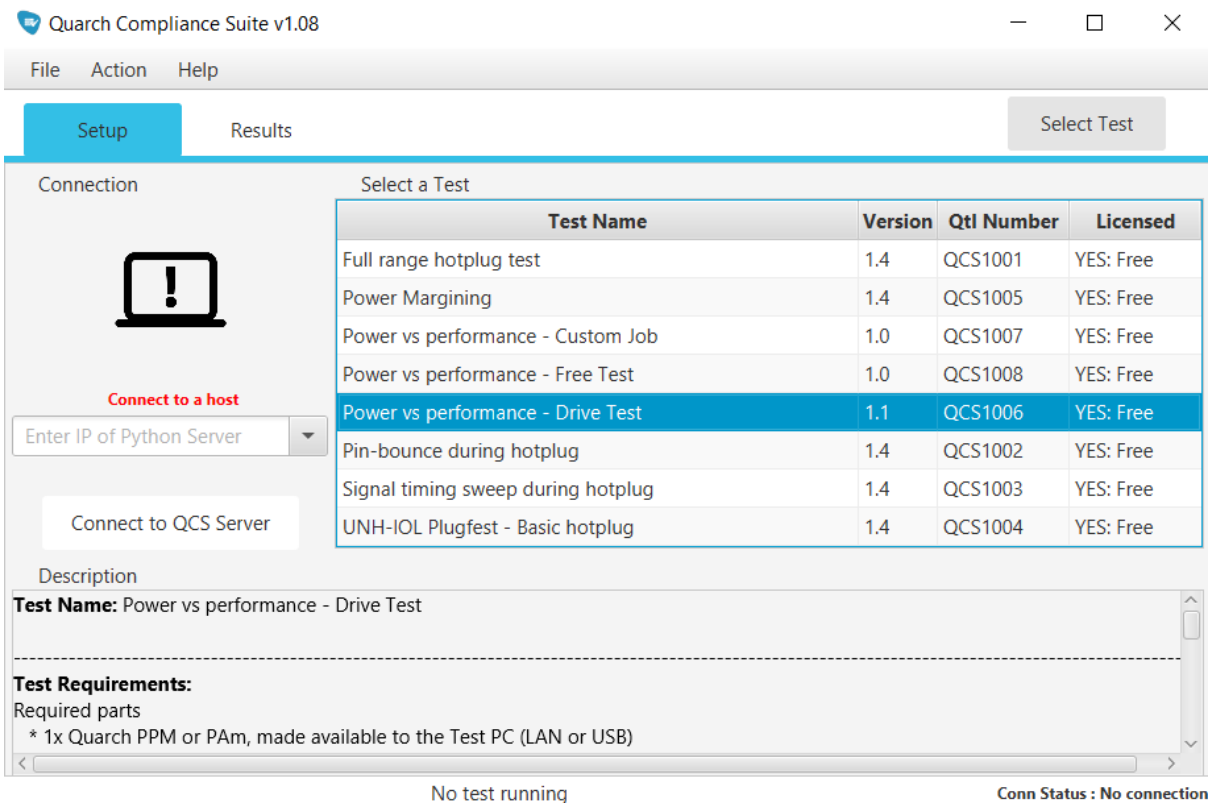
Quarch Technology Ltd

Quarch Compliance Suite

Setup & Test Specification

QCS1009 – PCIe Lane Reduction

V1.0



Change History

1.0		Initial Release

Contents

Introduction

A common use case for Quarch Module is to reduce the lane width of a module during different scenarios. In order to automate this task, Quarch has created this ‘PCIe Lane Reduction test’.

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 is supported.

Quarch breaker module.

- A PCIe breaker module is required in order to ‘turn off’ the specific signals required for this test.

Device under Test (DUT)

- Only PCIe NVMe devices are supported for this test.

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.

- Setup the Quarch PCIe Breaker module
  - Place the Quarch breaker between the DUT and host slot. Connect the ribbon cable to the Quarch Interface kit or Quarch array module. Connect this to the Host PC.
  - Power on the Quarch Module

    Choose either USB or Serial for the Quarch Breaker Module. The Module must be accessible to the **Host** PC, so be sure you cable to the right one if using USB.

    If you need to configure the breaker 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 cannot see the module and wish to check it is turned on, use TorridonTerminal to issue the command:

    ```
    > run:power up
    ```

Typical equipment layout

A typical equipment layout is shown below.

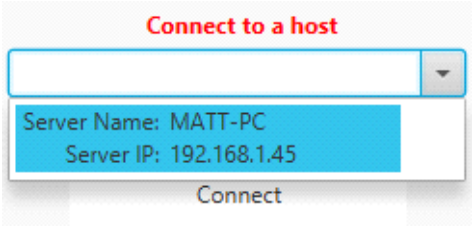
Begin the test

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

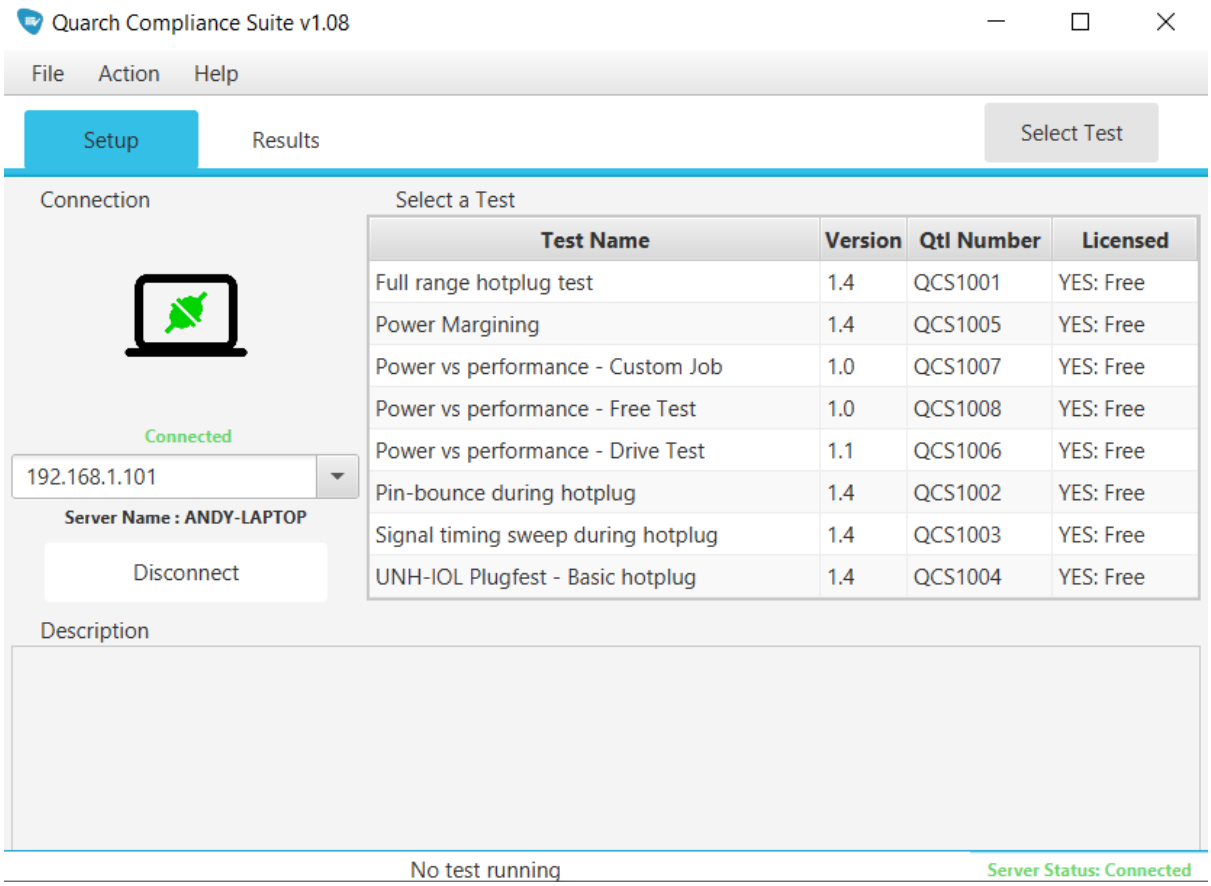
The server should start up almost immediately. Note the IP address and mDNS name which you will use to connect to the server later.

```
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 auto detect and be visible in the connection drop-down menu for fast connection.



- Select the test to run
- In this case, select the QCS1009, ‘PCIe Lane Reduction Test ‘ and either double-click or select ‘Select Test’

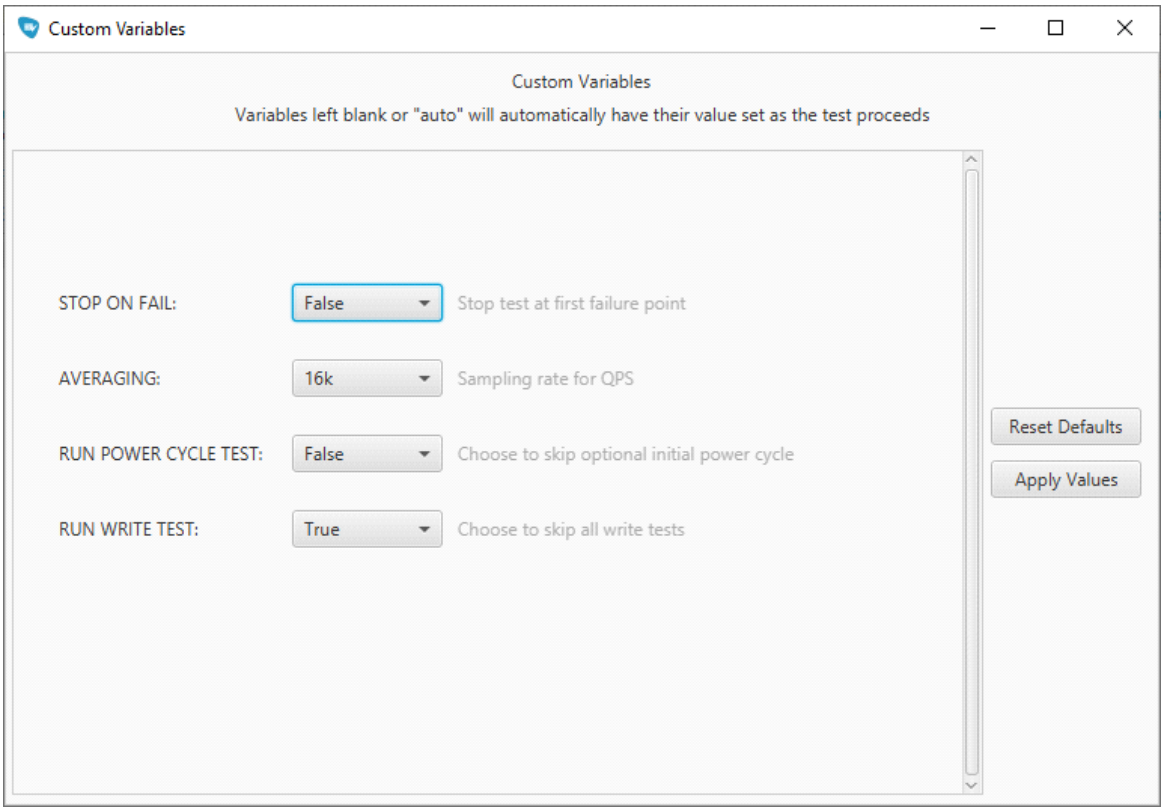


- This process can take 30 seconds or so, as the test is sent to the Server and the required applications are started on the Client.
- When the test is ready, the ‘Start/Play’ button will become available to begin running. If you want to change any setting for the test, you can do so now in the ‘Custom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

QCS1009 has several useful settings to consider:



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

Select the devices

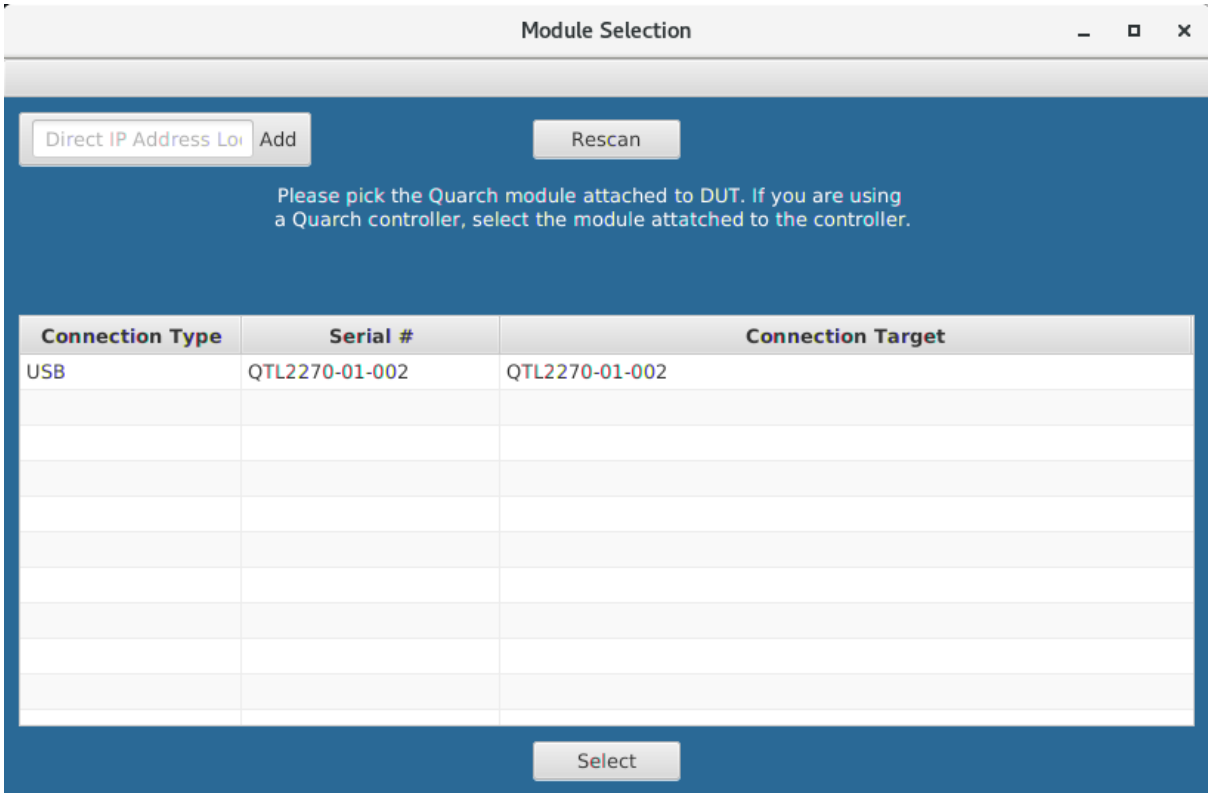
As the test starts running, you will be prompted to select the Quarch Breaker Module and storage device to use. The dialogs have a rescan button: just in case you have forgotten to plug something in!

Select the breaker module

First you will be prompted to select the Breaker Module. Here we have a QTL2270 (Gen4 PCIe U.3) module connected to the Client PC via USB.

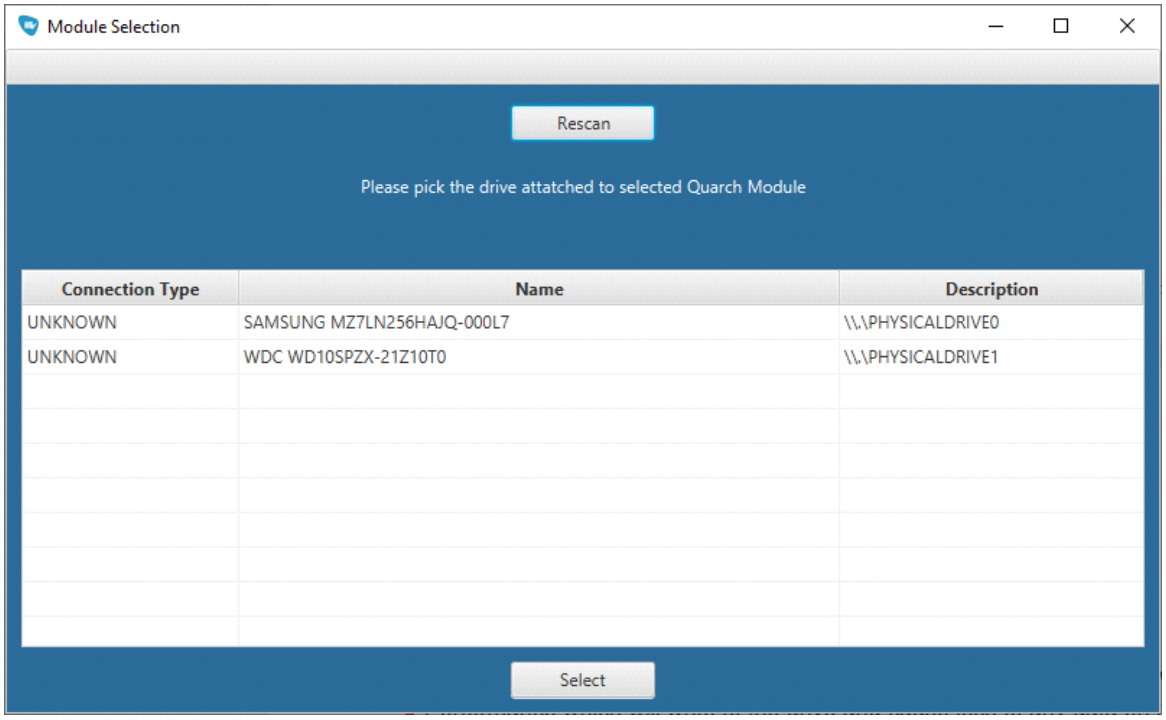
The breaker module must be available on the host PC. If it is not the test cannot be continued.

If using a Torridon Array module, make sure to select the breaker module, not the array module.



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 hotplugged.

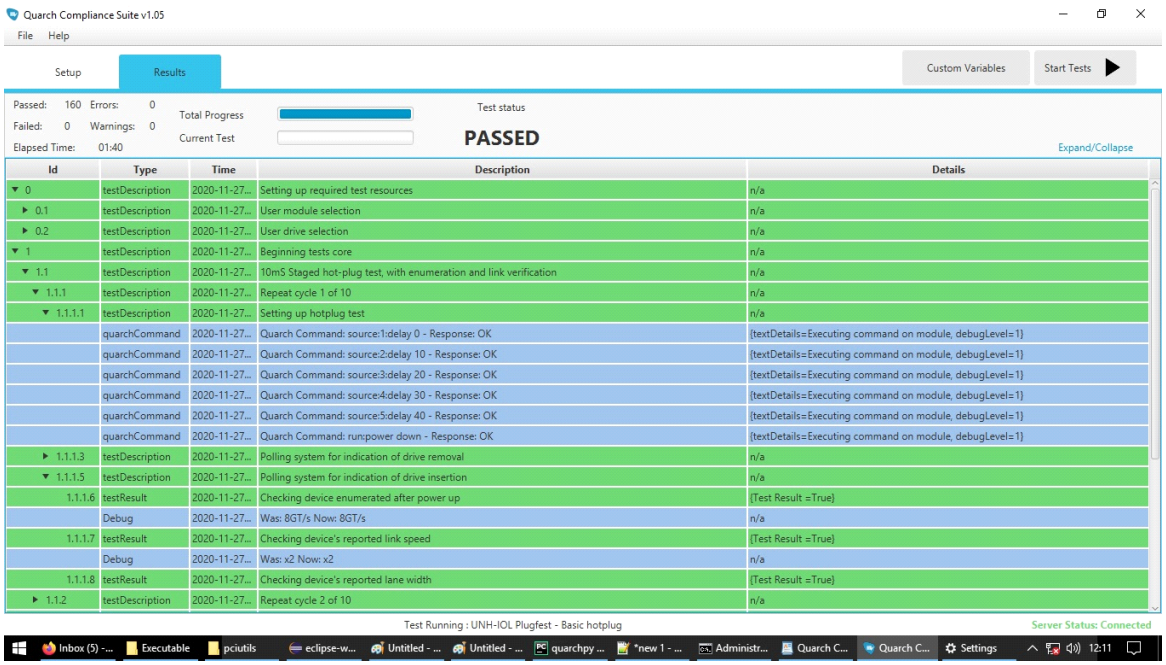
For this test, in order to run the third scenario, the user must enter a valid FIO path as a custom variable.

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.



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.

Test specification

Basis for testing

This test is PCIe only. It has been created in order to show lane width usage on PCIe drives.

Your comments, requests and suggestions are very welcome and can be directed to support@quarch.com.

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

Assumptions

We assume that the drive connected is in ‘optimal’ condition, to begin testing (ie: that it is empty and in ‘out the box’ condition).

We assume the drive under test is PCIe and is at its default lane width.

We assume the Breaker module attached is PCIe compatible with the drive.

Test itinerary

- Use Lspci to find drive’s default (starting) lane width~
- Use Quarch Module’s ‘Conf:width X’ commands to change data lanes for module.
    - This command halves the data lanes available.
      For example: ‘Conf:width 8’, would configure the module to only mate the data lanes 0-7.
- Use Quarch Modules “signal:laneX:source 0” command to remove individual data lane signals.
- For each cycle of the test, change the drive is at expected lane width
- Power cycle drive after every test to ensure drive is re-discovered on the system with its starting configurations

Test Scenarios

1. **Removing data lane groups on power up**
    a. Ensure drive Is powered on
    b. Power down drive
    c. Remove half of data lanes currently present using ‘conf:width x’ command.
    d. Power on drive
    e. Check drive width
    f. Power cycle drive, reset Quarch module and check drive is in default state.
2. **Removing upper / lower data lane of group on power up**
    a. Ensure drive Is powered on
    b. Power down drive
    c. Set the boundary of each data lane group to source 0 (Always powered off)
        i. The test removes the upper boundary signal first (e.g. Data lane 15) and tests drive’s lane width whilst this lane is removed.
        ii. This is repeated with the lower boundary signal (e.g. Data lane 8)
    d. Power on drive
    e. Check drive width
    f. Power cycle drive, reset Quarch module and check drive is in default state.
3. **Removing data lane groups whilst idle**
    a. Ensure drive Is powered on
    b. Remove half of data lanes currently present using ‘conf:width x’ command.
    c. Check drive width
    d. Power cycle drive, reset Quarch module and check drive is in default state.
4. **Removing upper / lower data lane of group whilst idle**
    a. Ensure drive Is powered on
    b. Set the boundary of each data lane group to source 0 (Always powered off)
        i. The test removes the upper boundary signal first (e.g. Data lane 15) and tests drive’s lane width whilst this lane is removed.
        ii. This is repeated with the lower boundary signal (e.g. Data lane 8)
    c. Check drive width
    d. Power cycle drive, reset Quarch module and check drive is in default state.

Passing a lane width check – NVMe / PCIe devices.

After the DUT is powered up and discovered, the test queries the LSPCI command using “lspci –vvv”, 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.