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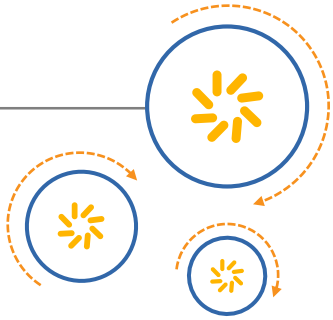

Qualcomm® Power Automation Toolkit

User Guide

80-NK067-1 Rev. G

September 11, 2015

Questions or comments: https://createpoint.qti.qualcomm.com/

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Revision history

Revision	Date	Description
A	November 2013	Initial release
B	December 2013	Added: ▪ Section: Device Requirements ▪ FAQ topic “Why am I seeing a low battery warning on my device during measurement?” ▪ Disclaimer
C	June 2014	Updated: ▪ Chapter 1, Introduction (includes former Chapter 2) ▪ Section 3.6, QPAT Installation ▪ Section 3.7, iPerf ▪ Section 5.2, Execute QPAT ▪ Section 5.6, Command line execution Added: ▪ Section 3.8, Web server ▪ Section 5.3, Advanced options ▪ Section 5.5, Debug logs ▪ Section 6.1.2, Camera Preview ▪ Section 6.1.4, FM Radio ▪ Section 6.1.6, Home Screen Scrolling ▪ Section 6.1.12, Video Recording ▪ Section 6.1.13, Wi-Fi Browsing ▪ Section 6.1.14, Wi-Fi Idle ▪ Section 6.1.15, Wi-Fi Video Streaming ▪ Section 6.1.16, Sensors
q	July 2014	▪ Added Chinese translated from Rev. C ▪ Changed headers/footers throughout the whole document and cover page legends based on the bilingual template approved by legal.
E	March 2015	Added Section 5.4, Custom test creation.
F	July 2015	Added Chapter 2 introduction Added new: ▪ Section 2.3, Agilent 663 Power Supply with USB ▪ Section 6.1, Bundle configuration ▪ Section 6.2.4, Download – MobileData ▪ Section 6.2.5, Final Fury ▪ Section 6.2.8, Graphics – 3D Game ▪ Section 6.2.16, Video Recording Updated: ▪ Section 5.2, Execute QPAT ▪ Section 5.3, Advanced options ▪ Section 6.2.1, Audio Playback (Offload and Non-offload)
G	September 2015	Updated Section 2.3 and added Section 2.3.1 to include USB and VBUS Switchboard information.

Contents

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1 Introduction

Welcome to the Qualcomm Power Automation Toolkit (QPAT), the complete solution to power measurement and debugging for Qualcomm devices. Thank you for selecting Qualcomm as your mobile chipset manufacturer.

1.1 QPAT at a glance

QPAT is an easy to use power measurement and debugging tool. This simple but powerful software tool lets you quickly and accurately measure the power consumption of Qualcomm devices under various test scenarios.

The QPAT tool uses third-party hardware, for example Monsoon's Power Monitor, to measure power at a sample frequency of 5 kHz, thus providing accurate results that can be easily repeated.

With the QPAT software, users can quickly verify new phone builds and also test multimedia and modem scenarios for power validation.

1.2 Getting help

- If you need help installing the QPAT software, follow the detailed installation procedures in Chapters 2 and 3.
- A video tutorial is also available on the Qualcomm CDMA Technologies (QCT) Documents and Downloads website (https://downloads.cdmatech.com/qdc/), referred to as the Qualcomm Docs and Downloads website in this document.
- If you are new to power measurement, follow the execution steps in Chapter 5 to get started. Web video tutorials are available on the Qualcomm Docs and Downloads website.
- If you are looking for detailed test case information, see Chapter 6.
- Common troubleshooting questions and answers are provided in Chapter 7.
- Known issues are listed in Chapter 8.
- Appendix A provides the code needed for the Android driver.

2 Hardware Setup

QPAT supports two different measurement solutions. The recommended hardware to use is the Monsoon Power Monitor because of the simple setup and the high sample rate. The alternative measurement device is the Agilent 663 series which can be used in conjunction with the Qualcomm supplied reference design for a USB switch.

2.1 Creating a dummy battery for devices

1. Take a real battery and note the positive and negative terminals.
2. Remove the plastic header from the battery and connect 20-gauge wires to the battery terminals. The wires should be approximately 1 foot in length.
3. Attach a 2200 µF, 25 V electrolytic bypass capacitor between the positive and negative wires.
4. Use the same ID resistor and thermistor as the real battery.
5. Glue the battery header onto sturdy material that has the same dimensions as the real battery.

Figure 2-1 QRD8x26 dummy battery

2.2 Connecting the power monitor

Important: It is essential to follow the steps in the order listed. If the Power Monitor device cannot be detected using the PowerTool, disconnect the Power Monitor from the PC and then reconnect using the steps listed.

1. Ensure that the Power Monitor switch is in the outward off position.
2. Connect the supplied 6 VDC/5 A power supply to the back of the Power Monitor.
3. Turn on the Power Monitor. The internal fan will briefly turn on and off.
4. Connect the USB B-type cable from the *back* of the Power Monitor to the host PC, and then connect the USB B-type cable from the *front* of the Power Monitor to the host PC.
5. With a dummy battery in the mobile device, use the supplied banana cables to connect the leads of the dummy battery to the red and black connectors of the Power Monitor.
6. Connect the Micro USB cable from the mobile device to the Power Monitor.

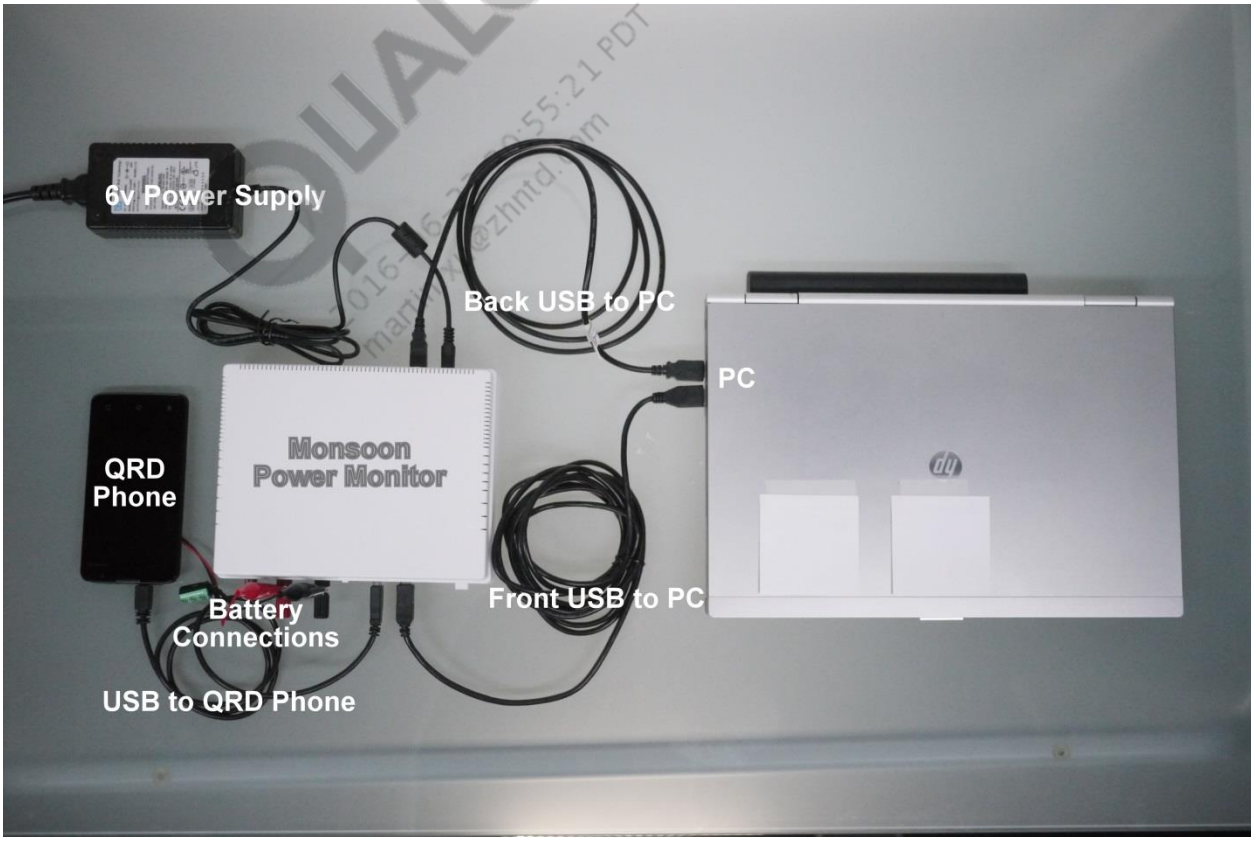


Figure 2-2 Overall QPAT setup

2.3 Agilent 663 Power Supply with USB switch

If the Monsoon Power Monitor is not available, QPAT can also be used with an Agilent Power Supply.

1. Connect the Agilent Power Supply to the host PC using a GPIB to USB connector.
2. Power on the Agilent Power Supply and set the Address to 16.
3. Ensure that the Power Supply is detected by the PC and that all necessary drivers are installed.
4. Connect the positive and negative terminals from the back of the power supply to the device's fake battery.
5. Check to make sure that the device can be powered on/off manually through the Agilent's front display panel.
6. Connect the Qualcomm USB controller as per the diagram below.

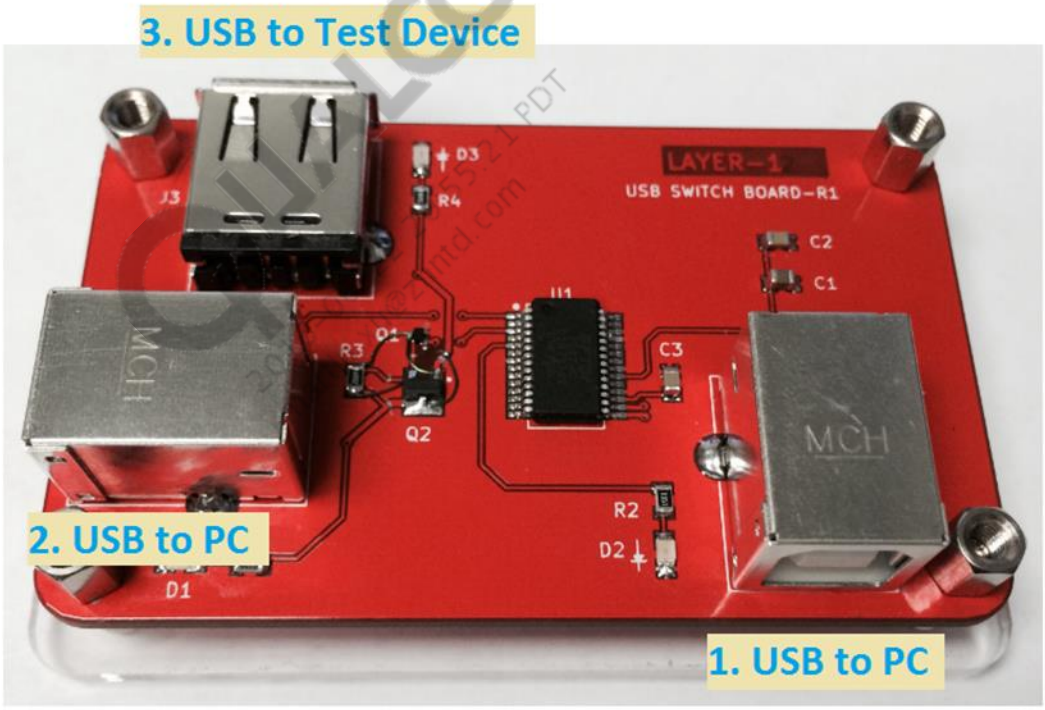


Figure 2-3 USB switch board

Figure legend:

1. This USB cable to PC is used to control the USB switch.
2. This USB cable to PC is the passthrough to the device and is switched on and off by the FTDI chip.
3. This USB cable to Test Device goes from the switch board to the DUT.

2.3.1 Creating a USB switch board

Table 2-1 USB switch parts list

Item	Qty	Ref Des	Vendor	Vendor PN	Mfg	MPN	Package	Description
1	1	C1	Mouser	581-08053D475K	AVX	08053D475KAT2A	805	CAP,CHIP CERAMIC 4.7UF 10% X5R 25V ROHS
2	2	C2, C3	Mouser	581-08055C104K	AVX	08055C104KAT2A	805	CAP,CHIP CERAMIC 0.1UF 10% X7R 50V ROHS
3	1	D1	Mouser	630-HSMY-C170	Avago	HSMD-C170	805	Standard LEDs - SMD Yellow Diffused
4	1	D2	Mouser	630-HSMG-C170	Avago	HSMG-C170	805	Standard LEDs - SMD GREEN Diffused
5	1	D3	Mouser	630-HSMS-C170	Avago	HSMS-C170	805	Standard LEDs - SMD RED Diffused
6	1	E1	Mouser	81-BLM21P221SG	Murata	BLM21PG221SN1D	805	EMI Filter 220 ohms 2A
7	2	J1, J2	Mouser	538-67068-9001	Molex	67068-9001	THD	USB B-Type Connector
8	1	J3	Mouser	538-67643-0910	Molex	67643-0910	THD	USB 2.0 A-Type Connector
9	2	Q1, Q3	Mouser	755-DTC143ZMT2L	Rohm	DTC143ZMT2L	VMT-3	Bipolar Transistors - Pre-Biased DGTL NPN 50V 100MA
10	1	Q2	Mouser	781-SI2333DS-T1-E3	Vishay	SI2333DS-T1-E3	SOT-23-3	MOSFET 12V 5.3A 1.25W 32 mohms @ 4.5V
11	1	R1	Mouser	667-ERJ-6ENF7150V	Panasonic	ERJ-6ENF7150V	805	RES SMD 300 OHM 5% 1/8W 0805 THICK FILM
12	1	R2	Mouser	667-ERJ-6ENF1151V	Panasonic	ERJ-6ENF1151V	805	RES SMD 510 OHM 5% 1/8W 0805 THICK FILM
13	1	R3	Mouser	667-ERJ-6ENF4992V	Panasonic	ERJ-6ENF4992V	805	RES SMD 49.9K OHM 1% 1/8W 0805
14	1	R4	Mouser	667-ERJ-6ENF8870V	Panasonic	ERJ-6ENF8870V	805	RES SMD 390 OHM 5% 1/8W 0805 THICK FILM
15	1	U1	Digikey	768-1007-1-ND	FTDI	FT232RL-REEL	SOIC-28	USB to Serial single channel
16	1	U2	Mouser	595-TS3USB30ERSWR	TI	TS3USB30ERSWR	UQFN-10	USB 2.0 Switch
17	1		Seed Studio	ACC12251M	Dangerous Prototypes	DP7043	70mm x 43mm	Sick Of Beige Basic Case v1 (DP7043) Enclosure
18	4		Mouser	855-R30-1001202	Harwin	R30-1001202		5.0 MM A/F, M3, 12MM LENGTH HEX STANDOFF
19	4		3M	SJ5012 Black	3M	70006352655		3M™ Bumpon™ Blister Pack SJ5012 Black, 0.500 in x 0.140 in, 56 Bumpons per blister

Notes:

1. Item #19 requires 4 adhesive rubber feet (Bumpons) per board. 3M part number 70006352655 is for package with 56 Bumpons (enough for 14 boards) http://www.shop3m.com/catalogsearch/result/?q=70006352655

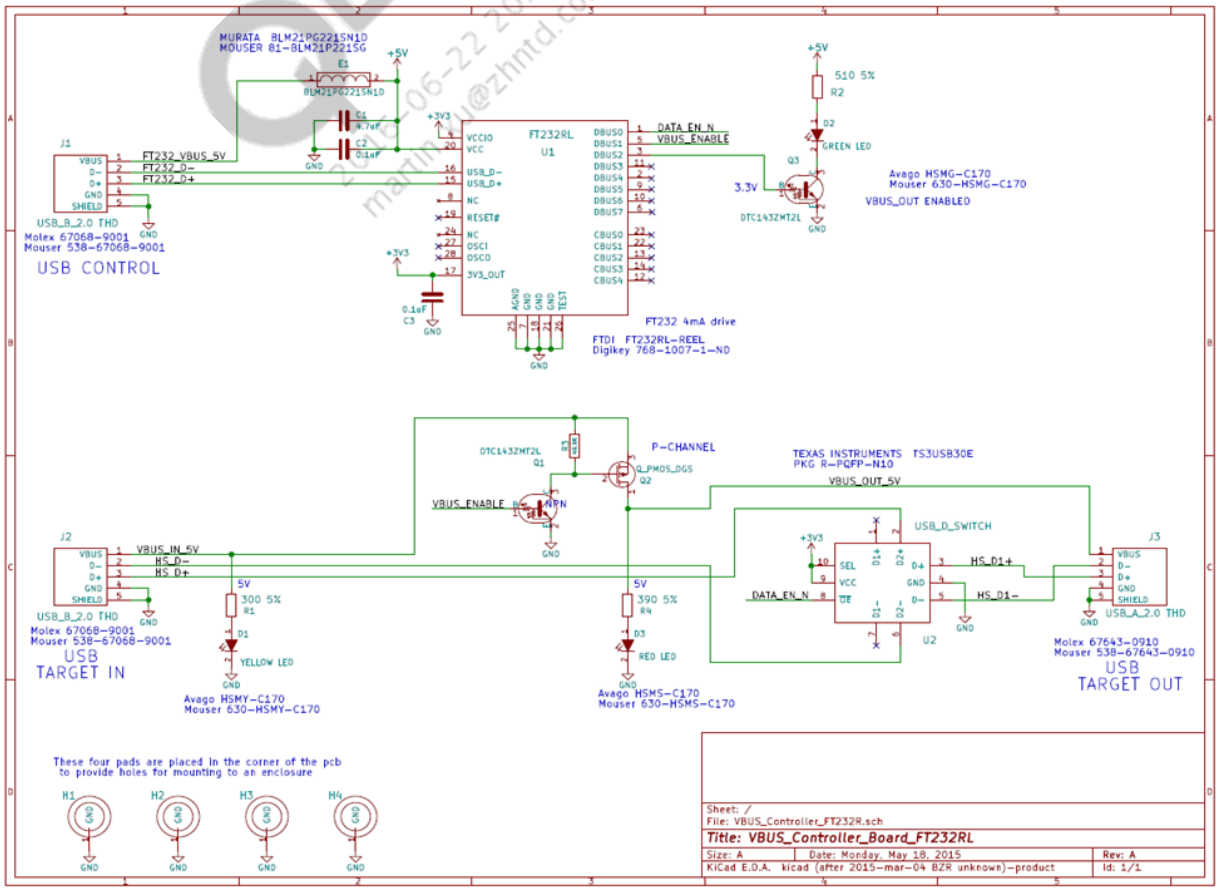


Figure 2-4 USB switch wiring diagram

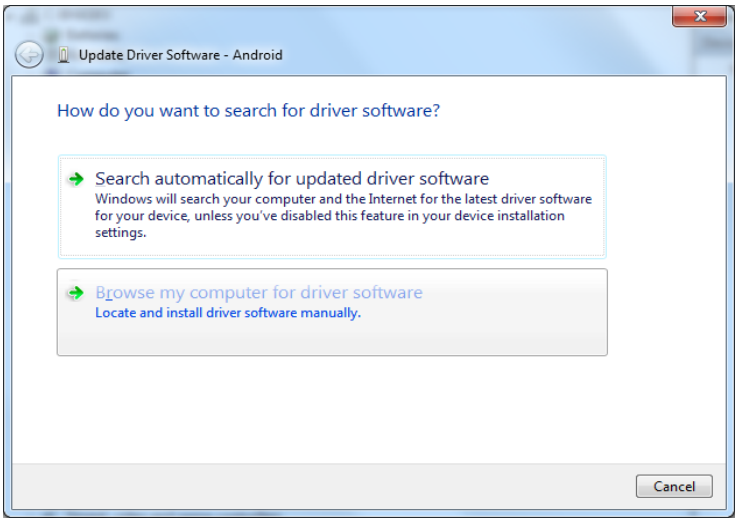
3 Software Setup

3.1 Overview

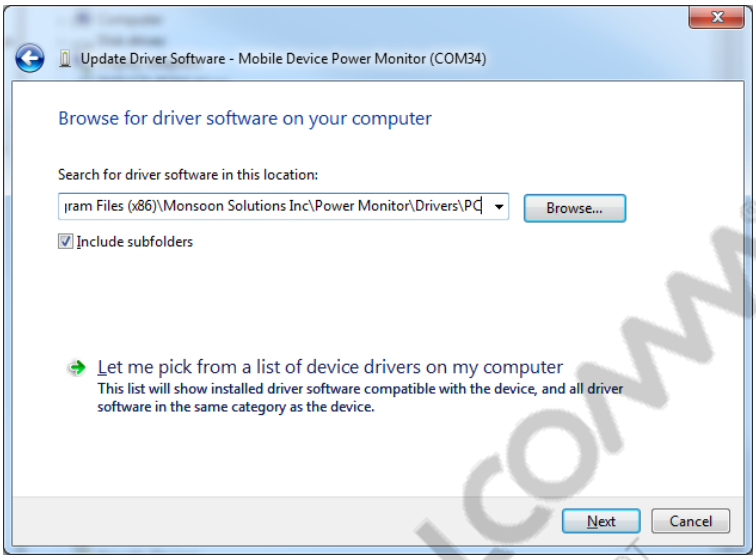
The software setup for QPAT involves installing multiple items. Monsoon's PowerTool software must be installed on the PC to control the Power Monitor hardware. Drivers for the Android device and Android Debug Bridge are also required for QPAT to communicate with the mobile device. These required tools must be installed and working on the host PC before running QPAT.

3.2 PowerTool installation

1. Go to http://msoon.github.io/powermonitor/.
2. Download PowerTool version 4.0.4.11.
3. Locate the downloaded installer and run the setup.
4. Install PowerTool to the default location.
5. After installation, make sure that the drivers were loaded correctly.
6. Open the Windows Device Manager: Right-click **My Computer,** select **Properties,** and click **Device Manager.**
7. Locate the entry for Mobile Device Power Monitor under the Ports' category. *If there is a yellow exclamation mark,* right-click **Mobile Device Power Monitor** and click **Update Driver Software.**
8. From the Device Driver Wizard, select **Locate and install driver software manually** in Windows 7, or install from a specific location in Windows XP.



9. Navigate to the PowerTool installation location and find the `Drivers` folder.
10. Click **Next** to continue and install the driver.



3.3 Android Debug Bridge (adb)

This step explains how to install adb. If adb is already installed and working, skip this section.

1. Go to http://developer.android.com/sdk/index.html.
2. Download the Android SDK ADT bundle.
3. Unzip the folder.
4. In the unzipped folder, navigate to the `sdk` folder. For example:

   C:\Users\Qualcomm\Downloads\adt-bundle-windows-x86_64-20130917\adt-bundle-windows-x86_64-20130917\sdk
5. Copy the `platform-tools` folder to your main hard drive at: `C:\platform-tools`.

3.4 Qualcomm drivers

These drivers are optional. If you already use adb to communicate with your Qualcomm mobile device, go to Section 3.6.

1. Download the installer for Qualcomm drivers from the Qualcomm Docs and Downloads website.
2. Run the installer and follow the documentation provided with it.

3.5 Android driver

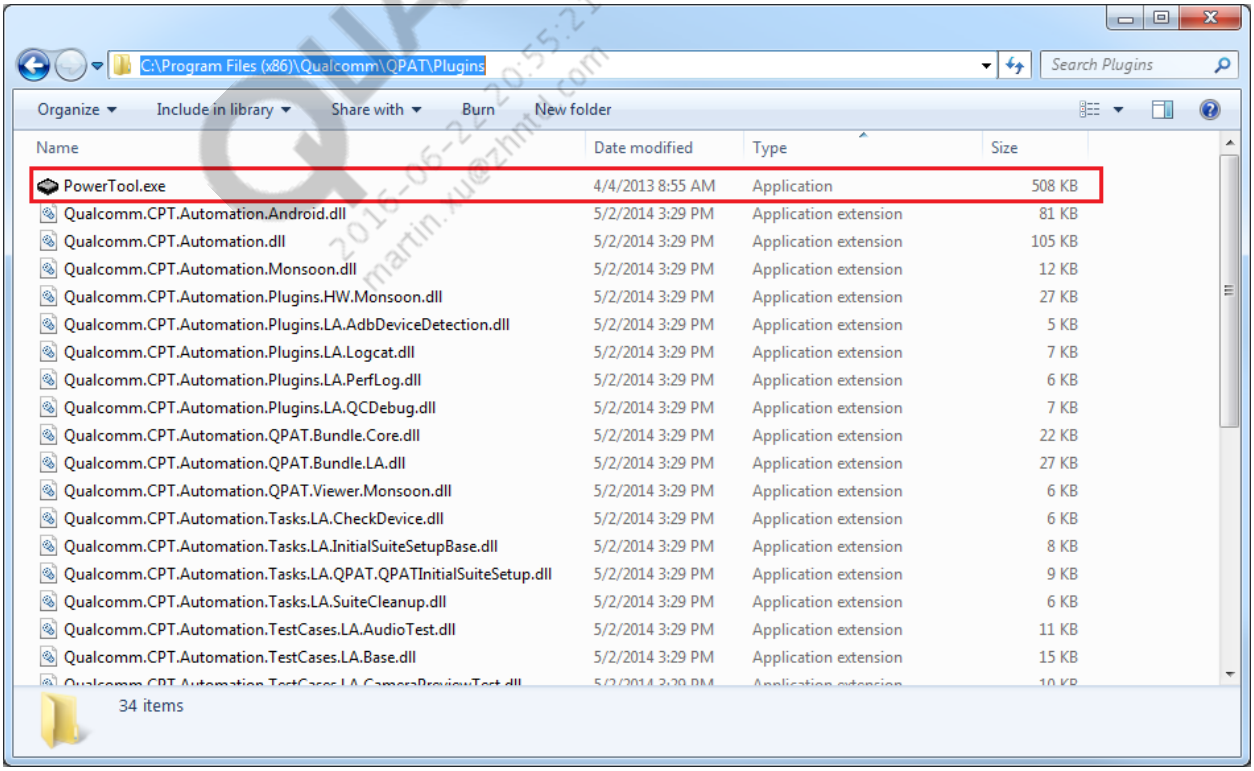
This driver is optional. If you already use adb to communicate with your device, go to Section 3.6.

1. Download the Android drivers at: http://developer.android.com/sdk/win-usb.html.
2. Use the Windows **Device Manager** to install the driver.

For more information, see Appendix A.

3.6 QPAT installation

1. Download the installer from the Qualcomm Docs and Downloads website.
2. Locate the downloaded installer and double-click the file to start the setup.
3. The Installshield Wizard will open and guide you through the rest of the process.
4. Manually copy `PowerTool.exe` from `C:\Program Files (x86)\ Monsoon Solutions Inc\Power Monitor` to your `Plugins` folder in the QPAT installation location. The default QPAT installation location is: `C:\Program Files (x86)\Qualcomm\QPAT`.



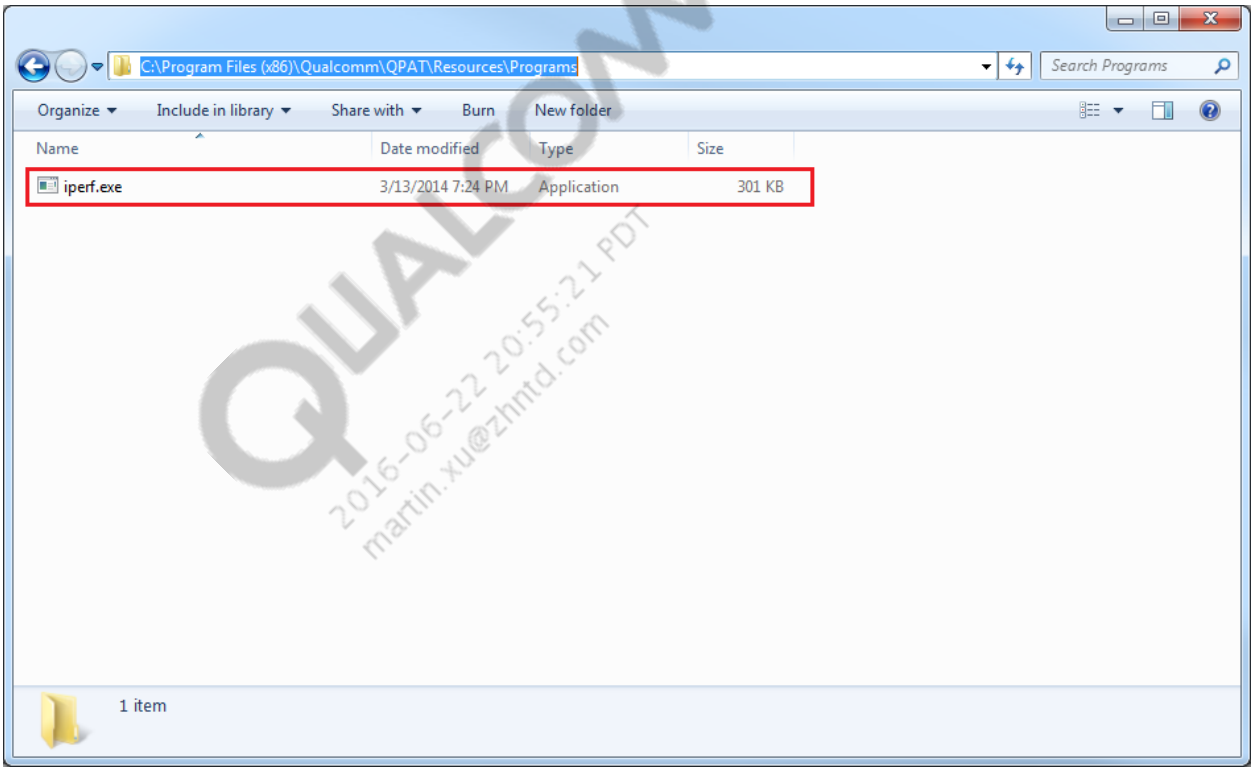
3.7 iPerf

The QPAT Data Call test case relies on a network tool called iPerf. For more information on the Data Call test, see Section 6.2.3.

1. Download iPerf from the following locations:
   - http://linhost.info/2010/02/iperf-on-windows/

   or

   - https://nocweboldcst.ucf.edu/files/iperf.exe
2. Copy the `iperf.exe` file from the downloaded location to the QPAT `\Resources\Programs` folder located in the installation location.



3.8 Web server

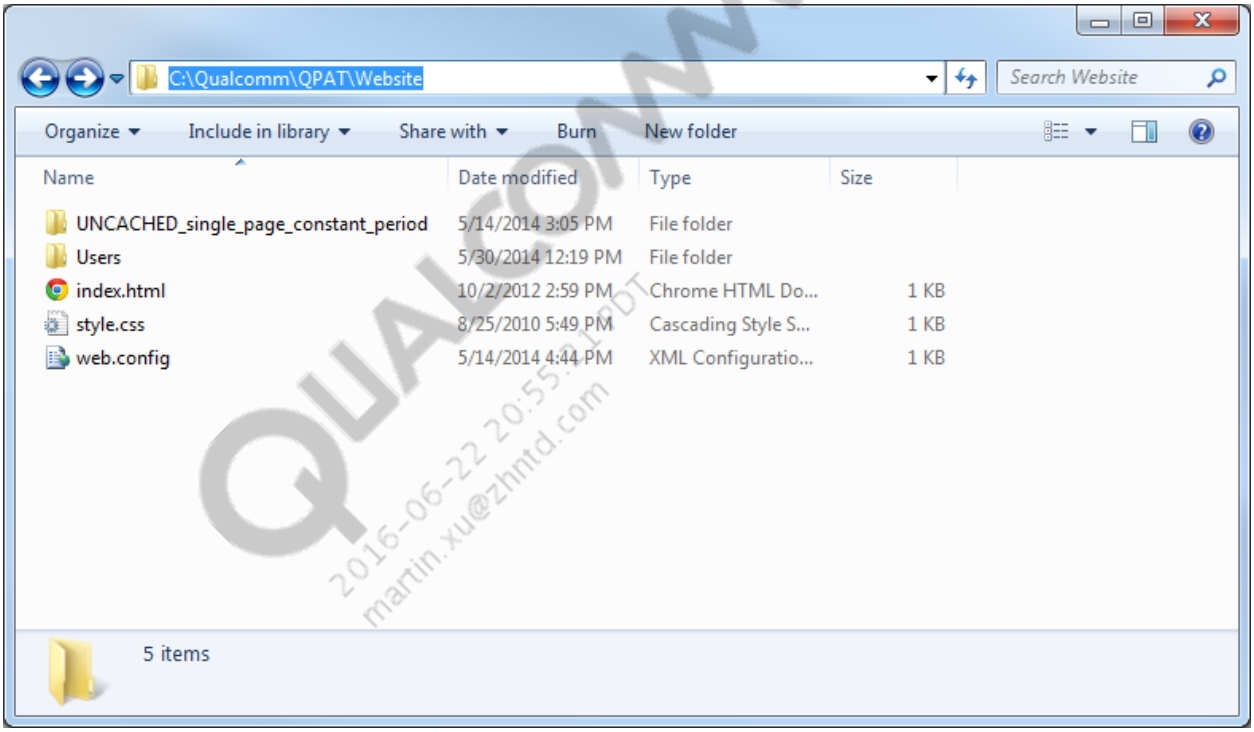
The QPAT Wi-Fi Browsing and Wi-Fi Streaming test cases require a web server setup. A batch file script has been provided in the C:\Qualcomm\QPAT\Website folder that will use the Windows IIS feature to create a localhost web server. Run this script in Command Prompt to set up your server, or use another web server of your choice. You can download the required web files from Qualcomm's Docs and Downloads website.

For the Wi-Fi Browsing test case:

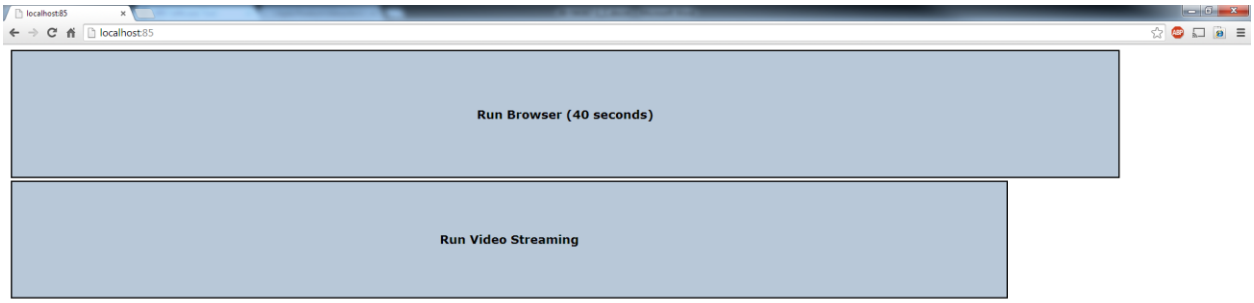
1. Download document ID: 72-N7696-1_4.6.01.zip.
2. Extract the files to C:\Qualcomm\QPAT\Website if using the IIS server, or to your own server location.

For the Wi-Fi Video Streaming test case:

1. Download document ID: MH80-VR010-11.
2. Extract the files to C:\Qualcomm\QPAT\Website if using the IIS server, or to your own server location.



3. Navigate to the website using your web browser to ensure that the setup is working. If using IIS, type, http://localhost:85; otherwise, use the IP address and port of your customer web server.



4 Device Requirements

4.1 Root access

QPAT may require root access to function properly. If root access is not available, execution will proceed as usual. However, warnings will be reported in the QPAT log should any issues arise.

If root access is not available, users may need to manually set the device settings described in Section 6.3.

4.2 Charging mode

QPAT requires that you disable the Charging Mode screen before execution. Proper power testing requires that a hard reboot, where power is cut off from the device, be performed between test cases. If charging mode cannot be disabled, QPAT should still function using the soft-reboot option that can be found in the **Configuration** menu. For details on the soft-reboot option, see Section 5.2.

To disable charging mode:

1. Reboot the device in fastboot mode.
2. From the command line enter: “fastboot oem disable-charger-screen”

4.3 Battery level

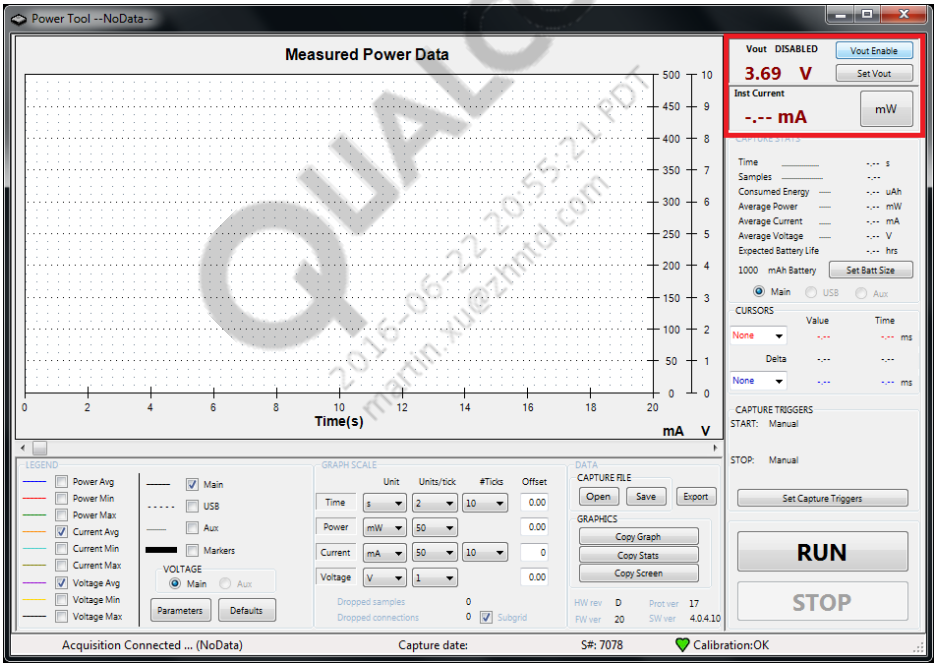
When power measurement is performed, the USB cable to the device is automatically disconnected. This may cause a popup warning to appear on the device, indicating that the battery level is low. Disable this popup before using QPAT. See Section 7.1 (FAQs) for details on how to bypass this warning message.

5 QPAT Use and Execution

5.1 Check installation

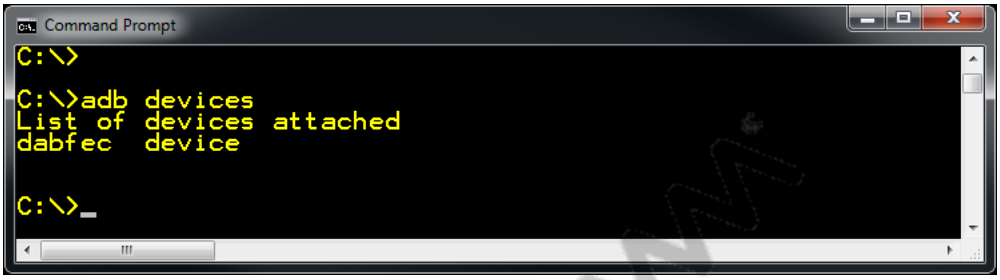
Before running QPAT, we strongly suggest that users make sure the hardware and software installation was performed correctly.

1. Launch PowerTool using the shortcut icon created on the desktop.
2. Enable Vout in the top right corner.



3. On the host PC, open the command prompt and type: `adb devices`.
4. Your mobile device should be listed.

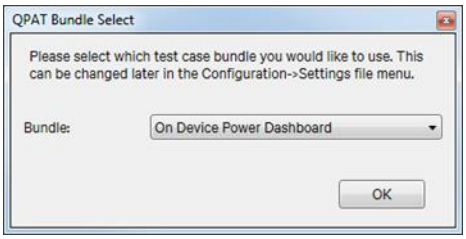
Important: Make sure that only one device is connected to the computer.



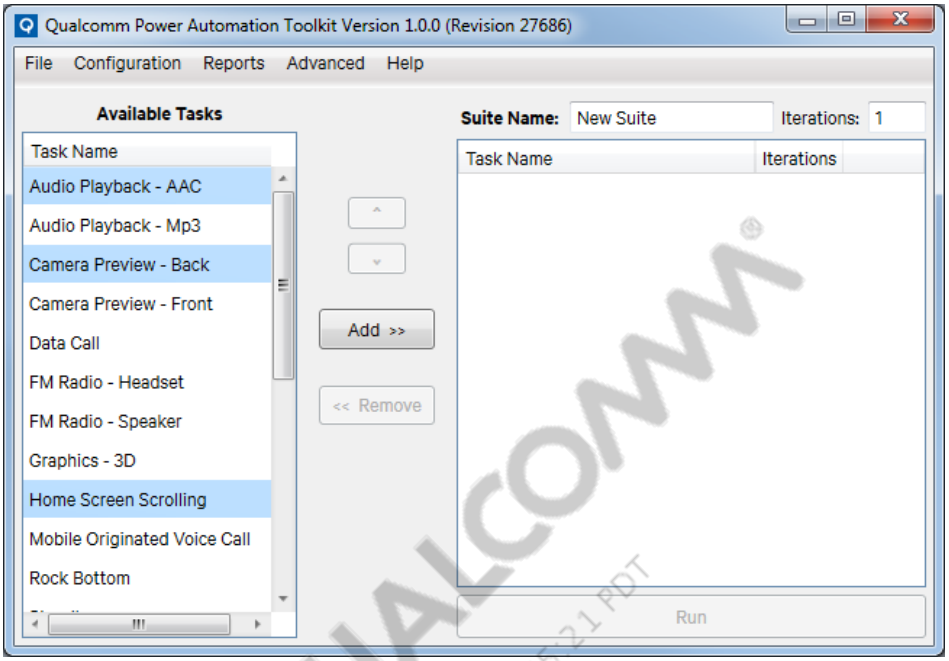
5.2 Execute QPAT

1. Double-click the QPAT shortcut icon created on the desktop.

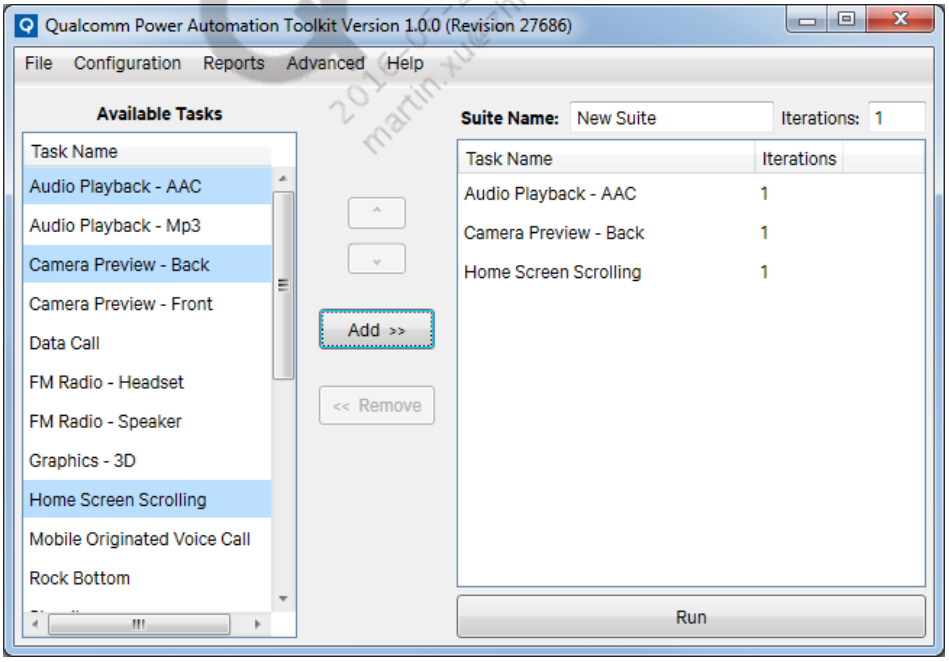
2. If this is the first time QPAT is launched, a Bundle Select window displays. See Section 6.1 for more information on which bundle to choose.



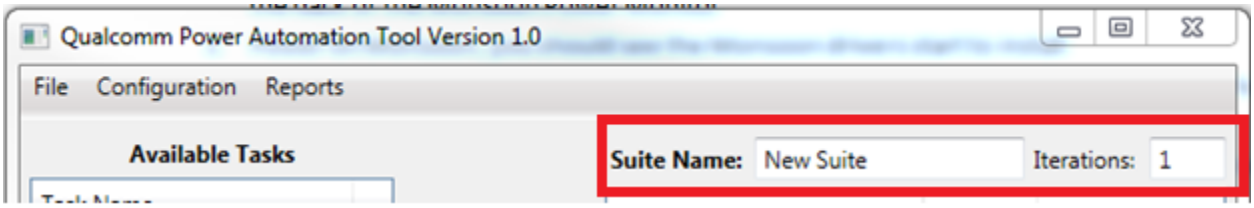
3. When a bundle is selected, the QPAT main window opens. In the Available Tasks' window, select the test cases (Task Names) to be added to your Test Suite.



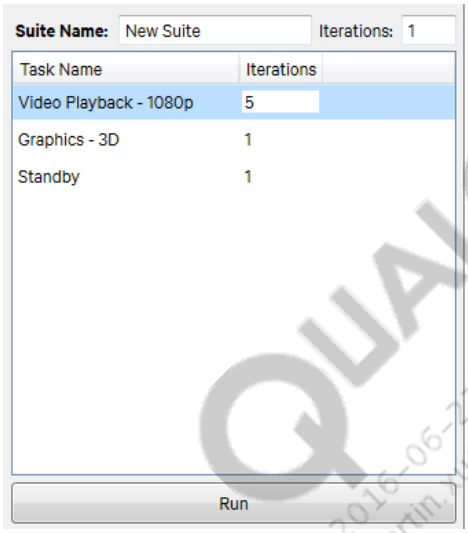
4. Click **Add** to move the test cases into your Test Suite.



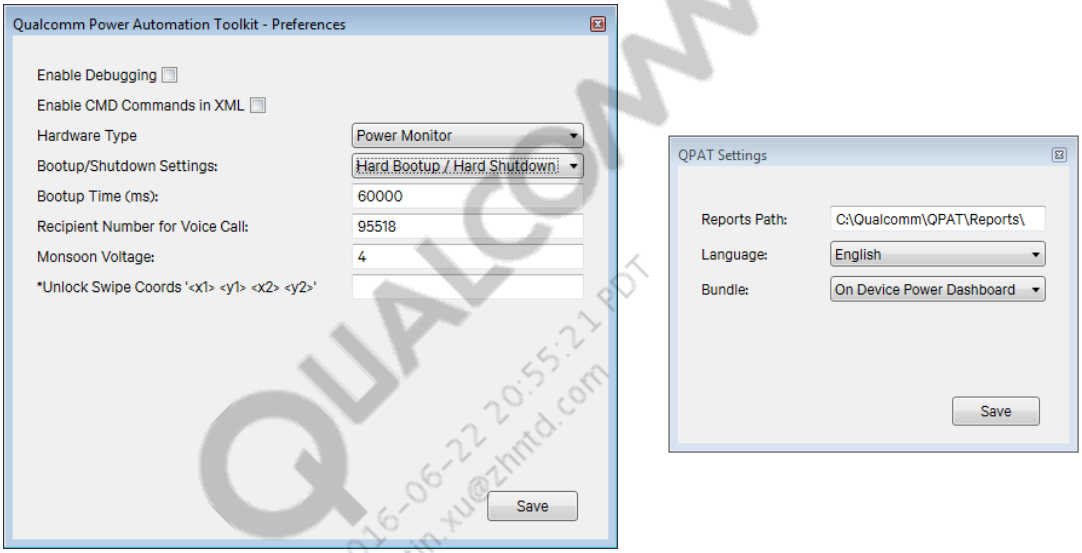
5. You can change the name of the test suite and set the number of iterations to cycle through the entire suite.



6. You can also change the number of iterations for each test case to be run by clicking the iteration number.



7. Use the **File** menu to save customized task suites and load previously created task suites.
8. Use the **Configuration** menu to change test case preferences, such as reboot options, Wi-Fi configurations, and a phone number for the MO Talk test case.
   a. If the Power Monitor Hardware Type is selected, make sure the hardware setup steps are completed in Section 2.2.
   b. If the Agilent Hardware Type is selected, make sure the hardware setup steps are completed in Section 2.3.
9. The Settings' window allows users to change the report path, user interface language, and the current test bundle. See the Section 6.1 for more information.



10. Use the **Reports** menu to load reports from previously executed test suites.
11. Click **Run** to start execution.

5.3 Advanced options

The **Advanced** menu allows users to edit common settings, for example Bluetooth, Wi-Fi, and Airplane mode.

1. In the QPAT GUI, select the test cases you want to run. Ensure that all the relevant settings and options are configured in the **Configuration → Preferences** menu.
2. Click Export QPAT Task Suite to CPT XML Task Suite File.
3. Select a location and save the XML file.

4. Use a text editor to open the file you just saved. You can view all your settings or make adjustments.

```
<Task ID="Qualcomm.CPT.Automation.TestCases.LA.AudioTest.AudioTest" Iterations="1">
  <Parameters>
    <Qualcomm.CPT.Automation.TestCases.LA.AudioTest.AudioTestParameters>
      <FileName>00_au4.mp3</FileName>
      <AirplaneModeOn>true</AirplaneModeOn>
      <BluetoothOn>false</BluetoothOn>
      <WifiOn>false</WifiOn>
      <SensorsOn>false</SensorsOn>
      <AutoRotateOn>false</AutoRotateOn>
    </Qualcomm.CPT.Automation.TestCases.LA.AudioTest.AudioTestParameters>
    <Qualcomm.CPT.Automation.TestCases.LA.Base.AndroidPowerTestParameters>
      <TestType>QPAT</TestType>
      <PreTestXOWaitDuration>0</PreTestXOWaitDuration>
      <EnableDebugging>false</EnableDebugging>
    </Qualcomm.CPT.Automation.TestCases.LA.Base.AndroidPowerTestParameters>
    <Qualcomm.CPT.Automation.PowerTestParameters>
      <UsbDisconnectDuration>65000</UsbDisconnectDuration>
    </Qualcomm.CPT.Automation.PowerTestParameters>
    <Qualcomm.CPT.Automation.Plugins.HW.Monsoon.MonsoonParameters>
      <MeasurementDuration>30000</MeasurementDuration>
      <DelayAfterUsbDisconnectBeforeMeasurement>30000</DelayAfterUsbDisconnectBeforeMeasurement>
      <SampleRate>5000</SampleRate>
      <Voltage>3.7</Voltage>
    </Qualcomm.CPT.Automation.Plugins.HW.Monsoon.MonsoonParameters>
  </Parameters>
```

5. When you finish editing, save the file.
6. In the QPAT **Advanced** menu, click **Run CPT Automation XML Task Suite File** and select your modified XML file.
7. Execution will begin.

5.4 Custom test creation

Users may create their own test cases in QPAT through the **Advanced** menu.

1. Power on the device and connect it to the PC running QPAT. Ensure that ADB is working properly.
2. In the QPAT main window, go to Advanced → Create Custom Task.
3. Fill in the fields for Test Case Name and Description. The test case name will be used in the list of Available Tasks after the custom task is saved; the description will become the tooltip when you hover over the test case name.
4. You may optionally set a fixed measurement duration for your custom task.
5. Click **Start Task**. Wait until the Test Duration timer starts. Recording will start when the device's display is first touched.
6. At any time you may start and stop measurement. If the fixed measurement time option is selected, then measurement will terminate automatically after the predefined amount of time.
7. Select **Stop Task** when you are done with your task.

8. Click **Save** to save your task. You will now be able to see the test in the Available Tasks list in the QPAT main window.

5.5 View reports

The location for QPAT reports is set by the user through the QPAT installer. The default location is `C:\Qualcomm\QPAT\Reports\`. All execution logs are automatically saved in this directory.

1. From the Main Window in QPAT, click **Reports** and select **Load Report.**
2. Navigate to the Test suite report directory and open the `.qpatlog` file.
3. A new report directory is created for each test suite execution. A timestamp is added to the folder name to differentiate the various test runs.
4. The **Report Viewer** window will open with the information from that test suite run.

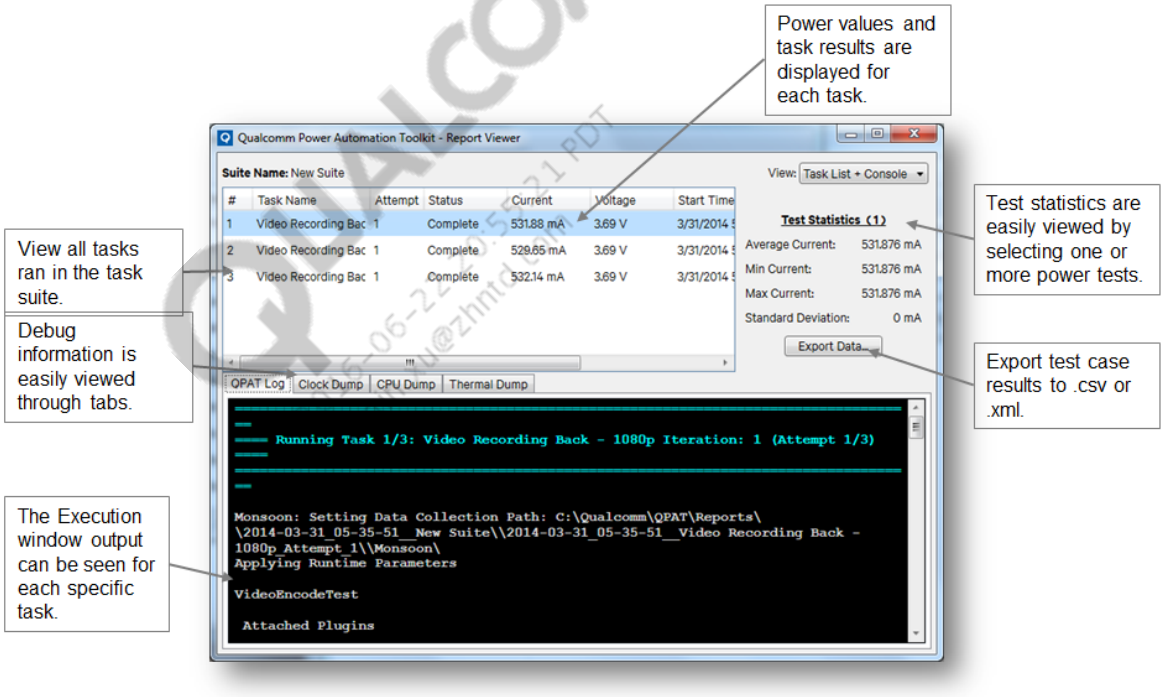


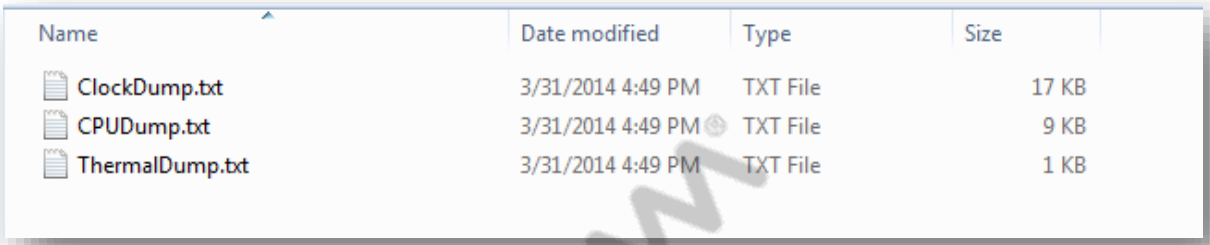
Figure 5-1 Report Viewer

At the end of execution, QPAT automatically saves log files in the `.qpatlog` file format. Once opened, a detailed list of previously run tasks appears, as well as the log output for each task and their respective current and voltage values.

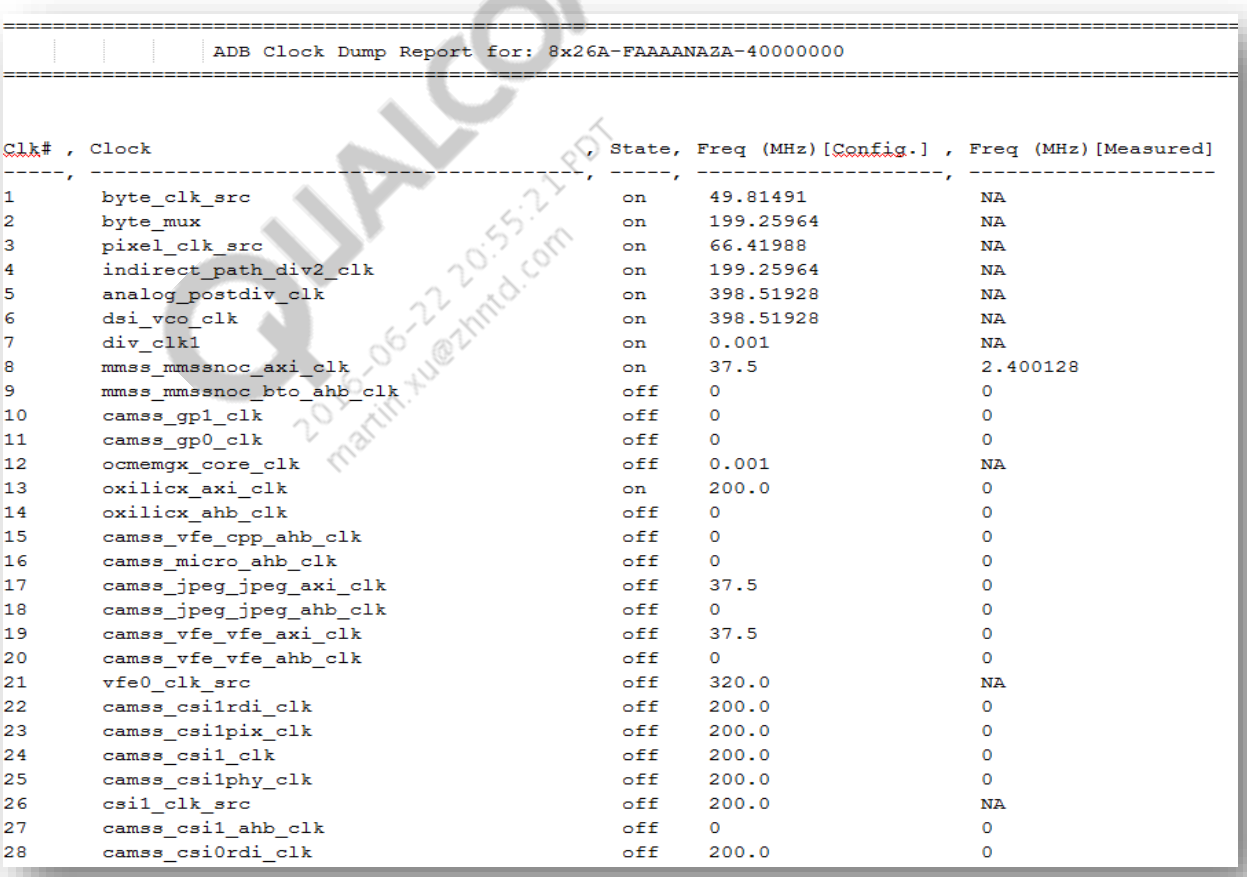
5.6 Debug logs

The **Report Viewer** displays debug logs collected during QPAT execution. Note that not all debug information will be available on all devices. Logs are also saved in your report directory as text files.

The log information helps you identify power issues and gives users a better understanding of device issues. Also, certain logs are not human readable and must be returned to your Qualcomm CE representative to parse and review. If you see any issues, report them to the Qualcomm CE team.



Name	Date modified	Type	Size
ClockDump.txt	3/31/2014 4:49 PM	TXT File	17 KB
CPUDump.txt	3/31/2014 4:49 PM	TXT File	9 KB
ThermalDump.txt	3/31/2014 4:49 PM	TXT File	1 KB



ADB Clock Dump Report for: 8x26A-FAAAANAZA-40000000

Clk#	Clock	State	Freq (MHz)[Config.]	Freq (MHz)[Measured]
1	byte_clk_src	on	49.81491	NA
2	byte_mux	on	199.25964	NA
3	pixel_clk_src	on	66.41988	NA
4	indirect_path_div2_clk	on	199.25964	NA
5	analog_postdiv_clk	on	398.51928	NA
6	dsi_vco_clk	on	398.51928	NA
7	div_clk1	on	0.001	NA
8	mmss_mmssnoc_axi_clk	on	37.5	2.400128
9	mmss_mmssnoc_bto_ahb_clk	off	0	0
10	camss_gp1_clk	off	0	0
11	camss_gp0_clk	off	0	0
12	ocmemgx_core_clk	off	0.001	NA
13	oxilicx_axi_clk	on	200.0	0
14	oxilicx_ahb_clk	off	0	0
15	camss_vfe_cpp_ahb_clk	off	0	0
16	camss_micro_ahb_clk	off	0	0
17	camss_jpeg_jpeg_axi_clk	off	37.5	0
18	camss_jpeg_jpeg_ahb_clk	off	0	0
19	camss_vfe_vfe_axi_clk	off	37.5	0
20	camss_vfe_vfe_ahb_clk	off	0	0
21	vfe0_clk_src	off	320.0	NA
22	camss_csi1rdi_clk	off	200.0	0
23	camss_csi1pix_clk	off	200.0	0
24	camss_csi1_clk	off	200.0	0
25	camss_csi1phy_clk	off	200.0	0
26	csi1_clk_src	off	200.0	NA
27	camss_csi1_ahb_clk	off	0	0
28	camss_csi0rdi_clk	off	200.0	0

5.6.1 Application-side logs

- Clock dumps provide an easy and fast way to detect issues with software builds.
- CPU logs display vital CPU stats including idle, active, and sleep times.
- Thermal logs give an instantaneous snapshot of the device temperature.

- PMIC dumps are raw registry values that must returned to Qualcomm Technologies, Inc. (QTI) for analysis. You need root access to view these registry values.

5.7 Command line execution

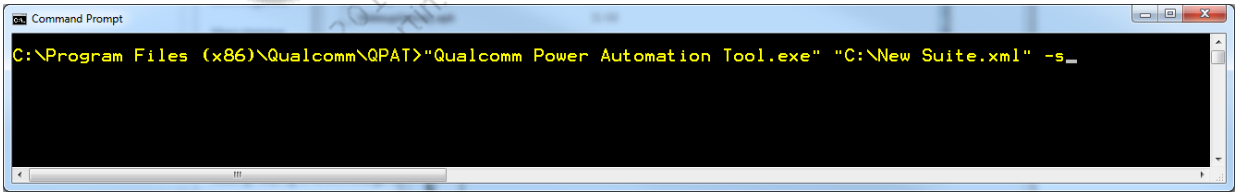
QPAT can be executed from the command line with a previously saved task suite file.

1. Open the QPAT GUI and save a custom task suite.
2. Launch the command prompt from the **Start** menu.
3. Navigate to the QPAT installation directory. The default location is:
   `C:\Program Files (x86)\Qualcomm\QPAT\`
4. Type the following:

   `"Qualcomm Power Automation Tool.exe" -i [location of task suite file] [-s] [-o] [output location of report files]`

   where

`{-i][location of task suite file]`	Full path to the task suite file to be used by QPAT.
`[-s]`	Optional. Perform initial device setup before running the tasks in the task suite file.
`[-o] [output location of report files]`	Optional. Full path to the output report directory. If this argument is not provided, QPAT uses the default output directory or the previously specified report location.



5. If you want to run QPAT with an advanced CPT XML file, specify `-ia` instead of `-i` in the command line:

   `"Qualcomm Power Automation Tool.exe" -ia [location of CPT XML file] [-o] [output location of report files]`

   where

`[-ia][location of CPT XML file]`	Full path to the CPT XML file to be used by QPAT.
`[-o][output location of report files]`	Optional. Full path to the output report directory. If this argument is not provided, QPAT uses the default output directory or the previously specified report location.

   If you specify a CPT XML file, you cannot use the `-s` option for initial device setup. The initial device setup will be included in the XML based on the user input when exporting the file.

6 Test Case Information

This chapter describes the tasks that QPAT currently supports. QPAT offers both multimedia and modem test case scenarios, thus providing a diverse range of mobile use scenarios. Tests range from basic scenarios, such as Rock Bottom, to complex situations, such as Data Call.

6.1 Bundle configuration

6.1.1 On device power dashboard

This bundle consists of 15 test cases that can be used on Android devices. A well-rounded power profile of the device can be achieved by executing these test cases.

6.1.2 Qualcomm power dashboard

There are 23 test cases in this bundle which focus on profiling the multimedia usage of a mobile device. These are the same test cases that are run within Qualcomm in order to optimize the Qualcomm® Snapdragon™ SoC's power features.

6.1.3 CMCC certification dashboard

This bundle consists of 34 test cases which CMCC uses to certify devices for release on their network. Because CMCC constantly updates their dashboard test cases, the tests provided in QPAT may not be up-to-date with those CMCC officially uses; however, the tests provided will still help profile the device in the same manner as CMCC does.

6.2 Test descriptions

6.2.1 Audio Playback (Offload and Non-offload)

These test cases evaluate the phone's power consumption during playback of mp3 files using the default Android music player. Qualcomm provides a sample audio file called `00_au4.mp3` that has a 128 kbps bitrate, two-channel stereo, and a sample rate of 44.1 kHz. The main advantage of Offload over Non-offload mode is that the LPASS does the decoding, freeing up the applications' processor for longer power collapse. Power consumption is measured with the device in airplane mode and the screen off. Audio is played through the phone's speaker with the volume level set to the lowest setting (1/15).

Measurement duration	30 secs
External file information	MP3, 128 kbps stereo, 44.1 kHz sample freq, 1.37 MB
Example power impact HW & SW variations	Speaker, SD card, general modifications

6.2.2 Camera Preview

This test case measures the power of the device while the Google Camera2 application is running in still-image preview mode. Power consumption is measured with the device in airplane mode and the screen set to the lowest brightness (10/255). Cover the camera sensor with thick black paper to minimize the impact of the camera sensor on power measurement.

Measurement duration	30 secs
External file information	Camera2 Apk provided by Google and modified by Qualcomm.
Example power impact HW & SW variations	Display, camera sensor, general modifications

6.2.3 Data Call

Data Call requires manual settings. Refer to Section 6.3.2 for further information.

The Data Call test case uses a network testing tool called iPerf to measure power consumption while UDP data packets are sent from the host PC to the mobile device through the cellular network. The UDP packets are sent every two seconds, with a bandwidth of 7.2 mbps and a buffer of 256 kbps. The display is turned off and measurement begins. Once measurement is complete, the UDP data throughput is checked and reported in the test log. This test case requires that the device and the host PC have access to the internet.

Measurement duration	30 secs
External file information	iPerf.exe windows client program iPerfApp.apk Android mobile server application
Example power impact HW & SW variations	Network Connection, general modifications

6.2.4 Download – MobileData

Power is measured when a 100mb file is downloaded from a file server. This test outlines the power consumption during data usage of the mobile device. Power measurement is performed with the display on and the application running.

NOTE: The Android application is not part of the QPAT installation. This application must be obtained by the user and placed in QPAT's Resources\Apps folder with the other QPAT applications.

Measurement duration	30 secs
External file information	BaiduYun_7.8.3.apk Android application
Example power impact HW & SW variations	Network Connection, general modifications

6.2.5 Final Fury

This test case uses the FinalFury video game in order to profile the device's power usage while playing video games. This high stress, high CPU and GPU usage application provides a thorough understanding of the Snapdragon chip's peak performance and power consumption.

NOTE: The Android application is not part of the QPAT installation. This application must be obtained by the user and placed in QPAT's Resources\Apps folder with the other QPAT applications.

Measurement duration	30 secs
External file information	com.Final Fury.a91_093910.apk Android application
Example power impact HW & SW variations	Backlight, touchscreen, general modifications

6.2.6 FM Radio

FM Radio test cases require manual interaction. For the application to work, the user must connect headphones to the device. The headset is used as an antenna in both the speaker and headset test cases. The user must also set the radio station to be used.

A sample FM radio application is installed on the device during the Initial Device Setup where power is measured for audio playback through headphones and through the device speaker. The display is turned off in both test scenarios, and volume is set to the lowest value (1/15).

Measurement duration	30 secs
External file information	FM2.apk Android application
Example power impact HW & SW variations	Radio station, general modifications

6.2.7 Graphics – 3D

Qualcomm's graphics team developed an application that provides the typical 3D stress scenario that mobile users often face. With this application, we can measure the power consumption of the device under stressful display situations.

Measurement duration	30 secs
External file information	Powerlift.apk Android application
Example power impact HW & SW variations	Backlight, touchscreen, general modifications

6.2.8 Graphics – 3D Game

Using GLBenchmark 2.5, the Egypt test scene is launched to simulate a user playing a video game on the device. With this application, we can measure the power consumption of the device under a controlled video game-like situation and also capture FPS information.

NOTE: The Android application is not part of the QPAT installation. This application must be obtained by the user and placed in QPAT's Resources\Apps folder along with the other QPAT applications.

Measurement duration	30 secs
External file information	GLBenchmark_2.5.1_b306a5.apk Android application
Example power impact HW & SW variations	Backlight, touchscreen, general modifications

6.2.9 Home Screen Scrolling

This is a basic use case that measures power while mimicking user scrolling on the device. Power consumption is measured when left and right swipe motions between different home screen windows are performed.

Measurement duration	105 secs
External file information	Autotest.apk Android application
Example power impact HW & SW variations	Backlight, touchscreen, general modifications

6.2.10 Mobile Originated Voice Call (MO Talk)

MO Talk requires manual settings. Refer to Sections 6.3.1 and 6.3.2 for further information.

This is a classic modem test case scenario. With the device connected to a cellular network, a call is placed from the device to the user's phone. Once the call is active, the display is turned off and measurement begins.

From QPAT main window, go to the **File** menu and select **Configuration → Preferences** to set the recipient phone number. Ensure that the recipient phone is set to auto-answer phone calls.

Measurement duration	30 secs
External file information	N/A
Example power impact HW & SW variations	Network Connection, general modifications

6.2.11 Rock Bottom

With the device in airplane mode and the screen off, this test case measures the phone in its lowest power state.

Measurement duration	30 secs
External file information	N/A
Example power impact HW & SW variations	General modifications

6.2.12 Sensors

NOTE: This use case will not work unless the Qualcomm Settings and QSensorTest applications are already installed and functioning on the device.

QPAT offers two different sensor test cases, one at 10 Hz with the display off and another at 15 Hz with the display on. The 10 Hz test case measures background sensor processing, while the 15 Hz test case measures power as an active accelerometer scenario.

Measurement duration	30 secs
External file information	QualcommSettings and QSensorTest applications
Example power impact HW & SW variations	Backlight, touchscreen, accelerometer sensor, general modifications

6.2.13 Standby

Standby requires manual settings. Refer to Section 6.3.2 or further information.

This test case measures the power consumption of the device with the device camped to a cellular network and screen off. This is very similar to the Rock Bottom test case, but there are modem wakeups.

Measurement duration	60 secs
External file information	N/A
Example power impact HW & SW variations	Network Connection, general modifications

6.2.14 Static Display

Power measurement is performed on the device while the device display is on a blank screen. As with all active test cases, the display brightness is set to the lowest level.

Measurement duration	30 secs
External file information	N/A
Example power impact HW & SW variations	Backlight, touchscreen, general modifications

6.2.15 Video Playback

In this test scenario we measure the device power consumption during video decoding and playback. There are two different test cases, one for 720p playback and the other for 1080p playback. Choose the appropriate test case for the device you are testing.

Both test cases sample mp4 video files provided by Qualcomm and are played using the Android Gallery application. The 1080p video file has a frame rate of 29 fps and a video bitrate of 20 Mbps. The audio is 128 kbps. The sample 720p file has a video bitrate of 4 Mbps and audio bitrate of 96 kbps. Both files are two-channel stereo and use the device speaker for playback.

Measurement duration	30 secs
External file information	Qtc88: MP4, 1920x1080, 29fps, 20Mbps, 128kbps stereo Qtc49: MP4, 1280x720, 29fps, 4Mbps, 96kbps stereo
Example power impact HW & SW variations	Backlight, touchscreen, SD card, general modifications

6.2.16 Video Recording

This test case uses the same application as the camera preview test case. In this scenario the device power consumption is measured during video encoding. There are two different test cases, one for the rear camera and the other for the front camera. Not all devices may have front and rear cameras, so choose the appropriate test case for the device you are testing. Both use cases capture video at the highest supported resolution, with face detection disabled, and the white balance mode set to incandescent. Cover the camera sensor with thick black paper to minimize the impact of the camera sensor. The frame rate of encode is set to 30fps. After the test case is complete, users may obtain the recorded file through the "`adb pull /sdcard/DCIM/Camera`" command.

Measurement duration	30 secs
External file information	Camera2.apk Android application
Example power impact HW & SW variations	Backlight, touchscreen, SD card, camera sensor, general modifications

6.2.17 WeChat Standby

Standby power measurement is performed while logged into the popular texting application, WeChat. QPAT requires that the user logs into the application one time prior to running the test case. The automation then takes care of opening the application, going into a standby state, and measuring power.

Measurement duration	270 secs
External file information	WeChat_ver_60068_r85925.apk Android application
Example power impact HW & SW variations	Network Connection, general modifications

6.2.18 Wi-Fi Browsing

This test case may require manual setup before execution.

During QPAT installation, an IIS web server was set up on the host computer. This use case instructs the device to connect to the same Access Point (AP) as the host computer. The device then connects to the local server and begins to simulate web browsing by refreshing a static webpage every 40 seconds. The images and icons are uncached, meaning that each refresh is similar to loading a new page.

Website files can be found at `C:\Qualcomm\QPAT\Website`. The default web IP address is `localhost:85`. We suggest using a dedicated AP for the Wi-Fi test cases to ensure that the amount of traffic over Wi-Fi is consistent.

Measurement duration	200 secs
External file information	Web files located on host computer, web server
Example power impact HW & SW variations	Backlight, touchscreen, Wi-Fi signal strength, Wi-Fi traffic, general modifications

6.2.19 Wi-Fi Idle

In the QPAT **Configuration** menu, the user must specify an SSID and Password to connect to. During the "Connected" use case, QPAT will instruct the device to connect to the Access Point.

Measurement will be performed with the display off and the device idle but connected over Wi-Fi. We suggest using a dedicated AP for the Wi-Fi test cases to ensure that the amount of traffic over Wi-Fi is consistent.

Measurement duration	60 secs
External file information	N/A
Example power impact HW & SW variations	Wi-Fi signal strength, general modifications

6.2.20 Wi-Fi Video Streaming

Similar to the Wi-Fi Browsing test case, in this scenario the device will navigate to a video file on the web server and begin to stream over Wi-Fi. This use case simulates the power consumption of the device when using websites such as YouTube or Netflix. We suggest using a dedicated AP for the Wi-Fi test cases to ensure that the amount of traffic over Wi-Fi is consistent.

Measurement duration	40 secs
External file information	N/A
Example power impact HW & SW variations	Backlight, touchscreen, Wi-Fi signal strength, Wi-Fi traffic, general modifications

6.3 Test case setup

6.3.1 General Android settings

Important: The following settings are performed by QPAT during initial device setup. They are mentioned for reference only and do not need to be done manually.

The following setting changes are performed by QPAT during the initial device setup.

General Android settings:

- Menu → Settings → Wifi off
- Menu → Settings → Bluetooth off
- Menu → Settings → Display → Auto-rotate screen (Deselect this)
- Menu → Settings → Display → Brightness (Set to lowest)
- Menu → Settings → Sound → Disable pad touch tones (Deselect this)
- Menu → Settings → Sound → Disable touch sound (Deselect this)
- Menu → Settings → Sound → Disable screen lock sound (Deselect this)

- Menu → Settings → Sound → Vibrate on touch (Deselect this)
- Menu → Settings → Mobile data → Turn on
- Menu → Settings → More → Mobile networks → Data roaming (Deselect this)
- Menu → Settings → Location & security → Use GPS satellites (Deselect this)
- Menu → Qualcomm settings→ Stay on plugged (Deselect this)
- Menu → Qualcomm settings → Content adaptive backlight option → Uncheck Enable content adaptive backlight option
- Menu → Qualcomm settings→ Sensors (Deselect this)
- Menu → Qualcomm settings→ Data monitor (Deselect this)
- Change media playback volume to 1/15

6.3.2 Network settings for modem test cases

Important: The following settings must be performed manually before executing modem test cases. These settings are only required once.

1. Insert *one* SIM into Slot 1.
2. Enable SUB1 under multi-sim settings on the UI.
3. Camp the device to the network mode of choice, e.g.,
4. Menu → Settings → More → Mobile networks → Network mode → WCDMA only.
5. Ensure that the device is camped to the correct network and that you can place voice calls manually.
6. Check that the web browser is working and that websites are loading properly.

NOTE: Other settings may be required to camp to a cell network. Ensure that any extra settings are done before running QPT modem test cases.

7 Troubleshooting

7.1 Frequently asked questions

What if ADB does not work?

1. Make sure your PATH variables are set correctly. It should have an entry that points to the folder containing `adb.exe`.
2. To check your PATH variable:
3. Click **Start.**
4. Right-click **Computer.**
5. Select **Properties → Advanced system settings → Advanced tab → Environment Variables**. Scroll down in the System variables list and click **Edit** on the PATH variable. Be very careful not to make any unwanted changes.

How do I manually upload files to the device?

1. Make sure that the device is powered on and directly connected to your PC.
2. Run `adb devices` to verify that the PC recognizes the Android device.
3. Run `adb push 00_au4.mp3/sdcard/00_au4.mp3` for the audio file, or use `01_qtc88.mp4` for the video file to upload the files to the device.

How do I manually play files on the device?

1. Make sure that the device is powered on and directly connected to your PC.
2. Run `adb devices` to be sure that the PC recognizes the Android device.
3. To play the files, execute:

```
adb shell am start –n com.android.music/.audioPreview –d
file:///sdcard//00_au4.mp3
```

or

```
adb shell am start –n com.android.gallery3d/.app.MovieActivity –d
file:///sdcard//01_qtc88.mp4
```

What if the Power Monitor is not turning on the power to the device (green led on the front left)?

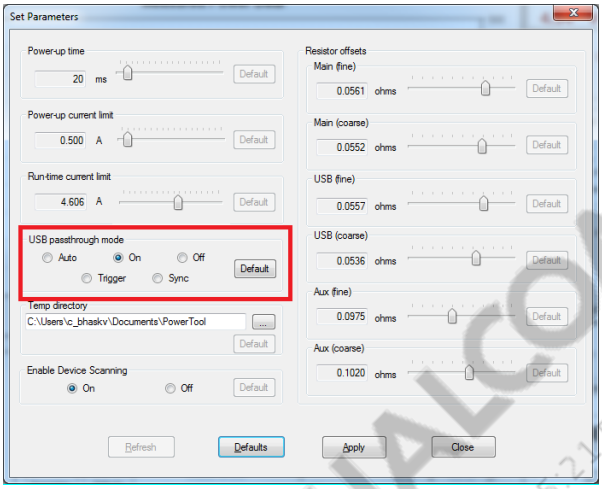
1. Manually reboot the power monitor using the power switch.
2. Unplug the power cord and USB cables from the Power Monitor. Follow the setup procedure in Chapter 2 to reconnect the Power Monitor.

What if none of the tests work?

1. Power on the mobile device and connect the USB cable directly to the PC.
2. Open the command prompt and enter `adb devices`.
3. Check to see if the device is listed:
4. *If it is listed:* Reconnect the mobile device to Monsoon and manually power cycle Monsoon.
5. *If it is **not** listed:* Open the **Device Manager** and ensure that you see Android Phone listed.
6. Check to see if the Mobile Device Power Monitor is listed in the Ports (COM & LPT):
7. *If it is **not** listed:* Make sure that the drivers are installed properly.

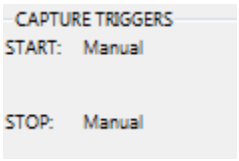
Why is the Monsoon USB not working?

1. Check to see whether the USB passthrough in the PowerTool software is enabled.
2. Launch PowerTool using the shortcut icon on the desktop.
3. Click Parameters.
4. Make sure the USB passthrough mode is On.



I am getting the "Error taking measurement, powertool is not sampling" message.

Open the `powertool.exe` located in the QPAT Plugins folder. Make sure that the start and stop capture triggers are set to "manual."



Why am I seeing a low battery warning on my device during measurement?

Users are required to set the fake battery charge before running QPAT. QPAT will try to set the battery level to 90% during the initial device setup, but this may not work on all devices.

To set the battery level:

1. Pull the `init.qcom.post_boot.sh` file from the device. This file is located in the `/etc` folder.
2. Add the following line to the device chipset section:

   ```
   echo 90 > /sys/module/qpnp_bms/parameters/bms_fake_battery
   ```

   For example:

```
case "$target" in
    "msm8610")
        echo 90 > /sys/module/qpnp_bms/parameters/bms_fake_battery
        echo 2 > /sys/module/lpm_resources/enable_low_power/l2
        echo 1 > /sys/module/lpm_resources/enable_low_power/pxo
        echo 1 > /sys/module/lpm_resources/enable_low_power/vdd_dig
        echo 1 > /sys/module/lpm_resources/enable_low_power/vdd_mem
```

3. Push the file back to the `/etc` folder on the device.

I am getting a No SIM error. Why do I need a SIM?

Certain devices need an active SIM card to be present in the device even when in airplane mode. This must be set up and validated before using QPAT.

8 Known Issues

8.1 QPAT issues

Issue: In the execution window, the log output sometimes gets cleared.

Solution: Click a different task and then return to the task in progress.

8.2 Monsoon issues

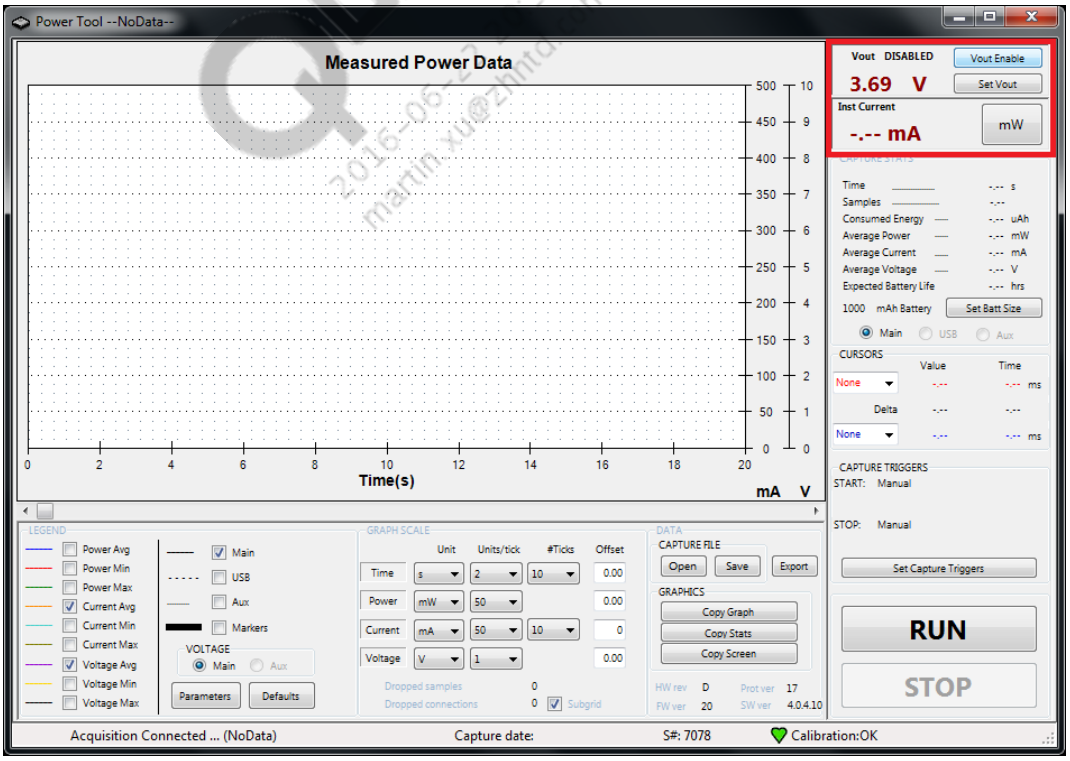
8.2.1 PowerTool

1. Vout Enable/Disable button requires multiple clicks.
2. Waveform graph scrollbar is disabled.

A Android Driver

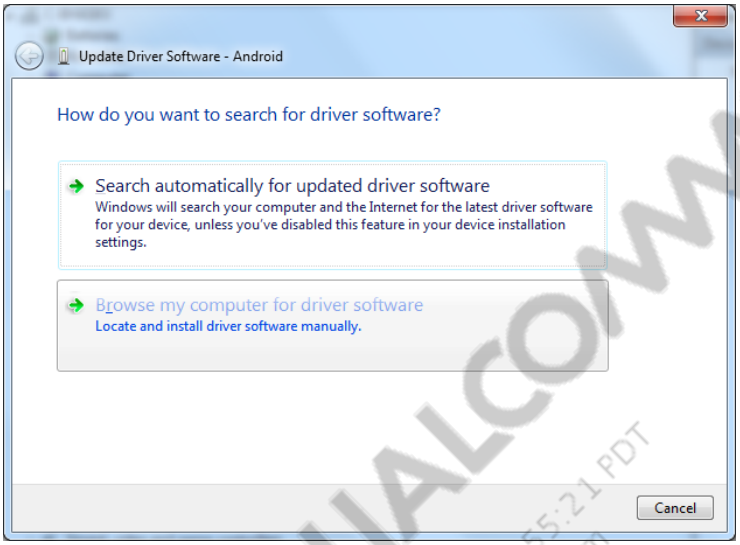
A.1 Installing the driver

1. Download Google's Android driver from http://developer.android.com/sdk/win-usb.html.
2. Unzip the folder and extract the `usb_driver` folder.
3. Using a text editor, open the `android_winusb.inf` file.
4. Overwrite the contents of this file with the contents copied from Appendix A.2. The Qualcomm VIDs are needed to connect to a mobile device with a Qualcomm build.
5. When the QPAT hardware setup is complete, launch the PowerTool using the desktop shortcut icon.
6. Double-click **Vout Enable** to enable Vout and supply power to the mobile device.

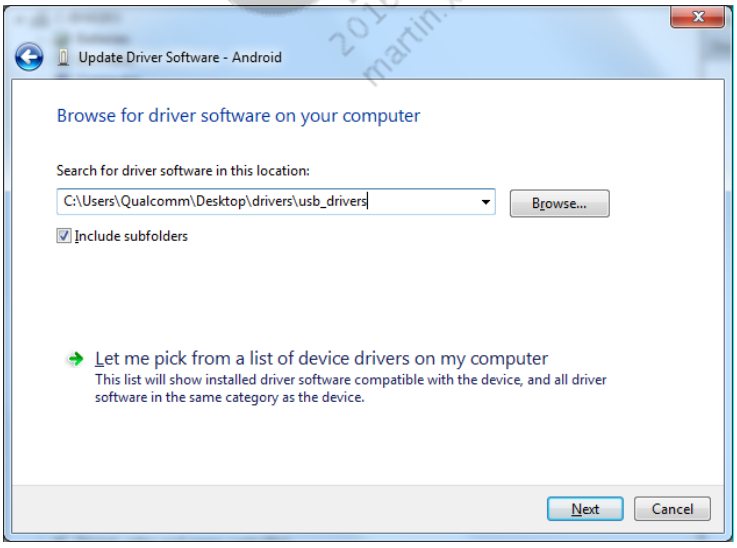


7. The Inst Current value should appear and the device should boot up. *If the device does not boot up,* press the power button on the mobile device to turn it on.
8. Once the phone is powered on, the host PC will try and install the device drivers.

9. Open the Windows Device Manager. You should see an Android device with a *yellow exclamation mark.*
10. Right-click Unknown Device and select Update Driver Software.
11. From the Device Driver Wizard, select **Locate and install driver software manually** in Windows 7, or install from a specific location in Windows XP.



12. Navigate to the location of the `usb_driver` folder that was downloaded.
13. Click **Next** to continue and install the driver.



A.2 Android_winsub.inf example code

```
;
; Android WinUsb driver installation.
;
[Version]
Signature        = "$Windows NT$"
Class            = AndroidUsbDeviceClass
ClassGuid        = {3F966BD9-FA04-4ec5-991C-D326973B5128}
Provider         = %ProviderName%
DriverVer        = 12/06/2010,4.0.0000.00000
CatalogFile.NTx86   = androidwinusb86.cat
CatalogFile.NTamd64 = androidwinusba64.cat

[ClassInstall32]
Addreg = AndroidWinUsbClassReg

[AndroidWinUsbClassReg]
HKR,,,0,%ClassName%
HKR,,Icon,,-1

[Manufacturer]
%ProviderName% = Google, NTx86, NTamd64

[Google.NTx86]
; HTC Dream
%SingleAdbInterface%        = USB_Install, USB\VID_0BB4&PID_0C01
%CompositeAdbInterface%     = USB_Install, USB\VID_0BB4&PID_0C02&MI_01
%SingleBootLoaderInterface% = USB_Install, USB\VID_0BB4&PID_0FFF
; HTC Magic
%CompositeAdbInterface%     = USB_Install, USB\VID_0BB4&PID_0C03&MI_01
;
;Moto Sholes
%SingleAdbInterface%        = USB_Install, USB\VID_22B8&PID_41DB
%CompositeAdbInterface%     = USB_Install, USB\VID_22B8&PID_41DB&MI_01
```

```
;
;Google NexusOne
%SingleAdbInterface%        = USB_Install, USB\VID_18D1&PID_0D02
%CompositeAdbInterface%     = USB_Install, USB\VID_18D1&PID_0D02&MI_01
%SingleAdbInterface%        = USB_Install, USB\VID_18D1&PID_4E11
%CompositeAdbInterface%     = USB_Install, USB\VID_18D1&PID_4E12&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_18D1&PID_4E22&MI_01
;
;Qualcomm Devices
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9025&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9024&MI_02
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9015&MI_00
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9018&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9029&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9031&MI_02
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9037&MI_02
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9035&MI_02
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9053&MI_02
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9039&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_904E&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_903A&MI_02
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_903F&MI_03
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9022&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_902D&MI_03
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_901D&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_903B&MI_02
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9042&MI_04
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9044&MI_02
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9046&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9059&MI_03
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9060&MI_03
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9064&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9065&MI_03
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9082&MI_05
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9084&MI_03
```

```
;
;Google Recovery
%SingleAdbInterface%        = USB_Install, USB\VID_18D1&PID_D001
;
;Google fastboot
%SingleBootLoaderInterface%     = USB_Install, USB\VID_18D1&PID_D00D

[Google.NTamd64]
; HTC Dream
%SingleAdbInterface%        = USB_Install, USB\VID_0BB4&PID_0C01
%CompositeAdbInterface%     = USB_Install, USB\VID_0BB4&PID_0C02&MI_01
%SingleBootLoaderInterface% = USB_Install, USB\VID_0BB4&PID_0FFF
; HTC Magic
%CompositeAdbInterface%     = USB_Install, USB\VID_0BB4&PID_0C03&MI_01
;
;Moto Sholes
%SingleAdbInterface%        = USB_Install, USB\VID_22B8&PID_41DB
%CompositeAdbInterface%     = USB_Install, USB\VID_22B8&PID_41DB&MI_01
;
;Google NexusOne
%SingleAdbInterface%        = USB_Install, USB\VID_18D1&PID_0D02
%CompositeAdbInterface%     = USB_Install, USB\VID_18D1&PID_0D02&MI_01
%SingleAdbInterface%        = USB_Install, USB\VID_18D1&PID_4E11
%CompositeAdbInterface%     = USB_Install, USB\VID_18D1&PID_4E12&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_18D1&PID_4E22&MI_01
;
;Qualcomm Devices
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9025&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9024&MI_02
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9015&MI_00
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9018&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9029&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9031&MI_02
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9037&MI_02
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9035&MI_02
```

```
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_9053&MI_02
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_9039&MI_01
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_904E&MI_01
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_903A&MI_02
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_903F&MI_03
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_9022&MI_01
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_902D&MI_03
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_901D&MI_01
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_903B&MI_02
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_9042&MI_04
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_9044&MI_02
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_9046&MI_01
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_9059&MI_03
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_9060&MI_03
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_9064&MI_01
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_9065&MI_03
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_9082&MI_05
%CompositeAdbInterface%    = USB_Install, USB\VID_05C6&PID_9084&MI_03
;
;Google Recovery
%SingleRecoveryInterface%   = USB_Install, USB\VID_18D1&PID_D001
;
;Google fastboot
%SingleBootLoaderInterface%     = USB_Install, USB\VID_18D1&PID_D00D

[USB_Install]
Include = winusb.inf
Needs   = WINUSB.NT

[USB_Install.Services]
Include     = winusb.inf
AddService  = WinUSB,0x00000002,WinUSB_ServiceInstall

[WinUSB_ServiceInstall]
DisplayName     = %WinUSB_SvcDesc%
```

ServiceType = 1

StartType = 3

ErrorControl = 1

ServiceBinary = %12%\WinUSB.sys

[USB_Install.Wdf]

KmdfService = WINUSB, WinUSB_Install

[WinUSB_Install]

KmdfLibraryVersion = 1.9

[USB_Install.HW]

AddReg = Dev_AddReg

[Dev_AddReg]

HKR,,DeviceInterfaceGUIDs,0x10000,"{F72FE0D4-CBCB-407d-8814-9ED673D0DD6B}"

[USB_Install.CoInstallers]

AddReg = CoInstallers_AddReg

CopyFiles = CoInstallers_CopyFiles

[CoInstallers_AddReg]

HKR,,CoInstallers32,0x00010000,"WdfCoInstaller01009.dll,WdfCoInstaller","WinUSBCoInstaller2.dll"

[CoInstallers_CopyFiles]

WinUSBCoInstaller2.dll

WdfCoInstaller01009.dll

[DestinationDirs]

CoInstallers_CopyFiles=11

[SourceDisksNames]

1 = %DISK_NAME%,,\i386

2 = %DISK_NAME%,,\amd64

[SourceDisksFiles.x86]

WinUSBCoInstaller2.dll = 1

WdfCoInstaller01009.dll = 1

[SourceDisksFiles.amd64]

WinUSBCoInstaller2.dll = 2

WdfCoInstaller01009.dll = 2

[Strings]

ProviderName = "Google, Inc."

SingleAdbInterface = "Android ADB Interface"

SingleRecoveryInterface = "Android ADB Recovery Interface"

CompositeAdbInterface = "Android Composite ADB Interface(Revision 4)"

SingleBootLoaderInterface = "Android Bootloader Interface"

WinUSB_SvcDesc = "Android USB Driver"

DISK_NAME = "Android WinUsb installation disk"

ClassName = "Android Phone"