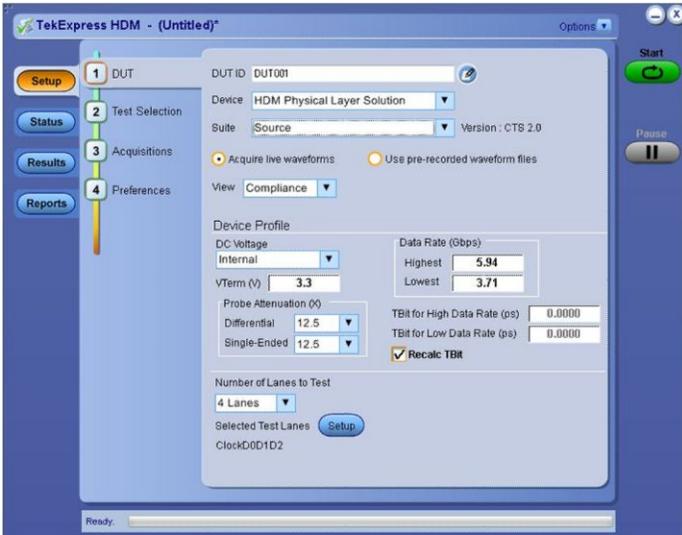
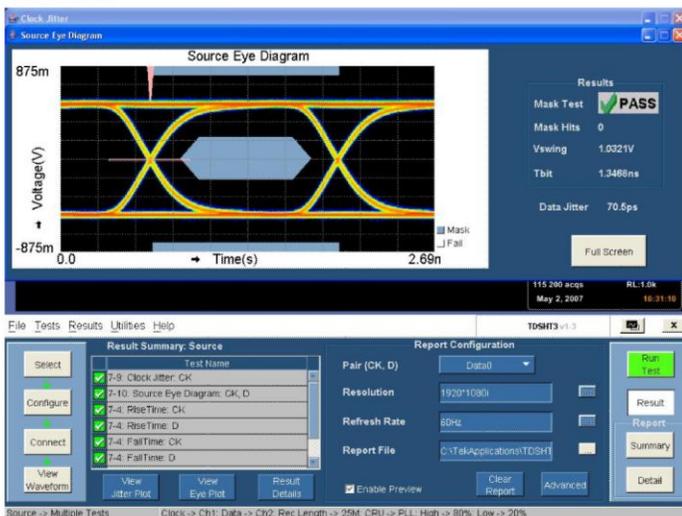


# HDMI compliance test software

## Options HDM, HDM-DS, HDM-DSM, HT3, and HT3-DS Datasheet



HDM software



HT3 software

### HDMI compliance test software

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. HDMI 2.0 supports features like 2160p (also known as Ultra HD/4K 2K 60/50 Hz), operating at 5.94 Gcps apart from 4K 2K 4:2:0, using the same Cat 2 cable and HDMI 1.4b connector. HDMI 1.4a/b introduces Automotive HDMI (Type E) in addition to Mobile HDMI (Type D), HEAC, 3D HDMI, 4K x 2K patterns, and new Calorimetric patterns, all operating up to 3.4 Gb/s.

Option HDM and HDM-DS Advanced Analysis and Compliance Software automates a comprehensive range of tests according to CTS 2.0. TDSHT3 and HT3-DS HDMI Compliance Test Software 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.

The new Option HDM-DSM adds Advanced Analysis and Characterization support for HDMI 2.0 Receiver tests.

### Key features

- Conformance to HDMI 2.0 Compliance Test Specification (CTS)
  - Introducing the innovative HDMI protocol analyzer solution for HDMI 1.4b
  - One-box solution for HDMI 1.4b physical-layer and protocol-layer testing
  - Fast, efficient direct synthesis solution
  - Conformance to HDMI 1.4a/b Standards and Compliance Test Specification 1.4a/b (CTS)
  - Complete validation to standards with wide range of tests for source, sink, and cable devices
  - Accurate source tests using precise measurement techniques
  - Dependable sink tests with closed-loop measurements that eliminate nonlinearities in test setup
  - Automation of complex sink and cable tests with remote control of signal sources and software emulation of cable effects, eliminating the need for hardware transition time converters (TTC) and cable emulators
  - 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 2.0/1.4a/b solution including test fixtures, DPO/ DSA/MSO70000 real-time oscilloscopes, P7313SMA differential probes, AWG70000/7000 signal sources, HDMI fixtures, and DSA8300 sampling oscilloscopes
- ### Option HDM-DSM
- Supports HDMI2.0 Pattern creation.
  - Supports all the VIC (video identification code) specified CEA861-F specification
  - Supported color depths: 24 bits, 30 bits, 36 bits, 48 bits

- Supported color sub-sampling: RGB, YCBCR 4-4-4, YCBCR 4-2-0, YCBCR 4-2-2
- Supported Image types: Gray scale, Color bar, Chess board, Aspect ratio and Custom images
- Supports all 3D frame types
- Customized for HDMI2.0 test specific configurations
- Ability to sync the patterns created in the AWG with TekExpress HDM solution
- Supports Closed loop calibration and has the ability to create patterns for margin tests

## Applications

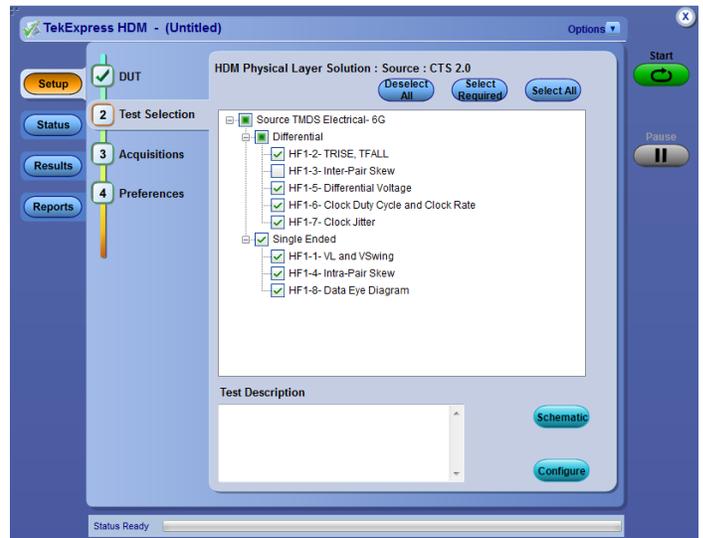
- Design and validation of HDMI 2.0/1.4a/b physical layer

## Reliable and dependable results

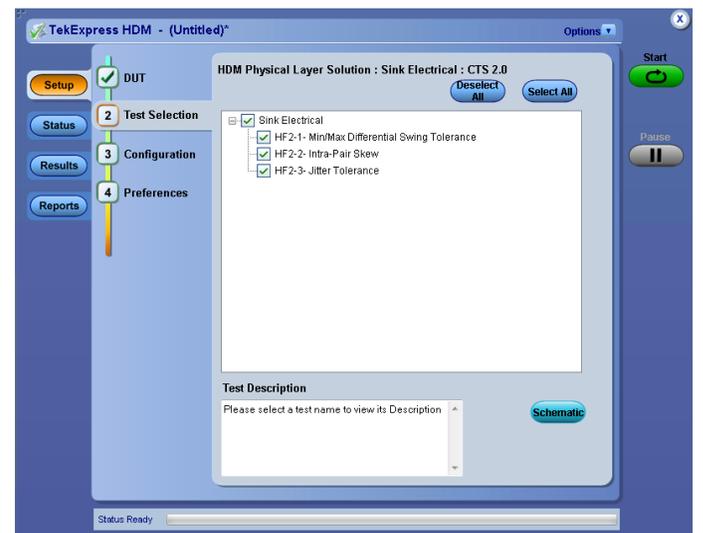
Option HDM embeds HDMI forum CTS 2.0 compliance test procedures, ensuring reliable results. Option HDM-DSM allows you to create required HDMI2.0 patterns. It also supports closed loop calibration and has the ability to create pattern for margin tests. TDSHT3 embeds the HDMI CTS 1.4a/b compliance test procedures, including the software clock recovery (SoftCRU), ensuring dependable results. Accurate eye rendering and precise violation testing deliver credible results. Perform accurate Sink tests with closed-loop measurements that eliminate nonlinearities of the test setup. Authentic measurement techniques and automation eliminate errors to provide repeatable results.

## Faster validation cycles

The unparalleled automation offered on the HDM, HDM-DS, HDM-DSM, TDSHT3 and HT3-DS enables faster validation. Reduce test times for complete HDMI Sink testing with HDM, HDM-DS, TDSHT3 and HT3-DS by digitally controlling cable emulator and TTC effects. 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.



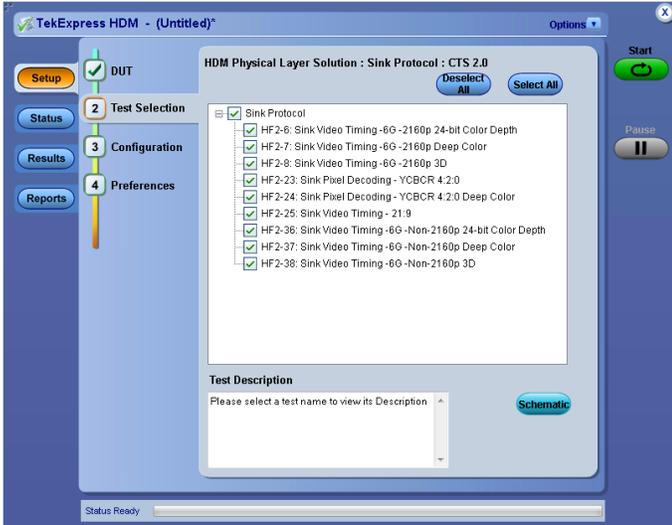
HDM SW - Source Test



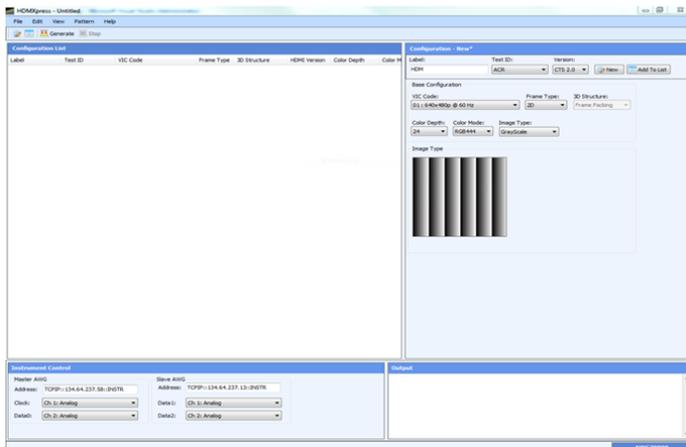
HDM-DS SW - Sink Test

## Test descriptions

Test	Description
<b>Source tests</b>	
Eye diagram <sup>1</sup>	PLL, raw, and ideal clock <sup>2</sup>
Clock jitter <sup>1</sup>	PLL, raw, and ideal clock <sup>2</sup>
Clock duty cycle	
Rise time and fall time	
Inter-pair skew	Data-Data
Low amplitude	
<b>Sink tests</b>	
Jitter tolerance <sup>1</sup>	
Jitter frequencies (D/CK)	500 kHz/10 MHz or 1 MHz/7 MHz
DUT frequency (pixel clock) for HDMI 1.4b	25, 27, 74.25, 148.5, 165, 225, 297, 330 MHz
DUT data rate for HDMI 2.0	3.71, 4.46, 5.94 Gbps
Direct Synthesis Solution provides a selection of cable emulators' emulation in the software. 1st Cable Emulator or 2nd Cable Emulator or Both. Covering the various Type 1, Type 2, Type 3, and Type E cable emulators required in CTS for HDMI 2.0/1.4a/b based upon resolution selection.	
Min/Max differential swing tolerance	250 mV - 70 mV, 20 mV steps. Direct Synthesis setup can also be used for this test
Intra-pair skew	<1 ns, 0.1 T <sub>bit</sub> steps. Direct Synthesis setup can also be used for this test <sup>3</sup>
Deep color tests	Selection under Direct Synthesis method <sup>3</sup>
<b>Cable tests</b> <sup>3</sup>	
Eye diagram <sup>1</sup>	TP1 and TP2. Direct Synthesis setup can also be used for this test
Repeater cable inter-pair skew test	Selection under Direct Synthesis method only



HDM-DS SW - Sink Protocol Test



HDM-DSM software



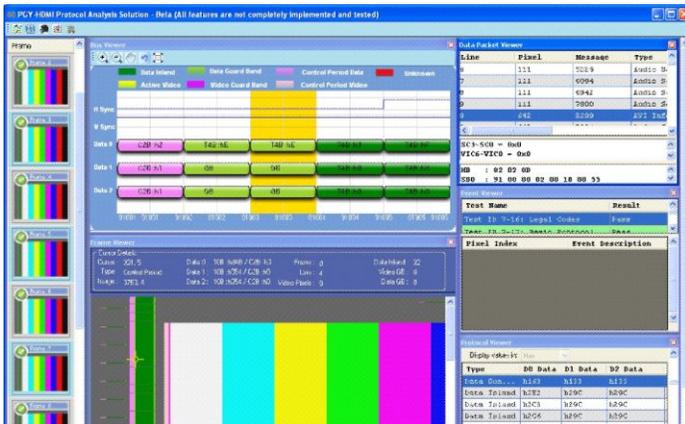
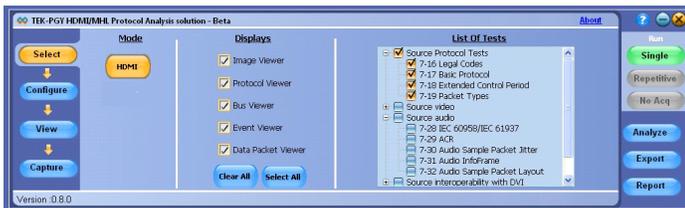
HT3-DS software

<sup>1</sup> Requires record length of more than 16M on each channel. HDMI 2.0 Eye Diagram is at TP2 after cable emulator effect.

<sup>2</sup> The PLL, raw and ideal clock options are applicable only for HDMI1.4/b

<sup>3</sup> Applicable for HDMI1.4/b

## TEK-PGY-HDMI-PA-SW



Tektronix supports HDMI 1.4/b with the HDMI protocol analyzer software developed by our third-party partner for the DPO/DSA/MSO70000B/C/D Series real-time oscilloscopes with bandwidth  $\geq 12.5$  GHz and above.

Salient features include:

- One-box solution for both HDMI physical- and protocol-layer testing leveraging real-time oscilloscopes.
- Detailed HDMI protocol decodes. Multi-view decode capability:
  - Bus viewer
  - Frame viewer
  - Event viewer
  - Data packet viewer
  - Protocol viewer
- Seamless link layer to physical layer analysis and decode capability:
  - Ability to view analog waveform with protocol decode
- Common probing technique for physical-layer and protocol-layer testing.

Refer to the Prodigy techno visions website (<http://www.prodigytechno.com>) for more details on the HDMI protocol analyzer software.

## HDMI Protocol Tests (CTS 1.4a/b)

Source protocol tests:

- 7-16 legal codes
- 7-17 basic protocol
- 7-18 extended control period
- 7-19 packet types
- 7-23/7-24 pixel encoding
- 7-25 video format timing
- 7-26 pixel reception
- 7-27 AVI info frame

Source audio:

- 7-28 IEC 60958/IEC 61937
- 7-29 ACR
- 7-30 audio sample packet jitter
- 7-31 audio info frame
- 7-32 audio sample packet interoperability
- 7-33 source interoperability with DVI

Source advanced features:

- 7-34 deep color
- 7-35 gamut metadata transmission
- 7-36 high bit rate audio
- 7-37 one-bit audio
- 7-38 3D video format timing
- 7-39 4KX2K video format timing – record length dependent
- 7-40 extended colorimetry transmission

## Combined HDMI and MHL protocol solution

We offer a combined HDMI and MHL protocol analyzer software to enable customers who work on both the technologies to leverage a cost-effective protocol software bundle. The bundled HDMI/MHL protocol analyzer software is a stand-alone option for the Tektronix real-time oscilloscopes with the following nomenclature: TEK-PGY-HDMH-PA-SW.

## MHL protocol compliance tests (CTS 1.1)

### Source Protocol Tests:

- Legal Codes
- Basic Protocol
- Packet Types
- Source Video
- Pixel Encoding
- Video Format Timing
- Video Quantization Test
- AVI Info Frame

### Source Audio Tests:

- Audio Test
- Audio Clock Regeneration Test
- Audio Info Frame

## Supported Tektronix instruments

- Real-time oscilloscopes

DPO/MSO70000 series real-time oscilloscopes support HDM, HDM-DS, HDM-DSM, HT3, HT3-DS, DPOFL-HDM and DPOFL-HDM-DS

**Note:** The recommended oscilloscope bandwidth for HDMI 2.0 is  $\geq 16$  GHz. Although a 12.5 GHz bandwidth oscilloscope is supported, it will have as much as a 10% variation in test results.

- Sampling oscilloscopes

TDR tests: DSA8300 oscilloscope with 80E03 and 80E04 modules

- Generators (using direct synthesis method)

AWG70002A with Opt. 02, Opt. 225 and Opt. 03 (sequencing option) (Qty: 2), or AWG7122B/C with Opt. 01, Opt. 02/06 and Opt. 08 (Qty: 2)

AFG3102/C or AFG3252/C - Used for synchronizing and triggering the 2 AWGs in the direct synthesis setup

## Ordering information

### HDM test software

**Test software includes:** Application CD, HDMI direct synthesis AWG patterns DVDs, and electronic documentation.

### Software options

To order with oscilloscope

Product/feature	Description
Option HDM	HDMI 2.0 Advanced Analysis and Compliance Software for Source testing. (Prerequisite for HDMI 2.0 is HDMI 1.4b testing; hence HT3 is required. Prerequisite is Option DJA, Opt 10XL (required for 100M RL), and SR-CUST).
Option HDM-DS	HDMI 2.0 Advanced Analysis and Compliance Software for Sink testing (Prerequisite HDM and HT3-DS). Since HDMI 1.4b is a prerequisite for HDMI 2.0 testing, HT3-DS is needed.
Option HDM-DSM	HDMI 2.0 Advanced Analysis and Characterization Software for Receiver tests (Prerequisite HDM-DS)
Option HT3	HDMI 1.4b Compliance Test Software
Option HT3-DS	HDMI 1.4b Direct Synthesis Software (requires Opt. HT3)
TEK-PGY-HDMI-PA-SW	HDMI 1.4b - only Protocol Analyzer Software (requires Option 20XL and (4) P7313SMA probes)
TEK-PGY-HDMH-PA-SW	Combined HDMI 1.4b and MHL Protocol Analyzer Software (requires Option 20XL, and (4) P7313SMA probes for HDMI protocol testing or (2) P7313SMA and (1) P7240 probes for MHL protocol testing)
DPOFL-HDM	Advanced Analysis and Compliance Software for HDMI 2.0 Tx floating license
DPOFL-HDM DS	Advanced Analysis and Compliance Software for HDMI 2.0 Rx floating license
DPOFT-HDM	Advanced Analysis and Compliance Software for HDMI 2.0 Tx floating license (trial version)
DPOFT-HDM DS	Advanced Analysis and Compliance Software for HDMI 2.0 Rx floating license (trial version)

## Software upgrades

### To upgrade an existing oscilloscope

Product/feature	Description
DPO/DSA/MSO70000	Order DPO-UP – Opt. HDM
DPO/DSA/MSO70000	Order DPO-UP – Opt. HDM-DS
DPO/DSA/MSO70000	Order DPO-UP – Opt. HT3
DPO/DSA/MSO70000	Order DPO-UP – Opt. HT3-DS <sup>4</sup>
TEK-PGY-HDMI-PA-SW	HDMI-only Protocol Analyzer Software (requires Option 20XL and (4) P7313SMA probes)
TEK-PGY-HDMH-PA-SW	Combined HDMI and MHL Protocol Analyzer Software (requires Option 20XL, and (4) P7313SMA probes for HDMI protocol testing or (2) P7313SMA and (1) P7240 probes for MHL protocol testing)
<b>Note:</b> The recommended oscilloscope bandwidth for performing both physical-layer and protocol-layer testing using the same oscilloscope is $\geq 12.5$ GHz, as the protocol analyzer software requires the 20XL record length option.	

## Recommended equipment and accessories

Accessory	Description
Oscilloscope	16M Record Length / Ch or more - Opt. 2XL on DPO/MSO70000 C, D, and DX series oscilloscopes (for eye diagram and jitter tests) 250M Record Length / Ch - Opt. 20XL on DPO/DPO/MSO70000 C, D, and DX series oscilloscopes (for protocol analysis) 100M Record Length Opt 10XL (needed for HDMI 2.0) Option DJA and SR-CUST (also required for HDM Software)
Signal sources	AWG70002A with opt 01, 03 and 225 or AWG7122C with option 01, 02/06, and 08 (for direct synthesis method)
Probes	
Differential probes	P7350SMA (2 probes required) - for testing TMDS clock rates less than or equal to 74.25 MHz Minimum two P7313SMA probes are required for testing all resolutions of HDMI 1.4a/b testing, and are also used for single-ended testing. Minimum 3 probes are recommended for HDMI 2.0 testing and are also used for single-ended testing. Four P7313SMA probes are recommended for faster physical layer testing of all 4 HDMI 1.4 and HDMI 2.0 channels. Four P7313SMA probes are required for protocol analysis.
Active probes	P7240 used with old 1.2 test fixtures (2 probes required); P7313SMA probes can also be used to test single-ended tests using 50 $\Omega$ short.
Probe positioner	PPM100 flexible arm probe positioner
HDMI direct synthesis accessory kit (required with Option HT3-DS and Option HDM-DS)	Consists of: Matched SMA cables (174-5771-xx) (Qty: 10) BNC cables (012-0057-xx) (Qty: 4) Bias tees from Mini-Circuits (ZX85-12G-S+) (Qty: 8) TTC filter from Picosecond pulse labs (5915-110-120PS) (Qty: 8) GPIB cables from NI (763061-xx) (Qty: 4) 6 dB attenuator from Mini-Circuits (BW-S6W2+) (Qty: 8) SMA Male to two SMA Female adapter (Qty: 2) Low pass filters (Qty: 8) SMA male to SMA male connector (Qty: 8)

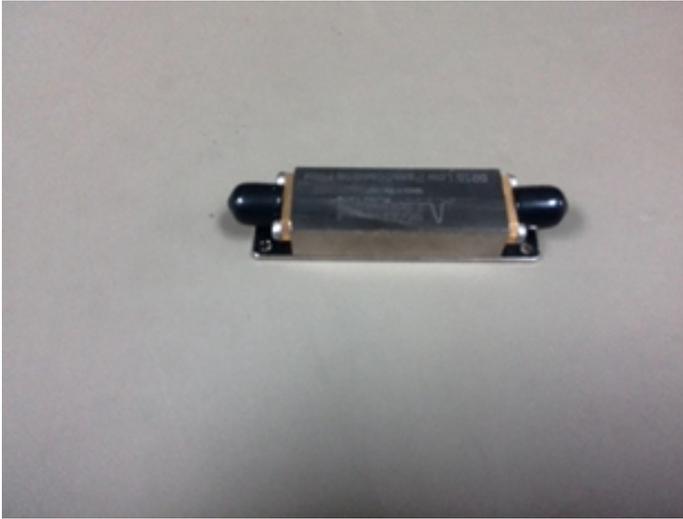
<sup>4</sup> HT3-DS is available on DPO/DSA/MSO70000 series scopes with bandwidth greater than 8 GHz.

Accessory	Description
External power supply	PWS4205 for providing bias voltage during Sink testing or optionally powering the fixture during source testing
Additional recommended accessories for HDMI 2.0	Delay line for introducing 112 ps skew from SPECTRUM (8001-SM21-02) (Qty: 6) Delay line for introducing 0.15 Tbit skew from Carlisle Interconnect Technologies (5018CCSF, SMA (M) to (F))(Qty: 6) 3.5mm Male to Male phase-equal adapter (Qty: 4) SMA Female to SMA Male attenuator (Qty: 8) BNC female to SMA male adapter (Qty: 4)
Additional recommended accessories for impedance test	50 $\Omega$ male terminations (015-1022-01) - (Qty: 6) 50 $\Omega$ female terminations (015-1004-01) - (Qty: 2) 50 $\Omega$ SMA cable, 1 M length from HUBER+SUHNER SUCOFLEX (104PE) - (Qty: 2) 80A09 DC-coupled voltage limiter, Tektronix 26 GHz ESD Protection Device - (Qty: 2)
HDMI 2.0 Fixture	Available, please contact Tektronix Local Representative for more details.
Sink test automation <sup>5</sup>	
NI GPIB-USB-A/B	USB-to-GPIB controller (with driver software)
NI GPIB-ENET/100	Ethernet GPIB controller (with driver software)

<sup>5</sup> For ordering, contact National Instruments (ni.com).

**Recommended test fixtures cables and tools**

Description	Image
<p><b>Description:</b> Cable assembly: Coaxial, RFD, 50 Ohm, 43 inch L, BNC, Male to BNC Male, Strain Relief Boots  <b>Part number:</b> 012-0057-xx  <b>Quantity:</b> 4</p>	
<p><b>Description:</b> GPIB cable: Low EMI  <b>Part number:</b> 012-0991-xx  <b>Quantity:</b> 4</p>	
<p><b>Description:</b> Fixed attenuator: 6 dB, SMA female to SMA male, 50 OHM, 2 W, DC TO 18 GHZ  <b>Part number:</b> 015-0735-xx  <b>Quantity:</b> 8</p>	

Description	Image
<p><b>Description:</b> Adapter: SMA male to 2 SMA females  <b>Part number:</b> 015-1016-xx  <b>Quantity:</b> 2</p>	
<p><b>Description:</b> RF, Low pass filter: 120 ps rise time, DC Ins loss &lt; 0.02 dB, VMAX = 50 V, IMAX = 1A, 50 OHM; 5915-100-120 ps, SMA Female-Female  <b>Part number:</b> 119-7601-xx  <b>Quantity:</b> 8</p>	
<p><b>Description:</b> RF Low pass filter, DC - 6400 MHz Passband, 20 dB Stop band 8300 - 12500 MHz, 30 dB Stop band 7700 - 10200 MHz, 1.2 VSWR, 7 section; VLF-6400+, SMA  <b>Part number:</b> 119-7635-xx  <b>Quantity:</b> 8</p>	

Description	Image
<p><b>Description:</b> Passive bias tee and DC block, 200 kHz to 12 GHz, 25 V, 30 dBm, ZX85 - 12G-S+, SMA  <b>Part number:</b> 131-8489-xx  <b>Quantity:</b> 8</p>	
<p><b>Description:</b> SMA male to SMA male connector  <b>Part number:</b> 131-8490-xx  <b>Quantity:</b> 8</p>	
<p><b>Description:</b> Cable assembly: Phase matched pair, SMA plug to SMA plug, 1 meter  <b>Part number:</b> 174-5771-xx  <b>Quantity:</b> 10</p>	

Description	Image
<p><b>Description:</b> Female BNC to male SMA adapter <b>Part number:</b> 015-0554-xx <b>Quantity:</b> 4</p>	 A photograph of a female BNC to male SMA adapter. The connector has a hexagonal BNC female jack on one end and a cylindrical SMA male plug on the other. The SMA plug has a small circular hole on its side. The metal has a brushed finish.
<p><b>Description:</b> Adapter, SMA male/plug push-on, SMA female/jack, straight <b>Part number:</b> 103-0491-xx <b>Quantity:</b> 6</p>	 A photograph of an SMA male to SMA female adapter. It features a threaded SMA male plug on one end and a hexagonal SMA female jack on the other. The hexagonal part has a textured, possibly black, surface. The metal is polished.

Description	Image
<p><b>Description:</b> Adapter: Phase adjustable, SM female/jack, SMA male/plug, straight, 26 GHz, 1.3 MAX VSWR, 510 degree min  <b>Part number:</b> 015-0783-xx  <b>Quantity:</b></p>	
<p><b>Description:</b> SMA female to female adapter, 0.500 L  <b>Part number</b> 015-1012-xx  <b>Quantity</b> 8</p>	

Description	Image
<p><b>Description:</b> SMA female to BNC male adapter  <b>Part number:</b> 015-0572-xx  <b>Quantity:</b> 4</p>	
<p><b>Description:</b> BNC T connector, Male to 2 Female  <b>Part number:</b> 100-0030-xx  <b>Quantity:</b> 2</p>	

## HDMI 1.4b type A fixtures

- TF-HDMI-TPA-S Test Adapter Set (used for Source, Sink, and Cable test) includes the following:
  - TF-HDMI-TPA-P plug fixture
  - TF-HDMI-TPA-CE EDID board with EDID EEPROM
- TF-HDMI-TPA-STX Test Adapter Set (used for Source and Sink test) includes the following:
  - TF-HDMI-TPA-P plug fixture
  - TF-HDMI-TPA-R receptacle fixtures (Qty: 2)
  - Calibration fixture
  - TF-HDMI-TPA-CE EDID board with EDID EEPROM

## HDMI 1.4b type C fixtures

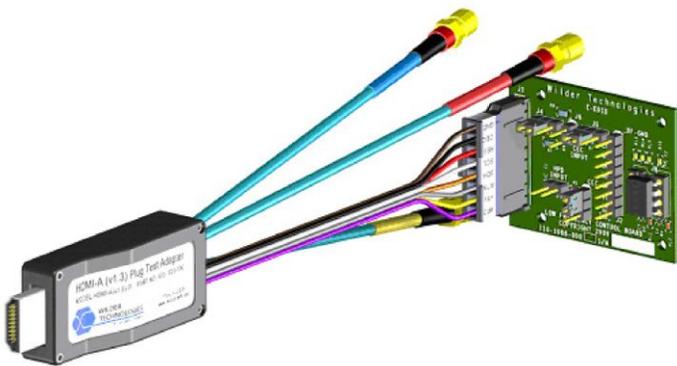
- TF-HDMIC-TPA-S Test Adapter Set (used for Source, Sink, and Cable testing) includes the following:
  - TF-HDMIC-TPA-P plug fixture
  - TF-HDMIC-TPA-R receptacle fixtures (Qty. 2)
  - Calibration fixture
  - TF-HDMI-TPA-CE EDID board with EDID EEPROM
- TF-HDMIC-TPA-STX Test Adapter Set (used for Source testing only) includes the following:
  - TF-HDMIC-TPA-P plug fixture
  - TF-HDMI-TPA-CE EDID board with EDID EEPROM

## HDMI 1.4b type D fixtures

- TF-HDMID-TPA-P Plug Board
- TF-HDMID-TPA-R Receptacle Board
- TF-HDMI-TPA-CE consisting of (to be ordered separately):
  - EDID Fixture PCBA
  - EEPROM with HDMI 1.4a/b Software
  - Ribbon Cable (174-5746-xx)
  - Customer Documentation

## HDMI 1.4b type E fixtures

- TF-HDMIE-TPA-KIT Test Adapter Kit (used for Source, Sink, and Cable testing) includes the following:
  - 1 TF-HDMIE-TPA-P plug board
  - 2 TF-HDMIE-TPA-R receptacle boards
- TF-HDMI-TPA-CE consisting of (to be ordered separately):
  - EDID Fixture PCBA
  - EEPROM with HDMI 1.4a/b Software
  - Ribbon Cable (174-5746-xx)
  - Customer Documentation



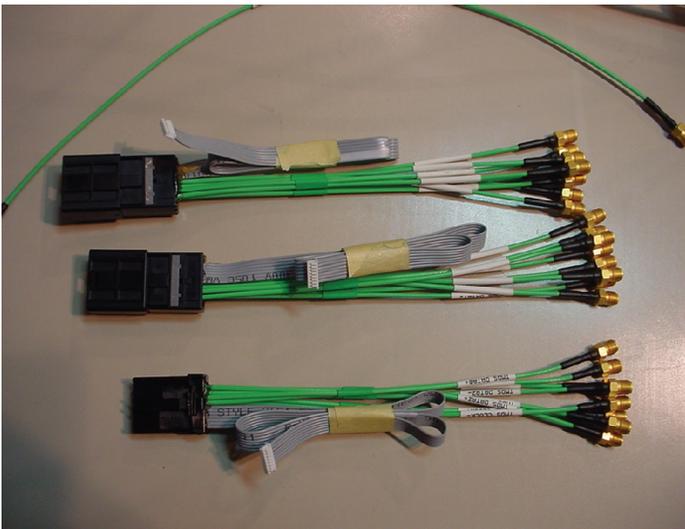
TF-HDMI-TPA-STX



TF-HDMID-TPA-P/R



TF-HDMI-TPA-T



TF-HDMIE-TPA-KIT



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.

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\* European toll-free number. If not accessible, call: +41 52 675 3777

Updated 10 April 2013

**For Further Information.** Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit [www.tektronix.com](http://www.tektronix.com).

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