Cl **000** *SC* **0** *P* *L* # r01-16

Anslow, Peter — Ciena Corporation

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

The numbering of some of the references to definitions in the draft do not match the numbering in the latest revision draft.
80.4, Page 102 line 43, "1.4.117" should be 1.4.160"
116.1.3, Page 115 line 29, "1.4.407" should be "1.4.480"
131.1.1, Page 122 line 17, "1.4.223" should be "1.4.275"
131.1.3, Page 123 line 39, "1.4.407" should be "1.4.480"
131.4, Page 128 line 36, "1.4.117" should be 1.4.160"
136.1, Page 196 line 51, "1.4.223" should be "1.4.275"
136.1, Page 197 line 5, "1.4.223" should be "1.4.275"
136.5, Page 199 line 44, "1.4.117" should be 1.4.160"
137.1, Page 245 line 41, "1.4.223" should be "1.4.275"
137.1, Page 245 line 49, "1.4.223" should be "1.4.275"
137.5, Page 248 line 30, "1.4.117" should be 1.4.160"
138.1.1, Page 265 line 52, "1.4.223" should be "1.4.275"
138.1.1, Page 266 line 7, "1.4.223" should be "1.4.275"
139.1.1, Page 290 line 36, "1.4.223" should be "1.4.275"
140.1.1, Page 314 line 35, "1.4.223" should be "1.4.275"

SuggestedRemedy

80.4, Page 102 line 43, change "1.4.117" to 1.4.160"
116.1.3, Page 115 line 29, change "1.4.407" to "1.4.480"
131.1.1, Page 122 line 17, change "1.4.223" to "1.4.275"
131.1.3, Page 123 line 39, change "1.4.407" to "1.4.480"
131.4, Page 128 line 36, change "1.4.117" to 1.4.160"
136.1, Page 196 line 51, change "1.4.223" to "1.4.275"
136.1, Page 197 line 5, change "1.4.223" to "1.4.275"
136.5, Page 199 line 44, change "1.4.117" to 1.4.160"
137.1, Page 245 line 41, change "1.4.223" to "1.4.275"
137.1, Page 245 line 49, change "1.4.223" to "1.4.275"
137.5, Page 248 line 30, change "1.4.117" to 1.4.160"
138.1.1, Page 265 line 52, change "1.4.223" to "1.4.275"
138.1.1, Page 266 line 7, change "1.4.223" to "1.4.275"
139.1.1, Page 290 line 36, change "1.4.223" to "1.4.275"
140.1.1, Page 314 line 35, change "1.4.223" to "1.4.275"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **000** *SC* **0** *P* *L* # r01-29

Ran, Adee — Intel Corporation

Comment Type **T** *Comment Status* **D** *ERL AUI*

ERL was added as a new method for electrical PMDs and their channels, but it does not apply to the internal interfaces, AUI-C2C and AUI-C2M.

The AUIs operate over lower loss channels with simpler receivers that need to achieve lower BER. Based on that, it is likely that reflections play an even more major role in the performance.

It is suggested to add ERL specifications as recommendations for all the AUI-C2C cases where RL is specified, based on the KR PMD specs.

For the C2M, it would be good to use ERL, but there is no reference we can readily use.

SuggestedRemedy

Add text in each of the subclauses of 135D.3 and 135F.3, recommending meeting the ERL limits of the Transmitter, receiver, and channels, based on the text and parameters in 137.9.2.1, 137.9.2.2, 137.9.2.3, respectively (with reference to the COM parameter table from 120D).

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Consider with comment r01-27.

Cl **000** *SC* **0** *P* *L* # r01-24

Ran, Adee — Intel Corporation

Comment Type **T** *Comment Status* **D** *ERL PMD*

ERL was added as a specification for channels and devices with the intent to replace frequency-domain return loss masks.

Recent results (heck_022118_3cd_adhoc) indicate that ERL is correlated to link performance (as measured by end-to-end COM result) much better than the maximum return loss at specific frequency. It is likely that it is better correlated than the RL margin at any frequency (this is to be verified).

In addition, dudek_022118_3cd_adhoc and following discussions suggest that when the TP0a-TP2 insertion loss is low, ERL limits the reflections effect on COM no worse than SNR_ISI does; and unlike SNR_ISI, ERL can be measured for both Tx and Rx.

It is therefore suggested to make ERL the normative specification instead of the differential RL masks. The latter can stay as a recommendation, and possibly removed entirely.

SuggestedRemedy

Part I - for the transmitter:
1. In 136.9.3.4, change "is recommended to be" to "shall be".
2. In Table 136-11, add the minimum ERL to the specifications, and change the line "Differential output return loss" to "recommended differential output return loss" or delete it from the table.
3. In 137.9.2, add a sixth item to the exceptions list: "Differential output return loss (min) is replaced by the Effective Return loss (ERL) specification in 137.9.2.1."

Part II - for the receiver:
1. In 136.9.4.5, change "is recommended to be" to "shall be".
2. In 136.9.4, create a summary table as in the transmitter specifications, including the requirements that apply (136.9.4.1 to 136.9.4, and to make ERL normative, 136.9.4.5).
3. Also in 136.9.4, rewrite the text so that the summary table is normative, and "the return loss requirements specified in 92.8.4.2 and 92.8.4.3" become a recommendation.
4. In 137.9.3, add a sixth item to the exceptions list: "Differential output return loss (min) is replaced by the Effective Return loss (ERL) specification in 137.9.3.1."

Part III - for the channel/cable assembly:
1. In Table 136-15, add the minimum ERL to the specifications, and change the line "Minimum differential return loss at 13.28 GHz" to "recommended differential output return loss" (with only reference to the equation, no value) or delete it from the table.
2. In 136.11.8, change "Channel ERL at TP1 and at TP4 are recommended to be greater than 10.5 dB" to "The minimum channel ERL at TP1 and at TP4 is 10.5 dB".
3. In 137.10, change "Channels are recommended to meet the insertion loss limits in 137.10.1. Channels shall meet the return loss limits in 137.10.2" to "Channels are recommended to meet the insertion loss limits in 137.10.1 and the return loss limits in 137.10.2. Channel shall meet the ERL specification in 137.10.3."
4. In 137.10.3, change "Channel ERL at TP0 and at TP5 are recommended to be greater than 9.5 dB" to "The minimum channel ERL at TP0 and at TP5 is 9.5 dB".

Implement with editorial license to apply any necessary changes the the above.

Proposed Response *Response Status* **W**

ACCEPT IN PRINCIPLE.

Pending task force discussion:

Implement the changes labeled “Part I”, deleting the “Differential output return loss” (item 2).

Implement the changes labeled “Part II”, except that the differential return loss requirement in 92.8.4.2 is removed and 92.8.4.3 (differential to common mode) is retained.

Implement the changes labeled “Part III”, except that:
1. The “Differential output return loss” is deleted (item 1).
2. Minimum ERL at TP1 and at TP4 is set to 14 dB (item 2), per other comments
3. Remove the “and the return loss limits in 137.10.2” (item 3)
4. Minimum ERL at TP0 and at TP5 is set to 11 dB (item 4), per other comments

Cl **1** *SC* **1.4.36** *P* **39** *L* **29** # r01-20

Slavick, Jeff — Broadcom Limited

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

There are two four lanes versions of the 100Gb/s Attachment Unit Interface, CAUI-4 and 100GAUI-4 not two versions of CAUI-4.

SuggestedRemedy

Change "Three widths of CAUI-n are defined:" to be "Three widths are defined:"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

This comment does not apply to the substantive changes between IEEE P802.3cd/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the previous ballots. Hence it is not within the scope of the recirculation ballot.

However, the suggested remedy is an improvement to the draft.

Implement the suggested remedy.

Cl **1** *SC* **1.4.387** *P* **40** *L* **33** # r01-6

Anslow, Peter — Ciena Corporation

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

"Comment i-36 against the revision project D3.0 has caused the definition of ""FORCE mode"" in 1.4.254 to be deleted.
As a consequence of this, all of the definition numbers above 254 have reduced their numbering by 1."

SuggestedRemedy

Change "1.4.387" to "1.4.386" in the editing instruction and the definition number

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **4A** *SC* **4A.4.2** *P* **333** *L* **18** # r01-2

Marris, Arthur — Cadence Design Syst

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

Missing comma after 100 Gb/s

SuggestedRemedy

Change to:
100 Gb/s, 200 Gb/s,

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **45** *SC* **45.2.1.1.3** *P* **49** *L* **34** # r01-31

Marris, Arthur — Cadence Design Syst

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

Add 2.5G and 5G to this to match revision project.

SuggestedRemedy

Add the following text "when set to 0110 the use of a 2.5G PMA/PMD is selected; when set to 0111 the use of a 5G PMA/PMD is selected;"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **45** *SC* **45.2.1.1.3** *P* **49** *L* **36** # r01-3

Marris, Arthur — Cadence Design Syst

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

2.5 and 5 Gb/s speeds are missing from the text in 45.2.1.1.3

SuggestedRemedy

Add thew following text:
when set to 0110 the use of a 2.5G PMA/PMD is selected; when set to 0111 the use of a 5G PMA/PMD is selected;

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **45** *SC* **45.2.1.110.2** *P* **58** *L* **9** # r01-7

Anslow, Peter — Ciena Corporation

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

In the brackets at the end of subclause 45.2.1.110.2, a comma has been added after 91.5.3.3, but is not underlined

SuggestedRemedy

underline the added comma.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **45** *SC* **45.2.1.111.8** *P* **59** *L* **32** # r01-8

Anslow, Peter — Ciena Corporation

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

In the brackets in the first sentence of subclause 45.2.1.111.8, a comma has been added after 91.5.3.3, but is not underlined.
Same issue for 45.2.1.111.9

SuggestedRemedy

underline the added comma in both 45.2.1.111.8 and 45.2.1.111.9

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **45** *SC* **45.2.1.139** *P* **75** *L* **34** # r01-21

Slavick, Jeff — Broadcom Limited

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

The hex character fields don't begin with 0x

SuggestedRemedy

Change "for lane 0, fbf1cb3e; for lane 1, fbb1e665; for lane 2, f3fdae46; for lane 3, f2ffa46b" to be "for lane 0, 0xfbf1cb3e; for lane 1, 0xfbb1e665; for lane 2, 0xf3fdae46; for lane 3, 0xf2ffa46b"

Proposed Response *Response Status* **W**

PROPOSED REJECT.

This comment does not apply to the substantive changes between IEEE 802.3cd/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the previous ballots. Hence it is not within the scope of the recirculation ballot.

The proposed changes are to legacy text which is included only for context and are not within the scope of this task force to change.

Cl **45** *SC* **45.2.3.4** *P* **77** *L* **13** # r01-4

Marris, Arthur — Cadence Design Syst

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

The text here is modified so inserted text should be underlined

SuggestedRemedy

Underline the inserted text in Table 45-179 and Table 45-181

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **45** *SC* **45.2.3.15.4** *P* **80** *L* **3** # r01-5

Marris, Arthur — Cadence Design Syst

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

Make 45.2.3.15.4 and 45.2.3.15.5 correctly reflect the base standard and 802.3cd

SuggestedRemedy

Make it as follows
Change the third sentence of 45.2.3.15.4 as follows:
This bit is a direct reflection of the state of the hi_ber variable in the 64B/66B state diagram and is defined in
49.2.13.2.2 for 5/10/25GBASE-R and in 82.2.19.2.2 for 40/50/100GBASE-R.

Change fourth sentence of 45.2.3.15.5 as follows:
For a 40/50/100GBASE-R PCS, this bit reflects the logical AND of the state of the block_lock<x> variables defined in 82.2.19.2.2.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **45** *SC* **45.2.3.15.4** *P* **80** *L* **3** # r01-9

Anslow, Peter — Ciena Corporation

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

The quoted text is not present in 45.2.3.15.4 of the base standard. It seems to reflect text from the subclause below (45.2.3.15.5) from the latest draft of the revision.
See also a companion comment to correct the text in 45.2.3.15.5 to be this text.

SuggestedRemedy

Change the editing instruction to:
Change third sentence of 45.2.3.15.4 (as modified by IEEE Std 802.3cb-201x) as follows:
Change the text to:
This bit is a direct reflection of the state of the hi_ber variable in the BER monitor state diagrams as defined in 49.2.13.2.2 for 5/10/25GBASE-R and in 82.2.19.2.2 for 40/<u>50/</u>100GBASE-R.
where <u> and </u> are the start and end of underline font, respectively.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **45** *SC* **45.2.3.15.5** *P* **80** *L* **14** # r01-10

Anslow, Peter — Ciena Corporation

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

The text in 45.2.3.15.5 has been changed in the revision project D3.1, so the text of this subclause has to be updated to match. This seems to have been done in error in the subclause above (45.2.3.15.4).
See also a companion comment to correct the text in 45.2.3.15.4.

SuggestedRemedy

Change the text in 45.2.3.15.5 to be that shown in 45.2.3.15.4:
For a 40/<u>50/</u>100GBASE-R PCS, this bit reflects the logical AND of the state of the block_lock<x> variables defined in <g>82.2.19.2.2</g>.
where <u> and </u> are the start and end of underline font, respectively and <g> and </g> are the start and end of forest green font, respectively.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **45** *SC* **45.2.3.16.3** *P* **81** *L* **6** # r01-11

Anslow, Peter — Ciena Corporation

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

The text shown as the first sentence of 45.2.3.16.3 does not match the text in the base standard.
"for 2.5GBASE-T" should be "in 2.5GBASE-T"
"55.3.6.2" should be "55.3.7.2"
"113.3.6.2.2" should be "113.3.7.2"

SuggestedRemedy

Change:
"for 2.5GBASE-T" to "in 2.5GBASE-T"
"55.3.6.2" to "55.3.7.2"
"113.3.6.2.2" to "113.3.7.2"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Regarding "in 2.5GBASE-T" the base standard is incorrect. A comment has been submitted against the revision project to correct this.

So:
leave "for 2.5GBASE-T" as is
and change:
"55.3.6.2" to "55.3.7.2"
"113.3.6.2.2" to "113.3.7.2"

Cl **45** *SC* **45.2.3.16.4** *P* **81** *L* **17** # r01-12

Anslow, Peter — Ciena Corporation

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

The text shown as the first sentence of 45.2.3.16.4 does not match the text in the base standard.
"for 2.5GBASE-T" should be "in 2.5GBASE-T"
"55.3.6.2" should be "55.3.7.2"
"113.3.6.2.2" should be "113.3.7.2"

SuggestedRemedy

Change:
"for 2.5GBASE-T" to "in 2.5GBASE-T"
"55.3.6.2" to "55.3.7.2"
"113.3.6.2.2" to "113.3.7.2"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Regarding "in 2.5GBASE-T" the base standard is incorrect. A comment has been submitted against the revision project to correct this.

So:
leave "for 2.5GBASE-T" as is
and change:
"55.3.6.2" to "55.3.7.2"
"113.3.6.2.2" to "113.3.7.2"

Cl **73** *SC* **73.3** *P* **89** *L* **42** # r01-1

Marris, Arthur — Cadence Design Syst

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

The change to 73.3 and other changes in Clause 73 have already been done by the 802.3cj revision project so no longer should be described in 802.3cd.

SuggestedRemedy

Remove the text relevant to the following changes from the 802.3cd draft in the following locations:

73.3 on page 89
73.7.1 on page 91
link_fail_inhibit_timer on page 92
73.11.4.7 on page 94

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **73** *SC* **73.3** *P* **89** *L* **42** # r01-13

Anslow, Peter Ciena Corporation

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

The changes shown to 73.3 have already been made in D3.1 of the revision project due to comment i-48:
http://www.ieee802.org/3/cj/comments/P8023-D3p0-Comments-Final-byID.pdf#page=17

SuggestedRemedy

Remove the whole of 73.3 from the draft.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **73** *SC* **73.7.1** *P* **91** *L* **4** # r01-14

Anslow, Peter Ciena Corporation

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

The changes shown to 73.7.1 have already been made in D3.1 of the revision project due to comment i-49:
http://www.ieee802.org/3/cj/comments/P8023-D3p0-Comments-Final-byID.pdf#page=17

SuggestedRemedy

Remove the whole of 73.7.1 from the draft (leave the heading for 73.7).

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **73** *SC* **73.7.6** *P* **91** *L* **46** # r01-30

Marris, Arthur Cadence Design Syst

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

2.55 should be 2.5

SuggestedRemedy

Change: "2.55Gb/s 1 lane"
To: "2.5Gb/s 1 lane"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **73** *SC* **73.10.2** *P* **92** *L* **28** # r01-15

Anslow, Peter Ciena Corporation

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

The changes shown to the link_fault_inhibit timer definition in 73.10.2 have already been made in D3.1 of the revision project due to comment i-50:
http://www.ieee802.org/3/cj/comments/P8023-D3p0-Comments-Final-byID.pdf#page=17

SuggestedRemedy

Remove the change to the link_fault_inhibit timer definition in 73.10.2 from the draft.
Also remove the whole of 73.11.4.7 from the draft as this has also been done in the revision D3.1

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **80** *SC* **80.1.5** *P* **100** *L* **8** # r01-32

Marris, Arthur Cadence Design Syst

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

PCS clause 82 is missing from Table 80-4a

SuggestedRemedy

Add column for Clause 82 PCS in Table 80-4a and make it manadatory similar to table 80-3

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

This comment does not apply to the substantive changes between IEEE P802.3cd/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the previous ballots. Hence it is not within the scope of the recirculation ballot.

However, the suggested remedy is an improvement to the draft.

Implement the suggested remedy.

Cl **131** *SC* **131.5** *P* **131** *L* **12** # r01-51

Dawe, Piers J G — Mellanox Technologie

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

This Table 131-6 (Skew Variation) still 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

Either:
Delete the rows for SP2 to SP5, adding a table note to explain that there is no SV at those points; or:
For SP2, delete the reference to 135.5.3.5, which is not relevant for a serial PMA/PMD interface,
For SP5, delete the reference to 135.5.3.6, which is not relevant for a serial PM/PMA interface, and
for SP2 to SP5, change the numbers to N/A.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The specifications at SP2 and SP5 ensure that the PMA is compatible with any current or future PHY. The specifications at SP3 and SP4 provide the skew variation limits for the net budget that are assumed for any future PHY that might have a 50GAUI with more than one lane and to be consistent with the budget methodology used for 40G, 100G, 200G, and 400G in IEEE Std 802.3-201x.

The references to 135.5.3.5/6 are retained as they would be relevant to any future multi-lane PMD.

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

[Editor's note: Comments r01-51, r01-53, r01-55, r01-56, and r01-58 from the same commenter relate to a similar topic.]

Cl **134** *SC* **134.5.2.4** *P* **150** *L* **50** # r01-17

Ran, Adee — Intel Corporation

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

Repeating comment i-33 against D3.0 (which was rejected).

The revision project has adopted a corresponding change in clause 91 (see comment i-43 against 802.3cj D3.0). It should be applied here as well.

SuggestedRemedy

Change FROM
"The incoming bit error ratio can be estimated by dividing the BIP block error ratio by a factor of 1 351 680."
TO
"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 ACCEPT IN PRINCIPLE.

This comment does not apply to the substantive changes between IEEE P802.3cd/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the previous ballots. Hence it is not within the scope of the recirculation ballot.

However, the suggested remedy makes this draft consistent with the base document.

Implement the suggested remedy.

Cl **135** *SC* **135.1** *P* **169** *L* **12** # r01-52

Dawe, Piers J G — Mellanox Technologie

Comment Type **E** *Comment Status* **D** *annex references*

In any long report, clause or whatever, the first section should say what it's about, including referring to all associated components.
See 136.1, first two paragraphs, for a good example.
Here, 135.1.1 eventually mentions annexes 135B to 135G but not Annex 135A.

SuggestedRemedy

Really, the clause and associated annexes should be introduced in the overview. But at a minimum, mention 135A in 135.1.1, e.g.before the last sentence of the first paragraph, add "Examples of PMA sublayer postioning and partitioning are given in Figure 135-3 and Annex 135A".

Proposed Response *Response Status* **W**

PROPOSED REJECT.

A similar comment i-28 against D3.0 with slightly different wording was considered by the task force and the following response was provided:

"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."

No changes are necessary based on the same reasoning provided for comment i-128.

Cl **135** *SC* **135.3** *P* **174** *L* **23** # r01-81

Dudek, Michael — Cavium

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

This is a very long complicated sentence that is difficult to understand.

SuggestedRemedy

Improve the wording if possible. At least split into two sentences at the "and". (removing the brackets around (if necessary). Make the equivalent change to 135.4 Page 175 line 6.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

The sentence referenced by the commenter is very long and contains a great deal of superfluous text.

For the paragraph starting on page 174 line 23...

Change:
In the Rx direction, the PMA passes the bits represented by the symbols from the input lanes into encoded symbols on the output lanes when data is being received from every input lane from the sublayer below the PMA that has a PCSL/FECL that is routed to a particular output lane at the PMA service interface, and (if necessary) buffers are filled to allow tolerating the Skew Variation that may appear between the input lanes, PCSLs/FECLs are demultiplexed from the input lanes, remultiplexed to the output lanes, and symbols are transferred over each output lane to the PMA client via the PMA:IS_UNITDATA_i.indication primitive.

To:
In the Rx direction, the PMA passes the bits represented by the symbols from the input lanes into encoded symbols on the output lanes. If necessary, buffers are filled to allow tolerating the Skew Variation that may appear between the input lanes. PCSLs/FECLs are demultiplexed from the input lanes, remultiplexed to the output lanes, and symbols are transferred over each output lane to the PMA client via the PMA:IS_UNITDATA_i.indication primitive.

For the paragraph starting on page 175 line 6...

Change:
In the Tx direction, the PMA passes the bits represented by the symbols from the input lanes into encoded symbols on the output lanes when data is being received via the PMA:IS_UNITDATA_i.request primitive from every input lane from the PMA client at the PMA service interface (see 135.3) that has a PCSL/FECL that is routed to this output lane, and (if necessary), buffers are filled to provide the ability to tolerate the Skew Variation that may appear between the input lanes from the PMA client, PCSLs/FECLs are demultiplexed from the input lanes, remultiplexed to the output lanes, and symbols are transferred over each output lane to the sublayer below the PMA.

To:

In the Tx direction, the PMA passes the bits represented by the symbols from the input lanes into encoded symbols on the output lanes. If necessary, buffers are filled to provide the ability to tolerate the Skew Variation that may appear between the input lanes from the PMA client. PCSLs/FECLs are demultiplexed from the input lanes, remultiplexed to the output lanes, and symbols are transferred over each output lane to the sublayer below the PMA.

Cl **135** *SC* **135.5.3** *P* **177** *L* **49** # r01-53

Dawe, Piers J G — Mellanox Technologie

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

Correct this text to acknowledge that not all PMA interfaces are multi-lane, so not all have Skew Variation, and some Skew values are not as given.

SuggestedRemedy

Change:
The limits for Skew and Skew Variation at physically instantiated interfaces are specified at Skew points SP0, SP1, and SP2 in the transmit direction and SP5, SP6, and SP7 in the receive direction as defined in 131.5 and illustrated in Figure 131-3 for 50GBASE-R and as defined in 80.5 and illustrated in Figure 80-8 for 100GBASE-P. to:
For 50GBASE-R, the limits for Skew at physically instantiated interfaces are specified at Skew points SP0, SP1, and SP2 in the transmit direction and SP5, SP6, and SP7 in the receive direction as defined in 131.5 and illustrated in Figure 131-3. For 50GBASE-R, the limits for Skew Variation at physically instantiated interfaces are specified at Skew points SP0 and SP1 in the transmit direction, and SP6 and SP7 in the receive direction, as defined in 131.5 and illustrated in Figure 131-3. For 100GBASE-P, the limits for Skew and Skew Variation at physically instantiated interfaces are specified at Skew points SP0, SP1, and SP2 in the transmit direction and SP5, SP6, and SP7 in the receive direction as defined in 80.5 and illustrated in Figure 80-8 for 100GBASE-P.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

This comment does not apply to the substantive changes between IEEE P802.3cd/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the previous ballots. Hence it is not within the scope of the recirculation ballot.

The description in the referenced paragraph relates to currently specified as well as any future PMD which may have more than one lane. The specific requirements for each PMD are specified in the PMD clause.

The beginning of the paragraph points out that skew variation only applies to cases with multiple lanes. "Any PMA that combines PCSLs/FECLs from different input lanes onto the same output lane must tolerate Skew Variation between the input lanes without changing the PCSL/FECL positions on the output."

[Editor's note: Comments r01-51, r01-53, r01-55, r01-56, and r01-58 from the same commenter relate to a similar topic.]

Cl **135** *SC* **135.5.3.5** *P* **179** *L* **12** # r01-55

Dawe, Piers J G — Mellanox Technologie

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

Correct this text to acknowledge that not all PMA interfaces are multi-lane, so not all have Skew Variation.

SuggestedRemedy

Change:
... 43 ns of Skew, and no more than 0.4 ns of Skew Variation ... to:
... 43 ns of Skew, and, for 100GBASE-P, no more than 0.4 ns of Skew Variation ...

Proposed Response *Response Status* **W**

PROPOSED REJECT.

This comment does not apply to the substantive changes between IEEE P802.3cd/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the previous ballots. Hence it is not within the scope of the recirculation ballot.

The description in the referenced paragraph relates to currently specified as well as any future PMD which may have more than one lane. The specific requirements for each PMD are specified in the PMD clause.

[Editor's note: Comments r01-51, r01-53, r01-55, r01-56, and r01-58 from the same commenter relate to a similar topic.]

Cl **135** *SC* **135.5.3.6** *P* **179** *L* **17** # r01-56

Dawe, Piers J G — Mellanox Technologie

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

Correct this text to acknowledge that not all PMA interfaces are multi-lane, so not all have Skew Variation.

SuggestedRemedy

Change:
135.5.3.6 Skew tolerance at SP5
If the PMD service interface... to:
135.5.3.6 Skew tolerance at SP5 for 100GBASE-P
If a 100GBASE-P PMD service interface...

Proposed Response *Response Status* **W**

PROPOSED REJECT.

This comment does not apply to the substantive changes between IEEE P802.3cd/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the previous ballots. Hence it is not within the scope of the recirculation ballot.

The description in the referenced paragraph relates to currently specified as well as any future PMD which may have more than one lane. The specific requirements for each PMD are specified in the PMD clause.

[Editor's note: Comments r01-51, r01-53, r01-55, r01-56, and r01-58 from the same commenter relate to a similar topic.]

Cl **135** *SC* **135.5.3.7** *P* **179** *L* **25** # r01-57

Dawe, Piers J G — Mellanox Technologie

Comment Type **E** *Comment Status* **D** *skew variation, heading <cc>*

Correct the subclause title to reflect the contents (like 135.5.3.5)

SuggestedRemedy

Change:
135.5.3.7 Skew generation at SP6 to:
135.5.3.7 Skew generation toward SP6

Proposed Response *Response Status* **W**

PROPOSED REJECT.

This comment does not apply to the substantive changes between IEEE P802.3cd/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the previous ballots. Hence it is not within the scope of the recirculation ballot.

The heading text is consistent with similar subclauses in Clause 80 and Clause 119 in the IEEE Std 802.3-201x. The text is not incorrect as written. The suggested remedy provides no improvement.

Cl **135** *SC* **135.5.3.7** *P* **179** *L* **30** # r01-58

Dawe, Piers J G — Mellanox Technologie

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

Correct this text to acknowledge that not all PMA interfaces are multi-lane, so not all have Skew Variation, and some Skew values are not as given.

SuggestedRemedy

Change:
If there is a physically instantiated PMD service interface that allows the Skew to be measured, the Skew measured at SP5 is limited to no more than 145 ns of Skew and no more than 3.6 ns of Skew Variation. If there is no physically instantiated PMD service interface, the Skew measured at SP4 is limited to no more than 134 ns of Skew, and no more than 3.4 ns of Skew Variation. to:
If there is a physically instantiated PMD service interface that allows the Skew to be measured, the Skew measured at SP5 is limited to no more than 43 ns of Skew for 50GBASE-R or 145 ns of Skew for 100GBASE-P, and to no more than 3.6 ns of Skew Variation for 100GBASE-P. If there is no physically instantiated PMD service interface, the Skew measured at SP4 is limited to no more than 43 ns of Skew for 50GBASE-R or 134 ns of Skew for 100GBASE-P, and to no more than 3.4 ns of Skew Variation for 100GBASE-P.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

This comment does not apply to the substantive changes between IEEE P802.3cd/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the previous ballots. Hence it is not within the scope of the recirculation ballot.

The description in the referenced paragraph relates to currently specified as well as any future PMD which may have more than one lane. The specific requirements for each PMD are specified in the PMD clause.

[Editor's note: Comments r01-51, r01-53, r01-55, r01-56, and r01-58 from the same commenter relate to a similar topic.]

Cl **135** *SC* **135.5.5** *P* **180** *L* **26** # r01-54

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D** *jitter mismatch*

This might be a suitable, though obscure, place to add hints that the implementer may have to pay attention to the low frequency jitter issue.

SuggestedRemedy

Add text e.g. "The PMA output attached to an AUI or PMD conditions the output clock such that the AUI output or PMD transmitter meets its requirements."
At line 38, add NOTE--Excessive low-frequency jitter might prevent the PMA from providing adequate clock quality, particularly when or multiple input lanes are mapped to a single output lane.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

A number of comments against D3.0 on this topics were considered by the task force. The common response to these comments was provided in the response to comment i-61 as follows:
"REJECT.
Reviewed http://www.ieee802.org/3/cd/public/Jan18/ghiasi_3cd_01_0118.pdf.
Straw poll #1 indicated lack of consensus to make any technical changes to the jitter specification.
Straw poll #1:
I would support making a technical change to the jitter specification.
Y: 4
N: 21
There is no support to make any changes to the jitter specifications."

The result of the straw poll was that there was no consensus to make any changes to the jitter specifications. However, there was less objection to providing text warning of potential issues.

Add the following sentence at the end of the first paragraph in 135.5.5:
"The PMA output attached to an AUI or PMD conditions the output clock such that the AUI output or PMD transmitter meets its requirements."

Add the following note after the first paragraph in 135.5.5:
"NOTE--Excessive low-frequency jitter might prevent the PMA from providing adequate clock quality."

Cl **135** *SC* **135.7.3** *P* **189** *L* **12** # r01-86

Dudek, Michael — Cavium

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

How are the PICS to be filled in for Fig 135A-4 application? The intermediate PMA between the FEC and the PMD isn't covered.

SuggestedRemedy

Change from "PMA is immediately below FEC" to "PMA is below FEC and not immediately above PMD"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

The commenter points out a scenario that is not covered by the Clause PICS in D3.1.

However, the suggested remedy does not properly correct the error.

Also, upon further inspection there may be a few other errors that should also be corrected.

A proposal will be provided for review at the task force meeting.

Cl **135A** *SC* **135A.2** *P* **346** *L* **39** # r01-79

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *jitter mismatch*

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. If we don't fix the specs we must warn implementers. D3.0 comments 61, 115, 87, 85, another D3.1 comment.

SuggestedRemedy

Add text:
e.g. NOTE--When n is 2 or 4 and p is 1, the sinusoidal jitter in the 100GAUI-n module stressed input test represents twice as much, in time or bits, as the sinusoidal jitter in the stressed receiver sensitivity test for the PMD.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

This comment does not apply to the substantive changes between IEEE P802.3cd/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the previous ballots. Hence it is not within the scope of the recirculation ballot.

Annex 135A is intended to provide examples of the relationship between the PMA, AUI, and other sublayers, as well as to demonstrate the MDIO addressing for PMA sublayers. It is not intended to provide any detailed information such as that proposed in the suggested remedy. Also, any such information, if provided, should be provided in a single location, not repeated in various places throughout the draft.

The response to to comment R01-54 provides guidance to implementers in an appopriate location in the draft.

Cl **135F** *SC* **135F.3** *P* **408** *L* **27** # r01-27

Rysin, Alexander — Mellanox Technologie

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

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, D3.0 comment 98. See also relevant comment in 802.3cj.

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) of the transmitter at TP0a is computed using the procedure in 93A.5 with the values in Table 137-5. Parameters that do not appear in Table 137-5 take values from Table 120D-8. The value of Tfx is twice the delay from TP0 to TP0a. Nbx is set to the value of Nb in Table 120D-8. ERL shall be at least 16.1 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 receiver shall meet all specifications in 120D.3.2 with the following exceptions:
* Effective return loss (ERL) of the receiver computed using the procedure in 93A.5 with the values in Table 137-5. Parameters that do not appear in Table 137-5 take values from Table 120D-8. The value of Tfx is twice the delay from TP5a to TP5. Nbx is set to the value of Nb in Table 120D-8. ERL shall be at least 16.1 dB.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

This comment is similar to the unsatisfied comment i-98. The response to that comment was:
"Although ERL was adopted for clauses 137 and 136, it is not clear whether it should be adopted for Annex 135F, since its electrical characteristics were intended to be essentially identical to 120D.
There is no consensus to implement the suggested remedy."

For task force discussion.

See comment r01-29.

Cl **135G** *SC* **135G.3.1** *P* **382** *L* **24** # r01-80

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *jitter mismatch*

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: see http://ieee802.org/3/cd/public/Jan18/dawe_3cd_02a_0118.pdf slide 8. 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 should be applied to 100GAUI-2 C2M host outputs (unless another remedy is chosen). It could be applied to 50GAUI-1 host outputs and/or the corresponding module inputs for consistency but this is not necessary. 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.
D3.0 comments 61, 115, 87, 85, another D3.1 comment.

SuggestedRemedy

Add text:
To limit the jitter at frequencies which a 100GBASE-DR PMD's optical receiver may not track well, it is recommended that for 100GAUI-2 C2M, the host output eye width and eye height specifications (120E.3.1.6), and the vertical eye closure specification, be met when measured using a clock recovery unit with a corner frequency of 2 MHz.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

A number of comments against D3.0 on this topics were considered by the task force. The common response to these comments was provided in the response to comment i-61 as follows:
"REJECT.
Reviewed http://www.ieee802.org/3/cd/public/Jan18/ghiasi_3cd_01_0118.pdf.
Straw poll #1 indicated lack of consensus to make any technical changes to the jitter specification.
Straw poll #1:
I would support making a technical change to the jitter specification.
Y: 4
N: 21
There is no support to make any changes to the jitter specifications."

The result of the straw poll was that there was clearly no consensus to make any changes to the jitter specifications.

[Editor's note: Comment r01-54 deals with a similar topic.]

Cl **135G** *SC* **135G.3.4** *P* **382** *L* **37** # r01-83

Dudek, Michael — Cavium

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

The vertical eye closure requirement isn't really an exception as in 120E there is no specification for VEC, but the "recipe" to create the stressed input is unlikely to create a signal that fails this specification.

SuggestedRemedy

Change "A 50GAUI-1 C2M or a 100GAUI-2 C2M module input shall meet all specifications in 120E.3.4, with the exception that for the module stressed input test in 120E.3.1 the input vertical eye closure, determined according to 135G.4.1, is less than 12 dB" to "A 50GAUI-1 C2M or a 100GAUI-2 C2M module input shall meet all specifications in 120E.3.4, with the modification that for the module stressed input test in 120E.3.1 the input vertical eye closure, determined according to 135G.4.1, is required to be less than 12 dB"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136** *SC* **136.4.9** *P* **228** *L* **19** # r01-38

Mellitz, Richard — Samtec, Inc.

Comment Type **TR** *Comment Status* **D** *remove RL*

It has been shown in many prior ad-hoc meetings that devices which fail return loss do not fail in systems. The lastest report may be found in:
http://www.ieee802.org/3/cd/public/adhoc/archive/heck_022118_3cd_adhoc.pdf
No correlation to return loss and COM has been demonstrated.

SuggestedRemedy

remove reference to 92.8.4.2
Remove editor's note on page 232 line 3.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with r01-24.

Cl **136** *SC* **136.4.9** *P* **231** *L* **46** # r01-39

Mellitz, Richard — Samtec, Inc.

Comment Type **TR** *Comment Status* **D** *Tx ERL, Rx ERL*

Transmitter and receiver ERL should be the same.

SuggestedRemedy

Make Clause 136.9.3.4 and 136.9.4.5 consistant

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Apply any changes made by other comments to both Tx and Rx ERL.

Cl **136** *SC* **136.6.1** *P* **200** *L* **16** # r01-59

Dawe, Piers J G — Mellanox Technologie

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

The Skew at SP3 (the output of the PMD), SP4 (the receiver MDI) and at SP5 (PMD service interface, output) have to be the same as at SP2 (PMD service interface, input of the PMD) for 50GBASE-CR, a serial PMD. As the receiver can't do anything about it, the "shall"s for SP4 and SP5 are not appropriate. What 802.3ba (all multilane) or 802.3bg (not a good precedent) did is not binding, nor a good choice for a family of serial PMDs. Any KR4-based 2-lane PMD can have its own independent Skew budget. Any future KP4-based 2-lane PMD can also have its own Skew budget, that could be like the 802.3bs one. What we write for a 1-lane PMA input cannot bind any 2-lane PMA. It's the SP6 spec that determines what future non-serial PMDs could be like, not SP3-5.
D3.0 comment 123.

SuggestedRemedy

Change:
The Skew at SP3 (the transmitter MDI) shall be less than 54 ns. Since the signal at the MDI represents a serial bit stream, there is no Skew Variation at this point.
The Skew at SP4 (the receiver MDI) shall be less than 134 ns. Since the signal at the MDI represents a serial bit stream, there is no Skew Variation at this point.
If the PMD service interface is physically instantiated so that the Skew at SP5 can be measured, then the Skew at SP5 shall be less than 145 ns. Since the signal at the PMD service interface represents a serial bit stream, there is no Skew Variation at this point. to:
The Skew at SP3 (the transmitter MDI) shall also be less than 43 ns. Since the signal at the MDI represents a serial bit stream, there is no Skew Variation at this point.
The Skew at SP4 (the receiver MDI) and SP5 (the output of the PMD at the PMD service interface) is the same as at SP2, and there is no Skew Variation at these points.

Correct Table 131-5, Summary of Skew constraints - as 50GBASE-R PMDs are serial it's simple to do. Change 54 134 145 to 43, 1434 3559 and 3852 to 1142. For SP2, remove the reference to 135.5.3.5. For SP5, remove the reference to 135.5.3.6.
Also 137.6.1 138.3.2.1 139.3.2.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Comments on this same topic with a similar suggested remedy have been addressed at previous task force meetings. Examples include comments #147, #148, #220, #221 against Draft 1.2, comments #40, #41 against Draft 1.3, and comments i-123 and i-125 against Draft 3.0.

The common response to the Draft 1.2 comments was as follows:
"REJECT.
Based on discussion and comment resolution at the January 2017 task force meeting WRT to the skew specifications for single-lane PMDs the consensus was to implement the specifications consistent with 40G, 100G, and 200G PHYs already specified in IEEE Std 802.3-2015 and P802.3bs.
See the final response for P802.3cd Draft 1.1 Comment #10"

The common response to the Draft 1.3 comments pointed back D1.2 comment #120 adding the note:
"There is no new information in the comment to support the suggested change."

The common response to the Draft 3.0 comments upheld and elaborated upon the previous responses as follows:
"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."

In the suggested remedy for this comment, the commenter is proposing essentially the same changes as in these previously addressed comments and the commenter is providing no new evidence to support the proposed changes.

As noted in the response above, the task force has consistently exhibited consensus to retain the specification methodology for Skew and Skew Variation used for 40G, 100G, and 200G PHYs specified in the base standard. The specifications for Skew and Skew Variation in this draft are consistent with those in the base standard.

Cl **136** *SC* **136.6.1** *P* **200** *L* **27** # r01-60

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D** *skew measurement <cc>*

This should not say "The measurements of Skew and Skew Variation are defined in 89.7.2." because that's 40GBASE-FR (not mainstream) and it says "using a clock and data recovery unit with high-frequency corner bandwidth of 16 MHz and a slope of -20 dB/decade". This should use a 4 MHz CRU.

SuggestedRemedy

Change 89.7.2 to 86.8.3.1.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

For reference, the CDRU BW of 16 MHz in 89.7.2 relates to measurement of the Skew for a 40GBASE-FR PMD. This bandwidth is consistent with the 40GBASE-FR transmitter measurement in 89.7.5.2 and receiver measurement in 89.7.10.

Correspondingly, the measurement CDRU bandwidth for each of the single-lane PMDs defined by P802.3cd is 4 MHz, so the skew measurement bandwidth should also be 4 MHz.

The suggested remedy proposes to point to 86.8.3.1, however, this subclause does not clarify that there is no skew variation for single-lane PMDs, like 89.7.2 does.

This comment applies to all single-lane PMDs specified in Clauses 136, 137, 138, 139, and 140.

In subclauses 136.6.1, 137.6.1, 138.3.2.1, 139.3.2, 140.3.2...
Change:
"defined in 89.7.2"
To:
"defined in 89.7.2 with the exception that the measurement clock and data recovery unit high-frequency corner bandwidth is 4 MHz"

Cl **136** *SC* **136.9** *P* **252** *L* **39** # r01-26

Rysin, Alexander Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *RL, Rx ERL, remove RL <cc>*

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, D3.0 comments 72, 76, 96.

SuggestedRemedy

* Remove the requirement for Differential return loss in Table 136-11.
* Add a requirement for Effective Return Loss (ERL) to be greater than 14.5 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 16.1 dB. There is no frequency domain return loss mask."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

The comment suggests to make ERL for transmitter and receiver normative in both clause 136 and clause 137, with values different from the current values.

In addition it suggests removing the Differential RL specification.

Resolve with r01-24, r01-89.

Cl **136** *SC* **136.9** *P* **259** *L* **7** # r01-25

Rysin, Alexander Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *Tx ERL, SNR_ISI <cc>*

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, D3.0 comments 71, 74, 97. 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 14.5 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 93A-5). ERL shall be at least 16.1 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.

The comment suggests to make ERL for the transmitter normative in both clause 136 and clause 137, with values different from the current values (as in r01-26).

In addition it proposes removing the SNR_ISI specification, but ad hoc presentation http://www.ieee802.org/3/cd/public/adhoc/archive/dudek_022118_3cd_adhoc.pdf suggests that SNR_ISI is still required to limit reflectivity in the transmitter, even with ERL.

Resolve with r01-24.

Cl **136** *SC* **136.9.3** *P* **223** *L* **23** # r01-18

Ran, Adee — Intel Corporation

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

Repeating comment i-21 against D3.0 (which was rejected).

The revision project has adopted a corresponding change in clause 93 (see comment i-29 against 802.3cj D3.0). A similar change should be applied here as well.

SuggestedRemedy

Add the following sentence at the end of the first paragraph of 136.9.3.
"The connection from TP2 to the test equipment is AC-coupled."

Add the following paragraph to 136.9.3 after the first paragraph:
"Measurement of the DC common-mode voltage is made with a high-impedance connection to TP2 where TP2 is AC-coupled to a 100 Ohm differential termination."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136** *SC* **136.9.3** *P* **223** *L* **39** # r01-34

Mellitz, Richard — Samtec, Inc.

Comment Type **TR** *Comment Status* **D** *remove RL*

It has been shown in many prior ad-hoc meetings that devices which fail return loss do not fail in systems. The lastest report may be found in:
http://www.ieee802.org/3/cd/public/adhoc/archive/heck_022118_3cd_adhoc.pdf
No correlation to return loss and COM has been demonstrated.

SuggestedRemedy

Remove the row "Differential output return loss (min.)" in table 136-11.
Remove editor's note on page 228 line 13.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with r01-24.

Cl **136** *SC* **136.9.3** *P* **224** *L* **7** # r01-35

Mellitz, Richard — Samtec, Inc.

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

ERL and SNR_ISI are measures of the same physical reflections and have been shown to be highly correlated. see:
http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_022118_3cd_adhoc.pdf slide 6 and 7.
It would be desirable to have the reflection measurement method consistent for transmitter and receivers in clause 136 and 137.
In addition, it has been show that SNR_ISI is difficult to measure for clause 137 transmit devices. see:
http://www.ieee802.org/3/cd/public/Sept17/rysin_3cd_02_0917.pdf

SuggestedRemedy

Remove the row "SNR_ISI (min.)b" in table 136-11 and note "b"
Remove editor's note on page 228 line 13.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Ad hoc presentation
http://www.ieee802.org/3/cd/public/adhoc/archive/dudek_022118_3cd_adhoc.pdf suggests that SNR_ISI is still required to limit reflectivity in the transmitter, even with ERL.

For task force discusssion.

Cl **136** *SC* **136.9.3** *P* **224** *L* **8** # r01-84

Dudek, Michael — Cavium

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

As was shown in the presentation "Can ERL replace SNRisi for 50GBASE-CR" given at the 2-18-18 ad hoc the existing SNRisi specification cannot differentiate between a host with low loss that gives good system performance but would fail the SNRisi specification, and a host with more loss that has reflections and has bad system performance. ERL has a similar problem. An updated presentation will be made.

SuggestedRemedy

Replace the SNRisi(min) specification with a new metric SNRisi+40*log(Pmax/Vf) Value 19.6dBmin. If SNRisi is replaced by ERL then the specification for the Tx should not be ERL it should be ERL+20*log(Pmax/Vf) with a value of 5.4dBmin.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Pending presentation and task force discussion.

Cl **136** *SC* **136.9.3** *P* **224** *L* **11** # r01-62

Dawe, Piers J G — Mellanox Technologie

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

even-odd jitter

SuggestedRemedy

Even-odd jitter

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136** *SC* **136.9.3** *P* **224** *L* **11** # r01-61

Dawe, Piers J G — Mellanox Technologie

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

Following the recipe for even-odd jitter in 120D.3.1.8 could lead to unexpected results, depending on just how the scope works.

SuggestedRemedy

Check with scope experts; if appropriate, add a NOTE explaining any practical issues.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

This comment does not apply to the substantive changes between IEEE P802.3cd/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the previous ballots. Hence it is not within the scope of the recirculation ballot.

The comment does not substantiate the claimed concern.

The suggested remedy is not detailed enough to enable implementation of any change in the draft.

Cl **136** *SC* **136.9.3.4** *P* **227** *L* **49** # r01-92

Sakai, Toshiaki — socionext

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

Two(2) periods".."

SuggestedRemedy

Change ".." (two peridos) to "." (one period).

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136** *SC* **136.9.3.4** *P* **227** *L* **49** # r01-36

Mellitz, Richard — Samtec, Inc.

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

N should be at least 2 times the reflection delay of a long test fixture cascaded with a long channel which is about 5 ns.

SuggestedRemedy

Change N to 300.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

N=200 shows a time span of about 7.5 ns. This corresponds to a test fixture delay of 3.75 ns, approximately the delay of 56 cm of PCB (with epsilon_r=4) which is more than enough for a realistic host board and test fixture scenario.

Cascading with a long channel is irrelevant for this measurement since the reference point is TP2.

See also r01-44.

Cl **136** *SC* **136.9.3.4** *P* **228** *L* **8** # r01-37

Mellitz, Richard — Samtec, Inc.

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

A rational and suggestion for rho_x and ERL min was made in http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_022118_3cd_adhoc.pdf

SuggestedRemedy

Change rho_x to 0.44 and
on line 11 page 228 to
Transmitter ERL at TP2 is recommended to be greater than 14.5 dB

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

This change requires consensus.

Pending task force discussion.

Cl **136** *SC* **136.9.4.5** *P* **231** *L* **48** # r01-91

Sakai, Toshiaki socionext

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

This sub-clause is talking about receiver and TP3.
Change
"delay associated with the TP2 test fixture"
to
"delay associated with the TP3 test fixture".
Please refer to "mellitz_3cd_020718_adhoc-v2.pdf" page-4.

SuggestedRemedy

Change
"delay associated with the TP2 test fixture"
to
"delay associated with the TP3 test fixture".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136** *SC* **136.9.4.5** *P* **232** *L* **1** # r01-90

Sakai, Toshiaki socionext

Comment Type **T** *Comment Status* **D** *Rx ERL*

Since this sub-clause is talking about receiver and TP3,
"Transmitter ERL at TP2 is recommended to be greater than 9 dB."
should be
"Receiver ERL at TP3 is recommended to be greater than 9 dB."
Please refer to "mellitz_3cd_020718_adhoc-v2.pdf" page-4.

SuggestedRemedy

Change
"Transmitter ERL at TP2 is recommended to be greater than 9 dB."
to
"Receiver ERL at TP3 is recommended to be greater than 9 dB."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Implement suggested remendy, taking into account any change of value or wording that may result from other comments.

Cl **136** *SC* **136.11.3** *P* **233** *L* **30** # r01-40

Mellitz, Richard Samtec, Inc.

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

It has been shown in many prior ad-hoc meetings that devices which fail return loss do not fail in systems. The lastest report may be found in:
http://www.ieee802.org/3/cd/public/adhoc/archive/heck_022118_3cd_adhoc.pdf
No correlation to return loss and COM has been demonstrated.

SuggestedRemedy

remove clause 136.11.3
Remove editor's note on page 237 line 44.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

During the committee discussion regarding adoption of ERL, there was opposition to deleting return loss.

For committee discussion.

Cl **136** *SC* **136.11.7** *P* **234** *L* **11** # r01-105

Tracy, Nathan

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

The stop frequency of the data input into the COM script has a large impact on the output value. Add stop frequency as clarification to the intended use of the script.

SuggestedRemedy

Add row to Table 136-16 "Minimum stop frequency, fstop 26.5 GHz"

Proposed Response *Response Status* **W**

PROPOSED REJECT.

This comment was submitted after Sponsor ballot recirculation closed.

The subclause 136.11.7 Cable assembly Channel Operating Margin references the procedure in 93A.1.

The stop frequency is addressed in last paragraph of 93A.1.1. "It is recommended that the scattering parameters be measured with uniform frequency step no larger than deltaf from a start frequency no larger than fmin to a stop frequency of at least the signaling rate fb."

Cl **136** *SC* **136.11.8** *P* **237** *L* **24** # r01-33

Ran, Adee Intel Corporation

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

Subclause title and text refer to Channel effective return loss, but it is actually the cable assembly.

SuggestedRemedy

Change "channel" to "cable assembly" throughout this subclause.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment r01-82.

Cl **136** *SC* **136.11.8** *P* **237** *L* **24** # r01-82

Dudek, Michael Cavium

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

This section is refering to the Cable Assembly not the whole channel

SuggestedRemedy

Change the section title replacing "channel" with "cable assembly" . For the first sentence of the section change to "ERL of the cable assembly at TP1 and TP4 is computed
On line 42 change to "Cable Assembly ERL at TP1 and at TP4 is recommended. Also in the title of Table 136-18 change "Channel" to "Cable Assembly"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Change 136.11.8 Channel effective return loss to 136.11.8 Cable assembly effective return loss. Reorder this section to below 136.11.3.

(1)For the first sentence of the section change to "ERL of the cable assembly at TP1 and TP4 is computed

(2)On line 42 change to "Cable Assembly ERL at TP1 and at TP4 is recommended.

(3)Also in the title of Table 136-18 change "Channel" to "Cable Assembly"

Cl **136** *SC* **136.11.8** *P* **237** *L* **24** # r01-93

Sakai, Toshiaki socionext

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

Since this sub-clause describes about cable assembly,
"136.11.8 Channel effective return loss"
should be
"136.11.8 Cable assembly effective return loss".
To be consistent with "136.11.7 Cable assembly Channel Operating Margin" and sub-clause 136.10 (p232L9) "The channel is defined between TP0 and TP5 to include the transmitter and receiver differential controlled
impedance printed circuit board and the cable assembly as illustrated in Figure 136-2.".

SuggestedRemedy

Change
"136.11.8 Channel effective return loss"
to
"136.11.8 Cable assembly effective return loss".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment r01-82.

Cl **136** *SC* **136.11.8** *P* **237** *L* **24** # r01-41

Mellitz, Richard Samtec, Inc.

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

N should be at least 5 times the reflection delay of the channel

SuggestedRemedy

set N to t_s/T_b*10
t_s and T_b may be found in Annex 93A.1.6

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The commentor has not provided sufficient justification for suggested change.

For committee discussion.

Cl **136** *SC* **136.11.8** *P* **237** *L* **26** # r01-94

Sakai, Toshiaki socionext

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

Since this sub-clause describes about cable assembly,
"ERL of the channel at TP1 and at TP4"
should be
"ERL of the cable assembly at TP1 and at TP4".

SuggestedRemedy

Change
"ERL of the channel at TP1 and at TP4"
to
"ERL of the cable assembly at TP1 and at TP4".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment#r01-82.

Cl **136** *SC* **136.11.8** *P* **237** *L* **32** # r01-95

Sakai, Toshiaki socionext

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

Since this sub-clause describes about cable assembly, "Table 136-18--Channel ERL parameter values" should be "Table 136-18--Cable Assembly ERL parameter values".

SuggestedRemedy

Change
"Table 136-18--Channel ERL parameter values"
to
"Table 136-18--Cable Assembly ERL parameter values".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment r01-82.

Cl **136** *SC* **136.11.8** *P* **237** *L* **39** # r01-42

Mellitz, Richard Samtec, Inc.

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

A rational and suggestion for rho_x and ERL min was made in
http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_022118_3cd_adhoc.pdf

SuggestedRemedy

Change rho_x to 0.44 and
line 42 page 237 to
Transmitter ERL at TP1 and at TP4 is recommended to be greater than 14 dB

Proposed Response *Response Status* **W**

PROPOSED REJECT.

This subclause is for Channel ERL not transmitter ERL. It is assumed that the commenter is referring to Channel ERL.

For committee discussion

Cl **136** *SC* **136.11.8** *P* **237** *L* **39** # r01-106

Tracy, Nathan

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

The stop frequency of the data input into the ERL script has a large impact on the output value. Add stop frequency as clarification to the intended use of the script.

SuggestedRemedy

Add row to Table 136-18 "Minimum stop frequency, fstop 26.5 GHz"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

This comment was submitted after Sponsor ballot recirculation closed.

In 93A.5.1 P338, L52 expand reference to 93A.1.1.

Delete (see 93A.1.1) and add sentence to end of paragraph, "See 93A.1.1 for scattering parameters measurement recommendations including frequency step, start, and stop."

Cl **136** *SC* **136.11.8** *P* **237** *L* **42** # r01-96

Sakai, Toshiaki socionext

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

Since this sub-clause describes about cable assembly, "Channel ERL at TP1 and at TP4 are recommended to be greater than 10.5 dB." should be "Cable assembly ERL at TP1 and at TP4 are recommended to be greater than 10.5 dB.".

SuggestedRemedy

Change
"Channel ERL at TP1 and at TP4 are recommended to be greater than 10.5 dB."
to
"Cable assembly ERL at TP1 and at TP4 are recommended to be greater than 10.5 dB.".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with comment r01-82.

Cl **137** *SC* **137.9.2** *P* **251** *L* **21** # r01-43

Mellitz, Richard Samtec, Inc.

Comment Type **TR** *Comment Status* **D** *remove RL, SNR_ISI*

ERL and SNR_ISI are measures of the same physical reflections and have been shown to be highly correlated. see:
http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_022118_3cd_adhoc.pdf slide 6 and 7.
It would be desirable to have the reflection measurement method consistent for transmitter and receivers in clause 136 and 137.
In addition, it has been show that SNR_ISI is difficult to measure for cause 137 transmit devices. see:
http://www.ieee802.org/3/cd/public/Sept17/rysin_3cd_02_0917.pdf

SuggestedRemedy

add an exception to the list in clause 137.9.2 to not use the line for 'Differential output return loss (min)" in table 120d-1 and remove item 3 in the list item "SNR_ISI is computed with Nb set to 12 and Dp set to 3." value of SNRISI (min) is 43 dB"
Remove editor's note on page 251 line 54

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Ad hoc presentation
http://www.ieee802.org/3/cd/public/adhoc/archive/dudek_022118_3cd_adhoc.pdf suggests that SNR_ISI is still required to limit reflectivity in the transmitter, even with ERL.

For task force discusssion.

For removal of differential output RL, Resolve with r01-24.

Cl **137** *SC* **137.9.2** *P* **251** *L* **23** # r01-63

Dawe, Piers J G Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *remove RL*

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. If we don't go forward to an ERL-based spec we should go back to what we had a few drafts ago.

SuggestedRemedy

Either: say that the differential output return loss limit in Table 120D-1 doesn't apply (when we have a normative Tx ERL), or:
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 Tx RL and the channel RL at low frequencies; 12 -0.625f, 8.7-0.075f. Add figure to illustrate.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with r01-24.

Cl **137** *SC* **137.9.2** *P* **251** *L* **27** # r01-23

Ran, Adee — Intel Corporation

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

SNR_ISI (min) for this clause is still set to 43 dB, which is too high to be measurable.

For comparison, in clause 136, the updated specifications are
SNDR (min): 32.2 dB (Tx spec)
SNR_TX: 32.5 dB (reference Tx in COM)
SNR_ISI (min): 31.2 dB (lower by more than 1 dB than both SNDR and SNR_TX)

While in clause 137 they are
SNDR (min): 32.5 dB (Tx spec)
SNR_TX: 32.5 dB (reference Tx in COM)
SNR_ISI (min): 43 dB

Based on the values above it is suggested to specify SNR_ISI (mi) in this clause to be 1 dB lower than SNDR.

SuggestedRemedy

Change SNR_ISI (min) from 43 dB to 31.5 dB.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **137** *SC* **137.9.2** *P* **251** *L* **28** # r01-85

Dudek, Michael — Cavium

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

The value for SNRisi is unreasonably high (43dB). In 120D the value is 34.8dB which was based in part on dudek_3bs_01_0517. It is not expected that the difference between np and dp will make a large change.

SuggestedRemedy

Change the value of SNRisi to 34.8dB

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with r01-23 (which proposes another value based on clause 136).

Cl **137** *SC* **137.9.2** *P* **251** *L* **29** # r01-64

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *SNDR <scope>*

SNDR is measured in 33 GHz while the effect of SNR_TX is calculated (Annex 93A) in a different, lower bandwidth. This seems to lead to an error - probably because sigma_e and sigma_n are affected by bandwidth more strongly than pmax is. SNDR should be measured in something less than ~19 GHz.
D3.0 comment 138.

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."

Proposed Response *Response Status* **W**

PROPOSED REJECT.

This is essentially a resubmit of comment i-138.

Comment i-138 was rejected with the following response:

"REJECT.

The sigma_TX term in COM is calculated under the assumption that the spectrum of the noise and the distortion 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, noise and distortion all 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 and distortion 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 and distortion measurement but there is insufficient evidence that this filter is more suitable than the current filter."

There is no new information that would justify accepting this comment now.

Cl **137** *SC* **137.9.2** *P* **281** *L* **28** # r01-28

Rysin, Alexander — Mellanox Technologie

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

Requirements for Transmitter output residual ISI SNR_ISI (min) of 43 dB and SNDR (min) of 32.5 dB in 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 137 are even more stringent than in 120D. COM packages were shown to generate worse SNDR and SNR_ISI for the target SNR_TX. D2.0 comment 140, D2.1 comment 49, D2.2 comment 22, D3.0 comments 71, 74, 97. Previous comments, suggesting ERL should replace SNR_ISI suggest a partial remedy.

SuggestedRemedy

* 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 "SNR_ISI is computed with Nb set to 12 and Dp set to 3. The value of SNR_ISI (min) is 30.5 dB"
* Change paragraph 4 in 137.9.2 from "The value of SNDR (min) is 32.5 dB." to "The value of SNDR (min) is 32 dB".

See presentation.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Pending presentation and task force discussion.

Cl **137** *SC* **137.9.2.1** *P* **251** *L* **37** # r01-44

Mellitz, Richard — Samtec, Inc.

Comment Type **T** *Comment Status* **D** *Tx ERL*

N should be at least 2 times the reflection delay of "longest" test fixture cascaded with a long transmit function which is about 3 ns.

SuggestedRemedy

Change N to 100.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Note: N=100 shows a time span of about 3.75 ns. This corresponds to a test fixture and transmit function delay of about 1.88 ns, approximately the delay of 28 cm of PCB (with epsilon_r=4) which covers realistic test fixture scenarios.

Note that the same value of N should be used in Rx ERL, 137.9.3.1.

For task force discussion.

Cl **137** *SC* **137.9.2.1** *P* **251** *L* **42** # r01-45

Mellitz, Richard — Samtec, Inc.

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

A rational and suggestion for rho_x and ERL min was made in http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_022118_3cd_adhoc.pdf

SuggestedRemedy

Change rho_x to 0.44 and
in line 51 page 251 change to
Transmitter ERL at TP0A is recommended to be greater than 16.1 dB

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with r01-89.

Cl **137** *SC* **137.9.2.1** *P* **251** *L* **50** # r01-65

Dawe, Piers J G — Mellanox Technologie

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

The draft recommendation for transmitter ERL at TP0a (greater than 19.5 dB) is far too high. It should be similar to the channel ERL.

SuggestedRemedy

Change it to something reasonable (lower than the channel spec). Make it normative.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with r01-89 which suggests 16.1 dB.

Cl **137** *SC* **137.9.2.1** *P* **251** *L* **50** # r01-87

Sakai, Toshiaki socionext

Comment Type **T** *Comment Status* **D** *Tx ERL*

"Transmitter ERL at TP0a" should be "Transmitter ERL at TP0", since test fixture effect (Tfx) is excluded in ERL calculation.
Though the measurement point itself is TP0a, ERL value is at TP0. To avoid misunderstanding, it looks better to be TP0, instead of TP0a.
Please refer to "mellitz_3cd_020718_adhoc-v2.pdf" page-4, 9 and 10.

SuggestedRemedy

Change
"Transmitter ERL at TP0a"
to
"Transmitter ERL at TP0"

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The measurement is conducted at TP0a and this is the reference point.

The test fixture effect is indeed expected to be removed by the procedure; that is the reason for using the ignoring reflections before Tfx. If the specifications were referenced to TP0, then ignoring the initial Tfx would not be justified.

Cl **137** *SC* **137.9.2.1** *P* **251** *L* **50** # r01-89

Sakai, Toshiaki socionext

Comment Type **T** *Comment Status* **D** *Tx ERL*

Based on the actual silicon measurement, Tx ERL limit (19.5dB) is too tough to meet, even Tx satisfies RL and other spec. And the Tx can transmit data without any issues.
- At ad hoc call on Feb/21, KR device ERLmin was updated to 16.1dB. This is enough.
- A presentation (sakai_3cd_01_0318) regarding KR device ERL measurement results will be explained at Rosemont F2F meeting.

SuggestedRemedy

Change transmitter ERL limit from
"greater than 19.5dB"
to
"greater than 16.1dB".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Pending presentation and task force discussion.

Cl **137** *SC* **137.9.3** *P* **252** *L* **2** # r01-46

Mellitz, Richard Samtec, Inc.

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

Transmitter and receiver ERL should be the same.

SuggestedRemedy

Make Clause 137.9.3 and 137.9.2 consistant

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Apply any changes made by other comments to both Tx and Rx ERL.

Cl **137** *SC* **137.9.3** *P* **252** *L* **4** # r01-66

Dawe, Piers J G Mellanox Technologie

Comment Type **TR** *Comment Status* **D** *remove RL*

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. If we don't go forward to an ERL-based spec we should go back to what we had a few drafts ago.
D3.0 comment 141.

SuggestedRemedy

Either: say that the differential output return loss limit in Table 120D-5 doesn't apply, or: 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 RL and the channel RL at low frequencies; 12 -0.625f, 8.7-0.075f. Add figure to illustrate or point to the figure for Tx RL (see another comment).

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with other ERL-related comments.

Cl **137** *SC* **137.9.3.1** *P* **252** *L* **21** # r01-88

Sakai, Toshiaki socionext

Comment Type **T** *Comment Status* **D** *Rx ERL*

"Receiver ERL at TP5a" should be
"Receiver ERL at TP5", since test fixture effect (Tfx) is excluded in ERL calculation.
Though the measurement point itself is TP5a, ERL value is at TP5. To avoid misunderstanding, it looks better to be TP5, instead of TP5a.
Please refer to "mellitz_3cd_020718_adhoc-v2.pdf" page-4, 9 and 10.

SuggestedRemedy

Change
"Receiver ERL at TP5a"
to
"Receiver ERL at TP5"

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The measurement is conducted at TP5a and this is the reference point.

The test fixture effect is indeed expected to be removed by the procedure; that is the reason for using the ignoring reflections before Tfx. If the specifications were referenced to TP5, then ignoring the initial Tfx would not be justified.

Cl **137** *SC* **137.9.3.1** *P* **252** *L* **21** # r01-67

Dawe, Piers J G Mellanox Technologie

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

The draft recommendation for transmitter ERL at TP5a (greater than 19.5 dB) is far too high. It should be significantly lower than the transmitter ERL (after that is corrected) because the receiver suffers the consequences of its own bad ERL in the RITT - so we barely need a spec at all.

SuggestedRemedy

Change it to something reasonable (lower than the corrected transmitter spec). Make it normative.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Note: "transmitter ERL" initially mentioned in the comment should be "receiver ERL". The subclause the comment refers to is about receiver ERL, not transmitter ERL.

Resolve with r01-49.

Cl **137** *SC* **137.10.2** *P* **254** *L* **11** # r01-47

Mellitz, Richard Samtec, Inc.

Comment Type **T** *Comment Status* **D** *remove RL*

It has been shown in many prior ad-hoc meetings that channels which fail return loss do no fail in systems. The lastest report may be found in:
http://www.ieee802.org/3/cd/public/adhoc/archive/heck_022118_3cd_adhoc.pdf
No correlation to return loss and COM has been demonstrated.

SuggestedRemedy

remove clause 137.10.1
Remove editor's note on page 255 line 50.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Note that 137.10.1 specifies the recommended maximum insertion loss, and does not discuss return loss. Return loss is the subject of 137.10.2.

Resolve with other ERL-related comments.

Cl **137** *SC* **137.10.3** *P* **255** *L* **35** # r01-48

Mellitz, Richard Samtec, Inc.

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

N should be at least 5 times the reflection delay of the channel

SuggestedRemedy

set N to t_s/T_b*10
t_s and T_b may be found in Annex 93A.1.6

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Indeed t_s may be found for a channel (from 4-port measurement) and can be used in selecting N.

However, the suggested remedy enables 10 transits through the channel, such that the resulting echo is subject to 10 times the insertion loss. This seems excessive; 5 transitions are enough.

Change "N is set to 200" to:
"N is set to an integer equal to or greater than 5*t_s*f_b, where t_s is obtained from step b) of 93A.1.6 for any values of c(-1), c(1), gDC, and gDC2".

Cl **137** *SC* **137.10.3** *P* **255** *L* **45** # r01-49

Mellitz, Richard — Samtec, Inc.

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

A rational and suggestion for rho_x and ERL min was made in http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_022118_3cd_adhoc.pdf and http://www.ieee802.org/3/cd/public/adhoc/archive/heck_022118_3cd_adhoc.pdf

SuggestedRemedy

Change rho_x to 0.44 and
in line 48 page 255 change to
Transmitter ERL at TP0 or TP5 is recommended to be greater than 11 dB

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

This change requires consensus.

Pending task force discussion:

based on the page and line, The comment refers to Channel ERL.

Resolve with r01-24.

Cl **137** *SC* **137.10.3** *P* **255** *L* **48** # r01-68

Dawe, Piers J G — Mellanox Technologie

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

The draft recommendation for channel ERL (greater than 9.5 dB) is much lower than for Tx and Rx when it should be slightly higher than Tx. It may be too low anyway.

SuggestedRemedy

Change it to something similar or higher than the corrected transmitter spec. Make it normative.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with r01-24.

Cl **138** *SC* **138** *P* **263** *L* **1** # r01-69

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, with some TDECQ changes inherited from other clauses. It needs more study. D3.0 comment 122.

SuggestedRemedy

Do the work. Show technical feasibility for the draft spec (after improvements).
The alternatives are:
withdraw the clause, which would be a pity; or
delay the project until the work gets done.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

No specific change to document suggested.

Measured data has been presented to the task force supporting the current specifications. See:
http://www.ieee802.org/3/cd/public/Jan18/king_3cd_02_0118.pdf
http://www.ieee802.org/3/cd/public/adhoc/archive/chang_011018_3cd_02_adhoc-v2.pdf

Cl **138** *SC* **138.7.1** *P* **273** *L* **22** # r01-70

Dawe, Piers J G — Mellanox Technologie

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

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. D.30 comment 119.
Also, it seems that the TDECQ spec limit can be "gamed" (D3.0 comment 116).

SuggestedRemedy

Compare a minimally compliant 100GBASE-SR4 transmitter and set the TDECQ limit accordingly. Provide a signal quality spec that cannot be "gamed".

Proposed Response *Response Status* **W**

PROPOSED REJECT.

No change to document suggested.

The issue that might be caused by a TDECQ limit of 4.9 dB has not been clarified. There is precedence for this kind of transmitter quality metric to be higher in MMF specifications than in SMF specifications.
To date no contribution has been made that demonstrates the problem, for example, a waveform that passes TDECQ but cannot be decoded by a reasonable receiver implementation.
Measured data has been presented to the task force supporting the current specifications.
See:
http://www.ieee802.org/3/cd/public/Jan18/king_3cd_02_0118.pdf
http://www.ieee802.org/3/cd/public/adhoc/archive/chang_011018_3cd_02_adhoc-v2.pdf

Cl **138** *SC* **138.8.5** *P* **276** *L* **17** # r01-102

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.
At Geneva interim, the joint presentation (liu_3cd_01a_0118) to propose the adaption of threshold adjustment in TDECQ measurements was reviewed, and team was asked to provide additional info to show
1) threshold adjustment doesn't result in SRS test source having too high a stress for the receiver, and
2) threshold adjustment significantly improves correlation between TDECQ and measured receiver sensitivity.
To address these two issues, the team has made significant efforts with the preliminary results presented in chang_021418_3cd_adhoc-v2, which showed
1. A maximum of 2% of threshold adjustment is sufficient to improve the TDECQ measurements
2. With threshold adjustment, the correlation between TDECQ and measured receiver sensitivity is improved
3. The impacts on Rx SRS is within 0.1 - 0.2 dB.
In addition, the measurement software has been developed by both Keysight and Tektronix.

SuggestedRemedy

Proposed Change: Propose to adopt threshold optimization in TDECQ measurement as described in mazzini_120617_3cd_adhoc-v2, liu_3cd_01a_0118, chang_021418_3cd_adhoc-v2 with the constraints on the allowable adjustment range to be 2% of signal OMAouter.

Add one more exception into '138.8.5 Transmitter and dispersion eye closure - quaternary (TDECQ)'.
- "Pth1, Pth2, and Pth3 are varied by up to 2% of OMA_outer."

An updated presentation of chang_021418_3cd_adhoc-v2 will be submitted for the March meeting to address additional issues raised at ad hoc with the summary of the proposal, supporting measurement data, and suggested changes in details.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Chang_021418_3cd_adhoc-v2 shows that adding threshold adjusts to the TDECQ

definition results in underestimation of system penalty even for a much longer equalizer (10 tap FFE) than the reference 5 tap T-spaced FFE. This introduces a link budget gap and risk of interoperability issues, as discussed in http://www.ieee802.org/3/cd/public/adhoc/archive/king_022818_3cd_adhoc.pdf

Subject to discussion and review of any new material in Task Force.

Cl **138** *SC* **138.8.5** *P* **276** *L* **32** # r01-97

Tamura, Kohichi — Oclaro

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

Several presentations raised the concern that the existing TDECQ specification is too stringent because acceptable link performance is observed with transmitters that have marginal or failing TDECQ (see way_3bs_01a_0717, tamura_3bs_01a_0917, baveja_3cd_01_1117). This creates the risk that transmitter yields will be needlessly impacted, which will increase cost. Allowing a small amount of optimization to the threshold levels Pth1, Pth2, and Pth3 (defined by equations (121-1), (121-2), and (121-3) in 121.8.5.3) will make TDECQ easier to pass, reducing the risk of low transmitter yield (see mazzini_120617_3cd_adhoc-v2, liu_3cd_01a_0118, and chang_021418_3cd_adhoc-v2). As long as the amount of variation is much smaller than the threshold optimization performed by real receivers, the existing receiver specifications will not be affected.

SuggestedRemedy

Add the following exception:

"Pth1, Pth2, and Pth3 are varied by up to 2% of OMA_outer."

Justification will be given in an updated version of chang_021418_3cd_adhoc-v2 at the March plenary meeting in Chicago.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See response to 102

Cl **138** *SC* **138.8.5** *P* **276** *L* **33** # r01-71

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 and because the signal is measured in a particularly low bandwidth.
D3.0 comment 116.

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 or 11.2 GHz filter response (before the FFE), 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 filter response (0.6254 for 13.28125 GHz, 0.6006 for 11.2 GHz).
Either, 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.
Or, if the same relative limit is acceptable for all PAM4 optical PMDs, the limit could be here in the TDECQ procedure. e.g. make the TDECQrms limit the same as the TDECQ limit, say here that both TDECQ and TDECQrms must meet the TDECQ spec.
2. To protect the receiver from having to "invert" heavily over-emphasised signals, set a minimum cursor weight, 0.9.
Similarly in clauses 139, 140.
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.

To date no contribution has been made that 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 802.3cd D3.0, 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 has not been established

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Cl **138** *SC* **138.8.5.1** *P* **276** *L* **37** # r01-72

Dawe, Piers J G — Mellanox Technologie

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

Specifications work at different levels: functional, logic/digital, analog (electrical or optical). "Functional" is the highest/most abstract, while this FFE diagram is part of the specification of an analog quantity. Examples "A functional block diagram of the RS-FEC sublayer is shown in Figure 134-2", "if the 50GMII is not implemented, a conforming implementation must behave functionally as though the RS and 50GMII were present", "PMD functional specifications". I know the copper clauses say "functional model for the transmit equalizer", but this isn't copper or a "transmit equalizer".

SuggestedRemedy

Change "symbol period. A functional model of the reference equalizer is shown in Figure 138-3" to "symbol period, as shown in Figure 138-3". Change the figure title from "TDECQ reference equalizer functional model" to "TDECQ reference equalizer". Similarly in 139.7.5.4 and 140.7.5.1.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The text and figure follow the precedent set in IEEE Std 802.3bs-2017 Annex 120D. Whether the transmission medium is copper or fiber and whether the equalizer is in the transmitter or the receiver makes no difference to how the equalizer is described.

Cl **138** *SC* **138.8.5.1** *P* **276** *L* **38** # r01-73

Dawe, Piers J G — Mellanox Technologie

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

Further investigation of possible minimally compliant MMF signals and their associated TDECQ FFE settings indicates that 2 pre, 2 post (making the cursor the third tap) is never significantly better than 1 pre, 3 post (making it the second tap), for compliant signals. Further refining the TDECQ search rules will avoid inefficiency both in product receiver design, testing and operation, and in TDECQ testing.

SuggestedRemedy

Change "Tap 1, tap 2, or tap 3, has" to "Tap 1 or tap 2 has". There is a separate comment for SMF because the different TDECQ limit there could lead to a different conclusion.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See response to comment r01-74

Cl **138** *SC* **138.8.5.1** *P* **276** *L* **38** # r01-74

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, hence the new rule for largest tap position. For the first position to be largest and for this to be significantly better than other solutions, the signal would have to be both fast (so that a precursor tap is not useful) and spread out (so that a fourth postcursor is useful). As the reference receiver bandwidth for MMF is only 0.42*fb (slower than for SMF), the MMF signal at the FFE won't be fast.

SuggestedRemedy

Unless we have evidence to the contrary, change "Tap 1, tap 2, or tap 3, has" to "Tap 2 or tap 3 has".
Consider the evidence and if appropriate, do the same in 139.7.5.4.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

A similar proposal was made against draft 3.0 (comments i-107 i-117 and i120) which was reviewed by the Task Force.

The agreed resolution was to limit the main tap to tap 1, tap 2, or tap 3. No new information has been brought forward since these comments were resolved.

The resolution to i-117 was:

ACCEPT IN PRINCIPLE.
Implement the changes proposed in
http://www.ieee802.org/3/cd/public/Jan18/king_3cd_03_0118.pdf with editorial license

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Cl **138** *SC* **138.8.7** *P* **277** *L* **30** # r01-22

Anslow, Peter — Ciena Corporation

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

In the Y axis label of Figures 138-4, 139-6, and 140-5, the "outer" is not a subscript.

SuggestedRemedy

In the Y axis label of Figures 138-4, 139-6, and 140-5, change the label so that "outer" is a subscript.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **138** *SC* **138.8.8** *P* **278** *L* **12** # r01-19

Ran, Adee
Intel Corporation

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

Several comments against D3.0 noted that the SRS test conditions can be calibrated in multiple ways.

(Note that although for the reference receiver the SRS result is independent of the choice of stress conditions, this may not be true for specific implementations. For example, a receiver with better equalization capabilities than the reference receiver but with more internal noise may pass the test if the stress is mostly ISI, but fail if the stress is mostly uncorrelated noise.)

The response to comment i-58 against D3.0 indicated that there is deliberate freedom in setting up the SRS test source.

Discussions following presentations related to that comment (e.g. schube_011718_3cd_adhoc) indicated that this freedom is desirable, since different PMD transmitters with different characteristics can be used by link partners (for example, high bandwidth with large noise, or low bandwidth with low noise). Narrowing down the test parameters may exclude conditions caused by some compliant transmitters.

This implies that in order to interoperate with any compliant transmitter, a receiver should pass the SRS test regardless of how the stress signal is calibrated.

This may seem obvious for people with deep understanding of the standard, but test engineers may have different interpretations, and may decide based on only one test condition that happens to make the DUT pass. This approach also enables "gaming the test" by choosing particular test conditions that are favorable for a device.

It is suggested to clarify the intent of the freedom of choice of stress conditions with an informative note.

Note that a similar comment is submitted to the revision project (802.3cj D3.1). If that comment is accepted, its effect will be inherited by all clauses in P802.3cd. This comment is submitted here for the editors' attention.

SuggestedRemedy

Add the following note at the end of 138.8.8:

NOTE--The stress conditions in the SRS test can be calibrated in several ways. A compliant PMD receiver is expected to meet the sensitivity requirements with a calibrated conformance test signal regardless of the choice of stress components.

Add similar notes in 139.7.9.2 and in 140.7.9.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

A similar comment R01-20, was submitted against 802.3cj clause 121; as 121 is the base reference for all TDECQ clauses, positive response to that comment will obviate the need for a change to 802.3cd.

Subject to discussion by the Task Force.

Cl **139** *SC* **139.7.5.1** *P* **299** *L* **42** # r01-50

Zivny, Pavel
Tektronix, Inc.

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

The system measuring the TDECQ is insufficiently specified.
The measurement bandwidth roll-off after the -3 dB point should be specified as per zivny_3cd_01a_0118.pdf, with slight modification based on the feedback received.
I agree that this is not a complete fix - specifying the tolerances more fully would be better - but it is an improvement over current situation (no limit on where to roll-off).

SuggestedRemedy

after this "The combination of the
O/E and the oscilloscope has a fourth-order Bessel-Thomson filter response with a bandwidth of
approximately 13.28125 GHz."
add
The roll-off past the -3 dB point should be gradual and no more than 3dB from nominal B-T filter at 0.9 * symbol rate frequency.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The current draft gives a precise definition across all frequencies, but allows the implementer to compensate for any deviation from a BT4 filter with the specified bandwidth.

The suggested remedy leaves the reference receiver response more loosely defined. If reference receiver response is not precisely defined over all frequencies, then there will be no way to determine what the 'correct' value for TDECQ is when a transmitter (with noise or signal power in the loosely defined frequency region) is measured using two different reference receiver implementations with differing but compliant frequency responses.

Cl **139** *SC* **139.7.5.3** *P* **300** *L* **44** # r01-99

Tamura, Kohichi — Oclaro

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

Several presentations raised the concern that the existing TDECQ specification is too stringent because acceptable link performance is observed with transmitters that have marginal or failing TDECQ (see way_3bs_01a_0717, tamura_3bs_01a_0917, baveja_3cd_01_1117). This creates the risk that transmitter yields will be needlessly impacted, which will increase cost. Allowing a small amount of optimization to the threshold levels Pth1, Pth2, and Pth3 (defined by equations (121-1), (121-2), and (121-3) in 121.8.5.3) will make TDECQ easier to pass, reducing the risk of low transmitter yield (see mazzini_120617_3cd_adhoc-v2, liu_3cd_01a_0118, and chang_021418_3cd_adhoc-v2). As long as the amount of variation is much smaller than the threshold optimization performed by real receivers, the existing receiver specifications will not be affected.

SuggestedRemedy

Change:
"TDECQ for 50GBASE-FR and 50GBASE-LR is measured as described in 121.8.5.3 with the exception that the reference equalizer is as specified in 139.7.5.4."

To:
"TDECQ for 50GBASE-FR and 50GBASE-LR is measured as described in 121.8.5.3 with the following exceptions:
- The reference equalizer is as specified in 139.7.5.4
- Pth1, Pth2, and Pth3 are varied by up to 2% of OMA_outer."

Justification will be given in an updated version of chang_021418_3cd_adhoc-v2 at the March plenary meeting in Chicago.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See response to comment r01-102.

Cl **139** *SC* **139.7.5.3** *P* **300** *L* **44** # r01-103

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.
At Geneva interim, the joint presentation (liu_3cd_01a_0118) to propose the adaption of threshold adjustment in TDECQ measurements was reviewed, and team was asked to provide additional info to show
1) threshold adjustment doesn't result in SRS test source having too high a stress for the receiver, and
2) threshold adjustment significantly improves correlation between TDECQ and measured receiver sensitivity.
To address these two issues, the team has made significant efforts with the preliminary results presented in chang_021418_3cd_adhoc-v2, which showed
1 A maximum of 2% of threshold adjustment is sufficient to improve the TDECQ measurements
2 With threshold adjustment, the correlation between TDECQ and measured receiver sensitivity is improved
3 The impacts on Rx SRS is within 0.1 - 0.2 dB.
In addition, the measurement software has been developed by both Keysight and Tektronix.

SuggestedRemedy

Propose to adopt threshold optimization in TDECQ measurement as described in mazzini_120617_3cd_adhoc-v2, liu_3cd_01a_0118, chang_021418_3cd_adhoc-v2 with the constraints on the allowable adjustment range to be 2% of signal OMAouter.

Change:
"TDECQ for 50GBASE-FR and 50GBASE-LR is measured as described in 121.8.5.3 with the exception that the reference equalizer is as specified in 139.7.5.4."
To:
"TDECQ for 50GBASE-FR and 50GBASE-LR is measured as described in 121.8.5.3 with the following exceptions:
- The reference equalizer is as specified in 139.7.5.4
- Pth1, Pth2, and Pth3 are varied by up to 2% of OMA_outer."

An updated presentation of chang_021418_3cd_adhoc-v2 will be submitted for the March meeting to address additional issues raised at ad hoc with the summary of the proposal, supporting measurement data, and suggested changes in details.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See response to comment r01-102.

Cl **139** *SC* **139.7.5.4** *P* **300** *L* **47** # r01-75

Dawe, Piers J G Mellanox Technologie

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

139.7.5.4

SuggestedRemedy

139.7.5.3.1 (twice)

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Unclear comment and suggested remedy.

If the commenter is proposing that "139.7.5.4 TDECQ reference equalizer" be changed to become a subclause of 139.7.5.3 (i.e., becomes "139.7.5.3.1 TDECQ reference equalizer"), then the structure of the subclauses under 139.7.5 "Transmitter and dispersion eye closure for PAM4 (TDECQ)" follows that of the equivalent structures in 121.8.5 and 122.8.5, so making this change here would make this structure different from what has gone before and would not improve the clarity of the document.

Cl **139** *SC* **139.7.5.4** *P* **301** *L* **1** # r01-76

Dawe, Piers J G Mellanox Technologie

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

Further investigation of possible minimally compliant SMF signals and their associated TDECQ FFE settings indicates that 2 pre, 2 post (making the cursor the third tap) is never significantly better than 1 pre, 3 post (making it the second tap), for compliant signals. Further refining the TDECQ search rules will avoid inefficiency both in product receiver design, testing and operation, and in TDECQ testing.

SuggestedRemedy

Change "Tap 1, tap 2, or tap 3, has" to "Tap 1 or tap 2 has". Do the same in 140.7.5.1 because the TDECQ limit is similar. There is a separate comment for MMF because the different TDECQ limit there could lead to a different conclusion.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See response to comment r01-74.

Cl **139** *SC* **139.7.10.2** *P* **299** *L* **54** # r01-100

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 link analysis has shown (see schube_3cd_02_0118) that the composition and ratio of the stressors in the stressed receiver sensitivity test can have a strong impact on link performance. In particular, the same SECQ can generate widely varying BER performance from the same receiver depending on the amount of ISI/bandwidth limitation as a portion of the overall SECQ stress. To address this we propose to clarify the current language describing the stressor ratio to be used to create the stressed Rx sensitivity conformance test input, to avoid understressing the receiver and causing interoperability issues.

SuggestedRemedy

Add the following sentence to the end of section 139.7.10.2: "Note that regardless of calibration method, and regardless of the characteristics of the reference/test transmitter before stressors are added, at least half of the total dB value of stressed eye closure (SECQ) should be from bandwidth limitations / ISI, as outlined in section 139.7.9.1 above."

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Subclause 139.7.10.2 does not exist. This should be 139.7.9.2 starting on page 303 of the draft.

The requirement that "The combination of the low-pass filter and the E/O converter should have a frequency response that results in at least half of the dB value of the stressed eye closure (SECQ) specified in Table 139-7 for 50GBASE-FR and 50GBASE-LR before the sinusoidal and Gaussian noise terms are added, according to the methods specified in 139.7.9.2." is already present in 139.7.9.1, so it is not necessary to repeat the requirement in 139.7.9.2.

[Editor's note: Comment r01-19 deals with a related topic]

Cl **140** *SC* **140.3.2** *P* **315** *L* **46** # r01-77

Dawe, Piers J G — Mellanox Technologie

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

The Skew at SP3 (the output of the PMD), SP4 (the receiver MDI) and at SP5 (PMD service interface, output) have to be the same as at SP2 (PMD service interface, input of the PMD) for 100GBASE-DR, a serial PMD. As the receiver can't do anything about it, the "shall"s for SP4 and SP5 are not appropriate. What we write for a 1-lane PMD and PMA input doesn't affect the multi-lane PMA interfaces and PMDs: the point that is common to diffrent PMDs is SP6, not SP3-5.
D3.0 comment 125.

SuggestedRemedy

Change:
The Skew at SP3 (the transmitter MDI) shall be less than 54 ns. Since the signal at the MDI represents a serial bit stream, there is no Skew Variation at this point.
The Skew at SP4 (the receiver MDI) shall be less than 134 ns. Since the signal at the MDI represents a serial bit stream, there is no Skew Variation at this point.
If the PMD service interface is physically instantiated so that the Skew at SP5 can be measured, then the Skew at SP5 shall be less than 145 ns. Since the signal at the PMD service interface represents a serial bit stream, there is no Skew Variation at this point. to:
The Skew at SP3 (the transmitter MDI) shall also be less than 43 ns. Since the signal at the MDI represents a serial bit stream, there is no Skew Variation at this point.
The Skew at SP4 (the receiver MDI) and SP5 (the output of the PMD at the PMD service interface) is the same as at SP2, and there is no Skew Variation at these points.

Correct Table 80-6, Summary of Skew constraints - add notes to the entries for SP3 SP4 SP4 saying that for 100GBASE-DR, the maximum Skew is as for SP2.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See response to comment r01-59.

Cl **140** *SC* **140.7.5** *P* **323** *L* **8** # r01-104

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.
At Geneva interim, the joint presentation (liu_3cd_01a_0118) to propose the adaption of threshold adjustment in TDECQ measurements was reviewed, and team was asked to provide additional info to show
1) threshold adjustment doesn't result in SRS test source having too high a stress for the receiver, and
2) threshold adjustment significantly improves correlation between TDECQ and measured receiver sensitivity.
To address these two issues, the team has made significant efforts with the preliminary results presented in chang_021418_3cd_adhoc-v2, which showed
1 A maximum of 2% of threshold adjustment is sufficient to improve the TDECQ measurements
2 With threshold adjustment, the correlation between TDECQ and measured receiver sensitivity is improved
3 The impacts on Rx SRS is within 0.1 - 0.2 dB.
In addition, the measurement software has been developed by both Keysight and Tektronix.

SuggestedRemedy

Propose to adopt threshold optimization in TDECQ measurement as described in mazzini_120617_3cd_adhoc-v2, liu_3cd_01a_0118, chang_021418_3cd_adhoc-v2 with the constraints on the allowable adjustment range to be 2% of signal OMAouter.

Add one more exception into '140.7.5 Transmitter and dispersion eye closure for PAM4 (TDECQ).
"Pth1, Pth2, and Pth3 are varied by up to 2% of OMA_outer."

An updated presentation of chang_021418_3cd_adhoc-v2 will be submitted for the March meeting to address additional issues raised at ad hoc with the summary of the proposal, supporting measurement data, and suggested changes in details.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See response to comment r01-102.

Cl **140** *SC* **140.7.5** *P* **323** *L* **23** # r01-98

Tamura, Kohichi — Oclaro

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

Several presentations raised the concern that the existing TDECQ specification is too stringent because acceptable link performance is observed with transmitters that have marginal or failing TDECQ (see way_3bs_01a_0717, tamura_3bs_01a_0917, baveja_3cd_01_1117). This creates the risk that transmitter yields will be needlessly impacted, which will increase cost. Allowing a small amount of optimization to the threshold levels Pth1, Pth2, and Pth3 (defined by equations (121-1), (121-2), and (121-3) in 121.8.5.3) will make TDECQ easier to pass, reducing the risk of low transmitter yield (see mazzini_120617_3cd_adhoc-v2, liu_3cd_01a_0118, and chang_021418_3cd_adhoc-v2). As long as the amount of variation is much smaller than the threshold optimization performed by real receivers, the existing receiver specifications will not be affected.

SuggestedRemedy

Add the following exception:

"Pth1, Pth2, and Pth3 are varied by up to 2% of OMA_outer."

Justification will be given in an updated version of chang_021418_3cd_adhoc-v2 at the March plenary meeting in Chicago.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See response to comment r01-102.

Cl **140** *SC* **140.7.5.1** *P* **323** *L* **29** # r01-78

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, as recognised by the new cursor position rule. Getting to a single cursor tap position will improve TDECQ consistency by avoiding an alternative "local minimum". A 100 Gb/s/lane SMF signal that needs the equalizer will be 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. But maybe not so extremely lopsided that the a fourth postcursor would be more use than a single precursor.

SuggestedRemedy

Unless we have evidence to the contrary, change "Tap 1, tap 2, or tap 3, has" to "Tap 2 or tap 3 has".
Consider the evidence and if appropriate, do the same in 139.7.5.4.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See response to comment r01-74.

Cl **140** *SC* **140.7.10** *P* **320** *L* **15** # r01-101

Liu, Hai-Feng — Intel Corporation

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

PAM4 link analysis has shown (see schube_3cd_02_0118) that the composition and ratio of the stressors in the stressed receiver sensitivity test can have a strong impact on link performance. In particular, the same SECQ can generate widely varying BER performance from the same receiver depending on the amount of ISI/bandwidth limitation as a portion of the overall SECQ stress. To address this we propose to clarify the current language describing the stressor ratio to be used to create the stressed Rx sensitivity conformance test input, to avoid understressing the receiver and causing interoperability issues.

SuggestedRemedy

Add the following sentence to the end of section 140.7.10: "Note that regardless of calibration method, and regardless of the characteristics of the reference/test transmitter before stressors are added, at least half of the total dB value of stressed eye closure (SECQ) should be from bandwidth limitations / ISI."

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See response to comment r01-100.