

MQP Electronics Ltd

Power Delivery Tester

USB-PDT

Guide to Performing PD Compliance Tests

25 April 2018

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1 Introduction

This is a brief introduction to the USB-PDT, specifically for running Cable E-Marker and PD Device Compliance Tests.

The USB-PDT is a Power Delivery Compliance tester.

Using the PDT-BT2-CON1 plug-in, it is capable of performing the Power Delivery Compliance Tests.



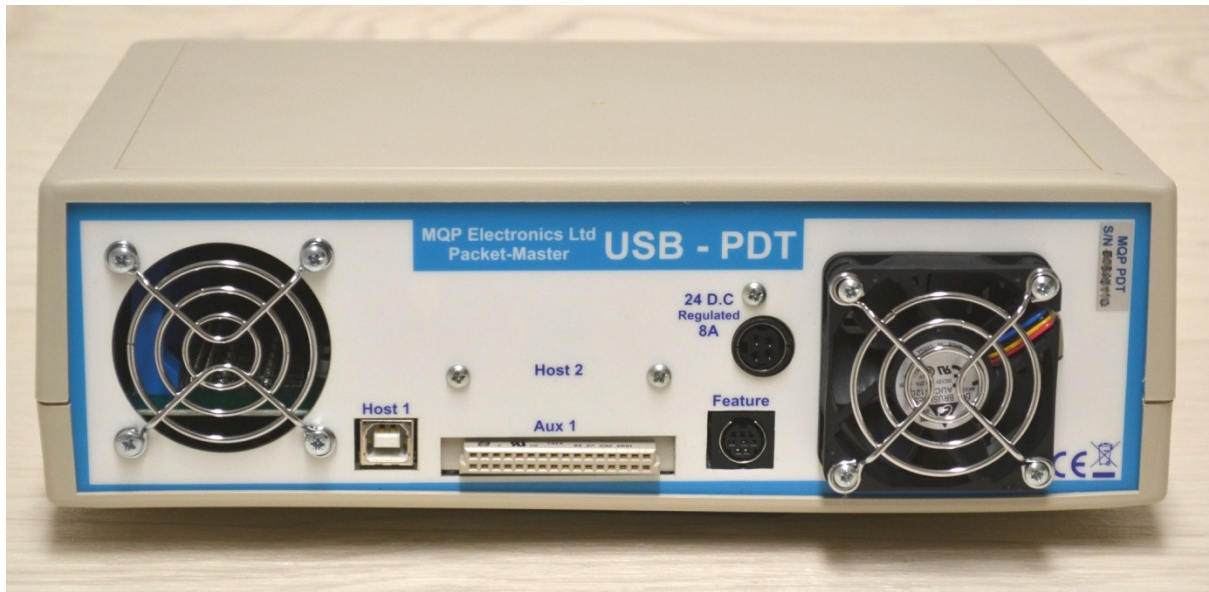
Notes: Currently the touch screen display is not a critical part of operation, but is reserved for future development.

Important: The SMA connectors provide a convenient place to access VBUS, CC1 and CC2. These are all directly connected to the signals in question, and the intention is that a high impedance oscilloscope be connected, if required. **On no account should a 50 Ohm input be connected, as it is likely that damage would result.**

2 Connecting up

The USB-PDT is powered by a 24V power adapter connected to the back of the USB-PDA by a 4-pin DIN connector. Ensure that the flat on the plug is facing away from the fan before trying to insert the plug. Damage could result from trying to force the plug in the wrong way round. Also do not attempt to force the plug into the 'Feature' connector.

The USB cable provided should be connected between the back of the USB-PDT (Host 1) and its host computer which should be running Windows.



The connectors 'Aux 1' and 'Feature' and (not-fitted) 'Host 2' are reserved for future development.

3 Installing Software

The software (GraphicUSB) is supplied on a CD, though the latest version is also available on our website www.mqp.com.

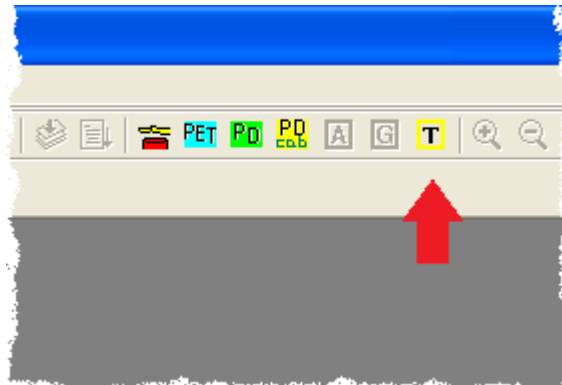
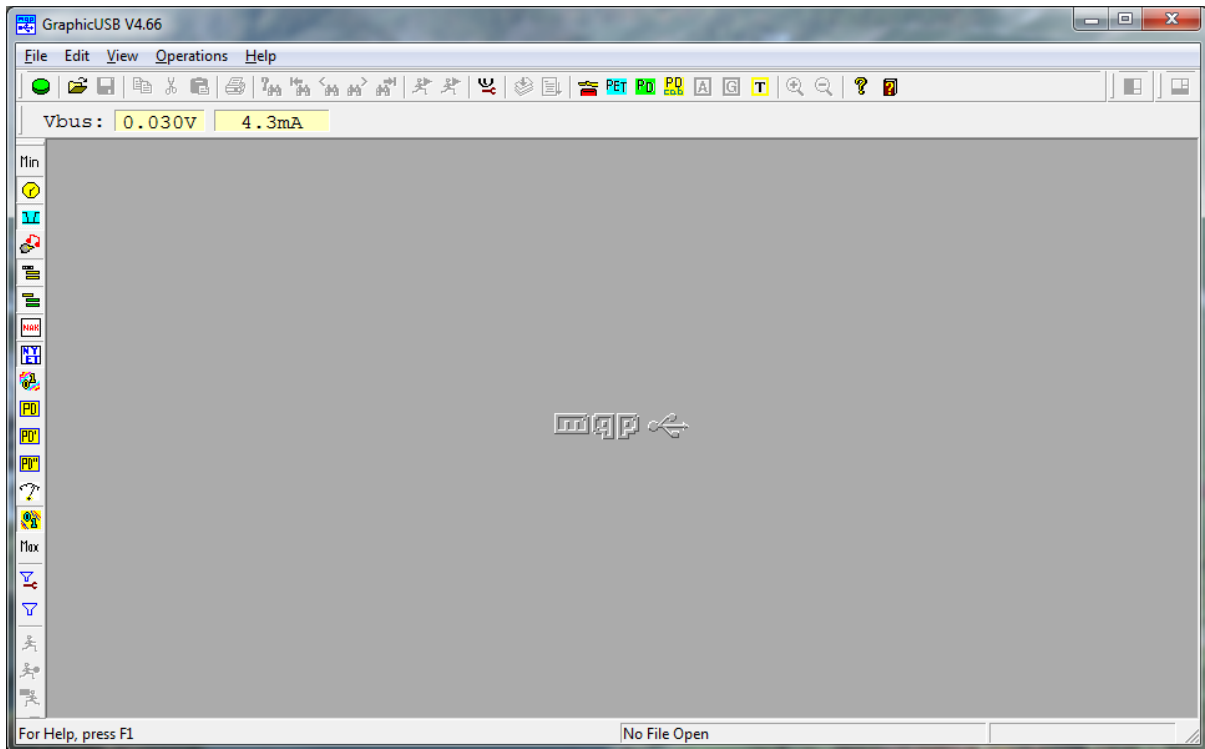
The file to run (if it doesn't happen automatically) is GraphicUSB_setup.exe .

This will also install the USB drivers for the unit.

See 6.8 for information on specifying resistance of calibrated cable.

4 Starting up

After plugging in the cables to the back of the USB-PDT, run the GraphicUSB software.



When the Tester is ready, the Tester icon on the toolbar will be lit, and the white LED on the Tester plug-in will also light.

Check that the unit (and its plug-in) has been recognised, by clicking Help...About GraphicUSB... and check that the unit shows up there and its plug-in is recognised.

5 Testing Cable Markers

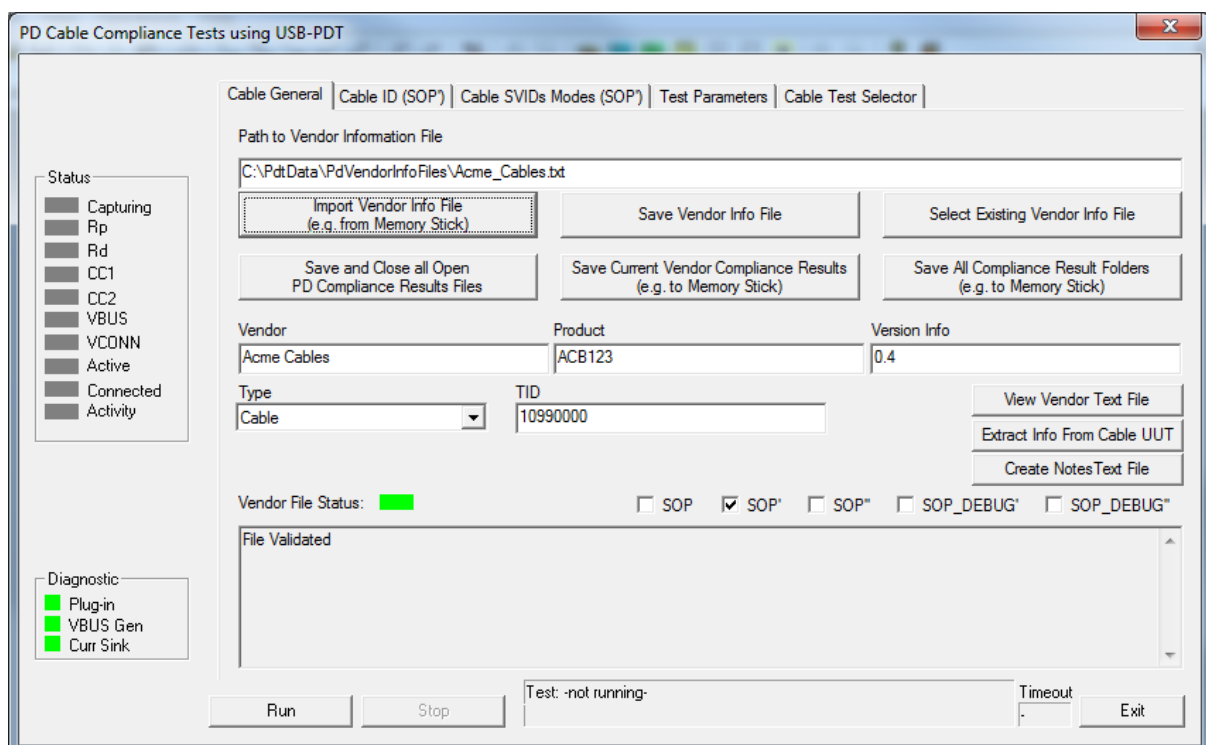
Connect one end of the Type-C Cable Under Test to the Type-C connector on the Tester plug-in. Leave the other end free. (After the test is complete, it is required that the complete test suite be run with the other end of the Cable Under Test connected.)

If the cable under test is actually a demonstration board, it must be connected to the Tester exactly as though it were a cable. This means:

- The cable used to connect the demo board must be a non-standard cable which conveys VCONN from the Tester to the demo board. (Normally VCONN is not propagated along a Type-C cable!)
- The demo board must be able to recognise, and correctly respond to VCONN being switched on and off. If this is not the case then exiting each test will not occur correctly, and the cable will fail the test.



Open the Cable Test Dialog by clicking on the yellow PD Cab icon, or by selecting Menu... Operations... PD... PD Cable Compliance...

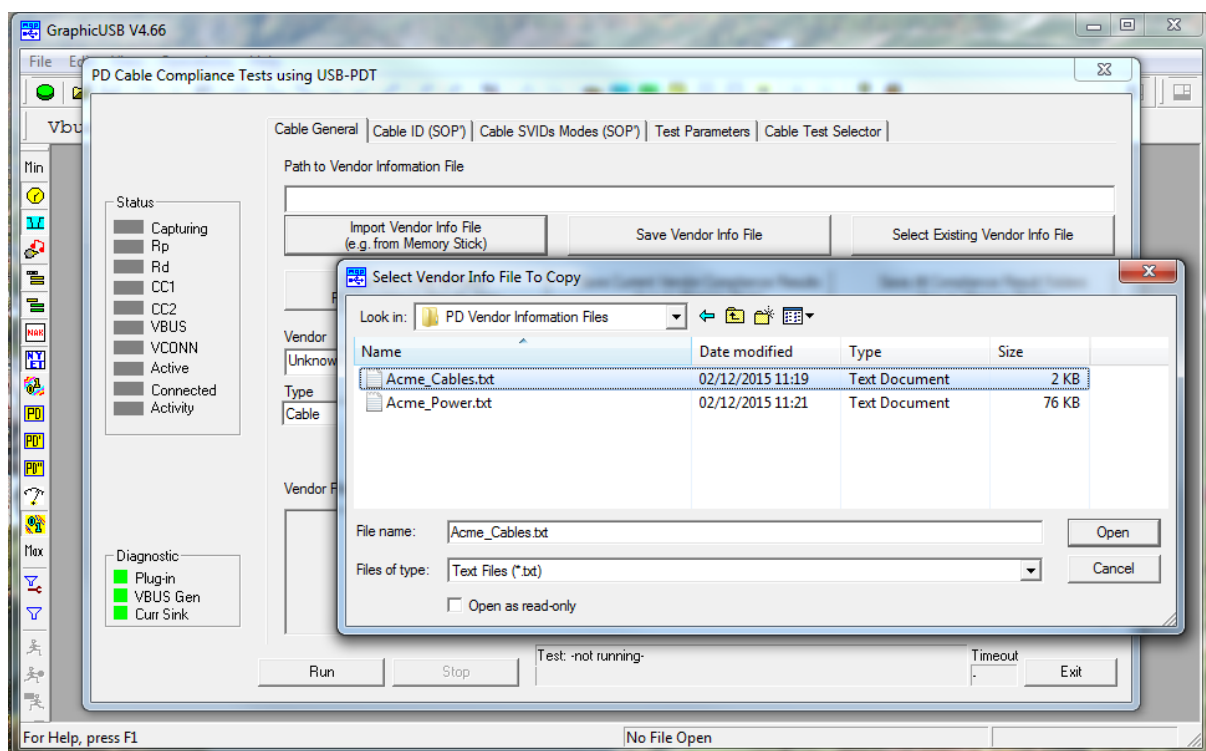


5.1 Vendor Information File (VIF)

When running compliance tests at a workshop, the vendor is expected to have provided a text file defining the characteristics of the product to be tested. This file can be produced by a USB-IF application or can equally well be generated by the GraphicUSB application. The GraphicUSB application can also be used to make a correction to the VIF. This should only be done with reference to the rules in effect at the workshop in progress. It will probably always be necessary to one particular modification; the TID, which is not usually known by the vendor when they run the VIF generator application. It is important that this is corrected before running the tests, so that the report can contain the TID reference.

For now we assumed that the vendor has supplied the file on a memory stick.

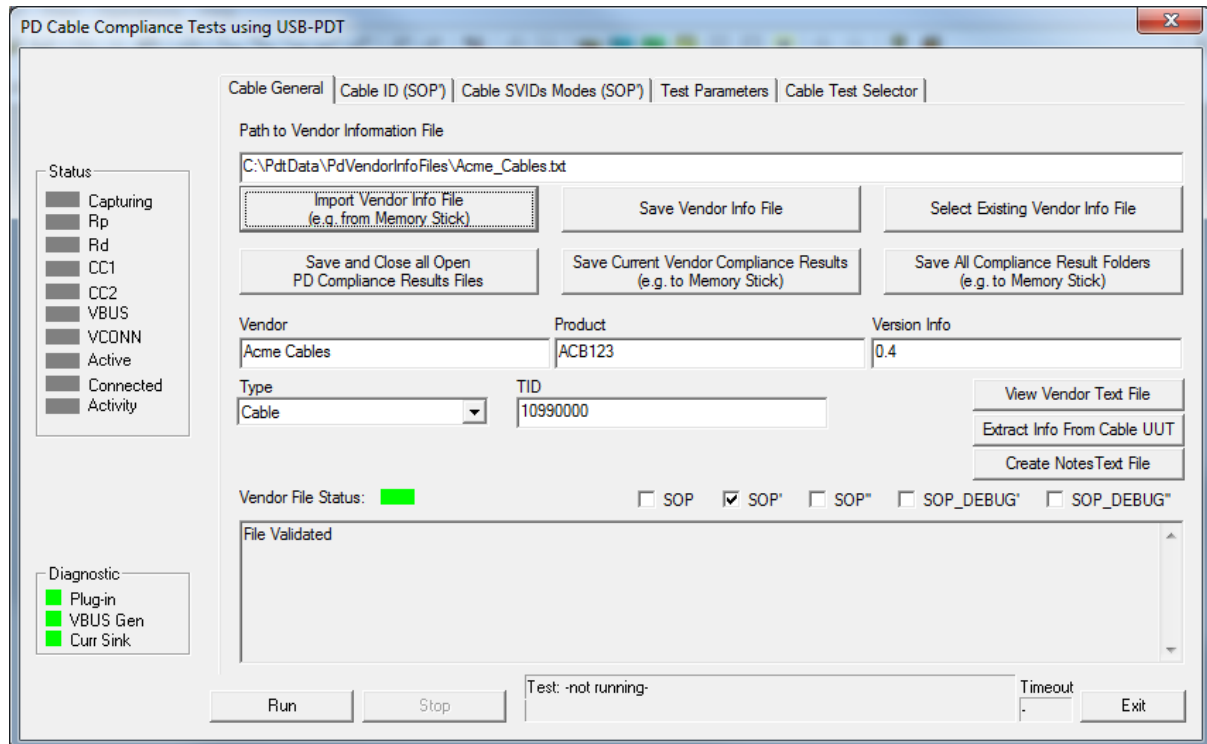
Click on the 'Import Vendor Info File (e.g. from Memory Stick)' button.



Use the File Dialog to locate the VIF, and click on 'Open'. The file will be copied to a location used by the GraphicUSB app ([data files]\PdVendorInfoFiles\), and read in.

5.2 General Information Tab

The contents of the file will be validated, and the result shown in the bottom window. This report will describe any problem with the file, to enable easy correction. 'Path to Vendor Information File' will show the internal location allocated by the version of Windows in use.



After correcting the TID, use the 'Save Vendor Info File' button, maintaining the suggested file name and location.

At this point, during a Workshop, it is recommended that you also use the 'Create Notes Text File' button. This creates a pre-initialised text document for making any observations about the testing. The file appears in the main window below this dialog. On saving, maintain the suggested file name and location.

The boxes under the buttons show the general characteristics of the vendor information file:

- Vendor Name
- Product Name
- TID
- UUT type (must be 'Cable' in this case)
- SOP* types which will be responded to with GoodCRC messages

5.3 Discover ID Tab

PD Cable Compliance Tests using USB-PDT

Cable General | **Cable ID (SOP)** | Cable SVIDs Modes (SOP) | Test Parameters | Cable Test Selector

Status
 Capturing
 Rp
 Rd
 CC1
 CC2
 VBUS
 VCONN
 Active
 Connected
 Activity

Diagnostic
 Plug-in
 VBUS Gen
 Curr Sink

VDM Header
 Struct VDM Ver: V1.0

ID Header
 Data As Host: NO | Data As Dev: NO | Product Type: Passive Cable | Modal Operat: NO | USB VID: 1D5C

Cert Stat
 XID: 0

Product VDO
 USB PID: 7001 | bcdDevice: 0

Cable VDO - SOP
 HW Vers: 0x1 | FW Vers: 0x3 | C to Type ABC: TYPE-C/Captive | C to Plg/Recept: Plug/Captive | Latency: <10ns

SSTX1 Dir Sup: NO | SSTX2 Dir Sup: NO | SSRX1 Dir Sup: NO | SSRX2 Dir Sup: NO | Term Type: Boths ends Pass. VCONN reqd

VBUS Curr: 3A | VBUS thru Cable: YES | SOP" Controller: NO | Superspeed: USB3.1 Gen1, Gen2 and USB 2.0

Run | Stop | Test: -not running- | Timeout: | Exit

The parameters associated with:

- The VDM Header
- The ID Header, and
- The Cable VDO

can be viewed in the second tab, 'Cable ID'.

The third tab, 'Cable SVIDs, Modes' shows the SVID and Mode information provided by the vendor.

5.4 SVID Tab

PD Cable Compliance Tests using USB-PDT

Cable General | Cable ID (SOP) | Cable SVIDs Modes (SOP) | Test Parameters | Cable Test Selector

Status

- Capturing
- Rp
- Rd
- CC1
- CC2
- VBUS
- VCONN
- Active
- Connected
- Activity

Diagnostic

- Plug-in
- VBUS Gen
- Curr Sink

☐ SVID List Fixed and In Order

Lowest number of SVIDs ever returned in Get SVIDs ACK:

Highest Number of SVIDs ever returned in Get SVIDs ACK:

No. of SVIDs defined:

SVID to view:

SVID Value (h):

☐ Mode List Fixed and in order

Lowest Number of Modes ever returned in Get Modes ACK:

Highest Number of Modes ever returned in Get Modes ACK:

No. of modes defined for SVID:

Mode to view:

☐ Enterable

Recognition Mask:

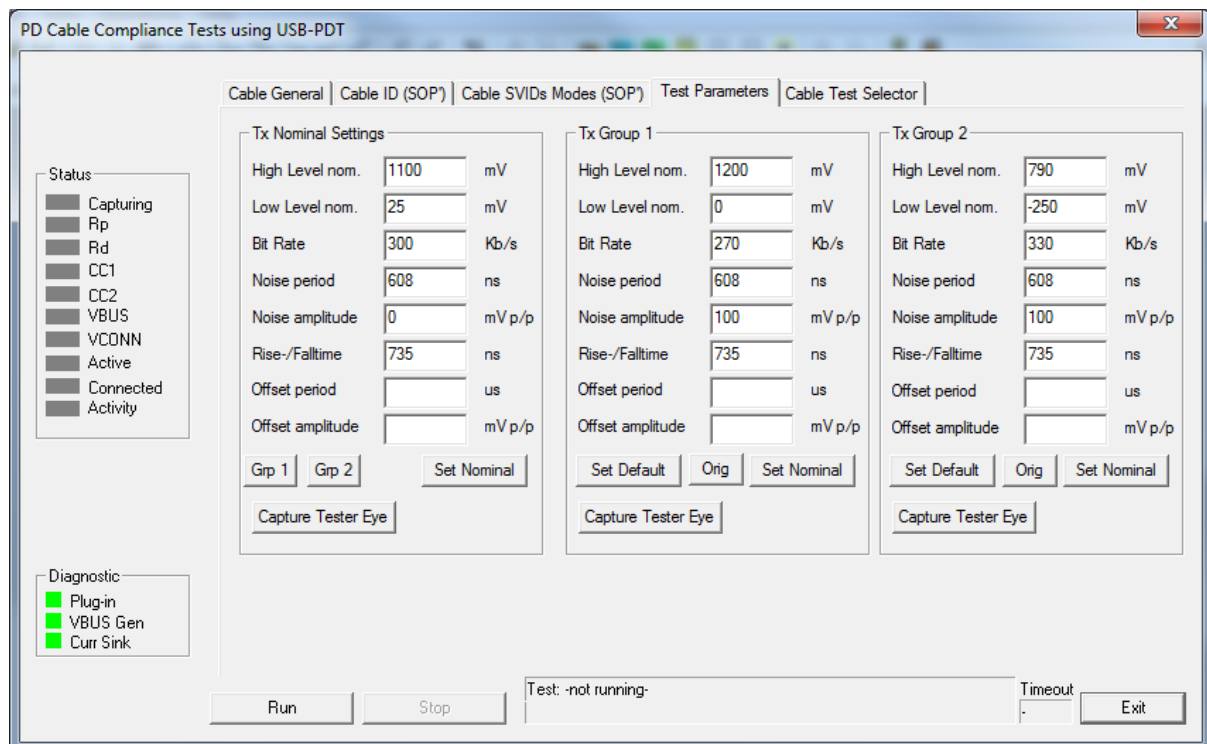
Recognition Value:

Buttons: Delete, Insert Before, Add, Delete, Insert Before, Add

Run Stop Test: -not running- Timeout: Exit

Note that these controls may be used to modify the vendor information file, see section on modifying vendor information.

5.5 Test Parameter Tab



The fourth tab is for the 'Test Parameters'.

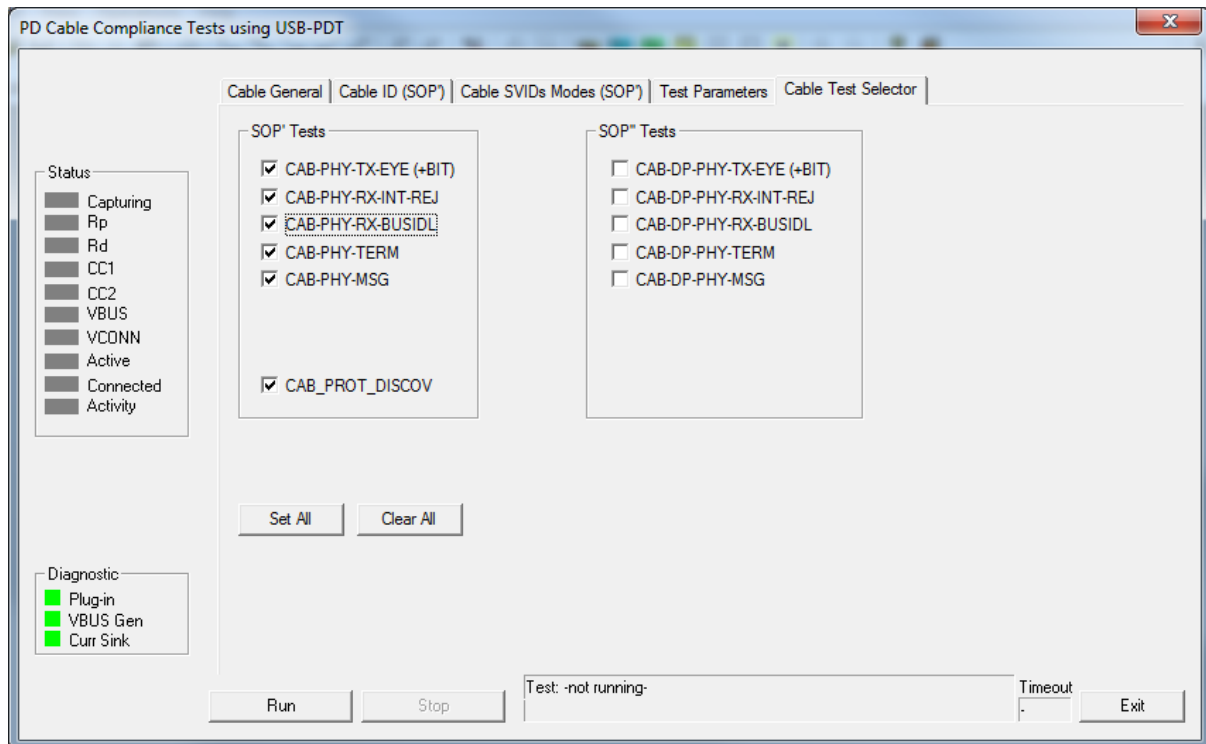
The Tx parameters define the waveform sent by the Tester transmitter:

- under normal conditions
- while sending BIST messages during PHY-TX-INT-REJ Group 1 noise testing
- while sending BIST messages during PHY-TX-INT-REJ Group 2 noise testing

The Capture Tester Eye buttons allow the generated waveform to be displayed. This is useful as a double check on calibration. Before clicking on this button, ensure that nothing is connected to the plug-in panel.

The parameters relating to group 1 and 2 noise default to the Compliance Plan values, but may be altered during development to alter the stress on the receiver.

5.6 Cable Test Selector Tab

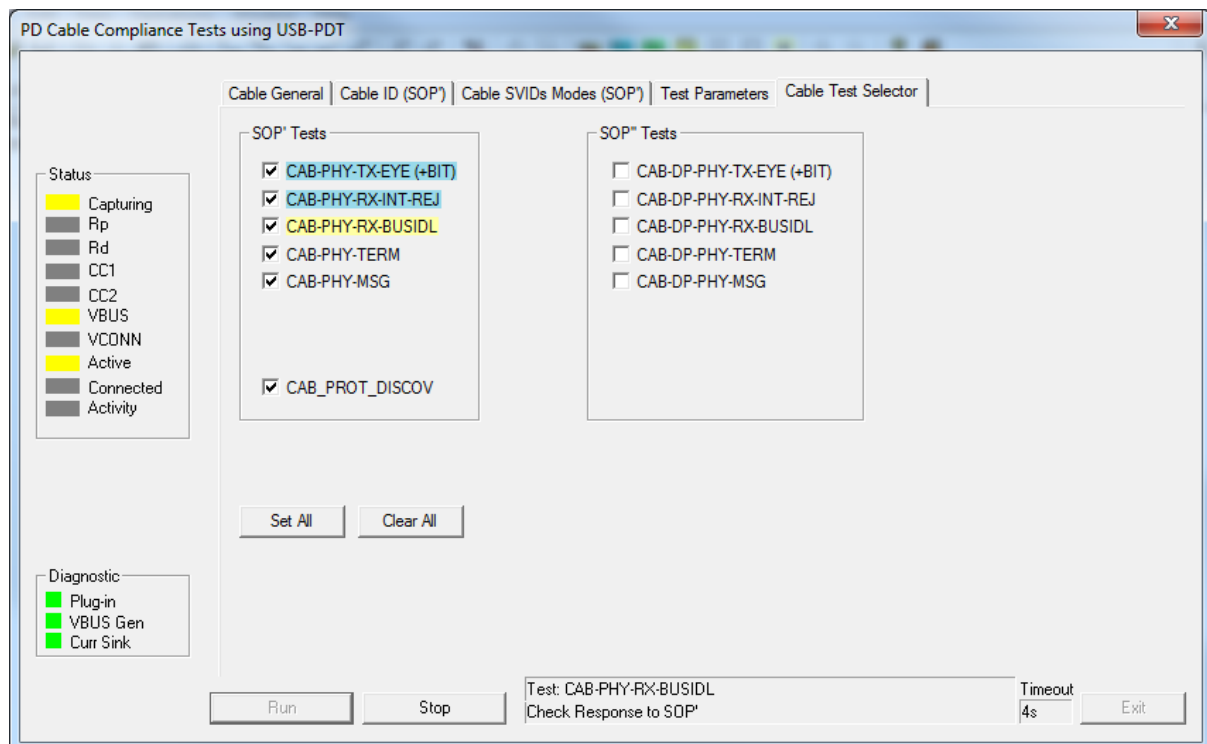


The last tab shows the selected tests (set on reading in the vendor file). Typically the SOP' tests will all be selected, and none of the SOP'' tests.

This actually depends on the setting of the 'SOP'' Controller Present' bit in the vendor file. To avoid running the SOP'' tests in this case, simply disable that bit (second tab), and resave the vendor info file, before re-running the test.

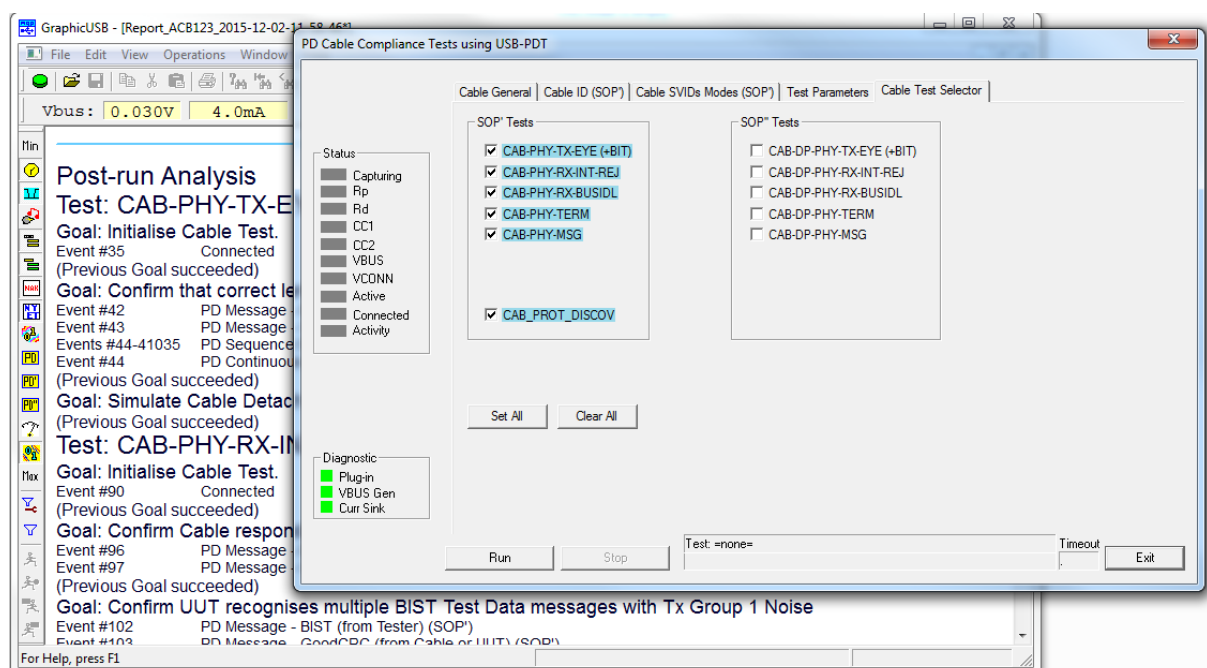
Any test may be enabled or disabled, in the dialog above. This may be useful if a certain test fails to complete for some reason.

5.7 Running the tests



Click on the 'Run' button (bottom left). This will start the test running and the test name and progress will be indicated at the bottom of the dialog. Test names will be colour-highlighted as they are run and completed.

Allow the test to run to completion before clicking on anything. This will be indicated by the Exit button being re-enabled.

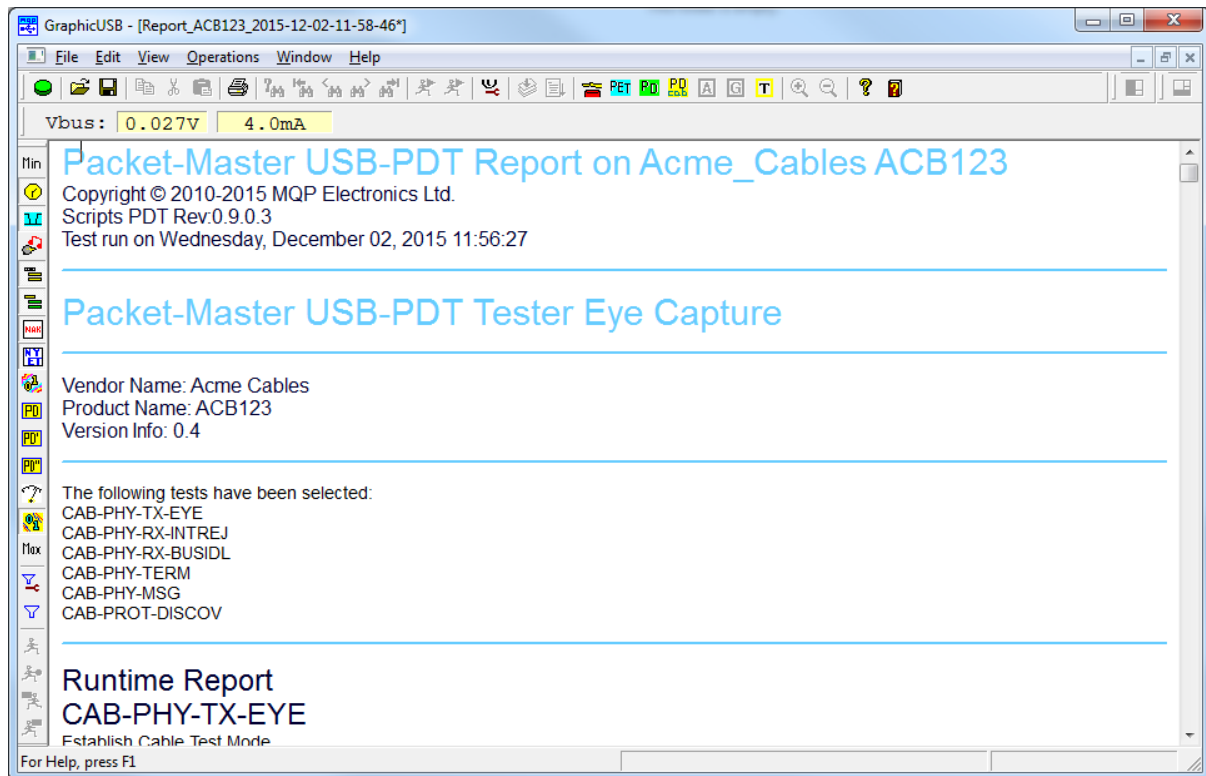


When the tests have completed, click on 'Exit'.

The test run will have created two documents:

- an HTML report
- an MQP Capture file (.mqu)

5.8 HTML Report



The HTML report comprises a number of sections:

- Header information describing
 - the test software version
 - the product being tested
 - The actual tests to be run
- Runtime Report

This is a description of the real time procedures. Some of these may result in test failures.
- Post-run Analysis Report

This is an analysis of the Analyser Capture file taken during the test run. The Capture file stores every PD event which occurred, together with embedded 'Goals'. The file is analysed for :

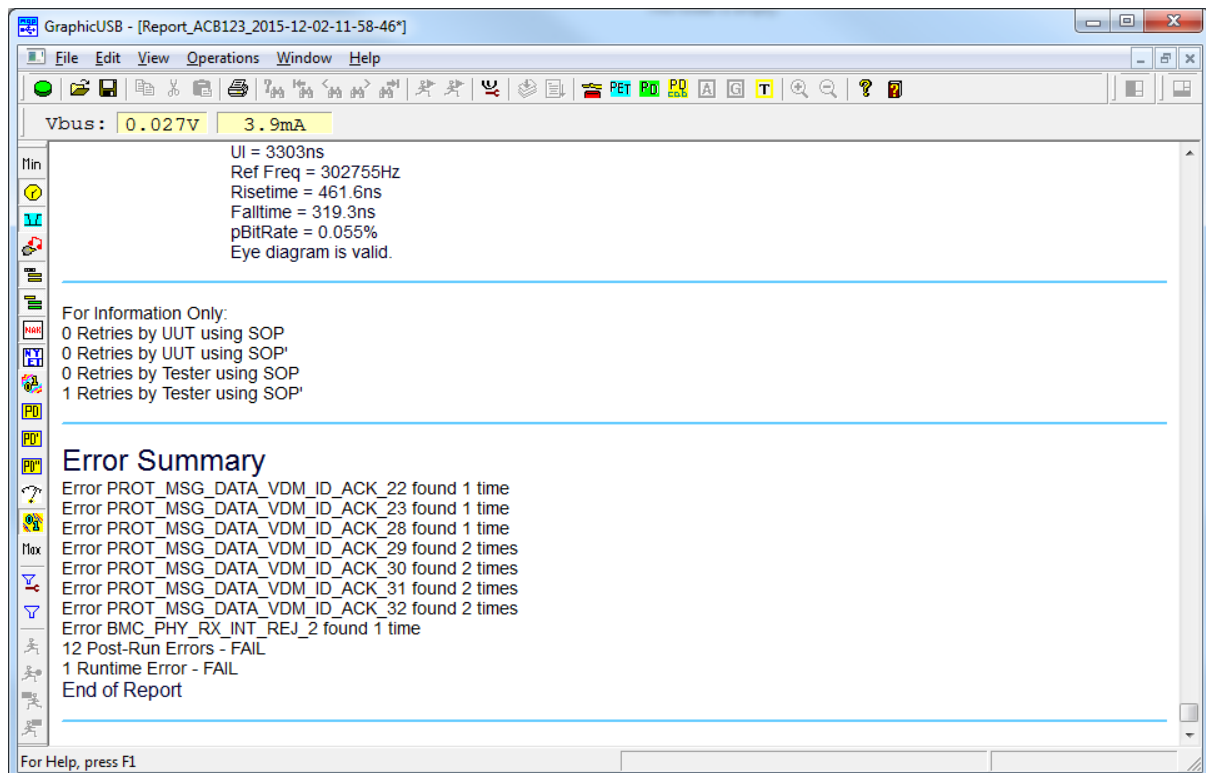
 - PD timing errors
 - PD protocol errors
 - valid usage of all parameter fields
 - match of all parameter fields with vendor supplied information
 - whether embedded test goals have been achieved

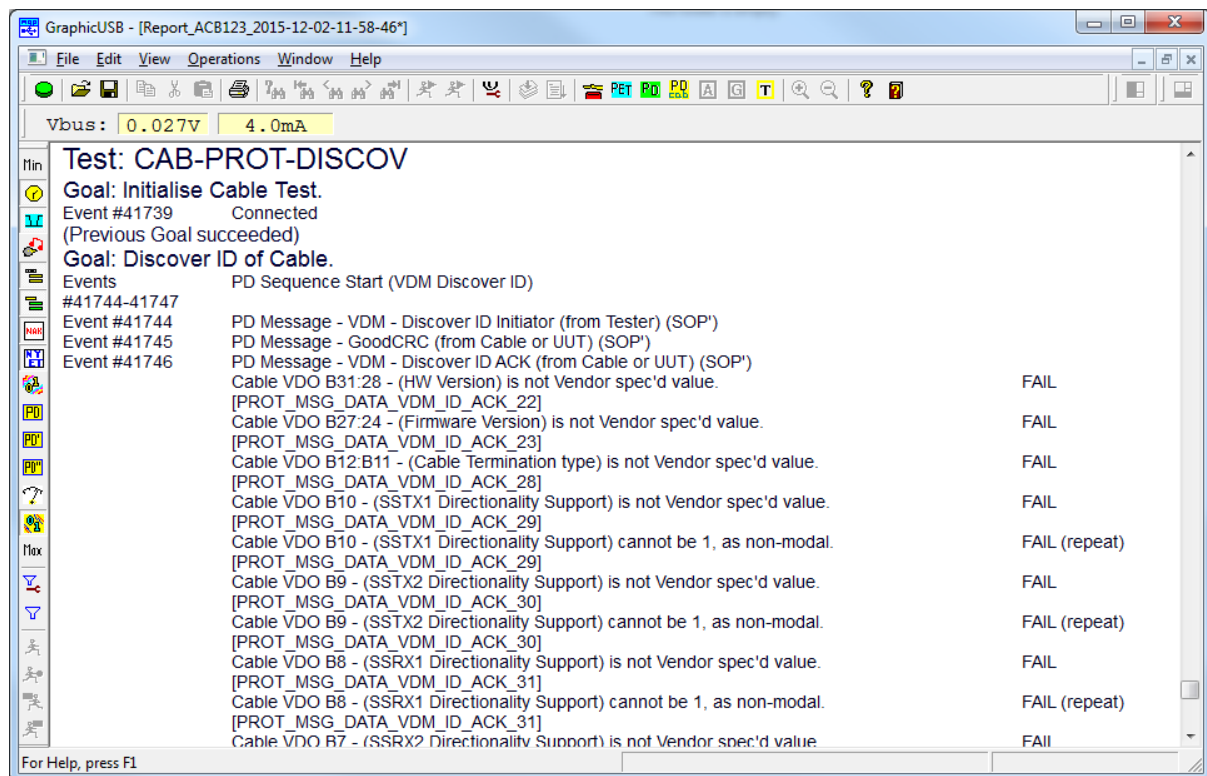
Every PD message is reported on in the Post-run Analysis Report (with the exception of multiple messages sent during the Interference Rejection tests).

At the end of the Post-run Analysis Report is a text summary of the Eye Diagram Scope report. This is sufficient to define Pass versus Fail for these PHY tests, but viewing the actual Scope capture (See below under Capture File) will always be beneficial.

- **Error Summary**

This lists the number of errors found, both run-time and post-run. Unless there is a good reason to decide otherwise, any error will result in a test failure.

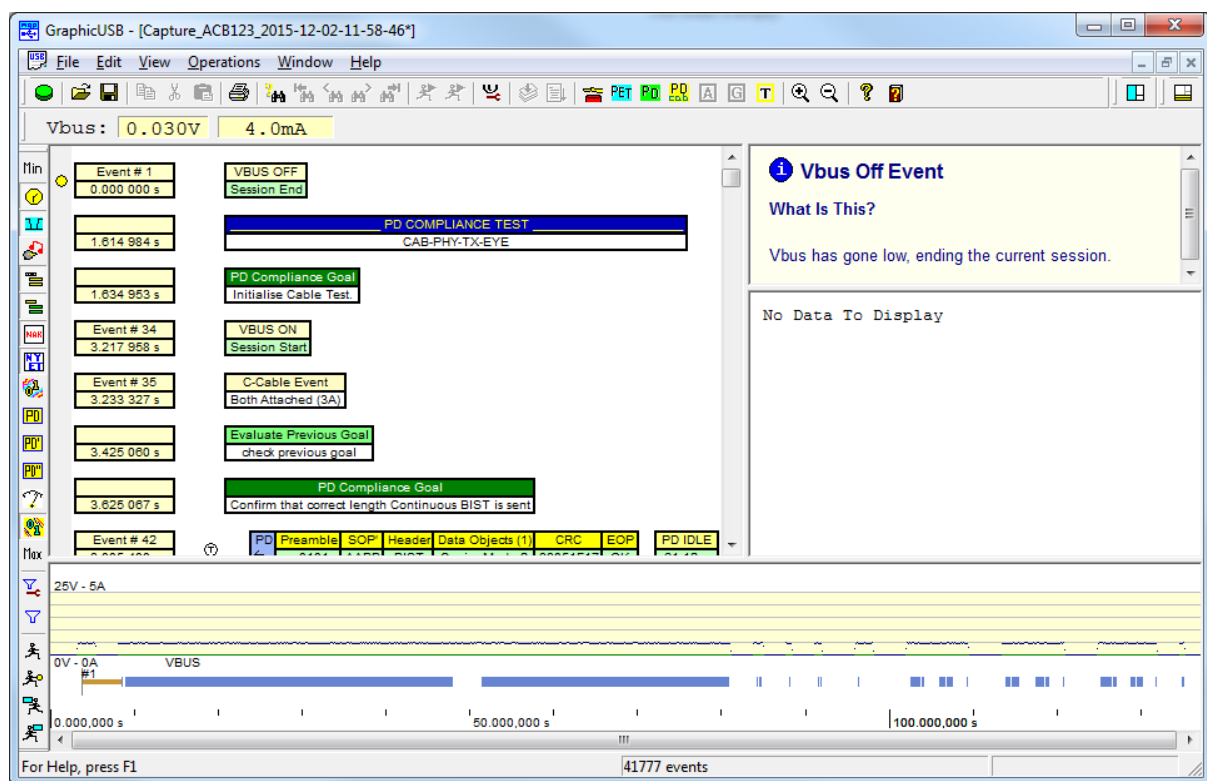




In the event of an error being found, it is reported in a manner similar to the example shown above. The word 'FAIL' will appear in the right hand column of the report.

To the left of this the error is described, both in words, and also by reference to the error code defined in the Compliance Plan. Searching the Compliance Plan for this code will reveal the exact clause which has been violated.

5.9 Analyser Capture Report



Underneath the HTML report (use menu item Window... to find it) is the Analyser Capture report.

The left hand pane shows the PD events (use Min and Max to reveal more or less detail).

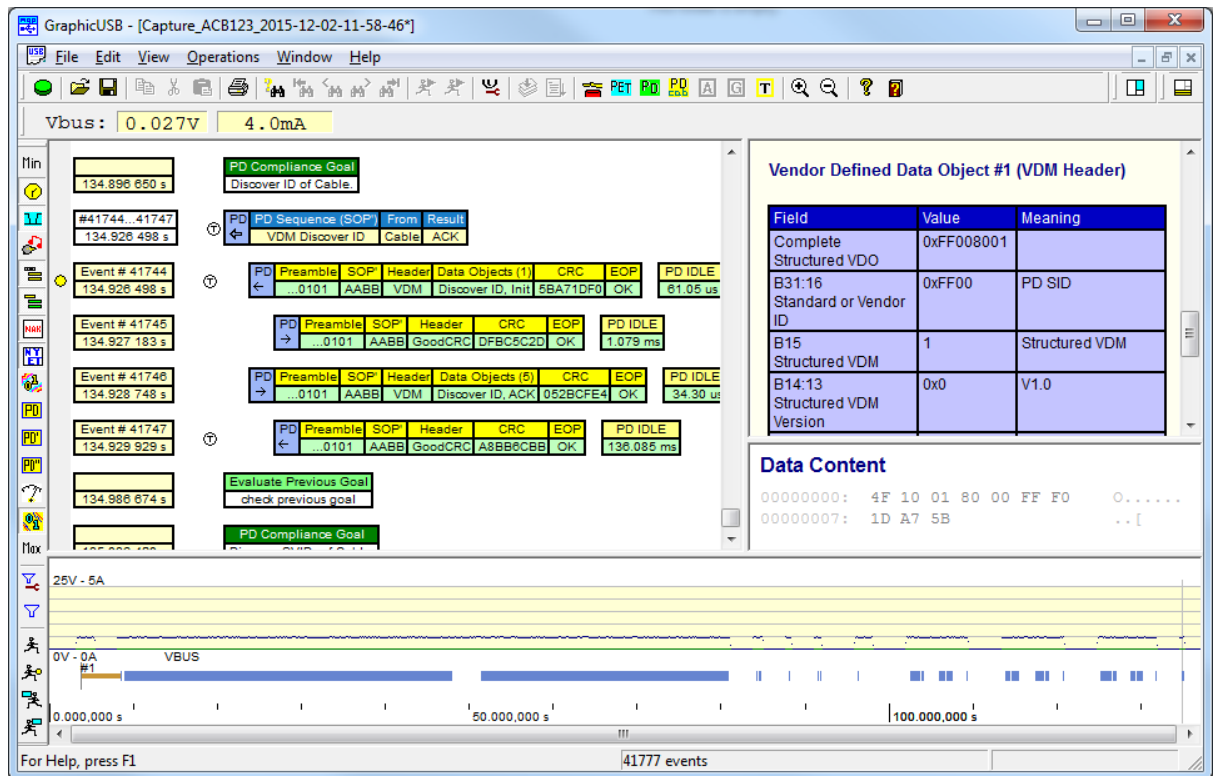
The top right hand (Detail) pane gives an analysis of the event selected in the event pane.

The pane below the Detail pane shows any data involved in the event selected.

The bottom pane shows a zoomable timeline of all the events in the complete capture.

In the example above can be seen the BIST continuous waveform on the left (in brown), followed by two long blue lines (each containing 13000 BIST test messages during the Interference Rejection test), followed by various other PD messages from the other tests.

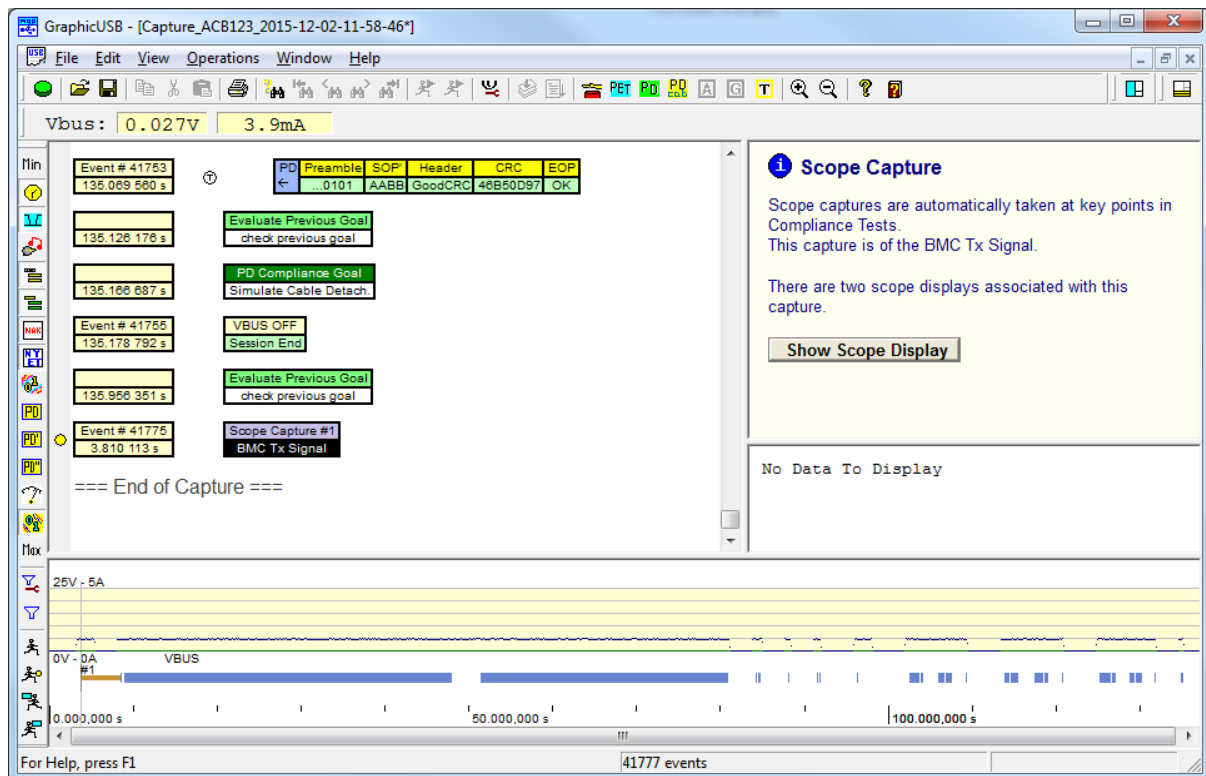
Above that is a simple representation of VBUS, going between 0 and 5V.



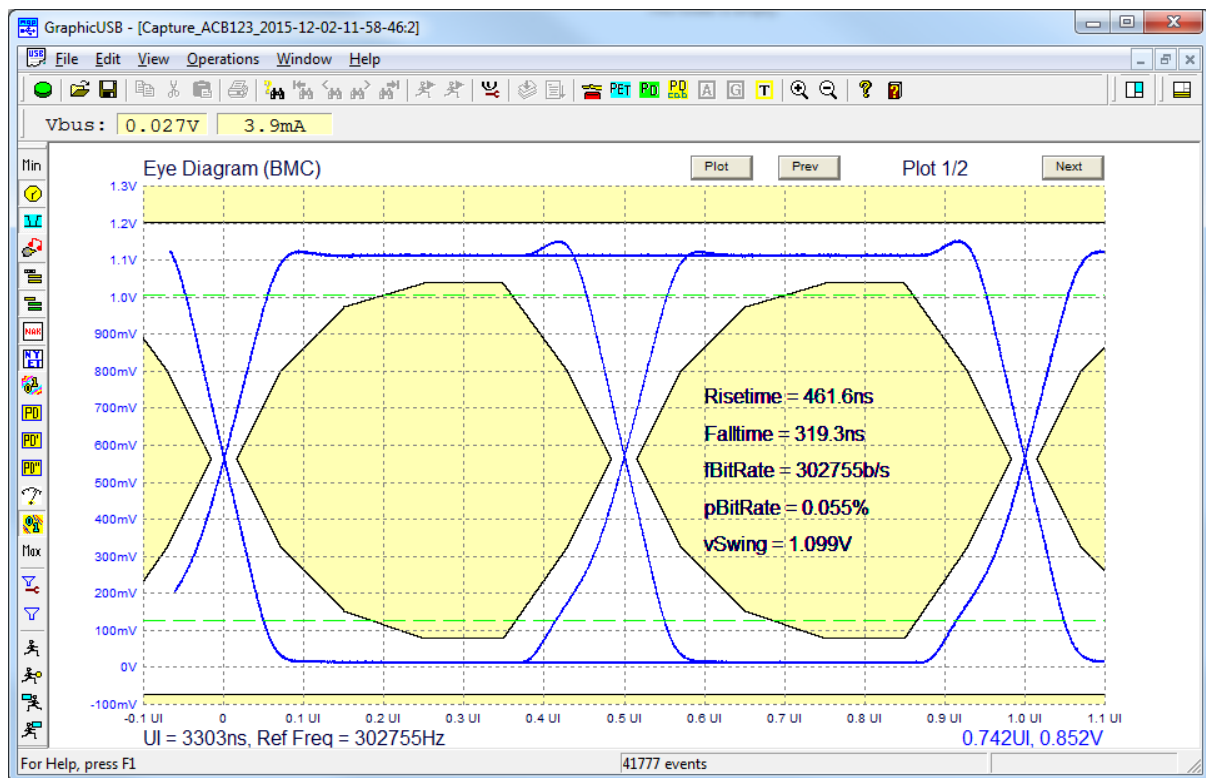
The capture file shows a complete analysis of the PD messages which were transferred. Any general error will be shown by the use of an orange or red coloured area in the appropriate pane. Such errors will be detailed in the Details pane.

Use the Details pane to examine every aspect of the messages captured.

5.10 Viewing Scope Captures



At the bottom of the Event pane is the Scope Capture event. This always comes at the end, if present. To view the scope capture, click on the Scope Capture event, then on the Show Scope Display in the Details pane.

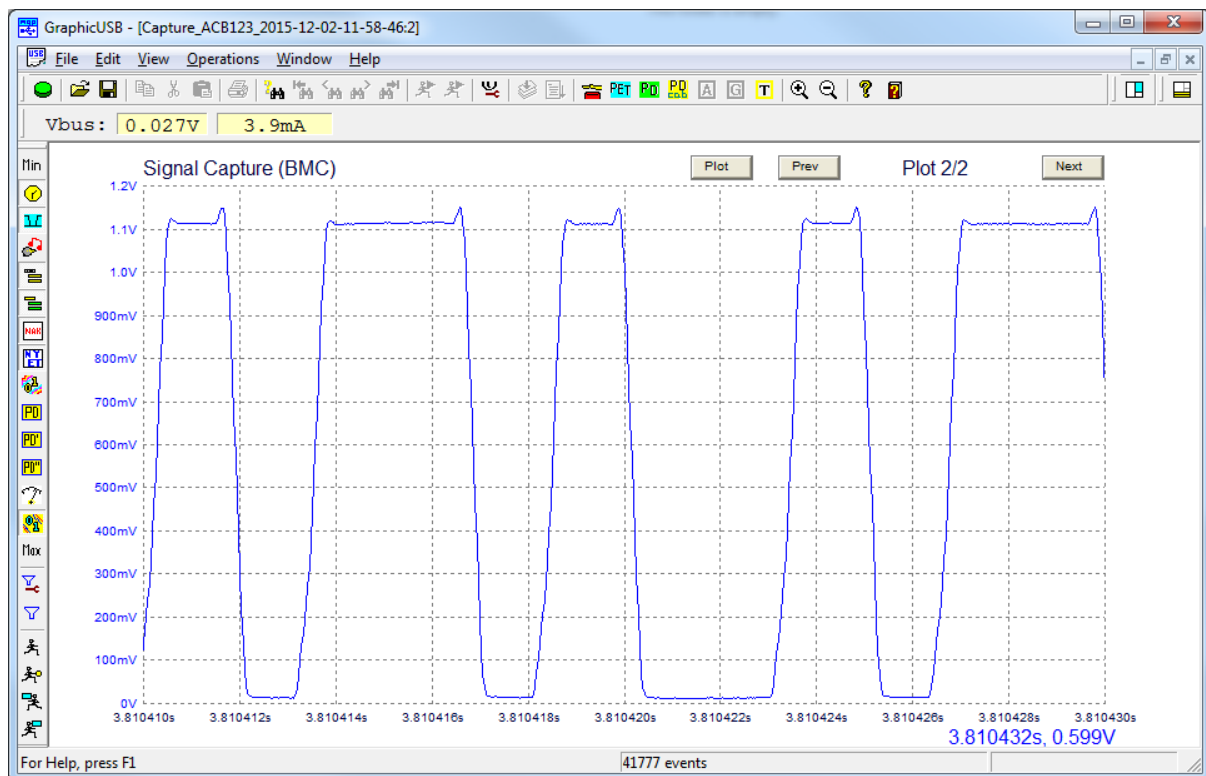


The requirement to pass this test are:

- that the plot does not cut through the mask (and thereby show in red)
- that the risetime and falltime do not show in red
- that the tBitRate and pBitRate do not show in red

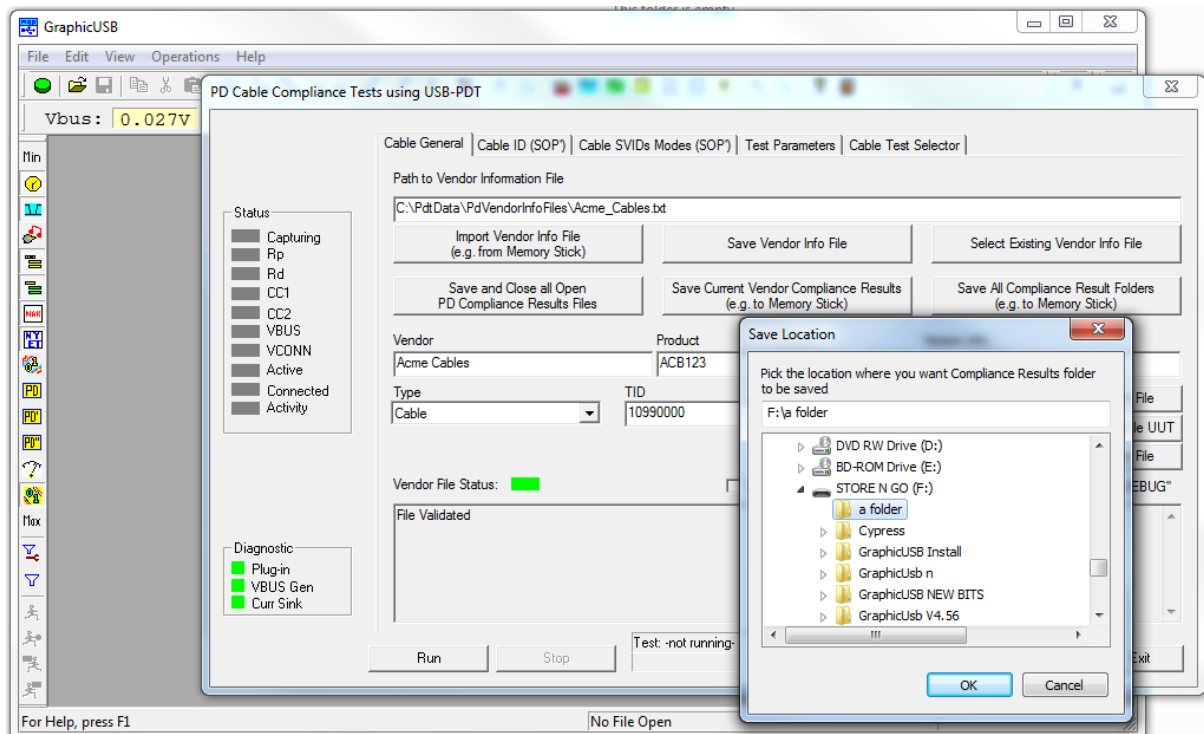
Further more the following should be observed:

- The crossing point at the centre should have a vertical position as close to 0.55V as possible. This assists in providing the maximum possible chance of avoiding the mask
- The left and right excursions should preferably not show more than one crossing point, or these points should have the smallest possible x distance. This results from the 1s and 0s having similar waveforms. If this is not the case, then meeting the eye diagram is made more difficult.



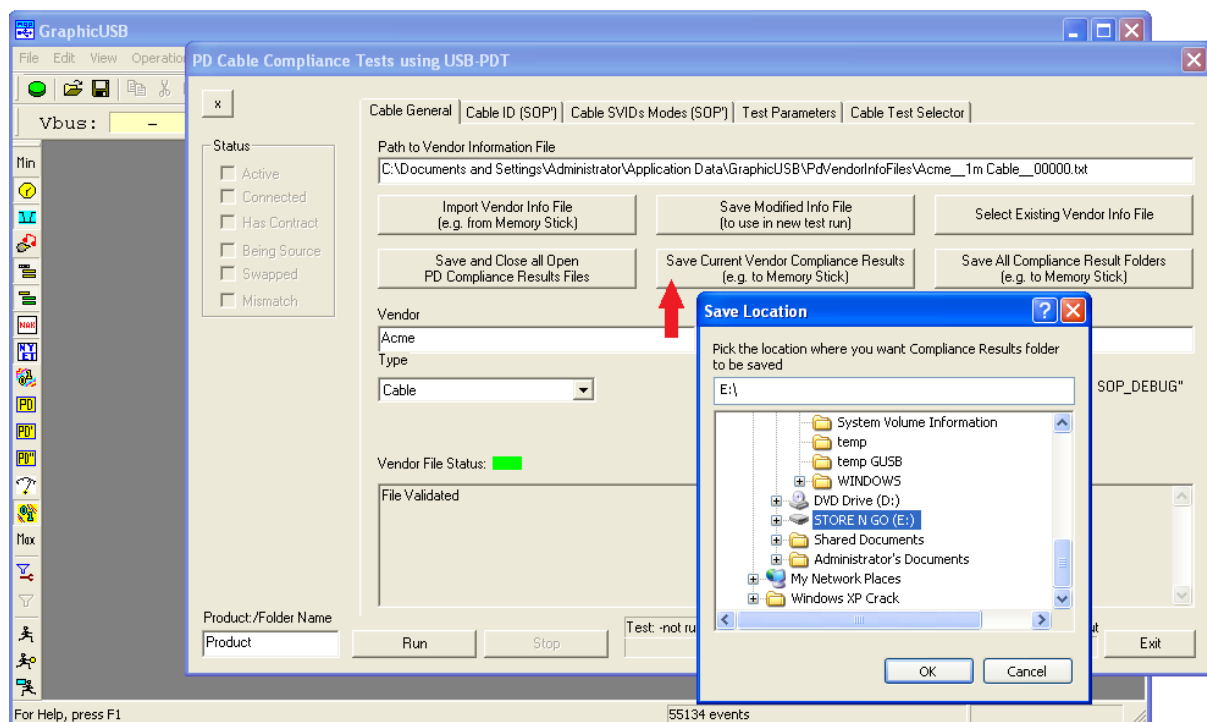
The second plot available is not required for compliance, but shows the actual BMC data waveform captured, and used to build the eye diagram.

5.11 Saving the Results Files To Disk



After viewing the report and capture documents it is required to close and save them for the record. To do this click on the 'Save and Close all Open PD Compliance Files' button. The open documents will be closed, and saved in a folder built from the Vendor name and the Product Name ([data files] \[vendor]\[product]).

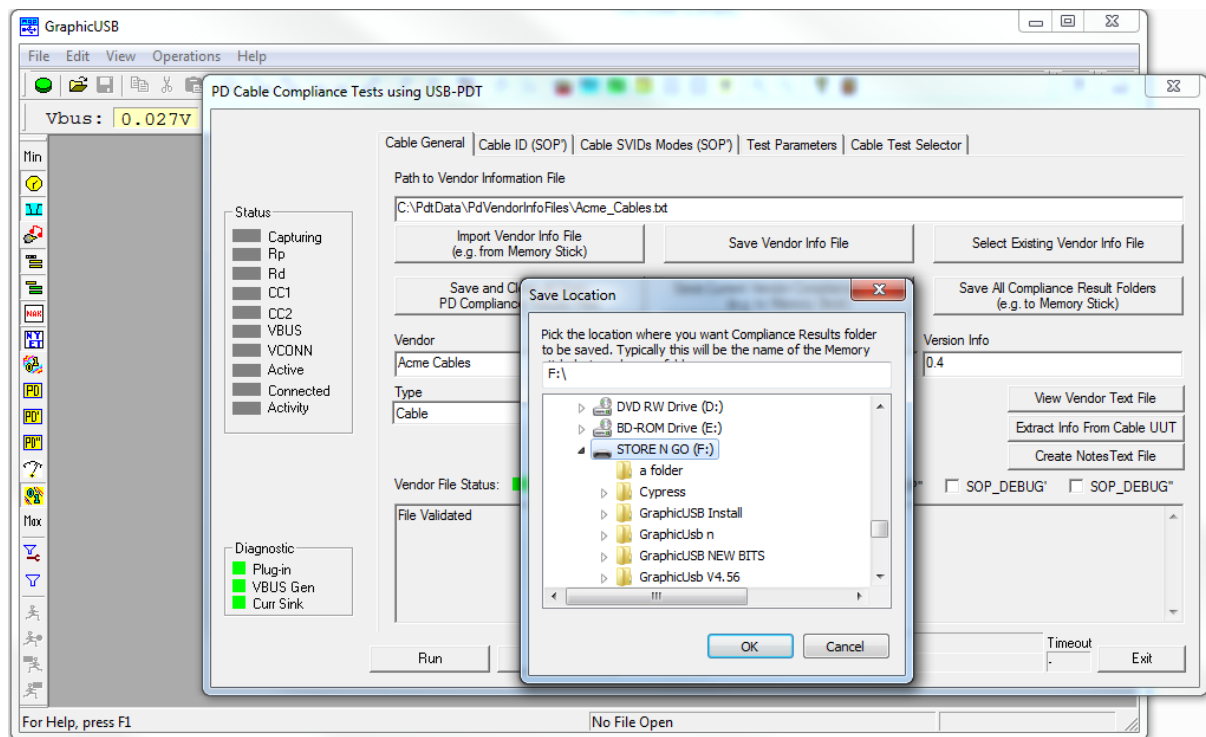
5.12 Providing Vendor with Results Files



In order to provide the vendor with the files which have been captured for his product, insert his Memory stick into a suitable USB socket, and click on the 'Save Current Vendor Compliance Results (e.g. to Memory Stick)' button (see picture above).

In the dialog which appears, locate the memory stick name. Click on OK. The files will be copied to a unique folder on the memory stick. The vendor can then take away these files on his stick.

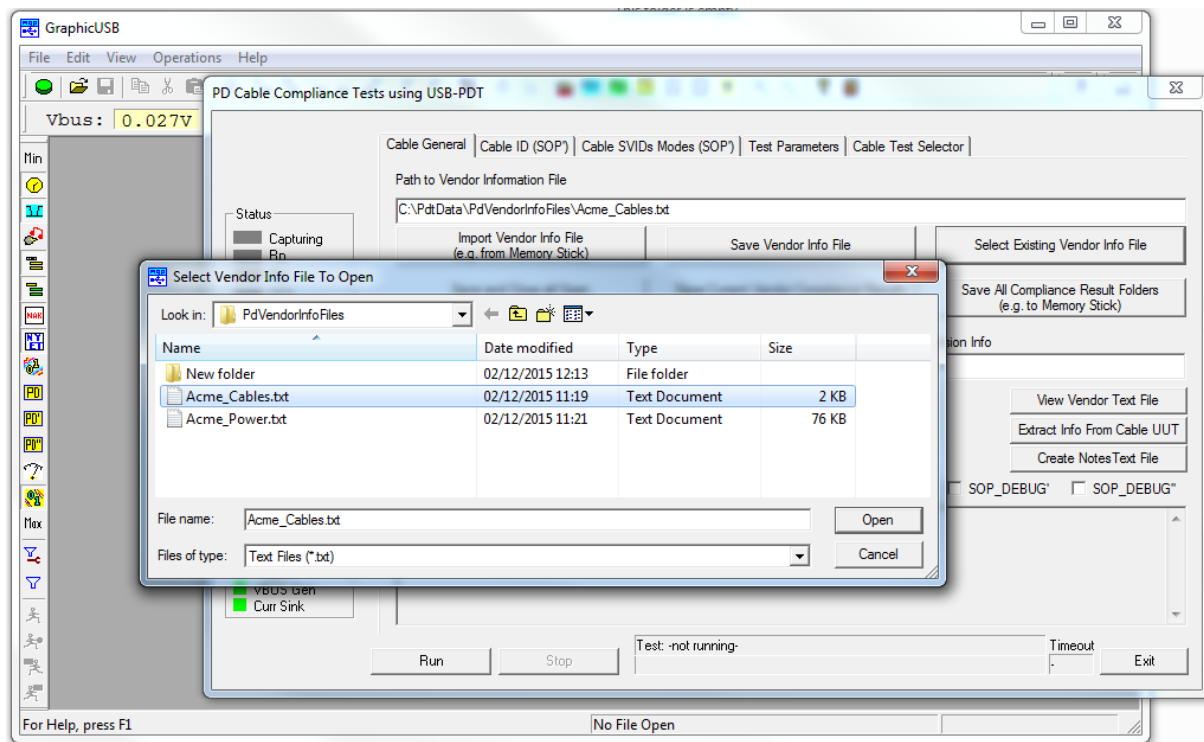
5.13 Exporting All Results Files



In order to provide another party with all the files which have been captured for every product, insert a Memory stick into a suitable USB socket, and click on the 'Save All Compliance Results Folders (e.g. to Memory Stick)' button (see picture above).

In the dialog which appears, locate the memory stick name. Click on OK. The files will be copied to a unique folder on the memory stick.

5.14 Selecting a Previously Loaded Vendor Information File

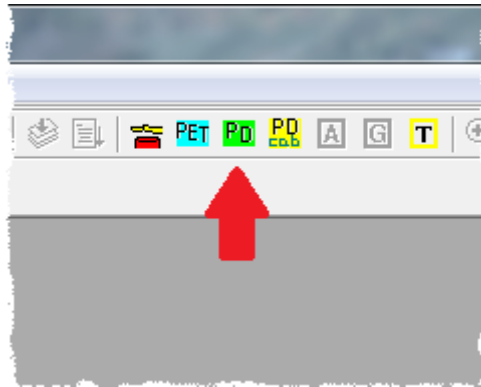


In the case that a test needs to be repeated, the Vendor Information file has already been read and this need not be repeated. Simply locate the existing file by clicking on the 'Select Existing Vendor Information File' button, and the choosing the relevant vendor information file.

6 Testing PD Devices

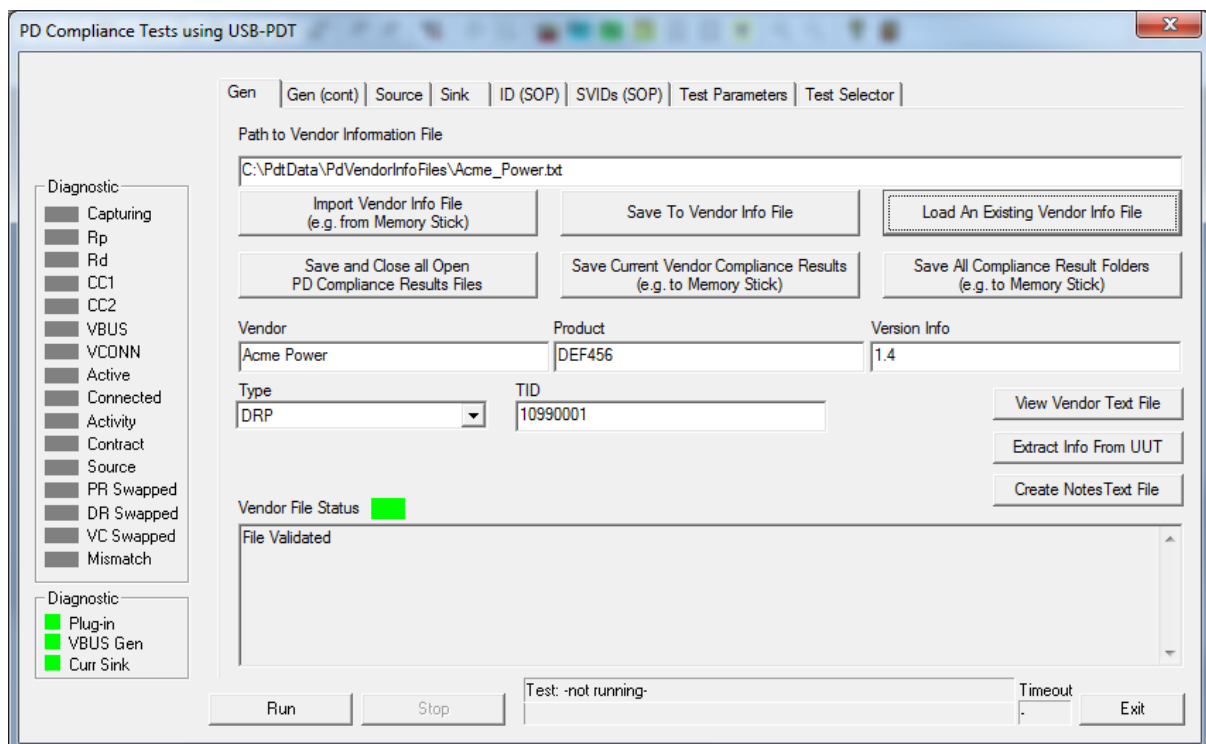
Connect one end of the supplied calibrated Type-C Test Cable to the Type-C receptacle on the Tester plug-in. Connect the other end to the Unit Under Test (UUT).

- If the UUT has a captive cable, connect this to the Type-C receptacle on the Tester plug-in.



Open the Test Dialog by clicking on the green PD icon, or by selecting Menu... Operations... PD... PD Compliance...

The PD Compliance Test dialog will open:

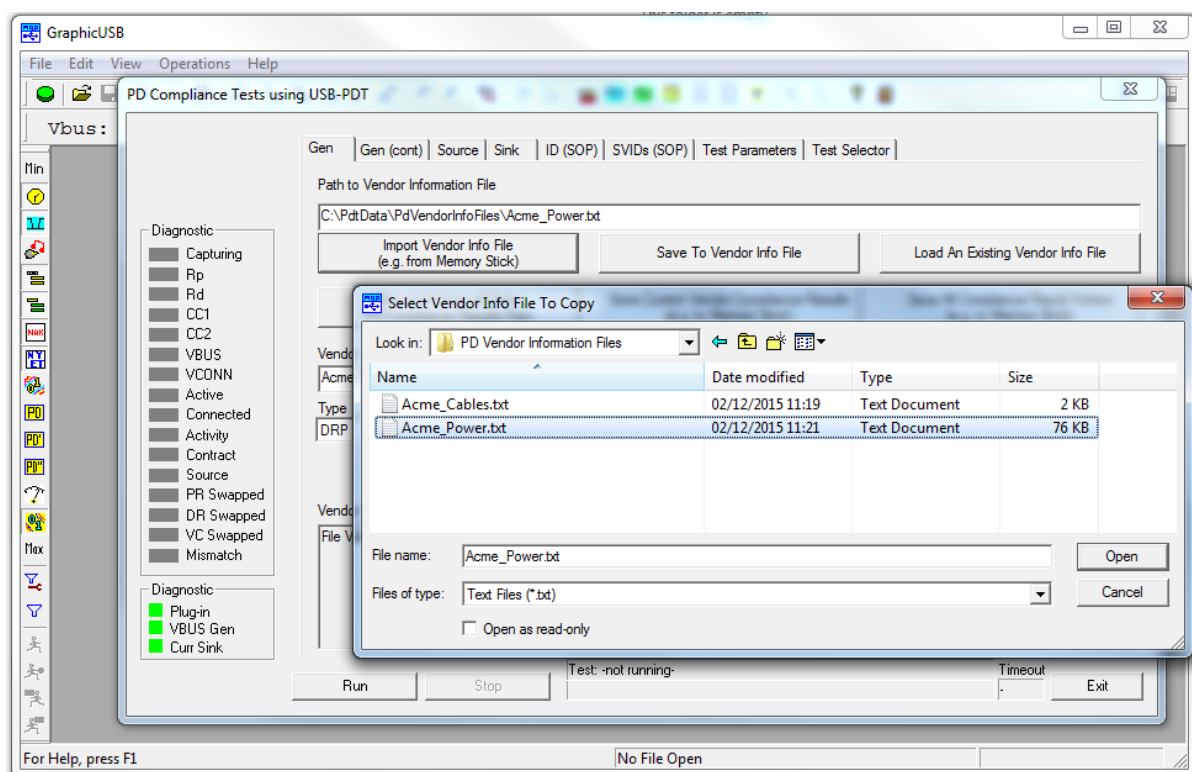


6.1 Vendor Information File

When running compliance tests at a workshop, the vendor is expected to have provided a text file defining the characteristics of the product to be tested. This file can be produced by a USB-IF application or can equally well be generated by the GraphicUSB application. The GraphicUSB application can also be used to make a correction to the VIF. This should only be done with reference to the rules in effect at the workshop in progress. It will probably always be necessary to one particular modification; the TID, which is not usually known by the vendor when they run the VIF generator application. It is important that this is corrected before running the tests, so that the report can contain the TID reference.

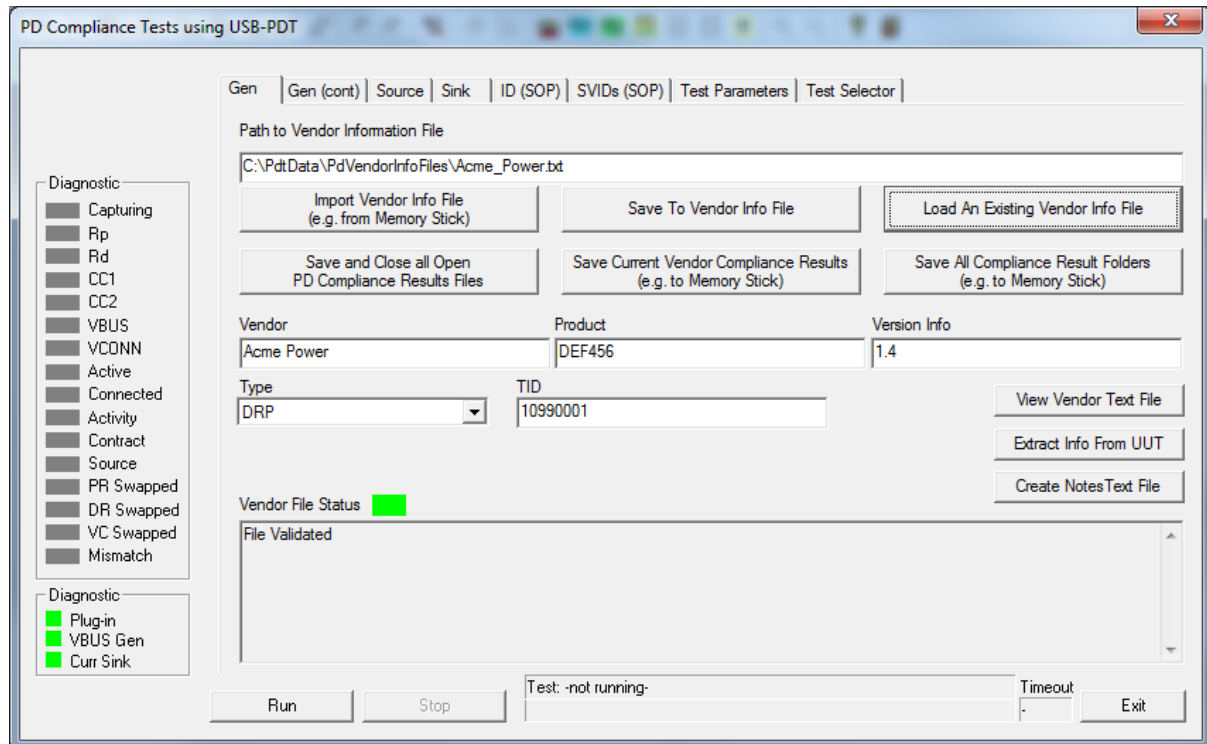
For now we assumed that the vendor has supplied the file on a memory stick.

Click on the 'Import Vendor Info File (e.g. from Memory Stick)' button.



6.2 General Information Tab

The contents of the file will be validated, and the result shown in the bottom window. This report will describe any problem with the file, to enable easy correction. 'Path to Vendor Information File' will show the internal location allocated by the version of Windows in use.



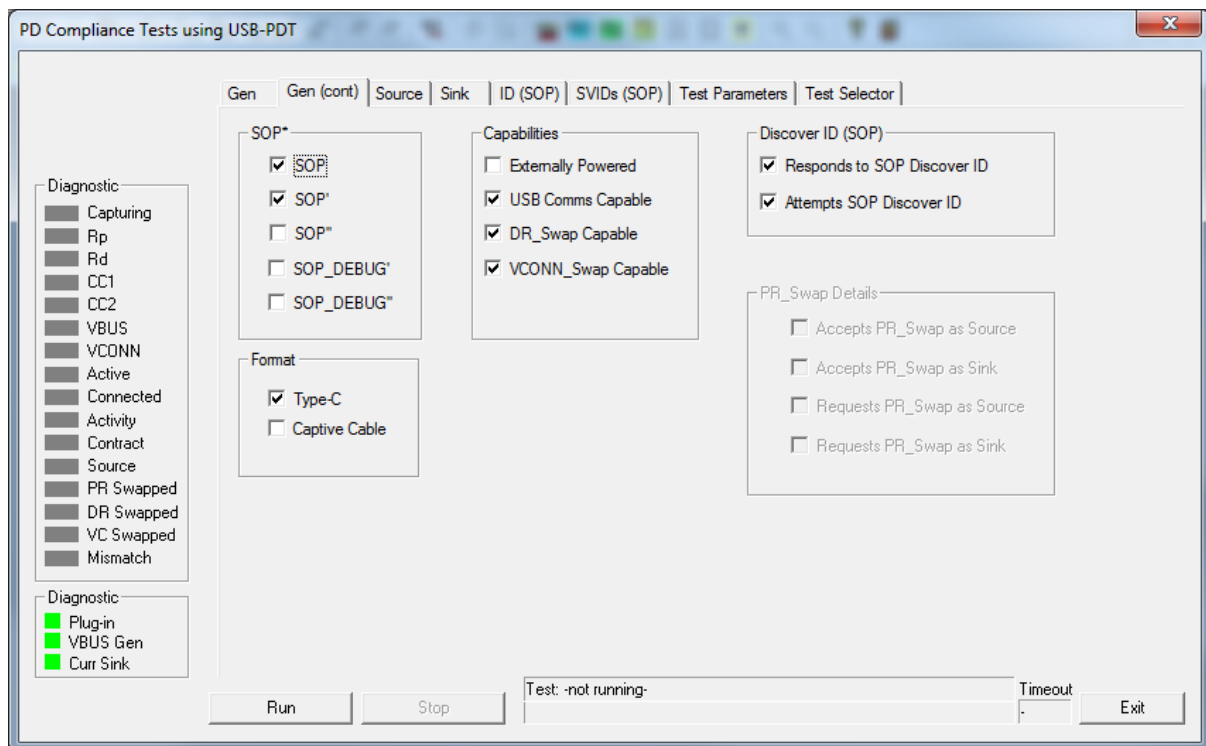
After correcting the TID, use the 'Save Vendor Info File' button, maintaining the suggested file name and location.

At this point, during a Workshop, it is recommended that you also use the 'Create Notes Text File' button. This creates a pre-initialised text document for making any observations about the testing. The file appears in the main window below this dialog. On saving, maintain the suggested file name and location.

The boxes under the buttons show the general characteristics of the vendor information file:

- Vendor Name
- Product Name
- Version Info
- TID
- UUT type

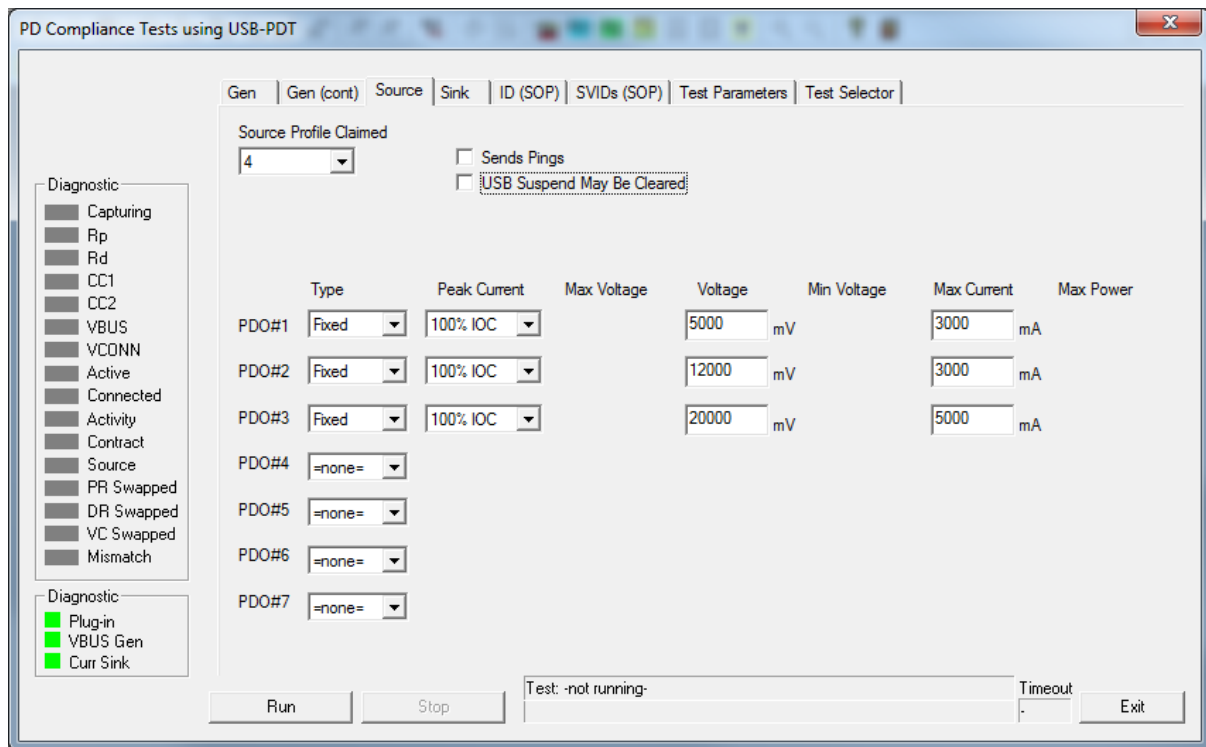
6.3 General Information (continued) Tab



The second tab shows more general information, usually derived from the Vendor Information File:

- SOP* types which will be responded to with GoodCRC messages
- Format of the product
- Capabilities not directly relating to being a Source or a Sink
- Whether the UUT attempts or responds to Discover ID (SOP)

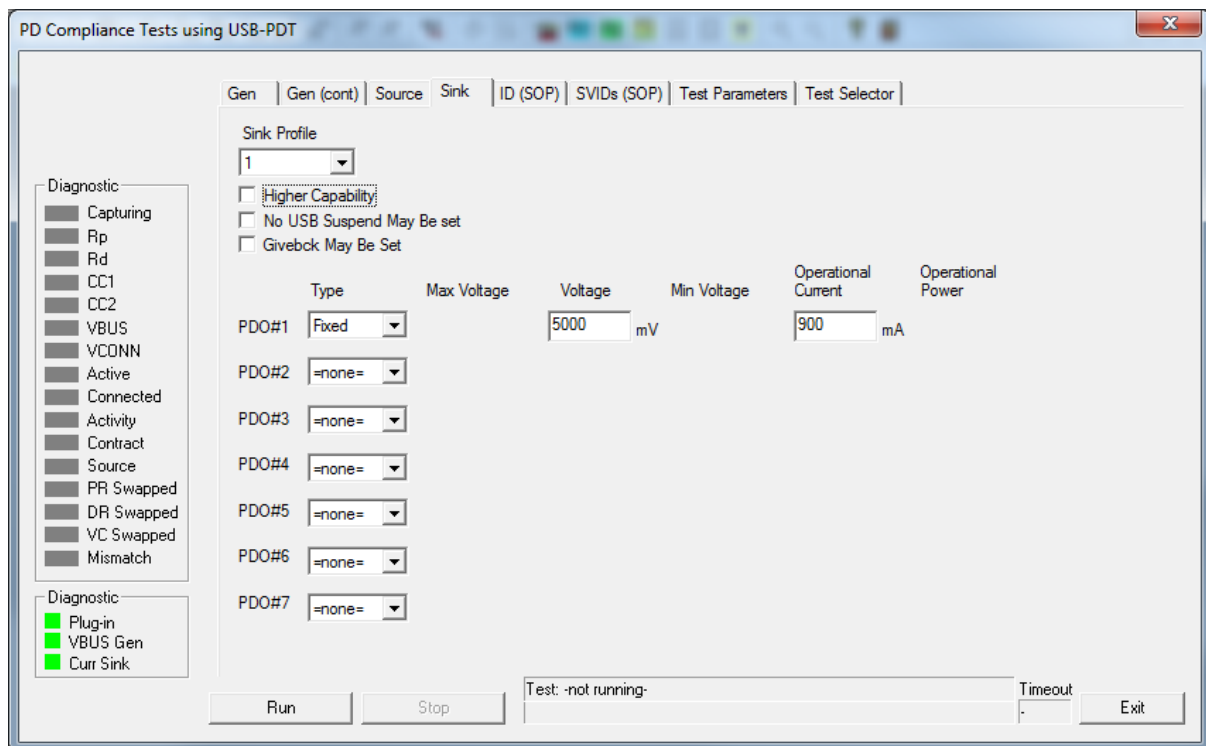
6.4 Source Capabilities Tab



The third tab shows information related to Source Capabilities, usually derived from the Vendor Information File:

- Source Profile Claimed (soon to be replaced with a different system!)
- Whether the UUT ever sends Pings
- Whether under any circumstances the UUT will clear to zero the USB Suspend bit
- The Source Capability details.

6.5 Sink Capabilities Tab



The fourth tab shows information related to Sink Capabilities, usually derived from the Vendor Information File:

- Sink Profile Claimed (soon to be replaced with a different system!)
- Whether the UUT sets the High Capability bit
- Whether under any circumstances the UUT will set to one the No USB Suspend bit
- Whether under any circumstances the UUT will set to one the Giveback bit
- The Sink Capability details.

6.6 Discover ID (SOP) Tab

The screenshot shows the 'Discover ID (SOP)' tab of the 'PD Compliance Tests using USB-PDT' application. The interface includes a sidebar with diagnostic options and a main area with various input fields for USB device information.

Diagnostic Options (Left Sidebar):

- ☐ Capturing
- ☐ Rp
- ☐ Rd
- ☐ CC1
- ☐ CC2
- ☐ VBUS
- ☐ VCONN
- ☐ Active
- ☐ Connected
- ☐ Activity
- ☐ Contract
- ☐ Source
- ☐ PR Swapped
- ☐ DR Swapped
- ☐ VC Swapped
- ☐ Mismatch

Diagnostic Status (Bottom Left):

- ☒ Plug-in
- ☒ VBUS Gen
- ☒ Curr Sink

Main Form Fields:

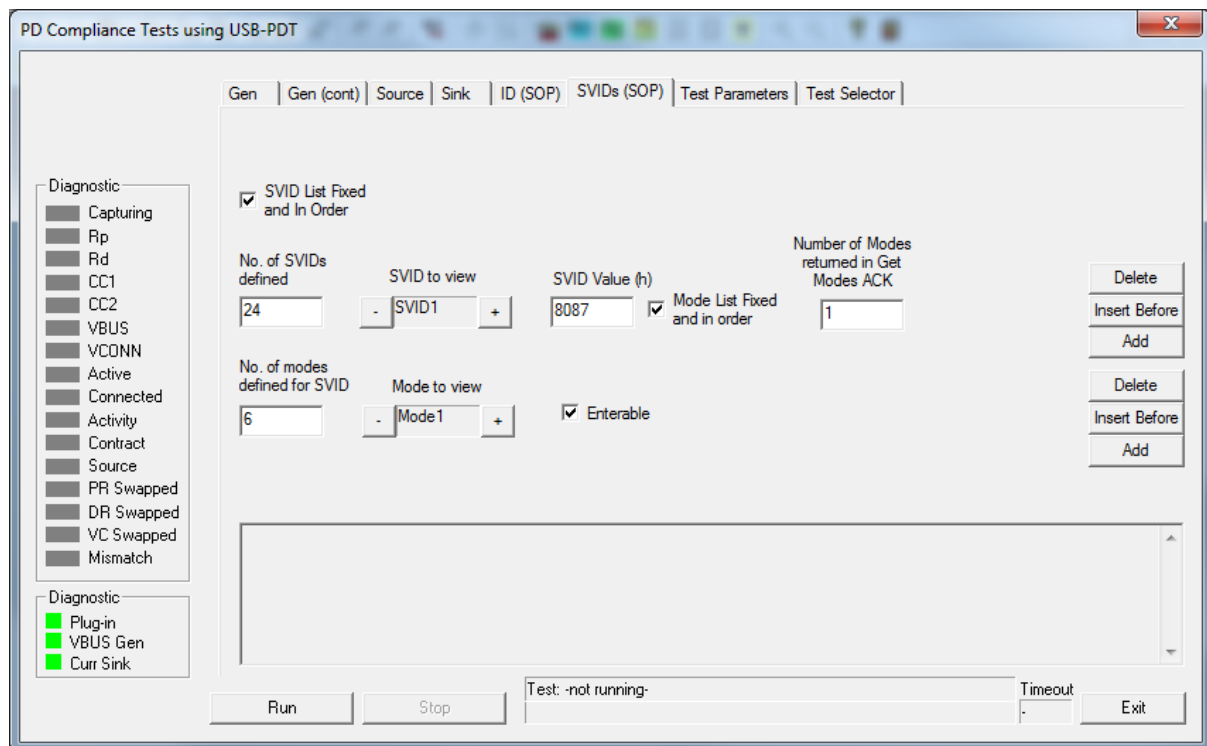
- Gen:** Gen (cont) | Source | Sink | **ID (SOP)** | SVIDs (SOP) | Test Parameters | Test Selector
- VDM Header:** Struct VDM Ver:
- ID Header:** Data As Host: Data As Dev: Product Type: Modal Operat: USB VID:
- Cert Stat:** XID:
- Product VDO:** USB PID: bcdDevice:
- AMA VDO:** HW Vers: FW Vers:
- SSTX1 Dir Sup:** **SSTX2 Dir Sup:** **SSRX1 Dir Sup:** **SSRX2 Dir Sup:**
- VCONN Power:** **VBUS Required:** **VCONN Required:** **Superspeed:**

Buttons: Run, Stop, Test: -not running-, Timeout: , Exit

The fifth tab shows information related to Discover ID (SOP), usually derived from the Vendor Information File:

- VDM Header Information
- ID Header Information
- Cert Stat Information
- Product VDO Information
- AMA VDO Information

6.7 SVID Tab



The sixth tab shows information related to Discover ID (SOP), usually derived from the Vendor Information File:

- SVID Information

6.8 Test Parameter Tab

The seventh tab shows the Test Parameter Settings.

Of particular importance is the Test Cable VBUS Loop Resistance setting. You should enter here the figure on your calibrated test cable, in milliohms.



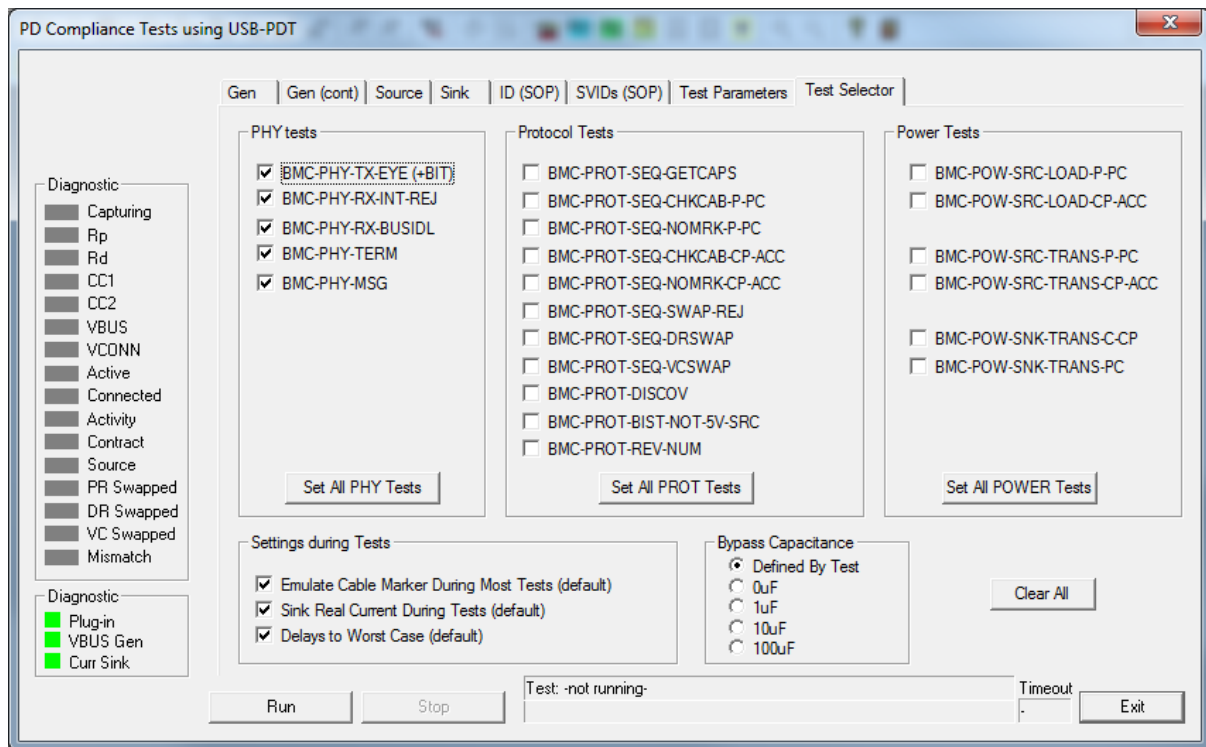
The Tx parameters define the waveform sent by the Tester transmitter:

- under normal conditions
- while sending BIST messages during PHY-TX-INT-REJ Group 1 noise testing
- while sending BIST messages during PHY-TX-INT-REJ Group 2 noise testing

The Capture Tester Eye buttons allow the generated waveform to be displayed. This is useful as a double check on calibration. Before clicking on this button, ensure that nothing is connected to the plug-in panel.

The parameters relating to group 1 and 2 noise default to the Compliance Plan values, but may be altered during development to alter the stress on the receiver.

6.9 Test Selector Tab



The last tab shows the Test Selectors.

PD Tests should be run as three separate groups: PHY, Protocol and Power. This is to avoid the resultant files becoming too large and too slow.

The 'Settings during Tests' options default to the standard required settings for a full Compliance Test. The settings may be altered to experiment with different options. 'Sink Real Current' may be switched off while performing PD tests on a 'Silicon Only' product.

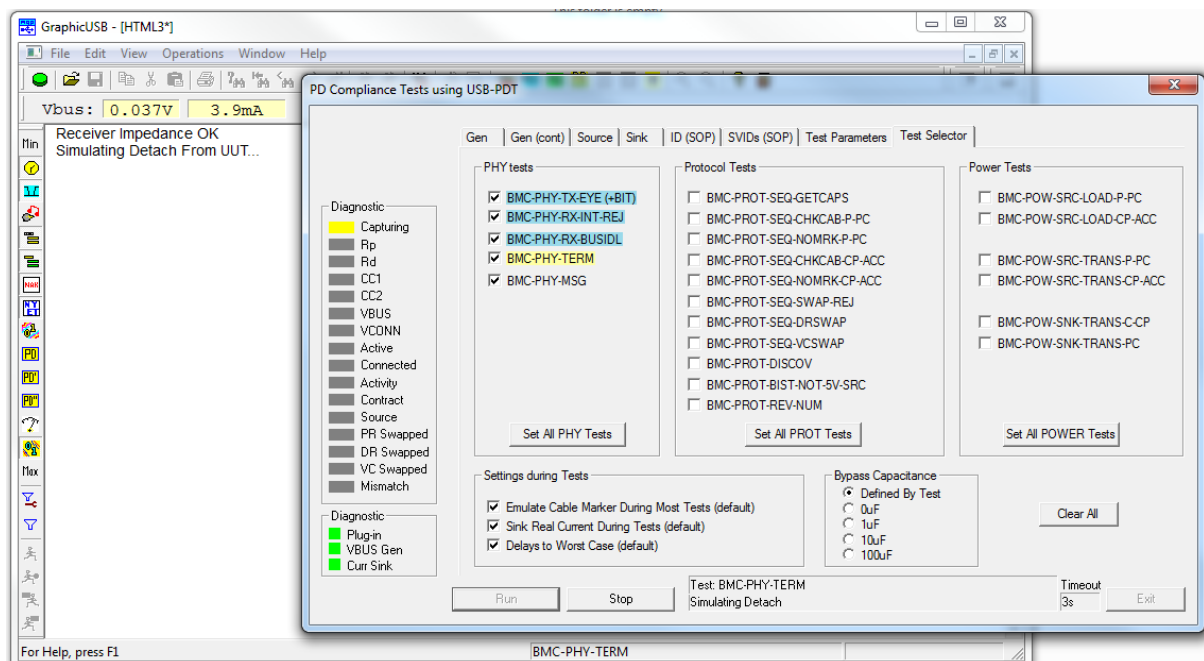
Bypass capacitance is normally set to various default values during tests. However for development reasons the value may be set to a specific value in this dialog.

As you may expect, any individual test may be selected, when working on a development issue.

The button 'Set All PHY Tests' causes the five PHY tests to be selected (and all others to be de-selected). After selecting the tests, click on the 'Run' button.

You may then exit the dialog and examine the results of just the PHY tests, or continue to perform the other two groups of tests first, depending on the situation.

6.10 Test Progress

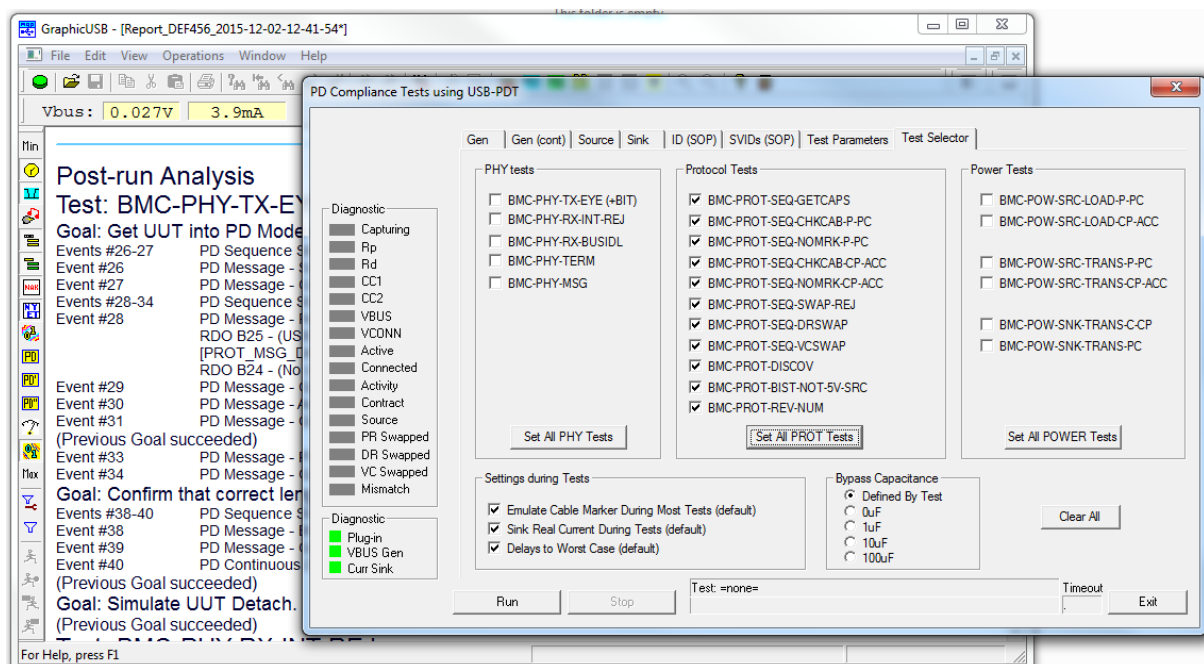


While running, progress will be indicated by the background colouring of the test name. Blue indicates a completed test while yellow indicates the test in progress.

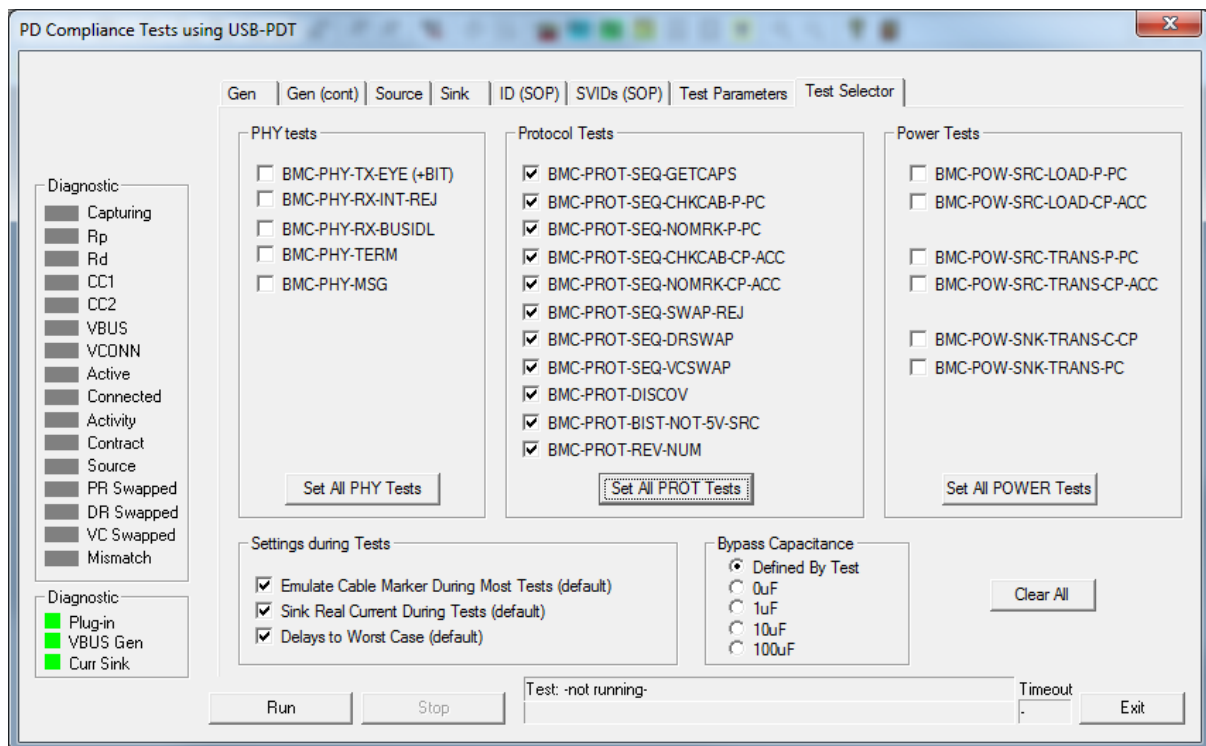
Two documents are created during the PHY test run:

- an HTML report (.html)
- an MQP Capture file (.mqu)

After the 'Exit' button is re-enabled, you may click it to gain access to the generated reports, or proceed to do the Protocol Tests.



6.11 Protocol Test Progress



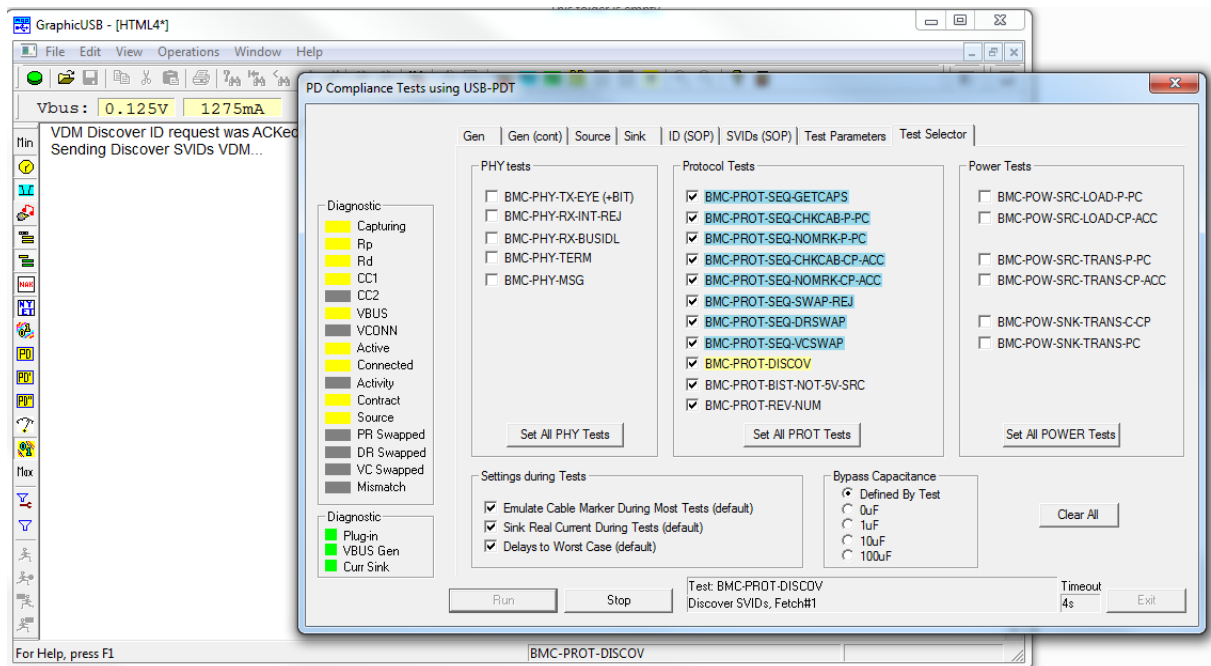
The button 'Set All PROT Tests' causes the eleven Protocol tests to be selected (and all others to be de-selected). Some tests may be inappropriate to the UUT Type. After selecting the tests, click on the 'Run' button.

While running, progress will be indicated by the background colouring of the test name. Blue indicates a completed test while yellow indicates the test in progress.

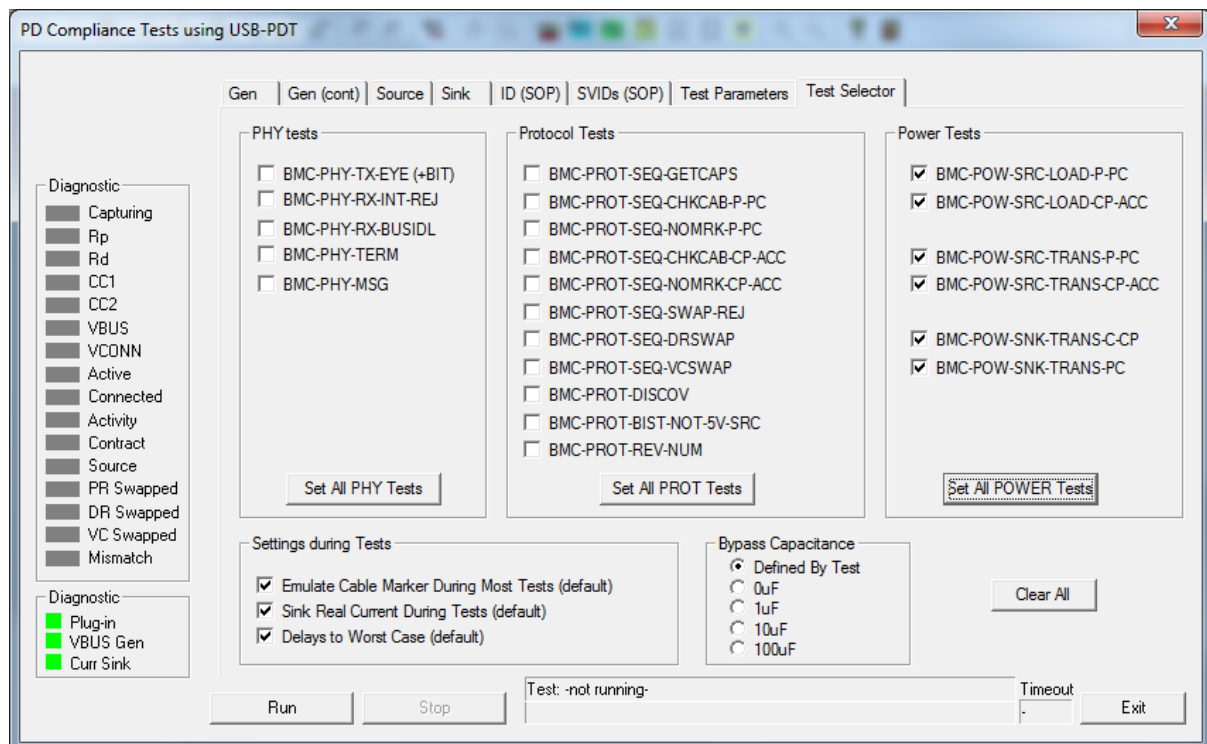
Two documents are created during the Protocol test run:

- an HTML report (.html)
- an MQP Capture file (.mqu)

After the 'Exit' button is re-enabled, you may click it to gain access to the generated reports, or proceed to do the Power Tests.



6.12 Power Test Progress

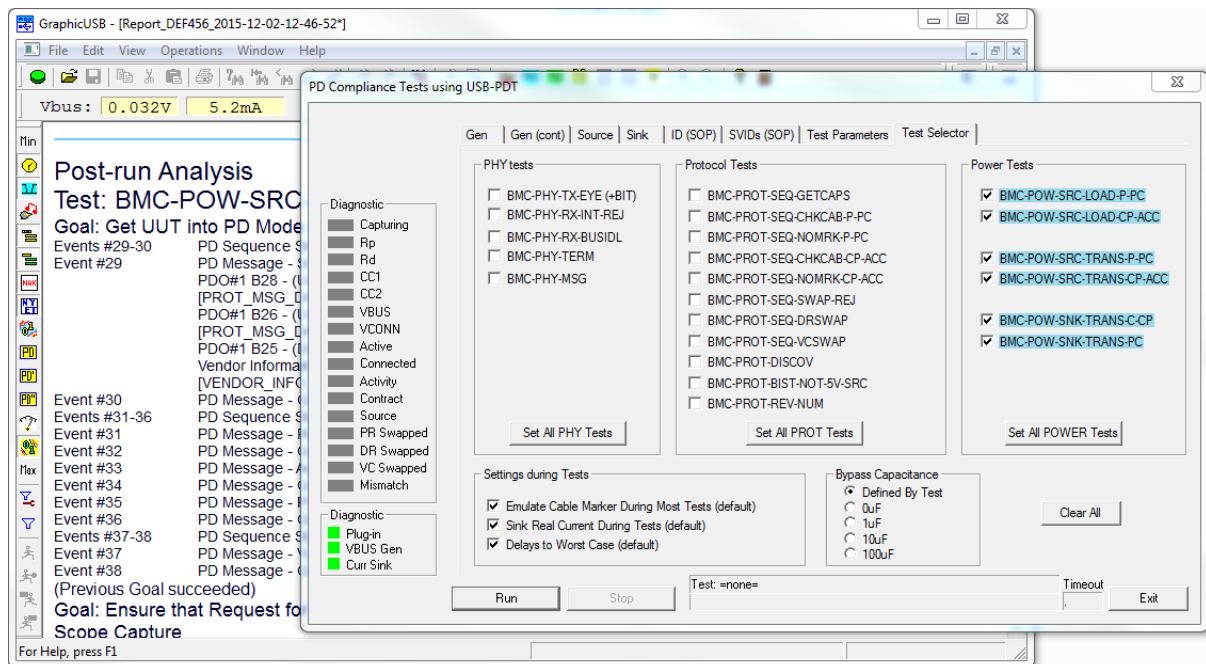
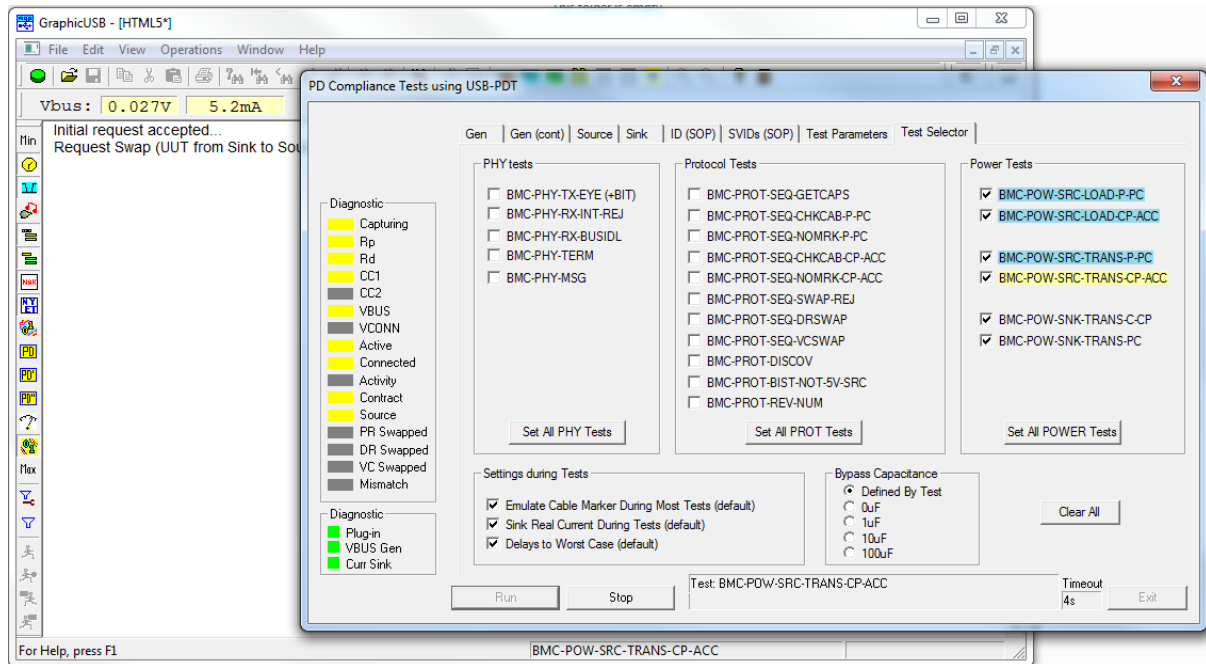


The button 'Set All POWER Tests' causes the six Power tests to be selected (and all others to be de-selected). Some tests may be inappropriate to the UUT Type. After selecting the tests, click on the 'Run' button.

Two documents are created during the Power test run:

- an HTML report (.html)
- an MQP Capture file (.mqu)

After the 'Exit' button is re-enabled, you may click it to gain access to the generated reports.



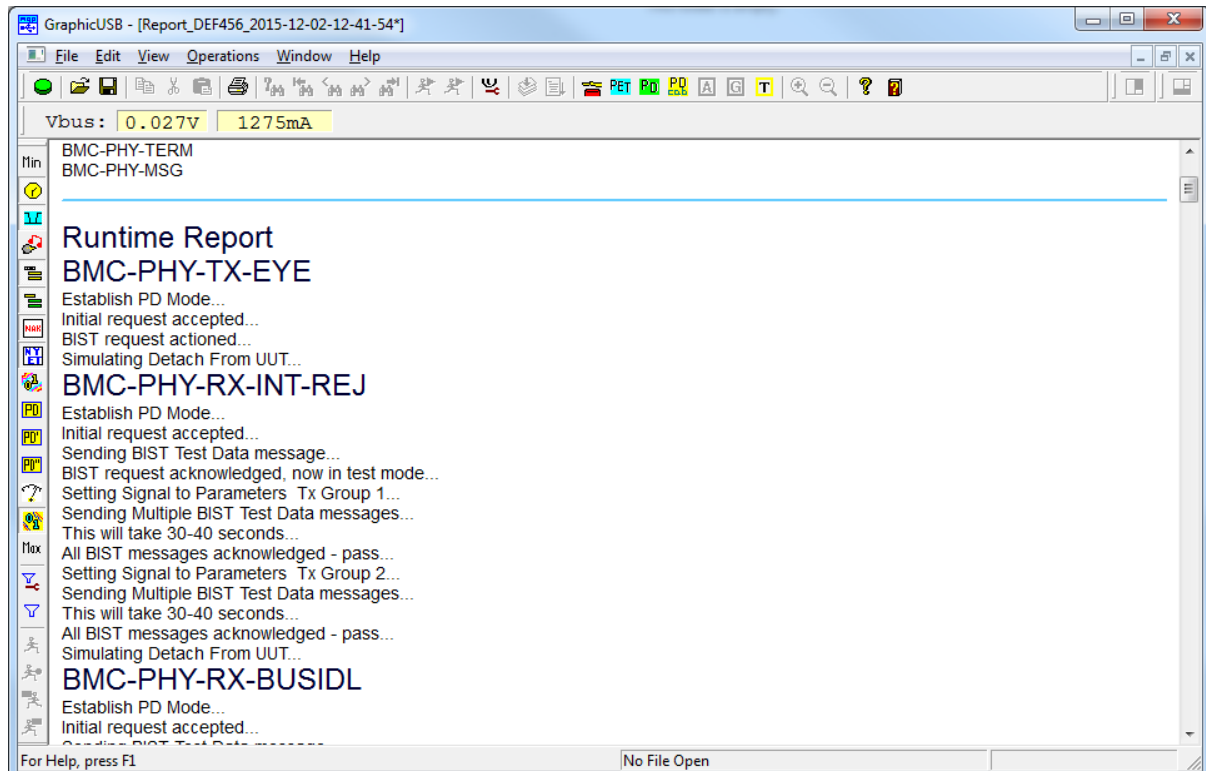
After the 'Exit' button is re-enabled, you may click it to gain access to the generated reports.

6.13 HTML Report File

The HTML report comprises a number of sections:

- Header information describing
 - the test software version
 - the product being tested
 - The actual tests to be run
- Runtime Report

This is a description of the run time procedures. Some of these may result in test failures.



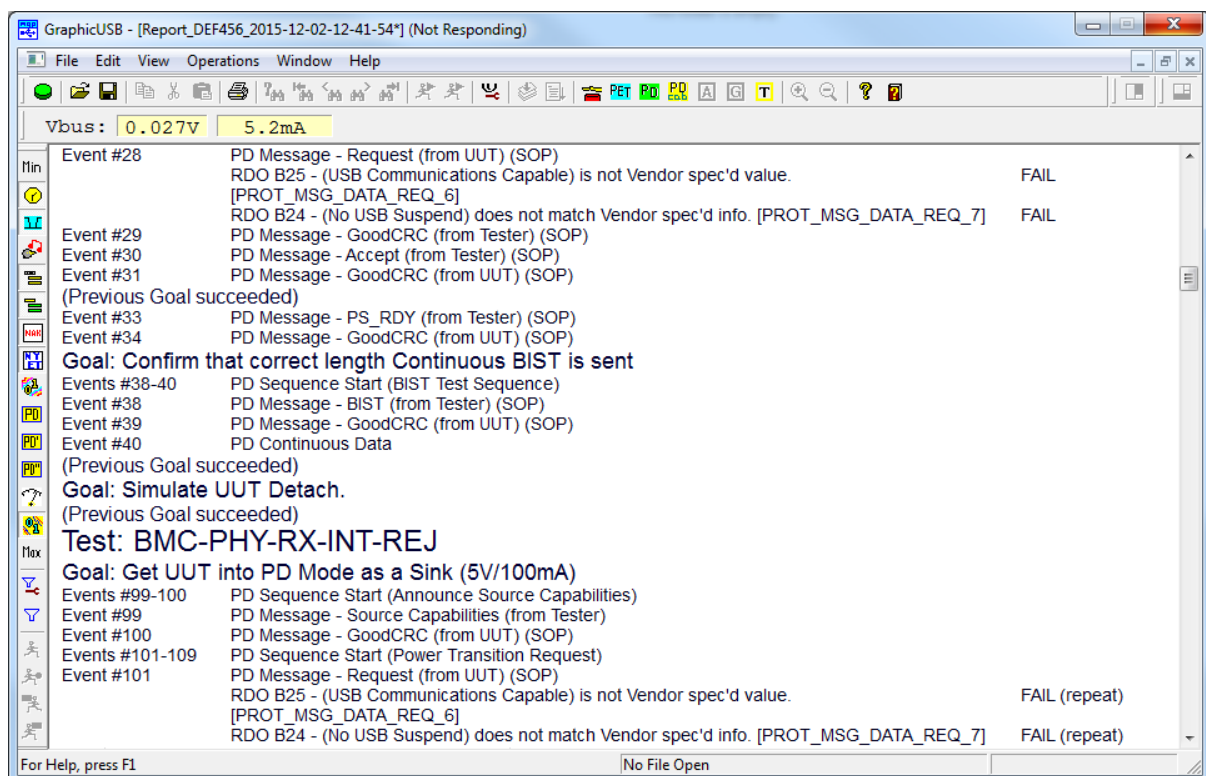
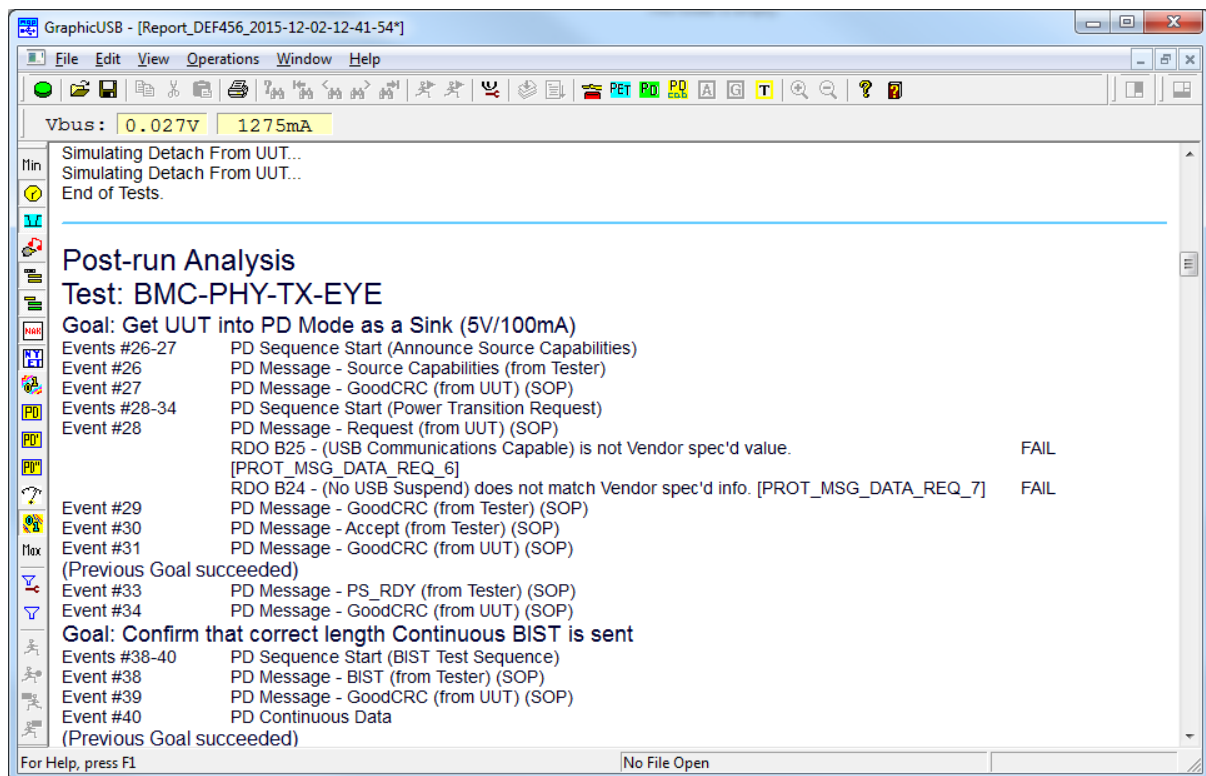
- Post-run Analysis Report

This is an analysis of the Analyser Capture file taken during the test run. The Capture file stores every PD event which occurred, together with embedded 'Goals'. The file is analysed for :

- PD timing errors
- PD protocol errors
- valid usage of all parameter fields
- match of all parameter fields with vendor supplied information
- whether embedded test goals have been achieved

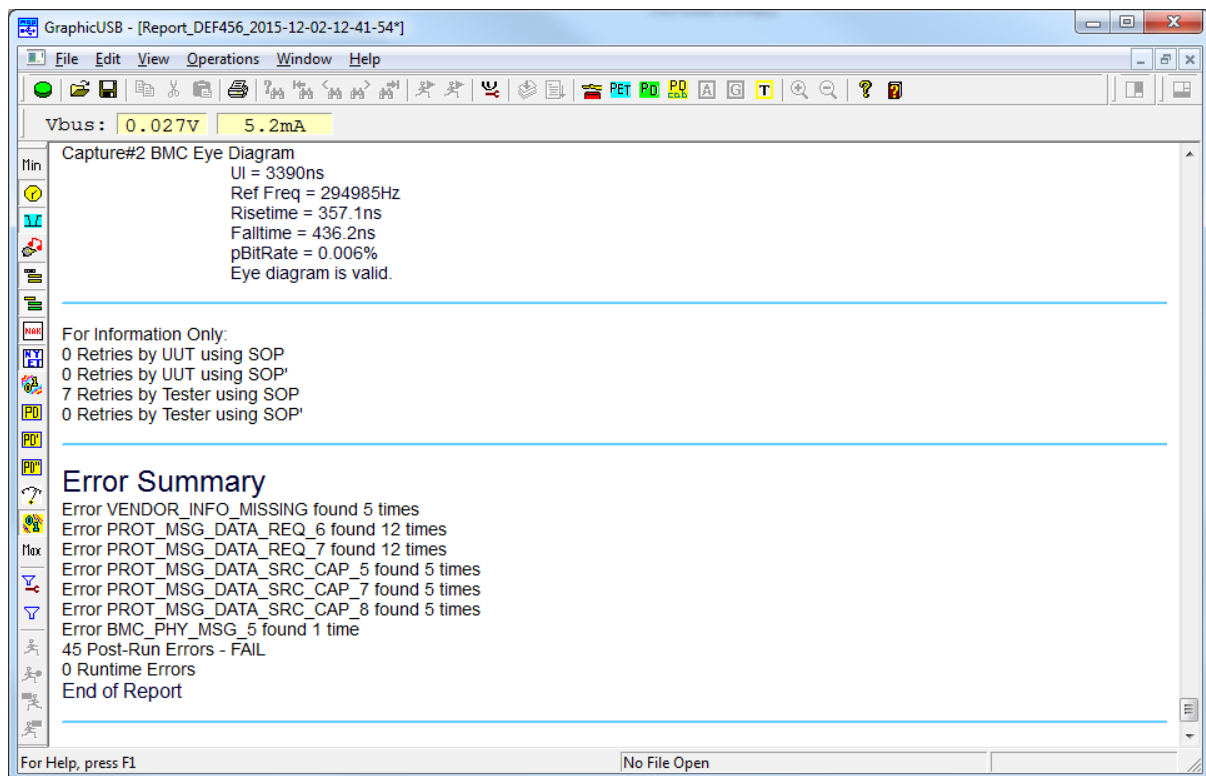
Every PD message is reported on in the Post-run Analysis Report (with the exception of multiple messages sent during the Interference Rejection tests).

At the end of the Post-run Analysis Report for the PHY tests is a text summary of the Eye Diagram Scope report. This is sufficient to define Pass versus Fail for these PHY tests, but viewing the actual Scope capture (See below under Capture File) will always be beneficial.



- Error Summary

This lists the number of errors found, both run-time and post-run. Unless there is a good reason to decide otherwise, any error will result in a test failure.



6.14 Capture File

Underneath the HTML report (use menu item Window... to find it) is the Analyser Capture report.

The left hand pane shows the PD events (use Min and Max to reveal more or less detail).

The top right hand (Detail) pane gives an analysis of the event selected in the event pane.

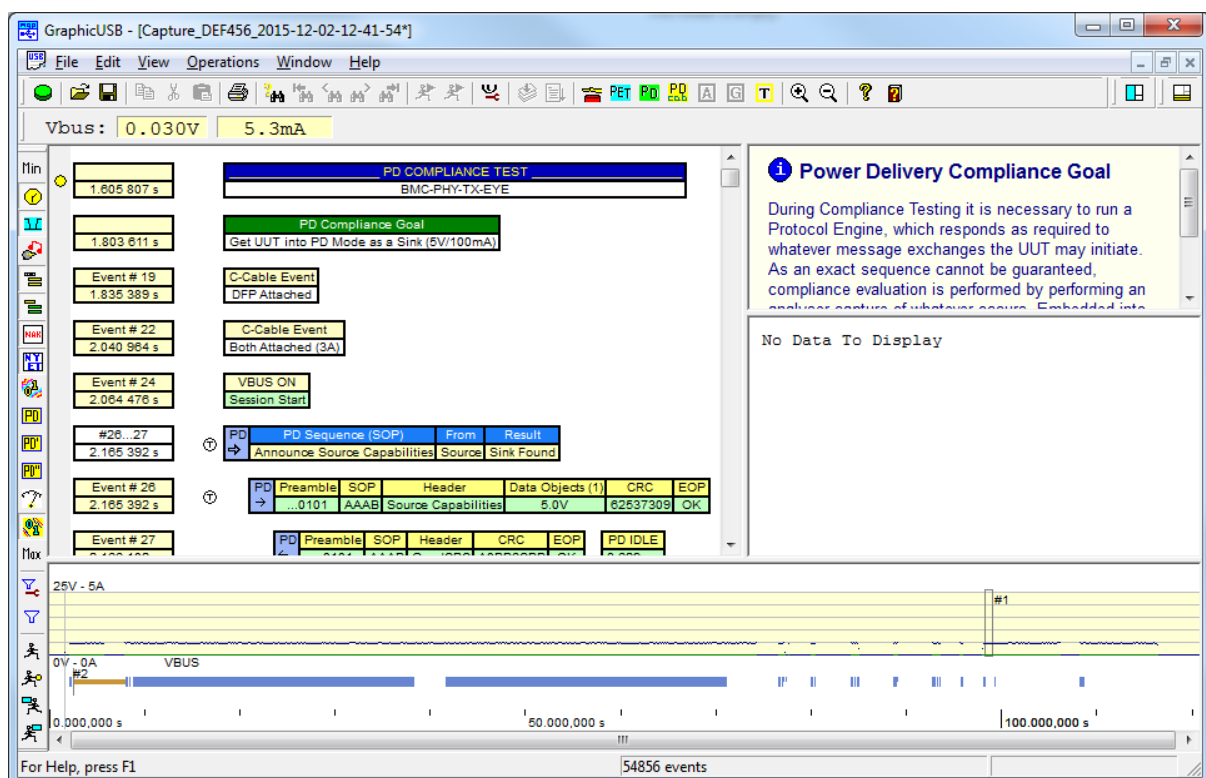
The pane below the Detail pane shows any data involved in the event selected.

The bottom pane shows a zoomable timeline of all the events in the complete capture.

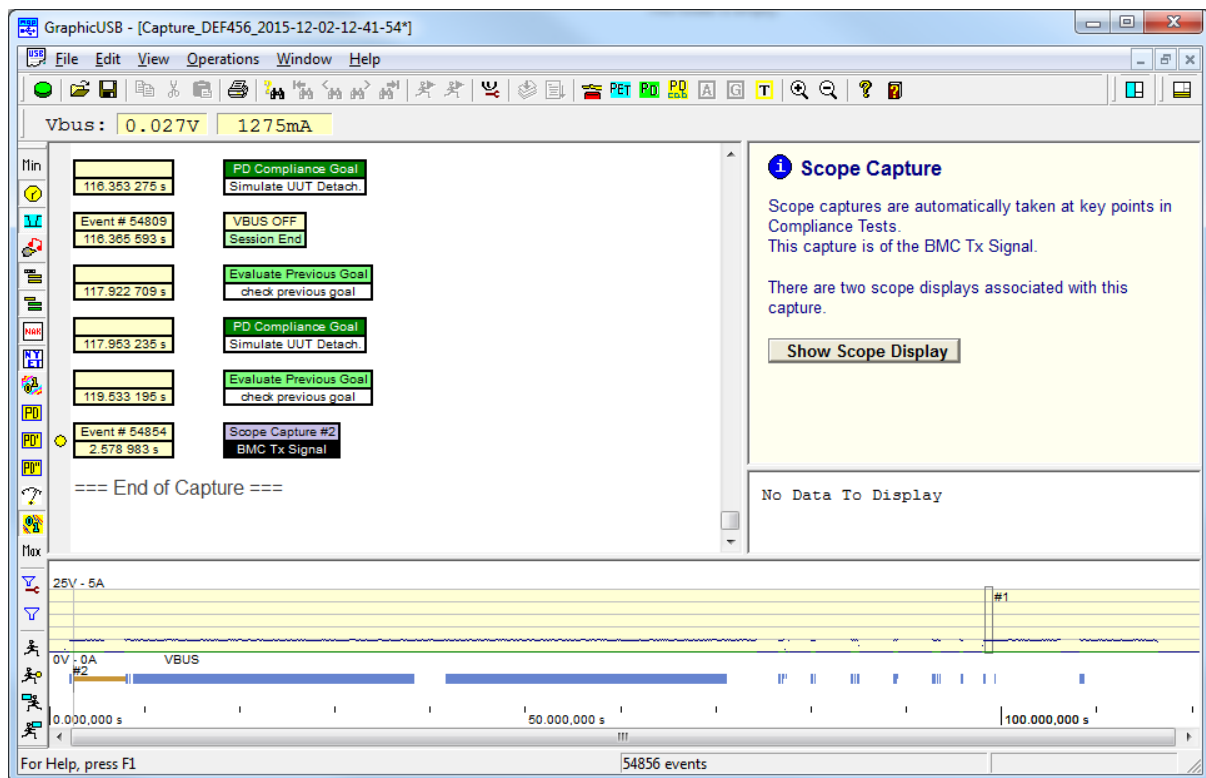
In the example above can be seen the BIST continuous waveform on the left (in brown), followed by two long blue lines (each containing 13000 BIST test messages during the Interference Rejection test), followed by various other PD messages from the other tests.

Above that is a simple representation of VBUS, going between 0 and 5V.

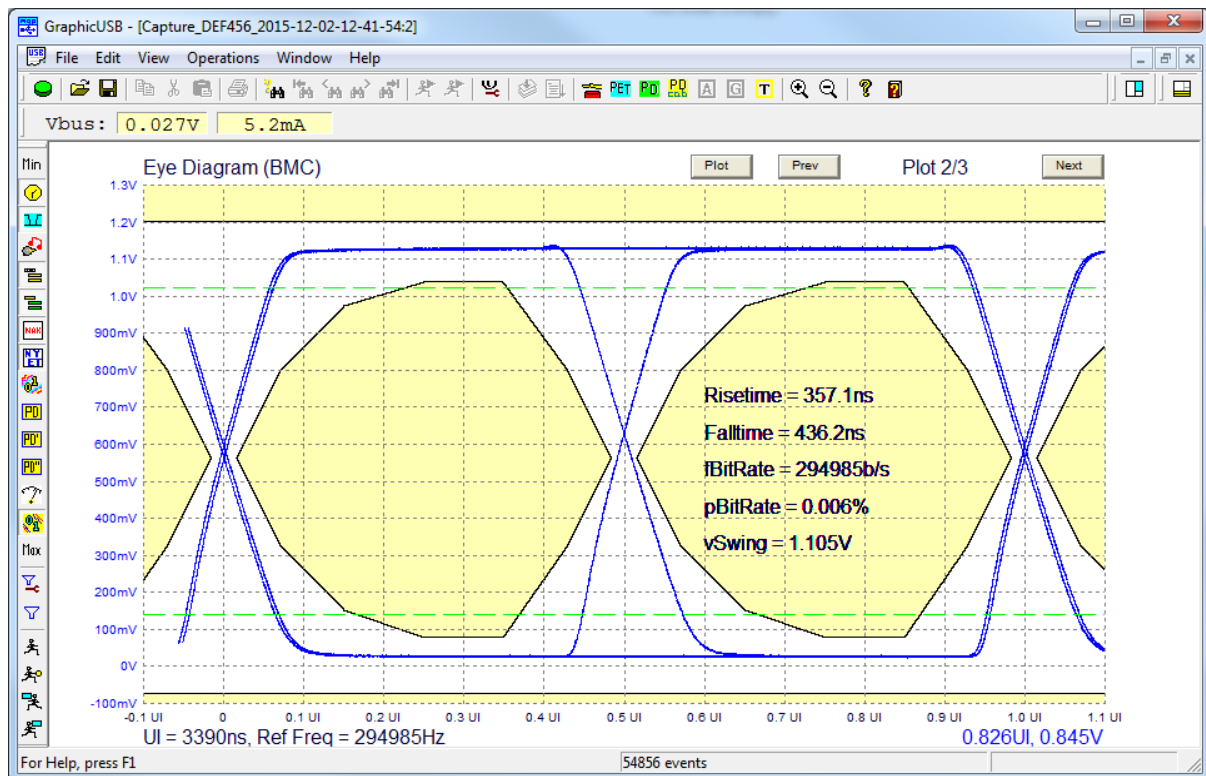
The black rectangle labelled #1 is a VBUS scope capture of a Hard Reset event.



6.15 Eye Diagram

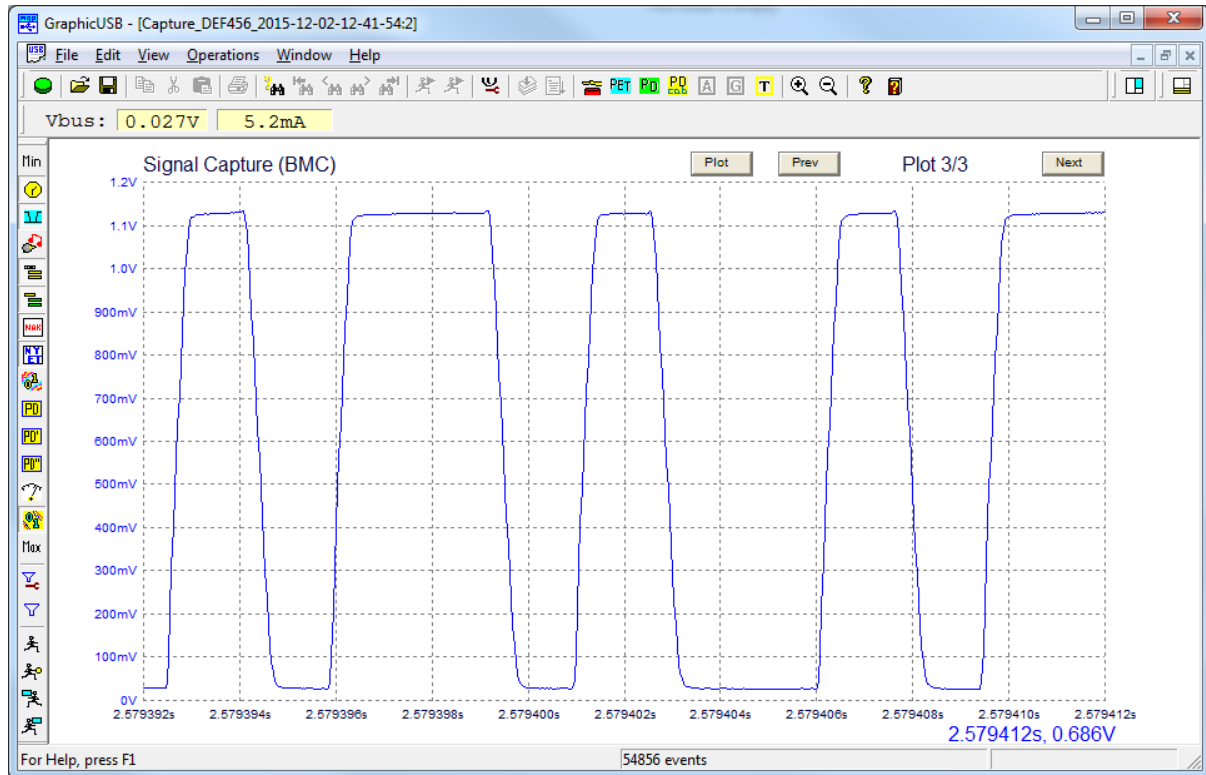


The last event in the Events pane is the Scope Capture event #2, relating to the eye diagram. Click on this event, then on Show Scope Display. The Eye Diagram will appear.



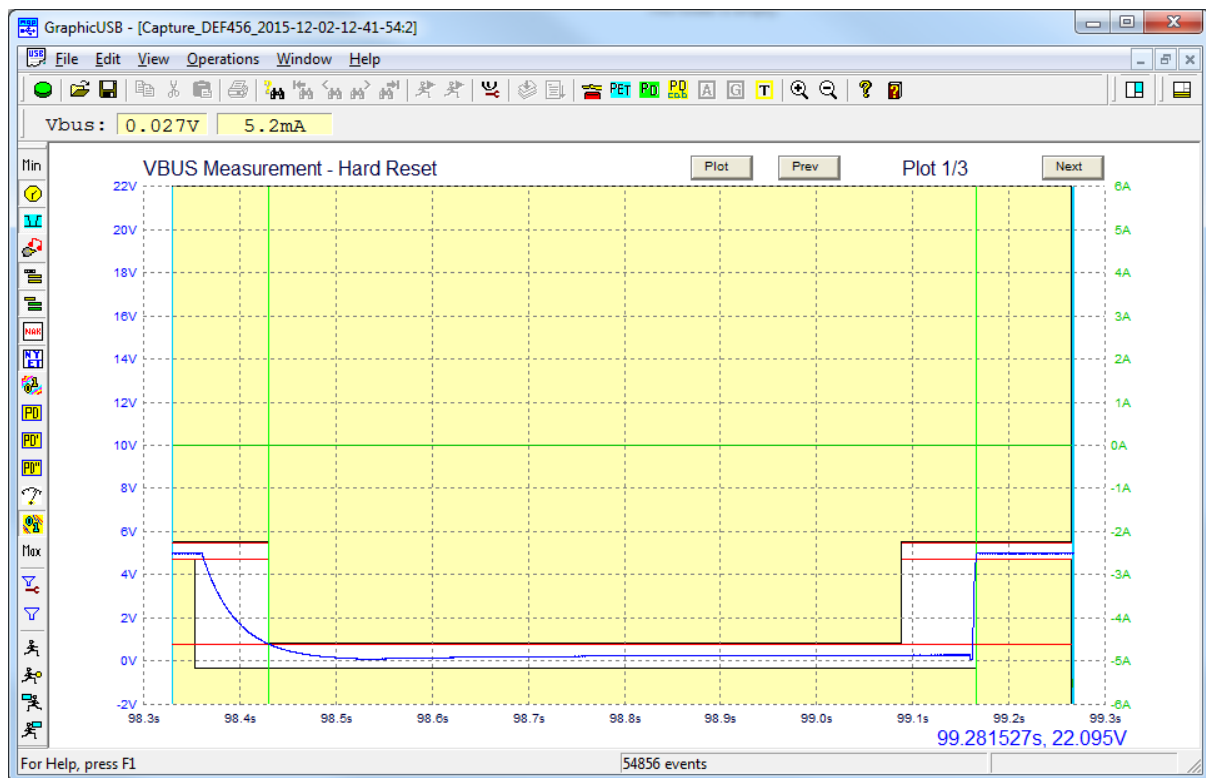
Clicking 'Next' on the Eye Diagram shows the complete captured BIST 2 waveform.

Zooming is achieved by placing the cursor at the bottom of the graph until a magnifying glass icon appears, and then using the scroll wheel.



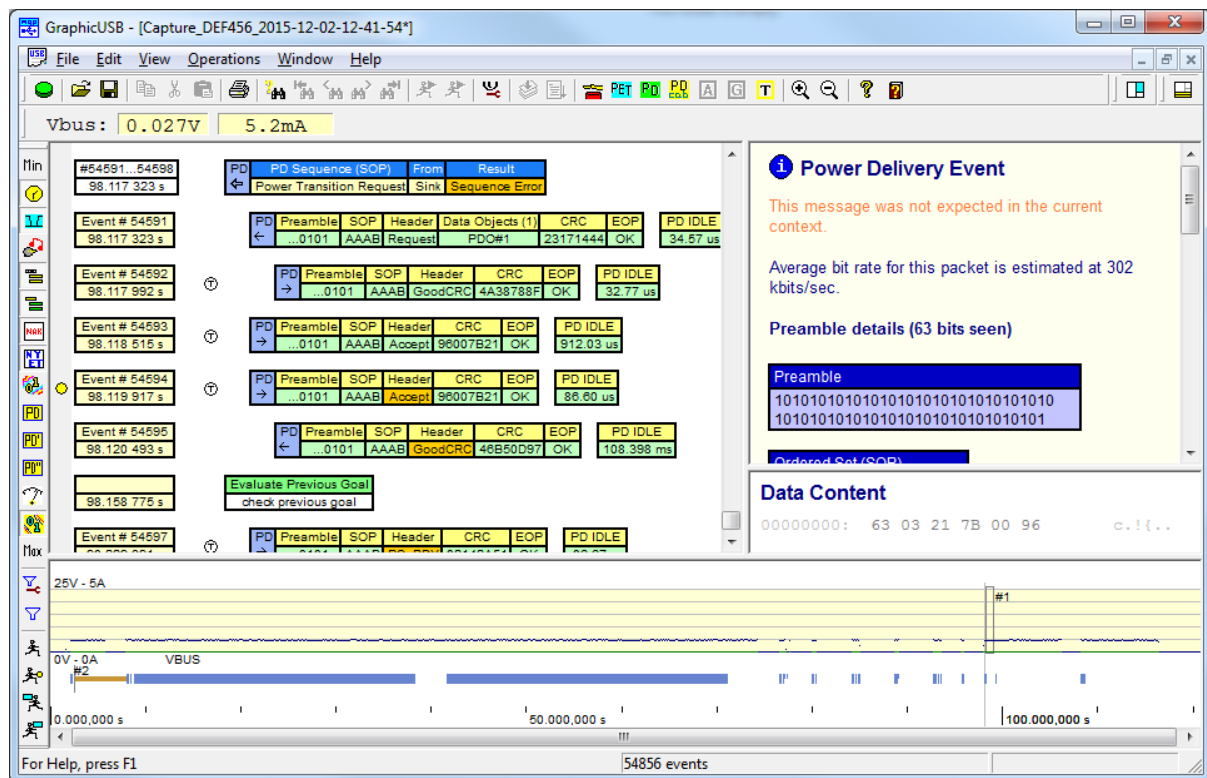
The waveform is not part of the compliance test but allows some development interpretation of various problem signals.

6.16 Hard Reset Scope Capture



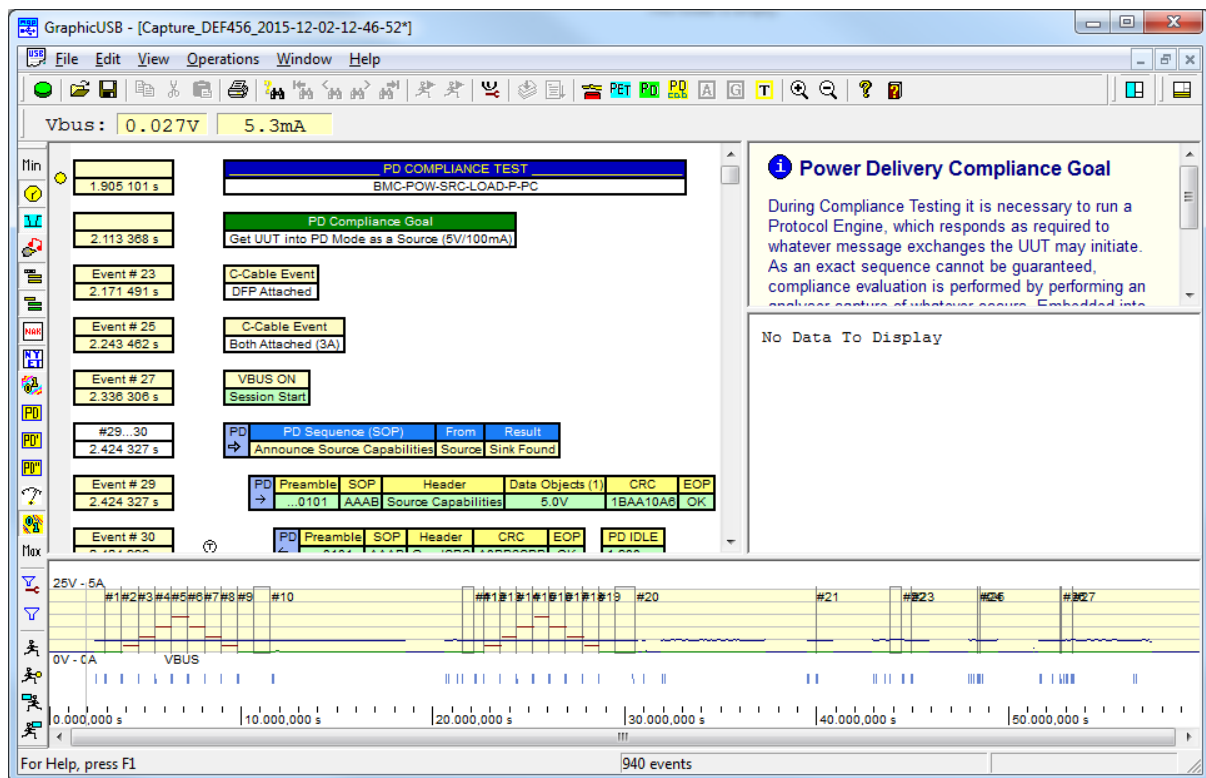
Scope Capture #1 in this case, is a Hard Reset, generated by the tester, with VBUS controlled by the tester. It is included here to show how a mask is automatically drawn to indicate valid areas for the VBUS waveform. Typically the blue voltage waveform will be coloured red if the VBUS cuts through part of the mask.

6.17 Capture File Error Indications



The Capture File indicates error

6.18 Power Supply Test Capture Details



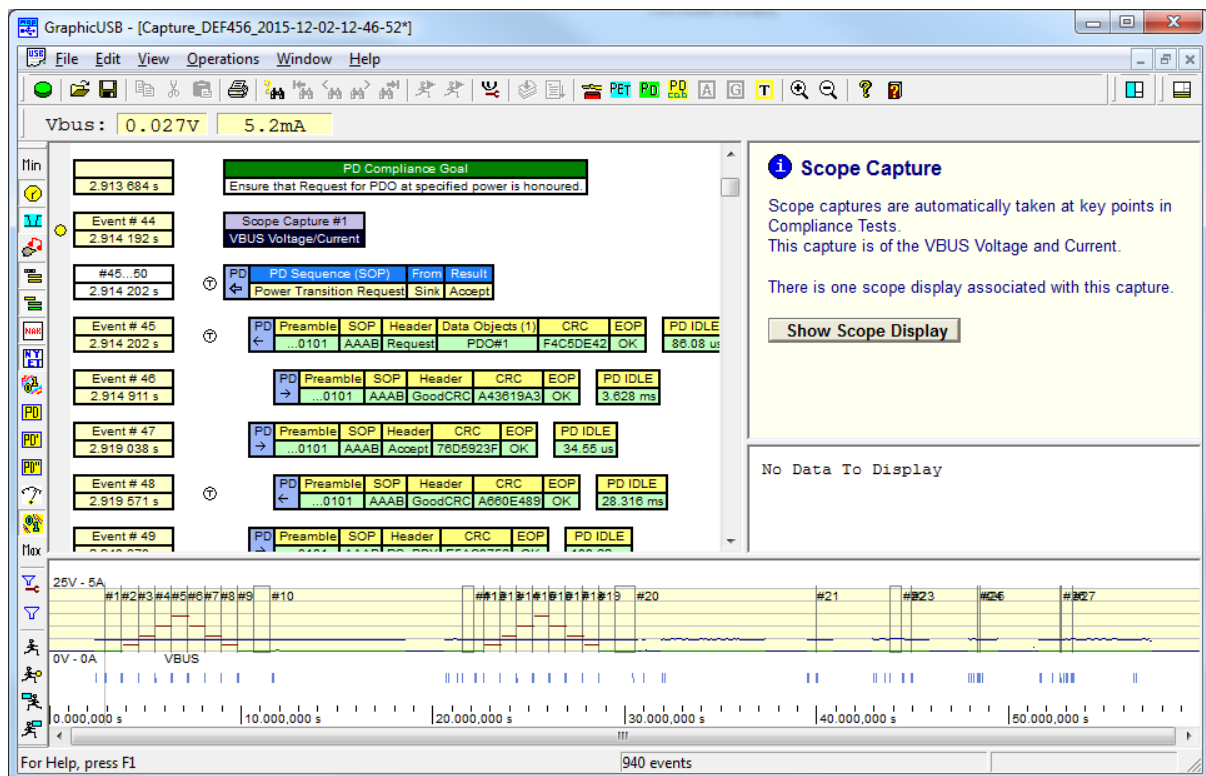
During the Power Supply tests, a number of scope captures are automatically made of the VBUS voltage and current waveforms, plotted against the points in time that PD messages are sent.

The sequences that attract scope captures are:

- PR_Swap sequences
- Request sequences
- Hard Reset sequences

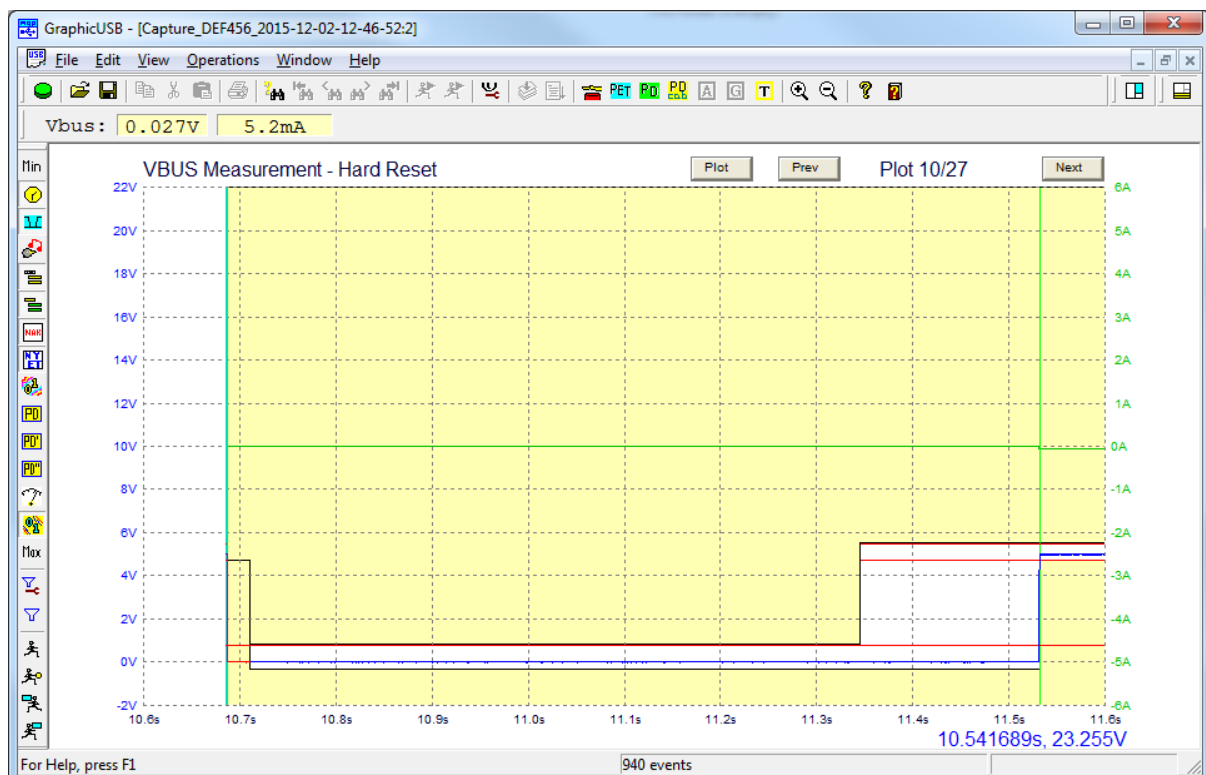
The scope captures are numbered, and can be viewed by:

- clicking inside the timeline view scope capture rectangle
- locating the scope capture event in the event pane and clicking on it, then on 'Show Scope Display' in the details pane



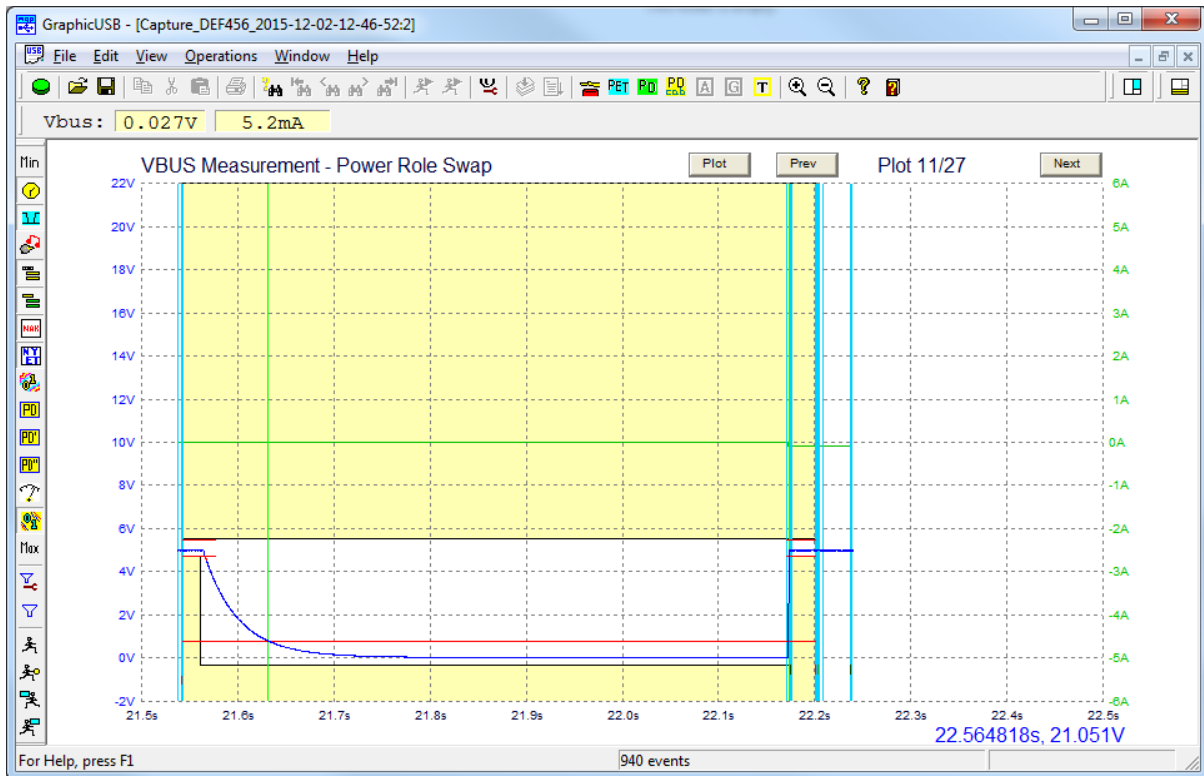
6.19 VBUS Scope Capture - Hard Reset

In the above view we click on scope capture timeline rectangle #10, and see the following 'Hard Reset' scope capture. It is noticeable that the mask has closed up at the left end because the voltage fell too quickly, and the waveform therefore cuts through the mask.

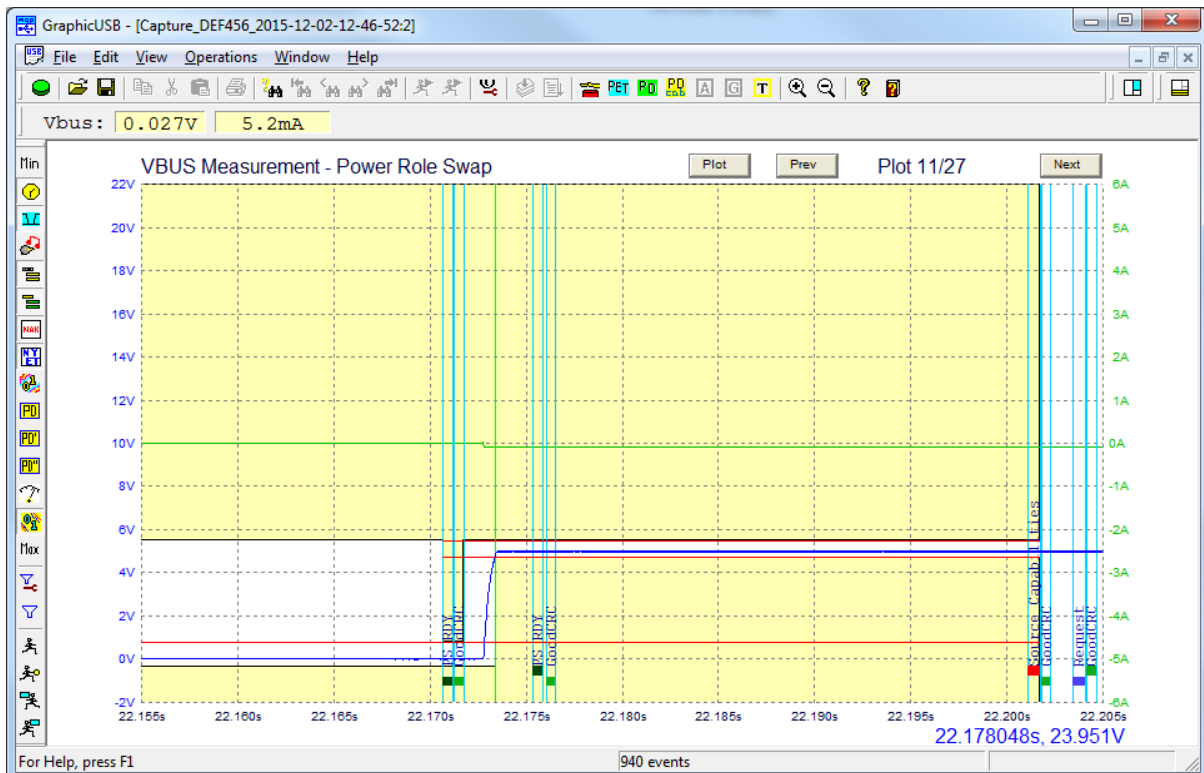


6.20 VBUS Scope Capture - Power Role Swap

The following scope capture shows a successful PR_Swap sequence:

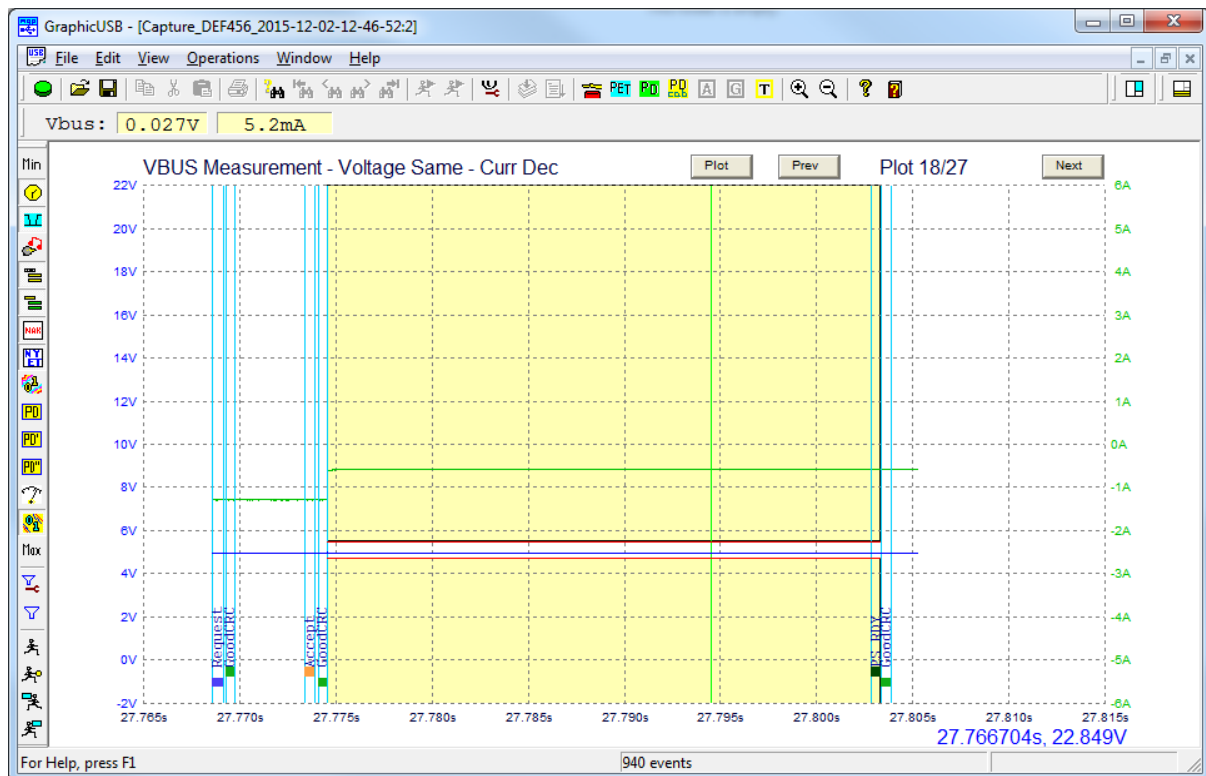


Zooming in shows how the PD message positions are indicated in their exact time positions:



This capture shows a Request sequence for a change of current without a voltage change. The green line indicates a current decrease at the start of the sequence. Negative current is current sunk by the PDT. Note that the voltage remains in specification.

The plotted voltage is calculated, on a point by point basis, to be the voltage at the source end of the cable. This is why the calibrated cable must be used and its resistance entered into the Test Parameter dialog:



7 Updating PDT Firmware

= to be added =

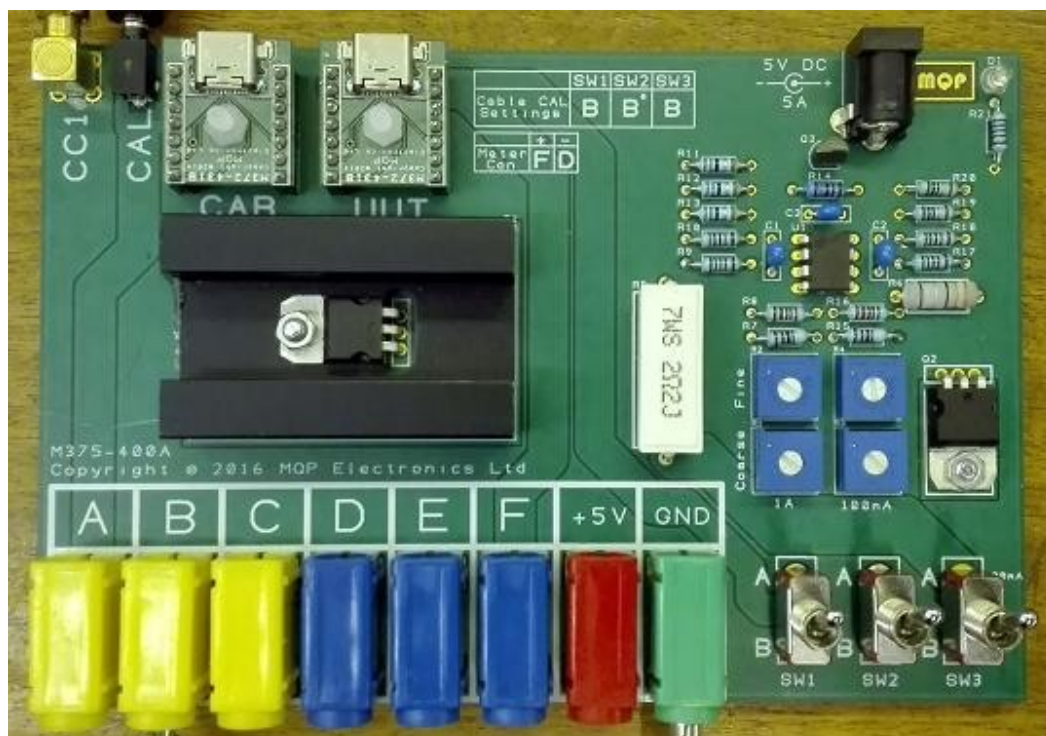
8 PDT Calibration Jig User Instructions



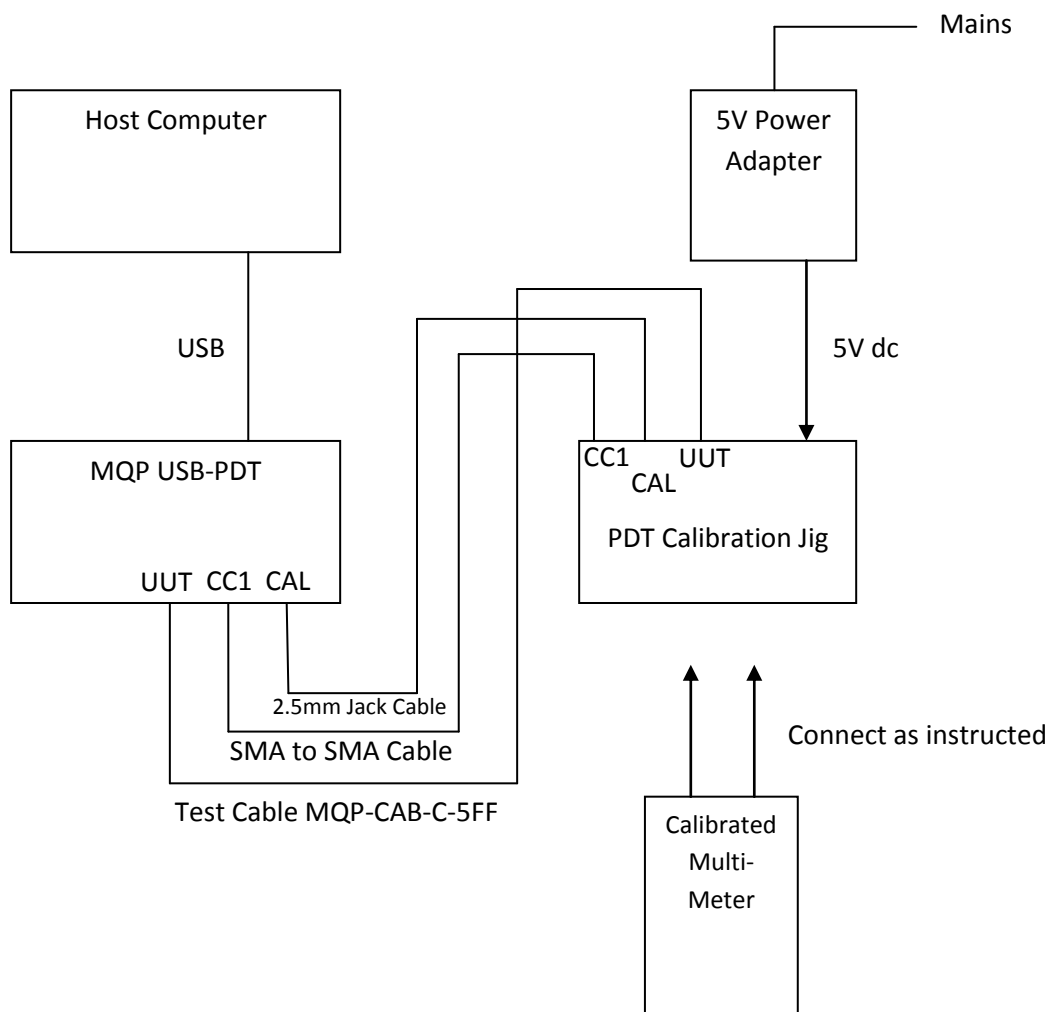
1.1 Contents of Calibration Kit

- Calibration Board
- 5V dc / 5A Power Adapter
- Mains cable for Power Adapter
- SMA to SMA cable
- 2.5mm jack plug to 2.5mm jack plug cable

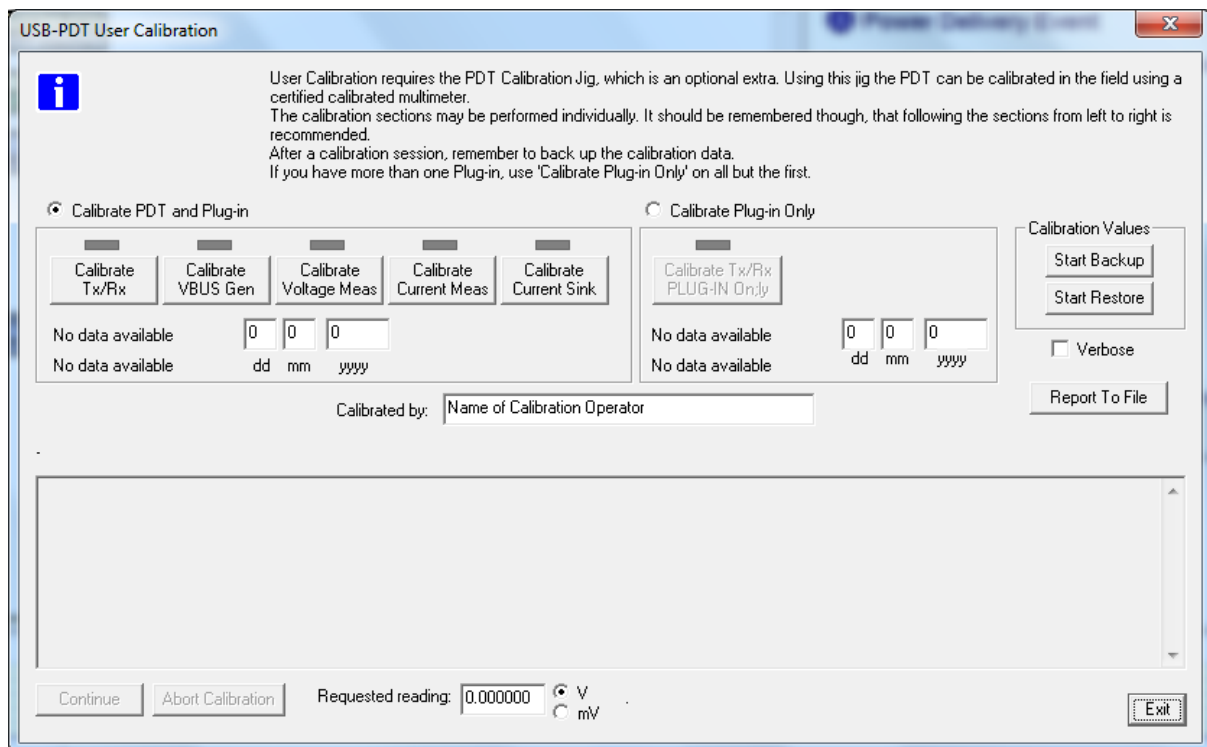
8.1 Calibration Board



8.2 Connection diagram



Set up the PDT and Calibration kit as shown above. Then run GraphicUSB on the Host Computer. Select menu... Operations...PD...PDT Calibration.



Now follow the instructions given in the dialog.

Normally:

- Select Calibrate PDT and Plug-in
- Enter name of person doing the calibration in the 'Calibrated by' box
- The calibration is performed in 5 separate stages, from left to right.
- Follow the instructions carefully

If you are calibrating a second plug-in it is important to only calibrate the plug-in and not the whole PDT unit, so in this case:

- Select Calibrate Plug-in Only
- Follow the instructions carefully

After successful calibration, click 'Start Backup' to save the calibration data to a file.

8.3 Calibrating Test Cable

Current Set Up

1. Connect 10 Amp Calibrated Meter between F & D
2. SW1, SW2 & SW3 to B,
3. Adjust 1A course & Fine pots for 1.000Amp.
4. Disconnect Current Meter.

Cable Resistance Calibration

1. Using 1 Amp Calibrated Source (see current set up above)
 2. Plug in C Cable between CAB & UUT Sockets
 3. Set all Switches to B (1A through Cable)
 4. Measure **Volts** between F & D.
 5. The Millivolt Reading = Milli Ohm Resistance Value
- Example: Reading = 123mV this equates to a resistance of 123mOhm
The value for PDT Cables will be between 95mR & 145mR
(This is based on the equation $R=V/I$ where $I=1$ Amp)

**Warning: Do Not Use an Ohm Meter to Measure Resistance Directly
As Damage May Be caused to the Meter by passing 1 Amp through it!**

