Keysight N6460B
MHL Source Compliance Test Software
For Infiniium Oscilloscopes

Data Sheet

KEYSIGHT
TECHNOLOGIES
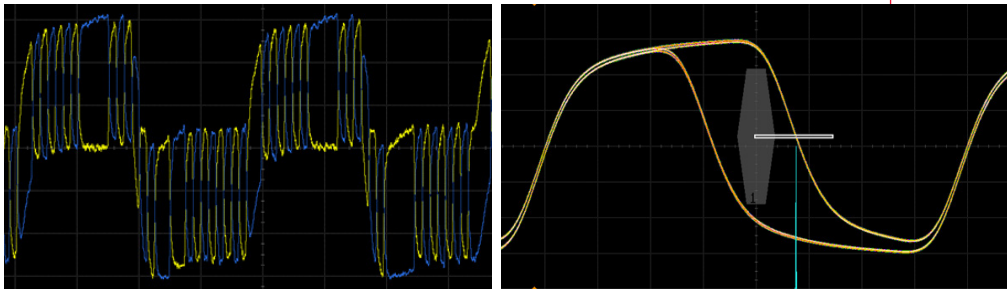
Introduction

MHL Source Compliance Test Software for Infiniium oscilloscopes provides you with a certified accurate way to verify and characterize your Mobile High Definition Link[1] (MHL) designs for mobile devices such as cell phones and tablets. The MHL source compliance test software is used in the MHL Authorized Test Centers (ATCs) and has been tested thoroughly and validated by MHL semiconductor leader Silicon Image for device compliance testing so you can confidently use it to execute MHL electrical checklist tests as well as employ it as a development tool.

The MHL Source Compliance Test Software performs the full physical layer compliance suites for MHL data transmission as identified in the MHL Compliance Test Specification 1.x, 2.x and 3.2 (CTS v3.2). These tests, in conjunction with MHL protocol tests, represent the full compliance regimen to qualify an MHL portable source design at an MHL-authorized test center. For MHL 3 portable device testing, there are additional test requirements for receiving data – see Table 7, Portable Device Receiver Testing Equipment and Software.

As an MHL adopter, your product must successfully pass compliance testing based on the MHL CTS specification so you can get a jump on the process by testing with the same instrumentation and software as the authorized test center. In this consumer market where weeks can determine success, this confidence will allow you to attend to higher risk areas in your product's market delivery.

Features

The MHL Source Compliance Test Software offers several features to simplify the validation of MHL designs:

– Test setup wizard for ease-of-use
– MHL test suites for CTS 1.x, 2.x and newly released 3.2.
– Backward data receive test calibrations
– Automated scope measurement setup
– Connection diagrams
– Test results report generation
– Pass/fail margin analysis

With the MHL electrical test software, you can use the same oscilloscope you use for everyday debugging to perform automated testing and margin analysis based on the MHL-specified test checklist.

1. Mobile High-Definition Link (www.mhlconsortium.org)

About MHL

MHL provides an efficient and low-profile way for owners of mobile devices to view and share their pictures and other video content by simple connection to large-screen televisions and monitors. Released originally in 2011 (v1.1), the specification has continually been refreshed to stay ahead of the persistent push to higher resolutions. With version 3, support for 4k x 2k monitors is provided as well as bidirectional data for complete usability of both portable device and television or display in the operational MHL link.

MHL version 3 brings a number of improvements to MHL. First, it no longer uses the common mode clocking method (as in earlier versions) for the TMDS audio-video (AV) stream. Instead, the CBUS line, which is used for MHL device discovery and link maintenance, is used to transport a TMDS clock. The clock is always at 75 MHz, but the TMDS data rate can be fixed rates of 1.5, 3.0 and 6.0 Gbs. The highest data rate is used to support 4k x 2k resolution monitors. Another change that significantly affects the validation and compliance measurement task is that non-AV data (such as from Human Interface Devices) can be transmitted and received by any MHL device over the CBUS line. The changes in the CBUS line's functionality warrants a nomenclature change to 'e-CBUS,' or the extended CBUS. Data is sent on the falling edge of the clock signal by modulating the location of the edge.

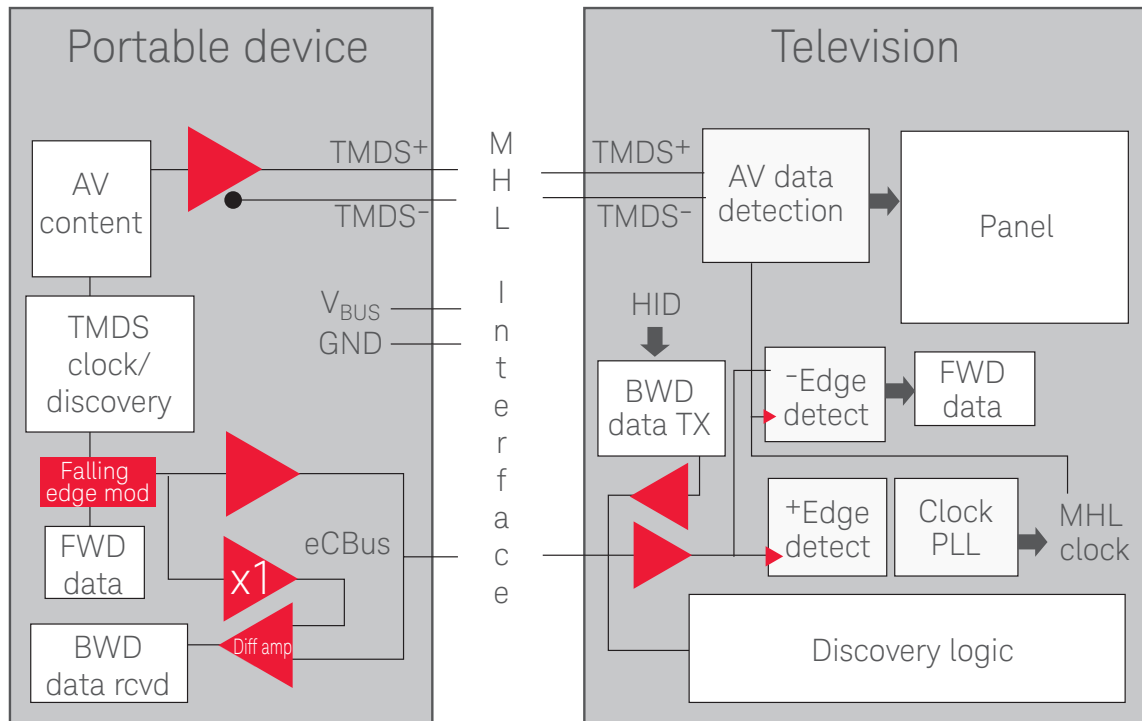A conceptual view of the MHL 3 interface/capability is shown below:

Figure 1. Conceptual diagram emphasizing the new MHL 3 functionality

MHL Source Compliance Test Software Saves You Time

The MHL Source Compliance Test Software saves you time by setting the stage for automatic execution of MHL electrical tests. Most of the difficulty of performing electrical tests for MHL lies in understanding the test requirements; confidently achieving proper connection of the oscilloscope to the target device; configuring the instrument for measurement; executing the test procedure; and then analyzing the measured results by comparing them to limits published in the specification. The MHL Electrical Test Software incorporates the CTS requirements in the tests, explicitly guiding you through connection requirements and automatically making the measurements needed. The software also incorporates calibration functions for MHL signal generators to enable the accurate testing of MHL sinks and allowing the characterization of cable loss effects, etc., which can be helpful in system design.

The MHL Source Compliance Test Software offers all the single-ended, differential and common mode tests required for source testing of an MHL portable device as stipulated in the MHL CTS. The Keysight automated test engine quickly walks you through the steps required to define the tests; set them up; perform them; and then view their results. The user can pick high-level test parameters to suit test process objectives and then proceed to select a category of tests all at once or specify individual tests. The user interface is oriented to minimize your necessary reconnections, which saves you time and minimizes the potential for operator error. You can save tests and configurations as project files and recall them later for quick testing and review of previous test results. Straightforward menus let you perform tests with a minimum number of mouse clicks. The software automatically configures the oscilloscope for each test; prompts the user for test connection and configuration; and provides an informative results report that includes margin analysis that indicates how close your product came to passing or failing that specification. See Table 1(a) and Table 1(b) for a complete list of the measurements made by the MHL Source Compliance Test Software.

Test Selection

The 'Select Tests' tab shows the test selection menu as well as status. As can be seen in the figure below, a check mark signifies a test selection and will be run subsequently. Also note that there are green checks that indicate a passing result and red x's that indicate a fail when tests are opened to the highest detail. When not opened to specific tests (say for groups of tests), a status circle is shown that may be empty indicating no testing of that group, or it may be colored red, green, or red and green. These signify states of failed, passed, and both failed and passed tests, respectively.
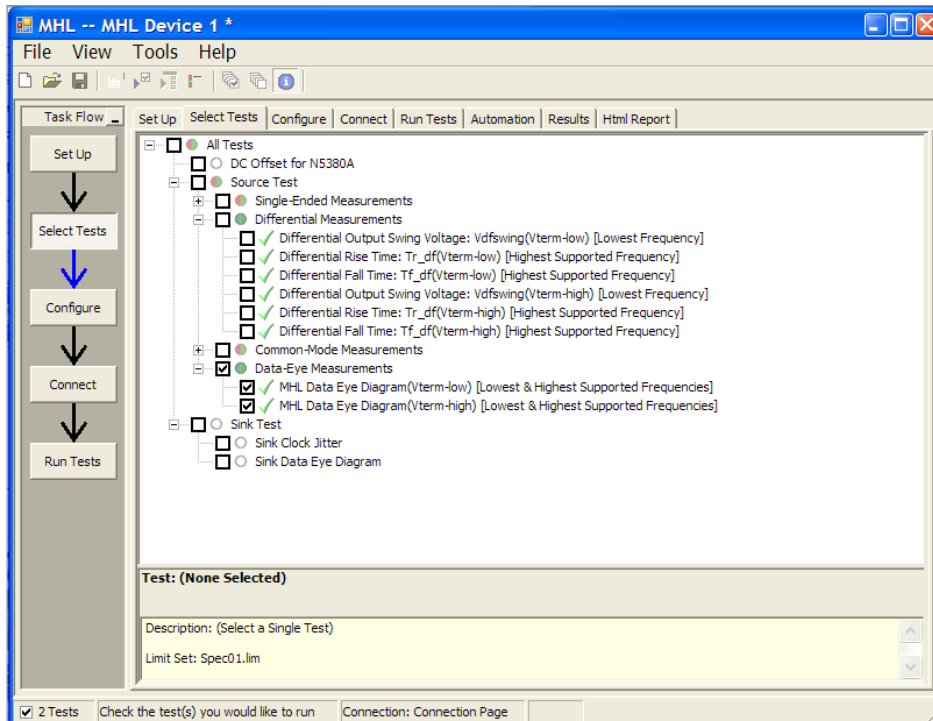

Figure 2. The Keysight automated test engine quickly guides you through selecting and configuring tests; setting up the connection; running the tests; and viewing the results. You can easily select individual tests or groups of tests with a mouse-click. Also the test status for the device under test can be easily seen.

After configuring the test according to your needs, the MHL software user interface will then show the connection screen (shown in Figure 3), which illustrates the connection guidance provided for a standard MHL device.
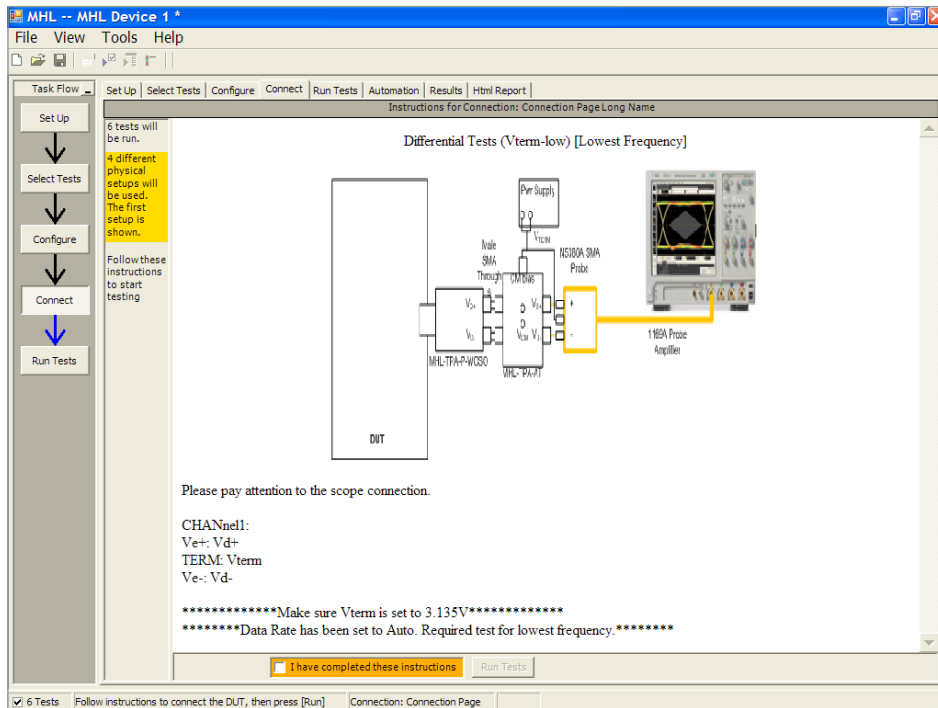

Figure 3. When you make multiple tests where the connections must be changed, the software prompts you with connection diagrams and/or photographs.

Thorough Performance Reporting

The MHL Source Compliance Test Software generates thorough reports that not only capture the performance and status of the device under test, but also the screen shots of your most significant measurements for your perusal and evaluation. The first page of the report lists equipment and configuration details required in standard quality assurance programs. It also provides a hot-linked results table that will quickly get you to the measurement report section of interest.
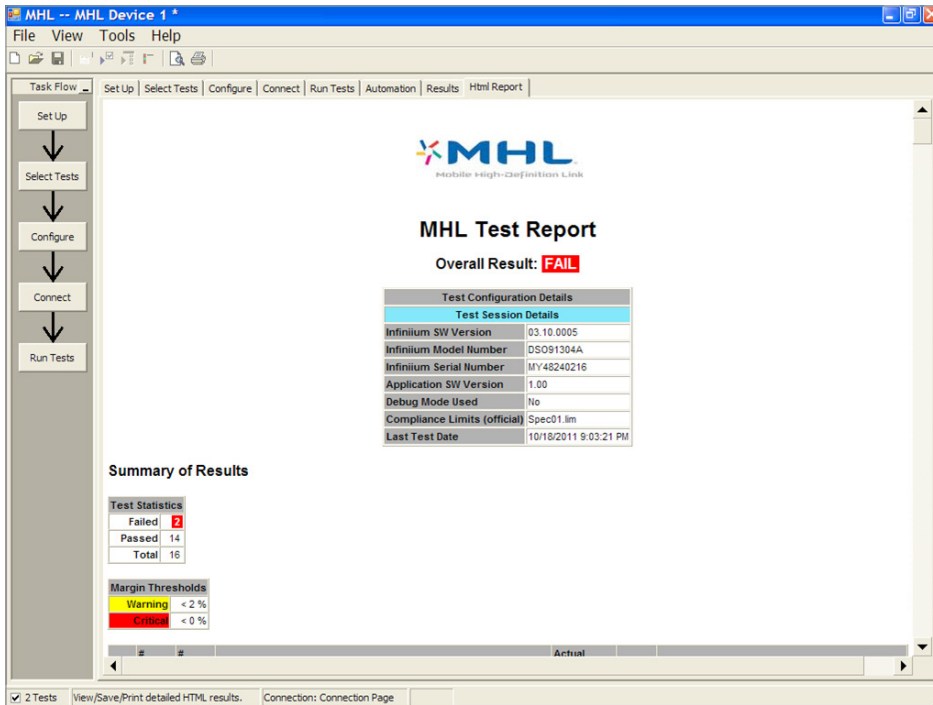
Figure 4. The MHL compliance software generates a summary report where you can quickly and clearly see the total test results for your device. This is the title page illustrating the important session information regarding the connection, device and measurement equipment.

The report lists the summary of results in a table form. This table has a wealth of information that is immediately visible to the user. The status of the device (pass or fail) is shown immediately to the left. If you had many test runs or several resolutions that you tested to, you will be alerted to your overall status for a given test by the number of that test's trials and the number of times that test failed. The test name is hot linked and will take you directly to the results you desire (see eye result in Figure 5). This data is also available in the 'Results' tab as shown in Figure 7.
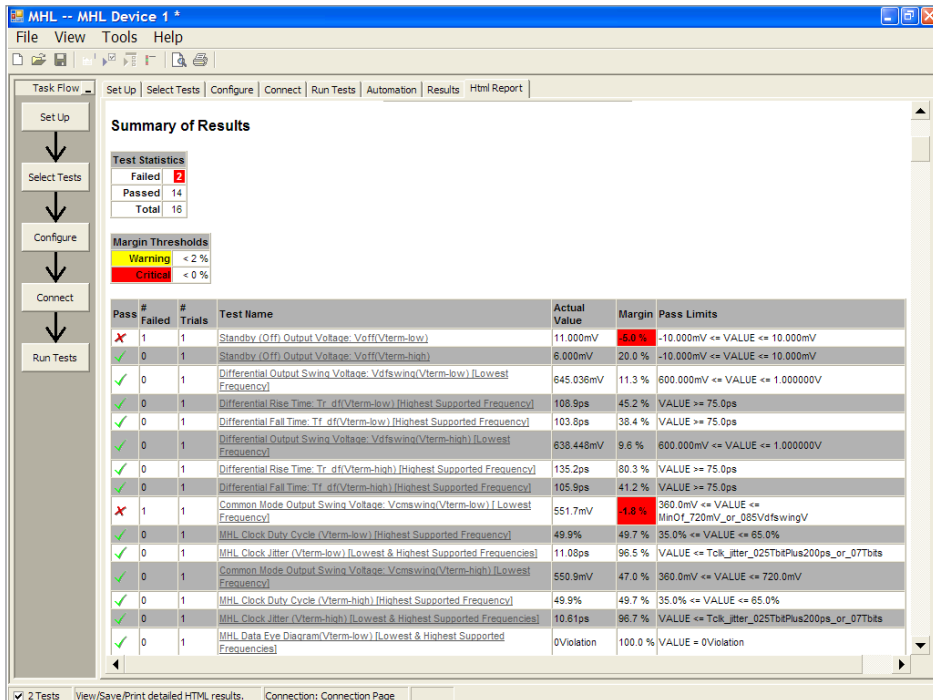
Figure 5. Additional details for each test are shown, including the test limits, test description and test results, including waveforms, if appropriate. In addition, the margin of the result is indicated to provide further insight.
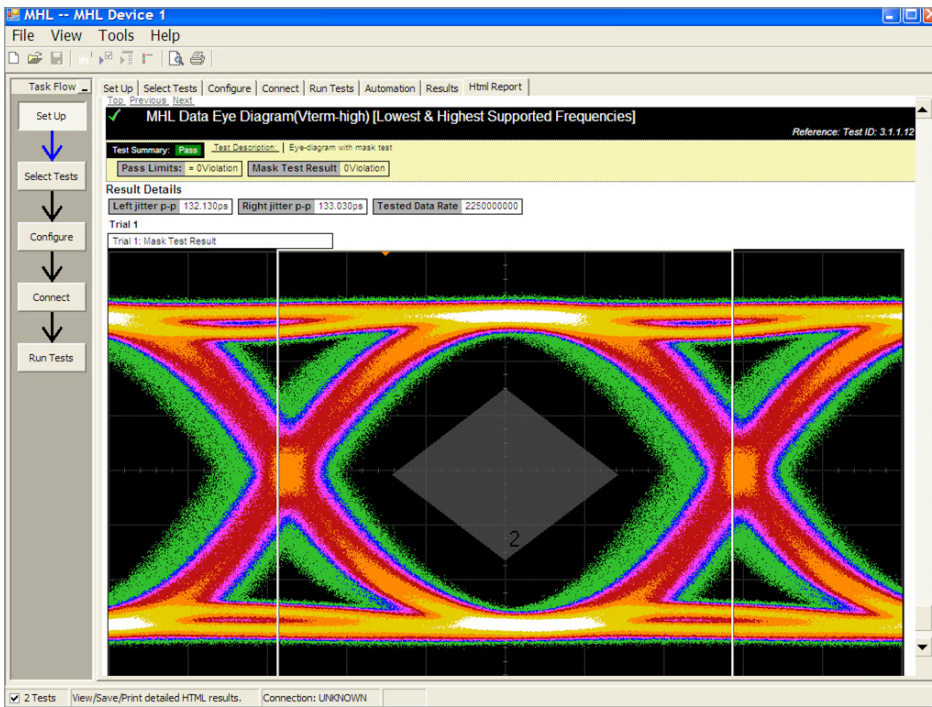
Figure 6. Summary report detail: the MHL software's summary report yields screen shots of all the measurements that have been performed. You can see the Data-Eye in this example. Observe the clear status and description at top and the measurement data just above the eye.

Figure 7. The MHL Source Compliance Test Software results report documents your test and indicates the Pass/Fail status, test specification range, measured values and margin.

Margin Analysis

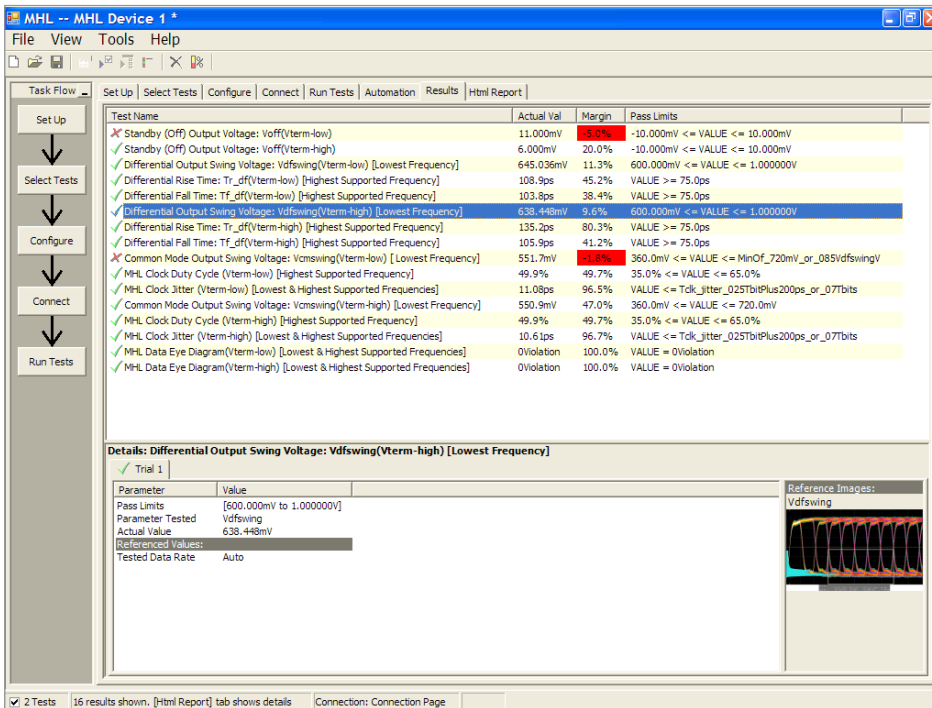In addition to providing you with measurement results, the MHL Source Compliance Test Software provides a report format that shows you not only where your product passes or fails, but also reports how close you are to the limits specified for a particular test assertion. You select the margin test report parameter, which means you can specify the level at which warnings are issued to alert you to the electrical tests where your product is operating close to the official test limit defined by the MHL Compliance Test Specification for a given test assertion.

Margin is calculated:

Single-sided specification:

$$\text{Margin} = (\text{Value}_{\text{Specification}} - \text{Value}_{\text{actual}})/\text{Value}_{\text{Specification}}$$

Double-sided specification:

$$\text{Margin} = \text{Lowest of: } (\text{Value}_{\text{Specification\_High}} - \text{Value}_{\text{actual}})/\text{Range}_{\text{Specification}} \text{ and}$$
$$(\text{Value}_{\text{Specification\_Low}} - \text{Value}_{\text{actual}})/\text{Range}_{\text{Specification}}$$

MHL 3 Complete Portable Device Testing Requires Transceiver Testing

The inclusion of a bidirectional data line on the eCBUS for MHL 3 requires validation of the eCBUS line not only for its positive going edge for the conveyance of the TMDS clock, but also for its falling edge for forward (FWD) data as well as jitter and level tolerance for the reverse (BWD) data. Figures 8 and 9 depict the test setups used for MHL 3 validation. Figure 8 illustrates the connections not only for the eCBUS, but also for the MHL AV (TMDS) lines. The device may have proprietary software for control (termed Direct Device Access) or be controlled through more automated means with the relay board and CBUS controller (SL 403A), which is controlled by the MHL compliance test software.
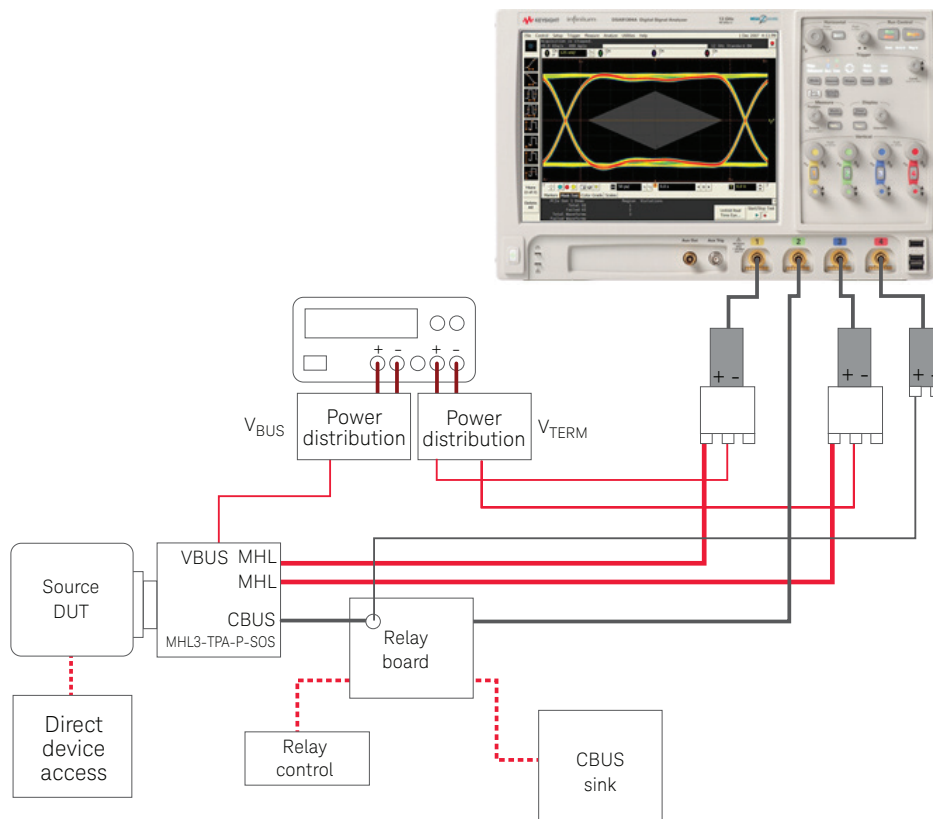
Figure 8. Test setup for TMDS and eCBUS testing of MHL 3 portable device.

Figure 9 illustrates the connections for eCBUS BWD data validation. BitifEye software (Valiframe option MHL) is used to control the MHL compliance test software to calibrate the eCBUS signal for level and timing (jitter) and applies the MHL signals to the portable device to validate that the worst case conditions are interpreted properly.
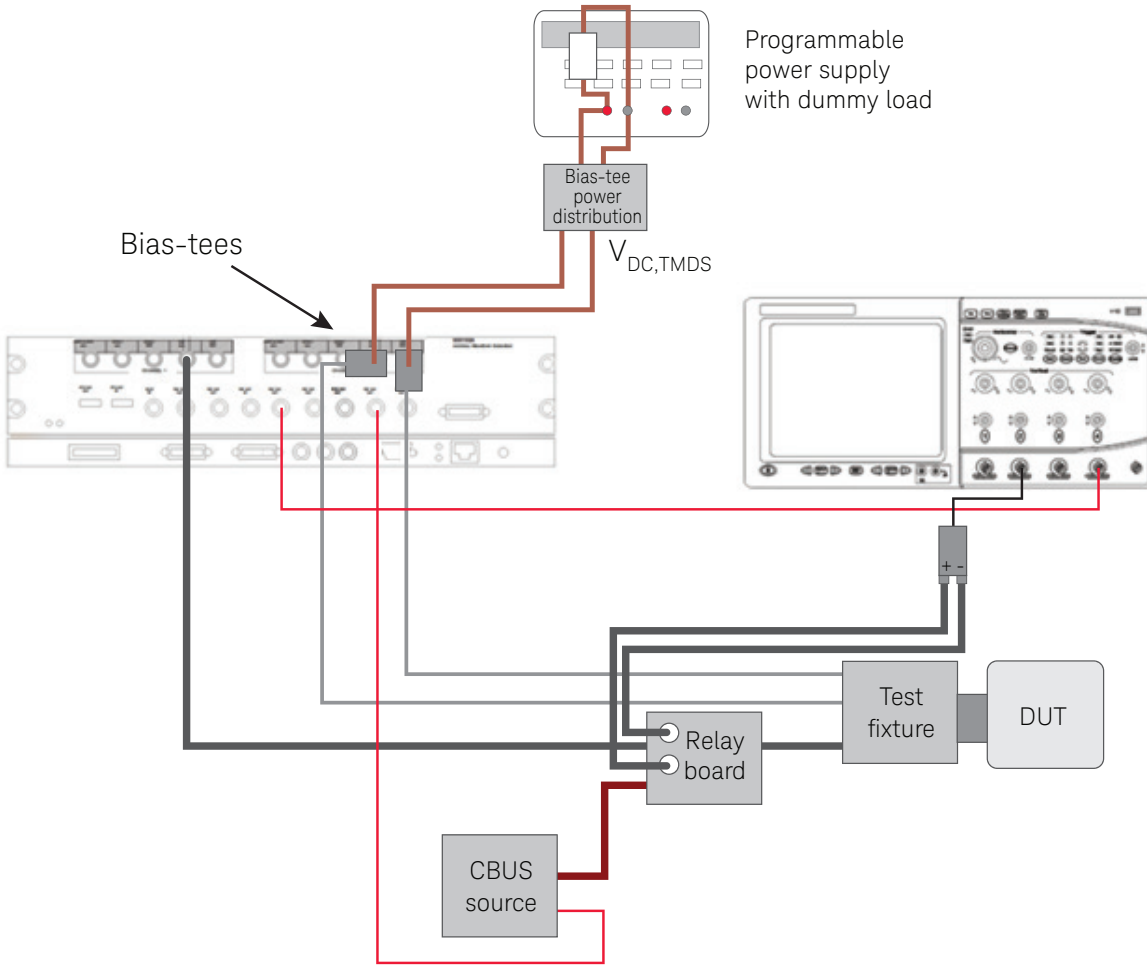
Figure 9. Test setup for eCBUS testing for BWD data of an MHL 3 portable device.

MHL Test Point Adaptors

To make measurements with the MHL Source Compliance Test Software, you will require signal access, which is achieved through test point access (TPA) fixture sets designed specifically for MHL. There is a set for the MHL 1.x and 2.x signal access and test, and another set for MHL CTS 3.2. Figure 10(a) shows a fixture set for source testing for MHL 1.x/2.x while Figure 10(b) shows the fixture set required for MHL 3.2 testing.
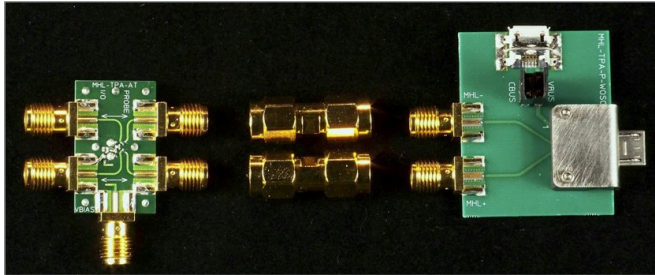
Figure 10(a). The MHL test point adaptors for MHL 1.x and 2.x source test (available from Wilder Technologies and BitifEye Corp.).

This fixture set interfaces to the micro USB connector of the device under test and performs two functions. One function is to break out low frequency signaling so the device under test may be controlled as desired, for example by connecting to a sink device or any other device that conveys EDID[1] information. The second function is to break out the high speed lines of MHL for measurement verification (also known as TMDS lines).
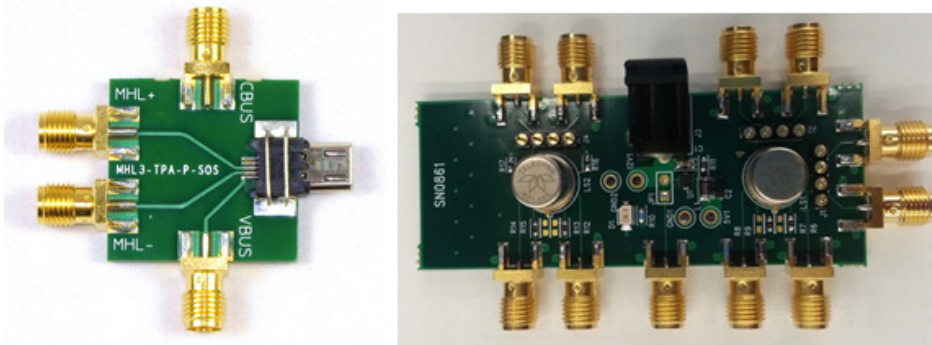
Figure 10(b). The MHL 3 TPA (M3-S-TPA-SRC-P) from Wilder Technologies and RELT board from SimplayLabs.

For MHL 3, more extensive control is required due to the added complexity of data transmission on the eCBUS and special control of output state that is required for test. For device control, SimplayLabs has developed the eCBUS controller (SL-403A MHL sink board), which is used to control the source device. SimplayLabs has also created a relay (SL-402A RELT) board to assist in the dynamic switching of paths to make measurements for backward (BWD) data measurement conditions. Figure 8 is a rendering of a test setup with these elements. The Keysight CTS 3.2 method of implementation (MOI) and the CTS itself should be studied to see how these are used.

1. EDID: Extended Display Identification Data

Measurement Requirements

To use the MHL Source Compliance Test Software with the Wilder Technologies TPAs and SimplayLabs devices (SL-402A, SL-403A) , you will need at least three 13 GHz or higher probe amplifiers with appropriate differential SMA probe heads. These are used to measure the differential and single-ended parameters identified in the compliance test specification. They function to terminate the transmission lines in 50 Ω and pull up the signal to 3.3 volts. To measure the common mode parameters where the bandwidth requirements are relaxed (1 GHz), an E2678A socketed differential probe head is used in the MHL 1.x/2.x tests.

Tests Performed

The MHL Electrical Performance Validation and Compliance Software performs the following tests as per the MHL Compliance Test Specifications.

Tests for MHL versions 1.x and 2.x identified in CTS section 3.1.1.

Table 1(a). MHL electrical tests performed by the MHL software for MHL 1.x and 2.x

Assertion No.	Description	CTS version	
Section 3.1.1	Transmitter tests	1.3	2.1
Test ID 3.1.1.1	Standby (off) output voltage: V_{OFF}	▪	▪
Test ID 3.1.1.2	Single-ended high level voltage: V_{SE_HIGH}	▪	▪
Test ID 3.1.1.3	Single-ended low level voltage: V_{SE_LOW}	▪	▪
Test ID 3.1.1.4	Differential output swing voltage: $V_{DFSWING}$	▪	▪
Test ID 3.1.1.5	Common mode output swing voltage: $V_{CMSWING}$	▪	▪
Test ID 3.1.1.6	Differential rise and fall times: T_{R_DF} T_{F_DF}	▪	▪
Test ID 3.1.1.7	Common mode rise and fall times: T_{R_CM} T_{F_CM}	▪	▪
Test ID 3.1.1.8	Differential intra-pair skew: T_{SKEW_DF}	▪	
Test ID 3.1.1.10	MHL clock duty cycle (24-bit mode)	▪	▪
Test ID 3.1.1.11	MHL clock jitter (24-bit mode)	▪	
Test ID 3.1.1.12	MHL data eye diagram (24-bit mode)	▪	
Test ID 3.1.1.14	MHL clock duty cycle (24-bit mode)	▪	
Test ID 3.1.1.15	MHL clock jitter (packed pixel mode)	▪	
Test ID 3.1.1.16	TP2 clock jitter in normal mode	▪	
Test ID 3.1.1.17	TP2 clock jitter in normal mode		▪
Test ID 3.1.1.18	TP2 eye diagram in normal mode		▪
Test ID 3.1.1.19	TP2 clock jitter in packed pixel mode		▪
Test ID 3.1.1.20	TP2 eye diagram in packed pixel mode		▪
Section 4.1.1	Sink test support (used to calibrate the MHL signal generator and debug)		
	Sink eye with TP1 or TP2 mask		
	2m/5m cable equalization		
	Sink jitter measurement		

MHL Compliance Software Tests for MHL CTS 3.2. Identified in sections section 3.7.2.

Table 1(b). MHL electrical tests performed by the MHL software for MHL CTS 3.2

Assertion No.	Description	Type[1]	In SW
Section 3.7.2	Source tests (portable transmit function: TMDS or eCBUS)	TMDS/eCBUS S-E/Diff	Yes/No
Test ID 3.7.2.1	Single-ended high level output voltage of differential TMDS data ±: $V_{SE\_HIGH\_DF\_TMDS\_DATA}$	TMDS S-E	Yes
Test ID 3.7.2.2	Single-ended low level output voltage of differential TMDS data ±: $V_{SE\_LOW\_DF\_TMDS\_DATA}$	TMDS S-E	Yes
Test ID 3.7.2.3	Single-ended high level output voltage of differential MHL CLK ± and eCBUS-D FWD ±: $V_{SE\_HIGH\_DF\_MHL\_CLK}$, $V_{SE\_HIGH\_DF\_eCBUS\_FWD}$	eCBUS S-E	Yes
Test ID 3.7.2.4	Single-ended low level output voltage of differential MHL CLK ± and eCBUS-D FWD ±: $V_{SE\_LOW\_DF\_MHL\_CLK}$, $V_{SE\_LOW\_DF\_eCBUS\_FWD}$	eCBUS S-E	Yes
Test ID 3.7.2.5	Differential output swing voltage of differential TMDS data: $V_{DF\_SWING\_DF\_TMDS\_DATA}$	TMDS Diff	Yes
Test ID 3.7.2.6	Differential output swing voltage of differential MHL clock and eCBUS-D FWD data: $V_{DF\_SWING\_DF\_MHL\_CLK}$, $V_{DF\_SWING\_DF\_eCBUS\_FWD}$	eCBUS Diff	No[2]
Test ID 3.7.2.7	Single-ended high level output voltage of single-ended MHL CLK and eCBUS-S FWD data: $V_{SE\_HIGH\_SE\_MHL\_CLK}$, $V_{SE\_HIGH\_SE\_eCBUS\_FWD}$	eCBUS S-E	Yes
Test ID 3.7.2.8	Single-ended low level output voltage of single-ended MHL CLK and eCBUS-S FWD data: $V_{SE\_LOW\_SE\_MHL\_CLK}$, $V_{SE\_LOW\_SE\_eCBUS\_FWD}$	eCBUS S-E	Yes
Test ID 3.7.2.9	Single-ended output swing voltage of single-ended MHL CLK and eCBUS-S FWD data: $V_{SE\_SWING\_SE\_MHL\_CLK}$, $V_{SE\_SWING\_SE\_eCBUS\_FWD}$	eCBUS S-E	Yes
Test ID 3.7.2.10	Differential MHL clock frequency: $F_{DF\_MHL\_CLK}$	eCBUS Diff	No[2]
Test ID 3.7.2.11	Differential MHL clock front porch: $T_{CFP\_DF\_MHL\_CLK}$	eCBUS Diff	No[2]
Test ID 3.7.2.12	Differential MHL clock back porch: $T_{CBP\_DF\_MHL\_CLK}$	eCBUS Diff	No[2]
Test ID 3.7.2.13	Rise time of differential TMDS data: $T_{R\_DF\_TMDS\_DATA}$	S-E	Yes
Test ID 3.7.2.14	Fall time of differential TMDS data: $T_{F\_DF\_TMDS\_DATA}$	S-E	Yes
Test ID 3.7.2.15	Rise time of differential MHL clock and eCBUS-D FWD data: $T_{R\_DF\_MHL\_CLK}$, $T_{R\_DF\_eCBUS\_FWD}$	eCBUS Diff	No[2]
Test ID 3.7.2.16	Fall time of differential MHL clock and eCBUS-D FWD data: $T_{F\_DF\_MHL\_CLK}$, $T_{F\_DF\_eCBUS\_FWD}$	eCBUS Diff	No[2]
Test ID 3.7.2.17	Peak-peak amplitude of differential TMDS data: $V_{PP\_TP1\_DF\_TMDS\_DATA}$	TMDS Diff	Yes
Test ID 3.7.2.18	Peak-peak amplitude of eCBUS-D FWD data: $V_{PP\_TP1\_DF\_eCBUS\_FWD}$	eCBUS Diff	No[2]
Test ID 3.7.2.19	Differential MHL clock jitter at TP2: $T_{CLOCK\_JITTER\_TP2\_DF\_MHL\_CLK}$	eCBUS Diff	No[2]
Test ID 3.7.2.20	Single-ended MHL clock frequency: $F_{SE\_MHL\_CLK}$	eCBUS S-E	Yes
Test ID 3.7.2.21	Single-ended MHL clock front porch: $T_{CFP\_SE\_MHL\_CLK}$	eCBUS S-E	Yes
Test ID 3.7.2.22	Single-ended MHL clock back porch: $T_{CBP\_SE\_MHL\_CLK}$	eCBUS S-E	Yes
Test ID 3.7.2.23	Rise time of single-ended MHL clock: $T_{R\_SE\_MHL\_CLK}$	eCBUS S-E	Yes
Test ID 3.7.2.24	Fall time of single-ended MHL clock and eCBUS-S FWD data: $T_{F\_SE\_MHL\_CLK}$, $T_{F\_SE\_eCBUS\_FWD}$	eCBUS S-E	Yes
Test ID 3.7.2.25	Peak-peak amplitude of eCBUS-S FWD data: $V_{PP\_TP1\_SE\_eCBUS\_FWD}$	eCBUS S-E	Yes
Test ID 3.7.2.26	Single-ended MHL clock jitter at TP2: $T_{CLOCK\_JITTER\_TP2\_SE\_MHL\_CLK}$	eCBUS S-E	Yes
Test ID 3.7.2.27	Differential TMDS data eye diagram at TP2	TMDS Diff	Yes
Test ID 3.7.2.28	eCBUS-D FWD data eye diagram at TP2	eCBUS Diff	No
Test ID 3.7.2.29	eCBUS-S FWD data eye diagram at TP2	eCBUS S-E	Yes
	BWD data tests (portable receiver function: eCBUS)		
Test ID 3.7.2.30	Input DC voltage tolerance of eCBUS-D BWD data: $V_{IDC\_DF\_eCBUS\_BWD}$	eCBUS S-E	Yes[3]
Test ID 3.7.2.31	Differential input swing voltage tolerance of eCBUS-D BWD data: $V_{IDF\_SWING\_DF\_eCBUS\_BWD}$	eCBUS Diff	No[2]
Test ID 3.7.2.32	Input DC voltage tolerance of eCBUS-S BWD data: $V_{IDC\_SE\_eCBUS\_BWD}$	eCBUS S-E	Yes[3]
Test ID 3.7.2.33	Single-ended input swing voltage tolerance of eCBUS-S BWD data: $V_{ISE\_SWING\_SE\_eCBUS\_BWD}$	eCBUS S-E	Yes[3]
Test ID 3.7.2.34	Intra-pair skew tolerance of eCBUS-D BWD data: $T_{SKEW\_TP1\_DF\_eCBUS\_BWD}$	eCBUS Diff	No[2]
Test ID 3.7.2.35	Jitter tolerance of eCBUS-D BWD data	eCBUS Diff	No[2]
Test ID 3.7.2.36	Jitter tolerance of eCBUS-S BWD data	eCBUS S-E	Yes[3]

1. Tests target either TMDS lane or eCBUS. TMDS tests are both differential and single-ended. The eCBUS may be implemented as single-ended line or differential pair.
2. MHL Source Compliance Software does not perform differential eCBUS tests.
3. For BWD data tests, the MHL Source Compliance Software provides calibration routines used by Valiframe software to perform the test function.

Ordering Information

To purchase the MHL compliance test software with a new or existing Infiniium Series oscilloscope, order from the following tables.

Recommended oscilloscopes

Table 2. Recommended oscilloscopes for MHL Source Compliance Test Software

MHL CTS	Minimum bandwidth	Number of scope channels	Oscilloscope models
MHL 3.x	13 GHz	4	Infiniium 90000 and Z-Series
MHL 1.x/2.x	8 GHz	4	Infiniium 90000 Series

Compliance software options

Table 3. MHL Source Compliance Software options selection.

Application	License type		Infiniium Z-Series	Infiniium 90000 Series
MHL source compliance test software MHL 1, MHL 2, MHL 3	Fixed	Factory-installed	N6460B-1FP	Option 082
		User-installed	N6460B -1FP	N6460B -1NL
	Floating	Transportable	N6460B -1TP	N6460B -1TP
		Server-based	N5435A-078	
MHL source compliance test software MHL 3 upgrade	Fixed	Factory-installed	n/a	n/a
		User-installed	N6460B -2TP	N6460B -2NL
	Floating	Transportable	n/a	n/a
		Server-based	n/a	
MHL source compliance test software MHL 1 and MHL 2	Fixed	Factory-installed	N6460B -3FP	Option 054
		User-installed	N6460B -3FP	N6460B-3NL
	Floating	Transportable	N6460B -3TP	N6460B -3TP
		Server-based	N5435A-050	

Probes

Table 4. Probes and amplifiers

Probe component	MHL CTS 1.x/2.x	MHL CTS 1.x/2.x/3.x	Infiniium Z-Series	Infiniium 90000 Series
Probe amplifiers	Qty = 2	Qty = 4	N280xA, or 1169A (with N5442A adaptors)	1169A
Differential SMA probe heads	Qty = 2	Qty = 4	N5444A, or N5380B (only with 1169A)	N5380B
Probe heads	Qty = 1		E2678A (only with 1169A)	E2678A
		Qty = 1	N5441A, or N5381A (only with 1169A)	N5381A

Additional oscilloscope software

Table 5. Software packages

Application	License type		Infiniium Z-Series	Infiniium 90000 Series
EZJIT Plus jitter (optional)	Fixed	Factory-installed	N5400A-1FP	Option 004
		User-installed	N5400A-1FP	N5400A-1NL
	Floating	Transportable	N5400A-1TP	N5400A-1TP
		Server-based	N5435A-001	
Equalization (optional)	Fixed	Factory-installed	N5461A-1FP	Option 012
		User-installed	N5461A-1FP	N5461A-1NL
	Floating	Transportable	N5461A-1TP	N5461A-1TP
		Server-based	N5435A-025	
InfiniiSim (required)	Fixed	Factory-installed	N5465A-1FP	Option 014
		User-installed	N5465A-1FP	N5465A-1NL
	Floating	Transportable	N5465A-1TP	N5465A-1TP
		Server-based	N5435A-027	
PrecisionProbe (recommended with 1169A probe amplifiers)	Fixed	Factory-installed	N2809A-1FP	Option 001
		User-installed	N2809A-1FP	N2809A-1NL
	Floating	Transportable	N2809A-1TP	N2809A-1TP
		Server-based	N5435A-003	

Fixtures and connection tools

For physical connections to an MHL device to perform tests with the MHL Source Compliance Test Software, order the following:

Table 6. Test fixtures for MHL portable device testing

Model number	Description	CTS	Supplier	Quantity
MHL-TPA-AGIL-SO	MHL source test adaptor kit PN 640-0466-001	MHL 1.x/2.x	Wilder Technologies	1
MHL3-TPA-P-SOS	MHL 3 source test adaptor	MHL 3.2	Wilder Technologies	1
E3633A/E3646A	DC supply	MHL 1.x/2.x/3.2	Keysight Technologies	1
BIT-1003-0000-0	Power distribution	MHL 1.x/2.x/3.2	BitifEye GmbH	1 (or as necessary)
SL-402-A	RELT board	MHL 3.2	SimplayLabs	1
SL- 403-A	CBUS sink/source board	MHL 3.2	SimplayLabs	1

Source receiver testing

MHL 3 devices require receiver testing for full portable device validation. The following equipment and software is required.

Portable device receiver testing equipment and software

Table 7. Receiver testing equipment

Model number	Description	CTS	Supplier	Quantity
N5990A	Valiframe factory automation software	MHL 3.2	BitifEye GmbH	1
N4877	Level control unit	MHL 3.2	Keysight Technologies	1
M8190A	Arbitrary waveform generator	MHL 3.2	Keysight Technologies	1
5547-107	Bias Tees	MHL 3.2	Picosecond Pulse Labs	2
Various	50 Ω termination	MHL 1.x	Assorted	2
BIT-1001-0010-0	900 ps TTC	MHL 3.2	BitifEye GmbH	1

Note: Power distribution; RELT and CBUS sink boards; power supply; and TPA identified in previous tables are used as well.

Related Literature

Publication title	Publication type	Publication number
Infiniium 90000 Series Oscilloscopes	Data sheet	5989-7819EN
N5990A Automation Software	Data sheet	5989-5483EN
HDMI Electrical Performance and Validation Software	Data sheet	5990-5299EN

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