Cl **030** *SC* **30.5.1.1.15** *P* **44** *L* **34** # r02-10

Dudek, Michael — Cavium

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

The FEC sublayer of clause 134 is never optional

SuggestedRemedy

Delete the word "optional".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

The purpose of the aFECAbility object is to indicate FEC ability in PHYs where FEC implementation is optional.

For 50G PHYs implementation of FEC is mandatory. Therefore aFECAbility is not ever relevant to Clause 134 and no amendment to 30.5.1.1.15 is required.

Delete the text amending subclause 30.5.1.1.15 from the 802.3cd draft.

Cl **093A** *SC* **93A.5.2** *P* **336** *L* **41** # r02-19

Mellitz, Richard — Samtec, Inc.

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

The last term in G_rr, eq. 93A-61, was implied to be 1 in slide 11 of http://www.ieee802.org/3/cd/public/Nov17/mellitz_3cd_01b_1117.pdf. As result Reff (eq. 93A-60) discontinuities corresponds to COM and ERL discontinuities in the correlation on slides 17 and 21 which are associated with a DFE.

The purpose of Grr is to include the effect of the re-reflections caused by DFE cursors but outside the DFE reach. The receiver removes the direct effect of the DFE cursors. However, the reflection waves from these are not actually removed in the channel. The effect can be more dominate than expected as shown in the pulse response waveforms on slide 15 and 16 of http://www.ieee802.org/3/cd/public/Nov17/mellitz_3cd_01b_1117.pdf.

Consider that the last term of Grr eq. 93A-61 in D3.2 is not 1, but rho_x*(1+rho_x), which removes apparent discontinuities in Reff due to re-reflection of DFE cursors outside the DFE reach.

Also It was shown in http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_022118_3cd_adhoc.pdf slide 5 that as specified in D3,2 rho_x is nothing more than a complicated scaling factor not tied to re-reflection at the test point interface. Tying back to re-reflection at the test point is accomplished by making the last term of Grr 1. This had been discussed without objection in the ad hoc meetings.

SuggestedRemedy

Change the last term of Grr in equation 93A-61 from rho_x*(1+rho_x) to 1.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

A presentation was made at the ad hoc meetings justifying the change.

Changing this parameter affects a number of specified parameters that need to be reassessed, which is not addressed in the suggested remedy.

For task force discussion.

Cl **135** *SC* **135.5.5** *P* **178** *L* **30** # r02-1

Anslow, Peter — Ciena Corporation

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

Comment r01-33 against the revision project D3.1 has slightly re-worded the note added to 120.5.5. See:
http://www.ieee802.org/3/cj/comments/P8023-D3p1-Comments-Final-byID-r1.pdf#page=12

As the same note is being added to 135.5.5 it would be a good idea to use the same wording here as in the revision.

SuggestedRemedy

Change
"where the output signaling rate is higher than the input signaling rate," to:
"where the signaling rate on each output lane is higher than the signaling rate on each input lane,"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135** *SC* **135.5.5** *P* **178** *L* **31** # r02-33

Dawe, Piers J G — Mellanox Technologie

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

The wording here and in 120.5.5 are slightly different. The 120.5.5 version came later and was preferred by the 802.3cj meeting.

SuggestedRemedy

Change
Note--For a PMA where the output signaling rate is higher than the input signaling rate, any low-frequency jitter on the input lanes may result in more jitter relative to the UI on the output lanes.
to
NOTE--For a PMA where the signaling rate on each output lane is higher than the signaling rate on each input lane, any low frequency jitter on the input lanes may result in more jitter relative to the UI on the output lanes.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135G** *SC* **135G.1** *P* **379** *L* **4** # r02-13

Dudek, Michael — Cavium

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

OIF defined CEI-56G-VSR in OIF-CEI-4.0 not OIF-CEI-3.2 and the reference has become B56 in 802.3cj

SuggestedRemedy

Change OIF-CEI-3.2[B55] to OIF-CEI-4.0 [B56]

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135G** *SC* **135G.3.1** *P* **379** *L* **21** # r02-6

Anslow, Peter — Ciena Corporation

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

Comment r01-31 against the revision project D3.1 has changed the specifications in Annex 120E to include a VEC requirement. See:
http://www.ieee802.org/3/cj/comments/P8023-D3p1-Comments-Final-byID-r1.pdf#page=11
http://www.ieee802.org/3/maint/public/anslow_2_0318.pdf

As 135G.3.1 references 120E.3.1, which now includes a requirement for the vertical eye closure to be less than 12 dB, there is no longer any need to repeat this requirement in 135G.3.1.
Similarly, as 135G.3.4 references 120E.3.4, which now includes a requirement for the input vertical eye closure in the module stressed input test to be less than 12 dB, there is no longer any need to repeat this requirement in 135G.3.4.
The vertical eye closure definition in 135G.4.1 is also now not needed as it has been added to Annex 120E as 120E.4.3.
In 135G.5.4.4, PICS item RM1 contains: ", with the exception that input vertical eye closure is less than 12 dB for stressed input test", which is no longer needed.

SuggestedRemedy

In 135G.3.1, delete "and vertical eye closure, determined according to 135G.4.1, shall be less than 12 dB".
In 135G.3.4, delete ", 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".
Delete the whole of 135G.4.1.
In 135G.5.4.4, item RM1, delete ", with the exception that input vertical eye closure is less than 12 dB for stressed input test".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **135G** *SC* **135G.3.1** *P* **379** *L* **22** # r02-12

Dudek, Michael — Cavium

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

802.3cj has added the VEC specification to 120E

SuggestedRemedy

Delete "and vertical eye closure, determined according to 135G.4.1, shall be less than 12 dB". Also delete section 135G.4.1

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve using the response to comment r02-6.

Cl **136** *SC* **136.9.3** *P* **221** *L* **49** # r02-32

Rysin, Alexander — Mellanox Technologie

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

Current TX ERL specification requires measuring both return loss and the transmitted waveform, which can be inconvenient, while the added value is questionable. Since re-reflections from the transmitter have a similar effect on the system performance as re-reflections from the receiver, there is no reason for discrepancy in the ERL specification. See mellitz_3cd_01_042518_adhoc.pdf, option 5

SuggestedRemedy

* Change TX ERL limit in Table 136-11 to 12 dB.
* Remove Equation 136-6 and the reference to it.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

For task force discussion.

Cl **136** *SC* **136.9.3** *P* **221** *L* **49** # r02-20

Mellitz, Richard — Samtec, Inc.

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

The analysis performed in http://www.ieee802.org/3/cd/public/Jan18/dudek_3cd_01_0118.pdf was predicated on the last term of Grr set to rho_x*(1+rho_x) and not 1.

Subsequent analysis in http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_041818_3cd_adhoc.pdf shows equation 136-3 would be different. Further investigation of false pass and false fail analysis in same and further work in http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_3cd_01_042518_adhoc.pdf suggests either 1- 40*log10(Pmax/Vf) or 3- 40*log10(Pmax/Vf) be complementary to the dudek_3cd_01_0118 work.

After discussion at the May 25 2018 IEEE 802.3 50 Gb/s, 100 Gb/s, and 200 Gb/s Ethernet Task Force Ad Hoc there seems to be good support for just having a single value for ERLmin of 12 dB for Tx and Rx hosts as suggested in the mellitz_041818_3cd_adhoc which balances false passes/fails.

Presentation to review will be provided at the interim.

SuggestedRemedy

Change line 48 in Table 136-11 for the host transmitter specifications, Effective return loss (A3ERL) (min.) , to 12 dB.
Replace line 19-20 on page 226 with:
The ERL at TP2 shall be greater than 12 dB.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolution of this comment is dependent on the resolution to comment r02-19.

For task force discussion.

Cl **136** *SC* **136.9.3.1.4** *P* **225** *L* **12** # r02-28

Ran, Adee — Intel Corporation

Comment Type **TR** *Comment Status* **D** *Tx Eq*

This subclause specifies the effect of a change request to a specific coefficient.

Based on precedence in Clause 72 training and equalizer specification, designers or adaptation algorithms can assume that a single coefficient (coef_sel) is changed, while all other coefficients are not changed.

(Table 72-7 does not explicitly specify the coefficient changes - it specifies changes in terms of square-wave measurements, but the "requirements" column and the paragraph following the table together result in a strict limitation of the allowed change in other coefficients - it is less than the minimum allowed step size).

However, the text in 136.9.3.1.4 does not state anything about other coefficients (the coefficients that are not selected and therefore are not explicitly under "hold"), creating a potential loophole.

While a straightforward implementation will probably not exploit this, the concern is that without any restrictions, the transmitter can behave in very unexpected ways that would not make it non-compliant. This may cause interoperability problems that would put the blame on the receiver.

The proposed change aligns the expected behavior with clause 72 implementations - if a single FFE tap is changed then other taps do not change (any change is limited by the allowed resolution).

SuggestedRemedy

Insert the following new paragraph after the second paragraph:

"The coefficients other than c(coef_sel) are not expected to change. The absolute change in any coefficient other than c(coef_sel) shall not exceed 0.005."

Update the PICS accordingly.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Subclause 136.8.11.4.3 is clear that the change is intended for a "individual equalizer coefficient".
"136.8.11.4.3 Coefficient update request process
A request to change an individual equalizer coefficient of the link partner's transmitter is made by using the following procedure:"

Also, the definition of the "CHECK_EQ is clear that will making a change to one coefficient "while keeping all other coefficients unchanged".
CHECK_EQ(ck_ask,k)
Compares the transmitter's steady-state voltage that would result from setting transmit equalization coefficient c(k) value to ck_ask, while keeping all other coefficients unchanged, against the transmitter's steady-state voltage (see 136.9.3.1.2) and equalization capability. Returns true if the resulting combination of coefficients would exceed the maximum steady-state voltage
or the transmitter's equalization capability. Otherwise returns false.

It is clear that functionally a request to change one coefficient shall not result in another coefficient being changed.

However, this does not constrain a change to a equalizer coefficient from affecting the other derived coefficients (e.g., caused by non-linearity, inadequate bandwidth, tap coupling, etc.).

For task force discussion.

Cl **136** *SC* **136.9.3.4** *P* **226** *L* **16** # r02-2

Anslow, Peter — Ciena Corporation

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

In Table 136-13, "Length of the reflection signal" has units of "--", but specifying a length without units does not make sense.
Table 93A-4, which lists the ERL parameters, however, has units for "Length of the reflection signal" of "UI".

Same issue for Tables 136-17, 137-5, 137-7.

SuggestedRemedy

In Tables 136-13, 136-17, 137-5, and 137-7 , for the "Length of the reflection signal" row, change the units from "--" to "UI".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136** *SC* **136.9.3.4** *P* **226** *L* **32** # r02-3

Anslow, Peter — Ciena Corporation

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

As set out in comment i-12 against P802.3cd D3.0:
The vote in Sponsor ballot is essentially a response to the question "Do you support sending this draft to RevCom?".
The draft contains six editor's notes:
Subclause 136.9.3.4 "Editor's note: Values in Equation (136-6) need confirmation."
Subclause 136.9.4.5 "Editor's note: the minimum value of ERL requires confirmation."
Subclause 136.11.4 "Editor's note: The value of ERL is to be confirmed."
Subclause 137.9.2.1 "Editor's note: the minimum value of ERL requires confirmation."
Subclause 137.9.3.1 "Editor's note: the minimum value of ERL requires confirmation."
Subclause 137.10.2 "Editor's note: the value of px and the minimum value of ERL require confirmation."
While any of these editor's notes remain, I do not support sending the draft to RevCom since they would not be likely to recommend approval of the draft.

SuggestedRemedy

Do whatever work is necessary to provide the required confirmation and remove these six editor's notes.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Pending resolution of other comments, the editor's notes are expected to be removed.

Cl **136** *SC* **136.9.4** *P* **226** *L* **13** # r02-21

Mellitz, Richard — Samtec, Inc.

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

In http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_3cd_032118_adhoc-v2.pdf changes to Grr were suggest and new more meaningful values of beta_x and rho_x are required. This is a cross-clause comment with clause 137. See proposed changes.

Values for these were presented in http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_040418_3cd_adhoc-v2.pdf and subsequent meetings.

Presentation to review will be provided at the interim.

SuggestedRemedy

In table 136-13 page 226 change beta x to 1.7 and rho_x to 0.3
In table 136-15 page 232 change beta x tp 1.7 and rho_x to 0.25
In table 137-5 page 249 change beta x to1.7 and rho_x to 0.32
In table 137-7 page 253 change beta x to1.7 and rho_x to 0.18

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Pending presentation and task force discussion.

Cl **136** *SC* **136.9.4** *P* **227** *L* **12** # r02-22

Mellitz, Richard — Samtec, Inc.

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

Changes to Grr, beta_x, and rho_x suggest a different limits for Rx Host ERL is required.

Data supporting a value for ERL (min) was presented in http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_041818_3cd_adhoc.pdf

Presentation to review will be provided at the interim.

SuggestedRemedy

In line 12 of table 136-14 change ERL (min.) to 12 dB
Change line 31 to:
Receiver ERL at TP3 shall be greater than or equal to 12 dB

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Pending presentation and task force discussion.

Cl **136** *SC* **136.9.4.1** *P* **227** *L* **12** # r02-31

Rysin, Alexander — Mellanox Technologie

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

RX ERL limit of 14.5 dB is too tight and causes a significant ratio of false failing systems. See mellitz_040418_3cd_adhoc-v2.pdf.

SuggestedRemedy

Change RX ERL limit to 12 dB.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolved with comment r02-22.

Cl **136** *SC* **136.9.4.2.4** *P* **229** *L* **11** # r02-29

Ran, Adee — Intel Corporation

Comment Type **TR** *Comment Status* **D** *ERL, RITT*

The pattern generator used in the receiver test is required to be compliant with output waveform requirements in 136.6.3. SNR_ISI was part of the output waveform requirements, but it is now removed and replaced with ERL.

ERL is not measured using the output waveform, so the pattern generator has no ERL requirements.

This enables pattern generators with very bad impedance matching that, when connected to a reflective channel, cause ISI beyond the receiver's expected tolerance, and thus over-stress the receiver.

The parallel specification in clause 137 uses the method of Annex 93C, where 93C.1 states: "The transmitter is functionally and parametrically compliant to the requirements of the invoking PMD clause". Since the transmitter in Clause 137 has an ERL specification, reflection ISI stress is limited.

SuggestedRemedy

Change
"The output waveform of the pattern generator shall comply with 136.9.3"
to:
"The output waveform and the ERL of the pattern generator shall comply with 136.9.3".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

For task force discussion.

Cl **136** *SC* **136.11** *P* **231** *L* **36** # r02-23

Mellitz, Richard — Samtec, Inc.

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

It does not seem reasonable that cable assemblies with good COM margin be subject to ERL specifications.

SuggestedRemedy

In Table 136-16 page 231 add a note: Cable assemblies with a COM greater than 4 dB are not required to meet minimum ERL.
Change line 28 on page 232 to Cable assembly ERL at TP1 and at TP4 shall be greater than or equal to 11 dB for cable assemblies that have a COM less than 4 dB.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The commenter has not provided sufficient justification supporting the suggested remedy.

For committee discussion.

Cl **136** *SC* **136.11.3** *P* **232** *L* **3** # r02-59

Tracy, Nathan

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

This clause retains return loss in addition to ERL although it makes RL informative. User's will effectively require full compliance to RL and ERL, adding unnecessary cost.

SuggestedRemedy

Delete Clause 136.11.3 in it's entirety.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Resolve with comment r02-24.

Cl **136** *SC* **136.11.3** *P* **232** *L* **3** # r02-24

Mellitz, Richard Samtec, Inc.

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

It does not make sense to have 2 specifications for the same phenomena. A recommended specification can develop into an industry burden.

SuggestedRemedy

remove clause 136.11.3

Proposed Response *Response Status* **W**

PROPOSED REJECT.

A straw poll taken at the last meeting did not support removal 136.11.3. The straw poll and summary as captured in http://www.ieee802.org/3/cd/public/Mar18/dudek_3cd_02_0318.pdf is repeated here for information.

"2. Remove / make informative / keep RL specifications for Cable Assembly.
Straw Poll. ET-1. I support the following (Chicago rules).
A ERL normative no RL spec
B ERL normative RL informative
C ERL normative RL normative
D ERL informative RL normative (Draft 3.1)
E ERL deleted. RL normative. (Draft 3.0).
A 15 B 21 C 0 D 8 E 0
Add an editor's note that the need for retaining the informative RL specification is under review.
Straw poll Have editor's note Yes 9 No 10
Based on this straw poll and the straw poll ET-1 Consensus is that ERL is to be normative and differential RL informative with no editor's note. Common mode RL remains normative."

For committee discussion.

Cl **136** *SC* **136.11.4** *P* **232** *L* **12** # r02-60

Tracy, Nathan

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

provide additional detail

SuggestedRemedy

Clarify ...the cable assembly test fixture being used. ..... by adding a reference to the test fixture loacation: ....the cable assembly test fixture being used (110.B.1.2 according to annex 136B.1).

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Add a reference to the test fixture used.

Change the sentence to:
"The value of Tfx is twice the delay associated with the cable assembly test fixture being used (136B.1)."

Cl **136** *SC* **136.11.4** *P* **232** *L* **28** # r02-15

Dudek, Michael Cavium

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

None of the cables that have been posted have ERL's as bad as 11dB and a presentation will be made that shows that a cable channel with an ERL as bad as 11dB would cause system problems.

SuggestedRemedy

Change the requirement for ERL of the cables to be 14dB. Also in table 136-16 and PICS CA4

Proposed Response *Response Status* **W**

PROPOSED REJECT.

For committee review of cited presentation.

Cl **136** *SC* **136.11.8** *P* **233** *L* **7** # r02-30

Ran, Adee — Intel Corporation

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

The COM parameters for clause 136 correspond to very well-matched channel terminations. The device single-ended termination resistance is 50 Ohm, the package model characteristic impedance is 95 Ohm, and the host board impedance (136.11.8.1) is 100 Ohm.

This creates a smooth channel with no reflections outside of the cable, except for the package capacitors (which are within the DFE reach).

In reality things will not be so nice. Actual devices and NICs will have reflections outside of the DFE reach (limited by ERL, not not zero). These reflections are not accounted for in the COM budget - leaving a deficit.

The effect of far-end reflections is not accounted for in the receiver interference tolerance test COM calibration. So receivers may perform well in the test but fail in real life scenarios.

I am planning a presentation with more details of the problem and proposed solutions.

SuggestedRemedy

Upcoming presentation.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

For committee review of cited presentation.

Cl **136** *SC* **136.11.8** *P* **234** *L* **15** # r02-4

Anslow, Peter — Ciena Corporation

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

In Table 136-18, "Decision feedback equalizer (DFE) length" has units of "--", but specifying a length without units does not make sense.
Table 93A-1, which lists the COM parameters, however, has units for "Decision feedback equalizer (DFE) length" of "UI".

Same issue for Table 137-6.

SuggestedRemedy

In Tables 136-18 and 137-6 , for the "Decision feedback equalizer (DFE) length" row, change the units from "--" to "UI".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136** *SC* **136.14.4.5** *P* **241** *L* **44** # r02-5

Anslow, Peter — Ciena Corporation

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

PICS item CA4 for ERL has a Subclause entry of "136.11.5", which is "Differential to common-mode return loss". This should be "136.11.4".

SuggestedRemedy

Change the Subclause entry for PICS item CA4 from "136.11.5" to "136.11.4"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **136A** *SC* **136A.6** *P* **387** *L* **39** # r02-14

Dudek, Michael — Cavium

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

The intent is that the cable system uses the same ASIC's and budget as the 50G backplane. It would be better to reference the backplane specification for 50GPAM4 rather than the backplane for 25G NRZ

SuggestedRemedy

Change the section title to "Channel effective return loss" and change "The recommended return loss for 50GBASE-CR, 100GBASE-CR2 and 200GBASE-CR4 channels is specified in Equation (92-27)." to "The 50GBASE-CR, 100GBASE-CR2 and 200GBASE-CR4 channels are recommended to meet the effective return loss requirements in 137.10.2."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Change the section title to "Channel effective return loss"

Change the sentence to:
"The 50GBASE-CR, 100GBASE-CR2 and 200GBASE-CR4 channels are recommended to meet the effective return loss specified in 137.10.2."

Cl **137** *SC* **137.9.2** *P* **249** *L* **30** # r02-34

Dawe, Piers J G — Mellanox Technologie

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

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. The response to D3.1 comment 64 says "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)" but I suspect this assumption is not near enough to the reality to be relied on, at least for sigma_e. SNDR should be measured in something less than ~19 GHz, representing the combined bandwith of Tx, Tx FFE, channel and Rx front end.
D3.0 comment 138, D3.1 comment 64.

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."
Or, ", when sigma_e is found from...", in which case there is no a specific new filter, it's just a matter of processing the waveform captured in 33 GHz.
Also in 136.9.3.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The comment is essentially a resubmit of comments on two previous drafts that were rejected - i-138 and r01-64.

Although the comment text disagrees with the rebuttal of the previous comments, there is still no new information that would justify accepting this comment now.

The commenter is welcome to provide data to support the claims in the comment and demonstrate the effects of the suggested change on transmitter compliance and on link performance.

Cl **137** *SC* **137.9.2.1** *P* **250** *L* **1** # r02-35

Dawe, Piers J G — Mellanox Technologie

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

The draft limit for transmitter ERL at TP0a (now greater than 16.1 dB) is still too high. It should be lower than the channel ERL.

SuggestedRemedy

Reduce it to lower than the channel spec.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with r02-25.

Cl **137** *SC* **137.9.2.1** *P* **250** *L* **1** # r02-25

Mellitz, Richard — Samtec, Inc.

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

Changes to Grr, beta_x, and rho_x suggest a different limit for ERL is required. Changes to Grr, beta_x, and rho_x suggest a different limit for ERL is required for transmitter and receiver (line 32, page 250)

ERL limit data was provided in
http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_3cd_01_042518_adhoc.pdf

Presentation to review will be provided at the interim.

SuggestedRemedy

change line 1 page 250 to: Transmitter ERL at TP0a shall be greater than or equal to 15 dB
change line 32 page 250 to: Receiver ERL at TP5a shall be greater than or equal to 15 dB

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Pending presentation and task force discussion.

Cl **137** *SC* **137.9.2.1** *P* **250** *L* **3** # r02-16

Dudek, Michael — Cavium

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

The ERL of the transmitter should be retained to limit double reflections.

SuggestedRemedy

Delete the editors note on this line

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **137** *SC* **137.9.3.1** *P* **250** *L* **32** # r02-36

Dawe, Piers J G — Mellanox Technologie

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

The draft limit for receiver ERL at TP5a (now greater than 16.1 dB) is still too high. It should be lower than the transmitter ERL because the receiver suffers the consequences of its own bad ERL in the RITT, and therefore, lower than the channel ERL - so we barely need a spec at all.

SuggestedRemedy

Reduce it to lower than the transmitter and channel specs.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with r02-25.

Cl **137** *SC* **137.9.3.1** *P* **250** *L* **35** # r02-17

Dudek, Michael — Cavium

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

The ERL of the receiver should be retained to limit double reflections.

SuggestedRemedy

Delete the editors note on this line

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **137** *SC* **137.10.1** *P* **252** *L* **19** # r02-37

Dawe, Piers J G — Mellanox Technologie

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

Channel Insertion loss

SuggestedRemedy

Channel insertion loss

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **137** *SC* **137.10.2** *P* **253** *L* **17** # r02-26

Mellitz, Richard — Samtec, Inc.

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

In http://www.ieee802.org/3/cd/public/adhoc/archive/mellitz_041818_3cd_adhoc.pdf it was shown that for backplane channels, N=300 does not provide enough time to represent a TDR waveform of a backplane channel. Data supporting N=1000 was shown.

SuggestedRemedy

In Table 137-7 on page 253 change N to 1000

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Cl **137** *SC* **137.10.2** *P* **253** *L* **17** # r02-11

Dudek, Michael — Cavium

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

Cabled backplanes may be used increasing the backplane delay

SuggestedRemedy

Increase N from 300 to 1000

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve with r02-26.

Cl **137** *SC* **137.10.2** *P* **253** *L* **20** # r02-61

Tracy, Nathan

Comment Type **T** *Comment Status* **D** *ERL (channel)*

The ERL limit of 10dB may allow usage of 10Gbps era channel components. Further investigation is on-going and if the concern is validated, a presentation will be provided by the time of the face to face meeting.

SuggestedRemedy

Increase the ERL limit for backplane channels

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The suggested remedy does not include specific details for implementation.

Pending presentation if provided and task force discussion.

Cl **137** *SC* **137.10.2** *P* **253** *L* **20** # r02-38

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D** *ERL (channel)*

The draft limit for channel ERL (now greater than 10 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.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

[Editor's note: subclause changed from origianl 137.10.3 to 137.20.2]

The sugggested remedy does not include specific details for implementation.

Resolve with r02-61.

Cl **138** *SC* **138** *P* **260** *L* **1** # r02-39

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, D3.1 comment 69. king_3cd_02_0118 indicates a lower TDECQ limit, chang_021418_3cd_adhoc-v2 has no results from VCSELs (or any DML).

SuggestedRemedy

The alternatives are:
Do the work, by showing technical feasibility for the draft spec (after improvements), not just the concept; or
Withdraw the clause; or
Move it to the NGMMF project; or
Delay this project until the work gets done.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

No specific change to the draft proposed.

This is a duplicate of comment r01-69 against draft 3.1.

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* **270** *L* **20** # r02-27

King, Jonathan — Finisar Corporation

Comment Type **TR** *Comment Status* **D** *tdecq slow*

Several comments against earlier drafts have shown concern that TDECQ and SECQ alone do not sufficiently constrain transmitter characteristics. Egregiously slow transmitters and very noisy transmitters should be excluded.

SuggestedRemedy

A proposed remedy is described in presentation king_3cd_01_0518: add a transmitter rise fall time spec to Table 138-8, and add a sentence in 138.8.8 to indicate that the SRS test source does not exceed the transmitter RIN_OMA spec in Table 138-8.

Make similar changes to clauses 139 and 140

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

For Task Force review. TF needs to see and evaluate specific proposed changes to the draft.

Cl **138** *SC* **138.7.1** *P* **270** *L* **22** # r02-41

Dawe, Piers J G — Mellanox Technologie

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

I suppose we should use the same description for TDECQ as in clauses 121, 122, 124.

SuggestedRemedy

Insert "for PAM4". Make the left column wider and the others narrower.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Use TDECQ parameter nomenclature consistent with 121, 122, 124, 139 and 140

Cl **138** *SC* **138.7.1** *P* **270** *L* **22** # r02-40

Dawe, Piers J G — Mellanox Technologie

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

A TDECQ limit of 4.9 dB still has not been justified, 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. king_3cd_02_0118 showed 1 to 2.5 with representative drive. The high limit in the draft would require a better equalizer (e.g. more precise tap settings) than needed for the MMF PMDs. D.30 comment 119, D3.1 comment 70.

SuggestedRemedy

Consider what actual PAM4 MMF transmitters do, and compare a minimally compliant 100GBASE-SR4 transmitter, and set the TDECQ limit accordingly, e.g. 3.8 dB.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See also response to comment r01-70 to D3.1
No specific changes to the draft proposed.

Cl **138** *SC* **138.7.1** *P* **270** *L* **30** # r02-42

Dawe, Piers J G — Mellanox Technologie

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

Traditionally, the OMA floor is set for a signal 1 dB worse than ideal. TDECQ for an ideal signal is less than 0.9 dB.

SuggestedRemedy

Change "Even if the TDECQ < 1.9 dB" to e.g. "Even if the TDECQ < 1.5 dB". Adjust Outer Optical Modulation Amplitude (OMAouter), each lane (min) and Average launch power, each lane (min) and Average receive power, each lane (min) by the same amount. Adjust the constant part of the equation and figure for receiver sensitivity to remain consistent.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

For task force discussion.

The value of 0.9 dB for the TDECQ of an ideal source was suported by calculation and experiments, shown in slides 24 to 25 of
http://www.ieee802.org/3/cd/public/July17/king_3cd_01a_0717.pdf
However, 802.3cd clauses 139 and 140 have set the OMA minimum to be offset by 1.4 dB above the value allowed by the Tx_OMA minus TDECQ spec for TDECQ = 0 dB.

There may be merit in making all clauses have the same value.

Cl **138** *SC* **138.7.2** *P* **271** *L* **23** # r02-43

Dawe, Piers J G — Mellanox Technologie

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

Table note d "Receiver sensitivity is informative and is defined for a transmitter with a value of SECQ up to 4.9 dB." duplicates text in 138.8.7.

SuggestedRemedy

Delete note d. Similarly in clauses 139 and 140.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Repeating the text in a note immediately under the table is helpful to the reader.

Removing the note would not improve the draft.

Cl **138** *SC* **138.8.1** *P* **272** *L* **39** # r02-44

Dawe, Piers J G — Mellanox Technologie

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

The second receiver sensitivity is missing from this table, and I did not see where the pattern(s) for this is/are specified.

SuggestedRemedy

Add a row for the second (presently "informative") receiver sensitivity. Same patterns as for stressed receiver sensitivity (3, 5, or valid 50GBASE-SR, 100GBASE-SR2, or 200GBASE-SR4 signal). Refer back to the table from 138.8.7. Similarly in clauses 139 and 140.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The receiver sensitivity is "informative" so test patterns are not necessary. Consistent with in-force Clause 121, 122, 123 and 124

Cl **138** *SC* **138.8.5** *P* **273** *L* **34** # r02-45

Dawe, Piers J G — Mellanox Technologie

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

The adjustable thresholds need more work.

SuggestedRemedy

If kept: reduce TDECQ limits according to the change in apparent TDECQ caused by adjustable thresholds, for a signal with no deliberate differences between the three eyes (clauses 138, 139, 140).
If not kept: allow the sum of the taps to deviate from 1, with limits +/-3% to be equivalent.
Also, instead of "the normalized frequency response Heq(f)" (in 121.8.5.3), use "the frequency response Heq(f)", for which Heq(f = 0) = 1 does not apply.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

See response to comment r02-9

Cl **138** *SC* **138.8.5** *P* **273** *L* **35** # r02-46

Dawe, Piers J G — Mellanox Technologie

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

In this draft, it is possible to make a bad MMF transmitter with emphasis (e.g. with a noisy or distorted signal) that even an equalizer better than the reference equalizer won't be able to improve. Note the receiver is tested for a slow signal only, not for such signals. This issue is worse for MMF because of the high TDECQ limit.
On the TDECQ map (see e.g. dawe_041818_3cd_adhoc-v2) we need to stop signals that are too high up the page.
D3.0 comment 116, D3.1 comment 71.

SuggestedRemedy

For a MMF TDECQ limit of 3.8 dB: Either:
1. Limit TDECQ -10*log10(Ceq) to <=4.2 dB for SMF PMDs.
or:
2. Define TDECQrms = 10*log10(A_RMS/(s*3*Qt*R)) where A_RMS is the standard deviation of the measured signal after the 13.28125 GHz filter response (before the FFE), Qt and R are as already in Eq 121-12. s is the standard deviation of a fast clean signal with OMA=2 and without emphasis, observed through the reference Bessel-Thomson filter response but before the reference equalizer (0.6006 for 11.2 GHz).
Limit 3.4 dB for MMF PMDs. This could be added to the transmitter tables.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

See comment response to r02-27 (rise and fall time) and r02-9 (on lowering TDECQ limit).

Cl **138** *SC* **138.8.5.1** *P* **273** *L* **41** # r02-47

Dawe, Piers J G — Mellanox Technologie

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

In this draft, 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 a lot of emphasis from the signal, contrary to what equalizers are primarily intended to do ("gaming the spec": D3.1 comment 70). Note the receiver is tested for medium to slow signals 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. On the TDECQ map (see e.g. dawe_041818_3cd_adhoc-v2) we need to stop signals that are too far to the left, which would be outside the range of what a typical equlaizer would be designed to cope with (e.g. would need strong tap weights of the opposite sign to normal) and provide no practical benefit in a system. At present there is no boundary on the left.
D3.0 comment 116, D3.1 comments 70, 71.

SuggestedRemedy

To protect the receiver from having to "invert" heavily over-emphasised signals, change "largest magnitude tap coefficient" to "largest magnitude tap coefficient, which is constrained to be at least 0.95."
Similarly in clauses 139, 140.
It may make sense to have a higher limit (1 to 1.1) for MMF because the transmitter is not tested without the filter emulating a low-pass fibre.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

For task force discussion.

Cl **138** *SC* **138.8.5.1** *P* **273** *L* **41** # r02-48

Dawe, Piers J G — Mellanox Technologie

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

For some equalizer architectures, precursors are much more expensive than post-cursors (sun_3cd_042518_adhoc).
D3.1 comment 73.

SuggestedRemedy

When we have decided what range of MMF signals are useful and allowed, continue the improvement made in king_3cd_03_0118: 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 also resolution to comment R02-47.

Cl **138** *SC* **138.8.7** *P* **274** *L* **23** # r02-49

Dawe, Piers J G — Mellanox Technologie

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

This receiver sensitivity is not as important as stressed receiver sensitivity, and it isn't the traditional unstressed "Receiver sensitivity" as in 52.9.8.

SuggestedRemedy

Swap 138.8.7 and 138.8.8. Similarly in clauses 139 and 140.
It would help if this item had a distinct name.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The ordering is the same as in Clauses 52, 121, 122, 139 and 140, and many other clauses where an informative unstressed receiver sensitivity is described in addition to the stressed receiver sensitivity.

The definition has evolved since clause 52 due to the reference receiver equalization, PAM4 signaling, and it's been extended include the partially stressed receiver sensitivity. Nevertheless, swapping 138.8.7 and 138.8.8 would be a deviation from previous optics clauses and would not improve the draft.

Cl **138** *SC* **138.8.7** *P* **274** *L* **24** # r02-50

Dawe, Piers J G — Mellanox Technologie

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

This receiver sensitivity is important to close the spec: it dissuades or stops receiver that pass the SRS test but don't have good enough sensitivity to receiver weaker, lower-TDECQ compliant signals.

SuggestedRemedy

Change "informative" to "recommended" and "normative" to "mandatory". Similarly in clauses 139 and 140.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The draft is not broken and the used wording is consistent with similar in-force Clauses, e.g. 121, 122, 123 and 124.

Cl **138** *SC* **138.8.7** *P* **275** *L* **19** # r02-51

Dawe, Piers J G — Mellanox Technologie

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

This graph shows SECQ as low as 0 dB. Although this is possible, it is better than an ideal signal, it would take extra effort to generate such a signal (either in test equipment for sensitivity testing or in a product transmitter), and there is no need to test a receiver for it because receiving anywhere on the horizontal line implies receiving at points to the left unless the signal is excessively over-emphasised (too far to the left on the TDECQ map) - which is not addressed in 138.8.7 but is addressed by another comment.

SuggestedRemedy

Remove the portion of the horizontal line from 0 dB to 0.5 dB, or make the start point consistent with the left-side (over-emphasis) TDECQ limit, in each of clauses 138-140.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The draft is not broken. The curve is for information and not a normative specification.

Cl **138** *SC* **138.8.8** *P* **275** *L* **44** # r02-18

Brown, Matthew MACOM

Comment Type **G** *Comment Status* **D**

Comment r01-19 against D3.1 was closed with the following response:

"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, text added by that comment to clause 121 may remove the need for a change to 802.3cd.
Make no change to the draft of 802.3cd."

The response requests no changes to P802.3cd D3.1, but implies that a decision would be made for P802.3cd after R01-20 against P802.3cj was addressed.

This comment has been submitted to ensure closure of r01-19.

SuggestedRemedy

Address the request in comment P802.3cd r01-19 based on the response to P802.3cj r01-20.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The suggested remedy to comment R01-20, submitted against 802.3cj clause 121 was accepted. No change to 802.3cd D3.2 is needed.

Cl **139** *SC* **139.6.1** *P* **292** *L* **43** # r02-9

King, Jonathan Finisar Corporation

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

802.3cd D3.2 introduced optimization of thresholds by up to +/-1% of OMAouter as part of TDECQ measurement method. This increases the sub-eye inequality allowed for a given TDECQ spec limit.
http://www.ieee802.org/3/cd/public/Mar18/king_3cd_01a_0318.pdf
showed TDECQ limits should be reduced by 0.4 dB to avoid increasing the sub-eye inequality allowed (summary on slide 13). This value has been validated experimentally, as reported in
http://www.ieee802.org/3/cd/public/adhoc/archive/mazzini_041118_3cd_adhoc.pdf

SuggestedRemedy

In clauses 139, 140 and 138, reduce TDECQ and SECQ values by 0.4 dB, and other dependent optical specs as described in Mazzini_3cd_01_0518 .

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Subject to review by task force of Mazzini_3cd_01_0518.

Cl **139** *SC* **139.6.1** *P* **293** *L* **9** # r02-58

Liu, Hai-Feng Intel Corporation

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

Simulation and analysis has shown (e.g. schube_3cd_02_0118.pdf, Piers Dawe cd ad hoc presentations e.g. "refiningTdecq7.pdf") that the same TDECQ value with different compositions of stress/impairment (e.g. bandwidth limitation, noise, other eye closure) may result in different link performance, causing potential interoperability issues at the margin. To partially address this we propose reasonable additional Tx limits/specs to avoid "corner case" transmitters that may cause interoperability issues.

SuggestedRemedy

Add maximum rise time specification to Table 139-6 (exact proposed value being worked out at this time)

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

See response to r02-27

Cl **139** *SC* **139.7.5.3** *P* **297** *L* **52** # r02-52

Dawe, Piers J G Mellanox Technologie

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

In this draft, it is possible to make a bad SMF transmitter with emphasis (e.g. with a noisy or distorted signal) that even an equalizer better than the reference equalizer won't be able to improve. Note the receiver is tested for a slow signal only, not for such signals.
On the TDECQ map (see e.g. dawe_041818_3cd_adhoc-v2) we need to stop signals that are too high up the page.
D3.0 comment 116, D3.1 comment 71.

SuggestedRemedy

For a SMF TDECQ limit of 3.2 or 3.4 dB: Either:
1. Limit TDECQ -10*log10(Ceq) to <=2.8 dB for SMF PMDs.
or:
2. Define TDECQrms = 10*log10(A_RMS/(s*3*Qt*R)) where A_RMS is the standard deviation of the measured signal after the 13.28125 GHz filter response (before the FFE), Qt and R are as already in Eq 121-12. s is the standard deviation of a fast clean signal with OMA=2 and without emphasis, observed through the reference Bessel-Thomson filter response but before the reference equalizer (0.6254 for 13.28125 GHz).
Limit 3 dB for SMF PMDs. This could be added to the transmitter tables.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

See response to r02-27.

Cl **139** *SC* **139.7.5.4** *P* **298** *L* **5** # r02-53

Dawe, Piers J G — Mellanox Technologie

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

For some equalizer architectures, precursors are much more expensive than post-cursors (sun_3cd_042518_adhoc). 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. See dawe_3cd_01a_0318. Further refining the TDECQ search rules will avoid inefficiency both in product receiver design, testing and operation, and in TDECQ testing. D3.1 comment 76.

SuggestedRemedy

Continue the improvement made in king_3cd_03_0118: 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 r02-8

Cl **139** *SC* **139.7.5.4** *P* **298** *L* **5** # r02-8

Sun, Junqing — Credo Semiconductor

Comment Type **GR** *Comment Status* **D**

Current spec allows TDECQ reference receiver to have up to two precursors. As explained in sun_3cd_042518_adhoc, this forces receivers to implement multiple precursors and choose power-hungry solutions. As a result, module power will be kept high forever to ensure interoperability with bad transmitters. On the other hand, precursor 2 impact on TDECQ is small and can be compensated by using TX FIR. Allowing no more than 1 precursors also helps to reduce test time.

SuggestedRemedy

Change:
Tap 1, tap 2, or tap 3, has the largest magnitude tap coefficient.
To:
Tap 1 or tap 2 has the largest magnitude tap coefficient.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

During the Jan 2018 task force meeting in Geneva, as result to comment i-107 to D3.0 the number of possible precursor taps was reduced from 4 to 2 on the basis of similar considerations.

Allowing just one pre-cursor in the reference EQ means the transmitted signal, when propagated through a worst case channel, cannot have a significant amount of pre-cursor response at the receiver without suffering higher TDECQ penalty.

An electrical channel typically can guarantee that, however the dispersion effects of the optical channel in combination with chirp may require the extra tap. No evidence has been provided to show otherwise.

Cl **139** *SC* **139.7.5.4** *P* **298** *L* **6** # r02-54

Dawe, Piers J G — Mellanox Technologie

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

The draft transmitter spec allows signals that are slower than the receiver is tested for in SRS, slower than the equivalent SMF PAM2 spec, and I believe slower than were allowed when the draft had a T/2-spaced equalizer. I have seen no evidence that implementers want to make super-slow transmitters. Yet receiving such a signal would place an extra burden on the receive equalizer e.g. better linearity and/or finer AtoD or tap resolution. This is one kind of "abusive signal" mentioned in D3.1 comment 71. See e.g. dawe_041818_3cd_adhoc-v2. The first option more directly protects the receiver and allows more trade-offs in transmitter design; both are free by-products of a TDECQ measurement and are at about 1.7 dB slowness penalty.

SuggestedRemedy

Limit the signals on the right of e.g. dawe_041818_3cd_adhoc-v2. Either:
Set a maximum cursor strength limit,1.4
or:
Set a maximum 20-80% transition time limit as observed after the reference Bessel-Thomson filter response but before the reference equalizer, 28 ps.
For Clause 140, the limits would be 1.5 and 15 ps (allowing relatively slower signals).
For Clause 138, the transmitters would have similar speed to Clause 139, but the signals are observed in a lower bandwidth, so a limit in between 1.4 and 1.5 should be used.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

See response to r02-27

Cl **139** *SC* **139.7.9.1** *P* **299** *L* **50** # r02-55

Dawe, Piers J G — Mellanox Technologie

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

The choice of "at least half of the dB value of the stressed eye closure" is not consistent with the transmitter specs.

SuggestedRemedy

When we have decided what range of signals are useful and allowed (for left-side limit, see other comments), revise this "at least half" to be consistent. Add an "at most" limit consistent with the right-side Tx limit. Also in 138 and 140.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

No specific changes to the draft suggested.

Cl **139** *SC* **139.7.9.2** *P* **300** *L* **53** # r02-56

Dawe, Piers J G — Mellanox Technologie

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

The SRS recipe says that some (see another comment) of the penalty comes from filtering, and some from SJ. There are no rules for the remainder (a mixture of SI and Gaussian noise), which means that a substantial amount of Gaussian noise could be added. This isn't realistic - a bad real transmitter could have bounded noise, patterning and nonlinearity but low to moderate Gaussian noise, as indicated by the RIN spec. The receiver could be over-stressed by one SRS test rig and not by another.

SuggestedRemedy

Set a maximum for the amount of Gaussian noise, based on the relevant RIN spec and reference bandwidth. Clauses 138, 139, 140.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

See response to r02-27

Cl **140** *SC* **140.6.1** *P* **317** *L* **9** # r02-57

Liu, Hai-Feng — Intel Corporation

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

Simulation and analysis has shown (e.g. schube_3cd_02_0118.pdf, Piers Dawe cd ad hoc presentations e.g. "refiningTdecq7.pdf") that the same TDECQ value with different compositions of stress/impairment (e.g. bandwidth limitation, noise, other eye closure) may result in different link performance, causing potential interoperability issues at the margin. To partially address this we propose reasonable additional Tx limits/specs to avoid "corner case" transmitters that may cause interoperability issues.

SuggestedRemedy

Add maximum rise time specification to Table 140-6 (exact proposed value being worked out at this time)

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

See response to r02-27

Cl **140** *SC* **140.7.5.1** *P* **320** *L* **31** # r02-7

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

Current spec allows TDECQ reference receiver to have up to two precursors. As explained in sun_3cd_042518_adhoc, this forces receivers to implement multiple precursors and choose power-hungry solutions. As a result, module power will be kept high forever to ensure interoperability with bad transmitters. On the other hand, precursor 2 impact on TDECQ is small and can be compensated by using TX FIR. Allowing no more than 1 precursors also helps to reduce test time.

SuggestedRemedy

Change:
Tap 1, tap 2, or tap 3, has the largest magnitude tap coefficient.
To:
Tap 1 or tap 2 has the largest magnitude tap coefficient.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

See response to r02-8.