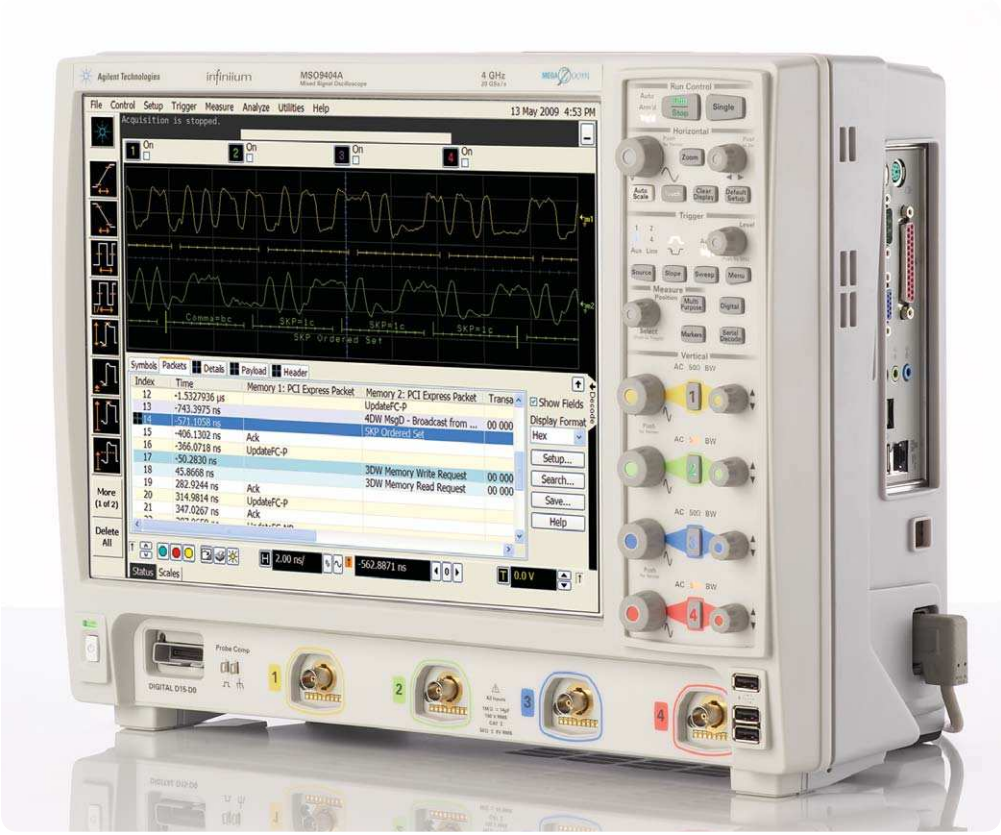
PCI Express® Protocol Triggering and Decode for Infiniium 9000 Series Oscilloscopes

Data sheet



This application is available in the following license variations.

- Order N5463B for a user-installed license
- Order Option 006 for a factory-installed license with new 9000 Series oscilloscopes
- Order N5435A Option 032 for a server-based license

Agilent Technologies

Easily debug and test designs that include PCI Express protocols using your Infiniium 9000 scope

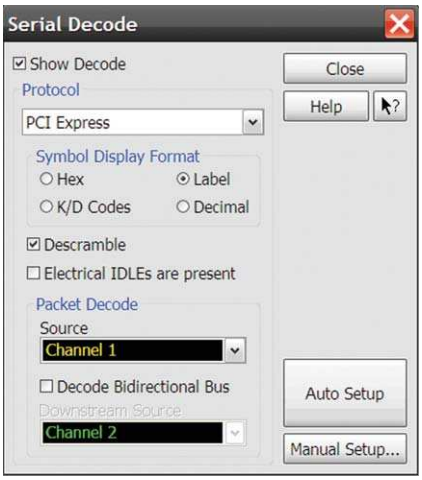
PCI Express® interfaces are gaining in popularity outside of the computer industry. PCIe® buses can provide a content-rich point for debug and test. However, since PCIe protocols transfer bits serially, using a traditional oscilloscope has limitations. Manually converting captured 1's and 0's to protocol can't be done in real-time. In addition, traditional scope triggers are not sufficient for specifying protocol-level conditions. Agilent provides an economical alternative for low-level PCIe debug.

Extend your scope capability with Agilent's PCIe protocol triggering and decode application. This application makes it easy to non-intrusively debug and test designs that include 2.5 Gb/s PCIe gen 1 using your Infiniium 9000 scope. Need to debug training and power management problems? This application can show what is happening during training. Using x4, x8, or even x16 links? Use the application to look at any lane, one lane at a time.

- Set up your scope to show PCIe gen 1 protocol decode in less than 30 seconds.
- Get access to a rich set of integrated protocol-level triggers.
- Save time and eliminate errors by viewing packets at the protocol level.
- Use time-correlated views to quickly troubleshoot serial protocol problems back to their timing or signal integrity root cause.

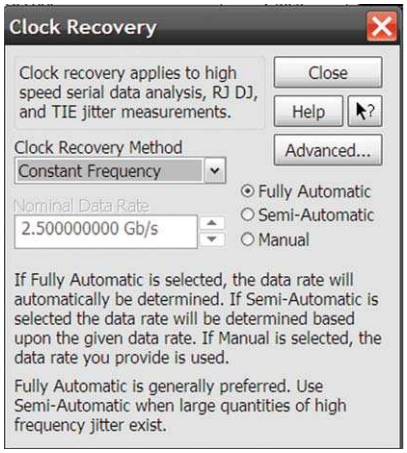
Easy to find

Turn decode on/off via the "Serial Decode" button on the front of the instrument or in the "Setup" menu. View decode embedded on the waveform display or in the protocol viewer listing window. (See pages 4-5).



30 Second Setup

Configure your oscilloscope to display protocol decode in under 30 seconds. Use "Auto Setup" to automatically configure sample rate, memory depth and threshold and trigger levels.



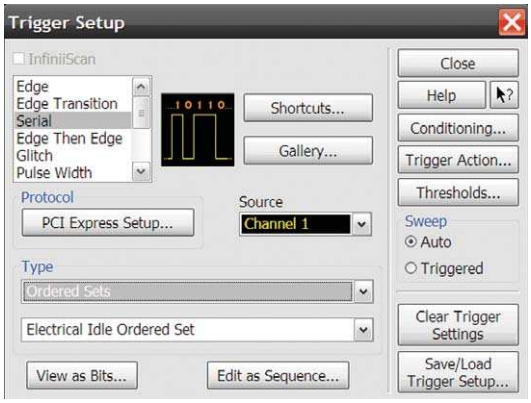
Auto Setup

AutoSetup also includes automatic clock recovery necessary for protocol decode and triggering.

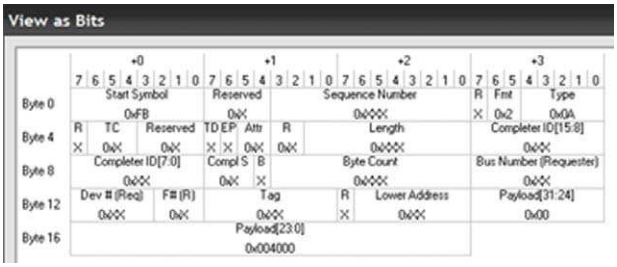
PCI Express protocol triggering and searching

Get access to a rich set of integrated protocol level triggers. The application includes a suite of configurable protocol-level trigger conditions specific to PCIe. When serial triggering is selected, the application enables special real-time triggering hardware inside the scope.

Hardware-based triggering ensures that the scope never misses a trigger event when armed. This hardware takes signals acquired using either scope or digital channels and reconstructs protocol frames. It then inspects these protocol frames against specified protocol-level trigger conditions and triggers when the condition is met.

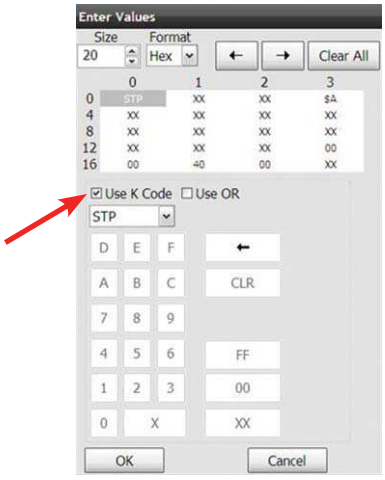


PCIe Trigger Setup
Choose triggers from a broad range of PCIe protocol, including token, data, handshakes, special and error types.



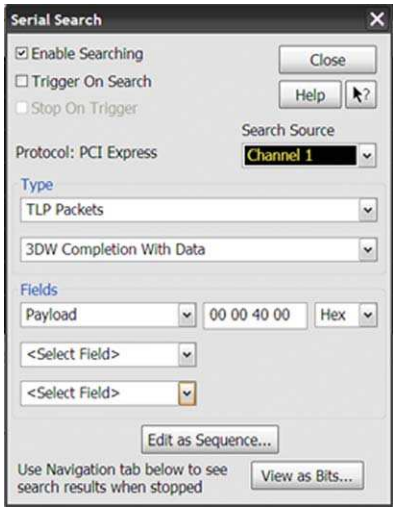
View trigger setup

View as bits button shows the trigger setup in a databook format for easy viewing.



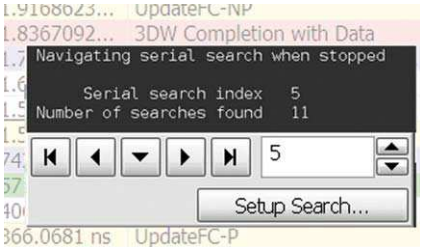
Sequence editor

Enter sequence values using K codes or at the bit level.



Post-acquisition searching

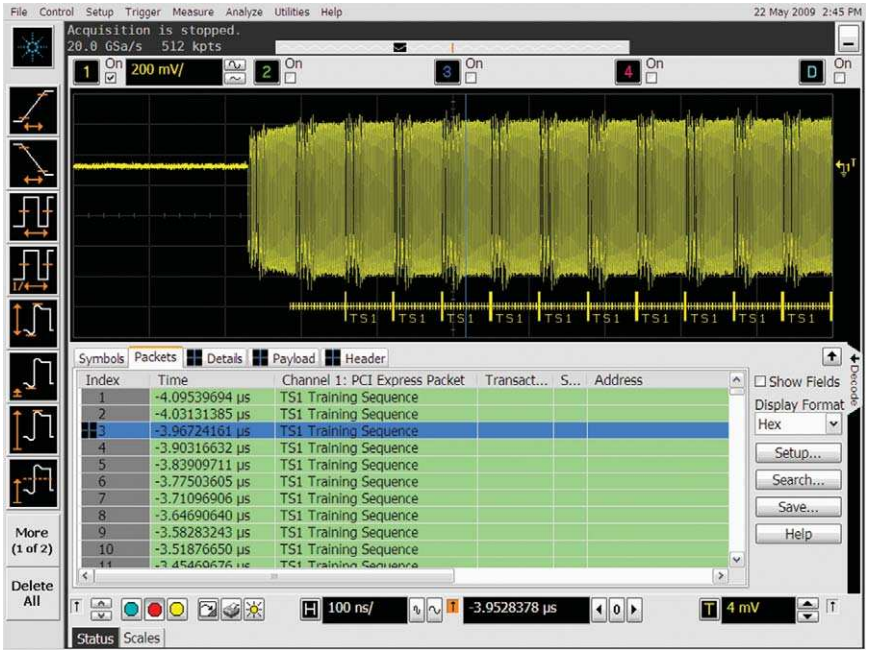
Search acquired protocol listings using a menu that is identical to the trigger menu.



Quickly find occurrences

Quickly move to next occurrence of a specified event.

PCI Express protocol decode

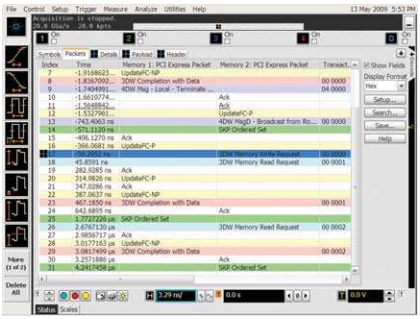


Debug training sequences with protocol viewer

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.

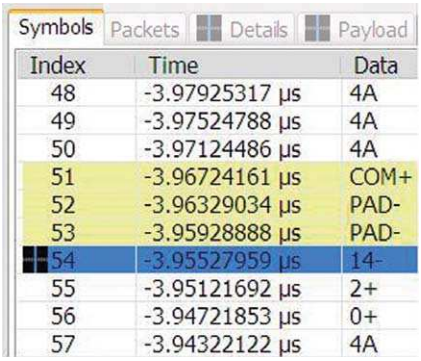
PCIe decode embedded in waveform area

Utilize the oscilloscope waveform area to display decode information. PCIe, minor ticks indicate clock transitions and major ticks show the beginning and end of each word in the serial packet. In this example an ordered set waveform and decode is shown.



Full screen PCIe listing

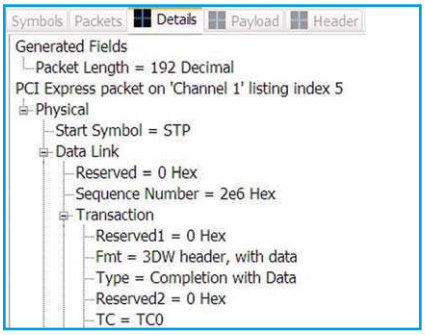
Fill the entire display with compact protocol information using the full screen listing. The protocol viewer window shows the index number, time stamp value, and data content for each serial packet in the list. Scroll though all decoded serial packets to find events of interest or errors in the transmission.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



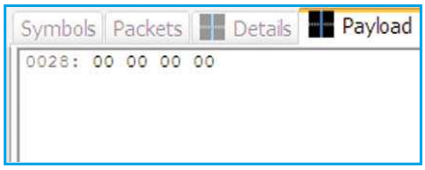
PCIe symbol tab

PCI Express protocol decode

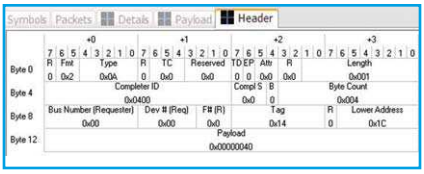
PCIe symbols tab
Easily trigger on and follow PCIe traffic. In this example the scope shows memory completion with data.



Details tab shows hierarchy of physical datalink and transaction layers. Hovering shows additional detail.



Payload tab shows data carried by the packet in byte-by-byte HEX and ASCII.



Header tab shows packets in a data book format. Hovering at any field reveals additional detail. In this example memory completion packet header is shown.

PCI Express triggering and decode specifications and characteristics

Supported 9000 Series scopes	4 GHz DSO and MSO scope channels with 5 GHz or higher bandwidth probes
PCIe sources (data and clock)	Analog channels 1,2,3 or 4 or any waveform memory
PCIe	gen 1 (2.5 Gb/s) x1 (bi-directional), can monitor x4, x8 or x16 one lane at a time
Auto Setup	Automatically configures trigger levels, measurement thresholds, clock recovery, memory depth, sample rate, trigger and holdoff for proper decode and triggering
Decode	Scrambled and unscrambled data symbols (control symbols are never scrambled) Control symbols Ordered Sets Data link and transaction layer packets including: • Header Fields • Data Payload
Triggering	Packets DLLP packets- Ack, nak, PM-enter L1, PM-enter L23, PM-active state request L1, PM- request ack, vendor specific, InitFC1-P, InitFC1-NP, InitFC1-Cpl, InitFC2-P, InitFC2-NP, InitFC2-Cpl, UpdateFC-P, UpdateFC-NP, UpdateFC-Cpl TLP packet 3DW packets- Memory read request, Memory request locked, I/O read request, Configuration read type 0, type 1, completion, Completion without data, with data, Lck mem read, No data, Memory write request, I/O write request, Configuration write type 0, type 1, Completion for Lck memory read 4DW Packets Memory read or write request Memory request locked Msg Routed to root complex Routed by address Routed by ID Broadcast from root complex Local terminate at receiver Gathered and routed to root complex MsgD Routed to root complex Routed by address Routed by ID Broadcast from root complex Local terminate at receiver Gathered and routed to root complex Symbol sequence- enter as K-codes, HEX, binary or decimal Errors- Bad 16B CRC, bad LCRC, bad ECRC, bad packet, zero field is nonzero Ordered sets- SKP ordered set, Fast training sequence, Electrical idle ordered set, Electrical idle exit sequence, TS1 training sequence, TS2 training sequence, modified compliance pattern, delayed modification compliance pattern, compliance pattern, delayed compliance pattern
Probing	Agilent recommends qty. 2 5-GHz or greater InfiniiMax differential probes (1132A)

Ordering information

This application is compatible with all 9000 Series oscilloscope models.

Software applications	Factory-installed node-locked license for new scope purchases	User-installed node-locked license	Server-based license (N5435A option)
PCI Express triggering and decode	006	N5463B	032

Related literature

Publication title	Publication type	Publication number
Infiniium 9000 Series Oscilloscopes	Data sheet	5989-3746EN
PCI Express Test Compliance for Infiniium 90000 Oscilloscopes	Data Sheet	5989-1240EN

Sharing the application across multiple instruments? Server-based licensing allows users to borrow an application license for a specified period of time.

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LXI is the LAN-based successor to GPIB, providing faster, more efficient connectivity. Agilent is a founding member of the LXI consortium.

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For more information on repair and calibration services, go to

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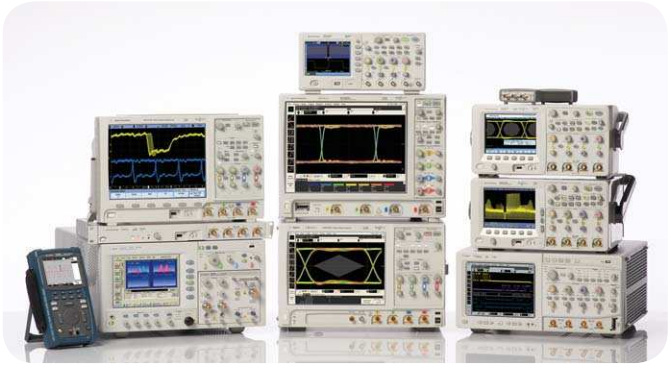

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Product specifications and descriptions in this document subject to change without notice.

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