Meeting 7+8
Comment Discussion

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TP4/TP4a Topics

TP4/TP4a FE channel comment 211, 212 (part 1)

TP4…

Cl 120G *SC* 120G.3.2 *P* 224 *L* 30 # 211

Ghiasi, Ali — Ghiasi Quantum/Inphi

Comment Type TR *Comment Status* D

The reference 4T equalizer given that TP4 near end and far end are measured with near ideal MCB vs host channels with via, need to consider impairment due to long barrel vias.

SuggestedRemedy

ghiasi_02_0620 investigates use of C0/C1 as in the CR methodology as one option, this method may result variation in the measurement due to interference but perhaps a better method is to increase eta_0 from 4.1E-8 to account for the board impairments. Eta_0 at TP4 near end is increased by 5x to account short channel impairments and eta_0 at TP4 far end increased by 2x from 4.1E-8. The contribution show that increasing eta_0 is a viable option. The 3rd option is just keep eta_0 at 4.1 E-8 without C0/C1 but instead reduce VEC and increase VEO. 1st option - increase eta_0, 2nd option - tighten the limit on VEO/VEC with eta_0=4.1E-8, 3rd option - add C0/C1.

Proposed Response *Response Status* W

PROPOSED REJECT.

It appears that the comment is proposing modifications to the reference receiver used for measurement of the module output (TP4) eye opening parameters.

For task force discussion to determine if a modification is required and if so which form of modification to implement.

Related to TP4a comment #212.

Pending review of the following presentation:
http://www.ieee802.org/3/ck/public/20_07/ghiasi_3ck_02_0720.pdf

Related to #195.

TP4a…

Cl 120G *SC* 120G.3.3.2 *P* 227 *L* 37 # 212

Ghiasi, Ali — Ghiasi Quantum/Inphi

Comment Type TR *Comment Status* D

The reference 4T equalizer will be calibrated with ideal HCB-MCB vs host channels with long barrel via, need to make sure the host is not over stressed given that host channel has more impairments.

SuggestedRemedy

ghiasi_02_0620 investigates use of C0/C1 as in the CR methodology as one option, this method may result variation in the measurement due to interference but perhaps a better method is to increase eta_0 from 4.1E-8 to account for the board impairments. Eta_0 at TP4 near end is increased by 5x to account short channel impairments and eta_0 at TP4 far end increased by 2x from 4.1E-8. The contribution show that increasing eta_0 is a viable option. The 3rd option is just keep eta_0 at 4.1 E-8 without C0/C1 but instead reduce VEC and increase VEO. 1st option - increase eta_0, 2nd option - tighten the limit on VEO/VEC with eta_0=4.1E-8, 3rd option - add C0/C1.

Proposed Response *Response Status* W

PROPOSED REJECT.

It appears that the comment is proposing modifications to the reference receiver used for measurement of the host stressed input (TP4a) eye opening parameters.

For task force discussion to determine if a modification is required and if so which form of modification to implement.

Related to TP4 comment #211.

Pending review of the following presentation:
http://www.ieee802.org/3/ck/public/20_07/ghiasi_3ck_02_0720.pdf

TP4/TP4a FE channel comment 211, 212 (part 2)

SR proposes enhancements to account for reflections in a real host channel.

Options proposed:
#1 increase eta_0, retain channel and EH/VEC values
#2 tighten the limit on VEO/VEC, retain channel and eta_0
#3 add C0/C1 to the channel, retain eta_0 and EH/VEC values

Specifics are provided on slide 3 of
http://www.ieee802.org/3/ck/public/20_07/ghiasi_3ck_02a_0720.pdf

The value 4.1E-8 chosen is already inflated to account for module input receiver package parasitics.

Slide 3 of
http://www.ieee802.org/3/ck/public/20_07/ghiasi_3ck_02a_0720.pdf

Module to ASIC Test Methodology Comments 211 and 212

- **Unlike ASIC-Module the Module-ASIC output at TP4 and TP5 measured with compliance board and reference trace typically has COM >6 dB dB with 4T DFE receiver**
  - If one replaces module compliance board with realistic host with long barrel via and a short stub then COM can drop by ~ 2 dB
  - COM can drop to 2-3 dB for realistic channel if one include the ASIC package
- **The method of benartsi_3ck_01a_0719 for CR link have been studied for module-chip TP4/farend measurements with (C0, C1)= (29, 19 fF)**
  - TP4 is measured directly without C0/C1
  - TP4 farend is measured with C0/C1
  - Benartsi method applied to C2M require C0/C1 be cascaded with the module S4P but actual measurement ignores the interaction between module and C0-TL-C1
  - C0-TL-C1 in effect is a low pass filter plus some interaction between C0-C1
- **An alternate method without above issue and sensitivity to reflection is to increase eta_0 to account for realistic board implementation without using (C0, C1)**
  - Eta_0 increased to 4x of TP1a noise (4.1E-8) at TP4 nearend to account for the host
  - Eta_0 increased to 2x of TP1a noise (4.1E-8) at TP4 farend account for the host.

A. Ghiasi IEEE 802.3ck Task Force 3

TP4 NE/FE eye definition comment 130, 228 (part 1)

Cl 120G *SC* 120G.3.2 *P* 224 *L* 36 # 130

Hidaka, Yasuo
Credo Semiconductor

Comment Type TR *Comment Status* D

The near-end eye and far-end eye of module output characteristics (at TP4) are not well defined. Table 120G-3 refers to 120E.3.3.2.1 for far-end eye height, but 120E.3.3.2.1 is host stressed input test.

SuggestedRemedy

Add a sub clause describing near-end and far-end eys in 120G.3.2.1, similar to 120E.3.2.1.1 like the following:

The near-end eye is measured using the method in 120G.5.2.

For the far-end eye, the signal measured at TP4 is first convolved with a host channel (~9.6 dB loss at Nyquist) that represents the worst case channel loss with some reflection in the host trace. The host channel is the host receiver PCB signal path S^(HOSPR) defined in 162.11.7.1.1 with an exception to use z_p = 244.7 mm. The methods in 120G.5.2 and TBD are then used to measure eye height, eye width, vertical eye closure, and far-end pre-cursor ISI ratio.

Change the references in Table 120G-3.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

For task force discussion.

Cl 120G *SC* 120G.3.3.2.1 *P* 229 *L* 15 # 228

Ran, Adee
Intel

Comment Type T *Comment Status* D

"The far-end eye height and vertical eye closure are measured according to the method in 120G.5.2"

The method in 120G.5.2 describes a "reference receiver" using COM method (references to 93A) and parameters in a table. it is perhaps suitable for analyzing a directly measured signal (near-end), but does not mention anything about far-end.

In comparison, the reference receiver for 50G C2M is defined in 120E.3.2.1.1, and for the far-end measurement it includes a loss channel:

"The signal measured at TP4 is first convolved with a loss channel (~6.4 dB loss at Nyquist) that represents the worst case channel loss. The loss channel is the host trace defined in 92.10.7.1.1 with Zp = 151 mm."

In order to define far-end measurements, some loss channel has to be included.

Using a convolution may not capture possible effects of reflections from that channel towards the HCB/MCB. It would be preferable to include a physical loss channel in the measurement (as done e.g. in the CR receiver test, see 110.8.4.2.2). However, changing the methodology from 120E may require more consensus, so the suggested remedy is to continue using a computational channel.

The host channel model in clause 162 is updated from the one in clause 92 (referenced by 120E) to include more capacitances and different loss parameters. The length should be set to create a 16 dB loss at 26.56 GHz. Calculation yields 407 mm.

SuggestedRemedy

Add a paragraph after the existing one in 120G.5.2 with the following text:

For the far-end measurements, the signal measured at TP4 is first convolved with a loss channel that represents the maximum host board loss, and then processed by the reference receiver. The loss channel is the host trace defined in 162.11.7.1 with Zp = 407 mm.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

For task force review.

TP4 NE/FE eye definition comment 130, 228 (part 2)

For the host length:
#130 proposes 244.7 mm
#228 proposes 407 mm

Proposed response for #130 (#228 points back to #130)

PROPOSED AIP.

Based on previous discussions, there does not seem to be consensus to include reflections on the host trace. Nor does the suggested remedy provide a method or criteria for this. For this a revised eta0 value or reflection method may be proposed for the next draft.

Add a new subclause describing near-end and far-end eyes in 120G.3.2, similar to 120E.3.2.1.1, as follows:

"The near-end eye is measured using the method in 120G.5.2.
For the far-end eye, the signal measured at TP4 is first convolved with a host channel (~9.6 dB loss at Nyquist) that represents the worst case channel loss. The host channel is the host receiver PCB signal path S^(HOSPR) defined in 162.11.7.1.1 with the exception that z_p = <value> mm. The methods in 120G.5.2 and TBD are then used to measure eye height, eye width, vertical eye closure, and far-end pre-cursor ISI ratio."

Change the references in Table 120G-3 to point to the new subclause.

Implement with editorial license.

162.11.7.1.1 Channel signal path

The scattering parameters of the channel signal path from TP0 to TP5 are calculated using Equation (162–12). The transmitter and receiver PCB signal paths are denoted as $S^{(HOSTxP)}$ and $S^{(HOSP)}$, and are calculated using Equation (162–12) and Equation (162–11), respectively. The PCB transmission line scattering parameters are denoted as $S^{(l)}$ and are calculated from Equation (93A–13) and Equation (93A–14) using z_p =110.3 mm in length and the parameter values given in Table 162–17, representing an insertion loss of 4.33 dB at 26.56 GHz on each PCB. The scattering parameters for the PCB via capacitances, $S^{(c0)}$ and $S^{(c1)}$, are calculated using Equation (93A-8) and the values in Table 162–17.

$$S^{(HOSPT)} = \text{cascade}(\text{cascade}(S^{(c0)}, S^{(l)}), S^{(c1)}) \quad (162\text{–}10)$$

$$S^{(HOSPR)} = \text{cascade}(\text{cascade}(S^{(c1)}, S^{(l)}), S^{(c0)}) \quad (162\text{–}11)$$

$$SCHS_p^{(k)} = \text{cascade}(\text{cascade}(S^{(HOSPT)}, S^{(CASP)}), S^{(HOSPR)}) \quad (162\text{–}12)$$

where

$SCHS_p^{(k)}$	is the channel signal path
$S^{(HOSPT)}$	is the host transmitter or PCB signal path
$S^{(HOSPR)}$	is the host (transmitter or receiver) PCB signal path
$S^{(CASP)}$	is the cable assembly signal path (TP1 to TP4)
k	is equal to zero

120E.3.2.1.1 Reference receiver for module output evaluation

A reference receiver is used to measure module eye width and eye height. The reference receiver includes a selectable continuous time linear equalizer (CTLE), which is defined in 120E.3.1.7. The equalizer may be implemented in software; however, the measured signal is not averaged.

The near-end eye is measured with the reference receiver. Equalizer settings corresponding to less than or equal to 3 dB of peaking from Table 120E–2 may be used to meet the output eye width and height requirements.

For the far-end eye, the signal measured at TP4 is first convolved with a loss channel (~6.4 dB loss at Nyquist) that represents the worst case channel loss. The loss channel is the host trace defined in 92.10.7.1.1 with Z_p = 151 mm. The reference receiver is then used to measure the eye width and height. Any of the equalizer settings from Table 120E–2 may be used.

TP4a VEC comments 178

Cl 120G SC 120G.3.3.2 P 227 L 37 # 178

Ran, Adee Intel

Comment Type T *Comment Status* D

With two available module settings, one for near-end and one for far-end, a host tested for host stressed input should be allowed to choose when module setting it prefers.

The test should be modified to let the host calibrate the stress either at the MCB output, or after a frequency-dependent attenuator as specified for module output far-end testing. meeting the required BER at one of the settings is sufficient.

SuggestedRemedy

Change 120G.3.3.2.1 text and Figure 120G–8 per the comment.

Proposed Response *Response Status* W

PROPOSED REJECT.

As specified in Draft 1.2, the module output does not support multiple equalization settings.

Comment #175 proposes that the module support two such modes.

If this comment is accepted then the response should provide editorial license.

!!! This comment response should be updated based on closed comment #175. !!!

Cl 120G SC 120G.3.2 P 224 L 29 # 175

Ran, Adee Intel

Comment Type T *Comment Status* A

Unlike a host transmitter, which has a fixed known channel and can be tuned to optimize the signal at the receiver input, the module has no knowledge of the channel. A fixed signal setting (swing and equalization) can be optimized for a high loss channel but will be inappropriate for a low loss channel, and vice versa.

To enable host management to choose the appropriate signal swing and equalization for the host channel in use, the module output should have more than one setting, and a control method to choose between them.

Discussions at this point indicate that it is desired to have no more than two settings. The suggested remedy is based on that. Future proposal may refine this idea.

SuggestedRemedy

Define two separate tests for the module output, near-end and far-end.

In the near-end test, only the near-end specifications are measured, with an MCB only. In the far-end test, only the far-end specifications are measured, with an MCB and a frequency dependent attenuator (specified stroitly to create the effect of a maximum-loss host channel).

The module shall have a 2-valued control variable (mapped to an MDIO register, although actual interface may be different) to select between two settings of its ouput. One setting will be tested in the near-end test and another will be tested in the far-end test.

Response *Response Status* C

ACCEPT IN PRINCIPLE.

Adopt a near end and a far end setting with an MDIO register bit to select between the setting as discussed in slide 9 of ran_3ck_01b_0720. Implement with editorial license.

Strawpoll #8 (decision)
I support closing comment 175 with: Adopt a near end and a far end setting with an MDIO register bit to select between the setting as discussed in slide 9 of ran_3ck_01b_0720. Implement with editorial license.
Yes: 37
No: 10

Proposed new response…

AIP

Comment #175 adopted a pair of TP4 TX settings to address low-loss and high-loss host channels. The setting is to be selected as appropriate by the host.

Implement the suggested remedy with editorial license.

TP4 FE CTLE g_DC, g_DC2 comments 121, 122, 202

Cl 120G *SC* 120G.3.4.1.1 *P* 235 *L* 23 # 202

Ghiasi, Ali — Ghiasi Quantum/Inphi

Comment Type TR *Comment Status* D

CTLE gain setting for TP4 far end are TBD

SuggestedRemedy

see ghiasi_3ck_02_0620 where includes min g_DC and g_DC_HP, min g_DC=10 dB and min g_DC_HP=3 dB

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Alternate ranges for near-end gDC and gDC2 are proposed by comments #121, #122, and #240.

Pending review of the following presentations:
http://www.ieee802.org/3/ck/public/20_07/ghiasi_3ck_02_0720.pdf
http://www.ieee802.org/3/ck/public/20_07/hidaka_3ck_01_0720.pdf

<under construction>

Cl 120G *SC* 120G.5.2 *P* 235 *L* 25 # 121

Hidaka, Yasuo — Credo Semiconductor

Comment Type TR *Comment Status* D

Range of gDC for TP4 far-end is TBD.
See hidaka_3ck_01_0720, slide 8.

SuggestedRemedy

Specify gDC range for TP4 far-end as min -9.0, max -3.0, step 1.0.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Resolve using the response to comment #202.

Cl 120G *SC* 120G.5.2 *P* 235 *L* 29 # 122

Hidaka, Yasuo — Credo Semiconductor

Comment Type TR *Comment Status* D

Range of gDC2 for TP4 far-end is TBD.
See hidaka_3ck_01_0720, slide 8.

SuggestedRemedy

Specify gDC2 range for TP4 far-end as min -3.0, max -1.5, step 0.5.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Resolve using the response to comment #202.

TP4 NE CTLE g_DC, g_DC2 comments 201, 240, 119, 120

CI 120G SC 120G.3.4.1.1 P 235 L 16 # 201

Ghiasi, Ali — Ghiasi Quantum/Inphi

Comment Type TR *Comment Status* D

CTLE gain setting for TP4 nearend are TBD

SuggestedRemedy

see ghiasi_3ck_02_0620 where includes min g_DC and g_DC_HP, min g_DC=5 dB and min g_DC_HP=2 dB

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Alternate ranges for near-end gDC and gDC2 are proposed by comments #119, #120, and #240.

Pending review of the following presentations:
http://www.ieee802.org/3/ck/public/20_07/ghiasi_3ck_02_0720.pdf
http://www.ieee802.org/3/ck/public/20_07/hidaka_3ck_01_0720.pdf

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CI 120G SC 120G.4.2 P 235 L 17 # 240

Dawe, Piers — Nvidia

Comment Type TR *Comment Status* D

Here are the combinations of gDC and gDC2 which I thought we had agreed on a conference call after a good discussion - but it turns out we adopted the TP1a limits only.

SuggestedRemedy

TP4 near end:
gDC2 | gDC
0: | -2 to -4
-1: | -2 to -5
-2: | -4 to -5
-3: | (none)
TP4 far end:
gDC2 | gDC
0: | -2 to -4
-1: | -2 to -7
-2: | -4 to -10
-3: | -8 to -10

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Resolve using the response to comment #201.

CI 120G SC 120G.5.2 P 235 L 17 # 119

Hidaka, Yasuo — Credo Semiconductor

Comment Type TR *Comment Status* D

Range of gDC for TP4 near-end is TBD.
See hidaka_3ck_01_0720, slide 8.

SuggestedRemedy

Specify gDC range for TP4 near-end as min -5.0, max -3.0, step 1.0.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Resolve using the response to comment #201.

CI 120G SC 120G.5.2 P 235 L 21 # 120

Hidaka, Yasuo — Credo Semiconductor

Comment Type TR *Comment Status* D

Range of gDC2 for TP4 near-end is TBD.
See hidaka_3ck_01_0720, slide 8.

SuggestedRemedy

Specify gDC2 range for TP4 near-end as min -2.0, max 0.0, step 0.5.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Resolve using the response to comment #201.

Summarize CTF proposals

<under construction>

TP4 TX EQ comment 195

Cl 120G SC 120G.3.2 P 224 L 37 # 195

Ghiasi, Ali — Ghiasi Quantum/Inphi

Comment Type TR *Comment Status* D

Reference equalizer to measure nearend and farend need to be defined

SuggestedRemedy

Reference the 4T DFE, but with following exception for near end B1max=0.15 and B2-B4(max)=0.05, far end equalizer B1max=0.35, B2-B4(max)=0.1. see ghiasi_03ck_02_0620

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

[Editor's note: changed SC/page/line from 120F.4.2/211/48]

Pending review of the following presentation.Http://www.ieee802.org/3/ck/public/20_07/ghiasi_3ck_02_0720.pdfRelated to #211.

SR proposes the following:
For TP4a NE measurement, use b_max {0.15, 0.05, 0.05, 0.05}
For TP4a FE measurement, use b_max {0.35, 0.1, 0.1, 0.1}

Current specification (for TP1a)…
b_max {0.4, 0.15, 0.1, 0.1}

Current reference receiver DFE constraints (for TP1a at least)…

Continuous time filter, low-frequency pole/zero	f_{LF}	f_b / 40	GHz
Decision feedback equalizer (DFE) length	N_b	4	UI
Normalized DFE coefficient magnitude limit $n = 1$ $n = 2$ $n = 3$ or 4	$b_{max}(n)$	 0.4 0.15 0.1	 — — —
One-sided noise spectral density	η_0	4.1×10^{-8}	V^2/GHz

TP4 FE pre-cursor ISI ratio comment 131

Cl 120G *SC* 120G.3.2 *P* 224 *L* 36 # 131

Hidaka, Yasuo Credo Semiconductor

Comment Type TR *Comment Status* D

Table 120G-3 specifies far-end pre-cursor ISI ratio with a reference to 120E.3.2.1.2. Some description in 120E.3.2.1.2 is not relevant for 120G.

SuggestedRemedy

Add a sub clause describing far-end pre-cursor ISI ratio in 120G.3.2.1, similar to 120E.3.2.1.2 like the following:

Capture the PRBS13Q waveform corresponding to the far-end eye (see TBD) and calculate the linear fit pulse using the procedure defined in 162.9.3.1.1. Any setting of the reference receiver at TP4 far-end in Table 120G-9 for which the far-end eye width and height satisfy the limits in Table 120G–3, may be used.
The peak amplitude of the linear fit pulse is p_max. The pre-cursor ISI p_pre is the value of the linear fit pulse 1 UI prior to the time of the pulse peak. The pre-cursor ISI ratio is p_pre / p_max.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

For task force discussion.

120E.3.2.1.2 Far-end pre-cursor ISI ratio

Capture the PRBS13Q waveform corresponding to the far-end eye (see 120E.3.2.1.1) and calculate the linear fit pulse using the procedure defined in 120D.3.1.3. Any setting of the reference CTLE for which the far-end eye width and height satisfy the limits in Table 120E–3, may be used.

The peak amplitude of the linear fit pulse is p_{max}. The pre-cursor ISI p_{pre} is the value of the linear fit pulse 1 UI prior to the time of the pulse peak. The pre-cursor ISI ratio is p_{pre} / p_{max}.

162.9.3.1.1 Linear fit to the measured waveform

The following procedure is used to determine the linear fit pulse response, linear fit error, and normalized transmitter coefficient values.

Set the transmitter under test to transmit the PRBS13Q test pattern (defined in 120.5.11.2.1). For each configuration of the transmit equalizer, capture at least one complete cycle of the test pattern at TP2, as specified in 85.8.3.3.4. The clock recovery unit (CRU) used in the measurement has a corner frequency of 4 MHz and a slope of 20 dB/decade.

In the following calculations, M should be an integer not less than 32. Interpolation of the captured waveform may be used to achieve this.

Compute the linear fit pulse response $p(k)$, k=1 to $M \times N_p$, from the captured waveform, as specified in 85.8.3.3.5, with $N_p = 200$ and $D_p = 4$, where the aligned symbols $x(n)$ are assigned normalized amplitudes -1, $-ES$, ES, and 1 to represent the PAM4 symbol values 0, 1, 2, and 3 respectively. ES is defined as $(|ES1| + |ES2|)/2$ where $ES1$ and $ES2$ are calculated according to 120D.3.1.2.

PROPOSED AIP

To be consistent with the methodology in 120G.5.2 the setting criteria should be based on EH and VEC. 162.9.3.1.1 includes both capture and linear fit methods. Some clarification of the reference is necessary.

In 120G.3.2, add a subclause describing far-end pre-cursor ISI ratio as follows:
“Capture the PRBS13Q waveform corresponding to the far-end eye and calculate the linear fit pulse using the procedure defined in 162.9.3.1.1. Any valid setting of the reference receiver continuous-time filter (see 120G.5.2) for which the far-end eye height and vertical eye closure satisfy the limits in Table 120G–3 may be used.
The peak amplitude of the linear fit pulse is p_max. The pre-cursor ISI p_pre is the value of the linear fit pulse 1 UI prior to the time of the pulse peak. The pre-cursor ISI ratio is p_pre / p_max.”

Change the reference in Table 120G-3 to point to the new subclause.

Implement with editorial license.

TP4a EH comments 115, 196 (part 1)

Cl 120g *SC* 120g.3.3.2 *P* 227 *L* 49 # 196

Ghiasi, Ali — Ghiasi Quantum/Inphi

Comment Type TR *Comment Status* D

Host stress far end eye height is TBD

SuggestedRemedy

Far end EH=20 mV, see ghiasi_3ck_02_0620

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Resolve using the response to comment #115.

Cl 120G *SC* 120G.3.3.2 *P* 227 *L* 49 # 115

Hidaka, Yasuo — Credo Semiconductor

Comment Type TR *Comment Status* D

Far end eye height of host stressed input test is TBD.
See hidaka_3ck_01_0720, slide 7.

SuggestedRemedy

Change TBD to 24mV.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Comment #115 proposes 24 mV.
Comment #196 proposes 20 mV.

Pending review of the following presentations and task force discussion.
Http://www.ieee802.org/3/ck/public/20_07/ghiasi_3ck_02_0720.pdf
http://www.ieee802.org/3/ck/public/20_07/hidaka_3ck_01_0720.pdf

!!! This comment response should be updated based on closed comment #177. !!!

The adopted value per comment #177 for EH at TP4a FE and NE is 24 mV. (see later slide)

Proposed new response:

PROPOSED ACCEPT IN PRINCIPLE.

The following presentations were reviewed by the task force.
http://www.ieee802.org/3/ck/public/20_07/ghiasi_3ck_02_0720.pdf
http://www.ieee802.org/3/ck/public/20_07/hidaka_3ck_01_0720.pdf

The value for TP4a FE EH should match the value for TP4 FE EH. The value for TP4 FE EH as adopted by comment #177 is 24 mV.

Set that TP4a FE EH value to 24 mV.

TP4a VEC comments 116, 197 (part 1)

Cl 120G SC 120G.3.3.2 P 227 L 50 # 116

Hidaka, Yasuo — Credo Semiconductor

Comment Type T *Comment Status* D

VEC of host stressed input test is not specified.

SuggestedRemedy

To table 120G-5, add a row of "Far-end vertical eye closure (max)" with a value of 7.5dB and a row of "Far-end vertical eye closure (min)" with a value of 7.0dB.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Resolve using the response to comment #197.

!!! This comment response should be updated based on closed comment #177. !!!

Cl 120g SC 120g.3.3.2 P 227 L 49 # 197

Ghiasi, Ali — Ghiasi Quantum/Inphi

Comment Type TR *Comment Status* D

Far end VEC is not listed

SuggestedRemedy

Far end VEC=7.5 dB, see ghiasi_3ck_02_0620

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Comment #197 proposes a target value of 7.5 dB.
Comment #116 proposes a range of 7.0 dB to 7.5 dB.

Pending review of the following presentation:
http://www.ieee802.org/3/ck/public/20_07/ghiasi_3ck_02_0720.pdf

!!! This comment should be updated based on closed response for comment #177. !!!

The adopted value per comment #177 for VEC at TP4a FE and NE is 7.5 dB. (see next slide)

Proposed new response:

PROPOSED ACCEPT IN PRINCIPLE.

The following presentations were reviewed by the task force.
http://www.ieee802.org/3/ck/public/20_07/ghiasi_3ck_02_0720.pdf
http://www.ieee802.org/3/ck/public/20_07/hidaka_3ck_01_0720.pdf

The value for TP4a FE VEC should match the value for TP4 FE VEC. The value for TP4 FE VEC as adopted by comment #177 is 7.5 dB.

Set that TP4a FE VEC value to 7.5 dB.

TP4a VEC/EH comments 115, 116, 196, 197 (part 2)

Cl 120G SC 120G.3.2 P 224 L 45 # 177

Ran, Adee Intel

Comment Type T *Comment Status* A

Addressing Near-end eye height, differential (min) and Far-end eye height, differential (min) which are TBDs.

The host output is now specified in terms of VEC. There is no reason that the module output should not use this specification method.

The proposed limit values are based on host output specification, and are the same for near-end and for far-end, at this time. The limit values may be adjusted in future drafts. The module can use different settings to meet the near-end and far-end requirements.

SuggestedRemedy

Change the minimum NEEH and FEEH values in Table 120G–3 to 15 mV. Add rows for Near-end VEC and Far-end VEC, both with maximum value of 9 dB. Clarify that different module output settings may be used in the tests.

Response *Response Status* C

ACCEPT IN PRINCIPLE.

For NE EH...
#177 proposes 15 mV
#135 proposes 50 mV
#191 proposes 40 mV

For FE EH...
#177 proposes 15 mV
#192 proposes 20 mV
#107 proposes 24 mV

For NE VEC...
#177 proposes 9 dB
#108 proposes 7.5 dB

For FE VEC...
#177 proposes 9 dB
#109 proposes 7 dB

The following presentations were reviewed:
http://www.ieee802.org/3/ck/public/20_07/ghiasi_3ck_02_0720.pdf
http://www.ieee802.org/3/ck/public/20_07/hidaka_3ck_01_0720.pdf
http://www.ieee802.org/3/ck/public/20_07/ran_3ck_01b_0720.pdf

Straw polls #4 and #5, indicated strong support for adopting the values for far-end and near-end VEC and EH as proposed on slide 9 of ran_3ck_01b_0720.

The closed response to comment #175 adopted two equalization settings for module transmitter.

Set far-end VEC (max) to 7.5 dB
Set near-end VEC (max) to 7.5 dB
Set far-end EH (min) to 24 mV
Set near-end EH (min) to 24 mV

[Editor's note added after the comment was closed:
The URL for second listed presentation should be the following...
http://www.ieee802.org/3/ck/public/20_07/hidaka_3ck_01d_0720.pdf
]

Proposal

New

(based on collection of suggested remedies, and offline discussion; may require subsequent work to verify feasibility and maybe modify some values)

Use the table below for resolving comments: 11060, 107, 108, 109, 115, 116, 135, 175, 176, 177, 178, 191, 192, 193, 194, 196, 197, 211, 212, 215, 238.

	Near-end, "S" setting	Far-end, "L" setting	Details
Measurement point	TP4 NE	TP4 FE (after loss channel)	Define new management variable and MDIO register to select between settings S and L in the module output. Support of both settings is mandatory. Module shall meet the respective requirements for both settings at the respective measurement point.
VEC (max.)	7.5 dB	7.5 dB	Measured after processing by the reference receiver
Min EH (max.)	24 mV	24 mV	Measured after processing by the reference receiver
Max diff. PtP (max.)	600 mV	600 mV	Measured before processing by the reference receiver
Host stressed input @TP4a	Calibrate @TP4 NE (max VEC + min EH)	Calibrate @TP4 FE (max VEC + min EH)	Host shall meet the BER requirements at least in one of the two calibrated conditions

TP4a RX adaptation comment 215

Cl **120G** *SC* **120G.3.3** *P* **227** *L* **3** # 215

Maki, Jeffery Juniper Networks

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

There is no prescription for channel equalization. The standard needs to be as prescriptive for the host as for the module. Module implementers need to know what they can expect of the host as must as the host must know what it can expect of the module. Both are parties to adoption and adherence to the standard.

SuggestedRemedy

Add the following sentence after the first sentence of the subclause, "Channel equalization is provided by an adaptive equalizer in the host."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

For task force discussion.

It is generally assumed that the receiver on the host will be a continuously adaptive receiver to track potential variations of the signal over time, e.g., due to aging, change in temperature.

This explicit statement qualification has never been used for the host receiver for in-force C2M interfaces. But the statement is a reasonable expectation and does no harm.

The proposed response is: ACCEPT

Miscellaneous Topics

Channel IL comment 172

Cl 120G *SC* 120G.1 *P* 219 *L* 17 # 172

Ran, Adee Intel

Comment Type T *Comment Status* D

The figure shows a host insertion loss of up to 11.9 dB, but in 120G.3.4.1.1 (module stressed input procedure) one of the test cases has 18.2 dB insetion loss, which "represents 16 dB channel loss with an additional allowance for host transmitter package loss". The informative graph at 120G.4.1 also looks like 16 dB.

SuggestedRemedy

Likely, change the value in the figure to 16 dB.

Proposed Response *Response Status* W

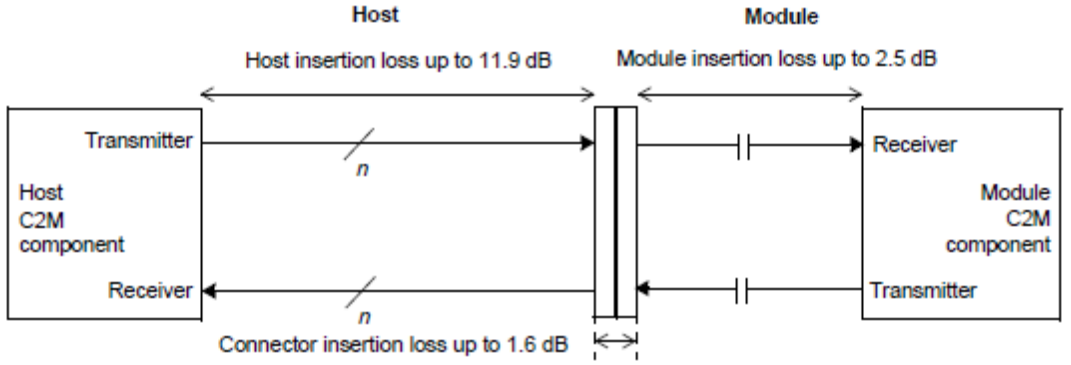
PROPOSED REJECT.

120G.3.4.1.1 (P232/L8) refers to the channel IL, which is from host transmitter to module receiver including the transmitter package, as opposed to the host IL.

In Figure 120G-2, the channel loss, which is a sum of the section losses, is 16 dB.

It seems that the commenter has misinterpreted the diagram.

16 dB is loss from host TX to module RX
11.9 + 1.6 + 2.5 = 16 dB



Note—The number of lanes *n* is equal to 1 for 100GAUI-1, 2 for 200GAUI-2, and 4 for 400GAUI-4.

Figure 120G–2—100GAUI-1, 200GAUI-2, and 400GAUI-4 C2M insertion loss budget at 26.56 GHz

EO method criteria comment 123, 246 (part 1)

Cl 120G *SC* 120G.5.2 *P* 236 *L* 21 # 123

Hidaka, Yasuo — Credo Semiconductor

Comment Type T *Comment Status* D

The condition "where eye height also meets the target value" seems not necessary and confusing. It is not clear what is "the target value".

SuggestedRemedy

Remove "where eye height also meets target value".

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

The intent of the reference phrase is to eliminate combinations of gDC and gDC2 where the EH height specification fails.

Change "where eye height also meets target value" to "where eye height also meets the specification for eye height (min) as specified for the interface".

Cl 120G *SC* 120G.5.2 *P* 236 *L* 20 # 246

Dawe, Piers — Nvidia

Comment Type T *Comment Status* D

This criterion "The values of eye height, eye width, and vertical eye closure are the values obtained with the combination of gDC and gDC2 that produces the minimum value of vertical eye closure where eye height also meets the target value" would fail a signal that passes all 3 criteria on a different Rx setting but fails ESMW at the setting for best VEC. We learnt in previous C2M projects that best vertical and best horizontal opening weren't at the same setting.
Editorial: the idea is not to meet a target, it is to meet or exceed a limit.

SuggestedRemedy

Change to:
The values of eye height, eye width, and vertical eye closure are the values obtained with the combination of gDC and gDC2 that produces the minimum value of vertical eye closure where eye height and ESMW also comply with the limits in the appropriate table.
Editorial: ESMW isn't really a measurement, it's a mask. Maybe define ESW as the measurement?

Proposed Response *Response Status* W

PROPOSED REJECT.

The commenter is requesting to changes to the criteria for finding the measured values of EH, EW, and VEC. First, that the criteria includes ESMW in addition to eye height. Second, that the clarify the intent of the criteria.

Comment #231 proposes to remove ESMW. Comment #173 proposes to remove EW. Comment #123 proposes a clarification to the criteria.

Resolve this comment using the responses to comments 172, 231, and 123.

New response for #246…
AIP

According to discussions related to and the response to comment #231, there is desired to remove the EH/ESMW parameters. However, there is no consensus to make changes in that regard. EH or ESM should not be added to the criteria at this time.

Resolve this comment using the response to comment #123.

EO method criteria comment 123, 246 (part 2)

Ad hoc 2020/6/24 Straw Poll #1 (below) indicated a desired to remove the EW/ESMW and replacing with an alternate horizontal specification.

Straw poll #7 (right) taken in conjunction with comment #231 indicated that there was no consensus to replace these specifications with the proposed jitter specifications.

Straw Poll #1:

For Annex 120G, I would support the following direction to deal with EW and ESMW (Chicago Rules):

A. Retain EW and ESMW as currently defined
B. Retain EW and ESMW and re-specify RR DFE
C. Remove EW and ESMW, add jitter specification at TP1a and TP4
D. Other approach not listed above

Results: A: 5 , B: 8 , C: 14 , D: 6

Cl 120G *SC* 120G.5.2 *P* 236 *L* 9 # 231

Ran, Adee Intel

Comment Type T *Comment Status* R

This subclause specifies measurement of "eye opening parameters eye height, eye width, and vertical eye closure".

Item e here:
"e) Compute the receiver input signal yrx(k) by applying the effect of the DFE to y2(k) using the
sampling phase ts"

May cause ambiguity in the resulting eye diagram, which can yield different EW and ESMW results.

The reason is that it does not fully specify how the sampling phase ts is used. To create a "nice" eye diagram, the DFE feedback is typicallly applied after some delay relative to ts. The time when the DFE feedback is applied will affect the eye shape, width and ESMW (though not the eye height at ts, which is maximized by the DFE coefficients).

Note that this delay is not necessarily what a real receiver will have, and the eye may not correspond to the performance of real receivers.

In another comment I suggest to remove the ESMW specification. Following the statements above, The EW specification may also be worth removing. EH (which does not depend on the DFE feedback timing) should be enough.

Without EW, jitter measurement and calibration should be done using other means. Jitter injected in host stressed input test is already calibrated using C2C methods. Jitter for host and module outputs can be specified using C2C methods too.

SuggestedRemedy

Remove all EW specifications and change the text in this subclause to omit EW.

(Alternatively. if ESMW and/or EW are retained, then the application of the DFE feedback should be specified explicitly. I would suggest specifying that the DFE feedback effect starts 1/2 UI after ts.)

Add jitter specifications J4U, JRMS, and EOJ, for host output and module output, using references to 120F.3.1 (same values as in Table 120F–1).

Response *Response Status* C

REJECT.

Note that comment #173 proposes to drop ESMW as well.

A straw poll taken at the July 24 ad hoc meeting indicated strong support to remove the ESMW and EW parameters.

Strawpoll #7 (decision)
I support removing the EW and ESMW parameters and replacing with jitter specifications as proposed in the suggested remedy of comment #231.
Yes: 11
No: 22

Although there was interest expressed in removing the EW/ESMW parameters, an appropriate alternate constraint may be necessary. Further work and consensus building is necessary.

There is no consensus to implement the suggested remedy.

EO method scope noise comment 243, 242

Cl 120G *SC* 120G.4.2 *P* 236 *L* 15 # 243

Dawe, Piers Nvidia

Comment Type TR *Comment Status* D

D1.1 comment 142: "Should account for scope noise as TDECQ does", "Allow RSSing out the scope noise (as done in TDECQ) if it's significant." It turns out that it is significant, but that the scopes can handle this; we should not second-guess them.

SuggestedRemedy

Change step g from:
Compute an eye diagram from yrx(k), including the effect of Gaussian noise with variance calculated in the previous step.
to:
Compute an eye diagram from yrx(k), including the effect of Gaussian noise with variance calculated in the previous step, but taking into account that some noise from to the measurement instrument's noise is already in y2(k).
(We could say yrx(k) instead of y2(k), the noise is the same)

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Implement suggested remedy with editorial license.

Cl 120G *SC* 120G.5.2 *P* 235 *L* 43 # 242

Dawe, Piers Nvidia

Comment Type TR *Comment Status* D

It may be that too few scopes can achieve this level of noise (which should warn us that it might be challenging for product receivers too!) As it may be undesirable to attempt to remove or deconvolve noise from a measurement, the solution is to increase the one-sided noise spectral density eta0. Then, this fixed noise makes signals from high loss hosts look relatively worse than from low loss hosts. To avoid that and include something for low-loss ripple effects (see Dudek presentations), we can use a second signal-strength-dependent noise to balance up the reported eye openings across a range of host losses

SuggestedRemedy

Increase eta0 to what is needed for practical measurements.
Use a second noise term proportional to the eye height (after equalization) i.e.
K*sum(AVupp + AVmid + AVlow). Use its variance similarly to eta0's, as in steps f and g.

Proposed Response *Response Status* W

PROPOSED REJECT.

[Editor's note: change SC from 120G.4.2.]

It is not clear which presentation the commenter is to referring to.

The suggested remedy does not provide a value for eta0.

RR bmin comment 241

Cl 120G *SC* 120G.5.2 *P* 235 *L* 41 # 241

Dawe, Piers Nvidia

Comment Type TR *Comment Status* D

A negative first DFE tap means the DFE is taking emphasis out of the signal. In C2M, this should never happen: remember this is a measurement of a signal not a channel, the idea is that a signal with only mild emphasis or shaping is transmitted, there is always some channel loss, and the receiver equalizes a low-pass-filtered signal. Real receivers don't have to cope with over-emphasised signals: in CR and KR they can ask the far transmitter to reduce its emphasis, in C2C the management entity does that on the receiver's behalf. In C2M, the receiver has to tolerate any compliant signal, so the equalizer limits in the eye measurement have to be set more carefully than in COM. The real receiver is not required to be constructed like the COM receiver, and low power receiver designs often can't remove emphasis (because they shouldn't need to).
The first DFE tap minimum and the CTLE gDC maximum must be chosen together to stop people setting up C2M outputs badly.
Further, there should be realistic tap minima for all the taps, as for C2C, KR and CR (see other comments).
See hidaka_3ck_adhoc_01_021920 slide 8 for example tap weights found. Remember that these weights aren't the only acceptable solutions: for example, b1 gDC and TxFIR setting can be traded.

SuggestedRemedy

Tap 1 min +0.1 (max is 0.4)
Tap 2 min -0.15 (max is 0.15)
Taps 3, 4 min -0.05 (max is 0.1)
Adjust names of limits and 93A.1 to support separate max and min limits (see other comments).

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

[Editor's note: changed SC from 120G.4.2.]

The referenced presentation is here:
http://www.ieee802.org/3/ck/public/adhoc/feb19_20/hidaka_3ck_adhoc_01_021920.pdf

For task force discussion.

No additional information or proposal.

TP1a RR gdc/gdc2 comment 117, 118, 225

Cl 120G *SC* 120G.5.2 *P* 235 *L* 7 # 118

Hidaka, Yasuo Credo Semiconductor

Comment Type TR *Comment Status* D

It is not good to restrict gDC range by gDC2.
My simulation showed that many cases had the best gDC at max (weakest) regardless of gDC2 value, and resulted out of the specified range in D1.2.
This is reasonable, because the best gDC2 may be low (strong) to cancel low-frequency loss due to skin effect, whereas the best gDC may be high (weak) to suppress enhancement of high-frequency noise.
Hence, we should not restrict gDC range by gDC2.

SuggestedRemedy

Make gDC range independent from gDC2.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

For task force discussion.

Resolve in conjunction with comment #225.

Cl 120G *SC* 120G.5.2 *P* 235 *L* 7 # 117

Hidaka, Yasuo Credo Semiconductor

Comment Type TR *Comment Status* D

This CTLE will have positive gain if gDC = -2dB.
To avoid positive gain, upper bound of gDC for TP1a should be limited up to -3dB.

SuggestedRemedy

Change upper bound of -2 of gDC for TP1a to -3.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

For task force discussion.

Cl 120G *SC* 120G.5.2 *P* 235 *L* 10 # 225

Dudek, Mike Marvell.

Comment Type T *Comment Status* D

Some channels appear to want GDC2 of less than -2dB even though GdC is more than -8dB

SuggestedRemedy

Change the 8dB to 6dB for GDC2 less than -2dB.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Resolve in conjunction with comment #118.

Under construction.

Summarize CTF proposals

<under construction>

TP1 EH comment 114, 200

Cl **120G** *SC* **120G.3.4.1** *P* **230** *L* **38** # **114**

Hidaka, Yasuo — Credo Semiconductor

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

Eye height of module stressed input test is TBD.
It should be 15mV for consistency with host output spec.

SuggestedRemedy

Change TBD mV to 15 mV.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve using the response to #200.

Cl **120G** *SC* **120G.3.4.1** *P* **230** *L* **35** # **200**

Ghiasi, Ali — Ghiasi Quantum/Inphi

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

Module stress eye height is TBD

SuggestedRemedy

This should be the same as TP1a 15 mV

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

[Editor's note: change SC/page/line from 120G.3.2/224/33.]

For task force discussion.

No additional information or proposal.

Thanks