ERL Discussion Slide

Overview:

Topic	Comments
ERL parameter	[113, kocsis_01], 175 [143, 145] Already decided in previos comments: 31
ERL value	[CR/CA: 114, 110, 3, 4, champion_01] [KR/C2C: 10, 87] [C2M: 90, 99, wu_03, 95, 104] Decided in previous comments: 202, 203, 8, 82, 85, ~~wu_02~~
ERL Tukey	34[4], 237, 238[4]
ERL wording	12, [Tfx wording: 176, 157, 217]
[4] in bucket4 Candidates for bucket 5	

Covered in this presentation
- Address and adopt into a single comment

Decisions already made:
#61 → KR/C2C dERL limit set to -3 dB
#40 → port TP0v (TX) method to TP5v (RX)

Pushing wording to bucket

Request to add a normative MTF ERL
- 122, 178, 123, 22, kocsis_02
- Address this in diminico_3ck_02

Summary of ERL Parameter/Value Comments

	162.9.3.4 CR TX	162.9.4.5 CR RX	162.11.3 Cable Ass.	163.9.2.1.2 KR Test Fixture	Sample Test point (TP0a)	163.9.2.3 KR TX	163.9.3.1 KR RX	163.10.3 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.3.3.1 Host input	120G.3.2.3 Module output	120G.3.4.2 Module input
	Table 162-12		Table 162-17	Table 163-6		Table 163-8		Table 163-12	Table 120F-2		Table 120F-8	Table 120G-2		Table 120G-4	
T_r	0.01 ns		0.01 ns	0.01 ns		0.01 ns		0.01 ns	0.01 ns		0.01 ns	0.01 ns		0.01 ns	
B_x	0 GHz		0 GHz	0 GHz		0 GHz		0 GHz	0 GHz		0 GHz	0 GHz		0 GHz	
P_x	0.618		0.618	0.618		0.618		0.618	0.618		0.618	0.618 ~~0.19~~		0.618 ~~0.19~~	
N	800 UI	#113	~~3500~~ 4500 UI	20 UI		200 UI		3500 UI	200 UI		2000 UI	800 UI	#143, 145	400 UI	
N_{bx}	0 UI		0 UI	0 UI		21 UI		21 UI	6 UI		6 UI	0 UI		0 UI	
T_{fx}	0.2 ns		0.2 ~~0.2 ± 10%~~ ns	0 ns		Twice the delay from TP0 to TP0v	Twice the delay from TP5~~a~~v to TP5	0 ns	Twice the delay from TP0 to TP0v	Twice the delay from TP5~~a~~v to TP5	0 ns	0.2 ns		0.2 ns	
T_w	1	#175	1	1		1		1	1		1	1		1	
	Table 163-10	Table 163-13	Table 162-16		Table 163-7 (TP0a)	Table 163-5	Table 163-9		Table 120F-1	Table 120F-4		Table 120G-1	Table 120G-5	Table 120G-3	Table 120G-8
ERL	~~TBD~~ 7.3 dB #3	~~TBD~~ 7.3 dB #4	~~TBD~~ 7.4 dB for cable	#110, 114	~~TBD~~ 15.5 dB wu_04	dERL -3 dB	dERL -3 dB	~~TBD~~ 9.7 dB	dERL -3 dB	dERL -3 dB	TBD dB #87, no value	~~TBD~~ 7.3 dB	~~TBD~~ 7.3 dB #90, 99, wu_03	TBD dB	TBD dB #95, 104, no values
						#61 & 40			#61 & 40						

Proposed Response to #114

- The following presentations were reviewed by the task force:
  - https://www.ieee802.org/3/ck/public/20_10/kocsis_3ck_01_1020.pdf
  - https://www.ieee802.org/3/ck/public/20_10/champion_3ck_01_1020.pdf
  - https://www.ieee802.org/3/ck/public/20_10/wu_3ck_02_1020.pdf
  - https://www.ieee802.org/3/ck/public/20_10/wu_3ck_03_1020.pdf
- ERL Parameter and Value comments were discussed together by reviewing https://www.ieee802.org/3/ck/public/20_10/kochuparambil_3ck_03_1020.pdf

- Consensus to implement, with editorial license, the ERL changes as noted in slides X-X of kochuparambil_3ck_03_1020

Tfx Wording

T_{fx} Wording Comments – going into bucket5??

Cl **162** *SC* **162.9.3.4** *P* **151** *L* **16** # **157**

Dudek, Mike — Marvell.

Comment Type **E** *Comment Status* **D** *ERL tfx*

The wording in the footnote doesn't properly describe what is being mitigated. In particular what is "the test point and transmission line". A test point doesn't have a return loss.

SuggestedRemedy

Change " which sufficiently mitigates the test point and transmission line return loss." to "which sufficiently mitigates the effect of reflections from the test connector and test fixture transmission line". Also on the footnote to table 162-17 on page 157 line 15

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

T_fx is defined in the variable list for Equation 93A-61 in 802.3cd-2018. However, the definition should be updated as follows:
Change: "is twice the propagation delay in ns associated with the test fixture, obtained by measurement or inspection"
To:"is twice the propagation delay in ns associated with the test fixture, obtained by measurement or inspection, or as specified by the clause that invokes this method"
[Editor's note: CC: 162, 163, 93A]

Cl **162** *SC* **162.11.3** *P* **158** *L* **15** # **176**

Haser, Alex — Molex

Comment Type **ER** *Comment Status* **D** *ERL tfx*

The note about fixture delay is misleading. The specified delay does not represent twice the transmission line delay. Only the coax is being removed from the fixture.

SuggestedRemedy

Change footnote to: "The specified Tfx value signficantly mitigates the test point and transmission line return loss by removing the coax connector and via from the measurement." or something along those lines

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve using the response to comment #157.

Cl **162** *SC* **162.9.3.4** *P* **151** *L* **12** # **217**

Dawe, Piers — Nvidia

Comment Type **T** *Comment Status* **D** *ERL tfx*

Both the parameter description and the note are incorrect: "Twice the propagation delay associated with the test fixture", "The specified Tfx value represents twice the transmission line delay which sufficiently mitigates the test point and transmission line return loss."
And the terminology doesn't match: propagation delay, transmission line delay - are they the same thing or what?

SuggestedRemedy

Tfx is windowing time that is larger than twice the delay associated with the test point connector but less than twice the delay from the test point connector to the other end of the test fixture's transmission line.
Also Tfx needs to appear in 93A.5, which is where the explanation should go, not here.
Make similar changes in each ERL section in the draft.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

The response to comment #157 addresses the first part of the suggested remedy.
T_fx is defined in the variable list for Equation 93A-61 in 802.3cd-2018.
However, the definition should be updated as follows:
Change:
"is twice the propagation delay in ns associated with the test fixture, obtained by measurement or inspection"
To:
"is twice the propagation delay in ns associated with the test fixture, obtained by measurement or inspection, or as specified by the clause that invokes this method"
[Editor's note: CC: 162, 163, 93A]

T_{fx} Wording

What's it look like now (Draft 1.3)

Table 162–12—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
Twice the propagation delay associated with the test fixture	T_{fx}	0.2[a]	ns
Tukey window flag	tw	1	—

[a]The specified T_{fx} value represents twice the transmission line delay which sufficiently mitigates the test point and transmission line return loss.

Cross-clause & 93A (next slide)

Table row, non-0 value for Tfx, & Footnote

Table 162–17—Cable assembly ERL parameter values

Table 120G–2—Host output and input ERL parameter values

Table 120G–4—Module output and input ERL parameter values

Table row, Tfx=0 (no footnote)

Table 163–6—Test fixture ERL parameter values

Table 163–12—Channel ERL parameter values

Table 120F–8—Channel ERL parameter values

T_{fx} Wording

What's it look like now (802.3cd-2018)

Table 93A–4—ERL parameters

Parameter	Reference	Symbol	Units
Signaling rate	93A.1.1	f_b	GBd
Transition time associated with a pulse	93A.2	T_r	ns
Receiver 3 dB bandwidth	93A.1.4.1	f_r	GHz
Number of signal levels	93A.1.6	L	—
Length of the reflection signal		N	UI
Number of samples per unit interval	93A.1.6	M	—
Equalizer length associated with reflection signal	93A.5.2	N_{bx}	UI
Incremental available signal loss factor	93A.5.2	β_x	GHz
Permitted reflection from a transmission line external to the device under test	93A.5.2	ρ_x	—
Target detector error ratio	93A.1.7	DER_0	—

93A.5.2 Effective reflection waveform

The effective reflection waveform, $R_{eff}(t)$, is computed by time gating and weighting the PTDR waveform, PTDR(t), according to Equation (93A–60). $R_{eff}(t)$ is a pure number.

$$R_{eff}(t) = PTDR(t) \times G_{rr}(t) \times G_{loss}(t) \quad \text{(93A–60)}$$

where $G_{rr}(t)$ and $G_{loss}(t)$ are time gating weighting functions defined in Equation (93A–61) and Equation (93A–62) with t in nanoseconds.

$$G_{rr}(t) = \begin{cases} 0 & t < T_{fx} \\ \rho_x(1+\rho_x)\exp\left(-\dfrac{[(t-T_{fx})f_b-(N_{bx}+1)]^2}{(N_{bx}+1)^2}\right) & T_{fx} \le t < T_{fx}+\dfrac{N_{bx}+1}{f_b} \\ 1 & t \ge T_{fx}+\dfrac{N_b+1}{f_b} \end{cases} \quad \text{(93A–61)}$$

where

t	is the time in ns starting from the peak of the injected pulse
T_{fx}	is twice the propagation delay in ns associated with the test fixture, obtained by measurement or inspection
ρ_x, f_b, N_{bx}	are supplied by the clause that invokes this method

T_{fx} Wording

The proposal

Table 93A–4—ERL parameters

Parameter	Reference	Symbol	Units
Signaling rate	93A.1.1	f_b	GBd
Transition time associated with a pulse	93A.2	T_r	ns
Receiver 3 dB bandwidth	93A.1.4.1	f_r	GHz
Number of signal levels	93A.1.6	L	—
Length of the reflection signal		N	UI
Number of samples per unit interval	93A.1.6	M	—
Equalizer length associated with reflection signal	93A.5.2	N_{bx}	UI
Incremental available signal loss factor	93A.5.2	β_x	GHz
Permitted reflection from a transmission line external to the device under test	93A.5.2	ρ_x	—
Target detector error ratio	93A.1.7	DER_0	—

Add T_{fx} to this table "Time-gated propagation delay"

93A.5.2 Effective reflection waveform

The effective reflection waveform, $R_{eff}(t)$, is computed by time gating and weighting the PTDR waveform, PTDR(t), according to Equation (93A–60). $R_{eff}(t)$ is a pure number.

$$R_{eff}(t) = PTDR(t) \times G_{rr}(t) \times G_{loss}(t) \quad \text{(93A–60)}$$

where $G_{rr}(t)$ and $G_{loss}(t)$ are time gating weighting functions defined in Equation (93A–61) and Equation (93A–62) with t in nanoseconds.

$$G_{rr}(t) = \begin{cases} 0 & t < T_{fx} \\ \rho_x(1+\rho_x)\exp\left(-\dfrac{[(t-T_{fx})f_b-(N_{bx}+1)]^2}{(N_{bx}+1)^2}\right) & T_{fx} \le t < T_{fx}+\dfrac{N_{bx}+1}{f_b} \\ 1 & t \ge T_{fx}+\dfrac{N_b+1}{f_b} \end{cases} \quad \text{(93A–61)}$$

where

t is the time in ns starting from the peak of the injected pulse

T_{fx} is twice the propagation delay in ns associated with the test fixture, obtained by measurement or inspection, or otherwise specified by the clause that invokes this method

ρ_x, f_b, N_{bx} are supplied by the clause that invokes this method

T_{fx} Wording
The proposal

Table 162–12—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
~~Twice the propagation delay associated with the test fixture~~	T_{fx}	0.2[a]	ns
Tukey window flag	tw	1	—

Time-gated propagation delay

[a]The specified T_{fx} value represents twice ~~the~~ transmission line delay which sufficiently mitigates ~~the test point and transmission line return loss.~~ the effect of reflections from the test connector and test fixture transmission line

a

Cross-clause impacts

Table row, non-0 value for Tfx, & Footnote

Table 162–17—Cable assembly ERL parameter values

Table 120G–2—Host output and input ERL parameter values

Table 120G–4—Module output and input ERL parameter values

Table row, Tfx=0 (no footnote)

Table 163–6—Test fixture ERL parameter values

Table 163–12—Channel ERL parameter values

Table 120F–8—Channel ERL parameter values