COM 2.40 with 100GEL Configurations Suggestions

Richard Mellitz, Samtec

July 25, 2018, Ad Hoc

COM 2.40

Adds long FFE capability

3 sample configurations

- ❑ 100 G KR PAM4 Long DFE example
  - config_com_ieee8023_93a=100GEL-KR_DFE_prop1.xls
- ❑ 100 G KR PAM4 example with Rx FFE
  - config_com_ieee8023_93a=100GEL-KR_DFE1_RxFFE_prop1.xls
- ❑ 100 G C2M PAM4 informative example:
  Tx FFE and Rx FFE (TP0 to TP2)
  - config_com_ieee8023_93a=100GEL_C2M_tp0_tp2_prop1.xls

100 G KR PAM4 Long DFE example

Table 93A-1 parameters			
Parameter	**Setting**	**Units**	**Information**
f_b	53.125	GBd	
f_min	0.05	GHz	
Delta_f	0.01	GHz	
C_d	[1.1e-4 1.1e-4]	nF	[TX RX]
z_p select	[1 2]		[test cases to run]
z_p (TX)	[12 30]	mm	[test cases]
z_p (NEXT)	[12 30]	mm	[test cases]
z_p (FEXT)	[12 30]	mm	[test cases]
z_p (RX)	[12 30]	mm	[test cases]
C_p	[0.9e-4 0.9e-4]	nF	[TX RX]
R_0	50	Ohm	
R_d	[45 45]	Ohm	[TX RX]
A_v	0.41	V	
A_fe	0.41	V	
A_ne	0.6	V	
L	4		
M	32		
filter and Eq			
f_r	0.75	*fb	
c(0)	0.6		min
c(-1)	[-0.25:0.05:0]		[min:step:max]
c(-2)	[0:0.025:0.1]		[min:step:max]
c(-3)	0		[min:step:max]
c(-4)	0		[min:step:max]
c(1)	0		[min:step:max]
N_b	24	UI	
b_max(1)	0.7		
b_max(2..N_b)	0.2		
g_DC	[-20:1:-10]	dB	[min:step:max]
f_z	21.25	GHz	
f_p1	21.25	GHz	
f_p2	53.125	GHz	
g_DC_HP	[-6:1:-3]		[min:step:max]
f_HP_PZ	0.6640625	GHz	
ffe_pre_tap_len	**0**	**UI**	
ffe_post_tap_len	**0**	**UI**	

I/O control		
DIAGNOSTICS	1	logical
DISPLAY_WINDOW	1	logical
CSV_REPORT	1	logical
RESULT_DIR	.\results\100GEL_WG_{date}\	
SAVE_FIGURES	0	logical
Port Order	[1 3 2 4]	
RUNTAG	KR_DFE_	
COM_CONTRIBUTION	0	logical
Operational		
COM Pass threshold	3	dB
DER_0	1.00E-04	
Include PCB	0	Value
T_r	6.16E-03	ns
FORCE_TR	1	logical

TDR and ERL options		
TDR	1	logical
ERL	1	logical
ERL_ONLY	0	logical
TR_TDR	0.01	ns
N	1000	
TDR_Butterworth	1	logical
beta_x	1.70E+09	
rho_x	**0.18**	
fixture delay time	0	
Receiver testing		
RX_CALIBRATION	0	logical
Sigma BBN step	5.00E-03	V

Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	UI
eta_0	8.20E-09	V^2/GHz
SNR_TX	33	dB
R_LM	0.95	

Table 93A–3 parameters		
Parameter	**Setting**	**Units**
package_tl_gamma0_a1_a2	[0 1.734e-3 1.455e-4]	
package_tl_tau	6.141E-03	ns/mm
package_Z_c	90	Ohm (tdr sel)

Table 92–12 parameters		
Parameter	**Setting**	
board_tl_gamma0_a1_a2	[0 4.114e-4 2.547e-4]	
board_tl_tau	6.191E-03	ns/mm
board_Z_c	110	Ohm
z_bp (TX)	151	mm
z_bp (NEXT)	72	mm
z_bp (FEXT)	72	mm
z_bp (RX)	151	mm

100 G KR PAM4 example: 2 precursor Tx FFE taps, 24 DFE taps, and CTF

filter and Eq			
f_r	0.75	*fb	
c(0)	0.6		min
c(-1)	[-0.25:0.05:0]		[min:step:max]
c(-2)	[0:0.025:0.1]		[min:step:max]
c(-3)	0		[min:step:max]
c(-4)	0		[min:step:max]
c(1)	0		[min:step:max]
N_b	24	UI	
b_max(1)	0.7		
b_max(2..N_b)	0.2		
g_DC	[-20:1:-10]	dB	[min:step:max]
f_z	21.25	GHz	
f_p1	21.25	GHz	
f_p2	53.125	GHz	
g_DC_HP	[-6:1:-3]		[min:step:max]
f_HP_PZ	0.6640625	GHz	
ffe_pre_tap_len	**0**	**UI**	
ffe_post_tap_len	**0**	**UI**	

Disables Rx FFE

Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	UI
eta_0	8.20E-09	V^2/GHz
SNR_TX	33	dB
R_LM	0.95	

Proposed COM reference Model with Rx FFE

Base on Method 3* slide 3
Configurations for Gain at cursor,
and quantized DFE method not considered here

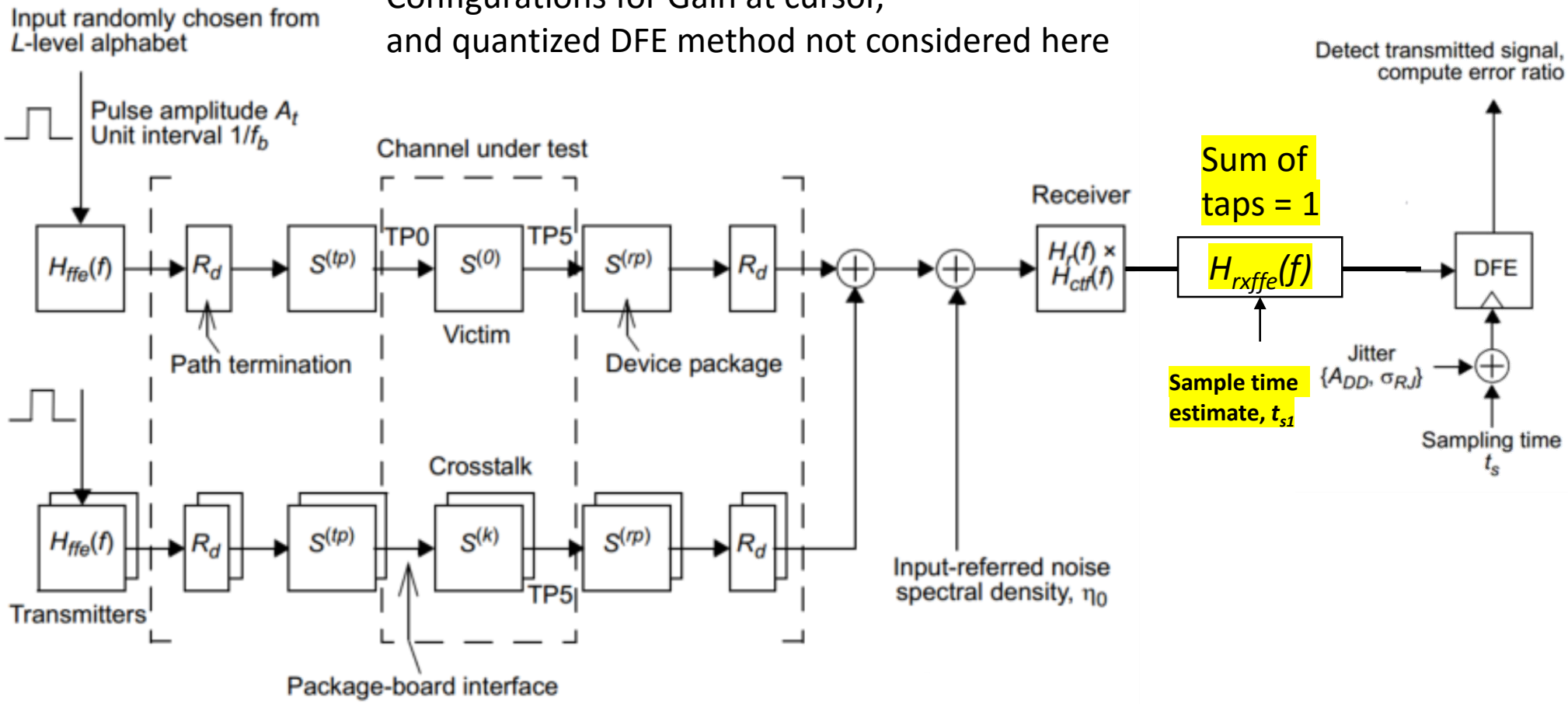

Figure 93A–1—COM reference model

* http://www.ieee802.org/3/ck/public/18_07/mellitz_3ck_01_0718.pdf

100 G KR PAM4 example with Rx FFE

Parameter	Setting	Units	Information
f_b	53.125	GBd	
f_min	0.05	GHz	
Delta_f	0.01	GHz	
C_d	[1.1e-4 1.1e-4]	nF	[TX RX]
z_p select	[1 2]		[test cases to run]
z_p (TX)	[12 30]	mm	[test cases]
z_p (NEXT)	[12 30]	mm	[test cases]
z_p (FEXT)	[12 30]	mm	[test cases]
z_p (RX)	[12 30]	mm	[test cases]
C_p	[0.9e-4 0.9e-4]	nF	[TX RX]
R_0	50	Ohm	
R_d	[45 45]	Ohm	[TX RX]
A_v	0.41	V	
A_fe	0.41	V	
A_ne	0.6	V	
L	4		
M	32		
filter and Eq			
f_r	0.75	*fb	
c(0)	0.6		min
c(-1)	[-0.25:0.05:0]		[min:step:max]
c(-2)	[0:0.025:0.1]		[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)	0.7		
g_DC	[-20:1:-10]	dB	[min:step:max]
f_z	21.25	GHz	
f_p1	21.25	GHz	
f_p2	53.125	GHz	
g_DC_HP	[-6:1:-3]		[min:step:max]
f_HP_PZ	0.6640625	GHz	
ffe_pre_tap_len	**3**	**UI**	
ffe_post_tap_len	**24**	**UI**	

DIAGNOSTICS	1	logical
DISPLAY_WINDOW	1	logical
CSV_REPORT	1	logical
RESULT_DIR	.\results\100GEL_WG_{date}\	
SAVE_FIGURES	0	logical
Port Order	[1 3 2 4]	
RUNTAG	KR_DFE1_RxFFE	
COM_CONTRIBUTION	0	logical
Operational		
COM Pass threshold	3	dB
DER_0	1.00E-04	
Include PCB	0	Value
T_r	6.16E-03	ns
FORCE_TR	1	logical

TDR and ERL options		
TDR	1	logical
ERL	1	logical
ERL_ONLY	0	logical
TR_TDR	0.01	ns
N	1000	
TDR_Butterworth	1	logical
beta_x	1.70E+09	
rho_x	**0.18**	
fixture delay time	0	
Receiver testing		
RX_CALIBRATION	0	logical
Sigma BBN step	5.00E-03	V

Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	UI
eta_0	8.20E-09	V^2/GHz
SNR_TX	33	dB
R_LM	0.95	

Parameter	Setting	Units
package_tl_gamma0_a1_a2	[0 1.734e-3 1.455e-4]	
package_tl_tau	6.141E-03	ns/mm
package_Z_c	90	Ohm (tdr sel)

Table 92–12 parameters		
Parameter	**Setting**	
board_tl_gamma0_a1_a2	[0 4.114e-4 2.547e-4]	
board_tl_tau	6.191E-03	ns/mm
board_Z_c	110	Ohm
z_bp (TX)	151	mm
z_bp (NEXT)	72	mm
z_bp (FEXT)	72	mm
z_bp (RX)	151	mm

100 G KR PAM4 example: 2 precursor Tx FFE taps, 1 DFE, 24 Rx FFE taps, and CTF

filter and Eq			
f_r	0.75	*fb	
c(0)	0.6		min
c(-1)	[-0.25:0.05:0]		[min:step:max]
c(-2)	[0:0.025:0.1]		[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)	0.7		
g_DC	[-20:1:-10]	dB	[min:step:max]
f_z	21.25	GHz	
f_p1	21.25	GHz	
f_p2	53.125	GHz	
g_DC_HP	[-6:1:-3]		[min:step:max]
f_HP_PZ	0.6640625	GHz	
ffe_pre_tap_len	**3**	**UI**	
ffe_post_tap_len	**24**	**UI**	

3 Pre Cursor
/ 24 Post Cursors

Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	UI
eta_0	8.20E-09	V^2/GHz
SNR_TX	33	dB
R_LM	0.95	

100 G C2M PAM4 informative example: Tx FFE and Rx FFE (TP0 to TP2)

Table 93A-1 parameters			
Parameter	**Setting**	**Units**	**Information**
f_b	53.125	GBd	
f_min	0.05	GHz	
Delta_f	0.01	GHz	
C_d	[1.1e-4 0]	nF	[TX RX]
z_p select	[1]		[test cases to run]
z_p (TX)	[12 30]	mm	[test cases]
z_p (NEXT)	[0 0]	mm	[test cases]
z_p (FEXT)	[12 30]	mm	[test cases]
z_p (RX)	[0 0]	mm	[test cases]
C_p	[0.9e-4 0.9e-4]	nF	[TX RX]
R_0	50	Ohm	
R_d	[45 45]	Ohm	[TX RX]
A_v	0.41	V	
A_fe	0.41	V	
A_ne	0.6	V	
L	4		
M	32		
filter and Eq			
f_r	0.75	*fb	
c(0)	0.6		min
c(-1)	[-0.25:0.025:0]		[min:step:max]
c(-2)	[0:0.025:0.1]		[min:step:max]
c(-3)	[-0.1:0.025:0]		[min:step:max]
c(-4)	0		[min:step:max]
c(1)	0		[min:step:max]
N_b	0	UI	
b_max(1)	0.7		
g_DC	[-15:1:-10]	dB	[min:step:max]
f_z	21.25	GHz	
f_p1	21.25	GHz	
f_p2	53.125	GHz	
g_DC_HP	[-4:1:-3]		[min:step:max]
f_HP_PZ	0.6640625	GHz	
ffe_pre_tap_len	0	UI	
ffe_post_tap_len	8	UI	

I/O control		
DIAGNOSTICS	1	logical
DISPLAY_WINDOW	1	logical
CSV_REPORT	1	logical
RESULT_DIR	.\results\100GEL_WG_{date}\	
SAVE_FIGURES	0	logical
Port Order	[1 3 2 4]	
RUNTAG	C2M_DFE1_RxFFE	
COM_CONTRIBUTION	0	logical
Operational		
COM Pass threshold	3	dB
EH_min	10	Value
EH_max	1000	Value
DER_0	1.00E-05	
Include PCB	0	Value
T_r	6.16E-03	ns
FORCE_TR	1	logical

EH limit	
EH limit	

TDR and ERL options		
TDR	0	logical
ERL	0	logical
ERL_ONLY	0	logical
TR_TDR	0.01	ns
N	1000	
TDR_Butterworth	1	logical
beta_x	1.70E+09	
rho_x	**0.18**	
fixture delay time	0	
Receiver testing		
RX_CALIBRATION	0	logical
Sigma BBN step	5.00E-03	V

Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	UI
eta_0	0.00E+00	V^2/GHz
SNR_TX	33	dB
R_LM	0.95	

Table 93A–3 parameters		
Parameter	**Setting**	**Units**
package_tl_gamma0_a1_a2	[0 1.734e-3 1.455e-4]	
package_tl_tau	6.141E-03	ns/mm
package_Z_c	90	Ohm (tdr sel)

Table 92–12 parameters		
Parameter	**Setting**	
board_tl_gamma0_a1_a2	[0 4.114e-4 2.547e-4]	
board_tl_tau	6.191E-03	ns/mm
board_Z_c	110	Ohm
z_bp (TX)	151	mm
z_bp (NEXT)	72	mm
z_bp (FEXT)	72	mm
z_bp (RX)	151	mm

100 G C2M PAM4 informative example: 3 Tx pre-cursor FFE taps and 8 Rx FFE post cursor taps, CTF, and no DFE

filter and Eq			
f_r	0.75	*fb	
c(0)	0.6		min
c(-1)	[-0.25:0.025:0]		[min:step:max]
c(-2)	[0:0.025:0.1]		[min:step:max]
c(-3)	[-0.1:0.025:0]		[min:step:max]
c(-4)	0		[min:step:max]
c(1)	0		[min:step:max]
N_b	0	UI	
b_max(1)	0.7		
g_DC	[-15:1:-10]	dB	[min:step:max]
f_z	21.25	GHz	
f_p1	21.25	GHz	
f_p2	53.125	GHz	
g_DC_HP	[-4:1:-3]		[min:step:max]
f_HP_PZ	0.6640625	GHz	
ffe_pre_tap_len	**0**	**UI**	
ffe_post_tap_len	**8**	**UI**	

Operational			
COM Pass threshold	3	dB	
EH_min	10	Value	EH limit
EH_max	1000	Value	EH limit
DER_0	1.00E-05		

3 pre cursors

No DFE

8 Post Cursors

Do we need to check EH too?

Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	UI
eta_0	0.00E+00	V^2/GHz
SNR_TX	33	dB
R_LM	0.95	

Other options may be explored

- More or less of any of the prior values may be explored
- Options abandoned because they are part of the COM limit as a receiver design prerogative

ffe_tap_step_size
ffe_main_cursor_min
ffe_pre_tap1_max
ffe_post_tap1_max
ffe_tapn_max

Thank You!