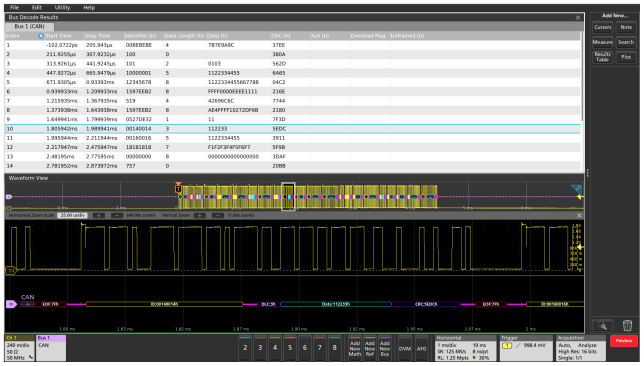
Serial Triggering and Analysis

3 Series MDO, 4/5/6 Series MSO Applications Datasheet



On a serial bus, a single signal often includes address, control, data, and clock information. This can make isolating events of interest difficult. Optional serial applications transform the oscilloscope into a robust tool for debugging serial buses with automatic decode and analysis for I^2C, SPI, eSPI, CAN, CAN FD, CAN XL, LIN, FlexRay, 10BASE-T1S, 100BASE-T1, SENT, RS-232/422/485, UART, USB 2.0, USB 3.0, USB 3.1 Gen 1, USB 3.2 Gen 1, Ethernet, I3C, SPMI, Spacewire, 8b10b, NFC, NRZ, MIL-STD-1553, ARINC 429, I^2S, LJ, RJ, PCIe Gen 1/Gen 2/Gen 3, PSI5, CPHY, CXPI, DPHY, SMBus, 1-WIRE, EtherCAT, and TDM.

Key features

- Automated Serial Decode and Analysis Options for I^2C, SPI, eSPI, I3C [1], CAN, CAN FD, CAN XL, LIN, FlexRay, SENT[1], RS-232/422/485, UART, USB 2.0, USB 3.0, USB 3.1 Gen 1, USB 3.2 Gen 1, Ethernet[1], SPMI[1], MIL-STD-1553, ARINC 429, I^2S, LJ, RJ, PSI5, PCIe Gen 1/Gen 2/Gen 3, DPHY, CXPI, CPHY, SMBus, 1-WIRE, EtherCAT, and TDM
- Trigger on all the critical elements of a serial bus such as address, data, etc.
- Decode all the critical elements of each message. No more counting 1s and 0s
- Search through long acquisitions with user-defined criteria to find specific messages
- Event Table shows decoded serial bus activity in a tabular, time-stamped format for quick summary of system activity

Serial Triggering and Analysis Applications

The serial applications support automatic trigger and decode for I^2C, SPI, CAN, CAN FD, CAN XL, LIN, FlexRay, 10BASE-T1S, 100BASE-T1, SENT, RS-232/422/485, UART, USB 2.0, USB 3.0, USB 3.1 Gen 1, USB 3.2 Gen 1, Ethernet, I3C, SPMI, Spacewire, 8b10b, NRZ, MIL-STD-1553, ARINC 429, I^2S, LJ, RJ, PCIe Gen 1/Gen 2/Gen 3, PSI5, SMBus, EtherCAT, and TDM buses, making it easier to locate, analyze, and debug events of interest.

Serial triggering

Trigger on packet content such as start of packet, specific addresses, specific data content, unique identifiers, etc. on popular serial interfaces such as I^2C, SPI, CAN, CAN FD, CAN XL, LIN, FlexRay, SENT, RS-232/422/485, UART, USB 2.0, USB 3.0, USB 3.1 Gen 1, USB 3.2 Gen 1, Ethernet, I3C, SPMI, MIL-STD-1553, ARINC 429, I^2S, LJ, RJ, PCIe Gen 1/Gen 2/Gen 3, PSI5, and TDM.

Bus display

The bus display provides a higher-level, combined view of the individual signals (clock, data, chip enable, and so on) that make up your bus, making it easy to identify where packets begin and end and identifying sub-packet components such as address, data, errors, and so on.

Bus decoding

Tired of having to visually inspect the waveform to count clocks, determine if each bit is a 1 or a 0, combine bits into bytes, and determine the hex value?

Let the oscilloscope with a serial application do it for you! Once you've set up a bus, the oscilloscope decodes each packet on the bus, and displays the value in hex, binary, ASCII, or decimal (certain buses only) in the bus waveform.

Results table

In addition to seeing decoded packet data on the bus waveform itself, you can view all captured packets in a tabular view much like you would see in a software listing. Packets are time stamped and listed consecutively with columns for each component (Address, Data, and so on).

Wave Inspector® search

Serial triggering is very useful for isolating the event of interest, but once you've captured it and need to analyze the surrounding data, what do you do?

In the past, users had to manually scroll through the waveform counting and converting bits and looking for what caused the event. With a serial application, you can enable the oscilloscope to automatically search through the acquired data for user-defined criteria including serial packet content. Each occurrence is highlighted by a search mark. Rapid navigation between marks is as simple as pressing the ← and → arrow buttons on the oscilloscope front panel or the Search badge. The 3 Series MDO uses the arrows in the Search badge to navigate.

1 Not available for 3 Series MDO.

I²C characteristics

Bus setup options

Characteristic	Description
I²C Sources (Clock and Data)	Analog channels Digital channels Active Math channels [1] Active Reference channels[1]
Thresholds	Per-channel thresholds
Recommended Probing	Single-ended
Include R/W in Address	Yes or No
Address/Data Formats Available	Hex Binary

Display modes

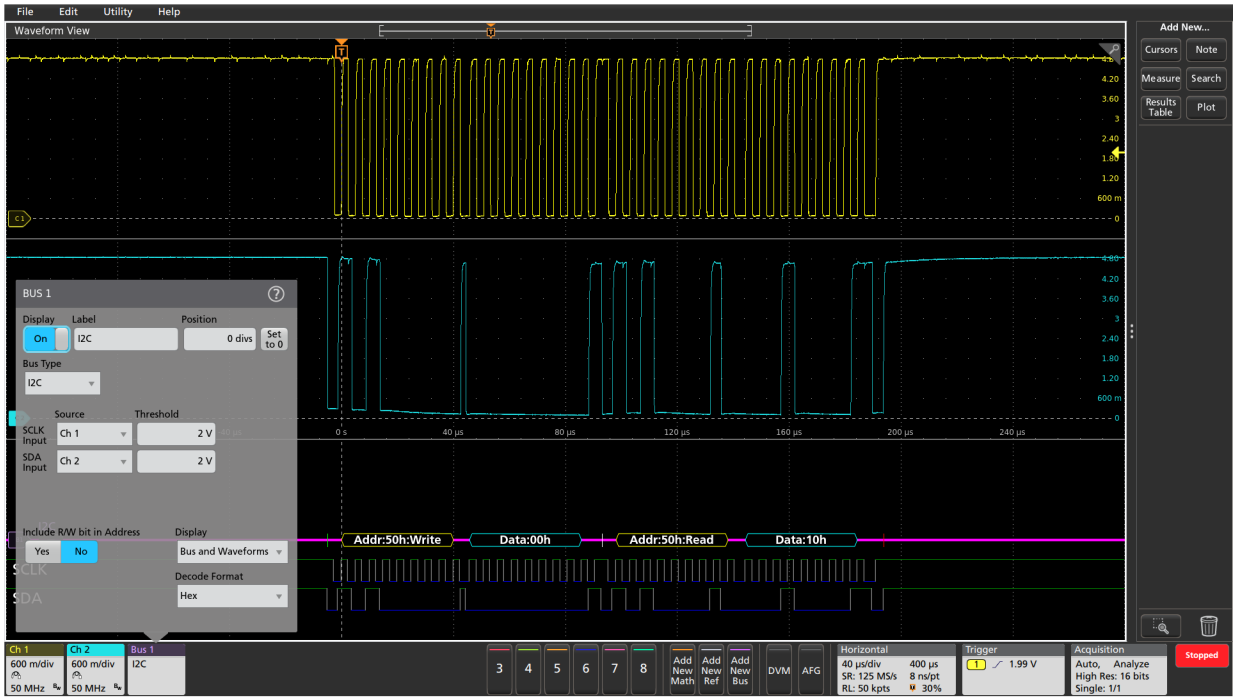
Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Bus trigger and search options

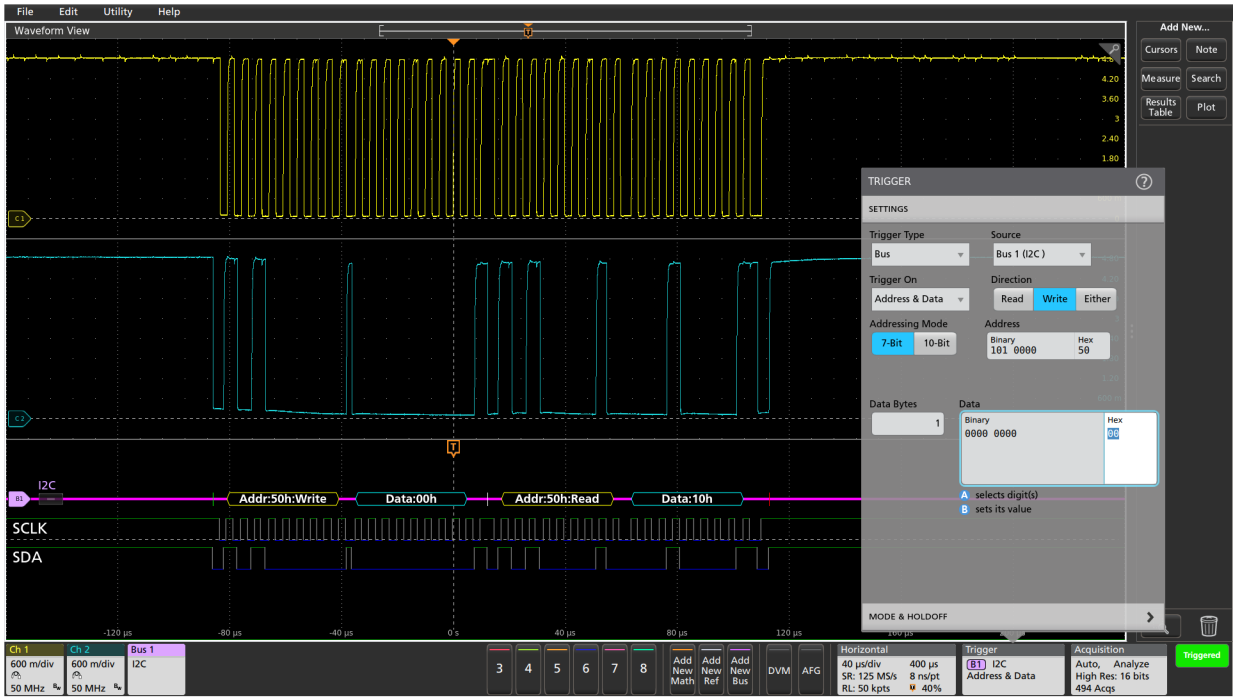
Characteristic	Description
Trigger and/or Search On	Start Repeated Start Stop Missing Ack Address (7 or 10 bit) Data (1-5 bytes) Address and Data

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 10 Mb/s (automatic selection)
Decode Display	Start (green bar) Address (yellow packet) Data (cyan packet) Missing Ack (! symbol in red box) Stop (red bar)



Color-coded I²C bus display, using hexadecimal display format.



Triggering on a specific address value on the I²C bus.

SPI characteristics

Bus setup options

Characteristic	Description
SPI Sources (Clock, Data, and Slave Select)	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Thresholds	Per-channel thresholds
Recommended Probing	Single-ended
Decode Configuration: Framing Clock Slave Select Data Word Size Bit Order	 Slave Select (3-wire SPI), Idle Time (2-wire SPI) Rising or Falling Edge Active High or Active Low Active High or Active Low 4 - 32 bits Most Significant (MS) First, Least Significant (LS) First
Formats Available	Hex Binary

Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

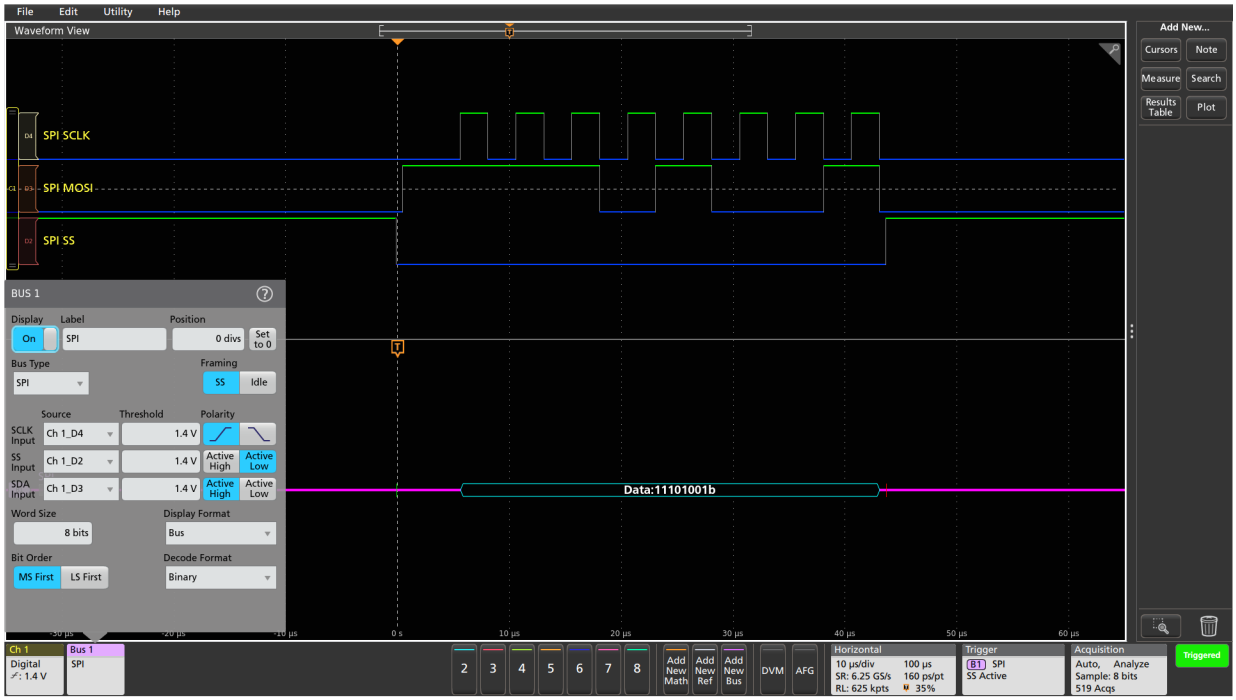
Table continued…

Bus trigger and search options

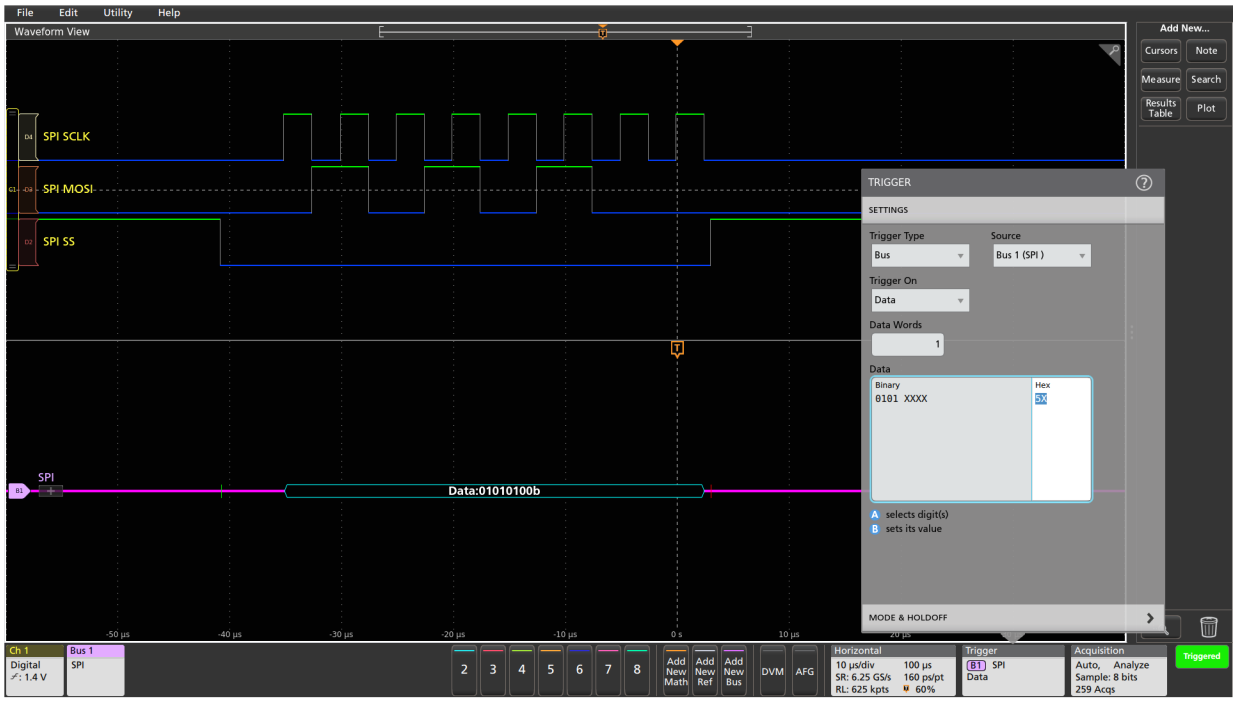
Characteristic	Description
Trigger and/or Search On	SS Active (3-wire SPI) Start of Frame (2-wire SPI) Data (1-16 bytes)

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 10 Mb/s (automatic selection)
Decode Display	Start (green bar) Data (cyan packet) Stop (red bar)



SPI bus, captured with digital channels, showing binary display format of the color-coded SPI bus decoding.



Triggering on a specific data value on the SPI bus.

I3C characteristics[1]

Bus setup options

Characteristic	Description
I3C Sources (Clock and Data)	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Speed	High Speed (480 Mb/s) Full Speed (12 Mb/s) Low Speed (1.5 Mb/s)
Recommended Probing	Single-ended
Formats Available	Hex Binary Mixed Hex
Version	1.0 1.1

Display modes

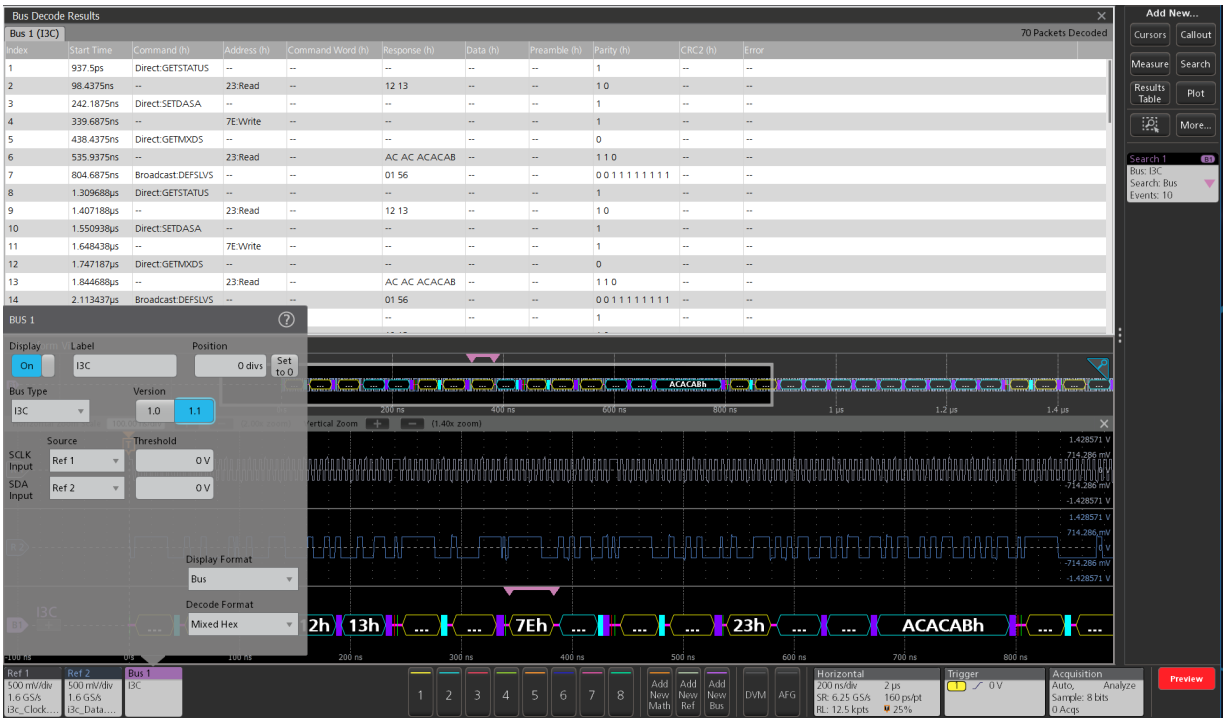
Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Bus search options

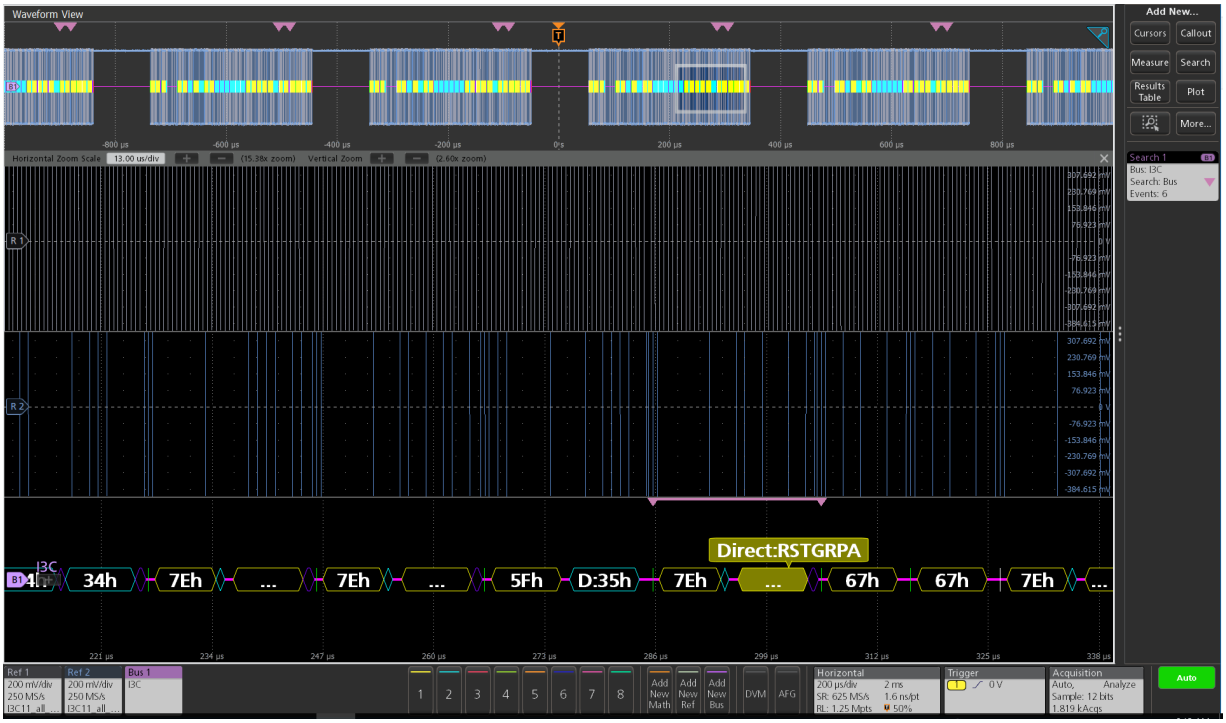
Characteristic	Description
Search On	Start Repeated Start Address Data I3C SDR Direct Message I3C SDR Broadcast Message I3C DDR Message Errors Hot-Join Direct Message End Stop HDR Restart HDR Exit

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 12.5 Mb/s (automatic selection)
Decode Display	Start (green bar) Address (yellow packet) Commands (cyan packet) Data (cyan packet) Parity (purple packet) Stop (red bar)



I3C bus setup and MixedHex display, showing decode with version 1.1.



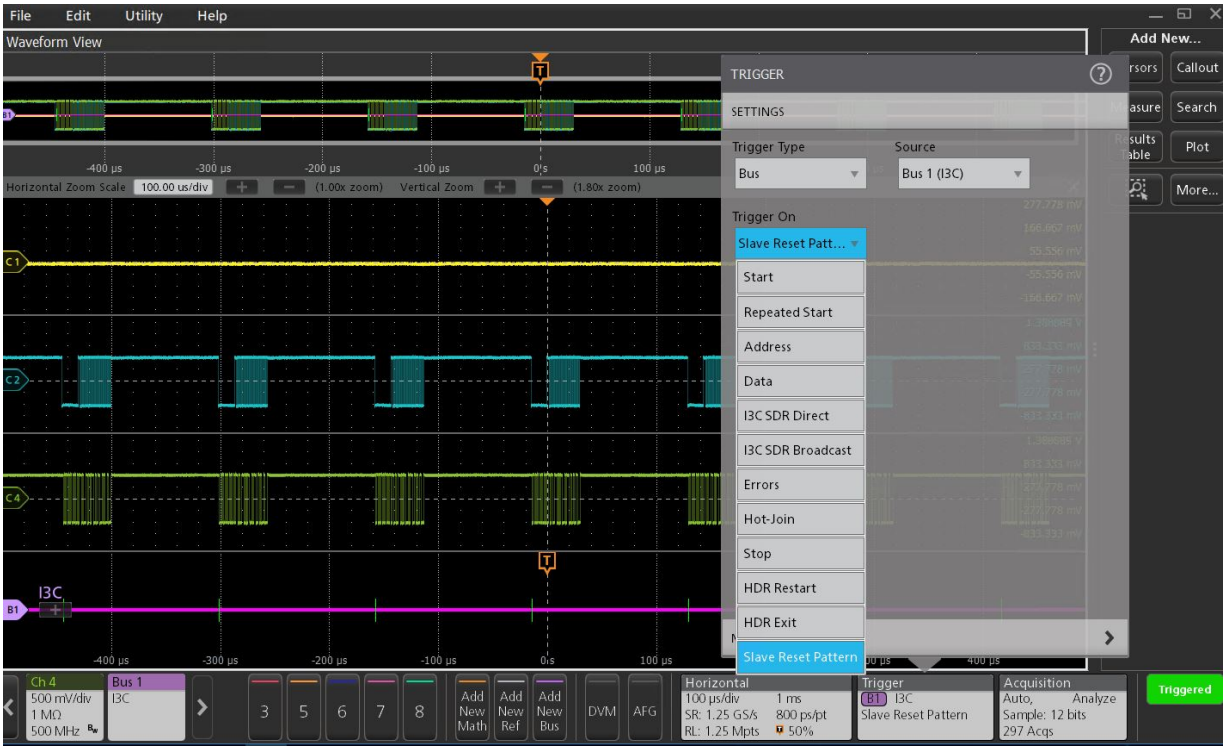
Searching the I3C bus with decode version 1.1 for the packet with Reset Group Address.

The Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the I3C bus.

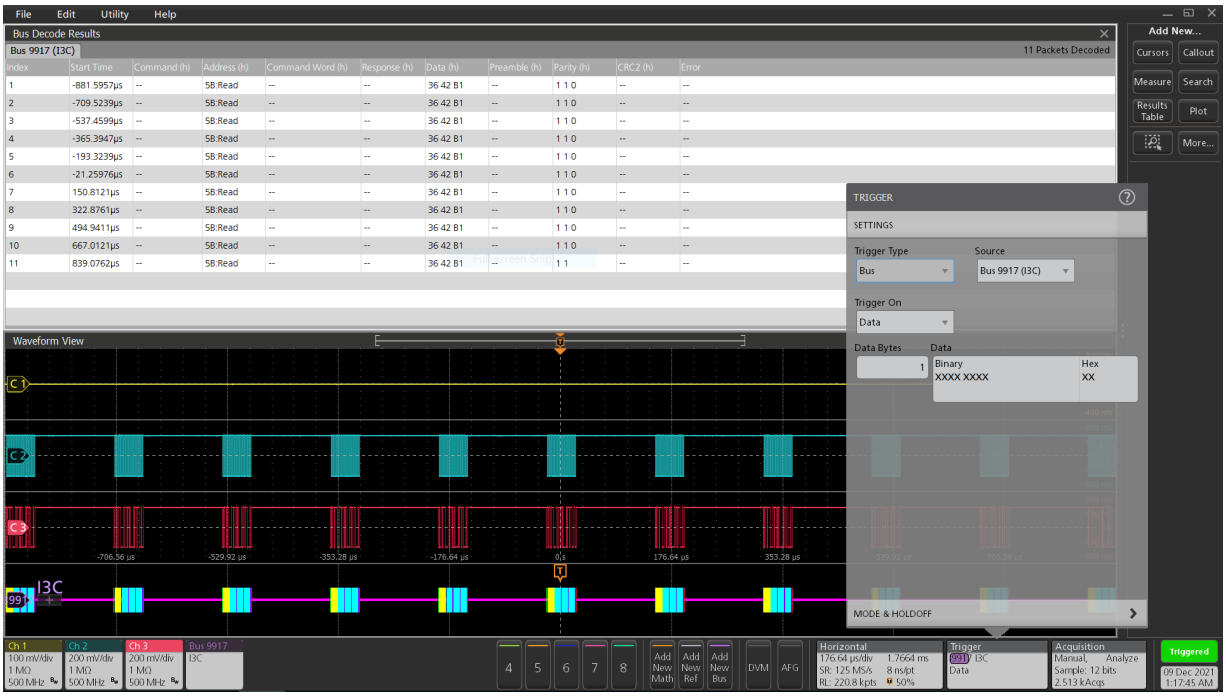
Searching on a specific data pattern on the I3C bus and automatically searching on Sync.

I3C (Trigger) characteristics

Characteristic	Description
I3C Sources	• Select the **I3C** bus on which to trigger. • **Trigger On** Select the type of information on which to trigger.
Trigger On	• Start • Repeated Start • Address • Data • I3C SDR Direct • I3C SDR Broadcast • Hot join • Errors • HDR Exit • HRD Restart • Stop • Slave Reset Pattern



I3C 1.1 version Slave Reset pattern trigger.



Triggering on a specific 7-Bit read address value on the I3C bus.

RS-232, RS-422, RS-485, UART characteristics

Bus setup options

Characteristic	Description
Sources, RS-232, UART	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Sources, RS-422, RS-485	Analog channels Active Math channels[1] Active Reference channels[1]
Polarity	Normal (RS-232) Inverted (UART, RS-422, RS-485)
Parity	None Odd Even
Recommended Probing, RS-232, UART	Single-ended
Recommended Probing, RS-422, RS-485	Differential
Number of Bits	7 - 9
Formats Available	Hex Binary ASCII Packet View
Data Inputs	One, Two
Bit Order	MSB, LSB

Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Table continued…

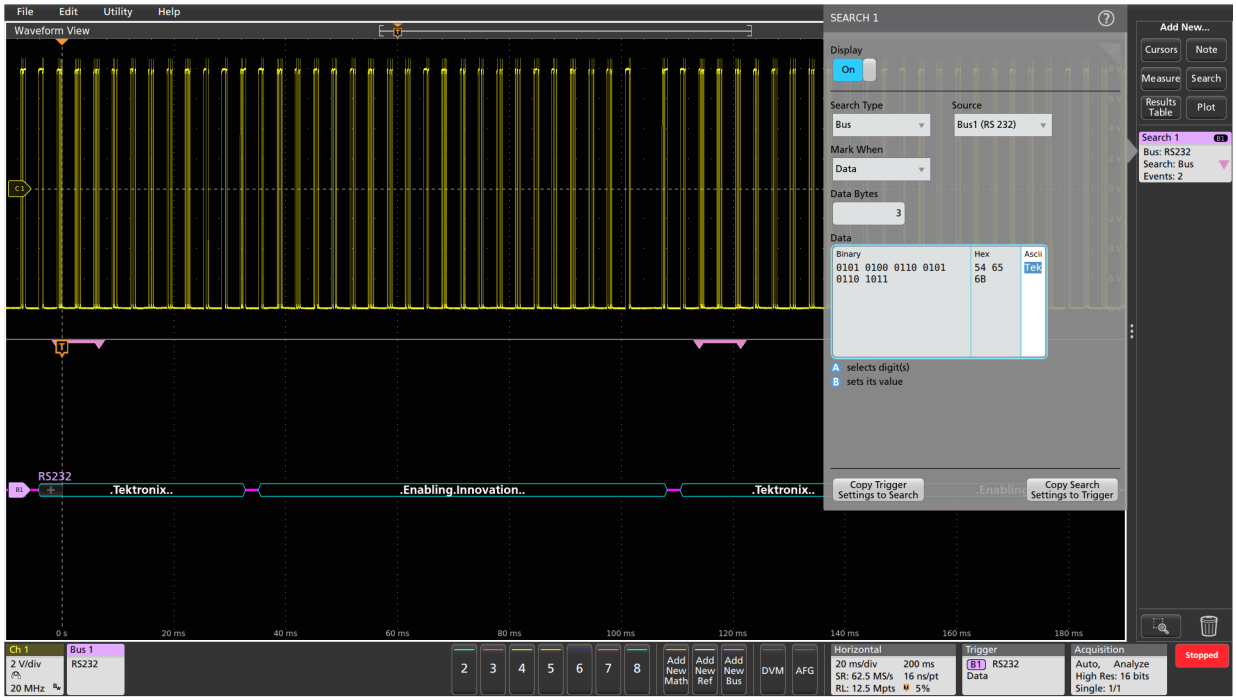
Bus trigger and search options

Characteristic	Description
Trigger and/or Search On	Start End of Packet Data (1 - 10 bytes) Parity Error

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 15 Mb/s For 3 Series MDO: Up to 10 Mb/s
Bit Rate Selection	300 b/s 1,200 b/s 2,400 b/s 9,600 b/s 19,200 b/s 38,400 b/s 115,200 b/s 921,600 b/s Custom (All but 3 Series MDO: 50 b/s - 15 Mb/s Custom (for 3 Series MDO): 50 b/s - 10 Mb/s
Decode Display	Start (green packet) Data (cyan packet) Parity (purple packet) Parity Error (red packet)

RS-232 bus setup and ASCII display, showing assignment of source signal, digital threshold, and polarity.



RS-232 bus shown in Packet View format, with the Wave Inspector search automatically searching for the data string "Tek".

CAN characteristics (Version 2.0)

Bus setup options

Characteristic	Description
Source for CAN_H, CAN_L, Rx, or Tx (single-ended probing)	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Source for Diff (differential probing)	Analog channels Active Math channels[1] Active Reference channels[1]
Thresholds	Per-channel thresholds
Recommended Probing: CAN_H, CAN_L, Rx, Tx Diff	Single-ended Differential
Bit Rate Selection: Predefined list of rates Custom	10 kb/s - 1 Mb/s All but 3 Series MDO: 1 kb/s - 1 Mb/s 3 Series MDO: 10 kb/s - 1 Mb/s

Table continued…

Characteristic	Description
Sample Point	All but 3 Series MDO: 0% - 100% of bit period of unit interval 3 Series MDO: 5% - 95% of bit period of unit interval
Formats Available	Mixed Hex Hex Binary Symbolic (.dbc)[1]

Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Bus trigger and search options

Characteristic	Description
Trigger and/or Search On	Start of Frame Type of Frame (Data, Remote, Error, Overload) Identifier (Standard or Extended) Data (number of bytes 1-8, trigger or search when =, ≠, <, ≤, >, ≥) Identifier and Data EOF Missing Ack Bit Stuff Error

Symbolic bus search options

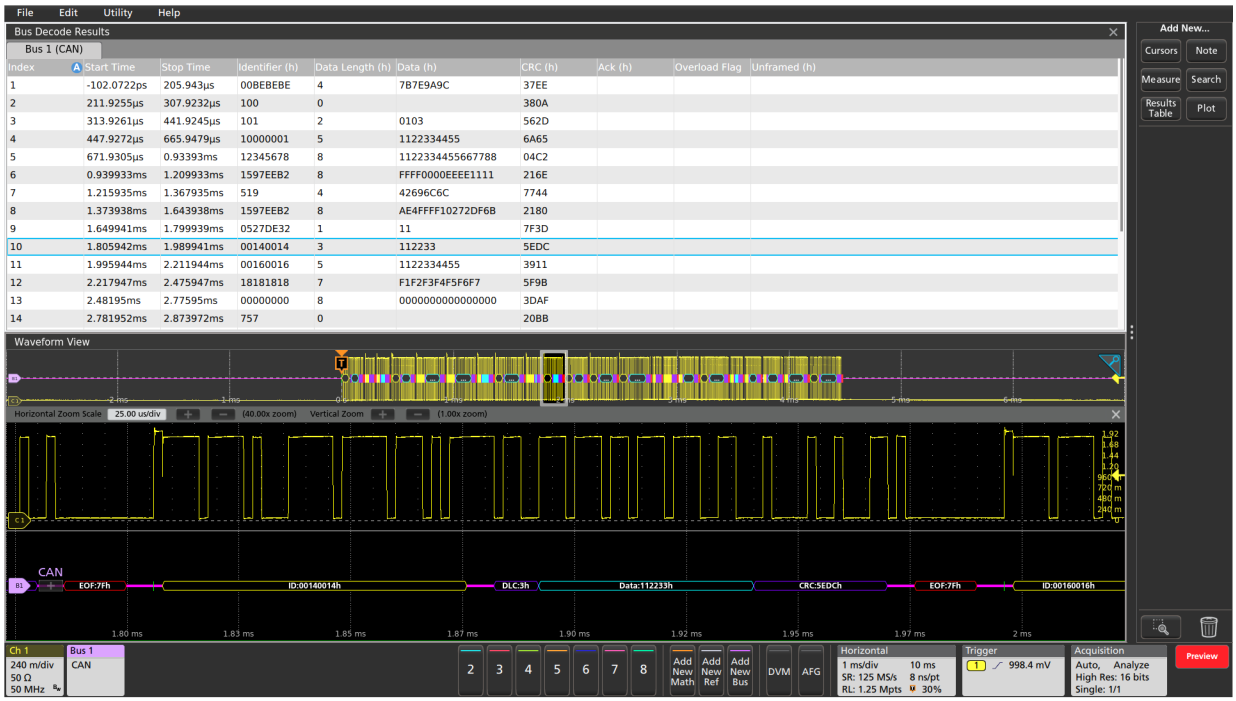
Characteristic	Description
Message	As defined by the .dbc file[1]

Table continued…

Characteristic	Description
Message and Signal	As defined by the .dbc file[1]

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 1 Mb/s (automatic selection)
Decode Display	Start of Frame (green bar) Identifier (yellow packet) Data Length Control (purple packet) Data (cyan packet) CRC (purple packet) End of Frame (red bar) Errors (red packet)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the CAN bus.

Triggering on a specific extended Identifier value on the CAN bus.

CAN XL characteristics

Bus setup options

Characteristic	Description
Source for CAN_H, CAN_L, Rx, or Tx (Single-ended probing)	Analog channels Digital channels Active Math channels Active Reference channels
Source for Diff (Differential probing)	Analog channels Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Recommended Probing: CAN_H, CAN_L, Rx, Tx Diff	 Single-ended Differential
Nominal Bit Rate Selection: Predefined list of rates Custom	 10 kb/s - 1 Mb/s 50 kb/s - 1 Mb/s
XL Bit Rate Selection: Predefined list of rates	 1 Mb/s - 20 Mb/s
Custom	500 kb/s - 20 Mb/s
Sample Point	55% - 95% of bit period of unit interval
Formats Available	Mixed Hex Hex Binary

Table continued…

Bus trigger and search options

Characteristic	Description
Trigger On	Start of Frame End of Error

Table continued…

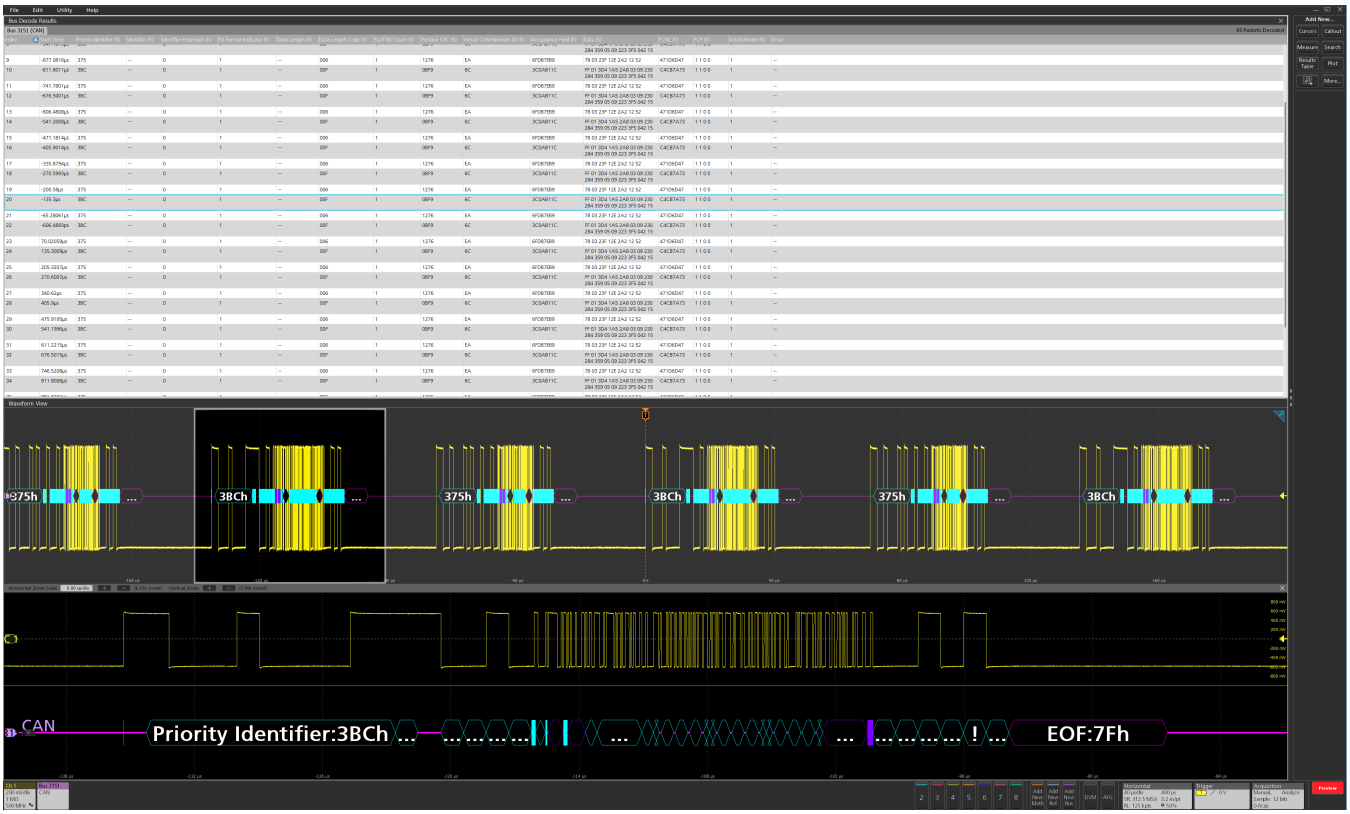
Characteristic	Description
Search On	Start of Frame Type of Frame (XL Data Frame) Priority Identifier Data (1 byte) XL Bits (Acceptance Field, Virtual CAN Network ID, SDU Type, Simple Extended Content, Stuff Bit Count, Arbitration to Data Sequence, Data to Arbitration Sequence) ADS Type (Arbitration to Data High Bit, Data High Bit 1, Data High Bit 2, Data Low Bit) DAS Type (DAH, Active High 1, Active High 2, Active Low 1) End of Frame Error (Missing Ack, XL Form Error, CRC, Any Error) CRC Type (PCRC, FCRC)

Bus decode

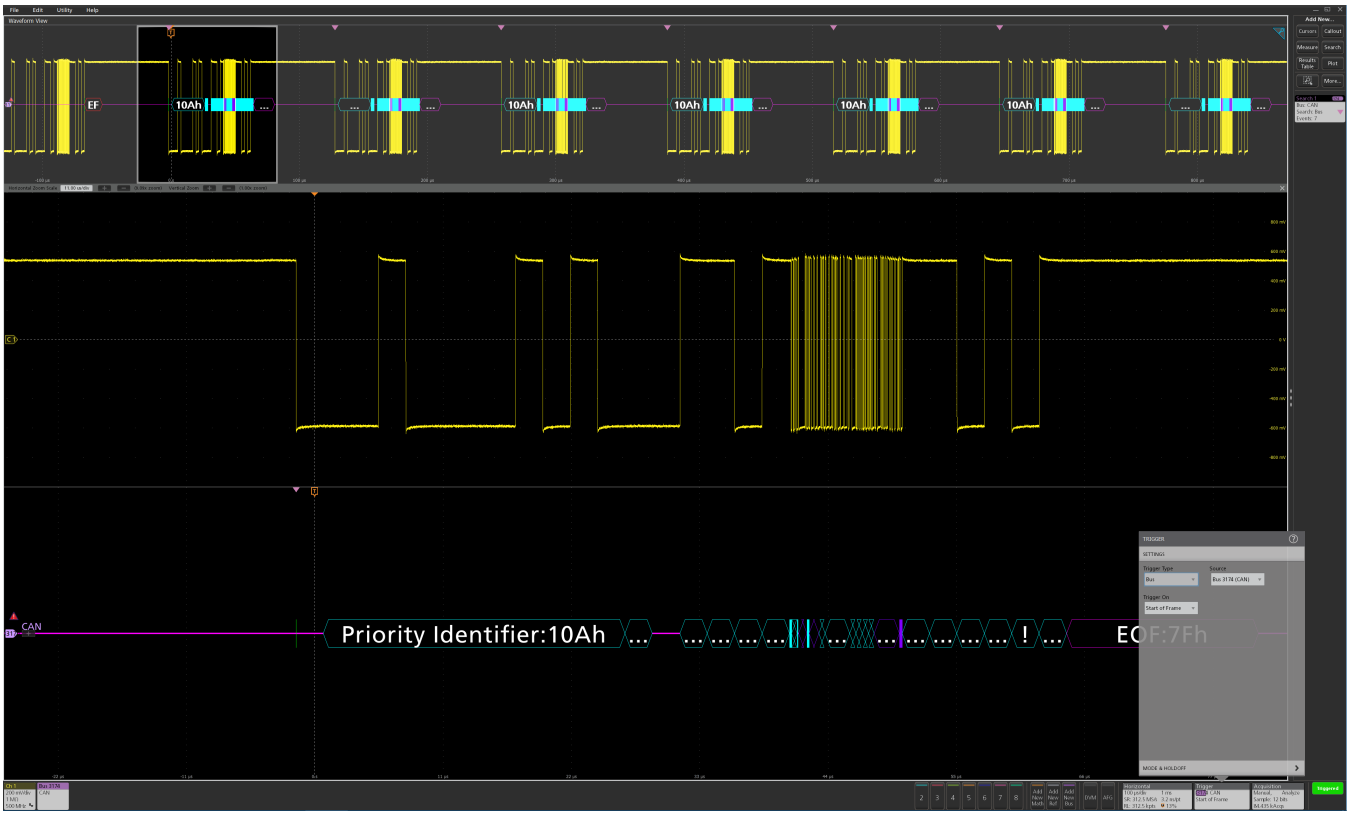
Characteristic	Description
Decode Display	Start of Frame (green bar) Priority Identifier (cyan packet) Remote Request Substitute (cyan packet) FD Format Indicator (cyan packet) XL Format Indicator (cyan packet) Reserved Bit XL Format (cyan packet) XL Bits (cyan packet) Data Length Control (purple packet)

Table continued…

Characteristic	Description
	PCRC (purple packet) Data (cyan packet) FCRC (purple packet) FCP (purple packet) Ack (cyan packet) Ack Delimiter (cyan packet) End of Frame (Dark pink packet) Errors (red packet)
Search On	Start of Frame Type of Frame (XL Data Frame) Priority Identifier Data (1 byte) XL Bits (Acceptance Field, Virtual CAN Network ID, SDU Type, Simple Extended Content, Stuff Bit Count, Arbitration to Data Sequence, Data to Arbitration Sequence) ADS Type (Arbitration to Data High Bit, Data High Bit 1, Data High Bit 2, Data Low Bit) DAS Type (DAH, Active High 1, Active High 2, Active Low 1) End of Frame Error (Missing Ack, XL Form Error, CRC, Any Error) CRC Type (PCRC, FCRC)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the CAN XL bus.



Triggering on Start of Frame on the CAN XL bus and searching on it.

CAN FD (ISO and non-ISO) characteristics

Bus setup options

Characteristic	Description
Source for CAN_H, CAN_L, Rx, or Tx (single-ended probing)	Analog channels Digital channels Active Math channels [1] Active Reference channels[1]
Source for Diff (differential probing)	Analog channels Active Math channels[1] Active Reference channels[1]
Thresholds	Per-channel thresholds
Recommended Probing: CAN_H, CAN_L, Rx, or Tx Diff	Single -ended Differential
Version	ISO non-ISO
SD Bit Rate Selection: Predefined list of rates Custom	10 kb/s - 1 Mb/s All but 3 Series MDO: 50 kb/s - 10 Mb/s 3 Series MDO: 10 kb/s - 1 Mb/s
FD Bit Rate Selection: Predefined list of rates Custom	All but 3 Series MDO: 1 Mb/s - 16 Mb/s 3 Series MDO: 1 Mb/s - 7 Mb/s All but 3 Series MDO: 500 kb/s - 16 Mb/s 3 Series MDO: 500 kb/s - 7 Mb/s
Sample Point	All but 3 Series MDO: 55% - 95% of bit period of unit interval 3 Series MDO: 15% - 95% of bit period of unit interval
Formats Available	Mixed Hex Hex Binary Symbolic (.dbc)[1]

Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Bus trigger and search options

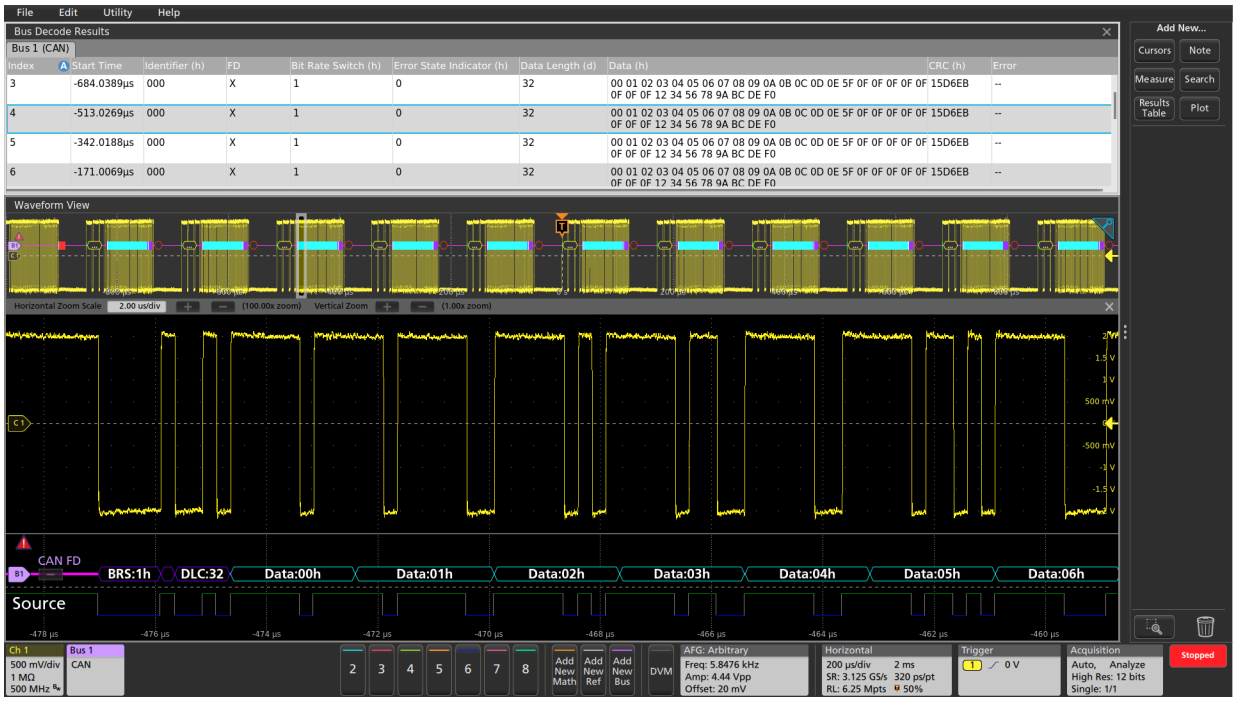
Characteristic	Description
Trigger and/or Search On	Start of Frame Type of Frame (Data, Remote, Error, Overload) FD Bits (Bit Rate Switch bit, Error State Indicator bit) Identifier (Standard or Extended) Data (1-8 bytes, trigger or search when =, ≠, <, ≤, >, ≥) Identifier and Data End of Frame Error (Missing Ack, Bit Stuffing Error, FD Form Error, Any Error)

Symbolic bus search options

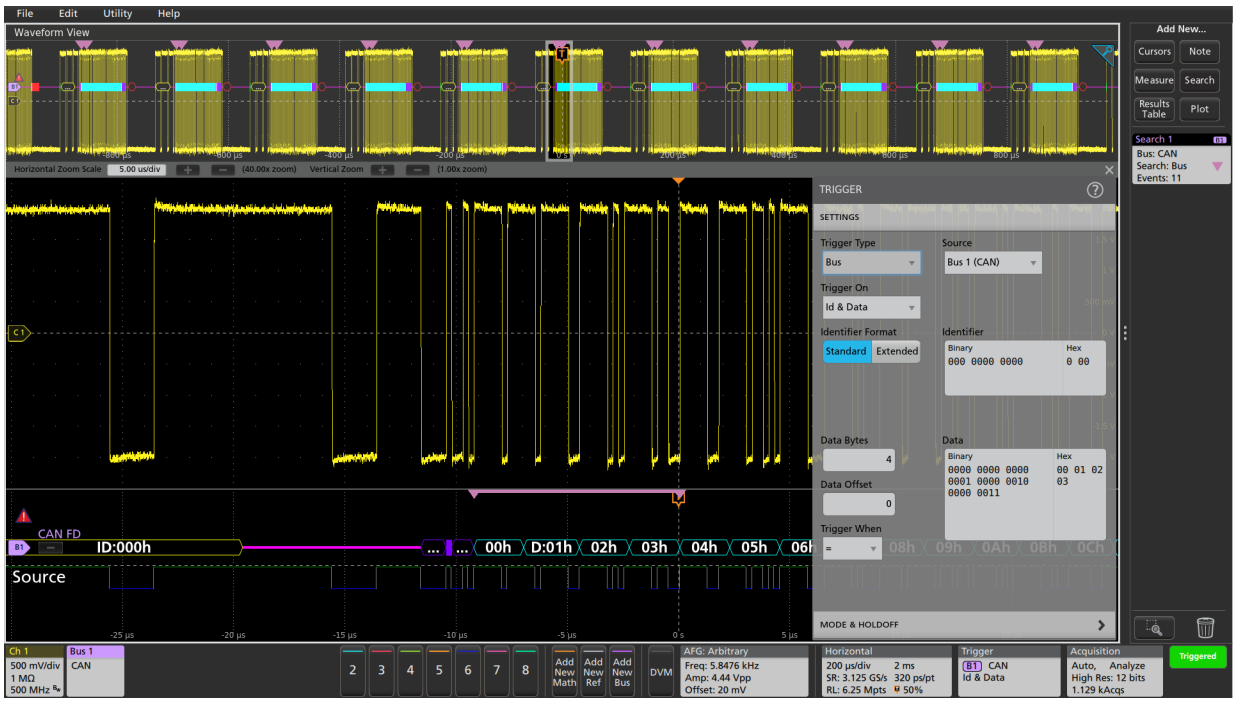
Characteristic	Description
Message	As defined by the .dbc file[1]
Message and Signal	As defined by the .dbc file[1]

Bus decode

Characteristic	Description
Decode Display	Start of Frame (green bar) Identifier (yellow packet) Data Length Control (purple packet) Data (cyan packet) CRC (purple packet) End of Frame (red bar) Errors (red packet)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the CAN FD bus.



Triggering on a specific Identifier value and data pattern on the CAN FD bus and automatically searching on the same data pattern.

LIN characteristics (Version 2.0)

Bus setup options

Characteristic	Description
LIN Source	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Thresholds	Per-channel thresholds
Recommended Probing	Single-ended
Polarity	Normal Inverted
Bit Rate Selection: Predefined list of rates Custom	 1.2 kb/s - 19.2 kb/s All but 3 Series MDO: 1 kb/s - 100 kb/s 3 Series MDO: 800 b/s - 100 kb/s
Sample Point	All but 3 Series MDO: 0% - 100% of bit period of unit interval 3 Series MDO: 10% - 90% of bit period of unit interval
LIN Standard	V 1.x V 2.x Both
Include Parity Bits with ID	Yes No
Formats Available	Hex Binary Mixed

Display modes

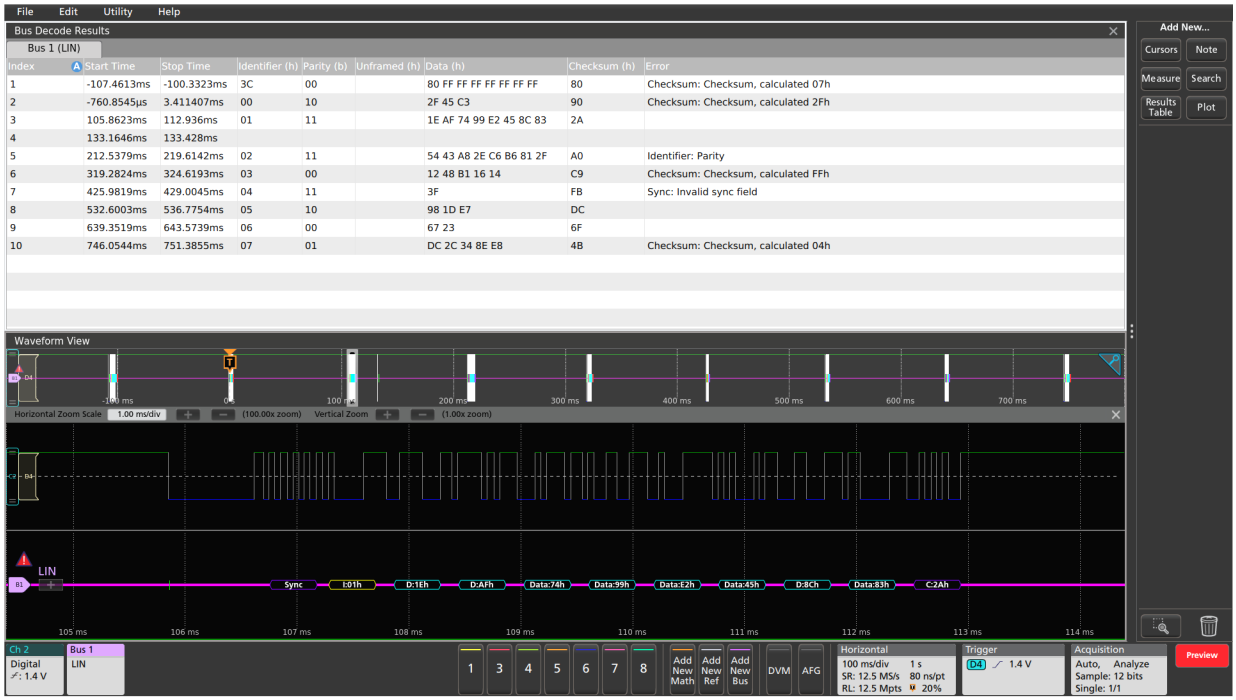
Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Bus trigger and search options

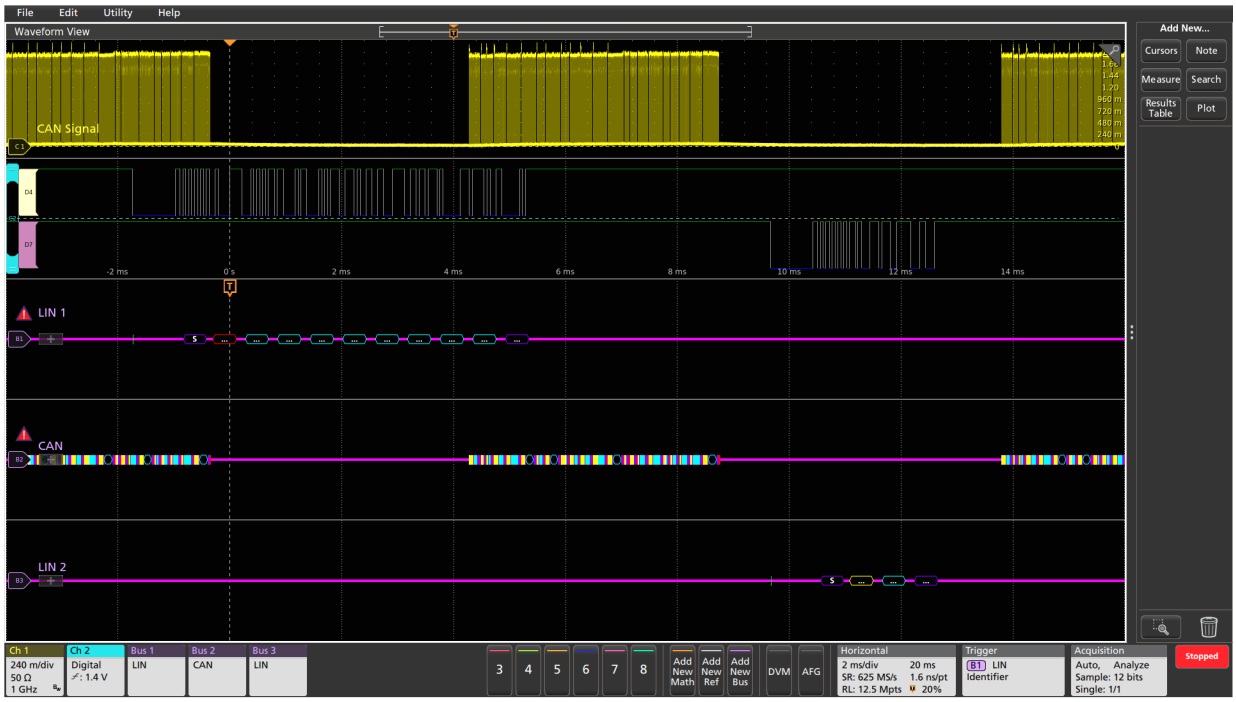
Characteristic	Description
Trigger and/or Search On	Sync Identifier Data (number of bytes 1-8, trigger or search when =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) ID and Data Wakeup Frame Sleep Frame Error (Sync, ID Parity, Checksum)

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 100 kb/s, by LIN definition up to 20 kb/s (for automated decoding of bus)
Decode Display	Start of Frame (green bar) Sync Identifier (yellow packet) Data (cyan packet) CRC (purple packet) Errors (red packet)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured LIN packets.



Display of multiple LIN and CAN buses, showing timing between the buses.

FlexRay characteristics (Version 2.0)

Bus setup options

Characteristic	Description
Source for Differential Probing (Bdiff)	Analog channels Active Math channels[1] Active Reference channels[1]
Source for Single-ended Probing (BP, BM)	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Source for Single-ended Probing (Tx, Rx)	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Thresholds: Bdiff BP, BM (analog channels) BP, BM (digital channels) Tx, Rx	High and Low thresholds High and Low thresholds Single threshold Single threshold
Recommended Probing: Bdiff, BP, BM Tx, Rx	Differential Single-ended
Channel Type	A B
Bit Rate Selection: Predefined list of rates Custom	2.5 Mb/s, 5 Mb/s, 10 Mb/s 1 Mb/s - 10 Mb/s
Formats Available	Hex Binary Mixed Hex (Decimal: ID, Len, and Count; Hex: Data and CRCs)

Display modes

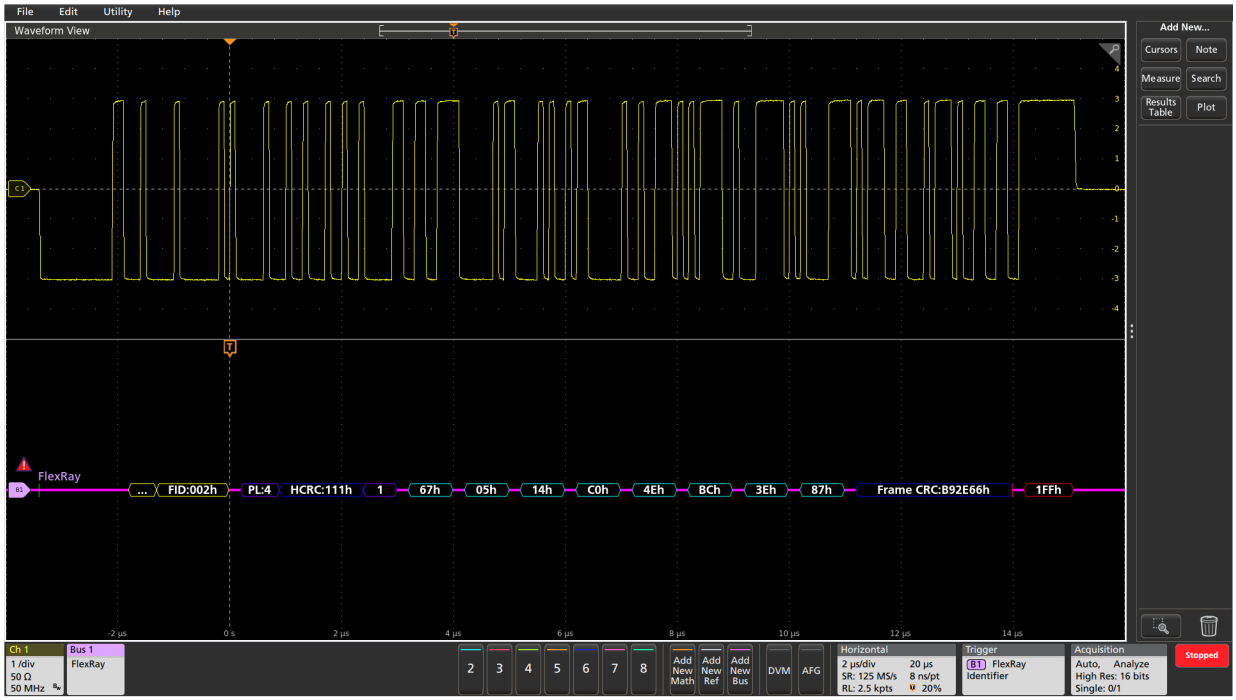
Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Bus trigger and search options

Characteristic	Description
Trigger and/or Search On	Start of Frame Indicator Bits (Normal, Payload, Null, Sync, Startup) Cycle Count (when =, ≠, <, ≤, >, ≥) Header Fields (Indicator Bits, Identifier, Payload Length, Header CRC, and Cycle Count) Identifier (when =, ≠, <, ≤, >, ≥) Data (when =, ≠, <, >, ≤, ≥) Identifier and Data End Of Frame (Static, Dynamic) Error (Header CRC, Trailer CRC, NULL Frame in Static, NULL Frame in Dynamic, Sync Frame in Dynamic, Start Frame No Sync)

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 10 Mb/s (for automated decoding of bus)
Decode Display	TTS (purple box) Start (green bracket) Frame ID (yellow box) Payload Length (purple box) Headers (purple box) Cycle Count (yellow box) Data (cyan box) CRC, DTS, CID (purple box) Stop (red bracket)



Decoded FlexRay bus, with the acquisition triggered on a specified identifier value.

Decoded FlexRay bus, with all data values in a specific range marked with pink brackets.

SENT Characteristics[1]

Bus setup options

Characteristic	Description
SENT source	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Recommended Probing	Single-ended
Polarity	Normal Inverted
Clock Tick	1 µs - 300 µs
Tick Tolerance	1% - 30%
Fast Data Channels	1 or 2
Data Nibbles (1 Fast Data Channel)	3, 4, or 6 nibbles
Channel Widths (C1/C2) (2 Fast Data Channels)	12/12, 14/10, or 16/8 bits
Pause Pulse	Yes No
Slow Channel	None Enhanced w/ 4-bit ID Enhanced w/ 8-bit ID Short
Formats Available	Mixed Hex Binary Hex Mixed Decimal

Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Table continued…

Bus trigger options

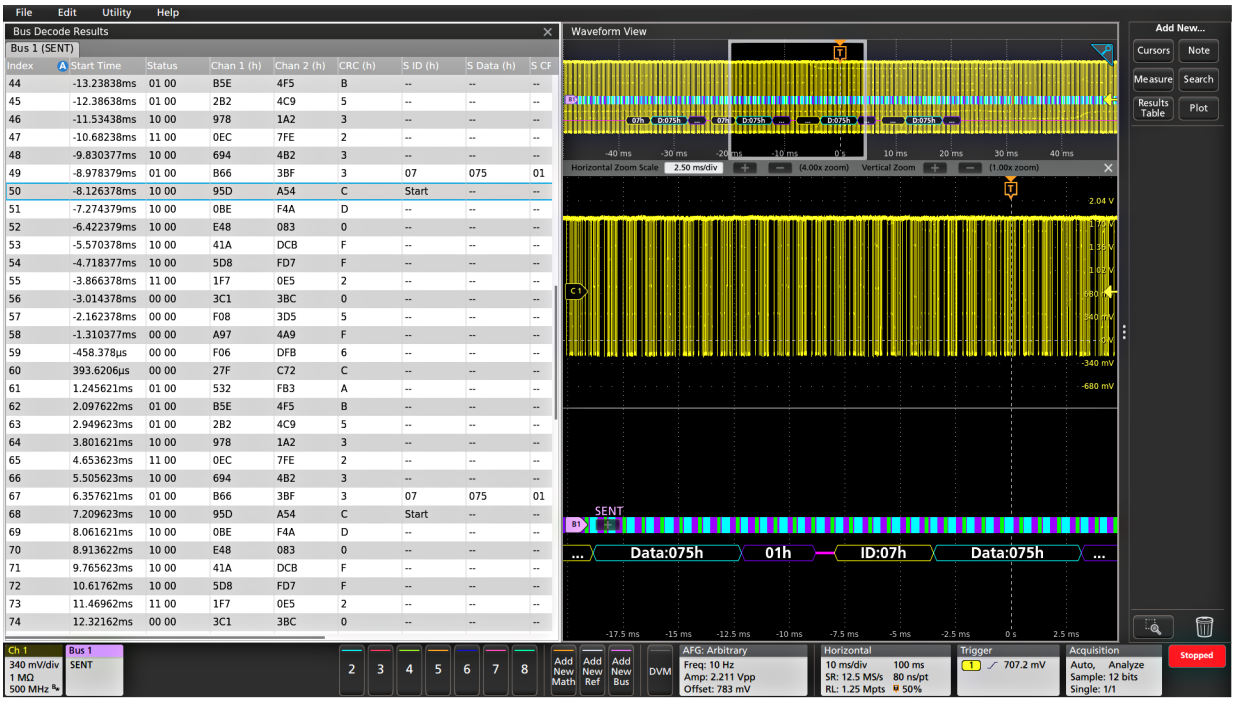
Characteristic	Description
Trigger On	Start of Packet Fast Channel(s) (Status/Communication, Data) Slow Channel (Message ID, Data) CRC Error (Fast channel, Slow channel)

Bus search options

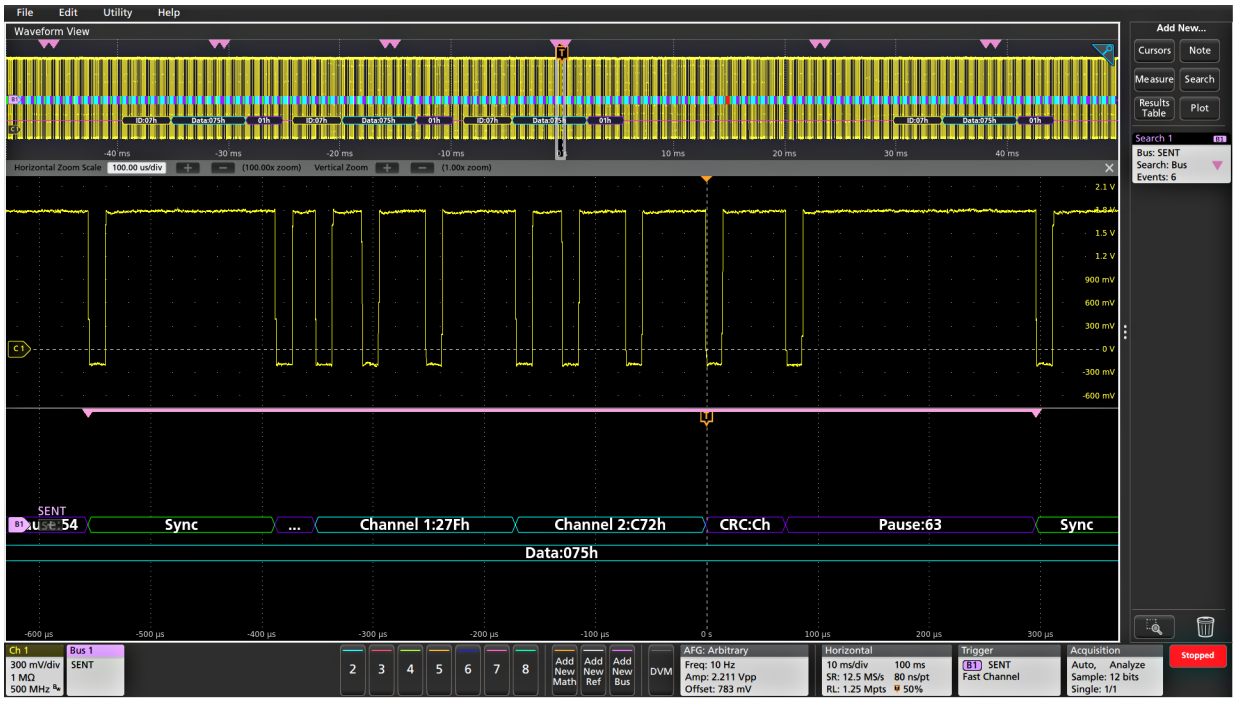
Characteristic	Description
Search On	Start of Packet Fast Channel(s) (Status/Communication, Data) Slow Channel (Message ID, Data) Pause Pulse (Number of Ticks) Error (Frame Length, Fast channel CRC, Slow channel CRC)

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 10 Mb/s (for automated decoding of bus)
Decode Display	Sync (green packet) Fast Channel Status (purple packet) Slow Channel Message ID (yellow packet) Data (cyan packet) CRC (purple packet) Pause (purple packet) Errors (red packet)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the SENT bus.



Triggering on a specific Fast Channel Status and data pattern on the SENT bus and automatically searching on the same data pattern.

MIL-STD-1553 characteristics

Bus setup options

Characteristic	Description
MIL-STD-1553 Source	Analog channels Active Math channels Active Reference channels
Polarity	Normal Inverted
Thresholds	Single-ended: Per-channel thresholds Differential: High and low thresholds
Recommended Probing	Single-ended or differential
Bit Rate	1 Mb/s per the standard
Response Time	2 µs-100 µs
Formats Available	Mixed Hex Mixed ASCII Hex Binary

Display modes

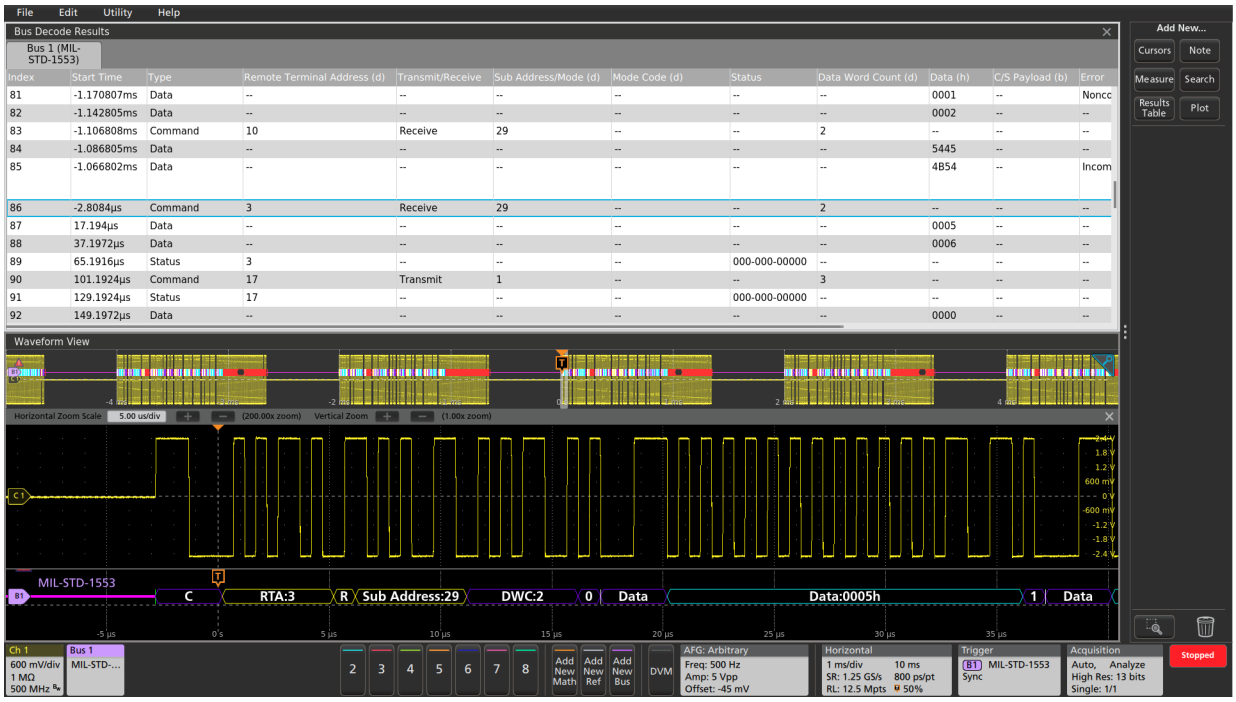
Characteristic	Description
Bus	Bus only
Results Table	Decoded packet data in a tabular view

Bus trigger and search options

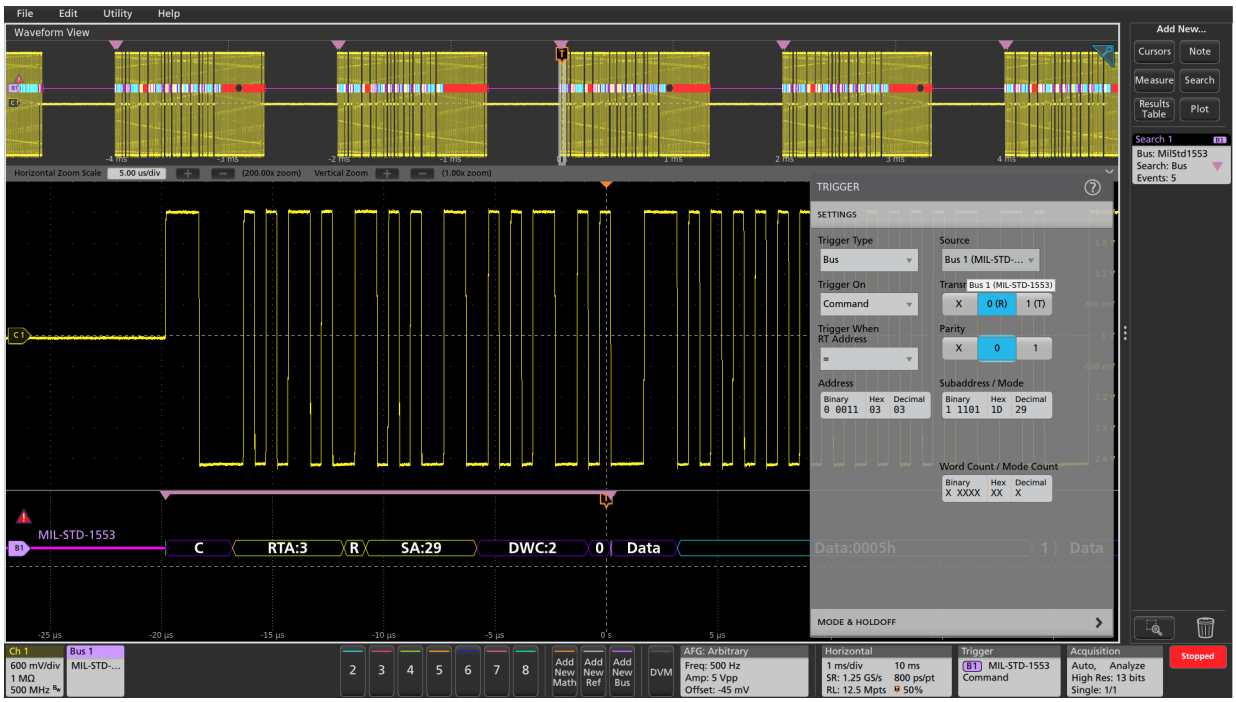
Characteristic	Description
Trigger and/or Search On	Sync Command (Transmit/Receive Bit, Parity, Subaddress / Mode, Word Count / Mode Count, and RT Address =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) Status (Parity, Bit 9 - Message Error, Bit 10 - Instrumentation, Bit 11 - Service Request, Bit 15 - Broadcast Command Received, Bit 16 - Busy, Bit 17 - Subsystem Flag, Bit 18 - Dynamic Bus Control Acceptance, Bit 19 - Terminal Flag, and Data =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) Data (Parity, and Data =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) Time (RT / IMG) (> Maximum, < Minimum, Inside range, Outside Range) Error (Parity Error, Sync Error, Manchester Error (trigger only), Non-contiguous Data)

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 1Mb/s (for automated decoding of bus)
Decode Display	Start (green bar) Sync (purple packet with Word Type identified) Address (yellow packet) R/T (purple packet) Word Count (purple packet) Data (cyan packet) Parity (purple packet) Errors (red packet) Stop (red bar)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured MIL-STD-1553 packets.



Triggering on a specific command pattern on the MIL-STD-1553 bus and automatically searching on the same pattern.

ARINC 429 characteristics (ARINC Specs 429 PART 1-17)

Bus setup options

Characteristic	Description
ARINC 429 Source	Analog channels Active Math channels Active Reference channels
Signal Type	Differential
Polarity	Normal Inverted
Thresholds	High and low thresholds
Recommended Probing	Differential
Bit Rate Selection: Predefined list of rates Custom	12.5 kb/s, 100 kb/s 10 kb/s - 1 Mb/s
Data Format	Data (19 bits) SDI+Data (21 bits) SDI+Data+SSM (23 bits)
Formats Available	Mixed Hex Hex Binary

Display modes

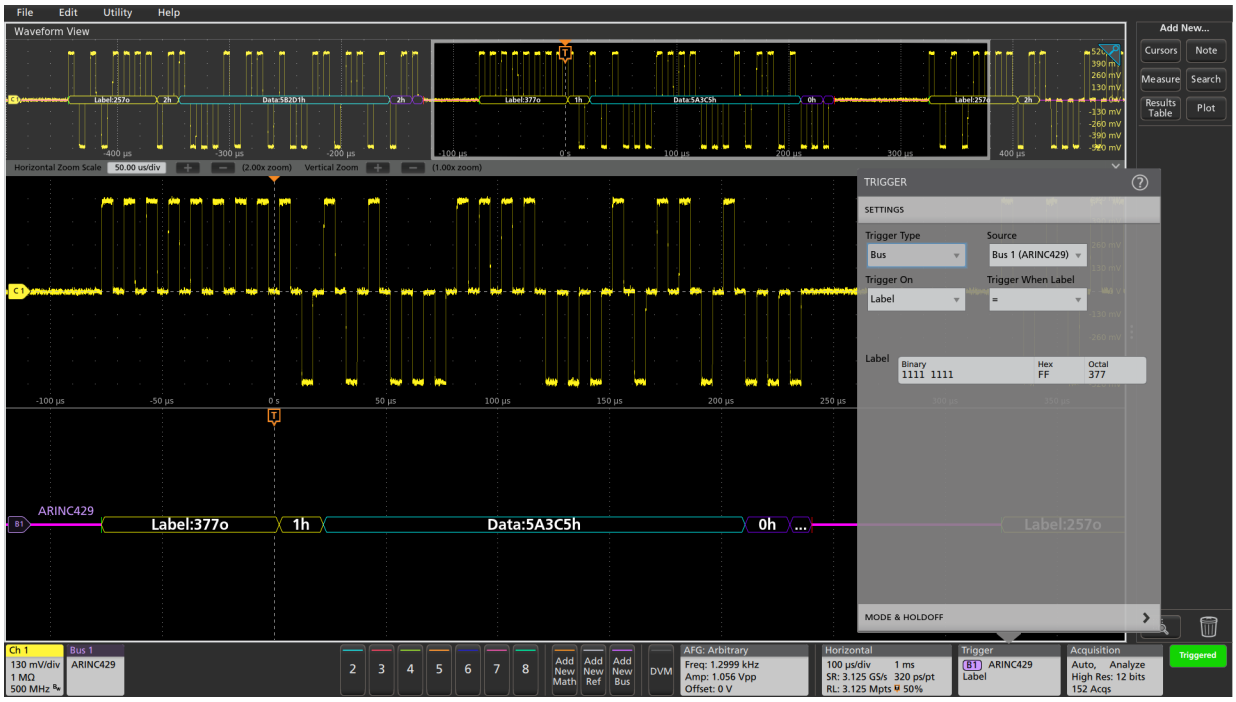
Characteristic	Description
Bus	Bus only
Results Table	Decoded packet data in a tabular view

Bus trigger and search options

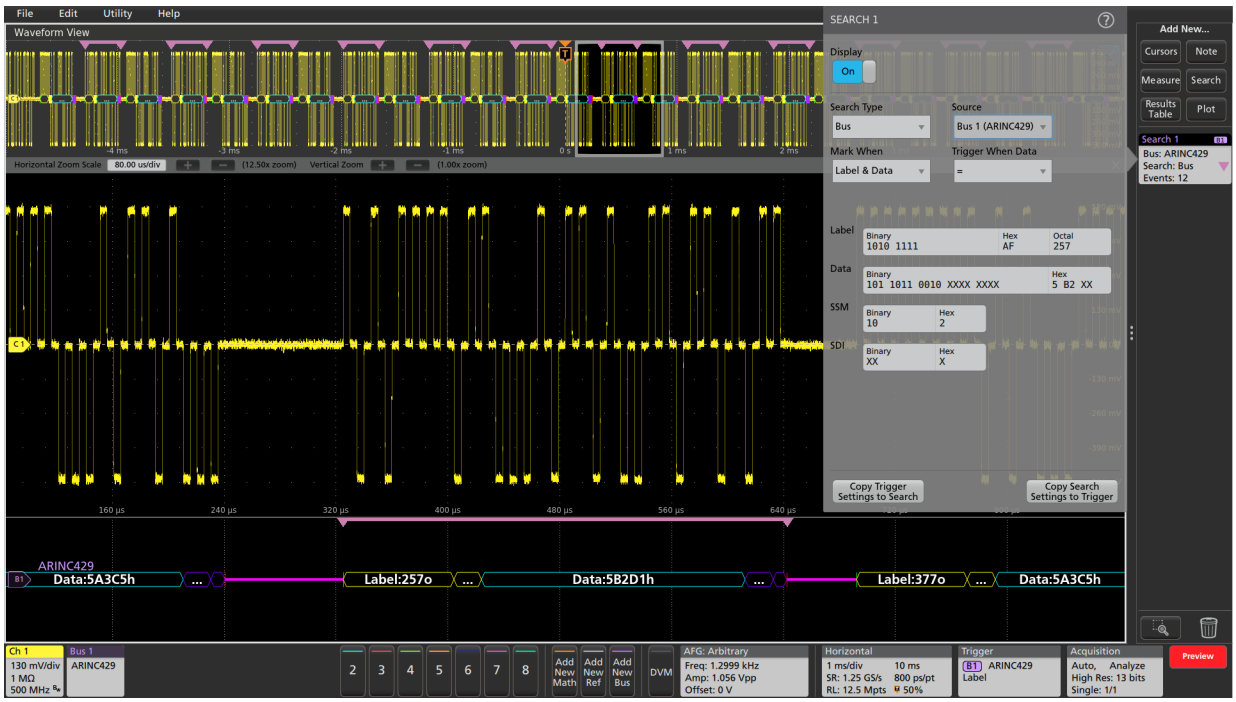
Characteristic	Description
Trigger and/or Search On	Word Start Label (when =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) Data (when =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) Label and Data (Label value and Data =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) Word End Error (Any Error, Parity Error, Word Error, Gap Error)

Bus decode

Characteristic	Description
Decode Display	Start (green bracket) Label (yellow box) Source Destination Identifier (yellow box) Data (cyan box) Sign/Status Matrix (purple box) Parity (purple box) Stop (red bracket) Error (red box)



Decoded ARINC 429 bus, with the acquisition triggered on a specified label value.



Decoded ARINC 429 bus, with all data values in a specific range marked with pink brackets.

Audio characteristics

Bus setup options

Characteristic	Description
Audio Sources (Bit Clock, Word Select, Data)	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Thresholds	Per-channel thresholds
Bit Clock Polarity	Rising Edge Falling Edge
Word Select Polarity	Normal Invert
Data Polarity	Active High Active Low
Word Size	4 - 32 bits
Formats Available	Hex Binary Signed Decimal

Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

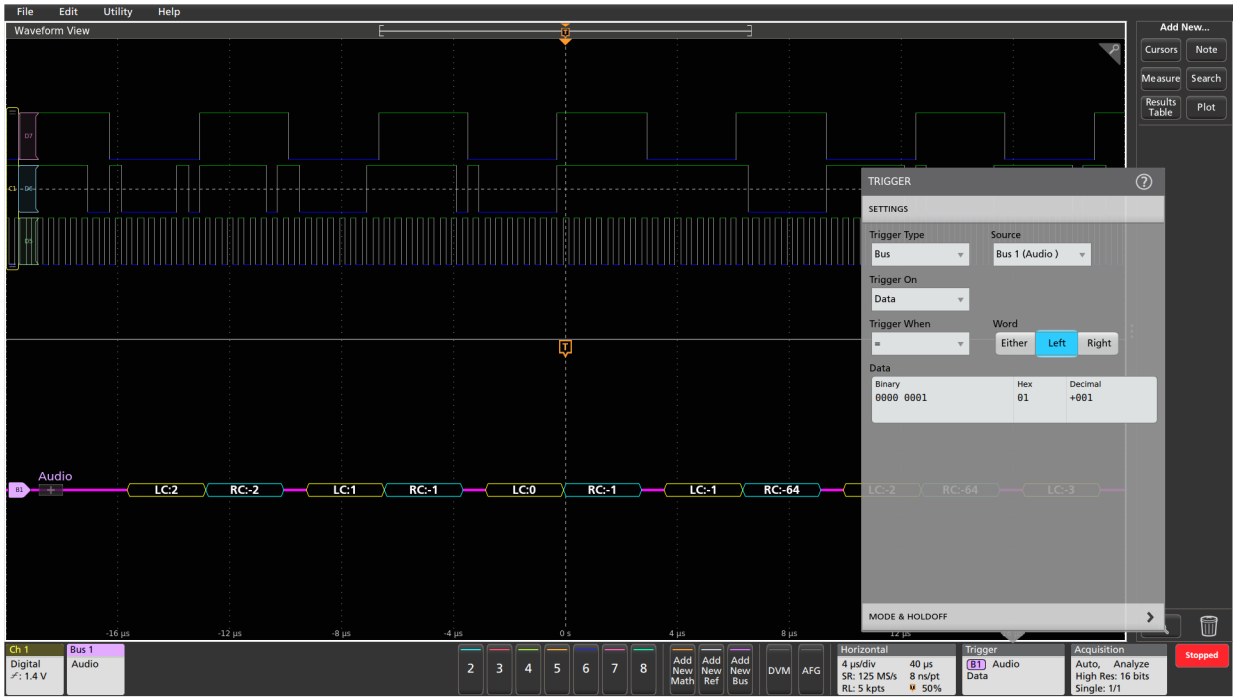
Table continued…

Bus trigger and search options

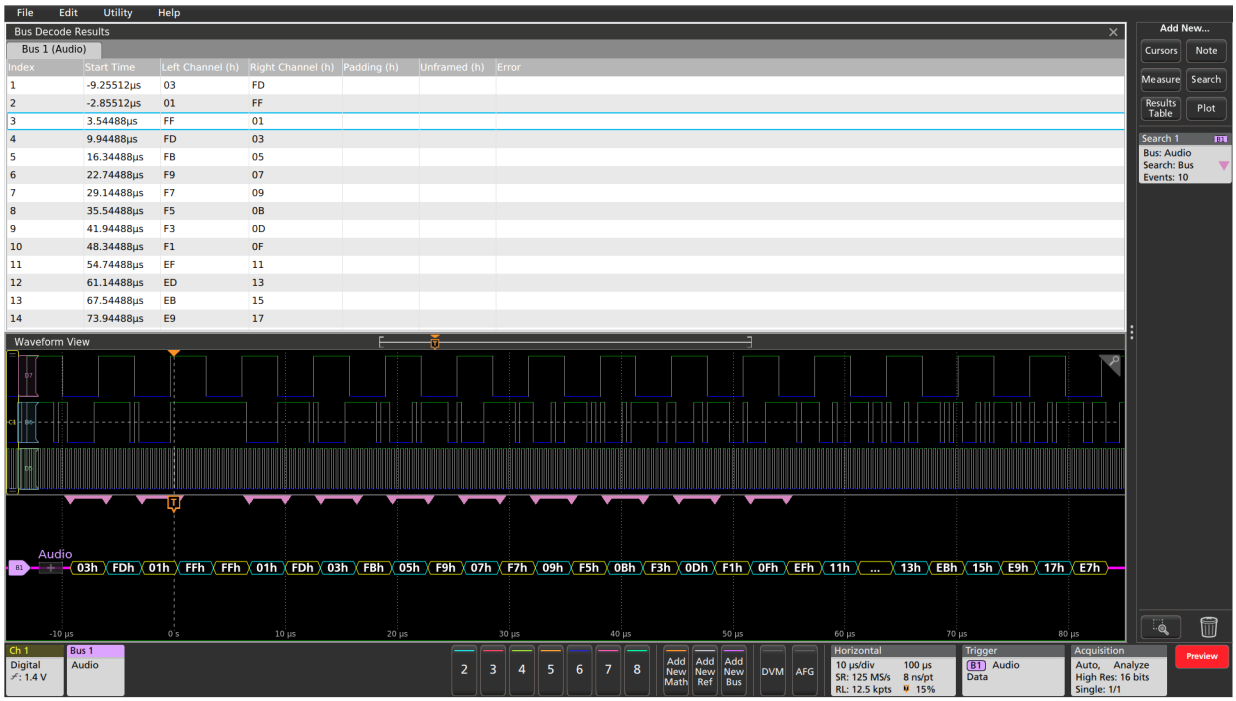
Characteristic	Description
Trigger and/or Search On	Word Select (I^2S, LJ, RJ only) Frame Sync (TDM only) Data (when =, ≠, <, >, ≤, ≥, Inside Range, Outside Range; Left, Right, or Either Word)

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	All but 3 Series MDO: Up to 10 Mb/s (for automated decoding of bus) 3 Series MDO: Up to 12.5 Mb/s (for automated decoding of I2S/LJ/RJ bus) 3 Series MDO: Up to 25 Mb/s (for automated decoding of TDM bus)
Decode Display	Left Channel Data (I^2S, LJ, RJ) (yellow box) Right Channel Data (I^2S, LJ, RJ) (cyan box) Channel 1 Data (TDM) (yellow box) Channel 2 - N Data (TDM) (cyan box)



Decoded I²S bus, with data values displayed in signed decimal format, and the MSO triggered on a specific data value.



Decoded I²S bus, with data values displayed in hex and Results Table format, and the Wave Inspector automatic search marking all occurrences of the data values equal to 0X hex.

USB 2.0 Characteristics (Version 2.0)

Bus setup options

Characteristic	Description
USB 2.0 Source(s)	Analog channels Digital channels (single-ended) Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Speed	USB 1.0 (1.5 Mbps) USB 1.1 (12 Mbps) USB 2.0 (480 Mbps)
Recommended Probing: USB 1.0 and USB 1.1 USB 2.0	 Single-ended Differential
Formats Available for USB 1.0, USB 1.1, and USB 2.0	Mixed Hex Hex Binary Mixed ASCII

Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Bus trigger options

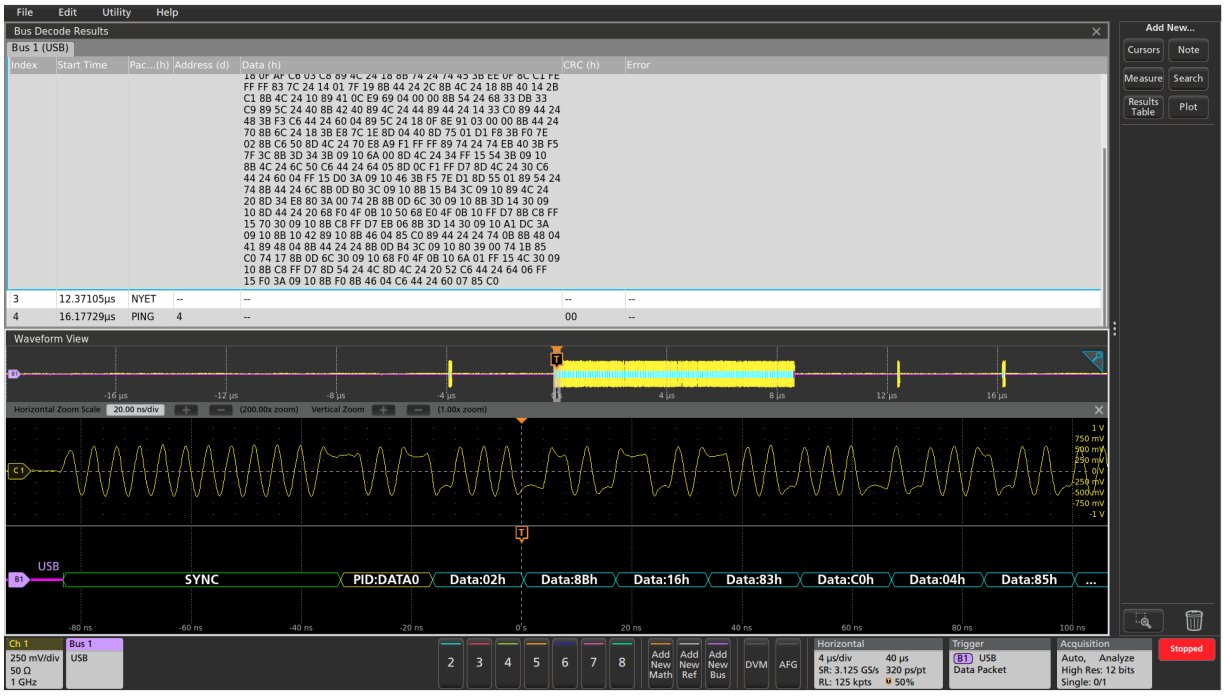
Characteristic	Description
Trigger On	Sync Reset Suspend Resume End of Packet Token (address) Packet Data Packet
	Handshake Packet: ACK, NAK, STALL, NYET (USB 2.0 only) Special Packet: PRE (USB 1.1 only), ERR, SPLIT, PING, Reserved Error: PID check, CRC5 or CRC16, Bit stuffing (USB 1.0 and USB 1.1 only)

Bus Search options

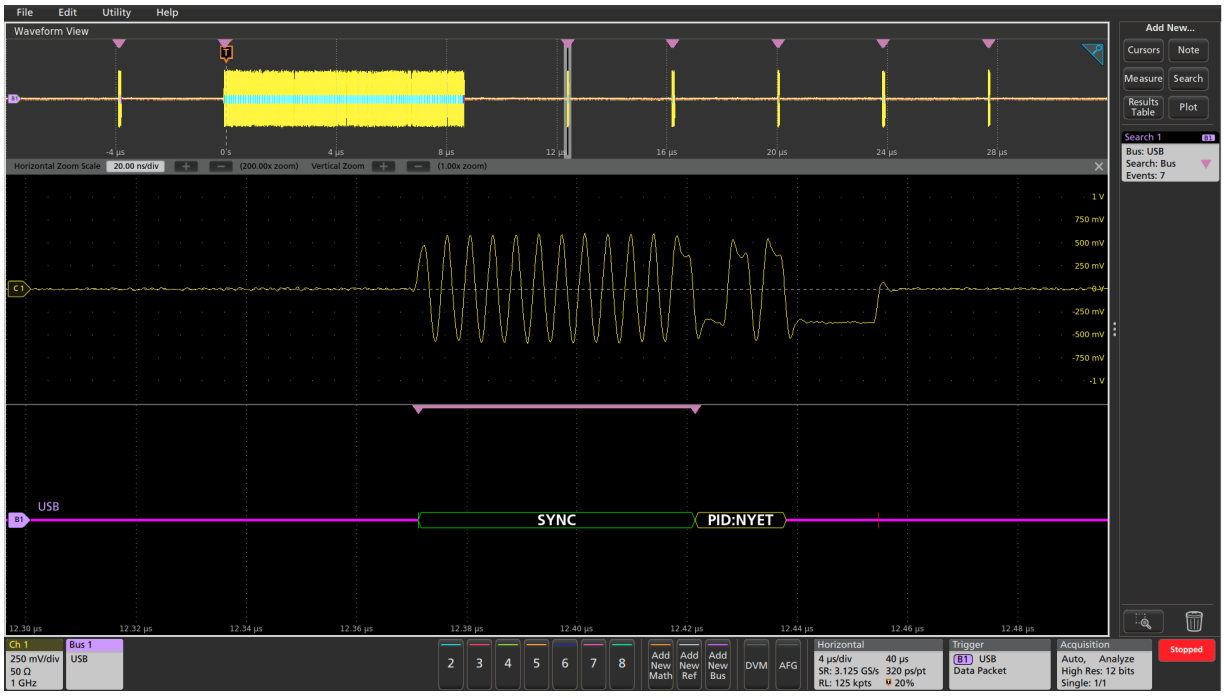
Characteristic	Description
Search On	Sync Reset Suspend Resume End of Packet Token (address) Packet Data Packet Handshake Packet: ACK, NAK, STALL, NYET (USB 2.0 only) Special Packet: PRE (USB 1.1 only), ERR, SPLIT, PING, Reserved Error: PID check, CRC5 or CRC16, Bit stuffing (USB 1.0 and USB 1.1 only)

Bus decode

Characteristic	Description
Decode Display	Start of packet (green bar) Sync (green packet) PID (yellow packet) Token (address) (yellow packet) Data (cyan packet) CRC (purple packet) Error (red packet) End of packet (red bar)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the USB bus.



Triggering on a specific data pattern on the USB 2.0 bus and automatically searching on Sync.

USB Characteristics (Version 3.0, 3.1 Gen 1, 3.2 Gen 1)

Bus setup options

Characteristic	Description
USB Source(s)	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Speed	USB 1.0 (1.5 Mbps) USB 1.1 (12 Mbps) USB 2.0 (480 Mbps) USB 3.0 (5 Gbps) USB 3.1 Gen 1 (5 Gbps) USB 3.2 Gen 1 (5 Gbps)
Recommended Probing: USB 1.0, USB 1.1, USB 3.0, USB 3.1 Gen 1, and USB 3.2 Gen 1 USB 2.0, USB 3.0, USB 3.1 Gen 1, and USB 3.2 Gen 1	 Single-ended Differential
Formats Available: USB 1.0, USB 1.1, and USB 2.0 USB 3.0, USB 3.1 Gen 1, and USB 3.2 Gen 1 	 Hex Binary Mixed Hex Mixed ASCII Hex Binary Mixed Hex

Table continued…

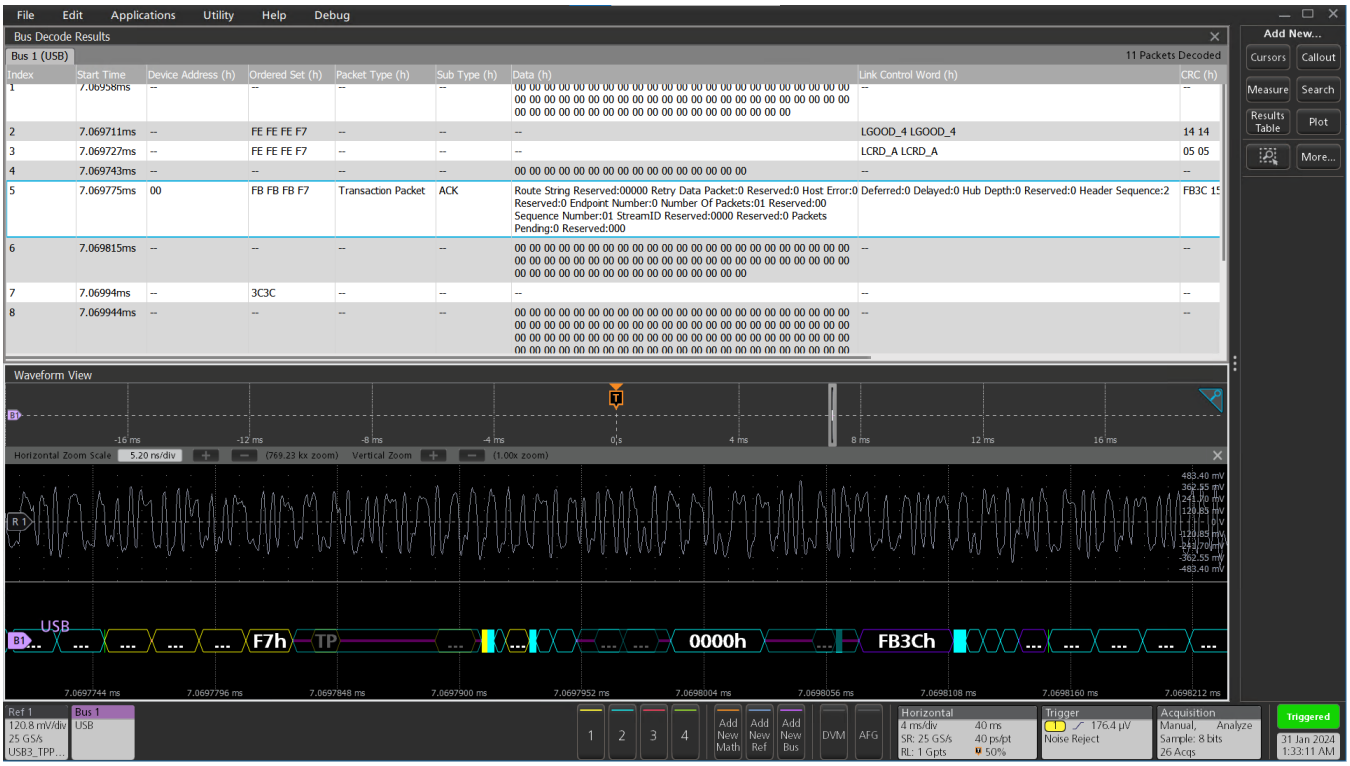
Characteristic	Description
Packet View for USB 3.0, USB 3.1 Gen 1, and USB 3.2 Gen 1	On Off

Display modes

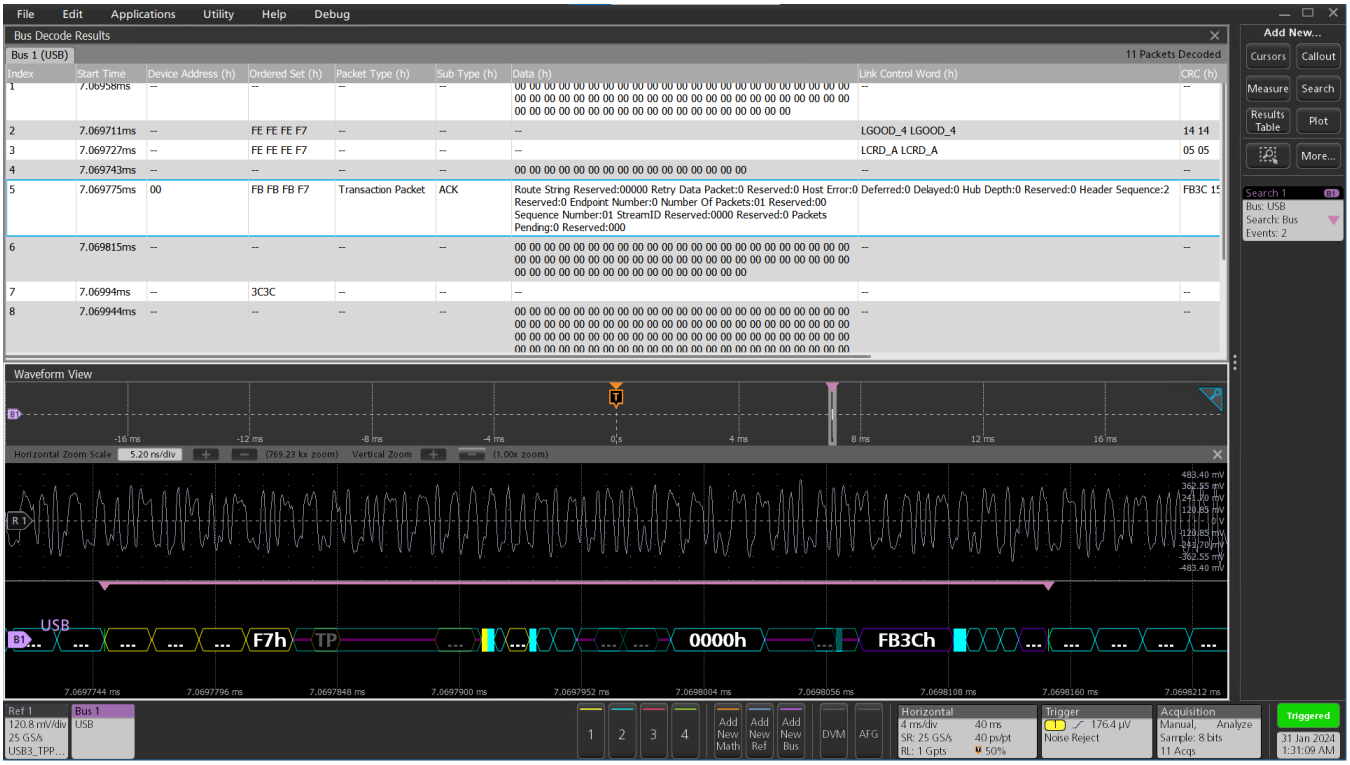
Characteristic	Description
Bus	Bus only
Results Table	Decoded packet data in a tabular view

Bus Search options

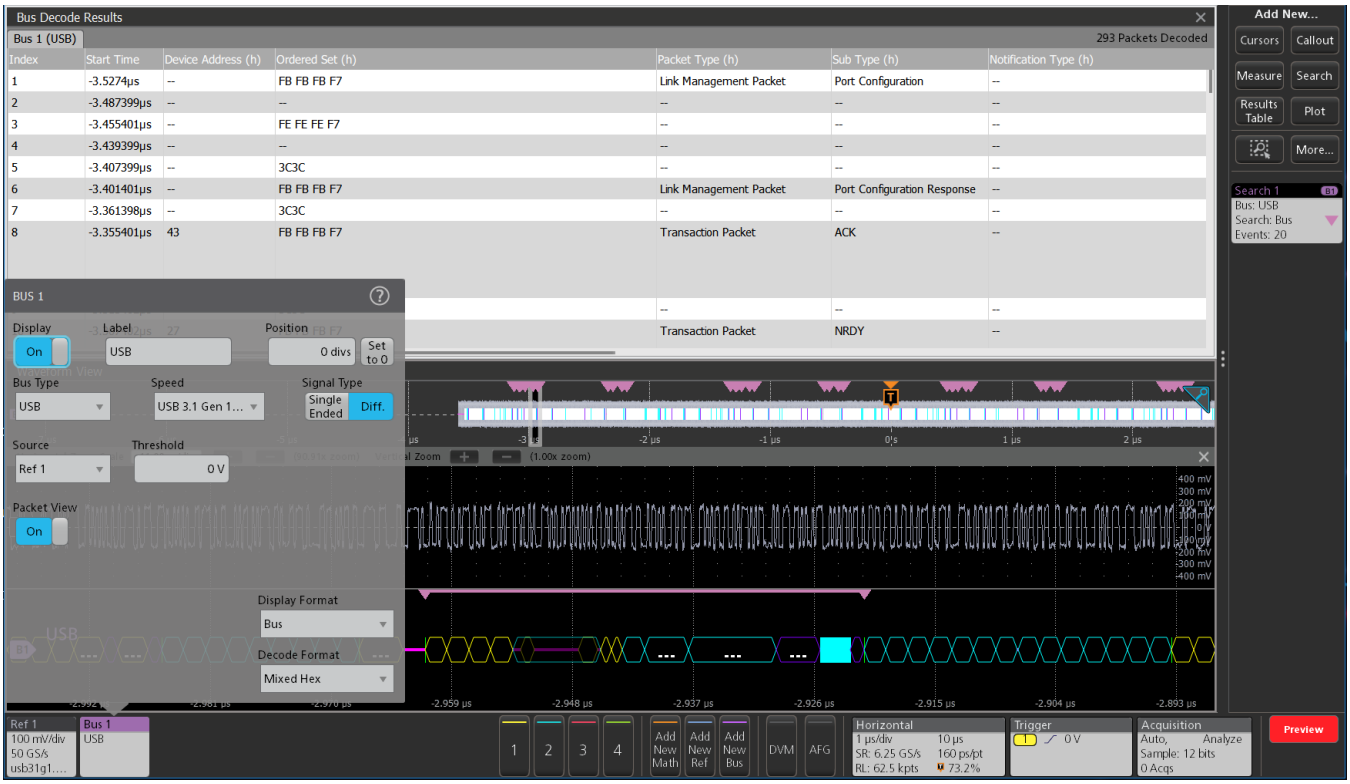
Characteristic	Description
Search On	Packet View On Only • Ordered Set: TSEQ, TS1, TS2, SKP, DPPSTART, DPPEND, DPPABORT, LCSTART, HPSTART • LMP: Port Capability, Port Configuration, Port Configuration Response, Precision Time Management, Set Link Function, U2 Inactivity Timeout, Vendor Device Test, ANY • TP: ACK, DEV Notification, ERDY, NRDY, PING, PING Response, STATUS, STALL, ANY • Packet Type: LMP, TP, DP, ITP, ANY • Error: CRC5, CRC16, CRC32 Packet View Off Only • Ordered Set: TSEQ, TS1, TS2, SKP • Compliance Pattern: CP0, CP1, CP2, CP3, CP4, CP5/6, CP7/8 • Custom • Error: Character, Disparity Control Character: COM, EDB, END, EPF, SDP, SHP, SKP, SLC, SUB, Any



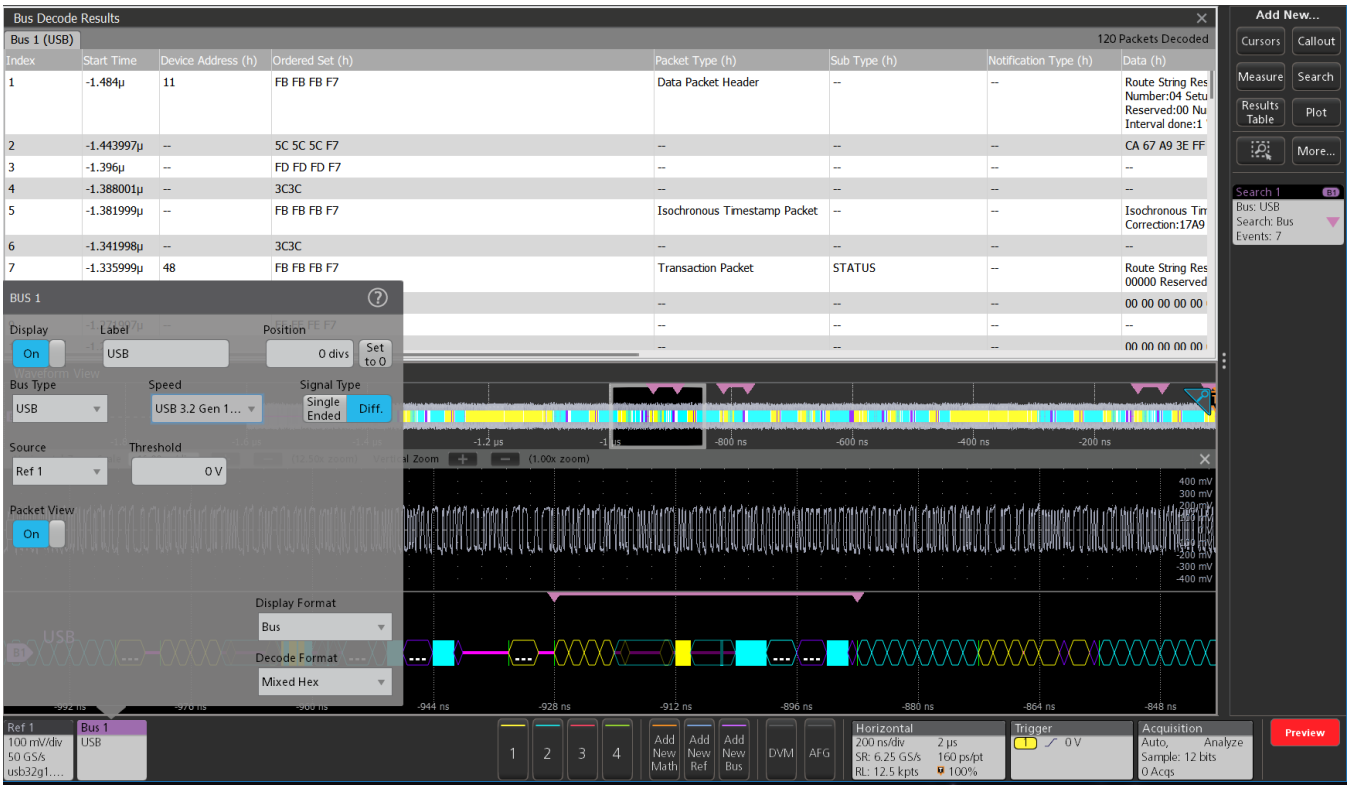
USB3 bus setup and Mixed Hex display, showing decode with speed USB 3.0 and packet view On.



Searching the USB bus with decode speed USB 3.0 and packet view On for the TP packets.



Searching the USB bus with decode speed USB 3.1 Gen 1 and packet view On for the TP packets. The results table at the top of the graticule.



Searching the USB bus with decode speed USB 3.2 Gen 1 and packet view On for the TP packets. The results table at the top of the graticule.

Ethernet characteristics[1]

Bus setup options

Characteristic	Description
Ethernet Source(s)	Analog channels Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Speed	10BASE-T 100BASE-TX
Recommended Probing	Differential
Formats Available	Mixed Hex Hex Binary Mixed ASCII

Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Bus trigger options

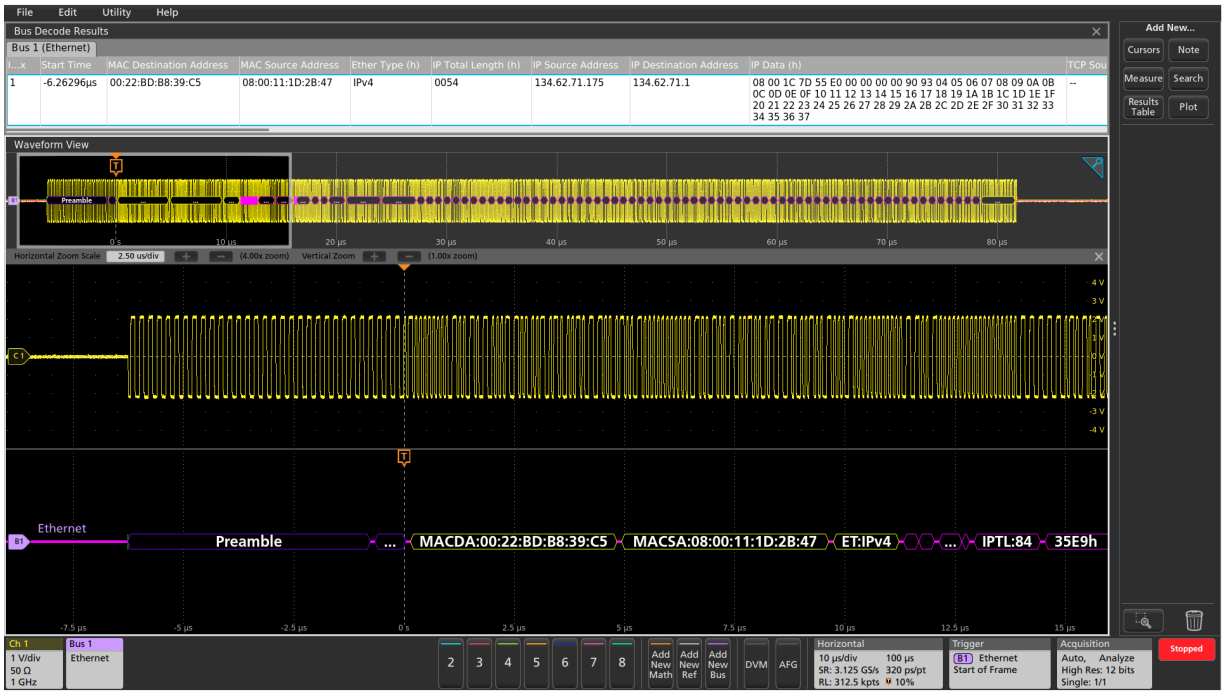
Characteristic	Description
Trigger On	Start Frame Delimiter MAC Addresses Q-Tag Control Information MAC Length/Type IPv4 Header TCP Header MAC Data TCP-IPv4 Client Data Idle End of Packet Frame Check Sequence (CRC) Error

Bus search options

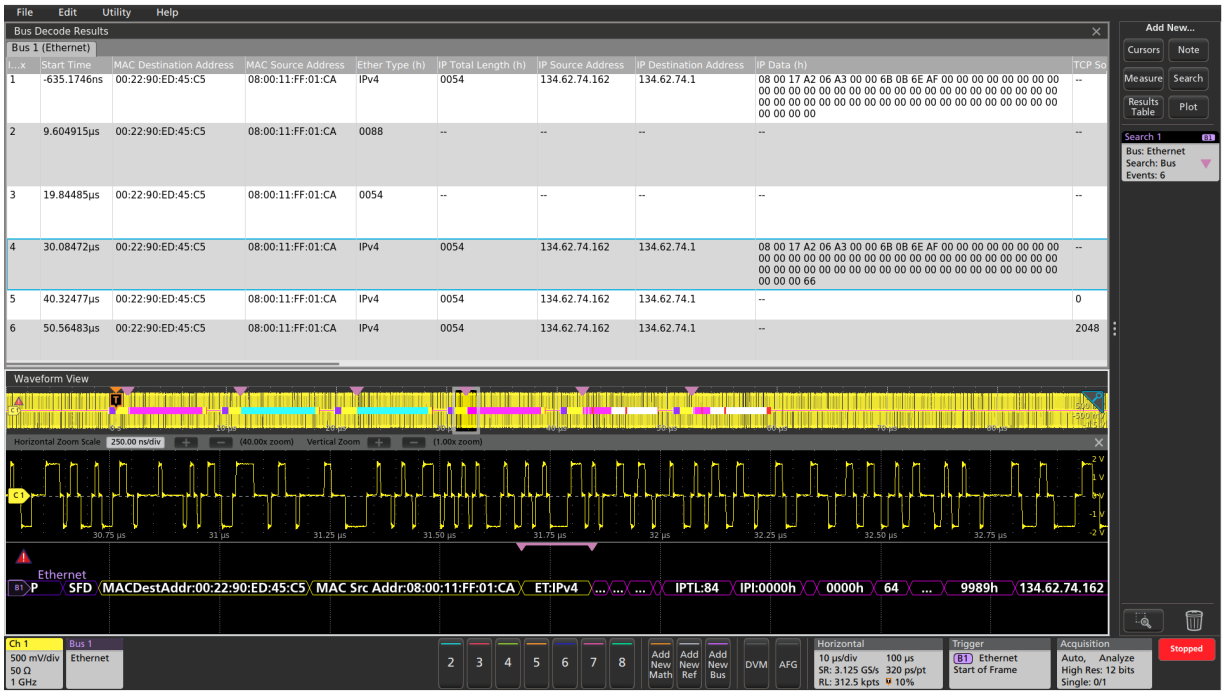
Characteristic	Description
Search On	Start Frame Delimiter MAC Addresses Q-Tag Control Information MAC Length/Type IPv4 Header TCP Header MAC Data TCP-IPv4 Client Data Idle End of Packet Frame Check Sequence (CRC) Error

Bus decode

Characteristic	Description
Decode Display	Start of Packet (green bar) Preamble (purple packet) SFD (purple packet) Address (yellow packet) EtherType (yellow packet) IP packet (purple packet) Data (cyan packet) IPv4 packet (pink packet) TCP packet (white packet) Frame Check Sequence (yellow packet) Error (red packet) End of packet (red bar)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the 10BASE-T Ethernet bus



Triggering and automatically searching on the 100BASE-TX Ethernet bus.

SPMI characteristics[1] (Version 2.0)

Bus setup options

Characteristic	Description
SPMI Sources (Clock and Data)	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Recommended Probing	Single-ended
Formats Available	Mixed Hex Hex Binary

Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Bus trigger options

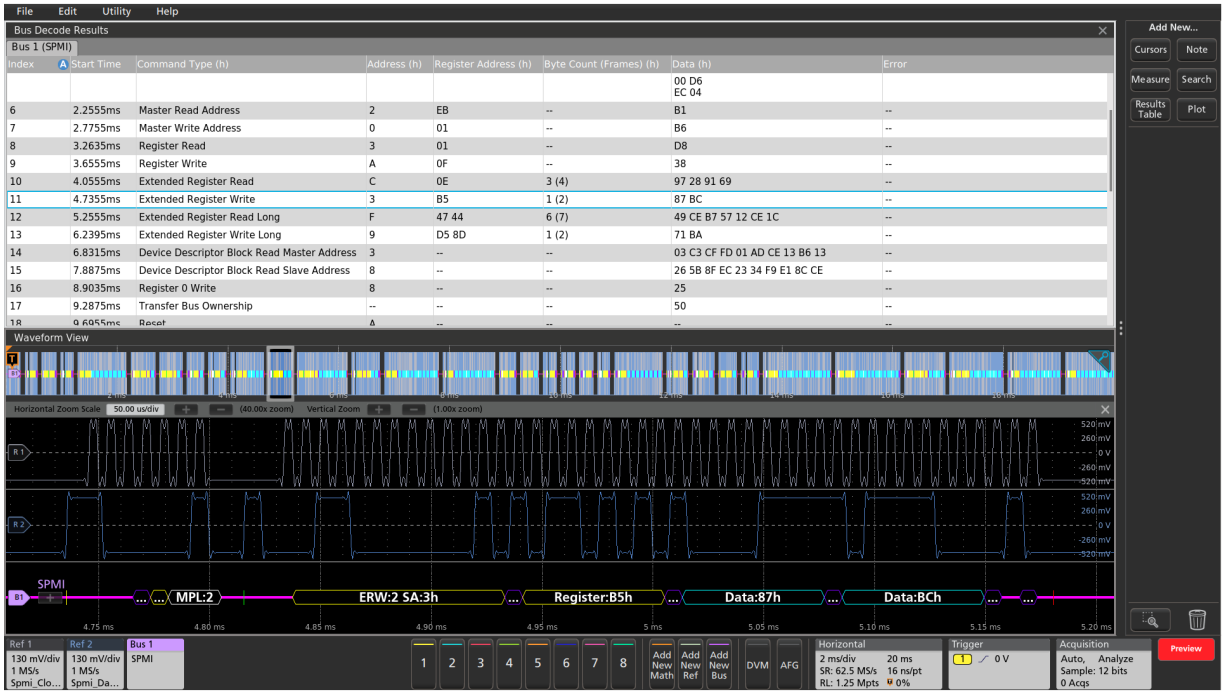
Characteristic	Description
Trigger On	Sequence Start Condition (SSC) Reset Sleep Shutdown Wakeup Authenticate Master Read Master Write Register Read Register Write Extended Register Read Extended Register Write Extended Register Read Long Extended Register Write Long Device Descriptor Block Master Read Device Descriptor Block Slave Read Register 0 Write Transfer Bus Ownership Parity Error

Bus search options

Characteristic	Description
Search On	Sequence Start Condition (SSC) Reset Sleep Shutdown Wakeup Authenticate Master Read Master Write Register Read Register Write Extended Register Read Extended Register Write Extended Register Read Long Extended Register Write Long Device Descriptor Block Master Read Device Descriptor Block Slave Read Register 0 Write Transfer Bus Ownership Parity Error

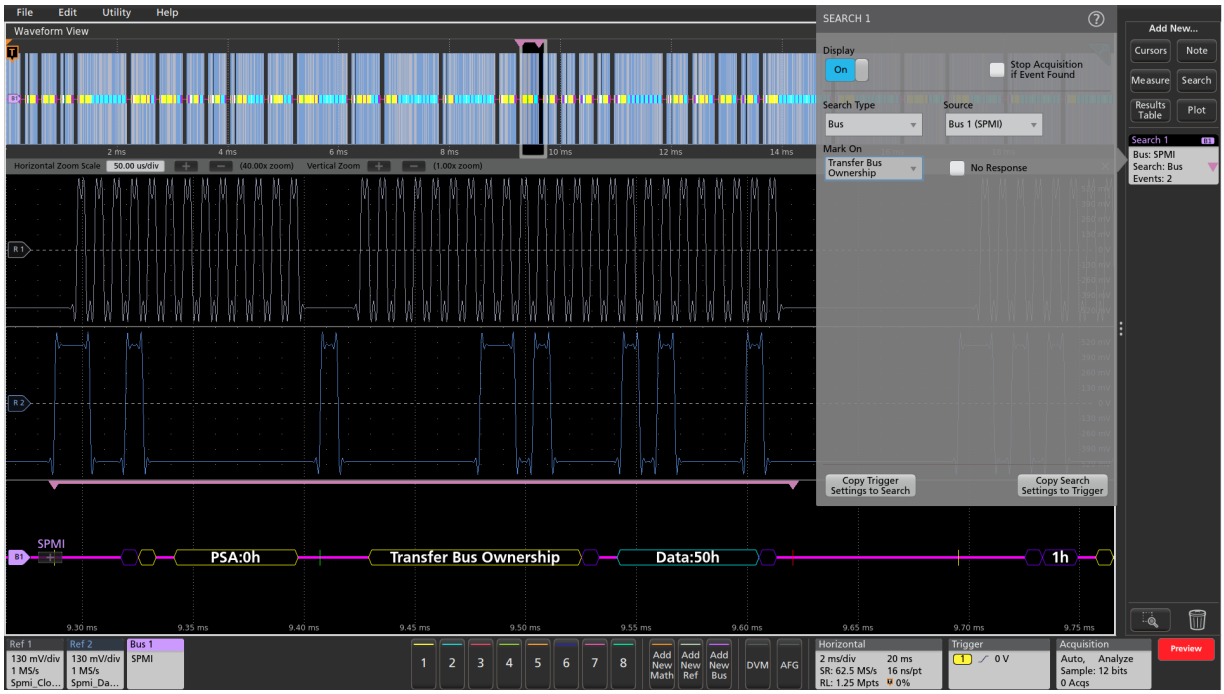
Bus decode

Characteristic	Description
Decode Display	Arbitration Start (yellow bar) Connect Bit (purple packet) Master ID (purple packet) Alert Bit (yellow packet) Slave Request Bit (yellow packet) Master Priority Level (gray packet) SSC (green bar) Command Frame, including Byte Count [2] (yellow packet) Address (yellow packet) Data (cyan packet) Parity (purple packet) Ack/Nack (purple packet) Parity error (red packet) End of packet (red bar)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the SPMI bus.

[2] The actual decimal Byte Count is displayed in Mixed Hex format, but the raw value is shown in Binary and Hex formats.



Automatically searching the SPMI bus for the Transfer Bus Ownership command

SpaceWire characteristics

Bus setup options

Characteristic	Description
SpaceWire Sources (Strobe and Data)	Analog Channels Digital Channels Active Math Channels Active Reference Channels
Thresholds	Per-Channel Thresholds
Recommended Probing	Differential
Address/Data Formats Available	Hex Binary

Display modes

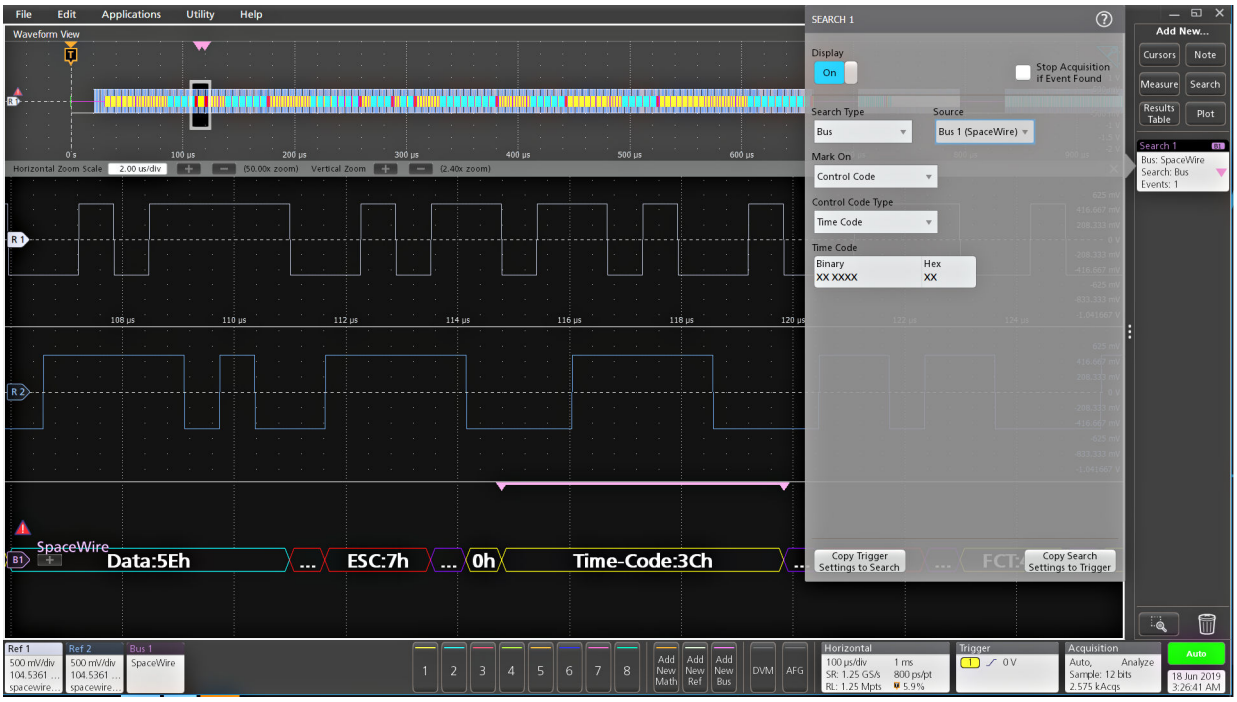
Characteristic	Description
Bus	Bus Only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Bus search options

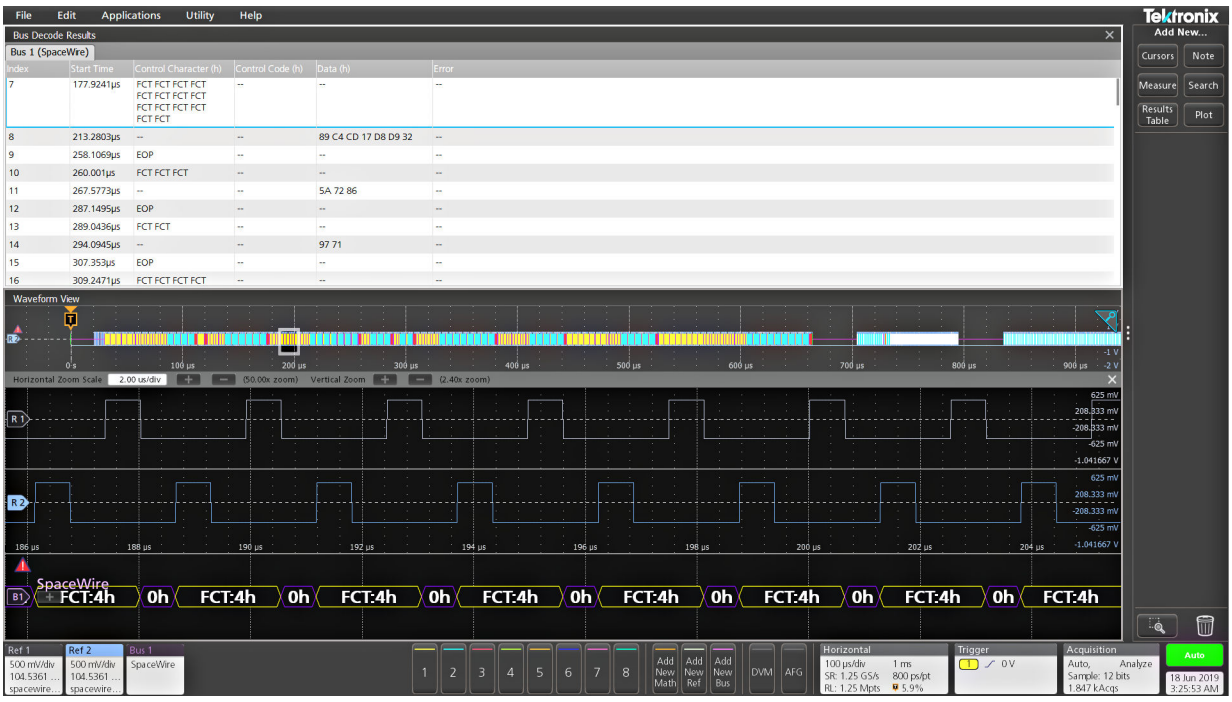
Characteristic	Description
Search On	Synchronization Control Code Control Character Data Errors

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	2 Mbits/sec to 200 Mbits/sec
Decode Display	Null Control Character Control Code FCT Time-Code Parity Data-Control Flag Data End Of Packet Error End Of Packet Escape Sequence Escape Error Start FCT Start NULL



Searching on a specific data pattern on the SpaceWire bus and automatically searching on Sync.



The Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the SpaceWire bus.

Automotive Ethernet (10BASE-T1S) characteristics

Bus setup options

Characteristic	Description
10Base-T1S Sources	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Per-channel Thresholds
Probing	Single-ended Differential
Bit Rate	Upto 1Gbps
Packet View	On Off
Formats Available	Hex Binary Mixed Hex

Display modes

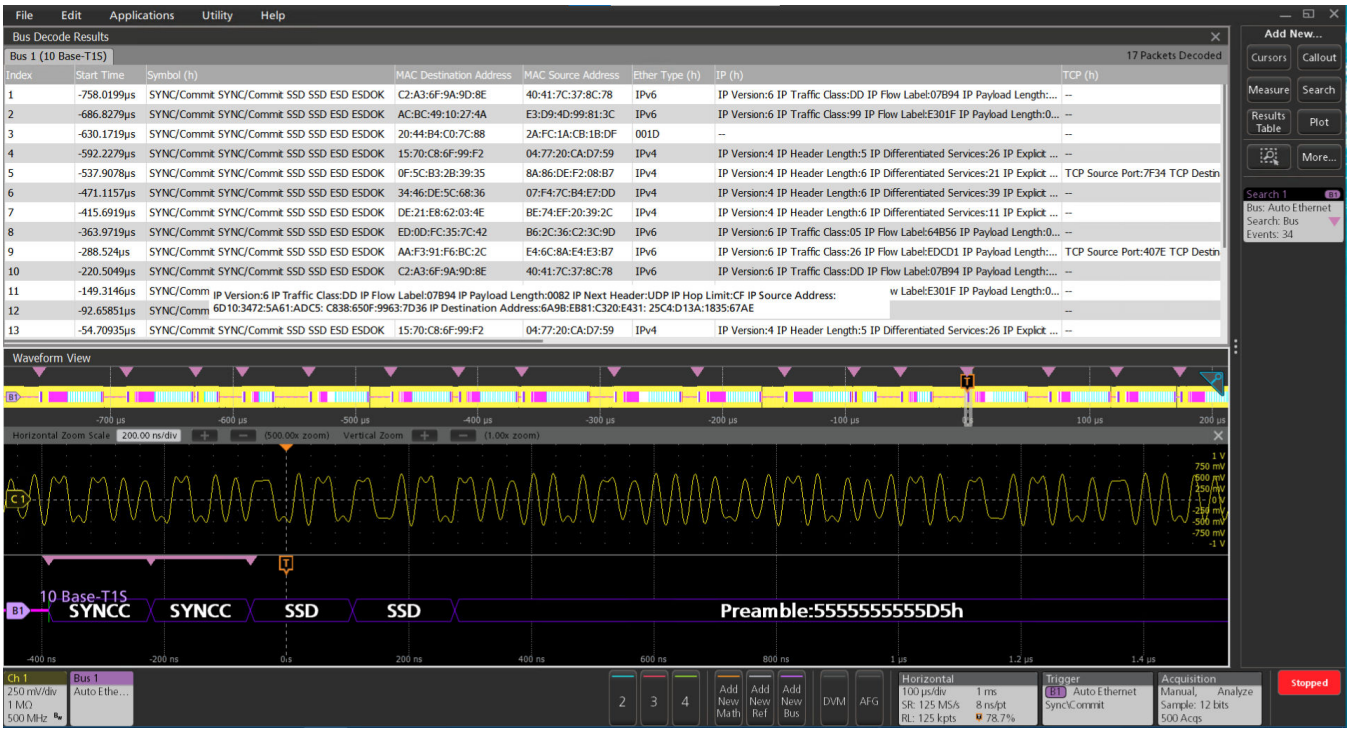
Characteristic	Description
Bus	Bus only
Results Table	Decoded packet data in a tabular view

Bus search options

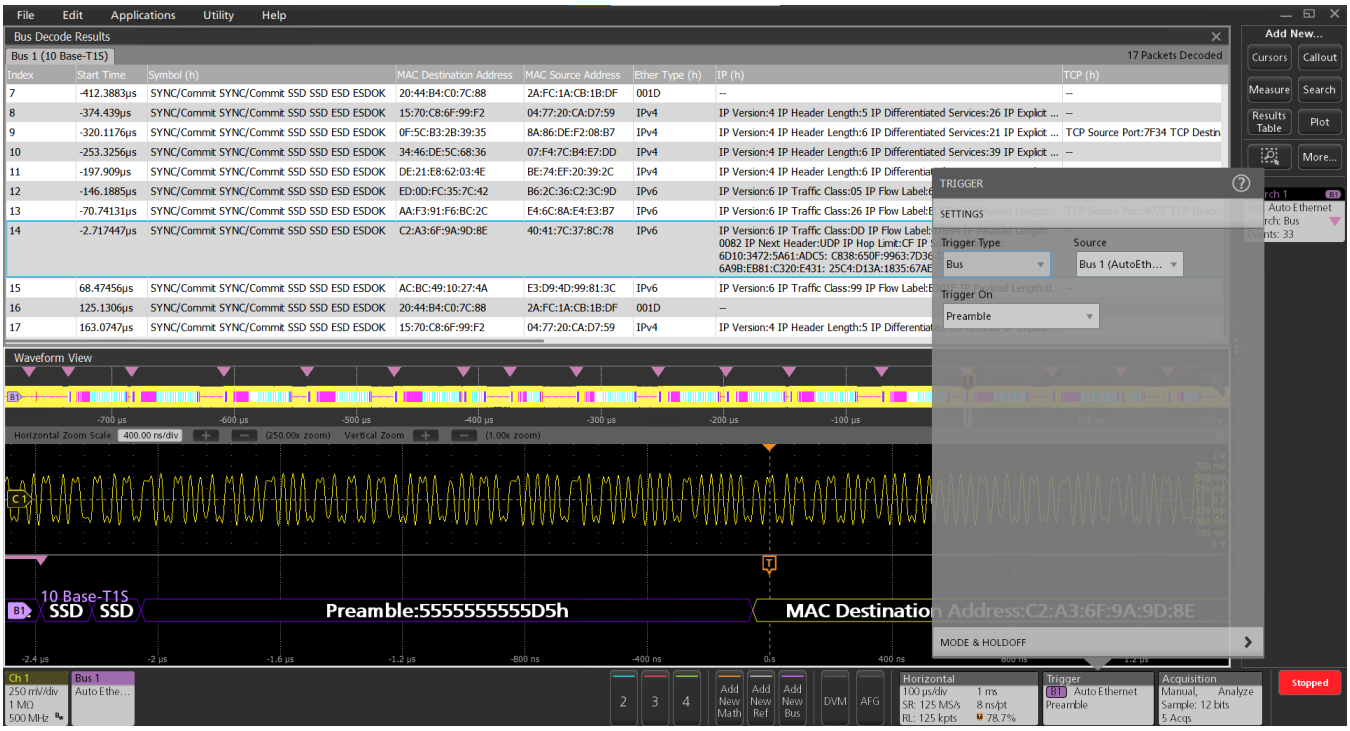
Characteristic	Description
Search On	SYNC/Commit Start of Stream Delimiter MAC address: Mac Address Source, Mac Address destination Beacon Ether Type: IPv4 and IPv6 with Header Type: TCP, UDP, ICMP Payload: Payload Bytes, Payload value Data: Data Bytes, Data End of stream Delimiter. End of stream Delimiter Ok Errors: CRC, ESDERR, ESDJAB, Checksum, Any

Bus trigger options

Characteristic	Description
Trigger On	SYNC/Commit Start of Stream Delimiter Preamble Beacon End of stream Delimiter. End of stream Delimiter Ok Errors: ESDERR, ESDJAB



10BASE-T1S bus decode and results table in a tabular format. Searching the 10BASE-T1S bus decode with search on Sync/Commit with 34 occurrences shown on the search badge.



10BASE-T1S bus decode with trigger on the preamble.

Automotive Ethernet (100BASE-T1) characteristics (Version BRR V3.2)

Bus setup options

Characteristic	Description
Ethernet Source(s)	Analog Channels Active Math Channels Active Reference Channels
Thresholds	Per-channel Thresholds
Speed	100 Mbits/sec
Recommended Probing	Differential
Formats Available	Mixed Hex Hex Binary Mixed ASCII

Display modes

Characteristic	Description
Bus	Bus Only
Results Table	Decoded packet data in a tabular view

Bus search options

Characteristic	Description
Search On	Start of Frame Start of Frame Delimiter MAC Addresses Q-Tag Control Information MAC Length/Type IPv4 Header TCP Header MAC Data TCP-IPv4 Client Data End of Packet Frame Check Sequence (CRC) Error

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	100 Mbits/sec
Decode Display	Start of Packet (green bar) Preamble (purple packet) SFD (purple packet) Address (yellow packet) EtherType (yellow packet) IP packet (purple packet) Data (cyan packet) IPv4 packet (pink packet) TCP packet (white packet) Frame Check Sequence (yellow packet) Error (red packet) End of packet (red bar)

The Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the Automotive Ethernet (100BASE-T1) bus.

Searching on a specific data pattern on the Automotive Ethernet (100BASE-T1) bus and automatically searching on Start of Frame.

8b10b Characteristics (Line encoding)

Bus setup options

Characteristic	Description
8b10b Sources (Strobe and Data)	Analog Channels Digital Channels Active Math Channels Active Reference Channels
Thresholds	Per-Channel Thresholds
Recommended Probing	Differential
Formats Available	Hex Binary Symbolic

Display modes

Characteristic	Description
Bus	Bus Only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

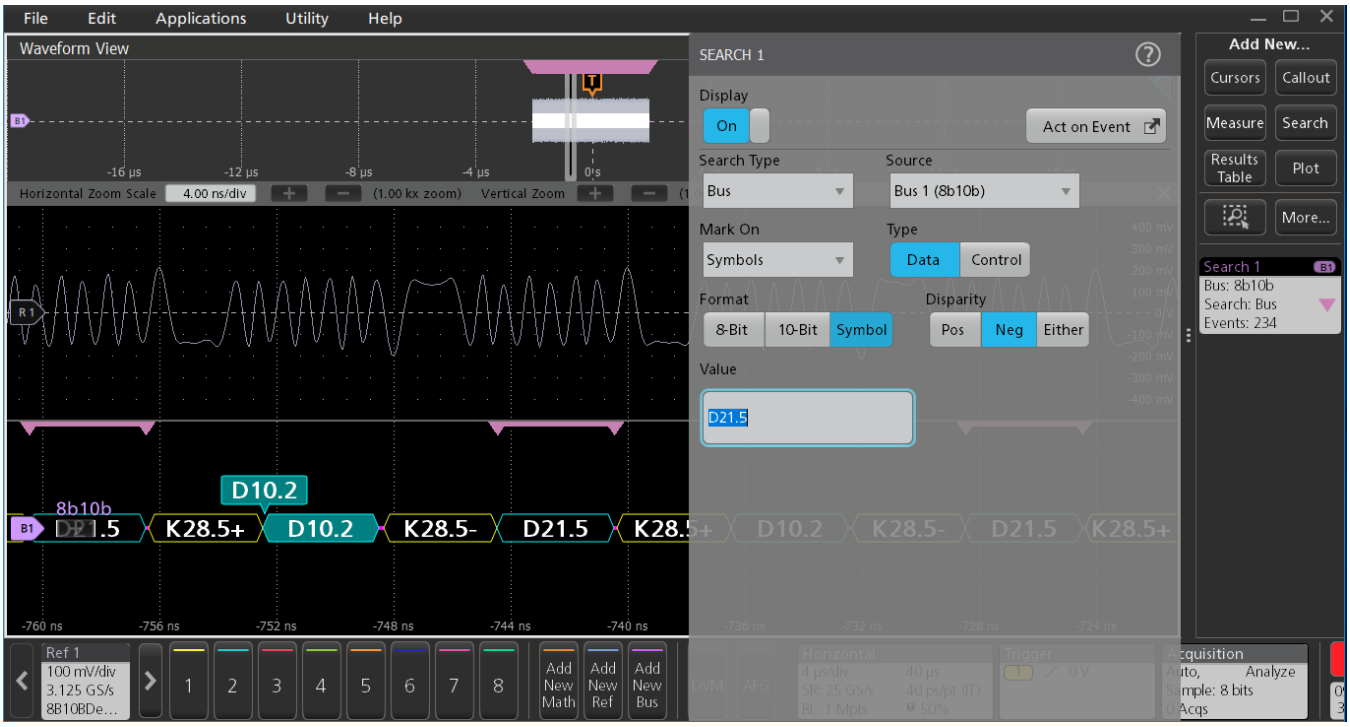
Bus search options

Characteristic	Description
Search On	Symbols [Format:8bit,10bit&symbol] Errors

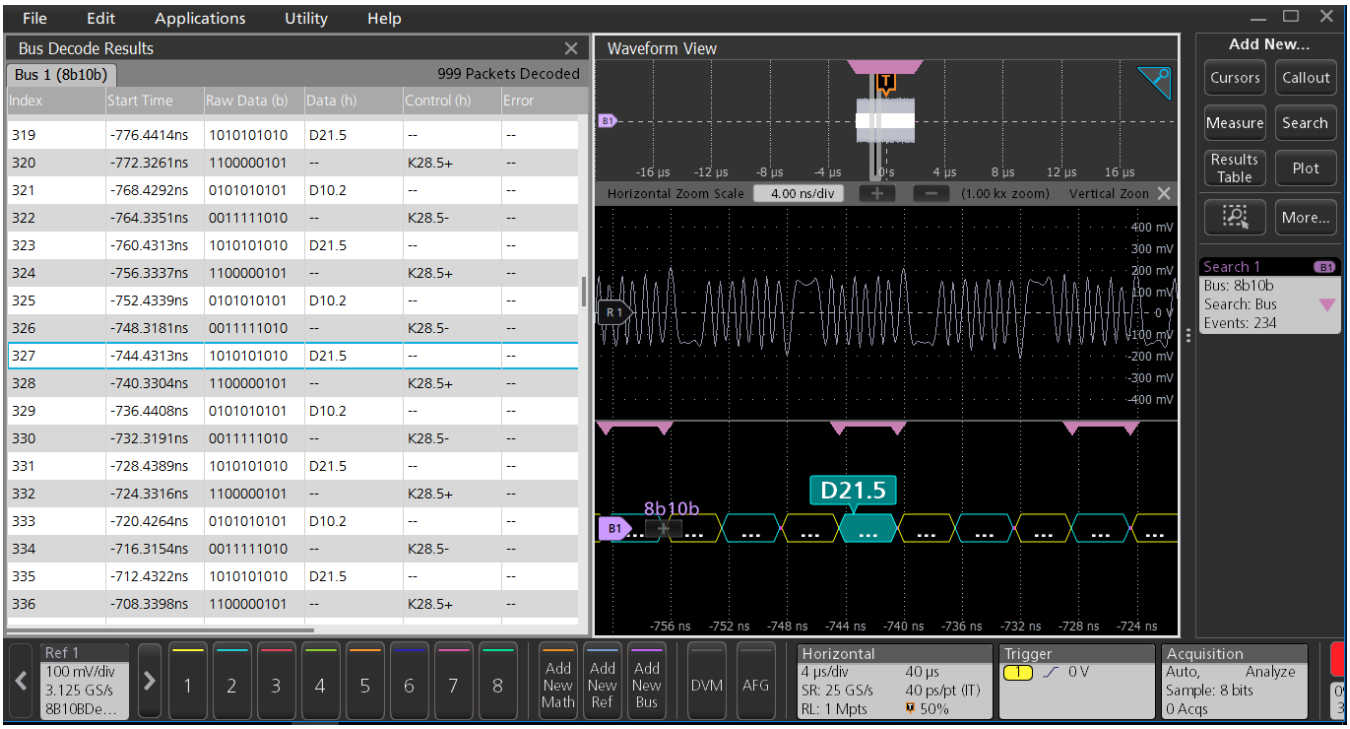
Bus decode

Characteristic	Description
Maximum Clock/Data Rate	1 Tbits/sec
Decode Display	Control Symbol (yellow packet) Data Symbol (cyan packet)
Error Handling	Invalid Symbols Running Disparity (6 bit and 4 bit)

Table continued…



Searching on a specific data symbol in symbol format on a 8b10b bus



The Protocol Decode results table provides time-stamped, tabular view of all captured packets on a 8b10b bus

NFC characteristics

Characteristic	Description
NFC sources	• Analog channels (Spectrum View to be turned on) • Active Math channels • Active Reference channels
Salient features	• Decode capability for NFC protocol • Decode capability for ISO/IEC 15693, ISO/IEC14443A, ISO/IEC14443B, and FeliCa Standards • Decode capability for Command and Response packets • Search capability for SOC, SOS, SYNC, EOC, SOF, AFI, PUPi, Identifier, Payload, UID, EOF, DATa, and EOS • Search capability for different ISO/IEC 14443A commands like REQ, WUPA, Proprietary, SELECT, and HLTA • Search capability for different ISO/IEC 15693, ISO/IEC 14443B, and FeliCa commands • Search capability for Response packets • Search capability for Errors like CRC, Parity
Product differentiators	• Perform NFC protocol decode and search seamlessly with a single oscilloscope instrument • Analyze and correlate analog RF and digital signals simultaneously for enhanced insight • Save transfer time and memory of large recordings with hardware DDC (digital downconverter) on each input • Trigger on 13.56 MHz RF envelope using RF vs. Time traces and triggers, reducing the need to trigger on other I/O signals
Recommended probing	• EMI-NF-PROBE near-field probe set for contact-less probing and manual troubleshooting • TPP1000 probe for conducted probing

Table continued…

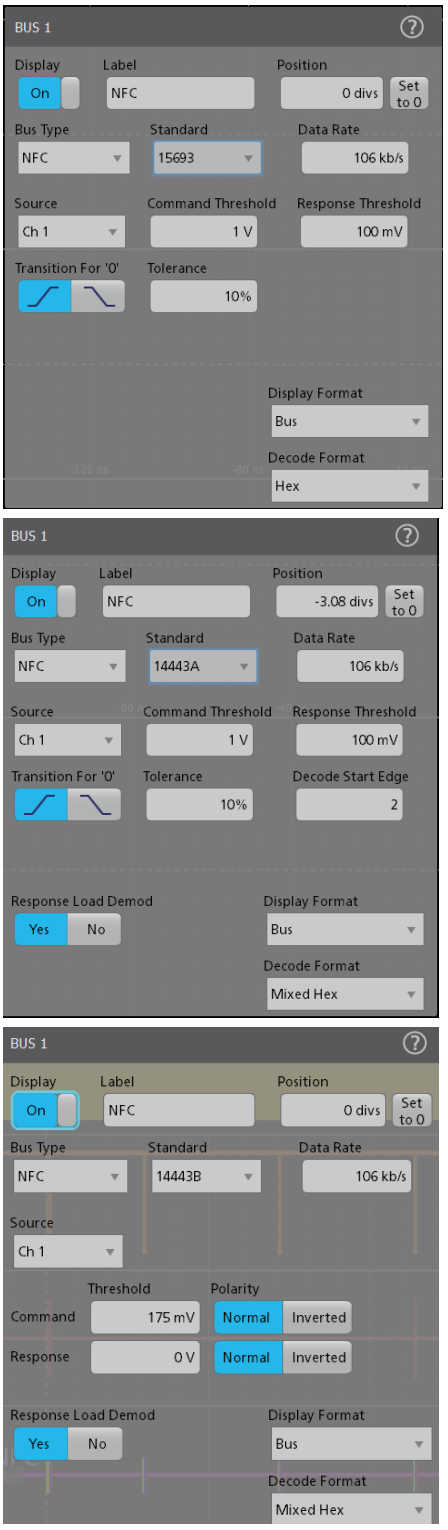
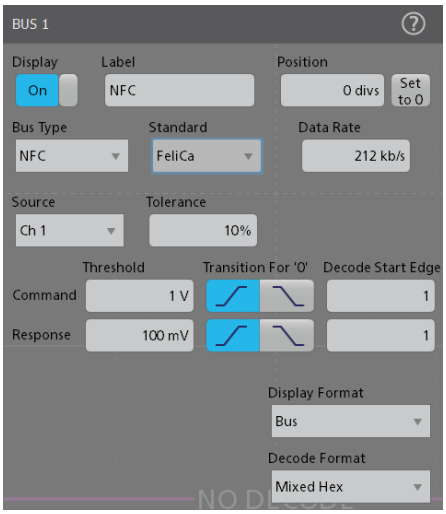
Characteristic	Description
Bus setup	

Table continued…

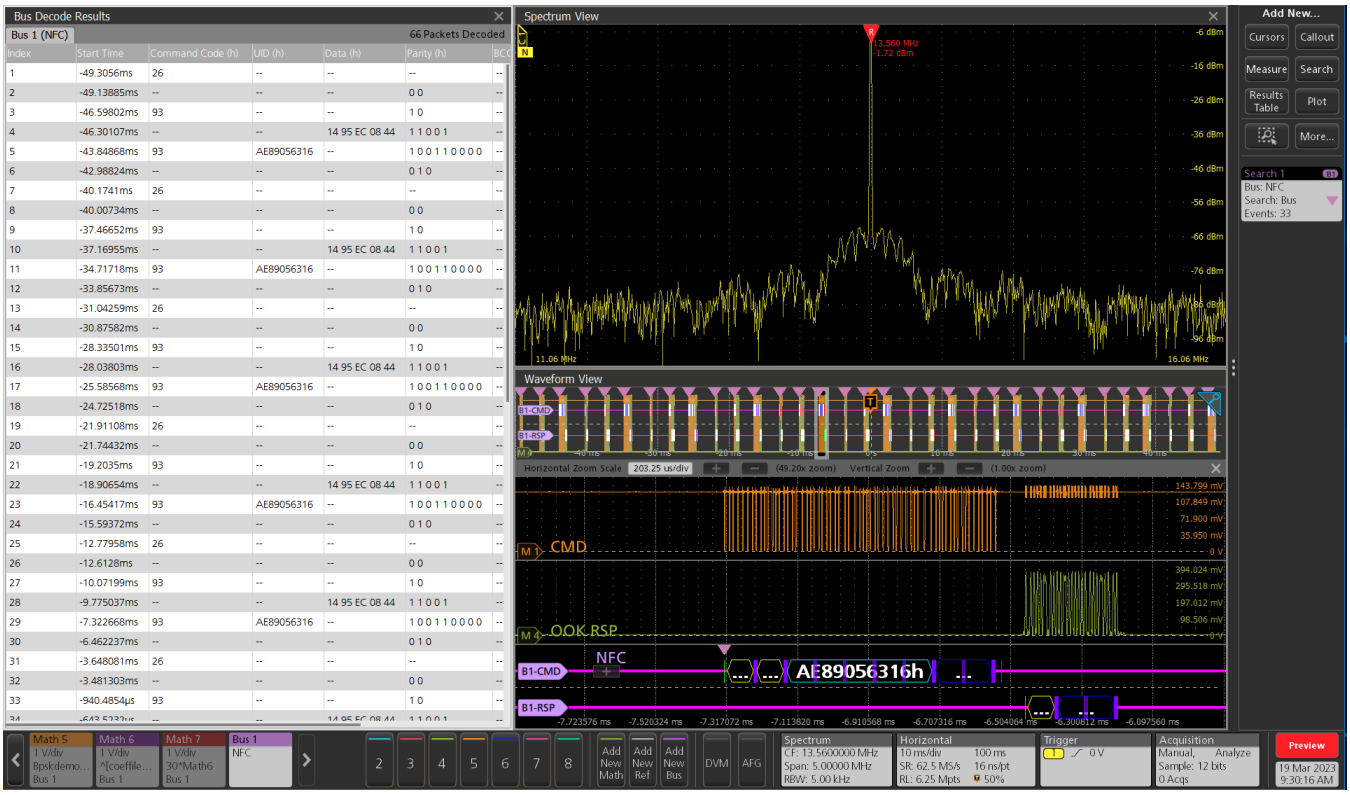
Characteristic	Description
	
Formats available	• Hex • Binary • Mixed Hex

Characteristic	Description
Bus	Bus only
Result Table	Decoded packet data in a tabular view with columns containing: • Flag • Command Code • Mask Value LSB MSB • Mask Length • DSFID • Message LSB MSB • Get Information Parameter Request • Custom Request Parameter LSB MSB • IC MFG Code • Length • Key ID • CSI • UID • Data LSB MSB • Optional AFI • AFI • Number Of Block • First Block • Error Code • Information Flags • VICC Memory Size

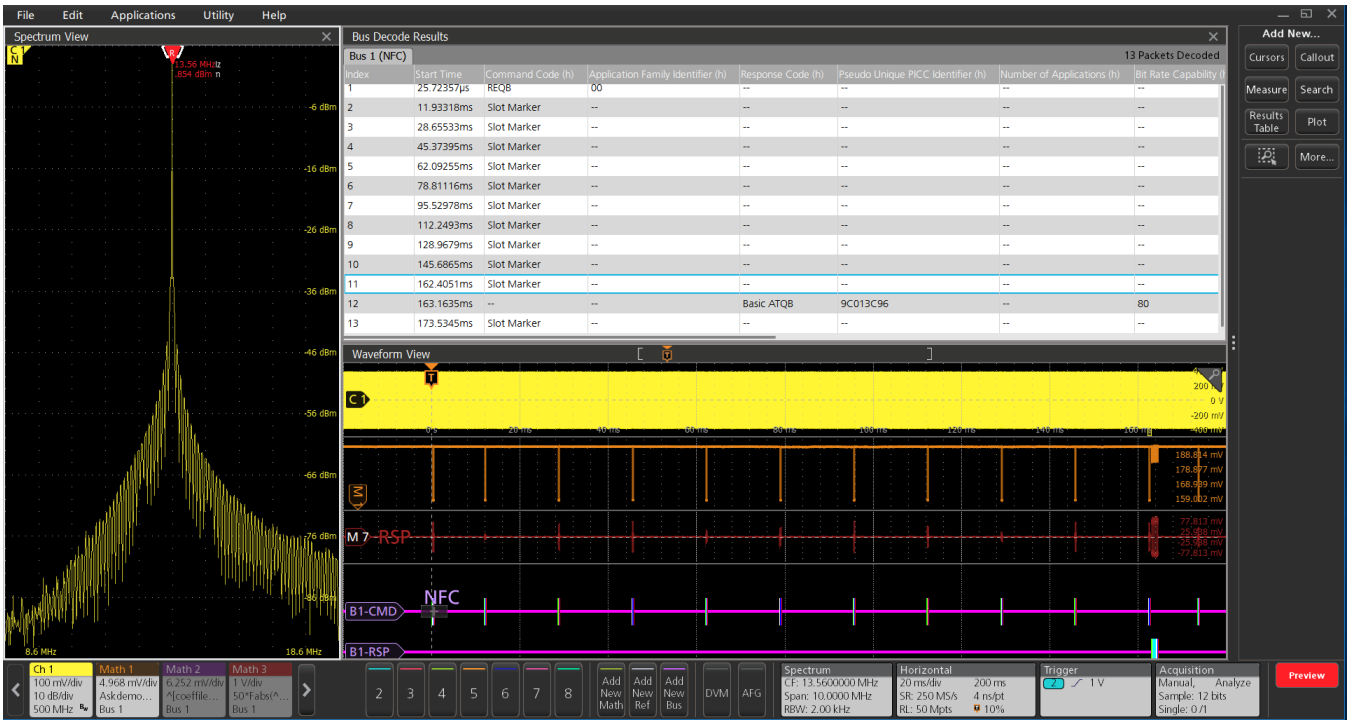
Characteristic	Description
	• SEL • NVB • Each Bit RFU • Propriety Coding • UID Size • SAK • Bit Frame AntiCollision • Parity • Response Code • PARAM • Data • Pseudo Unique PICC Identifier • Identifier • Param1 • Param2 • Param3 • Param4 • Higher Layer INF • Attrib Info • Higher Layer Response • CRC_B_APP • Application Data • Number of Applications • Bit Rate Capability • Max Frame Size • Protocol Type • Frame Waiting time Integer • Application Data Coding • NAD Frame Option • CID Frame Option • Start up Frame Guard Time • SYNC • BSt • BRt • BRS • BSi • BRi • DIDi • DIDt • FSL • General Byte • NADi • NADt

Characteristic	Description
	• nfcid2t • nfcid3t • nfcid3i • PPi • PPt

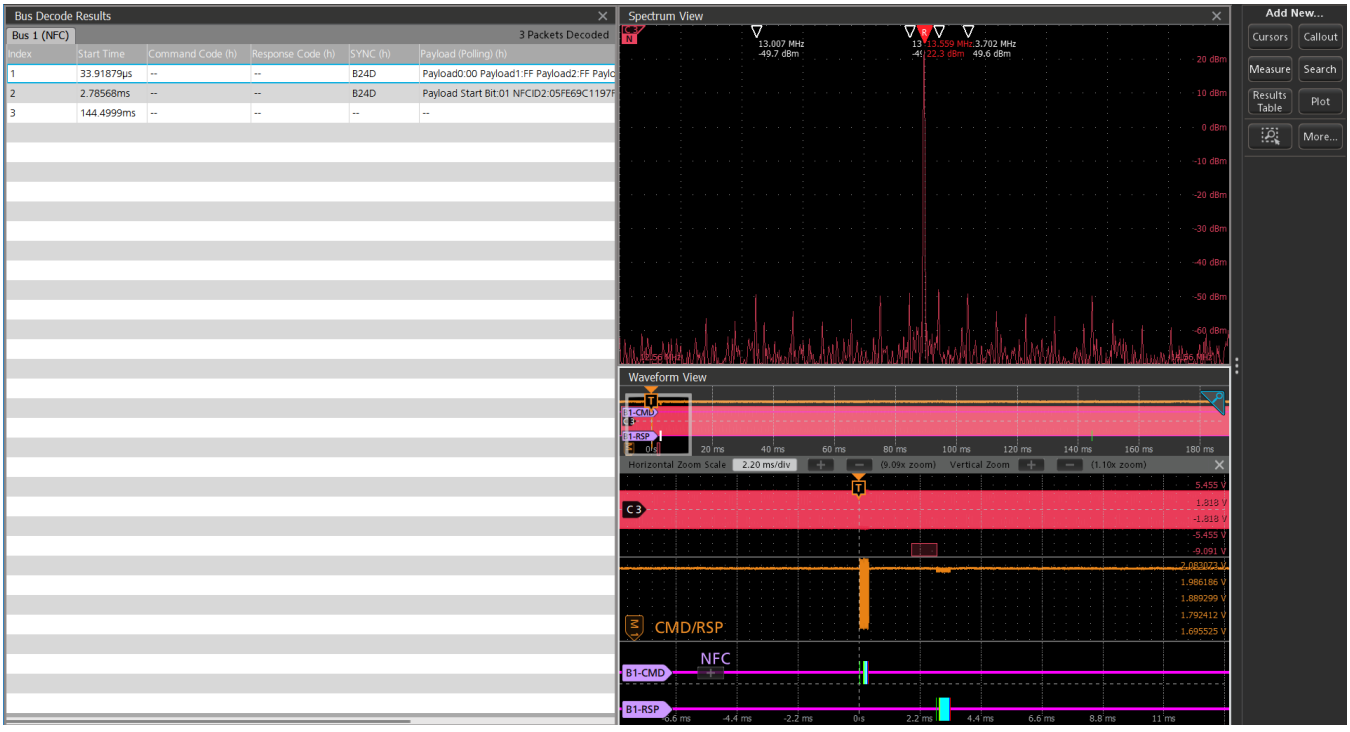
Characteristic	Description
	• PFB • Payload (Polling) • TO • Extra Data • CRC • Error • Unframed



The results table provides time-stamped, tabular view of all captured packets on the NFC bus. 33 occurrences of the event is searched on SOC on the command lane.



Result table for NFC 14443B



FeliCa decode with result table

Bus decode

Characteristic	Description
Maximum Data Rate	Max data rate for NFC Type B command is 1.7 Mbps
Result table	• SOF(Green Bar) • SOC(Green Bar) • SOS(Green Bar) • commandCode(Yellow Packet) • flag(Yellow Packet) • maskValue(Yellow Packet) • maskLength(Yellow Packet) • optionalAFI(Yellow Packet) • afi(Yellow Packet) • noOfBlock(Yellow Packet) • dataVariable(Cyan Packet) • firstBlock(Yellow Packet) • errorCode(Yellow Packet) • infoFlags(Yellow Packet) • viccMemorySize(Yellow Packet) • dsfid(Yellow Packet) • message(Yellow Packet) • Get Information Parameter Request(Yellow Packet) • customRequestParameter(Yellow Packet) • icMFGCode(Yellow Packet) • csi(Yellow Packet) • length(Yellow Packet) • keyID(Yellow Packet) • uid(Cyan Packet) • Parity(BusMisc) • SEL(Yellow Packet) • NVB(Yellow Packet) • EachBitRFU(Yellow Packet) • ProprietyCoding(Yellow Packet) • size_UID(Yellow Packet) • SAK(Yellow Packet) • BitFrameAntiCollision(Yellow Packet) • uid0(Cyan Packet) • uid1(Cyan Packet) • uid2(Cyan Packet) • uid3(Cyan Packet) • uid4(Cyan Packet) • RFU(Yellow Packet) • responseCode(Yellow Packet) • afi1(Yellow Packet)

Table continued…

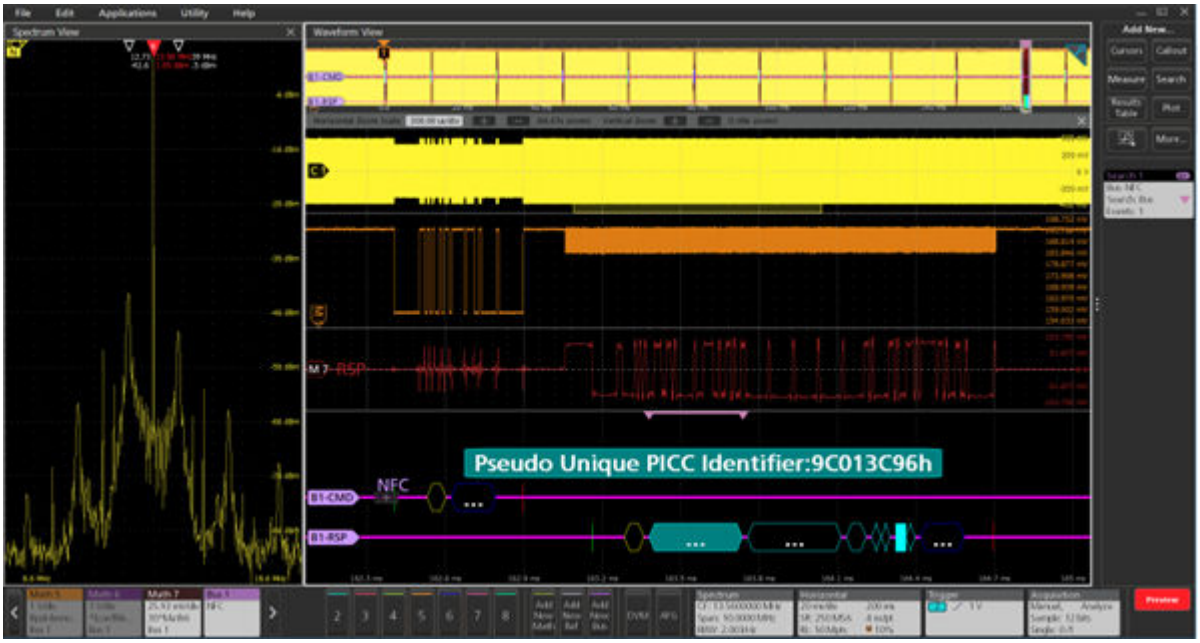
Characteristic	Description
	• PARAM(Yellow Packet) • Param1(Yellow Packet) • Param2(Yellow Packet) • Param3(Yellow Packet) • Param4(Yellow Packet) • INF(Yellow Packet) • Data(Cyan Packet) • Identifier(Cyan Packet) • PUPI(Cyan Packet) • APPDATA(Cyan Packet) • attribInfo(Cyan Packet) • higherLayerResponse(Cyan Packet) • CRC_B_APP(Blue Packet) • numberOfApp(Cyan Packet) • BR(Cyan Packet) • maxFrameSize(Cyan Packet) • PROTOCOLTYPE(Cyan Packet) • FWI(Cyan Packet) • ADC(Cyan Packet) • foNAD(Cyan Packet) • foCID(Cyan Packet) • SFGI(Cyan Packet) • BSt(Cyan Packet) • BRt(Cyan Packet) • BRS(Cyan Packet) • BSi(Cyan Packet) • BRi(Cyan Packet) • CMD(Yellow Packet) • DIDi(Cyan Packet) • DIDt(Cyan Packet) • extra_data(Cyan Packet) • FSL(Cyan Packet) • GB(Cyan Packet) • NADi(Cyan Packet) • NADt(Cyan Packet) • nfcid2t(Cyan Packet) • nfcid3t(Cyan Packet) • nfcid3i(Cyan Packet) • PPi(Cyan Packet) • PPt(Cyan Packet) • PFB(Cyan Packet) • payload1(Cyan Packet) • payload2(Cyan Packet)

Table continued…

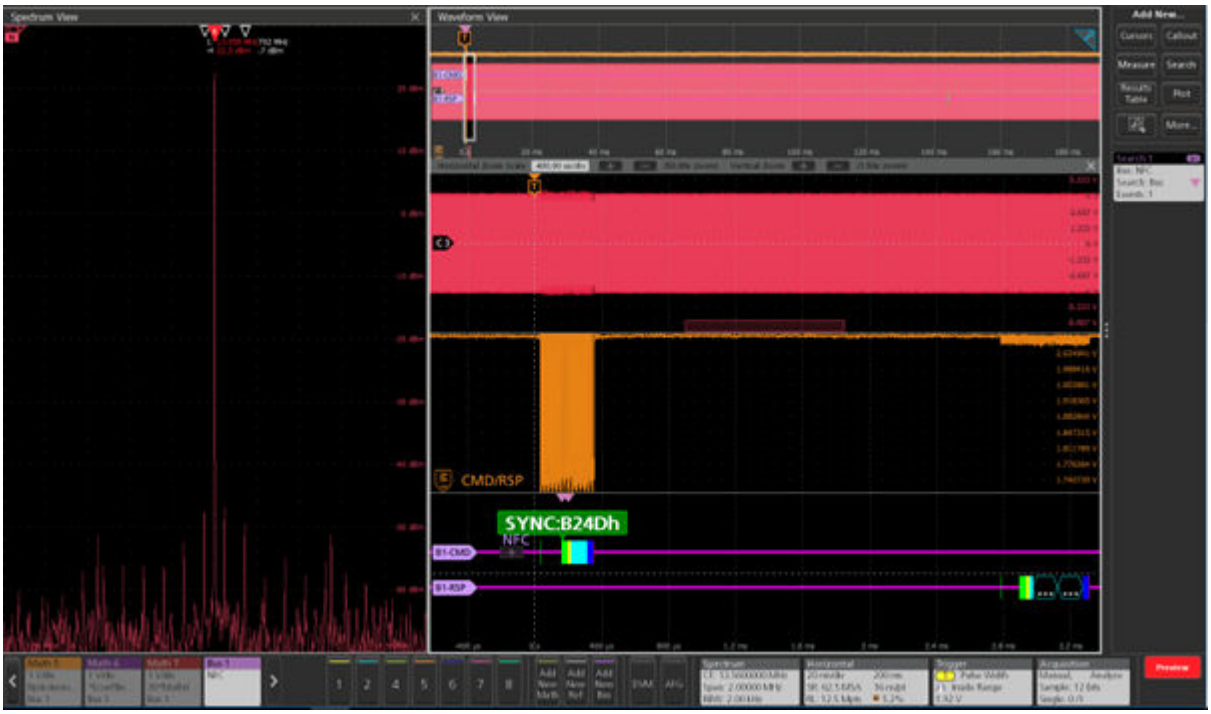
Characteristic	Description
	• payload3(Cyan Packet) • payload4(Cyan Packet) • payloadTSN(Cyan Packet) • payloadBit(Cyan Packet) • NFCID2(Cyan Packet) • Pad(Cyan Packet) • RSP(Yellow Packet) • SYNC(BusStart) • TO(Cyan Packet) • felicaData(Cyan Packet)
	• crc(Blue Packet) • EOC(Red Bar) • EOF(Red Bar) • EOS(Red Bar)

Bus Search

Characteristic	Description
Search ON	• SOF • SOC • SOS • Data • Payload • Command Code • Response Code • UID • AFI • Identifier • PUPI • EOC • EOF • EOS • Errors



NFC Search for PUPI



NFC Search for SYNC

NRZ Characteristics (Line encoding)

Bus setup options

Characteristic	Description
NRZ Source(s)	Analog Channels Digital Channels Active Math Channels Active Reference Channels
Thresholds	Per-channel Thresholds
Recommended Probing	Differential
Bit Order	MSB First LSB First
Polarity	Normal Invert
Formats Available	Hex Binary

Display modes

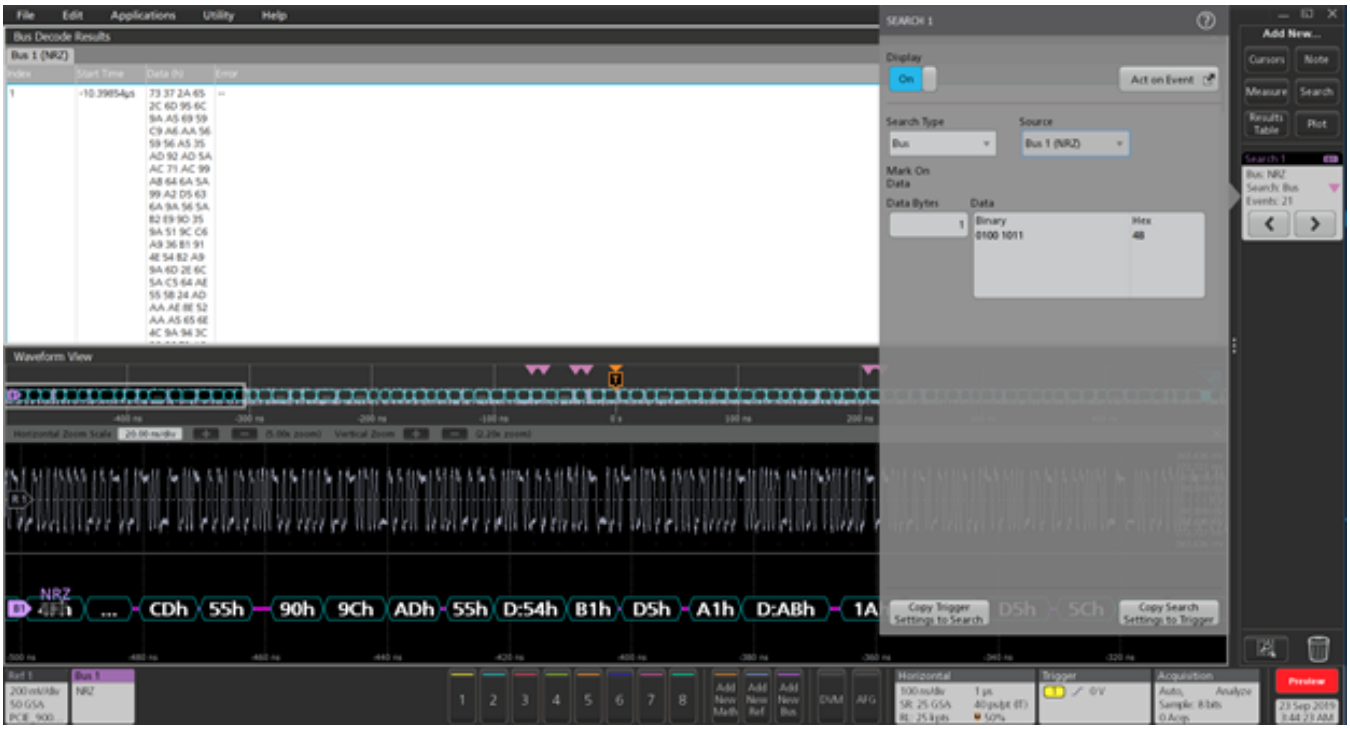
Characteristic	Description
Bus	Bus Only
Bus and Waveforms	Simultaneous display of bus and digital waveforms.
Results Table	Decoded packet data in a tabular view

Bus search options

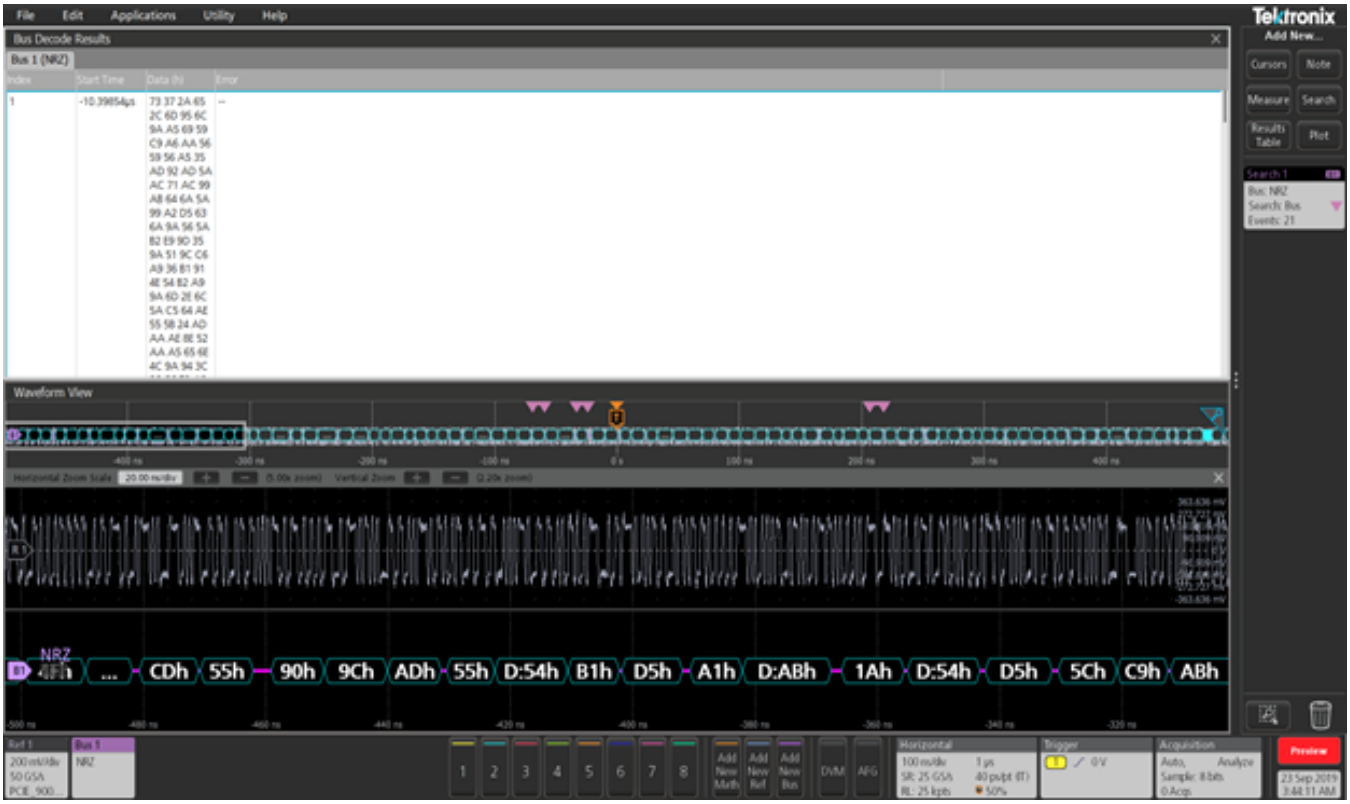
Characteristic	Description
Search On	Data Bytes [Maximum 5]

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	1Gbits/sec
Decode Display	Data (cyan packet)



Searching on a specific data symbol in symbol format in the NRZ bus



The Protocol Decode results table provides time-stamped, tabular view of all captured packets on the NRZ bus

PCIe Characteristics (Gen 1, Gen 2, and Gen 3)

Bus setup options

Characteristic	Description
PCIe Source(s)	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Speed	2.5 Gbps 5 Gbps 8 Gbps
Link Width	X1
Packet View	On Off
Formats Available	Hex Binary Mixed Hex

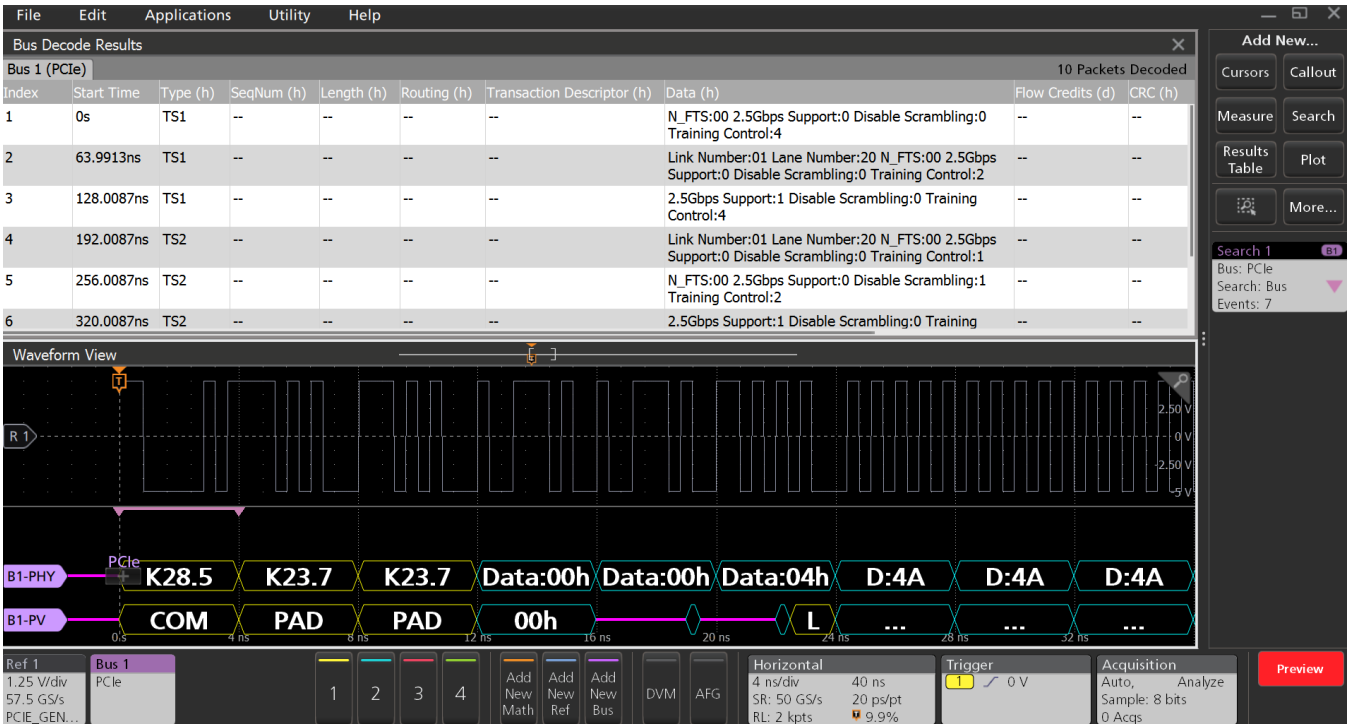
Display modes

Characteristic	Description
Bus	Bus Bus and Waveforms
Results Table	Decoded packet data in a tabular view

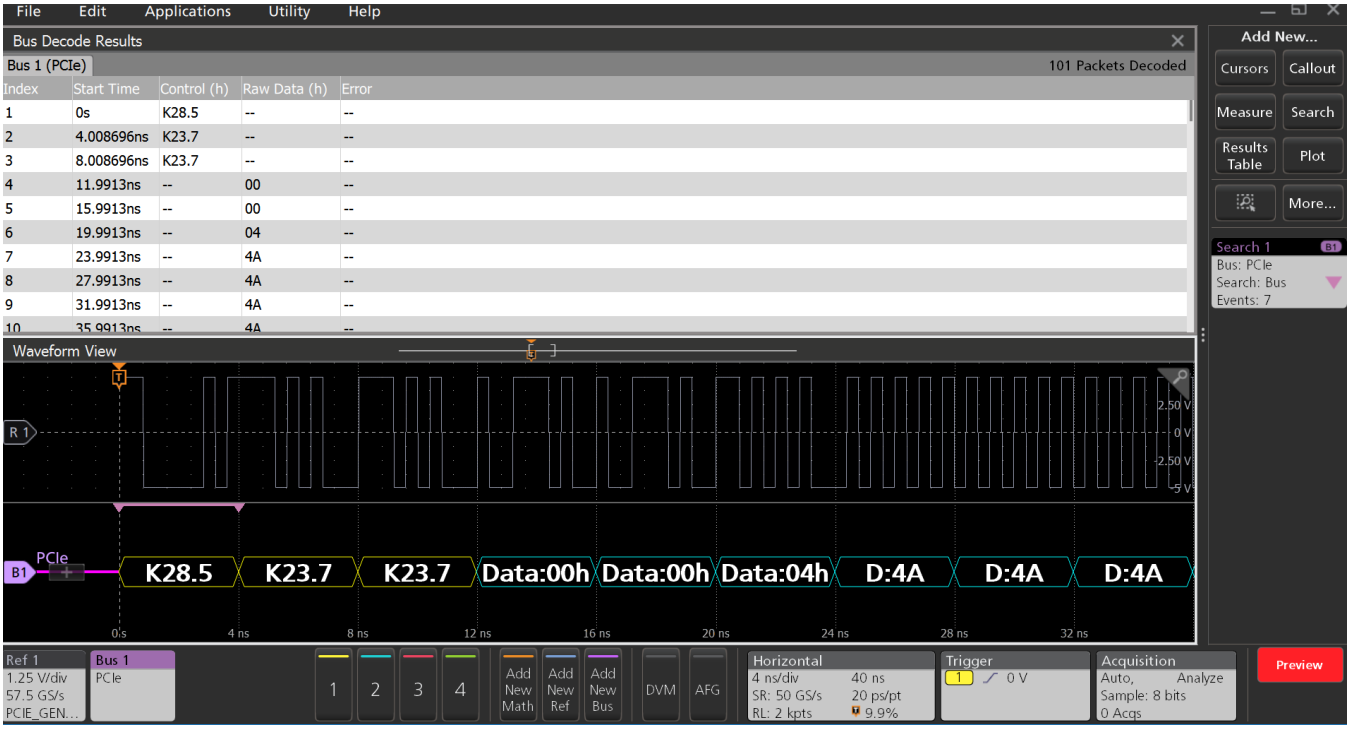
Table continued…

Bus Search options

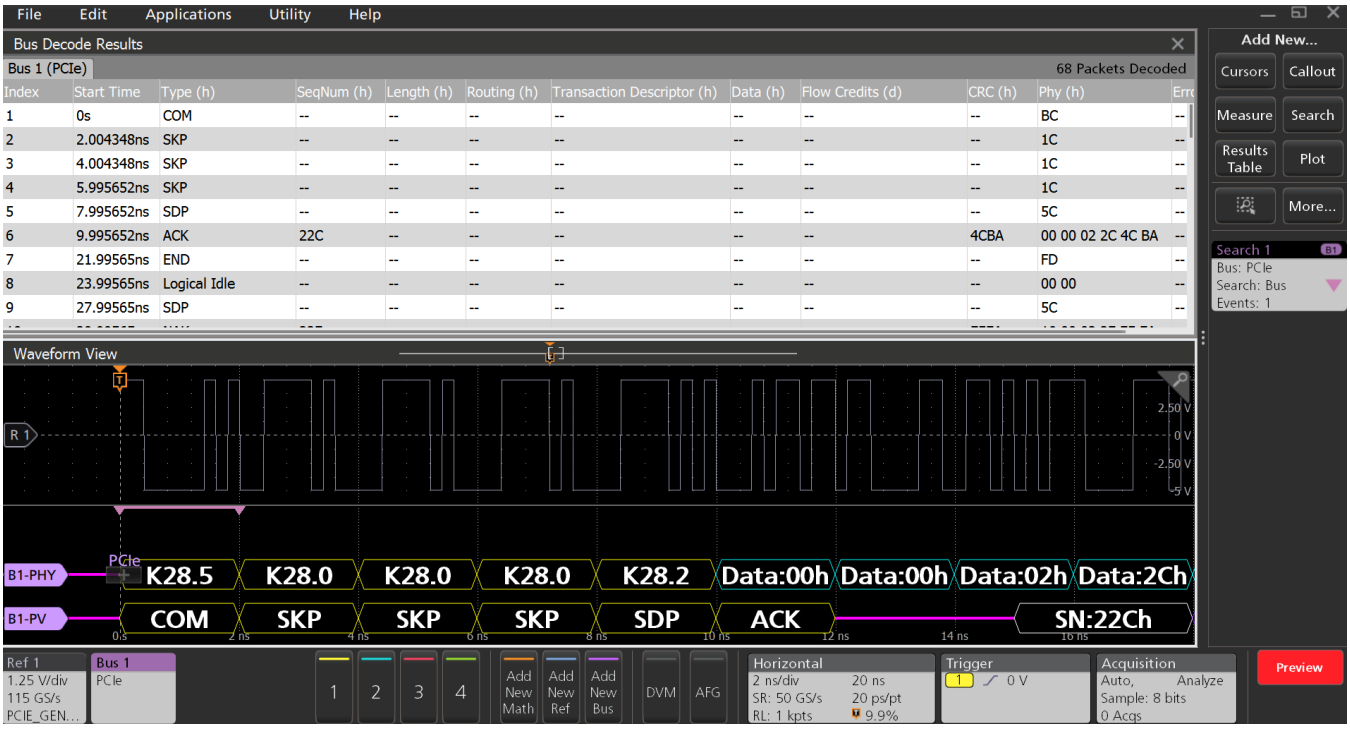
Characteristic	Description
Search On	• Control Characters COM, EDB, END, FTS, IDL, PAD, SDP, SKP, STP, EIE, Any • Sync Header • DLLP ACK/NAK, Power Management, Flow Control • TLP Memory, I/O, Config, Message, Completion, Atomic Operation, Prefix, Any • Ordered Set TS1, TS2, EIOS, EIEOS, FTS, SKP, SDS • Custom Pattern • Errors CRC, LCRC, ECRC, Frame Length, Disparity, Symbol, Packet



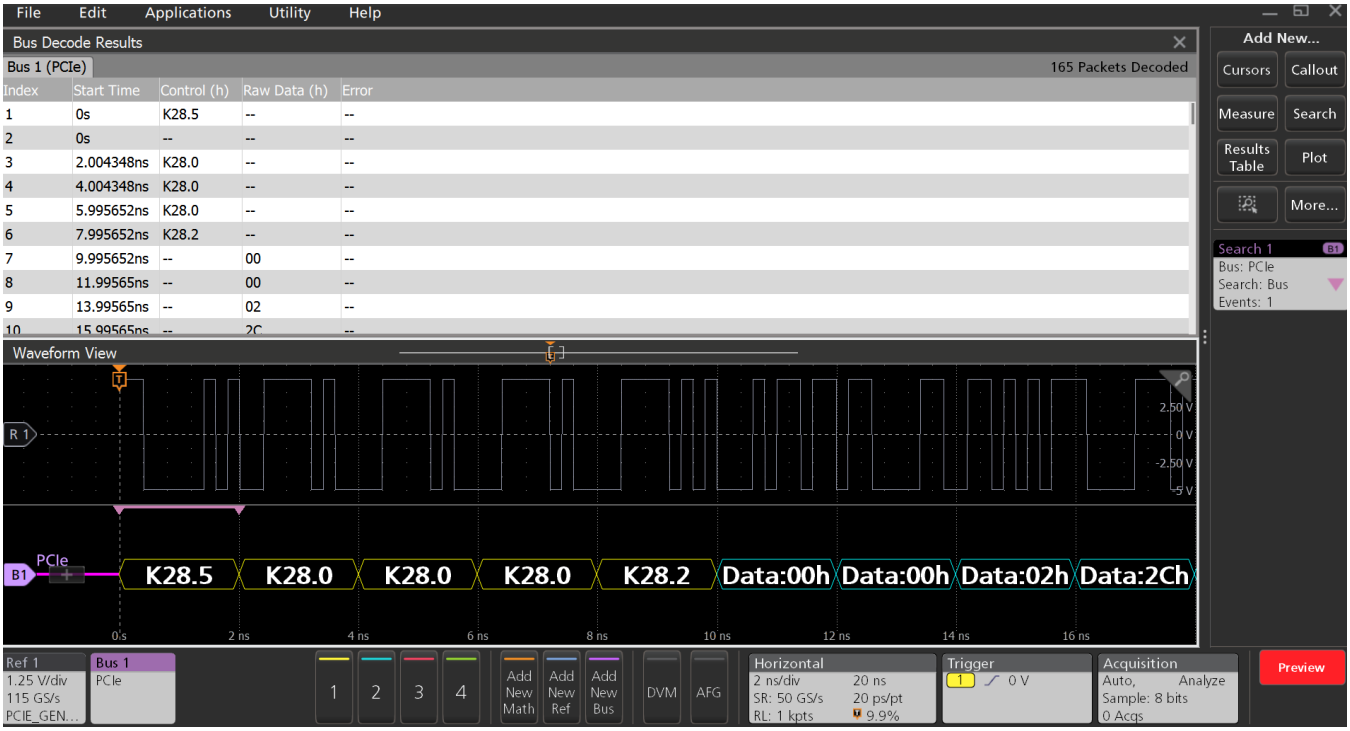
PCIe Gen 1 bus setup and MixedHex display, showing decode with packet view on. K28.5 searched with 7 occurrences.



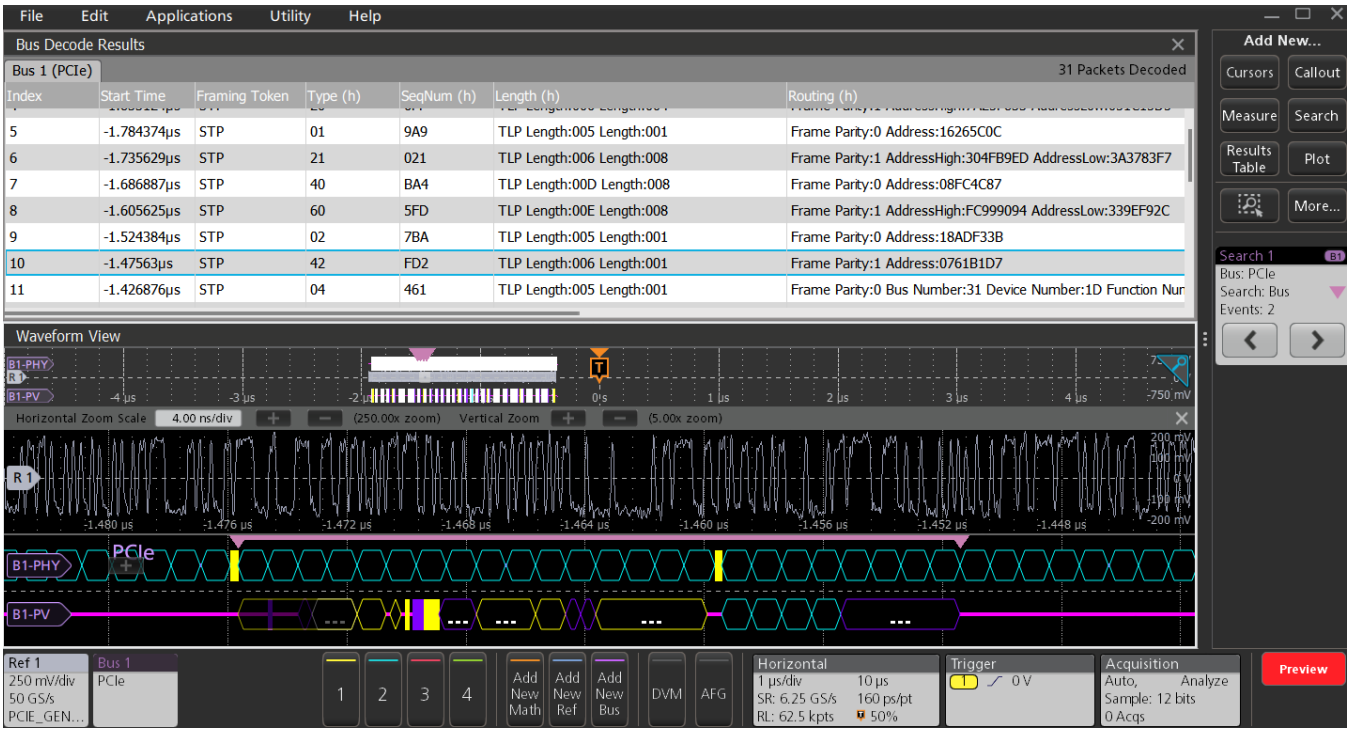
PCIe Gen 1 bus setup and MixedHex display, showing decode with packet view off. K28.5 searched with 7 occurrences.



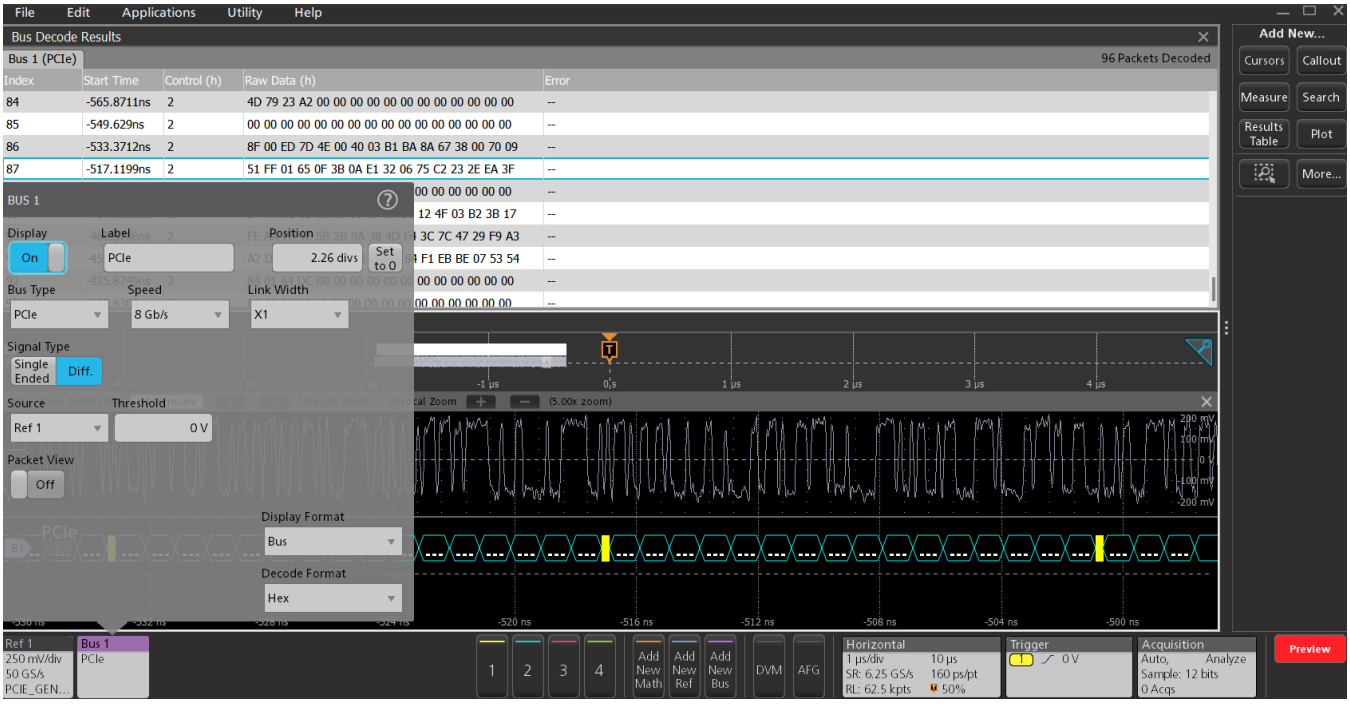
PCIe Gen 2 bus setup and MixedHex display, showing decode with packet view on. K28.5 searched with 1 occurrence.



PCIe Gen 2 bus setup and MixedHex display, showing decode with packet view off. K28.5 searched with 1 occurrence.



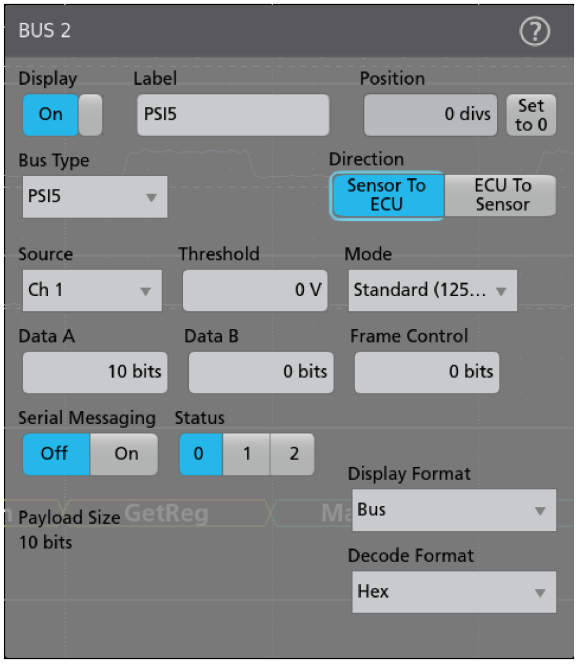
PCIe Gen 3 bus showing decode with packet view on. TLP packet of type I/O searched with 2 occurrences.



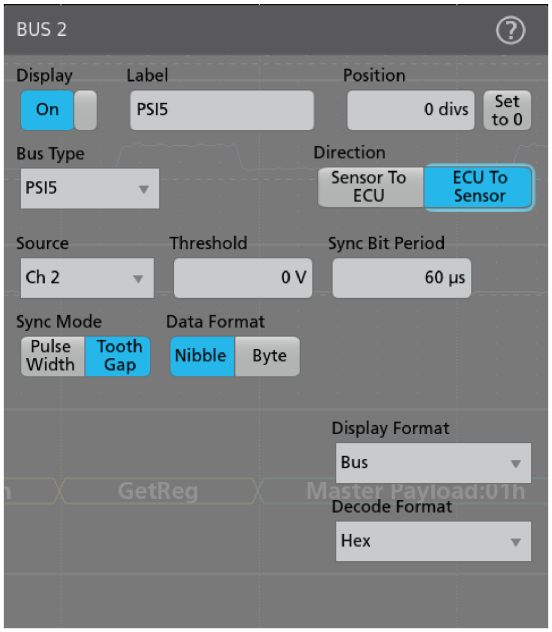
PCIe Gen 3 bus setup showing decode with packet view off.

PSI5 characteristics (Version 2.1)

PSI5 Sensor to ECU configuration



PSI5 ECU to Sensor configuration



Bus setup options

Characteristic	Description	
PSI5 Sources	Analog channels Digital channels Active Math channels Active Reference channels	
Thresholds	Per-channel thresholds	
Recommended Probing	Sensor to ECU	Current probe with minimum current rating of less than 50mA - TCP2020, TCP202A
	ECU to Sensor	Differential Voltage probe - TDP1000, TDP1500, and TAP1500
Direction	ECU to Sensor Sensor to ECU	
Direction - Sensor to ECU	Mode	Slow (83.3 kbps) Standard (125 kbps) Fast (189 kbps)
	Data A	10 - 24 bits
	Data B	0 - 12 bits
	Frame Control	0 - 4 bits
	Status	0 - 3 bits
Direction - ECU to Sensor	Sync Bit Period	1 us to 300 us
	Sync Mode	Pulse Width Tooth Gap
	Data Format	Nibble Byte
Decode Format	Hex Binary Mixed Hex	

Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous displays bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Bus search options

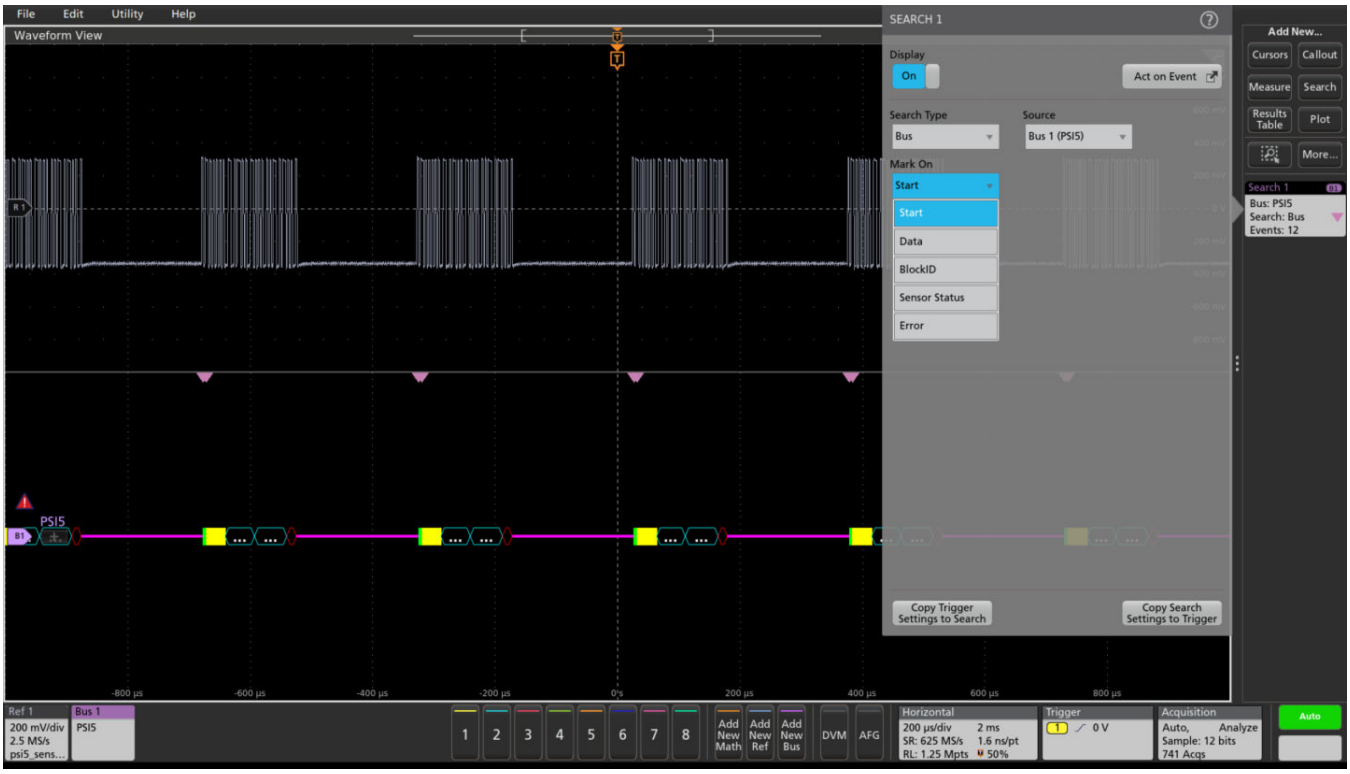
Characteristic	Description	
Mark On	Direction - Sensor to ECU	Start [Start of packet] Status Data [Region B and Region A] Block ID Sensor Status [5 different status] Errors [Parity CRC and any]
	Direction - ECU to Sensor	Start [Start of packet] Status Data [4 or 8 bits] Function Code Sensor Address Register Address CRC Error

Note: Bus Search option is depend on the direction in Bus Configuration.

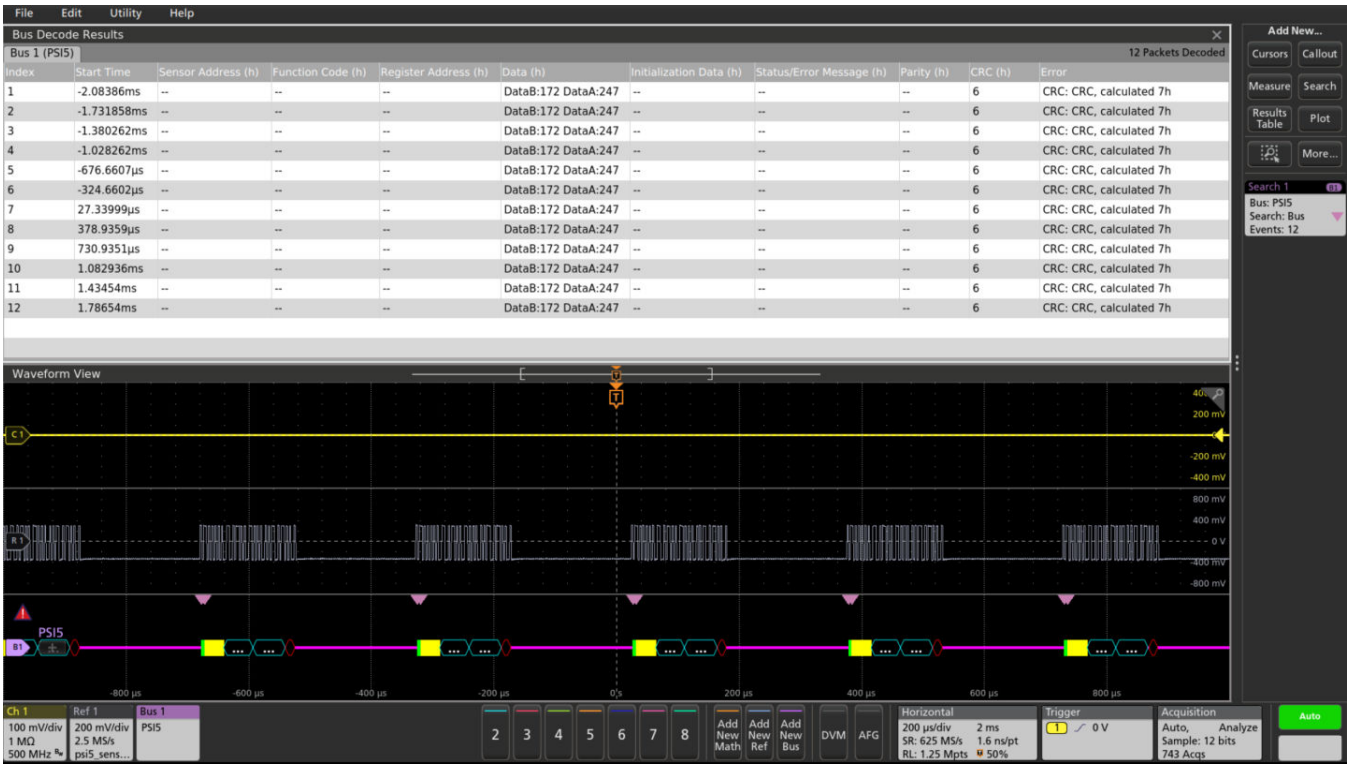
Bus decode

Characteristic	Description	
Decode Display	**Direction - Sensor to ECU Packets**	Message Field (Yellow Field) Status (Yellow Field) Frame Control (Yellow Field)
		Data B (Cyan Field) Data A (Cyan Field) Parity or CRC (Purple Field)
	Direction - ECU to Sensor Packets	Sensor Address (Yellow Field) Function Code (Yellow Field) Register Address (Yellow Field) Data (Cyan Field) CRC (Purple Field)
Error Type		Parity CRC Response Code (Sensor to ECU)

Table continued…



PSI5 Search configuration

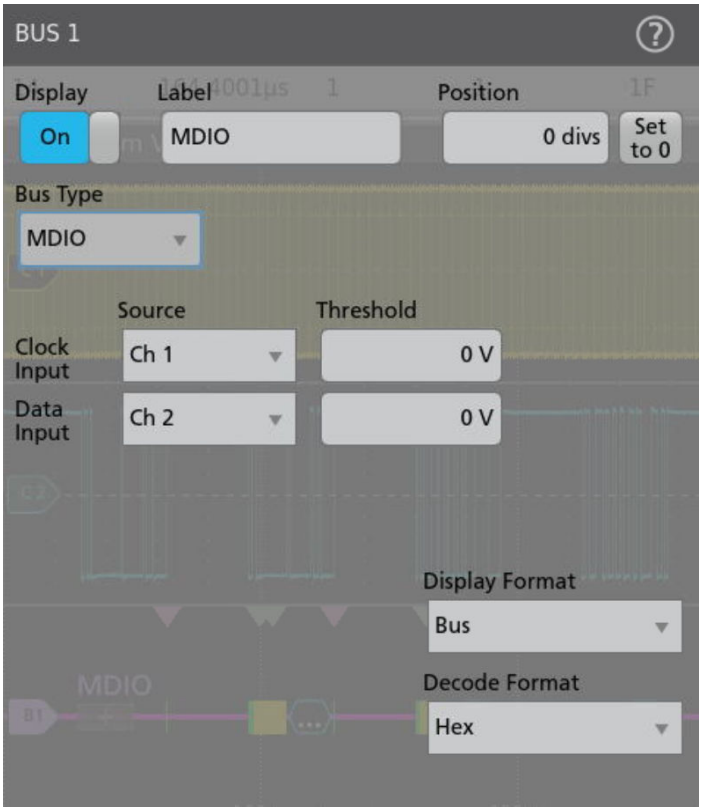


PSI5 Results table

MDIO Characteristics

Bus setup options

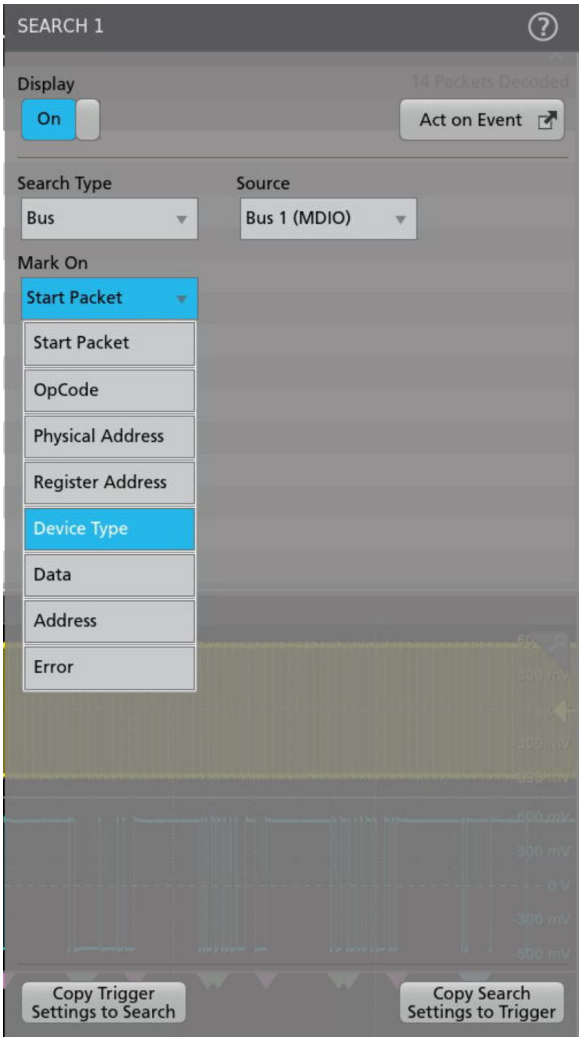
Characteristic	Description
MDIO Sources (Clock, Data)	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Pre-channel thresholds
Recommended Probing	Single-ended
Formats Available	Hex Binary Mixed Hex



Bus configuration

Bus search options

Characteristic	Description
Search On	Start Packet OpCode Physical Address Register Address Data Error: Any, OpCode Error, Device Type Error



Search configuration

Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Result Table	Decoded packet data in tabular view

Bus decode

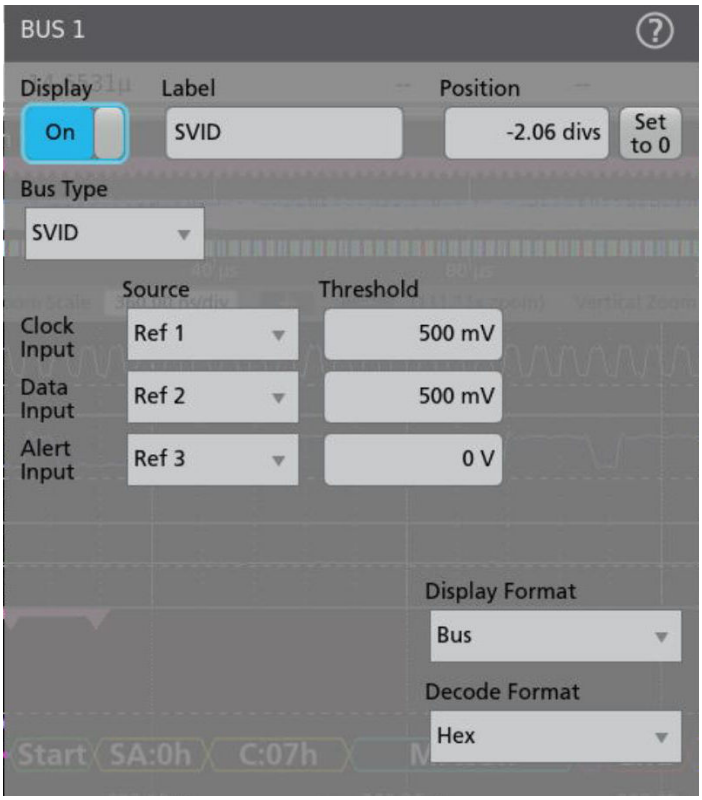
Characteristic	Description
Maximum Clock/Data Rate	Maximum frequency of up to 2.5 MHz
Decode Display	Start Packet (Green) Clause (Green) OpCode (Yellow)

Characteristic	Description
	Physical Address (Yellow) Register Address (Yellow) Device Type (Yellow) Data/Address (Cyan) Error: Any, OpCode Error, Device Type Error (Red)

SVID characteristics (Version 1.9)

Bus setup options

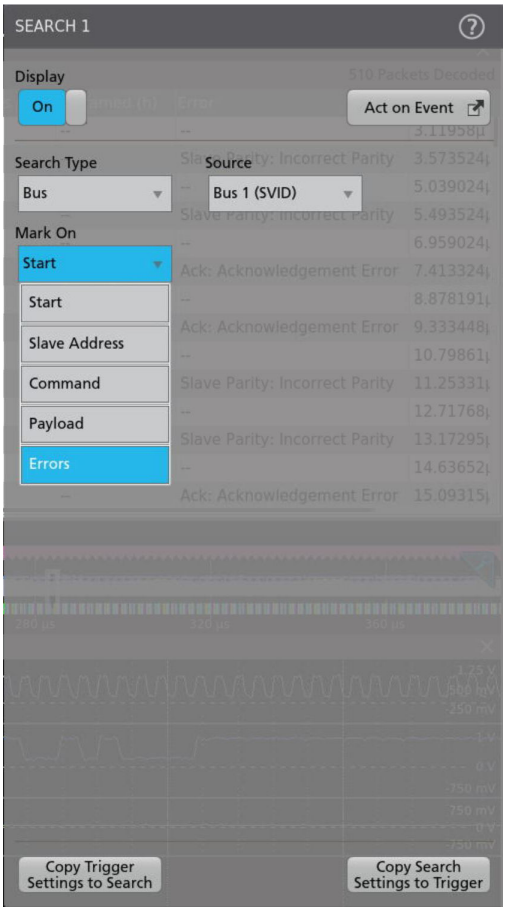
Characteristic	Description
SVID Sources (Clock, Data, Alert)	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Pre-channel thresholds
Recommended Probing	Single-ended
Formats Available	Hex Binary Mixed Hex



Bus configuration

Bus search options

Characteristic	Description
Search On	Start Slave Address Command Payload: Master, Slave, Either Errors: Any, Missing Ack, Parity End



Search configuration

Display modes

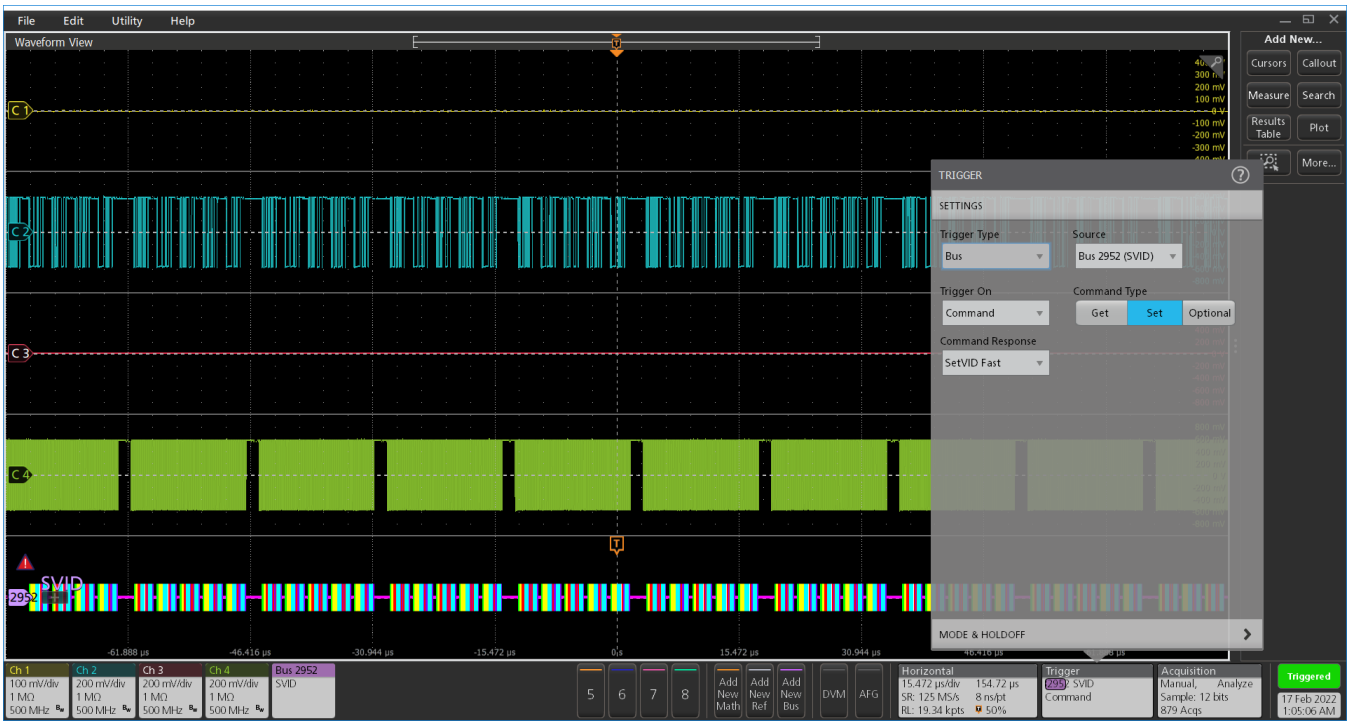
Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Result Table	Decoded packet data in tabular view

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Maximum frequency of 26.25 MHz
Decode Display	Start (Green) Slave Address (Yellow) Command (Yellow) Master Payload (Cyan) Master Parity (Purple) End (Purple) Turnaround (Purple) Ack (Purple) Slave Payload (Cyan) Slave Parity (Purple)

SVID (Trigger) characteristics

Characteristic	Description
SVID Sources	• Select the **SVID** bus on which to trigger. • **Trigger On** select the type of information on which to trigger.
Trigger On	• Start • Slave Address • Command • Payload • Errors

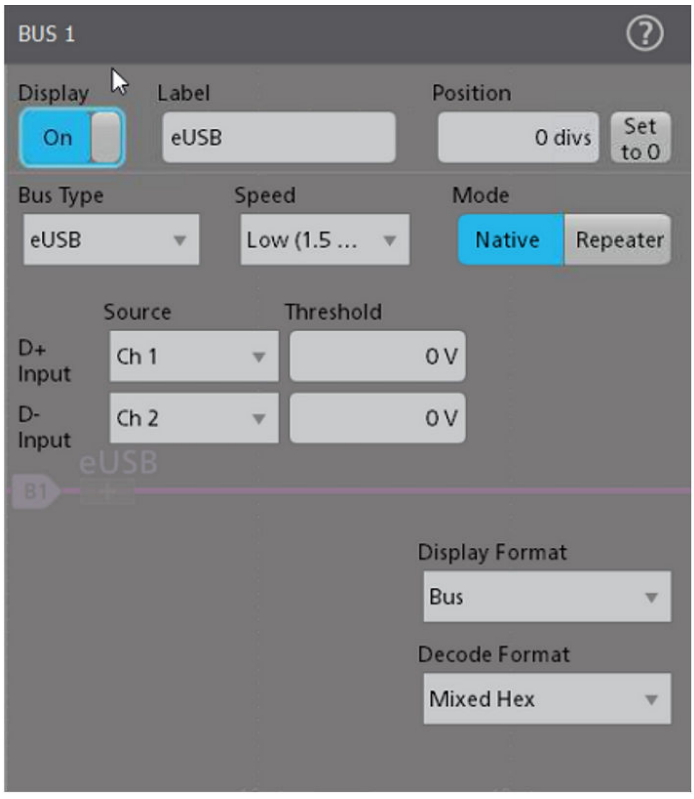


Triggering on a specific SetVID Fast command on the SVID bus

e-USB2 (Version 2.0)

Bus setup options

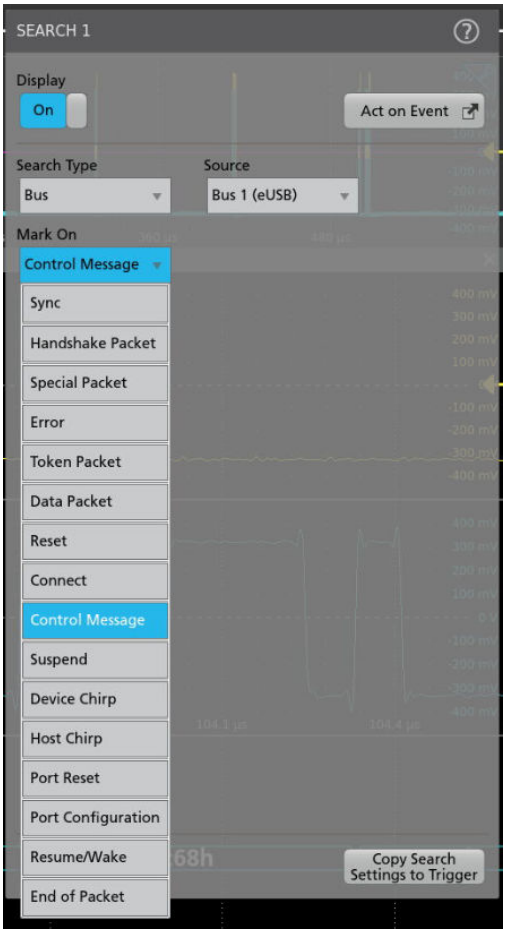
Characteristic	Description
Source(s)	Analog channels Digital channels(single-ended) Active Math channels Active Reference channels
Thresholds	Pre-channel thresholds
Speeds	Speed High Speed (480 Mb/s) Full Speed (12 Mb/s) Low Speed (1.5 Mb/s)
Recommended Probing, HS, LS, and FS	Single-ended [Active Single Ended TAP1500]
Formats Available	Mixed Hex Hex Binary Mixed ASCII



Bus configuration

Bus search options

Characteristic	Description
Search On	Characteristic Description Search On Sync Reset Suspend Resume/Wake Connect Control Message Port Reset Port Configuration Device Chirp Host Chirp End of Packet Token (address) Packet Data Packet Handshake Packet: ACK, NAK, STALL, NYET (HS only) Special Packet: PRE (FS only), ERR, SPLIT, PING Reserved Error: PID check, CRC5 or CRC16, Bit stuffing (LS and FS only)



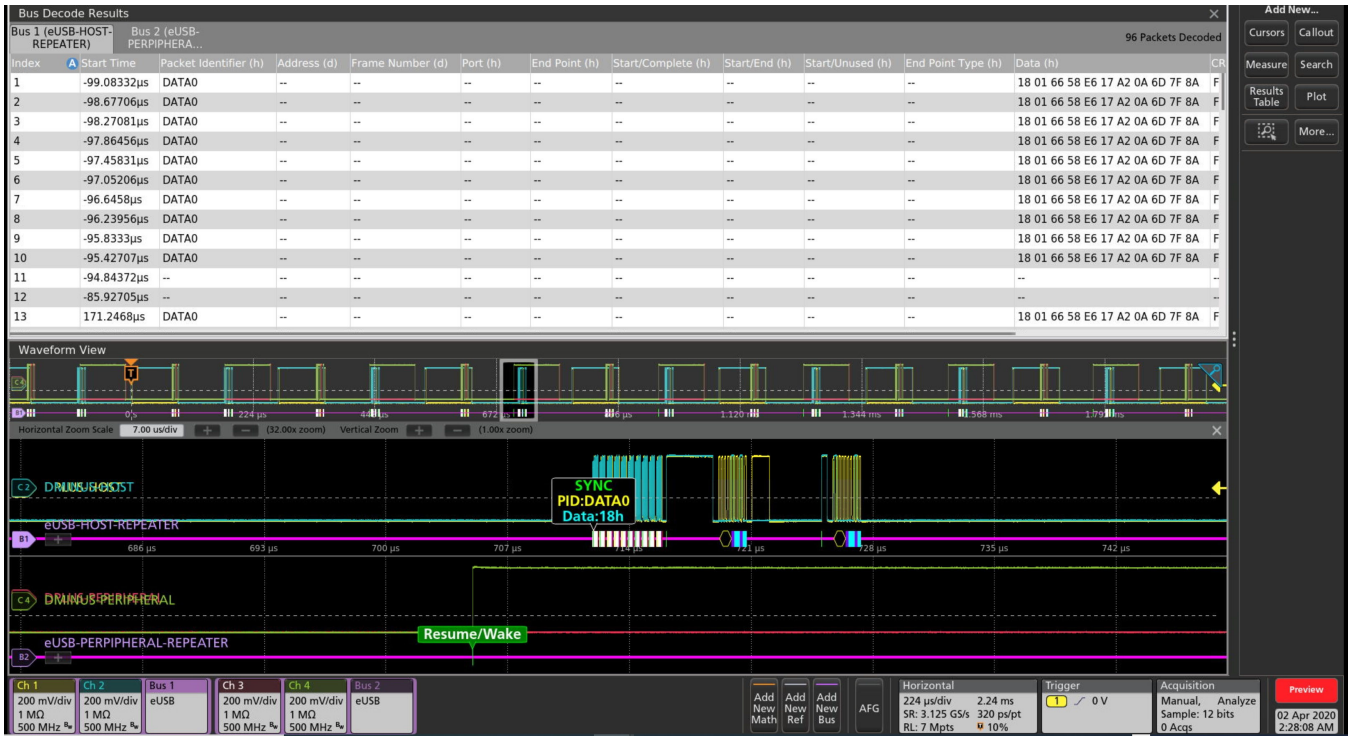
Search configuration

Bus decode

Characteristic	Description
Decode Display	Start of packet (green bar) Sync (green packet) PID (yellow packet) Token (address) (yellow packet) Data (cyan packet) CRC (purple packet) Error (red packet) End of packet (red bar) Control Message (Yellow packet) Zeros (Blue packet) Ack (Purple packet) Port Reset (Red Bar) Port Configuration(Green Bar) Connect (Green Bar) Resume/Wake(Green Bar) Device Chirp(Green Bar) Host Chirp (Green Bar) End Of reset(Red Bar)

Results & other features

Characteristic	Description
Table view * Depends on the Model	View more than 10000* points
Save	Save Result table as CSV
Sessions	Save sessions of your protocol setup
Simultaneous Buses * Depends on the Model	Load multiple Buses simultaneously*
Upcoming Future addition	Timing Measurements for Protocols
Search Table	Displays the Search hits along with Delta time difference between hits



Results table with decoded waveform

Manchester Characteristics (Line encoding)

Bus setup options

Characteristic	Description
Manchester Sources	Analog channels Digital channels(single-ended) Active Math channels Active Reference channels
Bus Setup: Threshold Idle Bits Transition For '0' Tolerance	
Recommended Probing	Differential/Single ended
Formats Available	Hex Binary
Packet View	

Bus search options

Characteristic	Description
Search On	Characteristic Description
	Search On Sync Reset Suspend Resume/Wake Connect Control Message Port Reset Port Configuration Device Chirp Host Chirp End of Packet Token (address) Packet Data Packet Handshake Packet: ACK, NAK, STALL, NYET (HS only) Special Packet: PRE (FS only), ERR, SPLIT, PING Reserved Error: PID check, CRC5 or CRC16, Bit stuffing (LS and FS only)

Display modes

Characteristic	Description
Bus	Bus Only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view with columns containing: Sync Pattern Packet Header Packet Data Packet Trailer Error

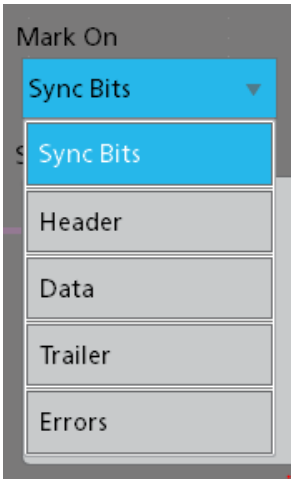
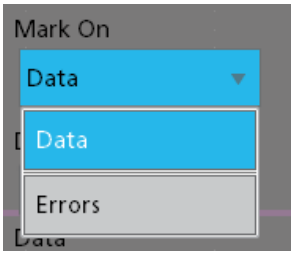
Bus decode

Characteristic	Description
Maximum Clock/Data Rate	1Gbps

Table continued...

Characteristic	Description
Decode Display	Control Field (yellow packet) Payload Field (cyan packet)
Error Handling	Parity Manchester
Search On	When Packet View is ON Sync Bits Header Data Trailer Errors When Packet View is OFF Data Errors

Bus search options

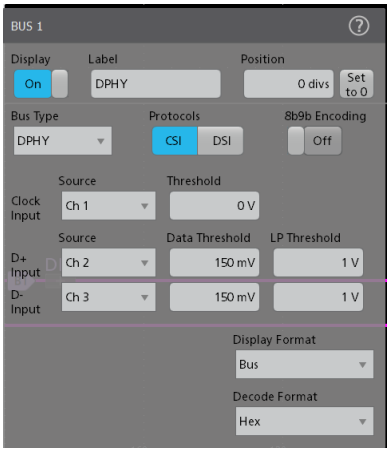
Characteristic	Description	
Search On (Packet View ON)	Sync Bits Header Data Trailer Errors	
Search On (Packet View OFF)	Data Errors	

Results & other features

Characteristic	Description
Table view * Depends on the Model	View more than 10000* points
Save	Save Result table as CSV
Results Table	Sessions
Simultaneous Buses * Depends on the Model	Load multiple Buses simultaneously*
Upcoming Future addition	Timing Measurements for Protocols
Search Table	Displays the Search hits along with Delta time difference between hits

DPHY(DSI2.0/CSI2.0) Characteristics (Version 2.0)

Bus setup options

Characteristic	Description
DPHY Sources	Analog channels Math channels Active Reference channels
Salient Features	Decode capability in for CSI/DSI protocols. Decode capability for Escape mode. Decode capability for High speed burst mode. Decode capability for 8b9b line encoding in LPDT and HS mode. Search capability for SoT/EoT Search capability for long and short packets Search capability for Escape mode Search capability for Errors like ECC, CRC, and Any
Bus Setup	
Recommended Probing	Clock – Single Ended/Differential Data – Single Ended Single ended probe: No. of probes: 3 (D+ and D- by default) Differential probe: No. of probes: Not supported
8b9b encoding mode	Select line encoding in LPDT and HS mode.
Formats Available	Hex Binary Mixed Hex

Display modes

Characteristic	Description
Bus	Bus Only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Result Table	Decoded packet data in a tabular view with columns containing: Mode Data Type Virtual Identifier ECC Data CRC End Error

Bus decode

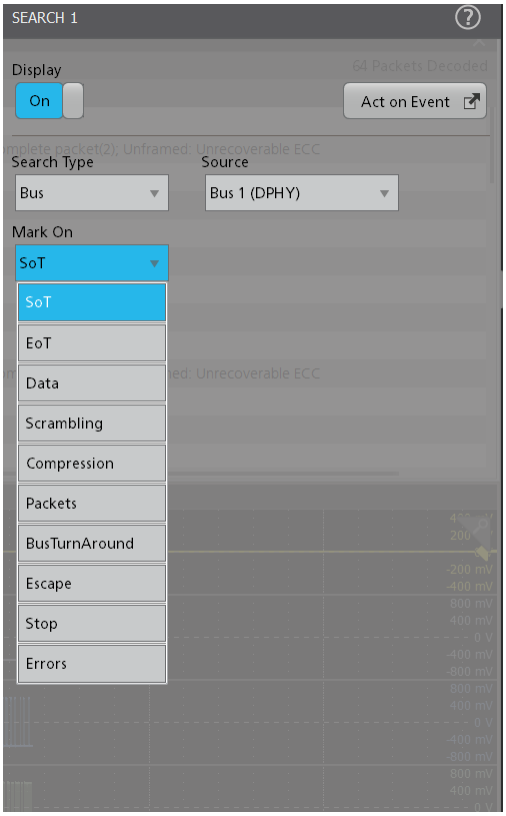
Characteristic	Description
Maximum Clock/Data Rate	2.5 Gbps
Decode Display	Control Field (yellow) ECC/CRC (Green) Pixel Fields (Red,Green,Blue,Yellow) Data Symbol (cyan) Raw Fields (Cyan)
Error Handling	ECC CRC SOT Sync

Bus search options

Characteristic	Description
Search On (CSI/DSI)	SoT – It searches SoT of each transmission in HS mode EoT – It searches EoT of each transmission in HS mode. Data – Data search (HS/LP) Scrambling – Search for scrambling mode command Compression – Search for Compression mode command. **Packets – Searches for Short and long packets Escape – Search for Escape entry mode STOP – Search for Escape mode exit Errors – Search for CRC and ECC errors. **Can select from the list of standard packet names

Result & other features

Characteristic	Description
Table view * Depends on the Model	View more than 10000* points
Save	Save Result table as CSV
Sessions	Save sessions of your protocol setup
Simultaneous Buses * Depends on the Model	Load multiple Buses simultaneously*
Upcoming Future addition	Timing Measurements for Protocols
Search Table	Displays the Search hits along with Delta time difference between hits



Bus search options

SDLC Characteristics (Version GA27-3093-3)

Bus setup options

Characteristic	Description
SDLC Source(s)	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Pre-channel thresholds
Recommended Probing	Differential
Modulo	8 [8-bit Control Word] 128 [16-bit Control Word]
Encoding	Discrete Transmission [NRZ] Invert On Zero [Inverted NRZi]
Formats Available	Hex Binary Mixed Hex

Display modes

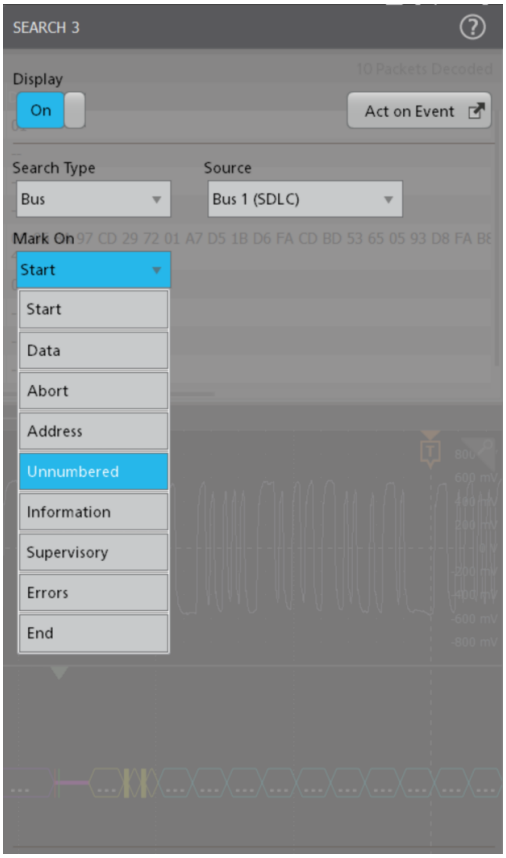
Characteristic	Description
Bus	Bus Only
Result Table	Decoded packet data in a tabular view

Bus decode

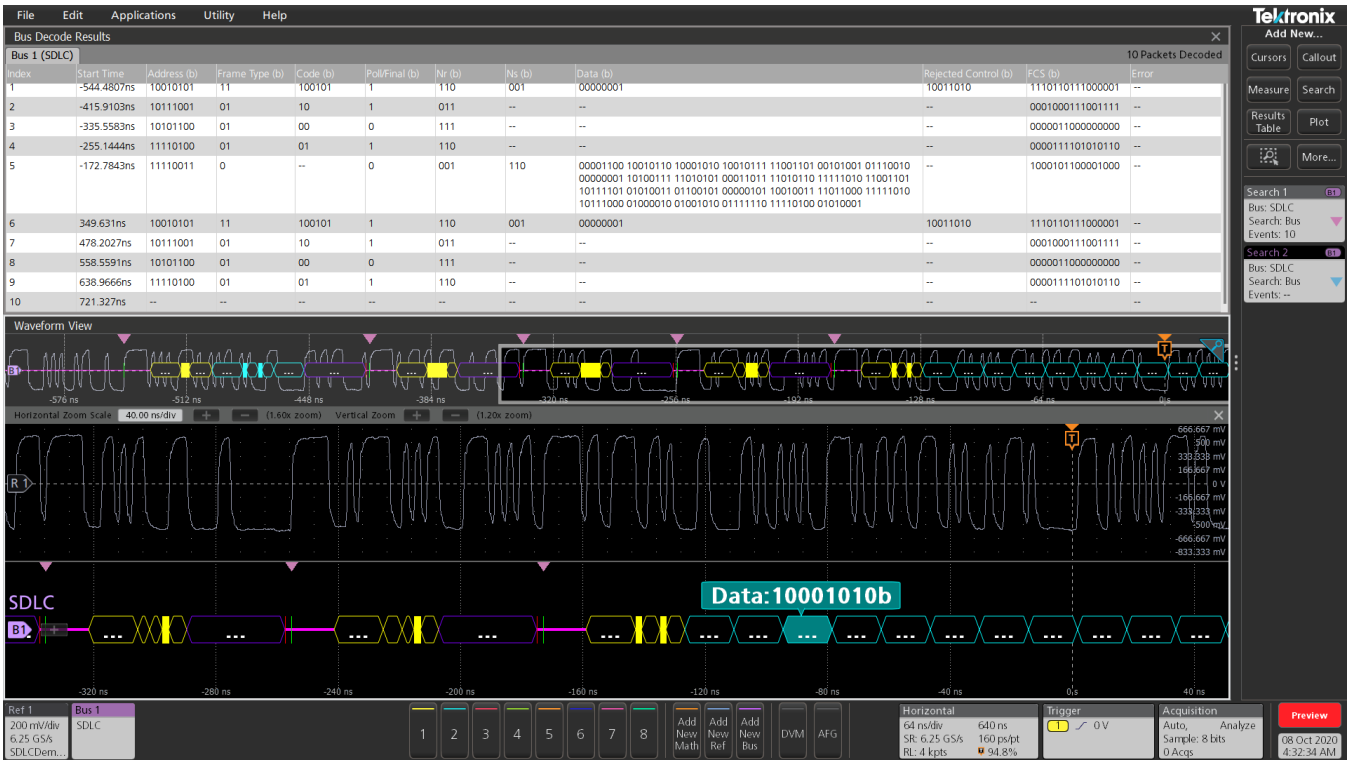
Characteristic	Description
Maximum Clock/Data Rate	1 Gbits/sec
Decode Display	Start (green vertical line) Address (yellow field) Frame Type (yellow field) Code (yellow field) Ns(yellow field) [Sequence number sent] Nr(yellow field) [Sequence number received] Poll/Final (yellow field) Data(cyan field) FCS(purple field) Abort (red vertical line)
Error handling	FCS [Frame Check Sequence Errors]

Bus search options

Characteristic	Description
Search On	Start [Searches for Start event] Data [Searches for Payload Data] Abort [Searches for Abort] Address Broadcast [Broadcast Packets] No Station [Packets not pertaining to secondary] Station [Valid Station Address] Unnumbered Commands [Searches for Primary Commands] Responses [Searches for Secondary Responses] Both Information [Searches for information frames] Supervisory [Searches for different receiver status] Receive Frame Ready Receive Frame Not Ready Reject frame Errors FCS [Searches for Frame Check Sequence errorrs] Out of Numeric Order [Searches for this frame] Stop



Bus search options



The Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the SDLC bus.

Searching on a station address on the SDLC bus.

CPHY Characteristics (Version 2.0)

Bus setup options

Characteristic	Description
CPHY Sources	Analog channels Digital channels Math channels Active reference channels
Salient Features	Decode capability in for CSI/DSI protocols. Decode capability for Escape mode. Decode capability for High speed burst mode. Decode capability for Word/Symbol Mode. Decode capability in single ended and differential mode Search capability for SoT/EoT Search capability for long and short packets Search capability for Escape mode Search capability for CRC Errors Search capability on Pixel value and Pixel number in CSI/DSI packet search
Sub Type	CSI DSI Word (16 Bit data word decode) Symbol (Symbol level decode of cphy data)
Signal Type	Single Ended: No. of probes: 3 Differential: No. of probes: 5 Minimum BW of probe: As minimum bitrate of HS is set to 4 Mbps, almost all probe should work. But considering the general CPHY HS speed is about 1 GHz and speed can vary depending on customer, the probe need to based on what speed the end customer want to test.
Formats Available	Hex Binary Mixed Hex
Bit Rate	Specifies the data rate in High Speed Mode

Display modes

Characteristic	Description
Bus	Bus Only
Result Table	Decoded packet data in a tabular view with columns containing: Mode Data Type Virtual Identifier PHCCRC Data CRC Symbols End Error

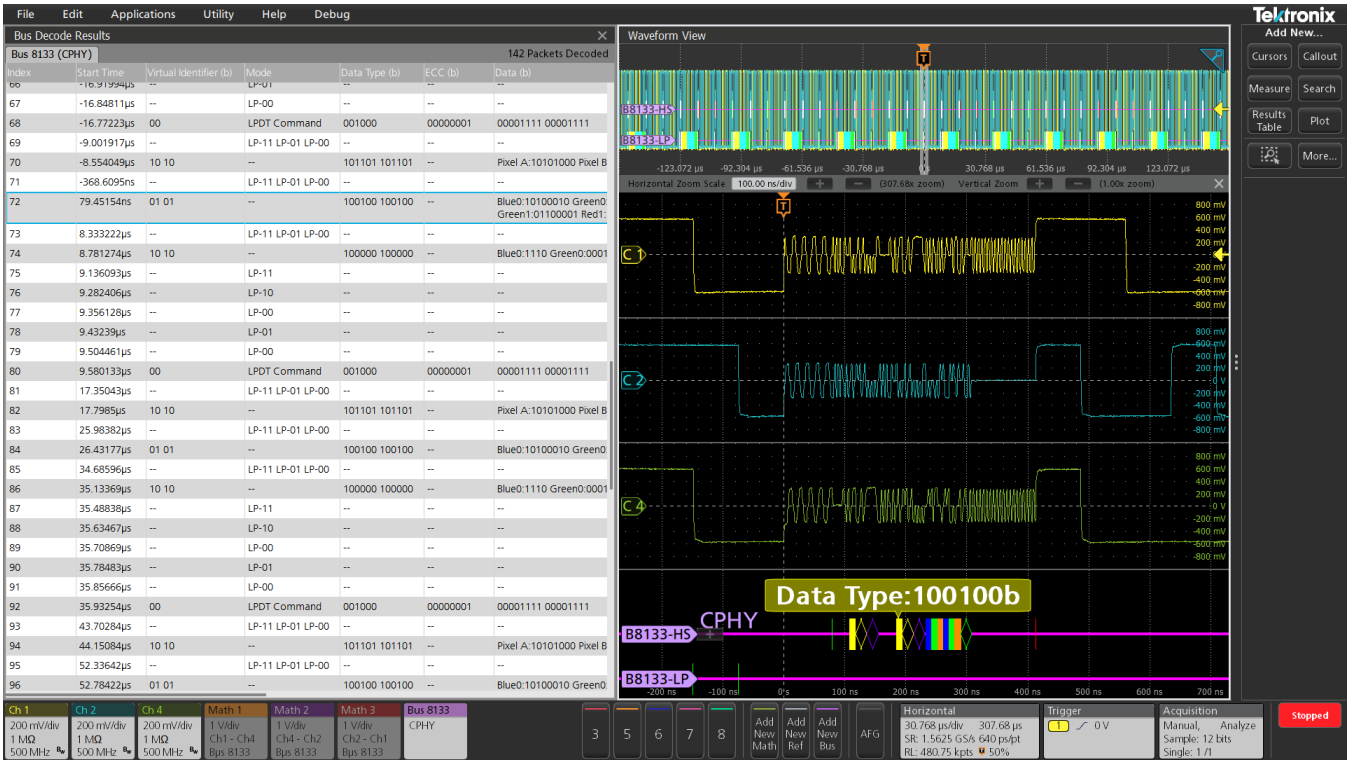
Bus decode

Characteristic	Description
Maximum Clock/Data Rate	10 Gbps
Decode Display	Control Field (yellow) ECC/CRC (Green) Pixel Fields (Red, Green, Blue, Yellow) Data Symbol (cyan) Raw Fields (Cyan) Word and Symbol Decode (cyan)
Error Handling	PHCRC CRC SOT Sync
Sub type	CSI (CSI packet decode) DSI (DSI packet decode in HS/LP) Word (16 bit word decode) Symbol Decode

Bus search options

Characteristic	Description
Search On (CSI/DSI)	SoT – Searches SoT of each transmission in HS mode EoT – Searches EoT of each transmission in HS mode. Data – Data search (HS/LP) Scrambling – Search for scrambling mode command Compression – Search for Compression mode command.

Characteristic	Description
	**Packets – Searches for Short and long packets Escape – Search for Escape entry mode Errors – Search for CRC and PHCRC errors. **Can select from the list of standard packet names
Word / Symbols Decode	Search for Words/Symbols respectively



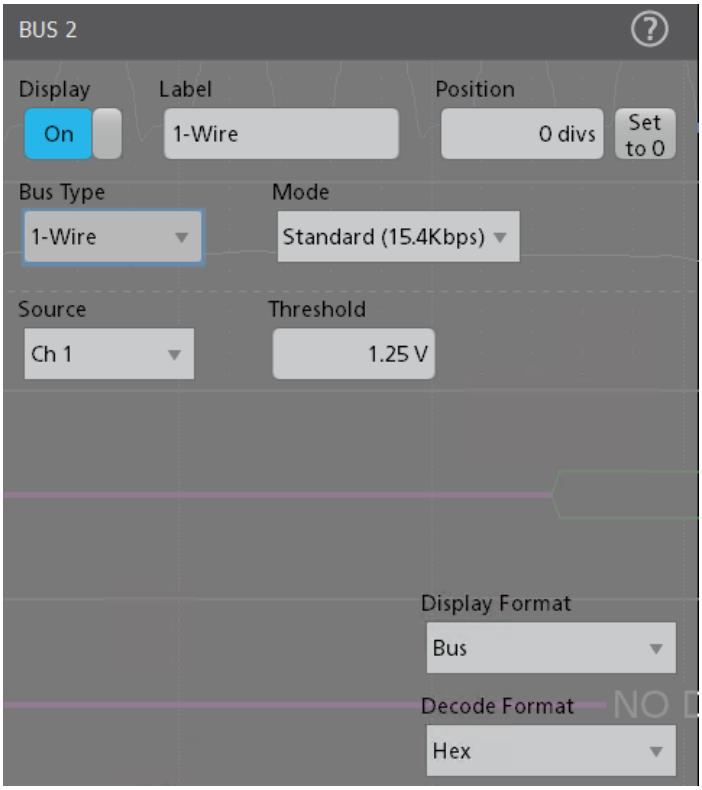
The protocol decode results table provides a time-stamped, tabular view of all captured pixel packets on the CPHY bus

CPHY search results display

ONEWIRE Characteristics

Bus setup options

Characteristic	Description
1-WIRE Sources	Analog channels Digital Channels Active Math channels Active Reference channels
Salient Features	Decode capability in for 1-WIRE protocol. Decode capability for Standard mode. Decode capability for Overdrive mode. Search capability for Reset, Presence events Search capability for Command, Data Search capability for different ROM packets such as Read/Match/Skip/Search ROM and Alarm based on the Standard or Overdrive mode chosen. Search capability for CRC Error
Formats Available	Hex Binary Mixed Hex
Mode	Specifies the mode of operation – Standard (15.4 kbits/s) or Overdrive (125 kbits/s).
Recommended Probing	Single Ended passive probe Differential passive probe



Bus setup

Display modes

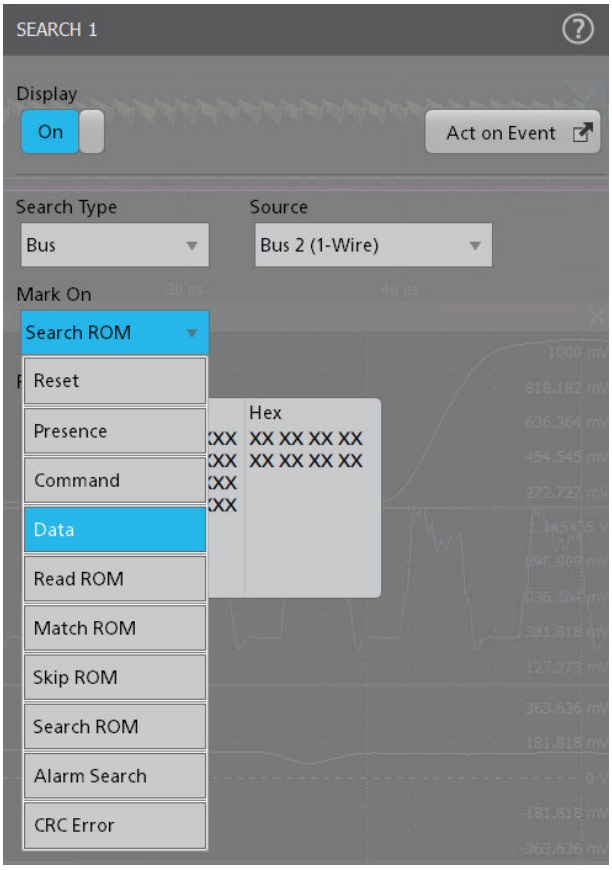
Characteristic	Description
Bus	Bus Only
Result Table	Decoded packet data in a tabular view with columns containing: Initialization ROM Command ROM Code CRC Command Data Error

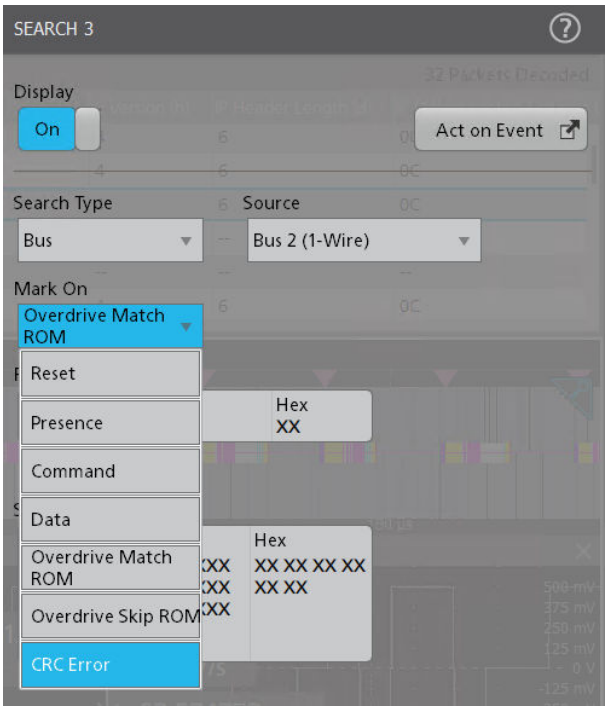
Bus decode

Characteristic	Description
Decode Display	ROM Command/ROM Code/ Command (yellow) CRC (purple) Reset/Presence event (Green) End event (Red)
Error Handling	CRC

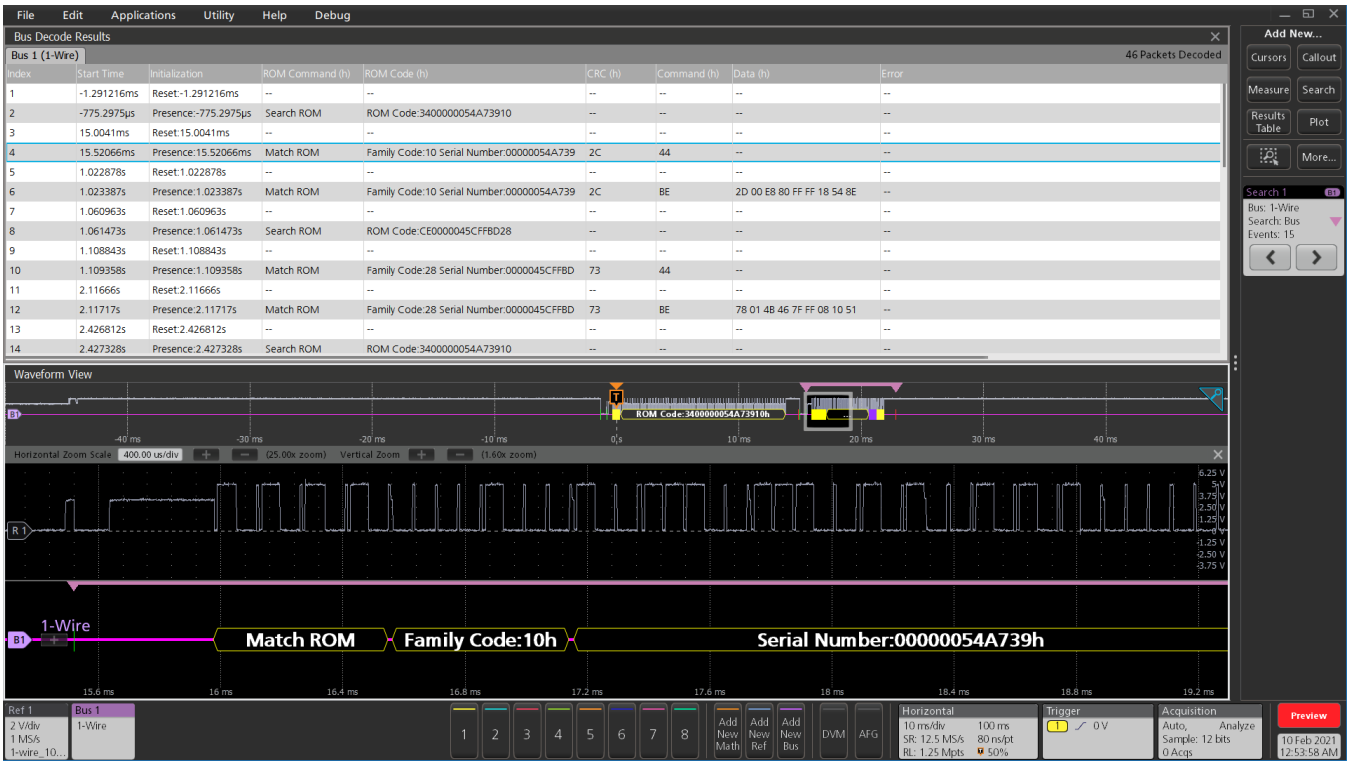
Bus search options

Characteristic	Description
Search On 1-WIRE	Reset – Searches for the Reset event. Reset is the default trigger on condition. Presence – Searches for the Presence event. Command – Searches for Command. Data – Searches for the Data. Read ROM – Searches for the Family code and Serial number of Read ROM. Match ROM – Searches for the Family code and Serial number of Match ROM. Overdrive Match ROM – Searches for the Family code and Serial number of Match ROM. Skip ROM – Searches for Skip ROM packet. Overdrive Skip ROM – Searches for the Overdrive Skip ROM packet. Search ROM – Searches for the ROM code. Alarm Search – Searches for the Alarm packet. CRC Error specifies the search condition as CRC Error.

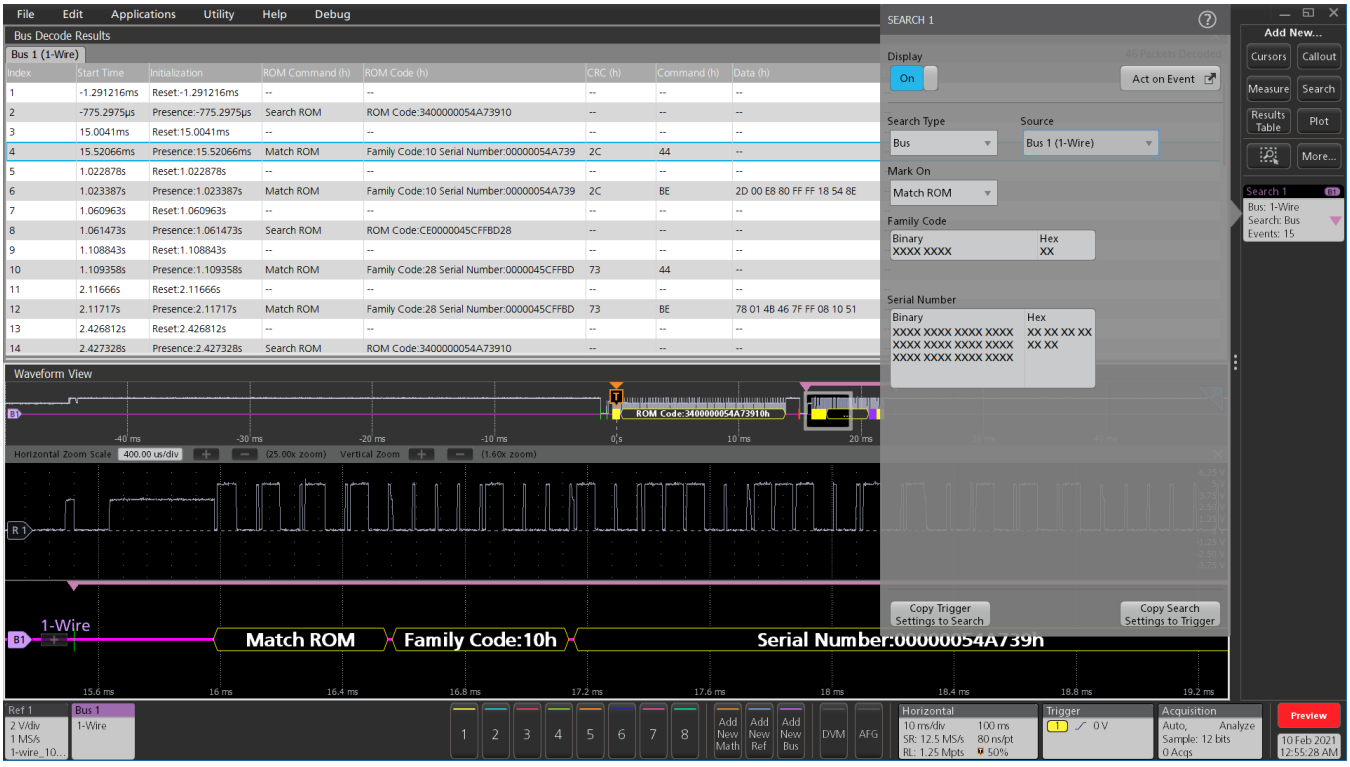




Search on 1-WIRE



The protocol decode results table provides a time-stamped, tabular view of all captured pixel packets on the 1-WIRE bus.



Searching on a MATCH ROM packet with Family Code and Serial Number on the 1-WIRE bus.

CXPI characteristics (Version: JASO D 015-3: 2014/J3076_201510)

Bus setup options

Characteristic	Description
CXPI sources (signal source)	• Analog channels- 1 • Active Reference channels- 1 • Digital channels • Math channels
Recommended Probes	It is a low speed protocol with voltage between 1.8 V-3.3 V • Active Probes P7240 • TPP1500 • Low Voltage Single Ended Probes
Product differentiator	Display IBS bits on decoded bus for Inter byte spacing clarity.
Salient features	CXPI source has recessive threshold level for signal decode. i.e. TH(rec) is 70% peak-to-peak of the signal. Transmitting node transmits data to the communication bus, it transmits to encoding circuit after converting the data to UART format.
Formats available	Hex Binary Mixed Hex
Bit rate	Specifies the data rate up to 20 kbs for CXPI bus decode.

Display modes

Characteristic	Description
Bus	Bus only
Result table	Decoded packet data in a tabular view with columns containing: • Start • Frame type • Frame ID • PTYPE ID • Sleep

Table continued…

Characteristic	Description
Result table	• Wakeup • Counter • DLC • EXTDLC • Data • Frame Parity • Ptype parity • CRC • Errors

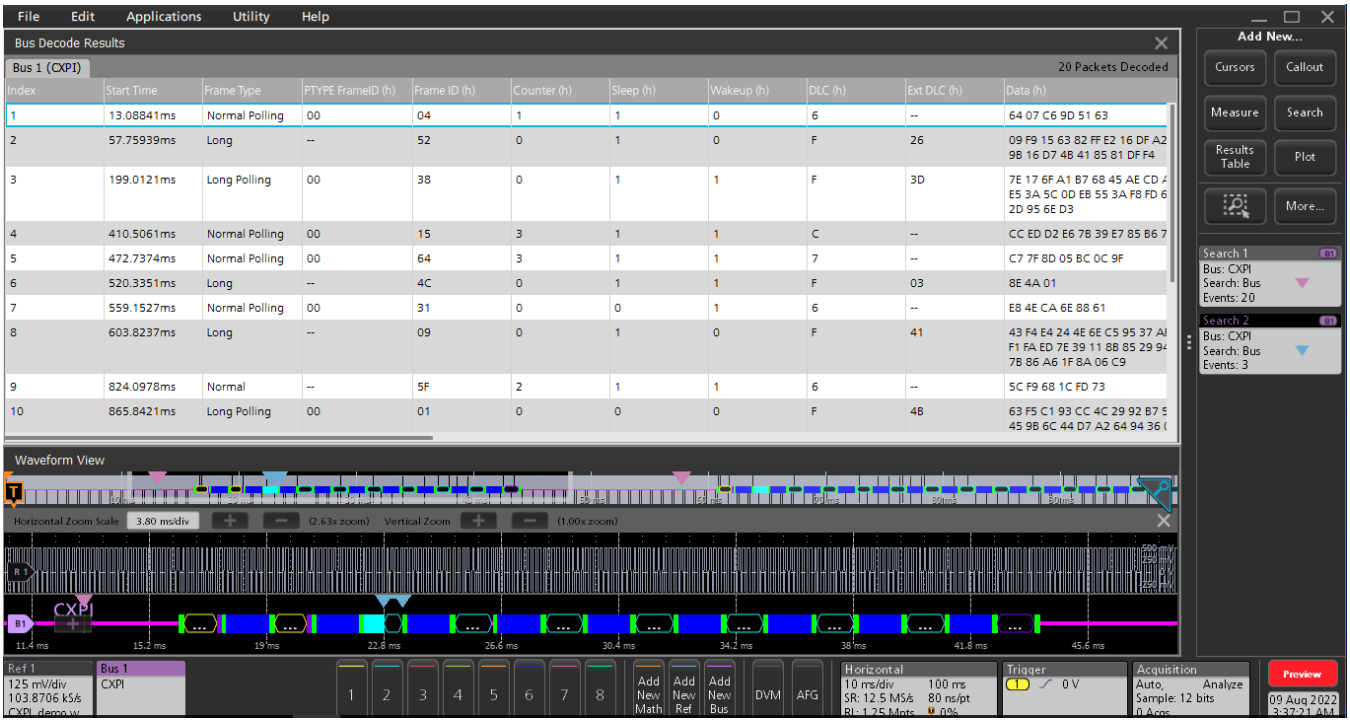
Bus decode

Characteristic	Description
Maximum Clock/Data Rate	20 kbs
Decode Display	• IFS (start event-vertical), Start bit and stop bit (Green) • Frame ID (Yellow) • IBS: (Dark blue) • Data, Counter, wakeup, sleep, DLC, and EXTDLC (cyan) • Parity and CRC (Purple)

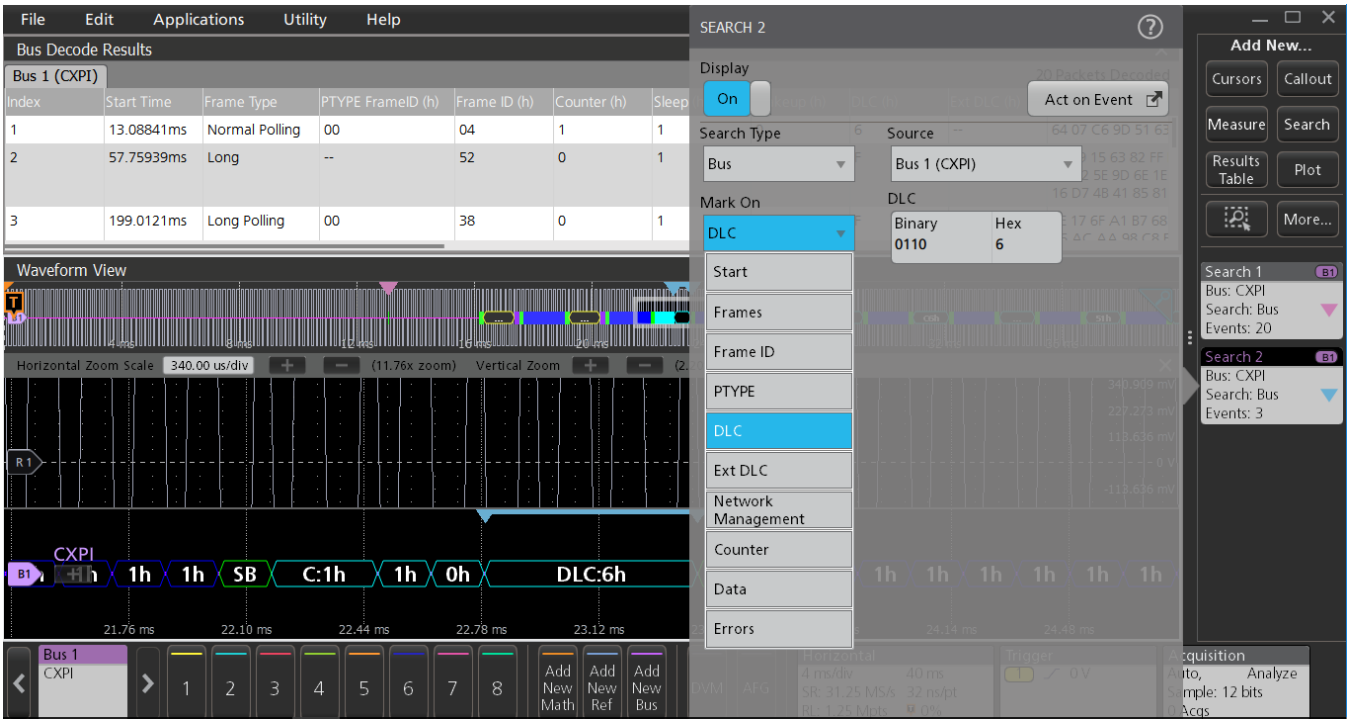
Error Handling	• CRC
	  • Parity
	  • IBS
	  • Frame error

Bus search options

Characteristic	Description
Search On	• Start • Frame • Frame ID • PTYPE • DLC • ExtDLC • Network management: Wakeup and sleep • Counter • Data • Errors: Parity, CRC, IBS, Frame.



The Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets with frame type along with supported errors on the CXPI bus.



Searching on a DLC field in packets with value 6(110) on the CXPI bus.

Enhanced serial peripheral interface (eSPI) characteristics (Version 1.0)

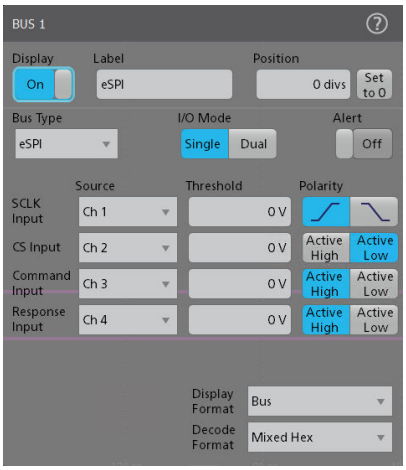
Bus setup options

Characteristic	Description
eSPI Sources	• Analog channels • Digital Channels • Active Math channels • Active Reference channels
Salient features	• Decode capability for eSPI protocol. • Decode capability for Single I/O mode with Alert as optional. • Decode capability for Dual I/O mode with Alert as optional. • Search capability for Start and End events • Search capability for Status and Wait state • Search capability for different channels: Channel Independent, Peripheral, OOB, Virtual Wire, and Flash Access based on command or response phase. Further, search capability for Command phase based on different channel related command opcodes and Response phase based on with/ without header. Both phases support sub field search based on corresponding cycle type. Search capability for Errors based on the phase: CRC/Cycle type/Command opcode/Defer/ Fatal/Non-Fatal/No Response.
Formats Available	Hex Binary Mixed Hex
I/O Mode	Specifies the mode of operation: • Single mode (CMD and RSP on different lanes) • Dual Mode (CMD and RSP on same lane)
Alert	Optional Alert channel- off by default
Polarity	Specifies the polarity of the input sources
Channels required for decode	4+1 (Clock, Chip Select, Command Input, Response Input + Alert)
Recommended Probes	It is a low speed protocol with voltage between 1.8 V-3.3 V 1. Active Probes P7240 2. TPP1500 3. Low Voltage Single Ended Probes

Differentiators	• Protocol Search options (additional search options available under protocol decode):
	  • Start and End Events
	  • Wait States
	  • Data
	  • Errors – Invalid command type, Invalid cycle type, Fatal/Non-Fatal Errors.
	• Decode formats in MIXED HEX.

Table continued…

Bus setup

Characteristic	Description
Single Mode (Default)	
Dual Mode	

Display modes

Characteristic	Description
Bus	Bus only

Table continued…

Characteristic	Description
Result Table	Decoded packet data in a tabular view with columns containing: • Command OpCode • Cycle Type • Header • Address • Data • Response • Status • CRC • Error • PEC

Bus decode

Characteristic	Description
Decode Display	Start (Green) Command OpCode, Response, Virtual Wire Count/Group/Index, Cycle Type, Tag, Length, Message Code, SMBus Slave address/Source address/Destination address/Source slave address/ OpCode, Byte Count, MCTP, Destination Point, Source Point, SOM, EOM, PEC, Latency Scale, Message Tag, TO, PktSeq, Wait (Yellow) Data, Double Word, Virtual Wire Data (Cyan) CRC (Purple) Stop, Response error, Unframed (Red)
Error Handling	CRC, Defer, Fatal, Non-Fatal, No Response, Command OpCode, Cycle type

Bus search options

Characteristic	Description
Search On eSPI	**Start**: Enables to search the start event of the packet decode. **Channel Independent**: Enables search on Channel Independent command and responses packets.
Search On eSPI	**Peripheral Channel**: Enables search on different types of Peripheral channel command and responses packets. **OOB Channel**: Enables search on different Out-Of-Band (OOB) channel command and Responses packets.
	Virtual Wire Channel: Enables search on different Virtual Wire channel command and responses packets. **Flash Access Channel**: Enables search on different Flash access channel command and responses packets. **Wait**: Enables to search on the wait state that appears after the TAR window. **End**: Enables to search on the End events when the packet decode ends. **Phase**: Select the type of phase between command and response for which to search. **Command**: Enables search on the command opcode of different channels specified under the mark on. **Response**: Enables to search on the response field. **Response With Header**: Enables to search on the RSP opcode that consists of a Response Code and a Response Modifier. **Response Without Header**: Enables to search on the RSP opcode that consists of a Response Code and a Response Modifier. **Command Opcode**: Enables search on the command opcode of different channels. **Cycle Type**: Enables search under command and response with header based on different cycle types for different channels. **Address**: Enables search on the address field for different channels based on different commands and response with header classified based on cycle types. **Tag**: Enables search on the tag field for different channels based on different commands and response with header classified based on cycle types.

Table continued…

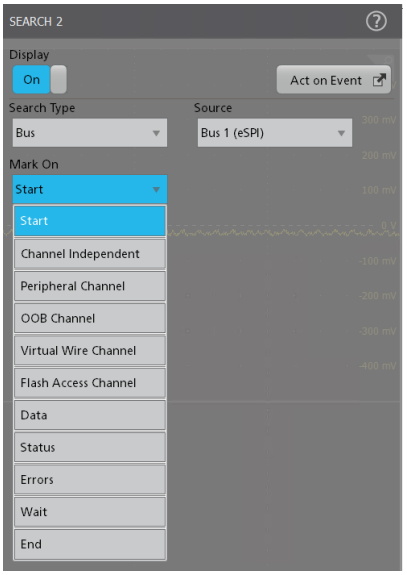
Characteristic	Description
Search On eSPI	**Length**: Enables search on the length field for different channels based on different commands and response with header classified based on cycle types. **SMBus Slave Address**: Enables search on SMBus Slave address under the OOB channel. **Virtual Wire Count**: Enables search on Virtual Wire Count for command and response with header under the virtual wire channel. **Virtual Wire Index**: Enables search on Virtual Wire index for command and response with header under the virtual wire channel. **Virtual Wire Data**: Enables search on Virtual Wire Data for command and response with header under the virtual wire channel. **Data Bytes**: Sets the number of data bytes for which to search. **Data**: Sets the data value for which to search. Searches based on command and response. **Status**: Enables search on the status field of the response packets. **Error Type**: Sets the error type for which to search based on command or response phase.
Mark On and Channel Independent	

Table continued…

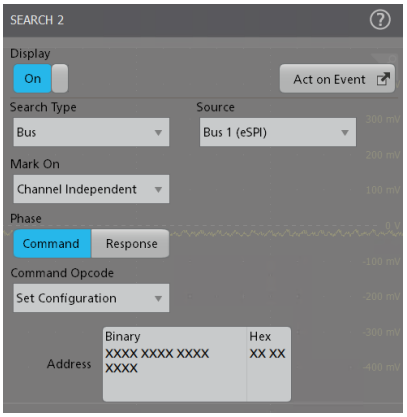
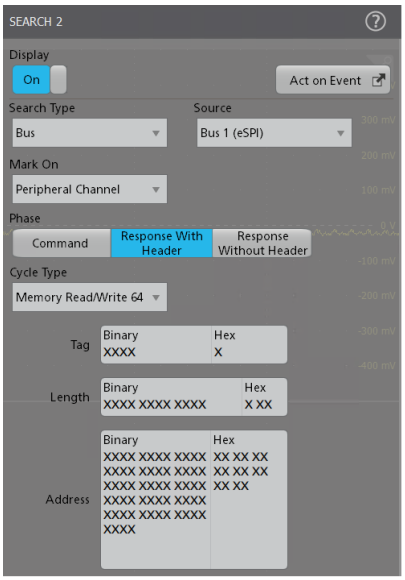
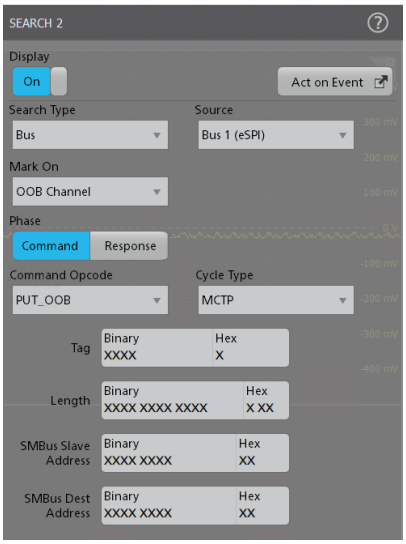
Characteristic	Description
Mark On and Channel Independent	  

Table continued…

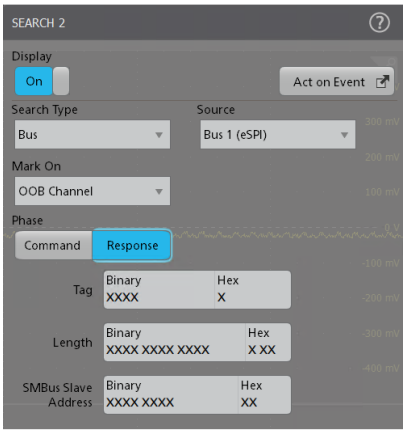
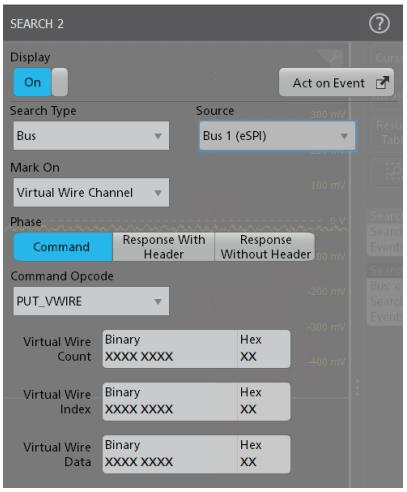
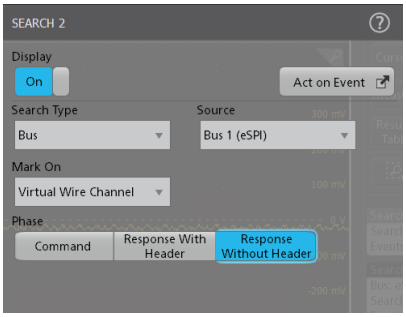
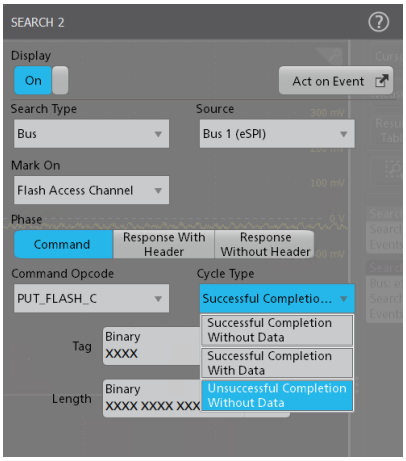
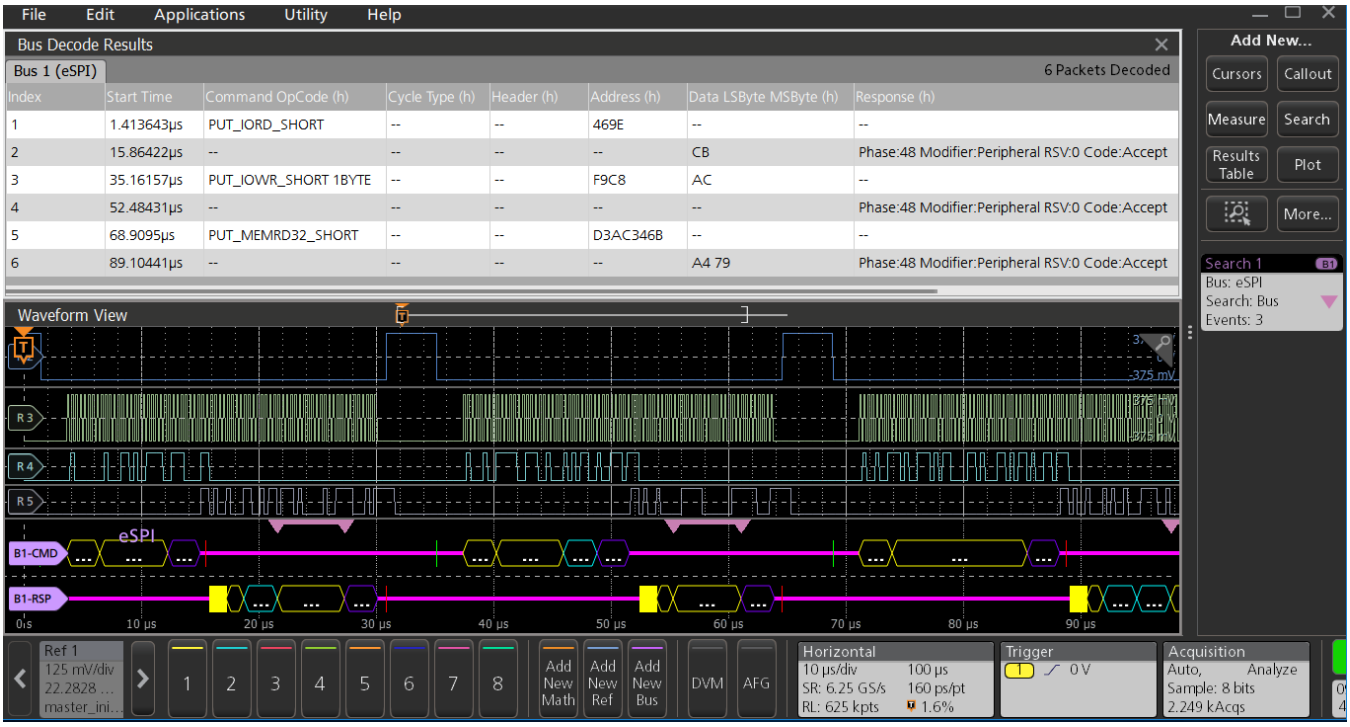
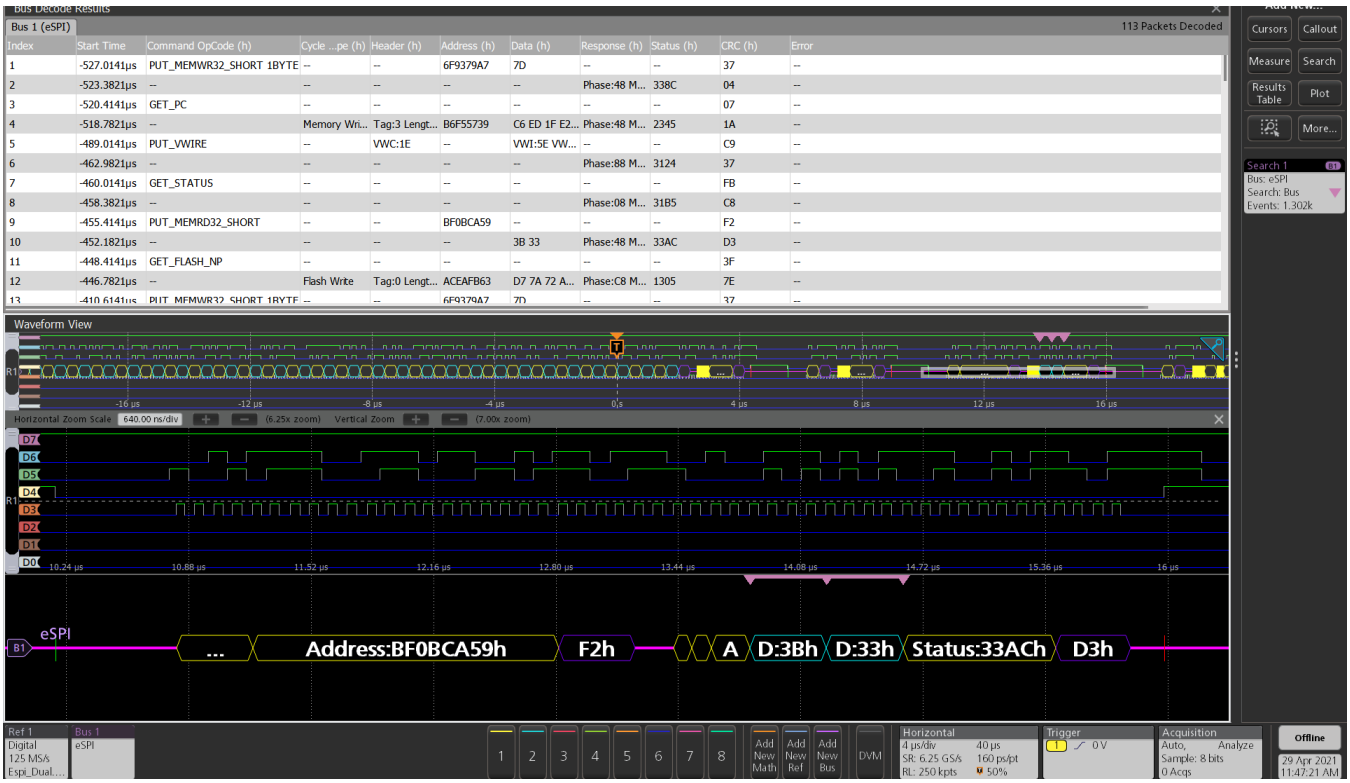
Characteristic	Description
Mark On and Channel Independent	 

Table continued…

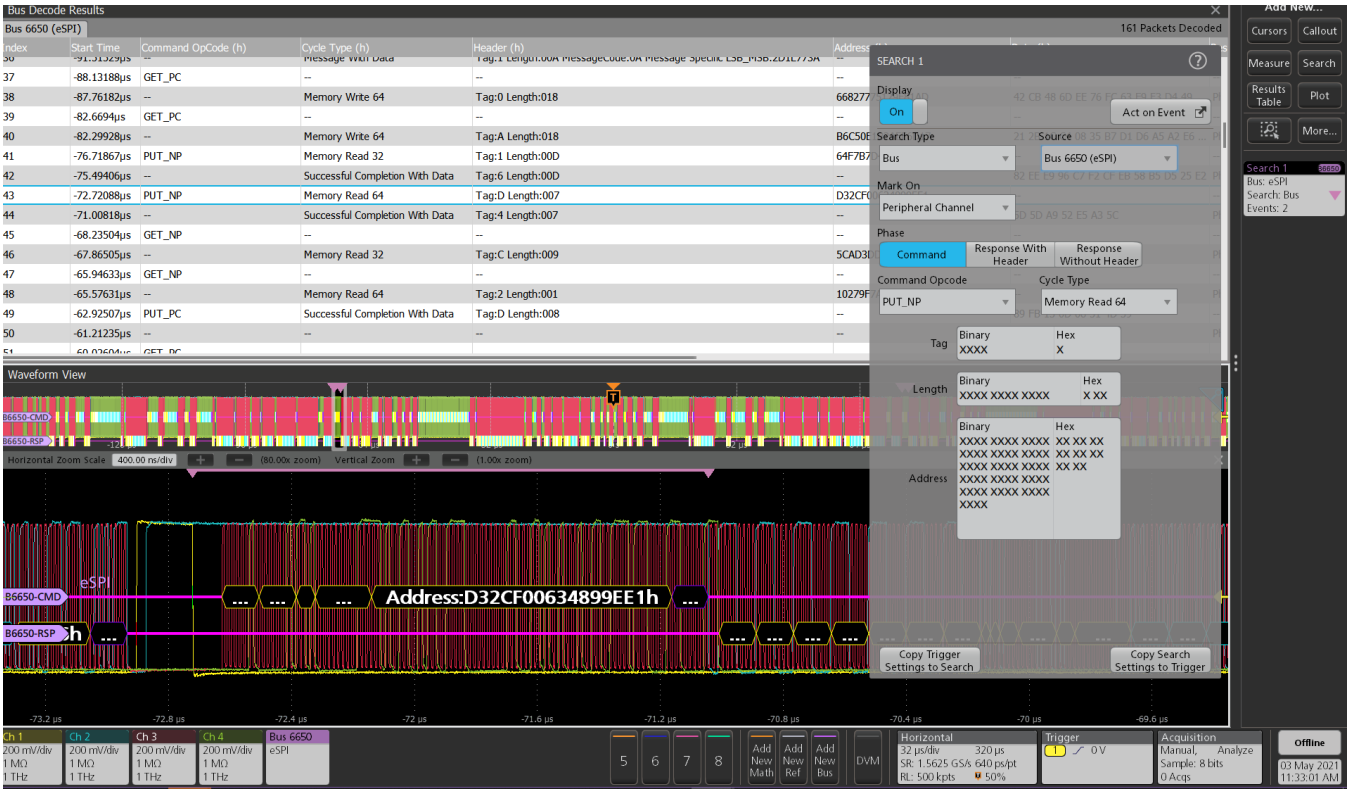
Characteristic	Description
	 Peripheral, OOB, and Virtual Wire Channel
Mark On and Channel Independent	 Flash Access and Peripheral Channels



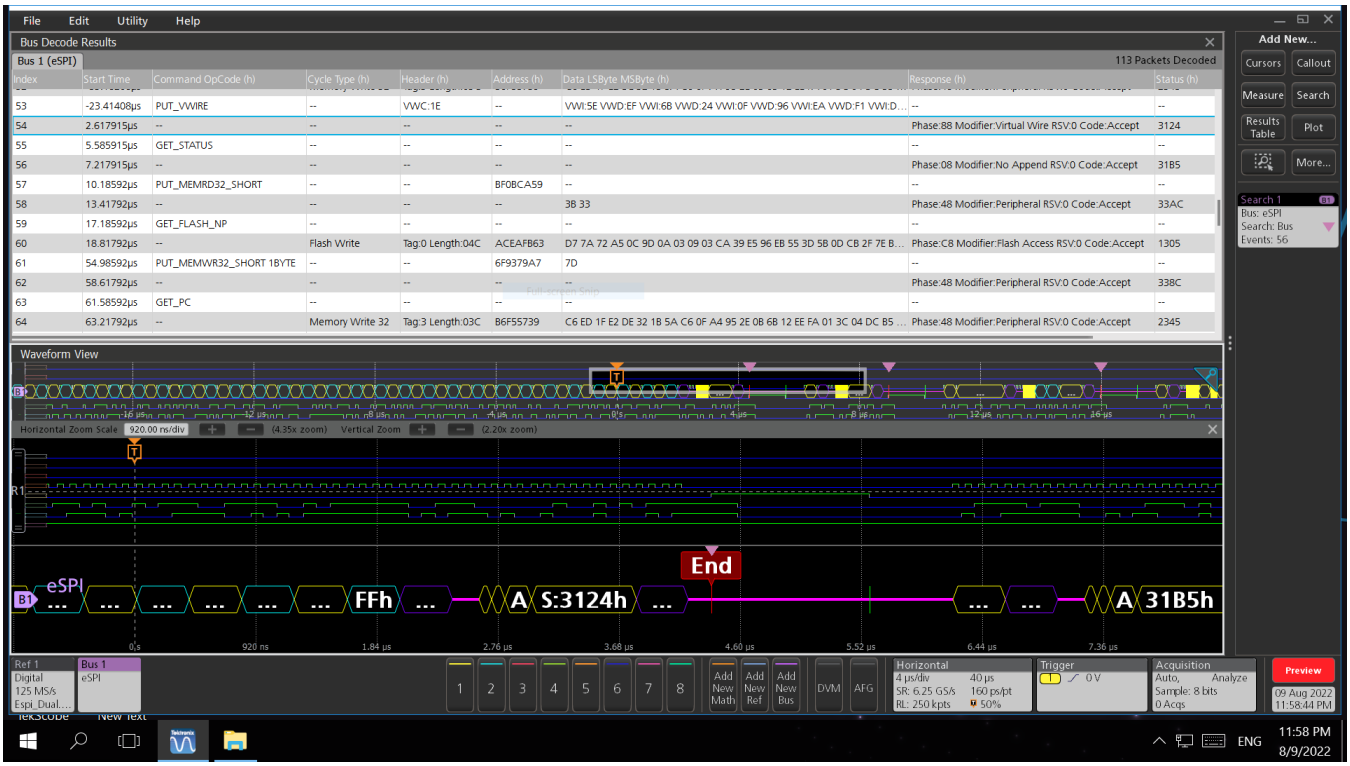
The Protocol Decode Results Table provides a time-stamped, tabular view of all captured pixel packets on the eSPI bus. (Single I/O Mode)



The Protocol Decode Results Table provides a time-stamped, tabular view of all captured pixel packets on the eSPI bus. (Dual I/O Mode)



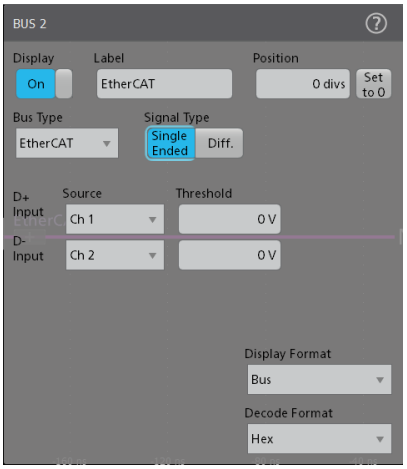
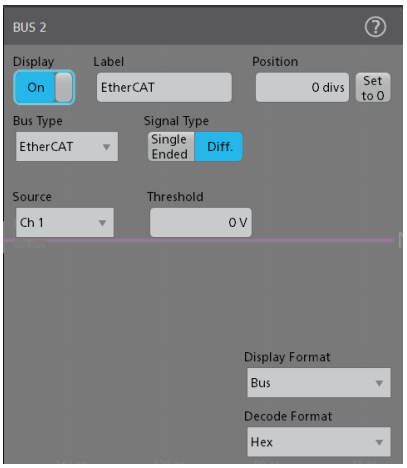
Searching on a Peripheral Channel packet with command OpCode as PUT_NP and cycle type as Memory Read 64 on the eSPI bus. (Single I/O Mode)



Searching on the Start/End event on the eSPI bus (Dual I/O Mode)

EtherCAT characteristics

Bus setup options

Characteristic	Description
Ethernet sources	Analog channels Digital channels Active math channels Active reference channels
Salient features	Decode capability for EtherCAT protocol in both single ended and differential modes
Bus setup (Single-Ended)	
Bus setup (Differential)	
Formats available	Hex Binary Mixed Hex
Signal Type	Single ended (default) Differential

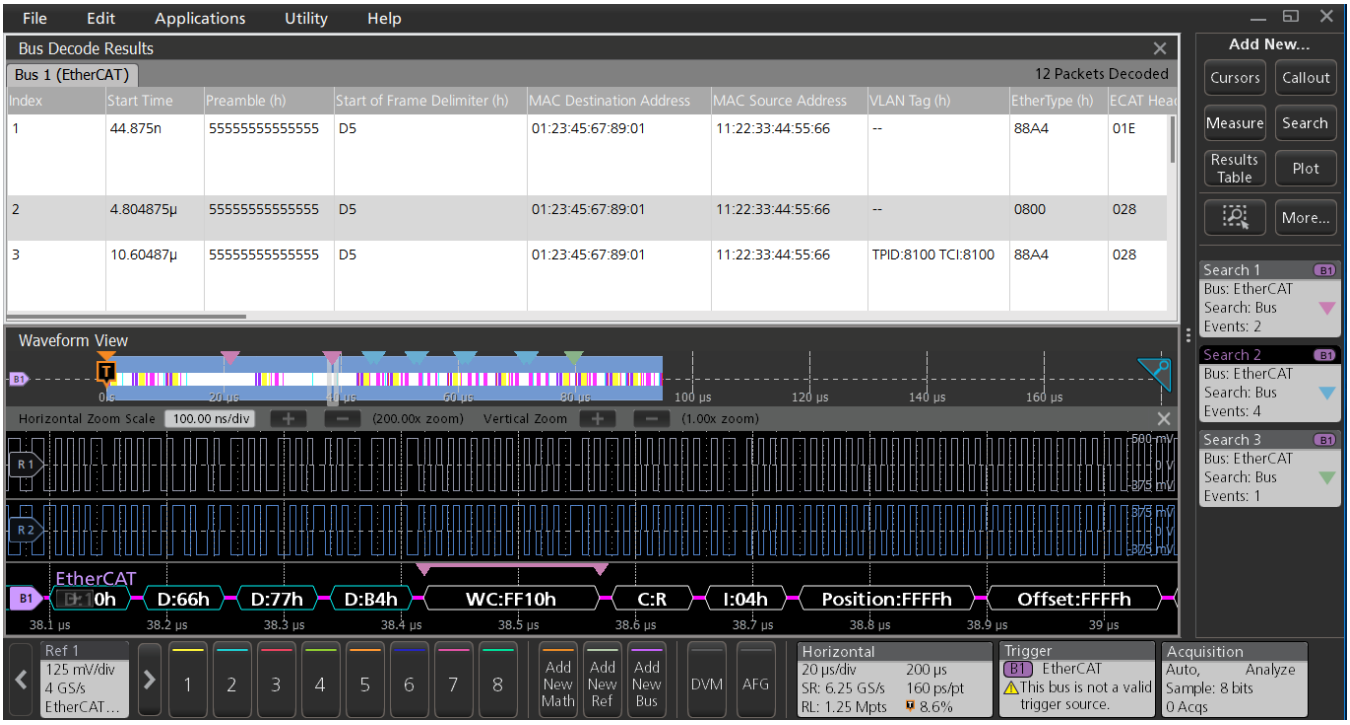
Display modes

Characteristic	Description
Bus	Bus only
Results table	Decoded packet data in a tabular view with columns containing: **1.** MAC Destination Address **2.** MAC Source Address **3.** VLAN Tag **4.** EtherType **5.** ECAT Header Length **6.** Protocol Type **7.** IP Source Address **8.** IP Destination Address **9.** Datagram Header **10.** Publisher Header **11.** Network Variable Header **12.** Mailbox Header **13.** Data **14.** Working Counter **15.** Service Data Detail Frame Check Sequence
Decode display	**Green:** Start of frame **Yellow:** MAC source address, MAC destination address, EtherType **Gray:** TPID, TCI, UDP Source Port, UDP Destination Port, Length, Checksum, Command, Index, Position, Offset, Address, Reserved, Circulating Frame, More EtherCAT datagrams, IRQ, Working Counter, PublisherID, Network Variable Count, Channel, Priority, Type **Dark Pink:** IP VersionHL, IP Service, IP Total Length, IP Identification, IP Flags, IP Fragment Offset, IP Time To Live , IP Protocol, IP Header Checksum, IP Source Address, IP Destination Address, Length, Reserved, Type, Padding, Hash, Quality **Cyan:** Data, Detail, Publisher Header **Red:** End
Error handling	FCS error

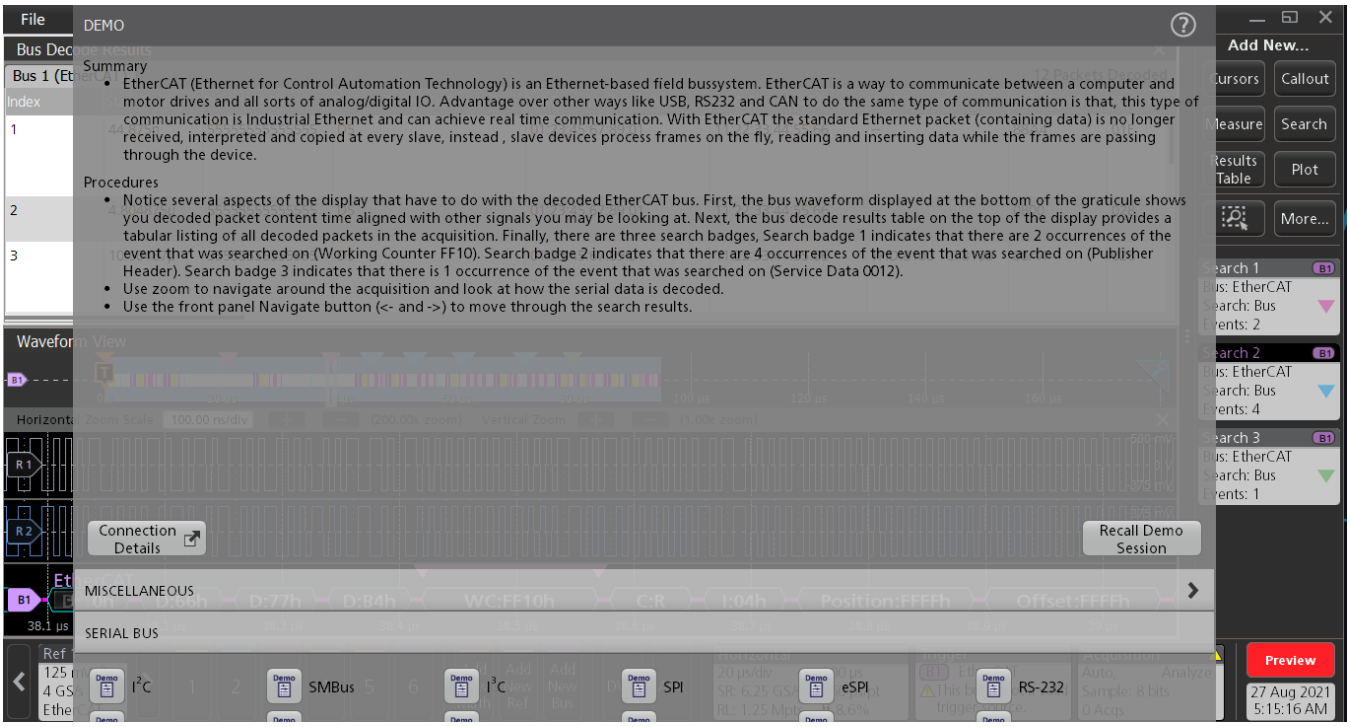
Bus search options

Characteristic	Description
Search On	**Start:** Select to search on Start of Frame. **Protocol:** Select to search on Protocol Types and then Frame type of each Protocol respectively. **IP Header:** Select to search on IP Header based on Identification, Source, and Destination Address Values. **UDP Header:** Set the 16-bit Source Port that you want to search. **MAC Address:** Select to search on Packets having the combination of Source and Destination Address Values. **Tag Control Information:** Sets the 16-bit tag control information that you want to search.

Characteristic	Description
	EtherCAT Header Length: Sets the 11-bit ethercat header length that you want to search. **Datagram:** Select to search on sub-fields of datagram including Datagram Header, Data, and Working Counter. **Network Variable:** Select to Search on sub-fields of network variable including Publisher Header, NV Header, and Data. **Mailbox:** Select to search on sub-fields of mailbox including Mailbox Header, Service Data, and Error Reply Service Data. **FCS Error:** Select to search on FCS Error if any. **End of Frame:** Select to search on end of frames.



Protocol Decode Results table provides a time-stamped, tabular view of all captured packets on the EtherCAT bus



The DEMO file content provides the information of the EtherCAT bus

SMBus characteristics

Bus setup options

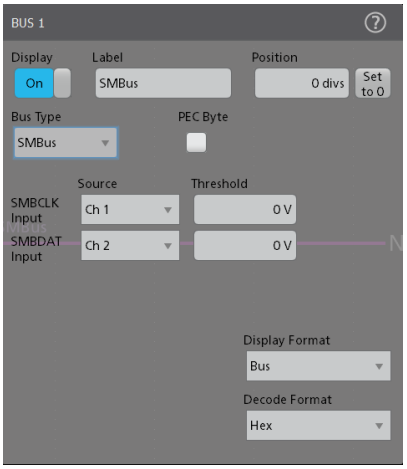
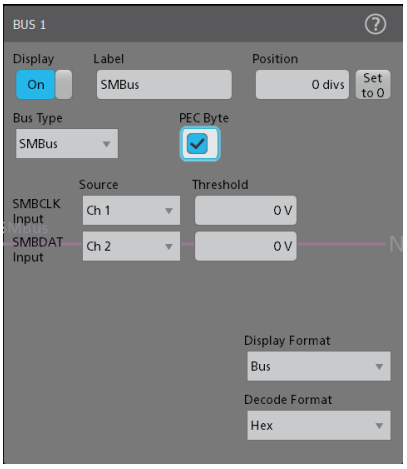
Characteristic	Description
SMBus sources	Analog channels Digital channels Active math channels Active reference channels
Salient features	Decode capability for SMBus protocol with PEC Byte as optional. Search capability for Start, Repeated Start, Stop, and Idle events. Search capability for addresses such as Host Address, Device Address, and Address. Search capability for Command Code, Data and UDID Data. Search capability for Errors – Any, ACK, NACK.
Bus setup	
PEC Byte as True	

Table continued…

Characteristic	Description
Formats available	Hex Binary Mixed
PEC	Optional PEC Byte – False as default

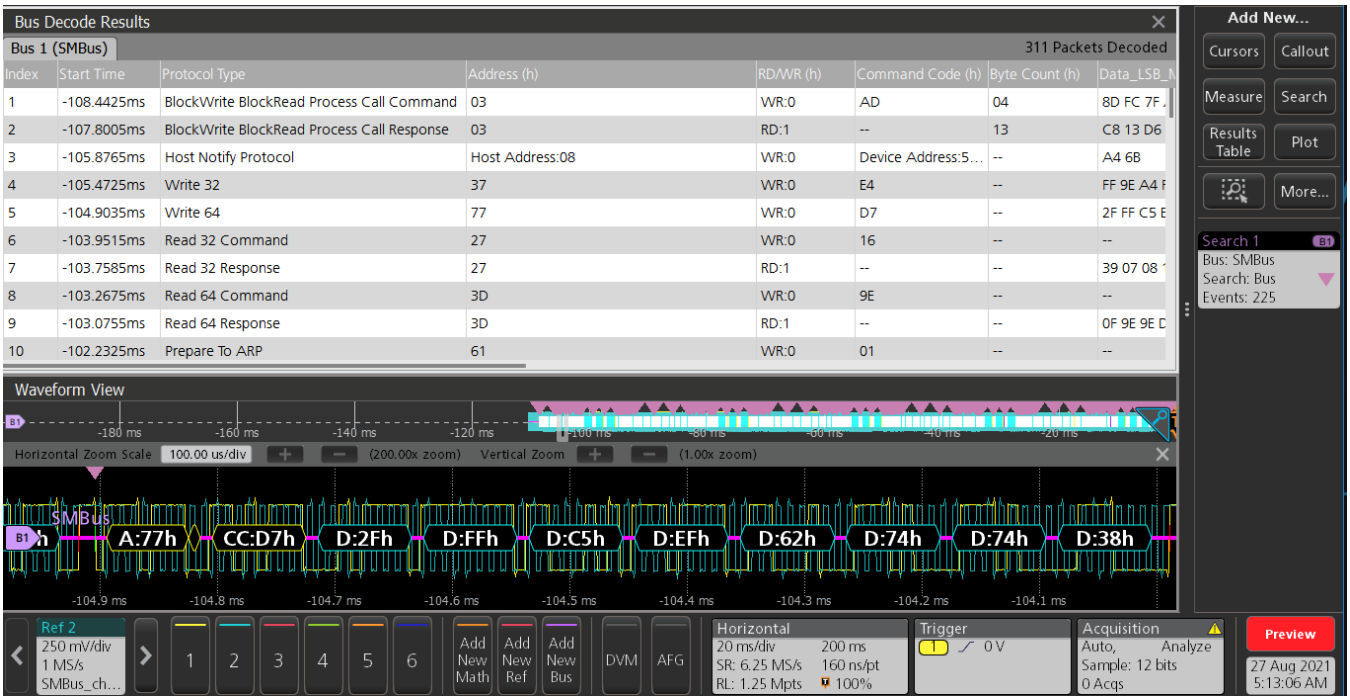
Display modes

Characteristic	Description
Bus	Bus only
Results table	Decoded packet data in a tabular view with columns containing: **1.** Protocol Type **2.** Address **3.** Read/Write **4.** Command Code **5.** Byte Count **6.** Data **7.** Acknowledgement PEC
Decode Display	**Green:** Start, Repeated Start **Yellow:** Address, Host Address, Device Address, Slave Address, Device Slave Address, Assigned Address, Targeted Slave Address, Read, Write, Read/Write, Command Code, Byte Count, Bit, Idle **Cyan:** Data, Device Capabilities, Version Revision, Interface, Vendor ID, Device ID, Subsystem Vendor ID, Subsystem Device ID, Vendor Specific ID **Purple:** PEC **Red:** End
Error Handling	Any, ACK, NACK

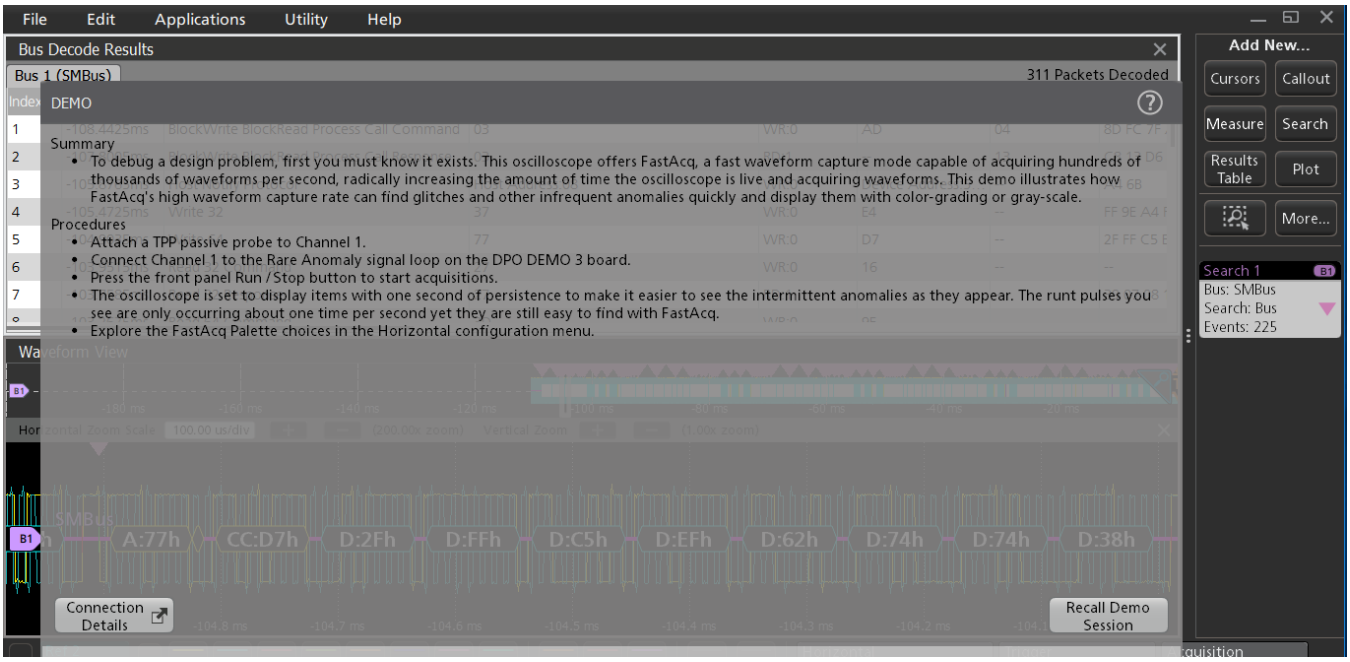
Bus search options

Characteristic	Description
Search On	**Start:** Select to search on the start events. **Repeated Start:** Select to search on the repeated start events. **Address:** Sets the 7-bit address pattern that you want to search. **Host Address:** Select to search on the host address. **Device Address:** Set the 7-bit device address that you want to search. **Command Code:** Sets the 8-bit command code that you want to search.

Characteristic	Description
	Data: Sets the data pattern that you want to search. **Data Bytes:** Sets the number of data bytes that you want to search (1 to 8 bytes). **Field Bytes:** Sets the field bytes as 1, 2, or 4 for **UDID Data**. **UDID Data:** Sets the UDID data that you want to search. **Error Type:** Sets the error bytes that you want to search. You can search on ANY, ACK, NACK, and PEC errors (PEC error search is available only when the **PEC Byte** in SMBus bus configuration is set as True). **Stop:** Select to search on the stop events. **Idle:** Select to search on the idle events.



The Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the SMBus bus. (PEC Byte set to False)



The DEMO file content provides the information of the SMBus bus

Ordering information

Protocol Bundles

Specially designed SW bundles with 1 year renewable and perpetual to suit your Design and validation needs.

Validate your Protocols with our industry standard Serial analysis software available for over 30 technologies.

Pro bundle for Serial Analysis teams. Our standards expertise and Integrated Protocol Decoders help you shorten your design cycle, gain greater technical insight and improve team productivity to bring new products and services to market much faster.

Serial Decode	Description	4 Series MSO	5 Series MSO	6 Series MSO
4-RL-1	Record length enhancement to 62.5 million sample points .	✔	✖	✖
5-RL-125M	Record length enhancement to 125 million sample points .	✖	✔	✖
6-RL-2	Record length enhancement to 250 million sample points .	✖	✖	✔
SRAUDIO	Audio Serial Triggering and Analysis (I2S, LI, RJ, TDM). Enables triggering on packet-level information on serial audio buses.	✔	✔	✔
SRAUTO	Automotive Serial Triggering and Analysis (CAN, CAN FD, CAN XL, LIN, FlexRay). Enables triggering on packet-level information on CAN/CAN FD/CAN XL/LIN/FelxRay.	✔	✔	✔
SRNET	Ethernet Serial Triggering and Analysis (10BASE-T, 100BASE-T). Enables decoding and analysis on Ethernet buses.	✔	✔	✔
SRI3C	I3C Serial Decoding and Analysis. Enables decoding and searching on packet-level information on MPI I3C.	✔	✔	✔
SRNRZ	NRZ Serial Decoding and Analysis. Supports NRZ with normal and inverted polarity with Bit order (MSB or LSB first).	✔	✔	✔
SRPM	Power Management Serial Triggering and Analysis. Enables triggering on packet-level information on SPMI buses.	✔	✔	✔
SRUSB2	USB 2.0 Serial Triggering and Analysis. Enables triggering on packet-level information on USB 2.0 buses.	✔	✔	✔
SRUSB3	USB 3.0, USB 3.1 Gen 1, USB 3.2 Gen 1 Serial Decoding and Analysis. Extensive search options.	✖	✖	✔
SRPCIE321	PCIe Serial Decoding and Analysis. Extensive search options.	✖	✖	✔
SRMDIO	MDIO Protocol Decoder and Search. Extensive search options.	✔	✔	✔
SRSVID	SVID Protocol Decider and Search. Supports version rev.1.92. Extensive search options	✔	✔	✔
SR8B10B	8B10B Serial Decoding and Analysis. Finds and displays parity error if found in 4-bit or 6-bit for the 10-bit symbol in 8b10b	✖	✔	✔
SRETHERCAT	ETHERCAT Protocol Decoder and search. Enables decoding and analysis on EtherCAT buses.	✔	✔	✔
SRSMBUS	SMBUS Protocol Decoder and search. Enables decoding and analysis on SMbus buses.	✔	✔	✔
1 Year License		4-PRO-SERIAL-1Y	5-PRO-SERIAL-1Y	6-PRO-SERIAL-1Y
Perpetual License		4-PRO-SERIAL-PER	5-PRO-SERIAL-PER	6-PRO-SERIAL-PER

Pro Bundle for Military and Aerospace designers. Our Software design tools help you shorten your design cycle, gain greater technical insight and improve team productivity to bring new products and services to market much faster.

Serial Decode	Description	4 Series MSO	5 Series MSO	6 Series MSO
4-RL-1	Record length enhancement to 62.5 million sample points.	✔	✖	✖

Table continued…

Serial Decode	Description	4 Series MSO	5 Series MSO	6 Series MSO
5-RI-125M	Record length enhancement to 125 million sample points.	✖	✔	✖
6-RL-2	Record length enhancement to 250 million sample points.	✖	✖	✔
SRAERO	Aerospace Serial Triggering and Analysis (MIL-STD-1553, ARINC429). Enables triggering on packet-level information.	✔	✔	✔
SRSPACEWIRE	SpaceWire serial analysis. Enables decoding and analysis on SpaceWire buses.	✔	✔	✔
MTM		✔	✔	✔
SRNRZ	NRZ Serial Decoding and Analysis. Supports NRZ with normal and inverted polarity with Bit order (MSB or LSB first).	✖	✔	✔
DJA	Jitter Analysis Package including TIE, Eye diagram, Histogram and other advanced analysis measurements.	✔	✔	✔
1 Year License		4-PRO-MILGOV-1Y	5-PRO-MILGOV-1Y	6-PRO-MILGOV-1Y
Perpetual License		4-PRO-MILGOV-PER	5-PRO-MILGOV-PER	6-PRO-MILGOV-PER

To add to an instrument at purchase

Serial bus type	3 Series MDO Option	4 Series MSO Option	5 Series MSO Option	6 Series MSO Option	Description
MIL-STD-1553, ARINC 429	3-SRAERO	4-SRAERO	5-SRAERO	6-SRAERO	Aerospace Serial Triggering and Analysis (MIL-STD-1553, ARINC 429). Enables triggering on packet-level information on MIL-STD-1553 and ARINC 429 buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
I^2S, LJ, RJ, TDM	3-SRAUDIO	4-SRAUDIO	5-SRAUDIO	6-SRAUDIO	Audio Serial Triggering and Analysis (I^2S, LJ, RJ, TDM). Enables triggering on packet-level information on serial audio buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
8b10b	N/A	N/A	5-SR8B10B	5-SR8B10B	8B10B Serial Decoding and Analysis. Enables decoding and searching the packet-level information on buses with analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information. Finds and displays parity error if found in 4-bit or 6-bit for the 10-bit symbol in 8b10b.
NRZ	N/A	4-SRNRZ	5-SRNRZ	6-SRNRZ	NRZ Serial Decoding and Analysis. Enables decoding and searching the packet-level information on buses with analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information. Variants like NRZ-I, NRZ-M, NRZ-S, and NRZ-C are not supported currently. Supports only NRZ with normal and inverted polarity with Bit Order (MSB or LSB First).
CAN, CAN FD, CAN XL, LIN, FlexRay	3-SRAUTO (Except CAN XL)	4-SRAUTO	5-SRAUTO	6-SRAUTO	Automotive Serial Triggering and Analysis (CAN, CAN FD, CAN XL, LIN, FlexRay). Enables triggering on packet-level information on CAN/CAN FD/CAN XL/LIN/FlexRay buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.

Table continued…

Serial bus type	3 Series MDO Option	4 Series MSO Option	5 Series MSO Option	6 Series MSO Option	Description
Automotive 10BASE-T1S, 100BASE-T1	N/A	N/A	5-SRAUTOEN1	6-SRAUTOEN1	10BASE-T1S Serial trigger with decoder and 100Base-T1 Automotive Ethernet serial decode. Includes analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
SENT	N/A	4-SRAUTOSEN	5-SRAUTOSEN	6-SRAUTOSEN	Automotive Sensor Serial Triggering and Analysis (SENT). Enables triggering on packet-level information on SENT buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
RS-232/422/485, UART	3-SRCOMP	4-SRCOMP	5-SRCOMP	6-SRCOMP	Computer Serial Triggering and Analysis (RS-232, RS-422, RS-485, UART). Enables triggering on packet-level information on RS-232/422/485 and UART buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
I ^{2}C, SPI	3-SREMBD	4-SREMBD	5-SREMBD	6-SREMBD	Embedded Serial Triggering and Analysis (I^{2}C, SPI). Enables triggering on packet-level information on I^{2}C and SPI buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
Ethernet	N/A	4-SRENET	5-SRENET	6-SRENET	Ethernet Serial Triggering and Analysis (10BASE-T, 100BASE-T). Enables triggering on packet-level information on Ethernet buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
I3C	N/A	4-SRI3C	5-SRI3C	6-SRI3C	I3C Serial Decoding and Analysis. Enables decoding and searching on packet-level information on MIPI I3C buses with analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
SPMI	N/A	4-SRPM	5-SRPM	6-SRPM	Power Management Serial Triggering and Analysis (SPMI). Enables triggering on packet-level information on SPMI buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
Spacewire	N/A	4-SRSPACEWIRE	5-SRSPACEWIRE	6-SRSPACEWIRE	Spacewire serial analysis. Enables decoding and analysis on Spacewire buses.
USB 2.0	3-SRUSB2	4-SRUSB2	5-SRUSB2	6-SRUSB2	USB 2.0 Serial Triggering and Analysis. Enables triggering on packet-level information on USB 2.0 buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
USB 3.0	N/A	N/A	N/A	6-SRUSB3	USB serial triggering and analysis (USB 3.0) for 6 Series oscilloscopes.
USB 3.1 Gen 1	N/A	N/A	N/A	6-SRUSB3	USB serial triggering and analysis (USB 3.1 (Gen 1, 2*)) for 6 Series oscilloscopes, * appears when upgrade is available.

Table continued…

Serial bus type	3 Series MDO Option	4 Series MSO Option	5 Series MSO Option	6 Series MSO Option	Description
USB 3.2 Gen 1	N/A	N/A	N/A	6-SRUSB3	USB serial triggering and analysis (USB 3.2 (Gen 1, 2*)) for 6 Series oscilloscopes, * appears when upgrade is available.
Serial options bundle	3-BND	N/A	N/A	N/A	Adds all serial analysis options and the power analysis option available for an instrument.
PCIe	N/A	N/A	N/A	6-SRPCIE321	PCIe serial decoding and analysis (PCIe Gen 1/Gen 2/Gen 3) for 6 Series B oscilloscope.
PSI5	N/A	4-SRPSI5	5-SRPSI5	6-SRPSI5	PSI5 Serial Decoding (v1.3 and 2.1) and analysis. Enables decoding and Search Packet level information with analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
MDIO	N/A	4-SRMDIO	5-SRMDIO	6-SRMDIO	MDIO Protocol Decoder and Search, No Hardware Trigger; Node locked
SVID	N/A	4-SRSVID	5-SRSVID	6-SRSVID	SVID Protocol Decoder and Search, No Hardware Trigger; Node locked
e-USB2	N/A	4-SREUSB2	5-SREUSB2	6-SREUSB2	eUSB2 Protocol Decoder and Search; Node locked
DPHY	N/A	N/A	5- SRDPY	6- SRDPY	DPHY CSI/DSI (DSI2.0 /CSI2.0 protocols decoder. Supports HS data transmission burst, and escape mode functionality. Data transmission can be with 8-bit raw data or using 8b9b encoded symbol
MANCHESTER	N/A	4-SRMANCH	5-SRMANCH	6-SRMANCH	Supports Generic Manchester decode. Decode of packets as per packet structure defined. Decode of Errors like Sync, Parity, Manchester
SDLC		4-SRSDLC	5-SRSDLC	6-SRSDLC	SDLC decoder and Search. Extensive search options on captured waveforms like unnumbered , Supervisory, address etc
CPHY 1.2	N/A	N/A	5-SRCPHY	6-SRCPHY	MIPI C-PHY CSI/DSI Protocol Decoder and Search
1-Wire	N/A	4-SRONEWIRE	5-SRONEWIRE	6-SRONEWIRE	1-Wire Protocol Decoder and search
eSPI	N/A	4-SRESPI	5-SRESPI	6-SRESPI	eSPI Protocol Decoder and search
CXPI	N/A	4-SRCXPI	5-SRCXPI	6-SRCXPI	CXPI Protocol Decoder and search
ETHERCAT	N/A	4-SRETHERCAT	5-SRETHERCAT	6-SRETHERCAT	ETHERCAT Protocol Decoder and search
SMBUS	N/A	4-SRSMBUS	5- SRSMBUS	6- SRSMBUS	SMBUS Protocol Decoder and search
NFC	N/A	4-RFNFC	5-RFNFC	6-RFNFC	NFC protocol decode and search

To upgrade an already purchased instrument

Serial bus [3]	3 Series MDO Node-Locked License [4]	4 Series MSO Node-Locked/ Floating License	5 Series MSO Node-Locked/ Floating License	6 Series MSO Node-Locked/ Floating License
MIL-STD-1553, ARINC 429	SUP3 SRAERO	SUP4-SRAERO SUP4-SRAERO-FL	SUP5-SRAERO SUP5-SRAERO-FL	SUP6-SRAERO SUP6-SRAERO-FL
I^2S, LJ, RJ, TDM	SUP3 SRAUDIO	SUP4-SRAUDIO SUP4-SRAUDIO-FL	SUP5-SRAUDIO SUP5-SRAUDIO-FL	SUP6-SRAUDIO SUP6-SRAUDIO-FL
CAN, CAN FD, CAN XL, LIN, FlexRay	SUP3 SRAUTO (Except CAN XL)	SUP4-SRAUTO SUP4-SRAUTO-FL	SUP5-SRAUTO SUP5-SRAUTO-FL	SUP6-SRAUTO SUP6-SRAUTO-FL
8B10B	N/A	N/A	SUP5-SR8B10B SUP5-SR8B10B-FL	SUP6-SR8B10B SUP6-SR8B10B-FL
NRZ	N/A	SUP4-SRNRZ SUP4-SRNRZ-FL	SUP5-SRNRZ SUP5-SRNRZ-FL	SUP6-SRNRZ SUP6-SRNRZ-FL
10BASE-T1S, 100BASE-T1 Automotive Ethernet	N/A	N/A	SUP5-SRAUTOEN1 SUP5-SRAUTOEN1-FL	SUP6-SRAUTOEN1 SUP6-SRAUTOEN1-FL
SENT	N/A	SUP4-SRAUTOSEN SUP4-SRAUTOSEN-FL	SUP5-SRAUTOSEN SUP5-SRAUTOSEN-FL	SUP6-SRAUTOSEN SUP6-SRAUTOSEN-FL
RS-232/422/485, UART	SUP3 SRCOMP	SUP4-SRCOMP SUP4-SRCOMP-FL	SUP5-SRCOMP SUP5-SRCOMP-FL	SUP6-SRCOMP SUP6-SRCOMP-FL
I^2C, SPI	SUP3 SREMBD	SUP4-SREMBD SUP4-SREMBD-FL	SUP5-SREMBD SUP5-SREMBD-FL	SUP6-SREMBD SUP6-SREMBD-FL
Ethernet	N/A	SUP4-SRENET SUP4-SRENET-FL	SUP5-SRENET SUP5-SRENET-FL	SUP6-SRENET SUP6-SRENET-FL
I3C	N/A	SUP4-SRI3C SUP4-SRI3C-FL	SUP5-SRI3C SUP5-SRI3C-FL	SUP6-SRI3C SUP6-SRI3C-FL
SPMI	N/A	SUP4-SRPM SUP4-SRPM-FL	SUP5-SRPM SUP5-SRPM-FL	SUP6-SRPM SUP6-SRPM-FL
Spacewire	N/A	SUP4-SRSPACEWIRE SUP4-SRSPACEWIRE	SUP5-SRSPACEWIRE SUP5-SRSPACEWIRE-FL	SUP6-SRSPACEWIRE SUP6-SRSPACEWIRE-FL
USB 2.0	SUP3 SRUSB2	SUP4-SRUSB2 SUP4-SRUSB2-FL	SUP5-SRUSB2 SUP5-SRUSB2-FL	SUP6-SRUSB2 SUP6-SRUSB2-FL
USB 3.0	N/A	N/A	N/A	SUP6-SRUSB3 SUP6-SRUSB3-FL

Table continued…

[3] Software is supplied with the instrument firmware. Always download and install the latest version of the firmware. Option documentation is part of the application Help.

[4] 3 Series MDO option license names do not have a dash in the option number.

Serial bus [3]	3 Series MDO Node-Locked License [4]	4 Series MSO Node-Locked/ Floating License	5 Series MSO Node-Locked/ Floating License	6 Series MSO Node-Locked/ Floating License
USB 3.1 Gen 1	N/A	N/A	N/A	SUP6-SRUSB3 SUP6-SRUSB3-FL
USB 3.2 Gen 1	N/A	N/A	N/A	SUP6-SRUSB3 SUP6-SRUSB3-FL
Serial analysis bundle [5]	SUP3 BND	N/A	N/A	N/A
PCIe Gen 1/Gen 2/Gen 3	N/A	N/A	N/A	SUP6-SRPCIE321 SUP6-SRPCIE321-FL
PSI5	N/A	SUP4-SRPSI5 SUP4-SRPSI5-FL	SUP5-SRPSI5 SUP5-SRPSI5-FL	SUP6-SRPSI5 SUP6-SRPSI5-FL
MDIO	N/A	SUP4-SRMDIO SUP4-SRMDIO-FL	SUP5-SRMDIO SUP5-SRMDIO-FL	SUP6-SRMDIO SUP6-SRMDIO-FL
SVID	N/A	SUP4-SRSVID SUP4-SRSVID-FL	SUP5-SRSVID SUP5-SRSVID-FL	SUP6-SRSVID SUP6-SRSVID-FL
e-USB2	N/A	SUP4-SREUSB2 SUP4-SREUSB2-FL	SUP5-SREUSB2 SUP5-SREUSB2-FL	SUP6-SREUSB2 SUP6-SREUSB2-FL
DPHY	N/A	N/A	SUP5-SRDPHY SUP5-SRDPHY -FL	SUP6-SRDPHY SUP6-SRDPHY-FL
MANCHESTER	N/A	SUP4-SRMANCH SUP4-SRMANCH-FL	SUP5-SRMANCH SUP5-SRMANCH-FL	SUP6- SRMANCH SUP6- SRMANCH -FL
SDLC	N/A	SUP4-SRSDLC SUP4- SRSDLC -FL	SUP5- SRSDLC SUP5- SRSDLC -FL	SUP6- SRSDLC SUP6- SRSDLC -FL
CPHY 1.2	N/A	N/A	SUP5-SRCPHY	SUP6-SRCPHY
1-Wire	N/A	SUP4-SRONEWIRE	SUP5-SRONEWIRE	SUP6-SRONEWIRE
eSPI	N/A	SUP4-SRESPI SUP4-SRESPI-FL	SUP5-SRESPI SUP5-SRESPI-FL	SUP6-SRESPI SUP6-SRESPI-FL
CXPI	N/A	SUP4-SRCXPI SUP4-SRCXPI-FL	SUP5-SRCXPI SUP5-SRCXPI-FL	SUP6-SRCXPI SUP6-SRCXPI-FL
ETHERCAT	N/A	SUP4-SRETHERCAT SUP4-SRETHERCAT-FL	SUP5-SRETHERCAT SUP5-SRETHERCAT-FL	SUP6-SRETHERCAT SUP6-SRETHERCAT-FL

Table continued…

3 Software is supplied with the instrument firmware. Always download and install the latest version of the firmware. Option documentation is part of the application Help.

4 3 Series MDO option license names do not have a dash in the option number.

Serial bus [3]	3 Series MDO Node-Locked License [4]	4 Series MSO Node-Locked/ Floating License	5 Series MSO Node-Locked/ Floating License	6 Series MSO Node-Locked/ Floating License
SMBUS	N/A	SUP4-SRSMBUS SUP4-SRSMBUS-FL	SUP5-SRSMBUS SUP5-SRSMBUS-FL	SUP6-SRSMBUS SUP6-SRSMBUS-FL
NFC	N/A	SUP4-RFNFC SUP4-RFNFC-FL	SUP5-RFNFC SUP5-RFNFC-FL	SUP6-RFNFC SUP6-RFNFC-FL

Recommended probes

Please refer to *www.tek.com/probes* for further information on the recommended models of probes and any necessary probe adapters.

Partner products ordering information

To add to an instrument at purchase (Supports Windows Option)

Serial bus type	Minimum Bandwidth	Recommended Probes	5 Series MSO Option	6 Series/6B Series MSO Option	Description
PGY-eMMC (Windows Option Only)	2 GHz	Standard probes of MSO5/6 series	PGY-eMMC	PGY-eMMC	eMMC and SD (UHS-I) electrical measurements and Protocol decoding. software conforms to eMMC version 4.41,4.51,5.0, 5.1 specification. Supports Boot, SDR, DDR, HS200 and HS400 mode for electrical measurement and protocol Decode
PGY-SDIO(Windows Option Only)	2 GHz	Standard probes of MSO5/6 series	PGY-I2C	PGY-I2C	I2C Electrical Validation and Protocol decode SW
PGY-QSPI(Windows Option Only)	500 MHz	Standard probes of MSO5/6 series	PGY-SPI	PGY-SPI	Electrical measurements compliance testing and protocol decoding as specified in QSPI specification. Supports Single and Dual Transfer rate (STR/DTR), electrical measurements and compliance testing for Ext SPI, Dual SPI and Quad SPI. Supports Triggering on command index and on S# falling edge. Supports Analog and Digital Channels of Tektronix MSO Series

Reference Selling of List of protocols supported on MSO series (please note: Windows only)

Serial bus type	Minimum Bandwidth	Recommended Probes	Ordering	5 Series MSO Option	6 Series/6B Series MSO Option	Description
RFFE	500 MHz	Standard probes of MSO5/6 series	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-RFFE	PGY-RFFE	RFFE Protocol Trigger & Decode Analysis Software. PGY-RFFE utilizes the hardware based real-time RFFE protocol aware trigger, protocol analysis of long acquisition record length up to 125MB to provide superior RFFE Protocol Analysis result at press of button.

Table continued…

[3] Software is supplied with the instrument firmware. Always download and install the latest version of the firmware. Option documentation is part of the application Help.

[4] 3 Series MDO option license names do not have a dash in the option number.

[5] All serial bus and power analysis options that are available for an instrument.

Serial bus type	Minimum Bandwidth	Recommended Probes	Ordering	5 Series MSO Option	6 Series/6B Series MSO Option	Description
I2S	500 MHx and above	standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-I2S	PGY-I2S	I2S Electrical, Audio and Protocol Testing SW
I2C	500 MHz and above	standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-I2C	PGY-I2C	I2C Electrical Validation and Protocol decode SW
SPI	500 MHz and above	standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-SPI	PGY-SPI	SPI Electrical Validation and Protocol decode SW
I3C	500 MHz and above	standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-I3C	PGY-I3C	I3C Electrical Validation, Protocol trigger and Decode software
JTAG	500 MHz and above	standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-JTAG	PGY-JTAG	JTAG Protocol decode Software
ONFI	4 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-ONFI	PGY-ONFI	ONFI Electrical Timing Analysis Sw
SPMI	500 MHz and above	standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-SPMI	PGY-SPMI	SPMI Protocol Decode Software
MPHY	16 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-UPRO PGY-LLI PGY-UFS(needs PGY-UPRO)	PGY-UPRO PGY-LLI PGY-UFS(needs PGY-UPRO)	MIPI MPHY -UniPro/LLI/UFS Protocol Decode Sw
USB 2.0	2 GHz	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-USB	PGY-USB	USB 2.0 Protocol Decode Sw
USB-PD	500 MHz and above	Standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-PD	PGY-PD	USB PD (CC) Protocol Analysis Sw
UART	500 MHz and above	Standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-UART	PGY-UART	UART Electrical Validation and Protocol Decode Software
KX/KR	12 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-NEGO	PGY-NEGO	KX/KR DME and Line Training Analysis Sw

Table continued…

Serial bus type	Minimum Bandwidth	Recommended Probes	Ordering	5 Series MSO Option	6 Series/6B Series MSO Option	Description
10Base-T1S	500 MHz and above	Standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-10Base T1S	PGY-10Base T1S	10 Base-T1S Protocol Decode Sw
100Base-T1	2 GHz and above	Standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-100Base T1	PGY-100Base T1	100 Base-T1 Protocol Decode Sw
SVID	500 MHz and above	Standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-SVID	PGY-SVID	SVID Protocol Decode Sw
USB3 Gen 1	23 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-USB3 Gen1	PGY-USB3 Gen1	USB3 Gen 1 5 Gbps Protocol Decode Sw
USB3 Gen 2	23 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-USB3 Gen1	PGY-USB3 Gen1	USB3 Gen 2 Protocol Decode Sw
8B10B	4 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-8B10B	PGY-8B10B	8B10B Protocol Decode Sw
1000T1-LT	4 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-1000T1-LT	PGY-1000T1-LT	1000BaseT1 Line Training Decode Software

Terms and Conditions Lead time of 2-3 Weeks ARO.

Tektronix is ISO 14001:2015 and ISO 9001:2015 certified by DEKRA.

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For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit *www.tek.com*.

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