# FCC SAR Test Report

| | | |
|---|---|---|
| **APPLICANT** | **:** | **Motorola Solutions, Inc.** |
| **EQUIPMENT** | **:** | **Touch Computer** |
| **BRAND NAME** | **:** | **Motorola** |
| **MODEL NAME** | **:** | **TC55CH** |
| **FCC ID** | **:** | **UZ7TC55CH** |
| **STANDARD** | **:** | **FCC 47 CFR Part 2 (2.1093)**<br>**ANSI/IEEE C95.1-1992**<br>**IEEE 1528-2003** |

**The product was testing completed on Jan. 29, 2014. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.**

**The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.**

Eric Huang

**Reviewed by: Eric Huang / Deputy Manager**

Jones Tsai

**Approved by: Jones Tsai / Manager**

ilac-MRA

TAF
Testing Laboratory
1190

***SPORTON INTERNATIONAL INC.***
***No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.***

# Table of Contents

# Revision History

| REPORT NO. | VERSION | DESCRIPTION | ISSUED DATE |
|---|---|---|---|
| FA3O1108-01 | Rev. 01 | Initial issue of report | Feb. 10, 2014 |
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# 1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Motorola Solutions, Inc. Touch Computer, TC55CH** are as follows.

**<Highest SAR Summary>**

| Exposure Position | Frequency Band | Reported 1g-SAR (W/kg) | Equipment Class | Highest Reported 1g-SAR (W/kg) |
|---|---|---|---|---|
| Head | CDMA2000 BC0 | 0.71 | PCE | 0.71 |
| | CDMA2000 BC1 | 0.43 | | |
| | LTE Band 13 | 0.50 | | |
| | WLAN 5.2GHz Band | 0.54 | NII | 0.70 |
| | WLAN 5.3GHz Band | 0.63 | | |
| | WLAN 5.5GHz Band | 0.70 | | |
| | WLAN 5.8GHz Band | 0.60 | DTS | 0.78 |
| | WLAN 2.4GHz Band | 0.78 | | |
| Hotspot (Separation 1cm) | CDMA2000 BC0 | 1.17 | PCE | 1.33 |
| | CDMA2000 BC1 | 1.33 | | |
| | LTE Band 13 | 1.01 | | |
| | WLAN 2.4GHz Band | 0.37 | DTS | 0.37 |
| Body-worn (Separation 1.5cm) | CDMA2000 BC0 | 0.99 | PCE | 1.34 |
| | CDMA2000 BC1 | 1.34 | | |
| | LTE Band 13 | 0.78 | | |
| | WLAN 5.2GHz Band | 0.49 | NII | 0.57 |
| | WLAN 5.3GHz Band | 0.57 | | |
| | WLAN 5.5GHz Band | 0.34 | | |
| | WLAN 5.8GHz Band | 0.12 | DTS | 0.22 |
| | WLAN 2.4GHz Band | 0.22 | | |

**<Highest Simultaneous transmission SAR>**

| Exposure Position | Frequency Band | Equipment Class | Highest Reported Simultaneous Transmission 1g-SAR (W/kg) |
|---|---|---|---|
| Body-worn | CDMA2000 BC1 | PCE | 1.56 |
| | WLAN 2.4GHz Band | DTS | |

| Exposure Position | Frequency Band | Equipment Class | Highest Reported Simultaneous Transmission 1g-SAR (W/kg) |
|---|---|---|---|
| Head | CDMA2000 BC1 | PCE | 1.37 |
| | Bluetooth | DSS | |

| Exposure Position | Frequency Band | Equipment Class | Highest Reported Simultaneous Transmission 1g-SAR (W/kg) |
|---|---|---|---|
| Hotspot | CDMA2000 BC0 | PCE | 1.56 |
| | WLAN 5.3GHz Band | NII | |

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2003.

# 2. Administration Data

## 2.1 Testing Laboratory

| | |
|---|---|
| **Test Site** | SPORTON INTERNATIONAL INC. |
| **Test Site Location** | No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978 |

## 2.2 Applicant

| | |
|---|---|
| **Company Name** | Motorola Solutions, Inc. |
| **Address** | One Motorola Plaza, Holtsville, NY 11742-1300 USA |

## 2.3 Manufacturer

| | |
|---|---|
| **Company Name** | Motorola Solutions, Inc. |
| **Address** | One Motorola Plaza, Holtsville, NY 11742-1300 USA |

## 2.4 Application Details

| | |
|---|---|
| **Date of Start during the Test** | Jan. 24, 2014 |
| **Date of End during the Test** | Jan. 29, 2014 |

# 3. General Information

## 3.1 Description of Equipment Under Test (EUT)

| Product Feature & Specification | |
|---|---|
| **EUT** | Touch Computer |
| **Brand Name** | Motorola |
| **Model Name** | TC55CH |
| **FCC ID** | UZ7TC55CH |
| **IMEI Code** | 358240505002421 |
| **Wireless Technology and Frequency Range** | CDMA2000 BC0: 824.7 MHz ~ 848.31 MHz<br>CDMA 2000 BC1: 1851.25 MHz ~ 1908.75 MHz<br>LTE Band 13: 779.5 MHz ~ 784.5 MHz<br>WLAN 2.4GHz Band: 2412 MHz ~ 2472 MHz<br>WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz<br>WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz<br>WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz<br>WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz<br>Bluetooth: 2402 MHz ~ 2480 MHz<br>NFC : 13.56 MHz |
| **Mode** | • CDMA2000 : 1xRTT/1xEv-Do(Rev.A)<br>• LTE: QPSK, 16QAM<br>• 802.11a/b/g/n HT20/HT40<br>• Bluetooth 3.0+EDR，Bluetooth 4.0+LE<br>• NFC:ASK |
| **Antenna Type** | WWAN: Monopole Antenna<br>WLAN: PIFA Antenna<br>Bluetooth: PIFA Antenna<br>NFC: Loop Antenna |
| **HW Version** | DV2.2 |
| **SW Version** | Android 4.1.2 |
| **FW Version** | BSP 1.7 |
| **Transfer Mode Category** | Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network. |
| **EUT Stage** | Identical Prototype |

**Remark:**
1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. 802.11n- HT40 is not supported in 2.4GHz frequency band.
3. Hotspot mode is supported in WLAN 2.4GHz frequency band, not supported in all 5GHz frequency bands

**The device supports 2 battery options:**

| Accessory | | |
|---|---|---|
| **Battery 1** | Brand Name | MOTOROLA |
| | Model Name | 82-164807-01 |
| | Capacity | 2940 mAh |
| **Battery 2** | Brand Name | MOTOROLA |
| | Model Name | 82-172087-01 |
| | Capacity | 4410 mAh |

## 3.2 Maximum RF output power among production units

| Mode | CDMA2000 BC0 | CDMA2000 BC1 | CDMA2000 BC1 |
|---|---|---|---|
| | Full power mode | Full power mode | Reduced power mode |
| Average Power (dBm) | | | |
| 1xRTT RC1 SO55 | 24.5 | 24.5 | 22.5 |
| 1xRTT RC3 SO55 | 24.5 | 24.5 | 22.5 |
| 1xRTT RC3 SO32 | 24.5 | 24.5 | 22.5 |
| 1xEV-DO Rev 0 (RTAP 153.6kbps) | 24.5 | 24.5 | 22.5 |
| 1xEV-DO Rev A (RETAP 4096 bits) | 24.5 | 24.5 | 22.5 |

| LTE Band 13 | | | | | |
|---|---|---|---|---|---|
| Average Power (dBm) | | | | | |
| Modulation | BW (MHz) | RB size | Target MPR | Normal | Hotspot |
| QPSK | 10 | ≤ 12 | 0 | 24 | 24 |
| QPSK | 10 | > 12 | 1 | 23 | 23 |
| 16QAM | 10 | ≤ 12 | 1 | 23 | 23 |
| 16QAM | 10 | > 12 | 2 | 22 | 22 |
| QPSK | 5 | ≤ 8 | 0 | 24 | 24 |
| QPSK | 5 | > 8 | 1 | 23 | 23 |
| 16QAM | 5 | ≤ 8 | 1 | 23 | 23 |
| 16QAM | 5 | > 8 | 2 | 22 | 22 |

| WLAN2.4GHz | IEEE 802.11 | | |
|---|---|---|---|
| Center Freq (MHz) | 11b | 11g | 11n-HT20 |
| Average Power (dBm) | | | |
| Ch1 | 19.5 | 13.5 | 13.5 |
| Ch2 | 19.5 | 16 | 16 |
| Ch6 | 20 | 18 | 17 |
| Ch7 | 20 | 18 | 17 |
| Ch11 | 18 | 11 | 11 |
| Ch12 | 14.5 | 10 | 10 |
| Ch13 | 10 | 5 | 5 |

| Mode / Band | Average Power (dBm) | | | |
|---|---|---|---|---|
| | 1Mbps (GFSK) | 2Mbps (π/4-DQPSK) | 3Mbps (8-DPSK) | BT4.0-LE (GFSK) |
| 2.4 GHz Bluetooth | 3 | 1.5 | 1.5 | 2.5 |

| WLAN5GHz Band | IEEE 802.11 | | |
|---|---|---|---|
| | 11a | 11n-HT20 | 11n-HT40 |
| Average Power (dBm) | | | |
| Ch36 | 13.5 | 13.5 | |
| Ch38 | | | 12 |
| Ch40 | 17 | 16 | |
| Ch44 | 17 | 16 | |
| Ch46 | | | 15 |
| Ch48 | 17 | 16 | |
| Ch52 | 17 | 16 | |
| Ch54 | | | 15 |
| Ch56 | 17 | 16 | |
| Ch60 | 17 | 16 | |
| Ch62 | | | 11.5 |
| Ch64 | 13.5 | 13.5 | |
| Ch100 | 15 | 15 | |
| Ch102 | | | 10.5 |
| Ch104 | 17 | 16 | |
| Ch108 | 17 | 16 | |
| Ch110 | | | 15 |
| Ch112 | 17 | 16 | |
| Ch116 | 17 | 16 | |
| Ch118 | | | 15 |
| Ch120 | 17 | 16 | |
| Ch124 | 17 | 16 | |
| Ch126 | | | 15 |
| Ch128 | 17 | 16 | |
| Ch132 | 17 | 16 | |
| Ch134 | | | 14.5 |
| Ch136 | 17 | 16 | |
| Ch140 | 13.5 | 13.5 | |
| Ch149 | 15.5 | 15.5 | |
| Ch151 | | | 14.5 |
| Ch153 | 17 | 16 | |
| Ch157 | 17 | 16 | |
| Ch159 | | | 14.5 |
| Ch161 | 17 | 16 | |
| Ch165 | 15.5 | 15.5 | |

## The table below summarized necessary items addressed in KDB 941225 D05 v02r03.

| | |
|---|---|
| FCC ID | UZ7TC55CH |
| EUT | Touch Computer |
| Operating Frequency Range of each LTE transmission band | LTE Band 13: 779.5 MHz ~ 784.5 MHz |
| Channel Bandwidth | LTE Band 13: 5MHz, 10MHz |

| Transmission (H, M, L) channel numbers and frequencies in each LTE band | | | | |
|---|---|---|---|---|
| Band 13 | | | | |
| | Bandwidth 5 MHz | | Bandwidth 10 MHz | |
| | Channel # | Frequency (MHz) | Channel # | Frequency (MHz) |
| L | 23205 | 779.5 | 23230 | 782 |
| M | 23230 | 782 | | |
| H | 23255 | 784.5 | | |

| | |
|---|---|
| E category, uplink modulations used | Category 3, QPSK, and 16QAM |
| LTE transmitter and antenna implementation (standalone or sharing hardware components / antennas ) | A primary antenna is used for LTE and other wireless interfaces (CDMA ) for transmitting and receiving. LTE and other wireless interfaces (CDMA ) share the same antenna, and cannot transmit simultaneously<br>A 2nd antenna is used for LTE and other wireless interfaces (CDMA ) for receiving only |
| LTE Voice / Data requirements | Data only |
| LTE MPR permanently built-in by design | Yes, per 3GPP TS 36.101 v11.0.0 (see Table 6.2.3-1 below) |
| LTE A-MPR | In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI) |
| Base station simulator used for Testing | Anritsu MT8820C |
| Power reduction applied to satisfy SAR compliance | No |

**Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3**

| Modulation | Channel bandwidth / Transmission bandwidth (RB) | | | | | | MPR (dB) |
|---|---|---|---|---|---|---|---|
| | 1.4 MHz | 3.0 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | |
| QPSK | > 5 | > 4 | > 8 | > 12 | > 16 | > 18 | ≤ 1 |
| 16 QAM | ≤ 5 | ≤ 4 | ≤ 8 | ≤ 12 | ≤ 16 | ≤ 18 | ≤ 1 |
| 16 QAM | > 5 | > 4 | > 8 | > 12 | > 16 | > 18 | ≤ 2 |

### Target Power reduction applied for each wireless mode

| Exposure Position / wireless mode | Hotspot(1) |
|---|---|
| CDMA2000 BC1 | 2.0 dB |

**Remark:**
1. (1): Reduced maximum limit applied by activation of Hotspot operation
2. When hotspot mode is enabled, power reduction will be activated to limit the maximum power of CDMA2000 BC1 band.
3. Power reduction is not applicable for WLAN and Bluetooth.

## 3.3 Applied Standard

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2003
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r02
- FCC KDB 865664 D02 SAR Reporting v01r01
- FCC KDB 447498 D01 General RF Exposure Guidance v05r01
- FCC KDB 648474 D04 Handset SAR v01r02
- FCC KDB 248227 D01 SAR meas for 802 11abg v01r02
- FCC KDB 941225 D05 SAR for LTE Devices v02r03
- FCC KDB 941225 D06 Hotspot Mode SAR v01r01

## 3.4 Device Category and SAR Limits

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

## 3.5 Test Conditions

### 3.5.1 Ambient Condition

| | |
|---|---|
| **Ambient Temperature** | 20 to 24 ℃ |
| **Humidity** | < 60 % |

### 3.5.2 Test Configuration

For WWAN SAR testing, the device was controlled by using a base station emulator. Communication between the device and the emulator was established by air link. The distance between the EUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of EUT.

During WLAN SAR testing EUT is configured with the WLAN continuous TX tool, and the transmission duty factor was monitored on the spectrum analyzer with zero-span setting
Duty factor observed as below:
*802.11b, 1Mbps: 97.16%*
*802.11a, 6Mbps: 87.26%*
For WLAN SAR testing, WLAN engineering testing software installed on the EUT can provide continuous transmitting RF signal.

# 4. Specific Absorption Rate (SAR)

## 4.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

## 4.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\mathbf{SAR} = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\mathbf{dm}}\right) = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\boldsymbol{\rho}\mathbf{dv}}\right)$$

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be either related to the temperature elevation in tissue by

$$\mathbf{SAR} = \mathbf{C}\left(\frac{\boldsymbol{\delta}\mathbf{T}}{\boldsymbol{\delta}\mathbf{t}}\right)$$

Where: C is the specific heat capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

$$\mathbf{SAR} = \frac{\boldsymbol{\sigma}|\mathbf{E}|^2}{\boldsymbol{\rho}}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

# 5. SAR Measurement System

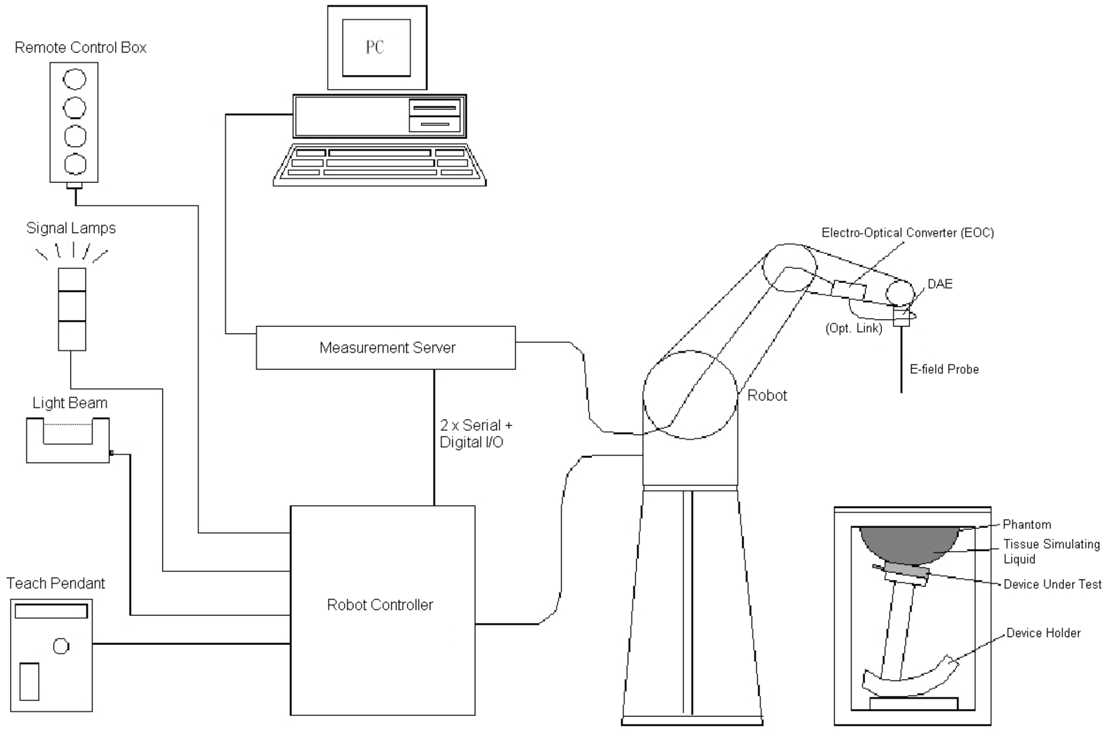



**Fig 5.1 SPEAG DASY System Configurations**

The DASY system for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software
- A data acquisition electronic (DAE) attached to the robot arm extension
- A dosimetric probe equipped with an optical surface detector system
- The electro-optical converter (EOC) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning
- A computer operating Windows XP
- DASY software
- Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
- The SAM twin phantom
- A device holder
- Tissue simulating liquid
- Dipole for evaluating the proper functioning of the system

Component details are described in in the following sub-sections.

## 5.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

### 5.1.1 E-Field Probe Specification

**<EX3DV4 Probe>**

| | | |
|---|---|---|
| **Construction** | Symmetrical design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) | <br>**Fig 5.2 Photo of EX3DV4/ES3DV4** |
| **Frequency** | 10 MHz to 6 GHz; Linearity: ± 0.2 dB | |
| **Directivity** | ± 0.3 dB in HSL (rotation around probe axis)<br>± 0.5 dB in tissue material (rotation normal to probe axis) | |
| **Dynamic Range** | 10 µW/g to 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/g) | |
| **Dimensions** | Overall length: 330 mm (Tip: 20 mm)<br>Tip diameter: 2.5 mm (Body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm | |

### 5.1.2 E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy shall be evaluated and within ± 0.25dB. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix C of this report.

## 5.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.
The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

**Fig 5.3 Photo of DAE**

## 5.3 Robot

The SPEAG DASY system uses the high precision robots (DASY4: RX90BL; DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB; DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

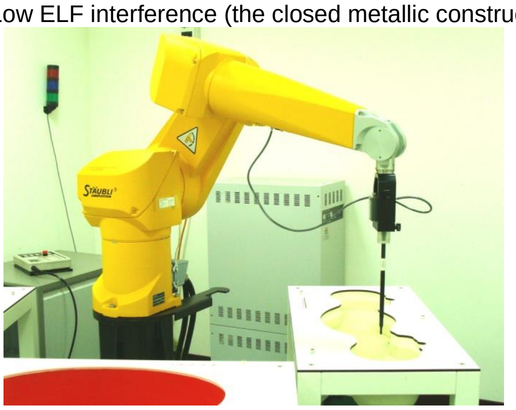


**Fig 5.4 Photo of DASY4**

**Fig 5.5 Photo of DASY5**

## 5.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chipdisk (DASY4: 32 MB; DASY5: 128 MB), RAM (DASY4: 64 MB, DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.


**Fig 5.6 Photo of Server for DASY4**


**Fig 5.7 Photo of Server for DASY5**

## *5.5 Phantom*

**<SAM Twin Phantom>**

| | |
|---|---|
| **Shell Thickness** | 2 ± 0.2 mm;<br>Center ear point: 6 ± 0.2 mm |
| **Filling Volume** | Approx. 25 liters |
| **Dimensions** | Length: 1000 mm; Width: 500 mm;<br>Height: adjustable feet |
| **Measurement Areas** | Left Hand, Right Hand, Flat Phantom |

**Fig 5.8 Photo of SAM Phantom**

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

**<ELI4 Phantom>**

| | |
|---|---|
| **Shell Thickness** | 2 ± 0.2 mm (sagging: <1%) |
| **Filling Volume** | Approx. 30 liters |
| **Dimensions** | Major ellipse axis: 600 mm<br>Minor axis: 400 mm |

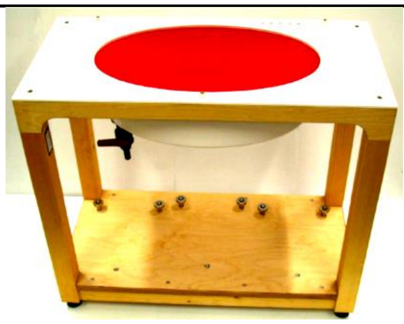


**Fig 5.9 Photo of ELI4 Phantom**

The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

## 5.6 Device Holder

### <Device Holder for SAM Twin Phantom>

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ± 0.5 mm would produce a SAR uncertainty of ± 20 %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity $\varepsilon = 3$ and loss tangent $\delta = 0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

**Fig 5.10 Device Holder**

### <Laptop Extension Kit>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.

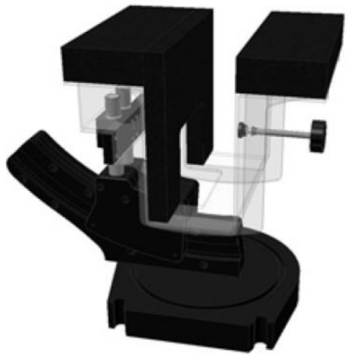


**Fig 5.11 Laptop Extension Kit**

## 5.7 Data Storage and Evaluation

### 5.7.1 Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The post-processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m], [mW/g]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-lose media, will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

### 5.7.2 Data Evaluation

The DASY post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software：

| | | |
|---|---|---|
| **Probe parameters**： | - Sensitivity | $Norm_i$, $a_{i0}$, $a_{i1}$, $a_{i2}$ |
| | - Conversion factor | $ConvF_i$ |
| | - Diode compression point | $dcp_i$ |
| **Device parameters**： | - Frequency | f |
| | - Crest factor | cf |
| **Media parameters**： | - Conductivity | σ |
| | - Density | ρ |

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as：

$$\mathbf{V_i} = \mathbf{U_i} + \mathbf{U_i^2} \cdot \frac{\mathbf{cf}}{\mathbf{dcp_i}}$$

with $V_i$ = compensated signal of channel i, (i = x, y, z)
$U_i$ = input signal of channel i, (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
$dcp_i$ = diode compression point (DASY parameter)

From the compensated input signals, the primary field data for each channel can be evaluated：

E-field Probes：$\mathbf{E_i} = \sqrt{\frac{\mathbf{V_i}}{\mathbf{Norm_i \cdot ConvF}}}$

H-field Probes：$\mathbf{H_i} = \sqrt{\mathbf{V_i}} \cdot \frac{\mathbf{a_{i0} + a_{i1} f + a_{i2} f^2}}{\mathbf{f}}$

with $V_i$ = compensated signal of channel i, (i = x, y, z)
$Norm_i$ = sensor sensitivity of channel i, (i = x, y, z), μV/(V/m)$^2$ for E-field Probes
ConvF = sensitivity enhancement in solution
$a_{ij}$ = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
$E_i$ = electric field strength of channel i in V/m
$H_i$ = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude)：

$$\mathbf{E_{tot}} = \sqrt{\mathbf{E_x^2 + E_y^2 + E_z^2}}$$

The primary field data are used to calculate the derived field units.

$$\mathbf{SAR} = \mathbf{E_{tot}^2} \cdot \frac{\boldsymbol{\sigma}}{\boldsymbol{\rho} \cdot \mathbf{1000}}$$

with SAR = local specific absorption rate in mW/g
$E_{tot}$ = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm$^3$

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

## 5.8 Test Equipment List

| Manufacturer | Name of Equipment | Type/Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Cal. | Due Date |
| SPEAG | 750MHz System Validation Kit | D750V3 | 1099 | Nov. 11, 2013 | Nov. 10, 2014 |
| SPEAG | 835MHz System Validation Kit | D835V2 | 4d162 | Nov. 11, 2013 | Nov. 10, 2014 |
| SPEAG | 1900MHz System Validation Kit | D1900V2 | 5d182 | Nov. 12, 2013 | Nov. 11, 2014 |
| SPEAG | 2450MHz System Validation Kit | D2450V2 | 924 | Nov. 13, 2013 | Nov. 12, 2014 |
| SPEAG | 5GHz System Validation Kit | D5GHzV2 | 1128 | Jul. 24, 2013 | Jul. 23, 2014 |
| SPEAG | Data Acquisition Electronics | DAE3 | 577 | May. 08, 2013 | May. 07, 2014 |
| SPEAG | Data Acquisition Electronics | DAE3 | 495 | May. 08, 2013 | May. 07, 2014 |
| SPEAG | Data Acquisition Electronics | DAE4 | 1399 | Nov. 07, 2013 | Nov. 06, 2014 |
| SPEAG | Dosimetric E-Field Probe | EX3DV4 | 3935 | Nov. 04, 2013 | Nov. 03, 2014 |
| SPEAG | Dosimetric E-Field Probe | EX3DV4 | 3931 | Sep. 10, 2013 | Sep. 09, 2014 |
| SPEAG | Dosimetric E-Field Probe | EX3DV4 | 3925 | Jun. 12, 2013 | Jun. 11, 2014 |
| Wisewind | Thermometer | HTC-1 | TM642 | Oct. 22, 2013 | Oct. 21, 2014 |
| Agilent | Wireless Communication Test Set | E5515C | MY48360820 | Jan. 10, 2014 | Jan. 09, 2015 |
| SPEAG | Device Holder | N/A | N/A | NCR | NCR |
| R&S | Signal Generator | SMF 100A | 101107 | May. 27, 2013 | May. 26, 2014 |
| SPEAG | Dielectric Probe Kit | DAK-3.5 | 1126 | Jul. 23, 2013 | Jul. 22, 2014 |
| Agilent | ENA Network Analyzer | E5071C | MY46316648 | Feb. 07, 2013 | Feb. 06, 2014 |
| Anritsu | Power Meter | ML2495A | 1132003 | Aug. 28, 2013 | Aug. 27, 2014 |
| Anritsu | Power Sensor | MA2411B | 1126017 | Aug. 27, 2013 | Aug. 26, 2014 |
| Agilent | Dual Directional Coupler | 778D | 50422 | Note 2 | |
| Woken | Attenuator 1 | WK0602-XX | N/A | Note 2 | |
| PE | Attenuator 2 | PE7005-10 | N/A | Note 2 | |
| PE | Attenuator 3 | PE7005- 3 | N/A | Note 2 | |
| AR | Power Amplifier | 5S1G4M2 | 328767 | Note 3 | |
| R&S | Spectrum Analyzer | FSP 7 | 101131 | Jul. 09, 2013 | Jul. 08, 2014 |

**Table 5.1 Test Equipment List**

**Note:**

1. The calibration certificate of DASY can be referred to appendix C of this report.
2. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
3. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio of 1W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it
4. Attenuator 1 insertion loss is calibrated by the network Analyzer, which the calibration is valid, before system check.

# 6. Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 6.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 6.2.

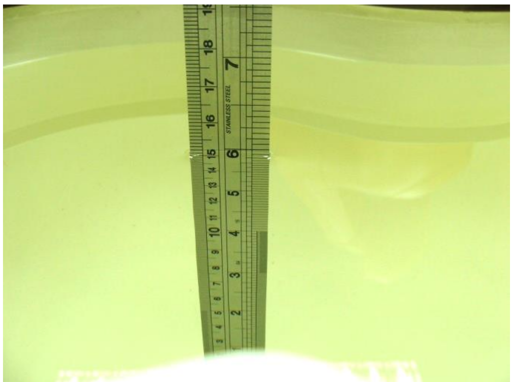


**Fig 6.1 Photo of Liquid Height for Head SAR**

**Fig 6.2 Photo of Liquid Height for Body SAR**

The following table gives the recipes for tissue simulating liquid.

| Frequency (MHz) | Water (%) | Sugar (%) | Cellulose (%) | Salt (%) | Preventol (%) | DGBE (%) | Conductivity ($\sigma$) | Permittivity ($\varepsilon_r$) |
|---|---|---|---|---|---|---|---|---|
| **For Head** | | | | | | | | |
| 750 | 41.1 | 57.0 | 0.2 | 1.4 | 0.2 | 0 | 0.89 | 41.9 |
| 835 | 40.3 | 57.9 | 0.2 | 1.4 | 0.2 | 0 | 0.90 | 41.5 |
| 900 | 40.3 | 57.9 | 0.2 | 1.4 | 0.2 | 0 | 0.97 | 41.5 |
| 1800, 1900, 2000 | 55.2 | 0 | 0 | 0.3 | 0 | 44.5 | 1.40 | 40.0 |
| 2450 | 55.0 | 0 | 0 | 0 | 0 | 45.0 | 1.80 | 39.2 |
| 2600 | 54.8 | 0 | 0 | 0.1 | 0 | 45.1 | 1.96 | 39.0 |
| **For Body** | | | | | | | | |
| 750 | 51.7 | 47.2 | 0 | 0.9 | 0.1 | 0 | 0.96 | 55.5 |
| 835 | 50.8 | 48.2 | 0 | 0.9 | 0.1 | 0 | 0.97 | 55.2 |
| 900 | 50.8 | 48.2 | 0 | 0.9 | 0.1 | 0 | 1.05 | 55.0 |
| 1800, 1900, 2000 | 70.2 | 0 | 0 | 0.4 | 0 | 29.4 | 1.52 | 53.3 |
| 2450 | 68.6 | 0 | 0 | 0 | 0 | 31.4 | 1.95 | 52.7 |
| 2600 | 68.1 | 0 | 0 | 0.1 | 0 | 31.8 | 2.16 | 52.5 |

**Table 6.1 Recipes of Tissue Simulating Liquid**

**Simulating Liquid for 5G, Manufactured by SPEAG**

| Ingredients | (% by weight) |
|---|---|
| Water | 64~78% |
| Mineral oil | 11~18% |
| Emulsifiers | 9~15% |
| Additives and Salt | 2~3% |

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an SPEAG DAK-3.5 Dielectric Probe Kit and an Agilent Network Analyzer.

The following table shows the measuring results for simulating liquid.

| Frequency (MHz) | Tissue Type | Liquid Temp. (℃) | Conductivity (σ) | Permittivity ($\varepsilon_r$) | Conductivity Target (σ) | Permittivity Target ($\varepsilon_r$) | Delta (σ) (%) | Delta ($\varepsilon_r$) (%) | Limit (%) | Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 750 | Head | 22.3 | 0.879 | 41.000 | 0.89 | 41.90 | -1.24 | -2.15 | ±5 | 2014/1/25 |
| 750 | Body | 22.4 | 0.961 | 53.900 | 0.96 | 55.50 | 0.10 | -2.88 | ±5 | 2014/1/25 |
| 835 | Head | 22.6 | 0.885 | 42.000 | 0.90 | 41.50 | -1.67 | 1.20 | ±5 | 2014/1/26 |
| 835 | Body | 22.6 | 0.963 | 54.536 | 0.97 | 55.20 | -0.72 | -1.20 | ±5 | 2014/1/24 |
| 835 | Body | 22.6 | 0.963 | 54.536 | 0.97 | 55.20 | -0.72 | -1.20 | ±5 | 2014/1/24 |
| 1900 | Head | 22.5 | 1.410 | 38.300 | 1.40 | 40.00 | 0.71 | -4.25 | ±5 | 2014/1/26 |
| 1900 | Body | 22.5 | 1.535 | 52.471 | 1.52 | 53.30 | 0.99 | -1.56 | ±5 | 2014/1/24 |
| 1900 | Body | 22.5 | 1.535 | 52.471 | 1.52 | 53.30 | 0.99 | -1.56 | ±5 | 2014/1/24 |
| 1900 | Body | 22.5 | 1.535 | 52.471 | 1.52 | 53.30 | 0.99 | -1.56 | ±5 | 2014/1/24 |
| 2450 | Head | 22.2 | 1.840 | 39.300 | 1.80 | 39.20 | 2.22 | 0.26 | ±5 | 2014/1/28 |
| 2450 | Head | 22.2 | 1.840 | 39.300 | 1.80 | 39.20 | 2.22 | 0.26 | ±5 | 2014/1/28 |
| 2450 | Body | 22.8 | 2.020 | 53.900 | 1.95 | 52.70 | 3.59 | 2.28 | ±5 | 2014/1/28 |
| 2450 | Body | 22.8 | 2.020 | 53.900 | 1.95 | 52.70 | 3.59 | 2.28 | ±5 | 2014/1/28 |
| 5200 | Head | 22.3 | 4.78 | 35.30 | 4.66 | 36.00 | 2.58 | -1.94 | ±5 | 2014/1/29 |
| 5200 | Body | 22.6 | 5.330 | 48.600 | 5.30 | 49.00 | 0.57 | -0.82 | ±5 | 2014/1/29 |
| 5300 | Head | 22.3 | 4.88 | 35.20 | 4.76 | 35.87 | 2.52 | -1.87 | ±5 | 2014/1/29 |
| 5300 | Body | 22.6 | 5.470 | 48.500 | 5.42 | 48.88 | 0.92 | -0.78 | ±5 | 2014/1/29 |
| 5600 | Head | 22.3 | 5.18 | 34.60 | 5.06 | 35.53 | 2.37 | -2.62 | ±5 | 2014/1/29 |
| 5600 | Body | 22.6 | 5.850 | 47.700 | 5.77 | 48.47 | 1.39 | -1.59 | ±5 | 2014/1/29 |
| 5800 | Head | 22.3 | 5.37 | 34.30 | 5.27 | 35.30 | 1.90 | -2.83 | ±5 | 2014/1/29 |
| 5800 | Body | 22.6 | 6.110 | 47.400 | 6.00 | 48.20 | 1.83 | -1.66 | ±5 | 2014/1/29 |

**Table 6.2 Measuring Results for Simulating Liquid**

# 7. System Verification Procedures

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

## 7.1 Purpose of System Performance check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

## 7.2 System Setup

In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:

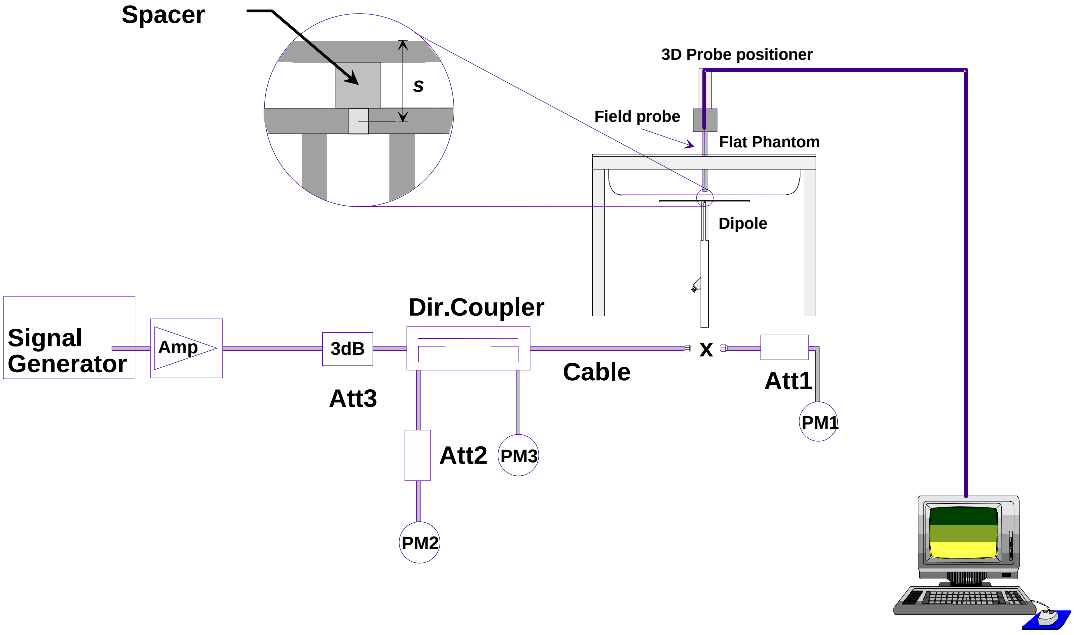



**Fig 7.1 System Setup for System Evaluation**

1. Signal Generator
2. Amplifier
3. Directional Coupler
4. Power Meter
5. Calibrated Dipole

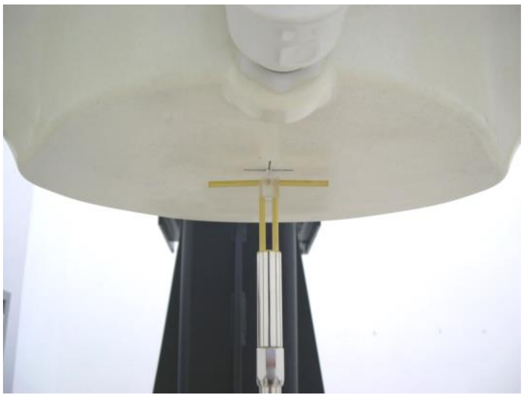


**Fig 7.2 Photo of Dipole Setup**

## *7.3 SAR System Verification Results*

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Table 7.1 shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

| Date | Frequency (MHz) | Tissue Type | Input Power (mW) | Dipole S/N | Probe S/N | DAE S/N | Measured SAR (W/kg) | Targeted SAR (W/kg) | Normalized SAR (W/kg) | Deviation (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2014/1/25 | 750 | Head | 250 | D750V3-1099 | 3925 | 495 | 2.08 | 8.42 | 8.32 | -1.19 |
| 2014/1/25 | 750 | Body | 250 | D750V3-1099 | 3925 | 495 | 2.28 | 8.56 | 9.12 | 6.54 |
| 2014/1/26 | 835 | Head | 250 | D835V2-4d162 | 3935 | 1399 | 2.47 | 9.53 | 9.88 | 3.67 |
| 2014/1/24 | 835 | Body | 250 | D835V2-4d162 | 3935 | 1399 | 2.41 | 9.28 | 9.64 | 3.88 |
| 2014/1/24 | 835 | Body | 250 | D835V2-4d162 | 3925 | 495 | 2.40 | 9.28 | 9.6 | 3.45 |
| 2014/1/26 | 1900 | Head | 250 | D1900V2-5d182 | 3935 | 1399 | 9.37 | 40.10 | 37.48 | -6.53 |
| 2014/1/24 | 1900 | Body | 250 | D1900V2-5d182 | 3935 | 1399 | 9.73 | 39.50 | 38.92 | -1.47 |
| 2014/1/24 | 1900 | Body | 250 | D1900V2-5d182 | 3931 | 577 | 9.72 | 39.50 | 38.88 | -1.57 |
| 2014/1/24 | 1900 | Body | 250 | D1900V2-5d182 | 3925 | 495 | 9.78 | 39.50 | 39.12 | -0.96 |
| 2014/1/28 | 2450 | Head | 250 | D2450V2-924 | 3925 | 495 | 12.90 | 52.40 | 51.6 | -1.53 |
| 2014/1/28 | 2450 | Head | 250 | D2450V2-924 | 3931 | 577 | 13.10 | 52.40 | 52.4 | 0.00 |
| 2014/1/28 | 2450 | Body | 250 | D2450V2-924 | 3931 | 577 | 13.20 | 50.20 | 52.8 | 5.18 |
| 2014/1/28 | 2450 | Body | 250 | D2450V2-924 | 3925 | 495 | 12.80 | 50.20 | 51.2 | 1.99 |
| 2014/1/29 | 5200 | Head | 100 | D5GHzV2-1128 | 3925 | 495 | 7.88 | 78.20 | 78.8 | 0.77 |
| 2014/1/29 | 5200 | Body | 100 | D5GHzV2-1128 | 3925 | 495 | 7.73 | 73.40 | 77.3 | 5.31 |
| 2014/1/29 | 5300 | Head | 100 | D5GHzV2-1128 | 3925 | 495 | 8.49 | 80.60 | 84.9 | 5.33 |
| 2014/1/29 | 5300 | Body | 100 | D5GHzV2-1128 | 3925 | 495 | 7.39 | 74.30 | 73.9 | -0.54 |
| 2014/1/29 | 5600 | Head | 100 | D5GHzV2-1128 | 3925 | 495 | 8.60 | 80.50 | 86 | 6.83 |
| 2014/1/29 | 5600 | Body | 100 | D5GHzV2-1128 | 3925 | 495 | 8.28 | 77.80 | 82.8 | 6.43 |
| 2014/1/29 | 5800 | Head | 100 | D5GHzV2-1128 | 3925 | 495 | 7.24 | 77.20 | 72.4 | -6.22 |
| 2014/1/29 | 5800 | Body | 100 | D5GHzV2-1128 | 3925 | 495 | 7.45 | 72.20 | 74.5 | 3.19 |

**Table 7.1 Target and Measurement SAR after Normalized**

# 8. EUT Testing Position

## 8.1 Define two imaginary lines on the handset

(a) The vertical centerline passes through two points on the front side of the handset - the midpoint of the width $w_t$ of the handset at the level of the acoustic output, and the midpoint of the width $w_b$ of the bottom of the handset.

(b) The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of the handset at point A.

(c) The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.

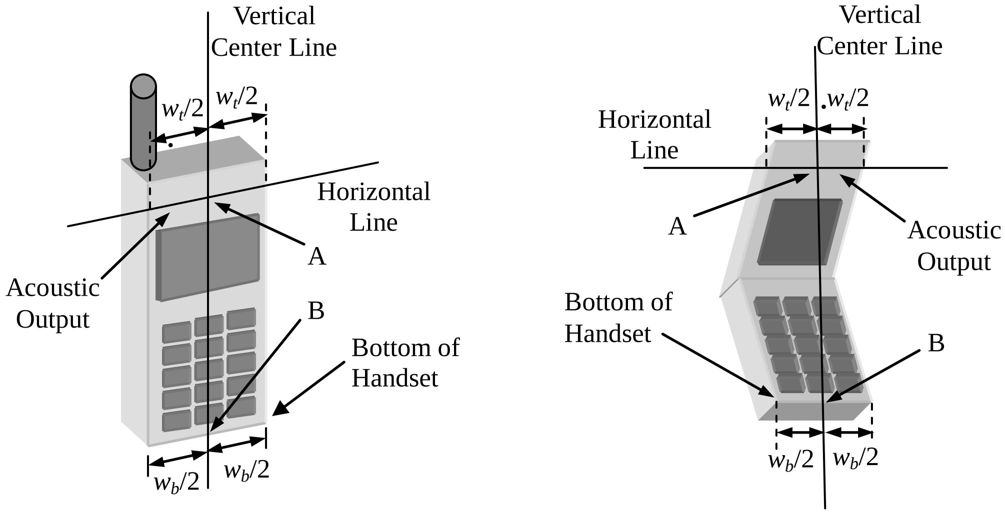



**Fig 8.1 Illustration for Handset Vertical and Horizontal Reference Lines**

## 8.2 Cheek Position

(a) To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M: Mouth, RE: Right Ear, and LE: Left Ear) and align the center of the ear piece with the line RE-LE.

(b) To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost (see Fig. 8.2).

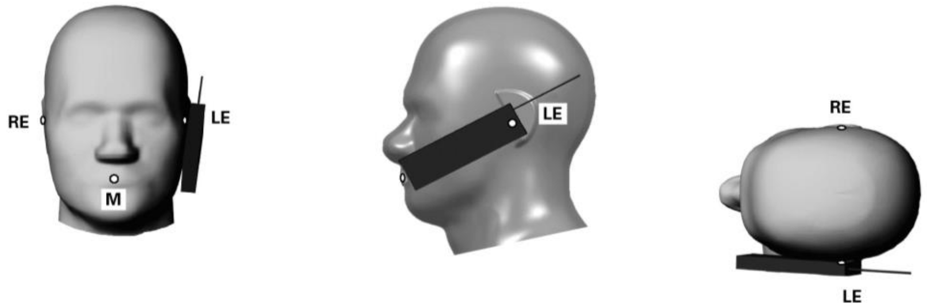



**Fig 8.2 Illustration for Cheek Position**

## 8.3 Tilted Position

(a) To position the device in the “cheek” position described above.

(b) While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see Fig. 8.3).

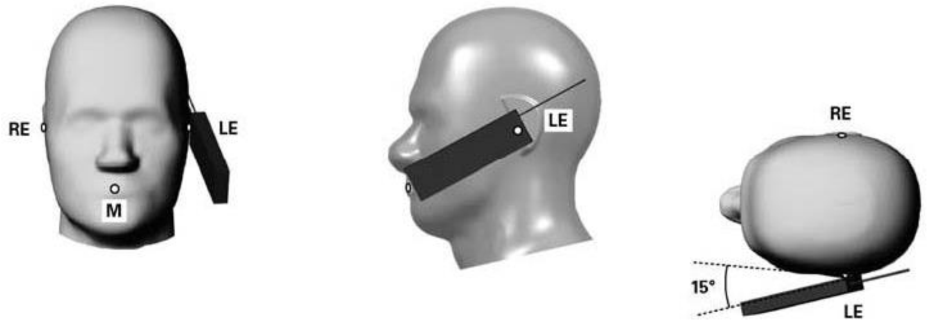



**Fig 8.3 Illustration for Tilted Position**

## 8.4 Body Worn Position

(a) To position the device parallel to the phantom surface with either keypad up or down.
(b) To adjust the device parallel to the flat phantom.
(c) To adjust the distance between the device surface and the flat phantom to 1.5 cm.
(d) To adjust the distance between the device with Holster and the flat phantom to 0cm.

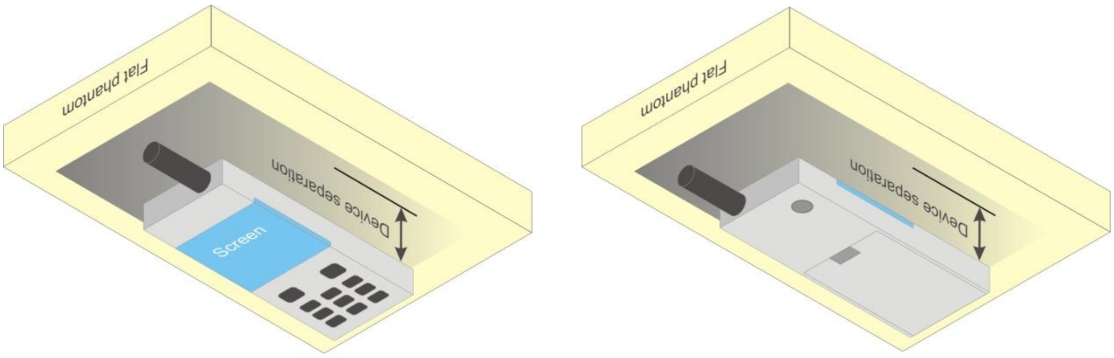



**Fig 8.4 Illustration for Body Worn Position**

## 8.5 Hotspot Position

(a) To position the device parallel to the phantom surface with all sides and either keypad up or down.
(b) To adjust the device parallel to the flat phantom.
(c) To adjust the distance between the device and the flat phantom to 1.0cm.

**<EUT Setup Photos>**

Please refer to Appendix D for the test setup photos.

# 9. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
(b) Read the WWAN RF power level from the base station simulator.
(c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
(d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
(b) Place the EUT in the positions as Appendix D demonstrates.
(c) Set scan area, grid size and other setting on the DASY software.
(d) Measure SAR results for the highest power channel on each testing position.
(e) Find out the largest SAR result on these testing positions of each band
(f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

## 9.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

## 9.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

## 9.3 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. Area scan and zoom scan resolution setting follows KDB 865664 D01v01r02 quoted below.

When the 1-g SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are required for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR.

| | | | $\leq$ 3 GHz | > 3 GHz |
|---|---|---|---|---|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface | | | 5 ± 1 mm | ½·δ·ln(2) ± 0.5 mm |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location | | | 30° ± 1° | 20° ± 1° |
| Maximum area scan spatial resolution: $\Delta x_{Area}$, $\Delta y_{Area}$ | | | $\leq$ 2 GHz: $\leq$ 15 mm<br>2 – 3 GHz: $\leq$ 12 mm | 3 – 4 GHz: $\leq$ 12 mm<br>4 – 6 GHz: $\leq$ 10 mm |
| | | | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device. | |
| Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$, $\Delta y_{Zoom}$ | | | $\leq$ 2 GHz: $\leq$ 8 mm<br>2 – 3 GHz: $\leq$ 5 mm* | 3 – 4 GHz: $\leq$ 5 mm*<br>4 – 6 GHz: $\leq$ 4 mm* |
| Maximum zoom scan spatial resolution, normal to phantom surface | uniform grid: $\Delta z_{Zoom}(n)$ | | $\leq$ 5 mm | 3 – 4 GHz: $\leq$ 4 mm<br>4 – 5 GHz: $\leq$ 3 mm<br>5 – 6 GHz: $\leq$ 2 mm |
| | graded grid | $\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface | $\leq$ 4 mm | 3 – 4 GHz: $\leq$ 3 mm<br>4 – 5 GHz: $\leq$ 2.5 mm<br>5 – 6 GHz: $\leq$ 2 mm |
| | | $\Delta z_{Zoom}(n>1)$: between subsequent points | $\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ | |
| Minimum zoom scan volume | x, y, z | | $\geq$ 30 mm | 3 – 4 GHz: $\geq$ 28 mm<br>4 – 5 GHz: $\geq$ 25 mm<br>5 – 6 GHz: $\geq$ 22 mm |

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

## 9.4 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

## 9.5 SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

## 9.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

# 10. Bluetooth Exclusions Applied

| Mode Band | Average power(dBm) | |
|---|---|---|
| | Bluetooth v3.0+EDR | Bluetooth v4.0+LE |
| 2.4GHz Bluetooth | 3.0 | 2.5 |

**Note:**

1. Per KDB 447498 D01v05r01, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:
   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] ·[$\sqrt{f(GHz)}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison

| Bluetooth Max Power (dBm) | Test Distance (mm) | Frequency (GHz) | exclusion thresholds |
|---|---|---|---|
| 3 | 5 | 2.48 | 0.63 |

2. Per KDB 447498 D01v05r01 exclusion thresholds is 0.63 < 3, RF exposure evaluation is not required.

# 11. Conducted RF Output Power (Unit: dBm)

**<CDMA2000 Conducted Power>**

**Note:**

1. Referring to KDB 941225 D01v02, the data device SAR is tested with Ev-Do Rev 0 (RTAP 153.6kbps). If 1xRTT and Ev-Do Rev A (RETAP 4096 bits) power is less than 1/4dB higher than Re v0, SAR tests with those settings are not necessary.
2. Considering VOIP capability, 1xEv-Do Rev. A SAR was repeated on the worst position of 1xRTT head SAR and body-worn SAR testing.
3. According to KDB 941225 D01v02, Head SAR for RC1+SO55 is not required because the maximum average output power of RC1 is less than 1/4 dB higher than RC3+SO55.
4. Referring to KDB 941225 D01v02, in Hotspot mode EUT is treated as data device and SAR is tested with Ev-Do Rev 0 (RTAP 153.6kbps). If 1xRTT and Ev-Do Rev A(RETAP 4096 bits) power is less than 1/4dB higher than Re v0, SAR tests with those settings are not necessary.

**Hotspot inactive - full power mode**

| Band | CDMA2000 BC0 | | | Tune-up Limit (dBm) | CDMA2000 BC1 | | | Tune-up Limit (dBm) |
|---|---|---|---|---|---|---|---|---|
| TX Channel | 1013 | 384 | 777 | | 25 | 600 | 1175 | |
| Frequency (MHz) | 824.7 | 836.52 | 848.31 | | 1851.25 | 1880 | 1908.75 | |
| 1xRTT RC1 SO55 | 24.38 | 24.43 | 24.35 | 24.50 | 24.42 | 24.42 | 24.46 | 24.50 |
| 1xRTT RC3 SO55 | 24.39 | 24.46 | 24.37 | 24.50 | 24.42 | 24.41 | 24.44 | 24.50 |
| 1xRTT RC3 SO32(+ F-SCH) | 24.39 | 24.44 | 24.37 | 24.50 | 24.46 | 24.47 | 24.47 | 24.50 |
| 1xRTT RC3 SO32(+SCH) | 24.38 | 24.45 | 24.34 | 24.50 | 24.44 | 24.45 | 24.49 | 24.50 |
| 1xEVDO RTAP 153.6Kbps | 24.39 | 24.39 | 24.36 | 24.50 | 24.46 | 24.40 | 24.44 | 24.50 |
| 1xEVDO RETAP 4096Bits | 24.36 | 24.42 | 24.33 | 24.50 | 24.42 | 24.40 | 24.48 | 24.50 |

**Hotspot active - reduced power mode**

| Band | CDMA2000 BC1 | | | Tune-up Limit (dBm) |
|---|---|---|---|---|
| TX Channel | 25 | 600 | 1175 | |
| Frequency (MHz) | 1851.25 | 1880 | 1908.75 | |
| 1xRTT RC1 SO55 | 22.44 | 22.47 | 22.40 | 22.50 |
| 1xRTT RC3 SO55 | 22.38 | 22.36 | 22.35 | 22.50 |
| 1xRTT RC3 SO32(+ F-SCH) | 22.42 | 22.36 | 22.42 | 22.50 |
| 1xRTT RC3 SO32(+SCH) | 22.43 | 22.40 | 22.43 | 22.50 |
| 1xEVDO RTAP 153.6Kbps | 22.44 | 22.44 | 22.46 | 22.50 |
| 1xEVDO RETAP 4096Bits | 22.41 | 22.43 | 22.45 | 22.50 |

## <LTE Conducted Power>

**Note:**

1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r03, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r03, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r03, when reported SAR of 1RB and 50%RB allocation for QPSK ≤0.8W/kg, and 100%RB with QPSK output power is less than 1RB and 50%RB, 100%RB allocation for QPSK is not required.
6. Per KDB 941225 D05v02r03, when reported SAR of 1RB and 50%RB allocation for QPSK >0.8W/kg for any exposure position, SAR testing of 100%RB allocation for QPSK is performed at the highest power channel.
7. 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, 16QAM SAR testing is not required.
8. Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, smaller bandwidth SAR testing is not required.

## <u><LTE Band 13 Conducted Power></u>

| BW [MHz] | Modulation | RB Size | RB Offset | Power Low Ch. / Freq. | Power Middle Ch. / Freq. | Power High Ch. / Freq. | Tune up Limit (dBm) | Target MPR (dB) |
|---|---|---|---|---|---|---|---|---|
| Channel | | | | | 23230 | | | |
| Frequency (MHz) | | | | | 782 | | | |
| 10 | QPSK | 1 | 0 | | 23.94 | | 24.0 | 0 |
| 10 | QPSK | 1 | 24 | | 23.92 | | | |
| 10 | QPSK | 1 | 49 | | 23.97 | | | |
| 10 | QPSK | 25 | 0 | | 22.60 | | 23.0 | 1 |
| 10 | QPSK | 25 | 12 | | 22.67 | | | |
| 10 | QPSK | 25 | 24 | | 22.57 | | | |
| 10 | QPSK | 50 | 0 | | 22.53 | | | |
| 10 | 16QAM | 1 | 0 | | 22.88 | | 23.0 | 1 |
| 10 | 16QAM | 1 | 24 | | 22.91 | | | |
| 10 | 16QAM | 1 | 49 | | 22.96 | | | |
| 10 | 16QAM | 25 | 0 | | 21.51 | | 22.0 | 2 |
| 10 | 16QAM | 25 | 12 | | 21.57 | | | |
| 10 | 16QAM | 25 | 24 | | 21.49 | | | |
| 10 | 16QAM | 50 | 0 | | 21.52 | | | |
| Channel | | | | 23205 | 23230 | 23255 | Tune up Limit (dBm) | Target MPR (dB) |
| Frequency (MHz) | | | | 779.5 | 782 | 784.5 | | |
| 5 | QPSK | 1 | 0 | 23.81 | 23.81 | 23.69 | 24.0 | 0 |
| 5 | QPSK | 1 | 12 | 23.84 | 23.82 | 23.80 | | |
| 5 | QPSK | 1 | 24 | 23.87 | 23.90 | 23.79 | | |
| 5 | QPSK | 12 | 0 | 22.79 | 22.78 | 22.91 | 23.0 | 1 |
| 5 | QPSK | 12 | 6 | 22.77 | 22.71 | 22.84 | | |
| 5 | QPSK | 12 | 11 | 22.74 | 22.79 | 22.73 | | |
| 5 | QPSK | 25 | 0 | 22.63 | 22.61 | 22.67 | | |
| 5 | 16QAM | 1 | 0 | 22.74 | 22.79 | 22.74 | 23.0 | 1 |
| 5 | 16QAM | 1 | 12 | 22.87 | 22.78 | 22.78 | | |
| 5 | 16QAM | 1 | 24 | 22.90 | 22.86 | 22.80 | | |
| 5 | 16QAM | 12 | 0 | 21.71 | 21.78 | 21.87 | 22.0 | 2 |
| 5 | 16QAM | 12 | 6 | 21.79 | 21.82 | 21.79 | | |
| 5 | 16QAM | 12 | 11 | 21.85 | 21.84 | 21.76 | | |
| 5 | 16QAM | 25 | 0 | 21.55 | 21.60 | 21.55 | | |

## <WLAN 2.4GHz Conducted Power>

**Note:**

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion
2. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate
3. Apply the test exclusion rule in KDB 248227 D01 v01r02 11g, 11n-HT20 output power is less than 1/4dB higher than 11b mode, thus the SAR can be excluded.

| Mode | Channel | Frequency (MHz) | Average power (dBm) | | | | Tune-Up Limit |
|---|---|---|---|---|---|---|---|
| | | | Data Rate | | | | |
| | | | 1Mbps | 2Mbps | 5.5Mbps | 11Mbps | |
| 802.11b | CH 1 | 2412 | 19.21 | 19.08 | 19.18 | 18.91 | 19.5 |
| | CH2 | 2417 | 19.25 | 19.07 | 19.15 | 19.19 | 19.5 |
| | CH 6 | 2437 | 19.65 | 19.48 | 19.59 | 19.35 | 20 |
| | CH7 | 2442 | 19.80 | 19.79 | 19.78 | 19.79 | 20 |
| | CH 11 | 2462 | 17.89 | 17.63 | 17.61 | 17.50 | 18 |
| | CH12 | 2467 | 14.26 | 14.23 | 14.23 | 14.18 | 14.5 |
| | CH 13 | 2472 | 9.03 | 8.82 | 8.69 | 8.48 | 10 |

| Mode | Channel | Frequency (MHz) | Average power (dBm) | | | | | | | | Tune-Up Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Data Rate | | | | | | | | |
| | | | 6Mbps | 9Mbps | 12Mbps | 18Mbps | 24Mbps | 36Mbps | 48Mbps | 54Mbps | |
| 802.11g | CH 1 | 2412 | 13.21 | 12.86 | 12.81 | 12.79 | 12.88 | 13.03 | 12.95 | 13.03 | 13.5 |
| | CH2 | 2417 | 15.63 | 15.55 | 15.62 | 15.57 | 15.59 | 15.60 | 15.62 | 15.60 | 16 |
| | CH 6 | 2437 | 17.90 | 17.88 | 17.87 | 17.82 | 17.54 | 17.85 | 17.74 | 17.89 | 18 |
| | CH7 | 2442 | 17.77 | 17.59 | 17.69 | 17.62 | 17.43 | 17.60 | 17.48 | 17.67 | 18 |
| | CH 11 | 2462 | 10.98 | 10.85 | 10.94 | 10.77 | 10.84 | 10.87 | 10.71 | 10.71 | 11 |
| | CH12 | 2467 | 9.72 | 9.57 | 9.64 | 9.63 | 9.70 | 9.67 | 9.70 | 9.68 | 10 |
| | CH 13 | 2472 | 1.10 | 0.09 | 0.22 | 0.35 | 0.44 | 0.51 | 0.43 | 0.61 | 5 |

| Mode | Channel | Frequency (MHz) | Average power (dBm) | | | | | | | | Tune-up Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MCS Index | | | | | | | | |
| | | | MCS0 | MCS1 | MCS2 | MCS3 | MCS4 | MCS5 | MCS6 | MCS7 | |
| 802.11n-HT20 | CH 1 | 2412 | 13.20 | 13.16 | 13.16 | 13.24 | 13.12 | 13.04 | 13.06 | 13.14 | 13.5 |
| | CH2 | 2417 | 15.88 | 15.76 | 15.66 | 15.60 | 15.68 | 15.56 | 15.73 | 15.64 | 16 |
| | CH 6 | 2437 | 16.70 | 16.74 | 16.46 | 16.57 | 16.64 | 16.44 | 16.49 | 16.67 | 17 |
| | CH7 | 2442 | 16.85 | 16.84 | 16.79 | 16.80 | 16.58 | 16.62 | 16.66 | 16.57 | 17 |
| | CH 11 | 2462 | 10.94 | 10.77 | 10.60 | 10.52 | 10.54 | 10.58 | 10.78 | 10.70 | 11 |
| | CH12 | 2467 | 9.69 | 9.42 | 9.51 | 9.53 | 9.46 | 9.60 | 9.67 | 9.62 | 10 |
| | CH 13 | 2472 | 0.12 | 0.10 | 0.10 | 0.11 | 0.07 | 0.10 | 0.08 | 0.09 | 5 |

## <WLAN 5GHz Conducted Power>

**Note:**

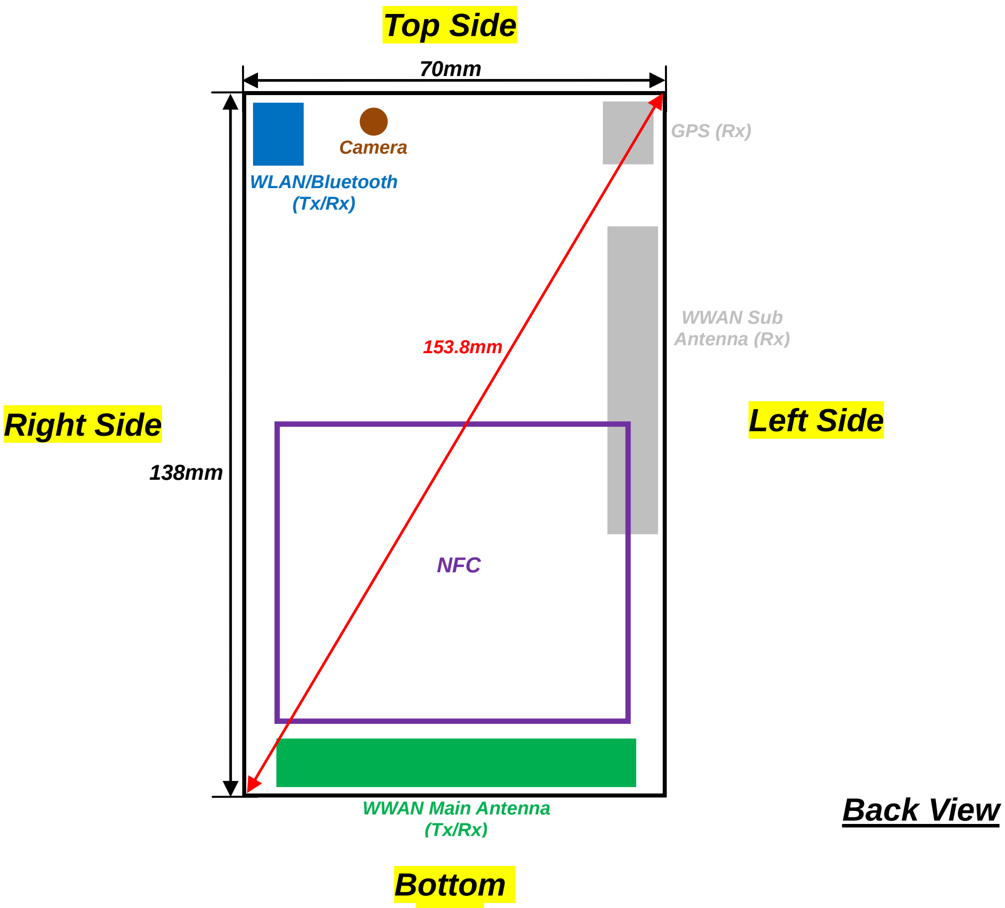
1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion
2. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate.
3. Apply the test exclusion rule in KDB 248227 D01 v01r02, 11n-HT20/HT40 output power is less than 1/4dB higher than 802.11a mode, thus the SAR can be excluded.

| Mode | Channel | Frequency (MHz) | Average Power (dBm) | | | | | | | | Tune-up Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Data Rate | | | | | | | | |
| | | | 6Mbps | 9Mbps | 12Mbps | 18Mbps | 24Mbps | 36Mbps | 48Mbps | 54Mbps | |
| 802.11a | CH 36 | 5180 | 13.08 | 13.03 | 13.03 | 13.07 | 13.07 | 13.07 | 13.04 | 13.03 | 13.5 |
| | CH 40 | 5200 | 16.84 | 16.83 | 16.80 | 16.81 | 16.83 | 16.81 | 16.79 | 16.80 | 17 |
| | CH 44 | 5220 | 16.84 | 16.75 | 16.80 | 16.70 | 16.83 | 16.82 | 16.82 | 16.79 | 17 |
| | CH 48 | 5240 | 16.73 | 16.72 | 16.67 | 16.71 | 16.69 | 16.68 | 16.69 | 16.68 | 17 |
| | CH 52 | 5260 | 16.86 | 16.85 | 16.82 | 16.84 | 16.85 | 16.83 | 16.82 | 16.82 | 17 |
| | CH 56 | 5280 | 16.83 | 16.81 | 16.78 | 16.77 | 16.79 | 16.81 | 16.82 | 16.81 | 17 |
| | CH 60 | 5300 | 16.52 | 16.50 | 16.51 | 16.50 | 16.50 | 16.50 | 16.50 | 16.48 | 17 |
| | CH 64 | 5320 | 13.28 | 13.25 | 13.24 | 13.24 | 13.20 | 13.23 | 13.24 | 13.24 | 13.5 |
| | CH 100 | 5500 | 14.71 | 14.69 | 14.69 | 14.68 | 14.66 | 14.70 | 14.63 | 14.63 | 15 |
| | CH 104 | 5520 | 16.67 | 16.65 | 16.65 | 16.64 | 16.60 | 16.65 | 16.64 | 16.62 | 17 |
| | CH 108 | 5540 | 16.63 | 16.59 | 16.50 | 16.61 | 16.46 | 16.61 | 16.55 | 16.52 | 17 |
| | CH 112 | 5560 | 16.60 | 16.52 | 16.41 | 16.55 | 16.49 | 16.55 | 16.57 | 16.54 | 17 |
| | CH 116 | 5580 | 16.57 | 16.46 | 16.40 | 16.47 | 16.55 | 16.53 | 16.53 | 16.43 | 17 |
| | CH 120 | 5600 | 16.53 | 16.51 | 16.41 | 16.51 | 16.47 | 16.41 | 16.52 | 16.48 | 17 |
| | CH 124 | 5620 | 16.54 | 16.49 | 16.53 | 16.53 | 16.46 | 16.53 | 16.43 | 16.50 | 17 |
| | CH 128 | 5640 | 16.55 | 16.44 | 16.50 | 16.44 | 16.46 | 16.53 | 16.47 | 16.50 | 17 |
| | CH 132 | 5660 | 16.66 | 16.62 | 16.50 | 16.54 | 16.50 | 16.63 | 16.54 | 16.58 | 17 |
| | CH 136 | 5680 | 16.64 | 16.55 | 16.62 | 16.61 | 16.63 | 16.61 | 16.60 | 16.58 | 17 |
| | CH 140 | 5700 | 13.31 | 13.27 | 13.30 | 13.27 | 13.29 | 13.30 | 13.27 | 13.30 | 13.5 |
| | CH 149 | 5745 | 15.13 | 15.01 | 14.91 | 15.10 | 15.09 | 15.12 | 15.03 | 15.11 | 15.5 |
| | CH 153 | 5765 | 16.82 | 16.67 | 16.65 | 16.68 | 16.69 | 16.70 | 16.66 | 16.70 | 17 |
| | CH 157 | 5785 | 16.71 | 16.67 | 16.65 | 16.68 | 16.69 | 16.70 | 16.66 | 16.70 | 17 |
| | CH 161 | 5805 | 16.70 | 16.61 | 16.59 | 16.62 | 16.63 | 16.64 | 16.60 | 16.64 | 17 |
| | CH 165 | 5825 | 15.02 | 15.11 | 15.04 | 15.19 | 15.11 | 15.22 | 15.14 | 15.30 | 15.5 |

| Mode | Channel | Frequency (MHz) | Average Power (dBm) | | | | | | | | Tune-up Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MCS Index | | | | | | | | |
| | | | MCS0 | MCS1 | MCS2 | MCS3 | MCS4 | MCS5 | MCS6 | MCS7 | |
| 802.11n-HT20 | CH 36 | 5180 | 13.14 | 13.13 | 13.12 | 13.11 | 13.09 | 13.13 | 13.08 | 13.11 | 13.5 |
| | CH 40 | 5200 | 15.38 | 15.35 | 15.33 | 15.27 | 15.29 | 15.33 | 15.28 | 15.37 | 16 |
| | CH 44 | 5220 | 15.49 | 15.45 | 15.44 | 15.41 | 15.42 | 15.40 | 15.40 | 15.43 | 16 |
| | CH 48 | 5240 | 15.55 | 15.49 | 15.43 | 15.43 | 15.47 | 15.51 | 15.51 | 15.46 | 16 |
| | CH 52 | 5260 | 15.60 | 15.58 | 15.52 | 15.57 | 15.53 | 15.55 | 15.58 | 15.54 | 16 |
| | CH 56 | 5280 | 15.46 | 15.45 | 15.39 | 15.44 | 15.40 | 15.39 | 15.28 | 15.36 | 16 |
| | CH 60 | 5300 | 15.73 | 15.69 | 15.70 | 15.72 | 15.70 | 15.69 | 15.68 | 15.70 | 16 |
| | CH 64 | 5320 | 13.40 | 13.36 | 13.29 | 13.36 | 13.38 | 13.39 | 13.28 | 13.33 | 13.5 |
| | CH 100 | 5500 | 14.78 | 14.74 | 14.76 | 14.77 | 14.76 | 14.71 | 14.77 | 14.68 | 15 |
| | CH 104 | 5520 | 15.51 | 15.25 | 15.22 | 15.11 | 15.32 | 15.39 | 15.30 | 15.36 | 16 |
| | CH 108 | 5540 | 15.58 | 15.55 | 15.39 | 15.37 | 15.49 | 15.43 | 15.48 | 15.56 | 16 |
| | CH 112 | 5560 | 15.46 | 15.45 | 15.40 | 14.35 | 14.39 | 14.40 | 14.38 | 14.36 | 16 |
| | CH 116 | 5580 | 15.55 | 15.52 | 15.47 | 15.51 | 15.43 | 15.53 | 15.48 | 15.50 | 16 |
| | CH 120 | 5600 | 15.54 | 15.52 | 15.39 | 15.35 | 15.49 | 15.41 | 15.28 | 15.47 | 16 |
| | CH 124 | 5620 | 15.47 | 15.45 | 15.40 | 15.44 | 15.39 | 15.41 | 15.28 | 15.37 | 16 |
| | CH 128 | 5640 | 15.56 | 15.48 | 15.50 | 15.48 | 14.47 | 14.53 | 14.48 | 14.55 | 16 |
| | CH 132 | 5660 | 15.60 | 15.57 | 15.59 | 15.58 | 15.59 | 15.59 | 15.28 | 15.37 | 16 |
| | CH 136 | 5680 | 15.63 | 15.59 | 15.59 | 15.58 | 15.59 | 15.59 | 15.50 | 15.56 | 16 |
| | CH 140 | 5700 | 13.37 | 13.31 | 13.33 | 13.36 | 13.33 | 13.30 | 13.31 | 13.36 | 13.5 |
| | CH 149 | 5745 | 15.46 | 15.42 | 15.44 | 15.43 | 15.43 | 15.43 | 15.44 | 15.32 | 15.5 |
| | CH 153 | 5765 | 15.69 | 15.26 | 15.43 | 15.40 | 15.61 | 15.47 | 15.10 | 15.17 | 16 |
| | CH 157 | 5785 | 15.63 | 15.58 | 15.54 | 15.58 | 15.60 | 15.62 | 15.60 | 15.61 | 16 |
| | CH 161 | 5805 | 15.54 | 15.20 | 15.37 | 15.34 | 15.55 | 15.41 | 15.04 | 15.11 | 16 |
| | CH 165 | 5825 | 15.18 | 15.14 | 15.08 | 15.16 | 15.08 | 15.18 | 15.17 | 15.15 | 15.5 |

| Mode | Channel | Frequency (MHz) | Average Power (dBm) | | | | | | | | Tune-up Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MCS Index | | | | | | | | |
| | | | MCS0 | MCS1 | MCS2 | MCS3 | MCS4 | MCS5 | MCS6 | MCS7 | |
| 802.11n-HT40 | CH 38 | 5190 | 11.80 | 11.74 | 11.57 | 11.57 | 11.56 | 11.58 | 11.67 | 11.70 | 12 |
| | CH 46 | 5230 | 14.71 | 14.62 | 14.69 | 14.69 | 14.68 | 14.65 | 14.60 | 14.68 | 15 |
| | CH 54 | 5270 | 14.82 | 14.74 | 14.78 | 14.80 | 14.75 | 14.81 | 14.81 | 14.76 | 15 |
| | CH 62 | 5310 | 11.17 | 11.05 | 11.09 | 11.02 | 11.12 | 11.16 | 11.16 | 11.06 | 11.5 |
| | CH 102 | 5510 | 10.46 | 10.44 | 10.38 | 10.37 | 10.44 | 10.42 | 10.36 | 10.36 | 10.5 |
| | CH 110 | 5550 | 14.83 | 14.81 | 14.69 | 14.74 | 14.75 | 14.82 | 14.71 | 14.77 | 15 |
| | CH 118 | 5590 | 14.46 | 14.34 | 14.41 | 14.39 | 14.44 | 14.33 | 14.16 | 14.16 | 15 |
| | CH 126 | 5630 | 14.75 | 14.74 | 14.74 | 14.73 | 14.7 | 14.71 | 14.69 | 14.68 | 15 |
| | CH 134 | 5670 | 13.96 | 13.94 | 13.91 | 13.94 | 13.91 | 13.86 | 13.93 | 13.87 | 14.5 |
| | CH 151 | 5755 | 13.89 | 13.80 | 13.85 | 13.82 | 13.87 | 13.88 | 13.87 | 13.81 | 14.5 |
| | CH 159 | 5795 | 13.98 | 13.97 | 13.97 | 13.92 | 13.97 | 13.97 | 13.96 | 13.97 | 14.5 |

# 12. Antenna Location




| Distance of the Antenna to the EUT surface/edge | | | | | | |
|---|---|---|---|---|---|---|
| Antennas | Back | Front | Top Side | Bottom Side | Right Side | Left Side |
| WWAN Main | ≤ 25mm | ≤ 25mm | 119mm | ≤ 25mm | ≤ 25mm | ≤ 25mm |
| BT&WLAN | ≤ 25mm | ≤ 25mm | ≤ 25mm | 126mm | ≤ 25mm | 53mm |

| Positions for SAR tests; Hotspot mode | | | | | | |
|---|---|---|---|---|---|---|
| Antennas | Back | Front | Top Side | Bottom Side | Right Side | Left Side |
| WWAN Main | Yes | Yes | No | Yes | Yes | Yes |
| BT&WLAN | Yes | Yes | Yes | No | Yes | No |

**Note:**

1. Referring to KDB 941225 D06 v01r01, when the overall device length and width are ≥ 9cm*5cm, the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge

# 13. SAR Test Results

**Note:**

1. Per KDB 447498 D01v05r01, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   d. For WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 648474 D04v01r02, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.
3. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
4. According to reduction plan to perform SAR testing, related SAR test procedures refer to “reduction plan”

## 13.1 Head SAR

### <CDMA SAR>

| Plot No. | Band | Mode | Test Position | Battery | Scanner | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CDMA BC0 | 1xRTT RC3 SO55 | Right Cheek | Battery1 | With Scanner | 384 | 836.52 | 24.46 | 24.5 | 1.009 | -0.032 | 0.705 | 0.712 |
| 3 | CDMA BC0 | 1xRTT RC3 SO55 | Right Tilted | Battery1 | With Scanner | 384 | 836.52 | 24.46 | 24.5 | 1.009 | 0.005 | 0.542 | 0.547 |
| 4 | CDMA BC0 | 1xRTT RC3 SO55 | Left Cheek | Battery1 | With Scanner | 384 | 836.52 | 24.46 | 24.5 | 1.009 | -0.031 | 0.691 | 0.697 |
| 5 | CDMA BC0 | 1xRTT RC3 SO55 | Left Tilted | Battery1 | With Scanner | 384 | 836.52 | 24.46 | 24.5 | 1.009 | -0.08 | 0.457 | 0.461 |
| 6 | CDMA BC0 | RETAP 4096 bits | Right Cheek | Battery1 | With Scanner | 384 | 836.52 | 24.42 | 24.5 | 1.019 | -0.01 | 0.666 | 0.678 |
| 7 | CDMA BC0 | 1xRTT RC3 SO55 | Right Cheek | Battery2 | With Scanner | 384 | 836.52 | 24.46 | 24.5 | 1.009 | -0.057 | 0.650 | 0.656 |
| 8 | CDMA BC0 | 1xRTT RC3 SO55 | Right Cheek | Battery1 | Without Scanner | 384 | 836.52 | 24.46 | 24.5 | 1.009 | 0.11 | 0.685 | 0.691 |
| 9 | CDMA BC0 | 1xRTT RC3 SO55 | Right Cheek | Battery1 | With Scanner | 1013 | 824.7 | 24.39 | 24.5 | 1.026 | 0.015 | 0.552 | 0.566 |
| 10 | CDMA BC0 | 1xRTT RC3 SO55 | Right Cheek | Battery1 | With Scanner | 777 | 848.31 | 24.37 | 24.5 | 1.030 | 0.043 | 0.517 | 0.533 |
| 2 | CDMA BC1 | 1xRTT RC3 SO55 | Right Cheek | Battery1 | With Scanner | 1175 | 1908.75 | 24.44 | 24.5 | 1.014 | -0.062 | 0.428 | 0.434 |
| 11 | CDMA BC1 | 1xRTT RC3 SO55 | Right Cheek | Battery1 | With Scanner | 25 | 1851.25 | 24.42 | 24.5 | 1.019 | 0.038 | 0.371 | 0.378 |
| 12 | CDMA BC1 | 1xRTT RC3 SO55 | Right Cheek | Battery1 | With Scanner | 600 | 1880 | 24.41 | 24.5 | 1.021 | -0.022 | 0.389 | 0.397 |

## <LTE SAR>

| Plot No. | Band | BW (MHz) | Modulation | RB Size | RB offset | Test Position | Battery | Scanner | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | LTE Band 13 | 10M | QPSK | 1 | 49 | Right Cheek | Battery1 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | -0.044 | 0.497 | 0.500 |
| 14 | LTE Band 13 | 10M | QPSK | 1 | 49 | Right Tilted | Battery1 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | -0.09 | 0.299 | 0.301 |
| 15 | LTE Band 13 | 10M | QPSK | 1 | 49 | Left Cheek | Battery1 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | -0.04 | 0.474 | 0.477 |
| 16 | LTE Band 13 | 10M | QPSK | 1 | 49 | Left Tilted | Battery1 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | 0.057 | 0.289 | 0.291 |
| 17 | LTE Band 13 | 10M | QPSK | 1 | 49 | Right Cheek | Battery2 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | -0.073 | 0.483 | 0.486 |
| 18 | LTE Band 13 | 10M | QPSK | 1 | 49 | Right Cheek | Battery1 | Without Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | 0.064 | 0.485 | 0.488 |
| 19 | LTE Band 13 | 10M | QPSK | 25 | 12 | Right Cheek | Battery1 | With Scanner | 23230 | 782 | 22.67 | 23 | 1.079 | -0.045 | 0.317 | 0.342 |

## <WLAN SAR DTS>

| Plot No. | Band | Mode | Test Position | Battery | Scanner | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | WLAN2.4GHz | 802.11b 1Mbps | Right Cheek | Battery1 | With Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | 0.02 | 0.664 | 0.741 |
| 22 | WLAN2.4GHz | 802.11b 1Mbps | Right Tilted | Battery1 | With Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | 0.006 | 0.694 | 0.775 |
| 23 | WLAN2.4GHz | 802.11b 1Mbps | Left Cheek | Battery1 | With Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | 0.038 | 0.513 | 0.573 |
| 24 | WLAN2.4GHz | 802.11b 1Mbps | Left Tilted | Battery1 | With Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | 0.111 | 0.538 | 0.601 |
| 25 | WLAN2.4GHz | 802.11b 1Mbps | Right Tilted | Battery2 | With Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | -0.025 | 0.624 | 0.697 |
| 26 | WLAN2.4GHz | 802.11b 1Mbps | Right Tilted | Battery1 | Without Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | -0.01 | 0.621 | 0.693 |
| 27 | WLAN2.4GHz | 802.11b 1Mbps | Right Tilted | Battery1 | With Scanner | 1 | 2412 | 19.21 | 19.5 | 1.070 | 97.16 | 1.029 | 0.071 | 0.561 | 0.618 |
| 28 | WLAN2.4GHz | 802.11b 1Mbps | Right Tilted | Battery1 | With Scanner | 11 | 2462 | 17.89 | 18 | 1.027 | 97.16 | 1.029 | -0.06 | 0.649 | 0.686 |
| 32 | WLAN5GHz | 802.11a 6Mbps | Right Cheek | Battery1 | With Scanner | 153 | 5765 | 16.82 | 17 | 1.042 | 87.26 | 1.146 | 0.058 | 0.181 | 0.216 |
| 45 | WLAN5GHz | 802.11a 6Mbps | Left Cheek | Battery1 | With Scanner | 153 | 5765 | 16.82 | 17 | 1.042 | 87.26 | 1.146 | 0.116 | 0.498 | 0.595 |
| 46 | WLAN5GHz | 802.11a 6Mbps | Left Cheek | Battery1 | With Scanner | 157 | 5785 | 16.71 | 17 | 1.069 | 87.26 | 1.146 | 0.115 | 0.410 | 0.502 |
| 47 | WLAN5GHz | 802.11a 6Mbps | Left Cheek | Battery1 | With Scanner | 161 | 5805 | 16.7 | 17 | 1.072 | 87.26 | 1.146 | 0.141 | 0.457 | 0.561 |

## <WLAN SAR NII>

| Plot No. | Band | Mode | Test Position | Battery | Scanner | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | WLAN5GHz | 802.11a 6Mbps | Right Cheek | Battery1 | With Scanner | 40 | 5200 | 16.84 | 17 | 1.037 | 87.26 | 1.146 | -0.113 | 0.308 | 0.366 |
| 33 | WLAN5GHz | 802.11a 6Mbps | Right Tilted | Battery1 | With Scanner | 40 | 5200 | 16.84 | 17 | 1.037 | 87.26 | 1.146 | -0.008 | 0.293 | 0.348 |
| 34 | WLAN5GHz | 802.11a 6Mbps | Left Cheek | Battery1 | With Scanner | 40 | 5200 | 16.84 | 17 | 1.037 | 87.26 | 1.146 | 0.121 | 0.401 | 0.477 |
| 35 | WLAN5GHz | 802.11a 6Mbps | Left Tilted | Battery1 | With Scanner | 40 | 5200 | 16.84 | 17 | 1.037 | 87.26 | 1.146 | 0.083 | 0.330 | 0.392 |
| 36 | WLAN5GHz | 802.11a 6Mbps | Left Cheek | Battery2 | With Scanner | 40 | 5200 | 16.84 | 17 | 1.037 | 87.26 | 1.146 | -0.105 | 0.385 | 0.458 |
| 37 | WLAN5GHz | 802.11a 6Mbps | Left Cheek | Battery1 | Without Scanner | 40 | 5200 | 16.84 | 17 | 1.037 | 87.26 | 1.146 | 0.001 | 0.328 | 0.390 |
| 38 | WLAN5GHz | 802.11a 6Mbps | Left Cheek | Battery1 | With Scanner | 44 | 5220 | 16.84 | 17 | 1.037 | 87.26 | 1.146 | 0.152 | 0.452 | 0.537 |
| 30 | WLAN5GHz | 802.11a 6Mbps | Right Cheek | Battery1 | With Scanner | 52 | 5260 | 16.86 | 17 | 1.032 | 87.26 | 1.146 | -0.042 | 0.279 | 0.330 |
| 39 | WLAN5GHz | 802.11a 6Mbps | Left Cheek | Battery1 | With Scanner | 52 | 5260 | 16.86 | 17 | 1.032 | 87.26 | 1.146 | -0.013 | 0.532 | 0.629 |
| 40 | WLAN5GHz | 802.11a 6Mbps | Left Cheek | Battery1 | With Scanner | 60 | 5300 | 16.52 | 17 | 1.116 | 87.26 | 1.146 | 0.072 | 0.395 | 0.505 |
| 31 | WLAN5GHz | 802.11a 6Mbps | Right Cheek | Battery1 | With Scanner | 104 | 5520 | 16.67 | 17 | 1.078 | 87.26 | 1.146 | 0.108 | 0.170 | 0.210 |
| 41 | WLAN5GHz | 802.11a 6Mbps | Left Cheek | Battery1 | With Scanner | 104 | 5520 | 16.67 | 17 | 1.078 | 87.26 | 1.146 | 0.048 | 0.559 | 0.691 |
| 42 | WLAN5GHz | 802.11a 6Mbps | Left Cheek | Battery1 | With Scanner | 112 | 5560 | 16.60 | 17 | 1.096 | 87.26 | 1.146 | 0.031 | 0.553 | 0.695 |
| 43 | WLAN5GHz | 802.11a 6Mbps | Left Cheek | Battery1 | With Scanner | 128 | 5640 | 16.55 | 17 | 1.109 | 87.26 | 1.146 | 0.069 | 0.430 | 0.546 |
| 44 | WLAN5GHz | 802.11a 6Mbps | Left Cheek | Battery1 | With Scanner | 136 | 5680 | 16.64 | 17 | 1.086 | 87.26 | 1.146 | 0.119 | 0.541 | 0.673 |

## 13.2 Hotspot SAR

| Distance of the Antenna to the EUT surface/edge | | | | | | |
|---|---|---|---|---|---|---|
| Antennas | Back | Front | Top Side | Bottom Side | Right Side | Left Side |
| WWAN Main | ≤ 25mm | ≤ 25mm | 119mm | ≤ 25mm | ≤ 25mm | ≤ 25mm |
| BT&WLAN | ≤ 25mm | ≤ 25mm | ≤ 25mm | 126mm | ≤ 25mm | 53mm |

| Positions for SAR tests; Hotspot mode | | | | | | |
|---|---|---|---|---|---|---|
| Antennas | Back | Front | Top Side | Bottom Side | Right Side | Left Side |
| WWAN Main | Yes | Yes | No | Yes | Yes | Yes |
| BT&WLAN | Yes | Yes | Yes | No | Yes | No |

**Note:**

1. Referring to KDB 941225 D06 v01r01, when the overall device length and width are ≥ 9cm*5cm, the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge

### <CDMA SAR>

| Plot No. | Band | Mode | Test Position | Gap (cm) | Battery | Scanner | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48 | CDMA BC0 | RTAP 153.6Kbps | Back | 1cm | Battery1 | With Scanner | 384 | 836.52 | 24.39 | 24.5 | 1.026 | -0.125 | 1.140 | 1.169 |
| 59 | CDMA BC0 | RTAP 153.6Kbps | Back | 1cm | Battery1 | With Scanner | 1013 | 824.7 | 24.39 | 24.5 | 1.026 | 0.05 | 0.971 | 0.996 |
| 60 | CDMA BC0 | RTAP 153.6Kbps | Back | 1cm | Battery1 | With Scanner | 777 | 848.31 | 24.36 | 24.5 | 1.033 | -0.022 | 0.788 | 0.814 |
| 50 | CDMA BC1 | RTAP 153.6Kbps | Front | 1cm | Battery1 | With Scanner | 1175 | 1908.75 | 22.46 | 22.5 | 1.009 | 0.061 | 0.704 | 0.711 |
| 49 | CDMA BC1 | RTAP 153.6Kbps | Back | 1cm | Battery1 | With Scanner | 1175 | 1908.75 | 22.46 | 22.5 | 1.009 | 0.102 | 1.320 | 1.332 |
| 51 | CDMA BC1 | RTAP 153.6Kbps | Right Side | 1cm | Battery1 | With Scanner | 1175 | 1908.75 | 22.46 | 22.5 | 1.009 | 0.122 | 0.200 | 0.202 |
| 52 | CDMA BC1 | RTAP 153.6Kbps | Left Side | 1cm | Battery1 | With Scanner | 1175 | 1908.75 | 22.46 | 22.5 | 1.009 | 0.101 | 0.080 | 0.081 |
| 53 | CDMA BC1 | RTAP 153.6Kbps | Bottom Side | 1cm | Battery1 | With Scanner | 1175 | 1908.75 | 22.46 | 22.5 | 1.009 | 0.011 | 1.300 | 1.312 |
| 55 | CDMA BC1 | RTAP 153.6Kbps | Back | 1cm | Battery2 | With Scanner | 1175 | 1908.75 | 22.46 | 22.5 | 1.009 | -0.011 | 0.704 | 0.711 |
| 56 | CDMA BC1 | RTAP 153.6Kbps | Back | 1cm | Battery1 | Without Scanner | 1175 | 1908.75 | 22.46 | 22.5 | 1.009 | -0.102 | 1.300 | 1.312 |
| 57 | CDMA BC1 | RTAP 153.6Kbps | Back | 1cm | Battery1 | With Scanner | 25 | 1851.25 | 22.44 | 22.5 | 1.014 | 0.109 | 1.260 | 1.278 |
| 58 | CDMA BC1 | RTAP 153.6Kbps | Back | 1cm | Battery1 | With Scanner | 600 | 1880 | 22.44 | 22.5 | 1.014 | -0.165 | 1.260 | 1.278 |

### <LTE SAR>

| Plot No. | Band | BW (MHz) | Modulation | RB Size | RB offset | Test Position | Gap (cm) | Battery | Scanner | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 73 | LTE Band 13 | 10M | QPSK | 1 | 49 | Front | 1cm | Battery1 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | 0.014 | 0.710 | 0.715 |
| 72 | LTE Band 13 | 10M | QPSK | 1 | 49 | Back | 1cm | Battery1 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | -0.034 | 1.000 | 1.007 |
| 74 | LTE Band 13 | 10M | QPSK | 1 | 49 | Right Side | 1cm | Battery1 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | -0.028 | 0.673 | 0.678 |
| 75 | LTE Band 13 | 10M | QPSK | 1 | 49 | Left Side | 1cm | Battery1 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | 0.04 | 0.636 | 0.640 |
| 77 | LTE Band 13 | 10M | QPSK | 1 | 49 | Bottom Side | 1cm | Battery1 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | 0.042 | 0.082 | 0.083 |
| 78 | LTE Band 13 | 10M | QPSK | 1 | 49 | Back | 1cm | Battery2 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | -0.039 | 0.758 | 0.763 |
| 79 | LTE Band 13 | 10M | QPSK | 1 | 49 | Back | 1cm | Battery1 | Without Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | 0.01 | 0.981 | 0.988 |
| 80 | LTE Band 13 | 10M | QPSK | 25 | 12 | Back | 1cm | Battery1 | With Scanner | 23230 | 782 | 22.67 | 23 | 1.079 | 0.018 | 0.719 | 0.776 |
| 81 | LTE Band 13 | 10M | QPSK | 50 | 0 | Back | 1cm | Battery1 | With Scanner | 23230 | 782 | 22.53 | 23 | 1.114 | -0.039 | 0.678 | 0.755 |

## <WLAN SAR DTS>

| Plot No. | Band | Mode | Test Position | Gap (cm) | Battery | Scanner | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 87 | WLAN2.4GHz | 802.11b 1Mbps | Front | 1cm | Battery1 | With Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | -0.111 | 0.257 | 0.287 |
| 88 | WLAN2.4GHz | 802.11b 1Mbps | Back | 1cm | Battery1 | With Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | -0.034 | 0.334 | 0.373 |
| 89 | WLAN2.4GHz | 802.11b 1Mbps | Right Side | 1cm | Battery1 | With Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | -0.078 | 0.249 | 0.278 |
| 92 | WLAN2.4GHz | 802.11b 1Mbps | Top Side | 1cm | Battery1 | With Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | -0.014 | 0.219 | 0.245 |
| 93 | WLAN2.4GHz | 802.11b 1Mbps | Back | 1cm | Battery2 | With Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | -0.013 | 0.198 | 0.221 |
| 94 | WLAN2.4GHz | 802.11b 1Mbps | Back | 1cm | Battery1 | Without Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | -0.127 | 0.289 | 0.323 |
| 95 | WLAN2.4GHz | 802.11b 1Mbps | Back | 1cm | Battery1 | With Scanner | 1 | 2412 | 19.21 | 19.5 | 1.070 | 97.16 | 1.029 | -0.129 | 0.300 | 0.330 |
| 96 | WLAN2.4GHz | 802.11b 1Mbps | Back | 1cm | Battery1 | With Scanner | 11 | 2462 | 17.89 | 18 | 1.027 | 97.16 | 1.029 | -0.059 | 0.316 | 0.334 |

# 13.3 Body Worn SAR

## <CDMA SAR>

| Plot No. | Band | Mode | Test Position | Gap (cm) | Headset | Holster | Battery | Scanner | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 61 | CDMA BC0 | 1xRTT RC3 SO32 | Back | 1.5cm | | | Battery1 | With Scanner | 384 | 836.52 | 24.44 | 24.5 | 1.014 | 0.011 | 0.976 | 0.990 |
| 70 | CDMA BC0 | 1xRTT RC3 SO32 | Back | 1.5cm | | | Battery1 | With Scanner | 1013 | 824.7 | 24.39 | 24.5 | 1.026 | 0.011 | 0.837 | 0.858 |
| 71 | CDMA BC0 | 1xRTT RC3 SO32 | Back | 1.5cm | | | Battery1 | With Scanner | 777 | 848.31 | 24.37 | 24.5 | 1.030 | -0.058 | 0.673 | 0.693 |
| 62 | CDMA BC1 | 1xRTT RC3 SO32 | Back | 1.5cm | | | Battery1 | With Scanner | 1175 | 1908.75 | 24.47 | 24.5 | 1.007 | -0.027 | 1.330 | 1.339 |
| 63 | CDMA BC1 | RETAP 4096 bits | Back | 1.5cm | | | Battery1 | With Scanner | 1175 | 1908.75 | 24.48 | 24.5 | 1.005 | 0.013 | 1.230 | 1.236 |
| 64 | CDMA BC1 | 1xRTT RC3 SO32 | Back | 0cm | | Holster | Battery1 | With Scanner | 1175 | 1908.75 | 24.47 | 24.5 | 1.007 | 0.09 | 0.836 | 0.842 |
| 65 | CDMA BC1 | 1xRTT RC3 SO32 | Back | 1.5cm | Headset | | Battery1 | With Scanner | 1175 | 1908.75 | 24.47 | 24.5 | 1.007 | 0.016 | 1.290 | 1.299 |
| 66 | CDMA BC1 | 1xRTT RC3 SO32 | Back | 1.5cm | Headset | | Battery1 | With Scanner | 25 | 1851.25 | 24.46 | 24.5 | 1.009 | -0.025 | 1.070 | 1.080 |
| 67 | CDMA BC1 | 1xRTT RC3 SO32 | Back | 1.5cm | Headset | | Battery1 | With Scanner | 600 | 1880 | 24.47 | 24.5 | 1.007 | -0.011 | 1.180 | 1.188 |
| 68 | CDMA BC1 | 1xRTT RC3 SO32 | Back | 1.5cm | | | Battery1 | With Scanner | 25 | 1851.25 | 24.46 | 24.5 | 1.009 | -0.004 | 0.941 | 0.950 |
| 69 | CDMA BC1 | 1xRTT RC3 SO32 | Back | 1.5cm | | | Battery1 | With Scanner | 600 | 1880 | 24.47 | 24.5 | 1.007 | 0.137 | 1.010 | 1.017 |

## <LTE SAR>

| Plot No. | Band | BW (MHz) | Modulation | RB Size | RB offset | Test Position | Gap (cm) | Holster | Battery | Scanner | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 83 | LTE Band 13 | 10M | QPSK | 1 | 49 | Back | 1.5cm | | Battery1 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | -0.008 | 0.779 | 0.784 |
| 84 | LTE Band 13 | 10M | QPSK | 1 | 49 | Back | 0cm | Holster | Battery1 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | -0.153 | 0.738 | 0.743 |
| 86 | LTE Band 13 | 10M | QPSK | 25 | 12 | Back | 1.5cm | | Battery1 | With Scanner | 23230 | 782 | 22.67 | 23 | 1.079 | 0.081 | 0.547 | 0.590 |

## <WLAN SAR DTS>

| Plot No. | Band | Mode | Test Position | Gap (cm) | Holster | Battery | Scanner | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 97 | WLAN2.4GHz | 802.11b 1Mbps | Back | 1.5cm | | Battery1 | With Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | -0.047 | 0.183 | 0.204 |
| 98 | WLAN2.4GHz | 802.11b 1Mbps | Back | 0cm | Holster | Battery1 | With Scanner | 6 | 2437 | 19.65 | 20 | 1.085 | 97.16 | 1.029 | -0.085 | 0.167 | 0.186 |
| 100 | WLAN2.4GHz | 802.11b 1Mbps | Back | 1.5cm | | Battery1 | With Scanner | 1 | 2412 | 19.21 | 19.5 | 1.070 | 97.16 | 1.029 | -0.018 | 0.171 | 0.188 |
| 101 | WLAN2.4GHz | 802.11b 1Mbps | Back | 1.5cm | | Battery1 | With Scanner | 11 | 2462 | 17.89 | 18 | 1.027 | 97.16 | 1.029 | 0.014 | 0.208 | 0.220 |
| 105 | WLAN5GHz | 802.11a 6Mbps | Back | 1.5cm | | Battery1 | With Scanner | 153 | 5765 | 16.82 | 17 | 1.042 | 87.26 | 1.146 | -0.196 | 0.098 | 0.117 |
| 115 | WLAN5GHz | 802.11a 6Mbps | Back | 1.5cm | | Battery1 | With Scanner | 157 | 5785 | 16.711848 | 17 | 1.069 | 87.26 | 1.146 | 0 | 0.101 | 0.124 |
| 116 | WLAN5GHz | 802.11a 6Mbps | Back | 1.5cm | | Battery1 | With Scanner | 161 | 5805 | 16.7 | 17 | 1.072 | 87.26 | 1.146 | 0 | 0.085 | 0.104 |

**<WLAN SAR NII>**

| Plot No. | Band | Mode | Test Position | Gap (cm) | Holster | Battery | Scanner | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 106 | WLAN5GHz | 802.11a 6Mbps | Front | 1.5cm | | Battery1 | With Scanner | 40 | 5200 | 16.84 | 17 | 1.037 | 87.26 | 1.146 | 0.025 | 0.035 | 0.042 |
| 102 | WLAN5GHz | 802.11a 6Mbps | Back | 1.5cm | | Battery1 | With Scanner | 40 | 5200 | 16.84 | 17 | 1.037 | 87.26 | 1.146 | -0.103 | 0.366 | 0.435 |
| 107 | WLAN5GHz | 802.11a 6Mbps | Back | 1.5cm | | Battery2 | With Scanner | 40 | 5200 | 16.84 | 17 | 1.037 | 87.26 | 1.146 | 0.051 | 0.307 | 0.365 |
| 108 | WLAN5GHz | 802.11a 6Mbps | Back | 1.5cm | | Battery1 | Without Scanner | 40 | 5200 | 16.84 | 17 | 1.037 | 87.26 | 1.146 | -0.019 | 0.324 | 0.385 |
| 109 | WLAN5GHz | 802.11a 6Mbps | Back | 0cm | Holster | Battery1 | With Scanner | 40 | 5200 | 16.84 | 17 | 1.037 | 87.26 | 1.146 | -0.002 | 0.225 | 0.267 |
| 110 | WLAN5GHz | 802.11a 6Mbps | Back | 1.5cm | | Battery1 | With Scanner | 44 | 5220 | 16.84 | 17 | 1.037 | 87.26 | 1.146 | -0.011 | 0.411 | 0.488 |
| 103 | WLAN5GHz | 802.11a 6Mbps | Back | 1.5cm | | Battery1 | With Scanner | 52 | 5260 | 16.86 | 17 | 1.032 | 87.26 | 1.146 | -0.018 | 0.333 | 0.394 |
| 111 | WLAN5GHz | 802.11a 6Mbps | Back | 1.5cm | | Battery1 | With Scanner | 60 | 5300 | 16.52 | 17 | 1.116 | 87.26 | 1.146 | -0.025 | 0.444 | 0.568 |
| 104 | WLAN5GHz | 802.11a 6Mbps | Back | 1.5cm | | Battery1 | With Scanner | 104 | 5520 | 16.67 | 17 | 1.078 | 87.26 | 1.146 | 0.015 | 0.212 | 0.262 |
| 112 | WLAN5GHz | 802.11a 6Mbps | Back | 1.5cm | | Battery1 | With Scanner | 112 | 5560 | 16.60 | 17 | 1.096 | 87.26 | 1.146 | -0.048 | 0.269 | 0.338 |
| 113 | WLAN5GHz | 802.11a 6Mbps | Back | 1.5cm | | Battery1 | With Scanner | 128 | 5640 | 16.55 | 17 | 1.109 | 87.26 | 1.146 | -0.016 | 0.182 | 0.231 |
| 114 | WLAN5GHz | 802.11a 6Mbps | Back | 1.5cm | | Battery1 | With Scanner | 136 | 5680 | 16.64 | 17 | 1.086 | 87.26 | 1.146 | 0.17 | 0.169 | 0.210 |

## 13.4 Repeated SAR Measurement

| Plot No. | Band | BW (MHz) | Modulation | RB Size | RB offset | Mode | Test Position | Gap (cm) | Battery | Scanner | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Ratio | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48 | CDMA BC0 | | | | | RTAP 153.6Kbps | Back | 1cm | Battery1 | With Scanner | 384 | 836.52 | 24.39 | 24.5 | 1.026 | -0.125 | 1.140 | - | 1.169 |
| 117 | CDMA BC0 | | | | | RTAP 153.6Kbps | Back | 1cm | Battery1 | With Scanner | 384 | 836.52 | 24.39 | 24.5 | 1.026 | 0.02 | 1.120 | 1.02 | 1.149 |
| 62 | CDMA BC1 | | | | | 1xRTT RC3 SO32 | Back | 1.5cm | Battery1 | With Scanner | 1175 | 1908.75 | 24.47 | 24.5 | 1.007 | -0.027 | 1.330 | - | 1.339 |
| 118 | CDMA BC1 | | | | | 1xRTT RC3 SO32 | Back | 1.5cm | Battery1 | With Scanner | 1175 | 1908.75 | 24.47 | 24.5 | 1.007 | -0.09 | 1.290 | 1.03 | 1.299 |
| 72 | LTE Band 13 | 10M | QPSK | 1 | 49 | | Back | 1cm | Battery1 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | -0.034 | 1.000 | - | 1.007 |
| 119 | LTE Band 13 | 10M | QPSK | 1 | 49 | | Back | 1cm | Battery1 | With Scanner | 23230 | 782 | 23.97 | 24 | 1.007 | -0.05 | 0.998 | 1.00 | 1.005 |

**Note:**

1. Per KDB 865664 D01v01r02, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg
2. Per KDB 865664 D01v01r02, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR <1.45W/kg, only one repeated measurement is required.
3. The ratio is the largest SAR to the smallest SAR among original and repeated measurement.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

## 13.5 Highest SAR Plot

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2014/1/24

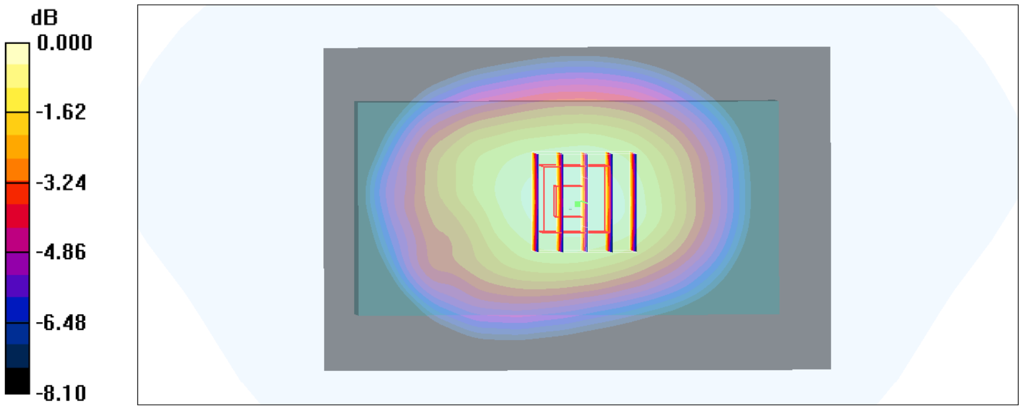
**#48_CDMA BC0_ RTAP 153.6Kbps_Back_1cm_Ch384;Battery1;With Scanner**

Communication System: CDMA ; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: MSL_850_140124 Medium parameters used: f = 837 MHz; $\sigma$ = 0.965 mho/m; $\varepsilon_r$ = 54.5; $\rho$ = 1000 kg/m$^3$
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(10.09, 10.09, 10.09); Calibrated: 2013/11/4
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1399; Calibrated: 2013/11/7
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Ch384/Area Scan (71x111x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.28 mW/g

**Ch384/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 37.9 V/m; Power Drift = -0.125 dB
Peak SAR (extrapolated) = 1.41 W/kg
**SAR(1 g) = 1.14 mW/g; SAR(10 g) = 0.871 mW/g**
Maximum value of SAR (measured) = 1.29 mW/g




0 dB = 1.29mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2014/1/24

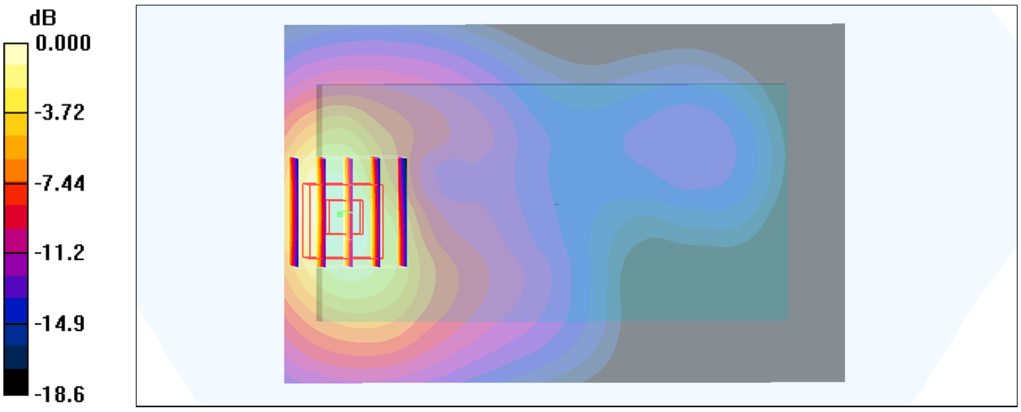
**#62_CDMA BC1_1xRTT RC3 SO32_Back_1.5cm_Ch1175;Battery1;With Scanner**

Communication System: CDMA ; Frequency: 1908.75 MHz;Duty Cycle: 1:1
Medium: MSL_1900_140124 Medium parameters used: f = 1909 MHz; $\sigma$ = 1.54 mho/m; $\varepsilon_r$ = 52.4; $\rho$ = 1000 kg/m$^3$
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(7.85, 7.85, 7.85); Calibrated: 2013/11/4
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1399; Calibrated: 2013/11/7
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Ch1175/Area Scan (71x111x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.71 mW/g

**Ch1175/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34.2 V/m; Power Drift = -0.027 dB
Peak SAR (extrapolated) = 2.17 W/kg
**SAR(1 g) = 1.33 mW/g; SAR(10 g) = 0.746 mW/g**
Maximum value of SAR (measured) = 1.77 mW/g




0 dB = 1.77mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2014/1/25

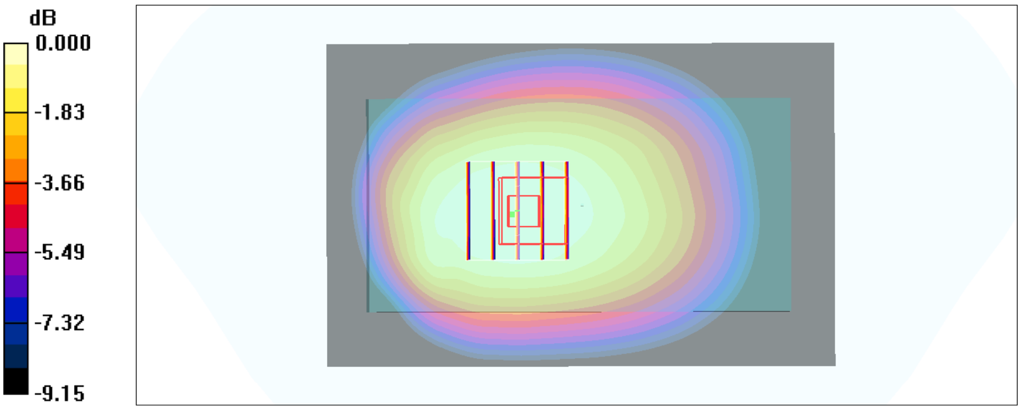
## #72_LTE Band 13_10M_QPSK_1RB_49offset_Back_1cm_Ch23230;Battery1;With Scanner

Communication System: LTE; Frequency: 782 MHz;Duty Cycle: 1:1
Medium: MSL_750_140125 Medium parameters used: f = 782 MHz; $\sigma$ = 0.986 mho/m; $\varepsilon_r$ = 53.2; $\rho$ = 1000 kg/m$^3$
Ambient Temperature：23.4 ℃; Liquid Temperature：22.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(10.24, 10.24, 10.24); Calibrated: 2013/6/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Ch23230/Area Scan (71x111x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.21 mW/g

**Ch23230/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 35.3 V/m; Power Drift = -0.034 dB
Peak SAR (extrapolated) = 1.30 W/kg
**SAR(1 g) = 1 mW/g; SAR(10 g) = 0.753 mW/g**
Maximum value of SAR (measured) = 1.17 mW/g




0 dB = 1.17mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2014/1/28

**#22_WLAN2.4GHz_802.11b 1Mbps_Right Tilted_Ch6;Battery1;With Scanner**

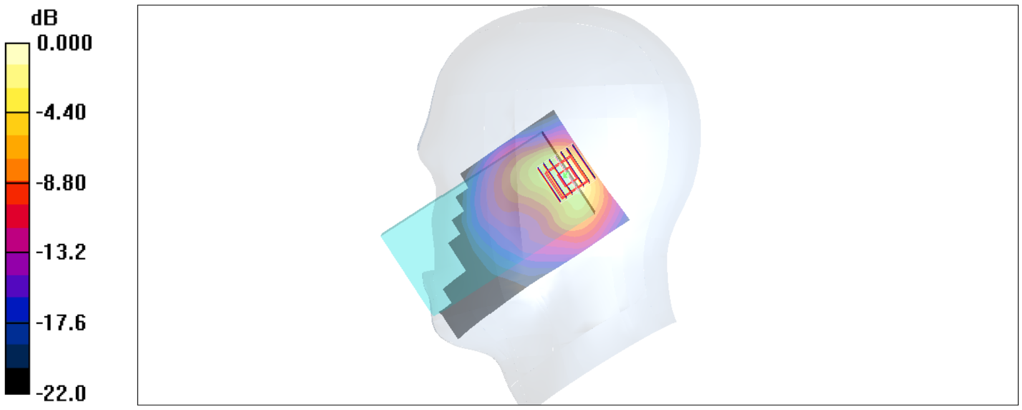
Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1.029
Medium: HSL_2450_140128 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.82 mho/m; $\varepsilon_r$ = 39.4; $\rho$ = 1000 kg/m$^3$

Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(7.25, 7.25, 7.25); Calibrated: 2013/6/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Ch6/Area Scan (81x131x1):** Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.980 mW/g

**Ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.7 V/m; Power Drift = 0.006 dB
Peak SAR (extrapolated) = 1.43 W/kg
**SAR(1 g) = 0.694 mW/g; SAR(10 g) = 0.323 mW/g**
Maximum value of SAR (measured) = 1.06 mW/g




0 dB = 1.06mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2014/1/29

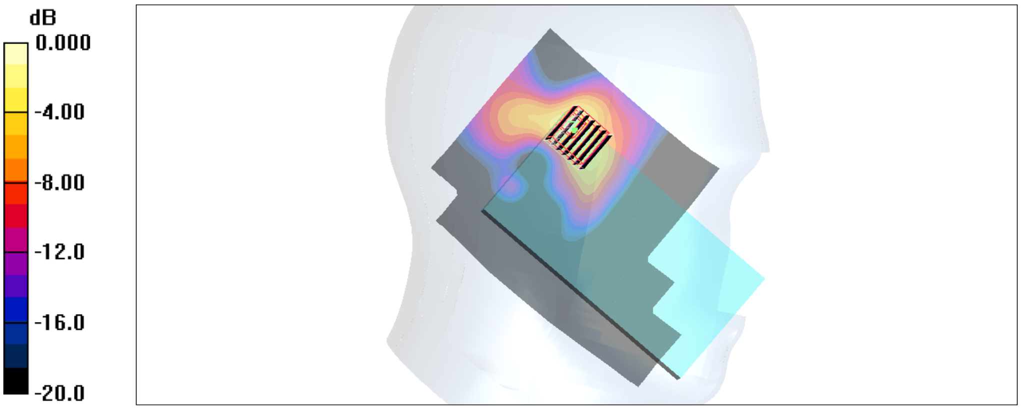
## #42_WLAN5GHz_802.11a 6Mbps_Left Cheek_Ch112;Battery1;With Scanner

Communication System: 802.11a; Frequency: 5560 MHz;Duty Cycle: 1:1.146
Medium: HSL_5G_140129 Medium parameters used: f = 5560 MHz; $\sigma$ = 5.14 mho/m; $\varepsilon_r$ = 34.7; $\rho$ = 1000 kg/$m^3$
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(4.73, 4.73, 4.73); Calibrated: 2013/6/12
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Ch112/Area Scan (121x201x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.920 mW/g

**Ch112/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 16.3 V/m; Power Drift = 0.031 dB
Peak SAR (extrapolated) = 2.38 W/kg
**SAR(1 g) = 0.553 mW/g; SAR(10 g) = 0.171 mW/g**
Maximum value of SAR (measured) = 1.40 mW/g




0 dB = 1.40mW/g

# 14. Simultaneous Transmission Analysis

| NO. | Simultaneous Transmission Configurations | Phone | | | Note |
|---|---|---|---|---|---|
| | | Head | Body-worn | Hotspot | |
| 1. | CDMA(Voice) + WLAN2.4GHz(data) | Yes | Yes | | |
| 2. | CDMA(Voice) + Bluetooth(data) | Yes | Yes | | |
| 3. | CDMA(Voice) + WLAN5GHz(data) | Yes | Yes | | |
| 4. | CDMA(Data) + WLAN2.4GHz(data) | Yes | Yes | Yes | 2.4GHz Hotspot |
| 5. | LTE(Data) + WLAN2.4GHz(data) | Yes | Yes | Yes | 2.4GHz Hotspot |
| 6. | CDMA(Data) + Bluetooth(data) | Yes | Yes | Yes | Bluetooth Tethering |
| 7. | LTE(Data) + Bluetooth(data) | Yes | Yes | Yes | Bluetooth Tethering |
| 8. | CDMA(data) + WLAN5 GHz(data) | No | No | No | |
| 9. | LTE(data) + WLAN5GHz(data) | No | No | No | |

**Note:**

1. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
2. By design, WLAN 5GHz frequency band does not support mobile hotspot operation or WiFi Direct operation, therefore, when CDMA/LTE operate in data mode cannot transmit simultaneously with WLAN 5GHz.
3. EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment.
4. The Scaled SAR summation is calculated based on the same configuration and test position.
5. Per KDB 447498 D01v05r01, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = $(SAR_1 + SAR_2)^{1.5}$ / (*min. separation distance, mm*), and the peak separation distance is determined from the square root of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$, where $(x_1, y_1, z_1)$ and $(x_2, y_2, z_2)$ are the coordinates of the extrapolated peak SAR locations in the zoom scan
   If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary
   iii) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg
6. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v05r01 based on the formula below.
   i) (*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)]·[$\sqrt{f(GHz)}/x$] W/kg for *test separation distances* ≤ 50 mm; where *x* = 7.5 for 1-g SAR, and *x* = 18.75 for 10-g SAR.
   ii) When the minimum test separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.
   iii) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the *test separation distances* is > 50 mm.

| Bluetooth Max Power | Exposure Position | Head | Hotspot | Body worn | Body worn (with Holster) |
|---|---|---|---|---|---|
| | Test separation | 0 mm | 10 mm | 15 mm | 0 mm |
| 3.0 dBm | Estimated SAR (W/kg) | 0.084 W/kg | 0.042 W/kg | 0.028 W/kg | 0.084 W/kg |

## 14.1 Head Exposure Conditions

**<WWAN + WLAN 2.4 GHz Band>**

| | WWAN | | | WLAN | | Summed SAR (W/kg) | SPLSR | Case No |
|---|---|---|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Plot No | SAR (W/kg) | | | |
| Right Cheek | CDMA2000 BC0 | 1 | 0.712 | 21 | 0.741 | 1.45 | | |
| | CDMA2000 BC1 | 2 | 0.434 | 21 | 0.741 | 1.18 | | |
| | LTE Band 13 | 13 | 0.500 | 21 | 0.741 | 1.24 | | |
| Right Tilted | CDMA2000 BC0 | 3 | 0.547 | 22 | 0.775 | 1.32 | | |
| | LTE Band 13 | 14 | 0.301 | 22 | 0.775 | 1.08 | | |
| Left Cheek | CDMA2000 BC0 | 4 | 0.697 | 23 | 0.573 | 1.27 | | |
| | LTE Band 13 | 15 | 0.477 | 23 | 0.573 | 1.05 | | |
| Left Tilted | CDMA2000 BC0 | 5 | 0.461 | 24 | 0.601 | 1.06 | | |
| | LTE Band 13 | 16 | 0.291 | 24 | 0.601 | 0.89 | | |

**<WWAN + WLAN 5.2 GHz Band>**

| | WWAN | | | WLAN | | **Summed SAR (W/kg)** | SPLSR | Case No |
|---|---|---|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Plot No | SAR (W/kg) | | | |
| Right Cheek | CDMA2000 BC0 | 1 | 0.712 | 29 | 0.366 | **1.08** | | |
| | CDMA2000 BC1 | 2 | 0.434 | 29 | 0.366 | **0.80** | | |
| Right Tilted | CDMA2000 BC0 | 3 | 0.547 | 33 | 0.348 | **0.90** | | |
| Left Cheek | CDMA2000 BC0 | 4 | 0.697 | 38 | 0.537 | **1.23** | | |
| Left Tilted | CDMA2000 BC0 | 5 | 0.461 | 35 | 0.392 | **0.85** | | |

**<WWAN + WLAN 5.3 GHz Band>**

| | WWAN | | | WLAN | | **Summed SAR (W/kg)** | SPLSR | Case No |
|---|---|---|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Plot No | SAR (W/kg) | | | |
| Right Cheek | CDMA2000 BC0 | 1 | 0.712 | 30 | 0.33 | **1.04** | | |
| | CDMA2000 BC1 | 2 | 0.434 | 30 | 0.33 | **0.76** | | |
| Right Tilted | CDMA2000 BC0 | 3 | 0.547 | | | **0.55** | | |
| Left Cheek | CDMA2000 BC0 | 4 | 0.697 | 39 | 0.629 | **1.33** | | |
| Left Tilted | CDMA2000 BC0 | 5 | 0.461 | | | **0.46** | | |

**<WWAN + WLAN 5.5 GHz Band>**

| | WWAN | | | WLAN | | Summed SAR (W/kg) | SPLSR | Case No |
|---|---|---|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Plot No | SAR (W/kg) | | | |
| Right Cheek | CDMA2000 BC0 | 1 | 0.712 | 31 | 0.210 | **0.92** | | |
| | CDMA2000 BC1 | 2 | 0.434 | 31 | 0.210 | **0.64** | | |
| Right Tilted | CDMA2000 BC0 | 3 | 0.547 | | | **0.55** | | |
| Left Cheek | CDMA2000 BC0 | 4 | 0.697 | 42 | 0.695 | **1.39** | | |
| Left Tilted | CDMA2000 BC0 | 5 | 0.461 | | | **0.46** | | |

**<WWAN + WLAN 5.8 GHz Band>**

| | WWAN | | | WLAN | | Summed SAR (W/kg) | SPLSR | Case No |
|---|---|---|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Plot No | SAR (W/kg) | | | |
| Right Cheek | CDMA2000 BC0 | 1 | 0.712 | 32 | 0.216 | **0.93** | | |
| | CDMA2000 BC1 | 2 | 0.434 | 32 | 0.216 | **0.65** | | |
| Right Tilted | CDMA2000 BC0 | 3 | 0.547 | | | **0.55** | | |
| Left Cheek | CDMA2000 BC0 | 4 | 0.697 | 45 | 0.595 | **1.29** | | |
| Left Tilted | CDMA2000 BC0 | 5 | 0.461 | | | **0.46** | | |

**<WWAN + Bluetooth>**

| | WWAN | | | Bluetooth | Summed SAR (W/kg) |
|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Estimated SAR (W/kg) | |
| Right Cheek | CDMA2000 BC0 | 1 | 0.712 | 0.084 | **0.80** |
| | CDMA2000 BC1 | 2 | 0.434 | 0.084 | **0.52** |
| | LTE Band 13 | 13 | 0.500 | 0.084 | **0.58** |
| Right Tilted | CDMA2000 BC0 | 3 | 0.547 | 0.084 | **0.63** |
| | LTE Band 13 | 14 | 0.301 | 0.084 | **0.39** |
| Left Cheek | CDMA2000 BC0 | 4 | 0.697 | 0.084 | **0.78** |
| | LTE Band 13 | 15 | 0.477 | 0.084 | **0.56** |
| Left Tilted | CDMA2000 BC0 | 5 | 0.461 | 0.084 | **0.55** |
| | LTE Band 13 | 16 | 0.291 | 0.084 | **0.38** |

## 14.2 Hotspot Exposure Conditions

**<WWAN + WLAN 2.4 GHz Band>**

| | WWAN | | | WLAN | | Summed SAR (W/kg) | SPLSR | Case No |
|---|---|---|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Plot No | SAR (W/kg) | | | |
| Front | CDMA2000 BC0 | | | 87 | 0.287 | **0.29** | | |
| | CDMA2000 BC1 | 50 | 0.711 | 87 | 0.287 | **1.00** | | |
| | LTE Band 13 | 73 | 0.715 | 87 | 0.287 | **1.00** | | |
| Back | CDMA2000 BC0 | 48 | 1.169 | 88 | 0.373 | **1.54** | | |
| | CDMA2000 BC1 | 49 | 1.332 | 88 | 0.373 | **1.71** | 0.02 | 1 |
| | CDMA2000 BC1 | 57 | 1.278 | 88 | 0.373 | **1.65** | 0.02 | 2 |
| | CDMA2000 BC1 | 58 | 1.278 | 88 | 0.373 | **1.65** | 0.02 | 3 |
| | CDMA2000 BC1 | 49 | 1.332 | 95 | 0.330 | **1.66** | 0.02 | 4 |
| | CDMA2000 BC1 | 57 | 1.278 | 95 | 0.330 | **1.61** | 0.02 | 5 |
| | CDMA2000 BC1 | 58 | 1.278 | 95 | 0.330 | **1.61** | 0.02 | 6 |
| | CDMA2000 BC1 | 49 | 1.332 | 96 | 0.334 | **1.67** | 0.02 | 7 |
| | CDMA2000 BC1 | 57 | 1.278 | 96 | 0.334 | **1.61** | 0.02 | 8 |
| | CDMA2000 BC1 | 58 | 1.278 | 96 | 0.334 | **1.61** | 0.02 | 9 |
| | LTE Band 13 | 72 | 1.007 | 88 | 0.373 | **1.38** | | |
| Left Side | CDMA2000 BC1 | 52 | 0.081 | | | **0.08** | | |
| | LTE Band 13 | 75 | 0.640 | | | **0.64** | | |
| Right Side | CDMA2000 BC0 | | | 89 | 0.278 | **0.28** | | |
| | CDMA2000 BC1 | 51 | 0.202 | 89 | 0.278 | **0.48** | | |
| | LTE Band 13 | 74 | 0.678 | 89 | 0.278 | **0.96** | | |
| Top Side | CDMA2000 BC0 | | | 92 | 0.245 | **0.25** | | |
| | CDMA2000 BC1 | | | 92 | 0.245 | **0.25** | | |
| | LTE Band 13 | | | 92 | 0.245 | **0.25** | | |
| Bottom Side | CDMA2000 BC1 | 53 | 1.312 | | | **1.31** | | |
| | LTE Band 13 | 77 | 0.083 | | | **0.08** | | |

**<WWAN + Bluetooth>**

| | WWAN | | | Bluetooth | **Summed SAR (W/kg)** |
|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Estimated SAR (W/kg) | |
| Front | CDMA2000 BC0 | | | 0.042 | **0.04** |
| | CDMA2000 BC1 | 50 | 0.711 | 0.042 | **0.75** |
| | LTE Band 13 | 73 | 0.715 | 0.042 | **0.76** |
| Back | CDMA2000 BC0 | 48 | 1.169 | 0.042 | **1.21** |
| | CDMA2000 BC1 | 49 | 1.332 | 0.042 | **1.37** |
| | CDMA2000 BC1 | 57 | 1.278 | 0.042 | **1.32** |
| | CDMA2000 BC1 | 58 | 1.278 | 0.042 | **1.32** |
| | CDMA2000 BC1 | 49 | 1.332 | 0.042 | **1.37** |
| | CDMA2000 BC1 | 57 | 1.278 | 0.042 | **1.32** |
| | CDMA2000 BC1 | 58 | 1.278 | 0.042 | **1.32** |
| | CDMA2000 BC1 | 49 | 1.332 | 0.042 | **1.37** |
| | CDMA2000 BC1 | 57 | 1.278 | 0.042 | **1.32** |
| | CDMA2000 BC1 | 58 | 1.278 | 0.042 | **1.32** |
| | LTE Band 13 | 72 | 1.007 | 0.042 | **1.05** |
| Left Side | CDMA2000 BC0 | | | 0.042 | **0.04** |
| | CDMA2000 BC1 | 52 | 0.081 | 0.042 | **0.12** |
| | LTE Band 13 | 75 | 0.640 | 0.042 | **0.68** |
| Right Side | CDMA2000 BC0 | | | 0.042 | **0.04** |
| | CDMA2000 BC1 | 51 | 0.202 | 0.042 | **0.24** |
| | LTE Band 13 | 74 | 0.678 | 0.042 | **0.72** |
| Top Side | CDMA2000 BC0 | | | 0.042 | **0.04** |
| | CDMA2000 BC1 | | | 0.042 | **0.04** |
| | LTE Band 13 | | | 0.042 | **0.04** |
| Bottom Side | CDMA2000 BC0 | | | 0.042 | **0.04** |
| | CDMA2000 BC1 | 53 | 1.312 | 0.042 | **1.35** |
| | LTE Band 13 | 77 | 0.083 | 0.042 | **0.13** |

## 14.3 Body-Worn Exposure Conditions

**<WWAN + WLAN 2.4 GHz Band>**

| | WWAN | | | WLAN | | Summed SAR (W/kg) | SPLSR | Case No |
|---|---|---|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Plot No | SAR (W/kg) | | | |
| Back | CDMA2000 BC0 | 61 | 0.990 | 101 | 0.220 | **1.21** | | |
| Back | CDMA2000 BC1 | 62 | 1.339 | 101 | 0.220 | **1.56** | | |
| Back | LTE Band 13 | 83 | 0.784 | 101 | 0.220 | **1.00** | | |
| Back (with Headset) | CDMA2000 BC1 | 65 | 1.299 | | | **1.30** | | |

**<WWAN + WLAN 5.2 GHz Band>**

| | WWAN | | | WLAN | | Summed SAR (W/kg) | SPLSR | Case No |
|---|---|---|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Plot No | SAR (W/kg) | | | |
| Back | CDMA2000 BC0 | 61 | 0.99 | 110 | 0.488 | **1.48** | | |
| Back | CDMA2000 BC1 | 62 | 1.339 | 110 | 0.488 | **1.83** | 0.02 | 10 |
| Back | CDMA2000 BC1 | 62 | 1.339 | 102 | 0.435 | **1.77** | 0.02 | 11 |
| Back (with Headset) | CDMA2000 BC1 | 65 | 1.299 | | | **1.30** | | |

**<WWAN + WLAN 5.3 GHz Band>**

| | WWAN | | | WLAN | | Summed SAR (W/kg) | SPLSR | Case No |
|---|---|---|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Plot No | SAR (W/kg) | | | |
| Back | CDMA2000 BC0 | 61 | 0.99 | 111 | 0.568 | **1.56** | | |
| Back | CDMA2000 BC1 | 62 | 1.339 | 111 | 0.568 | **1.91** | 0.02 | 12 |
| Back | CDMA2000 BC1 | 62 | 1.339 | 103 | 0.394 | **1.73** | 0.02 | 13 |
| Back (with Headset) | CDMA2000 BC1 | 65 | 1.299 | | | **1.30** | | |

**<WWAN + WLAN 5.5 GHz Band>**

| | WWAN | | | WLAN | | Summed SAR (W/kg) | SPLSR | Case No |
|---|---|---|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Plot No | SAR (W/kg) | | | |
| Back | CDMA2000 BC0 | 61 | 0.99 | 112 | 0.338 | **1.33** | | |
| Back | CDMA2000 BC1 | 62 | 1.339 | 112 | 0.338 | **1.68** | 0.02 | 14 |
| Back | CDMA2000 BC1 | 62 | 1.339 | 104 | 0.262 | **1.60** | 0.02 | 15 |
| Back (with Headset) | CDMA2000 BC1 | 65 | 1.299 | | | **1.30** | | |

**<WWAN + WLAN 5.8 GHz Band>**

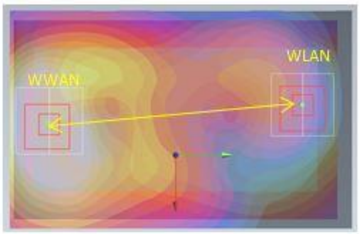
| | WWAN | | | WLAN | | Summed SAR (W/kg) | SPLSR | Case No |
|---|---|---|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Plot No | SAR (W/kg) | | | |
| Back | CDMA2000 BC0 | 61 | 0.99 | 115 | 0.124 | **1.11** | | |
| Back | CDMA2000 BC1 | 62 | 1.339 | 115 | 0.124 | **1.46** | | |
| Back (with Headset) | CDMA2000 BC1 | 65 | 1.299 | | | **1.30** | | |

**<WWAN + Bluetooth>**

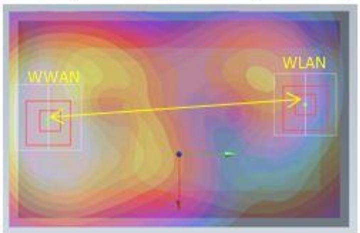
| | WWAN | | | Bluetooth | **Summed SAR (W/kg)** |
|---|---|---|---|---|---|
| Position | WWAN Band | Plot No | SAR (W/kg) | Estimated SAR (W/kg) | |
| Back | CDMA2000 BC0 | 61 | 0.990 | 0.028 | **1.02** |
| | CDMA2000 BC1 | 62 | 1.339 | 0.028 | **1.37** |
| | LTE Band 13 | 83 | 0.784 | 0.028 | **0.81** |
| Back (with Headset) | CDMA2000 BC1 | 65 | 1.299 | 0.028 | **1.33** |

## *14.4 SPLSR Evaluation and Analysis*

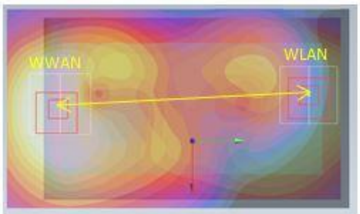
| Case 1 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 49 | CDMA BC1 | Back | 1.332 | 0 | -0.0165 | -0.061 | -0.202 | 122.4 | 1.71 | 0.02 | Not required |
| 88 | WLAN2.4G | | 0.373 | 0 | -0.0242 | 0.0612 | -0.203 | | | | |



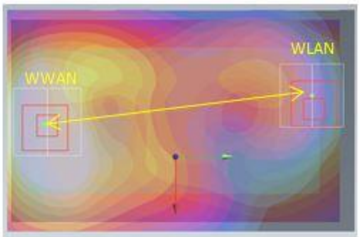

| Case 2 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 57 | CDMA BC1 | Back | 1.278 | 0 | -0.018 | -0.0635 | -0.202 | 124.9 | 1.65 | 0.02 | Not required |
| 88 | WLAN2.4G | | 0.373 | 0 | -0.0242 | 0.0612 | -0.203 | | | | |



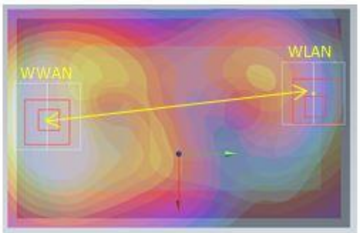

| Case 3 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 58 | CDMA BC1 | Back | 1.278 | 0 | -0.0195 | -0.0695 | -0.202 | 130.8 | 1.65 | 0.02 | Not required |
| 88 | WLAN2.4G | | 0.373 | 0 | -0.0242 | 0.0612 | -0.203 | | | | |



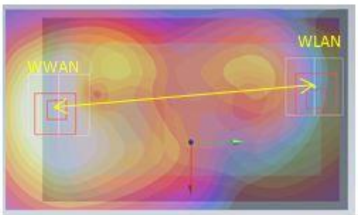
| Case 4 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 49 | CDMA BC1 | Back | 1.332 | 0 | -0.0165 | -0.061 | -0.202 | 125.8 | 1.66 | 0.02 | Not required |
| 95 | WLAN2.4G | | 0.33 | 0 | -0.019 | 0.0648 | -0.203 | | | | |



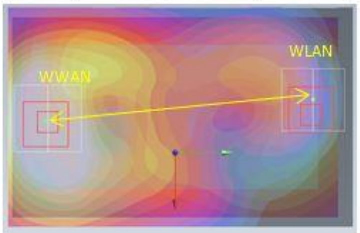

| Case 5 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 57 | CDMA BC1 | Back | 1.278 | 0 | -0.018 | -0.0635 | -0.202 | 128.3 | 1.61 | 0.02 | Not required |
| 95 | WLAN2.4G | | 0.33 | 0 | -0.019 | 0.0648 | -0.203 | | | | |



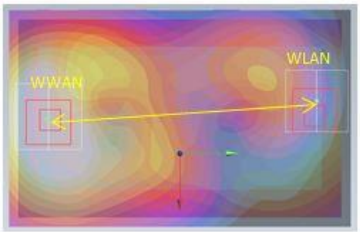

| Case 6 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 58 | CDMA BC1 | Back | 1.278 | 0 | -0.0195 | -0.0695 | -0.202 | 134.3 | 1.61 | 0.02 | Not required |
| 95 | WLAN2.4G | | 0.33 | 0 | -0.019 | 0.0648 | -0.203 | | | | |



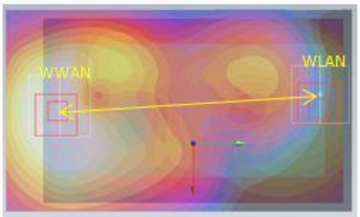
| Case 7 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 49 | CDMA BC1 | Back | 1.332 | 0 | -0.0165 | -0.061 | -0.202 | 127.0 | 1.67 | 0.02 | Not required |
| 96 | WLAN2.4G | | 0.334 | 0 | -0.0154 | 0.066 | -0.203 | | | | |



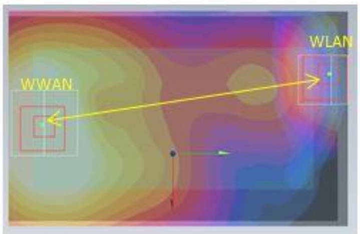

| Case 8 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 57 | CDMA BC1 | Back | 1.278 | 0 | -0.018 | -0.0635 | -0.202 | 129.5 | 1.61 | 0.02 | Not required |
| 96 | WLAN2.4G | | 0.334 | 0 | -0.0154 | 0.066 | -0.203 | | | | |



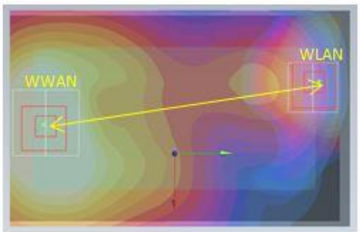

| Case 9 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 58 | CDMA BC1 | Back | 1.278 | 0 | -0.0195 | -0.0695 | -0.202 | 135.6 | 1.61 | 0.02 | Not required |
| 96 | WLAN2.4G | | 0.334 | 0 | -0.0154 | 0.066 | -0.203 | | | | |



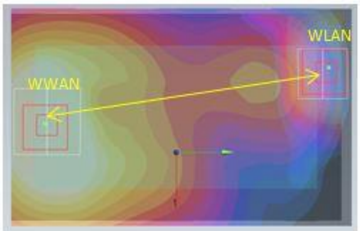
| Case 10 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 62 | CDMA BC1 | Back | 1.339 | 0 | -0.015 | -0.0625 | -0.202 | 141.7 | 1.83 | 0.02 | Not required |
| 110 | WLAN5G Band I | | 0.488 | 0 | -0.04 | 0.077 | -0.203 | | | | |



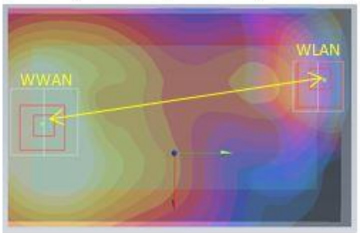

| Case 11 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 62 | CDMA BC1 | Back | 1.339 | 0 | -0.015 | -0.0625 | -0.202 | 131.2 | 1.77 | 0.02 | Not required |
| 102 | WLAN5G Band I | | 0.435 | 0 | -0.036 | 0.067 | -0.203 | | | | |



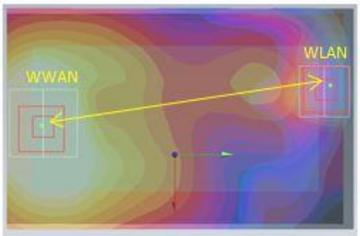

| Case 12 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 62 | CDMA BC1 | Back | 1.339 | 0 | -0.015 | -0.0625 | -0.202 | 135.5 | 1.91 | 0.02 | Not required |
| 111 | WLAN5G Band II | | 0.568 | 0 | -0.038 | 0.071 | -0.203 | | | | |



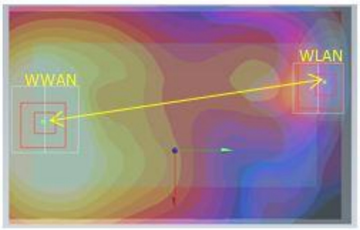
| Case 13 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 62 | CDMA BC1 | Back | 1.339 | 0 | -0.015 | -0.0625 | -0.202 | 133.2 | 1.73 | 0.02 | Not required |
| 103 | WLAN5G Band II | | 0.394 | 0 | -0.036 | 0.069 | -0.203 | | | | |




| Case 14 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 62 | CDMA BC1 | Back | 1.339 | 0 | -0.015 | -0.0625 | -0.202 | 134.3 | 1.68 | 0.02 | Not required |
| 112 | WLAN5G Band III | | 0.338 | 0 | -0.03 | 0.071 | -0.203 | | | | |




| Case 15 | Band | Position | SAR (W/kg) | Gap | SAR peak location (m) | | | 3D distance (mm) | Pair SAR sum (W/kg) | SPLSR | Simultaneous SAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot No | | | | (cm) | X | Y | Z | | | | |
| 62 | CDMA BC1 | Back | 1.339 | 0 | -0.015 | -0.0625 | -0.202 | 132.4 | 1.60 | 0.02 | Not required |
| 104 | WLAN5G Band III | | 0.262 | 0 | -0.03 | 0.069 | -0.203 | | | | |




**Test Engineer：** Iran Wang, Domo Hsiao, Mood Huang, Jerry Hu, Jack Wu, and Ted Sun

# 15. Uncertainty Assessment

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table 14.1

| Uncertainty Distributions | Normal | Rectangular | Triangular | U-Shape |
|---|---|---|---|---|
| Multi-plying Factor[(a)] | 1/k[(b)] | 1/√3 | 1/√6 | 1/√2 |

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) $\kappa$ is the coverage factor

**Table 15.1. Standard Uncertainty for Assumed Distribution**

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.

| Error Description | Uncertainty Value (±%) | Probability Distribution | Divisor | Ci (1g) | Ci (10g) | Standard Uncertainty (1g) | Standard Uncertainty (10g) |
|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | |
| Probe Calibration | 6.0 | Normal | 1 | 1 | 1 | ± 6.0 % | ± 6.0 % |
| Axial Isotropy | 4.7 | Rectangular | √3 | 0.7 | 0.7 | ± 1.9 % | ± 1.9 % |
| Hemispherical Isotropy | 9.6 | Rectangular | √3 | 0.7 | 0.7 | ± 3.9 % | ± 3.9 % |
| Boundary Effects | 1.0 | Rectangular | √3 | 1 | 1 | ± 0.6 % | ± 0.6 % |
| Linearity | 4.7 | Rectangular | √3 | 1 | 1 | ± 2.7 % | ± 2.7 % |
| System Detection Limits | 1.0 | Rectangular | √3 | 1 | 1 | ± 0.6 % | ± 0.6 % |
| Readout Electronics | 0.3 | Normal | 1 | 1 | 1 | ± 0.3 % | ± 0.3 % |
| Response Time | 0.8 | Rectangular | √3 | 1 | 1 | ± 0.5 % | ± 0.5 % |
| Integration Time | 2.6 | Rectangular | √3 | 1 | 1 | ± 1.5 % | ± 1.5 % |
| RF Ambient Noise | 3.0 | Rectangular | √3 | 1 | 1 | ± 1.7 % | ± 1.7 % |
| RF Ambient Reflections | 3.0 | Rectangular | √3 | 1 | 1 | ± 1.7 % | ± 1.7 % |
| Probe Positioner | 0.4 | Rectangular | √3 | 1 | 1 | ± 0.2 % | ± 0.2 % |
| Probe Positioning | 2.9 | Rectangular | √3 | 1 | 1 | ± 1.7 % | ± 1.7 % |
| Max. SAR Eval. | 1.0 | Rectangular | √3 | 1 | 1 | ± 0.6 % | ± 0.6 % |
| **Test Sample Related** | | | | | | | |
| Device Positioning | 2.9 | Normal | 1 | 1 | 1 | ± 2.9 % | ± 2.9 % |
| Device Holder | 3.6 | Normal | 1 | 1 | 1 | ± 3.6 % | ± 3.6 % |
| Power Drift | 5.0 | Rectangular | √3 | 1 | 1 | ± 2.9 % | ± 2.9 % |
| **Phantom and Setup** | | | | | | | |
| Phantom Uncertainty | 4.0 | Rectangular | √3 | 1 | 1 | ± 2.3 % | ± 2.3 % |
| Liquid Conductivity (Target) | 5.0 | Rectangular | √3 | 0.64 | 0.43 | ± 1.8 % | ± 1.2 % |
| Liquid Conductivity (Meas.) | 2.5 | Normal | 1 | 0.64 | 0.43 | ± 1.6 % | ± 1.1 % |
| Liquid Permittivity (Target) | 5.0 | Rectangular | √3 | 0.6 | 0.49 | ± 1.7 % | ± 1.4 % |
| Liquid Permittivity (Meas.) | 2.5 | Normal | 1 | 0.6 | 0.49 | ± 1.5 % | ± 1.2 % |
| **Combined Standard Uncertainty** | | | | | | ± 11.0 % | ± 10.8 % |
| **Coverage Factor for 95 %** | | | | | | K=2 | |
| **Expanded Uncertainty** | | | | | | **± 22.0 %** | **± 21.5 %** |

**Table 15.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz**

| Error Description | Uncertainty Value (±%) | Probability Distribution | Divisor | Ci (1g) | Ci (10g) | Standard Uncertainty (1g) | Standard Uncertainty (10g) |
|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | |
| Probe Calibration | 6.55 | Normal | 1 | 1 | 1 | ± 6.55 % | ± 6.55 % |
| Axial Isotropy | 4.7 | Rectangular | √3 | 0.7 | 0.7 | ± 1.9 % | ± 1.9 % |
| Hemispherical Isotropy | 9.6 | Rectangular | √3 | 0.7 | 0.7 | ± 3.9 % | ± 3.9 % |
| Boundary Effects | 2.0 | Rectangular | √3 | 1 | 1 | ± 1.2 % | ± 1.2 % |
| Linearity | 4.7 | Rectangular | √3 | 1 | 1 | ± 2.7 % | ± 2.7 % |
| System Detection Limits | 1.0 | Rectangular | √3 | 1 | 1 | ± 0.6 % | ± 0.6 % |
| Readout Electronics | 0.3 | Normal | 1 | 1 | 1 | ± 0.3 % | ± 0.3 % |
| Response Time | 0.8 | Rectangular | √3 | 1 | 1 | ± 0.5 % | ± 0.5 % |
| Integration Time | 2.6 | Rectangular | √3 | 1 | 1 | ± 1.5 % | ± 1.5 % |
| RF Ambient Noise | 3.0 | Rectangular | √3 | 1 | 1 | ± 1.7 % | ± 1.7 % |
| RF Ambient Reflections | 3.0 | Rectangular | √3 | 1 | 1 | ± 1.7 % | ± 1.7 % |
| Probe Positioner | 0.8 | Rectangular | √3 | 1 | 1 | ± 0.5 % | ± 0.5 % |
| Probe Positioning | 9.9 | Rectangular | √3 | 1 | 1 | ± 5.7 % | ± 5.7 % |
| Max. SAR Eval. | 4.0 | Rectangular | √3 | 1 | 1 | ± 2.3 % | ± 2.3 % |
| **Test Sample Related** | | | | | | | |
| Device Positioning | 2.9 | Normal | 1 | 1 | 1 | ± 2.9 % | ± 2.9 % |
| Device Holder | 3.6 | Normal | 1 | 1 | 1 | ± 3.6 % | ± 3.6 % |
| Power Drift | 5.0 | Rectangular | √3 | 1 | 1 | ± 2.9 % | ± 2.9 % |
| **Phantom and Setup** | | | | | | | |
| Phantom Uncertainty | 4.0 | Rectangular | √3 | 1 | 1 | ± 2.3 % | ± 2.3 % |
| Liquid Conductivity (Target) | 5.0 | Rectangular | √3 | 0.64 | 0.43 | ± 1.8 % | ± 1.2 % |
| Liquid Conductivity (Meas.) | 2.5 | Normal | 1 | 0.64 | 0.43 | ± 1.6 % | ± 1.1 % |
| Liquid Permittivity (Target) | 5.0 | Rectangular | √3 | 0.6 | 0.49 | ± 1.7 % | ± 1.4 % |
| Liquid Permittivity (Meas.) | 2.5 | Normal | 1 | 0.6 | 0.49 | ± 1.5 % | ± 1.2 % |
| **Combined Standard Uncertainty** | | | | | | ± 12.8 % | ± 12.6 % |
| **Coverage Factor for 95 %** | | | | | | K=2 | |
| **Expanded Uncertainty** | | | | | | **± 25.6 %** | **± 25.2 %** |

**Table 15.3. Uncertainty Budget for frequency range 3 GHz to 6 GHz**

# 16. References


[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] IEEE Std. 1528-2003, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, December 2003

[4] SPEAG DASY System Handbook

[5] FCC KDB 248227 D01 v01r02, “SAR Measurement Procedures for 802.11 a/b/g Transmitters”, May 2007

[6] FCC KDB 447498 D01 v05r01, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, May 2013

[7] FCC KDB 648474 D04 v01r01r02, “SAR Evaluation Considerations for Wireless Handsets”, Dec 2013

[8] FCC KDB 941225 D05 v02r03, “SAR Evaluation Considerations for LTE Devices”, Dec 2013

[9] FCC KDB 941225 D06 v01r01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", May 2013

[10] FCC KDB 865664 D01 v01r02, "SAR Measurement Requirements for 100 MHz to 6 GHz", Dec 2013.