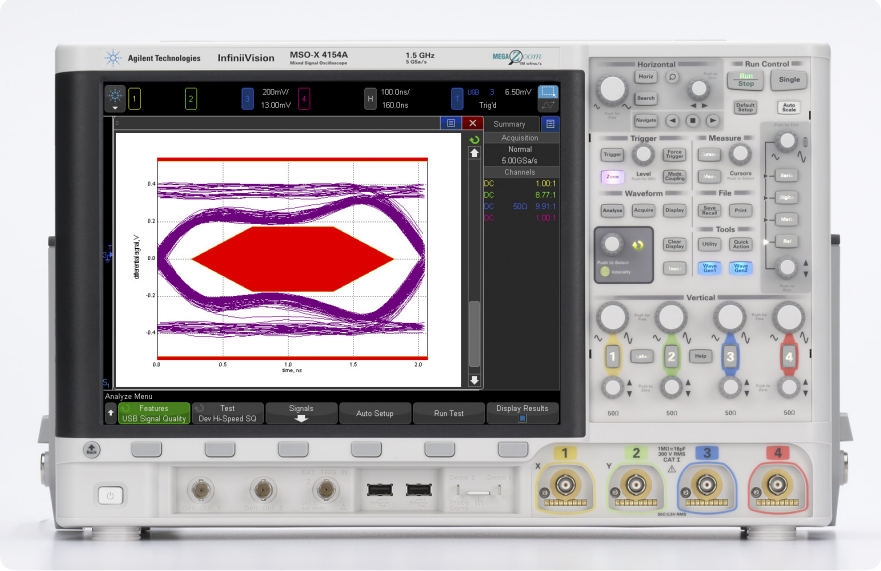
DSOX4USBSQ USB 2.0 Signal Quality Test Option for 4000 X-Series

Data Sheet

Features

- Pass/fail test comparison standards based on low-speed, full-speed, hi-speed, far-end, near-end, host, and device specifications
- Real-time eye test
- Consecutive, paired JK, and paired KJ jitter
- Sync test
- Cross-over voltage (low- and full-speed only)
- EOP bit-width
- Signaling rate
- Edge monotonicity
- Rise/fall edge rate
- Edge rate match (low- and full-speed only)
- HTML pass/fail report generation



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Introduction

The low-speed, full-speed, and hi-speed USB 2.0 serial bus is used today for not only traditional computer/PC applications, but also for a broad range of embedded connectivity applications. For years, oscilloscopes have been the primary measurement tool used by electrical engineers to verify the signal integrity of their USB 2.0 serial bus designs. With the DSOX4USBSQ signal quality test option licensed on an Agilent 4000 X-Series oscilloscope, you can now quickly verify the analog quality of your signals generated by USB hubs, hosts, and devices based on USB-IF compliance standards.

Although USB-IF physical layer compliance testing and certification is not normally performed on embedded electronic products with USB 2.0 interfaces, for reliability purposes designers of embedded systems often need to test the physical layer of their designs based on USB-IF specified standards as a "reality check" to insure signal quality standards are met before releasing their products into production.

For USB 2.0-based products in the traditional computer/PC/peripheral industry where USB-IF physical layer testing and certification is normally performed, purchasing a complete suite of high-performance test equipment to perform full pre-compliance testing is often cost-prohibitive for smaller companies in this industry. But with Agilent's USB 2.0 signal quality test option (DSOX4USBSQ) licensed on InfiniiVision 4000 X-Series oscilloscopes, engineers now have a more affordable solution that can perform what many consider to be the most important series of USB 2.0 physical layer tests (signal quality) before running their final product through complete certification testing at a USB-IF designated workshop.

After running a USB 2.0 signal quality test, a complete test report with color-coded pass/fail measurement results are shown on the scope's display with a scroll-bar to view all tests and screen images as shown in Figure 1. In addition, the complete test report can be saved as a HTML file for test documentation purposes. Figure 2 shows an example test report from a far-end, hi-speed device signal quality test. In this test, the device marginally failed the EOP bit-width test, but was granted a waiver.

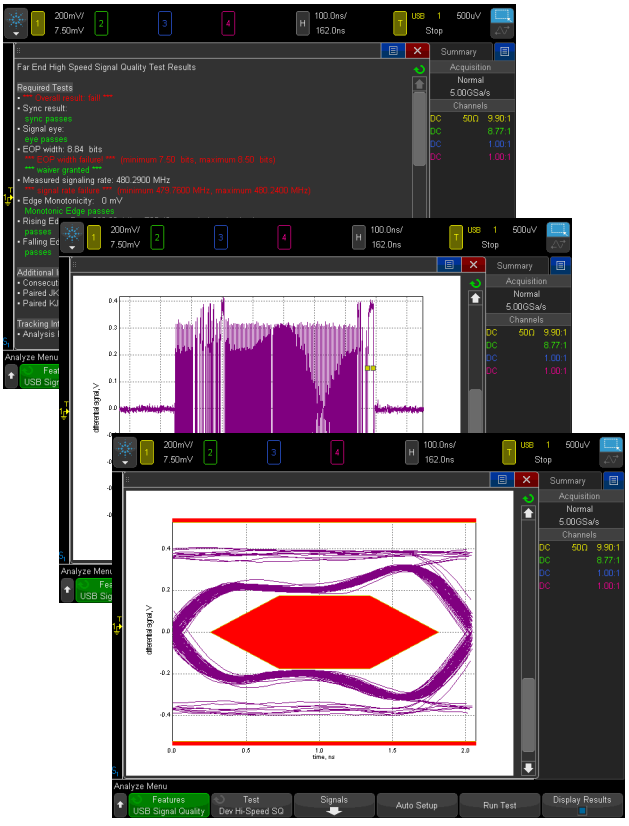


Figure 1. Scrollable on-screen signal quality test report.

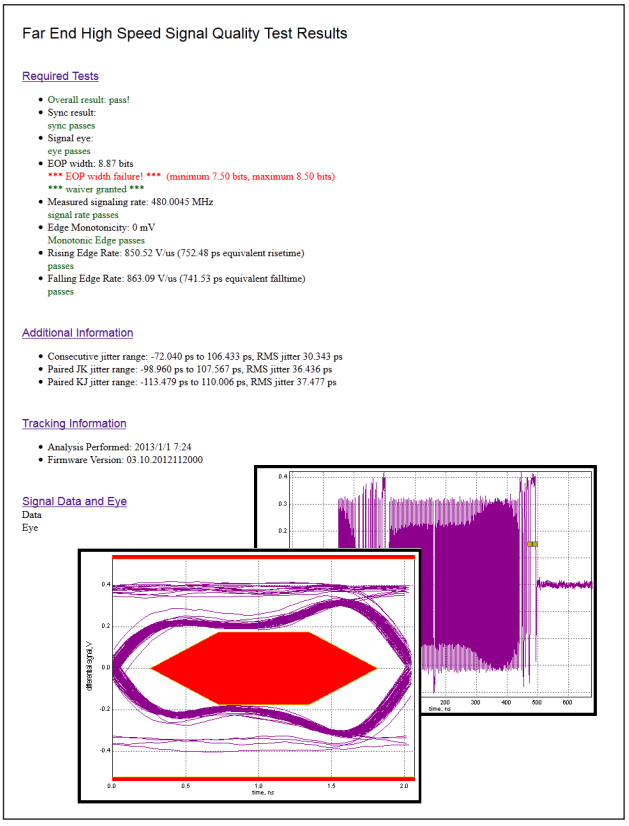


Figure 2. USB 2.0 signal quality test report in HTML format.

Probing the USB 2.0 Differential Bus

To test USB 2.0 low- and full-speed designs, the only probes required are two 10:1 passive probes, which are shipped as standard accessories with every Agilent InfiniiVision 4000 X-Series oscilloscope.

To test USB 2.0 hi-speed designs based on pre-compliance standards with the appropriate device or host test fixture, 50-Ω SMA cables with SMA-to-BNC adapters are all that is required. For this use-model of testing, the test fixture is programmed to generate a specific test pattern. However, during the design and debug phase of product development, engineers often need to test "live traffic" in their hi-speed designs (non-compliance testing). In this case, a test fixture is not required, but a differential active probe with sufficient bandwidth is required. For this use-model of testing, Agilent recommends an InfiniiMode N2750A Series differential active probe shown in Figure 3.

The N2750A Series probe is more than just a differential probe. With the press of the InfiniiMode button on the probe, you can quickly toggle between viewing the differential signal, high-side (D+) relative to ground, low-side (D-) relative to ground, or the common-mode signal. Although ultimately it is the quality of the differential signal that really matters, if signal integrity issues do exist on the differential bus, they can often be caused by issues such as system noise coupling into just one side of the bus (or perhaps improper PC board layout and termination related to just one side of the bus).

Figure 3. Agilent's InfiniiMode N2750A Series differential active probe.

USB 2.0 Test Fixtures

For testing "live traffic" (non-compliance testing) using recommended probing, test fixtures are not required.

For testing low- and full-speed products based on USB-IF compliance standards (pre-compliance signal quality testing), Agilent recommends using the E2646B "SQuIDD" test fixture shown in Figure 4. This test fixture provides easy-access probing test points for Agilent's N2800 Series 10:1 passive probes.

For testing a USB 2.0 hi-speed device based on USB-IF compliance standards (pre-compliance signal quality testing), Agilent recommends using the E2666B test fixture kit shown in Figure 5. Testing hi-speed devices using a programmed test pattern only requires that you connect the D+ and D- signals to the scope's input channels using SMA cabling along with the appropriate SMA-to-BNC adapters.

For testing USB 2.0 hi-speed hosts based on USB-IF compliance standards (pre-compliance signal quality testing), Agilent recommends using the E2667B test fixture kit shown in Figure 6. Testing hi-speed hosts using a programmed test pattern only requires that you connect the D+ and D- signals to the scope's input channels using SMA cabling along with the appropriate SMA-to-BNC adapters.

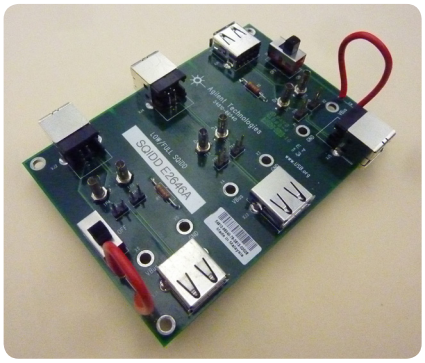


Figure 4. E2646B "SQuIDD" test fixture for testing USB 2.0 low- and full-speed products.

Figure 5. E2666B hi-speed device test fixture.

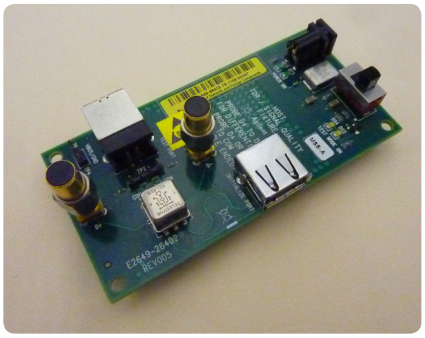
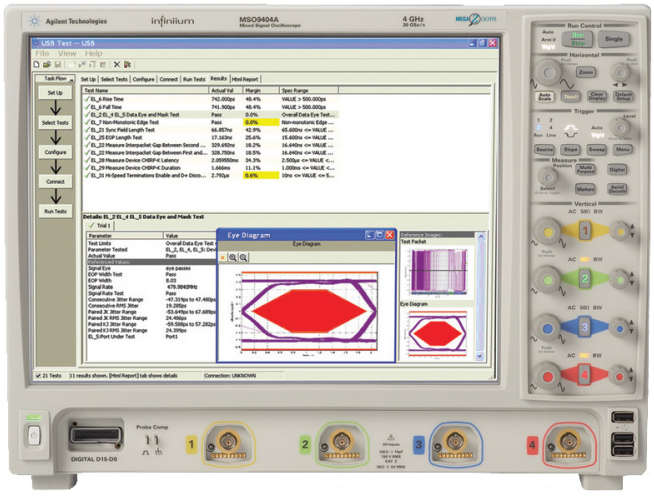


Figure 6. E2667B hi-speed host test fixture.

Related Products

If you need to perform complete USB 2.0 pre-compliance testing (beyond the series of signal quality tests provided by the DSOX4USBSQ option running on an Agilent InfiniiVision 4000 X-Series oscilloscope), Agilent recommends a Windows-based Infiniium 9000 Series oscilloscope with the N5416A USB 2.0 compliance test software shown in Figure 7.



Recommended Oscilloscope Configuration

The DSOX4USBSQ signal quality test option (DSOX4USBSQ) is compatible with any InfiniiVision 4000 X-Series oscilloscope running on firmware version 3.10 or later. However, signal quality tests on hi-speed devices and hosts require an InfiniiVision 1.5-GHz bandwidth model (DSOX4154A or MSOX4154A).

Although the USB 2.0 trigger and decode options (DSOX4USBFL and DSOX4USBH) are not required in order to run USB signal quality tests, if you plan to run these tests on "live traffic" (non-compliance testing), the USB trigger and decode options are recommended for isolating specific packets to test.

Even though one of the USB 2.0 signal quality tests is an eye-diagram mask test, the DSOX4MASK mask test option is not required.

Ordering Information

Refer to the InfiniiVision 4000 X-Series oscilloscope data sheet for ordering information about specific oscilloscope models and other licensed options.

Description	Model Number
USB 2.0 signal quality test option	DSOX4USBSQ
USB 2.0 low- and full-speed trigger and decode option	DSOX4USBFL
USB 2.0 hi-speed trigger and decode option	DSOX4USBH
1.5 GHz InfiniiMode differential active probe	N2750A
3.5 GHz InfiniiMode differential active probe	N2751A
USB 2.0 low- and full-speed test fixture (SQuIDD)	E2646B
USB 2.0 hi-speed device test fixture kit	E2666B
USB 2.0 hi-speed host test fixture kit	E2667B

Related Agilent Literature

Publication title	Publication type	Pub number
InfiniiVision 4000 X-Series Oscilloscopes	*Data Sheet*	5991-1103EN
N2750A/51A/52A InfiniiMode Differential Active Probes	*Data Sheet*	5991-0560EN
Serial Bus Options for InfiniiVision 3000 and 4000 X-Series Oscilloscopes	*Data Sheet*	5990-6677EN
Characterizing Hi-speed USB 2.0 Serial Buses in Embedded Designs	*Application Note*	5991-1148EN
Triggering on Infrequent Anomalies and Complex Signals using InfiniiScan Zone Trigger	*Application Note*	5991-1107EN
Using Oscilloscope Segmented Memory for Serial Bus Applications	*Application Note*	5990-5817EN

Product Web site

For the most up-to-date and complete application and product information, please visit our product Web site at:
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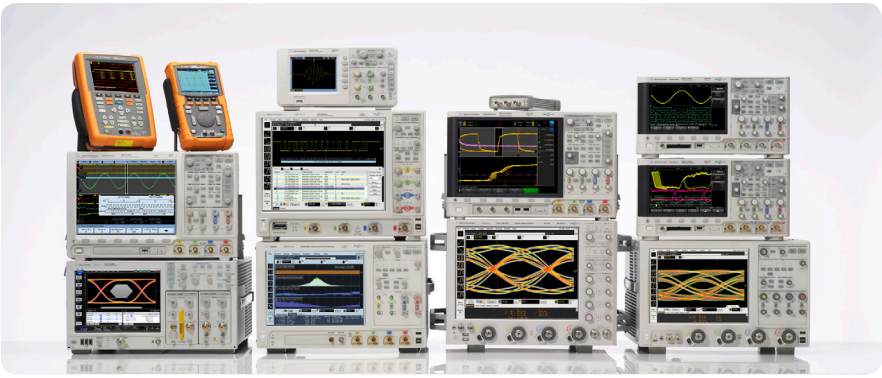

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