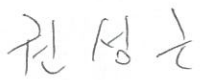





# SAR TEST REPORT

HCT CO., LTD

EUT Type:	850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN 2.4GHz and Hotspot	
FCC ID:	A3LGTI8552	
Model:	GT-I8552	
Date of Issue:	Mar. 08, 2013	
Test report No.:	HCTA1302FS05	
Test Laboratory:	<b>HCT CO., LTD.</b> 105-1, Jangam-ri, Majang-myeon, Icheon-si, Gyeonggi-do, Korea 467-811 TEL: +82 31 645 6300 FAX: +82 31 645 6401	
Applicant :	<b>SAMSUNG Electronics Co., Ltd.</b> 129, Samsung-ro, Yeongtong-gu, Suwon-City, Gyeonggi-do, 443-742 Republic of Korea	
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	 _____ Report prepared by : Sung-Kun Kwon Test Engineer of SAR Part	 _____ Approved by : Jae-Sang So Manager of SAR Part

---

# Table of Contents

---

<b>1. INTRODUCTION</b> .....	3
<b>2. TEST METHODOLOGY</b> .....	4
<b>3. DESCRIPTION OF DEVICE</b> .....	5
<b>4. DESCRIPTION OF TEST EQUIPMENT</b> .....	6
<b>5. SAR MEASUREMENT PROCEDURE</b> .....	1 3
<b>6. DESCRIPTION OF TEST POSITION</b> .....	1 5
<b>7. MEASUREMENT UNCERTAINTY</b> .....	1 7
<b>8. ANSI/ IEEE C95.1 - 1992 RF EXPOSURE LIMITS</b> .....	1 8
<b>9. SAR SYSTEM VALIDATION</b> .....	1 9
<b>10. SYSTEM VERIFICATION</b> .....	2 0
10.1 Tissue Verification .....	2 0
10.2 System Verification .....	2 1
10.3 System Verification Procedure .....	2 1
<b>11. RF CONDUCTED POWER MEASUREMENT</b> .....	2 2
11.1 GSM .....	2 2
11.2 WiFi .....	2 4
11. 3 Bluetooth Average Power .....	2 7
<b>12. SAR Test configuration &amp; Antenna Information</b> .....	2 8
<b>13. SAR TEST DATA SUMMARY</b> .....	2 9
13.1 Measurement Results (GSM850 Head SAR) .....	2 9
13.2 Measurement Results (GSM1900 Head SAR) .....	3 0
13.3 Measurement Results (802.11b/g/n Head SAR) .....	3 1
13.4 Measurement Results (GSM850 Hotspot SAR) .....	3 2
13.5 Measurement Results (GSM1900 Hotspot SAR) .....	3 3
13.6 Measurement Results (802.11b/g/n Hotspot SAR) .....	3 4
<b>14. SAR Summation Scenario</b> .....	3 5
<b>15. SAR Measurement Variability and Uncertainty</b> .....	3 8
<b>16. CONCLUSION</b> .....	3 9
<b>17. REFERENCES</b> .....	4 0
<b>Attachment 1. – SAR Test Plots</b> .....	4 1
<b>Attachment 2. – Dipole Verification Plots</b> .....	7 2
<b>Attachment 3. – Probe Calibration Data</b> .....	9 3
<b>Attachment 4. – Dipole Calibration Data</b> .....	1 0 5

# 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).**

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

where:

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

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

## **2. TEST METHODOLOGY**

---

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.

- . 447498 D01 General RF Exposure Guidance v05
- . 450824 D01 SAR Prob Cal and Ver Meas v01r01
- . 450824 D02 Dipole SAR Validation    Verification v01
- . 648474 D04 SAR Handsets Multi Xmitter and Ant v01
- . 865664 D01 SAR measurement 100 MHz to 6 GHz v01
- . 865664 D02 SAR Reporting v01
- . 941225 D01 SAR test for 3G devices v02

### 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:	850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN 2.4GHz and Hotspot					
FCC ID:	A3LGTI8552					
Model:	GT-I8552					
Trade Name	SAMSUNG Electronics Co., Ltd.					
Application Type	Certification					
Mode(s) of Operation	GSM850/ GSM1900/ 802.11b/g/n/BT v3.0(LE)					
Tx Frequency	824.20 - 848.80 MHz (GSM850) 1 850.20 – 1 909.80 MHz (GSM1900) 2 412- 2 462 MHz (802.11b/g/n)					
Rx Frequency	869.20 - 893.80 MHz (GSM850) 1 930.20 – 1 989.80 MHz (GSM1900) 2 412- 2 462 MHz (802.11b/g/n)					
Production Unit or Identical Prototype	Prototype					
Max SAR	Band	Tx Frequency (MHz)	Equipment Class	Reported 1g SAR (W/kg)		
				Head	Body-Worn	Hotspot
	GSM850	824.20 - 848.80	PCE	0.031	0.126	0.126
	GSM1900	1 850.20 – 1 909.80	PCE	0.157	0.557	0.557
	802.11b	2 412- 2 462	DTS	0.109	0.108	0.108
Bluetooth	2 402 - 2 480	DSS	-	-	-	
Simultaneous SAR per KDB 690783 D01				0.260	0.687	0.665
Date(s) of Tests	Feb. 19, 2013 ~ Jan. 20 2013 Mar 7, 2013					
Antenna Type	Integral Antenna					
GPRS	Multislot Class: 12, Mode Class: B					

## 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.3.1).

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.

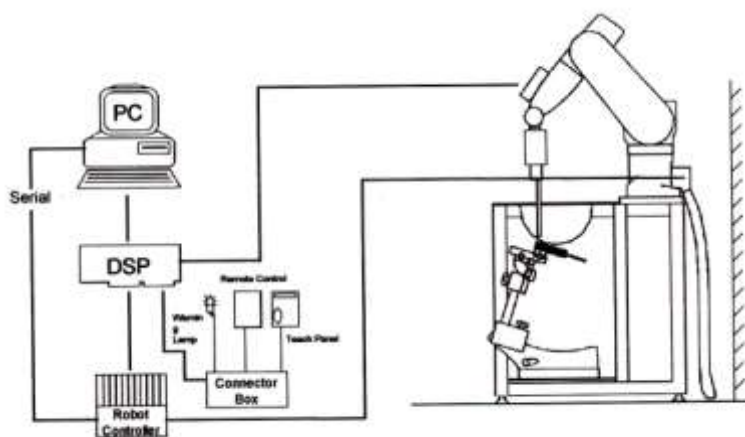


Figure 4.1 HCT SAR Lab. Test Measurement Set-up

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 DASY E-FIELD PROBE SYSTEM

### 4.2.1 EX3DV4 Probe Specification

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection System Built-in shielding against static charges
Calibration	In air from 10 MHz to 2.5 GHz In brain and muscle simulating tissue at Frequencies of 450 MHz, 900 MHz and 1.8 GHz (accuracy: 8 %)
Frequency	10 MHz to > 3 GHz; Linearity: $\pm 0.2$ dB (30 MHz to 3 GHz)
Directivity	$\pm 0.2$ dB in brain tissue (rotation around probe axis) $\pm 0.4$ dB in brain tissue (rotation normal probe axis)
Dynamic	5 $\mu$ W/g to > 100 mW/g;
Range Linearity:	$\pm 0.2$ dB
Surface Detection	$\pm 0.2$ mm repeatability in air and clear liquids over diffuse reflecting surfaces.
Dimensions	Overall length: 337 mm Tip length: 16 mm Body diameter: 12 mm Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application	General dissymmetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms



Figure 4.2 Photograph of the probe and the Phantom



Figure 4.3 EX3DV4 E-field Probe

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

## 4.3 PROBE CALIBRATION PROCESS

### 4.3.1 E-Probe Calibration

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

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

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

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

where:

$\Delta t$  = exposure time (30 seconds),

C = heat capacity of tissue (brain or muscle),

$\Delta T$  = temperature increase due to RF exposure.

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

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

where:

$\sigma$  = simulated tissue conductivity,

$\rho$  = Tissue density (1.25 g/cm<sup>3</sup> for brain tissue)

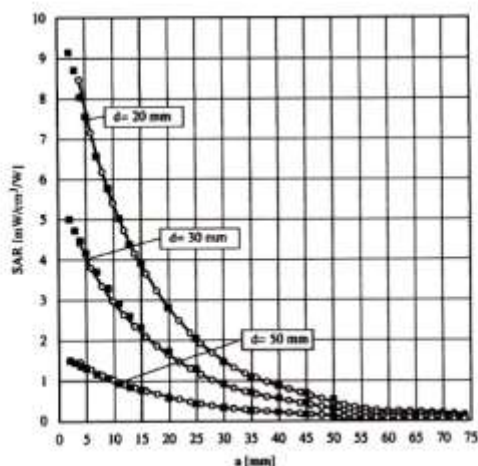


Figure 4.4 E-Field and Temperature measurements at 900 MHz

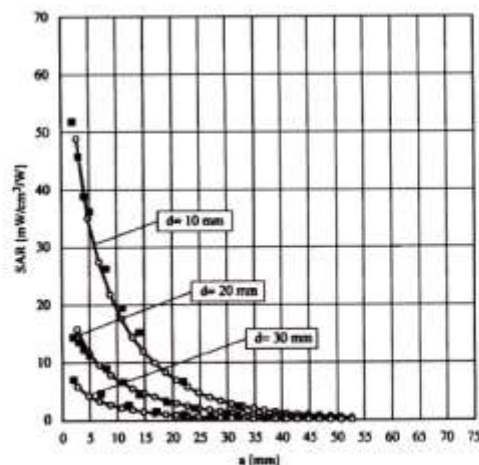


Figure 4.5 E-Field and temperature measurements at 1.8 GHz

### 4.3.2 Data Extrapolation

The DASY4 software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given like below;

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

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

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

E-field probes:

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

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

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

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

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

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

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

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

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

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

## 4.4 SAM Phantom

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



Figure 3.6 SAM Phantom

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)

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 4.6 MFP V5.1 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 produced infinite number of configurations. To produce the Worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.



Figure 4.7 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)											
	450		750		835		915		1 900		2 450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.2	51.7	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.4	1.0	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	57	47.2	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	0.2	0.0	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.2	0.1	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7

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 3.1 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	648	Apr. 27, 2012	Annual	Apr. 27, 2013
SPEAG	DAE4	869	Sep 18, 2012	Annual	Sep 18, 2013
SPEAG	E-Field Probe EX3DV4	3797	Nov. 22, 2012	Annual	Nov. 22, 2013
SPEAG	Verification Dipole D835V2	441	May 16, 2012	Annual	May 16, 2013
SPEAG	Verification Dipole D1900V2	5d032	July 20, 2012	Annual	July 20, 2013
SPEAG	Verification 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 778D	16072	Nov. 02, 2012	Annual	Nov. 02, 2013
Agilent	Base Station CMU200	110740	July 23, 2012	Annual	July 23, 2013
Agilent	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 ANALYZER	MY51110020	Jul. 31.2012	Annual	Jul. 31.2013
TESCOM	TC-3000C / BLUETOOTH	3000C000276	Jul. 11, 2012	Annual	Jul. 11, 2013

### NOTE:

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

2. CBT(Calibrating Before Testing). Prior to testing, the dielectric probe kit was calibrated via the network analyzer, with the specified procedure(calibrated in pure water) and calibration kit(standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Agilent

## 5. SAR MEASUREMENT PROCEDURE

The evaluation was performed with the following procedure:

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

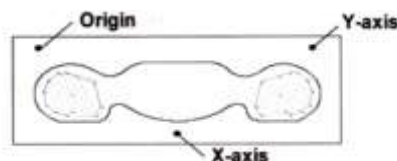


Figure 5.1 SAR Measurement Point in Area Scan

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

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

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

## 6. DESCRIPTION OF TEST POSITION

### 6.1 HEAD POSITION

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

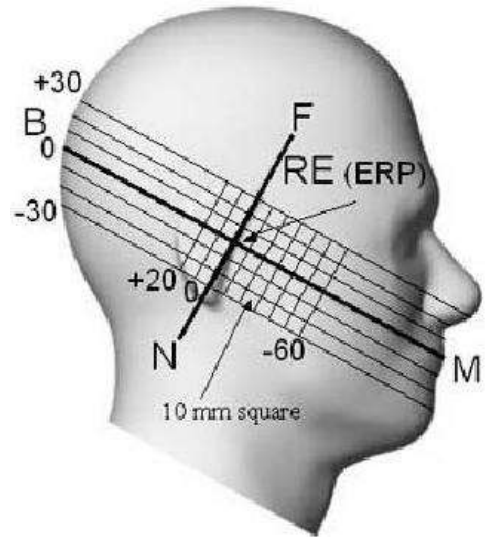


Figure 6.1 Side view of the phantom

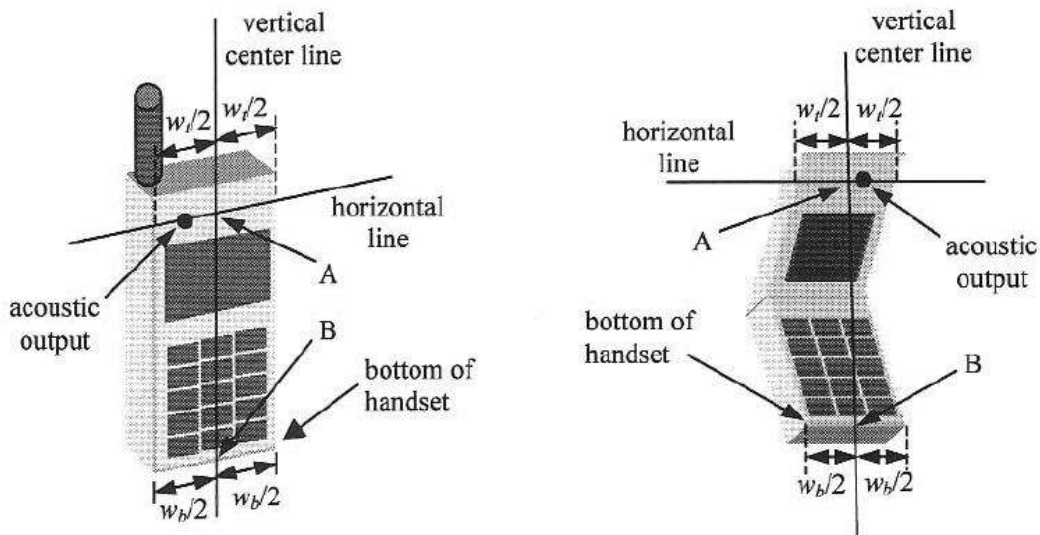


Figure 6.2 Handset vertical and horizontal reference lines

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

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

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

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

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

"See the Test SET-UP Photo"

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

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

## 7. MEASUREMENT UNCERTAINTY

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

Table 7.1 Uncertainty (800 MHz- 2450 MHz)

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

HUMAN EXPOSURE	UNCONTROLLED ENVIRONMENT 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 Validation Summary**

SAR Dasy System 3											
Probe	Tissue Type	Freq. [MHz]	CW Validation				Modulated Validations				
			Date	Dielectric Parameters			Data	Mod. Type	Dielectric Parameters		
				Measured ( $\epsilon_r$ )	Measured ( $\sigma_r$ )	Result			Measured ( $\epsilon_r$ )	Measured ( $\sigma_r$ )	Result
3797	Head	835	Dec.20,2012	40.4	0.92	Pass	Dec.20,2012	GMSK	40.4	0.92	Pass
3797	Head	1900	Dec.20,2012	39.8	1.40	Pass	Dec.20,2012	GMSK	39.8	1.40	Pass
3797	Head	2450	Dec.20,2012	38.1	1.83	Pass	Dec.20,2012	OFDM	38.1	1.83	Pass
3797	Body	835	Dec.17,2012	56.9	0.98	Pass	Dec.17,2012	GMSK	56.9	0.98	Pass
3797	Body	1900	Dec.17,2012	51.4	1.53	Pass	Dec.17,2012	GMSK	51.4	1.53	Pass
3797	Body	2450	Dec.17,2012	52.8	1.96	Pass	Dec.17,2012	OFDM	52.8	1.96	Pass

## 10. SYSTEM VERIFICATION

### 10.1 Tissue Verification

Freq. [MHz]	Date	Probe	Dipole	Liquid	Liquid Temp. [°C]	Parameters	Target Value	Measured Value	Deviation [%]	Limit [%]
835	Feb.19 2013	3797	441	Head	21.2	$\epsilon_r$	41.5	40.5	-2.41	$\pm 5$
						$\sigma$	0.90	0.919	2.11	$\pm 5$
	21.4				$\epsilon_r$	41.5	42.8	-3.04	$\pm 5$	
					$\sigma$	0.90	0.897	0.33	$\pm 5$	
835	Feb.19 2013		Body	21.2	$\epsilon_r$	55.2	56.9	3.08	$\pm 5$	
					$\sigma$	0.97	0.986	1.65	$\pm 5$	
1 900	Feb.20 2013		5d032	Head	20.9	$\epsilon_r$	40.0	40.9	2.25	$\pm 5$
						$\sigma$	1.40	1.37	-2.14	$\pm 5$
	21.3				$\epsilon_r$	40.0	41.4	-3.38	$\pm 5$	
					$\sigma$	1.40	1.39	0.72	$\pm 5$	
1 900	Feb.20 2013			Body	20.9	$\epsilon_r$	53.3	52.2	-2.06	$\pm 5$
						$\sigma$	1.52	1.55	1.97	$\pm 5$
	21.6	$\epsilon_r$			53.3	53.5	-0.37	$\pm 5$		
		$\sigma$			1.52	1.49	2.01	$\pm 5$		
2 450	Feb.19. 2013	743	Head	21.2	$\epsilon_r$	39.2	38.0	-3.06	$\pm 5$	
					$\sigma$	1.80	1.83	1.67	$\pm 5$	
2 450	Feb.19 2013		Body	21.2	$\epsilon_r$	52.7	53.6	1.71	$\pm 5$	
					$\sigma$	1.95	1.98	1.54	$\pm 5$	
	Mar.7 2013		Body	21.3	$\epsilon_r$	52.7	52.1	1.15	$\pm 5$	
					$\sigma$	1.95	1.89	3.17	$\pm 5$	

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

## 10.2 System Verification

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

Freq. [MHz]	Date	Probe (SN)	Liquid	Amb. Temp. [°C]	Liquid Temp. [°C]	1 W Target SAR <sub>1g</sub> (SPEAG) (mW/g)	Measured SAR <sub>1g</sub> (mW/g)	1 W Normalized SAR <sub>1g</sub> (mW/g)	Deviation [%]	Limit [%]
835	Feb. 19 2013	3797	Head	21.4	21.2	9.43	0.988	9.88	-4.55	$\pm 10$
835	Mar.7, 2013		Head	21.6	21.4	9.43	0.932	9.32	1.18	$\pm 10$
835	Feb. 19 2013		Body	21.4	21.2	9.50	0.963	9.63	-1.35	$\pm 10$
1 900	Feb. 20 2013		Head	21.1	20.9	39.0	3.77	37.7	3.45	$\pm 10$
1 900	Mar.7, 2013		Head	21.5	21.3	39.0	3.91	39.1	-0.26	$\pm 10$
1 900	Feb. 20 2013		Body	21.1	20.9	39.9	4.08	40.8	-2.21	$\pm 10$
1 900	Mar.7, 2013		Body	21.8	21.6	39.9	4.07	40.7	-1.97	$\pm 10$
2 450	Feb. 19, 2013		Head	21.4	21.2	52.7	5.39	53.9	-2.23	$\pm 10$
2 450	Feb.19, 2013		Body	21.4	21.2	51.2	5.28	52.8	-3.03	$\pm 10$
2 450	Mar.7, 2013		Body	21.5	21.3	51.2	5.16	51.6	-0.78	$\pm 10$

## 10.3 System Verification Procedure

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

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

Note;

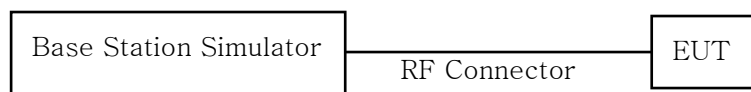
SAR Verification was performed according to the FCC KDB 450824.

## **11. RF CONDUCTED POWER MEASUREMENT**

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

### **11.1 GSM**

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



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

- GSM voice: Head SAR
- GPRS Multi-slots : GPRS850 Body SAR with GPRS Multi-slot Class12, 4Tx with CS 1 (GMSK)  
GPRS1900 Body SAR with GPRS Multi-slot Class12, 2Tx with CS 1 (GMSK)

#### **Note;**

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

GSM850

Target Power : 32.3 dBm

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

GSM1900

Target Power : 29.7 dBm

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

GSM Conducted output powers (Burst-Average)

Band	Channel	GSM	GPRS(GMSK) Data – CS1			
		Voice (dBm)	GPRS 1 TX Slot (dBm)	GPRS 2 TX Slot (dBm)	GPRS 3 TX Slot (dBm)	GPRS 4 TX Slot (dBm)
GSM 850	128	32.24	32.23	29.33	27.51	26.33
	190	32.31	32.31	29.41	27.59	26.41
	251	32.37	32.36	29.50	27.70	26.52
GSM 1900	512	29.62	29.63	26.74	24.95	23.60
	661	29.69	29.68	26.81	25.02	23.67
	810	29.73	29.71	26.87	25.07	23.72

GSM Conducted output powers (Frame-Average)

Band	Channel	GSM	GPRS Data			
		Voice (dBm)	GPRS 1 TX Slot (dBm)	GPRS 2 TX Slot (dBm)	GPRS 3 TX Slot (dBm)	GPRS 4 TX Slot (dBm)
GSM 850	128	23.21	23.2	23.31	23.25	23.32
	190	23.28	23.28	23.39	23.33	23.40
	251	23.34	23.33	23.48	23.44	23.51
GSM 1900	512	20.59	20.6	20.72	20.69	20.59
	661	20.66	20.65	20.79	20.76	20.66
	810	20.7	20.68	20.85	20.81	20.71

**Note:**

Time slot average factor is as follows:

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

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

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

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

## 11.2 WiFi

### 11.2.1 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"		
				§15.247 802.11b	802.11g	UNII
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

2.4GHz

802.11b : 16 dBm

802.11g : 13 dBm

802.11n : 11 dBm

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

**■ 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	15.47	30
		2 Mbps	15.40	30
		5.5 Mbps	15.45	30
		11 Mbps	15.41	30
2437	6	1 Mbps	15.57	30
		2 Mbps	15.58	30
		5.5 Mbps	15.77	30
		11 Mbps	15.66	30
2462	11	1 Mbps	15.60	30
		2 Mbps	15.72	30
		5.5 Mbps	15.79	30
		11 Mbps	15.65	30

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

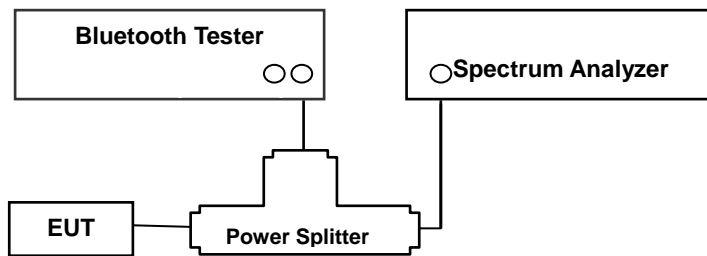
802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6 Mbps	12.70	30
		9 Mbps	12.78	30
		12 Mbps	12.73	30
		18 Mbps	12.75	30
		24 Mbps	12.86	30
		36 Mbps	12.79	30
		48 Mbps	11.54	30
		54 Mbps	11.49	30
2437	6	6 Mbps	13.20	30
		9 Mbps	13.23	30
		12 Mbps	13.23	30
		18 Mbps	13.22	30
		24 Mbps	12.97	30
		36 Mbps	12.84	30
		48 Mbps	11.59	30
		54 Mbps	11.52	30
2462	11	6 Mbps	12.86	30
		9 Mbps	12.86	30
		12 Mbps	12.83	30
		18 Mbps	12.78	30
		24 Mbps	13.01	30
		36 Mbps	12.93	30
		48 Mbps	11.69	30
		54 Mbps	11.50	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	12.70	30
		13 Mbps	12.78	30
		19.5 Mbps	12.73	30
		26 Mbps	12.75	30
		39 Mbps	12.86	30
		52 Mbps	12.79	30
		58.5 Mbps	11.54	30
		65 Mbps	11.49	30
2437	6	6.5 Mbps	13.20	30
		13 Mbps	13.23	30
		19.5 Mbps	13.23	30
		26 Mbps	13.22	30
		39 Mbps	12.97	30
		52 Mbps	12.84	30
		58.5 Mbps	11.59	30
		65 Mbps	11.52	30
2462	11	6.5 Mbps	12.86	30
		13 Mbps	12.86	30
		19.5 Mbps	12.83	30
		26 Mbps	12.78	30
		39 Mbps	13.01	30
		52 Mbps	12.93	30
		58.5 Mbps	11.69	30
		65 Mbps	11.50	30

## 11. 3 Bluetooth Average Power

### Test Configuration



### TEST PROCEDURE

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

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

Model	Channel	Frequency (MHz)	Output Power (dBm)		
			GFSK	8DPSK	$\pi/4$ DQPSK
GT-I8552	0	2402	7.41	4.53	4.54
	39	2440	7.81	5.31	5.32
	78	2480	7.55	5.28	5.28

Target power: 7.5 dBm

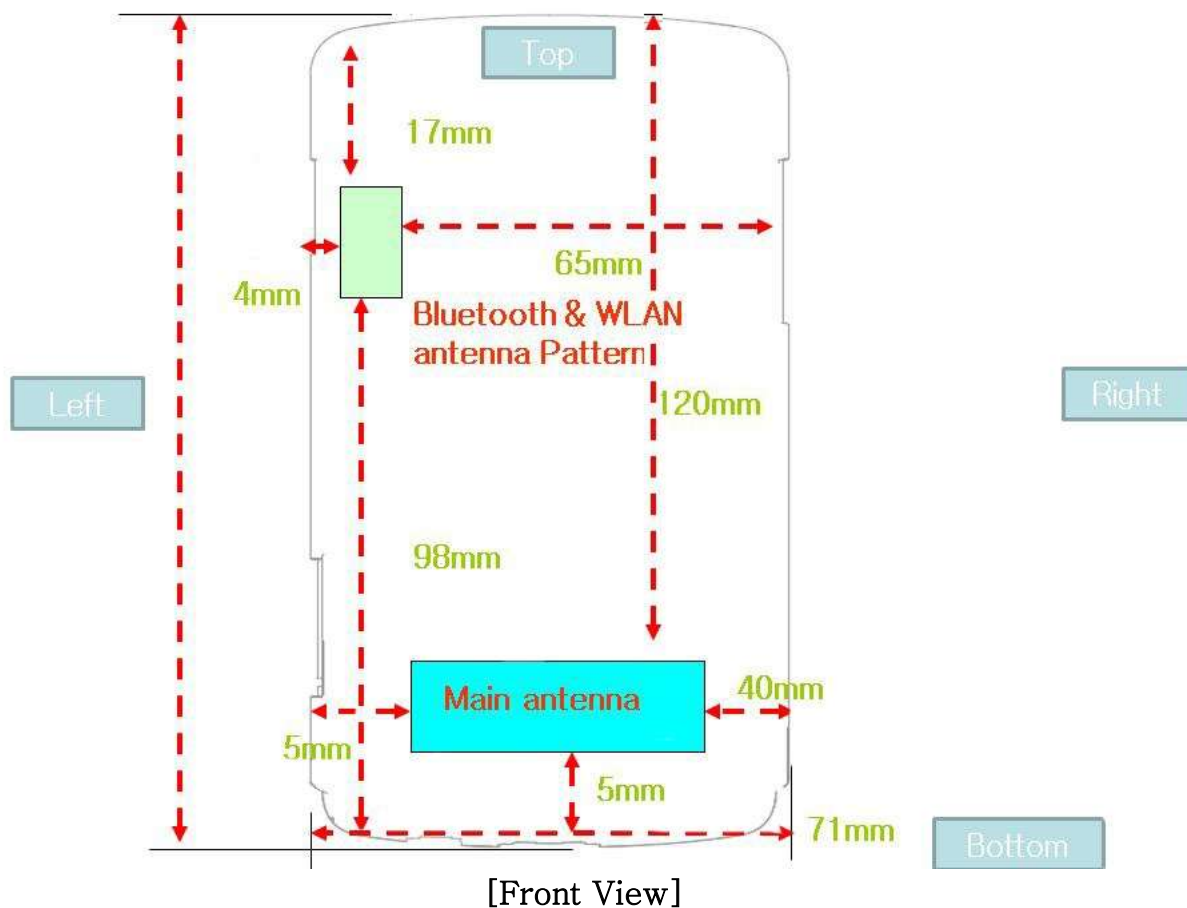
Power Tolerance: - 1.5dB/ + 0.5dB

## 12. SAR Test configuration & Antenna Information

Mode	Back	Front	Left	Right	Bottom	Top
850 GPRS	Yes	Yes	Yes	No	Yes	No
1900 GPRS	Yes	Yes	Yes	No	Yes	No
2.4 GHz WLAN	Yes	Yes	Yes	No	No	Yes

### 12.1 Antenna and Device Information

\* Distance between Bluetooth antenna and edge



## 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	32.31	0.152	Standard	Left Ear	0.028	0.031	1
			32.31	0.023	Standard	Left Tilt 15°	0.019	0.021	2
			32.31	0.133	Standard	Right Ear	0.020	0.022	3
			32.31	0.087	Standard	Right Tilt 15°	0.015	0.017	4
<b>ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population</b>						<b>Head 1.6 W/kg (mW/g) Averaged over 1 gram</b>			

#### NOTES:

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

## 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)	GSM1900	29.69	-0.073	Standard	Left Ear	0.14	0.157	5
			29.69	-0.063	Standard	Left Ear	0.081	0.091	6
			29.69	0.124	Standard	Left Ear	0.134	0.151	7
			29.69	0.060	Standard	Left Tilt 15°	0.084	0.094	8
<b>ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population</b>						<b>Head 1.6 W/kg (mW/g) Averaged over 1 gram</b>			

### NOTES:

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



## 13.4 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	26.41	0.000	Rear	1 cm	0.113	0.126	13
			26.41	-0.145	Front	1 cm	0.056	0.063	14
			26.41	0.133	Left	1 cm	0.075	0.084	15
			26.41	0.076	Bottom	1 cm	0.030	0.034	16
<b>ANSI/ IEEE C95.1 - 1992– Safety Limit</b> <b>Spatial Peak</b> <b>Uncontrolled Exposure/ General Population</b>						<b>Body</b> <b>1.6 W/kg (mW/g)</b> <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 Battery Type  Standard  Extended  Slim  
Batteries are fully charged for all readings.
- 6 Test Signal Call Mode  Manual Test cord  Base Station Simulator
- 7 Test Configuration  With Holster  Without Holster
- 8 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.

## 13.5 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								
1 880.0	661 (Mid)	GPRS 2Tx	26.81	-0.136	Rear	1 cm	0.498	0.557	17
			26.81	0.158	Front	1 cm	0.299	0.335	18
			26.81	0.106	Left	1 cm	0.098	0.110	19
			26.81	-0.054	Bottom	1 cm	0.310	0.347	20
<b>ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population</b>						<b>Body 1.6 W/kg (mW/g) Averaged over 1 gram</b>			

### NOTES:

- 1 The test data reported are the worst-case SAR value with the antenna-body position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
- 2 All modes of operation were investigated and the worst-case are reported.
- 3 Measured Depth of Simulating Tissue is 15.0 cm ± 0.2 cm.
- 4 Tissue parameters and temperatures are listed on the SAR plot.
- 5 Battery Type                     Standard                     Extended                     Slim  
Batteries are fully charged for all readings.
- 6 Test Signal Call Mode         Manual Test cord             Base Station Simulator
- 7 Test Configuration             With Holster                     Without Holster
- 8 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.

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

Frequency		Modulation	Conducted Power (dBm)	Power Drift (dB)	Configuration	Data Rate	Separation Distance	Measured SAR(mW/g)	Scaled SAR(mW/g)	Plot No.
MHz	Channel									
2 462	11(High)	802.11b	15.60	0.173	Rear	1Mbps	1 cm	0.088	0.108	21
			15.60	-0.162	Front	1Mbps	1 cm	0.003	0.004	22
			15.60	0.023	Left	1Mbps	1 cm	0.050	0.062	23
			15.60	0.176	Top	1Mbps	1 cm	0.004	0.005	24
<b>ANSI/ IEEE C95.1 - 1992– Safety Limit</b> <b>Spatial Peak</b> <b>Uncontrolled Exposure/ General Population</b>							<b>Body</b> <b>1.6 W/kg (mW/g)</b> <small>Averaged over 1 gram</small>			

### 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.

## 14. SAR Summation Scenario

	Position	Applicable Combination
Simultaneous Transmission	Head	GSM850 Voice + 2.4 GHz WiFi
		GSM1900 Voice + 2.4 GHz WiFi
	Body-worn	GSM850 Voice + 2.4 GHz WiFi
		GSM1900 Voice + 2.4 GHz WiFi
		GSM850 Voice + 2.4 GHz Bluetooth
		GSM1900 Voice + 2.4 GHz Bluetooth
	Hotspot	GSM850 Data + 2.4 GHz WiFi
		GSM1900 Data + 2.4 GHz WiFi
* BT and WLAN are not simultaneous transmission.		

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

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

Mode	Frequency	Maximum Allowed Power	Separatuin Distance	Estimated SAR
	[MHz]	[mW]	[mm]	[W/kg]
Bluetooth(Body)	2440	6	10	0.13

Note: Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission.

**Simultaneous Transmission Summation for Held to Ear**

Simultaneous TX	configuration	GSM850 Scaled SAR(W/kg)	2.4 GHz WIFI Scaled SAR (W/kg)	$\Sigma$ SAR (W/kg)	Simultaneous TX	configuration	GSM1900 Scaled SAR(W/kg)	2.4 GHz WIFI Scaled SAR (W/kg)	$\Sigma$ SAR (W/kg)
Head SAR	Left Cheek	0.031	0.002	0.033	Head SAR	Left Cheek	0.157	0.002	0.159
	Left Tilt	0.021	0.017	0.038		Left Tilt	0.091	0.017	0.108
	Right Cheek	0.022	0.109	0.131		Right Cheek	0.151	0.109	0.260
	Right Tilt	0.017	0.030	0.047		Right Tilt	0.094	0.030	0.124

**Simultaneous Transmission Summation for Body-Worn (1.0 cm)**

Simultaneous TX	configuration	GSM850 Scaled SAR(W/kg)	2.4 GHz WIFI Scaled SAR (W/kg)	$\Sigma$ SAR (W/kg)	Simultaneous TX	configuration	GSM1900 Scaled SAR(W/kg)	2.4 GHz WIFI Scaled SAR (W/kg)	$\Sigma$ SAR (W/kg)
Body SAR	Rear	0.126	0.108	0.234	Body SAR	Rear	0.557	0.108	0.665
Simultaneous TX	configuration	GSM850 Scaled SAR(W/kg)	BT SAR (W/kg)	$\Sigma$ SAR (W/kg)	Simultaneous TX	configuration	GSM1900 Scaled SAR(W/kg)	BT SAR (W/kg)	$\Sigma$ SAR (W/kg)
Body SAR	Rear	0.126	0.13	0.256	Body SAR	Rear	0.557	0.13	0.687

**Simultaneous Transmission Summation for Hotspot (1.0 cm)**

Simultaneous TX	configuration	GPRS850 Scaled SAR(W/kg)	2.4GHz WIFI Scaled SAR (W/kg)	$\Sigma$ SAR (W/kg)	Simultaneous TX	configuration	GPRS1900 Scaled SAR(W/kg)	2.4GHz WIFI Scaled SAR (W/kg)	$\Sigma$ SAR (W/kg)
Body SAR	Rear	0.126	0.108	0.234	Body SAR	Rear	0.557	0.108	0.665
	Front	0.063	0.004	0.067		Front	0.335	0.004	0.339
	Left	0.084	0.062	0.146		Left	0.110	0.062	0.172
	Right	-	-	-		Right	-	-	-
	Bottom	0.034	-	0.034		Bottom	0.347	-	0.347
	Top	-	0.005	0.005		Top	-	0.005	0.005

**Note;**

- **Body-Worn SAR** : Although body-worn accessory conditions are typically for voice configurations, the GPRS slot frame averaged output power was more conservative and was included for the body-worn accessory SAR assessment.
- The EUT front body-worn configuration is provided to cover any potential accessory that will position the EUT in this manner.

## 14.1 Simultaneous Transmission Conclusion

The above numerical summed SAR was below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit. No volumetric SAR summation is required per FCC KDB Publication 648474.

The above tables represent the worst-case simultaneous transmission scenarios possibility with this device.

Per FCC KDB 447498 D01v05, Bluetooth SAR were not required based on the maximum conducted power and the Bluetooth antenna to user separation distance.

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

Mode	Frequency	Maximum Allowed Power	Separatuin Distance	≤ 3.0
	[MHz]	[mW]	[mm]	
Bluetooth(Body)	2440	6	10	0.9

## 15. SAR Measurement Variability and Uncertainty

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

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

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

### **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.

※ Not Applicable to this Test

## 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.

## 17. REFERENCES

---

- [1] Federal Communications Commission, OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields, July 2001.
- [2] IEEE Standards Coordinating Committee 34 – IEEE Std. 1528-2003, IEE Recommended Practice or Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body from Wireless Communications Devices.
- [3] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radio frequency Radiation, Aug. 1996.
- [4] ANSI/IEEE C95.1 - 1991, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300 kHz to 100 GHz, New York: IEEE, Aug. 1992
- [5] ANSI/IEEE C95.3 - 1991, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, New York: IEEE, 1992.
- [6] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for Radio Frequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.
- [7] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.
- [8] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. 120-124.
- [9] K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.
- [10] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.
- [11] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Head Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.
- [12] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300 MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.
- [13] G. Hartsgrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectro magnetics, Canada: 1987, pp. 29-36.
- [14] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.
- [15] W. Gander, Computer mathematick, Birkhaeuser, Basel, 1992.
- [16] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Receptions in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.
- [17] Federal Communications Commission, OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields. Supplement C, Dec. 1997.
- [18] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.
- [19] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10 kHz-300 GHz, Jan. 1995.
- [20] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hochschule Zürich, Dosimetric Evaluation of the Cellular Phone.
- [21] SAR Evaluation of Handsets with Multiple Transmitters and Antennas #648474.
- [22] SAR Measurement Procedure for 802.11 a/b/g Transmitters #KDB 248227.

## Attachment 1. – SAR Test Plots

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.4 °C  
Ambient Temperature: 21.6 °C  
Test Date: Mar. 4 2013  
Plot No.: 1

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.898$  mho/m;  $\epsilon_r = 42.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn869; Calibrated: 2012-09-18
- Phantom: SAM 835/900 MHz; Type: SAM

GSM850 Left Touch 190/Area Scan (71x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.030 mW/g

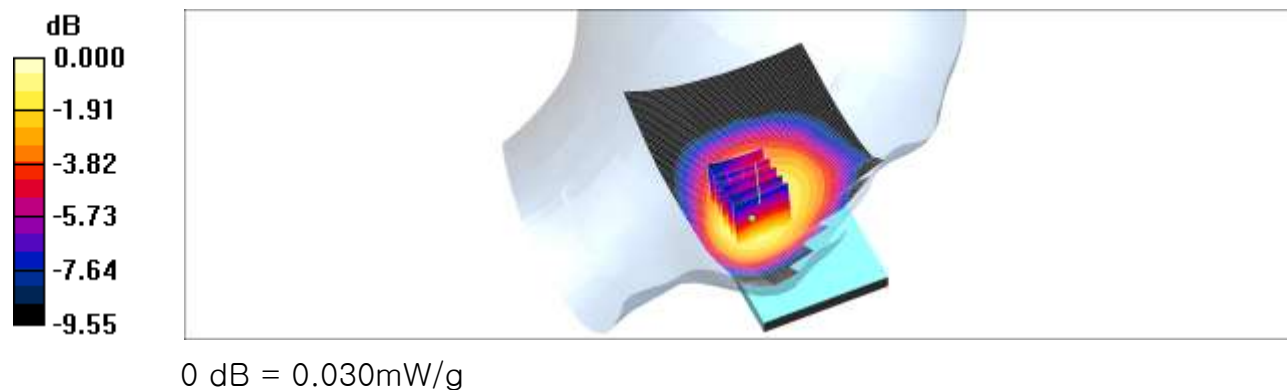
GSM850 Left Touch 190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.69 V/m; Power Drift = 0.152 dB

Peak SAR (extrapolated) = 0.038 W/kg

SAR(1 g) = 0.028 mW/g; SAR(10 g) = 0.021 mW/g

Maximum value of SAR (measured) = 0.030 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4 °C  
Test Date: Feb. 19 2013  
Plot No.: 2

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.92$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: SAM 835/900 MHz; Type: SAM

**GSM850 Left Tilt 190/Area Scan (71x111x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.019 mW/g

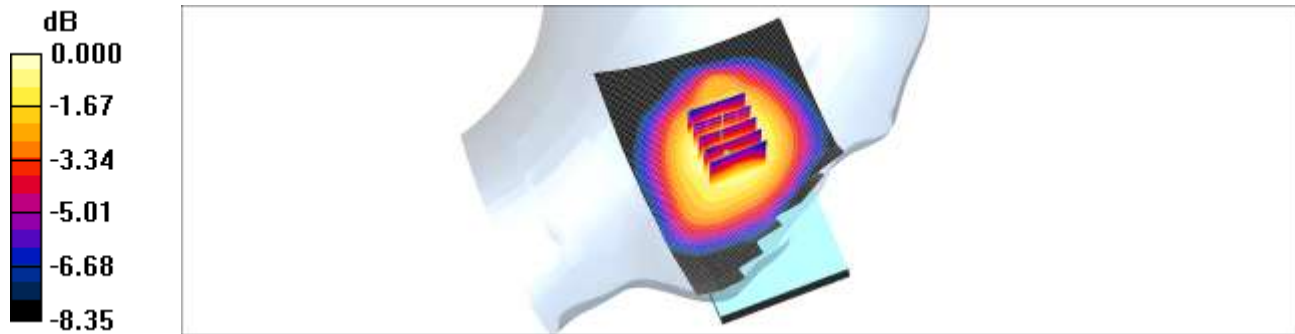
**GSM850 Left Tilt 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.29 V/m; Power Drift = 0.023 dB

Peak SAR (extrapolated) = 0.023 W/kg

**SAR(1 g) = 0.019 mW/g; SAR(10 g) = 0.015 mW/g**

Maximum value of SAR (measured) = 0.020 mW/g



0 dB = 0.020mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4°C  
Test Date: Feb. 19 2013  
Plot No.: 3

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.92$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: SAM 835/900 MHz; Type: SAM

**GSM850 Right Touch 190/Area Scan (71x111x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.020 mW/g

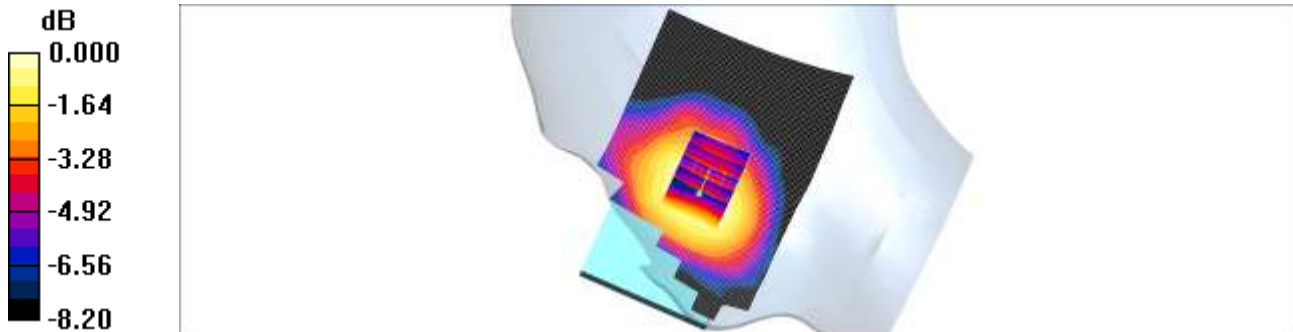
**GSM850 Right Touch 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.21 V/m; Power Drift = 0.133 dB

Peak SAR (extrapolated) = 0.026 W/kg

**SAR(1 g) = 0.020 mW/g; SAR(10 g) = 0.016 mW/g**

Maximum value of SAR (measured) = 0.021 mW/g



0 dB = 0.021mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4°C  
Test Date: Feb. 19 2013  
Plot No.: 4

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.92$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: SAM 835/900 MHz; Type: SAM

GSM850 right tilt 190/Area Scan (71x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.016 mW/g

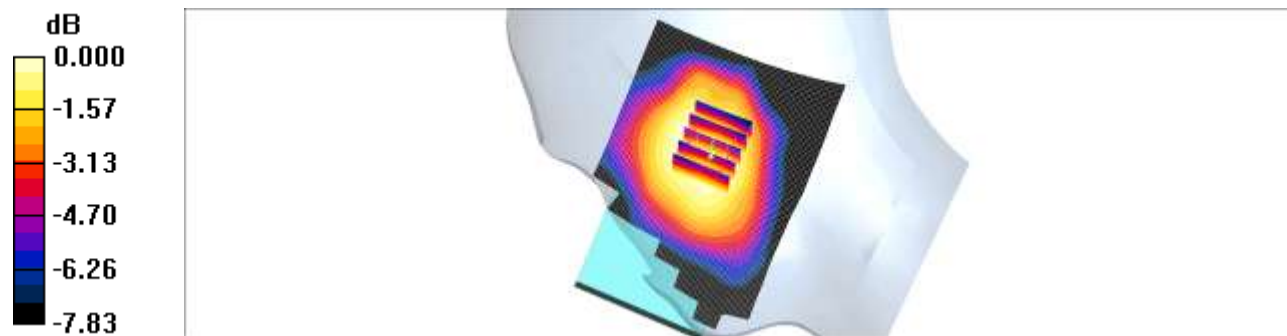
GSM850 right tilt 190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.94 V/m; Power Drift = 0.087 dB

Peak SAR (extrapolated) = 0.019 W/kg

SAR(1 g) = 0.015 mW/g; SAR(10 g) = 0.011 mW/g

Maximum value of SAR (measured) = 0.015 mW/g



0 dB = 0.015mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 20.9 °C  
Ambient Temperature: 21.1 °C  
Test Date: Feb. 20 2013  
Plot No.: 5

DUT: GT-I8552; Type: bar; Serial: FK-039-A

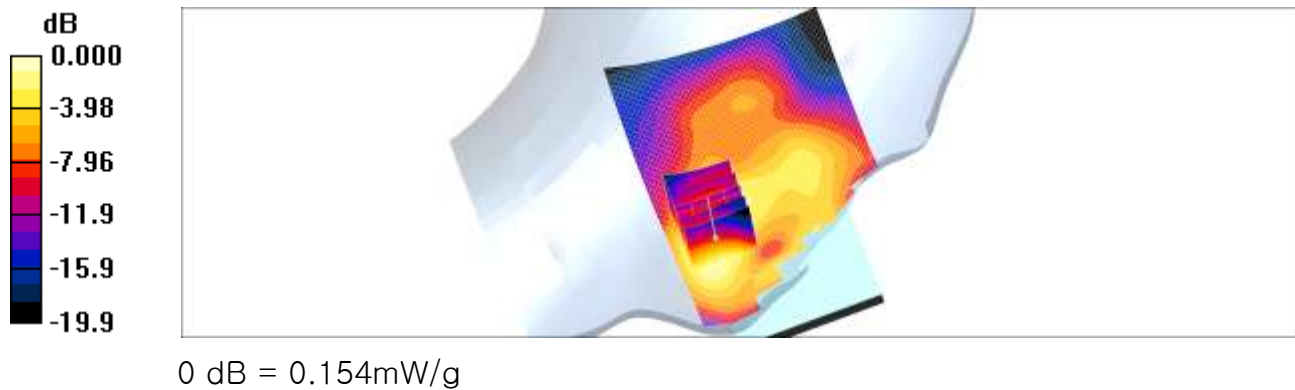
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.35$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: SAM 1800/1900 MHz; Type: SAM

GSM1900 Left Touch 661/Area Scan (71x111x1): Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.160 mW/g

GSM1900 Left Touch 661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 4.87 V/m; Power Drift = -0.073 dB  
Peak SAR (extrapolated) = 0.224 W/kg  
SAR(1 g) = 0.140 mW/g; SAR(10 g) = 0.082 mW/g  
Maximum value of SAR (measured) = 0.154 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 20.9 °C  
Ambient Temperature: 21.1 °C  
Test Date: Feb. 20 2013  
Plot No.: 6

DUT: GT-I8552; Type: bar; Serial: FK-039-A

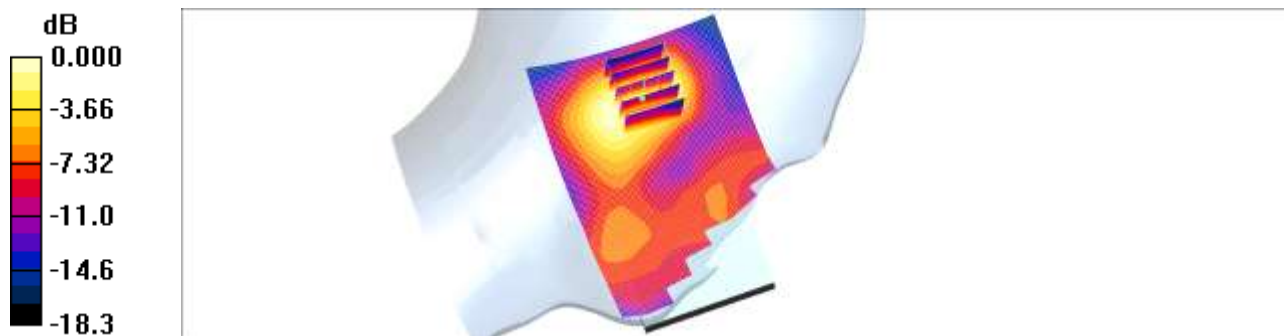
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.35$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: SAM 1800/1900 MHz; Type: SAM

**GSM1900 Left Tilt 661/Area Scan (71x111x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.091 mW/g

**GSM1900 Left Tilt 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 7.60 V/m; Power Drift = -0.063 dB  
Peak SAR (extrapolated) = 0.137 W/kg  
**SAR(1 g) = 0.081 mW/g; SAR(10 g) = 0.046 mW/g**  
Maximum value of SAR (measured) = 0.085 mW/g



0 dB = 0.085mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.3 °C  
Ambient Temperature: 21.5 °C  
Test Date: Mar. 4 2013  
Plot No.: 7

DUT: GT-I8552; Type: bar; Serial: FK-039-A

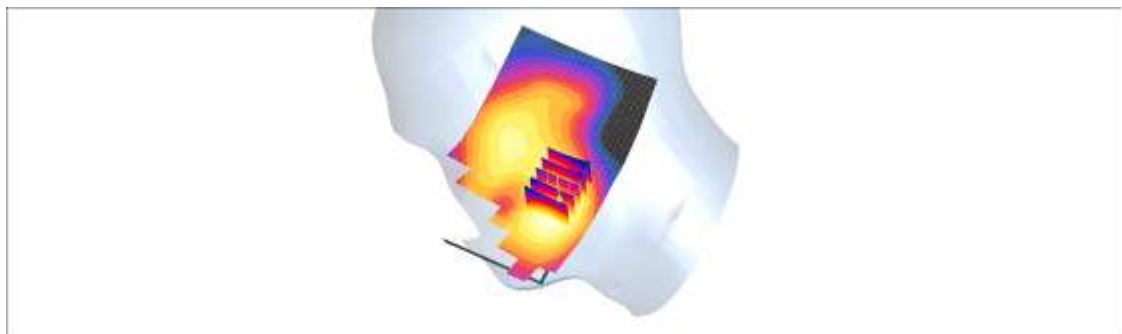
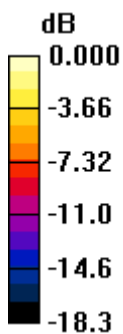
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.37$  mho/m;  $\epsilon_r = 41.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn869; Calibrated: 2012-09-18
- Phantom: SAM 1800/1900 MHz; Type: SAM

**GSM1900 Right Touch 661/Area Scan (71x111x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.150 mW/g

**GSM1900 Right Touch 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 4.21 V/m; Power Drift = 0.124 dB  
Peak SAR (extrapolated) = 0.222 W/kg  
**SAR(1 g) = 0.134 mW/g; SAR(10 g) = 0.080 mW/g**  
Maximum value of SAR (measured) = 0.145 mW/g



0 dB = 0.145mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 20.9 °C  
Ambient Temperature: 21.1 °C  
Test Date: Feb. 20 2013  
Plot No.: 8

DUT: GT-I8552; Type: bar; Serial: FK-039-A

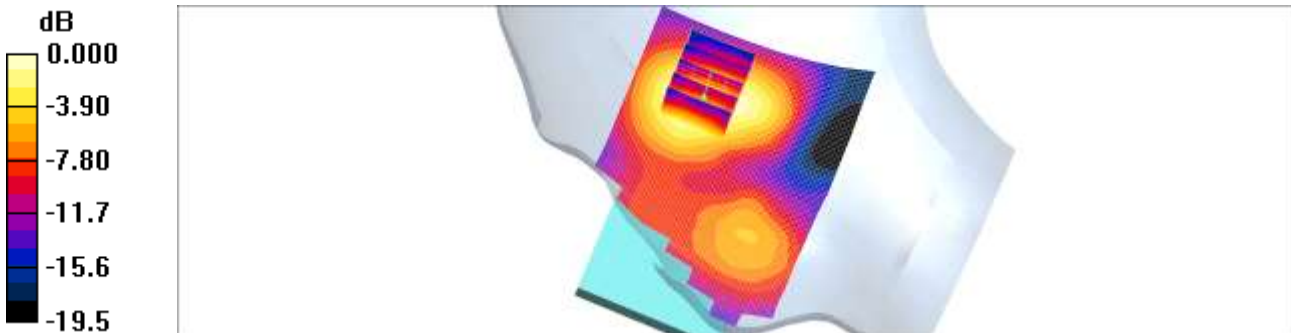
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3  
Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.35 \text{ mho/m}$ ;  $\epsilon_r = 40.9$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: SAM 1800/1900 MHz; Type: SAM

**GSM1900 Right Tilt 661/Area Scan (71x111x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.100 mW/g

**GSM1900 Right Tilt 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 6.83 V/m; Power Drift = 0.060 dB  
Peak SAR (extrapolated) = 0.137 W/kg  
**SAR(1 g) = 0.084 mW/g; SAR(10 g) = 0.050 mW/g**  
Maximum value of SAR (measured) = 0.089 mW/g



0 dB = 0.089mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4°C  
Test Date: Feb. 19 2013  
Plot No.: 9

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: 2450MHz FCC; Frequency: 2462 MHz;Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 1.85$  mho/m;  $\epsilon_r = 38$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

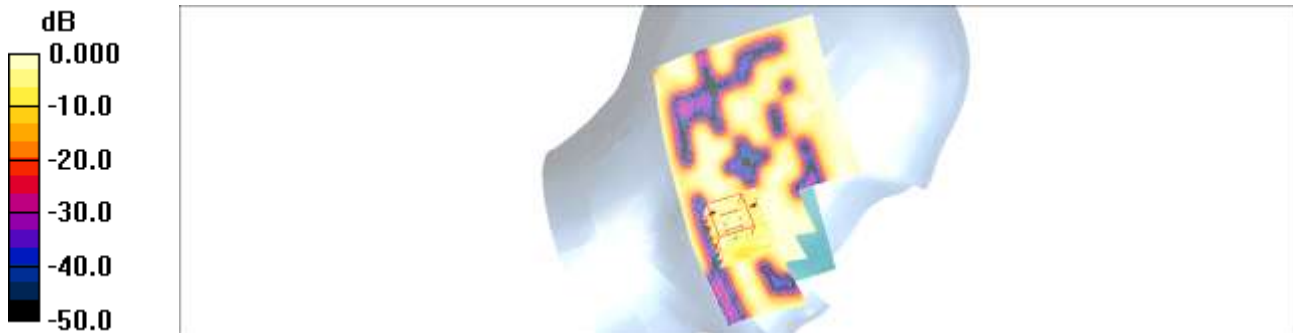
DASY4 Configuration:  
- Probe: EX3DV4 - SN3797; ConvF(6.76, 6.76, 6.76); Calibrated: 2012-11-22  
- Sensor-Surface: 4mm (Mechanical Surface Detection)  
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27  
- Phantom: 1800/1900 Phantom; Type: SAM

Left Touch 11ch 1Mbps/Area Scan (91x131x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.007 mW/g

Left Touch 11ch 1Mbps/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 0.438 V/m; Power Drift = 0.144 dB  
Peak SAR (extrapolated) = 0.006 W/kg  
SAR(1 g) = 0.00173 mW/g; SAR(10 g) = 0.000821 mW/g

Maximum value of SAR (measured) = 0.003 mW/g



0 dB = 0.003mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4 °C  
Test Date: Feb. 19 2013  
Plot No.: 10

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: 2450MHz FCC; Frequency: 2462 MHz; Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 1.85$  mho/m;  $\epsilon_r = 38$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

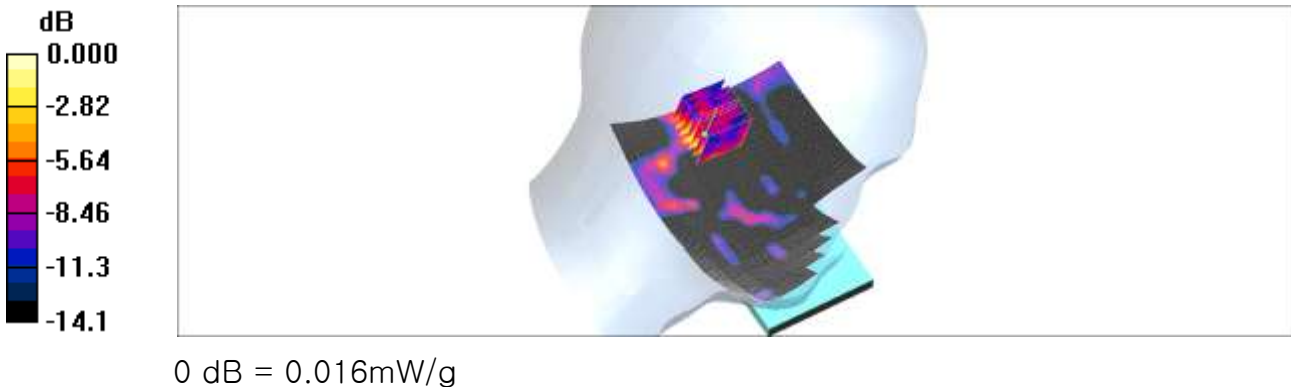
DASY4 Configuration:  
- Probe: EX3DV4 - SN3797; ConvF(6.76, 6.76, 6.76); Calibrated: 2012-11-22  
- Sensor-Surface: 4mm (Mechanical Surface Detection)  
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27  
- Phantom: 1800/1900 Phantom; Type: SAM

Left Tilt 11ch 1Mbps/Area Scan (101x131x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.010 mW/g

Left Tilt 11ch 1Mbps/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 1.87 V/m; Power Drift = 0.165 dB  
Peak SAR (extrapolated) = 0.029 W/kg  
**SAR(1 g) = 0.014 mW/g; SAR(10 g) = 0.0077 mW/g**

Maximum value of SAR (measured) = 0.016 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4°C  
Test Date: Feb. 19 2013  
Plot No.: 11

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: 2450MHz FCC; Frequency: 2462 MHz;Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 1.85$  mho/m;  $\epsilon_r = 38$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(6.76, 6.76, 6.76); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: 1800/1900 Phantom; Type: SAM

Right Touch 11ch 1Mbps/Area Scan (91x131x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.093 mW/g

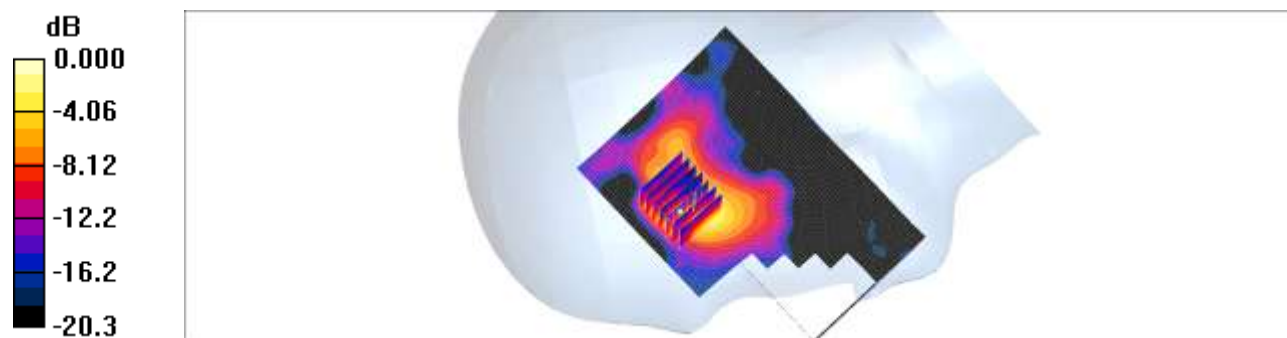
Right Touch 11ch 1Mbps/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.28 V/m; Power Drift = 0.162 dB

Peak SAR (extrapolated) = 0.226 W/kg

SAR(1 g) = 0.089 mW/g; SAR(10 g) = 0.038 mW/g

Maximum value of SAR (measured) = 0.105 mW/g



0 dB = 0.105mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4 °C  
Test Date: Feb. 19 2013  
Plot No.: 12

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: 2450MHz FCC; Frequency: 2462 MHz; Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 1.85$  mho/m;  $\epsilon_r = 38$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(6.76, 6.76, 6.76); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: 1800/1900 Phantom; Type: SAM

Right Tilt 11ch 1Mbps/Area Scan (91x131x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.027 mW/g

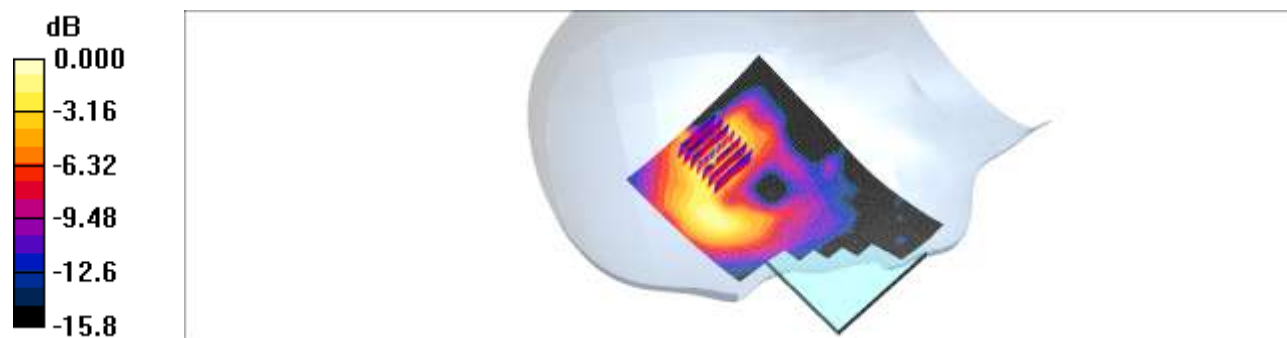
Right Tilt 11ch 1Mbps/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.91 V/m; Power Drift = 0.090 dB

Peak SAR (extrapolated) = 0.045 W/kg

SAR(1 g) = 0.024 mW/g; SAR(10 g) = 0.012 mW/g

Maximum value of SAR (measured) = 0.028 mW/g



0 dB = 0.028mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4°C  
Test Date: Feb. 19 2013  
Plot No.: 13

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:2.075  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.987$  mho/m;  $\epsilon_r = 56.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

**GSM850 Body Rear 190 4TX/Area Scan (111x61x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.118 mW/g

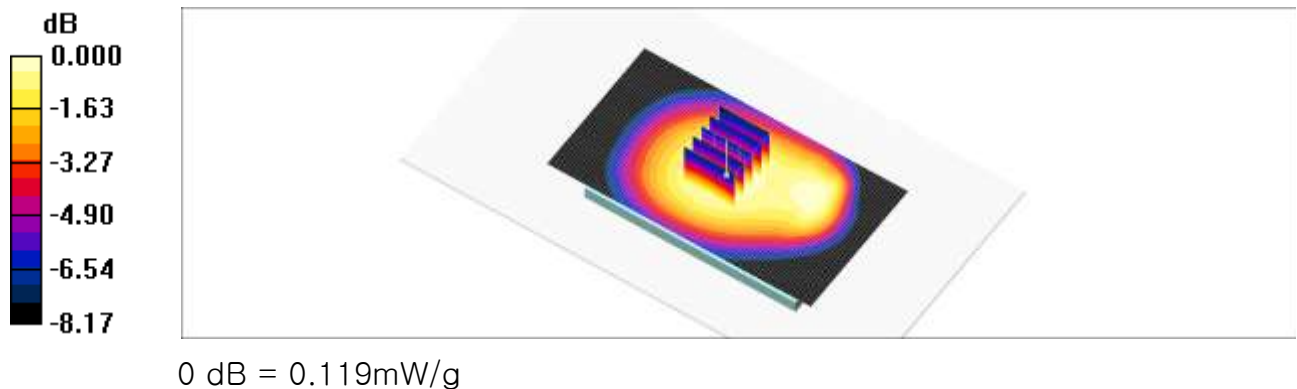
**GSM850 Body Rear 190 4TX/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.8 V/m; Power Drift = 0.000 dB

Peak SAR (extrapolated) = 0.144 W/kg

**SAR(1 g) = 0.113 mW/g; SAR(10 g) = 0.085 mW/g**

Maximum value of SAR (measured) = 0.119 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4°C  
Test Date: Feb. 19 2013  
Plot No.: 14

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:2.075  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.987$  mho/m;  $\epsilon_r = 56.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM850 Body Front 190 4TX/Area Scan (111x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.060 mW/g

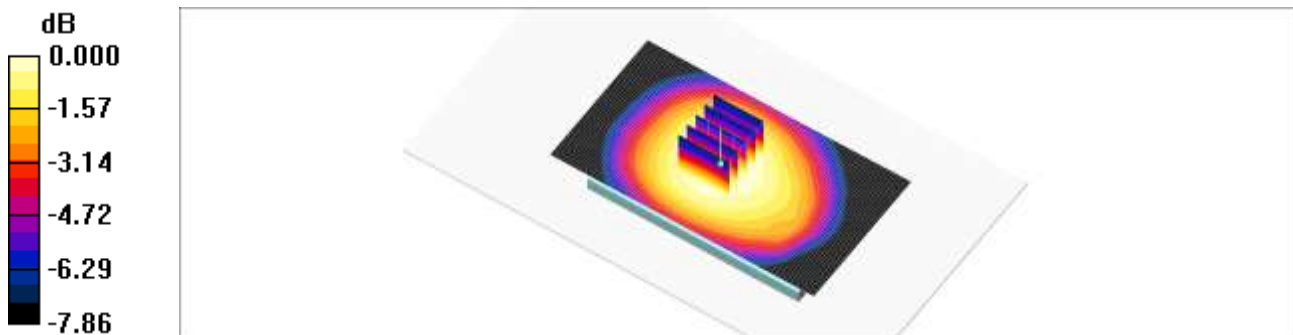
GSM850 Body Front 190 4TX/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 7.82 V/m; Power Drift = -0.145 dB

Peak SAR (extrapolated) = 0.071 W/kg

SAR(1 g) = 0.056 mW/g; SAR(10 g) = 0.042 mW/g

Maximum value of SAR (measured) = 0.058 mW/g



0 dB = 0.058mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4 °C  
Test Date: Feb. 19 2013  
Plot No.: 15

DUT: GT-I8552 Left; Type: bar; Serial: FK-039-A

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:2.075  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.987$  mho/m;  $\epsilon_r = 56.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM850 Body Left 190 4TX/Area Scan (111x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.081 mW/g

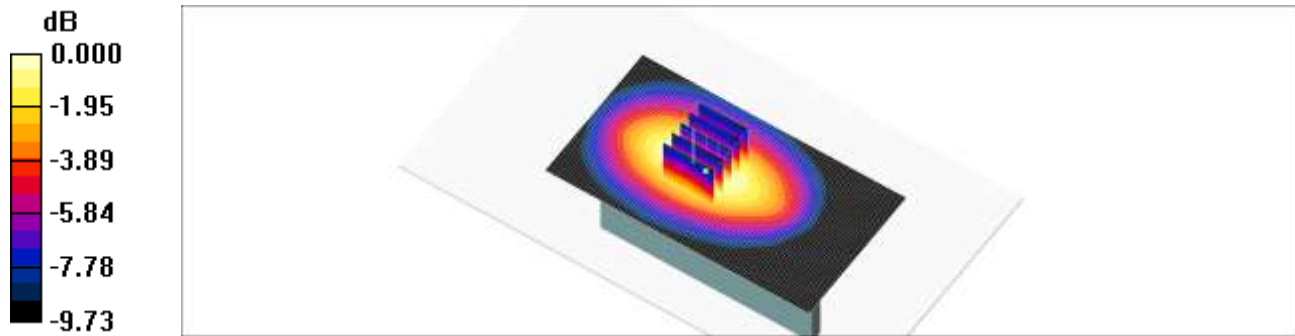
GSM850 Body Left 190 4TX/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.05 V/m; Power Drift = 0.133 dB

Peak SAR (extrapolated) = 0.107 W/kg

SAR(1 g) = 0.075 mW/g; SAR(10 g) = 0.051 mW/g

Maximum value of SAR (measured) = 0.080 mW/g



0 dB = 0.080mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4 °C  
Test Date: Feb. 19 2013  
Plot No.: 16

DUT: GT-I8552 Bottom; Type: bar; Serial: FK-039-A

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:2.075  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.987$  mho/m;  $\epsilon_r = 56.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM850 Body Bottom 190 4TX/Area Scan (61x71x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.035 mW/g

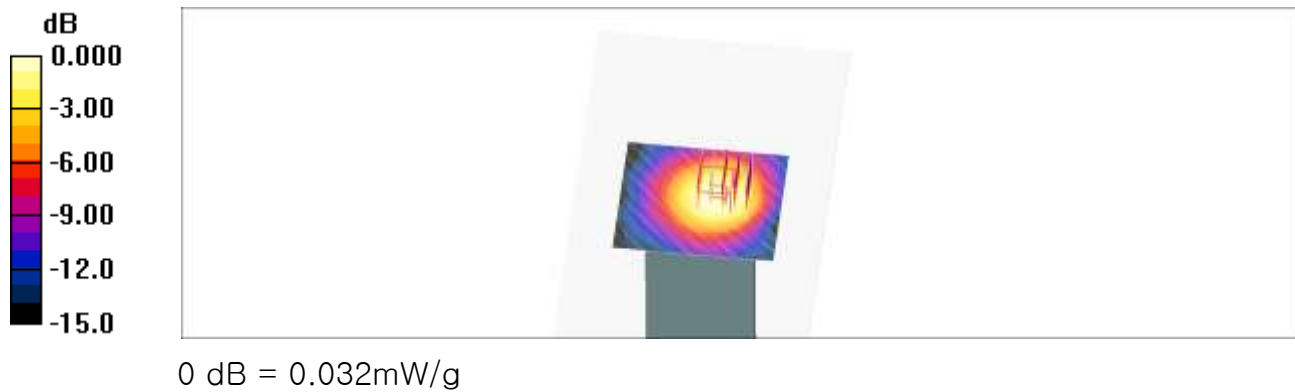
GSM850 Body Bottom 190 4TX/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.20 V/m; Power Drift = 0.076 dB

Peak SAR (extrapolated) = 0.045 W/kg

SAR(1 g) = 0.030 mW/g; SAR(10 g) = 0.020 mW/g

Maximum value of SAR (measured) = 0.032 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.6 °C  
Ambient Temperature: 21.8 °C  
Test Date: Mar. 4 2013  
Plot No.: 17

DUT: GT-I8552; Type: bar; Serial: FK-039-A

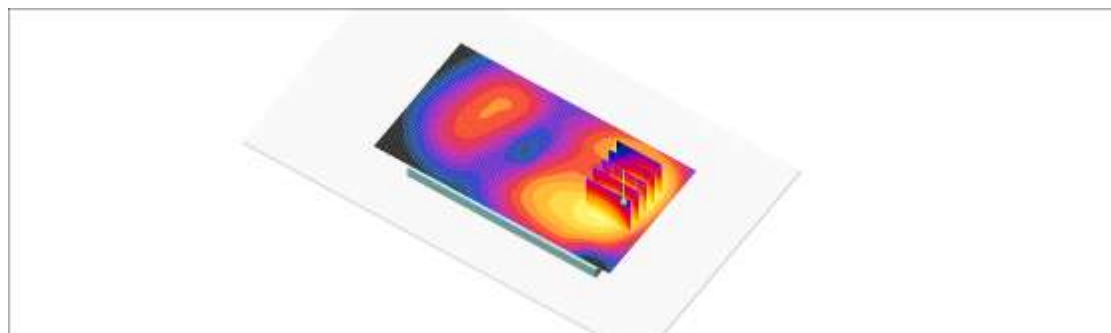
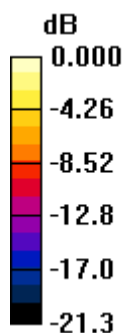
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:4.15  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.47$  mho/m;  $\epsilon_r = 53.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn869; Calibrated: 2012-09-18
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

**Body Rear 661 2TX/Area Scan (111x61x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.496 mW/g

**Body Rear 661 2TX/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 2.42 V/m; Power Drift = -0.136 dB  
Peak SAR (extrapolated) = 0.867 W/kg  
**SAR(1 g) = 0.498 mW/g; SAR(10 g) = 0.269 mW/g**  
Maximum value of SAR (measured) = 0.548 mW/g



0 dB = 0.548mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 20.9 °C  
Ambient Temperature: 21.1 °C  
Test Date: Feb. 20 2013  
Plot No.: 18

DUT: GT-I8552; Type: bar; Serial: FK-039-A

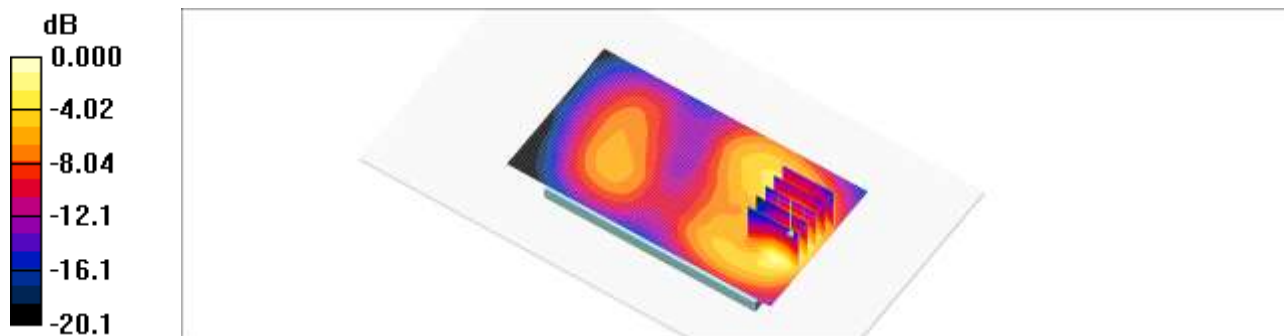
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:4.15  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.53$  mho/m;  $\epsilon_r = 52.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

**Body Front 661 2TX/Area Scan (111x61x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.325 mW/g

**Body Front 661 2TX/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 3.74 V/m; Power Drift = 0.158 dB  
Peak SAR (extrapolated) = 0.530 W/kg  
**SAR(1 g) = 0.299 mW/g; SAR(10 g) = 0.159 mW/g**  
Maximum value of SAR (measured) = 0.338 mW/g



0 dB = 0.338mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 20.9 °C  
Ambient Temperature: 21.1 °C  
Test Date: Feb. 20 2013  
Plot No.: 19

DUT: GT-I8552 Left; Type: bar; Serial: FK-039-A

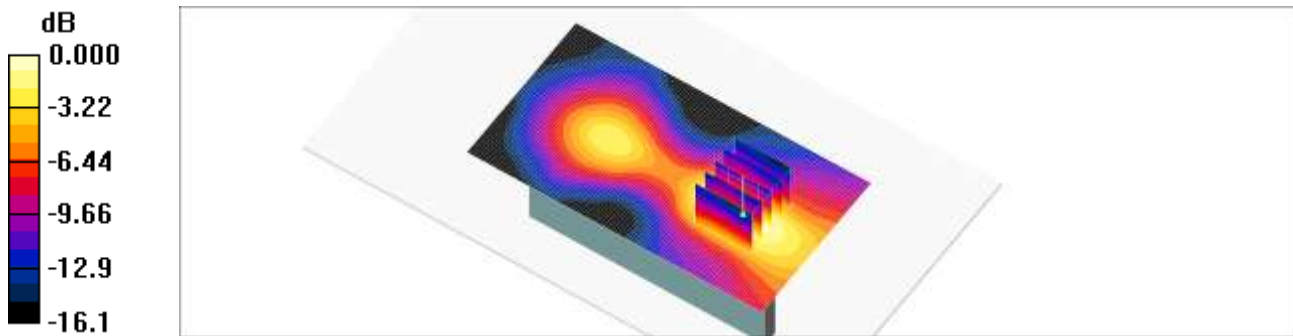
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:4.15  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.53$  mho/m;  $\epsilon_r = 52.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

Body Left 661 2TX/Area Scan (111x61x1): Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.108 mW/g

Body Left 661 2TX/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 4.76 V/m; Power Drift = 0.106 dB  
Peak SAR (extrapolated) = 0.158 W/kg  
SAR(1 g) = 0.098 mW/g; SAR(10 g) = 0.057 mW/g  
Maximum value of SAR (measured) = 0.108 mW/g



0 dB = 0.108mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 20.9 °C  
Ambient Temperature: 21.1 °C  
Test Date: Feb. 20 2013  
Plot No.: 20

DUT: GT-I8552 Bottom; Type: bar; Serial: FK-039-A

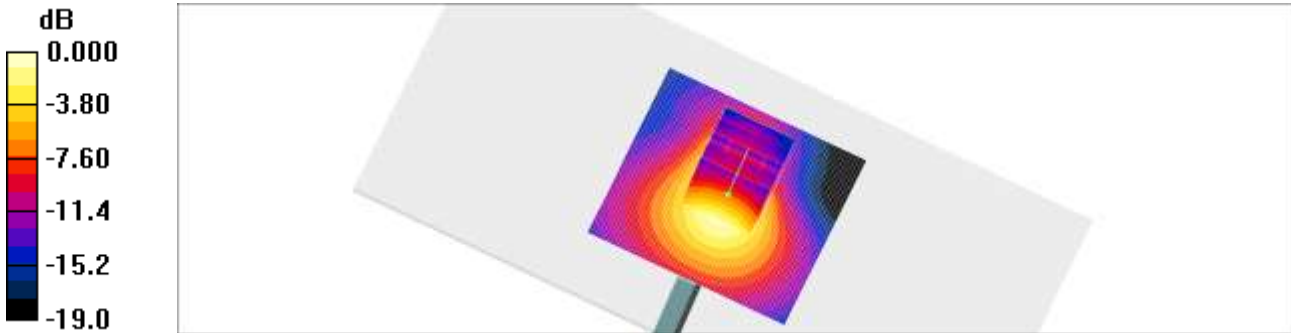
Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:4.15  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.53$  mho/m;  $\epsilon_r = 52.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

**Body Bottom 661 2TX/Area Scan (61x71x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.370 mW/g

**Body Bottom 661 2TX/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 15.1 V/m; Power Drift = -0.054 dB  
Peak SAR (extrapolated) = 0.494 W/kg  
**SAR(1 g) = 0.310 mW/g; SAR(10 g) = 0.179 mW/g**  
Maximum value of SAR (measured) = 0.347 mW/g



0 dB = 0.347mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.3 °C  
Ambient Temperature: 21.5 °C  
Test Date: Mar. 4 2013  
Plot No.: 21

DUT: GT-I8552; Type: bar; Serial: FK-039-A

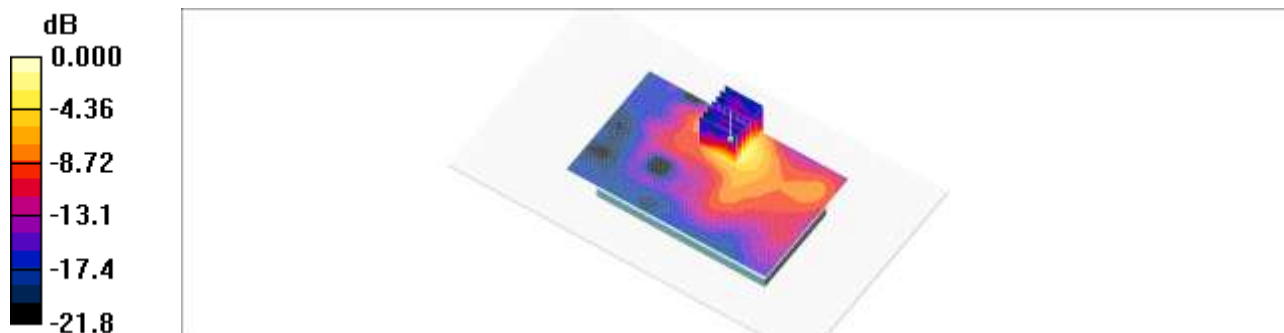
Communication System: 2450MHz FCC; Frequency: 2462 MHz; Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 2462 \text{ MHz}$ ;  $\sigma = 1.9 \text{ mho/m}$ ;  $\epsilon_r = 52.1$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(6.98, 6.98, 6.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn869; Calibrated: 2012-09-18
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

**Body\_rear 11ch 1Mbps/Area Scan (131x81x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$   
Maximum value of SAR (interpolated) = 0.104 mW/g

**Body\_rear 11ch 1Mbps/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$   
Reference Value = 1.68 V/m; Power Drift = 0.173 dB  
Peak SAR (extrapolated) = 0.197 W/kg  
**SAR(1 g) = 0.088 mW/g; SAR(10 g) = 0.039 mW/g**  
Maximum value of SAR (measured) = 0.102 mW/g



0 dB = 0.102mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4 °C  
Test Date: Feb. 19 2013  
Plot No.: 22

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: 2450MHz FCC; Frequency: 2462 MHz; Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 2$  mho/m;  $\epsilon_r = 53.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(6.98, 6.98, 6.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

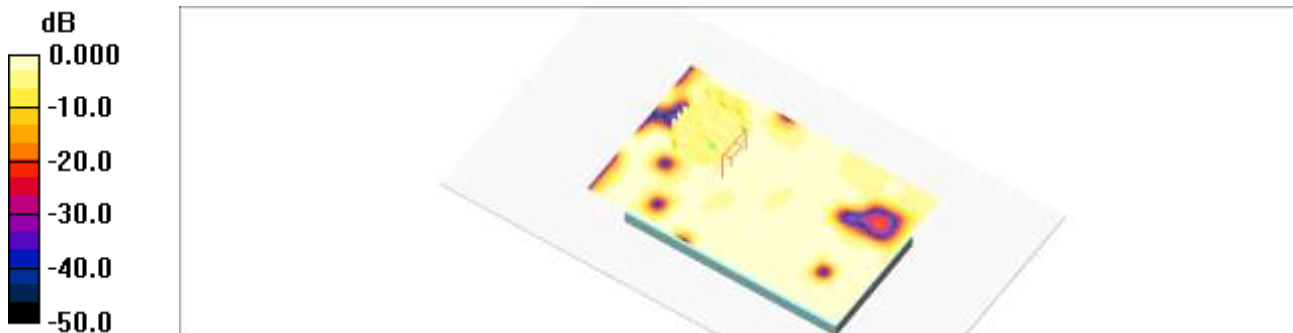
Body\_front 11ch 1Mbps/Area Scan (131x81x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.022 mW/g

Body\_front 11ch 1Mbps/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.22 V/m; Power Drift = -0.162 dB  
Peak SAR (extrapolated) = 0.006 W/kg  
SAR(1 g) = 0.00349 mW/g; SAR(10 g) = 0.00209 mW/g

Maximum value of SAR (measured) = 0.004 mW/g



0 dB = 0.004mW/g

Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4°C  
Test Date: Feb. 19 2013  
Plot No.: 23

DUT: GT-I8552 Left; Type: bar; Serial: FK-039-A

Communication System: 2450MHz FCC; Frequency: 2462 MHz;Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 2$  mho/m;  $\epsilon_r = 53.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

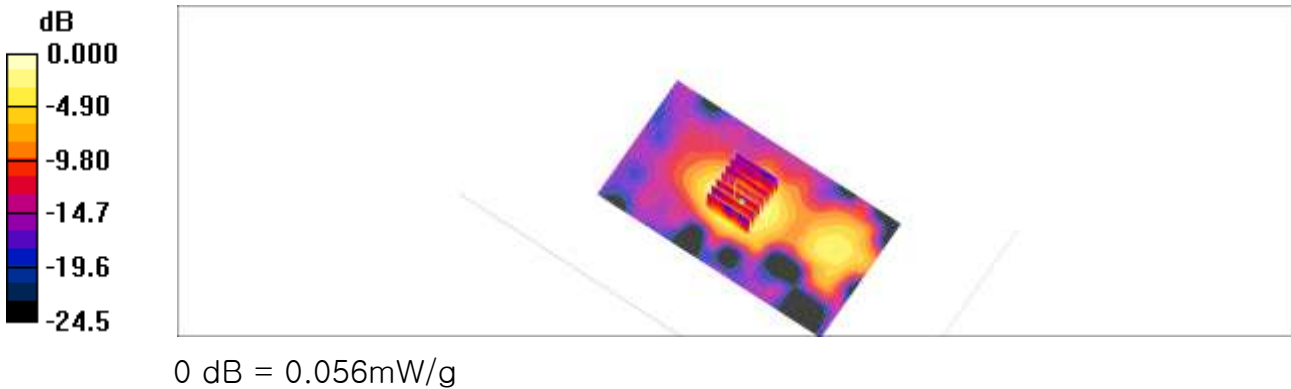
DASY4 Configuration:  
- Probe: EX3DV4 - SN3797; ConvF(6.98, 6.98, 6.98); Calibrated: 2012-11-22  
- Sensor-Surface: 4mm (Mechanical Surface Detection)  
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27  
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

Body Left side 11ch 1Mbps/Area Scan (131x71x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.054 mW/g

Body Left side 11ch 1Mbps/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 4.93 V/m; Power Drift = 0.023 dB  
Peak SAR (extrapolated) = 0.104 W/kg  
SAR(1 g) = 0.050 mW/g; SAR(10 g) = 0.024 mW/g

Maximum value of SAR (measured) = 0.056 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4 °C  
Test Date: Feb. 19 2013  
Plot No.: 24

DUT: GT-I8552 Left; Type: bar; Serial: FK-039-A

Communication System: 2450MHz FCC; Frequency: 2462 MHz; Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 2$  mho/m;  $\epsilon_r = 53.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

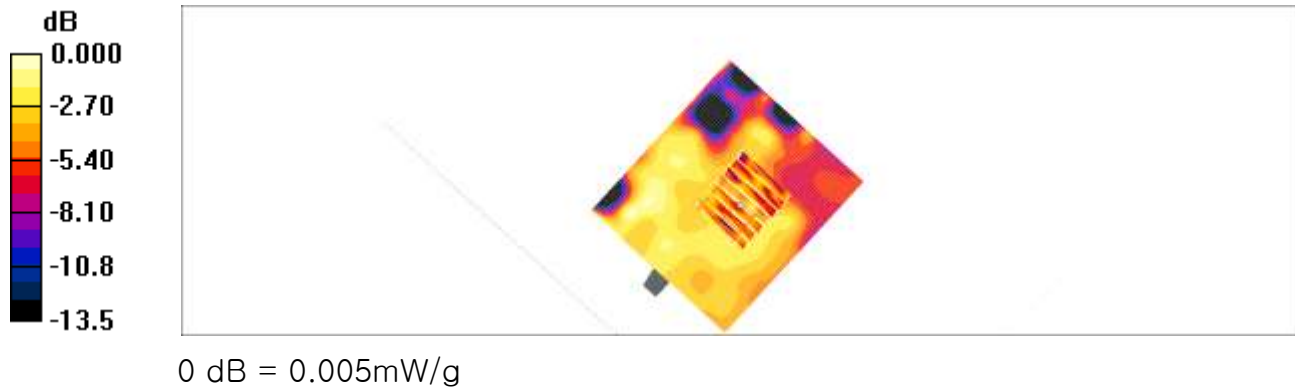
- Probe: EX3DV4 - SN3797; ConvF(6.98, 6.98, 6.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

Body Top 11ch 1Mbps/Area Scan (71x81x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.004 mW/g

Body Top 11ch 1Mbps/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 1.36 V/m; Power Drift = 0.176 dB  
Peak SAR (extrapolated) = 0.008 W/kg  
SAR(1 g) = 0.00397 mW/g; SAR(10 g) = 0.00253 mW/g

Maximum value of SAR (measured) = 0.005 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4 °C  
Test Date: Mar. 7 2013

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.898$  mho/m;  $\epsilon_r = 42.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn869; Calibrated: 2012-09-18
- Phantom: SAM 835/900 MHz; Type: SAM

GSM850 Left Touch 190/Area Scan (71x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.030 mW/g

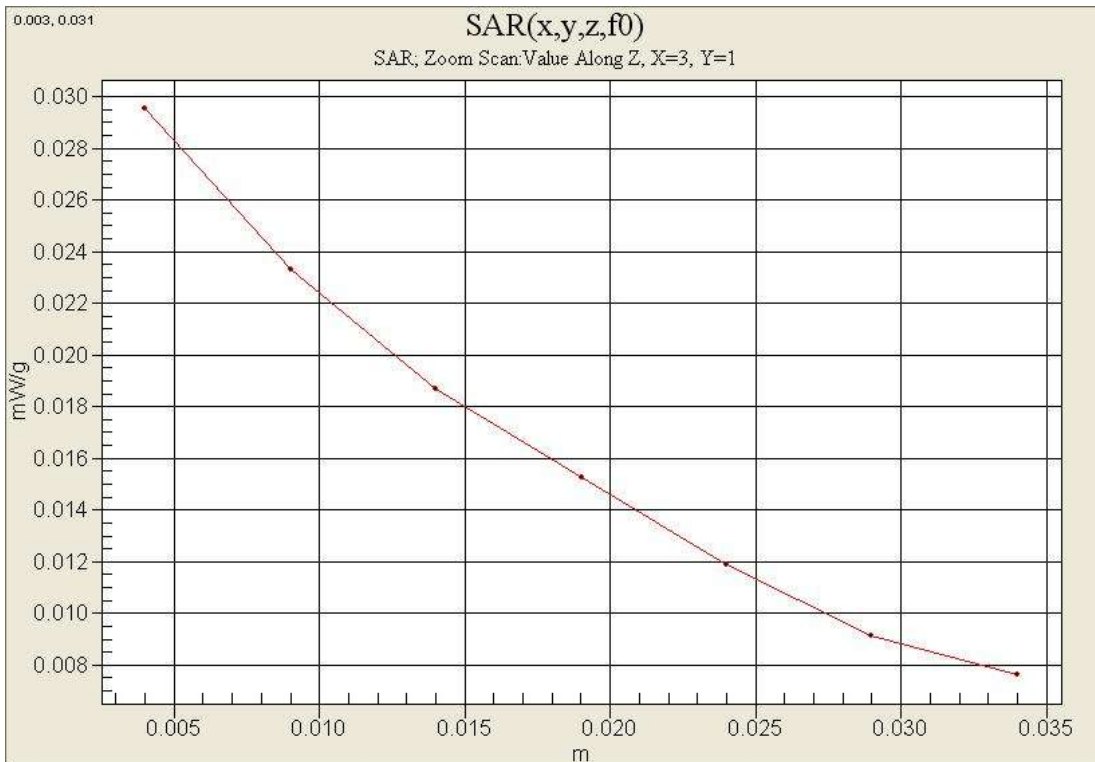
GSM850 Left Touch 190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.69 V/m; Power Drift = 0.152 dB

Peak SAR (extrapolated) = 0.038 W/kg

**SAR(1 g) = 0.028 mW/g; SAR(10 g) = 0.021 mW/g**

Maximum value of SAR (measured) = 0.030 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4 °C  
Test Date: Feb. 19 2013

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:2.075  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.987$  mho/m;  $\epsilon_r = 56.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM850 Body Rear 190 4TX/Area Scan (111x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.118 mW/g

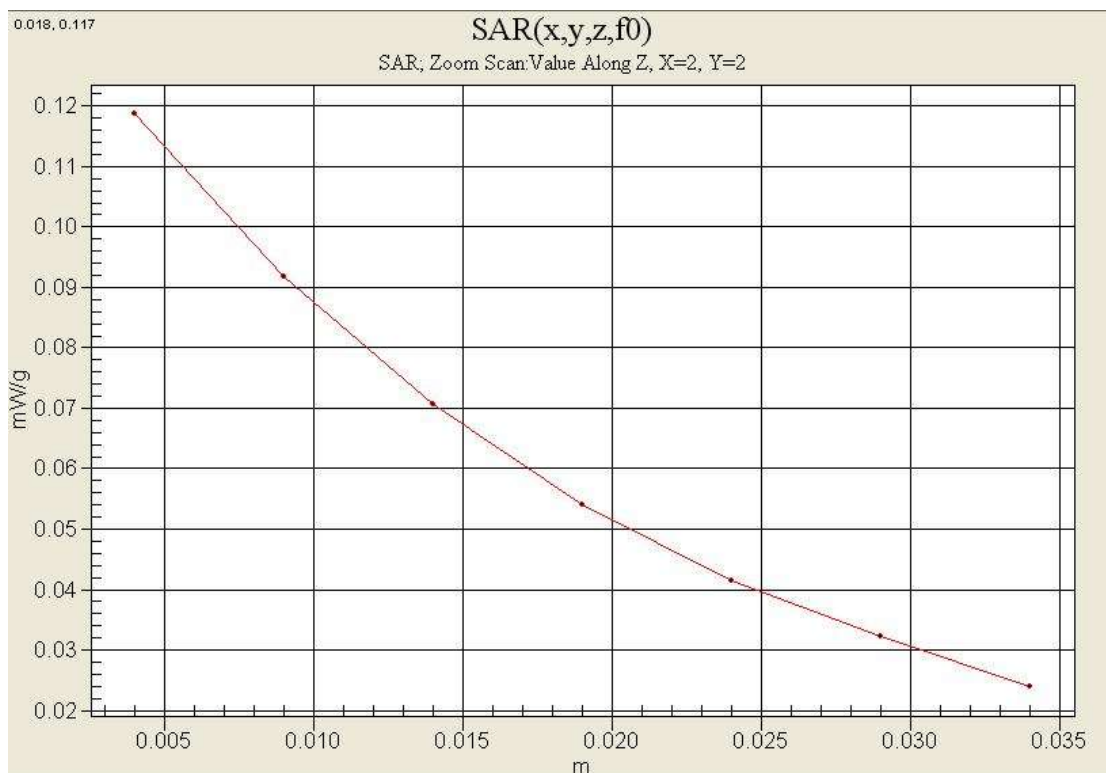
GSM850 Body Rear 190 4TX/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.8 V/m; Power Drift = 0.000 dB

Peak SAR (extrapolated) = 0.144 W/kg

SAR(1 g) = 0.113 mW/g; SAR(10 g) = 0.085 mW/g

Maximum value of SAR (measured) = 0.119 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.3 °C  
Ambient Temperature: 21.5 °C  
Test Date: Mar. 7 2013

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.37$  mho/m;  $\epsilon_r = 41.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn869; Calibrated: 2012-09-18
- Phantom: SAM 1800/1900 MHz; Type: SAM

**GSM1900 Right Touch 661/Area Scan (71x111x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.150 mW/g

**GSM1900 Right Touch 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 4.21 V/m; Power Drift = 0.124 dB  
Peak SAR (extrapolated) = 0.222 W/kg  
**SAR(1 g) = 0.134 mW/g; SAR(10 g) = 0.080 mW/g**  
Maximum value of SAR (measured) = 0.145 mW/g



Test Laboratory: HCT CO., LTD  
 EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
 2.4GHz and Hotspot  
 Liquid Temperature: 21.6 °C  
 Ambient Temperature: 21.8 °C  
 Test Date: Mar. 7 2013

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:4.15  
 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.47$  mho/m;  $\epsilon_r = 53.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn869; Calibrated: 2012-09-18
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

**Body Rear 661 2TX/Area Scan (111x61x1):** Measurement grid: dx=15mm, dy=15mm  
 Maximum value of SAR (interpolated) = 0.496 mW/g

**Body Rear 661 2TX/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
 Reference Value = 2.42 V/m; Power Drift = -0.136 dB  
 Peak SAR (extrapolated) = 0.867 W/kg  
**SAR(1 g) = 0.498 mW/g; SAR(10 g) = 0.269 mW/g**

Maximum value of SAR (measured) = 0.548 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.2 °C  
Ambient Temperature: 21.4 °C  
Test Date: Feb. 19 2013

DUT: GT-I8552; Type: bar; Serial: FK-039-A

Communication System: 2450MHz FCC; Frequency: 2462 MHz; Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 1.85$  mho/m;  $\epsilon_r = 38$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(6.76, 6.76, 6.76); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: 1800/1900 Phantom; Type: SAM

Right Touch 11ch 1Mbps/Area Scan (91x131x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.093 mW/g

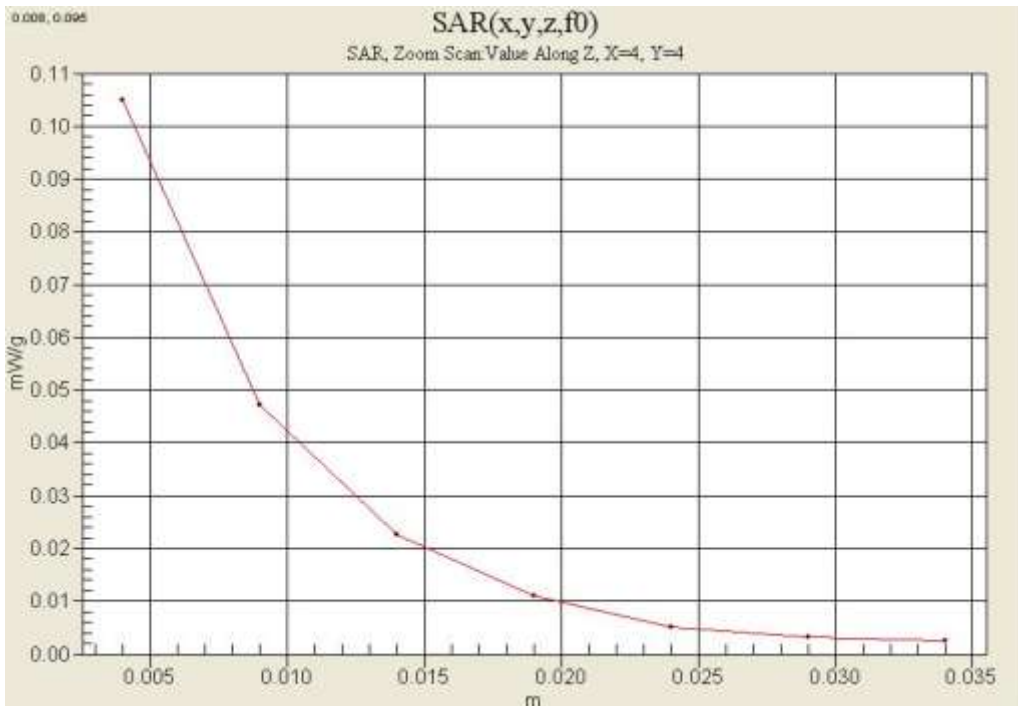
Right Touch 11ch 1Mbps/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.28 V/m; Power Drift = 0.162 dB

Peak SAR (extrapolated) = 0.226 W/kg

SAR(1 g) = 0.089 mW/g; SAR(10 g) = 0.038 mW/g

Maximum value of SAR (measured) = 0.105 mW/g



Test Laboratory: HCT CO., LTD  
EUT Type: 850/1900 GSM/GPRS/EDGE Phone with Bluetooth v3.0(LE), WLAN  
2.4GHz and Hotspot  
Liquid Temperature: 21.3 °C  
Ambient Temperature: 21.5 °C  
Test Date: Mar. 7 2013

DUT: GT-I8552; Type: bar; Serial: FK-039-A

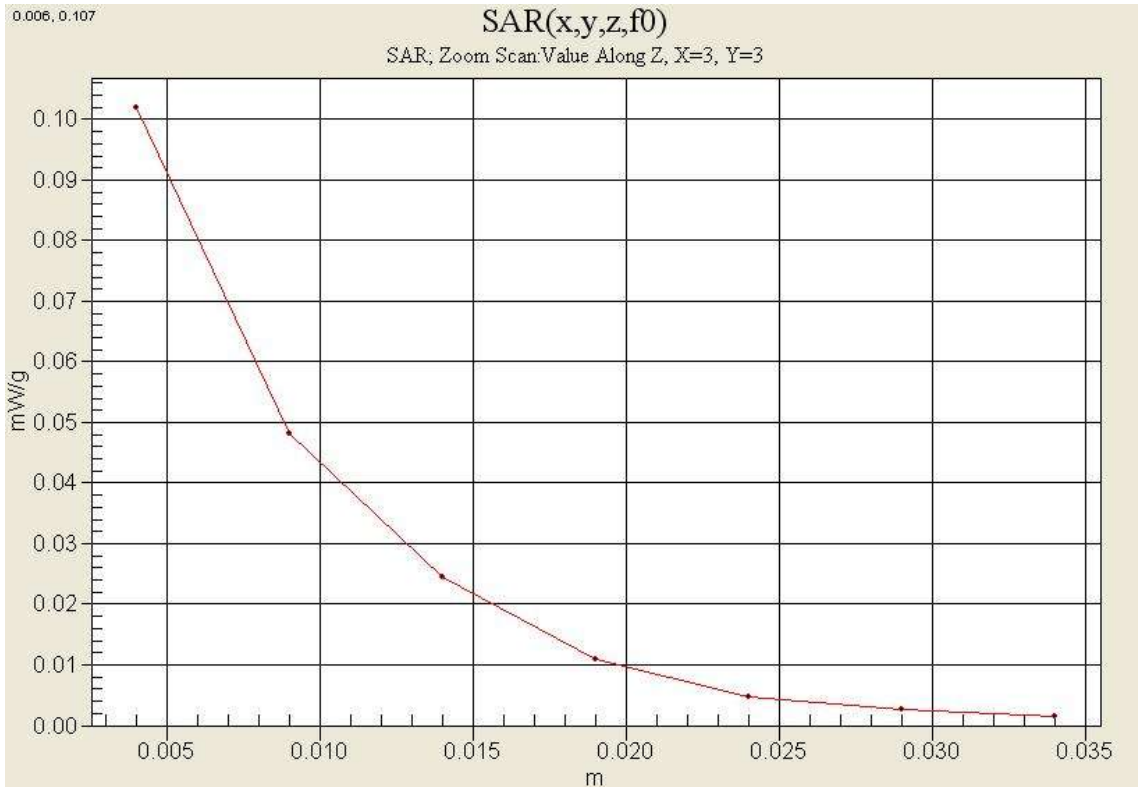
Communication System: 2450MHz FCC; Frequency: 2462 MHz; Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 1.9$  mho/m;  $\epsilon_r = 52.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(6.98, 6.98, 6.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn869; Calibrated: 2012-09-18
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

**Body\_rear 11ch 1Mbps/Area Scan (131x81x1):** Measurement grid: dx=12mm, dy=12mm  
Maximum value of SAR (interpolated) = 0.104 mW/g

**Body\_rear 11ch 1Mbps/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 1.68 V/m; Power Drift = 0.173 dB  
Peak SAR (extrapolated) = 0.197 W/kg  
**SAR(1 g) = 0.088 mW/g; SAR(10 g) = 0.039 mW/g**  
Maximum value of SAR (measured) = 0.102 mW/g



## Attachment 2. – Dipole Verification Plots

## ■ Verification Data (835 MHz Head)

Test Laboratory: HCT CO., LTD  
Input Power 100 mW (20 dBm)  
Liquid Temp: 21.2 °C  
Test Date: Feb. 19, 2013

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 – SN:441

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.919$  mho/m;  $\epsilon_r = 40.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

DASY4 Configuration:

- Probe: EX3DV4 – SN3797; ConvF(8.93, 8.93, 8.93); Calibrated: 2011-07-25
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: 1800/1900 Phantom; Type: SAM

**Validation 835MHz/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.08 mW/g

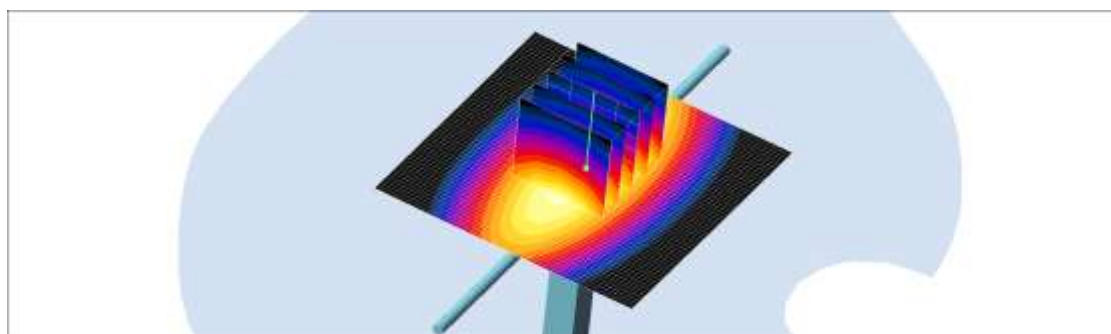
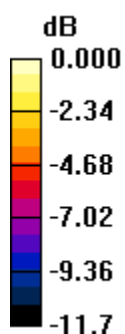
**Validation 835MHz/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 34.3 V/m; Power Drift = -0.008 dB

Peak SAR (extrapolated) = 1.62 W/kg

**SAR(1 g) = 0.988 mW/g; SAR(10 g) = 0.603 mW/g**

Maximum value of SAR (measured) = 1.09 mW/g



0 dB = 1.09mW/g

## ■ Verification Data (835 MHz Head 2)

Test Laboratory: HCT CO., LTD  
Input Power 100 mW (20 dBm)  
Liquid Temp: 21.4 °C  
Test Date: Mar. 7, 2013

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 – SN:441

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.897$  mho/m;  $\epsilon_r = 42.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

DASY4 Configuration:

- Probe: EX3DV4 – SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn869; Calibrated: 2012-09-18
- Phantom: SAM 835/900 MHz; Type: SAM

**Validation 835MHz/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.01 mW/g

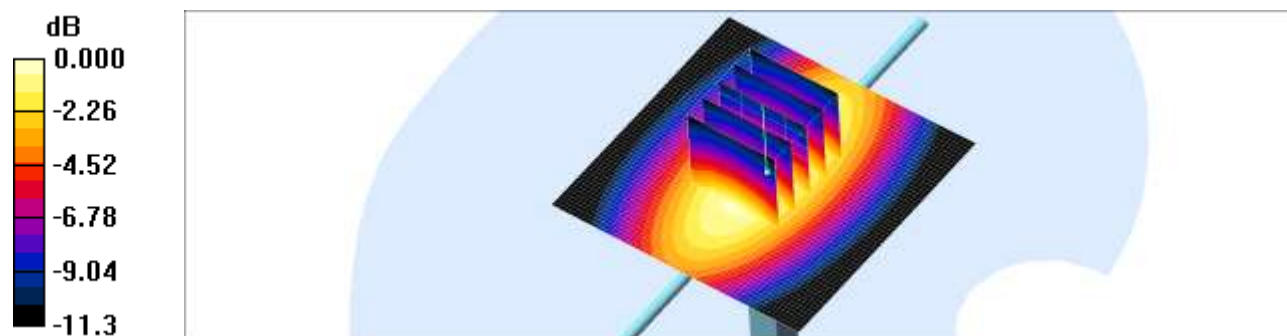
**Validation 835MHz/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 33.7 V/m; Power Drift = -0.053 dB

Peak SAR (extrapolated) = 1.47 W/kg

**SAR(1 g) = 0.932 mW/g; SAR(10 g) = 0.593 mW/g**

Maximum value of SAR (measured) = 1.01 mW/g



0 dB = 1.01mW/g

## ■ Verification Data (835 MHz Body)

Test Laboratory: HCT CO., LTD  
Input Power 100 mW (20 dBm)  
Liquid Temp: 21.2 °C  
Test Date: Feb. 19, 2013

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 – SN:441

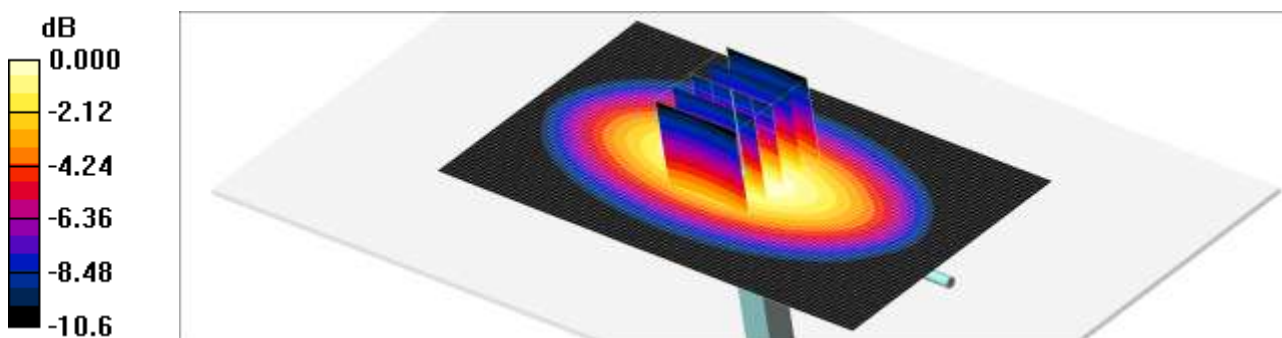
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.986 \text{ mho/m}$ ;  $\epsilon_r = 56.9$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 – SN3797; ConvF(9.14, 9.14, 9.14); Calibrated: 2011-07-25
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

**Validation 835 MHz/Area Scan (111x61x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 1.04 mW/g

**Validation 835 MHz/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 32.4 V/m; Power Drift = -0.005 dB  
Peak SAR (extrapolated) = 1.45 W/kg  
**SAR(1 g) = 0.963 mW/g; SAR(10 g) = 0.625 mW/g**  
Maximum value of SAR (measured) = 1.04 mW/g



0 dB = 1.04mW/g

## ■ Verification Data (1 900 MHz Head)

Test Laboratory: HCT CO., LTD  
Input Power 100 mW (20 dBm)  
Liquid Temp: 20.9 °C  
Test Date: Feb. 20, 2013

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 – SN:5d032

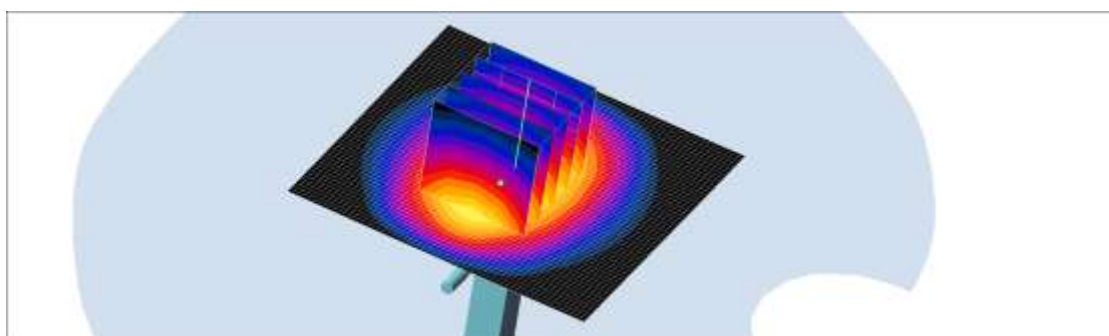
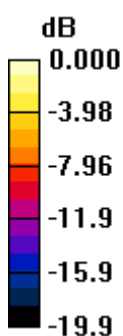
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.37$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 – SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: 1800/1900 Phantom; Type: SAM

Dipole 1900MHz Validation/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 4.44 mW/g

Dipole 1900MHz Validation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 55.1 V/m; Power Drift = 0.002 dB  
Peak SAR (extrapolated) = 7.31 W/kg  
**SAR(1 g) = 3.77 mW/g; SAR(10 g) = 1.93 mW/g**  
Maximum value of SAR (measured) = 4.15 mW/g



0 dB = 4.15mW/g

## ■ Verification Data (1 900 MHz Head 2)

Test Laboratory: HCT CO., LTD  
Input Power 100 mW (20 dBm)  
Liquid Temp: 21.3 °C  
Test Date: Mar. 7, 2013

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 – SN:5d032

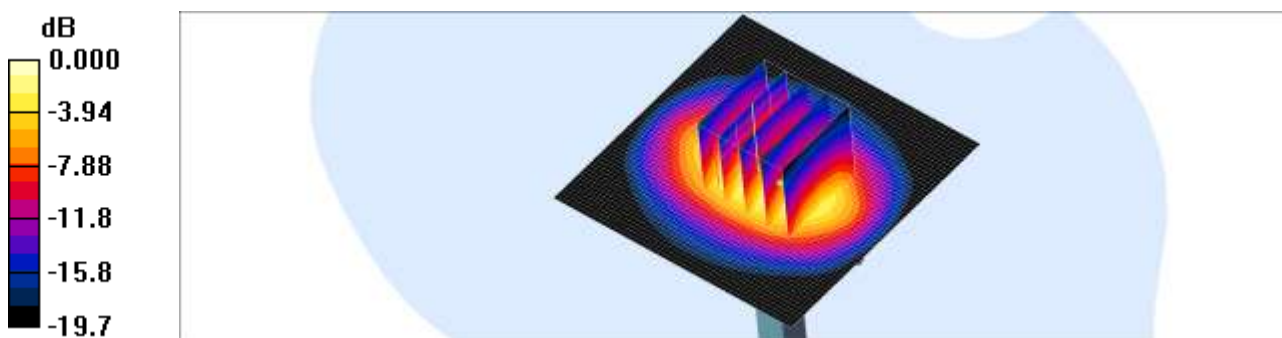
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.39$  mho/m;  $\epsilon_r = 41.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 – SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn869; Calibrated: 2012-09-18
- Phantom: 1800/1900 Phantom; Type: SAM

Dipole 1900MHz Validation/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 4.62 mW/g

Dipole 1900MHz Validation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 55.6 V/m; Power Drift = 0.006 dB  
Peak SAR (extrapolated) = 7.54 W/kg  
**SAR(1 g) = 3.91 mW/g; SAR(10 g) = 2 mW/g**  
Maximum value of SAR (measured) = 4.29 mW/g



## ■ Verification Data (1 900 MHz Body)

Test Laboratory: HCT CO., LTD  
Input Power 100 mW (20 dBm)  
Liquid Temp: 20.9 °C  
Test Date: Feb. 20, 2013

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 – SN:5d032

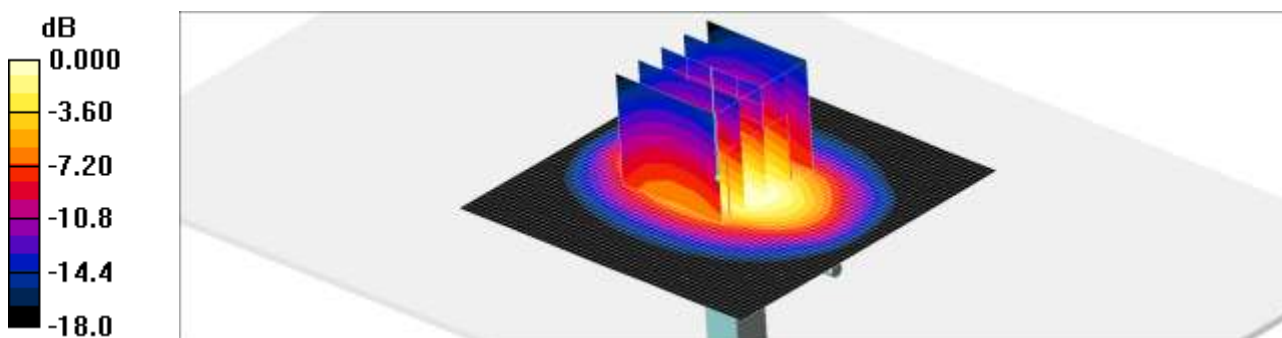
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.55$  mho/m;  $\epsilon_r = 52.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 – SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

Validation 1900 MHz/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 4.91 mW/g

Validation 1900 MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 53.3 V/m; Power Drift = 0.009 dB  
Peak SAR (extrapolated) = 7.38 W/kg  
SAR(1 g) = 4.08 mW/g; SAR(10 g) = 2.15 mW/g  
Maximum value of SAR (measured) = 4.48 mW/g



0 dB = 4.48mW/g

## ■ Verification Data (1 900 MHz Body 2)

Test Laboratory: HCT CO., LTD  
Input Power 100 mW (20 dBm)  
Liquid Temp: 21.6 °C  
Test Date: Mar. 7, 2013

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 – SN:5d032

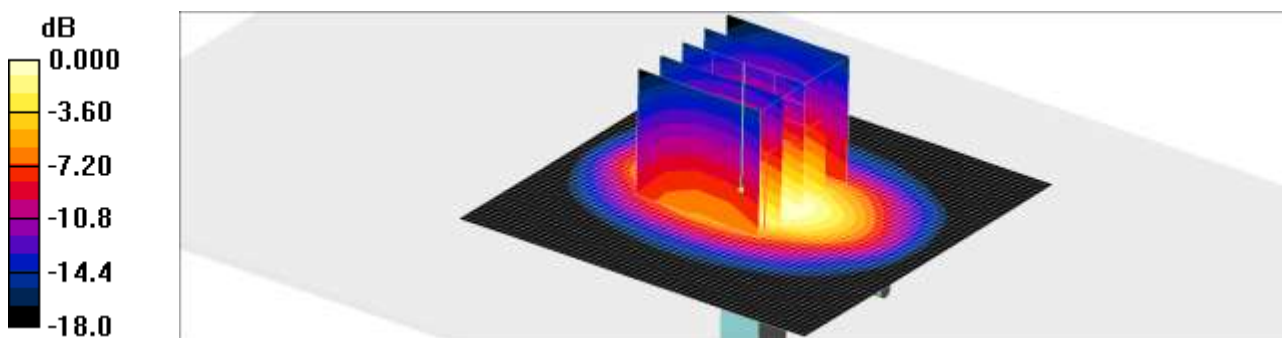
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.49$  mho/m;  $\epsilon_r = 53.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 – SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn869; Calibrated: 2012-09-18
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

Validation 1900 MHz/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 4.89 mW/g

Validation 1900 MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 54.4 V/m; Power Drift = -0.001 dB  
Peak SAR (extrapolated) = 7.34 W/kg  
SAR(1 g) = 4.07 mW/g; SAR(10 g) = 2.14 mW/g  
Maximum value of SAR (measured) = 4.47 mW/g



0 dB = 4.47mW/g

## ■ Verification Data (2 450 MHz Head)

Test Laboratory: HCT CO., LTD  
Input Power 100 mW (20 dBm)  
Liquid Temp: 21.2 °C  
Test Date: Feb. 19, 2013

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 – SN:743

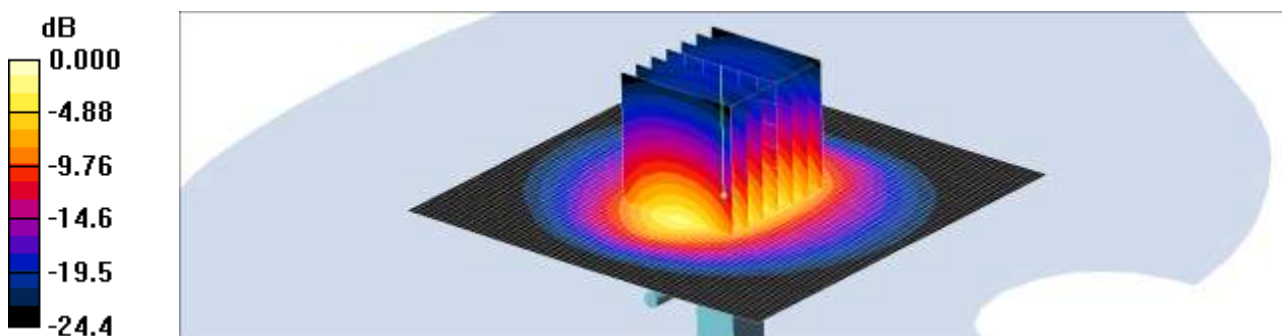
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.83$  mho/m;  $\epsilon_r = 38$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 – SN3797; ConvF(6.76, 6.76, 6.76); Calibrated: 2012-11-22
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: 835/900 Phantom ; Type: SAM

**Validation 2450MHz/Area Scan (81x81x1):** Measurement grid: dx=12mm, dy=12mm  
Maximum value of SAR (interpolated) = 8.50 mW/g

**Validation 2450MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 57.9 V/m; Power Drift = -0.013 dB  
Peak SAR (extrapolated) = 12.0 W/kg  
**SAR(1 g) = 5.39 mW/g; SAR(10 g) = 2.4 mW/g**  
Maximum value of SAR (measured) = 8.49 mW/g



0 dB = 8.49mW/g

## ■ Verification Data (2 450 MHz Body)

Test Laboratory: HCT CO., LTD  
Input Power 100 mW (20 dBm)  
Liquid Temp: 21.2 °C  
Test Date: Feb. 19, 2013

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 – SN:743

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.98$  mho/m;  $\epsilon_r = 53.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

DASY4 Configuration:

- Probe: EX3DV4 – SN3797; ConvF(6.98, 6.98, 6.98); Calibrated: 2012-11-22
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn648; Calibrated: 2012-04-27
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

Validation 2450MHz/Area Scan (81x81x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 8.65 mW/g

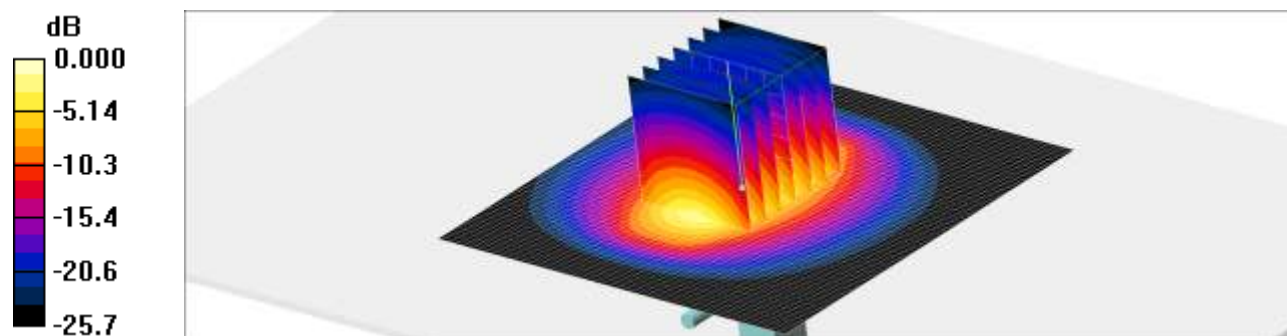
Validation 2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 50.2 V/m; Power Drift = -0.044 dB

Peak SAR (extrapolated) = 12.2 W/kg

SAR(1 g) = 5.28 mW/g; SAR(10 g) = 2.29 mW/g

Maximum value of SAR (measured) = 8.48 mW/g



0 dB = 8.48mW/g

## ■ Verification Data (2 450 MHz Body 2)

Test Laboratory: HCT CO., LTD  
Input Power 100 mW (20 dBm)  
Liquid Temp: 21.3 °C  
Test Date: Mar. 7, 2013

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 – SN:743

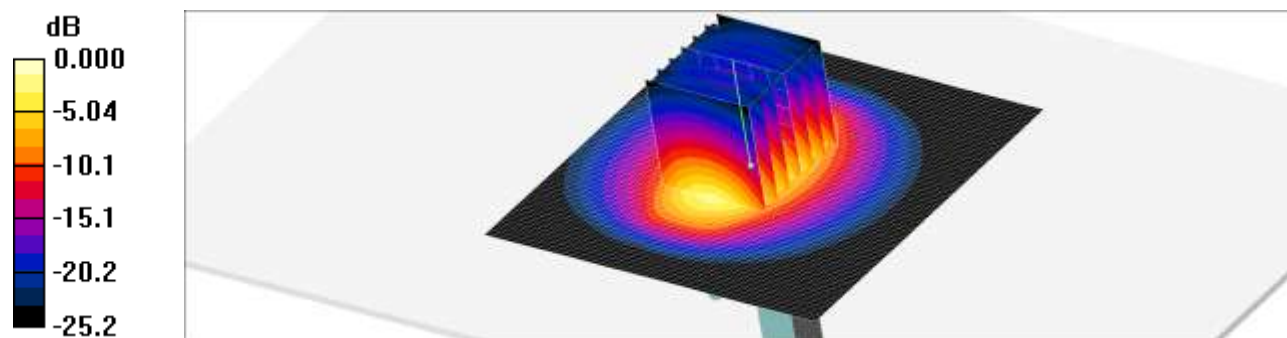
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.89$  mho/m;  $\epsilon_r = 52.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 – SN3797; ConvF(6.98, 6.98, 6.98); Calibrated: 2012-11-22
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn869; Calibrated: 2012-09-18
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

Validation 2450MHz/Area Scan (81x81x1): Measurement grid: dx=12mm, dy=12mm  
Maximum value of SAR (interpolated) = 8.26 mW/g

Validation 2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 50.2 V/m; Power Drift = 0.055 dB  
Peak SAR (extrapolated) = 11.8 W/kg  
SAR(1 g) = 5.16 mW/g; SAR(10 g) = 2.25 mW/g  
Maximum value of SAR (measured) = 8.27 mW/g



0 dB = 8.27mW/g

## ■ Dielectric Parameter (835 MHz Head)

Title                      GT-I8552  
SubTitle                 835MHz  
Test Date                Feb. 19, 2013

Frequency	e'	e''
800000000.0000	40.7233	19.9611
805000000.0000	40.6769	19.9229
810000000.0000	40.6414	19.8824
815000000.0000	40.5945	19.8775
820000000.0000	40.5621	19.8636
825000000.0000	40.4993	19.8527
830000000.0000	40.4954	19.8208
835000000.0000	40.4584	19.7824
840000000.0000	40.3854	19.7438
845000000.0000	40.3257	19.7125
850000000.0000	40.2872	19.7173
855000000.0000	40.2405	19.6522
860000000.0000	40.1871	19.6718
865000000.0000	40.1013	19.6084
870000000.0000	40.0938	19.5850
875000000.0000	40.0104	19.5427
880000000.0000	39.9314	19.5299
885000000.0000	39.8667	19.5286
890000000.0000	39.7957	19.4843
895000000.0000	39.7453	19.4398
900000000.0000	39.7010	19.4484

## ■ Dielectric Parameter (835 MHz Head 2)

Title GT-I8552  
SubTitle 835MHz  
Test Date Mar. 7, 2013

Frequency	e'	e''
800000000.0000	43.2574	19.4061
805000000.0000	43.1700	19.4297
810000000.0000	43.1429	19.3930
815000000.0000	43.0467	19.3762
820000000.0000	42.9922	19.3320
825000000.0000	42.9343	19.3106
830000000.0000	42.8781	19.2732
835000000.0000	42.7910	19.3085
840000000.0000	42.7397	19.2809
845000000.0000	42.6761	19.2625
850000000.0000	42.5966	19.2751
855000000.0000	42.5248	19.2389
860000000.0000	42.4591	19.2376
865000000.0000	42.4190	19.1982
870000000.0000	42.3223	19.2066
875000000.0000	42.2979	19.2141
880000000.0000	42.2416	19.1804
885000000.0000	42.1742	19.1405
890000000.0000	42.1491	19.1385
895000000.0000	42.1268	19.1106
900000000.0000	42.0382	19.1082

## ■ Dielectric Parameter (835 MHz Body)

Title GT-I8552  
SubTitle 835MHz  
Test Date Feb. 19, 2013

Frequency	e'	e''
800000000.0000	57.1963	21.6017
805000000.0000	57.1553	21.5437
810000000.0000	57.1090	21.4997
815000000.0000	57.0648	21.4439
820000000.0000	57.0152	21.3567
825000000.0000	56.9494	21.2991
830000000.0000	56.9031	21.2459
835000000.0000	56.8786	21.2181
840000000.0000	56.8416	21.1843
845000000.0000	56.7747	21.1569
850000000.0000	56.7623	21.1249
855000000.0000	56.6776	21.1162
860000000.0000	56.6620	21.1130
865000000.0000	56.6406	21.1339
870000000.0000	56.5827	21.1420
875000000.0000	56.5706	21.1532
880000000.0000	56.5538	21.1769
885000000.0000	56.4933	21.1431
890000000.0000	56.4803	21.1969
895000000.0000	56.4660	21.1285
900000000.0000	56.4604	21.1309

## ■ Dielectric Parameter (1 900 MHz Head)

Title                      GT-I8552  
SubTitle                 1 900MHz  
Test Date                Feb. 20, 2013

Frequency	e'	e''
1800000000.0000	41.2166	12.6430
1810000000.0000	41.1717	12.6677
1820000000.0000	41.1293	12.6992
1830000000.0000	41.0811	12.7111
1840000000.0000	41.0338	12.7516
1850000000.0000	41.0126	12.7700
1860000000.0000	40.9764	12.8238
1870000000.0000	40.9616	12.8511
1880000000.0000	40.9163	12.8748
1890000000.0000	40.8836	12.9037
1900000000.0000	40.8606	12.9235
1910000000.0000	40.8017	12.9630
1920000000.0000	40.7680	12.9775
1930000000.0000	40.7301	13.0201
1940000000.0000	40.7088	13.0575
1950000000.0000	40.6570	13.0696
1960000000.0000	40.6380	13.1059
1970000000.0000	40.5829	13.1229
1980000000.0000	40.5577	13.1640
1990000000.0000	40.5201	13.1783
2000000000.0000	40.4645	13.2068

## ■ Dielectric Parameter (1 900 MHz Head 2)

Title                      GT-I8552  
SubTitle                 1 900MHz  
Test Date                Mar. 7, 2013

Frequency	e'	e''
1800000000.0000	41.8382	12.8084
1810000000.0000	41.8013	12.8336
1820000000.0000	41.7671	12.9034
1830000000.0000	41.7742	12.9397
1840000000.0000	41.7357	12.9842
1850000000.0000	41.6905	13.0210
1860000000.0000	41.6464	13.0020
1870000000.0000	41.6111	13.0722
1880000000.0000	41.5161	13.0786
1890000000.0000	41.4695	13.0958
1900000000.0000	41.4102	13.1642
1910000000.0000	41.3705	13.1831
1920000000.0000	41.3246	13.1913
1930000000.0000	41.3104	13.2262
1940000000.0000	41.3013	13.2667
1950000000.0000	41.3036	13.2568
1960000000.0000	41.2987	13.2999
1970000000.0000	41.3137	13.3139
1980000000.0000	41.2245	13.3234
1990000000.0000	41.2168	13.3742
2000000000.0000	41.1401	13.3726

## ■ Dielectric Parameter (1 900 MHz Body)

Title                      GT-I8552  
SubTitle                 1 900MHz  
Test Date                Feb. 20, 2013

Frequency	e'	e''
1850000000.0000	52.3126	14.6068
1855000000.0000	52.3021	14.6149
1860000000.0000	52.2793	14.6249
1865000000.0000	52.2743	14.6415
1870000000.0000	52.2470	14.6587
1875000000.0000	52.2457	14.6547
1880000000.0000	52.2319	14.6692
1885000000.0000	52.2399	14.6763
1890000000.0000	52.2181	14.6789
1895000000.0000	52.1998	14.6808
1900000000.0000	52.1798	14.6975
1905000000.0000	52.1740	14.7179
1910000000.0000	52.1512	14.7154
1915000000.0000	52.1518	14.7230
1920000000.0000	52.1133	14.7363
1925000000.0000	52.1052	14.7453
1930000000.0000	52.0812	14.7702
1935000000.0000	52.0701	14.7763
1940000000.0000	52.0644	14.7747
1945000000.0000	52.0328	14.7880
1950000000.0000	52.0340	14.8009

## ■ Dielectric Parameter (1 900 MHz Body 2)

Title                      GT-I8552  
SubTitle                 1 900MHz  
Test Date                Mar. 7, 2013

Frequency	e'	e''
1850000000.0000	53.7061	13.9667
1855000000.0000	53.7107	13.9628
1860000000.0000	53.7106	13.9745
1865000000.0000	53.6850	13.9961
1870000000.0000	53.6925	14.0009
1875000000.0000	53.6376	14.0512
1880000000.0000	53.6087	14.0665
1885000000.0000	53.5727	14.0766
1890000000.0000	53.5397	14.0828
1895000000.0000	53.4871	14.1028
1900000000.0000	53.4725	14.1148
1905000000.0000	53.4572	14.1366
1910000000.0000	53.4246	14.1523
1915000000.0000	53.3494	14.1722
1920000000.0000	53.3523	14.2338
1925000000.0000	53.3389	14.2336
1930000000.0000	53.3075	14.2536
1935000000.0000	53.3255	14.2804
1940000000.0000	53.3313	14.2805
1945000000.0000	53.3215	14.3394
1950000000.0000	53.3413	14.3684

## ■ Dielectric Parameter (2 450 MHz Head)

Title                      GT-I8552  
SubTitle                 2450MHz  
Test Date                Feb. 19, 2013

Frequency	e'	e''
2400000000.0000	38.2640	13.3576
2405000000.0000	38.2310	13.3670
2410000000.0000	38.2015	13.3736
2415000000.0000	38.1918	13.3807
2420000000.0000	38.1606	13.3779
2425000000.0000	38.1492	13.3892
2430000000.0000	38.1316	13.3893
2435000000.0000	38.1051	13.4049
2440000000.0000	38.0760	13.4172
2445000000.0000	38.0600	13.4518
2450000000.0000	38.0384	13.4526
2455000000.0000	38.0170	13.4534
2460000000.0000	37.9816	13.4768
2465000000.0000	37.9594	13.4894
2470000000.0000	37.9475	13.5208
2475000000.0000	37.9396	13.5435
2480000000.0000	37.9246	13.5804
2485000000.0000	37.9081	13.6020
2490000000.0000	37.8836	13.6169
2495000000.0000	37.8640	13.6440
2500000000.0000	37.8481	13.6655

## ■ Dielectric Parameter (2 450 MHz Body)

Title GT-I8552  
SubTitle 2450MHz  
Test Date Feb. 19, 2013

Frequency	e'	e''
2400000000.0000	53.7603	14.3730
2405000000.0000	53.7504	14.3964
2410000000.0000	53.7333	14.4020
2415000000.0000	53.7184	14.4208
2420000000.0000	53.6894	14.4347
2425000000.0000	53.6834	14.4537
2430000000.0000	53.6663	14.4759
2435000000.0000	53.6589	14.4932
2440000000.0000	53.6101	14.5028
2445000000.0000	53.5995	14.5406
2450000000.0000	53.5900	14.5613
2455000000.0000	53.5618	14.5678
2460000000.0000	53.5378	14.6005
2465000000.0000	53.5102	14.6068
2470000000.0000	53.5009	14.6438
2475000000.0000	53.4870	14.6714
2480000000.0000	53.4636	14.7004
2485000000.0000	53.4635	14.7256
2490000000.0000	53.4249	14.7400
2495000000.0000	53.4259	14.7799
2500000000.0000	53.3946	14.8048

## ■ Dielectric Parameter (2 450 MHz Body 2)

Title                      GT-I8552  
SubTitle                 2450MHz  
Test Date                Mar. 7, 2013

Frequency	e'	e''
2400000000.0000	52.3097	13.6446
2405000000.0000	52.2886	13.6584
2410000000.0000	52.2582	13.6616
2415000000.0000	52.2397	13.6798
2420000000.0000	52.2215	13.6979
2425000000.0000	52.1848	13.7247
2430000000.0000	52.1711	13.7487
2435000000.0000	52.1618	13.7786
2440000000.0000	52.1709	13.7962
2445000000.0000	52.1430	13.8051
2450000000.0000	52.1186	13.8399
2455000000.0000	52.1020	13.8571
2460000000.0000	52.0931	13.8797
2465000000.0000	52.1077	13.8795
2470000000.0000	52.0781	13.8916
2475000000.0000	52.0736	13.8935
2480000000.0000	52.0473	13.9017
2485000000.0000	52.0340	13.9081
2490000000.0000	52.0339	13.8895
2495000000.0000	52.0165	13.8865
2500000000.0000	51.9983	13.8998

## Attachment 3. – Probe Calibration Data

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**S** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **HCT (Dymstec)**

Certificate No: **EX3-3797\_Nov12**

**CALIBRATION CERTIFICATE**

Object: **EX3DV4 - SN:3797**

Calibration procedure(s): **QA CAL-01.v8, QA CAL-12.v7, QA CAL-14.v3, QA CAL-23.v4,  
QA CAL-25.v4  
Calibration procedure for dosimetric E-field probes**

Calibration date: **November 22, 2012**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498967	29-Mar-12 (No. 217-01505)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013, Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660, Jun12)	Jun-13
Secondary Standards			
	ID	Check Date (in house)	Scheduled Check
RF generator HP 8048C	US3642LD1700	4-Aug-09 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 22, 2012

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**S** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

**Glossary:**

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\theta$	$\theta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ is normal to probe axis

**Calibration is Performed According to the Following Standards:**

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

**Methods Applied and Interpretation of Parameters:**

- **NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\theta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- **NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- **DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- **PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- **A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- **ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- **Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- **Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

EX3DV4 – SN:3797

November 22, 2012

# Probe EX3DV4

## SN:3797

Manufactured: April 5, 2011  
Calibrated: November 22, 2012

Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)

EX3DV4- SN:3797

November 22, 2012

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3797

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.63	0.59	0.57	± 10.1 %
DCP (mV) <sup>B</sup>	97.5	94.8	93.7	

### Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc <sup>C</sup> (k=2)
0	CW	0.00	X	0.0	0.0	1.0	134.7	±3.0 %
			Y	0.0	0.0	1.0	130.7	
			Z	0.0	0.0	1.0	130.3	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

<sup>B</sup> Numerical linearization parameter; uncertainty not required.

<sup>C</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

EX3DV4- SN:3797

November 22, 2012

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3797

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	43.5	0.87	9.30	9.30	9.30	0.15	3.00	± 13.4 %
835	41.5	0.90	8.94	8.94	8.94	0.44	0.78	± 12.0 %
900	41.5	0.97	8.83	8.83	8.83	0.37	0.88	± 12.0 %
1450	40.5	1.20	7.89	7.89	7.89	0.24	1.28	± 12.0 %
1750	40.1	1.37	7.77	7.77	7.77	0.75	0.60	± 12.0 %
1900	40.0	1.40	7.47	7.47	7.47	0.44	0.82	± 12.0 %
1950	40.0	1.40	7.27	7.27	7.27	0.80	0.59	± 12.0 %
2450	39.2	1.80	6.76	6.76	6.76	0.41	0.83	± 12.0 %
2600	39.0	1.96	6.68	6.68	6.68	0.46	0.81	± 12.0 %
5200	36.0	4.66	4.84	4.84	4.84	0.34	1.80	± 13.1 %
5300	35.9	4.76	4.61	4.61	4.61	0.34	1.80	± 13.1 %
5500	35.6	4.96	4.58	4.58	4.58	0.34	1.80	± 13.1 %
5600	35.5	5.07	4.45	4.45	4.45	0.31	1.80	± 13.1 %
5800	35.3	5.27	4.50	4.50	4.50	0.34	1.80	± 13.1 %

<sup>C</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

EX3DV4- SN:3797

November 22, 2012

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3797

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	10.22	10.22	10.22	0.07	3.31	± 13.4 %
835	55.2	0.97	8.98	8.98	8.98	0.44	0.85	± 12.0 %
1750	53.4	1.49	7.58	7.58	7.58	0.68	0.66	± 12.0 %
1900	53.3	1.52	7.28	7.28	7.28	0.49	0.79	± 12.0 %
2450	52.7	1.95	6.98	6.98	6.98	0.80	0.58	± 12.0 %
2600	52.5	2.16	6.73	6.73	6.73	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.17	4.17	4.17	0.46	1.90	± 13.1 %
5300	48.9	5.42	4.20	4.20	4.20	0.42	1.90	± 13.1 %
5500	48.6	5.65	4.05	4.05	4.05	0.41	1.90	± 13.1 %
5600	48.5	5.77	4.06	4.06	4.06	0.30	1.90	± 13.1 %
5800	48.2	6.00	4.19	4.19	4.19	0.42	1.90	± 13.1 %

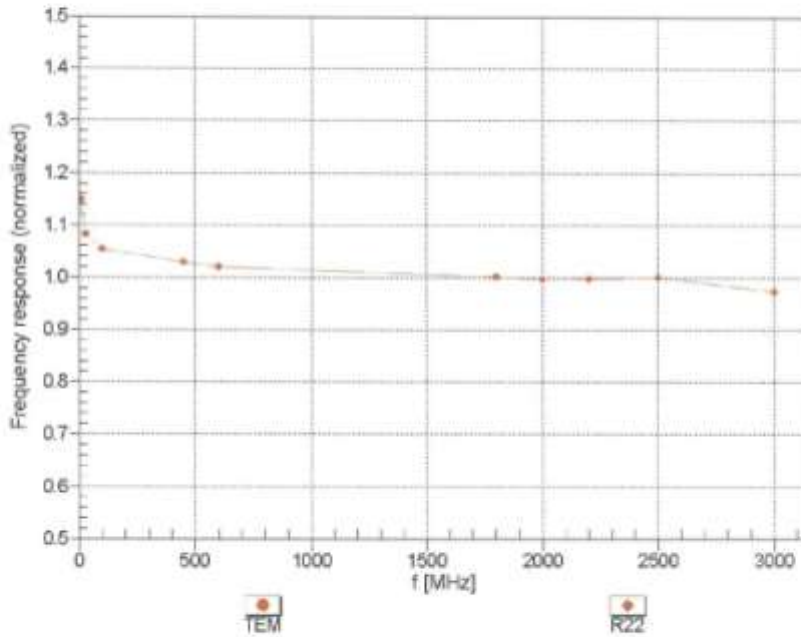
<sup>C</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

EX3DV4- SN:3797

November 22, 2012

### Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)

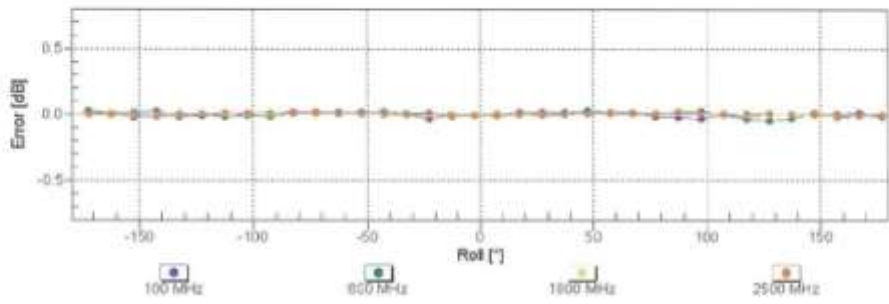
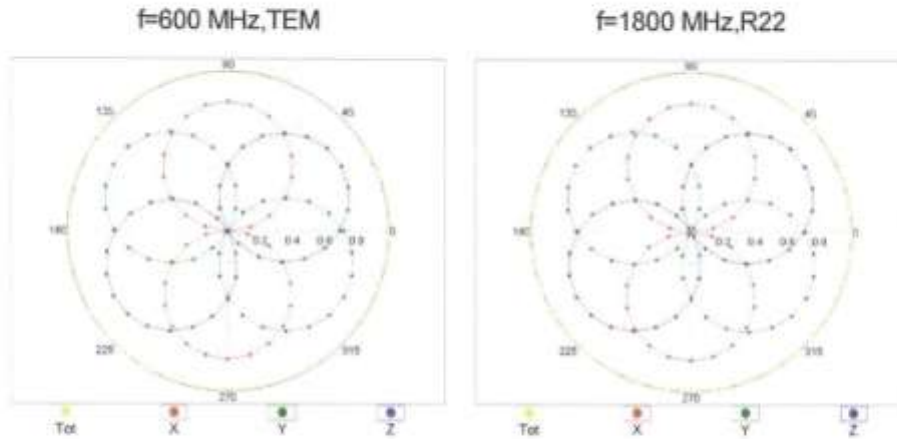


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

EX3DV4- SN:3797

November 22, 2012

**Receiving Pattern ( $\phi$ ),  $\theta = 0^\circ$**

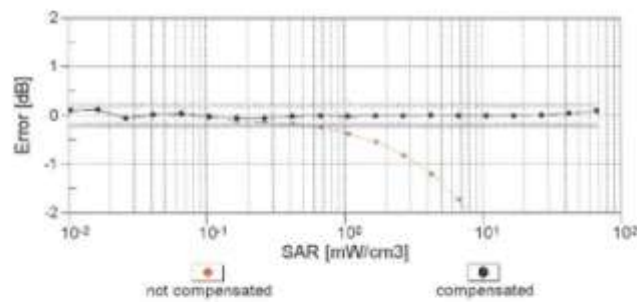
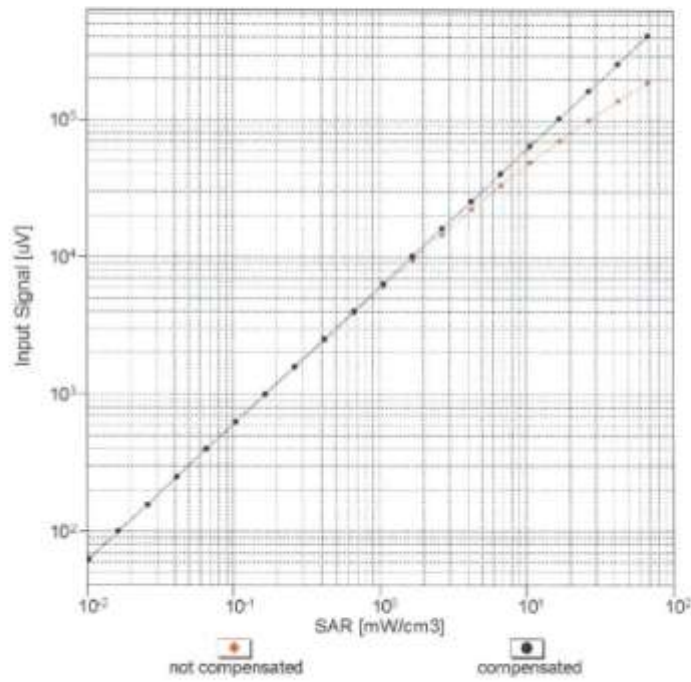


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

EX3DV4- SN:3797

November 22, 2012

### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f = 900 MHz)

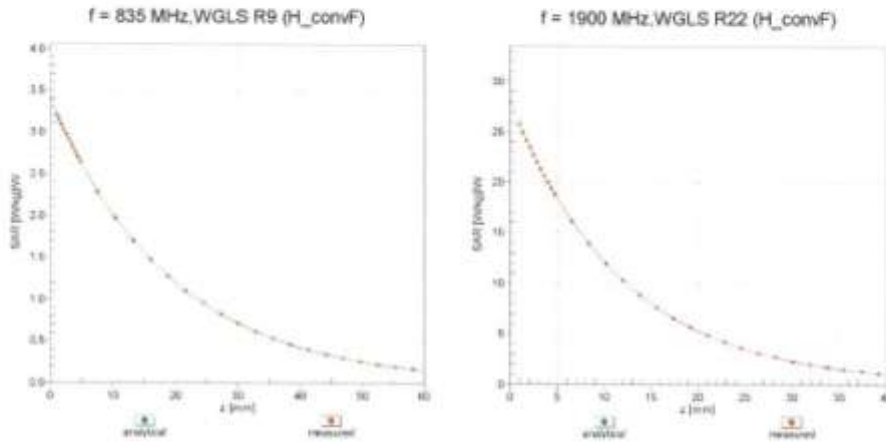


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

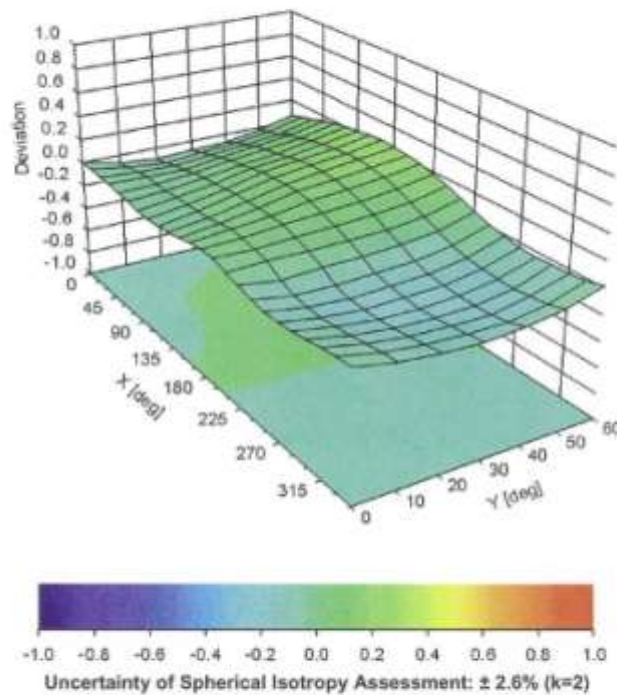
EX3DV4- SN:3797

November 22, 2012

### Conversion Factor Assessment



### Deviation from Isotropy in Liquid Error ( $\phi, \theta$ ), $f = 900$ MHz



EX3DV4-- SN:3797

November 22, 2012

**DASY/EASY - Parameters of Probe: EX3DV4 - SN:3797****Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	67.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

## Attachment 4. – Dipole Calibration Data

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **HCT (Dymstec)**

Certificate No: **D835V2-441\_May12**

CALIBRATION CERTIFICATE			
Object	D835V2 - SN: 441		
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz		
Calibration date:	May 16, 2012		
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.			
All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.			
Calibration Equipment used (M&TE critical for calibration)			
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5056 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	in house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	in house check: Oct-13
Network Analyzer HP 8753E	US37390586 S4206	18-Oct-01 (in house check Oct-11)	in house check: Oct-12
Calibrated by:	Name Ismail El-Naouq	Function Laboratory Technician	Signature 
Approved by:	Katja Pokovic	Technical Manager	
			Issued: May 16, 2012
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

Calibration Laboratory of  
Schmid & Partner  
Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst  
C Service suisse d'étalonnage  
S Servizio svizzero di taratura  
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

**Glossary:**

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

**Calibration is Performed According to the Following Standards:**

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

### Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.6 $\pm$ 6 %	0.89 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.35 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.43 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.54 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.18 mW / g $\pm$ 16.5 % (k=2)

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	54.3 $\pm$ 6 %	1.00 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.44 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.50 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.60 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.27 mW / g $\pm$ 16.5 % (k=2)

**Appendix**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	51.1 $\Omega$ - 5.8 j $\Omega$
Return Loss	- 24.6 dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	47.0 $\Omega$ - 8.1 j $\Omega$
Return Loss	- 21.0 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.372 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

Manufactured by	SPEAG
Manufactured on	March 09, 2001

**DASY5 Validation Report for Head TSL**

Date: 16.05.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 441**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.89$  mho/m;  $\epsilon_r = 40.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

**Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm 2/Zoom Scan (7x7x7)/Cube 0:**

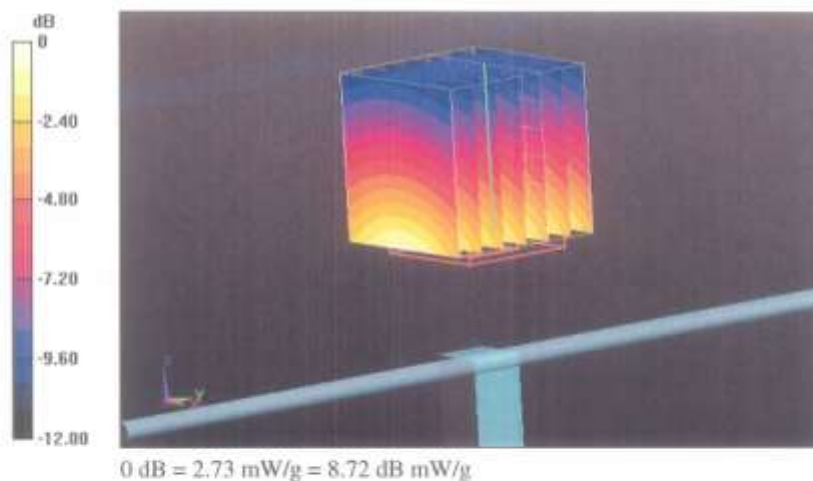
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.129 V/m; Power Drift = 0.00 dB

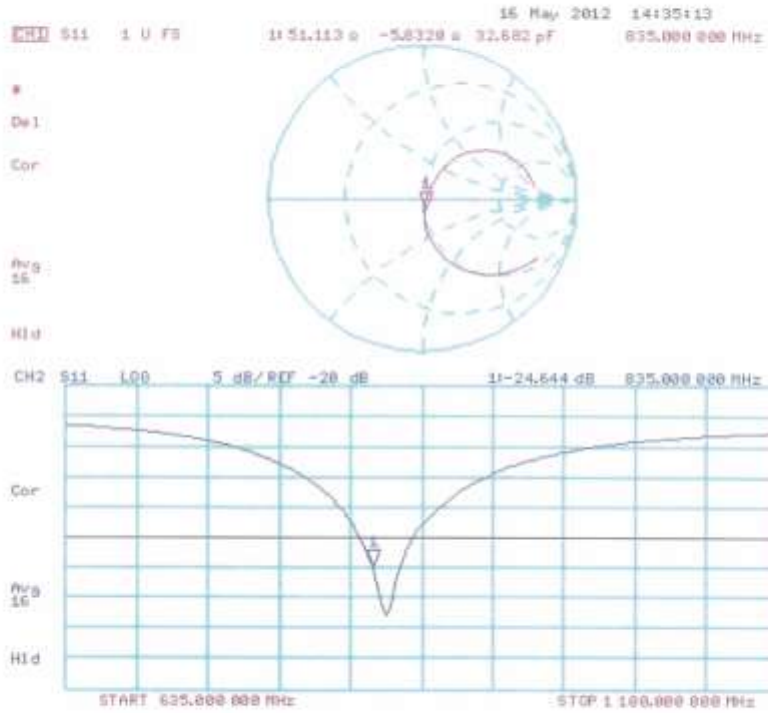
Peak SAR (extrapolated) = 3.474 mW/g

**SAR(1 g) = 2.35 mW/g; SAR(10 g) = 1.54 mW/g**

Maximum value of SAR (measured) = 2.73 mW/g



Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 16.05.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 441**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 1$  mho/m;  $\epsilon_r = 54.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

**DASY52 Configuration:**

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

**Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:**

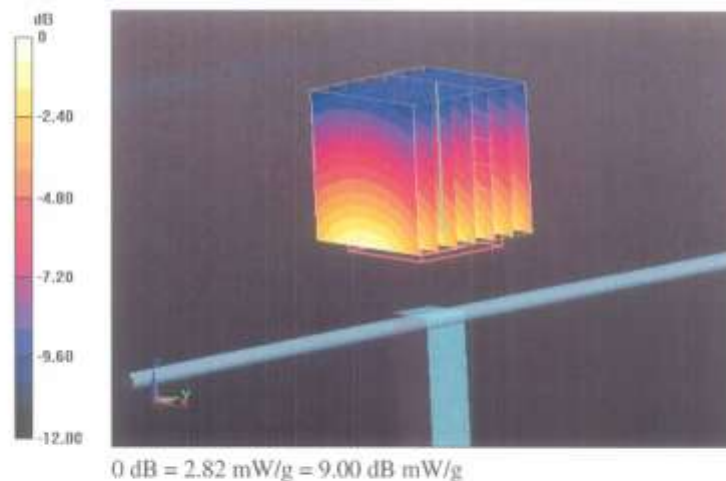
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.054 V/m; Power Drift = 0.03 dB

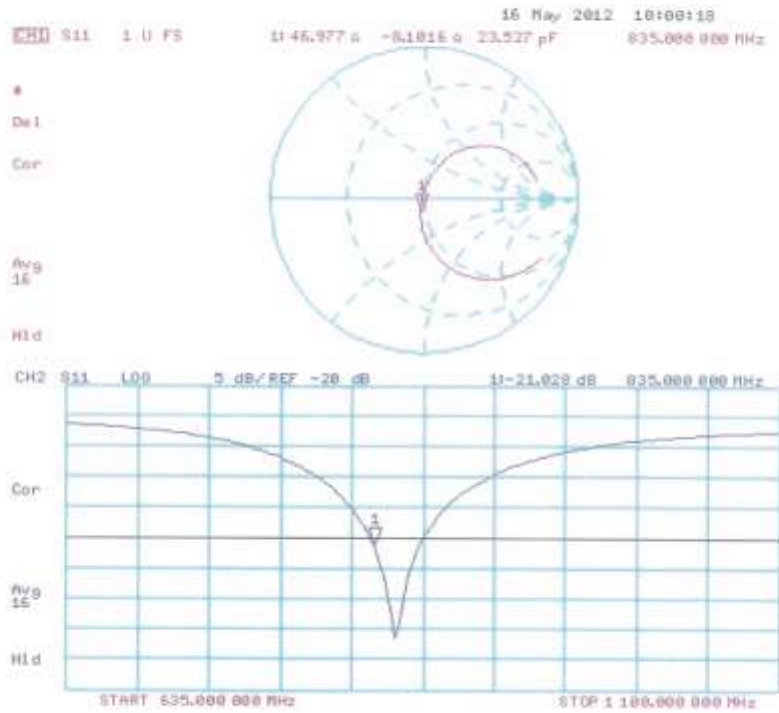
Peak SAR (extrapolated) = 3.533 mW/g

**SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g**

Maximum value of SAR (measured) = 2.82 mW/g



Impedance Measurement Plot for Body TSL



**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **HCT (Dymstec)**

Certificate No: **D1900V2-5d032\_Jul12**

**CALIBRATION CERTIFICATE**

Object	D1900V2 - SN: 5d032		
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz		
Calibration date:	July 20, 2012		
<p>This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity &lt; 70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p>			
<b>Primary Standards</b>	<b>ID #</b>	<b>Cal Date (Certificate No.)</b>	<b>Scheduled Calibration</b>
Power meter EPM-442A	QE37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
<b>Secondary Standards</b>	<b>ID #</b>	<b>Check Date (In house)</b>	<b>Scheduled Check</b>
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-09 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12
Calibrated by:	Name Dimitar Iliev	Function Laboratory Technician	Signature 
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature 
			Issued: July 20, 2012
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

Calibration Laboratory of  
Schmid & Partner  
Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst  
C Service suisse d'étalonnage  
S Servizio svizzero di taratura  
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

#### Glossary:

TSL tissue simulating liquid  
ConvF sensitivity in TSL / NORM x,y,z  
N/A not applicable or not measured

#### Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

#### Additional Documentation:

- DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

### Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.9 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.68 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	39.0 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.11 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.5 mW / g ± 16.5 % (k=2)

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.6 ± 6 %	1.52 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	---	---

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	39.9 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.30 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.2 mW / g ± 16.5 % (k=2)

**Appendix****Antenna Parameters with Head TSL**

Impedance, transformed to feed point	50.0 $\Omega$ + 3.1 j $\Omega$
Return Loss	-30.1 dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	46.2 $\Omega$ + 3.7 j $\Omega$
Return Loss	-25.2 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.194 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

Manufactured by	SPEAG
Manufactured on	March 17, 2003

**DASY5 Validation Report for Head TSL**

Date: 20.07.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d032**

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.38$  mho/m;  $\epsilon_r = 39.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

**Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**

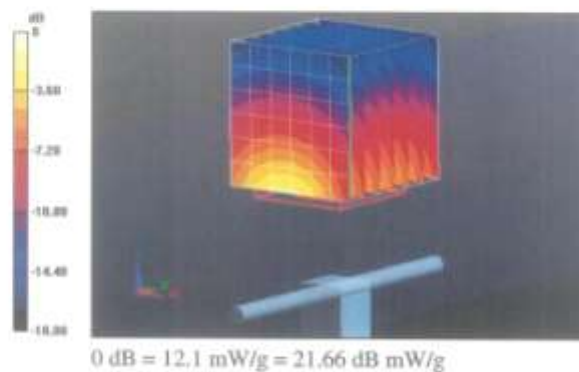
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.864 V/m; Power Drift = 0.03 dB

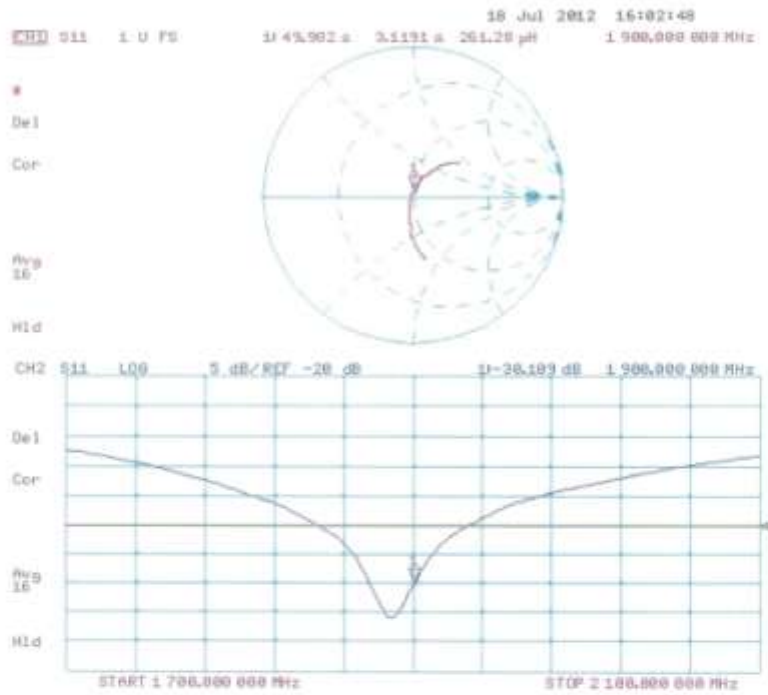
Peak SAR (extrapolated) = 17.209 mW/g

**SAR(1 g) = 9.68 mW/g; SAR(10 g) = 5.11 mW/g**

Maximum value of SAR (measured) = 12.1 mW/g



Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 20.07.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d032**

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.52$  mho/m;  $\epsilon_r = 52.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

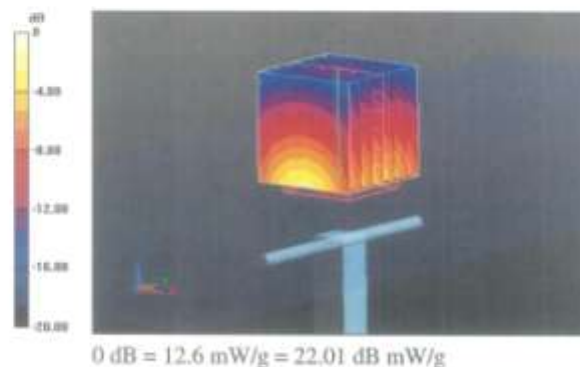
**Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 95.470 V/m; Power Drift = -0.00 dB

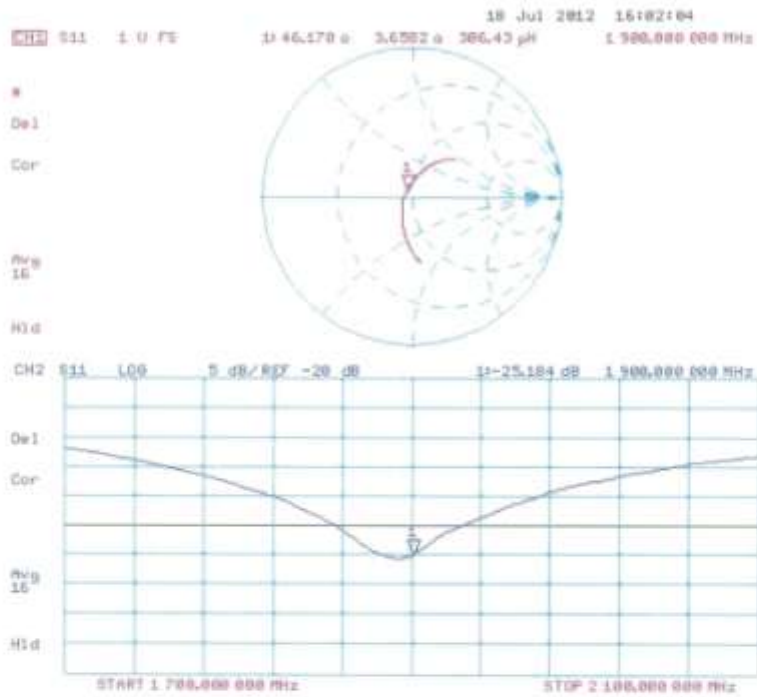
Peak SAR (extrapolated) = 17.332 mW/g

**SAR(1 g) = 10 mW/g; SAR(10 g) = 5.3 mW/g**

Maximum value of SAR (measured) = 12.6 mW/g



Impedance Measurement Plot for Body TSL



**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **HCT (Dymstec)**

Certificate No: **D2450V2-743\_Aug12**

**CALIBRATION CERTIFICATE**

Object: **D2450V2 - SN: 743**

Calibration procedure(s): **QA CAL-05.v8  
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **August 23, 2012**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility; environment temperature (22 ± 3°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 54206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

Calibrated by: **Name: Isma El-Neoug, Function: Laboratory Technician, Signature: [Handwritten Signature]**

Approved by: **Name: Katja Pokovic, Function: Technical Manager, Signature: [Handwritten Signature]**

Issued: August 23, 2012

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

**Calibration Laboratory of**  
Schmid & Partner  
Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

**Glossary:**

TSL tissue simulating liquid  
ConvF sensitivity in TSL / NORM x,y,z  
N/A not applicable or not measured

**Calibration is Performed According to the Following Standards:**

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices; Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

### Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.2 $\pm$ 6 %	1.81 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	52.7 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.18 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.7 mW / g $\pm$ 16.5 % (k=2)

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	51.3 $\pm$ 6 %	1.99 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	---	---

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	51.2 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.10 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.2 mW / g $\pm$ 16.5 % (k=2)

**Appendix**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	54.0 Ω + 4.7 jΩ
Return Loss	- 24.6 dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	50.9 Ω + 6.5 jΩ
Return Loss	- 23.7 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.158 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

Manufactured by	SPEAG
Manufactured on	December 01, 2003

**DASY5 Validation Report for Head TSL**

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 743**

Communication System: CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.81$  mho/m;  $\epsilon_r = 39.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

**Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**

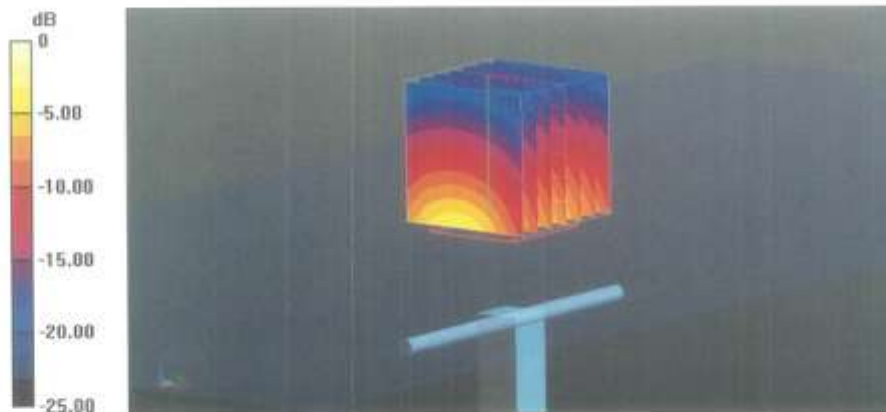
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.554 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 26.584 mW/g

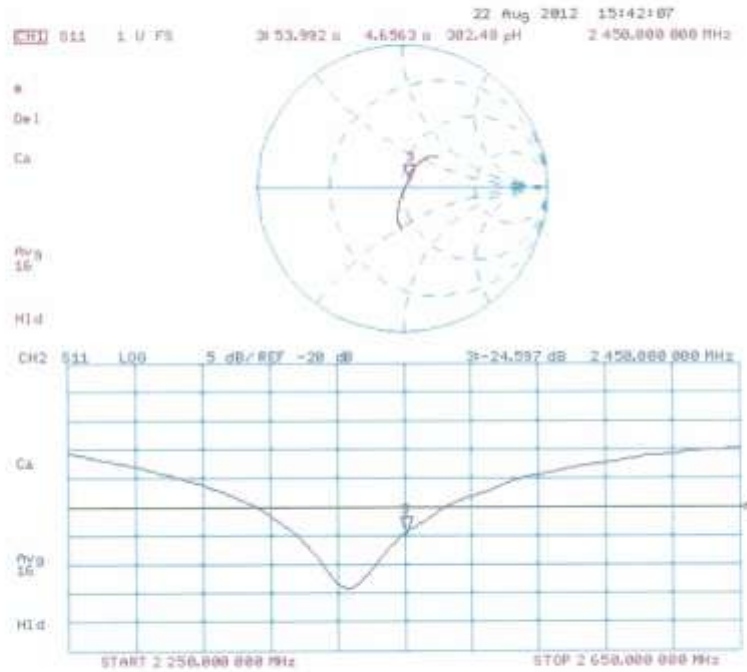
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.18 mW/g

Maximum value of SAR (measured) = 16.5 W/kg



0 dB = 16.5 W/kg = 24.35 dB W/kg

Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 22.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 743**

Communication System: CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.99$  mho/m;  $\epsilon_r = 51.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

**Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**

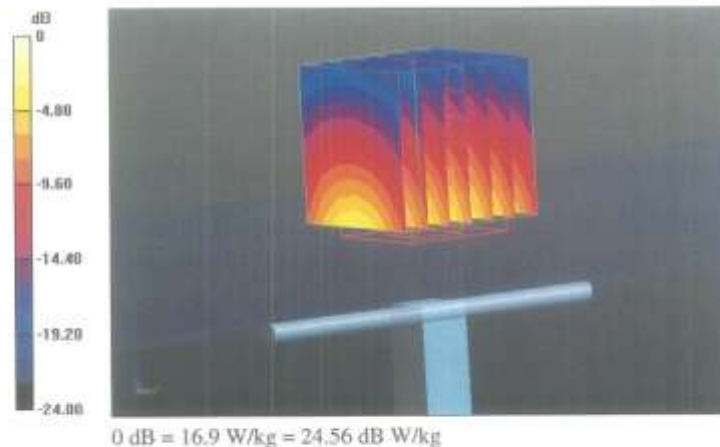
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.699 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 26.489 mW/g

SAR(1 g) = 13 mW/g; SAR(10 g) = 6.1 mW/g

Maximum value of SAR (measured) = 16.9 W/kg



Impedance Measurement Plot for Body TSL

