

# Granite River Labs

## USB4™ Return Loss Test MOI & User Guide Using

## Keysight E5071C ENA Vector Network Analyzer and GRL-USB4RL-KS Automation Software

All product names are trademarks, registered trademarks, or service marks of their respective owners.

The GRL disclaims all warranties and liability for the use of this document and the information contained herein and assumes no responsibility for any errors that may appear in this document, nor does the GRL make a commitment to update the information contained herein.

Contact the GRL office to obtain the latest revision of this document.

Questions regarding this document in the GRL may be forwarded to:

Granite River Labs 3500 Thomas Road, Suite A, Santa Clara, CA 95054

Phone: 408-627-7608 Fax: 408-912-1810

E-mail: [info@graniteriverlabs.com](mailto:info@graniteriverlabs.com)

<http://www.graniteriverlabs.com>

### DISCLAIMER

This document is provided “as is” with no warranties whatsoever, including any warranty of merchantability, no infringement, fitness for any particular purpose, or any warranty otherwise arising out of any proposal, specification, or sample. The GRL disclaims all liability for infringement of proprietary rights, relating to use of information in this specification. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted herein.

All product names are trademarks, registered trademarks, or service marks of their respective owners.



Copyright © 2021 Granite River Labs. All rights reserved.

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION</b>	<b>7</b>
<b>2</b>	<b>RESOURCE REQUIREMENTS</b>	<b>8</b>
2.1	EQUIPMENT REQUIREMENTS .....	8
2.2	SOFTWARE REQUIREMENTS.....	9
<b>3</b>	<b>INSTALLATION AND SETUP OF GRL-USB4RL-KS SOFTWARE</b>	<b>10</b>
3.1	DOWNLOAD GRL-USB4RL-KS SOFTWARE.....	10
3.1.1	Connect Keysight ENA Vector Network Analyzer with PC .....	12
3.1.2	Download and Install USB4 Electrical Test Tools (ETT) .....	13
3.1.3	Download and Install E5071C-TDR Remote Control Software.....	13
3.1.4	Launch and Set Up Software .....	15
<b>4</b>	<b>TIME AND FREQUENCY DOMAIN CALIBRATION SETUPS</b>	<b>17</b>
4.1	ELECTRONIC CALIBRATION (ECAL) CALIBRATION SETUP .....	17
4.2	MANUAL CALIBRATION .....	17
<b>5</b>	<b>CALIBRATING WITH GRL-USB4RL-KS SOFTWARE</b>	<b>19</b>
5.1	SELECT CALIBRATION .....	19
5.2	CONFIGURE CALIBRATION PARAMETERS .....	19
5.3	RUN CALIBRATION .....	20
<b>6</b>	<b>CONFIGURE PROPER SETUP IN CONFIGURATIONS MENU</b>	<b>21</b>
6.1	HOST DUT SETUP .....	21
6.2	DEVICE DUT SETUP FOR UFP.....	22
6.3	DEVICE DUT SETUP FOR DFP .....	22
<b>7</b>	<b>PERFORM TRACE GATING</b>	<b>23</b>
<b>8</b>	<b>DUT COMPLIANCE TESTING WITH GRL-USB4RL-KS SOFTWARE</b>	<b>24</b>
8.1	SELECT TESTS .....	24
8.2	CONFIGURE TEST PARAMETERS .....	24
8.3	PERFORMING IMPEDANCE AND RETURN LOSS MEASUREMENT .....	26
<b>9</b>	<b>TEST RESULTS AND REPORTS WITH GRL-USB4RL-KS SOFTWARE</b>	<b>28</b>
9.1	GENERATE TEST REPORT .....	28
9.1.1	DUT Information.....	29
9.1.2	Summary Table .....	29

9.1.3 Test Result Details..... 30

9.2 DELETE REPORTS ..... 31

**10 TROUBLESHOOTING GRL-USB4RL-KS ERRORS 32**

## **List of Figures**

Figure 1. Launching GRL Software Framework.....	10
Figure 2. Launching GRL-USB4RL-KS Application .....	11
Figure 3. License Details.....	11
Figure 4. Installed Application .....	11
Figure 5. Connecting Keysight ENA with Control PC .....	12
Figure 6. Setting ENA and PC Network .....	12
Figure 7. GRL Test Solution IP Addressing on Keysight ENA and TDR .....	15
Figure 8. Session Info Page .....	15
Figure 9. Select Test Port .....	16
Figure 10. Select Data Rate .....	16
Figure 11. ECal Calibration Setup for Time Domain And Frequency Domain Calibration .....	17
Figure 12. Manual Calibration Setup for Time and Frequency Domain Calibration .....	18
Figure 13. Software Calibration Guide Example .....	18
Figure 14. Select Calibration Types .....	19
Figure 15. Calibration Configuration Page .....	19
Figure 16. Run Tests Page .....	20
Figure 17. Test Setup for Host DUT .....	21
Figure 18. Configure Host DUT Example in GRL-USB4RL-KS Software.....	22
Figure 19. Configure Device DUT (UFP) Example in GRL-USB4RL-KS Software .....	22
Figure 20. Select and Run Trace Gating .....	23
Figure 21. Select Rx Measurement Tests.....	24
Figure 22. Select Tx Measurement Tests .....	24
Figure 23. Test Configuration Page .....	25
Figure 24. Run Tests Page .....	26
Figure 25. View Test Results Example .....	27
Figure 26. Generate Report Page.....	28
Figure 27. DUT Information .....	29
Figure 28. Summary Table .....	29
Figure 29. Test Result Details Example .....	30
Figure 30. Delete Individual Calibration/Test Results Example .....	31
Figure 31. Delete All Results.....	31

List of Tables

Table 1. Equipment Requirements – Systems ..... 8

Table 2. Equipment Requirements – Accessories..... 8

Table 3. Software Requirements ..... 9

Table 4. Calibration Parameters ..... 19

Table 5. Run Options ..... 20

Table 6. Test Parameters ..... 25

# **1 Introduction**

This MOI & User Guide documentation describes how to perform automated Calibration and Testing of the USB4™ Return Loss using the Keysight (E5071C) ENA Vector Network Analyzer and GRL-USB4RL-KS Automation Software.

The GRL automation software includes calibrating for time and frequency domain and measuring impedance and return loss for USB4 devices under test. When combined with a satisfactory level of interoperability testing, these tests provide a reasonable level of confidence that the device under test will function properly in many USB4 environments.

This MOI & User Guide documentation mainly covers the following for USB4 Return Loss calibration and testing.

1. Equipment required for calibration and testing.
2. GRL-USB4RL-KS Automation Software setup for calibration and testing.
3. Specification Standard automated calibration and test procedures.

## 2 Resource Requirements

### 2.1 Equipment Requirements

TABLE 1. EQUIPMENT REQUIREMENTS – SYSTEMS

System	Qty	Description	Key Specification
ENA Vector Network Analyzer (ENA)	1	Keysight E5071C 4-Port ENA Vector Network Analyzer <ul style="list-style-type: none"> <li>E5071C-010 – Time Domain Analysis</li> <li>E5071C-TDR – Enhanced Time Domain Analysis</li> <li>E5071C-4K5 – 4-Port Test Set, 300kHz to 20GHz with Bias Tees</li> </ul> Firmware Version: B.14.14 or above	20GHz 130dB max

TABLE 2. EQUIPMENT REQUIREMENTS – ACCESSORIES

Accessory	Qty.	Description	Key Specification
Computer	1	External PC for running GRL-USB4RL-KS Software	Windows 7+ OS
Calibration Kit	1	Keysight N4433A Electronic Calibration Module (ECal)	300kHz to 20GHz, 3.5mm, 4-port
	1	Anritsu TOSLKF50A-20 Coaxial Calibration Kit	Type K(f), DC to 20GHz, 50 ohms
USB4 Microcontroller	1	Wilder-Tech USB4 Gen3 $\mu$ Controller (USB4-TPA-UC-K, Kit Part No. 640-0961-000)	Optional for some test configurations, see Section 3.1.2
USB4 Test Fixture	1	Wilder-Tech USB4 CIO Plug board (USB4-TPA-UC-K, Kit, Part No. 600-1191-100)	
SMA-SMP Adapter or SMA-SMP Cables	4	Rosenberger 02K118-K00S3 Straight RPC-2.92 Jack-Mini-SMP Jack Adapter - Or - Wilder-Tech Part No. 415-0080-004 – 9” High Performance Phase Aligned Flexible Coaxial Cables w/ Female 2.92mm to Female SMP	DC to 40 GHz, 50 ohms
Matched Cable Pairs	2 pairs	Rosenberger UFC142A 2.92m (x2), 1m SMA cable	Phase matched $\pm 2^\circ$ at 40GHz Insertion loss 1dB max in 10GHz

**Note that gentle handling of the fixture coaxial cable connections is required to avoid damage. For instance, when connecting to the fixture, the coaxial cables should not be twisted, bended, or have tension applied where possible. The fixture should also be connected to the DUT prior to making any**



***SMP connections. Refer to the user documentation by Wilder Technologies for the full list of precaution steps to observe when using the cables.***

## **2.2 Software Requirements**

TABLE 3. SOFTWARE REQUIREMENTS

<b>Software</b>	<b>Source</b>
GRL-USB4RL-KS	Granite River Labs USB4 Return Loss Calibration and Test Automation Software – <a href="http://www.graniteriverlabs.com">www.graniteriverlabs.com</a> (Support > Download Center)
VISA (Virtual Instrument Software Architecture) API Software	VISA Software is required to be installed on the host PC running GRL-USB4RL-KS software. GRL's software framework has been tested to work with all three versions of VISA available on the Market:  1. NI-VISA: <a href="http://www.ni.com/download/ni-visa-17.0/6646/en/">http://www.ni.com/download/ni-visa-17.0/6646/en/</a> 2. Keysight IO Libraries: <a href="http://www.keysight.com">www.keysight.com</a> (Search on IO Libraries) 3. Tektronix TekVisa: <a href="http://www.tek.com">www.tek.com</a> (Downloads > Software > TekVisa)
USB4 Electrical Test Tool (ETT)	Downloadable from USB-IF's website. See Section 3.1.2 for more details.
E5071C-TDR Remote Control Software	The E5071C-TDR Remote Control Software has two installers, each for 32-bit CPU and 64-bit CPU. Download the appropriate installer package on your PC.

### 3 Installation and Setup of GRL-USB4RL-KS Software

This section provides procedures for installing, configuring, and verifying the operation of the GRL USB4 Return Loss Test solution and USB4 electrical test toolset. It also helps you familiarize with the basic operation of the GRL-USB4RL-KS software.

The software installer automatically creates shortcuts in the Desktop and Start Menu.

To open the application, follow the procedure in the following section.

#### 3.1 Download GRL-USB4RL-KS Software

Install, launch and set up the GRL-USB4RL-KS software on a PC (where the GRL-USB4RL-KS is referred to as ‘Control PC’ in this MOI & User Guide).

1. Install VISA (Virtual Instrument Software Architecture) on to the PC where GRL-USB4RL-KS is to be used (see Section 2.2).
2. Download the software ZIP file package from the Granite River Labs support site.
3. The ZIP file contains:
  - **GRLUSB4ReturnLoss00xxxxxxxSetup** – Run this on the PC to install the application.
  - **GRLUSB4ReturnLossSetupFileInstallation00xxxxxxxSetup** – Run this on the ENA to install the proper setup files.
4. Launch and set up the software as follows:
  - a) Open the **GRL** folder from the Windows Start Menu. Click on **GRL – Automated Test Solutions** within the GRL folder to launch the GRL software framework.

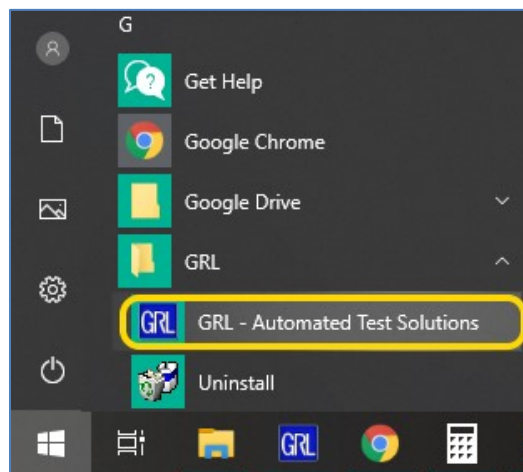


FIGURE 1. LAUNCHING GRL SOFTWARE FRAMEWORK

- b) From the **Application → Framework Test Solution** drop-down menu, select **USB4 Return Loss Test Application**. If the selection is grayed out, it means your license has expired.

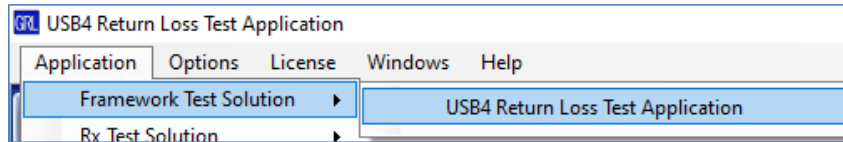


FIGURE 2. LAUNCHING GRL-USB4RL-KS APPLICATION

- i) To enable license, go to **License** → **License Details**.

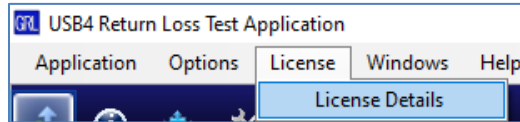


FIGURE 3. LICENSE DETAILS

- ii) Review the installed application.

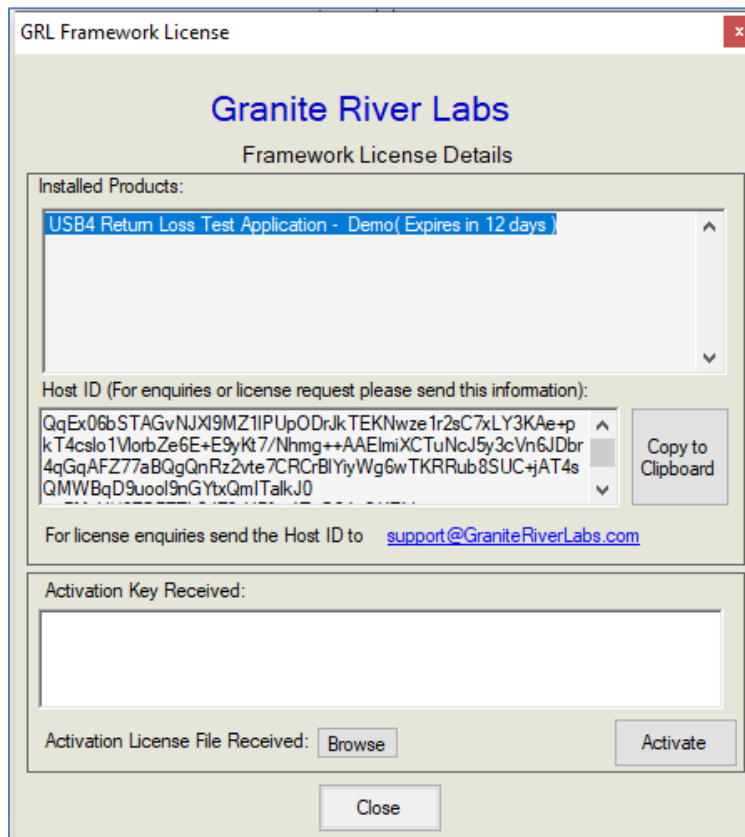


FIGURE 4. INSTALLED APPLICATION

- iii) Activate a License:

- [1] If you have an Activation Key, please enter it in the box provided and select **Activate**.
- [2] If you do not have an Activation Key, select **Close** to use the software for 10 days free of charge.

**Note:** Once the 10-day trial times out, you will need to request an Activation Key for future usage on the same PC. The demo software is also limited in its capability, in that it will only calibrate the

maximum frequency for each data rate. Thus, the demo version cannot be used to fully calibrate and test a device.

For Demo and Beta Customer License Keys, please request an Activation Key by contacting [support@graniteriverlabs.com](mailto:support@graniteriverlabs.com).

### 3.1.1 Connect Keysight ENA Vector Network Analyzer with PC

1. Connect the Keysight ENA with the Control PC using an Ethernet cable.

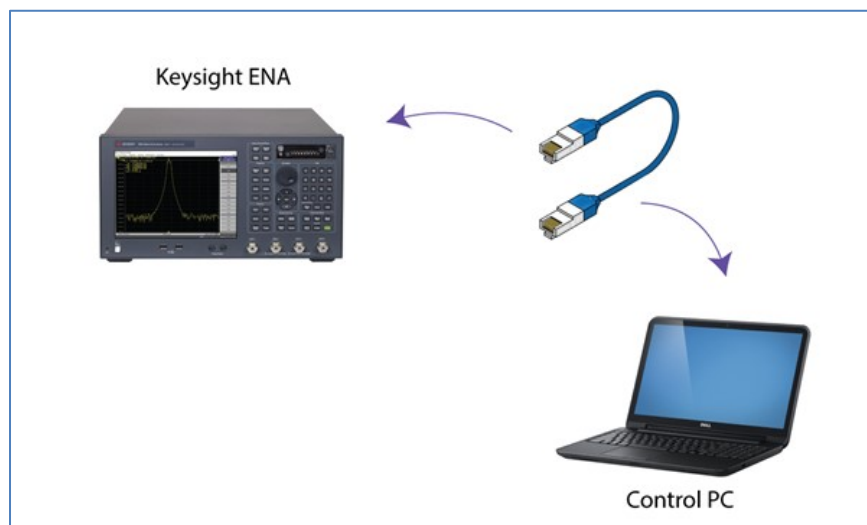
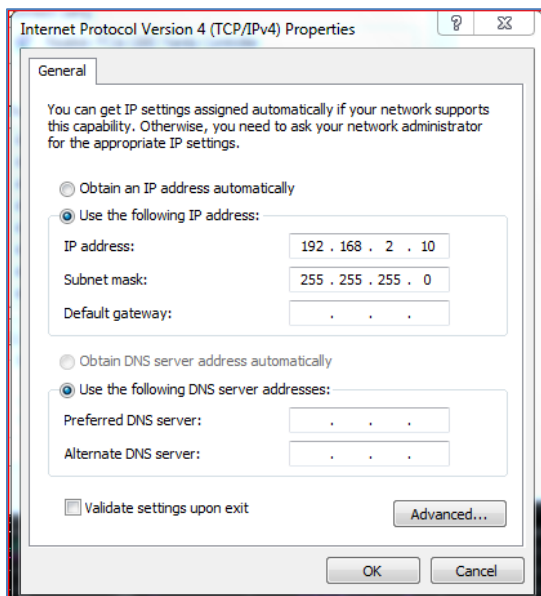
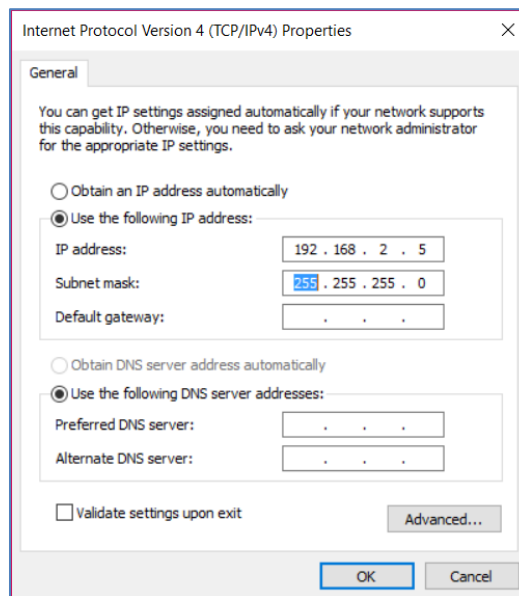


FIGURE 5. CONNECTING KEYSIGHT ENA WITH CONTROL PC

2. Set both ENA and PC to the same network.



ENA



Control PC

FIGURE 6. SETTING ENA AND PC NETWORK

### 3.1.2 Download and Install USB4 Electrical Test Tools (ETT)

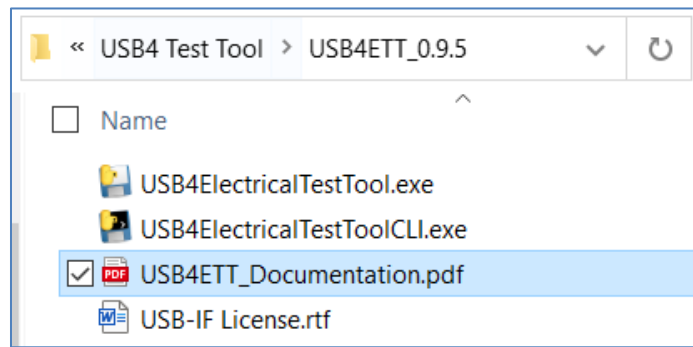
For USB4 Return Loss measurements, the Host/Device's CIO PHY must be in an active state during testing. Its transmitters shall be transmitting PRBS-31 into the ENA measurement channel during testing and its receivers shall have their terminations enabled during testing. Thus, a PHY microcontroller must be used to put the DUT into the right state for return loss testing.

#### Download ETT:

Visit the USB-IF official website and download "USB4 Electrical Test Tool" (ETT) at <https://www.usb.org/usb4tools>.

#### Install ETT:

Before running ETT, configure the Control PC's environment using the instructions in **USB4ETT\_Documentation.pdf** from the ETT package downloaded from USB-IF.



#### For USB4 Host Testing:

- The ETT can be loaded on the Control PC with the GRL-USB4RL-KS software. In this case, the Wilder-Tech  $\mu$ Controller is required. The DUT is controlled using an Apple 0.8m USB Type-C® cable from the Wilder-Tech  $\mu$ Controller to the Wilder-Tech USB4 Test Fixture.

#### For USB4 Device Testing:

- **Upstream Facing Port (UFP):** The ETT can be loaded on the Control PC with the GRL-USB4RL-KS software. In this case, the Wilder-Tech  $\mu$ Controller is required. The DUT is controlled using an Apple 0.8m USB Type-C cable from the Wilder-Tech  $\mu$ Controller to the Wilder-Tech USB4 Test Fixture.
- **Downstream Facing Port (DFP):** Connect the DUT's UFP to any USB4 host via the USB4 based USB-C® cable. The ETT tools can be loaded on the Control PC with the GRL-USB4RL-KS software. In this case, the Wilder-Tech  $\mu$ Controller is required. The DUT is controlled using an Apple 0.8m USB Type-C cable from the Wilder-Tech  $\mu$ Controller to the Wilder-Tech USB4 Test Fixture.

*\*Disclaimer: USB Type-C® and USB-C® are registered trademarks of USB Implementers Forum.*

### 3.1.3 Download and Install E5071C-TDR Remote Control Software

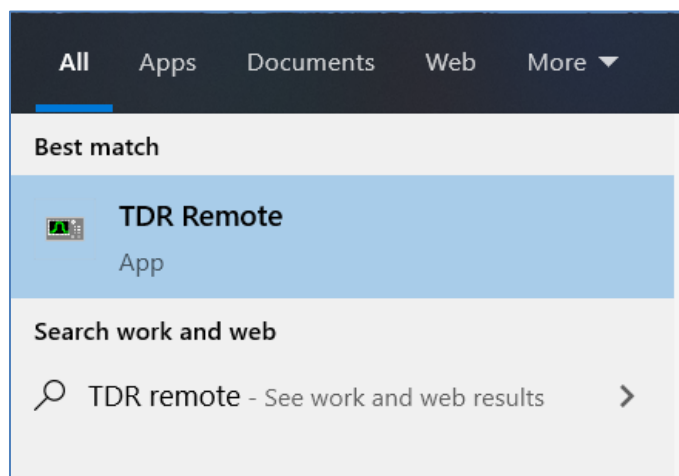
For USB4 Return Loss measurements, the ENA TDR function is used to measure impedance. To control the TDR function correctly, the E5071C-TDR remote control software must be installed on the Control PC with the GRL-USB4RL-KS software.

#### Download and Configure E5071C-TDR Remote Control Software:

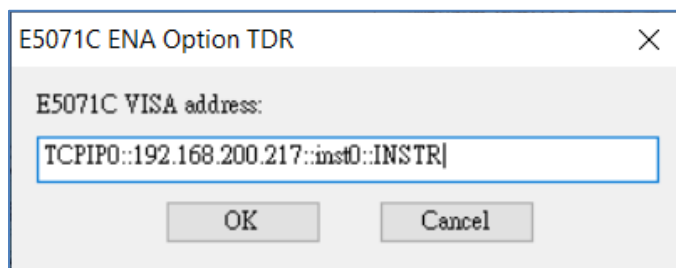
Visit Keysight's official website to download and install the "E5071C-TDR Remote Control Software".

Follow the instructions below to configure the E5071C-TDR remote control software:

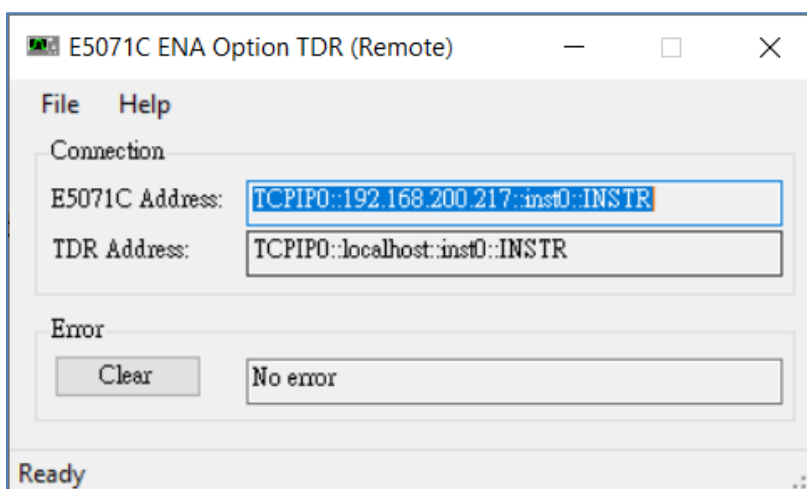
- a) On the Control PC, open the **TDR Remote** software and connect the ENA with the Control PC via GPIB, LAN or USB cable.



- b) Type in the VISA address and click **OK**.



- c) Once the following window appears, the E5071C-TDR remote control software is ready to be used with the GRL-USB4RL-KS software.



## 3.1.4 Launch and Set Up Software

### 3.1.4.1 On the Control PC

1. Launch GRL Host Application from Start Menu -> GRL -> GRL – Automated Test Solutions.
2. Select Application -> Framework Test Solution -> USB4 Return Loss Test Application.
3. Type in the respective IP Address of the Keysight ENA and TDR into the “Address” field and click the “lightning” button (⚡). The “lightning” button should turn green (⚡) if successfully connected to the ENA and TDR.

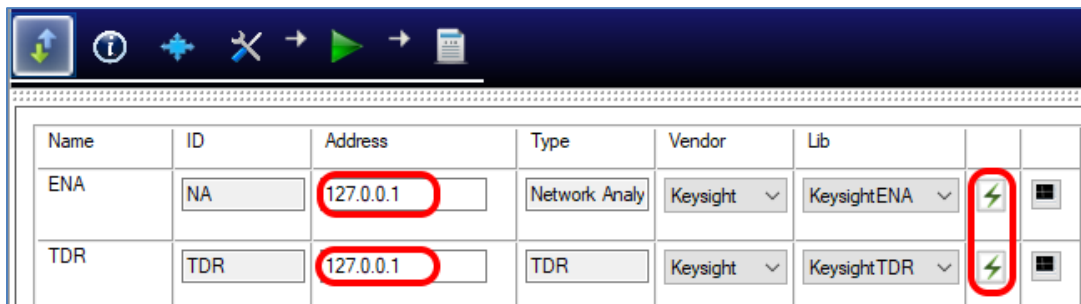



FIGURE 7. GRL TEST SOLUTION IP ADDRESSING ON KEYSIGHT ENA AND TDR

### 3.1.4.2 Session Info

Select the  button in the main software menu to access the Session Info page. The information provided will be included in the report.

- The **DUT Info** and **Test Info** are input by the user.
- The **Software Info** is automatically populated.

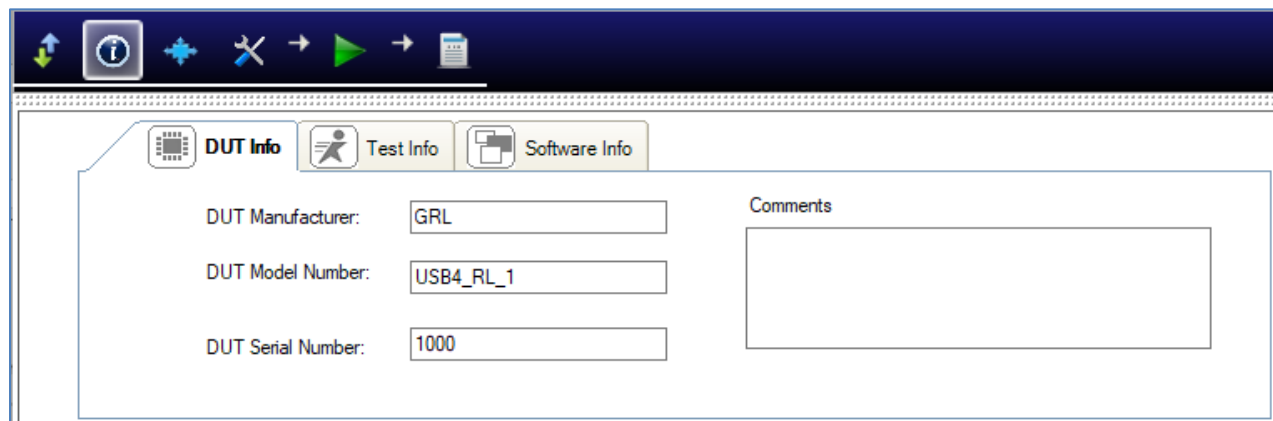



FIGURE 8. SESSION INFO PAGE

### 3.1.4.3 Test Conditions

Select the  button in the main software menu to access the Test Conditions page.

a) **Test Port tab:** Select the test ports on the device under test.

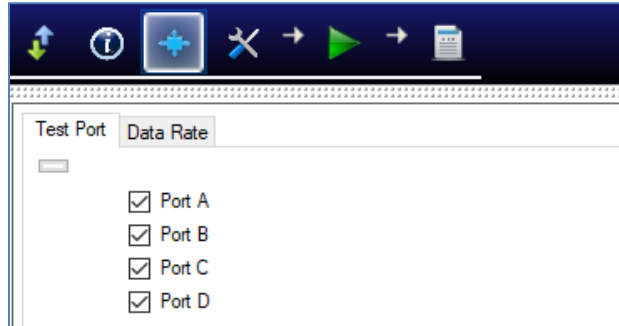


FIGURE 9. SELECT TEST PORT

b) **Data Rate tab:** Select the desired data rate.

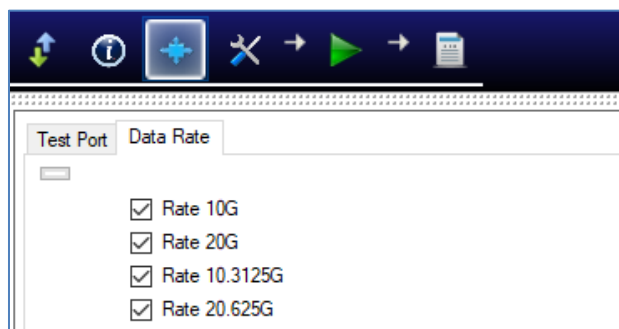


FIGURE 10. SELECT DATA RATE



## 4 Time and Frequency Domain Calibration Setups

Calibration is to be performed for RF effects such as delay, loss or mismatch of RF cables and SMA-SMP adapters using “SOLT” and “Port Extension” calibration methods before running measurements. Calibration must be performed for both the time domain and frequency domain.

*Note: The test fixture is not used for calibration.*

### 4.1 Electronic Calibration (ECal) Calibration Setup

The figure below shows the ECal calibration setup diagram for time and frequency domain, which requires the Keysight N4433A ECal module and Rosenberger SMP jack adapter.

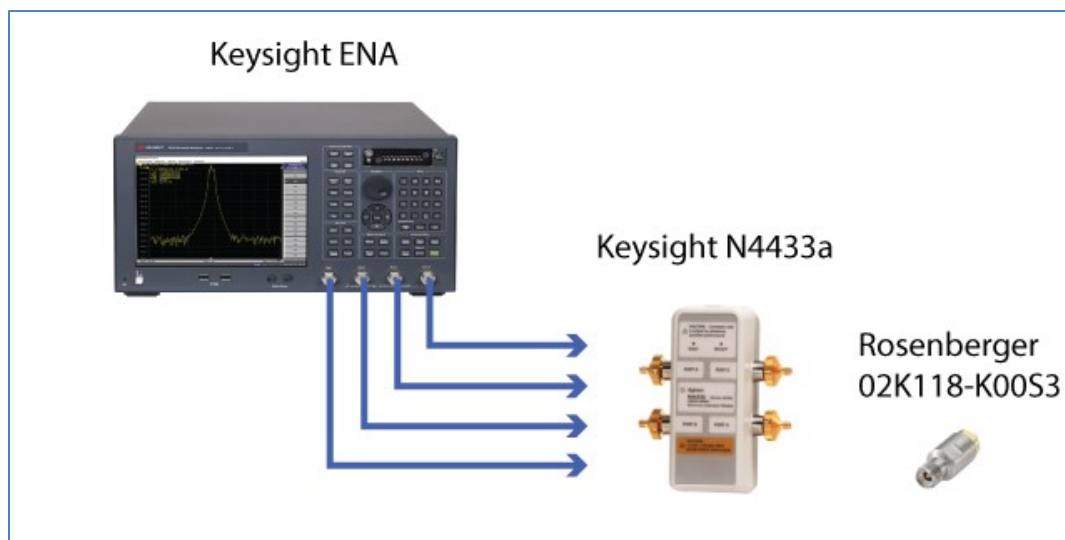


FIGURE 11. ECal CALIBRATION SETUP FOR TIME DOMAIN AND FREQUENCY DOMAIN CALIBRATION

Connect the four ports of the Keysight ENA to the Keysight N4433A ECal module using SMA cables. The GRL-USB4RL-KS software will automatically perform SOLT calibration for both time domain and frequency domain. The Rosenberger SMP jack adapter is required for the Port Extension calibration.

### 4.2 Manual Calibration

The figure below shows the manual calibration setup diagram for time and frequency domain, which requires the Anritsu TOSLKF50A-20 calibration kit and Rosenberger SMP jack adapter.

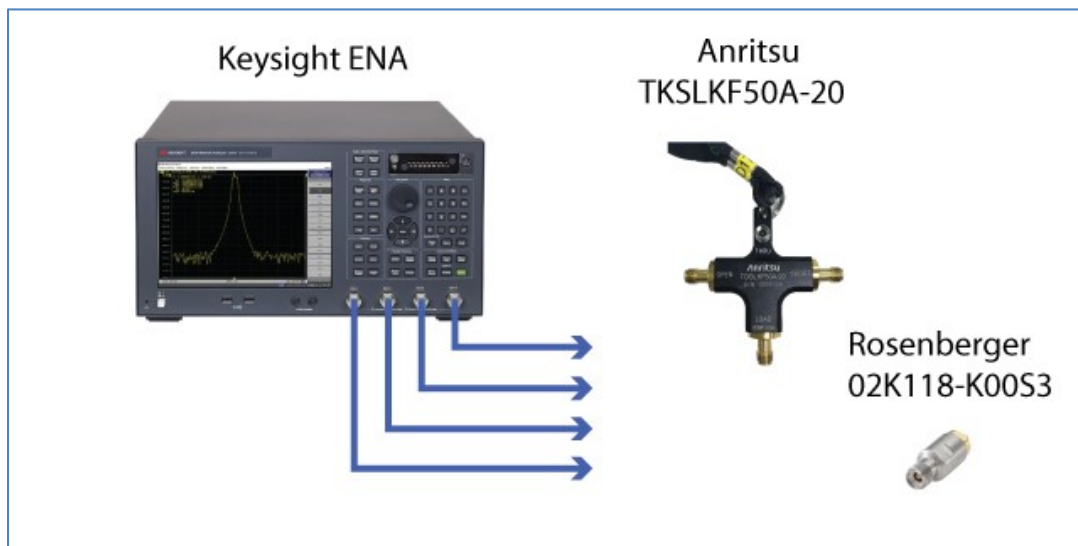
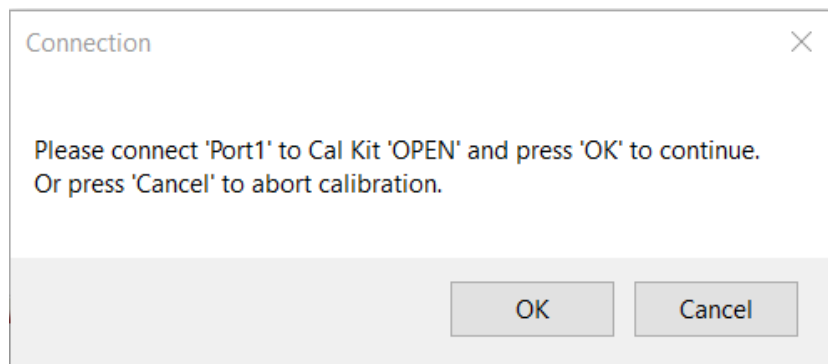


FIGURE 12. MANUAL CALIBRATION SETUP FOR TIME AND FREQUENCY DOMAIN CALIBRATION

*Note: The Anritsu TOSLKF50A-20 calibration kit is required for SOLT calibration, while the Rosenberger SMP jack adapter is required for Port Extension calibration.*

The GRL-USB4RL-KS software will guide user step by step on how to connect the equipment and perform the SOLT calibration and Port Extension calibration.



The following shows another pop-up example by the GRL-USB4RL-KS software to guide user to connect the SMP jack adapter to perform the Port Extension calibration.

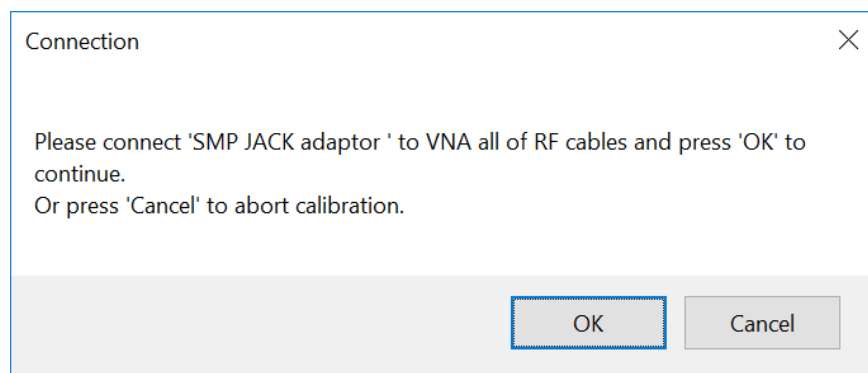


FIGURE 13. SOFTWARE CALIBRATION GUIDE EXAMPLE

## 5 Calibrating with GRL-USB4RL-KS Software

### 5.1 Select Calibration

The Select Tests page is the place where the calibration and tests that need to be performed are selected. Initially, when starting for the first time or changing anything in the setup, it is suggested to run Calibration first. If calibration is not completed, the tests will show an error message.

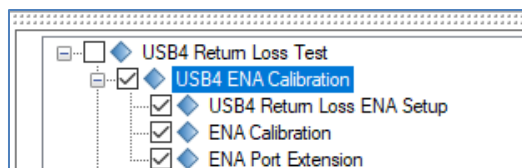



FIGURE 14. SELECT CALIBRATION TYPES

Select the USB4 ENA Calibration group to set up the ENA test environment and perform time & frequency domain and port extension calibration. The GRL-USB4RL-KS software will guide the user step by step while calibration is being run.

*Note: All calibrations must be performed for both the time domain and frequency domain.*

### 5.2 Configure Calibration Parameters

Select the  button in the main software menu to access the Configurations page. Set the parameters required for the calibration setup.

To return all parameters to their default values, select the 'Set Default' button.

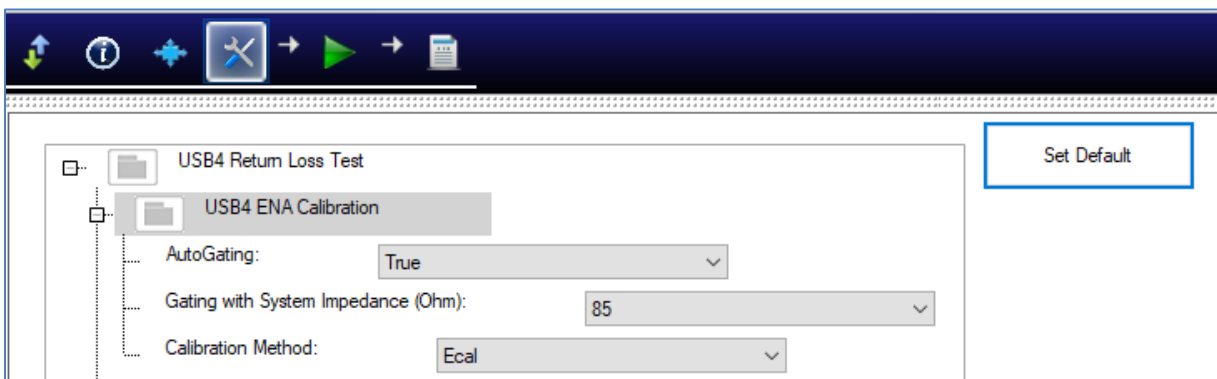



FIGURE 15. CALIBRATION CONFIGURATION PAGE

TABLE 4. CALIBRATION PARAMETERS

Parameter	Description
<b>AutoGating</b>	Select 'True' to enable auto gating method when performing trace gating.
<b>Gating with System Impedance (Ohm)</b>	Select to apply 85 or 100 ohms impedance for trace gating. For compliance testing, 85 ohms should be selected for both calibration and testing.
<b>Calibration Method</b>	Select the calibration kit to be used for calibration– 'Ecal' (Keysight N4433A calibration kit) or 'Manual' (Anritsu TOSLKF50A-20 calibration kit).

5.3 Run Calibration

Select the  button in the main software menu to access the Run Tests page.

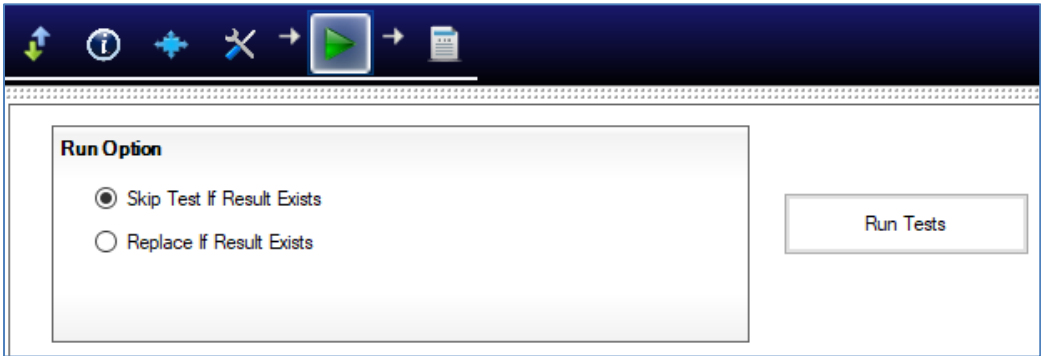


FIGURE 16. RUN TESTS PAGE

TABLE 5. RUN OPTIONS

Run Option	Description
<b>Skip Test if Result Exists</b>	If previous test or calibration results exist, then the software will <i>skip</i> the tests/calibration steps that have existing reports.
<b>Replace if Result Exists</b>	If previous test or calibration results exist, then the software will replace each step in the test/calibration with new results.

If you need to re-run only certain calibration/tests on certain conditions, please delete the calibration/tests from the Report page (see Section 9.2 for example) and Run with **Skip Test if Result Exists**. The GRL-USB4RL-KS software will keep track of the missing calibration/tests in the report and perform those tests only.

## 6 Configure Proper Setup in Configurations Menu

After calibration has completed, testing for DUT compliance can then be performed. The USB4 Return Loss ENA test setup consists of Impedance measurement (informative) and Return Loss measurement on receiver/transmitter lanes of the DUT. The USB4 ETT as listed in Section 2.2 is required to run the automation tests.

Refer to Section 3.1.2 for options on how to configure the test setup. The ETT can be loaded on the control PC. The Wilder-Tech  $\mu$ Controller can be used to test any Host or Device Port. Take note for the device DUT, if the port under test is a Downstream Facing Port (DFP), a USB4 Host will be required to connect to the DUT's Upwards Facing Port (UFP). Follow the steps in the below section for setup depending on the configuration chosen.

*Note that careful handling is needed when making coaxial connections on to the test fixture. Refer to the Wilder-Tech user documentation for detailed precautions (see Section 2.1).*

### 6.1 Host DUT Setup

If testing a Host, and the ETT have been loaded on the Control PC, and the  $\mu$ Controller has been connected to the Control PC via a USB cable, follow the below procedure:

1. Connect the equipment as follows:

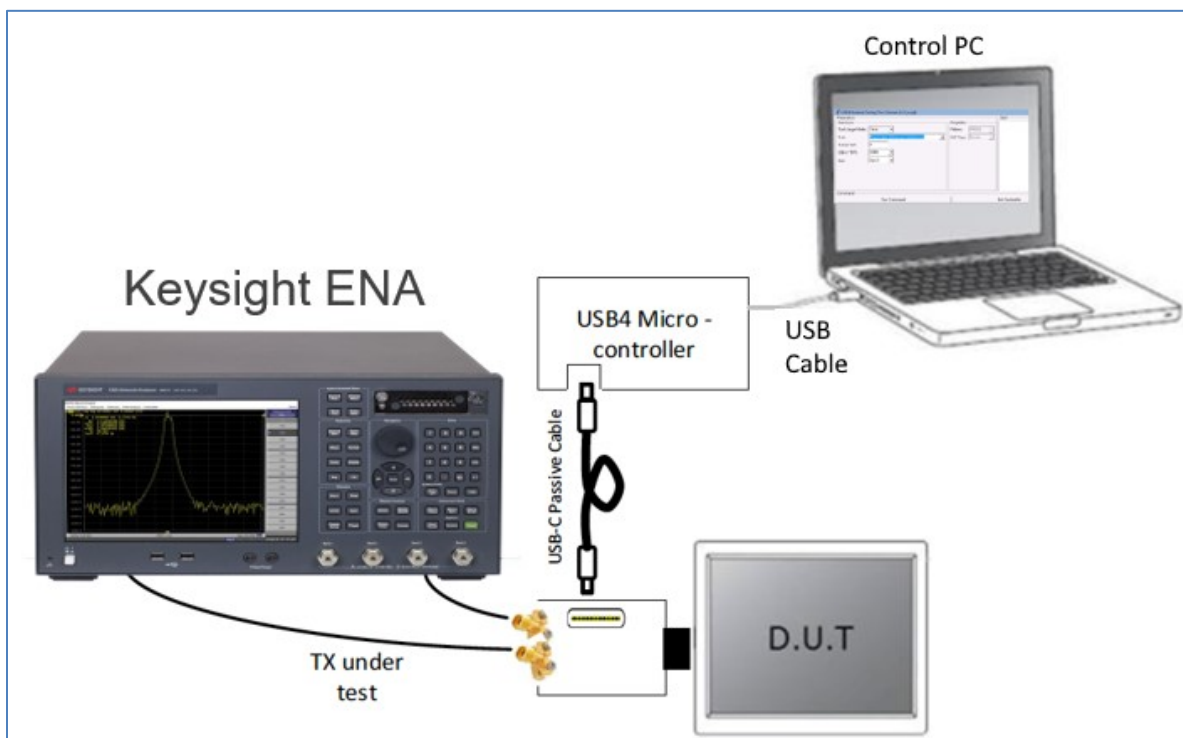

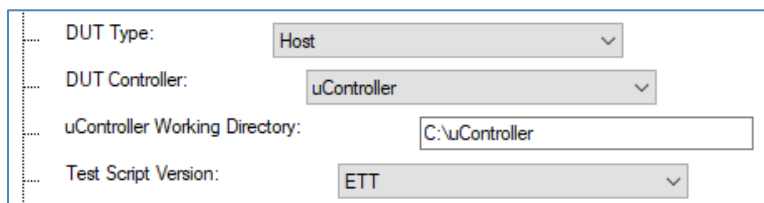


FIGURE 17. TEST SETUP FOR HOST DUT

2. On the main GRL software menu, select the  button to access the Configurations page.
  - a) Select “Host” in the “DUT Type” field.

- b) Select “uController” in the “DUT Controller” field.
- c) Select “ETT” in the “Test Script Version” field.
- d) Specify the directory of the ETT on the Host DUT in the “uController Working Directory” field.



The screenshot shows a configuration window with four fields: "DUT Type" set to "Host", "DUT Controller" set to "uController", "uController Working Directory" set to "C:\uController", and "Test Script Version" set to "ETT".

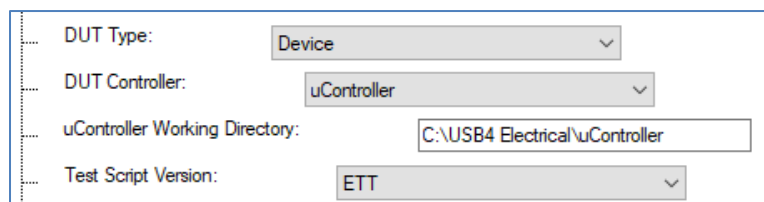
FIGURE 18. CONFIGURE HOST DUT EXAMPLE IN GRL-USB4RL-KS SOFTWARE

### 6.2 Device DUT Setup for UFP

If testing a Device’s UFP, connect the equipment similar to the Host DUT setup in Section 6.1. Then, follow the below procedure:

On the main GRL software menu, select the  button to access the Configurations page.

- a) Select “Device” in the “DUT Type” field.
- b) Select “uController” in the “DUT Controller” field.
- c) Select “ETT” in the “Test Script Version” field.
- d) Specify the directory of the ETT on the USB4 remote host in the “uController Working Directory” field.



The screenshot shows a configuration window with four fields: "DUT Type" set to "Device", "DUT Controller" set to "uController", "uController Working Directory" set to "C:\USB4 Electrical\uController", and "Test Script Version" set to "ETT".

FIGURE 19. CONFIGURE DEVICE DUT (UFP) EXAMPLE IN GRL-USB4RL-KS SOFTWARE

### 6.3 Device DUT Setup for DFP


If testing a Device’s DFP, connect the equipment similar to the Host DUT setup in Section 6.1. Take note that the DUT’s UFP should be connected to a USB4 host port.

Follow the same procedure as for the Device’s UFP setup in Section 6.2 above.

## 7 Perform Trace Gating

Trace gating can be performed to remove SMP connector effects between the SMP jack adapter and the test fixture.

*Note: Prior to running trace gating, make sure that the above relevant test setup (Section 6.1 to 6.3) has been completed.*

1. On the Select Tests page, select “Rx Trace Gating” or “Tx Trace Gating”, and click “Run Tests” under  to start running trace gating.

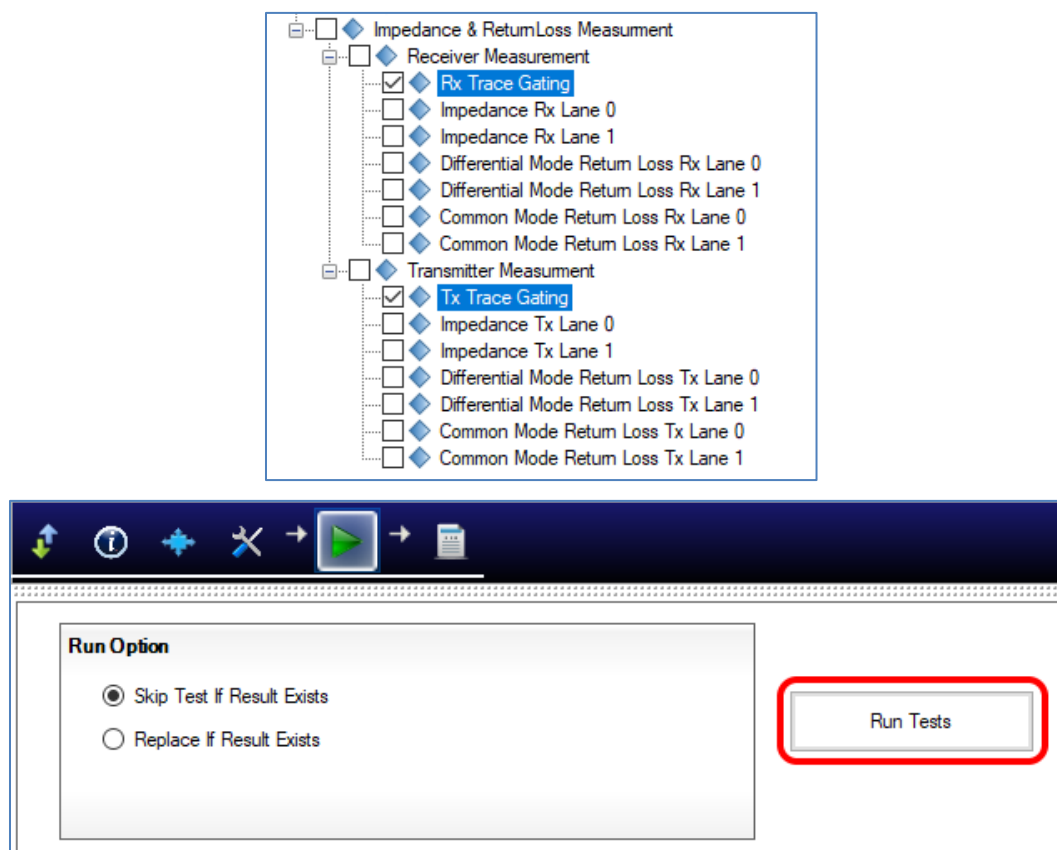


FIGURE 20. SELECT AND RUN TRACE GATING

2. Follow the software instructions step by step to complete the process.

## 8 DUT Compliance Testing with GRL-USB4RL-KS Software

### 8.1 Select Tests

On the Select Tests page, un-check all Calibration Selections as they have been performed and completed in the previous section. Then select the tests required to be run.

**Note: GRL recommends running Rx and Tx Tests Separately in this version of GRL-USB4RL-KS. Otherwise for each data rate a prompt will come up to change from Rx to Tx on the Fixture. If Rx and Tx are tested separately, then all Rx will be tested and then all Tx will be tested with only one change needed to the fixture.**

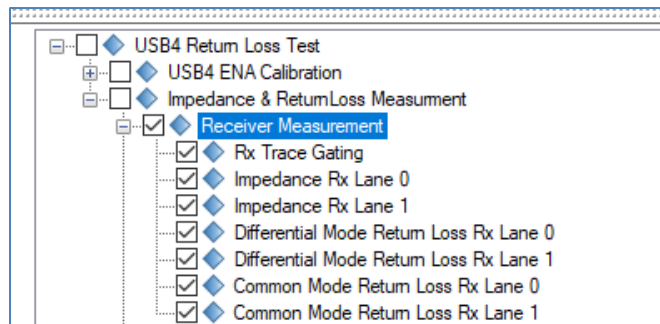


FIGURE 21. SELECT RX MEASUREMENT TESTS

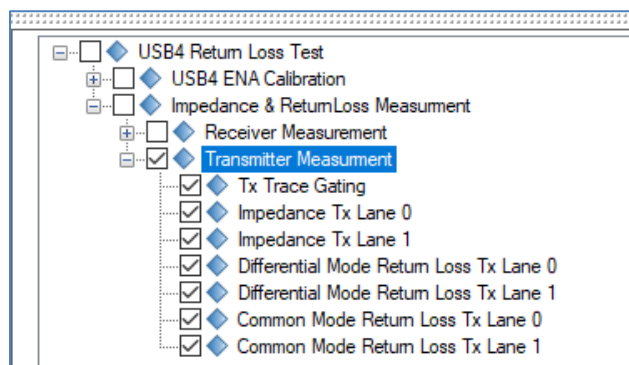



FIGURE 22. SELECT TX MEASUREMENT TESTS

### 8.2 Configure Test Parameters

Select the  button in the main software menu to access the Configurations page. Set the parameters required for the test setup.

To return all parameters to their default values, select the 'Set Default' button.



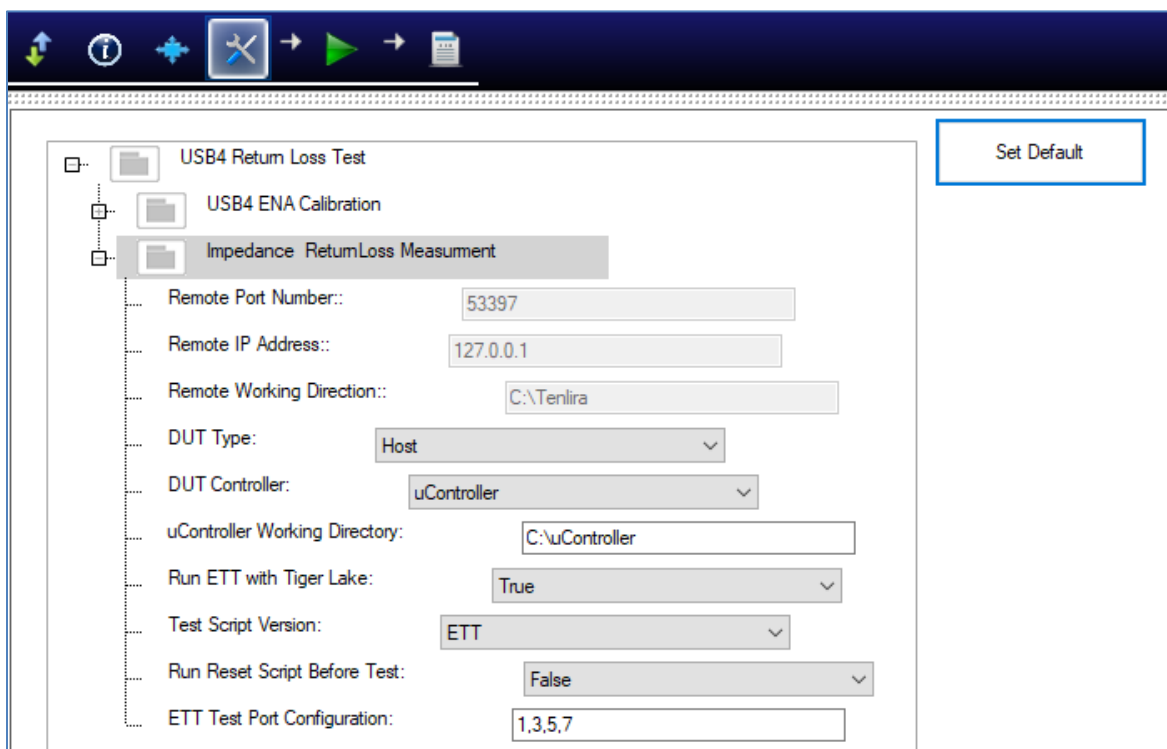


FIGURE 23. TEST CONFIGURATION PAGE

TABLE 6. TEST PARAMETERS

Parameter	Description
<b>DUT Type</b>	<b>Select this first.</b> Select whether DUT is <b>Host</b> or <b>Device</b> or <b>Tethered Device</b> (if DUT has tethering capability).
<b>DUT Controller</b>	<b>Select this second.</b> Select whether port will be controlled by <b>Remote USB4 Host</b> or <b>uController</b> or <b>JTAG</b> (if DUT supports JTAG technology).
<b>Remote Port Number</b>	If <b>DUT Controlled By: Remote Host and DUT is TBT3</b> , specify the remote server's port number of the controller host of the test script.
<b>Remote IP Address</b>	If <b>DUT Controlled By: Remote Host and DUT is TBT3</b> , specify the remote server's IP address of the controller host of the test script.
<b>Remote Working Directory</b>	If <b>DUT Controlled By: Remote Host and DUT is TBT3</b> , set the working directory to the path where the test script is installed in the remote controller host.
<b>uController Working Directory</b>	If <b>DUT Controlled By: uController</b> , set the working directory to the path where the $\mu$ Controller test script or ETT is installed on the control PC.
<b>Run ETT with Tiger Lake</b>	If <b>Test Script Version: ETT and DUT is USB4 Tiger Lake Host</b> , select "True".


<b>Test Script Version</b>	Select <b>ETT</b> to run ETT or <b>0.8.6 and above</b> to run Tenlira script.
<b>Run Reset Script Before Test</b>	Select <b>True</b> to enable the GRL-USB4RL-KS software to reset the $\mu$ Controller before running the test script or ETT command each time.
<b>ETT Test Port Configuration</b>	If <b>Test Script Version: ETT</b> and <b>DUT Type: Device</b> , specify the ETT API argument “-Dp”(DUT Test Port), {PortA,PortB,PortC,PortD}

### 8.3 Performing Impedance and Return Loss Measurement

The following example describes how to measure impedance and return loss. Impedance is measured at the time domain while return loss is measured at the frequency domain. Measurement should be performed on both the transmitter and receiver lanes.

*Note: The impedance measurement is carried out for information purpose only, meaning it has no test limit specification.*

*Note: Prior to running measurements, make sure that the relevant test setup described in Section 6 has been completed.*

1. Select the  button in the main GRL-USB4RL-KS software menu to access the Run Tests page and click “Run Tests”. Select whether to Skip existing results or Replace if results exist.

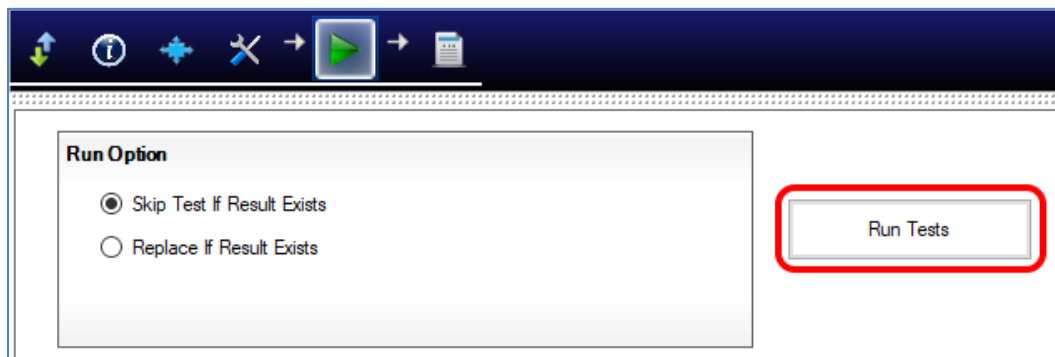




FIGURE 24. RUN TESTS PAGE

2. Follow the software instructions step by step to set up the connection and run the selected tests.
3. Once tests have completed, the test results will be saved automatically and populated on the Report page (select the  button on the main GRL-USB4RL-KS software menu). Click “Generate report” to view the details of each result.

GRL-USB4RL-KS MOI &amp; User Guide

## 9 Test Results and Reports with GRL-USB4RL-KS Software

The **Report**  page displays all the results from all test and calibration runs. If some of the results are not desired, they can be individually deleted by clicking the “Delete” button. Also for a PDF report, select the “Generate report” button.

### 9.1 Generate Test Report

The Report page shows all the results of tests and calibration. Select **Generate report** for the detailed report.

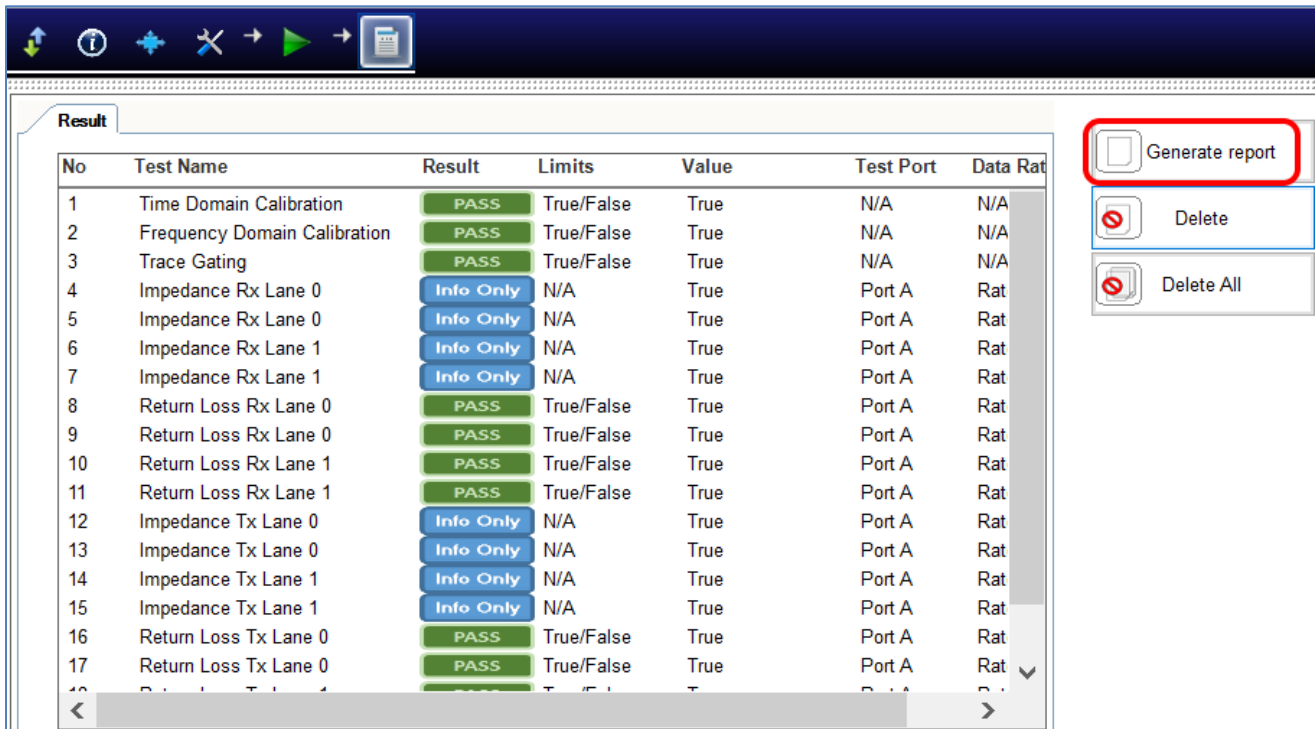


FIGURE 26. GENERATE REPORT PAGE

### 9.1.1 DUT Information

This portion is populated from the information in the DUT tab on the **Session Info** page.

USB4 Return Loss Test Application Report	
<b>DUT Information</b>	
DUT Manufacturer	: GRL
DUT Model Number	: USB4_RL_1
DUT Serial Number	: 1000
DUT Comments	:
<b>Test Information</b>	
Test Lab	: Granite River Labs
Test Operator	: David
Test Date	: 3 Oct 2020
<b>Software Version</b>	
Software Revision	: 0.0.0.1

FIGURE 27. DUT INFORMATION

### 9.1.2 Summary Table

This portion is populated from the tests and calibration performed and their results. This gives a summarized view of all the results and test conditions.

**USB4 Return Loss Test Application Report**

No	TestName	Limits	Value	Results	Test Port	Data Rate
1	<a href="#">USB4 Return Loss ENA Setup</a>	N/A	N/A	Pass		
2	<a href="#">ENA Calibration</a>	N/A	N/A	Pass		
3	<a href="#">ENA Port Extension</a>	N/A	N/A	Pass		
4	<a href="#">Rx Trace Gating</a>	N/A	N/A	Pass		
5	<a href="#">Impedance Rx Lane 0</a>	N/A	N/A	InfoOnly	PortA	Rate20G
6	<a href="#">Impedance Rx Lane 0</a>	N/A	N/A	InfoOnly	PortA	Rate10G
7	<a href="#">Impedance Rx Lane 0</a>	N/A	N/A	InfoOnly	PortA	Rate20p6G
8	<a href="#">Impedance Rx Lane 0</a>	N/A	N/A	InfoOnly	PortB	Rate10G
9	<a href="#">Impedance Rx Lane 0</a>	N/A	N/A	InfoOnly	PortB	Rate20p6G
10	<a href="#">Impedance Rx Lane 1</a>	N/A	N/A	InfoOnly	PortA	Rate10G
11	<a href="#">Impedance Rx Lane 1</a>	N/A	N/A	InfoOnly	PortA	Rate20p6G
12	<a href="#">Impedance Rx Lane 1</a>	N/A	N/A	InfoOnly	PortB	Rate10G
13	<a href="#">Impedance Rx Lane 1</a>	N/A	N/A	InfoOnly	PortB	Rate20p6G
14	<a href="#">Differential Mode Return Loss Rx Lane 0</a>	N/A	N/A	Pass	PortA	Rate10G
15	<a href="#">Differential Mode Return Loss Rx Lane 1</a>	N/A	N/A	Pass	PortA	Rate10G
16	<a href="#">Common Mode Return Loss Rx Lane 0</a>	N/A	N/A	Pass	PortA	Rate10G
17	<a href="#">Common Mode Return Loss Rx Lane 1</a>	N/A	N/A	Pass	PortA	Rate10G
18	<a href="#">Tx Trace Gating</a>	N/A	N/A	Pass		
19	<a href="#">Impedance Tx Lane 0</a>	N/A	N/A	InfoOnly	PortA	Rate10G
20	<a href="#">Impedance Tx Lane 0</a>	N/A	N/A	InfoOnly	PortB	Rate10G
21	<a href="#">Impedance Tx Lane 0</a>	N/A	N/A	InfoOnly	PortB	Rate20p6G
22	<a href="#">Impedance Tx Lane 0</a>	N/A	N/A	InfoOnly	PortA	Rate20p6G
23	<a href="#">Impedance Tx Lane 1</a>	N/A	N/A	InfoOnly	PortA	Rate10G
24	<a href="#">Impedance Tx Lane 1</a>	N/A	N/A	InfoOnly	PortB	Rate10G
25	<a href="#">Impedance Tx Lane 1</a>	N/A	N/A	InfoOnly	PortB	Rate20p6G
26	<a href="#">Impedance Tx Lane 1</a>	N/A	N/A	InfoOnly	PortA	Rate20p6G
27	<a href="#">Differential Mode Return Loss Tx Lane 0</a>	N/A	N/A	Pass	PortA	Rate10G
28	<a href="#">Differential Mode Return Loss Tx Lane 0</a>	N/A	N/A	Pass	PortA	Rate20p6G

FIGURE 28. SUMMARY TABLE

9.1.3 Test Result Details

This portion is populated from each of the test and calibration results. Here the results are explained in depth with supporting data points and screenshots.

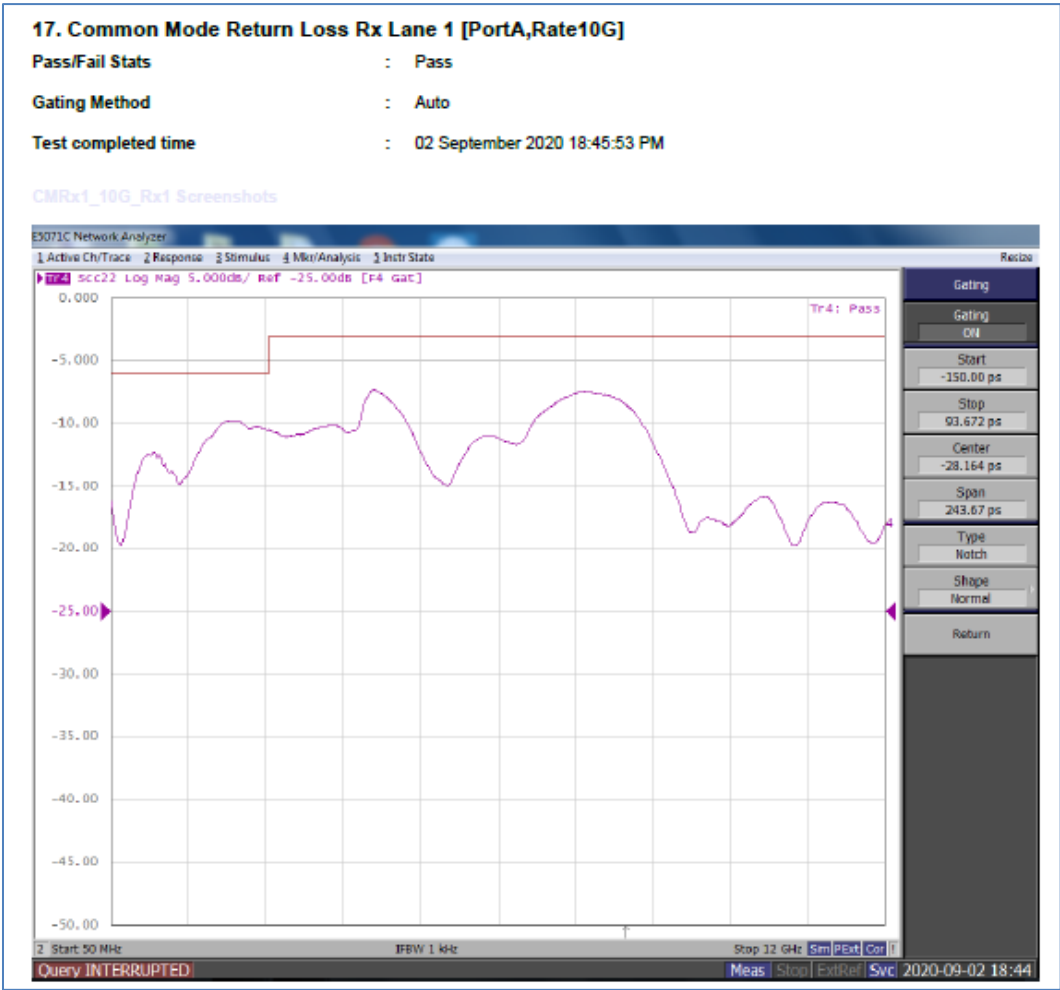


FIGURE 29. TEST RESULT DETAILS EXAMPLE

9.2 Delete Reports

If some of the results are not desired, they can be individually deleted by selecting the “Delete” button.

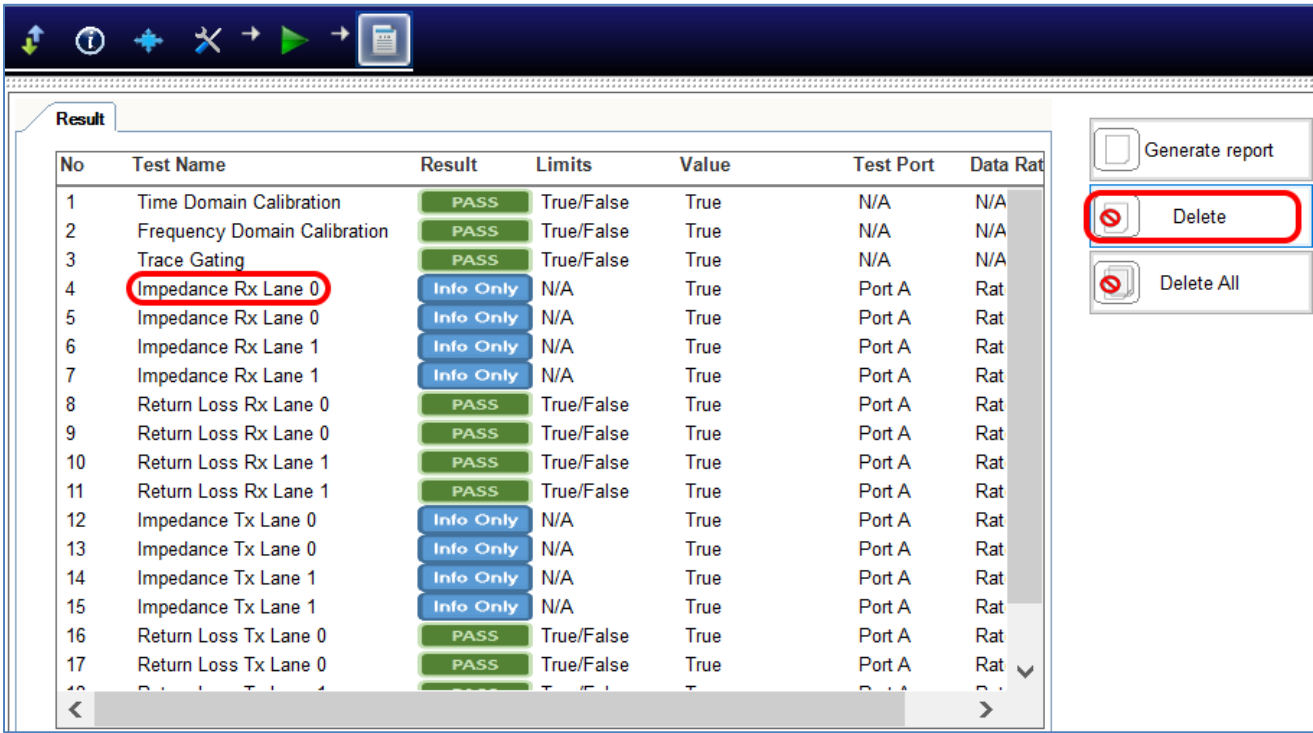


FIGURE 30. DELETE INDIVIDUAL CALIBRATION/TEST RESULTS EXAMPLE

To remove all results, select the “Delete All” button.

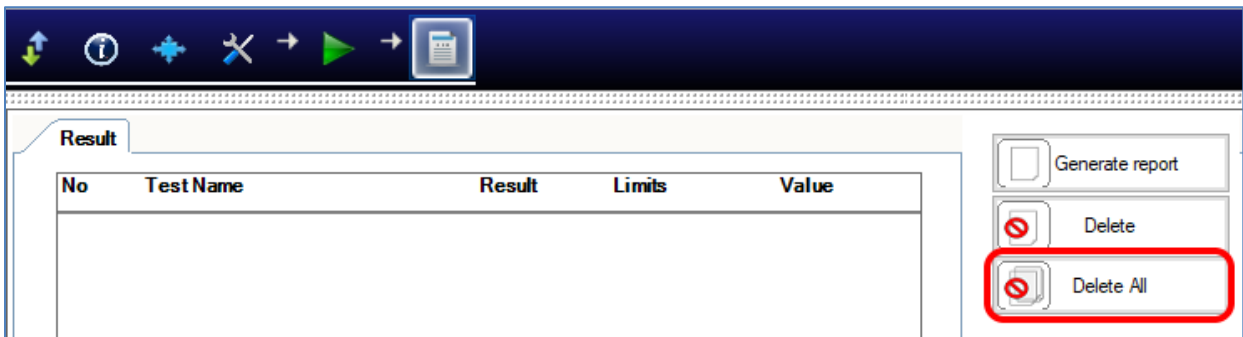


FIGURE 31. DELETE ALL RESULTS

## 10 Troubleshooting GRL-USB4RL-KS Errors

If an error is thrown by the GRL-USB4RL-KS software, it may be due to one of the following common issues:

1. The ENA's firmware needs to be updated – Confirm that the ENA's firmware is B.14.14 or above.
2. USB4 ETT is not properly installed – To troubleshoot this, follow the ETT PDF User Guide and confirm that **USB4ElectricalTestTool.exe** can be run manually from the ETT folder. If ETT is not properly installed, a software error may occur.
3. After checking the above and error persists, contact [support@graniteriverlabs.com](mailto:support@graniteriverlabs.com) for further support.

**END\_OF\_DOCUMENT**