Observation bandwidth

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Introduction

- CI 92 SC 92.8.3 P 194 L 41   Comment 130   Comment Type TR

- Following up on D2.0 comment 240: inconsistency between S-parameter frequency range and waveform measurement frequency range. Response says "The capability of an instrument to measure higher frequencies is not a justification to specify them." Adding to that, the cost and increased noise of measuring them is a justification to NOT specify them. Notice that in 92.10.11 Cable assembly integrated crosstalk noise (ICN), the 3 dB reference receiver bandwidth is set to 18.75 GHz.

- Suggested Remedy

- In clauses 92 and 93, Reduce the observation bandwidth for waveforms, jitter and similar from 33 GHz to between 18.75 GHz and 25 GHz TBD (e.g. 19.34).

- Make an exception for transition time.

- Alternatively, increase the S-parameter frequency range to the signalling rate, as OIF does.

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- This presentation is intended to collect relevant information for deciding what the best course of action is.

- A related but much more specific comment:

- CI 92 SC 92.10.11 P 216 L 9   Comment 143   Comment Type T
- This has a 3 dB reference receiver bandwidth of 18.75 GHz (scaled from Clause 85). But 3/4 of signalling rate would be 19.34 GHz.
- Suggested Remedy
- Consider if the reference receiver bandwidth should be 19.34 GHz.
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Status in 802.3bj

- In 802.3bj, waveforms are observed through a 33 GHz fourth order Bessel-Thomson response...
  - For 100GBASE-KR4 and 100GBASE-CR4. It's **?** GHz for 100GBASE-KP4
  - Bandwidth/signalling rate = 1.28. Similar to 40GBASE-CR4: DDJ measured in "at least 12 GHz" and nPPI: "waveform is observed through a 12 GHz low-pass filter response (such as a Bessel-Thomson response)." Bandwidth/signalling rate = 1.16
- and one of three "test fixtures"
  - Combined bandwidths are ...
- For ICN purposes, the reference receiver is an 18.75 GHz fourth order Butterworth filter
  - The reference transmitter is a 24.64 GHz second order Butterworth filter:
  - *Tnt fnt* = 0.2365 *Tnt* = 9.6 ps
- S-parameters are defined including one of three "test fixtures"
  - S-parameter specifications for transmitters, receivers and cables stop at 19 GHz
    - 40GBASE-CR4: 10 GHz. nPPI: 11.1 GHz
  - S-parameter specifications for test fixtures stop at 25 GHz
    - 40GBASE-CR4: 10 GHz. nPPI: 11.1 GHz

- By comparison, optical waveforms are measured in a fourth order Bessel-Thomson response, bandwidth 0.75 × signalling rate, or 7.5 GHz for 10G signals (19.34 GHz for 100 Gb/s / 4-lane signals)

Assumptions in COM

- COM includes a package model that filters the signal significantly

- At present there is no internal transmitter filter
- The receiver filter is a fourth order Butterworth filter, bandwidth 0.75 × signalling rate
- The receiver also has a continuous time (peaking) filter with poles at the signalling frequency (25.78125 or 13.59375 GHz) and 1/4 of that (e.g. 6.4453125 GHz) and an adjustable zero (see 93A.1.4.3)

- Cl 93 SC 93.8.1.1 P L   Comment 133   Comment Type TR
- The compliance boards in SFP+, Annex 86A (nPPI), InfiniBand FDR and Clause 92 each have a defined reference insertion loss curve. A user has an actual compliance board with a similar but not identical loss. For S-parameter measurements, he can de-embed his actual loss and re-embed the reference loss and get an accurate result. The documents also give a loss range, defining what is a good-enough pair of compliance boards. The ideal (reference) compliance board does not have intentional reflections.
- Clause 93's test fixtures are defined differently. There is a range of losses, and only at one frequency. Some ILD and reflections are allowed.
- A user with an actual compliance board can de-embed his actual loss, but has to re-embed a loosely specified loss, an ILD, and the reflections of Eq 93-1. Depending what he is measuring, he needs to re-embed the least or the most loss, ILD and/or reflections. He has to do the work at least twice over, possibly more times depending how many corners are relevant. Both in design/simulation and in measurement. The allowed test fixture variability leaks into measurement results unless everyone agrees which corners are relevant for which measurements (e.g. least insertion loss, most return loss of the test fixture for measuring product return loss, most loss for linear fit pulse peak, and so on).
- Suggested Remedy
- Use the range of losses, ILD and return loss as guidance for an adequate test fixture. But define the REFERENCE (ideal) test fixture with a specific insertion loss (preferably with an equation) and without deliberate ILD or return loss, as the other specs that use compliance boards do.
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