SAR TEST REPORT

HCT CO., LTD

EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA wireless Router with WLAN
FCC ID:	ZNFL03E
Model:	L-03E
Date of Issue:	Nov. 5. 2012
Test report No.:	HCTA1210FS05-01
Test Laboratory:	**HCT CO., LTD.** 105-1, Jangam-ri, Majang-myeon, Icheon-si,Gyeonggi-do,Korea 467-811 TEL: +82 31 645 6485 FAX: +82 31 645 6401
Applicant :	**LG Electronics MobileComm U.S.A., Inc.** 10101 Old Grove Road, San diego, CA 92131
Testing has been carried out in accordance with:	47CFR §2.1093 FCC OET Bulletin 65(Edition 97-01), Supplement C (Edition 01-01) ANSI/ IEEE C95.1 – 1992 IEEE 1528-2003 KDB 941225 D06 Hot Spot SAR v01
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 : Young-Soo Jang Test Engineer of SAR Part Approved by : Jae-Sang So Manager of SAR Part

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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 C95.1-1992Standard 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 (d*W*) absorbed by (dissipated in) an incremental mass (d*m*) contained in a volume element (d*V*) of a given density (*r*). 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:

σ = conductivity of the tissue-simulant material (S/m)

ρ = mass density of the tissue-simulant material (kg/m^3)

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.

-. 248227 D01 SAR Measurement Procedures for 802.11 a/b/g Transmittiers

-. 447498 D01 General RF Exposure Guidance v04

-. 450824 D01 SAR Prob Cal and Ver Meas v01r01

-. 450824 D02 Dipole SAR Validation Verification v01

-. 941225 D01 SAR test for 3G devices v02

-. 941225 D06 Hotspot SAR v01

3. DESCRIPTION OF DEVICE

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

EUT Type	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA wireless Router with WLAN		
FCC ID	ZNFL03E	Model(s)	L-03E
Trade Name	LG		
Serial Number(s)	#1		
Application Type	Certification		
Modulation(s)	GSM850/GSM1900/WCDMA850/802.11b/g/n		
Tx Frequency	826.4~846.6 MHz (WCDMA850)/2 412- 2 462 MHz (WLAN) 824.20 - 848.80 MHz (GSM850) /1 850.20 – 1 909.80 MHz (GSM1900)		
Rx Frequency	871.4 - 891.6 MHz (WCDMA850)/2 412- 2 462 MHz (WLAN) 869.20 - 893.80 MHz (GSM850)/ 1 930.20 – 1 989.80 MHz (GSM1900)		
FCC Classification	PCS Licensed Transmitter(PCB)		
Production Unit or Identical Prototype	Prototype		
Max. SAR	Band	1g SAR (W/kg)	
		Body-worn	Hotspot
	GSM850	0.267	0.267
	GSM1900	0.337	0.394
	WCDMA850	0.345	0.345
	802.11b	0.00702	0.00702
Simultaneous SAR per KDB 690783 D01		0.418	0.418
Date(s) of Tests	Oct.15, 2012 ~ Oct. 16, 2012, Oct. 31, 2012		
Antenna Type	Integral Antenna		
Key Features	Mobile Hotspot support		
DUT Size	91.2 mm * 61.9 mm (Length * Width)		

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.

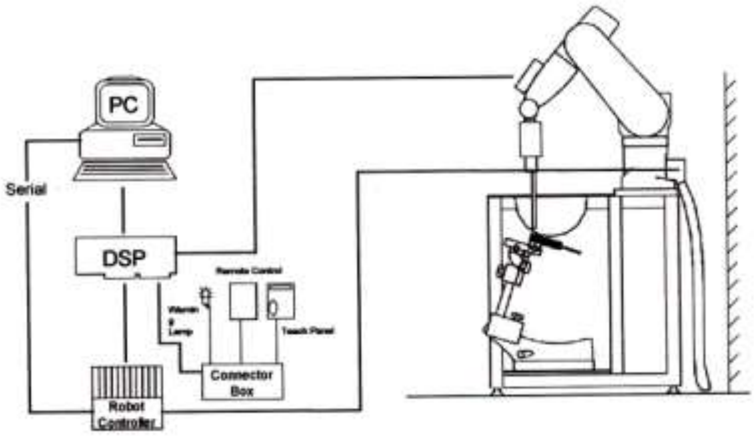


Figure 4.1 HCT SAR Lab. Test Measurement Set-up

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

4.1 ET3DV6 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 > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity	± 0.2 dB in brain tissue (rotation around probe axis) ± 0.4 dB in brain tissue (rotation normal probe axis)
Dynamic	5 μW/g to > 100 mW/g;
Range Linearity:	± 0.2 dB
Surface Detection	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces.
Dimensions	Overall length: 330 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 GSM/WCDMA Phones Fast automatic scanning in arbitrary phantoms

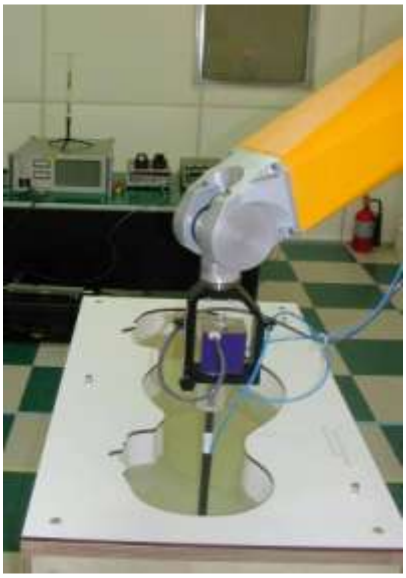


Figure 4.2 Photograph of the probe and the Phantom

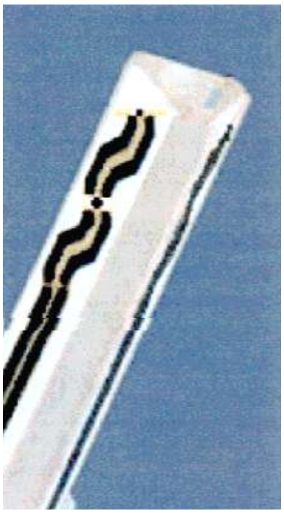


Figure 4.3 ET3DV6 E-field

The SAR measurements were conducted with the dosimetric probe ET3DV6, 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 2nd order fitting. The approach is stopped at reaching the maximum.

4.3 PROBE CALIBRATION PROCESS

4.3.1 E-Probe Calibration

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

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

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

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

where:

Δt = exposure time (30 seconds),

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

ΔT = temperature increase due to RF exposure.

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

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

where:

σ = simulated tissue conductivity,

ρ = Tissue density (1.25 g/cm³ for brain tissue)

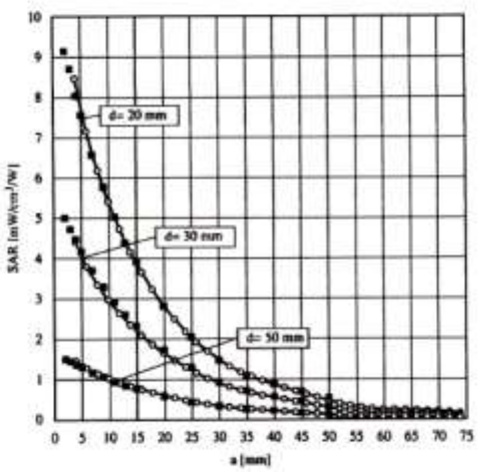


Figure 4.4 E-Field and Temperature measurements at 900 MHz

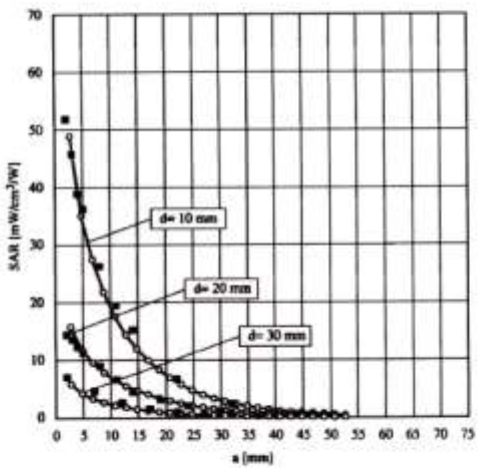


Figure 4.5 E-Field and temperature measurements at 1.8 GHz

4.3.2 Data Extrapolation

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

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

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

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

E-field probes:

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

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

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

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

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

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

with SAR = local specific absorption rate in W/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

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

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

with P_{pwe} = equivalent power density of a plane wave in W/cm^2
E_{tot} = total electric field strength in V/m

4.4 Flat Phantom

Triple Modular Phantom consists of tree 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 4.4 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 repeatable 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 4.5 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 bacteriacide 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		835		915		1 900		2 450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	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 4.1 Composition of the Tissue Equivalent Matter

4.7 SAR TEST EQUIPMENT

Manufacturer	Type / Model	S/N	Calib. Date	Calib.Interval	Calib.Due
SPEAG	SAM Phantom	-	N/A	N/A	N/A
Staubli	Robot RX90L	F01/5K09A1/A/01	N/A	N/A	N/A
Staubli	Robot ControllerCS7MB	F99/5A82A1/C/01	N/A	N/A	N/A
HP	Pavilion t000_puffer	KRJ51201TV	N/A	N/A	N/A
SPEAG	Light Alignment Sensor	265	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	D221340.01	N/A	N/A	N/A
SPEAG	DAE3	466	Feb. 21, 2012	Annual	Feb. 21, 2013
SPEAG	E-Field Probe ET3DV6	1630	Nov. 18, 2011	Annual	Nov. 18, 2012
SPEAG	Validation Dipole D835V2	441	May 16, 2012	Annual	May 16, 2013
SPEAG	Validation Dipole D1900V2	5d032	July 20, 2012	Annual	July 20, 2013
SPEAG	Validation Dipole D2450V2	743	Aug. 23, 2012	Annual	Aug. 23, 2013
Agilent	Power Meter(F) E4419B	MY41291386	Nov. 04, 2011	Annual	Nov. 04, 2012
Agilent	Power Sensor(G) 8481	MY41090870	Nov. 04, 2011	Annual	Nov. 04, 2012
HP	Dielectric Probe Kit	00721521	N/A	N/A	N/A
HP	Dual Directional Coupler	16072	Nov. 04, 2011	Annual	Nov. 04, 2012
Agilent	Base Station E5515C	GB44400269	Feb. 10, 2012	Annual	Feb. 10, 2013
HP	Signal Generator E4438C	MY42082646	Nov. 11, 2011	Annual	Nov. 11, 2012
HP	Network Analyzer 8753ES	JP39240221	Apr. 3, 2012	Annual	Apr. 3, 2013

NOTE:

The E-field probe was calibrated by SPEAG, by the waveguide technique procedure. Dipole Validation measurement is performed by HCT Lab. before each test. The brain 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-equivalent material.

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 20 mm x 20 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.

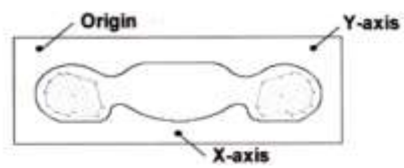


Figure 5.1 SAR Measurement Point in Area Scan

6. MEASUREMENT UNCERTAINTY

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

Table 6.1 Uncertainty (800 MHz- 2450 MHz)

7. 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 7.1 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).

8. SYSTEM VERIFICATION

8.1 Tissue Verification

Freq. [MHz]	Date	Liquid	Liquid Temp.[°C]	Parameters	Target Value	Measured Value	Deviation [%]	Limit [%]
835	Oct. 15, 2012	Body	21.3	ε r	55.2	53.3	- 3.44	± 5
				σ	0.97	0.996	+ 2.68	± 5
1 900	Oct. 16, 2012	Body	21.2	ε r	53.3	52	- 2.44	± 5
				σ	1.52	1.55	+ 1.97	± 5
2 450	Oct. 31, 2012	Body	21.1	ε r	52.7	53.7	+ 1.90	± 5
				σ	1.95	1.94	- 0.51	± 5

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

8.2 System Validation

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

Freq. [MHz]	Date	Probe (SN)	Liquid	Amb. Temp. [°C]	Liquid Temp. [°C]	1 W Target SAR_{1g} (SPEAG) (mW/g)	Measured SAR_{1g} (mW/g)	1 W Normalized SAR_{1g} (mW/g)	Deviation [%]	Limit [%]
835	Oct. 15, 2012	1630	Body	21.5	21.3	9.5	0.956	9.56	+ 0.63	± 10
1 900	Oct. 16, 2012	1630	Body	21.4	21.2	39.9	3.85	38.5	- 3.51	± 10
2 450	Oct. 31, 2012	1630	Body	21.3	21.1	51.2	5.22	52.2	+ 1.95	± 10

8.3 System Validation Procedure

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

- Cabling the system, using the validation 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.

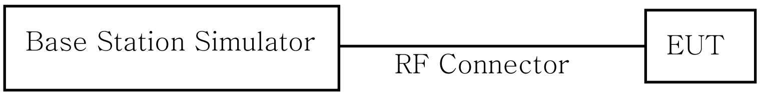
Note;
SAR Verification was performed according to the FCC KDB 450824.

9. 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 then 5 % occurred, the tests were repeated.

9.1 GSM

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



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

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

Note;

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

GSM Conducted output powers (Burst-Average)

Band	Channel	Voice	GPRS(GMSK) Data – CS1			
		GSM (dBm)	GPRS 1 TX Slot (dBm)	GPRS 2 TX Slot (dBm)	GPRS 3 TX Slot (dBm)	GPRS 4 TX Slot (dBm)
GSM 850	128	32.88	32.94	30.46	28.9	28.02
	190	32.98	33.05	30.56	28.93	28.2
	251	32.93	32.96	30.49	28.83	27.7
GSM 1900	512	29.88	29.98	28.55	26.31	25.05
	661	29.9	29.99	28.4	26.32	25.11
	810	29.95	29.96	28.43	26.3	24.98

GSM Conducted output powers (Frame-Average)

Band	Channel	Voice	GPRS(GMSK) Data – CS1			
		GSM (dBm)	GPRS 1 TX Slot (dBm)	GPRS 2 TX Slot (dBm)	GPRS 3 TX Slot (dBm)	GPRS 4 TX Slot (dBm)
GSM 850	128	23.85	23.91	24.44	24.64	25.01
	190	23.95	24.02	24.54	24.67	25.19
	251	23.9	23.93	24.47	24.57	24.69
GSM 1900	512	20.85	20.95	22.53	22.05	22.04
	661	20.87	20.96	22.38	22.06	22.1
	810	20.92	20.93	22.41	22.04	21.97

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

9.2 WCDMA

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

9.2.1 Output Power Verification

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

9.2.2 Head SAR Measurements

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

9.2.3 Body SAR Measurement

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

9.2.4 Handsets with Release 5 HSDPA

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

Sub-Test 1 Setup for Release 5 HSDPA

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	CM (dB) (2)
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15 (3)	15/15 (3)	64	12/15 (3)	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

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

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15.

Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

9.2.5 Handsets with Release 6 HSPA (HSDPA/HSUPA)

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

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

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

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

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

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

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

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

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]						MPR Target
			4132	Power reduction (dB)	4183	Power reduction (dB)	4233	Power reduction (dB)	
99	WCDMA	12.2 kbps RMC	23.09		23.10		23.09		-
99	WCDMA	12.2 kbps AMR	23.06		23.10		23.07		
5	HSDPA	Subtest 1	22.06	0.00	22.04	0.00	22.02	0.00	0
5		Subtest 2	22.02	-0.04	22.03	-0.01	22.02	0.00	0
5		Subtest 3	21.47	-0.59	21.55	-0.49	21.51	-0.51	0.5
5		Subtest 4	21.46	-0.60	21.54	-0.50	21.51	-0.51	0.5
6	HSUPA	Subtest 1	22.05	0.00	21.81	0.00	21.78	0.00	0
6		Subtest 2	20.52	-1.53	20.43	-1.38	20.50	-1.28	2
6		Subtest 3	20.16	-1.89	20.02	-1.79	19.98	-1.80	1
6		Subtest 4	21.53	-0.52	21.49	-0.32	21.45	-0.33	2
6		Subtest 5	21.68	-0.37	21.55	-0.26	21.52	-0.26	0

WCDMA Average Conducted output powers

9.3 WiFi

9.3.1 SAR Testing for 802.11b/g/n modes

General Device Setup

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

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

Frequency Channel Configurations

802.11 a/b/g and 4.9 GHz operating modes are tested independently according to the service requirements in each frequency band. 802.11 b/g modes are tested on channels 1, 6 and 11.802.11a is tested for UNII operations on channels 36 and 48 in the 5.15-5.25 GHz band; channels 52 and 64 in the 5.25-5.35 GHz band; Channels 104, 116, 124 and 136 in the 5.470-5.725 GHz band; and channels 149 and 161 in the 5.8 GHz band. When 5.8 GHz § 15.247 is also available, channels 149, 157 and 165 should be tested instead of the UNII channels. 4.9 GHz is tested on channels 1, 10 and 5 or 6, whichever has the higher output power, for 5 MHz channels; channels 11,15 and 19 for 10 MHz channels; and channels 21 and 25 for 20 MHz channels.

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

Mode		GHz	Channel	Turbo Channel	"Default Test Channels" §15.247 802.11b	802.11g	UNII	
802.11 b/g		2.412	1		√	∇		
		2.437	6	6	√	∇		
		2.462	11		√	∇		
802.11a	UNII	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	Unknown				*
		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

Ant.0

Band	Channel	Conducted Power (dBm)			
		Data Rate (Mbps)			
		1	2	5.5	11
IEEE 802.11b	1	11.15	11.07	10.97	10.96
	6	11.31	11.26	11.28	11.10
	11	11.42	11.41	11.37	11.25

Average IEEE 802.11b Conducted output power

Ant.0

Band	Channel	Conducted Power (dBm)							
		Data Rate (Mbps)							
		6	9	12	18	24	36	48	54
IEEE 802.11g	1	11.18	11.03	10.81	10.65	10.58	10.32	10.18	10.04
	6	11.42	11.39	11.36	11.20	10.98	10.70	10.48	10.39
	11	11.43	11.33	11.27	10.96	10.91	10.57	10.22	10.26

Average IEEE 802.11g Conducted output power

Ant.0

Band	Channel	Conducted Power (dBm)							
		Data Rate (Mbps)							
		6.5	13	20	26	39	52	58	65
IEEE 802.11n (HT-20)	1	11.08	10.97	10.71	10.70	10.10	10.18	9.75	9.63
	6	11.25	11.09	10.72	10.54	10.37	9.99	9.94	9.80
	11	11.09	10.91	10.91	10.75	10.53	10.33	10.26	10.16

Average IEEE 802.11n Conducted output power

Ant.0

Band	Channel	Conducted Power (dBm)							
		Data Rate (Mbps)							
		13.5	27	40.5	54	81	108	121.5	135
IEEE 802.11n (HT-40)	3	10.78	10.30	10.15	9.81	9.32	8.96	9.00	8.69
	6	10.84	10.50	10.29	9.99	9.51	9.15	9.11	8.88
	9	11.06	10.57	10.36	10.12	9.48	9.43	9.03	8.80

Average IEEE 802.11n Conducted output power

Ant.1

Band	Channel	Conducted Power (dBm)							
		Data Rate (Mbps)							
		6.5	13	20	26	39	52	58	65
IEEE 802.11n (HT-20)	1	10.08	9.86	9.69	9.55	9.17	8.93	8.81	8.74
	6	10.38	10.15	9.87	9.84	9.41	9.17	9.02	8.91
	11	10.53	10.24	10.05	9.99	9.57	9.34	9.28	9.19

Average IEEE 802.11n Conducted output power

Ant.1

Band	Channel	Conducted Power (dBm)							
		Data Rate (Mbps)							
		13.5	27	40.5	54	81	108	121.5	135
IEEE 802.11n (HT-40)	3	9.77	9.39	9.14	8.83	8.46	8.12	8.01	7.79
	6	9.81	9.57	9.21	8.91	8.57	8.16	7.96	7.88
	9	9.95	9.85	9.54	9.26	8.77	8.46	8.22	8.02

Average IEEE 802.11n Conducted output power

10. SAR Test configuration & Antenna Information

10.1 SAR Test configurations

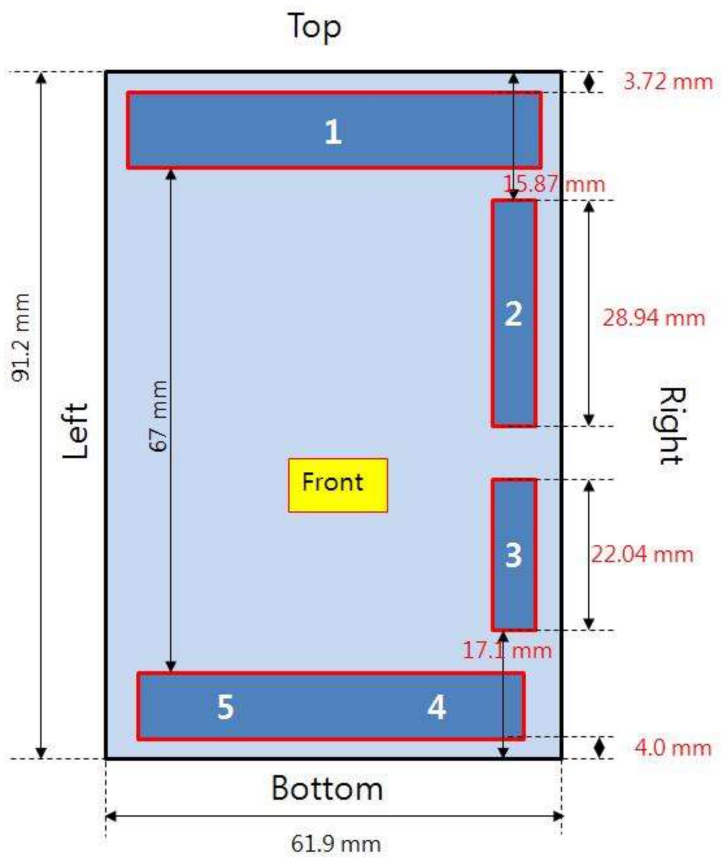
According to KDB 941225 D06, SAR must be measured for all sides and surfaces with a transmitting antenna located within 25 mm from that surface or edge.

For devices with form factors larger than 9 cm x 5 cm, a test separation distance of 10 mm is required.

Please refer to “SAR Test Setup Photos” file for the test setup photos.

Mode	Back	Front	Left	Right	Bottom	Top
WCDMA850	Yes	Yes	Yes	Yes	No	Yes
GSM850	Yes	Yes	Yes	Yes	No	Yes
GSM1900	Yes	Yes	Yes	Yes	No	Yes
2.4 GHz WLAN	Yes	Yes	No	Yes	Yes	No

10.2 Antenna and Device Information



[Front side View]

11. SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas

11.1 SAR Evaluation Considerations

These procedures were followed according to FCC "SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas", May 2008. The procedures are applicable to phones with built-in unlicensed transmitters, such as 802.11 a/b/g and Bluetooth devices.

	2.45	5.15 - 5.35	5.47 - 5.85	GHz
P_{Ref}	12	6	5	mW
Device output power should be rounded to the nearest mW to compare with values specified in this				

Table. 11.1 Output Power Thresholds for Unlicensed Transmitters

	Individual Transmitter	Simultaneous Transmission
Licensed Transmitters	Routine evaluation required	SAR not required: Unlicensed only ○ when stand-alone 1-g SAR is not required and antenna is ≥ 5 cm from other antennas Licensed & Unlicensed ○ when the sum of the 1-g SAR is < 1.6 W/kg for all simultaneous transmitting antennas ○ when SAR to peak location separation ratio of simultaneous transmitting antenna pair is < 0.3 SAR required: Licensed & Unlicensed antenna pairs with SAR to peak location separation ratio ≥ 0.3; test is only required for the configuration that results in the highest SAR in stand-alone configuration for each wireless mode and exposure condition Note: simultaneous transmission exposure conditions for head and body can be different for different style phones; therefore, different test requirements may apply
Unlicensed Transmitters	When there is no simultaneous transmission – ○ output ≤ 60/f: SAR not required ○ output > 60/f: stand-alone SAR required When there is simultaneous transmission – Stand-alone SAR not required when ○ output ≤ 2·P_{Ref} and antenna is ≥ 5.0 cm from other antennas ○ output ≤ P_{Ref} and antenna is ≥ 2.5 cm from other antennas ○ output ≤ P_{Ref} and antenna is < 2.5 cm from other antennas, each with either output power ≤ P_{Ref} or 1-g SAR < 1.2 W/kg Otherwise stand-alone SAR is required When stand-alone SAR is required ○ test SAR on highest output channel for each wireless mode and exposure condition ○ if SAR for highest output channel is > 50% of SAR limit, evaluate all channels according to normal procedures	
Jaw, Mouth and Nose	Flat phantom SAR required ○ when measurement is required in tight regions of SAM and it is not feasible or the results can be questionable due to probe tilt, calibration, positioning and orientation issues ○ position rectangular and clam-shell phones according to flat phantom procedures and conduct SAR measurements for these specific locations	When simultaneous transmission SAR testing is required, contact the FCC Laboratory for interim guidance.

Table. 11.2 SAR Evaluation Requirements for Cellphones with Multiple Transmitters

FCC ID: ZNFL03E

11.2 SAR Summation Scenario

Simultaneous Transmission Summation for Body-Worn (1cm)

Simultaneous TX	configuration	GPRS850 SAR(W/kg)	2.4 GHz WIFI SAR (W/kg)	∑SAR (W/kg)	Simultaneous TX	configuration	WCDMA850 SAR(W/kg)	2.4 GHz WIFI SAR (W/kg)	∑SAR (W/kg)
Body SAR	Back	0.23	0.00702	0.237	Body SAR	Back	0.294	0.00702	0.301
	Front	0.267	0.000502	0.268		Front	0.345	0.000502	0.346

Simultaneous TX	configuration	GPRS1900 SAR(W/kg)	2.4 GHz WIFI SAR (W/kg)	∑SAR (W/kg)
Body SAR	Back	0.337	0.00702	0.344
	Front	0.283	0.000502	0.284

Simultaneous Transmission Summation for Hotspot (1cm)

Simultaneous TX	configuration	GPRS850 SAR(W/kg)	2.4GHz WIFI SAR (W/kg)	∑SAR (W/kg)	Simultaneous TX	configuration	GPRS1900 SAR(W/kg)	2.4GHz WIFI SAR (W/kg)	∑SAR (W/kg)
Body SAR	Back	0.23	0.00702	0.237	Body SAR	Back	0.337	0.00702	0.344
	Front	0.267	0.000502	0.268		Front	0.283	0.000502	0.284
	Left	0.122	-	0.122		Left	0.034	-	0.034
	Right	0.132	0.000177	0.132		Right	0.184	0.000177	0.184
	Bottom	-	0.000545	0.001		Bottom	-	0.000545	0.001
	Top	0.046	-	0.046		Top	0.394	-	0.394

Simultaneous TX	configuration	WCDMA850 SAR(W/kg)	2.4GHz WIFI SAR (W/kg)	∑SAR (W/kg)
Body SAR	Back	0.294	0.00702	0.301
	Front	0.345	0.000502	0.346
	Left	0.179	-	0.179
	Right	0.177	0.000177	0.177
	Bottom	-	0.000545	0.001
	Top	0.066	-	0.066

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.

11.3 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.

The conducted output power level of the Ant.1 WLAN is less than 2*P_{ref}, the Ant.1 WLAN is more than 5 cm from the other antenna, therefore, a stand-alone Ant.1 WLAN SAR evaluation are not required.

12. SAR TEST DATA SUMMARY

12.1 Measurement Results (GSM850 Hotspot SAR)

Frequency		Modulation	Conducted Power (dBm)	Power Drift (dB)	Configuration	Separation Distance	SAR(mW/g)
MHz	Channel						
836.6	190 (Mid)	GPRS 4Tx	28.20	-0.019	Rear	1.0 cm	0.23
836.6	190 (Mid)	GPRS 4Tx	28.20	-0.022	Front	1.0 cm	0.267
836.6	190 (Mid)	GPRS 4Tx	28.20	-0.013	Left	1.0 cm	0.122
836.6	190 (Mid)	GPRS 4Tx	28.20	0.178	Right	1.0 cm	0.132
836.6	190 (Mid)	GPRS 4Tx	28.20	0.045	Top	1.0 cm	0.046
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						**Head 1.6 W/kg (mW/g)** Averaged over 1 gram	

NOTES:

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 Justification for reduced test configurations: per FCC/OET Supplement C (July, 2001), if the SAR measured at the middle channel for each test configuration (Left, right, cheek/touch, tilt/ear, extended and retracted) is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

9 For body SAR testing, the EUT was set in GPRS multi-slot class12 with 4uplink slots for GSM850 due to maximum source-based time-averaged output power.
According to the KDB 941225 D03 SAR test reduction GSM/GPRS/EDGE, the maximum output power configuration were chosen for Body SAR testing.

12.2 Measurement Results (GSM1900 Hotspot SAR)

Frequency		Modulation	Conducted Power (dBm)	Power Drift (dB)	Configuration	Separation Distance	SAR(mW/g)
MHz	Channel						
1 880.0	661 (Mid)	GPRS 2Tx	28.40	0.012	Rear	1.0 cm	0.337
1 880.0	661 (Mid)	GPRS 2Tx	28.40	-0.027	Front	1.0 cm	0.283
1 880.0	661 (Mid)	GPRS 2Tx	28.40	-0.009	Left	1.0 cm	0.034
1 880.0	661 (Mid)	GPRS 2Tx	28.40	-0.009	Right	1.0 cm	0.184
1 880.0	661 (Mid)	GPRS 2Tx	28.40	-0.115	Top	1.0 cm	0.394
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						**Head 1.6 W/kg (mW/g)** Averaged over 1 gram	

NOTES:

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 Justification for reduced test configurations: per FCC/OET Supplement C (July, 2001), if the SAR measured at the middle channel for each test configuration (Left, right, cheek/touch, tilt/ear, extended and retracted) is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
9 For body SAR testing, the EUT was set in GPRS multi-slot class12 with 2uplink slots for GSM850 due to maximum source-based time-averaged output power.
According to the KDB 941225 D03 SAR test reduction GSM/GPRS/EDGE, the maximum output power configuration were chosen for Body SAR testing.

12.3 Measurement Results (WCDMA850 Hotspot SAR)

Frequency		Modulation	Conducted Power (dBm)	Power Drift (dB)	Configuration	Separation Distance	SAR(mW/g)
MHz	Channel						
836.6	4183 (Mid)	WCDMA850	23.10	-0.165	Rear	1.0 cm	0.294
826.4	4183 (Mid)	WCDMA850	23.10	0.008	Front	1.0 cm	0.345
836.6	4183 (Mid)	WCDMA850	23.10	-0.014	Left	1.0 cm	0.179
836.6	4183 (Mid)	WCDMA850	23.10	-0.18	Right	1.0 cm	0.177
836.6	4183 (Mid)	WCDMA850	23.10	-0.112	Top	1.0 cm	0.066
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						**Body 1.6 W/kg (mW/g)** Averaged over 1 gram	

NOTES:

1 Measured Depth of Simulating Tissue is 15.0 cm ± 0.2 cm.
2 Tissue parameters and temperatures are listed on the SAR plot.
3 Test Signal Call Mode ☐ Manual Test cord ☒ Base Station Simulator
4 Test Configuration ☐ With Holster ☒ Without Holster
5 Justification for reduced test configurations: per FCC/OET Supplement C (July, 2001), if the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
6 WCDMA Mode was tested under RMC 12.2 kbps and HSPA Inactive.

12.4 Measurement Results (802.b/g/n Hotspot SAR)

Frequency		Modulation	Conducted Power (dBm)	Power Drift (dB)	Configuration	Separation Distance	Data Rate	SAR(mW/g)
MHz	Channel							
2 462	11 (High)	802.11b	11.42	0.02	Rear	1.0 cm	1 Mbps	0.00702
2 462	11 (High)	802.11b	11.42	0.07	Front	1.0 cm	1 Mbps	0.000502
2 462	11 (High)	802.11b	11.42	-0.07	Right	1.0 cm	1 Mbps	0.000177
2 462	11 (High)	802.11b	11.42	0.031	Bottom	1.0 cm	1 Mbps	0.000545
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						**Head 1.6 W/kg (mW/g)** Averaged over 1 gram		

NOTES:

1 The test data reported are the worst-case SAR value with the antenna-body position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].

2 All modes of operation were investigated and the worst-case are reported.

3 Measured Depth of Simulating Tissue is 15.0 cm ± 0.2 cm.

4 Tissue parameters and temperatures are listed on the SAR plot.

5 Battery Type ☒ Standard ☐ Extended ☐ Slim
Batteries are fully charged for all readings.

6 Test Signal Call Mode ☒ Manual Test code ☐ Base Station Simulator

7 IEEE 802.11g(including 802.11n) SAR testing is required when the conducted powers are equal to or greater than 0.25 dB Than the conducted powers in IEEE 802.11b.

8 For 2.4GHz WLAN, Highest average power channel for the lowest data rate was selected for SAR evaluation based on KDB 248227. Other channels are not necessary because 1g-average SAR < 0.8 W/Kg and peak SAR < 1.6W/Kg per KDB 248227.

13. Scaled SAR Values to the Maximum tune-up tolerances

The following measured results were scaled to the maximum tune-up tolerances, according to the output power of the channel tested for the highest measured results in each frequency band

Test Configuration	Mode	Ch #	Freq (MHz)	Power(dBm)		SAR(W/kg)	
				Max. Tune-up limit	Measured	Measured	Scaled
Front	GPRS850	190	836.6	28.20	28.20	0.267	0.267
Top	GPRS1900	661	1 880.0	28.70	28.40	0.394	0.422
Front	WCDMA850	4183	836.6	23.20	23.10	0.345	0.353
Rear	802.11b	11	2 462.0	11.52	11.43	0.00702	0.007167

14. 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.

15. REFERENCES

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Attachment 1. – SAR Test Plots

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.3 ℃
Ambient Temperature:	21.5 ℃
Test Date:	Oct.15, 2012
Separation Distance:	1.0 cm

DUT: L-03E; Type: bar; Serial: #1

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:2.075
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.997 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

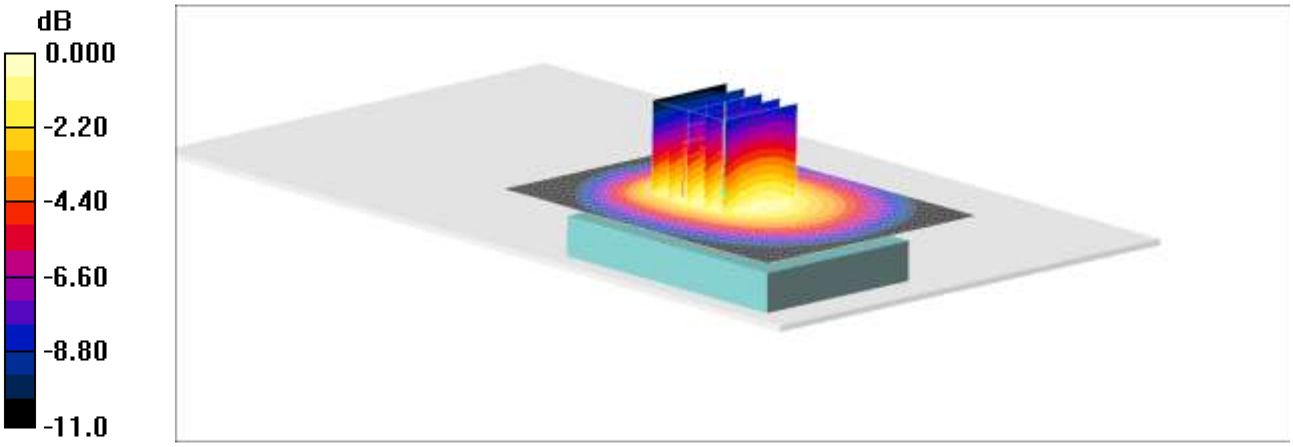
DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.27, 6.27, 6.27); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM850 Rear 190/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.243 mW/g

GSM850 Rear 190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.6 V/m; Power Drift = -0.165 dB
Peak SAR (extrapolated) = 0.308 W/kg
SAR(1 g) = 0.230 mW/g; SAR(10 g) = 0.161 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.245 mW/g



0 dB = 0.245mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.3 ℃
Ambient Temperature:	21.5 ℃
Test Date:	Oct.15, 2012
Separation Distance:	1.0 cm

DUT: L-03E; Type: bar; Serial: #1

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:2.075
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.997 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

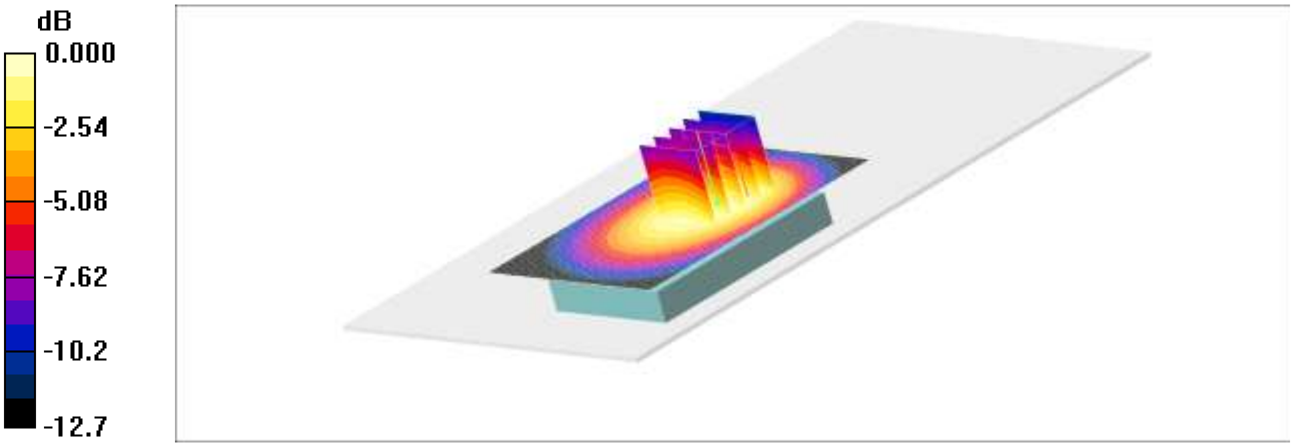
DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.27, 6.27, 6.27); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM850 Front 190/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.287 mW/g

GSM850 Front 190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.2 V/m; Power Drift = 0.008 dB
Peak SAR (extrapolated) = 0.350 W/kg
SAR(1 g) = 0.267 mW/g; SAR(10 g) = 0.188 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.285 mW/g



0 dB = 0.285mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.3 ℃
Ambient Temperature:	21.5 ℃
Test Date:	Oct.15, 2012
Separation Distance:	1.0 cm

DUT: L-03E; Type: bar; Serial: #1

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:2.075
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.997 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

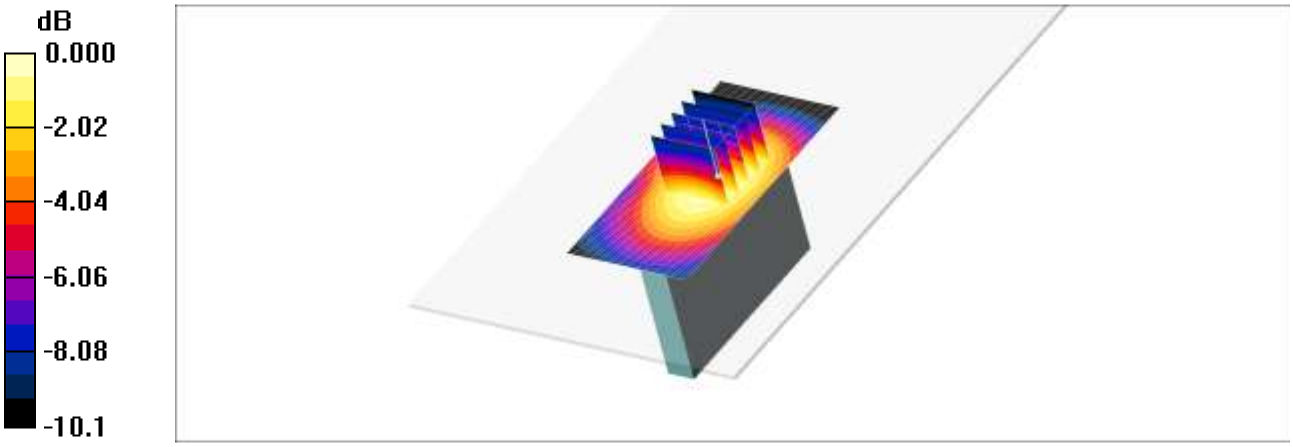
DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.27, 6.27, 6.27); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM850 Left 190/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.128 mW/g

GSM850 Left 190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.14 V/m; Power Drift = -0.014 dB
Peak SAR (extrapolated) = 0.165 W/kg
SAR(1 g) = 0.122 mW/g; SAR(10 g) = 0.084 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.131 mW/g



0 dB = 0.131mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.3 ℃
Ambient Temperature:	21.5 ℃
Test Date:	Oct.15, 2012
Separation Distance:	1.0 cm

DUT: L-03E; Type: bar; Serial: #1

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:2.075
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.997 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

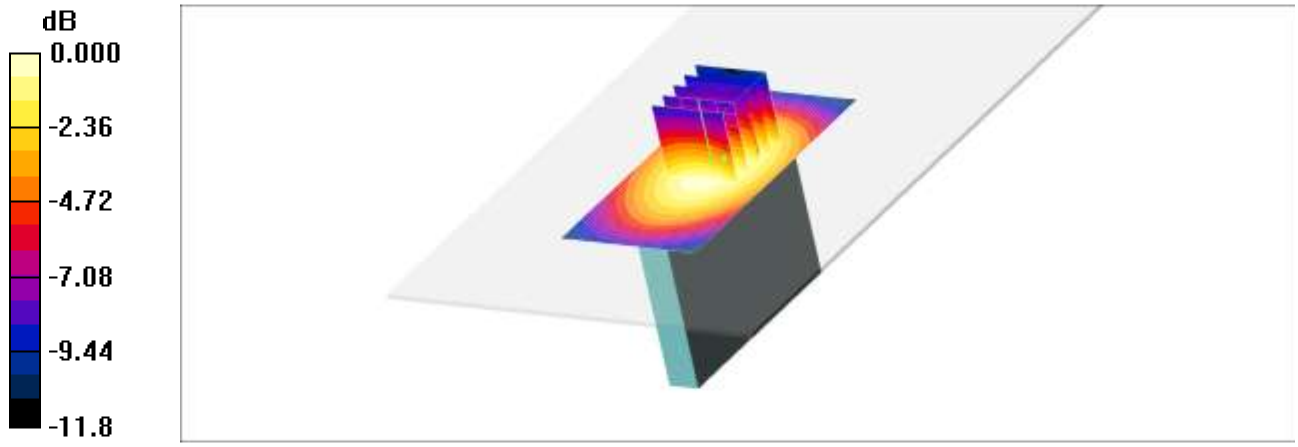
DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.27, 6.27, 6.27); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM850 Right 190/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.148 mW/g

GSM850 Right 190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.55 V/m; Power Drift = -0.180 dB
Peak SAR (extrapolated) = 0.175 W/kg
SAR(1 g) = 0.132 mW/g; SAR(10 g) = 0.092 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.141 mW/g



0 dB = 0.141mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.3 ℃
Ambient Temperature:	21.5 ℃
Test Date:	Oct.15, 2012
Separation Distance:	1.0 cm

DUT: L-03E; Type: bar; Serial: #1

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:2.075
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.997 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

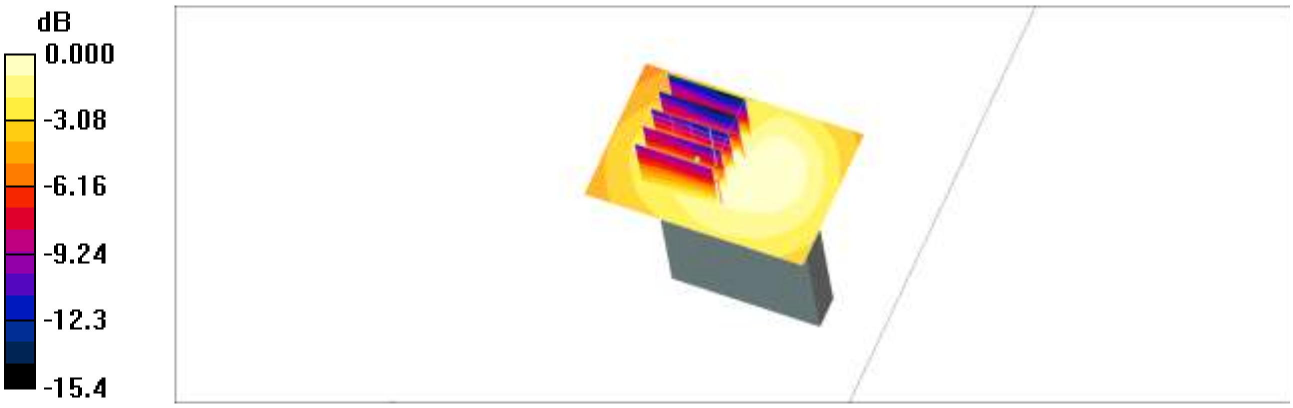
DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.27, 6.27, 6.27); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM850 top 190/Area Scan (61x41x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.050 mW/g

GSM850 top 190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.73 V/m; Power Drift = -0.112 dB
Peak SAR (extrapolated) = 0.092 W/kg
SAR(1 g) = 0.046 mW/g; SAR(10 g) = 0.027 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.049 mW/g



0 dB = 0.049mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.2 ℃
Ambient Temperature:	21.4 ℃
Test Date:	Oct.16, 2012
Separation Distance:	1.0 cm

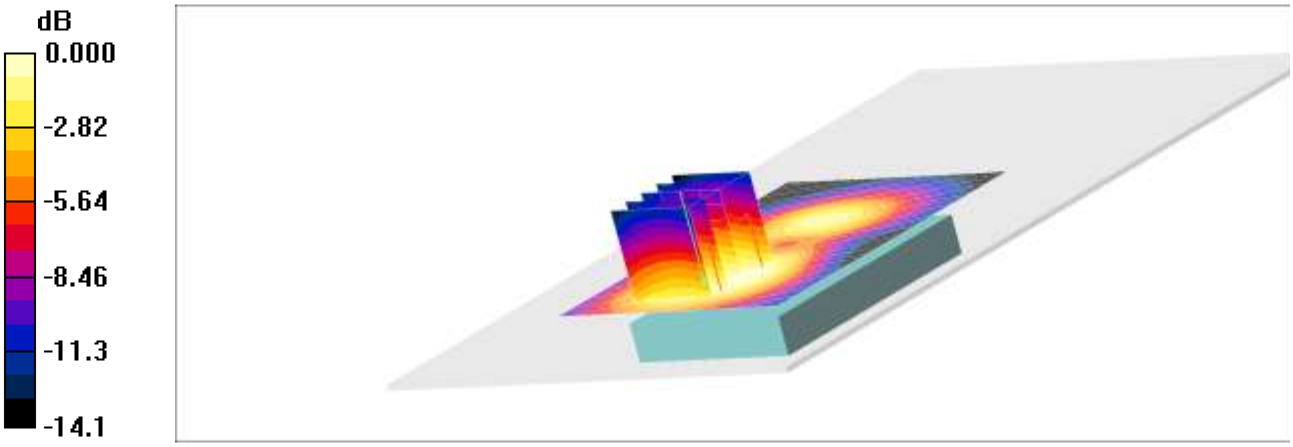
DUT: L-03E; Type: bar; Serial: #1

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:4.15
Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 52.1; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.75, 4.75, 4.75); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM1900 Rear 661/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.369 mW/g

GSM1900 Rear 661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.1 V/m; Power Drift = -0.019 dB
Peak SAR (extrapolated) = 0.492 W/kg
SAR(1 g) = 0.337 mW/g; SAR(10 g) = 0.225 mW/g
Maximum value of SAR (measured) = 0.359 mW/g



0 dB = 0.359mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.2 ℃
Ambient Temperature:	21.4 ℃
Test Date:	Oct.16, 2012
Separation Distance:	1.0 cm

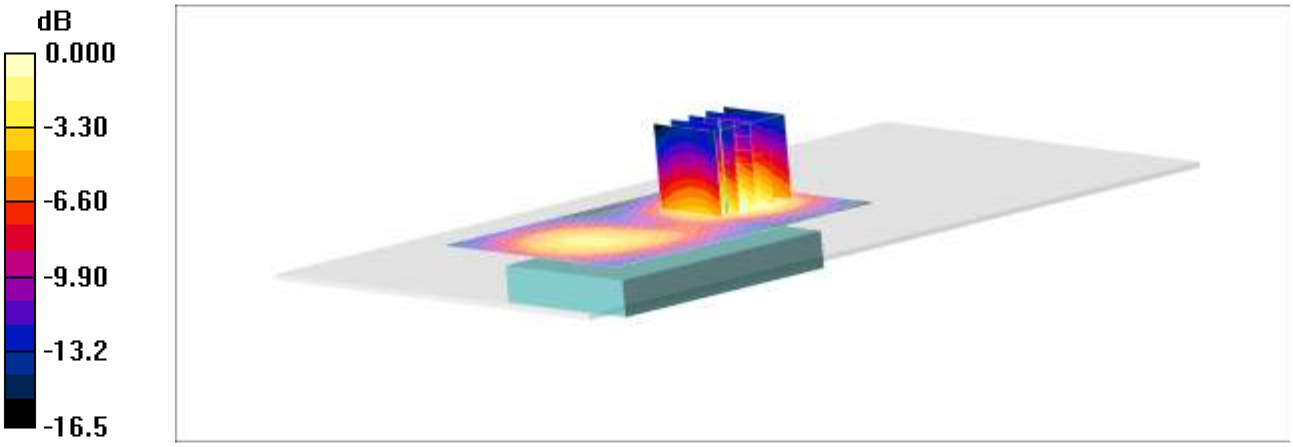
DUT: L-03E; Type: bar; Serial: #1

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:4.15
Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 52.1; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.75, 4.75, 4.75); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM1900 Front 661/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.316 mW/g

GSM1900 Front 661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.3 V/m; Power Drift = -0.022 dB
Peak SAR (extrapolated) = 0.468 W/kg
SAR(1 g) = 0.283 mW/g; SAR(10 g) = 0.162 mW/g
Maximum value of SAR (measured) = 0.311 mW/g



0 dB = 0.311mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.2 ℃
Ambient Temperature:	21.4 ℃
Test Date:	Oct.16, 2012
Separation Distance:	1.0 cm

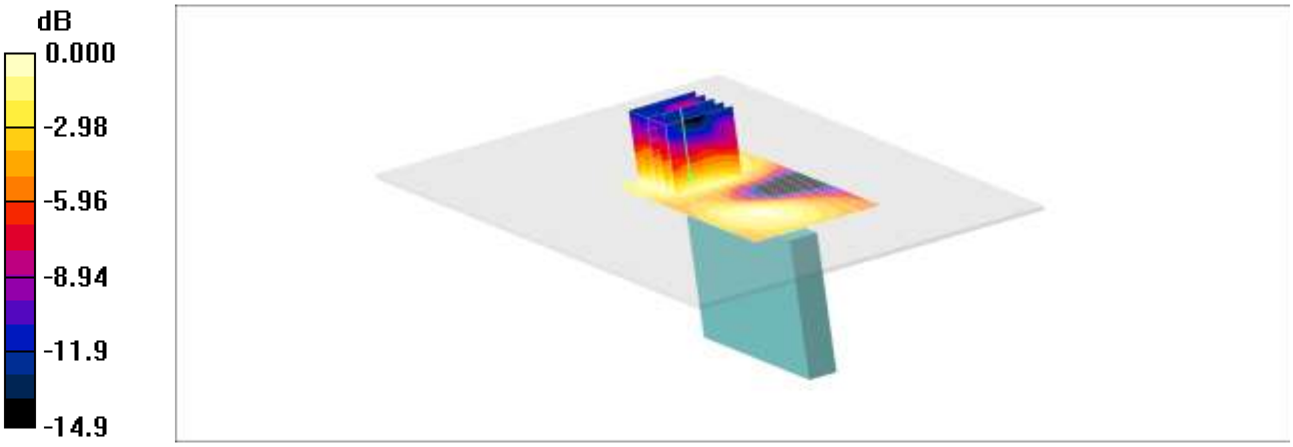
DUT: L-03E; Type: bar; Serial: #1

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:4.15
Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 52.1; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.75, 4.75, 4.75); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM1900 left 661/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.037 mW/g

GSM1900 left 661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.02 V/m; Power Drift = -0.013 dB
Peak SAR (extrapolated) = 0.062 W/kg
SAR(1 g) = 0.034 mW/g; SAR(10 g) = 0.021 mW/g
Maximum value of SAR (measured) = 0.036 mW/g



0 dB = 0.036mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.2 ℃
Ambient Temperature:	21.4 ℃
Test Date:	Oct.16, 2012
Separation Distance:	1.0 cm

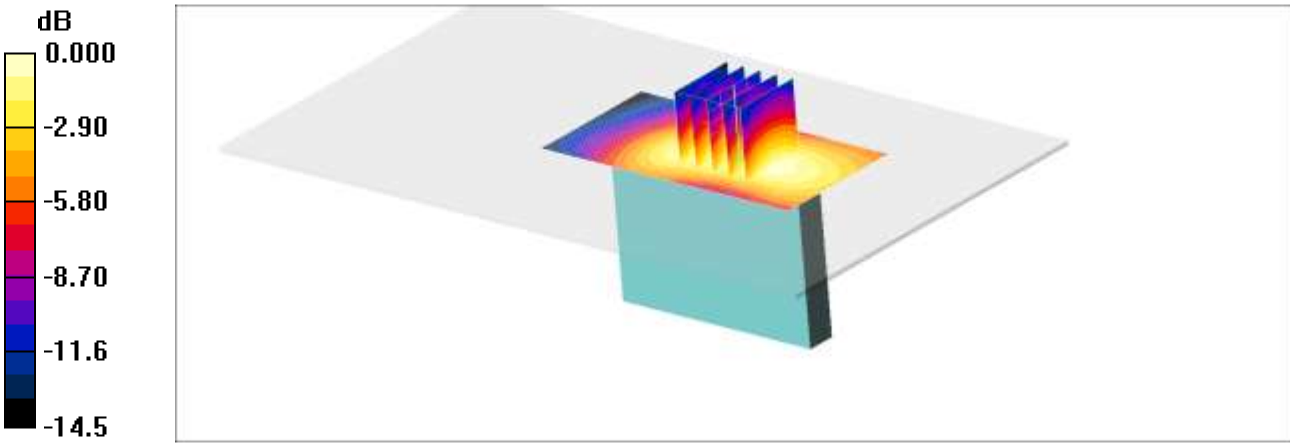
DUT: L-03E; Type: bar; Serial: #1

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:4.15
Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 52.1; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.75, 4.75, 4.75); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM1900 Right 661/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.198 mW/g

GSM1900 Right 661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.63 V/m; Power Drift = 0.178 dB
Peak SAR (extrapolated) = 0.294 W/kg
SAR(1 g) = 0.184 mW/g; SAR(10 g) = 0.116 mW/g
Maximum value of SAR (measured) = 0.199 mW/g



0 dB = 0.199mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.2 ℃
Ambient Temperature:	21.4 ℃
Test Date:	Oct.16, 2012
Separation Distance:	1.0 cm

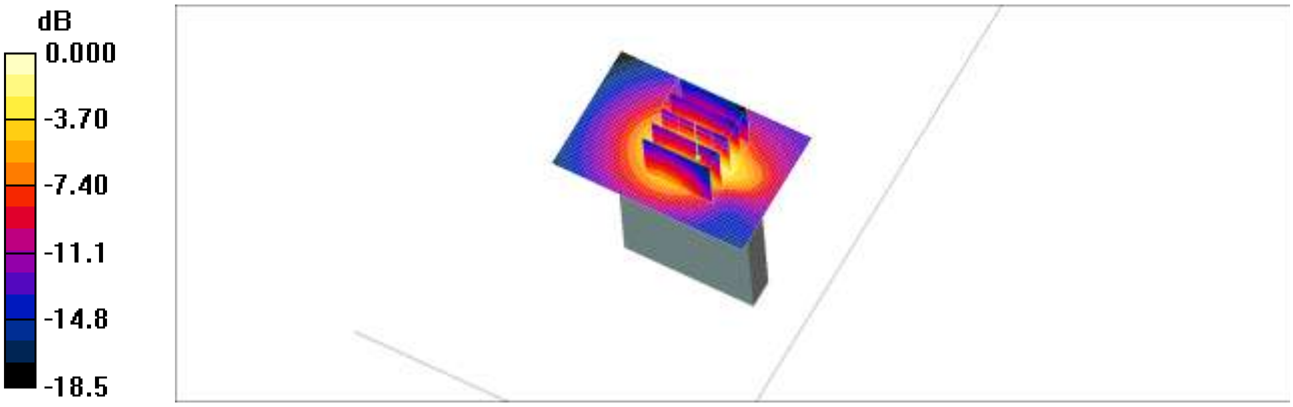
DUT: L-03E; Type: bar; Serial: #1

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:4.15
Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 52.1; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.75, 4.75, 4.75); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM1900 TOP 661/Area Scan (61x41x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.473 mW/g

GSM1900 TOP 661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.6 V/m; Power Drift = 0.045 dB
Peak SAR (extrapolated) = 0.685 W/kg
SAR(1 g) = 0.394 mW/g; SAR(10 g) = 0.211 mW/g
Maximum value of SAR (measured) = 0.443 mW/g



0 dB = 0.443mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.3 ℃
Ambient Temperature:	21.5 ℃
Test Date:	Oct.15, 2012
Separation Distance:	1.0 cm

DUT: L-03E; Type: bar; Serial: #1

Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.997 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

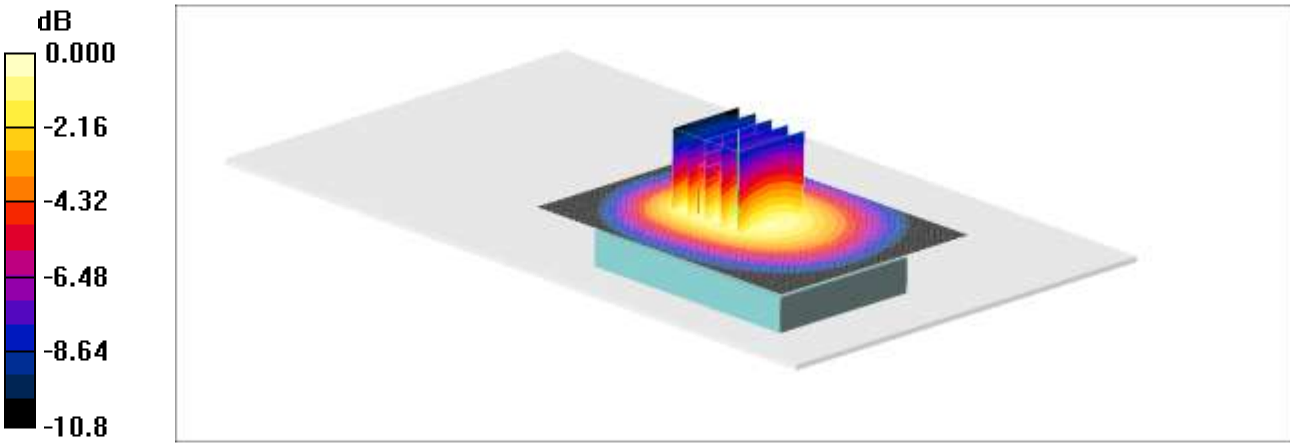
DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.27, 6.27, 6.27); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

WCDMA850 Rear 4183/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.318 mW/g

WCDMA850 Rear 4183/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.6 V/m; Power Drift = 0.012 dB
Peak SAR (extrapolated) = 0.384 W/kg
SAR(1 g) = 0.294 mW/g; SAR(10 g) = 0.206 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.315 mW/g



0 dB = 0.315mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.3 ℃
Ambient Temperature:	21.5 ℃
Test Date:	Oct.15, 2012
Separation Distance:	1.0 cm

DUT: L-03E; Type: bar; Serial: #1

Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.997 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

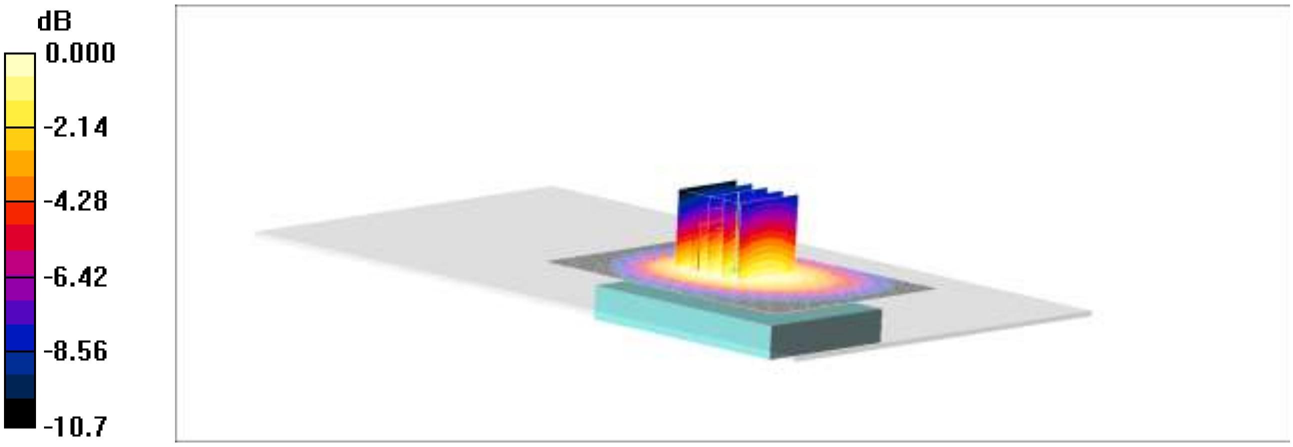
DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.27, 6.27, 6.27); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

WCDMA850 front 4183/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.371 mW/g

WCDMA850 front 4183/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.5 V/m; Power Drift = -0.027 dB
Peak SAR (extrapolated) = 0.445 W/kg
SAR(1 g) = 0.345 mW/g; SAR(10 g) = 0.244 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.369 mW/g



0 dB = 0.369mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.3 ℃
Ambient Temperature:	21.5 ℃
Test Date:	Oct.15, 2012
Separation Distance:	1.0 cm

DUT: L-03E; Type: bar; Serial: #1

Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.997 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

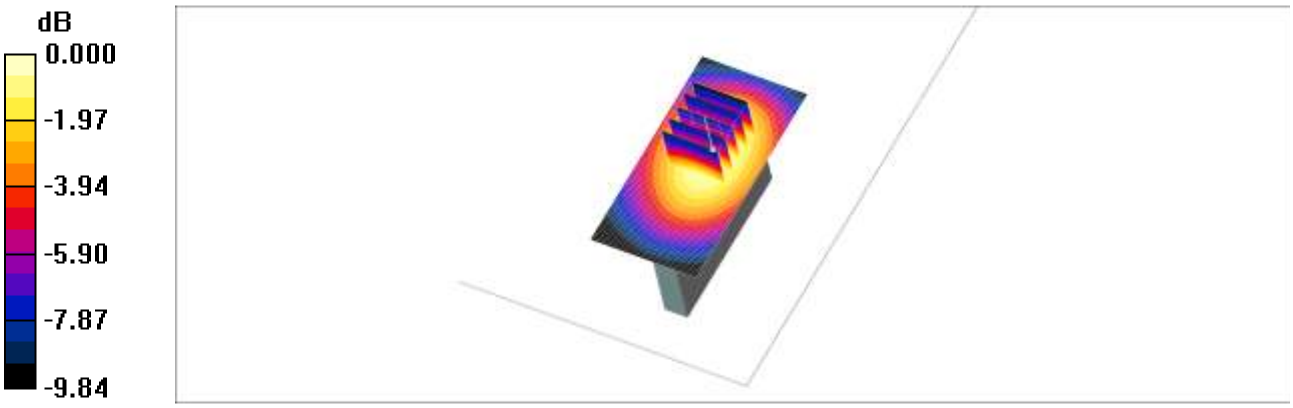
DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.27, 6.27, 6.27); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

WCDMA850 Left 4183/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.190 mW/g

WCDMA850 Left 4183/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.3 V/m; Power Drift = -0.009 dB
Peak SAR (extrapolated) = 0.236 W/kg
SAR(1 g) = 0.179 mW/g; SAR(10 g) = 0.123 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.192 mW/g



0 dB = 0.192mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.3 ℃
Ambient Temperature:	21.5 ℃
Test Date:	Oct.15, 2012
Separation Distance:	1.0 cm

DUT: L-03E; Type: bar; Serial: #1

Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.997 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

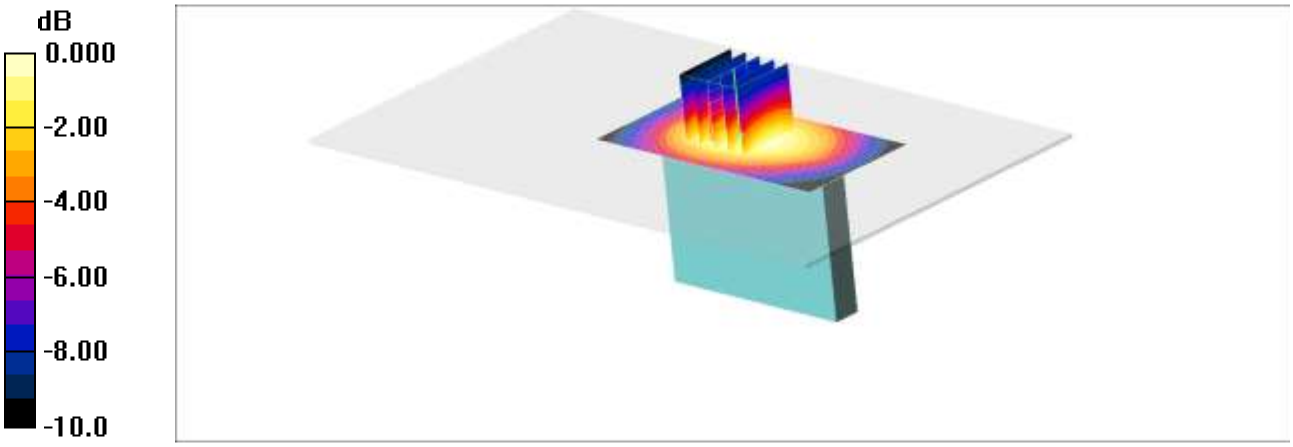
DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.27, 6.27, 6.27); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

WCDMA850 right 4183/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.190 mW/g

WCDMA850 right 4183/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.1 V/m; Power Drift = -0.009 dB
Peak SAR (extrapolated) = 0.235 W/kg
SAR(1 g) = 0.177 mW/g; SAR(10 g) = 0.123 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.190 mW/g



0 dB = 0.190mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.3 ℃
Ambient Temperature:	21.5 ℃
Test Date:	Oct.15, 2012
Separation Distance:	1.0 cm

DUT: L-03E; Type: bar; Serial: #1

Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.997 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.27, 6.27, 6.27); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

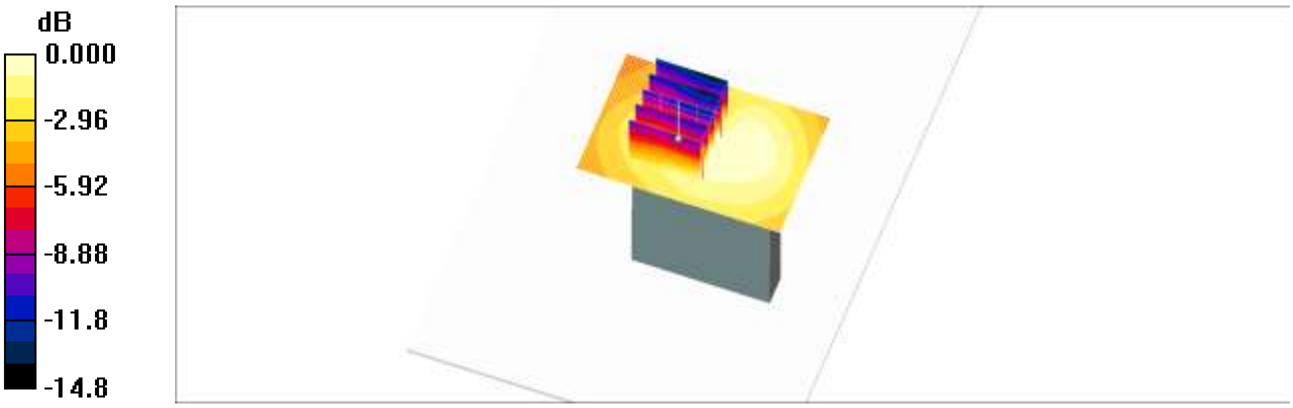
WCDMA850 top 4183/Area Scan (61x41x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.072 mW/g

WCDMA850 top 4183/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.94 V/m; Power Drift = -0.115 dB
Peak SAR (extrapolated) = 0.137 W/kg
SAR(1 g) = 0.066 mW/g; SAR(10 g) = 0.039 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.070 mW/g



0 dB = 0.070mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.1 ℃
Ambient Temperature:	21.3 ℃
Test Date:	Oct.31, 2012
Separation Distance:	1.0 cm

DUT: LG-L03E; Type: bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.96 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

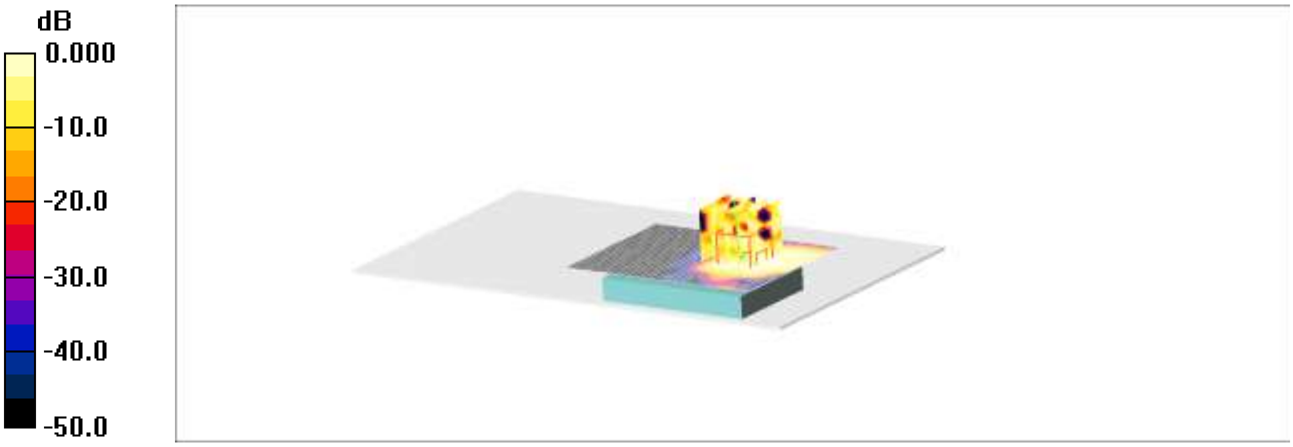
DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.3, 4.3, 4.3); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

WiFi2450 Body rear 11ch 1Mbps/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.015 mW/g

WiFi2450 Body rear 11ch 1Mbps/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.442 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.025 W/kg
SAR(1 g) = 0.00702 mW/g; SAR(10 g) = 0.00157 mW/g

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



0 dB = 0.015mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.1 ℃
Ambient Temperature:	21.3 ℃
Test Date:	Oct.31, 2012
Separation Distance:	1.0 cm

DUT: LG-L03E; Type: bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.96 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

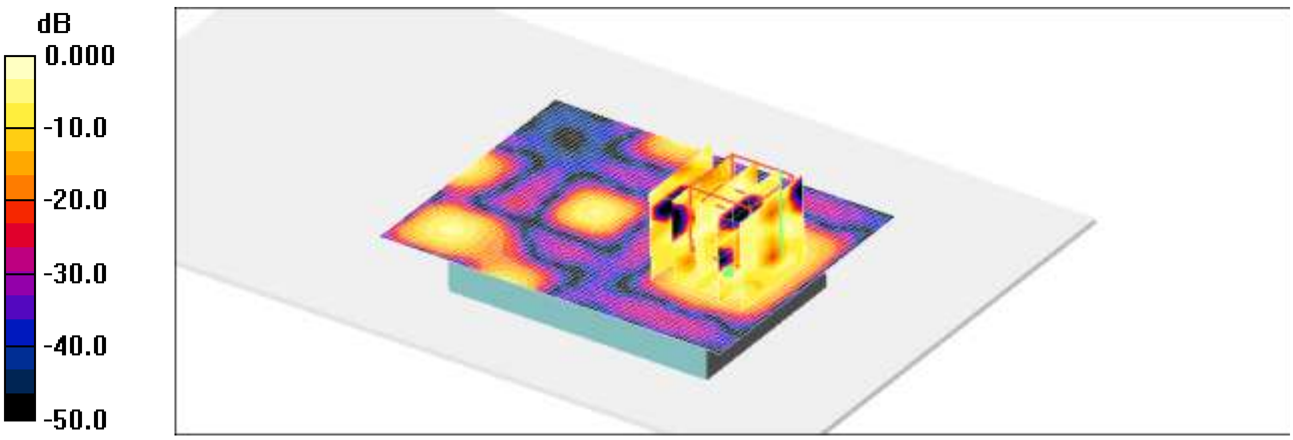
DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.3, 4.3, 4.3); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

WiFi2450 Body front 11ch 1Mbps/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.005 mW/g

WiFi2450 Body front 11ch 1Mbps/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.000 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.015 W/kg
SAR(1 g) = 0.000502 mW/g; SAR(10 g) = 5.87e-005 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.016 mW/g



0 dB = 0.016mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.1 ℃
Ambient Temperature:	21.3 ℃
Test Date:	Oct.31, 2012
Separation Distance:	1.0 cm

DUT: LG-L03E; Type: bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.96 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

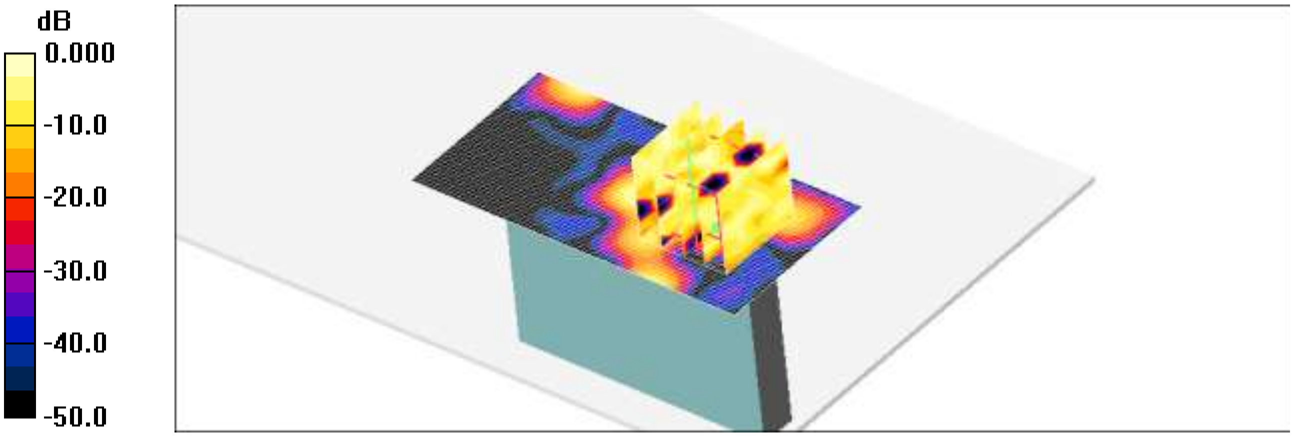
DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.3, 4.3, 4.3); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

WiFi2450 body right 11ch 1Mbps/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.006 mW/g

WiFi2450 body right 11ch 1Mbps/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.498 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.008 W/kg
SAR(1 g) = 0.000177 mW/g; SAR(10 g) = 4.49e-005 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.010 mW/g



0 dB = 0.010mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.1 ℃
Ambient Temperature:	21.3 ℃
Test Date:	Oct.31, 2012
Separation Distance:	1.0 cm

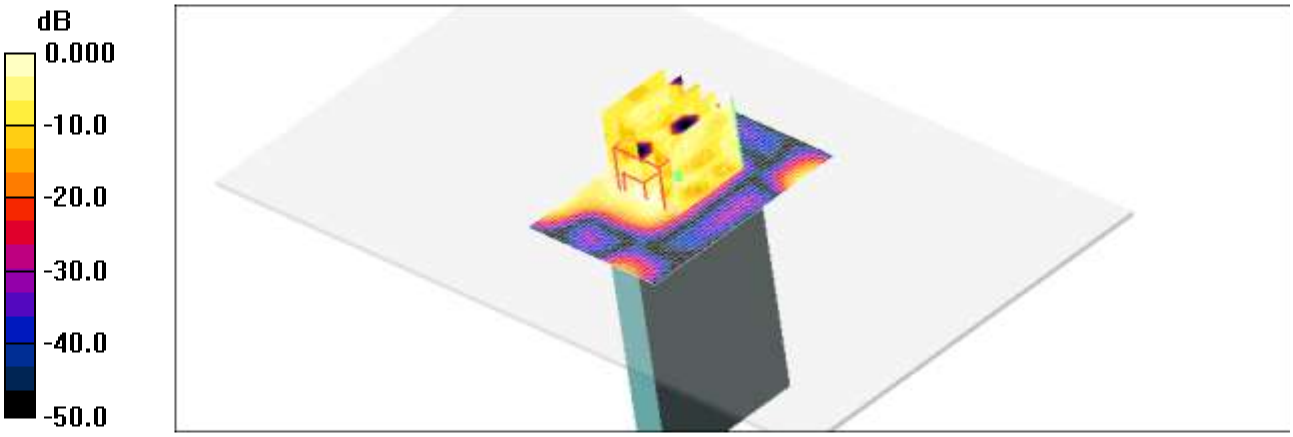
DUT: LG-L03E; Type: bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.96 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.3, 4.3, 4.3); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

WiFi2450 body bottom 11ch 1Mbps/Area Scan (61x41x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.012 mW/g

WiFi2450 body bottom 11ch 1Mbps/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.47 V/m; Power Drift = 0.031 dB
Peak SAR (extrapolated) = 0.011 W/kg
SAR(1 g) = 0.000545 mW/g; SAR(10 g) = 0.000112 mW/g
Maximum value of SAR (measured) = 0.010 mW/g



0 dB = 0.010mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.3 ℃
Ambient Temperature:	21.5 ℃
Test Date:	Oct.15, 2012
Separation Distance:	1.0 cm

DUT: LG-L03E; Type: bar; Serial: #1

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:2.075
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.997 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

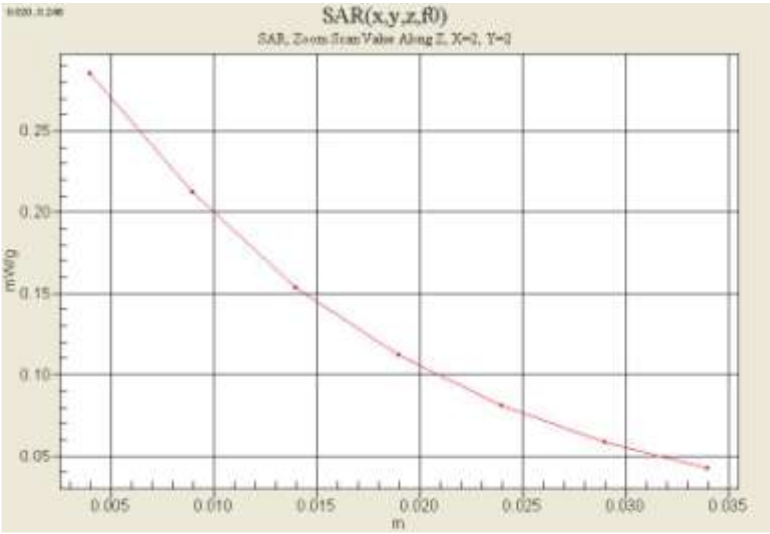
DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.27, 6.27, 6.27); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM850 Front 190/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.287 mW/g

GSM850 Front 190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.2 V/m; Power Drift = 0.008 dB
Peak SAR (extrapolated) = 0.350 W/kg
SAR(1 g) = 0.267 mW/g; SAR(10 g) = 0.188 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.285 mW/g



Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.2 ℃
Ambient Temperature:	21.4 ℃
Test Date:	Oct.16, 2012
Separation Distance:	1.0 cm

DUT: LG-L03E; Type: bar; Serial: #1

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:4.15
Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 52.1; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.75, 4.75, 4.75); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

GSM1900 TOP 661/Area Scan (61x41x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.473 mW/g

GSM1900 TOP 661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.6 V/m; Power Drift = 0.045 dB
Peak SAR (extrapolated) = 0.685 W/kg
SAR(1 g) = 0.394 mW/g; SAR(10 g) = 0.211 mW/g
Maximum value of SAR (measured) = 0.443 mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.3 ℃
Ambient Temperature:	21.5 ℃
Test Date:	Oct.15, 2012
Separation Distance:	1.0 cm

DUT: LG-L03E; Type: bar; Serial: #1

Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.997 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.27, 6.27, 6.27); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

WCDMA850 front 4183/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.371 mW/g

WCDMA850 front 4183/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.5 V/m; Power Drift = -0.027 dB
Peak SAR (extrapolated) = 0.445 W/kg
SAR(1 g) = 0.345 mW/g; SAR(10 g) = 0.244 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.369 mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	Cellular/PCS GSM/GPRS and Cellular WCDMA/HSDPA/HSUPA Wireless Router with WLAN
Liquid Temperature:	21.1 ℃
Ambient Temperature:	21.3 ℃
Test Date:	Oct.17, 2012
Separation Distance:	1.0 cm

DUT: LG-L03E; Type: bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.94 mho/m; ε_r = 54.4; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.3, 4.3, 4.3); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

WiFi2450 Body rear 11ch 1Mbps/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.089 mW/g

WiFi2450 Body rear 11ch 1Mbps/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.08 V/m; Power Drift = 0.171 dB
Peak SAR (extrapolated) = 0.150 W/kg
SAR(1 g) = 0.081 mW/g; SAR(10 g) = 0.045 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.087 mW/g

Attachment 2. – Dipole Validation Plots

■ Validation Data (835 MHz Body)

Test Laboratory: HCT CO., LTD
Input Power 100 mW (20dBm)
Liquid Temp: 21.3 ℃
Test Date: Oct.15, 2012

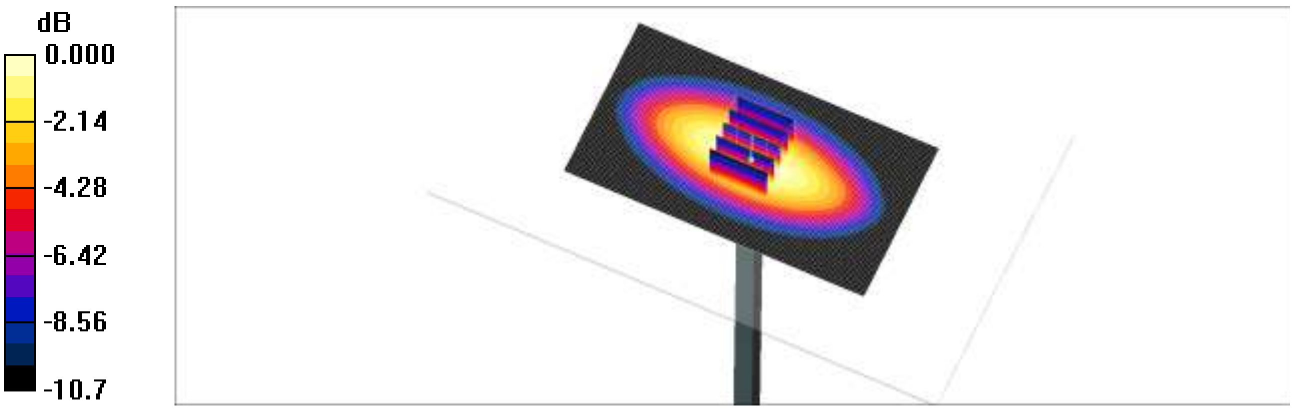
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:441

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.996 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.27, 6.27, 6.27); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- 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) = 1.03 mW/g

Validation 835 MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.7 V/m; Power Drift = -0.017 dB
Peak SAR (extrapolated) = 1.37 W/kg
SAR(1 g) = 0.956 mW/g; SAR(10 g) = 0.622 mW/g
Maximum value of SAR (measured) = 1.04 mW/g



0 dB = 1.04mW/g

■ Validation Data (1 900 MHz Body)

Test Laboratory: HCT CO., LTD

Input Power 100 mW (20dBm)

Liquid Temp: 21.2 ℃

Test Date: Oct.16, 2012

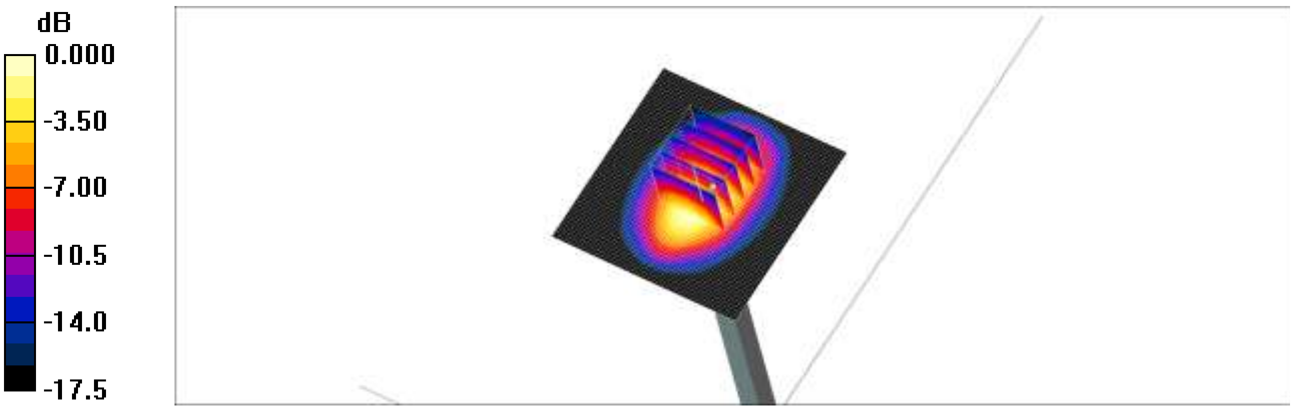
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d032

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.55 mho/m; ε_r = 52; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.75, 4.75, 4.75); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Validation1900 MHz/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 4.51 mW/g

Validation1900 MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 55.7 V/m; Power Drift = -0.054 dB
Peak SAR (extrapolated) = 6.61 W/kg
SAR(1 g) = 3.85 mW/g; SAR(10 g) = 2.07 mW/g
Maximum value of SAR (measured) = 4.25 mW/g



0 dB = 4.25mW/g

■ Validation Data (2 450 MHz Body)

Test Laboratory: HCT CO., LTD

Input Power 100 mW (20dBm)

Liquid Temp: 21.1 ℃

Test Date: Oct.31, 2012

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; σ = 1.94 mho/m; ε_r = 53.7; ρ = 1000 kg/m^3

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

DASY4 Configuration:

- Probe: ET3DV6 - SN1630; ConvF(4.3, 4.3, 4.3); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Validation 2450MHz/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 6.42 mW/g

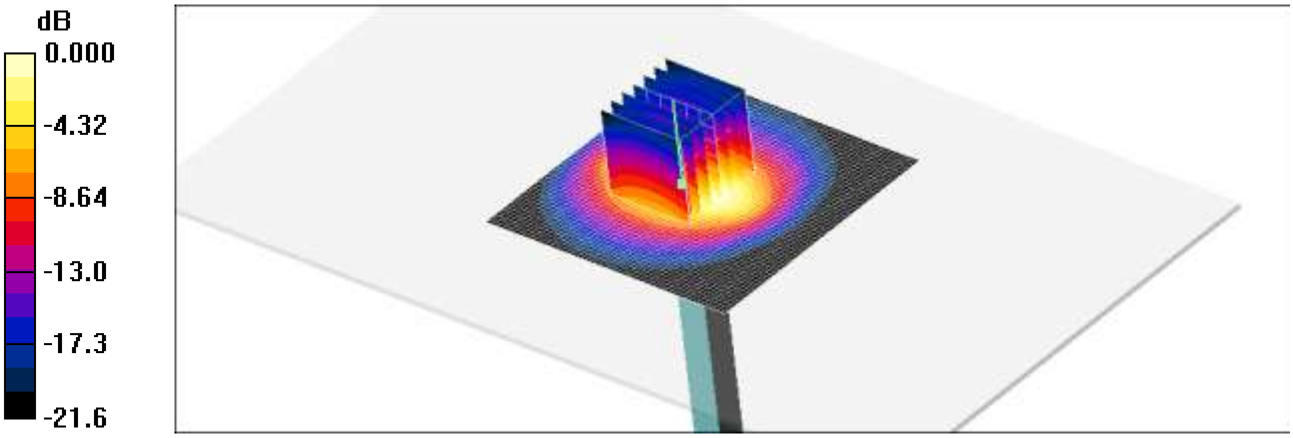
Validation 2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.9 V/m; Power Drift = -0.009 dB

Peak SAR (extrapolated) = 12.2 W/kg

SAR(1 g) = 5.22 mW/g; SAR(10 g) = 2.49 mW/g

Maximum value of SAR (measured) = 5.66 mW/g



0 dB = 5.66mW/g

■ Validation Data (2 450 MHz Body)

Test Laboratory: HCT CO., LTD

Input Power 100 mW (20dBm)

Liquid Temp: 21.1 ℃

Test Date: Oct.31, 2012

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; σ = 1.94 mho/m; ε_r = 53.7; ρ = 1000 kg/m^3

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

DASY4 Configuration:

- Probe: ET3DV6 - SN1630; ConvF(4.3, 4.3, 4.3); Calibrated: 2011-11-18
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2012-02-21
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Validation 2450MHz/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 6.42 mW/g

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

Reference Value = 55.9 V/m; Power Drift = -0.009 dB

Peak SAR (extrapolated) = 12.2 W/kg

SAR(1 g) = 5.22 mW/g; SAR(10 g) = 2.49 mW/g

Maximum value of SAR (measured) = 5.66 mW/g

■ Dielectric Parameter (850 MHz Body)

Title	L-03E
SubTitle	WCDMA850/GSM850 (Body)
Test Date	Oct.15, 2012

Frequency	e'	e''
800000000.0000	53.4283	21.7963
805000000.0000	53.4249	21.7271
810000000.0000	53.3913	21.6350
815000000.0000	53.3668	21.6473
820000000.0000	53.3462	21.5573
825000000.0000	53.3335	21.5041
830000000.0000	53.2976	21.4928
835000000.0000	53.2679	21.4351
840000000.0000	53.2447	21.4086
845000000.0000	53.1849	21.3845
850000000.0000	53.1660	21.3949
855000000.0000	53.1039	21.3884
860000000.0000	53.0452	21.4024
865000000.0000	53.0220	21.3926
870000000.0000	52.9660	21.4217
875000000.0000	52.9334	21.4527
880000000.0000	52.8749	21.4400
885000000.0000	52.8927	21.4305
890000000.0000	52.8776	21.4437
895000000.0000	52.8379	21.3769
900000000.0000	52.8641	21.3846

■ Dielectric Parameter (1 900 MHz Body)

Title	L-03E
SubTitle	GSM1900(Body)
Test Date	Oct.16, 2012

Frequency	e'	e''
1850000000.0000	52.1308	14.5159
1855000000.0000	52.1140	14.5255
1860000000.0000	52.0907	14.5523
1865000000.0000	52.0873	14.5592
1870000000.0000	52.0742	14.5645
1875000000.0000	52.0678	14.5684
1880000000.0000	52.0502	14.5807
1885000000.0000	52.0430	14.5942
1890000000.0000	52.0302	14.5923
1895000000.0000	52.0106	14.6046
1900000000.0000	52.0019	14.6212
1905000000.0000	51.9911	14.6332
1910000000.0000	51.9671	14.6330
1915000000.0000	51.9590	14.6458
1920000000.0000	51.9237	14.6589
1925000000.0000	51.9200	14.6739
1930000000.0000	51.9135	14.6893
1935000000.0000	51.8925	14.6783
1940000000.0000	51.8855	14.6871
1945000000.0000	51.8540	14.7168
1950000000.0000	51.8477	14.7252

■ Dielectric Parameter (2 450 MHz Body)

Title L-03E
SubTitle WiFi2450
Test Date Oct.31, 2012

Frequency	e'	e''
2400000000.0000	53.8476	14.0395
2405000000.0000	53.8492	14.0631
2410000000.0000	53.8216	14.0703
2415000000.0000	53.8067	14.0807
2420000000.0000	53.7711	14.1109
2425000000.0000	53.7788	14.1465
2430000000.0000	53.7612	14.1452
2435000000.0000	53.7307	14.1693
2440000000.0000	53.6920	14.1810
2445000000.0000	53.6744	14.2199
2450000000.0000	53.6690	14.2265
2455000000.0000	53.6490	14.2454
2460000000.0000	53.6171	14.2727
2465000000.0000	53.5958	14.3016
2470000000.0000	53.5803	14.3228
2475000000.0000	53.5747	14.3625
2480000000.0000	53.5615	14.3849
2485000000.0000	53.5360	14.4007
2490000000.0000	53.5174	14.4271
2495000000.0000	53.5023	14.4528
2500000000.0000	53.4911	14.4695

Attachment 3. – Probe 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
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: ET3-1630_Nov11

CALIBRATION CERTIFICATE

Object: ET3DV6 - SN:1630

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

Calibration date: November 18, 2011

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	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	3-May-11 (No. DAE4-654_May11)	May-12
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: November 18, 2011

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

Certificate No: ET3-1630_Nov11 Page 1 of 11

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

ilac-MRA SWISS CALIBRATION

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
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
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 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:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * 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*.
- *DCPx,y,z:* 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
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: 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 ≤ 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 *NORMx,y,z * 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 ± 50 MHz to ± 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.

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Probe ET3DV6

SN:1630

Manufactured: October 12, 2001
Calibrated: November 18, 2011

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

ET3DV6– SN:1630 November 18, 2011

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1630

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.71	1.62	1.60	± 10.1 %
DCP (mV)[B]	100.3	99.5	101.7	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	98.2	±2.7 %
			Y	0.00	0.00	1.00	101.9	
			Z	0.00	0.00	1.00	98.0	

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%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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DASY/EASY - Parameters of Probe: ET3DV6 - SN:1630

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	45.3	0.87	8.13	8.13	8.13	0.31	1.60	± 13.4 %
450	43.5	0.87	7.40	7.40	7.40	0.22	2.27	± 13.4 %
750	41.9	0.89	6.61	6.61	6.61	0.82	1.68	± 12.0 %
835	41.5	0.90	6.27	6.27	6.27	0.72	1.84	± 12.0 %
900	41.5	0.97	6.16	6.16	6.16	0.68	1.92	± 12.0 %
1450	40.5	1.20	5.57	5.57	5.57	0.54	2.48	± 12.0 %
1750	40.1	1.37	5.43	5.43	5.43	0.60	2.26	± 12.0 %
1900	40.0	1.40	5.17	5.17	5.17	0.63	2.15	± 12.0 %
1950	40.0	1.40	5.05	5.05	5.05	0.63	2.13	± 12.0 %
2450	39.2	1.80	4.57	4.57	4.57	0.81	1.74	± 12.0 %

[C] 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.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) 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 (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1630

Calibration Parameter Determined in Body Tissue Simulating Media

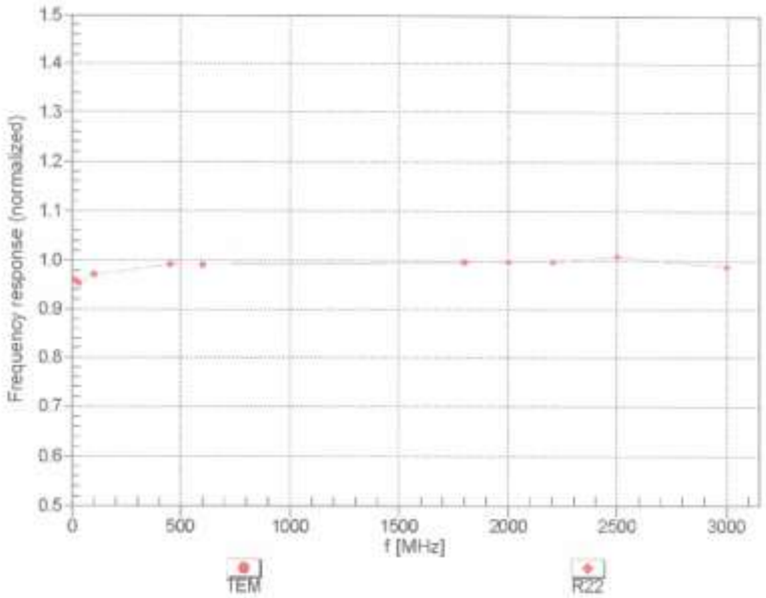
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	58.2	0.92	7.96	7.96	7.96	0.29	2.29	± 13.4 %
450	56.7	0.94	7.74	7.74	7.74	0.16	2.25	± 13.4 %
750	55.5	0.96	6.36	6.36	6.36	0.75	1.84	± 12.0 %
835	55.2	0.97	6.27	6.27	6.27	0.72	1.88	± 12.0 %
1450	54.0	1.30	5.46	5.46	5.46	0.70	1.97	± 12.0 %
1750	53.4	1.49	4.95	4.95	4.95	0.59	2.72	± 12.0 %
1900	53.3	1.52	4.75	4.75	4.75	0.60	2.56	± 12.0 %
2450	52.7	1.95	4.30	4.30	4.30	1.00	1.29	± 12.0 %

[C] 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.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) 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 (ε and σ) is restricted to ± 5%. The uncertainty in the RSS of the ConvF uncertainty for indicated target tissue parameters.

ET3DV6– SN:1630 November 18, 2011

Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)

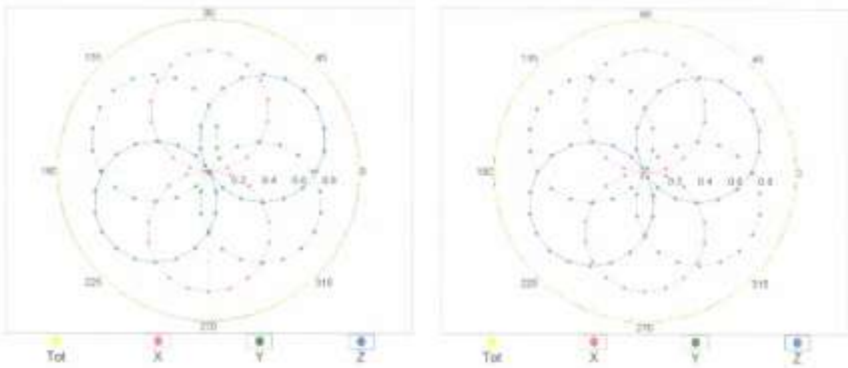


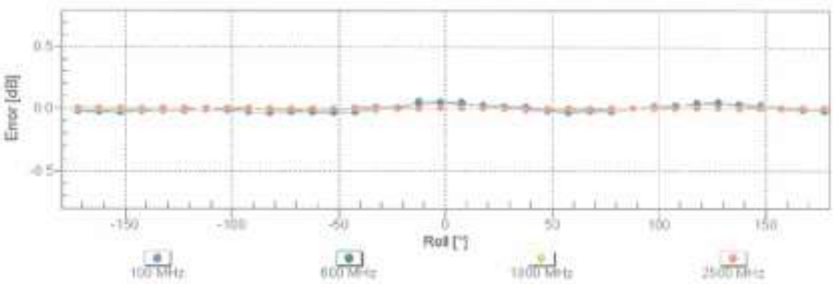
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Certificate No: ET3-1630_Nov11 Page 7 of 11

Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM f=1800 MHz,R22



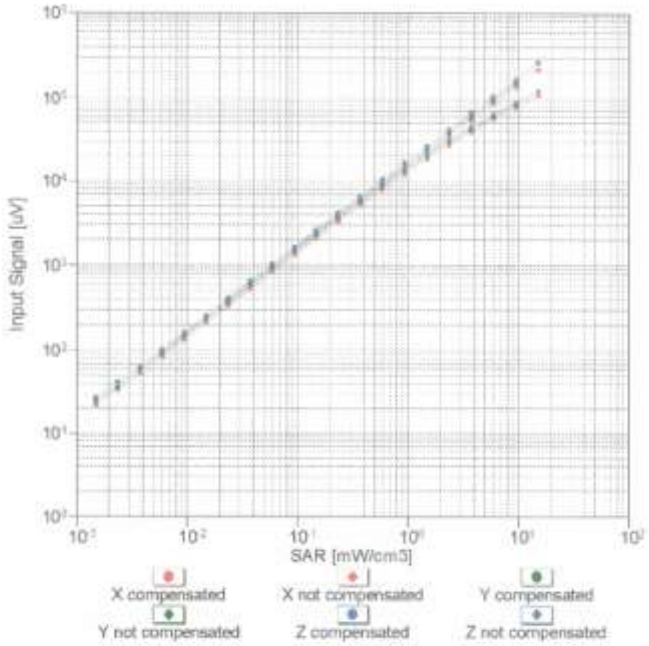


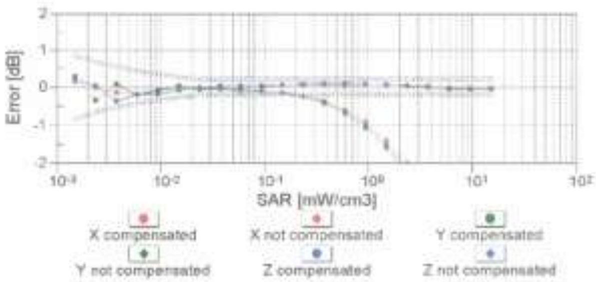
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

ET3DV6– SN:1630 November 18, 2011

Dynamic Range f(SAR_{head})

(TEM cell , f = 900 MHz)





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

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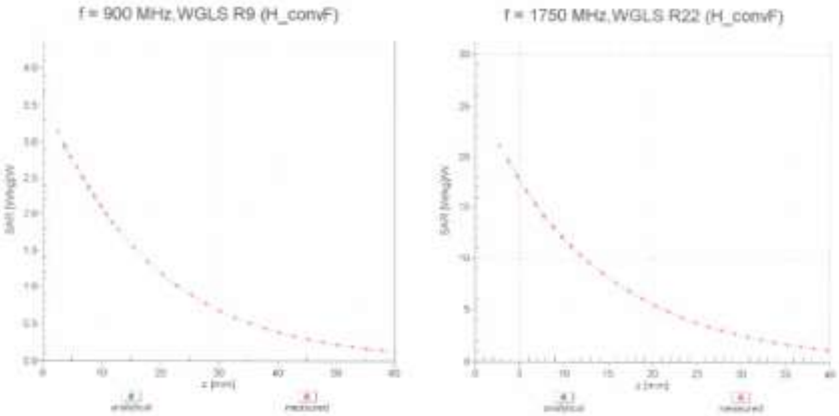
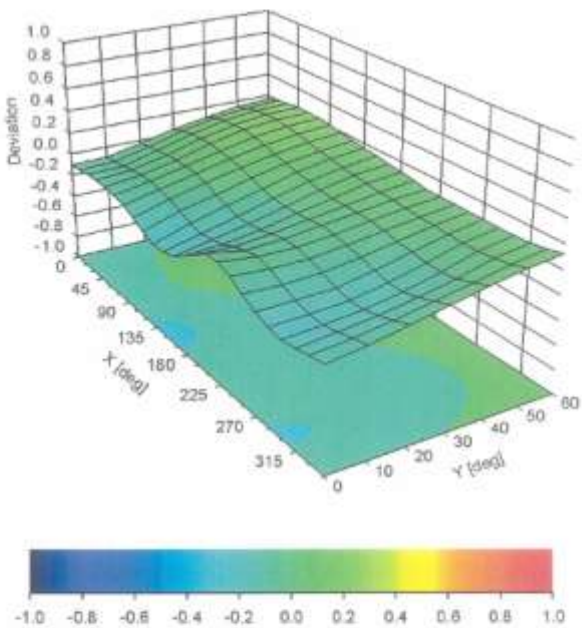
ET3DV6– SN:1630 November 18, 2011

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Certificate No: ET3-1630_Nov11 Page 10 of 11

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1630

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1630**
Place of Assessment:	**Zurich**
Date of Assessment:	**November 21, 2011**
Probe Calibration Date:	**November 18, 2011**

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 450, 900 MHz or at 1750 MHz.

Assessed by:

ET3DV6-SN:1630 Page 1 of 2 November 21, 2011

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Dosimetric E-Field Probe ET3DV6 - SN:1630

Conversion factor (± standard deviation)

150 ± 50 MHz	*ConvF*	8.03 ± 10%	ε_r = 52.3 ± 5% σ = 0.76 ± 5% mho/m (head tissue)
150 ± 50 MHz	*ConvF*	8.29 ± 10%	ε_r = 61.9 ± 5% σ = 0.80 ± 5% mho/m (body tissue)

Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

Please see also DASY Manual.

Attachment 4. – Dipole Calibration Data

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

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C Servizio svizzero di taratura
S Swiss Calibration Service

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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: 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	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	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: May 16, 2012

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

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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:

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
c) 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:

d) 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%.

Certificate No: D835V2-441_May12 Page 2 of 8

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 ± 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 ± 0.2) °C	40.6 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (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 ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (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 ± 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 ± 0.2) °C	54.3 ± 6 %	1.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (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 ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (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 ± 16.5 % (k=2)**

Certificate No: D835V2-441_May12 Page 3 of 8

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.1 Ω - 5.8 jΩ
Return Loss	- 24.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.0 Ω - 8.1 jΩ
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

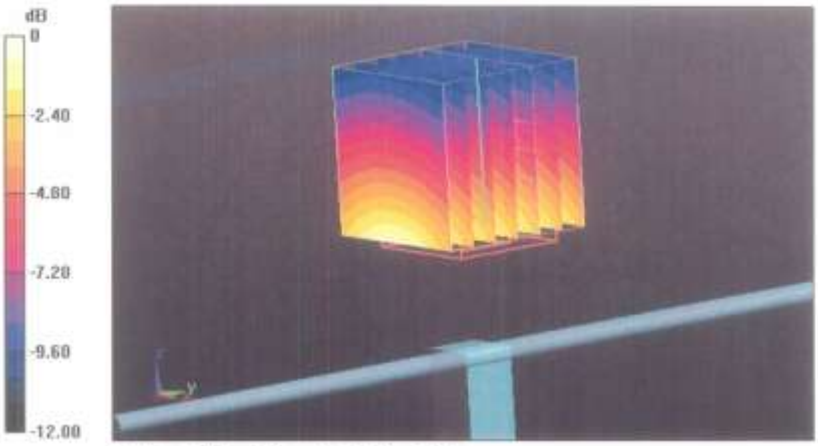
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 441

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 0.89$ mho/m; $\varepsilon_r = 40.6$; $\rho = 1000$ kg/m^3
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)

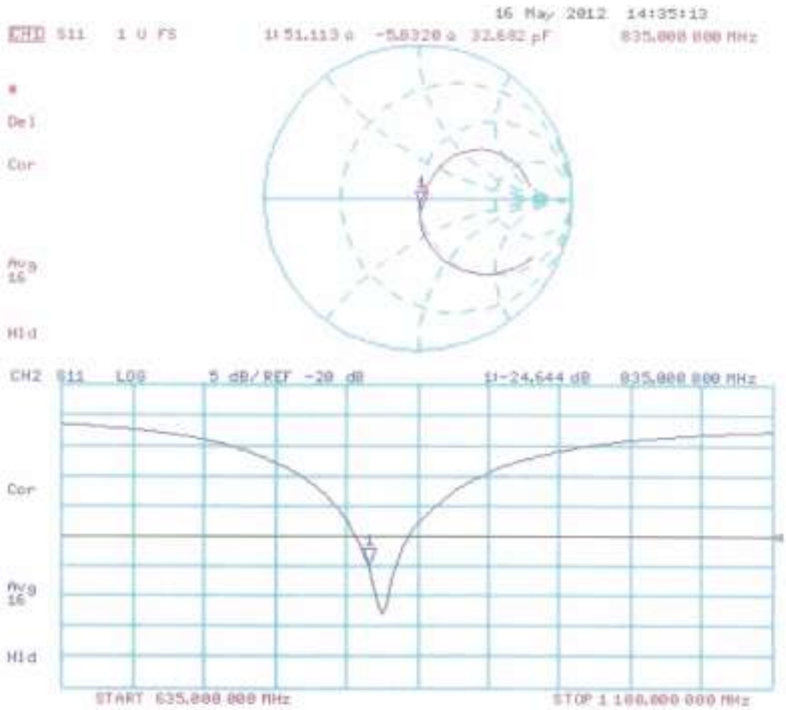
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm 2/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.129 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.474 mW/g
SAR(1 g) = 2.35 mW/g; SAR(10 g) = 1.54 mW/g
Maximum value of SAR (measured) = 2.73 mW/g



0 dB = 2.73 mW/g = 8.72 dB mW/g

Certificate No: D835V2-441_May12 Page 5 of 8

Impedance Measurement Plot for Head TSL



Certificate No: D835V2-441_May12 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 16.05.2012

Test Laboratory: SPEAG, Zurich, Switzerland

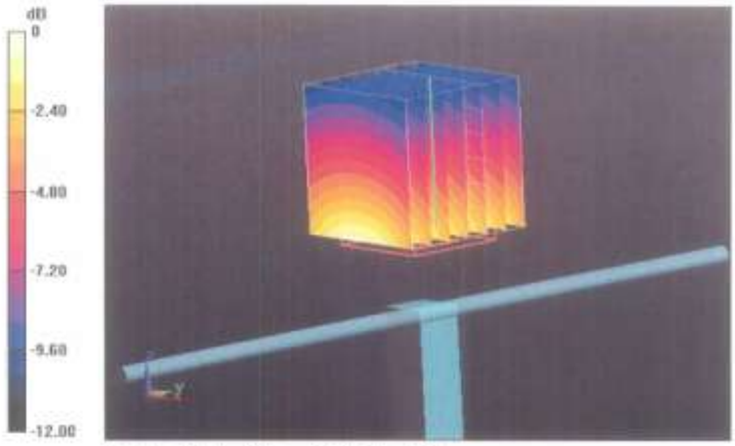
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 441

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1 mho/m; ε_r = 54.3; ρ = 1000 kg/m^3
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)

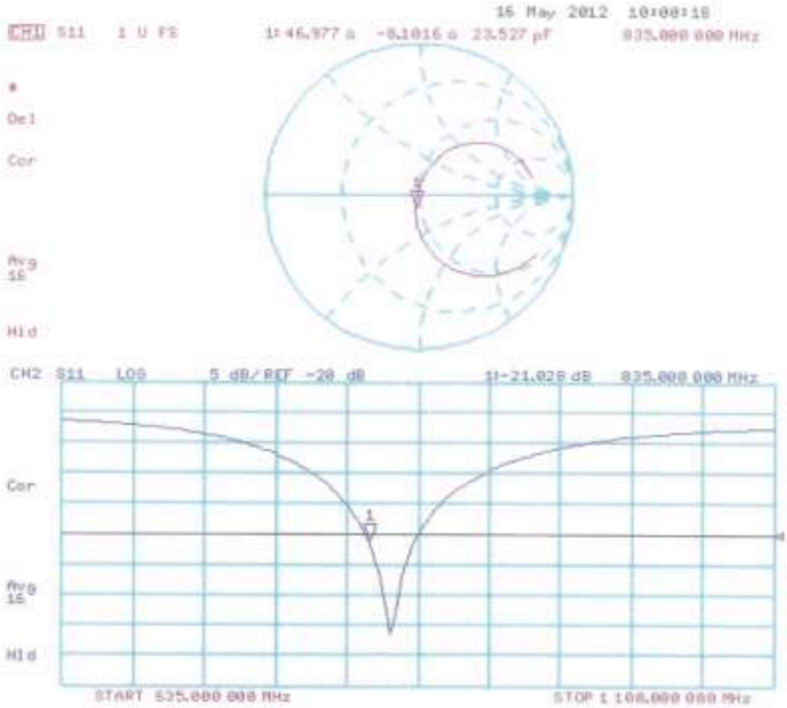
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.054 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 3.533 mW/g
SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g
Maximum value of SAR (measured) = 2.82 mW/g



0 dB = 2.82 mW/g = 9.00 dB mW/g

Certificate No: D835V2-441_May12 Page 7 of 8

Impedance Measurement Plot for Body TSL



Certificate No: D835V2-441_May12 Page 8 of 8

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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

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 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	D. Iliev
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 20, 2012

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

Certificate No: D1900V2-5d032_Jul12 Page 1 of 8

Calibration Laboratory of
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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:

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
c) 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:

d) 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%.

Certificate No: D1900V2-5d032_Jul12 Page 2 of 8

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^3 (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^3 (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^3 (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^3 (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)**

Certificate No: D1900V2-5d032_Jul12 Page 3 of 8

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.0 Ω + 3.1 jΩ
Return Loss	- 30.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.2 Ω + 3.7 jΩ
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

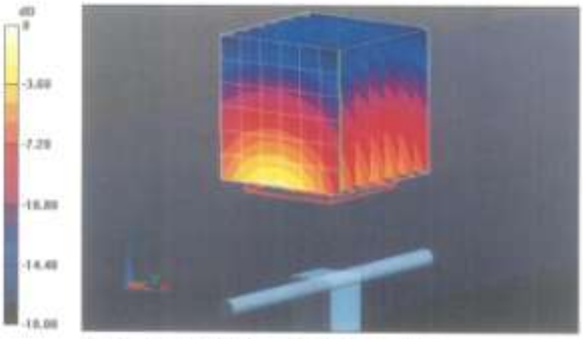
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d032

Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
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)

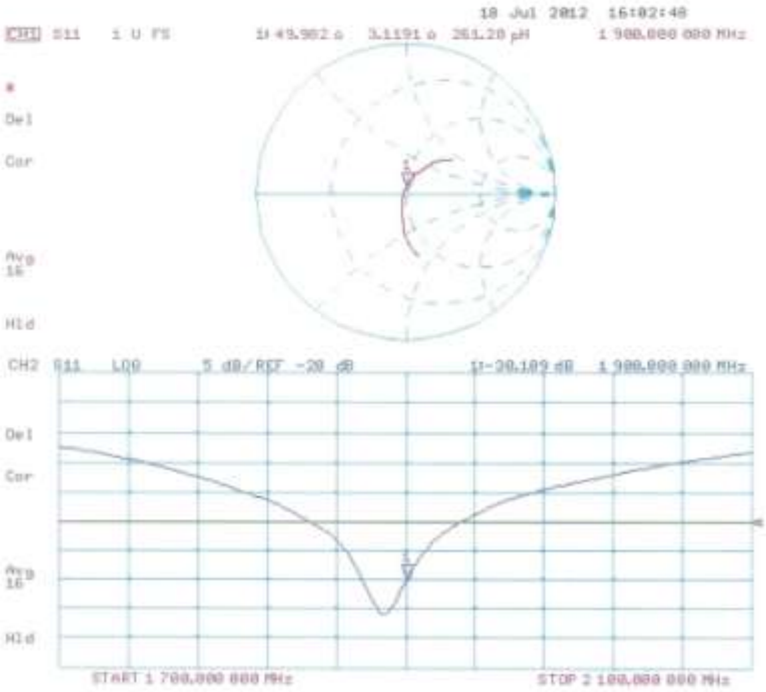
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.864 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 17.209 mW/g
SAR(1 g) = 9.68 mW/g; SAR(10 g) = 5.11 mW/g
Maximum value of SAR (measured) = 12.1 mW/g



0 dB = 12.1 mW/g = 21.66 dB mW/g

Certificate No: D1900V2-5d032_Jul12 Page 5 of 8

Impedance Measurement Plot for Head TSL



Certificate No: D1900V2-5d032_Jul12 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 20.07.2012

Test Laboratory: SPEAG, Zurich, Switzerland

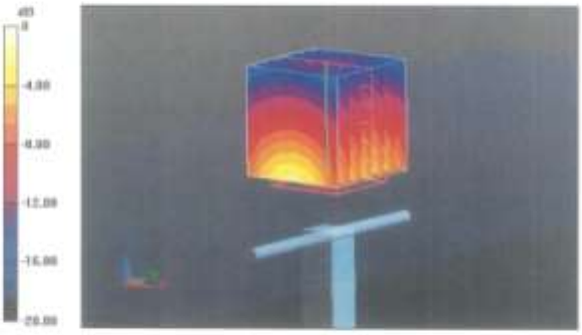
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d032

Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.52 mho/m; ε_r = 52.6; ρ = 1000 kg/m^3
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=5mm, dy=5mm, dz=5mm
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



0 dB = 12.6 mW/g = 22.01 dB mW/g

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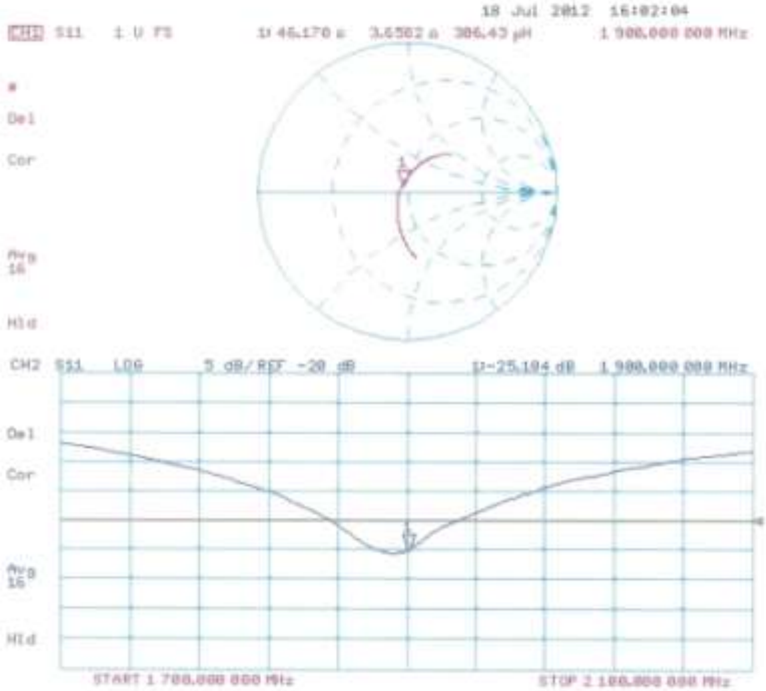
Impedance Measurement Plot for Body TSL



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

S Schweizerischer Kalibrierdienst
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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 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 23, 2012

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

Certificate No: D2450V2-743_Aug12 Page 1 of 8

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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:

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

c) 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:

d) 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 ± 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 ± 0.2) °C	39.2 ± 6 %	1.81 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (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 ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (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 ± 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 ± 0.2) °C	51.3 ± 6 %	1.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (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 ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (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 ± 16.5 % (k=2)**

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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

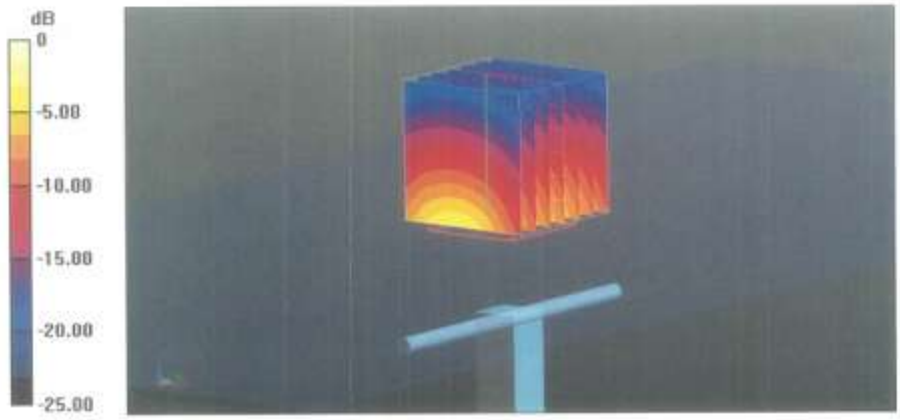
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 743

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.81 mho/m; ε_r = 39.2; ρ = 1000 kg/m^3
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

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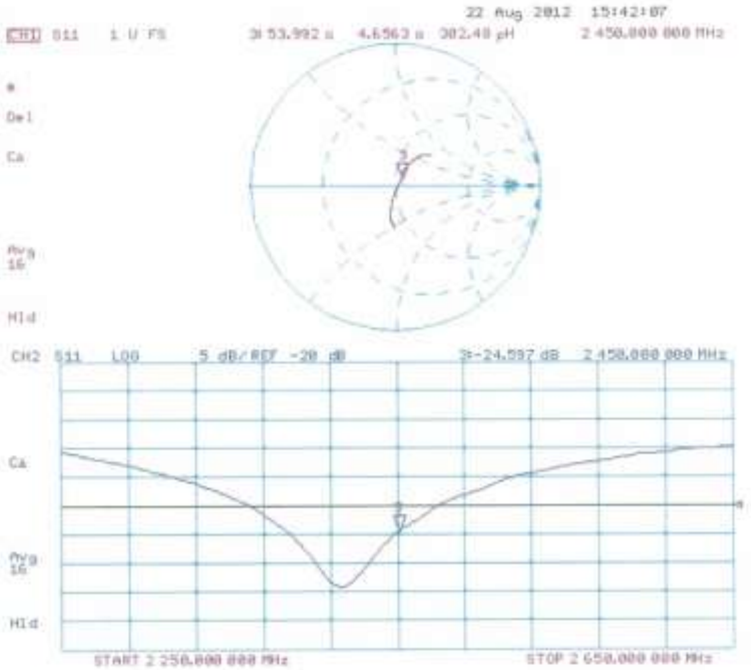
Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-743_Aug12 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 22.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

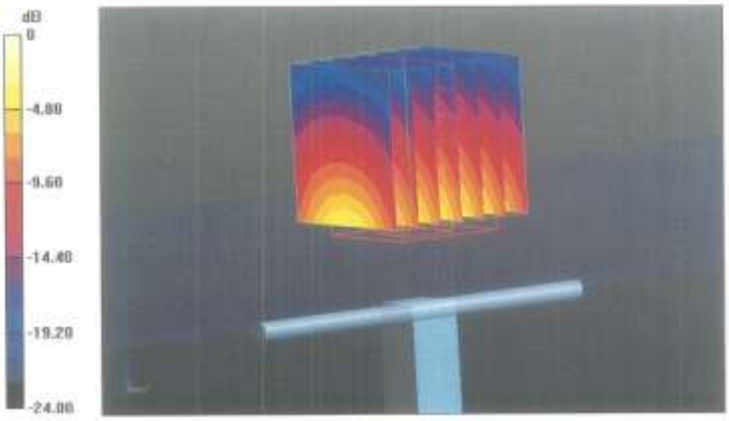
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 743

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.99 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
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



0 dB = 16.9 W/kg = 24.56 dB W/kg

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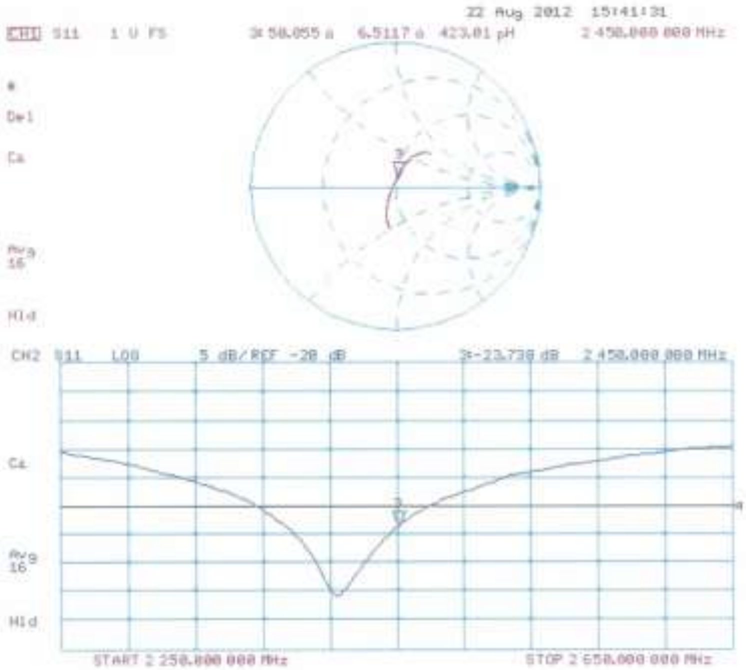
Impedance Measurement Plot for Body TSL



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