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

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R** *TDECQ limit*

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

SuggestedRemedy

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

Response *Response Status* **U**

REJECT.

No change to document suggested.
The issue caused by a TDECQ limit of 4.9 dB has not been clarified. There is precedence for this kind of transmitter quality metric to be higher in MMF specifications than in SMF specifications.

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

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R** *TDECQ limit*

A TDECQ limit of 4.9 seems very high, given that the same fibres and transmitter, and receiver front-ends that should not be worse, can do 100GBASE-SR4 (PAM2, almost the same signalling rate) without the FFE. D.30 comment 119.
Also, it seems that the TDECQ spec limit can be "gamed" (D3.0 comment 116).

SuggestedRemedy

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

Response *Response Status* **U**

REJECT.

No specific change to document suggested.

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

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

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R** *TDECQ precursor taps*

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

SuggestedRemedy

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

Response *Response Status* **U**

REJECT.

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

The agreed resolution was to limit the main tap to tap 1, tap 2, or tap 3.
http://www.ieee802.org/3/cd/public/Mar18/dawe_3cd_01a_0318.pdf was reviewed by the Task Force.
There was no consensus to make the proposed change.

The resolution to i-117 was:

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

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

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R** *TDECQ precursor taps*

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

SuggestedRemedy

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

Response *Response Status* **U**

REJECT.

See response to comment r01-73.

[Editor's note added after comment resolution completed:

For reference, the response to comment r01-73 is copied here:

REJECT.

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

The agreed resolution was to limit the main tap to tap 1, tap 2, or tap 3.
http://www.ieee802.org/3/cd/public/Mar18/dawe_3cd_01a_0318.pdf was reviewed by the Task Force.
There was no consensus to make the proposed change.

The resolution to i-117 was:

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

]

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

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R** *TDECQ limit*

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.

Response *Response Status* **U**

REJECT.

No specific changes to the draft proposed.

See also response to comment r02-39.

[
Editor's note added after comment resolution completed.
For reference, the response to r02-39 is:
"REJECT.
No specific change to the draft proposed.
This is a duplicate of comment r01-69 against draft 3.1.
There is no support to consider one of the options from the remedy.
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_01_adhoc-v2.pdf
http://www.ieee802.org/3/cd/public/May18/king_3cd_03_0518.pdf"
]

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

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R** *TDECQ precursor taps*

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.

Response *Response Status* **U**

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.

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

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R** *TDECQ precursor taps*

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.

Response *Response Status* **U**

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 dispersion effects of the optical channel in combination with chirp may require the extra tap. No evidence has been provided to show otherwise.

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* **U**

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

Dawe, Piers J G — Mellanox Technologies

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* **138.7.1** *P* **270** *L* **22** # r03-27

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R** *TDECQ limit*

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* **138.8.5.1** *P* **274** *L* **1** # r03-31

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R** *TDECQ main tap magnitude*

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* **138.8.5.1** *P* **273** *L* **45** # r03-32

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R** *TDECQ precursor taps*

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

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R** *TDECQ precursor taps*

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 **138** *SC* **138.7.2** *P* **271** *L* **17** # r04-11

Dawe, Piers J G — Mellanox Technologies

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

Even after the recent improvement to the transmitter spec, the penalty after equalization but before modal noise, at 4.5 dB on top of the 4.8 dB PAM4 penalty = 9.3 dB, is far higher than for any other optical Ethernet PMD type. Tiny amounts of modal noise will cause an additional penalty, magnified up by the "Pcross effect". There is only 0.1 dB in the budget for both mode partition noise and modal noise, which is about the same as in 100GBASE-SR4 (max TDEC 4.3 dB << 9.3). This is too small unless these noises are much smaller this time. 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, D3.0 comment 116, D3.1 comment 71, D3.2 comment 46, D3.3 comment 26) 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. Limiting TDECQ-10log10(Ceq) helps, but more improvement is needed.

SuggestedRemedy

Reduce max TDECQ and max TDECQ-10log10(Ceq) from 4.5 dB to 4.2 dB,
Increase TDECQ-OMAouter min from -5.9 to -5.6 dBm,
and increase the allocation for mode partition noise and modal noise in the budget from 0.1 dB to 0.4 dB; and/or
Adjust the definition of TDECQ for MMF to take these noises into account.
The SECQ in SRS should be the combination of Tx TDECQ and these other penalties (still 4.5, so no change), and the SRS OMA should be the lowest OMA that can be received, not below (receiver should not be tested outside its operating range): change SRS OMA from -3.4 to -3.3 (but see another comment pointing out that the power levels have slipped and should be corrected).
The budget table stays the same.

Response *Response Status* **U**

REJECT.

Presentation <http://www.ieee802.org/3/cd/public/Sept18/dawe_3cd_01b_0918.pdf> was reviewed.

Previous analysis has shown that the penalty for modal noise is significantly less than 0.1 dB for NRZ. Insufficient evidence has been provided to show that the penalty is large enough to warrant a change to the link budget.

See the following for previous analysis:
http://www.ieee802.org/3/aq/public/nov04/pepeljugoski_1_1104.pdf

There was no support to make a change.

Also, see response to r04-12.

Cl **138** *SC* **138.7.1** *P* **270** *L* **22** # r04-12

Dawe, Piers J G — Mellanox Technologies

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

TDECQ limit of 4.5 dB (on top of the 4.8 dB PAM4 penalty), is extremely high. Technology that can do 100GBASE-SR4 (PAM2, almost the same signalling rate but no equalizer) should do better. 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. king_3cd_02a_0718 slide 12 showed a multi-peaked distribution including some "failing" transmitters. dawe_3cd_01b_0518 slide 8 showed one at 4 dB and a few significantly better. The high limit in the draft requires a better equalizer (e.g. more precise tap and threshold settings) than needed for the SMF PMDs, and we need some more room in the budget for modal noise. D.30 comment 119, D3.1 comment 70, D3.2 comment 40, D3.3 comment 27.

SuggestedRemedy

Change max TDECQ and max TDECQ-10log10(Ceq) from 4.5 to 4.2 dB. Increase OMAouter-TDECQ in step.

Response *Response Status* **U**

REJECT.

This comment is similar to R03-27.

100GBASE-SR4 does not include receiver equalization, whereas the 100GBASE-SR2 does; therefore the penalty for each cannot be easily compared.

PAM4 transmitters for MMF with measured TDECQ values up to 5 dB have been shown in 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 (slide 9), and in http://www.ieee802.org/3/cd/public/July18/king_3cd_02a_0718.pdf (slide 12) which supports the P802.3cd draft 3.4 TDECQ limit of 4.5 dB, taking account of product variability with larger sample sizes.

http://www.ieee802.org/3/cd/public/July18/king_3cd_02a_0718.pdf also shows receiver sensitivity vs estimated SECQ for values up to 4 dB with no indication of problems.

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

The URLs for the presentations cited by the commenter and not called out above are:
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_01_adhoc-v2.pdf
http://www.ieee802.org/3/cd/public/May18/dawe_3cd_01b_0518.pdf

Presentation <http://www.ieee802.org/3/cd/public/Sept18/dawe_3cd_01b_0918.pdf> was reviewed.

There was no support to make a change.

Cl **138** *SC* **138.8.5.1** *P* **276** *L* **29** # r04-13

Dawe, Piers J G — Mellanox Technologies

Comment Type **TR** *Comment Status* **R** *MMF TX*

Make the MMF spec more consistent with the SMF specs so that a common equalizer IC can be used for both. While SMF TDECQ is measured for both extremes of channel, MMF TDECQ is measured for the slow channel only. That's OK, we can read across to the other case we don't measure, but recognise that a signal after a slow channel will look less emphasised than what the receiver has to tolerate. The reference equalizer's largest magnitude tap coefficient (0.8 for a fast channel) should be set consistently (as from the same transmitter) for the slow channel. dawe_3cd_01b_0518 proposed 0.87. The survey results for MMF (green points, slide 8, dawe_3cd_01b_0518) are all to the right of +0.5 dB (or tap strength about 1.1). So we could tighten up more than this proposal, but this is consistent with the SMF specs and still allows a strongly over-emphasised transmitter. See presentation.
D3.3 comment 31.

SuggestedRemedy

In "the largest magnitude tap coefficient, which is constrained to be at least 0.8", change 0.8 to 0.85. The SMF clauses can stay with 0.8.

Response *Response Status* **U**

REJECT.

VCSEL measurements to date have shown slightly higher TDECQ penalties than SMF transmitters due to low bandwidth, and the use of peaking can help to improve yield and reduce cost especially at process, temperature, and voltage corners.

Increasing the minimum coefficient of the largest magnitude tap will reduce the flexibility for the transmitter design.

Presentation <http://www.ieee802.org/3/cd/public/Sept18/dawe_3cd_01b_0918.pdf> was reviewed.

No support to make a change.

Cl **138** *SC* **138.8.5.1** *P* **274** *L* **2** # r04-14

Dawe, Piers J G
Mellanox Technologies

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

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, D3.3 comment 32. A direct-mod transmitter is not naturally biased to postcursor, nor is the reference filter the transmitter is assessed with. The argument in the response to comment 32 was incorrect for MMF. We should not allow deliberately strange transmitted signals that cause an extra burden for low-power receivers.

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".
There is a separate comment for SMF because the different TDECQ limit, dispersion and TDECQ test method there could lead to a different conclusion.

Response *Response Status* **U**

REJECT.

This comment is similar to several earlier comments including r03-32.

The final response to r03-32 was:

"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 "

Presentation <http://www.ieee802.org/3/cd/public/Sept18/dawe_3cd_01b_0918.pdf> was reviewed.

Straw Poll #3
For 50GBASE-SR, 100GBASE-SR2, and 200GBASE-SR4, I support constraining the largest magnitude tap coefficient to Tap 1 or tap 2.
Yes: 2, No: 15

There is no consensus to make the change.

Cl **139** *SC* **139.7.5.4** *P* **299** *L* **5** # r04-16

Dawe, Piers J G — Mellanox Technologies

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

For some equalizer architectures, precursors are much more expensive than post-cursors (sun_3cd_042518_adhoc). 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. The maximum chromatic dispersion is 3.2 ps/nm for 50GBASE-FR and 16 ps/nm for 50GBASE-LR. Compare 10GBASE-LR which is allowed 48 ps/nm. Scaling for signalling rate gives 7.2 ps/nm, twice as much as 50GBASE-FR. 10GBASE-LR doesn't have a receive equalizer and is not seen as dispersion-challenged. This indicates that it is likely that 50GBASE-FR doesn't need a second precursor, even with a direct mod transmitter. Improving 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, D3.3 comment 37.

SuggestedRemedy

Continue the improvement made in king_3cd_03_0118, as done for 100GBASE-DR: change "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-FR, tap 1 or tap 2, has the largest magnitude tap coefficient, and for 50GBASE-LR, tap 1, tap 2, or tap 3, has the largest magnitude tap coefficient. This coefficient is constrained to be at least 0.8".
There is a separate comment for MMF because the different TDECQ limit, dispersion and TDECQ test method there could lead to a different conclusion.

Response *Response Status* **U**

REJECT.

This comment is similar to r03-47.

The final response to r03-47 is shown here for reference:

"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"

Presentation <http://www.ieee802.org/3/cd/public/Sept18/dawe_3cd_01b_0918.pdf> was reviewed.

There was no support to make the change.

Cl **138** *SC* **138.8.5** *P* **273** *L* **47** # r05-2

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

As noted in previous comments, the combination of all penalties for the MMF PMDs, which is much higher than for SMF, is too high. See
http://ieee802.org/3/cm/public/adhoc/dawe_3cm_adhoc_01_092718.pdf
Also the relation between measured TDECQ and penalties in service should be improved.

SuggestedRemedy

Insert:
Equation (138-1) is used in place of Equation (121-11).
R=sqrt(sigmaG^2 + sigmaS^2 - M^2) (138-1)
where M = 0.0075Pave
[Note to reader: Pave is already defined in 121.8.5.3]
In 138.8.10 Stressed receiver sensitivity, e.g. at page 275 line 46, insert:
the values of M in Equation (138-1) is set to zero, and

Response *Response Status* **U**

REJECT.

This comment is a restatement of previous comments (r04-11 and r04-12) that have already been recirculated.

The following presentations were presented to and discussed by the task force:
http://www.ieee802.org/3/cd/public/Oct18/king_3cd_01_1018.pdf
http://www.ieee802.org/3/cd/public/Oct18/dawe_3cd_01a_1018.pdf

There was no support other than from the commenter for adopting the newly proposed remedy to the draft.

The response to comment r04-11 was:
REJECT.
Presentation <http://www.ieee802.org/3/cd/public/Sept18/dawe_3cd_01b_0918.pdf> was reviewed.
Previous analysis has shown that the penalty for modal noise is significantly less than 0.1 dB for NRZ. Insufficient evidence has been provided to show that the penalty is large enough to warrant a change to the link budget.
See the following for previous analysis:
http://www.ieee802.org/3/aq/public/nov04/pepeljugoski_1_1104.pdf
There was no support to make a change.
Also, see response to r04-12.

The response to comment r04-12 (to which r04-11 refers) was:
REJECT.
This comment is similar to R03-27.
100GBASE-SR4 does not include receiver equalization, whereas the 100GBASE-SR2 does; therefore the penalty for each cannot be easily compared.
PAM4 transmitters for MMF with measured TDECQ values up to 5 dB have been shown in
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 (slide 9), and in
http://www.ieee802.org/3/cd/public/July18/king_3cd_02a_0718.pdf (slide 12)
which supports the P802.3cd draft 3.4 TDECQ limit of 4.5 dB, taking account of product variability with larger sample sizes.
http://www.ieee802.org/3/cd/public/July18/king_3cd_02a_0718.pdf also shows receiver sensitivity vs estimated SECQ for values up to 4 dB with no indication of problems.
The current TDECQ limit was arrived at as a compromise between transmitter and receiver capabilities.
The URLs for the presentations cited by the commenter and not called out above are:
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_01_adhoc-v2.pdf
http://www.ieee802.org/3/cd/public/May18/dawe_3cd_01b_0518.pdf
Presentation <http://www.ieee802.org/3/cd/public/Sept18/dawe_3cd_01b_0918.pdf> was reviewed.
There was no support to make a change.