

Agilent E2969A Protocol Compliance Test Card
for PCI Express

User Manual



Agilent Technologies

Important Notice

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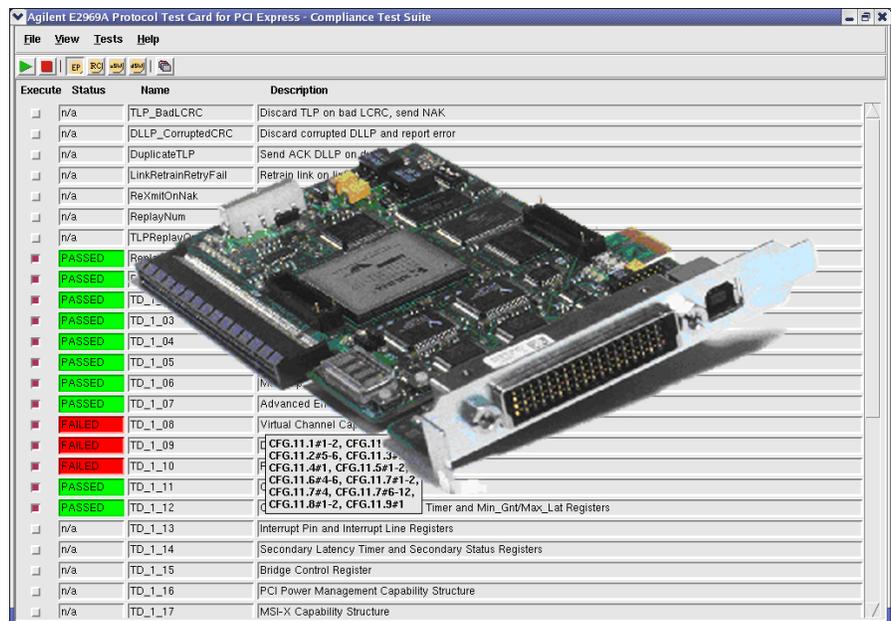
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Introduction

The Agilent E2969A protocol test card (PTC) is a combination of software and plug-in card that can be used for PCI Express compliance tests.



The PTC performs tests to verify and ensure compliance with PCI Express as defined by the PCI-SIG.

The card runs on a PCI Express x1 lane at 2.5 Gbit/s. It is plugged into one of the PCI Express slots of the target platform.

As an R&D engineer, you can use the PTC to validate the functional compliance of your PCI Express-based designs, including chips, add-in cards or systems.

The PTC provides a set of automated pre-programmed compliance tests for testing both transaction layer and data link layer as well as power management and configuration space. Furthermore, it monitors the

behavior of the DUT (device under test) in response to certain error conditions.

For more detailed analysis, the PTC provides a connector to Agilent's E2960 protocol analyzer. With the analyzer, you can monitor and analyze captured PCI Express traffic between an adapter card and a system, for example.

Further features include

- Field-upgradeable FPGA-based card
- USB 2.0 interface for programming and topology simulation mode
- Can act either as a PCI Express standalone add-in card, or as a PCI Express interposer card for x1 operation
- Card supplied with two different software packages:
 - The AIC test mode software which runs under Linux Operating system with the PCI Express compliance tests for Add-In-Cards
 - A windows software package that contains the AIC Tests for Windows as well as the Topology Tests. This package contains also some additional tools for checking and updating the Protocol Test Card, which runs under Windows via the USB connector.

Test Modes

The protocol test card provides three test modes:

- Add-In-Card test mode
- Known Endpoint test mode
- Topology test mode

The test software provides a list of tests for each of these modes. You can select the mode and execute the tests from the graphical user interface.

NOTE The current version of the PTC only supports the Add-In-Card test mode and Topology Test Mode. Known Endpoint test mode will be supported by one of the next releases.

Add-In-Card Test Mode

In the Add-In-Card test mode, the PTC acts as a switch device between the target platform and another PCI Express add-in card (DUT). The DUT is plugged into the PCI Express slot on top of the PTC.

NOTE Though the upper slot of the PTC is capable of accepting up to x16 cards, only x1 links are supported.

The tests in this mode check the correct behavior of the add-in card. The test software communicates with the PTC using PCI Express commands and performs various tests with the DUT.

In this mode it is necessary to power the PTC through the external power connector. Any standard ATX Power Supply can be used for this purpose.

Known Endpoint Test Mode

In the Known Endpoint test mode, the PTC behaves like a known endpoint device.

This mode is used for system testing. No other card can be plugged into the PTC in this mode. The software runs various KEP tests to test the systems behavior on certain error conditions.

NOTE The KEP mode will be supported by one of the next software releases.

Topology Mode

The Topology mode is used to test BIOS settings.

Controlled by software running on an external host connected through USB, the PTC pretends to behave like a variety of PCI Express devices. No other card can be plugged into the PTC in this mode.

All configuration accesses are handled via the software connected through the USB link. No other accesses or transactions are supported in this mode.

In this mode it is necessary to power the PTC through the external power connector. Any standard ATX Power Supply can be used for this purpose.

Installation

Test setups using the Agilent E2969A protocol test card (PTC) include the following components:

- E2969A Protocol Test Card (PTC) card plugged into the target platform
- Add-In-Card Tests: PTC software running on the target platform providing a graphical user interface used for controlling the tests and monitoring the test results
- Topology Mode Tests: PTC software running on an extra controlling host PC connected to the test card through USB to run the tests. This software package is also used for administration purposes.

This chapter shows how to install these components and verify their operation.

Prerequisites

The PTC supports the PCI Express Specification 1.0a.

It is intended to be used standalone or as part of Intel's Product Development Kits (PDKs) for PCI Express Technology. The PTC integrates into the PDK Software environment and tests.

For the Add-In-Card test mode as well as the Topology test mode, the PTC must be plugged into a target platform, for example, the one provided with the Intel PDK.

PCI Express traffic must be scrambled as described in the PCI Express specification. Unscrambled data transfer is not supported.

The Add-In-Card (AIC) tests run under the operating system Linux and Windows. In case of AIC Tests under Linux, the target platform must fulfill the following prerequisites:

- Red Hat Linux 9 installed, running the uniprocessor kernel
- “Kernel Development” package installed, including the Tk GUI toolkit for Tcl, with shared libraries
- at least one free PCI Express slot that can be configured to run as x1 PCI Express connection
- CD-ROM drive available

In case of AIC Tests under Windows, the target platform must fulfill the following prerequisites:

- Windows 2K or Windows XP installed
- at least one free PCI Express slot that can be configured to run as x1 PCI Express connection
- CD-ROM drive available

The controlling host for the Topology tests and administrative purposes must fulfill the following prerequisites:

- 1 GHz PC with a Pentium 4 or equivalent
- Windows 2000 or Windows XP installed
- USB connector available
- CD-ROM drive available

Installing the Software

The PTC comes with two software packages.

- A Linux version of the Software supporting the AIC Tests to perform PCI Express compliance tests with plugged in test cards.
- Windows Software for AIC Tests under Windows and Topology mode Test used with USB connection from an external host also under Windows. The software package also contains administration utilities.

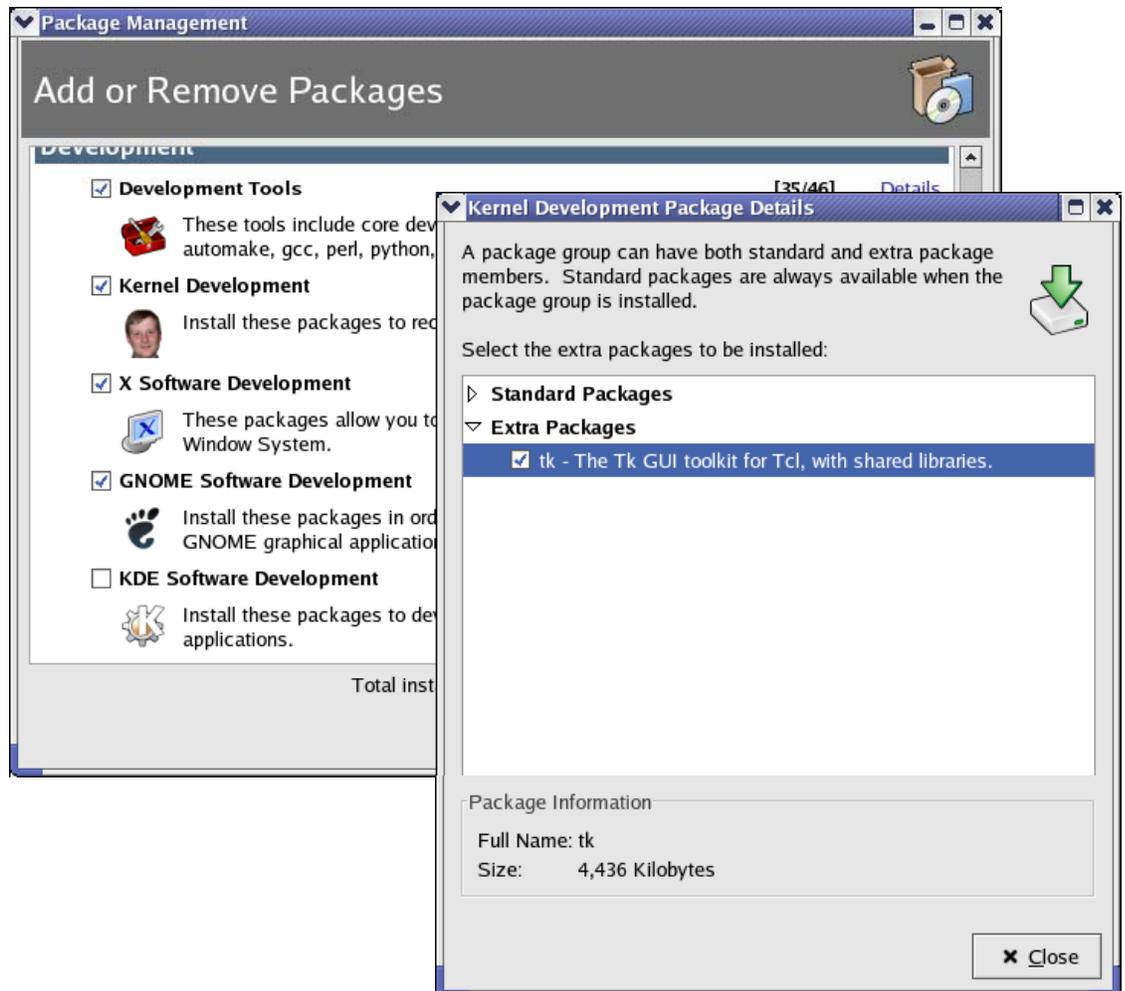
Both software packages are on the shipped CD.

AIC Test Mode Software – Linux Installation

The AIC mode tests for PCI Express run on the target platform itself and use the operating system Red Hat Linux 9.

Before installing the PTC software on the target platform, check the following:

- Has the Red Hat Linux 9 operating system been installed properly?
If not, proceed by installing the operating system. This software can be downloaded from
<http://ftp.redhat.com/pub/redhat/linux/9/en/iso/i386>
During installation, be sure to install the “Kernel Development” package, including the Tk GUI toolkit for Tcl, with shared libraries.
- At an existing installation of Red Hat Linux 9, check whether the “Kernel Development” package has been installed.
Select “Add or Remove Packages” and look for the “Kernel Development” package in the “Development” group.



- When booting an existing installation of Red Hat Linux 9, be sure to start the uni-processor kernel.

To check this at a running system, open a terminal window and type `uname -a`. If the output shows **SMP**, the multi-processor kernel has been started.

To install the target platform software:

- 1 Power up the target platform.
- 2 When Linux is being booted, start the uni-processor kernel.
At a multi-processor system, you are queried to select the kernel.
- 3 Log in to the system as **root**.
- 4 Open a terminal window to start installation.
- 5 Enter `mount /mnt/cdrom` to mount the CD-ROM drive.
- 6 Insert the PTC CD and enter the following command in the terminal window: `tar xvzf /mnt/cdrom/ptcgui-1.0.0.tar.gz`.
- 7 Enter `cd ptcgui-1.0.0`.
In this directory, you will find the files `install.sh` and a `README.TXT`.
Check the readme file for latest information.
- 8 Enter `./install.sh` to start the installation.

The target platform software (graphical user interface) for controlling the tests is now ready to run.

After installation, make sure that the directory `/usr/local/bin` is included in your path variable.

NOTE The installation and the program itself can only be run by the root user. If you want other users to execute the tests, you have to manually set the necessary permissions on `/dev/ttpi_proxy_device`, `/usr/local/bin/ptcgui.tcl`, and `/usr/local/lib/ptcgui/*`

NOTE No uninstall script is available for the target platform software. To uninstall the program, you have to manually delete all installed files. The files are installed in the following directories:

- `/usr/local/bin`
- `/usr/local/lib`
- `/usr/local/lib/ptcgui`
- `/dev`

AIC Mode Software and Topology Mode Software – Windows Installation

The AIC Mode and Topology Mode Software is installed by starting the executable: “Agilent E2969A Series for PCI Express <version> - Build <date>.exe”. The installation script does install all drivers and performs necessary system changes.

The software must be installed on a PC running Windows 2000 or Windows XP. In case of Topology mode the software must be installed on a different computer (controlling host) than the device under Test and communicates with the PTC through a USB connection. Minimum requirement for the topology mode tests to function correctly is a 1 GHz PC with a Pentium 4 or equivalent.

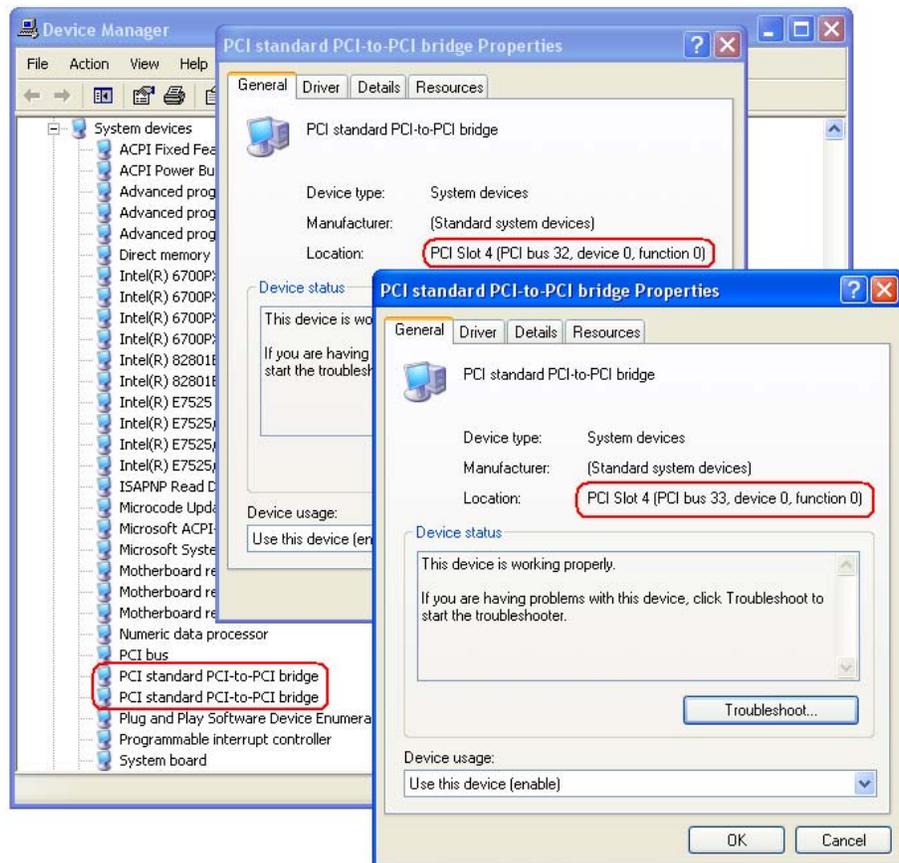
NOTE Be sure to install the software *before* connecting the controlling PC and the PTC with the USB cable.

NOTE For the AddInCard Drivers it is necessary that the PTC is plugged in, in the AddInCard Mode, properly installed in the system as two PCI-to-PCI

Bridges and no DUT is plugged in.

To ensure if the PTC is installed as 2 PCI-to-PCI Bridges, do following:

- 1 Go to Control Panel->System->Hardware->Device Manger
- 2 Select System Devices. Look for 2 “PCI standard PCI-to-PCI bridge” Devices with following PCI bus numbers. It should look like this:



If you install only the AIC tests and drivers it may be useful to install the USB-Driver for maintenance

The BootDisk, you are able to create while the installation, send a “Boot completed” command to the PTC and restarts the DUT. So you don’t have to Power cycle the DUT manually.

To install the software on the controlling host PC:

- 1 Log in to the PC.

You need administrator rights to install the software.

- 2 On the CD, look for the zip file named “Agilent E2969A Series for PCI Express <version> - Build <date>.exe”. and start it.
- 3 Run the executable

This install script installs all necessary software components and drivers onto your system.

- 4 Connect the PC with the PTC through the USB cable and power up the PTC (which means, power up the target platform).

The card should now be detected automatically (depending on the system speed this may take a while).

Installing the Hardware

CAUTION

The test card may become hot during use. Do NOT touch any of the components on the test card. Do NOT place the test card on flammable surfaces during or after operation.

To install the PTC in the target platform:

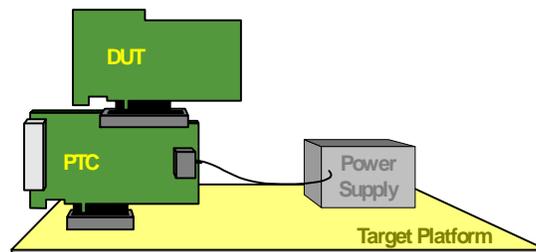
- 1 Power down the target platform.

2 Plug the test card into a free PCI Express slot.

This slot must be configured to run as an x1 PCI Express connection.

For the Add-In-Card test mode, it is necessary to power the PTC through the external power connector. For topology mode tests the PTC can either get powered by the system directly or via the external power connector.

3 Connect the external power connector of the PTC to any free standard ATX Power Connector in the target platform.



The above picture displays the setup for AIC test Mode. Topology test mode does not need a DUT card plugged into the PTC.

Next, proceed to check the installation as described in the following section.

NOTE As described above, the test card is usually powered through a standard ATX Power Connector provided by the target platform. If you attempt to connect the test card to an external power supply, only use power supplies that adhere to the industry standard ATX power supply specifications.

Testing the Installation

After installing hardware and software as described above, you should test the installation before starting to test your devices. This section provides some hints:

- When powering up the target platform, watch the four-digit display on the test card. The numbers indicate the states of the internal link state machine.

After some state switching, the four-digit should settle showing “xx10”.

The two digits on the right indicate the state of the link between the test card and the target platform. The digits “10” show that the link could be established.

If the display settles at any other number, an error has occurred (see *“Troubleshooting” on page 4-1*).

The left two digits indicate the state of the line between the test card and an add-in card plugged into the test card. If there is no card plugged onto the test card, this state is not relevant.

Linux

- While Linux boots up, make sure to start the uni-processor kernel and log in as root.

Open a terminal window and enter `lspci` to get a list of all PCI devices found in the system. This list should contain two unknown devices with the vendor ID 1855, indicating the two bridges contained in the PTC:

```

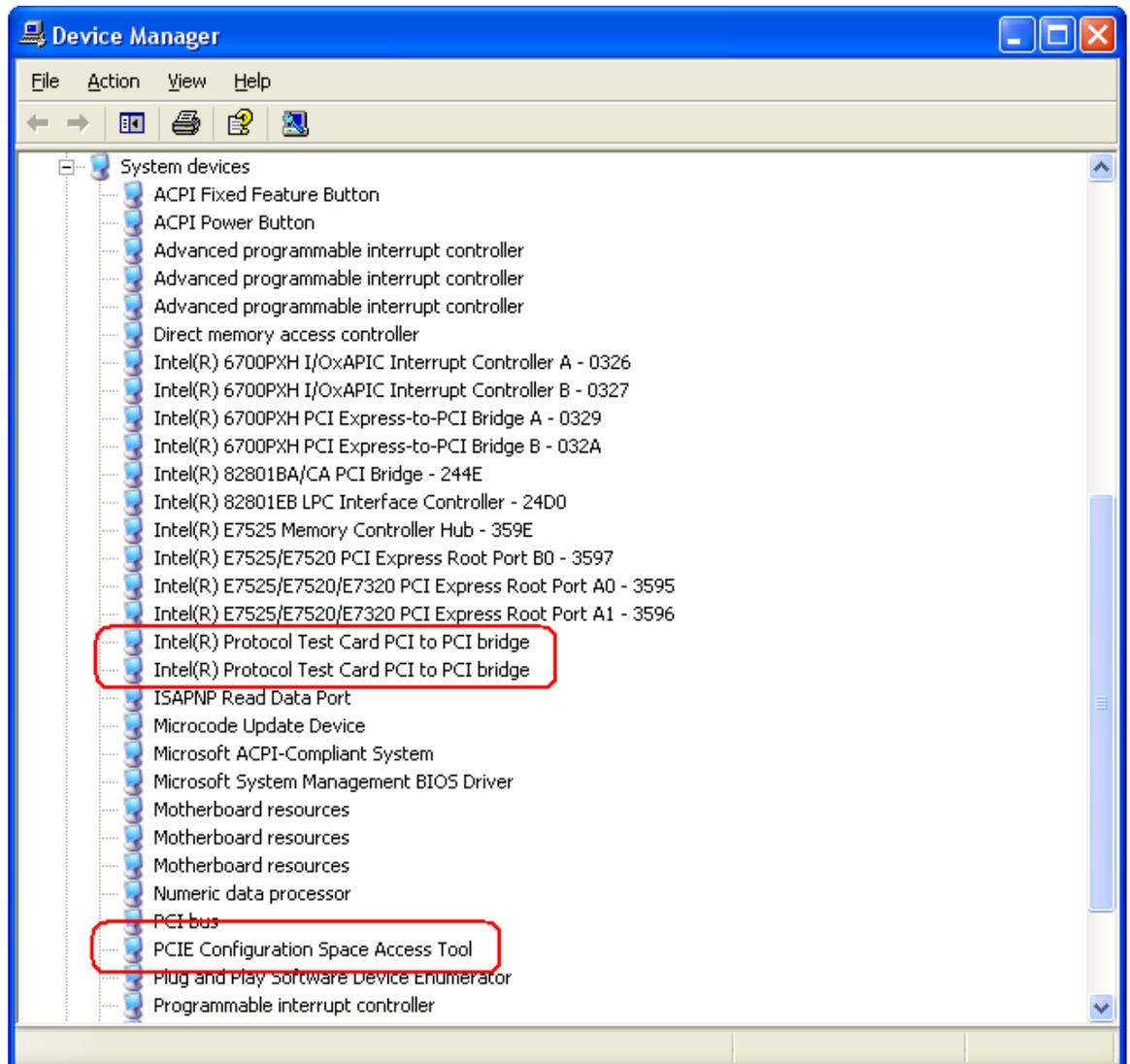
root@localhost:~
00:02.0 PCI bridge: Intel Corp.: Unknown device 3595 (rev 04)
00:04.0 PCI bridge: Intel Corp.: Unknown device 3597 (rev 04)
00:06.0 PCI bridge: Intel Corp.: Unknown device 3599 (rev 04)
00:08.0 System peripheral: Intel Corp.: Unknown device 359b (rev 04)
00:1d.0 USB Controller: Intel Corp. 82801EB USB (Hub #1) (rev 02)
00:1d.1 USB Controller: Intel Corp. 82801EB USB (Hub #2) (rev 02)
00:1d.2 USB Controller: Intel Corp. 82801EB USB (Hub #3) (rev 02)
00:1d.7 USB Controller: Intel Corp. 82801EB USB EHCI Controller (rev 02)
00:1e.0 PCI bridge: Intel Corp. 82801BA/CA/DB PCI Bridge (rev c2)
00:1f.0 ISA bridge: Intel Corp. 82801EB ISA Bridge (LPC) (rev 02)
00:1f.2 IDE interface: Intel Corp.: Unknown device 24d1 (rev 02)
00:1f.3 SMBus: Intel Corp. 82801EB SMBus (rev 02)
01:02.0 VGA compatible controller: ATI Technologies Inc Rage XL (rev 27)
02:00.0 PCI bridge: Intel Corp.: Unknown device 0329 (rev 04)
02:00.2 PCI bridge: Intel Corp.: Unknown device 032a (rev 04)
04:01.0 Ethernet controller: Intel Corp. 82545EM Gigabit Ethernet Controller (Co
pper) (rev 01)
04:03.0 SCSI storage controller: Adaptec AIC-7902 U320 (rev 03)
04:03.1 SCSI storage controller: Adaptec AIC-7902 U320 (rev 03)
06:00.0 PCI bridge: Unknown device 1855:0001 (rev 11)
07:00.0 PCI bridge: Unknown device 1855:0001 (rev 11)
[root@localhost root]#

```

- To test the communication between the PTC and the controlling host PC, connect both devices using the USB cable and use the "Maintenance" menu entry to retrieve a status message.

Windows AIC Drivers

- 1 Go to Control Panel->System->Hardware->Device Manger
- 2 Select System Devices. Look for 2 "Intel(R) Protocol Test Card PCI-to-PCI bridge" Devices with following PCI bus numbers and a "PCIE Configuration Space Access Tool" Device. Be sure, that there are no exclamation marks on this Devices. It should look like this:



If the installation was successfully you may now shutdown Windows, plug in the DUT, start Windows, select the DUT and begin with the AIC Tests.

Working with the PTC

Using the PTC to test your devices requires different steps, described in this chapter:

- You have to set up the test hardware (plug your DUT onto the PTC in case of AIC Tests or just plug the PTC into the system under test for KEP and Topology Test Mode).
- You have to launch the test software, connect to the DUT and execute the test.

Additionally, you may use the Windows version of the Software to connect with the PTC via USB to check for firmware and FPGA versions or to download new firmware images.

Setting up the Test Hardware for Add-In Card Mode

For setting up the test in Add-In-Card test mode, you have to plug the DUT (add-in card) into the PCI Express slot on top of the protocol test card. Make sure the PTC is switched to AIC Mode. You can do this with connecting the Windows software via USB and selecting the “Maintenance” menu tab to program the PTC to start up in AIC mode.

CAUTION

The test card may become hot during use. Do NOT touch any of the components on the test card. Do NOT place the test card on flammable surfaces during or after operation.

To plug the add-in card onto the PTC:

- 1 Power down the target platform.
- 2 Plug the DUT on top of the PTC (already plugged in the target platform).

NOTE For the Add-In-Card test mode, it is necessary to power the PTC through the external power connector. Connect the external power connector of the PTC to any free standard ATX Power Connector in the target platform. Make sure the jumpers next to the ATX power connector are set to external power.

- 3 Power up the target platform
- 4 When powering up the target platform, watch the numeric display on the test card.

The numbers indicate the states of the internal link state machine. After some state switching, the four-digit display should show “1010”.

The two digits on the right indicate the state of the line between the test card and the target platform. The digits on the left are for the line between the test card and the DUT. The digits “10” show that the line has been established successfully.

If the display settles at any other numbers, an error has occurred (see “*Troubleshooting*” on page 4-1).

- 5 To check whether the PTC is recognized correctly by the target platform, use the following commands:
 - For Linux: The `lspci` Linux command creates a list of PCI devices in the system. The PTC should show up as “PCI Bridge: Unknown Device 1855:0001”.
 - For Windows: Within the device manager the PTC should show up as two PCI-to-PCI Bridges with consecutive bus numbers. Make sure that the AIC drivers are installed correctly as it is shown in the installation chapter.

Setting up the Test Hardware for Topology Test Mode

For this mode, the system is the DUT. For setting up the test in Topology test mode, you have to plug the PTC into the PCI Express slot within the system. Make sure the PTC is switched to Topology Mode. This can be done with starting the Software and using the “Maintenance” Menu to program the PTC to start up in Topology Mode.

CAUTION

The test card may become hot during use. Do NOT touch any of the components on the test card. Do NOT place the test card on flammable surfaces during or after operation.

To plug in the PTC card into the system:

- 1 Power down the target platform.
- 2 Plug the PTC into the target platform.
- 3 Power up the target platform
- 4 When powering up the target platform, watch the numeric display on the test card.

The numbers indicate the states of the internal link state machine. After some state switching, the four-digit display should show “T10”.

The two digits on the right indicate the state of the line between the test card and the target platform. The digits “10” show that the line between PTC and system has been established successfully. The “T” on the left indicates that the PTC is switched to Topology Mode.

If the display settles at any other numbers, an error has occurred (see “*Troubleshooting*” on page 4-1).

Using the Test Software for AIC Tests under Linux

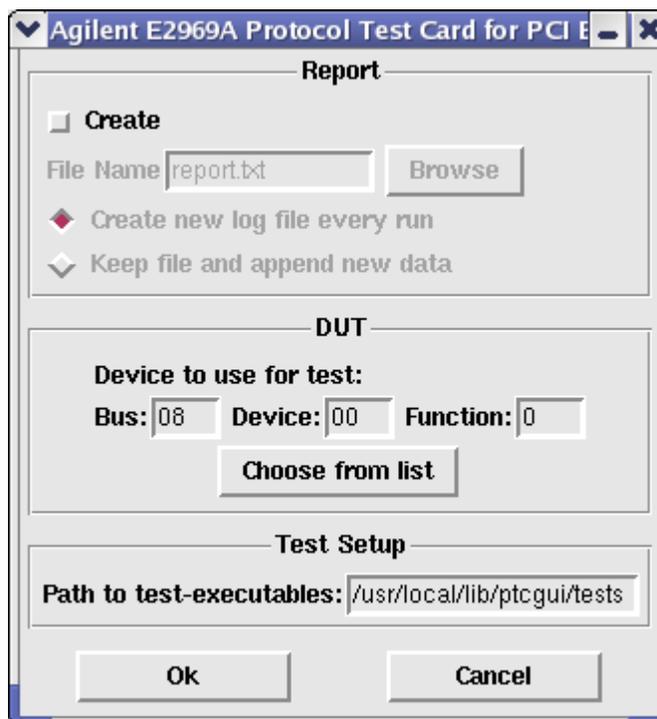
After setting up the test hardware, running the test is quite easy.

To start the test software:

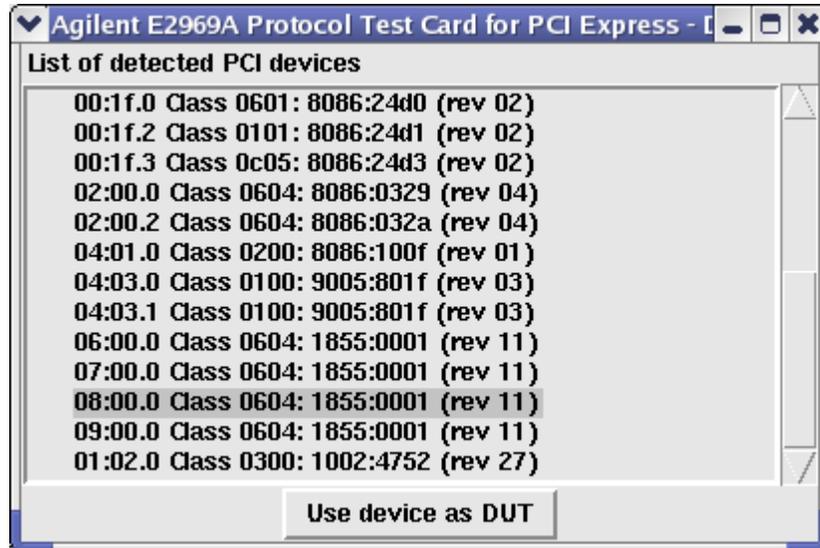
- 1 On the Linux desktop, press Alt+F2 to open a command window.
- 2 Enter `ptcgui.tcl` to start the test software.

To select the device to be tested:

- 1 Select the *View - Options* menu item.



- 2 In the Options dialog, click the *Choose from list* button.



- 3 From the list of detected PCI Express devices, select your DUT and click the *Use device as DUT* button.

To select the tests to be executed:

- 1 In the main window, select the checkboxes in the *Execute* column to determine the tests to be executed.
- 2 Click the run button .

The pass/fail results are shown for each test.

Execute	Status	Name	Description
<input type="checkbox"/>	n/a	TLP_BadLCRC	Discard TLP on bad LCRC, send NAK
<input type="checkbox"/>	n/a	DLLP_CorruptedCRC	Discard corrupted DLLP and report error
<input type="checkbox"/>	n/a	DuplicateTLP	Send ACK DLLP on duplicate TLP
<input type="checkbox"/>	n/a	LinkRetrainRetryFail	Retrain link on link fail
<input type="checkbox"/>	n/a	ReXmitOnNak	Retransmit TLP on NAK
<input type="checkbox"/>	n/a	ReplayNum	Retransmit TLP until REPLAY_NUM overflow
<input type="checkbox"/>	n/a	TLPReplayOrder	Ensure correct TLP order in replay
<input checked="" type="checkbox"/>	PASSED	ReplayTimer	Start REPLAY upon REPLAY_TIMER expiring
<input checked="" type="checkbox"/>	PASSED	DLLP_RsvdFields	All reserved fields must be 0
<input checked="" type="checkbox"/>	PASSED	TD_1_02	PCI Express Capability Structure Required Registers
<input checked="" type="checkbox"/>	PASSED	TD_1_03	PCI Express Capabilities Register
<input checked="" type="checkbox"/>	PASSED	TD_1_04	Device Capabilities, Control, and Status Registers
<input checked="" type="checkbox"/>	PASSED	TD_1_05	Link Capabilities, Control and Status Registers
<input checked="" type="checkbox"/>	PASSED	TD_1_06	MSI Capability Structure
<input checked="" type="checkbox"/>	PASSED	TD_1_07	Advanced Error Reporting
<input checked="" type="checkbox"/>	FAILED	TD_1_08	Virtual Channel Capability
<input checked="" type="checkbox"/>	FAILED	TD_1_09	CFG.11.1#1-2, CFG.11.2#1, CFG.11.2#5-6, CFG.11.3#2-3,
<input checked="" type="checkbox"/>	FAILED	TD_1_10	CFG.11.4#1, CFG.11.5#1-2, CFG.11.6#4-6, CFG.11.7#1-2, CFG.11.7#4, CFG.11.7#6-12, CFG.11.8#1-2, CFG.11.9#1
<input checked="" type="checkbox"/>	PASSED	TD_1_11	Timer and Min_Gnt/Max_Lat Registers
<input checked="" type="checkbox"/>	PASSED	TD_1_12	Timer and Min_Gnt/Max_Lat Registers
<input type="checkbox"/>	n/a	TD_1_13	Interrupt Pin and Interrupt Line Registers

The tests are named and programmed as specified in the “PCI Express Architecture Switch Compliance Checklist for the PCI Express Base 1.0a Specification” and the “PCI Express Architecture Configuration Space Test Considerations” published by the PCI-SIG.

The name of each test is shown in the *Name* column, the individual rules addressed by the test are shown as a tool tip, when you place the mouse pointer over the description of the test.

If you need more details about a failed test, check the report:

- ◆ Select the *View - Report* menu item.

The report shows more details about test execution and test results.

NOTE To help you find the cause for any failed tests, the PTC provides a connector to Agilent's E2960 protocol analyzer. With the analyzer, you can monitor and analyze captured PCI Express traffic between the add-in card and the target platform, for example.

Using the Test Software for AIC Tests under Windows

After setting up the test hardware, running the test is quite easy. The GUI software is identical between Linux and Windows and based on tcl/tk. Please see above screen shots for details.

To start the test software:

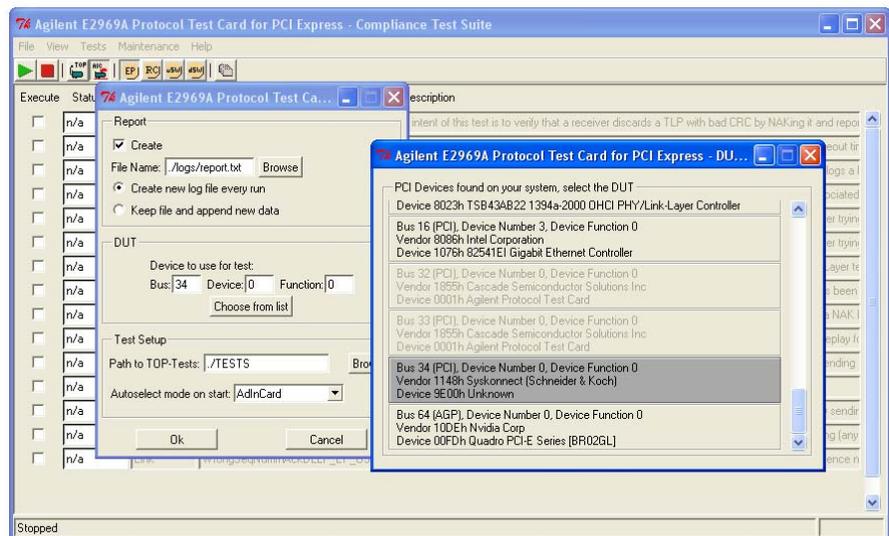
- 1 On the Windows desktop, start the PTC Software.

Select the device under test:

Select the *View-Options* Menu item.

In the options menu, click the *Choose from list* button.

From the *list* of detected PCI Express devices, click on the DUT entry



and confirm with *OK*.

- 2 Select the tests to be executed and press the run button to execute the tests.

Pass / Fail results are displayed per each test.

Using the Test Software for Topology Mode Tests under Windows

The graphical User Interface for the AIC and the Topology tests is identical. In the GUI the user can switch between AIC and TOPO tests via a menu button.

To start the test software:

- 1 On the Windows desktop, start the PTC Software.
- 2 Make sure the PTC is connected via USB and plugged into the System under Test. If an automated run of the topology based tests is required, make sure to create a bootable floppy disk with the boot image from the installation. You can do this via the start menu entry “create boot disk”. This boot disk is sending a special signal to the PTC to signalizing that the test has passed. Afterwards it reboots the System under Test to perform the next test. You can also manually reboot the system under test.
- 3 Make sure the PTC is switched to Topology Mode. You can check that with powering the system under Test and look if the display on the PTC shows “T10” for a correct topology mode with linkup. You can also

use the window under the menu entry “maintenance” to switch the PTC to topology mode if necessary.

- 4 Select the tests you would like to run and press the green run button.
- 5 Power on the system under test. While the system boots up, the PTC simulates a certain topology to the BIOS, depending on the current test. If the system is completely booted and the reboot floppy disk is inserted, it will automatically reboot for the next test. If not, please turn off the system to show to the software that the test is over. The software will then display a “Passed” or “Failed”.
- 6 After the tests are run, the log files will contain the configuration accesses and the programmed configuration space. In case of a test failure the software mentions the root cause in the log files.

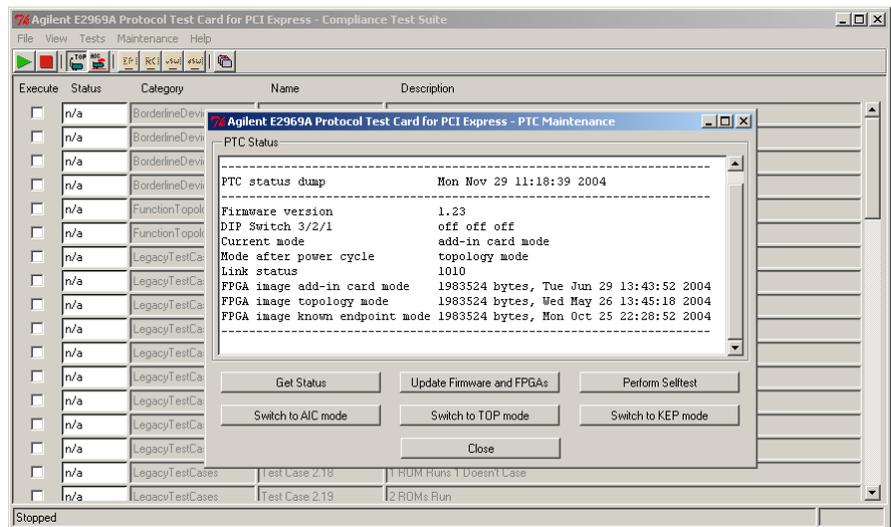
Pass / Fail results are displayed per each test.



The above picture gives an impression of the current look and feel of the topology test mode.

Administering the PTC

The windows version of the software can also be used to administer the PTC. A USB connection to the PTC is needed for that. This can be used when the PTC and the administration PC are connected via USB. The tab “maintenance” in the windows software version leads to the administering functions.



Please see the above picture for a sample.

- **GET STATUS:** This is used to get and up-to-date status of the PTC. It also displays firmware and FPGA image versions. These numbers are intended for debugging, trouble shooting and support purposes.
- **UPDATE FIRMWARE AND FPGAS:** This button will update the firmware and the FPGA images on the card with the newest images provided with the software version that is installed. Use this button to install new software packages loaded from the Agilent website.
- **PERFORM SELF TEST:** This runs a selftest that checks the internal hardware and software of the PTC to see if everything works ok. It creates also a high speed link on the PTC itself to check for signal

integrity issues within the PTC. Use this if you are unsure if the PTC might have a hardware issue.

- **SWITCH TO AIC MODE:** This switches the PTC to AIC mode and programs the PTC to come up in AIC mode with any further power up event.
- **SWITCH TO TOPO MODE:** This switches the PTC to Topology Test mode and programs the PTC to come up in Topology Test mode with any further power up event.
- **SWITCH TO KEP MODE:** This switches the PTC to Known Endpoint (KEP) test mode and programs the PTC to come up in KEP mode with any further power up event. The KEP mode will be supported with one of the next releases.

NOTE The firmware version is also briefly displayed on the four-digit display when the PTC powers up (for example, “V123” means version 1.23).

Troubleshooting

This chapter provides troubleshooting suggestions that help you to resolve general problems in setting up the target platform and testing devices.

If the PTC does not link to the target platform properly (Digital display of PTC is not “XX10”)

Description When the target platform powers up, the four-digit display on the test card indicates the state of the internal link state machine.

The two digits on the right indicate the linking state of the PTC and the target platform. If the display settles at any other numbers than “XX10”, an error has occurred. See “*Appendix*” on page 5-1 for a list of all possible states of the internal link machine.

Possible Actions Please try the following:

- Make sure that the PCI Express slot of the target platform is configured as a x1 PCI Express connection.
- To make sure that the linking problem is not caused by the DUT, check the linking state of the PTC only (in case of AIC test mode with a plugged in DUT):

Power down the target platform, pull out the DUT and power up the system again.

If the PTC is still not linked correctly, proceed with the next step in this list.

- Check whether the PTC was found by the target platform:

Linux: Open a terminal window and enter `lspci` to get a list of all PCI devices connected to the target platform.

The list should display two unknown devices, indicating the two bridges contained in the PTC (see “*Testing the Installation*” on page 2-10).

If the two required entries are not in the list, the PTC may not be plugged in correctly. Power down the target platform, take out the PTC and try to plug it in correctly.

Windows: Open the device manager and check for installed hardware. The PTC should show up as PCI device in the list of available hardware.

- Disable the SSC (Spread Spectrum Clocking) mode in the BIOS settings.

AIC Mode tests: If the PTC does not link to the DUT properly (Digital display of PTC is not “1010”)

Description When powering up the target platform, the four-digit display on the test card indicates the state of the internal link state machine.

The two digits on the left hand side indicate the linking state of the PTC and the DUT. If the display settles at any other numbers than “1010”, an error has occurred.

See “*Appendix*” on page 5-1 for a list of all possible linking states.

Possible Actions Please try the following:

- Make sure the DUT applies to the PCI Express Specification 1.0a. PCI Express Specification 1.0 devices are *not* supported by the PTC.
- If possible, check the functionality of the DUT:
Power down the target platform, remove the PTC, plug the DUT directly in the target platform, and power up the system again.
If the DUT is working properly, proceed with the next step in this list.
- To exclude malfunctions of the FPGA on board the PTC, you can set up the PTC so that it simply passes the electrical signal from the target

platform through to the DUT—without any modification of the signal by the FPGA.

To do so, power down the target platform, set the DIP switches to pass-through-mode (see “*Appendix*” on page 5-1) and power up the system again.

NOTE Before you continue testing, power down the target platform again and reset the DIP switches.

If the test software does not start under Linux

Description If the command for starting the test software was entered properly, but the GUI is not started, make sure that the “Kernel Development” package of Red Hat Linux 9 is installed, including the Tk GUI toolkit for Tcl.

Possible Actions To check for the Tk GUI toolkit and—if necessary—install it:

- 1 In the start menu (red hat), select “System Settings – Add or Remove Packages”.
- 2 In the “Development” group look for “Kernel Development” and click *Details*.
- 3 If not done already, select “Tk GUI toolkit” and click *Update*.

If the DUT cannot be selected

Description If the device to be tested cannot be selected from the *Options* dialog, the DUT is either not plugged in correctly, or you are not logged in as root user.

Possible Actions Please try the following:

- Check whether the DUT is properly plugged into the PTC.

Linux

- Reboot the system and log on as root user.

Windows

1 Go to Control Panel->System->Hardware->Device Manger

2 Look for the DUT.

- If you found it, double-click it, read the Bus, Device and Function numbers and write them manually into the corresponding fields in the Options Dialog.

If you can't find the DUT in the Device Manager, check the functionality of the DUT:

Power down the target platform, remove the PTC, plug the DUT directly in the target platform, and power up the system again.

Repeat the steps 1 and 2. If you can find it, check PTC FPGA functionality:

To do so, power down the target platform, set the DIP switches to pass-through-mode (see *"Appendix" on page 5-1*) and power up the system again.

NOTE Before you continue testing, power down the target platform again and reset the DIP switches.

If all tests fail

Possible Actions If all tests executed by the PTC software fail and you are not sure, whether this is a problem of the DUT, check the following:

- Determine whether the link between the PTC and the target platform and the link between the PTC and the DUT have been established successfully (see above).

Linux

- Make sure the uni-processor kernel is started:

Open a console window and type `uname -a`.

If the output shows `SMP`, the multi-processor kernel has been started. Reboot the target platform and make sure to select the uni-processor kernel when queried in the booting process.

- Make sure that the Linux driver for the PTC is installed.

Start a Test and without closing the software, open a console window and type `lsmod`.

The output should contain the following drivers:

- `splus`
- `ttpi_splus_kernel_lib`
- `pcie_user_config_driver`
- `pcie_config_lib`
- `DevMgmtLib`
- `complib`

If the output shows the above drivers, all drivers got installed correctly. Otherwise you can load the driver subsequently:

Open a console window and enter the following commands

```
- insmod /lib/modules/2.4.20-8/misc/complib.o
- insmod /lib/modules/2.4.20-8/misc/DevMgmtLib.o
- insmod /lib/modules/2.4.20-8/misc/pcie_config.o
- insmod /lib/modules/2.4.20-8/misc/pcie_user_config_driver.o
- insmod /lib/modules/2.4.20-8/misc/ttpi_splus_kernel_lib.o
- insmod /lib/modules/2.4.20-8/misc/splus.o
```

The Linux driver is now installed.

Windows

- Go for sure, that you have the right Bus/Device/Function number for the DUT
- Check the installation of the AIC drivers as it is shown in the Installation chapter.

- Check the Reportfile for errors, all errors will be shown there.

Still not working? / Other problems

If your problems are not described here, please visit http://www.agilent.com/find/E2969A_PTC for more information, or find your local support using <http://www.agilent.com/find/assist> .

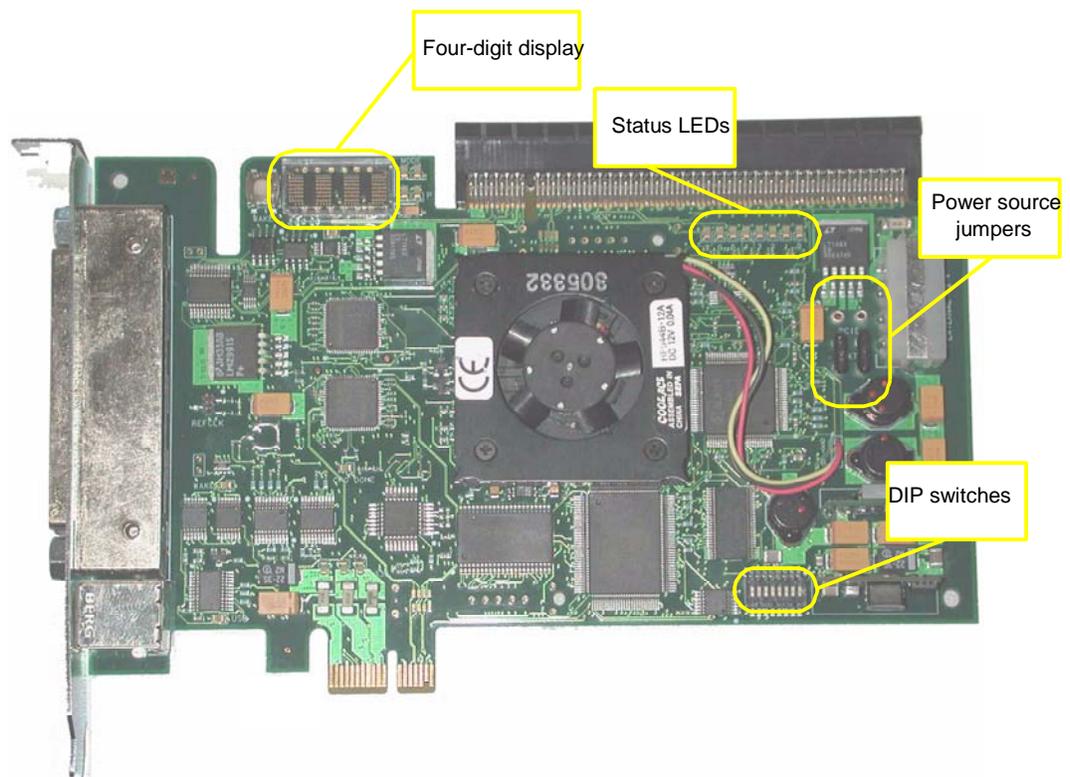
What should I do before calling the support?

Before calling, it is a good idea to run the Windows version of the software, connect the PTC via USB and perform a status read (via the maintenance menu entry) and a self test. The status read prints a few status lines in a window to help identify the internal versions of the firmware and FPGA images for the PTC. This might also give an indication which mode the card is in and which mode the card will switch into after the next power-up. The self test feature checks if the PTC is capable of establishing a link with itself and that the internal PTC hardware is functioning correctly.

Appendix

Hardware Description

On the Agilent E2969A protocol test card, there are a number of control elements that you may use in certain test and troubleshooting situations.



Four-Digit Display

This four-digit numeric display indicates the states of the internal link state machine.

The two digits on the left represent the downstream link of the test card (only in case of AIC Test Mode), the link between the test card and the add-in card plugged onto it.

The two digits on the right represent the upstream link of the test card, this is the link between the test card and the target platform.

When all links have been established successfully during boot up, the display shows “1010” for AIC Test Mode. Topology Test Mode displays a “T10”. All other numbers indicate an error.

The following table shows the link states represented by the individual numbers:

Number in display	Link state
00	Detect.Quiet
01	Detect.Active
02	Polling.Active
03	Polling.Compliance
04	Polling.Configuration
05	Polling.Speed1
06	Polling.Speed2
07	Configuration.Linkwidth.Start
08	Configuration.Linkwidth.Accept
09	Configuration.Lanenum.Wait

Number in display	Link state
0A	Configuration.Lanenum.Accept
0B	Configuration.Complete
0C	Configuration.Idle
0D	Recovery.RcvrLock
0E	Recovery.RcvrCfg
0F	Recovery.Idle
10	L0
11	L0S
12	L123.Send.Idle
13	L1.Idle
14	L2.Idle
15	L2.Transmit.Wake
16	Disabled.Entry
17	Disabled.Idle
18	Disabled
19	Loopback.Entry
1A	Loopback.Active
1B	Loopback.Exit
1C	Loopback.Exit.Timeout
1D	Hot.Reset.Entry
1F	Hot.Reset

Status LEDs

The following table shows the meaning of the LEDs, when they are on:

Number of LED	Information
0	Link up upstream port towards target platform
1	Link activity
2	(not used)
3	(not used)
4	Link up downstream port towards DUT
5	Link activity
6	(not used)
7	FPGA is correctly loaded (LED is flashing)

DIP Switches

The connector on the front plate of the PTC allows connecting the PTC to an Agilent E2960 protocol analyzer. The analyzer can be used to monitor the PCI Express traffic at one of the following points:

- between the target platform and the PTC (at the bottom connector)
- between the PTC and the add-in card plugged onto the test card (at the upper connector)

Of the eight DIP switches as shown in the picture above, the two switches on the left control these settings. All other DIP switches are for internal use only. Do NOT change their position.

The meaning of these two switches is as follows:

Switch 1	Switch 2	Meaning
0	0	The analyzer monitors communication between the PTC and the target platform.
0	1	Pass-through mode: PCI Express traffic between the target platform and the add-in card is simply passed through the PTC. The analyzer monitors communication between the add-in card and the target platform.
1	0	The analyzer monitors communication between the PTC and the add-in card.
1	1	For internal use only.

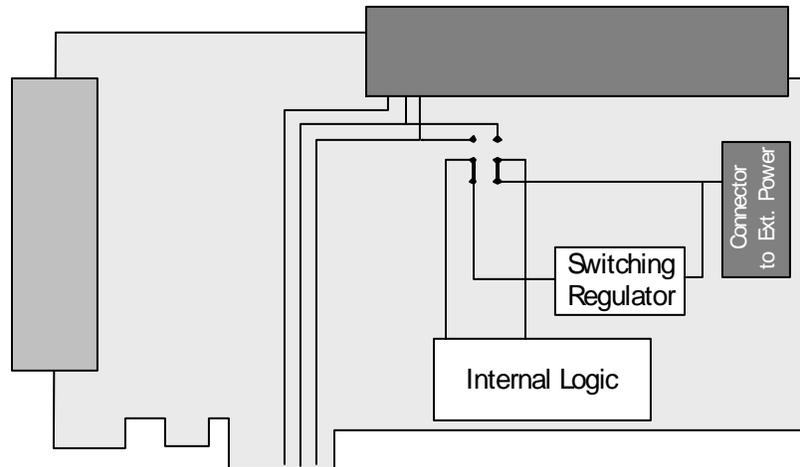
Power Distribution

The following picture shows an overview of how the power is distributed on the PTC.

The PTC can be powered by two sources alternatively:

- by an external power supply (default)
- by the target platform through the PCI Express connector just as any other PCI Express card.

The following figure shows the power distribution in both cases:



Power Source Jumpers

The two jumpers on the PTC select the power source to be used *by the PTC*. The power *for the DUT* is always drawn from the system under test.

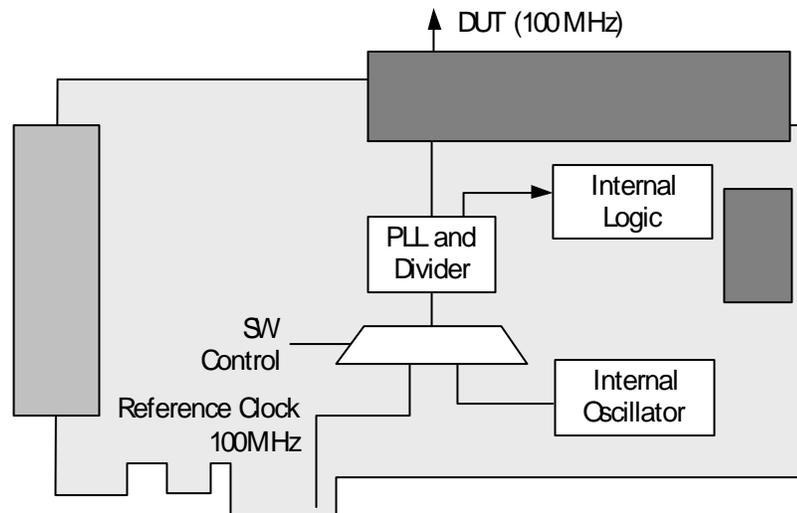
Both jumpers have to be set either up or down. Upward setting selects system under test for power supply, downward setting selects external power supply.

CAUTION

Do not change the jumpers while the test card or the target platform are powered.

Clock Distribution

The following figure shows an overview of the clock distribution.



The clock is generated using the system-provided 100 MHz PCI Express reference clock. However, there is also the possibility to use the internal clock oscillator if for some reason the system clock cannot be used. The reference clock and the internal clock are used for the internal logic of the PTC as well as for providing the clock to the DUT plugged onto the PTC.

To change the clock source use the administration tool `ptcdiag` on the administration PC connected to the PTC through USB.

To switch to the internal clock, enter the command: `ptcdiag -w 0xd818 0`

To switch back to the PCI Express reference clock, enter the command:
`ptcdiag -w 0xd818 1`

After the next power down, the PCI Express reference clock will be used again automatically.

NOTE With SSC in the target system external clock must be used. This is the

default.

Technical Specifications

General Specifications

Supported Protocol:	PCI Express Specification Version 1.0a
Lane width and speed:	PCI Express x1 link at 2.5 GB/s
Storage:	-10°C to 70°C
Operating Temperature:	0°C to 55°C
Mechanical Dimension:	Short card, occupying one slot.
Signal Loading:	PCI Express compliant
Power consumption:	Consumes less than 15W from PCIE-slot if not externally powered

NOTE The card creates approximately 100 mV voltage drop from bottom to top connector. If the DUT experiences problems, please power the DUT externally.

PCI Express High Speed Parameters

In some parameters the PTC slightly differs from the PCI Express specification.

Differential Receiver Output Specification

Parameter	PTC Value	PCI Express Spec
Maximum Time for transition to a valid electrical idle	40 ms	20 UI
Electrical Idle differential peak output voltage	Initially 1.4 Volts, after 30 μ s below 20 mV	20 mV

Differential Receiver Input Specification

Parameter	PTC Value	Spec requirement
AC Peak Common Mode Voltage	100 mV	150 mV
Powered Down DC Input Impedance	50 Ohms	200 kOhms
Electrical Idle Detect Threshold	Electrical Idle detection is not threshold based	Between 65 and 175 mV



Manufacturer's Name: Agilent Technologies Manufacturing GmbH & Co. KG
 Manufacturer's Address: Digital Verifications Solutions (DVS)
 Herrenberger Str. 130
 D-71034 Boeblingen

Declares under sole responsibility that the product as originally delivered

System Name:	Computer Verification Tools and Software products incl. options	
System Number:	E2920	
Product Names:	E2925B	PCI-Bus Exerciser/Analyzer; 32bit; 33 MHz
	E2926B	PCI-Bus Exerciser/Analyzer; 64bit; 33 MHz
	E2927A	PCI-Exerciser/Analyzer; 32/64bit; 66MHz
	E2928A	PCI-Exerciser/Analyzer; 32/64bit; 33/66MHz
	E2940A	Compact PCI Exerciser / Analyzer
	E2922A/E2922B	PCI-X Master Target Card; 64 bit; 133 MHz
	E2929A/E2929B	PCI-X Exerciser and Analyzer; 64 bit; 133 MHz
	E2969A	PCI Express Protocol Test Card
	E2991A	External Power Supply

complies with the essential requirements of the following applicable European Directives, and carries the CE marking accordingly:

- The Low Voltage Directive 73/23/EEC, amended by 93/68/EEC
- The EMC Directive 89/336/EEC, amended by 93/68/EEC

and conforms with the following product standards:

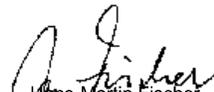
EMC (Technical Construction File) The product herewith complies with the requirements of the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE Marking accordingly (European Union).
 Against: EMC test specification EN 55011:1998 (Group 1, Class A)
 As detailed in Electromagnetic Compatibility (EMC) Certificate of Compliance No. 00-143
 Assessed by: CETECOM GmbH, D-45219 Essen

	Standard	Limit
EMC	IEC 61326:1997+A1/1998 / EN 61326:1997+A1/1998 CISPR 11:1997 / EN 55011:1998 IEC 61000-4-2:2001 / EN 61000-4-2:2001 IEC 61000-4-3:2001 / EN 61000-4-3:2001 IEC 61000-4-4:1995+A1:2000+A2:2001 / EN 61000-4-4:2002 IEC 61000-4-5:2001 / EN 61000-4-5:2001 IEC 61000-4-6:2001 / EN 61000-4-6:2001 IEC 61000-4-8:2001 / EN 61000-4-8:2001 IEC 61000-4-11:2001 / EN 61000-4-11:2001 Canada: ICES-001:1998 Australia/New Zealand: AS/NZS 2064.1	Group 1 Class A 4kV CD, 8kV AD 3 V/m, 80-1000 MHz 0.5kV signal lines, 1kV power lines 0.5 kV line-line, 1 kV line-ground 3V, 0.15-80 MHz 30A/m 1 cycle/100%
Safety	IEC 61010-1:2001 / EN 61010-1:2001 Canada: CSA C22.2 No. 1010.1:1992 USA: UL 3111-1:1994	

Supplemental Information:

The product was tested in a typical configuration with Agilent Technologies test systems.

2004-March-11
 Date


 Hans-Martin Fischer
 Name
 Product Regulations Representative
 Title

For further information, please contact your local Agilent Technologies sales office, agent or distributor.
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