100G Low Loss Channel Minimum Tap Weight (b1, b2) Impact

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Background: D1.1 Comment 136

Comment text for Comment: 13

136

Save and Close

Slide 6 of heck_3ck_01_0919 shows that the DFE taps are 2 and 3 are always strongly positive, and no taps strongly negative, yet the draft would allow such untypical/hypothetical channels that a real receiver need not, and maybe can't, cope with. kasapi_3ck_01_1119 slide 7 shows the first tap also. We need sensible minimum tap limits.

Discussion during D1.1 comment resolution suggested that we need to consider 'minimum loss' channels, in addition to the higher loss channels referenced by the comment. Suggested Remedy for Comment:136Add minimum tap weight limits:Tap 1: min +0.3Tap 2: min +0.05Remembering that a tap weight limit isn't a hard pass-fail limit; channels can gooutside it but pay a (very small, for one or two small excursions) increase in COMfor the excess ISI noise that they cause; and that cable channels are smootherthan backplane channels but can have higher loss:All other taps: min -0.03 (tighter than for KR).Turn the existing "Normalized DFE coefficient magnitude limit"s into "NormalizedDFE coefficient limit"s.Update definition of COM in 93A.1.

Summary

Objective Assess whether bmin(1) = 0.3 & bmin(2) = 0.05 hurts performance.

MethodCOM simulations with different minimum tap weights for lowloss CR and KR channels.

 \rightarrow Address concern raised during D1.1 comment resolution.

Channels

- Set 1 CR: 12 & 31 mm ref pkg, 2" host PCB trace, 0.5m cable
 KR: existing 16dB cabled BP channel (Cable_BKP_16dB_0p575m_more_isi)
 Set 2 CR: 6 mm ref pkg, 0.5" host PCB trace, 0.5m cable (retimer-to-retimer)
 KR: 12 & 21 mm ref pkg, 2" host PCB trace (0 connector BP)
- **Conclusion** No performance loss for the proposed reference DFE min tap limits. \rightarrow Including the lowest loss channels that we could conceive.

Set 1 Channels

Channels



KR channel can be found at

16.1dB

http://www.ieee802.org/3/ck/public/tools/backplane/heck_3ck_01a_1118_cable_BKP_16dB.zip

Set 1 Example COM Spreadsheet

Table 93A-1 parame	ters		1/	O control			Table 93A-3 parameter	5
Setting	Units	Information	DIAGNOSTICS	1	logical	Parameter	Setting	Units
53.125	GBd		DISPLAY_WINDOW	1	logical	package_tl_gamma0_a1_a	[0 0.0009909 0.0002772]	
0.05	GHz	0	CSV_REPORT	1	logical	package_tl_tau	6.141E-03	ns/mm
0.01	GHz		RESULT_DIR	.\results\100GEL_	KR_{date}	package_Z_c	[87.587.5;92.592.5]	Ohm
[1.2e-4 1.2e-4]	nF	[TX RX]	SAVE_FIGURES	0	logical	benarts	i_3ck_01_0119 & mellitz_3	3ck_01_0119
[0.12, 0.12]	nH	[TX RX]	Port Order	[1324]	0.0000000000000000000000000000000000000		Table 92–12 parameter	5
[0.3e-4 0.3e-4]	nF	[TX RX]	RUNTAG	KR_test1_update		Parameter	Setting	
[12]		[test cases to run]	COM_CONTRIBUTION	0	logical	board_tl_gamma0_a1_a2	0 3.8206e-04 9.5909e-05	1
[12 31; 1.8 1.8]	mm	[test cases]	Op	perational	<u></u>	board_tl_tau	5.790E-03	ns/mm
[12 29; 1.8 1.8]	mm	[test cases]	COM Pass threshold	3	dB	board_Z_c	100	Ohm
[12 31; 1.8 1.8]	mm	[test cases]	ERL Pass threshold	10.5	dB	z_bp (TX)	110.3	mm
[12 29; 1.8 1.8]	mm	[test cases]	DER_0	1.00E-04		z_bp (NEXT)	110.3	mm
[0.87e-40.87e-4]	nF	[TX RX]	Τr	6.16E-03	ns	z_bp (FEXT)	110.3	mm
50	Ohm		FORCE_TR	1	logical	z_bp (RX)	110.3	mm
[50 50]	Ohm	[TX RX]		í í		C_0	[0.29e-4]	nF
0.415	V	vp/vf=.694	TDR ar	nd ERL options		C_1	[0.19e-4]	nF
0.415	V	vp/vf=.694	TDR	1	logical	Include PCB	0	logical
0.608	V		ERL	1	logical			
4			ERL_ONLY	0	logical		Floating Tap Control	
32			TR_TDR	0.01	ns	N_bg	3	012 or 3 groups
filter and Eq			N	3000		N_bf	3	taps per group
0.75	*fb	o	beta_x	2.3407E+09	-1	N_f	40	UI span for floating taps
0.54	ŝ	min	rho_x	0.19		bmaxg	0.2	max DFE value for floating tap:
[-0.34:0.02:0]		[min:step:max]	fixture delay time	[00]	[port1 port2]	cable assemblies require	this for each HCB	
[0:0.02:0.12]		[min:step:max]	TDR_W_TXPKG	0			ICN parameters (v2.73)/
[-0.06:0.02:0]		[min:step:max]	N_bx	12	UI	f f	12.919	2
[-0.2:0.05:0]		[min:step:max]	Rece	eiver testing		f_n	12.919	
12	UI		RX_CALIBRATION	0	logical	f_2	39.844	
0.85			Sigma BBN step	5.00E-03	V	A_ft	0.600	а.
0.2	3. 		No	oise, jitter		A_nt	0.600	
0.3	2	90	sigma_RJ	0.01	UI	heck_3ck_03b_0319	Adopted Mar 2019	
0.05 -0.2*ones(1,10)			A_DD	0.02	UI	walker_3ck_01a_0719	Adopted July 2019	
[-20:1:0]	dB	[min:step:max]	eta_0	8.2E-09	V^2/GHz	result of R_d=50		
21.25	GHz		SNR_TX	33	dB	benartsi_3ck_01a_0719	no used for KR	
21.25	GHz		R_LM	0.95		mellitz_3ck_03_0919		
53.125	GHz		BREAD_CRUMBS	1				
[-6:1:0]	¢	[min:step:max]						
0.6640625	GHz							

Set 1 Results



No change in COM, b(1), or b(2) seen as a function of $b_{min}(1)$, $b_{min}(2)$

Set 2 Channels

Channels

	Tx Pkg	PCB		Rx Pkg
	802.3ck]	802.3ck
Min Loss KR	ref pkg	MEG6N		ref pkg
Channel	12/30mm	2" trace		12/30mm
	trace			trace
2.75dB				

Tap Range Cases

Тар	Limit		CAS	SE		
тар	LIIIIIL	1	2	3	4	
b1	max	0.85	0.85	0.85	0.85	
51	min	0	0	0.3	0.3	
b2	max	0.3	0.3	0.3	0.3	
02	min	-0.3	0.05	-0.3	0.05	
hn	max	0.2	0.2	0.2	0.2	
	min	-0.05	-0.05	-0.05	-0.05	
hfloat	max	0.05	0.05	0.05	0.05	
bfloat	min	-0.05	-0.05	-0.05	-0.05	

Set 2 COM Spreadsheets: KR

TEST 1 TEST 2 TEST 3 **TEST 4** Table 93A-1 parameters Table 93A-1 parameters Table 93A-1 parameters Table 93A-1 parameters Information Parameter Setting Units Information Parameter Setting Units Parameter Setting Units Information Parameter Setting Units Information fb 53.125 GBd 53.125 GBd f b fb 53.125 GBd fb 53.125 GBd f min 0.05 GHz f min 0.05 GHz f min 0.05 GHz f min 0.05 GHz Delta f 0.01 GHz Delta f 0.01 GHz Delta i 0.01 GHz Delta f 0.01 GHz Сd [1.2e-4 1.2e-4] nF [TX RX] Cd [1.2e-4 1.2e-4] nF [TX RX] Cd [1.2e-4 1.2e-4] nF [TX RX] Сd [1.2e-4 1.2e-4] nF [TX RX] [TX RX] [0.12, 0.12] nH Ls L_s [0.12, 0.12] nH [TX RX] Ls [0.12, 0.12] nH [TX RX] [0.12, 0.12] nH [TX RX] LS [0.3e-4 0.3e-4] Сb nF [TX RX] [0.3e-4 0.3e-4] nF [TX RX] Сb Сb [0.3e-4 0.3e-4] nF [TX RX] Cb [0.3e-4 0.3e-4] nF [TX RX] z_p select [12] test cases to run] z p select [12] test cases to run z_p select [12] test cases to run [12] z_p select [test cases to run] z p(TX) [12 30; 1.8 1.8] mm [test cases] z_p (TX) [12 30; 1.8 1.8] [12 30; 1.8 1.8] mm [test cases] z_p (TX) mm [test cases] z p(TX) [12 30; 1.8 1.8] [test cases] mm [12 30; 1.8 1.8] z_p (NEXT) mm [test cases] z_p (NEXT) [12 30; 1.8 1.8] [12 30; 1.8 1.8] [test cases] z_p (NEXT) [test cases] [12 30; 1.8 1.8] mm mm z p(NEXT) mm [test cases] z_p (FEXT) [12 30; 1.8 1.8] mm [test cases] z_p (FEXT) [12 30; 1.8 1.8] mm [test cases] z_p (FEXT) [12 30; 1.8 1.8] [test cases] mm z p(FEXT) [12 30; 1.8 1.8] mm [test cases] z_p (RX) [12 29; 1.8 1.8] mm [test cases] z_p (RX) [12 29; 1.8 1.8] [test cases] z_p (RX) [12 29; 1.8 1.8] mm mm [test cases] z_p (RX) [12 29; 1.8 1.8] mm [test cases] Ср [0.87e-4 0.87e-4] nF [TX RX] [0.87e-4 0.87e-4] [0.87e-4 0.87e-4] nF Ср nF [TX RX] Ср [TX RX] C_p [0.87e-4 0.87e-4] nF [TX RX] Ohm R 0 50 R 0 50 Ohm R 0 50 Ohm R 0 50 Ohm [50 50] [TX RX] Rd Ohm Rd [50 50] Ohm [TX RX] Rd [50 50] Ohm [TX RX] Rd [50 50] Ohm [TX RX]

A_v	0.415	V	vp/vf=.694	A_v	0.415	V	vp/vf=.694	A_v	0.415	V	vp/vf=.694	A_v	0.415	V	vp/vf=.694	
A_fe	0.415	V	vp/vf=.694	A_fe	0.415	v	vp/vf=.694	A_fe	0.415	V	vp/vf=.694	A_fe	0.415	V	vp/vf=.694	
A_ne	0.608	V		A_ne	0.608	v		A_ne	0.608	V		A_ne	0.608	V		
L	4			L	4			L	4			L	4			
м	32			м	32			M	32			M	32	[]		
	filter and Eq			filter and Eq					filter and Eq			filter and Eq				
f_r	0.75	*fb		f_r	0.75	*fb		f_r	0.75	*fb		f_r	0.75	*fb		
c(0)	0.54		min	c(0)	0.54		min	c(0)	0.54		min	c(0)	0.54	í – – – – – – – – – – – – – – – – – – –	min	
c(-1)	[-0.34:0.02:0]		[min:step:max]	c(-1)	[-0.34:0.02:0]		[min:step:max]	c(-1)	[-0.34:0.02:0]		[min:step:max]	c(-1)	[-0.34:0.02:0]	[]	[min:step:max]	
c(-2)	[0:0.02:0.12]		[min:step:max]	c(-2)	[0:0.02:0.12]		[min:step:max]	c(-2)	[0:0.02:0.12]		[min:step:max]	c(-2)	[0:0.02:0.12]	[]	[min:step:max]	
c(-3)	[-0.06:0.02: 0]		[min:step:max]	c(-3)	[-0.06:0.02: 0]		[min:step:max]	c(-3)	[-0.06:0.02: 0]		[min:step:max]	c(-3)	[-0.06:0.02:0]	í – – – – – – – – – – – – – – – – – – –	[min:step:max]	
c(1)	[-0.2:0.05:0]		[min:step:max]	c(1)	[-0.2:0.05:0]		[min:step:max]	c(1)	[-0.2:0.05:0]		[min:step:max]	c(1)	[-0.2:0.05:0]		[min:step:max]	
N_b	12	UI		N_b	12	UI		N_b	12	UI		N_b	12	UI		
b_max(1)	0.85			b_max(1)	0.85			b_max(1)	0.85			b_max(1)	0.85			
b_max(2N_b)	[0.3 0.2*ones(1,10)]			b_max(2N_b)	[0.3 0.2*ones(1,10)]			b_max(2N_b)	[0.3 0.2*ones(1,10)]			b_max(2N_b)	[0.3 0.2*ones(1,10)]			
b_min(1)	0			b_min(1)	0			b_min(1)	0.3			b_min(1)	0.3			
b_min(2N_b)	[-0.3 -0.05*ones(1,10)]			b_min(2N_b)	[0.05 -0.05*ones(1,10)]			b_min(2N_b)	[-0.3 -0.05*ones(1,10)]			b_min(2N_b)	[0.05 -0.05*ones(1,10)]	1		
g_DC	[-20:1:0]	dB	[min:step:max]	g_DC	[-20:1:0]	dB	[min:step:max]	g_DC	[-20:1:0]	dB	[min:step:max]	g_DC	[-20:1:0]	dB	[min:step:max]	
f_z	21.25	GHz		f_z	21.25	GHz		f_z	21.25	GHz		f_z	21.25	GHz		
f_p1	21.25	GHz		f_p1	21.25	GHz		f_p1	21.25	GHz		f_p1	21.25	GHz		
f_p2	53.125	GHz		f_p2	53.125	GHz		f_p2	53.125	GHz		f_p2	53.125	GHz		
g_DC_HP	[-6:1:0]		[min:step:max]	g_DC_HP	[-6:1:0]		[min:step:max]	g_DC_HP	[-6:1:0]		[min:step:max]	g_DC_HP	[-6:1:0]		[min:step:max]	
f HP PZ	0.6640625	GHz		f HP PZ	0.6640625	GHz		f_HP_PZ	0.6640625	GHz		f_HP_PZ	0.6640625	GHz		

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Set 2 COM spreadsheets: CR

	TEST 1				TEST 2				TEST 3						
	Table 93A-1 parameters				Table 93A-1 parame		Table 93A-1 parameters								
Parameter	Setting	Units	Information	Parameter	Setting	Units	Information	Parameter	Setting	Units	Information				
f_b	53.125	GBd		f_b	53.125	GBd		f_b	53.125	GBd					
f_min	0.05	GHz		fmin	0.05	GHz		f_min	0.05	GHz					
Delta_f	0.01	GHz		Delta f	0.01	GHz		Delta_f	0.01	GHz					
C_d	[1.2e-4 1.2e-4]	nF	[TX RX]	C_d	[1.2e-4 1.2e-4]	nF	[TX RX]	C_d	[1.2e-4 1.2e-4]	nF	[TX RX]				
L_s	[0.12, 0.12]	nH	[TX RX]	Ls	[0.12, 0.12]	nH	[TX RX]	L_S	[0.12, 0.12]	nH	[TX RX]				
C_b	[0.3e-4 0.3e-4]	nF	[TX RX]	C_b	[0.3e-4 0.3e-4]	nF	[TX RX]	C_b	[0.3e-4 0.3e-4]	nF	[TX RX]				
z_p select	[12]		[test cases to run]	z_p select	[12]		[test cases to run]	z_p select	[12]		[test cases to run]				
z_p (TX)	[6 6; 1.8 1.8]	mm	[test cases]	z_p (TX)	[6 6; 1.8 1.8]	mm	[test cases]	z_p (TX)	[6 6; 1.8 1.8]	mm	[test cases]				
z_p (NEXT)	[6 6; 1.8 1.8]	mm	[test cases]	z_p (NEXT)	[6 6; 1.8 1.8]	mm	[test cases]	z_p (NEXT)	[6 6; 1.8 1.8]	mm	[test cases]				
z_p (FEXT)	[6 6; 1.8 1.8]	mm	[test cases]	z_p (FEXT)	[6 6; 1.8 1.8]	mm	[test cases]	z_p (FEXT)	[6 6; 1.8 1.8]	mm	[test cases]				
z_p (RX)	[12 29; 1.8 1.8]	mm	[test cases]	z_p (RX)	[12 29; 1.8 1.8]	mm	[test cases]	z_p (RX)	[12 29; 1.8 1.8]	mm	[test cases]				
C_p	[0.87e-4 0.87e-4]	nF	[TX RX]	C_p	[0.87e-4 0.87e-4]	nF	[TX RX]	C_p	[0.87e-4 0.87e-4]	nF	[TX RX]				
R_0	50	Ohm		R_0	50	Ohm		R_0	50	Ohm					
R_d	[50 50]	Ohm	[TX RX]	R_d	[50 50]	Ohm	[TX RX]	R_d	[50 50]	Ohm	[TX RX]				
A_v	0.415	V	vp/vf=.694	A_v	0.415	V	vp/vf=.694	A_v	0.415	V	vp/vf=.694				
A_fe	0.415	V	vp/vf=.694	A_fe	0.415	V	vp/vf=.694	A_fe	0.415	V	vp/vf=.694				
A_ne	0.608	V		A_ne	0.608	V		A_ne	0.608	V					
L	4			L	4			L	4						
М	32			M	32			M	32						
	filter and Eq				filter and Eq				filter and Eq		_				
f_r	0.75	*fb		f_r	0.75	*fb		f_r	0.75	*fb					
c(0)	0.54		min	c(0)	0.54		min	c(0)	0.54		min				
c(-1)	[-0.34:0.02:0]		[min:step:max]	c(-1)	[-0.34:0.02:0]		[min:step:max]	c(-1)	[-0.34:0.02:0]		[min:step:max]				
c(-2)	[0:0.02:0.12]		[min:step:max]	c(-2)	[0:0.02:0.12]		[min:step:max]	c(-2)	[0:0.02:0.12]		[min:step:max]				
c(-3)	[-0.06:0.02: 0]		[min:step:max]	c(-3)	[-0.06:0.02: 0]		[min:step:max]	c(-3)	[-0.06:0.02: 0]		[min:step:max]				
c(1)	[-0.2:0.05:0]		[min:step:max]	c(1)	[-0.2:0.05:0]		[min:step:max]	c(1)	[-0.2:0.05:0]		[min:step:max]				
N_b	12	UI		N_b	12	UI		N_b	12	UI					
b_max(1)	0.85			b_max(1)	0.85			b_max(1)	0.85						
b_max(2N_b)	[0.3 0.2*ones(1,10)]			b_max(2N_b)	[0.3 0.2*ones(1,10)]			b_max(2N_b)	[0.3 0.2*ones(1,10)]						
b_min(1)	0.3			b_min(1)	0			b_min(1)	0.3						
b_min(2N_b)	0.05 -0.05*ones(1,10))]		b_min(2N_b)	0.05 -0.05*ones(1,10)]		b_min(2N_b)	[-0.3 -0.05*ones(1,10)]						
g_DC	[-20:1:0]	dB	[min:step:max]	g_DC	[-20:1:0]	dB	[min:step:max]	g_DC	[-20:1:0]	dB	[min:step:max]				
f_z	21.25	GHz		f_z	21.25	GHz		f_z	21.25	GHz					
f_p1	21.25	GHz		f_p1	21.25	GHz		f_p1	21.25	GHz					
f_p2	53.125	GHz		f_p2	53.125	GHz		f_p2	53.125	GHz					
g_DC_HP	[-6:1:0]		[min:step:max]	g_DC_HP	[-6:1:0]		[min:step:max]	g_DC_HP	[-6:1:0]		[min:step:max]				
f UD 07	0.6640635	CHA		f HD D7	0.6640625	CH ₇	I I	£ 110 07	0.6640625	CUL					

TEST 4

	5		5
	Table 93A-1 parame	ters	
Parameter	Setting	Units	Information
f_b	53.125	GBd	
f_min	0.05	GHz	
Delta_f	0.01	GHz	
C_d	[1.2e-4 1.2e-4]	nF	[TX RX]
L_s	[0.12, 0.12]	nH	[TX RX]
C_b	[0.3e-4 0.3e-4]	nF	[TX RX]
z_p select	[12]		[test cases to run]
z_p (TX)	[6 6; 1.8 1.8]	mm	[test cases]
z_p (NEXT)	[6 6; 1.8 1.8]	mm	[test cases]
z_p (FEXT)	[6 6; 1.8 1.8]	mm	[test cases]
z_p (RX)	[12 29; 1.8 1.8]	mm	[test cases]
C_p	[0.87e-4 0.87e-4]	nF	[TX RX]
R_0	50	Ohm	
R_d	[50 50]	Ohm	[TX RX]
A_v	0.415	V	vp/vf=.694
A_fe	0.415	V	vp/vf=.694
A_ne	0.608	V	
L	4		
м	32		
	filter and Eq		
f_r	0.75	*fb	
c(0)	0.54		min
c(-1)	[-0.34:0.02:0]		[min:step:max]
c(-2)	[0:0.02:0.12]		[min:step:max]
c(-3)	[-0.06:0.02: 0]		[min:step:max]
c(1)	[-0.2:0.05:0]		[min:step:max]
N_b	12	UI	
b_max(1)	0.85		
b_max(2N_b)	[0.3 0.2*ones(1,10)]		
b_min(1)	0.3		
b_min(2N_b)	0.05 -0.05*ones(1,10)]	
g_DC	[-20:1:0]	dB	[min:step:max]
f_z	21.25	GHz	
f_p1	21.25	GHz	
f_p2	53.125	GHz	
g_DC_HP	[-6:1:0]		[min:step:max]
f_HP_PZ	0.6640625	GHz	

Set 2 Results

Channel	b1min	b2min	LpkgTx (mm)	LpkgRx (mm)	Ildd (dB)	Ilchan (dB)	Ilfit (dB)	COM (dB)	c(-3)	c(-2)	c(-1)	c(0)	c(1)	b1	b2	gDC (dB)	gDChp (dB)	ERL (dB)
	0	-0.3				8 0921				0.08	-0.24			0.3170	0.1631		-1	
	0	0.05		12	16 12			5 31/19	-0.02			0.66	0					
	0.3	-0.3		12	10.12			5.5145	-0.02									10.02
CR	0.3	0.05	6				9.66									-1		
CIN	0	-0.3	Ŭ			1	5.00	5.1485	-0.02	0.08	-0.24	0.66	0	0.4083	0.1937	-		
	0	0.05		29	18.24													
	0.3	-0.3																
	0.3	0.05																
	0	-0.3						8.1337	0	0.02	-0.14	0.84	0	0.1815	0.0463	-2	0	
	0	0.05	12	12	8 38			8.1189	0	0.02	-0.12	0.86	9	0.2446	0.0597	-1	0	
	0.3	-0.3	12	12	0.50			7.7619	0	0.02	-0.12	0.86	0	0.3000	0.0708	0	0	
KR	0.3	0.05				2 72/15	2 7362	7.7619	0	0.02	-0.12	0.86	0	0.3000	0.0708	0	0	A1 31
NN	0	-0.3				2.7545	2.7502											41.31
	0	0.05	20	20	12 14			9 1562	0	0.02	-0.14	0.84	0	0 3/177	0 1012	-2	-1	
	0.3	-0.3	50	23	13.14			5.1502	Ŭ	0.02	-0.14	0.04	0	0.3477	0.1012	-2	-1	
	0.3	0.05																

Above 10dB (die-die): no observed sensitivity to b1min & b2min over the range considered. Below 10dB (die-die): no observed sensitivity to b2min

small sensitivity to b1min (relative to large COM margin)

Summary

Objective Assess whether bmin(1) = 0.3 & bmin(2) = 0.05 hurts performance.

MethodCOM simulations with different minimum tap weights for lowloss CR and KR channels.

 \rightarrow Address concern raised during D1.1 comment resolution.

Channels

- Set 1 CR: 12 & 31 mm ref pkg, 2" host PCB trace, 0.5m cable
 KR: existing 16dB cabled BP channel (Cable_BKP_16dB_0p575m_more_isi)
 Set 2 CR: 6 mm ref pkg, 0.5" host PCB trace, 0.5m cable (retimer-to-retimer)
 KR: 12 & 21 mm ref pkg, 2" host PCB trace (0 connector BP)
- **Conclusion** No performance loss for the proposed reference DFE min tap limits. \rightarrow Including the lowest loss channels that we could conceive.

Thank you!