1394 DS Signal Integrity

Users Guide

Version 1.1
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i. Revision History

Revision	Date	Description
V1.0	4/09/10	Initial Version
V1.1	6/01/10	Updates per customer request

ii. Reference Documents

Document #	Title	Author
IEEE-1394-2008	High Performance Serial Bus	IEEE
2002005	Base 1394 Test Suite Definition with Extensions for 1394b	1394 Trade Association

iii. Table of Contents

iv. Table of Figures

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1 Introduction

The Quantum Parametrics 1394 DS Signal Integrity Test System (QP-SSIB) is a test system for 1394A (1394 DS) transmit signal integrity testing, according to the Base 1394 Test Suite Definition and potentially other standards. The QP-SSIB tests all 1394 DS speeds (S100, S200, S400).

1.1 Signal Integrity Tester Components

1.1.1 SSIB Control Board

The SSIB Control Board provides hardware capabilities to test transmit signal integrity. It also provides a means through the responder node to generate the necessary test packet when testing a multi-port node.

1.1.2 Test Point Board / Patch Cable

The test point boards provide quality connections of the oscilloscope probes to the Unit Under Test (UUT). The test point board connects to the tester via an included RJ45 patch cable (a crossover will not work and may damage the system) that provides a 1394 connection so that the test can be run. This cable also provides 3.3V out on the other pair to power necessary circuitry on the Test Point board. This cable should only be used in conjunction with the Test Point Board and should never be plugged directly into any standard Ethernet port.

1.2 Other Required Equipment

1.2.1 Signal Integrity Application Software

The Signal Integrity Application software controls the testing process and compiles the test results.

1.2.2 Trigger Cable

A coaxial cable with BNC fittings is provided to connect the SSIB trigger out to the oscilloscope auxiliary trigger input.

1.2.3 DC Adapter

A 12V, positive tip DC power supply is included to power the SSIB. The SSIB may also be powered

1.2.4 Host Computer

The Signal Integrity application runs on a PC running Microsoft Windows XP/Vista/7. Minimal hard disk space and memory are required. Additional memory and faster processors will enable faster results processing.

1.2.5 Microsoft Excel

All raw test data is captured and analyzed in Microsoft Excel. Microsoft Excel 2003 is required on the host computer; though for best results, Excel 2007 is recommended. Microsoft Excel must be installed before installing the Signal Integrity Application.

1.2.6 Host PC Interface

The Signal Integrity application communicates with the SQT instrument via IEEE-1394 (1394). The host computer must

provide a 1394 interface. PCI, PCMCIA, and integrated 1394 host adapters are acceptable. NOTE: the PC host must support VersaPHY packets. The SSIB has one 1394A (6pin) connection. The 1394 host adaptor must be installed before installing the Signal Integrity application. The Signal Integrity application installation will install custom 1394 drivers.

1.2.7 GPIB Interface

The Signal Integrity application utilizes an IEEE-488 GPIB interface to transfer setups and results. PCI-GPIB, USB-GPIB, and PCMCIA-GPIB interfaces are acceptable. The GPIB interface and associated driver software must be installed on the host computer before installing the Signal Integrity application.

1.2.8 Digital Oscilloscope / Differential Probe

Accurate testing of 1394 signals requires a digital sampling oscilloscope and a differential probe with at least 2 GHz bandwidth and 10GSamples/second sampling rate. For some 1394 devices, it has been noticed that 4 GHz bandwidth and 20GSamples/second sampling rate is required. The scope must have enough memory to capture one entire 64 byte (plus the header and CRC gives a total of 84 bytes) along with a small amount of data prefix. The actual setup is loaded and saved by the user according to the Scope Setup Procedure document; items that enable automation are still included in the template file on a scope manufacturer basis. Contact Quantum Parametrics for the latest list of supported oscilloscopes. Generally, we test one scope in a product line and assume that the product line has the same firmware and GPIB command set.

2 SSIB Tester Tour

2.1 SSIB Tester

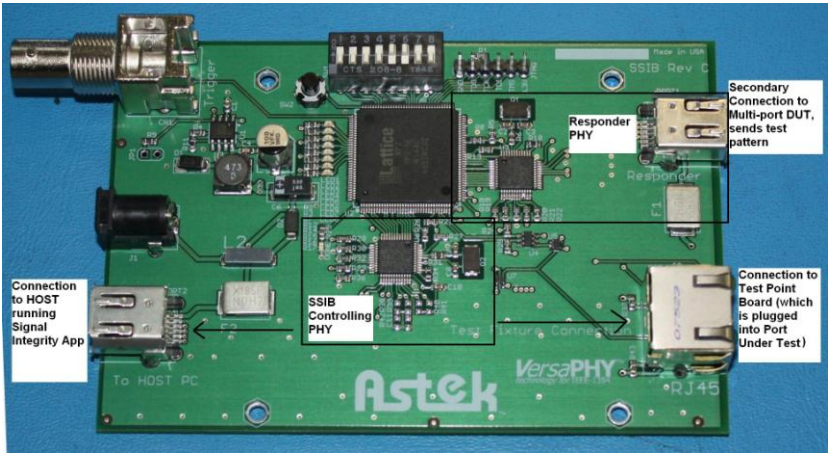

Figure 1 Top of SSIB

2.1.1 Host PC Connection

The Signal Integrity application communicates with the SSIB instrument via IEEE-1394 (the Backchannel). The host computer must provide a 1394 open host controller interface (OHCI). The SSIB has one 1394A Backchannel port. The Backchannel uses VersaPHY™ technology for communication between the PC and the SSIB. While VersaPHY is supported by most OHCI implementations, QP has found the TI TSB82AA2B OHCI IEEE-1394b controller does not support VersaPHY packets.

The Signal Integrity Application installation installs custom 1394 drivers. These drivers should allow applications currently using 1394 to continue to use the 1394 ports. However, it is REQUIRED that the PC and SSIB connection remain point-to-point while testing.

2.1.2 Test Fixture Connector (RJ45)

The Test Fixture connector on the front of the tester is not a standard 1394 port. This connector connects to the appropriate Transmit Signal Test Fixture through an RJ45 patch cable.

2.1.3 Responder Node Connection

The Responder node connection allows the user to test any multi-port 1394 device without loading any software on the DUT. This port is connected to a PHY that is used to transmit the necessary test pattern.

2.1.4 Tester Power

The SSIB is powered by the included 12-volt power supply connected to the back of the tester. It can also be powered with 1394 cable power through either of the standard 6pin connectors.

2.1.5 Trigger

The BNC connects the SSIB instrument to the oscilloscope as an external trigger input. The trigger is used in conjunction with the read response from either the DUT or the Responder port connection. This information is covered more thoroughly in the Scope Setup Procedure document.

3 Operational Overview

The SSIB is a transmit quality tester. The transmit quality tester is designed to measure the signal quality of the Unit Under Test (UUT) output.

3.1 Transmit Test Overview

The Transmit Tester is designed to measure the signal quality at the output of the UUT. These measurements are only specified for the output at the UUT connector for 1394 DS signaling.

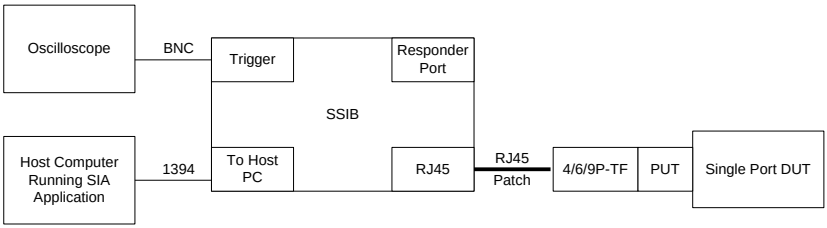

Figure 2 - Transmit Test Connection diagram (Single Port DUT).

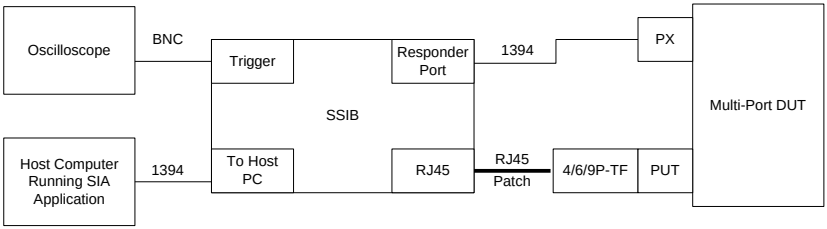

Figure 3 - Transmit Test Connection diagram (Multi-Port DUT).

The Transmit Test for 1394 DS requires an actual 1394 connection in order to proceed with the test. This connection is made from the RJ45 connector, through a patch cable, through the test fixture board, finally to the DUT. Once this connection

is made, the Signal Integrity application (SIA) software sets up the proper topology needed for the test.

When the proper topology is configured, the SIA software sends a write block request to setup the proper test pattern in either the DUT (if single port) or the responder port (if connected to a multiport device). The SIA software then reads from the written address which enables the Trigger out on the SSIB.

Once the proper data is captured on the scope it is downloaded into Microsoft excel and processed in order to determine the necessary measurements.

3.2 Backchannel

The Backchannel (**To Host PC**) interface is the communication link between the SSIB hardware and the SIA software. On the SSIB there is only one backchannel port. The backchannel should only be connected to a 1394 Host controller that has the Unibrain driver loaded.

4 1394A (DS) Transmit Testing Procedure

4.1 Start Application

Execute the QPSQT.exe file. After the SSIB is connected to the host computer (see below), select the DS Transmit tab at the top of the window to begin DS transmit testing.

4.2 Physical Configuration

4.2.1 Host Computer / SIA

If prompted on the main application window, connect the SSIB to the host computer with an IEEE-1394 cable to the port labeled 'To Host PC' on the front of the tester. If this connection is already made, the application may move to the next step.

Figure 4 - Host computer connection to SSIB

4.2.2 Oscilloscope GPIB/Ethernet

The GPIB or Ethernet interface on the test host computer must be connected to the oscilloscope. The application first checks the GPIB connection when the Transmit tab is selected. If the connection is not found, the user is prompted to check the connection. The oscilloscope must also be powered on to pass this configuration check. QP recommends the National Instrument's GPIB-USB-HS GPIB controller or an Ethernet connection to the scope for use with our products. Please see the GPIB/Ethernet configuration section for more details.

4.2.3 Oscilloscope Trigger

The trigger output from the SSIB must be connected to Channel 4 on the oscilloscope with a BNC terminated cable. The application is unable to verify this connection, so the user is always prompted to verify the connection before beginning Transmit testing.

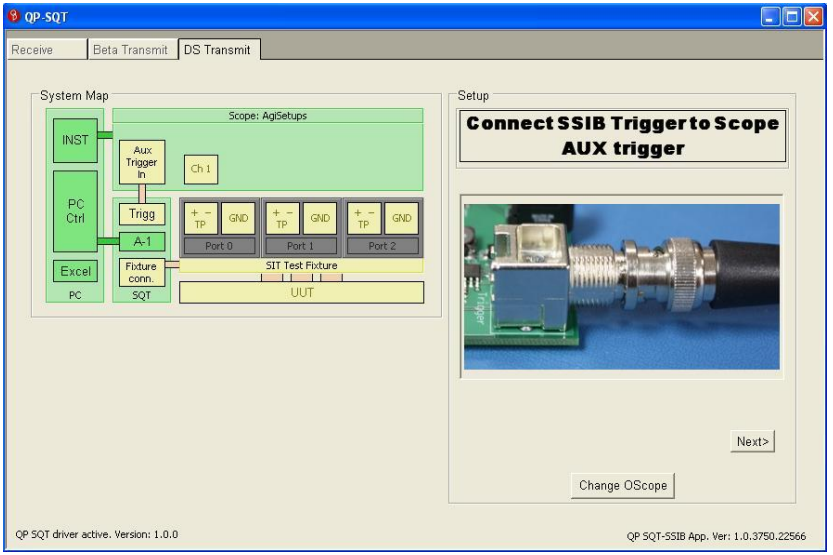

Figure 5 - Trigger connection to Oscilloscope

4.2.4 SSIB to Test Point Board

The SQT connects to the Test Point Board via the supplied Ethernet patch cable. The application verifies this connection when the topology is checked to make sure that it is valid. Only the Test Point Board should be connected to the "Test Fixture" connector on the front of the Signal Quality Tester.

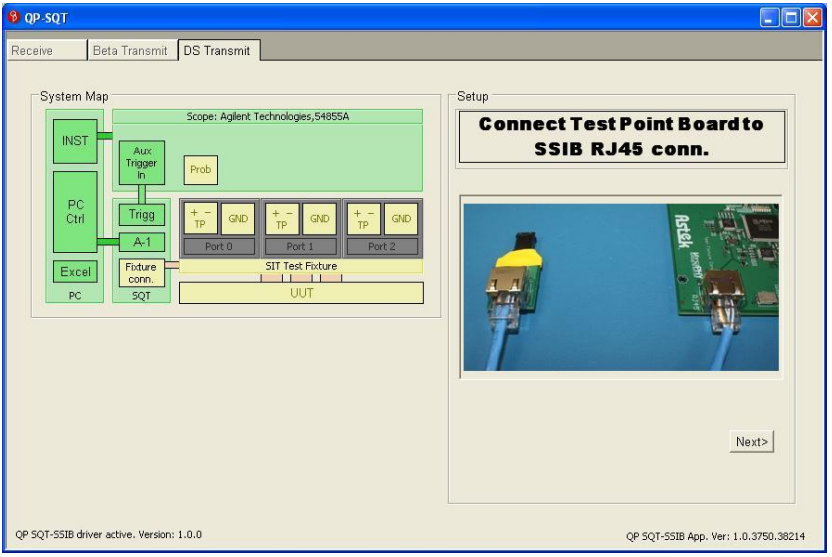

Figure 6 - Test fixture connection

4.2.5 Probe to Test Point Board

The Test Point Board provides two sets of test points designed to interface directly with differential oscilloscope probes. One set is for TpA, the other for TpB.

The application is pre-configured to collect information from differential probes connected to oscilloscope channels 1 and 2. These probes (Channel 1 and Channel 2) should be connected to TpA and TpB respectively. Note that + on the probes connects

to + on the Test Point Board, and the – on the probes connects to the – on the Test Point Board.

The application is unable to verify this connection, so the user is prompted at each stage of the test to connect the probe to a specified test point. If the oscilloscope probe is not connected to the specified test point during testing, invalid or no test results will be generated. Wait until instructed by the application to connect the probe to the Test Point Board.

4.3 UUT Setup

4.3.1 Test Point Board to Unit Under Test

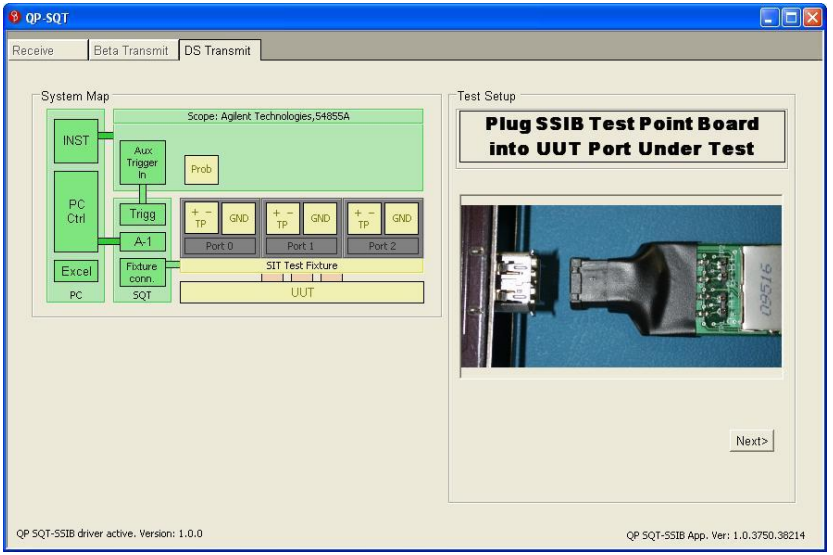

Figure 7 - Test Point Board Connection

The Test Point Board uses a standard plug to mate with the Unit Under Test (UUT). This connector goes in just as a cable would. The application verifies the correct topology during the testing process; the test may terminate prematurely if the correct topology is not found.

When using the test point board, be careful. The 1394 plug end does not have much strength, so be careful not to put too much weight hanging on it. Please support the board, patch cable and scope probes. This is a trade-off between signal integrity and manufacturability, where signal integrity is, of course, more important.

The UUT must be independently powered during testing. The SQT does not power the UUT. There is an optional header (JP3) that the user may install and use (at their own risk) that allows power to be provided from an external source. The cable power pin is connected to pin 1 (closest to 1394 plug) of the header and GND is connected to pin 2. This of course only applies for the 6 and 9 pin connectors as there is no power supplied by the 4 pin connector.

4.3.2 Name Results File

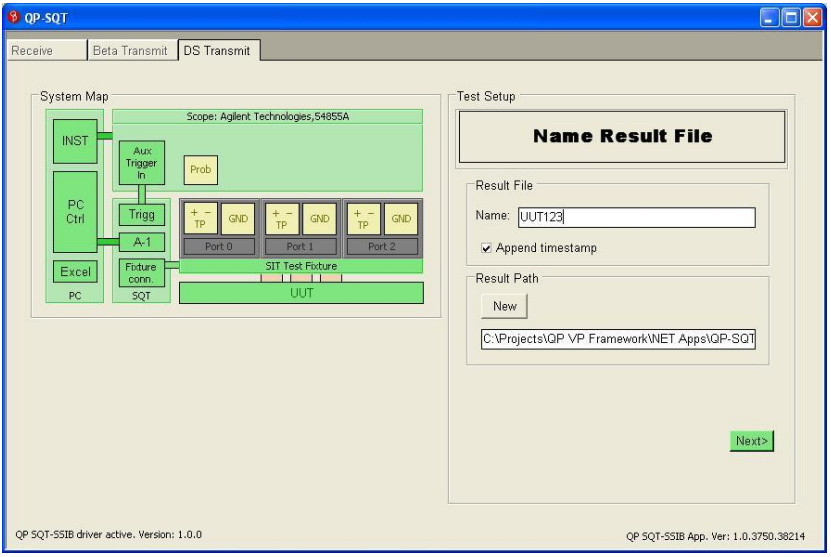

Figure 8 - Test result file naming

The user interface displays an input box to collect an identifier for the UUT. This identifier will be used in the file name and in the results summary.

The Append Timestamp to Filename check box may be selected to append a timestamp to the file name. This may be useful to allow many unique result files for one UUT.

Another input box is available to specify the path in which to store the results file.

4.3.3 Test Options

The Test Options screen allows the user to configure the test. Not all options are available for all configurations.

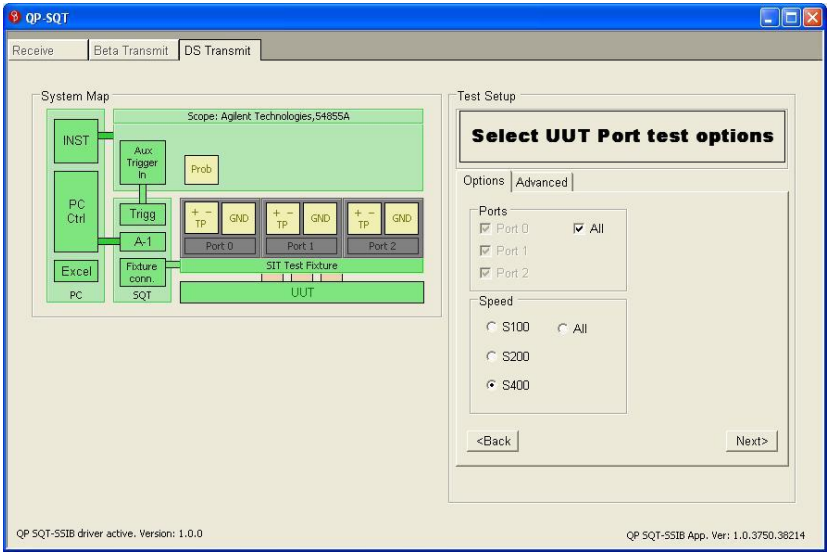

Figure 9 – DS Transmit test options

4.3.3.1 Ports

The test options screen allows the test to be run on any combination of up to 3 UUT ports.

4.3.3.2 Speed

The speed option allows the user to choose the speeds at which the test will be run.

4.3.4 Advanced Tab

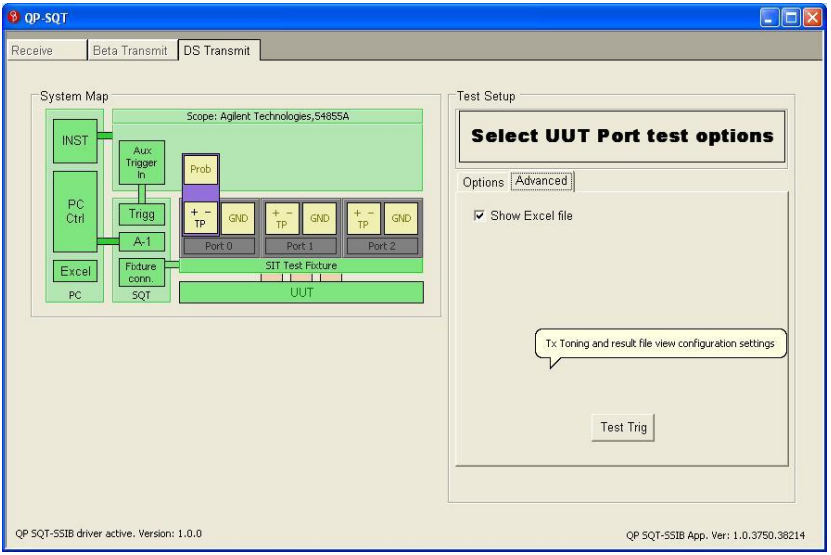

Figure 10 - Advanced transmit test options

4.3.4.1 Show Excel File

Under the advanced tab the Excel results file may be made viewable. If the Excel file is not enabled to be viewable, an Excel file is still created and filled; it is just not visible on the desktop during the test.

4.3.4.2 Test Trigger Button

The Test Trigger Button is used to emulate the process of running the test, but without actually capturing the data from the scope. This feature allows the user to debug the response of the responding device to the packet response and trigger. If needed the user may change the oscilloscope setting to better show the interaction between tester and the UUT. This can help verify probe connection, scope setup, and functionality of the responding device.

4.4 Port Test

4.4.1 Connect Probes to Test Points (A+/- B+/-)

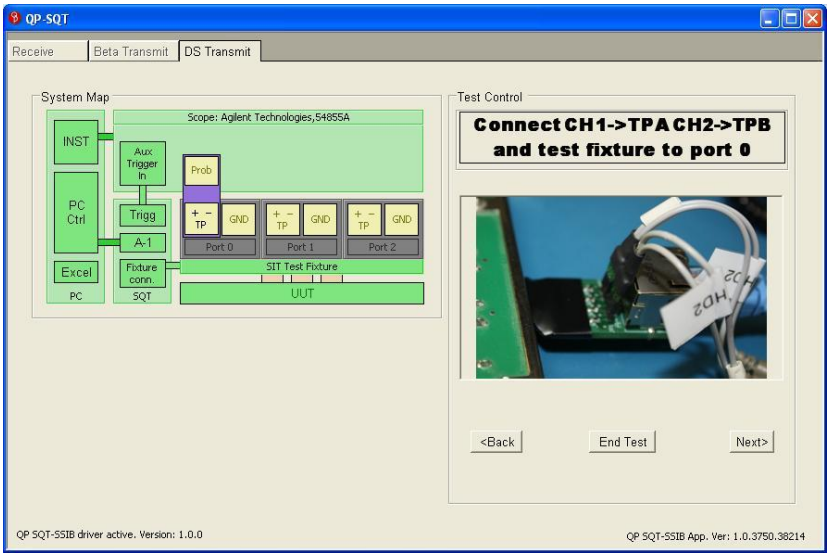

Figure 11 - Connection of probe for testing

The application now instructs the user to connect the probe to the test points and move the test point board to the appropriate port.

Selecting "Back" at this point will return the user to the previous port or screen depending on if the user is testing multiple ports.

Verify the probe is connected to the proper test point and select "Next."

4.4.2 Connect Probes to Test Points (A+/- B+/-)

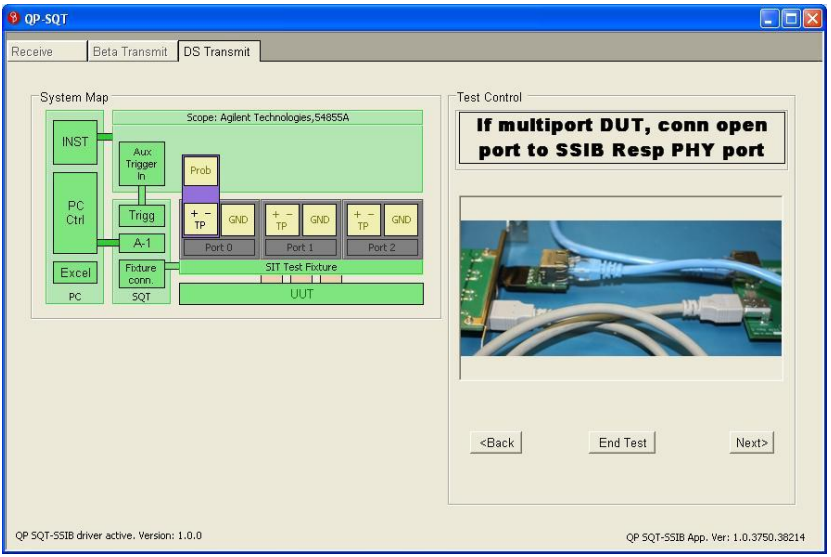

Figure 12 – If Multi-Port, connect to Responder node of SSIB

The application now instructs the user to connect an unused DUT port to the Responder port of the SSIB as shown. This is only if the device is a multiport device. This allows any multi-port device to run without needing software running on the DUT as the 1394 PHY will repeat the packet sent from the Responder port.

Selecting "Back" at this point will return the user to the previous screen.

Verify the probe is connected to the proper test point and select "Next."

The application will display "Testing Port x @ Sx00" and "Downloading Stream Data" as these actions are performed.

4.4.3 End Test Button

The end test button lets the user gracefully exit the test. When selected, the active report is closed and saved. The user is then directed to connect a new UUT.

4.4.4 Reacquire / Calculation

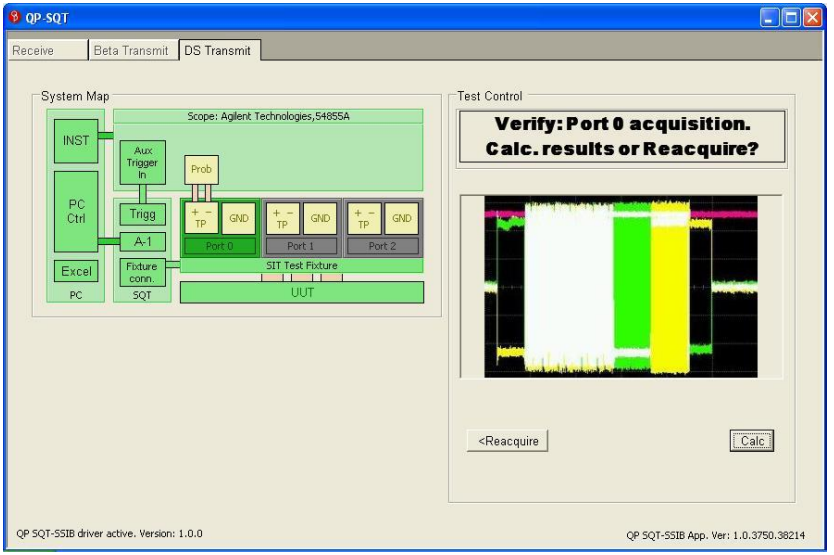

Figure 13 - Reacquire or Calculate results

After the samples are stored in the results file, the user may continue with result calculation or reacquire the samples for the current port under test.

If the oscilloscope display is not similar to the one shown in the picture (does not show a captured signal oscillating above and below 0 Volts) the sample should be reacquired.

After appropriate samples are captured and written, the Calc button will initiate the Excel-based signal analysis routines.

4.4.5 Reacquire / Next

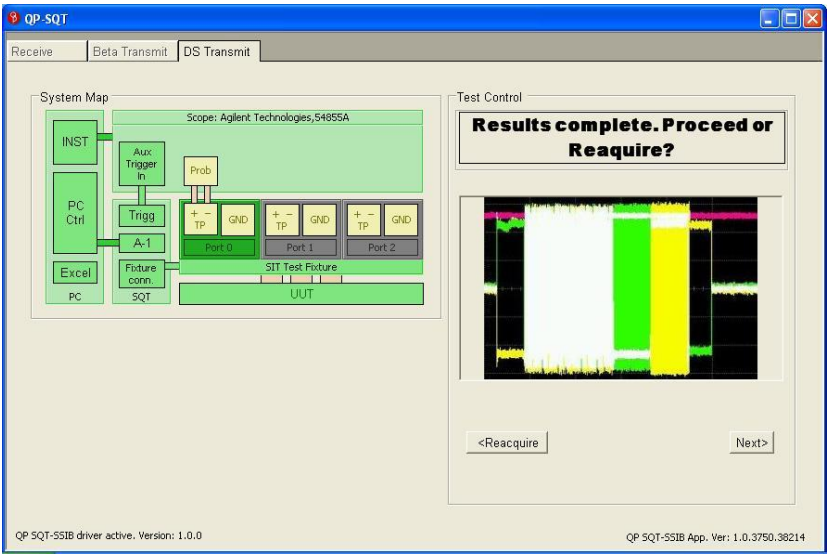

Figure 14 - Test results for port complete

After the calculations are complete, the user has the opportunity to examine the results and reacquire, if necessary, before proceeding with the rest of the test.

If the "Show Excel" option was selected in the advanced setup tab, the user may select the Excel file from the Taskbar and analyze the results before proceeding. The contents of the results file are described below.

Selecting "Next" will prompt the user to begin the next port test if there are more ports to test. Otherwise the application will proceed to test completion.

4.5 Testing the Next Port

If needed, after completing the test for a particular port the user is instructed to configure the system to test the next port. The user should keep the oscilloscope probes connected to the same test points and move the test point board to the appropriate port.

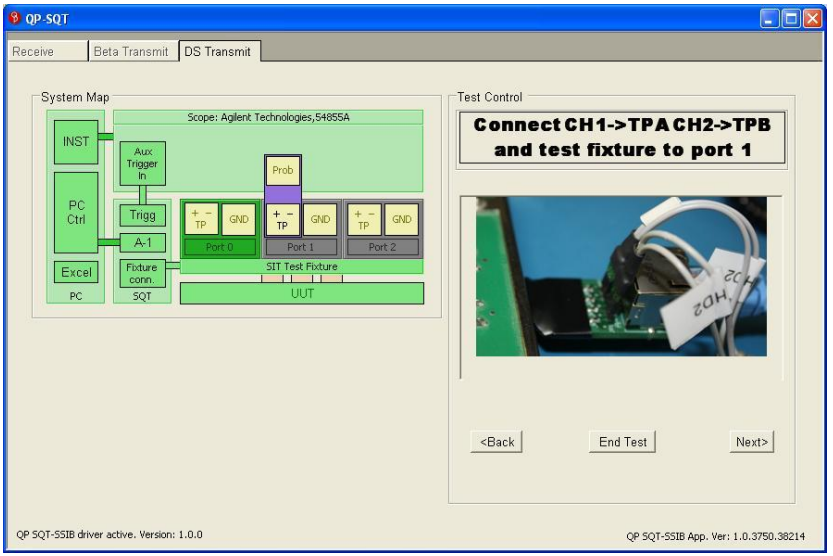

Figure 15 - Testing the next port

4.6 Test Completion

4.6.1 Remove Test Point Board from UUT

The user is instructed to remove the Test Point Board from the UUT. When the user clicks "Next," the Report file is saved and closed, whether or not it was visible.

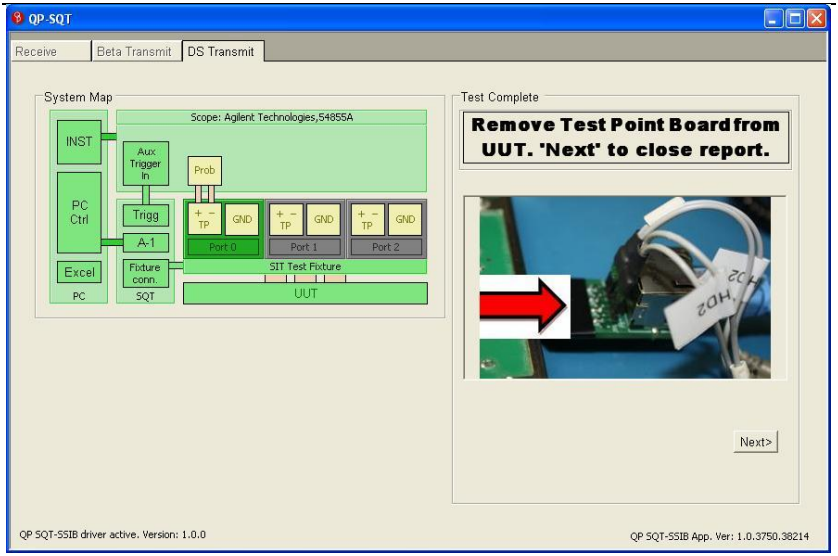

Figure 16 - Remove test point board

Selecting “Back” will return the user to reacquire the last port samples.

4.6.2 Next UUT

The transmit signal integrity test for the current UUT is now complete. Selecting “Next” will save and close the results file.

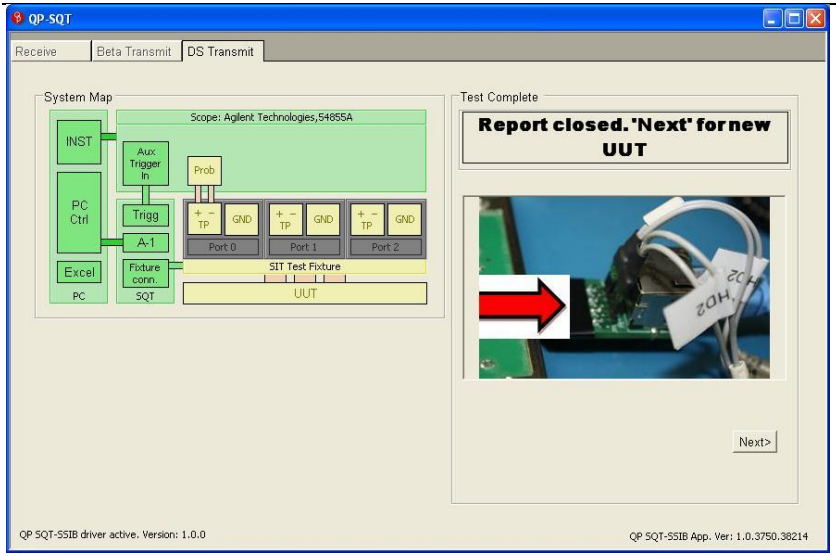

Figure 17 - Report closed and start next UUT test

4.7 DS Transmit Signal Integrity Results File

All port data and calculated results for each UUT test are stored in a single results file. By default transmit results are stored in the following directory:

C:\Program Files\Quantum Parametrics\QPSQT\DS_TxRresults\

4.7.1 Summary Page

The Summary Page is the first page in the workbook. It provides the final results of all the port tests side-by-side and validates them against the specification standards. Values that do not meet specification are colored red. For convenience, the specification values are shown below the calculated results.

4.7.2 Raw Data Pages

Each port test uses a worksheet to hold the raw stream data and the calculations used to provide results. Many of the intermediate calculations are erased after use to minimize file size and calculation time. All the important information from these pages is transferred to the Summary Page. A worksheet is generated for each combination of port and speed that is run.

4.7.3 Data Pages

A waveform diagram page is created for each port tested. This diagram displays a small portion of the captured waveform and is mostly used to verify that a valid 1394 waveform was imported from the scope.

4.7.4 Setups Page

The Setups page contains some data related to the test setup. There are no results on this page. There are no cells that should be changed by the user. Typically, this page is hidden to simplify management of the results workbook.

4.7.5 Oscilloscope Manufacturer Pages

Setup and control information for remote control is stored on a separate worksheet in the Excel file for each make of supported oscilloscope. There is no relevant user information on these pages. Typically, these pages are hidden to simplify management of the results workbook.

5 GPIB/Ethernet Configuration

QP-SIA now comes with a GPIB over Ethernet capability so that the Oscilloscope no longer needs a standard GPIB connection. The application still allows for either GPIB or Ethernet to be used, so it is backwards compatible. National Instruments' VISA Runtime is required and may be downloaded for free from the NI website or run from the QP-SQT installation disk.

5.1 Configuring on First run

After clicking on the Transmit tab, the application will look for any connected GPIB devices. If it finds any available they will automatically show up in the Automation Resources window.

5.1.1 GPIB Resources

In the picture below, it shows that there are two resources available. The first one, GPIB0::INTFC, cannot be used to interface to the oscilloscope and will give an error if selected. The second one, GPIB0::1::INSTR, will let the user actually interface with the oscilloscope. To use this option, simply click to select, and then click the OK button.

In order to manually check for GPIB resources, click the Find Resources button and it will run the search again.

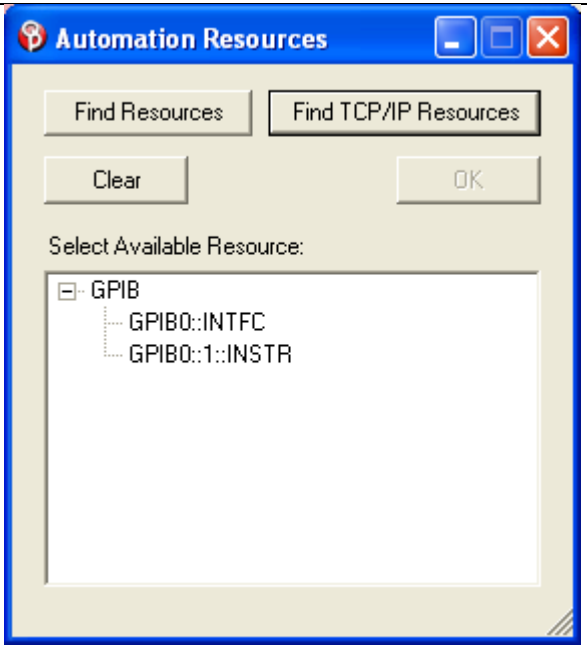

Figure 18 – Automation Resources with GPIB Resources

5.1.2 TCP/IP Resources

The Test host and oscilloscope must be connected over Ethernet in order for the scope to be found properly. If the two are already on the same network, then all the user needs is the IP address of the oscilloscope. In order to find the TCP/IP Resource, please select the Find TCP/IP Resources button in the Automation Resources window. This will pop up the TCP/IP Resource Verification Utility window. The circled area (TCP/IP Instrument Resources) is the one that we will refer to for the rest of this section; the TCP/IP Socket Resource is not currently used.

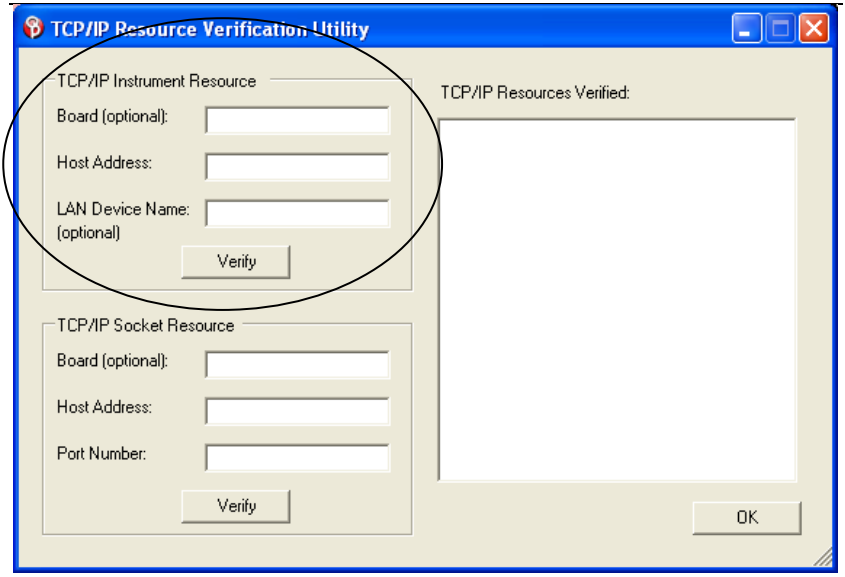

Figure 19 – TCP/IP Resource Verification Window

The user only needs to know the IP address of the device that they want to connect to in order to verify that the resource exists and that a connection can be made. Type in the IP address of the device in the Host Address section of the TCP/IP Instrument Resource block and click verify. This will bring up a list of any found TCP/IP resources at that specific IP address. If none are found, please verify the IP address and that the scope is setup for this kind of connection.

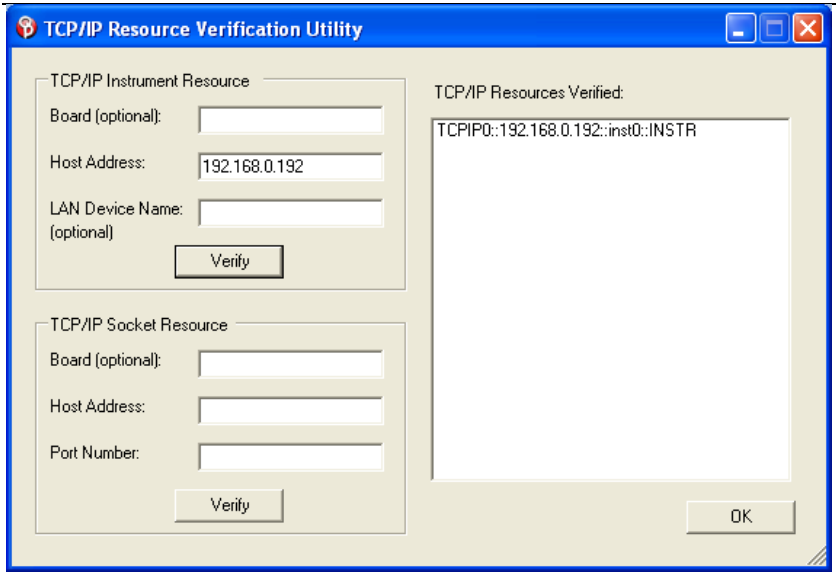

Figure 20 – Resource found

Once the resource has been verified, select that resource in the TCP/IP Resources verified list; in this case it is TCPIP0::192.168.0.192::inst0::INSTR. Then select the OK button in the lower right corner.

Now the Automation Resources window will have that TCP/IP resource listed. To use the resource, select it, and then select OK.

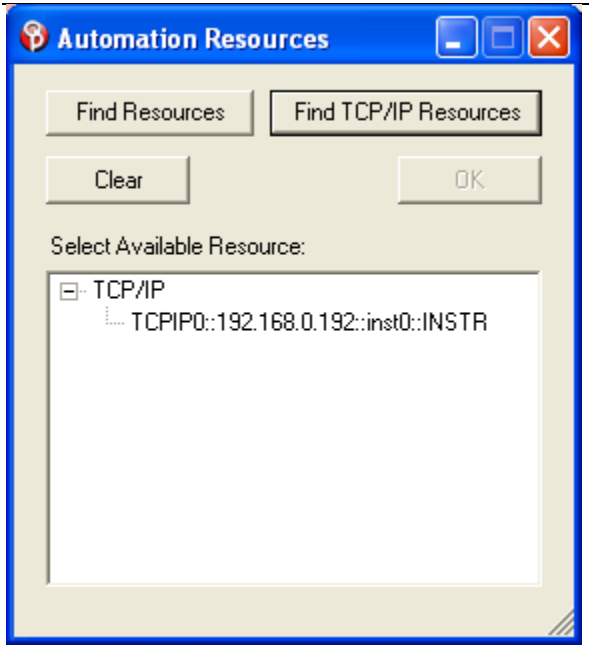

Figure 21 – TCP/IP resource selection list

5.2 Changing Devices

Once the user has successfully selected a device, it will be saved in the configuration file. When the application starts each time after that, it will try to connect to the last device that was used, eliminating the need to find the resource every time. If for some reason the resource is not found, an error will pop up stating this and the Automation Resources screen will come up to allow selection of a new device.

If for some reason after starting the application the user would like to change the device, there is a Change OScope button on the first screen when entering the Transmit test. This button can be used to bring up the Automation Resources window and a new device can be selected.

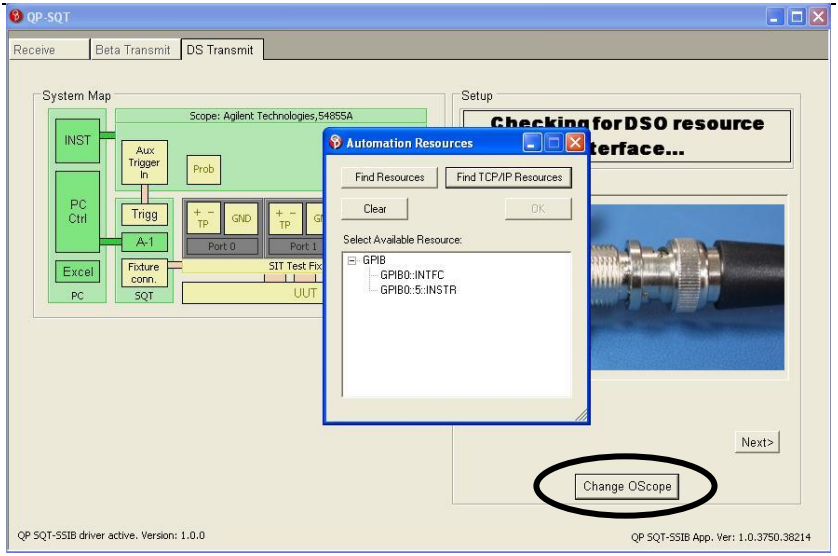

Figure 22 – Change OScope button

6 System Requirements and Installation

QP-SQT Suite runs on the IBM PC compatible family of computers with a 1.5 GHz Pentium IV processor or greater. Currently QP-SQT Suite runs under Windows XP or newer.

A National Instruments IEE488 GPIB or compatible adaptor is required.

A digital sampling oscilloscope with appropriate probes is required.

MS Excel version Office 2003 or higher is required.

Oscilloscope support is limited. Please contact QP for the most recent list of supported oscilloscopes.

6.1 Software Installation

1. This installation requires any version of Win-XP or higher to be installed on the target PC.
2. If a previous version of "QP SQT Tester" is present on the target system, first perform an un-install of the "QP SQT Tester" using the provided uninstaller in the QPSQT program directory.

3. Insert the "QP SQT Tester" CD. If target computer is configured for Autorun from CD media then the setup and installation will begin automatically.
    - If Autorun is not enabled on your computer you can start setup by going to Windows Explorer and right clicking on the installation CD drive icon and selecting 'autoplay' from

the drop down menu. This will automatically run the installation.

4. Follow all prompts.
5. Install the ubCorePro Software included on the SQT CD. This can be done by running the ubCorePro.exe file from the CD.

7 How to Contact Quantum Parametrics

Quantum Parametrics may be contacted by phone at:

(719) 592-1394 ext. 101 (USA)

or by email at:

info@quantumparametrics.com or visit our web site at:

www.quantumparametrics.com