Cl **9** *SC* **9.8** *P* **88** *L* **41** # i-12

Rannow, R K — Self

Comment Type **TR** *Comment Status* **R** *Bucket*

use of "i.e.," in this context appears ambiguous.

SuggestedRemedy

Remove "i.e.," to make a grammatically superior statement that is not potentially confusing.

Response *Response Status* **W**

REJECT.
Clause 9, Subclause 9.8 and Page 88 do not exist in the draft.

Cl **9** *SC* **9.8.2** *P* **89** *L* **38** # i-13

Rannow, R K — Self

Comment Type **GR** *Comment Status* **R** *Bucket*

Two instances of, "defined in that specification ..."

SuggestedRemedy

Perhaps a pointer/reference to "that specification".

Response *Response Status* **W**

REJECT.
Clause 9, Subclause 9.8.2, Page 89 and the text "defined in that specification" do not exist in the draft.

Cl **138** *SC* **138.8.5** *P* **39** *L* **38** # i-26

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R**

The 0.1 dB allocation for both modal noise and mode partition noise should be increased by 0.2 dB. See kolesar_3cm_adhoc_01_042519, dawe_3cm_adhoc_01_101118, castro_3cm_01_1118, pepeljugoski_1_1104 and castro_3cm_01_0119 (which said 0.23 to 0.45 dB for MN). The total penalties should be kept below 4.6 dB, which is unreasonably high already. The adjustment for MN should be done in the same way as for 100GBASE-SR4 with a formula, so as not to penalise good transmitters.
With this remedy, a 400GBASE-SR8 module used in breakout mode as 200GBASE-SR4, 100GBASE-SR2 or 50GBASE-SR is interoperable with and compliant to those specs (but a SR/SR2/SR4 module is not necessarily interoperable with anything, worst case, because of this gap in their specs).
It is better to provide an adequate yet compatible spec for 400GBASE-SR8 than repeat a mistake made in 802.3cd.

SuggestedRemedy

Add an exception in 138.8.5 as follows:
For the calculation of TDECQ (but not SECQ) for 400GBASE-SR8, Equation (138-1) is used in place of Equation (121-11).
R=sqrt(sigmaG^2 + sigmaS^2 - M^2) (138-1)
where M = 0.0065Pave

Response *Response Status* **U**

REJECT.
This comment is similar to comments #39 against D1.0, #4 against D1.1, #1 against D1.2, #6 against D2.0 and #1 against D2.1, which were rejected.
Insufficient evidence has been provided to justify a change.
It is highly desirable to keep the per lane specifications for 400GBASE-SR8 identical to the other PMDs in Clause 138 (50GBASE-SR, 100GBASE-SR2, and 200GBASE-SR4).

Cl **138** *SC* **138.8.5.1** *P* **39** *L* **45** # i-29

Dawe, Piers J G
Mellanox Technologies

Comment Type **TR** *Comment Status* **R**

SMF TDECQ is defined with minimum and maximum dispersion so that the signal after any allowed dispersion is acceptable. MMF TDECQ is defined with maximum dispersion only. We thought that was the worst case but it isn't always.

As explained in D2.0 comment 9, equalizing a signal after an 11.2 GHz BT4 filter with a 5-tap FFE needs at least one precursor unless the signal is carefully pre-distorted. If it is, and a fourth post-cursor is also needed, the same transmitter seen after a fast channel, e.g. a short fibre, can be difficult to receive (outside the TDECQ spec limit and/or receive power too low) because the 5-tap FFE can't correct the fourth post-cursor and the (now -ve) first precursor at the same time.
The signal after the fast channel can have more distortion from laser dynamics and a little more modal noise.
These three effects can outweigh the better Ceq after the fast channel.

Possible remedies include:
(a) Ensure there is at least one precursor (tap 2 or 3 is the largest), or
(b) Add ~0.4 dB to TDECQ if tap 1 is the largest, or
(c) Define MMF TDECQ with fast and slow channels, in the same spirit as SMF with high and low dispersion, noting that if tap 2 or 3 is the largest it can be assumed that TDECQ(fast) < TDECQ(slow), so no need to determine it.

No extra cost: an implementer who doesn't like option c, if adopted, can comply by following a or b. If he doesn't like b he can follow a. In practice, it seems that TDECQ uses at least one precursor for reasonable MMF transmitters, so there is no extra cost to a competent / responsible transmitter implementer, but the receiver needs protection from inferior transmitters that could appear in the future.

With this remedy, a 400GBASE-SR8 module used in breakout mode as 200GBASE-SR4, 100GBASE-SR2 or 50GBASE-SR is interoperable with and compliant to those specs (but a SR/SR2/SR4 module is not necessarily interoperable with anything, worst case, because of this gap in their specs).
It is better to provide an adequate yet compatible spec for 400GBASE-SR8 than repeat a mistake made in 802.3cd.

SuggestedRemedy

To ensure that the 400GBASE-SR8 transmitter is good enough for the intended range of channel bandwidths, either:
(a) Change the fourth sentence in 138.8.5.1 from "Tap 1, tap 2, or tap 3, has the largest magnitude tap coefficient, which is constrained to be at least 0.8." to
"For 50GBASE-SR, 100GBASE-SR2, and 200GBASE-SR4, tap 1, tap 2, or tap 3, has the largest magnitude tap coefficient, which is constrained to be at least 0.8. For 400GBASE-SR8, tap 2, or tap 3 has the largest magnitude tap coefficient, which is constrained to be at least 0.8."; or
(b) In 138.8.5, add another exception: "For 400GBASE-SR8, if tap 1 has the largest magnitude tap coefficient, TDECQ is 1.1 x the value given by Eq. (121-12). The TDECQ value with tap 2 having the largest magnitude tap coefficient may be used instead."; or
(c) Change the third exception in 138.8.5 to:
TDECQ is defined for two measurement conditions for 400GBASE-SR8, and for one measurement condition for 50GBASE-SR, 100GBASE-SR2, and 200GBASE-SR4. In the high bandwidth case, which applies to 400GBASE-SR8, the combination of the O/E converter and the oscilloscope used to measure the optical waveform is as in 121.8.5.1. In the low bandwidth case, it has a 3 dB bandwidth of 11.2 GHz with a fourth-order Bessel-Thomson response to at least 1.5 x 22.4 GHz. At frequencies above 1.5 x 22.4 GHz the response should not exceed -24 dB. Compensation may be made for any deviation from an ideal fourth-order Bessel-Thomson response. For 400GBASE-SR8, TDECQ is the higher of the results from the two bandwidth cases. If tap 2 or tap 3 has the largest magnitude tap coefficient in the low bandwidth case, it may be assumed that the result from the low bandwidth case is higher than the result from the high bandwidth case.

Response *Response Status* **U**

REJECT.
This comment is similar to comments #42 against D1.0, #7 against D1.1, #4 against D1.2, #9 against D2.0 and #4 against D2.1, which were rejected.
Insufficient evidence has been provided to justify a change.
Furthermore, it is highly desirable to keep the per lane specifications for 400GBASE-SR8 identical to the other PMDs in Clause 138 (50GBASE-SR, 100GBASE-SR2, and 200GBASE-SR4). Limiting to at most three post-cursors in the reference equalizer means that the transmitted signal, when propagated through the TDECQ reference response, cannot have a significant amount of fourth post-cursor response at the receiver without suffering higher TDECQ penalty.

Cl **150** *SC* **150.8.5** *P* **61** *L* **15** # r01-1

Dawe, Piers J G
Mellanox Technologies

Comment Type **TR** *Comment Status* **R**

SMF TDECQ is defined with minimum and maximum dispersion so that the signal after any allowed dispersion is acceptable. MMF TDECQ is defined with maximum dispersion only. We thought that was the worst case but it isn't always.

As explained in D3.0 comment 30, some unusual signals have a higher penalty with a short fibre than in the low-bandwidth MMF TDECQ test, hence could be effectively weaker than the budget, and could exceed the TDECQ limit.

Possible remedies include:
(a) With the low bandwidth, ensure there is at least one precursor (tap 2 or 3 is the largest), or
(b) With the low bandwidth, add ~0.4 dB to TDECQ if tap 1 is the largest, or
(c) Define MMF TDECQ with higher and lower bandwidths, in the same spirit as SMF with high and low dispersion. A measurement with the higher bandwidth can be processed in software to give TDECQ as in the lower bandwidth, so there is still only one measurement. But now, the scope bandwidth is the standard one for SMF TDECQ, and can be used for Clause 138 by the same software method, reducing test equipment cost. Typically, measurement accuracy will be improved too, because the extra filtering for the lower bandwidth and the equalisation to recover from net each other off, accurately, in software.

No extra cost: an implementer who doesn't like option c, can comply by following a or b, or noting that if tap 2 or 3 is the largest with the low bandwidth, it can be assumed that TDECQ(fast) < TDECQ(slow). In practice, it seems that TDECQ uses at least one precursor at the lower bandwidth for reasonable MMF transmitters, so there is no extra cost to a competent / responsible transmitter implementer, but the receiver needs protection from inferior transmitters that could appear in the future.

SuggestedRemedy

To ensure that the transmitter is good enough for the intended range of channel bandwidths, change the paragraph at line 15 to:
TDECQ is defined for two conditions. In the higher bandwidth case, the combination of the O/E converter and the oscilloscope used to measure the optical waveform is as in 121.8.5.1. In the lower bandwidth case, it has a 3 dB bandwidth of 8.96 GHz with a fourth-order Bessel-Thomson response to at least 1.5 x 17.92 GHz; in this case, at frequencies above 1.5 x 17.92 GHz the response should not exceed -24 dB. Compensation may be made for any deviation from an ideal fourth-order Bessel-Thomson response. The lower bandwidth TDECQ may be obtained by processing the data from the higher bandwidth measurement. TDECQ is the greater of the results from the two bandwidth cases.

Response *Response Status* **U**

REJECT.
This comment is similar to comments #48 against D1.0, #14 against D1.1, #9 against D1.2, #14 against D2.0, #5 against D2.1 and #i-30 against D3.0, which were rejected.
This comment is substantially similar to (and makes reference to) comment #i-30 against D3.0 which was rejected by the Task Force in the Indianapolis IEEE 802.3 Interim on September 9 2019. The commenter was unsatisfied. D3.1 was recirculated and closed successfully on October 11 2019 with no new negative votes.
Insufficient evidence has been provided to justify a change.
Furthermore, it is highly desirable that the TDECQ measurement methodology be common to all Clause 138 and Clause 150 PMDs. The suggested remedy effectively introduces a zero-dispersion condition in the TDECQ test of the transmitter. However, there is no equivalent zero-dispersion requirement specified in the in-force PAM4 equalized Clause 138 (50GBASE-SR, 100GBASE-SR2 and 200GBASE-SR4).

Cl **150** *SC* **150.8.5.1** *P* **59** *L* **28** # i-30

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R**

SMF TDECQ is defined with minimum and maximum dispersion so that the signal after any allowed dispersion is acceptable. MMF TDECQ is defined with maximum dispersion only. We thought that was the worst case but it isn't always.

As explained in D2.0 comment 14, equalizing a signal after an 8.96 GHz BT4 filter with a 5-tap FFE needs at least one precursor unless the signal is carefully pre-distorted. If it is, and a fourth post-cursor is needed, the same transmitter seen after a fast channel, e.g. a short fibre, can be difficult to receive (outside the TDECQ spec limit and/or receive power too low) because the 5-tap FFE can't correct the fourth post-cursor and the (now -ve) first precursor at the same time.
The signal after the fast channel can have more distortion from laser dynamics and a little more modal noise.
These three effects can outweigh the better Ceq after the fast channel.

Possible remedies include:
(a) Ensure there is at least one precursor (tap 2 or 3 is the largest), or
(b) Add ~0.4 dB to TDECQ if tap 1 is the largest, or
(c) Define MMF TDECQ with fast and slow channels, in the same spirit as SMF with high and low dispersion, noting that if tap 2 or 3 is the largest it can be assumed that TDECQ(fast) < TDECQ(slow), so no need to determine it.

No extra cost: an implementer who doesn't like option c, if adopted, can comply by following a or b. If he doesn't like b he can follow a. In practice, it seems that TDECQ uses at least one precursor for reasonable MMF transmitters, so there is no extra cost to a competent / responsible transmitter implementer, but the receiver needs protection from inferior transmitters that could appear in the future.

SuggestedRemedy

To ensure that the transmitter is good enough for the intended range of channel bandwidths, either:
(a) Change "Tap 1, tap 2, or tap 3, has" to "Tap 2 or tap 3 has"; or
(b) In 150.8.5, add another exception: "If tap 1 has the largest magnitude tap coefficient, TDECQ is 1.1 x the value given by Eq. (121-12). The TDECQ value with tap 2 having the largest magnitude tap coefficient may be used instead."; or
(c) Change the paragraph at line 15 to:
TDECQ is defined for two measurement conditions. In the high bandwidth case, the combination of the O/E converter and the oscilloscope used to measure the optical waveform is as in 121.8.5.1. In the low bandwidth case, it has a 3 dB bandwidth of 8.96 GHz with a fourth-order Bessel-Thomson response to at least 1.5 x 17.92 GHz. At frequencies above 1.5 x 17.92 GHz the response should not exceed -24 dB. Compensation may be made for any deviation from an ideal fourth-order Bessel-Thomson response. TDECQ is the higher of the results from the two bandwidth cases. If tap 2 or tap 3 has the largest magnitude tap coefficient in the low bandwidth case, it may be assumed that the result from the low bandwidth case is higher than the result from the high bandwidth case.

Response *Response Status* **U**

REJECT.
This comment is similar to comments #48 against D1.0, #14 against D1.1, #9 against D1.2, #14 against D2.0 and #5 against D2.1, which were rejected.
Limiting to at most three post-cursors in the reference equalizer means that the transmitted signal, when propagated through the TDECQ reference response, cannot have a significant amount of fourth post-cursor response at the receiver without suffering higher TDECQ penalty.
Insufficient evidence has been provided to justify a change.
Straw poll:
Do you support:
A) Make no change to the specification
B) Define TDECQ as the highest value obtained with 8.96 GHz and 13.28125 GHz filters
A: 6
B: 4