Cl **FM** *SC* **FM** *P* **8** *L* **23** # r03-2

Anslow, Peter Ciena Corporation

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

The names of the participants in the WG ballot stage should be added to the frontmatter.

SuggestedRemedy

Add the names of the WG ballot participants to the frontmatter.
Remove the names of all of the WG officers and editors from the list.
Apply footnote 1 to "Jonathan King":
"Not a member of the IEEE 802.3 working group at the beginning of the working group ballot."

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Add the names of the WG ballot participants to the frontmatter.
Remove the names of all of the WG officers and editors from the new list of WG ballot participants.
Apply footnote 1 to "Jonathan King":
"Not a member of the IEEE 802.3 working group at the beginning of the working group ballot."

Cl **000** *SC* **0** *P* *L* # r03-3

Anslow, Peter Ciena Corporation

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

Now that the P802.3cd draft is nearing the end of sponsor ballot, it is worth ensuring that all tables that split across pages have a "very thin" bottom ruling at the foot of the table on the first page.

SuggestedRemedy

Ensure that all tables that split across pages have a "very thin" bottom ruling at the foot of the table on the first page.
Applies to at least the table in 135.7.3, the table in 135.7.4.2, the table in 135.7.4.4, Table 136-11, Table 136-18 (2 places), Table 138-9, the table in 139.11.4.1, the table in 135G.5.4.1, and the table in 135G.5.4.2.

Response *Response Status* **C**

ACCEPT.

Cl **000** *SC* **0** *P* **1** *L* **2** # r03-1

Anslow, Peter Ciena Corporation

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

Provided that the IEEE SASB approve the IEEE Std 802.3 revision in their meeting on 14 June 2018, the "base_year" variable should be changed to 2018 throughout the draft.

SuggestedRemedy

Provided that the IEEE SASB approve the IEEE Std 802.3 revision in their meeting on 14 June 2018, change the "base_year" variable to 2018 in all of the files in the draft.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

The IEEE Std 802.3 revision was appoved.

Change the "base_year" variable to 2018 in all of the files in the draft.

Cl **001** *SC* **1** *P* **1** *L* **1** # r03-6

Rannow, R K IEEE/SELF

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

Various uses of undefined, and non-standard acronyms.

SuggestedRemedy

Response *Response Status* **W**

REJECT.

This comment does not apply to the substantive changes between IEEE P802.3cd D3.2 and D3.3 or the unsatisfied negative comments from the previous ballots. Hence it is not within the scope of the recirculation ballot. (out of scope)

The commenter has not indicated which of the acronyms are undefined or non-standard. Nor has the commenter provided a suggested remedy.

Cl **001** *SC* **1.4.387** *P* **40** *L* **39** # r03-5

Marris, Arthur — Cadence Design Syst

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

Consider adding Clauses 107, 119, 133 to the PCS clauses listed in: 1.4.387 Physical Coding Sublayer (PCS)

SuggestedRemedy

Update 1.4.387 to include the PCS Clauses for the 25G, 50G, and 200G and 400G speeds.

Also do the same for the PMA clauses in 1.4.392, the PMD clauses in 1.4.393 and the PHY clauses in 1.4.391.

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

Cl **069** *SC* **69.2.3** *P* **87** *L* **10** # r03-4

Marris, Arthur — Cadence Design Syst

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

In Table 69-3a correct 100GAUI references

SuggestedRemedy

100GAUI-4 C2C is defined in 135D
100GAUI-2 C2C is defined in 135F

Response *Response Status* **C**

ACCEPT.

Cl **135** *SC* **135.5.5** *P* **178** *L* **30** # r03-23

Dawe, Piers J G — Mellanox Technologie

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

Per D3.2 comment 33 and Style Manual

SuggestedRemedy

Change Note to NOTE

Response *Response Status* **C**

ACCEPT.

Cl **136** *SC* **136.9.3.4** *P* **226** *L* **16** # r03-18

Dudek, Michael — Cavium

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

The existing Transmitter Specifications allow transmitters to pass specification and provide significantly worse performance than the Transmitter used to test cables. This creates an inter-operability problem. A presentation will be made.

SuggestedRemedy

Add +3 to Equation 136-6

Response *Response Status* **U**

REJECT.

Note that a presentation on this topic was presented at an ad hoc meeting.
http://www.ieee802.org/3/cd/public/adhoc/archive/dudek_062718_3cd_adhoc.pdf

The presentation
http://www.ieee802.org/3/cd/public/July18/dudek_3cd_01a_0718.pdf
was reviewed and discussed.

Straw Poll #1:
I support applying the change in the suggested remedy:
Yes: 4
No: 16

Straw Poll #2
I support the suggested remedy with the addition of an exception in 136A.2 that the TP0a ERL recommendation is 18 dB.
Yes: 2
No: 11

There is no consensus to make the suggested change.

Cl **137** *SC* **137.9.2.1** *P* **249** *L* **52** # r03-19

Dudek, Michael — Cavium

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

The reference Tx used in COM has an ERL of over 21.5dB whereas the required specification for the Tx is only 15dB. This allows Tx's with significantly poorer performance to pass specification and creates an inter-operability problem. A presentation will be provided

SuggestedRemedy

Change the Tx ERL specification to 18dB.

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

Cl **138** *SC* **138.7.1** *P* **270** *L* **22** # r03-27

Dawe, Piers J G — Mellanox Technologie

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

A TDECQ limit of 4.5 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 dB with representative drive, and king_3cd_03_0518 shows better than 3.7 dB. chang_011018_3cd_01_adhoc-v2 showed 2.1 to 3.1 dB, the lower end with threshold adjust, although much of this was with PRBS15.
The high limit in the draft would require a better equalizer (e.g. more precise tap settings) than needed for the SMF PMDs. D.30 comment 119, D3.1 comment 70, D3.2 comment 40

SuggestedRemedy

Consider what actual PAM4 MMF transmitters do (more evidence like king_3cd_03_0518), and compare a minimally compliant 100GBASE-SR4 transmitter, and set the TDECQ limit accordingly, e.g. 4.0 dB.

Response *Response Status* **U**

REJECT.

PAM4 transmitters for MMF with measured TDECQ values up to 4.0 dB have been shown, in king_3cd_03_0518 and in dawe_3cd_01b_0518 (slide 9), which supports the P802.3cd draft 3.3 TDECQ limit of 4.5 dB taking account of product variability with larger sample sizes.

The same reference receiver is used for clause 138, 139, and 140. The higher TDECQ for 138 reflects the higher transmitter and link penalties for MMF, not a different reference equalizer.

The current TDECQ limit was arrived at as a compromise between transmitter and receiver capabilities.

[Editor's note added after comment resolution completed.

For reference, the URL for the cited presentations are provided here:
http://www.ieee802.org/3/cd/public/May18/king_3cd_03_0518.pdf
http://www.ieee802.org/3/cd/public/May18/dawe_3cd_01b_0518.pdf

]

Cl **138** *SC* **138.7.1** *P* **270** *L* **22** # r03-28

Dawe, Piers J G — Mellanox Technologie

Comment Type **E** *Comment Status* **R**

D3.2 comment 41, accepted

SuggestedRemedy

Make the left column wider and the others narrower

Response *Response Status* **C**

REJECT.

The approved response to r02-41 did not include the editorial change requested in this comment.

For reference, the response to comment r02-41 was:
"ACCEPT IN PRINCIPLE
Use TDECQ parameter nomenclature consistent with 121, 122, 124, 139 and 140"

Note that the draft is professionally edited prior to publication.

Cl **138** *SC* **138.7.2** *P* **271** *L* **9** # r03-25

Dawe, Piers J G — Mellanox Technologie

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

In D1.0, OMA-TDECQ was -5 dBm TBC, and the unstressed sensitivity was -7 dBm. Now, OMA-TDECQ is -5.9 and the implied unstressed sensitivity is about -7.3, equivalent to 50GBASE-LR and 1.5 dB harder for the receiver than 50GBASE-FR. The definition of TDECQ has changed a few times, which I think explains why the budget has gone up from 6 dB TBC to 6.5 dB. Min OMA at max TDECQ was -1 dBm TBC in D1.0, -1 in D3.2, is now -1.4. It looks like OMA-TDECQ should have been increased to -5.5 as the apparent TDECQ was reduced. king_3cd_01_0518 had proposed -5.7 dBm.

SuggestedRemedy

I think these changes restore the intent of D1.0, which was based on a TDECQ from about 0 to 4, to go with the present TDECQ which goes from about 0.5 to 4.5:
Increase OMA-TDECQ from -5.9 to -5.5 dBm. Increase SRS OMA from -3.4 back to -3 dBm (as in D1.0 and D3.2). Increase the other receiver sensitivity, equation 138-1, from max(-6.5, SECQ - 7.9) to max(-6.1, SECQ - 7.5).

Response *Response Status* **U**

REJECT.

The values in draft 3.3 reflect the discussion and decisions of the task force of TDECQ OMA-TDECQ and receiver sensitivity values which took place during comment resolution during the 802.3cd meeting in May 2018.

For reference see comment r02-9.

The comment does not provide sufficient evidence that the suggested remedy would improve the draft.

The following presentation was reviewed and discussed by the task force:
http://www.ieee802.org/3/cd/public/July18/dawe_3cd_02_0718.pdf

Based on straw poll #9 there is no consensus to make the proposed changes.

For reference the result of straw poll #9 is provided here:

Straw Poll #9
I would support implementing the changes proposed in the suggested remedy for comment r03-25.
Yes: 3
No: 12

[Editor's note added after comment resolution completed.
For reference, the response to comment r02-9 is provided here:
ACCEPT IN PRINCIPLE.
The Task Force reviewed the updated proposal in
http://www.ieee802.org/3/cd/public/May18/king_3cd_01_0518.pdf.

In Table 138-8 change value for "Transmitter and dispersion eye closure (TDECQ), each lane (max)" from 4.9 dB to 4.5 dB and change the parameter name to "Transmitter and dispersion eye closure for PAM4 (TDECQ), each lane (max)".
In Table 138-9:
Change value for "Stressed receiver sensitivity (OMAouter), each lane (max)" from -3 to -3.4 dBm.
Change value for "Stressed eye closure (SECQ), lane under test" from 4.9 dB to 4.5 dB.
Change note d to read "Receiver sensitivity is informative and is defined for a transmitter with a value of SECQ up to 4.5 dB."
In Table 138-10:
Change value for "Power budget (for max TDECQ)" from 6.9 dB to 6.5 dB.
Change value for "Allocation for penalties (for max TDECQ)" from 5 dB to 4.6 dB.
In 138.8.7 change "Receiver sensitivity is informative and is defined for a transmitter with a value of SECQ up to 4.9 dB" to "Receiver sensitivity is informative and is defined for a transmitter with a value of SECQ up to 4.5 dB"
Change the title for subclause 138.8.5 from "Transmitter and dispersion eye closure - quaternary (TDECQ)" to "Transmitter and dispersion eye closure for PAM4 (TDECQ)"
In Table 139-6 change value for "Transmitter and dispersion eye closure for PAM4 (TDECQ) (max)" from 3.2 dB to 2.8 dB for 50GBASE-FR and from 3.4 dB to 3 dB for 50GBASE-LR.
In Table 139-7:
Change value for "Stressed receiver sensitivity (OMAouter) (max)" from -5.1 to -5.5 dBm for 50GBASE-FR and from -6.4 dBm to -6.8 dBm for 50GBASE-LR.
Change value for "Stressed eye closure for PAM4 (SECQ)" from 3.2 dB to 2.8 dB for 50GBASE-FR and from 3.4 dB to 3 dB for 50GBASE-LR.
Change note c to read "Receiver sensitivity (OMAouter) (max) is informative and is defined for a transmitter with a value of SECQ up to 2.8 dB for 50GBASE-FR and 3 dB for 50GBASE-LR."
In Table 139-8:
Change value for "Power budget (for max TDECQ)" from 7.6 dB to 7.2 dB for 50GBASE-FR and from 10.3 dB to 9.9 dB for 50GBASE-LR.
Change value for "Allocation for penalties (for max TDECQ)" from 3.6 dB to 3.2 dB for 50GBASE-FR and from 4 dB to 3.6 dB for 50GBASE-LR.
In 139.7.8 change "For 50GBASE-FR, receiver sensitivity is informative and is defined for a transmitter with a value of SECQ up to 3.2 dB" to "For 50GBASE-FR, receiver sensitivity is informative and is defined for a transmitter with a value of SECQ up to 2.8 dB" and change "For 50GBASE-LR, receiver sensitivity is informative and is defined for a transmitter with a value of SECQ up to 3.4 dB" to "For 50GBASE-LR, receiver sensitivity is informative and is defined for a transmitter with a value of SECQ up to 3 dB".
In Table 140-6 change value for "Transmitter and dispersion eye closure for PAM4 (TDECQ) (max)" from 3.4 dB to 3 dB.
In Table 140-7:
Change value for "Stressed receiver sensitivity (OMAouter) (max)" from -1.9 to -2.3 dBm.
Change value for "Stressed eye closure for PAM4 (SECQ)" from 3.4 dB to 3 dB.
Change note c to read "Receiver sensitivity (OMAouter) (max) is informative and is defined for a transmitter with a value of SECQ up to 3 dB."
In Table 140-8:
Change value for "Power budget (for max TDECQ)" from 6.5 dB to 6.1 dB for ER >= 5 dB and from 6.8 dB to 6.4 dB for ER < 5 dB.
Change value for "Allocation for penalties (for max TDECQ)" to "6.1 minus max channel insertion loss per Table 140-12" for ER >= 5 dB and
to "6.4 minus max channel insertion loss per Table 140-12" for ER < 5 dB.
In 140.7.8 change "a value of SECQ up to 3.4 dB" to "a value of SECQ up to 3 dB".
In 138.8.5, 139.7.5.3 and 140.7.5 change "Pth1, Pth2, and Pth3 are varied from their nominal values by up to ±1% of OMAouter in order to optimize TDECQ." to "Pth1, Pth2, and Pth3 are varied from their nominal values by up to ±1% of OMAouter in order to optimize TDECQ. The same three thresholds are used for both the left and the right histogram."
With editorial license.
]

Cl **138** *SC* **138.7.3** *P* **271** *L* **42** # r03-26

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **A** *TDECQ limit*

The effect of modal noise and mode partition noise with a very high TDECQ transmitter (D.30 comment 119, D3.1 comment 70, D3.2 comment 40) and particularly with a very high penalty after equalization ("up the page": see TDECQ presentations) (D3.0 comment 116, D3.1 comment 71, D3.2 comment 46) is higher than with a more moderate penalty after equalization or without equalization as in 100GBASE-SR4. 100GBASE-SR4 takes this "Pcross" effect into account inside TDEC.

SuggestedRemedy

Reduce the headline TDECQ and limit TDECQ-10log10(Ceq) to make room for this in the budget, and/or
Adjust the definition of TDECQ for MMF to take this into account.
Adjust the budgets as needed.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

0.1 dB is included in the 'Allocation for penalties' to cover mode partition noise and modal noise penalties, and has been included in the link budget since adoption of the baseline.

However, based on straw polls #3 and #4 there is consensus to implement the additional limit on TDECQ in the form: TDECQ - 10*log10(Ceq) <= TDECQ (max)

Implement with editorial license, the changes for Clause 138, 139, and 140 in slides 3 to 8 outlined in:
http://www.ieee802.org/3/cd/public/July18/anslow_3cd_01a_0718.pdf

For reference, the result of straw polls #3 and #4 are provided here:

Straw Poll #3
For 50GBASE-FR, 50GBASE-LR, and 100GBASE-DR I support adding the constraint TDECQ-10*log10(CEQ) <= TDECQ (max)
Yes: 21
No: 13

Straw Poll #4
For 50GBASE-SR, 100GBASE-SR2, and 200GBASE-SR4 I support adding the constraint TDECQ-10*log10(CEQ) <= TDECQ (max)
Yes: 18
No: 10

Cl **138** *SC* **138.8.1** *P* **272** *L* **37** # r03-12

Le Cheminant, Greg

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

See above

SuggestedRemedy

Change "Square wave" to "Square wave or 6"

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

Cl **138** *SC* **138.8.5** *P* **273** *L* **34** # r03-9

Stassar, Peter — Huawei Technologies

Comment Type **TR** *Comment Status* **A** *srs filter*

Since the acceptance of modified filter characteristics for SECQ, as a result of resolution to comment #r02-62 at the May 2018 meeting, the filter characteristics for TDECQ, transition time and SECQ are now inconsistent. The difference between TDECQ and SECQ is only the presence of a test fiber in TDECQ, so the filter characteristics should be the same. The filter characteristics for TDECQ, Transition time and SECQ, will need to be aligned. Similarly for Clauses 139.7 and 140.7

SuggestedRemedy

There are 3 options to resolve this comment: 1. Reverting decision of Pittsburgh on the SECQ filter.
2. Adopting the revised SECQ filter characteristics also for TDECQ and Transition Time.
3. If the current SECQ filter is not adequate for TDECQ then create a formulation that is adequate for TDECQ and apply it also to transition time and SECQ.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

The following presentation was reviewed and discussed:
http://www.ieee802.org/3/cd/public/July18/king_3cd_01_0718.pdf

Implement with the following with editorial license.

Change the SRS test source measurement bandwidth definition in 138.8.10 to:
“This frequency response should be followed to at least 1.5x26.5625 GHz and at frequencies above 1.5x26.5625 GHz the response should not exceed -24 dB.”

Change the SRS test source measurement bandwidth definition in 139.7.10.2 to:
“The filter response of the combination of the O/E and the oscilloscope used for the SECQ measurement should be a fourth-order Bessel-Thomson filter response with a bandwidth of approximately 13.28125 GHz to at least 1.5x26.5625 GHz and at frequencies above 1.5x26.5625 GHz the response should not exceed -24 dB.”

Change the SRS test source measurement bandwidth definition in 140.7.10 to:
“The filter response of the combination of the O/E and the oscilloscope used for the SECQ measurement should be a fourth-order Bessel-Thomson filter response with a bandwidth of approximately 26.5625 GHz to at least 1.3x53.125 GHz and at frequencies above 1.3x53.125 GHz the response should not exceed -20 dB.”

Modify the filter definitions for TDECQ and rise/fall time measurements to match those defined above for SRS test source measurement with one exception as follows.

For the MMF transmitter TDECQ measurement in Clause 138 the filter frequency point would be 1.5 x 22.4 GHz rather than 1.5 x 26.5625 GHz.

Cl **138** *SC* **138.8.5** *P* **273** *L* **40** # r03-30

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **A** *TDECQ limit*

In this draft, it is still possible to make a bad MMF transmitter with emphasis (e.g. with a 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 and because the low bandwidth reference filter allows more Tx emphasis than for SMF.
But notice that in the survey (e.g. dawe_3cd_01b_0518 slide 8), the MMF points are to the right of 0.5 dB and below 2.5 dB, not near the upper left.
We need to exclude unnecessary regions, too high up the TDECQ map, that would waste equalizer power and complexity, and would allow non-resilient links if such signals were ever fielded.
D3.0 comment 116, D3.1 comment 71, D3.2 comment 46.

SuggestedRemedy

Limit TDECQ -10*log10(Ceq) to 0.5 dB less than the max. TDECQ.
E.g. for a MMF TDECQ limit of 4 dB, limit TDECQ -10*log10(Ceq) to 3.5 dB.
Add the limit to the transmitter and receiver (conditions of stressed receiver sensitivity test) tables if appropriate.
This limit protects the equalizer and decison circuit or A to D from very bad waveforms, while OMA-TDECQ protects the receiver front end from excessive sensitivity demands.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Resolve using the response to comment r03-26.

[Editor's note added after comment resolution completed.

For reference, the response to comment r03-26 is provided here:

ACCEPT IN PRINCIPLE.

0.1 dB is included in the 'Allocation for penalties' to cover mode partition noise and modal noise penalties, and has been included in the link budget since adoption of the baseline.

However, based on straw polls #3 and #4 there is consensus to implement the additional limit on TDECQ in the form: TDECQ - 10*log10(Ceq) <= TDECQ (max)

Implement with editorial license, the changes for Clause 138, 139, and 140 in slides 3 to 8 outlined in:
http://www.ieee802.org/3/cd/public/July18/anslow_3cd_01a_0718.pdf

For reference, the result of straw polls #3 and #4 are provided here:

Straw Poll #3
For 50GBASE-FR, 50GBASE-LR, and 100GBASE-DR I support adding the constraint

TDECQ-10*log10(CEQ) <= TDECQ (max)
Yes: 21
No: 13

Straw Poll #4
For 50GBASE-SR, 100GBASE-SR2, and 200GBASE-SR4 I support adding the constraint TDECQ-10*log10(CEQ) <= TDECQ (max)
Yes: 18
No: 10

]

Cl **138** *SC* **138.8.5.1** *P* **273** *L* **45** # r03-32

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **R** *precursor, MMF*

For some equalizer architectures, precursors are much more expensive than post-cursors (sun_3cd_042518_adhoc).
D3.1 comment 73, D3.2 comments 7, 8, 48, 53.

SuggestedRemedy

When we have decided what range of MMF signals are useful and allowed, review the value of the second precursor considering chromatic and modal dispersion. If it's small, 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 and dispersion there could lead to a different conclusion.

Response *Response Status* **U**

REJECT.

Repeat of previous comments r02-48 and r02-53. During comment resolution on D3.2 a similar proposal was rejected for 50G PAM4 based PMDs.

The response to r02-48 is shown here for reference:
"REJECT
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 chromatic and modal dispersion effects of the optical channel in combination with laser performance may require the extra tap. "

There was no related presentation for MMF PMDs, however there was a presentation on this topic for 50G SMF PMDs.
See: http://www.ieee802.org/3/cd/public/July18/sun_3cd_01b_0718.pdf

Based on straw poll #8 there is no consensus to make the proposed change.

For reference the result of straw poll #8 is provided here:

Straw Poll #8
For 50GBASE-SR, 100GBASE-SR2, and 200GBASE-SR4, I support constraining the largest magnitude tap coefficient to Tap 1 or tap 2.
Yes: 1
No: 16

Cl **138** *SC* **138.8.5.1** *P* **274** *L* **1** # r03-31

Dawe, Piers J G — Mellanox Technologie

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

TDECQ for MMF is measured through a specially low bandwidth, so for the same extreme transmitter emphasis, the reference equalizer's largest magnitude tap coefficient is larger (0.87 vs. 0.8 in dawe_3cd_01b_0518) than for SMF. Further, the survey results for MMF (green points, slide 3, dawe_3cd_01b_0518) are all to the right of +0.5 dB. So the spec can be made more realistic, which makes building the SRS tester easier as well as removing unnecessary design space from the receiver.

SuggestedRemedy

(Just for Clause 138) in "the largest magnitude tap coefficient, which is constrained to be at least 0.8", change 0.8 to 1.

Response *Response Status* **U**

REJECT.

TDECQ for MMF is measured through a receiver bandwidth which is lower that for SMF because it includes the channel response. TDECQ for SMF PMDs is measured through a worst case chromatic dispersion fibre which accounts for much, if not all, of the difference.

While VCSEL measurements to date have shown slightly higher TDECQ penalties than SMF transmitters due to low bandwidth, this does not reflect low temperature performance or future transmitter and VCSEL driver developments which would have better margins to the TDECQ limit and better yield/lower cost. Increasing the minimum coefficient of the largest magnitude tap will reduce the flexibility for the transmitter design.

There is no consensus to implement the proposed changes.

Cl **138** *SC* **138.8.7** *P* **274** *L* **25** # r03-44

Le Cheminant, Greg

Comment Type **T** *Comment Status* **A**

The transmitter transition time measurement that has been added to optical transmitter specifications uses a square wave pattern of eight sequential 3's followed by eight sequential 0's. The long runs of symbols ensure stable amplitudes from which to derive the 20% and 80% signal level thresholds used to construct a transition time measurement. The TDECQ, OuterOMA, and extinction ratio measurements can be made from a single acquisition of the SSPRQ pattern. To simplify the transmitter test process, a transmitter transition time measurement should also be considered valid if performed on the SSPRQ pattern. In the SSPRQ pattern there are two 0000033333 and two 3333300000 sequences. A transition time measurement made on either of these sequences should be equivalent to the measurement made on the square wave pattern.

SuggestedRemedy

Change 138.8.7 line 25 from ""......using the test pattern....."" to ""..........using a test pattern....."" And line 36 from ""..... square wave test pattern is used."" to ""..... square wave test pattern is used. When the SSPRQ pattern is used, P0 is measured over the central 2UI of the run of 5 zeroes and P3 is measured over the central 2UI of the run of 5 threes in the 0000033333 or 3333300000 sequences". Also change table 138-12 page 272 line 37 from "Square wave" to "Square wave or 6"

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Make the following changes with editorial license.

Change the first paragraph in 138.8.7 to:
The transmitter transition time of each lane shall be within the limits given in Table 138–8 if measured using a test pattern specified for transmitter transition time in Table 138–12.

Change the third paragraph in 138.8.7 to:
The 0% level and the 100% level are P0 and P3 as defined by the OMAouter measurement procedure (see 138.8.4), with the exception that the square wave test pattern can be used. When the SSPRQ pattern is used, the rising edge used for the measurement is that within the 00000333333 symbol sequence and the falling edge is that within the 33333000000 symbol sequence.

Also change table 138-12 page 272 line 37 from "Square wave" to "Square wave or 6".

Make equivalent changes in 139.7.7, Table 139-10, 140.7.7, and Table 140-10.

Cl **138** *SC* **138.8.7** *P* **274** *L* **25** # r03-11

Le Cheminant, Greg

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

The transmitter transition time measurement that has been added to optical transmitter specifications uses a square wave pattern of eight sequential 3's followed by eight sequential 0's. The long runs of symbols ensure stable amplitudes from which to derive the 20% and 80% signal level thresholds used to construct a transition time measurement. The TDECQ, OuterOMA, and extinction ratio measurements can be made from a single acquisition of the SSPRQ pattern. To simplify the transmitter test process, a transmitter transition time measurement should also be considered valid if performed on the SSPRQ pattern. In the SSPRQ pattern there are two 0000033333 and two 3333300000 sequences. A transition time measurement made on either of these sequences should be equivalent to the measurement made on the square wave pattern.

SuggestedRemedy

Change 138.8.7 line 25 from ""......using the test pattern....."" to ""..........using a test pattern....."" And line 36 from ""....square wave test pattern is used."" to ""....square wave test pattern is used. When the SSPRQ pattern is used, P0 is measured over the central 2UI of the run of 5 zeroes and P3 is measured over the central 2UI of the run of 5 threes in the 0000033333 or 3333300000 sequences"

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

Cl **138** *SC* **138.8.7** *P* **274** *L* **28** # r03-33

Dawe, Piers J G Mellanox Technologie

Comment Type **T** *Comment Status* **A**

1. For consistency and so that transition time is a free by-product of a TDECQ measurement as intended by D3.2 comment 54, we should be able to measure transition time on the same pattern as other things, SSPRQ, and with the same observation bandwidth.
2. As it is intended to exclude signals that would cause receive equalizer issues (e.g. require better linearity and/or finer AtoD or tap resolution or stronger tap weights), what matters is a fitted signal, not the actual signal. So the limit can be based on the average of the rising and falling edges rather than the slower of them.
3. Then, with a more consistent measurement, the limit might be tightened a little.

SuggestedRemedy

1. Add PRBS13Q and SSPRQ options for transition time measurement and associated P0 and P3: define the places in the patterns to measure, change the entry in Table 139-10, Test-pattern definitions and related subclauses, from "Square wave" to "4, 6 or square wave". If that doesn't work, consider changing to a maximum cursor strength limit, which really is a free by-product of a TDECQ measurement.
Check what difference it would make to measure in the 11.2 GHz bandwidth. If we do that for transmitters (free by-product) the limit for SRS would be that in 13.28125 GHz (going with SECQ).
2. Change "the slower of the time interval of the transition from 20% ..., or from 80% ..." to "the average of the time intervals of the transition from 20% ..., and from 80% ...".
3. Reduce 34 ps to 30-32 ps if appropriate.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

There was no support to include the PRBS13Q pattern. However, there is support for inclusion of the SSPRQ pattern. See response to comment r03-44, which adds support for the SSPRQ pattern for transition time measurements.

Transition time specifications for Tx have just been introduced in D3.3. Insufficient evidence/analysis has been provided to show that it is better to average rise and fall time.

There was no support to define the transition time based on the average or to change the transition time value.

Cl **138** *SC* **138.8.10** *P* **275** *L* **37** # r03-34

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **R**

This says "The SECQ of the stressed receiver conformance test signal is measured according to 138.8.5, except that the combination of the O/E and the oscilloscope..." but 138.8.5 doesn't mention SECQ.

SuggestedRemedy

Change to "The SECQ of the stressed receiver conformance test signal is measured similarly to TDECQ according to 138.8.5, except that the combination of the O/E and the oscilloscope..."

Response *Response Status* **C**

REJECT.

The draft states correctly that SECQ is measured according to 138.8.5, but with appropriate exceptions. This wording is consistent with Clauses 139 and 140.

Cl **138** *SC* **138.8.10** *P* **275** *L* **40** # r03-29

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **A** *srs filter*

D3.2 comment 62 proposed "to no less than 0.9 * 26.5625 GHz; afterwards the level doesn't grow past the level achieved at the abovementioned frequency" while this says "and at frequencies between 0.9 x 26.5625 GHz and 1.5 x 26.5625 GHz the response should not exceed the Bessel-Thomson response". As the Bessel-Thomson response continues to roll off between 0.9 x 26.5625 GHz and 1.5 x 26.5625 GHz, it's a significantly stricter requirement and may conflict with achieving an accurate response below 0.9 x 26.5625 GHz.

SuggestedRemedy

I just want to check if we really need such a particular and unusual requirement.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Resolve using the response to r03-9.

[Editor's note added after comment resolution completed.

For reference, the response to comment r03-9 is provided here:

ACCEPT IN PRINCIPLE.
The following presentation was reviewed and discussed:
http://www.ieee802.org/3/cd/public/July18/king_3cd_01_0718.pdf
Implement with the following with editorial license.
Change the SRS test source measurement bandwidth definition in 138.8.10 to:
“This frequency response should be followed to at least 1.5x26.5625 GHz and at frequencies above 1.5x26.5625 GHz the response should not exceed -24 dB.”
Change the SRS test source measurement bandwidth definition in 139.7.10.2 to:
“The filter response of the combination of the O/E and the oscilloscope used for the SECQ measurement should be a fourth-order Bessel-Thomson filter response with a bandwidth of approximately 13.28125 GHz to at least 1.5x26.5625 GHz and at frequencies above 1.5x26.5625 GHz the response should not exceed -24 dB.”
Change the SRS test source measurement bandwidth definition in 140.7.10 to:
“The filter response of the combination of the O/E and the oscilloscope used for the SECQ measurement should be a fourth-order Bessel-Thomson filter response with a bandwidth of approximately 26.5625 GHz to at least 1.3x53.125 GHz and at frequencies above 1.3x53.125 GHz the response should not exceed -20 dB.”
Modify the filter definitions for TDECQ and rise/fall time measurements to match those defined above for SRS test source measurement with one exception as follows.
For the MMF transmitter TDECQ measurement in Clause 138 the filter frequency point would be 1.5 x 22.4 GHz rather than 1.5 x 26.5625 GHz.

]

Cl **138** *SC* **138.8.10** *P* **275** *L* **43** # r03-39

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **A** *SRS compliance*

The rule of "at least half of the dB value of the stressed eye closure" is not consistent with the transmitter specs (D3.2 comment 55) for any of the optical PMDs.

SuggestedRemedy

When we have decided where the corner between the "top limit" and the "diagonal limit" on the TDECQ map is (see other comments), align the SRS range to that:
Add another exception, saying that 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) before the sinusoidal and Gaussian noise terms are added, does not apply.
Change "The signaling rate and the required stressed eye closure (SECQ) of the stressed receiver conformance test signal is specified in Table 138-9" to "The signaling rate, the required stressed eye closure (SECQ) and SECQ-10*log10(Ceq) of the stressed receiver conformance test signal are specified in Table 138-9. For a particular setup, one of SECQ and SECQ-10*log10(Ceq) matches the table and the other is lower. A pattern generator with emphasis may be used."
Do we want to give more advice about this, e.g. a 2-tap FIR, which one is the cursor? The FIR is to move the test condition to the left; to move it to the right the filter should be used.
Also in 138 and 140.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

This comment is a repeat of comment r02-55 against D3.2, which was rejected with statement: no changes to the draft proposed.

Based on the result of straw poll 5 there is consensus to make the proposed changes to Clause 138, 139, and 140.

Implement with editorial license, the changes for Clause 138, 139, and 140 in slides 10 to 16 outlined in:
http://www.ieee802.org/3/cd/public/July18/anslow_3cd_01a_0718.pdf

For reference, the result of straw poll #5 is shown here:

Straw Poll #5
For 50GBASE-FR, 50GBASE-LR, 100GBASE-DR, 50GBASE-SR, 100GBASE-SR2, and 200GBASE-SR4 I support removing constraint for SECQ dB to be at least half due to ISI from the low-pass filter and E/O converter.
Yes: 23
No: 0

Cl **138** *SC* **138.8.10** *P* **275** *L* **45** # r03-24

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **R** *RIN limit*

In practice, the receiver may experience noise from modal noise and mode partition noise as well as from RIN. Although there is a small allocation for these in the budget, it would be as well to allow the SRS to use the anticipated amount of noise from all causes, not just from RIN.

SuggestedRemedy

Change "should be no greater than the RIN12OMA (max) specified for the transmit characteristics in Table 138-8" (which means -128 dB/Hz) to "-127 dB/Hz" or "-126 dB/Hz" as appropriate.

Response *Response Status* **U**

REJECT.

No evidence provided that there is a problem with the draft and that the proposed remedy fixes the claimed problem.

Cl **138** *SC* **138.8.10** *P* **275** *L* **50** # r03-35

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **R**

The SRS recipe doesn't mention the largest magnitude tap coefficient limit. It should, else someone could create a very under-stressed signal (although not realistic) by applying too much emphasis.

SuggestedRemedy

Add: the largest magnitude tap coefficient in the SECQ calibration should be at least the limit given in 138.8.5.1 without the constraint mentioned there.

Response *Response Status* **C**

REJECT.

The current draft already includes this by refering to 138.8.5 with just one exception.

All other conditions in 138.8.5 apply.

"The SECQ of the stressed receiver conformance test signal is measured according to 138.8.5, except that the combination of the O/E and the oscilloscope..."

There is no consensus to make the proposed change.

Cl **139** *SC* **139.6** *P* **293** *L* **43** # r03-21

Tamura, Kohichi — Oclaro

Comment Type **TR** *Comment Status* **A**

In D3.2, 1% OMA threshold adjustment was introduced to the TDECQ algorithm in order to improve the yields of transmitters with slightly unequal eye levels and to improve correlation between changes in TDECQ and receiver sensitivity. Real receivers have threshold adjustment capability exceeding 1%, so the changes will mainly benefit transmitters with some nonlinearity, such as DML, but not adversely impact receivers. However, in D3.3, TDECQ (max) of 50GBASE-FR and 50GBASE-LR were reduced from 3.2 dB to 2.8 dB and from 3.4 dB to 3 dB, respectively, which negated the improvement gained with threshold adjustment. Furthermore, highly linear transmitters, for which TDECQ is the same with or without threshold adjustment, were penalized by a reduction in TDECQ (max) by 0.4 dB.

SuggestedRemedy

In Table 139-6, change TDECQ (max) of 50GBASE-FR from 2.8 dB to 3.2 dB.
In Table 139-6, change TDECQ (max) of 50GBASE-LR from 3 dB to 3.4 dB.

These changes will require additional changes as described below in other parts of the draft.
In Table 139-7, change "Stressed receiver sensitivity ... (max)" of 50GBASE-FR from -5.5 dB to -5.1 dB.
In Table 139-7, change "Stressed receiver sensitivity ... (max)" of 50GBASE-LR from -6.8 dB to -6.4 dB.
In Table 139-7, change foot note "c" from "... SECQ up to 2.8 dB for 50GBASE-FR and 3 dB for 50GBASE-LR." to "... SECQ up to 3.2 dB for 50GBASE-FR and 3.4 dB for 50GBASE-LR."
In Table 139-8, change "Power budget" of 50GBASE-FR from 7.2 dB to 7.6 dB.
In Table 139-8, change "Power budget" of 50GBASE-LR from 9.9 dB to 10.3 dB.
In Table 139-8, change "Allocation for penalties" of 50GBASE-FR from 3.2 dB to 3.6 dB.
In Table 139-8, change "Allocation for penalties" of 50GBASE-LR from 3.6 dB to 4 dB.
In 139.7.9, change "... SECQ up to 2.8 dB" to "... SECQ up to 3.2 dB" for 50GBASE-FR
In 139.7.9, change "... SECQ up to 3 dB" to "... SECQ up to 3.4 dB" for 50GBASE-LR.
In 139.7.9, change Figure 139-6 so that curves include SECQ of 3.2 dB and 3.4 dB for 50GBASE-FR and 50GBASE-LR, respectively.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

The task force reviewed and discussed the presentation
http://www.ieee802.org/3/cd/public/July18/tamura_3cd_01b_0718.pdf

Implement with editorial license the changes listed in the cited presentation on slide 11.

Cl **139** *SC* **139.6** *P* **293** *L* **43** # r03-43

Liu, Hai-Feng — Intel Corporation

Comment Type **TR** *Comment Status* **A**

The primary benefit of introducing threshold adjustment in D3.2 was to improve the TDECQ and link BER penalty correlation. This change would also relax the TDECQ for those Tx with unequal sub-eyes. In D3.3, TDECQmax was reduced to keep the maximum sub-eye inequality no greater than before threshold adjustment was added. However, the proposed 0.4 dB reduction from 3.4 dB to 3 dB was based on the simulation/measurement for the worst symmetric eye compression case under 1% threshold adjustment. Applying the same 0.4 dB reduction in TDECQ max across the board will unnecessarily penalize a large portion of good Tx that would have nearly equal sub-eyes. These Tx will gain little in terms of TDECQ from the threshold adjustment, but the 0.4 dB reduction in TDECQmax will result in significant loss. In addition, the worst symmetric eye compression case is far from practical as it can be avoided at least for MZI and EML based Tx.

SuggestedRemedy

In Table 139-6, change TDECQ (max) of 50GBASE-FR from 2.8 dB to 3.2 dB.
In Table 139-6, change TDECQ (max) of 50GBASE-LR from 3 dB to 3.4 dB.
In Table 139-7, change "Stressed receiver sensitivity ... (max)" of 50GBASE-FR from -5.5 dB to -5.1 dB.
In Table 139-7, change "Stressed receiver sensitivity ... (max)" of 50GBASE-LR from -6.8 dB to -6.4 dB.
In Table 139-7, change "Stress eye closure for PAM4 (SECQ) of 50GBASE-FR from 2.8 dB to 3.2 dB
In Table 139-7, change "Stress eye closure for PAM4 (SECQ) of 50GBASE-LR from 3 dB to 3.4 dB
In Table 139-7, change foot note "c" from "... SECQ up to 2.8 dB for 50GBASE-FR and 3 dB for 50GBASE-LR." to "... SECQ up to 3.2 dB for 50GBASE-FR and 3.4 dB for 50GBASE-LR."
In Table 139-8, change "Power budget" of 50GBASE-FR from 7.2 dB to 7.6 dB.
In Table 139-8, change "Power budget" of 50GBASE-LR from 9.9 dB to 10.3 dB.
In Table 139-8, change "Allocation for penalties" of 50GBASE-FR from 3.2 dB to 3.6 dB.
In Table 139-8, change "Allocation for penalties" of 50GBASE-LR from 3.6 dB to 4 dB.
In 139.7.9, change "... SECQ up to 2.8 dB" to "... SECQ up to 3.2 dB" for 50GBASE-FR
In 139.7.9, change "... SECQ up to 3 dB" to "... SECQ up to 3.4 dB" for 50GBASE-LR.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Resolve using the response to r03-21.

[Editor's note added after comment resolution completed.

For reference, the response to comment r03-21 is provided here:

ACCEPT IN PRINCIPLE.
The task force reviewed and discussed the presentation
http://www.ieee802.org/3/cd/public/July18/tamura_3cd_01b_0718.pdf

Implement with editorial license the changes listed in the cited presentation on slide 11.

]

Cl **139** *SC* **139.7.1** *P* **296** *L* **16** # r03-14

Le Cheminant, Greg

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

See above

SuggestedRemedy

Change "Square wave" to "Square wave or 6"

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

Cl **139** *SC* **139.7.5.3** *P* **298** *L* **52** # r03-36

Dawe, Piers J G

Mellanox Technologie

Comment Type **TR** *Comment Status* **A** *TDECQ limit*

In this draft, it is still possible to make a bad SMF transmitter with emphasis (e.g. with a 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. But notice that in the survey (e.g. dawe_3cd_01b_0518 slide 8), the 50G SMF points are near neutral and below 1.8 dB, not near the upper left.
We need to exclude unnecessary regions, too high up the TDECQ map, that would waste equalizer power and complexity.
D3.0 comment 116, D3.1 comment 71, D3.2 comment 52.

SuggestedRemedy

Limit TDECQ -10*log10(Ceq) to the lower of 3 dB or the max. TDECQ.
E.g. for a SMF TDECQ limit of 2.8 dB (50GBASE-FR), limit TDECQ -10*log10(Ceq) to 2.8 dB; for 3 dB (50GBASE-LR), limit TDECQ -10*log10(Ceq) to 3 dB.
Add the limit to the transmitter and receiver (conditions of stressed receiver sensitivity test) tables if appropriate.
This limit protects the equalizer and decison circuit or A to D from worse than reasonable waveforms, while OMA-TDECQ protects the receiver front end from excessive sensitivity demands.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

There have been presentations on this subject at the ad hoc meetings:
http://www.ieee802.org/3/cd/public/adhoc/archive/dawe_062718_01a_3cd_adhoc.pdf
http://www.ieee802.org/3/cd/public/adhoc/archive/anslow_062718_3cd_adhoc.pdf
http://www.ieee802.org/3/cd/public/adhoc/archive/tamura_062718_3cd_adhoc-v2.pdf

Resolve using the response to comment r03-26.

[Editor's note added after comment resolution completed.

For reference, the response to comment r03-26 is provided here:

ACCEPT IN PRINCIPLE.

0.1 dB is included in the 'Allocation for penalties' to cover mode partition noise and modal noise penalties, and has been included in the link budget since adoption of the baseline.

However, based on straw polls #3 and #4 there is consensus to implement the additional limit on TDECQ in the form: TDECQ - 10*log10(Ceq) <= TDECQ (max)

Implement with editorial license, the changes for Clause 138, 139, and 140 in slides 3 to 8 outlined in:
http://www.ieee802.org/3/cd/public/July18/anslow_3cd_01a_0718.pdf

For reference, the result of straw polls #3 and #4 are provided here:

Straw Poll #3
For 50GBASE-FR, 50GBASE-LR, and 100GBASE-DR I support adding the constraint TDECQ-10*log10(CEQ) <= TDECQ (max)
Yes: 21
No: 13

Straw Poll #4
For 50GBASE-SR, 100GBASE-SR2, and 200GBASE-SR4 I support adding the constraint TDECQ-10*log10(CEQ) <= TDECQ (max)
Yes: 18
No: 10

]

Cl **139** *SC* **139.7.5.4** *P* **299** *L* **5** # r03-37

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **R** *precursor, SMF*

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 (but not yet including chromatic dispersion). 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, D3.2 comment 53.

SuggestedRemedy

Review the value of the second precursor considering chromatic dispersion. If it's small, 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", like 100GBASE-DR. Increase the max TDECQ a little if appropriate.
There is a separate comment for MMF because the different TDECQ limit there could lead to a different conclusion.

Response *Response Status* **U**

REJECT.

No evidence has been shown that there is a problem with the current draft. The remedy is not specific.

The following related presentation was reviewed and discussed.
Http://www.ieee802.org/3/cd/public/July18/sun_3cd_01b_0718.pdf

Based on straw polls 6 and 7 there is no consensus to make the proposed changes.

For reference the results to straw polls are shown here:

Straw Poll #6.
For 50GBASE-FR, I support constraining the largest magnitude tap coefficient to Tap 1 or tap 2.
Yes: 4
No: 19

Straw Poll #7
For 50GBASE-LR, I support constraining the largest magnitude tap coefficient to Tap 1 or tap 2.
Yes: 0
No: 19

Cl **139** *SC* **139.7.5.4** *P* **299** *L* **22** # r03-47

Sun, Phil

Comment Type **T** *Comment Status* **R** *precursor, SMF*

Current spec allows TDECQ reference receiver to have up to two precursors for 50GBASE-FR and 50GBASE-LR. 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 minimal for 50GBASE-FR and small for 50GBASE-LR. Meanwhile it can be compensated by TX. Allowing no more than 1 precursor also helps to reduce test time.

SuggestedRemedy

"Add:
For 50GBASE-FR, Tap 1 or tap 2 has the largest magnitude tap coefficient."

Response *Response Status* **C**

REJECT.

This comment was received after the ballot closed. (late)

This is a similar comment to r02-53 for which the response is shown here for reference:
"REJECT:
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 chromatic and modal dispersion effects of the optical channel in combination with laser performance may require the extra tap. No evidence has been provided to show otherwise."

The following presentation was reviewed and discussed.
Http://www.ieee802.org/3/cd/public/July18/sun_3cd_01b_0718.pdf

Based on straw polls 6 and 7 there is no consensus to make the proposed changes.

For reference the results to straw polls are shown here:

Straw Poll #6.
For 50GBASE-FR, I support constraining the largest magnitude tap coefficient to Tap 1 or tap 2.
Yes: 4
No: 19

Straw Poll #7
For 50GBASE-LR, I support constraining the largest magnitude tap coefficient to Tap 1 or tap 2.
Yes: 0
No: 19

Cl **139** *SC* **139.7.7** *P* **299** *L* **34** # r03-45

Le Cheminant, Greg

Comment Type **T** *Comment Status* **A**

The transmitter transition time measurement that has been added to optical transmitter specifications uses a square wave pattern of eight sequential 3's followed by eight sequential 0's. The long runs of symbols ensure stable amplitudes from which to derive the 20% and 80% signal level thresholds used to construct a transition time measurement. The TDECQ, OuterOMA, and extinction ratio measurements can be made from a single acquisition of the SSPRQ pattern. To simplify the transmitter test process, a transmitter transition time measurement should also be considered valid if performed on the SSPRQ pattern. In the SSPRQ pattern there are two 0000033333 and two 3333300000 sequences. A transition time measurement made on either of these sequences should be equivalent to the measurement made on the square wave pattern.

SuggestedRemedy

Change 139.7.7 line 34 from ""......using the test pattern....."" to ""..........using a test pattern....."" And line 45 from ""....square wave test pattern is used."" to ""....square wave test pattern is used. When the SSPRQ pattern is used, P0 is measured over the central 2UI of the run of 5 zeroes and P3 is measured over the central 2UI of the run of 5 threes in the 0000033333 or 3333300000 sequences". Also change Table 139-10 page 296 line 16 from "Square wave" to "Square wave or 6"

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Resolve using the response to comment r03-44.

[Editor's note added after comment resolution completed.

For reference the response to r03-44 is provied here:

ACCEPT IN PRINCIPLE.
Make the following changes with editorial license.
Change the first paragraph in 138.8.7 to:
The transmitter transition time of each lane shall be within the limits given in Table 138–8 if measured using a test pattern specified for transmitter transition time in Table 138–12.
Change the third paragraph in 138.8.7 to:
The 0% level and the 100% level are P0 and P3 as defined by the OMAouter measurement procedure (see 138.8.4), with the exception that the square wave test pattern can be used. When the SSPRQ pattern is used, the rising edge used for the measurement is that within the 00000333333 symbol sequence and the falling edge is that within the 33333000000 symbol sequence.
Also change table 138-12 page 272 line 37 from "Square wave" to "Square wave or 6".
Make equivalent changes in 139.7.7, Table 139-10, 140.7.7, and Table 140-10.

]

Cl **139** *SC* **139.7.7** *P* **299** *L* **34** # r03-13

Le Cheminant, Greg

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

The transmitter transition time measurement that has been added to optical transmitter specifications uses a square wave pattern of eight sequential 3's followed by eight sequential 0's. The long runs of symbols ensure stable amplitudes from which to derive the 20% and 80% signal level thresholds used to construct a transition time measurement. The TDECQ, OuterOMA, and extinction ratio measurements can be made from a single acquisition of the SSPRQ pattern. To simplify the transmitter test process, a transmitter transition time measurement should also be considered valid if performed on the SSPRQ pattern. In the SSPRQ pattern there are two 0000033333 and two 3333300000 sequences. A transition time measurement made on either of these sequences should be equivalent to the measurement made on the square wave pattern.

SuggestedRemedy

Change 139.7.7 line 34 from ""......using the test pattern....."" to ""..........using a test pattern....."" And line 45 from ""....square wave test pattern is used."" to ""....square wave test pattern is used. When the SSPRQ pattern is used, P0 is measured over the central 2UI of the run of 5 zeroes and P3 is measured over the central 2UI of the run of 5 threes in the 0000033333 or 3333300000 sequences"

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

Cl **139** *SC* **139.7.7** *P* **299** *L* **37** # r03-38

Dawe, Piers J G Mellanox Technologie

Comment Type **T** *Comment Status* **A**

1. For consistency and so that transition time is a free by-product of a TDECQ measurement as intended by D3.2 comment 54, we should be able to measure transition time on the same pattern as other things, SSPRQ.
2. As it is intended to exclude signals that would cause receive equalizer issues (e.g. require better linearity and/or finer AtoD or tap resolution or stronger tap weights), what matters is a fitted signal, not the actual signal. So the limit can be based on the average of the rising and falling edges rather than the slower of them. Then, with a more consistent measurement, the limit can be tightened a little.
3. We should consider tightening the limit for 50GBASE-FR and 50GBASE-LR; it's the same as for MMF with a slower observation bandwidth and much higher TDECQ.

SuggestedRemedy

1. Add PRBS13Q and SSPRQ options for transition time measurement and associated P0 and P3: define the places in the patterns to measure, change the entry in Table 139-10, Test-pattern definitions and related subclauses, from "Square wave" to "4, 6 or square wave". If that doesn't work, consider changing to a maximum cursor strength limit, which really is a free by-product of a TDECQ measurement.
2. Change "the slower of the time interval of the transition from 20% ..., or from 80% ..." to "the average of the time intervals of the transition from 20% ..., and from 80% ...".
3. Reduce 34 ps to 28-32 ps TBD, considering the effect of the different observation bandwidth.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

There was no support to include the PRBS13Q pattern. However, there is support for inclusion of the SSPRQ pattern. See response to comment r03-44, which adds support for the SSPRQ pattern for transition time measurements.

Transition time specifications for Tx have just been introduced in D3.3. Insufficient evidence/analysis has been provided to show that it is better to average rise and fall time.

There was no support to define the transition time based on the observation bandwidth being different from Clause 138.

Cl **140** *SC* **140.6** *P* **318** *L* **42** # r03-42

Liu, Hai-Feng — Intel Corporation

Comment Type **TR** *Comment Status* **A**

The primary benefit of introducing threshold adjustment in D3.2 was to improve the TDECQ and link BER penalty correlation. This change would also relax the TDECQ for those Tx with unequal sub-eyes. In D3.3, TDECQmax was reduced to keep the maximum sub-eye inequality no greater than before threshold adjustment was added. However, the proposed 0.4 dB reduction from 3.4 dB to 3 dB was based on the simulation/measurement for the worst symmetric eye compression case under 1% threshold adjustment. Applying the same 0.4 dB reduction in TDECQ max across the board will unnecessarily penalize a large portion of good Tx that would have nearly equal sub-eyes. These Tx will gain little in terms of TDECQ from the threshold adjustment, but the 0.4 dB reduction in TDECQmax will result in significant loss. In addition, the worst symmetric eye compression case is far from practical as it can be avoided at least for MZI and EML based Tx.

SuggestedRemedy

In Table 140-6, change "TDECQ (max)" of 100GBASE-DR from 3 dB to 3.4 dB.
In Table 140-7, change "stressed receiver sensitivity ... (max)" of 100GBASE-DR from -2.3 dB to -1.9 dB.
In Table 140-7, change foot note "c" from "... SECQ up to 3 dB." to "... SECQ up to 3.4 dB."
In Table 140-8, change "Power budget" of 100GBASE-DR for extinction ratio >= 5 dB from 6.1 dB to 6.5 dB.
In Table 140-7, change the Stressed eye closure for PAM4 (SECQ) from 3 dB to 3.4 dB
In Table 140-8, change "Power budget" of 100GBASE-DR for extinction ratio < 5 dB from 6.4 dB to 6.8 dB.
In Table 140-8, change "Allocation for penalties" of 100GBASE-DR for extinction ratio >= 5 dB from 6.1 dB to 6.5 dB.
In Table 140-8, change "Allocation for penalties" of 100GBASE-DR for extinction ratio < 5 dB from 6.4 dB to 6.8 dB.
In page 323, 140.7.9, Change "...SECQ up to 3 dB" to "...SECQ up to 3.4 dB"

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Resolve using the response to comment r03-22.

[Editor's note added after comment resolution completed.

For reference, the response to comment r03-22 is provided here:

ACCEPT IN PRINCIPLE.
The task force reviewed and discussed the presentation
http://www.ieee802.org/3/cd/public/July18/tamura_3cd_01b_0718.pdf
Implement with editorial license the changes listed in the cited presentation on slide 12.

]

Cl **140** *SC* **140.6** *P* **318** *L* **42** # r03-22

Tamura, Kohichi — Oclaro

Comment Type **TR** *Comment Status* **A**

In D3.2, 1% OMA threshold adjustment was introduced to the TDECQ algorithm in order to improve the yields of transmitters with slightly unequal eye levels and to improve correlation between changes in TDECQ and receiver sensitivity. Real receivers have threshold adjustment capability exceeding 1%, so the changes will mainly benefit transmitters with some nonlinearity, such as DML, but not adversely impact receivers. However, in D3.3, TDECQ (max) of 100GBASE-DR reduced from 3.4 dB to 3 dB, which negated the improvement gained with threshold adjustment. Furthermore, highly linear transmitters, for which TDECQ is the same with or without threshold adjustment, were penalized by a reduction in TDECQ (max) by 0.4 dB.

SuggestedRemedy

In Table 140-6, change "TDECQ (max)" of 100GBASE-DR from 3 dB to 3.4 dB.
In Table 140-7, change "stressed receiver sensitivity ... (max)" of 100GBASE-DR from -2.3 dB to -1.9 dB.
In Table 140-7, change foot note "c" from "... SECQ up to 3 dB." to "... SECQ up to 3.4 dB."
In Table 140-7, change the "Stressed eye closure for PAM4 (SECQ)" from 3 dB to 3.4 dB
In Table 140-8, change "Power budget" of 100GBASE-DR for extinction ratio >= 5 dB from 6.1 dB to 6.5 dB.
In Table 140-8, change "Power budget" of 100GBASE-DR for extinction ratio < 5 dB from 6.4 dB to 6.8 dB.
In Table 140-8, change "Allocation for penalties" of 100GBASE-DR for extinction ratio >= 5 dB from 6.1 dB to 6.5 dB.
In Table 140-8, change "Allocation for penalties" of 100GBASE-DR for extinction ratio < 5 dB from 6.4 dB to 6.8 dB.
In 140.7.9, change "...SECQ up to 3 dB" to "...SECQ up to 3.4 dB"
In 140.7.9, change Figure 140-5 so curve includes up to SECQ of 3.4 dB.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

The task force reviewed and discussed the presentation
http://www.ieee802.org/3/cd/public/July18/tamura_3cd_01b_0718.pdf

Implement with editorial license the changes listed in the cited presentation on slide 12.

Cl **140** *SC* **140.7.1** *P* **321** *L* **5** # r03-10

Stassar, Peter — Huawei Technologies

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

In 3 instances in Table 140-10, 50GBASE-R is mentioned, which should be 100GBASE-R. Thanks to David Lewis for identifying this error.

SuggestedRemedy

Where applicable in Table 140-10 change "50GBASE-R" to "100GBASE-R"

Response *Response Status* **W**

ACCEPT IN PRINCIPLE.

Implement proposed remedy with editorial license.

Cl **140** *SC* **140.7.1** *P* **321** *L* **17** # r03-17

Dudek, Michael — Cavium

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

Measuing RIN with pattern 4 using the measurement methodology of 52.9.6 will result in the wrong result.

SuggestedRemedy

Change the pattern to "square wave" (as is already used in Clauses 138 and 139).

Response *Response Status* **W**

ACCEPT.

Cl **140** *SC* **140.7.2** *P* **321** *L* **17** # r03-16

Le Cheminant, Greg

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

See above

SuggestedRemedy

Change "Square wave" to "Square wave or 6"

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

Cl **140** *SC* **140.7.5** *P* **322** *L* **25** # r03-40

Dawe, Piers J G — Mellanox Technologie

Comment Type **TR** *Comment Status* **A** *TDECQ limit*

In this draft, it is still possible to make a bad SMF transmitter with emphasis (e.g. with a 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. But notice that in the survey (e.g. dawe_3cd_01b_0518 slide 8), the 100G SMF points are to the right or near neutral, not at the upper left.
We need to exclude unnecessary regions, too high up the TDECQ map, that would waste equalizer power and complexity.
D3.0 comment 116, D3.1 comment 71, D3.2 comment 52.

SuggestedRemedy

Limit TDECQ -10*log10(Ceq) to the the max. TDECQ.
E.g. for a SMF TDECQ limit of 3 dB (100GBASE-DR), limit TDECQ -10*log10(Ceq) to 3 dB; if it is increased to 3.4 dB, limit TDECQ -10*log10(Ceq) to 3.4 dB.
Add the limit to the transmitter and receiver (conditions of stressed receiver sensitivity test) tables if appropriate.
This limit protects the equalizer and decison circuit or A to D from worse than reasonable waveforms, while OMA-TDECQ protects the receiver front end from excessive sensitivity demands.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Resolve using the response to comment r03-26.

[Editor's note add after comment resolution completed.

ACCEPT IN PRINCIPLE.
0.1 dB is included in the 'Allocation for penalties' to cover mode partition noise and modal noise penalties, and has been included in the link budget since adoption of the baseline.
However, based on straw polls #3 and #4 there is consensus to implement the additional limit on TDECQ in the form: TDECQ - 10*log10(Ceq) <= TDECQ (max)
Implement with editorial license, the changes for Clause 138, 139, and 140 in slides 3 to 8 outlined in:
http://www.ieee802.org/3/cd/public/July18/anslow_3cd_01a_0718.pdf
For reference, the result of straw polls #3 and #4 are provided here:

Straw Poll #3
For 50GBASE-FR, 50GBASE-LR, and 100GBASE-DR I support adding the constraint TDECQ-10*log10(CEQ) <= TDECQ (max)
Yes: 21
No: 13

Straw Poll #4
For 50GBASE-SR, 100GBASE-SR2, and 200GBASE-SR4 I support adding the constraint TDECQ-10*log10(CEQ) <= TDECQ (max)

Yes: 18
No: 10

]

Cl **140** *SC* **140.7.7** *P* **323** *L* **6** # r03-15

Le Cheminant, Greg

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

The transmitter transition time measurement that has been added to optical transmitter specifications uses a square wave pattern of eight sequential 3's followed by eight sequential 0's. The long runs of symbols ensure stable amplitudes from which to derive the 20% and 80% signal level thresholds used to construct a transition time measurement. The TDECQ, OuterOMA, and extinction ratio measurements can be made from a single acquisition of the SSPRQ pattern. To simplify the transmitter test process, a transmitter transition time measurement should also be considered valid if performed on the SSPRQ pattern. In the SSPRQ pattern there are two 0000033333 and two 3333300000 sequences. A transition time measurement made on either of these sequences should be equivalent to the measurement made on the square wave pattern.

SuggestedRemedy

Change 140.7.7 line 6 from ".....using the test pattern....." to ".....using a test pattern....." And line 17 from ".....square wave test pattern is used." to ".....square wave test pattern is used. When the SSPRQ pattern is used, P0 is measured over the central 2UI of the run of 5 zeroes and P3 is measured over the central 2UI of the run of 5 threes in the 0000033333 or 3333300000 sequences"

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

Cl **140** *SC* **140.7.7** *P* **323** *L* **6** # r03-46

Le Cheminant, Greg

Comment Type **T** *Comment Status* **A**

The transmitter transition time measurement that has been added to optical transmitter specifications uses a square wave pattern of eight sequential 3's followed by eight sequential 0's. The long runs of symbols ensure stable amplitudes from which to derive the 20% and 80% signal level thresholds used to construct a transition time measurement. The TDECQ, OuterOMA, and extinction ratio measurements can be made from a single acquisition of the SSPRQ pattern. To simplify the transmitter test process, a transmitter transition time measurement should also be considered valid if performed on the SSPRQ pattern. In the SSPRQ pattern there are two 0000033333 and two 3333300000 sequences. A transition time measurement made on either of these sequences should be equivalent to the measurement made on the square wave pattern.

SuggestedRemedy

Change 140.7.7 line 6 from ".....using the test pattern....." to ".....using a test pattern....." And line 17 from ".....square wave test pattern is used." to ".....square wave test pattern is used. When the SSPRQ pattern is used, P0 is measured over the central 2UI of the run of 5 zeroes and P3 is measured over the central 2UI of the run of 5 threes in the 0000033333 or 3333300000 sequences". Also change Table 140-10 Page 321 line 16 from "Square wave" to "Square wave or 6"

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Resolve using the response to comment r03-44.

[Editor's note added after comment resolution completed.

For reference, the response to comment r03-44 is provided here:

ACCEPT IN PRINCIPLE.
Make the following changes with editorial license.
Change the first paragraph in 138.8.7 to:
The transmitter transition time of each lane shall be within the limits given in Table 138–8 if measured using a test pattern specified for transmitter transition time in Table 138–12.
Change the third paragraph in 138.8.7 to:
The 0% level and the 100% level are P0 and P3 as defined by the OMAouter measurement procedure (see 138.8.4), with the exception that the square wave test pattern can be used. When the SSPRQ pattern is used, the rising edge used for the measurement is that within the 00000333333 symbol sequence and the falling edge is that within the 33333000000 symbol sequence.
Also change table 138-12 page 272 line 37 from "Square wave" to "Square wave or 6".
Make equivalent changes in 139.7.7, Table 139-10, 140.7.7, and Table 140-10.

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Cl **140** *SC* **140.7.7** *P* **323** *L* **9** # r03-41

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **A**

1. For consistency and so that transition time is a free by-product of a TDECQ measurement as intended by D3.2 comment 54, we should be able to measure transition time on the same pattern as other things, SSPRQ.
2. As it is intended to exclude signals that would cause receive equalizer issues (e.g. require better linearity and/or finer AtoD or tap resolution or stronger tap weights), what matters is a fitted signal, not the actual signal. So the limit can be based on the average of the rising and falling edges rather than the slower of them.

SuggestedRemedy

1. Add PRBS13Q and SSPRQ options for transition time measurement and associated P0 and P3: define the places in the patterns to measure, change the entry in Table 140-10, Test-pattern definitions and related subclauses, from "Square wave" to "4, 6 or square wave". If that doesn't work, consider changing to a maximum cursor strength limit, which really is a free by-product of a TDECQ measurement.
2. Change "the slower of the time interval of the transition from 20% ..., or from 80% ..." to "the average of the time intervals of the transition from 20% ..., and from 80% ...".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

There was no support to include the PRBS13Q pattern. However, there is support for inclusion of the SSPRQ pattern. See response to comment r03-44, which adds support for the SSPRQ pattern for transition time measurements.

Transition time specifications for Tx have just been introduced in D3.3. Insufficient evidence/analysis has been provided to show that it is better to average rise and fall time.

[Editor's note added after comment resolution completed.

For reference, the response to comment r03-44 is provided here:

ACCEPT IN PRINCIPLE.
Make the following changes with editorial license.
Change the first paragraph in 138.8.7 to:
The transmitter transition time of each lane shall be within the limits given in Table 138–8 if measured using a test pattern specified for transmitter transition time in Table 138–12.
Change the third paragraph in 138.8.7 to:
The 0% level and the 100% level are P0 and P3 as defined by the OMAouter measurement procedure (see 138.8.4), with the exception that the square wave test pattern can be used. When the SSPRQ pattern is used, the rising edge used for the measurement is that within the 00000333333 symbol sequence and the falling edge is that within the 33333000000 symbol sequence.
Also change table 138-12 page 272 line 37 from "Square wave" to "Square wave or 6".
Make equivalent changes in 139.7.7, Table 139-10, 140.7.7, and Table 140-10.

]

Cl **140** *SC* **140.7.10** *P* **324** *L* # r03-8

Stassar, Peter — Huawei Technologies

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

140.7.10 should have an exception to use Figure 139-7 because it is a single lane PMD, in a similar way as in Subclause 139.7.10.2

SuggestedRemedy

Add another exception, "An example stressed receiver conformance test setup is shown in Figure 139-7; however, alternative test setups that generate equivalent stress conditions may be used."

Response *Response Status* **W**

ACCEPT.

Cl **140** *SC* **140.7.10** *P* **324** *L* **47** # r03-7

Stassar, Peter — Huawei Technologies

Comment Type **TR** *Comment Status* **A**

An exception, referring to test patterns in Table 140-10, is missing.

SuggestedRemedy

Add another exception "The test patterns used for stressed receiver sensitivity are specified in Table 140-10."

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

To be consistent with 139.7.10, change the first sentence of 140.7.10, to read:
“Stressed receiver sensitivity shall be within the limits given in Table 140–7 if measured using the method defined in 121.8.9, using the test pattern specified for SRS in Table 140–10, with the following exceptions: ”