Signal Quality Tester

And

Beta Signal Integrity Tester

Users Guide

Version 1.7
02/08/18

Astek Corporation
Web: www.astekcorp.com

i. Revision History

Revision	Date	Description
V1.0	2/5/08	Initial Version
V1.2	3/05/08	Added Beta Signal Integrity Tester
V1.3	3/26/08	Added Single Ended Support and Test Tone
V1.4	8/28/08	Added to Calibration Section
V1.5	8/29/08	Added more to Calibration Section
V1.6	9/05/08	Misc. Corrections, Added Overview
V1.7	02/08/18	Updated Astek references

ii. Reference Documents

Document #	Title	Author
IEEE-1394b-2002	High Performance Serial Bus (Supplement)	IEEE
AS5643/1	Test Plan/Procedure for AS5643/1 S400 Copper Media Interface	SAE
2002005	Base 1394 Test Suite Definition with Extensions for 1394b	1394 Trade Association

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1 Introduction

The Astek Corporation (Astek) Signal Quality Test System (QP-SQT) is a complete test system for Beta (1394b) testing transmit signal integrity and receive signal sensitivity, according to the AS5643/1 S400 Copper Media Interface Test Plan as well as the Base 1394 Test Suite Definition with Extensions for 1394b and potentially other standards. Currently the QP-SQT comes in an S400 (QP-SQT-4) and S800 (QP-SQT-8) versions. The S400 and S800 indicate the maximum data rate supported by the receive signal sensitivity test. The default configuration for the receiver sensitivity tester is capacitive coupled.

The transmit sections of this manual also apply to the Beta Signal Integrity Tester (QP-SIB4B (rev C)).

1.1 Signal Quality Tester Components

Signal Quality Tester

The Signal Quality Tester (SQT) provides hardware capabilities to test transmit signal integrity and receive signal compatibility.

SQT Application Software

The SQT application software controls the testing process and compiles the test results.

Test Point Board / Transmit Tester Cable

The test point board provides quality test point connections near the connector of the Unit Under Test (UUT). The test point board connects to the tester via an included Transmit Tester Cable that provides 1394 connection tones to induce the UUT to

transmit a signal. This cable also provides 3.3V out on the other pair in order to allow powering some military applications. This cable should only be used in conjunction with the Test Point Board and should never be plugged directly from the SQT to the DUT.

Receive Test Cables

Cables are used to connect the SQT to the UUT. These cables are not included with the QP-SQT. The user should calibrate the C1, C2, and C3 outputs before testing. The test cable connects the SQT to the UUT for receive compatibility testing.

Trigger Cable

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

DC Adaptor

A 12V DC power supply is included to power the SQT.

1.2 Other Required Equipment

Host Computer

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

Microsoft Excel

All raw test data is captured and analyzed in Microsoft Excel. Microsoft Excel 2003 or newer is required on the host

computer. Microsoft Excel must be installed before installing the SQT application.

Host PC Interface

The SQT application communicates with the SQT instrument via IEEE-1394 (1394). The host computer must provide a 1394 interface. PCI, PCMCIA, and integrated 1394 host adaptors are acceptable. NOTE: the PC host must support VersaPHY packets. The SQT has one 1394 bilingual connection (1) and two Beta only connections (0 and 2). The 1394 host adaptor must be installed before installing the SQT application. The SQT application installation will install custom 1394 drivers.

GPIB Interface

The SQT 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 SQT application.

Digital Oscilloscope / Differential Probe

Accurate testing of 1394b S400 signals requires a digital sampling oscilloscope and a differential probe with at least 2 GHz bandwidth and 10GSamples/second sampling rate. For 1394b S800 signals 4 GHz bandwidth and 20GSamples/second sampling rate is required. At these sampling rates the oscilloscope must acquire at least 3500 unit intervals. Specific oscilloscope model support is developed and tested one model at a time, usually at the customer's request. Contact Astek for the latest list of supported oscilloscopes.

2 Signal Quality Tester Tour

2.1 Front Panel

Figure 1 - Front Panel of SQT

Figure 2 - Front Panel of Beta Signal Integrity Tester

Host PC Connection

The SQT application communicates with the SQT instrument via IEEE-1394 (the Backchannel). The host computer must provide a 1394 open host controller interface (OHCI). The SQT has one bilingual (port 1) and two beta only ports (port 0 and 2). The Backchannel uses VersaPHY™[1] technology for communication between the PC and the SQT. While VersaPHY is supported by most OHCI implementations, Astek has found the TI TSB82AA2B OHCI IEEE-1394b controller does not support VersaPHY packets.

The SQT application installation installs custom 1394 drivers. These drivers should allow applications currently using 1394 to continue to use the 1394. However, it is STRONGLY RECOMMENDED that the PC and SQT connection remain point-to-point while testing.

[1] VersaPHY™ is a trademark of Astek Corporation, all rights reserved.

Power Light

If the Signal Quality Tester (SQT) is powered through the 12V jack and the on/off switch is in the *on* position, the Power LED should be illuminated.

TX Test Fixture Connector

The TX Test Fixture connector on the front of the tester is not a 1394 port. This connector connects to the appropriate Transmit Signal Test Fixture through a QP provided cable.

Error Rate Connections

The Error Rate Connections are labeled C-1, C-2, and C-3. These connections allow a two or three port device to be tested at a specific data rate and amplitude*.

*Please see the end of this document for legitimate test amplitudes.

2.2 Back Panel

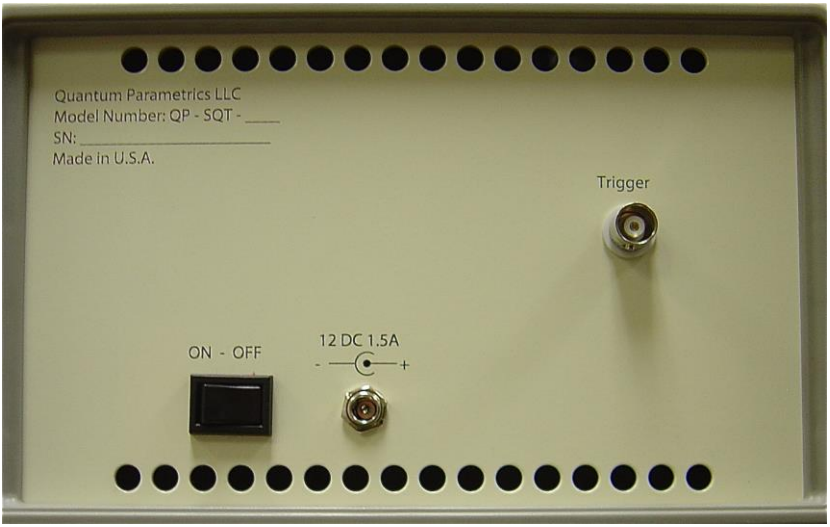

Figure 3 - Back Panel of SQT

Figure 4 - Back Panel of Beta Signal Integrity Tester

Tester Power

The SQT is powered by the included 12-volt power supply connected to the back of the tester.

ON/OFF Switch

The ON – OFF switch connects and disconnects the 12 volt power supply of the SQT internal circuitry.

Trigger

The BNC connects the SQT instrument to the oscilloscope auxiliary/trigger input. The trigger is used during the TX signal integrity test.

3 General Overview

The SQT tester is designed to test both the transmit and receive capabilities of the Device Under Test (DUT). In order to do this, it requires two different interfaces, the Transmit Interface, and the Receive Interface. In order to connect to the computer, and thus be controlled by the QP software, there is also a backchannel interface.

3.1 Transmit Test Overview

The Transmit Tester is designed to measure the signal quality at the output of the Device Under Test (DUT). This output may be at the near-end (at the receptacle of the DUT) or the far-end (at the end of a cable connected to the DUT). This is discussed in more detail in Section 6.

The Transmit Interface is used to emulate the connection process of a 1394B PHY. The TX Test Fixture Connection is that of an HSD connector. The supplied cable goes from the HSD connector to a regular 1394 9-pin connector (or possibly another style depending on the customer's needs) in order to minimize confusion. The TX Test Fixture Connection and cable are wired in such a way that they will not work in a regular 1394 connection and should only be used for the Transmit test. Never plug the supplied Transmit Tester cable directly from the Tx Test Fixture into the DUT.

During the Transmit test, tones are sent out by the SQT that make the connected device (DUT) think that a 1394B connection is happening. No high-speed tones are sent over the connection from the SQT to the Transmit Test Fixture Connection, only 50MHz tones. The B test point board is terminated on the DUT's transmit side so that it can take the most accurate electrical measurements possible.

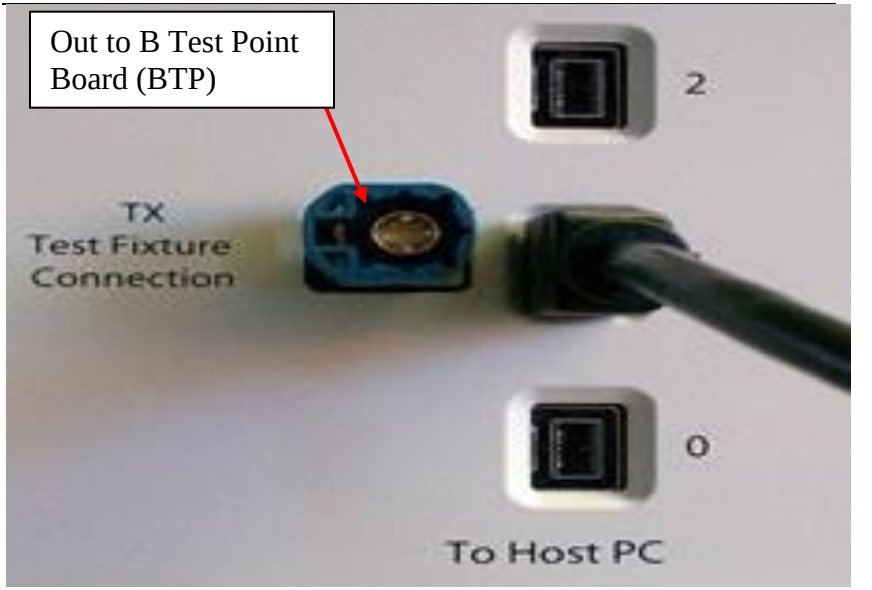

Figure 5 - Transmit Interface and Backchannel

3.2 Receive Test Overview

The 3, 1394B ports labeled C-1, C-2, and C-3 are the connections that actually run the receive test. The Receive Tester is designed to determine the receiver's ability to receive a signal or the cable media's quality. Each port of the device (assuming the device has either 2 or 3 ports) is connected to the appropriate Receive port connections. These should be connected so that Port 0 connects to C-1, Port 1 to C-2, and Port 2 to C-3. If these are connected in such a way that the order is incorrect, the test will still run, but may report incorrectly as it expects the setup described in the previous sentence.

While the test is actually running, the SQT configures itself into a 3 node topology consisting of the SQT C-X -- DUT -- SQT C-Y. Then, the SQT sends packets from one connection to the other. Upon reception, the packets are compared to an expected value and errors are reported. The test continues in this manner until all ports are tested.

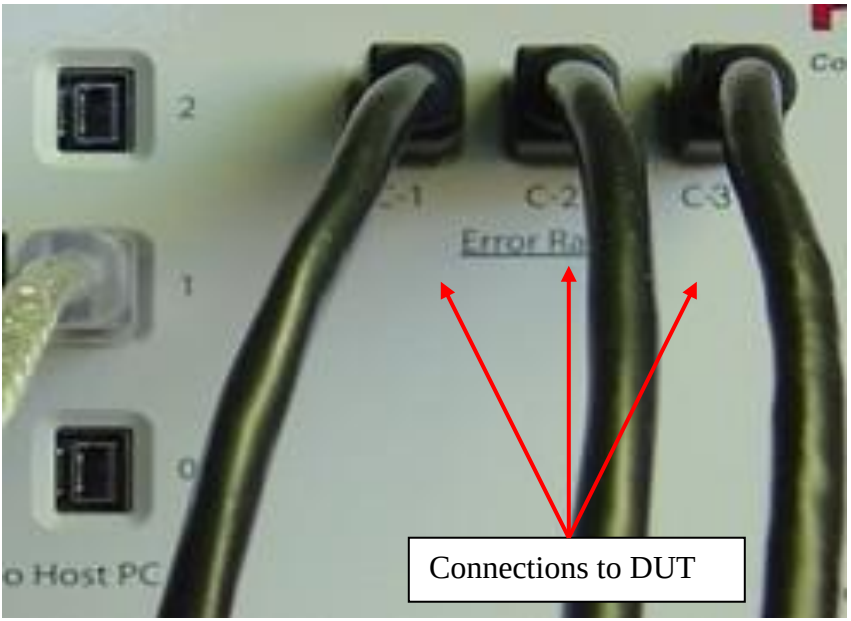

Figure 6 - Backchannel and Receive Interface

3.3 Backchannel

Backchannel Interface:

The Backchannel Interface is the communication link between the SQT hardware and the SQT software. The middle port of the backchannel is a bilingual (1394A/B) port, while the two outer ports are 1394B only connections. The backchannel should only be connected to a 1394 Host controller that has the QPVP driver loaded.

4 Transmit Testing Procedure

4.1 Start Application

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

4.2 Physical Configuration

Host Computer / SQT

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

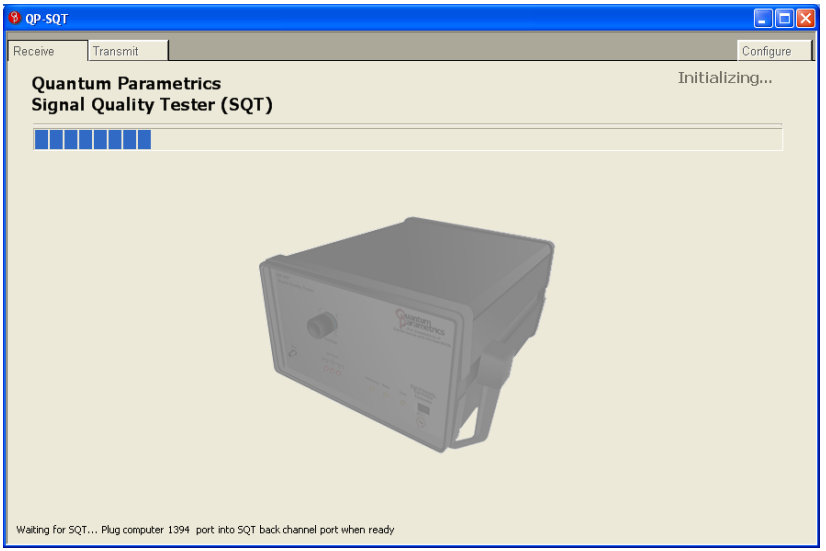

Figure 7 - Host computer connection to SQT

Oscilloscope GPIB

The GPIB interface on the test host computer must be connected to the oscilloscope. The application checks this 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 for use with our products.

Oscilloscope Trigger

The trigger output from the SQT must be connected to the auxiliary trigger input 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.

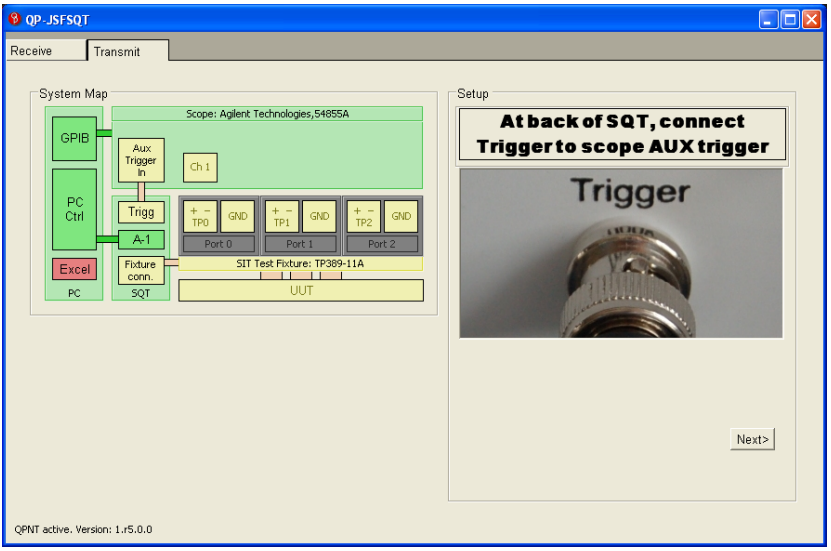

Figure 8 - Trigger connection to Oscilloscope

SQT to Test Point Board

The SQT connects to the Test Point Board via the supplied Transmit Test cable. The application is not able to verify this connection, so the user is always prompted to check it. Only the Test Point Board should be connected to the "Test Fixture" connector on the front of the Signal Quality Tester. **The Signal Quality Tester may be damaged if any 1394 device is connected to the Test Fixture connector.**

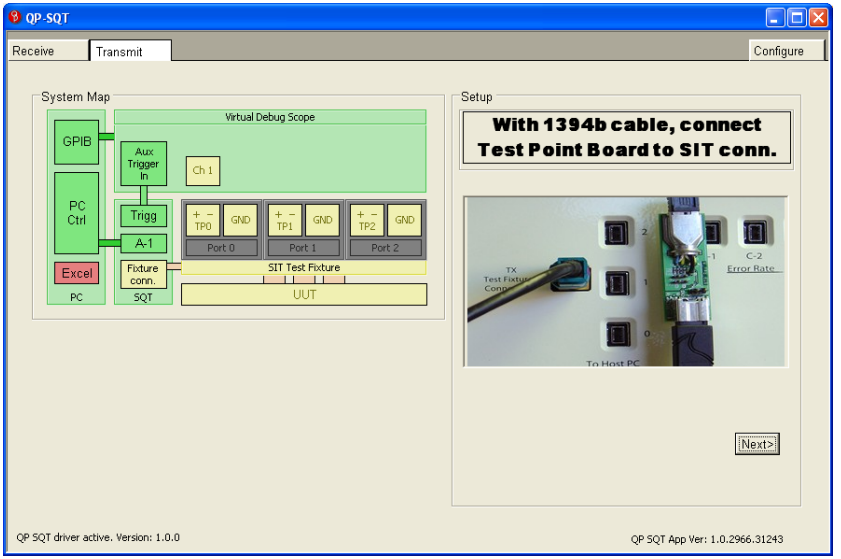

Figure 9 - Test fixture connection

Probe to Test Point Board

Depending on the Unit Under Test (UUT), Test Point Board may provide one or more test points designed to interface directly with differential oscilloscope probes. If using a 3 port Test Point Board, the UUT transmit differential signal pairs from port 0, port 1, and port 2 are routed to test points labeled TP0, TP1, and TP2 respectively. If the UUT has fewer than 3 ports then the Test Point Board may only support test points for

the supported ports. Pairs of test points labeled GND are also provided to collect calibration samples.

The application is pre-configured to collect information from a differential probe connected to oscilloscope channel 1.

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 test results will be generated.** Wait until instructed by the application to connect the probe to the Test Point Board.

UUT Specific Test Point Boards

IEEE-1394 is used in diverse applications and these applications require multiple different types of connectors. Therefore, QP provides an ever-expanding list of Test Point Boards from the standard 1394b 9-pin connector to custom 38999 connectors. Please contact QP for the latest list of Test Point Boards. QP also provides custom design services and can create specific Test Point Boards to meet our customer's needs.

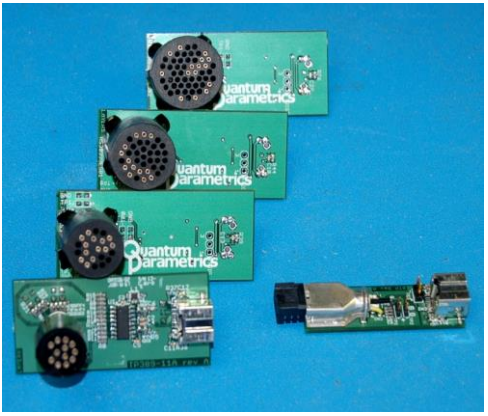

Figure 10 - Example Test Point Boards

4.3 UUT Setup

Test Point Board to Unit Under Test

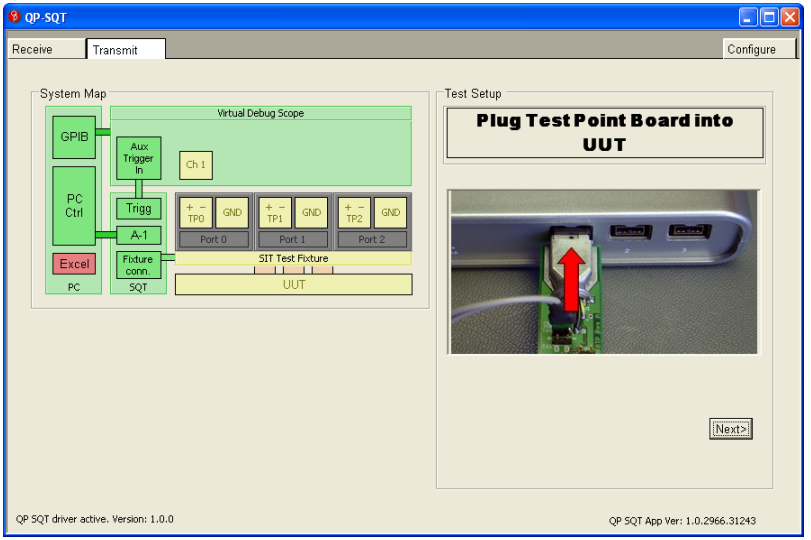

Figure 11 - Test Point Board Connection

The Test Point Board includes a connector to mate with the Unit Under Test (UUT). This connector is keyed to properly align the pins and sockets. The application is unable to verify this connection, so the user is always prompted to check it.

The UUT must be independently powered during testing. The SQT does not power the UUT.

Name Results File

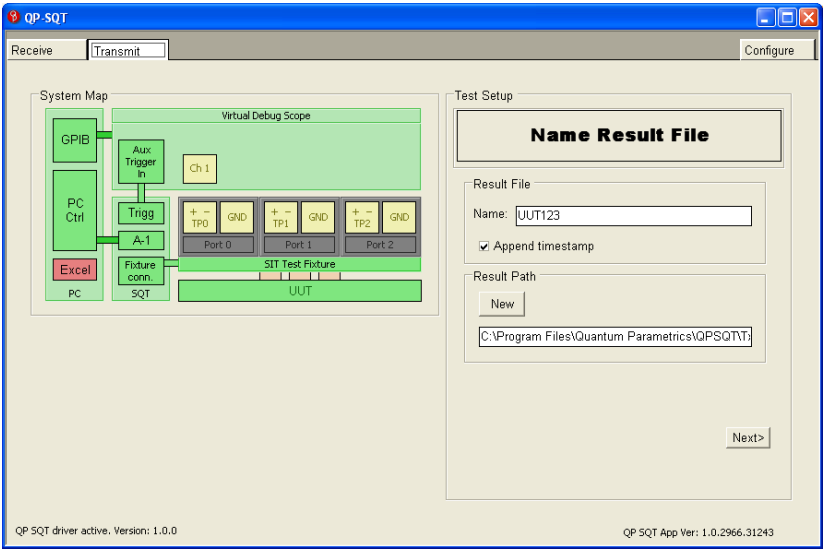

Figure 12 - Test result file naming

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.

Test Options

The Test Options screen allows the user to configure the test. Not all options are available for all configurations. For questions please contact Astek.

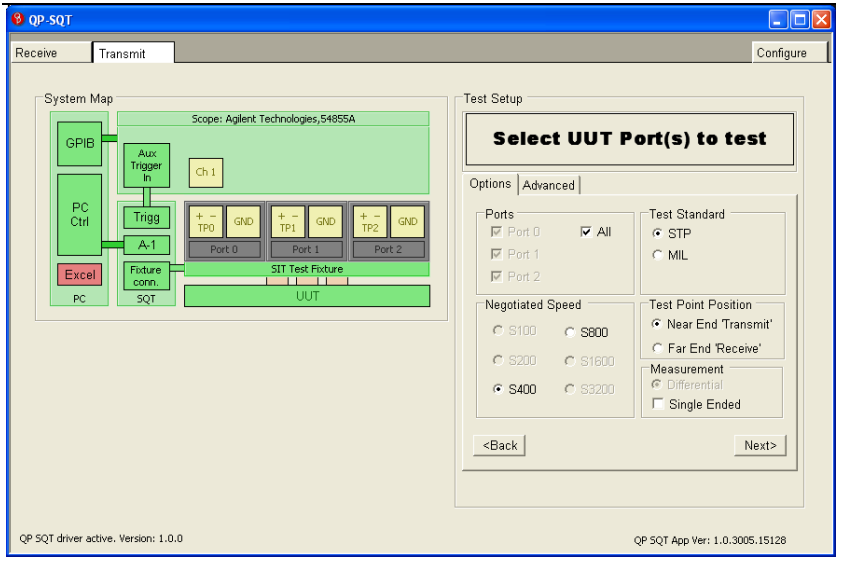

Figure 13 – Transmit test options

4.3.1.1 Ports

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

4.3.1.2 Test Standard

The STP and MIL test standard options allow the user to select either IEEE-1394b-2002 shield twist pair parameters or SAE AS5643/1 S400 Military test standard.

4.3.1.3 Negotiated Speed

This version of the SQT only supports S400 and S800. The negotiated speed option allows the user to choose the connection speed and test parameters that will be used to calculate results and determine pass or fail.

4.3.1.4 Test Point Position

The SIA post processor supports both Near End (TP2) and Fair End (TP3) calculation algorithms. This option allows the user to select which ones apply to the measurement being taken.

4.3.1.5 Measurement

The Differential (always enabled) and Single Ended options let the user select whether differential skew and common mode measurements will be taken. If Single Ended is not selected these measurements will not be taken. NOTE: for AC coupled implementations, Single Ended measurements may not be valid.

Advanced Tab

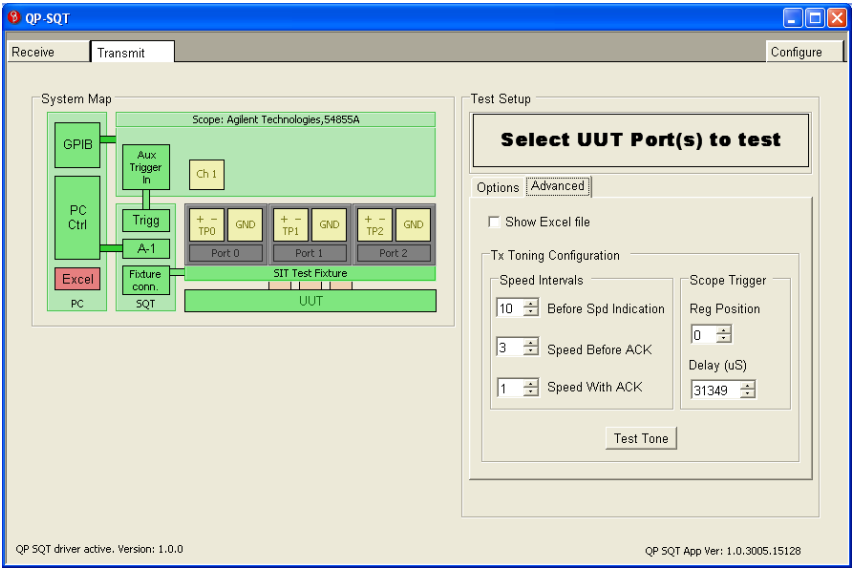

Figure 14 - Advanced transmit test options

Under the advanced tab on the options window, 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.

4.3.1.6 Tx Toning Configuration

Depending on the UUT PHY silicon, the user may wish to adjust the connection tone sequence. The Tx Toning Configuration allows the user to do this.

Before Spd Indication – This is the number of start only tones before the first tone interval with a speed indication.

Speed Before ACK – This is the number of start and speed tones before the first tone interval with an acknowledge tone.

Speed With ACK – This is the number of start, speed and acknowledge tone intervals.

Scope Trigger allows the user to place the oscilloscope trigger 666 usec from the start of the last tone interval to the end of that tone interval. This timing may need to be adjusted depending on when the UUT starts training relative to the last tone interval.

4.3.1.7 Test Tone Button

The Test Tone Button is used to send the toning sequence specified in the Tx Toning Configuration. This feature allows the user to debug the response of the UUT to the tone sequence. If needed the user may change the oscilloscope setting to better show the interaction between tester and the UUT. To show the trigger position the user may elect to move the trigger from AUX IN to a free channel.

4.4 Calibration

Calibration is performed once per UUT to minimize the effect of any differential probe DC offset.

Probe to GND

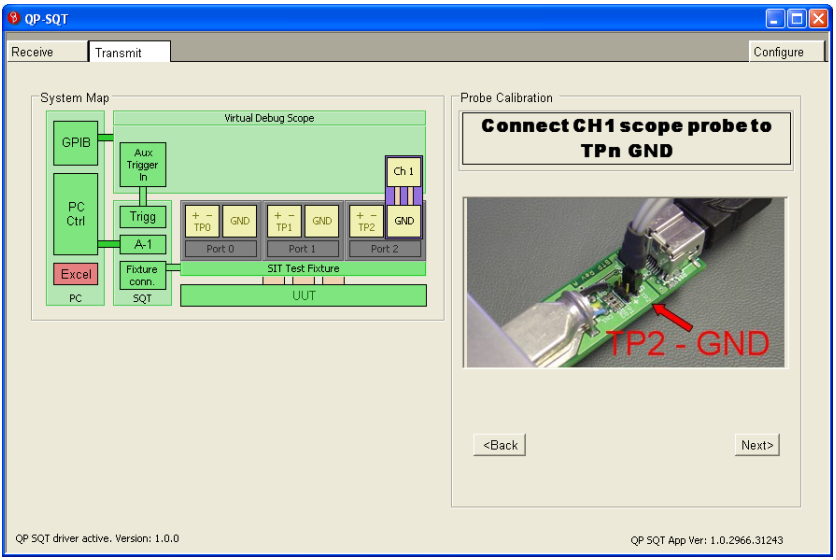

Figure 15 - Differential probe calibration

The application will instruct the user to connect the differential probe to GND test points. Click "Next" after this is manually verified.

At this point the application will configure the oscilloscope to capture the calibration samples, actually capture the calibration samples, and write them to the results file.

Next / Reacquire

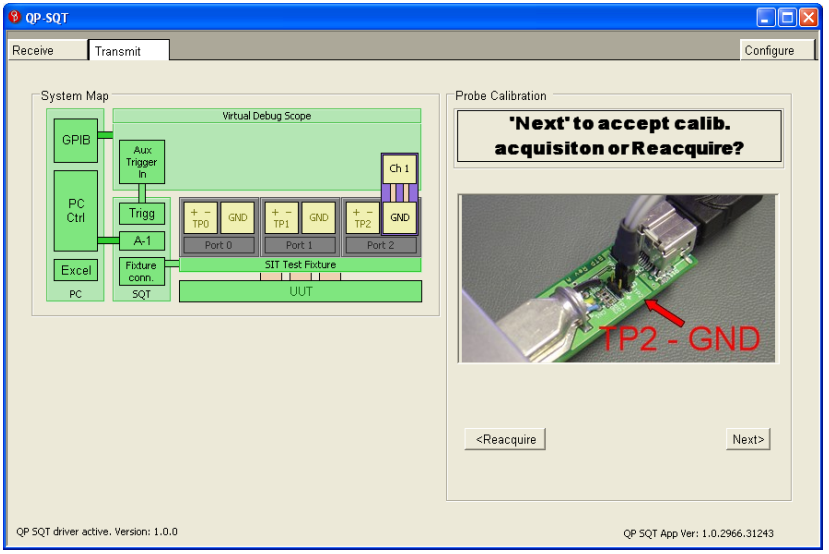

Figure 16 - Accept or recalibrate

After the calibration samples are written, the application offers a chance to reacquire them. If the oscilloscope display does not show a mostly flat trace near 0 volts, reacquisition will be required. This should be manually verified.

4.5 Port Test

Probe to TPx

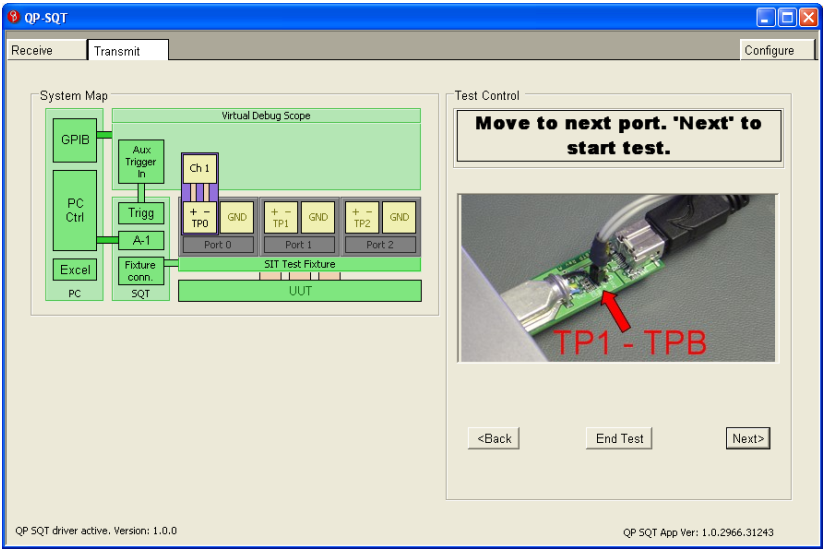

Figure 17 - Connection of probe for testing

The application now instructs the user to connect the probe to the test points of the next port to be tested, based on the selected ports to be tested and ports already tested. If the test point board only offers single port connectivity, for example the standard 9 pin 1394b test point board, the users should keep the oscilloscope probes connected to the same test point and move the test point board to the appropriate port.

Selecting “Back” at this point will return the user to the previous port or calibration acquisition step.

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

The application will display “Testing Port x” and “Downloading Stream Data” as these actions are performed.

End Test Button

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

Reacquire / Calculation

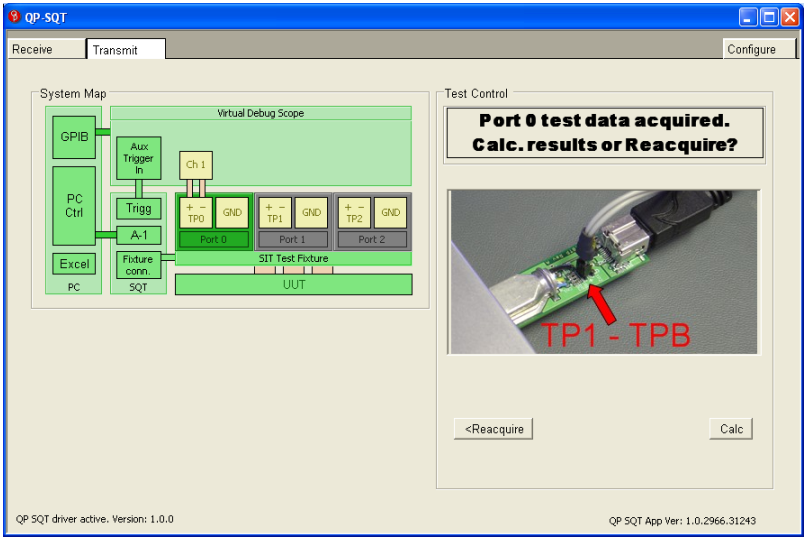

Figure 18 - Reacquire or Calculate results

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 below, does not show a captured signal oscillating above and below 0 Volts, the samples should be reacquired.

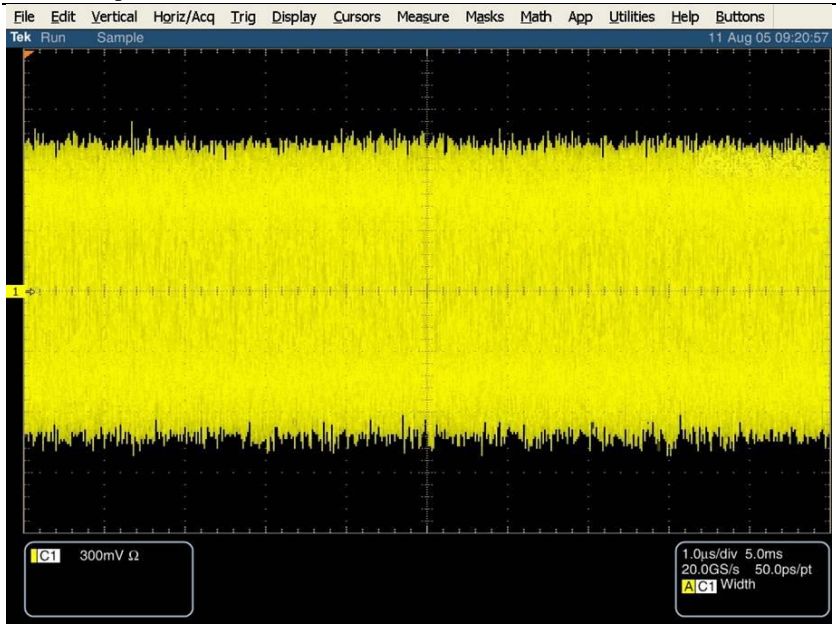

Figure 19 - Example oscilloscope capture

If this is the initial test and 1394b signal data is not captured, the user may re-arm the oscilloscope manually, click the Reacquire Button, then go back to the Options Page and select the Advanced Tab. On the Advanced Tabs the user may use the Test Tone Button (described in section 4.3.1.7) to troubleshoot the acquisition process without the lengthy automated capture process. After reasonable signals are seen, selecting the Options tab will allow the user to continue the automated process.

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

Reacquire / Next

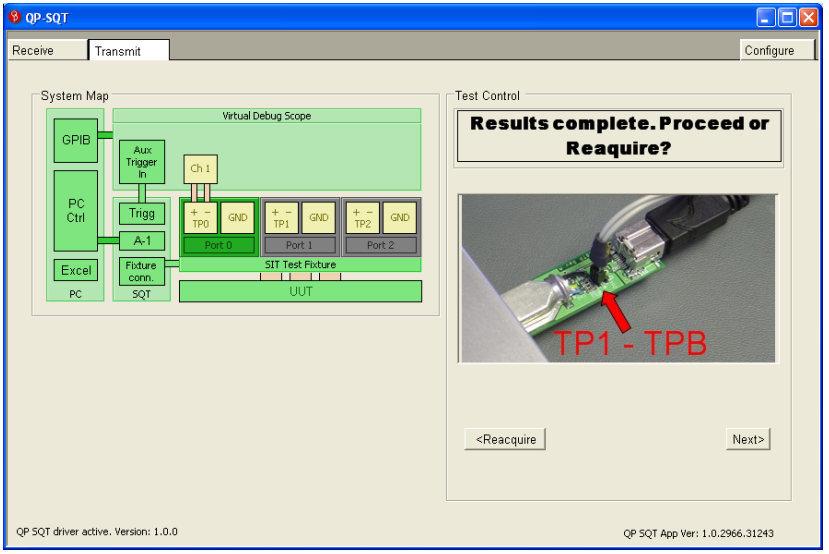

Figure 20 - Test results for port complete

After the result calculations are complete, the user has the opportunity to examine them 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.

4.6 Single Ended Measurements

If the Single Ended option is selected on the Advanced Tab, differential skew and common mode voltage measurements will

be enabled. The following additional steps will be added to the test procedure.

Differential skew and common mode voltage are measured in a two-step process. Because the common mode voltage can vary form 0 to 2.5V the first step involves locating the common voltage using a 1V scale. After the common mode voltage is found the oscilloscope offset is adjusted to that value. The vertical resolution is increased to make the differential skew measurement. The same process is repeated after the oscilloscope probes are swapped.

NOTE: Not all differential probes support the possible common mode voltage of 2.5V. Currently SQT only supports Agilent oscilloscopes using differential probes for the single ended measurements. For other oscilloscopes two single ended probes are required.

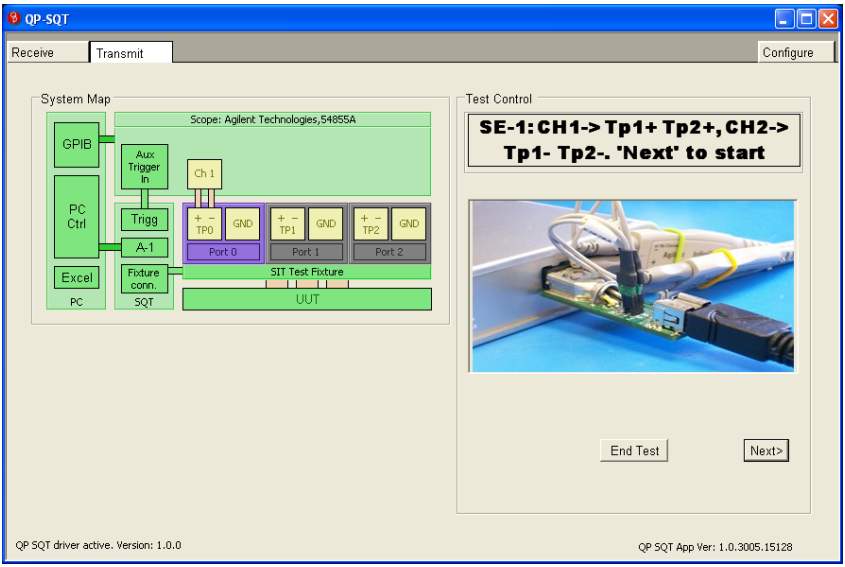

Figure 21 - First single ended scope probe connection

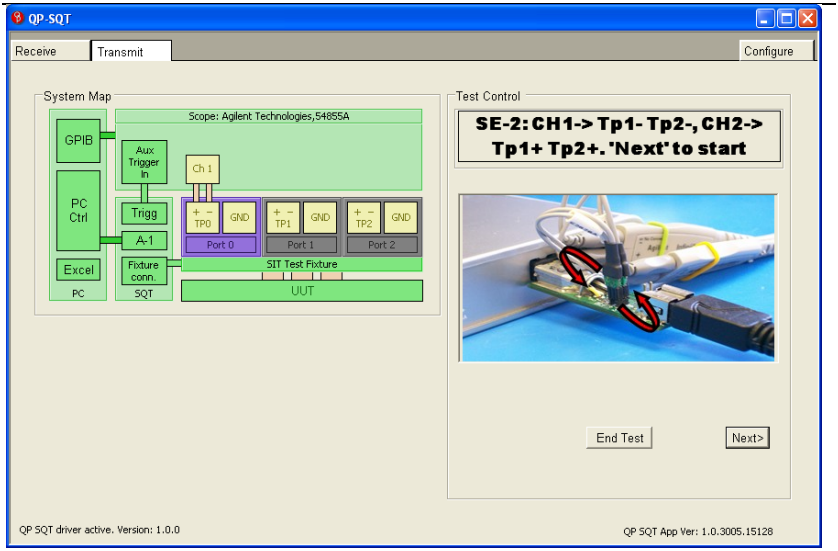

Figure 22 - Second single ended scope probe connection

4.7 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 configuration of the test point board is dependant on the UUT; therefore, the exact test configuration may vary. For example, if UUT uses standard 9 pin 1394b connectors, only one port is serviced per connector. Likewise, the test point board for the standard 9-pin 1394b connector only offers single port connectivity. In this case the users should keep the oscilloscope probes connected to the same test point and move the test point board to the appropriate port. In many aerospace applications a single connector services multiple ports. In this case the test point board services the multiple ports; therefore, the users should move the oscilloscope probe to the appropriate test point as directed by the application.

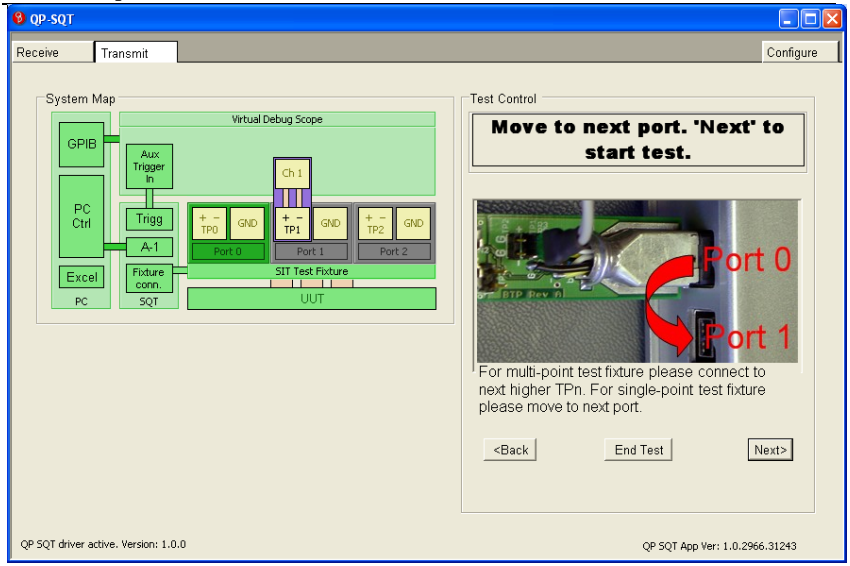

Figure 23 - Testing the next port

4.8 Test Completion

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.

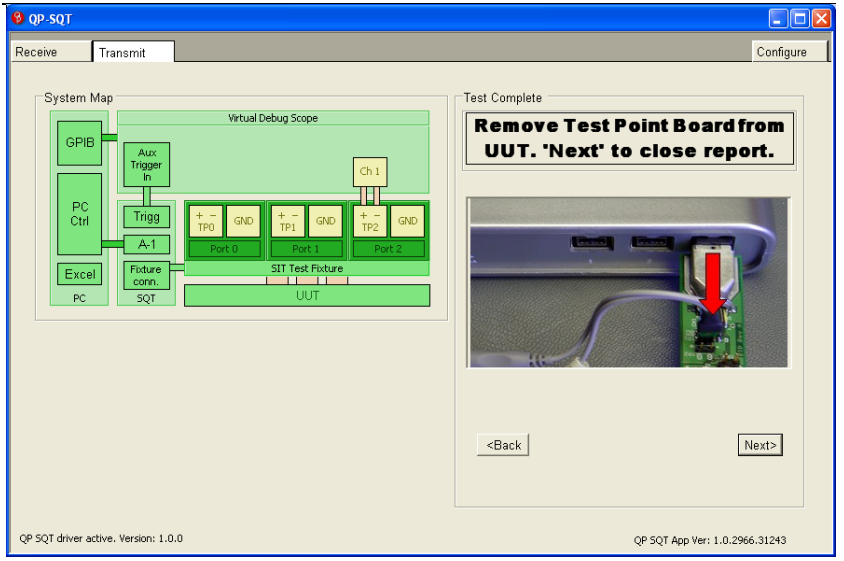

Figure 24 - Remove test point board

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

Next UUT

The transmit signal integrity test for the current UUT is now complete. Selecting “Next” will return the user to UUT Setup for another UUT.

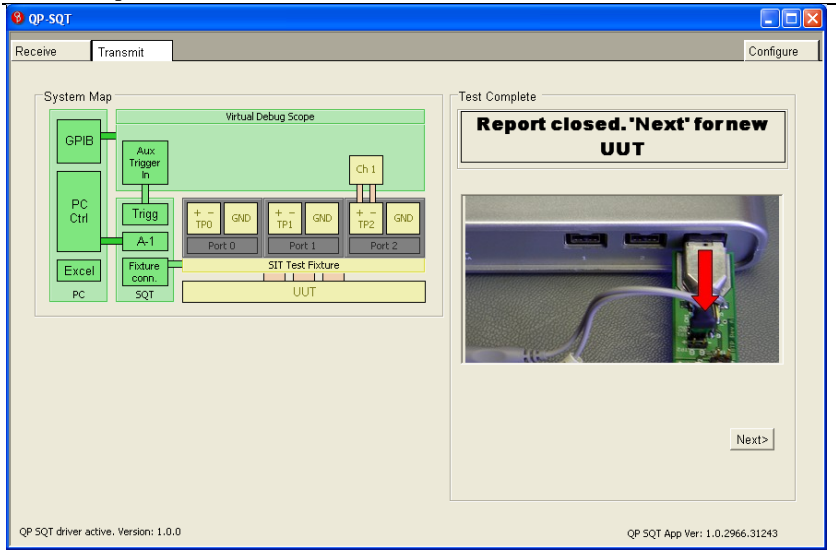

Figure 25 - Report closed and start next UUT test

4.9 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\Astek Corporation\QPSQT\TxRresults\

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.

Port 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.

Eye Pages

An eye diagram page is created for each port test. This diagram displays all the samples in the jitter calculation range of the stream compared against the IEEE 1394 specified absolute and normalized eye masks. The yellow eye is the absolute eye based on the specification maximum and minimum differential voltage levels. The red eye is the normalized eye based on percentages of the calculated signal level. The green lines across the chart show this calculated signal level.

DFT Pages

A frequency domain jitter plot is created for each port test. After pattern based jitter is normalized, frequency based jitter is analyzed. The three lines in the jitter plot display the jitter initially, after normalizing the first frequency component, then after normalizing the second frequency component.

These plots can be used to identify strong frequency-based sources of jitter.

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. The specification values are stored on this page. These values may be changed in the template should

the specification change. Typically, this page is hidden to simplify management of the results workbook.

Oscilloscope Pages

Setup and control information is stored on a separate worksheet in the transmit Excel file for each model 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 Receive Testing

5.1 Start Application

Execute the QPSQT.exe file. After the Signal Quality Tester (SQT) is connected select the Receive tab at the top of the window to begin receive testing.

5.2 Physical Configuration

Host Computer / Signal Quality Tester

If prompted on the main application window, connect the Signal Quality Tester to the host computer with an IEEE-1394 cable to one of the To Host PC ports on the front of the tester. Please see Figure 7 for details. If this connection is already made, the application may move to the next step. Under some circumstances the tester will need to be disconnected and reconnected to initialize the tester.

5.3 UUT Setup

Connect Unit Under Test

Connect the Unit Under Test (UUT) to the connectors labeled "Error Rate" on the front of the SQT.

When the UUT is properly connected, select the Next button. The ports are then verified to make sure that a connection can be established. Once this is verified the prompt will ask you to Name the Results File then click next; if this was done in the previous step, simply proceed by clicking the Next button.

Name Results File

The user interface next 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.

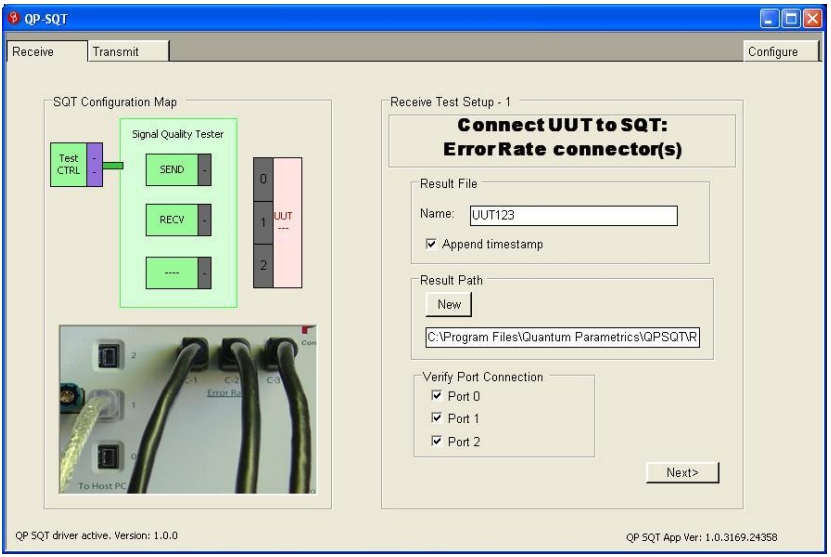

Figure 26 - Connection UUT to SQT

Test Options

Receive testing may be run to three different confidence levels:

- Debug
- Acceptance
- Qualification

The actual goal parameters for each of these levels are set in the Excel Receive template file. Typically Debug will take the least time, and Qualification will provide the best indication of error rate. The goals of the user will dictate which confidence level to select.

The Debug level test will always be run first on all selected ports; if Acceptance or Qualification is selected, they will proceed in turn on all selected ports. This enables a quick checkout of all ports before proceeding to longer tests. The Continuous radial button is not currently available, but will be made available for later revisions.

Checkboxes allow the test to be run on any combination or all of the 3 UUT ports. At least 2 Ports must be selected and connected and active in order for the test to be able to proceed.

Ports to Test and Test Levels

This section is for reporting status. The checkboxes display to the user which ports were selected to test on the initial page of the Receive Test.

Next to the check boxes are the levels at which the tests are currently set to run. These can not be changed manually at this time. To change them manually the user must use the back buttons to get to the start of the test which will make the configuration tab available. Please see the Calibration / Configuration Tab section below for more instructions.

Auto Set Level

This box allows the user to have the SQT program automatically find the levels at which the UUT fails and set the current test level accordingly.

The Start button starts the process of automatically finding the threshold level at which the device passes when running for a short period of time. This algorithm is run independently for each connection to the SQT Error Rate connectors.

The Stop button allows the user to abort the automatic process. Doing so will cause any values not set to revert to the previous test level.

The %Margin field allows the user to set a level of margin from the found lowest passing point. Example: If the user sets the %Margin to 10 and the algorithm finds that the DUT port fails at 200mV, the current test level for that port will be set to 220mV.

Please keep in mind that the SQT error rate outputs are calibrated to the output of the box at the Error Rate connectors.

Select “Next” after options and any advanced options are verified.

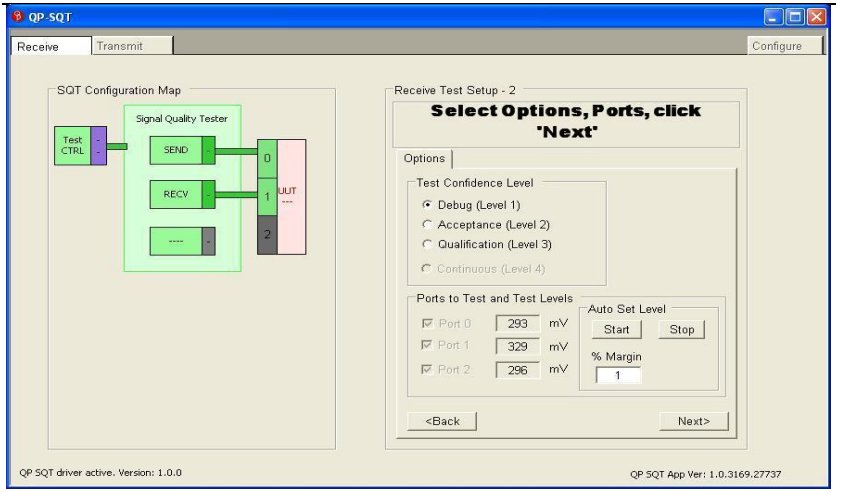

Figure 27 - Connection UUT to SQT

The SQT error rate outputs are calibrated to the output of the box at the Error Rate connectors.

5.4 Test Status Pane

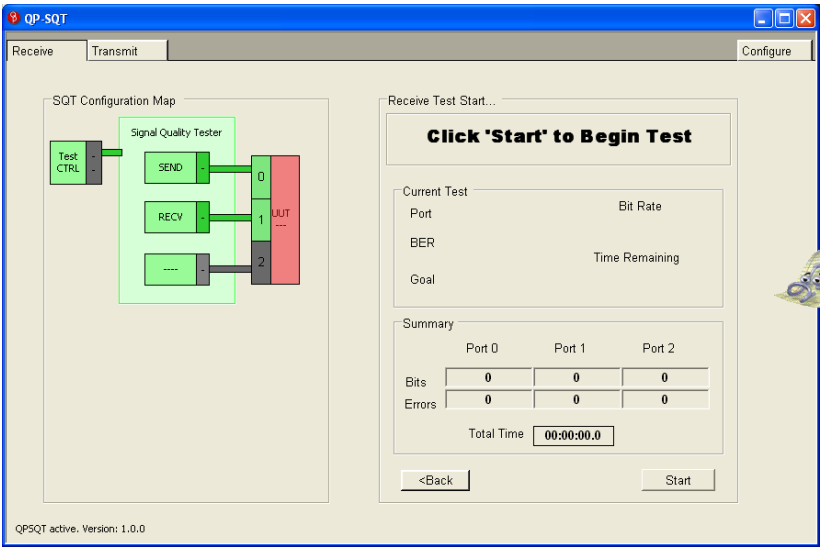

Figure 28 - Rx test status pane

Selecting the “Back” button allows the user to go back and set test options. Selecting the “Start” button actually configures the outputs and starts the test.

Current Test

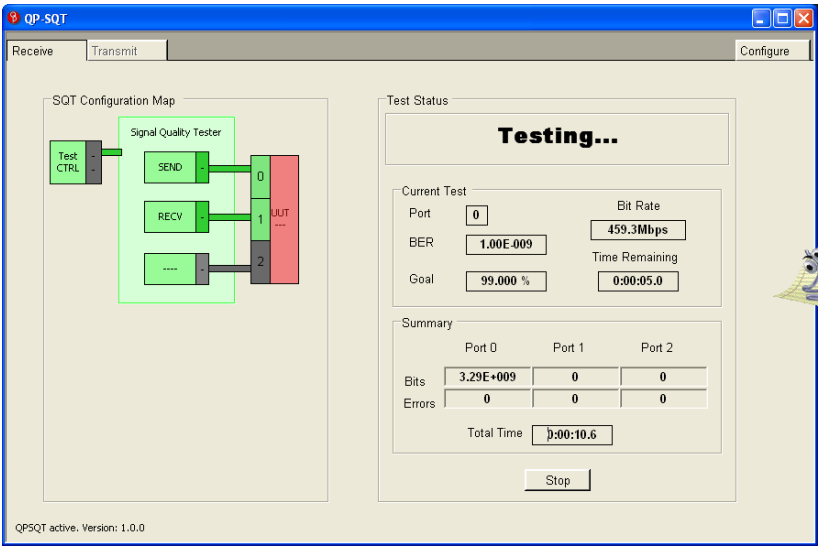

Figure 29 - Rx testing status pane

The “Current Test” frame identifies the current port under test, the current bit rate of the test, the bit error rate and confidence goals for the current test, and the estimated time remaining for the current port test.

Summary

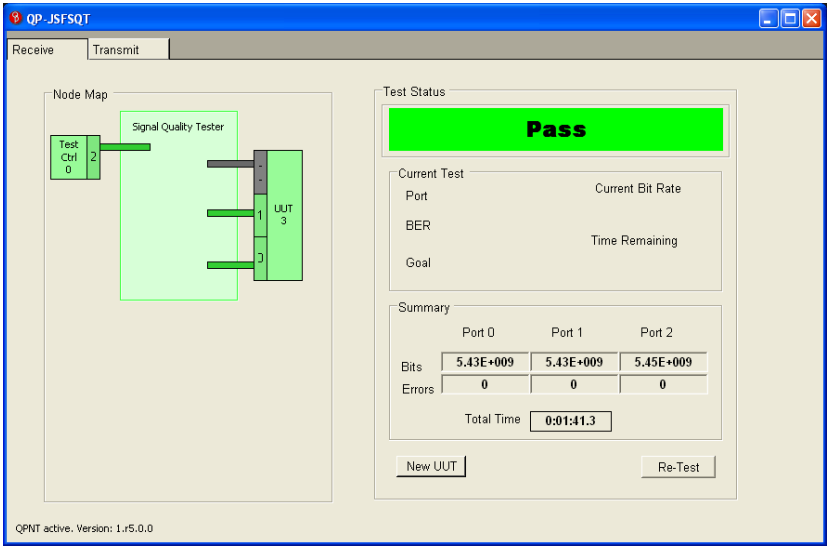

Figure 30 - Rx test summary pane

The "Summary" frame displays the cumulative results for all three ports of the UUT. It includes the number of bits sent to each of the ports, and the number of errors detected on each port.

The Total Time box tracks the cumulative total execution time for the current Unit Under Test (UUT).

5.5 Receive Signal Compatibility Results File

All port data and calculated results for each UUT test are stored in a single results file. For receive testing, all the information is in a single "Receive Results" worksheet, which by default is stored in the following directory:

C:\Program Files\Astek Corporation\QPSQT\Rx Results\

Parameters

The parameters are the bit error rate and statistical goals for receive testing (the sigma value for the goal is calculated by Excel). The goals are set in the receiveResults.xls template file which can be found in the C:\Program Files\Astek Corporation\QPSQT directory, and then copied into each new receive test. This enables organizations to select test requirements according to their individual needs, since there are no formally approved requirements.

The SQT system is configured for three progressively more difficult levels of receive testing, called Debug, Acceptance, and Qualification. The Debug level is for rapid checkout of a UUT. The Acceptance level is a more thorough check, possibly for 100% incoming inspection of new units. The Qualification level could be a very lengthy test for verifying first articles of new designs or selected samples of large lots.

Level

The Level cell contains the level selected from the user interface during the test setup.

Errors

The “Failure at:” Errors cell determines the number of errors at which a port test stops and failure is declared. This value is also set in the template file and applied to all subsequent tests.

Raw Data

The application records the number of bits sent to each port and the number of errors recorded on each port in the Raw Data Section.

Confidence

The Confidence section provides a statistical confidence that the given port meets or exceeds the given BER level, based on the current bit and error counts.

Bits Required / Remaining

The worksheet also estimates the number of bits required to meet the confidence goals. By subtracting the number of bits sent, it reports the number of bits remaining. This is used by the application to estimate remaining running time for the tests.

Parameters			
	BER	Risk Goal	Z Goal (σ)
Debug	1.00E-10	80.000%	-0.84
Acceptance	1.00E-11	80.000%	-0.84
Qualification	1.00E-12	60.000%	-0.25
Continuous	1.00E-10	50.000000000%	0.00

	Target
Level	2

Raw Data			
	Port 0	Port 1	Port 2
Errors	0	0	0
Bits	0.00E+00	0.00E+00	0.00E+00
Resets	0	0	0
Output (mV)	0	0	0
Data Rate	0	0	0

	Failure at:
Errors	10

Confidence UUT is Compliant			
BER	Port 0	Port 1	Port 2
1.00E-10	0.000%	0.000%	0.000%
1.00E-11	0.000%	0.000%	0.000%
1.00E-12	0.000%	0.000%	0.000%

Bits required to reach risk goal			
BER	Port 0	Port 1	Port 2
1.00E-10	7.083E+09	7.083E+09	7.083E+09
1.00E-11	7.083E+10	7.083E+10	7.083E+10
1.00E-12	6.418E+10	6.418E+10	6.418E+10
Continuous	1.938E-22	1.938E-22	1.938E-22

Bits remaining to reach risk goal			
BER	Port 0	Port 1	Port 2
1.00E-10	7.083E+09	7.083E+09	7.083E+09
1.00E-11	7.083E+10	7.083E+10	7.083E+10
1.00E-12	6.418E+10	6.418E+10	6.418E+10
Continuous	1.938E-22	1.938E-22	1.938E-22

Figure 31 - View of templateReceive excel sheet paramaters

6 Calibration/Configuration

6.1 Test Amplitude Level

The Test Amplitude and Calibration and the SQT amplitude are intermixed so both are discussed in this section. Both of these abilities are found on the Configure tab at the top right of the SQT application.

6.2 Near End and Far End Measurements

The amplitude coming out of the QP-SQT C-1, C-2 and C-3 port output levels may be measured at the Near End (at the SQT) or Far End (at the end of the cable connected to the SQT).

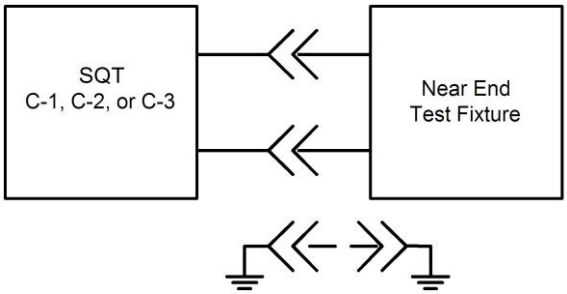

Figure 32 - Near End Measurement Block Diagram.

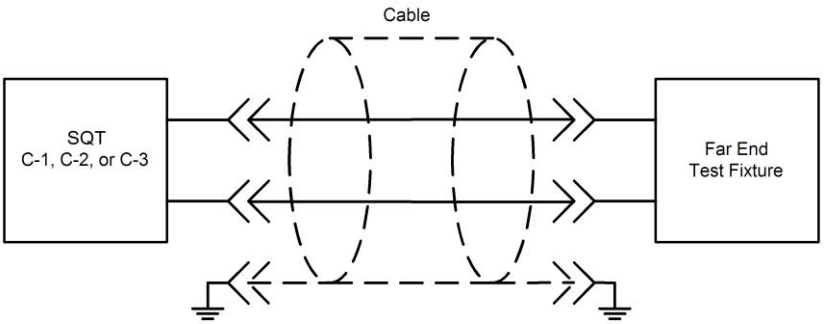

Figure 33 - Far End Measurement Block Diagram.

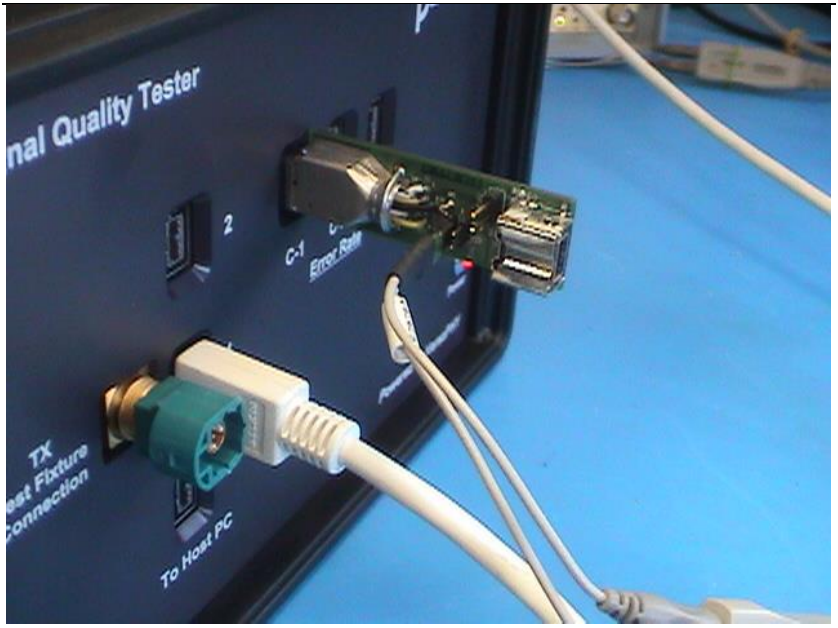

Figure 34 - C-1 Near End signal amplitude measurement.

Figure 35 - SQT to 38999 Far End test fixture setup.

Figure 36 - C-1 Far End signal amplitude measurement.

6.3 Observing Output Levels

The C-1, C-2, and C-3 may be observed by connecting the appropriate near end or far end test fixture to the desire port. Connect an oscilloscope to the appropriate test point on the test fixture. At this point tones from that port should be observable. An IEEE-1394b (beta) tone is a ~666us set of ~50MHz signals.

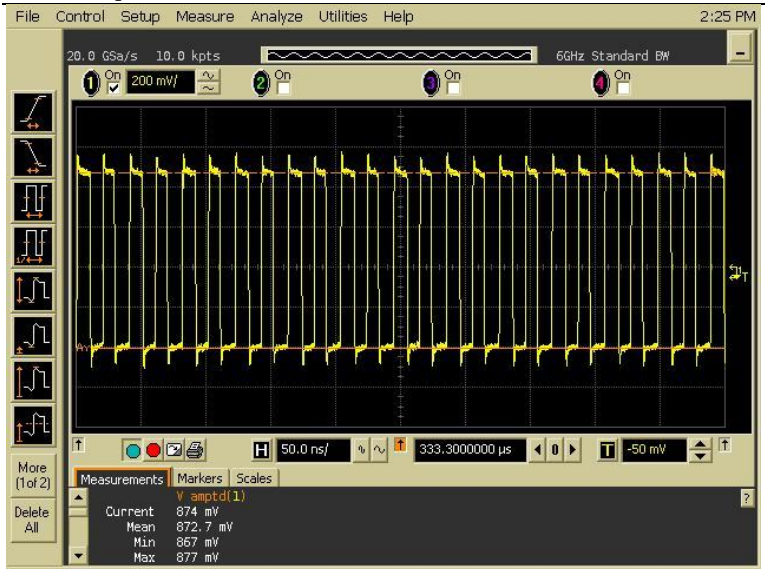

Figure 37 - Small Section of IEEE-1394b (beta) Tone

QP recommends setting the oscilloscope trigger, scale, and measurement as follows:

- Vertical scale to 200mV to 300mV
- Horizontal scale to 50ns
- Trigger to edge with a level of +/-50mV to +/-200mV
- Trigger delay to 333us (this will put the visible waveform roughly in the middle of the tone)
- Enable the Voltage Amplitude measurement. The actual 1 or 0 amplitude is ½ the amplitude level provided by this measurement therefore the TEST LEVEL * 2 should approximately equal the Voltage Amplitude measurement.

6.4 When to Calibrate

In general, the SQT shouldn't need to be calibrated by the customer. The calibration values set by QP should be correct for that SQT. However there are cases, which QP is working to resolve, when re-calibration may be necessary. Additionally, in

the past it was common for customers to calibrate the SQT for changes in cable media. However QP would like to suggest that the Near End calibration values are adequate and should never be changed.

The Far End values indicate the attenuation of the cable media (Near End value – Far End value) and should be a fixed subtractor from the Near End value. Therefore, one Far End measurement should be adequate to determine the attenuation of the cable used for that test. The user should simply add that attenuation amount to the TEST LEVEL to achieve the desired level at the Far End.

Example: If the SQT output level is set[2] to 300mV and the Far End measurement yields 250mV then the test operator can assume the actual signal level at the Far End of the cable is always 50mV less than the voltage indicated by the SQT application for that cable. If the test operator wishes to achieve a Far End level of 300mV then they would set the TEST LEVEL to 350mV.

6.5 Adjust Test Levels

As mentioned in the previous section the user should rarely need to re-calibrate the SQT output. However the user may wish to adjust the output levels of C-1, C-2, and C-3 often.

Adjust All Ports

To adjust the output levels of all SQT Error Rate ports at one time:

- Select the Configure tab then
- Type the desired level into the *Default Test Level all port (mV)* entry section.

[2] Assumes SQT was calibrated using Near End measurement values.

- Once the level has been entered, select the Set button in that section.
- Once the Set button is selected the output is immediately changed.
- If the user wishes to make the new level the Default then the Save Changes button in the *Calibration Update* section should be selected.

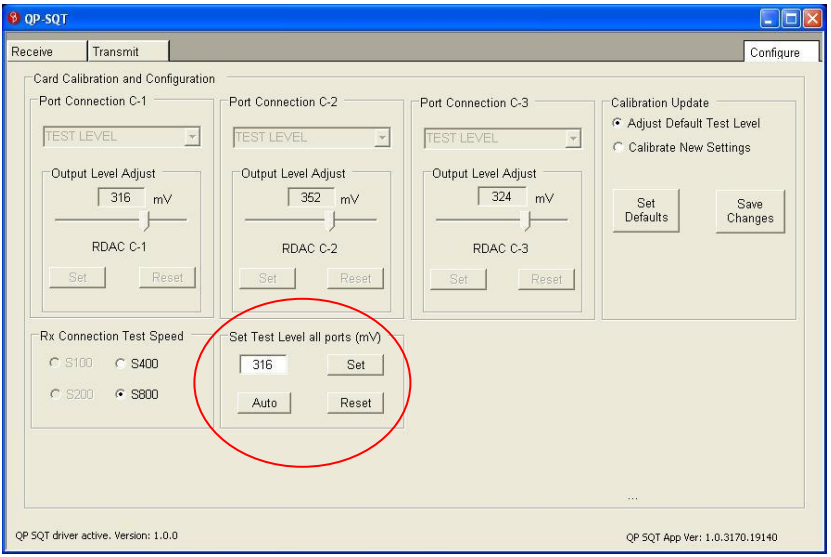

Figure 38 - Adjust output levels of all outputs.

Adjust Individual Ports

To adjust the output levels of C-1, C-2, or C-3 individually:

- The Calibrate New Settings radial button within the *Calibration Update* section should be selected.
- Once the radial button has been selected the three *Port Connection C-n* sections will become active.
- Using the pull down for the desired port select the TEST LEVEL option.
- Type the desired level into the Output Level Adjust.
- Once the desired level is entered select Set in that section.

- Once the Set button is selected the output is immediately changed.
- If the user wishes to make the new level the Default then the Save Changes button in the *Calibration Update* section should be selected.

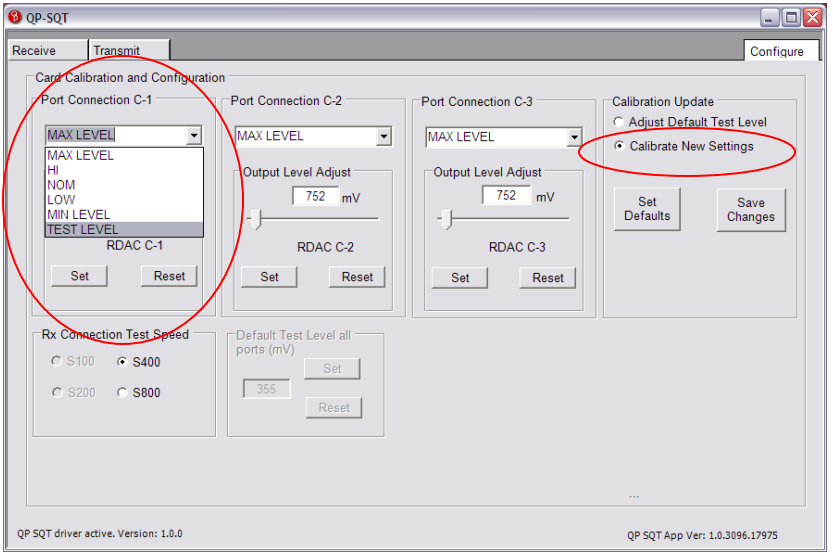

Figure 39 - Selecting TEST LEVEL option.

6.6 Calibrate

Calibration should only be needed if a major change to the SQT software required a new SQT_MOD.cfg file. In the future QP will change the application to protect against this as well.

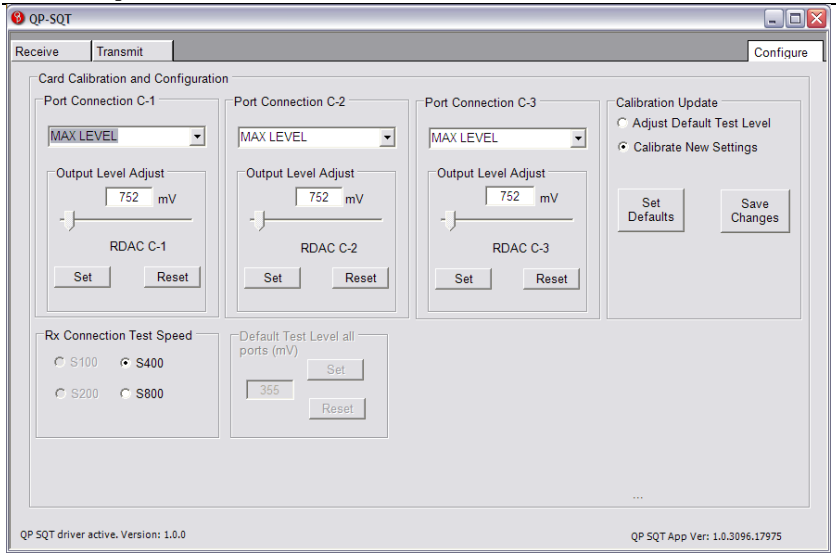

Figure 40 - Calibration Area.

Calibration Overview

To calibrate, an oscilloscope must be used to measure the voltage level for 5 points:

- MAX LEVEL
- HI
- NOM
- LOW
- MIN LEVEL

The user selects one of the 5 levels, measures the voltage, and then inputs the measured voltage in mV. This process is repeated for all 5 points.

From these 5 points, the SQT software calculates the TEST LEVEL requested by the user.

Astek calibrates each SQT C-1, C-2, and C-3 output at the near end before shipping to the customer.

Calibration Procedure

1. Open the QP SQT application and make sure the SQT box is connected.
2. Click the Configure tab
3. Select the Calibrate New Settings radial button in the Calibration Update section
4. For Port Connection C-1 do the following:
    a. Select the Level pull down menu and select MAX LEVEL
        i. Using an Oscope, please measure the amplitude of the waveform on screen using the method defined below.
        ii. Once measured, please enter the value into the Output Level Adjust text box
        iii. Select the Set button
    b. Select the Level pull down menu and select HI
        i. Follow the steps ii – iii as was done in part a.
    c. Follow the same process for NOM, LOW, and MIN LEVEL
5. Repeat Step 4 for C-2 and C-3

Measuring Amplitude procedure

This test procedure assumes toning will be used to measure signal amplitude and a QP far-end test fixture is used to terminate the signal and provide Oscope connection points.

1. Set the scope to trigger on CHn, rising edge, >50mV.
2. Set the scope so that the measurement is taken 333us after trigger (usually through horizontal delay)
3. Set the horizontal scale to 50ns/div.
4. Attach the far-end test fixture to the cable which is connected to the SQT Error Rate ports (C-1, C-2, C-3)
5. Attach CHn probe to the TPB's signal test points.
6. The scope should now be triggering on tones (~50Mhz ~50% duty cycle square wave) and displayed to the screen (please see Figure 37).
7. Now set up the scope to measure amplitude for CHn (scope dependent) and divide the mean value by 2.
8. This is the value that should be entered into the text box for CHn, and then select the SET button to save the value. NOTE: make sure to clear out the previous amplitude measurement between measurements.

*Note: In order to calibrate for the Near-End of the SQT box, follow the same steps as above using a Near-End Test Fixture plugged directly into the SQT.

7 System Requirements and Installation

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

A National Instruments IEE488 GPIB or compatible adaptor is required.

A digital sampling oscilloscope with appropriate probes is required.

MS Excel version Office 2003 is required.

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

7.1 Software Installation

1. This installation requires any version of Win-XP 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. If multiple OHCI devices are detected, the QPInstaller will prompt for a device selection after the “QP SQT Tester” installation completes. Select the OHCI device that you want to install the driver for and click ‘OK’.
   - The first run of the application will install the QPTntVdrv virtual device driver. You will be prompted through this operation with the “Found New Hardware Wizard”. This installation will only occur on the initial run of the “QP SQT Tester”
   - You are now ready to start using the “QP SQT Tester”

8 Error Rate Port Parametrics

QP-SQT-4 and -8 Receive Tester C-1, C-2 and C-3 Output Characteristics

Nominal Temperature (25ºC)

Please see the Calibration/Configuration section for details of how to calibrate the outputs.

Output	Min	Typ	Max	Units	Comments
Guaranteed TPB Differential Output Level (-4 and -8)	200[3]		675[4]	mV	Applies to all Rx Tester ports
[5]Variation in TPB Differential Output Level from Minimum to Maximum Level (-4 and -8)	-15	-/+ 6	+15	mV	Applies to all Rx Tester ports

[3] Levels below 200mV may be obtained but are not guaranteed.
[4] Levels above 675mV may be obtained but are not guaranteed.
[5] At levels below 200mV and above 675mV the variation may exceed these levels

9 How to Contact Astek Corporation

Astek may be contacted
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(719) 260-1625 (USA)

or by email at:

astek@astekcorp.com or visit our web site at:

www.astekcorp.com

