



# SAR TEST REPORT

HCT CO., LTD

|  |   |   |
|--|---|---|
| EUT Type:  | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n   |   |
| FCC ID:  | ZNFE440F  |   |
| Model:   | LG -E440f   |   |
| Additional Model                                 | LGE440f, E440f  |   |
| Date of Issue:                                   | Apr. 17, 2013   |   |
| Test report No.:                                 | HCTA1304FS03  |   |
| Test Laboratory:                                 | <b>HCT CO., LTD.</b><br>74, Seoicheon-ro 578 beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea<br>467-811 TEL: +82 31 645 6300 FAX: +82 31 645 6401   |   |
| Applicant :                                      | <b>LG Electronics, MobileComm U.S.A., Inc.</b><br>1000 Sylvan Avenue, Englewood Cliffs NJ 07632   |   |
| Testing has been carried out in accordance with: | RSS-102 Issue 4; Health Canada Safety Code 6<br>47CFR §2.1093<br>FCC OET Bulletin 65(Edition 97-01), Supplement C (Edition 01-01)<br>ANSI/ IEEE C95.1 – 1992<br>IEEE 1528-2003  |   |
| Test result:                                     | The tested device complies with the requirements in respect of all parameters subject to the test. The test results and statements relate only to the items tested. The test report shall not be reproduced except in full, without written approval of the laboratory. |   |
| Signature  | <br>_____<br>Report prepared by<br>: Yun-Jeang Heo<br>Test Engineer of SAR Part  | <br>_____<br>Approved by<br>: Jae-Sang So<br>Manager of SAR Part |

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# Table of Contents

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|   |       |
|---|-------|
| 1. INTRODUCTION .....                                   | 4     |
| 2. TEST METHODOLOGY .....                               | 5     |
| 3. DESCRIPTION OF DEVICE.....                           | 6     |
| 4. DESCRIPTION OF TEST EQUIPMENT .....                  | 7     |
| 5. SAR MEASUREMENT PROCEDURE.....                       | 1 4   |
| 6. DESCRIPTION OF TEST POSITION.....                    | 1 6   |
| 7. MEASUREMENT UNCERTAINTY .....                        | 1 8   |
| 8. ANSI/ IEEE C95.1 - 1992 RF EXPOSURE LIMITS .....     | 1 9   |
| 9. SAR SYSTEM VALIDATION.....                           | 2 0   |
| 10. SYSTEM VERIFICATION.....                            | 2 1   |
| 11. RF CONDUCTED POWER MEASUREMENT .....                | 2 3   |
| 12. SAR Test configuration & Antenna Information .....  | 3 2   |
| 13. SAR TEST DATA SUMMARY .....                         | 3 3   |
| 13.1 Measurement Results (GSM 850 Head SAR) .....       | 3 3   |
| 13.2 Measurement Results (GSM 1 900 Head SAR) .....     | 3 4   |
| 13.3 Measurement Results (WCDMA 850 Head SAR) .....     | 3 5   |
| 13.4 Measurement Results (802.11b/g/n Head SAR).....    | 3 6   |
| 13.5 Measurement Results (GSM850 Hotspot SAR) .....     | 3 7   |
| 13.6 Measurement Results (GSM1900 Hotspot SAR) .....    | 3 8   |
| 13.7 Measurement Results (WCDMA 850 Hotspot SAR) .....  | 3 9   |
| 13.8 Measurement Results (802.11b/g/n Hotspot SAR)..... | 4 0   |
| 13.9 Measurement Results (Body-worn SAR) .....          | 4 1   |
| 14. SAR Measurement Variability and Uncertainty.....    | 4 2   |
| 15. SAR Summation Scenario .....                        | 4 3   |
| 16. CONCLUSION.....                                     | 4 8   |
| 17. REFERENCES .....                                    | 4 9   |
| Attachment 1. – SAR Test Plots .....                    | 5 0   |
| Attachment 2. – Dipole Verification Plots.....          | 1 0 9 |
| Attachment 3. – Probe Calibration Data .....            | 1 1 6 |
| Attachment 4. – Dipole Calibration Data .....           | 1 2 8 |

## Version

| Rev | DATE          | DESCRIPTION                |
|-----|---------------|----------------------------|
|     | Apr. 08, 2013 | First Approval Report      |
| 1   | Apr. 17, 2013 | Page 6/43/44/46 is revised |

# 1. INTRODUCTION

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices.

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. The measurement procedure described in IEEE/ANSI C95.3-1992 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave is used for guidance in measuring SAR due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86 NCRP, 1986, Bethesda, MD 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

## SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative of the incremental electromagnetic energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body.

$$SAR = \frac{d}{dt} \left( \frac{dU}{dm} \right) = \frac{d}{dt} \left( \frac{dU}{\rho dV} \right)$$

**Figure 2. SAR Mathematical Equation**

**SAR is expressed in units of Watts per Kilogram (W/kg).**

where:

$$SAR = \sigma E^2 / \rho$$

$\sigma$  = conductivity of the tissue-simulant material (S/m)  
 $\rho$  = mass density of the tissue-simulant material (kg/m<sup>3</sup>)  
 $E$  = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.

## **2. TEST METHODOLOGY**

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The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C 01-01, IEEE Standard 1528-2003 & IEEE 1528a-2005 and the following published KDB procedures.

- FCC KDB Publication 941225 D01 SAR test for 3G devices v02
- FCC KDB Publication 941225 D02 Guidance for 3GPP R6 and R7 HSPA v02v01
- FCC KDB Publication 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- FCC KDB Publication 941225 D04 SAR for GSM E GPRS Dual Xfer Mode v01
- FCC KDB Publication 941225 D06 Hot Spot SAR v01
- FCC KDB Publication 248227 D01v01r02(SAR Considerationa for 802.11 Devices)
- FCC KDB Publication 447498 D01v05 (General SAR Guidance)
- FCC KDB Publication 648474 D04 SAR Handsets Multi Xmitter and Ant v01
- FCC KDB Publication 865664 D01 SAR measurement 100 MHz to 6 GHz v01
- FCC KDB Publication 865664 D02 SAR Reporting v01

### 3. DESCRIPTION OF DEVICE

Environmental evaluation measurements of specific absorption rate (SAR) distributions in emulated human head and body tissues exposed to radio frequency (RF) radiation from wireless portable devices for compliance with the rules and regulations of the U.S. Federal Communications Commission (FCC).

|  |  |                    |                 |                         |           |         |
|--|--|--------------------|-----------------|-------------------------|-----------|---------|
| EUT Type                               | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  |                    |                 |                         |           |         |
| FCC ID:                                | ZNFE440F   |                    |                 |                         |           |         |
| Model:                                 | LGE440f, E440f   |                    |                 |                         |           |         |
| Trade Name                             | LG Electronics, MobileComm U.S.A., Inc.  |                    |                 |                         |           |         |
| Application Type                       | Certification  |                    |                 |                         |           |         |
| Mode(s) of Operation                   | GSM850/ GSM1900/ WCDMA 850/ 802.11b/g/n  |                    |                 |                         |           |         |
| Tx Frequency                           | 824.20 - 848.80 MHz (GSM850)/ 1 850.20 – 1 909.80 MHz (GSM1900)<br>826.4 - 846.6 MHz (WCDMA850)/ 2 412- 2 462 MHz (802.11b/g/n)  |                    |                 |                         |           |         |
| Rx Frequency                           | 869.20 - 893.80 MHz (GSM850)/ 1 930.20 – 1 989.80 MHz (GSM1900)<br>871.4 - 891.6 MHz (WCDMA850) / 2 412- 2 462 MHz (802.11b/g/n) |                    |                 |                         |           |         |
| Production Unit or Identical Prototype | Prototype  |                    |                 |                         |           |         |
| Max SAR                                | Band   | Tx Frequency (MHz) | Equipment Class | Reported 1 g SAR (W/kg) |           |         |
|  |  |                    |                 | Head                    | Body-worn | Hotspot |
|  | GSM850   | 824.20 - 848.80    | PCE             | 0.618                   | 0.619     | 1.155   |
|  | GSM1900  | 1 850.20 -1 909.80 | PCE             | 0.511                   | 0.438     | 0.580   |
|  | WCDMA850   | 826.4 - 846.6      | PCE             | 0.502                   | 0.748     | 0.748   |
|  | Bluetooth  | 2 402 - 2 480      | DSS             | -                       |           |         |
|  | 802.11b  | 2 412- 2 462       | DTS             | 0.187                   | 0.042     | 0.042   |
| Simultaneous SAR per KDB 690783 D01    |  |                    |                 | 0.753                   | 1.235     | 1.197   |
| Date(s) of Tests                       | Mar. 29, 2013 ~ Apr. 02, 2013  |                    |                 |                         |           |         |
| Antenna Type                           | Integral Antenna   |                    |                 |                         |           |         |
| GPRS                                   | Multislot Class: 12  |                    |                 |                         |           |         |
| Key Feature(s)                         | This device supports Mobile Hotspot.   |                    |                 |                         |           |         |

## 4. DESCRIPTION OF TEST EQUIPMENT

### 4.1 SAR MEASUREMENT SETUP

These measurements are performed using the DASY4 automated dosimetric assessment system. It is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland. It consists of high precision robotics system (Staubli), robot controller, Pentium III computer, near-field probe, probe alignment sensor, and the generic twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Figure.4.1).

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The PC consists of the HP Pentium IV 3.0 GHz computer with Windows XP system and SAR Measurement Software DASY4, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.

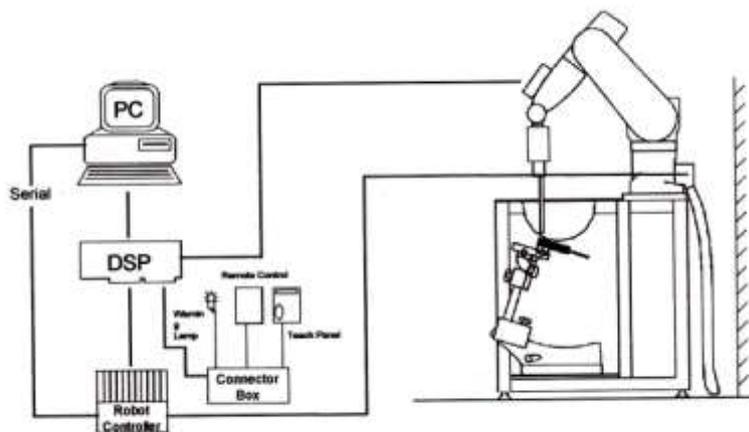


Figure 4.1 HCT SAR Lab. Test Measurement Set-up

The DAE4 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 PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in.

## 4.2 DASY4 E-FIELD PROBE SYSTEM

### 4.2.1 EX3DV4 Probe Specification

|               |   |
|---------------|---|
| Construction  | Symmetrical design with triangular core Interleaved sensors<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| Calibration   | Basic Broad Band Calibration in air<br>Conversion Factors (CF) for HSL 900 and HSL 1810<br>Additional CF for other liquids and frequencies upon request                         |
| Frequency     | 10 MHz to 4 GHz; Linearity: $\pm 0.2$ dB (30 MHz to 4 GHz)  |
| Directivity   | $\pm 0.2$ dB in HSL (rotation around probe axis)<br>$\pm 0.3$ dB in tissue material (rotation normal to probe axis)   |
| Dynamic Range | 5 $\mu$ W/g to > 100 mW/g; Linearity: $\pm 0.2$ dB  |
| Dimensions    | Overall length: 330 mm (Tip: 20 mm)<br>Tip diameter: 3.9 mm (Body: 12 mm)<br>Distance from probe tip to dipole centers: 2.0 mm  |
| Application   | General dosimetry up to 4 GHz<br>Dosimetry in strong gradient fields<br>Compliance tests of mobile phones   |



Figure 4.2 Photograph of the probe and the Phantom



Figure 4.3 EX3DV4 E-field Probe

The SAR measurements were conducted with the dosimetric probe EX3DV4, designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches a maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2<sup>nd</sup> order fitting. The approach is stopped at reaching the maximum.

## 4.3 PROBE CALIBRATION PROCESS

### 4.3.1 E-Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with an accuracy better than  $\pm 10\%$ . The spherical isotropy was evaluated with the proper procedure and found to be better than  $\pm 0.25$  dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe is tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a waveguide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$SAR = C \frac{\Delta T}{\Delta t}$$

where:

- $\Delta t$  = exposure time (30 seconds),
- C = heat capacity of tissue (brain or muscle),
- $\Delta T$  = temperature increase due to RF exposure.

SAR is proportional to  $\Delta T / \Delta t$ , the initial rate of tissue heating, before thermal diffusion takes place. Now it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E- field;

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

where:

- $\sigma$  = simulated tissue conductivity,
- $\rho$  = Tissue density (1.25 g/cm<sup>3</sup> for brain tissue)

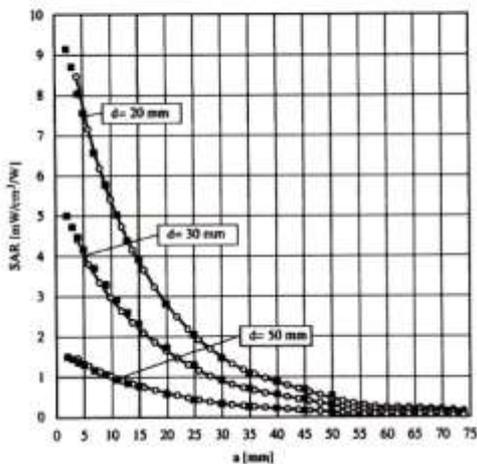


Figure 4.4 E-Field and Temperature measurements at 900 MHz

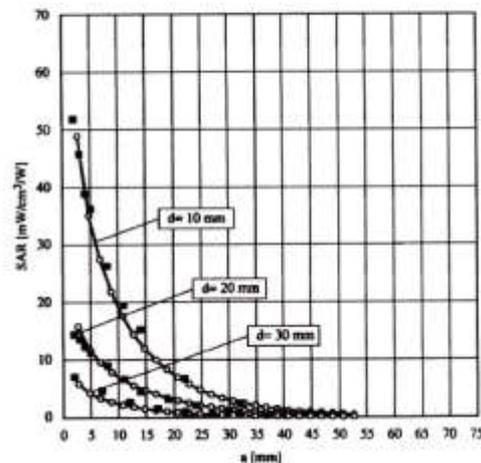


Figure 4.5 E-Field and temperature measurements at 1.8 GHz

### 4.3.2 Data Extrapolation

The DASY4 software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. 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 like below;

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

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)  
 $dcp_i$  = diode compression point (DASY parameter)

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

E-field probes:

$$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

with  $V_i$  = compensated signal of channel i (i = x,y,z)  
 $Norm_i$  = sensor sensitivity of channel i (i = x,y,z)  
 $\mu V/(V/m)^2$  for E-field probes  
 $ConvF$  = sensitivity of enhancement in solution  
 $E_i$  = electric field strength of channel i in V/m

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

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

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

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

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

The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{free} = \frac{E_{tot}^2}{3770}$$

with  $P_{free}$  = equivalent power density of a plane wave in W/cm<sup>2</sup>  
 $E_{tot}$  = total electric field strength in V/m

## 4.4 SAM Phantom

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.



|                 |   |                        |
|-----------------|---|------------------------|
| Shell Thickness | 2.0 mm ± 0.2 mm (6 ± 0.2 mm at ear point) |                        |
| Filling Volume  | about 25 L                                |                        |
| Dimensions      | 810 mm x 1 000 mm x 500 mm (H x L x W)    | Figure 4.6 SAM Phantom |

Triple Modular Phantom consists of three identical modules which can be installed and removed separately without emptying the liquid. It includes three reference points for phantom installation. Covers prevent evaporation of the liquid. Phantom material is resistant to DGBE based tissue simulating liquids. The MFP V5.1 will be delivered including wooden support only (**non-standard** SPEAG support).

Applicable for system performance check from 700 MHz to 6 GHz (MFP V5.1C) or 800 MHz - 6 GHz (MFP V5.1A) as well as dosimetric evaluations for body-worn operation.



|                 |                         |                                   |
|-----------------|-------------------------|-----------------------------------|
| Shell Thickness | 2.0 mm ± 0.2 mm         |                                   |
| Filling Volume  | approx. 9.2 L           |                                   |
| Dimensions      | 830 mm x 500 mm (L x W) | Figure 4.7 Triple Modular Phantom |

## 4.5 Device Holder for Transmitters

In combination with the SAM Phantom V 4.0, the Mounting Device (POM) enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatably positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produce infinite number of configurations. To produce the Worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.



Figure 4.8 Device Holder

## 4.6 Brain & Muscle Simulating Mixture Characterization

The brain and muscle mixtures consist of a viscous gel using hydrox-ethyl cellulose (HEC) gelling agent and saline solution (see Table 3.1). Preservation with a bactericide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The mixture characterizations used for the brain and muscle tissue simulating liquids are according to the data by C. Gabriel and G. Hartsgrove.

| Ingredients<br>(% by weight)  | Frequency (MHz) |       |       |       |               |      |
|-------------------------------|-----------------|-------|-------|-------|---------------|------|
|                               | 835             |       | 1 900 |       | 2 450 – 2 700 |      |
| Tissue Type                   | Head            | Body  | Head  | Body  | Head          | Body |
| Water                         | 40.45           | 53.06 | 54.9  | 70.17 | 71.88         | 73.2 |
| Salt (NaCl)                   | 1.45            | 0.94  | 0.18  | 0.39  | 0.16          | 0.1  |
| Sugar                         | 57.0            | 44.9  | 0.0   | 0     | 0.0           | 0.0  |
| HEC                           | 1.0             | 1.0   | 0.0   | 0     | 0.0           | 0.0  |
| Bactericide                   | 0.1             | 0.1   | 0.0   | 0     | 0.0           | 0.0  |
| Triton X-100                  | 0.0             | 0.0   | 0.0   | 0.0   | 19.97         | 0.0  |
| DGBE                          | 0.0             | 0.0   | 44.92 | 29.44 | 7.99          | 26.7 |
| Diethylene glycol hexyl ether | -               | -     | -     | -     | -             | -    |

Salt: 99 % Pure Sodium Chloride      Sugar: 98 % Pure Sucrose  
 Water: De-ionized, 16M resistivity      HEC: Hydroxyethyl Cellulose  
 DGBE: 99 % Di(ethylene glycol) butyl ether,[2-(2-butoxyethoxy) ethanol]  
 Triton X-100(ultra pure): Polyethylene glycol mono[4-(1,1,3,3-tetramethylbutyl)phenyl] ether

**Table 4.1 Composition of the Tissue Equivalent Matter**

## 4.7 SAR TEST EQUIPMENT

| Manufacturer    | Type / Model                | S/N             | Calib. Date   | Calib.Interval | Calib.Due     |
|-----------------|-----------------------------|-----------------|---------------|----------------|---------------|
| SPEAG           | SAM Phantom                 | -               | N/A           | N/A            | N/A           |
| Staubli         | Robot RX90L                 | F01/5K09A1/A/01 | N/A           | N/A            | N/A           |
| Staubli         | Robot ControllerCS7MB       | F99/5A82A1/C/01 | N/A           | N/A            | N/A           |
| HP              | Pavilion t000_puffer        | KRJ51201TV      | N/A           | N/A            | N/A           |
| SPEAG           | Light Alignment Sensor      | 265             | N/A           | N/A            | N/A           |
| Staubli         | Teach Pendant (Joystick)    | D221340.01      | N/A           | N/A            | N/A           |
| SPEAG           | DAE3                        | 446             | Jan. 16, 2013 | Annual         | Jan. 16, 2014 |
| SPEAG           | E-Field Probe EX3DV4        | 3797            | Nov. 22, 2012 | Annual         | Nov. 22, 2013 |
| SPEAG           | Validation Dipole D835V2    | 441             | May. 16, 2012 | Annual         | May. 16, 2013 |
| SPEAG           | Validation Dipole D1900V2   | 5d032           | Jul. 20, 2012 | Annual         | Jul. 20, 2013 |
| SPEAG           | Validation Dipole D2450V2   | 743             | Aug. 23, 2012 | Annual         | Aug. 23, 2013 |
| Agilent         | Power Meter(F) E4419B       | MY41291386      | Nov. 02, 2012 | Annual         | Nov. 02, 2013 |
| Agilent         | Power Sensor(G) 8481        | MY41090870      | Nov. 02, 2012 | Annual         | Nov. 02, 2013 |
| HP              | Dielectric Probe Kit 85070C | 00721521        | CBT           |                |               |
| HP              | Dual Directional Coupler    | 16072           | Nov. 02, 2012 | Annual         | Nov. 02, 2013 |
| HP              | Base Station E5515C         | GB44400269      | Feb. 14, 2013 | Annual         | Feb. 14, 2014 |
| HP              | Signal Generator 8664A      | 3744A02069      | Nov. 02, 2012 | Annual         | Nov. 02, 2013 |
| Hewlett Packard | 11636B/Power Divider        | 11377           | Nov. 11, 2012 | Annual         | Nov. 11, 2013 |
| Agilent         | N9020A/ SIGNAL              | MY51110020      | Jul. 31, 2012 | Annual         | Jul. 31, 2013 |
| TESCOM          | TC-3000C / BLUETOOTH        | 3000C000276     | Jul. 11, 2012 | Annual         | Jul. 11, 2013 |

**NOTE:**

1. The E-field probe was calibrated by SPEAG, by the waveguide technique procedure. Dipole Verification measurement is performed by HCT Lab. before each test. The brain/body simulating material is calibrated by HCT using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain/body-equivalent material.
2. CBT(Calibrating Before Testing). Prior to testing, 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

## 5. SAR MEASUREMENT PROCEDURE

The evaluation was performed with the following procedure:

1. The SAR value at a fixed location above the ear point was measured and was used as a reference value for assessing the power drop.
2. The SAR distribution at the exposed side of the head was measured at a distance of 3.9 mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 15 mm x 15 mm. Based on this data, the area of the maximum absorption was determined by spline interpolation.
3. Around this point, a volume of 32 mm x 32 mm x 30 mm was assessed by measuring 5 x 5 x 7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:
  - a. The data at the surface were extrapolated, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.
  - b. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed using the 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions. The volume was integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.
  - c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR value, at the same location as procedure #1, was re-measured. If the value changed by more than 5 %, the evaluation is repeated.

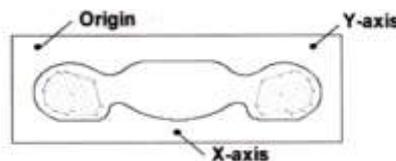


Figure 5.1 SAR Measurement Point in Area Scan

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 extend, 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 SASR-distribution over 10g.

Area scan and zoom scan resolution setting follow KDB 865664 D01v01 quoted below

|  |                                    | $\leq 3$ GHz   | $> 3$ GHz   |
|--|------------------------------------|--|---|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface   |                                    | $5 \pm 1$ mm   | $\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm                            |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location  |                                    | $30^\circ \pm 1^\circ$   | $20^\circ \pm 1^\circ$  |
| Maximum area scan spatial resolution: $\Delta x_{Area}$ , $\Delta y_{Area}$  |                                    | $\leq 2$ GHz: $\leq 15$ mm<br>2 – 3 GHz: $\leq 12$ mm  | 3 – 4 GHz: $\leq 12$ mm<br>4 – 6 GHz: $\leq 10$ mm                            |
|  |                                    | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device. |   |
| Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$ , $\Delta y_{Zoom}$  |                                    | $\leq 2$ GHz: $\leq 8$ mm<br>2 – 3 GHz: $\leq 5$ mm*   | 3 – 4 GHz: $\leq 5$ mm*<br>4 – 6 GHz: $\leq 4$ mm*                            |
| Maximum zoom scan spatial resolution, normal to phantom surface  | uniform grid: $\Delta z_{Zoom}(n)$ | $\leq 5$ mm  | 3 – 4 GHz: $\leq 4$ mm<br>4 – 5 GHz: $\leq 3$ mm<br>5 – 6 GHz: $\leq 2$ mm    |
|  | graded grid                        | $\Delta z_{Zoom}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface   | $\leq 4$ mm   |
|  |                                    | $\Delta z_{Zoom}(n>1)$ : between subsequent points   | $\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$   |
| Minimum zoom scan volume   | x, y, z                            | $\geq 30$ mm   | 3 – 4 GHz: $\geq 28$ mm<br>4 – 5 GHz: $\geq 25$ mm<br>5 – 6 GHz: $\geq 22$ mm |
| Note: $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.<br>* When zoom scan is required and the <i>reported</i> SAR from the area scan based <i>1-g SAR estimation</i> procedures of KDB 447498 is $\leq 1.4$ W/kg, $\leq 8$ mm, $\leq 7$ mm and $\leq 5$ mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz. |                                    |  |   |

## 6. DESCRIPTION OF TEST POSITION

### 6.1 HEAD POSITION

The device was placed in a normal operating position with the Point A on the device, as illustrated in following drawing, aligned with the location of the RE(ERP) on the phantom. With the ear-piece pressed against the head, the vertical center line of the body of the handset was aligned with an imaginary plane consisting of the RE, LE and M. While maintaining these alignments, the body of the handset was gradually moved towards the cheek until any point on the mouth-piece or keypad contacted the cheek. This is a cheek/touch position. For ear/tilt position, while maintain the device aligned with the BM and FN lines, the device was pivot against ERP back for 15° or until the device antenna touch the phantom. Please refer to IEEE 1528-2003 illustration below.

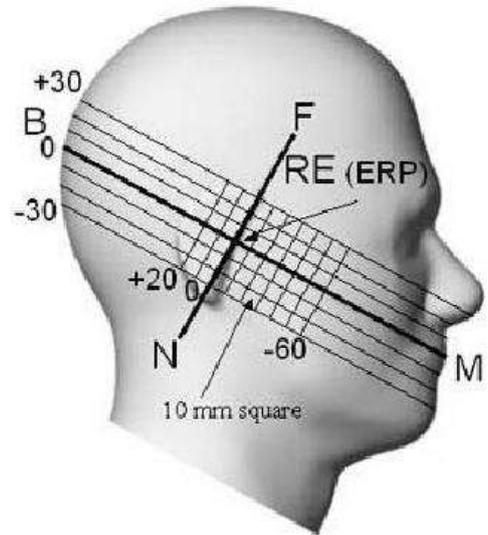


Figure 6.1 Side view of the phantom

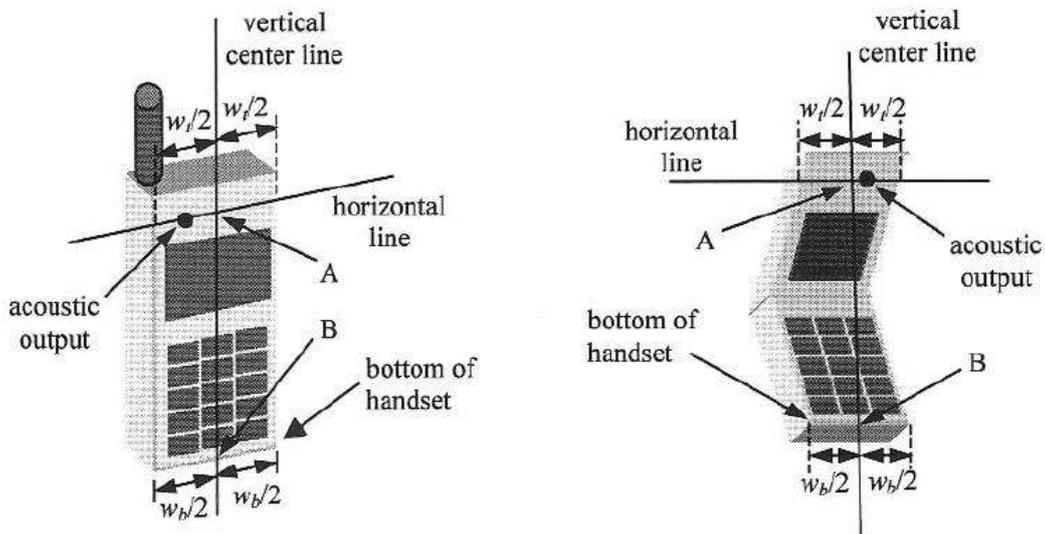


Figure 6.2 Handset vertical and horizontal reference lines

## **6.2 Body Holster/Belt Clip Configurations**

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration. A device with a headset output is tested with a headset connected to the device. Body dielectric parameters are used.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with each accessory. If multiple accessory share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some Devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used.

Since this EUT does not supply any body worn accessory to the end user a distance of 1.0 cm from the EUT back surface to the liquid interface is configured for the generic test.

"See the Test SET-UP Photo"

Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessory(ies), including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

In all cases SAR measurements are performed to investigate the worst-case positioning. Worstcase positioning is then documented and used to perform Body SAR testing.

## 7. MEASUREMENT UNCERTAINTY

| Error Description                   | Tol<br>(± %) | Prob.<br>dist. | Div. | $C_i$ | Standard<br>Uncertainty<br>(± %) | $V_{eff}$ |
|-------------------------------------|--------------|----------------|------|-------|----------------------------------|-----------|
| <b>1. Measurement System</b>        |              |                |      |       |                                  |           |
| Probe Calibration                   | 6.00         | N              | 1    | 1     | 6.00                             | ∞         |
| Axial Isotropy                      | 4.70         | R              | 1.73 | 0.7   | 1.90                             | ∞         |
| Hemispherical Isotropy              | 9.60         | R              | 1.73 | 0.7   | 3.88                             | ∞         |
| Boundary Effects                    | 1.00         | R              | 1.73 | 1     | 0.58                             | ∞         |
| Linearity                           | 4.70         | R              | 1.73 | 1     | 2.71                             | ∞         |
| System Detection Limits             | 1.00         | R              | 1.73 | 1     | 0.58                             | ∞         |
| Readout Electronics                 | 0.30         | N              | 1.00 | 1     | 0.30                             | ∞         |
| Response Time                       | 0.8          | R              | 1.73 | 1     | 0.46                             | ∞         |
| Integration Time                    | 2.6          | R              | 1.73 | 1     | 1.50                             | ∞         |
| RF Ambient Conditions               | 3.00         | R              | 1.73 | 1     | 1.73                             | ∞         |
| Probe Positioner                    | 0.40         | R              | 1.73 | 1     | 0.23                             | ∞         |
| Probe Positioning                   | 2.90         | R              | 1.73 | 1     | 1.67                             | ∞         |
| Max SAR Eval                        | 1.00         | R              | 1.73 | 1     | 0.58                             | ∞         |
| <b>2. Test Sample Related</b>       |              |                |      |       |                                  |           |
| Device Positioning                  | 2.90         | N              | 1.00 | 1     | 2.90                             | 145       |
| Device Holder                       | 3.60         | N              | 1.00 | 1     | 3.60                             | 5         |
| Power Drift                         | 5.00         | R              | 1.73 | 1     | 2.89                             | ∞         |
| <b>3. Phantom and Setup</b>         |              |                |      |       |                                  |           |
| Phantom Uncertainty                 | 4.00         | R              | 1.73 | 1     | 2.31                             | ∞         |
| Liquid Conductivity(target)         | 5.00         | R              | 1.73 | 0.64  | 1.85                             | ∞         |
| Liquid Conductivity(meas.)          | 2.07         | N              | 1    | 0.64  | 1.32                             | 9         |
| Liquid Permittivity(target)         | 5.00         | R              | 1.73 | 0.6   | 1.73                             | ∞         |
| Liquid Permittivity(meas.)          | 5.02         | N              | 1    | 0.6   | 3.01                             | 9         |
| <b>Combine Standard Uncertainty</b> |              |                |      |       | 11.13                            |           |
| <b>Coverage Factor for 95 %</b>     |              |                |      |       | $k=2$                            |           |
| <b>Expanded STD Uncertainty</b>     |              |                |      |       | 22.25                            |           |

**Table 7.1 Uncertainty (800 MHz- 2450 MHz)**

## 8. ANSI/ IEEE C95.1 - 1992 RF EXPOSURE LIMITS

| HUMAN EXPOSURE   | UNCONTROLLED ENVIRONMENT<br>General Population<br>(W/kg) or (mW/g) | CONTROLLED ENVIRONMENT<br>Occupational<br>(W/kg) or (mW/g) |
|--|--|--|
| SPATIAL PEAK SAR *<br>(Brain)                          | 1.60   | 8.00   |
| SPATIAL AVERAGE SAR **<br>(Whole Body)                 | 0.08   | 0.40   |
| SPATIAL PEAK SAR ***<br>(Hands / Feet / Ankle / Wrist) | 4.00   | 20.00  |

**Table 8.1 Safety Limits for Partial Body Exposure**

**NOTES:**

\* The Spatial Peak value of the SAR averaged over any 1 g of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

\*\* The Spatial Average value of the SAR averaged over the whole-body.

\*\*\* The Spatial Peak value of the SAR averaged over any 10 g of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

**Uncontrolled Environments** are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

**Controlled Environments** are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e.as a result of employment or occupation).

## 9. SAR SYSTEM VALIDATION

Per FCC KCB 865664 D02v01, SAR system validation status should be document to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in IEEE 1528-2003 and FCC KDB 865664 D01 v01. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

**SAR System Validation Summary**

| SAR System # | Probe | probe Type | Probe Calibration Point |      | Dipole | Date        | Dielectric Parameters |                       | CW Validation |                 |                | Modulation Validation |             |      |
|--------------|-------|------------|-------------------------|------|--------|-------------|-----------------------|-----------------------|---------------|-----------------|----------------|-----------------------|-------------|------|
|              |       |            |                         |      |        |             | Measured Permittivity | Measured conductivity | Sensitivity   | Probe Linearity | Probe Isortopy | MOD. Type             | Duty Factor | PAR  |
|              |       |            |                         |      |        |             |                       |                       |               |                 |                |                       |             |      |
| 3            | 3797  | EX3DV4     | Head                    | 835  | 441    | Dec.20,2012 | 40.4                  | 0.92                  | PASS          | PASS            | PASS           | GMSK                  | PASS        | N/A  |
| 3            | 3797  | EX3DV4     | Head                    | 1900 | 5d032  | Dec.20,2012 | 39.8                  | 1.4                   | PASS          | PASS            | PASS           | GMSK                  | PASS        | N/A  |
| 3            | 3797  | EX3DV4     | Head                    | 2450 | 743    | Dec.20,2012 | 38.1                  | 1.83                  | PASS          | PASS            | PASS           | OFDM                  | N/A         | PASS |
| 3            | 3797  | EX3DV4     | Body                    | 835  | 441    | Dec.21,2012 | 56.9                  | 0.98                  | PASS          | PASS            | PASS           | GMSK                  | PASS        | N/A  |
| 3            | 3797  | EX3DV4     | Body                    | 1900 | 5d032  | Dec.21,2012 | 51.8                  | 1.54                  | PASS          | PASS            | PASS           | GMSK                  | PASS        | N/A  |
| 3            | 3797  | EX3DV4     | Body                    | 2450 | 743    | Dec.21,2012 | 52.9                  | 1.96                  | PASS          | PASS            | PASS           | OFDM                  | N/A         | PASS |

## 10. SYSTEM VERIFICATION

### 10.1 Tissue Verification

| Freq. [MHz] | Date          | Probe | Dipole | Liquid | Liquid Temp.[°C] | Parameters   | Target Value | Measured Value | Deviation [%] | Limit [%] |
|-------------|---------------|-------|--------|--------|------------------|--------------|--------------|----------------|---------------|-----------|
| 835         | Mar. 29, 2013 | 3797  | 441    | Head   | 21.1             | $\epsilon_r$ | 41.5         | 40.5           | - 2.41        | $\pm 5$   |
|             |               |       |        |        |                  | $\sigma$     | 0.90         | 0.919          | + 2.11        | $\pm 5$   |
| 835         | Mar. 30, 2013 |       | 5d032  | Body   | 21.2             | $\epsilon_r$ | 55.2         | 56.8           | + 2.90        | $\pm 5$   |
|             |               |       |        |        |                  | $\sigma$     | 0.97         | 0.985          | + 1.55        | $\pm 5$   |
| 1 900       | Apr. 01, 2013 |       | 5d032  | Head   | 20.7             | $\epsilon_r$ | 40.0         | 40.8           | + 2.00        | $\pm 5$   |
|             |               |       |        |        |                  | $\sigma$     | 1.40         | 1.37           | - 2.14        | $\pm 5$   |
| 1 900       | Apr. 01, 2013 |       | 5d032  | Body   | 20.7             | $\epsilon_r$ | 53.3         | 52.3           | - 1.88        | $\pm 5$   |
|             |               |       |        |        |                  | $\sigma$     | 1.52         | 1.56           | + 2.63        | $\pm 5$   |
| 2 450       | Apr. 02, 2013 |       | 743    | Head   | 21.3             | $\epsilon_r$ | 39.2         | 38.9           | - 0.77        | $\pm 5$   |
|             |               |       |        |        |                  | $\sigma$     | 1.80         | 1.86           | + 3.33        | $\pm 5$   |
| 2 450       | Apr. 02, 2013 |       |        | Body   | 21.3             | $\epsilon_r$ | 52.7         | 53.6           | + 1.71        | $\pm 5$   |
|             |               |       |        |        |                  | $\sigma$     | 1.95         | 1.99           | + 2.05        | $\pm 5$   |

The Tissue dielectronic parameters were measured prior to the SAR evaluation using an Agilent 85070C Dielectronic Probe Kit and Agilent Network Analyzer.

### 10.2 System Verification

Prior to assessment, the system is verified to the  $\pm 10\%$  of the specifications at 835 MHz / 1 900 MHz / 2 450 MHz by using the system Verification kit. (Graphic Plots Attached)

| Freq. [MHz] | Date          | Probe (SN) | Dipole (SN) | Liquid | Amb. Temp. [°C] | Liquid Temp. [°C] | 1 W Target SAR <sub>1g</sub> (SPEAG) (mW/g) | Measured SAR <sub>1g</sub> (mW/g) | 1 W Normalized SAR <sub>1g</sub> (mW/g) | Deviation [%] | Limit [%] |
|-------------|---------------|------------|-------------|--------|-----------------|-------------------|---|-----------------------------------|---|---------------|-----------|
| 835         | Mar. 29, 2013 | 3797       | 441         | Head   | 21.3            | 21.1              | 9.43  | 0.953                             | 9.53                                    | + 1.06        | $\pm 10$  |
| 835         | Mar. 30, 2013 |            |             | Body   | 21.4            | 21.2              | 9.50  | 0.962                             | 9.62                                    | + 1.26        | $\pm 10$  |
| 1 900       | Apr. 01, 2013 |            | 5d032       | Head   | 20.9            | 20.7              | 39.0  | 3.78                              | 37.8                                    | - 3.08        | $\pm 10$  |
| 1 900       | Apr. 01, 2013 |            |             | Body   | 20.9            | 20.7              | 39.9  | 4.00                              | 40.0                                    | + 0.25        | $\pm 10$  |
| 2 450       | Apr. 02, 2013 |            | 743         | Head   | 21.5            | 21.3              | 52.7  | 5.48                              | 54.8                                    | + 3.98        | $\pm 10$  |
| 2 450       | Apr. 02, 2013 |            |             | Body   | 21.5            | 21.3              | 51.2  | 5.22                              | 52.2                                    | + 1.95        | $\pm 10$  |

## **10.3 System Verification Procedure**

SAR measurement was prior to assessment, the system is verified to the  $\pm 10\%$  of the specifications at each frequency band by using the system Verification kit. (Graphic Plots Attached)

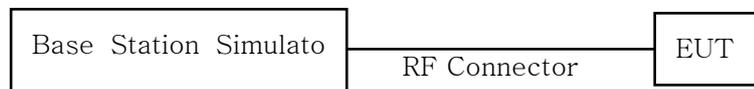
- Cabling the system, using the Verification kit equipments.
- Generate about 100 mW Input Level from the Signal generator to the Dipole Antenna.
- Dipole Antenna was placed below the Flat phantom.
- The measured one-gram SAR at the surface of the phantom above the dipole feed-point should be within 10 % of the target reference value.
- The results are normalized to 1 W input power.

## 11. RF CONDUCTED POWER MEASUREMENT

Power measurements were performed using a base station simulator under digital average power. The handset was placed into a simulated call using a base station simulator in a shielded chamber. Such test signals offer a consistent means for testing SAR and are recommended for evaluation SAR. SAR measurements were taken with a fully charged battery. In order to verify that the device was tested and maintained at full power, this was configured with the base station simulator. The SAR measurement Software calculates a reference point at the start and end of the test to check for power drifts. If conducted Power deviations of more than 5 % occurred, the tests were repeated.

### 11.1 GSM

Conducted output power measurements were performed using a base station simulator under digital average power.



SAR Test for WWAN were performed with a base station simulator Agilent E5515C. Communication between the device and the emulator was established by air link. Set base station emulator to allow DUT to radiate maximum output power during all tests. Please refer to the below worst case SAR operation setup.

- GSM voice: Head SAR
- GPRS Multi-slots : Body SAR with GPRS Multi-slot Class12 with CS 1 (GMSK)

**Note;**

CS1/MCS7 coding scheme was used in GPRS/EDGE output power measurements and SAR Testing, as a condition where GMSK/8PSK modulation was ensured. Investigation has shown that CS1 - CS4/ MCS5 – MCS9 settings do not have any impact on the output levels in the GPRS/EDGE modes.

GSM850

Target Power : 32.7 dBm

GSM1900

Target Power : 29.7 dBm

GPRS850

GPRS 1tx : 32.7 dBm

GPRS 2tx : 31.2 dBm

GPRS 3tx : 29.2 dBm

GPRS 4tx : 28.2 dBm

Tune-up Tolerance : -1.5dB/ +0.5dB

PCS1900

GPRS 1tx : 29.7 dBm

GPRS 2tx : 28.2 dBm

GPRS 3tx : 26.2 dBm

GPRS 4tx : 25.2 dBm

Tune-up Tolerance : -1.5dB/ +0.5dB

## GSM Conducted output powers (Burst-Average)

| Band     | Channel | Voice     | GPRS(GMSK) Data – CS1 |                      |                      |                      |
|----------|---------|-----------|-----------------------|----------------------|----------------------|----------------------|
|          |         | GSM (dBm) | GPRS 1 TX Slot (dBm)  | GPRS 2 TX Slot (dBm) | GPRS 3 TX Slot (dBm) | GPRS 4 TX Slot (dBm) |
| GSM 850  | 128     | 32.94     | 32.94                 | 31.44                | 29.45                | 28.52                |
|          | 190     | 32.87     | 32.87                 | 31.36                | 29.37                | 28.43                |
|          | 251     | 32.85     | 32.84                 | 31.36                | 29.36                | 28.45                |
| GSM 1900 | 512     | 29.85     | 29.86                 | 28.36                | 26.36                | 25.44                |
|          | 661     | 29.84     | 29.85                 | 28.34                | 26.34                | 25.40                |
|          | 810     | 29.84     | 29.84                 | 28.34                | 26.34                | 25.40                |

## GSM Conducted output powers (Frame-Average)

| Band     | Channel | Voice     | GPRS(GMSK) Data – CS1 |                      |                      |                      |
|----------|---------|-----------|-----------------------|----------------------|----------------------|----------------------|
|          |         | GSM (dBm) | GPRS 1 TX Slot (dBm)  | GPRS 2 TX Slot (dBm) | GPRS 3 TX Slot (dBm) | GPRS 4 TX Slot (dBm) |
| GSM 850  | 128     | 23.91     | 23.91                 | 25.42                | 25.19                | 25.51                |
|          | 190     | 23.84     | 23.84                 | 25.34                | 25.11                | 25.42                |
|          | 251     | 23.82     | 23.81                 | 25.34                | 25.1                 | 25.44                |
| GSM 1900 | 512     | 20.82     | 20.83                 | 22.34                | 22.1                 | 22.43                |
|          | 661     | 20.81     | 20.82                 | 22.32                | 22.08                | 22.39                |
|          | 810     | 20.81     | 20.81                 | 22.32                | 22.08                | 22.39                |

**Note:**

Time slot average factor is as follows:

1 Tx slot = 9.03 dB, Frame-Average output power = Burst-Average output power – 9.03 dB

2 Tx slot = 6.02 dB, Frame-Average output power = Burst-Average output power – 6.02 dB

3 Tx slot = 4.26 dB, Frame-Average output power = Burst-Average output power – 4.26 dB

4 Tx slot = 3.01 dB, Frame-Average output power = Burst-Average output power – 3.01 dB

## 11.2 WCDMA

Body SAR is not required for handsets with HSDPA capabilities when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2 kbps RMC is  $\leq 75\%$  of the SAR limit. Otherwise, SAR is Measured for HSDPA, using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration in 12.2 kbps RMC without HSDPA, on the maximum output channel with the body exposure configuration that results in the highest SAR in 12.2 kbps RMC for that RF channel.

### 11.2.1 Output Power Verification

Maximum output power is verified on the High, Middle and Low channels according to the general descriptions in section 5.2 of 3 GPP TS 34.121, using the appropriate RMC or AMR with TPC(transmit power control) set to all “1s”.

### 11.2.2 Head SAR Measurements

SAR for head exposure configurations is measured using the 12.2 kbps RMC with TPC bits configured to all “1s”. SAR in AMR configurations is not required when the maximum average output of each RF channel for 12.2 kbps AMR is less than ¼ dB higher than that measured in 12.2 kbps RMC. Otherwise, SAR is measured on the maximum output channel in 12.2 AMR with a 3.4 kbps SRB (signaling radio bearer using the exposure configuration that results in the highest SAR for that RF channel in 12.2 RMC.

### 11.2.3 Body SAR Measurement

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all “1s”.

### 11.2.4 Handsets with Release 5 HSDPA

Body SAR is not required for handsets with HSDPA capabilities when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2 kbps RMC is  $\leq 75\%$  of the SAR limit. Otherwise, SAR is Measured for HSDPA, using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration in 12.2 kbps RMC without HSDPA, on the maximum output channel with the body exposure configuration that results in the highest SAR in 12.2 kbps RMC for that RF channel.

**Sub-Test 1 Setup for Release 5 HSDPA**

| Sub-test | $\beta_c$            | $\beta_d$            | $\beta_d$<br>(SF) | $\beta_c/\beta_d$    | $\beta_{hs}^{(1)}$ | CM (dB) <sup>(2)</sup> |
|----------|----------------------|----------------------|-------------------|----------------------|--------------------|------------------------|
| 1        | 2/15                 | 15/15                | 64                | 2/15                 | 4/15               | 0.0                    |
| 2        | 12/15 <sup>(3)</sup> | 15/15 <sup>(3)</sup> | 64                | 12/15 <sup>(3)</sup> | 24/15              | 1.0                    |
| 3        | 15/15                | 8/15                 | 64                | 15/8                 | 30/15              | 1.5                    |
| 4        | 15/15                | 4/15                 | 64                | 15/4                 | 30/15              | 1.5                    |

Note 1:  $\Delta_{ACK}, \Delta_{NACK}$  and  $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$   
 Note 2: CM = 1 for  $\beta_c/\beta_d = 12/15, \beta_{hs}/\beta_c = 24/15$ .  
 Note 3: For subtest 2 the  $\beta_c/\beta_d$  ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 11/15$  and  $\beta_d = 15/15$ .

## 11.2.5 Handsets with Release 6 HSPA (HSDPA/HSUPA)

Body SAR is not required for handsets with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than ¼ dB higher than that measured without HSUPA/HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2 kbps RMC is ≤ 75 % of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.1 kbps RMC without HSPA. When VOIP is applicable for head exposure, SAR is not required when the maximum output of each RF channel with HSPA is less than ¼ dB higher than that measured using 12.2 kbps RMC; otherwise, the same HSPA configuration used for body measurement should be used to test for head exposure.

| Sub-test | $\beta_c$            | $\beta_d$            | $\beta_d$ (SF) | $\beta_c/\beta_d$    | $\beta_{hs}^{(1)}$ | $\beta_{ec}$ | $\beta_{ed}$                                 | $\beta_{ed}$ (SF) | $\beta_{ed}$ (codes) | CM <sup>(2)</sup> (dB) | MPR (dB) | AG <sup>(4)</sup> Index | E-TFCI |
|----------|----------------------|----------------------|----------------|----------------------|--------------------|--------------|--|-------------------|----------------------|------------------------|----------|-------------------------|--------|
| 1        | 11/15 <sup>(3)</sup> | 15/15 <sup>(3)</sup> | 64             | 11/15 <sup>(3)</sup> | 22/15              | 209/225      | 1039/225                                     | 4                 | 1                    | 1.0                    | 0.0      | 20                      | 75     |
| 2        | 6/15                 | 15/15                | 64             | 6/15                 | 12/15              | 12/15        | 94/75  | 4                 | 1                    | 3.0                    | 2.0      | 12                      | 67     |
| 3        | 15/15                | 9/15                 | 64             | 15/9                 | 30/15              | 30/15        | $\beta_{ed1}: 47/15$<br>$\beta_{ed2}: 47/15$ | 4                 | 2                    | 2.0                    | 1.0      | 15                      | 92     |
| 4        | 2/15                 | 15/15                | 64             | 2/15                 | 4/15               | 2/15         | 56/75  | 4                 | 1                    | 3.0                    | 2.0      | 17                      | 71     |
| 5        | 15/15 <sup>(4)</sup> | 15/15 <sup>(4)</sup> | 64             | 15/15 <sup>(4)</sup> | 30/15              | 24/15        | 134/15                                       | 4                 | 1                    | 1.0                    | 0.0      | 21                      | 81     |

Note 1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$ .

Note 2: CM = 1 for  $\beta_c/\beta_d = 12/15$ ,  $\beta_{hs}/\beta_c = 24/15$ . For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the  $\beta_c/\beta_d$  ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 10/15$  and  $\beta_d = 15/15$ .

Note 4: For subtest 5 the  $\beta_c/\beta_d$  ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 14/15$  and  $\beta_d = 15/15$ .

Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.

Note 6:  $\beta_{ed}$  can not be set directly; it is set by Absolute Grant Value.

WCDMA850

Target Power : 22.7 dBm

Tune-up Tolerance : -1.5dB/ +0.5dB

| 3GPP<br>Release<br>Version | Mode  | 3GPP 34.121   | Cellular Band [dBm] |                            |                    |                            |                    |                            | MPR<br>Target |
|----------------------------|-------|---------------|---------------------|----------------------------|--------------------|----------------------------|--------------------|----------------------------|---------------|
|                            |       | Subtest       | UL 4132<br>(826.4)  | Power<br>reduction<br>(dB) | UL 4183<br>(836.6) | Power<br>reduction<br>(dB) | UL 4233<br>(846.6) | Power<br>reduction<br>(dB) |               |
|                            |       |               | DL 4357             |                            | DL 4408            |                            | DL 4458            |                            |               |
| 99                         | WCDMA | 12.2 kbps RMC | 22.64               |                            | 22.61              |                            | 22.68              |                            | -             |
| 99                         | WCDMA | 12.2 kbps AMR | 22.63               |                            | 22.60              |                            | 22.66              |                            | -             |
| 5                          | HSDPA | Subtest 1     | 22.77               |                            | 22.74              |                            | 22.77              |                            | 0             |
| 5                          |       | Subtest 2     | 21.71               | 1.06                       | 21.65              | 1.09                       | 21.66              | 1.11                       | 0             |
| 5                          |       | Subtest 3     | 21.18               | 1.59                       | 21.15              | 1.59                       | 21.20              | 1.57                       | -0.5          |
| 5                          |       | Subtest 4     | 21.15               | 1.62                       | 21.12              | 1.62                       | 21.19              | 1.58                       | -0.5          |
| 6                          | HSUPA | Subtest 1     | 20.73               |                            | 20.67              |                            | 20.72              |                            | 0             |
| 6                          |       | Subtest 2     | 19.69               | 1.04                       | 19.67              | 1                          | 19.72              | 1                          | -2            |
| 6                          |       | Subtest 3     | 19.70               | 1.03                       | 20.19              | 0.48                       | 19.21              | 1.51                       | -1            |
| 6                          |       | Subtest 4     | 20.72               | 0.01                       | 20.18              | 0.49                       | 20.75              | -0.03                      | -2            |
| 6                          |       | Subtest 5     | 20.73               | 0                          | 20.68              | -0.01                      | 20.74              | -0.02                      | 0             |

WCDMA Average Conducted output powers

## 11.3 WiFi

### 11.3.1 SAR Testing for 802.11b/g/n modes

#### General Device Setup

Normal Network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable.

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

#### Frequency Channel Configurations

802.11 a/b/g and 4.9 GHz operating modes are tested independently according to the service requirements in each frequency band. 802.11 b/g modes are tested on channels 1, 6 and 11. 802.11a is tested for UNII operations on channels 36 and 48 in the 5.15-5.25 GHz band; channels 52 and 64 in the 5.25-5.35 GHz band; Channels 104, 116, 124 and 136 in the 5.470-5.725 GHz band; and channels 149 and 161 in the 5.8 GHz band. When 5.8 GHz § 15.247 is also available, channels 149, 157 and 165 should be tested instead of the UNII channels. 4.9 GHz is tested on channels 1, 10 and 5 or 6, whichever has the higher output power, for 5 MHz channels; channels 11,15 and 19 for 10 MHz channels; and channels 21 and 25 for 20 MHz channels.

These are referred to as the “default test channels”. 802.11g mode was evaluated only if the output power was 0.25 dB higher than the 802.11b mode.

| Mode            | GHz   | Channel | Turbo Channel  | "Default Test Channels" |         |   |
|-----------------|-------|---------|----------------|-------------------------|---------|---|
|                 |       |         |                | §15.247                 | UNII    |   |
|                 |       |         |                | 802.11b                 | 802.11g |   |
| 802.11 b/g      | 2.412 | 1       |                | √                       | √       |   |
|                 | 2.437 | 6       | 6              | √                       | √       |   |
|                 | 2.462 | 11      |                | √                       | √       |   |
| 802.11a         | 5.18  | 36      |                |                         |         | √ |
|                 | 5.20  | 40      | 43 (5.21 GHz)  |                         |         | * |
|                 | 5.22  | 44      |                |                         |         | * |
|                 | 5.24  | 48      | 50 (5.25 GHz)  |                         |         | √ |
|                 | 5.26  | 52      | 58 (5.29 GHz)  |                         |         | √ |
|                 | 5.28  | 56      |                |                         |         | * |
|                 | 5.30  | 60      |                |                         |         | * |
|                 | 5.32  | 64      |                |                         |         | √ |
|                 | 5.500 | 100     |                |                         |         | * |
|                 | 5.520 | 104     |                |                         |         | √ |
|                 | 5.540 | 108     |                |                         |         | * |
|                 | 5.560 | 112     |                |                         |         | * |
|                 | 5.580 | 116     |                |                         |         | √ |
|                 | 5.600 | 120     |                |                         |         | * |
|                 | 5.620 | 124     |                |                         |         | √ |
|                 | 5.640 | 128     |                |                         |         | * |
|                 | 5.660 | 132     |                |                         |         | * |
| 5.680           | 136   |         |                |                         | √       |   |
| 5.700           | 140   |         |                |                         | *       |   |
| UNII or §15.247 | 5.745 | 149     |                | √                       |         | √ |
|                 | 5.765 | 153     | 152 (5.76 GHz) |                         | *       | * |
|                 | 5.785 | 157     |                | √                       |         | * |
|                 | 5.805 | 161     | 160 (5.80 GHz) |                         | *       | √ |
| §15.247         | 5.825 | 165     |                | √                       |         | √ |

802.11 Test Channels per FCC Requirements

2.4GHz

802.11b : 15.5 dBm      802.11g : 11.0 dBm      802.11n : 8.5 dBm

Tune-up Tolerance : Max. Conducted Power ~ +0.5 dB

**■ TEST RESULTS-Average**
**Conducted Output Power Measurements (802.11b Mode)**

| 802.11b Mode   |             | Rate (Mbps) | Measured Power(dBm) | Limit (dBm) |
|----------------|-------------|-------------|---------------------|-------------|
| Frequency[MHz] | Channel No. |             |                     |             |
| 2412           | 1           | 1 Mbps      | 14.41               | 30          |
|                |             | 2 Mbps      | 14.32               | 30          |
|                |             | 5.5 Mbps    | 14.66               | 30          |
|                |             | 11 Mbps     | 14.11               | 30          |
| 2437           | 6           | 1 Mbps      | 15.72               | 30          |
|                |             | 2 Mbps      | 15.77               | 30          |
|                |             | 5.5 Mbps    | 15.17               | 30          |
|                |             | 11 Mbps     | 15.02               | 30          |
| 2462           | 11          | 1 Mbps      | 14.01               | 30          |
|                |             | 2 Mbps      | 14.31               | 30          |
|                |             | 5.5 Mbps    | 13.67               | 30          |
|                |             | 11 Mbps     | 13.15               | 30          |

**Conducted Output Power Measurements (802.11g Mode)**

| 802.11g Mode   |             | Rate (Mbps) | Measured Power(dBm) | Limit (dBm) |
|----------------|-------------|-------------|---------------------|-------------|
| Frequency[MHz] | Channel No. |             |                     |             |
| 2412           | 1           | 6 Mbps      | 9.19                | 30          |
|                |             | 9 Mbps      | 9.04                | 30          |
|                |             | 12 Mbps     | 8.93                | 30          |
|                |             | 18 Mbps     | 8.79                | 30          |
|                |             | 24 Mbps     | 8.50                | 30          |
|                |             | 36 Mbps     | 8.19                | 30          |
|                |             | 48 Mbps     | 7.86                | 30          |
|                |             | 54 Mbps     | 7.74                | 30          |
| 2437           | 6           | 6 Mbps      | 10.67               | 30          |
|                |             | 9 Mbps      | 10.68               | 30          |
|                |             | 12 Mbps     | 10.55               | 30          |
|                |             | 18 Mbps     | 10.34               | 30          |
|                |             | 24 Mbps     | 10.03               | 30          |
|                |             | 36 Mbps     | 9.70                | 30          |
|                |             | 48 Mbps     | 9.39                | 30          |
|                |             | 54 Mbps     | 9.24                | 30          |
| 2462           | 11          | 6 Mbps      | 10.40               | 30          |
|                |             | 9 Mbps      | 10.25               | 30          |
|                |             | 12 Mbps     | 10.22               | 30          |
|                |             | 18 Mbps     | 9.99                | 30          |
|                |             | 24 Mbps     | 9.79                | 30          |
|                |             | 36 Mbps     | 9.42                | 30          |
|                |             | 48 Mbps     | 9.07                | 30          |
|                |             | 54 Mbps     | 8.96                | 30          |

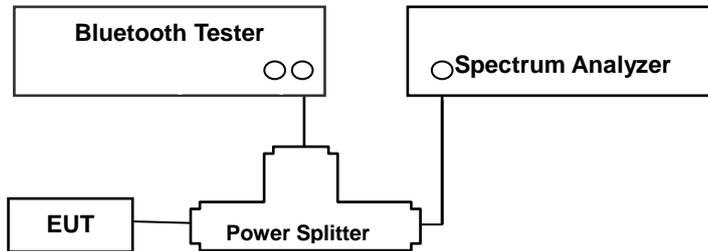
**Conducted Output Power Measurements (802.11n Mode)**

| 802.11n Mode   |             | Rate (Mbps) | Measured Power(dBm) | Limit (dBm) |
|----------------|-------------|-------------|---------------------|-------------|
| Frequency[MHz] | Channel No. |             |                     |             |
| 2412           | 1           | 6.5 Mbps    | 7.09                | 30          |
|                |             | 13 Mbps     | 6.85                | 30          |
|                |             | 19.5 Mbps   | 6.65                | 30          |
|                |             | 26 Mbps     | 6.42                | 30          |
|                |             | 39 Mbps     | 6.08                | 30          |
|                |             | 52 Mbps     | 5.75                | 30          |
|                |             | 58.5 Mbps   | 5.66                | 30          |
|                |             | 65 Mbps     | 5.52                | 30          |
| 2437           | 6           | 6.5 Mbps    | 8.79                | 30          |
|                |             | 13 Mbps     | 8.58                | 30          |
|                |             | 19.5 Mbps   | 8.34                | 30          |
|                |             | 26 Mbps     | 8.12                | 30          |
|                |             | 39 Mbps     | 7.80                | 30          |
|                |             | 52 Mbps     | 7.53                | 30          |
|                |             | 58.5 Mbps   | 7.36                | 30          |
|                |             | 65 Mbps     | 7.22                | 30          |
| 2462           | 11          | 6.5 Mbps    | 8.20                | 30          |
|                |             | 13 Mbps     | 8.03                | 30          |
|                |             | 19.5 Mbps   | 7.79                | 30          |
|                |             | 26 Mbps     | 7.61                | 30          |
|                |             | 39 Mbps     | 7.27                | 30          |
|                |             | 52 Mbps     | 6.89                | 30          |
|                |             | 58.5 Mbps   | 6.83                | 30          |
|                |             | 65 Mbps     | 6.65                | 30          |

Note;  
SAR testing was performed according to the FCC KDB 248227.

## 11. 4 Bluetooth Average Power

### Test Configuration



### TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. The Spectrum Analyzer is set to the average detector mode. This test is performed with hopping off.

1. Span = 2 MHz (GFSK) / 5 MHz ( $\pi/4$ DQPSK and 8DPSK)
2. RBW = auto (GFSK) / auto ( $\pi/4$ DQPSK and 8DPSK)
3. VBW = auto (GFSK) / auto ( $\pi/4$ DQPSK and 8DPSK)
4. Sweep = 1 s
5. Packet type= DH5 (GFSK) / 2-DH5 ( $\pi/4$ DQPSK) / 3-DH5 (8DPSK)

Target Power :

| Model    | Channel | Frequency (MHz) | BT Average Power (dBm) |       |               |
|----------|---------|-----------------|------------------------|-------|---------------|
|          |         |                 | GFSK                   | 8DPSK | $\pi/4$ DQPSK |
| LG-E440f | 0       | 2402            | 5.0                    | 1.5   | 1.5           |
|          | 39      | 2441            | 5.0                    | 1.5   | 1.5           |
|          | 78      | 2480            | 5.5                    | 2.5   | 2.5           |

Tune-up Tolerance : Max. Conducted Power ~ +0.5 dB

### Bluetooth Average Conducted output powers

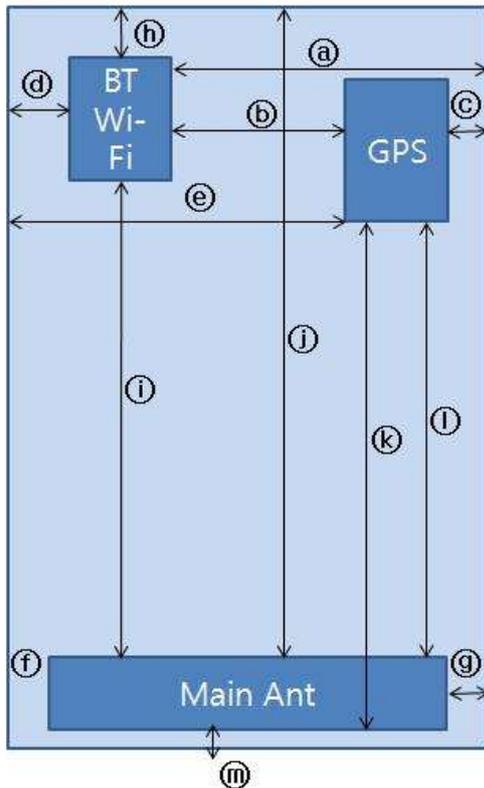
| Model    | Channel | Frequency (MHz) | BT Average Power (dBm) |       |               |
|----------|---------|-----------------|------------------------|-------|---------------|
|          |         |                 | GFSK                   | 8DPSK | $\pi/4$ DQPSK |
| LG-E440f | 0       | 2402            | 4.80                   | 1.52  | 1.51          |
|          | 39      | 2441            | 5.02                   | 1.84  | 1.84          |
|          | 78      | 2480            | 5.51                   | 2.39  | 2.39          |

## 12. SAR Test configuration & Antenna Information

### 12.1 SAR Test configurations

| Mode         | Rear | Front | Left | Right | Bottom | Top |
|--------------|------|-------|------|-------|--------|-----|
| GSM 850      | Yes  | Yes   | Yes  | Yes   | Yes    | No  |
| GSM 1 900    | Yes  | Yes   | Yes  | Yes   | Yes    | No  |
| WCDMA 850    | Yes  | Yes   | Yes  | Yes   | Yes    | No  |
| 2.4 GHz WLAN | Yes  | Yes   | Yes  | No    | No     | Yes |

### 12.2 Antenna and Device Information



| NO. | 거리 (mm) |
|-----|---------|
| a   | 55.82   |
| b   | 43.37   |
| c   | 5.45    |
| d   | 4.24    |
| e   | 52.28   |
| f   | 1.67    |
| g   | 1.67    |
| h   | 10.8    |
| i   | 75.42   |
| j   | 100.5   |
| k   | 78.57   |
| l   | 68.22   |
| m   | 1.67    |

[Front side View]

**Note;**

Per FCC KDB Publication 941225 D06, we performed the SAR testing at 1 cm from the top & bottom surfaces and also from side edges with a transmitting antenna  $\leq 2.5$  cm from an edge.

## 13. SAR TEST DATA SUMMARY

### 13.1 Measurement Results (GSM 850 Head SAR)

| Frequency   |           | Modulation | Conducted Power (dBm) | Power Drift (dB) | Battery  | Phantom Position   | Measured SAR(mW/g) | Scaled SAR(mW/g) | Plot No. |
|---|-----------|------------|-----------------------|------------------|----------|--|--------------------|------------------|----------|
| MHz   | Channel   |            |                       |                  |          |  |                    |                  |          |
| 836.6   | 190 (Mid) | GSM850     | 32.87                 | -0.178           | Standard | Left Ear   | 0.409              | 0.441            | 1        |
|   |           |            | 32.87                 | -0.023           | Standard | Left Tilt 15°  | 0.277              | 0.299            | 2        |
|   |           |            | 32.87                 | -0.171           | Standard | Right Ear  | 0.501              | 0.541            | 3        |
|   |           |            | 32.87                 | -0.024           | Standard | Right Tilt 15°   | 0.354              | 0.382            | 4        |
| 836.6   | 190 (Mid) | GPRS 4Tx   | 28.43                 | -0.121           | Standard | Left Ear   | 0.532              | 0.566            | 5        |
|   |           |            | 28.43                 | -0.152           | Standard | Left Tilt 15°  | 0.332              | 0.353            | 6        |
|   |           |            | 28.43                 | 0.167            | Standard | Right Ear  | 0.581              | 0.618            | 7        |
|   |           |            | 28.43                 | -0.102           | Standard | Right Tilt 15°   | 0.321              | 0.342            | 8        |
| <b>ANSI/ IEEE C95.1 - 1992- Safety Limit<br/>Spatial Peak<br/>Uncontrolled Exposure/ General Population</b> |           |            |                       |                  |          | <b>Head<br/>1.6 W/kg (mW/g)<br/>Averaged over 1 gram</b> |                    |                  |          |

#### NOTES:

- The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
- All modes of operation were investigated and the worst-case are reported.
- Measured Depth of Simulating Tissue is 15.0 cm ± 0.2 cm.
- Tissue parameters and temperatures are listed on the SAR plot.
- Battery Type  Standard  Extended  Slim  
Batteries are fully charged for all readings.
- Test Signal Call Mode  Manual Test cord  Base Station Simulator
- According to KDB 447498, Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.
- For Head SAR testing, the EUT was set in GPRS multi-slot class12 with 4uplink slots for GSM850 due to maximum source-based time-averaged output power.  
According to the KDB 941225 D03 SAR test reduction GSM/GPRS/EDGE, the maximum output power configuration were chosen for Body SAR testing.

## 13.2 Measurement Results (GSM 1 900 Head SAR)

| Frequency   |           | Modulation | Conducted Power (dBm) | Power Drift (dB) | Battery  | Phantom Position   | Measured SAR(mW/g) | Scaled SAR(mW/g) | Plot No. |
|---|-----------|------------|-----------------------|------------------|----------|--|--------------------|------------------|----------|
| MHz   | Channel   |            |                       |                  |          |  |                    |                  |          |
| 1 880.0   | 661 (Mid) | GSM1900    | 29.84                 | -0.102           | Standard | Left Ear   | 0.321              | 0.349            | 9        |
|   |           |            | 29.84                 | 0.028            | Standard | Left Tilt 15°  | 0.162              | 0.176            | 10       |
|   |           |            | 29.84                 | 0.007            | Standard | Right Ear  | 0.303              | 0.329            | 11       |
|   |           |            | 29.84                 | 0.010            | Standard | Right Tilt 15°   | 0.148              | 0.161            | 12       |
| 1 880.0   | 661 (Mid) | GPRS 4Tx   | 25.40                 | -0.082           | Standard | Left Ear   | 0.477              | 0.511            | 13       |
|   |           |            | 25.40                 | 0.028            | Standard | Left Tilt 15°  | 0.251              | 0.269            | 14       |
|   |           |            | 25.40                 | -0.037           | Standard | Right Ear  | 0.459              | 0.492            | 15       |
|   |           |            | 25.40                 | 0.055            | Standard | Right Tilt 15°   | 0.220              | 0.236            | 16       |
| <b>ANSI/ IEEE C95.1 - 1992– Safety Limit<br/>Spatial Peak<br/>Uncontrolled Exposure/ General Population</b> |           |            |                       |                  |          | <b>Head<br/>1.6 W/kg (mW/g)<br/>Averaged over 1 gram</b> |                    |                  |          |

### NOTES:

- The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
- All modes of operation were investigated and the worst-case are reported.
- Measured Depth of Simulating Tissue is 15.0 cm ± 0.2 cm.
- Tissue parameters and temperatures are listed on the SAR plot.
- Battery Type  Standard  Extended  Slim  
Batteries are fully charged for all readings.
- Test Signal Call Mode  Manual Test cord  Base Station Simulator
- According to KDB 447498, Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.
- For Head SAR testing, the EUT was set in GPRS multi-slot class12 with 4uplink slots for GSM1900 due to maximum source-based time-averaged output power.  
According to the KDB 941225 D03 SAR test reduction GSM/GPRS/EDGE, the maximum output power configuration were chosen for Body SAR testing.

### 13.3 Measurement Results (WCDMA 850 Head SAR)

| Frequency   |            | Modulation | Conducted Power (dBm) | Power Drift (dB) | Battery  | Phantom Position   | Measured SAR(mW/g) | Scaled SAR(mW/g) | Plot No. |
|---|------------|------------|-----------------------|------------------|----------|--|--------------------|------------------|----------|
| MHz   | Channel    |            |                       |                  |          |  |                    |                  |          |
| 836.6   | 4183 (Mid) | WCDMA 850  | 22.61                 | -0.189           | Standard | Left Ear   | 0.362              | 0.415            | 17       |
|   |            |            | 22.61                 | 0.197            | Standard | Left Tilt 15°  | 0.246              | 0.282            | 18       |
|   |            |            | 22.61                 | -0.116           | Standard | Right Ear  | 0.438              | 0.502            | 19       |
|   |            |            | 22.61                 | 0.018            | Standard | Right Tilt 15°   | 0.278              | 0.318            | 20       |
| <b>ANSI/ IEEE C95.1 - 1992– Safety Limit<br/>Spatial Peak<br/>Uncontrolled Exposure/ General Population</b> |            |            |                       |                  |          | <b>Head<br/>1.6 W/kg (mW/g)<br/>Averaged over 1 gram</b> |                    |                  |          |

**NOTES:**

- The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
- All modes of operation were investigated and the worst-case are reported.
- Measured Depth of Simulating Tissue is 15.0 cm ± 0.2 cm.
- Tissue parameters and temperatures are listed on the SAR plot.
- Battery Type  Standard  Extended  Slim  
Batteries are fully charged for all readings.
- Test Signal Call Mode  Manual Test cord  Base Station Simulator
- According to KDB 447498, Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.
- WCDMA Mode was tested under RMC 12.2 kbps and HSPA Inactive.

## 13.4 Measurement Results (802.11b/g/n Head SAR)

| Frequency   |         | Modulation | Conducted Power (dBm) | Power Drift (dB) | Battery  | Phantom Position   | Data Rate | Measured SAR(mW/g) | Scaled SAR(mW/g) | Plot No. |
|---|---------|------------|-----------------------|------------------|----------|--|-----------|--------------------|------------------|----------|
| MHz   | Channel |            |                       |                  |          |  |           |                    |                  |          |
| 2 437   | 6 (Mid) | 802.11b    | 15.72                 | 0.101            | Standard | Left Ear   | 1Mbps     | 0.175              | 0.187            | 21       |
|   |         |            | 15.72                 | -0.107           | Standard | Left Tilt 15°  | 1Mbps     | 0.101              | 0.108            | 22       |
|   |         |            | 15.72                 | 0.133            | Standard | Right Ear  | 1Mbps     | 0.095              | 0.101            | 23       |
|   |         |            | 15.72                 | -0.102           | Standard | Right Tilt 15  | 1Mbps     | 0.083              | 0.089            | 24       |
| <b>ANSI/ IEEE C95.1 - 1992– Safety Limit<br/>Spatial Peak<br/>Uncontrolled Exposure/ General Population</b> |         |            |                       |                  |          | <b>Head<br/>1.6 W/kg (mW/g)<br/>Averaged over 1 gram</b> |           |                    |                  |          |

### NOTES:

- The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
- All modes of operation were investigated and the worst-case are reported.
- Measured Depth of Simulating Tissue is 15.0 cm ± 0.2 cm.
- Tissue parameters and temperatures are listed on the SAR plot.
- Battery Type  Standard  Extended  Slim  
Batteries are fully charged for all readings.
- Test Signal Call Mode  Manual Test cord  Base Station Simulator
- IEEE 802.11g(including 802.11n) SAR testing is required when the conducted powers are equal to or greater than 0.25 dB Than the conducted powers in IEEE 802.11b.
- For 2.4GHz WLAN, Highest average power channel for the lowest data rate was selected for SAR evaluation based on KDB 248227. Other channels are not necessary because 1g-average SAR < 0.8 W/Kg and peak SAR < 1.6W/Kg per KDB 248227.

## 13.5 Measurement Results (GSM850 Hotspot SAR)

| Frequency   |            | Modulation | Conducted Power (dBm) | Power Drift (dB) | Configuration | Separation Distance                                      | Measured SAR(mW/g) | Scaled SAR(mW/g) | Plot No. |
|---|------------|------------|-----------------------|------------------|---------------|--|--------------------|------------------|----------|
| MHz   | Channel    |            |                       |                  |               |  |                    |                  |          |
| 824.2   | 128 (Low)  | GPRS 4Tx   | 28.52                 | -0.124           | Rear          | 1.0 cm   | 0.977              | 1.018            | 25       |
| 836.6   | 190 (Mid)  |            | 28.43                 | -0.136           | Rear          | 1.0 cm   | 0.957              | 1.018            | 26       |
| 848.8   | 251 (High) |            | 28.45                 | -0.008           | Rear          | 1.0 cm   | 1.09               | 1.155            | 27       |
| 836.6   | 190 (Mid)  |            | 28.43                 | -0.074           | Front         | 1.0 cm   | 0.594              | 0.632            | 28       |
| 836.6   | 190 (Mid)  |            | 28.43                 | -0.100           | Left          | 1.0 cm   | 0.386              | 0.411            | 29       |
| 836.6   | 190 (Mid)  |            | 28.43                 | -0.164           | Right         | 1.0 cm   | 0.650              | 0.692            | 30       |
| 836.6   | 190 (Mid)  |            | 28.43                 | 0.001            | Bottom        | 1.0 cm   | 0.110              | 0.117            | 31       |
| <b>ANSI/ IEEE C95.1 - 1992– Safety Limit<br/>Spatial Peak<br/>Uncontrolled Exposure/ General Population</b> |            |            |                       |                  |               | <b>Body<br/>1.6 W/kg (mW/g)<br/>Averaged over 1 gram</b> |                    |                  |          |

### NOTES:

- The test data reported are the worst-case SAR value with the antenna-body position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
- All modes of operation were investigated and the worst-case are reported.
- Measured Depth of Simulating Tissue is 15.0 cm ± 0.2 cm.
- Tissue parameters and temperatures are listed on the SAR plot.
- Battery Type  Standard  Extended  Slim  
Batteries are fully charged for all readings.
- Test Signal Call Mode  Manual Test cord  Base Station Simulator
- Test Configuration  With Holster  Without Holster
- According to KDB 447498, Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.
- For body SAR testing, the EUT was set in GPRS multi-slot class12 with 4uplink slots for GSM850 due to maximum source-based time-averaged output power.  
According to the KDB 941225 D03 SAR test reduction GSM/GPRS/EDGE, the maximum output power configuration were chosen for Body SAR testing.

## 13.6 Measurement Results (GSM1900 Hotspot SAR)

| Frequency   |           | Modulation | Conducted Power (dBm) | Power Drift (dB) | Configuration | Separation Distance                                      | Measured SAR(mW/g) | Scaled SAR(mW/g) | Plot No. |
|---|-----------|------------|-----------------------|------------------|---------------|--|--------------------|------------------|----------|
| MHz   | Channel   |            |                       |                  |               |  |                    |                  |          |
| 1 880   | 661 (Mid) | GPRS 4Tx   | 25.40                 | -0.011           | Rear          | 1.0 cm   | 0.541              | 0.580            | 32       |
|   |           |            | 25.40                 | 0.011            | Front         | 1.0 cm   | 0.491              | 0.526            | 33       |
|   |           |            | 25.40                 | -0.053           | Left          | 1.0 cm   | 0.105              | 0.113            | 34       |
|   |           |            | 25.40                 | -0.059           | Right         | 1.0 cm   | 0.117              | 0.125            | 35       |
|   |           |            | 25.40                 | 0.041            | Bottom        | 1.0 cm   | 0.382              | 0.409            | 36       |
| <b>ANSI/ IEEE C95.1 - 1992– Safety Limit<br/>Spatial Peak<br/>Uncontrolled Exposure/ General Population</b> |           |            |                       |                  |               | <b>Body<br/>1.6 W/kg (mW/g)<br/>Averaged over 1 gram</b> |                    |                  |          |

### NOTES:

- The test data reported are the worst-case SAR value with the antenna-body position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
- All modes of operation were investigated and the worst-case are reported.
- Measured Depth of Simulating Tissue is 15.0 cm ± 0.2 cm.
- Tissue parameters and temperatures are listed on the SAR plot.
- Battery Type  Standard  Extended  Slim  
Batteries are fully charged for all readings.
- Test Signal Call Mode  Manual Test cord  Base Station Simulator
- Test Configuration  With Holster  Without Holster
- According to KDB 447498, Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.
- For body SAR testing, the EUT was set in GPRS multi-slot class12 with 4uplink slots for GSM1900 due to maximum source-based time-averaged output power.  
According to the KDB 941225 D03 SAR test reduction GSM/GPRS/EDGE, the maximum output power configuration were chosen for Body SAR testing.

## 13.7 Measurement Results (WCDMA 850 Hotspot SAR)

| Frequency   |            | Modulation | Conducted Power (dBm) | Power Drift (dB) | Configuration | Separation Distance                                      | Measured SAR(mW/g) | Scaled SAR(mW/g) | Plot No. |
|---|------------|------------|-----------------------|------------------|---------------|--|--------------------|------------------|----------|
| MHz   | Channel    |            |                       |                  |               |  |                    |                  |          |
| 836.6   | 4183 (Mid) | WCDMA 850  | 22.61                 | -0.122           | Rear          | 1.0 cm   | 0.653              | 0.748            | 37       |
|   |            |            | 22.61                 | 0.122            | Front         | 1.0 cm   | 0.379              | 0.434            | 38       |
|   |            |            | 22.61                 | -0.021           | Left          | 1.0 cm   | 0.261              | 0.299            | 39       |
|   |            |            | 22.61                 | -0.040           | Right         | 1.0 cm   | 0.382              | 0.438            | 40       |
|   |            |            | 22.61                 | -0.164           | Bottom        | 1.0 cm   | 0.067              | 0.077            | 41       |
| <b>ANSI/ IEEE C95.1 - 1992– Safety Limit<br/>Spatial Peak<br/>Uncontrolled Exposure/ General Population</b> |            |            |                       |                  |               | <b>Body<br/>1.6 W/kg (mW/g)<br/>Averaged over 1 gram</b> |                    |                  |          |

### NOTES:

- The test data reported are the worst-case SAR value with the antenna-Body position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
- All modes of operation were investigated and the worst-case are reported.
- Measured Depth of Simulating Tissue is 15.0 cm ± 0.2 cm.
- Tissue parameters and temperatures are listed on the SAR plot.
- Battery Type  Standard  Extended  Slim  
Batteries are fully charged for all readings.
- Test Signal Call Mode  Manual Test cord  Base Station Simulator
- Test Configuration  With Holster  Without Holster
- According to KDB 447498, Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.
- WCDMA Mode was tested under RMC 12.2 kbps and HSPA Inactive.

## 13.8 Measurement Results (802.11b/g/n Hotspot SAR)

| Frequency   |         | Modulation | Conducted Power (dBm) | Power Drift (dB) | Configuration | Data Rate  | Measured SAR(mW/g) | Scaled SAR(mW/g) | Plot No. |
|---|---------|------------|-----------------------|------------------|---------------|--|--------------------|------------------|----------|
| MHz   | Channel |            |                       |                  |               |  |                    |                  |          |
| 2 437   | 6 (Mid) | 802.11b    | 15.72                 | 0.134            | Rear          | 1Mbps  | 0.039              | 0.042            | 42       |
|   |         |            | 15.72                 | 0.113            | Front         | 1Mbps  | 0.020              | 0.021            | 43       |
|   |         |            | 15.72                 | 0.011            | Left          | 1Mbps  | 0.012              | 0.013            | 44       |
|   |         |            | 15.72                 | 0.179            | Top           | 1Mbps  | 0.030              | 0.032            | 45       |
| <b>ANSI/ IEEE C95.1 - 1992– Safety Limit<br/>Spatial Peak<br/>Uncontrolled Exposure/ General Population</b> |         |            |                       |                  |               | <b>Body<br/>1.6 W/kg (mW/g)<br/>Averaged over 1 gram</b> |                    |                  |          |

### NOTES:

- 1 The test data reported are the worst-case SAR value with the antenna-body position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
- 2 All modes of operation were investigated and the worst-case are reported.
- 3 Measured Depth of Simulating Tissue is 15.0 cm ± 0.2 cm.
- 4 Tissue parameters and temperatures are listed on the SAR plot.
- 5 Battery Type  Standard  Extended  Slim  
Batteries are fully charged for all readings.
- 6 Test Signal Call Mode  Manual Test code  Base Station Simulator
- 7 IEEE 802.11g(including 802.11n) SAR testing is required when the conducted powers are equal to or greater than 0.25 dB Than the conducted powers in IEEE 802.11b.
- 8 For 2.4GHz WLAN, Highest average power channel for the lowest data rate was selected for SAR evaluation based on KDB 248227. Other channels are not necessary because 1g-average SAR < 0.8 W/Kg and peak SAR < 1.6W/Kg per KDB 248227.

## 13.9 Measurement Results (Body-worn SAR)

| Frequency   |            | Modulation       | Conducted Power (dBm) | Power Drift (dB) | Configuration | Separation Distance                                      | Measured SAR(mW/g) | Scaled SAR(mW/g) | Plot No. |
|---|------------|------------------|-----------------------|------------------|---------------|--|--------------------|------------------|----------|
| MHz   | Channel    |                  |                       |                  |               |  |                    |                  |          |
| 836.6   | 190 (Mid)  | GSM 850          | 32.87                 | -0.096           | Rear          | 1.0 cm   | 0.574              | 0.619            | 46       |
| 836.6   | 190 (Mid)  | GSM 850          | 32.87                 | -0.084           | Front         | 1.0 cm   | 0.384              | 0.414            | 47       |
| 1 880   | 661 (Mid)  | GSM 1900         | 29.84                 | -0.141           | Rear          | 1.0 cm   | 0.403              | 0.438            | 48       |
| 1 880   | 661 (Mid)  | GSM 1900         | 29.84                 | -0.154           | Front         | 1.0 cm   | 0.380              | 0.413            | 49       |
| 836.6   | 4183 (Mid) | WCDMA 850        | 22.61                 | -0.122           | Rear          | 1.0 cm   | 0.653              | 0.748            | 37       |
| 2 437   | 6 (Mid)    | 802.11b (1 Mbps) | 15.72                 | 0.134            | Rear          | 1.0 cm   | 0.039              | 0.042            | 42       |
| <b>ANSI/ IEEE C95.1 - 1992– Safety Limit<br/>Spatial Peak<br/>Uncontrolled Exposure/ General Population</b> |            |                  |                       |                  |               | <b>Body<br/>1.6 W/kg (mW/g)<br/>Averaged over 1 gram</b> |                    |                  |          |

### NOTES:

- 1 The test data reported are the worst-case SAR value with the antenna-body position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
- 2 All modes of operation were investigated and the worst-case are reported.
- 3 Measured Depth of Simulating Tissue is 15.0 cm ± 0.2 cm.
- 4 Tissue parameters and temperatures are listed on the SAR plot.
- 5 According to KDB 447498, Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.
- 6 Body-Worn accessory testing is typically associated with voice operation. Therefore, GSM voice was evaluated for body-worn SAR.

## 14. SAR Measurement Variability and Uncertainty

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01.

These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

- 1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is  $\geq 0.80$  W/kg, repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is  $\geq 1.45$  W/kg (~ 10% from the 1-g SAR limit).
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

| Frequency |            | Modulation | Battery  | Phantom Position | Original SAR(mW/g) | Repeated SAR(mW/g) | Largest to Smallest SAR Ratio | Plot No. |
|-----------|------------|------------|----------|------------------|--------------------|--------------------|-------------------------------|----------|
| MHz       | Channel    |            |          |                  |                    |                    |                               |          |
| 848.8     | 251 (High) | GSM850     | Standard | Rear             | 1.09               | 1.07               | 1.02                          | 50       |

### Note(s):

1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20.
2. Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg.

## 15. SAR Summation Scenario

|  | Position  | Applicable Combination              |
|--|-----------|-------------------------------------|
| Simultaneous Transmission  | Head      | GSM 850 Voice + 2.4 GHz WiFi        |
|  |           | GSM 1 900 Voice + 2.4 GHz WiFi      |
|  |           | GPRS 850 Data + 2.4 GHz WiFi(*)     |
|  |           | GPRS 1 900 Data + 2.4 GHz WiFi(*)   |
|  |           | WCDMA 850 Voice + 2.4 GHz WiFi      |
|  | Hotspot   | GPRS 850 Data + 2.4 GHz WiFi        |
|  |           | GPRS 1 900 Data + 2.4 GHz WiFi      |
|  |           | WCDMA 850 Data + 2.4 GHz WiFi       |
|  | Body-worn | GSM 850 Voice + 2.4 GHz WiFi(*)     |
|  |           | GSM 1900 Voice + 2.4 GHz WiFi(*)    |
|  |           | GSM 850 Voice + 2.4 GHz Bluetooth   |
|  |           | GSM 1900 Voice + 2.4 GHz Bluetooth  |
|  |           | WCDMA 850 Voice + 2.4 GHz WiFi      |
|  |           | WCDMA 850 Voice + 2.4 GHz Bluetooth |
| BT and WLAN are not simultaneous transmission.<br>(*)= For VoIP 3 <sup>rd</sup> party applications possibly installed and used by end-user |           |                                     |

Per FCC KDB 447498 D01v05, The SAR exclusion threshold for distance < 50mm is defined by the following equation:

$$\frac{\text{Max Power of Channel(mW)}}{\text{Test Separation Dist(mm)}} * \sqrt{\text{Frequency(GHz)}} \leq 3.0$$

| Mode      | Frequency | Maximum Allowed Power | Separatuin Distance | ≤ 3.0 |
|-----------|-----------|-----------------------|---------------------|-------|
|           | [MHz]     | [mW]                  | [mm]                |       |
| Bluetooth | 2480      | 4                     | 10                  | 0.63  |

Based on the maximum conducted power of Bluetooth and antenna to use separation distance, Bluetooth SAR was not required  $[(4/10)*\sqrt{2.480}] = 0.63 < 3.0$ .

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05 IV.C.1iii, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤ 1.6W/kg. When standalone SAR is not required to be measured per FCC KDB 447498 D01v05 4.3.22, the following equation must be used to estimate the standalone 1-g SAR for simultaneous transmission assessment involving that transmitter

$$\text{Estimated SAR} = \frac{\sqrt{f(\text{GHz})}}{7.5} * \frac{(\text{Max Power of channel, mW})}{\text{Min. Separation Distance}}$$

| . Mode    | Frequency | Maximum Allowed Power | Separatuin Distance (Body) | Estimated SAR (Body) |
|-----------|-----------|-----------------------|----------------------------|----------------------|
|           | [MHz]     | [mW]                  | [mm]                       | [W/kg]               |
| Bluetooth | 2480      | 4                     | 10                         | 0.08                 |

Note : Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission. The Estimated SAR results were determined according to FCC KDB447498 D01v05

### Simultaneous Transmission Summation for Held to Ear

| Band       | configuration | Scaled SAR(W/kg) | 2.4 GHz WIFI Scaled SAR (W/kg) | $\Sigma$ 1-g SAR (W/kg) |
|------------|---------------|------------------|--------------------------------|-------------------------|
| GSM 850    | Left Cheek    | 0.441            | 0.187                          | 0.628                   |
|            | Left Tilt     | 0.299            | 0.108                          | 0.407                   |
|            | Right Cheek   | 0.541            | 0.101                          | 0.642                   |
|            | Right Tilt    | 0.382            | 0.089                          | 0.471                   |
| GSM 1 900  | Left Cheek    | 0.349            | 0.187                          | 0.536                   |
|            | Left Tilt     | 0.176            | 0.108                          | 0.284                   |
|            | Right Cheek   | 0.329            | 0.101                          | 0.43                    |
|            | Right Tilt    | 0.161            | 0.089                          | 0.25                    |
| GPRS 850   | Left Cheek    | 0.566            | 0.187                          | 0.753                   |
|            | Left Tilt     | 0.353            | 0.108                          | 0.461                   |
|            | Right Cheek   | 0.618            | 0.101                          | 0.719                   |
|            | Right Tilt    | 0.342            | 0.089                          | 0.431                   |
| GPRS 1 900 | Left Cheek    | 0.511            | 0.187                          | 0.698                   |
|            | Left Tilt     | 0.269            | 0.108                          | 0.377                   |
|            | Right Cheek   | 0.492            | 0.101                          | 0.593                   |
|            | Right Tilt    | 0.236            | 0.089                          | 0.325                   |
| WCDMA 850  | Left Cheek    | 0.415            | 0.187                          | 0.602                   |
|            | Left Tilt     | 0.282            | 0.108                          | 0.39                    |
|            | Right Cheek   | 0.502            | 0.101                          | 0.603                   |
|            | Right Tilt    | 0.318            | 0.089                          | 0.407                   |

**Simultaneous Transmission Summation for Body-Worn (1 cm)**

| Band      | configuration | Scaled SAR(W/kg) | 2.4 GHz WIFI Scaled SAR (W/kg) | BT SAR (W/kg) | $\Sigma$ 1-g SAR (W/kg) |
|-----------|---------------|------------------|--------------------------------|---------------|-------------------------|
| GSM 850   | Rear          | 0.619            | 0.042                          |               | 0.661                   |
|           |               |                  |                                | 0.08          | 0.699                   |
| GSM 1900  | Rear          | 0.438            | 0.042                          |               | 0.48                    |
|           |               |                  |                                | 0.08          | 0.518                   |
| GPRS 850  | Rear          | 1.155            | 0.042                          |               | 1.197                   |
|           |               |                  |                                | 0.08          | 1.235                   |
| GPRS 1900 | Rear          | 0.58             | 0.042                          |               | 0.622                   |
|           |               |                  |                                | 0.08          | 0.66                    |
| WCDMA 850 | Rear          | 0.748            | 0.042                          |               | 0.79                    |
|           |               |                  |                                | 0.08          | 0.828                   |

**Simultaneous Transmission Summation for Hotspot (1 cm)**

| Band       | configuration | Scaled SAR(W/kg) | 2.4 GHz WIFI Scaled SAR (W/kg) | $\Sigma$ 1-g SAR (W/kg) |
|------------|---------------|------------------|--------------------------------|-------------------------|
| GPRS 850   | Rear          | 1.155            | 0.042                          | 1.197                   |
|            | Front         | 0.632            | 0.021                          | 0.653                   |
|            | Left          | 0.411            | 0.013                          | 0.424                   |
|            | Right         | 0.692            |                                | 0.692                   |
|            | Bottom        | 0.117            |                                | 0.117                   |
|            | Top           |                  | 0.032                          | 0.032                   |
| GPRS 1 900 | Rear          | 0.580            | 0.042                          | 0.622                   |
|            | Front         | 0.526            | 0.021                          | 0.547                   |
|            | Left          | 0.113            | 0.013                          | 0.126                   |
|            | Right         | 0.125            |                                | 0.125                   |
|            | Bottom        | 0.409            |                                | 0.409                   |
|            | Top           |                  | 0.032                          | 0.032                   |
| WCDMA 850  | Rear          | 0.748            | 0.042                          | 0.79                    |
|            | Front         | 0.434            | 0.021                          | 0.455                   |
|            | Left          | 0.299            | 0.013                          | 0.312                   |
|            | Right         | 0.438            |                                | 0.438                   |
|            | Bottom        | 0.077            |                                | 0.077                   |
|            | Top           |                  | 0.032                          | 0.032                   |

## **16. CONCLUSION**

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The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the ANSI/IEEE C95.1 1992.

These measurements are taken to simulate the RF effects exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests.

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- [21] SAR Evaluation of Handsets with Multiple Transmitters and Antennas #648474.
- [22] SAR Measurement Procedure for 802.11 a/b/g Transmitters #KDB 248227.

## Attachment 1. – SAR Test Plots

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 21.1 °C  
Ambient Temperature: 21.3 °C  
Test Date: Mar . 29, 2013  
Plot NO. 1

DUT: LG-E440F; Type: Bar; Serial: #1

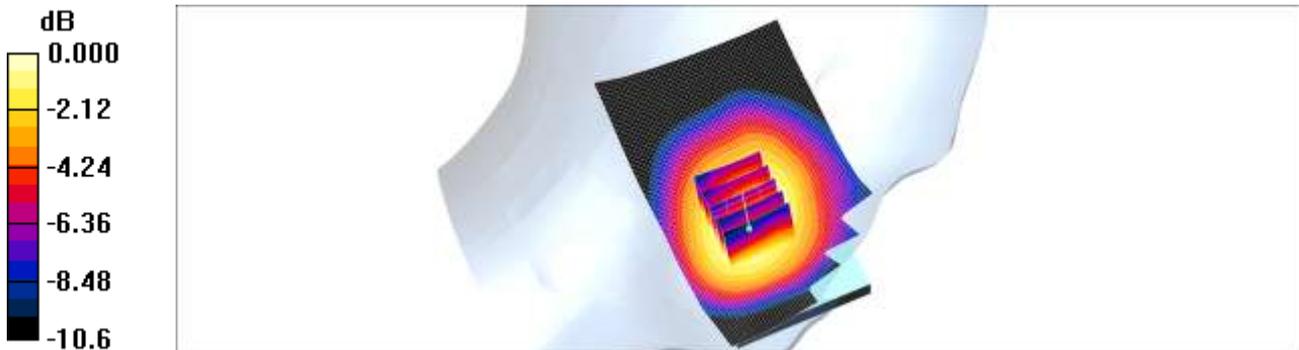
Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.921$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 835/900 MHz; Type: SAM

**Left touch 190/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.439 mW/g

**Left touch 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 6.27 V/m; Power Drift = -0.178 dB  
Peak SAR (extrapolated) = 0.525 W/kg  
**SAR(1 g) = 0.409 mW/g; SAR(10 g) = 0.304 mW/g**  
Maximum value of SAR (measured) = 0.430 mW/g



0 dB = 0.430mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 21.1 °C  
Ambient Temperature: 21.3 °C  
Test Date: Mar . 29, 2013  
Plot NO. 2

DUT: LG-E440F; Type: Bar; Serial: #1

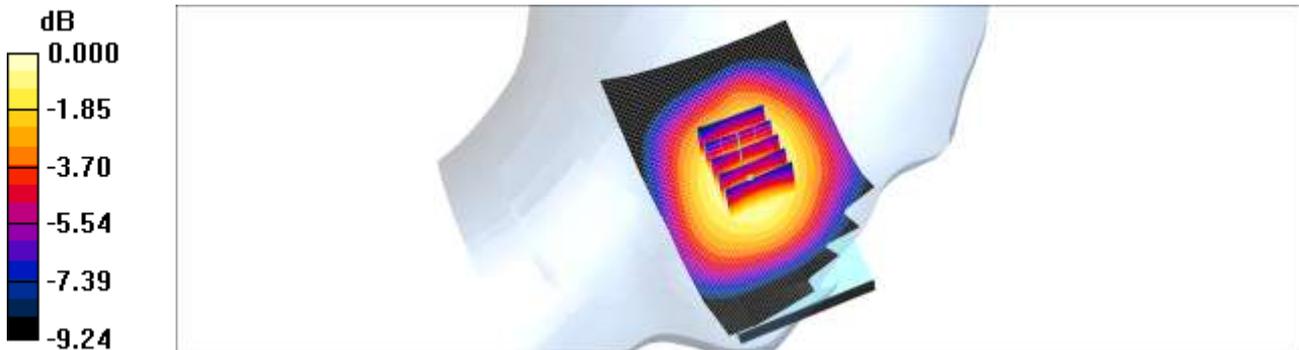
Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.921$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 835/900 MHz; Type: SAM

**Left tilt 190/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.293 mW/g

**Left tilt 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 10.2 V/m; Power Drift = -0.023 dB  
Peak SAR (extrapolated) = 0.346 W/kg  
**SAR(1 g) = 0.277 mW/g; SAR(10 g) = 0.211 mW/g**  
Maximum value of SAR (measured) = 0.288 mW/g



0 dB = 0.288mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 21.1 °C  
Ambient Temperature: 21.3 °C  
Test Date: Mar . 29, 2013  
Plot NO. 3

DUT: LG-E440F; Type: Bar; Serial: #1

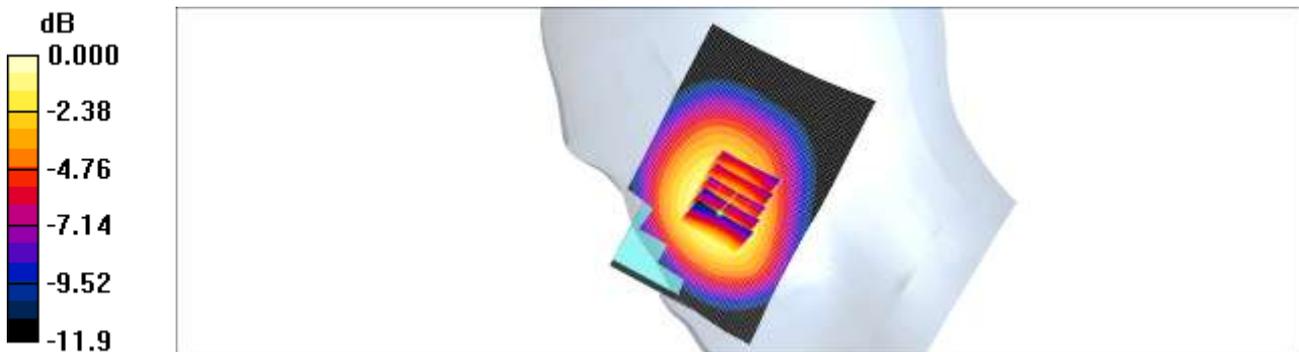
Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.921$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 835/900 MHz; Type: SAM

**Right touch 190/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.532 mW/g

**Right touch 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 7.19 V/m; Power Drift = -0.171 dB  
Peak SAR (extrapolated) = 0.617 W/kg  
**SAR(1 g) = 0.501 mW/g; SAR(10 g) = 0.370 mW/g**  
Maximum value of SAR (measured) = 0.531 mW/g



0 dB = 0.531mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 21.1 °C  
Ambient Temperature: 21.3 °C  
Test Date: Mar . 29, 2013  
Plot NO. 4

DUT: LG-E440F; Type: Bar; Serial: #1

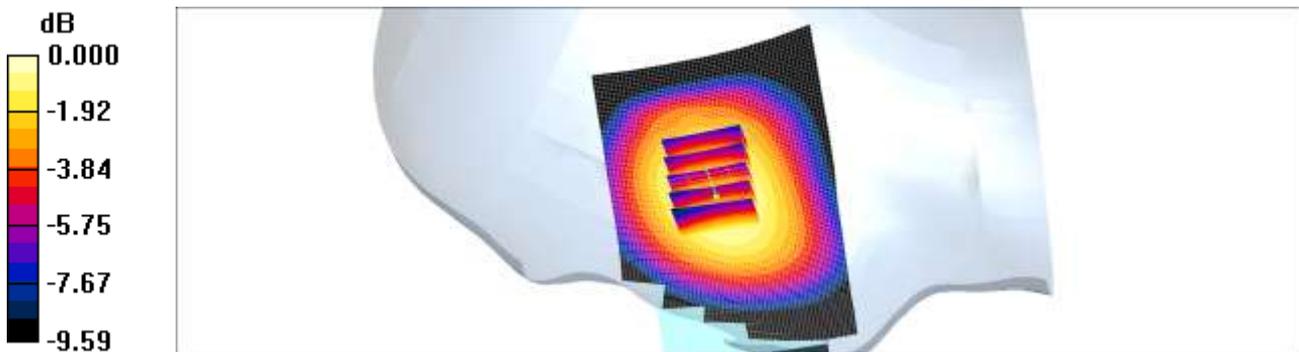
Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.921$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 835/900 MHz; Type: SAM

**Right tilt 190/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.371 mW/g

**Right tilt 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 12.7 V/m; Power Drift = -0.024 dB  
Peak SAR (extrapolated) = 0.440 W/kg  
**SAR(1 g) = 0.354 mW/g; SAR(10 g) = 0.268 mW/g**  
Maximum value of SAR (measured) = 0.374 mW/g



0 dB = 0.374mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 21.1 °C  
Ambient Temperature: 21.3 °C  
Test Date: Mar . 29, 2013  
Plot NO. 5

DUT: LG-E440F; Type: Bar; Serial: #1

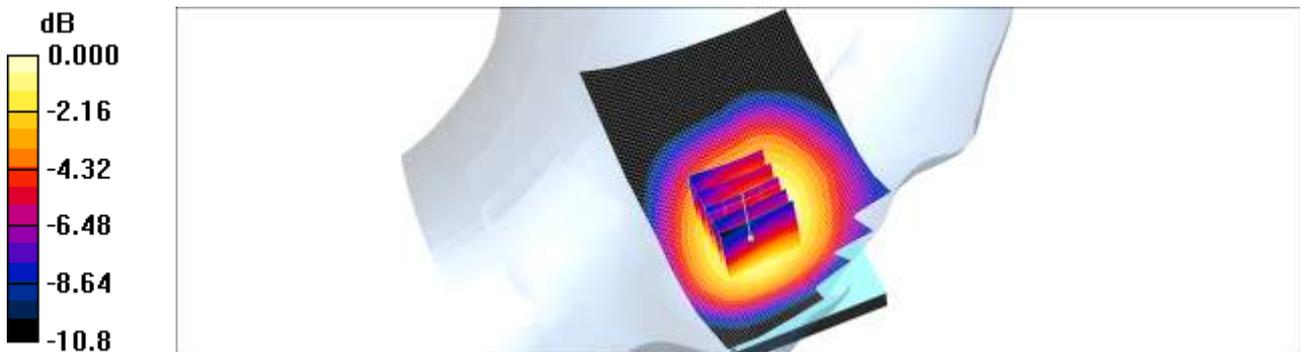
Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:2.075  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.921$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 835/900 MHz; Type: SAM

**Left touch 190/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.568 mW/g

**Left touch 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 4.97 V/m; Power Drift = -0.121 dB  
Peak SAR (extrapolated) = 0.676 W/kg  
**SAR(1 g) = 0.532 mW/g; SAR(10 g) = 0.397 mW/g**  
Maximum value of SAR (measured) = 0.553 mW/g



0 dB = 0.553mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 21.1 °C  
Ambient Temperature: 21.3 °C  
Test Date: Mar . 29, 2013  
Plot NO. 6

DUT: LG-E440F; Type: Bar; Serial: #1

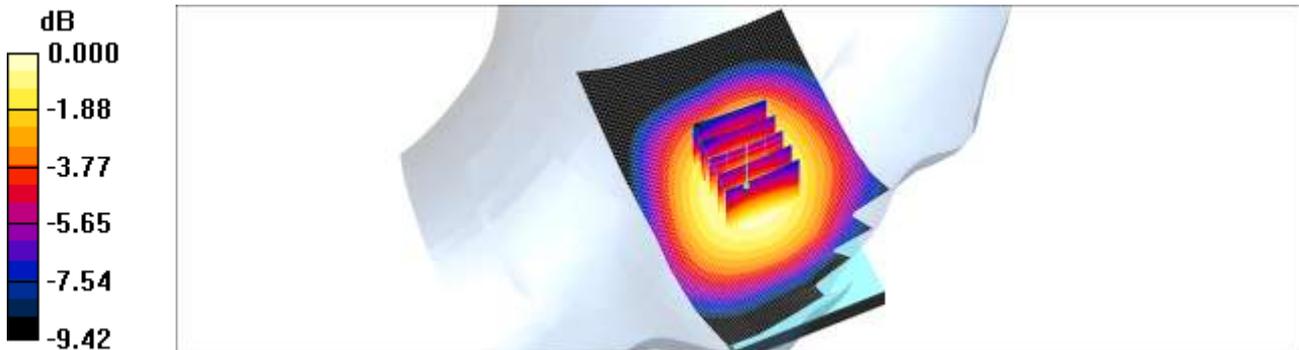
Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:2.075  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.921$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 835/900 MHz; Type: SAM

**Left tilt 190/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.363 mW/g

**Left tilt 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 9.04 V/m; Power Drift = -0.152 dB  
Peak SAR (extrapolated) = 0.404 W/kg  
**SAR(1 g) = 0.332 mW/g; SAR(10 g) = 0.248 mW/g**  
Maximum value of SAR (measured) = 0.351 mW/g



0 dB = 0.351mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 21.1 °C  
Ambient Temperature: 21.3 °C  
Test Date: Mar . 29, 2013  
Plot NO. 7

DUT: LG-E440F; Type: Bar; Serial: #1

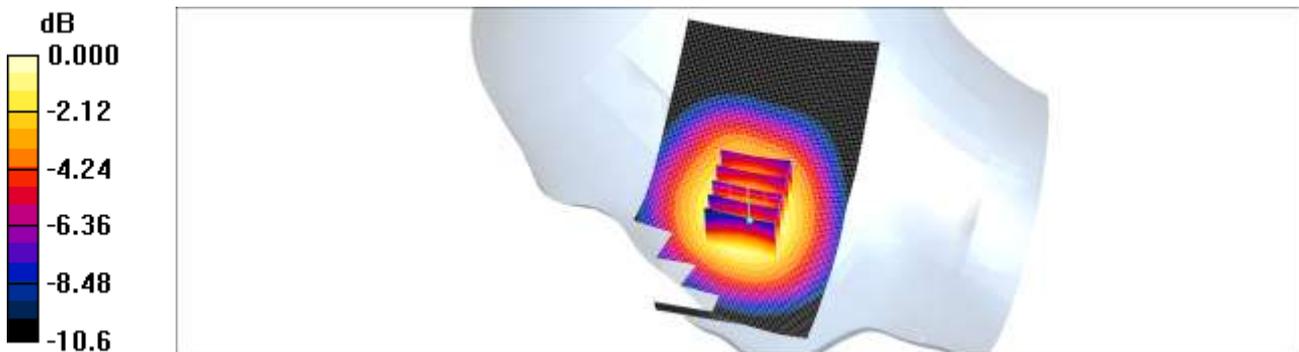
Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:2.075  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.921$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 835/900 MHz; Type: SAM

**Right touch 190/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.616 mW/g

**Right touch 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 4.82 V/m; Power Drift = 0.167 dB  
Peak SAR (extrapolated) = 0.693 W/kg  
**SAR(1 g) = 0.581 mW/g; SAR(10 g) = 0.442 mW/g**  
Maximum value of SAR (measured) = 0.614 mW/g



0 dB = 0.614mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 21.1 °C  
Ambient Temperature: 21.3 °C  
Test Date: Mar . 29, 2013  
Plot NO. 8

DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:2.075

Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.921$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

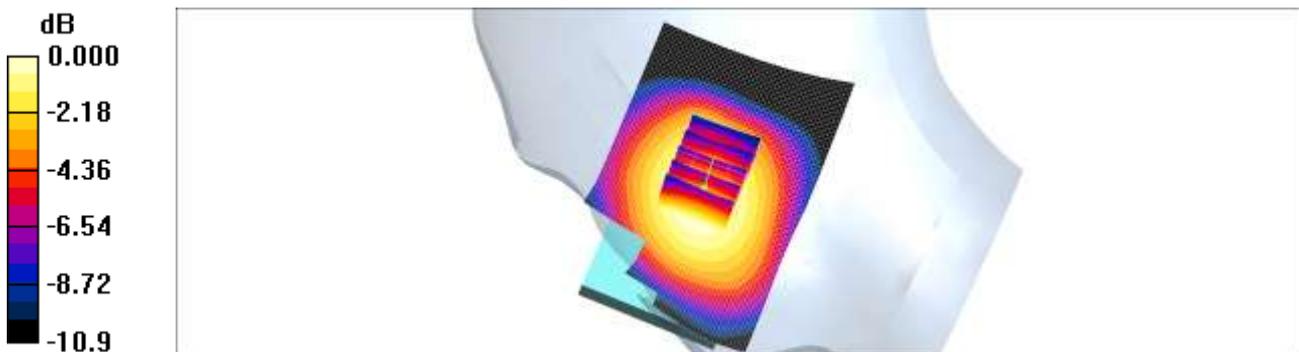
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: 835/900 Phantom ; Type: SAM

**Right tilt 190/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.340 mW/g

**Right tilt 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 8.00 V/m; Power Drift = -0.102 dB  
Peak SAR (extrapolated) = 0.413 W/kg  
**SAR(1 g) = 0.321 mW/g; SAR(10 g) = 0.237 mW/g**  
Maximum value of SAR (measured) = 0.336 mW/g



0 dB = 0.336mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 20.7 °C  
Ambient Temperature: 20.9 °C  
Test Date: Apr . 01, 2013  
Plot NO. 9

DUT: LG-E440F; Type: Bar; Serial: #1

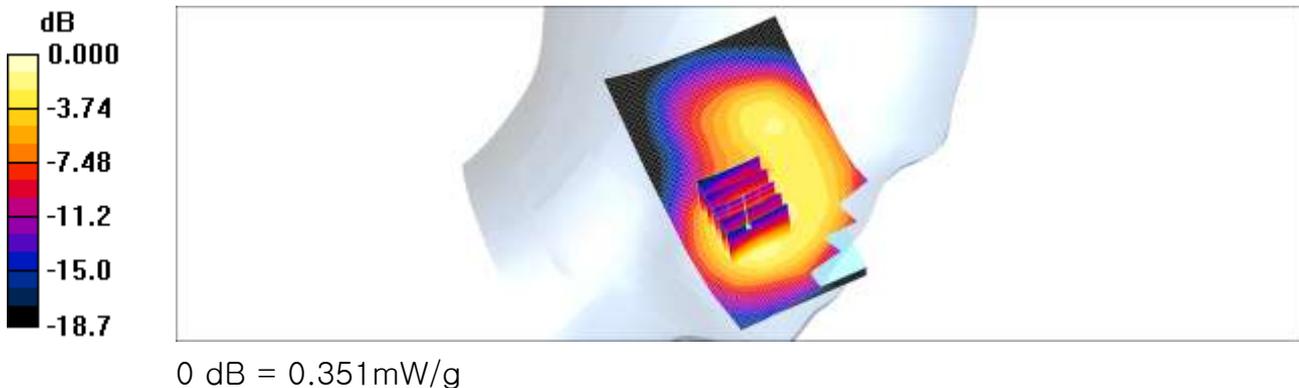
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.35$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 1800/1900 MHz; Type: SAM

**Left touch 661/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.366 mW/g

**Left touch 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 6.11 V/m; Power Drift = -0.102 dB  
Peak SAR (extrapolated) = 0.542 W/kg  
**SAR(1 g) = 0.321 mW/g; SAR(10 g) = 0.186 mW/g**  
Maximum value of SAR (measured) = 0.351 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 20.7 °C  
Ambient Temperature: 20.9 °C  
Test Date: Apr . 01, 2013  
Plot NO. 10

DUT: LG-E440F; Type: Bar; Serial: #1

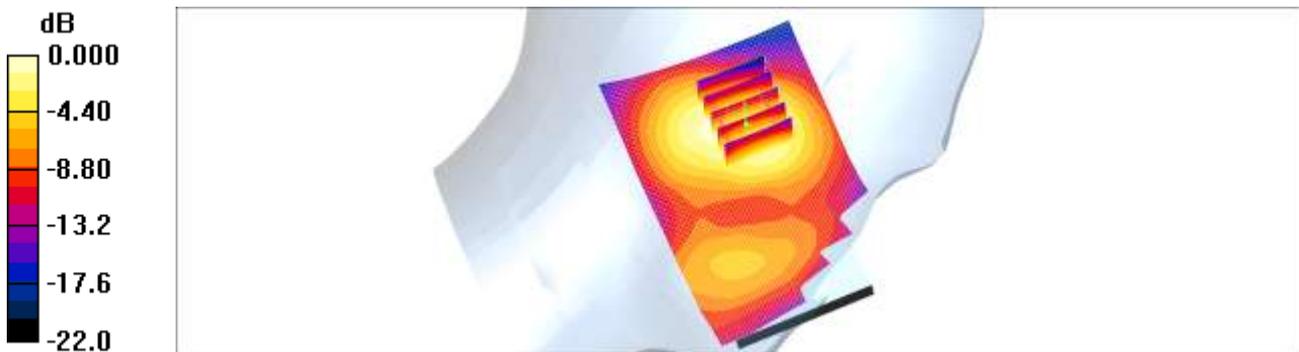
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.35$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 1800/1900 MHz; Type: SAM

**Left tilt 661/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.199 mW/g

**Left tilt 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 8.48 V/m; Power Drift = 0.028 dB  
Peak SAR (extrapolated) = 0.253 W/kg  
**SAR(1 g) = 0.162 mW/g; SAR(10 g) = 0.098 mW/g**  
Maximum value of SAR (measured) = 0.175 mW/g



0 dB = 0.175mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 20.7 °C  
Ambient Temperature: 20.9 °C  
Test Date: Apr . 01, 2013  
Plot NO. 11

DUT: LG-E440F; Type: Bar; Serial: #1

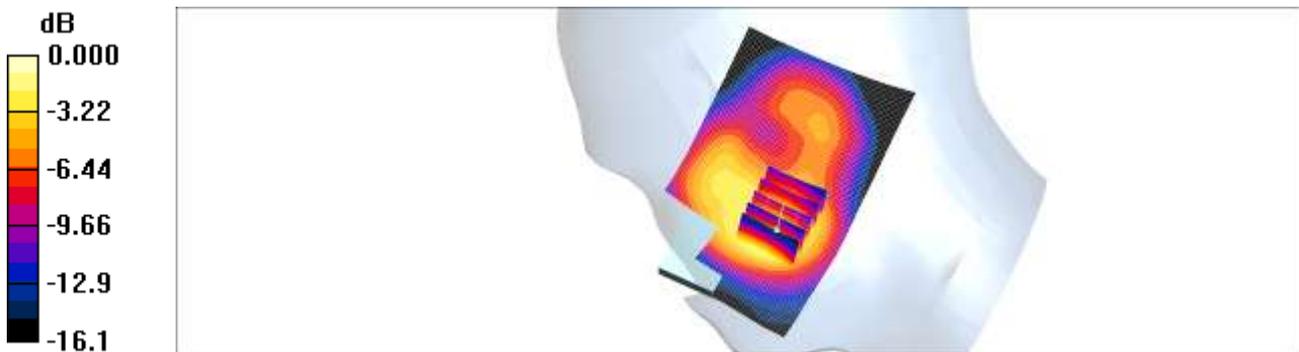
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.35$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: 800/900 Phantom; Type: SAM

**Right touch 661/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.343 mW/g

**Right touch 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 8.03 V/m; Power Drift = 0.007 dB  
Peak SAR (extrapolated) = 0.429 W/kg  
**SAR(1 g) = 0.303 mW/g; SAR(10 g) = 0.190 mW/g**  
Maximum value of SAR (measured) = 0.327 mW/g



0 dB = 0.327mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 20.7 °C  
Ambient Temperature: 20.9 °C  
Test Date: Apr . 01, 2013  
Plot NO. 12

DUT: LG-E440F; Type: Bar; Serial: #1

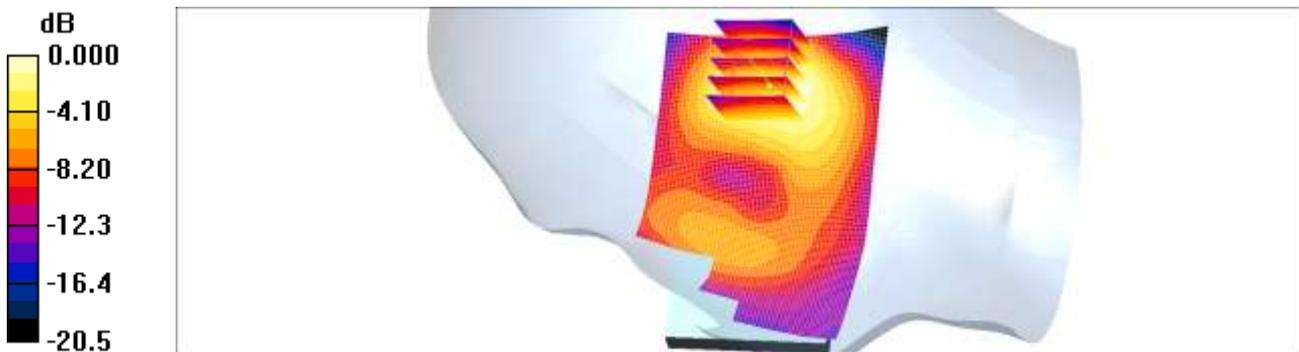
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.35$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: 800/900 Phantom; Type: SAM

**Right tilt 661/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.166 mW/g

**Right tilt 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 10.9 V/m; Power Drift = 0.010 dB  
Peak SAR (extrapolated) = 0.235 W/kg  
**SAR(1 g) = 0.148 mW/g; SAR(10 g) = 0.090 mW/g**  
Maximum value of SAR (measured) = 0.162 mW/g



0 dB = 0.162mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 20.7 °C  
Ambient Temperature: 20.9 °C  
Test Date: Apr . 01, 2013  
Plot NO. 13

DUT: LG-E440F; Type: Bar; Serial: #1

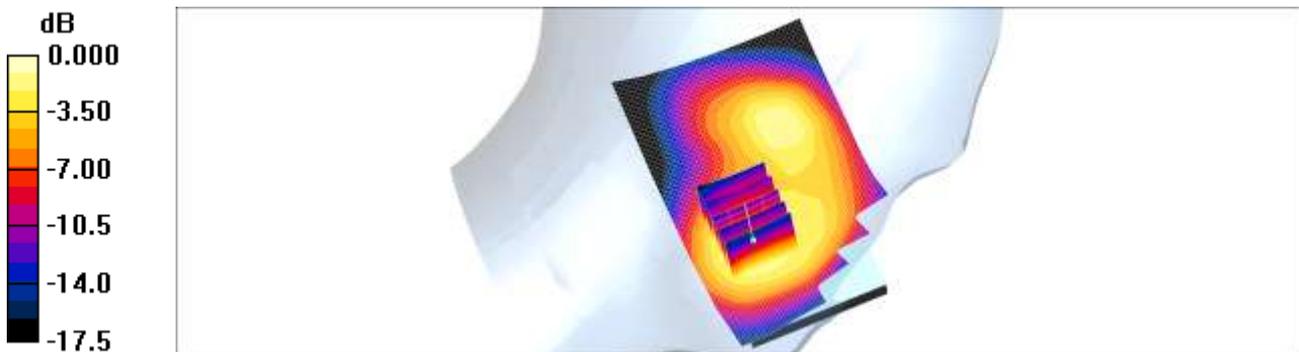
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:2.075  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.35$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 1800/1900 MHz; Type: SAM

**Left Touch 661 GPRS 4Tx/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.499 mW/g

**Left Touch 661 GPRS 4Tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 9.41 V/m; Power Drift = -0.082 dB  
Peak SAR (extrapolated) = 0.774 W/kg  
**SAR(1 g) = 0.477 mW/g; SAR(10 g) = 0.283 mW/g**  
Maximum value of SAR (measured) = 0.512 mW/g



0 dB = 0.512mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 20.7 °C  
Ambient Temperature: 20.9 °C  
Test Date: Apr . 01, 2013  
Plot NO. 14

DUT: LG-E440F; Type: Bar; Serial: #1

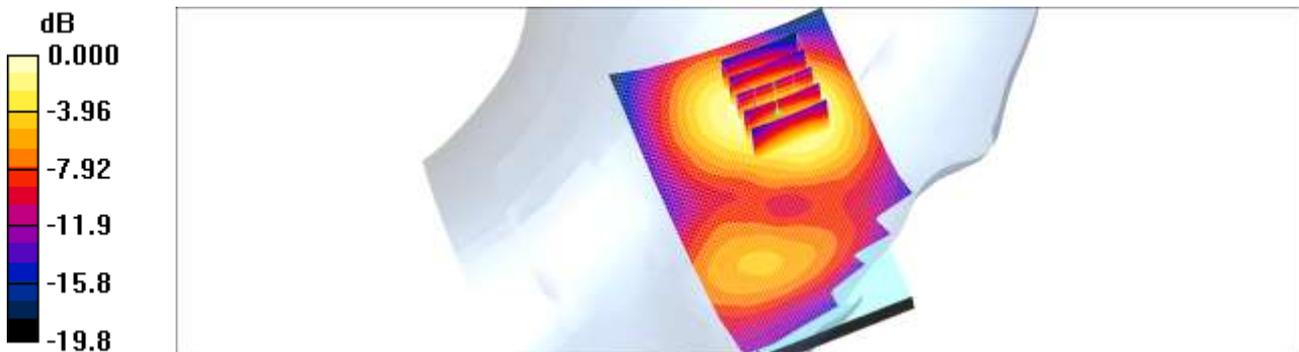
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:2.075  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.35$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 1800/1900 MHz; Type: SAM

**Left Tilt 661 GPRS 4Tx/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.296 mW/g

**Left Tilt 661 GPRS 4Tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 11.7 V/m; Power Drift = 0.028 dB  
Peak SAR (extrapolated) = 0.378 W/kg  
**SAR(1 g) = 0.251 mW/g; SAR(10 g) = 0.153 mW/g**  
Maximum value of SAR (measured) = 0.269 mW/g



0 dB = 0.269mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 20.7 °C  
Ambient Temperature: 20.9 °C  
Test Date: Apr . 01, 2013  
Plot NO. 15

DUT: LG-E440F; Type: Bar; Serial: #1

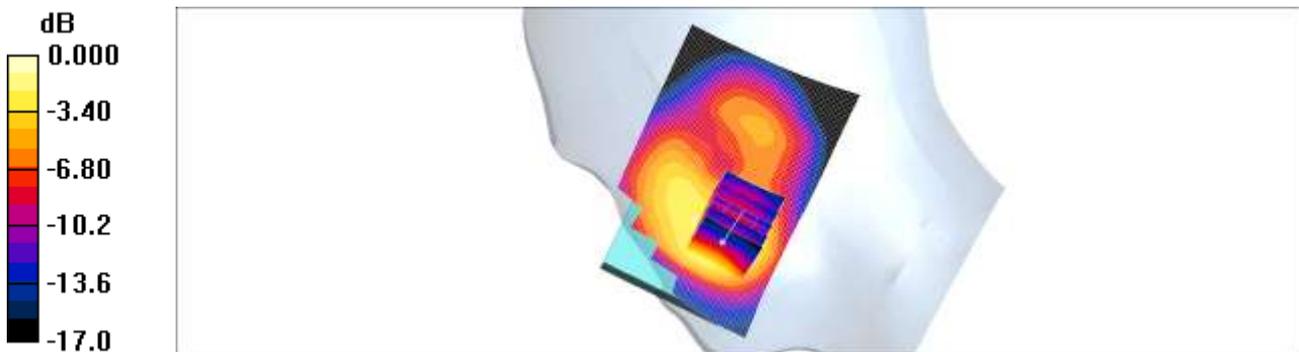
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:2.075  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.35$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 1800/1900 MHz; Type: SAM

**Right Touch 661/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.489 mW/g

**Right Touch 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 8.81 V/m; Power Drift = -0.037 dB  
Peak SAR (extrapolated) = 0.709 W/kg  
**SAR(1 g) = 0.459 mW/g; SAR(10 g) = 0.273 mW/g**  
Maximum value of SAR (measured) = 0.499 mW/g



0 dB = 0.499mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 20.7 °C  
Ambient Temperature: 20.9 °C  
Test Date: Apr . 01, 2013  
Plot NO. 16

DUT: LG-E440F; Type: Bar; Serial: #1

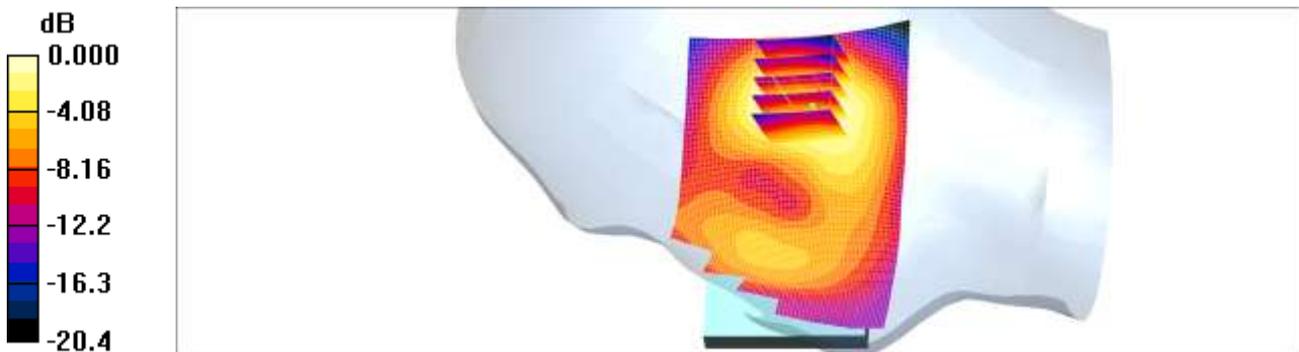
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:2.075  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.35$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 1800/1900 MHz; Type: SAM

**Right Tilt 661/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.244 mW/g

**Right Tilt 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 12.4 V/m; Power Drift = 0.055 dB  
Peak SAR (extrapolated) = 0.361 W/kg  
**SAR(1 g) = 0.220 mW/g; SAR(10 g) = 0.130 mW/g**  
Maximum value of SAR (measured) = 0.233 mW/g



0 dB = 0.233mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 21.1 °C  
Ambient Temperature: 21.3 °C  
Test Date: Mar . 29, 2013  
Plot NO. 17

DUT: LG-E440F; Type: Bar; Serial: #1

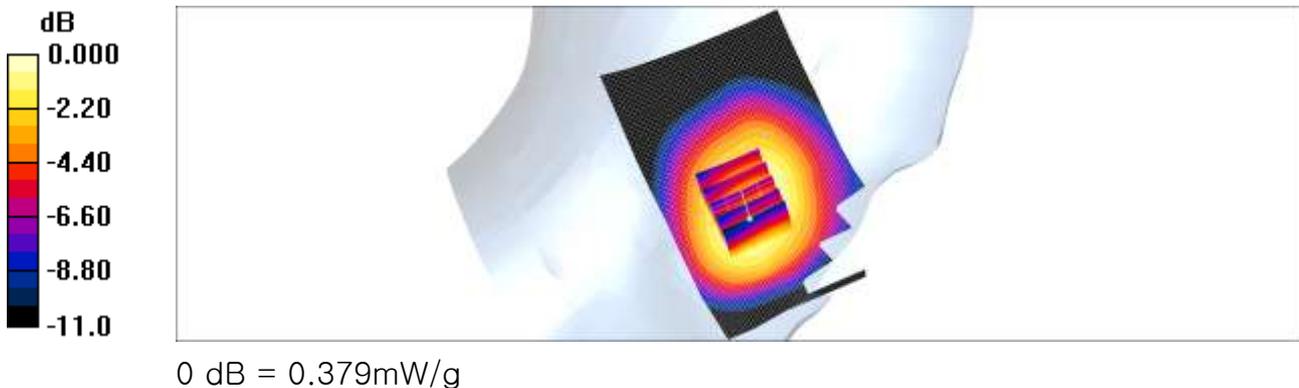
Communication System: WCDMA850; Frequency: 836.6 MHz; Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.921$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 835/900 MHz; Type: SAM

**Left touch 4183/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.387 mW/g

**Left touch 4183/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 5.51 V/m; Power Drift = -0.189 dB  
Peak SAR (extrapolated) = 0.467 W/kg  
**SAR(1 g) = 0.362 mW/g; SAR(10 g) = 0.268 mW/g**  
Maximum value of SAR (measured) = 0.379 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 21.1 °C  
Ambient Temperature: 21.3 °C  
Test Date: Mar . 29, 2013  
Plot NO. 18

DUT: LG-E440F; Type: Bar; Serial: #1

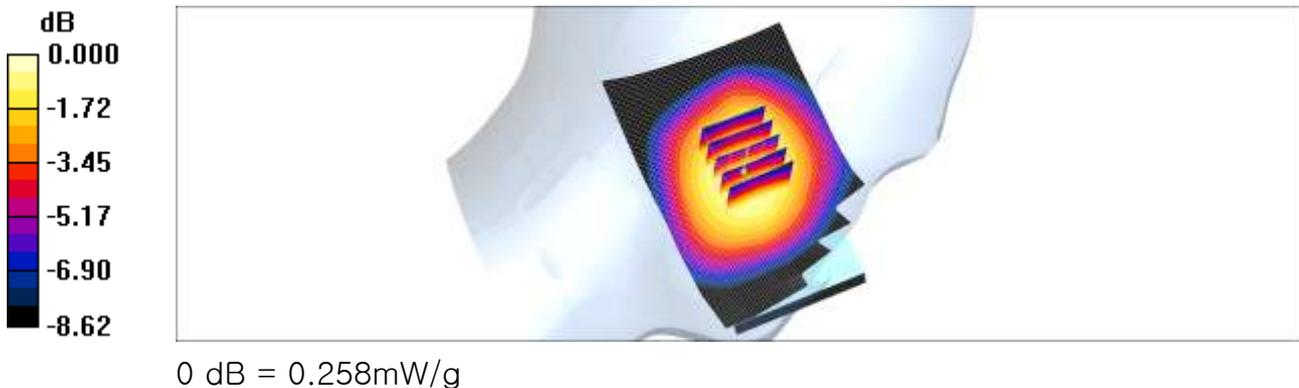
Communication System: WCDMA850; Frequency: 836.6 MHz; Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.921$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 835/900 MHz; Type: SAM

**Left tilt 4183/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.260 mW/g

**Left tilt 4183/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 9.42 V/m; Power Drift = 0.197 dB  
Peak SAR (extrapolated) = 0.302 W/kg  
**SAR(1 g) = 0.246 mW/g; SAR(10 g) = 0.188 mW/g**  
Maximum value of SAR (measured) = 0.258 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 21.1 °C  
Ambient Temperature: 21.3 °C  
Test Date: Mar . 29, 2013  
Plot NO. 19

DUT: LG-E440F; Type: Bar; Serial: #1

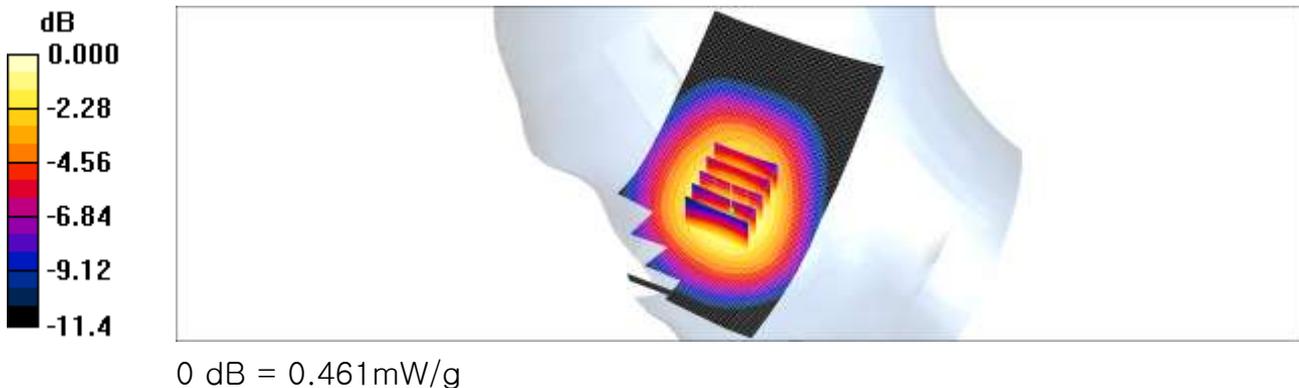
Communication System: WCDMA850; Frequency: 836.6 MHz; Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.921$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 835/900 MHz; Type: SAM

**Right touch 4183/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.461 mW/g

**Right touch 4183/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 5.34 V/m; Power Drift = -0.116 dB  
Peak SAR (extrapolated) = 0.538 W/kg  
**SAR(1 g) = 0.438 mW/g; SAR(10 g) = 0.327 mW/g**  
Maximum value of SAR (measured) = 0.461 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n  
Liquid Temperature: 21.1 °C  
Ambient Temperature: 21.3 °C  
Test Date: Mar . 29, 2013  
Plot NO. 20

DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: WCDMA850; Frequency: 836.6 MHz; Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.921$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 835/900 MHz; Type: SAM

**Right tilt 4183/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.292 mW/g

**Right tilt 4183/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 9.77 V/m; Power Drift = 0.018 dB  
Peak SAR (extrapolated) = 0.343 W/kg  
**SAR(1 g) = 0.278 mW/g; SAR(10 g) = 0.212 mW/g**  
Maximum value of SAR (measured) = 0.291 mW/g

