Transmitter and SRS test source metrics

P802.3bs SMF ad hoc

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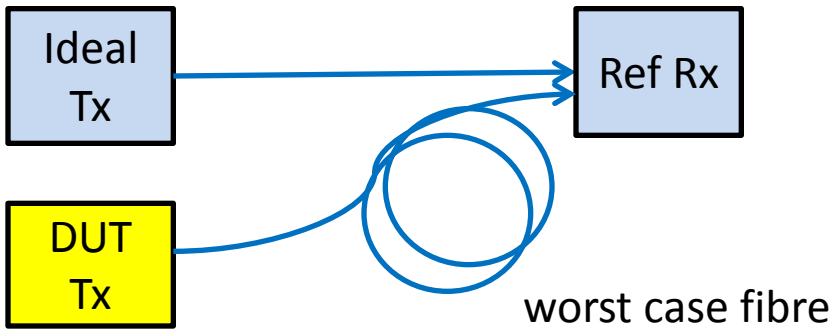
Tx eye quality and SRS test source metrics

Link budgets close provided:

- the Tx eye quality measurement and the SRS test source calibration measurement use equivalent methods
  - for example, 100GBASE-SR4
- and (ideally) the source metric yields a dB value which correlates with the system penalty of an imperfect Tx.
  - i.e. it should measure the difference between the measured sensitivity of an ideal reference Rx with a perfect Tx, and a DUT Tx with 'real' data (e.g. PRBS31 or equivalent), as measured over a worst case fibre link at the target BER.

TDP for LR

- For LR, 10G and 25G/lane NRZ , TDP is BER measurement based



What's new now

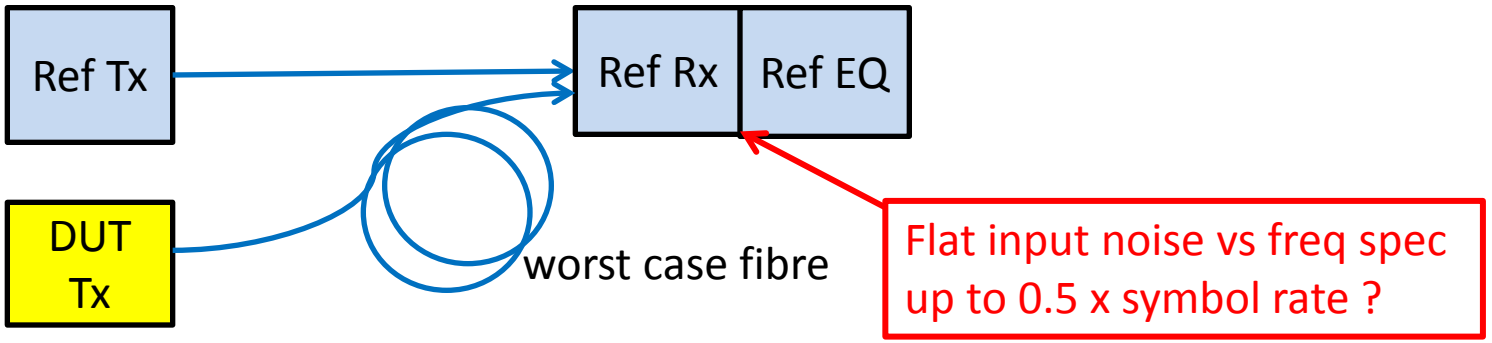
- PAM4 modulation
  - Tx and Rx likely to use equalization
  - Multiple eye openings to track
  - Eyes don't have to be open for link to close
- Suggests
  - Eye mask test no longer straightforward
    - limited value in measuring closed eyes
  - Tx quality metric should include Ref Rx and Ref EQ
    - most repeatable in software
    - hardware Rx and Eq capture long pattern effects and allow a BER test.

Options for 50G PAM4 Tx quality

	Description	Needs
'TDP'	BER measurement based DUT Tx (PRBS31) + worst case fibre H/W reference Rx and EQ	Worst case fibre for LR H/W reference Rx + EQ Reference Tx
'Soft TDP'	'Scope pattern capture + post process DUT Tx (SSPR, other ?) + worst case fibre S/W reference Rx and EQ.	Oscilloscope Worst case fibre for LR O/E (with linearity spec) Software Ref Rx + EQ Noise spec on DUT Tx
'TDEC'	'Scope eye capture + post process H/W reference Rx and EQ DUT Tx (PRBS31) and worst case fibre Post process to extract eye closure penalty	Oscilloscope Worst case fibre for LR H/W reference Rx + EQ Software

TDP for PAM4 LR, LR8

- Transmitter metric: BER measurement based with worst case chromatic dispersion fibre, reference Rx and Reference EQ.
  - Reference Tx could be an NRZ source at the same symbol rate



- SRS test source metric: BER measurement based (but without worst case fibre), using reference Rx and reference EQ; DUT Tx and fibre is replaced by the SRS test source.

Consequences of using TDP measurement

- Reference Tx needed to baseline TDP measurements:
  - Simplest practical ref Tx is an NRZ transmitter at the same symbol rate
    - since the ideal PAM4 modulation penalty is known
    - but reference receiver linearity must be constrained
  - For a standard
    - preferably define an NRZ ref Tx and ensure reference receiver linearity penalty is negligible
    - alternative is to use an ideal PAM4 transmitter as the reference
- Outer eye OMA can be used as a signal strength metric
- Some parameters would not need explicit specs
  - Tx RIN, ER, inner eye OMA
  - the effect of these would be captured in the TDP measured

Summary

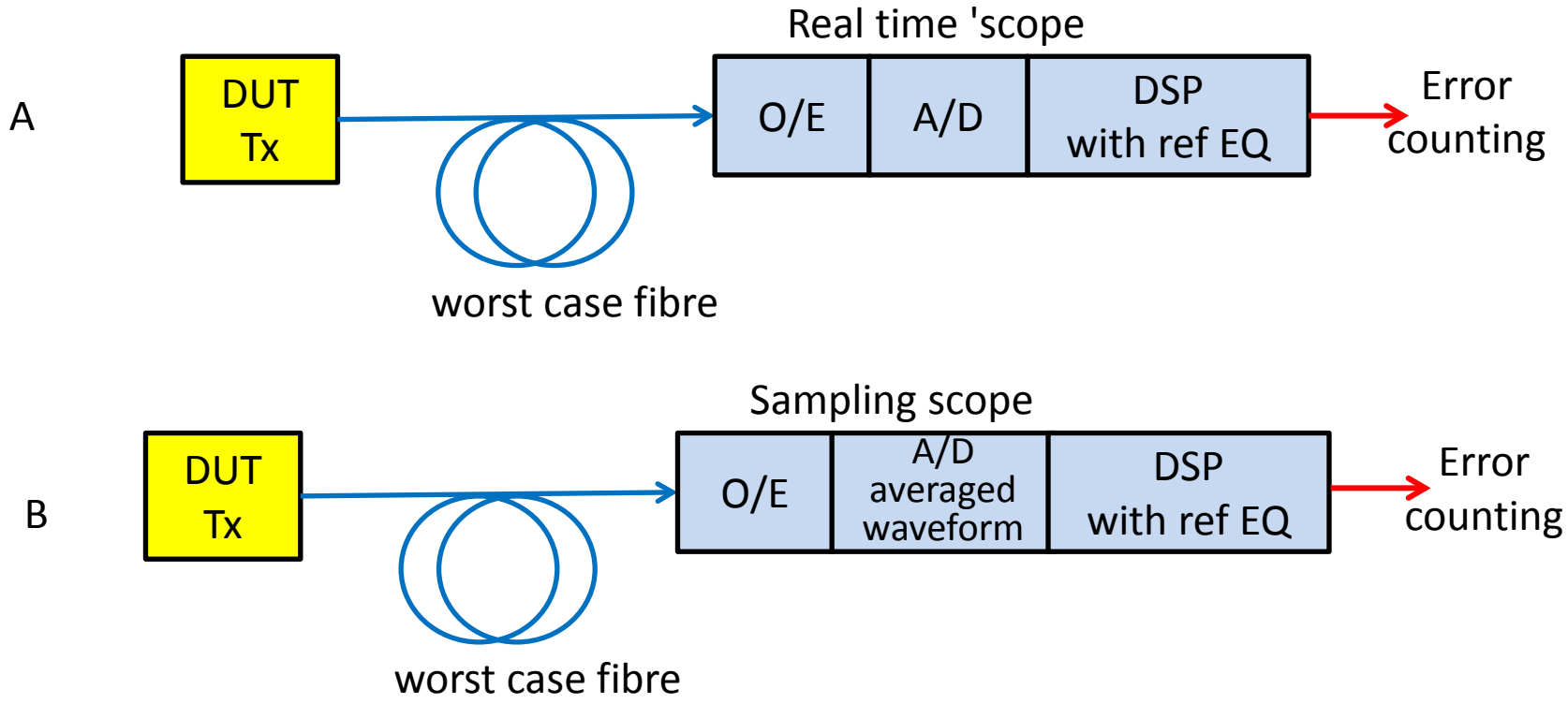
- Transmitter and SRS test source metrics based on a TDP measurement would allow several Tx parameters to be captured in the TDP value
  - should allow the largest design/implementation space for PAM4 transmitters
- The TDP test should include a reference receiver and reference equalizer
  - eg 0.8 x symbol rate and 5 T/2 tap FFE.

- Many details to be worked out….

Back up

'Scope based alternative TDP tests

- Hardware options



- Option A is the equivalent of a real -time BER test, but might be too capital intensive for production testing.
- Option B needs a RIN spec on Tx, and an additional test to ensure that low probability events (which might cause error floors) are not being averaged out. Could be simple Tx – Rx BER test
  - E.g. laser mode -hops, or other low probability timing or amplitude instabilities.