The Agilent Technologies
E2920 PCI/PCI-X Series

Application Note 1

Check for PCI and PCI-X™ protocol rule violations

Protocol rule violations do not always crash a computer system. If protocol rule violations are caused by several devices, however, the system is likely to crash. To exclude this possibility, you should take steps to locate all protocol rule violations that occur on your system.

The Agilent Protocol Observer, in combination with the Agilent Analyzer, simplifies the task of detecting protocol rule violations This is not always easy-you have to be able to spot them in a data trace..

Aims of this Application Note

- To show you how to obtain a quick overview of all protocol rule violations.

- To provide a simple way of focusing on the protocol rule violations of interest.

Questions that can be answered with the help of the PCI/PCI-X Protocol Observer

- Have any protocol rule violations occurred?

- What is a trace that contains a rule violation telling you?

- Which of the devices on the bus are responsible for protocol rule violations?

Benefits of the PCI/PCI-X Protocol Observer

- At-a-glance information on protocol rule violations in your system.

- Triggering on protocol errors to enable you to figure out the causes of errors.
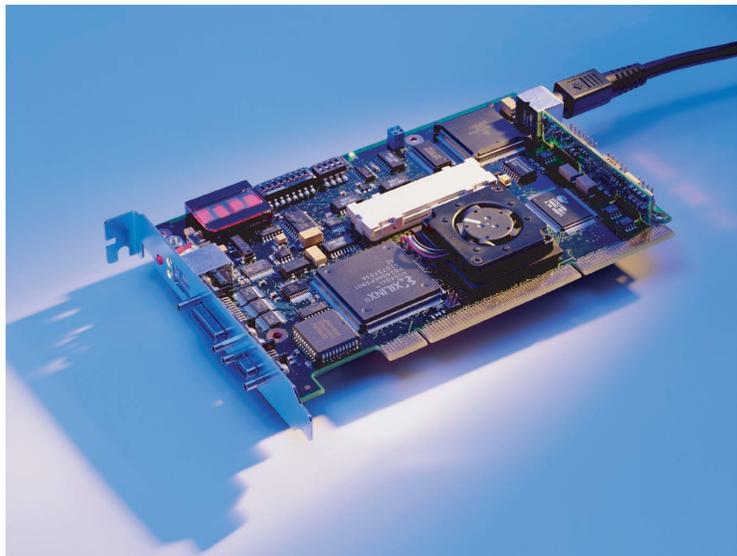
Agilent Technologies

Setting Up the Test

This application note is based around an example that shows you how the Agilent testcard can be used to detect a protocol violation that occurs during an access to the I/O space of a PCI graphics card.

Introduction

The protocol observer hardware implemented on the Agilent test-card simultaneously checks 53 different protocol rules against the PCI/PCI-X Specification. If a protocol rule is violated, the protocol observer generates a signal (the berr signal for PCI and the Proterr for PC!-X) that can be used to trigger the Analyzer, so that it can capture the bus traffic around the violation.

To check the protocol, you have to perform the following steps:

1. Run the Protocol Observer.

2. View the violated rules.

3. Disable all rules that you are not interested in.

4. Trigger on particular PCI and PCI-X protocol errors and run the Analyzer again.

5. Display the captured wave forms.

Running the Protocol Observer

When the testcard runs, the Protocol Observer continuously monitors the PCI/PCI-X bus. It operates in conjunction with the Analyzer, triggering the Analyzer when a protocol violation occurs.

Viewing Violated Rules

The Protocol Check window lets you view protocol rule violations that have been detected by the Protocol Observer.

- To open the Protocol Check window, select Protocol Check in the Analyzer menu.
  The Protocol Check window lists a total of 53 protocol rules. Any protocol rule violations are flagged up in the Status column as ERROR. You can scroll through the list to locate the errors.
  The total number of violated rules and the name of the first violated rule are shown in the Status field.

- To reset the list (clear the errors), click the Clear button.

- To update the list, click the Read from card button. This also updates the Status field.

- Double-click any rule name field to get an explanation of what that rule checks. The message box in the above figure shows the rule for LAT 0 (latency 0).

Figure 1.

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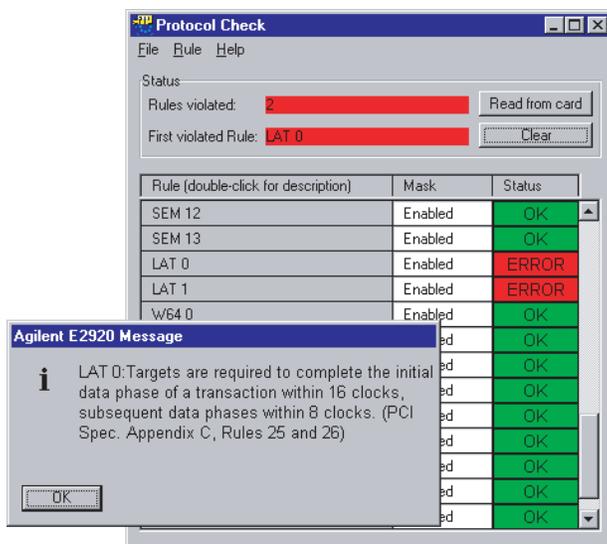
Focussing on Individual Errors

You can individually enable or disable each rule in the Protocol Check window. This prevents known errors from being flagged. The feature is very useful if several protocol rule violations have been detected and you want to examine just one of them in detail. The Analyzer display modes (Waveform Viewer, Bus Cycle Lister and Transaction Lister) display the bus traffic pertaining to this violated rule.

Programming the Protocol Observer to Trigger on Protocol Errors

In order to find out which device in your system caused a violation, you have to program the Protocol Observer to trigger the Analyzer when a protocol error occurred. Setting up the trigger involves a procedure that varies for PCI systems and for PCI-X systems. These are described separately below.

Trigger Setup for the PCI Bus (valid only with Agilent E2920 PCI Series)

The PCI Protocol Observer asserts an output signal (called berr) when any of the enabled protocol rules have been violated. To use this signal to trigger the built-in logic Analyzer, you need

to define it as a pattern term in the Analyzer's Capture window.
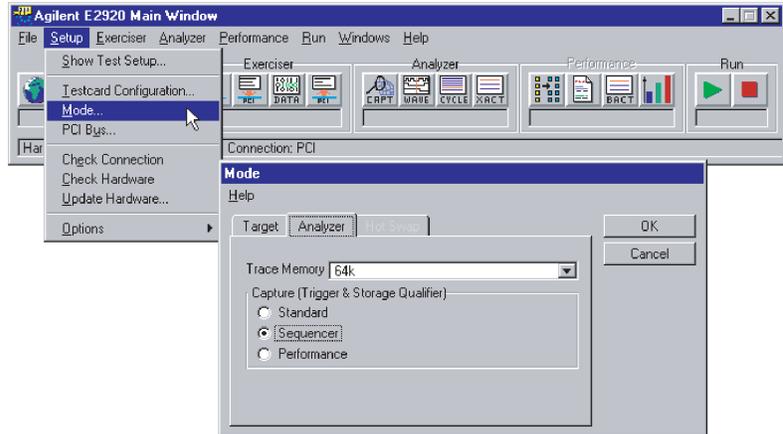
Figure 2.

2. Open the Capture window by selecting Capture in the Analyzer menu.
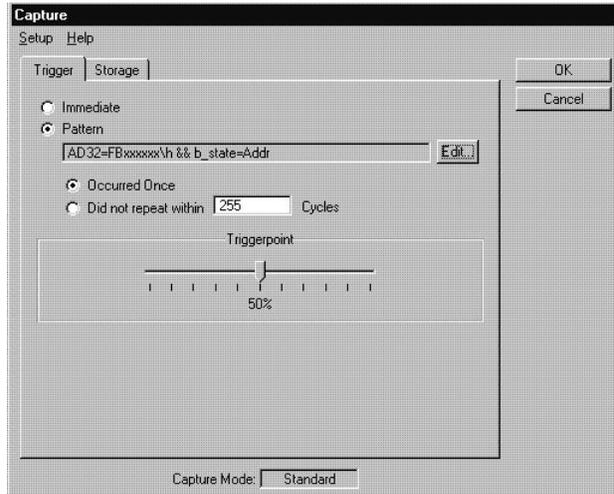
Figure 2a

3. Select Pattern, and press the Edit button next to the pattern term.This opens the Pattern Editor window.
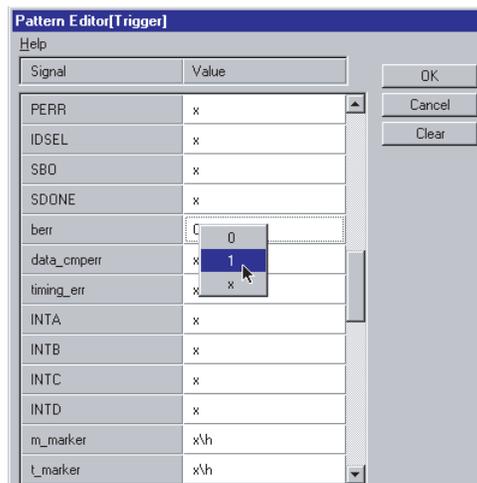
Figure 3.

4. In the Pattern Editor window, press the Clear button to reset all pattern terms to "x" (= don't care), then set the berr field to 1.

5. Run the Analyzer by selecting Run in the Analyzer menu. The Analyzer now triggers only on the selected protocol errors.

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Trigger Setup for the PCI-X Bus (valid only with Agilent E2920 PCI-X cards)

Set up the trigger as follows:

1. Open the Capture dialog box by selecting Capture from the Analyzer menu (or click the Capture button in the toolbar).

2. In the Capture dialog box, select the Trigger tab.

3. Choose the Trigger on: option.

4. Select the check box Any Error occurred.

5. Click OK.

The Capture window should now look like this.
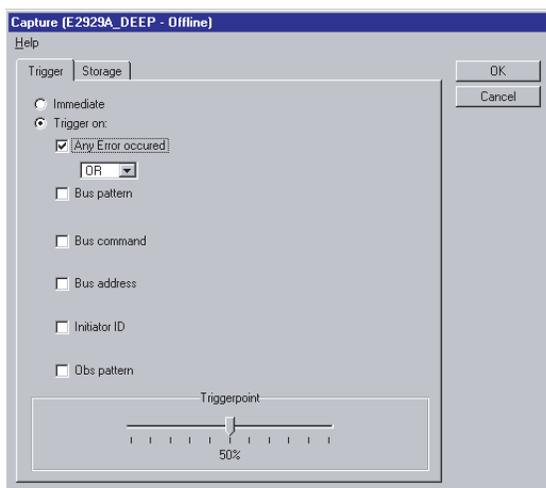
Figure 4.

6. Press OK in the Capture window; the Analyzer is now ready to run.

7. Run the Analyzer by selecting Run in the Analyzer menu. The Analyzer now triggers on protocol errors.

Displaying the Captured Waveforms

The display procedure is the same for PCI and PCI-X systems. Here, the waveforms produced when accessing a PCI device's I/O space are used as an example.

When the Analyzer runs and the device under test is accessed, the Analyzer triggers on the occurrence of the first violation. To view the results, proceed as follows:

1. Select Waveform Lister ... from the Analyzer menu to open the Waveform Viewer.
Your display will of course look different to that shown below. Note that you can add and remove signals from the display or rearrange their display order using the Arrange item from the Signals menu.

Note: The berr signal is labelled prot_rule in the Waveform Viewer and is asserted at the trigger point. For PCI_X the signal is labelled proterr in the waveform viewer and is asserted at the trigger point.

2. Identify the Device that Causes the Protocol Rule Violation
The error in this particular case has been caused by the target with physical address 0000E800\h. This target did not respond to the I/O Read with the first word of data within 16 clocks, as specified for LAT 0.
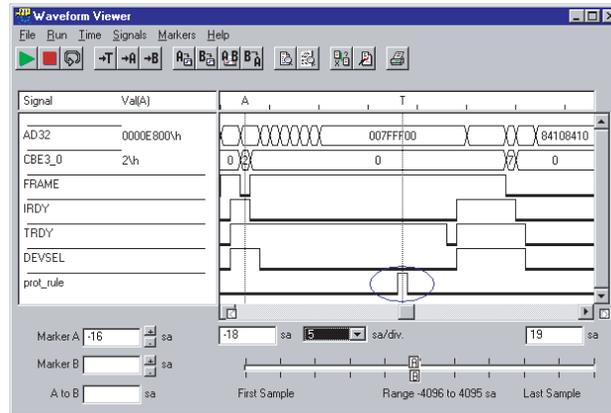
Figure 5.

Note for Identifying a Master Device that Causes an Error:

If a master device causes a protocol rule violation, for example, a LAT1 error, identification of this master is more complicated.
The testcard can only identify masters that are correctly connected to it. The GNT# and REQ# lines of the masters must be connected to the testcard's external trigger input pins-if necessary, by soldering wires.
To identify the master that causes the error, in the Waveform Viewer, check the levels of the external trigger input pins connected to the masters (trigger0, trigger1, ...) around the trigger point.

3. Select Bus Cycle Lister in the Analyzer menu. The lister shows the associated transaction, along with the protocol error message.
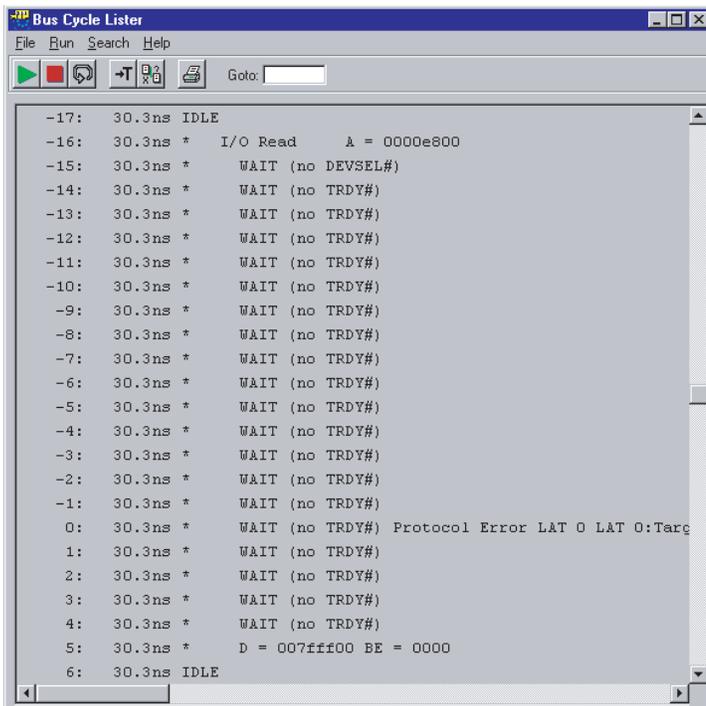
Figure 6.

Glossary

External Trigger
The testcard provides input lines to be used as trigger input and output.As input, they can be used in pattern terms just like PCI/PCI-X signals. As output, they can be used to trigger other devices.

Pattern Term
The pattern terms are programmable for recognizing bus events (signal patterns on the bus). They are part of the testcard's Analyzer.
The output of pattern terms (always 1 or 0) can be used in Analyzer functions, for example, to trigger trace memory or to count bus events.

PCI Analyzer
The testcard's Analyzer queries for information on the PCI bus, the state of the Exerciser, or the external trigger inputs, so that it can check timing and protocol rules, capture traffic and measure performance.

PCI-X Analyzer
The testcard's Analyzer queries for information on the PCI-X bus, the state of the Exerciser, or the external trigger inputs, so that it can check capture traffic.

PCI Protocol Observer
The PCI Protocol Observer is part of the PCI Analyzer. It is hardware implemented on the Agilent testcard, and simultaneously checks 53 different protocol rules against the PCI Specification.

PCI-X Protocol Observer
The PCI-X Protocol Observer is hardware implemented on the Agilent testcard, and simultaneously checks 53 different protocol rules against the PCI-X Specification.

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Two concepts underlay Agilent's overall support policy: "Our Promise" and "Your Advantage."

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of your Agilent instruments and systems, and obtain dependable measurement accuracy for
the life of those products.

Related Agilent Literature

· Agilent E2925B 32bit, 33 MHz, Agilent E2926B 32/64bit, 33 MHz PCI Exerciser & Analyzer, technical
  specifications, p/n 5968-3501E
· Agilent E2928A 32/64bit, 66 MHz, PCI Exerciser & Analyzer, technical specifications, p/n 5968-3506E
· Agilent E2929A PCI Exerciser & Analyzer, technical specifications, P/n 5968-8984E
· Agilent E2922A PCI-X Master Target Card, technical overview, p/n 5968-9577E
· Agilent E2940A CompactPCI Exerciser & Analyzer, technical overview, P/n 5968-1915E
· Agilent E2976A System Validation Pack, Agilent E2977A System Test Library, technical overview,
  p/n 5968-3500E
· Agilent E2920 Computer Verification Tools, PCI Series, brochure, p/n 5968-9694E
· Intel discusses basic concepts of PCI performance and efficient use of PCI with the Agilent E2920 series,
  case study, p/n 5988-0448ENDE
· HP NSD stabilizes server designs quickly and completely with the Agilent E2920 PCI Series, case study,
  p/n 5968-6948E
· HP HSTC speeds high-end server testing and reduces engineering costs with the Agilent E2920 PCI
  Series, case study, p/n 5968-6949E
· Agilent E2920 Verification Tools, PCI Series gives Altera Corporation competitive Advantage, case study,
  p/n 5968-4191E
· 5 measurements of Agilent E2920 PCI/PCI-X Series   p/n5988-3395en

You can find the current literature and software at:
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