Envision X14

MIPI C-Phy/D-Phy CSI/DSI Generator and Analyzer

July 2025

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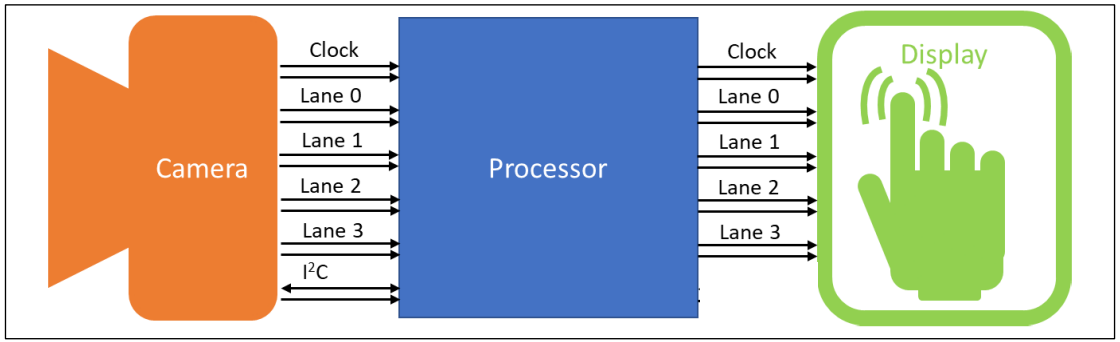
MIPI (Mobile Industry Processor Interface) D-Phy – Technical Overview

- D-Phy is the physical layer transport technology:
  - Provides a Low-cost, High-Speed serial interface solution for communication interconnection between components inside a mobile device.
  - Support Camera Serial Interface (CSI) for communication from a camera or image sensor to a processor.
  - Support Display Serial Interface (DSI) for communication from a processor to a Display Controller.



MIPI CSI/DSI Protocol Analysis/Generator – Envision X14 – SKUs

- The Envision X14 is a D-Phy/ C-Phy, Analyzer & Generator for CSI-2 and DSI-2 protocols.
- Envision X14 provides a One-Box hardware solution.
- Ala Carte Licensing:
  - Choose a Phy - C-Phy & D-Phy licensed separately.
  - Choose a Protocol: CSI & DSI are licensed separately.
  - Choose an Application: Generator and Analyzer are licensed separately.
  - One set of probes for both C-Phy and D-Phy).

SKU	Description
Envision X14 System	
ENV14-CD01-TAA-X	Envision X14 System
Envision X14 Licenses	
ENV14-CD01-ANA-A	Envision X14 Analyzer License
ENV14-CD01-CPHY-A	Envision X14 C-PHY License
ENV14-CD01-CSI-A	Envision X14 CSI Protocol License
ENV14-CD01-DPHY-A	Envision X14 D-PHY License
ENV14-CD01-DSI-A	Envision X14 DSI Protocol License
ENV14-CD01-GEN-A	Envision X14 Generator License
Envision X14 Probes	
ENV14-SDP01-CDPRB-X	Envision X14 Solder Down Probe Amp Assembly for Analyzer
ENV14-SDP01-PRBKT-X	Envision X14 Solder Down Probe Tip Spares/Replacement
Envision X14 Cable Accessories	
ENV14-SMPCAB-AC001-X	Envision X14 SMP Cables (qty 10)
ENV14-SMPCAB-AC002-X	Envision X14 SMP Cables Spares/Replacement (qty 2)

Envision X14 – Hardware System

Envision X14 System

Envision X14 System – Rear View

Envision X14 Probe Amplifier

Probe Tips

- The Envision X14 system features standard SMP connectors that support C-PHY or D-PHY signals to provide high fidelity capture or transmission of traffic from all active lanes simultaneously.
- Field upgradeable firmware enables the Envision X14 to evolve and support new features or changes to the MIPI D-Phy and C-Phy and CSI-2 and DSI-2 specifications.
- Envision X14's capture analysis functions provide complex event-base triggering and enables detailed analysis of the phy level events, packet types for low power, high speed burst modes, start and end of transmission sequences as well as CRC and ECC error counts.
- All our captures are portable and can be shared with colleagues at other locations and to Teledyne LeCroy.

Envision X14 Management – Local Administration

- Administration of the Envision X14. Similar to the M4 series products (M41h, M42de). There are three (3) management options.
- Connected HDMI Display at the rear HDMI admin port. Use mouse and keyboard for control.

Envision X14 Management – Remote, External Administration with Host PC

- The Envision X14 can also be controlled from the external Video Protocol Suite (VPS) software application running on a host PC connected to the network.
- Could also use VNC from a PC to access the embedded VPS software application.
- This management mode enables you to keep the captures on our local PC for off-line analysis and distribution to other colleagues and subject matter experts at other locations.
- Used for upgrading the Envision X14 system software.

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MIPI C-Phy/D-Phy CSI/DSI Analyzer/Generator

Overview of Applications

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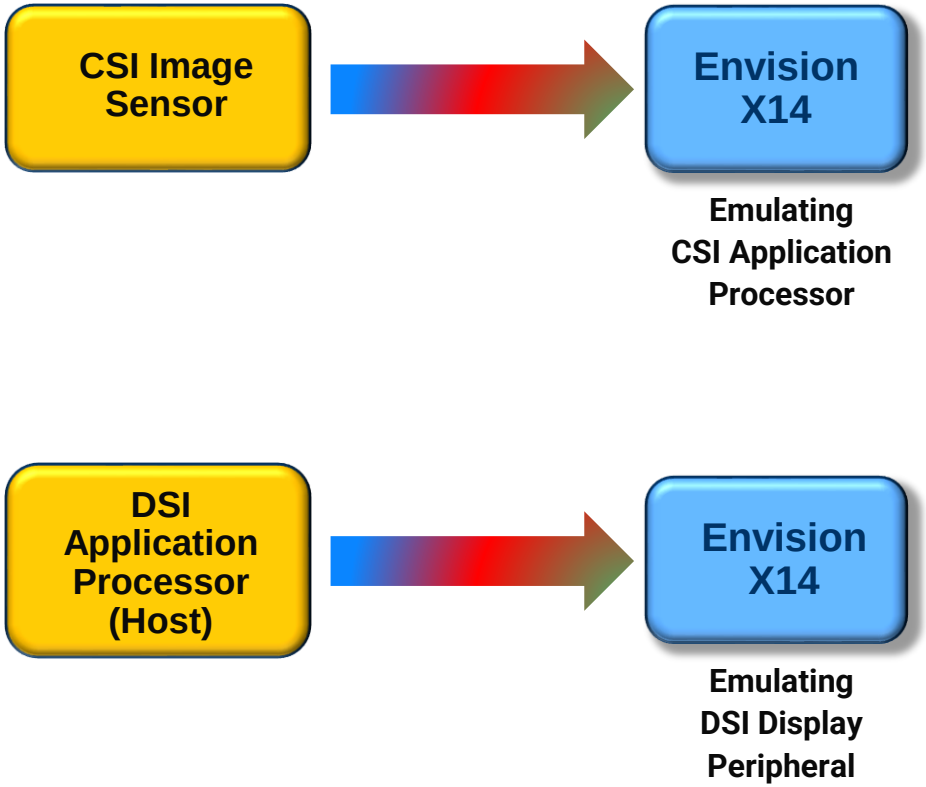
MIPI CSI/DSI Envision X14 Applications – CSI-2 & DSI-2 Emulation Analysis

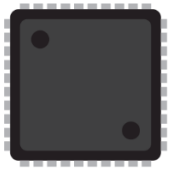


- Emulation Analysis
  - In the emulation analysis mode for either CSI or DSI (and either C-Phy or D-Phy, the Envision X14 is emulating either a CSI Application Processor or a DSI Display Peripheral.
  - **Note**: Solder-down probes are not used. These applications are depicted in the diagrams below for CSI and DSI respectively.

MIPI CSI/DSI Envision X14 Applications – CSI-2 and DSI-2 Emulation Analysis

CSI Camera (DUT)
(Image Sensor)

Envision X14
(CSI Host/SoC)

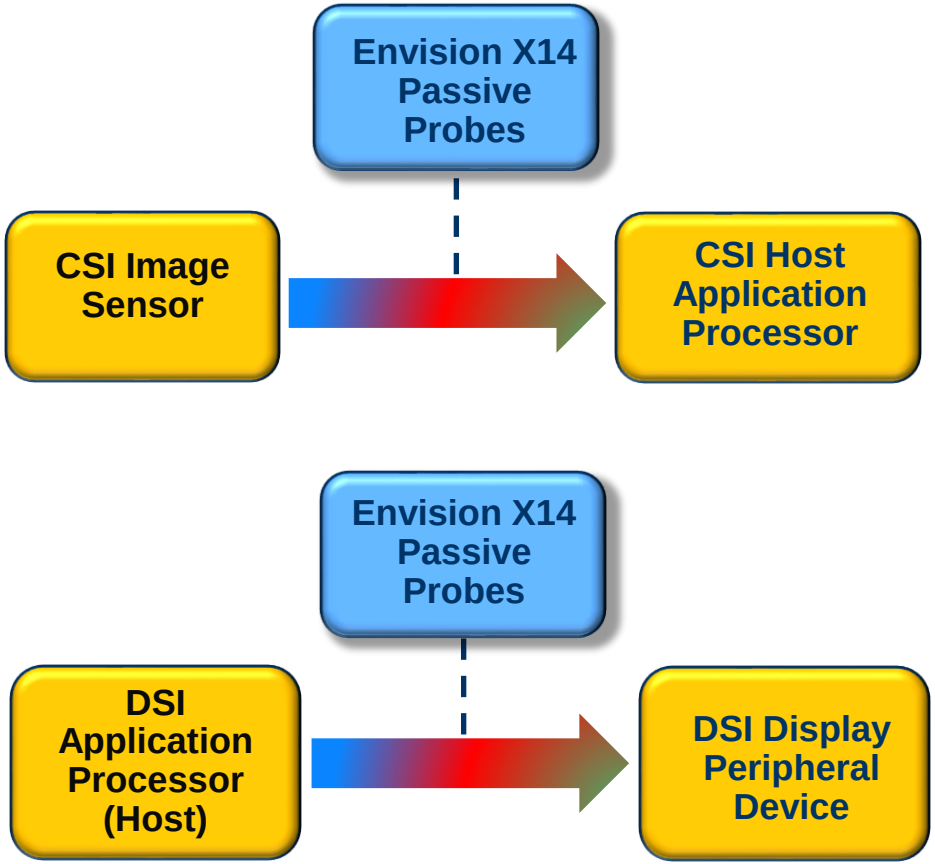


DSI Host SoC
DUT

Envision X14
(DSI Display Device)

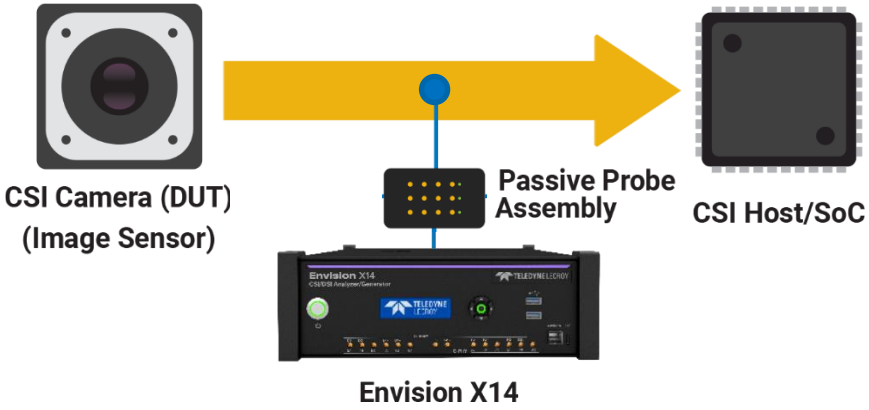
- The Envision X14 Analyzer can be positioned as an endpoint for SoC host emulation to test a CSI-2 stream from a camera or image sensor on a test board.
- The Envision X14 Analyzer can be positioned as an endpoint emulating a display device to test a DSI-2 SoC host on a test board.
- These configurations are depicted left and the connections are illustrated below.

MIPI CSI/DSI Envision X14 Applications – Passive Analysis



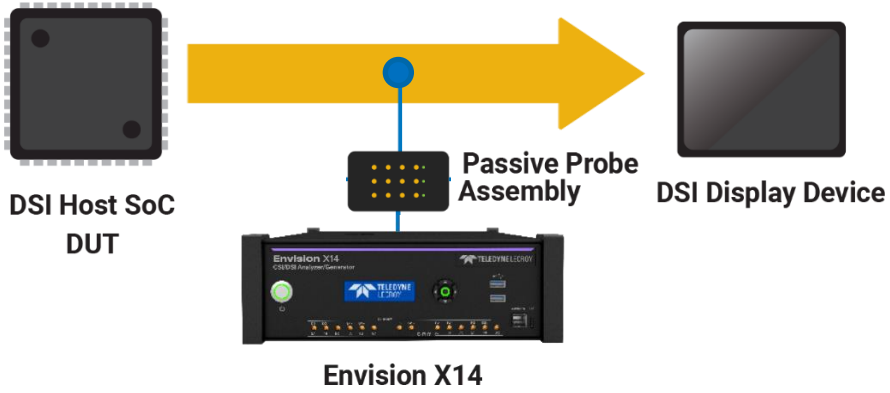
- Passive Monitoring Analysis
  - In the passive monitoring analysis mode the solder-down probe amplifier and probe tips are used. This application involves soldering the passive probes down between a CSI Image Sensor and the CSI Application processor or soldering the passive probes down between a DSI Application Processor and the DSI Display Peripheral.
  - **Note**: Solder-down probes are required. These applications are depicted in the diagrams below for CSI and DSI respectively.

MIPI CSI-2 Envision X14 Applications – Passive Analysis



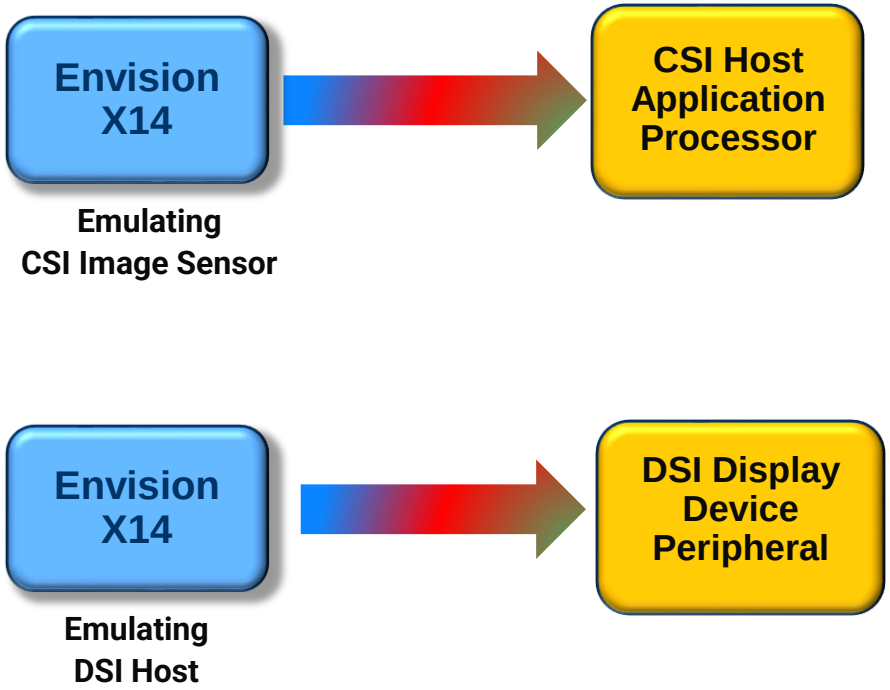
- The Envision X14 analyzer can be positioned as a passive tap between a CSI-2 host SoC and a CSI-2 camera or image sensor to passively sniff the traffic.
- Passive probing is invaluable where the transmission path undergoes a format conversion or traverses a transport facility.
- By positioning the Envision X14 passive probe elements at various points along the transport facility, you can segment and isolate the point of failure.

MIPI CSI-2 Envision X14 Applications – Passive Analysis



- The Envision X14 analyzer can be positioned as a passive tap between a DSI-2 host SoC and a DSI-2 display device to passively sniff the traffic.
- Passive probing is invaluable where the transmission path undergoes a format conversion or traverses a transport facility.
- By positioning the Envision X14 passive probe elements at various points along the transport facility, you can segment and isolate the point of failure.

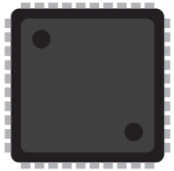
MIPI CSI-2/DSI-2 Envision X14 Applications – Image/Video Generation



- Image or Video Generation
  - In the generator mode, the Envision X14 is transmitting CSI image sensor data or DSI video pixel data.
  - **Note**: Solder-down probes are not used. These applications are depicted in the diagrams below for CSI and DSI respectively.

MIPI CSI-2/DSI-2 Envision X14 Applications – Image/Video Generation

Envision X14
Emulating a CSI-2 Image Sensor



CSI Host/SoC

Envision X14
Emulating a DSI-2 Host

DSI Display Device

- The Envision X14 generator can be emulate an CSI-2 to transmit image data to a CSI-2 host application processor.
- The Envision X14 generator can be emulate a DSI-2 application processor to transmit video data to a DSI-2 Display Device.
- These configurations are depicted left and the connections are illustrated below left.
- **Note**: The solder-down probes are not used in this application.

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MIPI C-Phy/D-Phy CSI/DSI – Status Update

Solder-Down Probes

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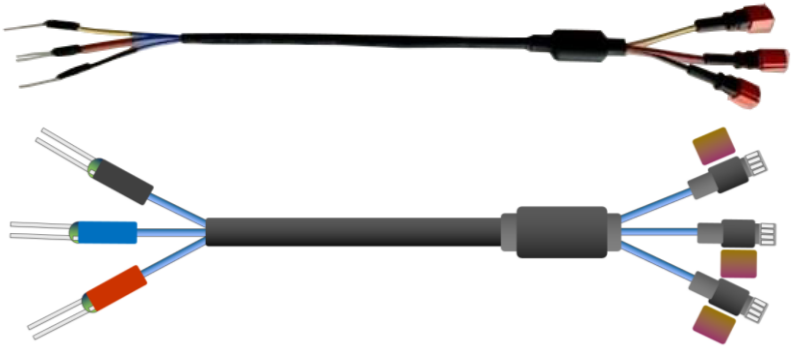
MIPI CSI/DSI Protocol Analysis – Envision X14 – Solder-Down Probes

- Envision X14 Solder-down probes Probe Amp Assembly SKU:

  ENV14-SDP01-CDPRB-X

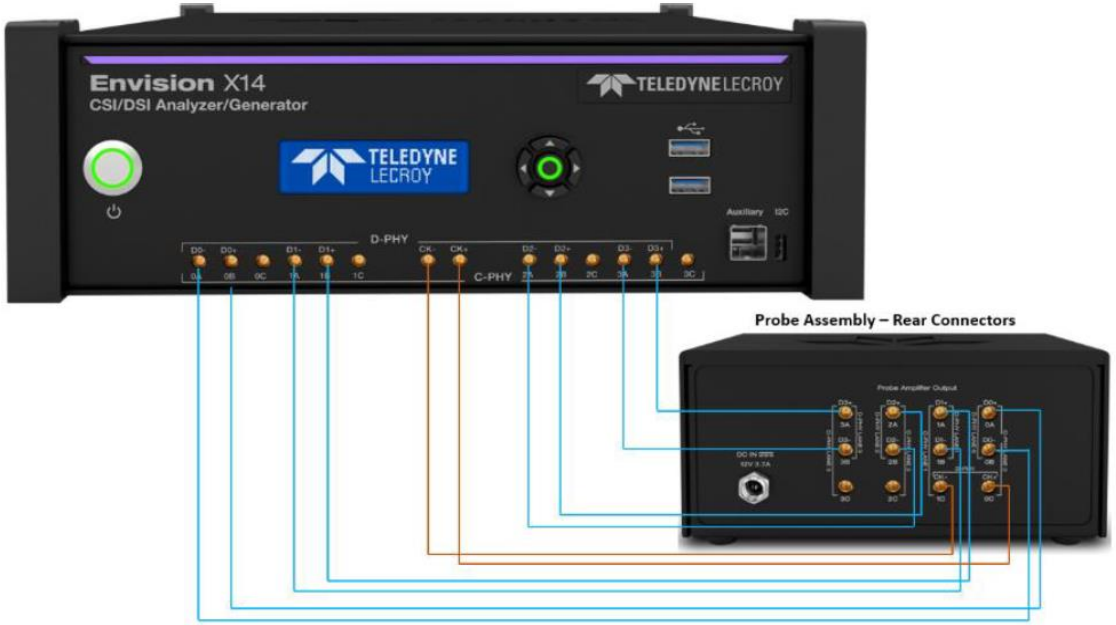
  Includes support for both C-Phy and D-Phy five (5) probe tips with three (3) Twinax connectors on one end and the three (3) solder-down probe tips on the other end. There will be one spare probe tip in a four (4) lane configuration for D-Phy.



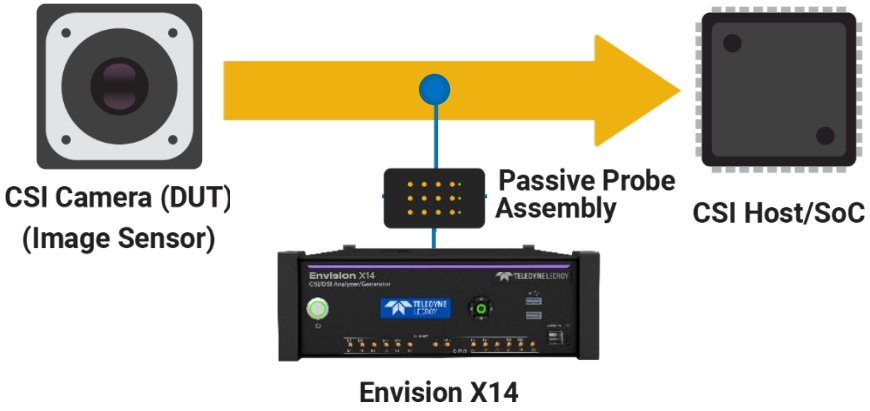
Envision X14 – Connections from Envision X14 System to Probe Amp Assembly.

To connect your source DUT to the Envision X14:

1. Connect the SMP cables provided with the Envision X14 and the Probe Assembly to the rear of the Envision X14 Probe Assembly using the illustration below.

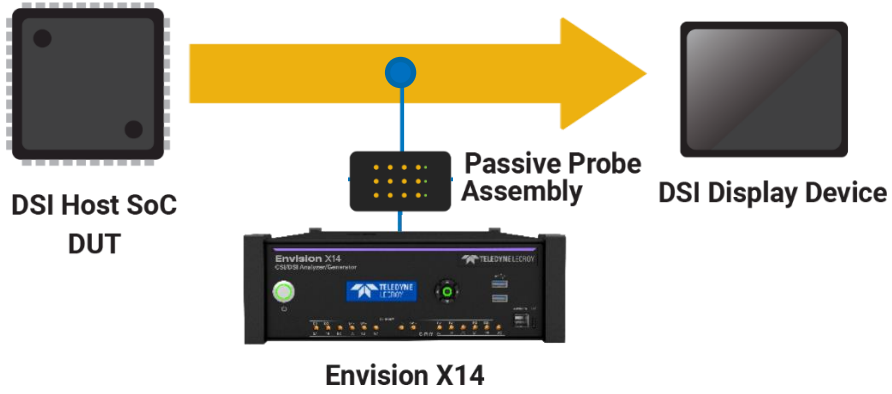


Envision X14 – MIPI C-Phy/D-Phy CSI-2 Analyzer Passive Probing



- The Envision X14 analyzer can be positioned as a passive tap between a CSI-2 host SoC and a CSI-2 camera or image sensor to passively sniff the traffic.
- Passive probing is invaluable where the transmission path undergoes a format conversion or traverses a transport facility.
- By positioning the Envision X14 passive probe elements at various points along the transport facility, you can segment and isolate the point of failure.

Envision X14 – MIPI C-Phy/D-Phy DSI-2 Analyzer Configurations



- In the DSI passive probing mode, the Envision X14 Analyzer is positioned as a passive tap between a DSI host SoC and a DSI display device to sniff traffic.
- This application is invaluable where the transmission path undergoes a format conversion or traverses a transport facility.
- By positioning the Envision X14 passive probe elements at various points along the transport facility, the Envision X14 can segment and isolate the point of failure.

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MIPI C-Phy/D-Phy CSI/DSI Analzyer

Examples of Analyzer operation

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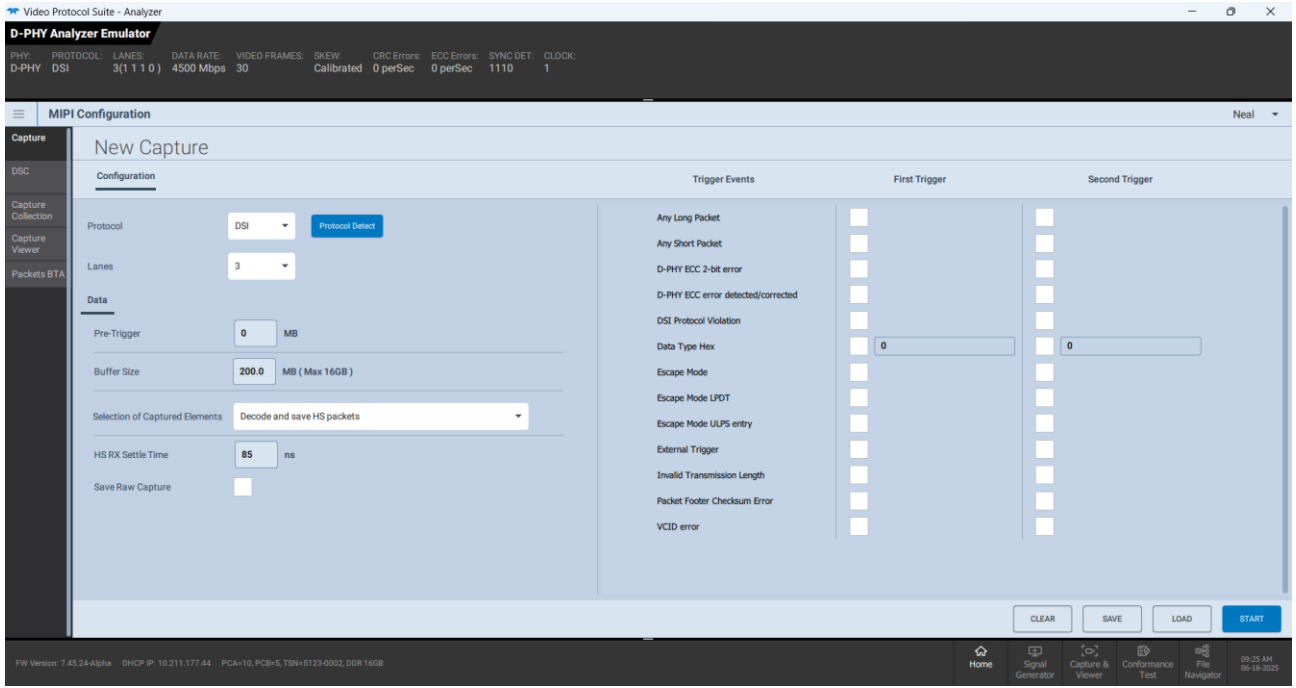
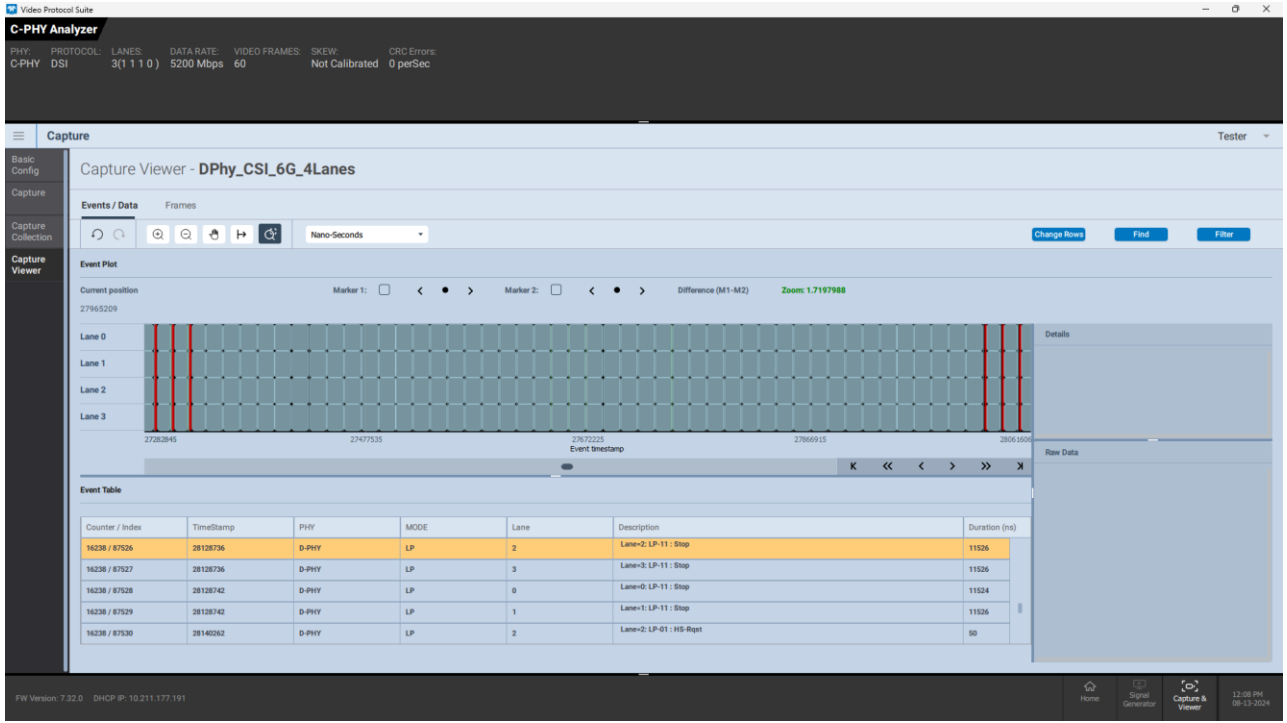
Envision X14 Analysis Software – Capture Triggering - New Triggers



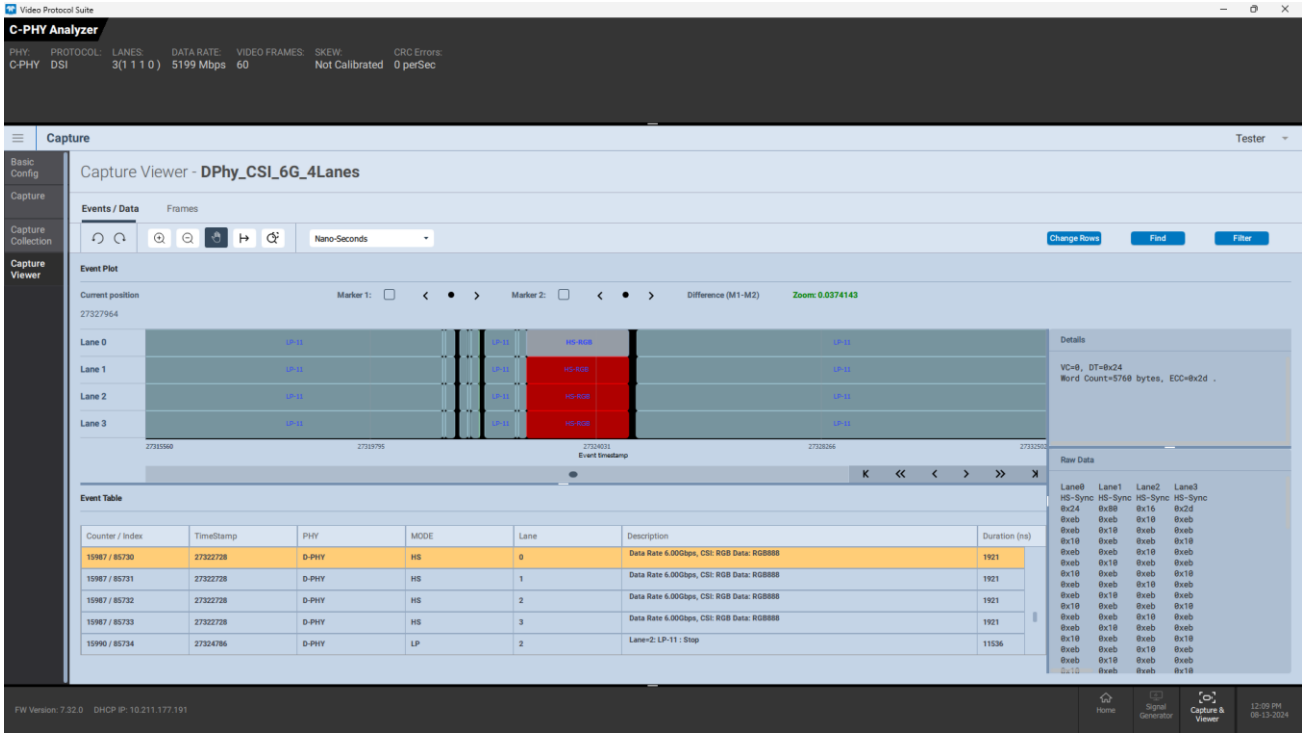
- Set up complex capture triggering to ensure that you capture the data of interest.
- Specify the event and the incident of an event to begin the capture.
- Specify multiple capture criteria as a logical OR and/or a logical AND function.
- The capture triggering feature also enables you to specify an external trigger condition through a connection from the SMA connector.
- Configure the capture trigger to capture data before and/or after the trigger condition(s) are met.

Envision X14 – Analysis Software – Showing D-Phy CSI Frame Blanking Region



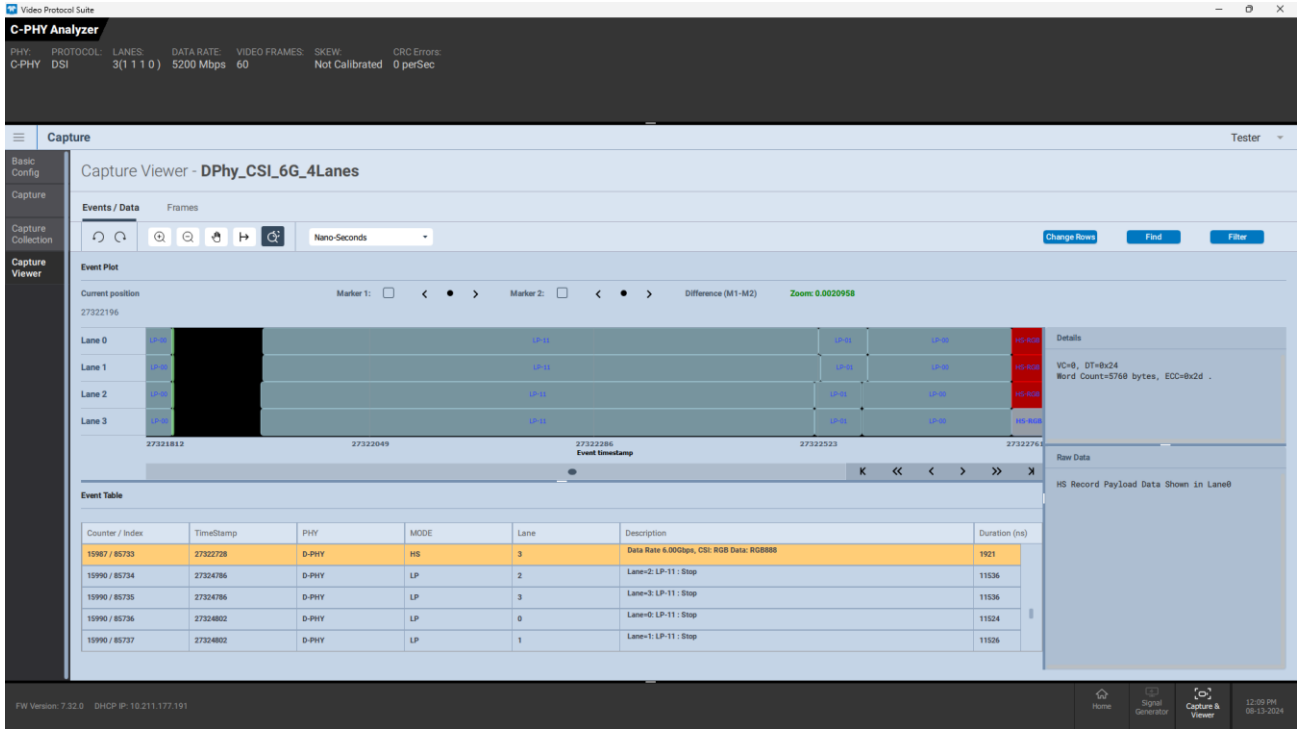
- The Envision X14 analysis software depicts the blanking area of a D-Phy CSI frame. You can see a few lines of the previous frame and a few lines of the next frame with the blanking in Low Power between.

Envision X14 – Analysis Software – Showing D-Phy CSI Burst



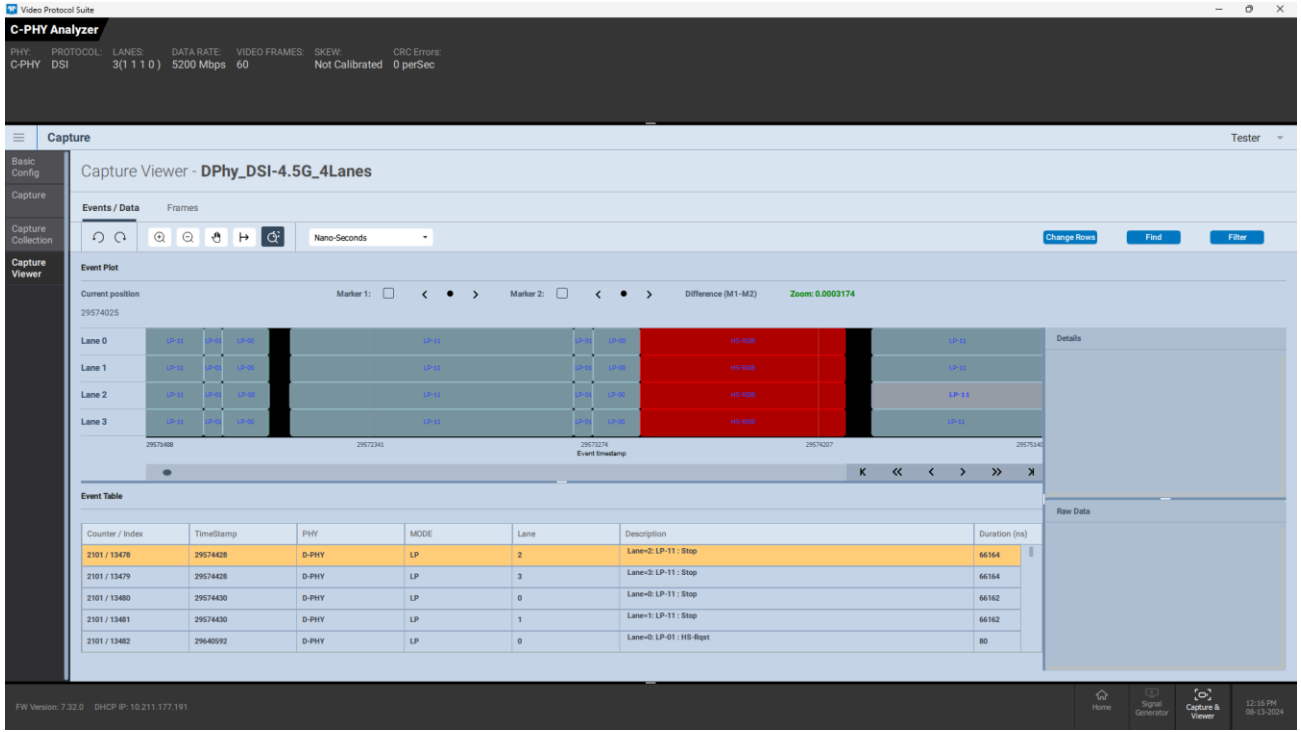
- The Envision X14 analysis software depicts the RGB high speed burst a D-Phy CSI frame. Details of the high speed image burst are shown on right panel.

Envision X14 – Analysis Software – Showing D-Phy CSI Start of New Frame



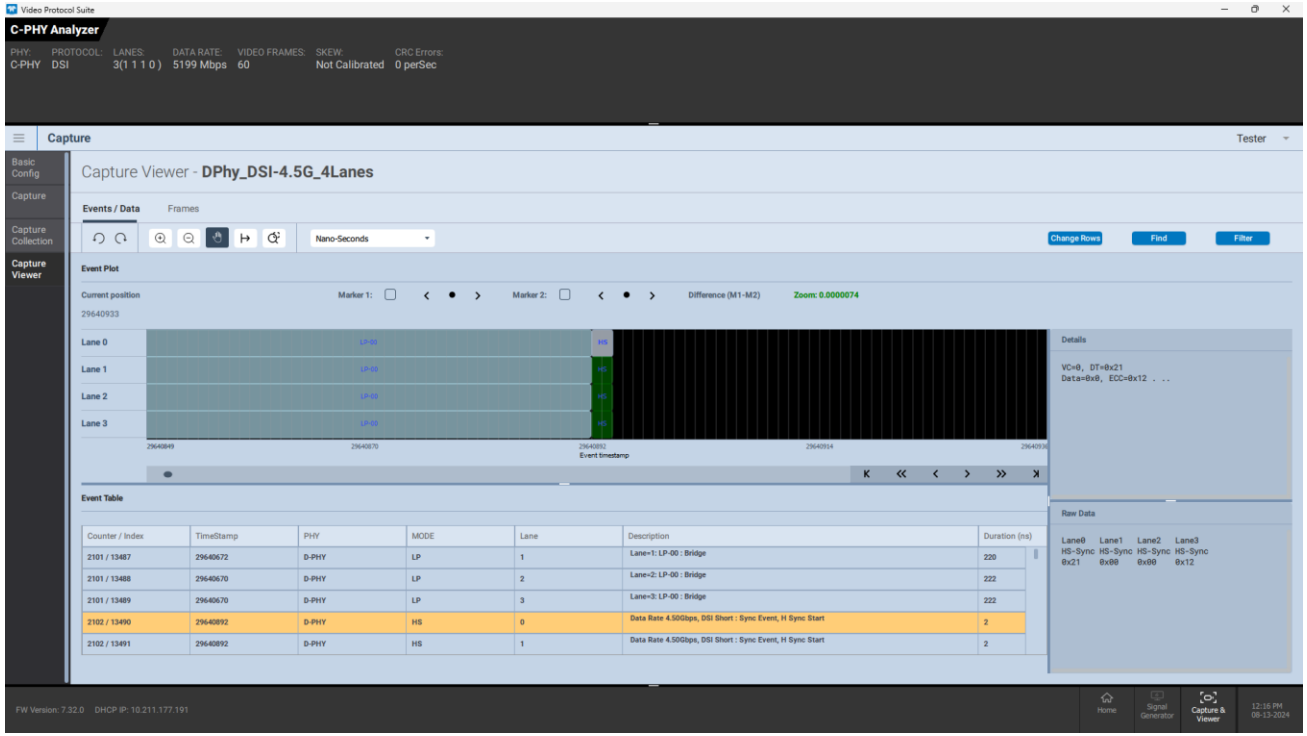
- The Envision X14 analysis software depicts the start of a new D-Phy CSI frame.

Envision X14 – Analysis Software – Showing D-Phy DSI Burst



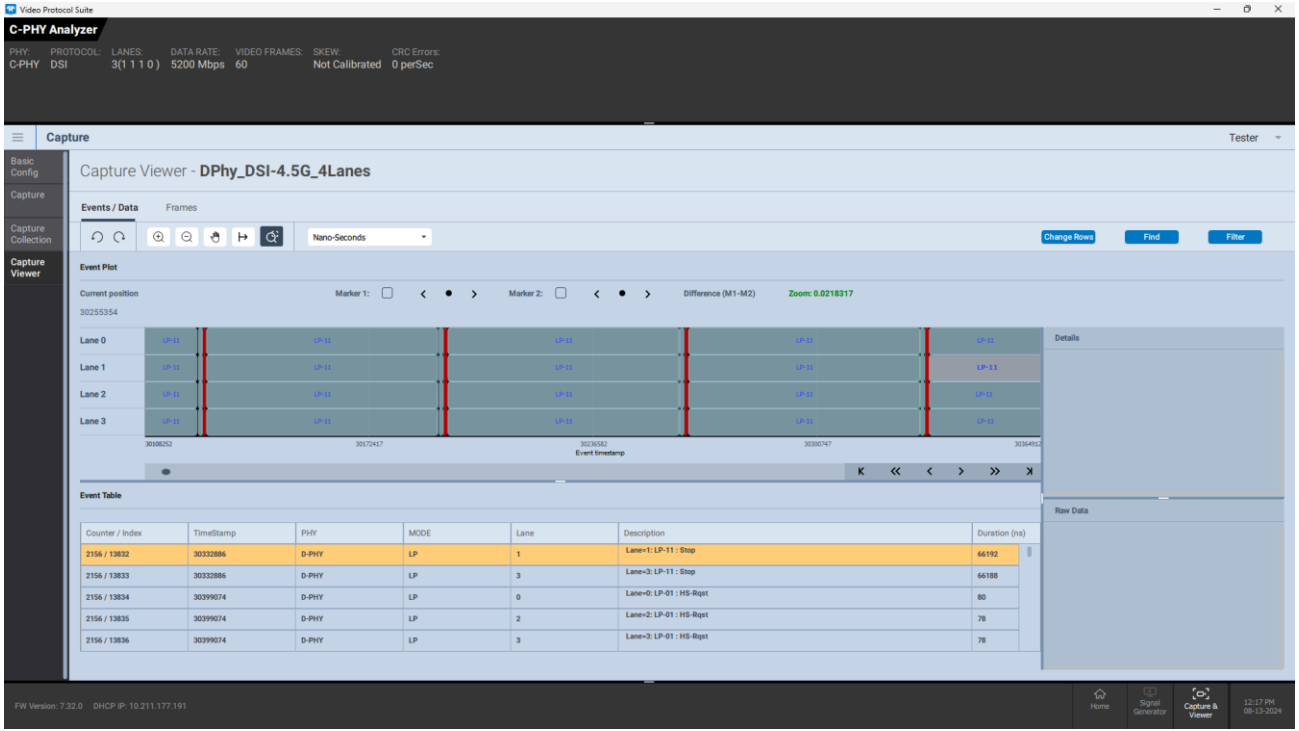
- The Envision X14 analysis software depicts a D-Phy DSI high speed burst.

Envision X14 – Analysis Software – Showing D-Phy DSI H Sync Start



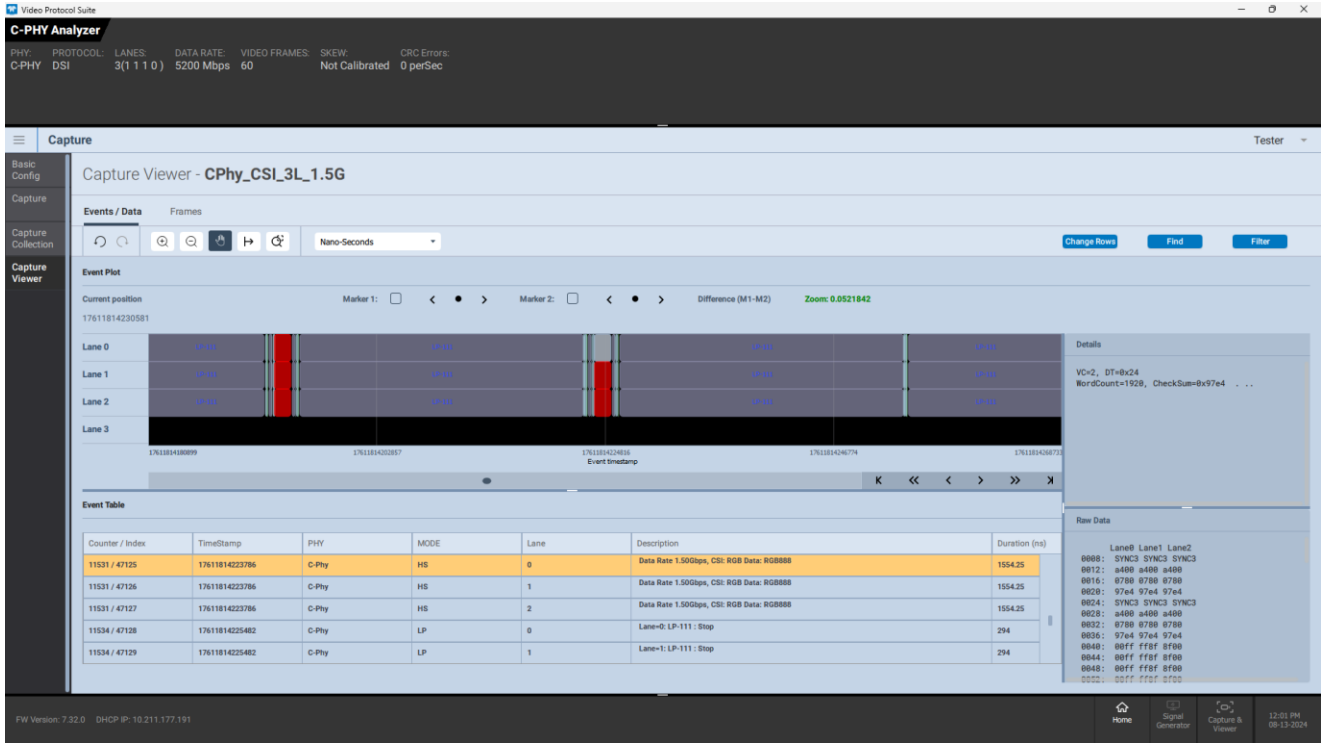
- The Envision X14 analysis software depicts a D-Phy DSI high speed Line Sync event. Details of the packet is shown on right panel.

Envision X14 – Analysis Software – Showing D-Phy DSI Burst Lines



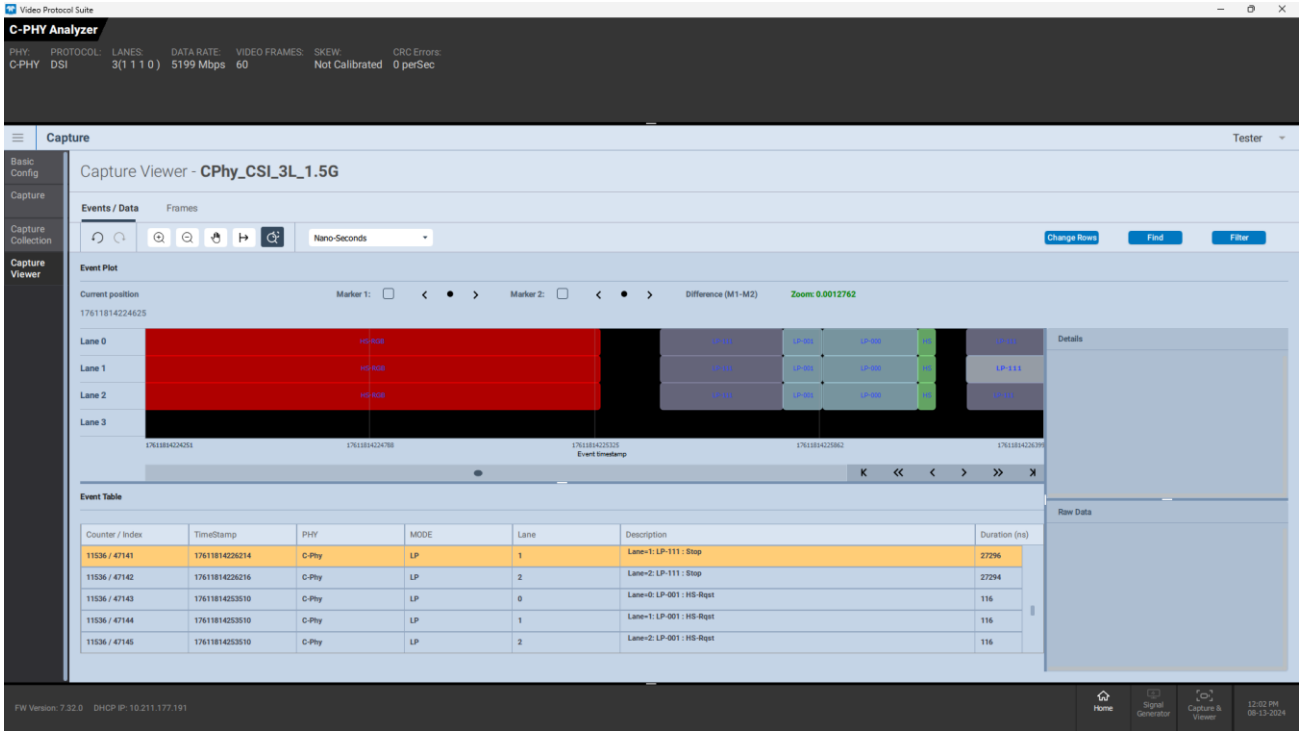
- The Envision X14 analysis software depicts a set of D-Phy DSI burst lines of a frame.

Envision X14 – Analysis Software – Showing C-Phy CSI Burst Lines



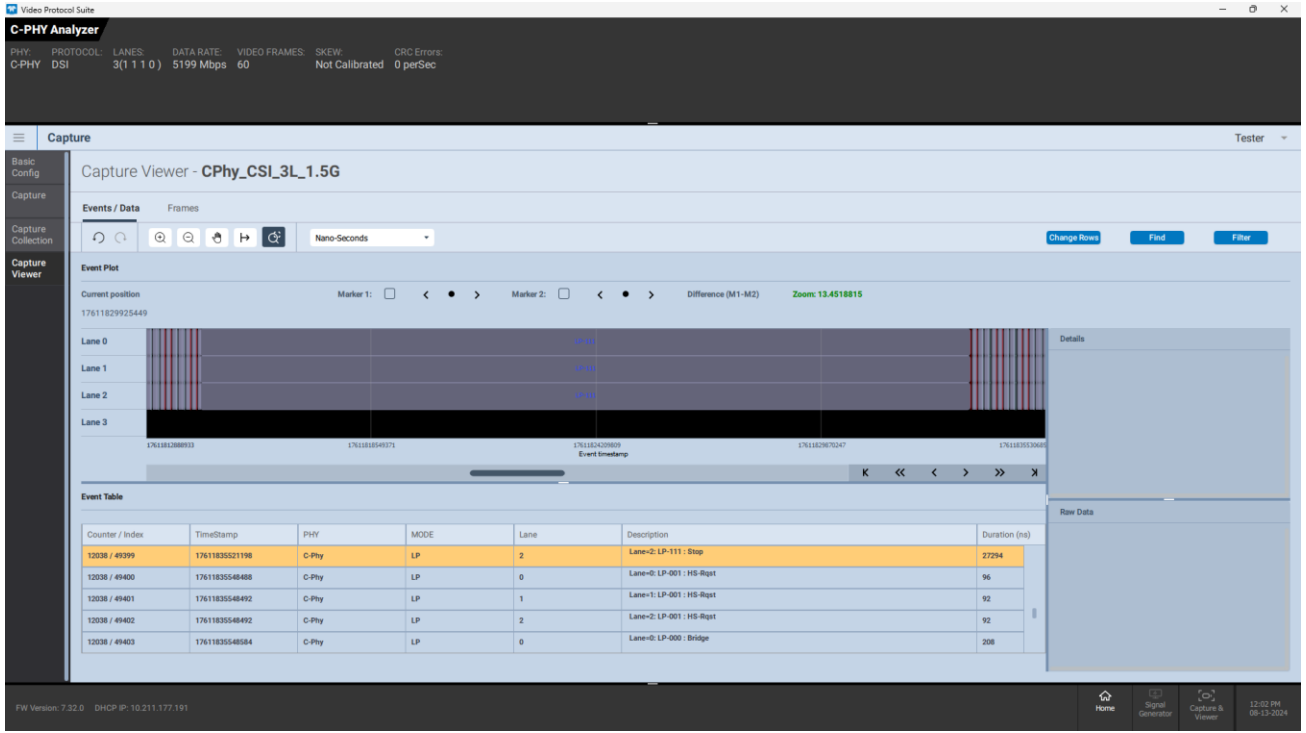
- The Envision X14 analysis software depicts a set of C-Phy CSI high speed burst lines of a frame. Details of the burst are shown on right panel.

Envision X14 – Analysis Software – Showing C-Phy CSI Frame End



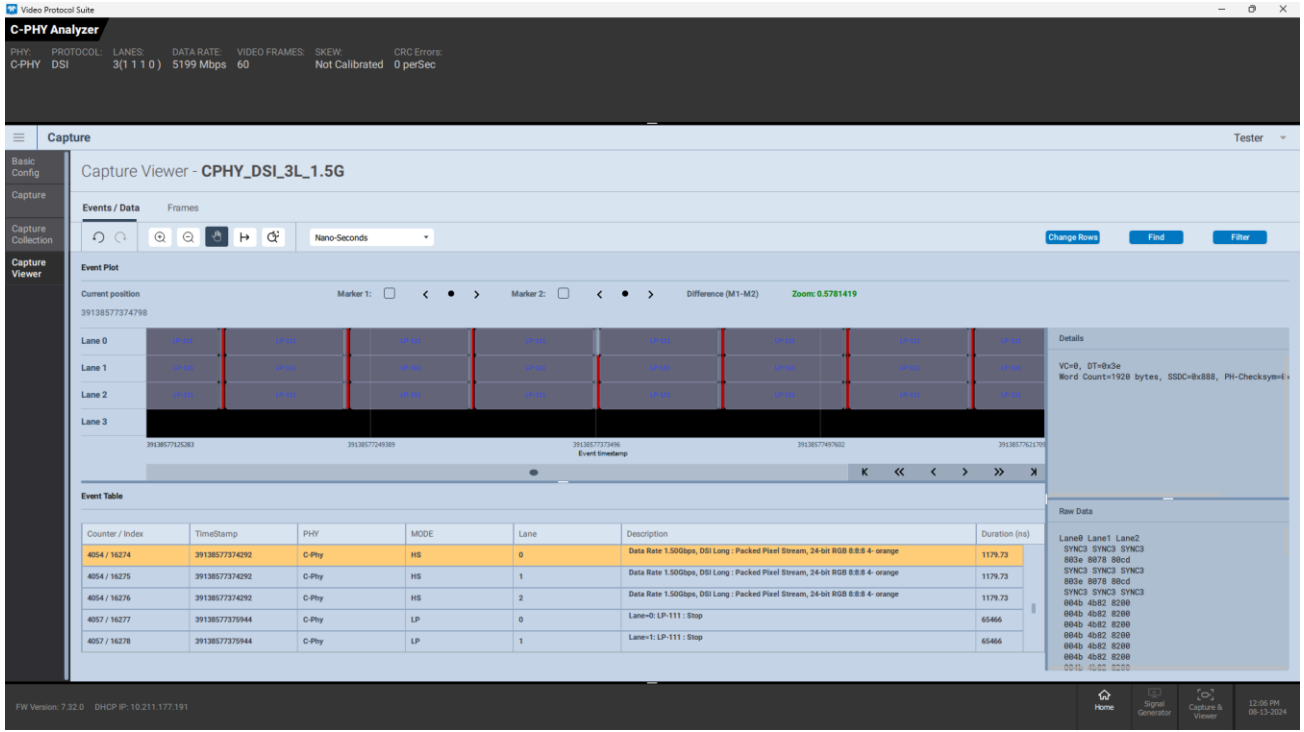
- The Envision X14 analysis software depicts a C-Phy CSI high speed frame end packet.

Envision X14 – Analysis Software – Showing C-Phy CSI Frame Blanking Region



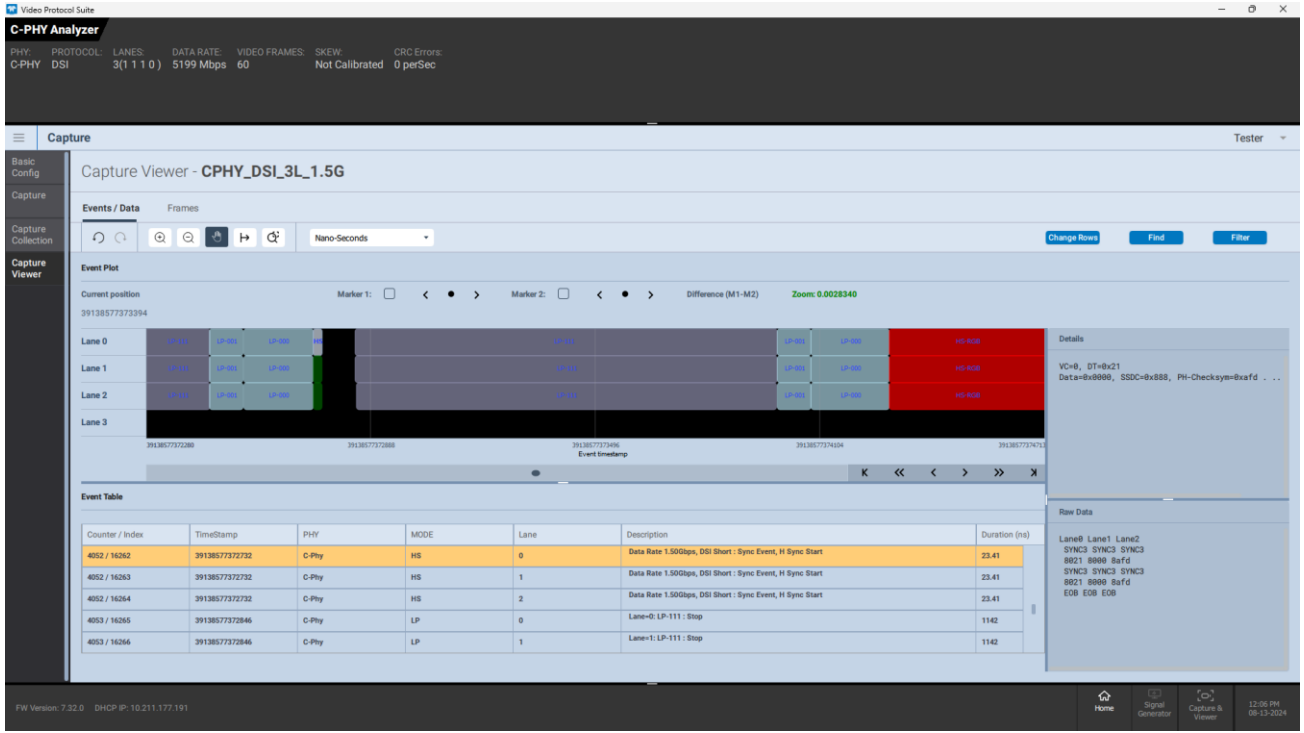
- The Envision X14 analysis software depicts a C-Phy CSI frame blanking region.

Envision X14 – Analysis Software – Showing C-Phy DSI Multiple Burst Lines



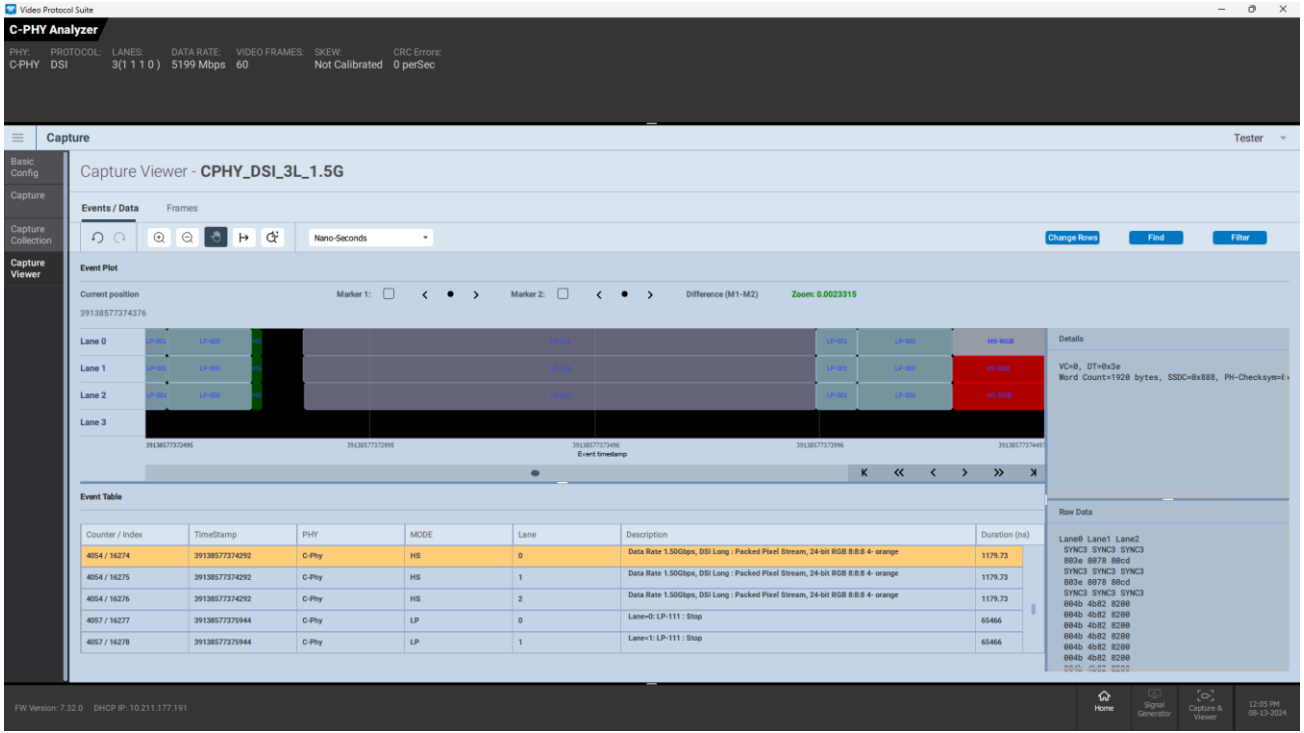
- The Envision X14 analysis software depicts a set of C-Phy DSI high speed video burst with the details of the burst data shown in the panel on the right.

Envision X14 – Analysis Software – Showing C-Phy DSI H-Sync Event



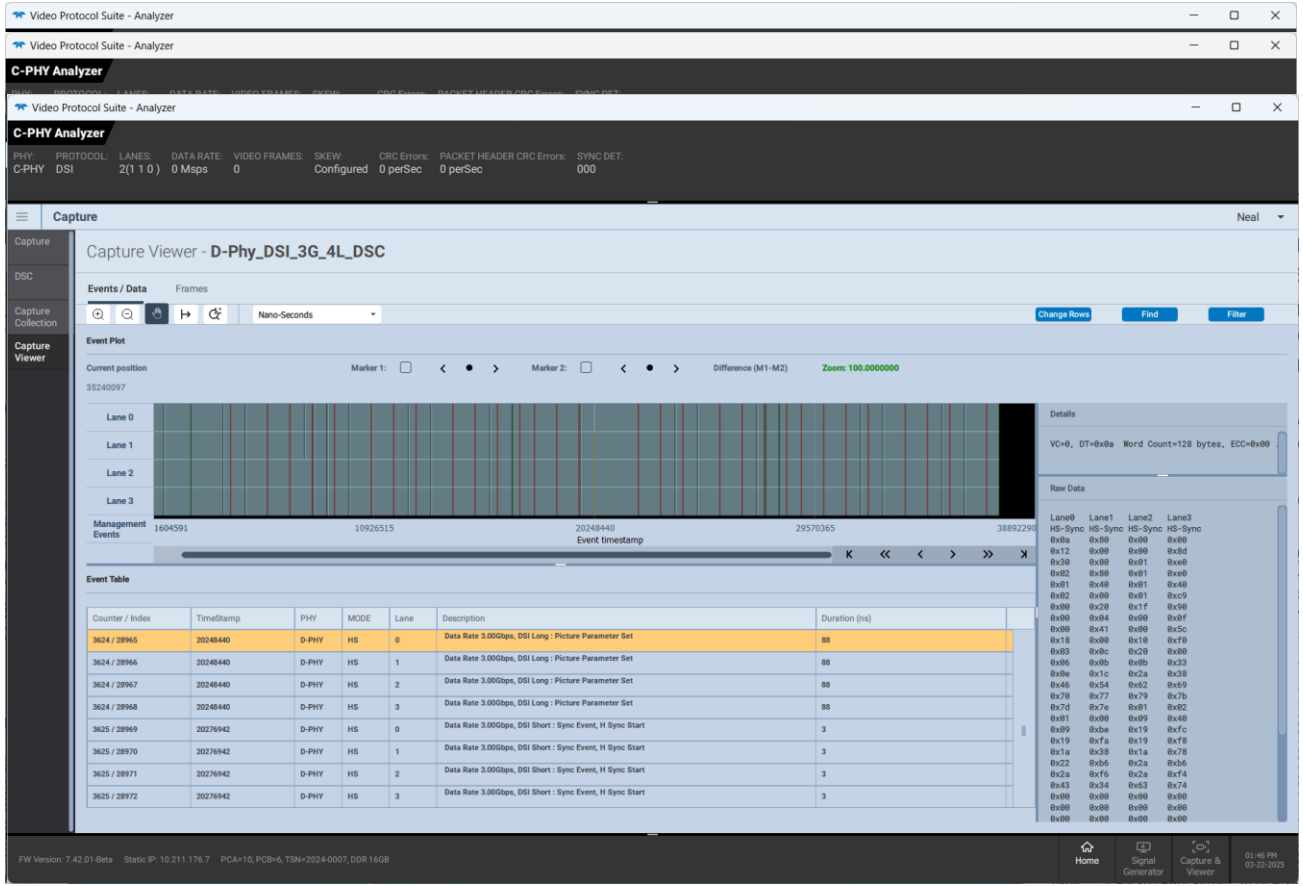
- The Envision X14 analysis software depicts a set of C-Phy DSI high speed line start packet with the packet details shown in the panel on the right.

Envision X14 – Analysis Software – Showing C-Phy DSI Data Burst



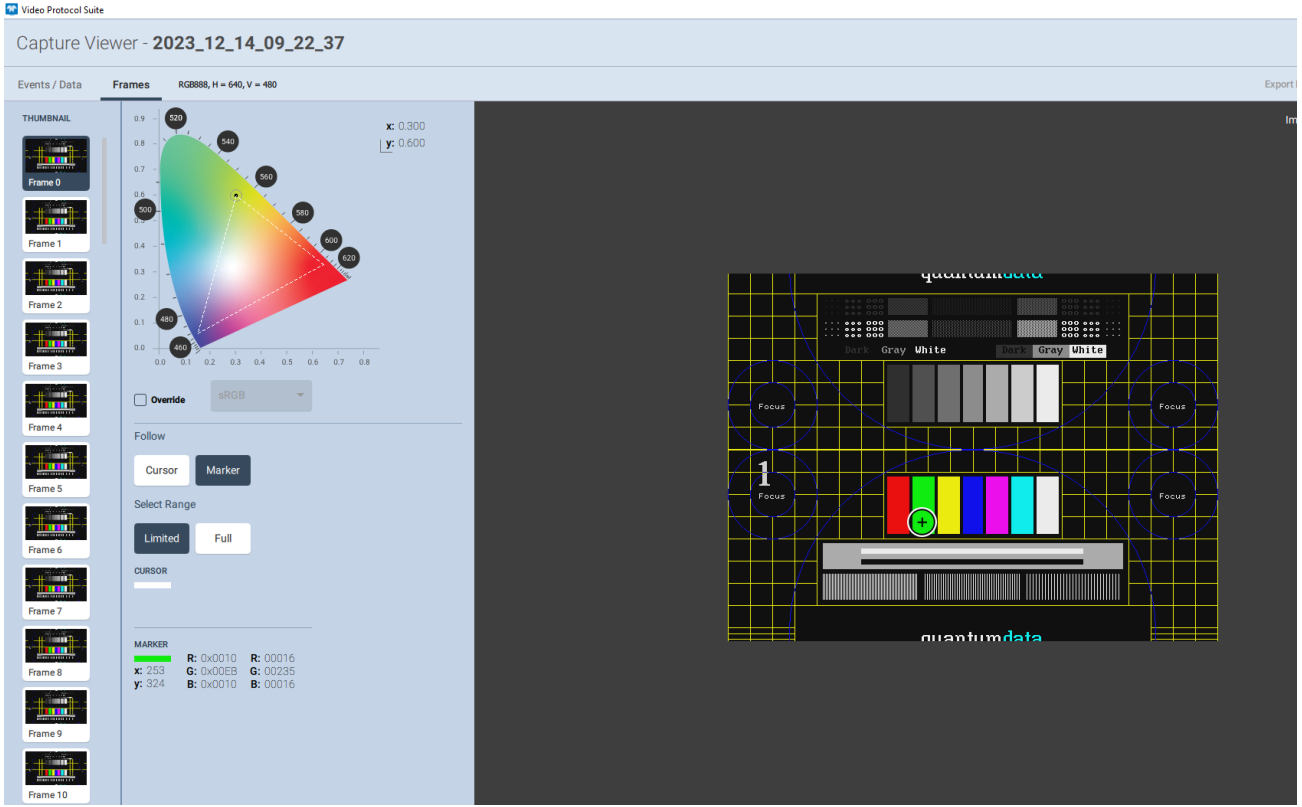
- The Envision X14 analysis software depicts a set of C-Phy DSI high speed line start packet with the packet details shown in the panel on the right.

Envision X14 – Analysis with DSI-2 Display Stream Compression (DSC)



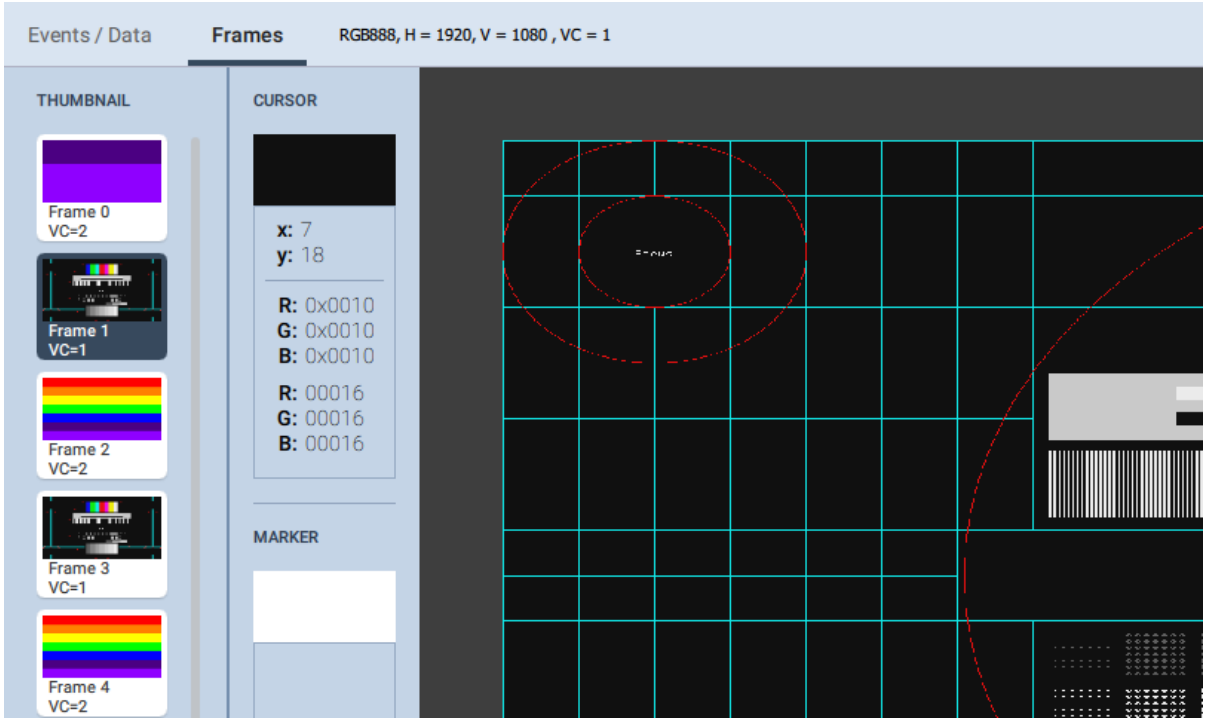
- DSI Display Stream Compression (DSC) for both C-Phy and D-Phy.
  - DSC Parameters can be entered on DSC tab.

Envision X14 Analysis Software – Frame Viewer



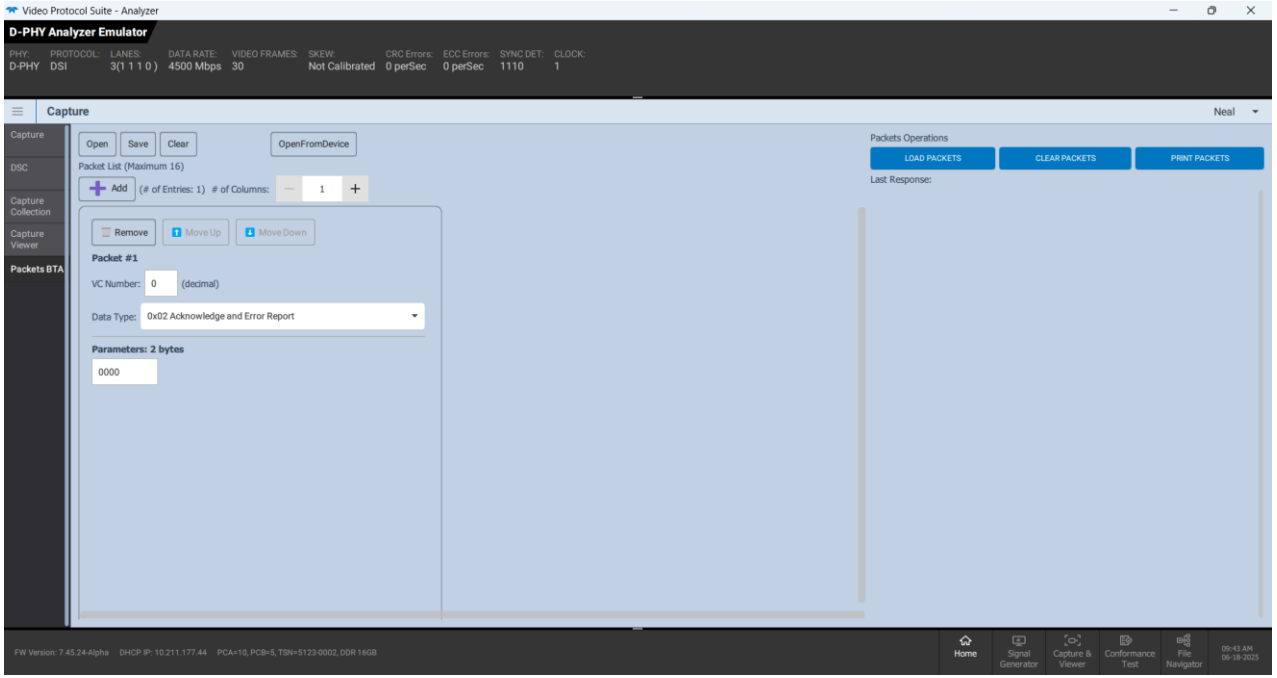
- The Envision X14 provides a view of the captured frames.
- You can view the image element or pixel values by selecting or mousing over an element.
- The Envision X14 Frame capture feature also enables you to view each image element on a CIE color chart.

Envision X14 Analysis Software – Viewing Virtual Channel Frames



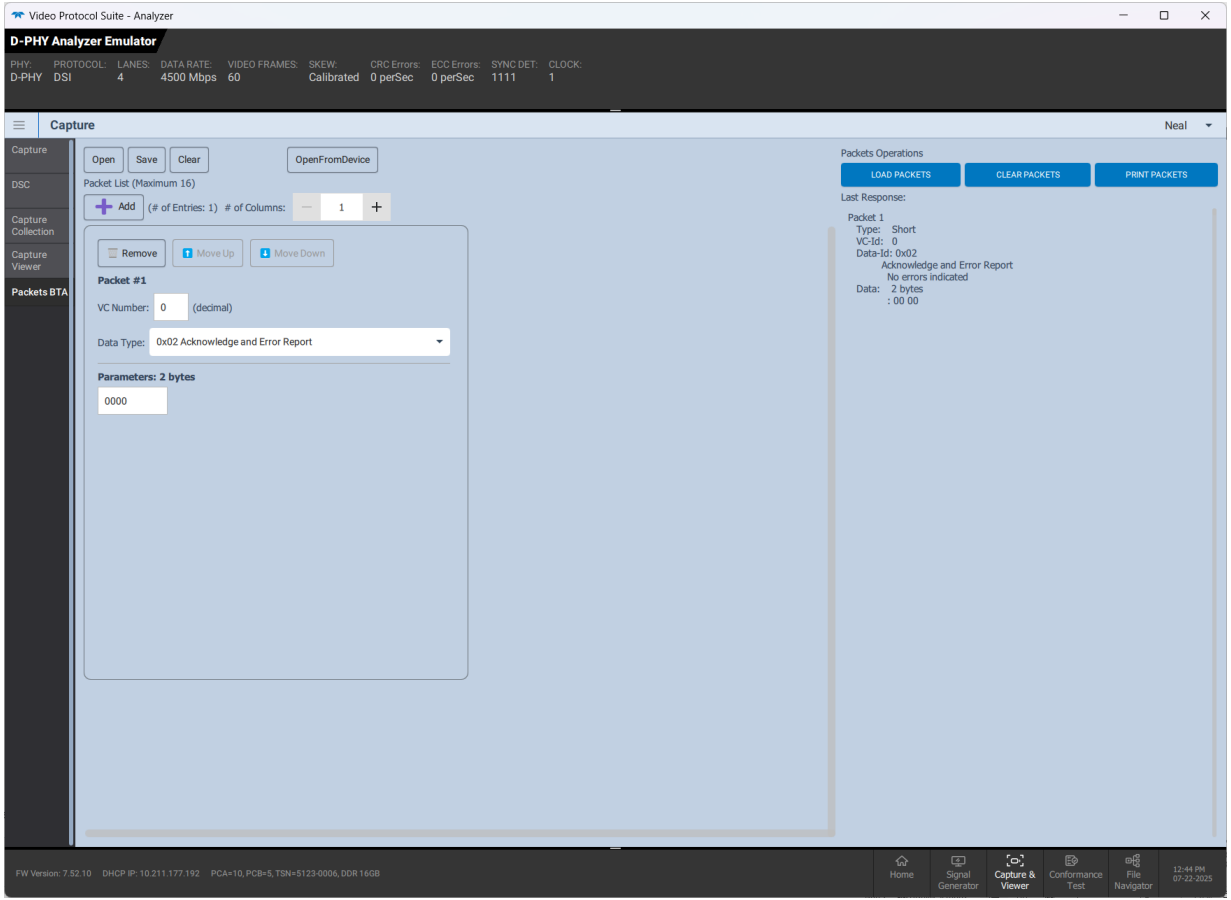
- The Envision X14 provides a view of the captured frames.
- You can view the image element or pixel values by selecting or mousing over an element.
- Example shows viewing the frames of different Virtual Channels.

Envision X14 Analysis Software – Packets Bus Turnaround for DSI DCS



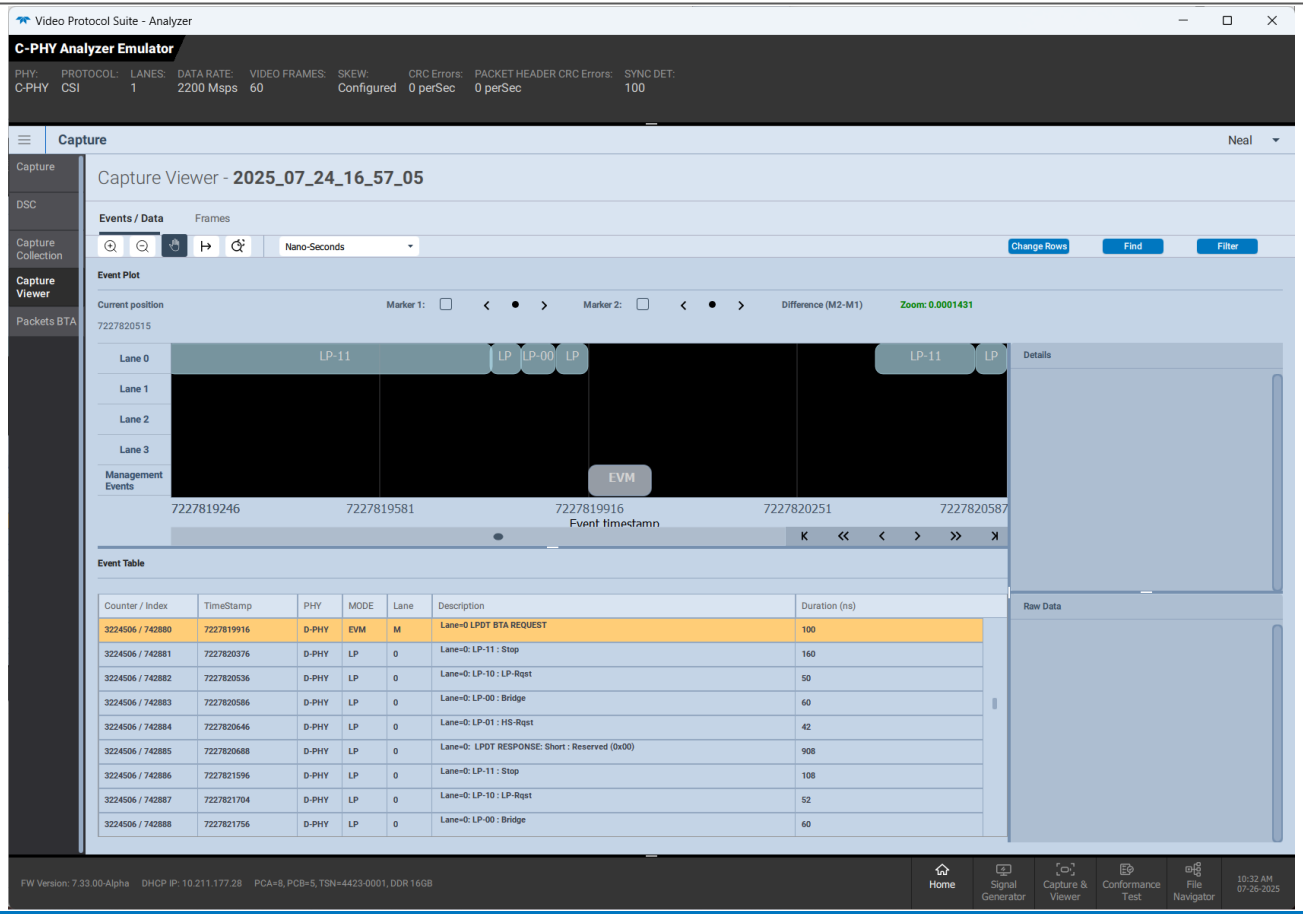
- The Envision X14 Analyzer (emulating a DSI display device) can be configured to product the desired response to a DSI DCS Command Mode command from the DSI Host.

Envision X14 Analysis Software – Packets Bus Turnaround for DSI DCS



- The Envision X14 Analyzer (emulating a DSI display device) can be configured to product the desired response to a DSI DCS Command Mode command from the DSI Host.
- Example show last response sent via the bus turnaround.

Envision X14 Analysis Software – Packets Bus Turnaround for DSI DCS



- The Envision X14 Analyzer (emulating a DSI display device) can be configured to product the desired response to a DSI DCS Command Mode command from the DSI Host.
- Example shows capture indicating a trigger on the bus turnaround in response to a DCS command and shows the Low Power Data Transmission (LPDT) command response.

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MIPI C-Phy/D-Phy CSI/DSI Analzyer

Examples of Generator operation

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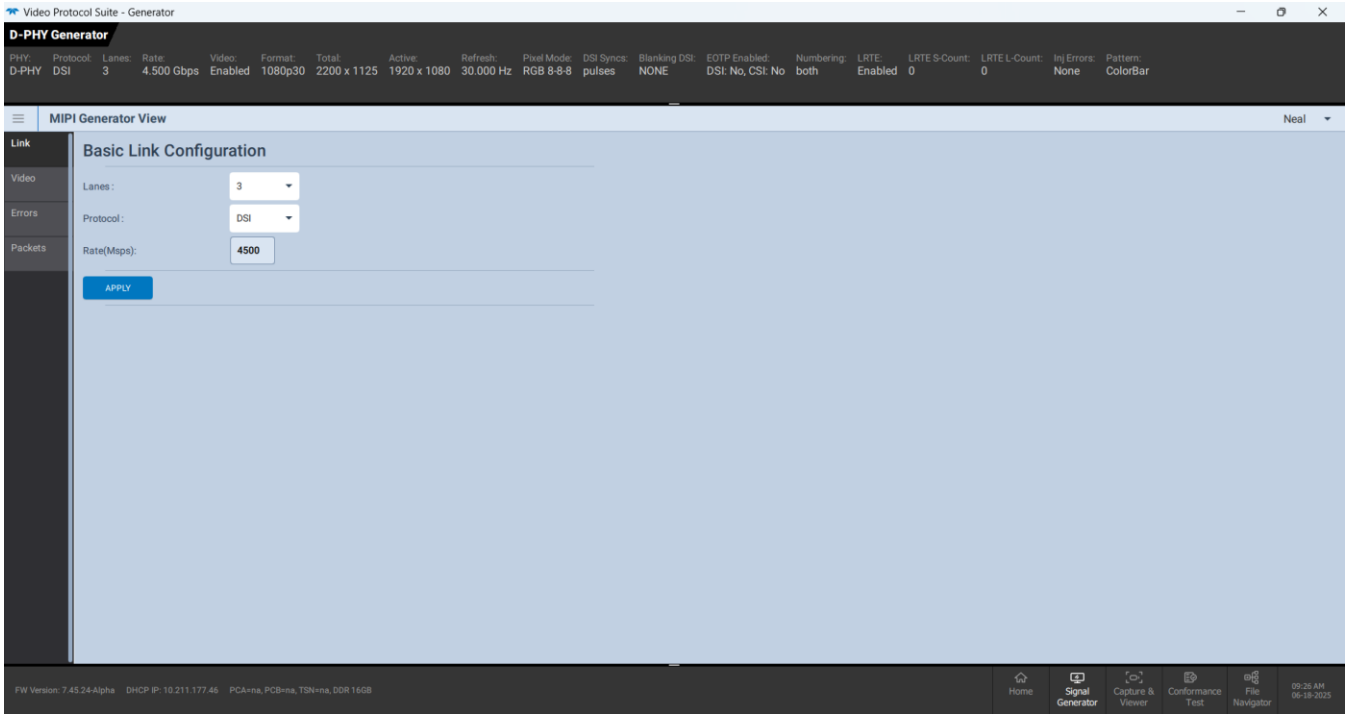
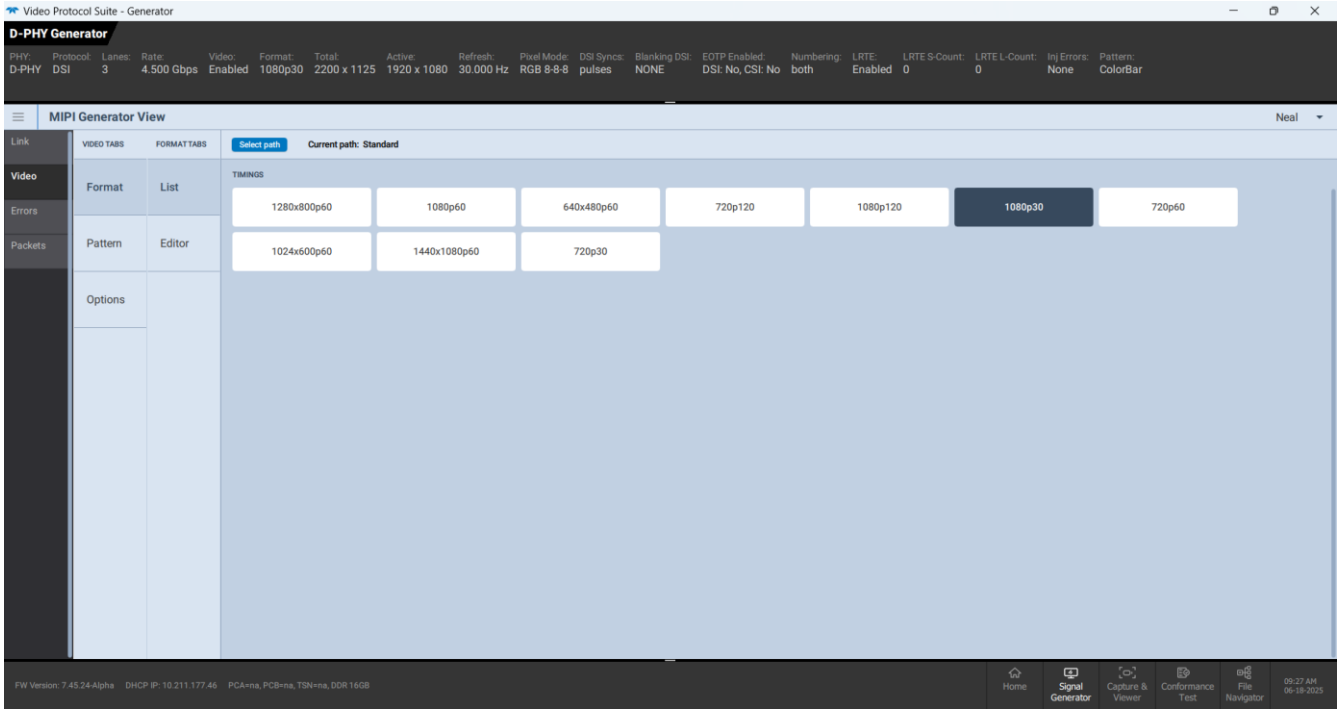
Envision X14 Generator Software – Link Tab



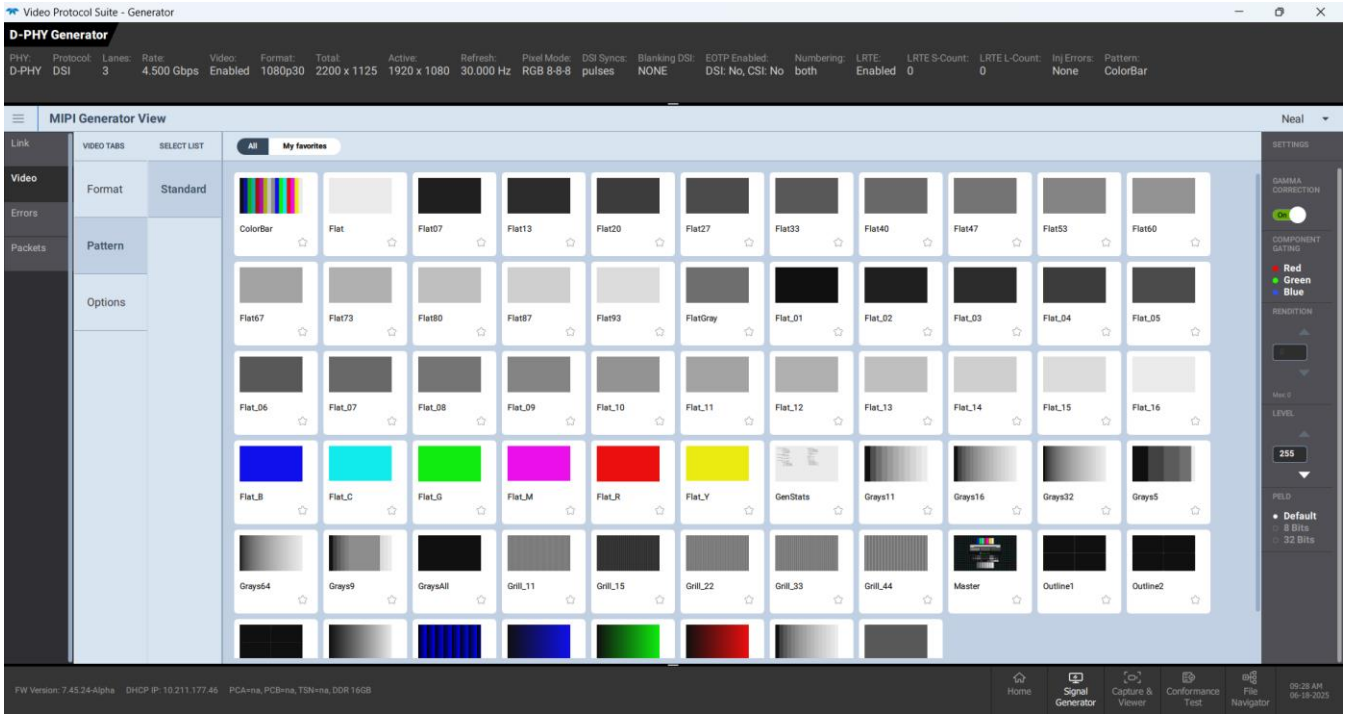
- Select Format, color mode and chroma sampling, test patterns and blanking options.

Envision X14 Generator Software – Format Selection



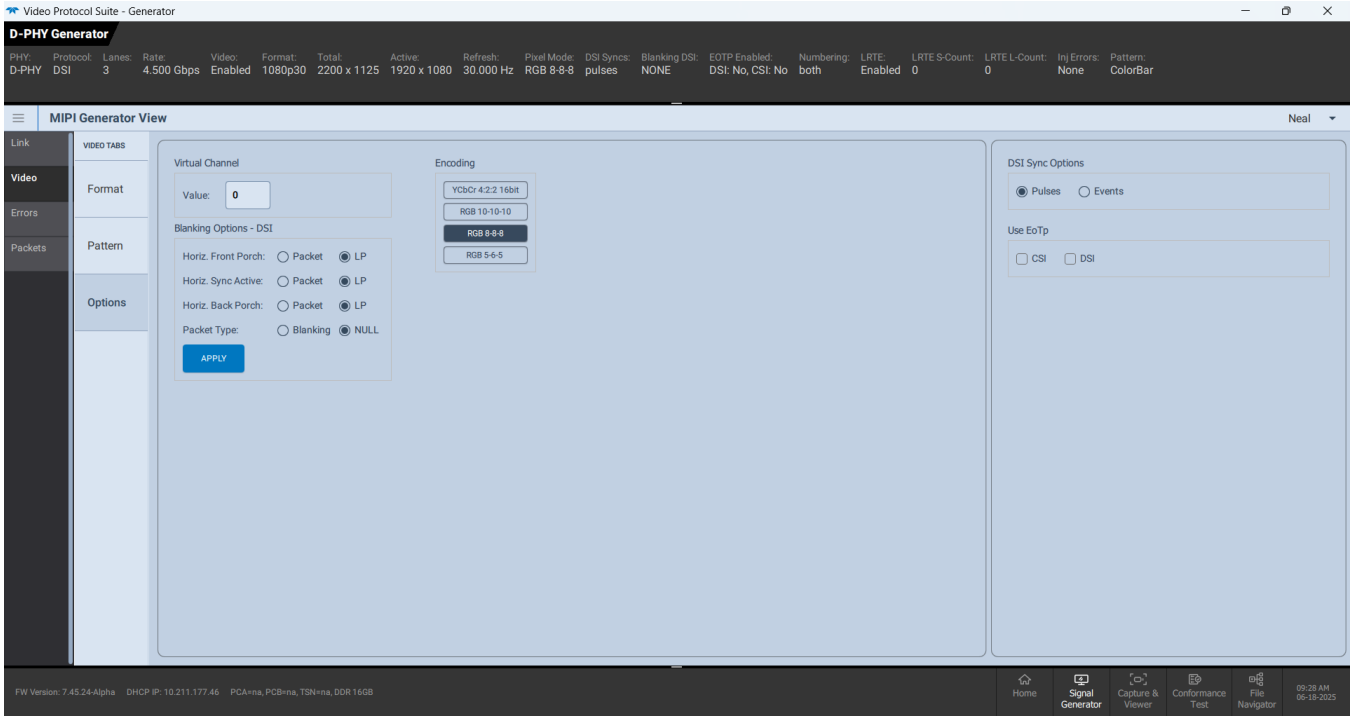
- Select Format, color mode and chroma sampling, test patterns and blanking options.

Envision X14 Generator Software – Test Pattern Selection



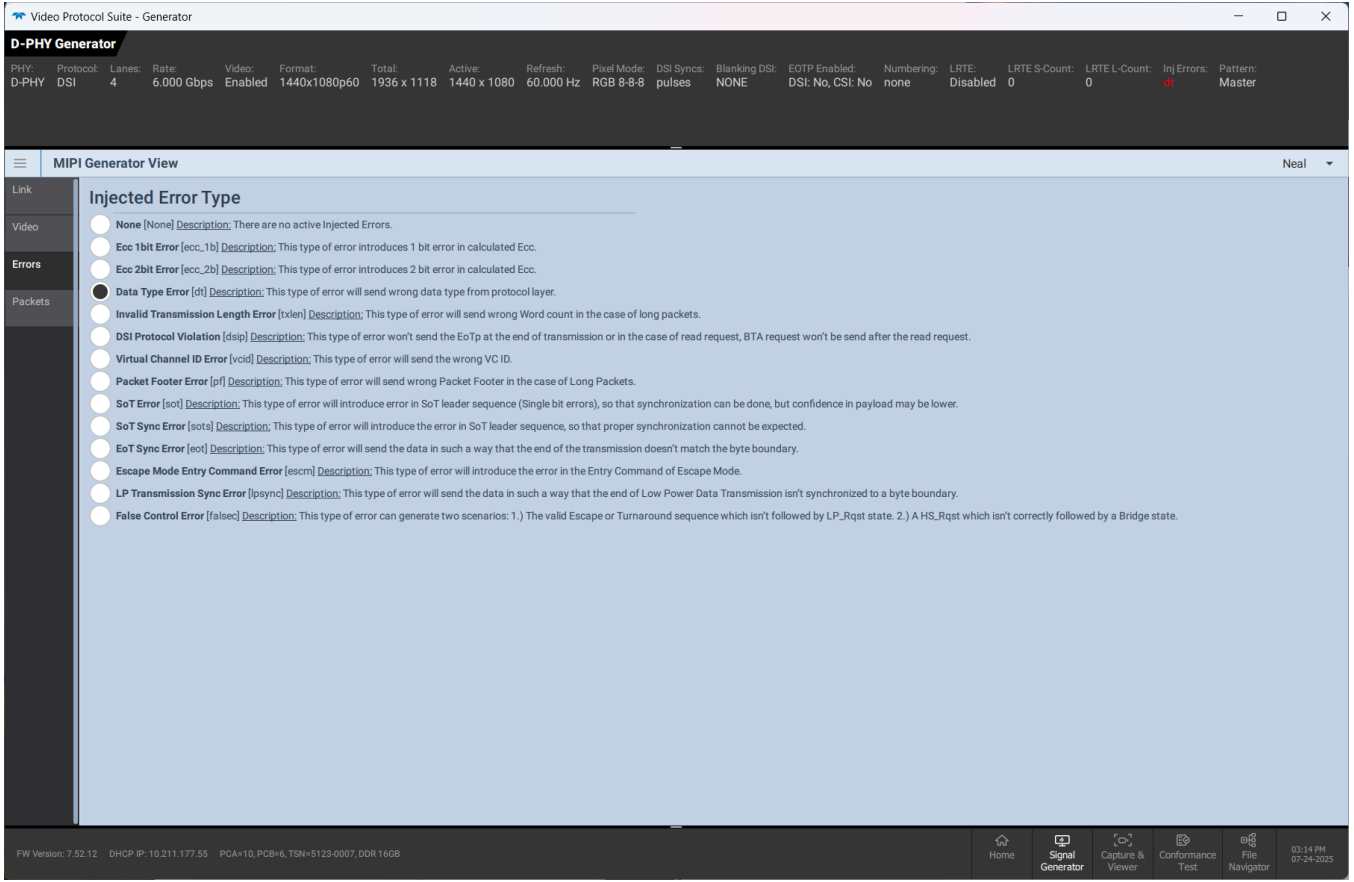
- Select Format, color mode and chroma sampling, test patterns and blanking options.

Envision X14 Generator Software – Blanking Configuration



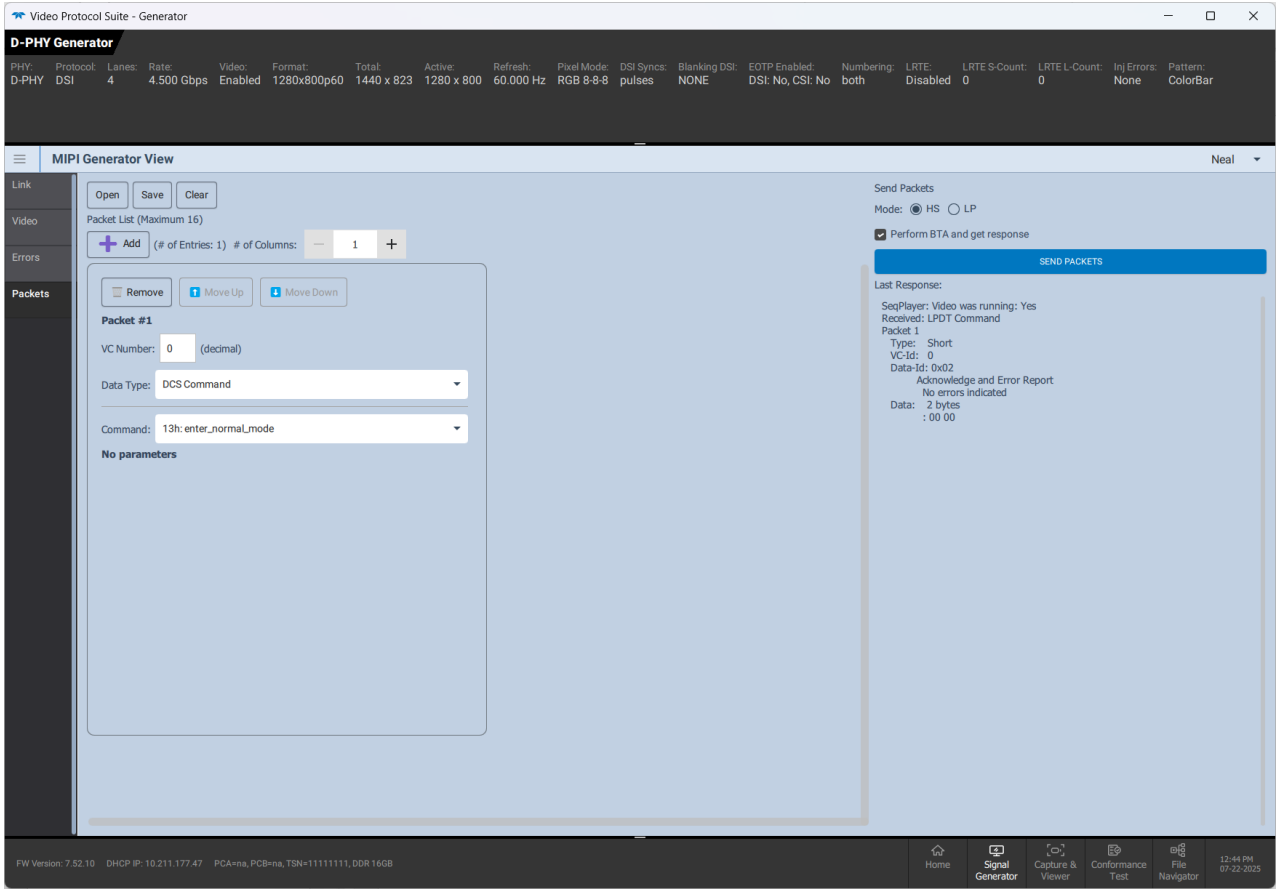
- Select Format, color mode and chroma sampling, test patterns and blanking options.

Envision X14 – Generator CSI/DSI Error Injection



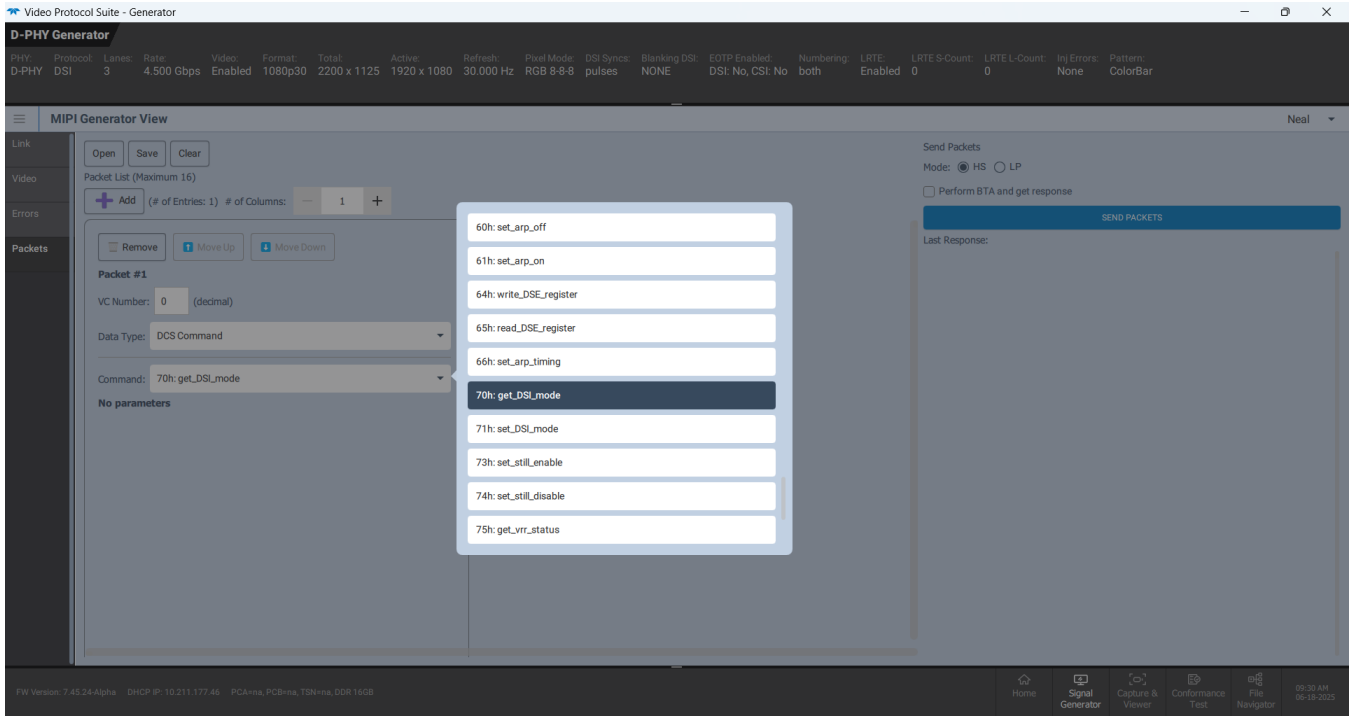
- C-Phy and D-Phy CSI Error Generation.
  - Inject both Phy and Protocol errors.

Envision X14 – DSI DCS Command Mode Control



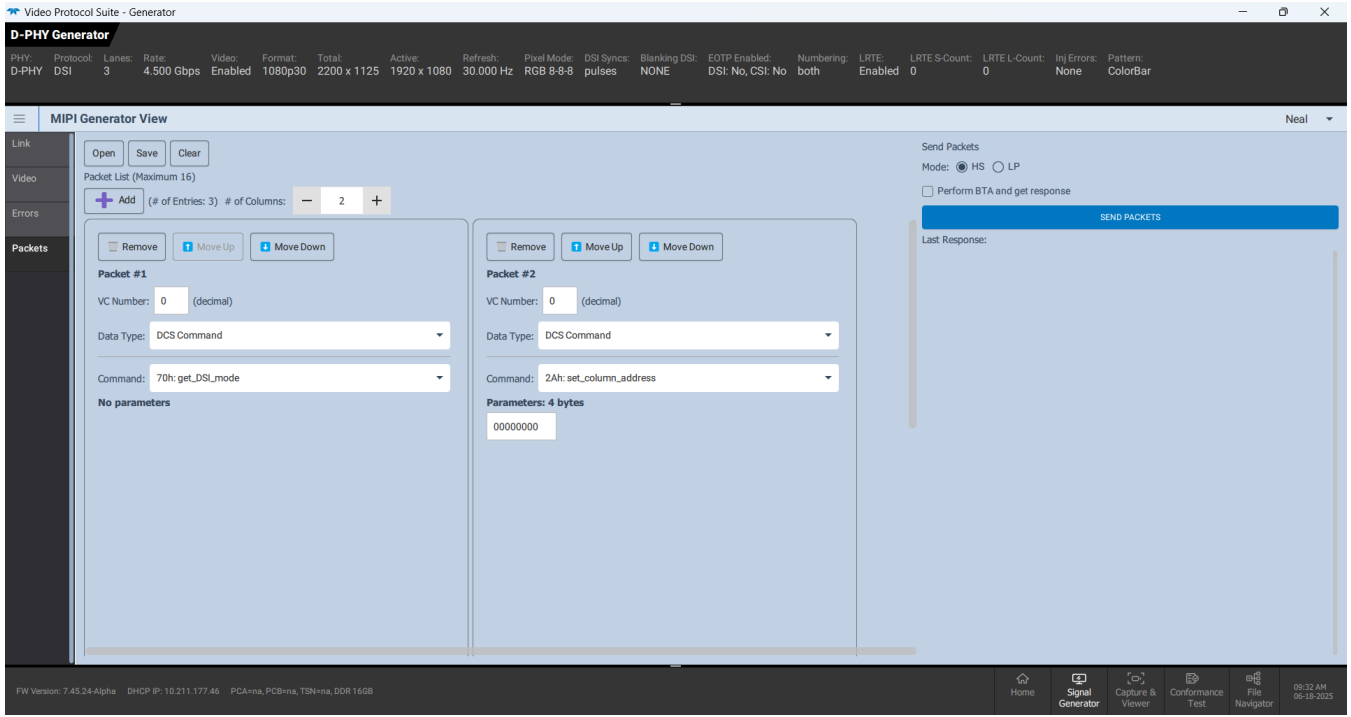
- C-Phy and D-Phy DSI DCS Command Mode.
  - Select commands from a pull-down menu to send to a DSI display device under test.

Envision X14 – DSI DCS Command Mode Control



- C-Phy and D-Phy DSI DCS Command Mode.
  - Select commands from a pull-down menu to send to a DSI display device under test.

Envision X14 – DSI DCS Command Mode Control



- C-Phy and D-Phy DSI DCS Command Mode.
  - Select commands from a pull-down menu to send to a DSI display device under test.
  - Configure multiple commands in a sequence.

Envision X14

MIPI C-Phy/D-Phy CSI/DSI – Status Update

Conformance Testing

July 2025

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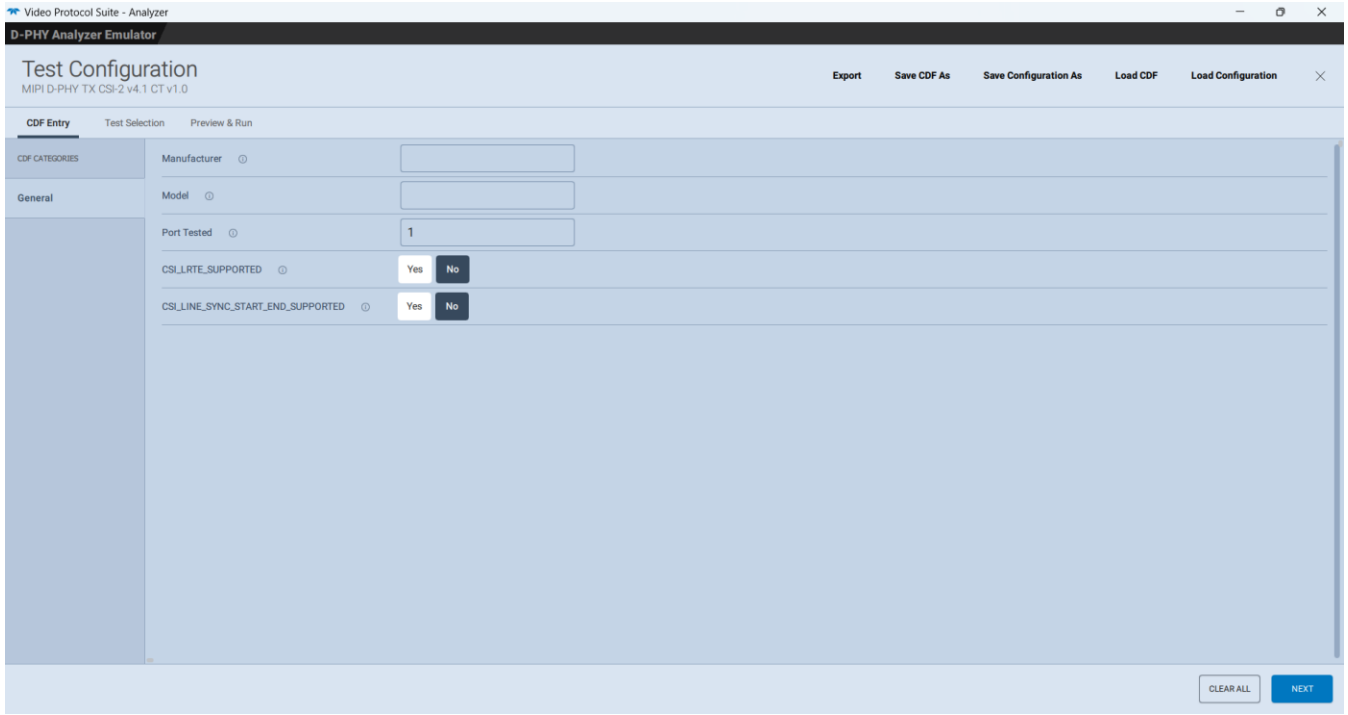
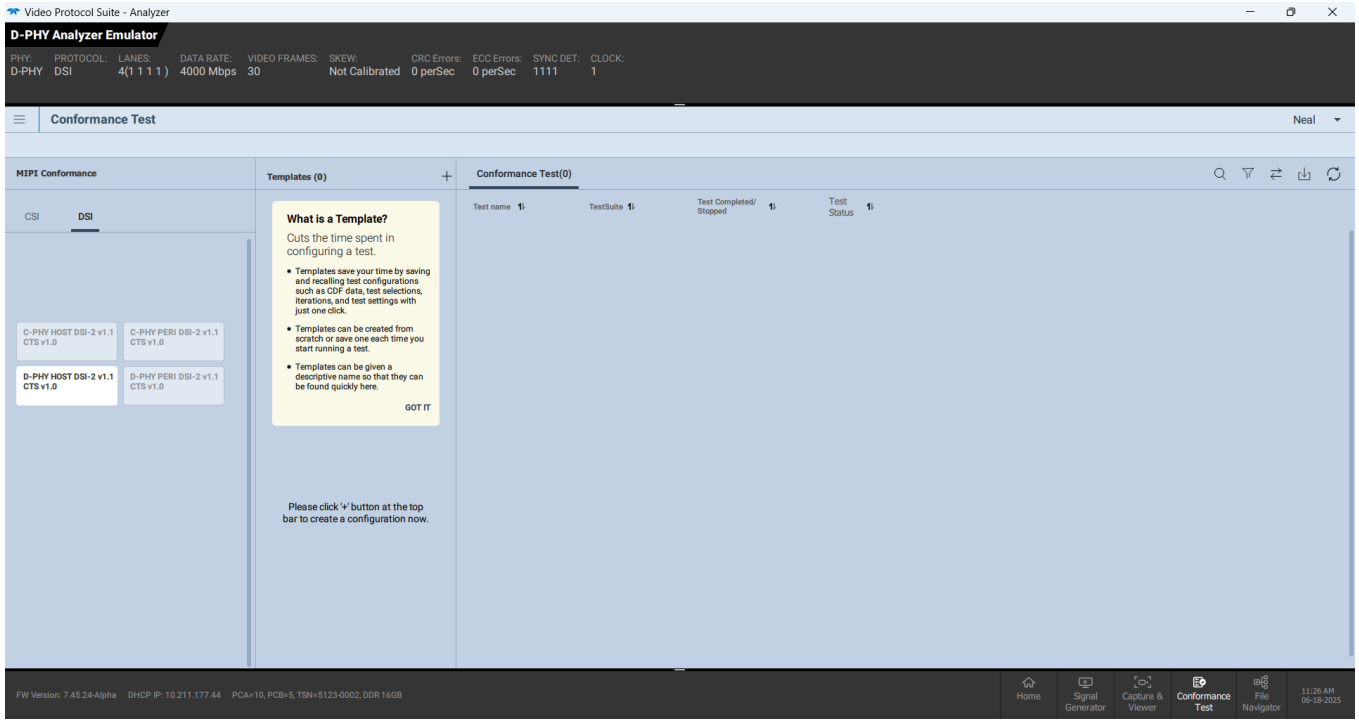
Envision X14 – Conformance Testing



- C-Phy and D-Phy CSI and DSI Conformance Testing.

Envision X14 – Conformance Testing



- C-Phy and D-Phy CSI and DSI Conformance Testing.

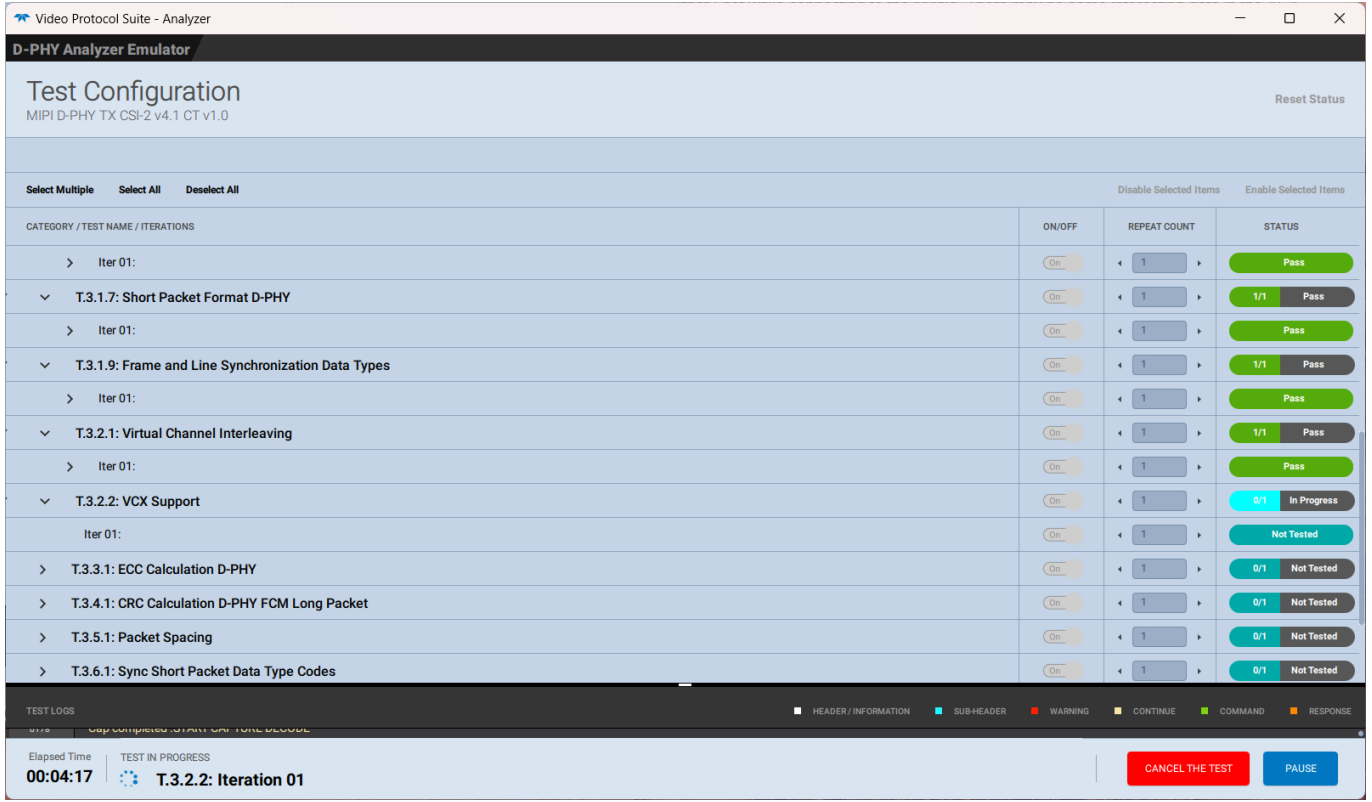
Envision X14 – Conformance Testing – Test Selection

- C-Phy and D-Phy CSI and DSI Conformance Testing.

Envision X14 – Conformance Testing – Test Review

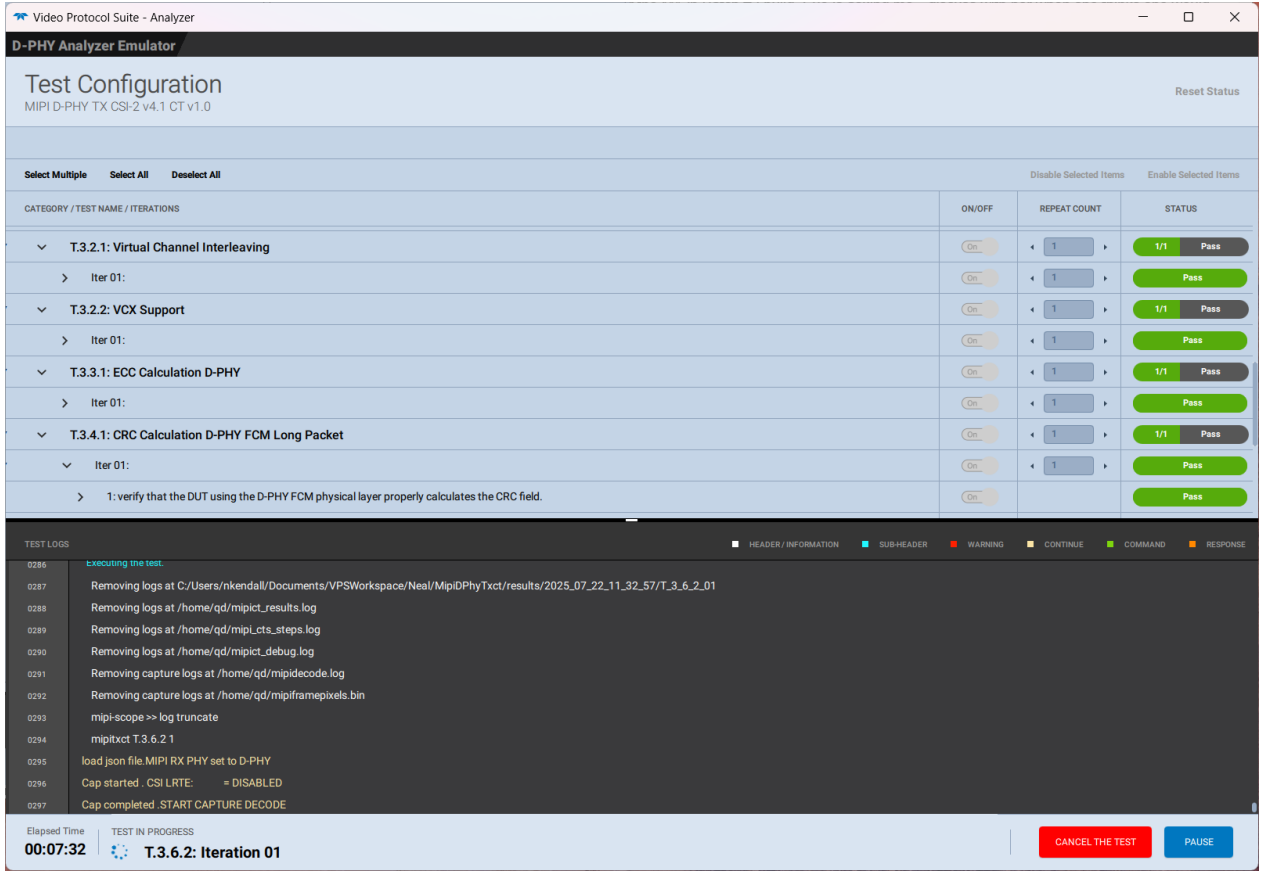
- C-Phy and D-Phy CSI and DSI Conformance Testing.
- Note that you can disable at test and set the number of iterations of each test.

Envision X14 – Conformance Testing



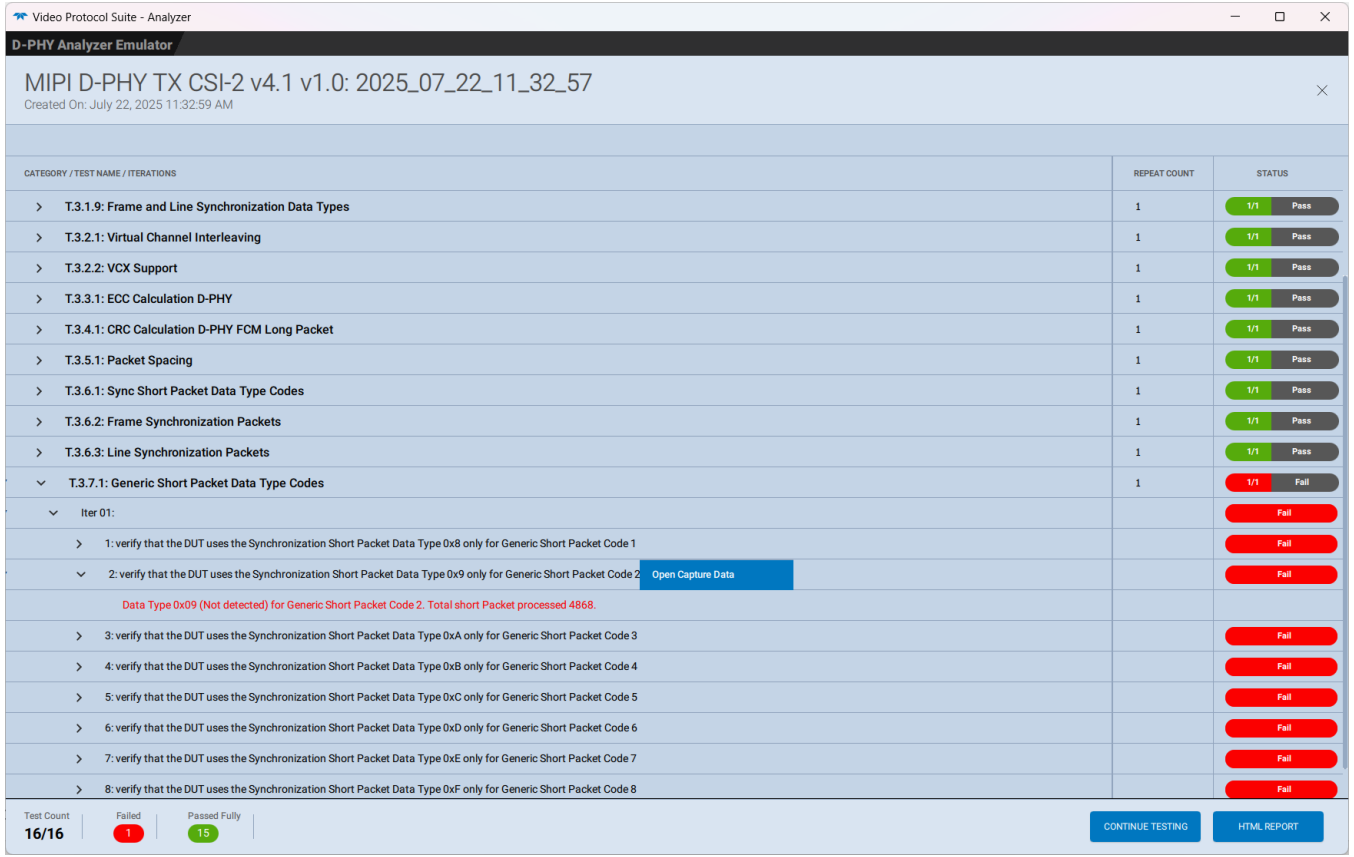
- C-Phy and D-Phy CSI and DSI Conformance Testing.
- Shows test suite in progress.

Envision X14 – Conformance Testing



- C-Phy and D-Phy CSI and DSI Conformance Testing.
- Shows test suite in progress.
- Shows viewing the detailed logs.

Envision X14 – Conformance Testing



- C-Phy and D-Phy CSI and DSI Conformance Testing.
- Shows test results.
- Note that you can link to the capture from the test results.