3m No-FEC Proposal

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Changes for 01a

- Added Supporters page.
- Editorial changes to make clearer.

Supporters.

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Background.

- **There is strong industry interest in having a 3m no FEC specification to enable low latency, with multiple comments against draft 2.0 and presentations eg. goergen_3by_02a_0715, andrewartha_3by_adhoc_081215-v2.)**
  - General agreement that this needs to include QSFP to SFP cables and that 26AWG cables need to be possible. Some think QSFP to QSFP is also needed.
- **The COM Cable specification for no-FEC cables (CA-N) assumes 100GBASE-CR4 (Clause 92) worst case hosts. 3m cables cannot pass the existing CA-N COM specification.**
- **However practical tests have shown that 3m cables (CA-S) do work without FEC with 100GBASE-CR4 hosts with margin.**

How to explain that 3m cables work without FEC

- **There is little spare margin in the specifications as the existing host specifications are generally well aligned with the parameters in COM.**
  - Rx is very well aligned, because the Interference Tolerance test is calibrated with COM. No room for spare margin here.
  - Tx in COM is used to derive the specifications for the Tx. Further work (Mellitz _040815_25GE_adhoc) has shown some inconsistencies but they have a minor impact.
- **Conclusion - The hosts used for the tests must have spare margin to the spec.**
- **Question. Can we reduce that margin and still leave enough margin for temperature, manufacturing tolerances, test guard bands etc. and if so how.**

Changes to COM and implications

- **The key changes needed to allow 3m cables to pass the CA-N specification is to change the parameters in the COM table or the pass/fail criterion and change the cable loss and loss used in the interference tolerance test.**
- **Changes to the parameters in COM will have an impact on hosts and the host specifications will need to track them. Those affecting the host Rx are listed below.**

Changes to COM cable test		
Parameters affecting Rx only	**Effect on Rx.**	**Text Changes to specs on Rx.**
COM pass/fail level	More loss in Interference tolerance test.	COM calibration level change in Interference tolerance test.
CTLE range increase	More loss in Interference tolerance test.	match value in Inteference tolerance test calibration with that in cable COM
Rx host trace length reduction	More loss in Interference tolerance test.	match value in Inteference tolerance test calibration with that in cable COM
Changes to Rx package capacitors	More loss in Interference tolerance test.	match value in Inteference tolerance test calibration with that in cable COM.
Changes to Rx package trace length/impdedance	More loss in Interference tolerance test.	match value in Inteference tolerance test calibration with that in cable COM.
Change to poles/zero's in COM CTLE	More loss in Interference tolerance test.	match value in Inteference tolerance test calibration with that in cable COM
Changes to number of dfe taps	More loss in Interference tolerance test.	match value in Inteference tolerance test calibration with that in cable COM

Discussion of Rx changes.

- All the changes have basically the same affect on the Rx. There will be more loss in the interference tolerance test high loss case (and the noise level will be adjusted as necessary. However assuming the changes result in the same COM for the test cable the noise will be the same whatever we do).
- The host Rx implementation is not (and should not) be specified so it is at liberty to cope with this increased loss however it wants to. (eg even if we make the change as an increase in CTLE gain, the host Rx doesn't need to increase it's CTLE gain, it could use a better lower loss package, or add a low frequency CTLE, or any of the other changes or combinations instead.)
- <u>Conclusion:</u> It is not important how the Rx changes are obtained.

Tx changes to COM.

- **If the Tx parameters are changed in COM the test specifications for the Tx at TP2 need to change to match. (They don't quite at the moment and should be adjusted so that they do). The effects are listed below.**

Changes to COM cable test	
Parameters affecting Tx only	**Spec Changes for Tx at TP2**
TxSNR	Change TxSNDR.
Changes to Tx package capacitors	Change TxSNDR. Change ratio of Pmax/Vf. Potential change to return loss spec
Changes to Tx package trace length/impdedance	Change TxSNDR. Change ratio of Pmax/Vf. Potential change to return loss spec
Change Tx host trace length	Change TxSNDR. Change ratio of Pmax/Vf.
Change to amplitudes of victim and crosstalk aggressors	Change to Vf steady state output voltage, and possibly max differential output voltage.

Conclusions.

- **There doesn’t seem to be a lot available from changing Tx specifications. They should be adjusted to match the equivalent TP2 specifications however.**
- **The needed change for the Rx might as well be obtained by reducing the COM pass/fail criterion for high loss cables, and making minimal other changes. For the low loss test case the added noise could be huge for a low loss channel, and better equalizers won’t compensate for that. The COM specification for lower loss cables should therefore stay unchanged.**
- **<u>Summary of proposal.</u>**
  - No Changes to Tx
  - Tighten Rx specifications by requiring more loss in interference tolerance test
  - Relax CA-N specifications to enable 3m cables to pass with No-FEC, but note this specification is still significantly tighter than the existing CA-S specification.

Proposal for text changes for CA-N and no-FEC high loss (test 2) interference tolerance test.

- Change Max cable loss to 16dB (table 110-9). Change loss of the high loss test cable for interference tolerance test to 22.98 linearly scaling the “a” parameters. (a1 becomes 3.35, a2 becomes 0.45, a4 becomes 0.031
- Change the pass-fail criterion for the COM to 2dB for the cable with attenuation greater than 12dB and the high loss test (test 2). Leave the value at 3dB for the low loss test (test 1) and for cables with attenuation less than 12dB. (modifications to Table 110-10 and text above that table).
- Change the value of max Ctle used in COM to 16dB (adding this row to the COM tables, 110-7 and 110-10).
- Change the value of Tx SNR used in COM to 28.4dB. (adding this row to the COM tables, 110-7 and 110-10). (To align TxSNR with existing Tx TP2 TxSNDR spec.
- In section 110.10 change the CA-N max distance to 3m.
- Make the corresponding changes to table 110A-1 (For CA-N Ilcamax becomes 16dB and Ilchmax becomes 28.52dB

Resulting changes to CA-S and CA-L

- **If slide 10 is adopted then proposed other changes.**
  - Make no changes to CA-L to keep it identical to the specification for each lane of 100GBASE-CR4
  - Use the improvements in the Rx that are required by the changes to the no-FEC option to extend the maximum reach to 4m when BASE-R FEC is used (and enable the use of thinner lower cost cables for 3m when BASE-R FEC is used).

Proposal for text changes to CA-S and BASE-R FEC interference tolerance test

- Change Max cable loss to 19.5dB (table 110-9). Change loss of the high loss test cable for interference tolerance test to 26.46 linearly scaling the “a” parameters. (a1 becomes 3.86, a2 becomes 0.52, a4 becomes 0.034
- Change the pass-fail criterion for the COM to 2dB for the cable with attenuation greater than 15.5dB and the high loss test (test 2). Leave the value at 3dB for cables with attenuation less than 15.5dB and for the low loss test (test 1)
- Change the value of max Ctle used in COM to 16dB (adding this row to the COM tables, 110-6 and 110-10).
- Change the value of Tx SNR used in COM to 28.4dB. (adding this row to the COM tables, 110-6 and 110-10).
- In section 110.10 change the CA-S max distance to 4m.
- Make the corresponding changes to table 110A-1 (For CA-S Ilcamax becomes 19.5dB and Ilchmax becomes 31.02dB