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USB4® Version 2.0 Return Loss Test User Guide & Method of Implementation (MOI) Using Keysight ENA Vector Network Analyzer and GRL-USB4V2RL-KS Automation Software

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1 Introduction

This User Guide & MOI describes how to perform automated Calibration and Testing of the USB4® Version 2.0 (or USB4 Gen 4) Return Loss using the Keysight E5080B / E5071C ENA Vector Network Analyzer and the GRL-USB4V2RL-KS Automation Software.

The GRL-USB4V2RL-KS automation software supports calibration for time and frequency domain and impedance and return loss measurements for USB4 Gen 4 Hosts and Devices. 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 Gen 4 environments.

This User Guide & MOI mainly covers the following for USB4 Gen 4 Return Loss calibration and testing:

1. Equipment required for calibration and testing.
2. GRL-USB4V2RL-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 E5080B 4-Port ENA Vector Network Analyzer - S96011B Enhanced Time Domain Analysis with TDR OR Keysight E5071C 4-Port ENA Vector Network Analyzer - E5071C-010 – Time Domain Analysis - E5071C-TDR – Enhanced Time Domain Analysis - E5071C-4K5 – 4-Port Test Set, 300kHz to 20GHz with Bias Tees Firmware Version: B.14.14 or above	53 GHz 140 dB max 20GHz 130 dB max

TABLE 2. EQUIPMENT REQUIREMENTS – ACCESSORIES

Accessory	Qty.	Description	Key Specification
Computer	1	External PC for running GRL-USB4V2RL-KS Software	Windows 10+ OS
Calibration Kit	1	Keysight N4433A Electronic Calibration Module (ECal)	300 kHz to 20 GHz, 3.5mm, 4-port
USB4 Microcontroller	1	USB4 Gen 4 Microcontroller	Optional for some test configurations, see Section 3.1.2
USB4 Test Fixture	1	USB4 CIO Plug board	
Matched Cable Pairs	2 pairs	Rosenberger UFC142A 2.92m (x2), 1m SMA cable	Phase matched $\pm 2^\circ$ at 40 GHz Insertion loss 1 dB max in 10 GHz

2.2 Software Requirements

TABLE 3. SOFTWARE REQUIREMENTS

Software	Source
GRL-USB4V2RL-KS	GRL Platform Solutions USB4 Version 2.0 Return Loss Calibration and Test Automation Software – www.grlps.com
VISA (Virtual Instrument Software Architecture) API Software	VISA Software is required to be installed on the host PC running GRL-USB4V2RL-KS software. GRL Platform Solutions' software framework has been tested to work with all three versions of VISA available on the Market: 1. NI-VISA: http://www.ni.com/download/ni-visa-17.0/6646/en/ 2. Keysight IO Libraries: www.keysight.com (Search on IO Libraries) 3. Tektronix TekVisa: www.tek.com (Downloads > Software > TekVisa)
SigTest Application	SigTest Version 0.9 is required. Downloadable from USB-IF's website. <i>(Note: Approval and NDA as a USB-IF Adopter is required to gain access to USB-IF products.)</i>
USB4 Electrical Test Tool (ETT)	ETT Version 2.0.0 is required. Downloadable from USB-IF's website. See Section 3.1.2 for more details.
E5071C-TDR Remote Control Software (for Keysight E5071C ENA)	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-USB4V2RL-KS Software

This section provides the procedure for installing, configuring, and verifying the operation of the GRL-USB4V2RL-KS and USB4 electrical test toolset (ETT). It also helps you familiarize yourself with the basic operation of the GRL-USB4V2RL-KS software.

The GRL-USB4V2RL-KS software installer automatically creates shortcuts in the Desktop and Start Menu.

To open the GRL-USB4V2RL-KS software application, follow the procedure in the following section.

3.1 Download and Set Up GRL-USB4V2RL-KS Software

Install, launch and set up the GRL-USB4V2RL-KS software on a PC (where the GRL-USB4V2RL-KS is referred to as 'Control PC' in this User Guide & MOI).

1. Install VISA (Virtual Instrument Software Architecture) on to the PC where GRL-USB4V2RL-KS is to be used (see Section 2.2).
2. Download the GRL-USB4V2RL-KS ZIP file package from the GRL Platform Solutions support site.
3. The ZIP file contains:
 - **GRLUSB4V2ReturnLoss00xxxxxxxSetup** – Run this on the PC to install the application.
 - **GRLUSB4V2ReturnLossSetupFileInstallation00xxxxxxxSetup** – Run this on the ENA to install the proper setup files. Note that the user needs to save the following:
 - ENA setup file “USB4_V2_Cal_Setup” to “C:\GRL\KeysightENA\setup\USB4_V2_Return_Loss_Test_Application” on the ENA.
 - ENA limit file “USB4V2_E5080_RL_Limit” or “USB4V2_E5070_RL_Limit” to “C:\GRL\KeysightENA\setup\USB4_V2_Return_Loss_Test_Application\Limit” on the ENA.
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 Platform Solutions software framework.

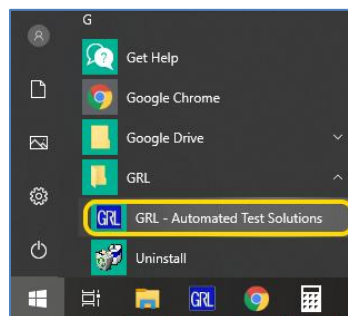


FIGURE 1. LAUNCHING GRL PLATFORM SOLUTIONS SOFTWARE FRAMEWORK

- b) From the **Application** → **Framework Test Solution** drop-down menu, select **USB4 V2 Return Loss Test Application**. If the selection is grayed out, it means your license has expired.

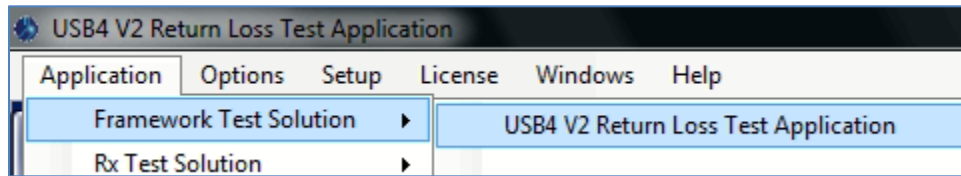


FIGURE 2. START GRL-USB4V2RL-KS APPLICATION

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

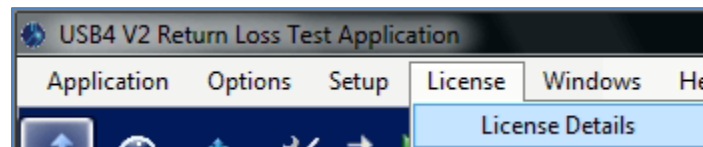


FIGURE 3. SEE LICENSE DETAILS

- ii) Check the license status for the installed application.

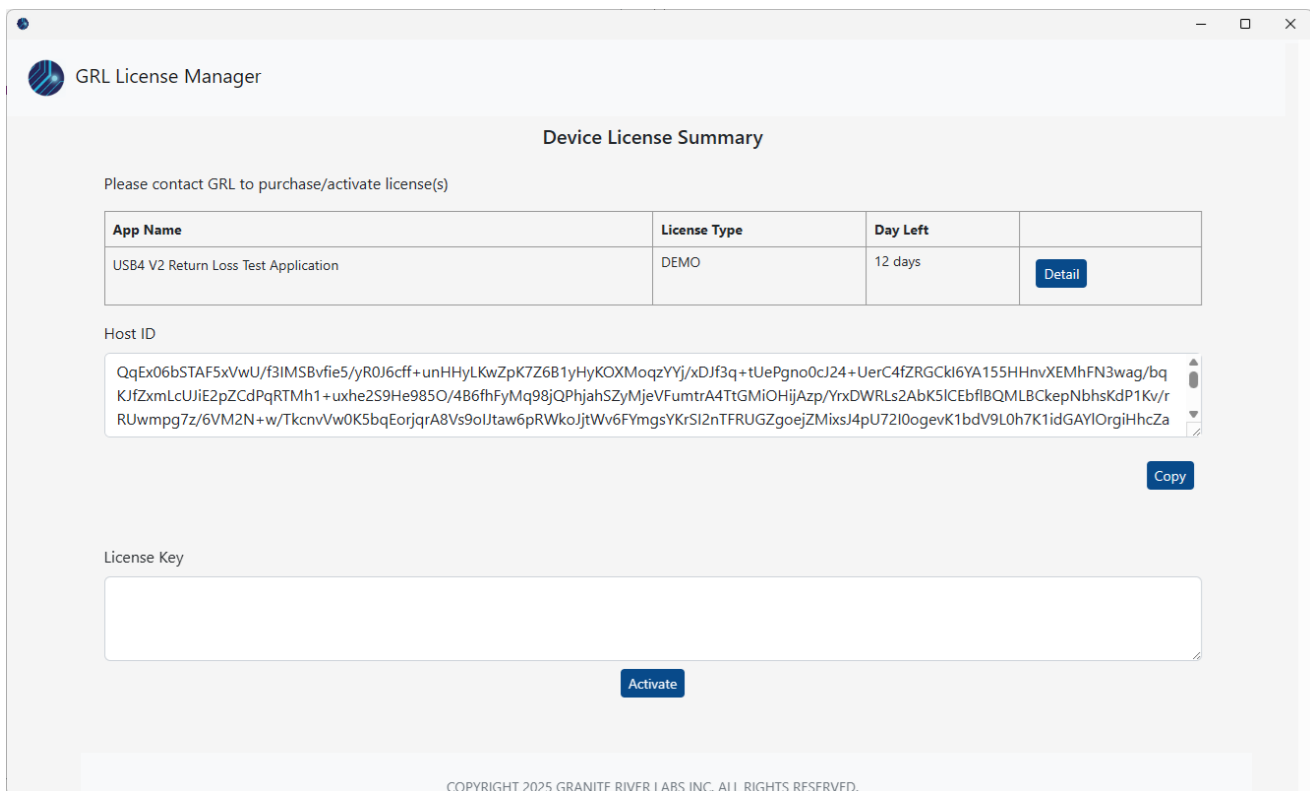


FIGURE 4. CHECK LICENSE FOR INSTALLED APPLICATION

- iii) Activate a License:

- If you have an Activation Key, enter it in the **License Key** field provided and select **Activate**. The installed application is ready for use upon successful activation.

- If you do not have an Activation Key, close the above window to use a demo version of the application over a free 12-day trial period.

Note: Once the 12-day trial period ends, you will need to request an Activation Key to continue using the application on the same computer by contacting support@grlps.com.

3.1.1 Connect Keysight ENA Network Analyzer with PC

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

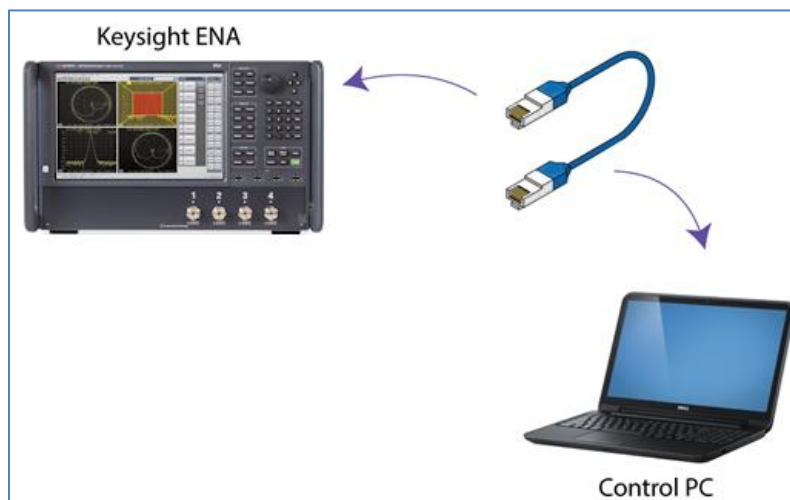


FIGURE 5. CONNECTING KEYSIGHT ENA WITH CONTROL PC

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

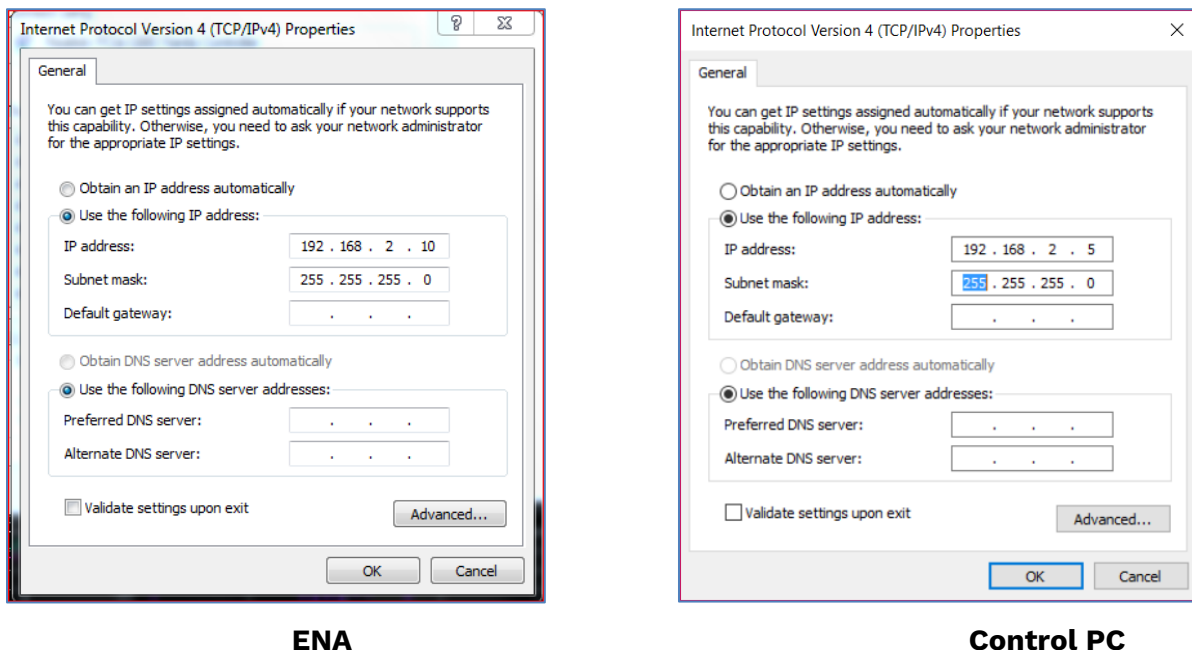


FIGURE 6. SETTING ENA AND CONTROL PC NETWORK

3.1.2 Download and Install USB4 Electrical Test Tools (ETT)

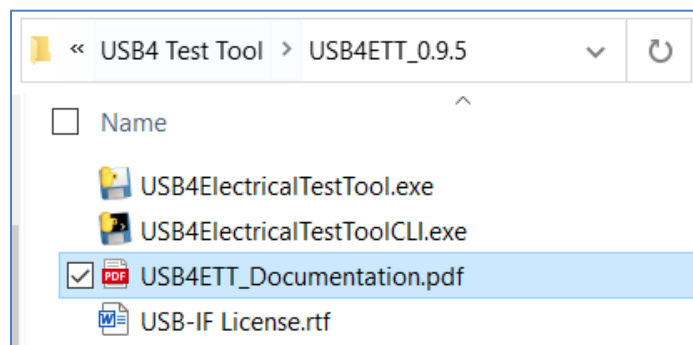
For USB4 Gen 4 Return Loss measurements, the Host/Device's CIO PHY must be in an active state during testing. Its transmitters shall be transmitting PRTS-7 into the ENA measurement channel during testing and its receivers shall have their terminations enabled during testing. Thus, a PHY microcontroller 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 Gen 4 Host Testing:

The ETT can be loaded on the Control PC with the GRL-USB4V2RL-KS software. In this case, the USB4 Gen 4 microcontroller is required. The DUT is controlled using an Apple 0.8m USB Type-C® cable from the microcontroller to the USB4 V2 Test Fixture.

For USB4 Gen 4 Device Testing:

- **Upstream Facing Port (UFP):** The ETT can be loaded on the Control PC with the GRL-USB4V2RL-KS software. In this case, the USB4 Gen 4 microcontroller is required. The DUT is controlled using an Apple 0.8m USB Type-C cable from the microcontroller to the USB4 V2 Test Fixture.
- **Downstream Facing Port (DFP):** Connect the DUT's UFP to any USB4 Gen 4 host via the USB4 based USB Type-C® cable. The ETT tools can be loaded on the Control PC with the GRL-USB4V2RL-KS software. In this case, the USB4 Gen 4 microcontroller is required. The DUT is controlled using an Apple 0.8m USB Type-C cable from the microcontroller to the USB4 V2 Test Fixture.

**Disclaimer: USB Type-C® is a registered trademark of USB Implementers Forum.*

3.1.3 [For the Keysight E5071C ENA Only] Download and Install E5071C-TDR Remote Control Software

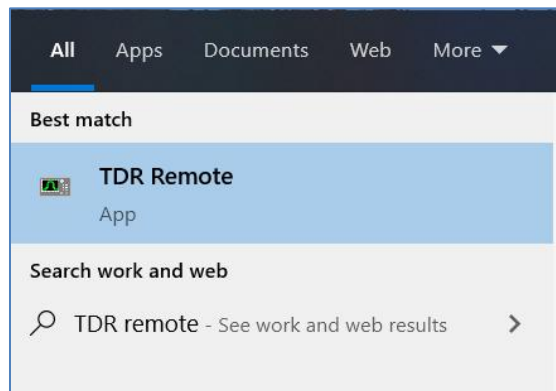
The Keysight E5071C ENA TDR function is used to measure impedance for USB4 Gen 4 Return Loss measurements. To control the TDR function correctly, the E5071C-TDR remote control software must be installed on the Control PC with the GRL-USB4V2RL-KS software.

Download and Configure E5071C-TDR Remote Control Software:

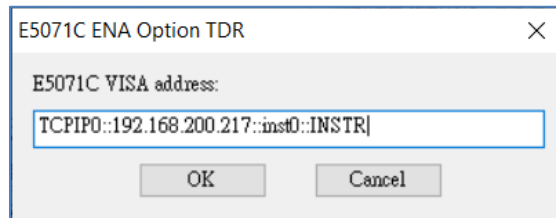
Visit Keysight's official website to download and install the "E5071C-TDR Remote Control Software".

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

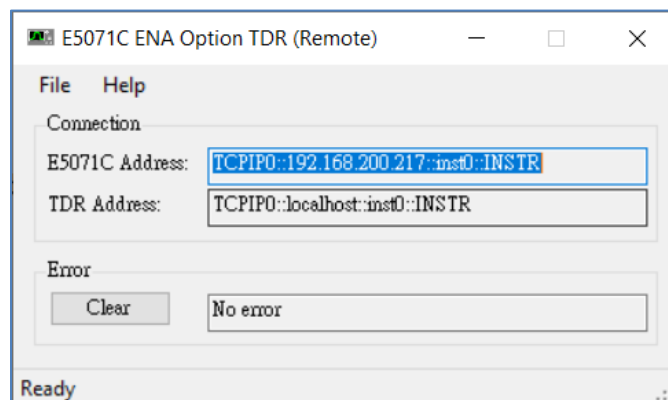
- a) On the Control PC, open the **TDR Remote** software and connect the ENA with the Control PC via GPIB, LAN or USB cable.



- 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-USB4V2RL-KS software.



3.1.4 Launch and Set Up GRL-USB4V2RL-KS Software

3.1.4.1 On the Control PC

1. Launch the GRL Platform Solutions Host Application from **Start Menu → GRL → GRL – Automated Test Solutions**.
2. Select **Application → Framework Test Solution → USB4 V2 Return Loss Test Application**.
3. Select the Equipment Setup icon  on the USB4 V2 Return Loss Test Application menu.
4. Under the “Lib” column, select the Keysight ENA model (E5080B or E5071C) to connect with.
5. If connecting to the Keysight E5080B ENA, type in the respective IP Address of the ENA into the “Address” field and click on the “lightning” button (). The “lightning” button should turn green () if successfully connected to the ENA.

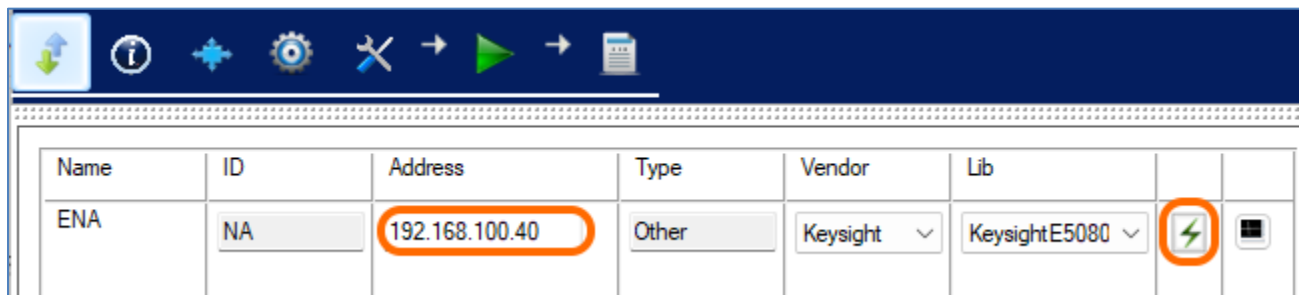


FIGURE 7. USB4 V2 RETURN LOSS TEST APPLICATION IP ADDRESSING ON KEYSIGHT E5080B ENA

6. If connecting to the Keysight E5071C ENA, type in the respective IP Addresses of the ENA and TDR into the “Address” fields and click on the “lightning” buttons (). The “lightning” buttons should turn green () if successfully connected to the ENA and TDR.

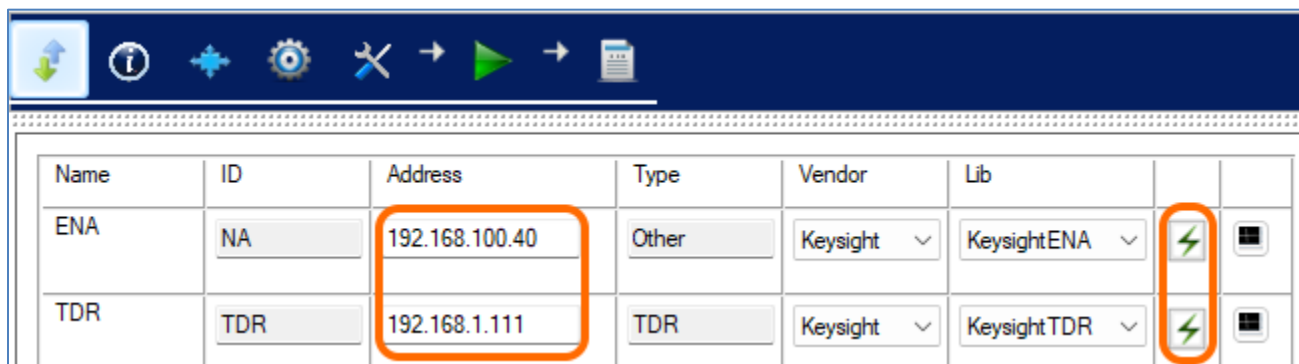


FIGURE 8. USB4 V2 RETURN LOSS TEST APPLICATION ON KEYSIGHT E5071C ENA

3.1.4.2 Session Info

Select  from the software menu to access the **Session Info** page. Enter the information as required for the calibration/test session that is currently being run. The information provided will be included in the test report generated by the software once calibration/tests are completed.

- The fields under **DUT Info** and **Test Info** are defined by the user.
- The **Software Info** field is automatically populated by the software.

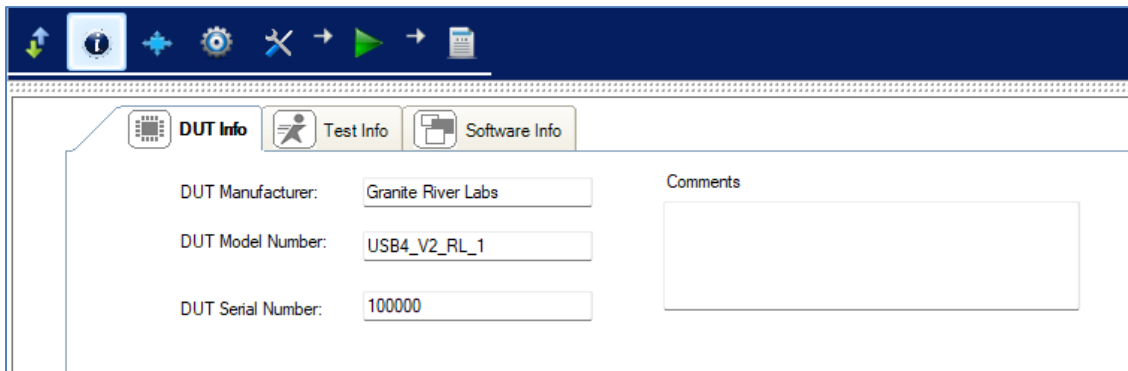


FIGURE 9. SESSION INFO PAGE

3.1.4.3 Test Conditions

Select  from the software menu to access the Conditions page.

In this section, conditions for calibration and testing will need to be set.

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

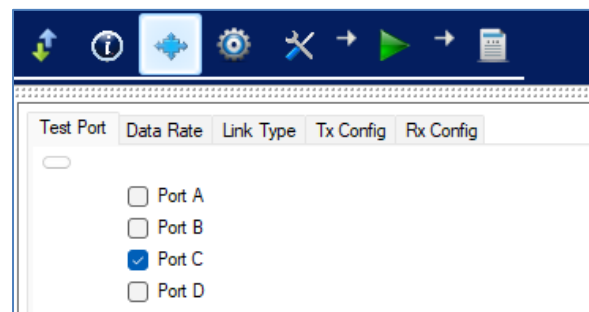


FIGURE 10. SELECT TEST PORT

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

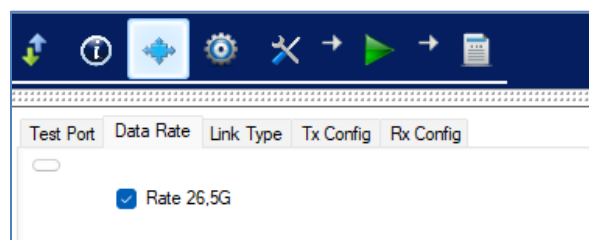


FIGURE 11. SELECT DATA RATE

- c) **Link Type tab:** Select the USB4 Symmetric Link (where the number of TX and RX lanes are the same, e.g. “1*TX/1*RX” or “2*TX/2*RX”) or Asymmetric Link (where one side transmits e.g. “3*TX/1*RX”, while the other side transmits “1*TX/3*RX”).

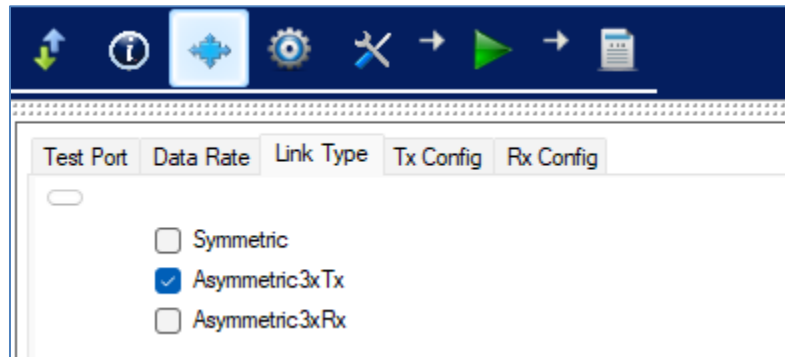


FIGURE 12. SELECT USB4 SYMMETRIC LINK AND ASYMMETRIC LINK

- d) **Tx Config tab:** For the selected test port and link type, select the Tx configuration (e.g., Tx test lane and straight/reverse insertion of the USB Type-C connector).

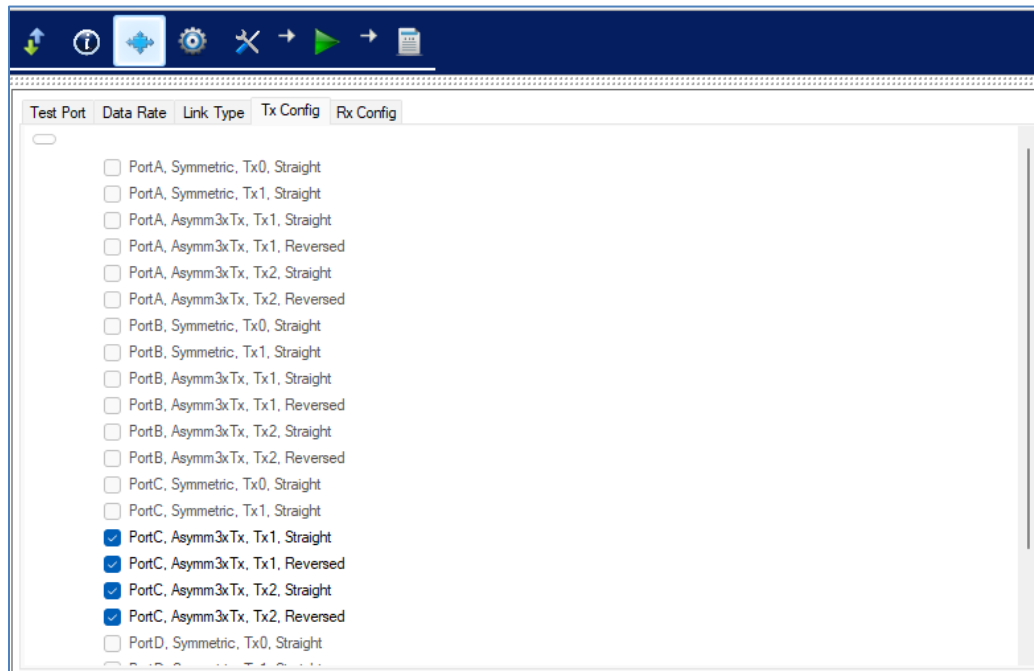


FIGURE 13. SELECT TX CONFIGURATION FOR SELECTED TEST PORT AND LINK TYPE

- e) **Rx Config tab:** For the selected test port and link type, select the Rx configuration (e.g., Rx test lane and straight/reverse insertion of the USB Type-C connector).

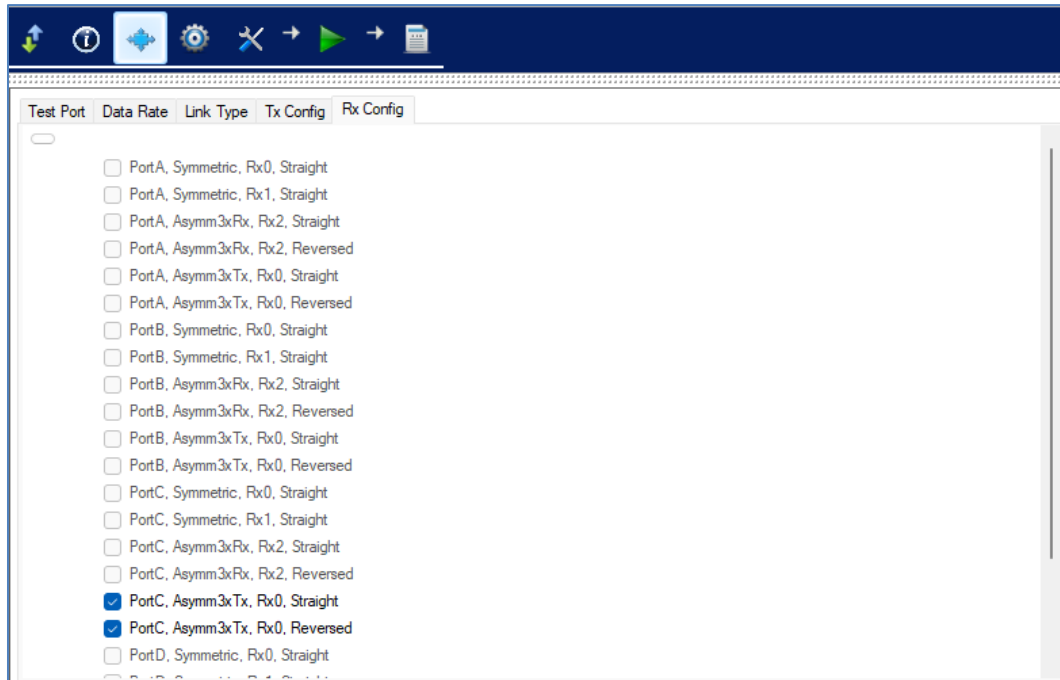


FIGURE 14. SELECT RX CONFIGURATION FOR SELECTED TEST PORT AND LINK TYPE

4 Time and Frequency Domain Calibration Setup

Perform calibration for RF effects such as delay, loss or mismatch of RF cables using the “SOLT” calibration method 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.

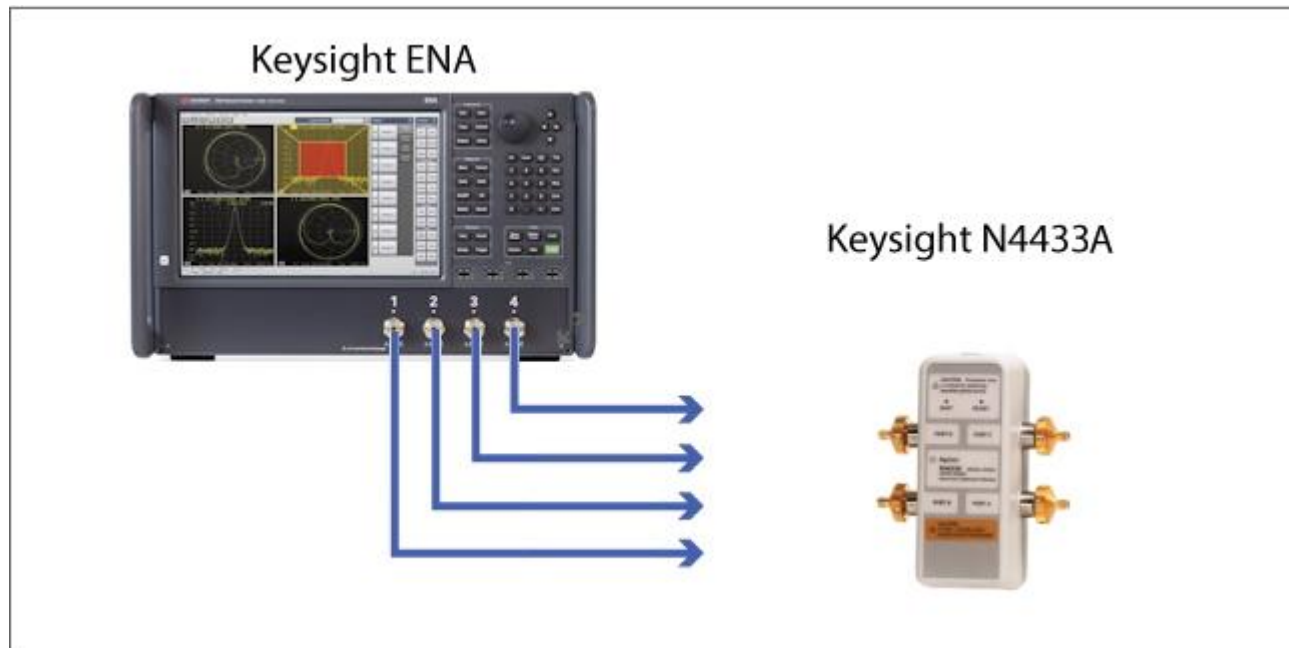


FIGURE 15. ECAL CALIBRATION SETUP FOR TIME DOMAIN AND FREQUENCY DOMAIN CALIBRATION

Connect the four ports of the Keysight ENA to the Keysight N4433A ECal module using SMA cables. The GRL-USB4V2RL-KS software will automatically perform SOLT calibration for both time domain and frequency domain.

5 Calibrating with GRL-USB4V2RL-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.

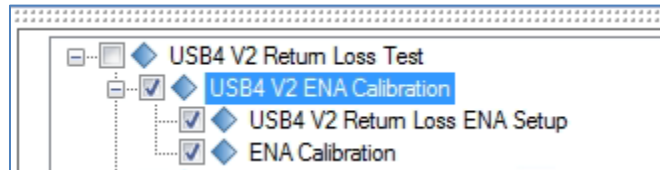


FIGURE 16. SELECT CALIBRATION TYPES

Select the “USB4 V2 ENA Calibration” group to set up the ENA test environment and perform time & frequency domain calibration. The GRL-USB4V2RL-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  from the 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 17. CALIBRATION CONFIGURATION PAGE

TABLE 4. CALIBRATION PARAMETERS

Parameter	Description
Calibration Method	Select the type of calibration to be performed – ‘Ecal’ (using the Keysight N4433A calibration kit) or ‘Manual’.

5.3 Run Calibration

Select  from the software menu to access the Run Tests page.

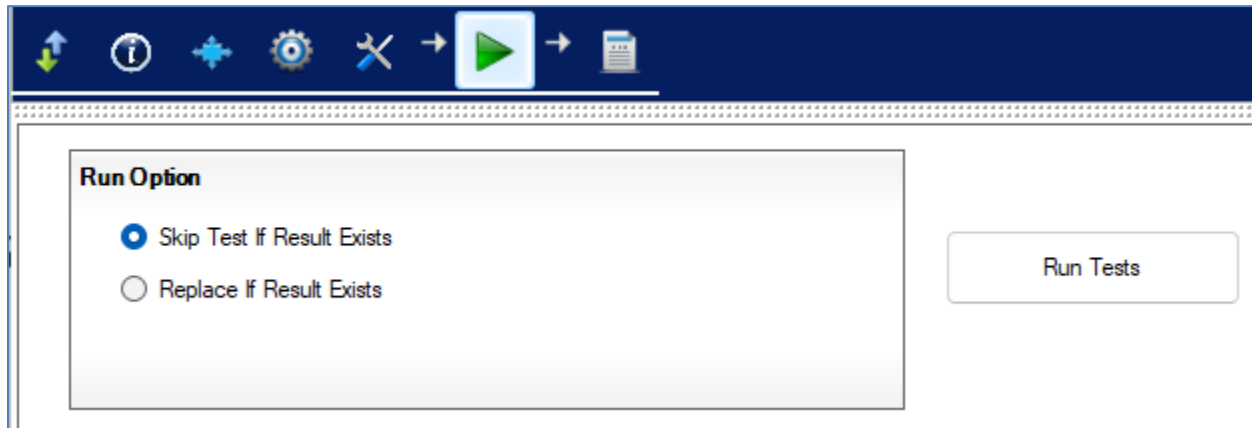


FIGURE 18. RUN TESTS PAGE

TABLE 5. RUN OPTIONS

Run Option	Description
Skip Test if Result Exists	If previous test or calibration results exist, then the software will <i>skip</i> the tests/calibration steps that have existing reports.
Replace if Result Exists	If previous test or calibration results exist, then the software will <i>replace</i> 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 8.2 for example) and Run with **Skip Test if Result Exists**. The GRL-USB4V2RL-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 V2 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 USB4 V2 microcontroller 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 Gen 4 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.

6.1 Host DUT Setup

If testing a Host, and the ETT's have been loaded on the Control PC, and the USB4 V2 Controller has been connected to the Control PC via a USB cable, follow the below procedure:

1. Connect the equipment as follows:

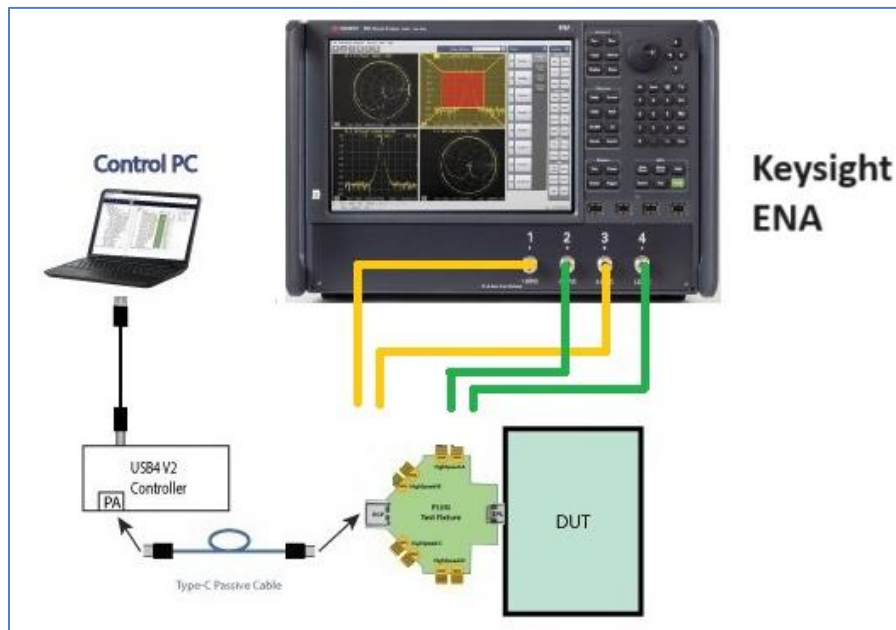


FIGURE 19. TEST SETUP FOR HOST DUT

Connection Steps:

- a) Connect a USB Type-C passive cable from the USB4 V2 Controller to the test fixture's receptacle.
- b) Connect the plug test fixture to the DUT's test port.
- c) Based on the setup configuration, connect cables from the Keysight ENA Port 1 and 3 to the first test lane pair according to the test port configuration in Figure 24.

d) For 2-lane testing, connect another set of cables from the Keysight ENA Port 2 and 4 to the second test lane pair on the test fixture's connectors, according to the test port configuration in Figure 24.

2. On the main GRL-USB4V2RL-KS software menu, select  to access the Configurations page.

a) Specify the directory of the ETT/SigTest on the Host DUT in the “ETT/SigTest Directory” field.

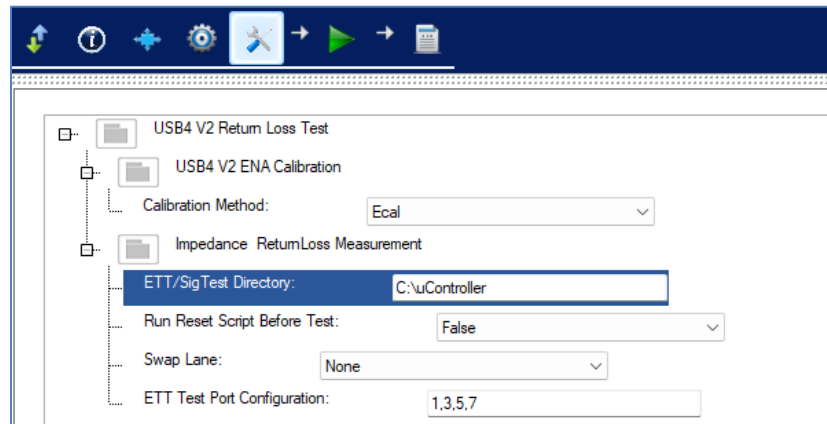
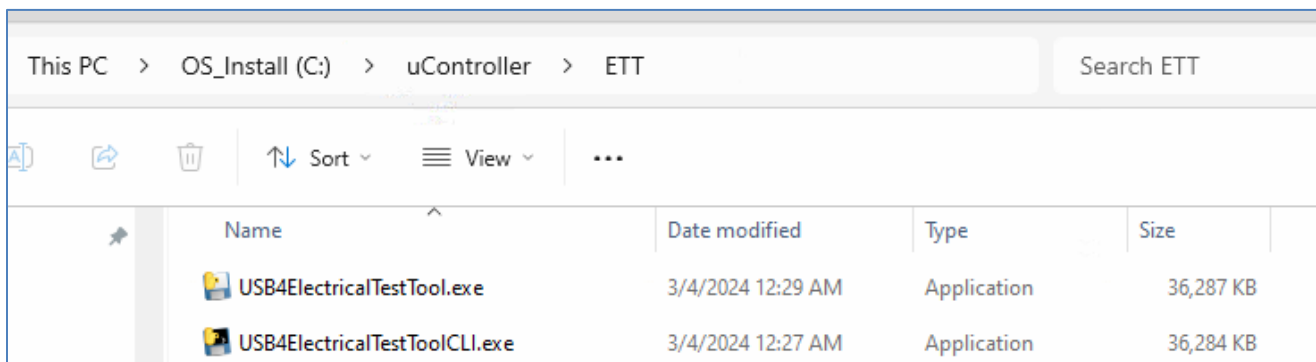
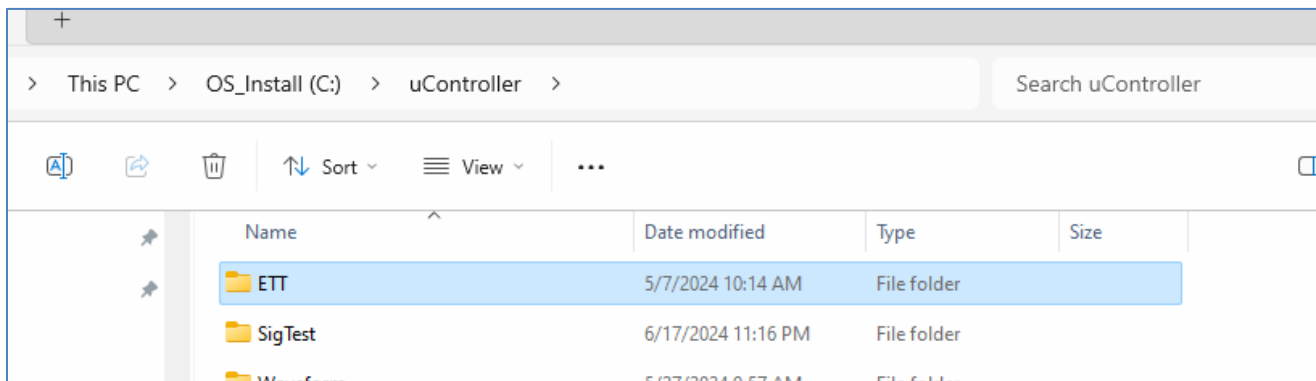
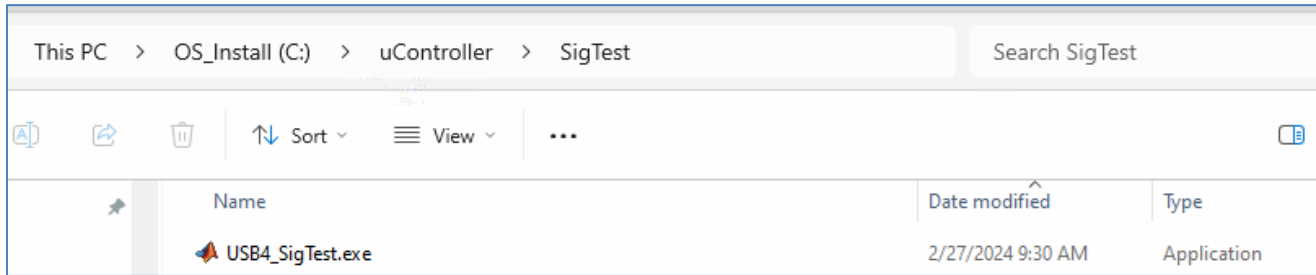


FIGURE 20. CONFIGURE HOST DUT EXAMPLE IN GRL-USB4V2RL-KS SOFTWARE

Note: Ensure that the ETT and SigTest software have already been installed to their respective ETT and SigTest folders in the specified directory. Examples as below:





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-USB4V2RL-KS software menu, select  to access the Configurations page.

- Specify the directory of the ETT/SigTest on the USB4 remote host in the "ETT/SigTest Directory" field.
- Specify the ETT API argument "-Dp"(DUT Test Port), {PortA,PortB,PortC,PortD} in the "ETT Test Port Configuration" field.

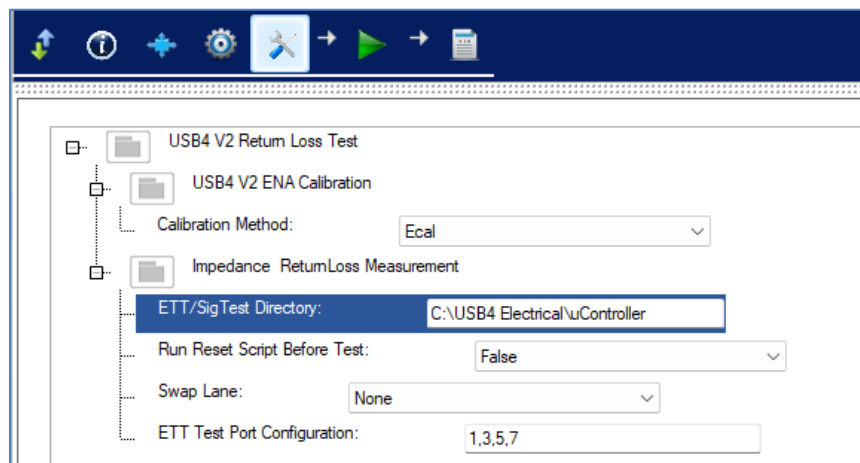


FIGURE 21. CONFIGURE DEVICE DUT (UFP) EXAMPLE IN GRL-USB4V2RL-KS SOFTWARE

Note: Similar to the Host DUT Setup, ensure that the ETT and SigTest software have already been installed to their respective ETT and SigTest folders in the specified directory.

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 Gen 4 host port.

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

7 DUT Compliance Testing with GRL-USB4V2RL-KS Software

7.1 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.

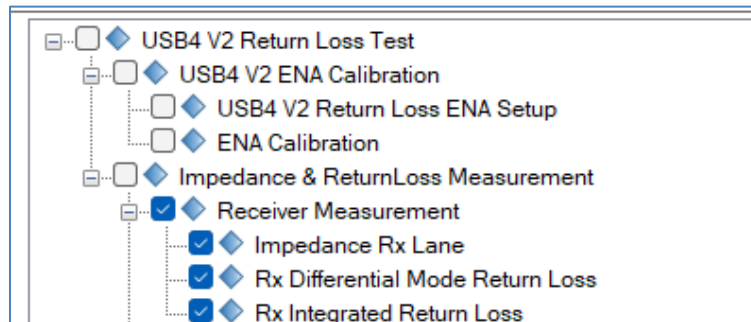


FIGURE 22. SELECT RX MEASUREMENT TESTS

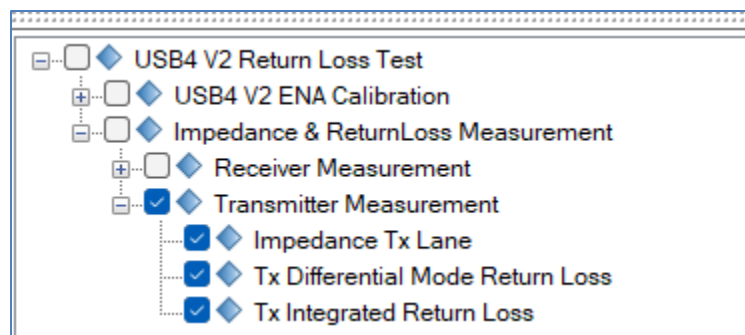


FIGURE 23. SELECT TX MEASUREMENT TESTS

7.2 Set Up Test Port and SigTest Waveform Path

Select  from the software menu to access the Setup Configuration page.

- Test Port Configuration** tab: Select the test lane to the corresponding differential port of the ENA.

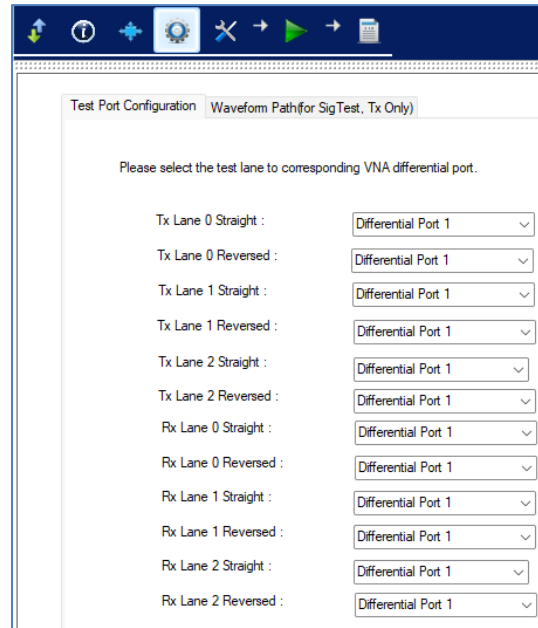


FIGURE 24. CONFIGURE TEST PORT

- b) **Waveform Path (for SigTest, Tx Only)** tab: Specify the path where captured waveforms are saved for the corresponding Tx test configuration to be used for SigTest analysis. SigTest allows captured waveforms to be analyzed and checked against the specified pass/fail criteria.

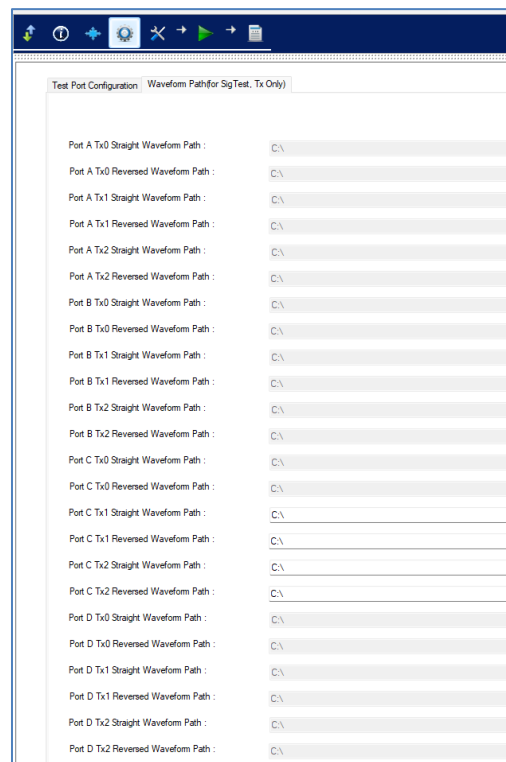


FIGURE 25. SET WAVEFORM PATH FOR SIGTEST PROCESSING

7.3 Configure Test Parameters

Select  from the 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.

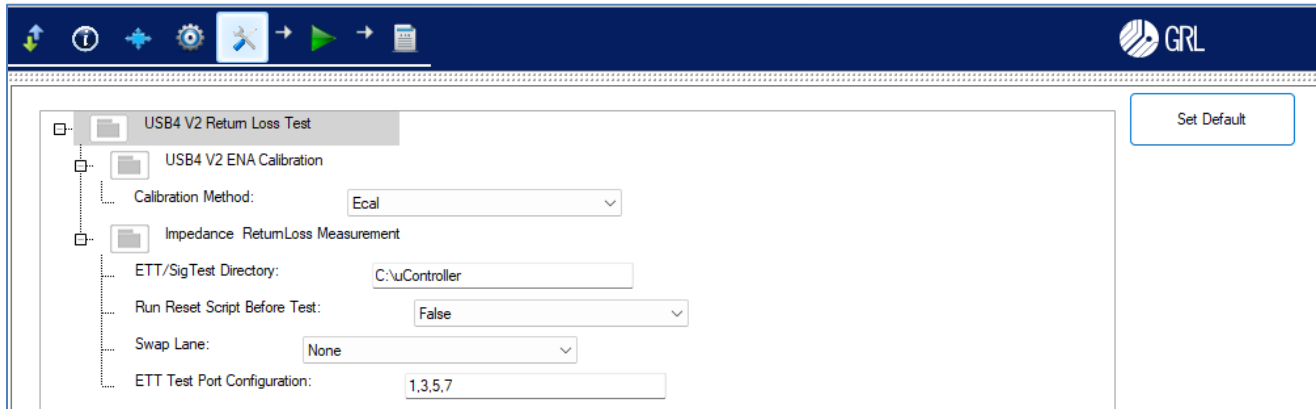


FIGURE 26. TEST CONFIGURATION PAGE

TABLE 6. TEST PARAMETERS

Parameter	Description
ETT/SigTest Directory	Set the working directory to the path where the μ Controller test script or ETT is installed on the control PC.
Run Reset Script Before Test	Select True to enable the GRL-USB4V2RL-KS software to reset the μ Controller before running the test script or ETT command each time.
Swap Lane	Select the Swap Lane(s) in the Router side (“None” is selected by default).
ETT Test Port Configuration	If the Device DUT is being used, specify the ETT API argument “-Dp”(DUT Test Port), {PortA,PortB,PortC,PortD}

7.4 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  from the GRL-USB4V2RL-KS software menu to access the Run Tests page and click on the “Run Tests” button. Select to Skip existing results or Replace if results exist.

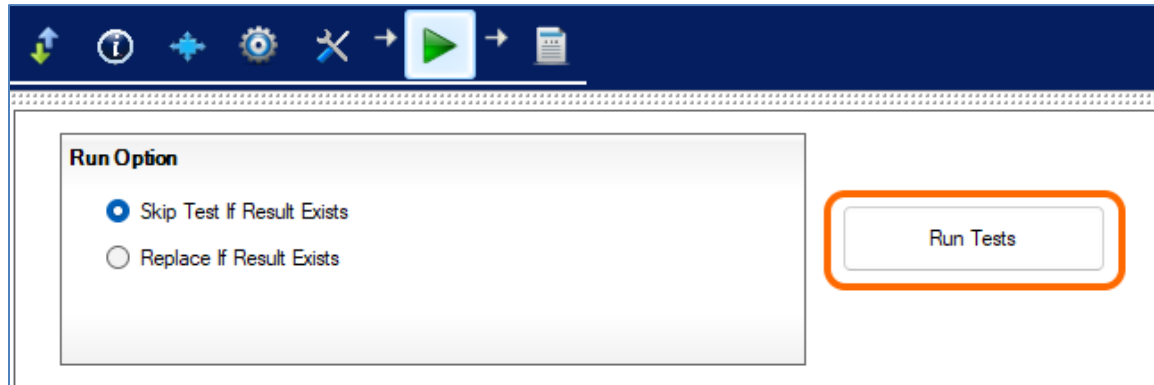
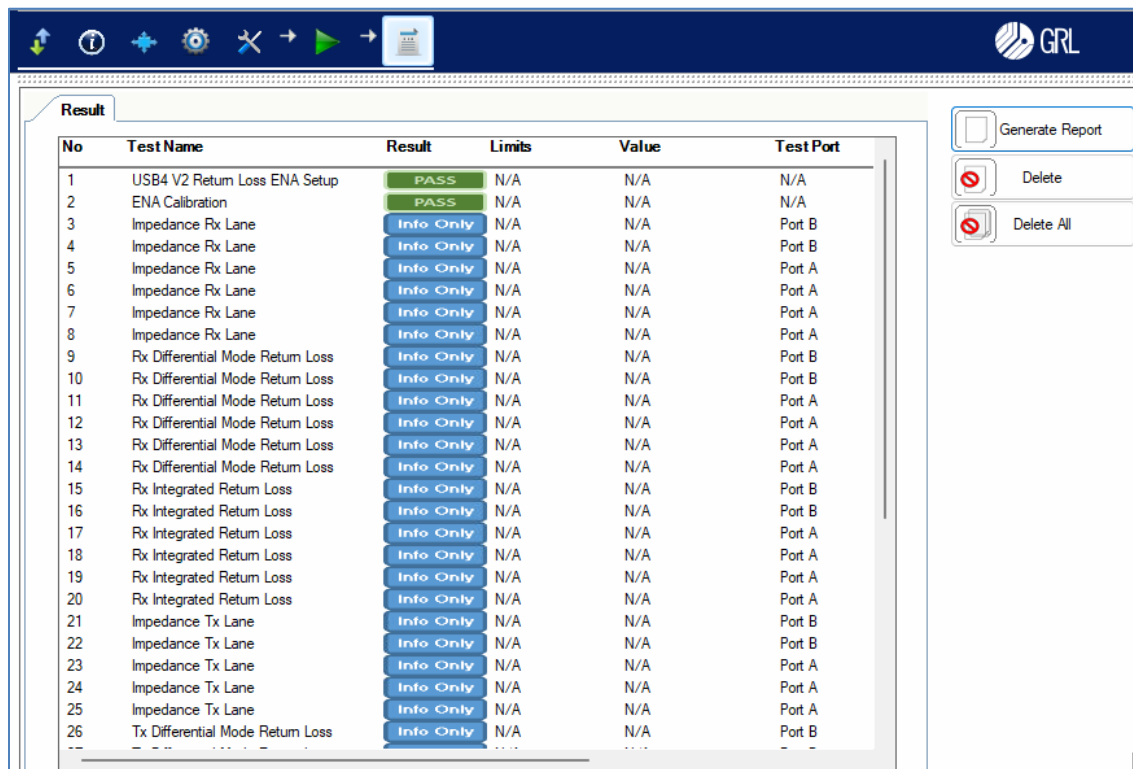


FIGURE 27. RUN TESTS PAGE

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  from the GRL-USB4V2RL-KS software menu). Click on the “Generate report” button to view details of each result.



No	Test Name	Result	Limits	Value	Test Port
1	USB4 V2 Return Loss ENA Setup	PASS	N/A	N/A	N/A
2	ENA Calibration	PASS	N/A	N/A	N/A
3	Impedance Rx Lane	Info Only	N/A	N/A	Port B
4	Impedance Rx Lane	Info Only	N/A	N/A	Port B
5	Impedance Rx Lane	Info Only	N/A	N/A	Port A
6	Impedance Rx Lane	Info Only	N/A	N/A	Port A
7	Impedance Rx Lane	Info Only	N/A	N/A	Port A
8	Impedance Rx Lane	Info Only	N/A	N/A	Port A
9	Rx Differential Mode Return Loss	Info Only	N/A	N/A	Port B
10	Rx Differential Mode Return Loss	Info Only	N/A	N/A	Port B
11	Rx Differential Mode Return Loss	Info Only	N/A	N/A	Port A
12	Rx Differential Mode Return Loss	Info Only	N/A	N/A	Port A
13	Rx Differential Mode Return Loss	Info Only	N/A	N/A	Port A
14	Rx Differential Mode Return Loss	Info Only	N/A	N/A	Port A
15	Rx Integrated Return Loss	Info Only	N/A	N/A	Port B
16	Rx Integrated Return Loss	Info Only	N/A	N/A	Port B
17	Rx Integrated Return Loss	Info Only	N/A	N/A	Port A
18	Rx Integrated Return Loss	Info Only	N/A	N/A	Port A
19	Rx Integrated Return Loss	Info Only	N/A	N/A	Port A
20	Rx Integrated Return Loss	Info Only	N/A	N/A	Port A
21	Impedance Tx Lane	Info Only	N/A	N/A	Port B
22	Impedance Tx Lane	Info Only	N/A	N/A	Port B
23	Impedance Tx Lane	Info Only	N/A	N/A	Port A
24	Impedance Tx Lane	Info Only	N/A	N/A	Port A
25	Impedance Tx Lane	Info Only	N/A	N/A	Port A
26	Tx Differential Mode Return Loss	Info Only	N/A	N/A	Port B

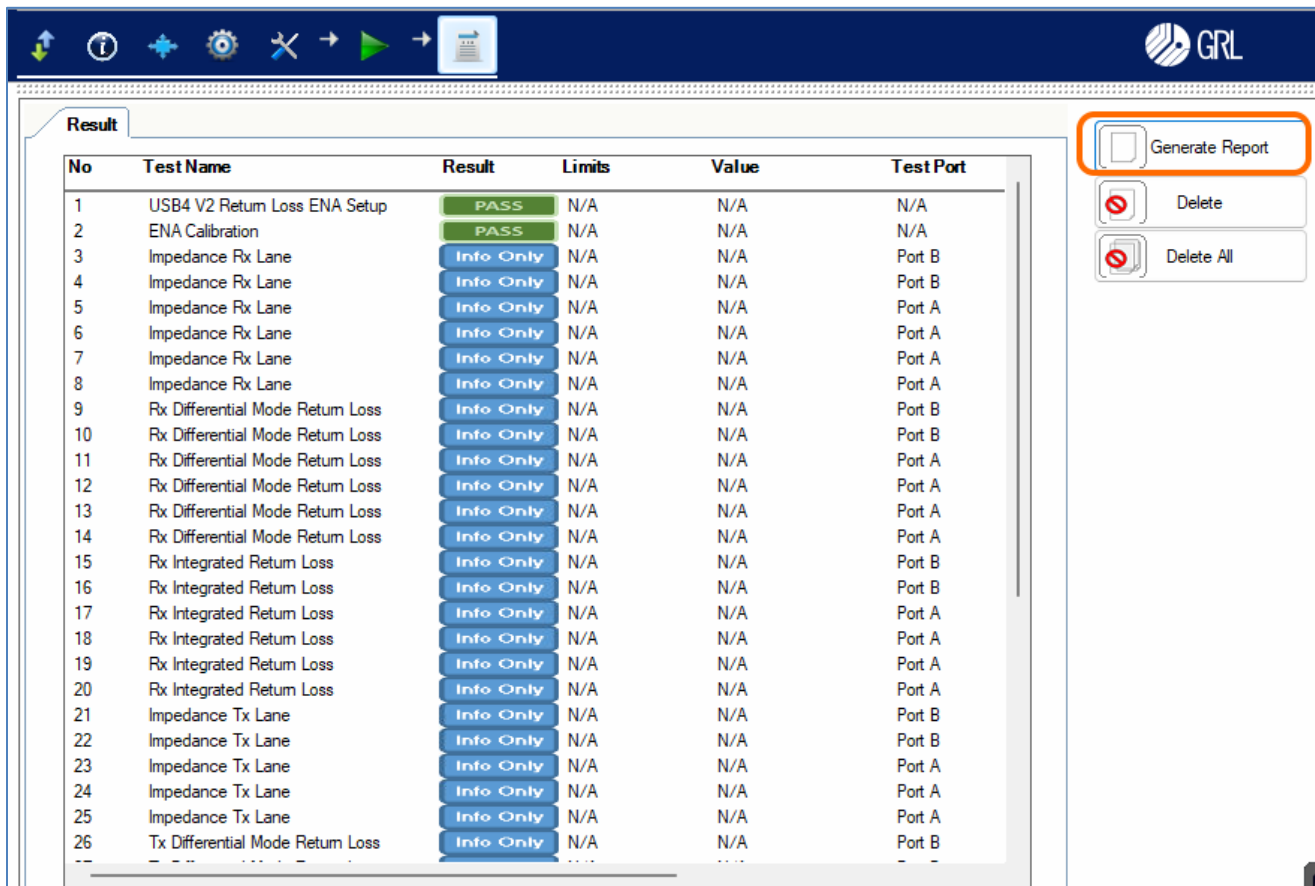
FIGURE 28. VIEW TEST RESULTS EXAMPLE

8 Test Results and Reports with GRL-USB4V2RL-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 on the “Delete” button. Also for a PDF report, select the “Generate report” button.

8.1 Generate Test Report

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



The screenshot shows the 'Result' page of the GRL-USB4V2RL-KS software. The main area contains a table with the following columns: No, Test Name, Result, Limits, Value, and Test Port. The table lists 26 test items, with results ranging from 'PASS' to 'Info Only'. On the right side, there is a sidebar with three buttons: 'Generate Report' (highlighted with an orange border), 'Delete', and 'Delete All'.

No	Test Name	Result	Limits	Value	Test Port
1	USB4 V2 Return Loss ENA Setup	PASS	N/A	N/A	N/A
2	ENA Calibration	PASS	N/A	N/A	N/A
3	Impedance Rx Lane	Info Only	N/A	N/A	Port B
4	Impedance Rx Lane	Info Only	N/A	N/A	Port B
5	Impedance Rx Lane	Info Only	N/A	N/A	Port A
6	Impedance Rx Lane	Info Only	N/A	N/A	Port A
7	Impedance Rx Lane	Info Only	N/A	N/A	Port A
8	Impedance Rx Lane	Info Only	N/A	N/A	Port A
9	Rx Differential Mode Return Loss	Info Only	N/A	N/A	Port B
10	Rx Differential Mode Return Loss	Info Only	N/A	N/A	Port B
11	Rx Differential Mode Return Loss	Info Only	N/A	N/A	Port A
12	Rx Differential Mode Return Loss	Info Only	N/A	N/A	Port A
13	Rx Differential Mode Return Loss	Info Only	N/A	N/A	Port A
14	Rx Differential Mode Return Loss	Info Only	N/A	N/A	Port A
15	Rx Integrated Return Loss	Info Only	N/A	N/A	Port B
16	Rx Integrated Return Loss	Info Only	N/A	N/A	Port B
17	Rx Integrated Return Loss	Info Only	N/A	N/A	Port A
18	Rx Integrated Return Loss	Info Only	N/A	N/A	Port A
19	Rx Integrated Return Loss	Info Only	N/A	N/A	Port A
20	Rx Integrated Return Loss	Info Only	N/A	N/A	Port A
21	Impedance Tx Lane	Info Only	N/A	N/A	Port B
22	Impedance Tx Lane	Info Only	N/A	N/A	Port B
23	Impedance Tx Lane	Info Only	N/A	N/A	Port A
24	Impedance Tx Lane	Info Only	N/A	N/A	Port A
25	Impedance Tx Lane	Info Only	N/A	N/A	Port A
26	Tx Differential Mode Return Loss	Info Only	N/A	N/A	Port B

FIGURE 29. GENERATE REPORT PAGE

8.1.1 DUT Information

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

USB4 V2 Return Loss Test Application Report	
DUT Information	
DUT Manufacturer	: Granite River Labs
DUT Model Number	: USB4_V2_RL_1
DUT Serial Number	: 100000
DUT Comments	:
Test Information	
Test Lab	: GRL
Test Operator	: David
Test Date	: 10 June 2024
Software Version	
Software Revision	: 1.0.0

FIGURE 30. DUT INFORMATION

8.1.2 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.

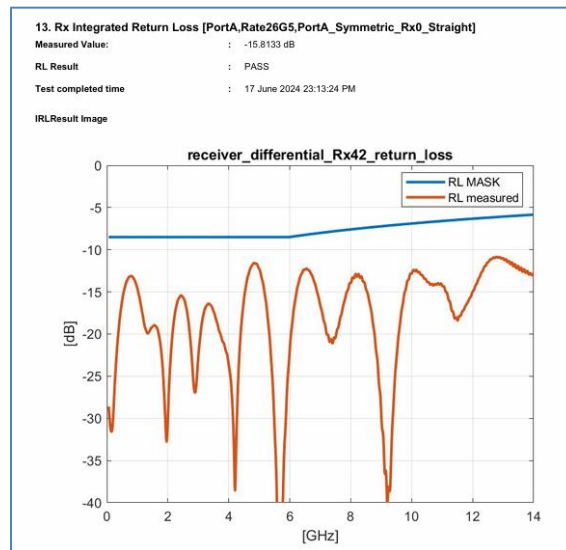
No	TestName	Limits	Value	Results	Test Port	Data Rate	Link Type	Tx Config	Rx Config
30	Tx Differential Mode Return Loss	N/A	N/A	InfoOnly	Port A	Rate 26,5G	N/A	PortA, Asymm3xTx, Tx1, Straight	N/A
31	Tx Differential Mode Return Loss	N/A	N/A	InfoOnly	Port A	Rate 26,5G	N/A	PortA, Asymm3xTx, Tx1, Reversed	N/A
32	Tx Differential Mode Return Loss	N/A	N/A	InfoOnly	Port A	Rate 26,5G	N/A	PortA, Symmetric, Tx1, Straight	N/A
33	Tx Differential Mode Return Loss	N/A	N/A	InfoOnly	Port A	Rate 26,5G	N/A	PortA, Symmetric, Tx0, Straight	N/A
34	Tx Integrated Return Loss	N/A	N/A	Fail	Port B	Rate 26,5G	N/A	PortB, Asymm3xTx, Tx2, Straight	N/A
35	Tx Integrated Return Loss	N/A	N/A	Fail	Port B	Rate 26,5G	N/A	PortB, Asymm3xTx, Tx2, Reversed	N/A
36	Tx Integrated Return Loss	N/A	N/A	Fail	Port B	Rate 26,5G	N/A	PortB, Asymm3xTx, Tx1, Straight	N/A
37	Tx Integrated Return Loss	N/A	N/A	Fail	Port B	Rate 26,5G	N/A	PortB, Asymm3xTx, Tx1, Reversed	N/A
38	Tx Integrated Return Loss	N/A	N/A	Pass	Port A	Rate 26,5G	N/A	PortA, Asymm3xTx, Tx1, Straight	N/A
39	Tx Integrated Return Loss	N/A	N/A	Pass	Port A	Rate 26,5G	N/A	PortA, Asymm3xTx, Tx1, Reversed	N/A
40	Tx Integrated Return Loss	N/A	N/A	Pass	Port A	Rate 26,5G	N/A	PortA, Symmetric, Tx1, Straight	N/A
41	Tx Integrated Return Loss	N/A	N/A	Pass	Port A	Rate 26,5G	N/A	PortA, Symmetric, Tx0, Straight	N/A

FIGURE 31. SUMMARY TABLE

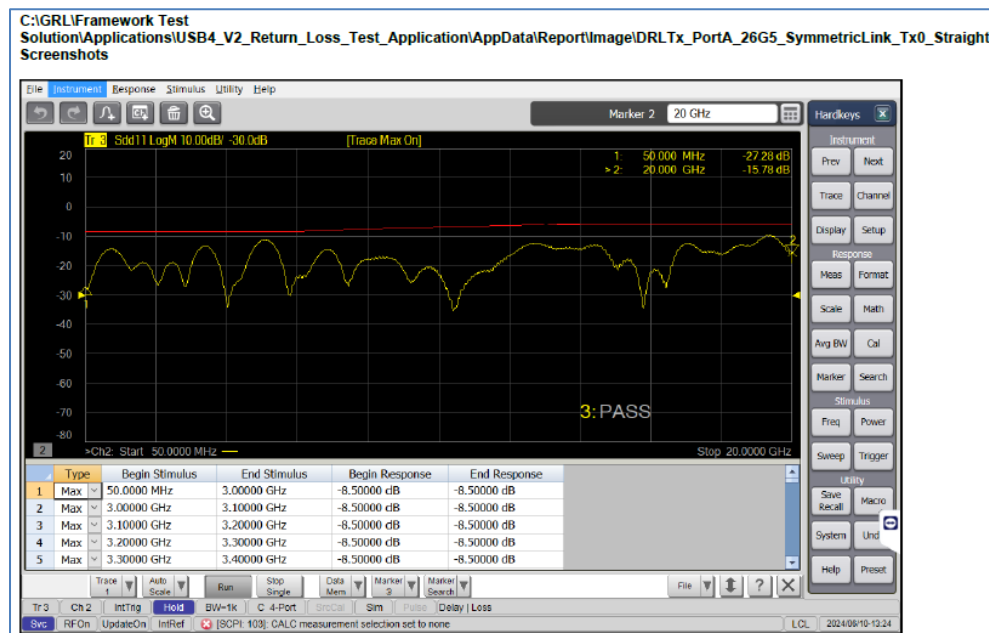
8.1.3 Test Result Details

This portion is populated from each of the test and calibration results. Here the results are shown with supporting screenshots.

Note: The user can obtain the .s2p and SigTest test results at “C:\GRL\Framework Test Solution\Applications\USB4_V2_Return_Loss_Test_Application\AppData\Report\Data”, and images from ENA capture at “C:\GRL\Framework Test Solution\Applications\USB4_V2_Return_Loss_Test_Application\AppData\Report\Image”.



Note: Trace plot images such as the example above will also be saved to “C:\GRL\Framework Test Solution\Applications\USB4_V2_Return_Loss_Test_Application\AppData\Report\Data\IRL_TestResult\”.



34. Tx Integrated Return Loss [PortB,Rate26G5,PortB_Asymm3xTx_Tx2_Straight]	
Pass/Fail Stats	: Fail
Measured Value:	: -7.7525 dB
Test completed time	: 06 June 2024 9:31:29 AM
35. Tx Integrated Return Loss [PortB,Rate26G5,PortB_Asymm3xTx_Tx2_Reversed]	
Pass/Fail Stats	: Fail
Measured Value:	: -7.7586 dB
Test completed time	: 06 June 2024 9:40:34 AM
36. Tx Integrated Return Loss [PortB,Rate26G5,PortB_Asymm3xTx_Tx1_Straight]	
Pass/Fail Stats	: Fail
Measured Value:	: -7.7522 dB
Test completed time	: 06 June 2024 10:10:18 AM

FIGURE 32. TEST RESULT DETAILS EXAMPLE

8.2 Delete Reports

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

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

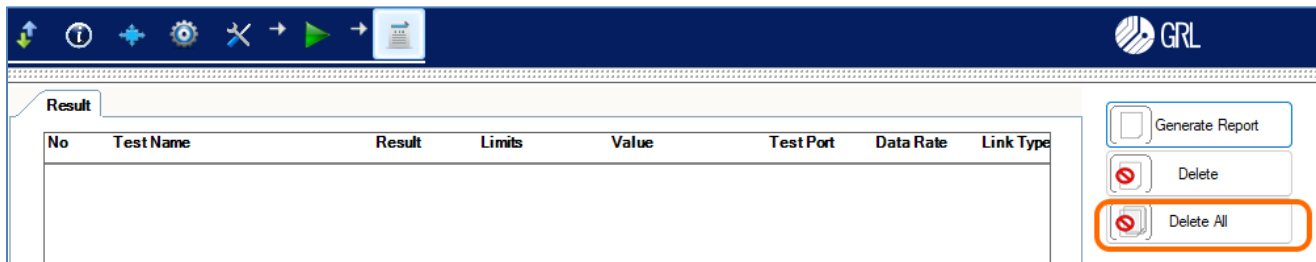


FIGURE 33. DELETE ALL RESULTS

9 Troubleshooting GRL-USB4V2RL-KS Errors

If an error is thrown by the GRL-USB4V2RL-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 A.17.25.05 or above (for the Keysight E5080B ENA) or B.14.14 or above (for the Keysight E5071C ENA).
2. The 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 the ETT is not properly installed, a software error may occur.
3. After checking the above and error persists, contact support@grlps.com for further support.

END_OF_DOCUMENT