

Granite River Labs

USB Type-C[®] Power Delivery and Alt Mode Test User Guide for GRL USB Type-C Power Delivery Tester and Analyzer (GRL-USB-PD-C2 / C2-EPR) Browser Application



This material is provided as a reference to install and get started with Granite River Labs (GRL) USB Power Delivery Compliance Test (GRL-USB-PD-C2 / C2-EPR) 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 latest USB-IF, VESA – DisplayPort[™] and Qualcomm[®] Quick Charge[™] (QC) specification versions respectively.

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/

1.2 VESA - DisplayPort

Download the DisplayPort document from the VESA Browser site:

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

1.3 QC Testing

Approval and NDA as a QC5 and Legacy Adopter is required to gain access to the QC Compliance Test Spec. Contact your Granite River Labs or Qualcomm QC representative for more details.

2 Scope of this User Guide

This User Guide serves as the primary user documentation for the GRL-USB-PD-C2 (aka GRL-C2) and GRL-USB-PD-C2-EPR (aka GRL-C2-EPR) GRL USB Type-C Power Delivery Tester and Analyzers Hardware and the GRL-C2 / C2-EPR Automation Test Browser Application. The subsequent sections describe the GRL-C2 / C2-EPR initial setup and each feature provided by the GRL-C2 / C2-EPR automation test browser application when connected to the GRL-C2 / C2-EPR tester hardware. For more details on the GRL-USB-PD-C2 / C2-EPR test solution, see related user documentation at http://graniteriverlabs.com/download-center/ and general overview at https://www.graniteriverlabs.com/en-us/test-solutions/.



3 Getting Started with GRL-USB-PD-C2 / C2-EPR

This section describes how to get started with the GRL-C2 / C2-EPR test solution for USB Power Delivery compliance testing. Whether you are installing for the first time or doing an upgrade, please make sure to follow all the steps in this section to verify your setup prior to testing a Device Under Test (DUT). The procedure is as follows:

- 1. Install the latest version of GRL-C2 / C2-EPR automation test browser application (Browser App) on the host computer (laptop or desktop) connected to the GRL-C2 / C2-EPR tester hardware. For best system operation using this Browser App, GRL recommends that the host computer 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-C2 / C2-EPR Browser App server.
- 2. Make sure the GRL-C2 / C2-EPR tester firmware has been updated to the latest version (see Section 4).

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

3.1 Install GRL-C2 / C2-EPR Browser App

- 1. Download the GRL-C2 / C2-EPR Browser App from <u>http://graniteriverlabs.com/download-center/</u>.
- 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-C2 / C2-EPR BROWSER APP INSTALLATION



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



FIGURE 3.2: ACCEPT GRL-C2 / C2-EPR BROWSER APP LICENSE AGREEMENT

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

\delta G	RL-C2_Browser_App 1.6.3.24 Setup	_		\times
Ins	talling			
Р	ease wait while GRL-C2_Browser_App 1.6.3.24 is being installed.			
E	ktract: functions_9.html 100%			
	Extract: functions_4.js 100%			^
	Extract: functions_5.html 100%			
	Extract: functions_5.js 100%			
	Extract: functions_6.html 100%			
	Extract: functions_6.js 100%			
	Extract: functions_7.html 100%			
	Extract: functions_7.js 100%			
	Extract: functions_8.html 100%			
	Extract: functions_8.js 100%			
	Extract: functions_9.html 100%			~
Nulls	oft Install System v3.02.1			
	< Pack No.	4 N	Car	scol
			Car	icei

FIGURE 3.3: GRL-C2 / C2-EPR BROWSER APP INSTALLATION IN PROGRESS





FIGURE 3.4: GRL-C2 / C2-EPR BROWSER APP INSTALLATION COMPLETED

5. The GRL-C2 / C2-EPR Browser App is now ready for use.

3.2 Start Up and Navigate GRL-C2 / C2-EPR Browser App

 Once installed, you can directly open the GRL-C2 / C2-EPR Browser App using the GRL-C2 -Browser App desktop shortcut. This will initiate the App server to run backend operations before launching the GRL-C2 / C2-EPR Browser App.

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



FIGURE 3.5: APP SERVER SCREEN RUNNING BACKEND OPERATIONS



- 2. The GRL-C2 / C2-EPR 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-C2 / C2-EPR Browser App when launched will display "Connection Setup" as the landing screen as follows:

🥠 GRL	USB Power Delivery and USB Type-C [™] Test Software (1.6.3.24) Se GRL-USB-PD-C2-EPR			pp Mode : CTS () API
Connection Setup Product Capability Test Config	Ethernet Connection Settings Scan Network C2-EPR IP Address 192.168.255.1 x Connect Setup Diagram Tool Updates Update Firmware Update Instructions	Tester Status Serial Number Firmware Version Tester IP Address Information Last Calibration Date Next Calibration Due Date Test Cable Calibration Status () C2-EPR Tester Calibration	Disconnected N/A N/A 192.168.255.1 - Calibration Error	
Image: Second		License Informatio	n License Period	

FIGURE 3.6: GRL-C2 / C2-EPR BROWSER APP LANDING SCREEN

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

3.2.1 Using GRL-C2 / C2-EPR Browser App in Chrome OS

Note: Make sure that the GRL-C2-EPR tester hardware is connected to a control PC running Windows 10.

- 1. Install the GRL-C2 / C2-EPR Browser App on a Windows 10 control PC connected to the GRL-C2 / C2-EPR tester hardware.
- 2. Once installed, open the GRL-C2 / C2-EPR Browser App using the **GRL-C2 Browser App** or **GRL-C2-EPR 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).





See Figure 3.7 below for an illustration of the above steps.

FIGURE 3.7: USING GRL-C2 / C2-EPR BROWSER APP IN CHROME OS

3.2.2 Using GRL-C2 / C2-EPR Browser App in macOS

Note: Make sure that the GRL-C2 / C2-EPR tester hardware is connected to a control PC running Windows 10.

- 1. Install the GRL-C2 / C2-EPR Browser App on a Windows 10 control PC connected to the GRL-C2 / C2-EPR tester hardware.
- 2. Once installed, open the GRL-C2 / C2-EPR Browser App using the **GRL-C2 Browser App** or **GRL-C2-EPR 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).

See Figure 3.8 below for an illustration of the above steps.





FIGURE 3.8: USING GRL-C2 / C2-EPR BROWSER APP IN MACOS





4 Safety Precautions for GRL-USB-PD-C2 / C2-EPR

Make sure to read, follow and adhere to the following safety precautions when handling the GRL-USB-PD-C2 / C2-EPR tester hardware.

4.1 Operating Conditions

The following conditions must be fulfilled for optimum performance and functionality of the GRL-USB-PD-C2 / C2-EPR tester hardware:

- The GRL-USB-PD-C2 / C2-EPR tester hardware should be calibrated.
- The GRL-USB-PD-C2 / C2-EPR tester hardware should be kept for 10 minutes warm up before performing tests.
- The AC Mains voltage should be within the specification of 100 240 VAC and should not have excessive noise or surge levels.
- The GRL-USB-PD-C2 / C2-EPR tester hardware, DUT and any other equipment used for testing must be connected to the common ground.
- The GRL-USB-PD-C2 / C2-EPR tester hardware must be operating in a stable physical environment (no vibrations).
- The Room temperature should be 20° C ± 5.
- The Relative humidity of the room must be maintained at $50\% \pm 20\%$.

4.2 Electrical Characteristics

The GRL-USB-PD-C2 / C2-EPR tester hardware should be operated with a 3-pin plug and the type of power source as indicated on the marking label of the tester hardware.

- 100-240 Volt AC, 50-60 Hz
- 10 Amps

4.3 Use Only in Laboratories

The GRL-USB-PD-C2 / C2-EPR tester hardware is designed to be used in a USB Test Laboratory for USB Compliance Testing, Research and Development.

- The GRL-USB-PD-C2 / C2-EPR tester hardware should be kept on a stable desk or bench while in use.
- The GRL-USB-PD-C2 / C2-EPR tester hardware should not be mounted to a wall or ceiling.
- The GRL-USB-PD-C2 / C2-EPR tester hardware should be placed away from sources such as Radiators, Air Conditioners or other products that would affect the temperature around the GRL-USB-PD-C2 / C2-EPR tester hardware.





4.4 Ventilation

Air suction and exhaust vents in the cabinet must be provided for ventilation to ensure reliable operation of the GRL-USB-PD-C2 / C2-EPR tester hardware and protect it from overheating. These vents must not be blocked or covered. The GRL-USB-PD-C2 / C2-EPR tester hardware should not be placed in a built-in installation such as a rack unless proper ventilation is provided, or the manufacturer's instructions have been followed.

The images below show where ventilation is required:



Front View



4.5 Cleaning

The following precautions should be observed when cleaning the GRL-USB-PD-C2 / C2-EPR tester hardware:

- Disconnect the AC Mains before cleaning the GRL-USB-PD-C2 / C2-EPR tester hardware.
- The GRL-USB-PD-C2 / C2-EPR tester hardware should be cleaned with a soft dry cloth only.
- NEVER clean the GRL-USB-PD-C2 / C2-EPR tester hardware with furniture wax, benzene, insecticides or other volatile liquids which may corrode the cabinet.

4.6 Hazard Warning/Caution

For own safety when using the GRL-USB-PD-C2 / C2-EPR tester hardware, take note of the following:

- To prevent a fire or shock hazard, do not expose the GRL-USB-PD-C2 / C2-EPR tester hardware to water or moisture.
- To prevent the risk of electric shock, do not open or remove the enclosure of the GRL-USB-PD-C2 / C2-EPR tester hardware.
- Do not connect the DUT while the GRL-USB-PD-C2 / C2-EPR tester hardware is booting up. Also, remove the DUT before power cycling the GRL-USB-PD-C2 / C2-EPR tester hardware.



• Do not use the GRL-SPL-Cable in between the Source and Sink DUT's without the prior precaution. This is because the GRL-USB-PD-C2 / C2-EPR tester hardware will not source the VCONN voltage but the DUT's will source the VCONN voltage instead when the GRL-SPL-Cable is being used.

Note: There are no user-serviceable parts inside. For any type of service assistance, please contact Granite River Labs. Alteration or modifications carried out without appropriate authorization may void the warranty.



5 Connection and Setup of GRL-C2 / C2-EPR Tester Hardware

Figure 5.1 shows how to connect the GRL-C2 / C2-EPR tester hardware with the host computer (control computer/PC) for testing a USB Power Delivery based DUT.



FIGURE 5.1: GRL-C2 HARDWARE CONNECTION SETUP FOR TESTING DUT



FIGURE 5.2: GRL-C2-EPR HARDWARE CONNECTION SETUP FOR TESTING DUT



The GRL-C2 / C2-EPR Browser App installed on a Windows 10 (or higher) computer automates the testing process. Below is the procedure for connecting the hardware and verifying proper hardware connections.

Note: Make sure to read and adhere to the safety precautions as outlined in Section 4 of this User Guide before using the GRL-C2 / C2-EPR tester hardware.

- 1. Connect power supply to the GRL-C2 / C2-EPR tester hardware (see Section 5.1).
- 2. Connect the GRL-C2 / C2-EPR tester hardware using a physical Ethernet connection between the control computer and the tester.

Note: Automation of the DUT power supply switching in the GRL-C2 / C2-EPR tester hardware is handled internally to the tester. Thus, there is no Ethernet, USB or GPIB connection attached to the power supply.

5.1 Connect Power Supply to GRL-C2 / C2-EPR Tester Hardware

Connect the GRL-C2 / C2-EPR Power interface using the Power Brick included with the tester hardware.



FIGURE 5.3: GRL-C2 POWER INTERFACE



FIGURE 5.4: GRL-C2-EPR POWER INTERFACE



5.2 Connect Ethernet Cable and Turn On GRL-C2 / C2-EPR Tester Hardware

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.



FIGURE 5.5: GRL-C2 ETHERNET CONNECTOR



FIGURE 5.6: GRL-C2-EPR ETHERNET CONNECTOR

Turn on the GRL-C2 / C2-EPR tester hardware using the 'Power' on/off button on the front of the tester.

POWER			CRI		
GRL-USB-PD-C2 GRANTE RIVER LAIBS FORT - 1 PD Fort - Detach DU Fort - Sink/UFP DU Mode - Sink/UFP DU Mode - Sink/UFP			GRANITE	RIVER LABS	
IP Address - 192,168,255.1 Firmware Version - 1,5,8,0,16 System Info - 126,156,126,095,156, ELoad FW Version(Port-1/Port-2) - 9,6/9,6					
USB Type-C [™] Power Delivery Tester GRL-USB-PD-C2	Port 1	Port 2	Extension	Trigger	

FIGURE 5.7: GRL-C2 POWER BUTTON





FIGURE 5.8: GRL-C2-EPR POWER BUTTON

5.2.1 Verify GRL-C2 / C2-EPR Tester Hardware Ethernet Connection

The Ethernet port on the control computer needs to be configured correctly for the GRL-C2 / C2-EPR tester hardware 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 5.9: Network Connections Before Connecting $\mathsf{GRL}\text{-}\mathsf{C2}\,/\,\mathsf{C2}\text{-}\mathsf{EPR}$

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

Ethernet 5 Properties	\times					
Networking Sharing						
Connect using:						
ASIX AX88179 USB 3.0 to Gigabit Ethernet Adapter						
Configure						
This connection uses the following items:						
Client for Microsoft Networks	1					
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						
across diverse interconnected networks.						
OK Cancel						

FIGURE 5.10: 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				
• 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 auto	omatically			
• Use the following DNS server ad	dresses:			
Preferred DNS server:				
Alternate DNS server:				
Ualidate settings upon exit	Advanced			
	OK Cancel			

FIGURE 5.11: 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 on the "OK" button on the Internet Protocol Properties and close the Ethernet Properties. Make sure the GRL-C2 / C2-EPR tester hardware is powered on and completely booted up (front panel display shows firmware version number) then connect the Ethernet cable from the GRL-C2 / C2-EPR tester hardware to the computer's Ethernet port that was just set up. The network connections panel should now look as pictured in Figure 5.12 below:



FIGURE 5.12: NETWORK CONNECTIONS AFTER SETUP AND CONNECTION OF GRL-C2 / C2-EPR

The GRL-C2 / C2-EPR tester hardware is now set up and ready for use.

Before running any tests, it is recommended that you verify that the control computer and the GRL-C2 / C2-EPR are communicating by going to the "Connection Setup" screen on the GRL-C2 / C2-EPR Browser App and clicking on the "Connect" button. The tester status should display "Connected". Refer to Section 6 for more information.

5.3 Connect GRL-SPL-EPR Test Cable (with Link Cable & USB Type-C Connector Screw) to GRL-C2-EPR Tester Hardware

The GRL-SPL-EPR test cable refers to the GRL special cable provided with the GRL-USB-PD-EPR pre-compliance board that is used to connect the board with the GRL-C2-EPR tester hardware and a USB Type-C based EPR Source/Sink DUT for EPR power testing.

Caution: Do not remove/disconnect the GRL-SPL-EPR cable during EPR power testing, to avoid damage to the GRL-C2-EPR tester hardware and DUT. Please make sure to tighten the screw on top of the cable before running tests.

Connect the GRL-SPL-EPR test cable assembly to the test port connectors as shown in below example:





FIGURE 5.13: GRL-SPL-EPR CABLE CONNECTION

Note: Make sure to place the GRL logo on the cable in the upward position to maintain the same cable orientation. This is important to obtain accurate test measurement results.

In the above image, take note that the VBUS Sense pin will also need to be connected along with the GRL-SPL-EPR test cable. This is important when performing the Cable IR Drop calibration to compensate for voltage loss of the cable under test due to high resistance. To avoid this Cable IR Drop measurement in the GRL-C2-EPR, the VBUS Sense pin must be connected to directly measure the VBUS at the DUT's Type-C connector.

Follow the steps below to properly connect/disconnect the GRL-SPL-EPR test cable assembly to/from the GRL-C2-EPR test port connectors to avoid damage to the cable.

5.3.1 Connect GRL-SPL-EPR Cable to GRL-C2-EPR Port



1. Position the GRL-SPL-EPR cable in a straight line as shown below:

FIGURE 5.14: GRL-SPL-EPL CABLE IN STRAIGHT POSITION

2. Insert the USB Type-C connector of the GRL-SPL-EPR cable to the GRL-C2-EPR test port as shown in the example in Figure 5.15. Make sure to tighten the screw on top of the cable.





FIGURE 5.15: CONNECTING USB TYPE-C CONNECTOR OF GRL-SPL-EPL CABLE TO GRL-C2-EPR PORT

3. Insert the VBUS Sense pin to the GRL-C2-EPR VBUS SENSE port by pressing the notch in the Sense pin. Place the notch in the upward position when inserting the pin (see images below).









FIGURE 5.16: CONNECTING VBUS SENSE PIN TO GRL-C2-EPR PORT





5.3.2 Disconnect GRL-SPL-EPR Cable from GRL-C2-EPR Port

1. First, loosen the screw on top of the USB Type-C connector of the GRL-SPL-EPR cable. Then, remove the USB Type-C connector from the GRL-C2-EPR test port as shown below.



FIGURE 5.17: REMOVING USB TYPE-C CONNECTOR OF GRL-SPL-EPL CABLE FROM GRL-C2-EPR PORT

2. To remove the VBUS Sense pin from the GRL-C2-EPR VBUS SENSE port, press and hold the notch in the Sense pin and pull back gently (do not grab the Sense wires while doing so). Refer to the following images.







FIGURE 5.18: REMOVING VBUS SENSE PIN FROM GRL-C2-EPR PORT



5.4 Set Up GRL-C2 / C2-EPR Tester Hardware for Custom OEM Testing

1. Connect the Custom OEM fixture to the DUT and GRL-C2 / C2-EPR tester hardware to perform Custom OEM tests as shown in below example:



FIGURE 5.19: CUSTOM OEM FIXTURE AND DUT CONNECTION

2. Connect channel 2 of the Keysight N6705C E-Load to the external E-Load port at the back of the GRL-C2 / C2-EPR tester hardware as shown below:

Note: The GRL-C2 / C2-EPR Browser App currently supports only the Keysight N6705C E-Load. Please refer to the Custom OEM specifications for more details.







FIGURE 5.20: CUSTOM OEM EXTERNAL E-LOAD CONNECTION

- 3. Use a USB cable to connect the Keysight N6705C E-Load to the control PC where the GRL-C2 / C2-EPR Browser App is being run.
- 4. Select all the Custom OEM test cases from the "Test Selection" panel and run the tests. Refer to Section 7.3.1.12 for more information.

Note: To run the CUSTOM OEM.TD.4.9.2 OCP and OVP Tests:

- On the GRL-C2, use an external E-Load.
- On the GRL-C2-EPR, the external E-Load in not required.





6 Connection and Setup of GRL-C2 / C2-EPR Browser App

Note: The following procedure assumes that the GRL-C2 / C2-EPR tester hardware has been properly set up as described in above sections.

To connect the GRL-C2 / C2-EPR Browser App with the GRL-C2 / C2-EPR tester hardware, do the following:

 On the GRL-C2 / C2-EPR Browser App landing page ("Connection Setup" screen), enter the IP address as displayed on the GRL-C2 / C2-EPR tester hardware screen and click on the **Connect** button. You can also click on the **Scan Network** button to detect all available GRL-C2 / C2-EPR tester hardware connected to the same network.

🅢 GRL	GRL-USB-PD-C2 Auto Mode - OFF
PORT – 1	PORT - 2
PD Port - Detach	PD Port - Detach
Tester Mode - Sink/UFP	Tester Mode - Sink/UFP
DUT Mode - NA	DUT Mode - NA
Voltage(mV) - NA	Voltage(mV) - NA
Current(mA) - NA	Current(mA) - NA
IP Address -	192.168.255.1
Firmware Version -	2.0.50
System Info -	253.254.253.177.306.
Eload FW Version(Po	ort-1/Port-2) - 9.8/9.8

FIGURE 6.1: IP ADDRESS AS SHOWN ON GRL-C2 TESTER HARDWARE SCREEN EXAMPLE

	GRL	GRL-USB-PD-C2-EPR Auto Mode - OFF
	PORT - 1	PORT - 2
PD Port Tester DUT Mod Voltage Current	- Detach Mode - Sink/UFP e - NA e(mV) - NA e(mA) - NA	PD Port - Detach Tester Mode - Sink/UFP DUT Mode - NA Voltage(mV) - NA Current(mA) - NA
	IP Address - Firmware Version - System Info - Eload/PPS FW Versio	192,168,255,1 1,0,56 GRL-C2-EPR-2022045 on - 1,2/1,2/3,2/3,2

FIGURE 6.2: IP ADDRESS AS SHOWN ON GRL-C2-EPR TESTER HARDWARE SCREEN EXAMPLE



🤣 GRL			USB Power Delivery and USB Type-C [™] Test Sol GRL-USB-PD-C2	ftware (1.4.63.0)		
\frown	Ethernet Connection Settings		ester Status		Conne	cted
Connection	Scan Naturark	S	erial Number		022.04	5.022.009.031.
Setup		Fi	irmware Version		1.3.52	/ 9.4 / 9.4
	C2 IP Address	P	ort Info		5002	
	192.168.4.152 x 👻 Connect	Te	ester IP Address Info		192.16	8.4.152
Product	Setup Diagram	L	ast Calibration Date		2018-0	5-30
Capability	Tool Updates	N	ext Calibration Due Date		2019-0	5-29
	Update Firmware Firmware Update Instructions		est Cable Calibration Status		Calibra	ited
			Z Tester Calibration		Calibra	ation Expired
Test Config	Update Eload Firmware			License Info		
B			Module Name	Licens	е Туре	License Period
			BC1.2 DCP Sink Tests	PE	RM	-
Ē.			C2	PE	RM	-
Report			C2 Starter	PE	RM	
			DP AUX Sniffer	PE	RM	
503			F1	PE	RM	-
Options			M1	PE	RM	-
			MFi Charger Tests	PE	RM	
?			Quick Charge 3 Plus Tests	PE	RM	-
Help			Quick Charge 3 Tests	PE	RM	-
			Quick Charge 4 - IOP Tests	PE	RM	-
			Quick Charge 4 Tests	PE	RM	
			Thunderbolt 3 Power Tests	PE	RM	
			USB-C Functional Tests	PE	RM	

FIGURE 6.3: GRL-C2 CONNECTION CONFIGURATION SCREEN AFTER SUCCESSFUL CONNECTION

🤣 GRL			USE	Power Delivery and USB Type-C [™] Test Software (1.6.6.27) GRL-USB-PD-C2-EPR				Set App Mode :	CTS 🚺 API
Connection Setup Product Capability	Ethernet Connection Settings Scan Network C2-2FD P.Adessa 192:062551 Zabru Canada Tool Updates Update System Rimware Etimeanes locates instructions	Connect C2-EPR	T S F T L N T C	ester Status erial Number Immare Vareion aster IP Address Information ast Calibration Due Date est Cable Calibration Status @ 		Connected GRL-C2-EPR-202 1.0.39 / 1.2 / 1.2 / 192.168.255.1 2022-04-10 2023-04-10 Calibrated Calibration Suc	21003 32/32		
Results				Module Name BC1.2 DCP Sink Tests	License Inform Licen	ation ise Type ERM	License Period		
Report				C2 C2 Starter Custom OEM Tests	P P	ERM ERM	- - -		
Coptions				DP AUX Sniffer EPR Tests GRL-C2-SFTY M1	R	ERM ERM ERM			
Help				Quick Charge 3 Plus Tests Quick Charge 3 Tests Quick Charge 4 - IOP Tests Quick Charge 4 - Tests	P P	ERM ERM ERM			
				Thunderbolt 3 Power Tests USB-C Functional Tests	P	ERM	-		

FIGURE 6.4: GRL-C2-EPR CONNECTION CONFIGURATION SCREEN AFTER SUCCESSFUL CONNECTION

- 2. The GRL-C2 / C2-EPR tester hardware and Browser App are now connected as indicated by the tester information display ("Tester Status", "Serial Number", "Firmware Version", etc.).
- 3. Optionally you can also select "Setup Diagram" below the IP Address field that shows you how to connect the DUT to the Port-1 USB Type-C port of the GRL-C2-EPR tester hardware using the USB Type-C cable provided by Granite River Labs or a compliant USB Type-C cable.



Along with each GRL-C2 / C2-EPR Browser App revision, a new version of firmware is provided. For the GRL-C2 Browser App, ensure that the FPGA firmware and E-Load code are up to date. For the GRL-C2-EPR Browser App, the baseboard firmware, E-load and PPS code should be updated. Use the following procedure to update the GRL-C2 / C2-EPR tester hardware's firmware.

4. Click on the **Update Firmware** or **Update ELoad Firmware** button to update the GRL-C2 tester hardware's FPGA and E-Load 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 6.5: UPDATE GRL-C2 FIRMWARE BUTTONS

5. Click on the **Update System firmware** button to update the GRL-C2-EPR tester hardware's baseboard firmware, E-load and PPS code. 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 (lpdates	
Upd	ate System firm	nware

FIGURE 6.6: UPDATE GRL-C2-EPR FIRMWARE BUTTON

6.1 Update GRL-C2 FPGA Firmware

Follow the steps below to perform FPGA firmware update for the GRL-C2 tester hardware:

1. Click on the **Update Firmware** button and the following pop-up message will appear (Figure 6.7 below). Using a standard USB Type-B cable, connect the USB Type-B port (for firmware update as indicated in the image) at the back of the GRL-C2 tester hardware to the control PC (where the GRL-C2 Browser App is running). When connected, click "Ok" to proceed.





Connection	Ethernet Connection Settings	Update C2 Firmware	306.
Product Capability	C2 IP Address 192.168.255.1 Setup Diagram	USB Type-B port for Firmware update	
Test Config	Tool Updates Update Firmware		ed
Results	Update Eload Firmware		Period
Report		Please refer above setup image and connect firmware update USB port of C2 to the test PC using standard USB Type-B cable where C2 Browser Application is running	
Options		Ovick Charge 3 Plus Tests	
Help		Quick Charge 3 Tests PERM	

FIGURE 6.7: UPDATE GRL-C2 FPGA FIRMWARE-#1

2. The firmware update process will start and may take a few minutes to complete (Figure 6.8 below).

Connection Setup	Ethernet Connection Settings Scan Network
Product Capability	C2 IP Address 192.168.255.1 x w Connect
Test Config	Tool Updates Update Firmware Firmware update is in progress. Please wait for few minutes
Results	Update Eload Firmware

FIGURE 6.8: UPDATE GRL-C2 FPGA FIRMWARE-#2

3. A pop-up message will appear when the firmware update process has completed successfully (Figure 6.9 below). Click "Ok" and wait for the GRL-C2 tester hardware to power cycle and reboot.



Connection	Ethernet Connection Settings	GRL-USB-PD-C2 Compliance Test Solution	306.
Setup	C2 IP Address 192.168.256.1 Setup Diagram	Firmware updated successfully. Please wait until the tester has rebooted to power the controller	
Test Config	Tool Updates Update Firmware Firmware update is in progress. Plea	Ok Se wait for few minutes	rred
あ	Update Eload Firmware	License Info	A

FIGURE 6.9: UPDATE GRL-C2 FPGA FIRMWARE-#3

4. After the GRL-C2 tester hardware has rebooted, click on the **Connect** button to re-establish connection with the tester (Figure 6.10 below).

\odot	Ethernet Connection Settings	Tester Status IP address "192.168.255.1" unreachable
Connection	Scan Network	Serial Number N/A
Setup	02.18.4.44	Firmware Version N/A
	C2 IP Address	Port Info N/A
Product	192.168.255.1 x v Connect	Tester IP Address Info 192.168.255.1
Capability	Setup Diagram	Last Calibration Date -
	Tool Undates	Next Calibration Due Date -
		Test Cable Calibration Status 🕦
Test Config	Update Firmware Firmware Update Instructions	C2 Tester Calibration Calibration Error
	Update Eload Firmware	

FIGURE 6.10: UPDATE GRL-C2 FPGA FIRMWARE-#4

5. The GRL-C2 tester hardware and Browser App should now be connected and ready for use with updated firmware (Figure 6.11 below).

\bigcirc	Ethernet Connection Setting	qs.	Te	ester Status		Со	nnected	
Connection	Scan Network		S	erial Number		253	3.254.253.177.306.	
Setup	02.10.4.1.1		Fi	irmware Version		1.3	.83D / 9.8 / 9.8	
	C2 IP Address		P	ort Info		50	02	
Product	192.168.255.1	× v Connect	Te	ester IP Address Info		192	2.168.255.1	
Capability	Setup Diagram		La	ast Calibration Date		201	19-03-21	
	Tool Updates		N	ext Calibration Due Date		202	20-03-20	
		Clearnes I ladets is structions	Te	est Cable Calibration Status 🕦		Ca	librated	
Test Config	Update Firmware	Firmware Opdate Instructions	C	2 Tester Calibration		Ca	libration Expired	
Results				Module Name	License Info License	Туре	License Period	
۲. ۲.				BC1.2 DCP Sink Tests	PERM	Ν	-	
Report				C2	PERM	N	-	
				C2 Starter	PERM	N	-	
<u></u>				DP AUX Sniffer	PERM	И	-	
Options				M1	EXPIR	ED	-	
				MFi Charger Tests	PERM	Ν	-	
\bigcirc				Quick Charge 3 Plus Tests	PERM	Л	-	

FIGURE 6.11: UPDATE GRL-C2 FPGA FIRMWARE-#5


Note: In the event that the firmware fails to update (after following the above steps), the user can manually update the firmware using the instructions as given by clicking on Firmware Update Instructions next to the "Update Firmware" button. This will display a set of instructions to guide the user through the entire manual updating process as shown in Figure 6.12 below.



FIGURE 6.12: MANUAL GRL-C2 FPGA FIRMWARE UPDATE INSTRUCTIONS

6.2 Update GRL-C2 E-Load Firmware

Follow the steps below to perform E-Load firmware update for the GRL-C2 tester hardware:

1. Click on the **Update ELoad Firmware** button and the following pop-up message will appear (Figure 6.13 below). Using a standard USB Mini-B cable, connect the USB Mini-B port (for E-Load firmware update as indicated in the image) at the back of the GRL-C2 tester hardware to the control PC (where the GRL-C2 Browser App is running). When connected, click "Ok" to proceed.





FIGURE 6.13: UPDATE GRL-C2 E-LOAD FIRMWARE-#1

2. If there are other USB cables connected to the GRL-C2 tester hardware, a pop-up message will appear to advise the user to remove all USB connections from the controller except for the USB Mini-B cable connected for E-Load firmware update (Figure 6.14 below). Once removed, click "Ok" to proceed.

Connection	Ethernet Connection Settings	GRL-USB-PD Compliance Test Solution	306.
Setup Product Canability	C2 IP Address 192.168.255.1 Setup Diagram	Software could not detected eload COM port, please remove all USB cables except the one which is connected to the e-load update port of C2.	
Test Config	Tool Updates Update Firmware		ed
Ð	Update Eload Firmware O Eload-Firmware update is in progres	s. Please wait for few minutes	9

FIGURE 6.14: UPDATE GRL-C2 E-LOAD FIRMWARE-#2

3. The next pop-up message will then require the user to select the COM port connected with the external E-Load from the drop-down menu (Figure 6.15 below). When selected, click "Ok" to proceed. If there is a need to terminate the E-Load firmware update process, click "Cancel".



Connection	Ethernet Connection Settings		Se	lect C2's eload COM Po	ort		306.
Setup	C2 IP Address		lease select eload's COI lick Cancel to stop e-loa	/I port in drop down menu and d FW update.	I then click OK		
Product	192.168.255.1 Setup Diagram	T					
	Tool Updates			COM7	•		
Test Config	Update Firmware 🔶 🗈		COM7 COM8		Ok	Cancel	ed
æ	Eload-Firmware update is in progres	s. Please wait for f	COM9		License Info		4

FIGURE 6.15: UPDATE GRL-C2 E-LOAD FIRMWARE-#3

4. The E-Load firmware update process will continue to run and may take a few minutes to complete (Figure 6.16 below).

Connection Setup	Ethernet Connection Settings Scan Network
	C2 IP Address
Product	192.168.255.1 x v Connect
Capability	Setup Diagram
	Tool Updates
Test Config	Update Firmware Eigenverse Update Instructions
	Update Eload Firmware
Ð	Eload-Firmware update is in progress. Please wait for few minutes

FIGURE 6.16: UPDATE GRL-C2 E-LOAD FIRMWARE-#4

5. A pop-up message will appear when the E-Load firmware update process has completed successfully (Figure 6.17 below). Click "Ok" and power cycle the GRL-C2 tester hardware to start using it with updated E-Load firmware (Figure 6.18 below).

Connection	Ethernet Connection Settings	Eload Firmware Updated	306.
Setup Product	C2 IP Address 192.168.255.1	Eload firmware completed. Please power cycle the controlle	er and start using it
Capability	Tool Updates		Ok Calibration Expiréd
Ð	Update Eload Firmware C Eload-Firmware update is in progres	. Please wait for few minutes	icense Info

FIGURE 6.17: UPDATE GRL-C2 E-LOAD FIRMWARE- #5



-	Ethernet Connection Settings	Tester Status		Connected	
Connection	Scan Network	Serial Number		253.254.253.177.306.	
Setup	C2 ID Address	Firmware Version		1.3.83D / 9.8 / 9.8	
	C2 IP Address	Port Info		5002	
Draduat	192.168.255.1 x v Connect	Tester IP Address Info		192.168.255.1	
Capability	Setup Diagram	Last Calibration Date		2019-03-21	
	To all landates	Next Calibration Due Date		2020-03-20	
		Test Cable Calibration Status 👔		Calibrated	
Test Config	Update Firmware	C2 Tester Calibration		Calibration Expired	
	Update Eload Eirmware				_
Ø			License Info		
(ALL)	Sucessiuily Opdated				
Results		Module Name	License Type	License Period	
-					1
Ē		BC1.2 DCP Sink Tests	PERM	-	
Report		C2	PERM	-	
		C2 Starter	PERM	-	
553		DP AUX Sniffer	PERM	-	
Options		M1	EXPIRED		
		MFi Charger Tests	PERM	-	
(?)		Quick Charge 3 Plus Tests	PERM	-	
Help		Quick Charge 3 Tests	PERM	-	V

FIGURE 6.18: UPDATE GRL-C2 E-LOAD FIRMWARE-#6

6.3 Update GRL-C2-EPR System Firmware

Follow the steps below to perform system firmware update for the GRL-C2-EPR tester hardware:

1. Using a standard USB Type-B cable, connect the USB Type-B port (for firmware update as indicated in the below image) at the back of the GRL-C2-EPR tester hardware to the control PC (where the GRL-C2-EPR Browser App is running).



2. When connected, click on the **Update System firmware** button to proceed with the PPS, E-Load and Baseboard firmware update respectively.

$\overline{\bullet}$	Ethernet Connection Settings	Tester Status	Connected
Connection	Scan Network	Serial Number	GRL-C2-EPR-2022045
Setup	C2 EDD ID Address	Firmware Version	1.0.40 / 1.2 / 1.2 / 3.2 / 3.2
	C2-LFR IF Address	Tester IP Address Information	192.168.255.1
Product	192.168.255.1 × • Connect	Last Calibration Date	2022-06-12
Capability	Setup Diagram	Next Calibration Due Date	2023-06-12
	Tool Updates	Test Cable Calibration Status 👔	Calibrated
		C2-EPR Tester Calibration	Calibration Success
Test Config	Update System firmware Update System firmware		
	PPS update is in progress. Please wait for few minutes - 1%		
Results		License Information	on
		Module Name License	Type License Period



$\overline{\bullet}$	Ethernet Connection Settings	Tester Status	Connected
Connection	Scan Network	Serial Number	GRL-C2-EPR-2022045
Setup		Firmware Version	1.0.40 / 1.2 / 1.2 / 3.2 / 3.2
	C2-EPR IP Address	Tester IP Address Information	192.168.255.1
Product	192.168.255.1 x = Connect	Last Calibration Date	2022-06-12
Capability	Setup Diagram	Next Calibration Due Date	2023-06-12
	Tool Updates	Test Cable Calibration Status 🕦	Calibrated
	Lindete Sustan firmunas	C2-EPR Tester Calibration	Calibration Success
Test Config	Opdate System firmware		
	Eload update is in progress. Please wait for few minutes - 10%		
(Ab)		License Info	ormation

FIGURE 6.19: GRL-C2-EPR SYSTEM FIRMWARE UPDATE IN PROGRESS

- 3. The firmware update process may take about 10 minutes at minimum to complete. During this time please do not interrupt the hardware connection setup until all firmware update has fully completed.
- 4. A pop-up message will appear when the firmware update process has completed successfully as shown in below image. Click "Ok" and wait for the GRL-C2-EPR tester hardware to power cycle and reboot.

Ethernet Connection Settings			Tester Status		Connected	_
Scan Network		GRL-USE	B-PD-C2-EPR Com	pliance Test Solutio	n	2045
C2-EPR IP Address				-		3.2 / 3.2
192.168.255.1	Fi	rmware updated s	uccessfully. Please wait	until the tester has reboo	ted to power the	
Setup Diagram	* "	ontroller				
Tool Updates	- 1 -1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-					
Update System firmware	date System firm	nware			Ok	ss
Firmware update is in progress. P	adic official and	indic			UK	

FIGURE 6.20: GRL-C2-EPR SYSTEM FIRMWARE UPDATE COMPLETED

5. The GRL-C2-EPR tester hardware and Browser App should now be connected and ready for use with updated firmware.

themet Connection Settings	Tester Status	Conr	nected
Scan Network	Serial Number	GRL	-C2-EPR-2022045
2.EPD ID Address	Firmware Version	1.0.4	0 / 1.2 / 1.2 / 3.2 / 3.2
	Tester IP Address Information	192.1	168.255.1
192.168.255.1 x - Connect	Last Calibration Date	2022	-06-12
<u>tup Diagram</u>	Next Calibration Due Date	2023	-06-12
ool Updates	Test Cable Calibration Status 👔	Calib	orated
Eirmware Undate Instructions	C2-EPR Tester Calibration	Calib	oration Success
	Module Name	ense Information	License Period
	Lice Module Name	ense Information License Type	License Period
	Lice Module Name	Ense Information	License Period
	Lice Module Name BC1.2 DCP Sink Tests	Ense Information License Type PERM	License Period
	BC1.2 DCP Sink Tests	Ense Information License Type PERM PERM	License Period
	BC1.2 DCP Sink Tests C2 C2 Starter	Perse Information License Type PERM PERM PERM	License Period
	BC1.2 DCP Sink Tests C2 C2 Starter Custom OEM Tests	PERM PERM PERM PERM PERM PERM	License Period
	Lice Module Name BC1.2 DCP Sink Tests C2 C2 Starter Custom OEM Tests DP AUX Sniffer	PERM PERM PERM PERM PERM PERM	License Period
	Lice Module Name BC1.2 DCP Sink Tests C2 C2 Starter Custom OEM Tests DP AUX Sniffer EPR Tests	PERM PERM PERM PERM PERM PERM PERM PERM	License Period



Note: In the event that the firmware fails to update (after following the above steps), the user can manually update the firmware using the instructions as given by clicking on Firmware Update Instructions next to the "Update System firmware" button. This will display a set of instructions to guide the user through the entire manual updating process as shown in below image.



FIGURE 6.21: MANUAL GRL-C2-EPR SYSTEM FIRMWARE UPDATE INSTRUCTIONS

6.4 GRL-C2 / C2-EPR Browser App License Activation

The licensing for the GRL-C2-EPR tester hardware is built in which means no additional license activation is needed. Take note certain tests like the Thunderbolt 3 power and Custom OEM tests require separate licensing. Check the "License Info" panel in the *Connection Setup* screen. Check the "License Info" panel in the *Connection Setup* screen. Check the "License Info" panel in the *Connection Setup* screen (Figure 6.3) to see which licenses are active on the tester. Contact Granite River Labs support (<u>support@graniteriverlabs.com</u>) if you have licensing questions or concerns.



7 Compliance Testing with GRL-C2 / C2-EPR

The GRL-C2 / C2-EPR tester hardware supports testing of various specifications such as the latest USB Power Delivery spec compliance, communications engine and deterministic tests as well as DisplayPort & Thunderbolt 3 Alt Mode tests and others. The GRL-C2 / C2-EPR tester hardware uses the GRL-C2 / C2-EPR Browser App for automated or manual test execution.

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

Apart from automated testing, you can also choose to execute tests using custom mode configurations or API's on the GRL-C2 / C2-EPR Browser App.

7.1 App Mode

The GRL-C2 / C2-EPR Browser App allows you to choose between the **CTS** mode and **API** mode for test execution. The CTS mode is applied by default, or you can select the API mode to run tests on the App using a defined list of GRL-C2 / C2-EPR API commands. Use the **Set App Mode** slider at the top right of screen to set the required mode.

Set App Mode : CTS API

FIGURE 7.1: APP MODE SELECTION

If the **API** mode is selected:

You will be directed to the *Results* screen and all other screens on the GRL-C2 / C2-EPR Browser App will not be accessible.



FIGURE 7.2: RESULTS SCREEN IN API MODE



You can choose to create custom test cases to meet more customized test requirements using a defined list of GRL-C2 / C2-EPR API commands. Custom test cases can be written in either C# or Python platform as an independent standalone application. These test cases call the API's defined in GrlPdApiLib.dll along with all the support functions and helper classes from *C*:*GRL\USBPD-C2-Browser-App\API\Libraries*. For details, refer to the **GRL USB PD API Documentation** on http://graniteriverlabs.com/download-center/ or "API Document" on the *Help* screen of this Browser App (see Section 11).

7.2 Product Capability

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

The *Product Capability* screen allows you to specify the method to determine the DUT type and display the capabilities of the DUT that is connected to either USB Type-C Port-1 or Port-2 or both Ports of the GRL-C2 / C2-EPR tester hardware.



FIGURE 7.3: PRODUCT CAPABILITY SCREEN

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

Project	Name
Test A	
Save	Save Project Folder

FIGURE 7.4: ENTER AND SAVE PROJECT NAME EXAMPLE



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 DUT type, reading the DUT capabilities and generating a VIF file from the configuration.

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

Connection	Project Name Test A	VIF Data Operation	⊙ 1 ± × 2	* 4
Setup	Select Test Mode Compliance			
Product Capability	Load XML VIF File USB-IF VIF Generator Download Link			
Test Config	Select Port			
	Primary Port DUT Type			
Results	Cable Selection			
Report	GRL-SPL EPR Test Cable 1			
ک رک Options				
(?) Help				

FIGURE 7.5: INFORMATIONAL TEST MODE DUT CONFIGURATION

- a. When testing a new DUT, clicking on the **Clear** button (see Figure 7.10) will clear all product configuration information including what has been read from a VIF and what was read directly from the device.
- b. "Primary Port" refers to the primary test port of the DUT that should be connected to Port-1 of the GRL-C2 / C2-EPR tester hardware. If the DUT is connected to both Port-1 and Port-2 of the GRL-C2 / C2-EPR tester hardware, select the "Is DUT Multiport" checkbox. This will enable the Secondary Port (Port -2) configuration panel as shown below.

Select Port					
Is DUT Multiport					
Primary Port					
Provider	Only 🔽 👔				
Cable Selection					
GRL-SPL EPR	fest Cable 2				
Read Device Data	* Clear				
Secondary Port DUT Type					
Provider Only					
Cable Selection					
GRL-SPL EPR	Fest Cable 1 🔹 🕤				

FIGURE 7.6: ENABLE 2-PORT DUT CONFIGURATION



Primary Port DUT Type						
Provider Only	•					
Consumer Only						
Consumer Provider	0					
Provider Consumer						
Provider Only						
Dual Role Power[DRP]						
Cable	•					
Type C Only)					

FIGURE 7.7: SELECTING DUT TYPE USING DROP-DOWN MENU

- c. Select the **DUT Type** field to enable the DUT 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).

Note: A BUS-powered dock (Consumer Only) will have two different VIF files for testing.

- **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 USB Power Delivery 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.

Note: A self-powered dock (DRP) will have two different VIF files for testing.

- **Cable** A USB Type-C cable that has a USB Power Delivery electronic marking chip which indicates through USB Power Delivery 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 USB Type-C connection state machine of the DUT as either a Source (**SRC**), Sink (**SNK**) or Dual Role Powered (**DRP**):

Primary Port DUT Type	
	Type C Only
State Machine	
Cable Selection	SRC
	SNK
🛢 Rea	DRP

FIGURE 7.8: SELECTING USB TYPE-C DUT CONNECTION STATE MACHINE



Cable Selection					
GRL-SPL EPR Test Cable 1	•				
GRL-SPL EPR Test Cable 1					
GRL-SPL EPR Test Cable 2					
USB-C STD Test Cable 1					
Captive Cable	•				
No Cable (For Cable Testing)					

FIGURE 7.9: PRODUCT CAPABILITY TEST CABLE SELECTION

- d. The test **Cable Selection** drop-down menu allows you to specify what cable connects the DUT to the specific USB Port or both Port 1 and Port 2 on the GRL-C2 / C2-EPR tester hardware:
 - The 'GRL-SPL EPR Test Cable' indicates the GRL special cable provided with the GRL-USB-PD-EPR pre-compliance board that is used to connect the board with the GRL-C2-EPR tester hardware and a USB Type-C based EPR Source/Sink DUT for EPR power testing. *Caution: Do not remove/disconnect the GRL-SPL-EPR cable during EPR power testing, to avoid damage to the GRL-C2-EPR tester hardware and DUT.*

Note: If the 'GRL-SPL EPR Test 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 test measurement results.

- The 'USB-C STD Test Cable' indicates the USB Type-C E-Mark cable.
- The 'No Cable' indicates that the DUT is attached directly to the GRL-C2 / C2-EPR USB Port without using any cable in between.
- The 'Captive Cable' indicates the USB Type-A to non-standard USB connector cable or the USB Type-C to non-standard USB connector cable.
- e. Once the device type has been defined, clicking on the **Read Device Data** button

Read Device Data will read the device capabilities from the device connected to each respective GRL-C2 / C2-EPR tester port. If no device is connected, the user will be notified. If the device type read using the **Read 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 DUT will appear under the "Device Data [C2 Generated]" column on the right panel for each respective Port tab and the VIF Data column remains blank. See Section 7.2.1 below for more details.



7.2.1 Read/Clear Device Data



FIGURE 7.10: PRODUCT CAPABILITY 'GET DEVICE DATA' AND 'CLEAR DEVICE DATA' BUTTONS

- a. Click on the **Read Device Data** button to read the configuration information from the device connected to a specific tester Port and display it.
- b. After clicking on the **Read Device Data** button, the *Product Capability* screen will switch to the *Results* screen which will initiate acquisition for the DUT capabilities. An example is as shown below.

	Test Results	Scroll To Current Test	TimeSta	amp	Descrip	ption											0	Search		@ 🍸
\bullet			10.402:	375:560			UUT	0 NONE	:Group(CmdTimi	ingPkt:D_	Plus - D	isconne	ect_DpD	Dn					
Connection	Stop Execution		15.629:	849:060				C2	#1 NON	IE:FSM_	State_Tra	ansition:F	SM_St	ate_Dis	sabled -	> FSM_	State_Una	attached_S	NK	
Setup	-		52.319:	423:890				#2 NOI	NE:Grou	upCmdT	imingPkt:	D_Plus -	Discon	inect_D)pDn <mark>uu</mark>	T				
	Test Status:		52.603:	901:330							#3 N	ONE:Ra	_Assert	ied:Ra	_CC2 c	2				
Product	Test Summary : 🥑 0 🛛 😒 0 🕞 0	↔ 0																		
Capability	O Fetching Device Capability																			
Test Config					_			-		4		100	_			C				
				Q	Q	Q	Q	~					•	X	Y	Ŷ		Channel	◎ 🔻 🌔	Live
(A)				1.0-																\ ^
Results			S(A S(A	0.8																
			ABL VBL	0.5																
Ē.			F	0.2																
E ×			Por	0.5																
кероп	_		\geq	0.0													in the second second		600	$ \rightarrow $
			85	3.0																
ર્જુટે			C10	2.0-																
Options			11-C	1.0-																
	1		OR	0.0																
ା				-1.0																
Help				1.0-																
					1.00	8.90		16.80	24	4.70	32.60 Time (4 Sec) :	0.50	48	.40	56.30) 6	4.20	72.10	80.00

c. Once the data acquisition has completed, the information from the DUT will appear under the "Device Data [C2 Generated]" column on the right panel as shown in the example below.

⊙ ∥ ≛ × ?	土 42		
VIF Data	Device Data [C2 Generated]		
	NO		
	VIF Data		

Note: 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.



d. Click on the **Clear** button to clear all the configuration information in both the 'VIF Data' and 'Device Data' sections of the information display area for a specific tester Port. This includes all the different categories associated with the information display area as well.

7.2.2 Create/Manage New VIF

a. The **Create New VIF** icon • on the right panel as shown below allows you to create a new VIF File in the XML format from the configuration when clicked.

VIF Data Operation	50 € ± × 2	* 4

b. The VIF Config pop-up message will appear as below. Select the DUT Type and select whether to set the current configuration as default values, and then click 'Ok'.

VIF Config					×
DUT Type		() No.	Provider Only		•
Set Default Value	Vres	U NO		Ok	

FIGURE 7.11: CREATE NEW VIF FILE

c. An example of a new VIF file creation is as shown in Figure 7.12 below:

VIF Data Operation	0 ≠ ± × 2	土 伯			
VIF Port Label [0]					
Parameter	VIF Data	Device Data [C2 Generated]			
VIF Specification	2.03				
Vendor Name	GRL				
Model Part Number	GRL				
Product Revision	QC4+				
TID	0				
VIF Product Type	0:Port Product 💌				

FIGURE 7.12: NEW VIF FILE CREATION EXAMPLE

- d. The "VIF" tab displays the product vendor information of the DUT while the "Port Label" tab displays the capabilities of the DUT. To edit, save or clear the displayed data, use the following icons $\checkmark \checkmark \checkmark \Rightarrow \checkmark$ as described below:
 - as described b
 - Select 🖋 to edit the values.



- Select ⁴ to download/save the data to a VIF file.
- Select X to remove all data.
- e. When configuration information is read from the device, you can generate a VIF file of the Read Capabilities information by clicking on the **Download VIF (Device Data)** icon



Download VIF (Device Data) . The 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 7.13: DEVICE DATA VIF FILE GENERATION

📥 🖆

- f. To copy the device configuration information to VIF, click on the Copy Device data to VIF data icon.
- g. If you want to convert VIF data to the XML file format, select the
 Subscription USB-IF VIF Generator Download Link 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.)

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 a Vendor File is provided, use the following procedure:



Project Name	
Test A	
Select Test Mode	O Load DUT's XML VIF File
	📤 Load XML VIF File
	% USB-IF VIF Generator Download Link

FIGURE 7.14: SELECTING COMPLIANCE TEST MODE USING VIF FILE

- a. In the Compliance Mode, click on the **Load XML VIF File** button to 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 respective file and click the 'Open' button to load it.
- b. Once the VIF file has been selected and loaded, the contents of the VIF file will be displayed under the VIF Data Operation section on the right panel for each respective Port tab.
- c. Select the cable that connects the primary port of the DUT to Port-1 of the GRL-C2 / C2-EPR tester hardware, as described in page 47.

Notes:

- The 'GRL-SPL EPR Test Cable' (VCONN pass-through cable) needs to be connected for running tests in the Compliance Mode. Tethered and cable DUT's can be attached directly to the GRL-C2 / C2-EPR tester hardware.
- If the standard USB Type-C cable is used to run tests, switch to the Informational Mode and select the test cable type.



7.3 Test Configuration

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

Connection Setup	Test Selection	☑ Timeout Pop-up Improve Popup Timer(sec) Messages 1 □ Rerun Selected 0 Tests Mode	Report Generation DUT Information Manufacturer Power Integrations
Product	All Supported Cartifications		Model Number DER 835 Serial Number 1.0
Capability	Expand Test List Selected Tests: 0/443	MOI Configurations	Test Information
	B C2 Test Cases	Select lest case for mol conligurations	Test Lab BLR
Test Config	Power Delivery 3.0 Tests-v1.19		Test Engineer PALANI
•	PD2 Communication Engine Tests-v1.09		Remarks/Comments QC
(AL)	USB-C Functional Tests-v0.82		Report Folder Path
Results	Source Power Tests-v0.74		
	USB Power Delivery Compliance Test Specification-v1		
Ēž	Quick Charge 5.0 Tests-v1.4 Quick Charge 4 Tests-v1.0		
Report	Thunderbolt Power Tests-Rev1.5 Ver0.9		
	DisplayPort Alternate Mode Tests-v4		
ŝ	⊯ ⊡ MFi Charger lests-v1.0 ⊛ ⊡ QC3+ Tests-v1.2		

FIGURE 7.15: TEST CONFIGURATION SCREEN

7.3.1 Test Selection and Configuration

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

7.3.1.1 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 7.2), 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 the Fast Role Swap based 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 Filter Selection Image: Colspan="2">Image: Colspan="2" Filter Selection Image: Colspan="2">Image: Colspan="2" Image: Colspan="2">Image: Colspan="2" Image: Colspan=""2" Image: Colspa	✓ Timeout Pop-up I Popup Timer(sec) Messages 1 □ Rerun Selected 0 □ Enable Debug Tests Mode
All Supported Certifications Q Search	Power Delivery 3.0 Test Configuration
 Expand test List Selected tests. 61/451 C2 Test Cases	□ FR_Swap AUTO Box Connected 1



FIGURE 7.16: 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 7.2), an additional input is available to select the V_{CONN} voltage.

Test Selection Filter Selection Image: Colspan="2">Image: Colspan="2" Filter Selection Image: Colspan="2">Image: Colspan="2" Image: Colspan="2">Image: Colspan="2" Image: Colspan=""2" Image: Colspa	 ✓ Timeout Pop-up Messages C Rerun Selected Tests Mode Popup Timer(sec) 1 C Enable Debug Mode
All Supported Certifications Q Search Expand Test List Selected Tests: 14/227	Power Delivery 3.0 Test Configuration
 □ C2 Test Cases □ Power Delivery 3.0 Tests-v1.19 □ TD.PD.LL3.E3 GoodCRC Compatibility with PD2 □ TD.PD.CBL3.E1 Receiving Chunked Extended M 	Vconn Voltage

FIGURE 7.17: CONFIGURATION FOR POWER DELIVERY 3.0 TESTS IF "CABLE" DUT IS SELECTED

7.3.1.2 Source Power Tests

Runs the USB Type-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 Timeout Pop-u
Filter Selection 🥑 😣 💿 🔶 🏹	Rerun Selected O Enable Debug
Start Execution	Tests Mode
All Supported Certifications Q Search Expand Test List Selected Tests: 7/443	Source Pc Two_Port
 C2 Test Cases Power Delivery 3.0 Tests-v1.19 Source Power Tests-v0.74 	Port Type Single_Port

FIGURE 7.18: CONFIGURATION FOR USB TYPE-C SOURCE POWER TESTS

7.3.1.3 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 7.2), an additional input is available to select the V_{CONN} voltage.



Test Selection Filter Selection	✓ Timeout Pop-up I Popup Timer(sec) Messages 1 □ Rerun Selected 0 □ Enable Debug
Start Execution All Supported Certifications Expand Test List Selected Tests: 43/227 C2 Test Cases Power Delivery 3.0 Tests-v1.19 PD2 Communication Engine Tests-v1.09 PD2 Deterministic Tests-v1.14	Tests Mode PD2 Det 2_75V _5_75V Vconn Voltage _2_75V

FIGURE 7.19: CONFIGURATION FOR PD2 DETERMINISTIC TESTS

7.3.1.4 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 Filter Selection	✓ Timeout Pop-up I Popup Timer(sec) Messages 1 □ Rerun Selected 0 □ Enable Debug I
Start Execution 1	Tests Mode
All Supported Certifications Q Search Expand Test List Selected Tests: 17/443	PD2 Communica Square Wave Noise
 C2 Test Cases Power Delivery 3.0 Tests-v1.19 PD2 Communication Engine Tests-v1.09 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 	Noise Type Two Tone Noise

FIGURE 7.20: CONFIGURATION FOR PD2 COMMUNICATION ENGINE TESTS

When "Cable" is selected as the DUT type (see Section 7.2), an additional input is available to select the V_{CONN} voltage.



Test Selection Filter Selection Image: Colspan="2">Image: Colspan="2" Filter Selection Image: Colspan="2">Image: Colspan="2" Image: Colspan="2">Image: Colspan="2" Image: Colspan=""2" Image: Colspa	 Timeout Pop-up Messages Rerun Selected Tests 	Popup Timer(sec) 1 Debug Mode
All Supported Certifications Q Search	PD2 Commun	_5_/5V
Expand Test List Selected Tests: 9/227		
⊟ IV C2 Test Cases	Noise Type	-4_20V
		_4_75V
PD2 Communication Engine Tests-v1.09	Vconn Voltage	751
TDA.1.1.1.1 CABLE PHY TX EYE		
TDA.1.1.1.2.1 CABLE PHY TX BIT		

FIGURE 7.21: CONFIGURATION FOR PD2 COMMUNICATION ENGINE TESTS IF "CABLE" DUT IS SELECTED

7.3.1.5 DisplayPort Alternate Mode Tests

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

Test Selection Filter Selection Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2" Image: Colspan="2" Ima	 Timeout Pop-up Messages Rerun Selected Tests 	 Popup Timer(sec) 1 Enable Debug Mode
All Supported Certifications Q Search	DisplayPort Alt	ernate Mode Test Configuration
C2 Test Cases C2 Test Cases R C2 Test Cases C3 0 Tests_v1 19	DP Device Type	DP_Sink
PD2 Communication Engine Tests-v1.09 PD2 Deterministic Tests-v1.14	DP Device Capability	DFP_Source
 DisplayPort Alternate Mode Tests-v4 TC.10.2.1 Enter Mode ACK Response TC.10.2.2 Status Update Command 	DP Sink Type	TypeC_DP_Adaptor
 TC.10.2.4 Time from HPD Event to PD Message TC.10.2.5 Proper Pin Assignment Support for Re TC.10.2.6 Proper Pin Assignment Support for C 1 TC.10.2.7 Proper Pin Assignment Support for Adiana TC.10.2.8 Percentacle based Power Consumer (International Consumer Consumer		

FIGURE 7.22: CONFIGURATION FOR DISPLAYPORT ALTERNATE MODE TESTS



7.3.1.6 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 1	
Filter Selection 🥑 🔕 💿 🜗 🏹	Rerun Selected 0 Enable Debug	Ð
Start Execution	Tests QC4	
All Supported Cartifications	QC4Plus	
	Quick Cl OC5	
Expand Test List Selected Tests: 33/443		
□ Z C2 Test Cases	QC4 DUT Type QC4Plus	
Power Delivery 3.0 Tests-v1.19		
■ Quick Charge 4 Tests-v1.0	Room Temperature 24	°C
QC4.TID.1 Class A Adapter		
QC4.TID.2 Class B Adapter		_
QC4.TID.3 Current Limit		
QC4.TID.4 Quick Charge Starting Procedure		
QC4.TID.5 Quick Charge Fault Condition		
QC4.TID.6 Inquire VDM		

FIGURE 7.23: CONFIGURATION FOR QUICK CHARGE 4 TESTS

7.3.1.7 Quick Charge 3.0 Tests

Runs the Legacy Quick Charge 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 DUT's Quick Charge specification and what cable is connected to the DUT, to allow you 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 you to specifically select the type of Quick Charge based DUT that is connected to single/dual ports and with/without USB Power Delivery support.





FIGURE 7.24: CONFIGURATION FOR LEGACY QUICK CHARGE TESTS

7.3.1.8 Quick Charge 3.0+ Tests

Runs the Quick Charge 3.0+ tests for power provider DUT's. These tests are proprietary to Qualcomm and are only available with arrangement through Qualcomm. These tests have additional inputs to indicate the DUT's Quick Charge specification and what cable is connected to the DUT, to allow you 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 you to specifically select the type of Quick Charge based DUT that is connected to single/dual ports and with/without USB Power Delivery support.





FIGURE 7.25: CONFIGURATION FOR QUICK CHARGE 3.0+ TESTS

7.3.1.9 Thunderbolt Power Tests

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





FIGURE 7.26: CONFIGURATION FOR THUNDERBOLT POWER TESTS

Before running the Thunderbolt power tests, you will need to perform the following:

- Cable IR drop calibration (refer to Section 10 for details)
- Thunderbolt self-calibration

7.3.1.9.1 Thunderbolt Self-Calibration

Use the following procedure to perform the Thunderbolt self-calibration:

- Go to the *Options* screen (see Section 8) and click on the **Config Controller** tab. In the Configure panel, select to enable Port-A and Channel CC1 and then click on the **TBT Self Calibration** button as shown in Figure 7.27.
- 2. Next, select to enable Port-A and Channel CC2 and click on the **TBT Self Calibration** button.
- 3. Next, select to enable Port-B and Channel CC1 and click on the **TBT Self Calibration** button.
- 4. Finally, select to enable Port-B and Channel CC2 and click on the **TBT Self Calibration** button.



				Five Po	ort Testing		Config Controller
		Config	ure				Send Message
Арр	Mode		CTS		•	Sop Type	SC
DP /	AUX Sniffer		P Sink side		•	Message Type	VDM Disocv
Port	Туре		Port2		•	SVID(0X0000) 0X	F001
Con	troller Mode		UFP/Sink		•	ſ	S
Test	Cable Type	GRL-	SPL Test Cabl	e 1		Read Reg	
PD	Spec Type		Spec Rev2			ling	
Cab	le Emulation	Ra in CC1			Write Reg		
Rp l	_evel		Rp 900mA				
			Apply				
Emu	ulate Cable	Attach		Detach			
Cha	nnels] D+ 🗌 D-	Try Cable Flip 🚯			
San	npling Ratio	1000					
Sigr	al Capture	Start		Stop			
Сар	ture File						
Port	s 💿	Port A O Port B					
Cha	nnels 🧿	CC1 O CC2					
		Do	wnload Captu	re			
	Γ	ТВ	T Self Calibrat	ion			

5. When completed, power cycle the GRL-C2 / C2-EPR tester hardware.

FIGURE 7.27: PERFORM THUNDERBOLT SELF-CALIBRATION

When running the Thunderbolt power tests for the GRL-C2, if the voltage measurement falls +/– 1% marginal to the minimum or maximum test limits e.g., 4.65 to 4.85, the GRL-C2 / C2-EPR Browser App will update that particular test step as a warning and request for a digital multimeter (DMM) to be connected using a USB Type-C breakout board (refer to Figure 7.35 below).

Note that the USB Type-C breakout board and DMM are not required in the GRL-C2-EPR setup as shown in Figure 7.29.



FIGURE 7.28: THUNDERBOLT DMM TEST SETUP CONNECTION DIAGRAM (FOR GRL-C2)





FIGURE 7.29: THUNDERBOLT TEST SETUP CONNECTION DIAGRAM (FOR GRL-C2-EPR)

Here are some examples of single port setups for VBUS Read and VCONN Read:



FIGURE 7.30: SETUP IMAGE FOR SINGLE PORT (VBUS READ)





FIGURE 7.31: SETUP IMAGE FOR SINGLE PORT (VCONN READ)

You will need to manually enter the measurement values in the pop-up screen as shown below.



FIGURE 7.32: DMM MANUAL MEASUREMENT POP-UP SCREEN



In the *Thunderbolt Power Test Configuration* panel, select the **Manual DMM Measurement** checkbox to perform manual measurements using the DMM as indicated below.

Test Selection	Timeout Pop-up Messages Rerun Selected Tests Timeout Pop-up Messages Timeout Pop-up Messages
Start Execution	Thunderbolt Power Test Configuration
All Supported Certifications Q Search	Ports Two_Port
 I I C2 Test Cases I USB Power Delivery Compliance Test Specification-v1.4 V2 OR 	Powered Type
PD2 Communication Engine Tests-v1.09 D2 Deterministic Tests-v1.14 DSB-C Functional Tests-v0.82	Device Type Host
B □ Source Power Tests-v0.74 □ Power Delivery 3.0 Tests-v1.19 □ Ovidk Charger 0 Tests-v1.4	TBT Version TBT_3
B □ Quick Charge 1.0 Tests-v1.0	Stress Test Timer 25 (secs)
 ^I Thunderbolt Power Tests-Rev1.5 Ver0.9 ^I DisplayPort Alternate Mode Tests-v4 ^I MFi Charger Tests-v1.0 ^I QC3+ Tests-v1.2 ^I 	Port-A CapMisMatch Port-B CapMisMatch Port-A GiveBackFlag Port-A GiveBackFlag Nanual DMM Measurement

FIGURE 7.33: DMM MANUAL MEASUREMENT OPTION

When running the manual measurements, a 'Warning' or 'Incomplete' alert indicates the following conditions:

- Warning: The voltage is either >4.65 or <4.85, or the voltage is >5.4 or <5.6
- Incomplete: The power is <1.45 or >1.55

7.3.1.10 USB Type-C Functional Tests

Runs the functional compliance tests for USB Type-C chargers. These tests have additional inputs that allow you to enable data validation at high USB speeds or through automation for the USB ports under test as well as select if the DUT is connected to a battery or whether the DUT is embedded if it is a hub.





FIGURE 7.34: CONFIGURATION FOR USB TYPE-C FUNCTIONAL TESTS

You can refer how to set up the equipment to automate data validation by selecting Setup Image.

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.

7.3.1.11 USB Power Delivery Compliance Test Specification-v1.4 V2 OR (Merged Tests)

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

For the GRL-C2-EPR tester hardware, when "GRL-SPL EPR Test Cable" is selected as the Cable Selection type (see Section 7.2), an additional input is available to allow you to perform tests using the GRL Fast Role Swap (FRSWAP) Board (GRL-C2-FR-SWAP-AUTO Box Board) for automating Fast Role Swap based 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 Filter Selection Image: Colspan="2">Image: Colspan="2" Image: Colspan=""Colspan="" Image: Colspan="2" Image: Colspa	✓ Timeout Pop-up I Messages 1 ○ Rerun Selected 0 ○ Enable Debug Tests Mode
All Supported Certifications Q Search Expand Test List Selected Tests: 130/525	USB Power Delivery Compliance Test Specification Configuration
 C2 Test Cases Power Delivery 3.0 Tests-v1.19 USB Power Delivery Compliance Test Specification-v PDMER_PHY_TEST_ALL_UUT PDMER_PHY_TEST_SRC_SNK_CAP_UUT PDMER PROT TEST ALL PD2 PD3 Mode 	✓ FR_Swap AUTO Box Connected

FIGURE 7.35: CONFIGURATION FOR USB POWER DELIVERY MERGED TESTS

7.3.1.12 Custom OEM Tests

Runs the Custom OEM compliance tests for Custom OEM chargers with Lightning connectors. These tests have additional inputs that allow you to configure external E-Load to run the Custom OEM tests. If the charger DUT 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 E-Load. When the external E-Load is set up properly, enter the correct VISA address of the external E-Load and click "Connect" to establish connection with the external E-Load. Otherwise click on the "Scan Eload" button to reset the connection.

Custom OEM Tests-v1.0	Custom OEM Tests Configuration
 Custom.OEM.TD.4.9.1 Voltage drop between transition test Custom.OEM.TD.4.9.2 OCP and OVP Test Custom.OEM.TD.4.9.3 USB Type C Current Advertisement Custom.OEM.TD.4.9.4 DCP Handshaking test Custom.OEM.TD.4.9.5 Custom OEM Charger VIF Check 	Charger has captive lightning plug 1
	E-Load Channel 1
	Scan E-Load
	External E-Load VISA Address

FIGURE 7.36: CONFIGURATION FOR CUSTOM OEM TESTS

Note: Refer to Section 5.4 for the procedure to set up the hardware connections for Custom OEM testing.



7.3.1.13 QC BC 1.2 DCP Sink Tests

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

Test Selection	Timeout Pop-up Timeout Pop-up Messages 1
Filter Selection 📀 😢 🕤 🔶 🍒	Rerun Selected 0 Enable Debug 1
All Supported Certifications Q Search Expand Test List Selected Tests: 5/525	Implemented BC 1.2 Not_Implemented
 C2 Test Cases Power Delivery 3.0 Tests-v1.19 BC1.2 DCP Sink Tests QC.BC.SNK.1 Initial Power-up Test - Weak Battery QC.BC.SNK.2 DCP Detection Test - Weak Battery 	Secondary Detection Not_Implemented Maximum Current 3
 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 Battery 	

FIGURE 7.37: CONFIGURATION FOR QC BC 1.2 DCP SINK 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 only want to select the tests that comply to a certain certification standard, click on the drop-down menu as shown below to filter out the test list as required.

Test Selection						
Filter Selection 🥝 🔕 🖨 🔶 🚡						
Start Execution	0					
All Supported Certifications	Q Search					
All Supported Certifications	0/525					
Quick Charge 4 Certification						
Quick Charger 3.0 Certification	sts-v1.09					
USB Power Delivery Certification						
Non-PD Type-C Certification						
Thunderbolt 3 Certification	e Test Specification-v					
DisplayPort Certification						

FIGURE 7.38: SELECTING CERTIFICATION COMPLIANCE FOR TESTS





Note: The GRL-C2 / C2-EPR 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.

7.3.2 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	Cable001			
Serial Number	001			
	Test Information			
Test Lab	Granite River Labs			
Test Engineer	Tech 1			
Remarks/Comments	Cable QC			
Report Folder Path				

FIGURE 7.39: REPORT GENERATION PANEL

The "DUT Information" and "Test Information" sections are text entry fields in which you can enter information germane to the specific DUT and the specific set of tests just run. Once tests have completed, the test report can be viewed in the *Report* screen (see Section 7.4).

7.3.3 Running Tests

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

Test Selection					
Filter Selection 🥑 🙁 🖨	•	70			
Start Execution	0				
All Supported Ce Execute test cases Search					
Expand Test List Selected Tests: 84	/525				
 Image: Section 2 C2 Test Cases Image: Image: Image:		2			

FIGURE 7.40: 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. If pop-up messages are enabled, enter the time interval in seconds in between pop-ups at the **Popup Timer(sec)** entry field.

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.





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



FIGURE 7.42: RESULTS SCREEN - TEST RUN INITIATION





🥠 GRL	USB Pow	ar Delivery and USB Type-C [™] Test Software (1.6.3.24) GRL-USB-PD-C2-EPR Set App Mode : CTS P AF	ท
$\overline{\bullet}$	Test Results Scroll To Current	📑 🗁 🛱 🛱 19. 19. 🔛 🎍 ┥ 🕨 🔺 🗸 Channels 🔻 🥑	ive
Connection	Stop Execution	Time Stamp Description	
Setup		28.503:272:620 C2 #38 SOP/SNK/ UFP:GoodCRC:	
	Test Status:	28.505:218:240 C22 #39 SOP/SNK/ UFP:Request:PDO#1; OpCurrent = 0.5A; MaxCur	
Product	Test Summary : 🤣 0 🛛 🙁 0 🔶 0	28.505:964:850 UUT #40 SOP/SRC/ DFP:GoodCRC:	
Capability		28.508:783:470 UUT #41 SOP/SRC/ DFP:Accept:	
	✓ Power Delivery 3.0 Tests	28.509:330:270 C2 #42 SOP/SNK/ UFP:GoodCRC:	
	ID.PD.LL3.E1 GoodCRC Specification Revision com	28.617:686:110 UUT #43 SOP/SRC/ DFP:PS_RDY:	
Test Config		28.618:236:720 28.618:236:720	
Results			
Report			
Options		S 30 V 20 V 10	
Help	KI 12	1.00 7.60 14,20 20,80 27,40 34,00 40,60 47,20 53,80 60,40 6 Time (Sec) >	7.00

FIGURE 7.43: RESULTS SCREEN – TEST RUN IN PROGRESS



FIGURE 7.44: 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.



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.



FIGURE 7.45: 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 web 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:

🗄 ┢ 🔂 🗑 😡		Packet Details				
Time Stamp 23.7 23.7 23.8 CC1 : 1.798V @ 0.001A 23.9 Time : 23.943:186:730 / ΔT : 1.0350	Description Dms C2 #18 NONE:FSM_S C2 #19 NONE:FSM_S #20 NONE:Rp_Ch	Start Time : 23.942151720000002 S End Time : 23.94318673 S Pkt Duration : 1.0350 ms Prev Pkt Delay : 19.7796 ms Post Pkt Delay : 1.0826 ms				
23.9 Vbus: 4.994V @ 0.002A 23.9 CC1: 1.798V @ 0.001A 23.9 CC2: 0.378V @ 0.002A	C2)#23 SOP/SNK/ UF C2)#23 SOP/SNK/ UF	Bits Field Type Raw Deco Descri ▶ 1.SourceCap> Header = 0x000041A1 (7)				
23.945:955:950	UUT#24 SOP/SRC/ DF Y	2.FS: 5V 3A { 0x0A01912C} (12)				
6.0		 3.FS: 9V 3A { 0x0002D12C} (12) 4.PPS: (3~5.9)V 3A { 0xC0761E3C} (9) 				
		▶ 5.PPS: (3~11)V 3A { 0xC0DC1E3C} (9)				
4.0						
1.76 5.78 9.80 13.81 Time	17.83 21.85 25.86 29.88 33.90 37.91 41.93 (Sec) >					

FIGURE 7.46: 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.

7.4 Test Report View

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

GRL	USE	Power Delivery and USB Type-C [™] Test Software (1.6.6.27) GRL-USB-PD-C2		Set App Mode :	CTS 🔵 API
	View Report Download Current HTML Report	Download Current DUT Report Data Report Data Management	Test C:\GRL\USBPD-C2-E	Reports Location Browser-App\Report\TempReport	
	DUT Information				
	Manufacturer	P18			
	Model Number	NXP_Portway			
	Serial Number	QC4+			
	Test Information				
	Test Lab				
	Test_Engineer	Test_Engineer			
	Remarks	Remarks			
	Date_and_Time	11-07-2022 06:25:50 PM			
	Controller and Instrument In	formation			
	Parameter	Value			
	GRL_USB_PD_C2_Serial_No	205.141.205.117.193.			
	GRL_USB_PD_Software_Version	1.6.6.27			
	GRL_USB_PD_Firmware_Version	2.0.50			
	GRL USB-PD Ethernet Buffer Size	62K			
	GRL USB-PD Eload Firmware Version	9.8 / 9.8			
	Board Calibration	Calibration Expired			
	RX mask Power selection	Neutral Power			
L	Device_Type	Provider Only			
	Cable Type	GRL_SPL_CABLE_1			-

FIGURE 7.47: 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 exam	ple below:
0010110000	to them the lott		In the chain	

🥠 GRL		U	SB Power Delivery and USB Type-C [™] Test Software (1.6.6.27) GRL-USB-PD-C2			Set App Mode :	CTS API
\odot	View Report	Download Current HTML Report	Download Current DUT Report Data Report Data Management	C:\GRL\USB	Test Reports Location PD-C2-Browser-App\Repo	rt\TempReport	
Connection	21	TEST.PD.PROT.ALL3.6	TEST.PD.PROT.ALL3.6 ChunkSenderResponseTimer Timeout	PASS			^
Oetup	22	TEST.PD.PROT.ALL3.7	TEST.PD.PROT.ALL3.7 Security Messages Supported	PASS			
	23	TEST.PD.PROT.PORT3.1	TEST.PD.PROT.PORT3.1 Get Battery Status Response	PASS			
Product	24	TEST.PD.PROT.PORT3.2	TEST.PD.PROT.PORT3.2 Invalid Battery Status	PASS			
Capability	25	TEST.PD.PROT.PORT3.3	TEST.PD.PROT.PORT3.3 Get Battery Cap Response	PASS			
	26	TEST.PD.PROT.PORT3.4	TEST.PD.PROT.PORT3.4 Invalid Battery Capabilities Reference	PASS			
	27	TEST.PD.PROT.PORT3.5	TEST.PD.PROT.PORT3.5 Get Country Codes Response	PASS			
Test Capfig	28	TEST.PD.PROT.PORT3.6	TEST.PD.PROT.PORT3.6 Get Country Info Response	PASS			
Test Conlig	29	TEST.PD.PROT.PORT3.7	TEST.PD.PROT.PORT3.7 Unchunked Extended Message Supported	NA			
•	30	TEST.PD.PROT.SRC.1	TEST.PD.PROT.SRC.1 Get Source Cap Response	PASS			
(A)	31	TEST.PD.PROT.SRC.2	TEST.PD.PROT.SRC.2 Get Source Cap No Request	PASS			
Results	32	TEST.PD.PROT.SRC.3	TEST.PD.PROT.SRC.3 Sender Response Timer Deadline	PASS			
	33	TEST.PD.PROT.SRC.4	TEST.PD.PROT.SRC.4 Reject Request	PASS			
r=-1	34	TEST.PD.PROT.SRC.5	TEST.PD.PROT.SRC.5 Reject Request Invalid Object Position	PASS			
=×	35	TEST.PD.PROT.SRC.6	TEST.PD.PROT.SRC.6 Atomic Message Sequence - Request	PASS			
Report	36	TEST.PD.PROT.SRC.7	TEST.PD.PROT.SRC.7 DR Swap	PASS			
	37	TEST.PD.PROT.SRC.8	TEST.PD.PROT.SRC.8 VCONN Swap Response	PASS			
563	38	TEST.PD.PROT.SRC.9	TEST.PD.PROT.SRC.9 PR Swap Response	PASS			
रेट्रेंट Options	39	TEST.PD.PROT.SRC.10	TEST.PD.PROT.SRC.10 PR Swap - PSSourceOnTimer Timeout	PASS			
	40	TEST.PD.PROT.SRC.11	TEST.PD.PROT.SRC.11 Unexpected Message Received in Ready State	PASS			
0	41	TEST.PD.PROT.SRC.12	TEST.PD.PROT.SRC.12 Get Sink Cap Response	PASS			
Help	42	TEST.PD.PROT.SRC.13	TEST.PD.PROT.SRC.13 PR Swap GoodCRC not sent in Response to PS_RDY	PASS			-

FIGURE 7.48: 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.




8 Using the Configuration Controller

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

- configure the DisplayPort AUX fixture connected to the GRL-C2-EPR tester hardware for capturing sideband messages for DisplayPort Standard AUX or DisplayPort Alternate Mode, and
- manually send USB Power Delivery Packets from the GRL-C2-EPR tester hardware to the DUT.

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

A		Five Port Testi	ng		Co	nfig Controller Cab	le IR Drop C	alibration		
Connection		Configure		Send & Configure Multiple Packet				View Packet (#1)		
Setup	App Mode	CTS 🔻	Ι.		Send	Config	re		Message Header	DataMessageTypes
	DP AUX Sniffer	DP Sink side			S.NO	Message Type	Act	ons	Message Type	SourceCap
Product Capability	Port Type	Port2			1	SourceCap	8	Û	Number of PDO's 🕦	1
	Controller Mode	UFP/Sink			2	SinkCap	Ø	Û	✓ PDO-1 Fixed:5000mV@3000mA	- Thurd
	Test Cable Type	GRL-SPL EPR Test Cable 1			3	EPR_Request	8	Û	Dual Pala Pawar	rixed VEC
Test Config	PD Spec Type	Spec Rev2	`						LISB Suspend Supported	
æ	Cable Emulation	Bain CC1							Unconstrained Power	
Results	Rp Level								USB Communications Canable	
									Dual Pole Data	
Ē		Apply							Unchunked Extended Messages	
Report	Emulate Cable	Attach Detach							Supported	YES •
	Channels	VBUS CC1 CC2 D+ D- Try Cable Flip							EPR Mode Capable	YES •
	Sampling Ratio	1000							Reserved 🚯	YES •
Options	Signal Capture	Start Stop							Peak Current	Peak current equals IOC
		Download Capture							Voltage [mV]	5000
?	Port Power Cal	ibration-							Maximum Current [mA]	3000
rieip		Port Calibration								
	TBT Self Calibr	ation								
	Capture File									
	Ports	Port 1 O Port 2								
	Channels	● CC1 ○ CC2								
		Run TBT Self Calibration								
				Send	Save Load	Add Set Default Remove All				
			1	Send	Save Load	Add Set Default Remove All				

FIGURE 8.1: CONFIGURATION CONTROLLER SCREEN

Testing the DUT 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.

8.1 Configure Panel

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



	Configu	re				
App Mode	CTS	◄				
DP AUX Sniffer connected to	DP Sink side	•				
Port Type	Port2	•				
Controller Mode	UFP/Sink	•				
Test Cable Type	GRL-SPL EPR Test Cable 1	•				
PD Spec Type	Spec Rev2	•				
Cable Emulation	Ra in CC1	•				
Rp Level	Rp 900mA	•				
		Ap	ply			
Emulate Cable	Attach		Detach			
Channels	✓ VBUS □ CC1 □ CC2 □	D+ (D- <u>Try Cable Flip</u>			
Sampling Ratio	1000					
Signal Capture	Start		Stop			
	Dov	vnloa	d Capture			
–Port Power Cali	bration					
	Po	ort Ca	libration			
-TBT Self Calibra	ation					
Capture File						
Ports	Port 1 Port 2					
Channels	O CC1 ○ CC2					
	Run Té	Run TBT Self Calibration				
	<u></u>					

FIGURE 8.2: CONFIGURATION CONTROLLER – CONFIGURE PANEL

- **App Mode** The App Mode drop down sets the tester hardware'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
 - **SNIFFER** Sniffer mode for sniffing USB Power Delivery and Qualcomm Quick Charge legacy traffic.
- **DP AUX Sniffer connected to** This drop down sets the GRL DP AUX Sniffer Fixture that is connected to either the DisplayPort Sink or Source side of the GRL-C2 / C2-EPR tester hardware for sniffing DisplayPort Standard Auxiliary traffic.
- **Port Type** For a 2-port DUT, select either "Port1" or "Port2" to apply the configuration for the selected test port.



- **Controller Mode** The Controller Mode drop down sets the tester hardware's mode of operation:
 - UFP/Sink Upward Facing Port, sink power
 - o **DFP/Source** Downward Facing Port, source power
 - o **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 DUT connected to the tester hardware.
- **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 DUT if cable emulation is enabled on the tester hardware 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 DUT.

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 tester hardware 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 tester hardware to Source Detach or Sink Detach.

- **Channels** Select the display channels (VBUS, CC1, CC2, D+ and D-) to be added to the signal acquisition trace plot. You can select "<u>Try Cable Flip</u>" to allow the connected cable to be flipped during the test run.
- **Sampling Ratio** Enter the sampling rate for signal acquisition.
- **Signal Capture** Select the **Start** button to start running signal acquisition or the **Stop** button to stop signal acquisition for the DUT. The **Start** function will initiate the test run in the Results screen as shown in the example below:



$\overline{\bullet}$		Test R	esults 🗌	Scroll To Current			Q	Q	Q]						Q Se	arch	Channel	s 🔻 🚺	Live
Connection		Stop E	Execution		Time St	amp							Des	cription			_		
Setup																			
	Test Status:																		
Product	Test Summary : 🥑 0	0 😢	0	0															
Capability	C DP Aux Read																		
Test Config																			
						10							•••						
(Å)					<mark>२</mark>	0.0													
Results					BUS	0.0													
					T2-V T2-V	0.5													
Ē					NOR NOR	0.3													
Report						0.0													
						3.0]
က်န					C2(V	2.8													
حمہ Options					-2-Ci	2.5													
					OR.	2.3													
\bigcirc						2.0													
Help							1.00	3.20	5.	40	7.60	9.80 Time	(Sec)	12.00 >	14.20	16.40	18.60	20.80	23.00

FIGURE 8.3: CONFIGURE PANEL – START SIGNAL CAPTURE IN RESULTS SCREEN EXAMPLE

- **Download Capture** Select the **Download Capture** button to download and save the signal acquisition to a file.
- **Port Power Calibration** Select the **Port Calibration** button to perform calibration for the power capabilities of the selected tester port.
- **TBT Self Calibration** Select the port and channel to perform self-calibration for Thunderbolt capabilities of the DUT followed by the **Run TBT Self Calibration** button.

8.2 Send & Configure Multiple Packets Panel

The Send & Configure Multiple Packets panel allows you to edit, send or request one or more Packets from the GRL-C2 / C2-EPR tester hardware during USB Power Delivery Contract negotiation phase.

8.2.1 Send Packets

The **Send** tab allows you to edit and send run-time packets/messages from the GRL-C2 / C2-EPR tester hardware to the connected DUT once a successful USB Power Delivery contract has been established. Figure 8.4 below shows the list of default packet/message types:

	Send & Configure Multiple Packet						
Send Configure							
		S.NO	Message Type	Acti	ons		
		1	SourceCap	Ø	Û		
		2	SinkCap	Ø	Û		
		3	EPR_Request	٢	Û		

FIGURE 8.4: SEND PACKETS TAB



- a. The user selects the desired packet/message type and then clicks on the **Send** button at the bottom of the screen to send the run-time packets/messages from the tester hardware to the DUT. When the user selects a packet/message from the table, the user can view the packet/message configuration details on the right panel.
- b. The user can edit a specific packet/message by clicking on the Edit Packet icon index the "Actions" column. This will enable the configuration fields for the respective packet/message to be editable on the right panel.
 - **Message Header** The Message Header dropdown allows you to select the main category of USB Power Delivery message being accessed/negotiated.
 - **Message Type** The Message Type dropdown allows you to select the type of USB Power Delivery Object (PDO) being accessed/negotiated for the selected message category. 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, Get PPS Status and BIST Test Data command.
 - Number of PDO's The Number of PDO's entry field allows you to enter the number of PDO's (up to 15) for the selected PDO type to be sent. Once entered, the user can edit the PDO configuration as required and click on the **Save** button at the bottom to save the edits.

Send & Configure Multiple Packet			Edit Packet (#1)				
5	Send Configure			Message Header	DataMessageTypes 🔹		
S.N	0	Message Type	Actio	ns	Message Type	SinkCap 🔻	
□ 1		SourceCap	1	Û	Number of PDO's 🕦	1	
2		SinkCap	8	â	✓ PDO-1 Fixed-Sink:5000mV@3000m	nA	
		EPD Deguest			Supply Type	Fixed-Sink	
,		LFR_Request			Dual Role Power	YES 🔻	
					Higher Capability	YES -	
					Unconstrained Power	YES -	
					USB Communications Capable	YES V	
					Dual Role Data	YES 🔻	
					Fast Role Swap 👔	Fast Swap not supported (default)	
					Reserved 👔	0	
					Voltage [mV] 🕦	5000	
					Operational Current [mA] 1	3000	
					3	2	

FIGURE 8.5: EDIT PACKET CONFIGURATION



- c. To add more packets/messages to be sent, click on the **Add** button at the bottom of the screen. In the "Add Packet" screen, the user can configure the packet/message similar to Edit Packet. Once configured, click on the **Add** button at the bottom of the screen. This will cause the new packet/message to be added to the list under the "Send" tab.
- d. Once all required packets/messages have been added/configured as described above, select all in the list and click on the **Send** button to cause the tester hardware to send the packets/messages to the DUT. An example is as shown below.



FIGURE 8.6: SEND PACKETS EXAMPLE

8.2.2 Write Packets

For writing packets/messages to registers, select the **Configure** tab and click on the **Add** button at the bottom of the screen to create a new list of packets/messages which is similar to "Edit Packets" as described under Section 8.2.1.

8.2.3 Save/Load/Set Default/Remove All Packet Data

The user can use the Save Load Set Default Remove All buttons at the bottom of the "Send & Configure Multiple Packet" panel to perform the following functions:

• **Save** button: Saves the packets/messages to the JSON file format in the Downloads folder when clicked.





- **Load** button: Loads the packet/message data from a selected saved JSON file when clicked. The user can then make configurations to the loaded packet/message data.
- **Set Default** button: Resets all user-defined packet/message configurations to the default state when clicked.
- **Remove All** button: Deletes all data in the "Send & Configure Multiple Packet" panel.



9 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:



FIGURE 9.1: 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-C2 / C2-EPR tester hardware. The GRL 5-Port Switch Board consists of a five ports switch extension fixture that is plugged in to the GRL-C2 / C2-EPR tester hardware and is used to connect up to five DUT'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-C2 / C2-EPR tester hardware. Click on the **Connect** button next to it to verify the assigned Port connection.



FIGURE 9.2: 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 The test cable selection drop down allows you to specify what cable connects the DUT to the specific USB Port on the GRL-C2 / C2-EPR tester hardware.

Cable Selection	GRL-SPL Test Cable 1	-0
DUT Information	GRL-SPL Test Cable 1	
VIF Source	GRL-SPL Test Cable 2	
MOLList	GRL-SPL EPR Test Cable 1	
MOI LIST	GRL-SPL EPR Test Cable 2	_ \ `
Repeat Count	USB-C STD Test Cable 1	÷ 1
Repeat Condition	Captive Cable	
report condition	No Cable (For Cable Testing)	~
		J.

FIGURE 9.3: FIVE PORT TESTING – SELECT CABLE

You can then select whether to use a **VIF** file for the DUT or querying the capabilities of the DUT (**DUT Type**) at the DUT Info field DUT Info **OUT 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 DUT capabilities, select the **DUT Type** checkbox to enable selection of the DUT type being used from the **DUT Type** drop down:



FIGURE 9.4: FIVE PORT TESTING - SELECT DUT TYPE

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



Proiect Name	USB Power Delivery Compliance Test Specification	4
Enable Port	PD2 Communication Engine Tests	1
Cable Selection	PD2 Deterministic Tests	
DUT Information	USB-C Functional Tests	
VIF Source	Source Power Tests	T
MOI List	Select MOI	~

FIGURE 9.5: 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	
VII Source	Fail Tests	
MOI List	Pass Tests	
Repeat Count	Incomplete Tests	
Repeat Condition	Select Condition	~

FIGURE 9.6: 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.



FIGURE 9.7: FIVE PORT TESTING – START TEST AND SAVE/LOAD FUNCTIONS





10 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 10.1: CABLE IR DROP CALIBRATION SCREEN

First make sure that the test cable is connected properly to the GRL-C2 / C2-EPR tester hardware 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 Na	me cablename				
Cable Name	cablename	()			
Cable Type	GRL-SPL test cable 1				
Calibration Status :	GRL-SPL test cable 1				
	GRL-SPL test cable 2	Download File			
	GRL-SPL EPR Test Cable 1				

FIGURE 10.2: 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 Statu	IS :	
	Calibrate	Download File

FIGURE 10.3: CABLE IR DROP CALIBRATION – RUN IR DROP CALIBRATION AND SAVE TO FILE



11 GRL-C2 / C2-EPR Browser App Information and Help

The *Help* screen allows you to view the current version of the GRL-C2 / C2-EPR Browser App as well as a brief description of the GRL-C2 / C2-EPR tester hardware. You can also access customer support debug logs and API documentation using the links provided.



FIGURE 11.1: HELP SCREEN

END_OF_DOCUMENT