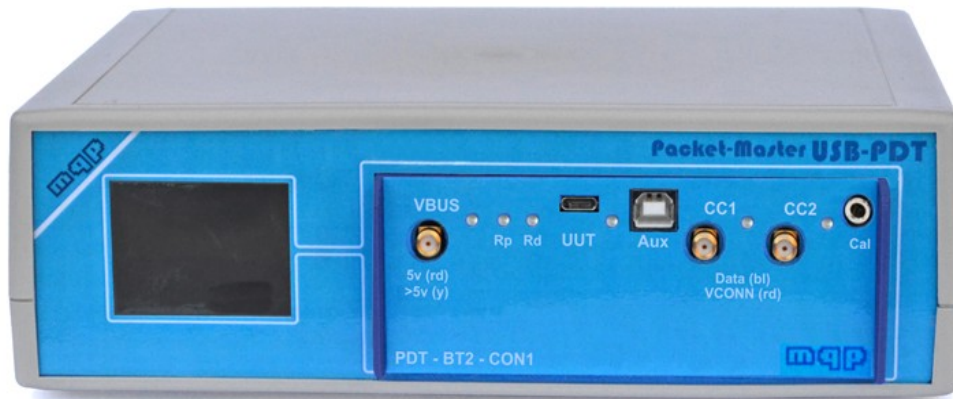


Packet-Master USB-PDT Power Delivery Compliance Tester

The **Packet-Master USB-PDT** is a USB Power Delivery Compliance Tester and development tool. The base unit was designed to be adaptable to either the FSK or the BMC variants of the Power Delivery specification.

The USB-PDT comes complete with our Windows application **GraphicUSB** for driving and reporting on the Compliance Tests and capturing and displaying every detail of the PD interactions.



The Packet-Master USB-PDT from MQP is the world's first comprehensive Power Delivery Compliance Tester, for testing protocol, measuring signal quality and power load testing, all within one unit.

Power Delivery

Power Delivery is a specification allowing USB to provide power in a more flexible and adaptable way. The FSK version uses two-way signalling superimposed on the existing VBUS wire in the USB cable. The BMC version uses two-way signalling on the CC wire of a USB C-cable.

Power Delivery Compliance Tester

The Packet-Master USB-PDT behaves as one end of a PD link. It can emulate the behaviour of an initial DFP or UFP in controlled ways, and as such is able to confirm the responses of the connected Unit Under Test (UUT).

Cable Marker Compliance Tester

It is also designed to perform all the required protocol and PHY Compliance Tests on Electronic Cable Markers. Nothing else is required for these tests

Exerciser

In Exerciser mode, the USB-PDT will behave as a Provider, Provider/Consumer, Consumer or Consumer/Provider, and the operation can be manually controlled to perform all the usual PD operations, including Requests, Swaps, Hard Resets and BIST Mode Requests. Simultaneously an analyser Capture may be performed, in order to view how the UUT responds.

Analyser

Analyser functionality is always available. An additional plug-in module is required to allow analysis of PD between two external PD devices.

Background

USB-PDT has been designed in conjunction with the PD Compliance Plan. Virtually any non-compliance with the protocol, timings, signal quality, or power control will be revealed, and a detailed description of the problem displayed.

Resources

The Tester is built around a 250Ms/s ADC and DAC, plus a number of other critical resources (see Table on next page)

Because of its design approach, the USB-PDT is equally capable of performing the PHY testing envisaged for the FSK variant of PD. This would require a different plug-in module.

Software/firmware updates are generally available free of charge from our website.

Report and Analysis Operation

The Packet-Master USB-PDT detects and displays the following in a simple-to-understand yet informative manner:

- Every PD message packet, including full detail of the pre-amble bits, SOP ordered set, header and data objects. Every bit field is analysed, described and any potential non-compliances are highlighted.
- Test Pattern Frames are displayed and analysed to indicate whether they contain a valid PRBS test pattern.
- Bit Stream and other continuous waveforms are displayed, with an analysis of their type.
- The VBUS voltage and current are monitored and displayed, on a zoomable timeline which also shows the actual PD message packets. Discrepancies between voltage and current changes and the occurrence of related messages are clearly shown.
- SOP', SOP", SOP'_debug and SOP"_debug messages are also displayed.

In minimum display mode, the graphical display shows message sequence headers, allowing a quick overview summary of the significant PD events. These headers can be double-clicked to reveal every PD packet in that segment of the event display.

Plug-In Modules

A special feature of the Packet-Master USB-PDT is the plug-in module for the connections to the Units Under Test. This has the following advantages:

- Some of the USB-PD connectors are easily damaged by rough handling. If a connector becomes damaged, simply replace the plug-in module. On the C-Type Plug-in the Socket itself is a plugged-in user replaceable item.
- Various different connector styles are available for USB-PD use. Swappable plug-in modules provides the flexibility required.
- It is a feature of USB-PD that extra connectors and adapters can result in voltage losses beyond that permitted for correct PD operation. For pure analyser purposes MQP recommends an analyser plug-in module with a captive PD cable. This has only two connectors, and therefore meets the required specification, while still providing non-intrusive PD message interpretation.
- It permits immediate switching between Baseband and FSK forms of PD, simply by using a new plug-in module with the appropriate connections. (FSK subject to availability).

Requirements

The minimum requirements for the Packet-Master USB-PDA Host are as follows:

- Pentium D - 2.66GHz or better.
- PC with High Speed USB 2.0 port should be dedicated to the USB-PDA.
- Windows XP (Service Pack 1 or better), Vista or Windows 7 or 8.
- CD ROM / DVD Drive
- 2GB RAM
- 100MB space on Hard Disk

Tester Resources

The tester has a number of built-in resources which contribute towards its capability as a comprehensive PD Compliance Tester: In general these resources are under the automatic control of the software, so for example capturing an Eye Diagram results from starting one particular test.

Signal Receiver	A 250Ms/s ADC samples the incoming signal. This is fed to programmable logic capable of filtering the signal, and also of storing the captured samples in order to perform Eye Diagram analysis on them. The Eye Diagram is plotted using the algorithm specified in the Compliance Plan
Signal Transmitter	The outgoing signal is generated by programmable logic, feeding a 250Ms/s DAC. This allows the generation of any shape of transmitted signal, from perfect signals to signals with any degree of simulated interference. Signals may of course be generated at any bitrate. The offset is also controllable. A Bus Idle condition with programmed aggression signal and programmed offset can also be generated.
Power Delivery Protocol Engine	A fully compliant policy/protocol engine emulates the behaviour of an ideal device, or deliberate errors may be introduced. As this is based on downloadable logic, the engine specification can be kept up to date, by means of software downloads, generally available free of charge from our web site.
Power Delivery Analyser	A non-intrusive PD Analyser provides captures of every detail of the PD protocol and timing between events. The analysis includes a zoomable time-line, which also displays VBUS voltage and current waveforms, allowing a quick check on message versus power timings.
VBUS Voltage Measuring Circuit	Measures VBUS voltage at up to 1Ms/s. -10 to +30V
VBUS Current Measuring Circuit	Measures VBUS current at up to 1Ms/s. -10 to +10A
100W VBUS Generator Circuit	Generates VBUS from 0V to 20V at up to 5A in steps of 50mV. Designed to meet PD specifications.
100W VBUS Programmable Current Load	Sinks currents up to 5A in steps of 10mA, or power up to 100W in steps of 250mW, with programmable rise and fall times. Designed to meet PD specifications.

PDT-BT2-CON Plug-in Module Resources

Connectors	<ul style="list-style-type: none"> • USB C-Type for UUT (user replaceable) • USB B-Type (auxilliary) • SMA VBUS External Scope Connection • SMA CC1 External Scope Connection • SMA CC2 External Scope Connection • Calibration Connector
LEDs	<ul style="list-style-type: none"> • Plug-in Active • VBUS at vSafe5V / VBUS at elevated voltage • Rp applied • Rd applied • CC1 data/VCONN • CC2 data/VCONN

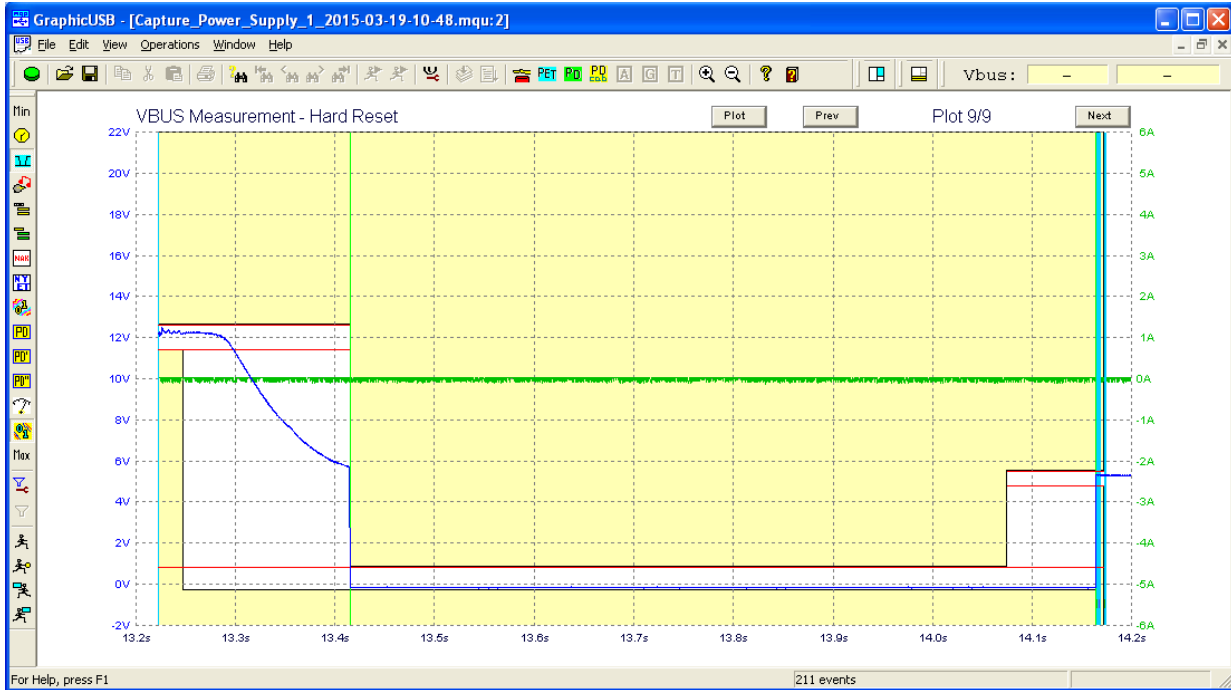
Transition

During a Compliance test involving a Transition, the VBUS voltage and current waveforms are captured, and plotted against the appropriate mask. The example above shows a positive voltage transition. The blue vertical lines show the boundaries of the PD messages (described in more detail on zooming in, see example on following page). The waveforms would be coloured red where they intersect the mask.

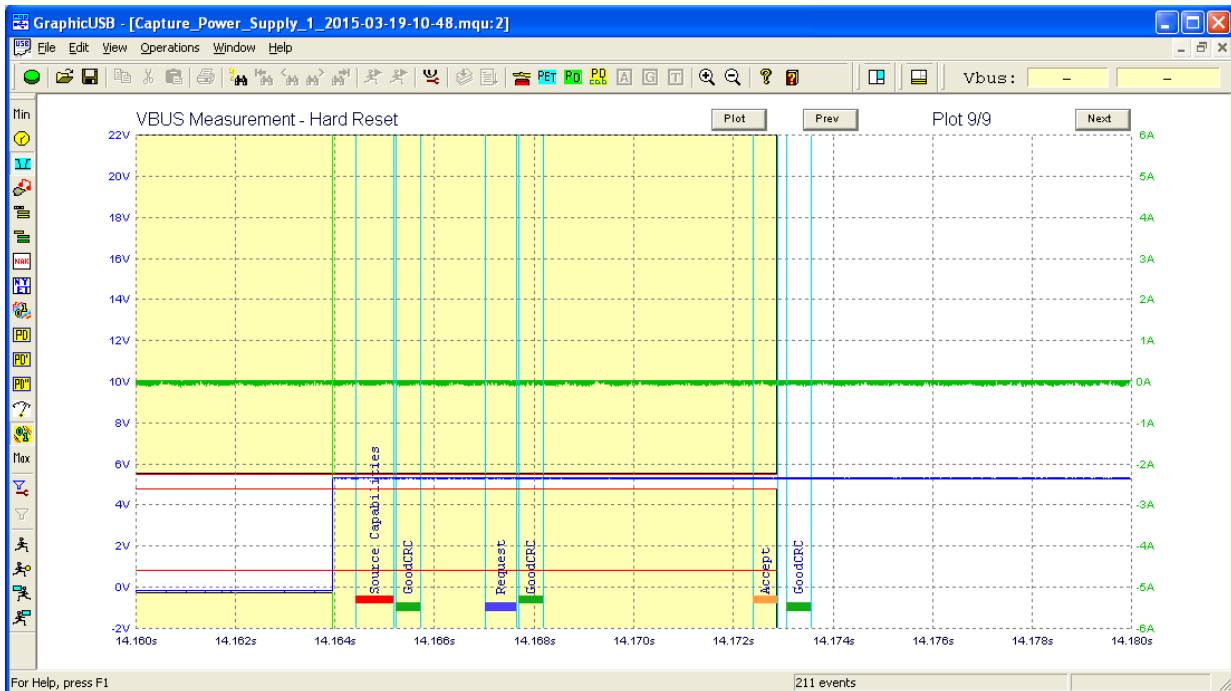


Hard Reset

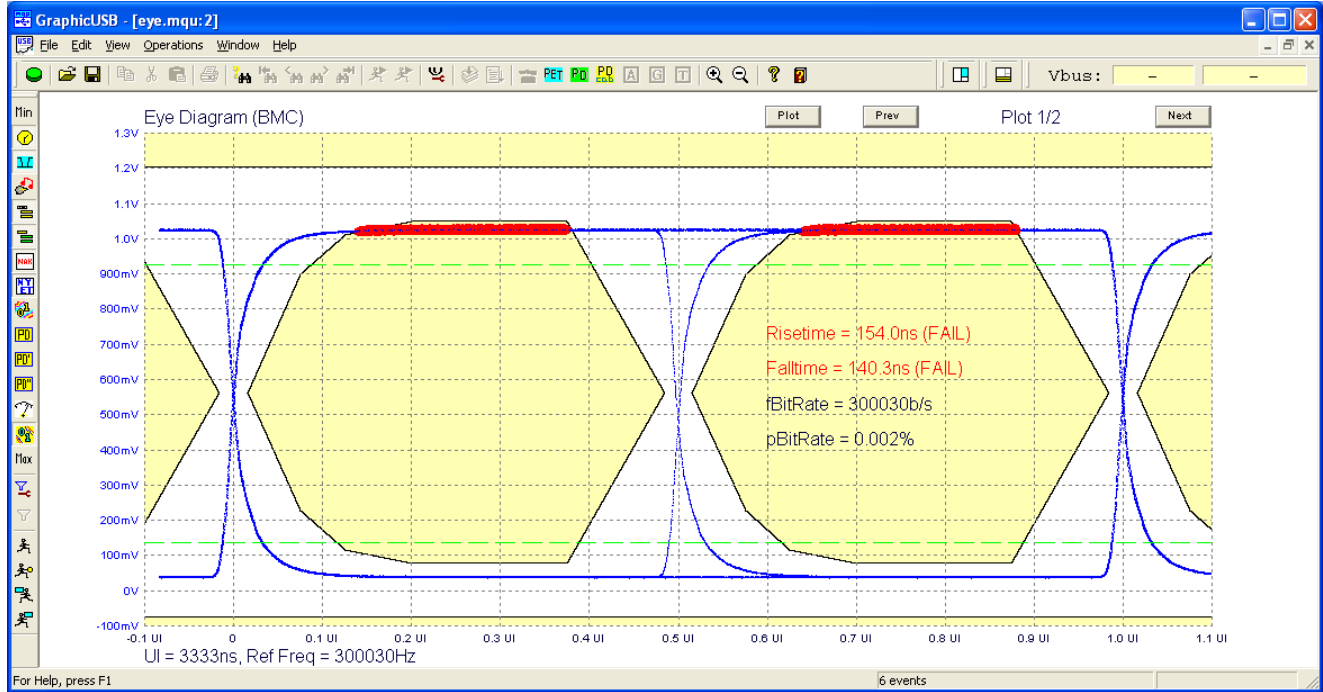
Another example is this Compliance Test capture of a Hard Reset, the VBUS voltage and current waveforms are plotted against the appropriate mask, defined by the PD Specification. The blue vertical lines show the boundaries of the PD messages (described in more detail on zooming in). The waveforms will be coloured red if they intersect the mask.



Zooming in on the end of this capture (shown below) we see the exact timing and description of the PD messages, in relation to the VBUS waveforms



Eye Diagram



One important capability of the Tester is to run an Eye Diagram test as specified in the Compliance Plan.

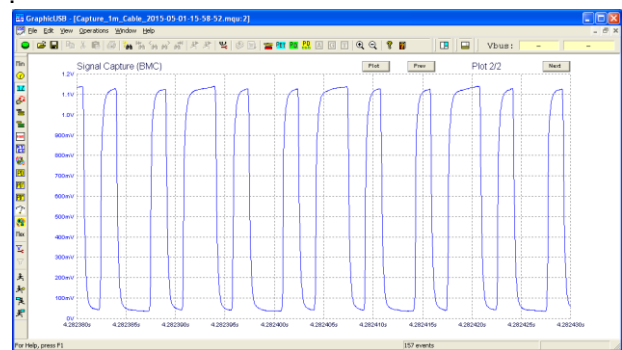
The Tester will establish PD communication with the UUT, transmit a BIST Mode 2 request, and during the 30-60ms continuous transmission resulting, will capture samples of the waveform from the UUT.

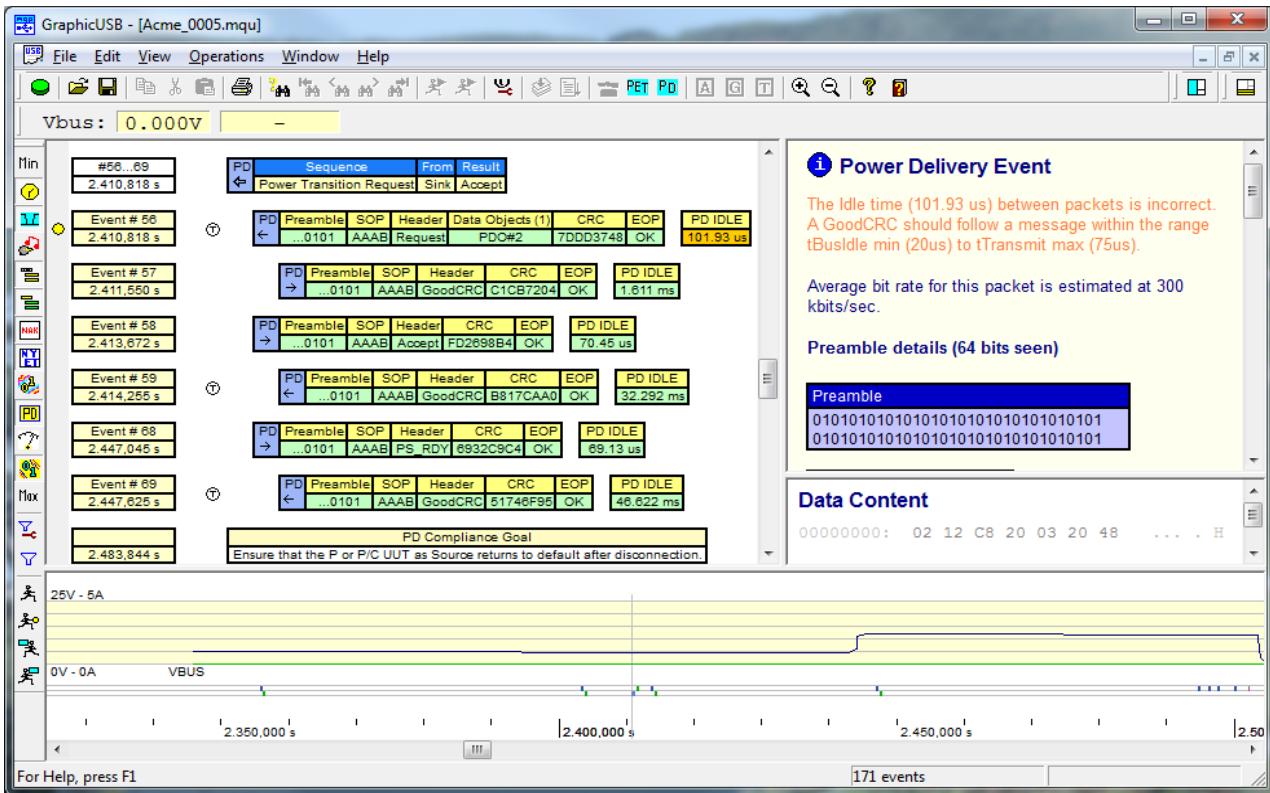
The UUT may be a PD device or an electrically marked Type-C cable.

The samples are plotted against the defined mask, with an indication of any places where the mask is intersected.

The other specification parameters; Risettime, Falltime, BitRate, and Bitrate drift are also calculated and displayed (and displayed in red if out of spec).

The original captured signal, used to build the eye diagram, is also available for display





The GraphicUSB Application User Interface

GraphicUSB Application

The Packet-Master product is supplied complete with our GraphicUSB software application.

Event Capture Panel

This panel (on the left) displays the captured events, either in summary header form, or detailing every event which is captured. Any event may then be selected for complete analysis.

Colour is used to draw attention to any specification violations.

Detail Panel

This displays the detailed analysis, down to bit level, of the event selected.

Detailed analysis of any specification violations is available in this panel.

(Note that the violation shown was before a spec change - the check is different in the current version.)

Timeline Panel VBUS Voltage and Current Frames Events

In the zoomable panel along the bottom is a VBUS voltage and current display, lasting for the full duration of the capture.

Below the voltage and current waveforms is a graphical representation of the position in time of each PD frame. Hovering over any of these shows a tooltip describing the frame.

Together these displays allow the developer to confirm the timing relationship between messages and voltage/current transitions.

Physical

USB-PDT (Tester)	
Size:	250 x 180 x 75 mm
Weight:	1800 gm (including one Plug-in module) 1100 gm for PSU
Temperature:	0°C - 40°C
Humidity:	20% - 80% non condensing
USB Current draw	Zero mA from USB.
Using the external power supply 24V/8A (included) is the required mode of operation.	

Comparison Chart

Feature	USB-PDT	USB-PDA	USB-PDA-E
Analyser	✓	✓	✓
Exerciser	✓		✓
Compliance Tester	✓		
PD VBUS Generator	✓		✓
PD VBUS Load	✓		
VBUS Voltage and Current Monitor	✓	✓	✓
Analyser Capture Start/Stop Controllable from Unit	✓	✓	✓
External Power Supply Provided	✓	✓	✓
RoHS Compliant	✓	✓	✓
Signal Quality Analysis	✓		
BMC and FSK Eye Diagram Compliance Tests	✓		
FSK Noise Spectrum Analysis and Compliance Tests	✓		

Product Coding

This table describes the system elements at the time of preparation of this brochure. Other plug-ins types may be supplied to order, please enquire.

Designation	Description	Availability
USB-PDT	Tester Base Unit. At least one plug-in should be ordered to complete the unit.	June 2015
PDT-BT2-CON	Plug-in C-Type Connector	June 2015

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