

IEEE P802.3ck Task Force D1.0 1st Task Force review comments

Cl 1 SC 1.4 P30 L3 # 208
 Ran, Adee Intel
 Comment Type E Comment Status X
 1.4.24 is not "100GBASE-X"
 SuggestedRemedy
 Change to "100BASE-X" (without G)
 Proposed Response Response Status O

Cl 69 SC 69.1.2 P61 L14 # 210
 Ran, Adee Intel
 Comment Type E Comment Status X
 In item l) there are now two MDIs.
 SuggestedRemedy
 Change "MDI" to "MDIs".
 Proposed Response Response Status O

Cl 45 SC 45.2.1.111.8 P40 L30 # 209
 Ran, Adee Intel
 Comment Type E Comment Status X
 References to subclauses of new clause 161 are inserted out of order. Here and in other places in clause 45.
 SuggestedRemedy
 Proposed Response Response Status O

Cl 69 SC 69.2.3 P62 L4 # 211
 Ran, Adee Intel
 Comment Type E Comment Status X
 The comma after Table 69–3a and the "Table69–3c" are new text.
 SuggestedRemedy
 Apply underline.
 Proposed Response Response Status O

Cl 45 SC 45.2.1.111.8 P40 L30 # 108
 Slavick, Jeff Broadcom
 Comment Type E Comment Status X
 Shouldn't 161 show up as the last entry in the list (listing clauses to look at in numerical order)
 SuggestedRemedy
 Update 45.2.1.111.8, 45.2.1.111.9, 45.2.1.112, 45.2.1.113, 45.2.1.115 lists that insert Cl161 to have Cl161 added at the end of the list.
 Proposed Response Response Status O

Cl 69 SC 69.2.3 P62 L10 # 212
 Ran, Adee Intel
 Comment Type E Comment Status X
 Underscores in editorial instruction should be spaces.
 SuggestedRemedy
 Change to spaces.
 Proposed Response Response Status O

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CI 69 SC 69.2.3 P62 L18 # 213

Ran, Adeo Intel
 Comment Type T Comment Status X

There is no column for AN in this table. AN is included in table 69.3 (the original 100G backplane table). It seems that 802.3cd omitted this column in the new tables (3a and 3b) it added here, although it is included in the tables that were added in clause 116.

May require maintenance approval but I assume it will be done in this project.

SuggestedRemedy

Add AN column and populate it - mandatory for all rows.

Also in tables 69-3b and 69-3c.

Proposed Response Response Status O

CI 69 SC 69.2.3 P63 L10 # 214

Ran, Adeo Intel
 Comment Type T Comment Status X

The column for clause 78 is not required since EEE is not defined at all for 400GBASE-KR4 (clause 78 is not mentioned in the new PMD clauses, and EEE is not in scope...) and there is no other PHY in this table.

Clause 116 also leaves this column blank (not even optional) for the new 200G and 400G PMDs.

SuggestedRemedy

Delete this column.

Proposed Response Response Status O

CI 73 SC 73.2 P64 L18 # 215

Ran, Adeo Intel
 Comment Type E Comment Status X

In the new figure 73-1, The label on the right of the arrow looks like two separate labels.

Also, in the label below "Medium", there is no space after "50 Gb/s", and there is no bottom-pointing brace above the list of PHYs (compare to Figure 69-5).

SuggestedRemedy

Add comma after XLGMII, and reduce line spacing (or delete the extra line break).

Add brace and add space after "50 Gb/s".

Proposed Response Response Status O

CI 73 SC 73.6.4 P65 L10 # 77

Gustlin, Mark Cisco Systems
 Comment Type T Comment Status X

Adopt the details of AN for 100GBASE-CR1/KR1

SuggestedRemedy

I will present the options to choose from, adopt if we have task force consensus.

Proposed Response Response Status O

CI 73 SC 73.10.2 P67 L25 # 216

Ran, Adeo Intel
 Comment Type E Comment Status X

Table 73-7 is shown with all rows, most of which are not changed, and is spread across two pages. Only one new row is inserted.

Using "some unchanged rows are not shown" here and keeping only the "link_fail_inhibit_timer" rows would make this change easier to understand.

SuggestedRemedy

Change table per comment with editorial license.

Proposed Response Response Status O

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CI 80 SC 80.4 P72 L20 # 217
 Ran, Adeel Intel
 Comment Type T Comment Status X
 There should be a new row in Table 80-5 for the delay constraints of the RS-FEC-Int sublayer.
 SuggestedRemedy
 Add a row based on the constraints in 161.4 (subject of another comment).
 Proposed Response Response Status O

CI 80 SC 80.5 P73 L38 # 113
 Nicholl, Shawn Xilinx
 Comment Type TR Comment Status X
 Since 161.5.3.1 specifies the Rx deskew capabilities, then "Table 80-6 -- Summary of Skew constraints" should contain a reference to 161.5.3.1
 SuggestedRemedy
 Propose to update Table 80-6 such that the Notes column for the "At RS-FEC receive" row contains a reference to Clause 161. Proposed text for the table cell is:
 See 91.5.3.1, 161.5.3.1
 Proposed Response Response Status O

CI 80 SC 80.5 P73 L36 # 112
 Nicholl, Shawn Xilinx
 Comment Type TR Comment Status X
 Since 161.5.2.2 says that it's identical to 91.5.2.2, then "Table 80-6 -- Summary of Skew constraints" should contain a reference to 161.5.2.2
 SuggestedRemedy
 Propose to update Table 80-6 such that the Notes column for the "At RS-FEC transmit" row contains a reference to Clause 161. Proposed text for the table cell is:
 See 91.5.2.2, 161.5.2.2
 Proposed Response Response Status O

CI 80 SC 80.5 P74 L32 # 114
 Nicholl, Shawn Xilinx
 Comment Type TR Comment Status X
 Since 161.5.2.2 says that it's identical to 91.5.2.2, then "Table 80-7 -- Summary of Skew Variation constraints" should contain a reference to 161.5.2.2
 SuggestedRemedy
 Propose to update Table 80-7 such that the Notes column for the "At RS-FEC transmit" row contains a reference to Clause 161. Proposed text for the table cell is:
 See 91.5.2.2, 161.5.2.2
 Proposed Response Response Status O

CI 80 SC 80.5 P73 L36 # 107
 Slavick, Jeff Broadcom
 Comment Type TR Comment Status X
 New FEC needs to be referenced
 SuggestedRemedy
 Add 161.5.2.2 to FEC transmit row and 161.5.3.1 to the FEC receive row into both Table 80-6 and 80-7
 Proposed Response Response Status O

CI 80 SC 80.5 P74 L34 # 115
 Nicholl, Shawn Xilinx
 Comment Type TR Comment Status X
 Since 161.5.3.1 specifies the Rx deskew capabilities, then "Table 80-7 -- Summary of Skew Variation constraints" should contain a reference to 161.5.3.1
 SuggestedRemedy
 Propose to update Table 80-7 such that the Notes column for the "At RS-FEC receive" row contains a reference to Clause 161. Proposed text for the table cell is:
 See 91.5.3.1, 161.5.3.1
 Proposed Response Response Status O

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Cl 82 **SC 82.2.13** **P152** **L 0** # **132**

Brown, Matt Huawei Technologies Canada

Comment Type **T** **Comment Status** **X**

Table 82-7 "Skew tolerance parameters" has an entry "100GBASE-R with RS-FEC". To be complete this should also include "RS-FEC-Int" per Clause 161.

SuggestedRemedy

Import Table 82-7, and show change of "100GBASE-R with RS-FEC" to "100GBASE-R with RS-FEC or RS-FEC-Int".

Proposed Response **Response Status** **O**

Cl 93A **SC 93A.1** **P186** **L 36** # **47**

Dudek, Mike Marvell

Comment Type **E** **Comment Status** **X**

For style consistency the other parameters that some clauses don't use should be in a footnote.

SuggestedRemedy

Add a footnote c stating "Some clauses that invoke this method do not provide a value for Nbg, Nbf, Nf, bgmax, sigmamax, Nts. See 93A.1.6

Proposed Response **Response Status** **O**

Cl 93a **SC 93a.1.6** **P189** **L 21** # **1**

Mellitz, Richard Samtec

Comment Type **TR** **Comment Status** **X**

If floating taps are not specified, for compatibility with older clauses, Nf should be Nb.

SuggestedRemedy

Change:
 ..are not specified then no floating taps are used.
 to
 ...are not specified then no floating taps are used and Nf takes the value of Nb from referring clauses.

Proposed Response **Response Status** **O**

Cl 93A **SC 93A.1.6.1** **P190** **L 12** # **159**

Kasapi, Athos Cadence

Comment Type **TR** **Comment Status** **X**

Likely typo; existing text refers to number of taps in bank, N_{bf}, as N_b

SuggestedRemedy

Change N_f - N_b + 1 to N_f - N_{bf} + 1

Proposed Response **Response Status** **O**

Cl 93a **SC 93a.1.6.1** **P190** **L 24** # **2**

Mellitz, Richard Samtec

Comment Type **TR** **Comment Status** **X**

This works better as its own clause. In future drafts we may want to apply to any tail tap starting location.

SuggestedRemedy

Bifurcate 93a.1.6.1 to 93a.1.6.1 and 93a.1.2. Title 93a.1.6.2 "limiting power in tail DFE taps". If N_ts is defined in the reference clause further limit the DFE tap as specified in 93a.1.6.2. Adjust wording to accommodate if Nf is not defined.

Proposed Response **Response Status** **O**

Cl 118 **SC 118.1.3** **P0** **L 0** # **109**

Slavick, Jeff Broadcom

Comment Type **TR** **Comment Status** **X**

Clause 118.1.3 lists the AUI that a 200/400GXS may use. The new 100G serial ones should be included in that list.

SuggestedRemedy

Bring in 118.1.3 and add 120G and 120F to both of the 200G and 400G lists of supported physically instantiated AUIs

Proposed Response **Response Status** **O**

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Cl 120 SC 120.1 P91 L4 # 110
 Slavick, Jeff Broadcom
 Comment Type E Comment Status X
 The w is missing from Overview
 SuggestedRemedy
 Add the w
 Proposed Response Response Status O

Cl 120 SC 120.5.1 P92 L43 # 219
 Ran, Adeo Intel
 Comment Type T Comment Status X
 In the original text, the list of annexes had "or" which made it clear that only one of the annexes is appropriate. The new "Annex 120B through Annex 120G" reads as if all specifications in all of the annexes should be met "as appropriate". It is not quite clear what is appropriate.
 Note that the corresponding transmitter specification appears in 120.5.6 with a full list of annexes and their corresponding AUIs.

Cl 120 SC 120.1 P91 L6 # 218
 Ran, Adeo Intel
 Comment Type E Comment Status X
 Label is "Overvie"
 SuggestedRemedy
 Change to "Overview".
 Proposed Response Response Status O

To make this more readable and maintainable, I suggest adding a new table mapping annexes to AUIs (this can be done in 120.1.1) and referring to this table in both places and everywhere else where it can be used, instead of the current text.
 Alternatively: change this sentence to "the PMA shall meet the electrical and timing specifications in the corresponding Annex (120B through 120G).
 Also applies to 135.5 and possibly other places.
 This comment is about existing clauses 120 and 135. Since these clauses are being changed anyway I assume this change is within the scope of the project.

Cl 120 SC 120.4.1 P201 L46 # 202
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 COM table and analysis does not include penalty due to burst error, current COM code on some weird channel
 SuggestedRemedy
http://www.ieee802.org/3/ck/public/19_03/anslow_3ck_01_0319.pdf page has 2 dB of SNR penalty with pre-coding on for tap weights [0.85, 0.05, 0.25, -0.05, 0.15], the Anslow analysis showed that non of the 115 channels would be as bad but how can we guarantee some weird channel will not in the mix that passes 3 dB COM but would fail due to burst error? Assuming there is interest we can bring a proposal in future task force meeting for an analytical burst error estimator that can be added to COM.
 Proposed Response Response Status O

SuggestedRemedy
 Add a new table mapping AUIs to Annexes and refer to it in this paragraph and elsewhere (if in scope), with editorial license.
 Proposed Response Response Status O

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CI 120 SC 120.5.7.2 P94 L44 # 221

Ran, Adeel Intel
 Comment Type T Comment Status X

In the text describing the precoding control for PMDs, the case where training is supported but is disabled by management is not covered. In this case the variables should be "set as required by implementation" similar to C2C.

Repeating the list of PMDs twice would make the text cumbersome. The change in the suggested remedy attempts a more general definition that should make the test easier to read and maintain.

Also applies to similar text in 135.5.7.2.

This comment is about existing clauses 120 and 135. Since these clauses are being changed anyway I assume this change is within the scope of the project.

SuggestedRemedy

Replace the 4th paragraph and the one inserted below it with the following:

"If the PMA is connected to the service interface of a PMD that uses the PMD control function (136.8.11), then precoder_tx_out_enable_i and precoder_rx_in_enable_i shall be set as determined by the PMD control function on lane i. The method by which the PMD control function affects these variables is implementation dependent.

If the PMA is connected to the service interface of a PMD that supports the PMD control function but training is disabled by the management variable mr_training_enable (see 136.7), or if the PMA is part of a 200GAUI-2 C2C or a 400GAUI-4 link, then precoder_tx_out_enable_i, precoder_rx_in_enable_i, precoder_tx_in_enable_i, and precoder_rx_out_enable_i are set as required by the implementation. The method described in 135F.3.2.1 may be used for 200GAUI-2 C2C or 400GAUI-4 links."

Apply a similar change in 135.5.7.2 with changes as necessary.

Implement with editorial license.

Proposed Response Response Status O

CI 120 SC 120.5.7.2 P94 L47 # 220

Ran, Adeel Intel
 Comment Type E Comment Status X

136.8.11.7.5 is an incorrect cross-reference - it points to the state diagrams subclause which which does not address precoding in any way.

It should be corrected to 136.8.11, here and also in clause 136 (possibly with maintenance approval).

SuggestedRemedy

Per comment.

Proposed Response Response Status O

CI 120 SC 120.5.11.2.4 P95 L32 # 148

Dawe, Piers Mellanox
 Comment Type TR Comment Status X

This editor's note says "the assumption that the square wave test pattern will continue to be required for 200GAUI-2 and 400GAUI-4 testing". But the square wave is not used for AUI testing at all, nor is it required for anything except measuring the RIN of an optical transmitter (which is typically done on the optical module alone, not in a complete system, anyway). The text at line 21 says it's optional, not required. This project does not add or alter optical PMDs.

SuggestedRemedy

Delete this editor's note, and the first part of the editor's note in 135.5.10.2.4.

Proposed Response Response Status O

CI 120 SC 120.7.3 P97 L3 # 222

Ran, Adeel Intel
 Comment Type E Comment Status X

Font size is inconsistent in this table (existing and new text).

SuggestedRemedy

use consistent font size

Proposed Response Response Status O

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CI 120A SC 120A P0 L0 # 136

Brown, Matt Huawei Technologies Canada

Comment Type T Comment Status X

Some layer diagrams in Annex 120A should show the new 200GAUI-2 and 400GAUI-4 in addition to 200GAUI-4/8 and 400GAUI-8/16.

SuggestedRemedy

Import portions of Annex 120A and add 200GAUI-2 and 400GAUI-4 or alternately add new diagrams to include these.

Proposed Response Response Status O

CI 120F SC 120F.1 P192 L22 # 48

Dudek, Mike Marvell

Comment Type T Comment Status X

The 100G Phys using RS544,514 are 100GBASE-P not 100GBASE-R

SuggestedRemedy

Chage 100GBASE-R to 100GBASE-P in figure 120F-1

Proposed Response Response Status O

CI 120F SC 120F.1 P192 L39 # 49

Dudek, Mike Marvell

Comment Type T Comment Status X

There are no examples of these C2C interfaces in 120A or 135A

SuggestedRemedy

Either delete the references to these annexes or bring these Annexes into 80.3ck and add examples (e.g. add n=1 to Figure 135A-8

Proposed Response Response Status O

CI 120F SC 120F.1 P193 L22 # 266

Ran, Adee Intel

Comment Type T Comment Status X

In some applications AC coupled is required to be inside the receiver. This can result from routing limitations and can provide signal integrity improvements.

C2C is an engineered link so the channel can be designed with knowledge of the Rx capability.

It would be good to mention that the receiver may implement internal AC coupling and in that case the channel is not required to have additional AC coupling.

SuggestedRemedy

Add a NOTE where convenient:

NOTE: Some devices include internal AC-coupling. Applications that use such devices may choose not to include AC-coupling in the channel if the devices are compatible with this design choice.

Proposed Response Response Status O

CI 120F SC 120F.1 P193 L26 # 267

Ran, Adee Intel

Comment Type E Comment Status X

The text for three AUIs (100G, 200G, 400G) is repetitive and the figures are almost identical.

Merging to a single figure and text would help the readers.

SuggestedRemedy

Per comment, Implement with editorial license.

Proposed Response Response Status O

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Cl 120F SC 120F.1 P194 L 33 # 268

Ran, Adeel Intel
 Comment Type T Comment Status X

"If implemented, the transmitter equalization feedback mechanism described in 120D.3.2.3 may be used to identify an appropriate setting"

That mechanism supports the equalizer that was specified in the original CAUI-4 C2M (Annex 83D), which has only 3 taps with 5% coefficient resolution. The PAM4 AUIs defined in 802.3.bs (120D.3.1.5) and re-used in 802.3cd have kept this structure.

However, in we now have a 5-tap equalizer with 2% resolution. Even if pre-cursor tap c(-3) is removed as suggested in 120F.3.1.4 it would not be identical to the FFE in Annex 83D.

Re-using this method for 100GAUI-1 is impossible if the specified Tx equalizer is different from what it was in Annex 83D. A new method should be defined.

Also applies to 45.2.1.129.

SuggestedRemedy

I am planning a presentation with some possible solutions.

Proposed Response Response Status O

Cl 120f SC 120f.1 P194 L 38 # 177

Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X

Missing informative channel loss

SuggestedRemedy

Add informative channel loss
 $Insertion_Loss(f)=1.083+1.25\sqrt{f}+0.47f$ $0.01\leq f\leq 50$ GHz

Proposed Response Response Status O

Cl 120F SC 120F.2 P194 L 6 # 270

Ran, Adeel Intel
 Comment Type T Comment Status X

This subclause's title is "Transmitter electrical characteristics". The first paragraph is about 1/(1+D) precoding, but precoding does not affect electrical characteristics.

Also, the "shall" here is not required from the electrical interface, but from the PMA above it.

SuggestedRemedy

Delete this paragraph. Maybe add instead some text to the introduction about the option to use precoding in the PMA client.

Proposed Response Response Status O

Cl 120F SC 120F.2 P194 L 43 # 269

Ran, Adeel Intel
 Comment Type E Comment Status X

The content of this subclause is

"The electrical characteristics for the 100GAUI-1 C2C, 200GAUI-2 C2C, and 400GAUI-4 C2C interfaces are as defined in 163.9.1"

This sentence is not about compliance points; it should be in 120F.3 (electrical characteristics) and it can replace the existing content there.

Where are the compliance points defined? The editor's note should be replaced by definitive text.

SuggestedRemedy

Move the sentence to 120F.3.

Add a description of the compliance points or refer to the correct place in the backplane clause.

Proposed Response Response Status O

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CI 120F SC 120F.3.1 P195 L 22 # 271

Ran, Adeel Intel
 Comment Type T Comment Status X

The current Tx specs in 93.8.1.3 allow common mode voltage up to 1.9 V. This precludes internal AC coupling when the Rx operates on lower voltages, since EMI diodes will cause nonlinear effects.

Many devices will have lower common mode voltages in the Tx which will enable using internal AC coupling in the Rx, which can help routing and signal integrity.

Since C2C is an engineered link, the integrator may benefit from knowing if the Tx has lower CM voltage and if the Rx has internal AC coupling. If both are true, then the integrator does not need to add AC caps on the channel.

- I suggest defining the following as optional features:
 1. Tx common mode voltage between 0 and 900 mV.
 2. Rx includes internal AC coupling

Both are to be included in the PICS and AC coupling is required only if either of them is not supported.

SuggestedRemedy

Discuss this idea; if it is plausible, we should think about possible ways to write it down.

Proposed Response Response Status O

CI 120F SC 120F.3.1 P195 L 33 # 26

Mellitz, Richard Samtec
 Comment Type TR Comment Status X

The dependence of Vf on Nv is confusing. The result is that a single device with a C2C and KR transmitter may have two specifications which are confusing for performing tests. Since we specify that ratio of Pmax to Vf there really is no good reason not to make Nv more like a real steady state voltage. See Mellitz_3ck_01b_0919 for reference.

SuggestedRemedy

Add a subsection detailing "Transmitter output waveform" similar to 163.9.3.1. Add exception and exception list for this subclause setting Nv to 200 for the determination of Vf. Refer to clause "136.9.3.1 Transmitter output waveform": Change k = -2 to 1 to k = -3 to 1 Refer to clause "120D.3.1.3 Linear fit to the measured waveform": Change Dp= 3 to Dp= 4 See Mellitz_3ck_01b_0919 for reference.

Proposed Response Response Status O

CI 120F SC 120F.3.1 P195 L 40 # 27

Mellitz, Richard Samtec
 Comment Type TR Comment Status X

If Nv is set to 200 UI then and packages in Table 120F-5 are the same as KR, then Signal-to-noise-and-distortion ratio SNDR (min) should be the same as for KR

SuggestedRemedy

Change Signal-to-noise-and-distortion ratio SNDR (min) from TBD to 33 dB. This matches SNR_Tx in 120F-5

Proposed Response Response Status O

CI 120F SC 120F.3.1.1 P196 L 6 # 176

Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X

Transmitter differential output return loss is redundant given that ERL will be used

SuggestedRemedy

Remove section and reference 163.9.2.1

Proposed Response Response Status O

CI 120F SC 120F.3.1.1 P196 L 14 # 272

Ran, Adeel Intel
 Comment Type T Comment Status X

This return loss mask can allow unacceptable reflections with most of the BW allowed to be worse than 4 dB. It is more relaxed than the 50G RL specs in 120D.3.1.1 and even the old 25G RL specs in 93.8.1.4.

We should use ERL for this annex, with similar specs to the PMDs.

SuggestedRemedy

Refer to the ERL specs in 163.

Proposed Response Response Status O

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CI 120F SC 120F.3.1.4 P197 L 39 # 140
 Dawe, Piers Mellanox
 Comment Type T Comment Status X
 The third precursor has only minor value for "28 dB" channels, so I don't expect it will be worthwhile for "20 dB" channels, yet it adds complexity to the silicon and the tuning.
 SuggestedRemedy
 Remove the third precursor.
 Proposed Response Response Status O

CI 120f SC 120f.4.1 P203 L 11 # 178
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 DFE tap length missing
 SuggestedRemedy
 Replace TBD with Nb=5 and see ghiasi_3ck_02_0120
 Proposed Response Response Status O

CI 120F SC 120F.3.2.3 P199 L 51 # 50
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 The sentence does not make sense. (missing reference equation).
 SuggestedRemedy
 Change to "The filtered voltage transfer function H(k)(f) calculated in Equation (93A-19) uses the filter Ht(f) defined by Equation (93A-46),"
 Proposed Response Response Status O

CI 120f SC 120f.4.1 P203 L 15 # 179
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type T Comment Status X
 C2M doesn't have floating taps
 SuggestedRemedy
 Remove the floating taps
 Proposed Response Response Status O

CI 120F SC 120F.4.1 P202 L 36 # 51
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 The step size for C(1) in table 120F-5 (0.05) does not match the max value in Table 120F-1.
 SuggestedRemedy
 Either change the step size in table 120F-5 to 0.02
 Or change Table 120F-1 to indicate that the max step size for C(1) is 0.05. (Be consistent with the step size for 162 and 163 which has similar comments).
 Proposed Response Response Status O

CI 120F SC 120F.4.1 P203 L 15 # 52
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 If there are floating taps then multiple additional rows are required to describe them. If not then Bmaxg should not be in the table.
 SuggestedRemedy
 Either delete Bmaxg row or add the other rows (see table in Annex 93A). Values TBD.
 Proposed Response Response Status O

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CI 120F SC 120F.4.1 P203 L15 # 141
 Dawe, Piers Mellanox
 Comment Type T Comment Status X
 C2C should have a DFE floating tap tail root-sum-of-squares limit as CR and KR do, although the limit might differ.
 SuggestedRemedy
 Add a DFE floating tap tail root-sum-of-squares limit.
 Proposed Response Response Status O

CI 120G SC 120G.1 P209 L43 # 53
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 The 100G Phys using RS544,514 are 100GBASE-P not 100GBASE-R
 SuggestedRemedy
 Chage 100GBASE-R to 100GBASE-P in figure 120G-1
 Proposed Response Response Status O

CI 120F SC 120F.4.1 P203 L15 # 70
 Wu, Mau-Lin MediaTek
 Comment Type T Comment Status X
 In Table 120F-5, the parameter of "Max DFE value for floating taps" shall be removed since we don't have consensus on applying DFE floating taps to C2C.
 SuggestedRemedy
 Remove the raw of "Max DFE value for floating taps" from Table 120F-5.
 Proposed Response Response Status O

CI 120G SC 120G.1 P210 L5 # 54
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 There are no examples of these C2M interfaces in 120A or 135A
 SuggestedRemedy
 Either delete the references to these annexes or bring these Annexes into 80.3ck and add examples (e.g. add n=1 to Figure 135A-8)
 Proposed Response Response Status O

CI 120F SC 120F.4.1 P203 L19 # 142
 Dawe, Piers Mellanox
 Comment Type TR Comment Status X
 One-sided noise spectral density of $8.2e-9 V^2/GHz$ is extremely aggressive and optimistic and was chosen to make 28 dB backplane channels pass COM. It is not appropriate for this 20 dB spec.
 SuggestedRemedy
 Change to $1.64e-8$, same as 50GBASE-CR. (For info, 50G/lane C2C (120C) has $2.6e-8$.)
 Proposed Response Response Status O

CI 120G SC 120G.1.1 P212 L27 # 55
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 Clause 120 does not apply to 100GAUI-1
 SuggestedRemedy
 Add "or clause 135 for 100GAUI-1"
 Proposed Response Response Status O

CI 120G SC 120G.3.1 P213 L30 # 180
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 Transmitter 4th order BT4 filter BW is TBD
 SuggestedRemedy
 Replace TBD with 39.8 GHz
 Proposed Response Response Status O

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CI 120G SC 120G.3.1 P213 L 34 # 72
 Wu, Mau-Lin MediaTek
 Comment Type T Comment Status X
 There are a lot of TBD values in Table 120G-1 - Host output characteristics at TP1a. I prepared one contribution, wu_3ck_02_0120, to address how to settle down on these.
 SuggestedRemedy
 Proposed to change values in Table 120G-1 according to the contribution, wu_3ck_02_0120.
 Proposed Response Response Status O

CI 120G SC 120G.3.1 P213 L 53 # 56
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 The vertical eye height is TBD
 SuggestedRemedy
 Adopt the value proposed in Dudek_3ck_01_1119 (7.5dB). A presentation will be made providing more information.
 Proposed Response Response Status O

CI 120G SC 120G.3.1 P213 L 52 # 189
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 Eye height min is TBD
 SuggestedRemedy
 per http://www.ieee802.org/3/ck/public/19_11/sun_3ck_01b_1119.pdf should be 15 mV
 Proposed Response Response Status O

CI 120G SC 120G.3.1.3 P215 L 25 # 59
 Dudek, Mike Marvell
 Comment Type E Comment Status X
 This section labelled Host output effective return loss is referenced by the Module output test, the Host input test and the module input test.
 SuggestedRemedy
 Either add separate sections for the module output ERL test or broaden the title and text of this section to include the other points. I think it may be better to have two sections one for the Host tests (using the HCB) and one for the Module tests (using the MCB).
 Proposed Response Response Status O

CI 120G SC 120G.3.1 P213 L 52 # 190
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 VEC is TBD
 SuggestedRemedy
 per http://www.ieee802.org/3/ck/public/19_11/sun_3ck_01b_1119.pdf should be 8.5 dB if EH < 15 mV
 $VEC - 0.1667 * EH - 15$, if EH is between 15 and 30m
 $VEC - 2.5dB$, if EH > 30mV
 Proposed Response Response Status O

CI 120G SC 120G.3.1.3 P215 L 28 # 71
 Wu, Mau-Lin MediaTek
 Comment Type T Comment Status X
 In the paragraph of "Host output effective return loss", the sentence of "The value of T_fx is twice the delay associated with the TP1a test fixture being used" is NOT appropriate because the section of 120G.3.1.3 is used not only for Host output ERL, but also Module output ERL, Module input ERL, and Host input ERL. Based on this, the current description is not appropriate.
 SuggestedRemedy
 The sentence of "The value of T_fx is twice the delay associated with the TP1a test fixture being used" shall be changed as "The value of T_fx is twice the delay associated with the specific test fixture being used."
 Proposed Response Response Status O

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Cl **120G** SC **120G.3.1.3** P**215** L**29** # **57**
 Dudek, Mike Marvell
 Comment Type **T** Comment Status **X**
 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".
 Proposed Response Response Status **O**

Cl **120G** SC **120G.3.1.5** P**216** L**30** # **181**
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type **TR** Comment Status **X**
 Transmitter 4th order BT4 filter BW is TBD
 SuggestedRemedy
 Replace TBD with 39.8 GHz
 Proposed Response Response Status **O**

Cl **120G** SC **120G.3.1.6** P**216** L**30** # **58**
 Dudek, Mike Marvell
 Comment Type **T** Comment Status **X**
 The counter-propagating signals should be asynchronous so that crosstalk is properly evaluated. (in the system the counter-propagating signals will be asynchronous).
 SuggestedRemedy
 Change "synchronous" to "asynchronous".
 Proposed Response Response Status **O**

Cl **120G** SC **120G.3.2** P**217** L**28** # **193**
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type **TR** Comment Status **X**
 Module output VEC is TBDs and need values
 SuggestedRemedy
 See ghiasi_3ck_03_0120 and
 Near end TP4 VEC = 7.0 dB
 Far end TP5-L1 VEC = 7.5 dB
 Far end TP5-L2 VEC = 7.5 dB
 Proposed Response Response Status **O**

Cl **120G** SC **120G.3.2** P**217** L**28** # **192**
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type **TR** Comment Status **X**
 Module output EH is TBDs and need values
 SuggestedRemedy
 See ghiasi_3ck_03_0120 and
 Near end TP4 EH = 50 mV
 Far end TP5-L1 EH = 32 mV
 Far end TP5-L2 EH= 20 mV
 Proposed Response Response Status **O**

Cl **120G** SC **120G.3.2** P**217** L**28** # **191**
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type **TR** Comment Status **X**
 Need improve test methodology for moule ouptut compliance
 SuggestedRemedy
 See ghiasi_3ck_03_0120
 Proposed Response Response Status **O**

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Cl **120G** SC **120G.3.2** P**217** L**30** # **182**
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type **TR** Comment Status **X**
 Transmitter 4th order BT4 filter BW is TBD
 SuggestedRemedy
 Replace TBD with 39.8 GHz
 Proposed Response Response Status **O**

Cl **120G** SC **120G.3.3.2** P**220** L**6** # **194**
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type **TR** Comment Status **X**
 Far end eye height is TBD
 SuggestedRemedy
 Replace TBD with 50 mV
 Proposed Response Response Status **O**

Cl **120G** SC **120G.3.2** P**217** L**50** # **144**
 Dawe, Piers Mellanox
 Comment Type **TR** Comment Status **X**
 Far-end pre-cursor ISI ratio has not been justified and doesn't fit well with the other C2M specs. Better to choose the reference receiver tap limits wisely.
 SuggestedRemedy
 Remove the row for far-end pre-cursor ISI ratio from the table.
 Proposed Response Response Status **O**

Cl **120G** SC **120G.3.3.2.1** P**221** L**39** # **63**
 Dudek, Mike Marvell
 Comment Type **T** Comment Status **X**
 The draft is missing the information for how to set up the stressed receiver input signal.
 SuggestedRemedy
 Insert the following (modified from 120E.3.3.2.1) " Random jitter and the pattern generator output levels are adjusted (without exceeding the differential pk-pk input voltage tolerance specification as shown in Table 120G-4) to result in the eye height for all three eyes and eye width for the smallest eye given in Table 120G-5 with the setting of the CTLE that maximizes the product of eye height and eye width.
 The far-end pre-cursor ISI ratio is measured using the method defined in 120E.3.2.1.2 and it shall meet the specification in Table 120G-3. Pre-emphasis capability is likely to be required in the pattern generator to meet this requirement". However consider whether the product of eye height and eye width is the best criteria or whether it would be better to replace "that maximizes the product of eye height and eye width" with "that minimizes the value of vertical eye closure."
 Proposed Response Response Status **O**

Cl **120G** SC **120G.3.3** P**219** L**43** # **60**
 Dudek, Mike Marvell
 Comment Type **E** Comment Status **X**
 The reference to ERL in table 120G-4 is directly to 120G.3.1.3 but there is a separate section 120G.3.3.1 (but it points directly to 120G.3.1.3 see other comment)
 SuggestedRemedy
 Either delete section 120G.3.3.1 or change the reference in table 120G-4 to 120G.3.3.1
 Proposed Response Response Status **O**

Cl **120G** SC **120G.3.4.1** P**222** L**32** # **195**
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type **TR** Comment Status **X**
 Module stress input eye height is TBD
 SuggestedRemedy
 Replace TBD with 15 mV @ nominal VEC of 8.5 dB
 Add 2nd test condition 30 mV @ nominal VEC of 11 dB
 Proposed Response Response Status **O**

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Cl 120G SC 120G.3.4.1.1 P224 L12 # 61
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 The sections referenced for measuring Eye height and VEC don't have the correct reference receiver and section 4.2 has more details about how to measure these.
 SuggestedRemedy
 Change "Eye height and VEC are then measured at TP1a based on the measurement methodology given in 120E.4.2 and vertical eye closure is measured according to 120E.4.3." to Eye height and VEC are then measured at TP1a as described in 120G.4.2 "
 Proposed Response Response Status O

Cl 120G SC 120G.3.4.1.1 P224 L22 # 62
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 Multiple presentations have shown that the VEC at TP1a is more critical for end to end performance than just the eye opening.
 SuggestedRemedy
 Add a VEC min specification to Table 120G-8. Value TBD. Move the sentence on line 22 beginnin with "In both cases" to a separate paragraph (to emphasis that it applies to both the high and low loss cases) and change it to "In both cases, the input VEC is less than TBD dB and greater than the value in table 120G-8
 Proposed Response Response Status O

Cl 120G SC 120G.4.1 P224 L51 # 64
 Dudek, Mike Marvell
 Comment Type E Comment Status X
 This section appears to be a direct copy of 120E.3.1 except that it only applies to the module and host Tx (not calibration of the stressed inputs)
 SuggestedRemedy
 Replace the text in the section with "The signal levels are as defined in 120E.3.1"
 Proposed Response Response Status O

Cl 120G SC 120G.4.2 P L # 162
 Li, Mike Intel
 Comment Type ER Comment Status X
 "with an effective sampling period of Tb/M with parameter M greater than or equal to 32" had been defined in 162.9.3.1.1 and references therein, there is not need to repeat.
 SuggestedRemedy
 delete "with an effective sampling period of Tb/M with parameter M greater than or equal to 32"
 Proposed Response Response Status O

Cl 120G SC 120G.4.2 P225 L28 # 273
 Hidaka, Yasuo Credo Semiconductor
 Comment Type TR Comment Status X
 Our study showed that VEC (vertical eye closure) is not a good performance metric of whole link performance, if we take account of receiver impairments. This is partly because VEC is not a function of channel insertion loss. EVEC (effective vertical eye closure) as proposed in sun_3ck_02_1119.pdf (page 3) is a better alternative, because it takes account of EH (eye height) as an indicator of channel insertion loss.
 SuggestedRemedy
 Replace "Vertical eye closure (max)" in Table 120G-1 with "Effective vertical eye closure (max)".
 Add a sub section to define effective vertical eye closure.
 A presentation of a detail proposal will be given at the January meeting.
 Proposed Response Response Status O

Cl 120G SC 120G.4.2 P225 L29 # 65
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 In the capture of the signals to be analyzed there is a BT filter with TBD bandwidth. This section is including a Butterworth noise filter in addition.
 SuggestedRemedy
 Consider whether both filters should be used. I hope to have information on the effect of the two filters on VEO and VEC for the next meeting.
 Proposed Response Response Status O

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CI 120G SC 120G.4.2 P225 L31 # 275

Hidaka, Yasuo Credo Semiconductor

Comment Type T Comment Status X

The reference receiver has a receiver noise filter as defined in 93A.1.4.1. Hence, we should not apply the 4th-order BT filter.

On the other hand, 120G.3.1 and 120G.3.2 specify that a 4th-order BT filter is to be used for all output signal measurements, unless otherwise specified.

However, this otherwise condition is not clearly stated in 120G.4.2

SuggestedRemedy

Add the following statement to 120G.4.2 prior to Table 120G-9.

When this eye opening measurement method is used, do not use the fourth-order Bessel-Thomson low-pass response in the output signal measurements.

Proposed Response Response Status O

CI 120G SC 120G.4.2 P225 L38 # 160

Li, Mike Intel

Comment Type E Comment Status X

3/4 is not a normal numerical representation

SuggestedRemedy

change it to 0.75

Proposed Response Response Status O

CI 120G SC 120G.4.2 P225 L40 # 158

Dawe, Piers Mellanox

Comment Type TR Comment Status X

These look like the CTLE limits for TP1a and TP4 far end.

SuggestedRemedy

Where are the limits for TP4 near end?

Proposed Response Response Status O

CI 120G SC 120G.4.2 P225 L44 # 157

Dawe, Piers Mellanox

Comment Type TR Comment Status X

This allows combinations such as gDC=-3, gDC2=-3 that should not happen, receivers don't need to design for, and waste time in the "for each valid combination of gDC and gDC2" measurement procedure.

SuggestedRemedy

Limit the combinations:

gDC2	gDC
0 or 1	3 to 14
2	6 to 14
3	9 to 14

Proposed Response Response Status O

CI 120G SC 120G.4.2 P225 L46 # 143

Dawe, Piers Mellanox

Comment Type T Comment Status X

Are 1 dB steps for gDC2 fine enough?

SuggestedRemedy

Change to 1/2 dB?

Proposed Response Response Status O

CI 120G SC 120G.4.2 P226 L9 # 154

Dawe, Piers Mellanox

Comment Type TR Comment Status X

The C2M normalized DFE coefficient magnitude limits need to be chosen carefully so that the reference receiver is not better than a range of real receiver implementations. Although this may not be a particularly good way of ensuring the spec has margin - see another comment about noise loading.

SuggestedRemedy

Start with bmax(1)=0.25, bmax(2:4)=0.1?

Proposed Response Response Status O

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Cl 120G SC 120G.4.2 P226 L9 # 196
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 Bmax values are TBDs
 SuggestedRemedy
 Limit B1(max)<=0.3 and B[2,3,4](max)<=0.1
 see ghiasi_3ck_03_0120 for justification.
 Proposed Response Response Status O

Cl 120G SC 120G.4.2 P226 L13 # 156
 Dawe, Piers Mellanox
 Comment Type TR Comment Status X
 This recipe is a weird combination of the existing C2M measurement method and COM,
 which is a simulation not a measurement method, for channels not signals, and for
 backplanes with transmitter training not low power C2M.
 SuggestedRemedy
 Unless someone can show that it works, change to the CTLE/FFE method as in OIF CEI-
 112G-VSR.
 Proposed Response Response Status O

Cl 120G SC 120G.4.2 P226 L10 # 145
 Dawe, Piers Mellanox
 Comment Type TR Comment Status X
 We need minimum limits for the C2M normalized DFE coefficient magnitudes. We saw for
 backplane that the minimum limits should be very different to the maximum limits.
 SuggestedRemedy
 Add bmin limits.
 Proposed Response Response Status O

Cl 120G SC 120G.4.2 P226 L14 # 161
 Li, Mike Intel
 Comment Type TR Comment Status X
 136.9.3.1.1 is a wrong reference
 SuggestedRemedy
 change it to 162.9.3.1.1 to be correct
 Proposed Response Response Status O

Cl 120G SC 120G.4.2 P226 L11 # 155
 Dawe, Piers Mellanox
 Comment Type TR Comment Status X
 In the same way that COM has eta0, this measurement should have a standardised
 "added" noise to represent noise that a product might have but the measurement doesn't,
 so that the reference receiver is not better than a range of real receiver implementations.
 This can be a constant in mV or V^2/GHz.
 Further, it needs a second noise term to account for reflections that a product might have
 but the measurement doesn't. This is proportional to the signal, so can be a set ratio to
 sum(AVupp + AVmid + AVlow).
 SuggestedRemedy
 Include two noise items in the measurement, one a constant in mV or V^2/GHz, the other a
 set ratio to sum(AVupp + AVmid + AVlow). To be RSSd with the measured, equalised
 signal. Allow RSSing out the scope noise (as done in TDECQ) if it's significant.
 Proposed Response Response Status O

Cl 120G SC 120G.4.2 P226 L23 # 164
 Li, Mike Intel
 Comment Type TR Comment Status X
 "136.9.3.1.1" is not the right reference.
 SuggestedRemedy
 Change it to "85.8.3.3.5 and 85.8.3.3.6"
 Proposed Response Response Status O

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Cl 120G SC 120G.4.2 P 226 L 23 # 163
 Li, Mike Intel
 Comment Type E Comment Status X
 "of p2(k)" does not read right
 SuggestedRemedy
 delete "of"
 Proposed Response Response Status O

Cl 120G SC 120G.4.2 P 226 L 24 # 166
 Li, Mike Intel
 Comment Type TR Comment Status X
 "Np equal to 200" is not appropriate as UI becomes half in second.
 SuggestedRemedy
 "Np equal to 200" to "Np equal to 400"
 Proposed Response Response Status O

Cl 120G SC 120G.4.2 P 226 L 24 # 165
 Li, Mike Intel
 Comment Type TR Comment Status X
 "Dp equal to 3" is not right as there are 3 pre-taps for the host
 SuggestedRemedy
 change "Dp equal to 3" to ""Dp equal to 4".
 Proposed Response Response Status O

Cl 120G SC 120G.4.2 P 226 L 28 # 274
 Hidaka, Yasuo Credence Semiconductor
 Comment Type TR Comment Status X
 In the performance study at TP1a in sun_3ck_02_1119.pdf, eta_0 noise of 8.20E-9 V²/GHz was added at the CTLE input. However, eta_0 noise is not added in the reference receiver described in 120G.4.2. If we do not add the eta_0 noise in the reference receiver in the scope, measured eye opening will be larger than the performance study. This will create a hole in the specification.

An easy fix is to add eta_0 noise in the reference receiver.

Another option is to re-do the performance study without eta_0 noise in the reference receiver in order to estimate the performance accurately, but it will take time. I recommend to add eta_0 noise in the reference receiver for now. We can remove it later, after we finish re-doing the performance study without eta_0 noise in the reference receiver.

SuggestedRemedy

Add eta_0 noise of 8.20E-9 V²/GHz to table 120G-9.
 Add a step to add eta_0 noise after step b in page 226.
 Here, eta_0 noise is a gaussian noise consistent with the third term of (93A-41).

Proposed Response Response Status O

Cl 120G SC 120G.4.2 P 226 L 33 # 66
 Dudek, Mike Marvell
 Comment Type E Comment Status X
 The paragraph describing what the measured values of Eye height, Eye width and VEC are is difficult to follow.
 SuggestedRemedy
 Consider replacing this paragraph with "The measured values of eye height, eye width and vertical eye closure are the values obtained with the combination of gDC and gDC2 that produces an eye height above the target value and the minimum value of vertical eye closure."

Proposed Response Response Status O

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CI 120G SC 120G.4.2 P226 L33 # 167

Li, Mike Intel

Comment Type TR Comment Status X

"Within the set of combinations of gDC and gDC2 with eye height meeting the target requirement, for the combination resulting in the smallest vertical eye closure, the eye height, eye width, and vertical eye closure are used as the measured values.", VEC alone will not be a good FOM for optimization, it needs to be the combination of VEC and EH, which is EVEC. Further, the clarity of the whole sentences is not good.

SuggestedRemedy

change the whole sentence to: "Within the set of combinations of gDC and gDC2, the eye height, eye width, and vertical eye closure, resulting in the smallest effective vertical eye closure, are used as the measured values."

Proposed Response Response Status O

CI 120G SC 120G.4.2 P226 L40 # 199

Ghiasi, Ali Ghiasi Quantum/Inphi

Comment Type TR Comment Status X

To speed up testing and eliminating weird cases one should gDC/gDC2 combinations

SuggestedRemedy

See ghiasi_3ck_03_0120 for table of allowed CTLE combinations.

Proposed Response Response Status O

CI 120G SC 120G.4.2 P226 L40 # 198

Ghiasi, Ali Ghiasi Quantum/Inphi

Comment Type TR Comment Status X

gDC max gain of 14 dB is unnecessary with a DFE receiver and channel <=16 dB

SuggestedRemedy

12 dB would be more than adequate and with further study we can even further reduce the gDC.

Proposed Response Response Status O

CI 120G SC 120G.4.2 P226 L40 # 197

Ghiasi, Ali Ghiasi Quantum/Inphi

Comment Type TR Comment Status X

gDC max gain of 14 dB is unnecessary with a DFE receiver and channel <=16 dB

SuggestedRemedy

12 dB would be more than adequate and with further study we can even further reduce the gDC.

Proposed Response Response Status O

CI 135 SC 135.1.4 P98 L42 # 223

Ran, Adeel Intel

Comment Type E Comment Status X

This phrasing "53.GBd by one-lane" is unnatural. It should be either by-1 or one-lane.

Preferably the latter.

This phrasing is used existing text, and is also awkward there. It should be changed.

SuggestedRemedy

Remove "by" in items 2-4 (the result would be simply four-lane, two-lane, and one-lane).

Proposed Response Response Status O

CI 135 SC 135.1.4 P99 L15 # 224

Ran, Adeel Intel

Comment Type T Comment Status X

In Figure 135-2, with the new variable p, PMAs above and below the 100GAUI-p should be PMA(4:p) and PMA(p:n) respectively.

SuggestedRemedy

Change labels per comment.

Proposed Response Response Status O

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CI 135 SC 135.1.4 P99 L15 # 30
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 There are errors in the MMD8 and MMD1 100G PMA's in figure 135-2
 SuggestedRemedy
 Change the MMD8 100G PMA between 100GAUI-4 and 100GAUI-P from PMA(4:2) to PMA(4:p) and change the PMA (2:n) to PMA (p:n).
 Proposed Response Response Status O

CI 135A SC 135A P0 L0 # 139
 Brown, Matt Huawei Technologies Canada
 Comment Type T Comment Status X
 Some layer diagrams in Annex 135A should include the RS-FEC (Clause 91), Inverse RS-FEC (Clause 152), and RS-FEC-Int (Clause 161).
 SuggestedRemedy
 Add layer diagram showing RS-FEC, Inverse RS-FEC, and RS-FEC-Int.
 Proposed Response Response Status O

CI 135 SC 135.5.7.2 P101 L29 # 225
 Ran, Adeel Intel
 Comment Type E Comment Status X
 The bottom brace below the "MEDIUM" and the text "50GBASE-R or 100GBASE-P" don't seem to serve any purpose in this diagram. These are families of PHYs, not specific PMDs or media. Also these are all the families in which this clause is used, so it goes without saying.
 SuggestedRemedy
 Delete the brace and the label.
 Proposed Response Response Status O

CI 135A SC 135A.2 P0 L0 # 111
 Slavick, Jeff Broadcom
 Comment Type TR Comment Status X
 We've added 100GAUI-1 so need to update Figure 135A-8 to indicate that
 SuggestedRemedy
 Change n = 2 or 4 to n = 1 or 2 or 4
 Proposed Response Response Status O

CI 135A SC 135A P0 L0 # 135
 Brown, Matt Huawei Technologies Canada
 Comment Type T Comment Status X
 Some layer diagrams in Annex 135A should show the new 100GAUI-1 C2C and C2M in addition to 100GAUI-2 and 100GAUI-1.
 SuggestedRemedy
 Import portions of Annex 135A and include 100GAUI-1 where 100GAUI-2 and 100GAUI-4 are shown.
 Proposed Response Response Status O

CI 161 SC 161.3 P107 L3 # 226
 Ran, Adeel Intel
 Comment Type E Comment Status X
 Missing period after the sentence
 SuggestedRemedy
 Add a period.
 Proposed Response Response Status O

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Cl 161 SC 161.4 P107 L7 # 116
 Nicholl, Shawn Xilinx
 Comment Type TR Comment Status X
 Since CL161 sublayer delay is larger than CL91 due to the interleaving of two codewords, the maximum delay constraint needs to be updated accordingly.
SuggestedRemedy
 Proposed to update text in 161.4 to following:
 The maximum delay contributed by the RS-FEC-Int sublayer (sum of transmit and receive delays at one end of the link) shall be no more than 51200 bit times (100 pause_quanta or 512 ns). A description of overall system delay constraints and the definitions for bit times and pause_quanta can be found in 80.4 and its references.
 Propose to update Table 80-5 to contain a new row after 100G-BASE-R RS-FEC entry. The new row to contain following cell values:
 * 100GBASE-R RS-FEC-Int
 * 51200
 * 100
 * 512
 * 161.4
 Proposed Response Response Status O

Cl 161 SC 161.4 P107 L7 # 227
 Ran, Adeo Intel
 Comment Type T Comment Status X
 Delay constraint of an interleaved FEC are likely not the same as those of clause 91.
 Interleaved FEC is defined in the PCS of clause 119. The delay constraint there is 313 pause_quanta, compared to 80 pause_quanta in clause 91.
 I would expect that the delay constraint is mainly affected by the buffering and decoding, and for interleaved FEC it should be twice the delay constraint of clause 91. But even if I add the delay of the 100GBASE-R PCS (69 pause_quanta), the numbers don't match - $2*80+69=229$, far from 313.
 The proposed change is based on the smaller number (doubling the constraint of clause 91) but if there is a reason behind the larger number of bit times in clause 119 it should be considered.
SuggestedRemedy
 Replace the content of this subclause with the following (taken from clause 91, doubling all numbers):
 The maximum delay contributed by the RS-FEC-Int sublayer (sum of transmit and receive delays at one end of the link) shall be no more than 81920 bit times (160 pause_quanta or 819.2 ns). A description of overall system delay constraints and the definitions for bit times and pause_quanta can be found in 80.4 and its references.
 Proposed Response Response Status O

Cl 161 SC 161.5.2.4 P107 L35 # 228
 Ran, Adeo Intel
 Comment Type E Comment Status X
 "EEE is unsupported" is only used here, similar text elsewhere in this draft uses "not supported".
SuggestedRemedy
 Change to "not supported".
 Proposed Response Response Status O

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CI 161 SC 161.5.2.6 P108 L 53 # 103

Slavick, Jeff Broadcom

Comment Type TR Comment Status X

The same alignment marker scheme is used for both CI91 and CI161. So if one direction sends the opposite format from expected, then the FEC engine will Alignment lock but will only get uncorrectable FEC codewords.

SuggestedRemedy

Change steps a) through e) to be either:

Option 1 (Flip-flop AM4-19 M0,1,2 and M4,5,6):

a) if $x \leq 3$ amp_tx_x<23:0> is set to M0, M1, and M2 as shown in Figure 82-9 (bits 25 to 2) using the values in Table 82-2 for PCS lane number 0. if $x \geq 4$ amp_tx_x<23:0> is set to M4, M5, and M6 as shown in Figure 82-9 (bits 57 to 34) using the values in Table 82-2 for PCS lane number x.

b) amp_tx_x<31:24> = am_tx_x<33:26>

c) if $x \leq 3$ amp_tx_x<55:32> is set to M4, M5, and M6 as shown in Figure 82-9 (bits 57 to 34) using the values in Table 82-2 for PCS lane number 0. if $x \geq 4$ amp_tx_x<55:32> is set to M0, M1, and M2 as shown in Figure 82-9 (bits 25 to 2) using the values in Table 82-2 for PCS lane number x.

d) amp_tx_x<63:56> = am_tx_x<65:58>

Option 2 (Use CI119 Common Marker instead of CI82 AM0):

a) if $x \leq 3$ amp_tx_x<23:0> is set to CM0, CM1, and CM2 as shown in Figure 119-4 (bits 23 to 0) using the values in Table 119-1 for PLCS lane number x. if $x \geq 4$ amp_tx_x<23:0> is set to M0, M1, and M2 as shown in Figure 82-9 (bits 25 to 2) using the values in Table 82-2 for PCS lane number x.

b) amp_tx_x<31:24> = am_tx_x<33:26>

c) if $x \leq 3$ amp_tx_x<55:32> is set to CM0, CM1, and CM2 as shown in Figure 119-4 (bits 55 to 32) using the values in Table 119-1 for PCS lane number x. if $x \geq 4$ amp_tx_x<55:32> is set to M4, M5, and M6 as shown in Figure 82-9 (bits 57 to 34) using the values in Table 82-2 for PCS lane number x.

d) amp_tx_x<63:56> = am_tx_x<65:58>

And update the paragraph that follows to align with the chosen Option.

Proposed Response Response Status O

CI 161 SC 161.5.2.6 P109 L 20 # 105

Slavick, Jeff Broadcom

Comment Type T Comment Status X

The process of creating am_txmapped is not optional

SuggestedRemedy

Change "may then be" to "is"

Proposed Response Response Status O

CI 161 SC 161.5.2.6 P109 L 46 # 229

Ran, Adeo Intel

Comment Type E Comment Status X

The phrase "every 20 x 16 384 66-bit blocks" is hard to read with the space in the number 16384 (and possibly misleading, it can be interpreted as the number 1638466).

This space does not appear in the similar text in clause 91. The separator convection is not helpful here, and it is not mandatory outside of tables.

Also applies in some other similar phrases in this subclause and in 161.5.4.3.

SuggestedRemedy

Change "16 384" to "16384".

Apply for other large numbers within the text in this clause.

Proposed Response Response Status O

CI 161 SC 161.5.2.6 P109 L 47 # 230

Ran, Adeo Intel

Comment Type E Comment Status X

The "x" in "81 920 x 257-bit blocks" is out of place - "257-bit" is not a number. This is also inconsistent with the text in the previous line, which does not have an "x" before "66-bit blocks".

Also in the next sentence and in 161.5.3.5.

SuggestedRemedy

Delete the "x" occurrences listed.

Proposed Response Response Status O

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Cl 161 SC 161.5.2.6 P109 L48 # 231

Ran, Adee Intel
 Comment Type E Comment Status X

The paratraph starting in line 46 seems to be unfinished. The next paragraph starts by repeating what was already stated in this one.

Perhaps this paragraph should be

"One group of aligned and reordered alignment markers are mapped every 20 x 16384 66-bit blocks. This group of aligned and reordered alignment markers is called the "alignment marker group" and is labeled am_txmapped<1284:0>. An alognment marker group shall be inserted so it appears in the output stream every 81920 257-bit blocks."

And then the first line in the next paragraph can be removed.

SuggestedRemedy

Modify per comment.

Proposed Response Response Status O

Cl 161 SC 161.5.2.6 P110 L16 # 232

Ran, Adee Intel
 Comment Type T Comment Status X

In figure 161-3, the labels A and B appear within the amp_tx blocks, but these blocks are not taken _from_ the codewords as the legend states - according to figure 161-5 they are inserted _into_ the stream of symbols that creates the codewords.

Also, the labels do not appear in the tx_scrambled area which contains the real traffic.

SuggestedRemedy

Change the legend to have "to FEC codeword A" and "to FEC codeword B" .

Continue the labeling into symbol in columns 32 and 33.

Proposed Response Response Status O

Cl 161 SC 161.5.2.9 P111 L16 # 234

Ran, Adee Intel
 Comment Type E Comment Status X

Per style manual, in general text, isolated numbers less than 10 should be spelled out.

Applies here and in several other places in this clause (where numbers are isolated, i.e. with no units following).

SuggestedRemedy

Change "4" to to "four". Apply in other places in this clause.

Proposed Response Response Status O

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Cl 161 SC 161.5.2.9 P111 L16 # 233

Ran, Adeo Intel
 Comment Type T Comment Status X

If we create four FEC lanes then a PMA(4:1) will be required to create a single-lane PMD interface. This PMA will bit-mux symbols from the four lanes.

Bit muxing of four lanes significantly weakens the RS-FEC in case of error bursts, since bursts are always going to impact more than one symbol. 8 errors in a block of 16 bits (8-UI burst) can corrupt 4 FEC symbols in each of the codewords (A/B). Without bit-muxing, similar corruption would require a bursty block of more than 70 bits (35 UI). This burst length is much less likely, so the probability of uncorrected codewords (and FLR) will be dramatically lower for the same SNR. Alternatively, the same FLR can be achieved with lower SNR, enabling power reduction.

Assuming this new FEC is intended only for single-lane 100G PHYs and that there are no lower-rate AUIs below it, using a single FEC lane (serial output) instead would prevent this degradation of the FEC coding gain. This can be done with the current definitions by simply changing the number of FEC lanes from 4 to 1.

Even if we do want to support bit-muxing below the FEC, e.g. for the near future devices that may not have 100G I/O, we should consider not imposing a large performance penalty for all future products.

We can consider having two modes of the FEC, with either 4 or 1 FEC lanes, in both directions, and choosing between them in auto-negotiation. The additional complexity should be much lower than having both clause 91 and clause 161.

We can also apply a similar choice for the clause 91 RS-FEC if desired.

SuggestedRemedy

Add a management variable to control the number of FEC lanes, either 4 or 1. Add a bit in the AN page for supporting 1 FEC lane - if both sides advertise it, then 1-lane mode will be used (symmetrically).

Proposed Response Response Status O

Cl 161 SC 161.5.2.10 P112 L13 # 235

Ran, Adeo Intel
 Comment Type E Comment Status X

The number "256" appears on the boundary of the block "tx_scrambled",

SuggestedRemedy

Move the number to the interior of the box.

Proposed Response Response Status O

Cl 161 SC 161.5.3.1 P113 L7 # 106

Slavick, Jeff Broadcom
 Comment Type TR Comment Status X

FEC synchronization FSM is not Figure 161-6

SuggestedRemedy

Change "161-6" to "91-8"

Proposed Response Response Status O

Cl 161 SC 161.5.3.3 P113 L26 # 76

Gustlin, Mark Cisco Systems
 Comment Type T Comment Status X

802.3cd added in subclause 91.5.3.3.1 FEC degraded SER (optional) to allow monitoring of the FEC performance. Add this into clause 161.

SuggestedRemedy

Add in the equivalent of 91.5.3.3.1 and its related text (variables etc), either by reference or directly.

Proposed Response Response Status O

Cl 161 SC 161.5.3.3 P113 L34 # 236

Ran, Adeo Intel
 Comment Type E Comment Status X

A cross-reference to the subclause which defines "bypass error indication" would be helpful.

SuggestedRemedy

Insert "(see 161.5.3.3.1)" between "If bypass error indication" and "is not supported".

Proposed Response Response Status O

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Cl 161 SC 161.5.3.3 P113 L36 # 81
 Koehler, Daniel MorethanIP
 Comment Type TR Comment Status X
 Does not reflect that there are 2 codewords to perform error indication for.
 SuggestedRemedy
 replace 'the codeword' with 'the two associated codewords'
 Proposed Response Response Status O

Cl 161 SC 161.5.3.3 P113 L38 # 104
 Slavick, Jeff Broadcom
 Comment Type TR Comment Status X
 There are 40 257b blocks that go into the FEC engine per pair of FEC codewords. So when an uncorrectable codeword occurs, it needs to mark across 40 257b blocks.
 SuggestedRemedy
 Change "20th" to "40th"
 Proposed Response Response Status O

Cl 161 SC 161.5.3.3 P113 L39 # 82
 Koehler, Daniel MorethanIP
 Comment Type TR Comment Status X
 As it is two codewords the last 257-bit is the 40th not 20th. Also needs to reflect that there are 2 codewords.
 SuggestedRemedy
 replace 'last ... 11.' with 'last (40th) 257-bit block in the two associated codewords are set to 11.'
 Proposed Response Response Status O

Cl 161 SC 161.5.3.3.1 P113 L42 # 237
 Ran, Adele Intel
 Comment Type T Comment Status X
 802.3cd added the FEC Degraded SER as an optional feature in 91.5.3.3.1. Do we intend to add it in this draft too?
 I am not sure this feature is useful, so I am fine with not having it in this clause. It can be more useful to monitor codewords instead (classify based on number of errors corrected, as was proposed in ran_083017_3cd_adhoc) and this method is being used in practice. This task force may want to reconsider adding it as a standard feature.

SuggestedRemedy
 If degraded SER is to be supported, the description (based on 91.5.3.3.1) should be placed here, and the corresponding variables and MDI mappings should be added.
 If codeword monitoring is desired, the proposal in ran_083017_3cd_adhoc slides 8-14 can be used as baseline (editorial changes such in clause numbers, etc., will be required).
 Proposed Response Response Status O

Cl 161 SC 161.5.3.3.1 P113 L53 # 83
 Koehler, Daniel MorethanIP
 Comment Type T Comment Status X
 The reaction of hi_ser should cause error indication as described in 91.5.3.3 to trigger PCS hi_ber instead using it in Fig. 161-6.
 SuggestedRemedy
 Keep text of line 53 but add new sentence like:
 While hi_ser is asserted, the Reed-Solomon decoder shall cause synchronization header rx_coded<1:0> of each subsequent 66-bit block that is delivered to the PCS to be assigned a value of 00 or 11. As a result, the PCS sets hi_ber=true, which inhibits the processing of received packets. When Auto-Negotiation is supported and enabled, assertion of hi_ber causes Auto-Negotiation to restart.
 Proposed Response Response Status O

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Cl 161 SC 161.5.4.1 P115 L10 # 238
 Ran, Adee Intel
 Comment Type E Comment Status X
 "Comprised on" is arguable language. 802.3bs used "composed of", other projects used "contains" or omitted this paragraph altogether (since 21.5 already states that state diagrams take precedence over text).
 I suggest "composed of".
 SuggestedRemedy
 Change "comprised" to "composed".
 Proposed Response Response Status O

Cl 161 SC 161.5.4.2.1 P115 L25 # 117
 Nicholl, Shawn Xilinx
 Comment Type ER Comment Status X
 Need to remove some editorial text related to cw_bad
 SuggestedRemedy
 Remove the text:
 No cw_bad variable, instead we have:
 Proposed Response Response Status O

Cl 161 SC 161.5.4.2.3 P116 L3 # 78
 Gustlin, Mark Cisco Systems
 Comment Type T Comment Status X
 Remove redundancy from counters, make references instead.
 SuggestedRemedy
 amp_bad_count - refer to 91.5.4.2.3, cwA_bad_count and cwB_bad_count, refer to 119.2.6.2.4
 Proposed Response Response Status O

Cl 161 SC 161.5.4.3 P117 L1 # 75
 Gustlin, Mark Cisco Systems
 Comment Type T Comment Status X
 Replace figure 161-6 with a reference to figure 119-13.
 SuggestedRemedy
 Add that some signals change name: align_status -> fec_align_status, pcs_enable_status -> fec_enable_status. If this change is not made, then there is one correction to be made in 161-6, one instance of pcs_enable_deskew s/b fec_enable_deskew.
 Proposed Response Response Status O

Cl 161 SC 161.5.4.3 P117 L2 # 84
 Koehler, Daniel MorethanIP
 Comment Type T Comment Status X
 hi_ser should be removed, not to cause LOSS_OF_ALIGNMENT. Its behavior is defined in 161.5.3.3.1 (see other comment) relying on the hi_ber feature of the PCS same as the Clause 91 RSFEC does.
 SuggestedRemedy
 remove '+ hi_ser' at top of figure.
 Proposed Response Response Status O

Cl 161 SC 161.7.3 P122 L6 # 239
 Ran, Adee Intel
 Comment Type T Comment Status X
 Item "**KR1" is marked "optional", but there is no another option (this sublayer is only used for CR1/KR1 PHYs), and no PICS item is defined as conditional on this feature. I don't see the purpose of this item.
 SuggestedRemedy
 Remove item "**KR1".
 Proposed Response Response Status O

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CI 161 SC 161.7.4.2 P124 L19 # 240
 Ran, Adeel Intel
 Comment Type T Comment Status X
 The method of indicating errors has a "shall ensure" (161.5.3.3) but there is no corresponding PICS item.
 Compare to item RF8 in clause 91 which states "Error indication function | 91.5.3.3 | Corrupts 66-bit block synchronization headers for uncorrected errored codewords (...)"
 SuggestedRemedy
 Add PICS item based on the quoted RF8.
 Proposed Response Response Status O

CI 162 SC 162.1 P125 L27 # 241
 Ran, Adeel Intel
 Comment Type T Comment Status X
 The PHY defined in this clause can use either RS-FEC or RS-FEC-int. This is the first time The difference between the two is not described and readers may find it hard to decide which one should be used. Compare with clause 110 (100.1 Overview) where the FEC choice affects the cable reach.
 The differences between the FEC sublayers may seem obvious for participants of the task force but we are writing the standard for other people too.
 In this clause we should indicate that the interleaved FEC provides better FEC protection but has a larger delay associated with it. It would be good to also relate the choice to the auto-negotiation.
 Also applies to clause 163.
 SuggestedRemedy
 Add text in the overview that describes the differences between RS-FEC and RS-FEC-Int when forming a 100GBASE-CR1 PHY, and note that the choice between the two can be done in auto-negotiation.
 Proposed Response Response Status O

CI 162 SC 162.1 P125 L35 # 242
 Ran, Adeel Intel
 Comment Type E Comment Status X
 Table 162-1 is carried over into the next page, but the continuation is not marked as such, as required by the style manual.
 Also in Table 162-3 and perhaps other tables will turn out to be broken in future drafts.
 There is also a customary "thin line at bottom" rule. We can perhaps defer applying this one to the last draft or to publication (it is not required in the style manual).
 SuggestedRemedy
 Add the "continued table" option for all tables.
 Proposed Response Response Status O

CI 162 SC 162.1 P125 L45 # 137
 Brown, Matt Huawei Technologies Canada
 Comment Type T Comment Status X
 In Table 162-1, the Clause 161 RS-FEC-Int is specified as TBD rather than Required or Optional in the second column.
 SuggestedRemedy
 Specify RS-FEC-Int as either "Optional" or "Required".
 Proposed Response Response Status O

CI 162 SC 162.1 P125 L45 # 133
 Brown, Matt Huawei Technologies Canada
 Comment Type T Comment Status X
 Tables 162-1 list two FEC types (RS-FEC and RS-FEC-Int) that might be used by a 100GBASE-CR1 PHY, but never explains the criteria for selecting one or the other, how that selection is made, nor the implications (e.g., conversion from RS-FEC to RS-FEC-Int).
 SuggestedRemedy
 Add a subclause to explain the relationship of the two FEC types, how an FEC type is selected, and the implications of the selection.
 Proposed Response Response Status O

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Cl 162 SC 162.1 P126 L15 # 31
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 The inverse RS-FEC is also required to change between RS-FEC (528,514) and RS-FEC (544,514)
SuggestedRemedy
 Add to footnote b. "and between RS-FEC (528,514) and RS-FEC (544,514)"
 Proposed Response Response Status O

Cl 162 SC 162.2 P127 L53 # 32
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 FEC is also used in "FEC symbol error rate" etc. where it also refers to the FEC within the 200 and 400G PCS.
SuggestedRemedy
 Add to the sentence "for 100GBASE-CR1 or the RS-FEC within the Clause 119 PCS for 200GBASE-CR2 and 400GBASE-CR4".
 Proposed Response Response Status O

Cl 162 SC 162.5 P129 L45 # 243
 Ran, Adeel Intel
 Comment Type T Comment Status X
 The assumed maximum one way delay through the medium was 20 ns in clause 136, where the longest medium was a 3 meter cable. Now with 2 meters the number should be scaled down to 14 ns.

There is a motivation for decreasing the assumed cable medium delay - it would allow more delay in the PMD, which is currently left with only 20.96 ns. This can help with some PMD implementations, with no penalty to upper layers which still assume 40.96 ns as in previously defined PHYs.

This can also be applied to the specifications of backplane PMDs. Although the physical length of the backplane is not specified, the existing medium delay matches the delay for cable assemblies, and the same numbers were used in previous backplane/cable PMDs. So a similar change should be made in 163.5.

These changes should also be applied in the new rows in tables 80-5 and 116-5.

SuggestedRemedy
 Change the maximum delay through the medium from "20 ns" to "14 ns" here, in 163.5, and in the new rows in tables 80-5 and 116-5.
 Proposed Response Response Status O

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Cl 162 SC 162.7 P134 L # 244

Ran, Adeel Intel
 Comment Type T Comment Status X

802.3cd added management registers for the control/status fields. The LP (Link Partner) registers are mapped in tables 162-5 and 162-6 so the link partner's training messages can be observed.

However, The PAM4 PMD training LD (Local Device) control and PAM4 PMD training LD status registers, defined in 45.2.1.137a and 45.2.1.138a respectively (Register 1.1120 through 1.1123 and Register 1.1420 through 1.1423), do not appear in tables 162-5 and 162-6. These registers allow control and observation of the local messages (visibility is required for both sides of the protocol).

These registers should be R/W or RO as listed in clause 45.

The LD mappings are also missing from clause 136, this should be considered in maintenance.

SuggestedRemedy

Add rows corresponding to registers in subclauses 45.2.1.137a and 45.2.1.138a.

Proposed Response Response Status O

Cl 162 SC 162.8.1 P136 L2 # 33

Dudek, Mike Marvell
 Comment Type E Comment Status X

The cable assembly specifications are in 162.11 not 162.10

SuggestedRemedy

Change the clause cross-reference from 162.10 to 162.11. Also on line 3 and line 19

Proposed Response Response Status O

Cl 162 SC 162.8.7 P137 L33 # 245

Ran, Adeel Intel
 Comment Type T Comment Status X

I wonder why lane-by-lane Tx disable is optional, when AN is mandatory and requires the ability to disable all but one lane. A PMD in a PHY that supports AN as specified must include implementation of LBLTD in some way.

Digging into history - LBLTD was mandatory in 10GBASE-KX4 but optional in all subsequent multi-lane PMDs... I don't know the reasoning. It seems to me that the MDIO implementation should be optional, but LBLTD should be mandatory, similar to the lane-by-lane signal detect in 162.8.5.

I am considering maintenance request for making it mandatory in existing PMD clauses that support AN. But I think this should better be initially discussed in 802.3ck.

Applies also to 163.8.9.

SuggestedRemedy

Remove the (optional) in the heading and change the text to make it mandatory.

Add a paragraph:

"If the MDIO interface is implemented, then PMD_transmit_disable_i shall be mapped to the corresponding PMD transmit disable i bit as specified in 45.2.1.8."

Proposed Response Response Status O

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CI 162 SC 162.8.11 P138 L22 # 246
 Ran, Adeel Intel
 Comment Type T Comment Status X
 The list of exceptions to the PMD control definition in 136.8.11 should include two more exceptions:
 In clause 136, Table 136–9 and Table 136–10 define the encoding for coefficient selection, between c(-2) and c(+1), but don't have an encoding for c(-3) which is required in 162.
 Also the text in 136.8.11.2.4 "Coefficient request" defines the effect of "no equalization" for c(-2) to c(+1) but does not mention c(-3).
SuggestedRemedy
 Add the following items:
 d) The Coefficient select bits in the Control field (Table 136–9) and the Coefficient select echo bits in the Status field (Table 136–10) have an additional combination, 1 0 1, for selecting c(-3).
 e) The "No equalization" value (see 136.8.11.2.4) of c(-3) is 0.
 Proposed Response Response Status O

CI 162 SC 162.8.11 P138 L32 # 247
 Ran, Adeel Intel
 Comment Type T Comment Status X
 The PMD control function as currently specified is only effective during start up.
 Operation across a wide range of temperatures in some environments may cause slow changes in channel and device characteristics that may require occasional changes of the Tx equalization, preferably without link flaps. It would be good to enable doing it while the link is up.
 In Data mode, the startup (training) protocol is inactive. We can specify that when mr_training_en set to 0, instead of exchanging the control and status fields through the protocol, these fields will be written to and read from management registers if MDIO is implemented. Management can relay the control and status fields to/from the link partner through higher level messaging (such as LLDP).
 A detailed proposal is planned, but the requested addition in the PMD clauses is a subclause for behavior of the PMD control function when training is false (data mode).
SuggestedRemedy
 Add the following paragraphs:
 When the training variable is set to false (see 136.8.11.7.1), the PMD control function may optionally continue using Equalization control as defined 136.8.11.4 in the SEND_DATA state, using MDIO registers or alternative methods to exchange control and status fields with the link partner instead of the training frame specified in 136.8.11.1.
 NOTE--When training is false, any update to variables corresponding to a change of the Modulation and precoding request bits or the Initial condition request bits, or to setting the Coefficient request bits to "No equalization", can be disruptive to a network.
 Proposed Response Response Status O

CI 162 SC 162.9.3 P139 L6 # 168
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 Transmitter BW is TBD
SuggestedRemedy
 Replace TBD with 39.8 GHz
 Proposed Response Response Status O

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CI 162 SC 162.9.3 P139 L27 # 3
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 ERL of 11 dB seems to capture most of posted channel data.
 SuggestedRemedy
 In table 162-8 change ERL(min) to 11 dB as suggested on slide 5 of mellitz_3ck_04_1119.
 Proposed Response Response Status O

CI 162 SC 162.9.3 P139 L31 # 6
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 TBD for Vf min may be determined since the baseline for device package was accepted. If Nv=200 is accepted for Vf then Vf min will be Av minus dc host and HCB losses.
 SuggestedRemedy
 Set the TBD Transmitter steady-state voltage, vf (min.) to 0.387 V as suggested for Av in mellitz_3ck_01b_0919
 Proposed Response Response Status O

CI 162 SC 162.9.3 P139 L34 # 8
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 TBD for the peak value of p(k) may be determined since the baseline for device package was accepted. If Nv=200 is accepted. If The peak value of p(k) in terms Vf may be determined based on the collection of posted channels as suggested in mellitz_3ck_01b_0919.
 SuggestedRemedy
 Change entry for the Linear fit pulse peak (min.) peak value to 0.397 x vf.
 Proposed Response Response Status O

CI 162 SC 162.9.3 P140 L8 # 248
 Ran, Adeel Intel
 Comment Type T Comment Status X
 The maximum step size for c(1) is 0.05, while for all other coefficient it is 0.02. From implementation point of view, there is no benefit from having c(1) with a larger step size than all others.
 Training algorithms can be made simpler if the steps are equal for all coefficients, so that decrements/increments in c(1) have the same effect on signal swing as other coefficients.
 SuggestedRemedy
 Change step size limits for c(1) to align with all other coefficients.
 Proposed Response Response Status O

CI 162 SC 162.9.3 P140 L9 # 35
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 The abs step size for c(1) max in table 162-8 is 0.05 which is different from the other taps but does match the value in the COM tab162-15 and is not specified in section 162.9.3.1.4. It is 0.02 in the C2C spec in 120F
 SuggestedRemedy
 Either Change 0.05 to 0.02 here and in table 162-15 and in 162.9.3.1.4 change "-3,-2 or -1" to "-3,-2,-1 or 1" (and make the equivalent change in clause 163 see separate comment) Or. Add an extra paragraph in 162.9.3.1.4 stating "When coef_sel is 1, the change in the normalized transmit equalizer coefficient c(coef_sel) corresponding to a request to "increment" shall be between 0.005 and 0.05, and the change in the normalized transmit equalizer coefficient c(coef_sel) corresponding to a request to "decrement" shall be between -0.05 and -0.005.
 Proposed Response Response Status O

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CI 162 SC 162.9.3 P140 L10 # 249

Ran, Adeel Intel
 Comment Type T Comment Status X

The maximum step size of 2% for a PAM4 equalizer creates a significant increase in complexity for a DAC-based transmitter implementation, compared to the step size allowed in the 802.3cd specs.

A PAM4 DAC with the 2.5% specification in 802.3cd is required to be able of outputting $6/0.025=240$ possible values, while with a 2% step size it requires $6/0.02=300$ possible values. This means an additional bit should be used in the logic implementing the FFE and DAC control, and the analog circuits should enable more combinations.

The estimated cost in power consumption of the FFE+DAC logic and analog circuits from this small change in resolution, with a non-naive design, is about 0.3-0.4 pJ/bit. This additional power is going to be consumed regardless of the channel in question.

The benefit from this finer resolution has not been analyzed thoroughly enough to justify such an increase in implementation burden and power consumption.

SuggestedRemedy

Change the (max.) values for c(-3) to c(0) to 0.024 (which can be met with a DAC capable of 256 output values).

Proposed Response Response Status O

CI 162 SC 162.9.3 P140 L20 # 251

Ran, Adeel Intel
 Comment Type T Comment Status X

SNDR (min) is currently TBD.

As an initial proposal for this value, I suggest re-using the values from 802.3cd: 32.5 dB for backplane/C2C and 32.2 dB for cable assembly.

The effect of SNDR is known so further analysis is not required. These values are more challenging to meet and to measure at 53 GBd, but it should not be impossible.

SuggestedRemedy

Change SNDR from TBD to values in the comment, here and in 163.9.2.

Proposed Response Response Status O

CI 162 SC 162.9.3 P140 L20 # 250

Ran, Adeel Intel
 Comment Type T Comment Status X

The reference for SNDR (min) is 120D.3.1.6. The method there includes a reference to the linear fit procedure in 120D.3.1.3, which has $D_p=2$ and coefficient calculations (in 92.8.3.5.1) suitable for a 3-tap equalizer. An exception should be made to use the fitting procedure in 162.9.3.1.1 (which is suitable for a 5-tap equalizer) instead. A table footnote can be used.

A similar change may also be required in clauses 136 and 137 (maintenance).

SuggestedRemedy

Add the following sentence as a footnote to the referenced subclause:

The measurement uses the method described in 120D.3.1.6 with the exception that the linear fit procedure in 162.9.3.1.1 is used.

Proposed Response Response Status O

CI 162 SC 162.9.3 P140 L24 # 252

Ran, Adeel Intel
 Comment Type T Comment Status X

Maximum for even-odd jitter is specified here. This is mainly required for transmitters which are driven by a half-rate clock.

For >53.1 GBd signaling, a >26.3 GHz clock is needed to drive the transmitter clock in half-rate. This is a high frequency for current CMOS processes and implementations with quarter-rate clocking (13.3 GHz clock) should be considered.

With quarter-rate signaling, even if the even-odd jitter (mismatches between phases 0:2 and between 1:3) is controlled to meet the specifications, the quadrature jitter (mismatches between phases 0:1 and between 2:3) can be large, and the current even-odd jitter measurements do not cover this impairment.

We need to limit quadrature jitter so a similar portion of the UI.

New specification for quadrature jitter will be provided in future contributions. I assume it will be similar to the EOJ measurement with slight modifications. For the time being the measurement method can be left as TBD.

SuggestedRemedy

Add a line for "Quadrature jitter, Pk-Pk", with subclause reference TBD, and value 0.019 UI.

Proposed Response Response Status O

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CI 162 SC 162.9.3 P141 L 39 # 253
 Ran, Adee Intel
 Comment Type T Comment Status X
 The addition of coefficient c(-3) requires several changes in the fitting procedure:

1. D_p should be changed from 3 to 4
2. The dimensions of R_m should be M*N_p-by-5 (instead of by-4)
3. l runs from -3 to 1 (instead of -2 to 1)
4. In equation 162-1, the left-hand term should be R_m(j, i+4) (instead of i+3).

SuggestedRemedy
 Change per comment.
 Proposed Response Response Status O

CI 162 SC 162.9.3.1.1 P141 L 50 # 34
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 There are three pre-cursors.
 SuggestedRemedy
 Change "-2 to 1" to "-3 to 1"
 Proposed Response Response Status O

CI 162 SC 162.9.3.1.2 P142 L 38 # 5
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 TBD for Vf min may be determined since the baseline for device package was accepted. If Nv=200 is accepted for Vf then Vf min will be Av minus dc host and HCB losses.
 SuggestedRemedy
 Set the TBD Vf min 0.387 V as suggested for Av in mellitz_3ck_01b_0919
 Proposed Response Response Status O

CI 162 SC 162.9.3.1.2 P142 L 38 # 4
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 The dependence of Vf on Nv is has proved to be confusing. Since we specify that ratio of Pmax to Vf there really is no good reason not to make Nv more like a real steady state voltage. See Mellitz_3ck_01b_0919 for reference.
 SuggestedRemedy
 Add exception in the exception list for this subclause setting Nv to 200 for the determination of Vf.
 Refer to clause "136.9.3.1 Transmitter output waveform" : Change k = -2 to 1 to k = -3 to 1
 Refer to clause "120D.3.1.3 Linear fit to the measured waveform": Change Dp= 3 to Dp= 4
 See Mellitz_3ck_01b_0919 for reference.
 Proposed Response Response Status O

CI 162 SC 162.9.3.1.2 P142 L 42 # 7
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 TBD for the peak value of p(k) may be determined since the baseline for device package was accepted. If Nv=200 is accepted. If The peak value of p(k) in terms Vf may be determined based on the collection of posted channels as suggested in mellitz_3ck_01b_0919.
 SuggestedRemedy
 Change to line 42 to: The peak value of p(k) shall be greater than 0.397 x vf after the transmit equalizer initial condition has been set to preset 1 (no equalization). See slide 15 mellitz_3ck_01b_0919
 Proposed Response Response Status O

CI 162 SC 162.9.3.1.2 P142 L 42 # 254
 Ran, Adee Intel
 Comment Type E Comment Status X
 Missing space after v_f
 SuggestedRemedy
 Add space.
 Proposed Response Response Status O

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Cl 162 SC 162.9.3.1.3 P143 L5 # 255
 Ran, Adeel Intel
 Comment Type T Comment Status X
 The tolerances in Table 162-9 should correspond to the maximum step size of each coefficient in Table 162-8.
 Currently all should be +/-0.02 except c(1) which is 0.05 (but subject to another comment may also be 0.02).
 SuggestedRemedy
 Change all values after the +/- signs per comment.
 Proposed Response Response Status O

Cl 162 SC 162.9.3.1.4 P143 L15 # 256
 Ran, Adeel Intel
 Comment Type T Comment Status X
 "When coef_sel is -3, -2, or -1, (...) between 0.005 and 0.02"
 According to Table 162-8 c(0) has the same maximum step size. c(1) subject to another comment may be changed to also have the same maximum.
 SuggestedRemedy
 Change "or -1" to "-1, or 0".
 If my other comment is accepted, also add 1 to the list.
 Proposed Response Response Status O

Cl 162 SC 162.9.3.1.4 P143 L20 # 257
 Ran, Adeel Intel
 Comment Type T Comment Status X
 "When coef_sel is 0, the change in the normalized transmit equalizer coefficient c(-2)"
 Should be "coef_sel is 1" and "coefficient c(+1)". But I suggest in another comment to make c(1) have the same steps as all others.
 SuggestedRemedy
 If my other comment is accepted, delete this paragraph. Otherwise, change per comment.
 Proposed Response Response Status O

Cl 162 SC 162.9.3.1.5 P143 L39 # 36
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 The max/min values in this section need to match those in table 162-8 and those in the COM table 162-15
 SuggestedRemedy
 on line 39 change -0.25 to -0.2, on line 42 change -0.25 to -0.34, on line 46 change 0.1 to 0.12.
 Proposed Response Response Status O

Cl 162 SC 162.9.3.1.5 P143 L49 # 258
 Ran, Adeel Intel
 Comment Type T Comment Status X
 This paragraph specifies the maximum value of c(-3) when it is set to the minimum setting.
 But the text says
 "and c(-2) having received sufficient "increment" requests so that it is at its maximum value"
 which is incorrect.
 SuggestedRemedy
 Change to
 "and c(-3) having received sufficient "decrement" requests so that it is at its minimum value".
 Proposed Response Response Status O

Cl 162 SC 162.9.3.4 P144 L18 # 37
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 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 TP2 test fixture" to from the measurement point TP2 to the beginning of the TP2 test fixture MDI connector". Make the equivalent change in section 162.9.4.5 for the Receiver ERL.
 Proposed Response Response Status O

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CI 162 SC 162.9.3.4 P144 L26 # 9
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 The relation between Pmax/Vf and ERL has not been established for this data rate
 SuggestedRemedy
 Change line 36 to ERL >= 11 dB. Change TBD parameters in table 162-10 beta_x, rho_x, N, and N_bx to 2.4 GHz, 0.3, 1000 UI, and 12 UI respectively as suggested on slide 6 of mellitz_3ck_04_1119.
 Proposed Response Response Status O

CI 162 SC 162.9.4 P145 L15 # 10
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 ERL of 11 dB seems to capture most of posted channel data as suggested in slide 5 mellitz_3ck_04_1119
 SuggestedRemedy
 Change ERL min to 11 dB
 Proposed Response Response Status O

CI 162 SC 162.9.4.3.1 P146 L9 # 169
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 Replace IL TBD test case 1
 SuggestedRemedy
 Min=19.84 dB, Max=21.84 dB, Delta Loss Between Test channel and cable assembly = 2(10.975-6.6)
 Proposed Response Response Status O

CI 162 SC 162.9.4.3.1 P146 L9 # 170
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 Replace IL TBD test case 2
 SuggestedRemedy
 Min=28 dB, Max=29 dB
 Proposed Response Response Status O

CI 162 SC 162.9.4.3.3 P146 L37 # 38
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 Table 162-12 only provides the COM value not all the parameters.
 SuggestedRemedy
 Change to the equivalent wording of clause 136 "The COM parameters are as modified by Table 162-12."
 Proposed Response Response Status O

CI 162 SC 162.9.4.3.5 P147 L1 # 259
 Ran, Adeel Intel
 Comment Type E Comment Status X
 "per-lane FEC symbol error counters (see 91.6)"
 this refers to RS-FEC, but RS-FEC-Int can be used instead.
 SuggestedRemedy
 Change to "per-lane FEC symbol error counters (see 91.6 or 161.6)".
 Proposed Response Response Status O

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CI 162 SC 162.9.4.5 P148 L48 # 11
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 ERL of 11 dB seems to capture most of posted channel data as suggested in slide 5 mellitz_3ck_04_1119
 SuggestedRemedy
 Change to "Receiver ERL at TP3 shall be greater than or equal to 11dB"
 Proposed Response Response Status O

CI 162 SC 162.11.3 P150 L8 # 13
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 ERL of 13.5 dB seems to capture most of posted channel data as suggested in slide 3 mellitz_3ck_04_1119
 SuggestedRemedy
 Change Minimum cable assembly ERL to 13.5 dB in table 162-13.
 Proposed Response Response Status O

CI 162 SC 162.11 P149 L26 # 39
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 Sentence does not make sense.
 SuggestedRemedy
 Delete "The are" if other MDI's are allowed, or just delete "are" if the MDI's are restricted to those in Annex 162C
 Proposed Response Response Status O

CI 162 SC 162.11.3 P150 L22 # 40
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 The delay being removed from the measurement should be better specified.
 SuggestedRemedy
 Change "delay associated with the specific cable assembly test fixture" to "delay from Tp1 or TP4 to the connector of the specific cable assembly test fixture"
 Proposed Response Response Status O

CI 162 SC 162.11.2 P150 L3 # 79
 Palkert, Tom Molex
 Comment Type T Comment Status X
 Differential to common-mode return loss, Differential to common mode conversion loss and Common-mode to common-mode return loss are not required if ERL and COM are used to specify Cable Assembly characteristics.
 SuggestedRemedy
 Delete Differential to common-mode return loss, Differential to common mode conversion loss and Common-mode to common-mode return loss from Table 162-13 (Cable assembly characteristics summary)
 Proposed Response Response Status O

CI 162 SC 162.11.3 P150 L39 # 12
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 ERL of 13.5 dB seems to capture most of posted channel data as suggested in slide 3 mellitz_3ck_04_1119
 SuggestedRemedy
 Change line 39 to Cable assembly ERL at TP1 and at TP4 shall be greater than or equal to 13.5 dB for cable assemblies that have a COM less than 4 dB. Also change TBD parameters in table 162-14 beta_x, rho_x, N, and N_bx to 2.4 GHz, 0.21, 3000 UI, and 12 UI respectively as suggested on slide 4 of mellitz_3ck_04_1119.
 Proposed Response Response Status O

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CI 162 SC 162.11.4 P150 L43 # 260

Ran, Adee Intel
 Comment Type T Comment Status X

The conversion parameter specifications were defined in clause 92 and re-used for all the cable assembly specs at rates where the Nyquist frequencies were about 13 GHz. This project needs new specs for the first time since 802.3bj.

My proposal in the suggested remedy creates similar shapes but with frequencies scaled by approximately the signaling rate ratio ($2 \cdot 68/66$).

If this proposal is not accepted, numbers can be left as TBDs and figures can be empty as placeholders.

SuggestedRemedy

Copy the text and equations from clause 92 and apply the following changes:

D2CRL (162.11.4): based on equation 92-28 changing frequencies: 25.78 to 53.135, 12.89 to 26.5625, and 19 to 39.

D2CCL (162.11.5): based on equation 92-29 changing frequencies: 12.89 to 26.5625, 15.7 to 32.4 and 19 to 40.

C2CRL (162.11.6): based on equation 92-30 (2 dB) changing frequencies: 19 to 40.

Add Figures with updated graphs.

Proposed Response Response Status O

CI 162 SC 162.11.7 P151 L24 # 200

Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X

COM table and analysis does not include penalty due to burst error, current COM code on some wired channel

SuggestedRemedy

http://www.ieee802.org/3/ck/public/19_03/anslow_3ck_01_0319.pdf page has 2 dB of SNR penalty with pre-coding on for tap weights [0.85, 0.05, 0.25, -0.05, 0.15], the Anslow analysis showed that non of the 115 channels would be as bad but how can we guarantee some wired channel will not in the mix that passes 3 dB COM but would fail due to burst error? Assuming there is interest we can bring a proposal in future task force meeting for an analytical burst error estimator that can be added to COM.

Proposed Response Response Status O

CI 162 SC 162.11.7 P152 L33 # 14

Mellitz, Richard Samtec
 Comment Type TR Comment Status X

To move forwards a value for SNR_Tx needs to be chosen

SuggestedRemedy

Replace TBD with 32 dB as in slide 8 of mellitz_3ck_03_1119, slide 9 of lim_3ck_01_1119 in Table 162-15.

Proposed Response Response Status O

CI 162 SC 162.11.7 P152 L38 # 150

Dawe, Piers Mellanox
 Comment Type TR Comment Status X

Slide 6 of heck_3ck_01_0919 shows that the DFE taps are never strongly negative, yet the draft would allow such untypical/hypothetical channels.

SuggestedRemedy

Remember that a tap weight limit isn't a hard pass-fail limit; channels can go outside it but don't get a free pass for the excess ISI noise that they cause, and that cable channels are smoother than backplane channels.

Add a minimum tap weight limit of -0.03 or greater for all taps, including the floating taps.

Proposed Response Response Status O

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CI 162 SC 162.11.7 P152 L 39 # 261

Ran, Adeo Intel
 Comment Type T Comment Status X

b_max(n) for n=2 was changed from the baseline proposal value 0.2 to 0.3. This change was accepted by Motion #13 in the November 2019 meeting without sufficient technical discussion on the benefits or costs. According to the minutes there was only 6 minutes of discussion just before the meeting closing time, and the motion was not announced beforehand.

The original 0.2 was the value which was used in all presentations and made the candidate channels work.

Allowing a large coefficient such as 0.3 for n=2 combined with the even higher limit (0.85) for n=1 results in a situation that the ISI the DFE has to cope with is >100% of the desired signal. This means that the receiver needs to have large dynamic ranges and low internal noises (including detection sensitivity). These parameters are not included in COM, but the implications are becoming impractical for real implementations, especially ADC/DSP based ones which are considered likely.

In order to match channel compliance with actual operation, we should make the reference receiver close to the expected performance of actual implementation, and not make it too capable. Real receivers will likely use linear equalization (Tx or CTLE) to cope with most of the loss-related ISI. If the reference Tx equalization and CTLE leave too much ISI, maybe they should be made more flexible and capable, rather than leave the ISI to a DFE with large taps. For example, we could add another zero-pole pair in the CTLE or another coefficient in the Tx.

This change was hasty and should be reverted, until a technical discussion (that did not take place in November) is conducted, including options, benefits and consequences.

SuggestedRemedy

Set b_max(2) back to 0.2.

Proposed Response Response Status O

CI 162 SC 162.11.7 P152 L 45 # 151

Dawe, Piers Mellanox
 Comment Type TR Comment Status X

40 UI span was chosen to fit data on backplane channels, and is excessive even for them. Cable channels are smoother. Very short low loss cables should pass easily anyway.

SuggestedRemedy

Change 40 to an appropriate number, e.g. 24.

Proposed Response Response Status O

CI 162 SC 162.11.7 P152 L 48 # 149

Dawe, Piers Mellanox
 Comment Type TR Comment Status X

This DFE floating tap tail root-sum-of-squares limit is 0.03. For the worst of 7 borderline channels in kasapi_3ck_01_1119 slide 12 (kareti1, which is an outlier and probably should not be supported), the value is 0.022. Even for this channel with the most unlucky combination of package lengths including out-of-scope ones, it's <= 0.025 (slide 13). We should not encourage even worse channels than this, such as the failing channels on slides 16-17, and cable channels are smoother than backplane channels.

SuggestedRemedy

Remember that this parameter isn't a hard pass-fail limit; channels can exceed the limit but don't get a free pass for the excess ISI noise that they cause. Change 0.03 to 0.02 or less.

Proposed Response Response Status O

CI 162 SC 162.11.7 P152 L 48 # 262

Ran, Adeo Intel
 Comment Type T Comment Status X

The bound on sigma_tmax is practically making the DFE floating taps not worth implementing. Which is a good thing, because the power cost of this method is prohibitive with the very challenging power budgets demanded by real applications, and it requires automatic optimization of the placement of taps - another challenge that may not be easy to handle in practice.

The reference receiver should represent a minimum receiver implementation. A floating-tap DFE as modeled here isn't what a minimum implementation will likely have, and most practical future channels will not need it. Therefore it should not be included in the reference receiver.

Applications that need better receivers may look for better than minimum ones, for example, ones that implement floating taps (since that seems to solve a specific problem), or that need less than 3 dB of COM.

SuggestedRemedy

Remove the floating tap banks from the reference receiver - including the new parameters related to it and all the new text in 93A.1.6.

Proposed Response Response Status O

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Cl 162 SC 162.11.7 P152 L 50 # 171
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 The DFE taps for RSS is on different line and not clear
 SuggestedRemedy
 Combine the requirement of DFE location and RSS limit in the single line. Here is a suggested wording "DFE floating tail taps [25-40] root-sum-of-squares limit
 Proposed Response Response Status O

Cl 162 SC 162.11.7 P153 L 4 # 15
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 Eta_0 needs to include the effects of host NEXT noise. Thus cannot be the same as for KR COM.
 SuggestedRemedy
 Replace 8.2e-9 V²/GHz with 9e-9 V²/GHz as in slide 8 of mellitz_3ck_03_1119 ans slide 9 of lim_3ck_01_1119 in Table 162-15.
 Proposed Response Response Status O

Cl 162 SC 162.11.7 P153 L 6 # 146
 Dawe, Piers Mellanox
 Comment Type T Comment Status X
 One-sided noise spectral density of 8.2e-9 V²/GHz is extremely aggressive and optimistic, being half that for 50GBASE-CR, and was chosen to make particular backplane channels with issues pass COM. As high loss cable channels are smoother than backplanes, we should not be so desperate in this clause.
 SuggestedRemedy
 Change to 1e-8, which is 61% of 50GBASE-CR.
 Proposed Response Response Status O

Cl 162 SC 162.11.7.1 P153 L 28 # 16
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 Fill in Zp TBD's with data from slide 8 of benartsi_3ck_01a_0719.
 SuggestedRemedy
 Change Line 28ff to Equation (93A-13) and Equation (93A-14) using zp = 110.3 mm in length and the parameter values given in {new table}, with the exception that Zc is 100 Ω, representing an insertion loss of 4.33 dB at 26.56 GHz on each PCB
 Proposed Response Response Status O

Cl 162 SC 162.11.7.1 P153 L 28 # 17
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 add {new table for 93A transmission line with data from slide 8 of benartsi_3ck_01a_0719.
 SuggestedRemedy
 gamma0, a1, a2 = [0 3.8206e-04 9.5909e-05]; tau=5.790E-03 ns/mm
 Proposed Response Response Status O

Cl 162 SC 162.11.7.2 P153 L 51 # 18
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 Fill in TBD's with data from slide 8 of benartsi_3ck_01a_0719.
 SuggestedRemedy
 use same data as for signal path
 Proposed Response Response Status O

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CI 162 SC 162.14.4.2 P159 L 23 # 263
 Ran, Adee Intel
 Comment Type T Comment Status X
 In Item PC4, The reference should be 162.8.11 and the value/comment should include the exceptions listed in 162.8.11 for including c(-3).
 Item PC5 has a reference to a subclause in 162 that does not exist 0 it should point to clause 136.
 SuggestedRemedy
 Per comment.
 Proposed Response Response Status O

CI 162 SC 162.14.4.5 P160 L 50 # 264
 Ran, Adee Intel
 Comment Type E Comment Status X
 In item CA3, spaces should be inserted between numbers and units.
 SuggestedRemedy
 Per comment.
 Proposed Response Response Status O

CI 162A SC 162A.5 P231 L 20 # 205
 Kocsis, Sam Amphenol
 Comment Type ER Comment Status X
 Eq. 162A-1 defines Ilchmax using Ilcamax, but Eq. 162A-2 defines ILch0.5m using Ilcamin.
 SuggestedRemedy
 Change notation of "ILch0.5m" to be "ILchmin"
 Proposed Response Response Status O

CI 162A SC 162A.5 P231 L 47 # 206
 Kocsis, Sam Amphenol
 Comment Type TR Comment Status X
 Table 162A-1, Parameter Ilcamin is based on an incorrect assumption from diminico_3ck_01a_0719. ILch0.5m is derived from Ilcamin, so it is also invalid.
 SuggestedRemedy
 Change Ilcamin to TBD, pending future contribution recommendation and motion. Change ILch0.5m to TBD, pending future contribution recommendation and motion.
 Proposed Response Response Status O

CI 162A SC 162A.5 P232 L 10 # 203
 Kocsis, Sam Amphenol
 Comment Type TR Comment Status X
 Figure 162A-1 has "MCB Via" included in the MCB allocated budget of 2.3dB.
 SuggestedRemedy
 Remove the markers including the "MCB Via" in the MCB allocated budget of 2.3dB. There is an additional 0.2dB via allowance for an MCB implementation, per adopted diminico_3ck_01a_0719 contribution.
 Proposed Response Response Status O

CI 162A SC 162A.5 P232 L 30 # 204
 Kocsis, Sam Amphenol
 Comment Type TR Comment Status X
 Figure 162A-1 has an incorrect note regarding the MCB implementation
 SuggestedRemedy
 Change wording, per adopted diminico_3ck_01a_0719 contribution. "NOTE - MCB PCB includes test point IL. Allowance for MCB via IL is 0.2dB.
 Proposed Response Response Status O

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CI 162A SC 162a.5 P232 L32 # 80
 Palkert, Tom Molex
 Comment Type T Comment Status X
 Need to clarify that insertion loss values include the sma connector on the compliance board
 SuggestedRemedy
 Add a note or modify diagrams in Fig 162A-1 to make it clear that insertion loss values include loss of sma connectors on compliance boards.
 Proposed Response Response Status O

CI 162B SC 162B.1.3 P235 L28 # 67
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 It is confusing to just refer to 92.11.3 where there are multiple specifications that don't apply.
 SuggestedRemedy
 Change to "92.11.3 as modified by 162B.1.3.1 to 162B.1.3.6"
 Proposed Response Response Status O

CI 162B SC 162B.1.1.1 P234 L46 # 183
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 The test fixture PCB frequency max of 40 GHz too low
 SuggestedRemedy
 Replace 40 GHz with 53 GHz
 Proposed Response Response Status O

CI 162B SC 162B.1.3.1 P235 L32 # 185
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 Mated text fixture loss need slight adjustment and min and max loss TBD need to be replaced with proposed limits
 SuggestedRemedy
 Nom IL=
 $0.9503 \cdot (0.471 \cdot \sqrt{A3} + 0.141 \cdot A3 + 0.0012 \cdot A3^2)$
 Max Loss= $(0.1 + 0.471 \cdot \sqrt{f} + 0.141 \cdot f) \times 0.9503 \text{ dB}$ $0.01 \leq f \leq 26.55 \text{ GHz}$
 $6.905 + 0.562 \cdot f$ $26.55 < f \leq 50 \text{ GHz}$
 MIN IL = $(0.0656 \cdot \sqrt{A2} + 0.164 \cdot A2)$
 See ghiasi_3ck_01_0120
 Proposed Response Response Status O

CI 162B SC 162B.1.2.1 P225 L46 # 184
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 The test fixture PCB frequency max of 40 GHz too low
 SuggestedRemedy
 Replace 40 GHz with 53 GHz
 Proposed Response Response Status O

CI 162B SC 162B.1.3.2 P237 L35 # 188
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 Differential return loss is TBD
 SuggestedRemedy
 DRL= $20 - 9 \cdot f$ from $0.01 < f \leq 3.1 \text{ GHz}$
 = $18 - 0.32 \cdot f \text{ dB}$ $3.1 \text{ GHz} < f \leq 32.5 \text{ GHz}$
 = 5 dB $32.5 < f \leq 50 \text{ GHz}$
 see ghiasi_3ck_01_0120
 Proposed Response Response Status O

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CI 162B SC 162B.1.3.3 P237 L1 # 129
 Brown, Matt Huawei Technologies Canada
 Comment Type T Comment Status X
 What is meant by common-mode conversion insertion loss? Is this common-mode to differential insertion loss?
 SuggestedRemedy
 Change "common-mode conversion insertion loss" to "common-mode to differential insertion loss". 4 instances
 Proposed Response Response Status O

CI 162B SC 162B.1.3.5 P237 L30 # 187
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 Common mode to differential transfer is TBD
 SuggestedRemedy
 $CMCIL=30+0.935*f$ from $0.01 < f \leq 15$ GHz
 $= 16$ dB 15 GHz $< f \leq 50$ GHz
 see ghiasi_3ck_01_0120
 Proposed Response Response Status O

CI 162B SC 162B.1.3.4 P237 L32 # 130
 Brown, Matt Huawei Technologies Canada
 Comment Type T Comment Status X
 No units specified.
 SuggestedRemedy
 Change "common-mode return loss" to "common-mode return loss in dB".
 Proposed Response Response Status O

CI 162B SC 162B.1.3.6 P239 L20 # 131
 Brown, Matt Huawei Technologies Canada
 Comment Type T Comment Status X
 In Table 162B-4, there are a few issues with the second column. The table title indicates that the table is for integrated crosstalk noise for multi-lane mated test fixture; so the title of the second column should be "Value" or similar. The values specified include text "less than"; this is typically indicated with the text "(max.)" in the parameter column.
 SuggestedRemedy
 Change the title of column 2 to "Value".
 For the values in column 2 remove "less than".
 For each parameter in column 1 add "(max.)".
 Proposed Response Response Status O

CI 162B SC 162B.1.3.5 P237 L30 # 186
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 Common mode to differential RL is TBD
 SuggestedRemedy
 $CMDRL=30+30*f/25.78$ from $0.01 < f \leq 12.89$ GHz
 $= 17.85+0.225*f$ dB 12.89 GHz $< f \leq 35$ GHz
 $= 10$ dB $35 < f \leq 50$ GHz
 see ghiasi_3ck_01_0120
 Proposed Response Response Status O

CI 162C SC 162C P242 L14 # 207
 Kocsis, Sam Amphenol
 Comment Type ER Comment Status X
 The adopted baseline at
["http://www.ieee802.org/3/ck/public/18_09/palkert_3ck_01_0918.pdf"](http://www.ieee802.org/3/ck/public/18_09/palkert_3ck_01_0918.pdf) should include relevant details from
["http://www.ieee802.org/3/ck/public/18_09/mcsorley_3ck_01a_0918.pdf"](http://www.ieee802.org/3/ck/public/18_09/mcsorley_3ck_01a_0918.pdf) for the DSFP MDI
 SuggestedRemedy
 Update Table162C-3, with details in Sheet1
 Proposed Response Response Status O

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Cl 162C SC 162C.1 P243 L5 # 68
 Dudek, Mike Marvell
 Comment Type E Comment Status X
 Incorrect references
 SuggestedRemedy
 Change 146.9 and 146.10 to 162.9 and 162.10
 Proposed Response Response Status O

Cl 162C SC 162C.1 P243 L12 # 28
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 The TBD in the title of table 162C-2 isn't necessary (compare table 136C-2)
 SuggestedRemedy
 Delete the (TBD) in the title of table162C-2
 Proposed Response Response Status O

Cl 162C SC 162C.2.5 P249 L41 # 29
 Dudek, Mike Marvell
 Comment Type E Comment Status X
 Wrong reference
 SuggestedRemedy
 Change Table 136C-3 to Table 162C-3. Also on page 250 line 43
 Proposed Response Response Status O

Cl 163 SC 163 P162 L13 # 265
 Ran, Adeel Intel
 Comment Type T Comment Status X
 Too many comments already just from reviewing 162.
 SuggestedRemedy
 Apply changes from accepted comments against clause 162 to clause 163 where necessary, and vice versa.
 Proposed Response Response Status O

Cl 163 SC 163.1 P162 L15 # 134
 Brown, Matt Huawei Technologies Canada
 Comment Type T Comment Status X
 Tables 163-1 list two FEC types (RS-FEC and RS-FEC-Int) that might be used by a 100GBASE-KR1 PHY, but never explains the criteria for selecting one or the other, how that selection is made, nor the implications (e.g., conversion from RS-FEC to RS-FEC-Int).
 SuggestedRemedy
 Add a subclause to explain the relationship of the two FEC types, how an FEC type is selected, and the implications of the selection. Reference to a similar subclause in Clause 162 might be sufficient.
 Proposed Response Response Status O

Cl 163 SC 163.1 P162 L15 # 138
 Brown, Matt Huawei Technologies Canada
 Comment Type T Comment Status X
 In Table 163-1, the Clause 161 RS-FEC-Int is specified as TBD rather than Required or Optional in the second column.
 SuggestedRemedy
 Specify RS-FEC-Int as either "Optional" or "Required".
 Proposed Response Response Status O

Cl 163 SC 163.1 P163 L32 # 41
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 The inverse RS-FEC is also required to change between RS-FEC (528,514) and RS-FEC (544,514)
 SuggestedRemedy
 Add to footnote b. "and between RS-FEC (528,514) and RS-FEC (544,514)"
 Proposed Response Response Status O

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Cl 163 SC 163.1 P165 L11 # 42
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 This paragraph is for 400G as well.
 SuggestedRemedy
 Change "200GAUI-n" to "200GAUI-n or 400GAUI-n" (this is how this is done in clause 162)
 Proposed Response Response Status O

Cl 163 SC 163.2 P165 L33 # 43
 Dudek, Mike Marvell
 Comment Type T Comment Status X
 FEC is also used in "FEC symbol error rate" etc. where it also refers to the FEC within the 200 and 400G PCS.
 SuggestedRemedy
 Add to the sentence "for 100GBASE-KR1 or the RS-FEC within the Clause 119 PCS for 200GBASE-KR2 and 400GBASE-KR4".
 Proposed Response Response Status O

Cl 163 SC 163.9.1 P169 L25 # 172
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 TP0 upper frequency for equation 93-1 and 93-2 is TBD
 SuggestedRemedy
 Replace TBD with 50 GHz and following equatiions

$$RLd(f) \geq \begin{cases} (20-f) \text{ dB} & 0.05 \leq f \leq 5 \text{ GHz} \\ 15 \text{ dB} & 5 < f \leq 25 \text{ GHz} \\ 22.5 - 0.3f \text{ dB}, & 25 < f \leq 50 \text{ GHz} \end{cases}$$

$$llref(f) = -0.0015 + 0.1\sqrt{f} + 0.035f \quad 0.05 \leq f \leq 50 \text{ GHz}$$
 See ghiasi_3ck_01_0120.pdf
 Proposed Response Response Status O

Cl 163 SC 163.9.1 P169 L26 # 19
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 Figure 93-3 and Figure 93-4 are not appropriate for the Nyquist sampling frequency and baud rate. Moving from 25 Gbps NRZ to 50 Gbps only incrementally changed the Nyquist frequency. 100 Gbps doubles it. In addition, specifying device fixtures to around 60 GHz may have new challenges which need to be comprehended in the standard
 SuggestedRemedy
 Either re-write 93-8.1.1 in terms of probational to Fb or replace 163.9.1 with new equations and figures. See presentation
 Proposed Response Response Status O

Cl 163 SC 163.9.1 P169 L30 # 173
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 TP5 upper frequency for equation 93-1 and 93-2 is TBD
 SuggestedRemedy
 Replace TBD with 50 GHz and following equatiions

$$RLd(f) \geq \begin{cases} (20-f) \text{ dB} & 0.05 \leq f \leq 5 \text{ GHz} \\ 15 \text{ dB} & 5 < f \leq 25 \text{ GHz} \\ 22.5 - 0.3f \text{ dB}, & 25 < f \leq 50 \text{ GHz} \end{cases}$$

$$llref(f) = -0.0015 + 0.1\sqrt{f} + 0.035f \quad 0.05 \leq f \leq 50 \text{ GHz}$$
 See ghiasi_3ck_01_0120.pdf
 Proposed Response Response Status O

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CI 163 SC 163.9.2 P170 L10 # 25

Mellitz, Richard Samtec
 Comment Type TR Comment Status X

The dependence of Vf on Nv is has proved to be confusing. The result is that a single device with a C2C and KR transmitter may have two specification which is confusing for performing tests. Since we specify that ratio of Pmax to Vf there really is no good reason no to make Nv more like a real steady state voltage. See Mellitz_3ck_01b_0919 for reference.

SuggestedRemedy

Add a subsection detailing "Transmitter output waveform" similar to 163.9.3.1. Add exception and exception list for this subclause setting Nv to 200 for the determination of Vf. Refer to clause "136.9.3.1 Transmitter output waveform" : Change k = -2 to 1 to k = -3 to 1 Refer to clause "120D.3.1.3 Linear fit to the measured waveform": Change Dp= 3 to Dp= 4 See Mellitz_3ck_01b_0919 for reference.

Proposed Response Response Status O

CI 163 SC 163.9.2 P170 L18 # 44

Dudek, Mike Marvell
 Comment Type T Comment Status X

See a comment on the abs step size for c(1) max in table 162-8 suggesting a possible change to the value from 0.02 to 0.05

SuggestedRemedy

If the change is made in clause 162 then Change 0.05 to 0.02 here and on line 52 page 174 in the COM table.

Proposed Response Response Status O

CI 163 SC 163.9.2 P170 L30 # 45

Dudek, Mike Marvell
 Comment Type T Comment Status X

In footnote b "The loss of the host channel doesn't make sense as there is no "host" fot the backplane.

SuggestedRemedy

Change "Loss of host channel" to "loss of Transmitter package and TP0 to TP0a test fixture."

Proposed Response Response Status O

CI 163 SC 163.9.2.1 P171 L5 # 20

Mellitz, Richard Samtec
 Comment Type TR Comment Status X

Nbx=Nb has been shown not correlate well to COM in mellitz_3ck_adhoc_02_100219. Nbx=24 seems to be a better choice

SuggestedRemedy

Change "Nbx is set to the value of Nb in Table 163-10" to "Nbx is set to 24 UI"

Proposed Response Response Status O

CI 163 SC 163.9.2.1 P171 L5 # 69

Wu, Mau-Lin MediaTek
 Comment Type T Comment Status X

Current ERL calculation doesn't consider DFE "floating-tap". The concern is the ERL is very sensitive across "N_bx" boundary as raised in wu_3ck_02a_1119. We need to enhance ERL calculation methodology.

SuggestedRemedy

Modify ERL as capable of DFE floating tap as proposed in wu_3ck_01_0120. The same methodology shall be applied to CR TX, CR RX, KR TX, & KR RX ERL calculations in the following subclauses.
 162.9.3.4 Transmitter effective return loss (ERL) 162.9.4.5 Receiver ERL
 163.9.2.1 Transmitter ERL
 163.9.3 Receiver characteristics

Proposed Response Response Status O

CI 163 SC 163.9.2.1 P171 L10 # 21

Mellitz, Richard Samtec
 Comment Type TR Comment Status X

Table 163-3 was developed for a different data rate and reference package assumption. Recommendation were proposed in mellitz_3ck_01_1119 slide 7.

SuggestedRemedy

In Table 163-3 set: beta_x=2.4 GHz , rho_x=.3

Proposed Response Response Status O

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CI 163 SC 163.9.3.1 P171 L44 # 22
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 Nbx=Nb has been shown not correlate well to COM in mellitz_3ck_adhoc_02_100219.
 Nbx=24 seems to be a better choice
 SuggestedRemedy
 Change "Nbx is set to the value of Nb in Table 163-10" to "Nbx is set to 24 UI"
 Proposed Response Response Status O

CI 163 SC 163.10 P174 L14 # 201
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 COM table and analysis does not include penalty due to burst error, current COM code on some weired channel
 SuggestedRemedy
http://www.ieee802.org/3/ck/public/19_03/anslow_3ck_01_0319.pdf page has 2 dB of SNR penalty with pre-coding on for tap weights [0.85, 0.05, 0.25, -0.05, 0.15], the Anslow analysis showed that non of the 115 channels would be as bad but how can we gurantee some weired channel will not in the mix that passes 3 dB COM but would fail due to burst error? Assuming there is interest we can bring a proposal in future task force meeting for an analytical burst error estimator that can be added to COM.
 Proposed Response Response Status O

CI 163 SC 163.10 P175 L25 # 23
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 SNR_Tx of 33 dB has been used for much recent data presented in the ad-hocs, plenaries, and interima for making decisions. No new data have been presented otherwise.
 SuggestedRemedy
 Change the TBD for SNR_Tx to 33 dB.
 Proposed Response Response Status O

CI 163 SC 163.10 P175 L31 # 153
 Dawe, Piers Mellanox
 Comment Type TR Comment Status X
 Slide 6 of heck_3ck_01_0919 shows that the DFE taps are never strongly negative, yet the draft would allow such untypical/hypothetical channels.
 SuggestedRemedy
 Remember that a tap weight limit isn't a hard pass-fail limit; channels can go outside it but don't get a free pass for the excess ISI noise that they cause. Add a minimum tap weight limit of -0.03 for all taps, including the floating taps.
 Proposed Response Response Status O

CI 163 SC 163.10 P175 L40 # 174
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type TR Comment Status X
 The DFE taps for RSS is on different line and not clear
 SuggestedRemedy
 Combine the requirement of DFE location and RSS limit in the single line. Here is a suggested wording "DFE floating tail taps [25-40] root-sum-of-squares limit
 Proposed Response Response Status O

CI 163 SC 163.10 P175 L40 # 152
 Dawe, Piers Mellanox
 Comment Type TR Comment Status X
 This DFE floating tap tail root-sum-of-squares limit is 0.03. For the worst of 7 borderline channels in kasapi_3ck_01_1119 slide 12 (kareti1, OACH4, which is an outlier and probably should not be supported), the value is 0.022. Even for this channel with the most unlucky combination of package lengths including out-of-scope ones, it's <= 0.025 (slide 13). We should not encourage even worse channels than this, such as the failing channels on slides 16-17, and we should not indulge this one so much.
 SuggestedRemedy
 Remember that this parameter isn't a hard pass-fail limit; channels can exceed this but don't get a free pass for the excess ISI noise that they cause.
 Change 0.03 to 0.02.
 Proposed Response Response Status O

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Cl 163 SC 163.10 P175 L46 # 147
 Dawe, Piers Mellanox
 Comment Type T Comment Status X
 One-sided noise spectral density of $8.2e-9 V^2/Hz$ is extremely aggressive and optimistic, being half that for 50GBASE-KR, and was chosen to make particular backplane channels with issues pass COM. Backplane channels are very varied, so sweating this will benefit few channels at a cost to all. New backplane connectors will provide better channels.
 SuggestedRemedy
 Change to $1e-8$, which is 61% of 50GBASE-CR.
 Proposed Response Response Status O

Cl 163 SC 163.10.2 P177 L13 # 24
 Mellitz, Richard Samtec
 Comment Type TR Comment Status X
 Table 163-11 was developed for a different data rate and reference package assumption. Recommendation were proposed in mellitz_3ck_01_1119 slide 5.
 SuggestedRemedy
 In Table 163-11 set: $\beta_x=2.4 GHz$, $\rho_x=.19$
 Proposed Response Response Status O

Cl 163 SC 163.10.1 P175 L52 # 46
 Dudek, Mike Marvell
 Comment Type E Comment Status X
 Equation should be a hot link. Also Equation 163-1 is for calculation of Add
 SuggestedRemedy
 Change the equation to 163-3 and make it a hot link
 Proposed Response Response Status O

Cl 163 SC 163.10.1 P176 L46 # 175
 Ghiasi, Ali Ghiasi Quantum/Inphi
 Comment Type T Comment Status X
 Beyond 50 GHz with loss >75 doesn't matter
 SuggestedRemedy
 Limit max frequency to 50 GHz instead of fb.
 Proposed Response Response Status O