Ultra320 SCSI Eye Diagram Data for a System with a Backplane and a Short Cable Assembly

Russ Brown
Quantum Corporation

Parallel SCSI Working Group Meeting
11 July 2000
Colorado Springs, CO
This presentation is for data gathered with a 10-slot backplane and a 0.7 meter cable in order to evaluate the effect of the short cable (see the next three slides for test set-up details; also see T10/00-214 for additional details).

Four slides are shown for each of three slots (1, 6, and 9):

- At the receiver without crosstalk, without transmitter precompensation (TxPC), and without receiver equalization (AAF),
- At the receiver with crosstalk and without TxPC and AAF,
- At the receiver with crosstalk using TxPC with 33% cutback, and
- The signal at the receiver with crosstalk after processing by the AAF.

The driver amplitudes used were:
- 500 mV for data without precompensation or AAF,
- 500 mV for data with AAF,
- 500 mV maximum and 330 mV cutback (33%) for data with transmitter precompensation, and
- 500 mV for crosstalk (since this is a "1010..." pattern, there would be no cutback).
Test System Configuration

- 10-slot, commercially available backplane fully populated with Quantum Ultra160 drives; 0.7 meter flat cable supplied by the backplane vendor.
50 Ω aggressor XTALK source 1†

50 Ω random data source*

50 Ω aggressor XTALK source 2‡

* TEK AWG2041
† H-P 81130A
‡ TEK P6247 into LeCroy DDA120 or TEK P6247 into TEK TDS694C

Perfect terminators of the test equipment

100Ω ± 1% resistors located at end of backplane

Differential probe on victim lines‡
Creating the Eye Diagram

- Differential data was captured at the receiver.
- For signals without AAF: raw data was sent to a PC and processed to create the eye diagrams.
- For signals with AAF: The "no TxPC/no AAF" data was processed by transistor level simulation of the AAF to create the eye diagrams.
The following is the color key for the "eye diagram" slides:

- The solid purple vertical line is the center of the bit cell being measured.
- The dashed purple vertical lines are the outer limits of the bit cell.
- The reddish-purple line inside the eye are the worst-case signals.
- The red lines are the 1010... training pattern before the random data.
- The green lines are transitions that changed state at the start of the cell being measured.
- The yellow lines are transitions that did not change state at the start of the cell being measured.
Slot 1, No TxPC, No AAF, No Xtalk

0.7 meter flat cable at slot 1

300mV by 2ns Eye Mask
Slot 1, No TxPC, No AAF, With Xtalk

No Precomp at slot 1

300mV by 2ns Eye Mask
Slot 1, TxPC cutback = 33%, W/Xtalk

Precomp 500mV/330mV at slot 1

Output amplitude

Time

300m by 2ns Eye Mask

11 July 2000
T10/00-274r0 – Ultra320 Eye Diagram Data for a Backplane and Short Cable
Slide 9
Slot 1, AAF w/boost = 1.1x, W/Xtalk

Equalizer boost=1.1 at slot 1

300mV by 2ns Eye Mask

Output amplitude

Time x 10^-8
Slot 6, No TxPC, No AAF, No Xtalk

0.7 meter flat cable at slot 6

300mV by 2ns Eye Mask
Slot 6, No TxPC, No AAF, With Xtalk

300mV by 2ns
Eye Mask
Slot 6, AAF w/boost = 1.0x, W/Xtalk

Equalizer boost=1.0 at slot 6

300mV by 2ns Eye Mask

Output amplitude

Time x 10^-8
Slot 9, No TxPC, No AAF, No Xtalk

300mV by 2ns Eye Mask
Slot 9, No TxPC, No AAF, With Xtalk

300mV by 2ns Eye Mask
Slot 9, TxPC cutback = 33%, W/Xtalk

![Graph](image-url)

Precomp 500mV/330mV at slot 9

Output amplitude

300mV by 2ns Eye Mask

Time x 10^-8

0 0.2 0.4 0.6 0.8 1 1.2
Slot 9, AAF w/boost = 1.4x, W/Xtalk

Equalizer boost=1.4 at slot 9

300mV by 2ns Eye Mask
Observations

- As noted in T10/00-235r0, there is a significant difference in attenuation from slot to slot in this backplane.
  - The AAF boost that was determined for different slots in this backplane for this testing ranged from 1.0x to 1.4x.
  - A single transmitter precomp cutback level is not optimum for all of the drives in this system.
  - It is unwieldy to set different transmitter precomp levels for different drives.

- Reflections are more pronounced in this system using a relatively short cable assembly.

- The negative effect of these reflections is aggravated by the transmitter precomp drivers.
  - The driver amplitudes used for TxPC in this data were only 500 mV maximum and 330 mV cutback.
  - Using higher amplitudes would increase the negative effect of TxPC on reflections.
Conclusions

- Because each of the eye diagrams is generated from only 10 microseconds of data, any eye diagram that appears marginal might possibly fail in a real-world application.
- Transmitter precomp with cutback seems to make things look worse and appears to exacerbate the effects of crosstalk and reflections in this configuration.
- There are some slots in this system where transmitter precomp with cutback doesn't appear as if it would work.
- Because of its adaptive capability (along with the advantages provided by its filter) AAF appears to provide excellent margin in all slots in this system.