Simplified Transmitter Functional Test proposal.

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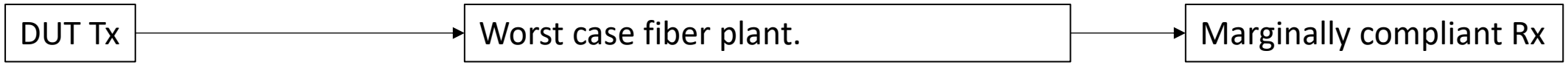
In support of 802.3dj comments 448 and 450 against draft D2.1

Introduction

- A Transmitter Functional test was incorporated in draft 2.1 of 802.3dj
- Further work has progressed on this resulting in the presentation Cole_3dj_01_adhoc_250908 which also proposes over fiber tests.
- This presentation takes a step back and proposes a simplified test. It leverages work and nomenclature from Cole_3dj_01_adhoc_250908
- It is in support of comments 448 and 450 against draft 2.1
- The presentation has been modified based on discussions on the Sept 8 Ad Hoc meeting but the proposal is essentially the same.

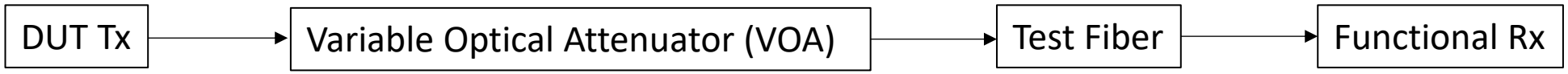
Purpose of test and Test block diagram

- The purpose of the test is to demonstrate that a Tx will be inter-operable with a worst case fiber plant and Rx.
- What we would really like



Worst case chromatic dispersion
Worst case MPI
Worst case DGD.
Maximum attenuation

- What we can have



Comments on Worst case Fiber plant and functional receiver.

- The worst case chromatic dispersion depends on the center wavelength of the DUT, and its chirp and other characteristics. To cover all the possibilities 3 test cases should be used. A fiber with maximum positive dispersion, a fiber with minimum negative dispersion and no fiber (just the same test cases as are used for the combination of TDECQ and TECQ and using the same fibers as are used for those tests). (Note that if dispersion is known not to be an issue (i.e. TDECQ=TECQ) then only the no-fiber test is needed, or if it is know that one of the test cases always gives the worst test result then only that case needs to be tested.)
- MPI and DGD are best handled the same way they are in the link power budget by assuming they are equivalent to additional loss in the system.
  - Note the MPI of the link will depend on the functional receiver return loss as well as the fiber performance (as well as the DUT return loss). If any attempt were made to adjust for the test fibers reflections as is suggested in Cole_3dj_01_adhoc_250908 it would have to be done for the combination of fiber and functional receiver. It is also expected to be a small amount in the test as the penalty is less than 0.1dB for 4 connectors at better than 45dB reflection (and with a 26dB reflectance in the Rx).
  - DGD penalty of the test fiber is very difficult to measure. The max penalty allowance in the specs is only 0.2dB except for the 10km link where 0.7dB is allocated. For the 10km link it may be worth considering allowing some compensation for this.
- The functional receiver is as is described in D2.1 and Cole_3dj_01_adhoc_250908.
- The pass/fail criterion is as described in Cole_3dj_01_adhoc_250908

Variable Optical Attenuator attenuation value.

- The attenuation of the variable optical attenuator (VOA) is given by the same equation for all clauses

  VOA_level = Test_SMF_correction + RxS_TECQ_correction - Test_margin

Where

- *Test_SMF_correction = Channel_insertion_loss (from spec)*
  + MPI+DGD_penalty_allocation (from spec)
  - Loss of test fiber used in the test.

- *RxS_TECQ_correction = RxS_OMA(max) (@DUT_TECQ) (from spec) - ORx_RxS (@DUT_TECQ).*

- *Test Margin is as described in Cole_3dj_01_adhoc_250908*

Advantages of this simplified test.

- No changes to the test set-up are required based on the DUT's TDECQ, ER, OMA etc.
- The Test description is much simpler.
- The DUT gets credit for the extra OMA (TDECQ-TECQ) it has on the no fiber case. (It will get this advantage in the real system when operating over low fiber dispersion). A similar advantage occurs when TDECQ is based on positive dispersion fiber and the test is with the negative dispersion fiber (or Vice Versa).
- It guarantees system inter-operability with any compliant receiver that has equalization capabilities equivalent to the functional receiver. (same restriction as in Cole_3dj_01_adhoc_250908)
- Any Tx that passes the other Tx tests should pass this test unless it has correlated error problems.

Additional possible simplification.

- The only VOA setting dependency on the DUT performance is in the *RxS_TECQ_correction* where the correction is determined at the DUT-TECQ value. If the sensitivity versus TECQ slope = 1 this correction would be a number based on the functional Rx sensitivity but independent of DUT-TECQ.
- This sensitivity versus TECQ slope is expected to vary depending on what degradations are creating higher TECQ.
  - Additional noise is expected to have a slope of 1
  - Non-equalizable ISI and distortion is expected to have a slope of 1
  - Bandwidth restriction had a lower slope than 1 before the DFE was added in the reference equalizer (because real receivers included the DFE), but Benefit of Adding DFE to TDECQ (ghiasi_3dj_04c_2507.pdf) shows that the slope is now closer to 1.

• Proposal

Change to

RxS_TECQ_correction = RxS_OMA(max) (@1.2dB TECQ) (from spec) - ORx_RxS (@1.2dB TECQ).

Detailed changes.

- On page 464 line 28. add the following. A transmitter is to be compliant for three dispersion cases between the transmitter and the functional receiver; with a total dispersion at least as negative as the “minimum dispersion” specified in Table 180–16 for the wavelength of the transmitter lane under test; at least as positive as the “maximum dispersion” columns specified in Table 180–16 for the wavelength of the transmitter lane under test; and with little dispersion. This may be achieved by adding channels consisting of fibers with lengths chosen to meet the dispersion requirements
- On page 465 line 20 Change “which is set to achieve functional receiver (FRx) OMA as defined in Equation (180–1). “ to “which is set to a value VOA_level as defined in Equation (180–1).
- Change Equation (180-1) to *VOA_level = Test_SMF_correction + RxS_TECQ_correction - Test_margin*
- *Add the following to the “where” list*

Test_SMF_correction = Channel_insertion_loss as given in Table 180-12 for zero discrete reflectances above -55dB.

+ MPI+DGD_penalty_allocation as given in Table 180-9

- Loss of the dispersion channel used in the test.