GRL
GRANITE RIVER LABS

# GRL Type-C Cable Test Application (GRL-TYPE-C-CABLE-TEST) Quick Start Guide

**V1.0**

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# 1 Resource Requirements

## 1.1 Equipment Requirements

TABLE 1. EQUIPMENT REQUIREMENTS – SYSTEMS

| System | Qty. | Description | Key Specification Requirement |
|---|---|---|---|
| Vector Network Analyzer (VNA) | 1 | Anritsu MS46524B ShockLine™ 4-Port Performance Vector Network Analyzer | 40GHz<br>140dB maximum |

TABLE 2. EQUIPMENT REQUIREMENTS – ACCESSORIES

| Accessories | Qty. | Description | Key Specification Requirement |
|---|---|---|---|
| Calibration Kit | 1 | Anritsu TOSLKF50A-20 Coaxial Calibration Kit | Type K(f), DC to 20GHz, 50 ohms |
| | 1 | Luxshare ICT TFU-31C4R Calibration Board – Thru | |
| | 1 | Luxshare ICT TFU-32C4R Calibration Board – SOLT | |
| | 1 | Luxshare ICT TFU-33C4R Calibration Board – TRL | |
| USB Type-C to Type-C (Gen 1) Test Fixture | 2 | Luxshare ICT TFU-23R2R USB Type-C Receptacle High Speed Test Fixture | |
| | 2 | Luxshare ICT TFU-24R3R USB Type-C Receptacle Low Speed Test Fixture | |
| USB Type-C to Type-C (Gen 2) Test Fixture | 2 | Luxshare ICT TFU-23R2R USB Type-C Receptacle High Speed Test Fixture | |
| | 2 | Luxshare ICT TFU-24R3R USB Type-C Receptacle Low Speed Test Fixture | |
| USB Type-C to Legacy Test Fixture | 1 | Luxshare ICT TFU-25P4R USB 2.0 Micro-B Plug | |
| | 1 | Luxshare ICT TFU-26R4R USB 2.0 Mini-B Receptacle | |
| | 1 | Luxshare ICT TFU-14R4R USB 2.0 Micro-B Receptacle | |
| | 1 | Luxshare ICT TFU-12P4R USB 3.1 Type-A Plug | |
| | 1 | Luxshare ICT TFU-12R4R USB 3.1 Type-A Receptacle | |
| | 1 | Luxshare ICT TFU-19R4R USB 3.1 Type-B Receptacle | |

TABLE 3. EQUIPMENT REQUIREMENTS – ACCESSORIES (CONTINUED)

| Accessories | Qty. | Description | Key Specification Requirement |
|---|---|---|---|
| Shielding Effectiveness | 1 | Luxshare ICT RFI Cable Assembly Shielding Effectiveness Test Fixture (Type C-to Type-C, Type-C to Type-A Receptacle, Type-C to Type-A Plug) | |

## 1.2 Software Requirements

TABLE 4. SOFTWARE REQUIREMENTS

| Product | Source |
|---|---|
| GRL-TYPE-C-CABLE-TEST | Granite River Labs Type-C Cable Calibration and Test Automation Software – www.graniteriverlabs.com. |
| Intel IntePar USB Type-C Cable Assembly Compliance Tool Rev 1.1 | Intel Corporation |

# 2 Installation and Setup of GRL-TYPE-C-CABLE-TEST Software

## 2.1 Setup

This section provides procedures for installing, configuring and verifying the operation of the GRL Type-C Cable Test solution. It also helps you familiarize with the basic operation of the application.

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

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

### 2.1.1 Download Software

Install, launch and set up the GRL Type-C Cable Test Application software:

1. Download the **TypeC_Cable_ANVX.X.X.zip** package from the Granite River Labs support site.
2. The zip file contains:
   - **TypeCCableTestApplication_AN00xxxxxxSetup.exe** – Run this on the PC.
3. Launch and set up the software as follows:
   a) Open the GRL Folder under the Windows Start Menu. Click on GRL Framework within the GRL Folder. The GRL Framework will launch.

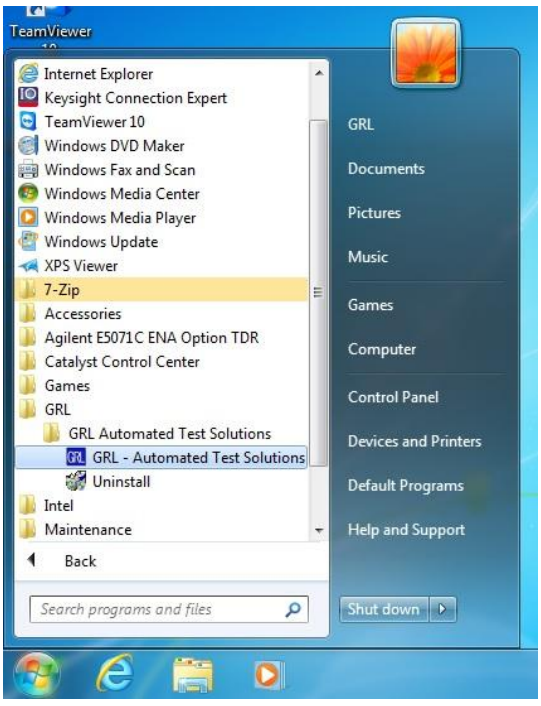



FIGURE 1. LAUNCHING GRL FRAMEWORK

b) From Application → Framework Test Solution drop-down menu, select "Anritsu Type-C Cable Test Application". If the selection is grayed out, then your license is expired.


FIGURE 2. LAUNCHING TYPE-C CABLE TEST APPLICATION

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

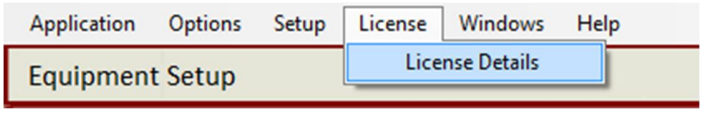



FIGURE 3. LICENSE DETAILS

ii) Review the installed applications.

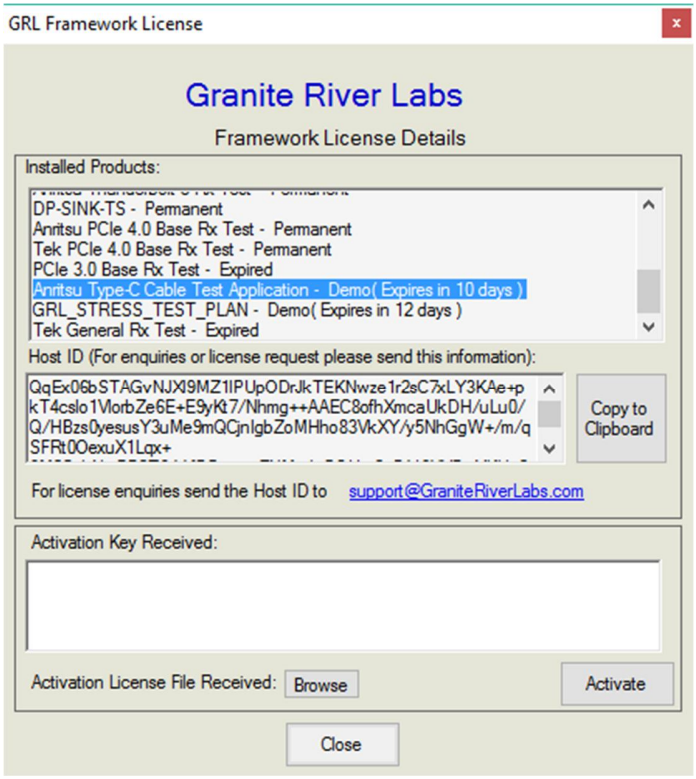



FIGURE 4. INSTALLED APPLICATIONS

iii) Activate a License:

[1] If you have an Activation Key, please enter it in the box provided, and press Activate.
[2] If you do not have an Activation Key, press 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 computer or oscilloscope. 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 full calibrate and test a device.

For Demo and Beta Customer License Keys, please request an Activation Key by contacting support@graniteriverlabs.com.

### 2.1.2 Connect Anritsu Vector Network Analyzer with PC

1. Connect the Anritsu VNA with the controller PC using an Ethernet cable.

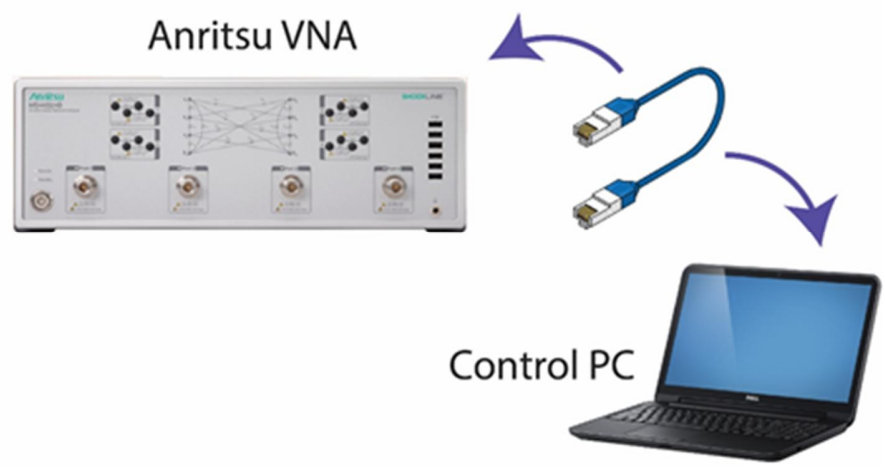
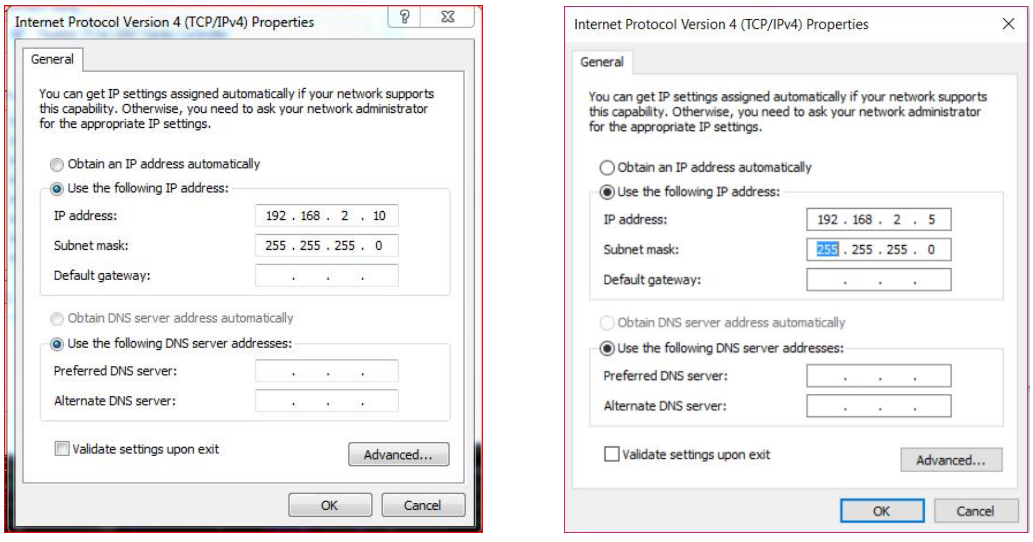



FIGURE 5. CONNECTING ANRITSU VNA WITH PC

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




**VNA** **PC**

FIGURE 6. SETTING VNA AND PC NETWORK

### 2.1.3 Launch and Set Up Software

#### 2.1.3.1 On the PC

1. Launch GRL Host Application from Start Menu -> GRL -> GRL – Automated Test Solutions.
2. Select Application -> Framework Test Solution -> Anritsu Type-C Cable Test Application.
3. Type in the IP Address of the Anritsu VNA into "Address" field and click the "lightning bolt" button  . The "lightning bolt" button should turn green if successfully connected to the equipment.

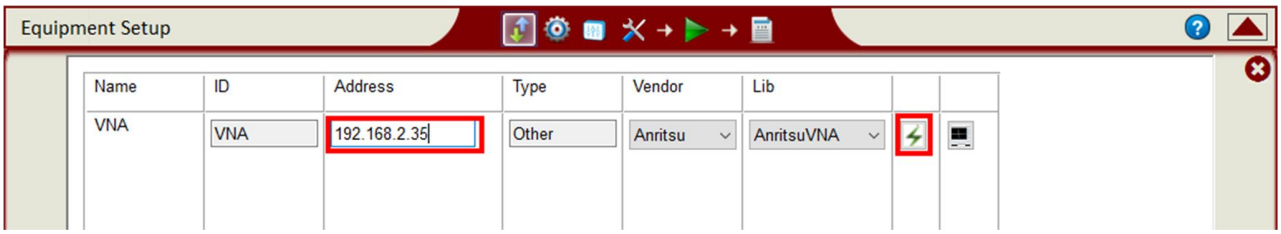



FIGURE 7. GRL TEST SOLUTION IP ADDRESSING ON VNA

# 3 Type-C Cable VNA Calibration Setups

The Type-C cable will be calibrated for RF effects such as delay, loss or mismatch of RF cables and test fixture traces before running measurements. The GRL software provides three calibration methods — "SOLT", "SOLT & De-embedding" and "TRL" calibrations, using Anritsu and/or Luxshare calibration kits/test fixtures. Each method of calibration is performed for both the time domain and frequency domain.

Calibration setup for the Type-C cable VNA is divided into the "High Speed" and "Low Speed" main groups. The VNA test setups will be different for the selected test speed and cable type.

The following sections show the setup connection diagrams for the "SOLT", "SOLT & De-embedding" and "TRL" calibration methods.

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

## 3.1 Connection Setup for SOLT Calibration Method

The figure below shows the calibration setup diagram for the SOLT calibration method, using the Anritsu TOSLKF50A-20 calibration kit.

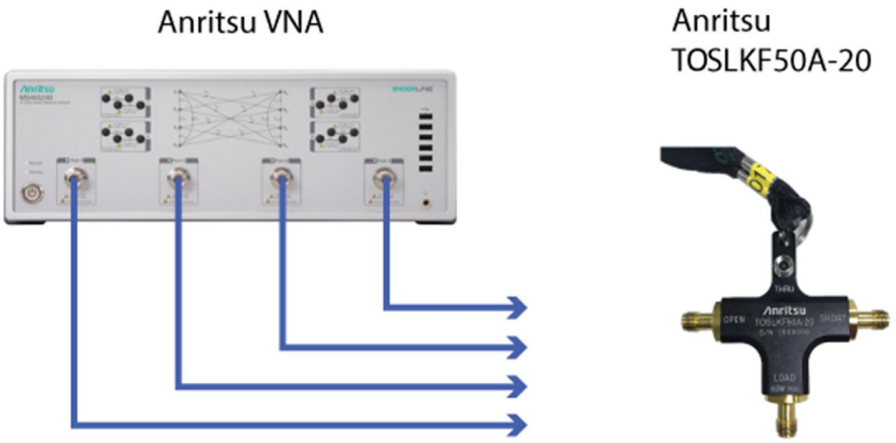



FIGURE 8. CALIBRATION SETUP FOR SOLT CALIBRATION METHOD

The GRL software will guide user on how to perform the calibration step by step without de-embedding the test fixture. This will include test fixture effects when running measurements.

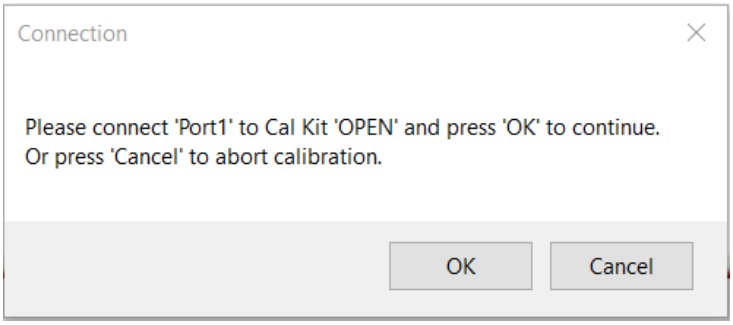



FIGURE 9. CONNECTION GUIDE EXAMPLE

## 3.2 Connection Setup for SOLT & De-embedding Calibration Method

The figure below shows the calibration setup diagram for the SOLT & De-embedding calibration method, using the Anritsu TOSLKF50A-20 and Luxshare ICT TFU-23C4R calibration kits.

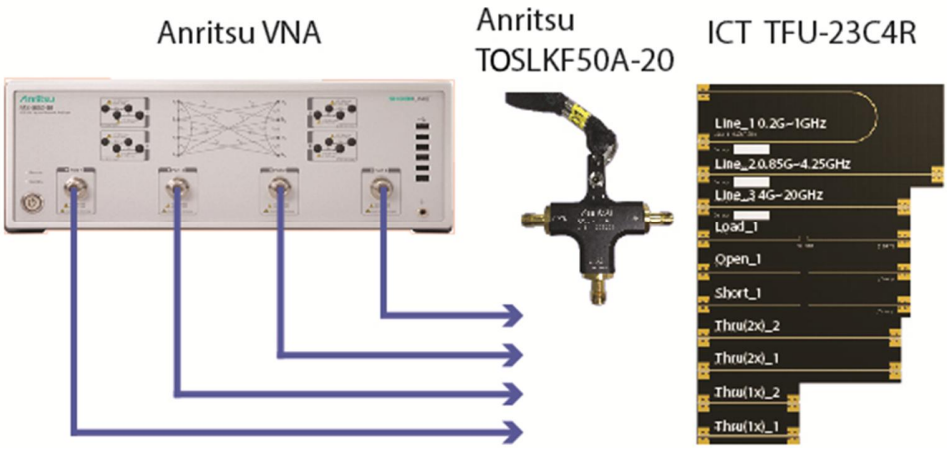



FIGURE 10. CALIBRATION SETUP FOR SOLT & DE-EMBEDDING CALIBRATION METHOD

The GRL software will perform the SOLT calibration and de-embedding of the test fixture automatically. Follow the software guide step by step to perform the calibration and de-embedding.

*Note: De-embedding requires "2x Thru" on the Luxshare TFU-23C4R Calibration Board – Thru to generate S2P de-embedding files. Refer to Appendix for the test fixture de-embedding procedure.*

## 3.3 Connection Setup for TRL Calibration Method

The figure below shows the calibration setup diagram for the TRL calibration method, using the Luxshare ICT TFU-23C4R calibration kit.

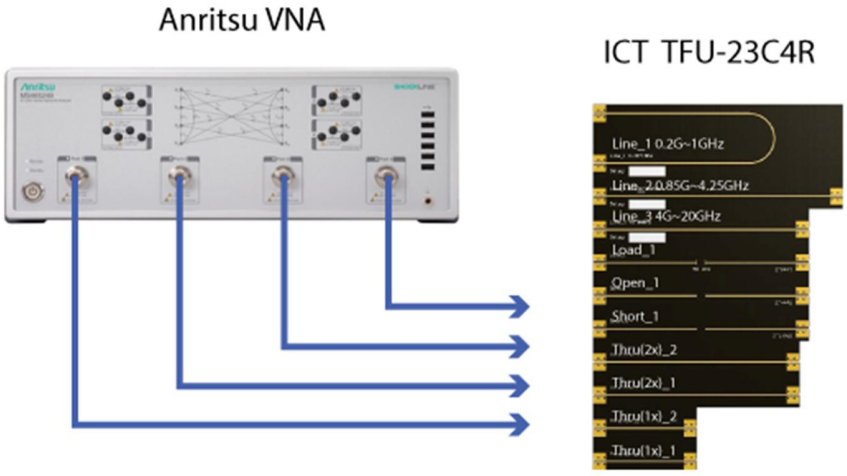



FIGURE 11. CALIBRATION SETUP FOR TRL CALIBRATION METHOD

Follow the software guide step by step to perform the TRL calibration.

# 4 Calibrating with GRL-TYPE-C-CABLE-TEST Software

## 4.1 Setup Configuration

Select the  button in the main software menu to access the Setup Configuration page.


FIGURE 12. SETUP CONFIGURATION PAGE

### 4.1.1 Cable Type Tab

Select the desired Type-C cable type and test speed for VNA test setup. The selected test speed will set the VNA setup in the high speed or low speed mode.

*Note: The test speed is fixed to the high speed mode for the Type-C to Legacy cable/adapter.*

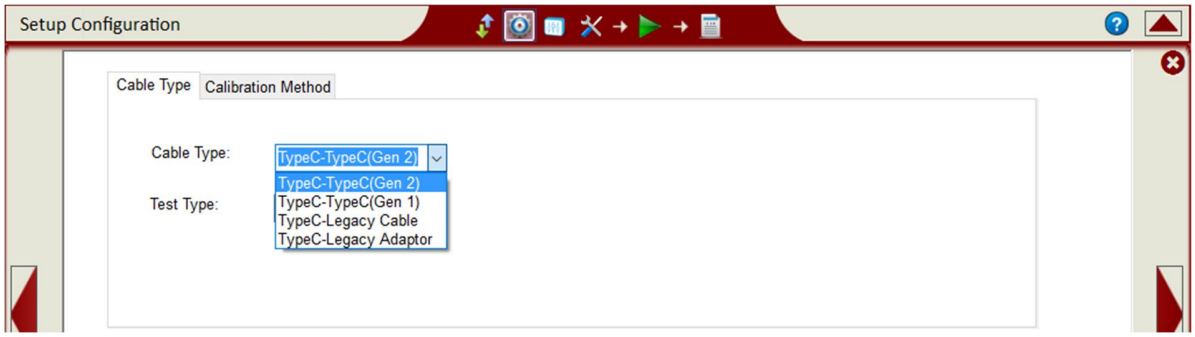



FIGURE 13. SELECT CABLE TYPE

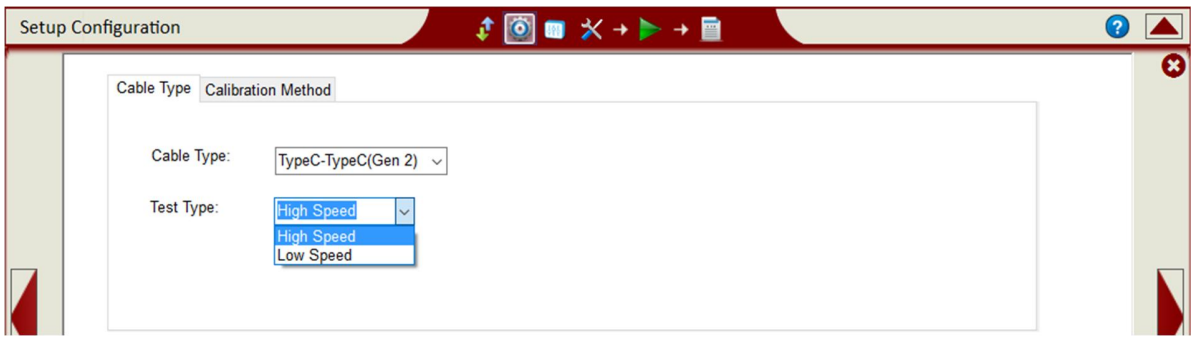



FIGURE 14. SELECT TEST SPEED

### 4.1.2 Calibration Method Tab

Select the desired method for calibration. All methods of calibration are performed for both the time domain and frequency domain.

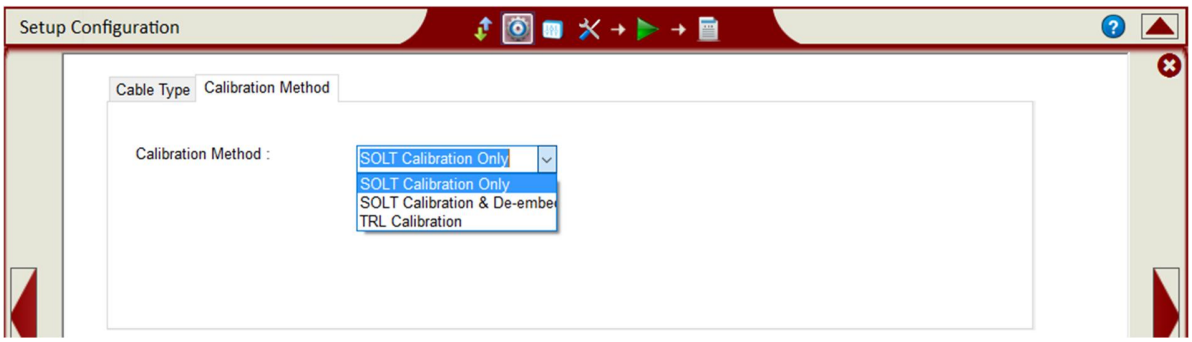



FIGURE 15. SELECT CALIBRATION METHOD

## 4.2 Select Calibration

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

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.

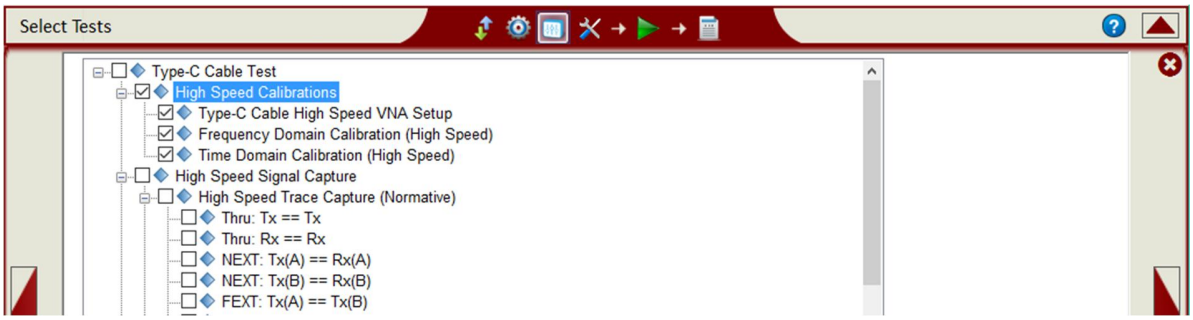



FIGURE 16. SELECT CALIBRATION TYPES

*Note: The Select Tests page will show the calibration/tests in the High Speed or Low Speed mode depending on the test speed selected in the Setup Configuration page.*

Select the "High Speed/Low Speed Calibrations" group to set up the VNA test environment and perform calibration for time and frequency domains for the respective test speed. Calibration will be performed using the calibration method selected in the Setup Configuration page.

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

## 4.3 Run Calibration

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

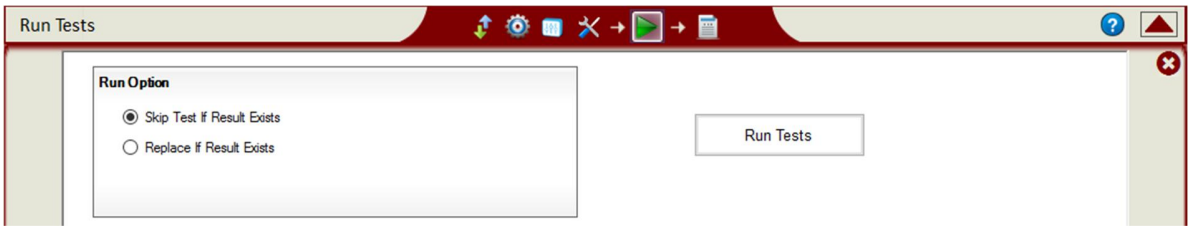



FIGURE 17. RUN TESTS PAGE

TABLE 5. RUN OPTIONS

| Run Option | Description |
|---|---|
| **Skip Test if Result Exists** | If previous test or calibration results exist, then the software will *skip* the tests/calibration steps that have existing reports. |
| **Replace if Result Exists** | 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 and Run with **Skip Test if Result Exists**. GRL software will keep track of the missing calibration/tests in the report and perform those tests only. See figure below.

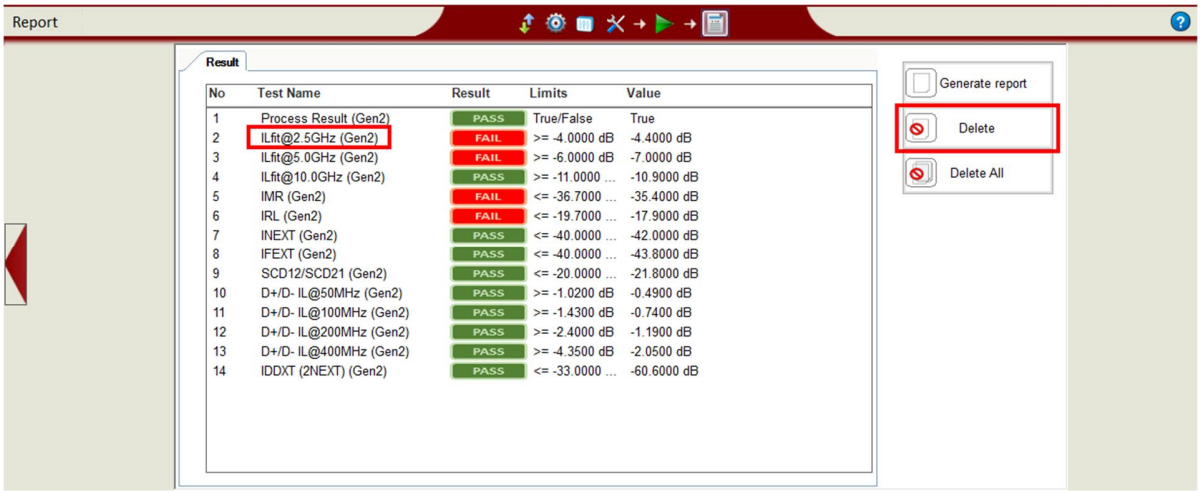



FIGURE 18. DELETE CALIBRATION/TEST RESULTS EXAMPLE

# 5 Testing Type-C Cable with GRL-TYPE-C-CABLE-TEST Software

After calibration has completed, testing for the Type-C cable can then be performed. Testing in the High Speed or Low Speed mode via the GRL software typically involves capturing the signal traces, measuring USB 2.0 D+/D- signal parameters (*for High Speed only*), importing the trace files to the Intel IntePar USB Type-C Cable Assembly Compliance Tool Rev 1.1 to analyse and acquire test results, and generating the test report. Testing can also be carried out using the software automation method.

GRL software also provides test analysis for transmitter/receiver shielding effectiveness of the Type-C cable.

## 5.1 Configure Test Parameters

Click the Configurations button  in the main software menu to access the test parameter Configurations page. Set the parameters for testing as described in Table 6 below.

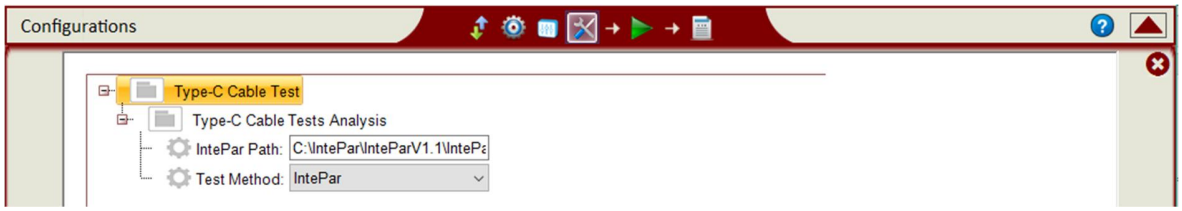



FIGURE 19. TEST PARAMETERS CONFIGURATION PAGE

TABLE 6. TEST PARAMETERS DESCRIPTION

| Parameter Name | Description |
|---|---|
| **IntePar Path** | Enter the IntePar folder path if using the Intel IntePar USB Type-C Cable Assembly Compliance Tool Rev 1.1 to analyse and acquire test results. |
| **Test Method** | Select to use either the IntePar or software automation (Automated) test method for testing. If 'Automated' is selected, GRL software will bypass the IntePar procedure to process test results automatically. |

## 5.2 Select Tests

Select the  button in the main software menu to access 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.

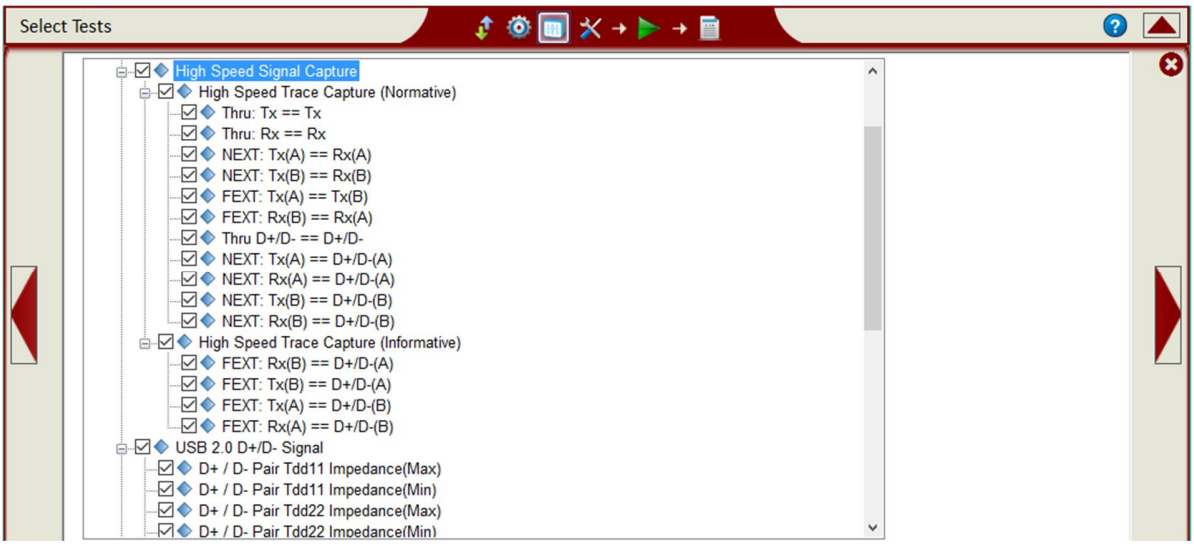



FIGURE 20. SELECT TESTS

*Note: The Select Tests page will show the calibration/tests in the High Speed or Low Speed mode depending on the test speed selected in the Setup Configuration page.*

## 5.3 Run Automated Tests Using GRL Software

From Section 5.1 Configurations page, select "Automated" in the Test Method field.

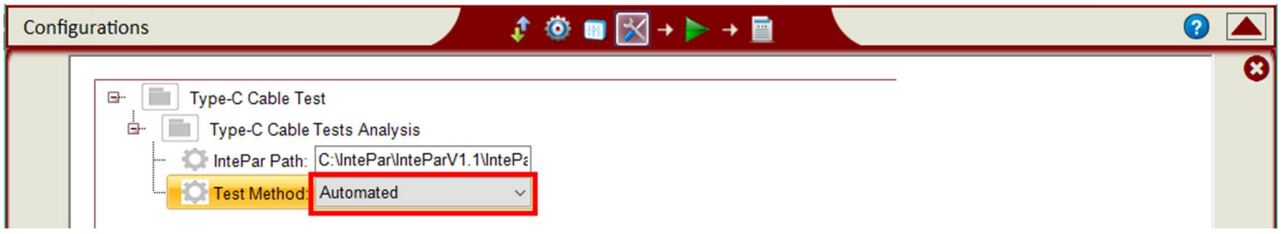



FIGURE 21. SELECT AUTOMATED TEST METHOD

From Section 5.2 Select Tests page, select the desired tests to run. Then select the  button in the main software menu to access the Run Tests page and click "Run Tests".

Follow the instructions on the pop-ups to guide you to run and complete testing step by step.

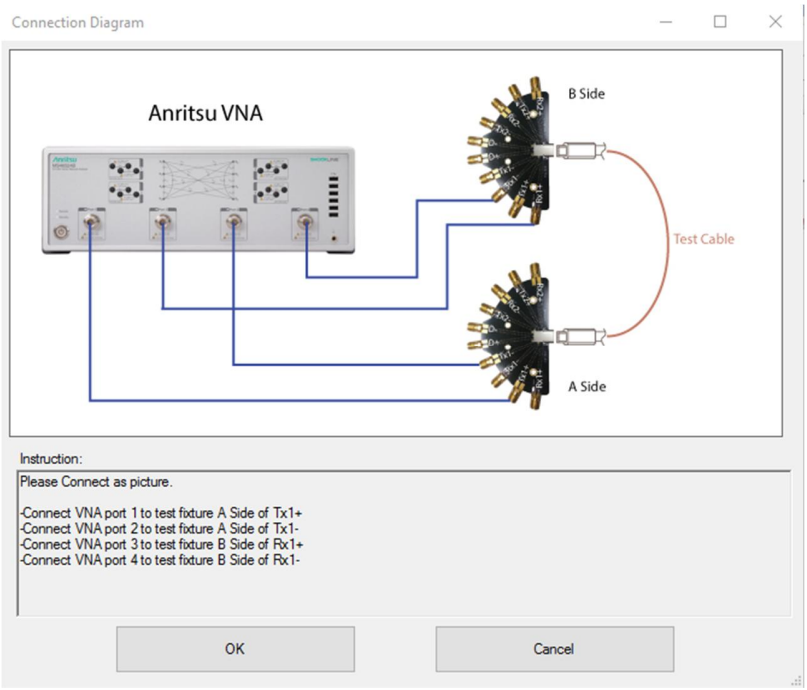



FIGURE 22. TEST INSTRUCTION POP-UP EXAMPLE

After tests are completed, you can view the test results on the Report page (select the  button on the main GRL software menu) or generate a detailed test report. Refer to Section 6 for more details.

## 5.4 Perform Type-C Cable Test Analysis Using Intel IntePar Method

The following example describes how to capture s4p trace files, analyse the s4p files using the Intel IntePar compliance tool to acquire test results, and generate the GRL test report, using the High Speed and Low Speed modes.

### 5.4.1 ILfitatNq, IMR, IXT, and Differential to Common-Mode Conversion (High Speed)

1. Select the High Speed test parameters as required to generate s4p trace files.

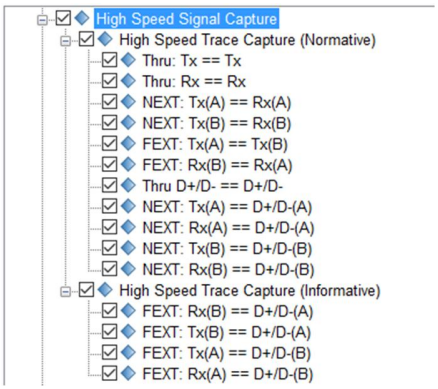



FIGURE 23. SELECT HIGH SPEED TEST PARAMETERS FOR TRACE CAPTURE

2. Select the  button in the main software menu to access the Run Tests page, and click "Run Tests".
3. Select the  button in the main software menu to access the Configurations page. Enter the correct IntePar folder path (e.g. *C:\IntePar1p1a\IntePar1p1a.exe*). Select "IntePar" as the Test Method.


FIGURE 24. SET UP INTEPAR

4. On the Select Tests page under the Type-C Cable Tests Analysis group, select "Process Result" to recall the IntePar software.

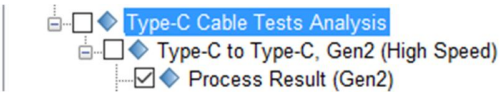
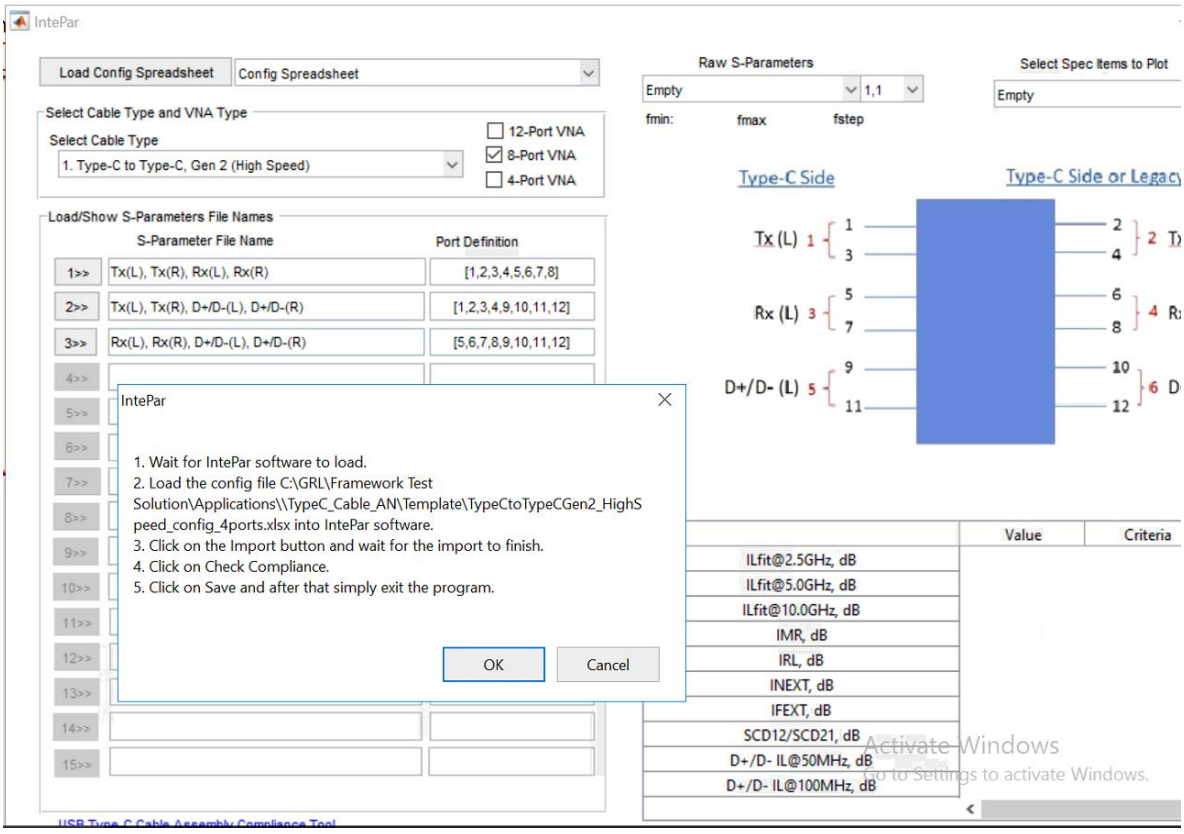



FIGURE 25. SELECT PROCESS RESULT FOR INTEPAR SOFTWARE ANALYSIS

5. Run "Process Result" and follow the instructions on the pop-ups. Click "OK" once completed.



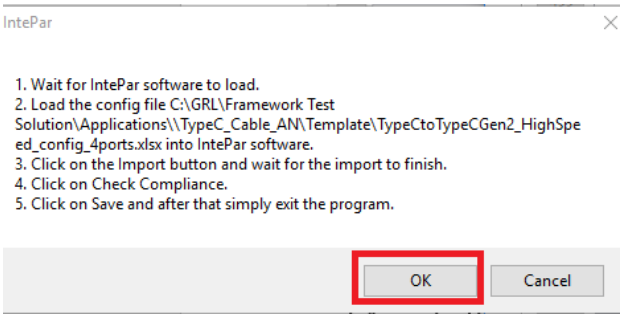



FIGURE 26. RUN AND COMPLETE INTEPAR TEST ANALYSIS

6. View the test results on the Report page (select the  button on the main GRL software menu).

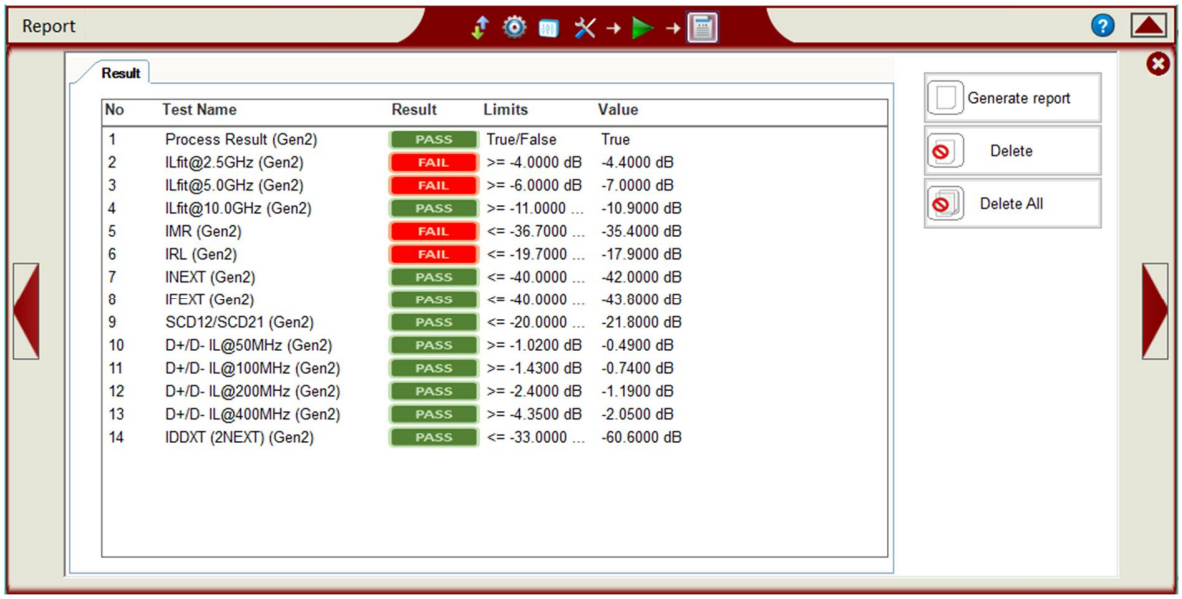



FIGURE 27. VIEW TEST RESULTS EXAMPLE

### 5.4.2 Signal Crosstalk, Vbus, Loop L/C, and Inductance Coupling Factor (Low Speed)

1. Select the Low Speed test parameters as required to generate s4p trace files.

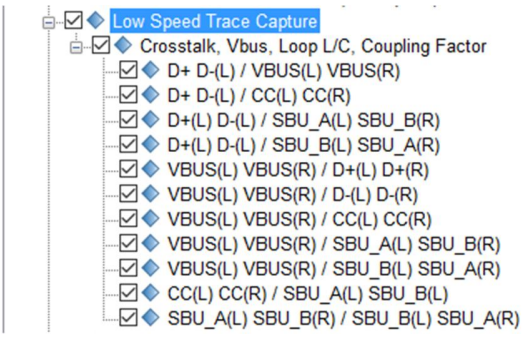



FIGURE 28. SELECT LOW SPEED TEST PARAMETERS FOR TRACE CAPTURE

2. Select the  button in the main software menu to access the Run Tests page, and click "Run Tests".
3. Select the  button in the main software menu to access the Configurations page. Enter the correct IntePar folder path (e.g. *C:\IntePar1p1a\IntePar1p1a.exe*). Select "IntePar" as the Test Method.


FIGURE 29. SET UP INTEPAR

4. On the Select Tests page under the Type-C Cable Tests Analysis group, select "Process Result" to recall the IntePar software.

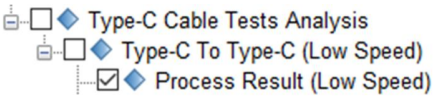
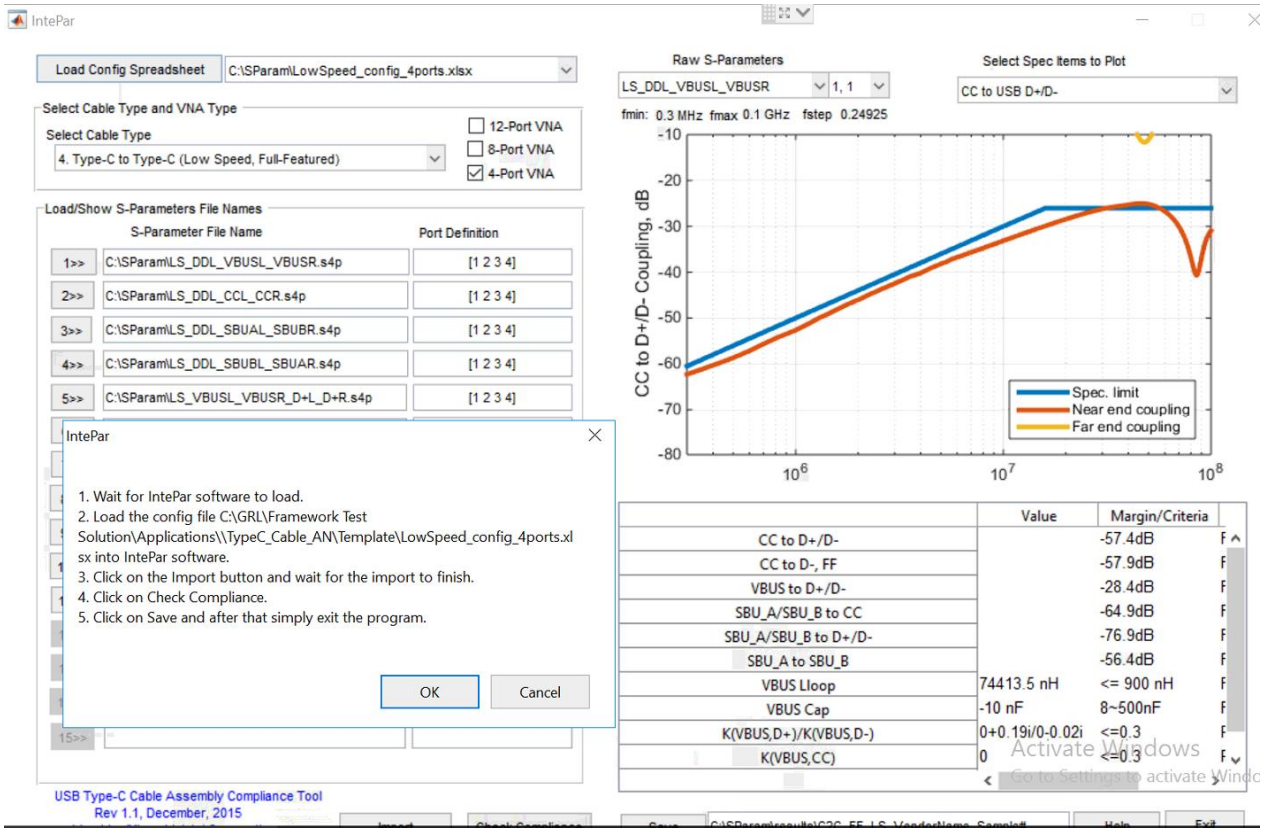



FIGURE 30. SELECT PROCESS RESULT FOR INTEPAR SOFTWARE ANALYSIS

5. Run "Process Result" and follow the instructions on the pop-up. Click "OK" once completed.



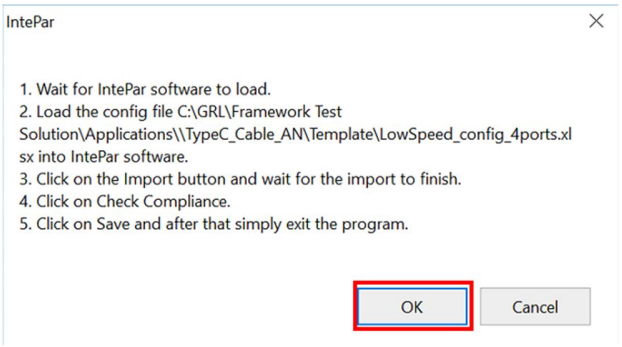



FIGURE 31. RUN AND COMPLETE INTEPAR TEST ANALYSIS

6. View the test results on the Report page (select the  button on the main GRL software menu).

# 6 Test Results and Reports with GRL-TYPE-C-CABLE-TEST 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, click the "Generate report" button.

## 6.1 Generate Test Report

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

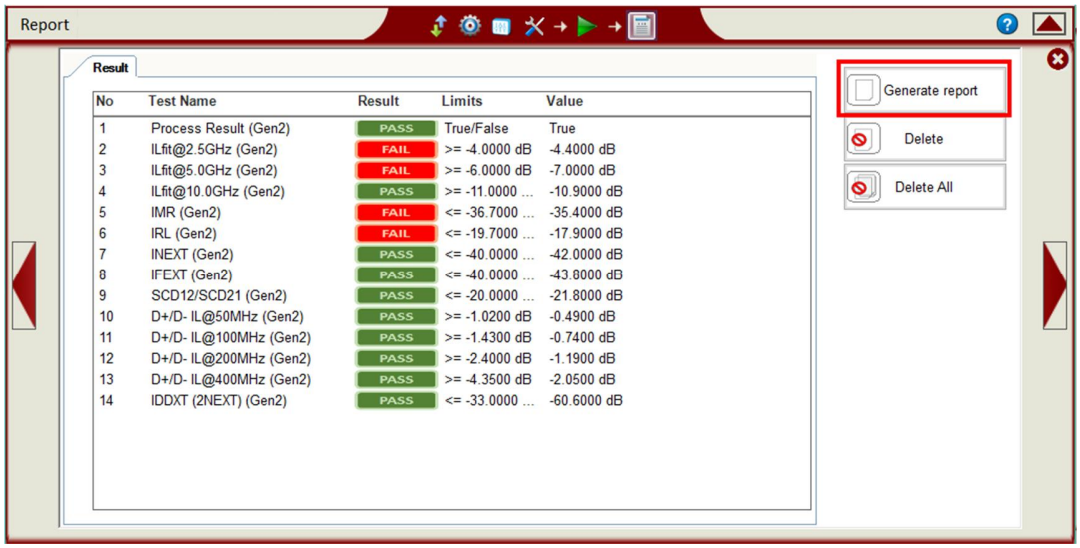



FIGURE 32. GENERATE REPORT PAGE

### 6.1.1 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.

**Anritsu Type-C Cable Test Application Report**

| No | TestName | Limits | Value | Results |
|---|---|---|---|---|
| 1 | Process Result (Legacy Adapter) | True/False | True | Pass |
| 2 | ILfit@2.5GHz (Legacy Adapter) | >= -2.4000 dB | -16.4000 dB | Fail |
| 3 | ILfit@5.0GHz (Legacy Adapter) | >= -3.5000 dB | -72.3000 dB | Fail |
| 4 | IMR@2.5GHz (Legacy Adapter) | < -34.0000 dB | -8.1000 dB | Fail |
| 5 | IMR@5.0GHz (Legacy Adapter) | < -27.0000 dB | -6.8000 dB | Fail |
| 6 | IRL@2.5GHz (Legacy Adapter) | < -14.5000 dB | -20.6000 dB | Pass |
| 7 | IRL@5.0GHz (Legacy Adapter) | < -12.0000 dB | -18.6000 dB | Pass |
| 8 | ISSXT (Legacy Adapter) | <= -37.0000 dB | -27.7000 dB | Fail |
| 9 | IDDXT (Legacy Adapter) | <= -30.0000 dB | -17.0000 dB | Fail |
| 10 | SCD12 and SCD21 (Legacy Adapter) | <= -15.0000 dB | -1.7000 dB | Fail |
| 11 | D+/D- IL@400MHz (Legacy Adapter) | >= -0.7000 dB | -2.4800 dB | Fail |

FIGURE 33. SUMMARY TABLE

### 6.1.2 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.

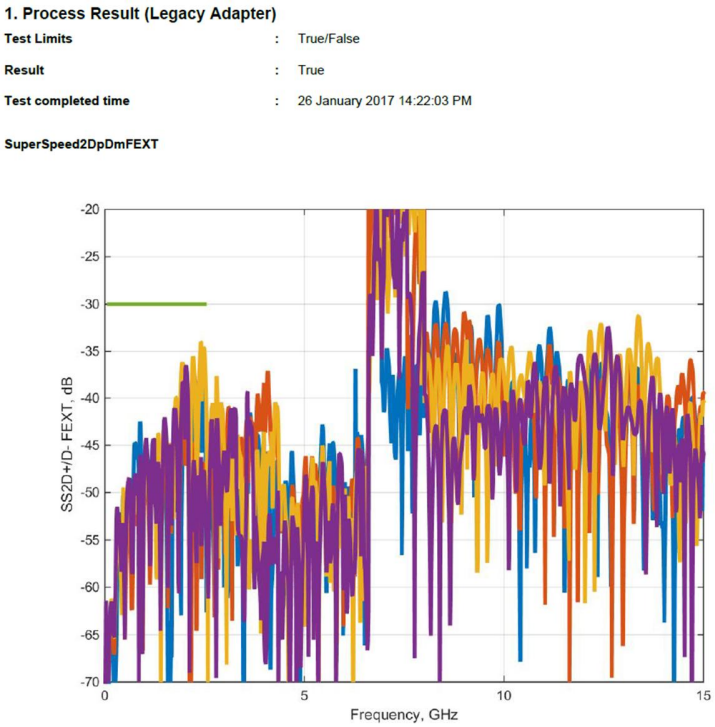



FIGURE 34. TEST RESULT DETAILS EXAMPLE

## 6.2 Delete Reports

If some of the results are not desired, they can be individually deleted by clicking the "Delete" button.

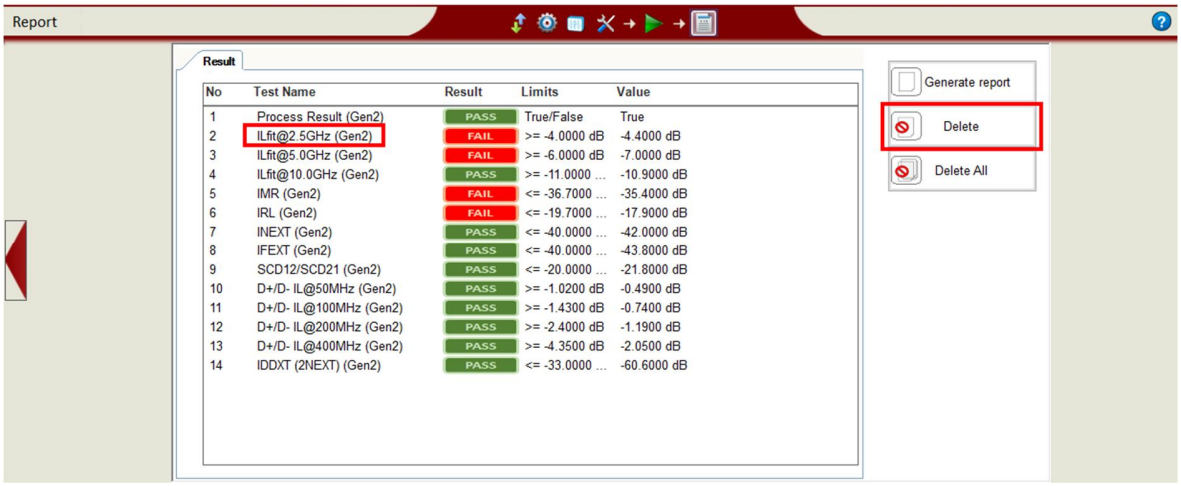



FIGURE 35. DELETE INDIVIDUAL CALIBRATION/TEST RESULTS EXAMPLE

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

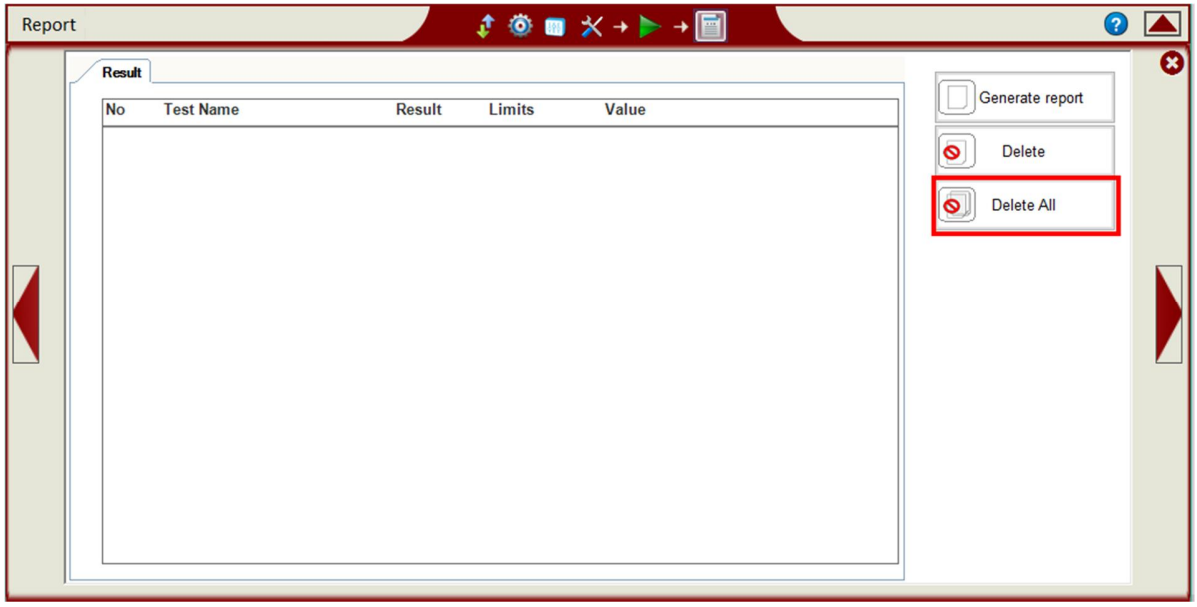



FIGURE 36. DELETE ALL RESULTS

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