PCI Express® Protocol Triggering and Decode for Infiniium 90000 Series Oscilloscopes

Data sheet

This application is available in the following license variations:

- Order N5463A for a user-installed license
- Order option 017 for a factory-installed license with a new 90000 Series oscilloscopes
- Order N5435A option 032 for a server-based license that works on both 9000 and 90000 Series oscilloscopes

Agilent Technologies

PCI Express ® (peripheral component interconnect express), PCIe, is a computer expansion card standard that enables high-speed serial technology. There are two main technologies protocol speeds from 2.5 Gb/s to 5 Gb/s (gen1 and gen2 respectively). PCIe gen 2 satisfies the increased need for bandwidth of high-performance applications such as graphics, and also allows existing applications to retain bandwidth while moving to a reduced pin count. The smaller link width ultimately leads to lower system cost. To understand what is occurring on the bus typically you must convert captured 1's and 0's to protocol with either protocol analyzer or manually. Of course, manually means that it can't be done in real-time, and includes potential for human error. Using a protocol analyzer sometimes increases the price for the PCIe solution as it requires an entirely new instrument. Unfortunately traditional oscilloscope hardware triggers and software capability typically are not sufficient for specifying protocol-level conditions and decoding complicated busses.

Agilent Technologies Infiniium PCIe protocol viewer software enables the industry's first totally integrated oscilloscope-based protocol analyzer that provides time correlated views of physical layer and transaction layer errors. You get packet-level decode for PCI Express built into a real-time oscilloscope. This software provides you with a fast, easy way to isolate signal integrity problems from logic-level coding errors on bidirectional serial data streams. This capability allows you to test, debug and characterize your designs to the logic and link layer. Extend your scope capability with Infiniium's protocol viewer application. This application makes it easy to debug and test designs that include PCIe gens 1 and 2 using your Infiniium 90000 scope.

- Setup wizard for quick setup, configuration and test.
- Decode button for decoding with the push of a button
- Packet-level decode of data symbols as well as link and transaction layers
- Decode of scrambled and unscrambled symbols
- Bi-directional symbol and packet level decode
- Simultaneous display of packet/ symbol lists and waveform overlay
- Capability to save symbol and packet data lists to .csv and .txt files
- Packet decode details tab provides detailed information on:
  - Packets
  - Channel information
  - Complete listing window
  - Data symbols
  - Control and data symbols
  - Transaction header fields
  - Data payload popup
  - Payload display shows data payload
- Unique packet-waveform correlation marker "blue line" makes it easy to scroll through waveforms to view synchronized packet and symbol lists
- Comprehensive serial search capabilities
- Software trigger and stop on search
- Control symbol and packet search
- Debug your training and power management problems

Rapid setup

Configure your oscilloscope to display protocol decode in under 30 seconds. Typically a variety of factors must be specified correctly in order for both software triggering and serial decode to work. These factors include sample rate, memory depth, trigger levels, and measurement thresholds. The application includes an AutoSetup capability that will automatically setup all of these parameters for the user. Or, choose to manually configure any or all of these scope settings or use the Serial Data Wizard

Use protocol viewer as a trigger out of the trigger menu, for the most in depth and complete software triggering available in oscilloscopes today.

Protocol decode

This application provides protocol decode capabilities. Decode can be turned in the "Setup" menu. Decode can be shown as symbols embedded on the waveform display or as a listing in a protocol viewer window. All decoding is time correlated.

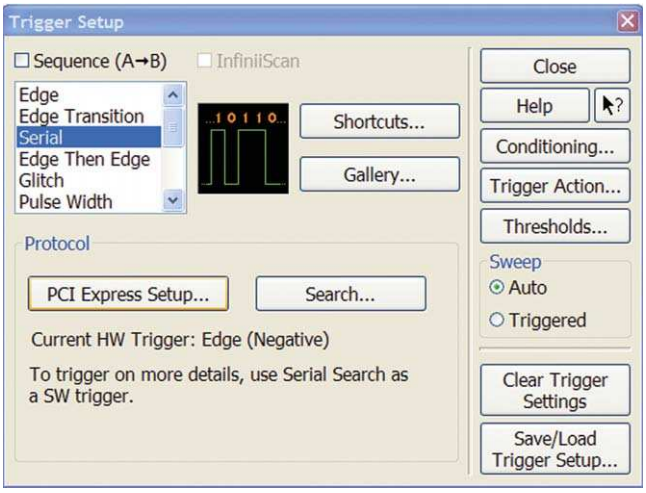


Figure 1: Easy triggering capability

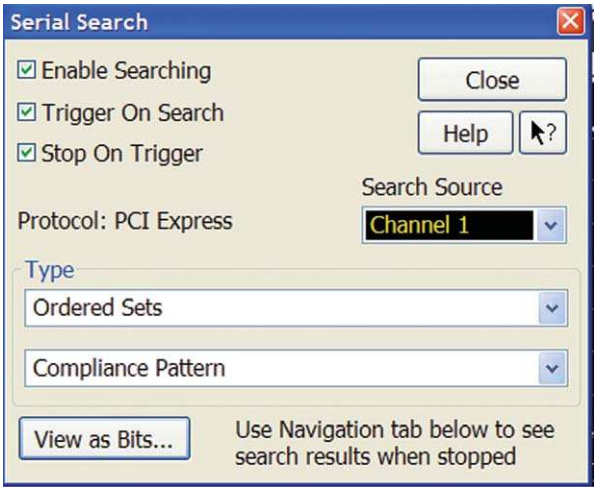


Figure 2: Unmatched triggering capability

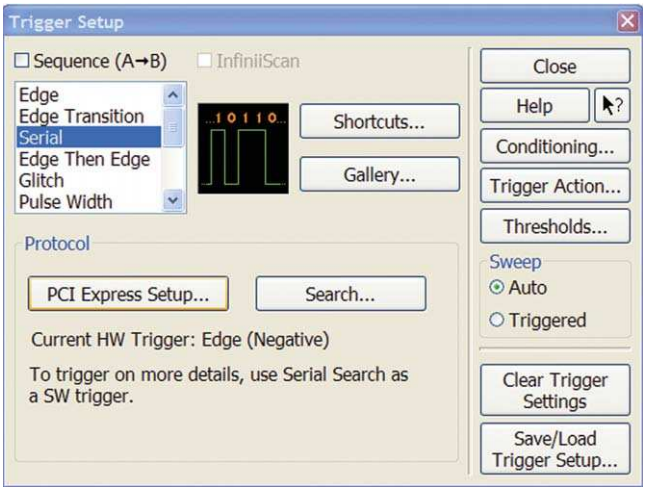


Figure 3: Integrated decoding capability PCIe protocol decode with precise time-correlation between waveforms and listing

Agilent's multi-tab protocol viewer includes correlation between the waveforms and the selected packet. The selected packet, highlighted blue row in the listing, is time-correlated with the blue line in the waveform display. Move the blue tracking marker in time through waveforms and the blue bar will automatically track in the packets window. Or, scroll through the packet viewer and highlight a specific packet. The time-correlation tracking marker will move to the associated point in the waveform.

Support for bi-directional serial and packet decode

Choose up to two channels and get deep decoding capability for upstream and downstream bi-directional PCIe bus Infiniium 90000 windows.

Full screen PCIe listing

Fill the entire display with compact protocol information using the full screen listing. The protocol viewer window shows the index number, time stamp value, and data content for each serial packet in the list. Scroll though all decoded serial packets to find events of interest or errors in the transmission. Data in the listing window can be saved to a .csv or .txt file for off-line analysis or documentation.

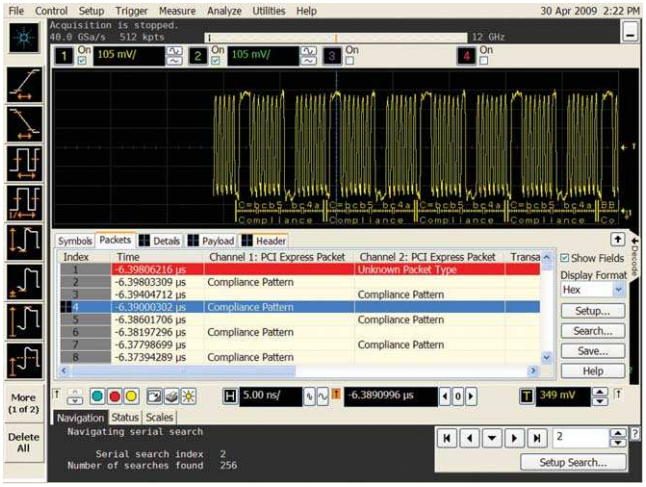


Figure 4: Time-correlated trigger menu

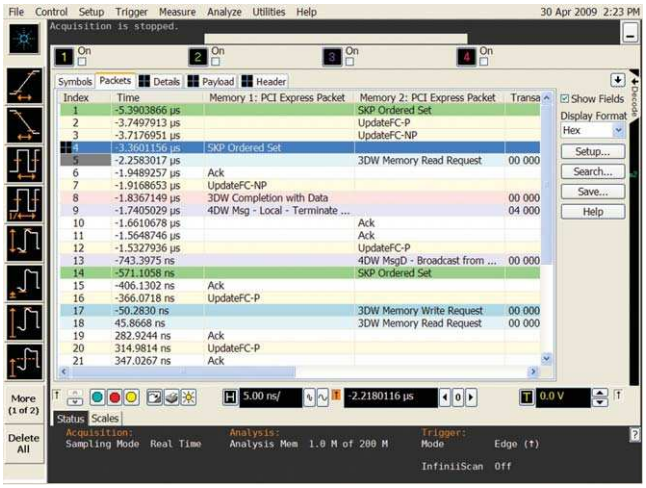


Figure 5: Full screen listing window

Easy navigation with search

The application includes a powerful serial search tool that allows you to search for a pattern that is a data control symbol or packet. The search capability also includes a comprehensive packet search and trigger capability that allows you to specify search conditions like errors or data packets. This allows you to specify desired trigger conditions and makes finding errors or packet types easy by eliminating the need to do manual searches of very long records.

The application Includes five "tabs" for easy viewing of the PCIe bus:

- Details tab breaks the packets into easy-to-read textual fields. Hovering shows additional detail.
- Payload tab shows data carried by the packet in byte-by-byte HEX and ASCI.
- Header tab shows packets in a data book format. Hovering on any tab reveals additional detail.
- Packets tab that shows full details of each individual packet
- Symbols tab that shows the high level decoding of the bus

The PCIe protocol viewer also includes an easy-to-use navigation pane that allows you to quickly isolate the detail that you need.

Figure 6: Easy navigation through the navigation paney

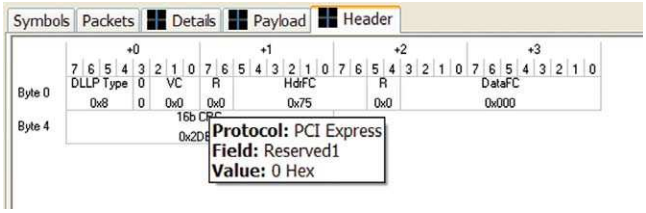


Figure 7: Header tab provides packets in a data book format

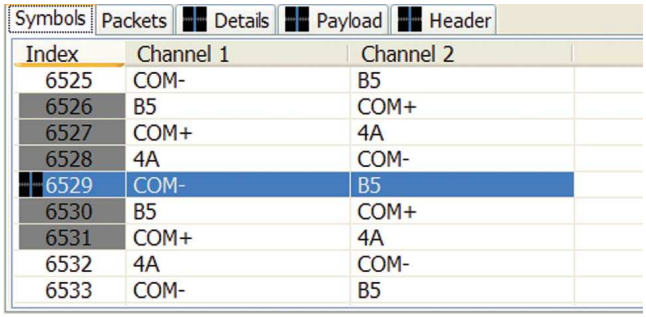


Figure 8: Symbol tab provides fast overview and searching capability

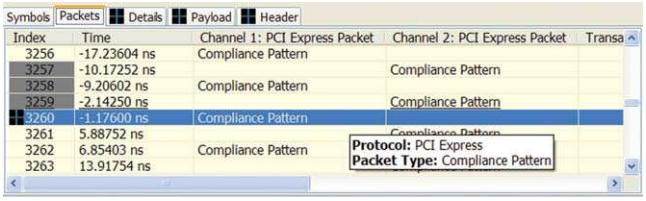


Figure 9: Packet view provides full detail of all PCIe packets

PCIe specifications and characteristics

PCIe source (clock and data)	Analog channels 1,2, 3, or 4 , Any waveform memory
PCIe	gen 2 (up to 5 Gbps (automatic)) or gen 1 (2.5 Mb/s) 1x (bi-directional)
Autoset	Automatically configures scope settings for proper PCIe decode and protocol triggering including clock recovery
Triggering (software-based search)	Packet types Ordered sets Packets DLLP packets TLP packets 3DW packets 4DW packets Symbol sequence Errors Packet set type SKP ordered set Fast training sequence Electrical Idle ordered set Electrical Idle exit set TS1 training sequence TS2 training sequence Modified compliance pattern Delayed modified compliance pattern Compliance pattern Delayed compliance
Decode options	Symbol display formats Hex K/D codes Label Decimal Maximum number of directions (2)

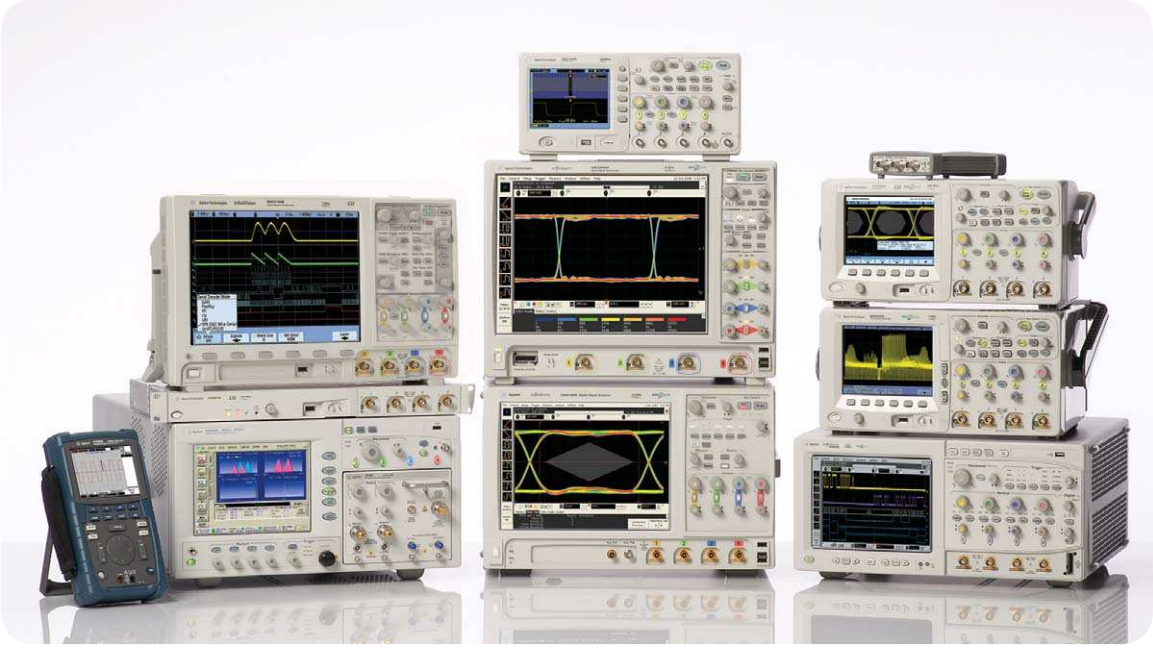
Ordering information

This application is compatible with all 90000 Series oscilloscope models.

Software applications	Factory-installed node-locked license for new scope purchases	User-installed node-locked licenses	Server-based license (N5435A option)
PCIe protocol triggering and decode	017	N5463A	032

Related literature

Publication title	Publication type	Publication number
Infiniium 90000 Series Data	Data sheet	5989-7819EN
PCI Express Compliance application	Data sheet	5989-1240EN



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