



# FCC SAR Test Report

**APPLICANT** : HTC Corporation  
**EQUIPMENT** : Smartphone  
**MODEL NAME** : PH39100  
**FCC ID** : NM8PH39100  
**STANDARD** : FCC 47 CFR Part 2 (2.1093)  
IEEE C95.1-1991  
IEEE 1528-2003  
FCC OET Bulletin 65 Supplement C (Edition 01-01)

The product was received on May 09, 2011 and completely tested on Jun 6, 2011. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.

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

Reviewed by:

Jones Tsai / Manager



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FCC ID: NM8PH39100

Page Number : 1 of 59

Report Issued Date : Jun. 19, 2011

Report Version : Rev. 02



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**Appendix E. LTE spectrum plots for different RB allocations**



### Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA142244-01A	Rev. 01	Initial issue of report	Jun. 10, 2011
FA142244-01A	Rev. 02	1. Update typo of SAR values in simultaneous SAR analysis at page 55,56 2. Add the description in note 1 at page 46, addressing possibility of VOIP in LTE mode through 3 <sup>rd</sup> party applications.	Jun. 19, 2011

**1. Statement of Compliance**

The maximum results of Specific Absorption Rate (SAR) found during testing for **HTC Corporation SmartphonePH39100** are as follows (with expanded uncertainty 21.4% for 300 MHz to 3 GHz).

Band	Position	SAR <sub>1g</sub> (W/kg)
<b>GSM 850</b>	Head	<b>0.241</b>
	Body-worn (1cm Gap)	<b>0.837</b>
	Hotspot (1cm Gap)	<b>0.837</b>
<b>GSM 1900</b>	Head	<b>0.566</b>
	Body (1cm Gap)	<b>0.791</b>
	Hotspot (1cm Gap)	<b>0.791</b>
<b>WCDMA V</b>	Head	<b>0.350</b>
	Body (1cm Gap)	<b>0.534</b>
	Hotspot (1cm Gap)	<b>0.534</b>
<b>WCDMA II</b>	Head	<b>1.280</b>
	Body (1cm Gap)	<b>1.090</b>
	Hotspot (1cm Gap)	<b>1.090</b>
<b>LTE Band 4</b>	Head	<b>0.734</b>
	Body (1cm Gap)	<b>0.862</b>
	Hotspot (1cm Gap)	<b>0.862</b>
<b>LTE Band 17</b>	Head	<b>0.615</b>
	Body (1cm Gap)	<b>0.154</b>
	Hotspot (1cm Gap)	<b>0.156</b>
<b>802.11b/g/n</b>	Head	<b>0.606</b>
	Body (1cm Gap)	<b>0.07</b>
	Hotspot (1cm Gap)	<b>0.07</b>
<b>Bluetooth</b>	Head	<b>N/A</b>
	Body	<b>N/A</b>
	Hotspot (1cm Gap)	<b>N/A</b>

**Note:**

1. Per KDB 648474, Bluetooth power 1.07dBm is < P(Ref), P(Ref)= 10.8dBm, and the distance to Phone01 antenna is 10.27cm > 5cm.
2. Per KDB 648474, Bluetooth power 1.07dBm is < P(Ref), P(Ref)= 10.8dBm, the distance to Phone02 antenna is < 2.5cm, the Phone02 antenna LTE band 17 maximum SAR =0.615W/kg < 1.2W/kg.
3. Therefore, Bluetooth can be excluded from standalone and simultaneous SAR consideration.

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 C95.1-1991, 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).



The table below summarized necessary items addressed in KDB 941225 D05 v01.

FCC ID	NM8PH39100						
DUT Type	Smartphone (Handset)						
Operating Frequency Range of each LTE transmission band	Band 4: TX: 1710~1755 MHz, RX: 2110~ 2155 MHz Band 17: TX: 704~ 716 MHz, RX: 734 ~ 746 MHz						
Channel Bandwidth	5MHz, 10MHz						
Transmission (H, M, L) channel numbers and frequencies in each LTE band	Band 4:	Bandwidth 5 MHz	Channel #	Frequency (MHz)	Bandwidth 10 MHz	Channel #	Frequency (MHz)
			19975	1712.5		20000	1715
			20175	1732.5		20175	1732.5
			20375	1752.5		20350	1750
	Band 17:	Bandwidth 5 MHz	Channel #	Frequency (MHz)	Bandwidth 10 MHz	Channel #	Frequency (MHz)
			23755	706.5		23780	709
			23790	710		23790	710
			23825	713.5		23800	711
	UE category, uplink modulations used	Category 3, QPSK, and 16QAM					
LTE transmitter and antenna implementation (standalone or sharing hardware components / antennas )	LTE band 17 transmitting, it shares the same antenna with 2G/3G TX/RX antenna LTE band 4 transmitting, it shares the same antenna with 2G/3G diversity RX antenna						
LTE Voice / Data requirements	1. Data only 2. Considering the users may install 3 <sup>rd</sup> party software to enable VOIP, LTE Head SAR is also evaluated.						
LTE MPR permanently built-in by design	Yes						
LTE A-MPR	Disabled during SAR testing. With CMW500, set NS value to NS_01 to disable A-MPR.						
LTE maximum averaged conducted output power	LTE Band 4 : 23.41 dBm LTE Band 17 : 23.15 dBm						
Other U.S. wireless operating modes / bands	GSM/GPRS/EDGE	GSM850: UL:824~849MHz/DL:869~894MHz PCS : UL:1850~1910MHz/DL:1930~1990MHz					
	WCDMA	WCDMA Band II: UL:1852.5~1907.6MHz/ DL:1932.5~1987.6MHz WCDMA Band V: UL:826.5~846.6MHz/ DL:871.5~891.6MHz					
Simultaneous transmission configurations	Details are In Section 12.2. The possible combinations are 2G/3G +WLAN and LTE+WLAN.						
Power reduction applied to satisfy SAR compliance	No						



## 2. Administration Data

### 2.1 Testing Laboratory

<b>Test Site</b>	SPORTON INTERNATIONAL INC.
<b>Test Site Location</b>	No. 52, HwaYa 1 <sup>st</sup> Rd., HwaYaTechnologyPark, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978

### 2.2 Applicant

<b>Company Name</b>	HTC Corporation
<b>Address</b>	No. 23, Xinghua Rd., Taoyuan City, Taoyuan County 330, Taiwan

### 2.3 Manufacturer

<b>Company Name</b>	HTC Corporation
<b>Address</b>	No. 23, Xinghua Rd., Taoyuan City, Taoyuan County 330, Taiwan

### 2.4 Application Details

<b>Date of Receipt of Application</b>	May 09, 2011
<b>Date of Start during the Test</b>	May. 15, 2011
<b>Date of End during the Test</b>	Jun 6, 2011



### 3. General Information

#### 3.1 Description of Device Under Test (DUT)

Product Feature & Specification	
<b>DUT Type</b>	Smartphone
<b>Model Name</b>	PH39100
<b>Tx Frequency</b>	GSM850 : 824 MHz ~ 849 MHz GSM1900 : 1850 MHz ~ 1910 MHz WCDMA 2 : 1852.5 MHz ~ 1907.6MHz WCDMA 5 : 826.5 MHz ~ 846.6 MHz LTE Band 4 : 1710MHz ~ 1755 MHz LTE Band 17 : 704 MHz ~ 716 MHz 802.11b/g/n : 2400 MHz ~ 2483.5 MHz Bluetooth : 2400 MHz ~ 2483.5 MHz
<b>Rx Frequency</b>	GSM850 : 869 MHz ~ 894 MHz GSM1900 : 1930 MHz ~ 1990 MHz WCDMA 2 : 1932.5 MHz ~ 1987.6 MHz WCDMA 5 : 871.5 MHz ~ 891.6 MHz LTE Band 4 : 2100 MHz ~ 2155 MHz LTE Band 17 : 734 MHz ~ 746 MHz 802.11b/g/n : 2400 MHz ~ 2483.5 MHz Bluetooth : 2400 MHz ~ 2483.5 MHz
<b>Maximum Output Power to Antenna</b>	GSM850 : 32.21 dBm GSM1900 : 29.81 dBm WCDMA Band V : 23.72 dBm WCDMA Band II : 23.36 dBm LTE Band 4 : 23.42 dBm LTE Band 17 : 23.15 dBm 802.11b : 18.19 dBm 802.11g : 13.21 dBm 802.11n (BW 20MHz) : 13.10 dBm Bluetooth : 1.07 dBm
<b>Antenna Type</b>	Fixed Internal Antenna
<b>Type of Modulation</b>	GSM : GMSK WCDMA : QPSK HSDPA : QPSK / 16QAM HSUPA : QPSK LTE: QPSK / 16QAM (uplink) 802.11b : DSSS (BPSK / QPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) Bluetooth (1Mbps) : GFSK Bluetooth EDR (2Mbps) : $\pi/4$ -DQPSK Bluetooth EDR (3Mbps) : 8-DPSK
<b>DUT Stage</b>	Identical Prototype

**Remark:**

1. The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. Device does not support Dual Transfer Mode (DTM).
3. Regarding GPRS/EDGE, DUT only supports up to class 10.





**3.3 Applied Standards**

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)
- IEEE C95.1-1991
- IEEE 1528-2003
- FCC OET Bulletin 65 Supplement C (Edition 01-01)
- FCC KDB 648474 D01 v01r05
- FCC KDB 248227 D01 v01r02
- FCC KDB 941225 D01 v02
- FCC KDB 941225 D03 v01
- FCC KDB 941225 D06 v01
- FCC KDB 941225 D05 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**

<b>Ambient Temperature</b>	20 to 24°C
<b>Humidity</b>	<60 %

**3.5.2 Test Configuration**

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 DUT 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 DUT. The DUT was set from the emulator to radiate maximum output power during all tests.

## 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

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

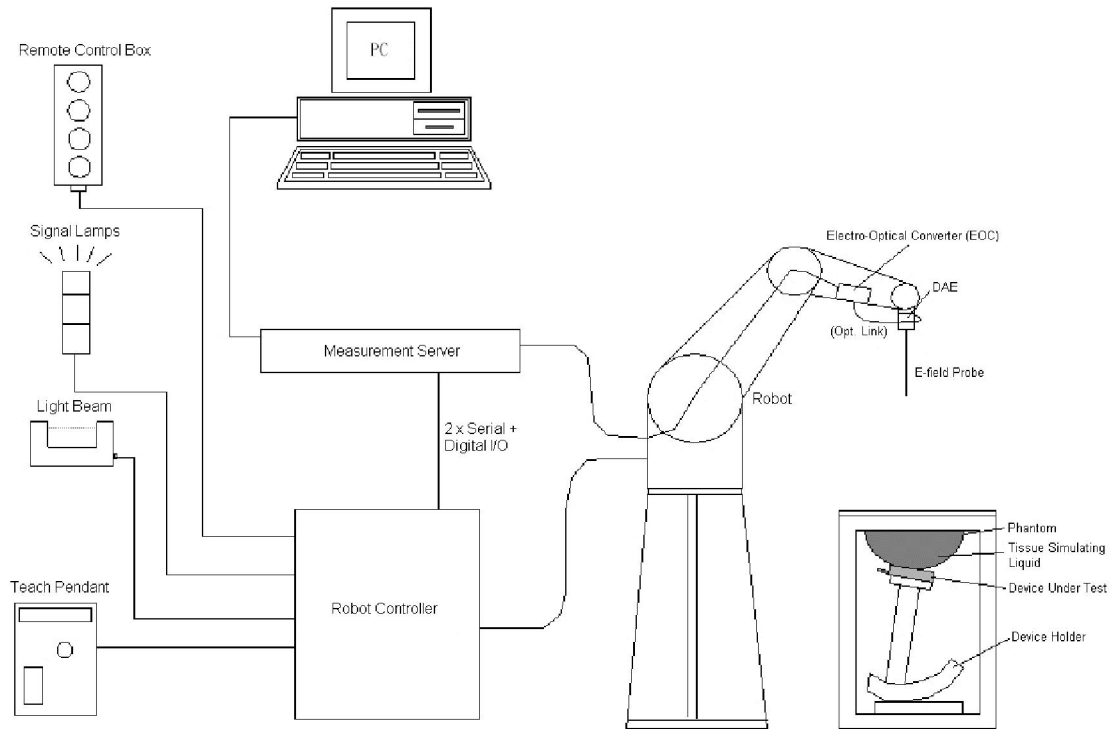
Where: C is the specific heat capacity,  $\delta T$  is the temperature rise and  $\delta t$  is the exposure duration, or related to the electrical field in the tissue by

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

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 DASY4 or DASY5 System Configurations**

The DASY4 or DASY5 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 (ECO) 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
- DASY4 or DASY5 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

Some of the components are described in details in the following sub-sections.

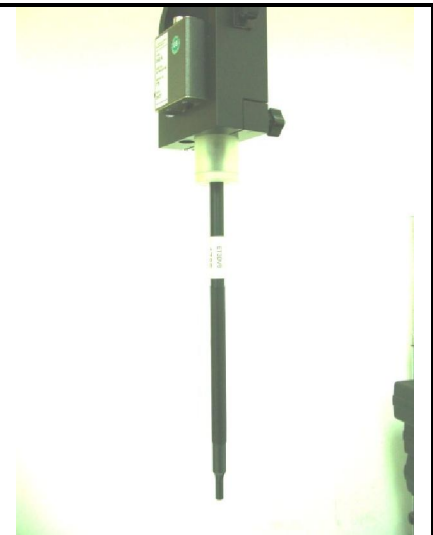
**5.1 E-Field Probe**

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**

**<ET3DV6>**

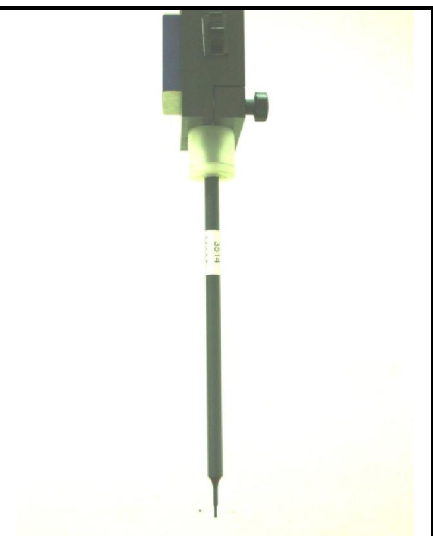
<b>Construction</b>	Symmetrical design with triangular core Built-in optical fiber for surface detection system. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
<b>Frequency</b>	10 MHz to 3 GHz; Linearity: $\pm 0.2$ dB
<b>Directivity</b>	$\pm 0.2$ dB in HSL (rotation around probe axis) $\pm 0.4$ dB in HSL (rotation normal to probe axis)
<b>Dynamic Range</b>	5 $\mu$ W/g to 100 mW/g; Linearity: $\pm 0.2$ dB
<b>Dimensions</b>	Overall length: 330 mm (Tip: 16 mm) Tip diameter: 6.8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.7 mm



**Fig 5.2 Photo of ET3DV6**

**<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 5.3 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  $\pm 0.25\text{dB}$ . 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 200M $\Omega$ ; the inputs are symmetrical and floating. Common mode rejection is above 80dB.



Fig 5.4 Photo of DAE

### 5.3 Robot

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

- High precision (repeatability  $\pm 0.035\text{ mm}$ )
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

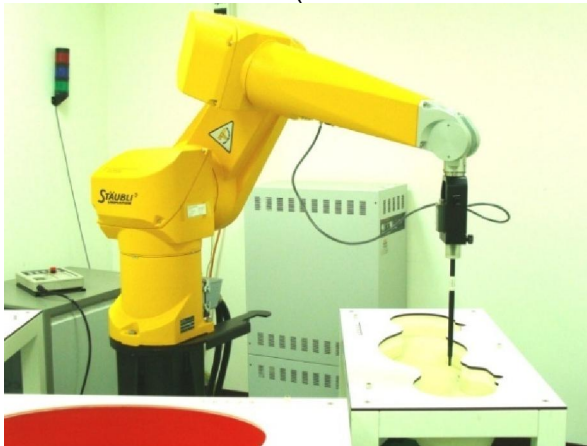


Fig 5.5 Photo of DASY4



Fig 5.6 Photo of DASY5

#### 5.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY4: 166MHz, Intel Pentium; DASY5: 400MHz, Intel Celeron), chipdisk (DASY4: 32 MB; DASY5: 128 MB), RAM (DASY4: 64 MB, DASY5: 128 MB). The necessary circuits for communication with the DAEElectronic box, as well as the 16bit ADconverter 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 5.7 Photo of Server for DASY4

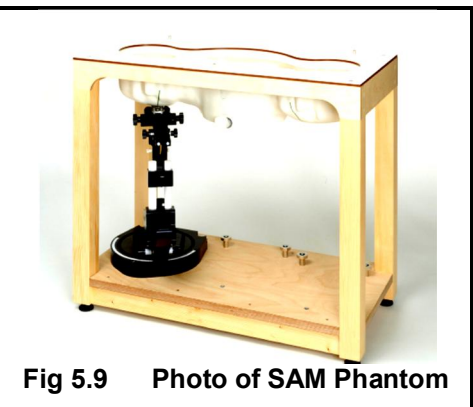


Fig 5.8 Photo of Server for DASY5

5.5 Phantom

<SAM Twin Phantom>

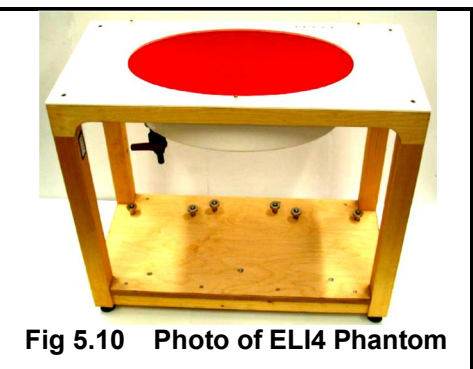
<b>Shell Thickness</b>	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
<b>Filling Volume</b>	Approx. 25 liters
<b>Dimensions</b>	Length: 1000 mm; Width: 500 mm; Height: adjustable feet
<b>Measurement Areas</b>	Left Hand, Right Hand, Flat Phantom



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

<ELI4 Phantom>

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



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



## 5.6 Device Holder

### <Device Holder for SAM Twin Phantom>

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of  $\pm 0.5$  mm would produce a SAR uncertainty of  $\pm 20\%$ . 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 (EPR). 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.

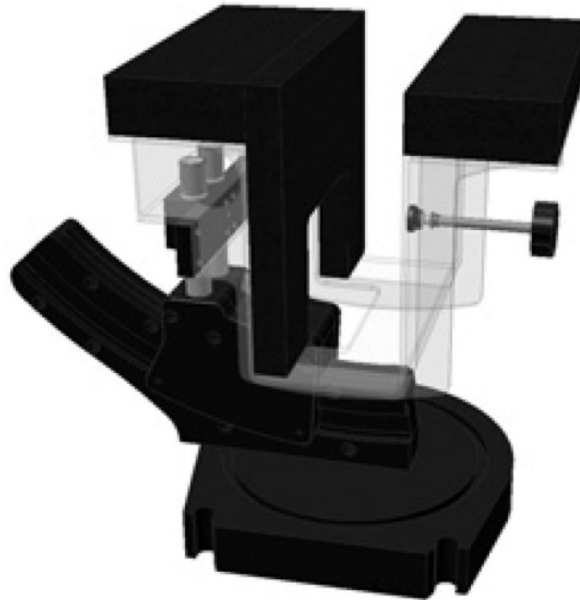


Fig 5.11 Device Holder



**<Laptop Extension Kit>**

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



**Fig 5.12**      **Laptop Extension Kit**



5.7 Data Storage and Evaluation

5.7.1 Data Storage

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

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

5.7.2 Data Evaluation

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

- Probe parameters :**
  - Sensitivity Norm<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>
- Device parameters :**
  - Frequency f
  - Crest factor cf
- Media parameters :**
  - Conductivity σ
  - Density ρ

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

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

The formula for each channel can be given as :

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

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),  $\mu\text{V}/(\text{V}/\text{m})^2$  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	Dosimetric E-Field Probe	EX3DV4	3731	Sep. 20, 2010	Sep. 19, 2011
SPEAG	Dosimetric E-Field Probe	EX3DV4	3697	Apr. 19, 2011	Apr. 18, 2012
SPEAG	750MHz System Validation Kit	D750V3	1012	Jun. 11, 2010	Jun. 10, 2012
SPEAG	835MHz System Validation Kit	D835V2	4d082	Jul. 20, 2010	Jul. 19, 2012
SPEAG	1800MHz System Validation Kit	D1800V2	2d052	Jun. 15, 2010	Jun. 14, 2012
SPEAG	1900MHz System Validation Kit	D1900V2	5d018	Jun. 15, 2010	Jun. 14, 2012
SPEAG	2450MHz System Validation Kit	D2450V2	735	Jun. 17, 2010	Jun. 16, 2011
SPEAG	Data Acquisition Electronics	DAE4	778	Oct. 22, 2010	Oct. 21, 2011
SPEAG	Data Acquisition Electronics	DAE3	495	Apr. 28, 2011	Apr. 27, 2012
SPEAG	Data Acquisition Electronics	DAE4	1249	Feb. 21, 2011	Feb. 20, 2012
SPEAG	Device Holder	N/A	N/A	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1303	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1383	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1446	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1478	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 001 BB	1026	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 001 BA	1029	NCR	NCR
Agilent	ENA Series Network Analyzer	E5071C	MY46106933	Jul. 06, 2010	Jul. 05, 2011
Agilent	Wireless Communication Test Set	E5515C	MY48360820	Jan. 12, 2010	Jan. 11, 2012
Agilent	Wireless Communication Test Set	E5515C	GB46311322	Mar. 23, 2011	Mar. 22, 2013
R&S	Universal Radio Communication Tester	CMU200	114256	Feb. 08, 2010	Feb. 07, 2012
R&S	Universal Radio Communication Tester	CMW500	102159	Sep. 09, 2010	Sep. 08, 2011
Agilent	Dielectric Probe Kit	85070D	US01440205	NCR	NCR
Agilent	Dual Directional Coupler	778D	50422	NCR	NCR
AR	Power Amplifier	5S1G4M2	0328767	NCR	NCR
R&S	Spectrum Analyzer	FSP40	100055	Jun. 11, 2010	Jun. 10, 2011

Table 5.1 Test Equipment List

Note: The calibration certificate of DASYS can be referred to appendix C of this report.

## 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.

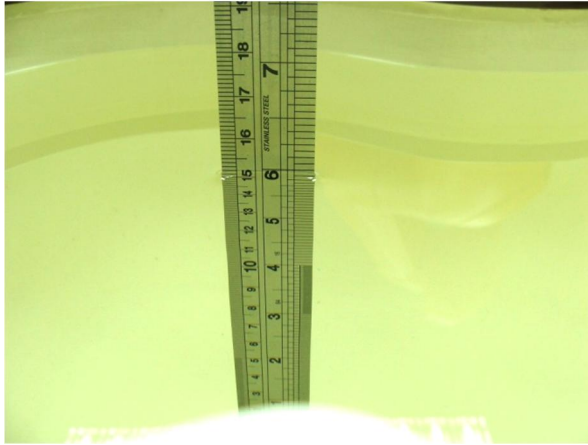


Fig 6.1 Photo of Liquid Height for Head SAR

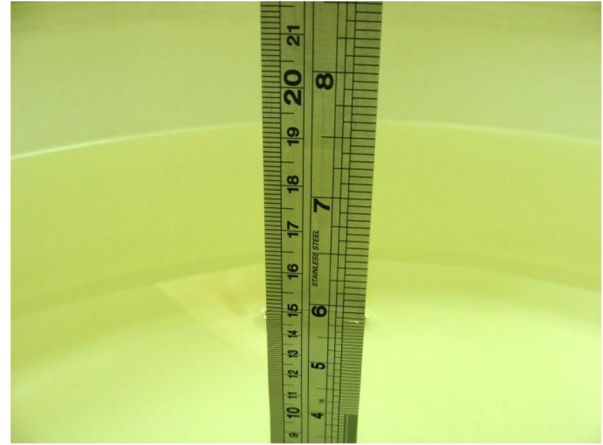


Fig 6.2 Photo of Liquid Height for Body SAR

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
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
<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
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7

Table 6.1 Recipes of Tissue Simulating Liquid



The following table gives the targets for tissue simulating liquid.

Frequency (MHz)	Liquid Type	Conductivity ( $\sigma$ )	$\pm 5\%$ Range	Permittivity ( $\epsilon_r$ )	$\pm 5\%$ Range
835	Head	0.90	0.86 ~ 0.95	41.5	39.4 ~ 43.6
1800, 1900, 2000	Head	1.40	1.33 ~ 1.47	40.0	38.0 ~ 42.0
835	Body	0.97	0.92 ~ 1.02	55.2	52.4 ~ 58.0
1800, 1900, 2000	Body	1.52	1.44 ~ 1.60	53.3	50.6 ~ 56.0
750	Head	0.89	0.84 ~ 0.93	41.9	39.9 ~ 43.9
750	Body	0.96	0.92 ~ 1.0	55.5	52.8 ~ 58.2
2450	Head	1.80	1.71 ~ 1.89	39.2	37.2 ~ 41.2
2450	Body	1.95	1.85 ~ 2.05	52.7	50.1 ~ 55.3

Table 6.2 Targets 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	Temperature ( $^{\circ}$ C)	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )	Measurement Date
709	Head	21.5	0.782	37.8	Jun. 02, 2011
710	Head	21.5	0.802	37.7	Jun. 02, 2011
711	Head	21.5	0.823	37.7	Jun. 02, 2011
750	Head	21.5	0.886	40.28	Jun. 02, 2011
709	Head	21.5	0.784	37.7	Jun. 04, 2011
710	Head	21.5	0.802	37.7	Jun. 04, 2011
711	Head	21.5	0.811	37.6	Jun. 04, 2011
750	Head	21.5	0.89	40.32	Jun. 04, 2011
709	Body	21.4	0.913	52.6	Jun. 02, 2011
710	Body	21.4	0.921	52.5	Jun. 02, 2011
711	Body	21.4	0.928	52.5	Jun. 02, 2011
750	Body	21.4	0.958	53.11	Jun. 02, 2011
709	Body	21.3	0.958	50	Jun. 04, 2011
710	Body	21.3	0.964	50	Jun. 04, 2011
711	Body	21.3	0.971	49.9	Jun. 04, 2011
750	Body	21.3	0.964	53.16	Jun. 04, 2011
1715	Head	21.3	1.34	38.4	Jun. 01, 2011
1732.5	Head	21.3	1.36	38.4	Jun. 01, 2011
1750	Head	21.3	1.38	38.3	Jun. 01, 2011
1800	Head	21.3	1.43	38.2	Jun. 01, 2011
1715	Head	21.2	1.35	40.1	Jun. 05, 2011
1732.5	Head	21.2	1.38	40.1	Jun. 05, 2011
1750	Head	21.2	1.4	40.2	Jun. 05, 2011
1800	Head	21.2	1.43	39.8	Jun. 05, 2011
1715	Body	21.6	1.51	51.9	Jun. 02, 2011
1732.5	Body	21.6	1.53	51.8	Jun. 02, 2011
1750	Body	21.6	1.54	51.8	Jun. 02, 2011
1800	Body	21.6	1.55	51.6	Jun. 02, 2011
1715	Body	21.5	1.46	53	Jun. 05, 2011
1732.5	Body	21.5	1.47	52.9	Jun. 05, 2011
1750	Body	21.5	1.49	52.9	Jun. 05, 2011
1800	Body	21.5	1.56	52.8	Jun. 05, 2011
835	Head	21.3	0.902	43.3	May 29, 2011
835	Head	21.5	0.912	43.4	May 30, 2011
835	Body	21.5	0.976	52.9	May 30, 2011
835	Body	21.7	0.979	52.7	Jun. 06, 2011



1900	Head	21.7	1.44	38.1	May 29, 2011
1900	Head	21.3	1.46	39	Jun. 01, 2011
1900	Body	21.5	1.53	52.5	May 30, 2011
1900	Body	21.5	1.54	52.6	Jun. 01, 2011
2450	Head	21.5	1.84	39.3	Jun. 02, 2011
2450	Body	21.6	2.02	53.9	Jun. 02, 2011

**Table 6.3 Measuring Results for Simulating Liquid**

## 7. 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 observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

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

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience and knowledge of the behavior and properties of relevant materials and instruments, manufacture’s specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table 7.1

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 7.1 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 showed in Table 7.2.





Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Standard Uncertainty (1g)
<b>Measurement System</b>					
Probe Calibration	5.5	Normal	1	1	±5.5 %
Axial Isotropy	4.7	Rectangular	√3	0.7	±1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	±3.9 %
Boundary Effects	1.0	Rectangular	√3	1	±0.6 %
Linearity	4.7	Rectangular	√3	1	±2.7 %
System Detection Limits	1.0	Rectangular	√3	1	±0.6 %
Readout Electronics	0.3	Normal	1	1	±0.3 %
Response Time	0.8	Rectangular	√3	1	±0.5 %
Integration Time	2.6	Rectangular	√3	1	±1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	±1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	±1.7 %
Probe Positioner	0.4	Rectangular	√3	1	±0.2 %
Probe Positioning	2.9	Rectangular	√3	1	±1.7 %
Max. SAR Eval.	1.0	Rectangular	√3	1	±0.6 %
<b>Test Sample Related</b>					
Device Positioning	2.9	Normal	1	1	±2.9 %
Device Holder	3.6	Normal	1	1	±3.6 %
Power Drift	5.0	Rectangular	√3	1	±2.9 %
<b>Phantom and Setup</b>					
Phantom Uncertainty	4.0	Rectangular	√3	1	±2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	±1.8 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	±1.6 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	±1.7 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	±1.5 %
<b>Combined Standard Uncertainty</b>					± 10.7%
<b>Coverage Factor for 95 %</b>					K=2
<b>Expanded Uncertainty</b>					± 21.4 %

Table 7.2 Uncertainty Budget of DASY for frequency range 300 MHz to 3 GHz

## 8. SAR Measurement Evaluation

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.

### 8.1 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.

### 8.2 System Setup

In the simplified setup for system evaluation, the DUT 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:

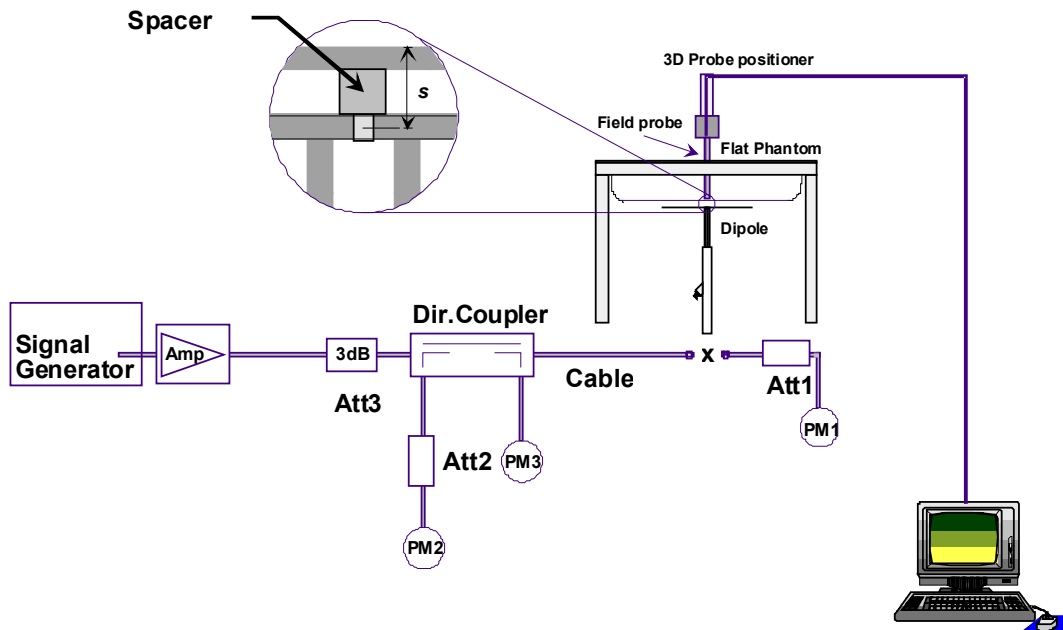
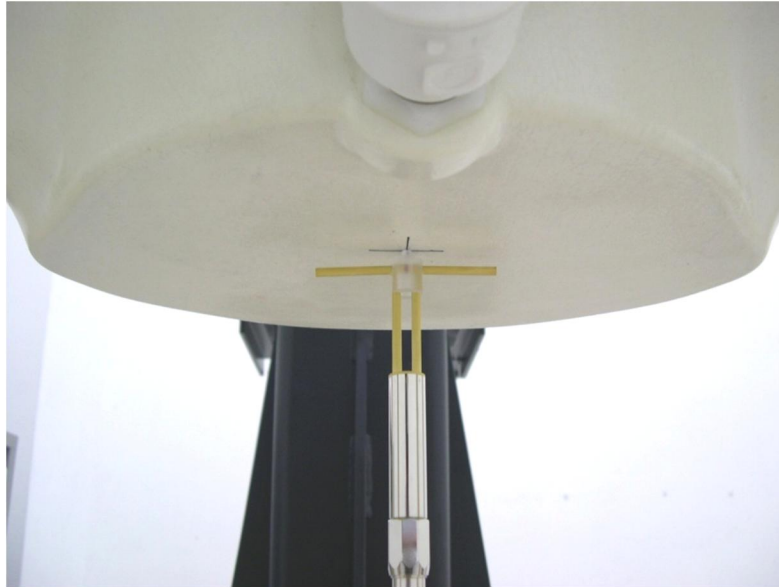


Fig 8.1 System Setup for System Evaluation

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

The output power on dipole port must be calibrated to 24 dBm (250mW) before dipole is connected.



**Fig 8.2 Photo of Dipole Setup**

**8.3 Validation Results**

Comparing to the original SAR value provided by SPEAG, the validation data should be within its specification of 10 %. Table 8.1 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.

Measurement Date	Frequency (MHz)	Liquid Type	Targeted SAR <sub>1g</sub> (W/kg)	Measured SAR <sub>1g</sub> (W/kg)	Normalized SAR <sub>1g</sub> (W/kg)	Deviation (%)
Jun. 02, 2011	750	Head	8.280	2.080	8.32	0.48
Jun. 04, 2011	750	Head	8.280	2.060	8.24	-0.48
Jun. 02, 2011	750	Body	8.860	2.280	9.12	2.93
Jun. 04, 2011	750	Body	8.860	2.210	8.84	-0.23
May 29, 2011	835	Head	9.650	2.400	9.60	-0.52
May 30, 2011	835	Head	9.650	2.350	9.40	-2.59
May 30, 2011	835	Body	10.000	2.670	10.68	6.80
Jun. 06, 2011	835	Body	10.000	2.680	10.72	7.20
Jun. 01, 2011	1800	Head	38.800	9.570	38.28	-1.34
Jun. 05, 2011	1800	Head	38.800	9.530	38.12	-1.75
Jun. 02, 2011	1800	Body	38.900	9.370	37.48	-3.65
Jun. 05, 2011	1800	Body	38.900	9.390	37.56	-3.44
May 29, 2011	1900	Head	39.200	9.410	37.64	-3.98
Jun. 01, 2011	1900	Head	39.200	9.600	38.40	-2.04
May 30, 2011	1900	Body	40.000	9.720	38.88	-2.80
Jun. 01, 2011	1900	Body	40.000	9.590	38.36	-4.10
Jun. 02, 2011	2450	Head	52.200	13.600	54.40	4.21
Jun. 02, 2011	2450	Body	53.500	14.400	57.60	7.66

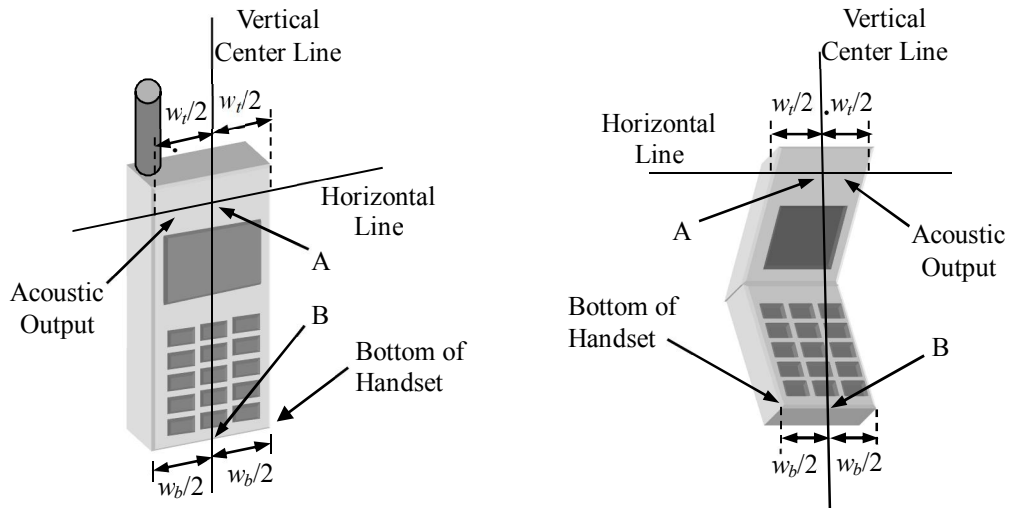
**Table 8.1 Target and Measurement SAR after Normalized**

## 9. DUT Testing Position

This DUT was tested in 10 different positions. They are right cheek, right tilted, left cheek, left tilted, and front face of the DUT with phantom 1.0 cm gap, rear face of the DUT with phantom 1.0 cm gap, right side of the DUT with phantom 1.0 cm gap, left side of the DUT with phantom 1.0 cm gap, top side of the DUT with phantom 1.0 cm gap, and down side of the DUT with phantom 1.0 cm gap as illustrated below:

### 1. Define two imaginary lines on the handset

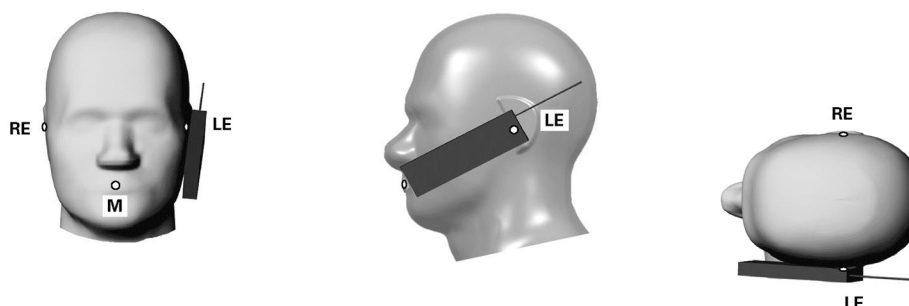
- (a) The vertical centerline passes through two points on the front side of the handset - the midpoint of the width  $w_t$  of the handset at the level of the acoustic output, and the midpoint of the width  $w_b$  of the bottom of the handset.
- (b) The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of the handset at point A.
- (c) The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.



**Fig 9.1 Illustration for Handset Vertical and Horizontal Reference Lines**

**2. Cheek Position**

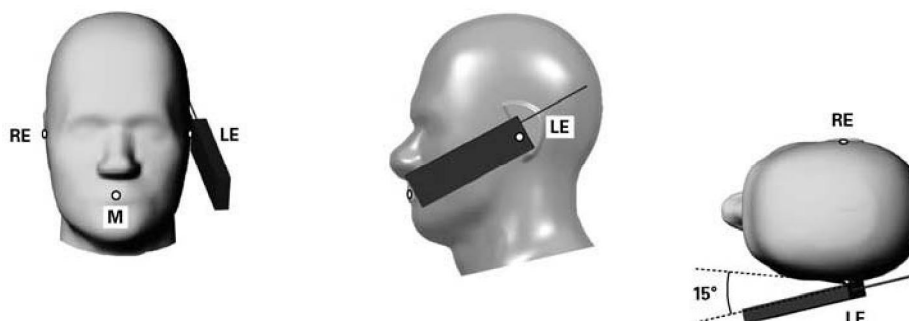
- (a) To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing 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. 9.2).



**Fig 9.2 Illustration for Cheek Position**

**3. Tilted Position**

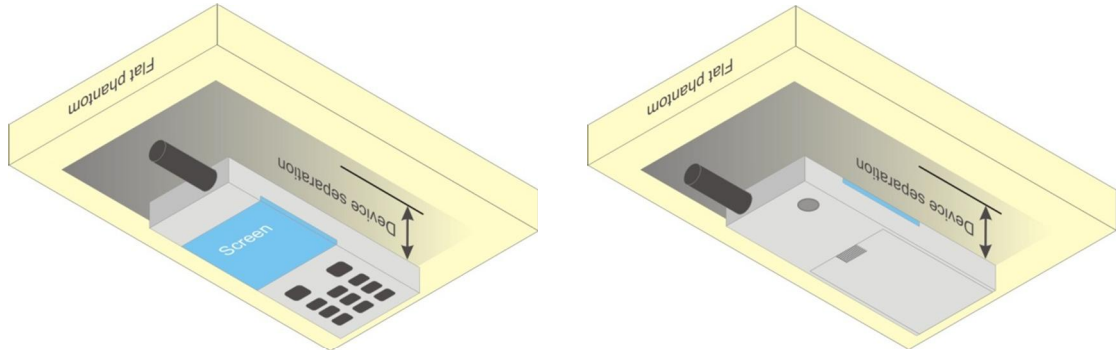
- (a) To position the device in the “cheek” position described above.
- (b) While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see Fig. 9.3).



**Fig 9.3 Illustration for Tilted Position**

#### 4. Body Worn Position

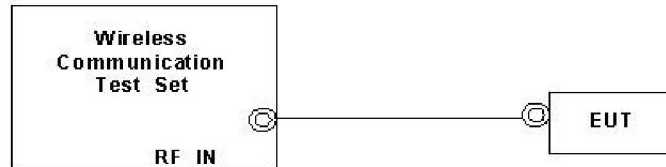
- (a) To position the device parallel to the phantom surface.
- (b) To adjust the device parallel to the flat phantom.
- (c) To adjust the distance between the device surface and the flat phantom to 1.0 cm.



**Fig 9.4 Illustration for Body Worn Position**

## 10. 3G SAR Measurement Procedures

The EUT was configured and tested according to the requirements of the FCC 3G procedures/TS 34.121, /KDB941225.



**Setup Configuration**

### WCDMA configuration settings:

- a. The DUT was connected to Wireless Communication Test Set referred to the drawing of Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between DUT and Base Station with following setting
  - i. Data rates: Varied from RMC 12.2Kbps.
  - ii. RMC Test Loop = Loop Mode 1
  - iii. Power Ctrl Mode = All Up bits
- d. The transmitted maximum output power was recorded.

### HSDPA configuration settings:

- a. The DUT was connected to Wireless Communication Test Set referred to the drawing of Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between DUT and Base Station with following setting:
  - i. Set Gain Factors ( $\beta_c$  and  $\beta_d$ ) and parameters were set according to each.
  - ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
  - iii. Set RMC12.2Kbps + HSDPA mode.
  - iv. Set Cell Power = -86 dBm
  - v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
  - vi. Select HSDPA Uplink Parameters
  - vii. Set DeltaACK, DeltaNACK and DeltaCQI = 8
  - viii. Set Ack-Nack Repetition Factor to 3
  - ix. Set CQI Feedback Cycle (k) to 4 ms
  - x. Set CQI Repetition Factor to 2
  - xi. Power Ctrl Mode = All Up bits
- d. The transmitted maximum output power was recorded.





**HSPA (HSUPA & HSPDA) configuration settings:**

- a. The DUT was connected to Wireless Communication Test Set referred to the drawing of Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between DUT and Test Set with following setting :
  - i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
  - ii. Set the Gain Factors ( $\beta_c$  and  $\beta_d$ ) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
  - iii. Set Cell Power = -86 dBm
  - iv. Set Channel Type = 12.2k + HSPA
  - v. Set UE Target Power
  - vi. Power Ctrl Mode= Alternating bits
  - vii. Set and observe the E-TFCI
  - viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
- d. The transmitted maximum output power was recorded.

## **11. Measurement Procedures**

The measurement procedures are as follows:

- (a) For WWAN function, link DUT with base station emulator in highest power channel
- (b) Set base station emulator to allow DUT to radiate maximum output power
- (c) Measure output power through RF cable and power meter
- (d) Place the DUT in the positions described in the last section
- (e) Set scan area, grid size and other setting on the DASY software
- (f) Taking data for the middle channel on each testing position
- (g) Find out the largest SAR result on these testing positions of each band
- (h) Measure SAR results for other channels in worst SAR testing position if the 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
- (e)

### **11.1 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



### **11.2 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 measures 5x5x7 points with step size 8, 8 and 5 mm for 300 MHz to 3 GHz, and 8x8x8 points with step size 4, 4 and 2.5 mm for 3 GHz to 6 GHz. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 1 g.

### **11.3 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 DUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing (step-size is 4, 4 and 2.5 mm). When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

### **11.4 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.

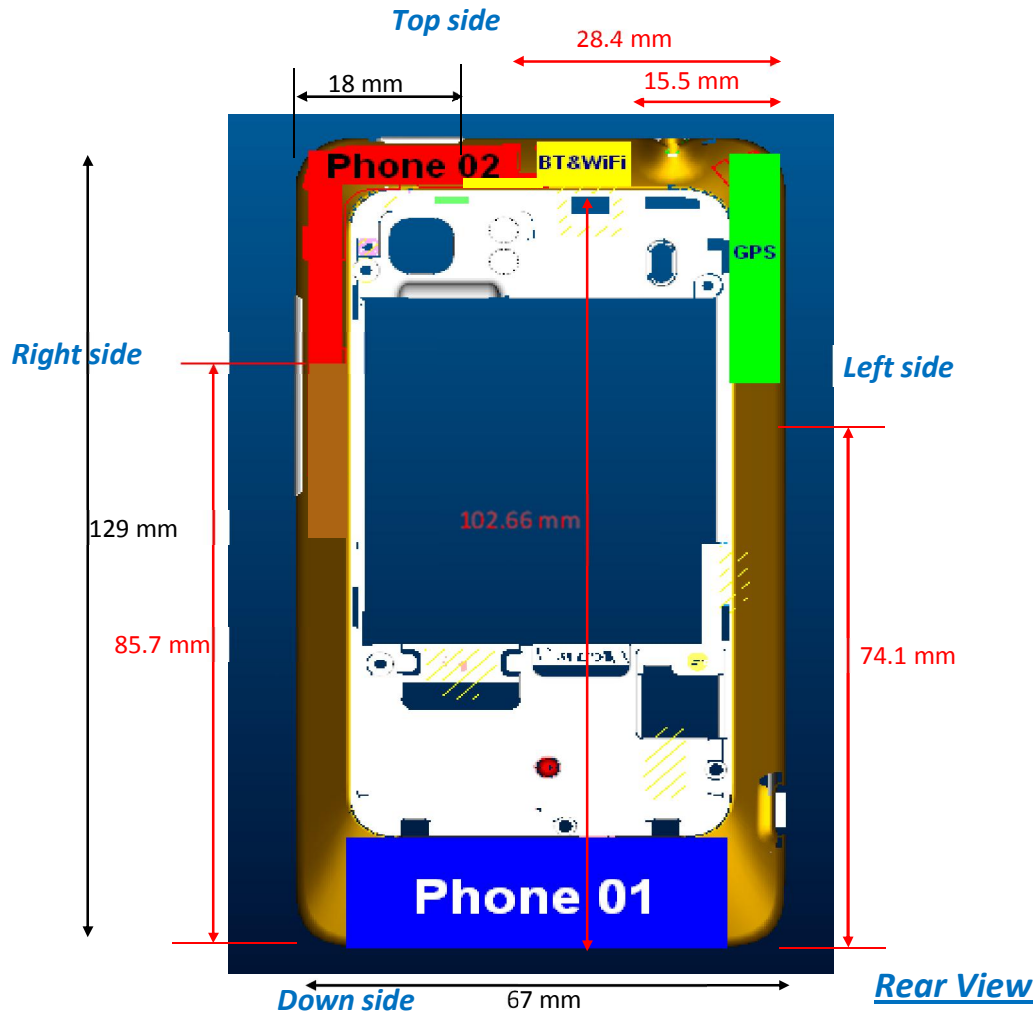
Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty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

### **11.5 Power Drift Monitoring**

All SAR testing is under the DUT 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 DUT 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 drift more than 5%, the SAR will be retested.

## 12. SAR Test Configurations

### 12.1 Exposure Positions Consideration



<b>Phone 01 antenna</b>	GSM850/900/1800/1900, TX/RX WCDMA Band 1/2/5, TX/RX LTE Band 4, TX/RX LTE Band 17, secondary antenna (Receiving only)
<b>Phone 02 antenna</b>	WCDMA Band 1/2/5, Diversity RX only LTE Band 17, TX/RX LTE Band 4, secondary antenna (Receiving only)
<b>WLAN &amp; BT antenna</b>	WLAN and Bluetooth TX/RX
<b>GPS antenna</b>	GPS receiving only

<b>Sides for SAR tests; Hotspot mode</b>						
<b>Test distance: 10 mm</b>						
	Rear Face	Front Face	Top Side	Down Side	Right Side	Left Side
GSM/GPRS/EDGE/WCDMA/HSPA LTE Band 4	✓	✓	x	✓	✓	✓
LTE Band 17	✓	✓	✓	x	✓	x
WLAN 11b/g/n 2.4GHz	✓	✓	✓	x	✓	✓

**Note:**

1. Referring to KDB 941225 D06, when the overall device length and width are  $\geq 9\text{cm} \times 5\text{cm}$ , 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.
2. Therefore, for Phone 01 antenna, top-side SAR can be excluded; for phone02 antenna, left-side and down-side SAR can be excluded; for WLAN antenna, down-side SAR can be excluded

<b>Sides for SAR tests; Body-worn configuration</b>						
<b>Test distance: 10 mm</b>						
	Rear Face	Front Face	Top Side	Down Side	Right Side	Left Side
GSM/GPRS/EDGE/WCDMA/HSPA LTE Band 4	✓	✓	x	x	x	x
LTE Band 17	✓	✓	x	x	x	x
WLAN 11b/g/n 2.4GHz	✓	✓	x	x	x	x

**Note:**

For Body-worn configuration, SAR is measured with 10 mm test distance, for both Front Face and Rear Face.

<b>Head SAR</b>				
	Right Cheek	Right Tilt	Left Cheek	Left Tilt
GSM/GPRS/EDGE/WCDMA/HSPA LTE Band 4	✓	✓	✓	✓
LTE Band 17	✓	✓	✓	✓
WLAN 11b/g/n 2.4GHz	✓	✓	✓	✓

**Note:**

1. LTE and WLAN may support VOIP via certain application utilities, so Head SAR is evaluated.
2. Because FCC has not published uniform procedures for VOIP in LTE, therefore all channels and modes and modulations required under the other KDB pub 941225 D05 FCC LTE procedures were used for the held-near-head testing



12.2 Simultaneous Transmitting Configurations

Simultaneous SAR consideration

	Combinations	Head	Body-worn	Hotspot	Remark
1	GSM/GPRS/EDGE	✓	✓	✓	
	WLAN 2.4GHz				
2	WCDMA/HSPA	✓	✓	✓	
	WLAN 2.4GHz				
3	LTE	✓	✓	✓	LTE VOIP may be supported via certain 3 <sup>rd</sup> party software
	WLAN 2.4GHz				
4	GSM/GPRS/EDGE	x	x	x	Note: 1, 2
	LTE				
5	WCDMA/HSPA	x	x	x	Note: 1, 2
	LTE				
6	GSM/GPRS/EDGE	x	x	x	Note: 1, 2
	LTE				
	WLAN 2.4GHz				
7	WCDMA/HSPA	x	x	x	Note: 1, 2
	LTE				
	WLAN 2.4GHz				

Note:

1. The handset supports CSFB (CS call fallback to 2G/3G); LTE and 2G/3G will not transmit simultaneously when there is voice call on 2G/3G
2. The handset will choose either 2G/3G or LTE network for data connection; LTE and 2G/3G will not transmit simultaneously in data connection.

### 13. SAR Test Results

#### 13.1 Conducted Power (Unit: dBm)

<LTE Band 4>

Frequency [MHz]	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Maximum Average Power [dBm]	3GPP MPR (dB)	Target MPR (dB)	MPR Result (dB)
1715	20000	10	1	0	QPSK	23.25	0	0	0.00
1715	20000	10	1	49	QPSK	23.18	0	0	0.07
1715	20000	10	25	13	QPSK	22.59	1	0.5	0.66
1715	20000	10	50	0	QPSK	22.58	1	0.5	0.67
1715	20000	10	1	0	16-QAM	22.88	1	0.5	0.37
1715	20000	10	1	49	16-QAM	22.88	1	0.5	0.37
1715	20000	10	25	13	16-QAM	22.51	2	1	0.74
1715	20000	10	50	0	16-QAM	22.23	2	1	1.02
1712.5	19975	5	1	0	QPSK	23.42	0	0	0.00
1712.5	19975	5	1	24	QPSK	23.10	0	0	0.32
1712.5	19975	5	12	6	QPSK	22.71	1	0.5	0.71
1712.5	19975	5	25	0	QPSK	22.67	1	0.5	0.75
1712.5	19975	5	1	0	16-QAM	22.61	1	0.5	0.81
1712.5	19975	5	1	24	16-QAM	22.95	1	0.5	0.47
1712.5	19975	5	12	6	16-QAM	22.33	2	1	1.09
1712.5	19975	5	25	0	16-QAM	22.63	2	1	0.79
1732.5	20175	10	1	0	QPSK	23.18	0	0	0.00
1732.5	20175	10	1	49	QPSK	22.95	0	0	0.23
1732.5	20175	10	25	13	QPSK	22.52	1	0.5	0.66
1732.5	20175	10	50	0	QPSK	22.50	1	0.5	0.68
1732.5	20175	10	1	0	16-QAM	22.84	1	0.5	0.34
1732.5	20175	10	1	49	16-QAM	22.55	1	0.5	0.63
1732.5	20175	10	25	13	16-QAM	22.55	2	1	0.63
1732.5	20175	10	50	0	16-QAM	22.10	2	1	1.08
1732.5	20175	5	1	0	QPSK	23.04	0	0	0.02
1732.5	20175	5	1	24	QPSK	23.06	0	0	0.00
1732.5	20175	5	12	6	QPSK	22.44	1	0.5	0.62
1732.5	20175	5	25	0	QPSK	22.47	1	0.5	0.59
1732.5	20175	5	1	0	16-QAM	22.68	1	0.5	0.38
1732.5	20175	5	1	24	16-QAM	22.62	1	0.5	0.44
1732.5	20175	5	12	6	16-QAM	21.91	2	1	1.15
1732.5	20175	5	25	0	16-QAM	22.44	2	1	0.62
1750	20350	10	1	0	QPSK	22.96	0	0	0.34
1750	20350	10	1	49	QPSK	23.30	0	0	0.00
1750	20350	10	25	13	QPSK	22.57	1	0.5	0.73
1750	20350	10	50	0	QPSK	22.58	1	0.5	0.72
1750	20350	10	1	0	16-QAM	22.70	1	0.5	0.60
1750	20350	10	1	49	16-QAM	23.22	1	0.5	0.08



1750	20350	10	25	13	16-QAM	22.57	2	1	0.73
1750	20350	10	50	0	16-QAM	22.21	2	1	1.09
1752.5	20375	5	1	0	QPSK	23.15	0	0	0.26
1752.5	20375	5	1	24	QPSK	23.41	0	0	0.00
1752.5	20375	5	12	6	QPSK	22.66	1	0.5	0.75
1752.5	20375	5	25	0	QPSK	22.63	1	0.5	0.78
1752.5	20375	5	1	0	16-QAM	22.88	1	0.5	0.53
1752.5	20375	5	1	24	16-QAM	23.23	1	0.5	0.18
1752.5	20375	5	12	6	16-QAM	22.27	2	1	1.14
1752.5	20375	5	25	0	16-QAM	22.67	2	1	0.74

Note:

- Per KDB 941225, if the output power variation across the band < 0.5dB, test middle channel SAR first and determine further test reduction based on the SAR results.

<LTE Band 17>

Frequency [MHz]	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Maximum Average Power [dBm]	3GPP MPR (dB)	Target MPR (dB)	MPR Result (dB)
709	23780	10	1	0	QPSK	23.07	0	0	0.00
709	23780	10	1	49	QPSK	22.98	0	0	0.09
709	23780	10	25	13	QPSK	22.51	1	0.5	0.56
709	23780	10	50	0	QPSK	22.35	1	0.5	0.72
709	23780	10	1	0	16-QAM	22.74	1	0.5	0.33
709	23780	10	1	49	16-QAM	22.65	1	0.5	0.42
709	23780	10	25	13	16-QAM	22.53	2	1	0.54
709	23780	10	50	0	16-QAM	22.01	2	1	1.06
706.5	23755	5	1	0	QPSK	23.05	0	0	0.10
706.5	23755	5	1	24	QPSK	23.15	0	0	0.00
706.5	23755	5	12	6	QPSK	22.55	1	0.5	0.60
706.5	23755	5	25	0	QPSK	22.57	1	0.5	0.58
706.5	23755	5	1	0	16-QAM	22.65	1	0.5	0.50
706.5	23755	5	1	24	16-QAM	22.76	1	0.5	0.39
706.5	23755	5	12	6	16-QAM	21.88	2	1	1.27
706.5	23755	5	25	0	16-QAM	22.53	2	1	0.62
710	23790	10	1	0	QPSK	22.95	0	0	0.12
710	23790	10	1	49	QPSK	23.07	0	0	0.00
710	23790	10	25	13	QPSK	22.38	1	0.5	0.69
710	23790	10	50	0	QPSK	22.23	1	0.5	0.84
710	23790	10	1	0	16-QAM	22.65	1	0.5	0.42
710	23790	10	1	49	16-QAM	22.76	1	0.5	0.31
710	23790	10	25	13	16-QAM	22.58	2	1	0.49
710	23790	10	50	0	16-QAM	21.81	2	1	1.26
710	23790	5	1	0	QPSK	23.10	0	0	0.00
710	23790	5	1	24	QPSK	23.05	0	0	0.05
710	23790	5	12	6	QPSK	22.42	1	0.5	0.68
710	23790	5	25	0	QPSK	22.40	1	0.5	0.70



710	23790	5	1	0	16-QAM	22.78	1	0.5	0.32
710	23790	5	1	24	16-QAM	22.75	1	0.5	0.35
710	23790	5	12	6	16-QAM	21.82	2	1	1.28
710	23790	5	25	0	16-QAM	22.50	2	1	0.60
711	23800	10	1	0	QPSK	23.15	0	0	0.00
711	23800	10	1	49	QPSK	22.94	0	0	0.21
711	23800	10	25	13	QPSK	22.27	1	0.5	0.88
711	23800	10	50	0	QPSK	22.29	1	0.5	0.86
711	23800	10	1	0	16-QAM	22.82	1	0.5	0.33
711	23800	10	1	49	16-QAM	22.59	1	0.5	0.56
711	23800	10	25	13	16-QAM	22.28	2	1	0.87
711	23800	10	50	0	16-QAM	21.76	2	1	1.39
713.5	23825	5	1	0	QPSK	23.04	0	0	0.00
713.5	23825	5	1	24	QPSK	23.00	0	0	0.04
713.5	23825	5	12	6	QPSK	22.31	1	0.5	0.73
713.5	23825	5	25	0	QPSK	22.37	1	0.5	0.67
713.5	23825	5	1	0	16-QAM	22.75	1	0.5	0.29
713.5	23825	5	1	24	16-QAM	22.59	1	0.5	0.45
713.5	23825	5	12	6	16-QAM	21.85	2	1	1.19
713.5	23825	5	25	0	16-QAM	22.29	2	1	0.75

**Note:**

1. Per KDB 941225, if the output power variation across the band < 0.5dB, test middle channel SAR first and determine further test reduction based on the SAR results.
2. In Appendix E, the LTE spectrum plots for different RB allocations are for demonstrating correct RB setting during output power and SAR measurement.

**LTE Target MPR level**

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]		MPR (dB) Target	3GPP MPR (dB)
	5 MHz	10 MHz		
QPSK	> 8	> 12	0.5	≤ 1
16 QAM	≤ 8	≤ 12	0.5	≤ 1
16 QAM	> 8	> 12	1	≤ 2

**Note:** The measurement result showed some difference from the target MPR level, due to expected 0.5dB measurement tolerance

<GSM/GPRS/EDGE>

GSM/GPRS/EDGE Burst Average Power						
Band	GSM850			GSM1900		
Channel	128	189	251	512	661	810
Frequency	824.2	836.4	848.8	1850.2	1880	1909.8
GSM	32.12	32.21	32.11	29.51	29.68	29.81
GPRS 8 (CS1)	32.17	32.21	32.17	29.70	29.44	29.80
GPRS 10 (CS1)	31.26	31.30	31.28	28.78	28.87	28.89
EDGE 8(MCS1)	32.00	32.08	32.04	29.75	29.51	29.56
EDGE 10(MCS1)	31.22	31.25	31.24	28.88	28.87	28.86
EDGE 8(MCS9)	27.16	27.14	27.20	26.47	26.51	26.53
EDGE 10(MCS9)	26.29	26.27	26.35	25.35	25.41	25.49
Source-Based Time-Averaged Power						
Band	GSM850			GSM1900		
Channel	128	189	251	512	661	810
GSM	23.12	23.21	23.11	20.51	20.68	20.81
GPRS 8 (CS1)	23.17	23.21	23.17	20.70	20.44	20.80
GPRS 10 (CS1)	25.26	25.30	25.28	22.78	22.87	22.89
EDGE 8(MCS1)	23.00	23.08	23.04	20.75	20.51	20.56
EDGE 10(MCS1)	25.22	25.25	25.24	22.88	22.87	22.86
EDGE 8(MCS9)	18.16	18.14	18.20	17.47	17.52	17.53
EDGE 10(MCS9)	20.29	20.27	20.35	19.35	19.41	19.49

Note:

- Following KDB 941225 D03, GPRS10 is used for Body-worn/Hotspot SAR testing due to its highest source-based time-averaged power.
- Per 2010/10 workshop, the maximum output power channel is used for SAR testing and for further SAR test reduction.

<WCDMA/HSDPA/HSUPA>

Band	WCDMA V			WCDMA II		
Channel	4132	4182	4233	9262	9400	9538
Rx Channel	4357	4407	4458	9662	9800	9938
Frequency	826.4	836.4	846.6	1852.4	1880	1907.6
AMR	23.70	23.60	23.71	23.15	23.34	23.00
RMC 12.2K	23.72	23.66	23.70	23.13	23.36	23.20
HSDPA Subtest-1	23.58	23.40	23.58	23.18	23.12	22.93
HSDPA Subtest-2	23.55	23.43	23.56	23.29	23.19	22.99
HSDPA Subtest-3	23.14	22.92	22.99	22.62	22.60	22.44
HSDPA Subtest-4	23.06	22.91	23.11	22.64	22.64	22.49
HSUPA Subtest-1	23.30	23.30	23.32	23.01	22.96	22.89
HSUPA Subtest-2	21.70	21.52	21.85	21.18	21.34	20.82
HSUPA Subtest-3	22.72	22.40	22.58	22.15	22.03	21.78
HSUPA Subtest-4	21.43	21.61	21.92	21.40	21.40	21.20
HSUPA Subtest-5	23.47	23.34	23.43	23.22	23.20	22.94



MPR							
3GPP Requirement		WCDMA band 2			WCDMA band 5		
0	HSDPA Subtest-1	0.00	0.00	0.00	0.00	0.00	0.00
0	HSDPA Subtest-2	0.03	-0.03	0.02	-0.11	-0.07	-0.06
0.5	HSDPA Subtest-3	0.44	0.48	0.59	0.56	0.52	0.49
0.5	HSDPA Subtest-4	0.52	0.49	0.47	0.54	0.48	0.44
0	HSUPA Subtest-1	0.17	0.04	0.11	0.21	0.24	0.05
2	HSUPA Subtest-2	1.77	1.82	1.58	2.04	1.86	2.12
1	HSUPA Subtest-3	0.75	0.94	0.85	1.07	1.17	1.16
2	HSUPA Subtest-4	2.04	1.73	1.51	1.82	1.80	1.74
0	HSUPA Subtest-5	0.00	0.00	0.00	0.00	0.00	0.00

**Note:**

- For Head SAR, Pre KDB 941225, RMC 12.2kbps setting is used to evaluate SAR. If AMR 12.2kbps power is < 1/4dB higher than RMC, SAR tests with AMR 12.2kbps can be excluded.
- For Body SAR, Pre KDB 941225, RMC 12.2kbps setting is used to evaluate WCDMA/HSDPA/HSUPA. If HSDPA subtest-1 and HSUPA subtest-5 output power is < 1/4dB higher than RMC, and SAR with RMC 12.2kbps setting is ≤1.2W/kg, HSDPA and HSUPA SAR evaluation can be excluded.

<WLAN>

Data Rate	11b-1Mbps			11g-6Mbps		
Channel	1	6	11	1	6	11
Frequency	2412	2437	2462	2412	2437	2462
Avg. Power	17.78	17.68	18.19	12.77	12.96	13.21

Mode	11n-20M BW		
Data Rate	MCS0		
Channel	1	6	11
Frequency	2412	2437	2462
Avg. Power	12.75	12.83	13.10

**Note:**

- Per KDB 248227, SAR tests with 11b mode due to highest output power; 11g/11n SAR tests can be excluded.
- Per 2010/10 TCB workshop, the maximum output power channel is used for SAR testing and further SAR test reduction determination. Therefore, CH11 in 11b mode is selected.

13.2 Test Records for Head SAR Test

<GSM>

Plot No.	Band	Mode	Test Position	Channel		SAR <sub>1g</sub> (W/kg)
1	GSM850	GSM	Right Cheek	189	-	0.204
2	GSM850	GSM	Right Tilted	189	-	0.175
4	GSM850	GSM	Left Tilted	189	-	0.16
<b>3</b>	<b>GSM850</b>	<b>GSM</b>	<b>Left Cheek</b>	<b>189</b>	-	<b>0.241</b>
12	GSM1900	GSM	Right Tilted	810	-	0.191
13	GSM1900	GSM	Left Cheek	810	-	0.313
14	GSM1900	GSM	Left Tilted	810	-	0.226
<b>11</b>	<b>GSM1900</b>	<b>GSM</b>	<b>Right Cheek</b>	<b>810</b>	-	<b>0.566</b>

Note:

Per KDB 648474, SAR ≤ 0.8W/kg and remaining channels SAR tests can be excluded.

<WCDMA>

Plot No.	Band	Mode	Test Position	Channel		SAR <sub>1g</sub> (W/kg)
6	WCDMA V	RMC12.2K	Right Cheek	4132	-	0.292
7	WCDMA V	RMC12.2K	Right Tilted	4132	-	0.234
9	WCDMA V	RMC12.2K	Left Tilted	4132	-	0.247
<b>8</b>	<b>WCDMA V</b>	<b>RMC12.2K</b>	<b>Left Cheek</b>	<b>4132</b>	-	<b>0.35</b>
17	WCDMA II	RMC12.2K	Right Tilted	9400	-	0.345
18	WCDMA II	RMC12.2K	Left Cheek	9400	-	0.515
19	WCDMA II	RMC12.2K	Left Tilted	9400	-	0.389
<b>16</b>	<b>WCDMA II</b>	<b>RMC12.2K</b>	<b>Right Cheek</b>	<b>9400</b>	-	<b>1.28</b>
20	WCDMA II	RMC12.2K	Right Cheek	9262	-	1.03
21	WCDMA II	RMC12.2K	Right Cheek	9538	-	1.12

Note:

Per KDB 648474, SAR ≤ 0.8W/kg and remaining channels SAR tests can be excluded.



<LTE>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB Offset	Test Position	Channel	LTE Output Power (dBm)	LTE Target MPR (dB)	SAR <sub>1g</sub> (W/kg)
65	LTE Band 4	10	QPSK	25	13	Right Cheek	20175	22.52	0.5	0.734
93	LTE Band 4	10	QPSK	1	0	Right Cheek	20175	23.18	0	0.683
94	LTE Band 4	10	QPSK	1	49	Right Cheek	20175	22.95	0	0.69
101	LTE Band 4	10	16QAM	25	13	Right Cheek	20175	22.55	1	0.679
102	LTE Band 4	10	16QAM	1	0	Right Cheek	20175	22.84	0.5	0.688
103	LTE Band 4	10	16QAM	1	49	Right Cheek	20175	22.55	0.5	0.696
79	LTE Band 17	10	QPSK	25	13	Right Cheek	23790	22.38	0.5	0.348
113	LTE Band 17	10	QPSK	1	0	Right Cheek	23790	22.95	0	0.29
114	LTE Band 17	10	QPSK	1	49	Right Cheek	23790	23.07	0	0.293
121	LTE Band 17	10	16QAM	25	13	Right Cheek	23790	22.38	1	0.286
122	LTE Band 17	10	16QAM	1	0	Right Cheek	23790	22.95	0.5	0.293
123	LTE Band 17	10	16QAM	1	49	Right Cheek	23790	23.07	0.5	0.297
66	LTE Band 4	10	QPSK	25	13	Right Tilted	20175	22.52	0.5	0.281
95	LTE Band 4	10	QPSK	1	0	Right Tilted	20175	23.18	0	0.269
96	LTE Band 4	10	QPSK	1	49	Right Tilted	20175	22.95	0	0.277
104	LTE Band 4	10	16QAM	25	13	Right Tilted	20175	22.55	1	0.251
105	LTE Band 4	10	16QAM	1	0	Right Tilted	20175	22.84	0.5	0.25
106	LTE Band 4	10	16QAM	1	49	Right Tilted	20175	22.55	0.5	0.269
80	LTE Band 17	10	QPSK	25	13	Right Tilted	23790	22.38	0.5	0.322
115	LTE Band 17	10	QPSK	1	0	Right Tilted	23790	22.95	0	0.344
116	LTE Band 17	10	QPSK	1	49	Right Tilted	23790	23.07	0	0.319
124	LTE Band 17	10	16QAM	25	13	Right Tilted	23790	22.38	1	0.333
125	LTE Band 17	10	16QAM	1	0	Right Tilted	23790	22.95	0.5	0.341
126	LTE Band 17	10	16QAM	1	49	Right Tilted	23790	23.07	0.5	0.344
67	LTE Band 4	10	QPSK	25	13	Left Cheek	20175	22.52	0.5	0.564
97	LTE Band 4	10	QPSK	1	0	Left Cheek	20175	23.18	0	0.595
98	LTE Band 4	10	QPSK	1	49	Left Cheek	20175	22.95	0	0.606
107	LTE Band 4	10	16QAM	25	13	Left Cheek	20175	22.55	1	0.593
108	LTE Band 4	10	16QAM	1	0	Left Cheek	20175	22.84	0.5	0.629
109	LTE Band 4	10	16QAM	1	49	Left Cheek	20175	22.55	0.5	0.633
81	LTE Band 17	10	QPSK	25	13	Left Cheek	23790	22.38	0.5	0.529
117	LTE Band 17	10	QPSK	1	0	Left Cheek	23790	22.95	0	0.562
118	LTE Band 17	10	QPSK	1	49	Left Cheek	23790	23.07	0	0.579
127	LTE Band 17	10	16QAM	25	13	Left Cheek	23790	22.38	1	0.561
128	LTE Band 17	10	16QAM	1	0	Left Cheek	23790	22.95	0.5	0.559
129	LTE Band 17	10	16QAM	1	49	Left Cheek	23790	23.07	0.5	0.58
68	LTE Band 4	10	QPSK	25	13	Left Tilted	20175	22.52	0.5	0.212
99	LTE Band 4	10	QPSK	1	0	Left Tilted	20175	23.18	0	0.188
100	LTE Band 4	10	QPSK	1	49	Left Tilted	20175	22.95	0	0.19
110	LTE Band 4	10	16QAM	25	13	Left Tilted	20175	22.55	1	0.178



111	LTE Band 4	10	16QAM	1	0	Left Tilted	20175	22.84	0.5	0.189
112	LTE Band 4	10	16QAM	1	49	Left Tilted	20175	22.55	0.5	0.181
82	LTE Band 17	10	QPSK	25	13	Left Tilted	23790	22.38	0.5	0.598
119	LTE Band 17	10	QPSK	1	0	Left Tilted	23790	22.95	0	0.614
<b>120</b>	<b>LTE Band 17</b>	<b>10</b>	<b>QPSK</b>	<b>1</b>	<b>49</b>	<b>Left Tilted</b>	<b>23790</b>	<b>23.07</b>	<b>0</b>	<b>0.615</b>
130	LTE Band 17	10	16QAM	25	13	Left Tilted	23790	22.38	1	0.587
131	LTE Band 17	10	16QAM	1	0	Left Tilted	23790	22.95	0.5	0.599
132	LTE Band 17	10	16QAM	1	49	Left Tilted	23790	23.07	0.5	0.607

**Note:**

1. Considering the users may install 3<sup>rd</sup> party software to enable VOIP, LTE Head SAR is also evaluated. Because FCC has not published uniform procedures for VOIP in LTE, therefore all channels and modes and modulations required under the other KDB pub 941225 D05 FCC LTE procedures were used for the held-near-head testing.
2. Per KDB 941225 D05, for LTE, if the smaller bandwidth output power is within +/- ½dB of the largest bandwidth, and the maximum SAR of the largest bandwidth is ≤ 1.45 W/kg, SAR for smaller bandwidth can be excluded.
3. Per KDB 941225 D05, if the measured 50%-RB QPSK 1g-SAR for the middle or highest output power channel is ≤ 0.8W/kg, remaining 2 channels SAR tests can be excluded. Otherwise, 50% RB allocation of the remaining 2 channels SAR tests are necessary.
4. Per KDB 941225 D05, for LTE, if 50%-RB QPSK SAR ≤ 1.45 W/kg, 100%-RB QPSK SAR can be excluded; if 50%-RB 16QAM SAR ≤ 1.45 W/kg, 100%-RB 16QAM SAR can be excluded.
5. If SAR of 1 RB allocation is ≤ 1.45W/kg, SAR of 1 RB allocation of remaining channels can be excluded.
6. Per KDB 648474, if the highest output channel SAR for each exposure position is ≤ 0.8 W/kg, other channels SAR tests are not necessary.

**<WLAN>**

Plot No.	Band	Mode	Test Position	Channel		SAR <sub>1g</sub> (W/kg)
83	802.11b	-	Right Cheek	11	-	0.483
<b>84</b>	<b>802.11b</b>	-	<b>Right Tilted</b>	<b>11</b>	-	<b>0.606</b>
85	802.11b	-	Left Cheek	11	-	0.316
86	802.11b	-	Left Tilted	11	-	0.43

**Note:**

If the highest output channel SAR for each exposure position is < 0.8 W/kg, other channels SAR tests are not necessary.

**13.3 Test Records for Body-worn SAR Test**

**<GSM>**

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Ch.		Ear-phone	SAR <sub>1g</sub> (W/kg)
23	<b>GSM850</b>	<b>GPRS10</b>	<b>Front Face</b>	1	<b>189</b>	-	-	<b>0.577</b>
24	<b>GSM850</b>	<b>GPRS10</b>	<b>Rear Face</b>	1	<b>189</b>	-	-	<b>0.837</b>
29	GSM850	GPRS10	Rear Face	1	128	-	-	0.636
30	GSM850	GPRS10	Rear Face	1	251	-	-	0.604
32	GSM850	GPRS10	Rear Face	1	189	-	v	0.514
197	GSM850	EDGE10	Rear Face	1	189	-	-	0.83
198	GSM850	EDGE10	Rear Face	1	128	-	-	0.836
199	GSM850	EDGE10	Rear Face	1	251	-	-	0.691
42	GSM1900	GPRS10	Rear Face	1	810	-	-	0.638
41	<b>GSM1900</b>	<b>GPRS10</b>	<b>Front Face</b>	1	<b>810</b>	-	-	<b>0.791</b>
48	GSM1900	GPRS10	Front Face	1	810	-	v	0.773

**Note:**

1. For Body-worn configuration, GPRS class 10 is used for SAR tests due to highest source-based time-averaged output power between all modes.
2. For Front Face, the highest output channel SAR for each exposure position is ≤ 0.8 W/kg, other channels SAR tests are not necessary.
3. If GPRS class 10 measured SAR is > 0.8W/kg, EDGE class 10 (MCS1) SAR is measured following KDB 941225 D03 and IEEE std-1528 footnote 11.

**<WCDMA>**

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Ch.		Ear-phone	SAR <sub>1g</sub> (W/kg)
33	WCDMA V	RMC12.2K	Front Face	1	4132	-	-	0.401
34	<b>WCDMA V</b>	<b>RMC12.2K</b>	<b>Rear Face</b>	1	<b>4132</b>	-	-	<b>0.534</b>
50	WCDMA II	RMC12.2K	Rear Face	1	9400	-	-	0.833
57	WCDMA II	RMC12.2K	Rear Face	1	9262	-	-	0.815
58	WCDMA II	RMC12.2K	Rear Face	1	9538	-	-	0.837
49	<b>WCDMA II</b>	<b>RMC12.2K</b>	<b>Front Face</b>	1	<b>9400</b>	-	-	<b>1.09</b>
55	WCDMA II	RMC12.2K	Front Face	1	9262	-	-	1.08
56	WCDMA II	RMC12.2K	Front Face	1	9538	-	-	1.03
62	WCDMA II	RMC12.2K	Front Face	1	9400	-	v	1.04
63	WCDMA II	RMC12.2K	Front Face	1	9262	-	v	1
64	WCDMA II	RMC12.2K	Front Face	1	9538	-	v	0.933

**Note:**

1. For Body SAR, Pre KDB 941225, RMC 12.2kbps setting is used to evaluate WCDMA/HSDPA/HSUPA. If HSDPA subtest-1 and HSUPA subtest-5 output power is < 1/4dB higher than RMC, and SAR with RMC 12.2kbps setting is ≤1.2W/kg, HSDPA and HSUPA SAR evaluation can be excluded.



<LTE>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB Offset	Test Position	Separation Distance (cm)	Ch.	LTE Output Power	Target MPR (dB)	Ear- phone	SAR <sub>1g</sub> (W/kg)
<b>74</b>	<b>LTE Band 17</b>	<b>10</b>	<b>QPSK</b>	<b>25</b>	<b>13</b>	<b>Front Face</b>	<b>1</b>	<b>23790</b>	<b>22.38</b>	<b>0.5</b>	-	<b>0.154</b>
133	LTE Band 17	10	QPSK	1	0	Front Face	1	23790	22.95	0	-	0.124
134	LTE Band 17	10	QPSK	1	49	Front Face	1	23790	23.07	0	-	0.125
143	LTE Band 17	10	QPSK	25	13	Front Face	1	23790	22.38	0.5	v	0.085
144	LTE Band 17	10	QPSK	1	0	Front Face	1	23790	22.95	0	v	0.088
145	LTE Band 17	10	QPSK	1	49	Front Face	1	23790	23.07	0	v	0.083
161	LTE Band 17	10	16QAM	25	13	Front Face	1	23790	22.38	1	-	0.113
162	LTE Band 17	10	16QAM	1	0	Front Face	1	23790	22.95	0.5	-	0.118
163	LTE Band 17	10	16QAM	1	49	Front Face	1	23790	23.07	0.5	-	0.121
<b>69</b>	<b>LTE Band 4</b>	<b>10</b>	<b>QPSK</b>	<b>25</b>	<b>13</b>	<b>Front Face</b>	<b>1</b>	<b>20175</b>	<b>22.52</b>	<b>0.5</b>	-	<b>0.862</b>
146	LTE Band 4	10	QPSK	25	13	Front Face	1	20000	22.59	0.5	-	0.833
147	LTE Band 4	10	QPSK	25	13	Front Face	1	20350	22.57	0.5	-	0.859
148	LTE Band 4	10	QPSK	1	0	Front Face	1	20175	23.18	0	-	0.819
149	LTE Band 4	10	QPSK	1	49	Front Face	1	20175	22.95	0	-	0.818
158	LTE Band 4	10	QPSK	25	13	Front Face	1	20175	22.52	0.5	v	0.861
159	LTE Band 4	10	QPSK	1	0	Front Face	1	20175	23.18	0	v	0.789
160	LTE Band 4	10	QPSK	1	49	Front Face	1	20175	22.95	0	v	0.806
179	LTE Band 4	10	16QAM	25	13	Front Face	1	20175	22.55	1	-	0.851
180	LTE Band 4	10	16QAM	1	0	Front Face	1	20175	22.84	0.5	-	0.816
181	LTE Band 4	10	16QAM	1	49	Front Face	1	20175	22.55	0.5	-	0.836
194	LTE Band 4	10	16QAM	25	13	Front Face	1	20175	22.55	1	v	0.81
195	LTE Band 4	10	16QAM	1	0	Front Face	1	20175	22.84	0.5	v	0.781
196	LTE Band 4	10	16QAM	1	49	Front Face	1	20175	22.55	0.5	v	0.796
<b>75</b>	<b>LTE Band 17</b>	<b>10</b>	<b>QPSK</b>	<b>25</b>	<b>13</b>	<b>Rear Face</b>	<b>1</b>	<b>23790</b>	<b>22.38</b>	<b>0.5</b>	-	<b>0.145</b>
135	LTE Band 17	10	QPSK	1	0	Rear Face	1	23790	22.95	0	-	0.128
136	LTE Band 17	10	QPSK	1	49	Rear Face	1	23790	23.07	0	-	0.123
164	LTE Band 17	10	16QAM	25	13	Rear Face	1	23790	22.38	1	-	0.126
165	LTE Band 17	10	16QAM	1	0	Rear Face	1	23790	22.95	0.5	-	0.13
166	LTE Band 17	10	16QAM	1	49	Rear Face	1	23790	23.07	0.5	-	0.122
176	LTE Band 17	10	16QAM	25	13	Rear Face	1	23790	22.38	1	v	0.105
177	LTE Band 17	10	16QAM	1	0	Rear Face	1	23790	22.95	0.5	v	0.107
178	LTE Band 17	10	16QAM	1	49	Rear Face	1	23790	23.07	0.5	v	0.101
70	LTE Band 4	10	QPSK	25	13	Rear Face	1	20175	22.52	0.5	-	0.615
150	LTE Band 4	10	QPSK	1	0	Rear Face	1	20175	23.18	0	-	0.621
151	LTE Band 4	10	QPSK	1	49	Rear Face	1	20175	22.95	0	-	0.627
182	LTE Band 4	10	16QAM	25	13	Rear Face	1	20175	22.55	1	-	0.643
<b>183</b>	<b>LTE Band 4</b>	<b>10</b>	<b>16QAM</b>	<b>1</b>	<b>0</b>	<b>Rear Face</b>	<b>1</b>	<b>20175</b>	<b>22.84</b>	<b>0.5</b>	-	<b>0.645</b>
184	LTE Band 4	10	16QAM	1	49	Rear Face	1	20175	22.55	0.5	-	0.661



**Note:**

1. Per KDB 941225 D05, for LTE, if the smaller bandwidth output power is within +/- ½dB of the largest bandwidth, and the maximum SAR of the largest bandwidth is ≤ 1.45 W/kg, SAR for smaller bandwidth can be excluded.
2. Per KDB 941225 D05, if the measured 50%-RB 1g-SAR for the middle or highest output power channel is ≤ 0.8W/kg, remaining 2 channels SAR tests can be excluded. Otherwise, 50% RB allocation of the remaining 2 channels SAR tests are necessary.
3. Per KDB 941225 D05, for LTE, if 50%-RB QPSK SAR ≤ 1.45 W/kg, 100%-RB QPSK SAR can be excluded; if 50%-RB 16QAM SAR ≤ 1.45 W/kg, 100%-RB 16QAM SAR can be excluded.
4. If SAR of 1 RB allocation is ≤ 1.45W/kg, SAR of 1 RB allocation of remaining channels can be excluded.
5. Per KDB 648474, if the highest output channel SAR for each exposure position is ≤ 0.8 W/kg, other channels SAR tests are not necessary.

**<WLAN>**

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Ch.		Ear-phone	SAR <sub>1g</sub> (W/kg)
87	802.11b	-	Front Face	1	11	-	-	0.066
<b>88</b>	<b>802.11b</b>	-	<b>Rear Face</b>	<b>1</b>	<b>11</b>	-	-	<b>0.07</b>
92	802.11b	-	Rear Face	1	11	-	v	0.059

**Note:**

Per KDB 648474, if the highest output channel SAR for each exposure position is ≤ 0.8 W/kg, other channels SAR tests are not necessary.



13.4 Test Records for Hotspot SAR Test

<GSM>

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Ch.		Ear-phone	SAR <sub>1g</sub> (W/kg)
23	GSM850	GPRS10	Front Face	1	189	-	-	0.577
26	GSM850	GPRS10	Down Side	1	189	-	-	0.092
27	GSM850	GPRS10	Left Side	1	189	-	-	0.521
28	GSM850	GPRS10	Right Side	1	189	-	-	0.423
<b>24</b>	<b>GSM850</b>	<b>GPRS10</b>	<b>Rear Face</b>	<b>1</b>	<b>189</b>	-	-	<b>0.837</b>
29	GSM850	GPRS10	Rear Face	1	128	-	-	0.636
30	GSM850	GPRS10	Rear Face	1	251	-	-	0.604
32	GSM850	GPRS10	Rear Face	1	189	-	v	0.514
197	GSM850	EDGE10	Rear Face	1	189	-	-	0.83
198	GSM850	EDGE10	Rear Face	1	128	-	-	0.836
199	GSM850	EDGE10	Rear Face	1	251	-	-	0.691
42	GSM1900	GPRS10	Rear Face	1	810	-	-	0.638
43	GSM1900	GPRS10	Top Side	1	810	-	-	0.083
44	GSM1900	GPRS10	Down Side	1	810	-	-	0.287
45	GSM1900	GPRS10	Left Side	1	810	-	-	0.235
46	GSM1900	GPRS10	Right Side	1	810	-	-	0.52
<b>41</b>	<b>GSM1900</b>	<b>GPRS10</b>	<b>Front Face</b>	<b>1</b>	<b>810</b>	-	-	<b>0.791</b>
48	GSM1900	GPRS10	Front Face	1	810	-	v	0.773

Note:

1. For Hotspot mode configuration, GPRS class 10 is used for SAR tests due to highest source-based time-averaged output power between all modes.
2. Per KDB 941225 D06, for DUT dimension ≥ 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.
3. As in (2), SAR for Front Face / Rear Face / Right Side / Left Side / Down Side is necessary.
4. For Front Face, the highest output channel SAR for each exposure position is ≤ 0.8 W/kg, other channels SAR tests are not necessary.
5. If GPRS class 10 measured SAR is > 0.8W/kg, EDGE class 10 (MCS1) SAR is measured following KDB 941225 D03 and IEEE std-1528 footnote 11.



<WCDMA>

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Ch.		Ear-phone	SAR <sub>1g</sub> (W/kg)
33	WCDMA V	RMC12.2K	Front Face	1	4132	-	-	0.401
36	WCDMA V	RMC12.2K	Down Side	1	4132	-	-	0.076
37	WCDMA V	RMC12.2K	Left Side	1	4132	-	-	0.431
38	WCDMA V	RMC12.2K	Right Side	1	4132	-	-	0.329
<b>34</b>	<b>WCDMA V</b>	<b>RMC12.2K</b>	<b>Rear Face</b>	<b>1</b>	<b>4132</b>	-	-	<b>0.534</b>
52	WCDMA II	RMC12.2K	Down Side	1	9400	-	-	0.474
53	WCDMA II	RMC12.2K	Left Side	1	9400	-	-	0.294
54	WCDMA II	RMC12.2K	Right Side	1	9400	-	-	0.667
50	WCDMA II	RMC12.2K	Rear Face	1	9400	-	-	0.833
57	WCDMA II	RMC12.2K	Rear Face	1	9262	-	-	0.815
58	WCDMA II	RMC12.2K	Rear Face	1	9538	-	-	0.837
<b>49</b>	<b>WCDMA II</b>	<b>RMC12.2K</b>	<b>Front Face</b>	<b>1</b>	<b>9400</b>	-	-	<b>1.09</b>
55	WCDMA II	RMC12.2K	Front Face	1	9262	-	-	1.08
56	WCDMA II	RMC12.2K	Front Face	1	9538	-	-	1.03
62	WCDMA II	RMC12.2K	Front Face	1	9400	-	v	1.04
63	WCDMA II	RMC12.2K	Front Face	1	9262	-	v	1
64	WCDMA II	RMC12.2K	Front Face	1	9538	-	v	0.933

Note:

1. For Hotspot mode configuration, RMC 12.2kbps is used for SAR tests following KDB 941225 D01.
2. Per KDB 941225 D01, HSDPA/HSUPA SAR can be excluded due to the power is less than RMC 12.2kbps.
3. Per KDB 941225 D06, for DUT dimension  $\geq 9\text{cm} \times 5\text{cm}$ , 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.
4. As in (3), SAR for Front Face / Rear Face / Right Side / Left Side / Down Side is necessary.
5. For Right Side / Left Side / Down Side, the highest output channel SAR is  $\leq 0.8 \text{ W/kg}$ , other channels SAR tests are not necessary.



<LTE>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB Offset	Test Position	Separation Distance (cm)	Ch.	LTE Output Power (dBm)	Target MPR (dB)	Ear- phone	SAR <sub>1g</sub> (W/kg)
<b>74</b>	<b>LTE Band 17</b>	<b>10</b>	<b>QPSK</b>	<b>25</b>	<b>13</b>	<b>Front Face</b>	<b>1</b>	<b>23790</b>	<b>22.38</b>	<b>0.5</b>	-	<b>0.154</b>
133	LTE Band 17	10	QPSK	1	0	Front Face	1	23790	22.95	0	-	0.124
134	LTE Band 17	10	QPSK	1	49	Front Face	1	23790	23.07	0	-	0.125
143	LTE Band 17	10	QPSK	25	13	Front Face	1	23790	22.38	0.5	v	0.085
144	LTE Band 17	10	QPSK	1	0	Front Face	1	23790	22.95	0	v	0.088
145	LTE Band 17	10	QPSK	1	49	Front Face	1	23790	23.07	0	v	0.083
161	LTE Band 17	10	16QAM	25	13	Front Face	1	23790	22.58	1	-	0.113
162	LTE Band 17	10	16QAM	1	0	Front Face	1	23790	22.65	0.5	-	0.118
163	LTE Band 17	10	16QAM	1	49	Front Face	1	23790	22.76	0.5	-	0.121
<b>69</b>	<b>LTE Band 4</b>	<b>10</b>	<b>QPSK</b>	<b>25</b>	<b>13</b>	<b>Front Face</b>	<b>1</b>	<b>20175</b>	<b>22.52</b>	<b>0.5</b>	-	<b>0.862</b>
146	LTE Band 4	10	QPSK	25	13	Front Face	1	20000	22.59	0.5	-	0.833
147	LTE Band 4	10	QPSK	25	13	Front Face	1	20350	22.57	0.5	-	0.859
148	LTE Band 4	10	QPSK	1	0	Front Face	1	20175	23.18	0	-	0.819
149	LTE Band 4	10	QPSK	1	49	Front Face	1	20175	22.95	0	-	0.818
158	LTE Band 4	10	QPSK	25	13	Front Face	1	20175	22.52	0.5	v	0.861
159	LTE Band 4	10	QPSK	1	0	Front Face	1	20175	23.18	0	v	0.789
160	LTE Band 4	10	QPSK	1	49	Front Face	1	20175	22.95	0	v	0.806
179	LTE Band 4	10	16QAM	25	13	Front Face	1	20175	22.55	1	-	0.851
180	LTE Band 4	10	16QAM	1	0	Front Face	1	20175	22.84	0.5	-	0.816
181	LTE Band 4	10	16QAM	1	49	Front Face	1	20175	22.55	0.5	-	0.836
194	LTE Band 4	10	16QAM	25	13	Front Face	1	20175	22.55	1	v	0.81
195	LTE Band 4	10	16QAM	1	0	Front Face	1	20175	22.84	0.5	v	0.781
196	LTE Band 4	10	16QAM	1	49	Front Face	1	20175	22.55	0.5	v	0.796
<b>75</b>	<b>LTE Band 17</b>	<b>10</b>	<b>QPSK</b>	<b>25</b>	<b>13</b>	<b>Rear Face</b>	<b>1</b>	<b>23790</b>	<b>22.38</b>	<b>0.5</b>	-	<b>0.145</b>
135	LTE Band 17	10	QPSK	1	0	Rear Face	1	23790	22.95	0	-	0.128
136	LTE Band 17	10	QPSK	1	49	Rear Face	1	23790	23.07	0	-	0.123
164	LTE Band 17	10	16QAM	25	13	Rear Face	1	23790	22.58	1	-	0.126
165	LTE Band 17	10	16QAM	1	0	Rear Face	1	23790	22.65	0.5	-	0.13
166	LTE Band 17	10	16QAM	1	49	Rear Face	1	23790	22.76	0.5	-	0.122
176	LTE Band 17	10	16QAM	25	13	Rear Face	1	23790	22.58	1	v	0.105
177	LTE Band 17	10	16QAM	1	0	Rear Face	1	23790	22.65	0.5	v	0.107
178	LTE Band 17	10	16QAM	1	49	Rear Face	1	23790	22.76	0.5	v	0.101
70	LTE Band 4	10	QPSK	25	13	Rear Face	1	20175	22.52	0.5	-	0.615
150	LTE Band 4	10	QPSK	1	0	Rear Face	1	20175	23.18	0	-	0.621
151	LTE Band 4	10	QPSK	1	49	Rear Face	1	20175	22.95	0	-	0.627
182	LTE Band 4	10	16QAM	25	13	Rear Face	1	20175	22.55	1	-	0.643
183	LTE Band 4	10	16QAM	1	0	Rear Face	1	20175	22.84	0.5	-	0.645
<b>184</b>	<b>LTE Band 4</b>	<b>10</b>	<b>16QAM</b>	<b>1</b>	<b>49</b>	<b>Rear Face</b>	<b>1</b>	<b>20175</b>	<b>22.55</b>	<b>0.5</b>	-	<b>0.661</b>
<b>71</b>	<b>LTE Band 4</b>	<b>10</b>	<b>QPSK</b>	<b>25</b>	<b>13</b>	<b>Left Side</b>	<b>1</b>	<b>20175</b>	<b>22.52</b>	<b>0.5</b>	-	<b>0.206</b>
152	LTE Band 4	10	QPSK	1	0	Left Side	1	20175	23.18	0	-	0.189
153	LTE Band 4	10	QPSK	1	49	Left Side	1	20175	22.95	0	-	0.19



185	LTE Band 4	10	16QAM	25	13	Left Side	1	20175	22.55	1	-	0.181
186	LTE Band 4	10	16QAM	1	0	Left Side	1	20175	22.84	0.5	-	0.184
187	LTE Band 4	10	16QAM	1	49	Left Side	1	20175	22.55	0.5	-	0.187
<b>77</b>	<b>LTE Band 17</b>	<b>10</b>	<b>QPSK</b>	<b>25</b>	<b>13</b>	<b>Right Side</b>	<b>1</b>	<b>23790</b>	<b>22.38</b>	<b>0.5</b>	-	<b>0.156</b>
139	LTE Band 17	10	QPSK	1	0	Right Side	1	23790	22.95	0	-	0.117
140	LTE Band 17	10	QPSK	1	49	Right Side	1	23790	23.07	0	-	0.111
170	LTE Band 17	10	16QAM	25	13	Right Side	1	23790	22.58	1	-	0.116
171	LTE Band 17	10	16QAM	1	0	Right Side	1	23790	22.65	0.5	-	0.119
172	LTE Band 17	10	16QAM	1	49	Right Side	1	23790	22.76	0.5	-	0.11
72	LTE Band 4	10	QPSK	25	13	Right Side	1	20175	22.52	0.5	-	0.366
154	LTE Band 4	10	QPSK	1	0	Right Side	1	20175	23.18	0	-	0.344
155	LTE Band 4	10	QPSK	1	49	Right Side	1	20175	22.95	0	-	0.344
188	LTE Band 4	10	16QAM	25	13	Right Side	1	20175	22.55	1	-	0.334
189	LTE Band 4	10	16QAM	1	0	Right Side	1	20175	22.84	0.5	-	0.348
<b>190</b>	<b>LTE Band 4</b>	<b>10</b>	<b>16QAM</b>	<b>1</b>	<b>49</b>	<b>Right Side</b>	<b>1</b>	<b>20175</b>	<b>22.55</b>	<b>0.5</b>	-	<b>0.375</b>
<b>78</b>	<b>LTE Band 17</b>	<b>10</b>	<b>QPSK</b>	<b>25</b>	<b>13</b>	<b>Top Side</b>	<b>1</b>	<b>23790</b>	<b>22.38</b>	<b>0.5</b>	-	<b>0.088</b>
141	LTE Band 17	10	QPSK	1	0	Top Side	1	23790	22.95	0	-	0.062
142	LTE Band 17	10	QPSK	1	49	Top Side	1	23790	23.07	0	-	0.059
173	LTE Band 17	10	16QAM	25	13	Top Side	1	23790	22.58	1	-	0.063
174	LTE Band 17	10	16QAM	1	0	Top Side	1	23790	22.65	0.5	-	0.066
175	LTE Band 17	10	16QAM	1	49	Top Side	1	23790	22.76	0.5	-	0.062
<b>73</b>	<b>LTE Band 4</b>	<b>10</b>	<b>QPSK</b>	<b>25</b>	<b>13</b>	<b>Down Side</b>	<b>1</b>	<b>20175</b>	<b>22.52</b>	<b>0.5</b>	-	<b>0.558</b>
156	LTE Band 4	10	QPSK	1	0	Down Side	1	20175	23.18	0	-	0.499
157	LTE Band 4	10	QPSK	1	49	Down Side	1	20175	22.95	0	-	0.508
191	LTE Band 4	10	16QAM	25	13	Down Side	1	20175	22.55	1	-	0.471
192	LTE Band 4	10	16QAM	1	0	Down Side	1	20175	22.84	0.5	-	0.467
193	LTE Band 4	10	16QAM	1	49	Down Side	1	20175	22.55	0.5	-	0.476

**Note:**

1. Per KDB 941225 D06, for DUT dimension  $\geq 9\text{cm} \times 5\text{cm}$ , 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.
2. As in (1), SAR for Front Face / Rear Face / Right Side / Left Side / Down Side is necessary for LTE Band 4; SAR for Front Face / Rear Face / Right Side / Top Side is necessary for LTE Band 17.
3. Per KDB 941225 D05, for LTE, if the smaller bandwidth output power is within +/- 1/2dB of the largest bandwidth, and the maximum SAR of the largest bandwidth is  $\leq 1.45 \text{ W/kg}$ , SAR for smaller bandwidth can be excluded.
4. Per KDB 941225 D05, if the measured 50%-RB 1g-SAR for the middle or highest output power channel is  $\leq 0.8\text{W/kg}$ , remaining 2 channels SAR tests can be excluded. Otherwise, 50% RB allocation of the remaining 2 channels SAR tests are necessary.
5. Per KDB 941225 D05, for LTE, if 50%-RB QPSK SAR  $\leq 1.45 \text{ W/kg}$ , 100%-RB QPSK SAR can be excluded; if 50%-RB 16QAM SAR  $\leq 1.45 \text{ W/kg}$ , 100%-RB 16QAM SAR can be excluded.
6. If SAR of 1 RB allocation is  $\leq 1.45\text{W/kg}$ , SAR of 1 RB allocation of remaining channels can be excluded.
7. Per KDB 648474, if the highest output channel SAR for each exposure position is  $\leq 0.8 \text{ W/kg}$ , other channels SAR tests are not necessary



<WLAN>

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Ch.		Ear-phone	SAR <sub>1g</sub> (W/kg)
87	802.11b	-	Front Face	1	11	-		0.066
<b>88</b>	<b>802.11b</b>	-	<b>Rear Face</b>	<b>1</b>	<b>11</b>	-		<b>0.07</b>
89	802.11b	-	Left Side	1	11	-		0.011
90	802.11b	-	Right Side	1	11	-		0.011
91	802.11b	-	Top Side	1	11	-		0.063
92	802.11b	-	Rear Face	1	11	-	v	0.059

Note:

1. Per KDB 941225 D06, for DUT dimension  $\geq 9\text{cm} \times 5\text{cm}$ , 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.
2. As in (1), SAR for Front Face / Rear Face / Right Side / Top Side / Left Side is necessary for WLAN
3. Per KDB 648474, if the highest output channel SAR for each exposure position is  $\leq 0.8 \text{ W/kg}$ , other channels SAR tests are not necessary

**13.5 Simultaneous Transmission SAR Analysis and Measurements**

**13.5.1 Simultaneous analysis - SAR summation**

**<Simultaneous Transmission – Head SAR>**

Position	GSM 850	GSM 1900	WCDMA Band V	WCDMA Band II	802.11b	Max. SAR Summation
Right Cheek	0.204	0.566	0.292	<b>1.28</b>	0.483	<b>1.76</b>
Right Tilted	0.175	0.191	0.234	<b>0.345</b>	0.606	<b>0.95</b>
Left Cheek	0.241	0.313	0.35	<b>0.515</b>	0.316	<b>0.83</b>
Left Tilted	0.16	0.226	0.247	<b>0.389</b>	0.43	<b>0.82</b>

Position	LTE Band 4	LTE Band 17	802.11b	Max. SAR Summation
Right Cheek	<b>0.734</b>	0.348	<b>0.483</b>	<b>1.22</b>
Right Tilted	0.281	<b>0.344</b>	<b>0.606</b>	<b>0.95</b>
Left Cheek	<b>0.633</b>	0.58	<b>0.316</b>	<b>0.95</b>
Left Tilted	0.212	<b>0.615</b>	<b>0.43</b>	<b>1.05</b>

**Note:**

1. For 1g-SAR scalar summation < 1.6 W/kg, simultaneous SAR measurement is not necessary,
2. Since the handset supports Circuit Switched Fall Back (CSFB) function, LTE transmission will not exist with 2G/3G transmission at the same time, therefore LTE+WLAN simultaneous transmission is considered separately.

**<Simultaneous Transmission –Body-worn SAR>**

Position	GSM 850	GSM 1900	WCDMA Band V	WCDMA Band II	802.11b	Max. SAR Summation
Front Face	0.577	0.791	0.40	<b>1.09</b>	<b>0.066</b>	<b>1.16</b>
Rear Face	<b>0.837</b>	0.638	0.534	<b>0.837</b>	<b>0.07</b>	<b>0.91</b>

Position	LTE Band 4	LTE Band 17	802.11b	Max. SAR Summation
Front Face	<b>0.862</b>	0.154	<b>0.066</b>	<b>0.93</b>
Rear Face	<b>0.661</b>	0.145	<b>0.07</b>	<b>0.73</b>

**Note:**

1. Since the handset supports CSFB, LTE transmission will not exist with 2G/3G transmission at the same time, therefore LTE+WLAN simultaneous transmission is considered separately.
2. Simultaneous SAR measurement is not necessary, since the summation is < 1.6W/kg



< Simultaneous Transmission – Hotspot mode SAR >

Position	GSM 850	GSM 1900	WCDMA Band V	WCDMA Band II	802.11b	Max. SAR Summation
Front Face	0.577	0.791	0.52	1.09	0.066	1.16
Rear Face	0.837	0.638	0.534	0.837	0.07	0.91
Top Side	0	0	0	0	0.063	0.06
Down Side	0.092	0.287	0.076	0.474	0	-
Left Side	0.521	0.235	0.431	0.294	0.011	0.53
Right Side	0.423	0.52	0.329	0.667	0.011	0.68

Position	LTE Band 4	LTE Band 17	802.11b	Max. SAR Summation
Front Face	0.862	0.154	0.066	0.93
Rear Face	0.661	0.145	0.07	0.73
Top Side	0	0.088	0.063	0.15
Down Side	0.558	0	0	0.56
Left Side	0.206	0	0.011	0.22
Right Side	0.375	0.156	0.011	0.39

Note:

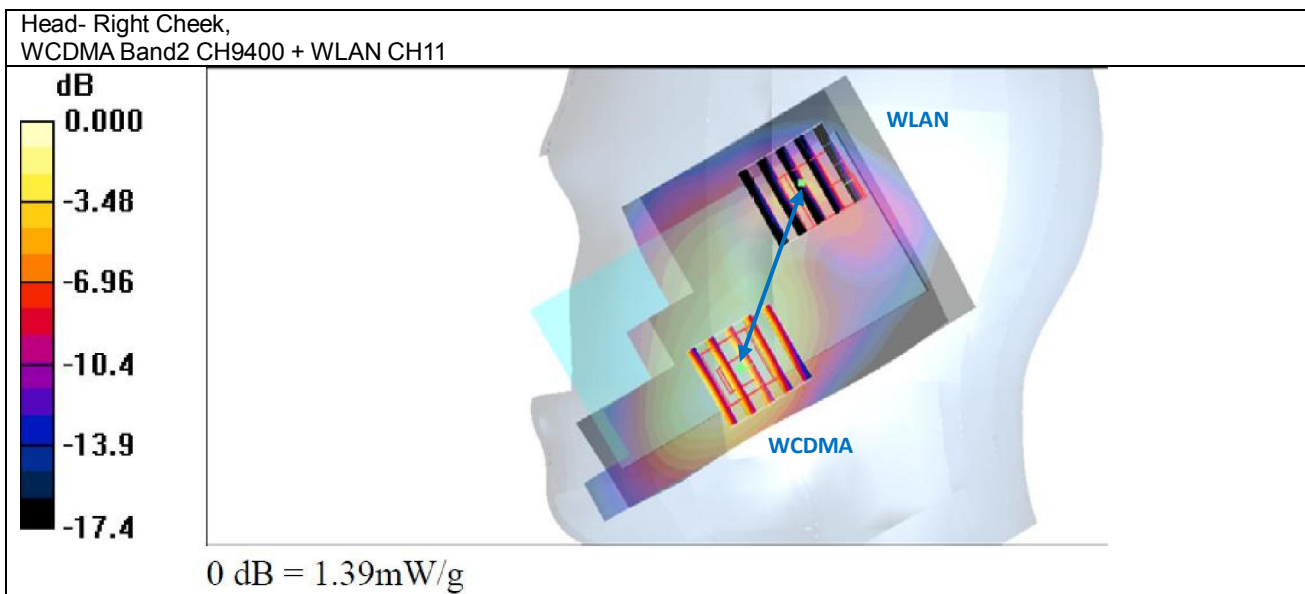
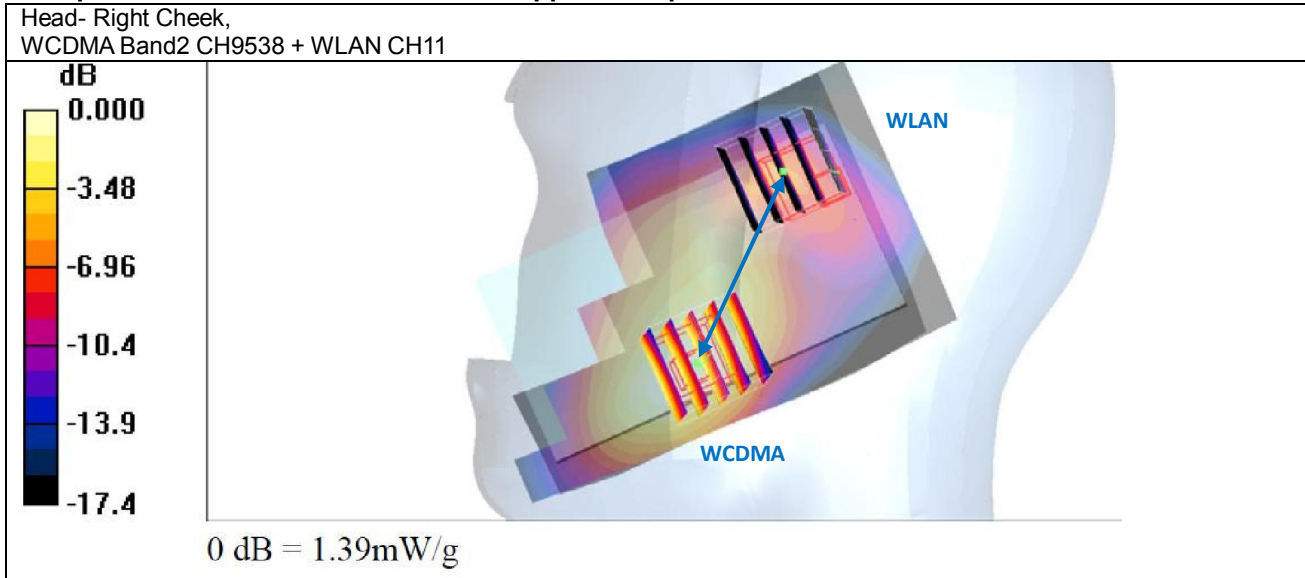
1. Since the handset supports CSFB, LTE transmission will not exist with 2G/3G transmission at the same time, therefore LTE+WLAN simultaneous transmission is considered separately.
2. Simultaneous SAR measurement is not necessary, since the summation is < 1.6W/kg.



13.5.2 Simultaneous analysis - SPLSR calculation

Head	TX		SAR peak location (m)			SAR (W/kg)	Ant Pair	Peak distance (cm)	pair SAR sum (W/kg)	SPLSR
			X	Y	Z					
Right Cheek	1	WCDMA, Band 2, CH 9400	0.0598	-0.254	-0.17	1.28	1+2	7.95	1.76	0.222
	2	WLAN, CH 11	0.0205	-0.323	-0.167	0.483				
Right Cheek	1	WCDMA, Band 2, CH 9538	0.0666	-0.25	-0.168	1.12	1+2	8.63	1.60	0.186
	2	WLAN, CH 11	0.0205	-0.323	-0.167	0.483				

<The peak location is shown in the overlapped SAR plots>





**Note:**

1. Considering SPLSR analysis, for WCDMA Band 2 + WLAN at Right-Cheek position, the 2 WCDMA channels resulting 1g-SAR summation  $\geq 1.6\text{W/kg}$  are analyzed here.
2. For Table 13.5.2, the SAR peak coordinates and SAR peaks distance are extracted and calculated following Speag TN-110209
3. SPLSR  $< 0.3$ , so volume scan is not necessary; referring to KDB 648474



## **14. References**

- [1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”
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- [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 D01v01r02, “SAR Measurement Procedures for 802.11 a/b/g Transmitters”, May 2007
- [7] FCC KDB 447498 D01 v04, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, November 2009
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- [9] FCC KDB 616217 D01 v01r01, “SAR Evaluation Considerations for Laptop Computers with Antennas Built-in on Display Screens”, November 2009
- [10] FCC KDB 616217 D03 v01, “SAR Evaluation Considerations for Laptop/Notebook/Netbook and Tablet Computers”, November 2009
- [11] FCC KDB 648474 D01v01r05, “SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas”, September 2008
- [12] FCC KDB 941225 D01 v02, “SAR Measurement Procedures for 3G Devices– CDMA2000 / Ev-Do / WCDMA / HSDPA / HSPA”, October 2007
- [13] FCC KDB 941225 D03 v01, “Recommended SAR Test Reduction Procedures for GSM/GPRS/EDGE”, December 2008
- [14] FCC KDB 941225 D04 v01, “Evaluating SAR for GSM/(E)GPRS Dual Transfer Mode”, January 272010
- [15] FCC KDB 941225 D05 v01, “SAR Test Considerations for LTE Handsets and Data Modems”



## ***Appendix A. Plots of System Performance Check***

The plots are shown as follows.



## ***Appendix B. Plots of SAR Measurement***

The plots are shown as follows.



## **Appendix C. DASYS Calibration Certificate**

The DASYS calibration certificates are shown as follows.