Granite River Labs

USB Type-CTM Power Delivery and Alt Mode Test Quick Start Guide

for GRL USB Type-C Power Delivery Tester and Analyzer (GRL-USB-PD-C2) Browser Application



This material is provided as a reference to install and get started with Rev 1.4.x.x of Granite River Labs (GRL) USB-PD Power Delivery Compliance Test (GRL-USB-PD-C2) Browser Application. For software support, contact support@graniteriverlabs.com.

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1 Reference Documents

The test methods outlined in this document are tests required by various technology adoptions of the USB Type-C Connector. Specifications that have adopted the USB Type-C Connector and may be referenced in this document include, but are not limited to, the following specification versions.

Note: In order to have access to all specifications, it may be required that you are a member of an industry group and have attained the proper permissions.

1.1 USB-IF

USB-IF Compliance Documents are available for download at:

http://www.usb.org/developers/docs/

Type-C Cable and Connector Specification USB Power Delivery Specification Rev 3.0 Version 1.2 USB Power Delivery Specification Rev2 Version 1.3 Power Delivery 3 0 Tests Version 1.13 (September 20, 2018) USB-C Source Power Test Specification Version 0.71 (March 03, 2017) PD Communications Engine USB PD Compliance MOI Version 1.09 (April 18, 2018) Deterministic PD Compliance MOI Version 1.14 (September 25, 2018)

1.2 VESA - DisplayPort

Download the DisplayPort document from the VESA Browser site:

http://www.vesa.org/join-vesamemberships/member-downloads/

DisplayPort Alt Mode on USB Type-C Standard, Ver. 1.0a, August 5th, 2016

DisplayPort Alt Mode on USB Type-C 1.0a Compliance Test Specification (CTS), Rev 1.0, Jan 24th, 2017

DisplayPort over on USB Type-C Pin Assignment SCR – May 16, 2017

1.3 QC4 Testing

Approval and NDA as a QC4/4+ Adopter is required to gain access to the QC4/4+ Compliance Test Spec. Contact your Granite River Labs or Qualcomm QC4 representative for more details.

Quick Charge 4 Test Specification Version 1.1 (August 30, 2018)

2 Scope of this Quick Start Guide

This Quick Start Guide describes how to use the Browser application of the GRL-USB-PD-C2 USB Type-C Test Controller for performing GRL-USB-PD Compliance Tests. For more details on the GRL-USB-PD-C2 test solution and controller, see related user documentation at http://graniteriverlabs.com/download-center/ and general overview at http://graniteriverlabs.com/usb-pd-c2 USB

3 Getting Started with GRL-USB-PD-C2 Browser Application

This section describes how to get started with the GRL-USB-PD-C2 Browser App for USB-PD compliance testing. If you are installing for the first time, please make sure to follow all the steps in this section to verify your setup prior to testing a Unit Under Test (UUT). The procedure is as follows:

- 1. Install the latest version of GRL-USB-PD-C2 Browser App on the host computer (laptop or desktop) connected to the GRL-USB-PD-C2 Test Controller. For best system operation using this App, GRL recommends that the host PC supports Intel Core i7 and 8GB RAM with Google Chrome version 80.0.3987.122 or above (64-bit). Make sure to clear the browser cache before launching the GRL-USB-PD-C2 browser application server.
- 2. Make sure the GRL-USB-PD-C2 Test Controller Firmware has been updated to the latest version (see Section 4).

If this procedure is followed and any issues arise, please contact support@graniteriverlabs.com.

3.1 Install GRL-USB-PD-C2 Browser App

- 1. Download the GRL-USB-PD-C2 Browser App from http://graniteriverlabs.com/download-center/.
- 2. Run the installer by double clicking the extracted executable (*GRL_GRL-C2_Browser_App_V1x.x.exe*) and then click on the 'Next' button.



FIGURE 3.1: START GRL-USB-PD-C2 BROWSER APP INSTALLATION

3. Read and accept the license agreement by clicking on the 'I Agree' button.

GRL-C2_Browser_App V1.4.7.52 Setup —	×
License Agreement	
Please review the license terms before installing GRL-C2_Browser_App V1.4.7.52.	GRL
Press Page Down to see the rest of the agreement.	
*********************************** ****	^
GRANITE RIVER LABS SOFTWARE LICENSE AGREEMENT ####################################	
INSTALLATION NOTICE: THIS IS A CONTRACT. BEFORE YOU DOWNLOAD THE SOFTWARE AND/OR COMPLETE THE INSTALLATION PROCESS, CAREFULLY READ THIS AGREEMENT. BY DOWNLOADING THE SOFTWARE AND/OR CLICKING THE APPLICABLE BUTTON TO COMPLETE THE INSTALLATION PROCESS, YOU CONSENT TO THE TERMS OF THIS AGREEMENT AND YOU AGREE TO BE BOUND BY THIS AGREEMENT. IF YOU DO NOT WISH TO BECOME A PARTY TO THIS AGREEMENT AND BE BOUND BY ALL OF ITS TERMS AND CONDITIONS, CLICK THE APPROPRIATE BUTTON TO CANCEL THE	¥
If you accept the terms of the agreement, click I Agree to continue. You must accept the agreement to install GRL-C2_Browser_App V1.4.7.52.	
Nullsoft Install System v3.02.1	:el

FIGURE 3.2: ACCEPT GRL-USB-PD-C2 BROWSER APP LICENSE AGREEMENT

4. The software installation will then proceed and upon completion, click on the 'Finish' button.

GRL	GRL-C2_Browser_App V1.4.7.52 Setup	_		\times
Ir	nstalling Please wait while GRL-C2_Browser_App V1.4.7.52 is being instal	ed.		GRL
	Extract: enumvalues_11.js 100%			
	Extract: enums .a.html 100%			•
	Extract: enums_a.js 100%			
	Extract: enumvalues_0.html 100%			
	Extract: enumvalues_1.html 100%			
	Extract: enumvalues_1.js 100%			
	Extract: enumvalues_10.html 100%			
	Extract: enumvalues 11.html 100%			
	Extract: enumvalues_11.js 100%			~
Nul	Isoft Install System V3.U2.1			
	< <u>B</u> ack	<u>N</u> ext >	Car	ncel

FIGURE 3.3: GRL-USB-PD-C2 BROWSER APP INSTALLATION IN PROGRESS



FIGURE 3.4: GRL-USB-PD-C2 BROWSER APP INSTALLATION COMPLETED

5. The GRL-USB-PD-C2 Browser App is now ready for use.

3.2 Start Up and Navigate GRL-USB-PD-C2 Browser App

Once installed, you can directly open the GRL-USB-PD-C2 Browser App using the GRL-C2

 Browser App desktop shortcut. This will initiate the App server to run backend operations before launching the GRL-USB-PD-C2 Browser App.

Note: Do not close this window only unless you need to exit from the GRL-USB-PD-C2 Browser App.



FIGURE 3.5: APP SERVER SCREEN RUNNING BACKEND OPERATIONS

2. The GRL-USB-PD-C2 Browser App should launch after a few seconds on a browser window with the appropriate port number. If for some reason the browser window does not appear after a few minutes, open a new browser tab and navigate to *http://IP address of windows software host PC:5001/* (for example, http://192.168.3.241:5001/).

3. The GRL-USB-PD-C2 Browser App when launched will display "Connection Setup" as the landing screen as follows:

GRL Granite River Labs	USB Power Delivery and USB Type-C [™] Test Software (1.4. GRL-USB-PD-C2	63.0)
OCKNITE KIVERCLASS Setup Connection Setup Product Capability C2 IP Address 192.168.255.1 192.168.255.1 Setup Diagram Tool Updates Update Firmware Update Eload Firmware Update Eload Firmware Vipdate Eload Firmware Vipdate Eload Firmware	Tester Status Serial Number Firmware Version Port Info Tester IP Address Info Last Calibration Date Next Calibration Due Date Test Cable Calibration Status C2 Tester Calibration License Info Module Name License Type	Disconnected N/A N/A N/A 192.168.255.1 - Calibration Error License Period

FIGURE 3.6: GRL-USB-PD-C2 BROWSER APP LANDING SCREEN

This screen allows you to set up connection between the GRL-USB-PD-C2 Browser App and the GRL-USB-PD-C2 Test Controller as well as performing firmware/software updates. More details are provided in Section 4.

3.2.1 Using GRL-USB-PD-C2 Browser App in Chrome OS

Note: Make sure that the GRL-USB-PD-C2 Test Controller is connected to a control PC running Windows 10.

- 1. Install the GRL-USB-PD-C2 Browser App on a Windows 10 control PC connected to the GRL-USB-PD-C2 Test Controller.
- 2. Once installed, open the GRL-USB-PD-C2 Browser App using the **GRL-C2 Browser App** desktop shortcut.
- 3. Open a new Chrome browser tab in Chrome OS and navigate to *http://IP address of windows software host PC:5001/* (for example, http://192.168.3.241:5001/).

Note: Make sure that both the Windows 10 control PC and Google Chromebook are connected to the same Ethernet network (wired or wireless).

3.2.2 Using GRL-USB-PD-C2 Browser App in macOS

Note: Make sure that the GRL-USB-PD-C2 Test Controller is connected to a control PC running Windows 10.

1. Install the GRL-USB-PD-C2 Browser App on a Windows 10 control PC connected to the GRL-USB-PD-C2 Test Controller.

- 2. Once installed, open the GRL-USB-PD-C2 Browser App using the GRL-C2 Browser App desktop shortcut.
- 3. Open a new Chrome browser tab in macOS and navigate to *http://IP address of windows software host PC:5001/* (for example, http://192.168.3.241:5001/).

Note: Make sure that both the Windows 10 control PC and Apple Macbook are connected to the same Ethernet network (wired or wireless).

4 Connection and Setup of GRL-USB-PD-C2 Browser App

Figure 4.1 shows how to set up the GRL-USB-PD-C2 Test Controller with the host PC (Control Computer) for testing a USB PD based UUT.



FIGURE 4.1: GRL-USB-PD-C2 HARDWARE SETUP FOR TESTING UUT

The GRL-USB-PD-C2 Browser App loaded on the control computer automates the testing process. Below is a procedure for connecting the hardware and verifying proper hardware connections.

- 1. Connect Power Supply to the GRL-USB-PD-C2 Controller.
- 2. Connect the GRL-USB-PD-C2 Controller using a physical Ethernet connection between the control computer and the C2.

Note: Automation of the UUT Power Supply switching in the GRL-USB-PD-C2 is handled internally to the C2. Thus, there is no Ethernet, USB or GPIB connection attached to the Power Supply.

4.1 Connect Power Supply to GRL-USB-PD-C2 Controller

Connect the GRL-USB-PD-C2 Power Interface using the 24V, 280W Power Brick included with the controller.

4.2 Connect Ethernet Cable and Turn On GRL-USB-PD-C2 Controller

Connect the Ethernet (RJ-45) connector to one of the control computer's Ethernet ports. A USB to Ethernet adapter can be used if there are no native Ethernet ports on the control computer.



Turn on the GRL-USB-PD-C2 controller using the On/Off button on the front of the instrument.

POWER				CRI	
GRANITE RIVER LABS FORT - 1	GRL-USB-PD-C2 PORT + 2			GRANITE	River Labs
Tester Mode — Sink/U DUT Mode — NA IP Address Firmware Versi System Info	FP Tester Mode - Sink/UFP DUT Mode - NA - 192,168,255,1 on - 1,5,8,0,16 - 126,156,126,095,156, on(Port-//Port-2) - 9,6/9,6				
USB Type-C [™] P GRL-USB-PD-C2	ower Delivery Tester	Port 1	Port 2	Extension	Trigger

4.3 Verify GRL-USB-PD-C2 Ethernet Installation

The Ethernet port on the control computer needs to be configured correctly for the GRL-USB-PD-C2 controller to recognize the control computer and vice versa.

To make sure the network connection is set up correctly, open the Network Connections panel from the control panel.



FIGURE 4.2: NETWORK CONNECTIONS BEFORE CONNECTING GRL-USB-PD-C2

Open the Ethernet panel for the Ethernet port that will connect to the GRL-USB-PD-C2, select "Internet Protocol Version 4 (TCP/IPv4)" and click on the "Properties" button below and to the right.

₩ Ethernet 5 Properties >	<					
Networking Sharing						
Connect using:						
ASIX AX88179 USB 3.0 to Gigabit Ethernet Adapter						
Configure This connection uses the following items:						
 Client for Microsoft Networks File and Printer Sharing for Microsoft Networks QoS Packet Scheduler Internet Protocol Version 4 (TCP/IPv4) Microsoft Network Adapter Multiplexor Protocol Microsoft LLDP Protocol Driver Internet Protocol Version 6 (TCP/IPv6) 						
Install Uninstall Properties						
Description Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.						

FIGURE 4.3: ETHERNET PROPERTIES

Set up the TCP/IPv4 properties as shown below.

Internet Protocol Version 4 (TCP/IPv4) Properties	×						
General							
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.							
Obtain an IP address automatically							
O Use the following IP address:							
IP address: 192 . 168 . 255 . 3							
Subnet mask: 255 . 255 . 255 . 0							
Default gateway: 192 . 168 . 255 . 1							
Obtain DNS server address automatically							
• Use the following DNS server addresses:							
Preferred DNS server:							
Alternate DNS server:							
Validate settings upon exit Advanced							
OK Cancel							

FIGURE 4.4: ETHERNET PROPERTIES WITH TCP/IPV4 SELECTED

Select a static IP address ("Use the following IP address:") which should be 192.168.255.n where *n* is any number between 2 and 255. The subnet mask should be 255.255.255.0 and the default gateway should be 192.168.255.1. The rest of the items should remain unchanged.

Click the "OK" button on the Internet Protocol Properties and close the Ethernet Properties. Make sure the GRL-USB-PD-C2 controller is powered on and completely booted up (front panel display shows firmware version number) then connect the Ethernet cable from the GRL-USB-PD-C2 controller to the computer's Ethernet port that was just set up. The network connections panel should now look as pictured in Figure 4.5 below:



FIGURE 4.5: NETWORK CONNECTIONS AFTER SETUP AND CONNECTION OF GRL-USB-PD-C2

The GRL-USB-PD-C2 controller is now set up and ready for use.

4.4 Connect GRL-USB-PD-C2 Browser App with GRL-USB-PD-C2 Controller

Before running any tests, you should verify that the control computer and the GRL-USB-PD-C2 controller are communicating properly as described below.

To connect the GRL-USB-PD-C2 Browser App (that is running on the control computer) with the GRL-USB-PD-C2 controller:

1. On the GRL-USB-PD-C2 Browser App landing page (Connection Setup screen), enter the IP address as displayed on the GRL-USB-PD-C2 controller screen and click on the **Connect** button. You can also click on the **Scan Network** button to detect all available GRL-USB-PD-C2 controllers connected to the same network.

GRL GRANITE RIVER LABS PORT - 1	PORT -	GRL-USB-PD-C2
PD Port - Detach Tester Mode - Sink/UFP DUT Mode - NA	PD Port Tester Mode DUT Mode	- Detach - Sink/UFP - NA
IP Address - Firmware Version - System Info - Eload FW Version(Po	192.168.4.152 1.3.14.0.21 107.145.107.02 ort-1/Port-2) -	7.049. 9.7/9.7

RL GRANITE RIVER	Labs	I	USB Power Delivery and USB Type-C [™] Test So GRL-USB-PD-C2	oftware (1.4.63.0)		
Connection	Ethernet Connection Settings Scan Network	Te	ster Status erial Number		Connect 022.045.	ted .022.009.031.
Setup	C2 IP Address 192.168.4.152 x * Connect	Po Te	mware version ort Info ster IP Address Info		1.3.5273 5002 192.168	.4.152
Product Capability	Setup Diagram Connect C2 Tool Updates	La Ne Te	Last Calibration Date Next Calibration Due Date Tot Calibration Status		2018-05-30 2019-05-29 Calibrated	
Test Config	Update Firmware Firmware Update Instructions Update Eload Firmware	CZ	PTester Calibration	License Info	Calibrat	ion Expired
Results			Module Name	Licens	е Туре	License Period
Report			C2 C2 C2 Starter	PEI	RM RM	-
Ś			DP AUX Sniffer F1	PE	RM RM	-
Options			M1 MFi Charger Tests	PEI	RM RM	-
Help			Quick Charge 3 Plus Tests Quick Charge 3 Tests	PEI	RM RM	-
			Quick Charge 4 - IOP Tests Quick Charge 4 Tests Thunderbolt 3 Power Tests	PEI	RM RM	-
			USB-C Functional Tests	PEI	RM	

FIGURE 4.6: CONNECTION CONFIGURATION SCREEN AFTER SUCCESSFUL CONNECTION

- 2. The GRL-USB-PD-C2 controller and Browser App are now connected as indicated by the controller information display (Tester Status, Serial Number, Firmware Version, etc.).
- 3. Optionally you can also select Setup Diagram below the IP address field to open the test setup connection screen. This shows you how to connect the UUT to Port 1 of the GRL-USB-PD-C2 controller using the USB Type-C cable provided by Granite River Labs or a compliant Type-C cable.



FIGURE 4.7: TEST SETUP CONNECTION SCREEN

Along with each GRL-USB-PD-C2 software revision, a new version of firmware and FPGA code is provided. Use the following procedure to update both the controller's and eLoad firmware and FPGA code.

4. Click on the **Update Firmware** or **Update ELoad Firmware** button to update the GRL-USB-PD-C2 controller's and eLoad firmware respectively. You can select Firmware Update Instructions next to the buttons to display the instructions to guide you through the entire updating process. Follow the instructions step by step to perform the updates accordingly.

Tool Updates
Update Firmware
Update Eload Firmware

FIGURE 4.8: UPDATE GRL-USB-PD-C2 FIRMWARE BUTTONS

4.5 GRL-USB-PD-C2 Browser App License Activation

The licensing for the GRL-USB-PD-C2 controller is built into the tester hardware so no additional license activation is needed. Take note that certain tests like the Thunderbolt 3 power and Apple MFi tests require separate licensing. Check the "License Info" panel in the *Connection Setup* screen (Figure 4.6) to see which licenses are active on the controller. Contact Granite River Labs support (support@graniteriverlabs.com) if you have licensing questions or concerns.

5 Compliance Testing with GRL-USB-PD-C2 Browser App

The GRL-USB-PD-C2 Browser App is capable of testing to various specifications such as the USB Power Delivery compliance, communications engine and deterministic tests as well as DisplayPort Alt Mode tests and others.

The various screens presented by the GRL-USB-PD-C2 Browser App allow the user to select, configure, run and generate reports from these tests for a variety of devices (Units Under Tests or UUT's). There are also more specific controls that allow the user to configure and debug specific UUT features and capabilities.

5.1 Product Capability

The Device Type and the Capabilities of a UUT define the compliance tests that need to be run on the UUT. There are two ways to gather the capabilities of the tests to be run. Either through using the UUT Type selection and querying the Capabilities of the UUT (**Informational** test mode) or by using a VIF File (**Compliance** test mode).

The *Product Capability* screen allows the user to specify the method to determine the UUT type and display the capabilities of the UUT that is connected to either USB Port 1 or Port 2 or both of the GRL-USB-PD-C2 Test Controller.



FIGURE 5.1: PRODUCT CAPABILITY SCREEN

You can also specify the name of the test session that is currently running typing into the **Project Name** field at the top of the screen. All the test configuration and results will be saved under the specified name.

If a VIF File is not provided or available:

Select the **Informational (No VIF)** test mode. This method of defining the device type is most useful when a Vendor Information File (VIF) is not available. It allows you to select and configure multiple options to execute tests without a VIF file by selecting the UUT type, reading the UUT capabilities and generating a VIF file from the configuration.

Note: For this version of GRL-USB-PD-C2 Browser App, the Informational test mode is the recommended method to be used.

$\overline{\bullet}$	Project Name		Paramete	r VI	IF Data	Device Data
Connection Setup	Select Test Mode	Compliance Informational (No VIF)				
		VIF Data Operation				
Product	Load VIF	Load XML VIF File				
Capability		Create New VIF Clear VIF Data				
Test Config		Generate VIF(VIF Data) Edit VIF Off				
		Port 1				
Ð	DUT Type	Consumer Only				
Results	Cable Selection	GRL-SPL Test Cable 1				
Ę		Get Device Data Clear Device Data				
Report		Port 2				
£53	DUT Type	Consumer Only 🔹 👔				
Options	Cable Selection	GRL-SPL Test Cable 1				
		Get Device Data Clear Device Data				
Help		Device Data Operation				

FIGURE 5.2: INFORMATIONAL TEST MODE UUT CONFIGURATION

When testing a new UUT, clicking on the **Clear Device Data** button (see Figure 5.9) will clear all product configuration information including what has been read from a VIF and what was read directly from the device.

Port 1				
DUT Type Consumer Only				
Cable Selection	Consumer Only	Ð		
	Consumer Provider			
Provider Consumer				
Provider Only				
DUT Type	Dual Role Power[DRP]	Ð		
	Cable			
Cable Selection	Type C Only	Ð		

FIGURE 5.3: SELECTING UUT TYPE USING DROP-DOWN MENU

Select the **DUT Type** field to enable the UUT type selection drop-down menus for both Port 1 and Port 2:

- **Consumer Only** A device with a USB Power Delivery Port (typically a Device's upstream facing port) which sinks power from the power conductor (e.g. VBUS).
- Consumer/Provider A Power Consumer which can also act as a Power Provider.
- **Provider/Consumer** A Power Provider which can also act as a Power Consumer.
- **Provider Only** A device with a PD Port (typically a downstream facing port of a Host, Hub, or Wall Wart DFP) which sources power over the power conductor (e.g. VBUS).
- **Dual Role Power (DRP)** A Consumer/Provider or Provider/Consumer capable port: A port capable of operating as either a Source or a Sink.

- **Cable** A USB Type-C Cable that has a USB-PD electronic marking chip which indicates through USB-PD messaging its capabilities and vendor information. Such cables are known as Electronic Mark or E-Mark cables.
- **Type-C Only** A device with a standard USB Type-C Port. When selected, the user can select the Type-C connection state machine of the UUT as either a Source (**SRC**), Sink (**SNK**) or Dual Role Powered (**DRP**):

DUT Type	Type C Only	•
State Machine		
Cable Selection	SRC	3
	SNK	
	DRP	

FIGURE 5.4: SELECTING TYPE-C UUT CONNECTION STATE MACHINE

Once the device type has been defined, clicking the **Get Device Data** button Get Device Data will read the device capabilities from the device connected to each respective C2 port. If no device is connected, the user will be notified. If the device type read using the **Get Device Data** button does not match the type selected from the 'DUT Type' drop-down menu, the user will also be notified.

The information from the UUT appears under the Device Data column on the right panel for each respective Port tab and the VIF Data column remains blank.

The **Create New VIF** button Create New VIF allows you to create a new VIF File in XML format from the configuration when clicked. A VIF Config pop-up message will appear as below. Select the DUT Type and select whether or not to set the current configuration as default values, and then click 'Ok'.

VIF Config					×
DUT Type Set Default Value	 Yes 	○ No	Provider Only	Ok	•

FIGURE 5.5: CREATE NEW VIF FILE

You can also save the current configuration to a VIF data file by clicking the Generate VIF (VIF

Data) button VIF(VIF Data). A Save File pop-up message will appear as below. Specify the name of the file to save as, and then click 'Ok'.

Save File		
 FileName		
VifData.xml		
	Ok Cancel	

FIGURE 5.6: GENERATE VIF DATA FILE

If a VIF File is provided:

For Certification a Vendor Information File (VIF) must be provided by the Product Vendor. The VIF informs the tester of all its capabilities and provides some input information needed to provide full testing. If the VIF file is not provided, full certification testing cannot be run and tests performed are informational. If Vendor File is provided, use the following procedure:

Connection Setup	Project Name Select Test Mode	Compliance Informational (No VIF)
		VIF Data Operation
Developed	Load VIF	Load XML VIF File
Capability		Creat Load DUT's XML VIF File Ia



Clicking on the **Load XML VIF File** button will read and load information from a selected VIF XML file on the host PC. A file selection dialog box will appear which allows you to navigate to the location of the Vendor Information File (VIF), select the correct file and click the 'Open' button to load it.

Once the VIF file has been selected and loaded, the contents of the VIF file will be displayed under the VIF Data column on the right panel for each respective Port tab. To enable edits to be made to the

data, use the 'Edit VIF' slider Edit VIF

When testing a new UUT, clicking on the **Clear Device Data** button (see Figure 5.9) will clear all product configuration information including what has been read from a VIF and what was read directly from the device.

Cable Selection	GRL-SPL Test Cable 1	
	GRL-SPL Test Cable 1	
	GRL-SPL Test Cable 2	
	USB-C STD Test Cable 1	
DUT Type	USB-C STD Test Cable 2	D
Cable Selection	Captive Cable	Ð
	No Cable	

FIGURE 5.8: PRODUCT CAPABILITY TEST CABLE SELECTION

The test cable selection drop-down menu's allow you to specify what cable connects the UUT to the specific USB Port on the GRL-USB-PD-C2 Test Controller. The 'USB-C STD Test Cable' indicates the USB Type-C eMarker cable, while the 'GRL-SPL Test Cable' indicates the GRL special cable provided with the GRL-USB-PD-C2 Test Controller which has been characterized specifically for compliance testing. The GRL special cable does not have an eMarker since, under very specific circumstances, an eMarker cable response can be confused with the UUT response during compliance testing. The 'No Cable' indicates that the UUT is attached directly to the GRL-USB-PD-C2 USB Port without using any cable in between. The 'Captive Cable' indicates the Type-A to non-standard USB connector cable.



FIGURE 5.9: PRODUCT CAPABILITY 'GET DEVICE DATA' AND 'CLEAR DEVICE DATA' BUTTONS

Clicking any of both **Get Device Data** Port buttons reads the configuration information from the device connected to that specific Port and displays it.

When configuration information is read from both a VIF and the device, the information is listed side-by-side for easy comparison. This comparison is also provided in the report files. In some cases, if the VIF and Read Capabilities information do not match, the device can fail compliance.

Clicking any of both **Clear Device Data** Port buttons clears all the configuration information in both the 'VIF Data' and 'Device Data' sections of the information display area for that specific Port. This includes all the different categories associated with the information display area as well.

Selecting the <u>Clear VIF Data</u> option resets all the edits made to the configuration to the previous values.

When configuration information is read from the device, you can generate a VIF file of the Read

Capabilities information by clicking the **Generate VIF (Device Data)** button VIF(Device Data) for the specific Port. A Save File pop-up message will appear as below. Specify the name of the file to save as, and then click 'Ok'.

Save File		
 FileName		
 DeviceData.Xml		
	Ok	

FIGURE 5.10: PRODUCT CAPABILITY VIF FILE GENERATION

To copy the device configuration information to VIF, click on the button.

If you want to convert VIF data to the XML file format, select the <u>VIF Generator</u> option. This will direct you to the USB-IF official website for the conversion process. (*Make sure you have permission from USB-IF to access the website.*)

5.2 Test Configuration

The *Test Config* screen allows you to select which set of tests is run on the UUT, set up test parameters for specific test categories, run selected tests and generate test reports.

Connection Setup	Test Selection Filter Selection Image: Colspan="3">Image: Colspan="3">Image: Colspan="3" Image:	Timeout Pop-up Messages Rerun Selected Tests Mode	DUT Information Manufacturer Nexus Model Number Updated
	Q Search	MOI Configurations *Select test case for MOI Configurations	Serial Number 1
Product Capability	All Supported Certifications		Test Lab
Test Config	Power Delivery 3.0 Tests PD2 Communication Engine Tests D2 Deterministic Tests USB-C Functional Tests Source Power Tests PD Merged Tests (Beta)		Remarks/Comments
Æ Results	Cluck Charger 3.0 Tests Cluck Charger 4 Tests Cluck Charge 4 Tests Cluck Charge 4 Tests Cluck Charge Tests Cluck Cluck Charger Tests Cluck Cluc		

FIGURE 5.11: TEST CONFIGURATION SCREEN

5.2.1 Test Selection and Configuration

Based on the type of UUT selected in the *Product Capability* screen and various specifications, the specific tests available to be run are shown on the "Test Selection" panel:

5.2.1.1 Power Delivery 3.0 Tests

Run the USB Power Delivery compliance tests based on the USB Power Delivery 3.0 specification.

When "Provider/Consumer" or "Dual Role Power (DRP)" is selected as the DUT type (see Section 5.1), an additional input is available to allow the user to perform tests using the GRL Fast Role Swap (FRSWAP) Board (GRL-C2-FR-SWAP-AUTO Box Board) for automating Fast Role Swap based

Copy Device Data to VIF Data

testing when checked. Note that the Fast Role Swap test results are currently meant for informational purpose only and not required for certification testing.

Test Selection	□ Timeout Pop-up Messages 🕦
Filter Selection 🥑 🔕 🕒 🔥 🏹	Rerun Selected 0 Enable Debug 1
Start Execution	
Q Search	Power Delivery 3.0 Test Configuration
All Supported Certifications	FR_Swap AUTO Box Connected
🖃 🗹 C2 Test Cases	
Power Delivery 3.0 Tests	
TD.PD.LL3.E1 GoodCRC Specification Rev	
TD.PD.LL3.E2 Retransmission	
TD.PD.LL3.E3 GoodCRC Compatibility with	
TD.PD.SRC3.E1 Source Capability Fields (
TD.PD.SRC3.E2 Accept Fields Checks	
✓ TD.PD.SRC3.E3 PSRDY Fields Checks	

FIGURE 5.12: CONFIGURATION FOR POWER DELIVERY 3.0 TESTS IF "PROVIDER/CONSUMER" OR "DUAL ROLE POWER (DRP)" UUT IS SELECTED

When "Cable" is selected as the DUT type (see Section 5.1), an additional input is available to select the V_{CONN} voltage.

Test Selection	🗌 Timeout Pop-up Messages 🕦
Filter Selection 🥑 🔕 🖨 🔶 🍾	Rerun Selected O Enable Debug Tests Mode
Start Execution (1)	
Q Search	Power Delivery 3.0 Test Configuration
	Vconn Voltage 2 75V
All Supported Certifications	
C2 Test Cases	
■ Power Delivery 3.0 Tests	
TD.PD.LL3.E3 GoodCRC Compatibility with I	
TD.PD.CBL3.E1 Receiving Chunked Extende	
TD.PD.CBL3.E2 ChunkSenderResponseTime	
TD.PD.CBL3.E3 Manufacturer Info Fields Ch	



5.2.1.2 Source Power Tests

Runs the USB-C Source Power Tests or "QuadraMax" tests for power providers. These tests have an additional input that allows for the selection of what port is used in the testing.

Test Selection	🗌 Timeout Pop-up Messages 👔
Filter Selection 🥑 😣 🕤 🔶 🍾	C Rerun Selected 0 C Enable Debug 1 Tests Mode
Start Execution	Single_Port
Q Search	Source F Two_Port
	Port Type Unknown
All Supported Certifications	
 C2 Test Cases Power Delivery 3.0 Tests PD2 Communication Engine Tests PD2 Deterministic Tests USB-C Functional Tests Source Power Tests SPT.1 Load Test SPT.2 Capabilities Test SPT.3 Hard Reset Test SPT.4 GiveBack Test SPT.5 Over Current Test SPT.6 PPS Voltage Step Test SPT.7 PPS Current Limit Test 	

FIGURE 5.14: CONFIGURATION FOR USB-C SOURCE POWER TESTS

5.2.1.3 PD2 Deterministic Compliance Tests

Runs the USB Power Delivery deterministic compliance tests based on the USB Power Delivery 2.0 specification. When "Cable" is selected as the DUT type (see Section 5.1), an additional input is available to select the V_{CONN} voltage.

Test Selection	🔲 Timeout Pop-up Messages 👔
Filter Selection 🥑 🔕 🖨 🔶 🍗	Rerun Selected 0 Enable Debug Tests Mode
Start Execution	_2_75V
O Search	PD2 De -5^{5}
	Vconn Voltage 2_75V
All Supported Certifications	
■ Z Test Cases	
PD2 Communication Engine Tests	
PD2 Deterministic Tests	
TD.PD.VDMU.E1 Fields Checks Discover I	
TD.PD.VDMU.E2 Fields Checks Discover S	
TD.PD.VDMU.E3 Fields Checks Discover N	
TD.PD.VDMU.E4 Fields Checks Enter Mod	

FIGURE 5.15: CONFIGURATION FOR PD2 DETERMINISTIC TESTS

5.2.1.4 PD2 Communication Engine Tests

Runs the USB Power Delivery communication engine compliance tests based on the USB Power Delivery 2.0 specification. These tests have an additional input that allows for the selection of Rx noise source.

Test Selection	🗌 Timeout Pop-up Messages 👔
Filter Selection 🥑 🔕 🖨 🔶 🏹	C Rerun Selected 0 C Enable Debug 1 Tests Mode
Start Execution	Two Tone Noise
Q Search	PD2 Communic Square Wave Noise
	Noise Type Two Tone Noise 🗸
All Supported Certifications	
■ Z C2 Test Cases ■ Power Delivery 3.0 Tests	
PD2 Communication Engine Tests	
TDA.2.1.1.1 BMC PHY TX EYE	
TDA.2.1.1.2 BMC PHY TX BIT	
TDA.2.1.2.2 BMC PHY RX INT REJ	
TDA.2.1.2.1 BMC PHY RX BUSIDL	
TDA.2.1.3.1 BMC PHY TERM	

FIGURE 5.16: CONFIGURATION FOR PD2 COMMUNICATION ENGINE TESTS

When "Cable" is selected as the DUT type (see Section 5.1), an additional input is available to select the V_{CONN} voltage.

Test Selection	📋 Timeout Pop-up Messages 👔
Filter Selection 📀 😣 💿 🔶 🍾	Rerun Selected Enable Debug Tests _5_75V 2 75V
Q Search	PD2 Commu _4_25V
All Supported Certifications	Vconn Voltage 2_75V
 C2 Test Cases Power Delivery 3.0 Tests V PD2 Communication Engine Tests TDA.1.1.1.1 CABLE PHY TX EYE TDA.1.1.2.1 CABLE PHY TX BIT TDA.1.1.2.1 CABLE PHY RX INT REJ TDA.1.1.2.1 CABLE PHY RX BUSIDL TDA.1.1.3.1.1 CAB PHY TERM TDA.1.1.3.2.1 CAB PHY MSG TDA.1.2.1 CAB PROT DISCOV TDA.2.2.1 CAB PROT CHUNK TDA.2.2.2 CAB PROT DISCOV R3 	

FIGURE 5.17: CONFIGURATION FOR PD2 COMMUNICATION ENGINE TESTS IF "CABLE" UUT IS SELECTED

5.2.1.5 DisplayPort Alternate Mode Tests

Runs the DisplayPort Alternate Mode compliance tests for the Alt Mode based UUT. These tests have additional inputs that allow for the selection of DisplayPort UUT type to be used in testing along with its Source or Sink capability.

Test Selection	Timeout Pop-up Messages 1
Filter Selection 🥑 🔕 🖨 🔶 🍾	Rerun Selected O Enable Debug Tests Mode
Start Execution	
Q Search	DisplayPort Alternate Mode Test Configuration
	DP Device Type DP_Sink
All Supported Certifications	DP Device Capability DFP_Source
 C2 Test Cases Power Delivery 3.0 Tests DisplayPort Alternate Mode Tests TC.10.2.1 Enter Mode ACK Response TC.10.2.2 Status Update Command TC.10.2.5 Proper Pin Assignment Support f 	DP Sink Type TypeC_DP_Adaptor

FIGURE 5.18: CONFIGURATION FOR DISPLAYPORT ALTERNATE MODE TESTS

5.2.1.6 Quick Charge 4 Tests

Runs the Quick Charge 4/4+ tests. These tests are proprietary to Qualcomm and are only available with arrangement through Qualcomm. These tests allow selection of the specific Quick Charge 4/4+ specification and additional setting of ambient room temperature to test against.

Test Selection	Timeout Pop-up Messages Rerun Selected Rerun Selected Rerun Selected Rerun Selected Rerun Selected Rerun Selected Rerun Selected Rerun Selected Rerun Selected Rerun Selected Rerun Selected Rerun Selected
Filter Selection 🧭 😫 🖨 🔶 🏅	Tests QC4
Start Execution	QC4Plus
Q Search	Quick C QC5
	QC4 DUT Type QC4
All Supported Certifications	Room Temperature 24
Power Delivery 3.0 Tests	
■ Quick Charge 4 Tests	
QC4.TID.1 Class A Adapter	
QC4.TID.2 Class B Adapter	
QC4.TID.3 Current Limit	

FIGURE 5.19: CONFIGURATION FOR QUICK CHARGE 4 TESTS

5.2.1.7 Quick Charge 3.0 Tests

Runs the Quick Charge Legacy 2.0/3.0 tests. These tests are proprietary to Qualcomm and are only available with arrangement through Qualcomm. These tests have additional inputs to indicate the UUT's Quick Charge specification and what cable is connected to the UUT, to allow the user to indicate the specific current rating (in amps) and power rating (in watts) as well as the IR drop value of the connected device to test against. Further inputs allow the user to specifically select the type of Quick Charge based UUT that is connected to single/dual ports and with/without USB Power Delivery support.

Test Selection	Timeout Pop-up Me	ssages 🕕
Filter Selection 🥑 🔕 🖨 🔶 🍾	Rerun Selected Tes	ts 0 🗌 Enable Debug Mode 👔
Start Execution	Quick Ch	arger 3.0 Test Configuration
Q Search	QC 2.0/3.0 DUT Type	QC3 •
All Supported Certifications	Connector Type	TypeA_TypeC 🔹
	Connector Type Cable	Standard_Cable
Q C2 Test Cases Power Delivery 3.0 Tests	Cable IR drop	0.22 (ohm)
■ Quick Charger 3.0 Tests	5V Max Current	3 (A)
QC_LEGACY_Shorting C_LEGACY_HVDCP	9V Max Current	3 (A)
QC_LEGACY_PD_Req QC_LEGACY_PD_Req	12V Max Current	3 (A)
■ QC_LEGACY_PD_Phy_Err_Rej	20V Max Current	3 (A)
■ QC_LEGACY_PD_Req_Reg	DUT Rated Power	18 (W)
■ ♥ QC_LEGACY_Irans ■ ♥ QC_LEGACY_Continuous_mode	Ports	Unknown
QC_LEGACY_Pwr_pf QC_LEGACY_USBPD_Trans	PD Support	Unknown
■ _ Quick Charge 4 Tests	QC DUT Type	Power_Adaptor 🗸
Thunderbolt Power Tests		
DisplayPort Alternate Mode Tests Description		

FIGURE 5.20: CONFIGURATION FOR LEGACY QUICK CHARGE TESTS

5.2.1.8 Quick Charge 3.0+ Tests

Runs the Quick Charge 3.0+ tests for power provider UUT's. These tests are proprietary to Qualcomm and are only available with arrangement through Qualcomm. These tests have additional inputs to indicate the UUT's Quick Charge specification and what cable is connected to the UUT, to allow the user to indicate the specific current rating (in amps) and power rating (in watts) as well as the IR drop value of the connected device to test against. Further inputs allow the user to specifically select the type of Quick Charge based UUT that is connected to single/dual ports and with/without USB Power Delivery support.

Test Selection	🔲 Timeout Pop-up Messages 🕦
Filter Selection 🥑 😢 🕒 🔥 🏹	Rerun Selected 0 Enable Debug Image: Im
Start Execution	
Q Search	Quick Charger 3.0 Test Configuration
	QC 2.0/3.0 DUT Type QC3
All Supported Certifications	Connector Type TypeA_TypeC
□ I C2 Test Cases	Connector Type Cable Standard_Cable
Power Delivery 3.0 Tests QC3+ Tests	Cable IR drop 0.22 (ohm)
QC3Plus.TD.1.QC3+ Detection Test	5V Max Current 3 (A)
 QC3Plus.TD.2.20mV Step Size Test QC3Plus.TD.3.Unsuccessful QC3+ Negotiation Te QC3Plus.TD.4.Twait Test QC3Plus.TD.5.TAdetection_TA Test QC3Plus.TD.6.TACAP_TA Test QC3Plus.TD.7.Ttransition Test QC3Plus.TD.8.Incorrect pulse during Testing TAC. QC3Plus.TD.9.Incorrect pulses during Testing TAC. 	9V Max Current 3 (A)
	12V Max Current 3 (A)
	20V Max Current 3 (A)
	DUT Rated Power 18 (W)
	Ports Unknown
QC3Plus.TD.10.Power Capability Test	PD Support Unknown
	QC DUT Type Power_Adaptor 👻

FIGURE 5.21: CONFIGURATION FOR QUICK CHARGE 3.0+ TESTS

5.2.1.9 Thunderbolt Power Tests

Runs the Thunderbolt power compliance tests. These tests have additional inputs to the number of ports to test, whether the UUT is self-powered or bus-powered and whether the UUT is a host or device. Further inputs allow the user to enable the capability mismatch flag and the giveback flag as well as also specify the time duration for adding stressors.

Test Selection Filter Selection Start Execution	 Timeout Pop-up Messages (1) Rerun Selected (0) Enable Debug (1) Tests Mode
Q Search	Thunderbolt Power Test Configuration
All Supported Certifications	Number Of Ports Single_Port Powered Type Self_Powered
□· ☑ C2 Test Cases □· □ Power Delivery 3.0 Tests	Device Type Host
✓ Thunderbolt Power Tests	Stress Test Timer 25 (secs)
 TBT.2.1 Power Capacity Host TBT.2.2 Power Capacity Device 	✓ Port-A CapMisMatch
TBT.2.3 Current Limit VBUS	Port-B CapMisMatch
TBT.2.4 Short Protection VBUS	Port-A GiveBackFlag
TBT.2.6 Short Protection VCONN	Port-B GiveBackFlag

FIGURE 5.22: CONFIGURATION FOR THUNDERBOLT POWER TESTS

5.2.1.10 USB Type-C Functional Tests

Runs the functional compliance tests for USB-C chargers. These tests have additional inputs that allow the user to enable data validation at high USB speeds or through automation as well as select if the UUT is connected to a battery.

Test Selection	🔲 Timeout Pop-up Messages 🕦
Filter Selection 🥑 😢 🖨 🔶 🏹	C Rerun Selected 0 C Enable Debug 1 Tests Mode
Start Execution	
Q Search	USB-C Functional Test Configuration
All Supported Certifications	Enable USB Data Validation
 ■ USB-C Functional Tests ■ TD.4.11.2 Sink Dead Battery Test ■ TD.4.11.Initial Voltage Test 	Automate USB Data Validation
 ✓ TD.4.2.1 Source Connect Sink Test ✓ TD.4.2.2 Source Connect SNKAS Test ✓ TD.4.2.3 Source Connect DRP 	Device URL
 TD.4.2.4 Source Connect Try SRC DRP TD.4.2.5 Source Connect Try SNK DRP TD.4.2.6 Source Connect Audio Accessory 	✓ Is Battery Connected to DUT (1)

FIGURE 5.23: CONFIGURATION FOR USB-C FUNCTIONAL TESTS

You can refer how to set up the equipment to automate data validation by selecting <u>Setup Image</u> as shown below:



FIGURE 5.24: USB-C FUNCTIONAL TEST AUTOMATION SETUP DIAGRAM

Once the equipment has been set up, enter the URL as shown on the Golden device (i.e., Google Pixel phone) in the "Device URL" field.

5.2.1.11 PD Merged Tests

Runs the merged USB Power Delivery compliance tests as per CTS requirements.

5.2.1.12 MFi Tests

Runs the Apple MFi compliance tests for Apple chargers. These tests have additional inputs that allow the user to configure external eLoad to run the MFi tests. If the charger UUT has a Lightning cable attached to it or a captive cable, select the "Charger has captive lightning plug" checkbox. You will need to select the channel connected to the external eLoad. When the external eLoad is set up properly, enter the correct VISA address of the external eLoad and click "Connect" to establish connection with the external eLoad. Otherwise click on the "Scan Eload" button to reset the connection.

Test Selection	🗌 Timeout Pop-up Messages 👔
Filter Selection 🥑 🙁 🖨 🔶 🏹	Rerun Selected O Enable Debug Tests Mode
Start Execution	
Q Search	MFi Test Configuration
All Supported Certifications	Charger has captive lightning plug 🚺
■ C2 Test Cases ■ Delivery 3.0 Tests	E-Load Channel
 MFi Charger Tests MFi.TD.4.9.1 Voltage drop between transition test MFi.TD.4.9.2 OCP and OVP Test 	Scan Eload
 MFi.TD.4.9.3 USB Type C Current Advertisement MFi.TD.4.9.4 DCP Handshaking test MFi.TD.4.9.5 MFi Charger VIF Check Quick Charge 4 Tests 	External eLoad VISA Address

FIGURE 5.25: CONFIGURATION FOR MFI TESTS

5.2.1.13 BC 1.2 Tests

Runs the USB Battery Charging 1.2 tests. These tests have additional inputs to the secondary detection mode, whether implemented or not and maximum current.

Test Selection	🔲 Timeout Pop-up Messages 🕦
Filter Selection 🥑 😣 🖨 🔸 🏹	C Rerun Selected 0 C Enable Debug 1 Tests Mode
Start Execution	
Q Search	BC 1.2 Test Configuration
	Secondary Detection None
All Supported Certifications	Maximum Current 0
Power Delivery 3.0 Tests	
BC1.2 DCP Sink Tests	
QC.BC.SNK.1 Initial Power-up Test - Weak Batter	
QC.BC.SNK.2 DCP Detection Test - Weak Battery	
QC.BC.SNK.3 CDP Detection Test - Weak Battery	
QC.BC.SNK.4 SDP Detection Test - Weak Battery	
QC.BC.SNK.5 QC Negotiation Test - Weak Batten	

FIGURE 5.26: CONFIGURATION FOR BC 1.2 TESTS

Individual tests are grouped together based on their definition in the selected specification. Selecting a group will cause all tests in that group to be selected and run. Selecting individual tests within a group will run just the individual tests selected.

If you just want to select the tests that comply to a certain certification standard, click on the dropdown menu as shown below to filter out the test list as required.

Test Selection				
Filter Selection 🥑 🙁 🖨 🔶 🌄				
Start Execution				
Q Search				
All Supported Certifications				
All Supported Certifications				
Quick Charge 4 Certification				
Quick Charger 3.0 Certification				
USB Power Delivery Certification				
Non-PD Type-C Certification				
Thunderbolt 3 Certification				
DisplayPort Certification				

FIGURE 5.27: SELECTING CERTIFICATION COMPLIANCE FOR TESTS

Note: The GRL-USB-PD-C2 supports several Compliance Test Specifications (CTS's) from different technologies using the USB Type-C Connector. For a detailed listing of all the tests and test methodology in the latest version of the specification, refer to the specification documents referenced in Section 1.

5.2.2 Report Generation

The "Report Generation" panel allows full reports to be created after running a set of tests.

Report Generation					
DUT Information					
Manufacturer	GRL				
Model Number	Cable				
Serial Number	001				
	Test Information				
Test Lab	GRL				
Test Engineer	Tech 1				
Remarks/Comments	Cable & Consistency Tests				

FIGURE 5.28: REPORT GENERATION PANEL

The "DUT Information" and "Test Information" sections are text entry fields in which you can enter information germane to the specific Device Under Test (DUT, another name for the UUT) and the specific set of tests just run. Once tests have completed, the test report can be viewed in the *Report* screen (see Section 5.3).

5.2.3 Running Tests

Once the desired tests have been selected, these tests can be run by clicking on the green **Start Execution** button:



FIGURE 5.29: RUN TESTS

If you are only running tests for informational purpose, you can choose to disable pop-up messages from showing up during test runs by selecting the **Timeout Pop-up Messages** checkbox.

To repeat running selected tests for a specific number of times, select the **Rerun Selected Tests** checkbox and enter the desired number.

For debug purposes, you can choose to turn on debug mode by selecting the **Enable Debug Mode** checkbox. This will cause additional data to be included in test acquisitions to be used for debugging.

🗌 Timeout Pop-up Messages 🕦				
Rerun Selected Tests	0	Enable Debug Mode	0	

FIGURE 5.30: TEST RUN OPTIONS

GRANITE RIVER LABS USB Power Delivery and USB Type-C[™] Test Software (1.4.63.0) GRL-USB-PD-C2 Test Results Scroll To Current Connection Setup 🗄 ┢ 🗑 ତ୍ iq iq 🔣 🍆 ┥ £ Ŷ Channels 🔻 Description UC, #29 SOP:Request PDO#1; Opcurrent = 0.5A; Maxcurrent = 0.5 Stop Execution Time Stamp 2.05811582240 2.058:925:850 UUT#30 SOP:GoodCRC: ٦ 0/1 🙁 0/1 🕒 0/1 **()** 0/1 2.061:704:680 UUT#31 SOP:Accept: Product Capability C2 #32 SOP:GoodCRC: ✓ ⊃Power Delivery 3.0 Tests 2.062:250:280 OTD.PD.LL3.E1 GoodCRC Specification Revision cor UUT#33 SOP:PS_RDY: 2.090:927:970 2.091:469:780 C2 #34 SOP:GoodCRC 6 000 風 4.500 3.000 1.500 Ê 0.000 4.000 3,000 ₹<u>0</u>} 2 000 Options 1.000 1.00 1.50 ? 0.50 3.00 3.50 4.00 0.00 2 50 5.00

Once testing has started you can view each test being run in real-time mode on the Results screen:

FIGURE 5.31: RESULTS SCREEN – TEST RUN INITIATION

GRL GRANITE RIVE	R LABS	USB Power Delive	nd USB Type-C [™] Test Software (1.4 GRL-USB-PD-C2	4.63.0)	1%
Connection Setup	Test Results Scroll To Curren	Time Stamp	Q Q Q X X X	Description	Channels 🔻 📕 Live
Product	rio () rio 🔵 rio 😒	2.054:356:490 2.054:895:890	#33 SOP:PS_RDY:		
Capability	OPower Delivery 3.0 Tests OTD.PD.LL3.E1 GoodCRC Specification Revision com	11.188:827:050 11.188:827:620 11.188:900:830		C2 #35 NONE:FSM UUT #36 NONE:Deta UUT #37 NONE:Grou	_State_Transition:FSM_State ch: pCmdTimingPkt:
Rest Connig		6.000 () () () () () () () () () () () () ()		····	
Results		3.000 V V V V V V V V V V V V V V V V V V			
Report		4.000 <u>5</u> 3.000			
Options		2.000 VI V V 1.000	0 1.90 3.80 5.70	7.60 9.50 11.40 13.30	15.20 17.10 19.00

FIGURE 5.32: RESULTS SCREEN – TEST RUN IN PROGRESS

GRL GRANITE RIVE	r Labs	U Test execution o	ompleted !		× ^{(1.4.63}	0)				
\bigcirc	Test Results	E - Q			-	< >		ΥX	🖗 Channels 🔻	Live
Connection	Start Execution	TimeStamp	_		_	Descri	ption	_		
Setup		Time : 3.364:279:81	8 / AT : 5989.8ms		Ra_Asserted: CO	22				
	🕑 1/1 🛛 0/1 🔵 0/1 🔶 0/1	Vbus : 5.146V CC1 : 1.609V		VE:	FSM_State_Tra	nsition:FSM_St	ate_Disabled	-> FSN_State_U	Jnattached_SNK	
Product	✓ Power Delivery 3.0 Tests	CC2:0.013V		NE:	Time : 9.354	:075:428 / AT :	5989.8ms			
	TD.PD.LL3.E1 GoodCRC Specification Revisi	1.699:340:990	C2	#3 NONE	S Vbus : 0.029	v		SNK -> FSM	State_AttachWait_SNK	
	•	1.890:308:960	U	JT#4 SOP	CC1 : 5.252	,				
Test Config		4 000.004.370	· · · · · · · · · · · · · · · · · · ·		.C	•••				
		5.000								î
U.S.		4.500 -								
Results		> 3.000− ≰								
ر تا		0 0 0								
Report		0.000								
		4.000)
<u> </u>		3.000 - 0								
Options		0-VI								
0		1.000								
(?)			0.16 1.59	3.01	4.43	5.85 Time (Sec) —>	7.27 8	3.69 10.12	2 11.54 12.96	5 14.38

FIGURE 5.33: RESULTS SCREEN – TEST RUN COMPLETION

While tests are running, the Test Results pane will display the pass/fail status of each test as well as each subtest which you can view by clicking the drop-down arrow of the test group if applicable. The PDO communications exchange protocol and waveform displays next to the Test Results pane allow you to scroll to the section representing the start of the selected test– this allows you to trace failing test to determine the cause of the test failure.

You can also track the progress of the test run through the progress indicator at the top right corner of the screen. If you only want to view specific channels on the trace plot, select the "Channels" drop down option and click/unclick on the checkbox(s) of the desired channels.

Channels 🔻 🖉 Live	
PORT1-VBUS(V)	
PORT1-VBUS(A)	
PORT1-CC1(V)	
PORT1-CC1(A)	
PORT1-CC2(V)	
PORT1-CC2(A)	

FIGURE 5.34: SELECT TRACE CHANNELS EXAMPLE

When the PDO communications exchange protocol is running, select the Stop Execution button

stop Execution at the top of the screen at any time to end or pause the process respectively.

The common plot specific buttons can be used to control the power trace view as desired which

includes panning, merge/unmerge, fit and zooming in/out of the trace plots. The we button in particular can be selected to enable cursors for a test/subtest which lets you turn on/off markers at certain areas of the plot. Click on a test/subtest to navigate to the exact time stamp and packet details of the plot as shown in the following example:

				nnels 🗸 🖉 Live		Packet D)etails		
Time Stamp Description Time: 5.505:869:803 / ΔT : 9146.2ms Defined Discover ID;NAK; Vbus: 5.146V Defined Discover ID;NAK; CC1 : 1.606V DCRC: CC2 : 0.013V rg Cran Time: 14.5532(00):572 / ΔT : 9146.2ms									
H	• 2.019:596:34	(2 #28 SOP	GoodCRC: Vbus : 0.029V		Bits	Field Type	Raw	Decoded	Description
F	2 021:529:160 CC #29 SOP Request PT CC2 : 0.020V								
F	6.	00			▼ PDO#1	> OpCurrent = 0.5A> MaxCurrent	= 0.5A { 0x	1080C832} (9)	
		00			[31]	Reserved	0×0	0	
•	08 2.0	00			[30:28]	Object_Position	0x1	1	
	¥I¥0 1.9	00			[27]	Give_Back_Flag	0x0	0	False
L	n. 0.0	00			[26]	Capability_Mismatch	0×0	0	False
	4.0 S	00			[25]	USB_Communications_Capable	0×0	0	False
	3 .0	00			[24]	No_USB_Suspend	0x0	0	False
		00			[23:20]	Reserved	0x8	8	
	<u> </u>	0.16 1.72 3.29	4.85 6.42 7.98 9.55 Tirre (Sec)	11.12 12.68 14.25 15.81	[19:10]	Operational_Current	0x32	0.5	0.5A

FIGURE 5.35: ENABLE TRACE MARKERS AND VIEW TEST DETAILS EXAMPLE

You can use your mouse cursor to hover on top of each plot specific button to view the description of each button function.

When the testing is complete, the screen displays all the data gathered during the testing process.

Select the Save 🖹 button to save the power trace plot to a file and the Load 🔎 button to open and use an existing saved power trace file.

You can then also return to the *Test Config* screen to filter out the test selection list for those tests with Pass/Fail/Warning/Incomplete status. This allows you to easily determine the status of each test

using the respective icons 🖉 😢 🗢 🔶 under the Test Selection panel. Clicking 🐱 will undo this function.

5.3 Test Report View

After running a set of tests, the *Report* screen allows full reports to be created:

	View Report Download Current HTML Report Download Current DUT Report Data Report Data Management CiGRL/USBPD-C2-Browser-App/ReportTempReport
Connection Setup	GRANITE RIVER LABS
Product Capability	Test Summary - Overall
	Total PASS FAIL PASS Rate(%) INCOMPLETE NA WARNING NOT_SELECTED 84 0 1 0% 1 0 83
	Test Summary - All MOI
Test Config	MOI Name Total PASS FAIL INCOMPLETE NOT_SELECTED OTHERS Power Delivery 3.0 Tests 84 0 1 0 83 0
	Power Delivery 3.0 Tests- Result Summary
æ	All the test results in this report are Informational only cannot be considered for certification
Bosults	SI No Test ID Test Name Test Result
Results	1 TD.PD.LL3.E1 TD.PD.LL3.E1 GoodCRC Specification Revision compatibility
	Power Delivery 3.0 Tests - Detailed Test Result
~	All the test results in this report are Informational only cannot be considered for certification
=×	Test Status Test Description
Report	FAIL 1. TD.PD.LL3.E1 GoodCRC Specification Revision compatibility (<u>Click to View Protocol Trace</u>)
	PD contract negotiation failed: Could not find expected messages, verify setup and re-run. PD. Contract Fail: Could not find expected messages, verify notocol canture and confirm the failure

FIGURE 5.36: REPORT SCREEN

The content of the generated reports can consist of one or more of:

- **Configuration** The product configuration information for the UUT.
- **Packet List** A list of all the packets exchanged during testing.
- **Test Results** The individual test Pass / Fail results.
- Eye Diagrams Any eye diagrams created during physical layer (PHY) testing.
- Saved Images Any other images created during the test process.

The most recent set of results for all tests run (regardless of when they were run) will be captured in the generated reports.

Scroll down to view the full report as shown in the example below:

	View Report Download Current HTML Report Download	vnload Current DUT Report Data Report Data Management C:\GRL\USBPI	Test Reports Location D-C2-Browser-App\Report\TempReport
\bullet	Manufacturer	Nexus	
Connection	Model Number	Updated	
Setup	Serial Number	1	
	Test Information		
	Test Lab		
Product	Test Engineer	Test Engineer	
Capability	Remarks	Remarks	
	Date_and_Time	15-10-2020 13:44:56	
	Controller and Instrument Info	ormation	
	Parameter	Value	
Test Config	GRL_USB_PD_C2_Serial_No	022.045.022.009.031.	
	GRL_USB_PD_Software_Version	1.4.63.0	
	GRL_USB_PD_Firmware_Version	1.3.52	
0	GRL USB-PD Ethernet Buffer Size	62K	
۵ <u>ک</u>	GRL USB-PD Eload Firmware Version	9.7 / 9.7	
Results	Browser Application Status	Information Only	
	Board Calibration	Calibration Expired	
	RX mask Power selection	Neutral Power	
	Device_Type	DRP	
Ē	Cable Type	GRL_SPL_CABLE_1	
Report	Impedance (milli ohm)	0	
порон	COMPLIANCE_TEST_PD3 CTS Version	1.14	
	VIF_File_Name		
	Noise Pattern Generation:	Square wave Noise	_
522	VIF info	*Since VIF was not loaded below test results are information Only.	
202	Application mode	Informational	_
Options	Disabled all Pop-up during test execution	False	
	Pop-up Timer	0	_
	Execution Time(In Minutes)	0	
0	DUT Max Power		
Help	Power	NA	
(top			

FIGURE 5.37: SCROLL DOWN TO VIEW FULL REPORT

Use these buttons above the report to perform the following functions:

- **Download Current DUT Report Data** button: Save all the result information to a ZIP folder.
- Download Current HTML Report button: Save the test report in HTML format.
- **Report Data Management** button: Access other test reports including from previous test runs. This allows you to delete or save the reports as desired from the database.
- View Report button: Jump to the beginning of the report.

6 Using the Configuration Controller

This section describes how to use the Config Controller utility, which allows the user to:

- configure the DisplayPort AUX or USB-C SBU fixture connected to the GRL-USB-PD-C2 controller for capturing sideband messages for DisplayPort Standard AUX or DisplayPort Alternate Mode respectively, and
- manually send USB-PD commands from the GRL-USB-PD-C2 controller to the UUT.

The *Options* screen will display the Config Controller page by clicking on the **Config Controller** tab at the top of screen:

\sim		Five Port Tes	ting Config	Controller Cable IR Drop C	Calibration
Connection		Configure		Send Message	Request
Setup	App Mode	CTS 💌	Sop Type	SOP	PDO Index Select Index Value
	Fixture Selection	C2 DP AUX Sniffer	Message Type	VDM Disocver ID Initiator	Supply Index Select Supply
	Port Type	PortB 💌	SVID(0X0000) 0X	FF001	Capability Mismatch
Product	Controller Mode	UFP/Sink		Send	USB Communications Cable Mismatch
Capability	Test Cable Type	GRL-SPL Test Cable 1			NO USB Suspend
	PD Spec Type	Spec Rev2 🔻			Unchuncked Extend Message Support
	Cable Emulation	Ra in CC1 💌			Request
Test Config	Rp Level	Rp 900mA 👻			
		Apply			
æ	Emulate Cable	Attach Detach			
Results	Channels	VBUS 🗌 CC1 🗌 CC2			
	Signal Capture	Start Stop			
-	Capture File				
=×		Download Capture			
Report					
ଽୖୢୄ					
Options					

FIGURE 6.1: CONFIGURATION CONTROLLER SCREEN

Testing the UUT for a particular scenario can be performed using the **Config Controller** utility. The screen contains multiple panels with input fields that can be selected to focus on specific capabilities and requirements.

6.1 Configure Panel

The Configure panel allows the user to set the configuration of the controller.

Configure				
App Mode	CTS	•		
Fixture Selection	C2 DP AUX Sniffer			
Port Type	PortB	•		
Controller Mode	UFP/Sin	ık 🔻		
Test Cable Type	GRL-SPL Test Cable 1			
PD Spec Type	Spec Rev2			
Cable Emulation	Ra in CC	c1 🔹		
Rp Level	Rp 900m	nA 🔻		
	Apply			
Emulate Cable	Attach	Detach		
Channels		002		
Signal Capture	Start	Stop		
Capture File				
	Download (Capture		

 $FIGURE \ 6.2: CONFIGURATION \ CONTROLLER - CONFIGURE \ PANEL$

- App Mode The App Mode drop down sets the controller's mode of application:
 - **CTS** Standard USB Power Delivery Protocol for decoding of USB Type-C Power Delivery packets
 - **DP AUX** DisplayPort Auxiliary Channel for decoding of DisplayPort sideband AUX messages
- **Fixture Selection** The Fixture Selection drop down sets the external test fixture that is connected to the controller:
 - **C2 DP AUX Sniffer** GRL DP AUX Sniffer Fixture for sniffing DisplayPort Standard Auxiliary traffic
 - USB-C SBU USB Type-C Sideband Use (SBU) fixture for DisplayPort Alternate Mode over Type-C testing
- **Port Type** For a 2-port UUT, select either "PortA" or "PortB" to apply the configuration for the selected test port.
- **Controller Mode** The Controller Mode drop down sets the controller's mode of operation:
 - UFP/Sink Upward Facing Port, sink power
 - DFP/Source Downward Facing Port, source power
 - **DRP** Dual Role Port
 - Cable Tester Cable only

- **Test Cable Type** The Test Cable Type drop down allows you to select the type of cable UUT connected to the Controller.
- **PD Spec Type** The PD Spec Type drop down allows you to select the USB Power Delivery specification limits to be applied accordingly.
- **Cable Emulation** The Cable Emulation drop down sets the Ra on CC1 or CC2 or both CC lines of the cable UUT if cable emulation is enabled on the controller when using the GRL special test cable for testing.
- **Rp Level** The Rp Level drop down sets the Rp value on the CC line of the cable UUT.

Clicking the **Apply** button causes all of the above configuration to be set.

• **Emulate Cable** – Select the **Attach** button to perform emulation for a connected cable. Depending on the controller mode, the **Attach** function presents Rp/Rd from the CC line and changes the state of the controller to Source Attach or Sink Attach.

Select the **Detach** button to stop emulation and remove the connected cable. The **Detach** function removes all the Rp/Rd values from the CC line and changes the state of the controller to Source Detach or Sink Detach.

- **Channels** Select the display channels (VBUS, CC1 and CC2) to be added to the signal acquisition trace plot.
- Signal Capture Select the Start button to start running signal acquisition or the Stop button to stop signal acquisition for the UUT. The Start function will initiate the test run in the Results screen as shown in the example below:



FIGURE 6.3: CONFIGURE PANEL – START SIGNAL CAPTURE IN RESULTS SCREEN EXAMPLE

• **Capture File** – Select the **Download Capture** button to download and save the signal acquisition to a file.

6.2 Request Panel

The Request panel allows the user to select the Request message settings which are sent from the Controller during PD Contract negotiation phase.

	Request		
PDO Index	Select Index Value		
Supply Index	Select Supply		
🔲 Capabilit	y Mismatch		
USB Communications Cable Mismatch			
NO USB Suspend			
Unchunc	ked Extend Message Support		
	Request		

FIGURE 6.4: CONFIGURATION CONTROLLER – REQUEST PANEL

- **PDO Index** The PDO Index dropdown allows you to select the index of the Power Data Object (PDO) being accessed.
- **Supply Index** The Supply Index dropdown allows you to select the type of PD power supply being accessed.
- You can also set other options by selecting its respective checkbox, for example, the "Capability Mismatch" option is set if there is a check mark in the box next to the title. Clicking on the check box will toggle the value between set and cleared. Similarly, the "No USB Suspend" option can be set (check mark in box) or cleared (no check mark) by clicking on the "No USB Suspend" check box.

Clicking the **Request** button causes the above configuration to be sent from the Controller.

6.3 Send Message Panel

The Send Message panel allows the user to send run-time messages from the Controller to the connected UUT after a successful PD Contract has been established. The user selects the desired message type then clicks on the **Send** button to send the run-time messages from the Controller to the UUT.

Send Message			
Sop Туре	SOP 🔻		
Message Type	VDM Disocver ID Initiator		
SVID(0X0000)	0X FF001		
	Send		

 $FIGURE \ 6.5: CONFIGURATION \ CONTROLLER - SEND \ MESSAGE \ PANEL$

- **SOP Type** The SOP Type drop down allows you to select the Start Of Packet (SOP) type in the message sent from the Controller. It includes SOP, SOP1 and SOP2.
- Message Type The Message Type dropdown allows you to select the type of command to be sent from the Controller. This includes Power, Data and VCONN swaps, Resets such as Hard Reset, Cable Reset and Soft Reset, Capability commands such as Get Sink Capability and Get Source Capability, Ping command and BIST Test Data command.
- **SVID(0X0000)** The SVID field allows you to set the SVID value of mode related messages sent from the Controller. VDM Mode Initiator, VDM Enter Mode Initiator and VDM Exit Mode Initiator are mode related messages. The SVID value is a four digit hexadecimal number.

After selecting the required command as described above, click on the **Send** button to cause the Controller to send the command message to the UUT.

7 Using the Five Port Testing Utility

This section describes how to use the **Five Port Testing** utility, which allows you to set up a multiport switch for the UUT. The *Options* screen will display the Five Port Testing page by clicking on the **Five Port Testing** tab at the top of screen as shown below:

	Five Port Testing	Config Controller Cable IR Drop Calibration
Connection Setup	Save Five Port Data Load Five Port Data	Timeout Pop-up Messages Rerun Selected Tests The first selected Tests The first selected Test se
	COM Port ⑦ COM4 Select Port 1 Connect	Power Delivery 3.0 Test Configuration
Product Capability	1 2 3 4 5	FR_Swap AUTO Box Connected
	Project_Name Project_Name	
	Enable Port Off	
Test Config	Cable Selection GRL-SPL Test Cable 1	
	DUT Info VIF O DUT Type	
(36)	VIF Source Load XML VIF File	
Results	MOI List Select MOI	
	Repeat Count 0	
Report	Repeat Condition V	
ईट्रे Options		

FIGURE 7.1: FIVE PORT TESTING SCREEN

This switch function requires the GRL 5-Port Switch Board (GRL-USB-PD-MULT option) to be used which is provided as a separate accessory for the GRL-USB-PD-C2 controller. The GRL 5-Port Switch Board consists of a five ports switch extension fixture that is plugged in to the GRL-USB-PD-C2 controller and used to connect up to five UUT's to perform switching during tests. For more information on the GRL 5-Port Switch Board, please contact support@graniteriverlabs.com.

To set up the switch for measurements, select and enter the Port value and path that is to be used on the GRL 5-Port Switch Board fixture that is connected with the GRL-USB-PD-C2 controller. Click on the **Connect** button next to it to verify the assigned Port connection.



FIGURE 7.2: FIVE PORT TESTING – ASSIGN AND CONNECT TO PORT

You can also assign new project for the selected Port by entering in the Project Name field.

To make configurations to the switch, turn 'On' the **Enable Port** slider **Enable Port On**. The test cable selection drop down allows you to specify what cable connects the UUT to the specific USB Port on the GRL-USB-PD-C2 controller.

	On	Enable Port
-0	GRL-SPL Test Cable 1	Cable Selection
	GRL-SPL Test Cable 1	DUT Info
	GRL-SPL Test Cable 2	
	USB-C STD Test Cable 1	VIF Source
 	USB-C STD Test Cable 2	MOI List
·	Captive Cable	
‡ 0	No Cable	Repeat Count
	GRL-SPL Test Cable 1 GRL-SPL Test Cable 1 GRL-SPL Test Cable 2 USB-C STD Test Cable 1 USB-C STD Test Cable 2 Captive Cable No Cable	Cable Selection DUT Info VIF Source MOI List Repeat Count

FIGURE~7.3:~FIVE~PORT~TESTING-SELECT~CABLE

You can then select whether to use a VIF file for the UUT or querying the capabilities of the UUT (**DUT Type**) at the DUT Info field **DUT Info VIF O DUT Type**.

If the VIF file is used, clicking on the Load XML VIF File button
 VIF Source Load XML VIF File
 will read and load information from a

selected VIF XML file on the host PC.

• If acquiring UUT capabilities, select the **DUT Type** checkbox to enable selection of the UUT type being used from the **DUT Type** drop down:



FIGURE 7.4: FIVE PORT TESTING – SELECT UUT TYPE

Finally select the tests that comply to a certain certification standard by selecting the MOI List drop down.

Project Name	Power Delivery 3.0 Tests	
Enable Port	Source Power Tests	
Cable Selection	Quick Charge 4 Tests	
DUT Info	PD2 Deterministic Tests	
VIF Source	USB-C Functional Tests	
MOI List	Select MOI	~

FIGURE 7.5: FIVE PORT TESTING – SELECT MOI TESTS

If required, you can set the number of times to repeat the test sequence (**Repeat Count** field) for the selected test status (**Repeat Condition** drop down).

Repeat Count	1	*
VIE Source	All Tests	
VIII Source	Fail Tests	
MOI List	Pass Tests	
Repeat Count	Incomplete Tests	
Repeat Condition	Select Condition	~

FIGURE 7.6: FIVE PORT TESTING – SET REPEAT TEST AND CONDITION

The 'MOI Configurations' pane on the right allows you to set up parameters for the tests that have been selected from the 'MOI List' drop down.

Once all configurations have been made, click on the top **Start Execution** button to execute the switch function for selected tests.

To save the switch configuration to a file, click on the **Save Five Port Data** button at the top of screen. To load and use a previously saved switch configuration file, click on the **Load Five Port Data** button.

Save Five Port Data	Load Five Port Data	
Start Execution		

FIGURE~7.7: FIVE~PORT~TESTING-START~TEST~AND~SAVE/LOAD~FUNCTIONS

8 Using the Cable IR Drop Calibration Utility

This section describes how to use the **Cable IR Drop Calibration** utility to perform IR drop calibration to compensate for voltage loss of the cable under test due to high resistance. The *Options* screen will display the Cable IR Drop Calibration page when clicking on the **Cable IR Drop Calibration** tab at the top of screen as shown below:



FIGURE 8.1: CABLE IR DROP CALIBRATION SCREEN

First make sure that the test cable is connected properly to the GRL-USB-PD-C2 controller test ports as shown in the setup image.

Select the **Cable Type** drop down to select what type of cable to be tested and enter a name for the selected cable in the **Cable Name** field.

Cable Name	cablename		
Cable Name		GRL-SPL test cable 1]
Cable Tune		GRL-SPL test cable 2	
Calibration Status		USB-C STD test cable 1	
	tatus :	USB-C STD test cable 2	

FIGURE 8.2: CABLE IR DROP CALIBRATION – SELECT AND ENTER NAME OF TEST CABLE

Take note of the 'Capture Location' file directory (*Capture Location: C:\GRL\USBPD-C2-Browser-App\CableCompensation*) under the table on the right that is used for saving the cable IR drop calibration data to a file after clicking on the **Download File** button.

Note: If the GRL-SPL-Cable is used, make sure to place the GRL logo on the cable in the upward position to maintain the same cable orientation. Also make sure to maintain the same cable

orientation for the other cable types. These are important to obtain accurate IR drop calibration values.

Finally click on the **Calibrate** button to start running the IR drop calibration. Details of the calibration run will be logged accordingly in the table on the right and the status will be shown next to "Calibration Status".

Calibration State	JS :	
	Calibrate	Download File

 $\label{eq:Figure 8.3: Cable IR Drop Calibration - Run IR Drop Calibration and Save to File$

9 GRL-USB-PD-C2 Browser App Information and Help

The *Help* screen allows you to view the current version of the GRL-USB-PD-C2 Browser App as well as a brief description of the GRL-USB-PD-C2 Test Controller. You can also access customer support using the links provided.



FIGURE 9.1: HELP SCREEN

END_OF_DOCUMENT