*Cl* **83D** *SC* **83D.1** *P* **141** *L* **10** # 52

Ghiasi, Ali — Independent

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

We are moving toward 20 dB C2C application for CAUI-4 with DFE there is also need for low power on-board ASIC to PIC

*SuggestedRemedy*

Suggest preserving current chapter D as 10-12 dB C2C with CTLE only then add new chapter F for C2C with 20 dB based on DFE, I will provide more detail remedies in ghiasi_02_0114

*Response* *Response Status* **U**

REJECT.
Adding another chip-to-chip annex would complicate the standard, fragment the market and go beyond the approved objective of:
Define re-timed 4-lane 100G PMA to PMA electrical interface for chip to chip applications
The commenter is invited to provide evidence for the Broad Market Potential and Distinct Identity for two CAUI-4 chip-to-chip solutions.

[Editor's note: Subclause changed from 1 to 83D.1]

A straw poll of the Task Force was taken.
Do you support the addition of a second CAUI-4 chip-to-chip interface for a 10 dB channel?
Yes 2
No 6

*Cl* **83E** *SC* **83E.1** *P* **163** *L* **24** # 27

Slavick, Jeff — Avago Technologies

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

Figure 83E-1 is missing a layout that could exist.

100GPCS + PMA20:n ====> PMA n:20 + RS-FEC + PMA 20:4 ===> PMA 4:4 + PMD with the PMA n:20 and RS-FEC being conditional based on PHY TYPE.

In other words you could have a gearbox chip between the host that provides the CAUI-4_c2m on one end and a CAUI-10 or CAUI-4_c2c to the host. The missing configuration would be viable for all flavors of the PHY types listed.

*SuggestedRemedy*

Insert a 3rd stackup that includes an intermdiate PMA with optional RS-FEC.

*Response* *Response Status* **U**

REJECT.
The intent of this figure is to show example of use cases and are not intended to be exhaustive.

*Cl* **83E** *SC* **83E.3.1** *P* **166** *L* **33** # 160

Dawe, Piers — Mellanox

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

The host must provide the recommended CTLE peaking values, in case the module needs it (see other comments). Also, the recommended value must be not too far from the truth or the eye opening will collapse rapidly with CTLE tuning. There is more than one way to achieve this.

*SuggestedRemedy*

Add text: The recommended CTLE peaking value shall be within 1 dB of the optimum CTLE peaking value.

*Response* *Response Status* **U**

ACCEPT IN PRINCIPLE.
See comment 21 and latchman_01_120913_CAUI
The commenter is invited to provide measurement or simulation evidence to support the statement that "the recommended value must be not too far from the truth or the eye opening will collapse rapidly with CTLE tuning"

*Cl* **83E** *SC* **83E.3.3.3.1** *P* **175** *L* **46** # 132

Dawe, Piers Mellanox

*Comment Type* **ER** *Comment Status* **R**

This says "Pattern 4 (PRBS9) as defined in Table 86-11" yet Table 86-11 doesn't define it: it says "Pattern defined in 83.5.10", and 83.5.10 says "a PRBS9 pattern (as defined in Table 68-6)".
Likewise in 83E.3.1.6, "Patterns 3 and 5 are defined in Table 86-11.", but Table 86-11 says they are defined in 83.5.10 and 82.2.10 (and that's not right for RS-FEC encoded Pattern 5 anyway): 83.5.10 says PRBS31 is defined in 49.2.8. Don't waste the reader's time.

*SuggestedRemedy*

Change
Pattern 4 (PRBS9) as defined in Table 86-11
to
Pattern 4 (PRBS9) as defined in Table 68-6 (see Table 86-11)
8 times.
Change
Patterns 3 and 5 are defined in Table 86-11.
to
Patterns 3 is defined in 49.2.8, Pattern 5 is defined in 82.2.10, and RS-FEC encoded Pattern 5 is defined in 91.5.2 (see Table 86-11).
6 times.
It would be better to put an improved version of Table 86-11-Test patterns in Clause 80 and refer to it from bj and bm clauses.
In Table 95-9, change the right hand column from 83.5.10; 83.5.10; 83.5.10; 82.2.10a to 83.5.10; 49.2.8; Table 68-6; 82.2.10a.

*Response* *Response Status* **U**

REJECT.

Suggested remedy still points to Table 86-11. Additonal text doesn't simplify the document for the user.

*Cl* **95** *SC* **95.7.1** *P* **102** *L* **37** # 148

Dawe, Piers Mellanox

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

The minimum OMA of -7.1 dB is based on the 0.9 dB TDP in footnote b, which is the same as for 40GBASE-SR4, although the maximum TDP is different. However, because of the way TDP is defined, a very good 100GBASE-SR4 transmitter is most unlikely to have a TDP below 1.4 dB (see dawe_02_0913_optx.pdf). We should rule out cases that just won't happen in a compliant situation so that the spec can be used for diagnostics.

*SuggestedRemedy*

Change the 0.9 dB TDP in footnote b to at least 1.4 dB.
Change minimum OMA of -7.1 dB to at least -6.6 dB.
Make consequent changes in receiver specs.
Increase the minimum average powers by the same amount.

*Response* *Response Status* **U**

REJECT.
As shown in dawe_03_0114_optx fast risetime transmitters can have a TDP below 0.9 dB. Low TDP transmitters should not be burdened.

*Cl* **95** *SC* **95.7.1** *P* **102** *L* **41** # 13

Petrilla, John — Avago Technologies

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

After calculating TDP for multiple worst case transmitters, ones that provide minimally acceptable link margin, i.e. zero, the ability of TDP to predict link margin for MMF links does not appear adequate. Another metric, TxVEC, based on vetrical eye closure measured at the Tx output, TP2, should be used instead. See petrilla_01_0114 for more details. Adoption of this metric will improve the balance of test-escapes vs false-positives that exists with the TDP metric and removes the problems associated with a reference Tx that's required for the TDP metric. The set of Tx attributes captured by TDP are also captured by TxVEC.

*SuggestedRemedy*

In Table 95-6, replace TDP with TxVEC; 3 times including footnote b. For Launch power in OMA minus TDP (min), change -8 to -8.1. For Transmitter and dispersion penalty (TDP), each lane (max) change 5 to 5.1. In footnote b, there's no need to change 0.9 dB.

In Table 95-8, change 'Power budget (for max TDP)' to 'Power budget (for max TxVEC)' and change 'Allocation for penalties (for max TDP)' to 'Allocation for penalties (for max TxVEC)'.

In Table 95-10, change 'Transmitter and dispersion penalty (TDP)' to 'Transmitter and dispersion penalty (TxVEC)'

In 95.8.11 change TDP (occurs twice) to TxVEC

Replace the subclause 95.8.5 Transmitter and dispersion penalty (TDP) with a new subclause 95.8.5 Transmitter Vertical Eye Closure found in petrilla_01_0114.

If any of the above values are updated they will be found in petrilla_01_0114.

In 95.12.4.4 replace "Transmitter and dispersion penalty" with "Transmitter vertical eye closure"

*Response* *Response Status* **U**

REJECT.
TDP vs a VEC spec has been (and continues to be) reviewed in the MMF ad hoc, no agreement to change the current draft has been reached. The commenter is invited to try to generate a consensus concerning this proposed change in the MMF Ad Hoc.

See petrilla_01_0114.

*Cl* **95** *SC* **95.7.1** *P* **102** *L* **41** # 146

Dawe, Piers — Mellanox

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

The TDP limit is much too high: we will use the TDP as defined and measured, which is lower than that calculated in the spreadsheet model. TDP of 5 is near to a "cliff" (see dawe_01_0513_optx.pdf and presentation for January).
We need to allow 0.2 dB more in the budget for modal noise (see mmfadhoc/meetings/nov6_13/ModalNoiseIn100GBASE-SR4v3a_mmf.pdf ).

*SuggestedRemedy*

Change 5 dB to 4 dB TBC.
Consequent changes: change OMA-TDP from -8 dB to -7 dB TBC;
Change Average launch power, each lane (min)?
In receive specs, change Average receive power, each lane (min)?
In receive specs, change Stressed receiver sensitivity (OMA), each lane (max)?
In Table 95-8, 100GBASE-SR4 illustrative link power budget, change Power budget (for max TDP) from 8.2 dB to 7.4 dB TBC.
In Table 95-8, change Allocation for penalties (for max TDP) from 6.3 dB to 5.5 dB TBC.
Other consequent changes?
Revise the eye mask (see another comment).

*Response* *Response Status* **U**

REJECT.
TDP and modal noise specs have been (and continue to be) reviewed in the MMF ad hoc, no agreement to change the current draft has been reached. The commenter is invited to try to generate a consensus concerning this proposed change in the MMF Ad Hoc.

*Cl* **95** *SC* **95.7.2** *P* **103** *L* **27** # 155

Dawe, Piers — Mellanox

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

Are the J2 and J4 values correct?

*SuggestedRemedy*

Review them in light of changes to TDP and VECP.

*Response* *Response Status* **U**

REJECT.
No specific remedy proposed.

*Cl* **95** *SC* **95.7.2** *P* **103** *L* **41** # 45

Ghiasi, Ali — Independent

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

LRM introduced a flawed jitter tolerance methdology where you take credit for transmitter SJ which exist in real system with addition of other stress, but the receiver is only tested unstress SJ

*SuggestedRemedy*

Add note stress receiver sensitivity that it must be tested SJ as defined by the golden CRU with 10 MHz corner frequency see ghiasi_01_0114

*Response* *Response Status* **U**

REJECT.

[Editor's note: Subclause changed from 7.2 to 95.7.2]

Separating SRS and jitter tolerance tests is considered a test cost reduction without compromise to reliability. It is allowed in clause 86, and no issues have been reported.

A straw poll of the Task Force was taken:
Do you support removal of the separate Jitter Tolerance test and the addition of an SJ mask to the SRS test as per the suggested remedy?
Yes 1
No 6

*Cl* **95** *SC* **95.7.3** *P* **104** *L* **12** # 158

Dawe, Piers — Mellanox

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

With the change to allow a very low extinction ratio, we need to allow an additional 0.2 dB in the budget for modal noise (see mmfadhoc/meetings/nov6_13/ModalNoiseIn100GBASE-SR4v3a_mmf.pdf ), but the TDP limit should be reduced anyway.

*SuggestedRemedy*

See other comments and presentations.

*Response* *Response Status* **U**

REJECT.
Initial analysis by Petar Pepeljugoski in the MMF ad hoc meeting of Dec 19th was not agreed to support an increase in allocated penalty for the modal noise. Further study was recommended to determine if an increase was needed.

See MMF ad hoc minutes for Dec 19th 2013.

*Cl* **95** *SC* **95.8** *P* **104** *L* **28** # 18

Petrilla, John — Avago Technologies

*Comment Type* **ER** *Comment Status* **R**

Since it is not the intention to mandate specific tests and test methods but only to require specified results if tested according to the methods defined in the subclauses of 95.8, such a statement should be included in 95.8. There is such a statement in 95.8.1.1 but it may not be understood as applying to all tests and test methods.

*SuggestedRemedy*

Insert the following as the first sentences in 95.8, "The tests and test methods defined in the subclauses of 95.8 are not mandated to be applied to each 100GBASE-SR4 transmitter and receiver, rather only that the defined results are realized if tested according to the defined method. Alternative test methods that generate equivalent results may be used." If inserted the sentence, "Alternative test methods that generate equivalent results may be used.", may be deleted from 95.8.1.1.

*Response* *Response Status* **U**

REJECT.

Each sub-section of 95.8 already includes either a parameter definition, or a reference to the spec value 'if measured using .' and a reference to the test definition. If this is not the case, then the commenter is invited to make specific comments to that effect.

No tests are mandated, but compliance to the spec value, if using the specified test method, is.

Whereas bit error ratios are unambiguous, other parameters (eg ER) when measured with different test methods could result in different numerical values; this would make checking spec compliance very complex.

*Cl* **95** *SC* **95.8.1** *P* **105** *L* **18** # 151

Dawe, Piers — Mellanox

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

Table 95-10, Test-pattern definitions and related subclauses, has two rows for OMA:
Optical modulation amplitude (OMA) Square wave or 4 95.8.4; and
Calibration of OMA for receiver tests Square wave or 4 52.9.9.
95.8.4 says "OMA shall be as defined in 52.9.5 for measurement with a square wave (8 ones, 8 zeros) test pattern or 68.6.2.."; and
52.9.9.3 (part of 52.9.9) says "OMA is measured per the method in 52.9.5 using the square wave pattern."
So 95.8.4 is the preferred definition, and should be used for receiver tests as well as launch OMA.

*SuggestedRemedy*

In Table 95-10, Test-pattern definitions and related subclauses, delete the row "Calibration of OMA for receiver tests Square wave or 4 52.9.9" so that the earlier row "Optical modulation amplitude (OMA) Square wave or 4 95.8.4" applies.
In 95.8.8 a), insert as second sentence "Optical modulation amplitude (OMA) is defined in 95.8.4."

*Response* *Response Status* **U**

REJECT.
The section referenced is for further information on the relevant test (in this case calibration of the signal used to test SRS) so referenceing section 52.9.9 is probably more useful to the user.

*Cl* **95** *SC* **95.8.1.1** *P* **105** *L* **29** # 87

Ran, Adee — Intel

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

For the receiver tests, according to 52.9.9.1: The receiver of the system under test is tested for conformance by enabling the error counter on the receiving side.

For pattern 5 (RS-FEC encoded scrambled idle), the adequate error counters are in the RS-FEC sublayer, since errors are corrected before being delivered to the PCS. RS-FEC error counters are per lane so this allows lane-by-lane measurement just as in pattern 3. It can also work with any valid RS-FEC encoded 100GBASE-R signal.

It should be noted that the RS-FEC error counters count 10-bit symbol errors, while the specification in 95.1.1 is for bit errors. Since the counts are expected to be the same (assuming bit errors are independent), the per-lane symbol error counters should be used to measure the lane-by-lane BER.

It should also be noted that pattern 3 testing uses error counters at the PMA (85.3.10) - I couldn't find any reference to this in the text (receiver test methods refer to clause 52).

For the TDP test, using pattern 5 requires an error detector capable of decoding this pattern, which requires all lanes to be received in parallel. Assuming this is intended, it should be noted.

*SuggestedRemedy*

Change this paragraph to read:

Receiver BER measurements are performed on a lane-by-lane basis. Lanes can be stressed at the same time or separately. To find the interface BER, the BERs of all the lanes when stressed are averaged. All aggressor lanes are operated as specified.

If Pattern 3 is used, each lane can be tested separately, and BER is read from error counters at the PMA (85.3.10) when stress is applied. If Pattern 5 (RS-FEC encoded scrambled idle) or valid RS-FEC encoded 100GBASE-R signal is used, transmission is done on all lanes in parallel, and BER is read from the per-lane RS-FEC symbol error counters (91.6.10) when stress is applied. Bit error count is considered equal to RS-FEC symbol error count for the purpose of this measurement.

Add the following paragraph:

TDP measurement with Pattern 5 requires an error detector capable of receiving all lanes in parallel and decoding this pattern. To allow unstressed lanes for the error detector may be created by setting the power at the reference receivers well above their sensitivities, or by conveying the contents of the transmit lanes not under BER test to the error detector by other means.

*Response* *Response Status* **U**

REJECT.
A stand-alone pattern generator and error counter could be used, there is no need to

access the RS-FEC layer.

The specifics of how to measure BER for every possible measurement method and test pattern is beyond the scope of this document.

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*Cl* **95** *SC* **95.8.5** *P* **106** *L* **25** # 147

Dawe, Piers Mellanox

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

This says "VECP, as defined in Equation (52-4)", but that equation defines it as 10 log10(OMA/AO) where AO is the amplitude of the eye opening from the 99.95th percentile of the lower histogram to the 0.05th percentile of the upper histogram, and OMA is the normal amplitude without ISI, as shown in Figure 52-11.
There are two problems with this.
More importantly, in spite of its name, VECP isn't a true penalty: as defined in Eq 52-4 it's a good estimate for the penalty at BER=1e-12 but significantly in error for BER=1e-5. This introduces a large error into TDP (the difference between its VECP and its transmitter penalty at 5e-5). See presentation. Also it ruins the calibration of the stressed receiver sensitivity test in 95.8.8.
Also, Figure 52-11 doesn't define OMA. As 52.9.5 says, "A method of approximating OMA is shown in Figure 52-11."

*SuggestedRemedy*

Define VECP for this clause in a new subclause 95.8.5, as 10 log10(OMA/AO) where AO is the amplitude of the eye opening from the Xth percentile of the lower histogram to the 1-Xth percentile of the upper histogram, and OMA is as defined in 95.8.4.
Refer to this VECP from 95.8.5 Transmitter and dispersion penalty (TDP), and from 95.8.8 Stressed receiver sensitivity.
In Table 95-10, Test-pattern definitions and related subclauses, change the row:
Vertical eye closure penalty calibration 3 or 5 52.9.9
to
Vertical Eye Closure Penalty (VECP) 3 or 5 [new subclause] 95.8.5
(See presentation for X. Note the capitals because this phrase doesn't have the common English meaning of the words: it is not a true penalty. Alternatively we could create a new name e.g. VEC2.)

*Response* *Response Status* **U**

REJECT.

Further supporting material is requested, for task force review, to show that VECP as defined in Eqn 52-4 is a poor estimate of penalty at BER=1e-5, and to support a change of value for X (other than that implied by the current draft value of 0.05).
TDP vs a VEC spec has been (and continues to be) reviewed in the MMF ad hoc, and the resolution of that issue is likely to affect this issue.

Note: the commenter proposed X = 0.5% during the presentation of dawe_02a_0114_optx

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*Cl* **95** *SC* **95.8.7** *P* **107** *L* **7** # 157

Dawe, Piers Mellanox

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

A mask hit ratio limit of 5e-5 was found suitable for PMDs with spec BER of 1e-12. Therefore it would be remarkable if 5e-5 were the appropriate hit ratio limit for a BER of 5e-5. Improving this is expected to improve the correlation between the mask test and performance in the field, improve eye measurement accuracy and/or reduce test time (4x more interesting with 16-lane 400G!).

*SuggestedRemedy*

Optimise the mask hit ratio limit, make this, mask coordinates and TDP consistent.

*Response* *Response Status* **U**

REJECT.
No specific remedy proposed.

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*Cl* **95** *SC* **95.8.8** *P* **107** *L* **25** # 149

Dawe, Piers Mellanox

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

The high TDP, lower VECP and use of non-FEC VECP mean that there is a large (1+ dB!) discrepancy between the situation in the SRS test and in service. This must be closed.

*SuggestedRemedy*

See other comments for new TDP limit and new VECP definition.

*Response* *Response Status* **U**

ACCEPT IN PRINCIPLE.
No specific remedy proposed here.
See comment #14