

# Envision X84

## CSI & DSI Protocol Analyzer and Compliance Tester for MIPI CSI-2 and DSI-2



### Key Features and Benefits

- **MIPI Camera Serial Interface (CSI-2)**  
**Specifications** - All packet types and data formats, CCI support
- **MIPI Display Serial Interface (DSI v2.0)**  
**Specification** - All packet types and data formats, command and video modes, high speed and low power write and read modes, and DCS
- **D-PHY support at 2.5 Gbps data transfer rate per data lane** - Scalable from 1-4 lanes
- **C-PHY supports 3G Symbols per second per trio** - Scalable from 1-3 trios or data lanes
- **Detailed protocol checking** - PHY-level and protocol level events including low-power and writes/reads
- **Event Based transaction** with 2.5ns event resolution
- **Traffic Overview** - Statistical view showing events, data and errors
- **Advanced Triggering** - Trigger on protocol events, errors or data patterns with hyperlink back to the events views
- **External Trigger In / Out** - Use the Teledyne LeCroy Envision X84 to identify any packet and toggle a scope or logic analyzer (via SMA connectors)
- **Compliance Test option** - Envision X84 has CTS options for both CSI-2 and DSI-2, making sure your device meets specifications
- **Automation API** for advanced test creation

With comprehensive support for MIPI CSI-2v2 and DSI-2 specifications, Teledyne LeCroy's Envision X84 analyzer platform provides the industry's most accurate and reliable capture of MIPI camera and display protocols for fast debug, analysis and problem solving. The Envision X84 is loaded with innovative features that help uncover elusive protocol errors, and is the intelligent choice for any camera and display validation needs.

The Envision X84 is available with an integrated MIPI Conformance Test Specification (CTS) capability for both CSI and DSI, providing checks across all camera and display modes, packet types, and video formats, including high speed and low-power modes. Highly configurable, this single platform is the 'one-stop' solution for MIPI camera and display compliance.

### Unmatched Flexibility

The Envision X84 platform conforms to the MIPI DSI and DSI-2 and the CSI-2 version 2 standards, and supports both C-PHY & D-PHY standards.

In DSI mode it acts as a MIPI Device that connects to an SoC device under test (DUT) that provides the MIPI Host interface. It can also be inserted into the interface between an SoC and a display to sniff traffic.

In CSI mode it acts as a MIPI Host that connects to a camera or image sensor device under test (DUT) that provides the MIPI device interface. It can also be inserted into the interface between an SoC and a camera to sniff traffic.

The Envision X84 analyzer is highly configurable across packet types and data formats, and command and video modes for complete post silicon validation.

## Flexible Hardware

The front-end of the Envision X84 analyzer features standard MCX connectors that support CPHY or DPHY 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 per-lane and protocol activity to help characterize and debug interface traffic. The Envision X84 platform includes 4-8GB of recording memory plus a GbE link for uploading recorded traffic to the host PC.

The heart of the Envision X84 analyzer is a patented Test IP Transaction Processor technology. This state-of-the-art protocol-processing core 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 possible packet type and error counts, including combinations, configurable as a trigger event. In wrap recording mode, the Envision X84 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 with an SoC.

For CSI and DSI, a General Purpose I/O connector is included for connection to the DUT. This is useful for control and status. For CSI, two pins are used as CCI. All are software controllable via the software GUI or instrument API.

## Analysis Software

The Envision X84 utilizes a software graphical interface to control the instrument. A user API is available for automated testing if desired. The software uses colors and patterns to train the eye to understand information faster. When recording mixed protocol and PHY traffic, packets are labeled and interleaved in a single display.

The screenshot displays the CSI Protocol Tool software interface. The main window is titled "CSI Protocol Tool - Event Files: raw8". It features a menu bar (File, Connect, Mode, Find, Mark Events, Loop, Options, Help) and several control panels. On the left, there's a "C-Phy" section with a "Start Capture" button, a "Lanes" dropdown set to "1", and "LP Frequency" and "HS Sample Rate (Mpsps)" settings. The "Event Filters" panel shows checkboxes for "All Events", "Show Errors", "Long packets", "Short Packets", "Phy Events", and "Exclude Low Level Events". The "Capture Setup" panel includes options for "Start on Events", "Stop on Events", "Trigger on Events", and "Timeout" (set to 100 seconds). On the right, the "Event Statistics" panel shows counts for Short Packets (4504), Long Packets (2160), Total Packets (6664), Bursts (6664), CRC1 (0), CRC2 (0), Payload CRC (0), ECC1 (0), ECC2 (0), and Total errors (0). The bottom section is a table of captured events with columns for Index, Time, Delta Time, Event Code, and Event. The table shows a sequence of events including "Start of HS Burst", "Line Start (Line 903)", "HS Burst End", "Start of HS Burst", "RAW8 Data Payload Size: 1920 bytes", and "Line End (Line 903)". The status bar at the bottom indicates "Update Time: 0.1 secs", "SN:", and "0x120018:A".

Index	Time	Delta Time	Event Code	Event
50606	6.205 mS	1.090 uS	0x47	Start of HS Burst
50607	6.206 mS	20.000 nS	0x02	Line Start (Line 903)
50612	6.206 mS	15.000 nS	0x48	HS Burst End
50625	6.206 mS	445.000 nS	0x47	Start of HS Burst
50626	6.206 mS	17.500 nS	0x2A	RAW8 Data Payload Size: 1920 bytes
50630	6.211 mS	4.818 uS	0x48	HS Burst End
50644	6.211 mS	445.000 nS	0x47	Start of HS Burst
50645	6.211 mS	20.000 nS	0x03	Line End (Line 903)
50650	6.211 mS	10.000 nS	0x48	HS Burst End
50663	6.212 mS	1.090 uS	0x47	Start of HS Burst
50664	6.212 mS	17.500 nS	0x02	Line Start (Line 904)
50669	6.212 mS	17.500 nS	0x48	HS Burst End
50682	6.213 mS	445.000 nS	0x47	Start of HS Burst
50683	6.213 mS	20.000 nS	0x2A	RAW8 Data Payload Size: 1920 bytes
50688	6.218 mS	4.815 uS	0x48	HS Burst End
50701	6.218 mS	445.000 nS	0x47	Start of HS Burst
50702	6.218 mS	17.500 nS	0x03	Line End (Line 904)
50709	6.218 mS	12.500 nS	0x48	HS Burst End
50720	6.219 mS	1.090 uS	0x47	Start of HS Burst
50721	6.219 mS	20.000 nS	0x02	Line Start (Line 905)

Each event is shown on a separate row with every field labeled and color-coded. Events can be individually filtered, searched or exported from the trace.

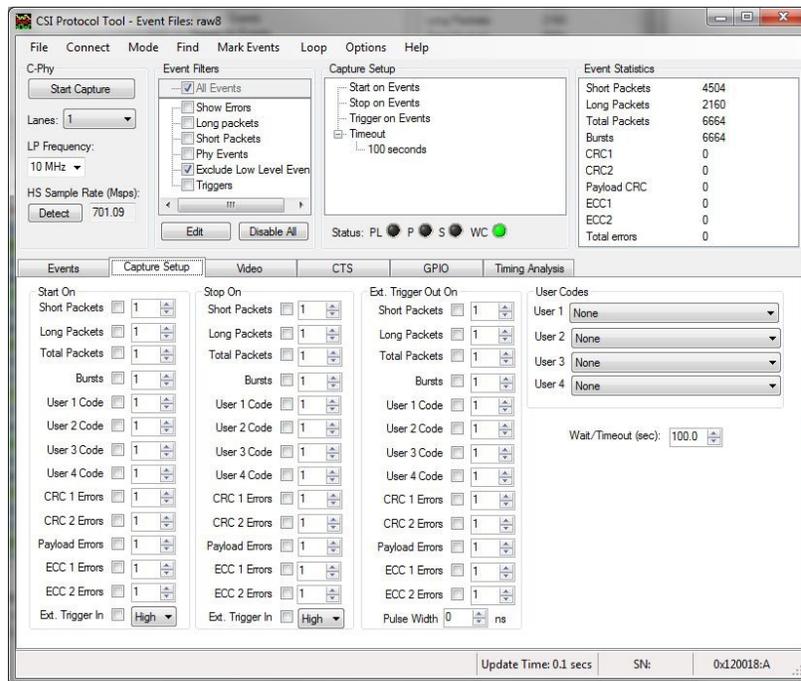
For each capture, event statistics are shown on the summary area on the top right. Capture triggers are shown on the middle right, to quickly view the setup selected.

Quick setup buttons are at the top left to start or stop captures, select the number of lanes, and set or detect PHY speed.

Pre-defined filters are available, as well as a user-defined filter mechanism, to allow quickly getting to the problem areas.

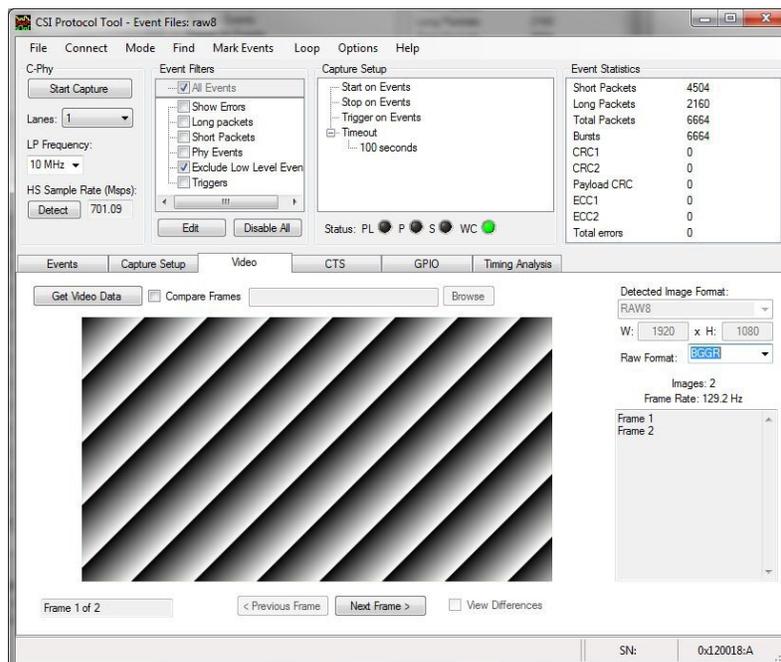
## Intelligent Triggering

The Envision X84 provides hardware triggering to pinpoint protocol events of interest. Trigger events can be specified at the protocol level, targeting general protocol types and specific counts, including errors. With the unified display of PHY and protocol events, debugging issues is optimized.



## Video Analysis

The Envision X84 can display all standard video and image types outlined in the MIPI CSI-2 and DSI-2 specifications. In addition, video images can be compared and regressed in looping mode with stop on errors. Also, for DSI, there is a video analysis tab that shows frame statistics.



## Conformance Test Options

The Envision X84 MIPI CSI and DSI CTS analyzer provides comprehensive support for conformance testing. It can look at individual runs or combinations of saved event files to provide robust coverage.

### One-button Compliance Testing

Fully automated, the compliance checker utilizes coverage technology to analyze one or more analysis runs, and provide users with a coverage report indicating what has been covered partially covered, or not covered. The application allows point-and-pick selection of individual coverage cases. Exporting of CTS coverage to a spreadsheet or CSV file is supported.

The screenshot displays the CSI Protocol Tool interface for event file analysis. The main window is titled "CSI Protocol Tool - Event Files: raw8". The interface is divided into several sections:

- File, Connect, Mode, Find, Mark Events, Loop, Options, Help**: Main menu items.
- C-Phy**: Includes "Start Capture", "Lanes: 1", "LP Frequency: 10 MHz", and "HS Sample Rate (Mpsps): 701.09".
- Event Filters**: A list of checkboxes for filtering events, including "All Events", "Show Errors", "Long packets", "Short Packets", "Phy Events", "Exclude Low Level Events", and "Triggers".
- Capture Setup**: Includes "Start on Events", "Stop on Events", "Trigger on Events", and "Timeout: 100 seconds".
- Event Statistics**: A table showing summary statistics for the analysis run.
- Buttons**: "Process Events", "Clear Events", "Browse", "Edit", and "Save Results".
- Event Counts**: A table listing event codes and their counts.
- Event Files**: A tree view showing the structure of the event file "raw8".
- CTS Test Results**: A table showing the results of various conformance tests.

Short Packets	4504
Long Packets	2160
Total Packets	6664
Bursts	6664
CRC1	0
CRC2	0
Payload CRC	0
ECC1	0
ECC2	0
Total errors	0

Code	Event	Lane
0x00	Frame Start (Frame 2)	3
0x01	Frame End (Frame 1)	3
0x02	Line Start (Line 1)	3
0x03	Line End (Line 1)	3
0x2A	RAW8 Data Payload Size: 19...	3
0x47	Start of HS Burst	3
0x48	HS Burst End	3

Test	Test Name	Comments
7.1.4	Forward Escape ULPM	No test yet - TBD
8.1.1	Sot Sequence	6664 HS Packets Sent with no errors
8.1.2	Lane Distributor	6664 HS Packets Sent with no errors
8.1.3	Byte Count not an Integer Multiple of the Number of Lanes	6664 HS Packets Sent with no errors Note: How to check not a multiple of number of lanes?
8.1.4	Lane Configuration	6664 HS Packet Sents with no errors Note: How to check all lane combinations?
9.1.1	Long Packet Data Types	2160 Long Packets Sent with no errors
9.1.2	Long Packet Format	2160 Long Packets Sent with no errors
9.1.3	Byte Ordering	2160 Long Packets 4504

Specifications	
Protocols Supported	MIPI CSI-2v2, MIPI DSI-2
Data Rates Supported	80 Mb/s to 2.5 Gb/s
Front Panel	<p>D-PHY and C-PHY Interconnect to DUT:            (12) MCX Jack Connectors            D-PHY (4) Lanes: D0+/- D1+/- D2+/- D3+/- CK+/-            C-PHY (3) Lanes: A0, B0, C0; A1, B1, C1; A2, B2, C2            Mates with MCX Straight Male (Plug)</p> <p>GPIO Connector:            Molex I-Grid 2x10 connector, Part Number 5018762040.            Mates with Molex I-Grid 2x10 Cable Connector,            Part Number: 501646-2000 and up to (20) Crimp Contacts,            Part Number: 501647-1000.</p> <p>Electrical Specifications:            Bi-Directional GPIO            Number of I/O Lines: 7            Voh: Open Collector Outputs,            Require pull-up resistors to <math>+1.8V \leq V_{pu} \leq +5.0V</math>.            Vol: +0.6V Max.@ 8mA            Vih: +1.2V Min. +5.0V Max.            Vil: +0.6V Max.            +3.3V @ 1.5A Output Power</p> <p>I2C Communication Bus            Open Drain with +3.3V 5K Pull-Up Resistors            400KHz</p> <p>Trigger Connectors:            Trigger IN: SMA Jack Input            Impedance: 700 KOhms            Max. Input Voltage: +3.5V            Vih: +2.0V Min.            Vil: +0.8V Max.</p> <p>Trigger OUT: SMA Jack Output            Impedance: 50 Ohm Series Termination            Max. Output Voltage: +3.3V            Voh: +2.3V Min. @ -12mA</p>
Dimensions (W x H x D)	Width: 16.0 in. (40.64cm) Height: 1.75 in. (4.45cm) Depth: 12.75 in. (32.39cm)
Weight	6.0 lbs (2.72kg)
Environmental	Operating Temperature: 0°C to 50°C (32°F to 122°F) Non-Operating Temperature: -10°C to 80°C (14° Temperature: Operating 0 °C to 55 °C (32 °F to 131 °F) Humidity: 10% to 90% RH (non-condensing)
Power Requirements	External 120-220V AC Power
Warranty	12 Month Hardware Warranty

## Ordering Information

### Product Description

Envision X84 Analyzer Hardware  
 Envision X84 - C-PHY License  
 Envision X84 - D-PHY License  
 Envision X84 - CSI License  
 Envision X84 - DSI License

### Product Code

ENV-CD01-TAA-X  
 ENV-CD01-CPHY-A  
 ENV-CD01-DPHY-A  
 ENV-CD01-CSI-A  
 ENV-CD01-DSI-A



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