SAS-2 Physical Layer Specification Compliance Method

Yuriy Greshishchev

www.pmc-sierra.com

T10/06-065r0

Introduction

- **This contribution compares compliance methods for Gigabit-range interfaces and suggests *a method*, which originates to OIF CEI-02.0 6G-LR, were both Tx and Rx equalizer functions are normative. A compliance channel then is defined as any channel which results in normative Rx eye after equalization**

- **In CEI-02.0 agreement, Statistical Eye methodology aims to evaluate, if channel yields normative Rx eye. Applicability of that particular method to SAS-2 is beyond the scope of this contribution. One can always assume that eye diagram simulations in time domain serve the purpose**

Rx compliance methods

- ***Normative Pass/Fail Test Setup*** for the Rx. Compliant Rx is the one which passes "Rx tolerance test"

    - Define normative test conditions. May define compliance channel(s)

    - Pros: Rx equalization scheme is open for competition

    - Cons: One test does not cover all practical cases. Potential interoperability problem

- ***Normative*** **Rx** ***functionality***

    - Define normative Rx equalizer functionality. It limits maximum ISI to equalize in a mixture with crosstalk noise

    - Pros: eliminates an interoperability problem with infinite number of worst case practical channels

    - Cons: the RX equalizer architecture is less open for competition

Compliance Methods

Standard	Compliant Tx	Compliant Channel	Compliant Rx
XAUI, FC-PI-2, SAS-1.1, PCIe-1, 2, XFI	Norm Eye	Compliance Channel, TCTF, Inner/Outer eye ratio	Norm Eye Rx Tol test (Does not specify Rx equalizer)
OIF CEI-02.0	Norm Eye, Equalizer	Compliant Channel must yield Rx Norm Eye	Norm Eye, Equalizer
10G BASE KR	Norm Eye, Equalizer	Informative Channel	Interference Tolerance test

• Compliance channel make sense if it defines "worst case" real channel (lower Gb range, low reflections, homogeneous interconnect)
• In practice, infinite number of channels exists that may create worst conditions at Rx. Theoretically impossible to define compliance test for Rx. This is why Rx normative equalizer is more practical

SAS-2 compliance method proposal

- Tx with Normative Equalizer
  - For instance, fixed M-dB pre-emphasis
- Rx with Normative Equalizer
  - For instance, N-tap DFE
  - An equivalent to normative is possible, however at expense of signal/noise performance
- Compliant channel: any channel which yields normative Rx eye
  - Common agreement on "normative methodology" how to analyze the channel (similar to Stat Eye) is helpful, but not an absolute requirement for the method itself

Compliant Channel Boundaries (CR/CR points example)
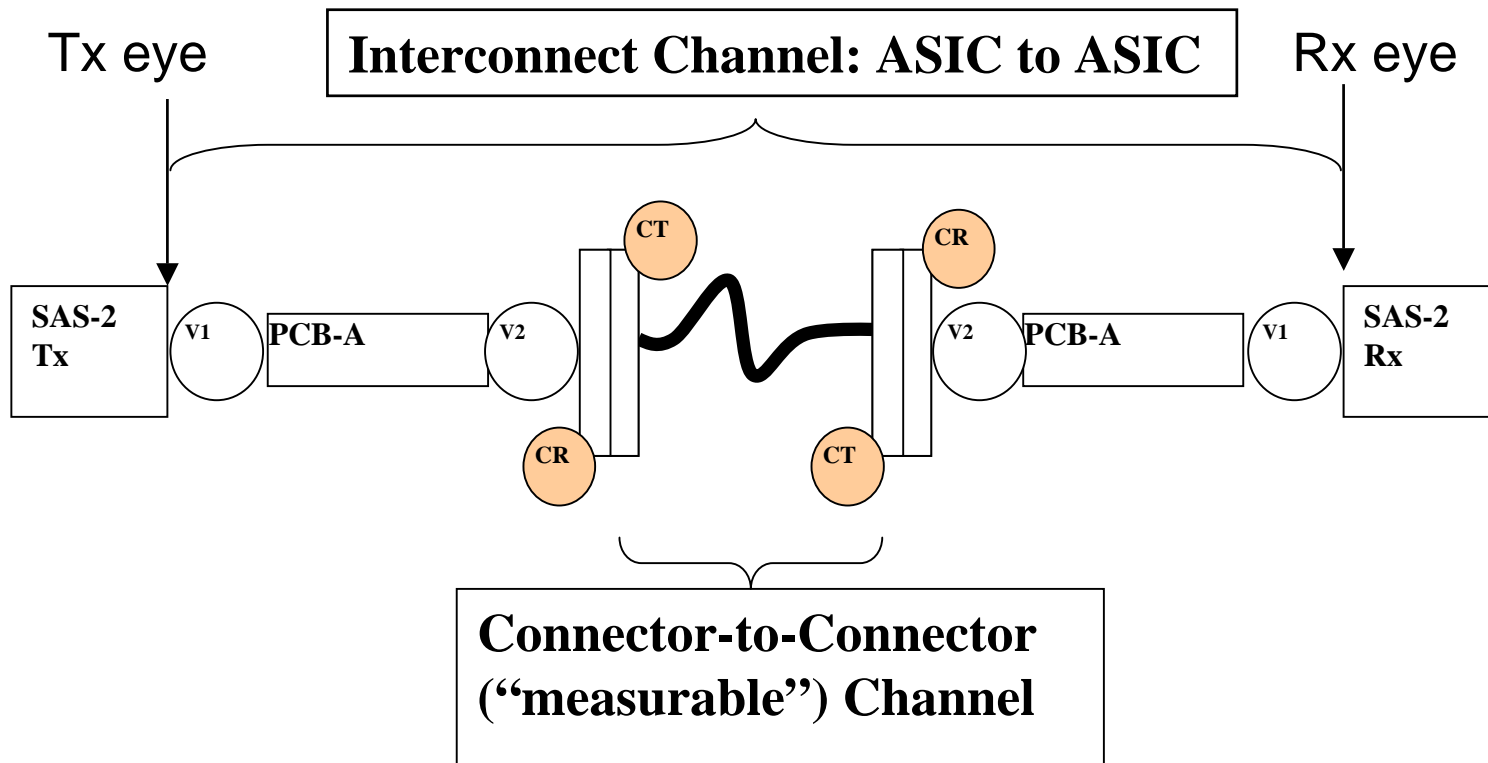
- **The whole "Interconnect Channel" must be verified on compliance**
- **If "Connector-to-Connector" part is selected to be "measurable" compliant interconnect, then there must be specification limits on interconnects to the ASICs**

Summary

- In SAS-2 specification where infinite number of worst case ISI conditions exist, a practical way is to define normative Tx and Rx equalizers functions

- The Rx compliance test would serve to verify that Rx posses specified maximum equalization abiliy

    - For instance with N-tap DFE a "compliance channel" will require for all N taps to be fully exercised to equalize the channel

    - Plus all of the other conditions defined in CEI-02.0 method (jitter, return loss, amplitude level, BER)

- This method provides a reasonable compromise to guarantee interoperability and freedom in actual Rx equalizer implementation

Thinking You Can Build On

www.pmc-sierra.com