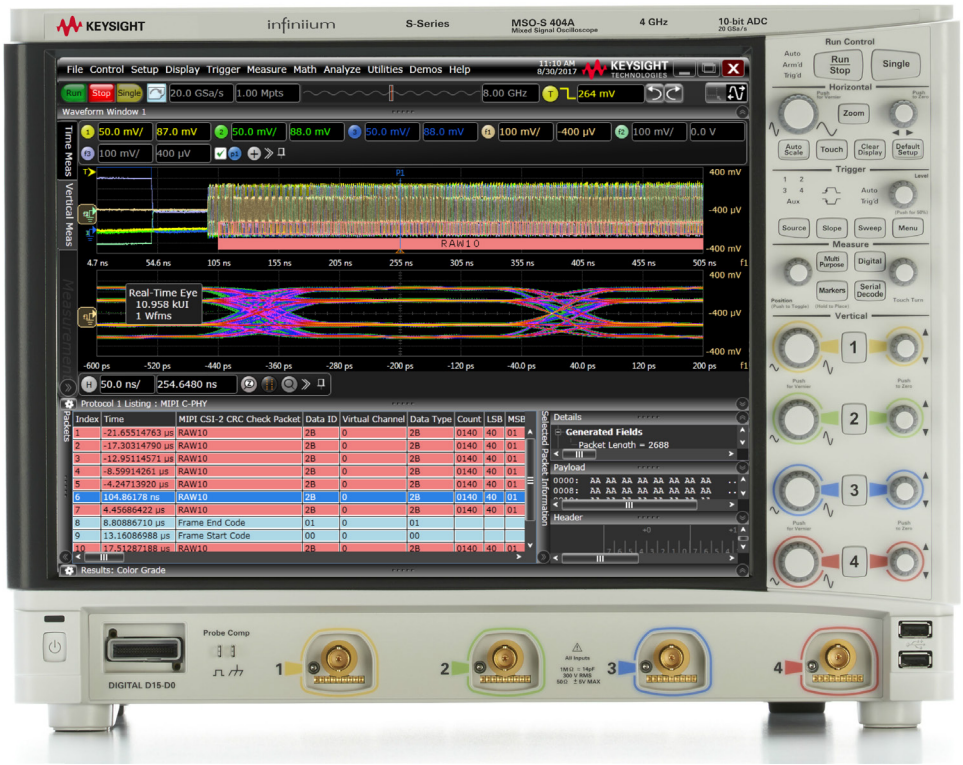
Keysight N8848A

MIPI C-PHY Protocol Decode Software For Infiniium Oscilloscopes

Technical Overview



KEYSIGHT TECHNOLOGIES

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Decode MIPI® C-PHY℠ Protocols Using Your Infiniium Oscilloscopes

C-PHY is a MIPI Alliance's physical layer (PHY) standard that provides high-throughput performance over bandwidth-limited channels to connect displays and cameras to an application processor. The standard provides a PHY for both MIPI Alliance's Camera Serial Interface (CSI-2℠) and Display Interface (DSI-2℠) specifications. This enables engineers to scale their implementations to support a wide range of higher resolution image sensors and displays, while keeping power consumption low. However, because the C-PHY supports two application layers, engineers implementing a C-PHY interface must be able to see a device's signal integrity and protocol data to ensure it conforms to the MIPI specification.

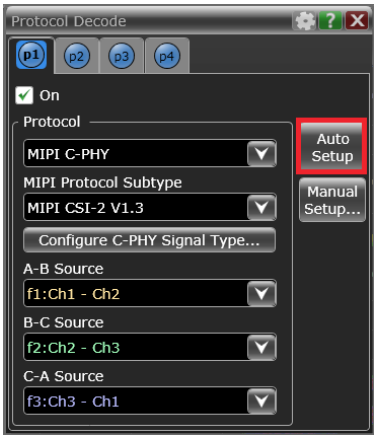
With C-PHY, seven consecutive symbols are used to transmit 16 bits of data over a minimum of 3 wires, after encoding. Troubleshooting C-PHY-based applications can, therefore, be time-consuming and error-prone because the engineer has to manually scroll through the waveform looking for regions of interest.

Using the Keysight Technologies, Inc. C-PHY protocol decoder software to extend the Infiniium oscilloscope capability, engineers can now save time when debugging and testing designs with CSI-2 and DSI-2 interfaces. With the C-PHY protocol decoder software, engineers can:

- Set up the Infiniium oscilloscope to show C-PHY protocol decode in less than 1 minute
- Save time and eliminate errors by viewing packets at the protocol level
- Use time-correlated views to quickly troubleshoot serial protocol problems

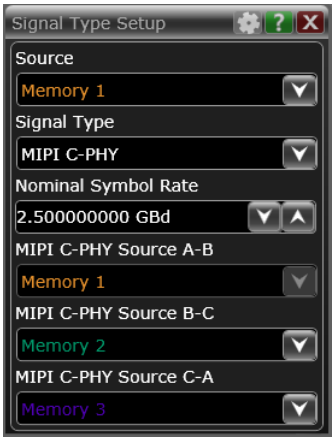
Easy to find

Turn decode on/off via the "Serial Decode" button, located on the front of the instrument or in the "Setup" menu. View the decode embedded on the waveform display or in the protocol viewer listing window.



1-Minute C-PHY setup

Configure the Infiniium oscilloscope to display C-PHY protocol decode in under 1 minute. Use "Auto Setup" to automatically configure sample rate, memory depth, and threshold and trigger levels.



Support for saved waveforms

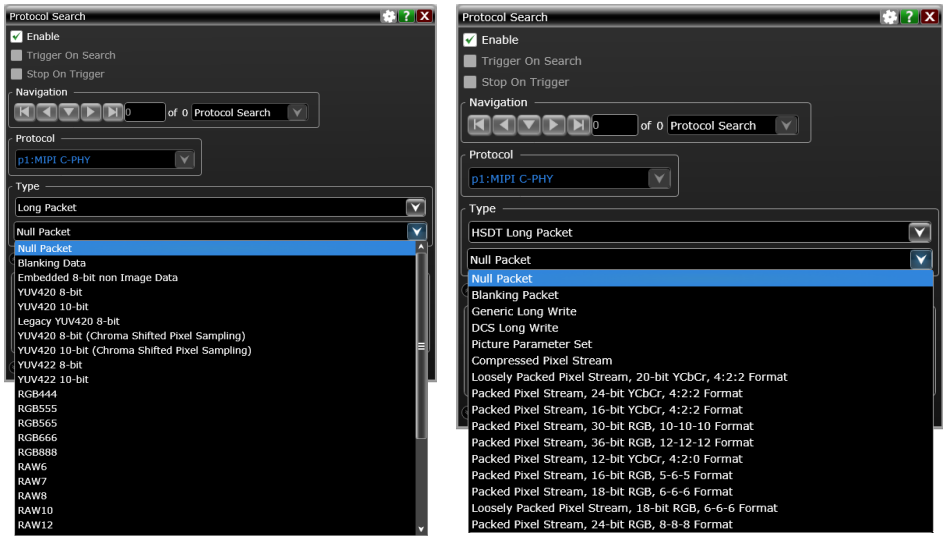
Acquire serial data using an analog channel. Software also supports captured waveforms using a memory channel, allowing users to capture signals first and analyze later.

C-PHY Protocol Searching

Included in Keysight's C-PHY protocol decoder software is a suite of configurable, protocol-level conditions for CSI-2 or DSI-2 interface buses that give engineers access to a rich set of integrated protocol-level searching capabilities. This protocol searching feature enables engineers to find and isolate error packets or specific patterns of interest from acquired data.

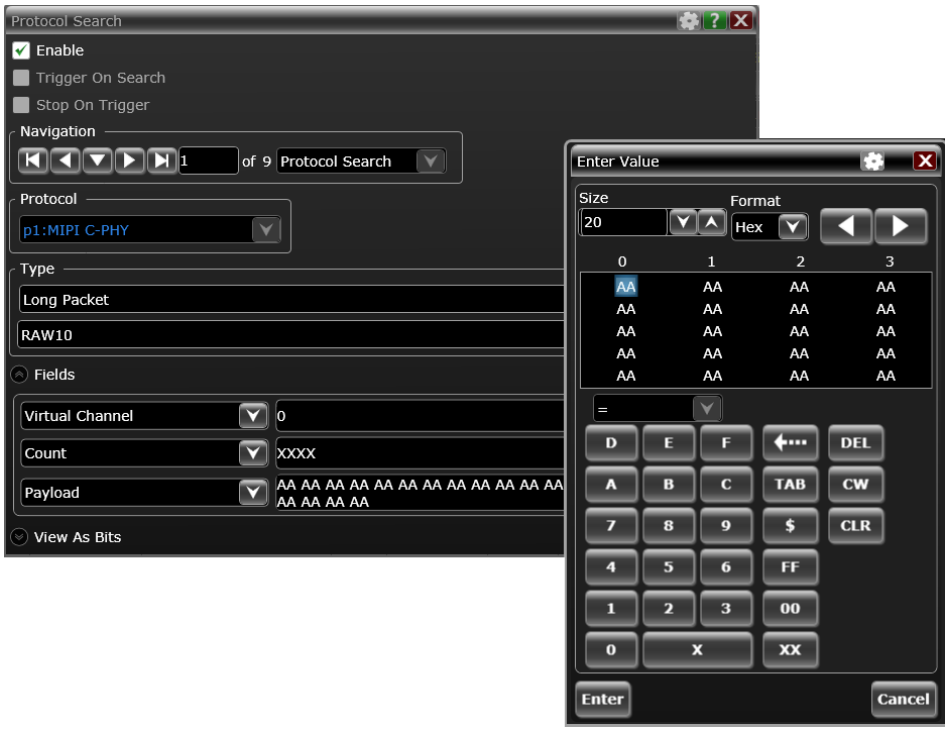
CSI-2 and DSI-2 post-acquisition searching

Search specific CSI-2 or DSI-2 packets from the acquired protocol listing.



In depth search

With the ability to specify up to 3 fields, engineers can search on the specific patterns they want to see.

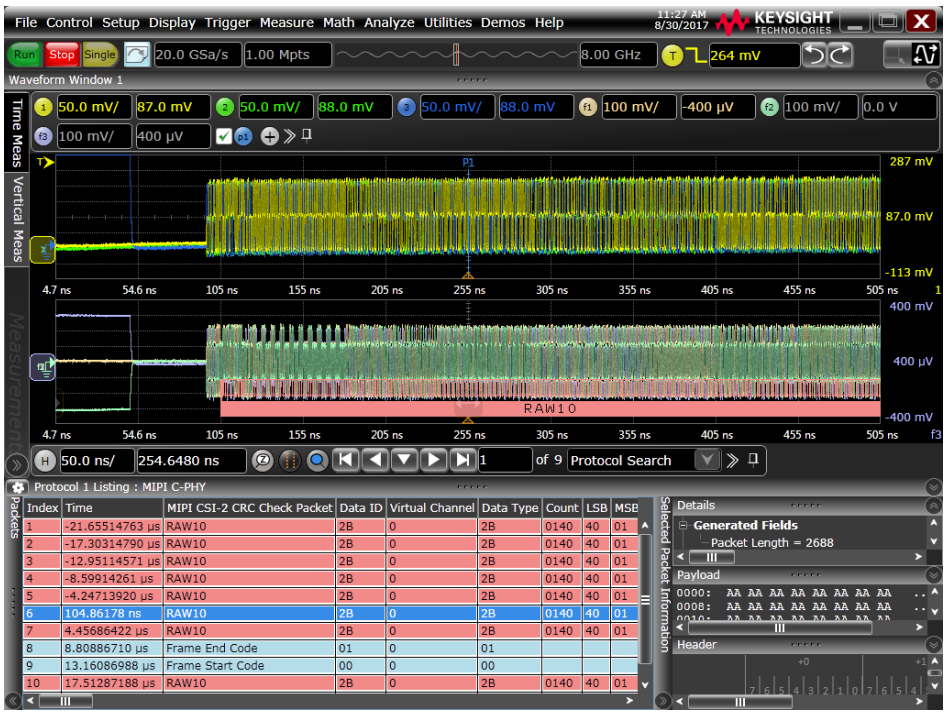


C-PHY Protocol Decode

Keysight's C-PHY protocol decoder software supports CSI-2 and DSI-2 protocol decode, as well as symbol and wire state decoding. Using it, engineer can easily identify issues relating to $T_{3\text{-PREAMBLE}}$, $T_{3\text{-SYNC}}$, and symbol.

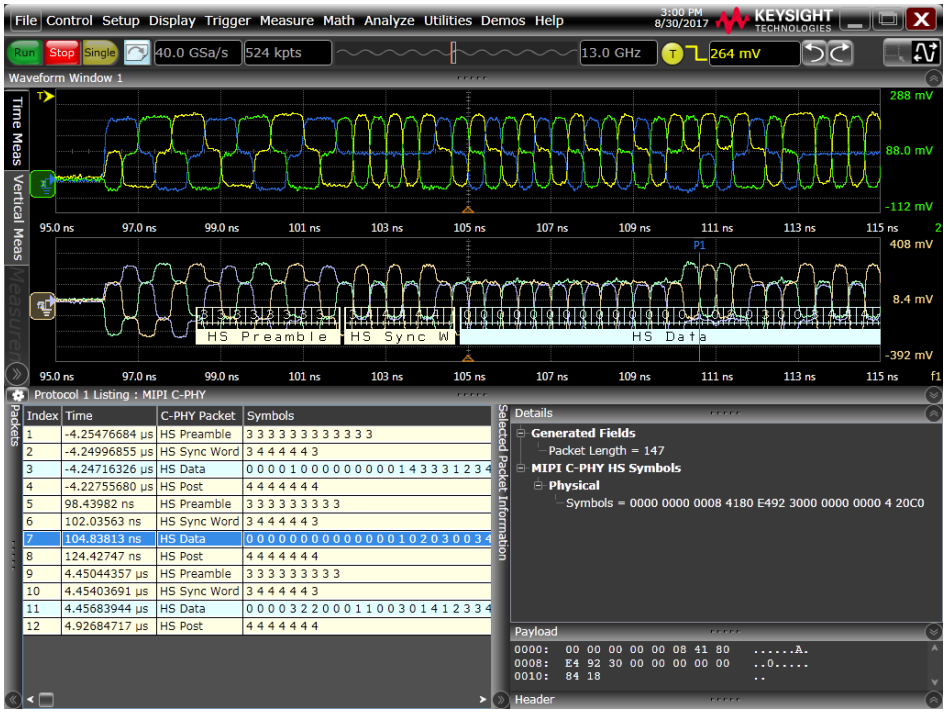
Protocol decode with time correlation between waveform and listing

The C-PHY protocol list window is correlated between the waveform and selected packet on the list. The selected packet (highlighted blue row), is time-correlated with the blue line in the waveform display so that engineers can easily see the signal shape of specific packet data.



C-PHY Symbol decoding

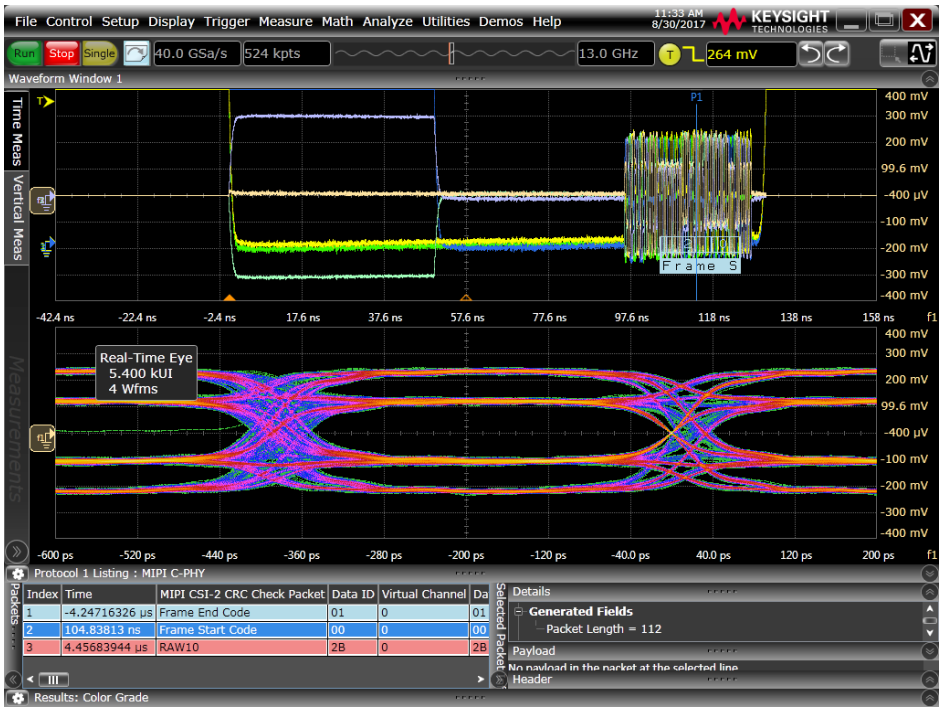
The C-PHY symbol decoding waveform viewer window shows the symbol state of each Unit interval (UI). With this information, engineers can easily distinguish between issues in symbol encoding versus the transmitter's original data.



C-PHY Protocol Decode (Continued)

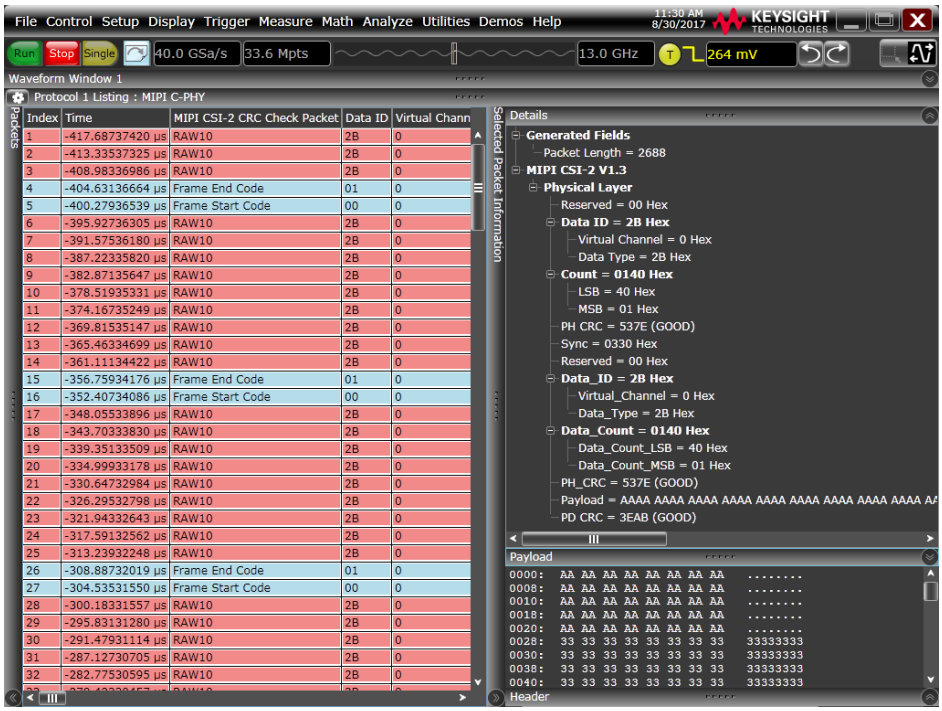
Debug both C-PHY signal quality and protocol decoding simultaneously

Keysight provides a unique C-PHY triggered eye diagram function with SDA (Serial Data Analysis) option for simultaneously monitoring signal quality and protocol. With this feature, engineers gain greater insight into the C-PHY signal and can better determine whether issues are due to signal quality or protocol data.



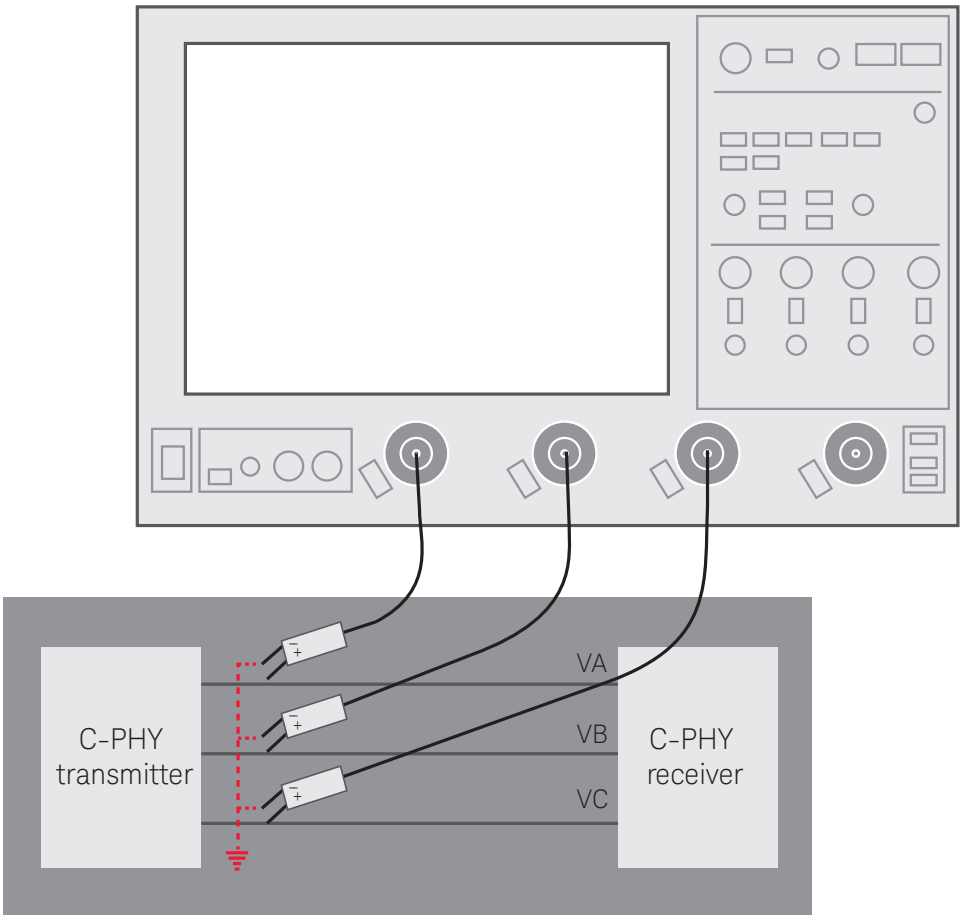
Resizable window size

The flexibility to change the protocol decoder's window size ensures greater usability, allowing engineers to see specific parts of interest. A full screen listing window shows even more protocol-dependent data on acquired waveforms, which helps engineers quickly and easily identify communication errors on the protocol side.



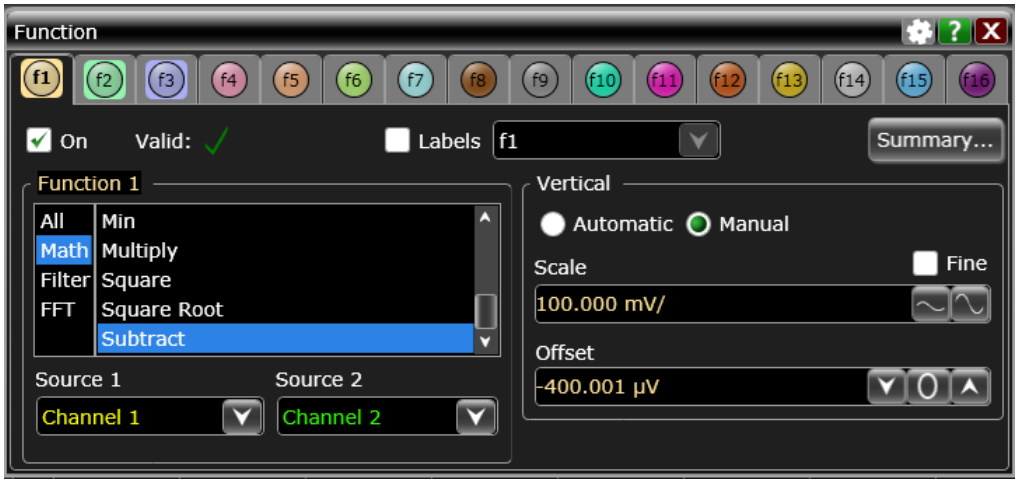
Recommended Connection

To achieve a higher symbol rate from the device under test (DUT), Keysight recommends connecting 3 differential active probes for single-end probing. It is also possible to probe differentially so that data can be obtained without having to configure functions. However, due to the long length between positive and negative pins on the differential active probe, the probe bandwidth may not fully cover the signal's bandwidth range as required to see the right signal shape.



Configuring Channels

The C-PHY decoder software requires 3 differential signals for decoding C-PHY data. A single-end probed signal must therefore be changed to a differential signal for decoding. To accomplish this, use the “Subtract” function to make 3 differential signals from a 3-wire signal before starting to decode the C-PHY protocol. The required signals will be VAB(VA-VB), VBC(VB-VC) and VCA(VC-VA).



Performance Characteristics

	Description
C-PHY Protocol supported	CSI-2 v1.3
	DSI-2 v1.0
C-PHY source (VA, VB, VC)	Analog channels 1, 2, 3, or 4
	Waveform memories
	The application relies on probing and measurement thresholds to properly condition the signal for decode.
Data rate	Up to 3.5 Gsps (symbols per second)
Supporting lane	One lane (3 wires) only
Search	Short packet
	Long packet
	Errors
	– Any error
	– Bad 16-bit CRC
	– Bad 16-bit PHCRC
	– Unknown packet

Recommended Oscilloscopes

The C-PHY protocol decode software is compatible with Keysight's Infiniium Series oscilloscopes running software version 6.10 or higher. Oscilloscopes running an earlier software version can be upgraded for free to utilize the C-PHY protocol decode application. Download your free upgrade software here: **www.keysight.com/find/scope-apps-sw**.

Symbol rate	Minimum bandwidth	Minimum channels	Recommended oscilloscopes
Up to 1.5 Gsps	4 GHz	3	9000, S-Series
Up to 2.5 Gsps	6 GHz	3	90000, V-Series and Z-Series
Up to 3.5 Gsps	10 GHz	3	90000, V-Series and Z-Series

Standard Configuration

9000A, S-Series oscilloscope	Oscilloscope + 3 x active probes
90000A Series oscilloscope	Oscilloscope + 3 x active probes (recommended probe: 1169B 12-GHz InfiniiMax II Series probe amplifier)
V-Series and Z-Series oscilloscope	Oscilloscope + 3 x active probes (recommended probe: 1169B 12-GHz InfiniiMax II Series probe amplifier with adaptor)

Ordering Information

The MIPI C-PHY application software is compatible with the following Infiniium oscilloscope models.

Application software			9000 Series	S-Series	90000 Series	V-Series	Z-Series
MIPI C-PHY protocol decode software [1]		Fixed	N8848A-1FP	N8848A-1FP	N8848A-1FP	N8848A-1FP	N8848A-1FP
	Floating	Transportable	N8848A-1TP	N8848A-1TP	N8848A-1TP	N8848A-1TP	N8848A-1TP
		Server-based	N5435A-125	N5435A-125	N5435A-125	N5435A-125	N5435A-125

1. Requires Infiniium 6.10 or above.

Related Literature

Publication title	Publication number
Infiniium S-Series High-Definition Oscilloscopes - Data Sheet	5991-3904EN
Infiniium 9000 Series Oscilloscopes - Data Sheet	5990-3746EN
Infiniium V-Series Oscilloscopes - Data Sheet	5992-0425EN
Infiniium 90000 Series Oscilloscopes - Data Sheet	5989-7819EN
Infiniium Z-Series Oscilloscopes - Data Sheet	5991-3868EN

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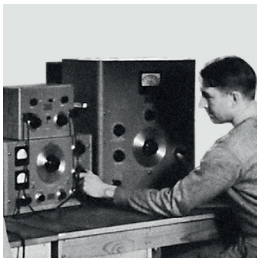

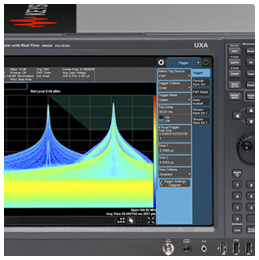

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