

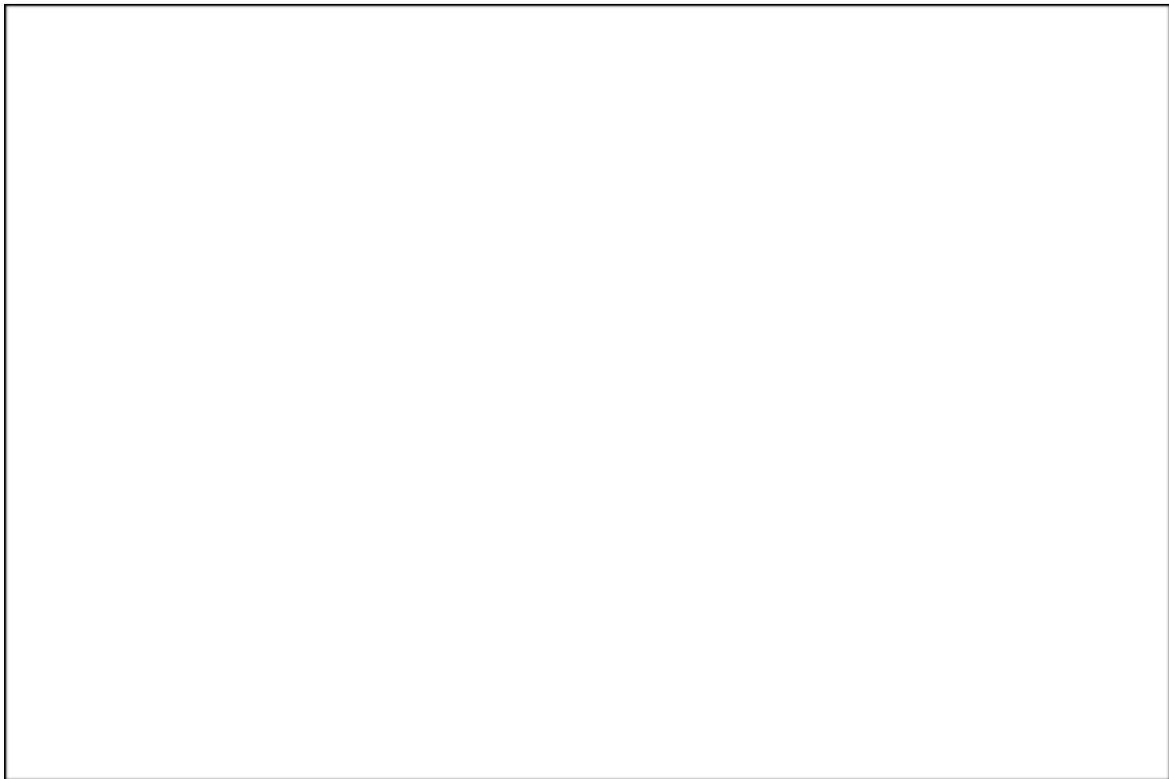
**Quarch Technology Ltd**

**Quarch Compliance Suite**

**Setup & Test Specification**

**QCS1005 – Power Margining Test**

V1.5



Quarch Compliance Suite v1.08

File Action Help

Setup Results Select Test

Connection

Select a Test

Test Name	Version	Qtl Number	Licensed
Full range hotplug test	1.4	QCS1001	YES: Free
Power Margining	1.4	QCS1005	YES: Free
Power vs performance - Custom Job	1.0	QCS1007	YES: Free
Power vs performance - Free Test	1.0	QCS1008	YES: Free
Power vs performance - Drive Test	1.1	QCS1006	YES: Free
Pin-bounce during hotplug	1.4	QCS1002	YES: Free
Signal timing sweep during hotplug	1.4	QCS1003	YES: Free
UNH-IOL Plugfest - Basic hotplug	1.4	QCS1004	YES: Free

Connect to a host

Enter IP of Python Server

Connect to QCS Server

Description

**Test Name:** Power vs performance - Drive Test

**Test Requirements:**  
Required parts  
\* 1x Quarch PPM or PAm, made available to the Test PC (LAN or USB)

No test running Conn Status : No connection

## Change History

1.0		Initial Release
1.1		Re-written in new format
1.3		Introduced reporting
1.4		Improved report output
1.5		Improving documentation for test

## Contents

## Introduction

To help show functionalities of the Programmable Power Module. Quarch has created the Power Margining Test.

This test is free to all users and demonstrates some of the uses of the PPM alongside the automation QCS provides for control of this module and utilising Quarch Power Studio simultaneously.

## Requirements

Host PC

- This is the PC which will mount the storage device under test (DUT). This system required admin privileges to install and execute the QCS server. Windows and Linux are supported.

#### Client PC

- This is the PC which will run the QCS client and record the results. This can be the same as the Host PC but it NOT recommended for this test. Windows and Linux are supported.

#### Quarch Programmable Power module.

- The power modules are to measure and provide power to the drive chosen for the test.

#### Quarch Power Injection Fixture

- An appropriate PPM fixture that is compatible with the DUT.

#### Device under Test (DUT)

- Your storage device. SAS, SATA and PCIe NVMe devices are supported.

## Installation

Initial installation and setup is described in the QCS 'Quickstart' guide. Please see this document if you are setting up for the first time. It will walk you through the QCS install process.

## Setup

Host and Client PC setup is common across all QCS tests, so some of the steps below are only required the first time you prepare for testing

- **Setup the Host PC**
  - As described in the QCS Quickstart document
  - Ensure the Host PC is connected to the LAN (assuming a separate Client PC is in use)
  - Use of WIFI is highly discouraged for this testing.
- **Setup the Client PC**
  - As described in the QCS Quickstart document
  - Ensure the Client PC is connected to the LAN (assuming a separate Host PC is in use)
  - Use of WIFI is highly discouraged for this testing.
  - Launch QPS and QIS on this machine. If Quarchpy is already installed on this machine, this can be launched via the command ***python -m quarchpy.run qps***  
Alternatively, this can be install from the quarch website:  
<https://quarch.com/file/power-studio/>
- **Setup the Quarch Power module**
  - Place the power fixture between the DUT and host slot. Connect the fixture cable to the Quarch Power Module. If you are using an SFF drive fixture, ensure the voltage selection jumper is correct for your drive.
  - Power on the Quarch Module
  - Choose either USB or LAN for the Quarch Power Module. The Module must be accessible to the **Client PC**, so be sure you cable to the right one if using USB.
  - If you need to configure the power module settings, you can do so via TorridonTerminal: <https://quarch.com/file/torridon-terminal/>
  - This is also helpful to ensure you have connected the module correctly and can see it. If you are using a PPM, the DUT will NOT be powered on yet. This will happen at the start of the test, if you want to turn it on now, use TorridonTerminal to issue the command:  
  
> run:power up

## Typical equipment layout

A typical equipment layout is shown below. The Quarch Power Module can be optionally connected via USB to the **Client** PC instead of using the LAN.

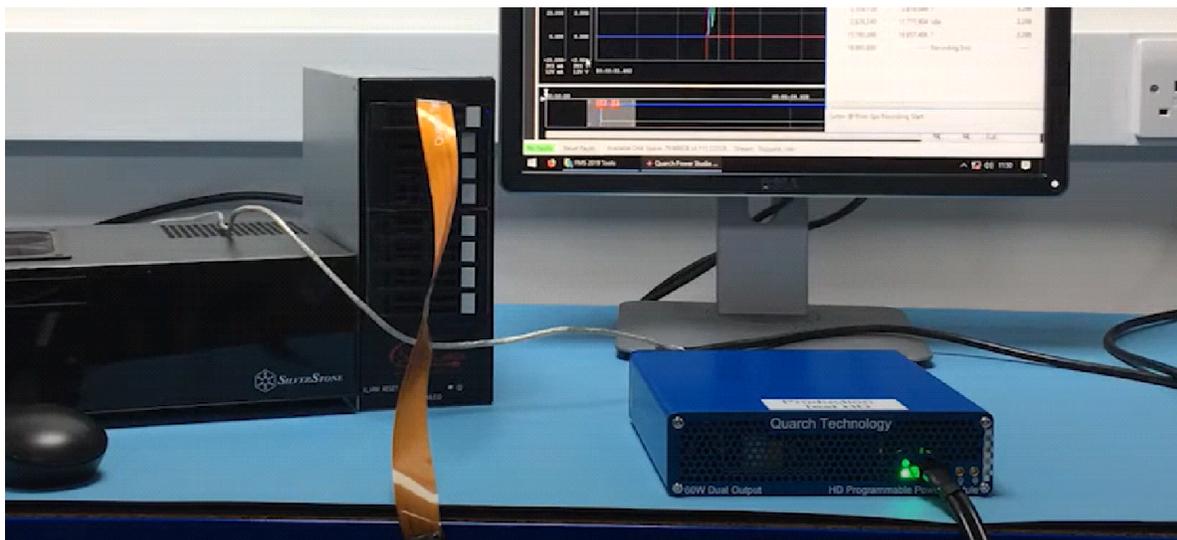
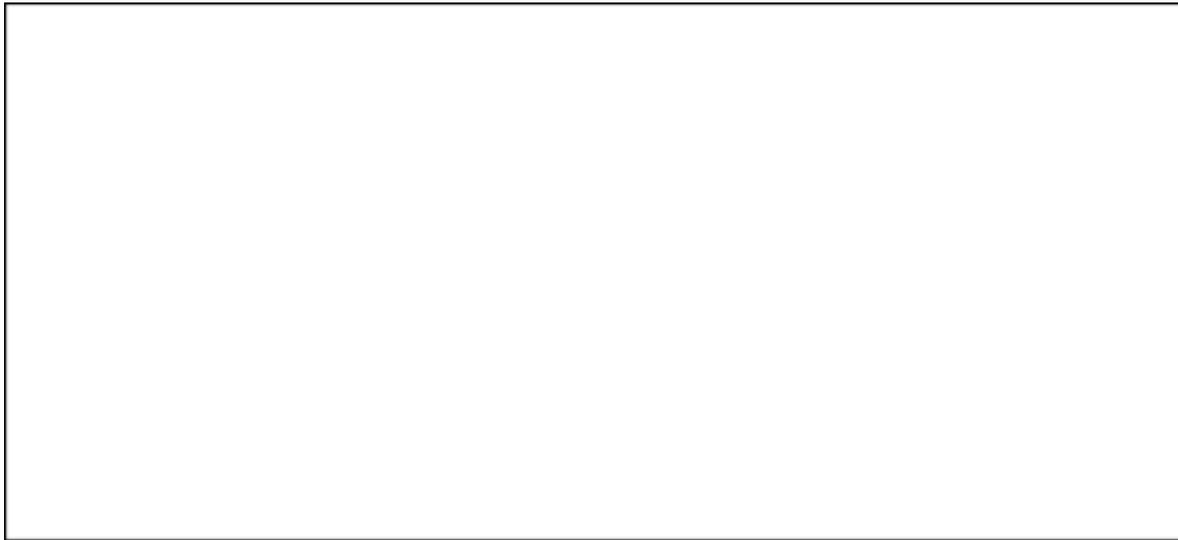
The Quarch Power Fixture must be fitted to correctly:

- For a PPM, the fixture (or output cable) must be able to supply power to the drive
- For a PAM, the fixture must be in the path of the power supplied by the host.

Example using a simple injection cabling with a PPM



## Example using SerialCables JBOD and SFF injection fixture



## Begin the test

- Start QCS server of the Host PC
- > python -m quarchpy.run qcs

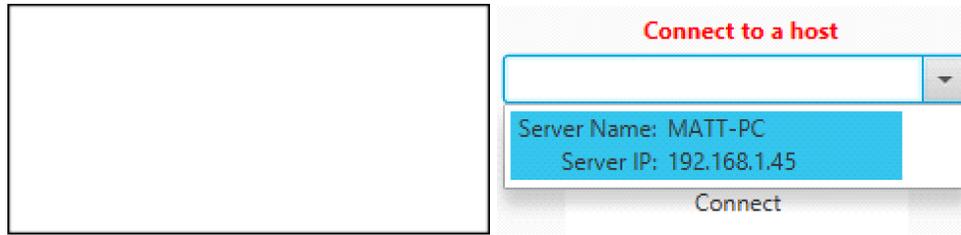
The server should start up almost immediately. Note the IP address and mDNS name which you will use to connect to the server later.

```
C:\WINDOWS\system32>python -m quarchpy.run qcs
Console Quick Edit Disabled

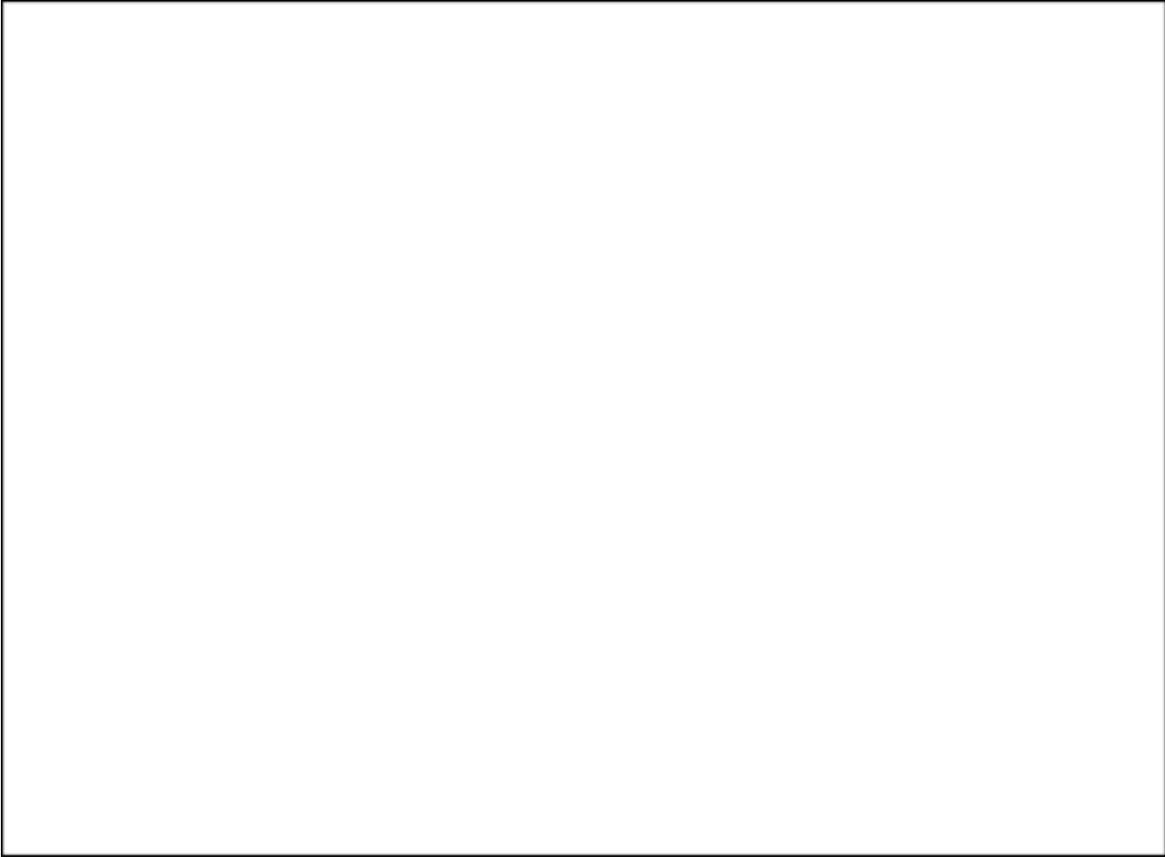
#####
                Welcome to
                Quarch Technology's
                Quarch Compliance Suite
                Quarchpy Version : 2.0.20.dev10
#####

DEBUG:root:Server Name: ANDY-LAPTOP
Server Name : ANDY-LAPTOP
Server IP : 192.168.1.101
Server Status : IDLE ( 02/05/2021, 10:51:22 )
DEBUG:root:Server IP: 192.168.1.101
```

- Start QCS application on the Client PC
- > Double click on the QCS icon to start
- Connect the Client to the Server
- Enter the IP address of the Server into the Client connection box. If 'zeroconf' is installed on the server then it should autodetect and be visible in the connection drop-down menu for fast connection.



- Select the test to run
- In this case, select the QCS1004, 'UNH-IOL Plugfest – Basic Hotplug ' and either double-click or select 'Select Test'



Quarch Compliance Suite v1.08

File Action Help

Setup Results Select Test

Connection



Connected

192.168.1.101

Server Name : ANDY-LAPTOP

Disconnect

Description

Select a Test

Test Name	Version	Qtl Number	Licensed
Full range hotplug test	1.4	QCS1001	YES: Free
Power Margining	1.4	QCS1005	YES: Free
Power vs performance - Custom Job	1.0	QCS1007	YES: Free
Power vs performance - Free Test	1.0	QCS1008	YES: Free
Power vs performance - Drive Test	1.1	QCS1006	YES: Free
Pin-bounce during hotplug	1.4	QCS1002	YES: Free
Signal timing sweep during hotplug	1.4	QCS1003	YES: Free
UNH-IOL Plugfest - Basic hotplug	1.4	QCS1004	YES: Free

No test running Server Status: Connected

- This process can take 30 seconds or so, as the test is sent to the Server and the required applications are started on the Client.
- When the test is ready, the 'Start/Play' button will become available to begin running. If you want to change any setting for the test, you can do so now in the 'Custom Variables' window.
- When you have made any changes you require, press the run button to begin.

## Custom variables

Most tests have several variables that can be set. These allow for things such as setting the number of times that a test loops or setting the time to wait for a drive to enumerate. These will be different in each test suite.

QCS1004 has several useful settings to consider:



Custom Variables

Custom Variables

Variables left blank or "auto" will automatically have their value set as the test proceeds

STOP ON FAIL:	False	Stop test at first failure point
AVERAGING:	16k	Sampling rate for QPS
RUN POWER CYCLE TEST:	False	Choose to skip optional initial power cycle
RUN WRITE TEST:	True	Choose to skip all write tests

Reset Defaults

Apply Values

**Stop on fail**

- When set to true, the test will halt if there are any errors or test failures

**Repeats**

- Amount of times to repeat each section of this test

**OnTime**

- Time to wait for drive to enumerate on system after a hotplug

**OffTime**

- Time to wait for host to remove drive

**Link Speed**

- Value to **compare** drive's link speed against

**Lane Width**

- Value to **compare** drive's lane width against

**Power decrease**

- Total % power decrease for the test.  
( Example. 12000mV @ 10% = 10800mV minimum voltage)

**Increments**

- Number of incremental steps to get to minimum voltage.  
( Example. 1200mV decrease @ 5 steps = 240mV decrease per step)

**Wait Time**

- Time to wait after a power up to show drive's power trace.  
This will be ignored if the time specified is less than the time taken to re-discover the drive.

**QPS Averaging**

- QPS averaging rate for the test – Default 16k

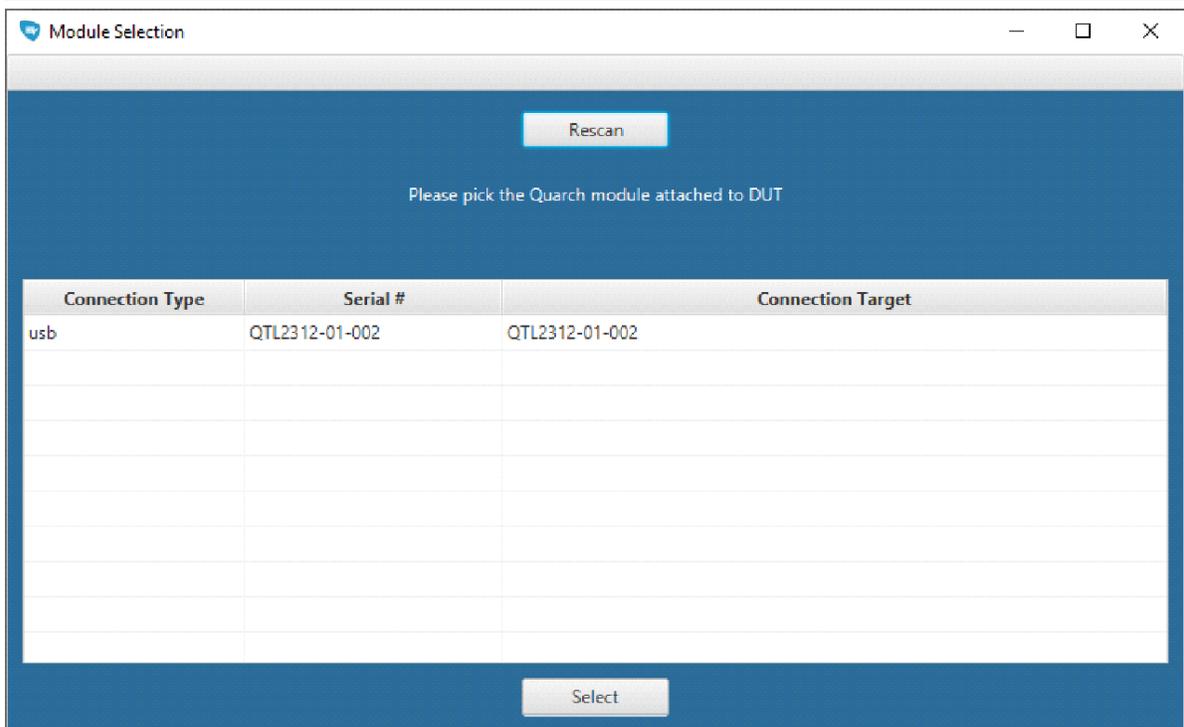
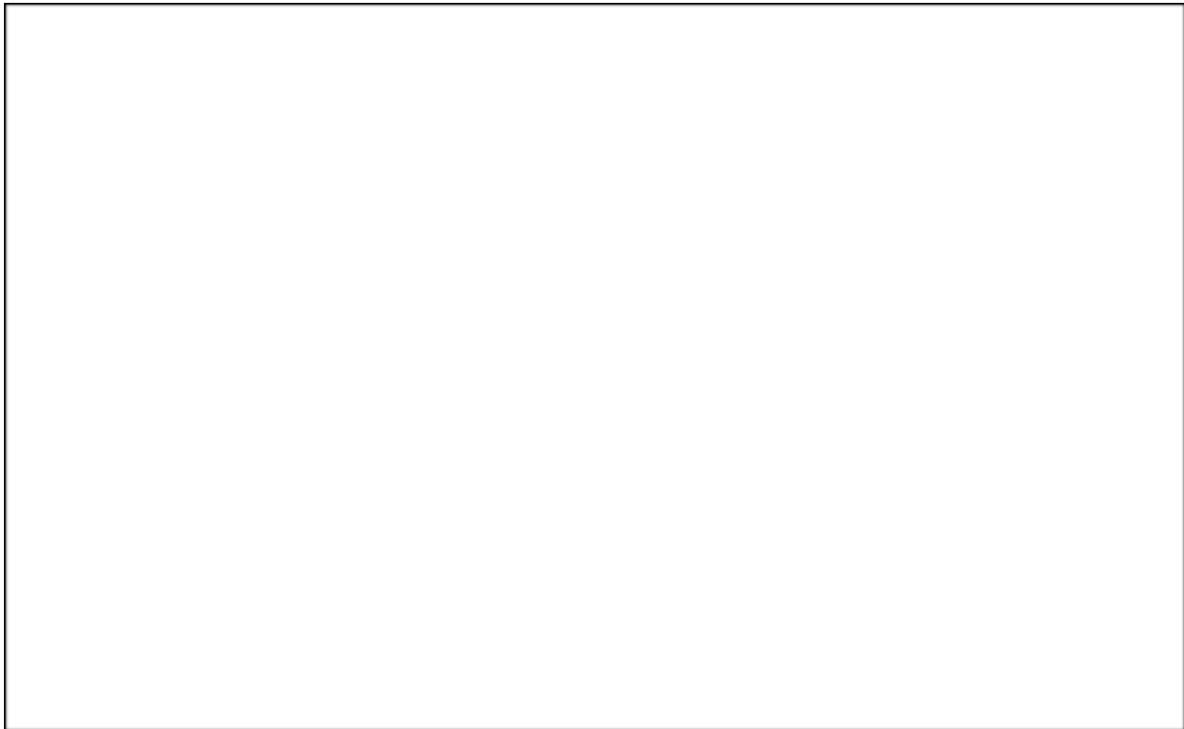
## Select the devices

As the test starts running, you will be prompted to select the Quarch Power Module and storage device to use. The dialogs have a rescan button: just in case you have forgotten to plug something in!

## Select the breaker module

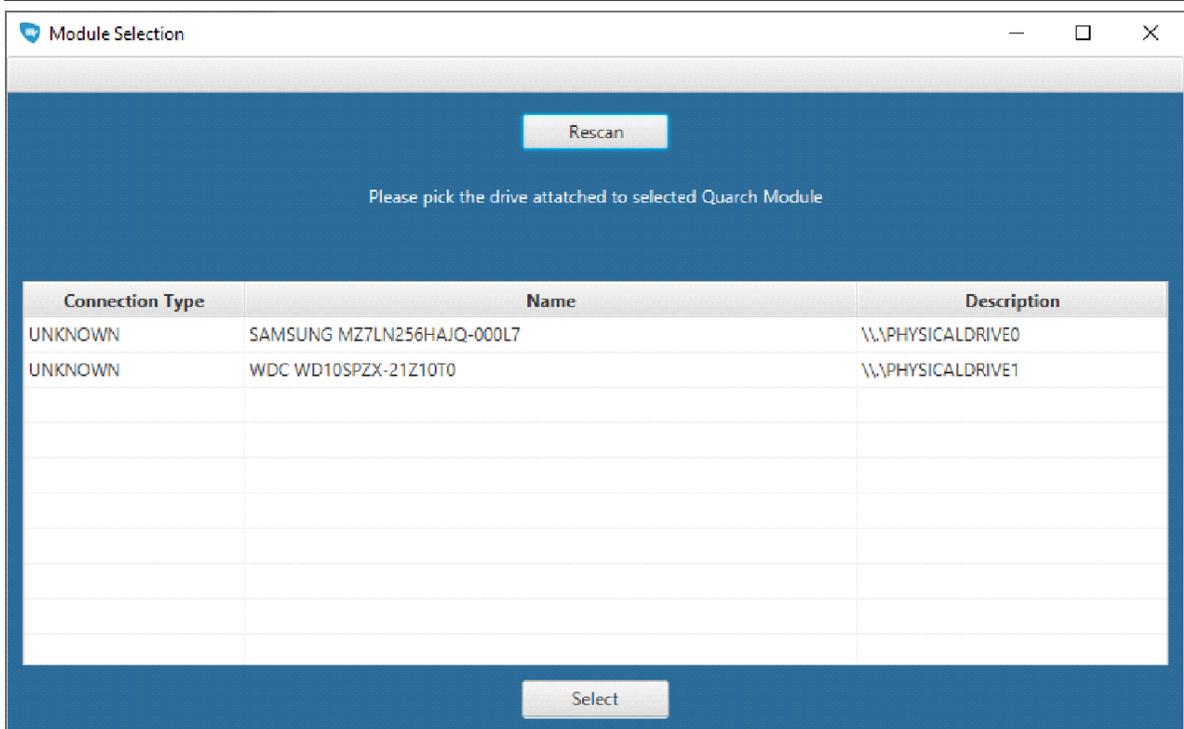
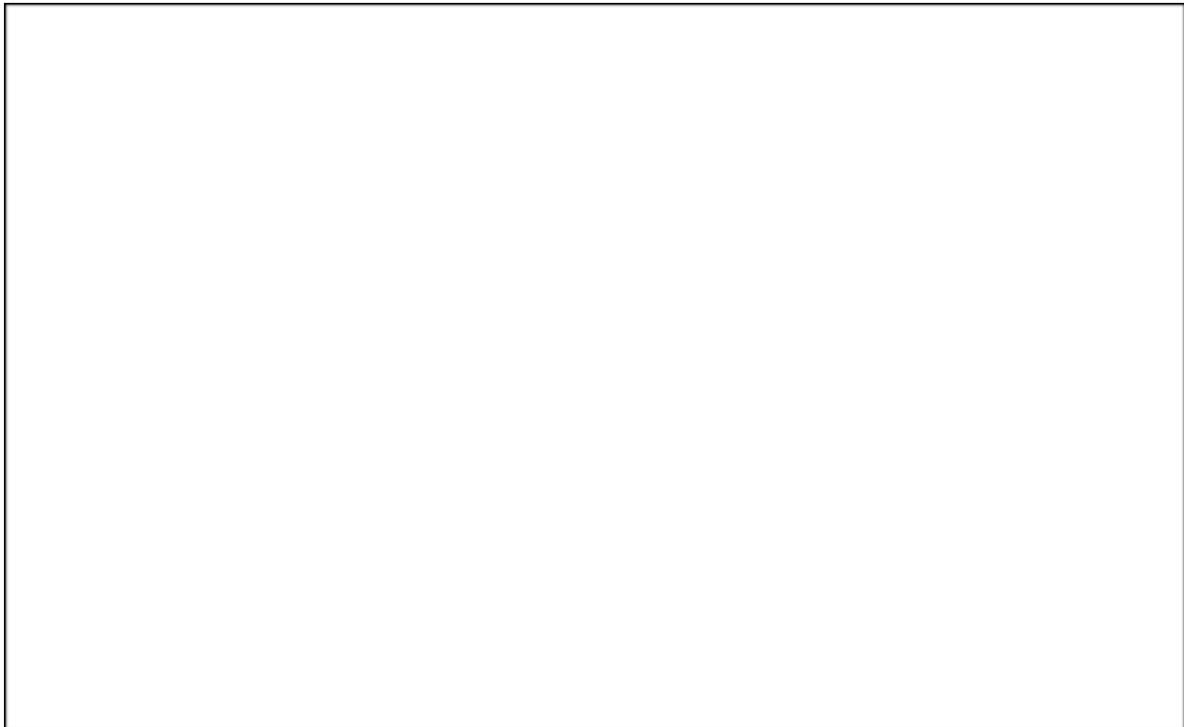
First you will be prompted to select the Power Module. Here we have a QTL2312 (PAM) module connected to the Client PC via USB.

The power module must be available on the client PC. If it is not the test cannot be continued.



### Select the storage device (DUT)

Next you will be prompted to select the storage device to test.



Be sure that you select the correct DUT.

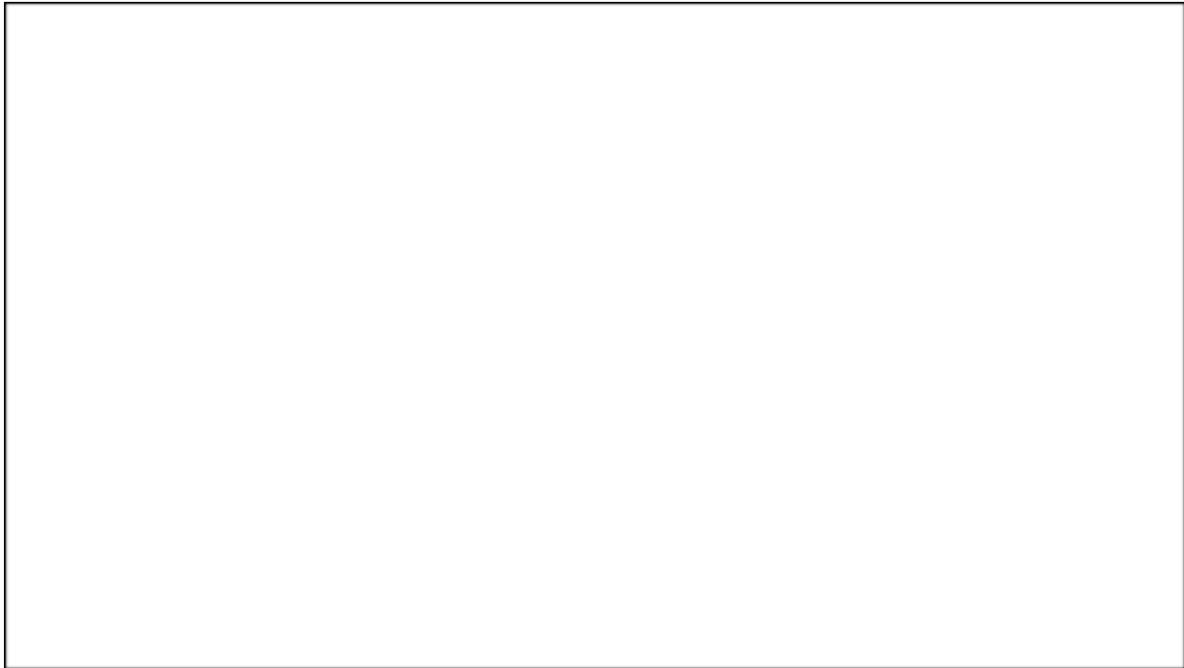
Selecting the wrong drive will show fail test points throughout half of the test as the drive being monitored in QCS is not the drive being power cycled..

## View test progress

This test suite with default variables is fast to complete, currently under 5 minutes depending on how fast the drive under test enumerates. Customizing the test variables will increase this total test time.

Real time results are displayed in the log. Any failures will be clearly marked in red, and noted on the error counters.

If many failures occur early on, it is likely that you have a problem with the setup of the equipment. Expanding the failed rows gives more information on the failure.



Quarch Compliance Suite v1.05

File Help

Setup Results Custom Variables Start Tests ▶

Passed: 160 Errors: 0 Total Progress  
Failed: 0 Warnings: 0 Current Test  
Elapsed Time: 01:40

**PASSED** Expand/Collapse

Id	Type	Time	Description	Details
▼ 0	testDescription	2020-11-27...	Setting up required test resources	n/a
▶ 0.1	testDescription	2020-11-27...	User module selection	n/a
▶ 0.2	testDescription	2020-11-27...	User drive selection	n/a
▼ 1	testDescription	2020-11-27...	Beginning tests core	n/a
▼ 1.1	testDescription	2020-11-27...	10mS Staged hot-plug test, with anumeration and link verification	n/a
▼ 1.1.1	testDescription	2020-11-27...	Repeat cycle 1 of 10	n/a
▼ 1.1.1.1	testDescription	2020-11-27...	Setting up hotplug test	n/a
	quarchCommand	2020-11-27...	Quarch Command: source:1:delay 0 - Response: OK	{textDetails=Executing command on module, debugLevel=1}
	quarchCommand	2020-11-27...	Quarch Command: source:2:delay 10 - Response: OK	{textDetails=Executing command on module, debugLevel=1}
	quarchCommand	2020-11-27...	Quarch Command: source:3:delay 20 - Response: OK	{textDetails=Executing command on module, debugLevel=1}
	quarchCommand	2020-11-27...	Quarch Command: source:4:delay 30 - Response: OK	{textDetails=Executing command on module, debugLevel=1}
	quarchCommand	2020-11-27...	Quarch Command: source:5:delay 40 - Response: OK	{textDetails=Executing command on module, debugLevel=1}
	quarchCommand	2020-11-27...	Quarch Command: runpower down - Response: OK	{textDetails=Executing command on module, debugLevel=1}
▶ 1.1.1.3	testDescription	2020-11-27...	Polling system for indication of drive removal	n/a
▼ 1.1.1.5	testDescription	2020-11-27...	Polling system for indication of drive insertion	n/a
1.1.1.6	testResult	2020-11-27...	Checking device enumerated after power up	{Test Result =True}
	Debug	2020-11-27...	Was: 8GT/s Now: 8GT/s	n/a
1.1.1.7	testResult	2020-11-27...	Checking device's reported link speed	{Test Result =True}
	Debug	2020-11-27...	Was: x2 Now: x2	n/a
1.1.1.8	testResult	2020-11-27...	Checking device's reported lane width	{Test Result =True}
▶ 1.1.2	testDescription	2020-11-27...	Repeat cycle 2 of 10	n/a

Test Running : UNH-IOL Plugfest - basic hotplug Server Status: Connected

## Common test failures

- **Command to a Quarch module fails to get a response.**
- Module has become disconnected or powered down. Check your cabling.
- **Command to a Quarch module returns a bad command or invalid parameter error.**
- The Module connected is not the correct one for the test, or it required an upgrade.
- **The DUT is not removed from the system correctly during the power cycle test.**
- The wrong DUT may be selected. Make sure you have chosen the right device. If uncertain, you can use TestMonkey or TorridonTerminal to manually hot swap the DUT and verify that it is powering the correct drive.
- **The DUT is not enumerated on the system after each hotplug test.**
- Does the DUT and Host system support hot plug? If you cannot manually hot plug a device in the Host and have it enumerated correctly, then the test will not work.
- **“Fail – Module already streaming”**
- The module chosen is already streaming. If you have an instance of QPS open connected to the same module that has a stream ongoing, click the “stop stream” button on the QPS interface.  
If there is no QPS instance running that is streaming this module, a simple power cycle of the module will release the connection and reset the stream state to stop.

## Test specification

### Basis for testing

This test is the Quarch power margining test.

Your comments, requests and suggestions are very welcome and can be directed to [support@quarch.com](mailto:support@quarch.com).

Future versions of the test suite will aim to include these improvements where practical.

## **Assumptions**

We assume the host system is capable of hotplug and that the DUT does not contain any important data. This test may cause volatility in the drive.

## Test itinerary

- Default power margining used
  - 10% total decrease in power
  - 5 incremental steps
- Every step checks for both drive removal and insertion for the system & link speed, lane width if the drive is of type NVMe / PCIe.
- By default, the DUT is expected to enumerate within 10 seconds of the power up command. In rare occasions where this is exceeded, this variable can be changed inside of the custom variables.

## Stages of Test

- Margin 12V rail
- Reset power module to default power outputs
- Margin 5V or 3V3 rail – Chosen rail depends on drive connected / Power fixture attached.
- Reset power module to default power outputs
- Margin 12V AND (5V / 3V3) rails together.
- Reset power module to default power outputs

## Steps per power increment.

- **Run power down to drive**

Send “run power down” command to Quarch module.

- **Wait 3 seconds for drive to ensure drive is powered off –  
Check the drive removed from system**

Sleep test for 3 second.

- **Decrease power available to drive for power up**
- **Run power up to the drive**

Send “run power up” command to Quarch module

- **Check drive is enumerated on the system**

Poll system commands to check for drive enumeration on system

- **Check link speed ( PCIE devices only )**

Compare link speed against link speed custom variable

*( Note – If there was no custom value input, the link speed to compare against will be what the drive originally started with )*

- **Check lane width ( PCIE devices only )**

Compare link speed against lane width custom variable

*( Note – If there was no custom value input, the lane width to compare against will be what the drive originally started with )*

- **Wait for time specified ( *Custom Variable : Wait time* )**

Wait for specified period of time after sending run power up to drive.

Should the drive take longer than this time to be re-discovered, this variable will be ignored and test will continue

**Passing a pull event.**

After sending a “run power down” to the Quarch module, the test will consistently query the system command used to find the drive. A drive passes this check point if it is successfully removed from the list of drives returned from the system command.

### **Passing a plug event.**

After sending a “run power up” to the Quarch module, the test will consistently query the system command used to find the drive. A drive passes this check point if it is successfully added to the list of drives returned from the system command.

### **Passing a link speed check – NVMe / PCIe devices.**

After the DUT is powered up and discovered, the test queries the LSPCI command using “lspci –vv”, giving a very verbose output of the drive capabilities. Found within these capabilities is its current link speed. A drive passes this check point if the link speed is consistent as to what was expected. By default – This is the link speed a drive has at the beginning of the test.

### **Passing a lane width check – NVMe / PCIe devices.**

After the DUT is powered up and discovered, the test queries the LSPCI command using “lspci –vv”, giving a very verbose output of the drive capabilities. Found within these capabilities is its current lanewidth. A drive passes this check point if the lane width is consistent as to what was expected. By default – This is the lane width a drive has at the beginning of the test.