Qualcomm
TECHNOLOGIES, INC

Power Consumption Measurement Procedure for MSM™ (Android™-Based)/MDM Devices

80-N6837-1 L

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Revision history

Revision	Date	Description
A	Jul 2011	Initial release
B	Sep 2011	Updated Chapter 1 and numerous changes in Chapter 2
C	Jan 2012	Numerous changes were made to Chapter 2. It should be read in its entirety.
D	Nov 2012	Numerous changes were made to Chapter 2. It should be read in its entirety.
E	Nov 2012	Added Section 2.13
F	Feb 2013	Updated Sections 2.5.3, 2.8.4, 2.10.5, and 2.11.6
G	Mar 2013	Added Sections 2.2.2 and 2.2.3
H	Jul 2013	Updated Section 2.4.1.1, Section 2.6, Section 2.10.1, Section 2.10.2, Section 2.10.5, Section 2.10.6, Section 2.11, Section 2.13, Section 2.13.2, Section 2.13.5, Section 2.13.6, Section 2.15.7, and Section 2.17.1; added Section 2.12 and Section 2.16
J	Nov 2013	Updated Sections 1.4, 2.5, 2.5.2, 2.5.3, 2.5.4, 2.6.2, 2.11.1, 2.12.1, 2.13.1, 2.15 and 2.16.3; added Sections 2.18 through 2.29, 2.34, and 2.35
K	Feb 2014	Updated Section 2.15.2
L	Feb 2014	Updated Section 2.15.2

Note: There is no Rev. I, O, Q, S, X, or Z per Mil. standards.

1 Introduction

1.1 Purpose

This document provides power measurement instructions for specific features and modes for Android™ devices such as the MSM8660, MSM8960, etc.

1.2 Scope

This document is intended for customers who need instructions on handset power measurement in specific modes.

1.3 Conventions

Function declarations, function names, type declarations, and code samples appear in a different font, e.g., `#include`.

Code variables appear in angle brackets, e.g., `<number>`.

Commands to be entered appear in a different font, e.g., **`copy a:*.* b:`**.

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

1.4 References

Reference documents are listed in Table 1-1. Reference documents that are no longer applicable are deleted from this table; therefore, reference numbers may not be sequential.

Table 1-1 Reference documents and standards

Ref.	Document	
Qualcomm Technologies		
Q1	*Application Note: Software Glossary for Customers*	CL93-V3077-1
Q2	*gpsOne™ Power Consumption Test Procedure*	80-VR003-1
Q3	*MP3 at 44.1 kHz 128 kbps Stereo Clip for Power Measurements*	MH80-VR010-5
Q4	*30 fps at VGA H.264 2 Mbps AAC+ 96 kbps 44.1 kHz Stereo (QTC48) Clip for Multimedia Power Measurement*	MH80-VR010-6
Q5	*30 fps at HD 720P H.264 10 Mbps AAC+ 96 kbps 44.1 kHz Stereo (QTC77) Clip for MM Power Measurement*	MH80-VR010-7
Q6	*30 fps AT HD 1080p H.264 20 Mbps AAC+ 96 kbps 44 kHz Stereo (QTC88) Clip for MM Power Measurement*	MH80-VR010-8
Q7	*EXE, Powerlift 3D OpenGL® ES Graphics Benchmark Tool V.4.6.01 for Linux Android™-Enabled Devices*	72-N5481-1
Q8	*MSM8960 LA Server and Hardware Component Setup for Video Streaming and Browser Test Cases*	80-N8520-1

Ref.	Document	
Q9	*514 kbps, 640 * 360 (16:9), AVC (Baseline at L3.0) (1 Ref Frame), 96.0 kbps, 44.1 kHz, 2 Channels, AAC (LC)*	MH80-VR010-10
Q10	*EXE, Ibench V.4.6.01 for Linux Android™-Enabled Devices*	72-N7696-1
Q11	*EXE, PowerLift 3D Linux Android Graphics Tool Release 5.2.00*	HK11-NC876-1
Q12	*Video: 514 KBPS, 640 * 360 (16:9), AVC (Baseline at L3.0) (1 Ref Frame), 96.0 KBPS, 44.1 KHZ, 2 Channels, AAC (LC)*	MH80-VR010-10
Q13	*Video: 720P 1280x720 30 fps H.264 HP 2.13 Mbps, AAC+ Stereo 44.1 KHz 128 Kbps (YouTube 720P)*	MH80-VR010-11
Q14	*VoLTE Audio Test File for Power Measurement*	MH80-VR010-21

1.5 Technical assistance

For assistance or clarification on information in this document, submit a case to Qualcomm Technologies, Inc. (QTI) at https://support.cdmatech.com/.

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

1.6 Acronyms

For definitions of terms and abbreviations, see [Q1].

2 Power Measurement

This chapter provides:

- Test equipment settings for WCDMA, GSM/GPRS/EDGE, CDMA, LTE, HSDPA, HSPA, EV-DO modes, Wi-Fi, and WLAN
- Handset setup and configuration
- Power measurement and clock dump procedures for each test case

2.1 System connectivity (QTI reference setup)

Figure 2-1 illustrates the system connectivity setup for power measurement.

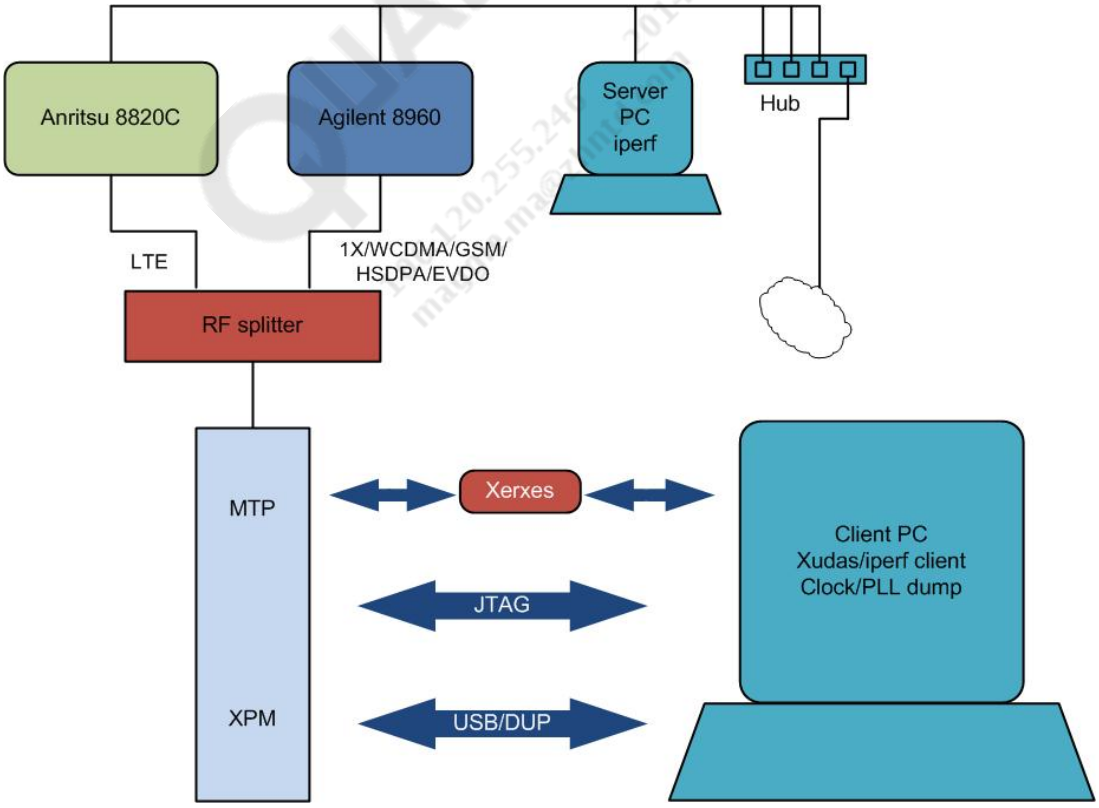


Figure 2-1 System connectivity setup

Block descriptions are:

- Anritsu 8820C – System emulator of LTE
- Agilent 8960 – System emulator of 1X/WCDMA/GSM/HSDPA/EV-DO
- MTP/XPM – Unit for power measurement
- Xeres/ – Complete hardware platform where XPM resides to provide many channels for voltage/current measurement
- Client PC – Roles for client PC include:
  - Running XUDAS software to control Xeres for making measurement
  - Running as iPerf client
  - Running T32 script to get clock/PLL dump via JTAG connection
- Server PC – iPerf server, responsible for pumping data stream to client PC via internet to system emulator, directing to MTP/XPM through radio interface

2.2 General settings

2.2.1 NV items

Configure the NV items as shown.

- For better standby current

1027	Enable MDSP logging	0
1892	Enable logging	0
1895	Enable logging	0
1962	Enable logging	0

- For network preference, based on user test modes

10	WCDMA only	14
10	GSM only	13
10	GSM and WCDMA only	17
10	CDMA only	9
10	CDMA + HDR only	19

- For WCDMA Receive Diversity (RxD), disabled by default

3851	WCDMA RxD	0
3852	WCDMA equalizer	6

- DCVS is enabled by default. Since DCVS is no longer adjusted through the QXDM NV item, if the user needs to disable DCVS, update Algorithm.txt from EFS as follows:
  - To enable DVCS, in nv\item_files\CoreCpu\CoreAll\Startup\Algorithm.txt, enter **Classic**.
  - To disable DCVS, in nv\item_files\CoreCpu\CoreAll\Startup\Algorithm.txt, enter **Disabled**.

2.2.2 Disabling data monitor

To disable the data monitor "Netstats" for Jelly Bean (JB)/Ice Cream Sanwich (ICS):

1. Open the ADB shell and run the following command to disable data monitor.

```
adb shell ndc bandwidth disable
```

   This command must be run every time the system reboots.

2. To check whether the data monitor is disabled, run the following command:

```
adb shell iptables –L
```

   Below is the sample output generated from the above command.

```
Chain bw_INPUT (1 references)
target prot opt source destination
all -- anywhere anywhere          ! quota globalAlert: 2097152 bytes
RETURN all -- anywhere anywhere
all -- anywhere anywhere owner socket exists
Chain bw_OUTPUT (1 references)
target prot opt source destination
all -- anywhere anywhere          ! quota globalAlert: 2097152 bytes
RETURN all -- anywhere anywhere
all – anywhere anywhere owner socket exists
```

   If the data monitor is disabled, the "globalAlert" message will *not* appear in the above.

2.2.3 Performance boot image

QTI uses a performance boot image with the metabuild for all the power measurements. Make sure that the performance boot image is used (to disable all the debug and other logging) before power measurements.

2.3 Airplane mode (AIR1)

2.3.1 Agilent 8960 setting

NA

2.3.2 Phone settings

To set Airplane mode:

1. Enable Airplane mode by selecting Settings→Wireless & Networks→Airplane mode.
2. Disable sensor by selecting Qualcomm Setting→Sensor→Disable (unclick).
3. Settings→Wireless & network→Mobile networks→Network setting→Airplane Mode.
4. Settings→Location Services→GPS Satellites→Disable (unclick).
5. Settings→Display→Auto-rotate screen→Disable (unclick).
6. Disable WLAN/Bluetooth®/Data Services.

2.3.3 Power measurement procedure (Android)

For power measurement:

1. Power up the phone.
2. Ensure the airplane icon is displayed on the top of the UI.
3. Wait until LCD/BL is off; start power measurement after 2 min to ensure the current has stabilized.

2.3.4 Power measurement procedure (MDM)

For power measurement:

1. Power up the phone.
2. Ensure the airplane icon is displayed at the top of the UI.
3. Start power measurement after 2 min to ensure the current has stabilized.

2.4 WCDMA standby, 2.56 sec (WS1)/WCDMA talk 0 dBm, IMT (WT1)

2.4.1 Agilent 8960 settings

For the Agilent 8960 setting:

- Ensure the RF In/Out Amplitude Offset state is turned on.
- Correctly specify cable losses.
- System Config→Control→Format Switch (F2)→WCDMA.

2.4.1.1 Call parameters

- Cell power – 50 dBm
- Channel type – 12.2 k RMC + HSDPA
- Paging service – AMR Voice
- Channel (UARFCN) Params (F12) – DL Channel – 10700 [UL Channel – 9750 or Auto]
- UE target power (3 of 3) – 0 dBm

2.4.1.2 Call control

- Paging parameters – Paging IMSI; TMSI – Off
- Cell information (2 of 6→F2) – Cell parameters

The MCC/MNC value depends on the SIM you are using; the following example is for the Agilent test SIM.

MCC	440
MNC	79
DRx cycle length (CN domain)	256 frames (2.56 sec)

- Generator information – AWGN power – Off
- Device Under Test (DUT) IP setup (values shown are examples for Agilent)

DUT IP address	xx.xx.xx.xx
DUT primary DNS server IP address	xxx.xx.xx.xx
DUT secondary DNS server IP address	xxx.xx.xx.xx
Route xxx.xxx.xxx.x/24 traffic to DUT	Off

- Security information (4 of 6 →F1) – Security parameters (F1)

Security operations	None

If you are using a valid Agilent test SIM, you could configure as follows and enable identity and authentication features in the phone as well.

Security operations	Auth & Int

- SIB11 cell information list – Cell information list – Absent (default)
- System config – RF cable loss – Use the calculated cable loss number
- Voice call – AMR setup

AMR radio access bearer	12.2 k voice [default]
AMR source	Echo
Speech echo loopback delay	500.0 ms

2.4.1.3 Measurement

- Measurement selection – Thermal power – Thermal power setup

Multimeasurement count	600
Trigger ARM®	Continuous
Measurement timeout	Off

2.4.2 Phone settings

NV items to modify are:

- 3851→0 (Rx diversity functionality disabled)
- 3852→6 (WCDMA equalizer)
- 10→WCDMA only

Phone UI settings (applicable for Android only) are:

1. Setting→Wireless & network→Mobile networks→Network setting→Network mode→WCDMA only.
2. Settings→Location Services→GPS Satellites→Disable (unclick).
3. Settings→Display→Auto-rotate screen→Disable (unclick).
4. Disable WLAN/Bluetooth/Data services.
5. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
6. Settings→Display→Screen Timeout to 15 sec.

2.4.3 Power measurement procedure for WCDMA standby (Android)

For power measurement:

1. Power up the phone.
2. Wait until the phone camps on the network.
3. Wait until LCD/BL is off; start power measurement after 2 min to ensure the current has stabilized.

2.4.4 Power measurement procedure for WCDMA talk (Android)

For power measurement:

1. Power up the phone.
2. Wait until the phone camps on the network.
3. Make an MT call from Agilent 8960 and answer the call.
4. Mute the phone.
5. Wait until LCD/BL is off; start power measurement after 2 min to ensure the current has stabilized.

2.4.5 Power measurement procedure for WCDMA standby (MDM)

For power measurement:

1. Power up the UE.
2. Wait until the UE camps on the network.
3. Start measurement after 2 min to ensure the current has stabilized.

2.4.6 Power measurement procedure for WCDMA talk (MDM)

For power measurement:

1. Power up the UE.
2. Wait until the UE camps on the network.
3. Make an MT call from Agilent 8960 and answer the call.
4. Start power measurement after 2 min to ensure the current has stabilized.

2.5 HSDPA DL 7.2 Mbps +0 dBm, IMT (HS21E/HS22E)/HSDPA DL 21 Mbps +0 dBm, IMT (HS41E/HS42E)

2.5.1 Agilent 8960 settings

For Agilent 8960 settings:

1. Ensure the RF In/Out Amplitude Offset state is turned on.
2. Correctly specify cable losses.
3. System Config→Format Switch (F2)→WCDMA.

NOTE: To achieve 7.2 Mbps, several necessary settings have to be made on top of the WCDMA settings. Be sure to configure Agilent 8960 and the phone as shown below.

2.5.1.1 Call control

- Paging parameters
  - CS paging identity type – IMSI
  - TMSI assignment – Off
- Cell information (2 or 6→F2) – Cell parameters (F2)

Item	Value
DRx cycle length (UTRAN)	8 frames

- Generator Information – Downlink Channel Codes (F2) – HSDPA/HSPA DL Channel Codes (F4)

Item	Value
PS data first HS-PDSCH channel code	5
RB Test mode first HS-PDSCH channel code	5

- DUT IP setup (examples only)

NOTE: Note that the DUP IP address will be called by the iPerf server.

Item	Value
DUT IP version	IPv4
DUT IP Address 1	10.52.72.137
DUT IP Address 2	10.52.72.138
DUT Primary DNS Server IP address	129.46.50.7
DUT Secondary DNS Server IP address	10.52.72.129
Route xxx.xxx.xxx.x/24 Traffic to DUT	Off

- Voice call (3 of 6→F5) – AMR setup (F1)

Item	Value
AMR radio access bearer	12.2 k voice [default]
AMR source	Echo
Speech echo loopback delay	500.0 ms

- Data channels (3 of 6→F4) – Packet data setup (F1)

Item	Value
GPRS radio access bearer	384 kbps UL/HSDPA DL PS

- SIB11 information (4 of 6→F3) – SIB11 cell information list – Cell information list – Absent (default)
- SIB11 information – SIB11 FACH measurement occasion information

Item	Value
FACH measurement occasion information control	Absent

2.5.1.2 Call parameters

- Cell power – - 45 dBm
- Channel type – 12.2 k + HSDPA (for data)
- HSPA parameters – HSDPA parameters (F10) – HSDPA PS data setup (F7)

Item	Value
HS-DSCH configuration type	CQI value
CQI value	25

- HSPA parameters – HSDPA parameters (F10) – HSDPA RB Test mode setup (F7)

Item	Value
HS-DSCH configuration type	User-defined
PS data HS-DSCH MAC-d PDU size	656
Number of active HS-PDSCHs	10
Transport block size index	48
Modulation type	16QAM
Inter-TTI interval	1
Number of HARQ processes	6
User defined UE IR buffer allocation	Implicit
Uplink 64k DTCH for HSDPA Loopback state	Off

- HSPA parameters – HSDPA parameters – UE category parameters (F9)

Item	Value
UE HS-DSCH category control	Manual
UE HS-DSCH category	8

- Channel (UARFCN) parameters (F12)

Item	Value
DL channel	10700
UL channel	Auto [– 9750]
Transmit SIB5bis	Std bands

- RLC reestablish (2 of 3→F9) – Auto
- UE target power (3 of 3→F7) – 0 dBm

2.5.2 Phone settings

NV items to modify are:

- 4118
  - →8 (HS21E/HS22E)
  - →14 (HS41E/HS42E)
- 3649
  - →2 (HS21E/HS22E)
  - →3 (HS21E/HS22E)
- 3851
  - 0→RxD functionality disabled (HS21E/HS41E)
  - 3→RxD functionality enabled (HS22E/HS42E)
- 3852→6 (WCDMA equalizer)
- 10→WCDMA only

Phone UI settings (applicable for Android only) are:

1. Settings→Location Services→GPS Satellites→Disable (unclick).
2. Settings→Display→Auto-rotate screen→Disable (unclick).
3. Disable WLAN/Bluetooth.
4. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
5. Setting→Wireless & network→Mobile networks→Network setting→Network mode→WCDMA only.
6. Settings→Display→Screen Timeout to 15 sec.
7. Enable data.

2.5.3 Power measurement procedure, embedded (Android)

For power measurement:

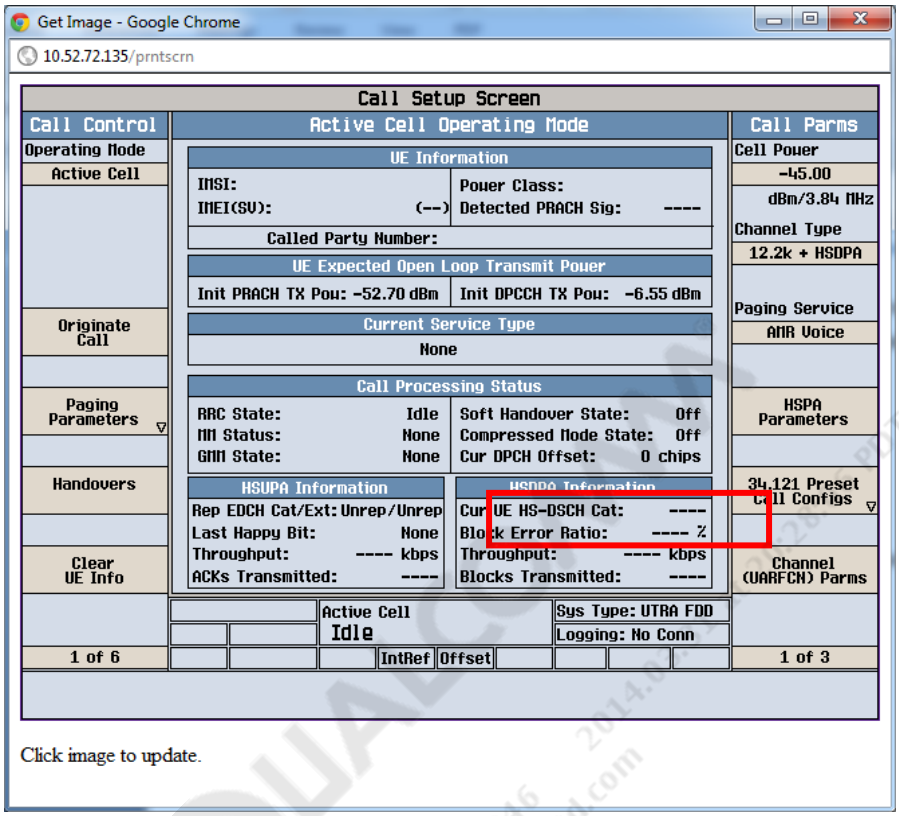
1. Power up the handset and verify that it is acquired on the desired network.
2. After powerup, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. Wait for the phone to camp on the network.
4. On the client (phone is the client here instead of the PC), push the embedded iPerf app to the phone through ADB (iperfApp.apk is available in the Android market):

```
adb install bin/iPerfApp.apk
adb push config.txt /data/data/com.android.iperfapp/config/config.txt
```

5. Disconnect the USB from the phone to the PC.
6. Open the iPerf app on the phone and run the command:
   a. Unselect the **disp on** and **file On** buttons.
   b. Press **run** to execute the following command, which exists by default in the iPerf command window.

```
s –u –i2
```

7. Make sure the UE HS-DSCH Category is 8 on the Agilent call box.



8. On the server PC, open a command window and execute:

```
cd c:\iperf
```

For HS21E/HS22E:

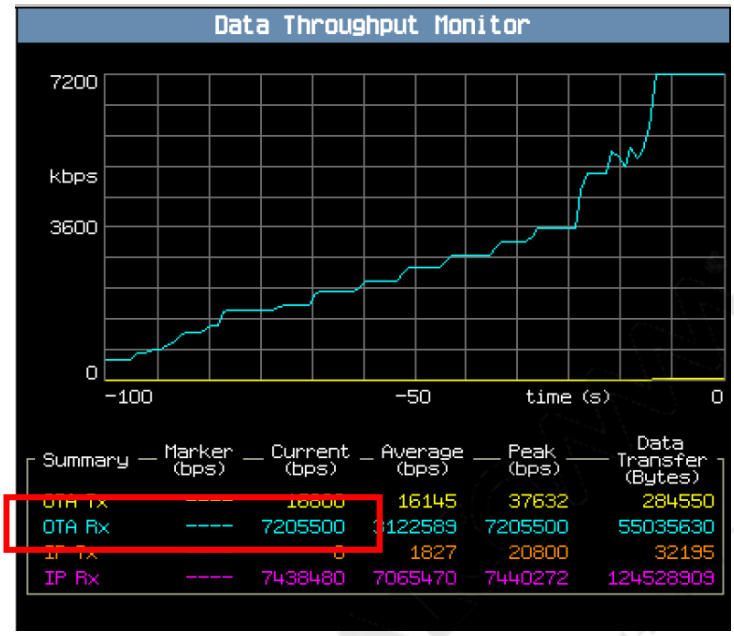
```
iperf -c 10.52.72.137 -u -t 3000 –l 1400 -i 2 –m 1200  -b 7M
```

For HS41E/HS42E:

```
iperf -c 10.52.72.137 -u -t 3000 –l 1400 -i 2 –m 1200 -b 21M
```

NOTE: 10.52.72.137 is the DUT IP address we set up in Agilent. Modify it according to your system configuration.

9. Make sure the throughput is correctly climbing to around 7.2 Mbps/21 Mbps.



10. Start power measurement using the power monitor.
11. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
12. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

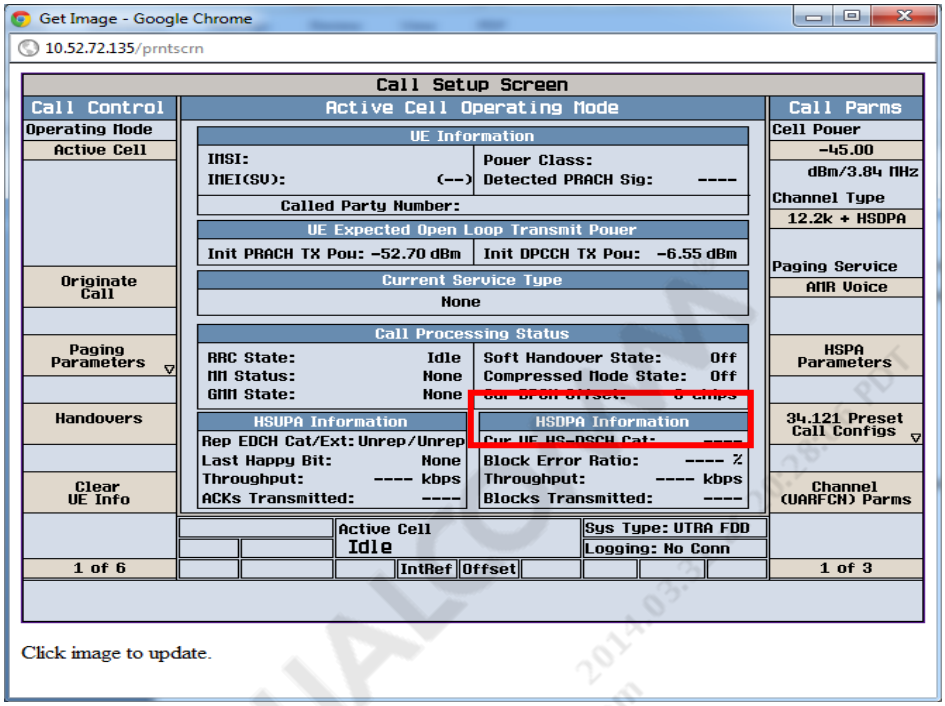
2.5.4 Power measurement procedure USB tethered (MDM)

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. After powerup, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. Wait for the UE to camp on the network.
4. On the client PC:
   a. Connect the handset with a USB.
   b. Disable USB charging.
5. Open QMI Test Pro/QMICM to connect to the handset.
6. Open a command window and execute:

```
cd c:\iperf
iperf –s –f k –I 2 –u
```

7. Make sure the UE HS-DSCH Category is 7/8 on the Agilent call box.



8. On the server PC, open a command window and execute.

   For HS21E/HS22E:

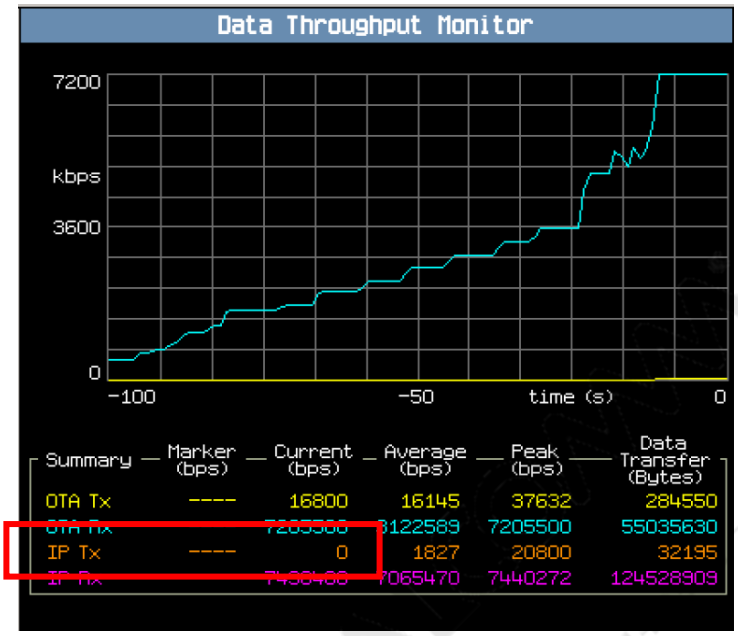
```
iperf -c 10.52.72.137 -u -t 3000 –l 1400 -i 2 –m 1200  -b 7M
```

   For HS41E/HS42E:

```
iperf -c 10.52.72.137 -u -t 3000 –l 1400 -i 2 –m 1200  -b 21M
```

NOTE: 10.52.72.137 is the DUT IP address we set up in Agilent. Modify it according to your system configuration.

9. Make sure the throughput is correctly climbing to around 7.2 Mbps.



10. Start power measurement in the power monitor.
11. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
12. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.6 HSDPA DC 42 Mbps +0 dBm, IMT (HS62E)

2.6.1 Agilent 8960 settings

For Agilent 8960 settings:

1. Ensure the RF In/Out Amplitude Offset state is turned on.
2. Correctly specify cable losses.

2.6.1.1 Call control

- Paging parameters
  - CS paging identity type – IMSI
  - TMSI assignment – Off
- Cell information (2 or 6→F2) – Cell parameters (F2)

Item	Value
DRX cycle length (CN domain)	64 frames
DRX cycle length (UTRAN)	8 frames

- Generator Information – Downlink Channel Codes (F2) – HSDPA/HSPA DL Channel Codes (F4)

Item	Value
PS data first HS-PDSCH channel code	1
RB Test mode first HS-PDSCH channel code	1

- DUT IP setup (examples only)

NOTE: Note that the DUP IP address will be called by the iPerf server.

Item	Value
DUT IP version	IPv4
DUT IP Address 1	10.52.72.137
DUT IP Address 2	10.52.72.138
DUT Primary DNS Server IP address	129.46.50.7
DUT Secondary DNS Server IP address	10.52.72.129
Route xxx.xxx.xxx.x/24 Traffic to DUT	Off

- Voice call (3 of 6→F5) – AMR setup (F1)

Item	Value
AMR radio access bearer	12.2 k voice [default]
AMR source	Echo
Speech echo loopback delay	500.0 ms

- Data channels (3 of 6→F4) – Packet data setup (F1)

Item	Value
GPRS radio access bearer	384 kbps UL/HSDPA DL PS

- SIB11 information (4 of 6→F3) – SIB11 cell information list – Cell information list – Present
- SIB11 information – SIB11 FACH measurement occasion information

Item	Value
FACH measurement occasion information control	Absent

2.6.1.2 Call parameters

- Cell power – - 50 dBm
- Channel type – 12.2 k + HSDPA (for data)
- Paging service – RB Test mode
- HSPA parameters – HSDPA parameters (F10) – HSDPA PS data setup (F7) – HSDPA PS Data Parms (F8)

Item	Value
DC-HSDPA state	On
HS-DSCH MAC-d PDU size control	Predefined
HS-DSCH MAC-d PDU size	336 bits
Number of HARQ processes	Auto
UE IR buffer allocation	Implicit
HS-DSCH MAC entity	MAC-ehs
Downlink AM RLC mode	Flexible
DL flexible RLC header extension special value	Exclude
DL Mac PDU payload size	1503

- HSPA parameters – HSDPA parameters (F10) – HSDPA RB Test mode setup (F7)

Item	Value
HS-DSCH configuration type	User-defined
User Defined DC-HSDPA state	On
Mode DC-HSDPA DPCH Loopback state	On
UHS-DSCH MAC Entity	MAC-ehs
User-defined flexible RLC SDU size	300
Number of HARQ processes	6
User-defined UE IR buffer allocation	Implicit
Uplink 64k DTCH for HSDPA Loopback state	Off

- HSPA parameters – HSDPA parameters – UE category parameters (F9)

Item	Value
UE HS-DSCH category control	Auto

- Channel (UARFCN) parameters (F12)

Item	Value
DL channel	10700
UL channel	Auto
Transmit SIB5bis	Standard bands

- RLC reestablish (2 of 3→F9) – Off
- UE target power (3 of 3→F7) – 0 dBm

2.6.2 Phone settings

NV settings are:

- 4118 – 24
- 3649 – 4
- 3851 – 3
- 3852 – 51

The phone UI settings are:

1. Settings→Location Services→GPS Satellites→Disable (unclick).
2. Settings→Display→Auto-rotate screen→Disable (unclick).
3. Disable WLAN/Bluetooth.
4. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
5. Setting→Wireless & network→Mobile networks→Network setting→Network mode→WCDMA only.
6. Settings→Display→Screen Timeout to 15 sec.
7. Enable data.

NOTE: These settings are applicable to Android only.

2.6.3 Power measurement procedure, embedded (Android)

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. After powerup, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. Wait for the phone to camp on the network.
4. On the client (phone is the client here instead of the PC), push the embedded iPerf app to the phone through ADB (iperfApp.apk is available in the Android market):

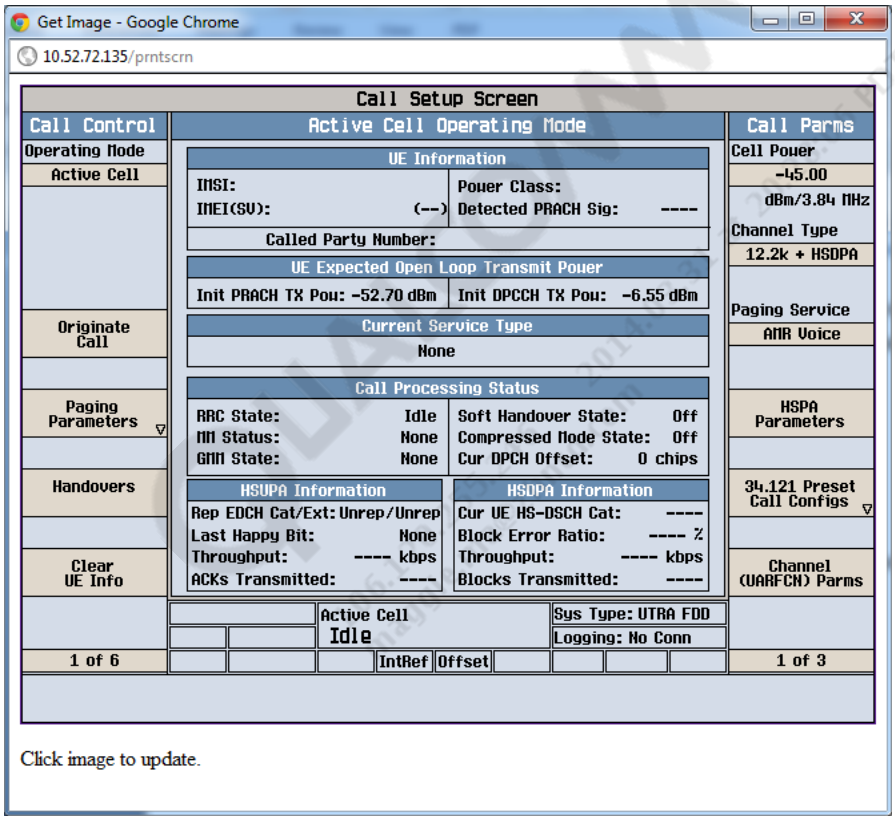
```
adb install bin/iPerfApp.apk
adb push config.txt /data/data/com.android.iperfapp/config/config.txt
```

5. Disconnect the USB from the phone to the PC.

6. Open the iPerf app on the phone and run the command:
   a. Unselect the **disp on** and **file On** buttons.
   b. Press **run** to execute the following command that exists by default in the iPerf command window:

```
s –u –i2
```

7. Make sure the UE HS-DSCH Category is 24 on the Agilent call box.



8. On the server PC, open a command window and execute:

```
cd c:\iperf
iperf -c 10.52.72.137 -u -t 3000 –l 1400 -i 2 –m 1200  -b 42M
```

NOTE: 10.52.72.137 is the DUT IP address that is set up in Agilent. Modify it according to your system configuration.

9. Start power measurement using the power monitor.

10. Measure current draw for 1024 sec. To ensure data integrity, confirm that the initial samples of the data capture are not included.
11. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

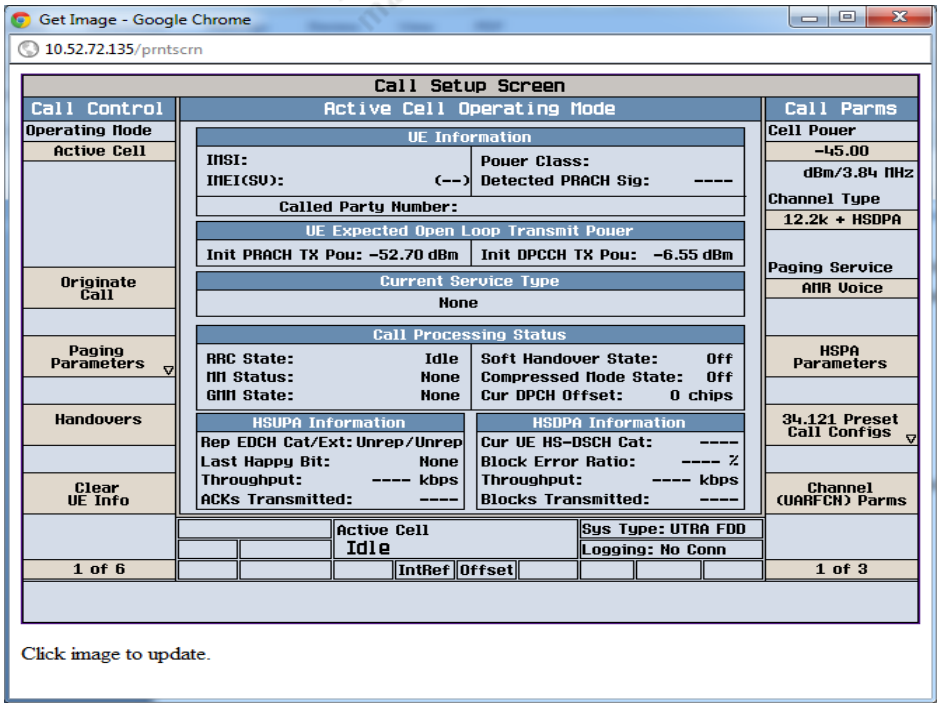
2.6.4 Power measurement procedure USB tethered (MDM)

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. Wait for the UE to camp on the network.
4. On the client PC:
   a. Connect the handset with a USB.
   b. Disable USB charging.
5. Open QMI Test Pro/QMICM to connect to the handset.
6. Open a command window and execute:

```
cd c:\iperf
iperf –s –f k –I 2 –u
```

7. Make sure the UE HS-DSCH Category is 24 on the Agilent call box.



8. On the server PC, open a command window and execute:

```
cd c:\iperf
iperf -c 10.52.72.137 -u -t 3000 –l 1400 -i 2 –m 1200 -b 42M
```

NOTE: 10.52.72.137 is the DUT IP address that is set up in Agilent. Modify it according to your system configuration.

9. Start power measurement in the power monitor.
10. Measure current draw for 1024 sec. To ensure data integrity, confirm that the initial samples of the data capture are not included.
11. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.7 CDMA QPCH 5.12 sec (CS2)/CDMA talk, 0 dBm CEL (CT1)

2.7.1 Agilent 8960 settings

For the Agilent 8960 settings:

- Ensure the RF In/Out Amplitude Offset state is turned on.
- Correctly specify cable losses.
- System Config→Format Switch (F2)→IS2000/IS-95/AMPS.

For Quick Paging Channel (QPCH) operation, follow the configurations shown in Table 2-1.

Table 2-1 cdma2000 base station settings for QPCH operation

Band class	0
Slot cycle index	2
Quick paging E_c/I_{or}	-7 dB
Quick paging channel rate	9600 bps
General page message position*	Second half frame
Configuration change indicator (CCI) bit	Off
Number of neighbors	20

*During QPCH operation, the handset does not monitor the paging channel unless the overhead information has changed or there is a page for the mobile. In the absence of either of these events, the handset can still be forced to monitor the paging channel if the QPCH bit is erroneously decoded as 1. To prevent this, ensure RF conditions are set per the values shown.

Additional base station settings

- Change the radio configuration to RC4(fWD4,RVS3);S033+F-SCH
- Data channels – F-SCH DATA RATE=153 kbps
- Set Route Traffic to DUT=On

2.7.1.1 Call control

- System type – IS 2000
- Generator information (2 of 5→F3) – AWGN power (F3) – Off
- Generator information (2 of 5→F3) – Code channel parameters (F2)

Item	Value
Cell 1 F-pilot level (E_c/I_{or})	-7.00 dB
Cell 1 F-sync level (E_c/I_{or})	-13.00 dB
Cell 1 F-paging level (E_c/I_{or})	-10.00 dB

- Cell information (F2) – Registration parameters

Item	Value
Timer-based registration	Off
Registration period	29
Power-up registration state	On

- Cell information (F2) – Registration parameters
- Paging channel MER (4 of 5→F6) – Paging channel MER ParmsCode channel parameters (F2)

Item	Value
Cell 1 F-pilot level (E_c/I_{or})	-7.00 dB
Cell 1 F-sync level (E_c/I_{or})	-13.00 dB
Cell 1 F-paging level (E_c/I_{or})	-10.00 dB

2.7.1.2 Call parameters

- Protocol Rev – 6 (IS-2000-0)
- Channel – 387
- Cell 1 power – -45 dBm/1.23 MHz
- Radio configuration – (fWD3,RVS3);S033+F-SCH

2.7.2 Phone settings

NV item to modify is:

- 10→CDMA only

Phone UI settings (applicable for Android only) are:

1. Setting→Wireless & Network→Mobile networks→Network setting→Network mode→CDMA.
2. Settings→Location Services→GPS Satellites→Disable (unclick).
3. Settings→Display→Auto-rotate screen→Disable (unclick).
4. Disable WLAN/Bluetooth/Data Services.
5. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
6. Settings→Display→Screen Timeout to 15 sec.
7. In the Preferred Roaming List (PRL) of the handset, set the Home SID and NID to match the SID and NID of the base station. This helps the handset acquire the home network properly.
8. Disconnect any USB or other connector cables from the handset. Reset the handset after disconnecting any cables to ensure all clocks in the handset are properly disabled.

2.7.3 Power measurement procedure for CDMA standby (Android)

For power measurement:

1. Power up the phone.
2. Wait until the phone camps on the network.
3. Wait until LCD/BL is off; start power measurement after 2 min to ensure the current has stabilized.

2.7.4 Power measurement procedure for CDMA talk (Android)

For power measurement:

1. Power up the phone.
2. Wait until the phone camps on the network.
3. Make an MT call from the Agilent 8960 and answer the call.
4. Mute the phone.
5. Wait until LCD/BL is off; start power measurement after 2 min to ensure the current has stabilized.

2.7.5 Power measurement procedure for CDMA standby (MDM)

For power measurement:

1. Power up the UE.
2. Wait until the UE camps on the network.
3. Start measurement after 2 min to ensure the current has stabilized.

2.7.6 Power measurement procedure for CDMA talk (MDM)

For power measurement:

1. Power up the UE.
2. Wait until the UE camps on the network.
3. Make an MT call from the Agilent 8960 and answer the call.
4. Start power measurement after 2 min to ensure the current has stabilized.

2.8 EV-DO DL 3.1 Mbps, 0 dBm, CEL (DD2E)

2.8.1 Agilent 8960 settings

For the Agilent 8960 settings:

1. Ensure the RF In/Out Amplitude Offset state is turned on.
2. Correctly specify cable losses.
3. System Config→Control→Format Switch (F2)→IS856.

EV-DO Standby mode configuration is:

- DRxcycle 5.12 sec (default is 40 sec after 1 min but needs to set NV 4231 to remain on 5.12 sec)
- RxAGCat phone – -50 dBm
- Single sector, no neighbors
- Band – US Cellular at 800 MHz

2.8.1.1 Call parameters

- Application config (1 of 3→F10)

Item	Value
Session application type	Default packet application

- Protocol Rel (2 of 3→F11)

Item	Value
Session application type	A(1xEV-DO-A)

2.8.2 Phone settings

NV item to modify is:

- 10→HDR only

For service programming:

1. Launch QPST™ and connect the UE/device to the computer.
2. When detected in QPST, select Start Clients→Service Programming.
3. Select your UE/device in the dialog box that appears, and click **OK**.
4. Click the **Read from phone** option, and a pop-up dialog appears with some 0s, click **OK**.
5. On the Settings tab, set Slot Cycle Index to 2.
6. Under the CDMA tab, set the phone number as 8584048819 or any 10 digit number.
7. MCC as 310.
8. Check EVRC Enabled→EVRC for Home Page, Home Orig, and Roam Orig.
9. On the System tab is a column for Home SID/NID. Double-click the first row and set SID to 4 and NID to 65535.
10. Load PRL by clicking **Roam→Load from file** to select your PRL file.
11. Click the **Write to Phone** radio button to transfer these changes to the phone. This also sends the phone command to reset (which may or may not work based on whether it is supported by your UE/device software).

Phone UI settings (applicable for Android only) are:

1. Setting→Wireless & network→ Mobile networks→Network setting→ Network mode→EVDO without CDMA.
2. Settings→Location Services→GPS Satellites→Disable (unclick).
3. Settings→Display→Auto-rotate screen→Disable (unclick).
4. Disable WLAN/Bluetooth.
5. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
6. Enable Data Services.
7. Settings→Display→Screen Timeout to 15 sec.

2.8.3 Power measurement procedure USB tethered (MDM)

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. Wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. On the client PC:
   a. Connect the handset with a USB.
   b. Disable USB charging. To do so, open a command window and execute:

```
adb shell setprop persist.usb.chgdisabled 1
adb shell “echo 1  > /sys/module/pm8921_charger/parameters/disabled”
adb shell sync
```

   c. Open QMICM to connect to the handset. Make sure the status shown in Agilent 8960 is Connected.
   d. Open a command window and execute:

```
cd c:\iperf
iperf –s –f k –I 2 –u
```

4. On the server PC, open a command window and execute:

```
cd c:\iperf
iperf -c 10.52.72.137 -u -t 3000 –l 1400 -i 2 -b 3.1M
```

NOTE: 10.52.72.137 is the DUT IP address we set up in Agilent. Modify it according to your system configuration.

5. Ensure the throughput is correctly climbing to around 3.1 Mbps.
6. Start power measurement on the correct channel in XUDAS.
7. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
8. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.8.4 Power measurement procedure embedded (Android)

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. Wait for the phone to camp on the network.
4. On the client (phone is the client here instead of the PC):
   a. Push the embedded iPerf app to the phone through ADB (iPerfApp.apk is available in the Android market):

```
adb install bin/iPerfApp.apk
adb push config.txt /data/data/com.android.iperfapp/config/config.txt
```

   b. Pause.
5. Disconnect the USB from the phone to the PC.
6. Open the iPerf app on the phone and run the command:
   a. Unselect **disp on** and **file on** buttons.
   b. Press **run** to execute the following command, which exists by default in the iperf command window.

```
s  –u –i2
```

7. On the server PC, open a command window and execute:

```
cd c:\iperf
iperf -c 10.52.72.137 -u -t 3000 –l 1400 -i 2 –m 1200  -b 3.1M
```

NOTE: 10.52.72.137 is the DUT IP address we set up in Agilent. Modify it according to your system configuration.

8. Make sure the throughput is correctly climbing to around 3.1 Mbps.
9. Start power measurement on the correct channel in XUDAS.
10. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
11. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.9 GSM standby,1.18 sec, PGSM (GS1)/GSM talk, 5 dBm, no DTX (GT1)

2.9.1 Agilent 8960 settings

For the Agilent 8960 settings:

1. Ensure the RF In/Out Amplitude Offset state is turned on.
2. Correctly specify cable losses.
3. System Config→Control→Format Switch (F2)→GSM/GPRS.

2.9.1.1 Call parameters

On the Call Parameters screen, set the parameter values as shown in Table 2-2.

Table 2-2 Call parameter settings

BCH parameters	Cell power	-45 dBm
	Cell band	PGSM
	Broadcast channel	50
TCH parameters	Downlink traffic power	Default
	Traffic band	PGSM
	Traffic channel	50
	MS Tx level	19 (5 dBm) or 7 (29 dBm)
	Channel mode setup	Default
PDTCH parameters	Downlink traffic power	Default
	Traffic band	PGSM
	Traffic channel	55
	MS Tx level	Default
	Coding scheme	Default
	Multislot Config	Default
	Measured burst	Default
	First burst to loop	Default
	Timing advance control	Default
	Frequency hopping	Off (Default)
	DTM parameters	Default
Handover parameters	GSM Handover setup	Default
	GPRS Handover setup	Default
	DTM Handover setup	Default
	External Handover setup	Default
Receiver control	Expected power control	Auto (default)

2.9.1.2 Control parameters

On the Control Parameters screen, set the parameter values as shown in Table 2-3.

Table 2-3 Control parameter settings

Operating mode		Active cell		GPRS, for idle
		Active cell		GSM, for voice
Data connection type		Auto		
Paging parameters		Paging multiframes		5
		Paging mode		Normal
		Paging identify type		IMSI
Cell information	Cell operation	Mobile DTx state		Off
		Downlink DTx state		Off
		Persistent Attach state		Off
		Tx Level FACCH signaling		On
	Cell parameters	Band indicator		DCS (Default)
		IMSI Attach state		Off (Default)
	Cell identification	Set Operating mode to Cell Off before setting Cell ID		
		MCC		310
		MNC		79
		Cell identity		0 (Default)
		After Cell ID changes, return Operating mode to Active Cell		
	Cell lists	GSM neighbors (BCH)		Off
		GSM neighbors (PBBCH)		Off
		CA table		Default
		3G FDD neighbors		Off
External trigger setup		Default		
Protocol logging		Default		
DUT PDP setup		DUT IP address		xx.xx.xx
		DUT Primary DNS Server IP address		xx.xx.xx
		DUT Secondary DNS Server IP address		xx.xx.xx
		Route xxx.xxx.xxx.0/24 traffic to DUT		Off
		All QoS profiles		Default
Protocol control		Default		
Short Message Service (SMS)		Default		
Measurement reports		Default		
Digital audio interface		Default		
Real-time vocoder		Default		
Security information		Authentication parameters	Authentication state	Off
		Ciphering parameters	Off	
Calling party number parameters		Default		

Turn off all GSM and 3G neighbors.

- Call Setup→Cell Information→Cell Lists→GSM Neighbors (BCH)→Ensure all neighbors are off.
- Call Setup→Cell Information→Cell Lists→GSM Neighbors (PBCCH)→Ensure all neighbors are off.
- Call Setup→Cell Information→Cell Lists→3G FDD Neighbors (PBCCH)→Ensure all neighbors are off.

2.9.2 Phone settings

NV item to modify is:

- 10→GSM only

Phone UI settings (applicable to Android only) are:

1. Setting→Wireless & network→Mobile networks→Network setting→Network mode→GSM only.
2. Settings→Location Services→GPS Satellites→Disable (unclick).
3. Settings→Display→Auto-rotate screen→Disable (unclick).
4. Disable WLAN/Bluetooth/Data services.
5. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
6. Settings→Display→Screen Timeout to 15 sec.

2.9.3 Power measurement procedure GSM standby (Android)

For power measurement:

1. Power up the phone.
2. Wait until the phone camps on the network.
3. Wait until LCD/BL is off; start power measurement after 2 min to ensure the current has stabilized.

2.9.4 Power measurement procedure for GSM talk (Android)

For power measurement:

1. Power on the phone and wait for the phone to camp to the network.
2. Make an MT call from the Agilent 8960 and answer the call.
3. Ensure the call is connected.
4. Press **Mute**.
5. Wait until LCD/BL is off; start power measurement after about 2 min to ensure the current has stabilized.

2.9.5 Power measurement procedure for GSM standby (MDM)

For power measurement:

1. Power up the UE.
2. Wait until the UE camps on the network.
3. Start measurement after 2 min to ensure the current has stabilized.

2.9.6 Power measurement procedure for GSM talk (MDM)

For power measurement:

1. Power up the UE.
2. Wait until the UE camps on the network.
3. Make an MT call from the Agilent 8960 and answer the call.
4. Start power measurement after 2 min to ensure the current has stabilized.

2.10 LTE standby, 2.56 sec (LS1)/LTE Cat3, 68/23 Mbps, Band 13, 0 dBm, 10 MHz BW (LTE1E)

2.10.1 Anritsu MT8820C settings

Common parameters	
Test parameter	Normal
Call processing	On
Frequency (for band 13)	
Frame structure	FDD
Channel bandwidth	10 MHz
UL channel and frequency	23230
DL channel and frequency	5230
Operation band	13; changing the band in Anritsu will automatically change the frequency settings
Level	
Input level	0.0 dBm; adjust as per cable losses
Output level	-30 dBm
AGWN level	-20 dB
External loss	On
Main UL	-3.5 dB
Main DL	0 dB
Aux	0 dB

Signal	
Channel coding	Packet
Antenna configuration	2x2 MIMO (closed loop multilayer)
Propagation matrix	None
RMC configuration	PUSCH
UE category	3
DTCH data pattern	MAC padding bits
UL RMC	
Number of RB	50
Starting RB	0
MCS index	20 (16QAM); change to get the desired throughput
DL RMC	
Number of RB	50
Starting RB	0
MCS index (1-4, 6-9)	28 (64QAM); change to get the desired throughput
MCS index (5)	28 (64QAM); change to get the desired throughput
MCS index (0)	28 (64QAM); change to get the desired throughput
MCS index (-)	NA
CFI	1
Physical channel parameters	
PSS power	0 dB
SSS power	0 dB
PBCH power	-3 dB
PCFICH power	-3 dB
PDICH power	-3 dB
PDCCH power	-3 dB
P_A	-3 dB
P_B	1
Call processing parameters (depends on SIM card)	
Cell ID	0
MCC	01
MNC	001
Mobile Station Identity (MSI)	Depends on SIM card
Security	Depends on SIM card

RMC	
Target state	State 3A
Test mode	On
Loopback activation	Off
RRC release during registration	On
Preregistration	Off
Group hopping	On
Sequence hopping	Off
Measurement report	Off
Call drop	On
Level optimization before H0	On
PDN type	Auto
Power control	
TPC pattern	Auto
Power control offset	0 dB
p-Max	35
p0-Nominal PUSCH	-85
Additional spectrum emission	NS_01
filterCoefficient	Fc4
BCCH/PCCH parameter	
Modification period coefficient	n4
Default paging cycle	rf256
nB	T
RACH parameters	
Power ramping step	dB2
Preample initial received target power	dBm -104
Preamble trans xax	N6
ra – Response window size	Sf10
Prach-config index	3
RAB connection	On
Random access response timing	1

1

2.10.2 Phone settings

NV settings are:

- 10→LTE only
- 65777→1
- 01896→1

For EFS settings

- Add two blank hex files into the EFS to ensure that the phone always operates in Offline mode. This is to make sure no neighbors are present; otherwise, by default the phone assumes 255 neighbor cells and keeps searching.
- Add these two files to /nv/item_files/modem/lte/ML1 through EFS explorer. These blank files can be created using any hex editor or can be provided on request.

Phone UI settings (applicable to Android only) are:

1. Setting→Wireless & network→Mobile networks→Network setting→Network mode→LTE.
2. Settings→Location Services→GPS Satellites→Disable (unclick).
3. Settings→Display→Auto-rotate screen→Disable (unclick).
4. Disable WLAN/Bluetooth.
5. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
6. Enable Data (For LTE-Cat3 only; disable for standby).
7. Settings→Display→Screen Timeout to 15 sec.
8. Make sure the APN is properly set on the phone; you can verify this in Settings→Wireless & Network→Mobile Networks→Access Point Names.

2.10.3 Power measurement procedure for LTE standby (Android)

For power measurement:

1. Power up the handset and wait for the device to camp to the network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. Wait for the phone to camp to the network.
4. Press **End call** on Anritsu and then wait until the phone enters sleep.
5. Press the power key on the phone to turn off the backlight and LCD display.
6. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture do not include the period where the phone is awake to monitor the paging channel.
7. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.10.4 Power measurement procedure for LTE standby (MDM)

For power measurement:

1. Power up the UE and wait for the device to camp to the network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. Wait for the UE to camp to the network.
4. Press **End call** on Anritsu and then wait until the UE enters sleep.
5. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture do not include the period where the UE is awake to monitor the paging channel.
6. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.10.5 Power measurement procedure for LTE Cat 3 embedded (Android)

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. On the client (the phone is the client here instead of the PC):
   a. Push the embedded iPerf app to the phone through the ADB (iPerfApp.apk is available in the Android market):

```
adb install bin/iPerfApp.apk.
adb push config.txt
/data/data/com.android.iperfapp/config/config.txt.
```

   b. Pause.
4. Disconnect the USB from the phone to the PC.
5. Open the iPerf app on the phone and run the command:
   a. Unselect the **disp on** and **file On** buttons.
   b. Press **run** to execute the following command, which exists by default in the iperf command window:

```
s –u –i2
```

6. On the server PC, open a command window and execute:

```
cd c:\iperf
iperf -c 192.168.20.11 -u -t 3000 –l 1400 -i 2 –m 1200  -b 68M -w 256k –d
```

NOTE: 192.168.20.11 is the IP assigned by Anritsu to the DUT IP address that is set up in Agilent. Modify it according to your system configuration. The IP can be checked using the adb shell netcfg command. The -d option is responsible for bidirectional data flow.

7. Make sure the throughput is correctly climbing to around 68 Mbps.
8. Start power measurement using the power monitor.
9. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
10. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.10.6 Power measurement procedure for LTE Cat 3 USB tethered (MDM)

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. On the client PC (downlink):
   a. Connect the handset with a USB.
   b. Disable USB charging. To do so, open a command window and execute:

```
adb shell setprop persist.usb.chgdisabled 1
adb shell “echo 1 > /sys/module/pm8921_charger/parameters/disabled”
adb shell sync
```

   c. Open QMICM or QPST Pro to connect to the handset.
   d. Open a command window and execute:

```
cd c:\iperf
iperf –s –f k –i 2 –u
```

4. On the server PC (downlink), open a command window and execute:

```
cd c:\iperf
iperf -c 192.168.20.11 -u -t 3000 –l 1400 -i 2 –m 1200 -b 68M
```

NOTE: 192.168.20.11 is the IP assigned by Anritsu to the DUT. Modify it according to your system configuration.

5. For the server PC (uplink), open a command window and execute:

```
cd c:\iperf
iperf –s –f k –i 2 –u
```

6. For the client PC (uplink), open a command window and execute:

```
cd c:\iperf
iperf -c 10.52.72.xxx -u -t 3000 –l 1400 -i 2 –m 1200 -b 23M
```

NOTE: 10.52.72.xxx is the IP address of the server PC.

7. Start power measurement using the power monitor.
8. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
9. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.11 LTE Cat 3 (100/50 Mbps, 0 dBm, Band 7), 20 MHz BW, (LTE6E)

2.11.1 Anritsu MT8820C settings

Common parameters	
Test parameter	Normal
Call processing	On
Frequency (for band 7)	
Frame structure	FDD
Channel bandwidth	20 MHz
UL channel and frequency	23230
DL channel and frequency	5230
Operation Band	7; changing the band in Anritsu will automatically change the frequency settings
Level	
Input level	0.0 dBm; adjust as per cable losses
Output level	-30 dBm
AGWN level	-20 dB
External loss	On
Main UL	-3.5 dB
Main DL	0 dB
Aux	0 dB
Signal	
Channel coding	Packet
Antenna configuration	2x2 MIMO; closed loop multilayer
Propagation matrix	None
RMC configuration	PUSCH
UE category	3
DTCH data pattern	MAC padding bits

UL RMC	
Number of RBs	100
Starting RB	0
MCS index	23 (16QAM); change to get the desired throughput
DL RMC	
Number of RBs	100
Starting RB	0
MCS index (1-4, 6-9)	28 (64QAM); change to get the desired throughput
MCS index (5)	28 (64QAM); change to get the desired throughput
MCS index (0)	28 (64QAM); change to get the desired throughput
MCS index (-)	NA
CFI	1
Physical channel parameters	
PSS power	0 dB
SSS power	0 dB
PBCH power	-3 dB
PCFICH power	-3 dB
PDICH power	-3 dB
PDCCH power	-3 dB
P_A	-3 dB
P_B	1
Call processing parameters (depends on SIM card)	
Cell ID	0
MCC	01
MNC	001
Mobile Station Identity (MSI)	Depends on SIM card
Security	Depends on SIM card
RMC	
Target state	State 3A
Test mode	On
Loopback activation	Off
RRC release during registration	On
Preregistration	Off

1

2.11.2 Phone settings

NV settings are:

- 10→LTE only
- 65777→1
- 01896→1

EFS settings are:

- Add two blank hex files into the EFS to ensure that the phone always operates in Offline mode. This is to make sure no neighbors are present; otherwise, by default, the phone assumes 255 neighbor cells and keeps searching.
- Add these two files to /nv/item_files/modem/lte/ML1 through EFS explorer. These blank files can be created using any hex editor or can be provided on request.

Phone UI settings (applicable to Android only) are:

1. Setting→Wireless & network→Mobile networks→Network setting→Network mode→LTE.
2. Settings→Location Services→GPS Satellites→Disable (unclick).
3. Settings→Display→Auto-rotate screen→Disable (unclick).
4. Disable WLAN/Bluetooth.
5. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
6. Enable Data (For LTE-Cat3 only Disable for Standby).
7. Settings→Display→Screen Timeout to 15 sec.
8. Make sure APN is properly set on the phone; you can verify this in Settings→Wireless & Network→Mobile Networks→Access Point Names.

2.11.3 Power measurement procedure for LTE Cat 3 embedded (Android)

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. On the client (the phone is the client here instead of the PC):
   a. Push the embedded iPerf app to the phone through the ADB (iPerfApp.apk is available in the Android market):

```
adb install bin/iPerfApp.apk.
adb push config.txt /data/data/com.android.iperfapp/config/config.txt
```

   b. Pause.
4. Disconnect the USB from the phone to the PC.
5. Open the iPerf app on the phone and run the command:
   a. Unselect the **disp on** and **file on** buttons.
   b. Press **run** to execute the following command, which exists by default in the iperf command window:

```
s –u –i2
```

6. On the server PC, open a command window and execute:

```
cd c:\iperf
iperf -c 192.168.20.11 -u -t 3000 –l 1400 -i 2 –m 1200  -b 100M -w 256k –d
```

NOTE: 192.168.20.11 is the IP assigned by Anritsu to the DUT. Modify it according to your system configuration. The IP can be checked by using the adb shell netcfg command. The -d option takes care of bidirectional data flow.

7. Make sure the throughput is correctly climbing to around 100 Mbps.
8. Start power measurement using power monitor.
9. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
10. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.11.4 Power measurement procedure for LTE Cat 3 USB tethered (MDM)

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. On the client PC (downlink):
   a. Connect the handset with a USB.
   b. Disable USB charging. To do so, open a command window and execute:

```
adb shell setprop persist.usb.chgdisabled
adb shell "echo 1  > /sys/module/pm8921_charger/parameters/disabled"
adb shell sync
```

   c. Open QMICM or QPST Pro to connect to the handset.
   d. Open a command window and execute:

```
cd c:\iperf
iperf –s –f k –i 2 –u
```

4. On the server PC (downlink), open a command window and execute:

```
cd c:\iperf
iperf -c 10.52.72.137 -u -t 3000 –l 1400 -i 2 –m 1200 -b 55M
```

NOTE: 10.52.72.137 is the DUT IP address we set up in MT8820C. Modify it according to your system configuration.

5. For the server PC (uplink), open a command window and execute:

```
cd c:\iperf
iperf –s –f k –i 2 –u
```

6. For the client PC (uplink), open a command window and execute:

```
cd c:\iperf
iperf -c 10.52.72.xxx -u -t 3000 –l 1400 -i 2 –m 1200  -b 4M
```

NOTE: 10.52.72.xxx is the IP address of the server PC.

7. Start power measurement using the power monitor.
8. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
9. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.12 LTE Cat 4 (150/50 Mbps, 0 dBm, Band 7), 20 MHz BW, (LTE7E)

2.12.1 Anritsu MT8820C settings

Common parameters	
Test parameter	Normal
Call processing	On
Frequency (for band 7)	
Frame structure	FDD
Channel bandwidth	20 MHz
UL channel and frequency	23230
DL channel and frequency	5230
Operation band	7; changing the band in Anritsu will automatically change the frequency settings
Level	
Input level	0.0 dBm; adjust as per cable losses
Output level	-30 dBm
AGWN level	-20 dB
External loss	On
Main UL	-3.5 dB
Main DL	0 dB
Aux	0 dB
Signal	
Channel coding	Packet
Antenna configuration	2x2 MIMO; closed loop multilayer
Propagation matrix	None
RMC configuration	PUSCH
UE category	4
DTCH data pattern	MAC padding bits
UL RMC	
Number of RBs	100
Starting RB	0
MCS index	23 (16QAM); change to get desired throughput

DL RMC	
Number of RBs	100
Starting RB	0
MCS index (1-4, 6-9)	28 (64QAM); change to get desired throughput
MCS index (5)	28 (64QAM); change to get desired throughput
MCS index (0)	28 (64QAM); change to get desired throughput
MCS index (-)	NA
CFI	1
Physical channel parameters	
PSS power	0 dB
SSS power	0 dB
PBCH power	-3 dB
PCFICH power	-3 dB
PDICH power	-3 dB
PDCCH power	-3 dB
P_A	-3 dB
P_B	1
Call processing parameters (depends on SIM card)	
Cell ID	0
MCC	01
MNC	001
Mobile Station Identity (MSI)	Depends on SIM card
Security	Depends on SIM card
RMC	
Target state	State 3A
Test mode	On
Loopback activation	Off
RRC release during registration	On
Preregistration	Off

1

2.12.2 Phone settings

NV settings are:

- 10→LTE only
- 65777→1
- 01896→1

EFS settings are:

- Add two blank hex files into the EFS to ensure that the phone always operates in Offline mode. This is to make sure no neighbors are present, otherwise by default the phone assumes 255 neighbor cells and keeps searching.
- Add these two files to /nv/item_files/modem/lte/ML1 through the EFS explorer. These blank files can be created using any hex editor or can be provided on request.

Phone UI settings (applicable to Android only) are:

1. Setting→Wireless & network→Mobile networks→Network setting→Network mode→LTE.
2. Settings→Location Services→GPS Satellites→Disable (unclick).
3. Settings→Display→Auto-rotate screen→Disable (unclick).
4. Disable WLAN/Bluetooth.
5. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
6. Enable Data (For LTE-Cat4 only; disable for standby).
7. Settings→Display→Screen Timeout to 15 sec.
8. Make sure the APN is properly set on the phone; you can verify this in Settings→Wireless & Network→Mobile Networks→Access Point Names.

2.12.3 Power measurement procedure for LTE Cat 4 embedded (Android)

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. On the client (the phone is the client here instead of the PC):
   a. Push the embedded iPerf app to the phone through the ADB. (iPerfApp.apk is available in the Android market):

```
adb install bin/iPerfApp.apk.
adb push config.txt
/data/data/com.android.iperfapp/config/config.txt.
```

   b. Pause.
4. Disconnect the USB from the phone to the PC.

5. Open the iPerf app on the phone and run the command:
   a. Unselect the **disp on** and **file on** buttons.
   b. Press **run** to execute the following command, which exists by default in the iperf command window:

```
s –u –i2
```

6. On the server PC, open a command window and execute:

```
cd c:\iperf
iperf -c 192.168.20.11 -u -t 3000 –l 1400 -i 2 –m 1200  -b 150M -w 256k –d
```

NOTE: 192.168.20.11 is the IP assigned by Anritsu to the DUT. Modify it according to your system configuration. The IP can be checked by using the adb shell netcfg command. The -d option takes care of bidirectional data flow.

7. Make sure the throughput is correctly climbing to around 150 Mbps.
8. Start power measurement using power monitor.
9. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
10. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.12.4 Power measurement procedure for LTE Cat 4 USB tethered (MDM)

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. On the client PC (downlink):
   a. Connect the handset with a USB.
   b. Disable USB charging. To do so, open a command window and execute:

```
adb shell setprop persist.usb.chgdisabled 1
adb shell “echo 1 > /sys/module/pm8921_charger/parameters/disabled”
adb shell sync
```

c. Open QMICM or QPST Pro to connect to the handset.

d. Open a command window and execute:

```
cd c:\iperf
iperf –s –f k –i 2 –u
```

4. On the server PC (downlink), open a command window and execute:

```
cd c:\iperf
iperf -c 10.52.72.137 -u -t 3000 –l 1400 -i 2 –m 1200 -b 150M
```

NOTE: 10.52.72.137 is the DUT IP address we set up in MT8820C. Modify it according to your system configuration.

5. For the server PC (uplink), open a command window and execute:

```
cd c:\iperf
iperf –s –f k –i 2 –u
```

6. For the client PC (uplink), open a command window and execute:

```
cd c:\iperf
iperf -c 10.52.72.xxx -u -t 3000 –l 1400 -i 2 –m 1200  -b 50M
```

NOTE: 10.52.72.xxx is the IP address of the server PC.

7. Start power measurement using the power monitor.
8. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
9. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.13 TD-LTE standby, 2.56 sec (LS3)/LTE TDD Cat 3 DL + UL (60/18 Mbps) 0 dBm, 20 MHz bandwidth, B38, DLUL Config 1 (LTE5E)

2.13.1 Anritsu MT8820C settings

Common parameters	
Test parameter	Normal
Call processing	On
Frequency (for band 13)	
Frame structure	TDD
Channel bandwidth	20 MHz
UL channel and frequency	38000
DL channel and frequency	38000
Operation Band	38; changing the band in Anritsu will automatically change the frequency settings
Level	
Input level	0.0 dBm; adjust as per cable losses
Output level	-30 dBm
AGWN level	-20 dB
External loss	On
Main UL	-3.5 dB
Main DL	0 dB
Aux	0 dB
Signal	
Channel coding	Packet
Antenna configuration	2x2 MIMO; closed loop multilayer
DCI format for single antenna	1A
Propagation matrix	None
RMC configuration	PUSCH
UE category	3
DTCH data pattern	MAC padding bits
UL RMC	
Number of RBs	100
Starting RB	0
MCS index	20 (16QAM); change to get the desired throughput

DL RMC	
Number of RBs	100
Starting RB	0
MCS index (1-4, 6-9)	28 (64QAM); change to get desired throughput
MCS index (5)	28 (64QAM); change to get desired throughput
MCS index (0)	28 (64QAM); change to get desired throughput
MCS index (-)	NA
CFI	1
TDD	
Uplink/downlink configuration	1 – (5 ms) D S U U D D D S U DU D
Special subframe configuration	7
Physical channel parameters	
PSS power	0 dB
SSS power	0 dB
PBCH power	-3 dB
PCFICH power	-3 dB
PDICH power	-3 dB
PDCCH power	-3 dB
P_A	-3 dB
P_B	1
Call processing parameters (depends on SIM card)	
Cell ID	0
MCC	01
MNC	001
Mobile Station Identity (MSI)	Depends on SIM card
Security	Depends on SIM card
RMC	
Target state	State 3A
Test mode	On
Loopback activation	Off
RRC release during registration	On
Preregistration	Off
Group hopping	On
Sequence hopping	Off
Measurement report	Off
Call drop	On
Radio resource configuration common update	RRC message
Level optimization before H0	On
PDN type	Auto
Robust Connection mode	Off
Scheduling type	Static

Power control	
Group hopping	On
Sequence hopping	Off
Measurement report	Off
Call drop	On
Radio resource configuration common update	RRC message
Level optimization before H0	On
BCCH/PCCH parameter (changes paging cycle time)	
Modification period coefficient	n4
Default paging cycle	rf256
nB	T
RACH parameters	
Power ramping step	dB2
Preample initial received target power	dBm -104
Preamble trans max	N6
ra – Response window size	Sf10
Prach-config index	3
RAB connection	On
Random access response timing	1
PUCCH parameter	
nRB-CQI	4
TDD Ack Nack Feedback mode	Multiplexing

2.13.2 Phone settings

NV settings are:

- 10→LTE only
- 65777 →1
- 01896 →1

EFS settings are:

- Add two blank hex files into the EFS to ensure that the phone always operates in Offline mode. This is to make sure no neighbors are present; otherwise, by default, the phone assumes 255 neighbor cells and keeps searching.
- Add these two files to /nv/item_files/modem/lte/ML1 through EFS explorer. These blank files can be created using any hex editor or can be provided on request.

Phone UI settings (applicable to Android only) are:

1. Setting→Wireless & network→Mobile networks→Network setting→Network mode→LTE.
2. Settings→Location Services→GPS Satellites→Disable (unclick).
3. Settings→Display→Auto-rotate screen→Disable (unclick).
4. Disable WLAN/Bluetooth.
5. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).

6. Enable Data (For LTE-Cat3 only Disable for Standby).
7. Settings→Display→Screen Timeout to 15 sec.
8. Make sure APN is properly set on the phone; you can verify this in Settings→Wireless & Network→Mobile Networks→Access Point Names.

2.13.3 Power measurement procedure for LTE standby (Android)

For power measurement:

1. Power up the handset and wait for the device to camp to the network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. Wait for the phone to camp to the network.
4. Press **End call** on Anritsu and then wait until the phone enters sleep.
5. Press the power key on the phone to turn off the backlight and LCD display.
6. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture do not include the period where the phone is awake to monitor the paging channel.
7. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.13.4 Power measurement procedure for LTE standby (MDM)

For power measurement:

1. Power up the UE and wait for the device to camp to the network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. Wait for the UE to camp to the network.
4. Press **End call** on Anritsu and then wait until the UE enters sleep.
5. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture do not include the period where the UE is awake to monitor the paging channel.
6. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.13.5 Power measurement procedure for LTE Cat 3 USB tethered (MDM)

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. On the client PC (downlink):
   a. Connect the handset with a USB.
   b. Disable USB charging. To do so, open a command window and execute:

```
adb shell setprop persist.usb.chgdisabled
adb shell "echo 1  > /sys/module/pm8921_charger/parameters/disabled"
adb shell sync
```

   c. Open QMICM or QPST Pro to connect to the handset.
   d. Open a command window and execute:

```
cd c:\iperf
iperf –s –f k –i 2 –u
```

4. On the server PC (downlink), open a command window and execute:

```
cd c:\iperf
iperf -c 10.52.72.137 -u -t 3000 –l 1400 -i 2 –m 1200 -b 60M
```

NOTE: 10.52.72.137 is the DUT IP address we set up in MT8820C. Modify it according to your system configuration.

5. For the server PC (uplink), open a command window and execute:

```
cd c:\iperf
iperf –s –f k –i 2 –u
```

6. For the client PC (uplink), open a command window and execute:

```
cd c:\iperf
iperf -c 10.52.72.xxx -u -t 3000 –l 1400 -i 2 –m 1200 -b 18M
```

NOTE: 10.52.72.xxx is the IP address of the server PC.

7. Start power measurement using the power monitor.

8. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
9. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.13.6 Power measurement procedure for LTE Cat 3 embedded (Android)

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. On the client (phone is the client here instead of the PC):
   a. Push the embedded iPerf app to the phone through ADB (iPerfApp.apk is available in the Android market):

```
adb install bin/iPerfApp.apk
adb push config.txt /data/data/com.android.iperfapp/config/config.txt
```

   b. Pause.
4. Disconnect the USB from the phone to the PC.
5. Open the iPerf app on the phone and run the command:
   a. Unselect the **disp on** and **file on** buttons.
   b. Press **run** to execute the following command, which exists by default in the iperf command window.

```
s –u –i2
```

6. On the server PC, open a command window and execute:

```
cd c:\iperf
iperf -c 192.168.20.11 -u -t 3000 –l 1400 -i 2 –m 1200  -b 60M -w 256k –d
```

NOTE: 192.168.20.11 is the IP assigned by Anritsu to the DUT IP address we set up in Agilent. Modify it according to your system configuration. The IP can be checked by using the adb shell netcfg command. The -d option takes care of bidirectional data flow.

7. Make sure the throughput is correctly climbing to around 60 Mbps.
8. Start power measurement using power monitor.

9. Measure current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
10. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.14 SVLTE active, 1X talk, Cell +LTE Cat2 Band 13, embedded (L2CT1E)

2.14.1 Agilent 8960 and Anritsu setting

Agilent 8960 settings are the same as 1X mode. Anritsu settings are the same as LTE mode.

2.14.2 Phone settings

NV setting is:

- 10→Global mode

Phone UI settings (applicable to Android only) are:

1. The phone should be in Global mode.
2. Settings→Location Services→GPS Satellites→Disable (unclick).
3. Settings→Display→Auto-rotate screen→Disable (unclick).
4. Disable WLAN/Bluetooth.
5. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
6. Enable Data.
7. Settings→Display→Screen Timeout to 15 sec.
8. Connect the primary channel out from Anritsu to the primary RF input on the phone.
9. Connect the 1X signal from the Agilent 8960 and secondary channel output from the Anritsu into a 2:1 splitter input respectively. Connect the splitter out to the secondary RF input of the phone.

2.14.3 Power measurement procedure (Android)

For power measurement:

1. After the above connections are made, make sure the phone is camped to 1X and LTE.
2. Initiate a 1X voice call and make sure the voice call is connected.
3. Execute the client and PC data transfer for LTE Cat2 (only downlink) with downlink at 50 Mbps by following steps similar to LTE Cat3.
4. Wait for the LCD backlight to turn off. Start measuring power after waiting 2 min.

2.14.4 Power measurement procedure (MDM)

For power measurement:

1. After the above connections are made, make sure the phone is camped to 1X and LTE.
2. Initiate a 1X voice call and make sure the voice call is connected.
3. Execute the client and PC data transfer for LTE Cat2 (only downlink) with downlink at 50 Mbps by following steps similar to LTE Cat3.
4. Start measuring power after waiting 2 min.

2.15 VoLTE Talk 0dBm, 50% DTX, 40 ms CDRX, dynamic scheduling (VoLTE1)

2.15.1 Agilent PXT settings

1. Set the CDRX settings:
   - Long DRx cycle – 40 ms
   - Inactivity timer – 2 ms
   - On duration – 2 ms
   - Short DRx – OFF
2. Maximum HARQ value – 1
3. Config – SR-Config Index is set according to DRx cycle
   - SR-Config Index = 35 for 40 ms
   - SR-Config Index = 15 for 20 ms

2.15.2 Phone settings

1. IMS server setting
   - IPv6 for IMS
   - IMS VoIP configuration
   - IMS SMS configuration
2. NV items to modify are:
   - Update this NV item on local copy of .scr file
   - 67261→0 0 0 **1** 0 0 0 0 (IMS DPL Configuration)
   - 67264→1 3 “VZWIMS” 0 0 0 1 “[**2002:c023:9c17:203::0a2a:5c21**]:5060 1” 0 0 0 0 0 “106” 0 “5,5,5” 0 “15” 3 “15” 0 0 (IMS Registration Module Configuration)
   - 67258→“sip:11111@test.3gpp.com” “11111” “11111@test.3gpp.com” “11111” **"test.3gpp.com"** "465b5ce8b199b49faa5f0a2ee238a6bc" 0 "5f1d289c5d354d0a140c2548f5f3e3ba (IMS Configuration)
   - 67259→“**11111**” 0 “+g.3gpp.smsip” “10” 0x00000600 “**vzwims**” 1
   - 69744→0 5060 7200 0 3000 16000 5000 30000 30000 1500 0 0 0 0 0 0 0 “” “”

- 67257→0 1 1 “urn:urn-7:3gpp-service.ims.icsi.mmtel” 1800 600 0 "1234" 0 1800 0 0 “”
- 01896 →1 – IPv6 enabled
- 00010 →14 – Automatic mode
- 00562 →1 – Hybrid enabled
- 04265 →0 – Enable VoIP registration
- 67218 →1 – Enable IMS registration
- 04230 →0 – SIP URI
- 65956 →0 – SIP URI (new NV)
- 67280 →20000 – QIP call ringing timer
- 67281 →20000 – QIP call ringback timer
- 67282 →20 – QIP call RTP link aliveness timer
- 67199 →1 – Domain selection is enabled
- 65959 →0 – No privacy header
- 65964 →1 – HD voice on (AMR WB)
- 66031 →0 – Mode 0 of the audio codec selected
- 66472 →1 –PS SMS preferred
- 66473 →1 – SMS mandatory
- 71527 →ims_rate_apn_information[0].iRAT = 24
  →ims_rat_apn_information[0].iAPNType+APNindex = 17
  →ims_rat_apn_information[0].iIMSServiceInfo = 2047
  →ims_rat_apn_information[0].iAuth_SEecType = 200
  →ims_rat_apn_information[0].iIPTupeInfo = 64(if you need to work with IPv4 set it to 32)
  →ims_rat_apn_information[1].iRAT = 24
  →ims_rat_apn_information[1].iAPNType+APNindex = 34
  →rat_apn_fb_information[0].iRATAPNFallback = 20992
  →rat_apn_fb_information[1].iRATAPNFallback = 16896
  →iNVPriority = 1
  →iIMSServiceStatus = 34815
  →ims_apn_name_db[0].cAPNName = ‘vzwims”
  →ims_apn_name_db[1].cAPNName = ‘vzwinternet”
  →ims_apn_name_db[2].cAPNName = ‘”

  The rest all are set to 0.
- 67300→[0].ft_quad_ind – 8
  →[0].state – 3

- set APN profile using Putty
  - Delete profile1.xml and profile2.xml from \pdp_profiles\consl_profiles in EFS and reset the UE
  - Connect the Modem serial port (MyComputer→Device Manager→Modems→ Qualcomm HS-USB Android Modem) using SecureCRT/Hyperterminal or Putty.
  - Configure the "vzwims" PDN by running the following commands in the serial connection

```
OK
at+cgdcont=1,"ipv4v6","vzwims"
OK
at+cgdcont?
+CGDCONT: 1,"IPV4V6","vzwims","0.0.0.0",0,0
```

NOTE: You need to update parameters in "**BOLD**" with the IP address, domain name, and user ID that are configured in your SIP.

2.15.3 Voice-centric device configuration

1. 00850 →0x1 – PS only
2. 65777 → 0 – Voice-centric
3. 66048 →3 – IMS PS voice preferred

2.15.4 SMS-only device configuration

1. 00850 → 0x2 – CS PS
2. 65777 →1 – Data-centric
3. 66048 → 0 – CS voice only

After you have done read/write for all, reset the device.

2.15.5 Making VoLTE call using Dialer app

1. Use the following given ADB commands:

```
adb shell setprop persist.radio.calls.on.ims true
adb shell setprop persist.radio.vrte_logic 1
```

   Additional configurations for JB are:

```
adb shell setprop persist.radio.jbims 1
```

2. Add an IMS account.
   a. Click the phone icon and then press **Menu** on the phone.
   b. Select Settings from the menu and then scroll to the bottom of the screen to find the IMS Account menu.
3. Set the type of call (voice/video).
4. Set the checkbox "Use IMS Always" to tell Android to always place an IMS call.
5. Click **Save** or **Back** to save the settings.

6. Go to the Dialer app setting on the UE interface and then to IMS settings.
7. Enable IMS for voice call.
8. Dial a number using the Dialer app.

2.15.6 Phone UI settings

1. The phone should be in Global mode.
2. Settings→Location Services→GPS Satellites→Disable (unclick).
3. Settings→Display→Auto-rotate screen→Disable (unclick).
4. Disable WLAN/Bluetooth.
5. Disable Sensor – Qualcomm Settings→Sensor→Disable (unclick).
6. Enable data.
7. Settings→Display→Screen Timeout to 15 sec.

2.15.7 Power measurement procedures

For power measurement, after the above connections are made, make sure the phone is camped to LTE.

Three states are tested separately:

- Talk state – Audio clip (see [Q14]) is played at the UE DUT while the remote device is muted.
- Listen state – DUT is muted and the audio clip (see [Q14]) is played at the remote device.
- Silent state – Both the DUT and the remote device should be muted.

2.16 LTE Cat 3 CA 10 MHz + 10 MHz, 100/25 Mbps, 0 dBm (LTE8E)

2.16.1 Call box information

- Anritsu MD8430A with LTE CA software upgrade; the call box multiplexes between PCC and SCC signals, hence a splitter is not necessary.
- SCC should be configured with the right EARFCN and Cell ID, with the correct RRC Connection Reconfiguration message.

2.16.2 Phone settings

NV settings are:

- 10→LTE only
- 65777→1
- 01896→1

EFS settings are:

- Add two blank hex files into the EFS to ensure that the phone always operates in Offline mode. This is to make sure no neighbors are present, otherwise by default the phone assumes 255 neighbor cells and keeps searching.
- Add these two files to /nv/item_files/modem/lte/ML1 through the EFS explorer. These blank files can be created using any hex editor or can be provided on request.

Phone UI settings (applicable to Android only) are:

1. Setting→Wireless & network→Mobile networks→Network setting→Network mode→LTE.
2. Settings→Location Services→GPS Satellites→Disable (unclick).
3. Settings→Display→Auto-rotate screen→Disable (unclick).
4. Disable WLAN/Bluetooth.
5. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
6. Enable Data (For LTE-Cat3 only; disable for standby).
7. Settings→Display→Screen Timeout to 15 sec.
8. Make sure the APN is properly set on the phone; you can verify this in Settings→Wireless & Network→Mobile Networks→Access Point Names.

2.16.3 Power measurement procedure

For power measurement:

1. Power up the handset and verify that it is acquired on the desired LTE network.
2. After power up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
3. On the client (UE is client here):
   a. Install the embedded iPerf app to the phone through ADB.
   b. Pause.
4. Open the iPerf app on the phone.
   a. Click the **disp on** and **file on** buttons.
   b. Press **run** to execute the following command, which exists by default in the iperf command window:

```
-s  -u -i2
```

5. On the server PC, open a command window and execute:

```
cd c:\iperf
iperf -c 192.168.20.12 -u -p 5001 -t 3000 -i 2 -w 1000000 -b 100M –d
```

6. Ensure that the throughput displayed on the UE is showing the correct values:
   - 99 Mbps DL
   - 22 Mbps UL
7. Deselect the **disp on** and **file on** buttons for power measurement on the UE.
8. Run the following ADB commands to disable data monitoring:

```
adb root
adb remount
adb shell ndc bandwidth disable
adb shell sync
```

9. Disconnect the USB from the UE.
10. Start power measurement on the correct channel in XUDAS.
11. Measure the current drawn for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
12. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

NOTE: 192.168.20.12 is the IP assigned by Anritsu to the DUT. Modify it according to your system configuration. The IP can be checked by using the adb shell netcfg command. The -d option takes care of bidirectional data flow.

2.17 TD-SCDMA standby (TCS1)/Talk 0 dBm (TCT1)/HSDPA 2.8 RB loopback (TDHS1)/HSUPA 2.2 RB loopback (TDHS2)

2.17.1 Anritsu MT8820C settings

Common parameters	
Test parameter	Normal
Call processing	On
Frequency	
Channel and frequency	10054

Level	
Input level	0.0 dBm; adjust as per cable loss
Output level	-50 dBm; adjust as per cable loss
AWGN level	-20 dB
External loss	Off
Main UL	0.0 dB
Aux	0.0 dB
Signal	
Channel coding	Voice or HSDPA RMC or HSUPA RMC (test-based)
HSDPA data rate	Category 15, max, VRC
HSUPA data rate	Peak data rate
DTCH	Echo
Physical channel parameters	
Scrambling code ID	0
Midamble Allocation mode	Default midamble
P-CCPCH power	-3.0 dB
DwPCH power	0.0 dB
Downlink power control	Off
HS-SCCH timeslot	0
#1 power	-10 dB
#2 - #4 power	-10 dB , off
HS-PDSCH power	0.0 dB
E-AGCH timeslot	0
power	0 dB
Absolute grant value	31
E-HICH timeslot	0
Power	0 dB
pattern	ACK
DPCH timeslot	1
Call processing parameters	
Base station identity	
MCC	460
MNC	02
LAC	001

Mobile station identity				
IMSI	001010123456789			
Paging IMSI	Auto			
Integrity protection	Off			
Authentication key	Depends on SIM card			
Registration mode	Combined			
Measurement report	Off			
Intra-frequency	On			
Quality	Off			
Call drop	On			
RRC state	CELL_DCH			
Handover type	Hard handover			
UE timers				
T313	3 sec			
N313	20			
CN DRx cycle length	128 x 10 ms			
Periodic location update	0			
SIB7 repetition period	128			
Maximum allowed UL Tx power	24 dBm			
Cell selection and reselection information				
Sintrasearch	-53, off			
Sintersearch	-53, off			
Ssearch, RAT	-53, off			
Qrxlevmin	-58			
Qhyst1s	0			
Open loop power control				
Primary CCPCH Tx power	24 dBm			
PRXUpPCHdes	-100 dBm			
Power ramp step Max Sync_UL transmissions	0 dB 1			
RAB connection	On			
Closed loop power control				
TPC step size	1 dB			
TPC pattern	Closed loop power control			
HSDPA				
HS-SCCH UE identity #1	0000 H			
HS-SCCH UE identity #2	5555 H			
HS-SCCH UE identity #3	AAAA H			
HS-SCCH UE identity #4	FFFF H			
Max number of HARQ transmissions	1			
Redundancy and constellation version	6	2	1	5
HARQ memory size	Explicit			

HSUPA	
UE identity (E-RNTI)	AAAA H
Packet parameter	
Server IP address	Based on configuration
Client IP address	Based on configuration
Audio parameters	
Mode	**Voice codec**
Audio input/output	AF
AF input	
Full scale	4000.00 mV
Handset	
Microphone volume	3
Speaker volume	3

2.17.2 Phone setting

NV items to modify are:

- 10→53 (TD-SCDMA only)
- 1896→1 (IPv6 enabled)
- 66011→0 (TDS RRC integrity protection enabled)
- 66012→0 (TDS RRC ciphering enabled)
- 66013→1 (TDS RRC fake security status)
- 66017→2 (TDS RRC version)
- 66020→15 (TDS RRC HSDPA category)
- 66021→6 (TDS RRC HSUPA category)

Phone UI settings (applicable to Android only) are:

1. Setting→Wireless & network→Mobile networks→Network setting→Network mode→TD-SCDMA only.
2. Settings→Location Services→GPS Satellites→Disable (unclick).
3. Settings→Display→Auto-rotate screen→Disable (unclick).
4. Disable WLAN/Bluetooth/Data services (if measuring talk/standby current draw).
5. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
6. Settings→Display→Screen Timeout to 15 sec.

2.17.3 Power measurement procedure for TD-SCDMA standby (Android)

For power measurement:

1. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
2. Wait for the phone to camp to the network.
3. Press **End call** on Anritsu and then wait until the phone enters sleep.
4. Press the power key on the phone to turn off the backlight and LCD display.
5. Measure current draw for 64 sec.

2.17.4 Power measurement procedure for TD-SCDMA talk (Android)

For power measurement:

1. On Anritsu MT8820C select Voice from Common Parameters→Signal→Channel Coding→Voice.
2. Power up the phone.
3. Wait until the phone camps on the network.
4. Make an MT call from Anritsu by pressing **Start Call** and answer the call.
5. Mute the phone.
6. Wait until LCD/BL is off; start power measurement after 2 min to ensure the current has stabilized. Measure current draw for 64 sec.

2.17.5 Power measurement procedure for TD-SCDMA HSDPA 2.8 Mbps, 0 dBm, RxD, RB call (Android)

For power measurement:

1. On Anritsu MT8820C select Voice from Common Parameters→Signal→Channel Coding→HSDPA RMC.
2. Power up the phone.
3. Wait until the phone camps on the network.
4. Start a data call by pressing **Start Call** on Anritsu MT8820C; the status should show **Connected** on the call box.
5. Wait until LCD/BL is off; start power measurement after 2 min to ensure the current has stabilized. Measure current draw for 64 sec.

2.17.6 Power measurement procedure for TD-SCDMA HSUPA 2.2 Mbps, 0 dBm, RxD, RB call (Android)

For power measurement:

1. On Anritsu MT8820C, select Voice from Common Parameters→Signal→Channel Coding→HSUPA RMC.
2. Power up the phone.
3. Wait until the phone camps on the network.
4. Start a data call by pressing **Start Call** on Anritsu MT8820C; the status should show **Connected** on the call box.
5. Wait until LCD/BL is off; start power measurement after 2 min to ensure the current has stabilized. Measure current draw for 64 sec.

2.17.7 Power measurement procedure for TD-SCDMA standby (MDM)

For power measurement:

1. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
2. Wait for the UE to camp to the network.
3. Press **End call** on Anritsu and then wait until the UE enters sleep.
4. Measure current draw for 64 sec.

2.17.8 Power measurement procedure for TD-SCDMA talk (MDM)

For power measurement:

1. On Anritsu MT8820C, select Voice from Common Parameters→Signal→Channel Coding→Voice.
2. Power up the UE.
3. Wait until the UE camps on the network.
4. Make an MT call from Anritsu by pressing **Start Call** and answer the call.
5. Start power measurement after 2 min to ensure the current has stabilized. Measure current draw for 64 sec.

2.17.9 Power measurement procedure for TD-SCDMA HSDPA 2.8 Mbps, 0 dBm, RxD, RB call (MDM)

For power measurement:

1. On Anritsu MT8820C, select Voice from Common Parameters→Signal→Channel Coding→HSDPA RMC.
2. Power up the UE.
3. Wait until the UE camps on the network.
4. Start a data call by pressing **Start Call** on Anritsu MT8820C; the status should show **Connected** on the call box.
5. Start power measurement after 2 min to ensure the current has stabilized. Measure current draw for 64 sec.

2.17.10 Power measurement procedure for TD-SCDMA HSUPA 2.2 Mbps, 0 dBm, RxD, RB call (MDM)

For power measurement:

1. On Anritsu MT8820C, select Voice from Common Parameters→Signal→Channel Coding→HSUPA RMC.
2. Power up the UE.
3. Wait until the UE camps on the network.
4. Start a data call by pressing **Start Call** on Anritsu MT8820C; the status should show **Connected** on the call box.
5. Start power measurement after 2 min to ensure the current has stabilized. Measure current draw for 64 sec.

2.18 TD-LTE standby (1.28 sec) + GSM standby (0.47 sec) (LSGS1)

2.18.1 Anritsu MT8820C settings (for TDD-LTE)

The Anritsu MT8820C settings are the same as those given in Section 2.13.1 except under the control parameters the DRx for TD-LTE is 1.28 sec.

BCCH/PCCH parameter (changes paging cycle time)	
Default paging cycle	rf128

2.18.2 Agilent 8960 settings (for GSM)

The Agilent call box settings are the same as those given in Section 2.9.1 except under the control parameters the DRx for GSM standby is 470 ms.

Paging parameters	Paging multiframes	2

2.18.3 Phone settings

NV settings are:

- 65777→1
- 0189→1

Phone UI settings are:

1. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
2. Setting→Wireless & network→Mobile networks→Network setting→Network mode→ TD-SCDMA/LTE/GSM/WCDMA/EV-DO/1X.
3. Go to Settings→Screen Timeout and set it to 30 min.

2.19 Test procedure for GSM+LTE standby

1. For the UE to operate in SGLTE mode, the policyman file needs to be copied to the policyman folder created in the root directory of the EFS location.

   The policyman file is located under \modem_proc\mmcp\policyman\configurations\ Carrier\CMCC\SGLTE\test.
2. Reboot the UE and verify that it camps on the desired network (GSM+LTE).
3. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
4. Disconnect the USB from the UE.
5. Start power measurement.
6. Measure the current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
7. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.20 TD-SCDMA standby (0.64 sec) + GSM standby (0.47 sec) (TCSGS1)

2.20.1 Anritsu MT8820C settings (for TD-SCDMA)

The Anritsu MT8820C settings are the same as those given in Section 2.17.1 except under the call processing parameters the DRx cycle for TD-SCDMA is 640 ms.

UE timers	
CN DRx cycle length	64 x 10 ms

2.20.2 Agilent 8960 settings (for GSM)

The Agilent callbox settings are the same as those given in Section 2.9.1 except under the control parameters the DRx cycle for GSM is 470 ms.

Paging parameters	Paging multiframes	2

2.20.3 Phone settings

NV settings are:

- 1896→1 – IPv6 enabled
- 66011→0 – TDS RRC integrity protection enabled
- 66012→0 – TDS RRC ciphering enabled
- 66013→1 – TDS RRC fake security status
- 66017→2 – TDS RRC version
- 66020→15 – TDS RRC HSDPA category
- 66021→6 – TDS RRC HSUPA category

Phone UI settings are:

1. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
2. Setting→Wireless & network→Mobile networks→Network setting→Network mode→ TDSCDMA/LTE/GSM/WCDMA/EVDO/1x.
3. Go to Settings→Screen Timeout and set it to 30 min.

2.21 Test procedure for GSM+TDS standby

1. For the UE to operate in SGLTE mode, the policyman file needs to be copied to the policyman folder created in the root directory of the EFS location.

   The policyman file is located at \modem_proc\mmcp\policyman\configurations\Carrier\CMCC\SGLTE\test.
2. Reboot the UE and verify that it camps on the desired network (GSM+TD-SCDMA).
3. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
4. Disconnect the USB from the UE.
5. Start power measurement.
6. Measure the current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
7. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.22 TDD LTE Cat 3, 20 MHz Cfg 1, B38 + GSM voice (LDEGT1)

2.22.1 Anritsu MT8820C settings (for TDD-LTE)

The Anritsu MT8820C settings are the same as those given in Section 2.13.1.

2.22.2 Agilent 8960 settings (for GSM)

The Agilent call box settings are the same as those given in Section 2.9.1.

2.22.3 Phone settings

NV settings are:

- 65777→1
- 01896→1

Phone UI settings are:

1. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
2. Setting→Wireless & network→Mobile networks→Network setting→Network mode→ TD-SCDMA/LTE/GSM/WCDMA/EV-DO/1X.
3. Go to Settings→Screen Timeout and set it to 30 min.

2.23 Test procedure for LTE Cat 3 (60/18), DLUL1, 0 dBm, MIMO, 20 MHz + GSM talk 5 dBm

1. For the UE to operate in SGLTE mode, the policyman file needs to be copied to the policyman folder created in the root directory of the EFS location.

   The policyman file is located at \modem_proc\mmcp\policyman\configurations\Carrier\CMCC\SGLTE\test.

2. Reboot the UE and verify that it camps on the desired network (GSM+LTE). Ensure data is enabled on the UE.
3. After power-up, wait at least 90 sec to allow any software/initialization timers to expire and any initial processing to complete.
4. On the client (the UE is the client here):
   a. Install the embedded iPerf app to the phone through ADB.
   b. Pause.
5. Open the iPerf app on the phone.
   a. Select the **disp on** and **file on** buttons.
   b. Press **run** to execute the following command, which exists by default in the iperf command window:

   ```
   –s  –u –i2
   ```

6. On the server PC, open a command window and execute:

   ```
   cd c:\iperf
   ```

   For LTE:

   ```
   iperf -c  192.168.20.12 -u -p 5001 -t 3000 -i 2 -w 1000000 -b 60M –d
   ```

   For TDS:

   ```
   iperf -c  192.168.20.12 -u -p 5001 -t 3000 -i 2 -w 1000000 -b 2.8M
   ```

7. Ensure that the throughput displayed on the UE shows the correct values; deselect the **disp on** and **file on** buttons for power measurement.
8. Run the following ADB commands to disable data monitoring:

   ```
   adb root
   adb remount
   adb shell ndc bandwidth disable
   adb shell sync
   ```

9. Disconnect the USB from the UE.
10. Start a GSM voice call; see Section 2.9.4 for more information.
11. Start power measurement.
12. Measure the current draw for 1024 sec. To ensure data integrity, ensure the initial samples of the data capture are not included.
13. To ensure stability of the test setup and repeatability of the test environment, repeat the test three times. If the test setup is well calibrated and tightly controlled, the variance should be less than 1%.

2.24 DSDS/DSDA G+G – 0.47 sec +0.47 sec (GGS2)

2.24.1 Agilent settings

The Agilent settings for both GSM subscriptions are the same as those given in Section 2.9.1 except under the control parameters the paging multiframes should be set to 2 for DRx to equal 0.47 sec. It is recommended to use two separate call boxes, otherwise the standby power could be higher.

Paging parameters	Paging multiframes	2

2.24.2 Phone settings

NV items to modify for DSDS are:

- 70266→1
- 4398→0
- 6876→5
- 67256→0
- 06907→1

NV items to modify for DSDA are:

- 70266→2
- Other NVs are the same as for DSDS

Reset the phone with the above settings and then open the NV browser, click **Multi SIM**.

- Select subscription 0 and set NV 10 to GSM only
- Select subscription 1 and set NV 10 to GSM only

Phone UI settings are (applicable to Android only):

1. Run the following ADB commands:

```
adb root
```

For DSDS:

```
adb shell setprop persist.multisim.config dsds
```

For DSDA:

```
adb shell setprop persist.multisim.config dsda
```

2. Reboot the phone.
3. Go to Multi SIM Settings→Configure Subscriptions.
4. Turn on both Subscription 1 and Subscription 2.
5. Settings→Location Services→GPS Satellites→Disable (unclick).
6. Settings→Display→Auto-rotate screen→Disable (unclick).
7. Disable WLAN/Bluetooth/Data Services.
8. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
9. Go to Settings→Display→Screen Timeout and set it to 15 sec.

2.24.3 Power measurement procedure for GSM standby (Android)

For power measurement:

1. Power up the phone.
2. Wait until the phone camps on the network.
3. Wait until the LCD/BL is off and wait 2 min to ensure the current has stabilized.
4. Start power measurement.

2.25 DSDS/DSDA W+G – 0.64 sec + 0.47 sec (WGS3)

2.25.1 Agilent settings

For GSM subscription, Agilent settings are the same as those given in Section 2.9.1 except under the control parameters the paging multiframes is set to 2 for DRx to be 0.47 sec.

Paging parameters	Paging multiframes	2

For WCDMA subscription, Agilent settings are the same as those given in Section 2.4.1 except under the cell parameters the DRx cycle is 640 ms.

MCC	440
MNC	79
DRx cycle length (CN domain)	64 frames (0.64 sec)

It is recommended to use two separate call boxes, otherwise the standby power could be higher.

2.25.2 Phone settings

NV items to modify for DSDS are:

- 70266→1
- 4398→0
- 6876→5
- 67256→0
- 06907→1

NV items to modify for DSDA are:

- 70266→2
- Other NVs are same as for DSDS

Reset the phone with the above settings and then open the NV browser, click **Multi SIM**.

- Select subscription 0 and set NV 10 to WCDMA only
- Select subscription 1 and set NV 10 to GSM only

Phone UI settings are (applicable to Android only):

1. Run the following ADB commands:

   ```
   adb root
   ```

   For DSDS:

   ```
   adb shell setprop persist.multisim.config dsds
   ```

   For DADA:

   ```
   adb shell setprop persist.multisim.config dsda
   ```

2. Reboot the phone.
3. Go to Multi SIM Settings→Configure Subscriptions.
4. Turn on both Subscription 1 and Subscription 2.
5. Settings→Location Services→GPS Satellites→Disable (unclick).
6. Settings→Display→Auto-rotate screen→Disable (unclick).
7. Disable WLAN/Bluetooth/Data Services.
8. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
9. Go to Settings→Display→Screen Timeout and set it to 15 sec.

2.25.3 Power measurement procedure for GSM standby (Android)

For power measurement:

1. Power up the phone.
2. Wait until the phone camps on the network.
3. Wait until the LCD/BL is off and wait 2 min to ensure the current has stabilized.
4. Start power measurement.

2.26 DSDA WCDMA talk 0 dBm + GSM standby 0.47 sec (WTGS1)

2.26.1 Agilent settings

For GSM subscription, the Agilent settings are the same as those given in Section 2.9.1 except under the control parameters paging multiframes is set to 2 for DRx to be 0.47 sec.

Paging parameters	Paging multiframes	2

For WCDMA subscription, the Agilent settings are the same as those given in Section 2.4.1.

It is recommended to use two separate call boxes, otherwise the standby power could be higher.

2.26.2 Phone settings

NV items to modify are:

- 70266→2
- 4398→0
- 6876→5
- 67256→0
- 06907→1
- 3851→0 – RxD functionality disabled
- 3852→6 – WCDMA equalizer
- 10→WCDMA only

Reset the phone with above settings and then open NV browser, click **Multi SIM**.

- Select subscription 0 and set NV 10 to WCDMA only
- Select subscription 1 and set NV 10 to GSM only

Phone UI settings are (applicable to Android only):

1. Run the following ADB commands:

```
adb root
adb shell setprop persist.multisim.config dsda
```

2. Reboot the phone.
3. Go to Multi SIM Settings→Configure Subscriptions.
4. Turn on Subscription 1 and Subscription 2.
5. Settings→Location Services→GPS Satellites→Disable (unclick).
6. Settings→Display→Auto-rotate screen→Disable (unclick).
7. Disable WLAN/Bluetooth/Data Services.
8. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
9. Go to Settings→Display→Screen Timeout and set it to 15 sec.

2.26.3 Power measurement procedure for GSM standby (Android)

For power measurement:

1. Power up the phone.
2. Wait until the phone camps on the network.
3. Wait until the LCD/BL is off and wait 2 min to ensure the current has stabilized.
4. Start power measurement.

2.26.4 Power measurement procedure for WCDMA talk (Android)

For power measurement:

1. Power up the phone.
2. Wait until the phone camps on the network.
3. Make an MT call from Agilent 8960 and answer the call.
4. Mute the phone.
5. Wait until the LCD/BL is off and wait 2 min to ensure the current has stabilized.
6. Start power measurement.

2.27 DSDA TD-SCDMA talk 0 dBm + GSM standby 0.47 sec (TCTGS1)

2.27.1 Agilent settings

For GSM subscription, the Agilent settings are the same as those given in Section 2.9.1 except under the control parameters paging multiframes is set to 2 for DRx to be 0.47 sec.

Paging parameters	Paging multiframes	2

For TD-SCDMA subscription, the Agilent settings are the same as those given in Section 2.17.1.

It is recommended to use two separate call boxes, otherwise the standby power could be higher.

2.27.2 Phone settings

NV items to modify are:

- 70266→2
- 4398→0
- 6876→5
- 67256→0
- 06907→1
- 10→53 – TD-SCDMA only
- 1896→1 – IPv6 enabled
- 66011→0 – TDS RRC integrity protection enabled
- 66012→0 – TDS RRC ciphering enabled
- 66013→1 – TDS RRC fake security status
- 66017→2 – TDS RRC version
- 66020→15 – TDS RRC HSDPA category
- 66021→6 – TDS RRC HSUPA category

Reset the phone with the above settings and then open the NV browser, click **Multi SIM**.

- Select subscription 0 and set NV 10 to TD-SCDMA only
- Select subscription 1 and set NV 10 to GSM only

Phone UI settings are (applicable to Android only):

1. Run the following ADB commands:

```
adb root
adb shell setprop persist.multisim.config dsda
```

2. Reboot the phone.
3. Go to Multi SIM Settings→Configure Subscriptions.
4. Turn on Subscription 1 and Subscription 2.
5. Settings→Location Services→GPS Satellites→Disable (unclick).
6. Settings→Display→Auto-rotate screen→Disable (unclick).
7. Disable WLAN/Bluetooth/Data Services.
8. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
9. Go to Settings→Display→Screen Timeout and set it to 15 sec.

2.27.3 Power measurement procedure GSM standby (Android)

For power measurement:

1. Power up the phone.
2. Wait until the phone camps on the network.
3. Wait until the LCD/BL is off and wait 2 min to ensure the current has stabilized.
4. Start power measurement.

2.27.4 Power measurement procedure for TD-SCDMA talk (Android)

For power measurement:

1. On Anritsu MT8820C select Voice from Common Parameters→Signal→Channel Coding→Voice.
2. Power up the phone.
3. Wait until the phone camps on the network.
4. Make an MT call from Anritsu by pressing **Start Call** and answer the call.
5. Mute the phone.
6. Wait until the LCD/BL is off and wait 2 min to ensure the current has stabilized.
7. Start power measurement and measure the current draw for 64 sec.

2.28 DSDA GSM talk 5 dBm + HSDPA 7.2 Mbps 0 dBm (No RxD) (GTHS21E1)/DSDA GSM talk 5 dBm + HSDPA 21 Mbps 0 dBm (No RxD) (GTHS41E1)/DSDA GSM talk 5 dBm + DC HSDPA DL 42 Mbps +0 dBm, IMT (No RxD) (GTHS62E1)

2.28.1 Agilent settings

For GSM subscription, the Agilent settings are the same as those given in Section 2.9.1.

For HSDPA subscription, the Agilent settings are the same as those given in Section 2.5.1.

2.28.2 Phone settings

NV items to modify are:

- 70266→2
- 4398→0
- 6876→5
- 67256→0
- 06907→1

Reset the phone with the above settings and open the NV browser, click **Multi SIM**.

- Select subscription 0 and set NV 10 to GSM only
- Select subscription 1 and set NV 10 to WCDMA only

Phone UI settings are (applicable to Android only):

1. Run the following ADB commands:

```
adb root
adb shell setprop persist.multisim.config dsda
```

2. Reboot the phone.
3. Go to Multi SIM Settings→Configure Subscriptions.
4. Turn on Subscription 1 and Subscription 2.
5. Settings→Location Services→GPS Satellites→Disable (unclick).
6. Settings→Display→Auto-rotate screen→Disable (unclick).
7. Disable WLAN/Bluetooth/Data Services.
8. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
9. Go to Settings→Display→Screen Timeout and set it to 15 sec.

2.28.3 Power measurement procedure for GSM Talk (Android)

For power measurement:

1. Power on the phone.
2. Wait for the phone to camp on the network.
3. Make an MT call from the Agilent 8960 and answer the call.
4. Ensure the call is connected.
5. Mute the phone.
6. Wait until the LCD/BL is off and wait 2 min to ensure the current has stabilized.
7. Start power measurement.

2.28.4 Power measurement procedure for HSDPA (Android)

For GTHS21E1/GTHS41E1, follow the procedure for HSDPA 7.2 Mbps/HSDPA 21 Mbps 0 dBm as given in Sections 2.5.2 and 2.5.3.

For GTHS62E1, follow the procedure for HSDPA 42 Mbps DC 0 dBm as given in Sections 2.6.2 and 2.6.3.

2.29 DSDA GSM talk 5 dBm + EVDO DL 3.1 Mbps 0 dBm (no RxD) (GTDD2E1)

2.29.1 Agilent settings

For GSM subscription, the Agilent settings are the same as those given in Section 2.9.1.

For EV-DO subscription, the Agilent settings are the same as those given in Section 2.8.1; see Section 2.8.2 for other settings.

2.29.2 Phone settings

NV items to modify are:

- 70266→2
- 4398→0
- 6876→5
- 67256→0
- 06907→1

Reset the phone with the above settings and open the NV browser, click **Multi SIM**.

- Select subscription 0 and set NV 10 to GSM only
- Select subscription 1 and set NV 10 to EV-DO only

Phone UI settings are (applicable to Android only):

1. Run the following ADB commands:

```
adb root
adb shell setprop persist.multisim.config dsda
```

2. Reboot the phone.
3. Go to Multi SIM Settings→Configure Subscriptions.
4. Turn on Subscription 1 and Subscription 2.
5. Settings→Location Services→GPS Satellites→Disable (unclick).
6. Settings→Display→Auto-rotate screen→Disable (unclick).
7. Disable WLAN/Bluetooth/Data Services.
8. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
9. Go to Settings→Display→Screen Timeout and set it to 15 sec.

2.29.3 Power measurement procedure for GSM Talk (Android)

For power measurement:

1. Power on the phone and wait for the phone to camp to the network.
2. Make an MT call from the Agilent 8960 and answer the call.
3. Ensure the call is connected.
4. Mute the phone.
5. Wait until the LCD/BL is off and wait 2 min to ensure the current has stabilized.
6. Start power measurement.

2.29.4 Power measurement procedure for EV-DO (Android)

See Section 2.8.4 for the detailed procedure.

2.30 BT Sniff+Scan with WCDMA standby 2.56 sec (BT2)

2.30.1 Agilent 8960 settings

Ensure that the phone is in WCDMA mode. All the phone settings are similar to WCDMA settings.

2.30.2 Phone settings

Phone UI settings are:

1. Navigate to the Bluetooth menu. Go to Settings→Wireless Networks→Bluetooth Settings.
2. Turn Bluetooth on.
3. Setting→Wireless & network→Mobile networks→Network setting→Network mode→ WCDMA only.
4. Settings→Location Services→GPS Satellites→Disable (unclick).
5. Settings→Display→Auto-rotate screen→Disable (unclick).
6. Disable Data Services.
7. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
8. Settings→Display→Screen Timeout to 15 sec.

2.30.3 Power measurement procedure

For power measurement:

1. Make sure that a WCDMA signal is received and the phone is camped to the network.
2. Once Bluetooth is turned on in the phone, the phone will start searching for nearby Bluetooth headsets (or other devices).
3. Make sure the Bluetooth headset is in Discover mode for the phone to find it.
4. Once the Bluetooth headset is found, click the device to pair and connect.
5. When the headset is connected, you will see Connected on the bottom of the Bluetooth device name on the phone.
6. Make sure you go back to the main menu.
7. Wait until display is off or switch off the display and start taking measurements.

2.31 WLAN with WCDMA standby 2.56 sec (WLS1)

2.31.1 Agilent 8960 setting

Ensure that the phone is in WCDMA mode. All the phone settings are similar to WCDMA Standby settings.

2.31.2 Phone settings

Phone UI settings are:

1. Navigate to the Wi-Fi menu. Go to Settings→Wireless Networks→Wi-Fi and turn on Wi-Fi.
2. Setting→Wireless & network→Mobile networks→Network setting→Network mode→ WCDMA only.
3. Settings→Location Services→GPS Satellites→Disable (unclick).
4. Settings→Display→Auto-rotate screen→Disable (unclick).
5. Disable Data Services.
6. Disable sensor – Qualcomm Setting→Sensor→Disable (unclick).
7. Settings→Display→Screen Timeout to 15 sec.

2.31.3 Power measurement procedure

For power measurement:

1. Make sure that a WCDMA signal is received and the phone is camped to the network.
2. Make sure a wireless access point is available for the phone to connect.
3. Once the Wi-Fi is turned on, the phone searches for the networks. Connect to the network after the expected network is seen on the phone.
4. Go back to the main menu.
5. Wait till the display is off or switch off the display and start taking measurements.

2.32 GNSS 1 Hz tracking high sensitivity with WCDMA standby 2.56 sec (GNSS1)

2.32.1 Agilent 8960 setting

This is the same as WCDMA standby.

2.32.2 Phone settings

Phone UI settings are:

1. Settings→Wireless & network→Mobile Networks→Network Setting→ Network Mode→WCDMA only.
2. Settings→Wireless & network→Mobile Networks – Uncheck the following items:
   - Data enabled
   - Data roaming
3. Settings→Display→Screen Timeout to 15 sec.
4. Settings→Display→Auto-rotate Screen – Uncheck this item.
5. Settings→Location & Security – Uncheck the following items:
   - Use assisted GPS
   - Use GPS satellites
   - Visible passwords
6. From Qualcomm Settings, uncheck the following items:
   - Stay on Plugged
   - Sensors
   - Socket Data call (only available on Gingerbread (GB), removed in ICS)
7. Disable USB charging. To do so, open the command window.

```
adb shell setprop persist.usb.chgdisabled 1
adb shell “echo 1 > /sys/module/pm8921_charger/parameters/disabled”
adb shell sync
```

Phone NV settings are:

1. Make sure XO is properly calibrated.
2. Execute CGPS_NV_Loader.pl from modem_proc\modem\gps\gnss_tools\pdapi_scripts directory and load the desired GPS-related NVs to the UE.
3. Additional NV configurations are:
   - NV 5596 – Dynamic Power Optimization (DPO) control set to **0** in order to disable DPO.
   - NV 6267 – QWIP Loc Engine Configuration set to **2** to disable Wi-Fi positioning.
   - NV 06773 – Set it to value 0.
   - NV 06759 – Set it to value 0.
   - NV 06760 – Set it to value 1.

2.32.3 Power measurement procedures

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
1. Open a DOS command prompt.
2. Navigate to the modem_proc\modem\gps\gnss_tools\pdapi_scripts directory and execute the following Perl commands:
   a. perl pd_startdiag.pl <com port> – QXDM should launch and connect to the specified COM port automatically.
   b. perl pd_delall.pl <com port> 9 – This deletes all existing aiding data on the UE. This step is very important when doing the test with a GPS simulator.
   c. perl pd_PowerConsumptionAlmDownloadTrack.pl <com port> – This starts the GPS engine. Wait for the first GPS fix to occur.
3. After the first fix, wait an additional 13 min in order to acquire the full GNSS (GPS + Glonass) Almanac.
4. In the QXDM Item View window, verify that GPS has entered the Tracking state by look for a string similar to:

   MGP ME/PP Medium pp_msg.c 00081 PP processed time tick Fc=14760 Tracking:1

   Ignore information such as the line number (81) and the time tick Fc (14760). If Tracking is equal to 1, then GPS engine is in Tracking, and vice versa. Alternatively, if selected Message Packets include MGP ME/CC MISC, the following message can also be used to determine whether the engine is in Tracking or not:

   MGP ME/MC Misc mc_gnsssearchstrategy.c 05203 Tracking State 1, Acq/Track State Change 0, DPO State Change 0
5. Disconnect the phone from QXDM Options→Communications drop-down menu. This is a very important step. Unexpected high current consumption might be observed if this step is not followed.
6. Disconnect the USB cable from the phone.
7. Wait 2 min then start the power measurement.

2.33 GPS 1 Hz tracking (DPO) with WCDMA standby 2.56 sec (GPS2)

2.33.1 Agilent 8960 settings

This is the same as WCDMA standby.

2.33.2 Phone settings

Phone UI settings are:

1. Settings→Wireless & network→Mobile Networks→Network Setting→Network Mode→WCDMA only.
2. Settings→Wireless & network→Mobile Networks – Uncheck the following items:
   - Data enabled
   - Data roaming
3. Settings→Display→Screen Timeout to 15 sec.
4. Settings→Display→Auto-rotate Screen – Uncheck this item.
5. Settings→Location & Security, uncheck the following items:
   - Use assisted GPS
   - Use GPS satellites
   - Visible passwords
6. From Qualcomm Settings, uncheck the following items:
   - Stay on Plugged
   - Sensors
   - Socket Data call (only available on GB, removed in ICS)
7. Disable USB charging. To do this, open the command window and execute:

```
adb shell setprop persist.usb.chgdisabled 1
adb shell “echo 1  > /sys/module/pm8921_charger/parameters/disabled”
adb shell sync
```

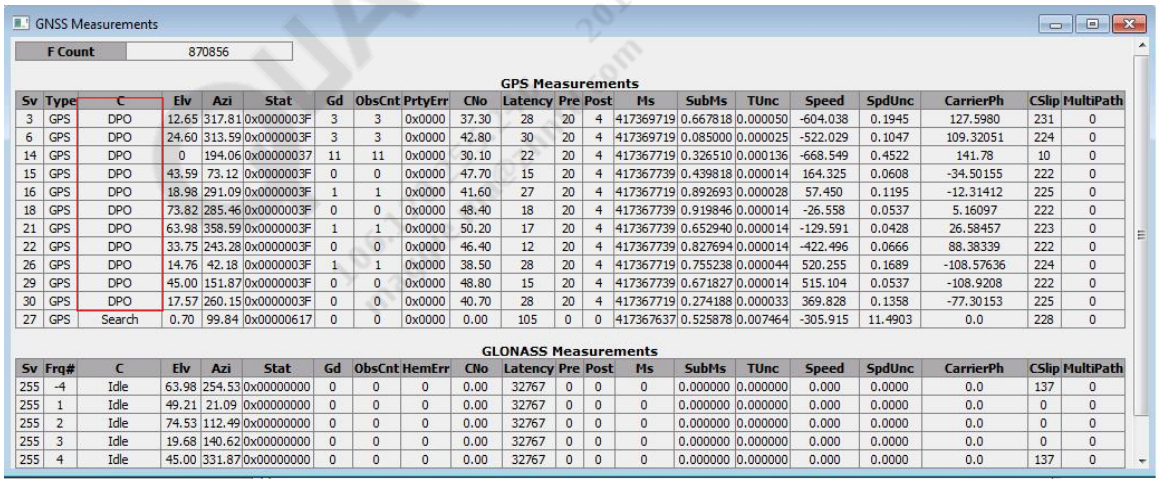
Phone NV settings are:

1. Make sure XO is properly calibrated.
2. Execute CGPS_NV_Loader.pl from modem_proc\modem\gps\gnss_tools\pdapi_scripts directory and load the desired GPS-related NVs to the UE.
3. Additional NV configurations are:
   - NV 5596 – Dynamic Power Optimization (DPO) control, set to 1 in order to enable DPO.
   - NV 6267 – QWIP Loc Engine Configuration, set to 2 to disable Wi-Fi Positioning.
   - NV 06773 – Set it to value 0.
   - NV 06759 – Set it to value 2 for DPO.
   - NV 06760 – Set it to value 0 for DPO.

2.33.3 Power measurement procedures

For power measurement:

1. Power up the handset and verify that it is acquired on the desired network.
2. Open a DOS command prompt.
3. Navigate to modem_proc\modem\gps\gnss_tools\pdapi_scripts directory and execute the following Perl commands:
   a. perl pd_startdiag.pl <com port> – QXDM should launch and connect to the specified COM port automatically.
   b. perl pd_delall.pl <com port> 9 – This deletes all existing aiding data on the UE. This step is very important when doing the test with a GPS simulator.
   c. perl pd_PowerConsumptionAlmDownloadTrack.pl <com port> – This starts the GPS engine. Wait for the first GPS fix to occur.
4. After the first fix, wait an additional 13 min in order to acquire the full GNSS (GPS + Glonass) Almanac.
5. Ensure the GPS engine is in DPO by looking at the QXDM GNSS Measurement window. If "DPO," as opposed to "Track," appears in the column circled below, GPS engine is in DPO.



6. Disconnect the phone from QXDM Options→Communications drop-down menu. This is a very important step. Unexpected high current consumption might be observed if this step is not followed.
7. Disconnect the USB cable from the phone.
8. Wait 2 min then start the actual power measurement.
9. MSM8x60 uses DPO2.0. See [Q7], integration time for DPO2.0 depends on the signal condition. To achieve power number listed in the dashboard, ensure the signal is strong and the total wakeup time is just slightly above 200 ms.

2.34 Multimedia use cases

2.34.1 Prerequisites

This section outlines the settings that need to be applied before performing any multimedia use case procedure.

- The device must be rebooted every time a use case is executed.
- All multimedia use cases must be performed in Airplane mode.
- The software build to be tested must be loaded on the target.
- The USB should not be connected.
- The headset should not be connected.
- The camera sensor (if detachable) should not be connected.

The settings in Table 2-4 describe the standard UI settings to be applied on the device.

Table 2-4 Standard UI settings

Standard UI settings		Setting state
a.	Brightness	Default
b.	Sync	Off
c.	Wi-Fi	Off
d.	Bluetooth	Off
e.	Airplane mode	On
f.	Screen timeout	30 min or maximum available
g.	Auto-rotate screen	Off
h.	Disable pad touch tones	Off
g.	Disable screen lock sound	Off
h.	Use GPS satellites	Off

1. From the Home screen, turn off sync.
2. Ensure the Display Brightness setting is *not* set to auto, e.g., on QTI XPM/MTP(s) it is 102. To check this through the ADB shell, run the following command:

```
cat /sys/class/leds/lcd-backlight/brightness
```

3. From the Home screen, go to the Main Menu and select **Settings**.
   a. Disable Wireless – Settings→Wi-Fi (deselect).
   b. Disable Bluetooth – Settings→Bluetooth (deselect).
   a. Enable Airplane mode – Settings→More→Airplane mode (select).
   c. Set the display screen timeout to the max timeout value available – Settings→Display→ Screen timeout (30 min or the max available timeout).
   d. Disable auto rotate screen – Settings→Display→Auto-rotate screen (deselect).
   e. Disable pad touch tones – Settings→Sound→Disable pad touch tones (deselect).
   f. Disable the screen lock sound – Settings→Sound→Disable screen lock sound (deselect).
   g. Disable GPS – Settings→Location & Security→Use GPS satellites (deselect).

   Table 2-5 lists the QTI UI setttings.

Table 2-5 QTI UI settings

QTI UI settings	Setting state
Stay on plugged	Off
Sensors	Off
Content adaptive backlight	Off

4. To disable the unnecessary features, from the Home screen, navigate to the Main menu and select **Qualcomm Settings**.
   a. Disable stay on plugged – Qualcomm Settings→Stay on plugged (deselect).
   b. Disable the sensors – Qualcomm settings→Sensors (deselect).
   c. Disable the content adaptive backlight option – Qualcomm settings→Content adaptive backlight option (deselect).

NOTE: The content adaptive backlight option can also be disabled by running the following ADB commands.

```
adb remount
adb pull /system/build.prop c:\build.prop
                    Edit the build.prop file to set ro.qualcomm.cabl=0
adb push build.prop /system/.
adb shell chmod 644 /system/build.prop

adb shell sync
adb reboot
```

NOTE: Before starting any use case procedure, perform the Rock Bottom Standby Current (RBSC) and Static image display use cases; see Sections 2.34.1.1 and 2.34.2 for more information.

2.34.1.1 RBSC use case

NOTE: The procedure to measure RBSC is described in detail in Section 2.3. It is repeated here for user convenience.

NOTE: It is recommended that the results and issues from the RBSC and Static image display use cases be reported to QTI's multimedia customer engineering power team.

It is recommended that the following basic sanity check use cases be performed before starting any multimedia active use cases:

- RBSC (also referred to as Airplane mode) – Screen is turned off during this use case
- Static image display – Screen is turned on during this use case

It is always recommended that RBSC and Static image display should be optimized against the number published by QTI. If the measured average power number is more than the specified target range for a given use case, it is necessary to debug or report the issue.

It is recommended to include the power numbers of the RBSC and Static Image Display use cases in all reported multimedia issues. It is advisable to include the power waveform with other debugging data when reporting the issues.

2.34.1.1.1 Procedure to measure the RBSC

This procedure assumes that the prerequisite steps and conditions described in Section 2.34.1 have been followed and are TRUE. If not, ensure all prerequisites are met before starting this use case.

1. Turn the device screen off.
2. Wait 2 min to ensure that the current has stabilized to allow the device to go into Low Power Mode (LPM) or XO shutdown.
3. Take the power measurements.
4. Collect three different measurements on the three different runs. Repeat Steps 1 to 3 every time a new measurement is taken.

If the RBSC power numbers are not within the expected target range, check whether the device went to VDD min or XO shutdown.

1. Ensure NV 453 is set to 0 for XO shutdown and vdd_min to work.
2. To check if the device is in XO shutdown, run the following ADB commands before and after turning off the screen.

```
adb root
adb shell mount -t debugfs none /sys/kernel/debug
adb shell cat /sys/kernel/debug/rpm_stats
```

3. Compare the counter values; the counter will increment for vdd_min or XO if the device went into XO shutdown.

- RPM mode – XO shutdown
  - Count – 0
  - Total time (µs) – 0
- RPM mode – vdd_min
  - Count – 1
  - Total time (µs) – 40870

2.34.2 Static image display (L CD04)

2.34.2.1 Power measurement procedure

This procedure assumes that the prerequisite steps and conditions described in Section 2.34.1 have been followed and are true. If not, ensure all prerequisites are met before starting this use case.

1. Turn on the screen and wait 30 sec to let the system stabilize.
2. Start power measurement.
3. Collect three different measurements on three different runs. Repeat Steps 1 and 2 every time a new measurement is taken.
4. Calculate the average battery power after 3 runs. Average battery power = (Measurement 1+ Measurement 2+ Measurement 3)/3.
5. MSM™ current contribution can be calculated by removing the LCD, backlight, and touchscreen contributions from the measured average battery power.

2.34.3 Audio decode use case (AU4)

2.34.3.1 Power measurement procedure

This procedure assumes that the prerequisite steps and conditions described in Section 2.34.1 have been followed and are true. If not, ensure all prerequisites are met before starting this use case.

1. Reboot the device.
2. Load the test clip on the device.
   a. The test clip used is AU4.

Test Clip	Description
AU4.mp3	MP3 at 44.1 kHz 128 kbps stereo; see [Q3]

   b. The clip can be downloaded from https://support.cdmatech.com/.
   c. Install the clip.
      i Connect a USB to the device.
      ii Push the clip to the devices using the following ADB command.

```
adb push <Clip Location>\Au4.mp3 /sdcard0/
```

      iii Disconnect the USB once installation is complete.
      iv Reboot the device.
3. Plug in the headset; the headset calibration is at .1 mW (for FFAs and XPM).

Table 2-6 lists the modes of audio testing available, depending on the chipset and type.

Table 2-6 Audio testing modes

Audio decoding mode	Description	Player used	Property to set in build.prop
Tunnel mode	Decoding on ADSP	Tunnel player	▪ tunnel.decode = TRUE ▪ lpa.decode = FALSE
Nontunnel – LPA mode	Decoding on Krait	LPA player	▪ tunnel.decode = FALSE ▪ lpa.decode = TRUE
Nontunnel – Non-LPA mode	Decoding on Krait	Audio player	▪ tunnel.decode = FALSE ▪ lpa.decode = FALSE

For example, on MSM8974 only Tunnel mode is supported.

4. Set the correct mode.
   a. Connect the USB to the device.
   b. Change the settings in one of the following ways:
      i Change the property tunnel.decode TRUE/FALSE using setprop on the command line.

```
adb root
adb remount
adb shell setprop tunnel.decode <true/false>
adb shell setprop lpa.decode <true/false>
```

      This change will not persist after the device reboots.

      ii Change the property in the build.prop file. To do this, search for strings tunnel.decode and lpa.decode and set the respective values to TRUE/FALSE as necessary for the use case.

```
adb root
adb remount
adb pull /system/build.prop
adb push (build.prop) /system/.
adb shell chmod 644 /system/build.prop
adb shell sync
```

CAUTION: Skipping the above two steps might brick the device. To unbrick the device, put the device into fastboot and reload the APSS image again.

```
adb reboot
```

5. Once the device boots up, check for the correct property value for tunnel.decode and ensure the device is set in the correct audio decoding mode using the following ADB command.

```
adb shell getprop tunnel.decode
adb shell getprop lpa.decode
```

6. Disconnect the USB from the device.
7. Wait approximately 2 min to ensure the current has stabilized.
8. Play the AU4 clip using the default Android music player.
9. Adjust the volume from mute so that it is set to 8/15.
10. Make sure Repeat mode is *not* selected while playing the clip.
11. Press the power key to turn off the LCD and backlight.
12. After MP3 playback starts, wait 30 sec and then take the power measurements for 30 sec.
13. Save the waveform and the power measurements.

14. Acquire the power numbers on three different runs; follow Steps 1 to 14 every time a measurement is taken.
15. Calculate the average battery power after 3 runs. Average battery power = (Measurement 1 + Measurement 2 + Measurement 3)/3.

NOTE: The audio decode use case is based on the measurements taken while audio is playing. Therefore, it is advised to avoid taking measurements for the first 5 sec and for the last 5 sec of the audio clip. To compare the power numbers with the published target dashboard numbers, any special sound effects must be disabled to avoid any audio postprocessing.

2.34.4 Video playback (QTCxx)

2.34.4.1 Power measurement procedure

This procedure assumes that the prerequisite steps and conditions described in Section 2.34.1 have been followed and are true. If not, ensure all prerequisites are met before starting this use case.

1. Reboot the device.
2. Load the test clip on the device, e.g., to decode 720p format video, download clip "qtc77."

   Available clips for testing are listed in Table 2-7.

Table 2-7 Video playback test clips

Test clip	Description
QTC48.mp4	30 fps at VGA H.264 2 Mbps AAC+ 96 kbps 44.1 kHz stereo; see [Q4]
QTC49a.mp4	Video: 30 fps at HD 720p 4 Mbps H.264 AAC+ 96 kbps 48 kHz stereo; see [Q13]
QTC77.mp4	30 fps at HD 720p H.264 10 Mbps AAC+ 96 kbps 44.1 kHz stereo; see [Q5]
QTC88.mp4	30 fps at HD 1080p H.264 20 Mbps AAC+ 96 kbps 44 kHz stereo; see [Q6]

   a. Download the test clip from https://support.cdmatech.com/login/.
   b. Connect a USB to the device.
   c. On the DOS command prompt using the ADB shell, push the clip being used to the device.

      ```
      adb push <Clip Location>\<Clip> /sdcard0/
      ```

   d. Disconnect the USB once done.
   e. Reboot the device.
3. Plug in the headset; the headset calibration is at .1 mW for FFAs and XPM.
4. Play the video clip using the Gallery application – Gallery2.apk.
5. Make sure Repeat mode is *not* selected.
6. When the clip starts playing, adjust the volume to mute and then increase the volume eight times from mute.

7. Video playback must execute in Landscape mode (default); the Gallery application must be installed in Landscape mode.

   For QTI MTP/XPM, the procedure to install the Gallery application in Landscape mode is:

   a. Mount the file system of type ext4 with label remount block device mmcblk0p12 in the system directory:

      ```
      adb shell mount -t ext4 -o remount,rw /dev/block/mmcblk0p12/system
      ```

   b. Remove the old Gallery2.apk:

      ```
      adb shell rm system/app/Gallery2.apk
      ```

   c. Download the latest Landscape mode Gallery application from https://support.cdmatech.com/login/.

   d. Install the Landscape mode Gallery application:

      ```
      adb install <Location Landscape_Mode Gallery App>\Gallery2.apk.
      adb shell sync.
      ```

8. After video playback starts, wait until the progress bar disappears, then take the power measurement for 30 sec.
9. Save the waveform and the battery power numbers measured.
10. Get the power number on three different runs. Follow steps 1 to 10 each time a new power measurement is taken.
11. Calculate the average battery power after 3 runs. Average battery power = (Measurement 1 + Measurement 2 + Measurement 3)/3.
12. Remove the LCD, backlight, and touchscreen contributions from the battery power measurement to get the MSM contribution.

NOTE: If the waveforms are not clean, it is possible that some unnecessary daemons are running. Run the following commands to disable some of the processes and see if power is better.

```
adb shell stop gsiff_daemon
adb shell stop qrngd
adb shell stop sensors
```

Other processes can also be disabled in the same way and the power number can be checked to see their impact.

13. Verification of the frame rate of decoded video can be done as a separate step, since enabling logging results in an increased power measurement.

There are two ways to confirm whether video is decoding at the same frame rate as it was encoded.

- Method 1
  a. To enable the fps information logging for the test video clip through the ADB shell, set the persist.debug.sf.statistics parameter to 1.
  b. adb shell setprop persist.debug.sf.statistics 1.
  c. Disconnect the USB.
  d. Play the video clip again.
  e. After measurement is complete, connect the USB and save the output to a text file.

     ```
     adb logcat  >  <filename>
     ```

     or

     ```
     adb logcat -v threadtime | tee <filename>
     ```

  f. Verify the frame rate by searching for fps in the saved file or by grepping for the fps using the following ADB command.

     ```
     adb logcat  | grep  - i “fps”
     ```

- Method 2
  a. Capture dumpsys media player information.
  b. Connect the USB cable to the device.
  c. Execute the following ADB command before playing the audio/video clip.

     ```
     adb shell sleep 50 && dumpsys media.player >> data/local/fps.txt &
     ```

  d. Disconnect the USB.
  e. Take power measurements for 30 sec as described in Step 9, while waiting for 50 sec to expire. Save the waveform and the measured power numbers.
  f. Connect the USB.
  g. Through the ADB shell, cat the contents of the saved file and grep for the string “Average frames per second” and confirm the frame rate.

     ```
     cat /data/local/fps.txt | grep “Average frames per second”
     ```

2.34.5 1080p video encoding (QMC31)

2.34.5.1 Power measurement procedure

This procedure assumes that the prerequisite steps and conditions described in Section 2.34.1 have been followed and are true. If not, ensure all prerequisites are met before starting this use case.

NOTE: On the QTI XPM, if the camera sensors are not connected at the time of loading the build, the Camera app will not display in the UI.

NOTE: During video decode use cases, the audio decoding is in Tunnel mode. For this the property tunnel.audiovideo.decode must be set to TRUE in the build.prop file.

1. Reboot the device.
2. After it boots up, wait 1 min to ensure the current has stabilized.
3. Plug in the headset and set volume to 8/15; headset calibration is at 1 mW for XPM.
4. Launch the default camera application.
5. Switch to Camcorder mode and apply the settings shown in Table 2-8, which will remain after rebooting the phone.

Table 2-8 MSM camcorder settings

Field	Value
Resolution	1080p
Encoding	H.264
White balance	Incandescent (looks like a bulb)
ADB shell	

`adb shell`
`adb shell setprop persist.audio.handset.mic analog`
`adb shell setprop persist.camera.mem.usecache 0`
`adb shell sync`
`adb reboot`	

NOTE: Recording is done in Portrait mode with the LCD and backlight on. The recorded video can be played using the Gallery application, QuickTime via Movie Inspector, and VLC.

6. Place a white paper in front of the camera sensor in a well lit area.
7. Ensure that the white paper is the only object visible onscreen to ensure video is encoding at 30 fps.
8. Start video recording, ensure that it is encoding in Portrait mode, and that the LCD and backlight are on.
9. After video encoding starts, wait approximately 5 sec and then measure power for 30 sec.
10. Save the waveform and the battery power numbers measured.

11. Get the power number on three different runs. Follow Steps 1 to 11 every time a new power measurement is taken.
12. Calculate the average battery power after 3 runs. Average battery power = (Measurement 1+ Measurement 2+ Measurement 3)/3.
13. Remove the LCD, backlight, and touchscreen contributions from the battery power measurement to get the MSM contribution.

There are two ways to verify the fps of the encoded video.

- Method 1
  a. Enable logging as described in Section 2.34.4.1.
  b. Use the Gallery application to play back the recoded stream.
- Method 2
  a. Check fps information by viewing the recorded clip in QuickTime via Movie Inspector and VLC.
  b. The clip can be extracted using the following ADB command.

```
adb pull /sdcard/dcim/camera c:\temp
```

2.34.6 Graphics PowerLift (QGC23A)

2.34.6.1 Power measurement procedure

This procedure assumes that the prerequisite steps and conditions described in Section 2.34.1 have been followed and are true. If not, ensure all prerequisites are met before starting this use case.

1. Install Powerlift 3D version 5.2. Download the latest powerlift tool from https://support.cdmatech.com/login/.

   Described below is the graphics application information.

Test	Description
QGC23A	Exe, PowerLift 3D LINUX Android Graphics Tool Release 5.2.00; see [Q11]

   a. Connect the USB to the device.
   b. On the DOS command prompt through the ADB shell, run the following:

```
adb uninstall com.qualcomm.powerlift
adb install <Powerlift location>\PowerLift.apk
adb shell chmod 777 /data/data/com.qualcomm.powerlift
adb shell mkdir /data/data/com.qualcomm.powerlift/files
adb shell chmod 777 /data/data/com.qualcomm.powerlift/files
adb push <Powerlift location>\config.txt
/data/data/com.qualcomm.powerlift/files/config.txt
```

c. Disconnect the USB.

d. Reboot the device.

2. Wait approximately 1 min and ensure the current has stabilized.
3. Ensure that the config file has the frame rate set to 30 fps.
4. Go to the main menu and click **PowerLift**.
5. PowerLift graphics plays in Portrait mode.
6. After PowerLift rendering starts, wait approximately 1 min and take the power measurements for 30 sec.
7. Save the waveform and power numbers.
8. Get the power number on three different runs. Follow steps 1 to 8 each time a new power measurement is taken.
9. Calculate the average battery power after 3 runs. Average battery power = (Measurement 1 + Measurement 2 + Measurement 3)/3.
10. Remove the LCD, backlight, and touchscreen contributions from the battery power measurement to get the MSM contribution.
11. Verify the 3D frame rate at 30 fps; through the UI the fps is displayed onscreen in the bottom left corner.

2.34.7 Gaming Egypt (QGC24A)

2.34.7.1 Power measurement procedure

This procedure assumes that the prerequisite steps and conditions described in Section 2.34.1 have been followed and are true. If not, ensure all prerequisites are met before starting this use case.

1. Download the commercial version of Egypt from the Android market.

NOTE: The Egypt version used varies based on the chipset used; see the respective chipset's Current Consumption Power document for details.

On QTI XPM/MTP(s), install Egypt.

a. Connect the USB to the device.

b. In the DOS command prompt through the ADB shell, run the following commands:

```
adb uninstall com.glbenchmark.glbenchmark2x
adb install   <Location>\egypt2XY4\GLBenchmark_2.X.Y_6C856F.apk
adb shell mkdir  /data/data/com.glbenchmark.glbenchmark2X/files/
adb push  <Location>\egypt2XY\config.txt
/data/data/com.glbenchmark.glbenchmark2X/files/config.txt
adb push  <Location>\egypt2XY\2_X_tests_corp.xml
/data/data/com.glbenchmark.glbenchmark2X/files/2_X_tests_corp.xml
adb shell sync
```

c. Ensure that the config file has the resolution set to 720p (1280x720).

d. Disconnect the USB from the device.

2. Reboot the device.
3. After the device boots up, wait 1 min to ensure the current has stabilized.
4. To start Egypt, go to the main menu and click **GL Benchmark**. Under the performance tests option, select **GLBenchmark 2.X Egypt (standard)**. Note that this option is subject to change.
5. After Egypt rendering starts, wait approximately 1 min and take the power measurement for 30 sec.
6. Capture the power numbers.
7. Get the power numbers on three different runs. Follow steps 1 to 7 every time a new power measurement is taken.
8. Calculate the average battery power after 3 runs. Average battery power = (Measurement 1 + Measurement 2 + Measurement 3)/3.
9. Remove the LCD, backlight, and touchscreen contributions from the battery power measurement to get the MSM contribution.

2.34.8 Browser (WB1A)

2.34.8.1 Power measurement procedure

This procedure assumes that the prerequisite steps and conditions described in Section 2.34.1 have been followed and are true. If not, ensure all prerequisites are met before starting this use case.

1. Turn on Wi-Fi.
2. Go to Settings→Wireless & network settings→Wi-Fi settings.
3. Select the Wi-Fi connection and connect to the local Wi-Fi network through which the apache server is accessible.
4. Make sure a Wi-Fi access point is within 6 ft of the device and that the wireless router is of the 802.11g type; for server and hardware setup, see [Q8].
5. Connect the USB.
6. Launch the standard Android browser and click the address bar.
7. In the command prompt type the following ADB command to input the apache server HTTP address where the Ibench webpage is stored:

```
adb shell
Input text “http:\\<server name> or <IP address>”
```

8. Bookmark the above HTTP address.
9. Disconnect the USB.
10. After the phone boots up, wait 1 min to ensure the current has stabilized.

11. Plug in the headset and set the volume to 8/15; headset calibration is at 1 mW for XPM.
12. Connect to a local Wi-Fi network and from the bookmark, select the apache server HTTP URL where the Ibench webpage is stored.

NOTE: If the Ibench webpage cannot be accessed, follow the setup procedure described in [Q10].

NOTE: Web page browsing should be done in Portrait mode.

13. Select **Run Test (40 sec)** and ensure the display is on while accessing the Ibench webpage.
14. After the webpage appears onscreen, take the power measurement for 200 sec and capture the power numbers. This will have five cycles, as web pages get refreshed every 40 sec.
15. Get the power numbers on three different runs. Follow steps 1 to 15 every time a new power measurement is taken.
16. Calculate the average battery power after 3 runs. Average battery power = (Measurement 1 + Measurement 2 + Measurement 3)/3.
17. Remove the LCD, backlight, and touchscreen contributions from the battery power measurement to get the MSM contribution.

2.34.9 Video Streaming (VSX)

2.34.9.1 Power measurement procedure

This procedure assumes that the prerequisite steps and conditions described in Section 2.34.1 have been followed and are true. If not, ensure all prerequisites are met before starting this use case.

1. Turn on Wi-Fi.
2. Go to Settings→Wireless & network settings→Wi-Fi settings.
3. Select the Wi-Fi connection and connect to the local Wi-Fi network through which the server is accessible.
4. Make sure the Wi-Fi access point is within 6 ft of the device and that the wireless router is of the 802.11g type.
5. For Linux Android video streaming server and hardware setup, see [Q8].
6. Connect the USB.
7. Launch the standard Android browser and click the address bar.
8. In the command prompt, type the following ADB command to input the apache server HTTP address where the video clip is stored:

```
adb shell
Input text “http://<server name> or <IP address>”
```

9. Bookmark the above HTTP address.
10. Disconnect the USB.
11. Plug in the headset; headset calibration is at 1 mW for XPM.

12. After the phone boots up, wait 1 min to ensure the current has stabilized.
13. When video streaming starts, adjust the volume to mute and then increase the volume eight times from mute.
14. Connect to a local Wi-Fi network and from the bookmark select the apache server HTTP URL where the clip is stored.
15. Select the video streaming clip according to the use case; see Table 2-9.

Table 2-9 Video streaming clips

Test clip	Description
VS4	Video: 514 Kbps, 640 * 360 (16:9), AVC (Baseline @ L3.0) (1 Ref Frame), 96.0 Kbps, 44.1 kHz, 2 channels, AAC (LC); see [Q12]
VS6	Video: 720p 1280x720 30 fps H.264 HP 2.13 Mbps, AAC+ Stereo 44.1 kHz 128 Kbps (YouTube 720p); see [Q13]

16. After video streaming playback starts, wait until the progress bar disappears and take the power measurement for 90 sec.
17. Get the power number on three different runs. Follow steps 1 to 17 every time a new power measurement is taken.
18. Calculate the average battery power after 3 runs. Average battery power = (Measurement 1 + Measurement 2 + Measurement 3)/3.

2.35 Sensor use cases

2.35.1 Basic setup

To replicate the test setup for the SSC power measurements:

1. Ensure the QSensorTest Android application is installed.
2. Ensure that sensor streaming works on the device, either by running QSensorTest or through logs.
3. Ensure that no sensors logging is enabled during any of the measurements.
4. If QXDM Pro is connected, disconnect both QXDM Pro and the USB.

5. Apply these settings:
   - Enable Airplane mode – Settings→More→Airplane mode (select)
   - Disable auto rotate – Settings→Display→Auto rotate screen (deselect)
   - Disable pad touch tones – Settings→Sound→Dial pad touch tones (deselect)
   - Disable touch sounds – Settings→Sound→Touch sounds (deselect)
   - Disable screen lock sound – Settings→Sound→Screen lock sound (deselect)
   - Disable GPS – Settings→Location access→GPS satellites (deselect)
   - Disable screen on while charging – Qualcomm settings→Stay on plugged (deselect)
   - Disable the adaptive backlight option – Qualcomm settings→Enable content adaptive backlight (deselect)
   - Disable data – Settings→Wireless and networks→Mobile networks→Data enabled (deselect)
   - Disable data roaming – Settings→Wireless and networks→Mobile networks→Data roaming (deselect)

2.35.2 Procedure for MSM8974 and MSM8x26

2.35.2.1 Active processing

To perform SSC power measurements:

1. Set the screen timeout to a high number (Settings→Display→Sleep), e.g., 30 min.
2. Ensure that the USB is not connected.
3. Wait 60 sec with the display up in the Home screen, and then collect power measurement. This measurement will be referred to as the active baseline measurement.
4. Start the QSensorTest application; see [Q2] for details on using QSensorTest.
5. Disable UI update and wake lock holding.
   - Menu→Screen update (deselect)
   - Menu→Wake lock held (deselect)
6. Select the Set Listener tab corresponding to Accel.
7. Select the UI for sensor stream rate. This starts sensor streaming to HAL at 15 Hz.
8. Keep the UI (home screen) on during measurement.
9. Wait for 60 sec.
10. Collect the power measurement. This measurement will be referred to as the active sensors measurement.
11. Calculate the sensors delta. Active sensors masurement - Active baseline measurement.

    The calculated delta includes sensor hardware consumption and SSC consumption.

2.35.2.2 Background processing

To perform background processing:

1. Set the screen timeout to a small number, e.g., 30 sec.
2. Ensure that the USB is not connected.
3. Wait 60 sec after the device goes into XO shutdown and then collect power measurement. This measurement will be referred to as the XO baseline measurement.
4. Wake up the device and start the QSensorTest application; see [Q2] for details on using QSensorTest.
5. Disable UI update and wake lock holding.
   - Menu→Update screen (deselect)
   - Menu→Wake lock held (deselect)
6. In the threshold menu, submit listener for Accel. Verify that the threshold values are X:32767, Y:32767, and Z:32767 and that the streaming rate (Hz) is set to 10 (indicates 10 Hz); these should be the default values.
7. Wait 60 sec after the screen turns off, indicating XO shutdown has been achieved, with sensors background use case continuing to run on ADSP.
8. Collect the power measurement. This measurement will be referred to as the background sensors measurement.
9. Calculate sensors delta. Background sensors measurement - XO baseline measurement.

   The calculated delta includes sensor hardware consumption and SSC consumption.
10. This number should be adjusted for power consumption of the sensor part being used and present on the device.
11. To verify that the sensors' threshold algorithm is continuing to operate during XO shutdown, enable sensors logging and repeat steps 1 to 7. Connect the USB. In QXDM Pro, select **SNS** and **QDSP6** (Hexagon™) in the F3 Config menu, and observe the F3 log to make sure the sensors' threshold algorithm is continuing to operate.
12. For any subsequent power measurements after this use case, ensure that QXDM Pro is not running, the USB is disconnected, and that sensors logging has been disabled.

2.35.3 Procedure for MSM8960 and APQ8064

2.35.3.1 Active processing

To perform DSPS power measurements:

1. Set the screen timeout to a high number (Settings→Display→Screen), e.g., 30 min.
2. Ensure that the USB is not connected.
3. Wait 60 sec with the display on in the Home screen, and collect the power measurement. This measurement will be referred to as the active baseline measurement.
4. Start the QSensorTest application; see [Q2] for details on using QSensorTest.
5. Navigate to the menu. There should be a Disable UI update tab; select it.
6. Select the Set Listener tab corresponding to Accel.
7. Select Normal for sensor stream rate. This starts sensor streaming to HAL at 5 Hz.
8. Keep the UI on during measurement.
9. Wait 60 sec.
10. Collect the power measurement. This measurement will be referred to as the active sensors measurement.
11. Calculate the sensors delta. Active sensors measurement - active baseline measurement

2.35.3.2 Background processing

To perform background processing:

1. Set the screen timeout to a small number, e.g., 30 sec.
2. Turn the display off, wait 60 sec, and collect the power measurement. This measurement will be referred to as the XO baseline measurement.
3. Plug in the USB, and connect the port in QXDM Pro.
4. To request Accel data at 1 Hz, send the following diag command.

```
send_data 128 64 2 0 1 0 2 0 0 40 33 0 0 0 40 0 1 1 0 8 2 1 0 1 3 2 0 1
0 4 1 0 0 5 20 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

5. Disconnect QXDM Pro and unplug the USB.
6. Ensure the display is turned off before proceeding (manually turn off the display or let the display time out).
7. Wait 60 sec.
8. Collect the power measurement. This measurement will be referred to as the background sensors measurement.
9. Calculate the sensors delta. Background sensors measurement - XO baseline measurement.