

SAR TEST REPORT

HCT CO., LTD

EUT Type:	GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n	
FCC ID:	ZNFE450J	
Model:	LG-E450j	
Additional Model:	LGE450j, E450j	
Date of Issue:	May. 06, 2013	
Test report No.:	HCTA1304FS08	
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Applicant :	LG Electronics, MobileComm U.S.A., Inc. 1000 Sylvan Avenue, Englewood Cliffs NJ 07632	
Testing has been carried out in accordance with:	RSS-102 Issue 4; Health Canada Safety Code 6 47CFR §2.1093 FCC OET Bulletin 65(Edition 97-01), Supplement C (Edition 01-01) ANSI/ IEEE C95.1 – 1992 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	 <hr/> Report prepared by : Yun-Jeang Heo Test Engineer of SAR Part	 <hr/> Approved by : Jae-Sang So Manager of SAR Part

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Version

Rev	DATE	DESCRIPTION
	Apr. 25, 2013	First Approval Report
1	May. 3, 2013	Page 69 ~ 74 is revised.
2	May. 6, 2013	Page 4 ~74 is revised.(change korean font)

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:

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

σ = conductivity of the tissue-simulant material (S/m)
 ρ = mass density of the tissue-simulant material (kg/m³)
 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

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:	ZNFE450J					
Model:	LG-E450j					
Additional Model	LGE450j, E450j					
Trade Name	LG Electronics, MobileComm U.S.A., Inc.					
Application Type	Certification					
Mode(s) of Operation	GSM850/ GSM1900 / WCDMA1900 / 802.11b/g/n					
Tx Frequency	824.20 - 848.80 MHz (GSM850) / 1 850.20 – 1 909.80 MHz (GSM1900) 1 852.4 – 1 907.6 MHz (WCDMA1900)/ 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	824.2 - 848.8	PCE	0.393	0.713	0.713
	GSM1900	1 850.2 -1 909.8	PCE	0.412	0.366	0.366
	WCDMA 1900	1 852.4 – 1 907.6	PCE	0.676	0.662	0.662
	Bluetooth	2 402 - 2 480	DSS	-		
	802.11b	2 412- 2 462	DTS	0.226	0.116	0.116
Simultaneous SAR per KDB 690783 D01				0.802	0.829	0.829
Date(s) of Tests	Apr.15, 2013 ~ Apr.17, 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.

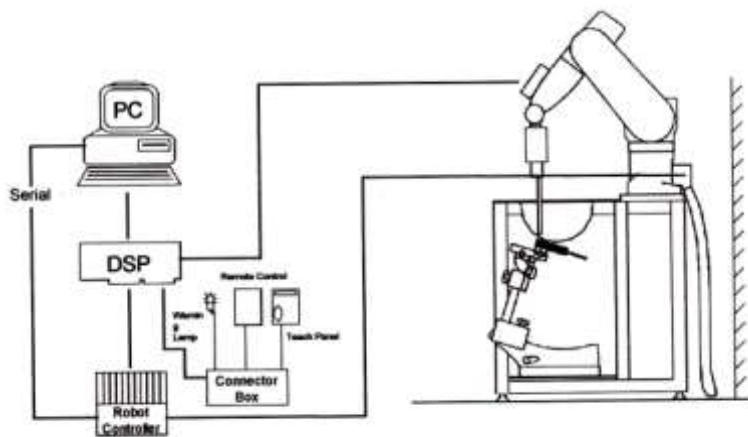


Figure 4.1 HCT SAR Lab. Test Measurement Set-up

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 DASYS4 E-FIELD PROBE SYSTEM

4.2.1 ET3DV6 Probe Specification

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	Basic Broad Band Calibration in air Conversion Factors (CF) for HSL 900 and HSL 1810 Additional CF for other liquids and frequencies upon request
Frequency	10 MHz to 3 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)
Dynamic Range	5 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones



Figure 4.2 Photograph of the probe and the Phantom

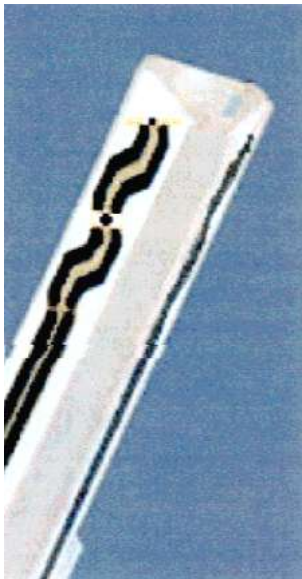


Figure 4.3 ET3DV6 E-field Probe

The SAR measurements were conducted with the dosimetric probe ET3DV6, designed in the classical triangular configuration [5] 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 mortar 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 DASYS4 software reads the reflection during a software approach and looks for the maximum using a 2nd 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 10 %. The spherical isotropy was evaluated with the proper procedure and found to be better than 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 bellow 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:

- Δt = exposure time (30 seconds),
- C = heat capacity of tissue (brain or muscle),
- ΔT = 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:

- σ = simulated tissue conductivity,
- ρ = Tissue density (1.25 g/cm³ for brain tissue)

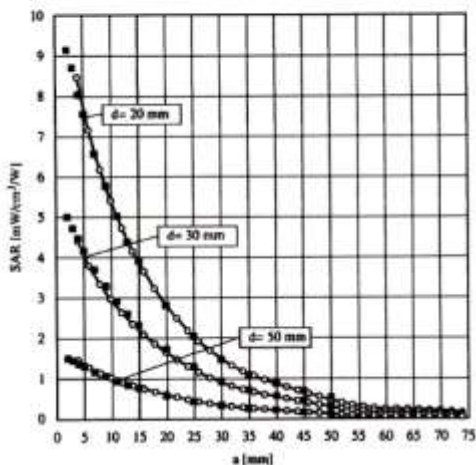


Figure 4.4 E-Field and Temperature measurements at 900 MHz

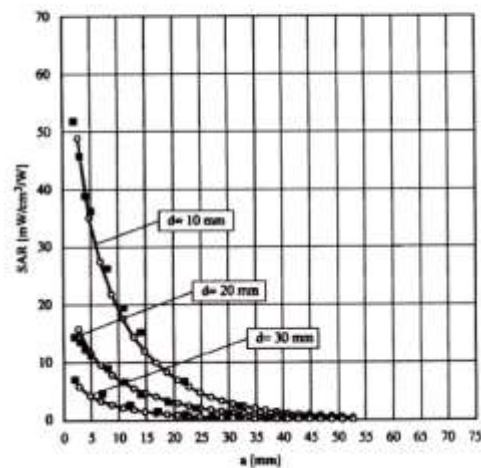


Figure 4.5 E-Field and temperature measurements at 1.8 GHz

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
 σ = conductivity in [mho/m] or [Siemens/m]
 ρ = equivalent tissue density in g/cm³

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

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

with P_{pwr} = equivalent power density of a plane wave in W/cm²
 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 an 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 (% by weight)	Frequency (MHz)							
	835		1 900		2 450 - 2700		5200-5800	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body
Water	40.45	53.06	54.9	70.17	71.88	73.2	65.52	78.66
Salt (NaCl)	1.45	0.94	0.18	0.39	0.16	0.1	0.0	0.0
Sugar	57.0	44.9	0.0	0	0.0	0.0	0.0	0.0
HEC	1.0	1.0	0.0	0	0.0	0.0	0.0	0.0
Bactericide	0.1	0.1	0.0	0	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	19.97	0.0	17.24	10.67
DGBE	0.0	0.0	44.92	29.44	7.99	26.7	0.0	0.0
Diethylene glycol hexyl ether	-	-	-	-	-	-	17.24	10.67

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	DAE4	652	Mar. 21, 2013	Annual	Mar. 21, 2014
SPEAG	E-Field Probe ET3DV6	1605	Apr. 26, 2012	Annual	Apr. 26, 2013
SPEAG	Validation Dipole D835V2	441	May 16, 2012	Annual	May 16, 2013
SPEAG	Validation Dipole D1900V2	5d032	July 20, 2012	Annual	July 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
R&S	Base Station CMW500	1201.0002K50_116858	Jan. 17, 2013	Annual	Jan. 17, 2014
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
HP	Network Analyzer 8753ES	JP39240221	Mar. 26, 2013	Annual	Mar. 26, 2014

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.

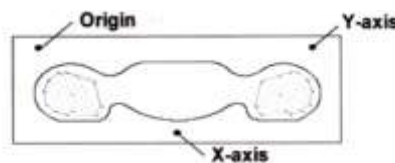


Figure 5.1 SAR Measurement Point in Area Scan

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

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

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.

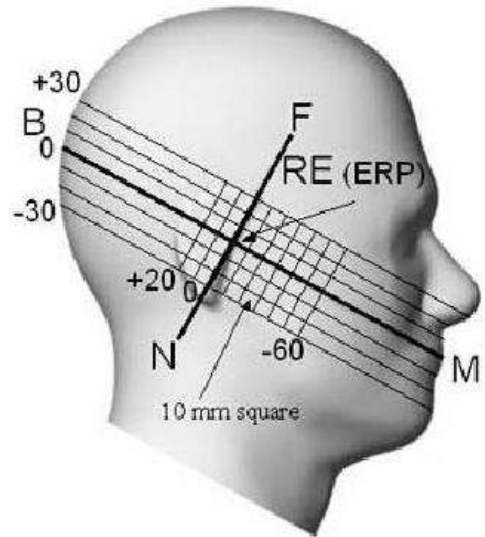


Figure 6.1 Side view of the phantom

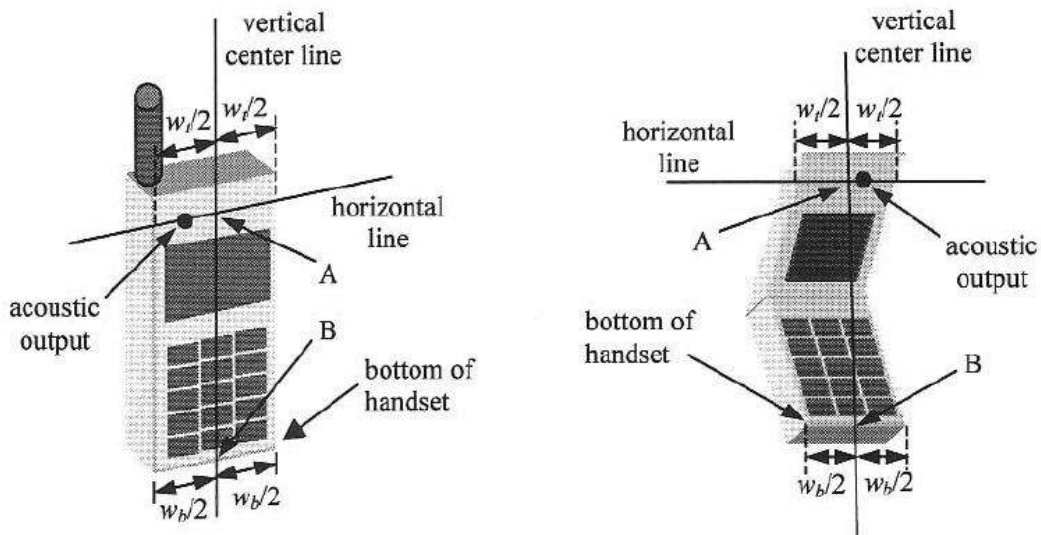


Figure 6.2 Handset vertical and horizontal reference lines

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 (± %)	Prob. dist.	Div.	C_i	Standard Uncertainty (± %)	V_{eff}
1. Measurement System						
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	∞
2. Test Sample Related						
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	∞
3. Phantom and Setup						
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
Combine Standard Uncertainty					11.13	
Coverage Factor for 95 %					$k=2$	
Expanded STD Uncertainty					22.25	

Table 7.1 Uncertainty (800 MHz- 2450 MHz)

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

HUMAN EXPOSURE	UNCONTROLLED ENVIRONMENT General Population (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT Occupational (W/kg) or (mW/g)
SPATIAL PEAK SAR * (Brain)	1.60	8.00
SPATIAL AVERAGE SAR ** (Whole Body)	0.08	0.40
SPATIAL PEAK SAR *** (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 #	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
4	1605	ET3DV6	Head	835	441	Dec.22,2012	42.1	0.88	PASS	PASS	PASS	GMSK	PASS	N/A
4	1605	ET3DV6	Head	1900	5d032	Dec.22,2012	38.7	1.42	PASS	PASS	PASS	GMSK	PASS	N/A
4	1605	ET3DV6	Head	2450	743	Dec.22,2012	40.1	1.79	PASS	PASS	PASS	OFDM	N/A	PASS
4	1605	ET3DV6	Body	835	441	Dec.23,2012	55.4	0.96	PASS	PASS	PASS	GMSK	PASS	N/A
4	1605	ET3DV6	Body	1900	5d032	Dec.23,2012	52.5	1.57	PASS	PASS	PASS	GMSK	PASS	N/A
4	1605	ET3DV6	Body	2450	743	Dec.23,2012	53.1	1.91	PASS	PASS	PASS	OFDM	N/A	PASS

SAR System Validation Summary

10. SYSTEM VERIFICATION

10.1 Tissue Verification

Freq. [MHz]	Date	Probe	Dipole	Liquid	Liquid Temp.[°C]	Parameters	Target Value	Measured Value	Deviation [%]	Limit [%]
835	Apr. 16 2013	1605	441	Head	21.4	r	41.5	40.4	- 2.65	± 5
							0.90	0.918	+ 2.00	± 5
835	Apr. 16 2013		Body	21.4	r	55.2	56.7	+ 2.72	± 5	
						0.97	0.986	+ 1.65	± 5	
1 900	Apr. 15 2013		5d032	Head	21.6	r	40.0	39.8	- 0.50	± 5
							1.40	1.41	+ 0.71	± 5
1 900	Apr. 15 2013	Body	21.6	r	53.3	52.2	- 2.06	± 5		
					1.52	1.56	+ 2.63	± 5		
2 450	Apr. 17 2013	743	Head	22.0	r	39.2	38.8	- 1.02	± 5	
						1.80	1.87	+ 3.89	± 5	
2 450	Apr. 17 2013	Body	22.0	r	52.7	53.5	+ 1.52	± 5		
					1.95	1.99	+ 2.05	± 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 ± 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 _{1g} (SPEAG) (mW/g)	Measured SAR _{1g} (mW/g)	1 W Normalized SAR _{1g} (mW/g)	Deviation [%]	Limit [%]
835	Apr. 16 2013	1605	441	Head	21.6	21.4	9.43	0.987	9.87	+ 4.67	± 10
835	Apr. 16 2013			Body	21.6	21.4	9.50	0.925	9.25	- 2.63	± 10
1 900	Apr. 15 2013		5d032	Head	21.8	21.6	39.0	3.87	38.7	- 0.77	± 10
1 900	Apr. 15 2013			Body	21.8	21.6	39.9	3.9	39	- 2.26	± 10
2 450	Apr. 17 2013		743	Head	22.2	22.0	52.7	5.32	53.2	+ 0.95	± 10
2 450	Apr. 17 2013			Body	22.2	22.0	51.2	5.27	52.7	+ 2.93	± 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 Output Power Specifications.

This device operates using the following maximum output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB publication 447498 D01v05.

GSM

GSM850	GSM1900
Target Power : 32.7 dBm	Target Power : 29.7 dBm
GPRS850	PCS1900
GPRS 1tx : 32.7 dBm	GPRS 1tx : 29.7 dBm
GPRS 2tx : 30.2 dBm	GPRS 2tx : 27.2 dBm
GPRS 3tx : 28.7 dBm	GPRS 3tx : 25.7 dBm
GPRS 4tx : 27.7 dBm	GPRS 4tx : 24.7 dBm
Tune-up Tolerance : -1.5dB/ +0.5dB	Tune-up Tolerance : -1.5dB/ +0.5dB

WCDMA

WCDMA1900
Target Power : 22.7 dBm
Tune-up Tolerance : -1.5dB/ +0.5dB

Wifi

Mode / Band	IEEE 802.11 (in dBm)			
	a	b	g	n
2.4 GHz WIFI		14	9.5	8.5

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

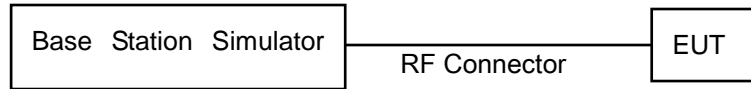
BT

Model	Channel	Frequency (MHz)	Output Power (dBm)		
			GFSK	8DPSK	$\pi/4$ DQPSK
LG-E450j	0	2402	2.50	-0.50	-0.50
	39	2441	3.50	0.50	0.50
	78	2480	4.50	1.50	1.50

Tolerance : - 1.5 dB / + 0.5 dB

11.2 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.

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	32.86	32.86	30.44	28.96	27.74
	190	32.89	32.89	30.49	28.99	27.79
	251	32.92	32.92	30.51	29.00	27.78
GSM 1900	512	30.01	30.01	27.58	26.07	25.11
	661	29.94	29.94	27.45	25.93	24.97
	810	29.85	29.85	27.32	25.79	24.82

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	23.83	23.83	24.42	24.7	24.73
	190	23.86	23.86	24.47	24.73	24.78
	251	23.89	23.89	24.49	24.74	24.77
GSM 1900	512	20.98	20.98	21.56	21.81	22.1
	661	20.91	20.91	21.43	21.67	21.96
	810	20.82	20.82	21.3	21.53	21.81

GSM Conducted output powers (Frame-Average)

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

11.3 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 ≤ 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 ≤ 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	β_c	β_d	β_d (SF)	β_c/β_d	$\beta_{hs}^{(2)}$	CM (dB) ⁽²⁾
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15 ⁽³⁾	15/15 ⁽³⁾	64	12/15 ⁽³⁾	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: Δ_{ACK} , Δ_{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 β_c/β_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	β_c	β_d	β_d (SF)	β_c/β_d	$\beta_{hs}^{(1)}$	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM ⁽²⁾ (dB)	MPR (dB)	AG ⁽⁴⁾ Index	E-TFCI
1	11/15 ⁽³⁾	15/15 ⁽³⁾	64	11/15 ⁽³⁾	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	$\beta_{ed1}: 47/15$ $\beta_{ed2}: 47/15$	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 ⁽⁴⁾	15/15 ⁽⁴⁾	64	15/15 ⁽⁴⁾	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, DPCCCH, HS-DPCCCH, E-DPDCH and E-DPCCCH the MPR is based on the relative CM difference.
- Note 3: For subtest 1 the β_c/β_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 β_c/β_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: β_{ed} can not be set directly; it is set by Absolute Grant Value.

V

WCDMA 1900

3GPP Release Version	Mode	3GPP 34.121	Cellular Band [dBm]						MPR
		Subtest	UL 9262 (1852.4)	Power reduction (dB)	UL 9400 (1880.0)	Power reduction (dB)	UL 9538 (1907.6)	Power reduction (dB)	
			DL 9662		DL 9800		DL 9938		
99	WCDMA	12.2 kbps RMC	22.79		22.79		22.59		-
99	WCDMA	12.2 kbps AMR	22.88		22.90		22.67		
5	HSDPA	Subtest 1	22.72	0.00	22.67	0.00	22.45	0.00	0
5		Subtest 2	21.71	-1.01	21.66	-1.01	21.43	-1.02	0
5		Subtest 3	21.24	-1.48	21.17	-1.50	20.96	-1.49	-0.5
5		Subtest 4	21.21	-1.51	21.15	-1.52	20.94	-1.51	-0.5
6	HSUPA	Subtest 1	20.76	0.00	20.81	0.00	20.54	0.00	0
6		Subtest 2	19.78	-0.98	19.81	-1.00	19.55	-0.99	-2
6		Subtest 3	20.26	-0.50	20.30	-0.51	19.99	-0.55	-1
6		Subtest 4	20.79	0.03	20.81	0.00	20.54	0.00	-2
6		Subtest 5	20.78	0.02	20.81	0.00	20.53	-0.01	0

11.4 WiFi

11.4.1 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	42 (5.21 GHz)			*
	5.22	44				*
	5.24	48	50 (5.25 GHz)			√
	5.26	52				√
	5.28	56	58 (5.29 GHz)			*
	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

■ 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	13.72	30
		2 Mbps	13.64	30
		5.5 Mbps	13.23	30
		11 Mbps	13.43	30
2437	6	1 Mbps	13.53	30
		2 Mbps	13.40	30
		5.5 Mbps	13.38	30
		11 Mbps	13.21	30
2462	11	1 Mbps	13.37	30
		2 Mbps	13.46	30
		5.5 Mbps	13.51	30
		11 Mbps	13.41	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	8.84	30
		9 Mbps	8.90	30
		12 Mbps	8.92	30
		18 Mbps	8.66	30
		24 Mbps	8.52	30
		36 Mbps	8.27	30
		48 Mbps	8.09	30
		54 Mbps	7.96	30
2437	6	6 Mbps	9.56	30
		9 Mbps	9.51	30
		12 Mbps	9.45	30
		18 Mbps	9.23	30
		24 Mbps	9.13	30
		36 Mbps	8.76	30
		48 Mbps	8.24	30
2462	11	6 Mbps	9.72	30
		9 Mbps	9.57	30
		12 Mbps	9.57	30
		18 Mbps	9.31	30
		24 Mbps	8.72	30
		36 Mbps	8.47	30
		48 Mbps	8.25	30
54 Mbps	8.57	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	7.85	30
		13 Mbps	7.85	30
		19.5 Mbps	7.75	30
		26 Mbps	7.55	30
		39 Mbps	7.25	30
		52 Mbps	6.91	30
		58.5 Mbps	6.89	30
		65 Mbps	6.85	30
2437	6	6.5 Mbps	7.90	30
		13 Mbps	8.29	30
		19.5 Mbps	8.21	30
		26 Mbps	7.50	30
		39 Mbps	7.78	30
		52 Mbps	7.54	30
		58.5 Mbps	7.41	30
		65 Mbps	7.36	30
2462	11	6.5 Mbps	8.05	30
		13 Mbps	8.45	30
		19.5 Mbps	8.31	30
		26 Mbps	8.13	30
		39 Mbps	7.41	30
		52 Mbps	7.67	30
		58.5 Mbps	7.48	30
		65 Mbps	6.96	30

Conducted Output Power Measurements (40 MHz BW)

802.11n Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2422	3	13.5 Mbps	8.28	30
		27 Mbps	8.01	30
		40.5 Mbps	7.67	30
		54 Mbps	7.43	30
		81 Mbps	6.93	30
		108 Mbps	6.57	30
		121.5 Mbps	6.43	30
		135 Mbps	6.38	30
2437	6	13.5 Mbps	8.18	30
		27 Mbps	8.34	30
		40.5 Mbps	7.51	30
		54 Mbps	7.75	30
		81 Mbps	6.73	30
		108 Mbps	6.37	30
		121.5 Mbps	6.21	30
		135 Mbps	6.13	30
2452	9	13.5 Mbps	7.88	30
		27 Mbps	7.53	30
		40.5 Mbps	7.17	30
		54 Mbps	7.36	30
		81 Mbps	6.41	30
		108 Mbps	6.04	30
		121.5 Mbps	5.85	30
		135 Mbps	5.85	30

11.4 SAR Test Exclusions Applied

11.4.1 Wi-Fi/BT

Since Wireless Router operations are not allowed by the chipset firmware using 5 GHz Wi-Fi, only 2.4 GHz Wi-Fi Hotspot SAR Tests and combinations are considered for SAR with respect to Wireless Router configurations according to FCC KDB 941225 D06v01.

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

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

. Mode	Frequency	Maximum Allowed Power	Separatuin Distance	≤ 3.0
	[MHz]	[mW]	[mm]	
Bluetooth	2480	3	10	0.5

Based on the maximum conducted power of Bluetooth and antenna to use separation distance, Bluetooth SAR was not required $[(3/10)*\sqrt{2.480}] = 0.5 < 3.0$.

his 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

$$\text{Estimated SAR} = \frac{\sqrt{f(\text{GHZ})}}{7.5} * \frac{(\text{Max Power of channel mW})}{\text{Min Seperation Distance}}$$

. Mode	Frequency	Maximum Allowed Power	Separatuin Distance (Body)	Estimated SAR (Body)
	[MHz]	[mW]	[mm]	[W/kg]
Bluetooth	2480	3	10	0.07

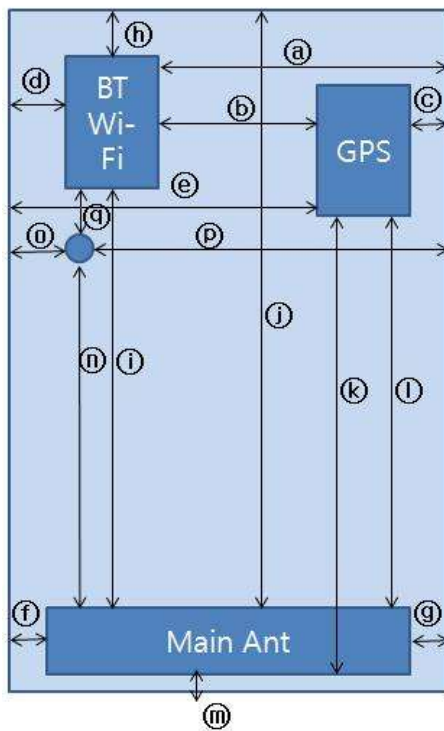
Note : Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission. The Estimated SAR results were determined according to FCC KDB447498 D01v05

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	No	Yes	No	Yes

12.2 Antenna and Device Information



NO.	Distance (mm)
a	46.46
b	25.01
c	4.46
d	4.75
e	40.62
f	1.18
g	1.18
h	3.68
i	87.17
j	106.01
k	85.56
l	79.16
m	1.09
n	68
o	6
p	52
q	15

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 ≤ 2.5 cm from an edge.

※ Please see LG-E450J_Ant_distance file for further information.

13. SAR TEST DATA SUMMARY

13.1 Measurement Results (GSM850 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	32.89	-0.126	Standard	Left Ear	0.287	0.308	
			32.89	-0.048	Standard	Left Tilt 15°	0.187	0.201	
			32.89	-0.154	Standard	Right Ear	0.245	0.263	
			32.89	0.007	Standard	Right Tilt 15°	0.161	0.173	
836.6	190 (Mid)	GPRS 4Tx	27.79	0.191	Standard	Left Ear	0.358	0.393	1
			27.79	-0.023	Standard	Left Tilt 15°	0.238	0.262	
			27.79	-0.163	Standard	Right Ear	0.320	0.352	
			27.79	-0.066	Standard	Right Tilt 15°	0.190	0.209	
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						Head 1.6 W/kg (mW/g) Averaged over 1 gram			

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 SAR testing.
- GSM GPRS VoIP is 3rd Party applications possibly installed and used by the end-user

13.2 Measurement Results (GSM1900 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)	GSM 1900	29.94	-0.130	Standard	Left Ear	0.170	0.180	
			29.94	-0.061	Standard	Left Tilt 15°	0.096	0.102	
			29.94	0.119	Standard	Right Ear	0.341	0.362	
			29.94	0.135	Standard	Right Tilt 15°	0.129	0.137	
1 880.0	661 (Mid)	GPRS 4Tx	24.97	-0.170	Standard	Left Ear	0.188	0.198	
			24.97	-0.031	Standard	Left Tilt 15°	0.113	0.119	
			24.97	0.038	Standard	Right Ear	0.391	0.412	2
			24.97	0.043	Standard	Right Tilt 15°	0.149	0.157	
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						Head 1.6 W/kg (mW/g) Averaged over 1 gram			

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 SAR testing.
- GSM GPRS VoIP is 3rd Party applications possibly installed and used by the end-user

13.3 Measurement Results (WCDMA 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								
1880.0	9400(Mid)	WCDMA1900	22.79	0.018	Standard	Left Ear	0.309	0.340	
			22.79	-0.082	Standard	Left Tilt 15°	0.182	0.200	
			22.79	0.088	Standard	Right Ear	0.615	0.676	3
			22.79	0.073	Standard	Right Tilt 15°	0.230	0.253	
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						Head 1.6 W/kg (mW/g) Averaged over 1 gram			

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	Chann									
2 412	1(Low)	802.11b	13.72	-0.070	Standard	Left Ear	1Mbps	0.189	0.226	4
			13.72	-0.067	Standard	Left Tilt 15°	1Mbps	0.133	0.159	
			13.72	0.178	Standard	Right Ear	1Mbps	0.105	0.126	
			13.72	-0.062	Standard	Right Tilt 15	1Mbps	0.111	0.133	
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						Head 1.6 W/kg (mW/g) Averaged over 1 gram				

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								
836.6	190 (Mid)	GPRS 4Tx	27.79	-0.165	Rear	1.0 cm	0.649	0.713	5
			27.79	-0.154	Front	1.0 cm	0.419	0.460	
			27.79	-0.115	Left	1.0 cm	0.484	0.532	
			27.79	0.174	Right	1.0 cm	0.431	0.474	
			27.79	0.025	Bottom	1.0 cm	0.057	0.063	
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						Body 1.6 W/kg (mW/g) Averaged over 1 gram			

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 3uplink 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	24.79	0.080	Rear	1.0 cm	0.333	0.366	6
1 880	661 (Mid)	GPRS 4Tx	24.79	-0.055	Front	1.0 cm	0.295	0.324	
1 880	661 (Mid)	GPRS 4Tx	24.79	-0.068	Left	1.0 cm	0.068	0.075	
1 880	661 (Mid)	GPRS 4Tx	24.79	-0.015	Right	1.0 cm	0.159	0.175	
1 880	661 (Mid)	GPRS 4Tx	24.79	-0.043	Bottom	1.0 cm	0.069	0.076	
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						Body 1.6 W/kg (mW/g) Averaged over 1 gram			

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 3uplink 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 1900 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								
1880.0	9400(Mid)	WCDMA 1900	22.79	0.029	Rear	1.0 cm	0.602	0.662	7
			22.79	-0.041	Front	1.0 cm	0.486	0.534	
			22.79	-0.073	Left	1.0 cm	0.104	0.114	
			22.79	-0.030	Right	1.0 cm	0.245	0.269	
			22.79	0.046	Bottom	1.0 cm	0.132	0.145	
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						Body 1.6 W/kg (mW/g) Averaged over 1 gram			

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	13.72	-0.182	Rear	1Mbps	0.097	0.116	8
			13.72	0.072	Front	1Mbps	0.043	0.051	
			13.72	-0.150	Right	1Mbps	0.056	0.067	
			13.72	0.130	Top	1Mbps	0.043	0.051	
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						Body 1.6 W/kg (mW/g) Averaged over 1 gram			

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 code 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.

13.9 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)	GSM850	32.89	-0.154	Rear	1.0 cm	0.560	0.601	
836.6	190 (Mid)	GSM850	32.89	-0.123	Front	1.0 cm	0.300	0.322	
836.6	190 (Mid)	GPRS 4Tx	27.79	-0.165	Rear	1.0 cm	0.649	0.713	5
836.6	190 (Mid)	GPRS 4Tx	27.79	-0.154	Front	1.0 cm	0.419	0.460	
1 880	661 (Mid)	GSM1900	29.94	-0.105	Rear	1.0 cm	0.326	0.346	
1 880	661 (Mid)	GSM1900	29.94	0.015	Front	1.0 cm	0.274	0.291	
1 880	661 (Mid)	GPRS 4Tx	24.79	0.080	Rear	1.0 cm	0.333	0.366	6
1 880	661 (Mid)	GPRS 4Tx	24.79	-0.055	Front	1.0 cm	0.295	0.324	
1 880.0	9400(Mid)	WCDMA1900	22.79	0.029	Rear	1.0 cm	0.602	0.662	7
1 880.0	9400(Mid)	WCDMA1900	22.79	-0.041	Front	1.0 cm	0.486	0.534	
2 437	6 (Mid)	802.11b (1Mbps)	13.72	-0.182	Rear	1Mbps	0.097	0.116	8
2 437	6 (Mid)	802.11b (1Mbps)	13.72	0.072	Front	1Mbps	0.043	0.051	
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						Body 1.6 W/kg (mW/g) <small>Averaged over 1 gram</small>			

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 ≥ 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 ≥ 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 ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .

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.

*In this model, not applicable

15. SAR Summation Scenario

	Position	Applicable Combination	Note
Simultaneous Transmission	Head	GSM850 Voice + 2.4 GHz WiFi	
		GSM1900 Voice + 2.4 GHz WiFi	
		WCDMA1900 Voice + 2.4 GHz WiFi	
		GPRS 850 Data + 2.4 GHz WiFi	
		GPRS 1900 Data + 2.4 GHz WiFi	
	Hotspot	GPRS850 Data + 2.4 GHz WiFi	
		GPRS1900 Data + 2.4 GHz WiFi	
		WCDMA1900 Data + 2.4 GHz WiFi	
	Body-worn	GSM850 Voice + 2.4 GHz WiFi	WIFI Direct
		GSM1900 Voice + 2.4 GHz WiFi	
		WCDMA1900 Voice + 2.4 GHz WiFi	
		GSM850 Voice + 2.4 GHz Bluetooth	
		GSM1900 Voice + 2.4 GHz Bluetooth	
		WCDMA1900 Voice + 2.4 GHz Bluetooth	
GPRS850 Data + 2.4 GHz WiFi		WIFI Direct	
GPRS1900 Data + 2.4 GHz WiFi			

* BT and WLAN are not simultaneous transmission.

Simultaneous Transmission Summation for Held to Ear

Band	configuration	Scaled SAR(W/kg)	2.4 GHz WIFI Scaled SAR (W/kg)	∑ 1-g SAR (W/kg)
GSM 850	Left Cheek	0.308	0.226	0.534
	Left Tilt	0.201	0.159	0.360
	Right Cheek	0.263	0.126	0.389
	Right Tilt	0.173	0.133	0.306
GSM 1 900	Left Cheek	0.180	0.226	0.406
	Left Tilt	0.102	0.159	0.261
	Right Cheek	0.362	0.126	0.488
	Right Tilt	0.137	0.133	0.270
WCDMA 1900	Left Cheek	0.340	0.226	0.566
	Left Tilt	0.200	0.159	0.359
	Right Cheek	0.676	0.126	0.802
	Right Tilt	0.253	0.133	0.386
GPRS 850	Left Cheek	0.393	0.226	0.619
	Left Tilt	0.262	0.159	0.421
	Right Cheek	0.352	0.126	0.478
	Right Tilt	0.209	0.133	0.342
GPRS 1 900	Left Cheek	0.198	0.226	0.424
	Left Tilt	0.119	0.159	0.278
	Right Cheek	0.412	0.126	0.538
	Right Tilt	0.157	0.133	0.290

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)	∑ 1-g SAR (W/kg)
GSM 850	Rear	0.601	0.116		0.717
				0.07	0.671
GSM 1900	Rear	0.346	0.116		0.462
				0.07	0.416
WCDMA 1900	Rear	0.662	0.116		0.778
				0.07	0.732
GPRS 850	Rear	0.713	0.116		0.829
					0.713
GPRS 1900	Rear	0.366	0.116		0.482
					0.366

Simultaneous Transmission Summation for Hotspot (1 cm)

Band	configuration	Scaled SAR(W/kg)	2.4 GHz WIFI Scaled SAR (W/kg)	Σ 1-g SAR (W/kg)
GPRS 850	Rear	0.713	0.116	0.829
	Front	0.460	0.051	0.511
	Left	0.532		0.532
	Right	0.474	0.067	0.525
	Bottom	0.063		0.063
	Top		0.051	0.051
GPRS 1 900	Rear	0.366	0.116	0.482
	Front	0.324	0.051	0.375
	Left	0.075		0.075
	Right	0.175	0.067	0.242
	Bottom	0.076		0.076
	Top		0.051	0.051
WCDMA 1900	Rear	0.662	0.116	0.778
	Front	0.534	0.051	0.585
	Left	0.114		0.114
	Right	0.269	0.067	0.336
	Bottom	0.145		0.145
	Top		0.051	0.051

16. CONCLUSION

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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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: 21.4 °C
Ambient Temperature: 21.6 °C
Test Date: Apr. 16, 2013
Plot No. 1

DUT: LG-E450j; 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; $\sigma = 0.92$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

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

DASY4 Configuration:

- Probe: ET3DV6 - SN1605; ConvF(6.64, 6.64, 6.64); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: 835/900 Phantom ; Type: SAM

Left Touch 190 GPRS 4Tx/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.379 mW/g

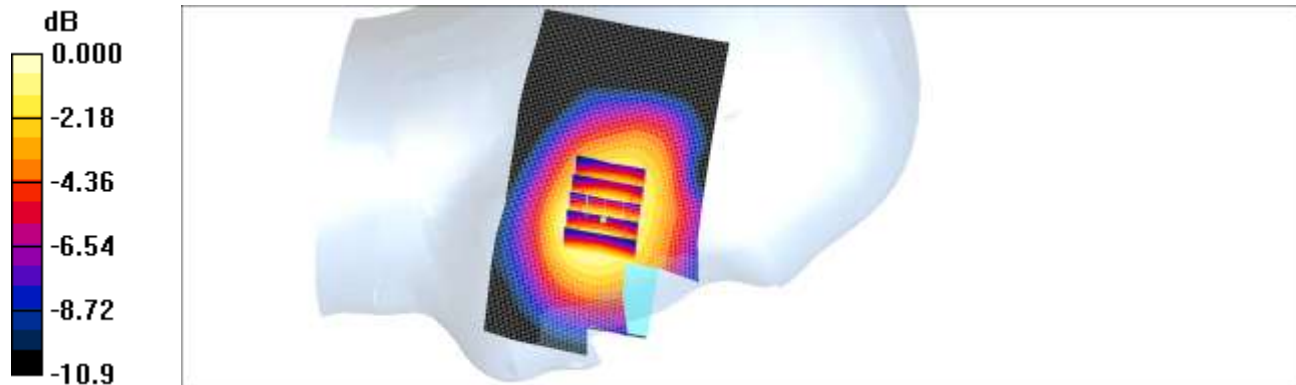
Left Touch 190 GPRS 4Tx/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.21 V/m; Power Drift = 0.191 dB

Peak SAR (extrapolated) = 0.480 W/kg

SAR(1 g) = 0.358 mW/g; SAR(10 g) = 0.259 mW/g

Maximum value of SAR (measured) = 0.372 mW/g



0 dB = 0.372mW/g

Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature: 21.6 °C
Ambient Temperature: 21.8 °C
Test Date: Apr. 15, 2013
Plot No. 2

DUT: LG-E450j; Type: bar; Serial: #1

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:2.075

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.39$ mho/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ET3DV6 - SN1605; ConvF(5.26, 5.26, 5.26); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: 800/900 Phantom; Type: SAM

Right Tilt 661 GPRS 4Tx/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.421 mW/g

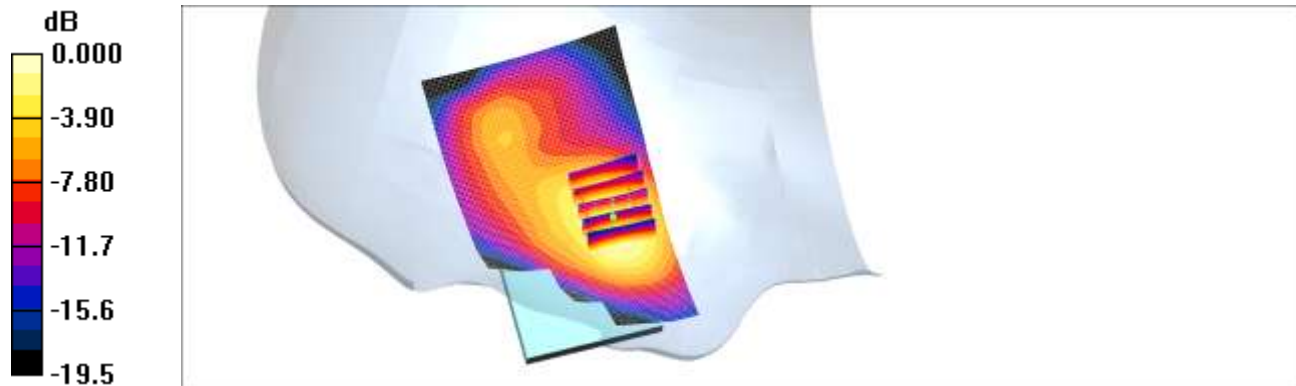
Right Tilt 661 GPRS 4Tx/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 7.35 V/m; Power Drift = 0.038 dB

Peak SAR (extrapolated) = 0.576 W/kg

SAR(1 g) = 0.391 mW/g; SAR(10 g) = 0.232 mW/g

Maximum value of SAR (measured) = 0.435 mW/g



0 dB = 0.435mW/g

Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature: 21.6 °C
Ambient Temperature: 21.8 °C
Test Date: Apr. 15, 2013
Plot No. 3

DUT: LG-E450j; Type: bar; Serial: #1

Communication System: WCDMA1900; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.39 \text{ mho/m}$; $\epsilon_r = 39.9$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ET3DV6 - SN1605; ConvF(5.26, 5.26, 5.26); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: 800/900 Phantom; Type: SAM

Right touch 9400/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.682 mW/g

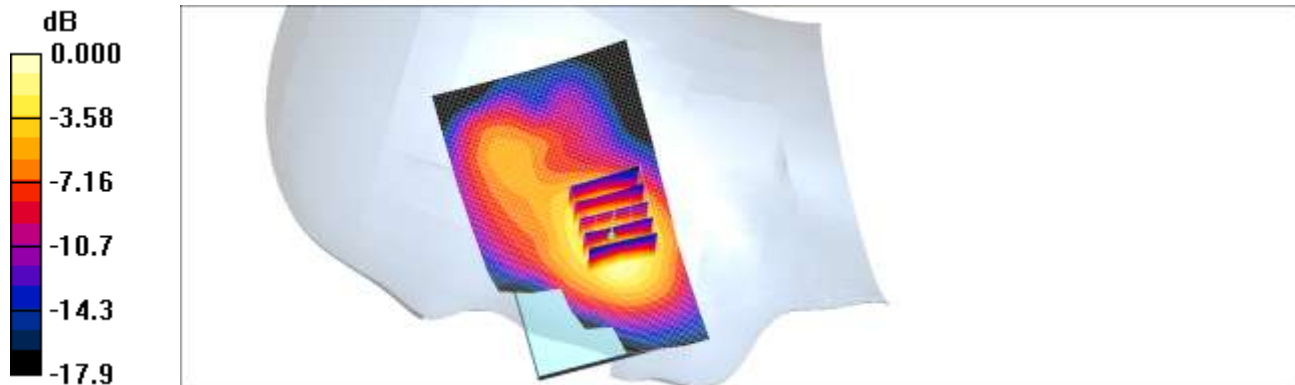
Right touch 9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.60 V/m; Power Drift = 0.088 dB

Peak SAR (extrapolated) = 0.924 W/kg

SAR(1 g) = 0.615 mW/g; SAR(10 g) = 0.367 mW/g

Maximum value of SAR (measured) = 0.675 mW/g



0 dB = 0.675mW/g

Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature: 22.0 °C
Ambient Temperature: 22.2 °C
Test Date: Apr. 17, 2013
Plot No. 4

DUT: LG-E450j; Type: bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.83$ mho/m; $\epsilon_r = 39$; $\rho = 1000$ kg/m³

Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ET3DV6 - SN1605; ConvF(4.59, 4.59, 4.59); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: 800/900 Phantom; Type: SAM

Left Touch CH1/Area Scan (71x121x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.202 mW/g

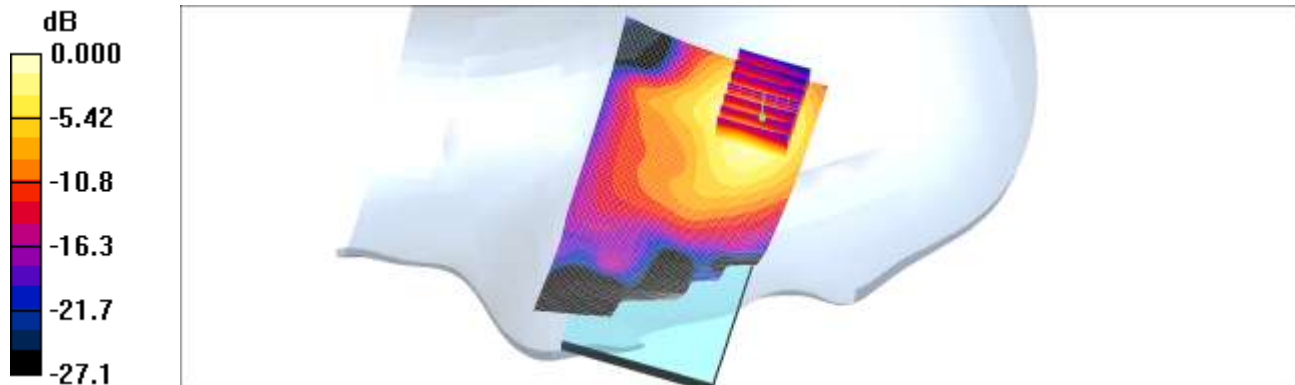
Left Touch CH1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.09 V/m; Power Drift = -0.070 dB

Peak SAR (extrapolated) = 0.391 W/kg

SAR(1 g) = 0.189 mW/g; SAR(10 g) = 0.096 mW/g

Maximum value of SAR (measured) = 0.209 mW/g



0 dB = 0.209mW/g

Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature: 21.4 °C
Ambient Temperature: 21.6 °C
Test Date: Apr. 16, 2013
Plot No. 5

DUT: LG-E450j; 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; $\sigma = 0.988$ mho/m; $\epsilon_r = 56.6$; $\rho = 1000$ kg/m³

Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ET3DV6 - SN1605; ConvF(6.52, 6.52, 6.52); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Body_Rear190/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.681 mW/g

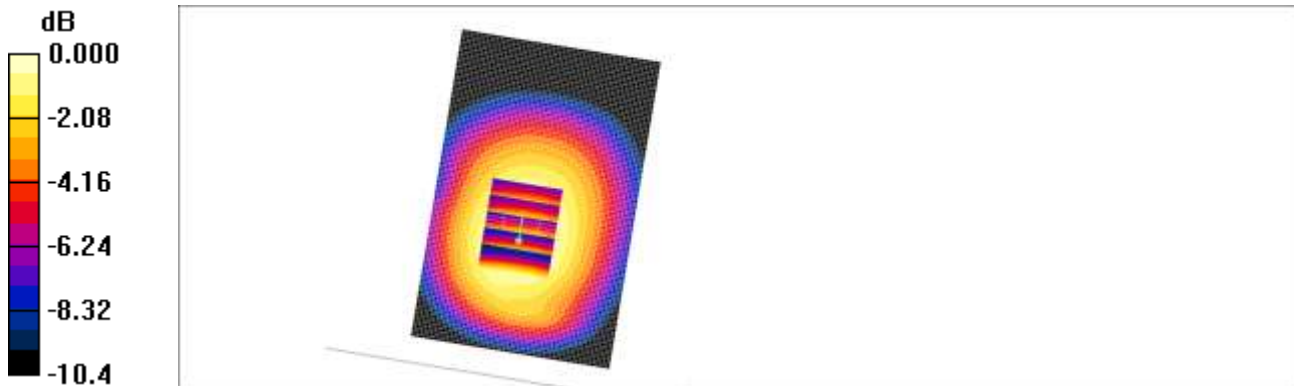
Body_Rear190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.10 V/m; Power Drift = -0.165 dB

Peak SAR (extrapolated) = 0.825 W/kg

SAR(1 g) = 0.649 mW/g; SAR(10 g) = 0.475 mW/g

Maximum value of SAR (measured) = 0.683 mW/g



0 dB = 0.683mW/g

Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature: 21.6 °C
Ambient Temperature: 21.8 °C
Test Date: Apr. 15, 2013
Plot No. 6

DUT: LG-E450j; Type: bar; Serial: #1

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:2.075

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.54$ mho/m; $\epsilon_r = 52.3$; $\rho = 1000$ kg/m³

Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ET3DV6 - SN1605; ConvF(4.64, 4.64, 4.64); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Body Rear 661 4tx/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.365 mW/g

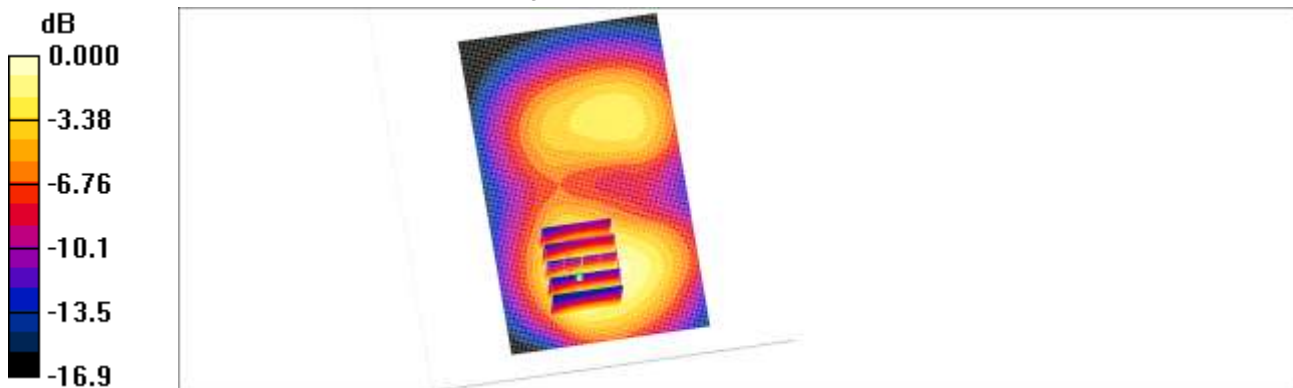
Body Rear 661 4tx/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.29 V/m; Power Drift = 0.080 dB

Peak SAR (extrapolated) = 0.502 W/kg

SAR(1 g) = 0.333 mW/g; SAR(10 g) = 0.207 mW/g

Maximum value of SAR (measured) = 0.354 mW/g



0 dB = 0.354mW/g

Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature: 21.6 °C
Ambient Temperature: 21.8 °C
Test Date: Apr. 15, 2013
Plot No. 7

DUT: LG-E450j; Type: bar; Serial: #1

Communication System: WCDMA1900; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.54$ mho/m; $\epsilon_r = 52.3$; $\rho = 1000$ kg/m³

Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ET3DV6 - SN1605; ConvF(4.64, 4.64, 4.64); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Body rear 9400/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.675 mW/g

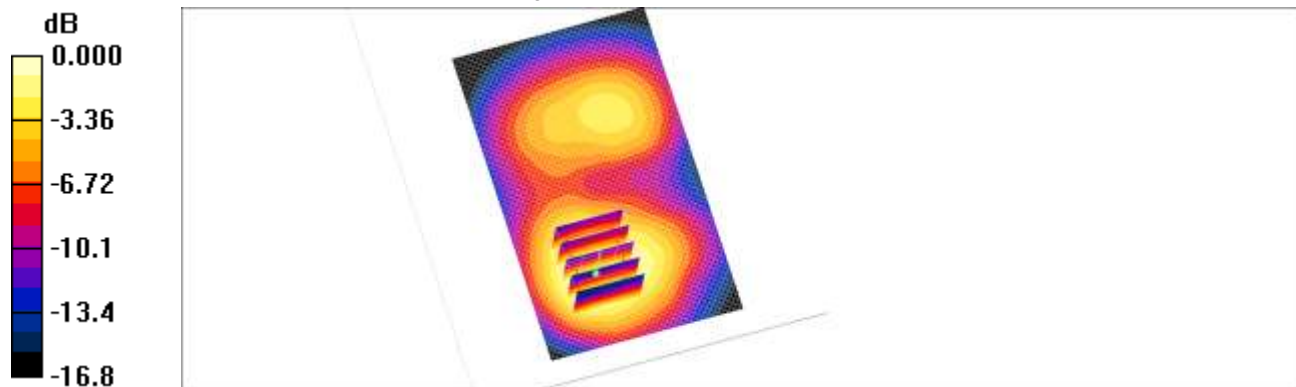
Body rear 9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 9.25 V/m; Power Drift = 0.029 dB

Peak SAR (extrapolated) = 0.926 W/kg

SAR(1 g) = 0.602 mW/g; SAR(10 g) = 0.370 mW/g

Maximum value of SAR (measured) = 0.649 mW/g



0 dB = 0.649mW/g

Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature: 22.0 °C
Ambient Temperature: 22.2 °C
Test Date: Apr. 17, 2013
Plot No. 8

DUT: LG-E450j; Type: bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 53.7$; $\rho = 1000$ kg/m³

Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ET3DV6 - SN1605; ConvF(4.07, 4.07, 4.07); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Body Rear CH1/Area Scan (71x121x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.116 mW/g

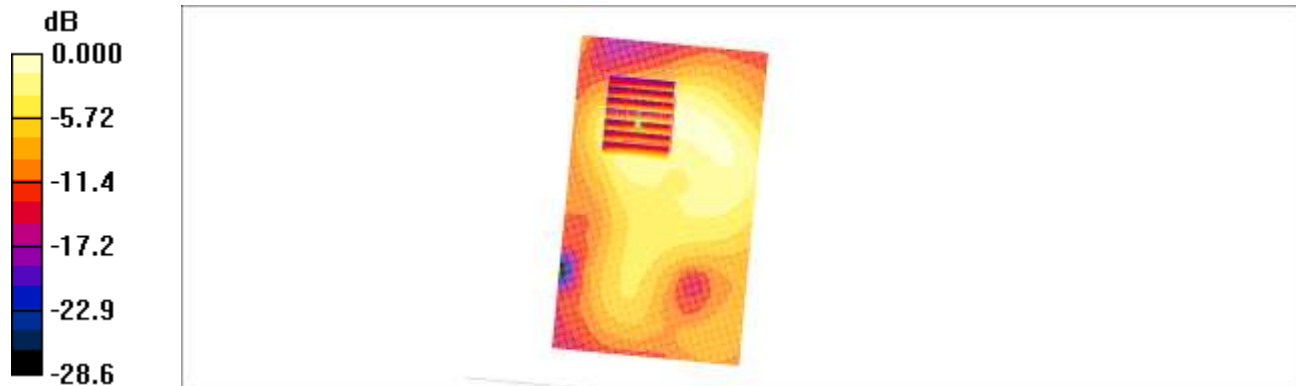
Body Rear CH1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.22 V/m; Power Drift = -0.182 dB

Peak SAR (extrapolated) = 0.208 W/kg

SAR(1 g) = 0.097 mW/g; SAR(10 g) = 0.050 mW/g

Maximum value of SAR (measured) = 0.106 mW/g



0 dB = 0.106mW/g

Test Laboratory: HCT CO., LTD
 EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
 Liquid Temperature: 21.4 °C
 Ambient Temperature: 21.6 °C
 Test Date: Apr. 16, 2013
 Plot No. 1

DUT: LG-E450j; 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; $\sigma = 0.92$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³
 Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184
 DASY4 Configuration:
 - Probe: ET3DV6 - SN1605; ConvF(6.64, 6.64, 6.64); Calibrated: 2012-04-26
 - Sensor-Surface: 4mm (Mechanical Surface Detection)
 - Electronics: DAE4 Sn652; Calibrated: 2013-03-21
 - Phantom: 835/900 Phantom ; Type: SAM

Left Touch 190 GPRS 4Tx/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
 Maximum value of SAR (interpolated) = 0.379 mW/g

Left Touch 190 GPRS 4Tx/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
 Reference Value = 4.21 V/m; Power Drift = 0.191 dB

Peak SAR (extrapolated) = 0.480 W/kg
SAR(1 g) = 0.358 mW/g; SAR(10 g) = 0.259 mW/g
 Maximum value of SAR (measured) = 0.372 mW/g



Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature: 21.6 °C
Ambient Temperature: 21.8 °C
Test Date: Apr. 15, 2013
Plot No. 2

DUT: LG-E450j; Type: bar; Serial: #1

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:2.075

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.39$ mho/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ET3DV6 - SN1605; ConvF(5.26, 5.26, 5.26); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: 800/900 Phantom; Type: SAM

Right Tilt 661 GPRS 4Tx/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.421 mW/g

Right Tilt 661 GPRS 4Tx/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 7.35 V/m; Power Drift = 0.038 dB

Peak SAR (extrapolated) = 0.576 W/kg

SAR(1 g) = 0.391 mW/g; SAR(10 g) = 0.232 mW/g

Maximum value of SAR (measured) = 0.435 mW/g



Test Laboratory: HCT CO., LTD
 EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
 Liquid Temperature: 21.6 °C
 Ambient Temperature: 21.8 °C
 Test Date: Apr. 15, 2013
 Plot No. 3

DUT: LG-E450j; Type: bar; Serial: #1

Communication System: WCDMA1900; Frequency: 1880 MHz; Duty Cycle: 1:1
 Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.39 \text{ mho/m}$; $\epsilon_r = 39.9$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ET3DV6 - SN1605; ConvF(5.26, 5.26, 5.26); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: 800/900 Phantom; Type: SAM

Right touch 9400/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.682 mW/g

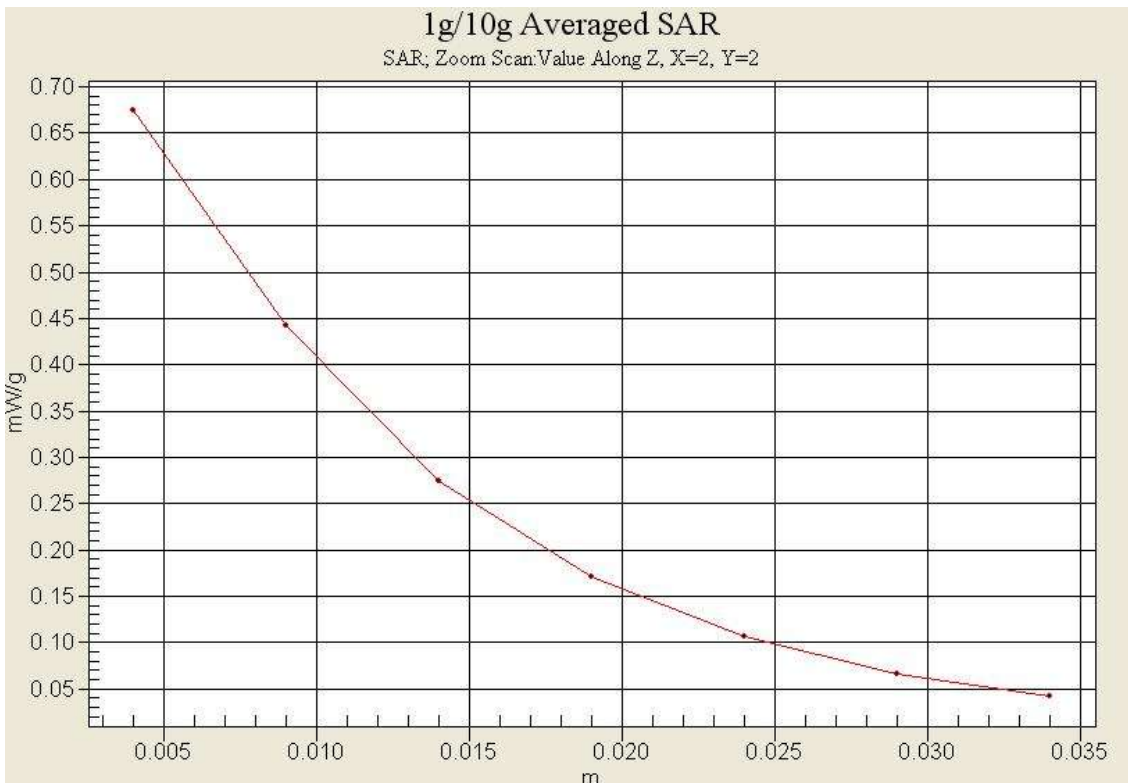
Right touch 9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.60 V/m; Power Drift = 0.088 dB

Peak SAR (extrapolated) = 0.924 W/kg

SAR(1 g) = 0.615 mW/g; SAR(10 g) = 0.367 mW/g

Maximum value of SAR (measured) = 0.675 mW/g



Test Laboratory: HCT CO., LTD
 EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
 Liquid Temperature: 22.0 °C
 Ambient Temperature: 22.2 °C
 Test Date: Apr. 17, 2013
 Plot No. 4

DUT: LG-E450j; Type: bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2412 MHz; Duty Cycle: 1:1
 Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.83$ mho/m; $\epsilon_r = 39$; $\rho = 1000$ kg/m³
 Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184
 DASY4 Configuration:
 - Probe: ET3DV6 - SN1605; ConvF(4.59, 4.59, 4.59); Calibrated: 2012-04-26
 - Sensor-Surface: 4mm (Mechanical Surface Detection)
 - Electronics: DAE4 Sn652; Calibrated: 2013-03-21
 - Phantom: 800/900 Phantom; Type: SAM

Left Touch CH1/Area Scan (71x121x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.202 mW/g

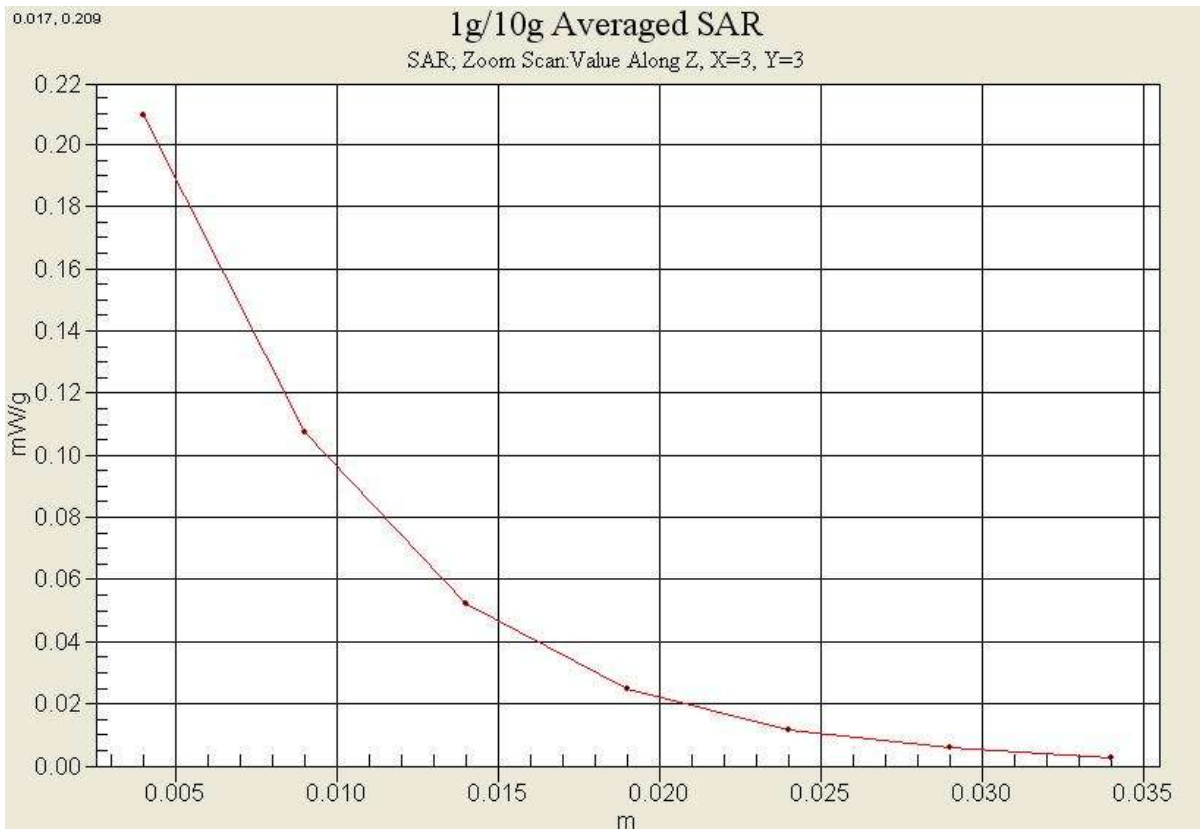
Left Touch CH1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.09 V/m; Power Drift = -0.070 dB

Peak SAR (extrapolated) = 0.391 W/kg

SAR(1 g) = 0.189 mW/g; SAR(10 g) = 0.096 mW/g

Maximum value of SAR (measured) = 0.209 mW/g



Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature: 21.4 °C
Ambient Temperature: 21.6 °C
Test Date: Apr. 16, 2013
Plot No. 5

DUT: LG-E450j; 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; $\sigma = 0.988$ mho/m; $\epsilon_r = 56.6$; $\rho = 1000$ kg/m³

Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ET3DV6 - SN1605; ConvF(6.52, 6.52, 6.52); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Body_ Rear190/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.681 mW/g

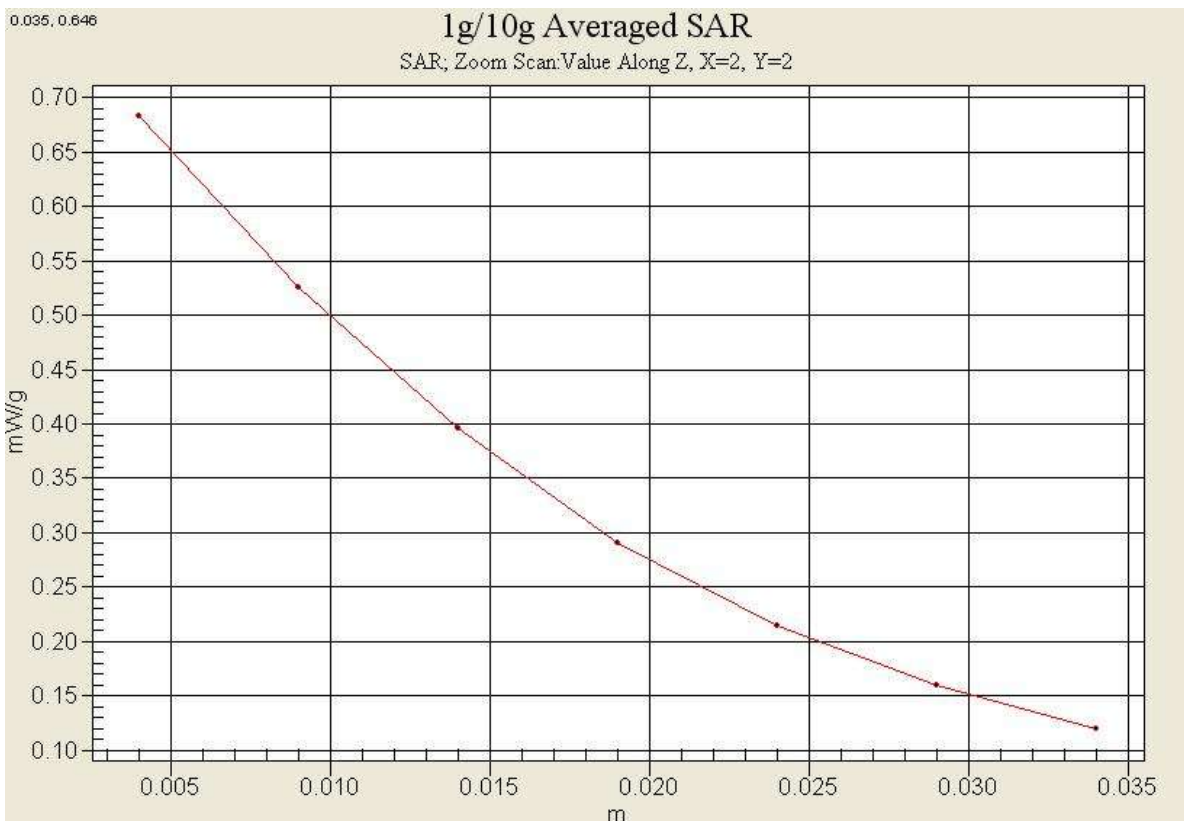
Body_ Rear190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.10 V/m; Power Drift = -0.165 dB

Peak SAR (extrapolated) = 0.825 W/kg

SAR(1 g) = 0.649 mW/g; SAR(10 g) = 0.475 mW/g

Maximum value of SAR (measured) = 0.683 mW/g



Test Laboratory: HCT CO., LTD
 EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
 Liquid Temperature: 21.6 °C
 Ambient Temperature: 21.8 °C
 Test Date: Apr. 15, 2013
 Plot No. 6

DUT: LG-E450j; Type: bar; Serial: #1

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:2.075
 Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.54 \text{ mho/m}$; $\epsilon_r = 52.3$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

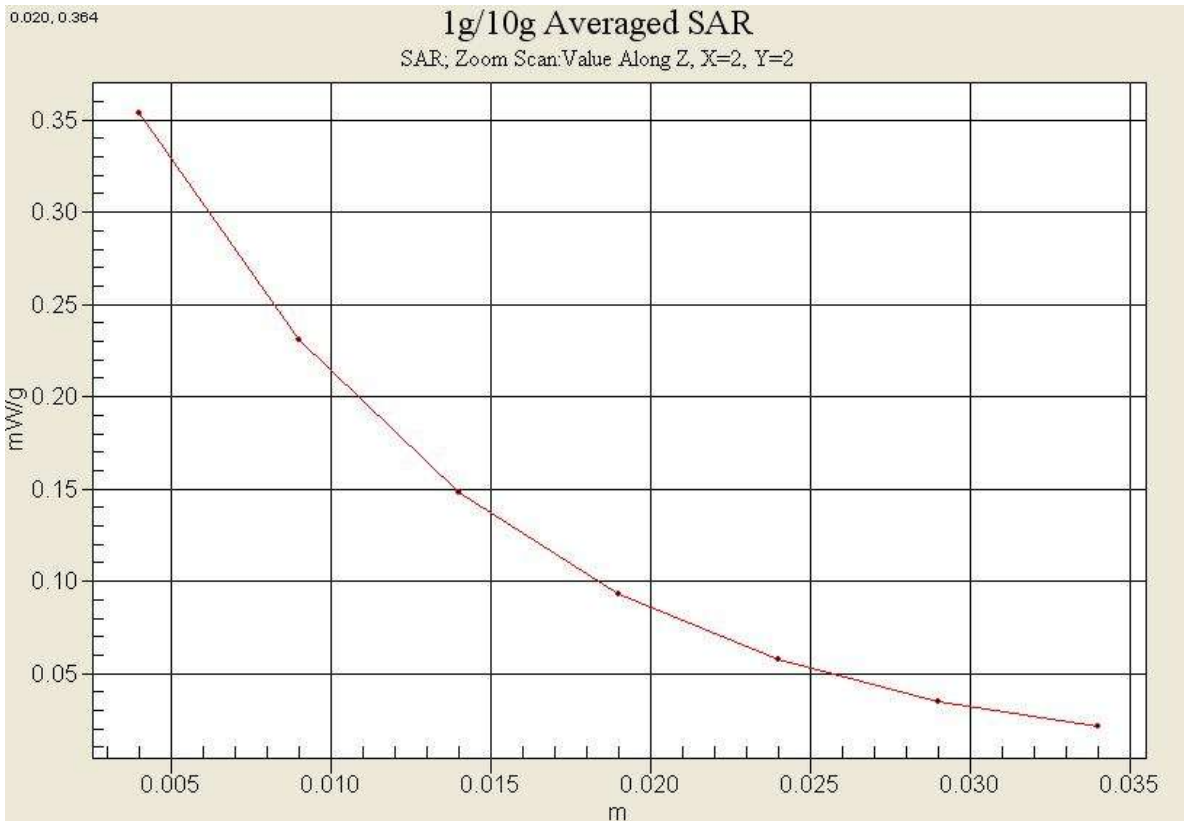
- Probe: ET3DV6 - SN1605; ConvF(4.64, 4.64, 4.64); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Body Rear 661 4tx/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
 Maximum value of SAR (interpolated) = 0.365 mW/g

Body Rear 661 4tx/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
 Reference Value = 6.29 V/m; Power Drift = 0.080 dB
 Peak SAR (extrapolated) = 0.502 W/kg

SAR(1 g) = 0.333 mW/g; SAR(10 g) = 0.207 mW/g

Maximum value of SAR (measured) = 0.354 mW/g



Test Laboratory: HCT CO., LTD
 EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
 Liquid Temperature: 21.6 °C
 Ambient Temperature: 21.8 °C
 Test Date: Apr. 15, 2013
 Plot No. 7

DUT: LG-E450j; Type: bar; Serial: #1

Communication System: WCDMA1900; Frequency: 1880 MHz; Duty Cycle: 1:1
 Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.54 \text{ mho/m}$; $\epsilon_r = 52.3$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ET3DV6 - SN1605; ConvF(4.64, 4.64, 4.64); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Body rear 9400/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
 Maximum value of SAR (interpolated) = 0.675 mW/g

Body rear 9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
 Reference Value = 9.25 V/m; Power Drift = 0.029 dB
 Peak SAR (extrapolated) = 0.926 W/kg

SAR(1 g) = 0.602 mW/g; SAR(10 g) = 0.370 mW/g
 Maximum value of SAR (measured) = 0.649 mW/g



Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature: 22.0 °C
Ambient Temperature: 22.2 °C
Test Date: Apr. 17, 2013
Plot No. 8

DUT: LG-E450j; Type: bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 53.7$; $\rho = 1000$ kg/m³

Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ET3DV6 - SN1605; ConvF(4.07, 4.07, 4.07); Calibrated: 2012-04-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2013-03-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Body Rear CH1/Area Scan (71x121x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.116 mW/g

Body Rear CH1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.22 V/m; Power Drift = -0.182 dB

Peak SAR (extrapolated) = 0.208 W/kg

SAR(1 g) = 0.097 mW/g; SAR(10 g) = 0.050 mW/g

Maximum value of SAR (measured) = 0.106 mW/g

