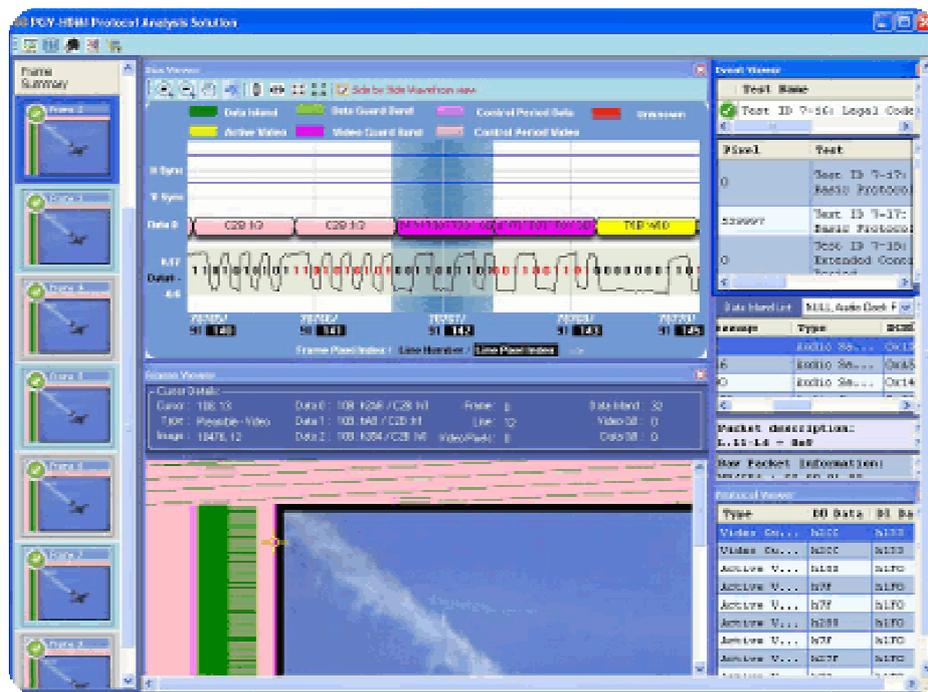


MHL/HDMI Protocol Analysis Software

TEK-PGY-MHL/HDMI-PA Data Sheet



Features

- Industry's first MHL/HDMI Protocol analysis software offers in-depth visibility from physical layer to video frames with unmatched data correlation between all the layers of MHL/HDMI protocol.
- Transforms the general purpose oscilloscope into sophisticated MHL/HDMI Protocol Analyzer.
- Debugging and troubleshooting made easy by cross-correlating the MHL/HDMI protocol data using frame summary viewer, frame viewer, Bus viewer, data packet and event viewers.
- Frame summary view helps to quickly locate error frames for detailed analysis.
- The Frame Viewer helps to view the transmitted frame with color coded MHL/HDMI operating modes as per the specification and eliminates the need of a Sink device in MHL/HDMI test setup by reproducing transmitted image in Oscilloscope display.
- Bus viewer with the Physical layer analog waveforms offers unmatched flexibility in correlating protocol errors with physical layer.
- The Protocol Viewer displays the tabular view of protocol information with decoded values.
- The Event Viewer lists detailed protocol errors and events in the MHL/HDMI compliance tests to quickly locate the protocol failures.
- Raw and detailed packet information in the Data packet viewer helps to identify the problems in Data Island periods.
- Supports 24, 30, 36, and 48 bits per video pixel for HDMI and 24 bits per pixel for MHL.
- Oscilloscope setup assistant automatically sets up the oscilloscope to obtain accurate and reliable test results.
- Performs the protocol Tests as per the MHL Compliance Test specification 1.1, HDMI Compliance Test specification 1.4a and displays quick Pass/Fail results.
- Conforms to HDMI Specification 1.4a and MHL Specification 1.1.
- Supports Oscilloscope live channels, Tektronix .wfm waveform files and .bin (P/A/V file format of HDMI Capture card) files

MHL/HDMI Protocol Analysis Software

TEK-PGY-MHL/HDMI-PA Data Sheet

- Generates comprehensive and customizable reports.
- Ability to export the analyzed data to .bmp, txt, csv, .bin (P/A/V File format) for advanced analysis.

The industry's first Oscilloscope based TEK-PGY-MHL/HDMI Protocol Analysis software lets you see every event in the MHL/HDMI stream from MHL/HDMI frame to physical layer analog signals which conventional protocol analyzer can not show.

TEK-PGY-MHL/HDMI Protocol Analyzer software performs the MHL/HDMI protocol compliance tests as per MHL CTS 1.1 and HDMI CTS 1.4a. It provides unmatched flexibility in analyzing, debugging, and correlating the test results from MHL/HDMI Frame to physical layer analog waveforms to address the MHL/HDMI design challenges.

For efficient debugging, TEK-PGY-MHL/HDMI software provides unique multi viewer which comprises of frame summary viewer, frame viewer, bus viewer, Protocol viewer, Data Island viewer and Event and test results viewer. Automatic cross-linking between all these viewers enables you to see and correlate the data in different parts of the MHL/HDMI protocol stack

oscilloscope offers a single box solution for physical and protocol layer testing.

Comprehensive MHL/HDMI Protocol Analysis

For efficient debugging and troubleshooting the MHL/HDMI protocol, TEK-PGY-MHL/HDMI Protocol analysis software offers Frame summary viewer, Frame viewer, Bus viewer, Protocol viewer, Data packet viewer and Event and test results viewers.

Frame summary viewer provides each frame's thumb nail image with summary of pass/fail test results of the corresponding frame. Frame summary viewer enables to quickly navigate to the failure frames for detailed analysis.

Frame Viewer shows the transmitted complete frame image as per the MHL/HDMI Specification. For easy identification of the operating modes, the Control period, preamble video, preamble data, data guard band, data island and video guard band, active video are shown with the different colours. Hovering over the image using mouse provides the respective operating mode's type, relative pixel information, transmitted 10bit data value and corresponding decoded information for the respective operating mode. Frame viewer eliminates the need for a MHL/HDMI sync device for viewing the image transmitted by the source.

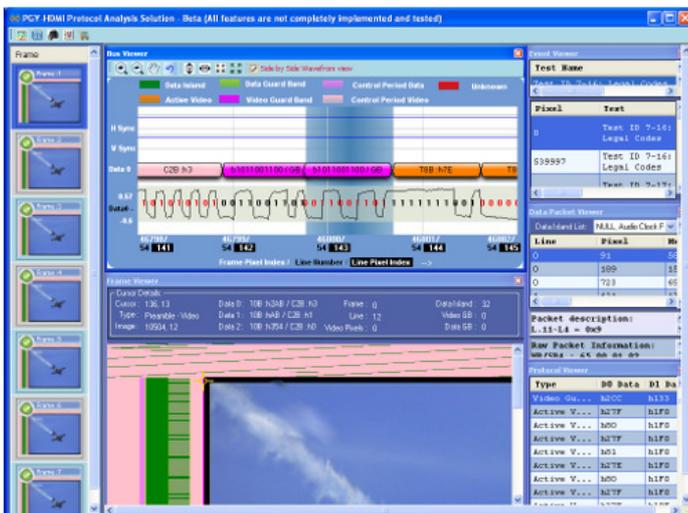


Figure 1: Multi viewer

TEK-PGY-MHL/HDMI protocol analysis software along with Tektronix physical layer compliance test solutions and Industry leading Tektronix high performance

MHL/HDMI Protocol Analysis Software

TEK-PGY-MHL/HDMI-PA Data Sheet

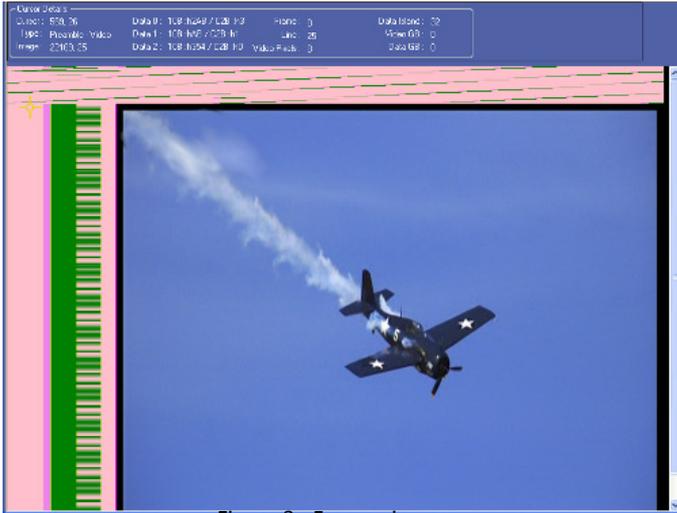


Figure 3: Frame viewer

Bus Viewer provides a way to visually inspect the transmitted MHL/HDMI information in Bus Diagram display along with the analog waveforms.

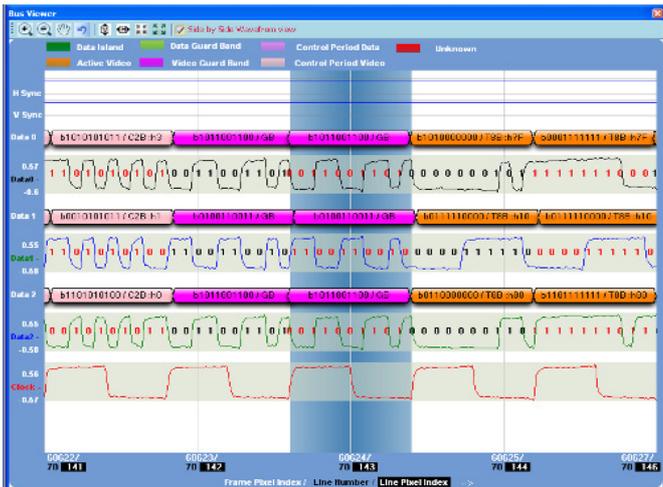


Figure 4: HDMI Bus viewer with Physical layer waveforms

The industry's first MHL/HDMI bus diagram and analog waveform with overlapped protocol data helps to identify the inter pair data skew, clock to data skew related problems. Each line is colour coded for Control period, preamble video, preamble data, data guard band, data island and video guard band, active video for easy error deduction. Apart from the bus information, the HDMI bus viewer also provides information about the H-Sync, V Sync active periods.



Figure 5: MHL Bus viewer with Physical layer waveforms

MHL bus viewer allows viewing the Data Positive and Data Negative waveforms and the corresponding common mode clock and data which are created using the captured MHL signals. MHL bus diagram also provides the transmitted multiplexed logical channel details as it is along with the de-multiplexed logical channels as per the MHL Protocol Specification.

For identifying and locating the errors in a specific period bus viewer provides pixel index in the selected frame, line number and pixel index within the line.

Utility functions such as zoom, un-zoom, pan, undo, fit horizontal, fit vertical, fit horizontal and vertical and side by side waveform and bus view helps to manoeuvre the bus diagram and analyze the MHL/HDMI protocol

The **Protocol Viewer** provides the table view of protocol listing with transmitted 10 bit data for each channel along with the decoded 8bit for active video, 4 bit TERC4 data for Data Island and 2 bit for Control period encoding along with the time stamp.

Figure 6: Protocol viewer



MHL/HDMI Protocol Analysis Software

TEK-PGY-MHL/HDMI-PA Data Sheet

Type	D0 Data	D1 Data	D2 Data	R Data	G Data	B Data	Time
Control Period Video	h354	hA8	h354	C2B :h0	C2B :h1	C2B :h0	13.968 ms
Control Period Video	h354	hA8	h354	C2B :h0	C2B :h1	C2B :h0	13.968 ms
Control Period Video	h354	hA8	h354	C2B :h0	C2B :h1	C2B :h0	13.968 ms
Control Period Video	h354	hA8	h354	C2B :h0	C2B :h1	C2B :h0	13.968 ms
Control Period Video	h354	hA8	h354	C2B :h0	C2B :h1	C2B :h0	13.968 ms
Control Period Video	h354	hA8	h354	C2B :h0	C2B :h1	C2B :h0	13.968 ms
Control Period Video	h354	hA8	h354	C2B :h0	C2B :h1	C2B :h0	13.968 ms
Control Period Video	h354	hA8	h354	C2B :h0	C2B :h1	C2B :h0	13.968 ms
Control Period Video	h354	hA8	h354	C2B :h0	C2B :h1	C2B :h0	13.968 ms
Control Period Video	h354	hA8	h354	C2B :h0	C2B :h1	C2B :h0	13.968 ms
Video Guard Band	h2CC	h133	h2CC	GB	GB	GB	13.968 ms
Video Guard Band	h2CC	h133	h2CC	GB	GB	GB	13.968 ms
Active Video	h1F0	h1F0	h1F0	T8B :h10	T8B :h10	T8B :h10	13.968 ms
Active Video	h10F	h10F	h10F	T8B :h11	T8B :h11	T8B :h11	13.968 ms
Active Video	h10E	h3F1	h10E	T8B :h12	T8B :h12	T8B :h12	13.968 ms
Active Video	h1F1	h30E	h30E	T8B :h13	T8B :h13	T8B :h13	13.968 ms
Active Video	h30E	h30E	h30E	T8B :h13	T8B :h13	T8B :h13	13.968 ms
Active Video	h10C	h3F3	h10C	T8B :h14	T8B :h14	T8B :h14	13.968 ms
Active Video	h1F3	h30C	h30C	T8B :h15	T8B :h15	T8B :h15	13.968 ms
Active Video	h1F2	h30D	h30D	T8B :h16	T8B :h16	T8B :h16	13.968 ms
Active Video	h10D	h10D	h3F2	T8B :h17	T8B :h17	T8B :h17	13.968 ms
Active Video	h108	h3F7	h108	T8B :h18	T8B :h18	T8B :h18	13.968 ms
Active Video	h1F7	h308	h1F7	T8B :h19	T8B :h19	T8B :h19	13.968 ms
Active Video	h308	h308	h1F7	T8B :h19	T8B :h19	T8B :h19	13.968 ms
Active Video	h309	h309	h1F6	T8B :h1A	T8B :h1A	T8B :h1A	13.968 ms
Active Video	h109	h109	h3F6	T8B :h1B	T8B :h1B	T8B :h1B	13.968 ms
Active Video	h30B	h30B	h30B	T8B :h1C	T8B :h1C	T8B :h1C	13.969 ms
Active Video	h10B	h10B	h3F4	T8B :h1D	T8B :h1D	T8B :h1D	13.969 ms
Active Video	hA0	h25F	h25F	T8B :h1E	T8B :h1E	T8B :h1E	13.969 ms

Data Packet Viewer lists the entire data packets transmitted in the selected frame. Each data island period type, line number, the pixel number, data island period's BCH data are displayed in the tabular format. Depending on the packet type the data packet viewer also provides the details of the data packet as per the CEA 861 specification.

Line	Pixel	Message	Type	BCH0	BCH1	BCH2	BCH3
0	91	56	Audio Sa...	0x1D08FD...	0x000000...	0x000000...	0x000000...
0	189	156	Audio Sa...	0xA508FD...	0x000000...	0x000000...	0x000000...
0	723	690	Audio Sa...	0x1488FC...	0x000000...	0x000000...	0x000000...
1	421	1252	Audio Sa...	0xC408FC...	0x000000...	0x000000...	0x000000...
2	120	1815	Audio Sa...	0xC000FC...	0x000000...	0x000000...	0x000000...
2	682	2377	Audio Sa...	0xD888FC...	0x000000...	0x000000...	0x000000...
3	381	2940	Audio Sa...	0xF888FC...	0x000000...	0x000000...	0x000000...
4	79	3502	Audio Sa...	0x7800FF...	0x000000...	0x000000...	0x000000...
4	642	4065	Audio Sa...	0x6580FF...	0x000000...	0x000000...	0x000000...

Packet description:
 CheckSum = 0x98
 RGB or YCbCr, Y1-Y0 = 0b10 (YCbCr 4:4:4) of PB1 (0x5d)
 Active Format Information Present, A0 = 0b10f PB1 (0x5d)
 Bar Info, B1-B0 = 0b11 of PB1 (0x5d)
 Scan Information, S1-S0 = 0b01 of PB1 (0x5d)
 Colorimetry, C1-C0 = 0b01 of PB2 (0x68)
 Picture Aspect Ratio, M1-M0 = 0b10 of PB2 (0x68)
 Active Format Aspect Ratio, R3-R0 = 0b1000 of PB2 (0x68)
 Non-uniform Picture Scaling, S1-S0 = 0b00 of PB2 (0x68)

Raw Packet Information:
 HB/SB4 : E4 0D 02 82
 SB0 : 58 00 00 12 00 68 5D 98
 SB1 : 00 00 00 00 00 00 00 00
 SB2 : 00 00 00 00 00 00 00 00
 SB3 : 00 00 00 00 00 00 00 00

Figure 7: Data Packet viewer

MHL/HDMI Protocol compliance testing MHL/HDMI Protocol Software makes comprehensive test as per HDMI Compliance Test Specification 1.4a and MHL Compliance test specification 1.1.

Event and Test results viewer list the selected tests results along with the description of each test pass/ fail information.

Test Name	Result
Test ID 7-16: Legal Codes	Pass
Test ID 7-17: Basic Protocol	Pass
Test ID 7-18: Extended Control Period	Pass
Test ID 7-19: Packet Types	Pass
Test ID 7-23/24: Pixel Encoding	Fail

Pixel	Test	Event Description
0	Test ID 7-23/24: Pixel Encoding	(7-23 and 7-24) Source DUT should always outputs required pixel encoding and also correlates with AVI fields Y0 and Y1.
4372	Test ID 7-23/24: Pixel Encoding	Error: AVI infoFrame field Y1 and Y0 does not indicate RGB encoding. (Actual = 2, Expected = 0).
0	Test ID 7-25: Video Format Timing	(7-25) Video Format Timing should be valid
1	Test ID 7-25: Video Format Timing	Pixel clock should be within allowable range -> No Error
1	Test ID 7-25: Video Format Timing	Pixel clock frequency is 27.000 Mhz. Selected format pixel clock frequency is 27.000 Mhz.
2	Test ID 7-25: Video Format Timing	HSYNC/VSYNC polarity should be equal to NEGATIVE/NEGATIVE -> No Error
3	Test ID 7-25: Video Format Timing	Number of pixels that HSYNC remains active should be equal to 64 (HS_LEN) -> No Error
4	Test ID 7-25: Video Format Timing	Number of pixels from end of Video Data Period to HSYNC active edge should be equal to 12 (VIDEO_TO_HS) -> No Error

Figure 8: Event and Test results viewer

Seamless oscilloscope integration

TEK_PGY-MHL/HDMI-PA software runs inside the Tektronix high performance windows oscilloscope. The oscilloscope setup assistant helps to set up the Oscilloscope automatically for reliable and accurate test results.

Software offers the flexibility of capturing 2sec video frames as per MHL/HDMI test procedure or few frames for quick debugging purpose.

Total Duration of Capture

Duration of capture: Sec

Total frames to be tested:

Frame Display

Display all captured data

Display only complete frames

Test all captured data

Test only complete frames

Oscilloscope Setup Assistant

Pixel clock frequency: Mhz

Figure 9: Capture settings

Automated customizable Report and Export

MHL/HDMI software's in-built automated report generator offers a customizable report generation capability helps to communicate the test reports

MHL/HDMI Protocol Analysis Software

TEK-PGY-MHL/HDMI-PA Data Sheet

effectively between the fellow team members and management.

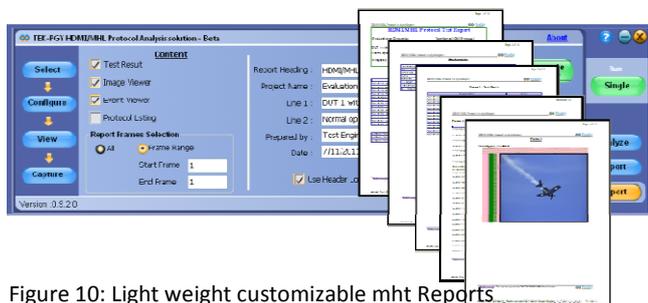


Figure 10: Light weight customizable mht Reports

To further analyze the data, the software also provides image, protocol and data island period data in multiple export formats. The P/A/V Binary format helps to cross correlate the TEK-PGY-MHL/HDMI data with the conventional protocol analyzer software.

Applications

Analyzing and Debugging HDMI and MHL protocol in:

- Mobile smart phones / PDAs
- Digital home appliances
- Portable Video Players
- Netbooks
- Gaming machines

Characteristics

Select panel	
Modes	HDMI / MHL
Displays	Frame summary viewer
	Frame Viewer
	Bus Viewer
	Protocol Viewer
	Data Packet Viewer
Event and Test results viewer	
HDMI Protocol Tests (As per CTS 1.4a)	
Source Protocol Tests	7-16 Legal Codes
	7-17 Basic Protocol
	7-18 Extended Control Period
	7-19 Packet Types

Source Video	7-23/7-24 Pixel Encoding
	7-25 Video Format Timing
	7-26 Pixel Reception
Source Audio	7-27 AVI Infoframe
	7-28 IEC 60958/IEC 61937
	7-29 ACR
	7-30 Audio Sample Packet Jitter
	7-31 Audio InfoFrame
Interoperability	7-32 Audio Sample Packet Layout
	7-33 Source Interoperability with DVI
Source Advanced features	7-34 Deep Color
	7-35 Gamut Metadata Transmission
	7-36 High Bitrate Audio
	7-37 One Bit Audio
	7-38 3D Video Format Timing
	7-39 4KX2K Video Format Timing
	7-40 Extended Colorimetry Transmission

MHL Protocol Compliance Tests (As per CTS 1.1)	
Source Protocol Tests	Legal Codes
	Basic Protocol
	Packet Types
Source Video	Pixel Encoding
	Video Format Timing
	Video Quantization test
Source Audio Tests	AVI Infoframe
	Audio Test
	Audio Clock Regeneration Test
Source	Audio InfoFrame
	Oscilloscope/ Tektronix .wfm files/ PAV Analyzer .bin file
HDMI Source	Clock, Data0, Data1, and Data2
MHL Source	Data+ and Data- / Common mode clock and Data
Pixel Encoding	RGB/ YCbCr 4:4:4/ YCbCr 4:2:2
Bits per pixel (HDMI)	24/30/36/48
Bits per pixel (HDMI)	24
Format	IEC 861-D/ IEC 861-E/ 3D – Frame Packed/ 3D Side by Side/ 3D Top and Bottom / 4Kx2K
Export	
Export formats	Image (.BMP / .JPEG/ CSV), Protocol (TXT/ CSV/.BIN), Events (CSV/ TXT)
Report	
Report format	HTML / MHL

MHL/HDMI Protocol Analysis Software

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DHCP	
DHCP	Not supported

- FlexRay Protocol and SI Analysis Software.
- USB 2.0 Protocol Decode Software.
- SPI Protocol Decode Software.
- UART/RS232 Protocol Decode solution.

Oscilloscopes Supported

Following Tektronix Oscilloscopes are supported. It is recommended to have option 20XL (Maximum of 250M record length per channel) for protocol compliance testing.

- DPO70000 Series Oscilloscope
- MSO70000 Series Oscilloscope
- DSA70000 Series Oscilloscope

Ordering Information

Option:

MHL Protocol Analyzer – TEK-PGY-MHL-PA-SW

HDMI Protocol Analyzer - TEK-PGY-HDMI –PA-SW

MHL/HDMI Protocol Analyzer – TEK-PGY-HDMI-MHL

To order contact the nearest Tektronix Sales office or Prodigy Technovations Pvt Ltd

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Phone: +91-80-3-255-1030

For more details, visit www.prodigytechno.com

About Prodigy Technovations Pvt Ltd

Prodigy Technovations Pvt Ltd (www.prodigytechno.com) is a leading global technology provider of Protocol Decode and PHY layer testing solutions on test and measurements equipments. The company's ongoing efforts include successful implementation of innovative and comprehensive protocol decode solutions as well as PHY Layer testing solutions that span the serial data, telecommunications, automotive, and defence electronics sectors worldwide.

Other products

- I2S Electrical, Audio and Protocol Testing Software.
- I2C Electrical Validation and Protocol Decode Software
- SPI Electrical Validation and Protocol Decode Software