**	UI	
ffe_post_tap_len	25	UI	
ffe_tap_step_size	0		
ffe_main_cursor_min	0.7		
ffe_pre_tap1_max	0.7		
ffe_post_tap1_max	0.7		
ffe_tapn_max	0.7		
Operational			
ERL Pass threshold	10	dB	
COM Pass threshold	3	db	
VEC Pass threshold	10	db	
DER_0	2.00E-05		
T_r	4.00E-03	ns	
FORCE_TR	1	logical	
Min_VEO_Test	0	mV	
PMD_type	C2C		
EH_min	5	Value	
EH_max	1000	Value	
T_O	50	mUI	
samples_for_C2M	100	samples/UI	
ts_anchor	1		
sample_adjustment	[-8 12]		
EW	1		
MLSE	0		
Local Search	2		

SAVE_CONFIG2MAT	0	
Receiver testing		
RX_CALIBRATION	0	logical
Sigma BBN step	5.00E-03	V
ICN parameters		
f_v	0.588	Fb
f_f	0.278	Fb
f_n	0.278	Fb
f_2	61.625	GHz
A_ft	0.450	V
A_nt	0.450	V

Parameter	**Setting**	
board_tl_gamma0_a1_a2	*[0 6.44084e-4 3.6036e-05]*	1.4 db/in @ 53.125G
board_tl_tau	*5.790E-03*	ns/mm
board_Z_c	100	Ohm
z_bp (TX)	*32*	mm
z_bp (NEXT)	*32*	mm
z_bp (FEXT)	*32*	mm
z_bp (RX)	*32*	mm
C_0	[0.2e-4 0]	nF
C_1	[0.2e-4 0]	nF
Include PCB	**0**	**logical**
Seletions (rectangle, gaussian,dual_rayleigh,triangle		
Histogram_Window_Weigh	gaussian	selection
Qr	*0.02*	UI
Floating Tap Control		
N_bg	**0**	0 1 2 or 3 groups
N_bf	4	taps per group
N_f	80	UI span for floating taps
bmaxg	0.2	max DFE value for floating taps
B_float_RSS_MAX	0.1	rss tail tap limit
N_tail_start	16	(UI) start of tail taps limit

benartsi_3df_01a_2211
mli_3df_02_220316
ran_3dj_elec_02_230622

Results of Sweep 1&2 for C2M channels

- ✓ Used 26 C2M channels selected in lusted_3dj_02a_2309, slide 12

- ❖ Sweeping only σ_{RJ} degrades COM only moderately
- ❖ Sweeping σ_{RJ} and A_{DD} results in larger COM degradation