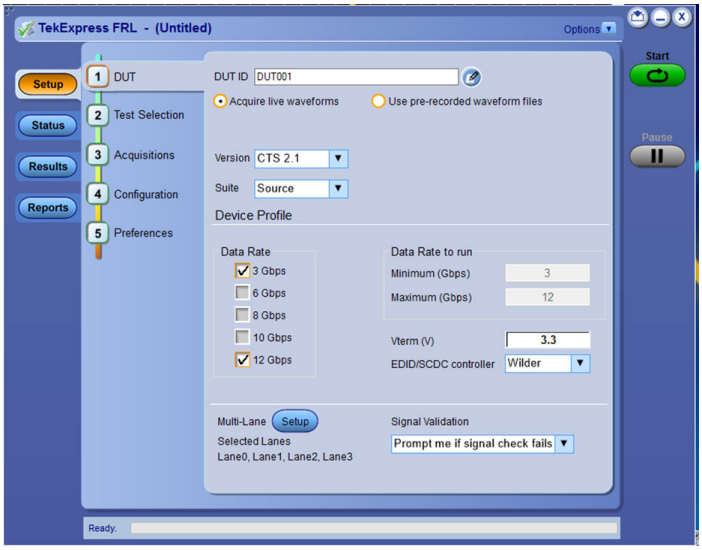
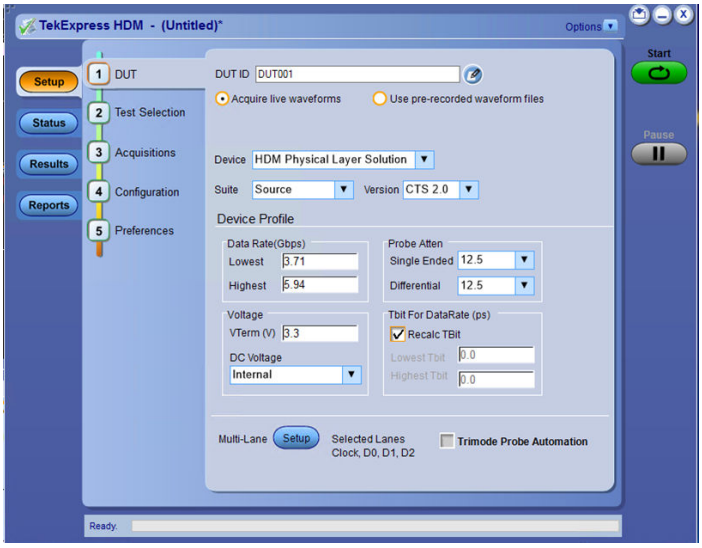
# HDMI Compliance Test Software

## TekExpress HDMI Source Compliance Test Application for HDMI 2.1/HDMI 2.0/HDMI 1.4

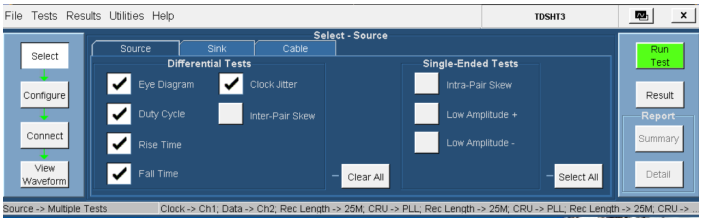



**HDMI 2.1**: Engineers designing and validating the HDMI physical layer of their devices face constant pressure to improve efficiency. Designers need to perform a wide range of compliance tests quickly and reliably, right on their bench. The HDMI 2.1 is known for Fixed Rate Link (FRL) supports up to 4 k at 120 Hz or 8 k at 60 Hz for both compressed and uncompressed video content. The FRL supports only predefined discrete data rates - 3 Gbps, 6 Gbps, 8 Gbps, 10 Gbps, and 12 Gbps on each of its 4 lanes, which means the FRL supports a post encoded link bandwidth of up to 48 Gbps.




**HDMI 2.0**: HDMI 2.0 supports features like 2160p (also known as Ultra HD/4K 2K 60/50 Hz), operating at 5.94 Gbps.

Option HDM compliance software automates a comprehensive range of tests according to CTS 2.0.




**HDMI 1.4**: TDSHT3 automate a comprehensive range of tests according to CTS 1.4b - enabling unprecedented efficiency with reliable results. HDMI 1.4b compliance testing is a PREREQUISITE for HDMI 2.0 testing.

### Key features

**HDMI 2.1 FRL (Opt. HD21/Opt. DJA/Opt. SDLA64)**

- Conformance to HDMI 2.1 Standards and Compliance Test Specification 2.1 (CTS)
- Simple and easy setup to perform measurements
- The TekExpress based software solution allows to completely automate the execution of all source measurements
- Fully integrated with EDID/SCDC emulators
- Statistically based Pass/Fail results, quick results with Pass/Fail notification, and limit margins.

**HDMI 2.0 HDM (Opt. HDM)**

- Conformance to HDMI 2.0 Compliance Test Specification (CTS)
- Accurate source tests using precise measurement techniques
- Quick results with automatic mask fit, measurements and Pass/Fail notification, and in-depth results with statistical analysis and mask margins
- Quick testing with one-button selection of multiple tests and CSV-format test summary and reports
- Comprehensive HDMI 2.0 solution including test fixtures, DPO/DSA/MSO70000

**HDMI 1.4 TDSHT3 (Opt. HT3)**

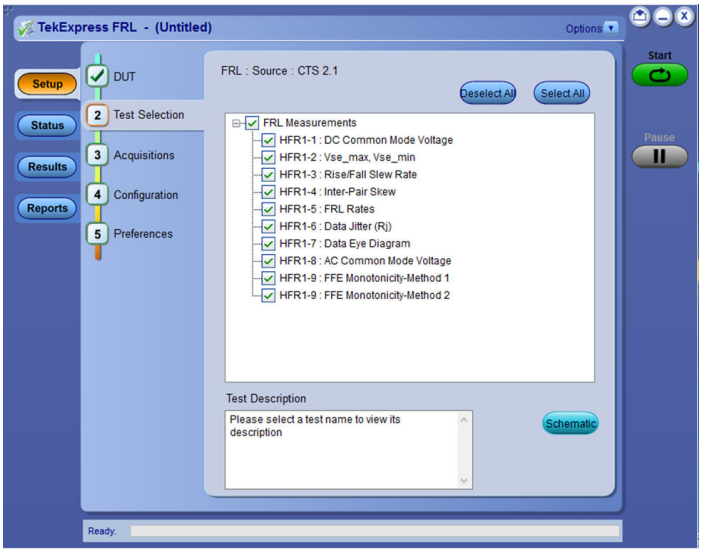
- Conformance to HDMI 1.4a/b Standards and Compliance Test Specification 1.4a/b (CTS)
- Accurate source tests using precise measurement techniques
- Quick results with automatic mask fit, measurements and Pass/Fail notification, and in-depth results with statistical analysis and mask margins

- Quick testing with one-button selection of multiple tests and CSV-format test summary and reports
- Comprehensive HDMI 1.4a/b solution including test fixtures, DPO/DSA/MSO70000

## Fully automated HDMI 2.1 FRL compliance testing

The TekExpress FRL compliance solution provides you the tools to easily run High Definition Multimedia Interface (HDMI) tests under the HDMI 2.1 compliance test specification. It provides a complete and reliable solution for quick testing.

Quick Pass/Fail tests substantiated with results make the TekExpress FRL application the preferred solution for HDMI 2.1 physical layer validation. In-depth analysis is possible with the statistical information about the performed tests.



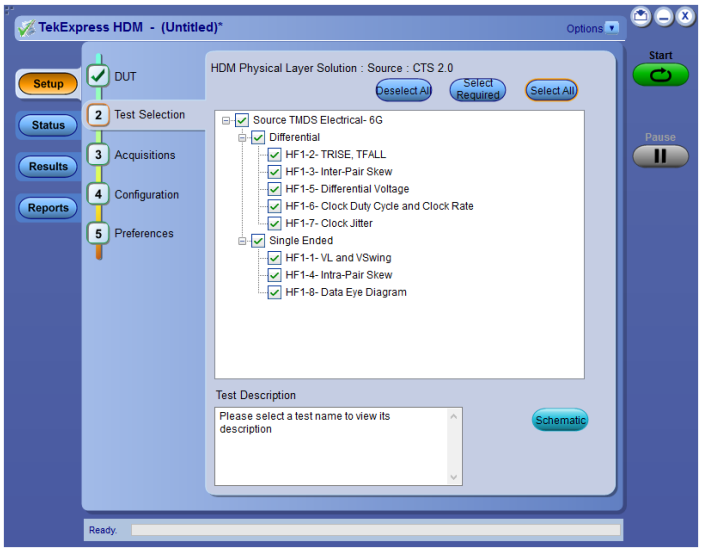

*HDMI 2.1 Source Measurements*

## Applications

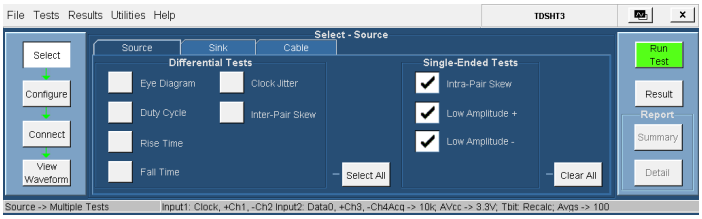
- Design and validation of HDMI 2.0/1.4a/b physical layer

## Reliable and dependable results

Option HDM embeds HDMI forum CTS 2.0 compliance test procedures, ensuring reliable results. TDSHT3 embeds the HDMI CTS 1.4a/b compliance test procedures, including the software clock recovery (SoftCRU), ensuring dependable results. Accurate eye rendering and precise violation testing deliver credible results. Authentic measurement techniques and automation eliminate errors to provide repeatable results.




*HDMI 2.0 Source Measurements*




*HDMI 1.4 Source Measurements*

## Faster validation cycles

The unparalleled automation offered on the HDM, TDSHT3 enables faster validation. Demonstrate efficiency by using the "Select All" feature to perform multiple tests. Quickly generate CSV-format summaries or detailed reports at a press of a button.

## Test descriptions

### Source Electrical Test List

#### HDMI 2.1 FRL

| Test ID | Test point | Measurement |
|---|---|---|
| HFR1-1 | TP1 | DC Common Mode |
| HFR1-2 | | Vse_max, Vse_min |
| HFR1-3 | | TRISE, TFALL |
| HFR1-4 | | Inter-Pair Skew |
| HFR1-5 | | FRL Rate |
| HFR1-6 | TP1/TP2 | Data Jitter (Rj) |
| HFR1-7 | TP2_EQ | Data Eye Diagram |
| HFR1-8 | TP1 | AC Common Mode Noise |
| HFR1-9 | | FFE |

### HDMI 2.0 HDM

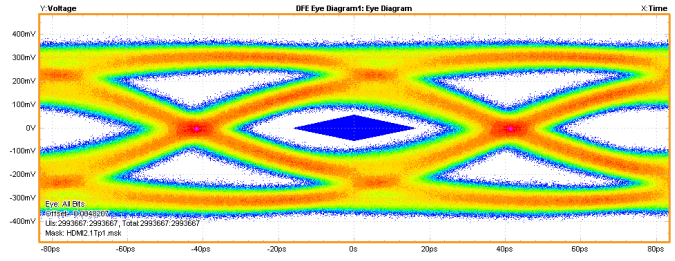
| Test ID | Test point | Test Mode |
|---|---|---|
| HF1-1 VL and Vswing | TP1 | Single-ended |
| HF1-2 Rise and Fall times | TP1 | Differential |
| HF1-3 Inter pair skew | | |
| HF1-4 Intra-pair skew | TP1 | Single-ended |
| HF1-6 Clock Duty cycle | TP1 | Differential |
| HF1-7 Clock Jitter | TP2_EQ | Differential |
| HF1-8 Data Eye Diagram | TP2_EQ | Single-ended |
| HF1-5 Differential Voltage | TP1 | Differential |

### HDMI 1.4 TDSHT3

| Test ID | Test point | Test Mode |
|---|---|---|
| 7-2 TMDS VL | TP1 | Single-ended |
| 7-4 TMDS Rise and Fall Times | | Differential |
| 7-6 TMDS Inter pair skew | | |
| 7-7 TMDS Intra-pair skew | | Single-ended |
| 7-8 TMDS Clock Duty cycle | | Differential |
| 7-9 TMDS Clock Jitter | | |
| 7-10 TMDS Data Eye diagram | | |
| 7-3 Voff | | Single-ended |

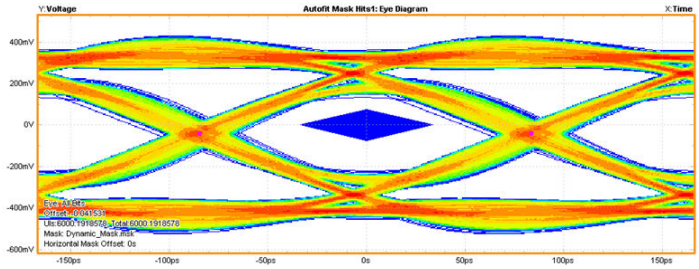
## Eye diagram analysis

**HDMI 2.1 Eye diagram capability:** Displays the eye diagram of the High-Speed signal with option DJA enabled on the oscilloscope for test HFR1-7 Data lane Eye Diagram. This test evaluates the waveform parameters over a significant interval of time to verify that with proper clock recovery and equalization, there is no signal incursion into regions defined by a mask to result in correct demodulation of data. The equalization (CTLE and DFE is applied for data rate equal to 12 Gbps; while CTLE only is applied, for any other data rate) on the resulting summed waveform for a wider eye-opening.



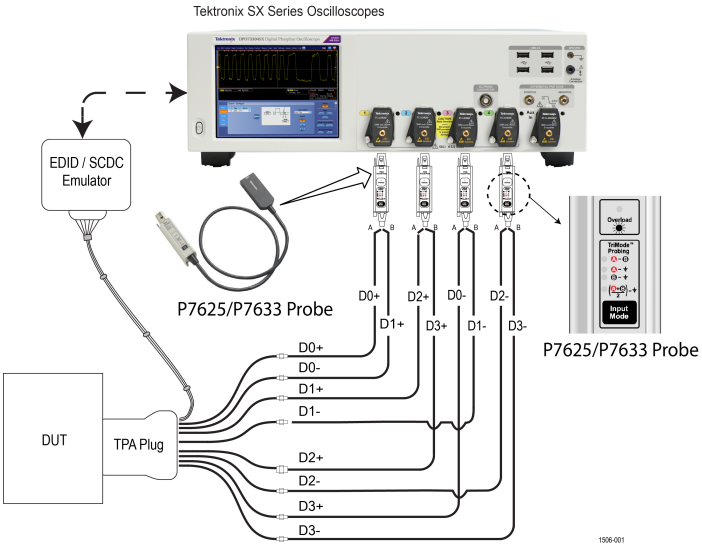

*Eye diagram analysis for HDMI 2.1, 12Gbps signal*

**HDMI 2.0 Eye diagram capability:** Displays the eye diagram of the High-Speed 6Gbps signal with option HDM and DJA enabled on the oscilloscope for test HF1-8 Data lane Eye Diagram. Software automatically applies WCM and CTLE to render HDMI 2.0 HF1-8 eye diagram measurement.




*Eye diagram analysis for HDMI 2.0, 6Gbps signal: Single Ended Input eye rendered at Tek lab with auto-mask adjust feature*

## Source Schematic with TriMode Differential Probes




*DPO70K SX/DX Oscilloscope with TriMode Differential Probes*

# Ordering information

### Required software

| Product/Feature | Description |
|---|---|
| Opt. HD21 | HDMI 2.1 Advanced Analysis and Compliance Software for Tx tests |
| Opt. DJA | DPOJET-Advanced Jitter Analysis |
| Opt. SDLA64 | Serial Data Link Analysis |
| Opt. HDM | HDMI 2.0 Advanced Analysis and Compliance Software for Source testing.<br>• Prerequisite for HDMI 2.0 is HDMI 1.4b testing; hence TDSHT3 is required.<br>• Prerequisite is Option DJA, Opt 10XL (required for 100M RL), and SR-CUST. |
| Opt. HT3 | HDMI 1.4b Compliance Test Software |
| DPOFL-HDM | Advanced Analysis and Compliance Software for HDMI 2.0 Tx floating license |
| DPOFT-HDM | Advanced Analysis and Compliance Software for HDMI 2.0 Tx floating license (trial version) |

## Software upgrades

| Product/Feature | Description |
|---|---|
| DPO/DSA/MSO70000 SX/DX | Order DPO-UP – Opt. HD21 |
| DPO/DSA/MSO70000 SX/DX | Order DPO-UP – Opt. HDM |
| DPO/DSA/MSO70000 SX/DX | Order DPO-UP – Opt. HT3 |

## Recommended equipment and accessories

### HDMI 2.1/2.0/1.4 source single oscilloscope

| Accessory | Description |
|---|---|
| Description | • DPO/MSO70000 series real-time oscilloscopes: DPO72304SX[1] Digital Phosphor Oscilloscope with bandwidth ≥ to 23 GHz; 4 Ch, 23 GHz, 50 GS/s or 2 Ch, 23 GHz, 100 GS/s (Needed for HDMI 2.1)<br>• DPO/MSO70000 SX/DX series real-time oscilloscopes with min 16M Record Length Opt. 2XL on and DX series oscilloscopes (For eye diagram and jitter tests) (Needed for HDMI 2.0)<br>• 100M Record Length Opt 10XL (Needed for HDMI 2.0)<br>• Option DJA and SR-CUST (Also required for HDM Software)<br>• HDMI 1.4b Compliance Test Software |
| Probes | • P7625/P7633/P7720 Tri-mode probe with P76CA-292C (4 Nos.) |
| Differential probes | • Minimum 3 probes are recommended for HDMI 2.0 testing and are also used for single-ended testing.<br>• Four P76xx/P7720 Tri-mode probe with P76CA-292C probes are recommended for faster physical layer testing of all 4 HDMI 1.4 and HDMI 2.0 channels. |

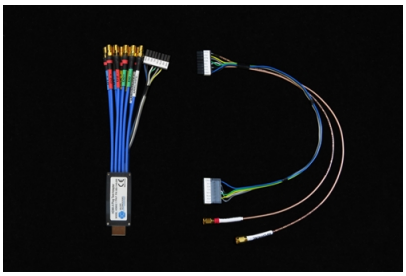
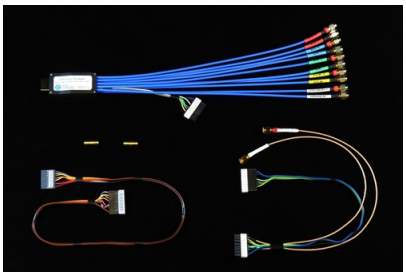
[1] Any 4 channel 23 GHz or greater

**Recommended test fixture cables and tools**

| Description | Image |
|---|---|
| **Description:** Cable assembly: Phase matched pair, SMA plug to SMA plug, 1 meter<br>**Part number:** 174-5771-xx<br>**Quantity:** 2 |  |
| **Description:** SMA female to female adapter, 0.500 L<br>**Part number:** 015-1012-xx<br>**Quantity:** 8 |  |

## HDMI fixtures

| Fixture Type | Nomenclature |
|---|---|
| HDA 2.1-TPA-P | HDMI 2.1 Type A Plug Adapter (1 Qty) |
| HD-EDID-TEMSS | HDMI EDID Controller Kit Wilder (1 Qty) |
| HDMI 2.0 Type-A | TF-HDMI-TPA-P plug fixture |
| | TF-HDMI-TPA-T |
| | HD-EDID-TEMSS or AJSC-1<br>(HDMI EDID Controller Kit /Allion SCDC/EDID Controller) |
| HDMI 1.4b Type-A | TF-HDMI-TPA-P plug fixture |
| | TF-HDMI-TPA-CE EDID board with EDID EEPROM |

| | | |
|---|---|---|
| **Model number:** HDMIA2.1-TPA-P<br>**Part number:** 640-0860-000<br>  | **Model number:** HDMIA2-TPA-12P<br>**Part number:** 640-0770-200<br>  | **Model number:** HDMI-TPA-T<br>**Part number:** 640-0408-000<br>  |

## Supported Tektronix instruments

**Real-time oscilloscopes**

**HDMI 2.1 Tx compliance software**

- DPO/MSO70000 series real-time oscilloscopes: DPO72304SX[1] Digital Phosphor Oscilloscope with bandwidth ≥ to 23 GHz; 4 Ch, 23 GHz, 50 GS/s or 2 Ch, 23 GHz, 100 GS/s support HDMI 2.1 FRL compliance software.
- DPS 70000 SX (Two Stack) series: DPO75002SX[2], DPO75902SX[2], and DPO77002SX[2].

**HDMI 2.0, HDMI 1.4 Tx compliance software**

- DPO/MSO70000 Series real-time oscilloscopes support HDMI 2.0 HDM, HDMI 1.4 TDSHT3 compliance softwares.

  **Note:** The recommended oscilloscope bandwidth for HDMI 2.0 is ≥ to 16 GHz. Although a 12.5 GHz bandwidth oscilloscope is supported, it will have as much as a 10% variation in test results.
- DPS 70000 SX (Two Stack) series: DPO75002SX[2], DPO75902SX[2], and DPO77002SX[2].

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Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.

Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

[2] Supports Two stack series with 50 GHz and above ATI scopes with 4 x probes for HDMI 2.1, 2.0, and 1.4 compliance testing.

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