ERL Consensus Discussion

For the purpose of closing comments on Draft 1.2

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7/21/2020

ERL Comments

Parameters

- Tr Values – 14, 44
- N Values – 45*, 50, 51, 52
- Nbx Values – 6, 46, 47, 48, 15, 49
- ERL Values – 68*, 5, 8, 10, 16, 18, 23
- COM Qualifier – 11163

Method

- TDR method – 43

Wording

- “beginning of the ____ connector” – 110, 111, 112, 113
- C2M/TP4 table reference - 51*, 50, 52, 19 (21, 24, 26 from bucket)
- Editorial Fixes

ERL Parameter Comments

The Goal: Adopt parameter changes indicated on Slide 4 of kochuparambil_3ck_01_0720 into Comment 45 or 68 (depending on where there is consensus)

- If needed, make modifications into new rev of these slides based on straw poll consensus.
- Tr Values – 14, 44
- N Values – 45*, 50, 51, 52
- Nbx Values – 6, 46, 47, 48, 15, 49
- ERL Values – 68*, 5, 8, 10, 16, 18, 23
- COM Qualifier – 11163

Nbx Value Discussion, if needed

	162.9.3.4 CR TX	162.9.4.5 CR RX	162.11.3 Cable Ass.	163.9.1.1 KR TX	163.9.2.1 KR RX	163.10.2 KR Chan.	120F.3.1.1 C2C TX	120F.3.2.1 C2C RX	120F.4.3 C2C Chan.	120G.3.1.3 Host output	120G.3.2.2 Module output	120G.3.3.1 Host input	120G.3.4.2 Module input
N_{bx}	0 UI		0 UI	~~TBD~~ 21 UI		~~TBD~~ 21 UI	~~TBD~~ 6 UI		~~TBD~~ 6 UI	0 UI			

- 6/10 Ad Hoc discussion AND 2 comments submitted both propose 21
- Proposed Accept
  - Mau-lin and Rich to kick off discussion, if needed

CL 163 KR channel N_{bx} option

Option A:

- N_{bx} of 35 correlates best to channels which have reflections near the end of the channel
  - I.e. 40 UI from Tp0 or Tp5
  - See backup data
- N_{bx} of 35 may pass channel with considerable reflections up to 40 UI which could fail in a system
  - I.e. Beyond the capability of floating taps.

Option B

- N_{bx} of 21 is the conservative tact
  - The physical location would be a the bga interface just after the 30 mm package
  - Takes care of the device.

IEEE 802.3 100 Gb/s, 200 Gb/s, and 400 Gb/s Electrical Interfaces Task Force 9

http://www.ieee802.org/3/ck/public/adhoc/jun10_20/mellitz_3ck_adhoc_01a_061020.pdf

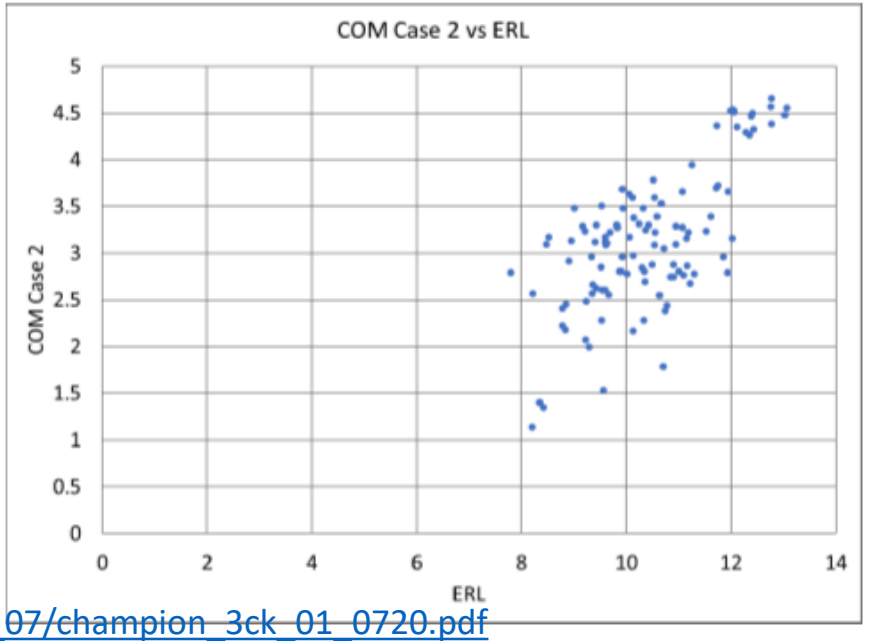
ERL Value Discussion, if needed

	162.9.3.4 CR TX	162.9.4.5 CR RX	162.11.3 Cable Ass.	163.9.1.1 KR TX	163.9.2.1 KR RX	163.10.2 KR Chan.	120F.3.1.1 C2C TX	120F.3.2.1 C2C RX	120F.4.3 C2C Chan.	120G.3.1.3 Host output	120G.3.2.2 Module output	120G.3.3.1 Host input	120G.3.4.2 Module input
ERL	TBD ~~(equation)~~	TBD dB	~~TBD~~ 8 dB for cable assemblies that have a COM less than 4 dB	~~TBD~~ 13 dB	~~TBD~~ 13 dB	TBD dB	~~TBD~~ 11 dB	~~TBD~~ 11 dB	TBD dB	~~TBD~~ 9.5 dB	TBD dB	~~TBD~~ 9.5 dB	TBD dB

- Proposed Accept
  - Bruce, Mau-lin, and Rich to kick off discussion, if needed

COM vs ERL using Varying Eta_0 Values

- Plot on right shows COM vs ERL for 110 channels
- Min ERL is 8.7
- A min ERL of 8 is recommended for specification to allow room to limit for other forms factors in addition to cable assembly and connector variation



http://www.ieee802.org/3/ck/public/20_07/champion_3ck_01_0720.pdf

Summary of ERL Parameter Comments

	162.9.3.4 CR TX	162.9.4.5 CR RX	162.11.3 Cable Ass.	163.9.1.1 KR TX	163.9.2.1 KR RX	163.10.2 KR Chan.	120F.3.1.1 C2C TX	120F.3.2.1 C2C RX	120F.4.3 C2C Chan.	120G.3.1.3 Host output	120G.3.2.2 Module output	120G.3.3.1 Host input	120G.3.4.2 Module input
	Table 162-11		Table 162-15	Table 163-6		Table 163-11	Table 120F-2		Table 120F-7	Table 120G-2			
Tr	0.01 ns		~~TBD~~ 0.01 ns	0.01 ns		0.01 ns	~~TBD~~ 0.01 ns		TBD ns	0.01 ns			
Bx	0 GHz		0 GHz	0 GHz		0 GHz	0 GHz		0 GHz	0 GHz			
Px	0.618		0.618	0.618		0.618	0.618		0.618	0.618			
N	800 UI		~~7000~~ 3500 UI	200 UI		3500 UI	200 UI		2000 UI	800 UI	~~800~~ 400 UI	800 UI	~~800~~ 400 UI
N_{bx}	0 UI		0 UI	~~TBD~~ 21 UI		~~TBD~~ 21 UI	~~TBD~~ 6 UI		~~TBD~~ 6 UI	0 UI			
	Table 163-9	Table 163-12	Table 162-14	Table 163-5	Table 163-7		Table 120F-1	Table 120F-3		Table 120G-1	Table 120G-3	Table 120G-4	Table 120G-7
ERL	TBD ~~(equation)~~	TBD dB	~~TBD~~ 8 dB for cable assemblies that have a COM less than 4 dB	~~TBD~~ 13 dB	~~TBD~~ 13 dB	TBD dB	~~TBD~~ 11 dB	~~TBD~~ 11 dB	TBD dB	~~TBD~~ 9.5 dB	TBD dB	~~TBD~~ 9.5 dB	TBD dB

ERL Method Comment

Cl **93A** *SC* **93A.5** *P* **195** *L* **1** # 43

Mellitz, Richard Samtec

Comment Type **TR** *Comment Status* **D** *ERL*

Creating a TDR (or PTDR) from return loss data may result in factious noise in the TDR response. The reason is high frequency data may not be well behaved enough to perform a reliable Inverse Fourier Transform. Instrument manufacturers may employ proprietary windowing when determining TDR from frequency domain data. A Tukey window (non-proprietary) is a cosine window which will give good consistent results between implementation of the inverse Fourier Transform. See https://en.wikipedia.org/wiki/Window_function#Tukey_window

SuggestedRemedy

Add term H_tw to 93A-58. I.e. H_ii(f)=H_t(f)* s_ii(f)*H_r(f)*H_Tw(f)

Define f_tw_period=2*(f_b- f_b*(1-f_r));
Define: H_tw
When f<- f_r, H_tw=1
When f> f_r <= f_b, H_tw=0.5*cos(2*pi*(f-f_b)/f_tw_period=-pi)+.5
When f> f_v, H_tw=0

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE

Implement the suggested remedy with editorial license.

ERL Wording Comments

Wording Discussion for “beginning of the connector”

Comments 110, 111, 112, 113

Cl 120G SC 120G.3.1.3 P 222 L 38 # 110

Hidaka, Yasuo Credo Semiconductor

Comment Type T *Comment Status* D

"The beginning of the host connector" is not clear.

SuggestedRemedy

Change "the beginning of the host connector" to "the mating interface of the connector between HCB and host under test".

Proposed Response *Response Status* W

PROPOSED REJECT

It is not clear that the proposed modification improves the specification.The term "under test" is superfluous so if there is consensus to adopt the proposed change, change "the beginning of the host connector" to "the mating interface of the connector between HCB and host".

Resolve with comments 112, 111, and 113.

120G.3.1.3 Host output effective return loss (ERL)

ERL of the host output at TP1a is computed using the procedure in 93A.5 with the values in Table 120G–2. Parameters that do not appear in Table 120G–2 take values from Table TBD. The value of T_{fx} is twice the delay from the measurement point TP1a to the beginning of the host connector.

Host output ERL at TP1a shall be greater than TBD.

Draft 1.2

- This was a cross functional discussion that resulted in this text on draft 1.0/1.1
- Proposed Reject as experts associated with connectors and cables agreed this was clear in previous draft

Draft 1.1

120G.3.1.3 Host output effective return loss (ERL)

ERL of the host output at TP1a is computed using the procedure in 93A.5 with the values in Table 120G–2. Parameters that do not appear in Table 120G–2 take values from Table TBD. The value of T_{fx} is twice the delay associated with the TP1a test fixture being used. N_{bx} is set to the value of N_b in Table TBD.

Cl 120G SC 120G.3.1.3 P 222 L 37 # 10057

Dudek, Mike Marvell

Comment Type T *Comment Status* A *ERL*

[Comment resubmitted from Draft 1.0. Subcl. 120G.3.1.3 - Pg 215 - ln 29]

The test fixture delay should be clarified so that the connector is not included in the delay that is removed

SuggestedRemedy

Change "associated with the TP1a test fixture" to from the measurement point TP1a to the beginning of the TP1a test fixture MDI connector".

Response *Response Status* C

ACCEPT IN PRINCIPLE.

"The value of T_fx is twice the delay from the measurement point TP1a to the beginning of the host connector."

Add similar text for the module input and output.

Implement with editorial license.

Wording Discussion for C2M/TP4 table reference

Comments 51* ,50, 52, 19, 21, 24, 26

120G.3.4.2 Module input effective return loss (ERL)

ERL of the module input at TP1 is computed using the procedure in 93A.5 with the values in Table 120G–2. Parameters that do not appear in Table 120G–2 take values from Table TBD. The value of T_{fx} is twice the delay from the measurement point TP1 to the beginning of the MCB connector.

Module input ERL at TP1 shall be greater than TBD.

- Comments point out the TBD in the second sentence
  - One commenter proposes to put in reference 120G-9
  - Another commenter proposes to strike this sentence, but add onto the previous sentence if a value differs from Table 120G-2

- Recommend to AIP #51.
  - Implement suggested remedy and apply similar fix with editorial license to 120G.3.1.3 (Host output), 120G.3.2.2 (Module output), & 120G.3.4.2 (Module input)

http://www.ieee802.org/3/ck/public/adhoc/jun10_20/wu_3ck_adhoc_01_061020.pdf

Other COM parameter values for C2M

- We need to confirm the referenced COM parameter tables for ERL calculation for C2M
  - 120G.3.1.3 Host output ERL
    - "ERL of the host output at TP1a is computed using the procedure in 93A.5 with the values in Table 120G-2. Parameters that do not appear in Table 120G-2 take values from Table **TBD**."
- Table 120G-9 had been used for eye opening calculation
  - Table 120G-9 – Eye opening reference receiver parameter values
- Proposal
  - Adopt 120G-9 for ERL calculation
  - The same for module output, host input, & module input as well

Cl 120G *SC* 120G.3.3.1 *P* 227 *L* 30 # 51

Mellitz, Richard Samtec

Comment Type T *Comment Status* D *ERL parameters*

There doesn't see to be a need for table TBD

SuggestedRemedy

Remove sentence: "
Parameters that do not appear in Table 120G–2 take values from Table TBD "

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE

For task force review.

Editorial Fixes

- ERL value is in 2 places… wording AND table. Change wording to point to the table.
  - Proposed Accept in Principle of similar changes in Bucket comments
  - Remove the TBD equation (162-6) & have 162.9.3.4 point to the ERL value in Table 162-9
  - Replace the TBD ERL value in 162.9.4.5 point to the ERL value in Table 162-12
  - Replace the TBD ERL value in 162.11.3 point to the ERL value in Table 162-14
- Table 120F-7 label says TX and RX ERL Parameter Values. Correct table label to match contents "Channel ERL Parameter values"

162.9.3.4 Transmitter effective return loss (ERL)

ERL of the transmitter at TP2 is computed using the procedure in 93A.5 with the values in Table 162–11. Parameters that do not appear in Table 162–11 take values from Table 162–16. The value of T_{fx} is twice the delay from TP2 to the beginning of the TP2 test fixture MDI connector being used.

Table 162–11—Transmitter and receiver ERL parameter values

Parameter	Symbol	Value	Units
Transition time associated with a pulse	T_r	0.01	ns
Incremental available signal loss factor	β_x	0	GHz
Permitted reflection from a transmission line external to the device under test	ρ_x	0.618	—
Length of the reflection signal	N	800	UI
Equalizer length associated with reflection signal	N_{bx}	0	UI

Transmitter ERL at TP2 shall meet Equation (162–6).

$$ERL \geq TBD \quad \text{(dB)} \qquad (162\text{–}6)$$

where

ERL	is the effective return loss in dB
v_f	is the steady-state voltage, defined in 162.9.3.1.2
$p(k)$	is the linear fit pulse at preset 1 (no equalization) (see 162.9.3.1.2)

Table 162–9—Summary of transmitter specifications at TP2

Parameter	Subclause reference	Value	Units
Signaling rate		53.125 ± 100 ppm	GBd
Differential pk-pk voltage with Tx disabled (max.)[a]	93.8.1.3	30	mV
DC common-mode voltage (max.)[a]	93.8.1.3	1.9	V
AC common-mode RMS voltage, v_{cmf} (max.)[a]	93.8.1.3	30	mV
Differential pk-pk voltage, v_{df} (max.)[a]	93.8.1.3	1200	mV
Effective return loss (ERL) (min.)	162.9.3.4	TBD	dB
Common-mode to differential mode return loss (min.)	92.8.3.3	See Equation (TBD)	dB
Common-mode to common-mode return loss (min.)	92.8.3.4	See Equation (TBD)	dB
Transmitter steady-state voltage, v_f (min.) Transmitter steady-state voltage, v_f (max.)	162.9.3.1.2	0.387 0.6	V
Linear fit pulse peak (min.)	162.9.3.1.2	0.397 × v_f	V
Level separation mismatch ratio R_{LM} (min.)	120D.3.1.2	0.95	—
Transmitter output waveform[b] abs step size for all taps (min.) abs step size for all taps (max.) value at minimum state for $c(1)$ (max.) value at minimum state for $c(-1)$ (max.) value at maximum state for $c(-2)$ (min.) value at minimum state for $c(-3)$ (max.)	 162.9.3.1.4 162.9.3.1.4 162.9.3.1.5 162.9.3.1.5 162.9.3.1.5 162.9.3.1.5	 0.005 0.025 −0.2 −0.34 0.12 −0.06	 — — — — — —
Signal-to-noise-and-distortion ratio, SNDR (min.)[c]	120D.3.1.6	31.5	dB