Finisar

Fiber Optic Solutions
for High-Speed Networks

802.3ba 40GE/100GE SMF SRS Test Proposal

IEEE 802.3ba Task Force

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Outline

- Background of SRS test definition problem
- SRS test alternatives
- SRS test proposal
- Practical SRS test example

Background of SRS test definition problem

- At the last 802.3ba meeting, during resolution of comments 614 and 615 (40GE and 100GE SMF Stressed Receiver Sensitivity (SRS) tests) Jeff Maki and others commented that the method referenced from LX4 is rarely if ever used by module manufacturers or users.
- Jeff suggested that 802.3ba should define a receiver sensitivity test that is practical and more likely to be used.
- Such test should be entirely described within 802.3ba, rather than scattered and with a long list of exceptions as in the current draft.
- The encouragement from the meeting was to form an open group of experts who would define a new SRS test, translate it into text which could then be directly dropped into clauses 87 and 88, discuss it at this 802.3ba meeting, and request Task Force approval.
- An email discussion was started after the meeting, among interested module, system and IC suppliers to discuss SRS test alternatives.
- The following pages summarize the proposed new SRS test.
- Jonathan King has drafted language for clauses 87 and 88, which formally captures the informal description in this presentation.

Email Discussion Participants

- Participants who contributed to this presentation
  - Listed on the title page
- Participants who have confirmed their support of this presentation
  - Patrick Drolet – Exfo
  - Jörg-Peter Elbers – Adva
  - John French – JDSU
  - Atul Gupta – Inphi
  - Kiyo Hiramoto – Opnext
  - Francis Ho – Inphi
  - Sergio Prestipino – Exfo
  - Joey Thompson – JDSU
  - Eddie Tsumura – Sumitomo
  - Li Zeng – Huawei
- Participants who have not confirmed their support of this presentation
  - John D'Ambrosia – Force10
  - Alessandro Cavaciuti – Cisco
  - Carlo Mariotti – Cisco
  - Gary Nicholl – Cisco
  - John Petrilla – Avago
  - Dan Rausch – Avago
  - Andre Szczepanek
  - Matt Traverso – Opnext
  - Steve Trowbridge – ALU

802.3ba 40GE/100GE SMF SRS Test Alternatives

1. Existing LX4 'black box' methodology
   - 802.3ae definition with 802.3ba optical specifications
   - Meets standards methodology criteria
   - Not rigorous; could test the module below specification limits
   - Not used in practice because of expense
2. Modified LX4 'black box' methodology
   - 802.3ae definition but with all input signals tuned to worst case wavelength in each band to maximize crosstalk penalties
     - Tune channel under test wavelength to max receive insertion loss and tune each interferer wavelength to max crosstalk (instead of 802.3ae specified band edge)
     - Measure SRS with 802.3ba optical specifications
   - Meets standards methodology criteria
   - Rigorous; tests the module at specification limits
   - Not likely to be used in practice because of expense

802.3ba 40GE/100GE SMF SRS Test Alternatives

3. New ‘black box’ methodology
   - Use a tunable laser ‘interferer’ to sweep all bands
   - Measure required OMA to achieve a given crosstalk penalty
   - Calculate effective interferer crosstalk power for each channel
   - Measure SRS using 802.3ba specifications
   - Overstresses module resulting in excess penalty
   - Rigorous; tests the module beyond specification limits
   - Not likely to be used in practice because of expense

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4. New practical methodology
   - Test each channel in turn using a stressed eye for the channel under test, and unstressed for the interferer channels, all at nominal wavelengths
   - Increase the OMA of the interferer channels to account for finite channel isolation between channels
     - Set the interferer channels to a relative OMA above the channel under test by max OMA delta between channels, plus max insertion loss variation in the channel under test, plus max variation in optical isolation of each interferer channel.
   - Measure the module's de-multiplexing characteristics using tunable laser to sweep all bands, and measure insertion loss and optical isolation for all channels using internal module receive optical readout (RSSI)
   - Alternately, directly measure optical properties of components
   - Overstresses module (modestly for modules with low in-band ripple and high channel-to-channel isolation)

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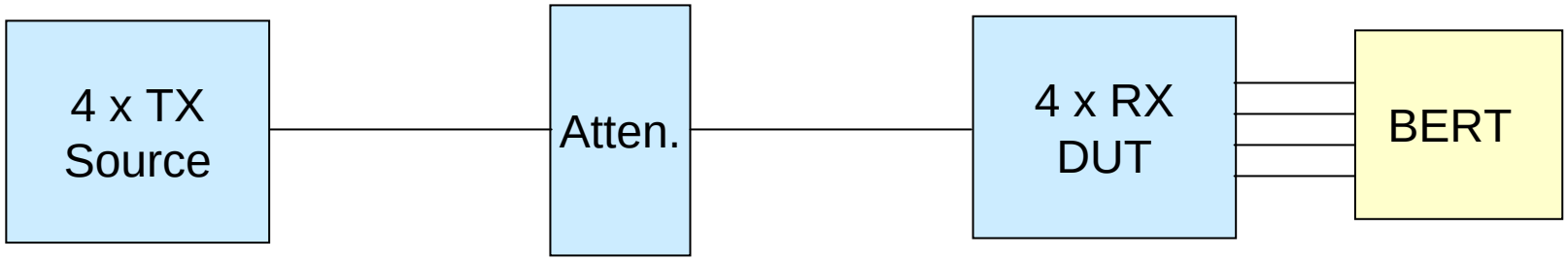
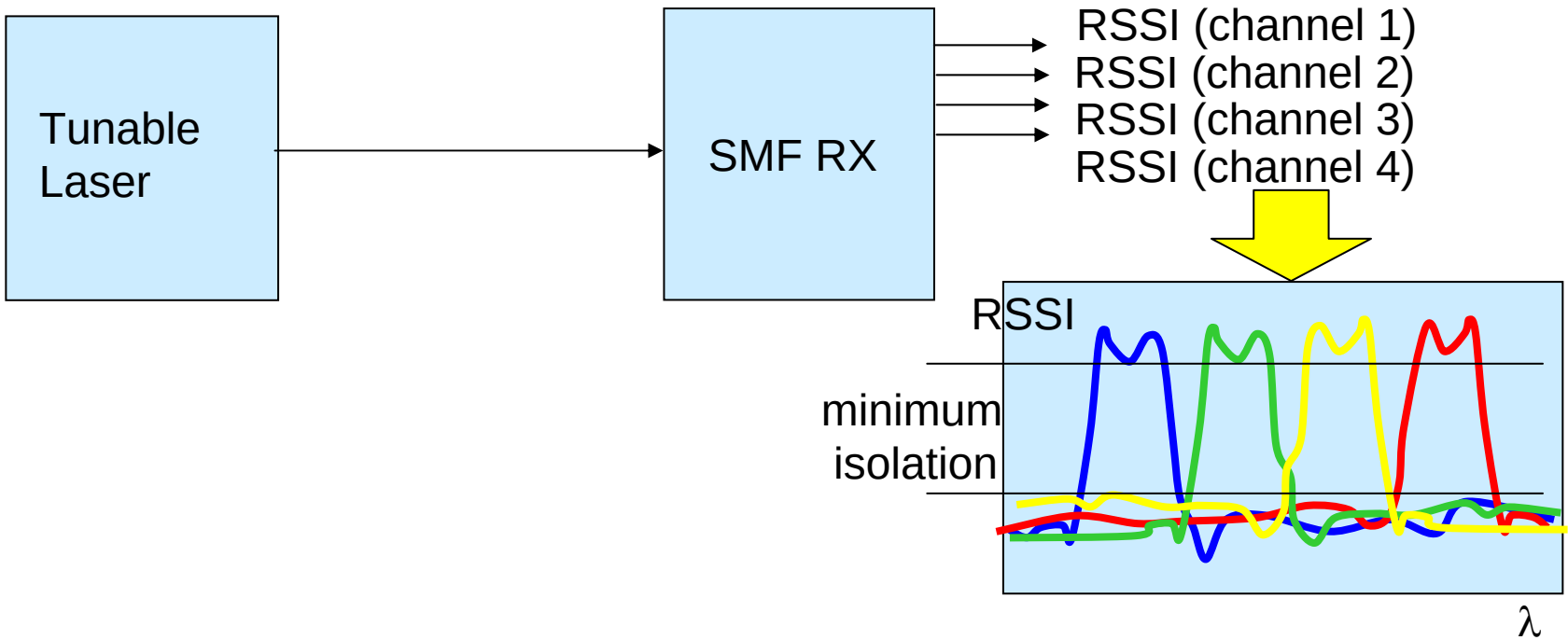
- Define a SRS test, using 802.3ae LX4 stress methodology and a rigorous measurement methodology which tunes all channels to worst case wavelengths (SRS test alternative 2).
- Recognize that this is an expensive measurement methodology which is unlikely to be used in practice, and is primarily a SRS test “gold standard” for comparison against other more practical methods.
- Define an alternative SRS test (SRS test alternative 4), which uses practical measurement methodologies and can be used instead of the above SRS test.
- Give examples of practical measurement methodologies.
- Recognize that there are other acceptable practical measurement methodologies, which are not given as examples.

Practical SRS Test Definition



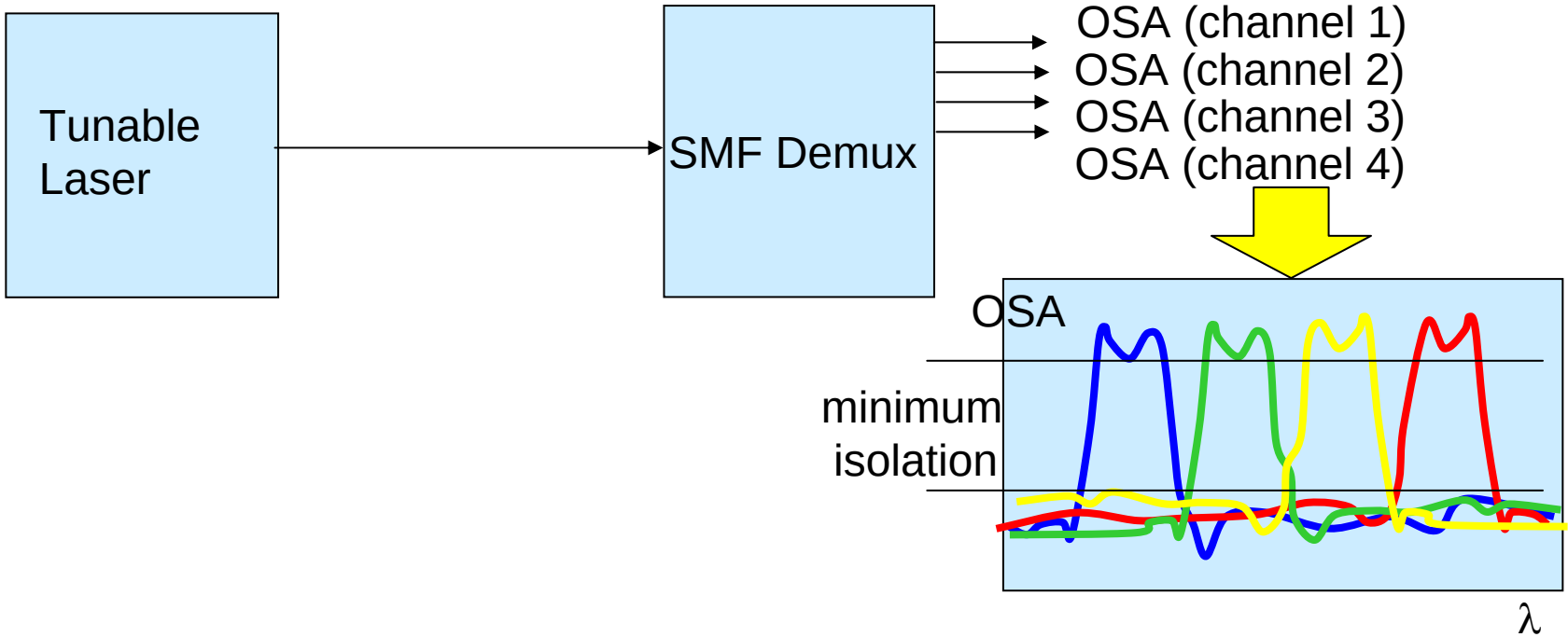
- Stress the TX channel driving RX DUT channel using LX4 methodology but at nominal wavelength, while the other three (interferer) TX channels are unstressed and also at nominal wavelength (with no requirement for tunable lasers.)
- Determine max RX DUT channel isolation loss plus max RX interferer channel isolation variation to obtain interferer power correction factor, using one of the two measurement options on the following two pages.
- Set TX channel driving RX DUT channel to min OMA, while setting other (interferer) TX channels to min OMA plus max OMA delta plus interferer power correction factor.

Optical Isolation Measurement Example 1



- Tunable laser + module RSSI readout optical isolation measurement
  - Measure minimum isolation for all channels
  - Determine max insertion loss variation adder
- Other module optical isolation measurements can be used to determine max insertion loss variation adder

Optical Isolation Measurement Example 2



- Tunable laser + OSA readout optical isolation measurement
  - Measure minimum isolation for all channels
  - Determine max insertion loss variation adder
  - Justify methodology 'by design' of the module (ex. discrete RXs)
- Other component optical isolation measurements can be used to determine max insertion loss variation adder