Qualcomm Technologies, Inc.

SDM670/SDM710 Linux Android Current Consumption Data

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Revision history

Revision	Date	Description
A	October 2017	Initial release
B	December 2017	Numerous changes were made to this document; it should be read in its entirety.
C	December 2017	Added Section 4.1.2 and Chapter 5
D	March 2018	Updated Section 4.3
E	April 2018	Document updated to align with the SDM710 and SDM670 CS details and configuration. Read in entirety.

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1 Introduction

1.1 Purpose

This document provides the current consumption data for the SDM670/SDM710 chipset with AMSS SDM670/SDM710 software. The current consumption is highly dependent on the software optimization.

1.2 Conventions

Shading indicates content that has been added or changed in this revision of the document.

1.3 Expectations

Device variation

The current consumption measurements recorded in this document are not expected to match either the current consumption measurements of an OEM design or another CDP of identical part numbers loaded with identical software.

Variations in consumption measurements when compared to the OEM device are caused by the CDP using different components than the OEM design, that is, memory ICs, display ICs, peripheral ICs, and so on. Potential variations in measurement when compared to an identical CDP loaded with identical software by normal silicon process variations in both the Qualcomm Technologies, Inc. (QTI) and non-QTI components, and power supply tolerances. Any differences in the measurement technique, equipment, or temperature also causes variations. Other factors, such as, floating CMOS inputs or taking measurements at maximum Tx power can affect both the reliability and repeatability of current consumption measurements.

The targets and measurements contained in this document are typical values measured on a single CDP in a lab bench environment (room temperature). The measurements are provided as a relative reference point and not as an absolute goal to attain.

Test case selection

The test cases selected for measurement in this document are intended to provide a wide range of coverage. Although the specific conditions required by an OEM may not appear in this list. However, a test case or a combination of test cases that suit the OEM requirements can be used for the baseline comparison.

OEM platform power optimization starts with comparisons to the QTI platform under one or more baseline test conditions provided in this document. When the OEM and CDP670 platforms are compared and optimized in this known test case, then the differences between baseline and required test cases are measured on the OEM platform and analyzed with QTI for optimization, if necessary.

Power optimization of an OEM platform is an iterative process that involves:

1. Identifying power consumption differences between an OEM and QTI platforms in similar test conditions
2. Determining the source of those differences; they could be test conditions, hardware configuration differences, software control differences, and so on
3. Deciding whether the source is an error that must be corrected, or is intentional
4. Correcting errors that are identified
5. Repeating until all differences are corrected or determined to be intentional

As OEMs update their hardware platforms or integrate new software releases from QTI, the power consumption may change, triggering additional power optimization. It is necessary to note that during the software development process, the current consumption for some test cases may increase, as power improvement features may need to be delayed to a later release to meet stability requirements. Figure 1-1 is an example of OEM power consumption vs. CDP power consumption.

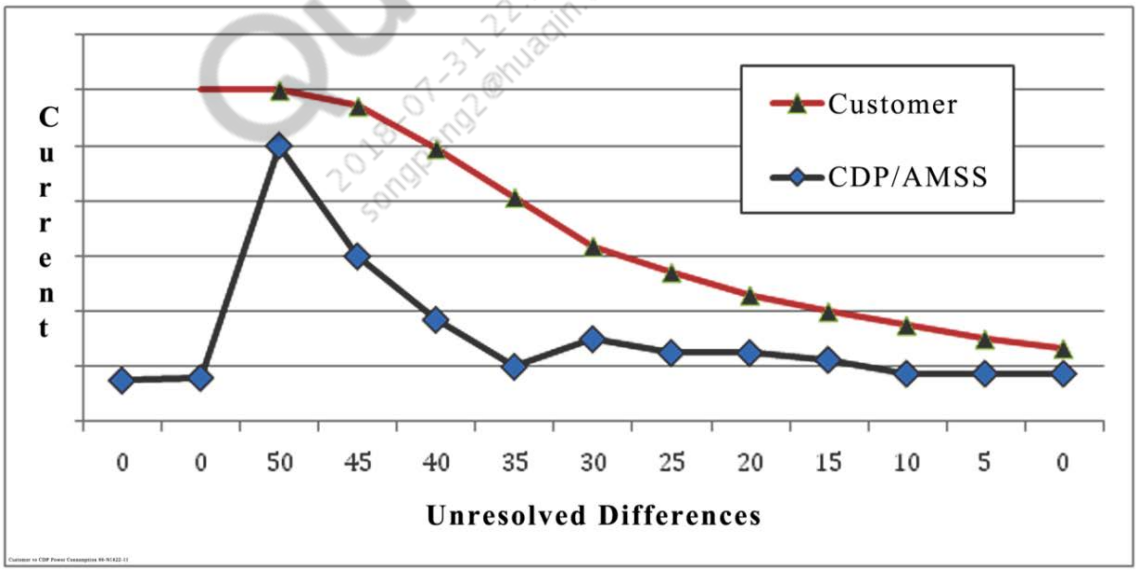

Figure 1-1 Representation of customer vs. CDP power consumption

When discussing power optimization with QTI, it is necessary to provide detailed information, including the following:

- Specific test conditions
- Available history of power measurements for these test conditions
- Goals for power optimization
- Recent hardware or software changes that may have affected the power consumption
- Power consumption breakdown per voltage rail, if possible

1.4 Publication timeline for power measurement data

This document will be updated monthly with the latest available current consumption goals. Following the Feature Complete (FC) software release, key power rail breakdowns will be included once available. The measurement of these power rail breakdowns depends upon OEM requests for specific test cases and software releases. Table 1-1 lists the publication timeline for current consumption data.

Table 1-1 Timeline for publishing current consumption data

Information provided	Guidelines for availability
Target current consumption for commercial software release	Available at the time of hardware engineering samples
Key power rail breakdowns for Table 3-1 test cases	Available on an as-requested basis for FC and later software releases; submit requests at https://createpoint.qti.qualcomm.com/

1.5 GPIO configuration

To minimize the current consumption, OEMs must configure any or all unused GPIOs in one of the following methods:

- As outputs in their Logic Low state
- As inputs with their internal pull-downs enabled

In addition, any GPIO pin configured as an input that is driven by a peripheral device (Bluetooth, WLAN, NFC, and so on) are programmed with an internal pull-down, whenever the corresponding peripheral signal is set to its High Impedance state. The GPIOs are reprogrammed to remove the pull-down when the peripheral signal is taken out of its High Impedance state. These steps are required to prevent unwanted oscillation or high current leakage at the device pins.

For additional information, refer to *Configuration of Input Pins During Device Sleep* (80-VN499-7).

1.6 Technical assistance

For assistance or clarification on information in this document, submit a case to QTI at https://createpoint.qti.qualcomm.com/.

If you do not have access to the CDMATech Support website, register for access or send email to support.cdmatech@qti.qualcomm.com.

Core modem power consumption measurement requests

To submit a request for power measurement not currently found in this document, open a Wireless Device Support case at https://createpoint.qti.qualcomm.com/. The following information must be included in the case:

- Correct chipset, AMSS software build ID, and OS
- Initial problem type – Software
- Problem area 1 – BSP/HLOS
- Problem area 2 – Power/Thermal (BSP/HLOS)
- Problem area 3 – OEM-appropriate selection
- Problem description – Include battery level or breakdown, and the test case

Priority is given to standard test cases, as listed in Table 3-1, and the measurements are provided within one week. Requests for nonstandard test conditions are evaluated on a case-by-case basis.

Multimedia power consumption measurement requests

To submit a request for a multimedia power measurement not currently found in this document, open a Wireless Device Support case at https://createpoint.qti.qualcomm.com/. The following information must be included in the case:

- Correct chipset, AMSS software build ID, and OS
- Initial problem type – Software
- Problem area 1 – Multimedia
- Problem area 2 – Power
- Problem area 3 – Customer appropriate selection
- Problem description – Include battery level or breakdown, and the test case

Priority is given to standard test cases, as listed in Table 3-1, and the measurements are provided within one week. Requests for nonstandard test conditions are evaluated on a case-by-case basis.

2 Test setup

2.1 Devices used for testing

The following hardware and software configurations are used for measurements:

- SDM670/SDM710 and PM670 devices, installed on a specially configured CDP670 resistive current measurement (RCM) evaluation platform for power measurement purposes only.
- Various SDM670/SDM710 AMSS software releases as defined throughout this document, along with the current consumption data presented.
- Display resolutions with memory configuration used are 1080p or 1440 p DSI with 4 GB LPDDR4X; Command mode panel, Portrait mode panel orientation.
- The current consumption measurement is performed using the QTI power measurement tool on the CDP-RCM (or RCM) platform.

The following is a list of the chipset devices used on the CDP670 power measurement platform for each set of tests.

- SDM670/SDM710
- PM670
- SDR660
- WCN3990
- WCD9340

NOTE: Throughout this document, the phrase *SDM670/SDM710 chipset* refers to the combination of these devices.

2.2 Air interface test equipment

Chipset current consumption is measured with the SDM670/SDM710 platform configured for an air interface operating in a specific mode. The tested modes are defined in Chapter 3. The test equipment used to emulate the air interface are:

- CDMA measurements – Agilent 8960 *Wireless Communications Test Set*
- LTE measurements – Anritsu MT8820C

- WCDMA measurements – Agilent 8960 or the Anritsu MT8820C *Radio Communication Analyzer*
- GSM measurements – Agilent 8960 or Anritsu MT8820C

2.3 Power tree

To view the SDM670/SDM710 power tree, select SDM670/SDM710_Power_Grid.pdf from the Attachments panel, or click the icon. 

The power tree for the SDM670/SDM710 chipset shows the power rails for other devices such as the WCN3990 and WCD9340, and external circuitry such as UFS, SD card, display, camera, and sensors. RCM channel information for the RCM-configured CDP is also shown on the power tree.

The current consumption numbers listed in the power tree are estimated worst-case currents. These numbers are preliminary and are intended for PCB routing reference only. In a real world scenario, all the loads at a node does not run concurrently with peak consumption.

Actual currents from third-party components, for example, display, camera, and sensors, may be different from what is shown in the grid.

3 Test definitions

Definitions of test conditions (air interface configuration, multimedia, display activity, lighting status, and so on) for the current consumption tests are listed in Table 3-1.

Table 3-1 Test definitions

Test case	Code	Operating band	Definition
Sleep (Airplane mode, rock bottom)	AIR1	–	Airplane mode selected through UI; if UI support is not present, configure modem in Low-Power mode with no wake-ups for paging processing; backlight and display off.
WCDMA standby 2.56 sec	WS1	B1	WCDMA idle, stationary A, Discontinuous receive (DRx) 2.56 sec, RxAGC at phone -50 dBm, duration 64 sec; Sintrasearch (intrafrequency) and Sintersearch (interfrequency) CPICH E_c/I_0 < -10 dB; backlight and display off.
WCDMA talk + 0 dBm,	WT1	B1	WCDMA AMR voice, muted, empty frames on uplink and downlink, total Tx 0 dBm, RxAGC at phone approximately -50 dBm, IMT, no Receive Diversity (RxD); backlight and display off.
CDMA QPCH standby 5.12 sec	CS2	Cell	CDMA QPCH Standby mode, SCI = 2 (5.12 sec), RxAGC at phone approximately -50 dBm, single sector, no neighbors; cell band; backlight and display off.
CDMA talk + 0 dBm, cell band	CT1	BC0	CDMA-only mode, muted, empty frames on uplink and downlink, total Tx = 0 dBm, RxAGC at phone approximately -50 dBm, EVRC RC3 full rate, no headset, cell band; backlight and display off.
GSM standby 1.18 sec	GS1	PGSM	GPRS standby, MFRM5 (1.17 sec), RxAGC at phone approximately -50 dBm, PGSM, no neighbor, duration 59 sec; backlight and display off.
GSM talk 5 dBm, no Discontinuous Transmit (DTx), PGSM	GT1	PGSM	GSM full-rate voice, muted, DTx off, empty frames on uplink and downlink, total Tx = 5 dBm, RxAGC at phone approximately -50 dBm, PGSM, 100% voice activity; backlight and display off.
TD-SCDMA standby 1.28 sec	TCS1	Band 34	TD-SCDMA idle, stationary A, DRX 1.28 sec, Rx power level -50 dBm at phone antenna connector, test duration 64 sec. Sintrasearch (intra frequency) and Sintersearch (inter frequency) CPICH E_c/I_o is about -15 dB; backlight and display off.
TD-SCDMA talk 0 dBm, B34	TCT1	Band 34	TD-SCDMA voice, muted, empty frames on uplink and downlink, total Tx 0 dBm, Rx power level -50 dBm at phone antenna connector, IMT (B1); backlight and display off.

Test case	Code	Operating band	Definition
VoLTE TDD (40 ms DRX cycle, +0 dBm, MIMO, B38)	VoLTE 6	B38	VoLTE talk 0 dBm 40% voice activity + 40% listen state + 20% silent state, 40 ms CDRX, SPS, CMCC config, B38 **Test conditions** Embedded LTE AMR-WB full-rate voice, Tx power 0 dBm, LTE TDD 20 MHz bandwidth, UL/DL config 1, SSF 7, 40 ms CDRX, HARQ: 4 Dynamic scheduling in UL and DL, 40% voice activity + 40% listen state + 20% silent state, backlight and display off, on-duration of 2 ms, inactivity timer of 2 ms. Average the power over three runs. 1. Run with 0% voice activity (play 100% VA file in the remote device, mute local device) 2. Run with 100% voice activity (mute remote device, play 100% VA file in the local device) Run with 0% activity with both devices (mute remote device as well as local device)
VoLTE FDD 20 MHz 0 dBm	VoLTE 11	B13	VoLTE 0 dBm, 40% voice activity+40% listen state+20% silent state, 40 ms CDRX, SPS, 20MHZ, Timers 4 ms, B13 **Test conditions** Embedded AMR-WB full rate speech, Transmit power 0 dBm, LTE 20 MHz BW, CDRX with 40 ms duration, Semi-persistent (SPS) scheduling in UL and DL, 40% voice activity+40% listen state+20% silent state, On-duration of 4 ms, Inactivity timer of 4 ms. Backlight and display off. Calculate based on 40% voice activity+40% listen state+20% silent state: 1. Listen: First run with 0% voice activity (play 100% VA file in the remote device, mute local device) 2. Talk: Second run with 100% voice activity (mute remote device, play 100% VA file in the local device) 3. Silent: Third run with both remote device and local device mute, 0% voice activity on both ends
HSPA+DC Cat 24 (42 Mbps DL, B1), with Rel-99 UL, Tx at 0 dBm, RxD on	HS62E	B1	HSPA+DC Cat 24 (42 Mbps DL, B1), with Rel-99 UL, Tx at 0 dBm, RxD on, Embedded. **Test Conditions:** HSPA+ Cat 24 Data socket initiated through UI, Rel-99 UL, Dual Carrier [42 Mbps], UDP, 64 QAM, RxD ON.
TD-SCDMA HSDPA 2.8 Mbps	TDHS1E	B34/39	TD-SCDMA HSDPA at 2.8 Mbps, Tx 0 dBm, without USB, 16 QAM, RxD off, band 34/39; backlight and display off.
LTE standby 2.56 sec	LS1	Band 13	LTE Standby mode, DRx = 2.56 sec, RxAGC at phone approximately -50 dBm, no neighbors, duration 64 sec; backlight and display off.
LTE TDD standby 2.56 sec	LS3	B41	LTE TDD Standby mode, DRx = 2.56 sec, ULDL2, SSF#7, B41, Rx power level -50 dBm at phone antenna connector, measurement duration 64 sec; Sintra = 0 and Snonintra = 0, no neighbor cells, backlight, and display off; EPRE = -50 dBm/kHz.

Test case	Code	Operating band	Definition
FDD LTE CDRx standby 320 sec	CDRxS1	B13	LTE FDD CDRX Standby with idle DRX=1.28 sec, RxAGC at phone approximately -50dBm, no neighbors. display/ backlight is off. UE camps on CDRX with no traffic. RRC idle timer is set to high value to ensure that RRC connection release is not sent, CQI reporting in the first subframe, 40 ms CQI reporting interval CDRX params: 320 ms Long CDRX cycle, 200 ms inactivity timer, 10 ms on Duration, retransmission time 2 ms, disable short_CDRX_cycle, BW, 10 MHz.
TDD LTE CDRx standby 320 sec	CDRxS4	B41	LTE TDD CDRX Standby with idle DRX=1.28 sec, RxAGC at phone approximately -50dBm, UL DL cfg #1, SSF #7, no neighbors. display/ backlight is off. UE camps on CDRX with no traffic. RRC idle timer is set to high value to ensure that RRC connection release is not sent, CQI reporting in the first subframe, 40 ms CQI reporting interval. CDRX params: 320 ms Long CDRX cycle, 200 ms inactivity timer, 10 ms on duration, retransmission time 2 ms, disable short_CDRX_cycle, BW 20 MHz
LTE Cat 3 (68/23 Mbps, + 0 dBm, B13)	LTE1E	Band 13	LTE data Cat 3, 2 x 2 MIMO, RB 50, MCS 28, 64 QAM, CP normal; PCFICH 3sym, DCI 1 A, type 0, PHICH 1/6, Tx 0 dBm, downlink spectrum bandwidth 10 MHz; backlight and display off – Embedded.
LTE Cat 4 (150/50 Mbps, 0 dBm, B7)	LTE7E	Band 38	LTE data Cat 4, 2 x 2 MIMO, RB 100, MCS 28, 64 QAM, CP normal; PCFICH 3sym, DCI 1 A, type 0, PHICH 1/6, Tx 0 dBm, downlink spectrum bandwidth 20 MHz; backlight and display off – Embedded.
LTE TDD Cat 3 20 MHz (60/18 Mbps + 0 dBm, B41)	LTE5E	B38	LTE data Cat 3, ULDL1, SSF#7, 2 x 2 MIMO, RB 100, MCS 23, 64 QAM, B41, CP normal, PCFICH 3sym, DCI 1 A, type 0, PHICH 1/6, Tx 0 dBm, DL spectrum Bandwidth 20 MHz; backlight and display off.
LTE FDD Cat6, CA, 20 MHz + 20 MHz (300/50 DL/UL, B3tx + B4), 0 dBm	LTE10E	B3(Tx)+B 4	LTE FDD Cat6, 2xCA, 20 MHz + 20 MHz (300/50 DL/UL, B3tx+B4), Embedded, 0 dBm. **Test Conditions:** Carrier aggregation, 20 MHz BW from 1 carrier and 20 MHz BW from second carrier. Backlight and display off, LTE Data socket is initiated through UI-embedded
LTE FDD Cat9, 3xCA, 20 MHz + 20 MHz + 20 MHz (450/50 DL/UL, B3 (Tx) + B7 + B20), embedded, 0 dBm	LTE21E	B3 (Tx) + B7 + B20	LTE FDD Cat9, 3xCA, 20 MHz + 20 MHz + 20 MHz (450/50 DL/UL, B3(Tx)+B7+B20), Embedded, 0 dBm **Test Conditions:** Carrier aggregation, 20 MHz BW from all three Carriers. Backlight and display off, LTE Data socket is initiated through UI- Embedded, Tx at 0 dBm, RB=100 MCS=28. Record Tj (for comparison with Tj goal mentioned in Power dashboard).

Test case	Code	Operating band	Definition
LTE FDD PDCCH only 10 MHz B13	LTE16E	B13	LTE FDD PDCCH only, 10 MHz, +0dbm, B13 **Test Conditions:** LTE Data Cat 3, 10 MHz, 2 x 2 MIMO, lowest RB/MCS for DL/UL to sustain the call, QPSK, Tx 0 dBm, Rx -45dBm, DL spectrum BW 10 MHz. Backlight and display off.- Embedded
LTE FDD PDCCH only 20 MHz B7	LTE17E	B7	LTE FDD PDCCH only, 20 MHz, +0dbm, B7 **Test Conditions:** LTE Data Cat 3, 20 MHz, 2 x 2 MIMO, lowest RB/MCS for DL/UL to sustain the call, QPSK, Tx 0 dBm, Rx -45dBm, DL spectrum BW 10 MHz. Backlight and display off.- Embedded
LTE PDCCH ONLY CA (B7+B3)	LTE47E	(B7+B3)	FDD LTE PDCCH Only 20+20 MHz B3+B7 **Test Conditions:** Bandwidth- 20 MHz + 20 MHz; RF band B3[Tx]+B7; Lowest RB/MCS for DL/UL to sustain the call, QPSK, Tx 0 dBm, Rx -45dBm. Backlight and display off. Embedded.
WCDMA + WCDMA Standby (0.64+0.64)	WWS1	B1	WCDMA (0.64 sec) + WCDMA (0.64 sec) Standby DSDS. **Test Conditions:** DSDS WCDMA IMT(B1) Standby 0.64 sec + WCDMA IMT (B1) Standby - 0.64 sec
DSDS WCDMA + GSM (0.64 sec + 0.47 sec)	WGS3	B1, PGSM	WCDMA band = IMT (B1); GSM band = PGSM; WCDMA Slot1 – DRX = 0.64 sec, RxAGC approximately 50 dBm, GSM Slot2 – MFRM = 2 (0.47 sec), RxAGC approximately -50 dBm Sintrasearch (intrafrequency) and Sintersearch (interfrequency) CPICH E_c/I_o < -10 dB; backlight and display off.
TD-SCDMA + WCDMA Standby (0.64+0.64)	TCWS1	B34, B1	–
TD-SCDMA (0.64 sec) + GSM (0.47 sec) standby	TCSGS1	B34, PGSM	TD-SCDMA idle, stationary A, DRX 0.64 sec, Rx power level -50 dBm at phone antenna connector, test duration 64 sec. CPICH E_c/I_o is about -15 dB; backlight and display off + EPRE = -50 dBm/kHz + GPRS standby, DRX (0.47 sec), RxAGC at phone approximately -50 dBm, PGSM, no neighbor, duration 64 sec; backlight and display off.
GPS 1 Hz Trk (DPO) with WCDMA standby	GPS2	IMT	GPS stand-alone 1 Hz tracking (DPO); GPS stand-alone 1 Hz tracking in strong signal conditions; backlight and display off.
Global navigation satellite system (GNSS) 1 Hz Trk high sensitivity with WCDMA standby	GNSS1	IMT	GLONASS stand-alone 1 Hz tracking high sensitivity; backlight and display off.

Test case	Code	Operating band	Definition
MP3 playback 128 kbps TM	AU4A	–	MP3 at 44.1 kHz 128 kbps stereo; refer to *MP3 at 44.1 kHz 128 kbps Stereo Clip for Power Measurements* (MH80-VR010-5).
Listen – 100% silence	AU34A	–	Listen keyword detection using 16 kHz mono signal, 100% silence, user-verification on, single keyword.
Listen – 100% speech	AU35A	–	Listen keyword detection using 16 kHz mono speech, 100% speech, user-verification on, single keyword.
Video decode (H.264 720p, 30 fps)	QTC77A	–	30 fps at HD 720p H.264 10 Mbps aacPlus 96 kbps 44.1 kHz stereo; refer to *30 fps at HD 720p H.264 10 Mbps aacPlus 96 kbps 44.1 kHz Stereo (Qtc77) Clip for Multimedia Power Measurement* (MH80-VR010-7).
Video decode H.264 30 fps 1080p, 20 Mbps	QTC88A	–	30 fps at HD 1080p 20 Mbps aacPlus 96 kbps 44 kHz stereo; refer to *30 fps at HD 1080p H.264 20 Mbps aacPlus 96 kbps 44 kHz Stereo (Qtc88) Clip for Multimedia Power Measurement* (MH80-VR010-8)).
16 MP, 30 fps at HD 1080p 20 Mbps encode at full screen resolution, at Vsync, AAC 96 kbps 48 kHz stereo.	QMC31A	–	**Test scenario**: 1. Place the system in Airplane mode 2. Set display brightness to default 3. Auto brightness feature is disabled, if applicable 4. Set all camera settings to default. 5. Fps is set at the default value of 30 6. Set aacPlus audio encode at 96 kbps, 48 kHz stereo. Recommended audio recording chain: HPF > Audio Mic Gain > EANS > IIR > AIG > MBDRC > Volume (COPP) > Volume (POPP).
Graphics (3D UI full-screen resolution 30 fps [PowerLift]) – Comp. bypass	QGC23A	–	EXE, PowerLift 3D OpenGL ES Graphics Benchmark Tool version 4.6.01 for Linux Android-enabled devices; refer to *EXE, PowerLift 3D Linux Android Graphics Tool Release 5.2.00* (HK11-NC876-1).
Static image display	LCD04A	–	Static image display, at full-screen resolution, at VSync
Accelerometer 10 Hz background processing	SNS5A	–	**Test scenario**: 1. Disable screen autorotate. 2. Set to Airplane mode. 3. Disable GPS. 4. Allow screen timeout when charging. 5. Set screen time out to 1 min. 6. Power cycle the DUT. 7. Verify that screen is off during test. For more information on this test, refer to *Power Consumption Measurement Procedure for MSM (Android-Based)/MDM Devices* (80-N6837-1).
Accelerometer 15 Hz active processing	SNS4A	–	Airplane mode, display on, 15 Hz running using Qsensor test application.
Bluetooth (page scan + sniff) with WCDMA standby	BT2	IMT	Bluetooth headset bonded, connected, and UE accepting other Bluetooth connection requests; Bluetooth sniff cycle 1.28 sec and page scan cycle of 1.28 sec; backlight and display off.

Test case	Code	Operating band	Definition
WLAN DTIM1 with WCDMA standby	WLS1	IMT	**Test scenario**: 1. Turn on the Airplane mode. 2. In the configuration file, set listen interval to 100 ms and enable BET. 3. Turn on the Wi-Fi and connect to the AP. 4. Turn off the display. For more information on this test, refer to *Power Consumption Measurement Procedure for MSM (Android-Based)/MDM Devices* (80-N6837-1). **Note:** Measurement should be in a shielded environment.
Browser over Wi-Fi	WB1A	Wi-Fi	Loading and rendering of low complexity web page (no JavaScript, no Flash); reload every 40 sec (for video, refer to *EXE, iBench V.4.6.01 for Linux Android-Enabled Devices* (72-N7696-1).
Video streaming over Wi-Fi	VS6A	Wi-Fi	Video streaming over Wi-Fi (720p 2.3 Mbps)

Note: All test codes ending with A were performed in Airplane mode.

4 Chipset current consumption

4.1 Commercial software release target values

Commercial software release target values are predictions of the current consumption for the first commercial-quality software release for an OS. These targets ***are not updated*** after the commercial software is released.

Commercial software release target values for the operational modes defined in Table 3-1 are listed in Table 4-1 for SDM670/SDM710 with PM670. These values show optimized hardware and software configurations and are normalized to a 3.7 V Vsupply voltage.

4.1.1 Power dashboard

The power ranges listed in Table 4-1 are the projected power consumption values for a typical device at the 50th and the 95th percentile of the device distribution. Devices that fall outside this range are to be expected. For maximum power specifications, QTI provides a power limit for the AP Dhrystone power and sleep power of the VDD_CORE and VDD_MEM voltage rails. Refer to *SDM670 Device* (80-PB873-1) and *SDM710 Device Specification* (80-PG301-1) for details.

NOTE: The 10 nm manufacturing process variations across parts and foundries lead to power distribution. The exact shape and median of this distribution is expected to vary over time with the maturing of the 10 nm process across foundries.

NOTE: The following power dashboard numbers are estimated power range goals and do not include contribution from the peripheral components such as LCM and camera sensors.

Table 4-1 Top-level current consumption targets for SDM670/SDM710 with PM670

Category	Test case	Code	Tj (°C)	SDM670/SDM710 4 GB LPDDR4X FHD Command mode display, PM670, WCD9340 codec, WCN3990, SDR660 estimated power range goal (mA)	SDM670/SDM710 4 GB LPDDR4X WQHD Command mode display, PM670, WCD9340 codec, WCN3990, SDR660 estimated power range goal (mA)
Modem	Airplane	AIR1	25	3.15 to 4.15	3.15 to 4.15
	WCDMA Standby 2.56 sec	WS1	25	3.51 to 4.66	3.51 to 4.66
	CDMA (5.12 s) QPCH Standby	CS2	25	3.44 to 4.44	3.44 to 4.44
	GSM Standby 1.18 sec	GS1	25	3.91 to 5.15	3.91 to 5.15
	LTE FDD (2.56 sec, 10 MHz) Standby	LS1	25	3.62 to 4.81	3.62 to 4.81
	LTE TDD Standby (2.56 sec, 20 MHz)	LS3	25	3.65 to 4.89	3.65 to 4.89
	TD-SCDMA Standby 1.28 sec	TCS1	25	3.75 to 4.98	3.75 to 4.98
	LTE FDD CDRX with 320 ms long CDRX cycle, 10 MHz	CDRxS1	25	10.59 to 12.36	10.59 to 12.36
	LTE TDD CDRX with 320 ms long CDRX cycle, 20 MHz	CDRxS4	25	12.8 to 14.29	12.8 to 14.29
	WCDMA + GSM Standby (0.64+0.47)	WGS3	25	6.97 to 8.07	6.97 to 8.07
	TD-SCDMA + GSM Standby (0.64+0.47)	TCGS4	25	6.55 to 7.65	6.55 to 7.65
	WCDMA + WCDMA Standby (0.64+0.64)	WWS1	25	6.55 to 7.65	6.55 to 7.65
	TD-SCDMA + WCDMA Standby (0.64+0.64)	TCWS1	25	6.14 to 7.24	6.14 to 7.24
	CDMA Talk, 0 dBm	CT1	25	91 to 100	91 to 100
	WCDMA Talk, 0 dBm	WT1	25	91 to 100	91 to 100
	GSM Talk 5 dBm, no DTx, PGSM	GT1	25	69 to 76	69 to 76
	VoLTE FDD 20 MHz 0 dBm	VOLTE11	25	70 to 76	70 to 76

Category	Test case	Code	Tj (°C)	SDM670/SDM710 4 GB LPDDR4X FHD Command mode display, PM670, WCD9340 codec, WCN3990, SDR660 estimated power range goal (mA)	SDM670/SDM710 4 GB LPDDR4X WQHD Command mode display, PM670, WCD9340 codec, WCN3990, SDR660 estimated power range goal (mA)
Modem (cont.)	VoLTE TDD, 20 MHz, 0dbm	VOLTE6	25	74 to 81	74 to 81
	FDD LTE Cat3 10 MHz (PDCCH only)	LTE16E	25	68 to 75	68 to 75
	FDD LTE Cat4 20 MHz (PDCCH only)	LTE17E	25	79 to 87	79 to 87
	LTE PDCCH only CA (B7+B3)	LTE47E	25	131 to 144	131 to 144
	HSPA+DC Cat 24, 42 Mbps DL with Rel-99 UL, Tx at 0 dBm, RxD on	HS62E	25	164 to 179	164 to 179
	FDD LTE Cat3 10 MHz	LTE1E	25	161 to 176	161 to 176
	TDD LTE Cat3 20 MHz	LTE5E	25	151 to 165	151 to 165
	FDD LTE Cat4 20 MHz	LTE7E	25	197 to 217	197 to 217
	LTE FDD Cat6, CA, 20 MHz + 20 MHz, (300/50 DL/UL), 0 dBm	LTE34E	25	292 to 319	292 to 319
	LTE TDD Cat6, CA, 20 MHz + 20 MHz (180/10 DL/UL), 0 0 dBm	LTE23E-1	25	229 to 247	229 to 247
	LTE FDD Cat9, 3xCA, 20 MHz + 20 MHz + 20 MHz (450/50 DL/UL), embedded, 0 dBm	LTE21E	35	445 to 485	445 to 485
	LTE TDD Cat 9, 3CA, 20 MHz + 20 MHz + 20 MHz (270/10 DL/UL), Embedded, 0 dBm	LTE37E	35	327 to 372	327 to 372
	GNSS 1 Hz Trk	GNSS1	25	38.5 to 41.85	38.5 to 41.85
	GPS 1 Hz TrK (DPO)	GPS2	25	8 to 8.73	8 to 8.73

Category	Test case	Code	Tj (°C)	SDM670/SDM710 4 GB LPDDR4X FHD Command mode display, PM670, WCD9340 codec, WCN3990, SDR660 estimated power range goal (mA)	SDM670/SDM710 4 GB LPDDR4X WQHD Command mode display, PM670, WCD9340 codec, WCN3990, SDR660 estimated power range goal (mA)
Multimedia	MP3 playback 128 Kbps Tunnel mode	AU4A	25	22 to 28	22 to 28
	MP3 at 44.1 kHz 128 kbps stereo over USB headset	AU38A	25	31 to 39	31 to 39
	Listen keyword detection using 16 kHz mono speech, 100% speech, user verification Off, single keyword	AU35A	25	4.1 to 5.3	4.1 to 5.3
	Static image display, at fullscreen resolution, at VSync	LCD04A	25	6.1 to 7.1	6.1 to 7.1
	H.264 1080p decode, 30 fps	QTC88A	25	68 to 79	71 to 82
	30 fps at UHD 8b H.264 42 Mbps Speedboat, aacPlus 128 kbps 44 KHz stereo	QTC101A	25	101 to 111	108 to 118
	60 fps at UHD 10b H.265 50 Mbps Speedboat, aacPlus 128 kbps 44 KHz stereo	QTC106A	25	197 to 215	202 to 220
	1080p at 30 fps encodes with FD, EIS3.0, Sensor 16MP at 30 fps	QMC42A	25	268 to 294	272 to 298
	ZSL Camera Preview with FD, WQXGA at 30 fps, Sensor 21 MP at 30 fps	QMC38A-8	25	236 to 264	278 to 306
	UHD at 30 fps encodes with FD, EIS3.0, Sensor 12MP at 30 fps	QMC45AT	35/45	445 to 483	453 to 491
	720p at 240 fps encode, Sensor 1MP at 240 fps	QMC41A	35	363 to 397	369 to 403
	1080p at 120 fps encode, Sensor 2.1 MP at 120 fps	QMC44AT	35/45	450 to 488	456 to 494

Category	Test case	Code	Tj (°C)	SDM670/SDM710 4 GB LPDDR4X FHD Command mode display, PM670, WCD9340 codec, WCN3990, SDR660 estimated power range goal (mA)	SDM670/SDM710 4 GB LPDDR4X WQHD Command mode display, PM670, WCD9340 codec, WCN3990, SDR660 estimated power range goal (mA)
Connectivity	Bluetooth (1.28 sec) sniffs and page scan + WS1	BT2	25	3.64 to 4.74	3.64 to 4.74
	DTIM1 at 2.4 GHz screen room + WS1	WLS1	25	4.09 to 5.19	4.09 to 5.19
	DTIM5 at 2.4 GHz screen room + WS1	WLS5	25	3.59 to 4.69	3.59 to 4.69
	WLAN 1 x 1 TCPDL 2G 11n7 72 Mbps @ 20 MHz (HT20)	WLTCPD2	25	106 to 120	106 to 120
	WLAN 2 x 2 TCPDL 5G 11ac9 833 Mbps @ 80 MHz (VHT80)	WLT80D5-2	25	301 to 325	301 to 325
Sensors	Accelerometer batching background processing + AIR1	SNS6A	25	3.25 to 4.21	3.25 to 4.21
	Accelerometer active processing + LCD04A	SNS4A	25	9 to 10.50	9 to 10.50
	Total Motion Awareness (TMA) with Coarse Motion Classifier (CMC) Stationary + AIR1,	SNS9A	25	3.24 to 4.20	3.24 to 4.20
	Total Motion Awareness (TMA) with Coarse Motion Classifier (CMC) Motion + AIR1	SNS10A	25	3.32 to 4.30	3.32 to 4.30
High performance	T-Rex HD 1080p, at 60 fps at fullscreen resolution at Vsync	QGC29AT	45	–	420 to 463
	Manhattan 3.0 1080p (Single Frame) 15 fps, On-Screen	QGC33AT	35	–	524 to 571
	12MP@20fps Burst shot w/FD, Sensor 16MP@30fps	QMC57AT	55	–	789 to 852
	LTE FDD Cat9, 3 x CA, 20 MHz + 20 MHz + 20 MHz (450/50 DL/UL, B3 (Tx) + B7 + B20), 23 dBm	LTE21ET	65	–	783 to 896

4.1.2 Global days of use (GDoU)

Table 4-2 lists the GDoU current consumption data for various technology areas. For test case summary and detailed description, refer to *Global Days of Use Test Plan* (80-P1544-2). The power ranges listed in Table 4-2 are the projected power consumption values for a typical device approximately at the 50th percentile of the device distribution.

The 10 nm manufacturing process variations across parts and foundries lead to power distribution. The exact shape and median of this distribution is expected to vary over time with the maturing of the 10 nm process across foundries.

Table 4-2 GDoU power dashboard

SDM670/SDM710 4 GB LPDDR4X FHD Command mode display, PM670, WCD9340 codec, WCN3990, SDR660					
Tech Area	**Test ID**	**Network**	**Test case Name**	**Weightage (%)**	**Estimated power consumption (mA)**
Standby	SBYBG03	4G + Bluetooth (connected) and Wi-Fi (Not connected)	Standby (with background applications) + 4G (BLE Device (MI band) connected with Bluetooth) + Wi-Fi (not connected)	10	11
	SBYBG05	4G + Wi-Fi + Bluetooth (not connected)	Standby (with background applications) + 4G + Bluetooth (not connected) + Wi-Fi	24	10
Display	LCD08W	APM + Wi-Fi	Live wallpaper	2	73
Multimedia	QCE17A	APM	Camera snapshot	2.5	229
	QMC04A	APM	1080p (FD, WNR) encoding	2	324
	AU39A	APM	MP3 local playback (with loudspeaker) (with PP Features SRS audio)	1	26
	AU40A	APM + Bluetooth	MP3 local playback (with Bluetooth device) (with PP Features SRS Audio)	1	32
	QTC108A	APM	1080p playback	2	104
	AS06	4G + Bluetooth	Play music online via 4G (Tunein)	2	85
	AS08W	APM+ Wi-Fi	Play music online via Wi-Fi (Google music)	2	55
	VS06	4G	Online video using 4G (Youtube)	2	136
	VS08W	APM+ Wi-Fi	Online video using Wi-Fi (Youtube)	2	139

SDM670/SDM710 4 GB LPDDR4X FHD Command mode display, PM670, WCD9340 codec, WCN3990, SDR660					
Gaming	TCRS01A	APM	Thunder cross	2.5	153
	RIPTIDE01W	APM+ Wi-Fi	Riptide	2.5	259
	PAW01A	APM	Pacific Air War	2.5	120
IM	MSG03A	APM	SMS	1	59
	WCHTSND01	4G	WeChat send message	3	98
Social Network	FB02W	APM+ Wi-Fi	Facebook	3	90
Browser	WB12W	APM+ Wi-Fi	China top browser (UC Browser) over Wi-Fi	4	127
	WB13	4G	Default/Chrome browsing over 4G	4	131
Email	GMS03	4G	Email send over 4G (Gmail)	2	81
	GMR03	4G	Email receive over 4G (Gmail)	2	21
e-Book	IRDR01	4G	iReader	2	65
UI	WCHATSCR01	4G	WeChat moments Scroll	2	94
Download	DD24	4G	Downloading data from Internet via 4G (One Drive)	1.5	82
	DD24W	APM+ Wi-Fi	Downloading data from Internet via Wi-Fi (One Drive)	1.5	75
Concurrency	PMWN01	4G	Play music (headset) and Watch the news	2	86
Carrier goal	GPS05	4G	Navigation (with map download over 4G)	1	137
	WT1-D	3G	Voice call with 4G SIM (WCDMA with IRATS (LTE) neighbor)	4	87
	VC03W	APM+ Wi-Fi	Video call over Hangout/WeChat	2	392
	VOLTE6-W	4G	VoLTE Call (40% Voice + 40% Listen + 20% Silent), no SPS (FDD 20 MHz) for Global (TDD 20 MHz) for China	1	80
	VOWI-FI01	APM+ Wi-Fi	Voice over Wi-Fi	1	98
App launch and exit	APPLNCH01W	APM+ Wi-Fi	Application launch and exit	3	159

Battery size for SDM670/SDM710-based designs

The SDM platform current consumption estimates and OEM product-specific requirements or carrier requirements (for example, Days of Use (DoU)) play a crucial role in determining the appropriate battery size for the product.

The power data comparison provides the estimated current consumption for SDM670/SDM710 platform, based on the projected power distribution across 50 to 95 percent of the device population.

NOTE: OEMs are expected to select an appropriate battery size to meet their product requirements and specifications.

4.2 Measured values

See the SDM670/SDM710 release notes for battery-level measured values.

4.3 Breakdown measurements (per regulator values)

This section lists the rail level breakdown data for modem and multimedia power dashboard use cases based on the SDM670/SDM710.LA.1.0-00288-STD.HY11-1 CS equivalent build for LA1.0 release for SDM670/SDM710, 4GB LPDDR4X, WTR6955, WCN3990, WCD9340, FHD command mode panel.

Modem use cases

To view the rail-level breakdown data for modem use cases, select Modem-Master.xlsx from the attachments panel, or click the icon.

Multimedia use cases: FHD panel

To view the rail-level breakdown data for multimedia use cases for the FHD panel, select Multimedia-Master.xlsx from the attachments panel, or click the icon.

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5 SDM670/SDM710 CPU Dhrystone power

Figure 5-1 shows the CPU power consumption of the application processor for different DMIPS points in the SDM670/SDM710 chipset.

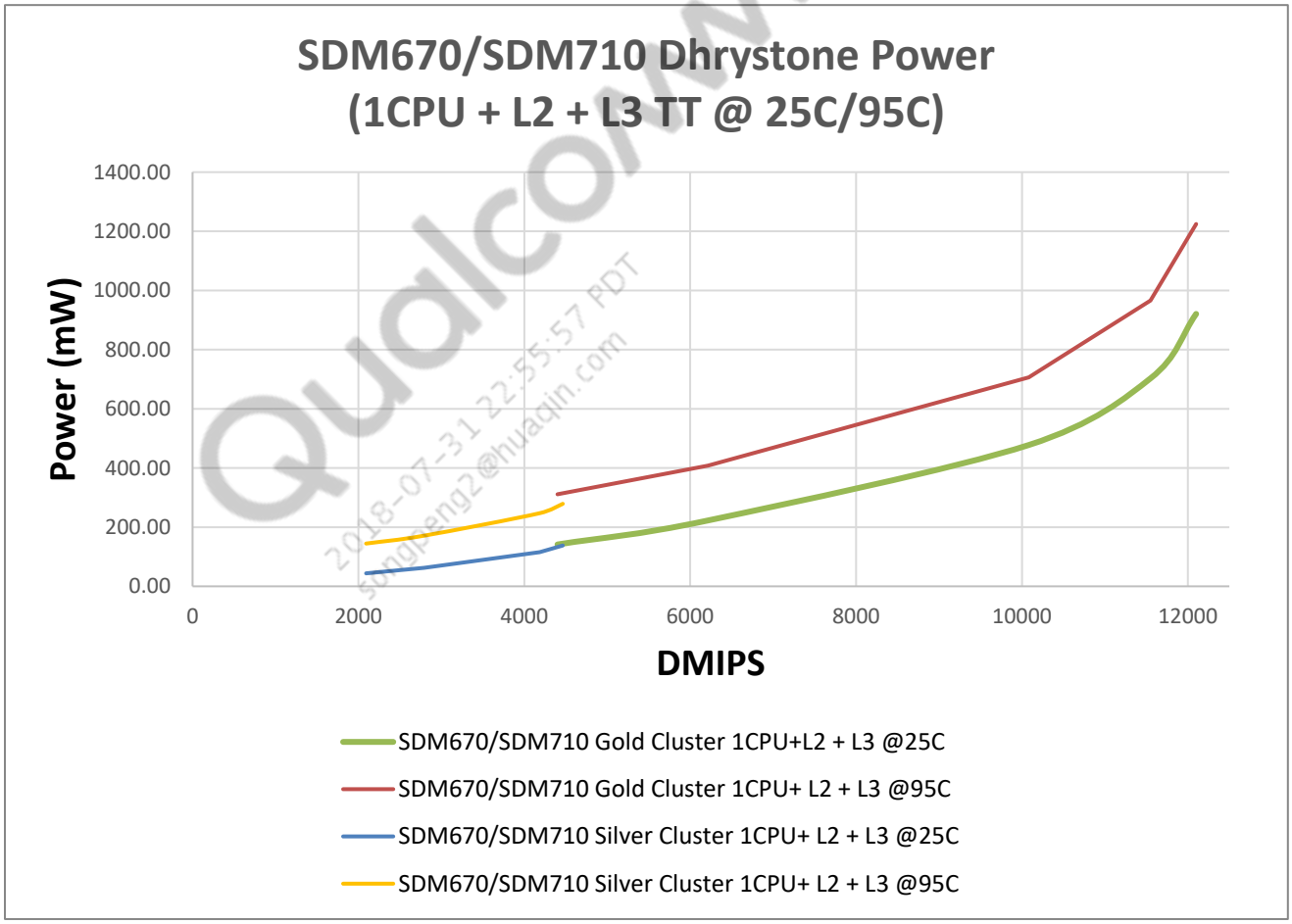

Figure 5-1 SDM670/SDM710 Dhrystone power

NOTE: The Dhrystone performance benchmark used previously, does not consider the memory subsystem or the branch prediction. For current workloads, the SPECint benchmark is recommended for the performance and efficiency comparison.

A References

A.1 Related documents

Title	Number
Qualcomm Technologies, Inc.	
SDM670 Device Specification	80-PB873-1
SDM710 Device Specification	80-PG301-1
Configuration of Input Pins During Device Sleep	80-VN499-7
30 fps at HD 1080p H.264 20 Mbps aacPlus 96 kbps 44 kHz Stereo (Qtc88) Clip for Multimedia Power Measurement	MH80-VR010-8
MP3 at 44.1 kHz 128 kbps Stereo Clip for Power Measurements	MH80-VR010-5
30 fps at HD 720p H.264 10 Mbps aacPlus 96 kbps 44.1 kHz Stereo (Qtc77) Clip for Multimedia Power Measurement	MH80-VR010-7
Video: 720p 1280 x 720 30 fps H.264 HP 2.13 Mbps, aacPlus Stereo 44.1 kHz 128 Kbps (YouTube720p)	MH80-VR010-11
EXE, PowerLift 3D Linux Android Graphics Tool Release 5.2.00	HK11-NC876-1
EXE, iBench V.4.6.01 for Linux Android-Enabled Devices	72-N7696-1
SDM670/SDM710 + PM670 + PM670A/PM670L Reference Schematic	80-PB873-41
PM660 Power Management IC Device Specification	80-P7905-1
Power Consumption Measurement Procedure for MSM (Android-Based)/ MDM Devices	80-N6837-1
Global Days of Use Test Plan	80-P1544-1

A.2 Acronyms and terms

Acronym or term	Definition
DoU	Days of use
DRx	Discontinuous receive
FC	Feature complete
GDoU	Global days of use
GNSS	Global navigation satellite system
OS	Operating system
RCM	Resistive current measurement
RxD	Receive diversity