

224G – CR/KR Channel Analysis

- keeping up with updates from draft specification and COM
-

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Open Reddy Kareti, Cisco Systems Inc.

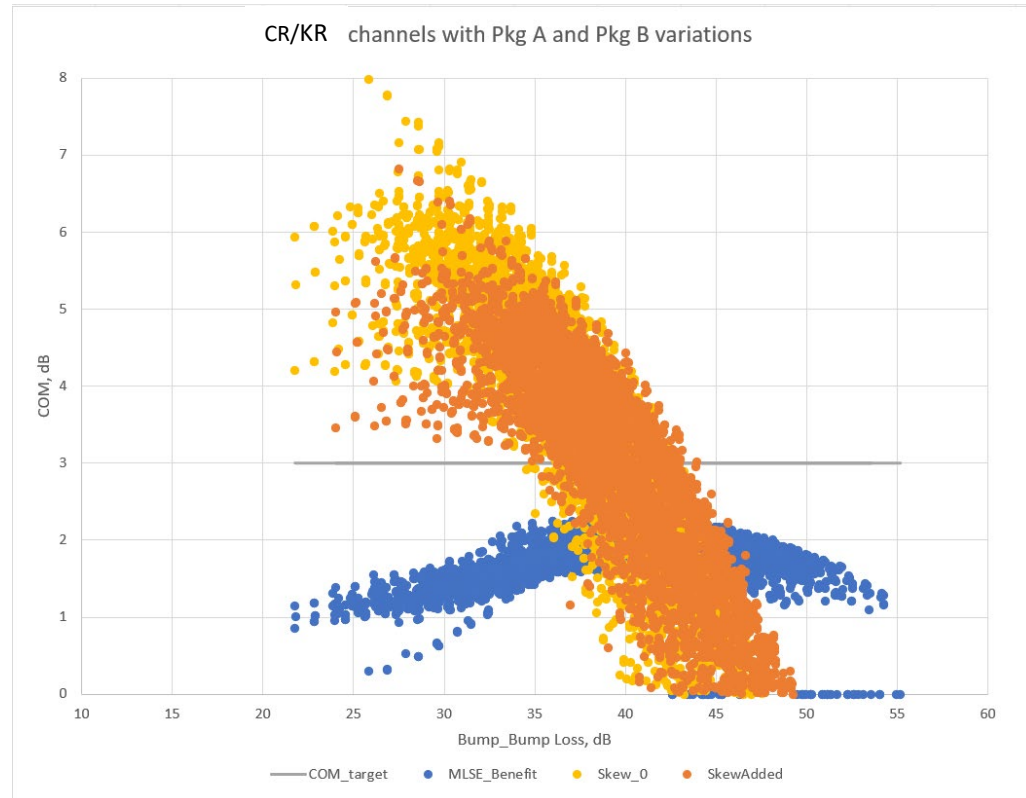
CR/KR Channel Analysis - Setup

Phase 1 evaluations

- COM tool version: 4.6 Beta 2.
- [All channels that were contributed to 802.3dj project for CR/KR interfaces.](#)
 - Includes PCB-host and Cabled-host channels
 - Most CR channels are PCB host channels
 - Most KR channels are Cabled Host channels
 - Except Megha Shanbhag contributed channels have all combinations
- Base configuration for simulation and test Configs Include:
 - Both types of packages (Type A and Type B)
 - But presenting here only with Package B
 - Mixing of Package types for Package variations
 - Transmitter package trace lengths – 8 mm to 45 mm
 - Receiver package trace lengths – 8 mm to 45 mm
 - Presenting only Package B length variations – 36 combinations
 - Cover all CR/KR channels contributed to IEEE C2M interface
 - *Added skew variations by max tolerable skew for all channels (Identifying basic skew profiles in freq. domain slide 13 of [kareti_3dj_02_2401.pdf](#) – actual step by step procedure is not shared)*
 - Impedance variations
 - Temperature variations
 - Receiver
 - Num of RX FFE pre-cursors : 6
 - Num of RX FFE fixed post cursors : 200; 8 to 16
 - Number of banks of floating up to 60 UI -100 UI: 1 to 3
 - Input Reference Noise (ETA_0) levels (V²/GHz) : 1e-8
 - NEXT Voltage levels
 - A_ne = A_v

Reference Receiver Options

CR/KR Channel Analysis – Ethernet data rate -212.5 Gbps



Config: 1 - Intended for finding High side book-end Ref. Receiver solution
 Receiver

- Num of RX FFE pre-cursors : 6
- Num of RX FFE fixed post cursors : 200

**Max Tolerable Skew cases included but separated the stats.*

Total#cases	11190	9308	1882	1712	9478
Cases <40 dB	6837	Cabled Host	PCB Host	CR	KR

1 tap DFE (No MLSE)

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	0	24-32	0	32-40	968	>40	3883
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	431	537	2427	1456

MLSE - No Limit Placed

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	0	24-32	0	32-40	24	>40	1614
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	3	21	942	672

Number unique channels (No skew added) failed COM 3 dB with loss <=40dB : 11 out of 153

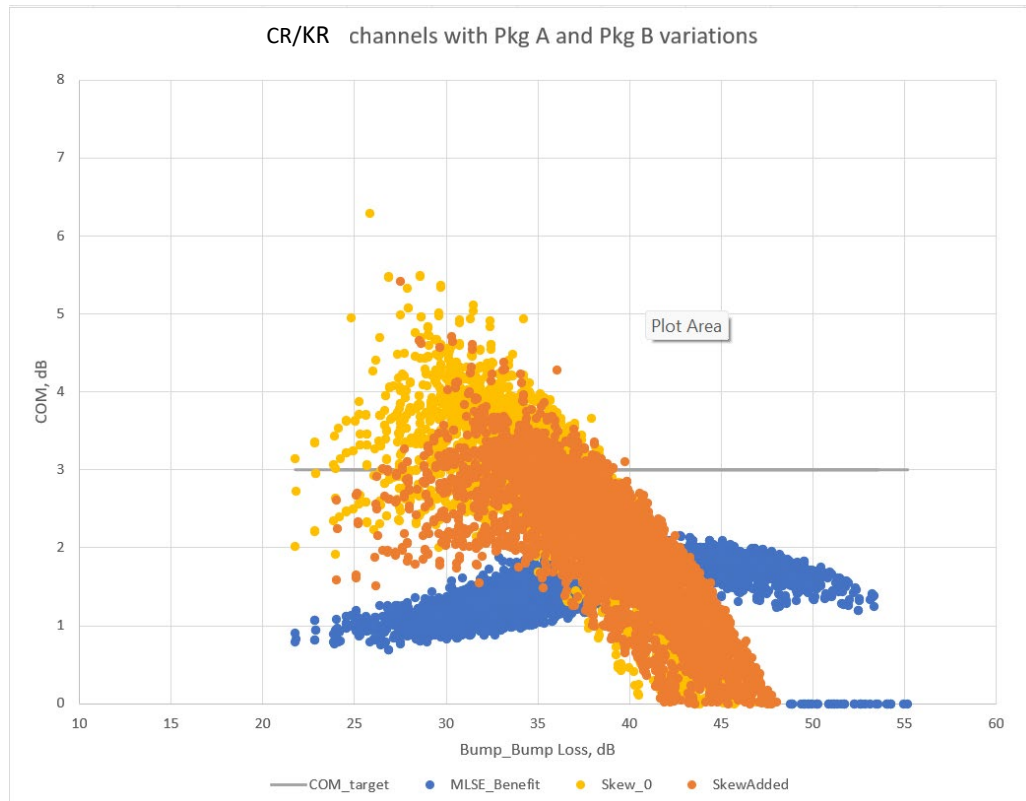
MLSE with max benefit limited to 1 dB

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	0	24-32	0	32-40	146	>40	2685
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	55	91	1652	1033

Number unique channels (No skew added) failed COM 3 dB with loss <=40dB : 22

CR/KR Channel Analysis – Ethernet data rate -212.5 Gbps



Config: 2
Receiver

- Num of RX FFE pre-cursors : 6
- Num of RX FFE fixed post cursors : 16
- Number of banks of floating up to 60 UI: 1

**Max Tolerable Skew cases included but separated the stats.*

Total#cases	11094	9222	1872	1656	9438
Cases <40 dB	6926	Cabled Host	PCB Host	CR	KR

1 tap DFE (No MLSE)

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	10	24-32	359	32-40	4185	>40	4168
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
1	9	187	172	2166	2019	2617	1551

MLSE - No Limit Placed

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	3	24-32	7	32-40	150	>40	2546
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
1	2	7	0	74	76	1537	1009

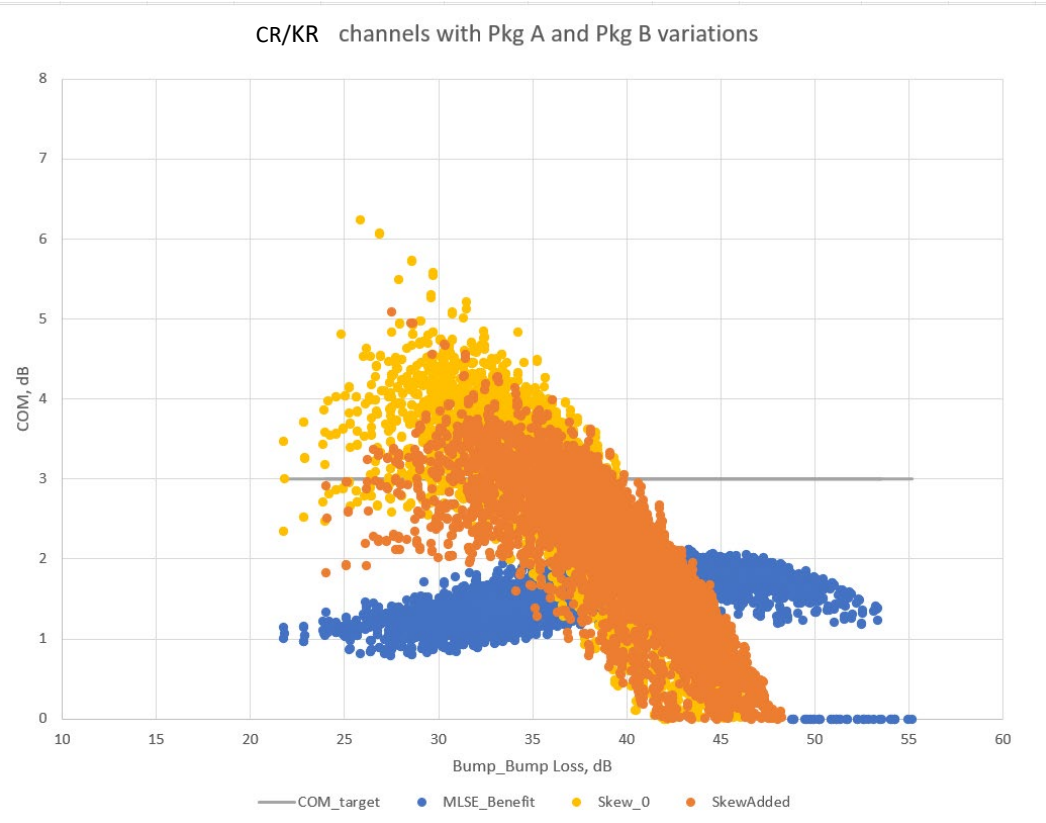
MLSE with max benefit limited to 1 dB

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	3	24-32	29	32-40	944	>40	3821
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
1	2	29	0	506	438	2377	1444

Number unique channels (No skew added) failed COM 3 dB with loss <=40dB : 99

CR/KR Channel Analysis – Ethernet data rate -212.5 Gbps



Total#cases	10926	9054	1872	1656	9270
Cases <40 dB	6859	Cabled Host	PCB Host	CR	KR

Config: 3

Receiver

- Num of RX FFE pre-cursors : 6
- Num of RX FFE fixed post cursors : 8
- Number of banks of floating up to 80 UI: 2

**Max Tolerable Skew cases included but separated the stats.*

1 tap DFE (No MLSE)

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	7	24-32	230	32-40	3738	>40	4067
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
1	6	138	92	1991	1747	2552	1515

MLSE - No Limit Placed

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	0	24-32	0	32-40	127	>40	2315
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	74	53	1396	919

MLSE with max benefit limited to 1 dB

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

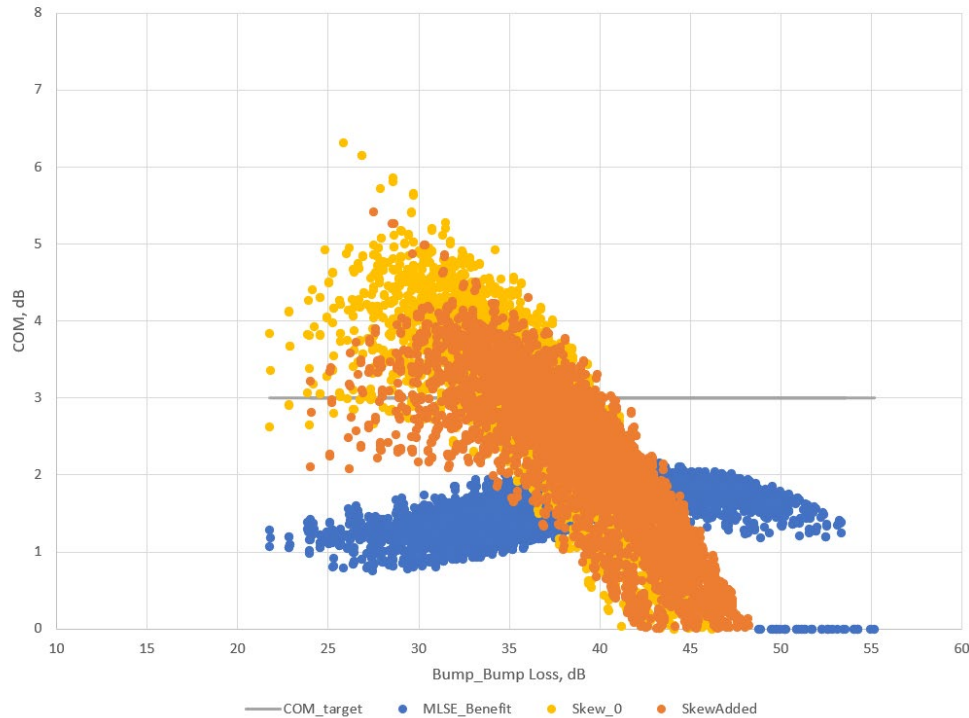
<=24	1	24-32	5	32-40	790	>40	3628
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
1	0	5	0	434	356	2254	1374

Number unique channels (No skew added) failed COM 3 dB with loss <=40dB : 80

CR/KR Channel Analysis – Ethernet data rate -212.5 Gbps



CR/KR channels with Pkg A and Pkg B variations



Total#cases	10926	9054	1872	1656	9270
Cases <40 dB	6859	Cabled Host	PCB Host	CR	KR

Config: 4

Receiver

- Num of RX FFE pre-cursors : 6
- Num of RX FFE fixed post cursors : 8
- Number of banks of floating up to 80 UI: 3

*Max Tolerable Skew cases included but separated the stats.

1 tap DFE (No MLSE)

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	5	24-32	153	32-40	3215	>40	4065
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
1	4	105	48	1677	1538	2550	1515

MLSE - No Limit Placed

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	0	24-32	0	32-40	76	>40	2211
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	37	39	1323	888

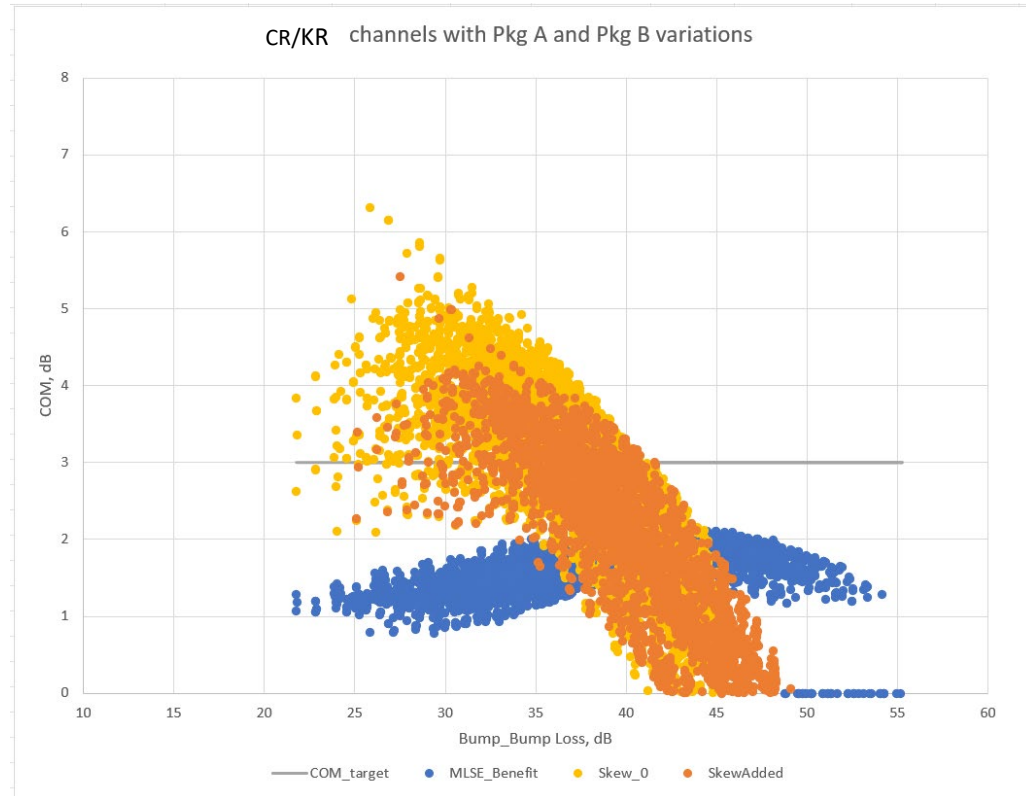
MLSE with max benefit limited to 1 dB

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	0	24-32	0	32-40	587	>40	3522
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	296	291	2174	1348

Number unique channels (No skew added) failed COM 3 dB with loss <=40dB : 47

CR/KR Channel Analysis – Ethernet data rate -212.5 Gbps



Total#cases	10678	8832	1846	1630	9048
Cases <40 dB	6735	Cabled Host	PCB Host	CR	KR

Config: 5

Receiver

- Num of RX FFE pre-cursors : 6
- Num of RX FFE fixed post cursors : 8
- Number of banks of floating up to 100 UI: 3

**Max Tolerable Skew cases included but separated the stats.*

1 tap DFE (No MLSE)

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	5	24-32	116	32-40	2707	>40	3910
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
1	4	94	22	1459	1248	2454	1456

MLSE - No Limit Placed

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	0	24-32	0	32-40	63	>40	1886
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	31	32	1126	760

Number unique channels (No skew added) failed COM 3 dB with loss <=40dB : 8 out of 151

MLSE with max benefit limited to 1 dB

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

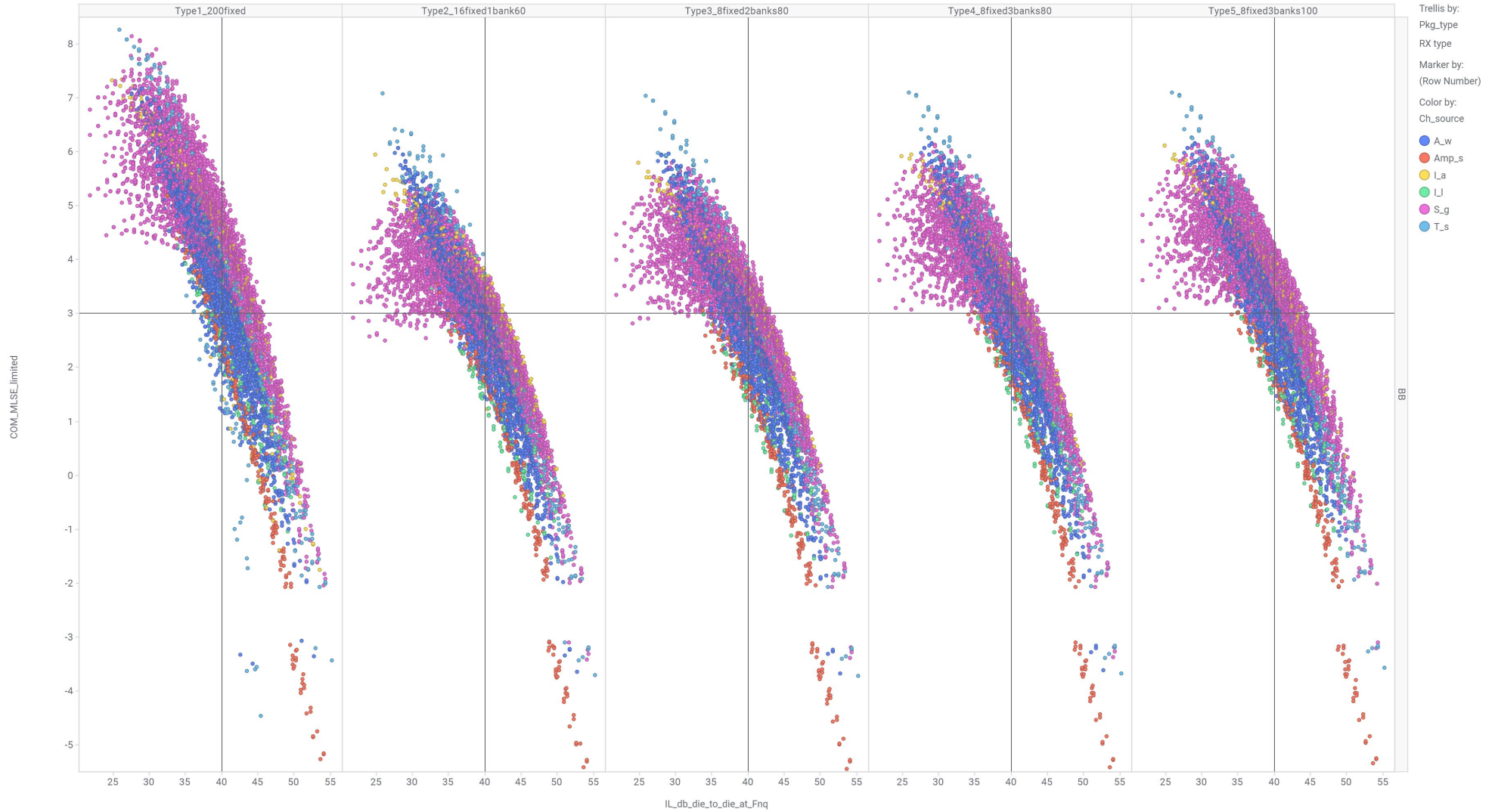
<=24	0	24-32	0	32-40	440	>40	3164
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	229	211	1946	1218

Number unique channels (No skew added) failed COM 3 dB with loss <=40dB : 38

Ref.RX comparison with Max MLSE Benefit limited to 1 B



COM_MLSE_limited vs. IL_db_die_to_die_at_Fnq



Filter Settings
- Pkg_type: (BB)

Reference Receiver Options Summary

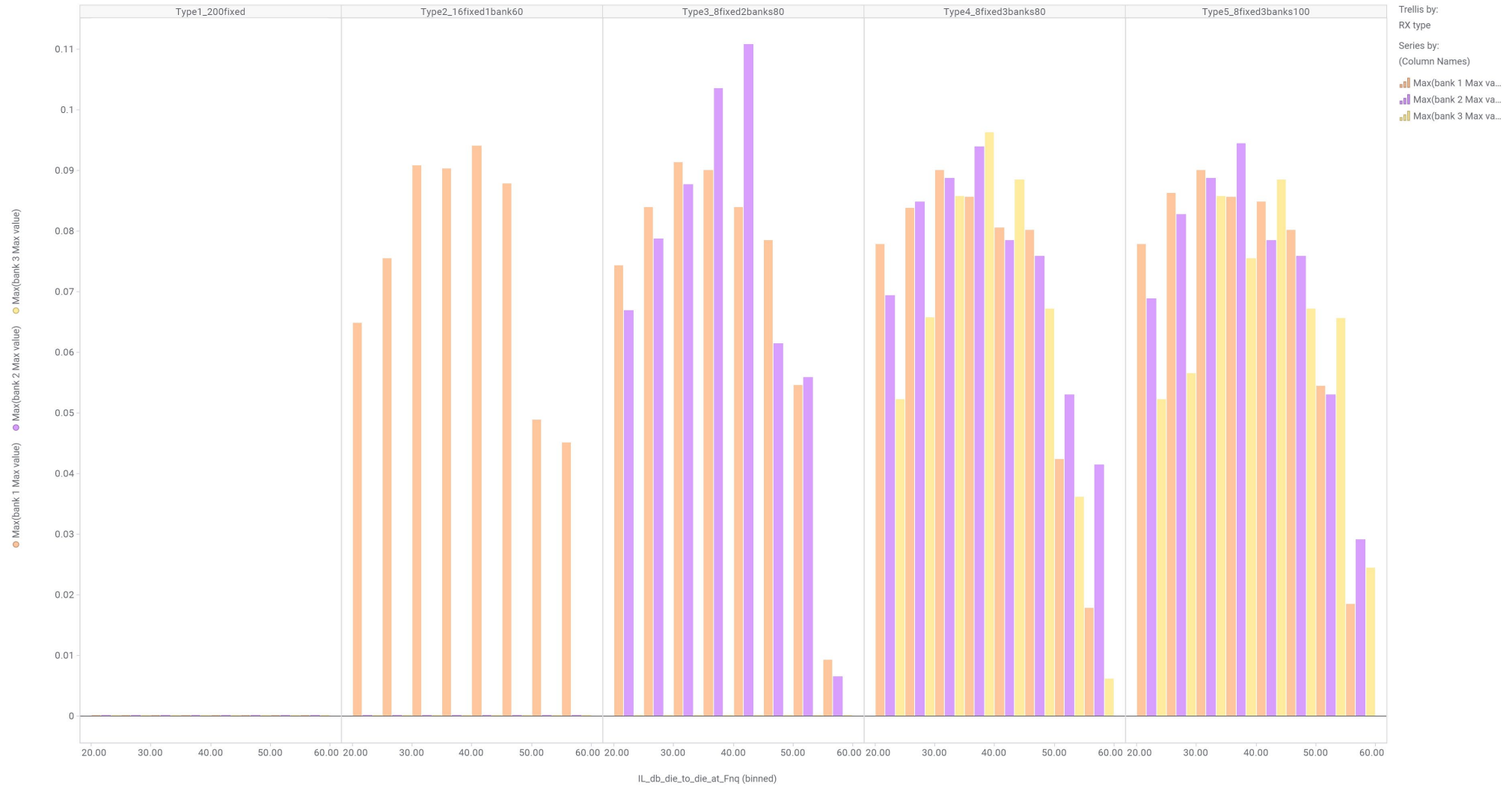
- Config1 is only used for to high side book-end solution for Ref. Receiver
- Config 5 seems to be a solution for consideration
- Observations:
 - Present COM code is reporting floating point location(s) are misaligned with positions in tap values field
 - When 1 bank is used 8 taps misalignment is observed
 - When 2 or 3 banks are used 16 taps misalignment is observed
 - E.g., when 100 UI span is used in Config 5 with 3 floating banks, floating taps are only up to max 84 UI (farthest 3rd bank was in positions 78-81 UI.
 - COM fixed these in code version 4.6 beta 4 and is used for Phase 2 evaluations

Floating Tap locations and Max values

Bank Max Value



bank 1 Max value, bank 2 Max value, bank 3 Max value per IL_db_die_to_die_at_Fnq



Bank Location - Max Value table



Floating tap starting location

Column	(Subsets)	Avg	Max	Median	Count
Rxffe_Bank1	Current filtering	17.22	66	15.00	54814
Rxffe_Bank2	Current filtering	21.10	71	20.00	54814
Rxffe_Bank3	Current filtering	19.92	78	0.00	54814

Max Floating tap Value

Column	(Subsets)	Avg	Min	Max	Median	Count
bank 1 Max v...	Current filtering	0.02	0.00	0.09	0.02	54814
bank 2 Max v...	Current filtering	0.02	0.00	0.11	0.01	54814
bank 3 Max v...	Current filtering	0.01	0.00	0.10	0.00	54814

Bank Location - Max Value table – config 5



Config: 5
Receiver

- Num of RX FFE pre-cursors : 6
- Num of RX FFE fixed post cursors : 8
- Number of banks of floating up to 100 UI: 3
- Number of taps in each bank 4

**Max Tolerable Skew cases included but separated the stats.*

Channels < 40 dB and passing 3dB COM.

Floating tap starting location

Column	(Subsets)	Avg	Max	Median	Count
Rxffe_Bank1	Current filtering	18.86	66	17.00	6295
Rxffe_Bank2	Current filtering	33.49	71	37.00	6295
Rxffe_Bank3	Current filtering	51.88	78	57.00	6295

Max Floating tap Value

Column	(Subsets)	Avg	Min	Max	Median	Count
bank 1 Max v...	Current filtering	0.02	0.00	0.09	0.02	6295
bank 2 Max v...	Current filtering	0.03	0.00	0.09	0.03	6295
bank 3 Max v...	Current filtering	0.03	0.00	0.08	0.02	6295

Channels < 40 dB and failing 3dB COM.

Floating tap starting location

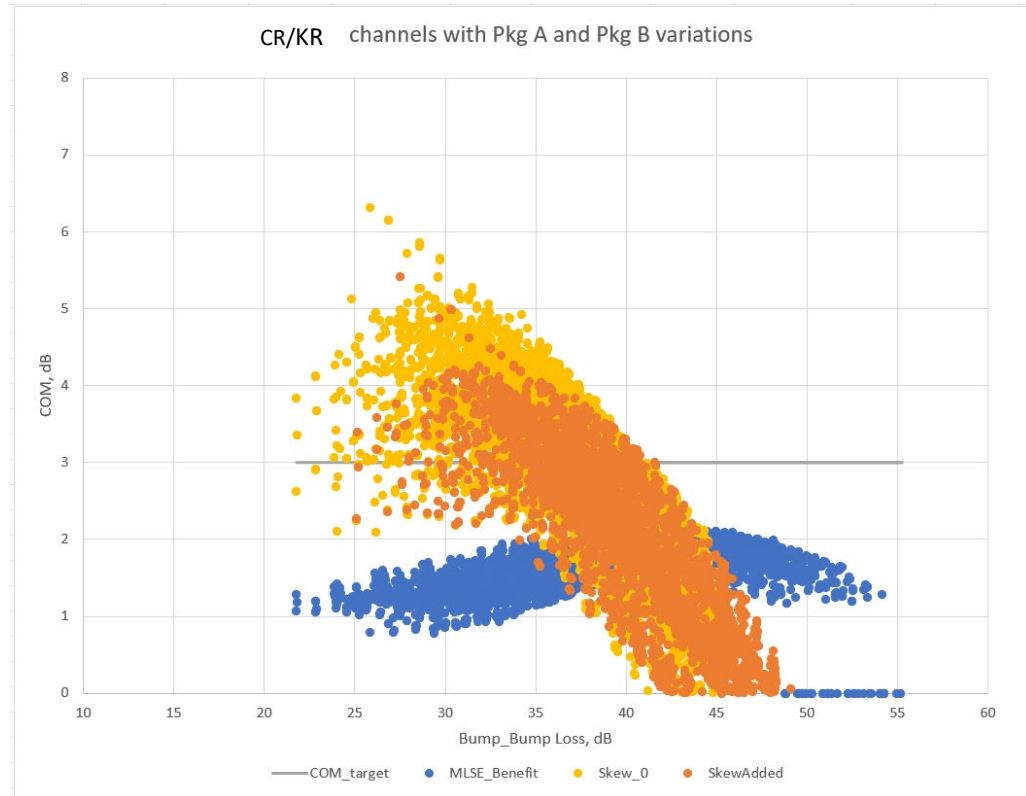
Column	(Subsets)	Avg	Max	Median	Count
Rxffe_Bank1	Current filtering	13.56	53	10.00	439
Rxffe_Bank2	Current filtering	25.66	71	24.00	439
Rxffe_Bank3	Current filtering	47.31	78	49.00	439

Max Floating tap Value

Column	(Subsets)	Avg	Min	Max	Median	Count
bank 1 Max v...	Current filtering	0.03	0.00	0.09	0.03	439
bank 2 Max v...	Current filtering	0.03	0.00	0.09	0.03	439
bank 3 Max v...	Current filtering	0.02	0.00	0.09	0.02	439

Package Combinations - Class A and Class B

CR/KR Channel Analysis – Ethernet data rate -212.5 Gbps



Total#cases	10678	8832	1846	1630	9048
Cases <40 dB	6735	Cabled Host	PCB Host	CR	KR

Package Combination: **BB**

Config: 5
Receiver

- Num of RX FFE pre-cursors : 6
- Num of RX FFE fixed post cursors : 8
- Number of banks of floating up to 100 UI: 3

**Max Tolerable Skew cases included but separated the stats.*

1 tap DFE (No MLSE)

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	5	24-32	116	32-40	2707
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
1	4	94	22	1459	1248

>40	3910
Skew_Added	Skew_0
2454	1456

MLSE - No Limit Placed

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	0	24-32	0	32-40	63
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	31	32

>40	1886
Skew_Added	Skew_0
1126	760

MLSE with max benefit limited to 1 dB

Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644

<=24	0	24-32	0	32-40	440
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	229	211

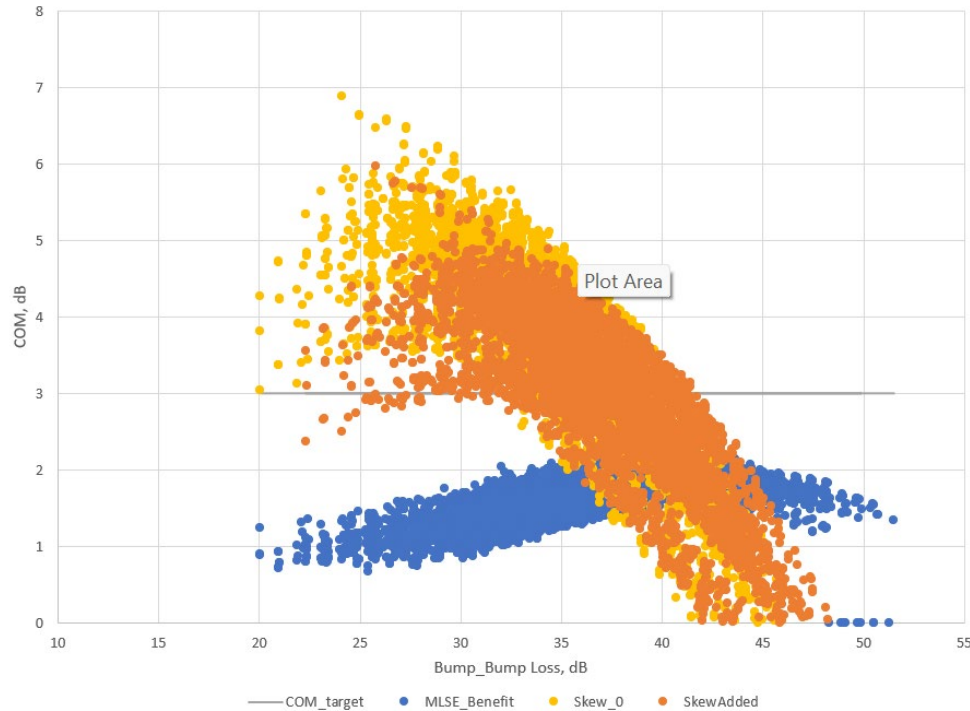
>40	3164
Skew_Added	Skew_0
1946	1218

Number unique channels (No skew added) failed COM 3 dB with loss <=40dB : 47

CR/KR Channel Analysis – Ethernet data rate -212.5 Gbps



CR/KR channels with Pkg A and Pkg B variations



Total#cases	10745	8888	1857	1641	9104
Cases <40 dB	8842	Cabled Host	PCB Host	CR	KR

Package Combination: AA

Config: 5

Receiver

- Num of RX FFE pre-cursors : 6
- Num of RX FFE fixed post cursors : 8
- Number of banks of floating up to 100 UI: 3

*Max Tolerable Skew cases included but separated the stats.

1 tap DFE (No MLSE)

Loss Range /number of COM failures -- Loss Range: 20.0305 : 51.4992

<=24	3	24-32	33	32-40	1980	>40	1854
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
3	0	33	0	1139	841	1272	582

MLSE - No Limit Placed

Loss Range /number of COM failures -- Loss Range: 20.0305 : 51.4992

<=24	0	24-32	0	32-40	39	>40	738
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	13	26	456	282

MLSE with max benefit limited to 1 dB

Loss Range /number of COM failures -- Loss Range: 20.0305 : 51.4992

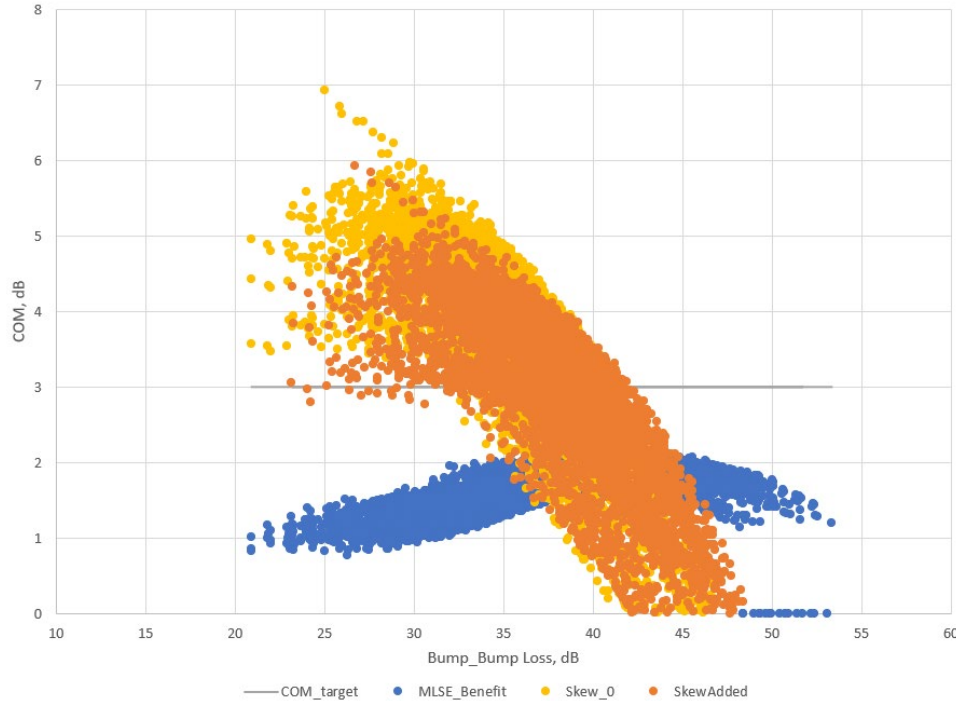
<=24	0	24-32	0	32-40	295	>40	1330
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	147	148	879	451

Number unique channels (No skew added) failed COM 3 dB with loss <=40dB : 28

CR/KR Channel Analysis – Ethernet data rate -212.5 Gbps



CR/KR channels with Pkg A and Pkg B variations



Total#cases	10736	8880	1856	1640	9096
Cases <40 dB	7789	Cabled Host	PCB Host	CR	KR

Package Combination: AB

Config: 5

Receiver

- Num of RX FFE pre-cursors : 6
- Num of RX FFE fixed post cursors : 8
- Number of banks of floating up to 100 UI: 3

*Max Tolerable Skew cases included but separated the stats.

1 tap DFE (No MLSE)

Loss Range /number of COM failures -- Loss Range: 20.8977 : 53.3318

<=24	1	24-32	48	32-40	2024	>40	2851
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
1	0	48	0	1179	845	1860	991

MLSE - No Limit Placed

Loss Range /number of COM failures -- Loss Range: 20.8977 : 53.3318

<=24	0	24-32	0	32-40	43	>40	1128
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	19	24	694	434

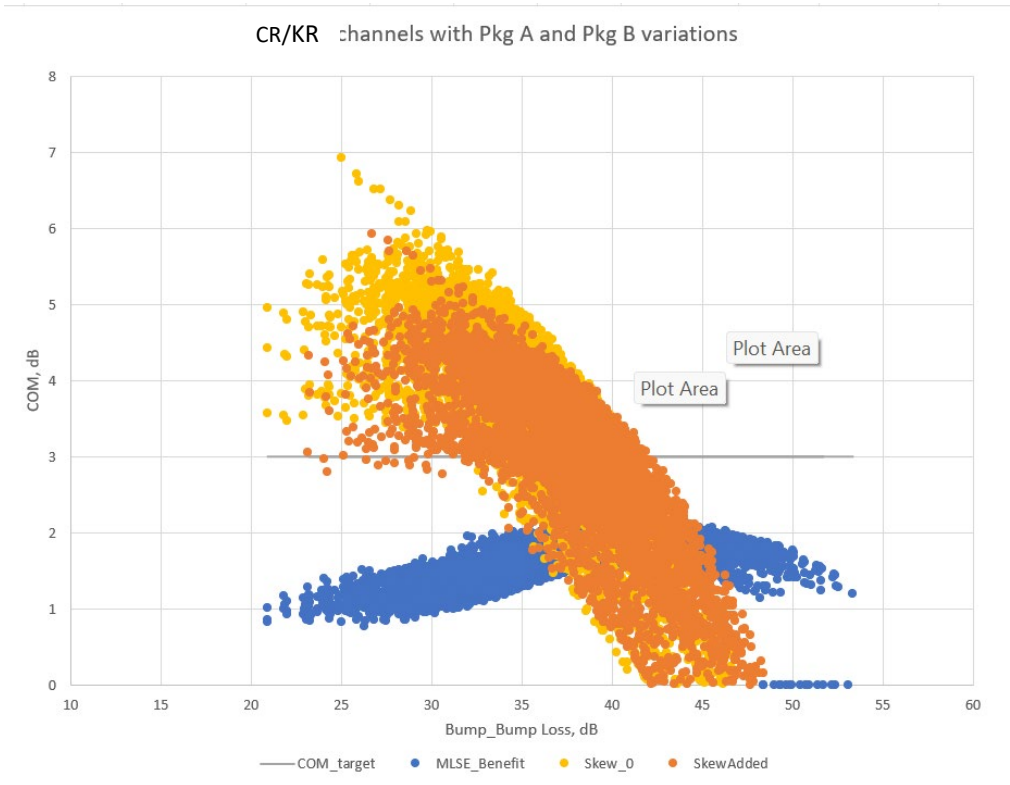
MLSE with max benefit limited to 1 dB

Loss Range /number of COM failures -- Loss Range: 20.8977 : 53.3318

<=24	0	24-32	0	32-40	288	>40	2063
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	151	137	1318	745

Number unique channels (No skew added) failed COM 3 dB with loss <=40dB : 25

CR/KR Channel Analysis – Ethernet data rate -212.5 Gbps



Total#cases	10736	8880	1856	1640	9096
Cases <40 dB	7789	Cabled Host	PCB Host	CR	KR

Package Combination: BA

Config: 5

Receiver

- Num of RX FFE pre-cursors : 6
- Num of RX FFE fixed post cursors : 8
- Number of banks of floating up to 100 UI: 3

**Max Tolerable Skew cases included but separated the stats.*

1 tap DFE (No MLSE)

Loss Range /number of COM failures -- Loss Range: 20.9001 : 53.3318

<=24	0	24-32	13	32-40	1931	>40	2819
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	13	0	1030	901	1827	992

MLSE - No Limit Placed

Loss Range /number of COM failures -- Loss Range: 20.9001 : 53.3318

<=24	0	24-32	0	32-40	50	>40	1108
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	24	26	680	428

MLSE with max benefit limited to 1 dB

Loss Range /number of COM failures -- Loss Range: 20.9001 : 53.3318

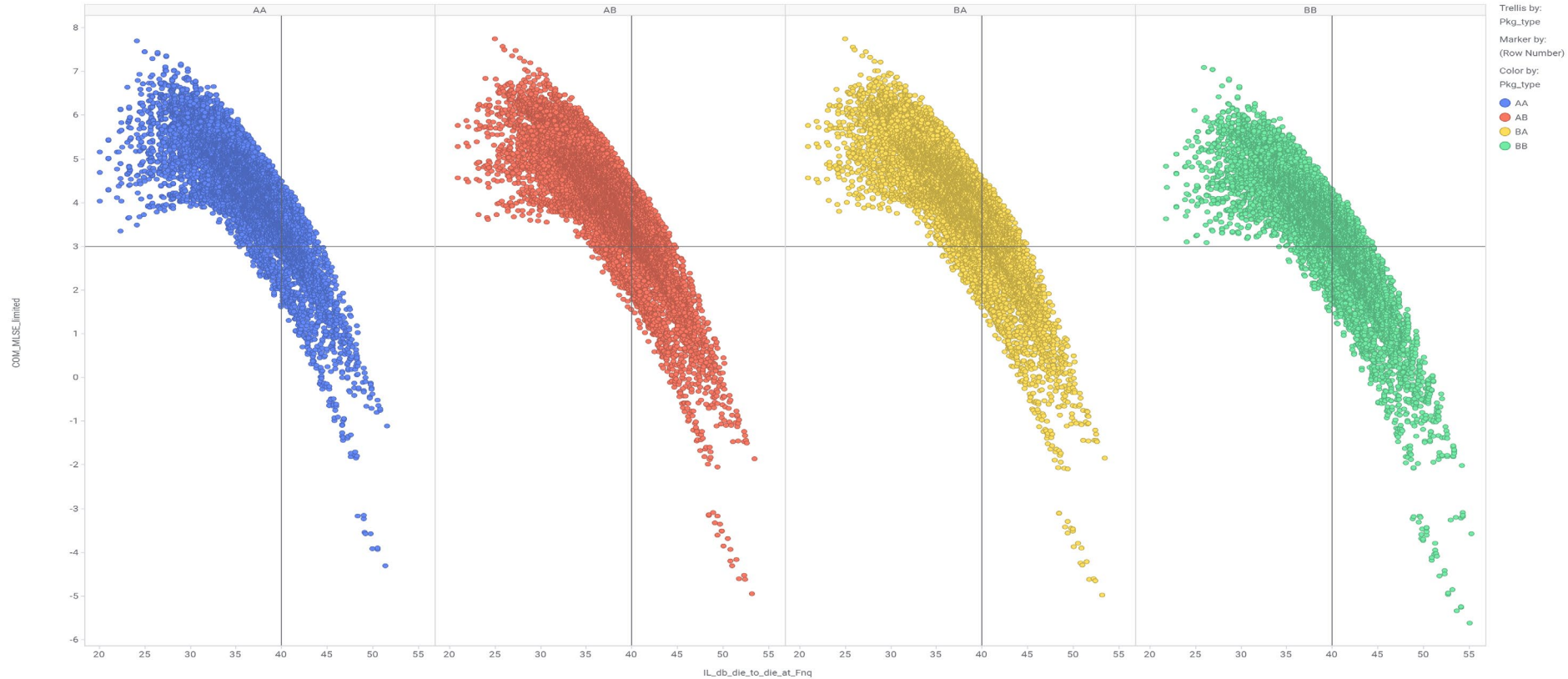
<=24	0	24-32	0	32-40	318	>40	2005
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	166	152	1263	742

Number unique channels (No skew added) failed COM 3 dB with loss <=40dB : 25

Package class combination comparison for Ref. RX with Config 5 with MLSE benefit limited to max 1 dB



COM_MLSE_limited vs. IL_db_die_to_die_at_Fnq



Filter Settings

- RX type: (Type5_8fixed3banks100)

Package Combinations Summary

- Class A and Class B

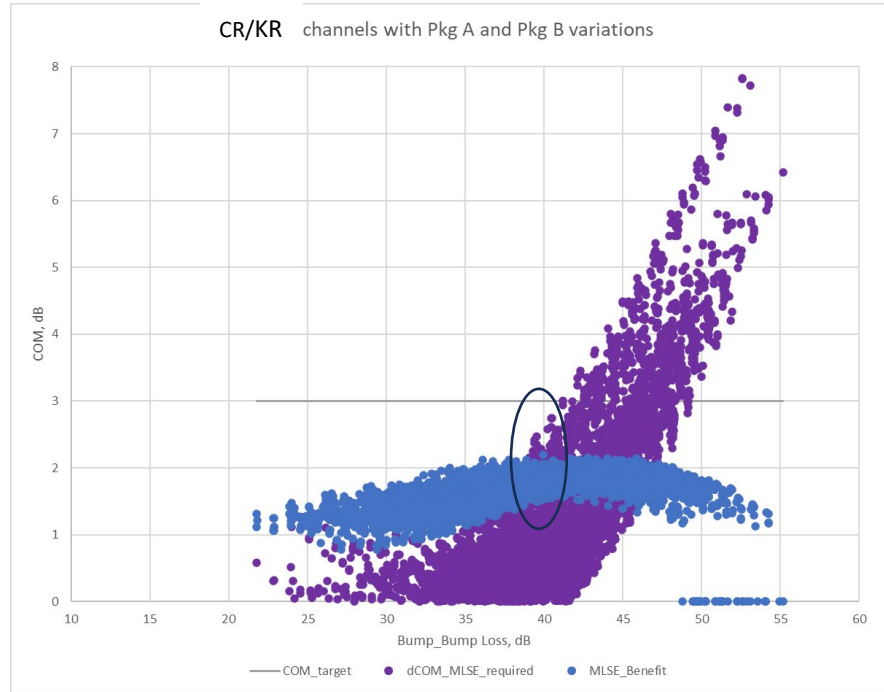
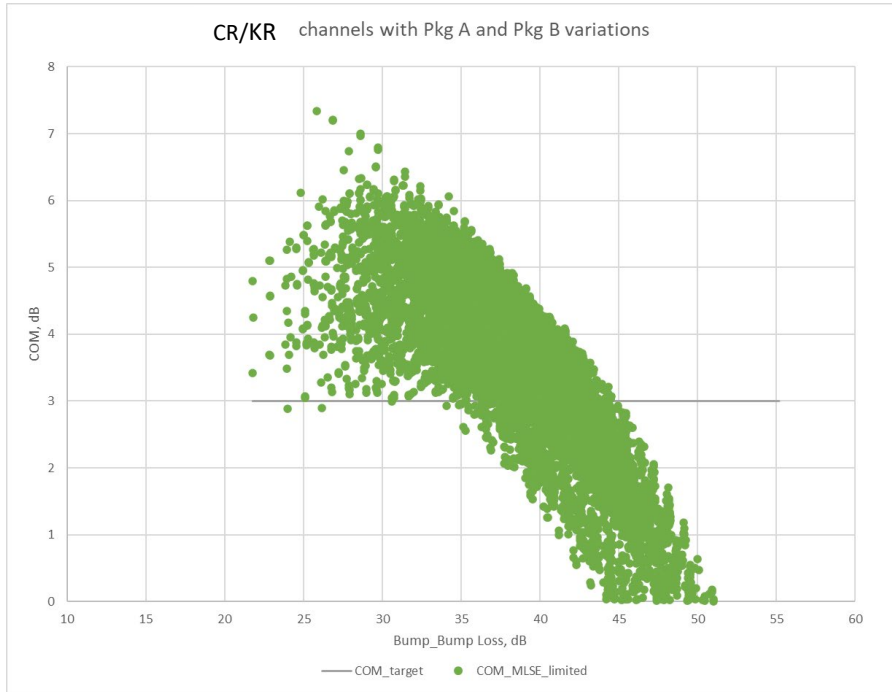
- Package Combinations of Class B with Class B (TX -> RX) seems to create most stress cases when multiple package trace lengths are considered
- Going forward we may be able to limit our focus on Package combination (TX ->RX) BB.

Updates based on Draft 1.0 Comment resolutions

Phase 2 Evaluations

- Consider updates from Comment resolution
 - RDr and RDt set to 46.25 ohms
 - SNDR set to 33.5 dB
 - F_r set to 0.55 *fbaud
 - A_fe and A_ne set to 0.45v
- Focus on Config 5 from Phase 1 with TX->RX package combination : BB
- Use updated COM version 4.6 beta 4 which fixes
 - ✓ Sampling point adaptation improvements
 - ✓ Reporting of RXFFE Floating tap bank location
 - ✓ Appropriate selection of Package length and voltages from TX and RX packages

CR/KR Channel Analysis – Ethernet data rate -212.5 Gbps



Config: 5 with Package Combination: **BB**

Receiver

- Num of RX FFE pre-cursors : 6
- Num of RX FFE fixed post cursors : 8
- Number of banks of floating up to 100 UI: 3

**Max Tolerable Skew cases included but separated the stats.*

MLSE - No Limit Placed					
Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644					
<=24	0	24-32	0	32-40	66
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
0	0	0	0	32	34

>40	1753
Skew_Added	Skew_0
1055	698

MLSE with max benefit limited to 1 dB					
Loss Range /number of COM failures -- Loss Range: 21.7672 : 55.1644					
<=24	1	24-32	2	32-40	428
Skew_Added	Skew_0	Skew_Added	Skew_0	Skew_Added	Skew_0
1	0	2	0	247	181

>40	3056
Skew_Added	Skew_0
1894	1162

Number unique channels (No skew added) failed COM 3 dB with loss <=40dB : 38

Total#cases	10678	8832	1846	1630	9048
Cases <40 dB	6735	Cabled Host	PCB Host	CR	KR

Failed channels and their characteristics

ThruFN per TX_pkg_len, RX_pkg_len and COM_MLSE_limited

TX_pkg_len	RX_pkg_len	x < -1.23	-1.23 ≤ x < 3.06	3.06 ≤ x	Grand total
40	15	-	7	-	7
	24	-	9	-	9
	30	-	2	-	2
	40	-	3	-	3
45	45	-	3	-	3
	8	-	9	-	9
	15	-	12	-	12
	24	-	6	-	6
45	30	-	3	-	3
	40	-	1	-	1
	45	-	1	-	1
	8	-	17	-	17
45	15	-	10	-	10
	24	-	8	-	8
	30	-	2	-	2
	40	-	1	-	1
Grand total		-	38	-	38

UniqueCount(ThruFN)

←

Only Partial tables displayed

→

ThruFN per TX_pkg_len, RX_pkg_len and COM_MLSE_limited

TX_pkg_len	RX_pkg_len	x < -1.23	-1.23 ≤ x < 3.06	3.06 ≤ x	Grand total
40	15	-	A_w_si0n10_H...	-	A_w_si0n10_H...
	24	-	A_w_si0n10_H...	-	A_w_si0n10_H...
	30	-	A_w_si0n10_H...	-	A_w_si0n10_H...
	40	-	A_w_si0n10_H...	-	A_w_si0n10_H...
45	45	-	A_w_si0n10_H...	-	A_w_si0n10_H...
	8	-	A_w_si0n10_H...	-	A_w_si0n10_H...
	15	-	A_w_si0n10_H...	-	A_w_si0n10_H...
	24	-	A_w_si0n10_H...	-	A_w_si0n10_H...
45	30	-	A_w_si0n10_H...	-	A_w_si0n10_H...
	40	-	S_g_si0n10_KR...	-	S_g_si0n10_K...
	45	-	S_g_si0n10_KR...	-	S_g_si0n10_K...
	8	-	A_w_si0n10_H...	-	A_w_si0n10_H...
45	15	-	A_w_si0n10_H...	-	A_w_si0n10_H...
	24	-	A_w_si0n10_H...	-	A_w_si0n10_H...
	30	-	A_w_si0n10_H...	-	A_w_si0n10_H...
	40	-	S_g_si0n10_KR...	-	S_g_si0n10_K...
Grand total		-	A_w_si0n10_H...	-	A_w_si0n10_H...

UniqueConcatenate(ThruFN)

ThruFN per ICN_mV and FOM_ILD

ICN_mV (bin...)	0.05 ≤ x < 0.10	0.10 ≤ x < 0.15	0.15 ≤ x < 0.20	0.20 ≤ x < 0.25	0.25 ≤ x < 0.30	0.30 ≤ x < 0.35	Grand total
0.00 ≤ x < 0.20	-	-	-	-	-	-	-
0.20 ≤ x < 0.40	-	-	-	-	-	-	-
0.40 ≤ x < 0.60	-	-	-	-	-	-	-
0.60 ≤ x < 0.80	1	3	-	-	-	-	4
0.80 ≤ x < 1.00	1	1	-	1	-	-	3
1.00 ≤ x < 1.20	-	1	1	-	-	-	2
1.20 ≤ x < 1.40	13	2	2	-	-	-	17
1.40 ≤ x < 1.60	-	1	3	-	-	-	4
1.60 ≤ x < 1.80	-	-	1	-	-	-	1
1.80 ≤ x < 2.00	-	-	2	-	-	-	2
2.00 ≤ x < 2.20	-	-	-	-	-	-	-
2.20 ≤ x < 2.40	-	-	2	-	-	-	2
2.40 ≤ x < 2.60	-	-	-	-	-	-	-
2.60 ≤ x < 2.80	-	-	-	-	-	-	-
2.80 ≤ x < 3.00	-	-	2	-	-	-	2
3.00 ≤ x < 3.20	-	-	-	-	-	-	-
3.20 ≤ x < 3.40	-	-	-	-	-	-	-
3.40 ≤ x < 3.60	-	-	1	-	-	-	1
4.00 ≤ x < 4.20	-	-	-	-	-	-	-
4.20 ≤ x < 4.40	-	-	-	-	-	-	-
5.00 ≤ x < 5.20	-	-	-	1	-	-	-
Grand total	15	8	14	1	-	-	38

UniqueCount(ThruFN)

ThruFN per IL_db_die_to_die_at_Frq and ERL

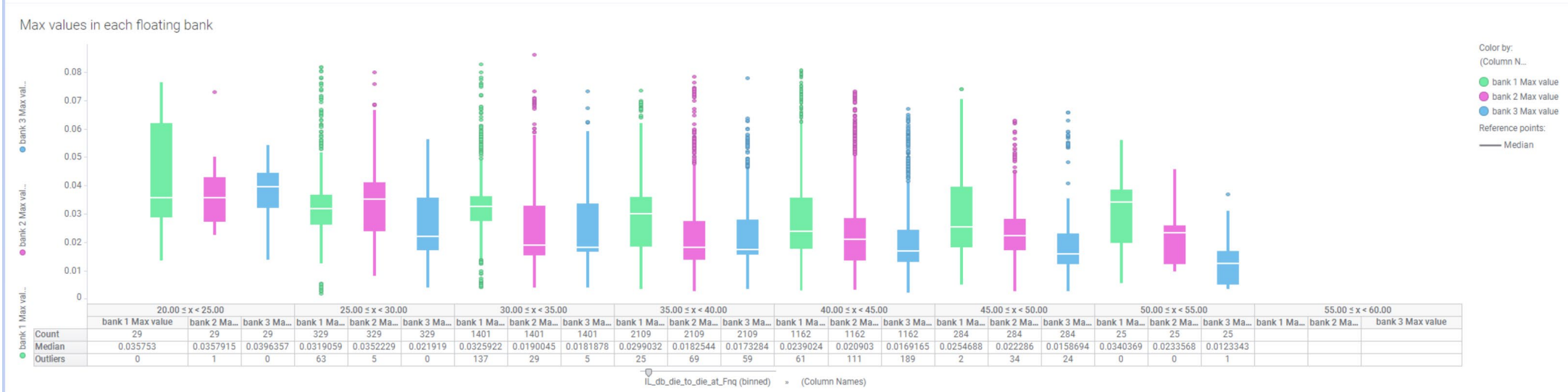
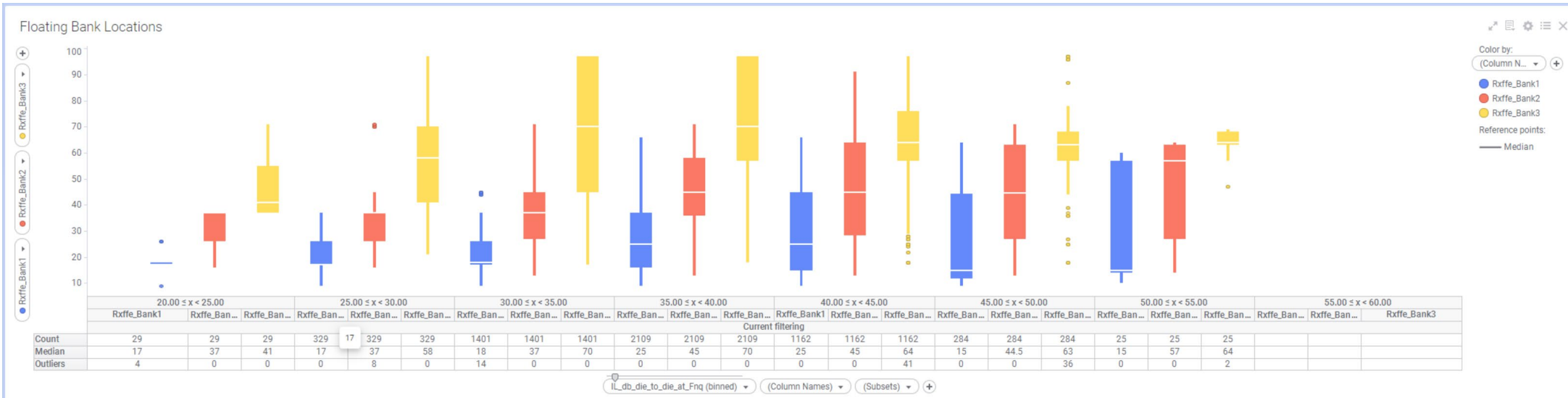
IL_db_die_to_die_at_Frq (binned)	15.00 ≤ x < 16...	16.00 ≤ x < 17...	17.00 ≤ x < 18...	18.00 ≤ x < 19...	19.00 ≤ x < 20...	20.00 ≤ x < 21...	21.00 ≤ x < 22...	Grand total
20.00 ≤ x < 2...	-	-	-	-	-	-	-	-
25.00 ≤ x < 3...	-	-	-	-	-	-	-	-
30.00 ≤ x < 3...	-	-	-	-	-	-	-	-
35.00 ≤ x < 4...	3	9	11	5	8	2	-	38
40.00 ≤ x < 4...	-	-	-	-	-	-	-	-
45.00 ≤ x < 5...	-	-	-	-	-	-	-	-
50.00 ≤ x < 5...	-	-	-	-	-	-	-	-
55.00 ≤ x < 6...	-	-	-	-	-	-	-	-
Grand total	3	9	11	5	8	2	-	38

UniqueCount(ThruFN)

- Difficult to eliminate channels from failed channel list, based characteristics alone - like ICN, FOM_ILD and / or ERL

Floating Tap locations and Max values for Phase 2 Evaluations

RX FFE Floating tap Bank(s) details



Phase 2 evaluation Summary

- Compared to Phase 1 evaluations
 - Overall improved w.r.t number channels passing
 - Short channel performance deteriorated while long channel performance improved
 - In Loss range from 35-40 dB required improvement in COM is more than present MLSE can provide, even when no limited is placed
 - Difficult to eliminate channels from failed channel list, based on ICN, FOM_ILD and / or ERL.
 - For further improvement - we may need to Consider more reasonable option for MLSE implementation penalty (other than arbitrary MLSE limit like 1 dB) and possibility of increasing number of overall RXFFE post taps keeping in mind even with 200 fixed RXFFE taps some cases fail.

Backup

Sample COM Configuration Table –Phase 1

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	5.00E+01	Ohm	
R_d	[50 50]	Ohm	[TX RX]
PKG_NAME	PKG_HIR_CLASSB PKG_HIR_CLASSB		TX RX
A_v	0.413	V	
A_fe	0.413	V	
A_ne	0.608	V	
z_p select	[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 31 32 33 34 35 36]		
L	4		
M	32		
filter and Eq			
f_r	0.58	*fb	
c(0)	0.55		min
c(-1)	0		[min:step:max]
c(-2)	0		[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)	1		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	[0]	dB	[min:step:max]
f_z	42.50	GHz	
f_p1	42.50	GHz	
f_p2	106.25	GHz	
g_DC_HP	[-10:1:0]		[min:step:max]
f_HP_PZ	1.328125	GHz	
Butterworth	1	logical	include in fr

I/O control	Setting	Units	Information
DIAGNOSTICS	1	logical	
DISPLAY_WINDOW	1	logical	
CSV_REPORT	1	logical	
RESULT_DIR	.\results\CRKR_BB_(date)\		
SAVE_FIGURES	0	logical	
Port Order	[1 3 2 4]		
RUNTAG	CRKR_BB_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		UI	
sigma_RJ	0.01	UI	
A_DD	0.02	V ² /GHz	
eta_0	1.00E-08	dB	
SNR_TX	33		
R_LM	0.95		

Batch control options			
BATCH_RUN	1	logical	
CHANNEL_DIR	.\Channels\IEEE channels\All_KRCR_skew4s_tds_channels\		

baseline

Parameter	Setting	Units	Information
package_tl_gamma0_a1_a2	[5e-4 0.00065 0.0003]		
package_tl_tau	0.006141	ns/mm	
package_Z_c	[92 92 ; 70 70; 80 80; 100 100]	Ohm	
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 to run]
z_p (NEXT)	[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 (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 24 30 45 ; 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	[test cases]
Operational			
ERL Pass threshold	10	dB	
COM Pass threshold	3	db	
DER_0	2.00E-04		
T_r	0.00400	ns	
FORCE_TR	1	logical	
PMD_type	C2C		
EW	1		
MLSE	3	logical	
ts_anchor	1		
sample_adjustment	[-32 32]		
Local Search	0		
Filter: Rx FFE			
ffe_pre_tap_len	6	UI	
ffe_post_tap_len	8	UI	
ffe_pre_tap1_max	1	(normalized)	
ffe_post_tap1_max	1	(normalized)	
ffe_tapn_max	1	(normalized)	
FFE_OPT_METHOD	MMSE		FV-LMS or MMSE
num_ui_RXFF_noise	1024		
RXFFE FLOAT CTL	FOM		FOM o ISI
Floating Tap Control			
N_bg	3	0 1 2 or 3 groups	
N_bf	4	taps per group	
N_f	100	UI span for floating taps	
bmaxg	0.2	max DFE value for floating taps	
B_float_RSS_MAX	1	rss tail tap limit	
N_tail_start	25	(UI) start of tail taps limit	

Parameter	Setting	Information
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
board_tl_gamma0_a1_a2		
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		
Selelions (rectangle, gaussian,dual_rayleigh,triangle)	0	logical
Histogram_Window_Weight	gaussian	selection
Qr	0.02	UI

COM tool version: 4.6 Beta 2

Sample COM Configuration Table –Phase 2

Table 93A-1 parameters				I/O control			Table 93A-3 parameters				SAVE_CONFIG2MAT	0	
Parameter	Setting	Units	Information	DIAGNOSTICS	1	logical	Parameter	Setting	Units	Information	Receiver testing		
f_b	106.25	GBd		DISPLAY_WINDOW	1	logical	package_tl_gamma0_a1_a2	[5e-4 0.00065 0.0003]			RX_CALIBRATION	0	logical
f_min	0.05	GHz		CSV_REPORT	1	logical	package_tl_tau	0.006141	ns/mm		Sigma BBN step	5.00E-03	V
Delta_f	0.01	GHz		RESULT_DIR	.\results\CRKR_BB_{date}\		package_Z_c	2 92 ; 70 70; 80 80; 100 100	Ohm		ICN parameters		
C_d	[0.4e-4 0.9e-4 1.1e-4; 0.4e-4 0.9e-4 1.1e-4]	nF	[TX RX]	SAVE_FIGURES	0	logical	z_p (TX)	; 1 1 1 1; 1 1 1 1; 0.5 0	mm	[test cases to run]	f_v	0.278	Fb
L_s	[0.13 0.15 0.14; 0.13 0.15 0.14]	nH	[TX RX]	Port Order	[1 3 2 4]		z_p (NEXT)	; 1 1 1 1; 1 1 1 1; 0.5 0	mm	[test cases]	f_f	0.278	Fb
C_b	[0.3e-4 0.3e-4]	nF	[TX RX]	RUNTAG	CRKR_BB_eval_		z_p (FEXT)	; 1 1 1 1; 1 1 1 1; 0.5 0	mm	[test cases]	f_n	0.278	Fb
R_0	5.00E+01	Ohm		COM_CONTRIBUTION	1	logical	z_p (RX)	; 1 1 1 1; 1 1 1 1; 0.5 0	mm	[test cases]	f_2	58.438	GHz
R_d	[46.25 46.25]	Ohm	[TX RX]	TDR and ERL options			C_p	[0.4e-4 0.4e-4]	nF	[test cases]	A_ft	0.450	V
PKG_NAME	PKG_HIR_CLASSB PKG_HIR_CLASSB		TX RX	TDR	1	logical	Operational				A_nt	0.450	V
A_v	0.413	V		ERL	1	logical	ERL Pass threshold	10	dB		Parameter Setting		
A_fe	0.413	V		ERL_ONLY	0	ns	COM Pass threshold	3	db		board_tl_gamma0_a1_a2	[0.644084e-4 3.6036e-05]	1.4 db/in @ 53.125G
A_ne	0.608	V		TR_TDR	0.01		DER_0	2.00E-04			board_tl_tau	5.790E-03	ns/mm
z_p select	11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36]			N	4000	logical	T_r	0.00400	ns		board_Z_c	100	Ohm
L	4			TDR Butterworth	1		FORCE_TR	1	logical		z_bp (TX)	32	mm
M	32			beta_x	0		PMD_type	C2C			z_bp (NEXT)	32	mm
filter and Eq				rho_x	0.618		EW	1			z_bp (FEXT)	32	mm
f_r	0.55	*fb		TDR_W_TPKG	0	UI	MLSE	3	logical		z_bp (RX)	32	mm
c(0)	0.55		min	N_bx	20		ts_anchor	1			C_0	[0.2e-4 0]	nF
c(-1)	0		[min:step:max]	fixture delay time	[0 0]		sample_adjustment	[-32 32]			C_1	[0.2e-4 0]	nF
c(-2)	0		[min:step:max]	Tukey_Window	1		Local Search	0			Include PCB 0 logical		
c(-3)	0		[min:step:max]	Noise, jitter			Filter: Rx FFE				Seletions (rectangle, gaussian,dual_rayleigh,triangle		
c(-4)	0		[min:step:max]	sigma_RJ	0.01	UI	ffe_pre_tap_len	6	UI		Histogram_Window_Weight	gaussian	selection
c(1)	0		[min:step:max]	A_DD	0.02	V^2/GHz	ffe_post_tap_len	8	UI		Qr	0.02	UI
N_b	1	UI		eta_0	1.00E-08	dB	ffe_pre_tap1_max	1	(normalized)				
b_max(1)	1		As/dffe1	SNR_TX	33.5		ffe_post_tap1_max	1	(normalized)				
b_max(2..N_b)	0.3		As/dfe2..N_b	R_LM	0.95		ffe_tapn_max	1	(normalized)				
b_min(1)	0		As/dffe1	Batch control options			FFE_OPT_METHOD	MMSE		FV-LMS or MMSE			
b_min(2..N_b)	-0.15	S	As/dfe2..N_b	BATCH_RUN	1	logical	num_ui_RXFF_noise	1024					
g_DC	[0]	dB	[min:step:max]	CHANNEL_DIR	E:\channels\All_KRCR_skew4stds_chann		RXFFE_FLOAT_CTL	FOM		FOM o ISI			
f_z	42.50	GHz		Floating Tap Control			N_bg	3	0 1 2 or 3 groups				
f_p1	42.50	GHz		ENOB	32	default 32	N_bf	4	taps per group				
f_p2	106.25	GHz		trunc	15	default 128	N_f	100	UI span for floating taps				
g_DC_HP	[-10:1:0]		[min:step:max]	baseline			bmaxg	0.2	max DFE value for floating taps				
f_HP_PZ	1.328125	GHz					B_float_RSS_MAX	1	rss tail tap limit				
Butterworth	1	logical	include in fr				N_tail_start	9	(UI) start of tail taps limit				

COM tool version: 4.6 Beta 4

