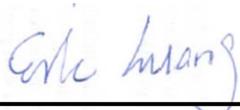


# FCC SAR Test Report

APPLICANT : ZTE CORPORATION  
EQUIPMENT : CDMA-LTE Dual-Mode Digital Mobile Phone  
BRAND NAME : ZTE  
MODEL NAME : Z932L  
MARKETING NAME : Martin  
FCC ID : Q78-Z932L  
STANDARD : FCC 47 CFR Part 2 (2.1093)  
ANSI/IEEE C95.1-1992  
IEEE 1528-2003  
FCC OET Bulletin 65 Supplement C (Edition 01-01)

The product was completely tested on May 24, 2013. We, SPORTON INTERNATIONAL (KUNSHAN) 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 (KUNSHAN) INC., the test report shall not be reproduced except in full.



Reviewed by: Eric Huang / Deputy Manager



Approved by: Jones Tsai / Manager



**SPORTON INTERNATIONAL (KUNSHAN) INC.**  
No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P.R.C.



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**1. Statement of Compliance**

The maximum results of Specific Absorption Rate (SAR) found during testing for **ZTE CORPORATION; DUT: CDMA-LTE Dual-Mode Digital Mobile Phone; Brand Name: ZTE; Model Name: Z932L; Marketing Name: Martin** are as follows.

**<Highest Reported standalone SAR Summary>**

Exposure Position	Frequency Band	Reported 1g-SAR (W/kg)	Equipment Class	Highest Reported 1g-SAR (W/kg)
Head	CDMA 2000 BC0	0.51	PCE	1.37
	CDMA 2000 BC1	0.51		
	LTE Band 13	1.37		
	WLAN 2.4GHz Band	0.12	DTS	0.12
Hotspot (1cm Gap)	CDMA 2000 BC0	0.90	PCE	1.31
	CDMA 2000 BC1	1.31		
	LTE Band 13	0.70		
	WLAN 2.4GHz Band	0.23	DTS	0.23
Body-worn (1cm Gap)	CDMA 2000 BC0	0.94	PCE	1.31
	CDMA 2000 BC1	1.31		
	LTE Band 13	0.71		
	WLAN 2.4GHz Band	0.23	DTS	0.23

**<Highest Simultaneous transmission SAR>**

Frequency Band	Equipment Class	Exposure Position	Highest Reported Simultaneous Transmission 1g-SAR (W/kg)
CDMA2000 BC0	PCE	Head	1.55
LTE Band 13			
WLAN 2.4GHz Band			

Frequency Band	Equipment Class	Exposure Position	Highest Reported Simultaneous Transmission 1g-SAR (W/kg)
CDMA2000 BC1	PCE	Body	1.59
LTE Band 13			
2.4GHz Bluetooth	DSS		

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 and FCC OET Bulletin 65 Supplement C (Edition 01-01).



## 2. Administration Data

### 2.1 Testing Laboratory

Test Site	SPORTON INTERNATIONAL (KUNSHAN) INC.
Test Site Location	No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P.R.C. TEL: +86-0512-5790-0158 FAX: +86-0512-5790-0958

### 2.2 Applicant

Company Name	ZTE CORPORATION
Address	ZTE Plaza, Keji Road South, Hi-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, 518057, P. R. China

### 2.3 Manufacturer

Company Name	ZTE CORPORATION
Address	ZTE Plaza, Keji Road South, Hi-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, 518057, P. R. China

### 2.4 Application Details

Date of Start during the Test	May 21, 2013
Date of End during the Test	May 24, 2013



### 3. General Information

#### 3.1 Description of Equipment Under Test (EUT)

Product Feature & Specification	
DUT	CDMA-LTE Dual-Mode Digital Mobile Phone
Brand Name	ZTE
Model Name	Z932L
Marketing Name	Martin
FCC ID	Q78-Z932L
MEID Code	99000142102053
TX Frequency	CDMA2000 BC0: 824.7 MHz ~ 848.31 MHz CDMA 2000 BC1: 1851.25 MHz ~ 1908.75 MHz LTE Band 13: 779.5 MHz ~ 784.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Antenna Type	WWAN: PIFA Antenna LTE: PIFA Antenna WLAN: PIFA Antenna Bluetooth: PIFA Antenna
HW Version	Z932LHWV1.1
SW Version	Z932LV1.0
Uplink Modulations	CDMA2000 : QPSK CDMA2000 1xEV-DO : QPSK / 8PSK LTE: QPSK, 16QAM 802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) Bluetooth BDR (1Mbps) : GFSK Bluetooth EDR (2Mbps) : $\pi/4$ -DQPSK Bluetooth EDR (3Mbps) : 8-DPSK Bluetooth v4.0 - LE: GFSK
DUT 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, For SVLTE mode which means LTE (data) and CDMA 1xRTT (voice) transmitting simultaneously, power reduction is not implemented, due all resulting SPLSR $\leq$ 0.04 from full power combination.

**3.2 Maximum RF output power among production units**

Band	CDMA2000 BC0	CDMA2000 BC1
	average power(dBm)	
1xRTT RC1 SO55	24	24
1xRTT RC3 SO55	24	24
1xRTT RC3 SO32(+ F-SCH)	24	24
1xRTT RC3 SO32(+SCH)	24	24
1xEVDO RTAP 153.6Kbps	24	24
1xEVDO RETAP 4096Bits	24	24

IEEE 802.11 maximum power(dBm)				
Mode/Band	a	b	g	n-HT20
WLAN 2.4GHz		16.5	13.5	13.5

Mode / Band	Bluetooth maximum power(dBm)			
	1Mbps (GFSK)	2Mbps ( $\pi/4$ -DQPSK)	3Mbps (8-DPSK)	BT4.0-LE (GFSK)
2.4GHz Bluetooth	1	0	0	1

LTE Band 13				
average power(dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Target Power
QPSK	10	$\leq 12$	0	23.5
QPSK	10	$> 12$	1	22.5
16QAM	10	$\leq 12$	1	22.5
16QAM	10	$> 12$	2	21.5
QPSK	5	$\leq 8$	0	23.5
QPSK	5	$> 8$	1	22.5
16QAM	5	$\leq 8$	1	22.5
16QAM	5	$> 8$	2	21.5

**Remark:**

1. By design, other RB configurations and higher-order modulation RF output power will never exceed maximum output power listed above; detailed information is included in "tune-up procedure" exhibit.
2. LTE MPR implementation is the same for normal mode and power reduction mode.



The table below summarized necessary items addressed in KDB 941225 D05 v02.

FCC ID	Q78-Z932L			
DUT	CDMA-LTE Dual-Mode Digital Mobile Phone			
Operating Frequency Range of each LTE transmission band	LTE Band 13: 779.5 MHz ~ 784.5 MHz			
Channel Bandwidth	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 )	LTE owns standalone transmitter and antenna.																																						
LTE Voice / Data requirements	Data only																																						
LTE MPR permanently built-in by design	<p>Yes, per 3GPP TS 36.101 v11.0.0</p> <p style="text-align: center;"><b>Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Modulation</th> <th colspan="6">Channel bandwidth / Transmission bandwidth (RB)</th> <th rowspan="2">MPR (dB)</th> </tr> <tr> <th>1.4 MHz</th> <th>3.0 MHz</th> <th>5 MHz</th> <th>10 MHz</th> <th>15 MHz</th> <th>20 MHz</th> </tr> </thead> <tbody> <tr> <td>QPSK</td> <td>&gt; 5</td> <td>&gt; 4</td> <td>&gt; 8</td> <td>&gt; 12</td> <td>&gt; 16</td> <td>&gt; 18</td> <td>≤ 1</td> </tr> <tr> <td>16 QAM</td> <td>≤ 5</td> <td>≤ 4</td> <td>≤ 8</td> <td>≤ 12</td> <td>≤ 16</td> <td>≤ 18</td> <td>≤ 1</td> </tr> <tr> <td>16 QAM</td> <td>&gt; 5</td> <td>&gt; 4</td> <td>&gt; 8</td> <td>&gt; 12</td> <td>&gt; 16</td> <td>&gt; 18</td> <td>≤ 2</td> </tr> </tbody> </table>	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
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																																
LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing.																																						
Base station simulator used for Testing	Anritsu MT8820C																																						
Power reduction applied to satisfy SAR compliance	No																																						



### 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 OET Bulletin 65 Supplement C (Edition 01-01)
- FCC KDB 447498 D01 v05
- FCC KDB 648474 D04 v01
- FCC KDB 248227 D01 v01r02
- FCC KDB 941225 D01 v02
- FCC KDB 941225 D05 v02r01
- FCC KDB 941225 D06 v01
- FCC KDB 865664 D01 v01

### 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 °C
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

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 ( $\rho$ ). The equation description is as below:

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

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

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

$$\text{SAR} = c \left( \frac{\delta T}{\delta t} \right)$$

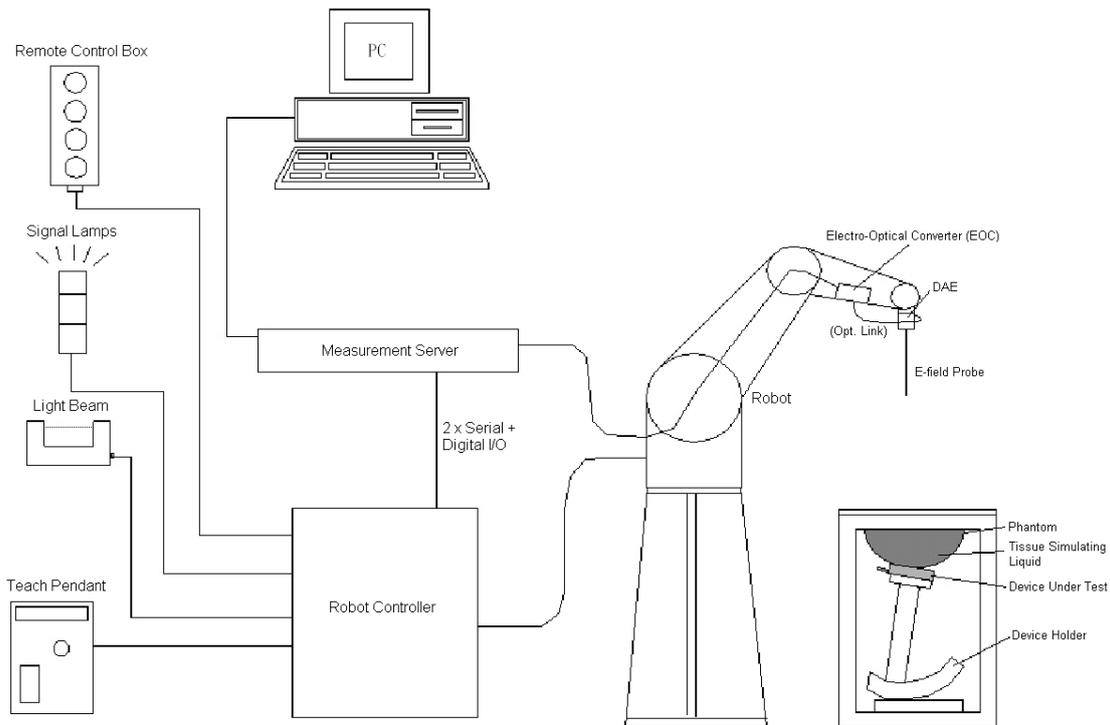
Where: C is the specific heat capacity,  $\delta T$  is the temperature rise and  $\delta t$  is the exposure duration, or related to the electrical field in the tissue by

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

Where:  $\sigma$  is the conductivity of the tissue,  $\rho$  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
- Remote control with teach pendant and additional circuitry for robot safety such as warning 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>**

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



**Fig 5.2 Photo of EX3DV4**

**5.1.2 E-Field Probe Calibration**

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than  $\pm 10\%$ . The spherical isotropy shall be evaluated and within  $\pm 0.25$ dB. 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 (DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability  $\pm 0.035$  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 DASY5

### 5.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY5: 400 MHz, Intel Celeron), chipdisk (DASY5: 128 MB), RAM (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 5.5 Photo of Server for DASY5

### 5.5 Phantom

<SAM Twin Phantom>

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



Fig 5.6 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.

### 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  $\epsilon = 3$  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 5.7 Device Holder

## 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 :

<b>Probe parameters :</b>	- Sensitivity	Norm <sub>i</sub> , a <sub>i0</sub> , a <sub>i1</sub> , a <sub>i2</sub>
	- Conversion factor	ConvF <sub>i</sub>
	- Diode compression point	dcp <sub>i</sub>
<b>Device parameters :</b>	- Frequency	f
	- Crest factor	cf
	<b>Media parameters :</b>	- Conductivity
	- 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 :

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

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<sub>i</sub> = diode compression point (DASY parameter)

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

$$\text{E-field Probes : } E_i = \sqrt{\frac{V_i}{\text{Norm}_i \cdot \text{ConvF}}}$$

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

with  $V_i$  = compensated signal of channel i, (i = x, y, z)  
 $\text{Norm}_i$  = sensor sensitivity of channel i, (i = x, y, z),  $\mu\text{V}/(\text{V/m})^2$  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) :

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

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

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

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

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	735MHz System Validation Kit	D735V3	1065	Jul. 12, 2012	Jul. 11, 2013
SPEAG	835MHz System Validation Kit	D835V2	4d091	Nov. 18, 2011	Nov. 16, 2013
SPEAG	1900MHz System Validation Kit	D1900V2	5d118	Nov. 21, 2011	Nov. 16, 2013
SPEAG	2450MHz System Validation Kit	D2450V2	736	Jul. 25, 2011	Jul. 24, 2013
SPEAG	Data Acquisition Electronics	DAE4	1210	Dec. 05, 2012	Dec. 04, 2013
SPEAG	Data Acquisition Electronics	DAE4	679	Jan. 16, 2013	Jan. 15, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV4	3857	Jun. 20, 2012	Jun. 19, 2013
SPEAG	SAM Twin Phantom	QD 000 P40 CB	TP-1477	NCR	NCR
SPEAG	SAM Twin Phantom	QD 000 P40 CB	TP-1479	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Anritsu	Radio communication analyzer	MT8820C	6201074235	Nov. 29, 2012	Nov. 28, 2013
Agilent	Wireless Communication Test Set	E5515C	MY48367160	Oct. 25, 2012	Oct. 24, 2013
R&S	Universal Radio Communication Tester	CMU200	116456	Sep. 19, 2012	Sep. 18, 2013
Agilent	ENA Series Network Analyzer	E5071C	MY46106933	Aug. 31, 2012	Aug. 30, 2013
R&S	Signal Generator	SMR40	100455	Jan. 18, 2013	Jan. 17, 2014
Agilent	Power Meter	E4416A	MY45101555	Aug. 22, 2012	Aug. 21, 2013
Agilent	Power Sensor	E9327A	MY44421198	Aug. 22, 2012	Aug. 21, 2013
Agilent	Dual Directional Coupler	778D	50422		Note 4
Woken	Attenuator 1	WK0602-XX	N/A		Note 4
PE	Attenuator 2	PE7005-10	N/A		Note 4
PE	Attenuator 3	PE7005- 3	N/A		Note 4
Agilent	Dielectric Probe Kit	85070D	US01440205		Note 5
AR	Power Amplifier	5S1G4M2	328767		Note 6
R&S	Spectrum Analyzer	FSP30	101399	Jun. 01, 2012	May 31, 2013

**Table 5.1 Test Equipment List**

**Note:**

1. The calibration certificate of DASY can be referred to appendix C of this report.
2. Referring to KDB 865664 D01v01, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The justification data of dipole D835V2, SN: 4d091, D1900V2, SN: 5d118, D2450V2, SN: 736 can be found in appendix C. The return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration.
4. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
5. The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Agilent.
6. 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
7. 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 ( $\epsilon_r$ )
<b>For Head</b>								
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
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
<b>For Body</b>								
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
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

Table 6.1 Recipes of Tissue Simulating Liquid



The dielectric parameters of the liquids were verified prior to the SAR evaluation using an Agilent 85070D Dielectric Probe Kit and an Agilent Network Analyzer.

The following table shows the measuring results for simulating liquid.

Frequency (MHz)	Liquid Type	Liquid Temp. (°C)	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )	Conductivity Target ( $\sigma$ )	Permittivity Target ( $\epsilon_r$ )	Delta ( $\sigma$ ) (%)	Delta ( $\epsilon_r$ ) (%)	Limit (%)	Date
750	Head	21.2	0.895	41.004	0.89	41.9	0.56	-2.14	±5	May. 21, 2013
835	Head	21.2	0.88	40.875	0.90	41.5	-2.22	-1.51	±5	May. 23, 2013
1900	Head	21.5	1.423	39.009	1.40	40.0	1.64	-2.48	±5	May. 23, 2013
2450	Head	21.2	1.856	37.685	1.80	39.2	3.11	-3.86	±5	May. 24, 2013
750	Body	21.3	0.97	54.642	0.96	55.5	1.04	-1.55	±5	May. 21, 2013
835	Body	21.1	0.982	54.871	0.97	55.2	1.24	-0.60	±5	May. 21, 2013
1900	Body	21.2	1.55	53.139	1.52	53.3	1.97	-0.30	±5	May. 23, 2013
2450	Body	21.3	1.942	50.946	1.95	52.7	-0.41	-3.33	±5	May. 24, 2013

Table 6.2 Measuring Results for Simulating Liquid

## 7. SAR System Verification

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:

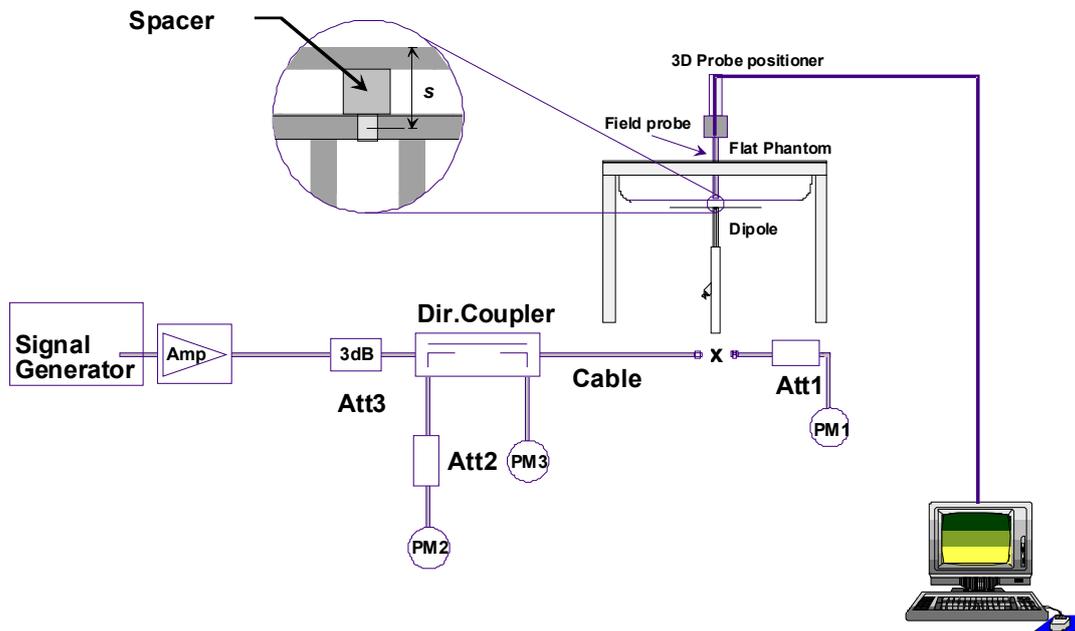


Fig 7.1 System Setup for System Evaluation

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)	Liquid Type	Power fed onto reference dipole (mW)	Targeted SAR <sub>1g</sub> (W/kg)	Measured SAR <sub>1g</sub> (W/kg)	Normalized SAR <sub>1g</sub> (W/kg)	Deviation (%)
May. 21, 2013	750	Head	250	8.37	2.05	8.2	-2.03
May. 23, 2013	835	Head	250	9.40	2.34	9.36	-0.43
May. 23, 2013	1900	Head	250	40.3	10.1	40.4	0.25
May. 24, 2013	2450	Head	250	54.8	13.6	54.4	-0.73
May. 21, 2013	750	Body	250	8.71	2.2	8.8	1.03
May. 21, 2013	835	Body	250	9.42	2.35	9.4	-0.21
May. 23, 2013	1900	Body	250	41.8	10.5	42	0.48
May. 24, 2013	2450	Body	250	52.3	12.5	50	-4.40

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

## 8. EUT Testing Position

This EUT was tested in ten different positions. They are right cheek/right tilted/left cheek/left tilted for Head, Front/Back/Right Side/Left Side/Top Side/Bottom Side of the EUT with phantom 1 cm gap, as illustrated below, please refer to Appendix D for the test setup photos.

### 8.1 Define two imaginary lines on the handset

- 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.
- 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.
- 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.

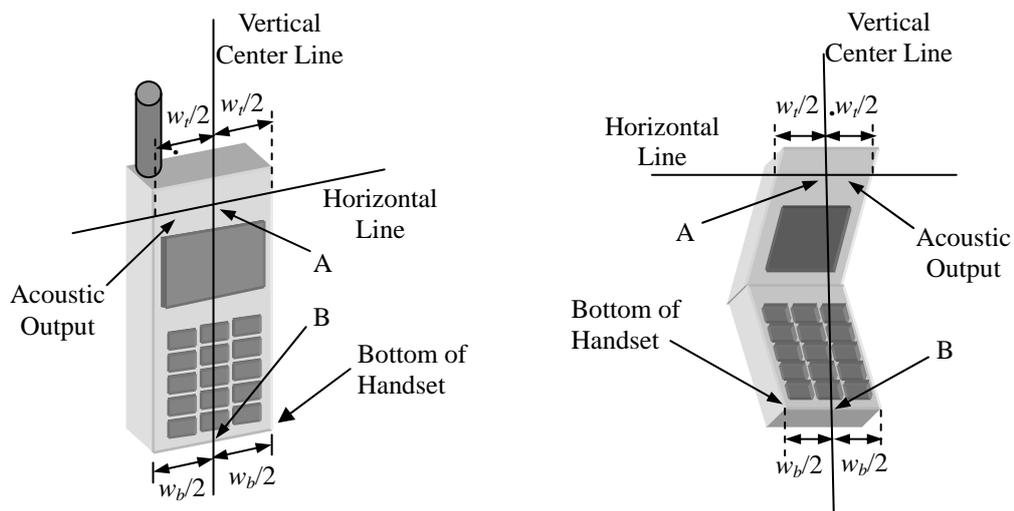
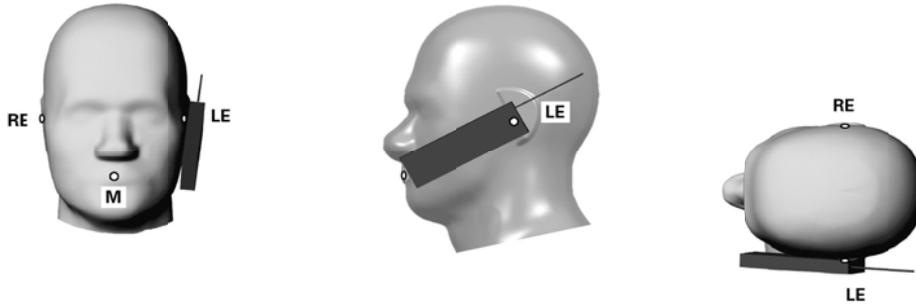


Fig 8.1 Illustration for Handset Vertical and Horizontal Reference Lines

**8.2 Cheek Position**

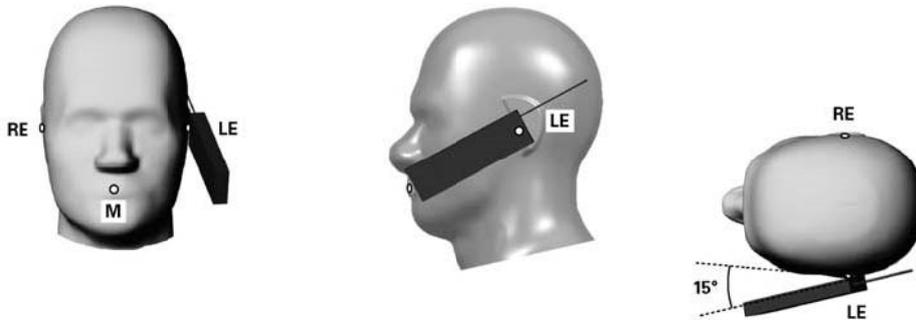
- (a) To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing 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**

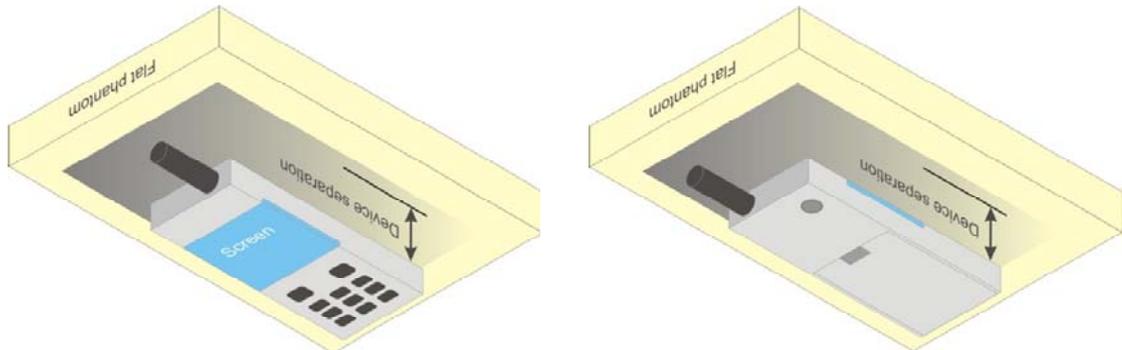
- (a) To position the device in the “cheek” position described above.
- (b) While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (sees Fig. 8.3).



**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 cm.



**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 cm.

#### **<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 from 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 D01v01 quoted below.

For any secondary peaks found in the area scan which are within 2 dB of the maximum peak and are not within this zoom scan, the zoom scan should be repeated

		≤ 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: Δx <sub>Area</sub> , Δy <sub>Area</sub>		≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 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 ≤ 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: Δx <sub>Zoom</sub> , Δy <sub>Zoom</sub>		≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: Δz <sub>Zoom(n)</sub>	≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid Δz <sub>Zoom(1)</sub> : between 1 <sup>st</sup> two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
	Δz <sub>Zoom(n&gt;1)</sub> : between subsequent points	≤ 1.5·Δz <sub>Zoom(n-1)</sub>	
Minimum zoom scan volume	x, y, z	≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 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 <i>reported</i> SAR from the area scan based <i>I-g SAR estimation</i> procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 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 DASYS, 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 DASYS 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. Conducted RF Output Power (Unit: dBm)

#### <CDMA2000 Conducted Power>

**Note:**

1. Referring to KDB 941225 D01, 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 D01, 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 D01, 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.

Band TX Channel	CDMA2000 BC0			CDMA2000 BC1		
	1013	384	777	25	600	1175
Frequency (MHz)	824.7	836.52	848.31	1851.25	1880	1908.75
1xRTT RC1 SO55	23.85	23.83	23.64	23.71	23.77	23.57
1xRTT RC3 SO55	23.78	23.70	23.58	23.63	23.69	23.53
1xRTT RC3 SO32(+ F-SCH)	23.75	23.74	23.64	23.63	23.65	23.52
1xRTT RC3 SO32(+SCH)	23.74	23.71	23.59	23.57	23.60	23.51
1xEVDO RTAP 153.6Kbps	23.83	23.81	23.58	23.59	23.60	23.52
1xEVDO RETAP 4096Bits	23.81	23.75	23.55	23.57	23.65	23.48

<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 D05v02, 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 D05v02, 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 D05v02, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure
5. 16QAM output power for each RB allocation configuration is not > ½ dB higher than the same configuration in QPSK
6. Smaller bandwidth output power for each RB allocation configuration is not > ½ dB higher than the same configuration in the largest supported bandwidth

<LTE Band 13>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Target MPR	MPR Low Ch. / Freq.	MPR Middle Ch. / Freq.	MPR High Ch. / Freq.	
Channel				-	23230	-		-	23230	-	
Frequency (MHz)				-	782	-		-	782	-	
10	QPSK	1	0	-	23.37	-	0	-	0.00	-	
10	QPSK	1	24	-	23.24	-		-	0.13	-	
10	QPSK	1	49	-	23.25	-		-	0.12	-	
10	QPSK	25	0	-	22.26	-	1	-	1.11	-	
10	QPSK	25	12	-	22.17	-		-	1.20	-	
10	QPSK	25	24	-	22.24	-		-	1.13	-	
10	QPSK	50	0	-	22.15	-	1	-	1.22	-	
10	16QAM	1	0	-	22.33	-		-	1.04	-	
10	16QAM	1	24	-	22.16	-		-	1.21	-	
10	16QAM	1	49	-	22.25	-	2	-	1.12	-	
10	16QAM	25	0	-	21.20	-		-	2.17	-	
10	16QAM	25	12	-	21.19	-		-	2.18	-	
10	16QAM	25	24	-	21.08	-	2	-	2.29	-	
10	16QAM	50	0	-	21.03	-		-	2.34	-	
Channel				23205	23230	23255			23205	23230	23255
Frequency (MHz)				779.5	782	784.5		779.5	782	784.5	
5	QPSK	1	0	23.28	23.20	23.16	0	0.00	0.00	0.00	
5	QPSK	1	12	23.21	23.16	23.11		-	0.07	0.04	0.05
5	QPSK	1	24	23.12	23.15	23.05		-	0.16	0.05	0.11
5	QPSK	12	0	22.28	22.20	22.16	1	1.00	1.00	1.00	
5	QPSK	12	6	22.23	22.18	22.19		-	1.05	1.02	0.97
5	QPSK	12	11	22.17	22.11	22.24		-	1.11	1.09	0.92
5	QPSK	25	0	22.22	22.15	22.08	1	1.06	1.05	1.08	
5	16QAM	1	0	22.38	22.03	22.18		-	0.90	1.17	0.98
5	16QAM	1	12	22.22	21.99	22.15		-	1.06	1.21	1.01
5	16QAM	1	24	22.36	21.90	22.10	2	0.92	1.30	1.06	
5	16QAM	12	0	21.36	21.14	21.20		-	1.92	2.06	1.96
5	16QAM	12	6	21.26	21.22	21.17		-	2.02	1.98	1.99
5	16QAM	12	11	21.19	21.26	21.23	2	2.09	1.94	1.93	
5	16QAM	25	0	21.15	21.05	21.16		-	2.13	2.15	2.00

<WLAN 2.4GHz Band Conducted Power>

Mode	Channel	Frequency (MHz)	Average power (dBm)			
			Data Rate			
			1Mbps	2Mbps	5.5Mbps	11Mbps
802.11b	CH 1	2412	15.71	15.78	16.03	15.88
	CH 6	2437	15.92	16.04	16.01	16.05
	CH 11	2462	16.06	16.05	16.02	16.02

Mode	Channel	Frequency (MHz)	Average power (dBm)							
			Data Rate							
			6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
802.11g	CH 1	2412	12.50	12.69	12.54	12.37	12.68	12.43	12.56	12.66
	CH 6	2437	12.69	12.91	12.90	12.84	12.54	12.74	12.37	12.90
	CH 11	2462	13.18	13.16	12.87	12.93	12.98	12.89	13.04	13.14

Mode	Channel	Frequency (MHz)	Average power (dBm)							
			MCS Index							
			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n-HT20	CH 1	2412	12.48	12.91	12.93	12.90	12.38	12.69	12.76	12.81
	CH 6	2437	12.87	12.93	12.81	13.01	12.91	12.93	12.94	13.02
	CH 11	2462	12.97	12.91	13.00	13.02	12.97	12.95	12.91	13.14

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. Per KDB 248227 D01 v01r02, 11g and 11n-HT20 output power is less than 1/4dB higher than 11b mode, thus the SAR can be excluded. 2.4GHz WLAN SAR was tested on 802.11b 1Mbps.

<Bluetooth Conducted Power>

Bluetooth Average Power (dBm)										
Channel	Frequency (MHz)	Data Rate (bps)								
		DH1	DH3	DH5	2DH1	2DH3	2DH5	3DH1	3DH3	3DH5
CH 00	2402	-0.53	-0.60	-0.63	-1.80	-2.04	-2.03	-1.75	-2.05	-1.99
CH 39	2441	0.82	0.86	0.87	-0.22	-0.44	-0.40	-0.17	-0.39	-0.35
CH 78	2480	-0.95	-1.02	-1.01	-2.17	-2.44	-2.40	-1.00	-1.78	-1.89

Channel	Frequency (MHz)	Average power (dBm)
		Mode
		BT v4.0 LE, GFSK
CH 0	2402	-0.67
CH 19	2440	0.58
CH 39	2480	-1.35

Note:

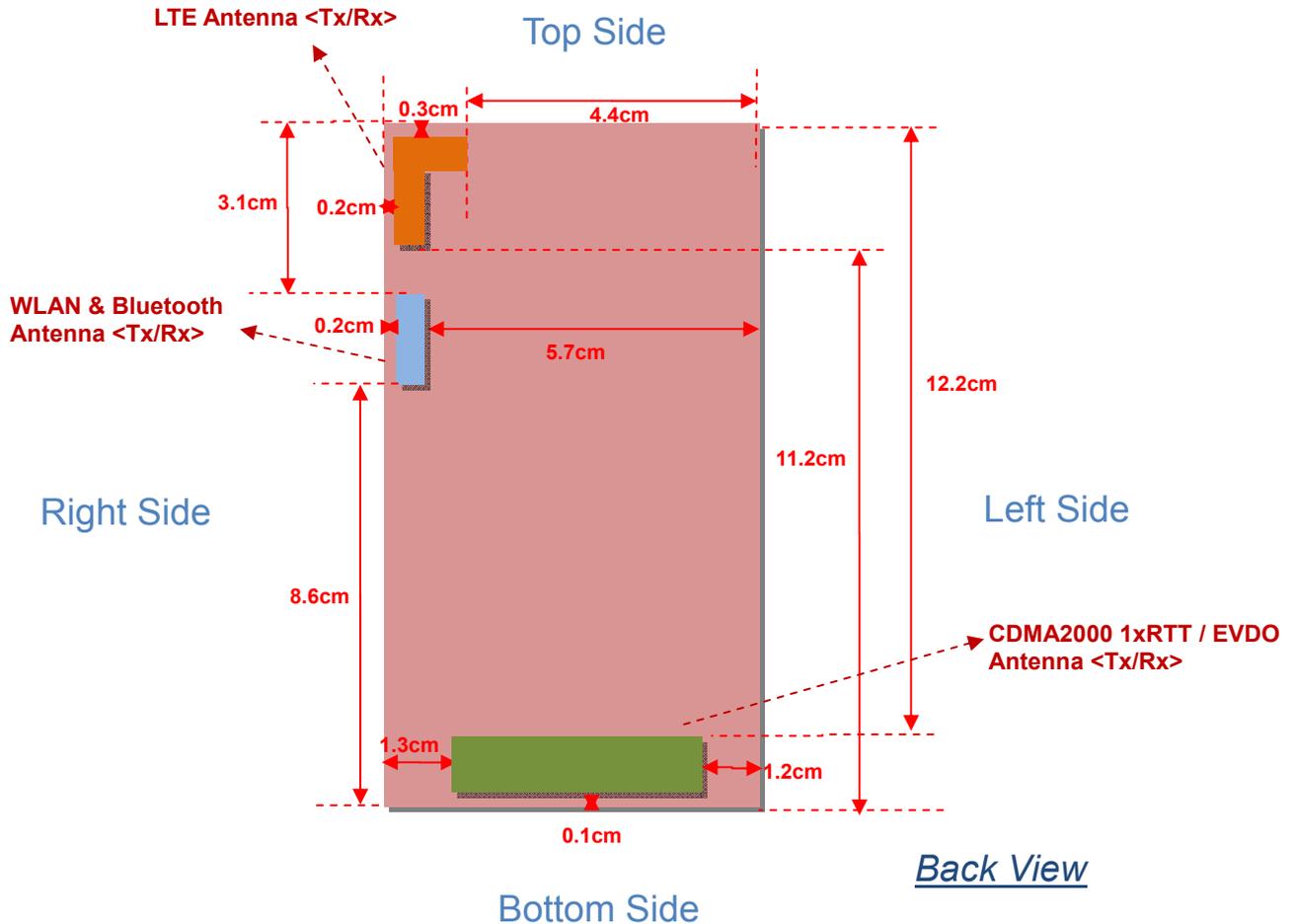
- Per KDB 447498 D01v05, the 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:  

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$$
for 1-g 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
  - If the test separation distance (antenna-user) is < 5mm, 5mm is used for excluded SAR calculation

Bluetooth Max Power (dBm)	mW	Test Distance (mm)	Frequency (GHz)	exclusion thresholds
1	1.26	5	2.48	0.40

- Per KDB 447498 D01v05 exclusion thresholds is 0.40 < 3, RF exposure evaluation is not required.

### 11. Exposure Positions Consideration



Length: 13.5cm  
Width: 6.6cm

Distance of the Antenna to the EUT surface/edge						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
CDMA 1xRTT / EVDO	≤ 25mm	≤ 25mm	122mm	≤ 25mm	≤ 25mm	≤ 25mm
LTE	≤ 25mm	≤ 25mm	≤ 25mm	112mm	≤ 25mm	44mm
WLAN & Bluetooth	≤ 25mm	≤ 25mm	31mm	86mm	≤ 25mm	57mm

Positions for SAR tests; Hotspot mode						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
CDMA 1xRTT / EVDO	Yes	Yes	NO	Yes	Yes	Yes
LTE	Yes	Yes	Yes	NO	Yes	NO
WLAN & Bluetooth	Yes	Yes	NO	NO	Yes	NO

Remark:

- Referring to KDB 941225 D06 v01, 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

## 12. SAR Test Results

**Note:**

1. Per KDB 447498 D01v05, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.  
 $Scaling\ Factor = \frac{tune-up\ limit\ power\ (mW)}{EUT\ RF\ power\ (mW)}$ , where tune-up limit is the maximum rated power among all production units.  
 $Reported\ SAR(W/kg) = Measured\ SAR(W/kg) * Scaling\ Factor$
2. Per KDB 447498 D01v05, for each exposure position, if the highest output channel reported SAR  $\leq 0.8W/kg$ , other channels SAR testing is not necessary.
3. Additional WLAN SAR testing was performed for simultaneous transmission analysis
4. For Hotspot SAR testing, per KDB 941225 D06, for EUT dimension  $\geq 9cm*5cm$ , the test distance is 1cm. SAR must be measured for all surfaces and sides with a transmitting antenna located within 2.5cm from that surface or edge.
5. Considering the possibility of VOIP operation, LTE SAR for the head exposure positions and body-worn positions are performed.
6. Considering the possibility of VOIP operation, per KDB 941225 D01 1xEv-Do RevA (4096 bits) SAR for the head exposure positions and body-worn positions are performed.

### 12.1 Test Records for Head SAR Test

**<CDMA SAR>**

Plot No.	Antenna	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
1	1xRTT/EVDO	CDMA2000 BC0	RC3 SO55	Right Cheek	1013	824.7	23.78	24	1.052	-0.13	0.488	0.513
2	1xRTT/EVDO	CDMA2000 BC0	RC3 SO55	Right Tilted	1013	824.7	23.78	24	1.052	-0.02	0.320	0.337
3	1xRTT/EVDO	CDMA2000 BC0	RC3 SO55	Left Cheek	1013	824.7	23.78	24	1.052	0.04	0.475	0.500
4	1xRTT/EVDO	CDMA2000 BC0	RC3 SO55	Left Tilted	1013	824.7	23.78	24	1.052	0.06	0.293	0.308
5	1xRTT/EVDO	CDMA2000 BC0	RETAP 4096	Right Cheek	1013	824.7	23.81	24	1.045	0.0079	0.484	0.506
6	1xRTT/EVDO	CDMA2000 BC1	RC3 SO55	Right Cheek	600	1880	23.69	24	1.074	-0.01	0.472	0.507
7	1xRTT/EVDO	CDMA2000 BC1	RC3 SO55	Right Tilted	600	1880	23.69	24	1.074	-0.10	0.178	0.191
8	1xRTT/EVDO	CDMA2000 BC1	RC3 SO55	Left Cheek	600	1880	23.69	24	1.074	0.10	0.386	0.415
9	1xRTT/EVDO	CDMA2000 BC1	RC3 SO55	Left Tilted	600	1880	23.69	24	1.074	-0.03	0.164	0.176
10	1xRTT/EVDO	CDMA2000 BC1	RETAP 4096	Right Cheek	600	1880	23.65	24	1.084	-0.04	0.417	0.452



<LTE SAR>

Plot No.	Antenna	Band	BW (MHz)	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
11	LTE	LTE Band 13	10M	QPSK 1RB 0offset	Right Cheek	23230	782	23.37	23.5	1.030	0.01	0.947	0.976
12	LTE	LTE Band 13	10M	QPSK 1RB 0offset	Right Tilted	23230	782	23.37	23.5	1.030	0.05	0.746	0.769
13	LTE	LTE Band 13	10M	QPSK 1RB 0offset	Left Cheek	23230	782	23.37	23.5	1.030	0.04	1.330	1.370
15	LTE	LTE Band 13	10M	QPSK 1RB 0offset	Left Tilted	23230	782	23.37	23.5	1.030	0.04	1.080	1.113
16	LTE	LTE Band 13	10M	QPSK 25RB 0offset	Right Cheek	23230	782	22.26	22.5	1.057	-0.0038	0.669	0.707
17	LTE	LTE Band 13	10M	QPSK 25RB 0offset	Right Tilted	23230	782	22.26	22.5	1.057	-0.0094	0.524	0.554
18	LTE	LTE Band 13	10M	QPSK 25RB 0offset	Left Cheek	23230	782	22.26	22.5	1.057	0.0035	0.967	1.022
19	LTE	LTE Band 13	10M	QPSK 25RB 0offset	Left Tilted	23230	782	22.26	22.5	1.057	0.09	0.686	0.725
20	LTE	LTE Band 13	10M	QPSK 50RB 0offset	Right Cheek	23230	782	22.15	22.5	1.084	-0.04	0.668	0.724
21	LTE	LTE Band 13	10M	QPSK 50RB 0offset	Right Tilted	23230	782	22.15	22.5	1.084	0.10	0.511	0.554
22	LTE	LTE Band 13	10M	QPSK 50RB 0offset	Left Cheek	23230	782	22.15	22.5	1.084	0.06	0.963	1.044
23	LTE	LTE Band 13	10M	QPSK 50RB 0offset	Left Tilted	23230	782	22.15	22.5	1.084	0.01	0.674	0.731

Note:

- Per KDB 941225 D05v02, 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.
- 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 D05v02, 16QAM SAR testing is not required.
- Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth.

<WLAN2.4GHz Band SAR>

Plot No.	Antenna	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
24	WLAN/BT	WLAN 2.4GHz Band	802.11b, 1Mbps	Right Cheek	11	2462	16.06	16.5	1.107	0.06	0.053	0.059
25	WLAN/BT	WLAN 2.4GHz Band	802.11b, 1Mbps	Right Tilted	11	2462	16.06	16.5	1.107	0.06	0.055	0.061
26	WLAN/BT	WLAN 2.4GHz Band	802.11b, 1Mbps	Left Cheek	11	2462	16.06	16.5	1.107	0.06	0.106	0.117
27	WLAN/BT	WLAN 2.4GHz Band	802.11b, 1Mbps	Left Tilted	11	2462	16.06	16.5	1.107	0.17	0.064	0.071



12.2 Test Records for Hotspot SAR Test

<CDMA SAR>

Plot No.	Antenna	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
28	1xRTT/EVDO	CDMA2000 BC0	RTAP 153.6	Front	1	1013	824.7	23.83	24	1.040	0.01	0.618	0.643
29	1xRTT/EVDO	CDMA2000 BC0	RTAP 153.6	Back	1	1013	824.7	23.83	24	1.040	-0.06	0.865	0.900
30	1xRTT/EVDO	CDMA2000 BC0	RTAP 153.6	Left Side	1	1013	824.7	23.83	24	1.040	-0.04	0.679	0.706
31	1xRTT/EVDO	CDMA2000 BC0	RTAP 153.6	Right Side	1	1013	824.7	23.83	24	1.040	0.00069	0.569	0.592
32	1xRTT/EVDO	CDMA2000 BC0	RTAP 153.6	Bottom Side	1	1013	824.7	23.83	24	1.040	-0.02	0.074	0.077
33	1xRTT/EVDO	CDMA2000 BC0	RTAP 153.6	Back	1	384	836.52	23.81	24	1.045	-0.08	0.840	0.878
34	1xRTT/EVDO	CDMA2000 BC0	RTAP 153.6	Back	1	777	848.31	23.58	24	1.102	0.02	0.721	0.794
41	1xRTT/EVDO	CDMA2000 BC1	RTAP 153.6	Front	1	600	1880	23.6	24	1.096	-0.05	0.766	0.840
42	1xRTT/EVDO	CDMA2000 BC1	RTAP 153.6	Back	1	600	1880	23.6	24	1.096	-0.11	1.050	1.151
43	1xRTT/EVDO	CDMA2000 BC1	RTAP 153.6	Left Side	1	600	1880	23.6	24	1.096	-0.03	0.207	0.227
44	1xRTT/EVDO	CDMA2000 BC1	RTAP 153.6	Right Side	1	600	1880	23.6	24	1.096	-0.07	0.177	0.194
45	1xRTT/EVDO	CDMA2000 BC1	RTAP 153.6	Bottom Side	1	600	1880	23.6	24	1.096	-0.01	1.110	1.217
46	1xRTT/EVDO	CDMA2000 BC1	RTAP 153.6	Front	1	25	1851.25	23.59	24	1.099	0.07	0.646	0.710
47	1xRTT/EVDO	CDMA2000 BC1	RTAP 153.6	Front	1	1175	1908.75	23.52	24	1.117	0.0099	0.771	0.861
48	1xRTT/EVDO	CDMA2000 BC1	RTAP 153.6	Back	1	25	1851.25	23.59	24	1.099	-0.06	0.898	0.987
49	1xRTT/EVDO	CDMA2000 BC1	RTAP 153.6	Back	1	1175	1908.75	23.52	24	1.117	-0.16	1.170	1.307
50	1xRTT/EVDO	CDMA2000 BC1	RTAP 153.6	Bottom Side	1	25	1851.25	23.59	24	1.099	-0.06	0.885	0.973
51	1xRTT/EVDO	CDMA2000 BC1	RTAP 153.6	Bottom Side	1	1175	1908.75	23.52	24	1.117	-0.0039	1.050	1.173

<LTE SAR>

Plot No.	Antenna	Band	BW (MHz)	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
65	LTE	LTE Band 13	10M	QPSK 1RB 0offset	Front	1	23230	782	23.37	23.5	1.030	-0.05	0.571	0.588
66	LTE	LTE Band 13	10M	QPSK 1RB 0offset	Back	1	23230	782	23.37	23.5	1.030	0.04	0.676	0.697
67	LTE	LTE Band 13	10M	QPSK 1RB 0offset	Right Side	1	23230	782	23.37	23.5	1.030	0.02	0.648	0.668
68	LTE	LTE Band 13	10M	QPSK 1RB 0offset	Top Side	1	23230	782	23.37	23.5	1.030	0.06	0.236	0.243
70	LTE	LTE Band 13	10M	QPSK 25RB 0offset	Front	1	23230	782	22.26	22.5	1.057	-0.02	0.409	0.432
71	LTE	LTE Band 13	10M	QPSK 25RB 0offset	Back	1	23230	782	22.26	22.5	1.057	-0.0086	0.489	0.517
72	LTE	LTE Band 13	10M	QPSK 25RB 0offset	Right Side	1	23230	782	22.26	22.5	1.057	0.06	0.466	0.492
73	LTE	LTE Band 13	10M	QPSK 25RB 0offset	Top Side	1	23230	782	22.26	22.5	1.057	0.11	0.168	0.178

Note:

- Per KDB 941225 D05v02, 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.
- 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 D05v02, 16QAM SAR testing is not required.
- 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 D05v02, smaller bandwidth SAR testing is not required.



<WLAN2.4GHz Band SAR>

Plot No.	Antenna	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
74	WLAN/BT	WLAN 2.4GHz Band	802.11b, 1Mbps	Front	1	11	2462	16.06	16.5	1.107	0.05	0.033	0.037
75	WLAN/BT	WLAN 2.4GHz Band	802.11b, 1Mbps	Back	1	11	2462	16.06	16.5	1.107	0.07	0.211	0.233
76	WLAN/BT	WLAN 2.4GHz Band	802.11b, 1Mbps	Right Side	1	11	2462	16.06	16.5	1.107	-0.021	0.158	0.175



**12.3 Test Records for Body Worn SAR Test**

**Note:**

1. For Body-worn SAR testing: "V" in the Headset column means the Headset is plugged during SAR testing.
2. Body-worn SAR testing was performed at 10mm separation, and this distance is determined by the handset manufacturer that there will be body-worn accessories that users may acquire at the time of equipment certification, to enable users to purchase aftermarket body-worn accessories with the required minimum separation.
3. Per KDB 941225 D06, when the same wireless modes and device transmission configurations are required for testing body-worn accessories and hotspot mode, it is not necessary to test body-worn accessory SAR for the same device orientation if the test separation distance for hotspot mode is more conservative than that used for body-worn accessories.
4. Body-worn exposure conditions are intended to voice call operations, therefore CDMA voice call mode is selected to be tested.
5. Pre KDB648474 D04v01, When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset
6. LTE and WLAN SAR testing with headset connected were performed for simultaneous transmission analysis.

**<CDMA SAR>**

Plot No.	Antenna	Band	Mode	Test Position	Gap (cm)	Headset	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
35	1xRTT/EVDO	CDMA2000 BC0	RC3 SO32	Front	1	-	1013	824.7	23.75	24	1.059	-0.02	0.615	0.651
36	1xRTT/EVDO	CDMA2000 BC0	RC3 SO32	Back	1	-	1013	824.7	23.75	24	1.059	-0.0024	0.723	0.766
37	1xRTT/EVDO	CDMA2000 BC0	RETAP 4096	Back	1	-	1013	824.7	23.81	24	1.045	0.12	0.893	0.933
<b>39</b>	<b>1xRTT/EVDO</b>	<b>CDMA2000 BC0</b>	<b>RETAP 4096</b>	<b>Back</b>	<b>1</b>	<b>-</b>	<b>384</b>	<b>836.52</b>	<b>23.75</b>	<b>24</b>	<b>1.059</b>	<b>-0.09</b>	<b>0.886</b>	<b>0.938</b>
40	1xRTT/EVDO	CDMA2000 BC0	RETAP 4096	Back	1	-	777	848.31	23.55	24	1.109	-0.008	0.788	0.874
52	1xRTT/EVDO	CDMA2000 BC1	RC3 SO32	Front	1	-	600	1880	23.65	24	1.084	0.05	0.820	0.889
53	1xRTT/EVDO	CDMA2000 BC1	RC3 SO32	Back	1	-	600	1880	23.65	24	1.084	-0.02	1.040	1.127
54	1xRTT/EVDO	CDMA2000 BC1	RC3 SO32	Front	1	-	25	1851.25	23.63	24	1.089	-0.04	0.680	0.740
55	1xRTT/EVDO	CDMA2000 BC1	RC3 SO32	Front	1	-	1175	1908.75	23.52	24	1.117	0.00013	0.874	0.976
56	1xRTT/EVDO	CDMA2000 BC1	RC3 SO32	Back	1	-	25	1851.25	23.63	24	1.089	-0.05	0.901	0.981
<b>57</b>	<b>1xRTT/EVDO</b>	<b>CDMA2000 BC1</b>	<b>RC3 SO32</b>	<b>Back</b>	<b>1</b>	<b>-</b>	<b>1175</b>	<b>1908.75</b>	<b>23.52</b>	<b>24</b>	<b>1.117</b>	<b>-0.07</b>	<b>1.170</b>	<b>1.307</b>
58	1xRTT/EVDO	CDMA2000 BC1	RETAP 4096	Back	1	-	1175	1908.75	23.48	24	1.127	-0.03	1.070	1.206
59	1xRTT/EVDO	CDMA2000 BC1	RETAP 4096	Back	1	-	25	1851.25	23.57	24	1.104	-0.09	0.857	0.946
60	1xRTT/EVDO	CDMA2000 BC1	RETAP 4096	Back	1	-	600	1880	23.65	24	1.084	-0.10	1.020	1.106
61	1xRTT/EVDO	CDMA2000 BC1	RC3 SO32	Back	1	v	1175	1908.75	23.52	24	1.117	-0.04	1.150	1.284
62	1xRTT/EVDO	CDMA2000 BC1	RC3 SO32	Back	1	v	25	1851.25	23.63	24	1.089	-0.09	0.871	0.948
63	1xRTT/EVDO	CDMA2000 BC1	RC3 SO32	Back	1	v	600	1880	23.65	24	1.084	-0.03	1.020	1.106



<LTE SAR>

Plot No.	Antenna	Band	BW (MHz)	Mode	Test Position	Gap (cm)	Headset	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
65	LTE	LTE Band 13	10M	QPSK 1RB 0offset	Front	1	-	23230	782	23.37	23.5	1.030	-0.05	0.571	0.588
66	LTE	LTE Band 13	10M	QPSK 1RB 0offset	Back	1	-	23230	782	23.37	23.5	1.030	0.04	0.676	0.697
69	LTE	LTE Band 13	10M	QPSK 1RB 0offset	Back	1	v	23230	782	23.37	23.5	1.030	-0.06	0.687	0.708
70	LTE	LTE Band 13	10M	QPSK 25RB 0offset	Front	1	-	23230	782	22.26	22.5	1.057	-0.02	0.409	0.432
71	LTE	LTE Band 13	10M	QPSK 25RB 0offset	Back	1	-	23230	782	22.26	22.5	1.057	-0.009	0.489	0.517

<WLAN2.4GHz Band SAR>

Plot No.	Antenna	Band	Mode	Test Position	Gap (cm)	Headset	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
74	WLAN/BT	WLAN 2.4GHz Band	802.11b, 1Mbps	Front	1	-	11	2462	16.06	16.5	1.107	0.05	0.033	0.037
75	WLAN/BT	WLAN 2.4GHz Band	802.11b, 1Mbps	Back	1	-	11	2462	16.06	16.5	1.107	0.07	0.211	0.233
77	WLAN/BT	WLAN 2.4GHz Band	802.11b, 1Mbps	Back	1	v	11	2462	16.06	16.5	1.107	-0.03	0.203	0.225



12.4 Repeated SAR Measurement

Plot No.	Antenna	Band	BW (MHz)	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR <sub>1g</sub> (W/kg)	Ratio	Reported SAR <sub>1g</sub> (W/kg)
13	LTE	LTE Band 13	10M	QPSK 1RB 0offset	Left Cheek	-	23230	782	23.37	23.5	1.030	0.04	1.330	1	1.370
14	LTE	LTE Band 13	10M	QPSK 1RB 0offset	Left Cheek	-	23230	782	23.37	23.5	1.030	0.04	1.300	1.023	1.340
37	1xRTT/EVDO	CDMA2000 BC0	-	RETAP 4096	Back	1	1013	824.7	23.81	24	1.045	0.12	0.893	1	0.933
38	1xRTT/EVDO	CDMA2000 BC0	-	RETAP 4096	Back	1	1013	824.7	23.81	24	1.045	-0.1	0.883	1.011	0.922
57	1xRTT/EVDO	CDMA2000 BC1	-	RC3 SO32	Back	1	1175	1908.75	23.52	24	1.117	-0.07	1.170	1	1.307
64	1xRTT/EVDO	CDMA2000 BC1	-	RC3 SO32	Back	1	1175	1908.75	23.52	24	1.117	-0.1	1.160	1.009	1.296

Note:

- Per KDB 865664 D01v01, for each frequency band, repeated SAR measurement is required only when the measured SAR is  $\geq 0.8W/kg$
- Per KDB 865664 D01v01, if the ratio among the repeated measurement is  $\leq 1.2$  and the measured SAR  $< 1.45W/kg$ , only one repeated measurement is required.
- The ratio is the difference in percentage between original and repeated *measured SAR*.
- All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

### 12.5 Highest SAR Plot

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2013-5-21

#39 CDMA2000 BC0\_RETAP 4096\_Back 1cm\_Ch384

DUT: 342701

Communication System: CDMA2000; Frequency: 836.52 MHz; Duty Cycle: 1:1

Medium: MSL\_835\_130521 Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.985$  mho/m;  $\epsilon_r = 54.848$ ;

$\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.3 °C; Liquid Temperature : 21.1 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-6-20
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2013-1-16
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.4.5 (3634)

Ch384/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.007 mW/g

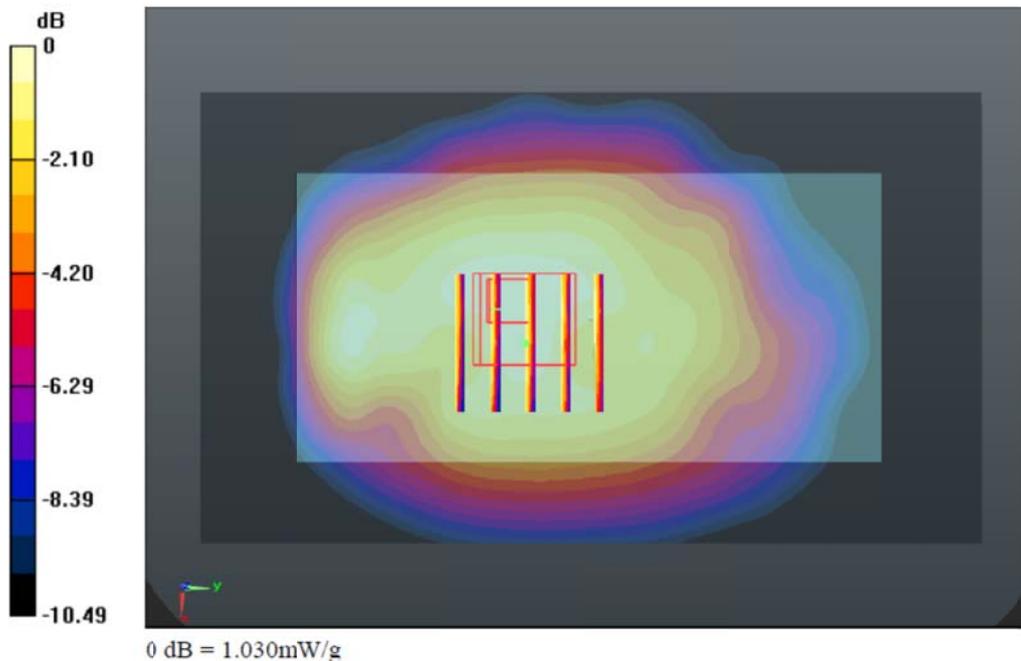
Ch384/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 29.456 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 1.339 W/kg

SAR(1 g) = 0.886 mW/g; SAR(10 g) = 0.642 mW/g

Maximum value of SAR (measured) = 1.025 mW/g



Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2013-5-23

#49 CDMA2000 BC1\_RTAP 153.6\_Back 1cm\_Ch1175

**DUT: 342701**

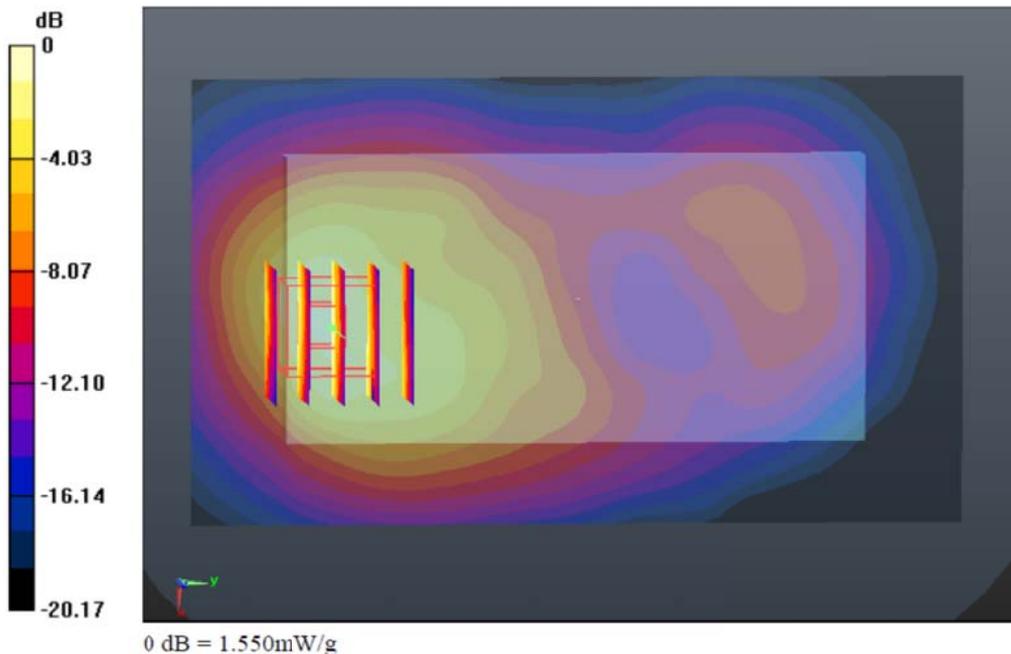
Communication System: CDMA2000; Frequency: 1908.75 MHz; Duty Cycle: 1:1  
 Medium: MSL\_1900\_130523 Medium parameters used:  $f = 1909$  MHz;  $\sigma = 1.559$  mho/m;  $\epsilon_r = 53.113$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Ambient Temperature : 23.3 °C; Liquid Temperature : 21.2 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.35, 7.35, 7.35); Calibrated: 2012-6-20
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2013-1-16
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.4.5 (3634)

**Ch1175/Area Scan (71x121x1):** Measurement grid: dx=15mm, dy=15mm  
 Maximum value of SAR (interpolated) = 1.225 mW/g

**Ch1175/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
 Reference Value = 9.466 V/m; Power Drift = -0.16 dB  
 Peak SAR (extrapolated) = 1.837 W/kg  
**SAR(1 g) = 1.170 mW/g; SAR(10 g) = 0.630 mW/g**  
 Maximum value of SAR (measured) = 1.551 mW/g



Test Laboratory: Sporton International Inc. SARHAC Testing Lab

Date: 2013-5-23

#57 CDMA2000 BC1\_RC3 SO32\_Back 1cm\_Ch1175

DUT: 342701

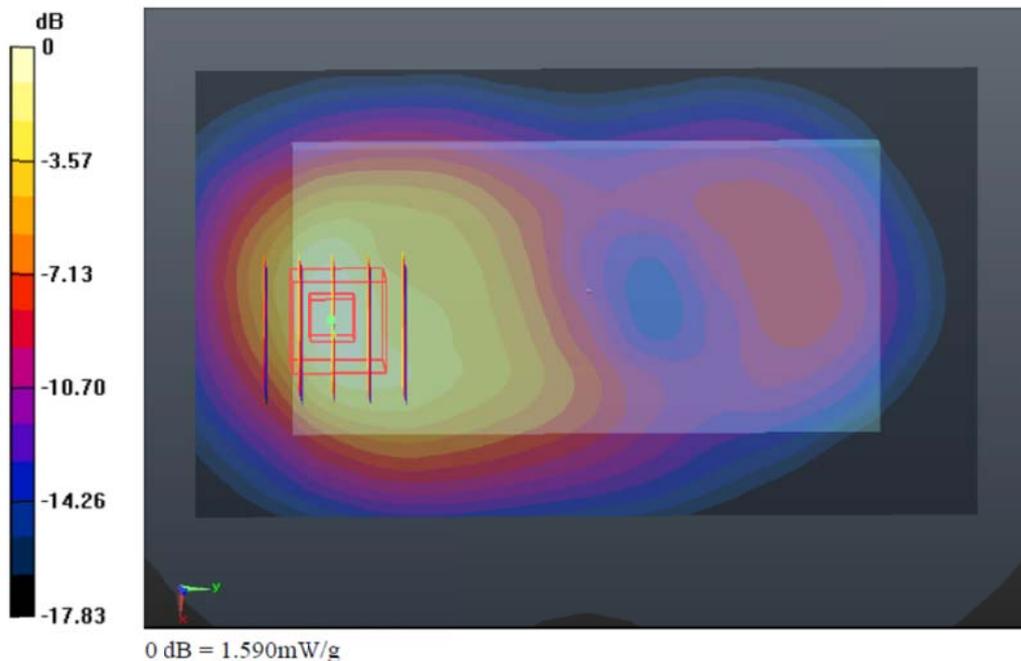
Communication System: CDMA2000; Frequency: 1908.75 MHz; Duty Cycle: 1:1  
Medium: MSL\_1900\_130523 Medium parameters used:  $f = 1909$  MHz;  $\sigma = 1.559$  mho/m;  $\epsilon_r = 53.113$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C; Liquid Temperature : 21.2 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.35, 7.35, 7.35); Calibrated: 2012-6-20
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2013-1-16
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.4.5 (3634)

**Ch1175/Area Scan (71x121x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 1.620 mW/g

**Ch1175/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 8.742 V/m; Power Drift = -0.07 dB  
Peak SAR (extrapolated) = 1.901 W/kg  
SAR(1 g) = 1.170 mW/g; SAR(10 g) = 0.660 mW/g  
Maximum value of SAR (measured) = 1.593 mW/g



Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2013-5-21

#69 LTE Band 13\_10M\_QPSK 1RB 0offset\_Back 1cm\_Ch23230\_Headset

**DUT: 342701**

Communication System: LTE; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: MSL\_750\_130521 Medium parameters used:  $f = 782 \text{ MHz}$ ;  $\sigma = 0.996 \text{ mho/m}$ ;  $\epsilon_r = 53.964$ ;

$\rho = 1000 \text{ kg/m}^3$

Ambient Temperature : 23.2 °C ; Liquid Temperature : 21.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(9.18, 9.18, 9.18); Calibrated: 2012-6-20
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2012-12-5
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.4.5 (3634)

**Ch23230/Area Scan (71x111x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.892 mW/g

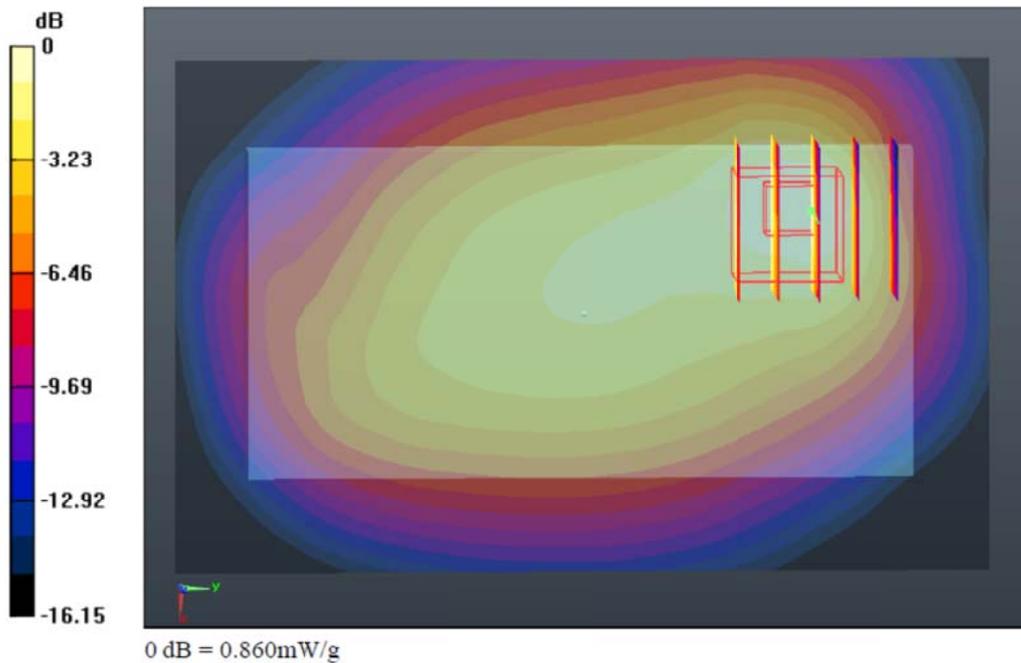
**Ch23230/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 22.402 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 1.019 W/kg

**SAR(1 g) = 0.687 mW/g; SAR(10 g) = 0.447 mW/g**

Maximum value of SAR (measured) = 0.857 mW/g



Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2013-5-24

#75 802.11b\_Back 1cm\_1M\_Ch11

**DUT: 342701**

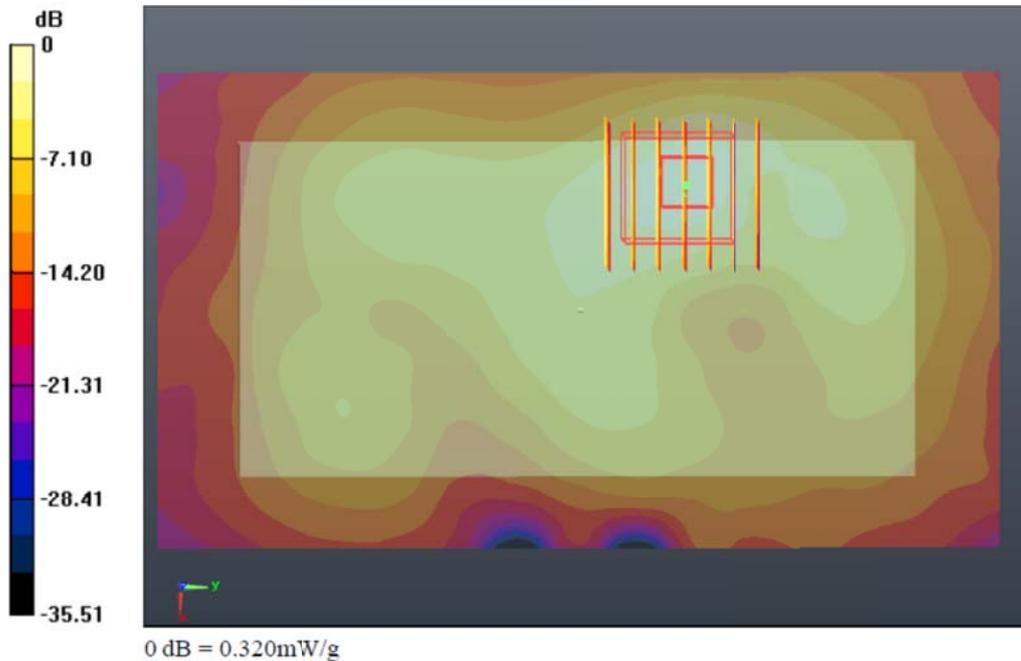
Communication System: WIFI; Frequency: 2462 MHz;Duty Cycle: 1:1  
 Medium: MSL\_2450\_130524 Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.958$  mho/m;  $\epsilon_r = 50.897$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Ambient Temperature : 23.3 °C; Liquid Temperature : 21.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(6.94, 6.94, 6.94); Calibrated: 2012-6-20
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2013-1-16
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.4.5 (3634)

**Ch11/Area Scan (81x141x1):** Measurement grid: dx=12mm, cy=12mm  
 Maximum value of SAR (interpolated) = 0.317 mW/g

**Ch11/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
 Reference Value = 6.277 V/m; Power Drift = 0.07 dB  
 Peak SAR (extrapolated) = 0.452 W/kg  
**SAR(1 g) = 0.211 mW/g; SAR(10 g) = 0.096 mW/g**  
 Maximum value of SAR (measured) = 0.318 mW/g



### 13. Simultaneous Transmission Analysis

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

**Note:**

1. WLAN 2.4GHz Band and Bluetooth share the same antenna, and cannot transmit simultaneously.
2. 1xRTT and EVDO share the same antenna, and no SVDO feature in this device.
3. The reported SAR summation is calculated based on the same configuration and test position.
4. Per KDB 447498 D01v05, simultaneous transmission SAR is compliant if,
  - i) Scalar SAR summation < 1.6W/kg.
  - ii)  $SPLSR = (SAR_1 + SAR_2)^{1.5} / (min. \text{ separation distance, mm})$ , 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  $SPLSR \leq 0.04$ , simultaneously transmission SAR measurement is not necessary
  - iii) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg
5. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v05 based on the formula below.
  - i)  $(max. \text{ power of channel, including tune-up tolerance, mW}) / (min. \text{ test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})} / x] \text{ W/kg}$  for test separation distances  $\leq 50 \text{ mm}$ ; where  $x = 7.5$  for 1-g SAR.
  - ii) 0.4 W/kg for 1-g SAR, when the test separation distances is > 50 mm.

In this report, 50mm separation is applied to conservatively estimate SAR value for separation distance > 50mm

Maximum Power	Exposure Position	Head	Hotspot	Body-worn
	Test separation	0 mm	10 mm	10 mm
1 dBm	Estimated SAR (W/kg)	0.053W/kg	0.026W/kg	0.026W/kg



**13.1 Head Exposure Conditions**

Position	WWAN (voice)			WWAN (data)			WLAN 2.4GHz Band		WWAN + WLAN 2.4GHz Band (W/kg)	SPLSR	Case No
	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	Plot No	Max. WLAN SAR (W/kg)			
Right Cheek	CDMA2000 BC0	1	0.513	LTE Band 13	11	0.976	24	0.059	1.55		
	CDMA2000 BC1	6	0.507	LTE Band 13	11	0.976	24	0.059	1.54		
Right Tilted	CDMA2000 BC0	2	0.337	LTE Band 13	12	0.769	25	0.061	1.17		
	CDMA2000 BC1	7	0.191	LTE Band 13	12	0.769	25	0.061	1.02		
Left Cheek	CDMA2000 BC0	3	0.500	LTE Band 13	13	1.370	26	0.117	1.99	0.04	#1
	CDMA2000 BC1	8	0.415	LTE Band 13	13	1.370	26	0.117	1.90	0.04	#2
Left Tilted	CDMA2000 BC0	4	0.308	LTE Band 13	15	1.113	27	0.071	1.49		
	CDMA2000 BC1	9	0.176	LTE Band 13	15	1.113	27	0.071	1.36		

Position	WWAN (voice)			WWAN (data)			Bluetooth	WWAN + Bluetooth (W/kg)	SPLSR	Case No
	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	Estimated Bluetooth SAR (W/kg)			
Right Cheek	CDMA2000 BC0	1	0.513	LTE Band 13	11	0.976	0.053	1.54		
	CDMA2000 BC1	6	0.507	LTE Band 13	11	0.976	0.053	1.54		
Right Tilted	CDMA2000 BC0	2	0.337	LTE Band 13	12	0.769	0.053	1.16		
	CDMA2000 BC1	7	0.191	LTE Band 13	12	0.769	0.053	1.01		
Left Cheek	CDMA2000 BC0	3	0.500	LTE Band 13	13	1.370	0.053	1.92	0.04	#3
	CDMA2000 BC1	8	0.415	LTE Band 13	13	1.370	0.053	1.84	0.04	#4
Left Tilted	CDMA2000 BC0	4	0.308	LTE Band 13	15	1.113	0.053	1.47		
	CDMA2000 BC1	9	0.176	LTE Band 13	15	1.113	0.053	1.34		



**13.2 Hotspot Exposure Conditions**

Position	WWAN (data)			WLAN 2.4GHz Band		WWAN + WLAN 2.4GHz Band (W/kg)	SPLSR	Case No
	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	Plot No	Max. WLAN SAR (W/kg)			
Front	CDMA2000 BC0	28	0.643	74	0.037	<b>0.68</b>		
	CDMA2000 BC1	47	0.861	74	0.037	<b>0.90</b>		
	LTE Band 13	65	0.588	74	0.037	<b>0.63</b>		
Back	CDMA2000 BC0	29	0.900	75	0.233	<b>1.13</b>		
	CDMA2000 BC1	49	1.307	75	0.233	<b>1.54</b>		
	LTE Band 13	66	0.697	75	0.233	<b>0.93</b>		
Left Side	CDMA2000 BC0	30	0.706	-	-	<b>0.71</b>		
	CDMA2000 BC1	43	0.227	-	-	<b>0.23</b>		
	LTE Band 13	-	-	-	-	-		
Right Side	CDMA2000 BC0	31	0.592	76	0.175	<b>0.77</b>		
	CDMA2000 BC1	44	0.194	76	0.175	<b>0.37</b>		
	LTE Band 13	67	0.668	76	0.175	<b>0.84</b>		
Top Side	CDMA2000 BC0	-	-	-	-	-		
	CDMA2000 BC1	-	-	-	-	-		
	LTE Band 13	68	0.243	-	-	<b>0.24</b>		
Bottom Side	CDMA2000 BC0	32	0.077	-	-	<b>0.08</b>		
	CDMA2000 BC1	45	1.217	-	-	<b>1.22</b>		
	LTE Band 13	-	-	-	-	-		

Position	WWAN (data)			Bluetooth Estimated Bluetooth SAR (W/kg)	WWAN + Bluetooth (W/kg)	SPLSR	Case No
	WWAN Band	Plot No	Max. WWAN SAR (W/kg)				
Front	CDMA2000 BC0	28	0.643	0.026	<b>0.67</b>		
	CDMA2000 BC1	47	0.861	0.026	<b>0.89</b>		
	LTE Band 13	65	0.588	0.026	<b>0.61</b>		
Back	CDMA2000 BC0	29	0.900	0.026	<b>0.93</b>		
	CDMA2000 BC1	49	1.307	0.026	<b>1.33</b>		
	LTE Band 13	66	0.697	0.026	<b>0.72</b>		
Left Side	CDMA2000 BC0	30	0.706	-	<b>0.71</b>		
	CDMA2000 BC1	43	0.227	-	<b>0.23</b>		
	LTE Band 13	-	-	-	-		
Right Side	CDMA2000 BC0	31	0.592	0.026	<b>0.62</b>		
	CDMA2000 BC1	44	0.194	0.026	<b>0.22</b>		
	LTE Band 13	67	0.668	0.026	<b>0.69</b>		
Top Side	CDMA2000 BC0	-	-	-	-		
	CDMA2000 BC1	-	-	-	-		
	LTE Band 13	68	0.243	-	<b>0.24</b>		
Bottom Side	CDMA2000 BC0	32	0.077	-	<b>0.08</b>		
	CDMA2000 BC1	45	1.217	-	<b>1.22</b>		
	LTE Band 13	-	-	-	-		



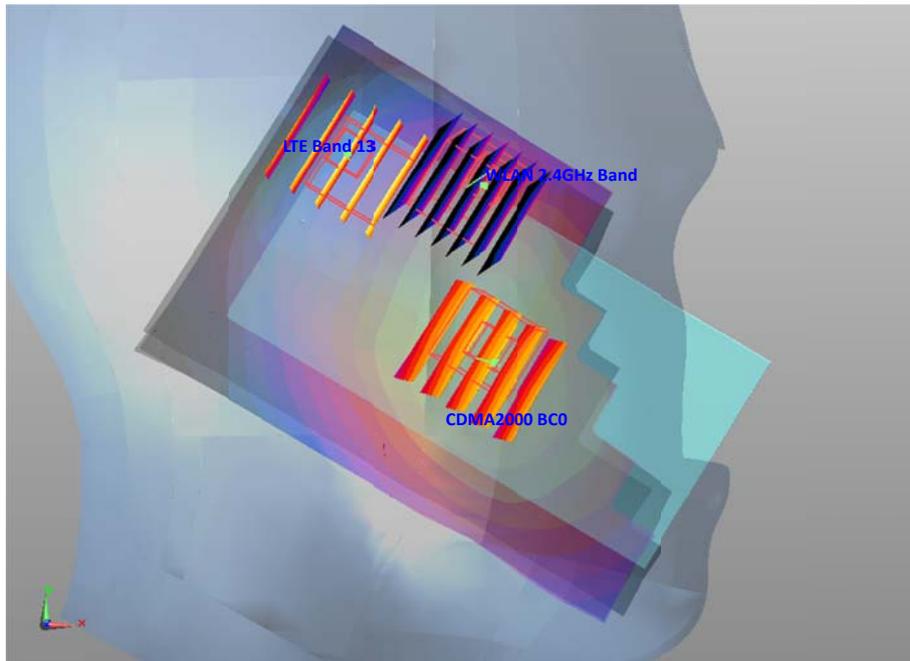
**13.3 Body-Worn Exposure Conditions**

Position	WWAN (voice)			WWAN (data)			WLAN 2.4GHz Band		WWAN + WLAN 2.4GHz Band (W/kg)	SPLSR	Case No
	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	Plot No	Max. WLAN SAR (W/kg)			
Front	CDMA2000 BC0	35	0.651	LTE Band 13	65	0.588	74	0.037	1.28		
	CDMA2000 BC1	55	0.976	LTE Band 13	65	0.588	74	0.037	1.60	0.02	#5
Back	CDMA2000 BC0	39	0.938	LTE Band 13	66	0.697	75	0.233	1.87	0.04	#6
	CDMA2000 BC1	57	1.307	LTE Band 13	66	0.697	75	0.233	2.24	0.04	#7
Back (w/ headset)	CDMA2000 BC0	-	-	LTE Band 13	69	0.708	74	0.037	0.75		
	CDMA2000 BC1	61	1.284	LTE Band 13	69	0.708	77	0.225	2.22	0.03	#8

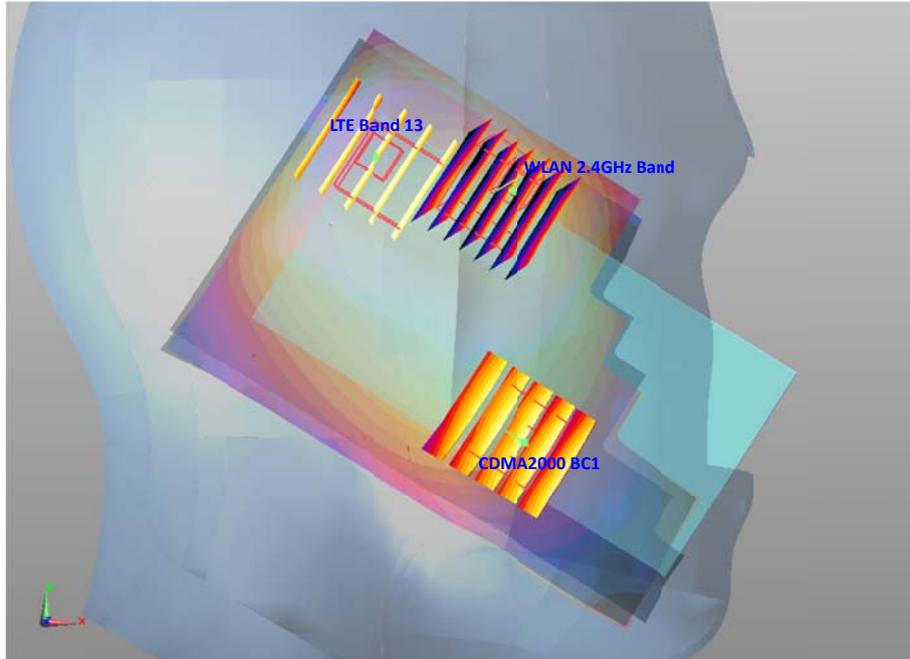
Position	WWAN (voice)			WWAN (data)			Bluetooth	WWAN + Bluetooth (W/kg)	SPLSR	Case No
	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	Estimated Bluetooth SAR (W/kg)			
Front	CDMA2000 BC0	35	0.651	LTE Band 13	65	0.588	0.026	1.27		
	CDMA2000 BC1	55	0.976	LTE Band 13	65	0.588	0.026	1.59		
Back	CDMA2000 BC0	39	0.938	LTE Band 13	66	0.697	0.026	1.66	0.03	#9
	CDMA2000 BC1	57	1.307	LTE Band 13	66	0.697	0.026	2.03	0.03	#10
Back (w/ headset)	CDMA2000 BC0	-	-	LTE Band 13	69	0.708	0.026	0.73		
	CDMA2000 BC1	61	1.284	LTE Band 13	69	0.708	0.026	2.02	0.03	#11

13.4 SPLSR Evaluation and Analysis

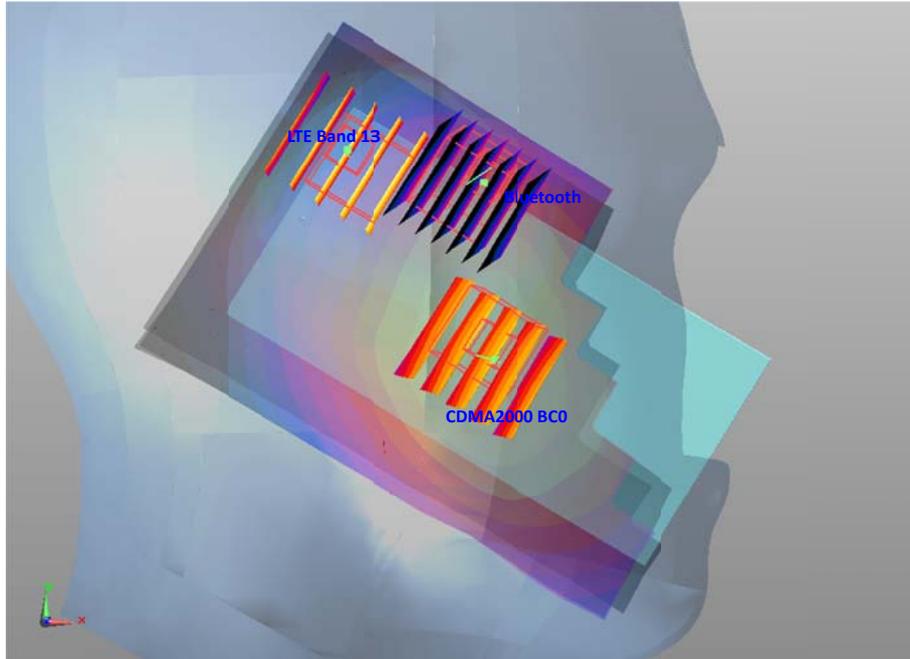
Case No #1	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
3	CDMA2000 BC0	Left Check	0.500	-	0.0683	0.271	-0.173	71.9	1.87	0.04	Not required
13	LTE Band 13		1.370	-	0.0258	0.329	-0.174				
3	CDMA2000 BC0		0.500	-	0.0683	0.271	-0.173	54.1	0.62	0.01	Not required
26	WLAN 2.4G Band		0.117	-	0.0662	0.325	-0.171				
13	LTE Band 13		1.370	-	0.0258	0.329	-0.174	40.7	1.49	0.04	Not required
26	WLAN 2.4G Band		0.117	-	0.0662	0.325	-0.171				



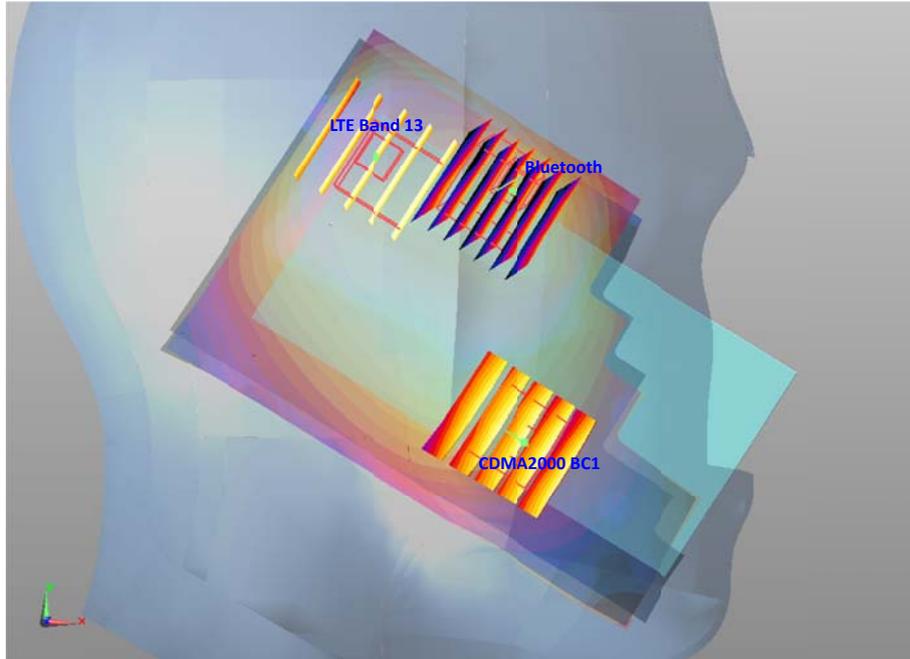
Case No #2	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
8	CDMA2000 BC1	Left Check	0.415	-	0.0705	0.251	-0.17	90.0	1.79	0.03	Not required
13	LTE Band 13		1.370	-	0.0258	0.329	-0.174				
8	CDMA2000 BC1		0.415	-	0.0705	0.251	-0.17	74.1	0.53	0.01	Not required
26	WLAN 2.4G Band		0.117	-	0.0662	0.325	-0.171				
13	LTE Band 13		1.370	-	0.0258	0.329	-0.174	40.7	1.49	0.04	Not required
26	WLAN 2.4G Band		0.117	-	0.0662	0.325	-0.171				



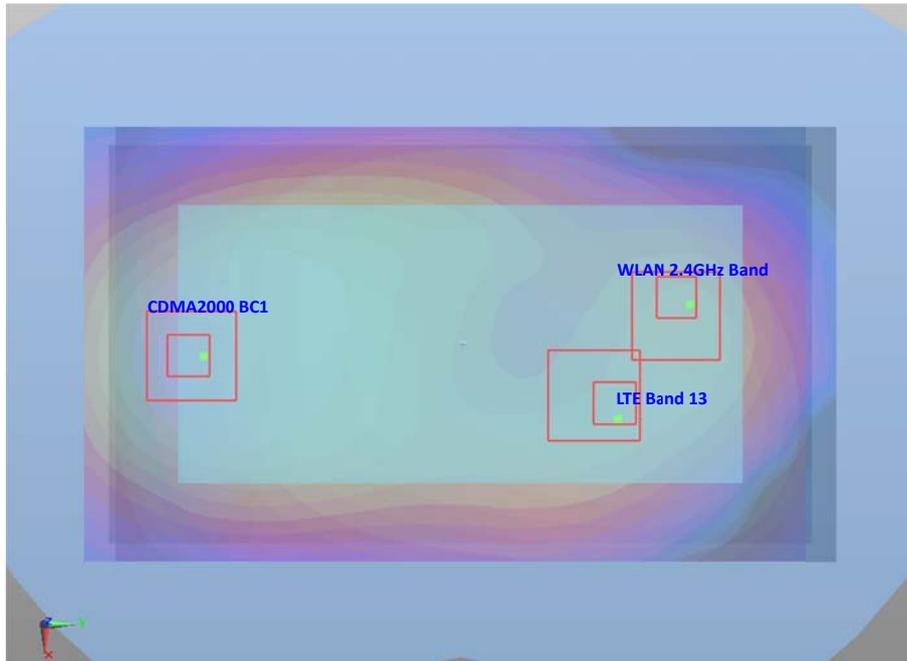
Case No #3	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
Plot No					X	Y	Z				
3	CDMA2000 BC0	Left Check	0.500	-	0.0683	0.271	-0.173	71.9	1.87	0.04	Not required
13	LTE Band 13		1.370	-	0.0258	0.329	-0.174				
3	CDMA2000 BC0		0.500	-	0.0683	0.271	-0.173	54.1	0.55	0.01	
	Bluetooth		0.053	-	0.0662	0.325	-0.171				
13	LTE Band 13		1.370	-	0.0258	0.329	-0.174	40.7	1.42	0.04	
	Bluetooth		0.053	-	0.0662	0.325	-0.171				



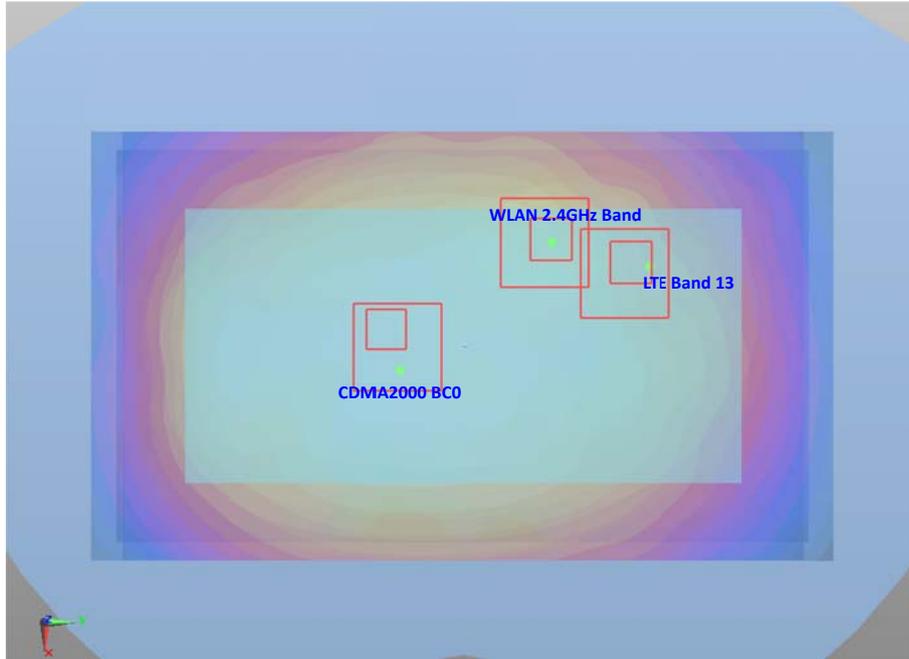
Case No #4	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
8	CDMA2000 BC1	Left Check	0.415	-	0.0705	0.251	-0.17	90.0	1.79	0.03	Not required
13	LTE Band 13		1.370	-	0.0258	0.329	-0.174				
8	CDMA2000 BC1		0.415	-	0.0705	0.251	-0.17	74.1	0.47	0.00	Not required
	Bluetooth		0.053	-	0.0662	0.325	-0.171				
13	LTE Band 13		1.370	-	0.0258	0.329	-0.174	40.7	1.42	0.04	Not required
	Bluetooth		0.053	-	0.0662	0.325	-0.171				



Case No #5	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
55	CDMA2000 BC1	Front	0.976	1	-0.014	-0.0615	-0.205	100.1	1.56	0.02	Not required
65	LTE Band 13		0.588	1	0.001	0.0375	-0.205				
55	CDMA2000 BC1		0.976	1	-0.014	-0.0615	-0.205	111.3	1.01	0.01	Not required
74	WLAN 2.4G Band		0.037	1	-0.0256	0.0492	-0.205				
65	LTE Band 13		0.588	1	0.001	0.0375	-0.205	29.1	0.63	0.02	Not required
74	WLAN 2.4G Band		0.037	1	-0.0256	0.0492	-0.205				



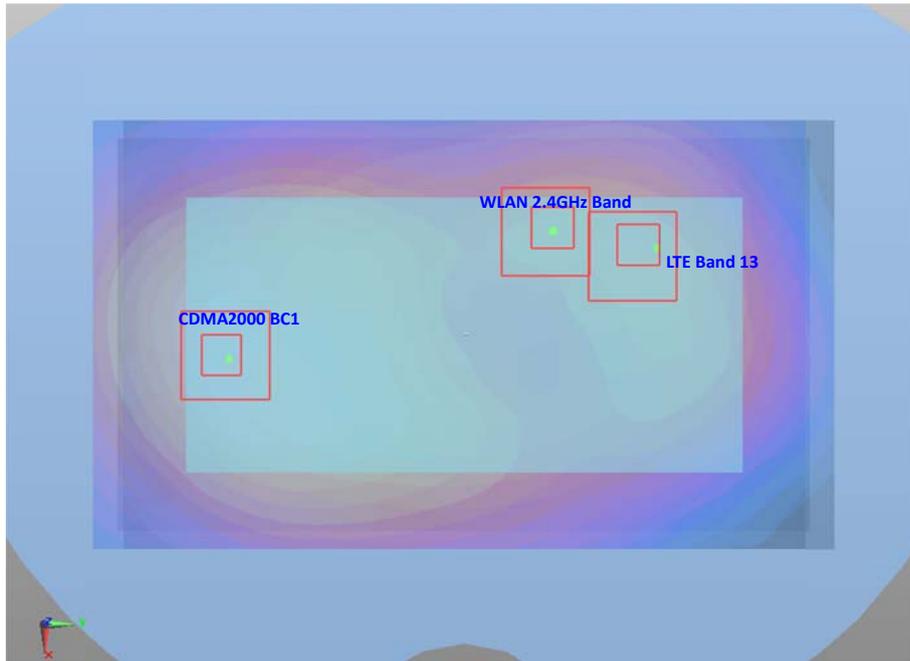
Case No #6	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
39	CDMA2000 BC0	Back	0.938	1	-0.019	-0.023	-0.205	70.2	1.64	0.03	Not required
66	LTE Band 13		0.697	1	-0.0365	0.045	-0.205				
39	CDMA2000 BC0		0.938	1	-0.019	-0.023	-0.205	48.9	1.17	0.03	Not required
75	WLAN 2.4G Band		0.233	1	-0.0412	0.0206	-0.205				
66	LTE Band 13		0.697	1	-0.0365	0.045	-0.205	24.8	0.93	0.04	Not required
75	WLAN 2.4G Band		0.233	1	-0.0412	0.0206	-0.205				



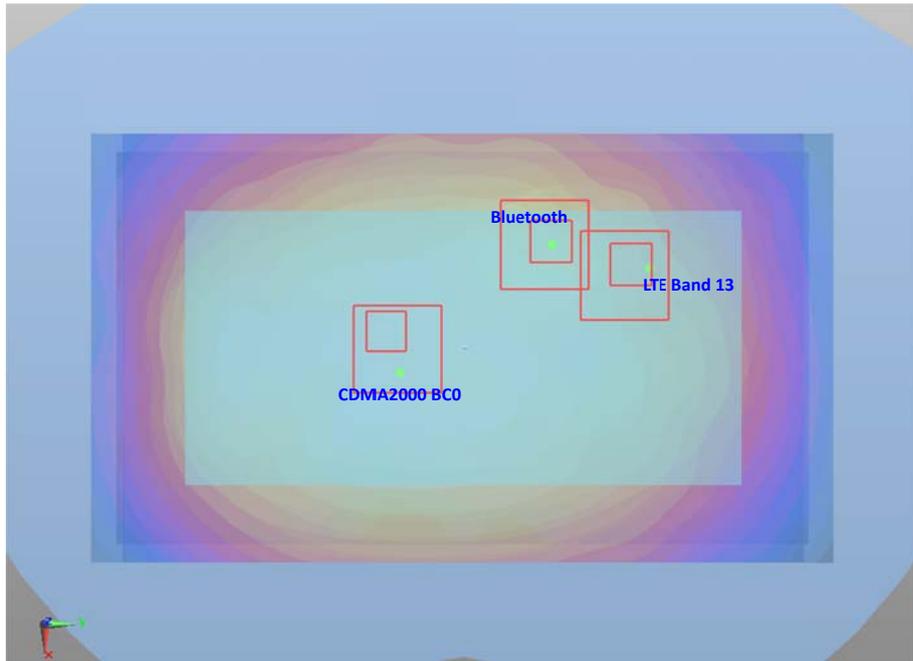
Case No #7	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
57	CDMA2000 BC1	Back	1.307	1	-0.011	-0.0585	-0.205	106.6	2.00	0.03	Not required
66	LTE Band 13		0.697	1	-0.0365	0.045	-0.205				
57	CDMA2000 BC1		1.307	1	-0.011	-0.0585	-0.205	84.7	1.54	0.02	Not required
75	WLAN 2.4G Band		0.233	1	-0.0412	0.0206	-0.205				
66	LTE Band 13		0.697	1	-0.0365	0.045	-0.205	24.8	0.93	0.04	Not required
75	WLAN 2.4G Band		0.233	1	-0.0412	0.0206	-0.205				



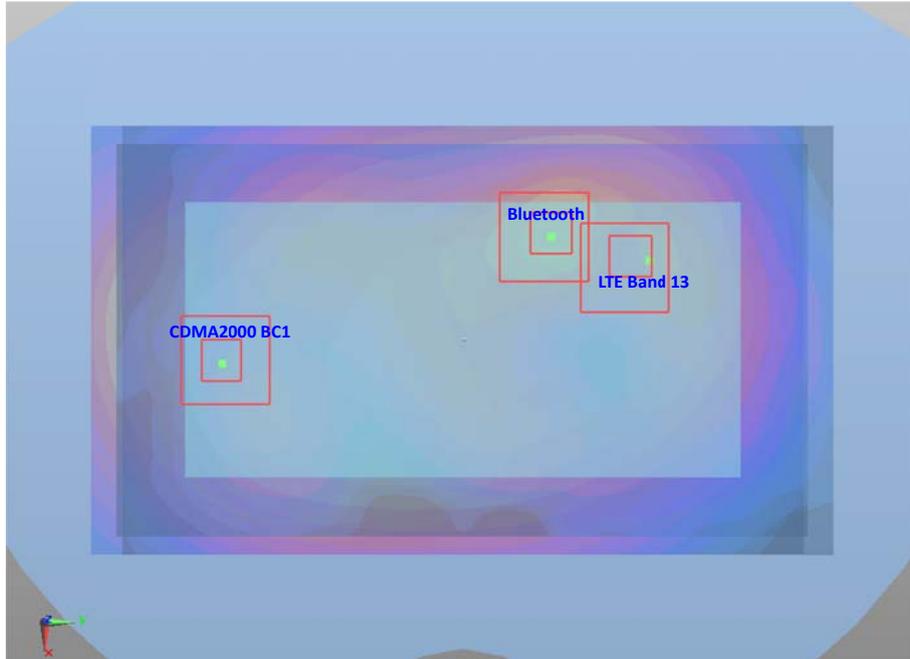
Case No #8	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
61	CDMA2000 BC1	Back	1.284	1	-0.011	-0.057	-0.205	107.0	1.99	0.03	Not required
69	LTE Band 13		0.708	1	-0.038	0.0465	-0.205				
61	CDMA2000 BC1		1.284	1	-0.011	-0.057	-0.205	83.3	1.51	0.02	Not required
77	WLAN 2.4G Band		0.225	1	-0.0412	0.0206	-0.205				
69	LTE Band 13		0.708	1	-0.038	0.0465	-0.205	26.1	0.93	0.03	Not required
77	WLAN 2.4G Band		0.225	1	-0.0412	0.0206	-0.205				



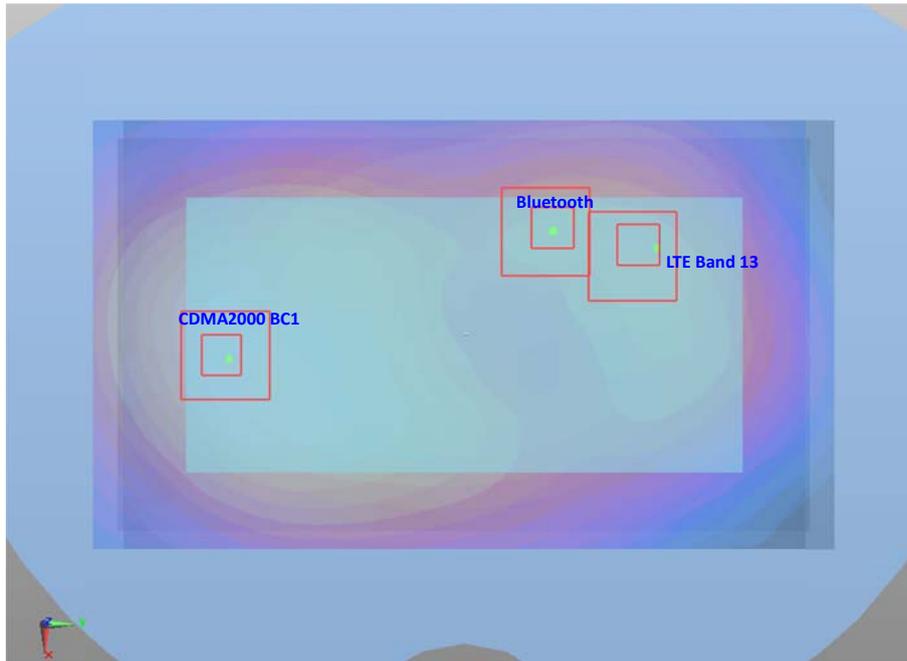
Case No #9	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
39	CDMA2000 BC0	Back	0.938	1	-0.019	-0.023	-0.205	70.2	1.64	0.03	Not required
66	LTE Band 13		0.697	1	-0.0365	0.045	-0.205				
39	CDMA2000 BC0		0.938	1	-0.019	-0.023	-0.205	48.9	0.96	0.02	Not required
	Bluetooth		0.026	1	-0.0412	0.0206	-0.205				
66	LTE Band 13		0.697	1	-0.0365	0.045	-0.205	24.8	0.72	0.02	Not required
	Bluetooth		0.026	1	-0.0412	0.0206	-0.205				



Case No #10	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
57	CDMA2000 BC1	Back	1.307	1	-0.011	-0.0585	-0.205	106.6	2.00	0.03	Not required
66	LTE Band 13		0.697	1	-0.0365	0.045	-0.205				
57	CDMA2000 BC1		1.307	1	-0.011	-0.0585	-0.205	84.7	1.33	0.02	Not required
	Bluetooth		0.026	1	-0.0412	0.0206	-0.205				
66	LTE Band 13		0.697	1	-0.0365	0.045	-0.205	24.8	0.72	0.02	Not required
	Bluetooth		0.026	1	-0.0412	0.0206	-0.205				



Case No #11	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
61	CDMA2000 BC1	Back	1.284	1	-0.011	-0.057	-0.205	107.0	1.99	0.03	Not required
69	LTE Band 13		0.708	1	-0.038	0.0465	-0.205				
61	CDMA2000 BC1		1.284	1	-0.011	-0.057	-0.205	83.3	1.31	0.02	Not required
	Bluetooth		0.026	1	-0.0412	0.0206	-0.205				
69	LTE Band 13		0.708	1	-0.038	0.0465	-0.205	26.1	0.73	0.02	Not required
	Bluetooth		0.026	1	-0.0412	0.0206	-0.205				



Test Engineer : Fulu Hu

## 14. Uncertainty Assessment

The component of uncertainty may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainty by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observations 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 12.1

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor <sup>(a)</sup>	1/k <sup>(b)</sup>	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 14.1 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	Probability	Divisor	Ci	Ci	Standard	Standard
	Value (±%)	Distribution		(1g)	(10g)	Uncertainty (1g)	Uncertainty (10g)
<b>Measurement System</b>							
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 %
<b>Test Sample Related</b>							
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 %
<b>Phantom and Setup</b>							
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 %
<b>Combined Standard Uncertainty</b>						± 11.0 %	± 10.8 %
<b>Coverage Factor for 95 %</b>						K=2	
<b>Expanded Uncertainty</b>						± 22.0 %	± 21.5 %

Table 14.2 Uncertainty Budget for frequency range 300 MHz to 3 GHz



Error Description	Uncertainty	Probability	Divisor	Ci	Ci	Standard	Standard
	Value (±%)	Distribution		(1g)	(10g)	Uncertainty (1g)	Uncertainty (10g)
<b>Measurement System</b>							
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 %
<b>Test Sample Related</b>							
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 %
<b>Phantom and Setup</b>							
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 %
<b>Combined Standard Uncertainty</b>						± 12.8 %	± 12.6 %
<b>Coverage Factor for 95 %</b>						K=2	
<b>Expanded Uncertainty</b>						± 25.6 %	± 25.2 %

Table 14.3 Uncertainty Budget for frequency range 3 GHz to 6 GHz



## **15. 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] FCC OET Bulletin 65 (Edition 97-01) Supplement C (Edition 01-01), “Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields”, June 2001
- [5] SPEAG DASY System Handbook
- [6] FCC KDB 248227 D01 v01r02, “SAR Measurement Procedures for 802.11 a/b/g Transmitters”, May 2007
- [7] FCC KDB 447498 D01 v05, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, October 2012
- [8] FCC KDB 648474 D04 v01, “SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas”, October 2012
- [9] FCC KDB 941225 D05 v01, “SAR Test Considerations for LTE Handsets and Data Modems”, December 15 2010
- [10] FCC KDB 941225 D01 v02, “SAR Measurement Procedures for 3G Devices – CDMA 2000 / Ev-Do / WCDMA / HSDPA / HSPA”, October 2007
- [11] FCC KDB 941225 D06 v01, “SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities”, April 2011
- [12] FCC KDB 865664 D01 v01, “SAR Measurement Requirements for 100MHz to 6 GHz”, October 2012