

# Channel Operating Margin Program Usage, Review, and Plans

Richard Mellitz  
Intel Corporation  
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Inclusion of comment resolutions from,  
09-2012

IEEE802.3bj Geneva Interim

# Operation

- Running com2l
  - Interactive file input (Q/A)
    - Spreadsheet selection windows
    - File selection windows
  - Scriptable single line entry
- Spreadsheet (XLS file) configures parameters
  - Values in most sheet slides are syntax examples unless noted
- Versions
  - 1.05 (com2\_r105) on Geneva, 09-2012 meeting site
  - 1.06 will be updated to Draft 1.2
  - 1.07 proposed changes
- Output
  - Display to MatLab® window
  - Frequency plots to floating window
  - Floating progress windows
- The COM2L runs in MatLab® version 7
- First step – check/edit configuration spreadsheet
- Next step – run com2l in MatLab®

# Configuration Spreadsheet: Select Port Type, r1.05

	A	B	C	D	E	F	G
1	Parameter	Setting		Config/Interface Types			Operational Control
2	Coding/Port Type	NRZ Clause 93 D1.1		NRZ Clause 93	INCLUDE_CTLE	1	
3	Unit Interval (UI)	3.87879E-11		NRZ/FEC Clause 93	INCLUDE_FILTER	1	
4	tx_ffe	[.1 .4]		PAM4 Clause 94	DEBUG	0	
5	ndfe	12		NRZ Clause 93 D1.1	DISPLAY_WINDOW	1	
6	max_ctle	12		NRZ/FEC Clause 93 D1.1	CSV_REPORT	1	
7	a_thru	0.4		PAM4 Clause 94 D1.1	SAVE_RESP	0	
8	a_fext	0.4			GET_FD	1	
9	a_next	0.6			INC_PACKAGE	4	
10	AG	1			USE_EXTERNAL_PARAM	0	
11	specBER				RESULT_DIR	./result1/	
12	Allowance						
13	G_s_noise						
14	g_dd_noise						
15	Na_rms						
16	Samples Per UI	32					
17	Port Order	[1 3 2 4]					
18	G01	0.01					
19	G02	0.01					
20	Fscale1	2					
21	Fscale2	2					
22	ctle_step	1					
23	tx_ffe_step	0.02					
24	maxc1	1					
25	maxcx	1					
26	f_v	0.55					
27	f_f	0.55					
28	f_n	1					
29	f_r	0.75					
30							

  

	D	E	F	G	H	I	J	K	L
	ndfe	max_ctle	a_thru	a_fext	a_next	AG	specBER	Allowance	G_s_noise
12	12	12	0.4	0.4	0.6	1	1.00E-12	3	0.01
16	16	12	0.4	0.4	0.6	1	1.00E-05	3	0.01
16	16	12	0.4	0.4	0.6	0.33333	1.00E-05	3	0.005
12	12	12	0.4	0.4	0.6	1	1.00E-12	0	0.01
12	12	12	0.4	0.4	0.6	1	1.00E-05	0	0.01
16	16	12	0.4	0.4	0.6	0.33333	1.00E-05	0	0.01

Coding and port type selection roller

Data can be directly entered or defaults can be set in the lookup data table tab when using the selection roller.

r1.05

	A	B	C	D	E	F	G
1	Parameter	Setting		Coding/Port Type	Operational Control		
2	Coding/Port Type	NRZ/FEC Clause 93 d1.2		NRZ Clause 93 d1.2	INCLUDE_CTLE	1	
3	Unit Interval (UI)	3.87879E-11		NRZ/FEC Clause 93 d1.2	INCLUDE_FILTER	1	
4	tx_ffe	[.1 .4]		PAM4 Clause 94 d.1.2	DEBUG	1	
5	ndfe	14		NRZ Clause 93 alt	DISPLAY_WINDOW	1	
6	max_ctle	12		NRZ/FEC Clause 93 alt	CSV_REPORT	1	
7	a_thru	0.4		PAM4 Clause 94 alt	SAVE_RESP	0	
8	a_fext	0.4			GET_FD	1	
9	a_next	0.6			INC_PACKAGE	1	
10	AG	1			USE_EXTERNAL_PARAM	1	
11	specBER	1.00E-05			RESULT_DIR	result_nrz\	
12	Allowance	3			PKG_LOSS	1	
13	G_s_noise	0.005					
14	g_dd_noise	0.08					
15	Na_rms	0.001					
16	Samples Per UI	32					
17	Port Order	[1 3 2 4]					
18	G01	0.315					
19	G02	0.315					
20	Fscale1	0.8					
21	Fscale2	0.8					
22	ctle_step	1					
23	tx_ffe_step	0.02					
24	maxc1	1					
25	maxcx	1					
26	f_v	0.55					
27	f_f	0.55					
28	f_n	1					
29	f_r	0.75					
30	PKG_a0	8.00E-10					
31	PKG_a1	4.20E-15					
32	PKG_a2	5.10E-25					
33	PKG_Length	7070					
34	PKG_C_die	2.50E-13					
35	PKG_C_ball	2.20E-13					
36	PKG_vel	1.62E+14					
37							

**Rich Mellitz:**  
Tx DC package parameter  
benartsi\_3bj\_02\_0912, p 6

**Rich Mellitz:**  
0 no pkg  
benartsi\_3bj\_02\_0912, p 9  
h21porposed1 VTF  
h21porposed2 VTF  
h21porposed3 VTF  
h21porposed4 VTF

# D1.2 Sheet: KR4 for r1.06

**Richard Mellitz:**  
benartsi\_3bj\_02\_0912, p 6

	A	B	C	D	E	F	G
1	Parameter	Setting		Coding/Port Type	Operational Control		
2	Coding/Port Type	NRZ/FEC Clause 93 d1.2		NRZ Clause 93 d1.2	INCLUDE_CTL	1	
3	Unit Interval (UI)	3.87879E-11		NRZ/FEC Clause 93 d1.2	INCLUDE_FILTER	1	
4	tx_ffe	[.1.4]		PAM4 Clause 94 d.1.2	DEBUG	1	
5	ndfe	14		NRZ Clause 93 alt	DISPLAY_WINDOW	1	
6	max_ctle	12		NRZ/FEC Clause 93 alt	CSV_REPORT	1	
7	a_thru	0.4		PAM4 Clause 94 alt	SAVE_RESP	0	
8	a_fext	0.4			GET_FD	1	
9	a_next	0.6			INC_PACKAGE	1	
10	AG	1			USE_EXTERNAL_PARAM	1	
11	specBER	1.00E-05			RESULT_DIR	result_nrz\	
12	Allowance	3			PKG_LOSS		
13	G_s_noise	0.005					
14	g_dd_noise	0.08					
15	Na_rms	0.001					
16	Samples Per UI	32					
17	Port Order	[1 3 2 4]					
18	G01	0.315					
19	G02	0.315					
20	Fscale1	0.8					
21	Fscale2	0.8					
22	ctle_step	1					
23	tx_ffe_step	0.02					
24	maxc1	1					
25	maxcx	1					
26	f_v	0.55					
27	f_f	0.55					
28	f_n	1					
29	f_r	0.75					
30	PKG_a0	8.00E-10					
31	PKG_a1	4.20E-15					
32	PKG_a2	5.10E-25					
33	PKG_Length	7070					
34	PKG_C_die	2.50E-13					
35	PKG_C_ball	2.20E-13					
36	PKG_vel	1.62E+14					

**Rich Mellitz:**  
Tx DC package parameter  
benartsi\_3bj\_02\_0912, p 6

**Rich Mellitz:**  
0 no pkg  
benartsi\_3bj\_02\_0912, p 9  
h21porposed1 VTF  
h21porposed2 VTF  
h21porposed3 VTF  
h21porposed4 VTF

# D1.2 Sheet: KR4/FEC for r1.06

**Richard Mellitz:**  
benartsi\_3bj\_02\_0912, p 6

	A	B	C	D	E	F	G
1	<b>Parameter</b>	<b>Setting</b>		<b>Coding/Port Type</b>		<b>Operational Control</b>	
2	Coding/Port Type	PAM4 Clause 94 d.1.2		NRZ Clause 93 d1.2	INCLUDE_CTLE	1	
3	Unit Interval (UI)	7.35632E-11		NRZ/FEC Clause 93 d1.2	INCLUDE_FILTER	1	
4	tx_ffe	[.1.4]		PAM4 Clause 94 d.1.2	DEBUG	1	
5	ndfe	16		NRZ Clause 93 alt	DISPLAY_WINDOW	1	
6	max_ctle	12		NRZ/FEC Clause 93 alt	CSV_REPORT	1	
7	a_thru	0.4		PAM4 Clause 94 alt	SAVE_RESP	0	
8	a_fext	0.4			GET_FD	1	
9	a_next	0.6			INC_PACKAGE	1	
10	AG	0.333333333			USE_EXTERNAL_PARAM	1	
11	specBER	1.00E-05			RESULT_DIR	result_nrz\	
12	Allowance	3			PKG_LOSS		
13	G_s_noise	0.0025					
14	g_dd_noise	0.04					
15	Na_rms	0.001					
16	Samples Per UI	32					
17	Port Order	[1 3 2 4]					
18	G01	0.315					
19	G02	0.315					
20	Fscale1	1.517241379					
21	Fscale2	1.517241379					
22	ctle_step	1					
23	tx_ffe_step	0.02					
24	maxc1	1					
25	maxcx	0.2					
26	f_v	0.55					
27	f_f	0.55					
28	f_n	1					
29	f_r	0.75					
30	PKG_a0	8.00E-10					
31	PKG_a1	4.20E-15					
32	PKG_a2	5.10E-25					
33	PKG_Length	7070					
34	PKG_C_die	2.50E-13					
35	PKG_C_ball	2.20E-13					
36	PKG_vel	1.62E+14					

**Rich Mellitz:**  
Tx DC package parameter  
benartsi\_3bj\_02\_0912, p 6

**Rich Mellitz:**  
0 no pkg  
benartsi\_3bj\_02\_0912, p 9  
h21porposed1 1 VTF  
h21porposed1 2 VTF  
h21porposed1 3 VTF  
h21porposed1 4 VTF

# D1.2 Sheet: KP4 for r1.06

**Richard Mellitz:**  
benartsi\_3bj\_02\_0912, p 6

# Configuration Spreadsheet, r1.06

Parameter	Setting		Coding/Port Type		Operational Control
Coding/Port Type	NRZ/FEC Clause 93 d1.2		NRZ Clause 93 d1.2	INCLUDE_CTL	1
Unit Interval (UI)	3.87879E-11		NRZ/FEC Clause 93 d1.2	INCLUDE_FILTER	1
tx_ffe	[.1 .4]		PAM4 Clause 94 d.1.2	DEBUG	1
ndfe	14		NRZ Clause 93 alt	DISPLAY_WINDOW	1
max_ctle	12		NRZ/FEC Clause 93 alt	CSV_REPORT	1
a_thru	0.4		PAM4 Clause 94 alt	SAVE_RESP	0
a_fext	0.4			GET_FD	1
a_next	0.6			INC_PACKAGE	1
AG	1			USE_EXTERNAL_PARAM	1
specBER	1.00E-05			RESULT_DIR	.\result_nrz\
Allowance	3			PKG_LOSS	1
G_s_noise	0.005				
g_dd_noise	0.08				
Na_rms	0.001				
Samples Per UI	32				
Port Order	[1 3 2 4]				
G01	0.315				
G02	0.315				
Fscale1	0.8				
Fscale2	0.8				
ctle_step	1				
tx_ffe_step	0.02				
maxc1	1				
maxcx	1				
f_v	0.55				
f_f	0.55				
f_n	1				
f_r	0.75				
PKG_a0	8.00E-10				
PKG_a1	4.20E-15				
PKG_a2	5.10E-25				
PKG_Length	7070				
PKG_C_die	2.50E-13				
PKG_C_ball	2.20E-13				
PKG_vel	1.62E+14				

# Parameter list

	Draft parameter ref	Example Setting	
Coding/Port Type	Coding/Port Type	NRZ/FEC Clause 93 d1.2	selector for port type
Unit Interval (UI)	Unit Interval (UI)	3.87879E-11	unit interval in seconds
tx_ffe	tx_ffe	[.1 .4]	Transmitter equalizer, max pre and post cursor coefficient
ndfe	W	14	Victim single bit response exception window (in UI)
max_ctle	G_DC	12	Continuous time filter, max DC gain
a_thru	A_v	0.4	Transmitter differential peak output voltage for victim
a_fext	A_f	0.4	Transmitter differential peak output voltage for Far-end aggressor
a_next	A_n	0.6	Transmitter differential peak output voltage for Near-end aggressor
AG	1/(L-1)	1	related to number of levels, L (symbol gain)
specBER	SER_0	1.00E-05	Target uncorrected symbol error ratio. FEC=1e-5 NRZ=1e-12
Allowance	COM_0	3	Minimum channel operating margin. Will be used as min COM criteria
G_s_noise	sigma_G	0.005	Normalized RMS Gaussian noise. Connected to rms jitter
g_dd_noise	A_DD	0.08	Normalized peak dual-Dirac noise. Connected to total deterministic jitter.
Na_rms	-	0.001	RMS Gaussian noise . May include voltage sensitivity and other parameters
Samples Per UI	M	32	
Port Order	Port Order	[1 3 2 4]	for the 4 ports the first two listed are inputs and respective last two are outputs (RX)
G01	Gamma_01	0.315	Transmitter reflection coefficient DC value. Values < .01 disables
G02	Gamma_02	0.315	Receiver reflection coefficient DC value. Values < .01 disables
Fscale1	Fscale1	0.8	Transmitter reflection coefficient reference frequency scale. Value > 2 disables
Fscale2	Fscale2	0.8	Receiver reflection coefficient reference frequency scale. Value > 2 disables
ctle_step	-	1	Continuous time filter step size dB
tx_ffe_step	-	0.02	Transmitter equalizer, pre/post cursor coefficient step size
maxcx1	-	1	No used
maxcx	-	1	max in W region
f_v	f_v	0.55	Transmitter 3 dB bandwidth for victim. Set to > 2 to deactivate
f_f	f_f	0.55	Transmitter 3 dB bandwidth for Far-end aggressor. Set to > 2 to deactivate
f_n	f_n	1	Transmitter 3 dB bandwidth for Near-end aggressor. Set to > 2 to deactivate
f_r	f_r	0.75	Receiver 3dB bandwidth



# Parameter list

	Draft parameter ref	Example Setting	
PKG_a0		8.00E-10	Transmission line loss parameter. benartsi_3bj_02_0912, p 6
PKG_a1		4.20E-15	Transmission line loss parameter. benartsi_3bj_02_0912, p 6
PKG_a2		5.10E-25	Transmission line loss parameter. benartsi_3bj_02_0912, p 6
PKG_Length		7070	Transmission line length parameter. benartsi_3bj_02_0912, p 6
PKG_C_die		2.50E-13	Die capacitance. benartsi_3bj_02_0912, p 6
PKG_C_ball		2.20E-13	Board to package interface capacitancebenartsi_3bj_02_0912, p 6
PKG_vel		1.62E+14	Propagaion velocity paramenter, benartsi_3bj_02_0912, p 6

# Operational Control

INCLUDE_CTLE	0 = do not include CTLE 1 = include CTLE. Will eventually be removed
INCLUDE_FILTER	0 = do not include TX/RX filters 1 = include TX/RX filters. Will eventually be removed
DEBUG	0 = do not print internal data; 1 = prints and graphs internal data. Will eventually be removed
DISPLAY_WINDOW	0 - do not display FD graphs 1 - display FD graphs (IL, ILD, ICR, RL, MDPST)
CSV_REPORT	0 - do not create CSV report file 1- create CSV report file in .\results directory
SAVE_RESP	0 - do no save channel time domian data 1 - save channel time domian data in mat file
GET_FD	0 - do not report frequency domain metrics 1 - report some frequency domain metrics
INC_PACKAGE	0 - do not use package models 1 – use proposal 1 for h21(f) (d1.1), benartsi_3bj_02_0912, p 9 2 – use proposal 2 for h21(f), benartsi_3bj_02_0912, p 9 3 – use proposal 3 for h21(f), benartsi_3bj_02_0912, p 9 4 – use proposal 4 for h21(f), benartsi_3bj_02_0912, p 9
USE_EXTERNAL_PARAM	set to 0 . Will eventually be removed
RESULT_DIR	Point to the results directory
PKG_LOSS	0 – do not include package insertion loss 1- include package insertion loss

# CSV and display outputs

Output Parameters	
channel_operating_margin_dB: (COM)	Figure of merit. Adjusted so that above zero passes and below fails
peak_interference_mV:	Peak interference on channel include chip and system noise. For a test type of channel, this would be the value for additive rx tolerance injected noise. Since this is peak value of interference, dividing by 7 may be the amount of rms noise from an AWGN generator. Peak interference is measure at the spec BER.
peak_channel_interference_mV:	The peak interference. contribution for residual ISI and crosstalk.
peak_ISI_mV:	The peak interference. contribution for residual ISI.
peak_MDXTK_interference_mV:	The peak interference. contribution for all crosstalk.
icn_mV:	If FD is selected this is the integrated crosstalk noise. Information about channel design may discerned from $7 * ICN - peak\_MDXTK\_interference$
peak_MDNEXT_interference_mV:	The peak interference contribution for all NEXT crosstalk.
peak_MDFEXT_interference_mV:	The peak interference contribution for all FEXT crosstalk.
available_signal_after_eq_mV:	Essentially the “zero-first-precursor” signal height after filtering and reference equalization
fit_loss_dB_at_Fnq:	If FD is selected this is the value of the fitted IL loss at Nyquist. Same as SCAT, IL_fit_atNq
IL_dB_at_Fnq:	If FD is selected this is the value of the IL loss at Nyquist.
ILD_RMS:	This may be useful for a quick evaluation of a channel. It is the RMS of the Insertion Loss Deviation in dB
file_names:	List of channel files