HDMI 2.1 Compliance Test Solution

Comprehensive Physical Layer Compliance Testing

HDMI 2.1 is Happening Now

The HDMI 2.1 standard has been released since Nov 2017 and every major player in HDMI will need to support it. There are some radical changes in the latest standard such as doubling of the data rate of each data channel to 12 Gbps, introduction of new video transport method (fixed rate link), the new ultra-high-speed Category 3 connector and cable specifications requiring new test regimen, and enhanced audio return channel (eARC) capability. As transmission speeds of HDMI standard continue to increase, validation engineers need a measurement solution with high bandwidth and <25 picosecond rise-time specifications, complete with the right fixture and automation software to quickly and accurately perform all the tests in HDMI Forum CTS (Compliance Test Specification) documents.

What's new in HDMI 2.1:

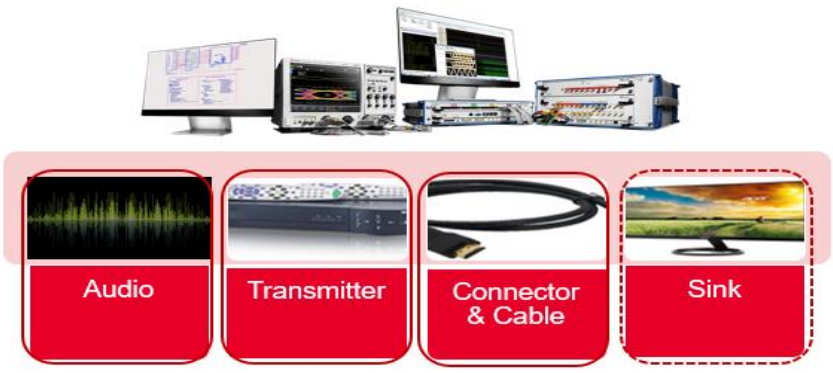
- 8K60Hz and 4K120Hz support
- 10K resolutions
- Dynamic HDR
- Bandwidth increases to 48 Gbps
- Ultra-high-speed HDMI cable support
- eARC simplifies audio connectivity and improves audio performance
- Enhanced refresh rate ensures smooth and seamless motion and transitions

Your HDMI Test Challenges

Is your company ready to bring HDMI 2.1 products to the market? Whether your product is a Blu-ray player, a graphic card, an audio device or a HDMI cable or connector, your first article will need to be compliance tested by an authorized test center (ATC). What is your thought of the turnaround time? Are you confident that your product will pass the first time?

Do you have concerns on having enough test data? How many units do you need to test to know the performance of your design? One, ten or hundreds?

Keysight is here to help. Our superiority in oscilloscope performance, our dominance in authorized test centers, our test time advantages and our experts in the HDMI Forum will help you to confidently test your latest HDMI products and allow you to bring your product to the market faster.

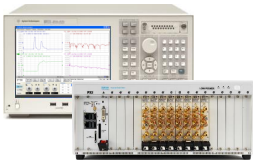
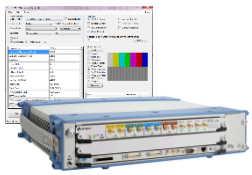


Keysight HDMI 2.1 physical layer compliance solutions

KEYSIGHT TECHNOLOGIES

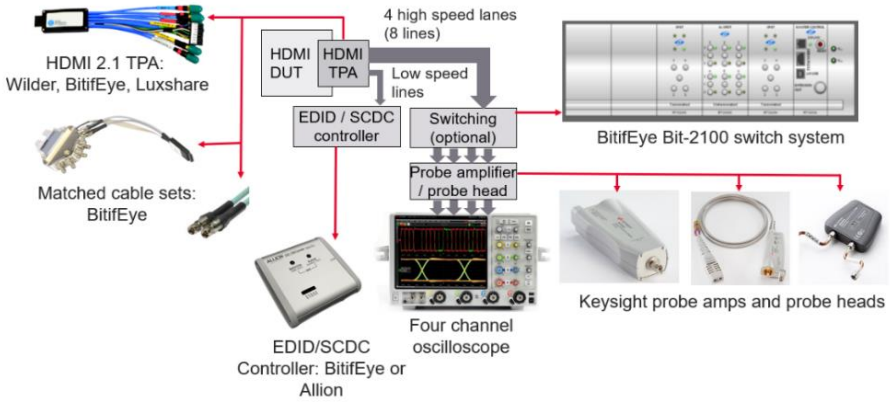
Keysight HDMI 2.1 Test Solutions At A Glance

Keysight's certified HDMI 2.1 test solutions cover all physical layer compliance tests for source, cable and connector, sink and eARC tests.

Source PHY Layer Test	Category 3 Cable and Connector Test	Sink PHY Layer Test	eARC Test
 **V, Z and UXR Series Oscilloscopes and N5399E Compliance Test Software**	 **E5071C ENA or M937x PXI VNA**	 **M8195A AWG and N5990A Compliance Software**	 **V, Z and UXR Series Oscilloscopes, BitifEye DSGA and 81160A Generator**
• Perform fully automated test cycle for all data rates with the well-established N5399E compliance test software (used by many ATCs) • Include the control of EDID/SCDC controller to enable the source to output the required data rates • Complete with probe amp and probe head for single connection FRL testing • Minimum 20 GHz bandwidth scope is recommended • Double the productivity of your oscilloscope with the N5399E Infinium offline software. • TMDS Method of Implementation (MOI) approved. FRL MOI under review.	• Enable one connection FRL testing with 16-port PXI VNA; measure all 4 differential lanes with industry's fastest test time of 15 minutes. Reliable results with less operator errors. • Industry workhouse solution with E5071C 4-port VNA testing, with fast test time of 90 minutes. • MOI approved for Cat3 connector test while Cat3 cable is under review.	• Perform full automation of all the tests in HDMI 2.1 CTS document with the N5990A compliance software. Test results can be used to prove the compliance with HDMI 2.1 specifications • Superior intra-pair skew performance with less than one picosecond of accuracy for FRL testing • MOI under review	• Complete eARC TX and RX test with N5990A compliance software • Cover eight audio sampling rates and up to eight-channel formats providing users with full flexibility and functionality required for the tests • MOI approved.

Source Test

Keysight source test solution is a fully automated test solution that enables the source device to output the required data rates. The Keysight N5399E/F HDMI Electrical Performance Validation and Compliance Software controls the contents of the EDID/SCDC controller so that the source device is forced to operate at the required data rate. The probe amplifier and probe head are required to terminate the tested and untested lanes into 50 ohms pulled up to 3.3 V. BitifEye switch system can be added to achieve full measurements on the device under test without reconnections. The N5399E compliance test software operates on Keysight's Infiniium oscilloscope family and provides a complete test execution environment for validating and troubleshooting the electrical performance of HDMI 1.4b and HDMI 2.1 source devices. This software is one of the measurement tools accepted in the methods of implementation (MOI) of HDMI components and is already well-established globally through HDMI ATCs. Offline analysis software is available to double the productivity of your oscilloscope. The Keysight E5399E/F software performs all the tests as per the HDMI Compliance Test Specifications (CTS 1.4b and 2.1) as documented in the respective base specifications.



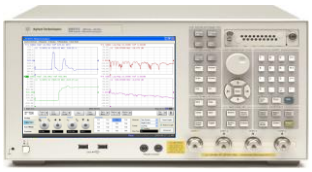
Category 3 Cable and Connector Test

Two solutions are available from Keysight for the new Category 3 cable and connecter test.

The M9327x PXI Multi-Port VNA supports full 16-port VNA testing. With only one connection, this solution can measure all four differential lanes in 15 minutes. This solution increases the lifetime of system accessories and provides more reliable test results due to fewer operator errors.

The E5071C ENA 4-port VNA is the industry workhorse solution for cable and connecter tests. This solution requires 15 reconnections to measure all four differential lanes and will take approximately 90 minutes to complete the test. The ENA test solution performs all the cable's S-parameter measurements. From the S-parameters, processing software included inside the instrument calculates a stressed eye diagram.

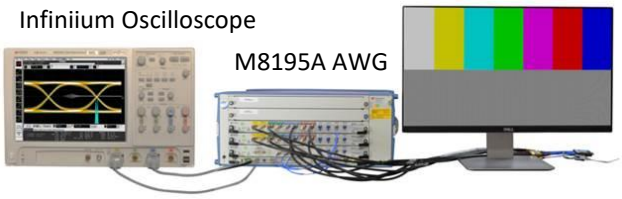
M937x PXI Multi-port
Vector Network Analyzer



E5071C 4-port Vector Network
Analyzer

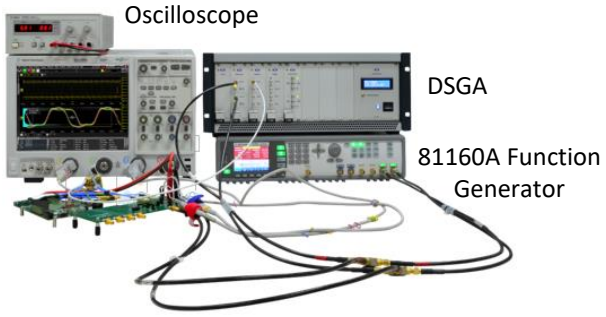
Sink Test

Sink testing requires a source capable of generating a wide range of test pattern and the ability to add a precise amount of impairments to the output signal. The major high-speed tests are sensitivity, skew, jitter tolerance and timing. The core of the Keysight HDMI sink test solution is based on the M8195A 65 GSa/s Arbitrary Waveform Generator (AWG) and the N5990A option 151 test automation software, which guides you through the test procedure and required system connectivity with detailed instructions. This sink test solution supports full HDMI 2.1 TMDS and FRL data rates, character error detection for FRL and video inspection for TMDS. This test solution also enables independent clock and data jitter injection for accurate sink characterization.



eARC Test

Keysight offers eARC TX and RX compliance test solutions based on the S, V, Z and UXR series oscilloscopes, 81160A function generator and BitifEye dynamic sequencing generator and analyzer (BIT-3000 DSGA). The oscilloscope is used for signal calibration. The 81160A function generator is used to generate differential eARC signals while the DSGA is used to create common mode eARC signals. The eARC discovery mechanism (communication with DUT) is handled by the DSGA for both TX and RX test setup. Jitter is injected using the 81160A. In total, the solution covers eight audio sampling rates and up to eight-channel format, providing user full flexibility and every possible functionality required to perform the tests.



More Information

Website: www.keysight.com/find/HDMI

HDMI 2.1 application note: http://literature.cdn.keysight.com/litweb/pdf/5992-0235EN.pdf

Keysight N5399E, N5399F HDMI electrical performance validation and compliance software datasheet: https://literature.cdn.keysight.com/litweb/pdf/5992-3096EN.pdf

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

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