

IEEE P802.3cd 50 Gb/s, 100 Gb/s, 200 Gb/s Ethernet 4th Sponsor recirculation ballot comments

Cl 138 SC 138.7.1 P272 L17 # 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 P273 L22 # 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/Jan18/king_3cd_02_0118.pdf)

[http://www.ieee802.org/3/cd/public/adhoc/archive/chang\\_011018\\_3cd\\_02\\_adhoc-v2.pdf](http://www.ieee802.org/3/cd/public/adhoc/archive/chang_011018_3cd_02_adhoc-v2.pdf)

Cl 138 SC 138.8.5.1 P276 L38 # 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](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](http://www.ieee802.org/3/cd/public/Jan18/king_3cd_03_0118.pdf) with editorial license

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Cl 139 SC 139.7.5.4 P301 L1 # 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](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](http://www.ieee802.org/3/cd/public/Jan18/king_3cd_03_0118.pdf) with editorial license

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Cl 138 SC 138.7.1 P270 L22 # 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/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/adhoc/archive/chang_011018_3cd_01_adhoc-v2.pdf)  
[http://www.ieee802.org/3/cd/public/May18/king\\_3cd\\_03\\_0518.pdf](http://www.ieee802.org/3/cd/public/May18/king_3cd_03_0518.pdf)

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CI 138 SC 138.8.5.1 P273 L41 # 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.

CI 139 SC 139.7.5.4 P298 L5 # 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 daw\_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.

CI 001 SC 1 P1 L1 # 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.

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Cl 138 SC 138.8.10 P275 L45 # 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 P270 L22 # 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 daw\_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/king_3cd_03_0518.pdf)  
[http://www.ieee802.org/3/cd/public/May18/dawe\\_3cd\\_01b\\_0518.pdf](http://www.ieee802.org/3/cd/public/May18/dawe_3cd_01b_0518.pdf)

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Cl 138 SC 138.8.5.1 P274 L1 # 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 than 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 P273 L45 # 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](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

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Cl 139 SC 139.7.5.4 P299 L5 # 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](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 P271 L17 # 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](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](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.

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Cl 138 SC 138.7.1 P270 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. daw\_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/king_3cd_03_0518.pdf), [http://www.ieee802.org/3/cd/public/May18/daw\\_3cd\\_01b\\_0518.pdf](http://www.ieee802.org/3/cd/public/May18/daw_3cd_01b_0518.pdf) (slide 9), and in [http://www.ieee802.org/3/cd/public/July18/king\\_3cd\\_02a\\_0718.pdf](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](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/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/adhoc/archive/chang_011018_3cd_01_adhoc-v2.pdf) [http://www.ieee802.org/3/cd/public/May18/daw\\_3cd\\_01b\\_0518.pdf](http://www.ieee802.org/3/cd/public/May18/daw_3cd_01b_0518.pdf)

Presentation <[http://www.ieee802.org/3/cd/public/Sept18/daw\\_3cd\\_01b\\_0918.pdf](http://www.ieee802.org/3/cd/public/Sept18/daw_3cd_01b_0918.pdf)> was reviewed.

There was no support to make a change.

Cl 138 SC 138.8.5.1 P276 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. daw\_3cd\_01b\_0518 proposed 0.87. The survey results for MMF (green points, slide 8, daw\_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/daw\\_3cd\\_01b\\_0918.pdf](http://www.ieee802.org/3/cd/public/Sept18/daw_3cd_01b_0918.pdf)> was reviewed.

No support to make a change.

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Cl 138 SC 138.8.5.1 P274 L2 # r04-14  
Dawe, Piers J G Mellanox Technologies

Yes: 1  
No: 16 "

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.

Presentation <[http://www.ieee802.org/3/cd/public/Sept18/dawe\\_3cd\\_01b\\_0918.pdf](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.

*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](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.



IEEE P802.3cd 50 Gb/s, 100 Gb/s, 200 Gb/s Ethernet 4th Sponsor recirculation ballot comments

CI 139 SC 139.7.5.4 P299 L5 # r04-16  
 Dawe, Piers J G Mellanox Technologies

[Http://www.ieee802.org/3/cd/public/July18/sun\\_3cd\\_01b\\_0718.pdf](http://www.ieee802.org/3/cd/public/July18/sun_3cd_01b_0718.pdf)

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 daw\_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.

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](http://www.ieee802.org/3/cd/public/Sept18/dawe_3cd_01b_0918.pdf)> was reviewed.

There was no support to make the change.

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.