

HDMI Electrical Compliance Test Adapters

For HDMI source, sink device, and cable tests



Introduction

Keysight's D9021HDMC HDMI Tx electrical performance validation and compliance software, together with the N5991HP1A HDMI 2.1 Receiver Compliance Test Software, offers a complete test execution environment for validating and troubleshooting the electrical performance of HDMI 1.4 and HDMI 2.1 source and sink devices.

Wilder Technologies has developed a robust test point adapter (TPA) plug and receptacle product offering to enable the HDMI source/sink device or cable electrical testing.

HDMI 2.1 Application Overview

The new HDMI 2.1 specification includes a dramatically different transport system called 'Fixed Rate Link' (FRL). FRL uses the four high speed lanes for data transport using 16b/18b encoding and increases the maximum data rate to 12 Gbs per lane, which nearly triples the video payload. A typical HDMI 2.1 system is illustrated in Figure 1 below.

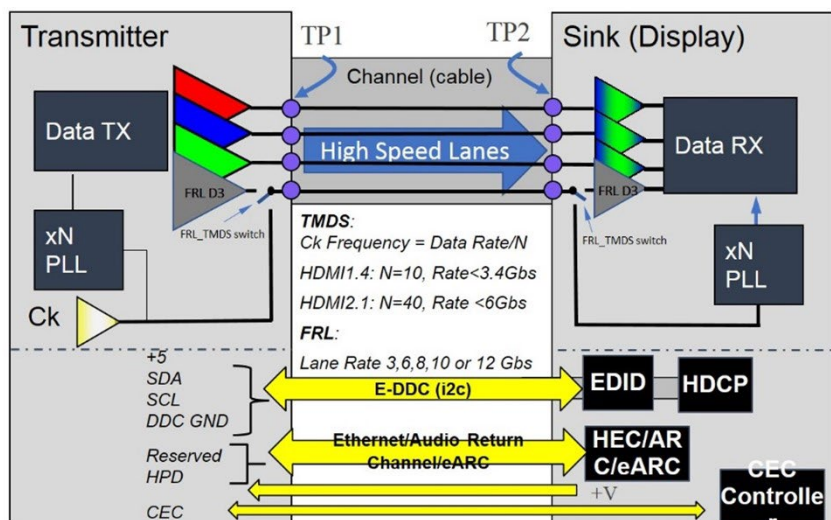


Figure 1. HDMI 2.1 system

Transmitter test use case

To test a digital transmitter of any sort, the test equipment must be connected to an interface. Since physical layer test equipment uses coaxial connectors, a test point access adapter (TPA) that breaks out the test signals from the device under test with HDMI connector to the test equipment must employ a coaxial connector. Figure 2 shows a simplified illustration of how HDMI signals are accessed by the measurement system using the SP0612-60001 HDMI A2.1-TPA-P.

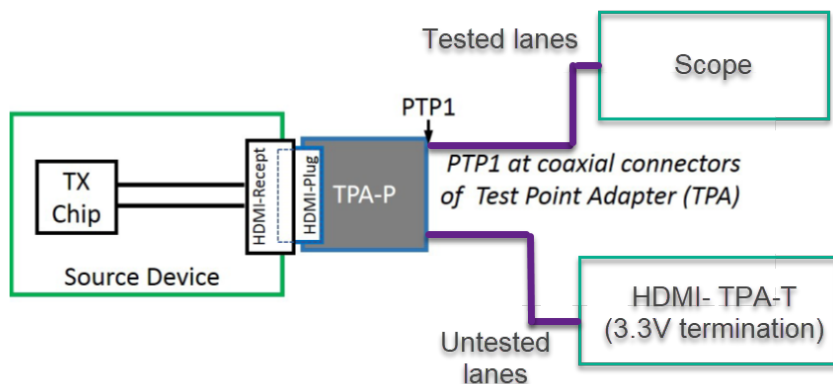


Figure 2. TPA-P connection at source device

When not all HDMI highspeed signals can be connected to the measurement system at the same time, the D9021HDMC software will guide the user through the test process to establish a re-connection of signals when necessary. In these cases, untested lanes should be terminated properly with 3.3 V, where $RT=50\text{ ohms}$, using the SP0614-60001 HDMI-TPA-T.

Receiver test use case

The HDMI Receiver (N5991 Valiframe) testing supports automatic control of Keysight's M8195A AWG (Arbitrary Waveform Generator). It calibrates the stress conditions and controls all test electronic equipment for automated receiver tolerance tests. A typical calibration setup is shown in Figure 3 whereby the TPA-P and TPA-R are used together.

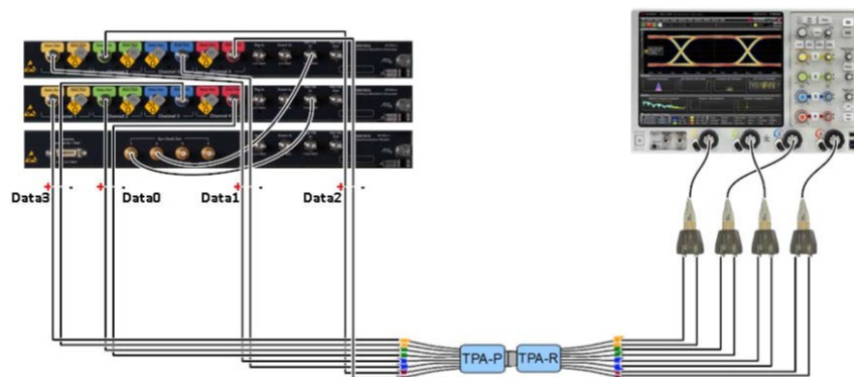


Figure 3. N5991 receiver test calibration setup

The N5991 software implements the tests according to the requirements of the Compliance Test Specification for Sink Devices of HDMI version 1.4 and 2.1. It also offers some custom characterization tests to provide more details on DUT behavior beyond the limits. The final setup of a typical HDMI sink test using the N5991, with only the TPA-P connected to the DUT, is illustrated in Figure 4.

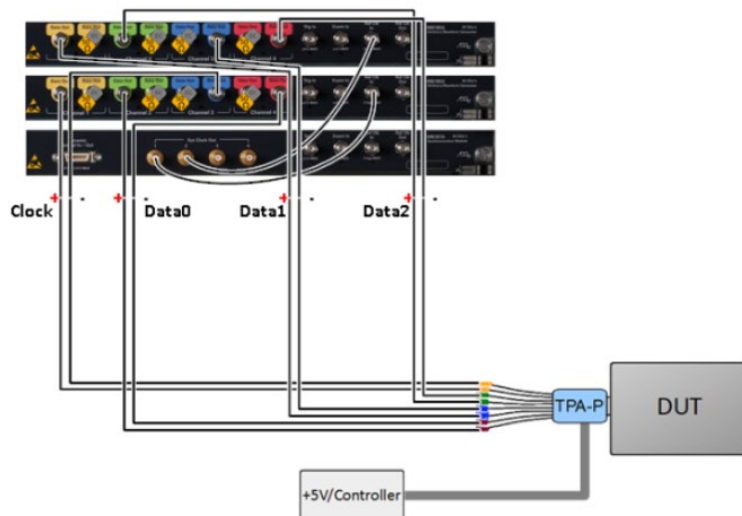




Figure 4. N5991 receiver test setup

Test Point Adapters (TPAs)

	Keysight Part Number	Wilder Cross-Reference	Description	Capabilities and Features
	SP0612-60001	HDMIA2.1-TPA-P (640-0860-000)	640-0860-000 HDMI Type-A 2.1 3.5 mm Plug Test Adapter	<ul style="list-style-type: none"> Up to 48 Gb/s data rate supported Certified for CAT3 cable testing GCTS Compliance Fixtures Supports FRL/EDID testing Supports eARC testing
	SP0613-60001	HDMIA2.1-TPA-R (640-0861-000)	640-0861-000 HDMI Type-A 2.1 3.5 mm Receptacle Test Adapter	<ul style="list-style-type: none"> Up to 48 Gb/s data rate supported Certified for CAT3 cable testing GCTS Compliance Fixtures Supports FRL/EDID testing Supports eARC testing

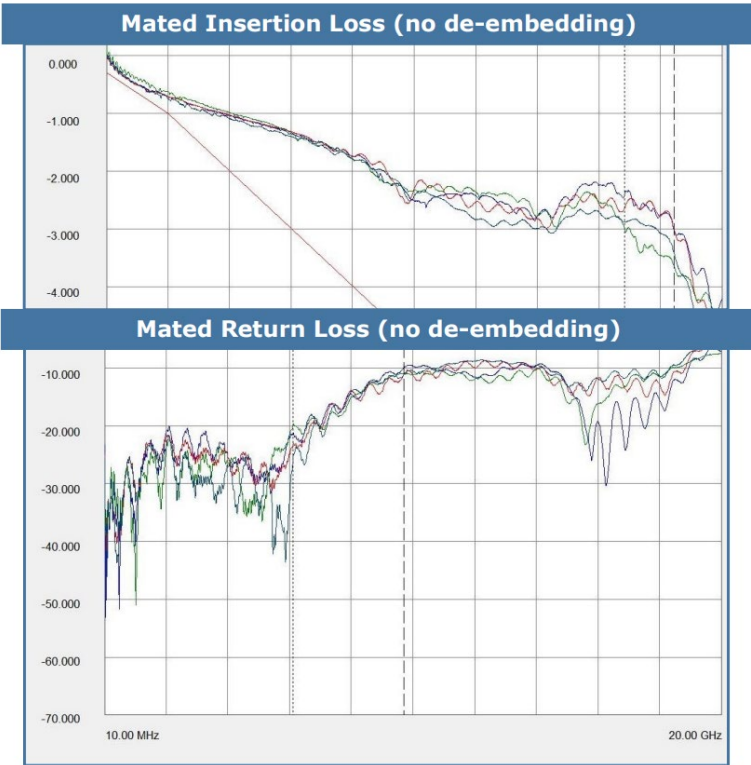


Figure 5. TPA-P/R insertion loss and return loss



Keysight Part Number	Wilder Cross-Reference	Description	Capabilities and Features
SP0614-60001	HDMI-TPA-T (640-0408-000)	640-0408-000 HDMI Termination Module 3.5 mm Interface	<ul style="list-style-type: none"> Used to terminate the TMDS/FRL signals that are not being tested Termination of these signals is required for proper operation of HDMI protocol Power is provided by USB connection

SPECIFICATION	MINIMUM	TYPICAL	MAXIMUM	NOTES
Balanced Return Loss (GHz), at -20 db		7.44		HDMI Termination without power applied.
VSWR, at 7.5 GHZ		1.21:1		HDMI Termination without power applied.
Resistance of termination (ohms)	49	50	51	
Termination Voltage (V)	3.2	3.3	3.4	

Figure 6. Table showing the specifications for HDMI-TPA-T

Keysight Resources and HDMI Test Solutions

Keysight's High-Definition Multimedia Interface (HDMI)

Solution Model Numbers	Real-Time Oscilloscope Test Solution Descriptions
D9021HDMC	Electrical TX Test for HDMI Source
N5991HP1A	Electrical RX Test for HDMI Sink

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.



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