Baseline Proposal for 100, 200 and 400 Gb/s Backplane (Update)

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March 2019

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

Acknowledgements

- Thank you to Beth Kochuparambil, Rich Mellitz, Phil Sun, Adam Healey, Kent Lusted, Mike Dudek and Upen Kareti for guidance, feedback and questions.

- This proposal follows the approach used in li_3cd_01b_0916.pdf from Mike Li and Mike Dudek.

Method

- Leverage the 802.3cd specification with modifications for updated COM reference package, reference receiver and SerDes parameters.
  - Clause 137
  - Annex 93A

- Propose to use the same per lane specifications for 100GBASE-KR1, 200GBASE-KR2 and 400GBASE-KR4. The presentation refers to 100GBASE-KR1 for all of these per lane specifications.

Contents

- PMD
- Compliance Points
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PMD

- ## PMD clause structure
  - Follow the structure contained in 137.1-137.8.
  - Several functional specifications in 137.8 (PMD functional specifications) refer to requirements in Clause 136. Need to coordinate this with the corresponding 100GBASE-CR1 Clause.

- ## MDI
  - The MDI for 50GBASE-KR1 PHY is an implementation-dependent direct electrical connection between the PMD and the medium.
  - The MDI comprises two differential pairs, one for the transmit function and one for the receive function, marked by TP0 and TP5 in Figure 137–2.
  - Transmitter and receiver characteristics are defined at TP0a and TP5a, which are connected to the MDI through the test fixtures described in 93.8.1.1 and 93.8.2.1.
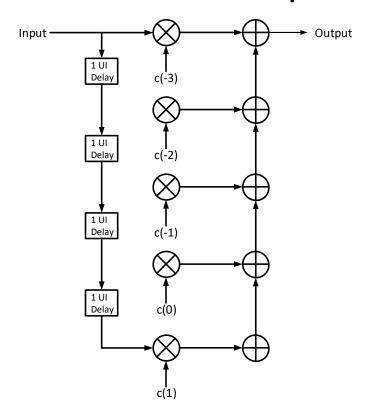
Compliance Points

- Compliance point definition
  - The electrical characteristics for the 100GBASE-KR interfaces are defined at compliance points for the transmitter (TP0a) and receiver (TP5a), respectively.
  - The location of TP0a and electrical characteristics of the test fixture used to measure transmitter characteristics are defined in Figure 93-5 and 93.8.1.1, respectively.
  - The location of TP5a and electrical characteristics of the test fixture used to measure the receiver are defined in Figure 93-10 and 93.8.2.1, respectively.

Transmitter Characteristics

- Transmitter electrical characteristics at TP0a for 100GBASE-KR1 are the same as those summarized in Table 120D-1 and detailed in 120D.3.1.1 through 120D.3.1.2.2, except
  - Steady state voltage v_f (max): 0.60 V
  - Steady state voltage v_f (min): 0.40 V
  - Linear fit pulse peak (min): TBD
  - Signal-to-noise-and-distortion ratio (min): TBD dB

- Equalization: See slide 8

- ERL: See slide 10

Parameters in magenta need to be confirmed.

Transmitter Equalization

Coefficient	Amplitude		Step Size
	Min	Max	
$c(-3)$	-0.06	0	0.02
$c(-2)$	0	0.12	0.02
$c(-1)$	-0.34	0	0.02
$c(0)$	0.54		
$c(1)$	-0.2	0	0.05

TxEQ values go in the COM Table (refer to Table 137-6 for an example). Refer to "config_com_ieee8023_93a=100GEL-KR_DFE_121918.xls" in

http://www.ieee802.org/3/ck/public/tools/tools/mellitz_3ck_adhoc_01_121918_COM2p57.zip.

Receiver Spec

- Receiver characteristics at TP5a for 100GBASE-KR1 are the same as those in 137.9, except:

  - Insertion loss @ 26.5625 GHz values for Test 1 are 13.5 (min) and 14.5 (max).
  - Insertion loss @ 26.5625 GHz values for Test 2 are 27.5 (min) and 28.5 (max).

- ERL: See Slide 10.

Transmitter/Receiver ERL

Parameter	Symbol	Value	Units
Transition time associated with a pulse	T_r	0.01	ns
Incremental available signal loss factor	β_x	1.7	GHz
Permitted reflection from a transmission line external to the device under test	ρ_x	0.32	—
Length of the reflection signal	N	200	UI

Minimum spec = TBD dB

Parameters in magenta need to be confirmed.

Channel Spec

- ERL: See Slide 12

- Insertion Loss: See Slide 13

- COM: base upon table 137-6 with modifications per "config_com_ieee8023_93a=100GEL-KR_DFE_121918.xls" in mellitz_3ck_adhoc_01_121918_COM2p57.zip.

  - Transmit equalizer per the values in slide 8.

  - Flexible reference package per slide 14.

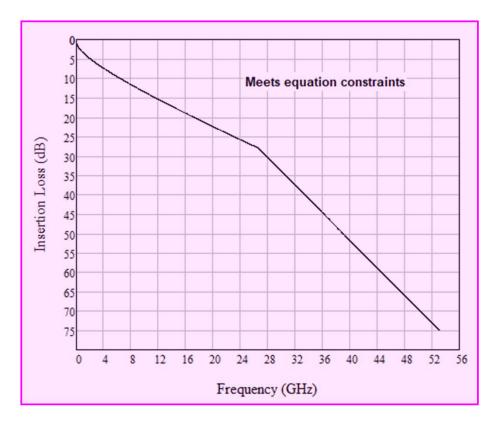 - Parameter values that differ from Table 137-6 are shown on slides 15-17.

Channel ERL

Parameter	Symbol	Value	Units
Transition time associated with a pulse	T_r	0.010	ns
Incremental available signal loss factor	β_x	1.7	GHz
Permitted reflection from a transmission line external to the device under test	ρ_x	0.25	—
Length of the reflection signal	N	2000	UI

pass/fail spec = 10 dB

Parameters in magenta need to be confirmed.

Channel Insertion Loss
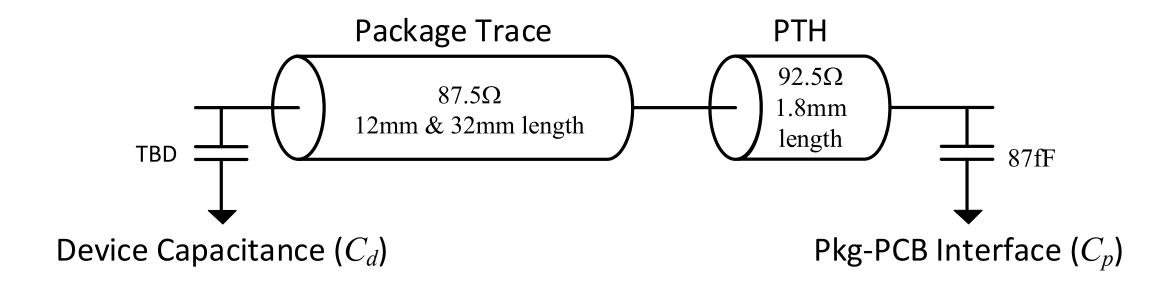
Parameters in magenta need to be confirmed.

- Insertion loss (informative): maximum 28 dB at Nyquist.

- Use a modified version of equation 137-1.

- Proposed equation:

$$IL(f) \leq \begin{cases} 0.693 + 2.161\sqrt{f} + 0.607f & 0.01 \leq f \leq f_b/2 \\ -19.12 + 1.773f & f_b/2 < f \leq 53.135 GHz \end{cases}$$

Channel Spec – Reference Package

- Adopt the flexible package model proposed in http://www.ieee802.org/3/ck/public/19_01/benartsi_3ck_01_0119.pdf.

- Modify 93.A.1.2 to comprehend the flexible package model.

COM

Differences from Table 137-6:

Parameter	Symbol	Value	Units
Device package model			
Single-ended device capacitance	C_d	TBD	nF
Transmission line length, Test 1	z_p	12; 1.8	mm
Transmission line length, Test 2	z_p	32; 1.8	mm
Single-ended package capacitance at package-to-board interface	C_p	0.087×10^{-3}	nF
Package transmission line nominal characteristic impedance	Z_c	87.5; 92.5	Ω

Parameters in magenta need to be confirmed.

COM (2)

Parameter	Symbol	Value	Units
Transmit equalizer minimum coefficient, minimum	$c(0)$	0.54	—
Transmit equalizer, 1st pre-cursor coefficient	$c(-1)$		—
Minimum value		-0.34	
Maximum value		0	
Step size		0.02	
Transmit equalizer, 2nd pre-cursor coefficient	$c(-2)$		—
Minimum value		0	
Maximum value		0.12	
Step size		0.02	

COM (3)

Parameter	Symbol	Value	Units
Transmit equalizer, 3rd pre-cursor coefficient	$c(-3)$		—
Minimum value		-0.06	
Maximum value		0	
Step size		0.02	
Transmit equalizer, post-cursor coefficient	$c(1)$		—
Minimum value		-0.2	
Maximum value		0	
Step size		0.05	

Parameters in magenta need to be confirmed.

Environmental Specs & PICS

- Environmental Specs: Base on 137-11.
- PICS: Base on 137-12 with updates as needed.

COM Reference Receiver

DFE-based as in existing Clause 137 & Annex 93A with the following exceptions:

- Nb = TBD, location of DFE taps is TBD.
- bmax(1)=TBD, bmax(2…Nb)=TBD

Parameters in magenta need to be confirmed.

Proposal

- Propose that the P802.3ck task force adopt the baseline proposal contained on slides 4-18.

Thank you!