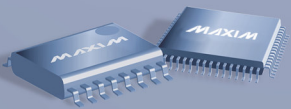




DFEEYE Reference Receiver Solutions for SAS-2 Compliance Testing 08-330r0

Kevin Witt

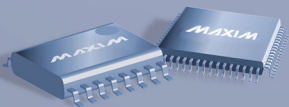
8-14-08





Overview

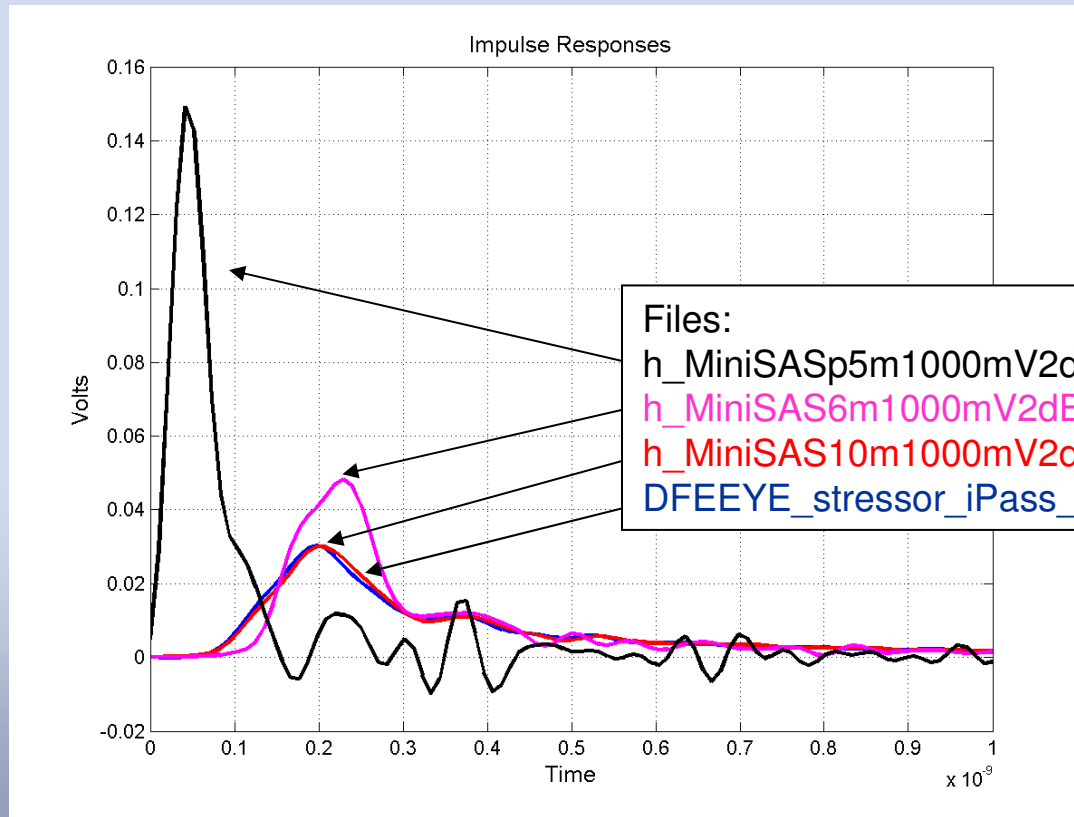
- **SAS-2 Specification Compliance Framework is based on Eye opening after a Reference DFE Receiver**
 - “StatEye or Equivalent” processing
- **The SAS-2 User Community Needs a Reference Receiver Software Solution based on Captured Waveform Data**
 - Tx Compliance
 - Stressed Rx Compliance ISI generator Calibration
- **Goal**
 - Investigate if Compliance Test can be Based on DFE EYE
- **Initial investigation,**
 - Can we Process Synthesized and measured Waveforms and How do the Results Compare to Impulse Response Based Processing



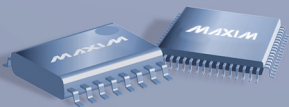


Channels of Interest

- Impulse Responses Considered



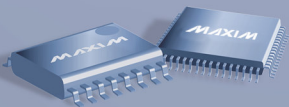
Note: Noise_rms = 6.8mV in All Files





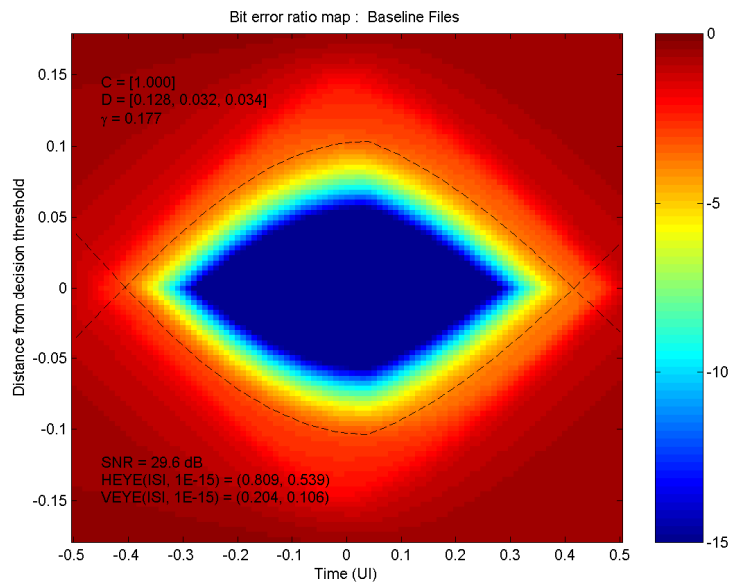
References

- DFEEYE Software
 - T11/07-550v0 Introduction to DFEEYE, Adam Healey, LSI, Sept 2007
- STATEYE
 - www.Stateeye.org
 - Stateye results
 - 08-031r0
 - 08-227r1
- Channels & Data Files
 - h_MiniSASp5m1000mV2dBDEPRBS716X.txt, T10/05-401r0
 - h_MiniSAS6m1000mV2dBDEPRBS716X.txt, T10/05-404r0
 - h_MiniSAS10m1000mV2dBDEPRBS716X.txt, T10/07-193r1
 - DFEEYE_stressor_iPass_10m_h0Table_6g0_16X.txt, T11/07-550v0
 - SAS_CJTPAT_samples.txt , T11/07-550v0
 - SAS_CJTPAT_symbols.txt , T11/07-550v0

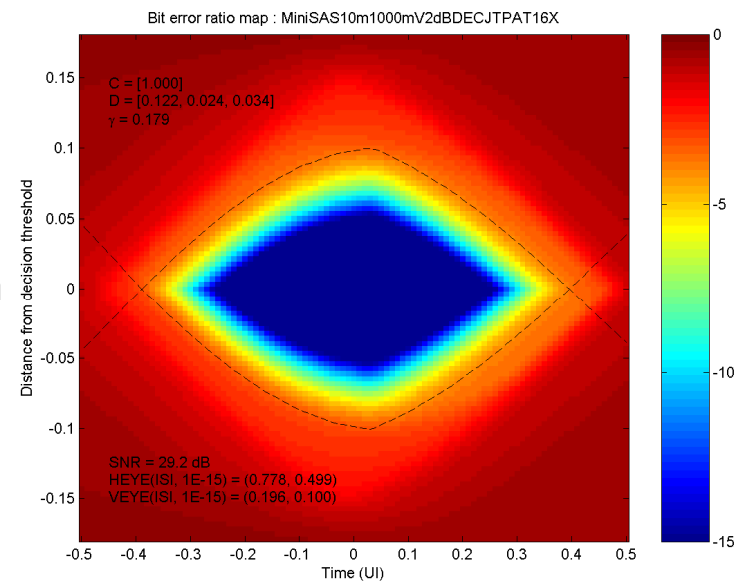


Repeat of Baseline Impulse Response Based Processing

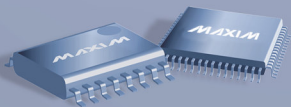
DFEYE_stressor_iPass_10m_h0Table_6g0_16X.txt



h_MiniSAS10m1000mV2dBDECJTPAT16X.txt

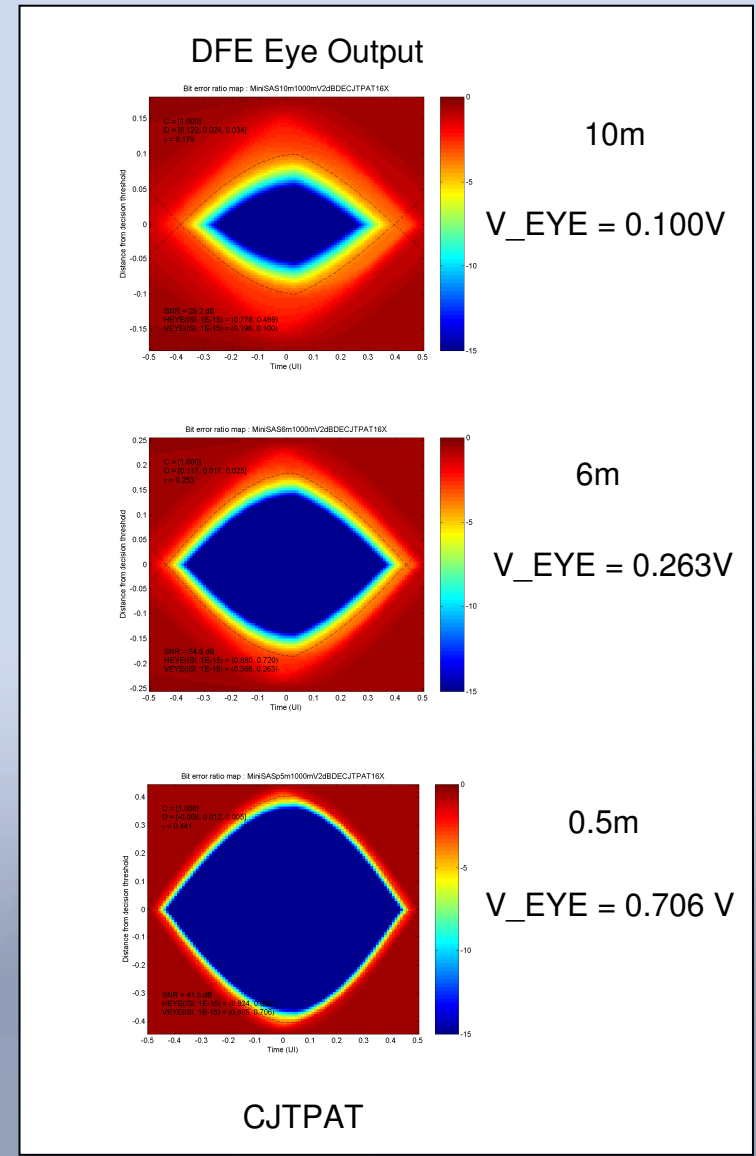
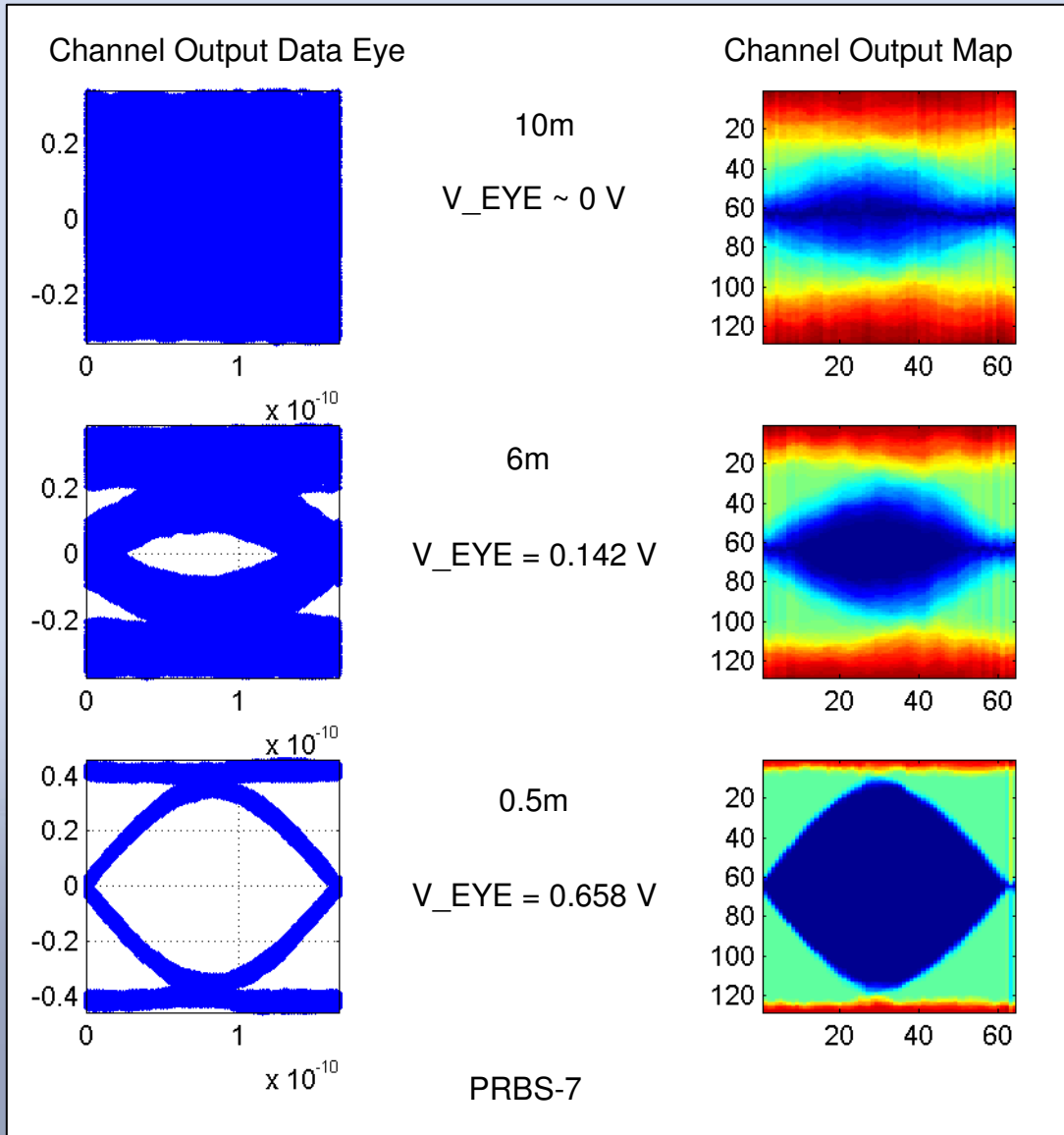


sampleFile = 'SAS_CJTPAT_samples.txt';
 symbolFile = 'SAS_CJTPAT_symbols.txt';



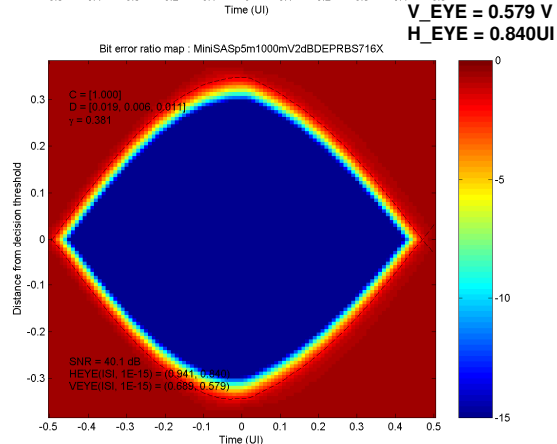
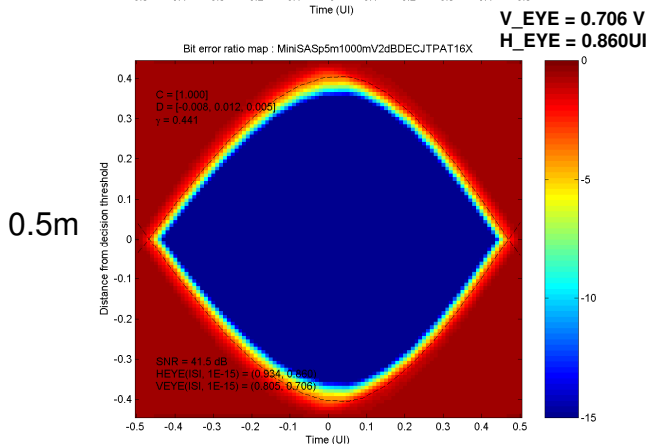
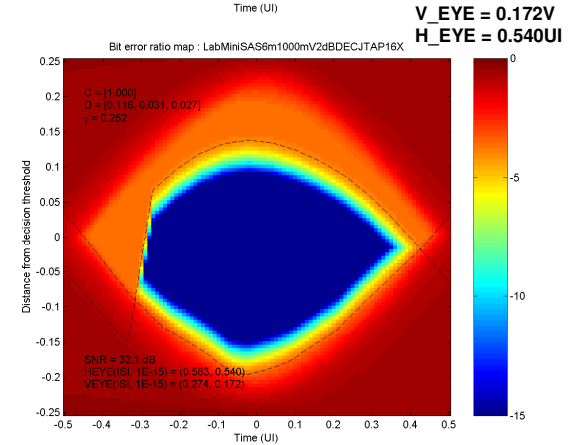
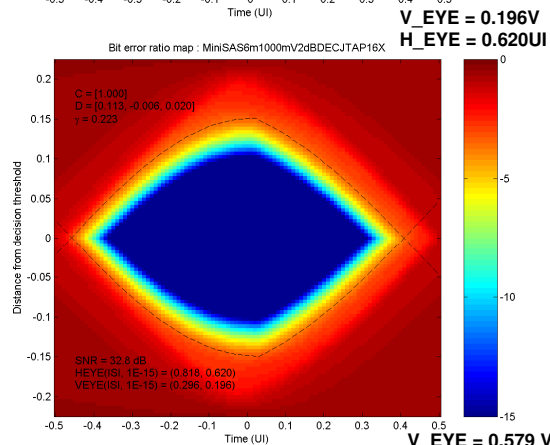
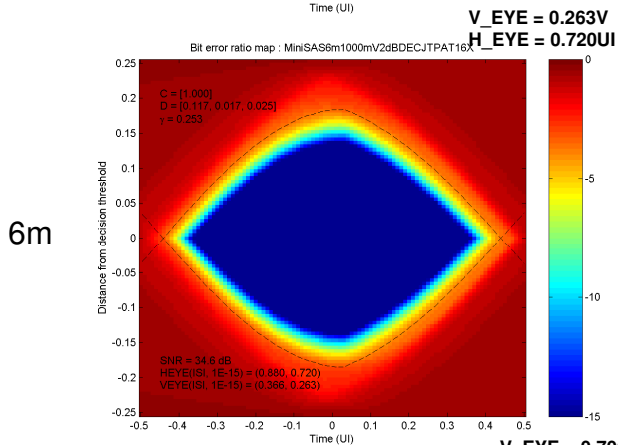
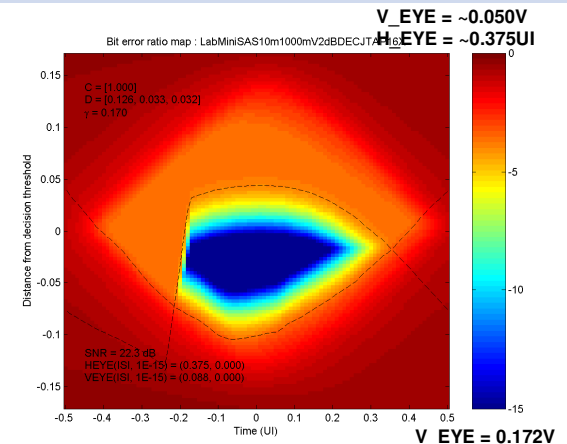
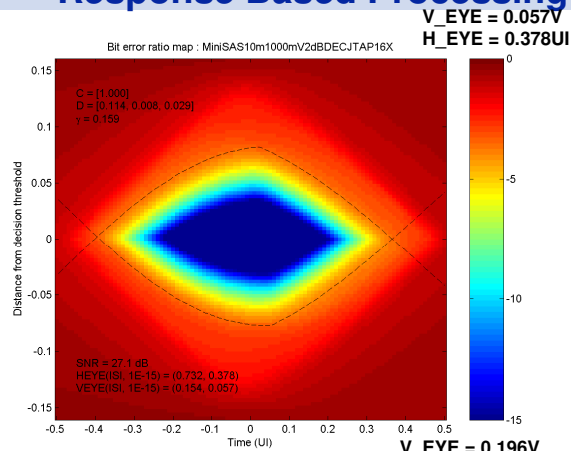
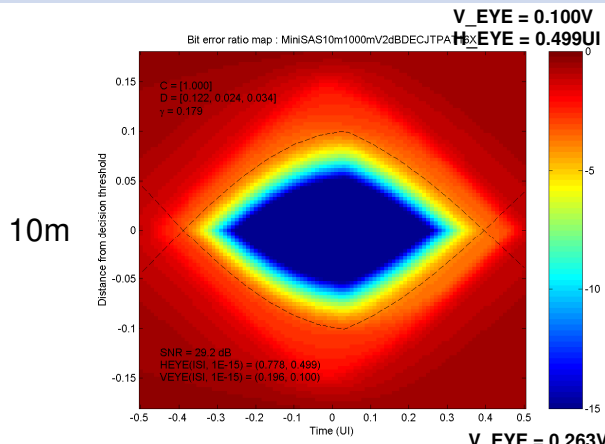


Impulse Response Based Processing





Waveform & Impulse Response Based Processing



CJTPAT
RMS Noise = 6.8mV

Impulse Based

Synthesized Waveform Based

Measured Lab Waveform Based



Matlab Code

DFEEYE_1p1_Mod2.m
Data files to be located in ./T10_datafiles
Images written to ./T10_graphics

Baseline example files

DFEEYE_stressor_iPass_10m_h0Table_6g0_16X.txt
SAS_CJTPAT_samples.txt
SAS_CJTPAT_symbols.txt
y_SAS_CJTPAT.txt (a waveform generated by DFEEYE)

Synthesized Impulse Responses

h_MiniSAS10m1000mV0dBDECJTAP16X.txt
h_MiniSAS6m1000mV0dBDEPRBS716X.txt
h_MiniSASp5m1000mV2dBDECJTAP16X.txt
h_MiniSAS10m1000mV0dBDEPRBS716X.txt
h_MiniSAS6m1000mV2dBDECJTAP16X.txt
h_MiniSASp5m1000mV2dBDEPRBS716X.txt
h_MiniSAS10m1000mV2dBDECJTAP16X.txt
h_MiniSAS6m1000mV2dBDEPRBS716X.txt
h_MiniSAS10m1000mV2dBDEPRBS716X.txt
h_MiniSASp5m1000mV0dBDECJTAP16X.txt
h_MiniSAS6m1000mV0dBDECJTAP16X.txt
h_MiniSASp5m1000mV0dBDEPRBS716X.txt

Symbol files

symbols_LabMiniSAS10m1000mV2dBDECJTAP16X.txt
symbols_MiniSAS6m1000mV0dBDEPRBS716X.txt
symbols_LabMiniSAS10m1000mV2dBDEPRBS716X.txt
symbols_MiniSAS6m1000mV2dBDECJTAP16X.txt
symbols_LabMiniSAS6m1000mV2dBDECJTAP16X.txt
symbols_MiniSAS6m1000mV2dBDEPRBS716X.txt
symbols_LabMiniSAS6m1000mV2dBDEPRBS716X.txt
symbols_MiniSASp5m1000mV0dBDECJTAP16X.txt
symbols_MiniSAS10m1000mV0dBDECJTAP16X.txt
symbols_MiniSASp5m1000mV0dBDEPRBS716X.txt
symbols_MiniSAS10m1000mV0dBDEPRBS716X.txt
symbols_MiniSASp5m1000mV2dBDECJTAP16X.txt
symbols_MiniSAS10m1000mV2dBDECJTAP16X.txt
symbols_MiniSASp5m1000mV2dBDEPRBS716X.txt
symbols_MiniSAS10m1000mV2dBDEPRBS716X.txt
symbols_MiniSASp5m1000mV2dBDEPRBS716X.txt
symbols_MiniSAS10m1000mV2dBDEPRBS716X.txt
symbols_MiniSAS6m1000mV0dBDECJTAP16X.txt

Files

Samples files (Symbols file at sample rate)

samples_LabMiniSAS10m1000mV2dBDECJTAP16X.txt
samples_MiniSAS6m1000mV0dBDEPRBS716X.txt
samples_LabMiniSAS10m1000mV2dBDEPRBS716X.txt
samples_MiniSAS6m1000mV2dBDECJTAP16X.txt
samples_LabMiniSAS6m1000mV2dBDECJTAP16X.txt
samples_MiniSAS6m1000mV2dBDEPRBS716X.txt
samples_LabMiniSAS6m1000mV2dBDEPRBS716X.txt
samples_MiniSASp5m1000mV0dBDECJTAP16X.txt
samples_MiniSAS10m1000mV0dBDECJTAP16X.txt
samples_MiniSASp5m1000mV0dBDEPRBS716X.txt
samples_MiniSAS10m1000mV0dBDEPRBS716X.txt
samples_MiniSASp5m1000mV2dBDECJTAP16X.txt
samples_MiniSASp5m1000mV2dBDECJTAP16X.txt
samples_MiniSAS10m1000mV2dBDECJTAP16X.txt
samples_MiniSASp5m1000mV2dBDEPRBS716X.txt
samples_MiniSAS10m1000mV2dBDEPRBS716X.txt
samples_MiniSAS6m1000mV0dBDECJTAP16X.txt

Channel Output pwl

y_LabMiniSAS10m1000mV2dBDECJTAP16X.txt
y_MiniSAS6m1000mV0dBDEPRBS716X.txt
y_LabMiniSAS10m1000mV2dBDEPRBS716X.txt
y_MiniSAS6m1000mV2dBDECJTAP16X.txt
y_LabMiniSAS6m1000mV2dBDECJTAP16X.txt
y_MiniSAS6m1000mV2dBDEPRBS716X.txt
y_LabMiniSAS6m1000mV2dBDEPRBS716X.txt
y_MiniSASp5m1000mV0dBDECJTAP16X.txt
y_MiniSAS10m1000mV0dBDECJTAP16X.txt
y_MiniSASp5m1000mV0dBDEPRBS716X.txt
y_MiniSAS10m1000mV0dBDEPRBS716X.txt
y_MiniSASp5m1000mV2dBDECJTAP16X.txt
y_MiniSAS10m1000mV2dBDECJTAP16X.txt
y_MiniSASp5m1000mV2dBDEPRBS716X.txt
y_MiniSAS10m1000mV2dBDEPRBS716X.txt
y_MiniSAS6m1000mV0dBDECJTAP16X.txt

Channel input pwl

x_LabMiniSAS10m1000mV2dBDECJTAP16X.txt
x_MiniSAS6m1000mV0dBDEPRBS716X.txt
x_LabMiniSAS10m1000mV2dBDEPRBS716X.txt
x_MiniSAS6m1000mV2dBDECJTAP16X.txt
x_LabMiniSAS6m1000mV2dBDECJTAP16X.txt
x_MiniSAS6m1000mV2dBDEPRBS716X.txt
x_LabMiniSAS6m1000mV2dBDEPRBS716X.txt
x_MiniSASp5m1000mV0dBDECJTAP16X.txt
x_MiniSAS10m1000mV0dBDECJTAP16X.txt
x_MiniSASp5m1000mV0dBDEPRBS716X.txt
x_MiniSAS10m1000mV0dBDEPRBS716X.txt
x_MiniSASp5m1000mV2dBDECJTAP16X.txt
x_MiniSAS10m1000mV2dBDECJTAP16X.txt
x_MiniSASp5m1000mV2dBDEPRBS716X.txt
x_MiniSAS10m1000mV2dBDEPRBS716X.txt
x_MiniSAS6m1000mV0dBDECJTAP16X.txt





Output Eyes Generated

>> ls T10_graphics

// Impulse response based eyes

Baseline Files _imp_dfeeye.png

MiniSAS6m1000mV2dBDECJTAP16X_imp_dfeeye.png

MiniSAS10m1000mV2dBDECJTAP16X_imp_dfeeye.png

MiniSASp5m1000mV2dBDECJTAP16X_imp_dfeeye.png

// Waveform based eyes

Baseline Files _wf_dfeeye.png

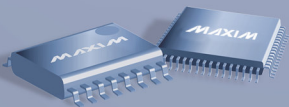
MiniSASp5m1000mV2dBDECJTAP16X_wf_dfeeye.png

MiniSAS6m1000mV2dBDECJTAP16X_wf_dfeeye.png

MiniSAS10m1000mV2dBDECJTAP16X_wf_dfeeye.png

LabMiniSAS6m1000mV2dBDECJTAP16X_wf_dfeeye.png

LabMiniSAS10m1000mV2dBDECJTAP16X_wf_dfeeye.png

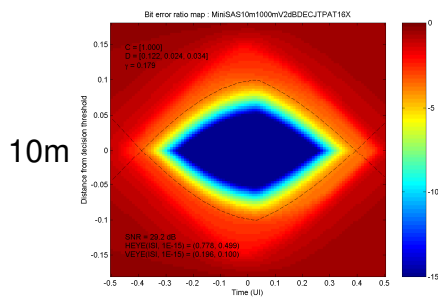




Fundamental Difference

- **DFE Eye uses input referred noise w/o Tx Jitter**
 - AM to PM causes Jitter
- **StatEye uses Jitter w/o input referred noise.**

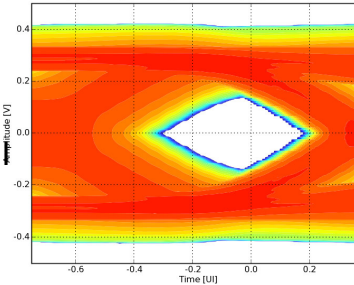
DFE Eye Output



V_EYE = 0.100V
H_EYE = 0.499UI

RMS Noise = 6.8mV

Eye Opening 0.276V, Jitter 0.510Upp @ BER=10**⁻¹⁵



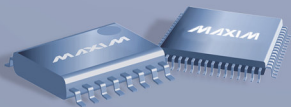
StatEye V5.071210
Output (08-031r0)
1V?

V_EYE = 0.276V
H_EYE = 0.490UI

StatEye V5.080111
Output (08-227r1)
850 mV, 2dB

V_EYE = 0.084V
H_EYE = 0.410UI
8b10b

DJ	= 0.10	# Deterministic pp jitter
RJ	= 0.01	# Random RMS jitter,



Next Step

- **Need to understand differences between impulse response based eye and synthesized waveform based eye.**
- **Need to understand how to handle RJ and DJ specs in Tx compliance test.**

Summary

- **Initial runs complete and a few issues observed**
- **With some work this could serve as a Reference Rx code set**

