

Backplane Reference Receiver Tap Weight Data

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Contents

- Analysis Cases
- COM Results
- Tap Weight Stats
- Tap Weights for Specific Channels
 - $b(3) - b(2) > 0$
 - most negative tap
- ERL Study

Objective & Contents

Objective

Provide backplane tap weight data for use in establishing 100GBASE-KR1 FEC direction.

Contents

- Analysis Cases
- COM Results
- Tap Weight Stats
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Analysis Cases

Refer to

http://www.ieee802.org/3/ck/public/19_07/walker_3ck_01d_0719.pdf.

- Reference Rx DFE:
 - Fixed: 12 taps
 - Float: 3 banks, 3 taps/bank, 40UI span
 - $b_{max}(2..n) = 0.2$. Also analyzed $b_{max}(2..n) = 0.3$.
- Reference Package: 31mm Tx/29mm Rx and 12mm Tx/Rx trace lengths.
- Reference Termination: Inductor-based model
- Channels: sub-29dB fitted IL channels from the full set of contributed channels
- COM 2.70

COM Results Summary

Δ between $b_{max}(2 \dots n) = 0.3$ & 0.2 :

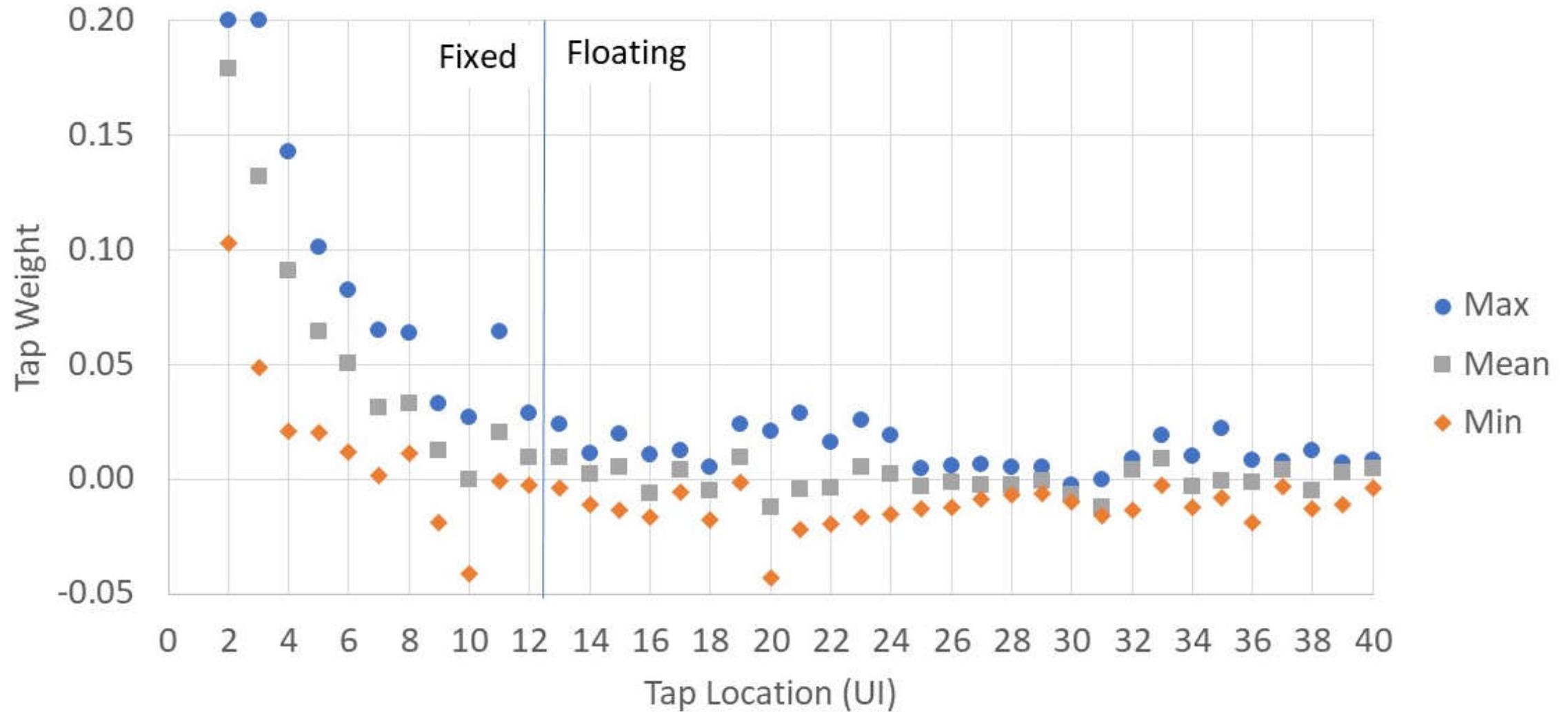
- Mean COM value decreases by ~ 0.12 dB.
- COM spread (Sigma) increases slightly.
- 3 channels that meet 3dB COM @ 0.3 fail to meet @ 0.2.

<i>Lpkg (mm)</i>	<i>bmax</i>	% Pass	Mean COM	Sigma COM
12	0.3	92.0%	5.03	1.12
12	0.2	92.0%	4.90	1.16
31	0.3	86.4%	4.48	1.13
31	0.2	83.0%	4.36	1.14

Channel		COM (dB) w/ $b_{max}(2\dots n)=$	
		0.3	0.2
CAch2_a2p5	78	3.01	2.89
Bch2_b7p5_7	70	3.06	2.90
OAch4	96	3.12	2.83

Tap Weights for $b_{\max}(2..n)=0.2$

Note: 1st postcursor tap is not shown.



Tap Weight Summary Statistics

$$b_{max}(2..n) = 0.2$$

Fixed

Tap Location (UI)	1	2	3	4	5	6	7	8	9	10	11	12	
bmax=0.2	Max	0.85	0.20	0.20	0.14	0.10	0.08	0.07	0.06	0.03	0.03	0.06	0.03
	Min	0.41	0.103	0.05	0.02	0.02	0.01	0.00	0.01	-0.02	-0.04	0.00	0.00
	Mean	0.68	0.18	0.13	0.09	0.06	0.05	0.03	0.03	0.01	0.00	0.02	0.01
	Sigma	0.120	0.022	0.032	0.025	0.015	0.013	0.012	0.010	0.010	0.019	0.014	0.006

Floating

Tap Location (UI)	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
bmax=0.2	Max	0.02	0.01	0.02	0.01	0.01	0.00	0.02	0.02	0.03	0.02	0.03	0.02	0.00	0.01
	Min	0.00	-0.01	-0.01	-0.02	-0.01	-0.02	0.00	-0.04	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01
	Mean	0.01	0.00	0.01	-0.01	0.00	-0.01	0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
	Sigma	0.005	0.004	0.007	0.004	0.004	0.005	0.006	0.016	0.011	0.009	0.010	0.009	0.005	0.004

Tap Location (UI)	27	28	29	30	31	32	33	34	35	36	37	38	39	40
bmax=0.2	Max	0.01	0.01	0.01	0.00	0.00	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01
	Min	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	0.00	-0.01	-0.01	-0.02	0.00	-0.01	-0.01
	Mean	0.00	0.00	0.00	-0.01	-0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	Sigma	0.005	0.005	0.005	0.003	0.004	0.006	0.005	0.008	0.011	0.007	0.003	0.006	0.005

Tap Weight Summary Statistics

$$b_{max}(2..n) = 0.3$$

Fixed

Tap Location (UI)	1	2	3	4	5	6	7	8	9	10	11	12	
bmax=0.3	Max	0.85	0.30	0.26	0.18	0.12	0.10	0.08	0.07	0.04	0.03	0.06	0.04
	Min	0.45	0.13	0.06	0.04	0.02	0.01	0.00	0.01	-0.01	-0.04	0.00	0.00
	Mean	0.75	0.26	0.18	0.12	0.08	0.06	0.04	0.04	0.02	0.00	0.02	0.01
	Sigma	0.087	0.041	0.038	0.024	0.018	0.014	0.013	0.011	0.010	0.019	0.013	0.007

Floating

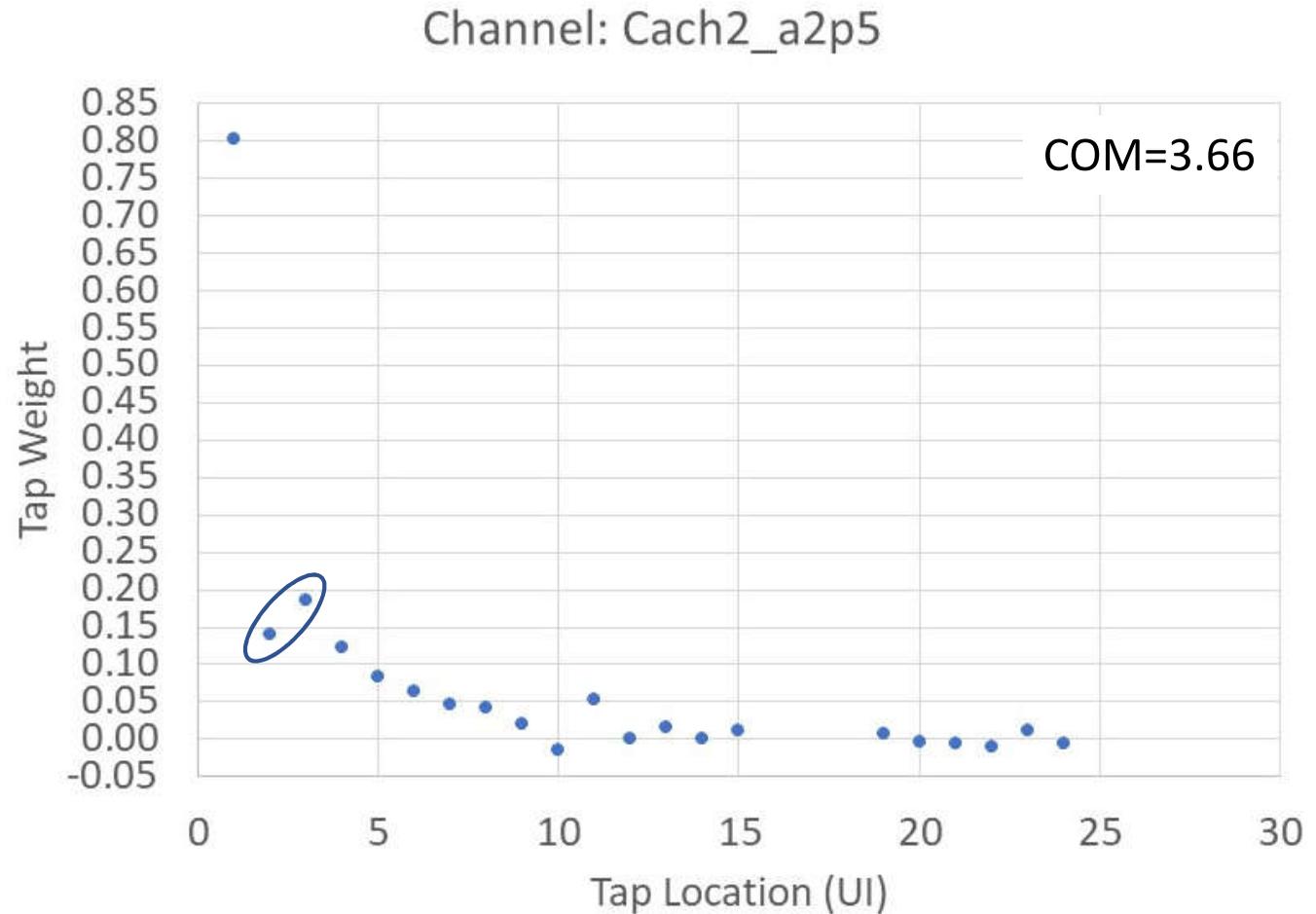
Tap Location (UI)	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
bmax=0.3	Max	0.03	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.03	0.02	0.03	0.02	0.01	0.01
	Min	-0.01	-0.01	-0.01	-0.02	0.00	-0.02	0.00	-0.04	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01
	Mean	0.01	0.00	0.01	-0.01	0.00	-0.01	0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
	Sigma	0.005	0.004	0.006	0.004	0.004	0.005	0.006	0.015	0.010	0.009	0.010	0.008	0.005	0.005

Tap Location (UI)	27	28	29	30	31	32	33	34	35	36	37	38	39	40
bmax=0.3	Max	0.01	0.01	0.00	0.00	-0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01
	Min	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	0.00	-0.01	-0.01	-0.02	0.00	-0.01	-0.01
	Mean	0.00	0.00	0.00	-0.01	-0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	Sigma	0.005	0.004	0.004	0.002	0.002	0.005	0.005	0.009	0.013	0.006	0.003	0.006	0.005

Tap Weights: Cach2_a2p5 with 12mm package

This channel has $b(3) > b(2)$.

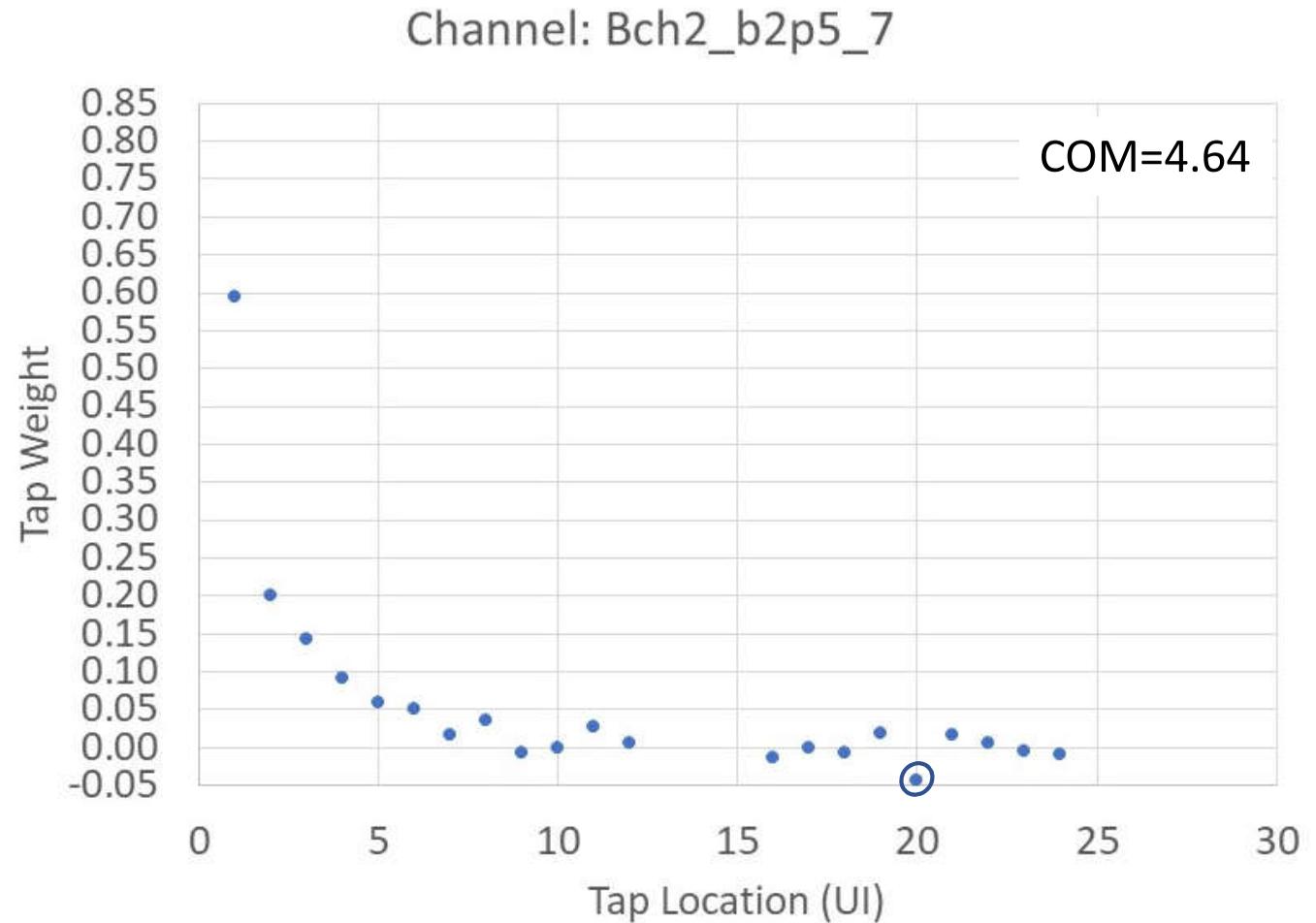
UI	b(n)
1	0.802
2	0.139
3	0.187
4	0.124
5	0.083
6	0.063
7	0.048
8	0.042
9	0.021
10	-0.014
11	0.053
12	0.002
13	0.015
14	0.001
15	0.011
19	0.008
20	-0.004
21	-0.006
22	-0.010
23	0.011
24	-0.006



Tap Weights: Bch2_b2p5_7 with 31mm package

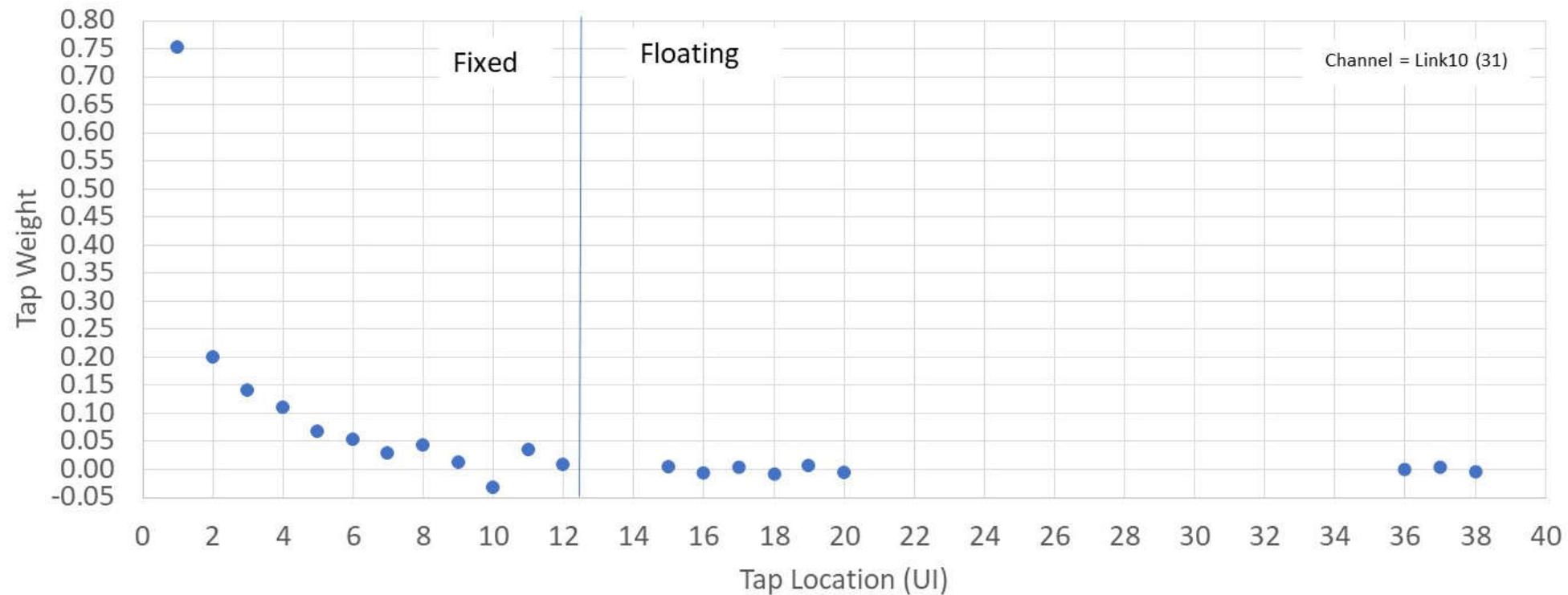
This channel has the WC minimum tap weight (-0.043 @ UI=20).

UI	b(n)
1	0.594
2	0.200
3	0.144
4	0.092
5	0.060
6	0.051
7	0.017
8	0.036
9	-0.006
10	-0.001
11	0.028
12	0.005
16	-0.013
17	-0.001
18	-0.007
19	0.018
20	-0.043
21	0.017
22	0.006
23	-0.005
24	-0.010



Tap Weights: Link10 with 12mm package

This is one of the channels that has 9 changes in tap weight sign.



n	b(n)
1	0.752
2	0.199
3	0.140
4	0.110
5	0.068
6	0.053
7	0.029
8	0.042
9	0.013
10	-0.032
11	0.034
12	0.009
13	0.003
14	-0.006
15	0.004
16	-0.009
17	0.007
18	-0.007
19	0.004
20	-0.004
21	0.005
22	0.003
23	-0.006
24	0.004
25	-0.009
26	0.007
27	-0.007
28	0.004
29	-0.004
30	0.005
31	0.003
32	-0.006
33	0.004
34	-0.009
35	0.007
36	-0.007
37	0.004
38	-0.004
39	0.005

Additional Information

Channels – Full Set

#	Main File	Folder	Files	Documentation	#	Main File	Folder	Files	Documentation
1	cable_CKP_16dB.zip	Cable_BKP_16dB_Op575m.zip	Cable_BKP_16dB_Op575m_*.s4p	heck_3ck_02_0119.pdf	55	kareti_3ck_01_1118_backplane.zip	Bch1_3p5	kareti_3ck_01a_1118.pdf	
2		Cable_BKP_16dB_Op575m_more_isi.zip	Cable_BKP_16dB_Op575m_more_isi_*.s4p		56		Bch2_7		
3		Cable_BKP_16dB_Op995m_updated.zip	Cable_BKP_16dB_Op995m_updated_*.s4p		57		Bch2_a0_7		
4		Cable_BKP_16dB_Op995m_more_isi_updated.zip	Cable_BKP_16dB_Op995m_more_isi_updated_*.s4p		58		Bch2_a10_7		
5	Cable_BKP_20dB_Op575m.zip	Cable_BKP_20dB_Op575m_*.s4p	59	Bch2_a12p5_7					
6	Cable_BKP_20dB_Op575m_more_isi.zip	Cable_BKP_20dB_Op575m_more_isi_*.s4p	60	Bch2_e15_7					
7	Cable_BKP_20dB_Op995m_updated.zip	Cable_BKP_20dB_Op995m_updated_*.s4p	61	Bch2_a2p5_7					
8	Cable_BKP_20dB_Op995m_more_isi_updated.zip	Cable_BKP_20dB_Op995m_more_isi_updated_*.s4p	62	Bch2_a5_7					
9	Cable_BKP_24dB_Op575m.zip	Cable_BKP_24dB_Op575m_*.s4p	63	Bch2_a7p5_7					
10	Cable_BKP_24dB_Op575m_more_isi.zip	Cable_BKP_24dB_Op575m_more_isi_*.s4p	64	Bch2_b10_7					
11	Cable_BKP_24dB_Op995m_updated.zip	Cable_BKP_24dB_Op995m_updated_*.s4p	65	Bch2_b15_7					
12	Cable_BKP_24dB_Op995m_more_isi_updated.zip	Cable_BKP_24dB_Op995m_more_isi_updated_*.s4p	66	Bch2_b2p5_7					
13	Cable_BKP_28dB_Op575m.zip	Cable_BKP_28dB_Op575m_*.s4p	67	Bch2_b2_7					
14	Cable_BKP_28dB_Op575m_more_isi.zip	Cable_BKP_28dB_Op575m_more_isi_*.s4p	68	Bch2_b4_7					
15	Cable_BKP_28dB_Op995m_updated.zip	Cable_BKP_28dB_Op995m_updated_*.s4p	69	Bch2_b6_7					
16	Cable_BKP_28dB_Op995m_more_isi_updated.zip	Cable_BKP_28dB_Op995m_more_isi_updated_*.s4p	70	Bch2_b7p5_7					
17	tracy_3ck_02_0119_orthoBP.zip	DPO_IL_12dB	DPO_4in_Meg7_*.s4p	tracy_3ck_01b_0119.pdf	71	Bch2_b8_7	kareti_3ck_01a_1118.pdf		
18		DPO_IL_24dB	DPO_10in_Meg7_*.s4p		72	Bch3_14			
19		DPO_IL_28dB	DPO_12in_Meg7_*.s4p		73	Bch4_30			
20		DPO_IL_32dB	DPO_14in_Meg7_*.s4p		74	CAch1_b2			
21	tracy_3ck_03_0119_tradBP.zip	-	Std_BP_12inch_Meg7_*.s4p	75	CAch1				
22	zambell_3ck_01_1118_links01to09.zip	Link_1	See the folder	zambell_3ck_01_1118.pdf	76	CAch2_a0			
23		Link_2			77	CAch2_a10			
24		Link_3			78	CAch2_a2p5			
25		Link_4			79	CAch2_a5			
26		Link_5			80	CAch2_a7p5			
27		Link_6			81	CAch2_b10			
28		Link_7			82	CAch2_b2p5			
29		Link_8			83	CAch2_b2			
30		Link_9			84	CAch2_b4			
31	zambell_3ck_01_1118_links10to18.zip	Link_10	See the folder	zambell_3ck_01_1118.pdf	85	CAch2_b6			
32		Link_11			86	CAch2_b7p5			
33		Link_12			87	CAch2_b8			
34		Link_13			88	CAch2			
35		Link_14			89	CAch3_b2			
36		Link_15			90	CAch3			
37		Link_16			91	CAch4_b2			
38	Link_17	92	CAch4						
39	zambell_3ck_01_1118_links19to278.zip	Link_18	See the folder	zambell_3ck_01_1118.pdf	93	OAch1			
40		Link_19			94	OAch2			
41		Link_20			95	OAch3			
42		Link_21			96	OAch4			
43		Link_22			97	OAch5			
44		Link_23			98	OAch6			
45		Link_24			99	OAch7			
46		Link_25			100	Och1			
47		Link_26			101	Och2			
48	Link_27	102	Och3						
49	mellitz_3ck_adhoc_02_081518_cabledbackplane.zip	CaBP_BGAVia_Opt1_24dB.zip	CaBP_BGAVia_Opt1_24dB_*.s4p	mellitz_3ck_adhoc_02_081518.pdf	103	Och4			
50		CaBP_BGAVia_Opt1_28dB.zip	CaBP_BGAVia_Opt1_28dB_*.s4p		104	Och5			
51		CaBP_BGAVia_Opt1_32dB.zip	CaBP_BGAVia_Opt1_32dB_*.s4p		105	Och6			
52		CaBP_BGAVia_Opt2_24dB.zip	CaBP_BGAVia_Opt2_24dB_*.s4p		106	Och7			
53		CaBP_BGAVia_Opt2_28dB.zip	CaBP_BGAVia_Opt2_28dB_*.s4p		107	Och8			
54		CaBP_BGAVia_Opt2_32dB.zip	CaBP_BGAVia_Opt2_32dB_*.s4p						

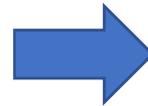
107 channels pulled from the p802.3ck repository.

As in the past, we analyzed two subsets:

- <29dB
- <28dB

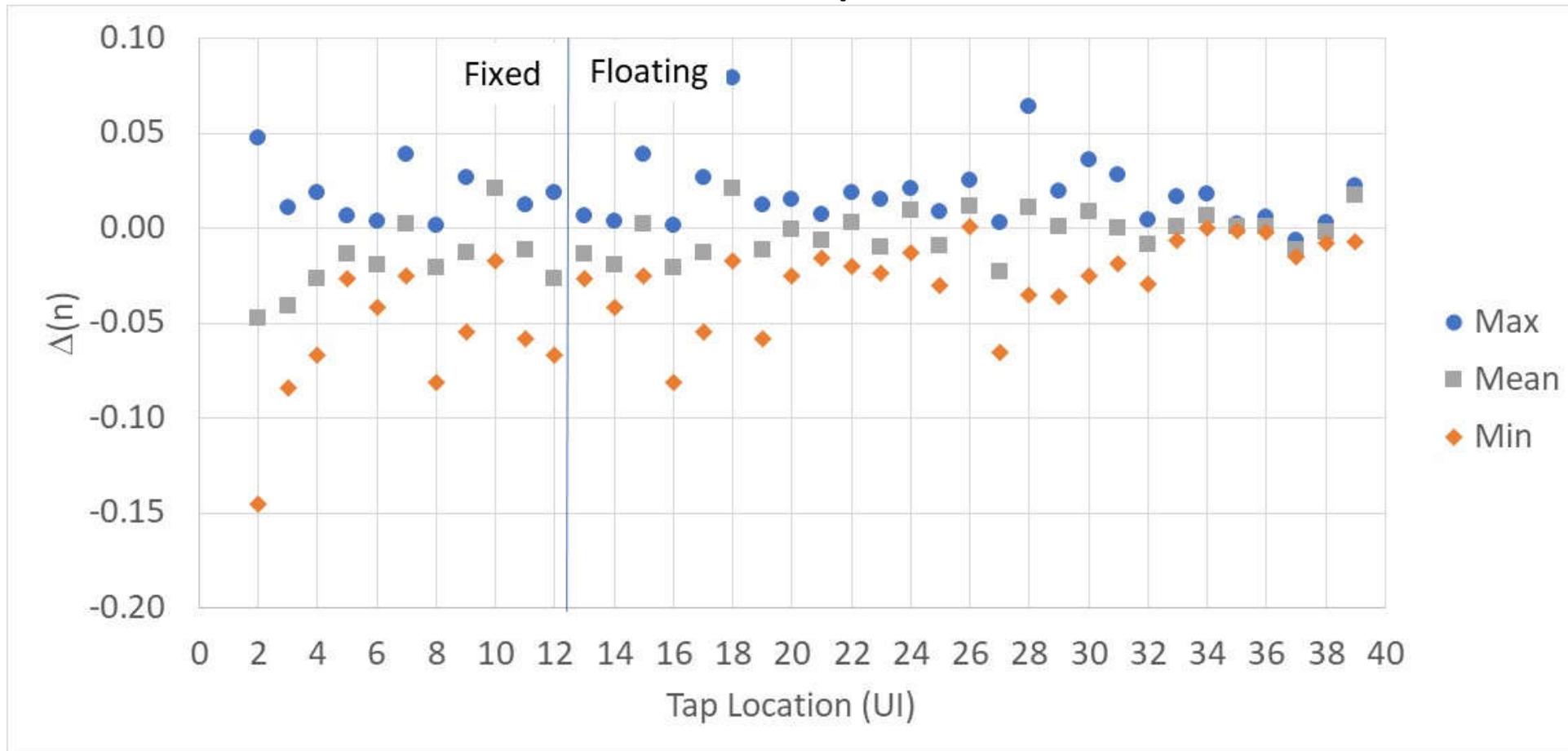
Package Delay Estimates

Value	Symbol	Quantity	Units
6.141	τ	T-line propagation delay	ps/mm
12	z_{p1}	Min Tx/Rx pkg length	mm
31	z_{p1}	Max Tx pkg length	mm
29	z_{p1}	Max Rx pkg length	mm
1.8	z_{p2}	Pkg via length	mm
120	C_d	Device capacitance	fF
120	L_s	Series inductance	pH
30	C_b	Bump capacitance	fF
87	C_p	Ball capacitance	fF
87.5	Z_{cpkg}	pkg T-line Z0	Ω
53.125	f_b	Signaling Rate	Gbd
37.647	UI	Unit interval	ps



Quantity	Min	Max		Units
	Tx&Rx	Tx	Rx	
Pkg Length	13.8	32.8	30.8	mm
T-line delay	84.7	201.4	189.1	ps
Cd delay	5.3	5.3	5.3	ps
Is delay	5.3	5.3	5.3	ps
Cb delay	1.3	1.3	1.3	ps
Cp delay	3.8	3.8	3.8	ps
Pkg delay	100.4	217.0	204.8	ps
Pkg delay	5.3	11.5	10.9	UI
Round trip	10.7	23.1	21.8	UI

Δ Between Consecutive Taps



Plot shows the difference in weight between consecutive taps, $\Delta(n) = b(n + 1) - b(n)$, starting with $\Delta(2)$.

Tap Weight Δ Summary Statistics

Fixed

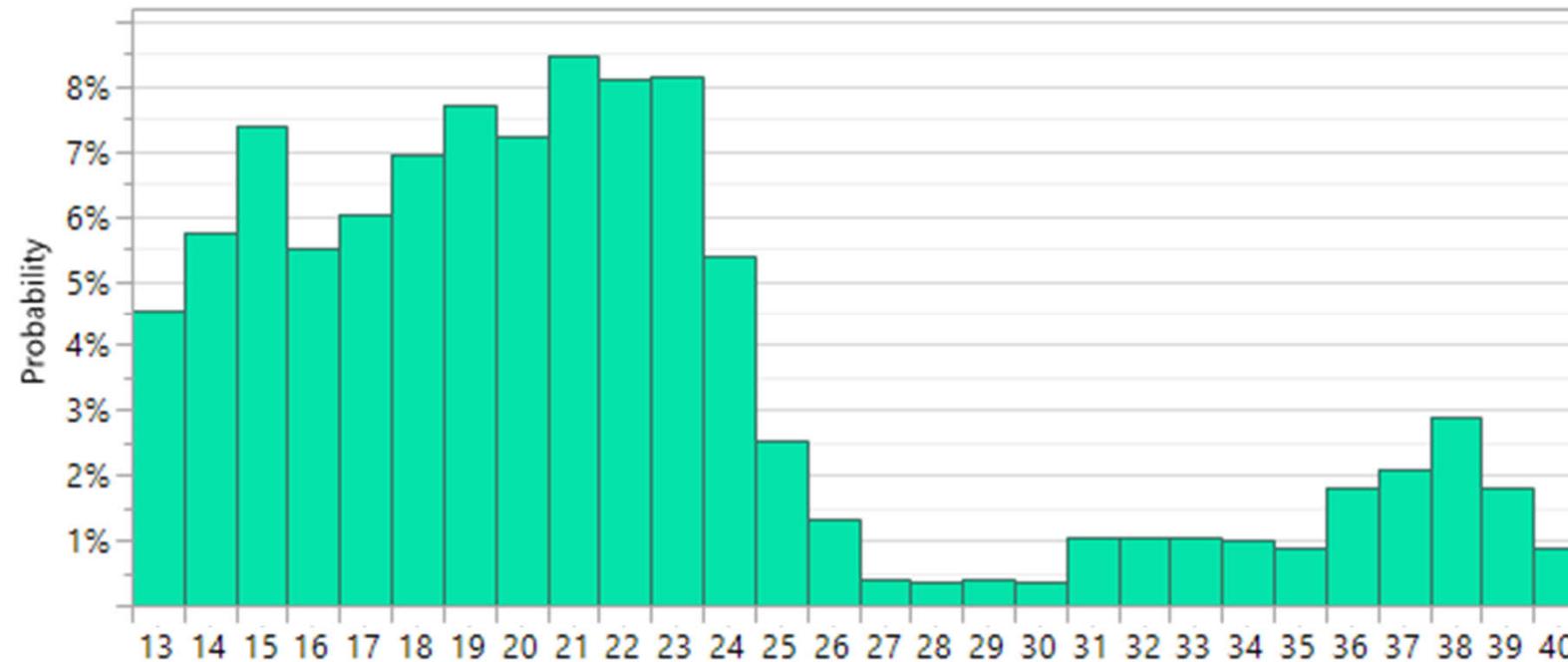
n (UI)	1	2	3	4	5	6	7	8	9	10	11	12
$n+1$ (UI)	2	3	4	5	6	7	8	9	10	11	12	13
Max	-0.235	0.048	0.011	0.019	0.006	0.003	0.039	0.002	0.026	0.079	0.012	0.019
Min	-0.696	-0.146	-0.084	-0.067	-0.027	-0.041	-0.025	-0.081	-0.055	-0.017	-0.058	-0.067
Mean	-0.497	-0.047	-0.041	-0.027	-0.014	-0.019	0.002	-0.021	-0.013	0.021	-0.011	-0.027
Sigma	0.123	0.032	0.024	0.018	0.006	0.009	0.014	0.016	0.018	0.029	0.014	0.0183

Floating

n (UI)	13	14	15	16	17	18	19	20	21	22	23	24	25	26
$n+1$ (UI)	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Max	0.006	0.003	0.039	0.002	0.026	0.079	0.012	0.015	0.007	0.019	0.015	0.021	0.009	0.025
Min	-0.027	-0.041	-0.025	-0.081	-0.055	-0.017	-0.058	-0.025	-0.016	-0.020	-0.024	-0.013	-0.030	0.001
Mean	-0.014	-0.019	0.002	-0.021	-0.013	0.021	-0.011	-0.001	-0.007	0.003	-0.010	0.009	-0.009	0.012
Sigma	0.006	0.009	0.014	0.016	0.018	0.029	0.014	0.007	0.004	0.008	0.008	0.005	0.006	0.005

n (UI)	27	28	29	30	31	32	33	34	35	36	37	38	39
$n+1$ (UI)	28	29	30	31	32	33	34	35	36	37	38	39	40
Max	0.003	0.064	0.019	0.036	0.028	0.005	0.017	0.018	0.002	0.006	-0.007	0.003	0.022
Min	-0.065	-0.035	-0.036	-0.025	-0.019	-0.029	-0.007	0.000	-0.001	-0.002	-0.015	-0.008	-0.007
Mean	-0.023	0.011	0.001	0.009	0.000	-0.009	0.001	0.006	0.001	0.001	-0.012	-0.002	0.017
Sigma	0.021	0.027	0.009	0.017	0.013	0.009	0.006	0.010	0.002	0.003	0.004	0.005	0.007

Floating Tap Locations



Data from all sub-29 dB channels, both package lengths, all floating taps.