Cl **000** *SC* **000** *P* *L* # i-2

Marris, Arthur — Cadence Design Syst

Comment Type **ER** *Comment Status* **D** *<bucket>*

Update the editing instructions throughout the document to reference the new revision to the base standard, due to be published in 2018. Also do this on future drafts of 802.3cd to take into account future changes to the revision project draft standard.

SuggestedRemedy

Update editing instructions in draft 3.0 and future drafts to align with the new base standard.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **000** *SC* **000** *P* *L* # i-12

Anslow, Peter — Ciena Corporation

Comment Type **TR** *Comment Status* **D** *editor's notes <cc>*

The vote in Sponsor ballot is essentially a response to the question "Do you support sending this draft to RevCom?".
The draft contains five editor's notes:
Clause 136 "Editor's note: The values for SNDR, SNR_ISI, and SNR_TX require confirmation and may change."
Clause 136 "Editor's note: The value for Zc requires confirmation and may change."
Clause 138 "Editor's note: The values for OMAouter, OMAouter minus TDECQ, and TDECQ require confirmation and may change."
Clause 138 "Editor's note: The values for SRS, receiver sensitivity, and SEC require confirmation and may change."
Clause 138 "Editor's note: The values for link budget and allocation for penalties require confirmation and may change."
While any of these editor's notes remain, I do not support sending the draft to RevCom since they would not be likely to recommend approval of the draft.

SuggestedRemedy

Do whatever work is necessary (which may be none) and remove these five editor's notes.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Relating to the editor's notes in Clause 136, there are several comments against D3.0 that address these.

Comments addressing SNDR, SNR_ISI, and SNR_TX are i-48, i-49, i-74, i-88, and i-97.

Comments addressing Zc are i-80, i-135, and i-162.

In Clause 136, remove editor's notes that are addressed by resolution of the listed comments.

Relating to the editor's notes in Clause 138, measured data has been presented at the 802.3cd ad hoc supporting the current specifications.

See:
http://www.ieee802.org/3/cd/public/adhoc/archive/king_122017_3cd_adhoc.pdf
http://www.ieee802.org/3/cd/public/adhoc/archive/chang_011018_3cd_02_adhoc-v2.pdf

Remove all editor's notes in Clause 138.

Cl **000** *SC* **000** *P* *L* # i-14

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Some external cross-references are shown in black text, but should have character tag "External" applied to them.

SuggestedRemedy

Apply character tag "External" to:
"Equation (93A-19)" page 231, line 12
"83A", "83B", "83D", "83E" , page 309, lines 25 to 30

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **000** *SC* **000** *P* *L* # i-37

RAN, ADEE — Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

The convention in most of 802.3 text is that the acronym FEC is preceded by the article "an" rather than "a".

See comment i-19 in http://www.ieee802.org/3/by/public/comments/8023by_D30_comment_final_responses_by_ID_v2.pdf.

SuggestedRemedy

Change "a FEC" to "an FEC" in the following:

133.5.3
134.5.4.2.3
136.9.4.1

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **000** *SC* **000** *P* *L* # i-9

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Some cross-references in the draft are in forest green although the target is in the draft.

SuggestedRemedy

Change references to Clause 73 to be cross-references in the following places:
Page 90, line 32 (73.5.1)
Change references to Clause 82 to be cross-references in the following places:
Page 266, line 3 (80.5), line 4 (Figure 80-8), and line 18 (80.5)
Change references to Clause 82 to be cross-references in the following places:
Page 262, line 8
Change references to Clause 91 to be cross-references in the following places:
Page 87, line 48
Page 104, line 36 (91.5.3.1)
Page 105, line 40 (91.5.3.1)
Page 232, line 19 (91.6)
Change references to Clause 120 to be cross-references in the following places:
Page 40, line 36
Page 85, line 41
Page 87, line 8
Page 95, line 54
Page 96, lines 5, 7, and 8
Page 119, lines 8 and 31
Page 198, line 38
Page 246, line 38
Page 262, line 41
Change references to Clause 119 to be cross-references in the following places:
Page 85, line 40
Page 87, lines 8 and 49
Page 199, line 9
Page 245, line 54
Page 262, line 39

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **000** *SC* **000** *P* *L* # i-20

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Tables that split across two pages need the bottom ruling on the first page set to "very thin" and the table continuation variable applied to the heading.

SuggestedRemedy

Make the bottom ruling change to all such tables in the draft, including Tables 134-2, 135-2, 135-4, 136-5, 136-6 (2 places), 136-11, 136-15, 137-5, 138-9, 139-6, 140-6, 93A-2, 136C-3, the tables in 134.7.4.1, 134.7.4.2, 136.14.3, 136.14.4.3, 136.14.4.5, 137.12.3, 137.12.4.1, 137.12.4.3, 138.11.4.1, 139.11.4.1, 140.11.4.1, 135E.5.4.1, 135F.6.4.1
Add the table continuation variable to the heading of Table 93A-2.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **000** *SC* **000** *P* *L* # i-86

RAN, ADEE — Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

The style manual (Presentation of data and table format, 13.3.2) says: "All numbers should be aligned at the decimal point". This is not always followed (e.g. table 131-4).

It also says "Digits should be separated into groups of three [with space separating], counting from the decimal point toward the left and right". In this draft this is sometimes followed (e.g. table 131-4) and sometimes not (Table 80-5).

The style manual does not require numbers outside of tables to be three-digit-grouped, either left or right of the decimal point. In this draft this is usually done for large integers (left of the decimal point), but not done for fractions (right of the decimal point). The readability of numbers outside of tables is not improved by this grouping.

We should consistently follow the stated table convention, and choose a convention for non-table data.

SuggestedRemedy

Go over all tables and format according to 13.3.2 in the style manual.

Go over numbers in the text and remove the three-digit grouping.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

The number formatting in all legacy (amended) clauses and annexes is purposely consistent with the formatting in the base standard. Concerns with this formatting should be addressed against the base standard.

For all new clauses and annexes, modify the numbers in the tables and text per the suggested remedy, as appropriate.

Cl **000** *SC* **000** *P* **95** *L* **1** # i-113

Maytum, Michael — RETIRED/unemployed

Comment Type **E** *Comment Status* **D** *<bucket>*

Energy-Efficient

SuggestedRemedy

make Energy Efficient to match other 11 occurances

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Replace all instance of "Energy Efficient Ethernet" with "Energy-Efficient Ethernet".

See comments i-111 and i-112.

Cl **000** *SC* **000** *P* **97** *L* **13** # i-109

Maytum, Michael RETIRED/unemployed

Comment Type **E** *Comment Status* **D** *<bucket>*

64-bit wide

SuggestedRemedy

make 64-bit-wide to match other occurances

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The occurrence of "64-bit wide" in Clause 80 is in unchanged text from Clause 80. Any changes to this text are out of scope for this project and must be addressed against the base standard through the revision project or maintenance process.

All other occurences are in new clauses and are consistently written as "64-bit-wide".

Cl **000** *SC* **000** *P* **183** *L* **5** # i-110

Maytum, Michael RETIRED/unemployed

Comment Type **E** *Comment Status* **D** *<bucket>*

bit-times

SuggestedRemedy

make bit times to match other 24 occurances

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

On page 183 line 5, change "bit-times" to "bit times".

Cl **000** *SC* **000** *P* **199** *L* **16** # i-111

Maytum, Michael RETIRED/unemployed

Comment Type **E** *Comment Status* **D** *<bucket>*

Energy-Efficient

SuggestedRemedy

make Energy Efficient to match other 11 occurances

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Replace all instances of "Energy Efficient Ethernet" with "Energy-Efficient Ethernet".

See comments i-112 and i-113.

Cl **000** *SC* **000** *P* **247** *L* **1** # i-112

Maytum, Michael RETIRED/unemployed

Comment Type **E** *Comment Status* **D** *<bucket>*

Energy-Efficient

SuggestedRemedy

make Energy Efficient to match other 11 occurances

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Replace all instances of "Energy Efficient Ethernet" with "Energy-Efficient Ethernet".

See comments i-111 and i-113.

Cl **000** *SC* **4.4.2** *P* **41** *L* **8** # i-103

Healey, Adam Broadcom Ltd.

Comment Type **E** *Comment Status* **D**

IEEE P802.3cd will end up being an amendment to IEEE Std 802.3-201x (and not IEEE Std 802.3-2015 as modified by...). It is expected that all amendments except IEEE P802.3bt, IEEE P802.3cb, and IEEE P802.3cd (and, of course, any subsequent amendments) will be part of the base document and should not be called out in the frontmatter and editing instructions. It is also necessary to track relevant changes made to these amendments during the IEEE P802.3 (IEEE 802.3cj) ballot (some such changes have been submitted as separate comments).

SuggestedRemedy

At a convenient point in the process, align the draft to the expected base document.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

[Editor changed to Clause from 4 to 000.]

The 802.3cd draft will be aligned with the new base standard.

Relevant changes made to the P802.3cb amendment and new base standard during the IEEE P802.3 (IEEE 802.3cj) ballot will be incorporated, when it is convenient to do so, into future 802.3cd drafts.

Cl **001** *SC* **1.4** *P* **39** *L* **3** # i-104

Healey, Adam — Broadcom Ltd.

Comment Type **E** *Comment Status* **D** *<bucket>*

The definition sort order used by IEEE 802.3 is defined at <http://www.ieee802.org/3/WG_tools/editorial/requirements/words.html> (search for "Definition sort order"). Based on this order, the specified insertion point for the definition of 100GBASE-CR2 is not correct. Also, IEEE P802.3cd will end up being an amendment to IEEE Std 802.3-201x (currently IEEE P802.3 (IEEE 802.3cj) D3.0 which is in Sponsor ballot). "100GBASE-R encoding" is not 1.4.52 in the expected base document.

SuggestedRemedy

Apply the correct definition sort order relative the locations of definitions in the expected base document.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

To align with the 802.3-201x revision, apply the correct definition sort order according to <http://www.ieee802.org/3/WG_tools/editorial/requirements/words.html> relative the locations of definitions in the 802.3-201x base document.

Cl **030** *SC* **30.3.2.1.2** *P* **42** *L* **11** # i-65

Marris, Arthur — Cadence Design Syst

Comment Type **E** *Comment Status* **D** *<bucket>*

Editorial instruction should say the insertion is after 40GBASE-T rather than 40GBASE-R

SuggestedRemedy

Change 40GBASE-R to 40GBASE-T on lines 12 and 21 on page 42

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **030** *SC* **30.3.2.1.5** *P* **42** *L* **39** # i-66

Marris, Arthur — Cadence Design Syst

Comment Type **E** *Comment Status* **D** *<bucket>*

The reference should be to Table 81-4 rather than 81-3

SuggestedRemedy

Change 81-3 to 81-4

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **030** *SC* **30.5.1.1.2** *P* **42** *L* **51** # i-67

Marris, Arthur — Cadence Design Syst

Comment Type **E** *Comment Status* **D** *<bucket>*

The 50G entries should go after 40GBASE-T rather than 40GBASE-FR

SuggestedRemedy

Change 40GBASE-FR to 40GBASE-T

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **030** *SC* **30.6.1.1.5** *P* **46** *L* **21** # i-68

Marris, Arthur — Cadence Design Syst

Comment Type **E** *Comment Status* **D** *<bucket>*

The 50GR entry goes after 40GBASE-T rather than 40GBASE-CR4

SuggestedRemedy

Change 40GBASE-CR4 to 40GBASE-T

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **031B** *SC* **31B.4.6** *P* **330** *L* **23** # i-19

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Comment #15 against D2.0 of the 802.3 revision project changed the format of the table in 31B.4.6. See:
http://www.ieee802.org/3/cj/comments/P8023-D2p0-Comments-Final-byID.pdf#page=3
When the P802.3cd draft is changed to become an amendment to the output of the revision, equivalent changes need to be made to the P802.3cd draft.

SuggestedRemedy

When the P802.3cd draft is changed to become an amendment to the output of the revision:
in the Value/Comment cell, apply footnote a to "117 pause_quanta"
in the Support cell, change "N/A [ ] M: Yes [ ]" to "Yes [ ] N/A [ ]"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **045** *SC* **45.2.1.6** *P* **50** *L* **31** # i-1

Marris, Arthur — Cadence Design Syst

Comment Type **ER** *Comment Status* **D** *<bucket>*

The editorial instruction should be simplified to just show the changes to the relevant reserved bit descriptions in the new revision

SuggestedRemedy

Simplify Table 45-7 to just show changes to the relevant reserved fields for bits 1.7.6:0

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **045** *SC* **45.2.1.116d** *P* **60** *L* **35** # i-11

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Tables that split across two pages need the bottom ruling on the first page set to "very thin" and the table continuation variable applied to the heading.

SuggestedRemedy

Make these two changes to tables 45-90ab, 45-90c, 45-90d, 45-90e

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **045** *SC* **45.2.1.116d.2** *P* **61** *L* **49** # i-23

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Generally, text in Clause 45 uses "one" or "zero" when describing the value a bit is set to rather than "1" or "0". However, there are some inconsistencies.
There are 188 instances of "to one" and 27 instances of "to 1".
There are 175 instances of "to zero" and 5 instances of "to 0".
A comment has been submitted against the revision project D3.0 to change these instances of "1" and "0" to "one" and "zero"

SuggestedRemedy

Change "to 1" to "to one" on:
Page 61, line 49
Page 62, line 5
Page 64, lines 18 and 26

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **069** *SC* **69.2.3** *P* **85** *L* **49** # i-7

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Comment r01-11 against D3.1 of P802.3cb has changed the table inserted by P802.3cb from Table 69-2a to Table 69-1aa. See:
http://www.ieee802.org/3/cb/comments/IEEE_P802d3cb_D3p1_Cmt_Resolution_by_ID--20171106_1445.ldb.pdf#page=3
This change hast to be accounted for in the P802.3cb draft.

SuggestedRemedy

Change the base text (before changes) to: "Table 69-1, Table 69-1aa, Table 69-1a, and Table 69-2 specify the correlation..."
Change the inserted tables to be Table69-2a, Table69-2b, and Table69-2c
Change the editing instruction on page 86, line 10 to: "Insert Table69-2a, Table69-2b, and Table69-2c after Table69-2 as follows:

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

[Editor's note. Updated since first posting.]

Align the changes with the 802.3-201x revision as modified by IEEE Std 802.3cb-201x.

Cl **073** *SC* **73.6.4** *P* **90** *L* **1** # i-3

Marris, Arthur — Cadence Design Syst

Comment Type **TR** *Comment Status* **D** *<bucket>*

Maintenance request 1283 has been implemented by the P802.3cj revision project to the base standard so there is no need for it in 802.3cd

SuggestedRemedy

Remove the text in 802.3cd concerning maintenance request 1283

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **073** *SC* **73.6.4** *P* **90** *L* **1** # i-99

Healey, Adam — Broadcom Ltd.

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

IEEE P802.3cd will end up being an amendment to IEEE Std 802.3-201x (currently IEEE P802.3 (IEEE 802.3cj) D3.0 which is in Sponsor ballot). The proposed changes and editing instructions should be aligned with the expected base document. This expected base document incorporates IEEE Std 802.3by-2016, has removed the paragraph shown in strikethrough starting at line 4, and already includes a note similar to the one starting at line 10.

SuggestedRemedy

Change the editing instruction to: "Change the fourth and fifth paragraphs (as modified by IEEE Std 802.3cb-201x) as follows:". Remove the strikethrough paragraph starting at line 4 and the note starting at line 10.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

See also comment i-3.

It is only the last paragraph that has changed so also remove the fourth paragraph at line 12 in addition to removing the strikethrough paragraph starting at line 4 and the note starting at line 10.

Change the editing instruction to:

"Change the last paragraph of 73.6.4 (as modified by IEEE Std 802.3cb-201x) as follows:"

Cl **073** *SC* **73.11.4.7** *P* **94** *L* **26** # i-8

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

The editing instruction could be improved

SuggestedRemedy

Change "Change Table" to "Change PICS item SD15"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **078** *SC* **78.5** *P* **96** *L* **20** # i-69

Marris, Arthur — Cadence Design Syst

Comment Type **E** *Comment Status* **D** *<bucket>*

The insertion should be below the row for 40GBASE-T

SuggestedRemedy

Change 40GBASE-KR to 40GBASE-T

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **080** *SC* **80.1.3** *P* **97** *L* **47** # i-70

Marris, Arthur — Cadence Design Syst

Comment Type **E** *Comment Status* **D** *<bucket>*

40GBASE-T is missing from the list

SuggestedRemedy

Add:
m) The MDI as specified in Clause 113 for 40GBASE-T uses a 4 lane data path.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

To align with the 802.3-201x revision implement the suggested remedy.

Cl **080** *SC* **80.5** *P* **105** *L* **16** # i-126

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *skew variation <cc>*

This table 80-7 (Skew Variation) does not agree with e.g. 138.3.2.1, which says "Since the signal at XX represents a serial bit stream, there is no Skew Variation at this point". All 50GBASE-R PMDs are serial.

SuggestedRemedy

Correct the table, at least for SP2-6, by using Table 131-6 (corrected) for 100G serial.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

The only 100G interface that uses 53.125 GBd per lane is the 100GBASE-DR which has a single lane. There is therefore no skew variation from lane to lane.

In Table 80-7, remove the column for 53.125 GBd lanes and footnote d.

In 80.5…

The references in Table 80-6 to 140.4 are incorrect.
In Table 80-6, change 140.4 to 140.3 (four instances).

The references in Table 80-7 to 140.4 are not relevant.
In Table 80-7, delete references to 140.4.

See also comments i-13 and i-124.

Cl **091** *SC* **91.5.3.1** *P* **111** *L* **5** # i-4

Marris, Arthur — Cadence Design Syst

Comment Type **TR** *Comment Status* **D** *<bucket>*

Maintenance request 1299 has been implemented by the P802.3cj revision project to the base standard so there is no need for it in 802.3cd

SuggestedRemedy

Remove the text and figure 91-8 in 802.3cd in Clauses 45 and 91 concerning maintenance request 1299.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **093A** *SC* **93A.1.4.2** *P* **332** *L* **38** # i-166

Dudek, Michael — Cavium

Comment Type **T** *Comment Status* **D** *<bucket>*

The footnote below table 93A-1 implies that there is more information about what to do with C(-2) for clauses that don't have it in 93A.1.4.2. There isn't any and it should be added.

SuggestedRemedy

Add a paragraph. "Some clauses do not provide information about c(-2). For those clauses c(-2) is always zero.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

The information for c(-2) when the clause doesn't provide it exists in 93A.1.6 (page 333) rather than 93A.1.4.2.

Change the cross-reference in the footnote of table 93A-1 from 93A.1.4.2 to 93A.1.6.

Cl **120** *SC* **120.5.7** *P* **122** *L* **11** # i-10

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Heading 120.5.7 is being added with an Insert editing instruction, so it should not be underlined

SuggestedRemedy

Remove the underline from the heading 120.5.7

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **131** *SC* **131.1.2** *P* **126** *L* **15** # i-144

Nicholl, Gary — Cisco Systems, Inc.

Comment Type **TR** *Comment Status* **D** *<bucket>*

"uses a two-lane data path as specified in Annex 135F or Annex 135G." should be "uses a one-lane data path as specified in Annex 135F or Annex 135G"

SuggestedRemedy

Change "two-lane" to "one-lane"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **131** *SC* **131.5** *P* **134** *L* **5** # i-6

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

In the heading row of Table 131-6, "Gbd" should be "GBd" (2 instances)

SuggestedRemedy

In the heading row of Table 131-6, change "Gbd" to "GBd" (2 instances)

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **131** *SC* **131.5** *P* **134** *L* **14** # i-124

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *skew variation <cc>*

This table 131-6 (Skew Variation) does not agree with e.g. 138.3.2.1, which says "Since the signal at XX represents a serial bit stream, there is no Skew Variation at this point". All 50GBASE-R PMDs are serial.

SuggestedRemedy

Correct the table, at least for SP2-6.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

50GAUI-1 and all 50G PMDs specified in this draft are serial interfaces so there is no skew variation.

The skew variation specifications in this Table 131-6 are relevant only for LAUI-2 (25.78125 GBd NRZ) and 50GAUI-2 (26.5625 GBd NRZ) lanes.

In footnote "b", change "50GAUI-n or PMD" to "50GAUI-2".

In rows for SP2, SP3, SP4, and SP5 remove references to 136.6, 137.6, 138.3.2, and 139.3.

See also comment i-126.

Cl **133** *SC* **133.1.2** *P* **141** *L* **17** # i-32

RAN, ADEE — Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

"The 50GBASE-R PCS is identical to the 40GBASE-R PCS specified in Clause 82 with the following exceptions:"

The list of exceptions here is identical to the list of exceptions in "133.2.1 Functions within the PCS".

The repetition is unnecessary. Whenever I read this text I wonder if there is any difference.

Also, The PCS is not _identical_ with these exceptions; it also has slightly different delay constraints. The wording in 133.2.1 is more appropriate.

SuggestedRemedy

Replace the text from the second paragraph to the end of the subclause with the following:

The 50GBASE-R PCS specifications are based on the 40GBASE-R PCS specifications in Clause 82, with the modifications listed in 133.2 and 133.3.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **133** *SC* **133.1.2** *P* **141** *L* **21** # i-145

Nicholl, Gary — Cisco Systems, Inc.

Comment Type **E** *Comment Status* **D** *<withdrawn>*

Add a reference at the end of the bullet 2 pointing to section 133.2.2.

SuggestedRemedy

Add a reference at the end of the bullet 2 pointing to section 133.2.2.

Proposed Response *Response Status* **Z**

PROPOSED REJECT.

This comment was WITHDRAWN by the commenter.

Cl **133** *SC* **133.1.2** *P* **141** *L* **24** # i-146

Nicholl, Gary — Cisco Systems, Inc.

Comment Type **E** *Comment Status* **D** *<withdrawn>*

Add a reference at the end of the bullet 3 pointing to section 133.2.4.

SuggestedRemedy

Add a reference at the end of the bullet 3 pointing to section 133.2.4.

Proposed Response *Response Status* **Z**

PROPOSED REJECT.

This comment was WITHDRAWN by the commenter.

Cl **133** *SC* **133.1.4** *P* **141** *L* **50** # i-16

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Space missing between number and unit

SuggestedRemedy

Change 50Gb/s to 50 Gb/s using a non-breaking space (Ctrl space)

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **134** *SC* **134.1.1** *P* **151** *L* **13** # i-147

Nicholl, Gary — Cisco Systems, Inc.

Comment Type **E** *Comment Status* **D** *<bucket>*

In bullet (1) shouldn't we also mention that the nominal rate for the PCS lanes is different than the noiminal rate for 100G PCS lanes. We have a similar statement at the beginning of Clause 133.

SuggestedRemedy

Add some text to include the nominal rate of the PCS lanes, and note that the nominal rate is different from the 100G PCS lanes. Also add reference to 134.2.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **134** *SC* **134.1.1** *P* **151** *L* **15** # i-148

Nicholl, Gary — Cisco Systems, Inc.

Comment Type **E** *Comment Status* **D** *<bucket>*

Add a reference at the end of the bullet 3 pointing to section 134.5.2.7

SuggestedRemedy

Add a reference at the end of the bullet 3 pointing to section 134.5.2.7

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **134** *SC* **134.1.1** *P* **151** *L* **18** # i-149

Nicholl, Gary — Cisco Systems, Inc.

Comment Type **E** *Comment Status* **D** *<bucket>*

Add a reference at the end of the bullet 4 pointing to section 134.5.2.6.

SuggestedRemedy

Add a reference at the end of the bullet 4 pointing to section 134.5.2.6.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **134** *SC* **134.1.1** *P* **151** *L* **22** # i-150

Nicholl, Gary — Cisco Systems, Inc.

Comment Type **E** *Comment Status* **D** *<bucket>*

Add a reference at the end of the bullet 5 pointing to section 134.5.4.

SuggestedRemedy

Add a reference at the end of the bullet 5 pointing to section 134.5.4.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **134** *SC* **134.5.2.4** *P* **153** *L* **50** # i-33

RAN, ADEE — Intel Corporation

Comment Type **T** *Comment Status* **D**

"The incoming bit error ratio can be estimated by dividing the BIP block error ratio by a factor of 1 351 680"

This sentence is misleading; within this subclause, it is not the _incoming bit error ratio_ that most readers would think it is, but rather the bit error ratio in the data stream from the local PCS to the RS-FEC input. This data path is not described, but in some applications it may create errors.

Unlike errors in the incoming data (from the link partner), any errors in this data stream are neither detected nor corrected. This is not obvious from reading the text.

A similar comment against clause 91 was submitted to 802.3cj.

SuggestedRemedy

Change the quoted text to the following and add an informative note:

The bit error ratio in the data received from the local PCS can be estimated by dividing the BIP block error ratio by a factor of 1 351 680.

NOTE--The data received from the local PCS is processed by the RS-FEC transmit function without error correction.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The text is technically correct as written. The term "incoming" is clear in the context of the subclause (i.e., the transmit function of the RS-FEC sub-layer) and when looking at the functional block diagram in Figure 134-2.

For Task Force discussion.

Cl **134** *SC* **134.5.2.6** *P* **156** *L* **20** # i-62

Trowbridge, Stephen — Nokia

Comment Type **E** *Comment Status* **D** *<bucket>*

Figure 134-3 has some sloppy drawing elements. The line above amp_tx_0 is either a different width than the line above amp_tx_2 or is two lines slightly offset. The line to the right of amp_tx_3(56:57) doesn't quite line up with the line between RS index 12 and 13 on the row above at every level of magnification on the PDF

SuggestedRemedy

Tidy up the figure. Zoom in close and nudge the items to line up. Use continuous lines where things are supposed to line up

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **134** *SC* **134.5.2.8** *P* **156** *L* **40** # i-42

RAN, ADEE Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

"in a round robin distribution from the lowest to the highest numbered FEC lane"

This can be simplified, since there are only two FEC lanes.

Also in 134.5.3.6 and in the corresponding PICS.

SuggestedRemedy

Change the quoted text to

"alternating between FEC lanes 0 and 1".

Update PICS items TF10 and RF11 accordingly.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Change the identified text in 134.5.2.8:
from: "one 10-bit symbol at a time in a round robin distribution from the lowest to the highest numbered FEC lane "
to: "one 10-bit symbol at a time alternating between FEC lanes 0 and 1"

Change the value/comment text for PICS TF10 in 134.7.4.1:
from: "Distributed to 2 FEC lanes, one 10-bit symbol at a time in a round robin distribution from the lowest to the highest numbered FEC lane"
to: "Distributed to 2 FEC lanes, one 10-bit symbol at a time alternating between FEC lanes 0 and 1"

Note, the same change is not applicable for 134.5.3.6 and the associated PICS RF11, as in this case the data is distributed to four PCS lanes and the text cannot be simplified as suggested by the commenter.

Cl **134** *SC* **134.5.3.1** *P* **157** *L* **4** # i-63

Trowbridge, Stephen Nokia

Comment Type **E** *Comment Status* **D** *<bucket>*

Several of the bit numbers in Figure 134-4 are touching the lines on the right side of the box: Four instances of "65" on line 4 and 256 on line 12.

SuggestedRemedy

Adjust the position of these numbers to be the same distance from the right edge of the box as the "0" is from the left edge of the corresponding box. The digits 0 and 9 should be centered in the C543, C542 boxes. Some similar adjustments (although fewer problems) should be made to Figure 134-5

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **134** *SC* **134.5.3.3** *P* **158** *L* **23** # i-34

RAN, ADEE Intel Corporation

Comment Type **T** *Comment Status* **D**

"The probability that the decoder fails to indicate a codeword with t+1 errors as uncorrected is not expected to exceed 10^-6"

With RS(544,514) the probability is much lower; 802.3bs (119.2.5.3) states 10^-16 for the same code.

See the response to comment #74 in http://www.ieee802.org/3/bs/comments/P802d3bs_D1p2_comments_final_ID.pdf.

SuggestedRemedy

Change "10^-6" to "10^-16".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **134** *SC* **134.5.3.7** *P* **160** *L* **26** # i-43

RAN, ADEE Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Missing period after "am_rxmapped".

SuggestedRemedy

Add a period.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **134** *SC* **134.5.4** *P* **160** *L* **32** # i-35

RAN, ADEE Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Superfluous period after "diagrams".

SuggestedRemedy

Remove it.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **134** *SC* **134.5.4.2.3** *P* **162** *L* **52** # i-36

RAN, ADEE Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Missing period after "FEC lane".

SuggestedRemedy

Add a period.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **134** *SC* **134.6** *P* **164** *L* **36** # i-39

RAN, ADEE Intel Corporation

Comment Type **E** *Comment Status* **D** *<withdrawn>*

This clause has no state diagrams but it does define variables. The conventional text "The following subclauses define variables that are not otherwise defined, e.g., for use by state diagrams" creates a long list of 21 subclauses.

Unlike the common variable definition lists, these subclauses are not sorted by a meaningful order, and there is no separation to variables and counters.

It may be friendlier for readers to have the usual structure of variables and counters, sorted alphabetically.

SuggestedRemedy

Create a new subclause 134.7 titled "Variable definitions" (renumbering the PICS to 134.8).

Create two subclauses, 134.7.1 "Variables" and 134.7.2 "Counters".

Move the variable definitions in 136.6.1 through 136.6.21 to these subclauses, sorted alphabetically, with the usual variable-list format.

Proposed Response *Response Status* **Z**

PROPOSED REJECT.

This comment was WITHDRAWN by the commenter.

Cl **134** *SC* **134.6.11** *P* **165** *L* **49** # i-40

RAN, ADEE Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Superfluous period after "91.5.4.3".

SuggestedRemedy

Delete it.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

[Editor's note. Updated since first posting.]

Replace period with space.

Cl **134** *SC* **134.6.17** *P* **166** *L* **36** # i-38

RAN, ADEE
Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Missing period after "(see 134.5.2.2)".

SuggestedRemedy

Add a period.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **134** *SC* **134.7.4.1** *P* **170** *L* **3** # i-41

RAN, ADEE
Intel Corporation

Comment Type **T** *Comment Status* **D** *<bucket>*

Item TF8 "feature" text "Alignment marker insertion point" is incorrect.

It resembles item TF7 "Alignment marker insertion", but the requirement it refers to in 134.5.2.6 is stated differently: the 257-bit block _following_ the AM corresponds to the PCS blocks 0, 1, 2 and 3 following the alignment marker. (P156 L4)

SuggestedRemedy

Change "feature" text from "Alignment marker insertion point" to "First 257-bit block inserted after am_txmapped".

Change "value/comment" by deleting the aforementioned words.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Change the "feature" text for PICS TF8 in 134.7.4.1:
from: "Alignment marker insertion point"
to: "First 257-bit block inserted after am_txmapped"

Cl **135** *SC* **135** *P* **176** *L* **52** # i-45

RAN, ADEE
Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

The identifiers p, q, i, j, and k are not consistently italicized throughout this clause.

There are also identifiers m, n, and z, denoting number of lanes, which are never italicized; so it's unclear whether p and q (which also denote the number of lanes) should be italicized.

Since p usually it italicized, I assume that all instances of p and q should be italicized. It may be decided otherwise. But for a specific identifier it should be consistent.

SuggestedRemedy

Search through clause 135 for isolated p/q/i/j/k and for UNITDATA_k and UNITDATA_i, and italicize the p/q/i/j/k identifiers.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135** *SC* **135.1** *P* **172** *L* **6** # i-128

Dawe, Piers J G — Mellanox Technologie

Comment Type **E** *Comment Status* **D**

Missing text: compare 136.1.

SuggestedRemedy

Mention all seven annexes briefly, in the style of 136.1.
e.g. Add some text in for the overview explaining what this clause is about - take text from 135.1.1 if appropriate:
"The Physical Medium Attachment sublayer (PMA) allows the PCS (see Clause 133 and Clause 82) and FEC (see Clause 134 and Clause 91) to connect in a media-independent way with a range of physical media. This clause has seven associated annexes ..."

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Clause 136 specifies a PMD. It is common style to defined the components of the PMD in the first subclause of a PMD clause.

Clause 135 specifies a pair of PMAs and no PMDs. Consistency with a PMD clause is not directly relevant.

The six Annexes relating to 50GAUI-n and 100GAUI-n are introduced in the third paragraph of 135.1.1.

Annex 135A, which gives examples of PHY layering when a 50GAUI-n or 100GAUI-n is used, is referenced in the first paragraph of 135.1.4.

This is consistent with the style of Clause 83 (40G/100G PMA) in 802.3-2015 and Clause 120 (200G/400G PMA) in 802.3bs-2018.

Cl **135** *SC* **135.1.3** *P* **172** *L* **46** # i-129

Dawe, Piers J G — Mellanox Technologie

Comment Type **E** *Comment Status* **D**

We have added another function, precoding. This isn't the same as Gray mapping, which is part of PAM4 coding - a PMA with PAM4 input and output might do precoding but not PAM4 coding (because that's already done). Another PMA might do PAM4 coding but not precoding.

SuggestedRemedy

add item k, In some circumstances, perform precoding for PAM4.
Add full stop to item j.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Precoding is part of the processing required for PAM4 modulated signals. It is never required for NRZ modulated signals.

Note that under the subclause 135.5.7 "PAM4 Encoding" includes subclauses 135.5.7.1 "Gray mapping for PAM4 encoded lanes" and 135.5.7.2 "Precoding for PAM4 encoded lanes".

Cl **135** *SC* **135.1.4** *P* **175** *L* **18** # i-151

Dudek, Michael — Cavium

Comment Type **E** *Comment Status* **D** *<bucket>*

poor grammar.

SuggestedRemedy

add word "in" after specified

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135** *SC* **135.3** *P* **176** *L* **44** # i-44

RAN, ADEE — Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Superfluous ")" after "indication".

SuggestedRemedy

Delete it.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135** *SC* **135.3** *P* **177** *L* **22** # i-64

Trowbridge, Stephen Nokia

Comment Type **TR** *Comment Status* **D** *<bucket>*

It is not correct that the PMA passes symbols from the input lanes to the output lanes unless the symbols are bits. According to Figure 135-5, PAM4 symbols are decoded (converted to pairs of bits), passed through a bit mux, and encoded to PAM4 symbols at the output.

SuggestedRemedy

Change "the PMA passes symbols from the input lanes to the output lanes" to "the PMA passes the bits represented by the symbols from the input lanes into encoded symbols on the output lanes". Same issue Page 178 line 5 in the reverse direction.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135** *SC* **135.5.7.2** *P* **184** *L* **12** # i-130

Dawe, Piers J G Mellanox Technologie

Comment Type **T** *Comment Status* **D**

Because a lane can run through PMAs or PMDs, this text is ambiguous: does an indirect connection count? In the first paragraph we have "PMA lanes connected to" and in the last two paragraphs we have "PMA lanes adjacent to".
Also, per 120D.1, "The... C2C link is described in terms of a ... C2C transmitter, a ... C2C channel, and a ... C2C receiver." So a PMA lane connected to a C2C link (not part of the link) might be further up or down the chain.
The remedy is a corrected version of the November proposal; further improvements may be appropriate.

SuggestedRemedy

Change "For PMA lanes connected to a 50GAUI-1 C2C or 100GAUI-2 C2C link, or to the PMD service interface of
a 50GBASE-CR, 50GBASE-KR, 100GBASE-CR2, or 100GBASE-KR2 PMD, the PMA shall provide 1/(1+D) mod 4 precoding capability on each output lane and may optionally provide 1/(1+D) mod 4 decoding capability on each input lane."
to "A PMA shall provide 1/(1+D) mod 4 precoding capability on each output lane that is part of a 50GAUI-1 C2C or 100GAUI-2 C2C transmitter, or is adjacent to the PMD service interface of a 50GBASE-CR, 50GBASE-KR, 100GBASE-CR2, or 100GBASE-KR2 PMD. A PMA may optionally provide 1/(1+D) mod 4 decoding capability on each input lane that is part of a 50GAUI-1 C2C or 100GAUI-2 C2C receiver, or is adjacent to the PMD service interface of a 50GBASE-CR, 50GBASE-KR, 100GBASE-CR2, or 100GBASE-KR2 PMD."
In the penultimate paragraph, change "For PMA lanes adjacent to a 50GBASE-CR PMD" to "For PMA inputs and outputs adjacent to a 50GBASE-CR PMD".
In the last paragraph, change "For PMA lanes adjacent to a 50GAUI-1 C2C" to "For PMA inputs and outputs that are part of a 50GAUI-1 C2C".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Some clean-up of the wording would be helpful to the reader. However, the language should be kept consistent throughout the subclause.

Change: "For PMA lanes connected to a 50GAUI-1 C2C or 100GAUI-2 C2C link, or to the PMD service interface of a 50GBASE-CR, 50GBASE-KR, 100GBASE-CR2, or 100GBASE-KR2 PMD, the PMA shall provide 1/(1+D) mod 4 precoding capability on each output lane and may optionally provide 1/(1+D) mod 4 decoding capability on each input lane."
To: "A PMA shall provide 1/(1+D) mod 4 precoding capability on each output lane that is part of a 50GAUI-1 C2C or 100GAUI-2 C2C link, or connected to the PMD service interface of a 50GBASE-CR, 50GBASE-KR, 100GBASE-CR2, or 100GBASE-KR2 PMD. A PMA may optionally provide 1/(1+D) mod 4 decoding capability on each input lane that is part of a 50GAUI-1 C2C or 100GAUI-2 C2C link, or connected to the PMD service interface of a 50GBASE-CR, 50GBASE-KR, 100GBASE-CR2, or 100GBASE-KR2 PMD."

In the penultimate paragraph…
Change: "For PMA lanes adjacent to a 50GBASE-CR PMD"

To: "For PMA input and output lanes connected to the PMD service interface of a 50GBASE-CR PMD".

In the last paragraph…
Change "For PMA lanes adjacent to a 50GAUI-1 C2C or a 100GAUI-2 C2C"
To: "For PMA input and output lanes that are part of a 50GAUI-1 C2C or 100GAUI-2 C2C link".

Cl **135** *SC* **135.5.10** *P* **186** *L* **17** # i-152

Dudek, Michael — Cavium

Comment Type **E** *Comment Status* **D** *<bucket>*

poor grammar.

SuggestedRemedy

add word "it " after not

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135** *SC* **135.5.10.1** *P* **186** *L* **24** # i-153

Dudek, Michael — Cavium

Comment Type **E** *Comment Status* **D** *<bucket>*

The intent here is to differentiate between NRZ test patterns and PAM4 test patterns (if it isn't this sentence has little value). Using "clause" here includes both.

SuggestedRemedy

Change "clause" to "sub-clause". Also on line 46

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

On page 185 lines 24 and 46 change "clause" to "subclause".

Cl **135** *SC* **135.5.10.2.2** *P* **187** *L* **7** # i-154

Dudek, Michael — Cavium

Comment Type **T** *Comment Status* **D**

A PRBS31Q checker is also optionally needed, (and is already included in the PICs).

SuggestedRemedy

Change the sentence and add an extra paragraph to be equivalent to the NRZ section. Change to "A PMA may optionally include a PRBS31Q test-pattern generator on output lanes in either direction as specified in 120.5.11.2.2.Add a sentence. "A PMA may optionally include a PRBS31Q test-pattern checker on input lanes in either direction as specified in 120.5.11.2.2."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135** *SC* **135.7.4.2** *P* **193** *L* **19** # i-46

RAN, ADEE — Intel Corporation

Comment Type **T** *Comment Status* **D** *<bucket>*

I can't find the definitions of conditional features "PIU", "PID", and "PIP" which appear in the status column..

SuggestedRemedy

Add the definitions for these features, or change the conditions of items using them to something else.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135** *SC* **135.7.4.3** *P* **194** *L* **19** # i-47

RAN, ADEE — Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

It doesn't make sense that all items in this table have status "M". They should be conditional on data rate and number of lanes.

In addition, item E8 requires 53.125 GBd for a one-lane interface; does this rule out a one-lane 50GBASE-*R PMD?

SuggestedRemedy

Add necessary conditions for each case.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135** *SC* **135.7.4.3** *P* **194** *L* **20** # i-155

Dudek, Michael — Cavium

Comment Type **E** *Comment Status* **D** *<bucket>*

Subclause references are missing

SuggestedRemedy

Add them

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135B** *SC* **135B.5.4.2** *P* **345** *L* **12** # i-167

Dudek, Michael — Cavium

Comment Type **T** *Comment Status* **D** *<bucket>*

There are no exceptions to Table 83D-5 in 135B.3.2

SuggestedRemedy

Delete "with the exceptions in 135B.3.2"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135C** *SC* **135C.1** *P* **347** *L* **22** # i-168

Dudek, Michael — Cavium

Comment Type **E** *Comment Status* **D** *<bucket>*

poor English

SuggestedRemedy

Change "using" to "uses"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135D** *SC* **135D.5.4.2** *P* **357** *L* **12** # i-169

Dudek, Michael — Cavium

Comment Type **E** *Comment Status* **D**

The exceptions are listed in 120B.3.2 and 135D.3.2 only contains a reference to 120B.3.2

SuggestedRemedy

Change to "with the exceptions in 120B.3.2" but keep the subclause reference as 135D.3.2

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135F** *SC* **135F.1** *P* **367** *L* **7** # i-142

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D** *precoding*

This annex does not refer to Clause 135 at all, nor does it mention precoding for the data path.

SuggestedRemedy

Make reference to 135.
Here, add sentence saying that a receiver may request precoding and a transmitter should? shall? follow the request.
In 135F.3.1, say that in addition the C2C transmitter provides a precoding function that can be switched on and off.
In 135F.3.2, say that in addition the C2C receiver may provide an inverse precoding function.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

In 135F.1 expand the first sentence of the second paragraphs as follows:
"50GAUI-1 C2C and 100GAUI-2 C2C are physical instantiations of the PMA service interface between the FEC and the PMD, as described in 135.1.4."

Make similar changes in 135B.1, 135C.1, 135D.1, 135E.1, and 135G.1.

Add a new paragraph at the end of 135F.1 as follows:
"The 50GAUI-1 C2C or 100GAUI-2 C2C transmitter and receiver processing may include precoding as specified in 135F.3.1 and 135F.3.2, respectively. Precoding may be enabled and disabled using the precoder request mechanism specified in 135F.3.2.1."

Add a new paragraph in 135F.3.1 as follows:
"In addition, the 50GAUI-1 C2C or 100GAUI-2 C2C transmitter on each end of the link shall support 1/(1+D) mod 4 precoding as specified in 135.5.7.2 that may be enabled or disabled as required."

Add a new paragraph in 135F.3.2 as follows:
"In addition, the 50GAUI-1 C2C or 100GAUI-2 C2C receiver on each end of the link may optionally support 1/(1+D) mod 4 decoding as specified in 135.5.7.2 that may be enabled or disabled as required."

Cl **135F** *SC* **135F.3** *P* **367** *L* **18** # i-98

Rysin, Alexander — Mellanox Technologie

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

Transmitter output residual ISI SNR_ISI (min) 34.8 dB (Clause 120D) is too high - can barely measure the IC through the test fixture. The warning NOTE in 120D.3.1.7 shows the issue, but doesn't solve it. D2.0 comment 140, D2.1 comment 49, D2.2 comment 22.
Since both SNR_ISI and Effective Return Loss (ERL) represent uncompensated reflections from the transmitter and the test fixtures, measurements of ERL can replace SNR_ISI.
Also, frequency domain return loss mask does not truly represent digital signaling at a given bit error ratio. There is no real proof that violating return loss masks is directly tied to failures and a number of false negatives have been shown. D2.0 comment 141, D2.1 comments 26, 27 and 28.

SuggestedRemedy

Change 135F.3.1 from "A 50GAUI-1 C2C or a 100GAUI-2 C2C transmitter shall meet all specifications in 120D.3.1" to
"A 50GAUI-1 C2C or a 100GAUI-2 C2C transmitter shall meet all specifications in 120D.3.1 with the following exceptions:
Effective Return Loss (ERL) is calculated with Nb set to 10 (see Annex New). ERL shall be at least 16.2 dB. The Transmitter Output residual ISI SNR_ISI and the return loss specifications in Table in Table 120D-1 do not apply."

Change 135F.3.2 from "A 50GAUI-1 C2C or a 100GAUI-2 C2C receiver shall meet all specifications in 120D.3.1" to
"A 50GAUI-1 C2C or a 100GAUI-2 C2C transmitter shall meet all specifications in 120D.3.2 with the following exceptions:
Effective Return Loss (ERL) is calculated with Nb set to 10 (see Annex New). ERL shall be at least 16.2 dB. There is no frequency domain return loss mask."

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The suggested remedy is contingent upon the addition of new Annex defining ERL. This Annex currently does not exist so the suggested remedy is incomplete.

There has been a great deal of discussion in regard to the specification of return loss and the use of ERL, but it is not clear that there is consensus to adopt ERL as a specification.

For task force discussion.

Cl **135F** *SC* **135F.3.2** *P* **367** *L* **25** # i-170

Dudek, Michael — Cavium

Comment Type **T** *Comment Status* **D**

The Receiver should be allowed to use the Transmitter precoding to meet the FEC symbol error ratio requirements.

SuggestedRemedy

Add the following "with the optional use of Transmitter pre-coding to achieve the required FEC symbol error ratio."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with response to i-142.

Cl **135F** *SC* **135F.6.4.1** *P* **371** *L* **38** # i-171

Dudek, Michael — Cavium

Comment Type **T** *Comment Status* **D** *<bucket>*

The 12mV is incorrect. It is 30mV in the specifications in 120D.3.1 and was corrected in the 802.3bs PICs from 12mV to 30mV in the last revision

SuggestedRemedy

Change 12mV to 30mV.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135F** *SC* **135F.6.4.3** *P* **372** *L* **36** # i-172

Dudek, Michael — Cavium

Comment Type **T** *Comment Status* **D** *<bucket>*

The Pics for the Channel Return loss is missing

SuggestedRemedy

Add the equivalent Pics to CC2 in 120D.5.4.3

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135G** *SC* **135G.3.1** *P* **375** *L* **21** # i-115

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *jitter mismatch <cc>*

As pointed out in both 802.3bs and this project, a host output with 50 Gb/s lanes is allowed to make twice as much low frequency jitter at very low frequencies as a receiver with 100 Gb/s lane(s) is required to receive. A jitter buffer does not fix this unless it is infinite. To assure interoperability, there must be industry-wide agreement that tightens 50G/lane host low frequency jitter generation, increases 100G/lane receiver low frequency jitter tolerance, or a combination. The proposed remedy is as simple as any of the options considered. Also it is likely to be compatible with 100G electrical lanes. This remedy must be applied to 100GAUI-2 C2M host outputs (unless another remedy is chosen), but may be applied to 50GAUI-1 host outputs and/or the corresponding module inputs for consistency. As any 50G/lane E/O conversions basically pass the low frequency jitter along for something else to tolerate, we can leave their specs alone.

SuggestedRemedy

Add to the end of the sentence "with the exception that the clock recovery unit's corner frequency (see 120E.4.2) is 2 MHz not 4 MHz".

If desired, change 135G.3.4: add "with the exceptions that the sinusoidal jitter (see 120E.3.4.1.1 and Table 120E-8) is defined by Table 135G-New, and that the reference CRU's corner frequency (see 120E.3.4.1.1of 4 MHz) is 2 MHz not 4 MHz".
Table 135G-New--Applied sinusoidal jitter
Parameter Case A Case B Case C Case D Case E Case F Units
Jitter frequency 0.02 0.667 2 6 20 60 MHz
Jitter amplitude 5 0.15 0.05 0.05 0.05 0.05 UI

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Resolve with comment i-61.

Cl **135G** *SC* **135G.3.1** *P* **375** *L* **21** # i-61

RAN, ADEE — Intel Corporation

Comment Type **TR** *Comment Status* **D** *jitter mismatch <cc>*

100GAUI-2 C2M host output is specified by reference to 120E.3.1. This means jitter is measured with a CRU with corner frequency of 4 MHz (per 120E.4.2).

Low-frequency jitter will be attenuated by the CRU - that means it is assumed to be tracked by the module's CDR.

This creates a problem if the module is a 100GBASE-DR PMD; the tracked jitter will be forwarded to the optical transmitter with the same time values, so doubled magnitude in UI terms.

This means that the link partner's optical receiver, with assumed CDR BW of 4 MHz too (per 140.7.9 and 121.8.9.4 SRS definitions), will see low frequency jitter that can be twice of what it is tested to tolerate.

The CDRs used in practice are second-order, so at very low frequencies this higher jitter level will likely be acceptable; but there is no specification for the integral gain of the CDR, so at medium frequencies the jitter tolerance is implementation dependent (even for fully compliant PMDs).

Having excessive untracked low-frequency jitter may be detrimental for BER even with FEC; the SNR will vary over time, and even if the average is good, uncorrectable codewords may be more frequent than what could be expected. This can cause unexpected deployment problems.

This issue was not resolved in 802.3bs although there have been comments about having the same CDR bandwidth for 50 and 100 Gb/s per lane interfaces. The least painful way to solve it at this point seems to be a recommendation for the host output jitter. This will leave all optical specs unmodified.

SuggestedRemedy

Add the following text after the single paragraph in 135G.3.1:

To limit the jitter at frequencies which a 100GBASE-DR PMD's optical receiver may not track well, it is recommended that in addition to the specifications in 120E.3.1, the Host output eye width and eye height specifications (120E.3.1.6) be met when measured using a clock recovery unit with a corner frequency of 2 MHz.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

For background, this comment is similar to Draft 2.2 comment #7. The response was as follows:
"REJECT.
The specifications for 100GBASE-DR in P802.3cd are intentionally the same as for 400GBASE-DR4 in P802.3bs.

The potential problem identified in comments #5 and #7 was discussed during the cd Ad Hoc on 25 October 2017 in association with http://www.ieee802.org/3/cd/public/adhoc/archive/dietrich_102517_3cd_adhoc.pdf, explaining the potential problem and proposing some solutions.
Based on that discussion, it is not clear if any changes are warranted or if the proposed changes may result in new problems. A more thorough analysis of the highlighted problem and the impact of the proposed solutions is required.
Further analysis and building of consensus supporting both the highlighted issue and a proposed solution is encouraged to happen.
The comments may be resubmitted in sponsor ballot with any updated information."

D3.0 comments 61, 85, 87, and 115 are all addressing the same issue but with two different proposed solutions as summarized below.

Comments 61, 85, and 115 propose to alter the 50GAUI and 100GAUI specifications such that the transmitters specifications are measured with a 2 MHz CRU.

Comment 87 proposes that no specifications are changed, but a note should be added in Clause 140 pointing out that the PMA adjacent to the PMD must adapt the jitter appropriately so that the PMD may meet the transmitter specifications.

For task force discussion.

See also comments i-85, i-87, and i-115.

Cl **135G** *SC* **135G.3.1** *P* **375** *L* **22** # i-114

Dawe, Piers J G — Mellanox Technologie

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

As shown in http://ieee802.org/3/bs/public/adhoc/elect/05Oct_17/dawe_01b_100517_elect.pdf and http://www.ieee802.org/3/cd/public/Nov17/dawe_3cd_01_1117.pdf there is a need for an additional spec to protect the module from e.g. very noisy hosts, and a max VEC spec provides worthwhile protection.
This was agreed in principle (D2.2 comment 30) but not implemented at that time. Now is the time.

SuggestedRemedy

Here, add a requirement for VEC, max 12 dB. In a new 135G3.1.1 or 135G.4.1, add definition of VEC, based on the definition in P802.3bs D2.0 120E.4.2.1: see dawe_3cd_01_1117 slide 13 (or successor) for proposed text. Add new PICS for 135G.5.1.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

A presentation and proposal on this subject was considered at the previous task force meeting. The response included the following:
"Viewed dawe_3cd_01_1117. There was general agreement with the proposal.
A presentation providing detailed implementation is encouraged.
The commenter is encouraged to resubmit this comment at Sponsor ballot."

For task force discussion.

Cl **135G** *SC* **135G.3.1** *P* **375** *L* **33** # i-87

Wertheim, Oded — Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *jitter mismatch <cc>*

The jitter specification for the 100G per lane 100GBASE-DR1 receiver uses the same frequency corner as the 50G per lane 100GAUI-2 with the same jitter but with half the peak-to-peak jitter as the jitter mask is defined in UIs. This requires the 100GBASE-DR transceiver PMA to implement a de-jitterizer, which requires to add a PLL to handle the low frequency jitter and a large jitter buffer (which may be unbounded when attempting to reduce also the very low frequencies jitter). This adds unnecessary complexity, cost and power to the transceiver.

SuggestedRemedy

Scale the corner frequency for 100GAUI-2 to 2MHz (half the corner frequency of 100GBASE-DR). The proposed resolution doesn't introduce constraints on future 100G per lane interfaces and provides simpler solution than alternative solutions that were investigated, with no change to the optical specs.

1. Add an exception to 135G.4 50GAUI-1 C2M and 100GAUI-2 C2M measurement methodology with an exception that:
a. The reference CRU for the Eye width and eye height measurement method has a corner frequency of 2MHz for the host output and module input tests.

2. Add an exception to 135G.3.4 50GAUI-1 C2M and 100GAUI-2 C2M module input characteristics:
With an exception that:
a. The reference CRU for the Module stressed input test has a corner frequency of 2MHz
b. The applied sinusoidal jitter values for 100GAUI-2 Module stressed input test shall be:
{Jitter frequency, Jitter amplitude}
Case A: {0.02, 5}
Case B: {0.66, 0.15}
Case C: {2, 0.05}
Case D: {6, 0.05}
Case E: {20, 0.05}

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Resolve with comment i-61.

Cl **136** *SC* **136** *P* **207** *L* **20** # i-158

Dudek, Michael — Cavium

Comment Type **T** *Comment Status* **D** *<bucket>*

There are two cable assembly test fixtures in the cable assembly specifications.

SuggestedRemedy

Change "the cable assembly test fixture" to "two cable assembly test fixtures"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

The comment correctly points out that two test fixtures are included in the specifications.

However, the test fixtures and the cable assembly include the mated connectors; there is no need to list the mated connector pairs separately.

Change from "Two mated connector pairs and the cable assembly test fixture"
To "Two cable assembly test fixtures".

Cl **136** *SC* **136.1** *P* **198** *L* **10** # i-156

Dudek, Michael — Cavium

Comment Type **E** *Comment Status* **D** *<cc>*

In the stack Clause 91 FEC will always be below the Clause 83 annexes. It would read better if Table 136-2 were in the same order.

SuggestedRemedy

In table 136-2 Move the row for clause 91 immediately below the row for Annex 83D. Make the same change in Table 137-2.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The ordering of Clauses in this table is not intended to define the sublayer stack order.

Cl **136** *SC* **136.3** *P* **200** *L* **45** # i-157

Dudek, Michael — Cavium

Comment Type **E** *Comment Status* **D** *<bucket>*

With just two possible values of I the use of "or" instead of "to" is better.

SuggestedRemedy

Change "to" to "or"

Proposed Response *Response Status* **W**

PROPOSED REJECT.

This is consistent with other definitions with multiple lanes, e.g, 0 to 3. Also, it is not incorrect as written.

Cl **136** *SC* **136.3** *P* **234** *L* **30** # i-77

Mellitz, Richard — Samtec, Inc.

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

Return loss has not been demonstrated to limit sufficiently limit COM variability. There is no clear relation between the DFE in the reference signaling architecture and portions of reflections which are re-reflected. Apparently, there is no clear tie-in between the host input/output return loss and cable assembly return loss. ERL addresses these reflections directly and provided a linkage to input/output return loss.

SuggestedRemedy

Rename clause 136.11.3 from "Cable Assembly Differential Return Loss" to ""Cable Assembly Effective Return Loss". Remove all the content of 136.11.3. Replace with: "The minimum effective return loss of the cable assembly shall be greater than 11.2 dB only when COM is less than 4 dB computed using beta_x=10.7e9, rho_x=0.15, PTDR Tr=18.9ps, and N_b is set by this clause."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-74.

Cl **136** *SC* **136.6.1** *P* **202** *L* **19** # i-123

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *skew <cc>*

The Skew at SP4 (the receiver MDI) has to be the same as the Skew at SP3 (the transmitter MDI) for these serial PMDs.

SuggestedRemedy

Correct the numbers at SP4 and SP5. Correct Table 131-5, Summary of Skew constraints - all 50GBASE-R PMDs are serial so it's simple to do. Also 137.6.1 138.3.2.1 139.3.2.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The skew constraints for 100G in Table 80-5 and for 50G in Table 131-5 are consistent with the budget and methodology adopted by 802.3ba and 802.3bg and used in subsequent projects (e.g., 802.3bm, 802.3bs).

The skew constraints are established to ensure that the FEC/PCS skew tolerance is sufficient to support the worst case skew for any currently specified or potential (within reason) future PHY (e.g., 2-lane PMD for reach longer than 40 km). This is accomplished by having the same skew constraint at SP5 regardless of the PMD type.

The skew constraint at SP5 includes allocation for skew accumulated through the TX PMD (SP2 to SP3), the medium (SP3 to SP4), and the RX PMD (SP4 to SP5). Rather than specifying unique values for SP3, SP4, and SP5 based on PMD type, the adopted approach was to use the same numbers for all PMD types for consistency.

The approach described above is consistent for all PHY types defined by 802.3ba and subsequent projects. For instance, the medium skew accumulation (SP3 to SP4) of 80 ns was based on an 80 km multi-lane optical PMD. Nevertheless, the same value is used for other PMDs where the skew would be considerably lower (e.g., 100GBASE-SR4, 100GBASE-KR4, 100GBASE-CR4, etc.).

This specification methodology does not preclude an engineered implementation that optimizes the FEC/PCS skew buffering based on assumed lower PMD and medium skew accumulation. However, it should be noted that this implementation would not be compliant to 802.3cd.

Cl **136** *SC* **136.8.1** *P* **207** *L* **15** # i-24

Lusted, Kent — Intel Corporation

Comment Type **ER** *Comment Status* **D** *<bucket>*

Incorrect cross reference. this should reference 136.10 (Channel characteristics), not 136.9 (PMD electrical characteristics)

SuggestedRemedy

Change reference to 136.10

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136** *SC* **136.8.2** *P* **208** *L* **1** # i-25

Lusted, Kent — Intel Corporation

Comment Type **TR** *Comment Status* **D** *PAM4 levels <cc>*

there is no explicit mapping of the differential output voltage to tx_symbol = two and tx_symbol = one.

SuggestedRemedy

Add the explicit mapping of the differential output voltage to tx_symbol = two and tx_symbol = one.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

In the second paragraph, change FROM
"The highest differential output voltage (SLi<p> minus SLi<n>) shall correspond to tx_symbol = three and the lowest differential output voltage shall correspond to tx_symbol = zero"
TO
"The differential output voltage (SLi<p> minus SLi<n>) meets the specifications in 136.9.3.1.1 where the PAM4 symbol values 0, 1, 2, and 3 correspond to the tx_symbol values zero, one, two, and three, respectively, with the highest differential output voltage corresponding to tx_symbol = three and the lowest differential output voltage corresponding to tx_symbol = zero".

In the third paragraph, change FROM
"The highest differential output voltage (SLi<p> minus SLi<n>) shall correspond to the symbol 3 and the lowest differential output voltage shall correspond to the symbol 0"
TO
"The differential output voltage (SLi<p> minus SLi<n>) meets the specifications in 136.9.3.1.1, with the highest differential output voltage corresponding to the PAM4 symbol 3 and the lowest differential output voltage corresponding to the PAM4 symbol 0".

A similar clarification should be provided for the optical PMDs.

In 138.5.2, 139.5.2, and 140.5.2 ...
change: “The highest optical power level in the signal stream shall correspond to tx_symbol = three and the lowest shall correspond to tx_symbol = zero.”
to: “The four optical power levels in the signal stream in order from lowest to highest shall correspond to tx_symbols zero, one, two, and three, respectively.”

In 138.5.3, 139.5.3, and 140.5.3 ...
change: “The highest optical power level in each signal shall correspond to rx_symbol = three and the lowest shall correspond to rx_symbol = zero..”
to: “The four optical power levels in each signal stream in order from lowest to highest shall correspond to rx_symbols zero, one, two, and three, respectively.”

Cl **136** *SC* **136.8.2** *P* **208** *L* **6** # i-26

Lusted, Kent — Intel Corporation

Comment Type **ER** *Comment Status* **D** *<bucket>*

The second paragraph in 136.8.2 reference the tx_symbol values as "three" and "zero". The first paragraph in 136.8.3 reference the rx_symbol values as "three" and "zero".

however, the 3rd paragraph of 136.8.2 does not use "three" and "zero" but "3" and "0".

SuggestedRemedy

In the 3rd paragraph of 136.8.2, change to "three" and "zero"

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The 3rd paragraph uses "3" and "0" because in TRAINING mode the input to the PMD transmit function comes from the PMD control function, which is specified using the numbers 0 to 3 (the numbers are mapped to tx_symbol values, see 136.8.11.1).

Cl **136** *SC* **136.8.11.1** *P* **210** *L* **4** # i-27

Lusted, Kent — Intel Corporation

Comment Type **TR** *Comment Status* **D** *<bucket>*

the term "the symbol values..." in the parenthesis is a bit confusing. The first sentence of the paragraph references PAM4 symbols as well as tx_symbol and rx_symbol.

SuggestedRemedy

change "the symbol values" to "the PAM4 symbol values"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136** *SC* **136.8.11.4.1** *P* **215** *L* **47** # i-89

Slavick, Jeff — Broadcom Limited

Comment Type **E** *Comment Status* **D** *<bucket>*

This sub-section has 2 chunks of information, the first part describes how to Request an Initial Condition and the second part how to respond to a Request. It would be cleaner if these were split into two sections.

SuggestedRemedy

Change title of 136.8.4.11.1 to be "Initial condition setting request process"
Insert new sub-heading 136.8.4.11.2 titled "Initial condition setting response process" before the paragraph starting with "The handling of"
Update 136.8.11.7.2 UPDATE_IC reference to the new sub-section

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

[Editor's note. Updated since first posting.]

This response is the same as the suggested remedy, except with subclause number corrected.

Change title of 136.8.11.4.1 to be "Initial condition setting request process".

Insert new subclause heading 136.8.11.4.2 titled "Initial condition setting response process" before the paragraph starting with "The handling of".

Update 136.8.11.7.2 UPDATE_IC reference to the new subclause 136.8.11.4.2.

Cl **136** *SC* **136.8.11.4.2** *P* **216** *L* **28** # i-90

Slavick, Jeff — Broadcom Limited

Comment Type **E** *Comment Status* **D** *<bucket>*

This sub-section has 2 chunks of information, the first part describes how to Request a Coefficient update and the second part how to respond to a Request. It would be cleaner if these were split into two sections.

SuggestedRemedy

Change title of 136.8.4.11.2 to be "136.8.4.2.11.3 Coefficient update request process"
Insert new sub-heading 136.8.4.11.4 titled "Coefficient update response process" before the paragraph starting with "The handling of"
Update 136.8.11.7.2 UPDATE_C(k) reference to the new sub-section

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-89 using appropriate updated subclause numbers.

Cl **136** *SC* **136.8.11.6** *P* **218** *L* **15** # i-159

Dudek, Michael Cavium

Comment Type **E** *Comment Status* **D** *<bucket>*

It would read better if the order of the sentence were changed.

SuggestedRemedy

Change "The time from the receipt of a new request to the time that request is acknowledged shall be less than 2 ms when the receiver frame lock bit in the status field of transmitted training frames is set to 1." to "When the receiver frame lock bit in the status field of transmitted training frames is set to 1 the time from the receipt of a new request to the time that request is acknowledged shall be less than 2 ms."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Change FROM
"The time from the receipt of a new request to the time that request is acknowledged shall be less than 2 ms when the receiver frame lock bit in the status field of transmitted training frames is set to 1."
TO
"When the receiver frame lock bit in the status field of transmitted training frames is set to 1, the time from the receipt of a new request to the acknowledgment of that request shall be less than 2 ms."

Cl **136** *SC* **136.8.11.7.3** *P* **221** *L* **27** # i-91

Slavick, Jeff Broadcom Limited

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

The initial suggested maximum link train duration provided during baseline adoptions was 1.5s which was made without significant operation of the newly proposed training protocol. With the benefit of additional experience gained over the last 18 months it has become clear that additional time would be beneficial. Some of the reasons the new protocol is taking longer are
1) Additional equalization tap provided (pre2)
2) Protocol serializes the coefficient updates
3) Additional Preset condition to test
4) Additional transmission modes (ie. precode)
5) PAM4 is more sensitive to mis-equalization

SuggestedRemedy

Change the max_wait_timer in 136.8.11.7.3 to be 3s
Change the link_inhibit_fail_timer in Table 73-7 to range from 3.1 to 3.2 seconds for the PAM4 PHYs

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136** *SC* **136.9** *P* **225** *L* **39** # i-96

Rysin, Alexander Mellanox Technologie

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

Frequency domain return loss mask does not truly represent digital signaling at a given bit error ratio. There is no real proof that violating return loss masks is directly tied to failures and a number of false negatives have been shown. D2.0 comment 141, D2.1 comments 26, 27 and 28.

SuggestedRemedy

* Add annex describing ERL measurement and computation. See prior presentations for description.
* Remove the requirement for Differential return loss in Table 136-11.
* Add a requirement for Effective Return Loss (ERL) to be greater than 18.2 dB in Table 136-11.
* In 136.9.4 change "The receiver shall meet the return loss requirements specified in 92.8.4.2 and 92.8.4.3." to "The receiver shall meet the effective return loss requirement in 136.9.3."
* Add a paragraph in 137.9.2 and to 137.9.3 - "Effective Return Loss (ERL, min) is 16.2 dB. There is no frequency domain return loss mask."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-74.

Cl **136** *SC* **136.9** *P* **226** *L* **8** # i-97

Rysin, Alexander — Mellanox Technologie

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

Transmitter output residual ISI SNR_ISI (min) 36.8 dB (Clause 136) and 43 dB (Clause 137) is too high - can barely measure the IC through the test fixture. The warning NOTE in 120D.3.1.7 shows the issue, but doesn't solve it. The limits for SNR_ISI in Clause 136 and Clause 137 are even more stringent than in 120D. D2.0 comment 140, D2.1 comment 49, D2.2 comment 22.
Since both SNR_ISI and Effective Return Loss (ERL) represent uncompensated reflections from the transmitter and the test fixtures, measurements of ERL can replace SNR_ISI.

SuggestedRemedy

* Remove reference to SNR_ISI in Table 136-11 --Summary of transmitter specifications at TP2.
* Add a requirement for Effective Return Loss (ERL) to be greater than 18.2 dB in Table 136-11.
* Change paragraph 3 in 137.9.2 from "SNR_ISI is computed with Nb set to 12 and Dp set to 3. The value of SNR_ISI (min) is 43 dB." to "Effective Return Loss (ERL) is calculated with Nb set to 12 (see Annex New). ERL shall be at least 16.2 dB. The Transmitter Output residual ISI SNR_ISI specification in Table in Table 120D-1 does not apply."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-74.

Cl **136** *SC* **136.9.3** *P* **225** *L* **23** # i-21

RAN, ADEE — Intel Corporation

Comment Type **TR** *Comment Status* **D** *AC-coupling*

Scope connection through AC coupling is not specified in this clause. Transmitter tests should be done through AC coupling (except for common mode tests).

See http://www.ieee802.org/3/cd/public/adhoc/archive/ran_112717_3cd_adhoc.pdf

SuggestedRemedy

In the first paragraph:

"Unless specified otherwise, all transmitter measurements are made for each lane separately, at TP2, utilizing the test fixtures specified in Annex 136B, using a test system with a fourth-order Bessel-Thomson low-pass response with 33 GHz 3 dB bandwidth"

Append: "connected as shown in Figure 92-15".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

[Editor changed CommentType from GR to TR]

Implement suggested remedy.

Cl **136** *SC* **136.9.3** *P* **225** *L* **37** # i-50

RAN, ADEE — Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

"1 200"

According to the style guide (13.3.2), "In numbers of four digits, the space is not necessary, unless four-digit numbers are grouped in a column with numbers of five digits or more".

SuggestedRemedy

Remove the space here and in all other occurrences of four-digit numbers.

Consider removing spaces from all numbers within normal text (excluding tables).

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Change "1 200" to "1200".

See also comment i-86.

Cl **136** *SC* **136.9.3** *P* **225** *L* **39** # i-74

Mellitz, Richard — Samtec, Inc.

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

Comments and supporting presentations in prior drafts reported difficulty making SNDR and SNR_ISI measurements. SNR_IS is a small difference of large numbers. Thus, is somewhat problematic. SNR_ISI is related to return loss. Clause 136.9.3 specifies return loss pointing to 92.8.3.2. Return loss is a measurement of reflections. However, return loss does not comprehend a DFE and impact of cable assembly return loss which is a component of host return loss as well as SNR_ISI. Re-reflection was also not considered in SNR_ISI.

SuggestedRemedy

ERL is a direct measure of pertinent reflections in the context of host loss and a DFE, plus allowing for a specific budgeted amount of cable assembly reflection derived from channel ERL. In table 136-11 remove row for "SNRISI (min.)". Replacing row for "differential output return loss (min)" in Table 136-11 with ERL (min) which shall be greater than 12.9 dB using beta_x=10.7e9, and rho_x=0.28, PTDR T_r=18.9 ps, and N_b is set by this clause. Also add annex 137A describing ERL computation. See presentation on implementation.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Pending presentation and task force discussion.

Cl **136** *SC* **136.9.3** *P* **225** *L* **46** # i-161

Dudek, Michael — Cavium

Comment Type **TR** *Comment Status* **D** *Tx electrical*

The value of linear fit pulse peak needs to correlate with the value expected with the transmitter and host board used in COM to specify the cable. The existing value for this parameter is the same as 802.3by which have larger die and package capacitance. It is expected therefore that the value of this parameter should be larger than 0.49

SuggestedRemedy

Complete the simulation and change the value. A presentation is expected. Make the change on page 228 line 23 as well.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Pending presentation and task force discussion.

Cl **136** *SC* **136.9.3** *P* **226** *L* **7** # i-48

RAN, ADEE — Intel Corporation

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

The SNR_ISI requirement in this clause (36.8 dB) is very demanding and may be impossible to meet with a test setup that includes imperfectly-matched test fixture and scope, and low-loss instrument-grade cables.

This specification is based on budgeting the residual ISI and the measured SNDR as the SNR_ISI COM parameter. But counting all measured ISI beyond the DFE range as residual ISI may be too stringent.

For instance: in reality, only a fraction of the transmitted energy will be returned from the remote end of the cable and bounce back (triple transit), due to the insertion loss of the cable (so this effect gets weaker with increased cable loss). But in a lab setup, the triple-transit reflection through a short, low-loss instrument-grade cable may be much stronger and cause degradation in the measured SNR_ISI.

Adding a directional coupler in the measurement may help reduce the latter effect.

The comment also applies to the similar specification in 137.9.2 (43 dB, which is impossible to measure in practice).

SuggestedRemedy

Add a recommendation for using a directional coupler in the measurement setup.

Consider replacing the SNR_ISI specification with an alternative method such as ERL.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-74.

Cl **136** *SC* **136.9.3** *P* **226** *L* **7** # i-75

Mellitz, Richard — Samtec, Inc.

Comment Type **TR** *Comment Status* **D** *<bucket>*

see previous

SuggestedRemedy

see previous

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Comment and remedy do not provide sufficient detail to make any change in the draft.

Cl **136** *SC* **136.9.3** *P* **226** *L* **7** # i-49

RAN, ADEE — Intel Corporation

Comment Type **TR** *Comment Status* **D** *Tx electrical*

The SNR_ISI specification in 120D.3.1.7 uses N_b from Table 120D-8, which is 10; but in this clause the reference receiver has N_b=12. This should be an exception to the procedure.

SuggestedRemedy

Add to footnote b: Calculation of SNR_ISI is done with N_b given in Table 136-15 replacing the value in Table 120D-8.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Note that other comments may result in removal of SNR_ISI.

If SNR_ISI is not removed, apply suggested remedy.

Cl **136** *SC* **136.9.3** *P* **226** *L* **10** # i-131

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *Tx electrical*

As noted in D2.0 comment 143 and 144, and D2.1 comment 43, these TP2 Jrms and J4u limits, which are copies of the ones in Table 120D-1 (different BER, different test point) should be replaced with Jrms and J3u limits that are consistent (not the same) as the TP0a limits. Crosstalk at the connector combined with the slower edges increases J3u from TP0a to TP2.

SuggestedRemedy

Change J4u to J3u, here and in 137. Choose the limits at TP2 considering the jitter limit at TP0a, the mated compliance board crosstalk specs, and the slower edges at TP2.
In 136.9.4.2.3 step e, change J4u to J3u (3 places).

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The suggested remedy lacks sufficient detail for implementation.

Although J3u may better represent system performance, there is merit for consistency in keeping the test method identical to the one in Annex 120A which defines J4u measurement methodology, possibly changing values due to possible increase of jitter from TP0a to TP2.

The commenter is encouraged to suggest specific values for jitter at TP2 and build consensus around a proposal.

Resolve with comment i-106.

Cl **136** *SC* **136.9.3** *P* **226** *L* **22** # i-88

Szczepanek, Andre — HSZ Consulting Ltd

Comment Type **TR** *Comment Status* **D** *editor's notes <cc>*

The editors note "The values for SNDR, SNR_ISI, and SNR_TX require confirmation and may change." indicates that values in Table 136-11 are not ready for standardisation.

Like-wise the editors notes on pages: 236, 271, 272, & 273 which all relate to table values that "require confirmation and may change".

SuggestedRemedy

Gain the required confirmation of the values and then remove the editors note(s).

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

For task force discussion, following resolution of other comments.

Cl **136** *SC* **136.9.4** *P* **259** *L* **40** # i-76

Mellitz, Richard — Samtec, Inc.

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

Clause 136.9.4 specifies return loss pointing to 92.8.4.2. Return loss is a measurement of reflections. However, return loss does not comprehend a DFE and impact of cable assembly return loss.

SuggestedRemedy

ERL is a direct measure of pertinent reflections in the context of package loss and a DFE, plus allowing for a specific budgeted amount of cable assemble reflection derived from channel ERL. Remove the reference to 92.9.4.2. Add text indicating that ERL (min) for the host input shall be greater than 12.9 dB using beta_x=10.7e9, and rho_x=0.28, PTDR T_r=18.9ps, and N_b is set by this clause. Also add annex 137A describing ERL computation. See presentation on implementation.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-74.

Cl **136** *SC* **136.9.4.2** *P* **230** *L* **26** # i-101

Healey, Adam — Broadcom Ltd.

Comment Type **TR** *Comment Status* **D** *Rx electrical*

The responses to comments #135 and #136 against IEEE P802.3 (IEEE 802.3cj) D2.0 clarified that the COM value for interference tolerance testing is a "target" and not a "max" value. Table 136-13 would also benefit from this clarification.

SuggestedRemedy

Stradde the "min" and "max" columns for the COM row (keeping the same COM value). Add a note to the COM value similar to note c) of Table 110-6 in IEEE P802.3 (IEEE 802.3cj)/D3.0 i.e. "The COM value is the target value for the SNR_TX calibration defined in 136.9.4.2.3 item f). The SNR_TX value measured at the Tx test reference should be as close as practical to the value needed to produce the target COM. If lower SNR_TX values are used, this would demonstrate margin to the specification but this is not required for compliance."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

See comment i-132.

Cl **136** *SC* **136.9.4.2** *P* **230** *L* **26** # i-132

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *Rx electrical*

The COM value in the receiver interference tolerance isn't a maximum, it's the reference value that defines what we mean by receiver interference tolerance, and it is used as a target when adjusting the injected noise. See maintenance D2.0 comments 135 and 136.

SuggestedRemedy

In Table 136-13, straddle the "Min" and "Max" columns for the "COM" row and place the contents of the "Max" column into the straddled column. Add the following table footnote to the "COM" parameter label.
"The COM value is the target value for the SNR_TX calibration defined in 136.9.4.2.3 item f). The SNR_TX value measured at the Tx test reference should be as close as practical to the value needed to produce the target COM. If lower SNR_TX values are used, this would demonstrate margin to the specification but this is not required for compliance."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136** *SC* **136.9.4.2** *P* **230** *L* **26** # i-52

RAN, ADEE — Intel Corporation

Comment Type **T** *Comment Status* **D** *Rx electrical*

COM is specified as maximum here.

As of D3.0 of 802.3cj, the COM in receiver tolerance tests was changed to be a target (or both minimum and maximum), with a clarifying comment. The same should be done here.

SuggestedRemedy

Straddle the COM value across all columns.

Add a footnote with the following text:

The COM value is the target for the injected noise calibration defined in 136.9.4.2.3 step f). The noise level should be as close as practical to the value needed to produce the target COM. If higher noise levels are used, it would demonstrate margin to the specification but this is not required for compliance.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

See comment i-132.

Cl **136** *SC* **136.9.4.2** *P* **230** *L* **27** # i-51

RAN, ADEE — Intel Corporation

Comment Type **T** *Comment Status* **D** *Rx electrical*

b_max(1) and DER_0 values specified here are the same as the values for the cable assembly specification (Table 136-15) so they need not be listed.

SuggestedRemedy

Delete the bottom two rows from Table 136-13.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136** *SC* **136.9.4.2.2** *P* **230** *L* **42** # i-133

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D** *Rx electrical*

As pointed out in hidaka_3cd_01a_0517.pdf and hidaka_060717_3cd_adhoc-v2.pdf, and D2.0 comment 72, we need a spec for the test channel RL (Rx end) that's better than the regular cable RL spec given by 92.10.3, eq 92-27: 16.5-2rt.f to 4.1 GHz then 10.66-14log10(f/5.5). The comment proposed the mated test fixtures return loss limit, eq 92-38, 20-f to 4 GHz then 18-0.5f. Adopting a limit about half way between these two would be much better than doing nothing. See hidaka_3cd_01a_0517 slides 17/18 to end.

SuggestedRemedy

Insert new requirement into 136.9.4.2.2:
The test channel is the same as the one defined in 110.8.4.2.2, except that the cable assembly meets the
requirements of 136.11, the differential return loss of the test channel measured at the Rx test reference (see Figure 110-3b) meets Equation (136-new)."
Eq 136-new: 18-f to 4 GHz then 16-0.5f (about half way between eq 92-27 and eq 92-38).

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Comment #72 against D2.0 was rejected due to lack of consensus.

No new material or consensus to make the proposed changes has been shown since then.

Cl **136** *SC* **136.9.4.2.3** *P* **231** *L* **12** # i-28

RAN, ADEE — Intel Corporation

Comment Type **E** *Comment Status* **D** *Rx electrical*

"Equation (93A-19)" is an external cross reference.

SuggestedRemedy

Unless overtaken by another comment, apply external format.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with i-29 which may change this text.

Cl **136** *SC* **136.9.4.2.3** *P* **231** *L* **12** # i-29

RAN, ADEE — Intel Corporation

Comment Type **T** *Comment Status* **D** *beta*

Following the updates in the revision project (as of 802.3cj D3.0), the correction term beta is not needed any more.

The definition of Equation (93A-19) encompasses Equation (93A-46), so only the value of T_r is needed.

SuggestedRemedy

Change FROM
"The filtered voltage transfer function H(k)(f) calculated in Equation (93A-19) uses the filter Ht(f) defined by Equation (93A-46), where \beta is 2 and Tr is the 20% to 80% transition time at the Tx test reference"
TO
"The filtered voltage transfer function H(k)(f) calculated in Equation (93A-19) uses Tr equal to the 20% to 80% transition time at the Tx test reference."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Note that other comments are proposing to align P802.3cd D3.1 with the 802.3 revision rather than 802.3-2015 and its amendments.

Implement the suggested remedy.

Cl **136** *SC* **136.9.4.2.3** *P* **231** *L* **13** # i-18

Anslow, Peter — Ciena Corporation

Comment Type **T** *Comment Status* **D** *beta*

Comment #116 against D2.0 of the 802.3 revision project changed "<beta>" to "2" in Equation (93A-46). See:
http://www.ieee802.org/3/cj/comments/P8023-D2p0-Comments-Final-byID.pdf#page=30
When the P802.3cd draft is changed to become an amendment to the output of the revision, equivalent changes need to be made to the P802.3cd draft.

SuggestedRemedy

When the P802.3cd draft is changed to become an amendment to the output of the revision:
In 136.9.4.2.3, remove the phrase "<beta> is 2 and" from the second sentence of item d).
In 136.11.7, remove the phrase "and <beta> is 2" from the second sentence.
In 137.10, remove the phrase "and <beta> is 2" from the first sentence.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

See i-29 and i-31.

Cl **136** *SC* **136.9.4.2.3** *P* **231** *L* **25** # i-139

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D** *Rx electrical*

SNDR should be measured in the right bandwidth, or at least sigma_e and sigma_n should, because it's used in COM without further filtering: eq 93A-30. And see another comment.

SuggestedRemedy

Add another exception that sigma_e and sigma_n are found from signals observed with a fourth-order Bessel-Thomson low-pass response with 19.34 GHz 3 dB bandwidth.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Per Equation (93A-19) the voltage transfer function includes the receiver filter, which is a fourth-order Butterworth filter (with a cutoff frequency f_r, 19.9219 GHz for this clause).

The noise corresponding to SNDR is affected by h(0), which is the integral of that voltage transfer function, So it is affected by the receiver filter.

Note that the SNDR is calibrated by injecting "Broadband noise". Typical test equipment generate noise in a limited bandwidth, so there is little practical concern.

See also the response to comment i-138.

Cl **136** *SC* **136.9.4.2.3** *P* **231** *L* **36** # i-53

RAN, ADEE — Intel Corporation

Comment Type **TR** *Comment Status* **D** *Rx electrical*

In equation (136-7), if J4u is too large compared to J_RMS, then the discriminant may be negative and the resulting A_DD may become complex.

This may happen in practice, if the transmitter in the test does not have a dual-Dirac jitter distribution; for example, a low jitter most of the time with large but not too frequent excursions (such as sinusoidal jitter) may cause large J4 and small J_RMS.

Assuming we allow such a transmitter in a test setup (to enable injecting sinusoidal jitter in the JTT), it should be considered to have a large but purely "deterministic" jitter; A_DD=J4/2 and sigma_RJ=0.

As a sanity check, a Dual-dirac distribution with these values would yield the original J4u but its J_RMS would be higher than what was measured. This means COM would be "too pessimistic" and it may somewhat relax the test's stress; I think we can live with it.

SuggestedRemedy

Change equation (136-7) to consist of two cases:
When (Q4^2+1)*J_RMS^2 >= (J4u/2)^2 : the current equation holds.
Otherwise: J4u/2.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136** *SC* **136.9.4.4** *P* **233** *L* **11** # i-92

Kirkland, William

Comment Type **T** *Comment Status* **D** *Rx electrical*

I take issue with the use of the word "approximately" where using more than 1 or two significant figures. e.g. approximately 37.64706 ps is hardly approximate, it is quite exact.

SuggestedRemedy

Remedy: use a judicious choice of significant digitals when saying approximately, e.g. 1/Baud Rate or approximately 37.6 ps

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

[Editor changed CommentType from G to T.]

Using language from similar clauses (e.g., Clause 85, Annex 120E, Annex 83E) change the sentence to:

This translates to a nominal unit interval of 37.64706 ps.

Cl **136** *SC* **136.11** *P* **233** *L* **42** # i-54

RAN, ADEE Intel Corporation

Comment Type **T** *Comment Status* **D** *AC-coupling*

The important requirement that cable assemblies are AC coupled does not appear in the Cable assembly characteristics as it should.

The requirement does exist in the MDI annex 136C, but that annex mainly deals with mechanical parameters and pin-outs; other than AC coupling (in the overview) it contains no electrical parameters. Readers interested in AC coupling specifications may have a hard time finding it.

It is suggested to move the AC coupling requirement to the Cable assembly characteristics subclause, with the following considerations:

1. AC coupling is between corresponding contacts in two connectors at each end (may be obvious but is not currently stated).

2. The current text in the MDI annex specifies AC coupling "within the plug connector"; This goes without saying if AC coupling requirement is part of the cable assembly specification (and if anyone implements AC coupling in the middle of the cable, we shouldn't care - it is not observable).

3. The text also includes the sentence "The capacitor limits the inrush charge and baseline wander". This is not a specification, and it's arguably even informative, so it doesn't seem to be required.

SuggestedRemedy

Insert the following paragraph after the paragraph starting with "50GBASE-CR, 100GBASE-CR2, and 200GBASE-CR4":

"The path between corresponding contacts in the connectors at each end of a cable assembly shall include AC-coupling. It should be noted that there may be various methods for AC-coupling in actual implementations. The low-frequency 3 dB cutoff of the AC-coupling shall be less than 50 kHz. It is recommended that the value of the coupling capacitors be 100 nF."

Delete the fourth paragraph in annex 136C (which deals with AC coupling).

Change the reference of PICS item CA9 from 136.12 to 136.11, and change value comment to "Between corresponding contacts, 3 dB cutoff frequency less than 50 kHz".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-160

Cl **136** *SC* **136.11.7** *P* **234** *L* **50** # i-30

RAN, ADEE Intel Corporation

Comment Type **T** *Comment Status* **D**

Following the updates in the revision project (as of 802.3cj D3.0), the correction term beta is not needed any more.

Also in 136.9.4.2.3.

SuggestedRemedy

Delete "and \beta is 2" here.

Delete "\beta is 2 and" in 136.9.4.2.3.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-100

Cl **136** *SC* **136.11.7** *P* **234** *L* **50** # i-100

Healey, Adam Broadcom Ltd.

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

IEEE P802.3cd will end up being an amendment to IEEE Std 802.3-201x (currently IEEE P802.3 (IEEE 802.3cj) D3.0 which is in Sponsor ballot). The proposed changes and editing instructions should be aligned with the expected base document. The term <beta> has been removed from Equation (93A-46) (its value has been fixed at 2).

SuggestedRemedy

Remove the phrase "and <beta> is 2" at line 50 here and in 137.10 (p251, l49).

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-30.

Cl **136** *SC* **136.11.7** *P* **235** *L* **18** # i-162

Dudek, Michael — Cavium

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

The use of the approx 110 Ohm PCB trace in the COM calculation provides cables with impedances close to this value (or higher impedance still) a false improvement in COM relative to their expected system performance. It would be better to use 100 ohm PCB traces and it would be better to also change the package parameters to the nominal values used in clause 137. This however will significantly improve the COM values for the cable, implying better performance than is expected in the real system with hosts with 100 Ohm +/-10% PCB traces. It will also increase the COM in the interference tolerance test resulting in more noise being added in the test.

SuggestedRemedy

In table 136-15 change Rd to 50 Ohms and Zc to 95 Ohm
On page 236 line 38 and line 49, and page 237 line 17 Change "parameter values given in Table 92-12" to "parameter values given in Table 92-12 except that Zc=100 Ohms"
On page 235 line 2 and in table 136-14 change the pass/fall spec for COM from 3dB to 4dB. Also in the PICs on page 244 line 6.
In Table 136-13 change the COM from 3 to 3.5dB.
A presentation will be provided.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

The commenter's cited presentation was reviewed during the IEEE 802.3cd Jan 10th, 2018 ad hoc.
http://www.ieee802.org/3/cd/public/adhoc/archive/dudek_011018_3cd_adhoc.pdf

Address the comment and suggested remedy based on the presentation and further task force discussion.

Cl **136** *SC* **136.11.7** *P* **235** *L* **18** # i-134

Dawe, Piers J G — Mellanox Technologie

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

The COM impedances should be moved towards neutral, as explained in D2.0 comment 71 and 113.

SuggestedRemedy

Make changes similar to D2.0 comment 71 and hidaka_3cd_01_0717

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-162.

Cl **136** *SC* **136.11.7** *P* **235** *L* **18** # i-60

RAN, ADEE — Intel Corporation

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

Package transmission line characteristic impedance is set at 90 Ohm. This is an increase from the default value in Annex 93A which is 78.2 Ohm.

The reason for the relatively low value 78.2 Ohm was that to typical packages (especially large ones with many lanes) have lower impedance to improve their matching to silicon and ball impedances, and to reduce the trace insertion loss. This is not expected to change; most practical packages will not have impedance close to 100 Ohm.

In practice, termination can be adjusted and board design can be optimized to match lower impedance package and improve performance (even if cables are 100 Ohm)

It is suggested to acknowledge the expected lower impedance of practical devices in the reference package and termination parameters: assume packages are 80 Ohm while termination and board are 90 Ohm (imperfect matching).

Also applies in 137.10 (Table 137-5).

SuggestedRemedy

In both Table 136-15, and Table 137-5, change the value of Zc to 80 Ohm and Rd to 45 Ohm.

In 136.11.7.1, add an exception to the parameter values from Table 92-12: Z_c is set to 90 Ohm.

Consider changing the reference impedance for channels from 100 Ohm to 85 Ohm (136.11.1 and 137.10, and COM tables).

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The COM parameter values for cable assemblies in Table 136-15 are used to calculate COM. Changes in the COM parameter values should be supported with comparisons between the commentors proposed values versus the Table-136-15 values to assess differences in computed COM results from measurements of a given cable assembly signal, near-end crosstalk and far-end crosstalk paths or some other metric yielding comparative results.

For committee discussion.

Cl **136** *SC* **136.11.7** *P* **235** *L* **45** # i-17

Anslow, Peter — Ciena Corporation

Comment Type **T** *Comment Status* **D**

Comment #132 against D2.0 of the 802.3 revision project changed the name of COM parameter f_z to be "Continuous time filter, zero frequency for g_DC = 0". See: http://www.ieee802.org/3/cj/comments/P8023-D2p0-Comments-Final-byID.pdf#page=35
When the P802.3cd draft is changed to become an amendment to the output of the revision, equivalent changes need to be made to the P802.3cd draft.

SuggestedRemedy

When the P802.3cd draft is changed to become an amendment to the output of the revision:
Change the name of f_z to be "Continuous time filter, zero frequency for g_DC = 0" in Table 136-15 and Table 137-5

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

[Editor's note. Updated since first posting.]

Draft 3.1 will be updated to align with 802.3-201x revision. Implement suggested remedy.

See comment i-102.

Cl **136** *SC* **136.11.7** *P* **235** *L* **45** # i-102

Healey, Adam — Broadcom Ltd.

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

IEEE P802.3cd will end up being an amendment to IEEE Std 802.3-201x (currently IEEE P802.3 (IEEE 802.3cj) D3.0 which is in Sponsor ballot). The proposed changes and editing instructions should be aligned with the expected base document. Parameter f_z has been given the more accurate name "Continuous time filter, zero frequency for g_DC = 0".

SuggestedRemedy

Change the name of parameter f_z in Tables 136-15 and 137-5 accordingly.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

[Editor's note. Updated since first posting.]

Resolve with comment i-17.

Cl **136** *SC* **136.11.7** *P* **235** *L* **51** # i-163

Dudek, Michael — Cavium

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

It is intended that the same ASIC would be used for CR and KR.

SuggestedRemedy

Change the values of Av and Afe to 0.415 and Ane to 0.604

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The suggested changes are likely of little consequence, however some analysis should be provided.

For committee discussion.

Cl **136** *SC* **136.11.7.1** *P* **236** *L* **39** # i-135

Dawe, Piers J G — Mellanox Technologie

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

Using 109.8 ohm PCB impedance in COM could provide an incentive to build cables to that (wrong) impedance, which seems unhelpful.

SuggestedRemedy

Change text to ..."and the parameter
values given in Table 92-12, with the exception that Zc is 100 [ohm]." Similarly in 136.11.7.1.1 and 136.11.7.1.2.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-162.

Cl **136A** *SC* **136A.2** *P* **379** *L* **21** # i-173

Dudek, Michael Cavium

Comment Type **T** *Comment Status* **D**

It is strange to say that characteristics are constrained in an informative section.

SuggestedRemedy

Change the sentence to "The recommended transmitter characteristics at TP0 as measured at TP0a are described in 137.9.2"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Characteristics and measurements are referred to TP0a.

"The recommended transmitter characteristics as measured at TP0a are described in 137.9.2"

Cl **136A** *SC* **136A.3** *P* **379** *L* **26** # i-174

Dudek, Michael Cavium

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

It is strange to say that characteristics are constrained in an informative section.

SuggestedRemedy

Change the sentence to "The recommended receiver characteristics at TP5 as measured at TP5a are described in 137.9.3"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

The characteristics and measurements are referred to TP5a.

"The recommended receiver characteristics as measured at TP5a are described in 137.9.3"

Cl **136A** *SC* **136A.7** *P* **381** *L* **43** # i-175

Dudek, Michael Cavium

Comment Type **E** *Comment Status* **D**

The Channel Operating Margin (min) value is not in Table 136-15 and this is a normative value not an informative value.

SuggestedRemedy

Delete section 136A.7

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136C** *SC* **136C.1** *P* **387** *L* **41** # i-160

Dudek, Michael Cavium

Comment Type **T** *Comment Status* **D** *AC-coupling*

The requirement for the AC coupling of the cable is a cable requirement not an MDI requirement. Exactly where the AC coupling is in the cable is not important.

SuggestedRemedy

Delete this paragraph here and insert an equivalent somewhat modified paragraph in section 136.11 Paragraph to say "For 50GBASE-CR, 100GBASE-CR2, and 200GBASE-CR4, the lanes are AC-coupled. The AC-coupling shall be within the cable assembly. It is recommended that it is within the plug connectors. It should be noted that there may be various methods for AC-coupling in actual implementations. The low-frequency 3 dB cutoff of the AC-coupling shall be less than 50 kHz. It is recommended that the value of the coupling capacitors be 100 nF. The capacitor limits the inrush charge and baseline wander." Change the reference on Page 225 line 6 to 136.11

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Delete paragraph P387, L41.
Add paragraph 136.11, P233, L42
"For 50GBASE-CR, 100GBASE-CR2, and 200GBASE-CR4, the lanes are AC-coupled. The AC-coupling shall be within the cable assembly. It is recommended that it is within the plug connectors. It should be noted that there may be various methods for AC-coupling in actual implementations. The low-frequency 3 dB cutoff of the AC-coupling shall be less than 50 kHz. It is recommended that the value of the coupling capacitors be 100 nF. The capacitor limits the inrush charge and baseline wander."

In the sentence Page 225 line 5 and 6, change the reference to 136.11 and delete "plug connectors" .

Cl **136C** *SC* **136C.1** *P* **387** *L* **41** # i-143

Dawe, Piers J G Mellanox Technologie

Comment Type **T** *Comment Status* **D** *AC-coupling*

The paragraph about AC coupling, which should be a property of and requirement on the cable not the MDI, is in the wrong place. The subclause reference in PICS CA9 is wrong.

SuggestedRemedy

Move this paragraph to 136.11 just before 136.11.1 (older clauses have it in the equivalent of 136.12, which is not really correct but at least it's in the clause). Update the subclause reference in PICS CA9.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-160

Cl **137** *SC* **137.9.2** *P* **251** *L* **22** # i-106

Healey, Adam — Broadcom Ltd.

Comment Type **TR** *Comment Status* **D** *Tx electrical*

The jitter requirements at TP2 are identical to the jitter requirements at TP0a. It seems that the uncorrelated jitter allowances should be larger at TP2 to account for a) the reduction in the slope of the waveform due to channel loss combined with b) the addition of noise in the form connector crosstalk. A similar concern was raised during the IEEE P802.3bj/D3.1 ballot (see comment r01-44 in <http://www.ieee802.org/3/bj/comments/P8023bj-D3p1-Comments_Final_byID.pdf>). See also <http://www.ieee802.org/3/bj/public/mar14/healey_3bj_03_0314.pdf>. No change was made to the IEEE P802.3bj draft because all lanes (the lane under test and aggressors) transmit the same test pattern (PRBS9). This was due to limitations on the configuration of the test pattern generators. It was postulated that crosstalk from PRBS9 aggressors would appear as correlated interference and show up in the SNDR results (as linear fit error) and not in uncorrelated noise/jitter results. However, the Clause 120 test pattern generator definition allows the PRBS13Q pattern to be sent only on the lane under test while aggressors send PRBS31Q (or a valid xxxBASE-R signal). For this case, it seems connector crosstalk will appear in uncorrelated jitter measurements and an increase in the TP2 jitter allowance (relative to TP0a) is warranted.

SuggestedRemedy

Increase uncorrelated jitter limits at TP2 to account for connector crosstalk. While there may be concerns that this would allow lower quality transmitters with low loss/noise host channels, one can always point to 136A.2 as a statement that such transmitters are still not allowed. This is expected to have no impact on channel compliance since the COM parameters are based on TP0/TP0a requirements.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Based on the comment, we are assuming that the commenter was referring to 136.9.3, not 137.9.2.

The suggested remedy lacks sufficient detail for implementation.

The commenter is welcome to suggest specific values for J4u / J_RMS and build consensus.

Cl **137** *SC* **137.9.2** *P* **251** *L* **23** # i-136

Dawe, Piers J G — Mellanox Technologie

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

Now that COM is defined with a near-neutral termination and package impedance, we don't expect transmitter return loss to align to the COM model any more. This RL is much tighter than CEI-56G-LR-PAM4 at low (and high) frequency (although apparently looser between 4 and 9 GHz). At low frequencies it is tighter than the channel RL, which seems back to front. The effect of (good) RL at low frequency is much less than the less good RL at higher frequencies anyway, and there is less concern about end-to-end reflections at higher frequencies than in C2C because the loss is higher when the receiver is challenged. So we can go back to what we had a few drafts ago, or go forward to something like ERL.

SuggestedRemedy

Either: Insert a new first item in the list of exceptions to Table 120D-1, create a new equation for Tx RL that is similar to the Cl.93 and the channel RL at low frequencies; 12 - 0.625f, 8.7-0.075f. Add figure to illustrate.
Or: change to an ERL spec or similar for the transmitter. Same Nb set to 12.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-74.

Cl **137** *SC* **137.9.2** *P* **251** *L* **28** # i-71

Mellitz, Richard — Samtec, Inc.

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

Comments and supporting presentations in prior drafts reported difficulty making SNDR and SNR_ISI measurements. SNR_ISI is a small difference of large numbers. Thus, is somewhat problematic. Return loss is a measurement of reflections. However, return loss does not comprehend a DFE and SNR_ISI does. Re-Reflection was also not considered in SNR_ISI. Loss is a part of a return loss measurement making a short package look much worse than a long package. However, on the average short packages may perform better a performance limits. (approximately 3 to 3.5 dB of COM).

SuggestedRemedy

ERL is a direct measure of pertinent reflections in the context of package loss and a DFE, plus allowing for a specific budgeted amount of channel reflection derived from channel ERL. Remove item 3 in exception list. Add exception item indicating that in Table 120D-1 "differential output return loss (min)" is replaced with ERL (min) which shall be greater than 16.2 dB using beta_x=10.7e9, and rho_x=0.318, PTDR T_r=18.9ps, and N_b is set by this clause. Also add annex 137A describing ERL computation. See presentation on implementation.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Pending presentation and task force discussion.

This comment is about the transmitter characteristics.

Resolve with i-72 and i-73.

Cl **137** *SC* **137.9.2** *P* **251** *L* **28** # i-137

Dawe, Piers J G — Mellanox Technologie

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

Transmitter output residual ISI, SNR_ISI (min) 36.8 dB (Clause 136) and 43 dB (Clause 137) is still too high - can barely measure the IC through the test fixture. The warning NOTE in 120D.3.1.7 (where it's "only" 34.8 dB) shows the issue, but doesn't solve it. D2.0 comment 140, D21. comment 49.

SuggestedRemedy

Change to ERL spec or similar for the transmitter. Same Nb set to 12. Delete the SNR_ISI spec.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-71.

Cl **137** *SC* **137.9.2** *P* **251** *L* **29** # i-138

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *Tx electrical*

Signal-to-noise-and-distortion ratio (min), increased to 33.3 dB (Clause 136) and to 32.5 dB (Clause 137) for all Tx emphasis settings, is still too high. D2.0 comment 139, D2.1 comment 50. It turns out that the SNDR method captures sort of "high frequency distortion" that is filtered out by a real channel and receiver 3fb/4 bandwidth (see 93A.1.4.1), partly un-filtered by the equalizer. So it should be measured in something less than ~19 GHz.

SuggestedRemedy

Add ", when sigma_e and sigma_n are found from signals observed with a fourth-order Bessel-Thomson low-pass response with 19.34 GHz 3 dB bandwidth.
NOTE--pmax is found from a signal observed with a fourth-order Bessel-Thomson low-pass response with 33 GHz 3 dB bandwidth."
If we wish, we can tweak the limit for pmax and measure it in the same 19.34 GHz, which would more correctly remove the harmonics from the measurement.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The sigma_TX term in COM is calculated under the assumption that the spectrum of the noise is identical to the spectrum of the ideal signal at the transmitter output (sinc shaped per Eq. 93A-23). If that is the case, the signal and the noise go through the same transfer function, which includes the transmitter, receiver, and channel (Eq. 93A-19).

The actual effect on the receiver depends on the Tx noise spectrum (if high frequencies dominate, sigma_tx is too high because they will be more attenuated by channel and Rx than the signal; if low frequencies dominate, sigma_tx is too low since they will be less attenuated).

The suggested remedy includes a specific new filter for noise measurement but there is no evidence that this filter is more suitable than the current filter.

Note that the reference receiver 3 dB bandwidth is 19.92 GHz, not 19.34 GHz.

For task force discussion.

Cl **137** *SC* **137.9.2** *P* **251** *L* **29** # i-105

Healey, Adam — Broadcom Ltd.

Comment Type **TR** *Comment Status* **D** *Tx electrical*

The minimum SNDR at TP2 (subject to confirmation per the editor's note) is 33.3 dB. However, in 136A.2 it is stated that "the transmitter characteristics at TP0 are constrained at TP0a by 137.9.2" and 137.9.2 sets the minimum SNDR at TP0a at 32.5 dB. Is it a reasonable expectation for the SNDR at TP2 to be better than the SNDR at TP0a? Comparing 100GBASE-CR4 to 100GBASE-KR4 (and 25GBASE-CR to 25GBASE-KR), the minimum SNDR at TP2 is 1 dB lower than the minimum SNDR at TP0a. This seems to make more sense since, while some noise and distortion observed at TP0a will be attenuated by the host channel, the numerator of the SNDR equation (linear fit pulse peak) is also reduced and the crosstalk of the host connector is an additional noise source. While there may be concerns that this would allow lower quality transmitters with low loss host channels, one can always point to 136A.2 as a statement that such transmitters are still not allowed. Finally, this is expected to have no impact on channel compliance since the COM parameters are based on TP0/TP0a requirements.

SuggestedRemedy

Set the "confirmed" minimum SNDR at TP2 to be less than the minimum SNDR at TP0a. A margin of 1 dB is suggested based on the margin allocated for 100GBASE-CR4 and 25GBASE-CR.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Note than SNDR in TP0a per 137.9.2 is equal to SNR_TX in COM, which assumes negligible unhandled ISI (indeed SNR_ISI is currently 43 dB). SNDR in this clause may need to be changed.

The suggested remedy may be either to change SNDR in Table 136-11 from 33.3 dB to 31.5 dB, or to change SNDR in 137.9.2 from 32.5 dB to 34.3 dB.

For task force discussion.

Cl **137** *SC* **137.9.2** *P* **251** *L* **30** # i-140

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *Tx electrical*

This clause with a BER of 2.4e-4 needs a J3u spec, just as 120D with a BER of 1e-5 uses J4u. Using J3u enables a shorter measurement as well as a more relevant, accurate one. The J3u value can be found using eq 136-7 and 136-8 to convert Table 120D1's J_rms and J4u to A_DD and sigma_RJ, then used again with Q3 instead of Q4 to find J_rms (same as original) and J3u.

SuggestedRemedy

Add exception 5: the J4u limit in Table 120E-1 does not apply but the maximum J3u is 0.106 UI.
In Eq 136-7 and 136-8 and the NOTE, change J4u to J3u, Q4=3.8906 to Q3=3.2905, Q(Q3) = 5 x10^-4.
Jrms and its value don't change.
If wished, add an informative NOTE in 137.9.2 saying that the J3u limit here is consistent with the J4u limit in Table 120D-1.
Add a new subclause:
136.9.3.n J3u Jitter
J3u is defined similarly to J4u (see 120D.3.1.8). J3u is defined as the time interval that includes all but 10^-3 of fJ(t), from the 0.05th to the 99.95th percentile of fJ(t).

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Note that this change reduces the effect of RJ and increases the effect of DJ (with a probability higher than 1e-3) on the jitter specification.

Also note that there is merit in keeping the test method identical to the one in Annex 120 (J4u).

The informative note in the suggested remedy is correct only in case the jitter distribution matches the dual-Dirac model exactly (with A_DD=0.02 UI and Sigma_RJ=0.01 UI). It is not true in general, and real transmitters may meet one specification and fail another. It is proposed not to include this note.

For task force discussion.

Cl **137** *SC* **137.9.3** *P* **251** *L* **35** # i-141

Dawe, Piers J G — Mellanox Technologie

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

Now that COM is defined with a near-neutral termination and package impedance, receiver mismatch is the receiver designer's concern, not the standard's, unless it is very extreme, because the receiver interference tolerance test finds its effect combined with other receiver attributes. And we don't expect receiver return loss to align to the COM model any more. This RL is much tighter than CEI-56G-LR-PAM4 at low (and high) frequency (although apparently looser between 4 and 9 GHz). At low frequencies it is tighter than the channel RL, which is the wrong way round. The effect of (good) RL at low frequency is much less than the less good RL at higher frequencies anyway. So we can go back to what we had a few drafts ago, or go forward to something like ERL.

SuggestedRemedy

Either: Insert a new first item in the list of exceptions to Table 120D-5, create a new equation for Rx RL that is similar to the Cl.93 and the channel RL at low frequencies; 12 - 0.625f, 8.7-0.075f. Add figure to illustrate or pont to the figure for Tx RL (see another comment).
Or: change to an ERL spec or similar for the receiver. I think it can be more lenient than the transmitter spec because we have the receiver interference tolerance test.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-71.

Cl **137** *SC* **137.9.3** *P* **251** *L* **43** # i-72

Mellitz, Richard — Samtec, Inc.

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

Clause 137.9.3 specifies return loss pointing to Table 120D-5. Return loss is a measurement of reflections. There is no direct tie-in to channel return loss. However, return loss does not comprehend a DFE and insertion loss as a part of a return loss measurement making a short package look much worse than a long package. However, on the average short packages may perform better a performance limits. (approximately 3 to 3.5 dB of COM).

SuggestedRemedy

ERL is a direct measure of pertinent reflections in the context of package loss and a DFE, plus allowing for a specific budgeted amount of channel reflection derived from channel ERL. Add exception item indicating that in Table 120D-5 "differential input return loss (min)" is replaced with ERL (min) which shall be greater than 16.2 dB using beta_x=10.7e9, and rho_x=0.318, PTDR T_r=18.9ps, and N_b is set by this clause. Also add annex 137A describing ERL computation. See presentation on implementation.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Pending presentation and task force discussion.

(This comment is about the receiver characteristics; resolve with i-71, i-73)

Cl **137** *SC* **137.10** *P* **251** *L* **49** # i-31

RAN, ADEE — Intel Corporation

Comment Type **T** *Comment Status* **D** *beta*

Following the updates in the revision project (as of 802.3cj D3.0), the correction term beta is not needed any more.

SuggestedRemedy

Delete "and \beta is 2".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Note that other comments are proposing to align P802.3cd D3.1 with the 802.3 revision rather than 802.3-2015 and its amendments.

Implement suggested remedy.

Cl **137** *SC* **137.10.2** *P* **253** *L* **40** # i-73

Mellitz, Richard — Samtec, Inc.

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

Return loss has not been demonstrated to sufficiently limit COM variability. There is no clear relation between the DFE in the reference signaling architecture and portions of reflections which are re-reflected. Apparently, there is no clear tie-in between the input/output return loss and channel return loss. ERL addresses these reflections directly and provided a linkage to input/output return loss.

SuggestedRemedy

Rename clause 137.10.2 from "Return Loss" to "Effective Return Loss". Remove all the content of 137.10.2. Replace with: "The minimum effective return loss of the channel shall be greater than 10.2 dB only when COM is less than 4 dB computed using beta_x=10.7e9, rho_x=0.15, PTDR Tr=18.9ps, and N_b is set by this clause."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Pending presentation and task force discussion.

(This comment is about the channel characteristics; resolve with i-71, i-72)

Cl **137** *SC* **137.12.3** *P* **256** *L* **40** # i-55

RAN, ADEE — Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Large font size in "RS(544,514)".

SuggestedRemedy

Fix it.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **137** *SC* **137.12.4.3** *P* **258** *L* **47** # i-164

Dudek, Michael — Cavium

Comment Type **T** *Comment Status* **D** *<bucket>*

Clause 137.9.1 contains an exception to 93.8.1.1. We should therefore refer to 137.9.1

SuggestedRemedy

Change 93.8.1.1 to 137.9.1

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

(accepting the suggested remedy)

In item TC1, change "subclause" from 93.8.1.1 to 137.9.1, adding internal cross-reference.

Cl **137** *SC* **137.12.4.3** *P* **258** *L* **50** # i-56

RAN, ADEE — Intel Corporation

Comment Type **T** *Comment Status* **D** *<bucket>*

Differential and common mode return loss are defined in Table 120D-1.

SuggestedRemedy

Change "value/comment" in TC3 and TC3 to "Per Table 120D-1".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Change "value/comment" in both TC3 and TC4 from "Meets equation constraints" to "Per Table 120D-1".

Cl **137** *SC* **137.12.4.4** *P* **259** *L* **24** # i-165

Dudek, Michael — Cavium

Comment Type **T** *Comment Status* **D** *<bucket>*

Clause 137.9.1 contains an exception to 93.8.2.1. We should therefore refer to 137.9.1

SuggestedRemedy

Change 93.8.2.1 to 137.9.1

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

(accepting the suggested remedy)

In item RC1, change "subclause" from 93.8.2.1 to 137.9.1, adding internal cross-reference.

Cl **138** *SC* **138** *P* **261** *L* **1** # i-122

Dawe, Piers J G — Mellanox Technologie

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

This clause has received next to no attention - it's still the baseline. It needs more (some) study.

SuggestedRemedy

Do the work. Show technical feasibility for the draft spec (after improvements).
The alternative is to withdraw the clause, which would be a pity.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

No change to document suggested.

Cl **138** *SC* **138.1** *P* **263** *L* **12** # i-57

RAN, ADEE — Intel Corporation

Comment Type **E** *Comment Status* **D**

"The 50GBASE-SR, 100GBASE-SR2 and 200GBASE-SR4 sublayers provide point-to-point 50, 100, and 200 Gigabit Ethernet links over one, two, or four, pairs of multimode fiber, up to at least 100 m"

This text is oddly placed after the list of references. It repeats the text in P261 L9 (four paragraphs before) almost verbatim, except that the word "PMD" is replaced by the three specific PMD names, and the words "with a reach of" are omitted.

This repetition is unnecessary.

SuggestedRemedy

Delete the quoted text.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The first occurrence is in the opening paragraph describing the PMDs in clause 138; the 'repetition' may be helpful to the reader because it occurs in a later (3 pages later) part of the overview section which is describing, and adjacent to, the sublayer diagram.

Cl **138** *SC* **138.7.1** *P* **272** *L* **17** # i-119

Dawe, Piers J G — Mellanox Technologie

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

A TDECQ limit of 4.9 seems very high, given that the same fibres and transmitter and receiver front-ends that should not be worse can do 100GBASE-SR4 (PAM2, almost the same signalling rate) without the FFE.

SuggestedRemedy

This needs more study. We should be able to use information from 802.3bm.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

No change to document suggested.

Cl **138** *SC* **138.8.2** *P* **274** *L* **18** # i-5

Anslow, Peter — Ciena Corporation

Comment Type **T** *Comment Status* **D** *<bucket>*

Comments #128 and #130 against D2.0 of the 802.3 revision project removed TIA-455-127-A-2006 from the references section of the base standard. See:
http://www.ieee802.org/3/cj/comments/P8023-D2p0-Comments-Final-byID.pdf#page=33
This comment proposes to make equivalent changes to the P802.3cd draft.

SuggestedRemedy

In 138.8.2, delete "TIA/EIA-455-127-A or"
In 138.11.4.4 OM2, delete "TIA/EIA-455-127-A or"
In 139.7.2, and 140.7.2:
change the subclause title to "Wavelength and side mode suppression ratio (SMSR)"
in the text change "wavelength" to "wavelength and SMSR" and delete "TIA/EIA-455-127-A or"
In Table 139-10: replace the em-dash with a cross-reference to subclause 139.7.2
In Table 140-10: replace the em-dash with a cross-reference to subclause 140.7.2
In 139.11.4.5 OM2 and 140.11.4.4 OM2:
change "Center wavelength" to "Center wavelength and SMSR"
delete "TIA/EIA-455-127-A or"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **138** *SC* **138.8.5** *P* **274** *L* **31** # i-79

Liu, Hai-Feng — Intel Corporation

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

The sub-eye threshold levels in current TDECQ measurement are determined by the OMAouter and the average optical power of the PAM4 eye diagram (Pave) as defined in equations (121-1), (121-2) and (121-3). While this is good for perfectly linear PAM4 signals with 3 equal eye amplitudes, it would lead to pessimistic TDECQ values as compared to the link sensitivity penalty measurements where thresholds are adjusted by real receivers to achieve the lowest BER even if the signal is not perfectly linear.
Several vendors have contributed data (way_3bs_01a_0717, tamura_3bs_01a_0917, baveja_3cd_01_1117) showing many units that are able to close the link with good sensitivity/BER margin would fail to meet the maximum TDECQ specification, causing good transmitters to be failed.

SuggestedRemedy

Propose to adopt threshold optimization in TDECQ measurement as described in mazzini_120617_3cd_adhoc-v2 with the additional constraints on the allowable adjustment range.
Detailed presentation to be submitted for the January meeting with the summary of the proposal, measurement data to support the proposal, and suggested changes in details.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The referenced mazzini presentation
http://www.ieee802.org/3/cd/public/adhoc/archive/mazzini_120617_3cd_adhoc-v2.pdf
does not provide sufficient details to implement. This presentation allows some non-linearity to be compensated by adjusting thresholds but proposes to limit non-linearity by some other means, which would not allow trade off between OMA and non-linearity. It is not clear that the suggested remedy would be an improvement to the draft.

Awaiting commenter's presentation and discussion at Task Force meeting.

The editor notes that the P802.3cd D3.0 definition of TDECQ penalizes transmitters with unequal eye heights - while allowing trade-off against OMA, through the Tx_OMA-TDEC spec. This was first proposed in P802.3bs ad hoc presentation

http://www.ieee802.org/3/bs/public/adhoc/smf/16_04_19/king_01a_0416_smf.pdf

and then agreed by the Task Force in adopting the changes described in

http://www.ieee802.org/3/bs/public/16_05/king_3bs_01a_0516.pdf

Cl **138** *SC* **138.8.5** *P* **274** *L* **39** # i-116

Dawe, Piers J G — Mellanox Technologie

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

It seems that it is possible to make a bad transmitter (e.g. with a noisy or distorted signal), use emphasis to get it to pass the TDECQ test, yet leave a realistic, compliant receiver with an unreasonable challenge, such as high peak power, high crest factor, or a need to remove emphasis from the signal, contrary to what equalizers are primarily intended to do. Note the receiver is tested for a very slow signal only, not for any of these abusive signals. This is an issue for all the PAM4 optical PMDs, although it may be worse for MMF because of the high TDECQ limit.

SuggestedRemedy

1. To screen for noisy or distorted signals with heavy emphasis
Define TDECQrms = 10*log10(A_RMS/(s*3*Qt*R)) where A_RMS is the standard deviation of the measured signal after the 13.28125 GHz filter response, Qt and R are as already in Eq 212-12. s is the standard deviation of a fast clean signal with OMA=2 and without emphasis, observed through the 13.28125 GHz filter response (around 0.7). Set limit for TDECQrms according to what level of dirty-but-emphasised signal we decide is acceptable, add max TDECQrms row to each transmitter table. Alternatively, if the same relative limit is acceptable for all PAM4 optical PMDs, the limit could be here in the TDECQ procedure.
Similarly in clauses 139, 140.
2. To protect the TIA input, consider a peak power spec as in Clause 86.
3. To protect the TIA and any AGC and TIA from unreasonable signals, consider a crest factor spec.
4. To protect the receiver from having to "invert" heavily over-emphasised signals, set a minimum cursor weight.
To protect the equalizer from having to support unnecessary settings for waveforms that can't or shouldn't ever happen, constrain the cursor position - see other comments .

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The need for additonal transmitter specs has not been established, and insufficient evidence has been provided that the proposed remedy fixes the claimed problem.

A contribution is invited that demonstrates the problem (a waveform that passes TDECQ but cannot be decoded by a reasonable receiver implementation) and that the proposed additional requirement prevents this issue from occurring. A similar proposal to create a TDECQrms spec was suggested in comment #r02-35 against 802.3bs D3.2, which was similarly rejected.

A peak power spec has not been shown to be necessary, and a definition and value has not been provided.
A crest factor limit has not been shown to be necessary, and a definition and value has not been provided.

The need for a limit to cursor weight or cursor position has not been established (see also

the response to comment i-107)

Cl **138** *SC* **138.8.5.1** *P* **274** *L* **51** # i-120

Dawe, Piers J G — Mellanox Technologie

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

Excluding scenarios that won't happen will pave the way to more efficient receivers (see another comment). A worst signal will involve a slow transmitter (not "anti-causal") and modal dispersion that might appear anti-causal but is contained by the launch and fibre specs, and the receiver (near to neutral). The combination won't be very strongly "anti-causal".
TR because it may take us a while to find enough evidence on what might/won't happen with a range of fibres.

SuggestedRemedy

Add "The reference equalizer shall not use more than two? three? pre-cursor taps." Define pre-cursor. Or the taps could be numbered and this rule expressed in terms of the cursor position.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The current specification puts no limit to the number of precursors. A need for a limit to cursor weight or cursor position not been established sufficiently and insufficient evidence has been provided that the proposed remedy fixes the claimed problem.

A similar comment r03-26 for P802.3bs D3.3 was discussed in the P802.3bs task force with regard to SMF PMDs and there was no consensus to make any changes in this regard. No new information has been provided in the meantime.

For task force discussion.

Cl **138** *SC* **138.8.5.1** *P* **274** *L* **54** # i-95

Kirkland, William

Comment Type **T** *Comment Status* **D**

I believe that the following "NOTE" in the TDECQ reference equalizer is NOT true, especially since there is no requirement on the reference tap location. NOTE--This reference equalizer is part of the TDECQ test and does not imply any particular receiver implementation. Not specifying the reference location clearly allows the system to favour both response with significant pre-cursors or post cursors. The use of FFE in this way precludes the use of a CTLE.

SuggestedRemedy

Remove the note. I suspect most people understand the implications on a 5 T t-spaced equalizer.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The NOTE is correct. The FFE reference equalizer does not preclude use of a CTLE in an implementation, but a CTLE equalizer is probably not a good choice for MMF links (where ~ 50% of all links will have anti-causal impulse responses) or SMF links where chirp and chromatic dispersion can cause assymetric pulse distortion.

Cl **138** *SC* **138.8.8** *P* **275** *L* **16** # i-58

RAN, ADEE

Intel Corporation

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

The SRS methodology in 121.8.9.1 and 121.8.9.3 has several flaws that need to be addressed:

- Half of the SECQ should be obtained without noise or jitter, using the combination of low-pass filter and E/O converter (which is marked as "Tunable" in Figure 139-5, and also in Figure 122-5, but not in Figure 121-6). Different E/O converters that may be used in the test setup may have different characteristics (noise and BW), which will result in very different setting for the low-pass filter. This freedom enables very different test conditions, some of which may be favorable for some devices.

- The remaining SECQ is met by adjusting the Gaussian noise (with unspecified power), sinusoidal interferer amplitude (with unspecified amplitude and frequency), and low-pass filter (with no specified limits); the sinusoidal jitter stress (which is specified) also affects SECQ. There are too many degrees of freedom here, which again enable very different test conditions (as demonstrated in http://www.ieee802.org/3/cd/public/Nov17/chang_3cd_01_1117.pdf).

- The effect of sinusoidal jitter on SECQ measurement is difficult to predict, since the measurement is done with a CRU (which tracks all frequencies to some extent). Also, the pattern used for calibration is very short and the length captured is not specified (e.g. no requirement to measure at least a full cycle of the sinusoidal jitter, which may be much longer than the test pattern). This may result in repeatability problems.

The too many degrees of freedom need to be limited, ideally to one knob that has to be turned to reach the required SECQ. This is the motivation for the proposed change.

Also applies to 139.7.9 and 140.7.9.

SuggestedRemedy

Add exceptions or additions to the methods of 121.8.9.1 and 121.8.9.3 including the following:

1. Specify the combined bandwidth of the E/O and the low-pass filter (without equalization), e.g. -3 dB at 15 GHz (or an agreed upon value). This may be measured using a different transmitter (e.g. sinusoidal generator). This step is prior to any SECQ measurement

2. Specify that the target SECQ is achieved by addition of Gaussian noise only (without sinusoidal interference), this will be the knob to turn to achieve the SECQ.

3. Specify that SECQ is calibrated once before addition of sinusoidal jitter, and calibration is not repeated for every jitter frequency. (If necessary, reduce SECQ target to accommodate for expected jitter effect).

Implement the chosen solution (with different bandwidth and SECQ targets) also in 139.7.9 and 140.7.9.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

It has not been demonstrated that there is a problem with the draft, nor has it been demonstrated that the proposed remedy fixes it.

The work presented in
http://www.ieee802.org/3/cd/public/Nov17/chang_3cd_01_1117.pdf
showed good correlation between SECQ and Rx sensitivity and the freedom to set up the SRS stress was explored quite thoroughly.

The freedom to set up the SRS test source is a balance between pragmatism and precision; the SECQ test metric ensures that the penalty (for the reference equalizer) of the induced stresses for different test source set-ups, is identical.

Cl **138** *SC* **138.8.8** *P* **275** *L* **28** # i-93

Kirkland, William

Comment Type **T** *Comment Status* **D**

Again, the use of approximately with an excessive amount of signifant figures. "approximately 13.28125 GHz". Just how close does one have to be to satisfy this requirement?. This occurs in TDECQ sections as well.

SuggestedRemedy

one half the baud rate, or x times the baud rate. If there is give or take, then there should be a +/- accuracy spec., I suspect 13.3 GHz is sufficient.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The current text refers back to subclause 121.8.5.1 which describes the combined O/E and oscilloscope bandwidth to be "approximately 13.28125 GHz." It also goes on to say that "Compensation may be made for any deviation
from an ideal fourth-order Bessel-Thomson response." Deviation from a BT4 bandwidth of 13.28125 GHz introduces a measurement difference, which may be compensated for. It is left to the implementer to decide the trade-off between bandwidth accuracy vs the degree of compensation that would be required.

The intent is that the measurement definition should describe an exact reference receiver bandwidth which can be implemented using a combination of inexact components and compensation techniques.

Cl **138** *SC* **138.10** *P* **277** *L* **13** # i-59

RAN, ADEE — Intel Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

Paragraph is not justified (i.e. it is aligned left).

SuggestedRemedy

Format as regular clause text.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **139** *SC* **139.6.1** *P* **292** *L* **49** # i-22

Anslow, Peter — Ciena Corporation

Comment Type **T** *Comment Status* **D**

There are errors in P802.3bs D3.5 in Table 122-9, 122-10, and Table 122-16 that have propagated through to the P802.3cd draft.
For IEEE 802.3 single-mode optical PMD clauses, the optical return loss of the transmitter compliance channel usually matches the Optical return loss tolerance (max) value in the transmit characteristics table.
Also, in the IEEE Std 802.3bs-2017 amendment, because of the increased sensitivity of the PAM4 modulation format to MPI, the Optical return loss tolerance (max) value was calculated from coherent addition of the worst case discrete reflectances allowed in the channel.
For Clause 122 in draft D2.0 of P802.3bs, the values for 200GBASE-FR4 and 400GBASE-FR8 were 17.8 dB and those for 200GBASE-LR4 and 400GBASE-LR8 were 15.7 dB in both places. These values were correctly derived from one -26 dB reflectance from the receiver combined with 4 or 6 -35 dB reflectances in the channel for the FR or LR cases respectively.
However, in D2.1 of P802.3bs a more complicated set of requirements for discrete reflectances in the channel were introduced. This allowed 10 x -40 dB reflections for FR and 10 x -38 dB reflections for LR. This changed the worst case combined reflection values to 16.5 dB and 15.1 dB for FR and LR respectively. Unfortunately, while the values in Table 122-9 and 122-10 were changed accordingly, the values in Table 122-16 were not.
In D3.2 of P802.3bs a further small change was made to the maximum reflectances in the channel so that for FR the worst case was 10 x -41 dB reflections and for LR it was 8 x -37 dB reflections. See http://www.ieee802.org/3/bs/public/adhoc/smf/17_05_16/anslow_01_0517_smf.pdf This again changed the worst case combined reflection values, this time to 17.1 dB and 15.6 dB for FR and LR respectively. Unfortunately, none of the values in Table 122-9, 122-10, or Table 122-16 were changed accordingly and these errors were taken over into the P802.3cd draft.
A comment has been submitted to the revision project to fix this in Table 122-9, Table 122-10, and Table 122-16.

SuggestedRemedy

In Table 139-6:
change "RIN16.5OMA (max)" to "RIN17.1OMA (max)"
change "RIN15.1OMA (max)" to "RIN15.6OMA (max)"
change the Optical return loss tolerance (max) values for FR and LR from 16.5 dB and 15.1 dB to 17.1 dB and 15.6 dB, respectively

In Table 139-11:
change the Optical return loss for 50GBASE-FR from 17.8 dB to 17.1 dB
change the Optical return loss for 50GBASE-LR from 15.7 dB to 15.6 dB

In 139.7.7:
in the title change "(RIN16.5OMA and RIN15.1OMA)" to "(RIN17.1OMA and RIN15.6OMA)
in a) change "16.5 dB for 500GBASE-FR and 15.1 dB for 50GBASE-LR"
to "17.1 dB for 50GBASE-FR and 15.6 dB for 50GBASE-LR"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **139** *SC* **139.7.5** *P* **296** *L* **20** # i-80

Liu, Hai-Feng Intel Corporation

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

The sub-eye threshold levels in current TDECQ measurement are determined by the OMAouter and the average optical power of the PAM4 eye diagram (Pave) as defined in equations (121-1), (121-2) and (121-3). While this is good for perfectly linear PAM4 signals with 3 equal eye amplitudes, it would lead to pessimistic TDECQ values as compared to the link sensitivity penalty measurements where thresholds are adjusted by real receivers to achieve the lowest BER even if the signal is not perfectly linear.
Several vendors have contributed data (way_3bs_01a_0717, tamura_3bs_01a_0917, baveja_3cd_01_1117) showing many units that are able to close the link with good sensitivity/BER margin would fail to meet the maximum TDECQ specification, causing good transmitters to be failed.

SuggestedRemedy

Propose to adopt threshold optimization in TDECQ measurement as described in mazzini_120617_3cd_adhoc-v2 with the additional constraints on the allowable adjustment range.
Detailed presentation to be submitted for the January meeting with the summary of the proposal, measurement data to support the proposal, and suggested changes in details.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See resolution to comment i-79

Cl **139** *SC* **139.7.5.4** *P* **297** *L* **52** # i-117

Dawe, Piers J G Mellanox Technologie

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

An equalizing optical receiver has to search through and optimise many dimensions - this flexibility has a cost in design and test, and possibly time to start the link, power and sensitivity. Excluding scenarios that won't happen will pave the way to more efficient receivers in the future. It seems that an SMF signal that needs the equalizer could be slow, "causal" like an electrical signal, to "neutral" like a BT4 filter, to mildly anti-causal in appearance - maybe. But not strongly "anti-causal". We can make practical use of such knowledge (even if the search space would be different for a different PMD).
TR because it may take us a while to find enough evidence on what might/won't happen with a range of transmitter implementations.

SuggestedRemedy

Add "The reference equalizer shall not use more than two pre-cursor taps." Define pre-cursor. Or the taps could be numbered and this rule expressed in terms of the cursor position.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See resolution to comment i-107

Cl **139** *SC* **139.7.5.4** *P* **297** *L* **52** # i-107

Sun, Junqing — Credo Semiconductor

Comment Type **T** *Comment Status* **D**

5-tap T/2-spaced reference receiver has no more than 2 UI precursor coverage. Current reference equalizer with 5-tap T-spaced FFE allows up to 4 precursors. On one hand, a good system does not need so many precursors. On the other hand, supporting so many precursors may allow problematic transmitters to enter the market. This forces receivers to have high complexity and power to ensure interop. Given the fact that no more than 2 precursors are needed in the tests having been reported (e.g. mazzini_01a_0517_smf.pdf), the number of precursors shall be limited to no more than two.

SuggestedRemedy

Add a constraint on main tap location:

139.7.5.4 TDECQ reference equalizer
The reference equalizer for 50GBASE-FR and 50GBASE-LR is a 5 tap, T spaced, feed-forward equalizer (FFE), where T is the symbol period. The sum of the equalizer tap coefficients is equal to 1. Main tap location shall not be higher than three.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The current specifications put no limits to the number of precursors. A need for a limit to cursor weight or cursor position not been established sufficiently and insufficient evidence has been provided that the proposed remedy fixes the claimed problem.
This proposed resolution is consistent with the agreed resolution to comment r03-26 to P802.3 bs draft 3.3.

Cl **139** *SC* **139.7.5.4** *P* **298** *L* **1** # i-94

Kirkland, William

Comment Type **T** *Comment Status* **D**

I believe that the following "NOTE" in the TDECQ reference equalizer is NOT true, especially since there is no requirement on the reference tap location. NOTE--This reference equalizer is part of the TDECQ test and does not imply any particular receiver implementation. Not specifying the reference location clearly allows the system to favour both response with significant pre-cursors or post cursors. The use of FFE in this way precludes the use of a CTLE.

SuggestedRemedy

Remove the note. I suspect most people understand the implications on a 5 T t-spaced equalizer.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See resolution to comment i-95

Cl **139** *SC* **139.7.9.1** *P* **298** *L* **45** # i-82

Liu, Hai-Feng — Intel Corporation

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

PAM4 test results have shown (see chang_3cd_01_1117, particularly p. 20) that the composition and ratio of the stressors in the stressed receiver sensitivity test has a strong impact on link performance. In particular, the same SECQ can generate widely varying BER performance from the same receiver depending on whether the dominant stressor added to the bandwidth filtering was Gaussian noise or sinusoidal interferer. To address this we propose to more specifically prescribe the stressor ratio used to create the stressed Rx sensitivity conformance test input, to avoid understressing the receiver and causing interoperability issues.

SuggestedRemedy

In the second paragraph of section 139.7.9.1, after the existing sentence "The combination of the low-pass filter and the E/O converter should...", add the sentence "Of the remaining dB value of stressed eye closure (SECQ), at least half should be from the Gaussian noise stressor."

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Chang_3cd_01_1117.pdf showed good correlation between SECQ and Rx sensitivity and the freedom to set up the SRS stress was explored quite thoroughly.

The freedom to set up the SRS test source is a balance between pragmatism and precision; the SECQ test metric ensures that the penalty (for the reference equalizer) of the induced stresses for different test source set-ups, is identical.

Cl **139** *SC* **139.7.9.2** *P* **299** *L* **54** # i-83

Liu, Hai-Feng — Intel Corporation

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

[note that a comment is needed in this section in addition to the comment above to avoid any confusion with the less clear instructions in the referenced 802.3bs section 121.8.9.2] PAM4 test results have shown (see chang_3cd_01_1117, particularly p. 20) that the composition and ratio of the stressors in the stressed receiver sensitivity test has a strong impact on link performance. In particular, the same SECQ can generate widely varying BER performance from the same receiver depending on whether the dominant stressor added to the bandwidth filtering was Gaussian noise or sinusoidal interferer. To address this we propose to more specifically prescribe the stressor ratio used, to avoid understressing the receiver and causing interoperability issues.

SuggestedRemedy

Add the following sentence to the end of section 139.7.9.2: "As outlined in section 139.7.9.1 above, half of the dB value of stressed eye closure (SECQ) should be from bandwidth limitations from the low-pass filter and E/O converter, while of the remaining dB value of stressed eye closure (SECQ), at least half should be from the Gaussian noise stressor."

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Chang_3cd_01_1117.pdf showed good correlation between SECQ and Rx sensitivity, the freedom to set up the SRS stress was explored quite thoroughly. The freedom to set up the SRS test source is a balance between pragmatism and precision; the SECQ test metric ensures that the penalty (for the reference equalizer) of the induced stresses for different test source set-ups, is equivalent.

Cl **140** *SC* **140.1** *P* **309** *L* **14** # i-85

Maki, Jeffery — Juniper Networks, Inc.

Comment Type **TR** *Comment Status* **D** *jitter mismatch <cc>*

Table 140-1 lists a variety of AUI options (e.g., CAUI-4 C2M, 100GAUI-4 C2M, 100GAUI-2 C2M) to build a PHY using a 100GBASE-DR PMD with no explicit regard to the potential mismatch of the output jitter of the AUI and the compliant output jitter of the 100GBASE-DR PMD.

SuggestedRemedy

Add text stating, "The PMA between the AUI and the PMD is responsible for adapting the output jitter of the chosen AUI option to meet the compliant output jitter of the 100GBASE-DR PMD."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment i-61.

Cl **140** *SC* **140.1** *P* **309** *L* **33** # i-15

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D** *<bucket>*

There are some items of text in Table 140-1 that should be cross-references.

SuggestedRemedy

Make the following into cross-references: on lines 33 to 38, "135D", "135E", "135F", "135G"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **140** *SC* **140.3.2** *P* **311** *L* **39** # i-13

Anslow, Peter — Ciena Corporation

Comment Type **T** *Comment Status* **D**

Clause 140 defines the 100GBASE-DR PMD, so the skew constraints are those for a 100G PHY not a 50G PHY. Consequently, the cross-references in 140.3.2 should point to Clause 80 and Clause 83 rather than Clause 131 and Clause 135.

SuggestedRemedy

On line 39, change:
"Skew and Skew Variation are defined in 131.5 and specified at the points SP0 to SP7 shown in Figure 131-3." to:
"Skew and Skew Variation are defined in 80.5 and specified at the points SP0 to SP7 shown in Figure 80-8."
On line 43 change:
"Skew at SP2 is limited to 43 ns as defined by 135.5.3.5." to:
"Skew at SP2 is limited to 43 ns as defined by 83.5.3.4."
On page 312, line 1, change:
"For more information on Skew and Skew Variation, see 131.5." to:
"For more information on Skew and Skew Variation, see 80.5."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Implement suggested remedy.

See also comment i-126.

Cl **140** *SC* **140.3.2** *P* **311** *L* **39** # i-127

Dawe, Piers J G — Mellanox Technologie

Comment Type **E** *Comment Status* **D**

Wrong reference: this is 100G, 131.5 is for 50G.

SuggestedRemedy

Change 131.5 to 80.5, twice. Change Figure 131-3 to Figure 80-8.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

See response to comment i-13

Cl **140** *SC* **140.3.2** *P* **311** *L* **49** # i-125

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *Skew <cc>*

The Skew at SP4 (the receiver MDI) has to be the same as the Skew at SP3 (the transmitter MDI) for this serial PMD.

SuggestedRemedy

Correct the numbers at SP4 and SP5. Correct Table 80-5, Summary of Skew constraints, at least for SP2-6, e.g. by using Table 131-5 (corrected) for 100G serial.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

See response to comment i-123

Cl **140** *SC* **140.6.2** *P* **316** *L* **42** # i-78

Lewis, David — Lumentum

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

Stressed receiver sensitivity (OMAouter) (max) is measured with a single value of SECQ, 3.4 dB. Receivers tested are therefore verified to be compliant at worst case stress levels. However this is not sufficient because stressed sensitivity is supposed to improve linearly as the stress level (SECQ) is reduced from 3.4 dB down to 1.4 dB, at which point sensitivity needs to be better than -3.9 dBm. For very low stress signals, with SECQ between 0.9 and 1.4 dB, sensitivity can have the same value (-3.9 dBm) because compliant transmitters have OMA (min) of -0.8 dBm in this region. The concern is that a receiver can be designed to pass the current SRS test by having strong equalization for the impairments present in the SRS test signal, but at the same time may have high enough noise to not meet the sensitivity requirements at lower values of SECQ.

SuggestedRemedy

In Table 140-7:
Change the value of Stressed receiver sensitivity (OMAouter) (max) from -1.9 to "below the mask in Figure - XX"
Delete the entry for Receiver sensitivity (OMAouter) (max) and note c.
Change the value of Stressed receiver sensitivity (OMAouter) (max) from -1.9 to "below the mask in Figure - XX"
Change the value of Stressed eye closure for PAM4 (SECQ) from 3.4 to "vary between 0.9 and 3.4"
Add Figure - XX:

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Evidence has not been provided detailing what “impairments present in the SRS test signal can be removed by strong equalization” to justify a change to the specification.

The proposed remedy is incomplete as figure xx has not been supplied.

For discussion at Task Force Meeting.

Cl **140** *SC* **140.7.5** *P* **319** *L* **19** # i-108

Sun, Junqing — Credo Semiconductor

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

5-tap T/2-spaced reference receiver has no more than 2 UI precursor coverage. Current reference equalizer with 5-tap T-spaced FFE allows up to 4 precursors. A good system does not need so many precursors. Meanwhile supporting so many precursors may allow problematic transmitters to enter the market. This forces receivers to implement many precursors to ensure interop. Therefore receiver hardware complexity and power are increased, although these precursors are not needed for good systems. Given the fact that no more than 2 precursors are needed in the tests having been reported (e.g. mazzini_01a_0517_smf.pdf), the number of precursors shall be limited to no more than two.

SuggestedRemedy

Add one more exception:

Main tap location of the reference equalizer shall not be higher than three.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See resolution to comment i-107

Cl **140** *SC* **140.7.5** *P* **319** *L* **19** # i-81

Liu, Hai-Feng — Intel Corporation

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

The sub-eye threshold levels in current TDECQ measurement are determined by the OMAouter and the average optical power of the PAM4 eye diagram (Pave) as defined in equations (121-1), (121-2) and (121-3). While this is good for perfectly linear PAM4 signals with 3 equal eye amplitudes, it would lead to pessimistic TDECQ values as compared to the link sensitivity penalty measurements where thresholds are adjusted by real receivers to achieve the lowest BER even if the signal is not perfectly linear.
Several vendors have contributed data (way_3bs_01a_0717, tamura_3bs_01a_0917, baveja_3cd_01_1117) showing many units that are able to close the link with good sensitivity/BER margin would fail to meet the maximum TDECQ specification, causing good transmitters to be failed.

SuggestedRemedy

Propose to adopt threshold optimization in TDECQ measurement as described in mazzini_120617_3cd_adhoc-v2 with the additional constraints on the allowable adjustment range.
Detailed presentation to be submitted for the January meeting with the summary of the proposal, measurement data to support the proposal, and suggested changes in details.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See resolution to comment i-79

Cl **140** *SC* **140.7.5** *P* **319** *L* **22** # i-121

Dawe, Piers J G — Mellanox Technologie

Comment Type **E** *Comment Status* **D**

I don't think the reference equalizer as described in 121.8.5.4 is suitable because there, T the symbol period is twice what we need here.

SuggestedRemedy

Add text explaining that the symbol period T is not the same as in 121.8.5.4.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

change:
"using a reference equalizer as described in 121.8.5.4"
to:
"using a reference equalizer as described in 121.8.5.4 where T is the symbol period for 100GBASE-DR"

Cl **140** *SC* **140.7.5** *P* **319** *L* **23** # i-118

Dawe, Piers J G — Mellanox Technologie

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

Excluding scenarios that won't happen will pave the way to more efficient receivers (see another comment). It seems that a 100 Gb/s/lane SMF signal that needs the equalizer will be slow (slower relative to the signalling rate than a 50 Gb/s/lane signal), and in the range of "causal" like an electrical signal, to "neutral" like a BT4 filter, to mildly anti-causal in appearance - maybe. But not so extremely lopsided that the a fourth postcursor would be better than a single precursor, nor strongly "anti-causal" the other way.
TR because it may take us a while to find enough evidence on what might/won't happen with a range of transmitter implementations.

SuggestedRemedy

Add "The reference equalizer shall use one or two pre-cursor taps." Define pre-cursor. Or the taps could be numbered and this rule expressed in terms of the cursor position.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See resolution to comment i-107

Cl **140** *SC* **140.7.9** *P* **320** *L* **15** # i-84

Liu, Hai-Feng
Intel Corporation

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

PAM4 test results have shown (see chang_3cd_01_1117, particularly p. 20) that the composition and ratio of the stressors in the stressed receiver sensitivity test has a strong impact on link performance. In particular, the same SECQ can generate widely varying BER performance from the same receiver depending on whether the dominant stressor added to the bandwidth filtering was Gaussian noise or sinusoidal interferer. To address this we propose to more specifically prescribe the stressor ratio used to create the stressed Rx sensitivity conformance test input, to avoid understressing the receiver and causing interoperability issues.

SuggestedRemedy

Add the following bullet to the end of section 140.7.9, "Of the remaining half of stressed eye closure (SECQ) that is not generated by bandwidth limitations from the low-pass filter and E/O converter, at least half of the remaining stress (in dB of SECQ) should be from the Gaussian noise stressor."

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See resolution to comment i-82