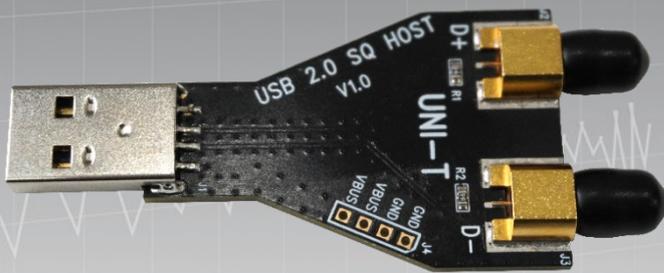




# USB2.0 Signal Quality Test

## Fixture Kit

### USB20-SQ-HD



User Manual

USB20-SQ-HD.1.0

October 2024

## Foreword

Thank you for choosing this UNI-T instrument. For safe and proper use this instrument, please read this manual carefully, especially the safety instructions section.

After reading this manual, it is recommended to keep the manual in a convenient location, preferably near the device, for future reference.

## Document Overview

This document introduces the designs and applications of two types of test fixtures used for USB 2.0 signal quality testing.

### Fixtures

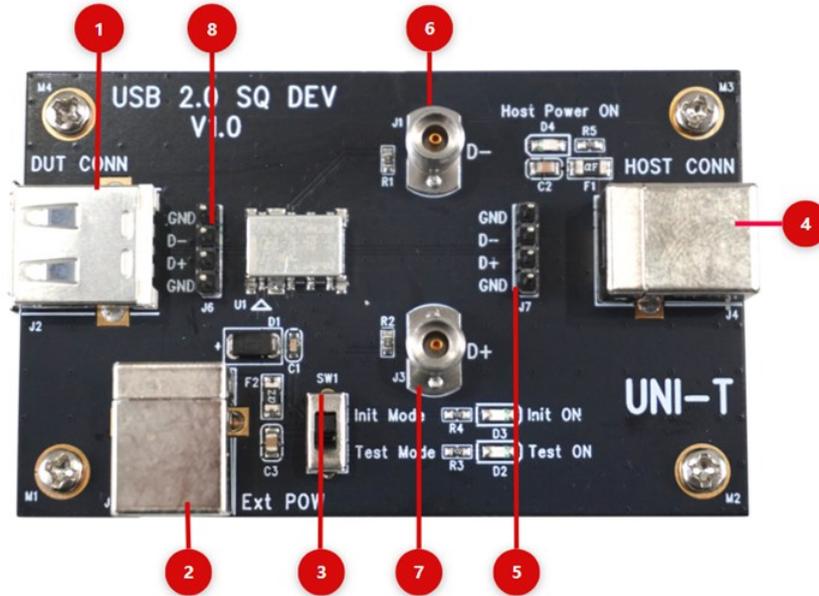
- High-Speed Device Signal Quality Test Fixture
- High-Speed Host Signal Quality Test Fixture

### Fixture Application Scenarios

- High-Speed Device Signal Quality Testing
- High-Speed Host Signal Quality Testing
- Hub Upstream High-Speed Signal Quality Testing
- Hub Downstream High-Speed Signal Quality Testing

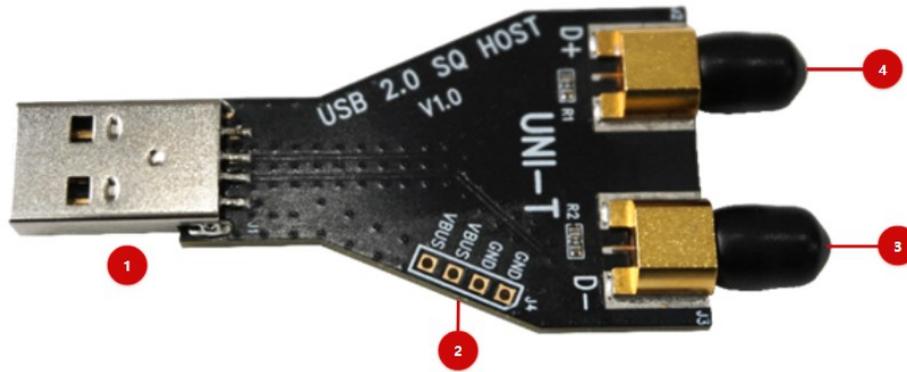
# Fixture Layout

## High-Speed Device Signal Quality Test Fixture



No.	Connector	Description
1	DUT CONN (J2)	DUT connector: USB-A female socket
2	EXT POW (J5)	Fixture power supply port: USB-B female socket
3	SW1	Test switch: Switches between Init mode and Test mode
4	HOST CONN (J4)	Host connector: Connects to a device with USB test software via a USB-B female socket
5	J7	USB2.0 remote test point
6	J1	USB signal differential negative voltage output terminal: Connects to an oscilloscope using an SMA cable
7	J3	USB signal differential positive voltage output terminal: Connects to an oscilloscope using an SMA cable
8	J6	USB2.0 near-end test point

## High-Speed Host Signal Quality Test Fixture



No.	Connector	Description
1	J1	A device with USB test software (host): USB-A male socket
2	J4	VBUS voltage test point: Connects using a single-ended port
3	J3	USB signal differential negative voltage output terminal: Connects to an oscilloscope using an SMA cable
4	J2	USB signal differential positive voltage output terminal: Connects to an oscilloscope using an SMA cable

## High-Speed Device Signal Quality Test Item

Test Item	HOST	Device	HUB Upstream	HUB Downstream
Eye Diagram	√	√	√	√
EOP Bit Width	√	√	√	√
Signal Rate	√	√	√	√
Edge monotonicity	√	√	√	√
Cross-over point voltage	√	×	×	×
Consecutive Jitter	√	√	√	√
Paired JK Jitter	√	√	√	√
Paired KJ Jitter	√	√	√	√
Rising Rate	√	√	√	√
Falling Rate	√	√	√	√
Rising Time	√	√	√	√
Falling Time	√	√	√	√
VBUS Voltage Decay	√	×	×	√
VBUS Voltage Sag	√	×	×	√

**Note:** High-speed signal quality testing is an important part of compliance analysis testing.

"√" indicates that testing is required, and "x" indicates that testing is not required.

## Test Preparation

Before conducting the test, ensure the following preparations are made:

- Oscilloscope: Supports the USB 2.0 analysis function.
- Computer: With a USB 2.0 port. Install the "High-Speed Electrical Test Software" (XHCI - HSETT) on the computer, which can download from the website <https://www.usb.org/document-library/xhsett-x64>  
The software installation package is named XHSETT 1.3.6.8 Installer - x64 Release.exe.
- DUT (Device Under Test): The DUT will be tested.
- Additional test tools: Fixtures, probes, and SMA cables.

## Oscilloscope

According to the requirements of USB Implementers Forum (USB-IF), the digital oscilloscope is required to have a minimum bandwidth of 2.0 GHz and a sample rate of 5 GSa/s or higher.

It is recommended to use the UNI-T MSO7000X and MSO8000HD oscilloscopes for this purpose.

For the digital oscilloscope used in testing, please ensure the following operations have been performed:

- The oscilloscope should be warmed up for at least 30 min.
- When the ambient temperature variation fluctuates by 5°C or more, perform the self-calibration operation.
- Perform the "Function Inspection" and "Probe Compensation" operation on the oscilloscope.

**Note:** The oscilloscope used for test connections and steps in this manual is taken as an example of the MSO7000X series oscilloscope. For instructions on executing the self-calibration

program, performing the function check, and conducting the probe calibration operation, please refer to the following manuals:

- MSO7000X Series Mixed Signal Oscilloscopes – User Manual
- UT-PA2000 Active Single-Ended Probe – User Manual
- UT-PD2500 Active Differential Probe – User Manual

## Probe

The differential probe and single-ended probe are used for high-speed signal quality test.

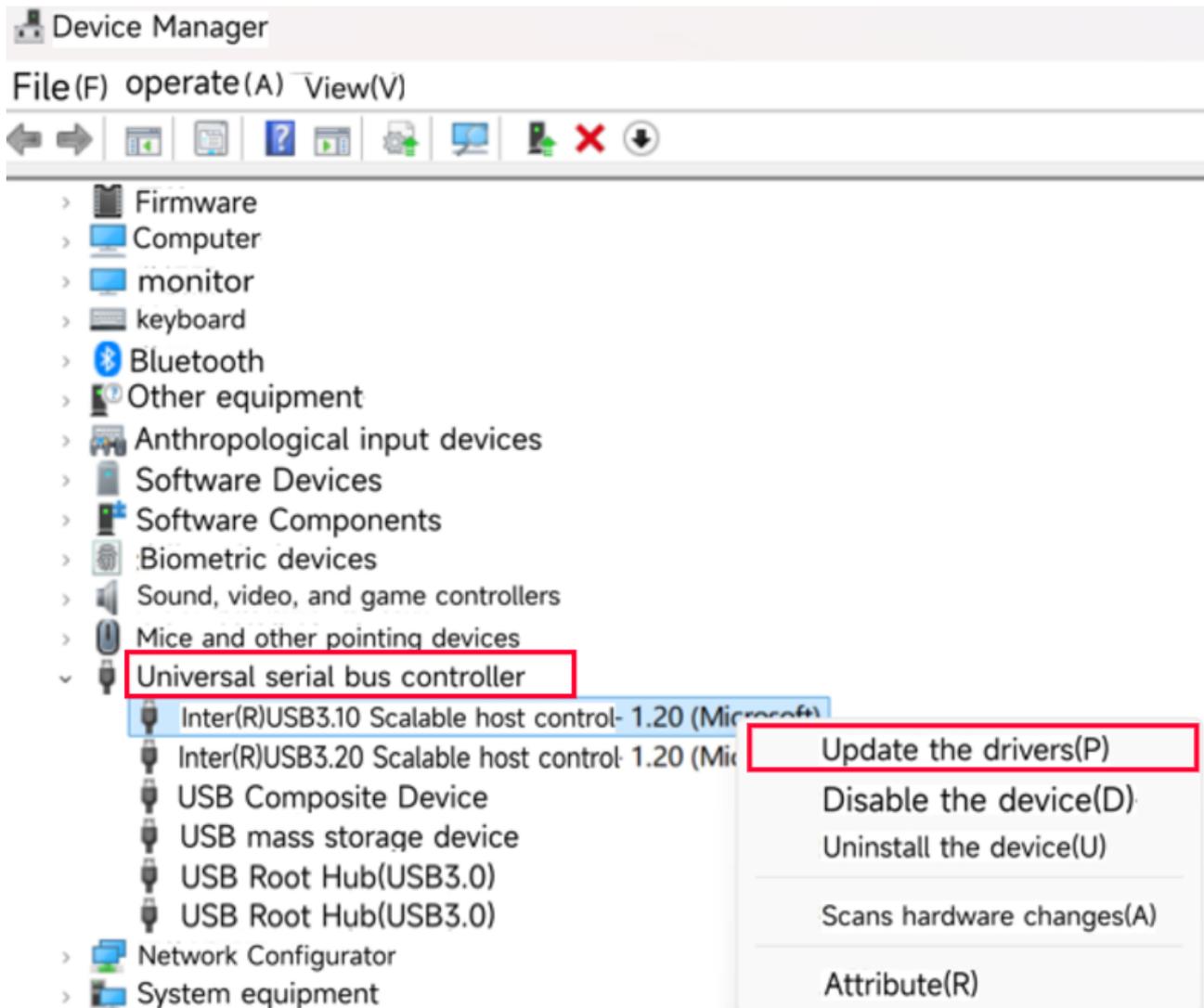
**Differential probe:** The bandwidth should be at least 2.0 GHz. It is recommended to use the UT-PD2500 active differential probe for this purpose.

**Single-ended probe:** The bandwidth should be at least 2.0 GHz. It is recommended to use the UT-PA2000 active single-ended probe (with at least two cables) for this purpose.

## Driver Installation

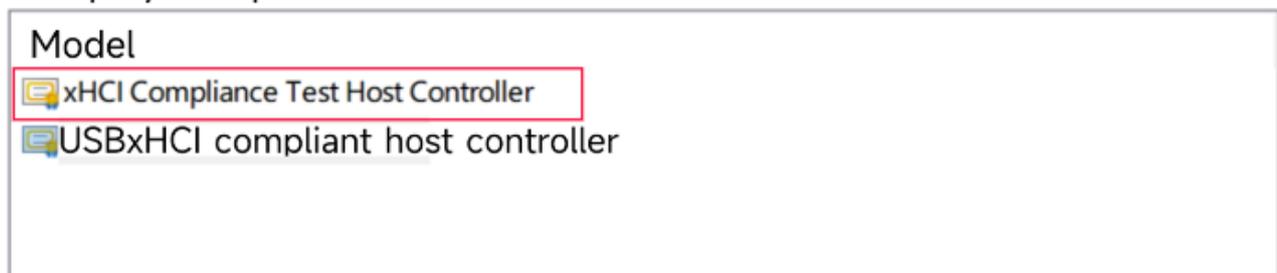
1. After installing the "High-Speed Electrical Test Tool" (XHCI-HSETT) software, if the driver is not automatically updated, the user must manually update the driver for the "xHCI Compliance Test Host Controller" via the device manager on the PC. The steps are as follows.

Open the device manager on the PC, navigate to "Universal Serial Bus Controller", and right-click on "USB Extensible Host Controller" to select "Update Driver" from the context menu, as shown in the following figure.



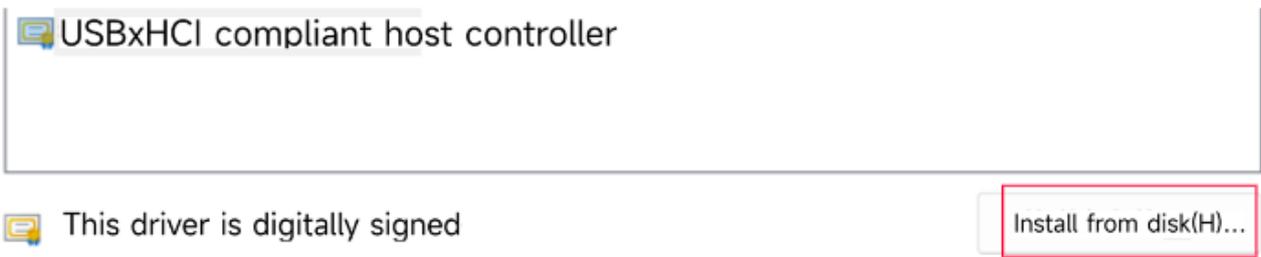
- From the driver program context menu, click "Browse My Computer for Driver software". Next, select "Let me pick from a list of available drivers on my computer." Finally, click "xHCI Compliance Test Host Controller" to complete the driver update process.

#### • Display compatible hardware(C)



- If "xHCI Compliance Test Host Controller" is not listed under "Show Compatible Hardware", the driver must be installed manually.

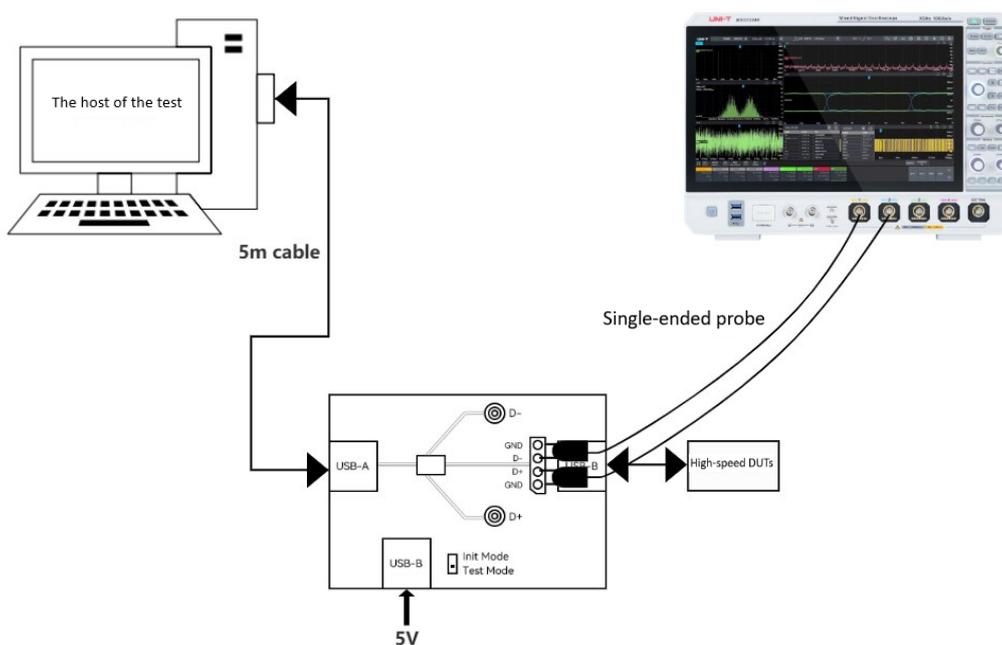
Click “Install from Disk, the default path is “C:\Program Files\USB-IF Test Suite \Drivers and Firmware\xHCI Host Drivers”. If the path has been modified, the path is located in the directory “\USB-IF Test Suite\Drivers and Firmware\xHCI Host Drivers”.



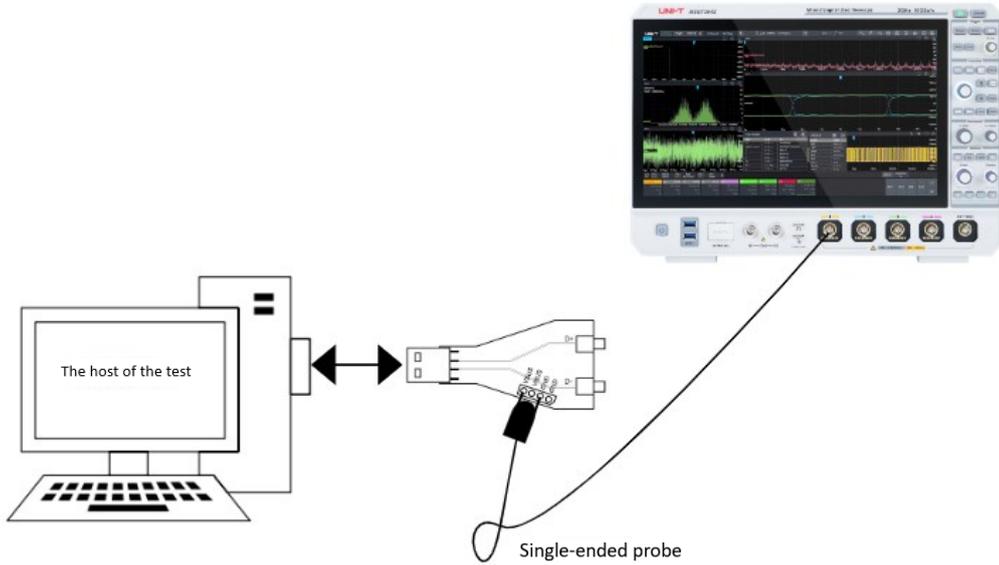
**Note:** After switching the driver program of the serial port, all USB interfaces on the host may become disabled (e.g., USB devices such as keyboards and mice may no longer function). In such cases, the host can only be operated remotely from another computer, or by using a touchpad or a PS/2 mouse. Do not restart the computer during the test.

## Fixture Application Scenarios

### Single-ended Probe Connection Diagram

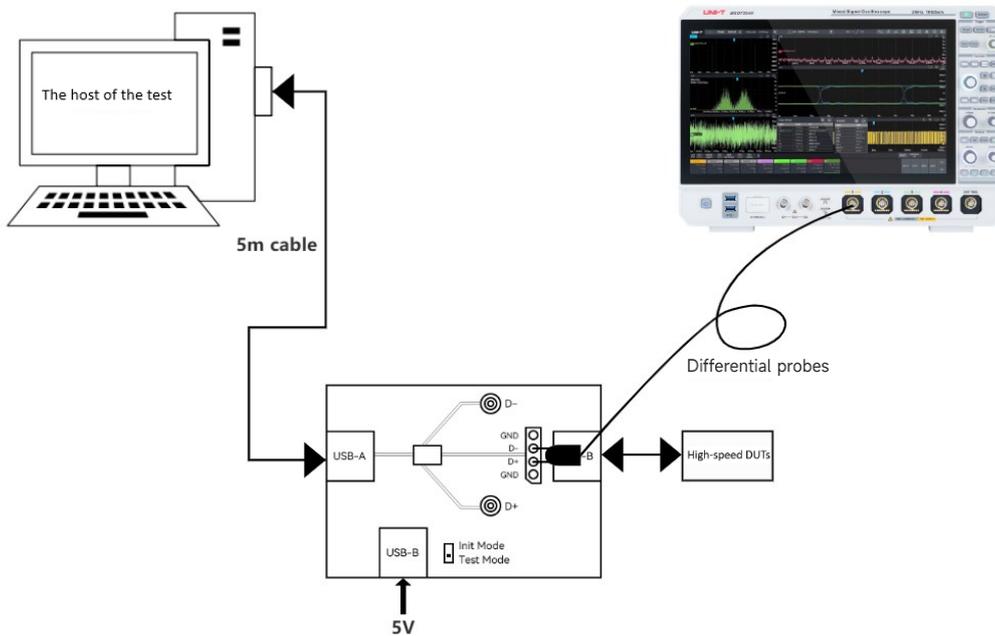


### Single-ended Probe Connection Diagram for High-Speed Device Signal Quality Test



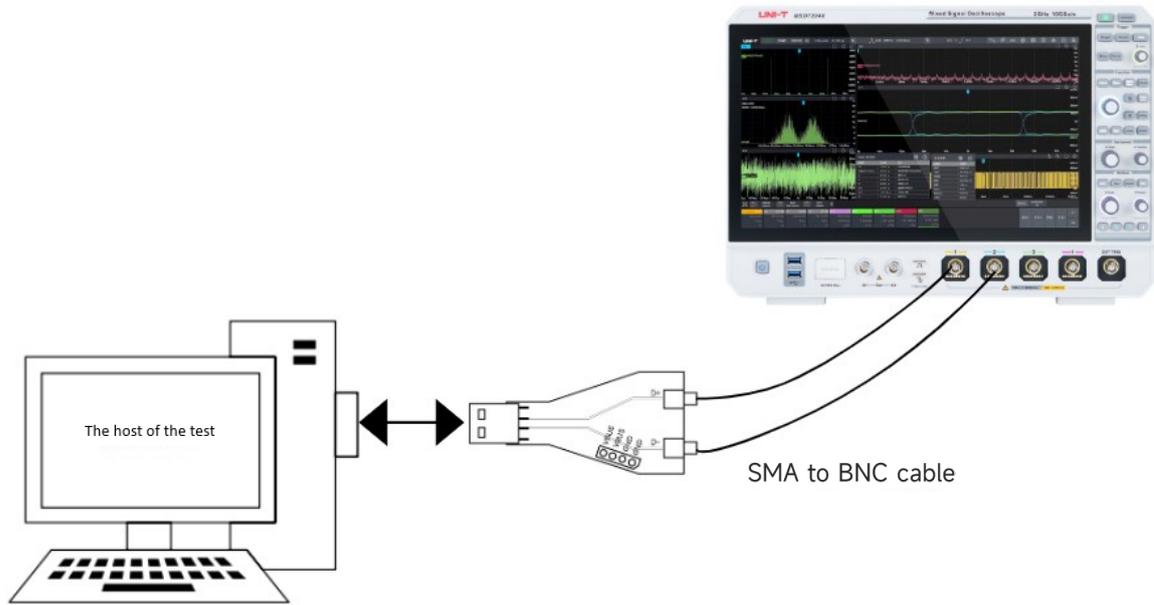
### Single-ended Probe Connection Diagram for VBUS Voltage Sag

## Differential Probe Connection Diagram

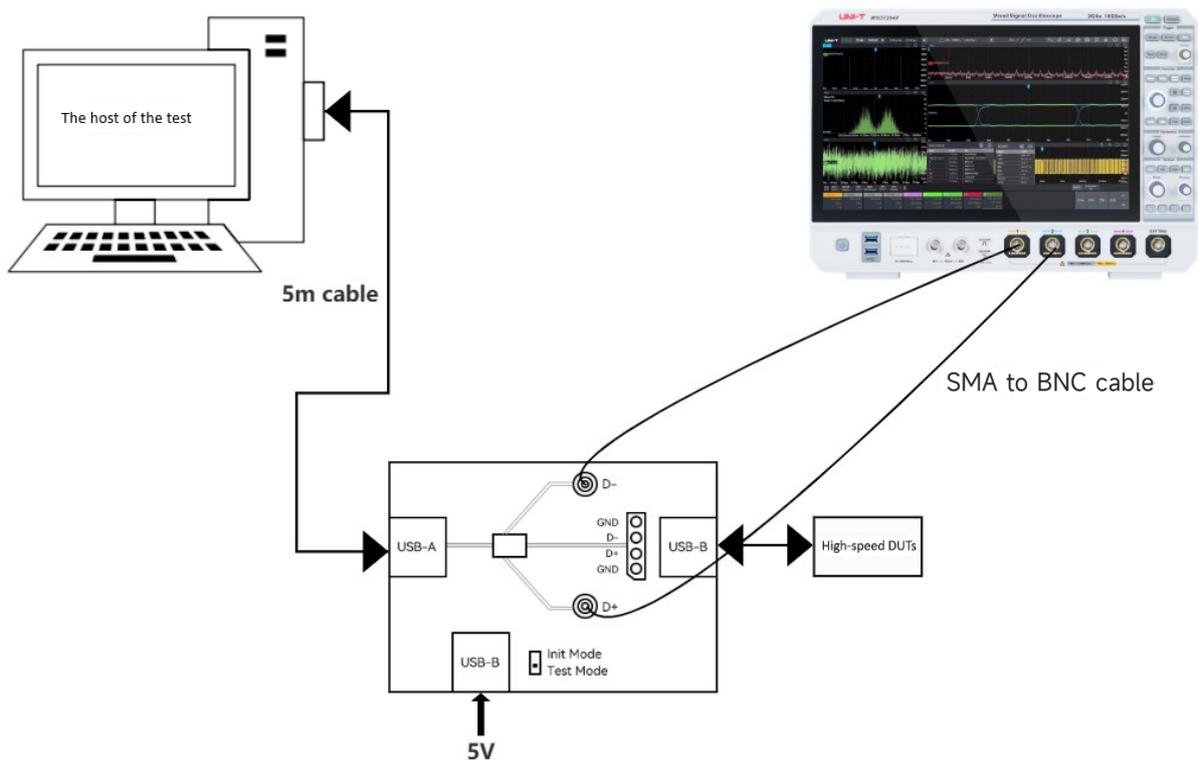


### Differential Probe Connection Diagram for High-Speed Device Signal Quality Test

# SMA Cable Connection Diagram



SMA Cable Connection Diagram for High-Speed Host Signal Quality Test



SMA Cable Connection Diagram for High-Speed Device Signal Quality Test

## Test Example

### USB2.0 DEVICE High-Speed Signal Eye Diagram Test

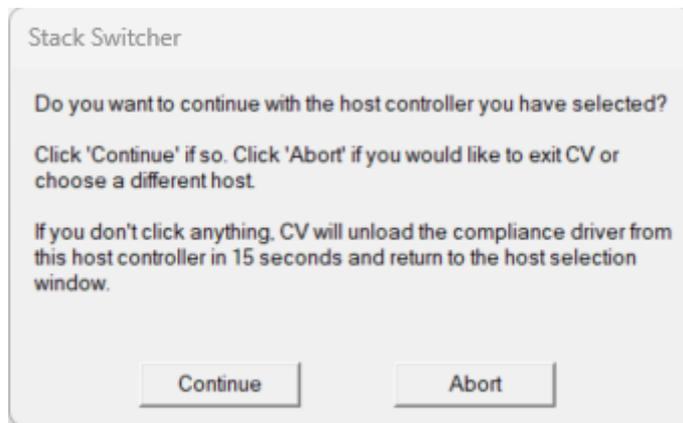
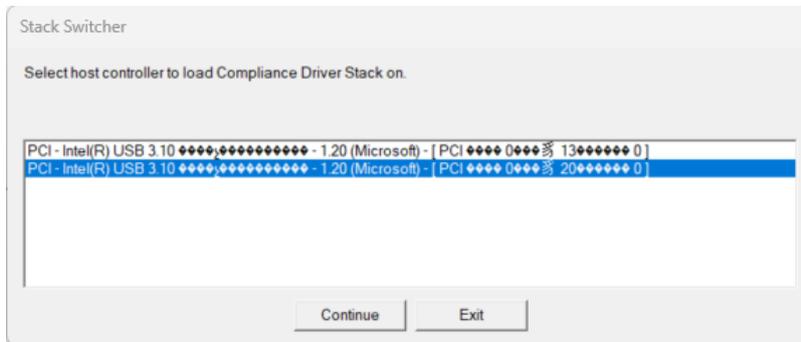
#### Test Steps

1. Connect the test instrument and devices following the instructions in the high-speed device signal quality test connection diagram. You may use differential probes, single-ended probes, or SMA cables for testing. This example demonstrates the use of SMA cables for connections.
2. Ensure the driver program is switched or installed according to the steps mentioned in the Driver Installation section.
3. Once the driver installation is complete, launch the “XHCI HSETT” software. After selecting the appropriate controller, click Continue to proceed with the test. When the following prompt

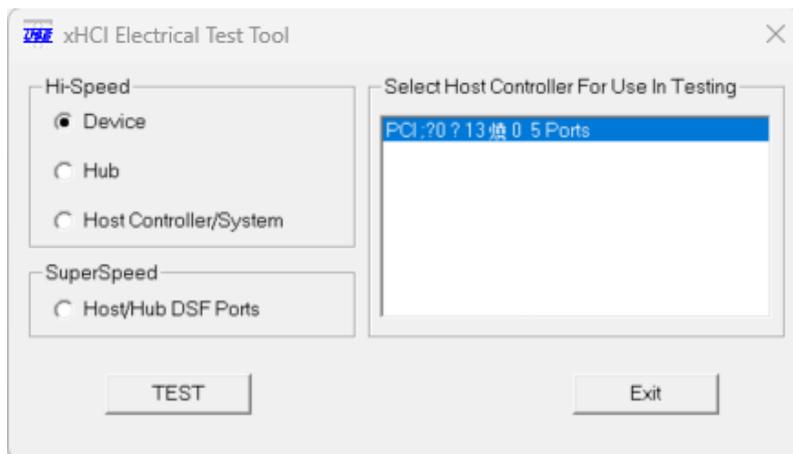
appears, click Continue again, as shown in the following figure.

**Note:** During this process, external USB devices such as a mouse or keyboard may not function.

It is recommended to use a computer with a touch screen for convenience.



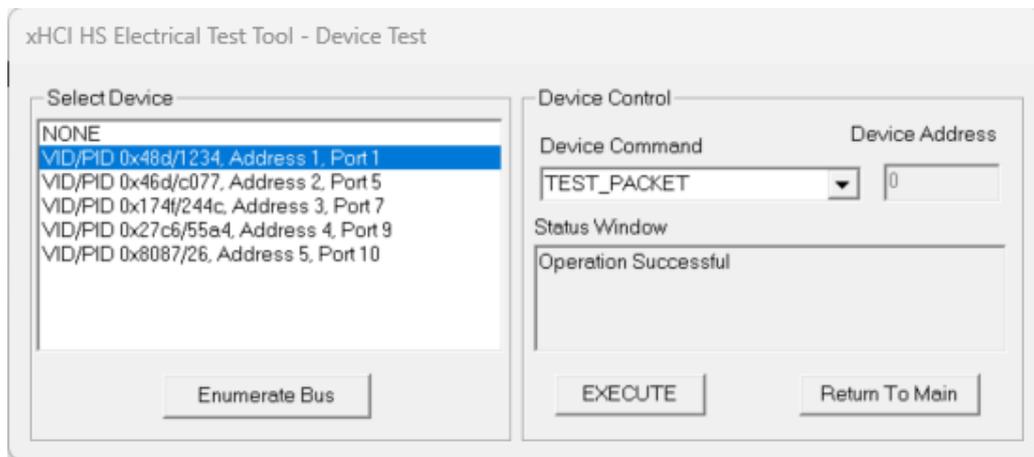
4. Select "Device" as the high-speed test item and click "TEST" to start the test.



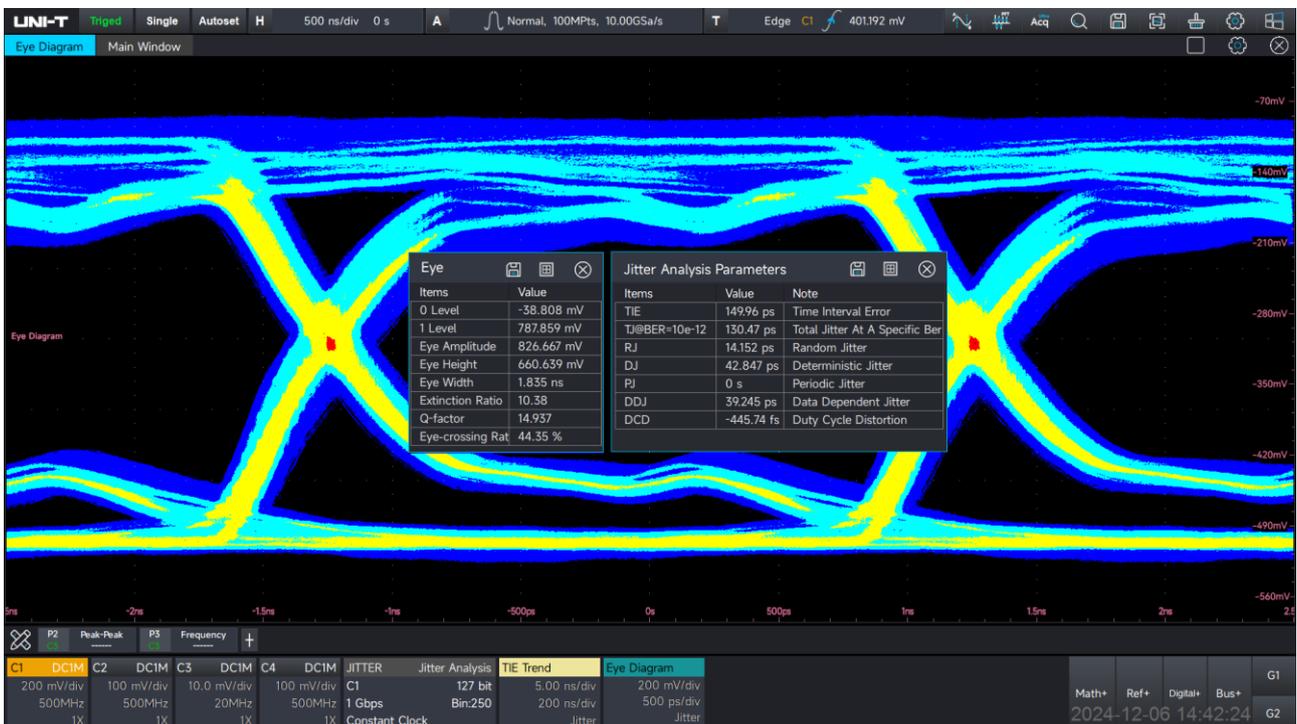
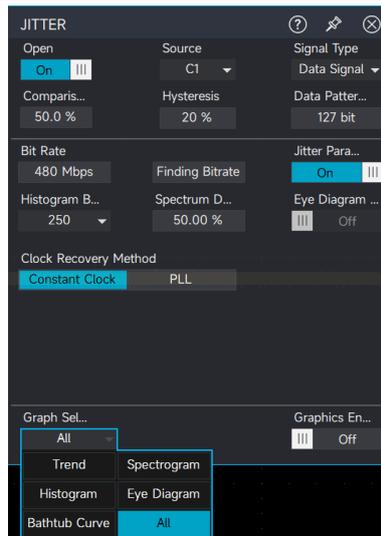
5. Set the fixture mode to "Init mode" and click the "Enumerate Bus" button to refresh the device port. If the device port is not refreshed, disconnect the fixture from PC, reconnect it, and repeat the steps to enable the "XHCI HSETT" software for enumeration.

**Note:** It is common for multiple device ports to be enumerated on a computer. A useful tip is to unplug the device under test and refresh the enumeration to identify which port becomes disconnected. The disconnected port corresponds to the device under test.

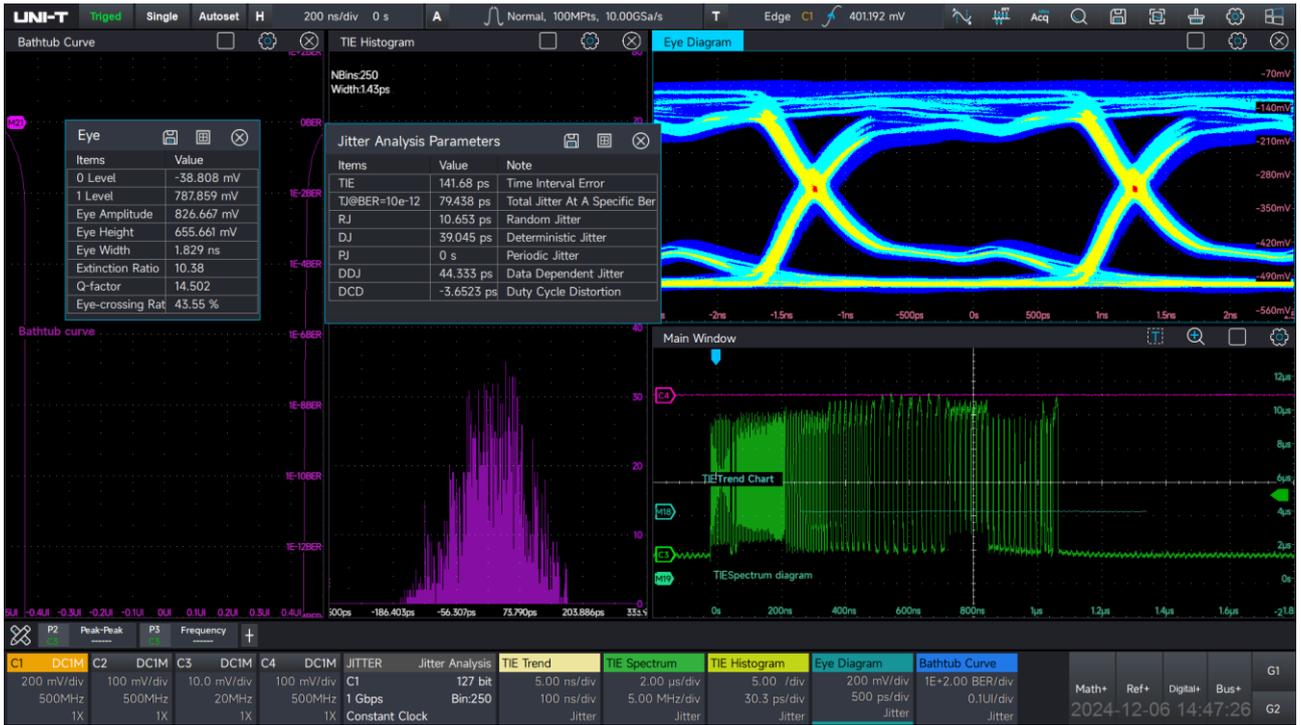
- After selecting the port of the device under test, choose “TEST\_PACKET” in the “Device Command”. Once selected, click EXECUTE. If the Status Window displays “Operation Successful”, indicating that the selected signal has been output successfully.



- Switch the test fixture mode to “Test mode” to send the signal to the fixture. At this point, adjust the oscilloscope's basic parameters to capture the signal packet.
- Open the oscilloscope's jitter analysis software and enable it. Configure the required settings for the eye diagram. After setting the jitter analysis parameters, select “Eye Diagram” in the graph selection menu and enable the graph.



The eye diagram provides an intuitive representation of the signal quality of a USB 2.0 device during transmission. In addition to the eye diagram, the jitter analysis software offers various graphs to support USB 2.0 signal jitter measurement. By selecting “All” in the graph selection menu, users can access TIE trend graphs, histograms, spectrograms, bathtub curves, and more for comprehensive jitter measurement and analysis.



## Limited Warranty and Liability

UNI-T guarantees that the Instrument product is free from any defect in material and workmanship within three years from the purchase date. This warranty does not apply to damages caused by accident, negligence, misuse, modification, contamination, or improper handling. If you need a warranty service within the warranty period, please contact your seller directly. Uni-T will not be responsible for any special, indirect, incidental, or subsequent damage or loss caused by using this device. For the probes and accessories, the warranty period is one year. Visit [instrument.uni-trend.com](http://instrument.uni-trend.com) for full warranty information.



Learn more at: [www.uni-trend.com](http://www.uni-trend.com)



Register your product to confirm your ownership. You will also get product notifications, update alerts, exclusive offers and all the latest information you need to know.

## Statement and Contact Us

**UNI-T** is the licensed trademark of UNI-TREND TECHNOLOGY (CHINA) CO., Ltd.

UNI-T products are protected under patent laws in China and internationally, covering both granted and pending patents. Licensed software products are the properties of Uni-Trend and its subsidiaries or suppliers, all rights reserved. This manual contains information that replaces all earlier published versions. The product information in this document subject to update without notice. For more information on UNI-T Test & Measure Instrument products, applications, or service, please contact UNI-T instrument for support, the support center is available on [www.uni-trend.com](http://www.uni-trend.com) ->[instruments.uni-trend.com](http://instruments.uni-trend.com)

<https://instruments.uni-trend.com/ContactFor>

### Headquarter

UNI-TREND TECHNOLOGY  
(CHINA) CO., Ltd.

Address: No.6, Industrial  
North 1st Road, Songshan  
Lake Park, Dongguan City,  
Guangdong Province, China  
Tel: (86-769) 8572 3888

### Europe

UNI-TREND TECHNOLOGY  
EU GmbH

Address: Affinger Str. 12  
86167 Augsburg Germany  
Tel: +49 (0) 821 8879980

### North America

UNI-TREND TECHNOLOGY  
US INC.

Address: 3171 Mercer Ave  
STE 104, Bellingham, WA  
98225  
Tel: +1-888-668-8648