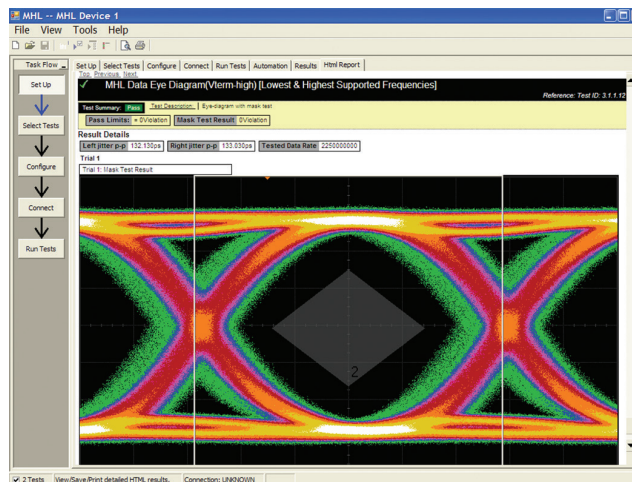# Keysight N6460B
MHL Source Compliance Test Software for Infiniium Oscilloscopes

Data Sheet

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Introduction

Keysight Technologies, Inc. MHL source compliance test software for Infiniium oscilloscopes provides you with a fast and easy way to verify and characterize your Mobile High Definition-Link (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 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 suite for MHL data transport as identified in the MHL Compliance Test Specification 1.3 and 2.1 (CTS 1.3/2.1). These tests, in conjunction with protocol tests, represent the full compliance regimen to qualify an MHL design at an MHL authorized test center.

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 enable you to attend to higher risk areas in your product's market delivery.

Features

The MHL electrical test software offers several features to simplify the validation of MHL designs:

- Test setup wizard for ease-of-use
- Full complement of MHL electrical tests for the high speed interface.
- Automated scope measurement setup
- Test results report generation
- Pass/fail margin analysis

With the MHL source compliance 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.

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. Part of the difficulty of performing electrical tests for MHL is connecting 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 test software does almost all of this work for you. The software also incorporates calibration functions for MHL signal generators to enable the accurate testing of MHL sinks. Part of the value of having this function available is to characterize cable loss effects etc. which can be helpful in system design.

The MHL source compliance test software offers all of the single ended, differential and common mode tests required for the MHL CTS. The Keysight automated test engine walks you quickly through the steps required to define the tests, set up the tests, perform them, and view the test results. The user is allowed to pick high level test parameters to suit test process objectives, and then can proceed to select a category of tests all at once, or specify individual tests. The user interface is oriented to minimize your reconnections necessary which saves time as well as minimizes 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 of mouse clicks. The software automatically configures the oscilloscope for each test, prompts the user for test connection and configuration, and it provides an informative results report that includes margin analysis indicating how close your product is to passing or failing that specification. See Table 2 for a complete list of the measurements made by the MHL source compliance test software.

Test Selection

The 'Select Tests' tab shows test selection menu as well as status. As can be seen in Figure 1, a check mark signifies a test selection and will be run subsequently. Also note, however, 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. The circle may be empty, indicating no testing of that group, or it may be colored red, green, or red and green. These signify states of Fail, Pass, and both Failed and Passed tests, respectively.
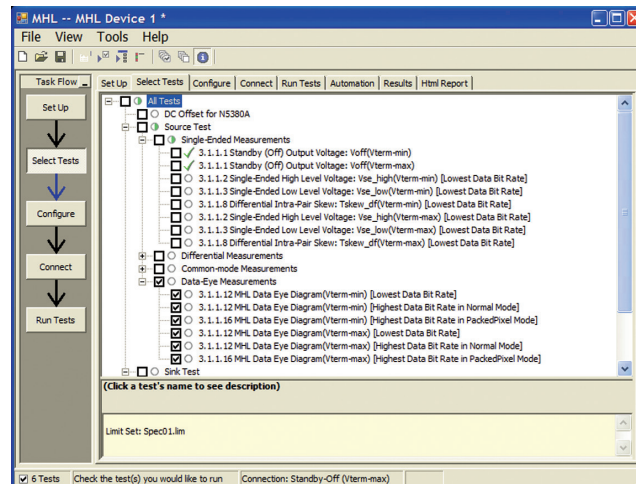

Figure 1. The Keysight automated test engine guides you quickly through selecting tests and configuring tests, setting up the connection, running the tests, and viewing the results. You can easily select individual tests or groups of tests with a mouse-click. Also easily seen is the test status for the device under test.

After configuring the test according to your needs, the MHL compliance software user interface will then present you the connection screen which is shown in Figure 2 illustrating the connection guidance provided for standard MHL device.
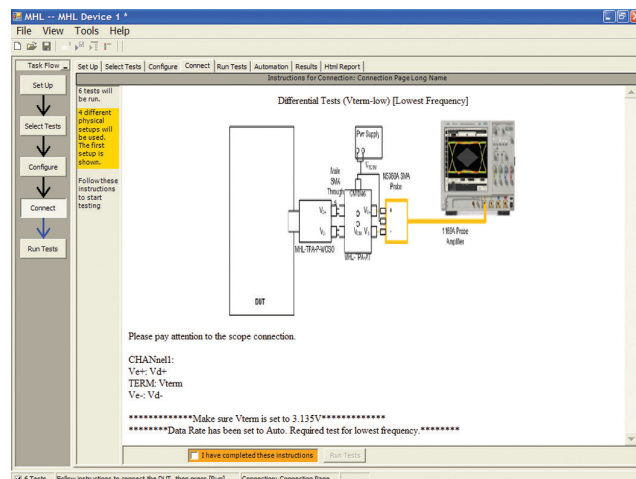

Figure 2. When you make multiple tests where the connections must be changed, the software prompts you with connection diagrams and/or photographs.

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 the 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.

The report then 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 in very obvious form. If you should have many test runs or several resolutions at which to test you will be alerted to your overall status for a given test by the number of trials of that test and number of times that test failed. The test name is hot linked and will take you directly to results you desire to dig into (see eye result below, Figure 5). This data is also available in the 'Results' tab as shown in Figure 6.
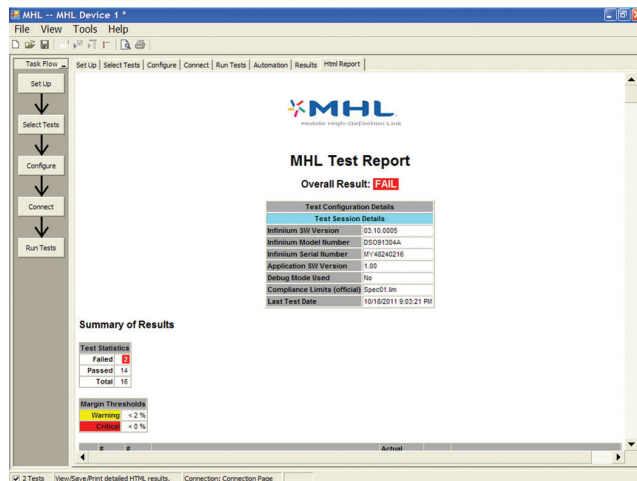

Figure 3. The MHL compliance software generates a summary report where you can see the total test results for your device quickly and clearly. This is the title page illustrating the important session information regarding the connection, device and measurement equipment.
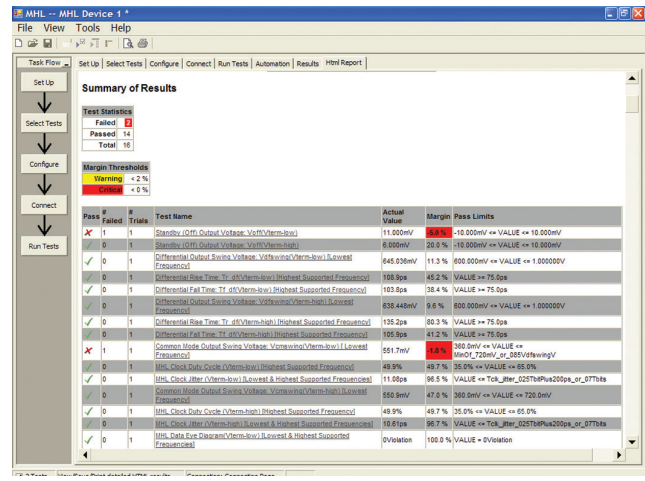

Figure 4. Additional details for each test including the test limits, test description, and test results, including waveforms, if appropriate. In addition, the margin of the result is indicated to provide further insight.
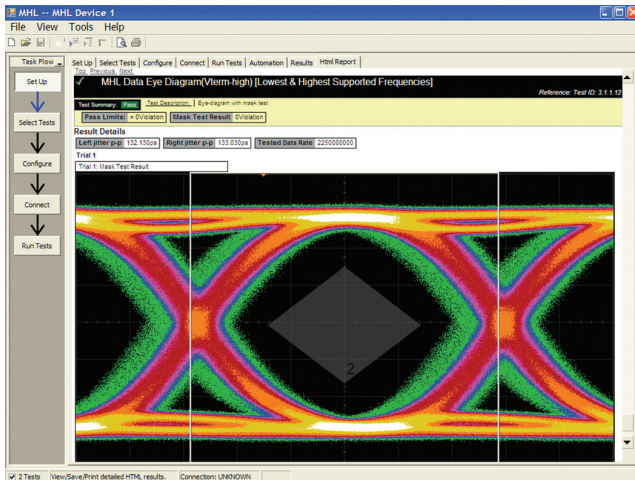
Figure 5. Summary Report Detail: the MHL summary report yields all the screen shots of all the measurements that have been performed. In this figure you can see the Data-Eye. Observe the clear status and description at top and the measurement data just above the eye.
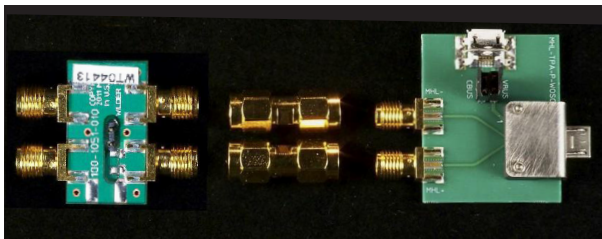
MHL Test Point Adaptors

Figure 5a. The MHL Test Point Adaptors for MHL Source Test (available from Wilder Technologies or through Bitifeye Corp).

Figure 6. The MHL source compliance test software results report documents your test, indicates the pass/fail status, the test specification range, the measured values, and the 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:
   Margin = (ValueSpecification – Valueactual)/ValueSpecification

Double-sided Specification:
   Margin = Lowest of: (ValueSpecification_High – Valueactual)/
            RangeSpecification and
   (ValueSpecification_Low – Valueactual)/RangeSpecification

Extensibility

You may add additional custom tests or steps to your application using the User Defined Application (UDA) development tool (www.keysight.com/find/uda). Use UDA to develop functional "Add-Ins" that you can plug into your application.

Add-ins may be designed as:

- Complete custom tests (with configuration variables and connection prompts)
- Any custom steps such as pre or post processing scripts, external instrument control and your own device control
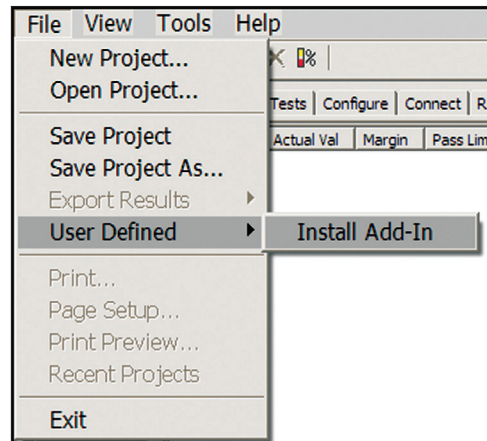

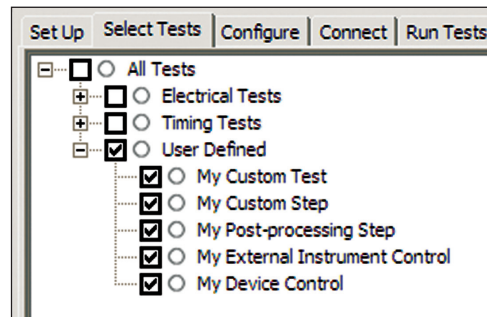Figure 7. Importing a UDA Add-In into your test application.

Figure 8. UDA Add-In tests and utilities in your test application.

Automation

You can completely automate execution of your application's tests and Add-Ins from a separate PC using the included remote interface feature (download free toolkit from www.keysight.com/find/scope-apps-sw). You can even create and execute automation scripts right inside the application using a convenient built-in client.

The commands required for each task may be created using a command wizard or from "remote hints" accessible throughout the user interface.

Using automation, you can accelerate complex testing scenarios and even automate manual tasks such as:

- Opening projects, executing tests and saving results
- Executing tests repeatedly while changing configurations
- Sending commands to external instruments
- Executing tests out of order

Combine the power of built-in automation and extensibility to transform your application into a complete test suite executive:

- Interact with your device controller to place it into desired states or test modes before test execution.
- Configure additional instruments used in your test suite such as a pattern generator and probe switch matrix.
- Export data generated by your tests and post-process it using your favorite environment, such as MATLAB, Python, LabVIEW, C, C++, Visual Basic etc.
- Sequence or repeat the tests and "Add-In" custom steps execution in any order for complete test coverage of the test plan.
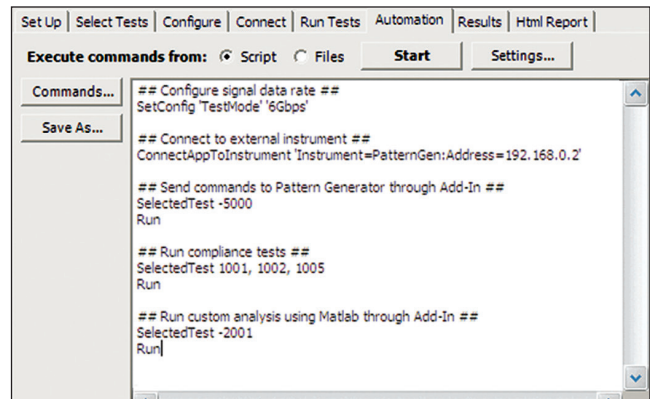

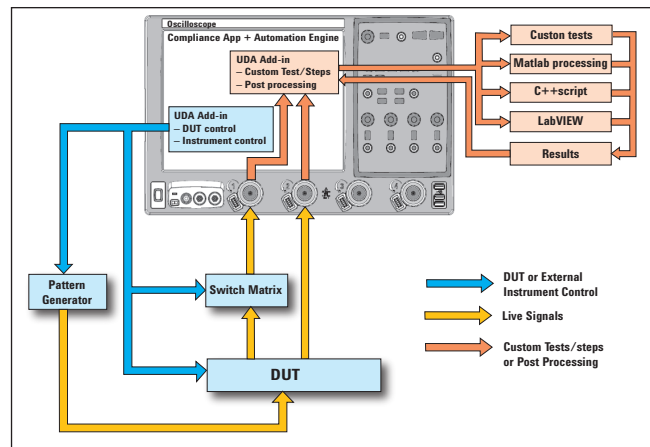Figure 9. Remote Programming script in the Automation tab.

Figure 10. Combine the power of built-in automation and extensibility to transform your application into a complete test suite executive.

To make measurements with the MHL source compliance test software, you will require signal access which is achieved through test point access (TPA) fixture set designed by Wilder Technologies. 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 connection to a sink device or to any other device that conveys EDID information. The second function is to break out the high speed lines of MHL for measurement verification.

Measurement Requirements

To use the MHL source compliance test software with the Wilder Technologies TPAs, you will need at least two 10GHz or higher InfiniiMax 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 ohms and to pull up the signal to 3.3 volts. To measure the common mode parameters where the bandwidth requirements are relaxed (500 MHz), a socketed differential probe head is needed.

Recommended Oscilloscopes

The MHL source compliance test software is compatible with Keysight Infiniium Series oscilloscopes with operating software revision 4.20 or higher. For oscilloscopes with earlier revisions, free upgrade software is available here: www.keysight.com/find/scope-apps-sw

Table 1: Recommended oscilloscopes.

MHL specification	Minimum bandwidth	Number channels	Compatible oscilloscopes
MHL 1.x/2.x	8 GHz	2	Infiniium 90000 and Z-Series

Tests Performed

The MHL source compliance test software performs the following tests as per the MHL Compliance Test Specifications 1.2 and 2.1.

Table 2. MHL electrical tests performed by the MHL software

Assertion No.	Description	CTS Version	
Section 3.1.1	Transmitter tests	1.2	2.1
Test ID 3.1.1.1	Standby (Off) Output Voltage: VOFF	•	•
Test ID 3.1.1.2	Single-Ended High Level Voltage: VSE_HIGH	•	•
Test ID 3.1.1.3	Single-Ended Low Level Voltage: VSE_LOW	•	•
Test ID 3.1.1.4	Differential Output Swing Voltage: VDFSWING	•	•
Test ID 3.1.1.5	Common Mode Output Swing Voltage: VCMSWING	•	•
Test ID 3.1.1.6	Differential Rise and Fall Times: TR_DF TF_DF	•	•
Test ID 3.1.1.7	Common Mode Rise and Fall Times: TR_CM TF_CM	•	•
Test ID 3.1.1.8	Differential Intra-Pair Skew: TSKEW_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 (Packed Pixel Mode)	•	
Test ID 3.1.1.15	MHL Clock Jitter (Packed Pixel Mode)	•	
Test ID 3.1.1.16	Data Eye Diagram TPI (Packed Pixel 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 PackedPixel Mode		•
Test ID 3.1.1.20	TP2 Eye Diagram in PackedPixel 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		

Ordering Information

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

Table 3a. Software ordering information.

Application	License type		Infiniium Z-Series	Infiniium 90000 Series
MHL source compliance test software MHL1.x/2.x	Fixed	Factory-installed	N6460B -3FP	Option 054
		User-installed	N6460B -3FP	N6460B-3NL
	Floating	Transportable	N6460B -3TP	N6460B -3TP[1,2]
		Server-based	N5435A-050	N5435A-050

1. Requires software 5.00 and above.
2. Software 4.30 or above requires Windows 7. N2753A Infiniium Windows XP to 7 OS upgrade kit (oscilloscope already has M890 motherboard). N2754A Infiniium Windows XP to 7 OS and M890 motherboard upgrade kit (oscilloscope without M890 motherboard). Verify the M890 motherboard using the procedure found in the Windows 7 upgrade kit data sheet with the publication number 5990-8569EN.
3. For full switch configuration, please refer to www.keysight.com/find/switching or the brochure Automated Switching Solution for Oscilloscopes with the publication number 5991-2413EN.

Probes

Probe component	MHL Spec 1.x/2.x	Infiniium Z-Series	Infiniium 90000 Series
Probe amplifiers	Qty 2	N280xA or 1169A 1169A requires N5442A adaptors	1169A
Probe amplifiers			
Differential SMA probe heads (qty 4)**	Qty 2	N5444A or N5380B (only with 1169A)	N5380B
Socket probe heads	Qty 1	E2678A	E2678A

Optional software

Table 3b. Optional software ordering information.

| Application	License type		Infiniium Z-Series	Infiniium 90000 Series
EZJIT Plus jitter	Fixed	Factory-installed	N5400A-1FP	Option 004
		User-installed	N5400A-1FP	N5400A-1NL
	Floating	Transportable	N5400A-1TP	N5400A-1TP
		Server-based	N5435A-001	N5435A-001
Equalization	Fixed	Factory-installed	N5461A-1FP	Option 012
		User-installed	N5461A-1FP	N5461A-1NL
	Floating	Transportable	N5461A-1TP	N5461A-1TP
		Server-based	N5435A-025	N5435A-025
InfiniiSim (recommended)	Fixed	Factory-installed	N5465A-1FP	Option 014
		User-installed	N5465A-1FP	N5465A-1NL
	Floating	Transportable	N5465A-1TP	N5465A-1TP
		Server-based	N5435A-027	N5435A-027
PrecisionProbe (optional)	Fixed	Factory-installed	N2809A-1FP	Option 001
		User-installed	N2809A-1FP	N2809A-1NL
	Floating	Transportable	N2809A-1TP	N2809A-1TP[1,2]
		Server-based	N5435A-003	N5435A-003

For physical connections to an MHL device to perform tests with the N6460B MHL compliance test software, order one of the following:

Table 3c. MHL test adaptor solution ordering information

Model Number	Description	Supplier	Quantity
MHL-TPA-AGIL-SO	MHL Source Test Adaptor Kit PN 640-0466-001	Wilder Technologies	1
BIT-1070-0000-0	MHL Source Test Fixture Kit	BitifEye Corp.	1
BIT-1003-0000-0	Power distribution	BitifEye Corp.	1
E3633A/E3646A	Multimeter/DC supply	Keysight Technologies	1

Related Keysight Literature

Publication title	Publication type	Publication number
Infiniium 90000 Series Oscilloscopes	Data sheet	5989-7819EN
Infiniium Z-Series Oscilloscopes	Data sheet	5991-3868EN
N5990A Automation Software	Data sheet	5989-5483EN
HDMI Electrical Performance Validation and Compliance Software	Data sheet	5990-5299EN
N5461A Serial Data Equalization Software	Data sheet	5990-3300EN
EZJIT Plus Jitter Analysis Software	Data sheet	5989-0109EN
N5465A InfiniiSim Waveform Transformation Toolset	Data sheet	5990-4059EN
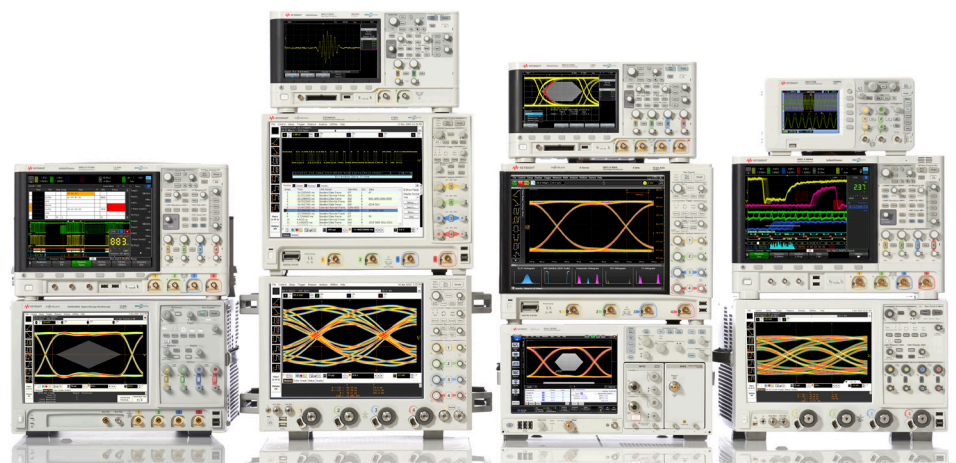
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For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at:
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For other unlisted countries:
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