TELEDYNE LECROY
Everywhereyoulook™

Envision X14 C-PHY℠/D-PHY℠ Analyzer/Generator

for CSI-2® and DSI-2®

Analyzer Key Features

- Deep protocol capture - Analyze all CSI and DSI packet types and data formats, command and video modes, high speed and low power read and write modes, and DCS (for DSI) supported
- Complex event-based capture triggering for captures - Detailed protocol checking – PHY-level and protocol level events including low-power, high speed bursts and read/writes
- Display Stream Compression (DSC) – Decode incoming DSC encrypted content from a DSI-2 host including parsing the Picture Parameter Set metadata parameters
- Image Capture, Extraction and Replay
- 9.0 Gbps D-PHY data transfer rate/data lane, scalable from 1-4 data lanes; 6.0 Giga Samples/second C-PHY data transfer rate/data lane, scalable from 1-3 data trios/lanes
- Debug and analysis statistics for received data and errors including CRC, ECC, Start of Transmission and End of Transmission, etc.
- Solder-down probe system for analyzing development boards for D-Phy/C-Phy and for CSI-2/DSI-2
- External Trigger In/Out - Trigger external equipment based on packet structures or event; trigger a capture from an event on an external device
- Conformance Test Suite for CSI-2 and DSI-2 for evaluating your device against specifications
- API for test automation

Generator Key Features

- Create and generate all packet types, data formats and frame timing for CSI-2 and DSI-2
- Command Set (DCS) or video streams; generate Camera Control Interface (CCI) responses for CSI-2
- Detailed protocol checking - PHY-level and protocol level events including low-power and writes/reads
- Advanced Triggering - Start and stop generation on protocol events, data patterns, and external triggers
- External Trigger In / Out - generate any event and toggle a scope or logic analyzer (via SMA connectors)
- API for test automation

Teledyne LeCroy's Envision X14 Analyzer and Generator offers comprehensive support for MIPI C-PHY/D-PHY and CSI-2 and DSI-2 specifications.

A highly configurable single-box system, the Envision X14 is the ideal choice for any camera and display testing and validation needs.

Envision X14 Analyzer

The Envision X14 Analyzer provides deep analysis for MIPI camera and display protocols over C-PHY and D-PHY layers. The X14 Analyzer can be positioned either as an endpoint to test a CSI-2 or DSI-2 stream or tapped in between a CSI-2 or DSI-2 device and host for passive monitoring and analysis. The Envision X14 ensures fast Time-to-Insight through its rich set of innovative features for debug analysis and identifying and resolving elusive protocol errors.

The Envision X14 Analyzer offers an integrated MIPI Conformance Test Specification (CTS) suite for both CSI-2 and DSI-2. This CTS suite provides checks protocol conformance across all camera and display modes, packet types, and video formats, including high speed and low-power modes.

Envision X14 Generator (Exerciser)

Teledyne LeCroy's Envision X14 Video Generator is a versatile and flexible tool for MIPI camera and display protocols. Like the Envision X14 Analyzer, the Exerciser offers a rich suite of innovative features for generating DSI-2 and CSI-2 packets, frames and images. The Envision X14 Video Generator can be configured to generate images and video streams at various resolutions, color modes, sampling rates and frame timings.

Flexible Hardware System

The Envision X14 system features standard SMP connectors that support C-PHY or D-PHY signals to provide high fidelity capture of traffic from all active lanes simultaneously. Concurrent recording of PHY-level and protocol-level events allows viewing of protocol activity to help characterize and debug interface traffic. The system includes 16GB of recording memory plus a Gigabit Ethernet link for uploading recorded traffic on the instrument or to an optional host PC.

The Envision X14 Analyzer offers a state-of-the-art protocol-processing core that incorporates a real-time recording engine and configurable tools to selectively monitor and record MIPI CSI and DSI traffic. Field upgradeable firmware allows the Transaction Processor to evolve and support new features or future changes to the MIPI CSI and DSI specifications.

The built-in triggering provides unprecedented flexibility with every packet type and error counts, including combinations, configurable as a trigger event. In wrap recording mode, the Analyzer captures continuously and provides debug back tracing of events for extended debug sessions. All triggers can also generate an external trigger event for synchronizing external scopes or other instruments. An input trigger is useful for coordinating analysis with external events.

The system can be easily configured and upgraded through a flexible software options scheme, to fit your needs and allow you to extend to new use cases.

Analysis Software

The Envision X14 utilizes a software application to control the instrument. The user interface uses colors and patterns to train the eye to understand information faster. When recording mixed protocol and PHY traffic, packets are color coded and interleaved in a single display. The Envision X14 can be controlled through the CSI/DSI Protocol Suite software application hosted on a remote computer. The software can be used for viewing traces taken by other engineers for effective collaboration.

Emulation Mode Test Configurations

CSI-2 Test Configuration – Host Emulation Mode

In CSI host emulation mode, the X14 Analyzer acts as a MIPI Host connected to a camera or image sensor device under test (DUT) that provides the MIPI device interface.

CSI Camera (DUT)
(Image Sensor)

Envision X14
(CSI Host/SoC)

DSI-2 Test Configuration – Device Emulation Mode

In DSI device emulation mode, the X14 Analyzer acts as a MIPI Display device connected to an SoC device under test (DUT) that provides the MIPI Host interface.

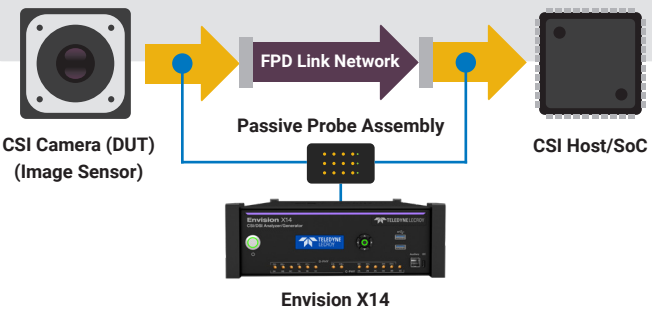
DSI Host SoC
DUT

Envision X14
(DSI Display Device)

Passive Probe Mode Test Configurations

CSI-2 Test Configuration – Passive Probing Mode

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



CSI Camera (DUT)
(Image Sensor)

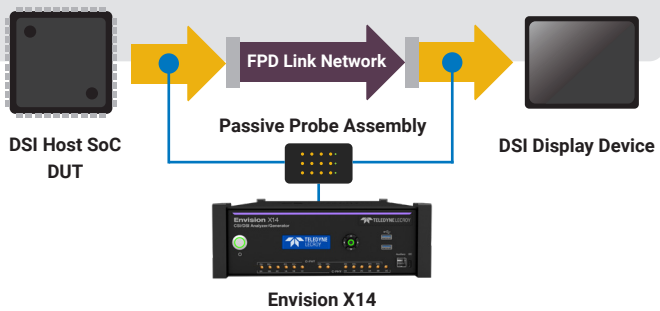
Passive Probe Assembly

CSI Host/SoC

Envision X14

DSI-2 Test Configuration – Passive Probing Mode

In the DSI passive probing mode, the 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 X14 passive probe elements at various points along the transport facility, the X14 can segment and isolate the point of failure.



DSI Host SoC
DUT

Passive Probe Assembly

DSI Display Device

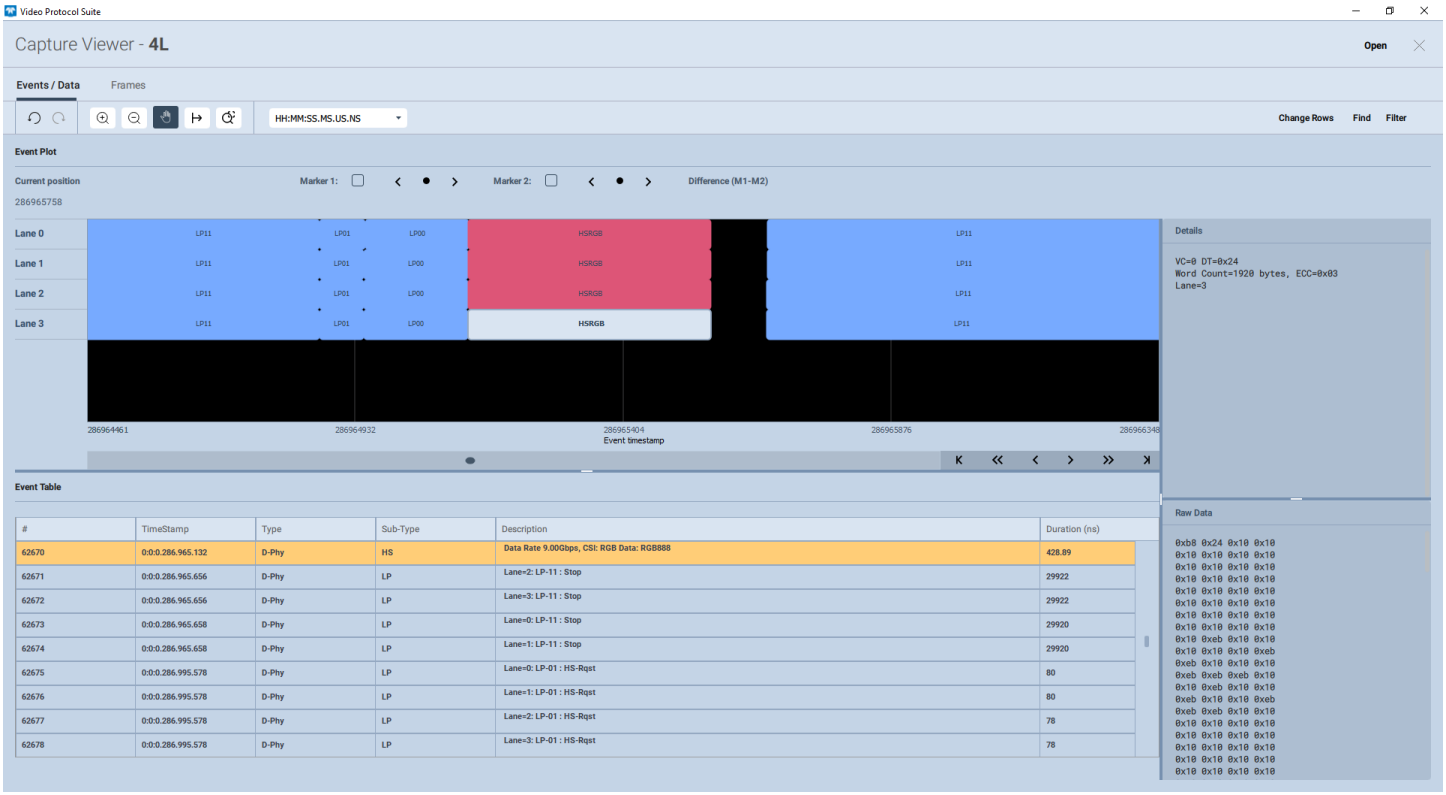
Envision X14

Envision X14 CSI/DSI Protocol Suite

The Teledyne LeCroy CSI/DSI Protocol Suite's Events tab shows each packet on a separate row with every field labeled and color-coded. Events can be individually filtered, searched or exported from the captured trace.

For each capture, Event Statistics are shown in the summary area (top right on screen examples). The examples show cases with both Phy and protocol elements (right) and only protocol packets (below) in this case both Long and Short protocol packets. The Capture configuration that is used to acquire a capture is also provided (Capture Setup upper middle [right]).

The Event Filters area enables users to include/exclude types of protocol traffic from the various analysis tabs (Events, Video, Video Analysis, Timing, Errors). Pre-defined filters are available as well as a user-defined filter mechanism, to facilitate quick Time-to-Insight into problem areas.



Intelligent Capture Triggering

The Envision X14 Analyzer provides hardware triggering to ensure particular protocol events of interest are captured. Trigger events can be specified at the protocol level, targeting specific protocol structures, counts and errors. External triggers from a scope for example can also be used to initiate a capture.

Envision X14 - Generation (Exerciser)

The Generator can be programmed to all standard video and image types outlined in the MIPI CSI-2 and DSI-2 specifications. This enables you to emulate a variety of image sensors and parameters over multiple lane configurations. The Exerciser handles the lane deskewing necessary where multiple lanes are used.

Camera Emulation Mode Test Configuration

CSI Test Configuration – Camera Emulation Mode

In CSI Camera emulation mode, the X14 Exerciser acts as a MIPI CSI image Sensor/Camera connected to a CSI Host/Image Processor under test (DUT).

Envision X14 CSI Camera (Image Sensor) — **CSI Host SoC**

Host Emulation Mode Test Configuration

DSI Test Configuration – Camera Emulation Mode

In DSI Host emulation mode, the X14 Exerciser acts as a MIPI DSI Host SoC connected to a DSI Display Device under test (DUT).

Envision X14 (DSI Host/SoC) — **DSI Display Device**

Envision X14 Solder-Down Probes

The Teledyne LeCroy solder-down probe system is comprised of a Probe Amplifier Assembly with Probe Tips and a set of SMP cables. The Envision X14 Probe system is suitable for C-Phy and D-Phy and for both CSI-2 and DSI-2 analysis.

Probe Assembly – Front View

Probe Assembly – Rear View

Probe Tip

Probe Assembly – Connection Diagram

Specifications

General	
Protocols Supported	MIPI CSI-2 v4.0.1, MIPI DSI-2 v2.1
Data Rates – D-PHY	Hardware-ready for 9Gb/s per lane; 1-4 lanes
Data Rates – C-PHY	Hardware-ready for 6G symbols/sec per lane; 1-3 Lanes
Analyzer Recording Memory	16 GBytes
Generator memory for images	4 GBytes
Connectors - Front	
D-PHY & C-PHY Interconnection	(10) SMP Jacks (signal); (2) SMP jacks for D-PHY clock D-PHY (4) Lanes: D0+/- D1+/- D2+/- D3+/- CK+/- C-PHY (3) Lanes: A0 B0 C0; A1 B1 C1; A2 B2 C2
Auxiliary Connector	Future Functionality
I2C Connector	I2C Communication Bus for CSI Camera Control Interface (CCI) 400kHz
Trigger IN Connector	SMA Jack Input Impedance: 700 Kohms; Impedance: 700 Kohms; Vih: +2.0V Min., Vil: +0.8V Max
Trigger OUT Connector	SMA Jack Output Impedance: 50 ohms; Max. Input Voltage: +3.3V; Voh: +2.3V Min. @ 12mA
Envision X14 Probe System - Connectors (Front)	
D-Phy & C-Phy Interconnection	(10) SMP Jacks (signal); (2) SMP jacks for D-PHY clock
Envision X14 Probe System - Connectors (Rear)	
D-Phy & C-Phy Interconnection	(10) SMP Jacks (signal); (2) SMP jacks for D-PHY clock
Envision X14 Base System - Physical/Electric/Admin	
Dimensions (W x H x D)	Height: 3.44 in. (8.74 cm) Width: 9.57 in. (24.30 cm) Depth: 10.94 in. (27.79 cm)
Weight	7.6 LBS; 5.057 Kg
Rack mountable	2 RU mounts in 19-inch rack with rack mounting brackets
Environmental	Operating Temperature: 0°C to 50°C (32°F to 122°F) Non-Operating Temperature: -10°C to 80°C (14°F to 176°F) Humidity: 10% to 90% RH (non-condensing)
Power Requirements	External 120-220V AC Power
Regulatory	CE, RoHs 2015, CSA, UKCA
Warranty	12 Months Hardware Warranty
Envision X14 Probe System - Physical/Electric/Admin	
Dimensions (W x H x D)	Height: 3.44 in. (8.74 cm) Width: 9.57 in. (24.30 cm) Depth: 10.94 in. (27.79 cm)
Weight	0.92 LBS; 0.42 Kg
Rack mountable	2 RU mounts in 19-inch rack with rack mounting brackets
Environmental	Operating Temperature: 0°C to 50°C (32°F to 122°F) Non-Operating Temperature: -10°C to 80°C (14°F to 176°F) Humidity: 10% to 90% RH (non-condensing)
AC Adapter	100-240 VAC, 47-63Hz
Regulatory	CE, RoHs 2015, CSA, UKCA
Warranty	12 Months Hardware Warranty

Ordering Information

Product Description	Product Code
Envision X14 Hardware	ENV14-CD01-TAA-X
Envision X14 D-PHY and C-PHY Solder Down Probes	ENV14-SDP01-CDPRB-X
Envision X14 D-PHY License	ENV14-CD01-DPHY-A
Envision X14 C-PHY License (enabled by a software license; available soon)	ENV14-CD01-CPHY-A
Envision X14 Camera Serial (CSI-2) License	ENV14-CD01-CSI-A
Envision X14 Display Serial (DSI-2) License	ENV14-CD01-DSI-A
Envision X14 Analyzer License	ENV14-CD01-ANA-A
Envision X14 Generator License (enabled by a software license; available soon)	ENV14-CD01-GEN-A

Local sales offices are located throughout the world.
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