SRS revision to include TxVEC as main stress metric

MMF ad hoc working document

jpk

SRS and stressed receiver conformance signal

In the MMF ad hoc of 24 July 2014 it was agreed that the primary measure of stress of the stressed receiver conformance signal should be the same as the primary Tx quality metric. Changes agreed during 7th August meeting:

- Section 95.8.8.2, need to modify the fifth indented paragraph describing the iteration of adjustable features, to be consistent with using TxVEC target value as the main metric of the stressed receiver conformance signal.
- Describe measurement of TxVEC stressed receiver conformance signal: refer to 95.8.5 with exceptions that the O/E and oscilloscope combination have a BT4 bandwidth of 19.34 GHz.
- After meeting, it was pointed out that an additional exception may be needed, to set M to zero – this is still under investigation.
- Replace VECP row with TxVEC in Table 95-7, remove the last row; Replace VECP with TxVEC in note d
- Replace 'VECP' with 'TxVEC of stressed eye conformance signal' in Table 95-10, and change related subclause to 95.8.8.
- 95.8.8 – (first section) no change
- 95.8.8.1 – 'The low-pass filter is used to create ISI-induced vertical eye closure ~~penalty (VECP)~~.'
- 95.8.8.3 and 95.8.8.5 – no change

Table 95-7

Conditions of stressed receiver sensitivity test:[d]		
~~Vertical eye closure penalty (VECP),[d] lane under test~~	~~4.2~~	~~dB~~
TxVEC of stressed receiver conformance test signal, lane under test	5	dB
Stressed eye J2 Jitter,[d] lane under test	0.41	UI
Stressed eye J4 Jitter,[d] lane under test	0.55	UI
OMA of each aggressor lane	3	dBm
Stressed receiver eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.28, 0.5, 0.5, 0.33, 0.33, 0.4}	
~~TxVEC of stressed eye conformance signal[d]~~	~~5~~	~~dB~~

[a]The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level on one lane. The receiver does not have to operate correctly at this input power.

[b]Average receive power, each lane (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.

[c]Measured with conformance test signal at TP3 (see 95.8.8) for the BER specified in 95.1.1.

[d]~~Vertical eye closure penalty and stressed eye jitter~~The conditions of the stressed receiver sensitivity test are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Table 95-10

Stressed receiver sensitivity	3, 5 or valid 100GBASE-SR4 signal	95.8.8
~~Vertical eye closure penalty calibration~~ TxVEC of stressed receiver conformance test signal calibration	~~3 or 5~~ 3, 5 or valid 100GBASE-SR4 signal	~~87.8.11~~95.8.8

Section 95.8.8.1

95.8.8.1 Stressed receiver conformance test block diagram

A block diagram for the receiver conformance test is shown in Figure 95–5. The patterns used for the received compliance signal are specified in Table 95–10. The optical test signal is conditioned (stressed) using the stressed receiver methodology defined in 95.8.8.2, and has sinusoidal jitter applied as specified in 95.8.8.5. A suitable test set is needed to characterize and verify that the signal used to test the receiver has the appropriate characteristics. The low-pass filter is used to create ISI-induced vertical eye closure ~~penalty (VECP)~~. The low-pass filter, when combined with the E/O converter, should have a frequency response that results in the appropriate level of initial vertical eye closure before the sinusoidal terms are added.

The sinusoidal amplitude interferer 1 causes jitter that is intended to emulate instantaneous bit shrinkage that can occur with DDJ. This type of jitter cannot be created by simple phase modulation. The sinusoidal amplitude interferer 2 causes additional eye closure, but in conjunction with the finite edge rates from the limiter, also causes some jitter. The sinusoidally jittered clock represents other forms of jitter and also verifies that the receiver under test can track low-frequency jitter. The sinusoidal amplitude interferers may be set at any frequency between 100 MHz and 2 GHz, although care should be taken to avoid harmonic relationships between the sinusoidal interferers, the sinusoidal jitter, the signaling rate, and the pattern repetition rate. The Gaussian noise generator, the amplitude of the sinusoidal interferers, and the low-pass filter are adjusted so that the ~~VECP~~TxVEC, stressed eye J2 Jitter, and stressed eye J4 Jitter specifications

Section 95.8.8.2

95.8.8.2 Stressed receiver conformance test signal characteristics and calibration

The conformance test signal is used to validate that the PMD receiver of the lane under test meets BER requirements with near worst-case waveforms at TP3.

The primary parameters of the stressed receiver conformance test signal are ~~vertical eye closure penalty (VECP), stressed eye J2 Jitter and stressed eye J4 Jitter. VECP is measured at the time center of the eye, half way between the normalized times of 0 and 1 on the unit interval (UI) scale as determined by the eye crossing means. VECP is given by Equation (87-1), and illustrated in Figure 87-4 (see 87.8.11.2).~~ its TxVEC, stressed eye J2 Jitter and stressed eye J4 Jitter. The TxVEC of the stressed receiver conformance test signal is measured according to 95.8.5, except that the combination of the O/E and the oscilloscope used to measure the waveform has a fourth-order Bessel-Thompson filter response with a bandwidth of 19.34 GHz. Stressed eye J2 Jitter and stressed eye J4 Jitter are defined in 95.8.8.3.

An example stressed receiver conformance test setup is shown in Figure 95–5, however any approach that modulates or creates the appropriate levels and frequencies of the ~~VECP~~ TxVEC and jitter components is acceptable.

Section 95.8.8.2

An example stressed receiver conformance test setup is shown in Figure 95–5, however any approach that modulates or creates the appropriate levels and frequencies of the ~~VECP~~ TxVEC and jitter components is acceptable.

The following steps describe a possible method for setting up and calibrating a stressed eye conformance signal when using a stressed receiver conformance test setup as shown in Figure 95–5:

1) Set the signaling rate of the test pattern generator to meet the requirements in Table 95–7.
2) With the sinusoidal interferers, sinusoidal jitter, and Gaussian noise generator turned off, set the extinction ratio of the E/O to approximately the minimum specified in Table 95–6.
3) The required values of ~~VECP, J2~~ Jitter and J4 Jitter of the stressed receiver conformance signal are given in Table 95–7.

   With the sinusoidal interferers, sinusoidal jitter, and Gaussian noise generator turned off, greater than two thirds of the dB value of the ~~VECP~~ TxVEC should be created by the selection of the appropriate bandwidth for the low-pass filter. Any remaining ~~VECP~~ TxVEC must be created with a combination of sinusoidal jitter, sinusoidal interferer 2 ~~or sinusoidal jitter~~, and the Gaussian noise generator.

TxVEC

- Additional VECP caught and replaced after the meeting

Section 95.8.8.2 continued

Iterate the adjustments of sinusoidal interferers and Gaussian noise generator and extinction ratio until the values of ~~VECP~~TxVEC, stressed eye J2 Jitter and stressed eye J4 Jitter meet the requirements in Table 95–7, the extinction ratio is approximately the minimum specified in Table 95–6, and sinusoidal jitter above 10 MHz is as specified in Table 95–11~~.~~

~~The TxVEC of the stressed eye conformance signal should not exceed the value given in Table 95–7, and is measured according to 95.8.5, except that the combination of the O/E and the oscilloscope used to measure the optical waveform has a fourth-order Bessel-Thomson filter response with a bandwidth of 19.34 GHz~~.