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SAR TEST REPORT

LG Electronics, MobileComm U.S.A., Inc.
1000 Sylvan Avenue, Englewood Cliffs NJ 07632

Date of Issue: September 03, 2014
Test Report No.: HCT-A-1408-F004-1
Test Site: HCT CO., LTD.

FCC ID: ZNFD390

Equipment Type:	**GSM/WCDMA/LTE phone with Bluetooth/WLAN**
Model Name:	**LG-D390**
Additional Model Name:	**LGD390, D390, LG-D392d, LGD392d, D392d**
Testing has been carried out in accordance with:	**47CFR §2.1093** **ANSI/ IEEE C95.1 – 1992** **IEEE 1528-2003**
Date of Test:	**August 18, 2014~ August 26, 2014**

This device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in FCC KDB procedures and had been tested in accordance with the measurement procedures specified in FCC KDB procedures.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested By

Yun-Jeang Heo
Test Engineer / SAR Team
Certification Division

Reviewed By

Dong-Seob Kim
Technical Manager / SAR Team
Certification Division

Revision History

Rev.	Issue DATE	DESCRIPTION
HCT-A-1408-F004	Aug. 22, 2014	Initial Issue
HCT-A-1408-F004-1	Sep. 03, 2014	Sec.10.1 was revised (Typo)

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

SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative of the incremental electromagnetic energy (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 1. 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 KDB Procedure, IEEE Standard 1528-2003 & IEEE 1528a-2005 and the following published KDB procedures.

- FCC KDB Publication 941225 D01 SAR test for 3G devices v02
- FCC KDB Publication 941225 D02 HSPA and 1x Advanced v02r02
- FCC KDB Publication 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- FCC KDB Publication 941225 D05 SAR for LTE Devices v02r03
- FCC KDB Publication 941225 D06 Hot Spot SAR v01r01
- FCC KDB Publication 248227 D01v01r02(SAR Considerationa for 802.11 Devices)
- FCC KDB Publication 447498 D01v05r02 (General SAR Guidance)
- FCC KDB Publication 648474 D04 Handset SAR v01r02
- FCC KDB Publication 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03
- FCC KDB Publication 865664 D02 SAR Reporting v01r01
- October 2013 TCB Workshop Notes (GPRS testing criteria)

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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).

<table>
<tr><td>EUT Type</td><td colspan="6">GSM/WCDMA/LTE phone with Bluetooth/WLAN</td></tr>
<tr><td>FCC ID:</td><td colspan="6">ZNFD390</td></tr>
<tr><td>Model:</td><td colspan="6">LG-D390</td></tr>
<tr><td>Additional Model:</td><td colspan="6">LGD390, D390, LG-D392d, LGD392d, D392d</td></tr>
<tr><td>Trade Name</td><td colspan="6">LG Electronics, MobileComm U.S.A., Inc.</td></tr>
<tr><td>Application Type</td><td colspan="6">Certification</td></tr>
<tr><td>Production Unit or Identical Prototype</td><td colspan="6">Prototype</td></tr>
<tr><td rowspan="13">Max. SAR</td><td rowspan="2">Band</td><td rowspan="2">Tx Frequency (MHz)</td><td rowspan="2">Equipment Class</td><td colspan="3">Reported 1g SAR (W/Kg)</td></tr>
<tr><td>Head</td><td>Body-worn</td><td>Hotspot</td></tr>
<tr><td>GSM/GPRS/ EDGE 850</td><td>824.2 - 848.8</td><td>PCE</td><td>0.46</td><td>0.61</td><td>0.61</td></tr>
<tr><td>GSM/GPRS/ EDGE1900</td><td>1 850.2 -1 909.8</td><td>PCE</td><td>0.46</td><td>0.45</td><td>0.45</td></tr>
<tr><td>WCDMA 850</td><td>826.4 - 846.6</td><td>PCE</td><td>0.37</td><td>0.54</td><td>0.54</td></tr>
<tr><td>WCDMA 1900</td><td>1 852.4 – 1 907.6</td><td>PCE</td><td>0.59</td><td>0.62</td><td>0.63</td></tr>
<tr><td>LTE 2</td><td>1 850.7 ~ 1 909.3</td><td>PCE</td><td>0.60</td><td>0.71</td><td>0.71</td></tr>
<tr><td>LTE 4</td><td>1 710.7 – 1 754.3</td><td>PCE</td><td>0.58</td><td>0.74</td><td>0.75</td></tr>
<tr><td>LTE 7</td><td>2 502.5 – 2 567.5</td><td>PCE</td><td>0.15</td><td>0.70</td><td>0.83</td></tr>
<tr><td>LTE 17</td><td>706.5 ~ 713.5</td><td>PCE</td><td>0.30</td><td>0.48</td><td>0.48</td></tr>
<tr><td>802.11b</td><td>2 412.0 - 2 462.0</td><td>DTS</td><td>0.82</td><td>0.15</td><td>0.18</td></tr>
<tr><td>Bluetooth</td><td>2 402 – 2 480</td><td>DSS/DTS</td><td>-</td><td>0.17*</td><td>-</td></tr>
<tr><td colspan="3">Simultaneous SAR per KDB 690783 D01v01r03</td><td>1.42</td><td>0.91</td><td>0.88</td></tr>
<tr><td>Date(s) of Tests</td><td colspan="6">Aug. 18, 2014 ~ Aug. 26, 2014</td></tr>
<tr><td>Antenna Type</td><td colspan="6">Integral Antenna</td></tr>
<tr><td>GPRS / EDGE</td><td colspan="6">Multislot Class: 12</td></tr>
<tr><td>Key Feature(s)</td><td colspan="6">This device supports Mobile Hotspot.</td></tr>
</table>

* BT Body-worn SAR value is estimate SAR value that should not be reported standalone SAR on grants of equipment approval.

3.1 KDB 941225 LTE information

Item.	Description
Frequency Range:	Band 2: 1 850.7 MHz ~ 1 909.3 MHz , Band 4: 1 710.7 MHz – 1 754.3 MHz
	Band 7: 2 502.5 MHz ~ 2 567.5 MHz, Band 17: 706.5 MHz ~ 713.5 MHz
Channel Bandwidth:	Band 2: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
	Band 4: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
	Band 7: 5 MHz, 10 MHz, 15MHz, 20MHz
	Band 17: 5 MHz, 10 MHz
Channel Number & Frequency:	(see tables below)

Channel Number & Frequency:

Band 2											
1.4 MHz		3 MHz		5 MHz		10 MHz		15 MHz		20 MHz	
Ch.	Freq. (MHz)	Ch.	Freq. (MHz)	Ch.	Freq. (MHz)	Ch.	Freq. (MHz)	Ch.	Freq. (MHz)	Ch.	Freq. (MHz)
18607	1850.7	18615	1851.5	18625	1852.5	18650	1855	18675	1857.5	18700	1860
18900	1880	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880
19193	1909.3	19185	1908.5	19175	1907.5	19150	1905	19125	1902.5	19100	1900

Band 4											
1.4 MHz		3 MHz		5 MHz		10 MHz		15 MHz		20 MHz	
Ch.	Freq. (MHz)	Ch.	Freq. (MHz)	Ch.	Freq. (MHz)	Ch.	Freq. (MHz)	Ch.	Freq. (MHz)	Ch.	Freq. (MHz)
19957	1 710.7	19965	1 711.5	19975	1 712.5	20000	1 715	20025	1 717.5	20050	1 720
20175	1 732.5	20175	1 732.5	20175	1 732.5	20175	1 732.5	20175	1 732.5	20175	1 732.5
20393	1 754.3	20385	1 753.5	20375	1 752.5	20350	1 750	20325	1 747.5	20300	1 745

Band 7							
5 MHz		10 MHz		15 MHz		20 MHz	
Ch.	Freq. (MHz)	Ch.	Freq. (MHz)	Ch.	Freq. (MHz)	Ch.	Freq. (MHz)
20775	2 502.5	20800	2 505	20825	2 507.5	20850	2 510
21100	2 535	21100	2 535	21100	2 535	21100	2 535
21425	2 567.5	21400	2 565	21375	2 562.5	21350	2 560

Band 17			
5 MHz		10 MHz	
Ch.	Freq. (MHz)	Ch.	Freq. (MHz)
23755	706.5	23780	709
23790	710	23790	710
23825	713.5	23800	711

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Item.	Description
UE Category & Uplink Modulation	UE Category 3 QPSK, 16QAM
Description of the LTE Transmitter & antenna	This model have two Tx antennas. -, One is for GSM and WCDMA and LTE. It can not transmit simultaneously. - The other is for BT & WLAN. It can not transmit simultaneously. Please find the section 12
LTE voice/data requirements	Data Only, LTE voice is available via VoIP. Considering the users may install 3rd party software to enable VoIP, LTE Head SAR is also evaluated.
Identify if MPR is optional or mendatory optional or mendatory	The EUT incorporates MPR as per 3GPP TS36.101. The MPR is permanently built-in by design as a mandatory. A-MPR is not implemented in the EUT. See section 11.4 RF output power measurements in the SAR report.
Maximum average conducted output power(dBm) Identify all other U.S. wireless operating modes, device exposure configurations and frequency bands	GSM850/1900, WCDMA850/1900, LTE Band 2, LTE Band 4, LTE Band 7 and LTE Band 17 : Head & Body SAR are required.
Maximum average conducted output power for other wireless mode and frequency	See section 11 RF output power measurements in the SAR report.
Simultaneous Transmission condition	This device supports simultaneous transmission. Please find the section 15.
Power reduction explanation	This device doesn't implements power reduction.
Description of the test equipment, software, etc.	LTE SAR Testing was performed using a CMW500. UE transmits with maximum output power during SAR testing.

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.2).

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.

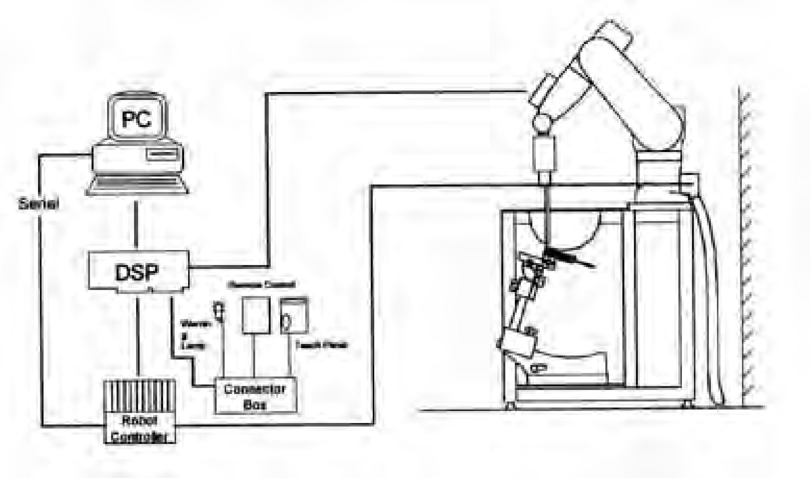

Figure 2. HCT SAR Lab. Test Measurement Set-up

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 > 3 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 ㎼/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 WCDMA/LTE Phones Fast automatic scanning in arbitrary phantoms

Figure 3. Photograph of the probe and the Phantom

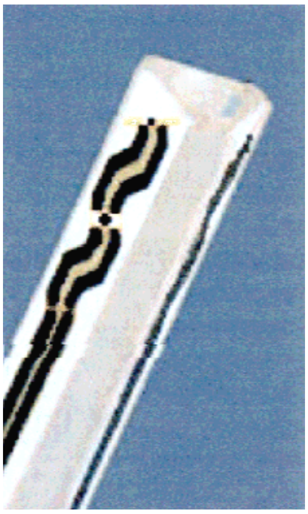

Figure 4. ET3DV6 E-field Probe

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.

4.2.1 EX3DV4 Probe Specification

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

Figure 5. Photograph of the probe and the Phantom

Figure 6. EX3DV4 E-field Probe

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

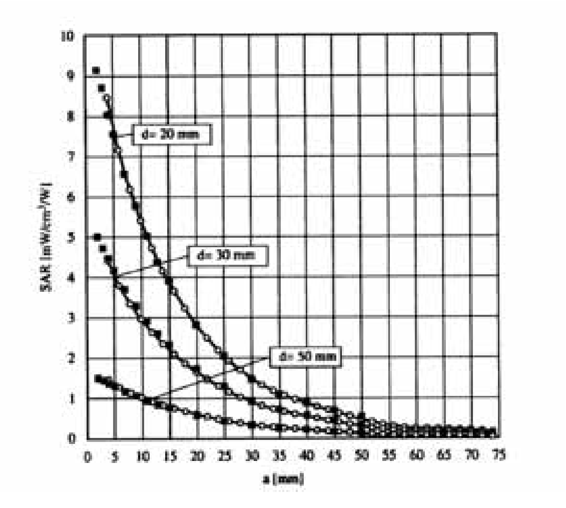

Figure 7. E-Field and Temperature measurements at 900 MHz

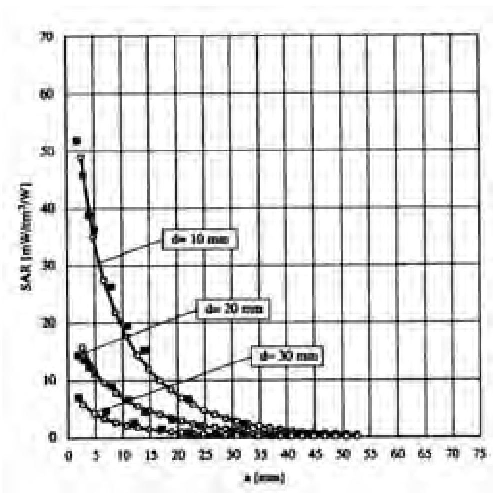

Figure 8. E-Field and temperature measurements at 1.8 GHz

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 poing (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):

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

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 SAM Phantom

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

Figure 9. SAM Phantom

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

Triple Modular Phantom consists of 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 10. 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 11. Device Holder

4.6 Tissue Simulating Mixture Characterization

The mixture is characterized to obtain proper dielectric constant (permittivity) and conductivity of the tissue of interest. The tissue dielectric parameters recommended in IEEE 1528 and IEC 62209 have been used as targets for the compositions, and are to mach within 5%, per the FCC recommendations .

Ingredients (% by weight)	Frequency (MHz)							
	835		1 900		2 450 ~ 2 700		5 200 - 5 800	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body
Water	40.45	53.06	54.9	70.17	71.88	73.2	65.52	78.66
Salt (NaCl)	1.45	0.94	0.18	0.39	0.16	0.1	0.0	0.0
Sugar	57.0	44.9	0.0	0	0.0	0.0	0.0	0.0
HEC	1.0	1.0	0.0	0	0.0	0.0	0.0	0.0
Bactericide	0.1	0.1	0.0	0	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	19.97	0.0	17.24	10.67
DGBE	0.0	0.0	44.92	29.44	7.99	26.7	0.0	0.0
Diethylene glycol hexyl ether	-	-	-	-	-	-	17.24	10.67

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

Table 4.1 Composition of the Tissue Equivalent Matter

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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
SPEAG	Triple Modular Phantom	-	N/A	N/A	N/A
Staubli	Robot RX90B L	F01/5K09A1/A/01	N/A	N/A	N/A
Staubli	Robot TX90 XLspeag	F13/5R4XF1/A/01	N/A	N/A	N/A
Staubli	Robot ControllerCS7MB	3403-91935	N/A	N/A	N/A
Staubli	CS8Cspeag-TX90	F13/5R4XF1/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
SPEAG	Light Alignment Sensor	SE UKS 030 AA	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	D221340.01	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	D21142605	N/A	N/A	N/A
SPEAG	DAE4	1417	Jan. 03, 2014	Annual	Jan. 03, 2015
SPEAG	DAE4	652	Mar. 26, 2014	Annual	Mar. 26, 2015
SPEAG	DAE3	466	Feb. 27, 2014	Annual	Feb. 27, 2015
SPEAG	E-Field Probe ET3DV6	1630	Apr. 21, 2014	Annual	Apr. 21, 2015
SPEAG	E-Field Probe ET3DV6	1605	Jan. 31, 2014	Annual	Jan. 31, 2015
SPEAG	E-Field Probe EX3DV4	3863	Jul. 24, 2014	Annual	Jul. 24, 2015
SPEAG	Dipole D750V3	1014	Jul. 24, 2014	Annual	Jul. 24, 2015
SPEAG	Dipole D835V2	4d165	Jan.07, 2014	Annual	Jan.07, 2015
SPEAG	Dipole D1800V2	2d006	Mar.24, 2014	Annual	Mar.24, 2015
SPEAG	Dipole D1900V2	5d061	Jul. 23, 2014	Annual	Jul. 23, 2015
SPEAG	Dipole D2450V2	743	Jul. 24, 2014	Annual	Jul. 24, 2015
SPEAG	Dipole D2600V2	1015	Apr. 23, 2014	Annual	Apr. 23, 2015
Agilent	Power Meter(F) E4419B	MY41291386	Nov. 01, 2013	Annual	Nov. 01, 2014
Agilent	Power Sensor(G) 8481	MY41090680	Oct. 30, 2013	Annual	Oct. 30, 2014
Agilent	Dielectric Probe Kit 85070C	00721521	CBT		
HP	Dual Directional Coupler 778D	16072	Oct. 31, 2013	Annual	Oct. 31, 2014
Agilent	Base Station E5515C	GB44400269	Feb. 10, 2014	Annual	Feb. 10, 2015
HP	Signal Generator 8664A	3744A02069	Nov. 04, 2013	Annual	Nov. 04, 2014
Hewlett Packard	11636B/Power Divider	11377	Nov. 10. 2013	Annual	Nov. 10. 2014
Agilent	N9020A/ SIGNAL ANALYZER	MY50510407	Mar. 25, 2014	Annual	Mar. 25, 2015
TESCOM	TC-3000C / BLUETOOTH TESTER	3000C000276	Apr. 11, 2014	Annual	Apr. 11. 2015
HP	Network Analyzer 8753ES	JP39240221	Mar. 21, 2014	Annual	Mar. 21, 2015
R&S	Base Station CMW500	1201.0002K50_116858	Jan. 17, 2014	Annual	Jan. 17, 2015

NOTE:

1. The E-field probe was calibrated by SPEAG, by the waveguide technique procedure. Dipole Verification measurement is performed by HCT Lab. before each test. The brain/body simulating material is calibrated by HCT using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain/body-equivalent material.
2. CBT(Calibrating Before Testing). Prior to testing, the dielectric probe kit was calibrated via the network analyzer, with the specified procedure(calibrated in pure water) and calibration kit(standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Agilent

5. SAR MEASUREMENT PROCEDURE

The evaluation was performed with the following procedure:

1. The SAR value at a fixed location above the ear point was measured and was used as a reference value for assessing the power drop.

2. The SAR distribution at the exposed side of the head was measured at a distance of 3.9 mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 15 mm x 15 mm. Based on this data, the area of the maximum absorption was determined by spline interpolation.

3. Around this point, a volume of 32 mm x 32 mm x 30 mm was assessed by measuring 5 x 5 x 7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:
   a. The data at the surface were extrapolated, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.
   b. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed using the 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions. The volume was integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.
   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

4. The SAR value, at the same location as procedure #1, was re-measured. If the value changed by more than 5 %, the evaluation is repeated.

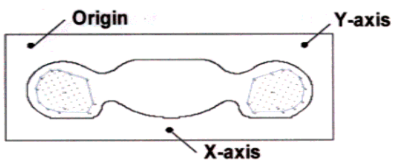

Figure 12. SAR Measurement Point in Area Scan

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s).
The measurement grid within an Area Scan is defined by the grid extend, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the hightest E-field value to determine the averaged SASR-distribution over 10g.
Area scan and zoom scan resolution setting follow KDB 865664 D01v01r03 quoted below.

<table>
<tr><td colspan="3"></td><td>$\leq$ 3 GHz</td><td>$>$ 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>$\leq$ 2 GHz: $\leq$ 15 mm
2 – 3 GHz: $\leq$ 12 mm</td><td>3 – 4 GHz: $\leq$ 12 mm
4 – 6 GHz: $\leq$ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

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6. DESCRIPTION OF TEST POSITION

6.1 HEAD POSITION

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

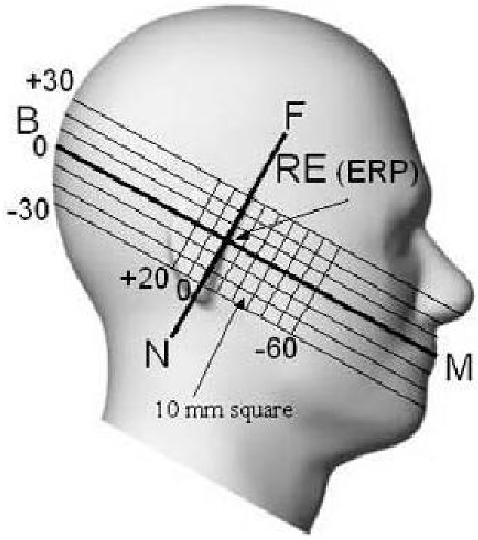

Figure 13. Side view of the phantom

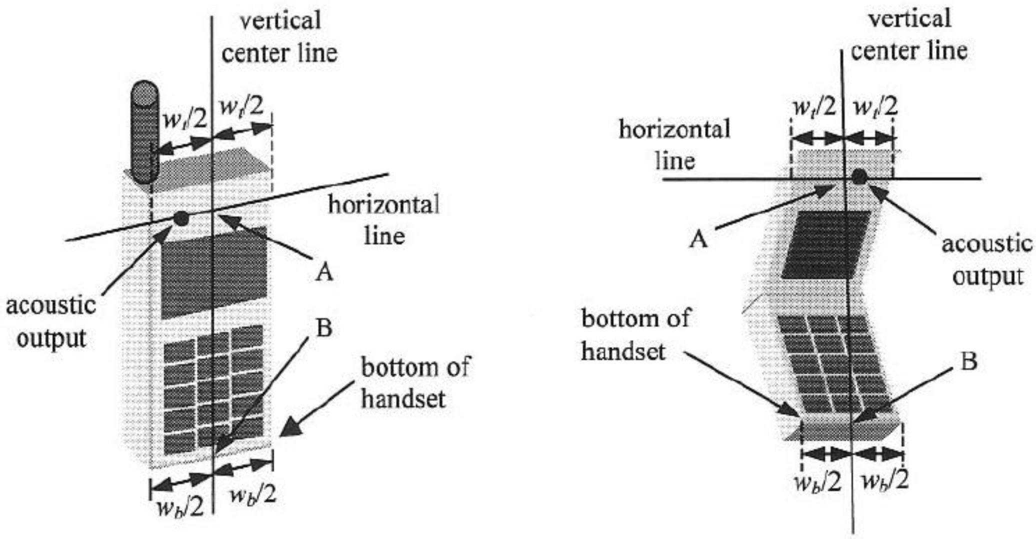

Figure 14. Handset vertical and horizontal reference lines

6.2 Body Holster/Belt Clip Configurations

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

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

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

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

"See the Test SET-UP Photo"

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

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

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7. MEASUREMENT UNCERTAINTY

Error Description	Tol (± %)	Prob. dist.	Div.	c_i	Standard Uncertainty (± %)	v_{eff}
1. Measurement System						
Probe Calibration	6.00	N	1	1	6.00	∞
Axial Isotropy	4.70	R	1.73	0.7	1.90	∞
Hemispherical Isotropy	9.60	R	1.73	0.7	3.88	∞
Boundary Effects	1.00	R	1.73	1	0.58	∞
Linearity	4.70	R	1.73	1	2.71	∞
System Detection Limits	1.00	R	1.73	1	0.58	∞
Readout Electronics	0.30	N	1.00	1	0.30	∞
Response Time	0.8	R	1.73	1	0.46	∞
Integration Time	2.6	R	1.73	1	1.50	∞
RF Ambient Conditions	3.00	R	1.73	1	1.73	∞
Probe Positioner	0.40	R	1.73	1	0.23	∞
Probe Positioning	2.90	R	1.73	1	1.67	∞
Max SAR Eval	1.00	R	1.73	1	0.58	∞
2.Test Sample Related						
Device Positioning	2.90	N	1.00	1	2.90	145
Device Holder	3.60	N	1.00	1	3.60	5
Power Drift	5.00	R	1.73	1	2.89	∞
3.Phantom and Setup						
Phantom Uncertainty	4.00	R	1.73	1	2.31	∞
Liquid Conductivity(target)	5.00	R	1.73	0.64	1.85	∞
Liquid Conductivity(meas.)	2.07	N	1	0.64	1.32	9
Liquid 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 7.1 Uncertainty (800 MHz- 2 450 MHz)

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

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

Table 8.1 Safety Limits for Partial Body Exposure

NOTES:

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

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

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

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

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

9. SAR SYSTEM VALIDATION

Per FCC KCB 865664 D02v01r01, SAR system validation status should be document to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in IEEE 1528-2003 and FCC KDB 865664 D01v01r03. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

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

SAR System #	Probe	probe Type	Probe Calibration Point		Dipole	Date	Dielectric Parameters		CW Validation			Modulation Validation		
							Measured Permittivity	Measured conductivity	Sensitivity	Probe Linearity	Probe Isortopy	MOD. Type	Duty Factor	PAR
4	1605	ET3DV6	Head	750	1014	Aug. 01,2014	42.1	0.9	PASS	PASS	PASS	N/A	N/A	N/A
7	1630	ET3DV6	Head	835	4d165	May.07,2014	41.7	0.9	PASS	PASS	PASS	GMSK	PASS	N/A
1	3863	EX3DV4	Head	1800	2d006	Apr.10,2014	40.2	1.41	PASS	PASS	PASS	N/A	N/A	N/A
1	3863	EX3DV4	Head	1900	5d061	Aug.05,2014	39.8	1.4	PASS	PASS	PASS	GMSK	PASS	N/A
1	3863	EX3DV4	Head	2450	743	Aug.05,2014	38.2	1.79	PASS	PASS	PASS	OFDM	N/A	PASS
1	3863	EX3DV4	Head	2600	1015	Aug.05,2014	38.5	1.98	PASS	PASS	PASS	N/A	N/A	N/A
4	1605	ET3DV6	Body	750	1014	Aug. 01,2014	55.7	0.98	PASS	PASS	PASS	N/A	N/A	N/A
7	1630	ET3DV6	Body	835	4d165	May.07,2014	54.9	0.98	PASS	PASS	PASS	GMSK	PASS	N/A
7	1630	ET3DV6	Head	1800	2d006	May.07,2014	41.6	1.39	PASS	PASS	PASS	N/A	N/A	N/A
7	1630	ET3DV6	Head	1900	5d061	Aug.05,2014	39.8	1.4	PASS	PASS	PASS	GMSK	PASS	N/A
7	1630	ET3DV6	Body	2450	743	Aug.06,2014	53.2	1.95	PASS	PASS	PASS	OFDM	N/A	PASS
1	3863	EX3DV4	Body	2600	1015	Aug.06,2014	52.7	2.09	PASS	PASS	PASS	N/A	N/A	N/A

SAR System Validation Summary

Note;

All measurement were performed using probes calibrated for CW signal only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01v01r03. SAR system were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5 dB), such as OFDM according to KDB 865664 D01v01r03.

10. SYSTEM VERIFICATION

10.1 Tissue Verification

Freq. [MHz]	Date	Probe	Dipole	Liquid	Liquid Temp. [°C]	Parameters	Target Value	Measured Value	Deviation [%]	Limit [%]
750	Aug. 21, 2014	1605	1014	Head	22.6	ε r	41.9	42.7	+ 1.91	± 5
						σ	0.89	0.907	+ 1.91	± 5
750	Aug. 20, 2014	1605		Body	20.6	ε r	55.5	54.7	- 1.44	± 5
						σ	0.96	0.983	+ 2.40	± 5
835	Aug. 18, 2014	1630	4d165	Head	21.8	ε r	41.5	42.6	+ 2.65	± 5
						σ	0.90	0.903	- 1.85	± 5
835	Aug. 18, 2014	1630		Body	20.2	ε r	55.2	56.9	+ 3.08	± 5
						σ	0.97	0.985	+ 1.55	± 5
1 800	Aug. 19, 2014	3863	2d006	Head	21.1	ε r	40.0	39.8	- 0.50	± 5
						σ	1.40	1.38	- 1.43	± 5
1 800	Aug. 19, 2014	1630		Body	20.6	ε r	53.3	51.9	- 2.63	± 5
						σ	1.52	1.52	+ 0.00	± 5
1 900	Aug. 20, 2014	3863	5d061	Head	21.8	ε r	40.0	39	- 2.50	± 5
						σ	1.40	1.38	- 1.43	± 5
1 900	Aug. 19, 2014	1630		Body	20.6	ε r	53.3	52.6	- 1.31	± 5
						σ	1.52	1.5	- 1.32	± 5
2 450	Aug. 18, 2014	3863	743	Head	21.2	ε r	39.2	39.783	+ 1.49	± 5
						σ	1.80	1.798	- 0.11	± 5
2 450	Aug. 18, 2014	1630		Body	20.2	ε r	52.7	52.4	- 0.57	± 5
						σ	1.95	1.93	- 1.03	± 5
2 600	Aug. 26, 2014	3863	1015	Head	19.6	ε r	39.0	39	+ 0.00	± 5
						σ	1.96	2.02	+ 3.06	± 5
2 600	Aug. 25, 2014	3863		Body	21.7	ε r	52.5	52.6	+ 0.19	± 5
						σ	2.16	2.11	- 2.31	± 5

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

10.2 System Verification

Prior to assessment, the system is verified to the ± 10 % of the specifications at 750 MHz/ 835 MHz / 1800 MHz/ 1 900 MHz / 2 450 MHz/ 2 600 MHz by using the system Verification kit. (Graphic Plots Attached)

[System Verification Results]

Freq. [MHz]	Date	Probe (SN)	Dipole (SN)	Liquid	Amb. Temp. [°C]	Liquid Temp. [°C]	1 W Target SAR_{1g} (SPEAG) (mW/g)	Measured SAR_{1g} (mW/g)	1 W Normalized SAR_{1g} (mW/g)	Deviation [%]	Limit [%]
750	Aug. 21, 2014	1605	1014	Head	22.8	22.6	8.31	0.866	8.66	+ 4.21	± 10
750	Aug. 20, 2014	1605		Body	20.8	20.6	8.63	0.915	9.15	+ 6.03	± 10
835	Aug. 18, 2014	1630	4d165	Head	22.0	21.8	9.24	0.957	9.57	+ 3.57	± 10
835	Aug. 18, 2014	1630		Body	20.4	20.2	9.58	0.988	9.88	+ 3.13	± 10
1 800	Aug. 19, 2014	3863	2d006	Head	21.3	21.1	38.1	3.76	37.6	- 1.31	± 10
1 800	Aug. 19, 2014	1630		Body	20.8	20.6	38.1	3.7	37	- 2.89	± 10
1 900	Aug. 20, 2014	3863	5d061	Head	22.0	21.8	40.6	3.94	39.4	- 2.96	± 10
1 900	Aug. 19, 2014	1630		Body	20.8	20.6	40.8	4.22	42.2	+ 3.43	± 10
2 450	Aug. 18, 2014	3863	743	Head	21.4	21.2	53.2	5.24	52.4	- 1.50	± 10
2 450	Aug. 18, 2014	1630		Body	20.4	20.2	51.3	5.14	51.4	+ 0.19	± 10
2 600	Aug. 26, 2014	3863	1015	Head	19.8	19.6	57.7	5.72	57.2	- 0.87	± 10
2 600	Aug. 25, 2014	3863		Body	21.9	21.7	55.5	5.57	55.7	+ 0.36	± 10

10.3 System Verification 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 Verification kit. (Graphic Plots Attached)

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

Note;
SAR Verification was performed according to the FCC KDB 865664 D01v01r03.

11. RF CONDUCTED POWER MEASUREMENT

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

11.1 Output Power Specifications.

This device operates using the following maximum output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB publication 447498 D01v05r02.

GSM

GSM850		GSM1900	
Target Power : 32.7 dBm		Target Power : 29.7 dBm	
GPRS850		PCS1900	
GPRS 1tx : 32.7 dBm	EGPRS 1tx : 26.7 dBm	GPRS 1tx : 29.7 dBm	EGPRS 1tx : 25.7 dBm
GPRS 2tx : 30.7 dBm	EGPRS 2tx : 26.2 dBm	GPRS 2tx : 27.7 dBm	EGPRS 2tx : 25.2 dBm
GPRS 3tx : 28.7 dBm	EGPRS 3tx : 25.2 dBm	GPRS 3tx : 25.7 dBm	EGPRS 3tx : 24.2 dBm
GPRS 4tx : 27.7 dBm	EGPRS 4tx : 24.2 dBm	GPRS 4tx : 24.7 dBm	EGPRS 4tx : 23.2 dBm
Tune-up Tolerance : -1.5 dB/ +0.5 dB			

WCDMA

WCDMA850		WCDMA1900	
Target Power : 22.7 dBm		Target Power : 22.7 dBm	
HSDPA Sub-test1	Target Power : 22.7 dBm	HSDPA Sub-test1	Target Power : 22.7 dBm
HSDPA Sub-test2	Target Power : 22.7 dBm	HSDPA Sub-test2	Target Power : 22.7 dBm
HSDPA Sub-test3	Target Power : 22.2 dBm	HSDPA Sub-test3	Target Power : 22.2 dBm
HSDPA Sub-test4	Target Power : 22.2 dBm	HSDPA Sub-test4	Target Power : 22.2 dBm
DC-HSDPA Sub-test1	Target Power : 22.7 dBm	DC-HSDPA Sub-test1	Target Power : 22.7 dBm
DC-HSDPA Sub-test2	Target Power : 22.7 dBm	DC-HSDPA Sub-test2	Target Power : 22.7 dBm
DC-HSDPA Sub-test3	Target Power : 22.2 dBm	DC-HSDPA Sub-test3	Target Power : 22.2 dBm
DC-HSDPA Sub-test4	Target Power : 22.2 dBm	DC-HSDPA Sub-test4	Target Power : 22.2 dBm
Tune-up Tolerance : -1.5 dB/ +0.5 dB			

* MPR Tolerance: Max. average power +0.5dB/-0.5dB
* The HSUPA transmitter power will not exceed the R99 maximum transmit Power in devices based on Qualcomm's HSPA chipset solutions

LTE

Mode/Band	LTE Band 2	LTE Band 4	LTE Band 7	LTE Band 17
Target Power	23.2 dBm	23.2 dBm	21.9 dBm	23.7 dBm
Tune-up Tolerance : -1.5 dB/ +0.5 dB				

Wifi

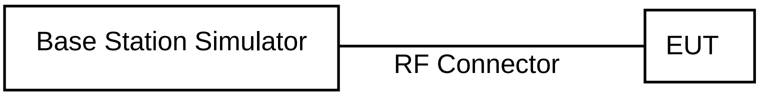
Wifi (Average Power)	Mode / Band		
	2.4 GHz		
	802.11b	802.11g	802.11n
Maximum	18 dBm	14 dBm	13 dBm
Nominal	17 dBm	13 dBm	12 dBm

BT.

Mode / Band	1Mbps(GFSK)	2Mbps(DPSK)	3Mbps(8DPSK)	LE
Maximum	9 dBm	7 dBm	7 dBm	0 dBm
Nominal	8 dBm	6 dBm	6 dBm	-1 dBm

11.2 GSM

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



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

- GSM voice: Head SAR
- GPRS Multi-slots : Body SAR with GPRS/EDGE 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	Ch.	Voice	GPRS(GMSK) Data – CS1				EDGE Data			
		GSM (dBm)	GPRS 1 TX Slot (dBm)	GPRS 2 TX Slot (dBm)	GPRS 3 TX Slot (dBm)	GPRS 4 TX Slot (dBm)	EDGE 1 TX Slot (dBm)	EDGE 2 TX Slot (dBm)	EDGE 3 TX Slot (dBm)	EDGE 4 TX Slot (dBm)
GSM 850	128	32.60	32.63	31.18	28.89	27.24	26.50	26.13	25.16	23.99
	190	32.70	32.66	31.19	28.93	27.71	26.62	26.19	25.32	24.09
	251	32.69	32.68	31.19	29.04	27.77	26.81	26.40	25.49	24.26
GSM 1900	512	29.95	29.91	28.15	26.15	25.09	25.58	25.03	23.97	23.24
	661	30.09	30.05	28.14	26.17	25.11	25.60	25.11	24.05	23.24
	810	29.91	29.88	28.14	26.16	25.19	25.62	25.06	24.08	23.27

GSM Conducted output powers (Frame-Average)

Band	Ch.	Voice	GPRS(GMSK) Data – CS1				EDGE Data			
		GSM (dBm)	GPRS 1 TX Slot (dBm)	GPRS 2 TX Slot (dBm)	GPRS 3 TX Slot (dBm)	GPRS 4 TX Slot (dBm)	EDGE 1 TX Slot (dBm)	EDGE 2 TX Slot (dBm)	EDGE 3 TX Slot (dBm)	EDGE 4 TX Slot (dBm)
GSM 850	128	23.57	23.60	25.16	24.63	24.23	17.47	20.11	20.90	20.98
	190	23.67	23.63	25.17	24.67	24.70	17.59	20.17	21.06	21.08
	251	23.66	23.65	25.17	24.78	24.76	17.78	20.38	21.23	21.25
GSM 1900	512	20.92	20.88	22.13	21.89	22.08	16.55	19.01	19.71	20.23
	661	21.06	21.02	22.12	21.91	22.10	16.57	19.09	19.79	20.23
	810	20.88	20.85	22.12	21.90	22.18	16.59	19.04	19.82	20.26

Note:

Time slot average factor is as follows:

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

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

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

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

11.3 WCDMA

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

11.3.1 Output Power Verification

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

11.3.2 Head SAR Measurements

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

11.3.3 Body SAR Measurement

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

11.3.4 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 $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$.

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

11.3.5 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.

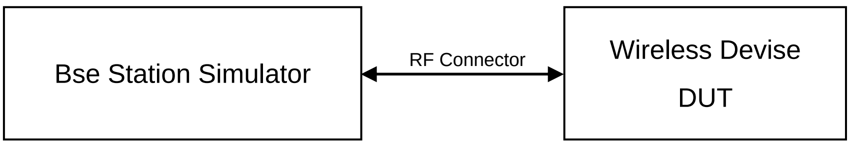
11.3.6 DC-HSDPA

UMTS SAR was tested under RMC 12.2 kbps with HSPA inactive per KDB publication 941225 D01v02.
HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.

DC-HSDPA Considerations:

- 3GPP Specification 34.121-1 Release 8 Ver 8.10.0 was used for DC-HSDPA guidance
- H-Set 12(QPSK) was confirmed to be used during DC-HSDPA measurements
- Measured maximum output powers for DC-HSDPA were not greater than 1/4 dB higher than the WCDMA 12.2 kbps RMC maximum output and as a result, SAR is not required for DC-HSDPA
- The DUT supports UE category 24 for HSDPA

It is expected by the manufacturer that MPR for some HSUPA subtests may be up to 1 dB more than specified by 3GPP, but also as low as 0 dB according to the chipset implementation in this model.



WCDMA 850

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]		
			UL 4132 DL 4357	UL 4183 DL 4408	UL 4233 DL 4458
99	WCDMA	12.2 kbps RMC	22.91	23.08	23.11
99	WCDMA	12.2 kbps AMR	22.94	23.08	23.05
5	HSDPA	Subtest 1	22.85	22.99	22.94
5		Subtest 2	22.82	22.98	22.91
5		Subtest 3	22.32	22.49	22.42
5		Subtest 4	22.28	22.48	22.32
6	HSUPA	Subtest 1	22.23	22.08	22.66
6		Subtest 2	21.34	21.32	20.99
6		Subtest 3	21.47	21.52	21.65
6		Subtest 4	21.32	21.37	21.24
6		Subtest 5	22.10	21.97	22.57
8	DC-HSDPA	Subtest 1	22.64	22.63	22.55
8		Subtest 2	22.61	22.69	22.58
8		Subtest 3	22.10	22.18	22.08
8		Subtest 4	22.09	22.25	22.06

WCDMA Average Conducted output powers

WCDMA1900

3GPP Release Version	Mode	3GPP 34.121 Subtest	PCS Band [dBm]		
			UL 9262 DL 9662	UL 9400 DL 9800	UL 9538 DL 9938
99	WCDMA	12.2 kbps RMC	22.82	23.05	22.82
99	WCDMA	12.2 kbps AMR	22.80	23.07	22.79
5	HSDPA	Subtest 1	22.70	22.91	22.74
5		Subtest 2	22.80	22.91	22.73
5		Subtest 3	22.32	22.33	22.32
5		Subtest 4	22.22	22.34	22.30
6	HSUPA	Subtest 1	22.29	22.78	22.57
6		Subtest 2	20.79	21.34	21.18
6		Subtest 3	21.33	21.97	21.75
6		Subtest 4	21.48	21.49	21.01
6		Subtest 5	22.24	22.79	22.50
8	DC-HSDPA	Subtest 1	22.57	22.58	22.21
8		Subtest 2	22.66	22.65	22.22
8		Subtest 3	22.12	22.11	21.77
8		Subtest 4	22.14	22.10	21.79

WCDMA Average Conducted output powers

11.4 LTE

SAR testing was performed according to the FCC KDB 941225 D05v02r03 publication.
This DUT is developed base on MPR. The MPR is mandatory.
The device will not operate with any other MPR setting than that stated in the table as indicated.
SAR Testing was performed using a CMW500. UE transmits with Maximum output power during SAR testing.
A-MPR has been disabled for all SAR tests by setting NS=01 on the R&S CMW500.

- LTE Band 2

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				18607ch 1850.7MHz	18900ch 1880MHz	19193ch 1909.3MHz
1.4MHz	QPSK	1	0	23.37	23.39	23.38
		1	3	23.38	23.49	23.38
		1	5	23.36	23.42	23.36
		3	0	23.28	23.28	23.27
		3	1	23.29	23.31	23.32
		3	3	23.29	23.30	23.31
		6	0	22.38	22.36	22.44
	16QAM	1	0	22.07	22.10	22.15
		1	3	22.01	22.17	22.17
		1	5	22.13	22.08	22.16
		3	0	22.09	22.14	22.11
		3	1	22.12	22.17	22.13
		3	3	22.14	22.24	22.20
		6	0	21.34	21.25	21.43

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				18615ch 1851.5MHz	18900ch 1880MHz	19185ch 1908.5MHz
3MHz	QPSK	1	0	23.42	23.50	23.44
		1	7	23.48	23.49	23.45
		1	14	23.41	23.44	23.51
		8	0	22.42	22.24	22.32
		8	4	22.38	22.22	22.28
		8	7	22.34	22.28	22.37
		15	0	22.38	22.33	22.36
	16QAM	1	0	22.16	22.10	22.12
		1	7	22.17	22.18	22.13
		1	14	22.12	22.02	22.22
		8	0	21.24	21.07	21.24
		8	4	21.22	21.17	21.15
		8	7	21.16	21.13	21.24
		15	0	21.2	21.17	21.20

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				18625 1852.5MHz	18900 1880MHz	19175 1907.5MHz
5MHz	QPSK	1	0	23.64	23.47	23.63
		1	12	23.66	23.53	23.52
		1	24	23.59	23.33	23.53
		12	0	22.58	22.26	22.27
		12	6	22.56	22.27	22.33
		12	11	22.53	22.11	22.39
		25	0	22.53	22.26	22.27
	16QAM	1	0	22.53	22.37	22.40
		1	12	22.59	22.43	22.51
		1	24	22.49	22.29	22.40
		12	0	21.55	21.36	21.41
		12	6	21.53	21.17	21.35
		12	11	21.47	21.09	21.32
		25	0	21.56	21.11	21.26

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				18650 1855MHz	18900 1880MHz	19150 1905MHz
10MHz	QPSK	1	0	23.56	23.60	23.61
		1	24	23.53	23.52	23.51
		1	49	23.47	23.51	23.48
		25	0	22.47	22.31	22.29
		25	12	22.52	22.36	22.39
		25	24	22.40	22.25	22.33
		50	0	22.43	22.23	22.23
	16QAM	1	0	22.47	22.40	22.30
		1	24	22.52	22.35	22.40
		1	49	22.40	22.32	22.44
		25	0	21.57	21.26	21.32
		25	12	21.48	21.26	21.38
		25	24	21.30	21.20	21.32
		50	0	21.37	21.14	21.25

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				18675 1857.5MHz	18900 1880MHz	19125 1902.5MHz
15MHz	QPSK	1	0	23.66	23.59	23.58
		1	36	23.54	23.56	23.46
		1	74	23.46	23.39	23.47
		36	0	22.58	22.28	22.31
		36	18	22.47	22.35	22.46
		36	36	22.33	22.44	22.46
		75	0	22.44	22.41	22.31
	16QAM	1	0	22.63	22.43	22.29
		1	36	22.5	22.41	22.36
		1	74	22.21	22.53	22.40
		36	0	21.65	21.47	21.26
		36	18	21.44	21.28	21.34
		36	36	21.31	21.42	21.35
		75	0	21.36	21.28	21.29

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				18700 1860MHz	18900 1880MHz	19100 1900MHz
20MHz	QPSK	1	0	23.63	23.58	23.53
		1	49	23.56	23.55	23.54
		1	99	23.49	23.56	23.52
		50	0	22.45	22.38	22.28
		50	25	22.4	22.29	22.31
		50	49	22.38	22.33	22.43
		100	0	22.47	22.43	22.26
	16QAM	1	0	22.51	22.22	22.24
		1	49	22.37	22.3	22.22
		1	99	22.29	22.34	22.26
		50	0	21.53	21.4	21.28
		50	25	21.32	21.32	21.40
		50	49	21.24	21.28	21.45
		100	0	21.4	21.34	21.39

- LTE Band 4

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				19957 1710.7 MHz	20175 1732.5 MHz	20393 1754.3 MHz
1.4MHz	QPSK	1	0	23.38	23.38	23.35
		1	3	23.35	23.31	23.34
		1	5	23.34	23.34	23.31
		3	0	23.25	23.26	23.24
		3	1	23.16	23.14	23.18
		3	3	23.11	23.16	23.11
		6	0	22.17	22.19	22.03
	16QAM	1	0	21.85	21.95	21.97
		1	3	21.95	21.95	21.95
		1	5	21.99	21.99	21.93
		3	0	21.95	22.03	21.97
		3	1	21.93	22.03	21.96
		3	3	21.89	22.03	21.95
		6	0	21.21	21.17	21.12

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				19965 1711.5 MHz	20175 1732.5 MHz	20385 1753.5 MHz
3MHz	QPSK	1	0	23.34	23.34	23.36
		1	7	23.26	23.39	23.35
		1	14	23.31	23.37	23.31
		8	0	22.04	22.11	22.07
		8	3	22.11	22.12	22.08
		8	7	21.94	22.13	22.07
		15	0	22.09	22.13	22.11
	16QAM	1	0	22.01	21.88	21.91
		1	7	21.91	21.99	21.99
		1	14	21.93	22.02	21.95
		8	0	21.13	21.12	21.13
		8	3	21.08	21.06	21.09
		8	7	20.99	21.06	21.07
		15	0	20.99	21.12	21.15

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				19975 1712.5 MHz	20175 1732.5 MHz	20375 1752.5 MHz
5MHz	QPSK	1	0	23.34	23.45	23.45
		1	12	23.31	23.44	23.43
		1	24	23.26	23.41	23.22
		12	0	22.22	22.32	22.17
		12	6	22.47	22.37	22.28
		12	11	22.18	22.33	22.20
		25	0	22.1	22.3	22.15
	16QAM	1	0	22.41	22.26	22.23
		1	12	22.33	22.26	22.31
		1	24	22.11	22.34	22.18
		12	0	21.38	21.42	21.31
		12	6	21.26	21.34	21.28
		12	11	21.34	21.29	21.22
		25	0	21.21	21.28	21.23

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				20000 1715 MHz	20175 1732.5 MHz	20350 1750 MHz
10MHz	QPSK	1	0	23.49	23.49	23.45
		1	24	23.4	23.46	23.41
		1	49	23.28	23.43	23.42
		25	0	22.13	22.25	22.40
		25	12	22.31	22.27	22.36
		25	24	22.14	22.33	22.35
		50	0	22.14	22.26	22.27
	16QAM	1	0	22.29	22.23	22.30
		1	24	22.24	22.31	22.41
		1	49	22.07	22.28	22.24
		25	0	21.33	21.29	21.43
		25	12	21.16	21.35	21.39
		25	24	21.23	21.35	21.25
		50	0	21.08	21.38	21.32

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				20025 1717.5 MHz	20175 1732.5 MHz	20325 1747.5 MHz
15MHz	QPSK	1	0	23.46	23.47	23.42
		1	36	23.44	23.39	23.30
		1	74	23.28	23.31	23.22
		36	0	22.27	22.34	22.35
		36	18	22.26	22.39	22.32
		36	36	22.24	22.33	22.20
		75	0	22.18	22.28	22.35
	16QAM	1	0	22.16	22.16	22.36
		1	36	22.28	22.29	22.27
		1	74	22.05	22.20	22.16
		36	0	21.37	21.30	21.40
		36	18	21.38	21.34	21.37
		36	36	21.38	21.37	21.23
		75	0	21.17	21.34	21.40

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
					20175 1732.5 MHz	
20MHz	QPSK	1	0		23.47	
		1	49		23.38	
		1	99		23.32	
		50	0		22.20	
		50	25		22.30	
		50	49		22.29	
		100	0		22.27	
	16QAM	1	0		22.27	
		1	49		22.22	
		1	99		22.24	
		50	0		21.26	
		50	25		21.32	
		50	49		21.29	
		100	0		21.31	

Note: LTE Band 4 (AWS) at 20 MHz Bandwidth does not support three non-overlapping chennels. Per KDB 941225 D05v02r03, when a device supports overipping channel assignment in a channel bandwidth configuration, the mid channel of the group of overiapping channels should be selected for testing.

- LTE Band 7

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				20775 2502.5MHz	21100 2535MHz	21425 2567.5MHz
5MHz	QPSK	1	0	22.2	22.25	22.19
		1	12	22.16	22.25	22.27
		1	24	22.17	22.26	22.30
		12	0	21.06	21.00	21.02
		12	6	21.12	21.01	21.03
		12	11	21.03	21.11	21.04
		25	0	20.98	20.86	20.94
	16QAM	1	0	21.15	21.13	21.08
		1	12	21.03	21.07	21.10
		1	24	21.09	21.18	21.14
		12	0	20.15	19.92	19.93
		12	6	20.09	19.92	19.95
		12	11	19.92	19.90	19.97
		25	0	19.90	19.84	19.87

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				20800 2505MHz	21100 2535MHz	21400 2565MHz
10MHz	QPSK	1	0	22.21	22.27	22.22
		1	24	22.22	22.22	22.26
		1	49	22.25	22.41	22.26
		25	0	21.04	20.99	21.01
		25	12	20.92	21.02	20.99
		25	24	20.97	20.94	21.04
		50	0	20.88	20.92	20.94
	16QAM	1	0	21.15	21.13	21.08
		1	24	21.10	21.04	21.07
		1	49	21.17	21.18	21.11
		25	0	19.95	19.92	19.86
		25	12	19.84	19.84	19.85
		25	24	19.96	19.76	19.87
		50	0	19.89	19.85	19.82

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				20825 2507.5MHz	21100 2535MHz	21375 2562.5MHz
15MHz	QPSK	1	0	22.17	22.22	22.16
		1	36	22.23	22.26	22.25
		1	74	22.33	22.21	22.27
		36	0	21.15	21.1	21.04
		36	18	21.03	21.03	21.05
		36	36	21.12	21.26	21.1
		75	0	21.1	21.08	21.04
	16QAM	1	0	21.1	21.06	21.04
		1	36	21.05	21.07	21.08
		1	74	21.21	21.06	21.16
		36	0	20.09	20.04	20.01
		36	18	20.05	20.02	19.95
		36	36	20.13	20.17	19.98
		75	0	19.99	20.11	19.98

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
				20850 2510MHz	21100 2535MHz	21350 2560MHz
20MHz	QPSK	1	0	22.07	22.23	22.17
		1	49	22.03	22.21	22.12
		1	99	21.98	22.20	22.16
		50	0	21.11	21.02	21.06
		50	25	21.10	21.05	21.07
		50	49	21.18	21.06	21.04
		100	0	21.08	21.12	21.07
	16QAM	1	0	21.09	21.09	21.13
		1	49	21.12	21.09	21.15
		1	99	21.09	21.05	21.13
		50	0	19.93	19.78	19.95
		50	25	20.06	19.95	20.04
		50	49	20.12	20.09	19.96
		100	0	20.08	20.05	19.94

- LTE Band 17

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
					23790 710 MHz	
5MHz	QPSK	1	0		23.89	
		1	12		23.84	
		1	24		24.05	
		12	0		22.70	
		12	6		22.80	
		12	11		22.84	
		25	0		22.74	
	16QAM	1	0		22.68	
		1	12		22.73	
		1	24		22.95	
		12	0		21.87	
		12	6		21.84	
		12	11		21.87	
		25	0		21.85	

Bandwidth	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
					23790 710 MHz	
10MHz	QPSK	1	0		23.78	
		1	24		23.69	
		1	49		24.03	
		25	0		22.71	
		25	12		22.81	
		25	24		22.86	
		50	0		22.69	
	16QAM	1	0		22.86	
		1	24		22.78	
		1	49		22.97	
		25	0		21.81	
		25	12		21.90	
		25	24		21.94	
		50	0		21.79	

Note: LTE Band 17 at 5 MHz &10 MHz Bandwidth does not support three non-overlapping chennels. Per KDB 941225 D05v02r03, when a device supports overipping channel assignment in a channel bandwidth configuration, the mid channel of the group of overiapping channels should be selected for testing.

Note;
The EUT enables maximum power reduction in accordance with 3GPP 36.101. The MPR settings are configured during the manufacture process and are not configurable by the network, carrier, or end user.

11.5 WiFi

11.5.1 SAR Testing for 802.11b/g/n modes

General Device Setup

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

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

Frequency Channel Configurations

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

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

Mode		GHz	Channel	Turbo Channel	“Default Test Channels”			
					§15.247		UNII	
					802.11b	802.11g		
802.11b/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

IEEE 802.11b Average RF Power

Mode	Freq. [MHz]	Channel	802.11b (2.4 GHz) Conducted Power [dBm] Data Rate (Mbps)			
			1	2	5.5	11
802.11b	2412	1	16.48	16.44	16.64	16.57
	2437	6	16.45	16.58	16.68	16.65
	2462	11	16.20	16.20	16.32	16.35

IEEE 802.11g Average RF Power

Mode	Freq. [MHz]	Channel	802.11g (2.4 GHz) Conducted Power [dBm] Data Rate (Mbps)							
			6	9	12	18	24	36	48	54
802.11g	2412	1	13.55	13.49	13.53	13.53	13.55	13.49	13.53	13.61
	2437	6	13.43	13.43	13.23	13.43	13.46	13.45	13.49	13.56
	2462	11	12.99	13.05	12.71	13.04	13.05	13.06	13.15	13.20

IEEE 802.11n Average RF Power

Mode	Freq. [MHz]	Channel	802.11n (2.4 GHz) Conducted Power [dBm] Data Rate (Mbps)							
			6.5	13	19.5	26	39	52	58.5	65
802.11n (20MHz)	2412	1	12.63	12.67	12.66	12.57	12.68	12.66	12.66	12.79
	2437	6	12.61	12.61	12.62	12.56	12.65	12.66	12.19	12.24
	2462	11	12.27	12.24	12.25	12.23	12.32	12.35	12.32	12.47

11.6 Test Exclusions Applied

11.6.1 BT

Per FCC KDB 447498 D01v05r02, The SAR exclusion threshold for distance < 50 mm is defined by the following equation:

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

Mode	Frequency	Maximum Allowed Power	Separatuin Distance	≤ 3.0
	[MHz]	[mW]	[mm]	
Bluetooth	2480	8	10	1.26

Based on the maximum conducted power of Bluetooth and antenna to use separation distance, Bluetooth SAR was not required [(8/10)*√2.480] = 1.26 < 3.0.

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05r02 IV.C.1iii, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤ 1.6W/kg. When standalone SAR is not required to be measured per FCC KDB 447498 D01v05r02 4.3.22, the following equation must be used to estimate the standalone 1-g SAR for simultaneous transmission assessment involving that transmitter.

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

Mode	Frequency	Maximum Allowed Power	Separatuin Distance (Body)	Estimated SAR (Body)
	[MHz]	[mW]	[mm]	[W/kg]
Bluetooth	2480	8	10	0.17

Note :

1) Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission. The Estimated SAR results were determined according to FCC KDB447498 D01v05r02.

2) The frequency of Bluetooth using for estimated SAR was selected highest channel of Bluetooth for highest estimated SAR.

3) Bluetooth LE conducted Power is not calculated on the SAR test exclusions table. Because Bluetooth LE conducted power is lower than Bluetooth conducted Power.

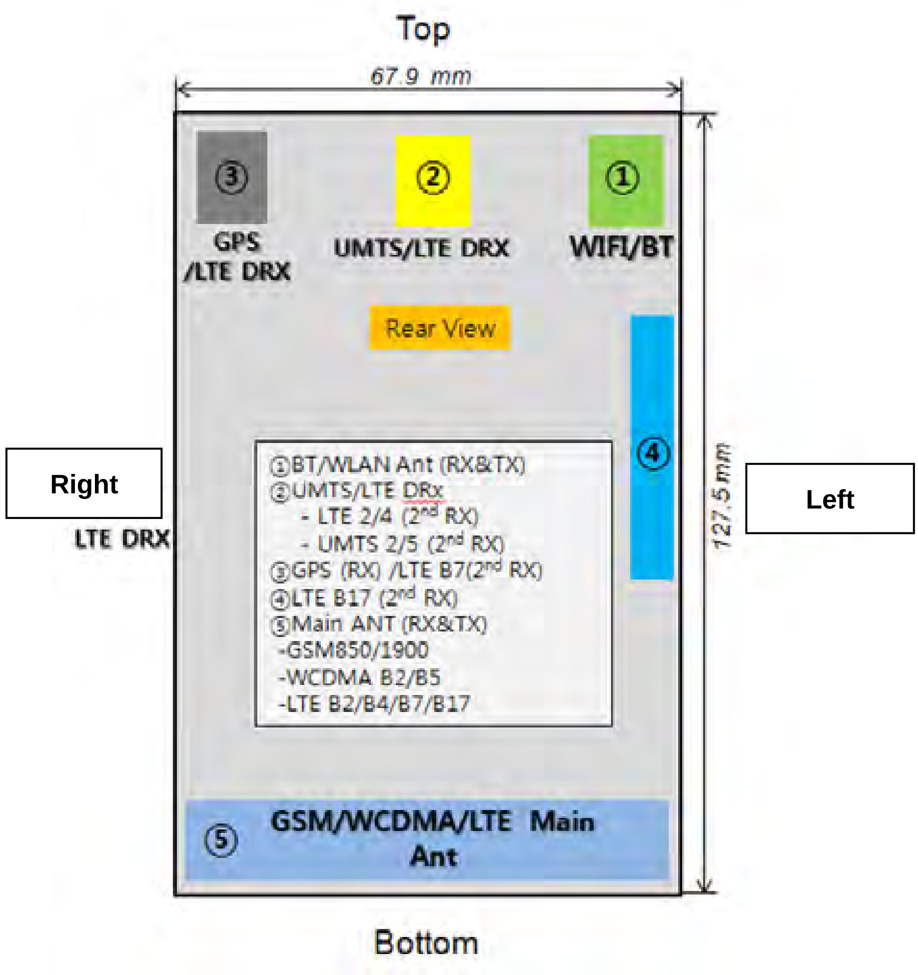
12. SAR Test configuration & Antenna Information

12.1 Mobile Hotspot sides for SAR Testing configurations

Mode	Rear	Front	Left	Right	Bottom	Top
GSM/GPRS 850	Yes	Yes	Yes	Yes	Yes	No
GSM/GPRS 1900	Yes	Yes	Yes	Yes	Yes	No
WCDMA 850	Yes	Yes	Yes	Yes	Yes	No
WCDMA 1 900	Yes	Yes	Yes	Yes	Yes	No
LTE Band 2	Yes	Yes	Yes	Yes	Yes	No
LTE Band 4	Yes	Yes	Yes	Yes	Yes	No
LTE Band 7	Yes	Yes	Yes	Yes	Yes	No
LTE Band 17	Yes	Yes	Yes	Yes	Yes	No
2.4 GHz WLAN	Yes	Yes	Yes	No	No	Yes

Note; All test configurations are based on front view.

12.2 Antenna and Device Information



Note;

1. Per FCC KDB Publication 941225 D06v01r01, we performed the SAR testing at 1.0 cm from the top & bottom surfaces and also from side edges with a transmitting antenna ≤ 2.5 cm from an edge.

*Please see the LG-D390_Antenna distance for futher information

13. SAR TEST DATA SUMMARY

13.1-1 Measurement Results (GSM850 Head SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Battery	Phantom Position	Measured SAR(mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power							
836.6	190	GSM850	33.2	32.70	0.166	Standard	Left Ear	0.333	1.122	0.374	-
836.6	190		33.2	32.70	-0.077	Standard	Left Tilt	0.169	1.122	0.190	-
836.6	190		33.2	32.70	0.027	Standard	Right Ear	0.246	1.122	0.276	-
836.6	190		33.2	32.70	-0.020	Standard	Right Tilt	0.148	1.122	0.166	-
836.6	190	GPRS 2Tx	31.2	31.19	0.068	Standard	Left Ear	0.457	1.002	**0.458**	1
836.6	190		31.2	31.19	-0.022	Standard	Left Tilt	0.208	1.002	0.208	-
836.6	190		31.2	31.19	0.115	Standard	Right Ear	0.319	1.002	0.320	-
836.6	190		31.2	31.19	-0.125	Standard	Right Tilt	0.185	1.002	0.185	-
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Head 1.6 W/kg (mW/g) Averaged over 1 gram				

13.1-2 Measurement Results (GSM1900 Head SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Battery	Phantom Position	Measured SAR(mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power							
1 880.0	661	GSM1900	30.2	30.09	-0.076	Standard	Left Ear	0.286	1.026	0.293	-
1 880.0	661		30.2	30.09	0.175	Standard	Left Tilt	0.163	1.026	0.167	-
1 880.0	661		30.2	30.09	0.060	Standard	Right Ear	0.285	1.026	0.292	-
1 880.0	661		30.2	30.09	-0.042	Standard	Right Tilt	0.236	1.026	0.242	-
1 880.0	661	GPRS 4Tx	25.2	25.11	-0.108	Standard	Left Ear	0.409	1.021	0.418	-
1 880.0	661		25.2	25.11	-0.044	Standard	Left Tilt	0.247	1.021	0.252	-
1 880.0	661		25.2	25.11	0.173	Standard	Right Ear	0.449	1.021	**0.458**	2
1 880.0	661		25.2	25.11	0.078	Standard	Right Tilt	0.342	1.021	0.349	-
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Head 1.6 W/kg (mW/g) Averaged over 1 gram				

13.1-3 Measurement Results (WCDMA850 Head SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Battery	Phantom Position	Measured SAR(mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power							
836.6	4183	WCDMA 850	23.2	23.08	-0.130	Standard	Left Ear	0.363	1.028	**0.373**	3
836.6	4183		23.2	23.08	0.001	Standard	Left Tilt	0.181	1.028	0.186	-
836.6	4183		23.2	23.08	-0.083	Standard	Right Ear	0.281	1.028	0.289	-
836.6	4183		23.2	23.08	-0.037	Standard	Right Tilt	0.191	1.028	0.196	-
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Head 1.6 W/kg (mW/g) Averaged over 1 gram				

13.1-4 Measurement Results (WCDMA1900 Head SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Battery	Phantom Position	Measured SAR(mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power							
1880	9400	WCDMA 1900	23.2	23.05	0.150	Standard	Left Ear	0.522	1.035	0.540	-
1880	9400		23.2	23.05	0.145	Standard	Left Tilt	0.308	1.035	0.319	-
1880	9400		23.2	23.05	-0.080	Standard	Right Ear	0.565	1.035	**0.585**	4
1880	9400		23.2	23.05	0.039	Standard	Right Tilt	0.433	1.035	0.448	-
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Head 1.6 W/kg (mW/g) Averaged over 1 gram				

13.1-5 Measurement Results (LTE Band 2 20MHz Head SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Battery	Phantom Position	RB Size	RB Offset	Measured SAR (mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No
MHz	Ch.		Tune-Up Limit	Conducted Power									
1 860	18700	QPSK	23.7	23.63	0.158	Standard	Left Ear	1	0	0.484	1.016	0.492	-
1 860	18700		22.7	22.45	0.193	Standard	Left Ear	50	0	0.396	1.059	0.419	-
1 860	18700		23.7	23.63	0.079	Standard	Left Tilt	1	0	0.338	1.016	0.343	-
1 860	18700		22.7	22.45	-0.010	Standard	Left Tilt	50	0	0.268	1.059	0.284	-
1 860	18700		23.7	23.63	0.109	Standard	Right Ear	1	0	0.585	1.016	**0.595**	5
1 860	18700		22.7	22.45	0.153	Standard	Right Ear	50	0	0.479	1.059	0.507	-
1 860	18700		23.7	23.63	-0.012	Standard	Right Tilt	1	0	0.447	1.016	0.454	-
1 860	18700		22.7	22.45	0.146	Standard	Right Tilt	50	0	0.357	1.059	0.378	-
ANSI/ IEEE C95.1 1992 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population								Head 1.6 W/kg (mW/g) Averaged over 1 gram					

13.1-6 Measurement Results (LTE Band 4 20MHz Head SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Battery	Phantom Position	RB Size	RB Offset	Measured SAR (mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No
MHz	ch.		Tune-Up Limit	Conducted Power									
1 732.5	20175	QPSK	23.7	23.47	0.115	Standard	Left Ear	1	0	0.381	1.054	0.402	-
1 732.5	20175		22.7	22.30	0.181	Standard	Left Ear	50	25	0.313	1.096	0.343	-
1 732.5	20175		23.7	23.47	0.183	Standard	Left Tilt	1	0	0.342	1.054	0.361	-
1 732.5	20175		22.7	22.30	0.113	Standard	Left Tilt	50	25	0.263	1.096	0.288	-
1 732.5	20175		23.7	23.47	-0.191	Standard	Right Ear	1	0	0.553	1.054	**0.583**	6
1 732.5	20175		22.7	22.30	0.126	Standard	Right Ear	50	25	0.443	1.096	0.486	-
1 732.5	20175		23.7	23.47	0.186	Standard	Right Tilt	1	0	0.416	1.054	0.439	-
1 732.5	20175		22.7	22.30	0.102	Standard	Right Tilt	50	25	0.312	1.096	0.342	-
ANSI/ IEEE C95.1 1992 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population								Head 1.6 W/kg (mW/g) Averaged over 1 gram					

13.1-7 Measurement Results (LTE Band 7 20MHz Head SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Battery	Phantom Position	RB Size	RB Offset	Measured SAR (mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No
MHz	ch.		Tune-Up Limit	Conducted Power									
2 535	21100	QPSK	22.4	22.23	-0.108	Standard	Left Ear	1	0	0.127	1.040	0.132	-
2 510	20850		21.4	21.18	0.122	Standard	Left Ear	50	49	0.092	1.052	0.097	-
2 535	21100		22.4	22.23	0.172	Standard	Left Tilt	1	0	0.049	1.040	0.051	-
2 510	20850		21.4	21.18	0.155	Standard	Left Tilt	50	49	0.032	1.052	0.034	-
2 535	21100		22.4	22.23	-0.125	Standard	Right Ear	1	0	0.140	1.040	**0.146**	7
2 510	20850		21.4	21.18	-0.159	Standard	Right Ear	50	49	0.096	1.052	0.101	-
2 535	21100		22.4	22.23	0.162	Standard	Right Tilt	1	0	0.035	1.040	0.036	-
2 510	20850		21.4	21.18	0.134	Standard	Right Tilt	50	49	0.026	1.052	0.027	-
ANSI/ IEEE C95.1 1992 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population								Head 1.6 W/kg (mW/g) Averaged over 1 gram					

13.1-8 Measurement Results (LTE Band 17 10MHz Head SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Battery	Phantom Position	RB Size	RB Offset	Measured SAR (mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No
MHz	Ch.		Tune-Up Limit	Conducted Power									
710	23790	QPSK	24.2	24.03	-0.034	Standard	Left Ear	1	49	0.291	1.040	**0.303**	8
710	23790		23.2	22.86	0.022	Standard	Left Ear	25	24	0.173	1.081	0.187	-
710	23790		24.2	24.03	-0.139	Standard	Left Tilt	1	49	0.132	1.040	0.137	-
710	23790		23.2	22.86	-0.036	Standard	Left Tilt	25	24	0.106	1.081	0.115	-
710	23790		24.2	24.03	0.120	Standard	Right Ear	1	49	0.185	1.040	0.192	
710	23790		23.2	22.86	0.110	Standard	Right Ear	25	24	0.144	1.081	0.156	-
710	23790		24.2	24.03	0.034	Standard	Right Tilt	1	49	0.123	1.040	0.128	-
710	23790		23.2	22.86	0.007	Standard	Right Tilt	25	24	0.090	1.081	0.097	-
ANSI/ IEEE C95.1 1992 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population								Head 1.6 W/kg (mW/g) Averaged over 1 gram					

13.1-9 Measurement Results (DTS Head SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Battery	Phantom Position	Data Rate	Measured SAR (mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power								
2412	1	802.11b	18	16.48	0.10	Standard	Left Ear	1Mbps	0.275	1.419	0.390	-
2412	1		18	16.48	-0.13	Standard	Left Tilt	1Mbps	0.189	1.419	0.268	-
2412	1		18	16.48	0.16	Standard	Right Ear	1Mbps	0.580	1.419	**0.823**	9
2437	6		18	16.45	0.05	Standard	Right Ear	1Mbps	0.422	1.429	0.603	-
2462	11		18	16.20	0.10	Standard	Right Ear	1Mbps	0.365	1.514	0.552	-
2412	1		18	16.48	0.17	Standard	Right Tilt	1Mbps	0.309	1.419	0.438	-
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Head 1.6 W/kg (mW/g) Averaged over 1 gram					

13.2-1 Measurement Results (GSM850 Hotspot SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Configuration	Separation Distance	Measured SAR(mW/g)	Scaling Factor	Scaled SAR(mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power							
836.6	190	GPRS 2Tx	31.2	31.19	-0.173	Rear	1.0 cm	0.605	1.002	**0.606**	10
836.6	190		31.2	31.19	-0.129	Front	1.0 cm	0.492	1.002	0.493	-
836.6	190		31.2	31.19	-0.036	Left	1.0 cm	0.520	1.002	0.521	-
836.6	190		31.2	31.19	0.008	Right	1.0 cm	0.542	1.002	0.543	-
836.6	190		31.2	31.19	0.180	Bottom	1.0 cm	0.246	1.002	0.247	-
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Body 1.6 W/kg (mW/g) Averaged over 1 gram				

13. 2-2 Measurement Results (GSM1900 Hotspot SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Configuration	Separation Distance	Measured SAR(mW/g)	Scaling Factor	Scaled SAR(mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power							
1 880.0	661	GPRS 4Tx	25.2	25.11	-0.183	Rear	1.0 cm	0.439	1.021	**0.448**	11
1 880.0	661		25.2	25.11	0.063	Front	1.0 cm	0.415	1.021	0.424	-
1 880.0	661		25.2	25.11	-0.101	Left	1.0 cm	0.145	1.021	0.148	-
1 880.0	661		25.2	25.11	0.050	Right	1.0 cm	0.156	1.021	0.159	-
1 880.0	661		25.2	25.11	0.008	Bottom	1.0 cm	0.279	1.021	0.285	-
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Body 1.6 W/kg (mW/g) Averaged over 1 gram				

13. 2-3 Measurement Results (WCDMA850 Hotspot SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Configuration	Separation Distance	Measured SAR(mW/g)	Scaling Factor	Scaled SAR(mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power							
836.6	4183	WCDMA 850	23.2	23.08	-0.014	Rear	1.0 cm	0.523	1.028	**0.538**	12
836.6	4183		23.2	23.08	0.062	Front	1.0 cm	0.385	1.028	0.396	-
836.6	4183		23.2	23.08	-0.055	Left	1.0 cm	0.295	1.028	0.303	-
836.6	4183		23.2	23.08	0.023	Right	1.0 cm	0.266	1.028	0.273	-
836.6	4183		23.2	23.08	0.042	Bottom	1.0 cm	0.182	1.028	0.187	-
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Body 1.6 W/kg (mW/g) Averaged over 1 gram				

13. 2-4 Measurement Results (WCDMA1900 Hotspot SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Configuration	Separation Distance	Measured SAR(mW/g)	Scaling Factor	Scaled SAR(mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power							
1 880.0	9400	WCDMA 1900	23.2	23.05	-0.040	Rear	1.0 cm	0.603	1.035	0.624	13
1 880.0	9400		23.2	23.05	-0.032	Front	1.0 cm	0.606	1.035	**0.627**	14
1 880.0	9400		23.2	23.05	0.041	Left	1.0 cm	0.189	1.035	0.196	-
1 880.0	9400		23.2	23.05	0.093	Right	1.0 cm	0.201	1.035	0.208	-
1 880.0	9400		23.2	23.05	0.075	Bottom	1.0 cm	0.399	1.035	0.413	-
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Body 1.6 W/kg (mW/g) Averaged over 1 gram				

13.2-5 Measurement Results (LTE Band 2 20MHz Hotspot SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Configuration	RB Size	RB Offset	Separation Distance	Measured SAR (mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power									
1 860	18700	QPSK	23.7	23.63	0.045	Rear	1	0	1.0 cm	0.703	1.016	**0.714**	15
1 860	18700		22.7	22.45	0.020	Rear	50	0	1.0 cm	0.587	1.059	0.622	-
1 860	18700		23.7	23.63	-0.047	Front	1	0	1.0 cm	0.676	1.016	0.687	-
1 860	18700		22.7	22.45	-0.039	Front	50	0	1.0 cm	0.555	1.059	0.588	-
1 860	18700		23.7	23.63	-0.089	Left	1	0	1.0 cm	0.179	1.016	0.182	-
1 860	18700		22.7	22.45	0.017	Left	50	0	1.0 cm	0.146	1.059	0.155	-
1 860	18700		23.7	23.63	-0.157	Right	1	0	1.0 cm	0.177	1.016	0.180	-
1 860	18700		22.7	22.45	-0.037	Right	50	0	1.0 cm	0.146	1.059	0.155	-
1 860	18700		23.7	23.63	0.019	Bottom	1	0	1.0 cm	0.326	1.016	0.331	-
1 860	18700		22.7	22.45	0.088	Bottom	50	0	1.0 cm	0.271	1.059	0.287	-
ANSI/ IEEE C95.1 1992 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Body 1.6 W/kg (mW/g) Averaged over 1 gram						

13.2-6 Measurement Results (LTE Band 4 20MHz Hotspot SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Configuration	RB Size	RB Offset	Separation Distance	Measured SAR (mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power									
1 732.5	20175	QPSK	23.7	23.47	-0.029	Rear	1	0	1.0 cm	0.699	1.054	0.737	16
1 732.5	20175		22.7	22.30	0.113	Rear	50	25	1.0 cm	0.554	1.096	0.607	-
1 732.5	20175		23.7	23.47	-0.084	Front	1	0	1.0 cm	0.709	1.054	**0.748**	17
1 732.5	20175		22.7	22.30	-0.068	Front	50	25	1.0 cm	0.540	1.096	0.592	-
1 732.5	20175		23.7	23.47	-0.004	Left	1	0	1.0 cm	0.137	1.054	0.144	-
1 732.5	20175		22.7	22.30	-0.027	Left	50	25	1.0 cm	0.111	1.096	0.122	-
1 732.5	20175		23.7	23.47	0.004	Right	1	0	1.0 cm	0.240	1.054	0.253	-
1 732.5	20175		22.7	22.30	0.134	Right	50	25	1.0 cm	0.199	1.096	0.218	-
1 732.5	20175		23.7	23.47	0.058	Bottom	1	0	1.0 cm	0.346	1.054	0.365	-
1 732.5	20175		22.7	22.30	-0.008	Bottom	50	25	1.0 cm	0.246	1.096	0.270	-
ANSI/ IEEE C95.1 1992 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Body 1.6 W/kg (mW/g) Averaged over 1 gram						

13.2-7 Measurement Results (LTE Band 7 20MHz Hotspot SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Configuration	RB Size	RB Offset	Separation Distance	Measured SAR (mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power									
2 535	21100	QPSK	22.4	22.23	-0.174	Rear	1	0	1.0 cm	0.673	1.040	0.700	18
2 510	20850		21.4	21.18	-0.141	Rear	50	49	1.0 cm	0.571	1.052	0.601	-
2 535	21100		22.4	22.23	0.160	Front	1	0	1.0 cm	0.424	1.040	0.441	-
2 510	20850		21.4	21.18	0.103	Front	50	49	1.0 cm	0.331	1.052	0.348	-
2 535	21100		22.4	22.23	0.114	Left	1	0	1.0 cm	0.058	1.040	0.060	-
2 510	20850		21.4	21.18	-0.171	Left	50	49	1.0 cm	0.042	1.052	0.044	-
2 535	21100		22.4	22.23	0.013	Right	1	0	1.0 cm	0.114	1.040	0.119	-
2 510	20850		21.4	21.18	0.117	Right	50	49	1.0 cm	0.083	1.052	0.087	-
2 510	20850		22.4	22.07	0.009	Bottom	1	0	1.0 cm	0.634	1.079	0.684	-
2 535	21100		22.4	22.23	-0.019	Bottom	1	0	1.0 cm	0.801	1.040	**0.833**	19
2 560	21350		22.4	22.17	-0.023	Bottom	1	0	1.0 cm	0.765	1.054	0.807	-
2 510	20850		21.4	21.18	-0.017	Bottom	50	49	1.0 cm	0.559	1.052	0.588	-
2 535	21100		21.4	21.07	0.069	Bottom	100	0	1.0 cm	0.617	1.079	0.666	-
ANSI/ IEEE C95.1 1992 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Body 1.6 W/kg (mW/g) Averaged over 1 gram						

13.2-8 Measurement Results (LTE Band 17 10MHz Hotspot SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Configuration	RB Size	RB Offset	Separation Distance	Measured SAR (mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power									
710	23790	QPSK	24.2	24.03	-0.002	Rear	1	49	1.0 cm	0.460	1.040	**0.478**	20
710	23790		23.2	22.86	0.017	Rear	25	24	1.0 cm	0.359	1.081	0.388	-
710	23790		24.2	24.03	-0.004	Front	1	49	1.0 cm	0.323	1.040	0.336	-
710	23790		23.2	22.86	-0.060	Front	25	24	1.0 cm	0.233	1.081	0.252	-
710	23790		24.2	24.03	0.019	Left	1	49	1.0 cm	0.278	1.040	0.289	-
710	23790		23.2	22.86	-0.028	Left	25	24	1.0 cm	0.200	1.081	0.216	-
710	23790		24.2	24.03	-0.017	Right	1	49	1.0 cm	0.118	1.040	0.123	-
710	23790		23.2	22.86	-0.043	Right	25	24	1.0 cm	0.078	1.081	0.084	-
710	23790		24.2	24.03	0.000	Bottom	1	49	1.0 cm	0.134	1.040	0.139	-
710	23790		23.2	22.86	0.121	Bottom	25	24	1.0 cm	0.102	1.081	0.110	-
ANSI/ IEEE C95.1 1992 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Body 1.6 W/kg (mW/g) Averaged over 1 gram						

13. 2-9 Measurement Results (WLAN Hotspot SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Configuration	Data Rate	Separation Distance	Measured SAR (mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power								
2412	1	802.11b	18	16.48	0.075	Rear	1Mbps	1.0 cm	0.102	1.419	0.145	21
			18	16.48	-0.001	Front	1Mbps	1.0 cm	0.078	1.419	0.111	-
			18	16.48	0.085	Left	1Mbps	1.0 cm	0.072	1.419	0.102	-
			18	16.48	-0.134	Top	1Mbps	1.0 cm	0.124	1.419	**0.176**	22
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Body 1.6 W/kg (mW/g) Averaged over 1 gram					

13.3-1 Measurement Results (WLAN Body-worn SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Configuration	Data Rate	Separation Distance	Measured SAR (mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power								
2412	1	802.11b	18	16.48	0.075	Rear	1Mbps	1.0 cm	0.102	1.419	0.145	21
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							Body 1.6 W/kg (mW/g) Averaged over 1 gram					

13.3-2 Measurement Results (Body-worn SAR)

Frequency		Mode	Power (dBm)		Power Drift (dB)	Configuration	Separation Distance	Measured SAR (mW/g)	Scaling Factor	Scaled SAR (mW/g)	Plot No.
MHz	Ch.		Tune-Up Limit	Conducted Power							
836.6	190	GSM850	33.2	32.70	0.170	Rear	1.0 cm	0.438	1.122	0.491	23
836.6	190	GPRS 2Tx	31.2	31.19	-0.173	Rear	1.0 cm	0.605	1.002	**0.606**	10
1 880.0	661	GSM1900	30.2	30.09	-0.106	Rear	1.0 cm	0.326	1.026	0.334	24
1 880.0	661	GPRS 4Tx	25.2	25.11	-0.183	Rear	1.0 cm	0.439	1.021	**0.448**	11
836.6	4183	WCDMA850	23.2	23.08	-0.014	Rear	1.0 cm	0.523	1.028	0.538	12
1 880.0	9400	WCDMA1900	23.2	23.05	-0.040	Rear	1.0 cm	0.603	1.035	0.624	13
1 860	18700	LTE Band 2	23.7	23.63	0.045	Rear	1.0 cm	0.703	1.016	0.714	15
1 732.5	20175	LTE Band 4	23.7	23.47	0.029	Rear	1.0 cm	0.699	1.054	0.737	16
2 535	21100	LTE Band 7	22.4	22.23	-0.174	Rear	1.0 cm	0.673	1.040	0.700	18
710	23790	LTE Band 17	24.2	24.03	-0.002	Rear	1.0 cm	0.460	1.040	0.478	20
ANSI/ IEEE C95.1 - 1992– Safety Limit Spatial Peak Uncontrolled Exposure/ General Population								Body 1.6 W/kg (mW/g) Averaged over 1 gram			

13.4 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, FCC KDB Procedure.
2. Batteries are fully charged at the beginning of the SAR measurements. A standard battery was used for all SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB 447498 D01v05r02.
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
7. Per FCC KDB 648474 D04v01r02, SAR was evaluated without a headset connected to the device. Since the standalone reported SAR was $\leq$ 1.2 W/kg, no additional SAR evaluation using a headset cable were required.
8. Per FCC KDB 865664 D01v01r03, variability SAR tests were performed .Please see Section 14 for variability analysis information.

GSM/GPRS Test Notes:

1. This device supports GSM VOIP in the head and the body-worn configurations therefore GPRS was additionally evaluated for head and body-worn compliance.
2. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
3. Justification for reduced test configurations per KDB 941225 D03v01: The source-based time-averaged output power was evaluated for all multi-slot operations. The multi-slot configuration with the highest frame averaged output power was evaluated for SAR.
4. Per FCC KDB 447498 D01v05r02, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is $\leq$ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is 1/2 dB, instead of the middle channel, the highest output power channel must be used.
5. Justification for reduced test configurations per KDB Publication 941225 D03v01 and October 2013 TCB Workshop Notes: The source-based frame-averaged output power was evaluated for all GPRS/EDGE slot configurations. The configuration with the highest target frame averaged output power was evaluated for hotspot SAR. When the maximum frame-averaged powers are equivalent across two or more slots (within 0.25 dB), the configuration with the most number of time slots was tested.

UMTS Notes:

1. UMTS mode in Body SAR was tested under RMC 12.2 kbps with HSPA inactive per KDB 941225 D01v02. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.
2. Per FCC KDB 447498 D01v05r02, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is $\leq$ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the channel highest output power channel was used.
3. Measured maximum output powers for DC-HSDPA were not greater than 1/4 dB higher than the WCDMA 12.2 kbps RMC maximum output and as a result, SAR is not required for DC-HSDPA and SAR was less than 1.2 W/kg.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Consideration for LTE Devices in FCC KDB 941225 D05v02r03.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to target MPR is indicated alongside the SAR results.
3. A-MPR was diabled for all SAR tests by setting NS=01 on the base station simulator.
4. Pre-installed VOIP applications are considered.

WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB 248227 D01v01r02 and Oct. 2012 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11b. Other IEEE 802.11 modes (including 802.11 g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
2. Since the maximum extrapolated peak SAR of the zoom scan for the maximum output channel was ≤ 1.6 W/kg and the reported 1g averaged SAR was < 0.8 W/kg, SAR testing on other default channels was not required.

14. SAR Measurement Variability and Uncertainty

In accordance with published RF Exposure KDB procedure 865664 D01v01r03 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

Frequency		Modulation	Battery	Configuration	Conducted Power(dBm)	Original SAR(mW/g)	Repeated SAR(mW/g)	Largest to Smallest SAR Ratio	Plot No.
MHz	Channel								
2 535	21100	LTE 7	Standard	Bottom	22.23	0.801	0.789	1.02	25

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

15. SAR Summation Scenario

	Position	Applicable Combination	Note
Simultaneous Transmission	Head	GSM 850 Voice + 2.4 GHz WiFi	
		GPRS VoIP 850 + 2.4 GHz WiFi	
		GSM 1900 Voice + 2.4 GHz WiFi	
		GPRS VoIP 1900+ 2.4 GHz WiFi	
		WCDMA850 + 2.4 GHz WiFi	
		WCDMA1900 + 2.4 GHz WiFi	
		LTE Band 2 Data + 2.4 GHz WiFi	*3rd Party applications are considered.
		LTE Band 4 Data + 2.4 GHz WiFi	
		LTE Band 7 Data + 2.4 GHz WiFi	
		LTE Band 17 Data + 2.4 GHz WiFi	
	Hotspot	GPRS 850 Data + 2.4 GHz WiFi	
		GPRS 1900 Data + 2.4 GHz WiFi	
		WCDMA850 + 2.4 GHz WiFi	
		WCDMA1900 + 2.4 GHz WiFi	
		LTE Band 2 Data + 2.4 GHz WiFi	
		LTE Band 4 Data + 2.4 GHz WiFi	
		LTE Band 7 Data + 2.4 GHz WiFi	
		LTE Band 17 Data + 2.4 GHz WiFi	
	Body-worn	GSM 850 Voice + 2.4 GHz WiFi	
		GPRS VoIP 850 + 2.4 GHz WiFi	
		GSM 1900 Voice + 2.4 GHz WiFi	
		GPRS VoIP 1900+ 2.4 GHz WiFi	
		WCDMA850 + 2.4 GHz WiFi	
		WCDMA1900 + 2.4 GHz WiFi	
		LTE Band 2 Data + 2.4 GHz WiFi	
		LTE Band 4 Data + 2.4 GHz WiFi	
		LTE Band 7 Data + 2.4 GHz WiFi	
		LTE Band 17 Data + 2.4 GHz WiFi	
		GSM 850 Voice + 2.4 GHz Bluetooth	
		GPRS VoIP 850 + 2.4 GHz Bluetooth	
		GSM 1900 Voice + 2.4 GHz Bluetooth	
		GPRS VoIP 1900 + 2.4 GHz Bluetooth	
		WCDMA850 + 2.4 GHz Bluetooth	
		WCDMA1900 +2.4 GHz Bluetooth	
		LTE Band 2 Data +2.4 GHz Bluetooth	
		LTE Band 4 Data +2.4 GHz Bluetooth	
		LTE Band 7 Data + 2.4 GHz Bluetooth	
		LTE Band 17 Data + 2.4 GHz Bluetooth	

* BT and WLAN are not simultaneous transmission.

15.1 Simultaneous Transmission Summation for Head

Simultaneous Transmission Summation with 2.4 GHz WIFI

Band	configuration	Scaled SAR (W/kg)	2.4 GHz WIFI Scaled SAR (W/kg)	∑ 1-g SAR (W/kg)
GSM 850	Left Cheek	0.374	0.390	0.764
	Left Tilt	0.190	0.268	0.458
	Right Cheek	0.276	0.823	1.099
	Right Tilt	0.166	0.438	0.604
GPRS 850	Left Cheek	0.458	0.390	0.848
	Left Tilt	0.208	0.268	0.476
	Right Cheek	0.320	0.823	1.143
	Right Tilt	0.185	0.438	0.623
GSM 1900	Left Cheek	0.293	0.390	0.683
	Left Tilt	0.167	0.268	0.435
	Right Cheek	0.292	0.823	1.115
	Right Tilt	0.242	0.438	0.680
GPRS 1900	Left Cheek	0.418	0.390	0.808
	Left Tilt	0.252	0.268	0.520
	Right Cheek	0.458	0.823	1.281
	Right Tilt	0.349	0.438	0.787
WCDMA 850	Left Cheek	0.373	0.390	0.763
	Left Tilt	0.186	0.268	0.454
	Right Cheek	0.289	0.823	1.112
	Right Tilt	0.196	0.438	0.634
WCDMA 1900	Left Cheek	0.540	0.390	0.930
	Left Tilt	0.319	0.268	0.587
	Right Cheek	0.585	0.823	1.408
	Right Tilt	0.448	0.438	0.886
LTE Band 2	Left Cheek	0.492	0.390	0.882
	Left Tilt	0.343	0.268	0.611
	Right Cheek	0.595	0.823	**1.418**
	Right Tilt	0.454	0.438	0.892
LTE Band 4	Left Cheek	0.402	0.390	0.792
	Left Tilt	0.361	0.268	0.629
	Right Cheek	0.583	0.823	1.406
	Right Tilt	0.439	0.438	0.877
LTE Band 7	Left Cheek	0.132	0.390	0.522
	Left Tilt	0.051	0.268	0.319
	Right Cheek	0.146	0.823	0.969
	Right Tilt	0.036	0.438	0.474
LTE Band 17	Left Cheek	0.303	0.390	0.693
	Left Tilt	0.137	0.268	0.405
	Right Cheek	0.192	0.823	1.015
	Right Tilt	0.128	0.438	0.566

15.2 Simultaneous Transmission Summation for Body-Worn

Simultaneous Transmission Summation with Wifi (1 cm)

Band	configuration	Scaled SAR(W/kg)	2.4 GHz WIFI Scaled SAR (W/kg)	∑ 1-g SAR (W/kg)
GSM 850	Rear	0.491	0.145	0.636
GPRS 850	Rear	0.606	0.145	0.751
GSM 1900	Rear	0.334	0.145	0.479
GPRS 1900	Rear	0.448	0.145	0.593
WCDMA850	Rear	0.538	0.145	0.683
WCDMA1900	Rear	0.624	0.145	0.769
LTE Band 2	Rear	0.714	0.145	0.859
LTE Band 4	Rear	0.737	0.145	0.882
LTE Band 7	Rear	0.700	0.145	0.845
LTE Band 17	Rear	0.478	0.145	0.623

Simultaneous Transmission Summation with Bluetooth (1 cm)

Band	configuration	Scaled SAR(W/kg)	BT SAR (W/kg)	∑ 1-g SAR (W/kg)
GSM 850	Rear	0.491	0.17	0.661
GPRS 850	Rear	0.606	0.17	0.776
GSM 1900	Rear	0.334	0.17	0.504
GPRS 1900	Rear	0.448	0.17	0.618
WCDMA850	Rear	0.538	0.17	0.708
WCDMA1900	Rear	0.624	0.17	0.794
LTE Band 2	Rear	0.714	0.17	0.884
LTE Band 4	Rear	0.737	0.17	**0.907**
LTE Band 7	Rear	0.700	0.17	0.870
LTE Band 17	Rear	0.478	0.17	0.648

15.3 Simultaneous Transmission Summation for Hotspot

Simultaneous Transmission Summation with 2.4 GHz WIFI (1 cm)

Band	configuration	Scaled SAR (W/kg)	2.4 GHz WIFI Scaled SAR (W/kg)	∑ 1-g SAR (W/kg)
GSM 850	Rear	0.606	0.145	0.751
	Front	0.493	0.111	0.604
	Left	0.521	0.102	0.623
	Right	0.543		0.543
	Bottom	0.247		0.247
	Top		0.176	0.176
GSM 1900	Rear	0.448	0.145	0.593
	Front	0.424	0.111	0.535
	Left	0.148	0.102	0.250
	Right	0.159		0.159
	Bottom	0.285		0.285
	Top		0.176	0.176
WCDMA 850	Rear	0.538	0.145	0.683
	Front	0.396	0.111	0.507
	Left	0.303	0.102	0.405
	Right	0.273		0.273
	Bottom	0.187		0.187
	Top		0.176	0.176
WCDMA 1900	Rear	0.624	0.145	0.769
	Front	0.627	0.111	0.738
	Left	0.196	0.102	0.298
	Right	0.208		0.208
	Bottom	0.413		0.413
	Top		0.176	0.176
LTE Band 2	Rear	0.714	0.145	0.859
	Front	0.687	0.111	0.798
	Left	0.182	0.102	0.284
	Right	0.180		0.180
	Bottom	0.331		0.331
	Top		0.176	0.176
LTE Band 4	Rear	0.737	0.145	**0.882**
	Front	0.748	0.111	0.859
	Left	0.144	0.102	0.246
	Right	0.253		0.253
	Bottom	0.365		0.365
	Top		0.176	0.176
LTE Band 7	Rear	0.700	0.145	0.845
	Front	0.441	0.111	0.552
	Left	0.060	0.102	0.162
	Right	0.119		0.119
	Bottom	0.833		0.833
	Top		0.176	0.176
LTE Band 17	Rear	0.478	0.145	0.623
	Front	0.336	0.111	0.447
	Left	0.289	0.102	0.391
	Right	0.123		0.123
	Bottom	0.139		0.139
	Top		0.176	0.176

15.4 Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit. And therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v05r02.

16. CONCLUSION

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

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

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Attachment 1. – SAR Test Plots

Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature: 21.8 ℃
Ambient Temperature: 22.0 ℃
Test Date: Aug. 18, 2014
Plot No. 1

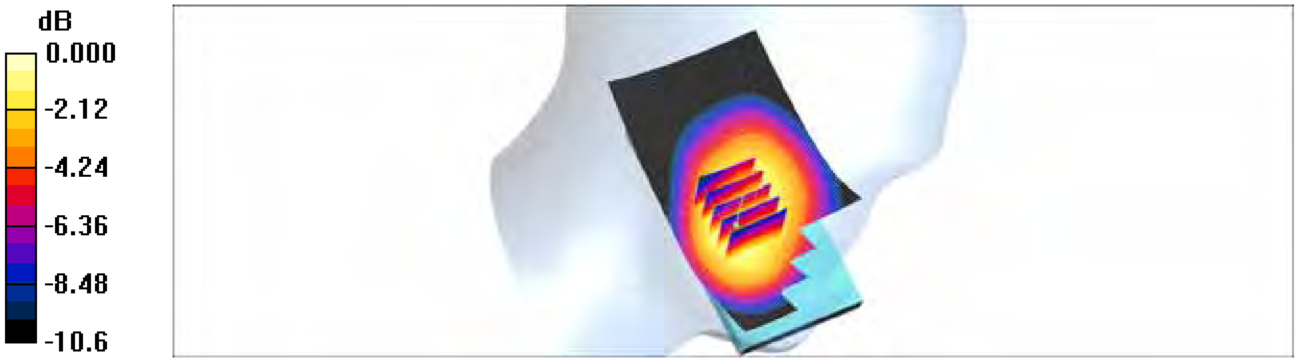
DUT: LG-D390; Type: bar;

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:4.15
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.904 mho/m; ε_r = 42.6; ρ = 1000 kg/m^3
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.67, 6.67, 6.67); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: 835/900 Phantom; Type: SAM

GSM850 Left Touch 190ch GPRS 2Tx/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.494 mW/g

GSM850 Left Touch 190ch GPRS 2Tx/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.48 V/m; Power Drift = 0.068 dB
Peak SAR (extrapolated) = 0.659 W/kg
SAR(1 g) = 0.457 mW/g; SAR(10 g) = 0.332 mW/g
Maximum value of SAR (measured) = 0.483 mW/g



0 dB = 0.483mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	21.8 ℃
Ambient Temperature:	22.0 ℃
Test Date:	Aug. 20, 2014
Plot No.	2

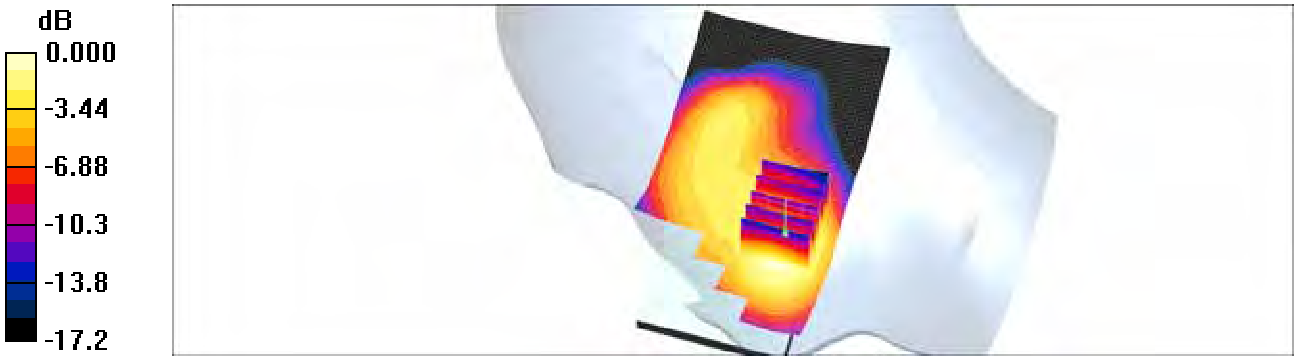
DUT: LG-D390; Type: bar;

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:2.075
Medium parameters used: f = 1880 MHz; σ = 1.36 mho/m; ε_r = 39.1; ρ = 1000 kg/m^3
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: EX3DV4 - SN3863; ConvF(8.02, 8.02, 8.02); Calibrated: 2014-07-24
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2014-02-27
- Phantom: 1800/1900; Type: SAM

GSM1900 Right Touch 661ch GPRS 4Tx/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.472 mW/g

GSM1900 Right Touch 661ch GPRS 4Tx/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.18 V/m; Power Drift = 0.173 dB
Peak SAR (extrapolated) = 0.874 W/kg
SAR(1 g) = 0.449 mW/g; SAR(10 g) = 0.278 mW/g
Maximum value of SAR (measured) = 0.482 mW/g



0 dB = 0.482mW/g

Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature: 21.8 ℃
Ambient Temperature: 22.0 ℃
Test Date: Aug. 18, 2014
Plot No. 3

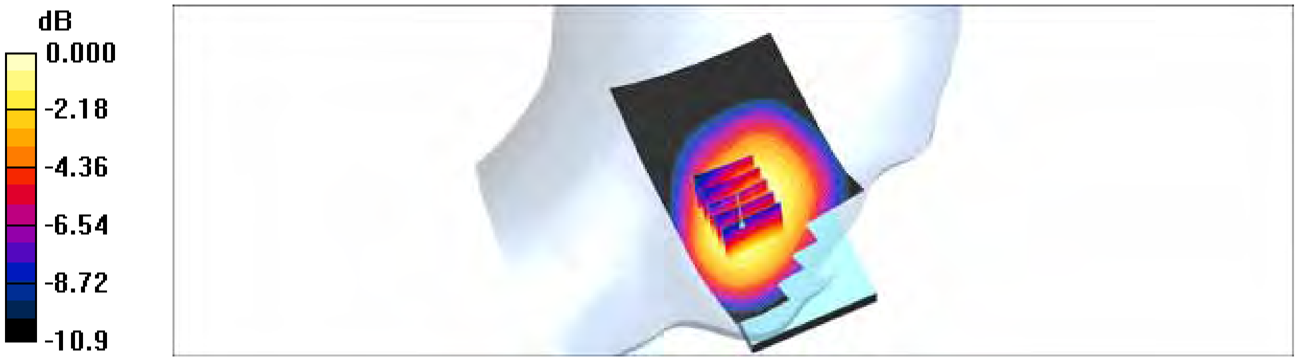
DUT: LG-D390; Type: bar;

Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.904 mho/m; ε_r = 42.6; ρ = 1000 kg/m^3
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.67, 6.67, 6.67); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: 835/900 Phantom; Type: SAM

WCDMA850 Left Touch 4183ch/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.392 mW/g

WCDMA850 Left Touch 4183ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.44 V/m; Power Drift = -0.130 dB
Peak SAR (extrapolated) = 0.516 W/kg
SAR(1 g) = 0.363 mW/g; SAR(10 g) = 0.267 mW/g
Maximum value of SAR (measured) = 0.390 mW/g



0 dB = 0.390mW/g

Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature: 21.8 ℃
Ambient Temperature: 22.0 ℃
Test Date: Aug. 20, 2014
Plot No. 4

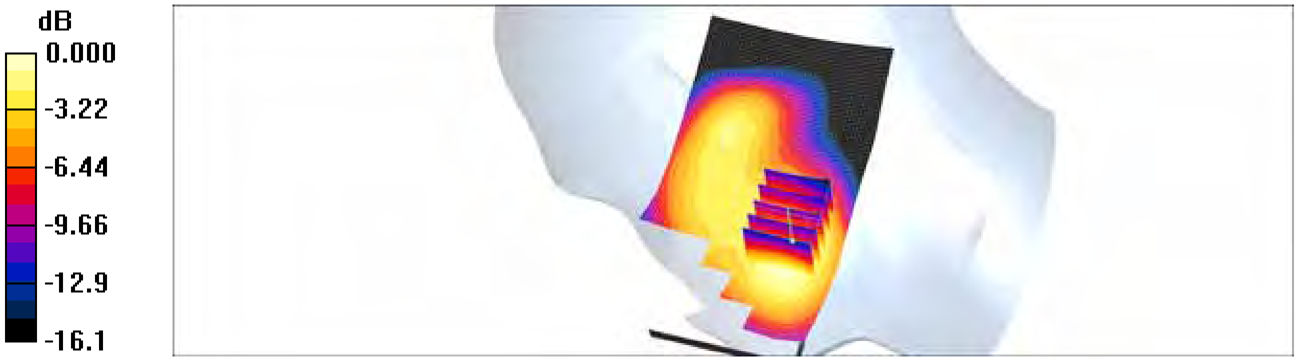
DUT: LG-D390; Type: bar;

Communication System: WCDMA1900; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.36 mho/m; ε_r = 39.1; ρ = 1000 kg/m^3
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: EX3DV4 - SN3863; ConvF(8.02, 8.02, 8.02); Calibrated: 2014-07-24
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2014-02-27
- Phantom: 1800/1900; Type: SAM

WCDMA1900 Right Touch 9400ch/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.581 mW/g

WCDMA1900 Right Touch 9400ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.99 V/m; Power Drift = -0.080 dB
Peak SAR (extrapolated) = 0.888 W/kg
SAR(1 g) = 0.565 mW/g; SAR(10 g) = 0.351 mW/g
Maximum value of SAR (measured) = 0.618 mW/g



0 dB = 0.618mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	21.8 ℃
Ambient Temperature:	22.0 ℃
Test Date:	Aug. 20, 2014
Plot No.	5

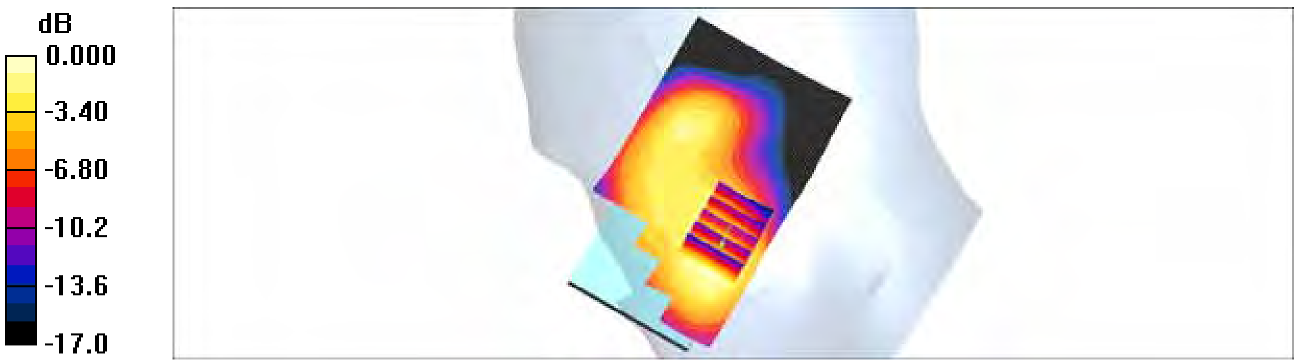
DUT: LG-D390; Type: bar;

Communication System: LTE band 2; Frequency: 1860 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1860 MHz; σ = 1.34 mho/m; ε_r = 39.1; ρ = 1000 kg/m^3
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: EX3DV4 - SN3863; ConvF(8.02, 8.02, 8.02); Calibrated: 2014-07-24
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2014-02-27
- Phantom: 1800/1900; Type: SAM

LTE2 Right Touch QPSK 20MHz 1RB 18700ch/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.614 mW/g

LTE2 Right Touch QPSK 20MHz 1RB 18700ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.04 V/m; Power Drift = 0.109 dB
Peak SAR (extrapolated) = 0.906 W/kg
SAR(1 g) = 0.585 mW/g; SAR(10 g) = 0.365 mW/g
Maximum value of SAR (measured) = 0.645 mW/g



0 dB = 0.645mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	21.1 ℃
Ambient Temperature:	21.3 ℃
Test Date:	Aug. 19, 2014
Plot No.	6

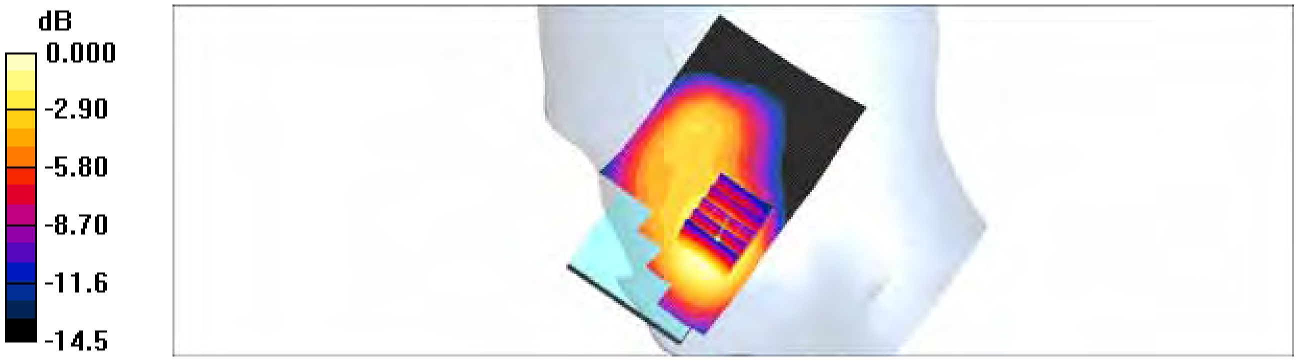
DUT: LG-D390; Type: bar;

Communication System: LTE Band 4; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1732.5 MHz; σ = 1.32 mho/m; ε_r = 40.1; ρ = 1000 kg/m^3
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: EX3DV4 - SN3863; ConvF(8.38, 8.38, 8.38); Calibrated: 2014-07-24
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2014-02-27
- Phantom: 1800/1900; Type: SAM

LTE4 Right Touch QPSK 20MHz 1RB 0offset 20175ch/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.582 mW/g

LTE4 Right Touch QPSK 20MHz 1RB 0offset 20175ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.90 V/m; Power Drift = -0.191 dB
Peak SAR (extrapolated) = 0.825 W/kg
SAR(1 g) = 0.553 mW/g; SAR(10 g) = 0.357 mW/g
Maximum value of SAR (measured) = 0.598 mW/g



0 dB = 0.598mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	19.6 ℃
Ambient Temperature:	19.8 ℃
Test Date:	Aug. 26, 2014
Plot No.	7

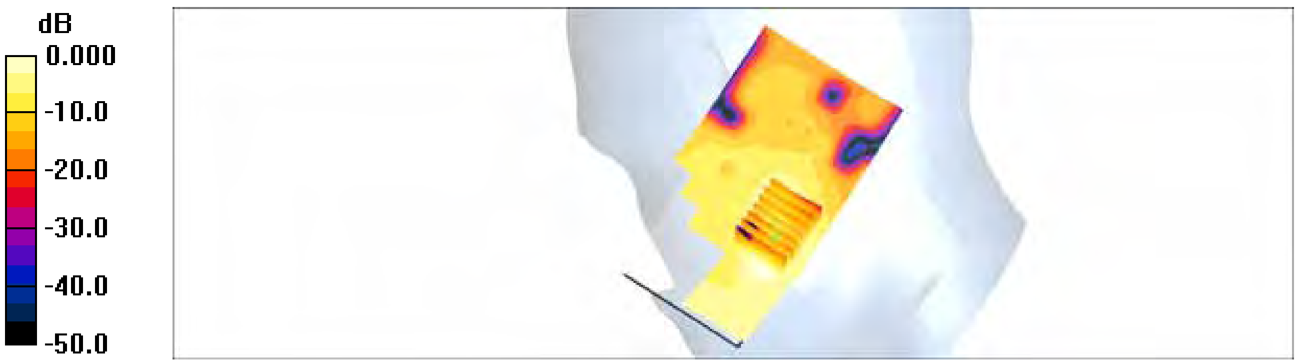
DUT: LG-D390; Type: bar;

Communication System: LTE Band 7; Frequency: 2535 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2535 MHz; σ = 1.95 mho/m; ε_r = 39.3; ρ = 1000 kg/m^3
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: EX3DV4 - SN3863; ConvF(7.05, 7.05, 7.05); Calibrated: 2014-07-24
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1417; Calibrated: 2014-01-03
- Phantom: 835/900 Phantom; Type: SAM

LTE7 Right Touch QPSK 20MHz 1RB 0offset 21100ch/Area Scan (71x121x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.163 mW/g

LTE7 Right Touch QPSK 20MHz 1RB 0offset 21100ch/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.78 V/m; Power Drift = -0.125 dB
Peak SAR (extrapolated) = 0.264 W/kg
SAR(1 g) = 0.140 mW/g; SAR(10 g) = 0.072 mW/g
Maximum value of SAR (measured) = 0.158 mW/g



0 dB = 0.158mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	22.6 ℃
Ambient Temperature:	22.8 ℃
Test Date:	Aug. 21, 2014
Plot No.	8

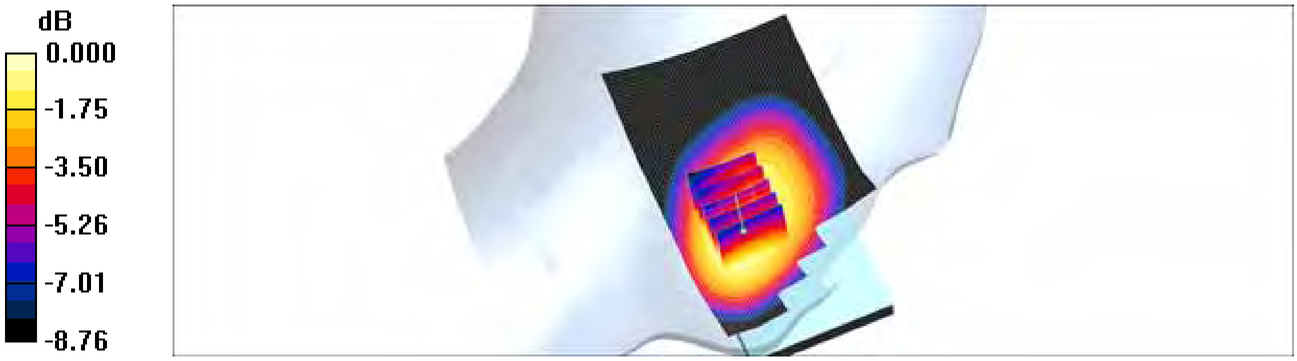
DUT: LG-D390; Type: bar;

Communication System: LTE 17; Frequency: 710 MHz;Duty Cycle: 1:1
Medium parameters used: f = 710 MHz; σ = 0.871 mho/m; ε_r = 43.3; ρ = 1000 kg/m^3
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1605; ConvF(6.88, 6.88, 6.88); Calibrated: 2014-01-31
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2014-02-27
- Phantom: 835/900 Phantom; Type: SAM

LTE17 Left Touch QPSK 10MHz 1RB 49offset 23790ch/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.316 mW/g

LTE17 Left Touch QPSK 10MHz 1RB 49offset 23790ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.99 V/m; Power Drift = -0.034 dB
Peak SAR (extrapolated) = 0.380 W/kg
SAR(1 g) = 0.291 mW/g; SAR(10 g) = 0.222 mW/g
Maximum value of SAR (measured) = 0.308 mW/g



0 dB = 0.308mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	21.2 ℃
Ambient Temperature:	21.4 ℃
Test Date:	Aug. 18, 2014
Plot No.	9

DUT: LG-D390; Type: Bar;

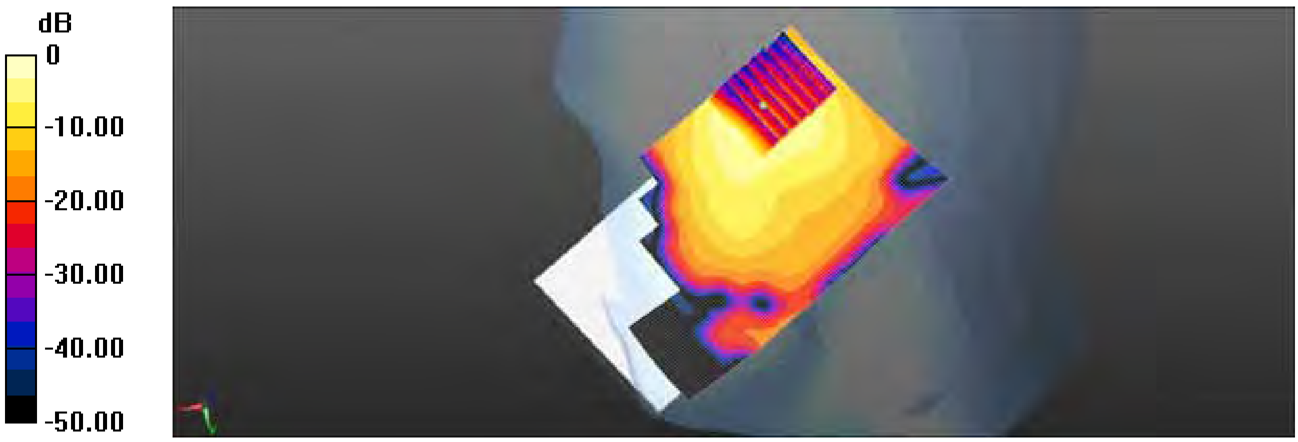
Communication System: UID 0, 2450MHz FCC (0); Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.753 S/m; ε_r = 39.917; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3863; ConvF(7.15, 7.15, 7.15); Calibrated: 2014-07-24;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2014-02-27
- Phantom: SAM_Front_2014_03_03; Type: SAM; Serial: TP-1573
- ; SEMCAD X Version 14.6.10 (7331)

LG-D390/802.11b Right Touch 1ch 1Mbps/Area Scan (71x121x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.959 W/kg

LG-D390/802.11b Right Touch 1ch 1Mbps/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.684 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 1.24 W/kg
SAR(1 g) = 0.580 W/kg; SAR(10 g) = 0.279 W/kg
Maximum value of SAR (measured) = 0.887 W/kg



0 dB = 0.959 W/kg = -0.18 dBW/kg

Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature: 20.2 ℃
Ambient Temperature: 20.4 ℃
Test Date: Aug. 18, 2014
Plot No. 10

DUT: LG-D390; Type: Bar; Serial: #1

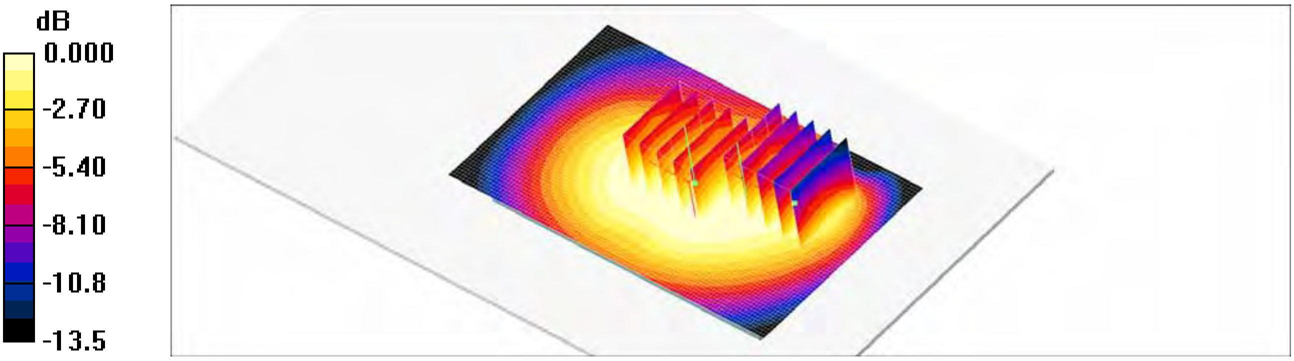
Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:4.15
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.987 mho/m; ε_r = 56.9; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.59, 6.59, 6.59); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

GSM850 Body Rear 190 GPRS 2Tx/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.679 mW/g

GSM850 Body Rear 190 GPRS 2Tx/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.7 V/m; Power Drift = -0.173 dB
Peak SAR (extrapolated) = 0.828 W/kg
SAR(1 g) = 0.605 mW/g; SAR(10 g) = 0.422 mW/g
Maximum value of SAR (measured) = 0.675 mW/g

GSM850 Body Rear 190 GPRS 2Tx/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.7 V/m; Power Drift = -0.173 dB
Peak SAR (extrapolated) = 0.802 W/kg
SAR(1 g) = 0.472 mW/g; SAR(10 g) = 0.329 mW/g
Maximum value of SAR (measured) = 0.502 mW/g



0 dB = 0.502mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	20.6 ℃
Ambient Temperature:	20.8 ℃
Test Date:	Aug. 19, 2014
Plot No.	11

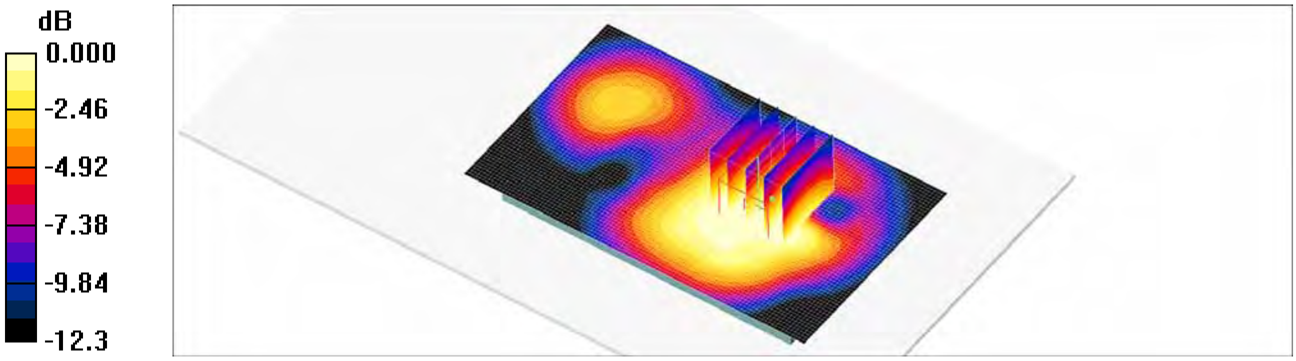
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:2.075
Medium parameters used: f = 1880 MHz; σ = 1.48 mho/m; ε_r = 52.4; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.73, 4.73, 4.73); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

GSM1900 Body Rear 661 GPRS 4Tx/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.502 mW/g

GSM1900 Body Rear 661 GPRS 4Tx/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.07 V/m; Power Drift = -0.183 dB
Peak SAR (extrapolated) = 0.575 W/kg
SAR(1 g) = 0.439 mW/g; SAR(10 g) = 0.311 mW/g
Maximum value of SAR (measured) = 0.462 mW/g



0 dB = 0.462mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	20.2 ℃
Ambient Temperature:	20.4 ℃
Test Date:	Aug. 18, 2014
Plot No.	12

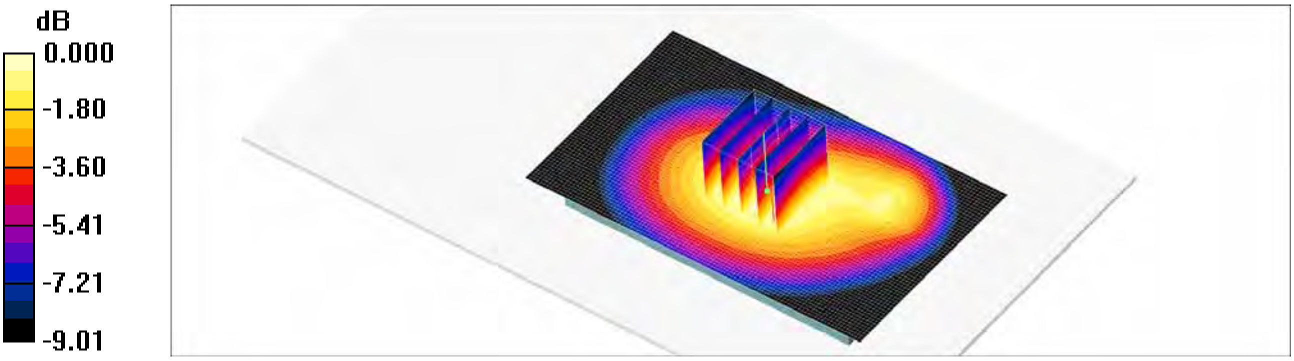
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.987 mho/m; ε_r = 56.9; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.59, 6.59, 6.59); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

WCDMA850 Body Rear 4183/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.549 mW/g

WCDMA850 Body Rear 4183/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.4 V/m; Power Drift = -0.014 dB
Peak SAR (extrapolated) = 0.706 W/kg
SAR(1 g) = 0.523 mW/g; SAR(10 g) = 0.378 mW/g
Maximum value of SAR (measured) = 0.551 mW/g



0 dB = 0.551mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	20.6 ℃
Ambient Temperature:	20.8 ℃
Test Date:	Aug. 19, 2014
Plot No.	13

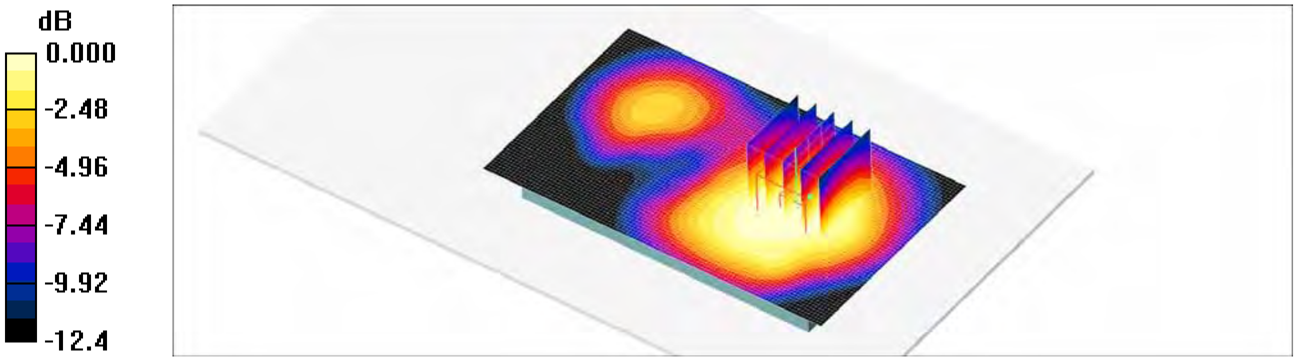
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: WCDMA1900; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.48 mho/m; ε_r = 52.4; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.73, 4.73, 4.73); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

WCDMA1900 Body Rear 9400/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.636 mW/g

WCDMA1900 Body Rear 9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.8 V/m; Power Drift = -0.040 dB
Peak SAR (extrapolated) = 0.803 W/kg
SAR(1 g) = 0.603 mW/g; SAR(10 g) = 0.423 mW/g
Maximum value of SAR (measured) = 0.634 mW/g



0 dB = 0.634mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	20.6 ℃
Ambient Temperature:	20.8 ℃
Test Date:	Aug. 19, 2014
Plot No.	14

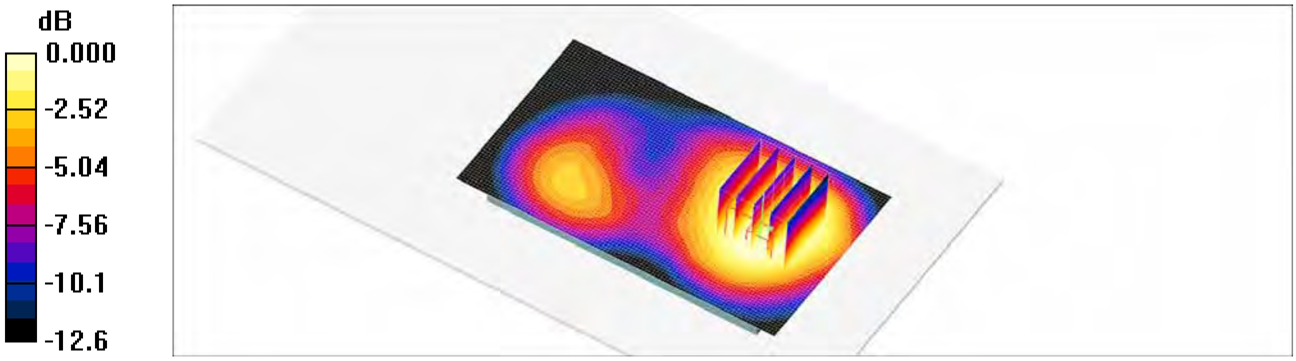
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: WCDMA1900; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.48 mho/m; ε_r = 52.4; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.73, 4.73, 4.73); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

WCDMA1900 Body Front 9400/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.647 mW/g

WCDMA1900 Body Front 9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.1 V/m; Power Drift = -0.032 dB
Peak SAR (extrapolated) = 0.842 W/kg
SAR(1 g) = 0.606 mW/g; SAR(10 g) = 0.422 mW/g
Maximum value of SAR (measured) = 0.643 mW/g



0 dB = 0.643mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	20.6 ℃
Ambient Temperature:	20.8 ℃
Test Date:	Aug. 19, 2014
Plot No.	15

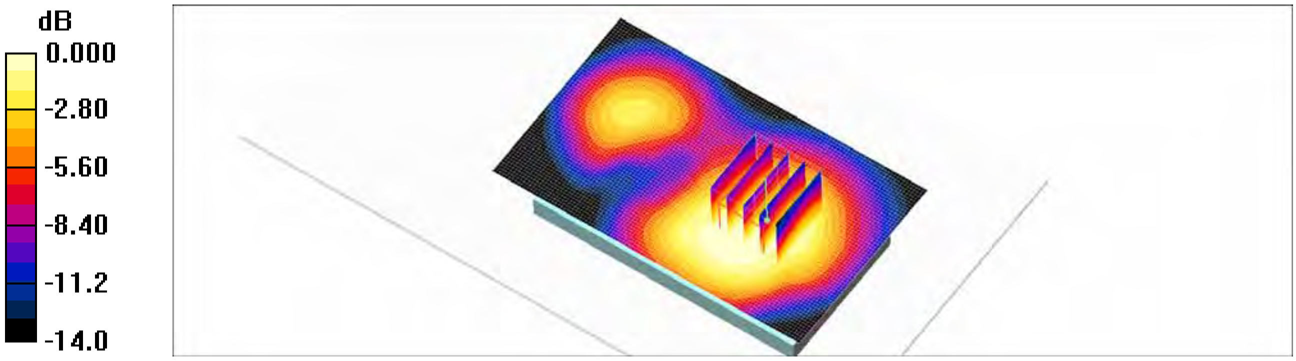
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: LTE Band 2; Frequency: 1860 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1860 MHz; σ = 1.46 mho/m; ε_r = 52.5; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.73, 4.73, 4.73); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

QPSK 20MHz 1RB 0offset Body Rear/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.778 mW/g

QPSK 20MHz 1RB 0offset Body Rear/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.6 V/m; Power Drift = 0.045 dB
Peak SAR (extrapolated) = 0.963 W/kg
SAR(1 g) = 0.703 mW/g; SAR(10 g) = 0.479 mW/g
Maximum value of SAR (measured) = 0.751 mW/g



0 dB = 0.751mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	20.6 ℃
Ambient Temperature:	20.8 ℃
Test Date:	Aug. 19, 2014
Plot No.	16

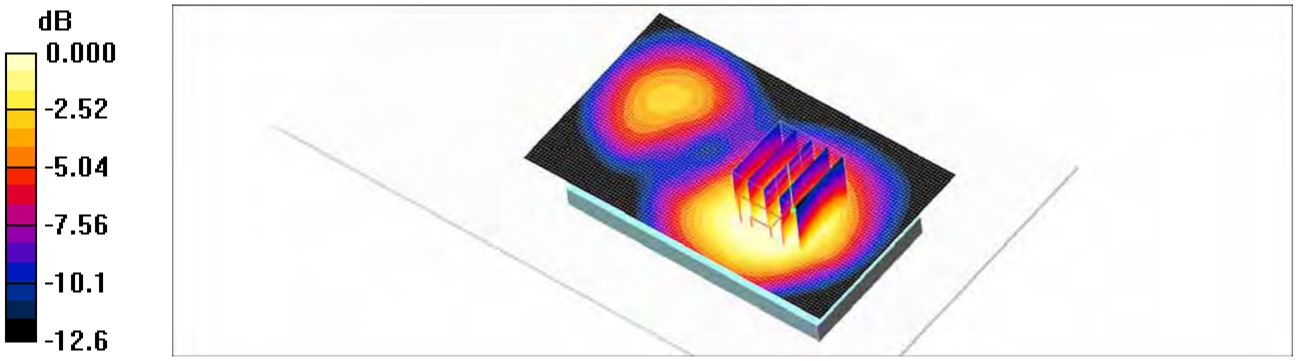
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: LTE Band 4; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1732.5 MHz; σ = 1.46 mho/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.93, 4.93, 4.93); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

QPSK 20MHz 1RB 0offset Body Rear 20175ch/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.763 mW/g

QPSK 20MHz 1RB 0offset Body Rear 20175ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.8 V/m; Power Drift = -0.029 dB
Peak SAR (extrapolated) = 0.924 W/kg
SAR(1 g) = 0.699 mW/g; SAR(10 g) = 0.491 mW/g
Maximum value of SAR (measured) = 0.734 mW/g



0 dB = 0.734mW/g

Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature: 20.6 ℃
Ambient Temperature: 20.8 ℃
Test Date: Aug. 19, 2014
Plot No. 17

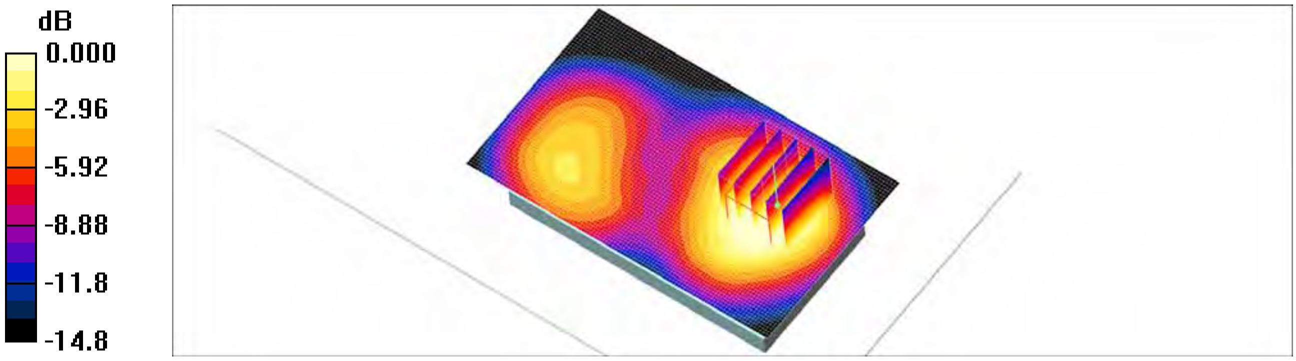
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: LTE Band 4; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1732.5 MHz; σ = 1.46 mho/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.93, 4.93, 4.93); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

QPSK 20MHz 1RB 0offset Body Front 20175ch/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.854 mW/g

QPSK 20MHz 1RB 0offset Body Front 20175ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.5 V/m; Power Drift = -0.084 dB
Peak SAR (extrapolated) = 0.946 W/kg
SAR(1 g) = 0.709 mW/g; SAR(10 g) = 0.492 mW/g
Maximum value of SAR (measured) = 0.756 mW/g



0 dB = 0.756mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	21.7 ℃
Ambient Temperature:	21.9 ℃
Test Date:	Aug. 25, 2014
Plot No.	18

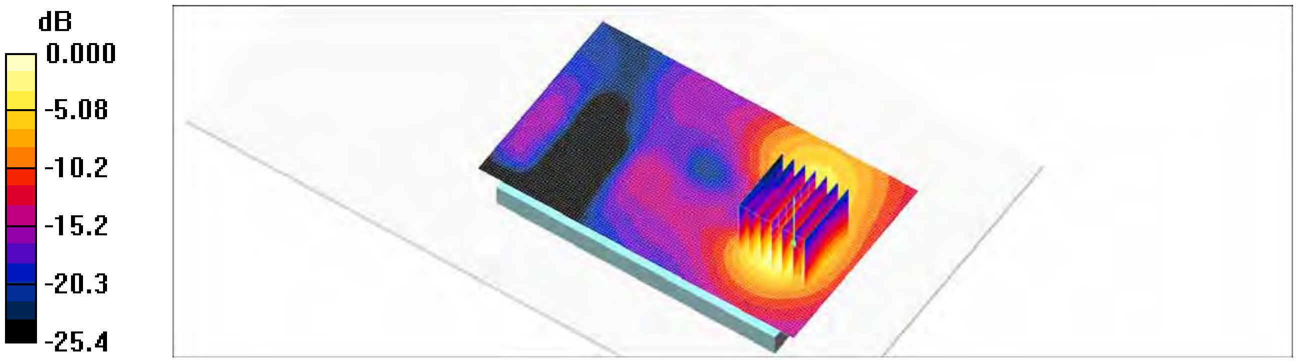
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: LTE Band 7; Frequency: 2535 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2535 MHz; σ = 2.02 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: EX3DV4 - SN3863; ConvF(6.87, 6.87, 6.87); Calibrated: 2014-07-24
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

QPSK 20MHz 1RB 0offset Body Rear/Area Scan (71x121x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.764 mW/g

QPSK 20MHz 1RB 0offset Body Rear/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.42 V/m; Power Drift = -0.174 dB
Peak SAR (extrapolated) = 1.30 W/kg
SAR(1 g) = 0.673 mW/g; SAR(10 g) = 0.305 mW/g
Maximum value of SAR (measured) = 0.769 mW/g



0 dB = 0.769mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	21.7 ℃
Ambient Temperature:	21.9 ℃
Test Date:	Aug. 25, 2014
Plot No.	19

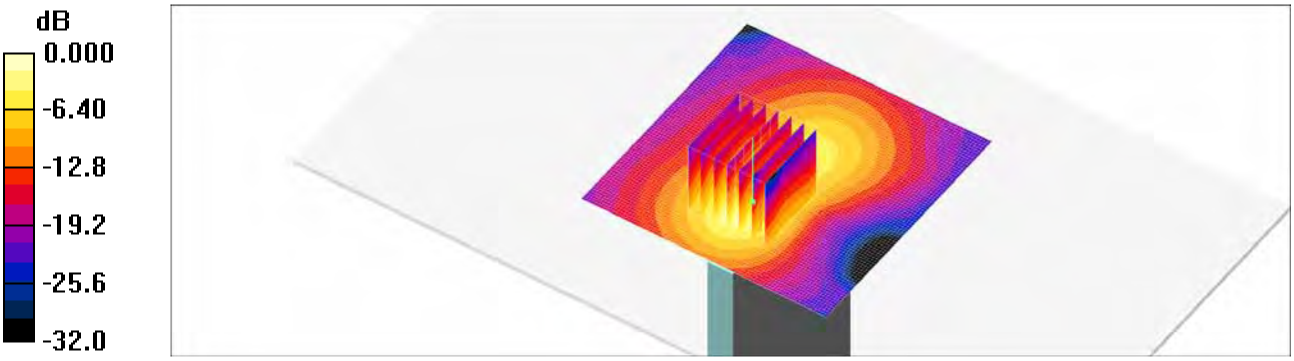
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: LTE Band 7; Frequency: 2535 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2535 MHz; σ = 2.02 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: EX3DV4 - SN3863; ConvF(6.87, 6.87, 6.87); Calibrated: 2014-07-24
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

QPSK 20MHz 1RB 0offset Body Bottom/Area Scan (81x81x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.913 mW/g

QPSK 20MHz 1RB 0offset Body Bottom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.3 V/m; Power Drift = -0.019 dB
Peak SAR (extrapolated) = 1.56 W/kg
SAR(1 g) = 0.801 mW/g; SAR(10 g) = 0.360 mW/g
Maximum value of SAR (measured) = 0.941 mW/g



0 dB = 0.941mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	20.6 ℃
Ambient Temperature:	20.8 ℃
Test Date:	Aug. 20, 2014
Plot No.	20

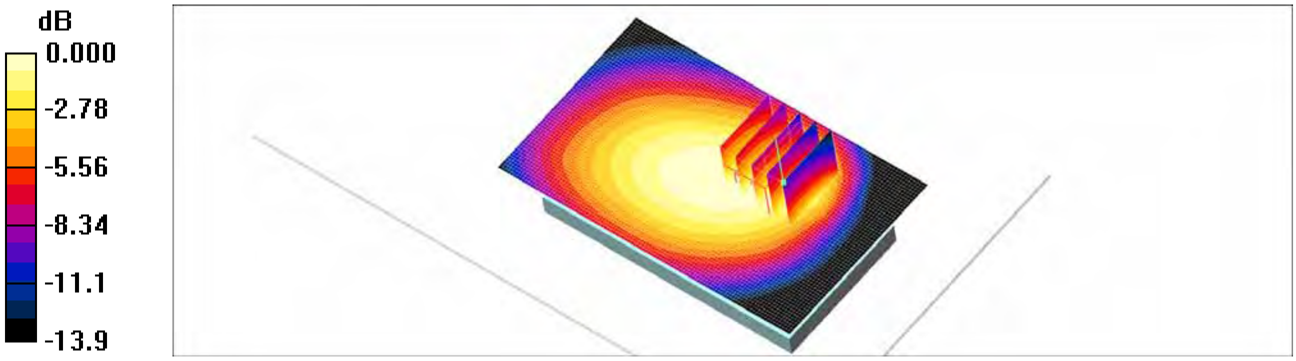
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: LTE Band 17; Frequency: 710 MHz;Duty Cycle: 1:1
Medium parameters used: f = 710 MHz; σ = 0.947 mho/m; ε_r = 55.2; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1605; ConvF(6.45, 6.45, 6.45); Calibrated: 2014-01-31
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

QPSK 10MHz 1RB 49offset Body Rear/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.522 mW/g

QPSK 10MHz 1RB 49offset Body Rear/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.5 V/m; Power Drift = -0.002 dB
Peak SAR (extrapolated) = 0.753 W/kg
SAR(1 g) = 0.460 mW/g; SAR(10 g) = 0.332 mW/g
Maximum value of SAR (measured) = 0.485 mW/g



0 dB = 0.485mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	20.2 ℃
Ambient Temperature:	20.4 ℃
Test Date:	Aug. 18, 2014
Plot No.	21

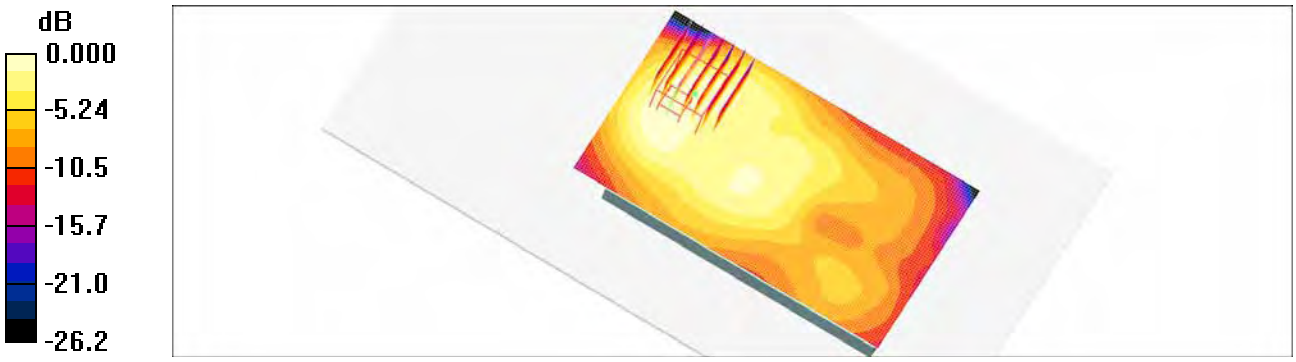
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.88 mho/m; ε_r = 52.5; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.26, 4.26, 4.26); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

WIFI2450 body rear 1ch/Area Scan (71x121x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.109 mW/g

WIFI2450 body rear 1ch/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.29 V/m; Power Drift = 0.075 dB
Peak SAR (extrapolated) = 0.234 W/kg
SAR(1 g) = 0.102 mW/g; SAR(10 g) = 0.054 mW/g
Maximum value of SAR (measured) = 0.107 mW/g



0 dB = 0.107mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	20.2 ℃
Ambient Temperature:	20.4 ℃
Test Date:	Aug. 18, 2014
Plot No.	22

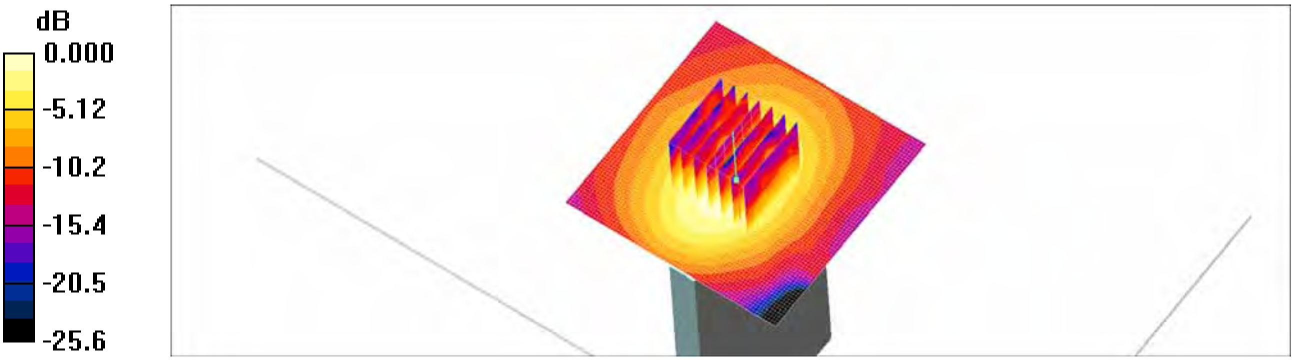
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.88 mho/m; ε_r = 52.5; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.26, 4.26, 4.26); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

WIFI2450 body Top 1ch/Area Scan (71x71x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.130 mW/g

WIFI2450 body Top 1ch/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.03 V/m; Power Drift = -0.134 dB
Peak SAR (extrapolated) = 0.302 W/kg
SAR(1 g) = 0.124 mW/g; SAR(10 g) = 0.062 mW/g
Maximum value of SAR (measured) = 0.133 mW/g



0 dB = 0.133mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	20.2 ℃
Ambient Temperature:	20.4 ℃
Test Date:	Aug. 18, 2014
Plot No.	23

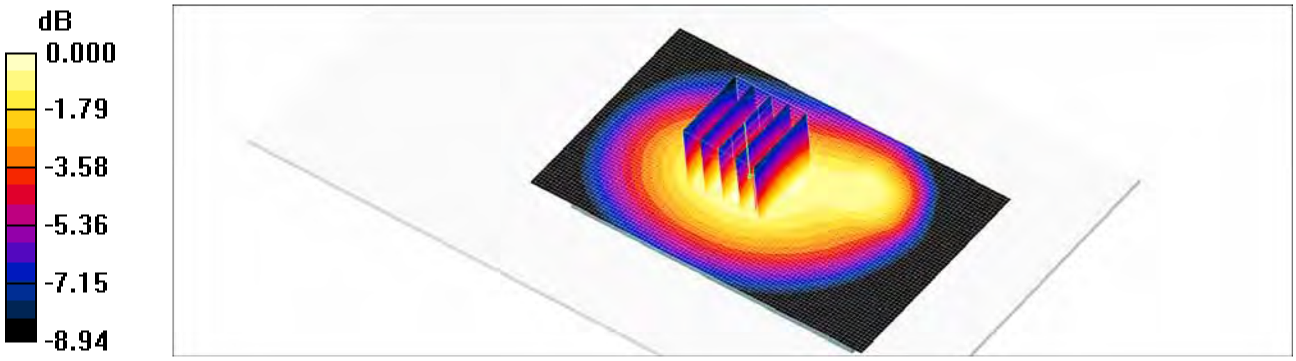
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.987 mho/m; ε_r = 56.9; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.59, 6.59, 6.59); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

GSM850 Body Rear 190 GPRS/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.461 mW/g

GSM850 Body Rear 190 GPRS/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.7 V/m; Power Drift = 0.170 dB
Peak SAR (extrapolated) = 0.579 W/kg
SAR(1 g) = 0.438 mW/g; SAR(10 g) = 0.320 mW/g
Maximum value of SAR (measured) = 0.463 mW/g



0 dB = 0.463mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	20.6 ℃
Ambient Temperature:	20.8 ℃
Test Date:	Aug. 19, 2014
Plot No.	24

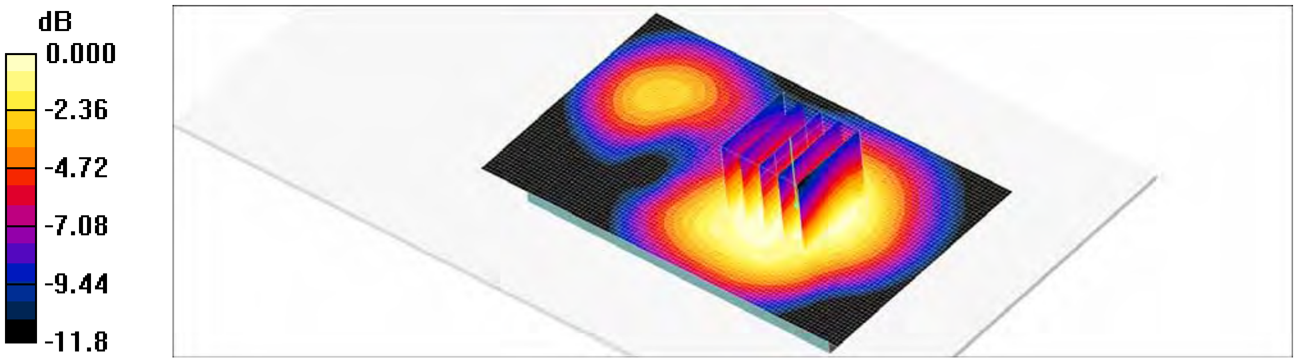
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1880 MHz; σ = 1.48 mho/m; ε_r = 52.4; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.73, 4.73, 4.73); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

GSM1900 Body Rear 661 Body Worn/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.347 mW/g

GSM1900 Body Rear 661 Body Worn/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.06 V/m; Power Drift = -0.106 dB
Peak SAR (extrapolated) = 0.433 W/kg
SAR(1 g) = 0.326 mW/g; SAR(10 g) = 0.230 mW/g
Maximum value of SAR (measured) = 0.342 mW/g



0 dB = 0.342mW/g

Test Laboratory:	HCT CO., LTD
EUT Type:	GSM/WCDMA/LTE phone with Bluetooth/WLAN
Liquid Temperature:	21.7 ℃
Ambient Temperature:	21.9 ℃
Test Date:	Aug. 25, 2014
Plot No.	25

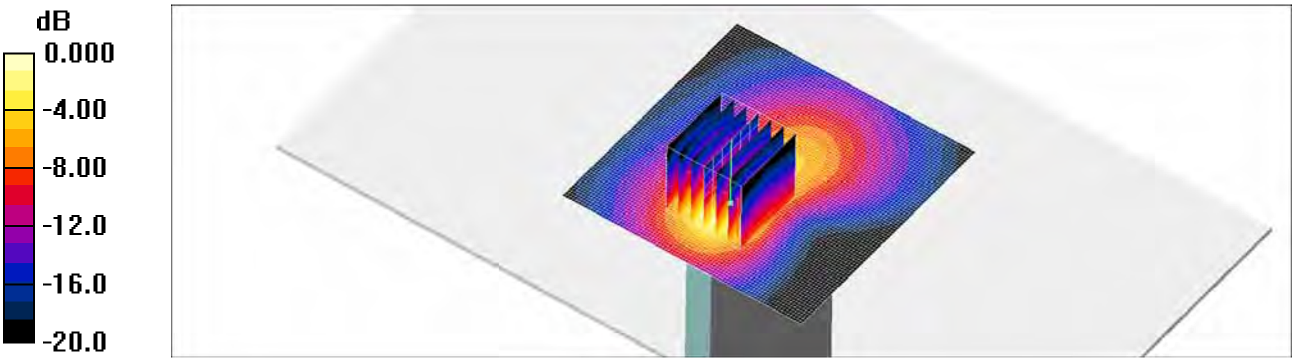
DUT: LG-D390; Type: Bar; Serial: #1

Communication System: LTE Band 7; Frequency: 2535 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2535 MHz; σ = 2.02 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: EX3DV4 - SN3863; ConvF(6.87, 6.87, 6.87); Calibrated: 2014-07-24
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

QPSK 20MHz 1RB 0offset Body Bottom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.8 V/m; Power Drift = 0.050 dB
Peak SAR (extrapolated) = 1.55 W/kg
SAR(1 g) = 0.789 mW/g; SAR(10 g) = 0.358 mW/g
Maximum value of SAR (measured) = 0.927 mW/g

QPSK 20MHz 1RB 0offset Body Bottom/Area Scan (81x81x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.941 mW/g



0 dB = 0.927mW/g

Attachment 2. – Dipole Verification Plots

■ Verification Data (750 MHz Head)

Test Laboratory:	HCT CO., LTD
Input Power	100 mW (20 dBm)
Liquid Temp:	22.6 ℃
Test Date:	Aug. 21, 2014

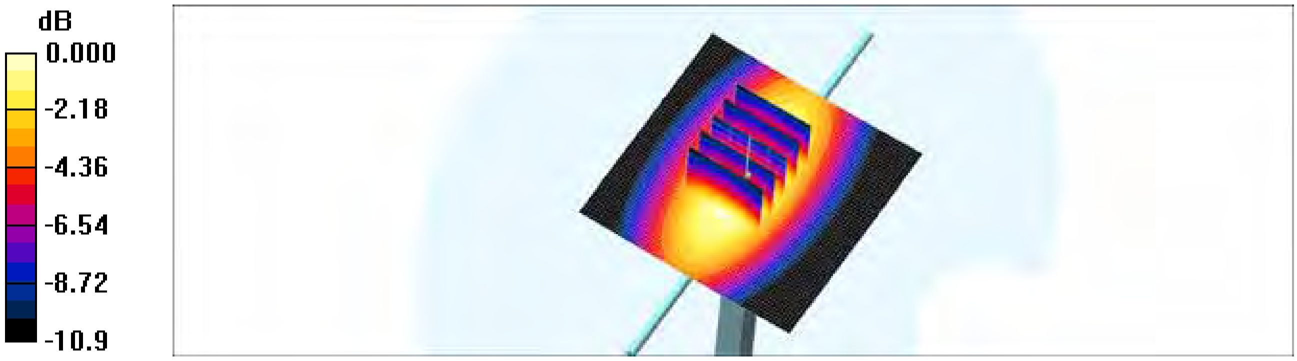
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1014

Communication System: CW; Frequency: 750 MHz;Duty Cycle: 1:1
Medium parameters used: f = 750 MHz; σ = 0.907 mho/m; ε_r = 42.7; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1605; ConvF(6.88, 6.88, 6.88); Calibrated: 2014-01-31
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2014-02-27
- Phantom: SAM 1800/1900 MHz; Type: SAM

Verification 750MHz/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.950 mW/g

Verification 750MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.4 V/m; Power Drift = 0.005 dB
Peak SAR (extrapolated) = 1.26 W/kg
SAR(1 g) = 0.866 mW/g; SAR(10 g) = 0.561 mW/g
Maximum value of SAR (measured) = 0.942 mW/g



0 dB = 0.942mW/g

■ Verification Data (750 MHz Body)

Test Laboratory: HCT CO., LTD
Input Power 100 mW (20 dBm)
Liquid Temp: 20.6 ℃
Test Date: Aug. 20, 2014

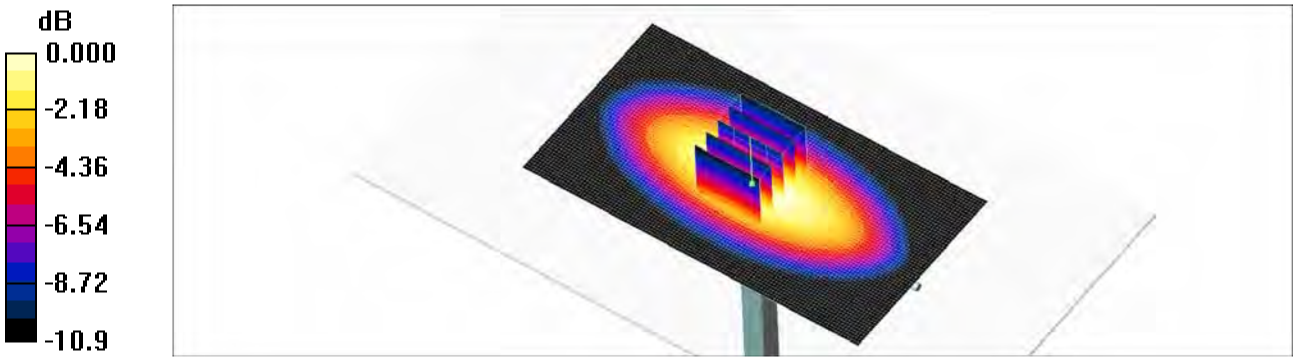
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1014

Communication System: CW; Frequency: 750 MHz;Duty Cycle: 1:1
Medium parameters used: f = 750 MHz; σ = 0.983 mho/m; ε_r = 54.7; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1605; ConvF(6.45, 6.45, 6.45); Calibrated: 2014-01-31
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

Verification 750 MHz/Area Scan (111x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.998 mW/g

Verification 750 MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 32.7 V/m; Power Drift = -0.021 dB
Peak SAR (extrapolated) = 1.36 W/kg
SAR(1 g) = 0.915 mW/g; SAR(10 g) = 0.592 mW/g
Maximum value of SAR (measured) = 0.991 mW/g



0 dB = 0.991mW/g

■ Verification Data (835 MHz Head)

Test Laboratory: HCT CO., LTD
Input Power 100 mW (20 dBm)
Liquid Temp: 21.8 ℃
Test Date: Aug. 18, 2014

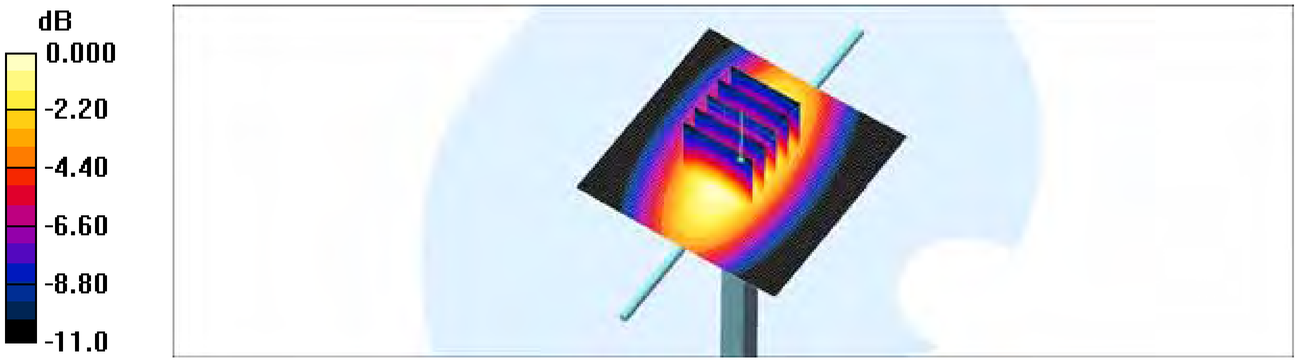
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d165

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.903 mho/m; ε_r = 42.6; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.67, 6.67, 6.67); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: SAM 1800/1900 MHz; Type: SAM

Verification 835MHz/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.04 mW/g

Verification 835MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34.8 V/m; Power Drift = -0.023 dB
Peak SAR (extrapolated) = 1.50 W/kg
SAR(1 g) = 0.957 mW/g; SAR(10 g) = 0.609 mW/g
Maximum value of SAR (measured) = 1.03 mW/g



0 dB = 1.03mW/g

■ Verification Data (835 MHz Body)

Test Laboratory: HCT CO., LTD
Input Power 100 mW (20 dBm)
Liquid Temp: 20.2 ℃
Test Date: Aug. 18, 2014

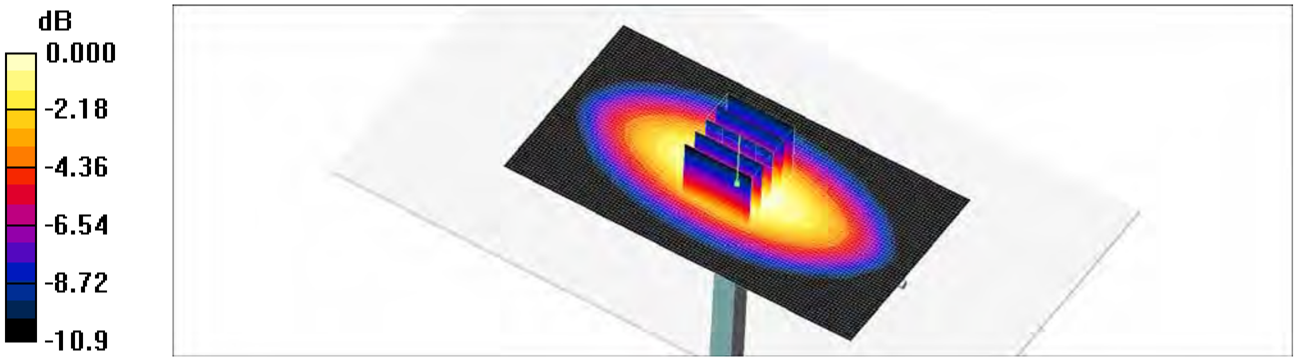
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d165

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.985 mho/m; ε_r = 56.9; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(6.59, 6.59, 6.59); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

Verification 835 MHz/Area Scan (111x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.08 mW/g

Verification 835 MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.6 V/m; Power Drift = -0.015 dB
Peak SAR (extrapolated) = 1.55 W/kg
SAR(1 g) = 0.988 mW/g; SAR(10 g) = 0.634 mW/g
Maximum value of SAR (measured) = 1.06 mW/g



0 dB = 1.06mW/g

■ Verification Data (1 800 MHz Head)

Test Laboratory: HCT CO., LTD
Input Power 100 mW (20 dBm)
Liquid Temp: 21.1 ℃
Test Date: Aug. 19, 2014

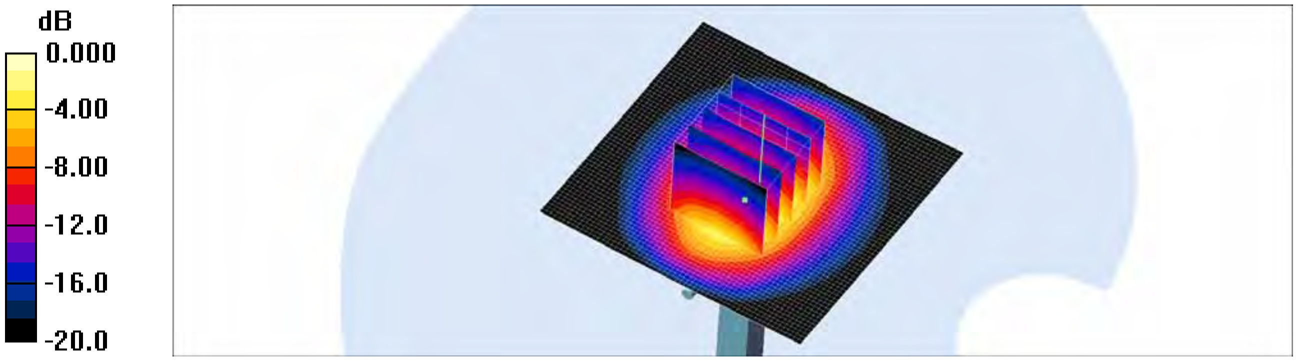
DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:2d006

Communication System: CW; Frequency: 1800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1800 MHz; σ = 1.38 mho/m; ε_r = 39.8; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: EX3DV4 - SN3863; ConvF(8.38, 8.38, 8.38); Calibrated: 2014-07-24
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2014-02-27
- Phantom: SAM 1800/1900 MHz; Type: SAM

Verification 1800MHz/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 4.44 mW/g

Verification 1800MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 54.7 V/m; Power Drift = -0.004 dB
Peak SAR (extrapolated) = 7.23 W/kg
SAR(1 g) = 3.76 mW/g; SAR(10 g) = 1.92 mW/g
Maximum value of SAR (measured) = 4.11 mW/g



0 dB = 4.11mW/g

■ Verification Data (1 800 MHz Body)

Test Laboratory: HCT CO., LTD

Input Power 100 mW (20 dBm)

Liquid Temp: 20.6 ℃

Test Date: Aug. 19, 2014

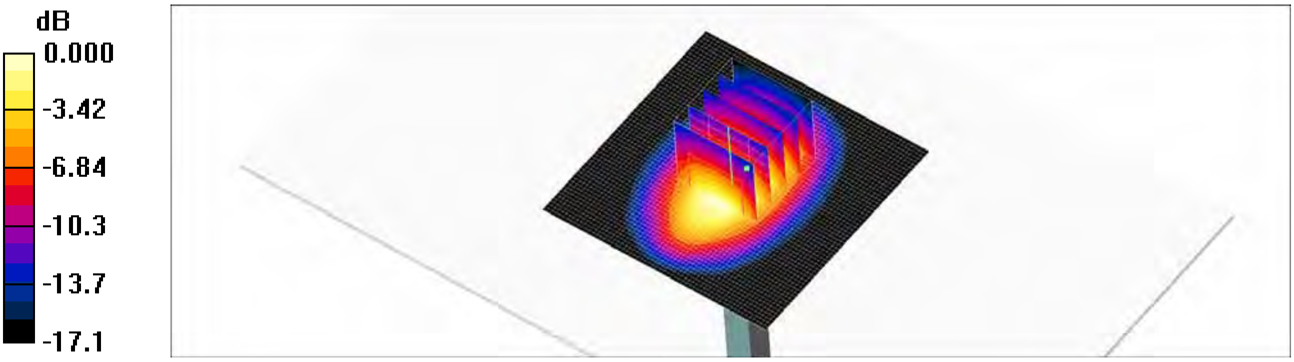
DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:2d006

Communication System: CW; Frequency: 1800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1800 MHz; σ = 1.52 mho/m; ε_r = 51.9; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.93, 4.93, 4.93); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Verification 1800 MHz/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 4.30 mW/g

Verification 1800 MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 57.3 V/m; Power Drift = -0.014 dB
Peak SAR (extrapolated) = 5.69 W/kg
SAR(1 g) = 3.7 mW/g; SAR(10 g) = 2.06 mW/g
Maximum value of SAR (measured) = 4.16 mW/g



0 dB = 4.16mW/g

■ Verification Data (1 900 MHz Head)

Test Laboratory: HCT CO., LTD

Input Power 100 mW (20 dBm)

Liquid Temp: 21.8 ℃

Test Date: Aug. 20, 2014

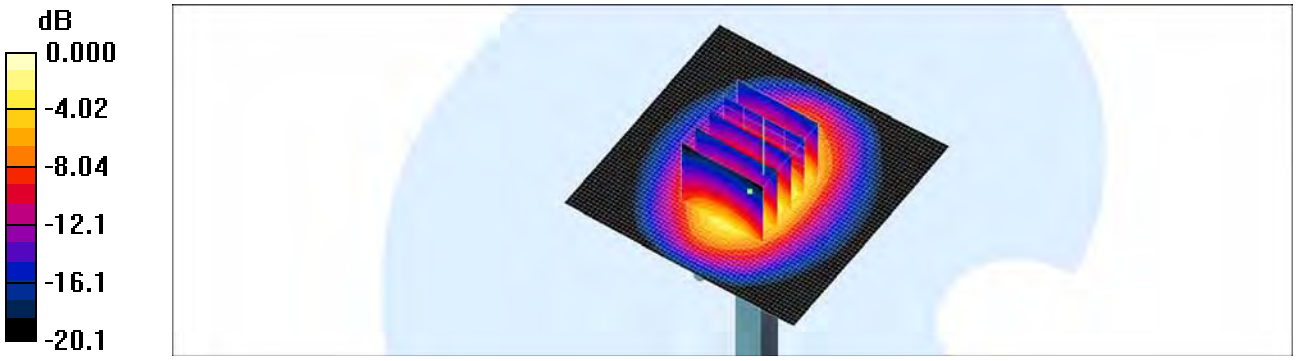
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d061

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.38 mho/m; ε_r = 39; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: EX3DV4 - SN3863; ConvF(8.02, 8.02, 8.02); Calibrated: 2014-07-24
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2014-02-27
- Phantom: SAM 1800/1900 MHz; Type: SAM

Verification 1900MHz/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 4.65 mW/g

Verification 1900MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 56.4 V/m; Power Drift = -0.009 dB
Peak SAR (extrapolated) = 7.61 W/kg
SAR(1 g) = 3.94 mW/g; SAR(10 g) = 2.01 mW/g
Maximum value of SAR (measured) = 4.35 mW/g



0 dB = 4.35mW/g

■ Verification Data (1 900 MHz Body)

Test Laboratory: HCT CO., LTD
Input Power 100 mW (20 dBm)
Liquid Temp: 20.6 ℃
Test Date: Aug. 19, 2014

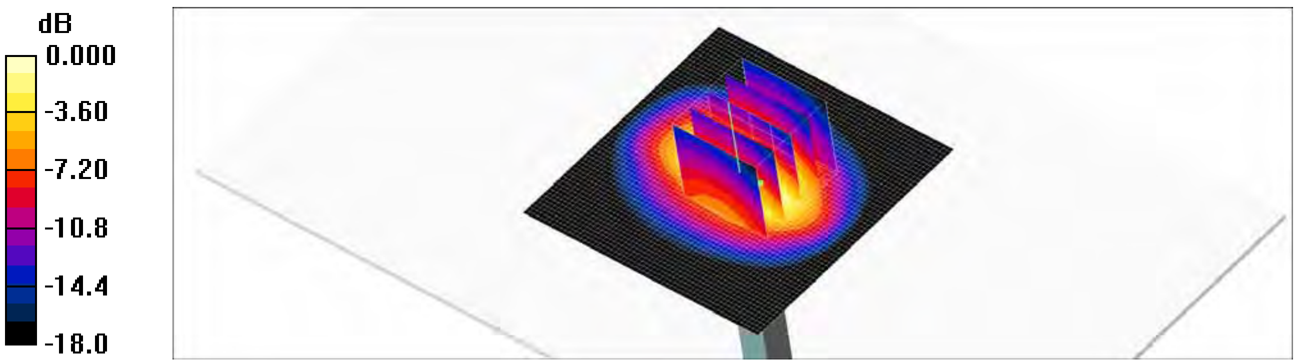
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d061

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.5 mho/m; ε_r = 52.6; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.73, 4.73, 4.73); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Verification 1900 MHz/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 4.94 mW/g

Verification 1900 MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 59.6 V/m; Power Drift = -0.029 dB
Peak SAR (extrapolated) = 6.94 W/kg
SAR(1 g) = 4.22 mW/g; SAR(10 g) = 2.29 mW/g
Maximum value of SAR (measured) = 4.73 mW/g



0 dB = 4.73mW/g

■ Verification Data (2 450 MHz Head)

Test Laboratory:	HCT CO., LTD
Input Power	100 mW (20 dBm)
Liquid Temp:	21.2 ℃
Test Date:	Aug. 18, 2014

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

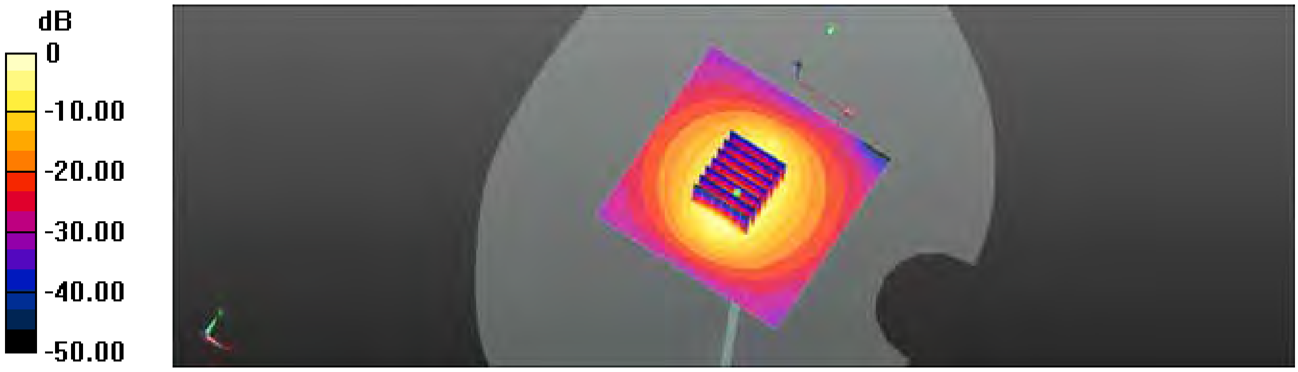
Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.798 S/m; ε_r = 39.783; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY4 Configuration:

- Probe: EX3DV4 - SN3863; ConvF(7.15, 7.15, 7.15); Calibrated: 2014-07-24;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn466; Calibrated: 2014-02-27
- Phantom: SAM_Front_2014_03_03; Type: SAM; Serial: TP-1573
- ; SEMCAD X Version 14.6.10 (7331)

Verification/Verification 2450MHz/Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 8.43 W/kg

Verification/Verification 2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.01 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 12.3 W/kg
SAR(1 g) = 5.24 W/kg; SAR(10 g) = 2.29 W/kg
Maximum value of SAR (measured) = 8.43 W/kg



0 dB = 8.43 W/kg = 9.26 dBW/kg

■ Verification Data (2 450 MHz Body)

Test Laboratory: HCT CO., LTD

Input Power 100 mW (20 dBm)

Liquid Temp: 20.2 ℃

Test Date: Aug. 18, 2014

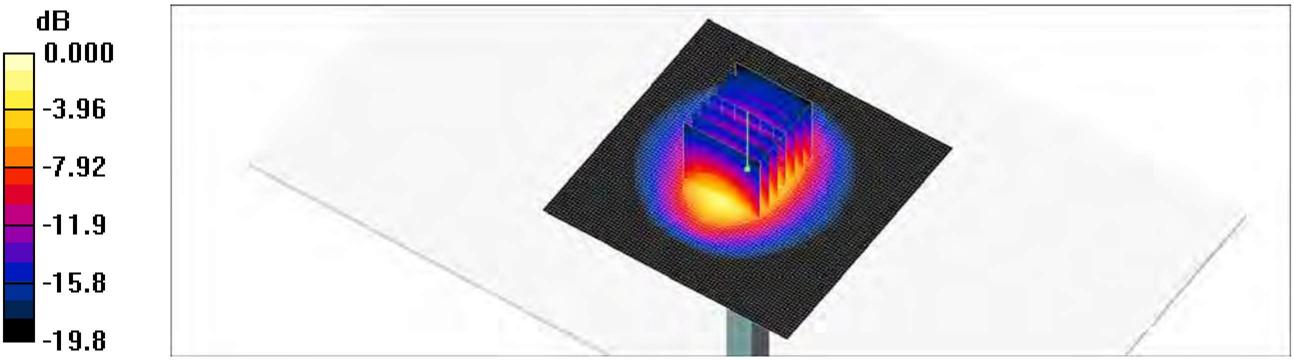
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:743

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.93 mho/m; ε_r = 52.4; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: ET3DV6 - SN1630; ConvF(4.26, 4.26, 4.26); Calibrated: 2014-04-21
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

Verification 2450MHz/Area Scan (81x81x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 5.72 mW/g

Verification 2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.9 V/m; Power Drift = 0.052 dB
Peak SAR (extrapolated) = 12.5 W/kg
SAR(1 g) = 5.14 mW/g; SAR(10 g) = 2.4 mW/g
Maximum value of SAR (measured) = 5.59 mW/g



0 dB = 5.59mW/g

■ Verification Data (2 600 MHz Head)

Test Laboratory: HCT CO., LTD
Input Power 100 mW (20 dBm)
Liquid Temp: 19.6 ℃
Test Date: Aug. 26, 2014

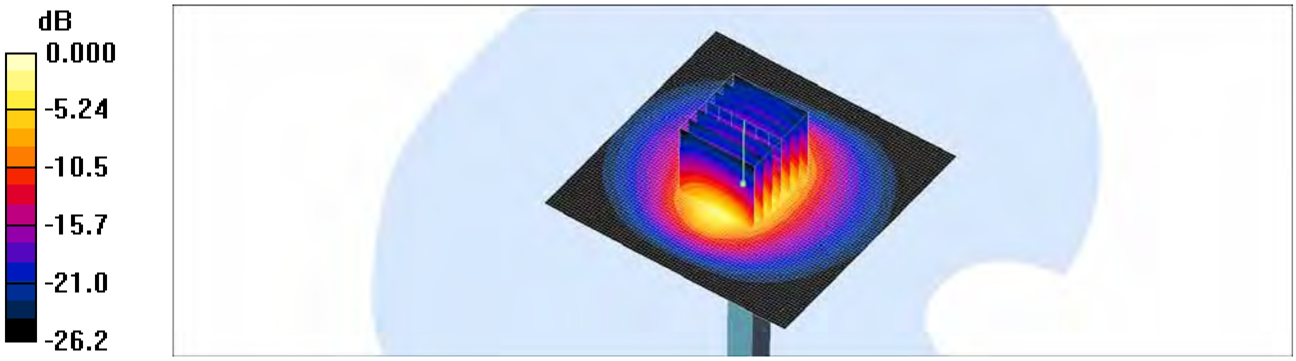
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1015

Communication System: CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2600 MHz; σ = 2.02 mho/m; ε_r = 39; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: EX3DV4 - SN3863; ConvF(7.05, 7.05, 7.05); Calibrated: 2014-07-24
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1417; Calibrated: 2014-01-03
- Phantom: 835/900 Phamtom ; Type: SAM

Verification 2600MHz/Area Scan (81x81x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 9.42 mW/g

Verification 2600MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.9 V/m; Power Drift = -0.052 dB
Peak SAR (extrapolated) = 13.3 W/kg
SAR(1 g) = 5.72 mW/g; SAR(10 g) = 2.49 mW/g
Maximum value of SAR (measured) = 9.21 mW/g



0 dB = 9.21mW/g

■ Verification Data (2 6000 MHz Body)

Test Laboratory: HCT CO., LTD

Input Power 100 mW (20 dBm)

Liquid Temp: 21.7 ℃

Test Date: Aug. 25, 2014

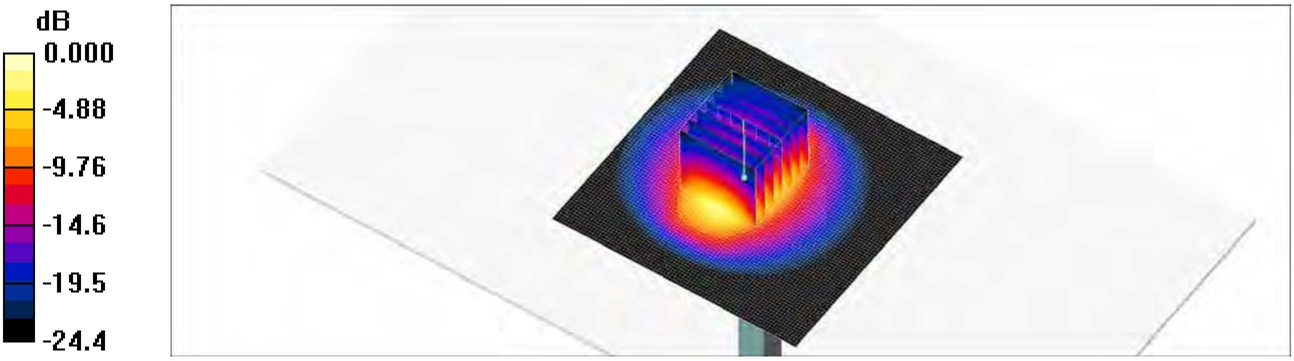
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1015

Communication System: CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2600 MHz; σ = 2.11 mho/m; ε_r = 52.6; ρ = 1000 kg/m^3
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

DASY4 Configuration:
- Probe: EX3DV4 - SN3863; ConvF(6.87, 6.87, 6.87); Calibrated: 2014-07-24
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn652; Calibrated: 2014-03-26
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

Verification 2600MHz/Area Scan (81x81x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 9.09 mW/g

Verification 2600MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 47.5 V/m; Power Drift = -0.070 dB
Peak SAR (extrapolated) = 12.5 W/kg
SAR(1 g) = 5.57 mW/g; SAR(10 g) = 2.47 mW/g
Maximum value of SAR (measured) = 8.87 mW/g



0 dB = 8.87mW/g

Attachment 3. – Probe Calibration Data

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Accreditation No.: SCS 108

Client HCT (Dymstec)

Certificate No: ET3-1605_Jan14/2

CALIBRATION CERTIFICATE (Replacement of No: ET3-1605_Jan14)

Object: ET3DV6 - SN:1605

Calibration procedure(s): QA CAL-01.v9, QA CAL-12.v9, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: January 31, 2014

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	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: January 31, 2014

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

Certificate No: ET3-1605_Jan14/2 Page 1 of 11

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The Swiss Accreditation Service is one of the signatories to the EA
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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, D	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
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
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; Dx,y,z; VRx,y,z*: *A, B, C, D* 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.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Certificate No: ET3-1605_Jan14/2 Page 2 of 11

Probe ET3DV6

SN:1605

Manufactured: July 27, 2001
Repaired: January 24, 2014
Calibrated: January 31, 2014

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

ET3DV6– SN:1605 January 31, 2014

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1605

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m)^2)[A]	1.49	1.76	1.49	± 10.1 %
DCP (mV)[B]	97.1	97.1	98.1	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√µV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	176.1	±3.5 %
		Y	0.0	0.0	1.0		186.9	
		Z	0.0	0.0	1.0		183.4	

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:1605

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 [G]	Depth [G] (mm)	Unct. (k=2)
150	52.3	0.76	8.22	8.22	8.22	0.10	1.35	± 13.3 %
300	45.3	0.87	8.06	8.06	8.06	0.23	2.40	± 13.3 %
450	43.5	0.87	7.34	7.34	7.34	0.26	2.82	± 13.3 %
750	41.9	0.89	6.88	6.88	6.88	0.31	3.00	± 12.0 %
835	41.5	0.90	6.57	6.57	6.57	0.33	3.00	± 12.0 %
900	41.5	0.97	6.37	6.37	6.37	0.31	3.00	± 12.0 %
1450	40.5	1.20	5.69	5.69	5.69	0.44	2.69	± 12.0 %
1750	40.1	1.37	5.43	5.43	5.43	0.78	2.13	± 12.0 %
1900	40.0	1.40	5.20	5.20	5.20	0.80	2.05	± 12.0 %
1950	40.0	1.40	5.05	5.05	5.05	0.80	2.18	± 12.0 %
2300	39.5	1.67	4.83	4.83	4.83	0.80	1.92	± 12.0 %
2450	39.2	1.80	4.55	4.55	4.55	0.80	1.72	± 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.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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DASY/EASY - Parameters of Probe: ET3DV6 - SN:1605

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 [G]	Depth [G] (mm)	Unct. (k=2)
150	61.9	0.80	7.44	7.44	7.44	0.15	1.35	± 13.3 %
300	58.2	0.92	7.57	7.57	7.57	0.18	2.03	± 13.3 %
450	56.7	0.94	7.34	7.34	7.34	0.19	2.19	± 13.3 %
750	55.5	0.96	6.45	6.45	6.45	0.27	2.96	± 12.0 %
835	55.2	0.97	6.35	6.35	6.35	0.33	3.00	± 12.0 %
1750	53.4	1.49	4.81	4.81	4.81	0.80	2.59	± 12.0 %
1900	53.3	1.52	4.57	4.57	4.57	0.80	2.39	± 12.0 %
2450	52.7	1.95	3.97	3.97	3.97	0.57	1.04	± 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.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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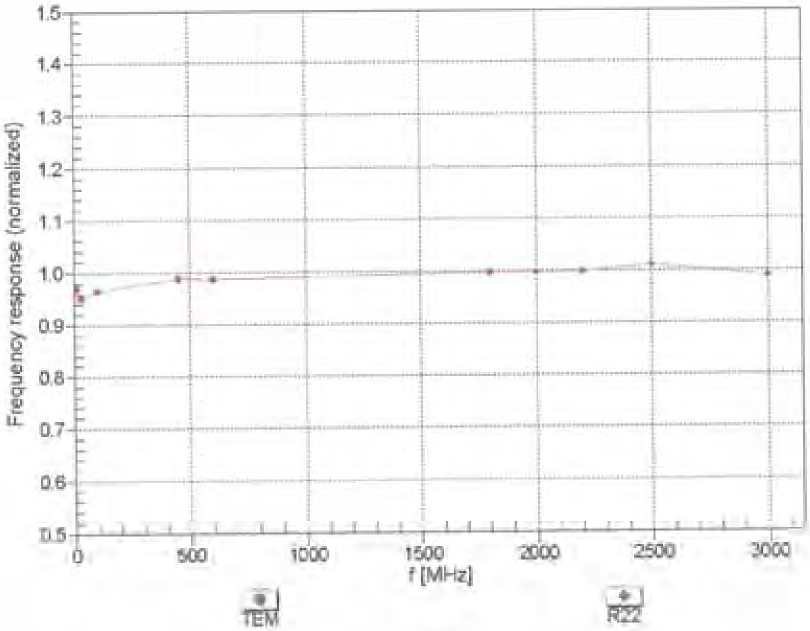
ET3DV6– SN:1605

January 31, 2014

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



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

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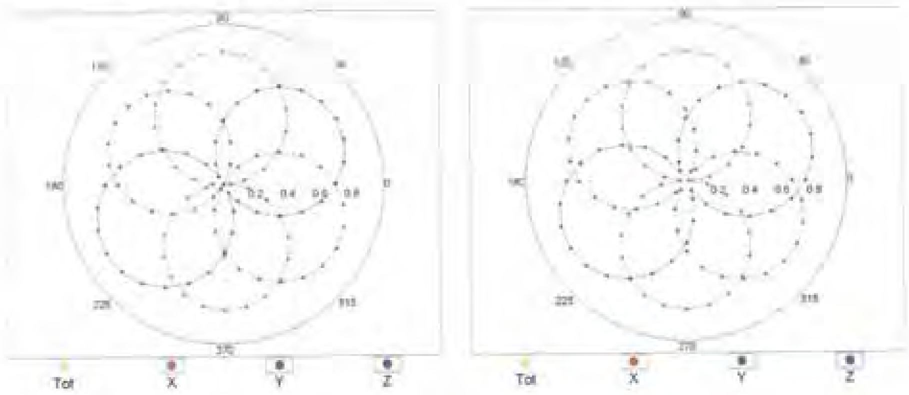
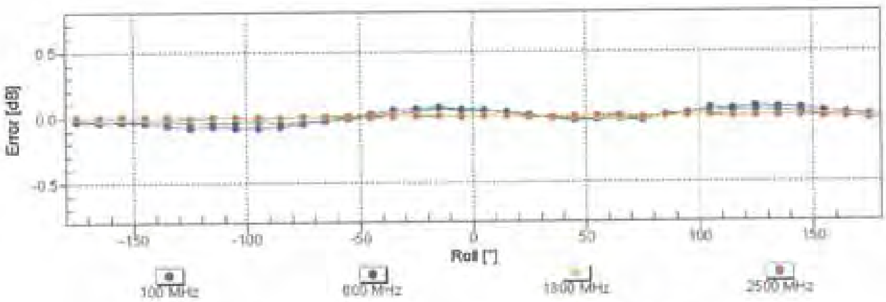
ET3DV6– SN:1605 January 31, 2014

Receiving Pattern (ϕ), $\vartheta = 0°$

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

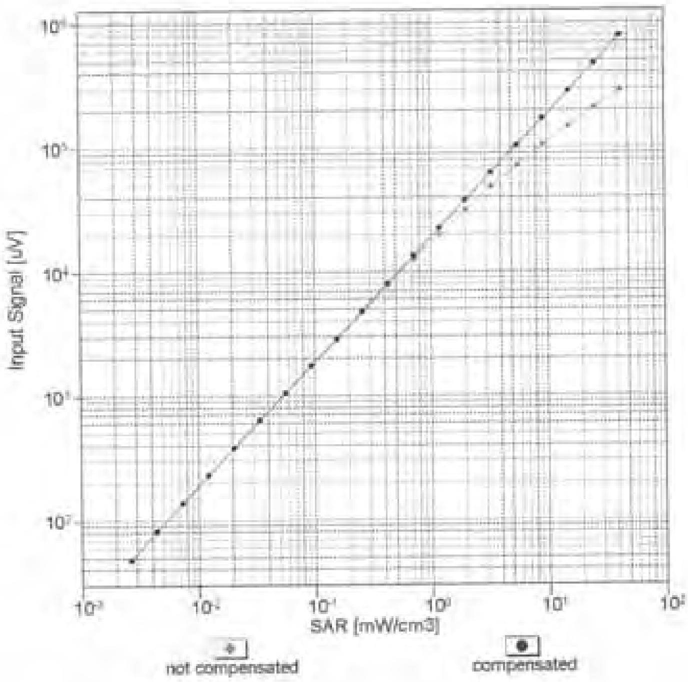


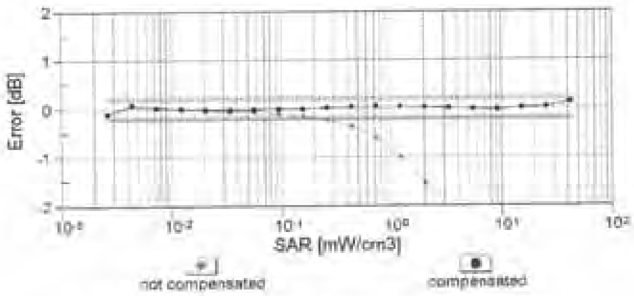


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

ET3DV6– SN:1605 January 31, 2014

Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)



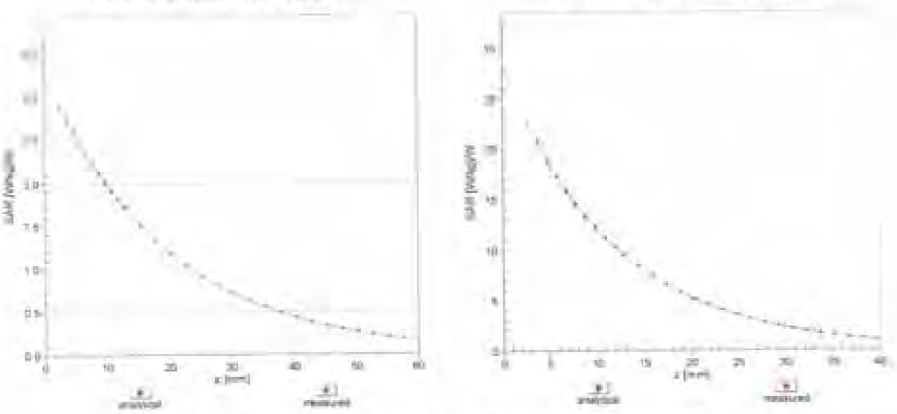


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Certificate No: ET3-1605_Jan14/2 Page 9 of 11

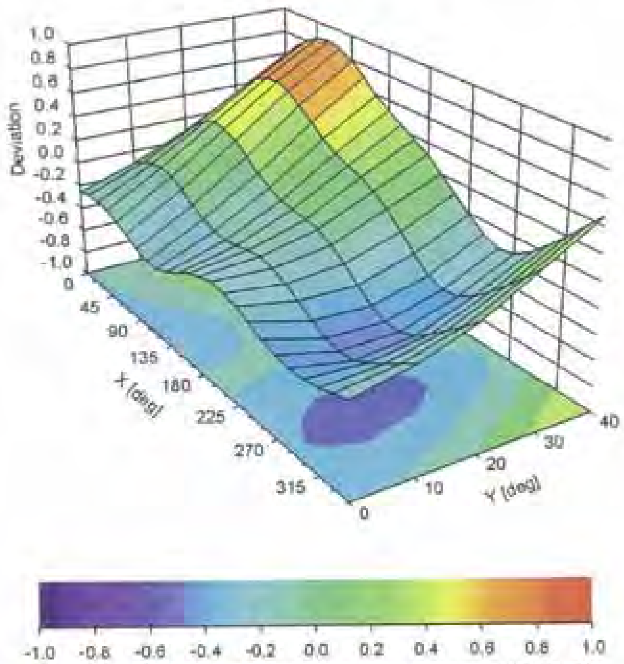
ET3DV6– SN:1605 January 31, 2014

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: ET3-1605_Jan14/2 Page 10 of 11

ET3DV6– SN:1605 January 31, 2014

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1605

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-125
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

Certificate No: ET3-1605_Jan14/2 Page 11 of 11

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Accreditation No.: **SCS 108**

Client **HCT (Dymstec)**

Certificate No: **ET3-1630_Apr14**

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1630
Calibration procedure(s)	QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	April 21, 2014

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
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Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 21, 2014

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Certificate No: ET3-1630_Apr14 Page 1 of 11

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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, D	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
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
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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; Dx,y,z; VRx,y,z: A, B, C, D* 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.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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Probe ET3DV6

SN:1630

Manufactured: October 12, 2001
Calibrated: April 21, 2014

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

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]	1.78	1.81	1.62	± 10.1 %
DCP (mV)[B]	99.2	101.0	98.5	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	252.3	±3.5 %
		Y	0.0	0.0	1.0		252.3	
		Z	0.0	0.0	1.0		246.1	

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.

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 [G]	Depth [G] (mm)	Unct. (k=2)
835	41.5	0.90	6.67	6.67	6.67	0.80	1.43	± 12.0 %
900	41.5	0.97	6.59	6.59	6.59	0.67	1.29	± 12.0 %
1450	40.5	1.20	5.65	5.65	5.65	0.45	2.67	± 12.0 %
1750	40.1	1.37	5.37	5.37	5.37	0.71	2.22	± 12.0 %
1900	40.0	1.40	5.17	5.17	5.17	0.80	2.02	± 12.0 %
1950	40.0	1.40	5.01	5.01	5.01	0.80	1.95	± 12.0 %
2450	39.2	1.80	4.57	4.57	4.57	0.80	1.64	± 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.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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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 [G]	Depth [G] (mm)	Unct. (k=2)
835	55.2	0.97	6.59	6.59	6.59	0.80	1.32	± 12.0 %
1750	53.4	1.49	4.93	4.93	4.93	0.80	2.40	± 12.0 %
1900	53.3	1.52	4.73	4.73	4.73	0.80	2.35	± 12.0 %
2450	52.7	1.95	4.26	4.26	4.26	0.63	1.14	± 12.0 %

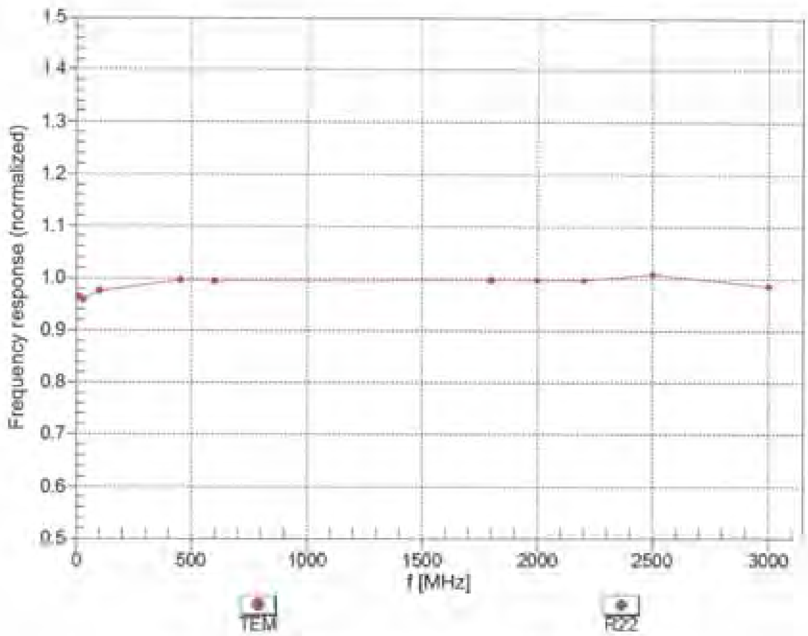
[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

[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.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

ET3DV6– SN:1630 April 21, 2014

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



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

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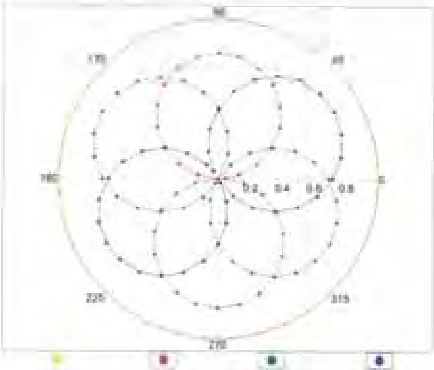
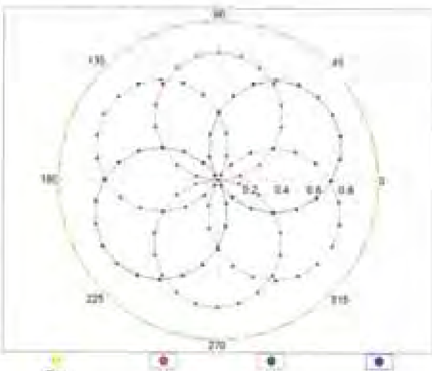
ET3DV6– SN:1630 April 21, 2014

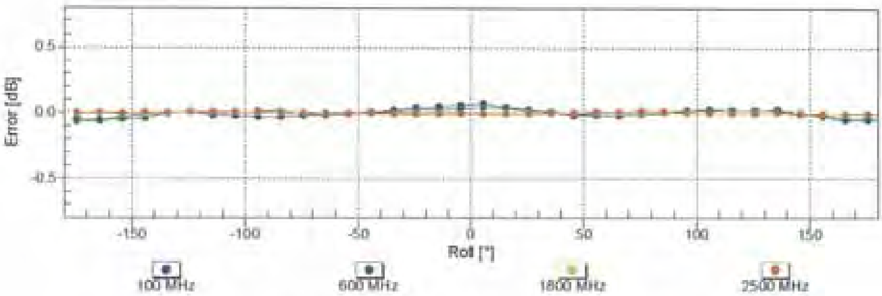
Receiving Pattern (φ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22





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

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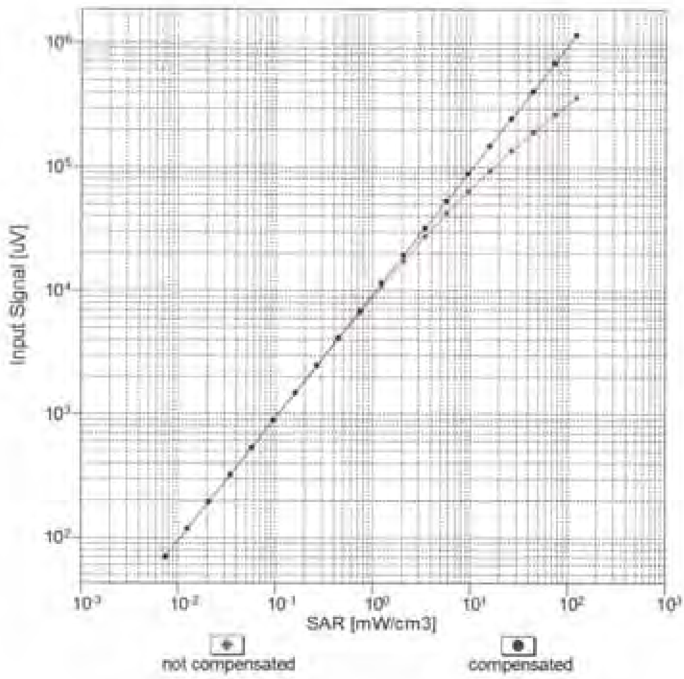
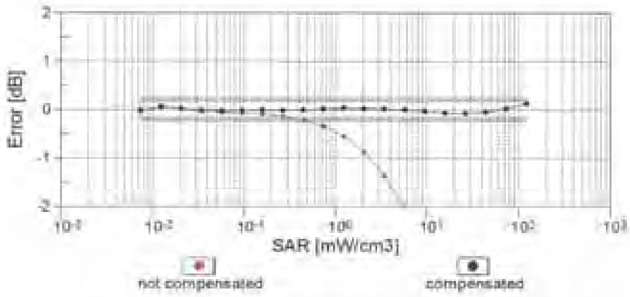
ET3DV6– SN:1630 April 21, 2014

Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)





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

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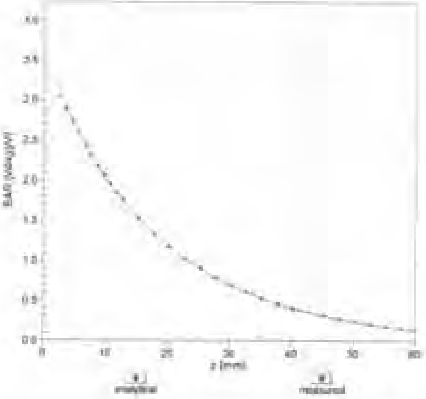
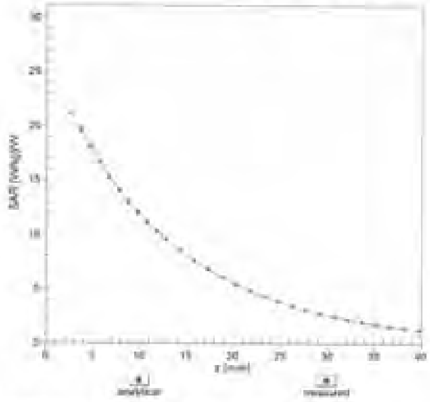
ET3DV6– SN:1630 April 21, 2014

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

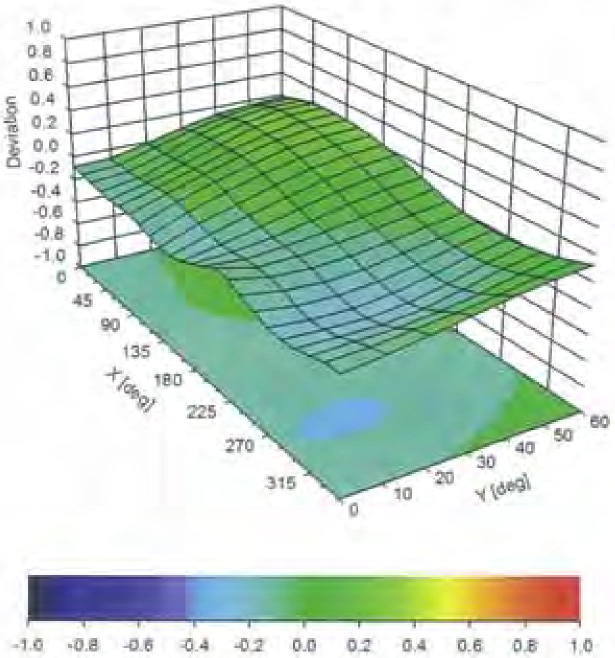
f = 1750 MHz,WGLS R22 (H_convF)





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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ET3DV6– SN 1630 April 21, 2014

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-54.3
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

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Engineering AG
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Swiss Calibration Service

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Accreditation No.: **SCS 108**

Client **HCT (Dymstec)**

Certificate No: **EX3-3863_Jul14**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3863

Calibration procedure(s): QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: July 24, 2014

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	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: July 24, 2014

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

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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, D	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
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
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; Dx,y,z; VRx,y,z: A, B, C, D* 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.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe EX3DV4

SN:3863

Manufactured: February 2, 2012
Calibrated: July 24, 2014

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3863

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.37	0.35	0.45	± 10.1 %
DCP (mV)[B]	99.8	98.7	100.6	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	133.0	±2.5 %
		Y	0.0	0.0	1.0		131.3	
		Z	0.0	0.0	1.0		149.9	

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: EX3DV4 - SN:3863

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 [G]	Depth [G] (mm)	Unct. (k=2)
835	41.5	0.90	9.50	9.50	9.50	0.80	0.50	± 12.0 %
900	41.5	0.97	9.21	9.21	9.21	0.59	0.71	± 12.0 %
1450	40.5	1.20	8.50	8.50	8.50	0.66	0.65	± 12.0 %
1750	40.1	1.37	8.38	8.38	8.38	0.75	0.58	± 12.0 %
1900	40.0	1.40	8.02	8.02	8.02	0.78	0.59	± 12.0 %
1950	40.0	1.40	7.71	7.71	7.71	0.56	0.70	± 12.0 %
2300	39.5	1.67	7.48	7.48	7.48	0.54	0.69	± 12.0 %
2450	39.2	1.80	7.15	7.15	7.15	0.70	0.59	± 12.0 %
2600	39.0	1.96	7.05	7.05	7.05	0.50	0.74	± 12.0 %
5200	36.0	4.66	4.98	4.98	4.98	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.77	4.77	4.77	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.76	4.76	4.76	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.58	4.58	4.58	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.55	4.55	4.55	0.45	1.80	± 13.1 %

[C] Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[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.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3863

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 [G]	Depth [G] (mm)	Unct. (k=2)
835	55.2	0.97	9.43	9.43	9.43	0.80	0.61	± 12.0 %
1750	53.4	1.49	7.80	7.80	7.80	0.52	0.75	± 12.0 %
1900	53.3	1.52	7.36	7.36	7.36	0.26	1.18	± 12.0 %
2450	52.7	1.95	6.97	6.97	6.97	0.80	0.50	± 12.0 %
2600	52.5	2.16	6.87	6.87	6.87	0.63	0.50	± 12.0 %
5200	49.0	5.30	4.50	4.50	4.50	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.27	4.27	4.27	0.40	1.90	± 13.1 %
5500	48.6	5.65	4.01	4.01	4.01	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.83	3.83	3.83	0.45	1.90	± 13.1 %
5800	48.2	6.00	4.07	4.07	4.07	0.50	1.90	± 13.1 %

[C] Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[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.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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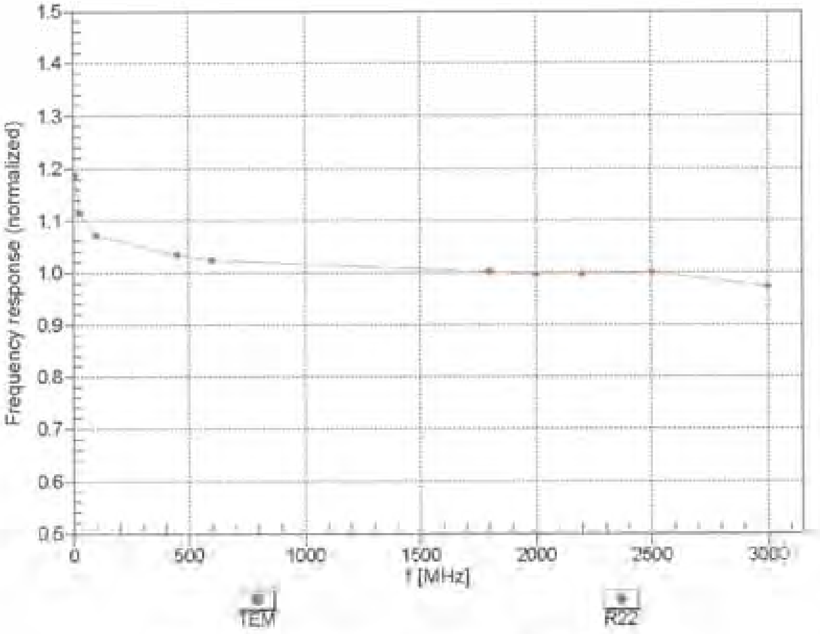
EX3DV4– SN:3863 July 24, 2014

Frequency Response of E-Field

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



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

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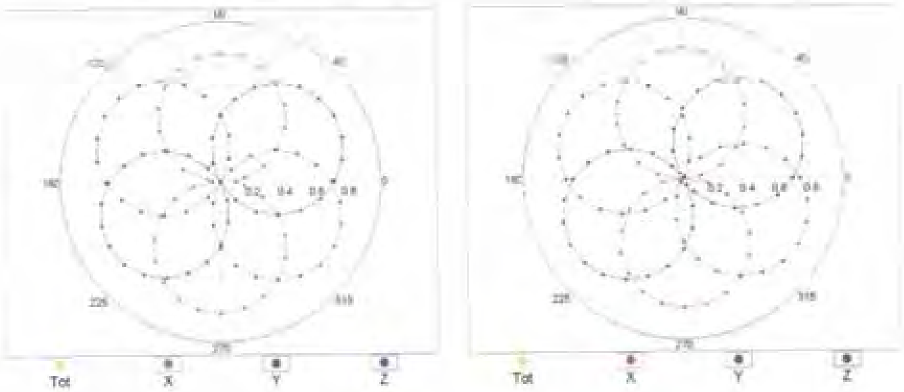
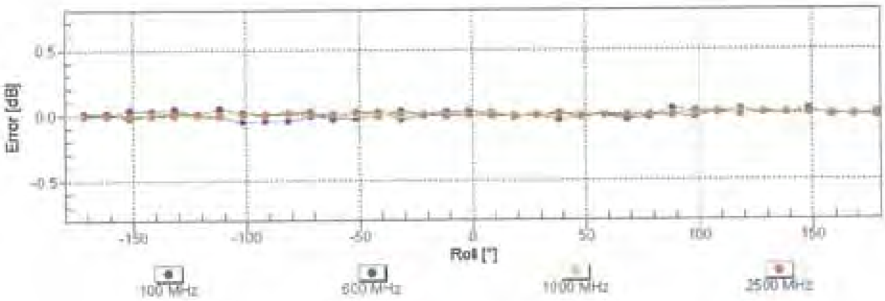
EX3DV4– SN:3863 July 24, 2014

Receiving Pattern (ϕ), ϑ = 0°

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



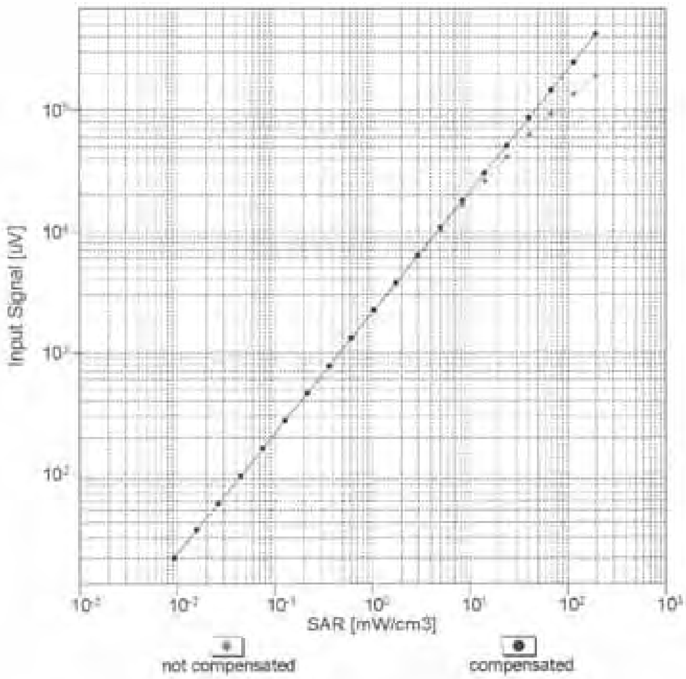


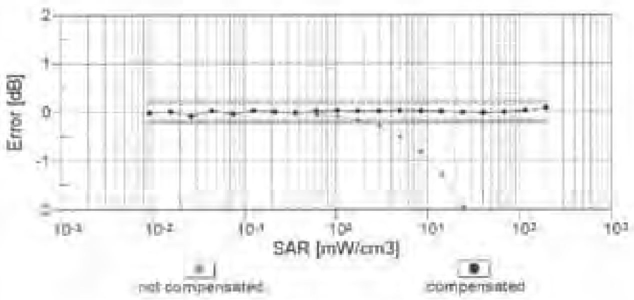
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Certificate No: EX3-3863_Jul14 Page 8 of 11

EX3DV4– SN:3863 July 24, 2014

Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)



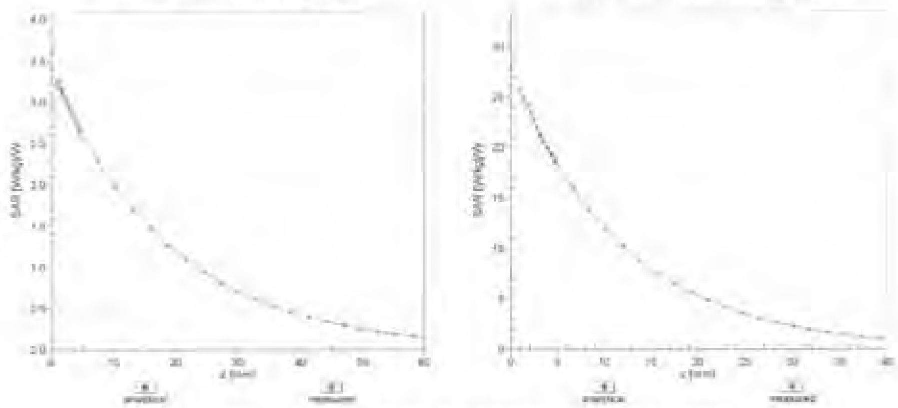


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Certificate No: EX3-3863_Jul14 Page 9 of 11

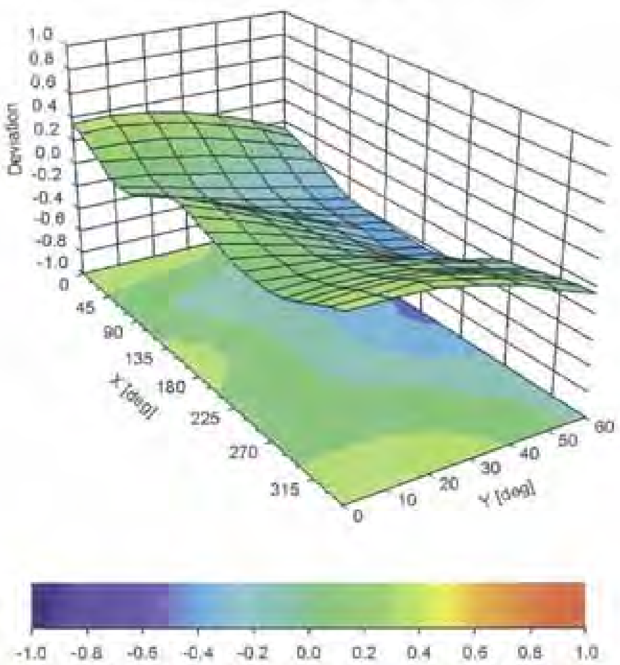
Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF) f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

HCT CO., LTD.
74, Seoicheon-ro 578 beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea 467-811
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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3863

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-71.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Attachment 4. – Dipole Calibration Data

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TEL: +82 31 645 6300 FAX: +82 31 645 6401

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **HCT (Dymstec)**

Certificate No: **D750V3-1014_Jul14**

CALIBRATION CERTIFICATE

Object: D750V3 - SN: 1014

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: July 24, 2014

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	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 24, 2014

Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
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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 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
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) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

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: D750V3-1014_Jul14 Page 2 of 8

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.2 ± 6 %	0.92 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	2.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.31 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.47 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.9 ± 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	2.24 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.63 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.48 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.75 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.2 Ω + 2.5 jΩ
Return Loss	- 26.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.4 Ω + 0.3 jΩ
Return Loss	- 43.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.037 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 22, 2010

DASY5 Validation Report for Head TSL

Date: 24.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

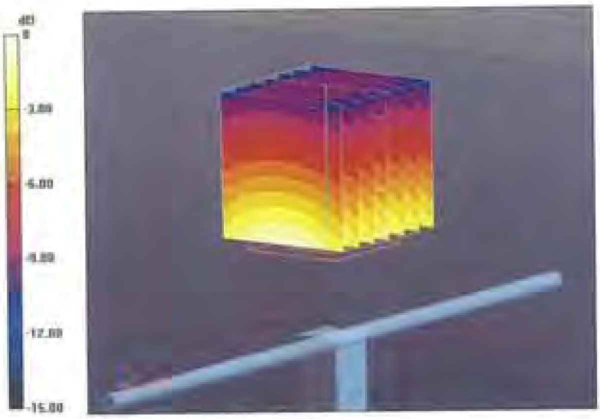
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1014

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.92 S/m; ε_r = 41.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.37, 6.37, 6.37); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

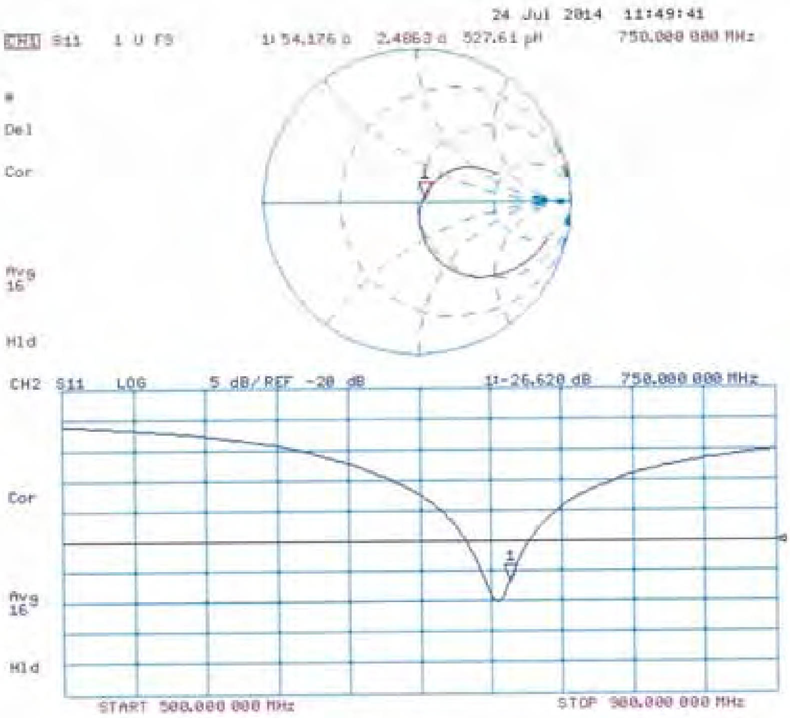
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.98 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.23 W/kg
SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.4 W/kg
Maximum value of SAR (measured) = 2.52 W/kg



0 dB = 2.52 W/kg = 4.01 dBW/kg

Certificate No: D750V3-1014_Jul14 Page 5 of 8

Impedance Measurement Plot for Head TSL



Certificate No: D750V3-1014_Jul14 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 17.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

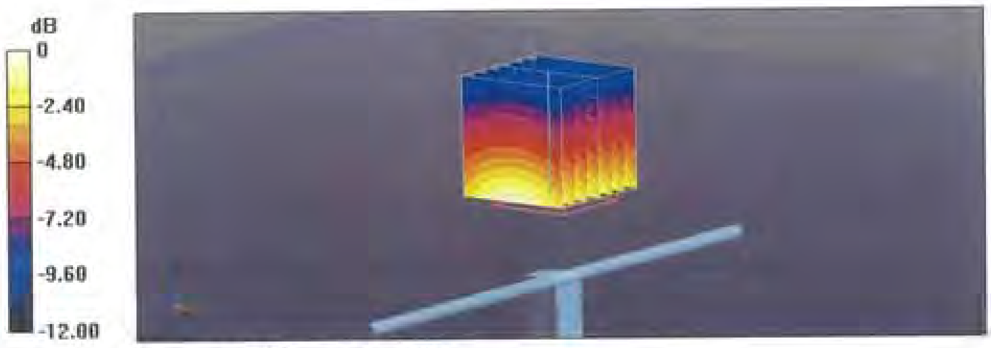
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1014

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 1 S/m; ε_r = 53.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.13, 6.13, 6.13); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

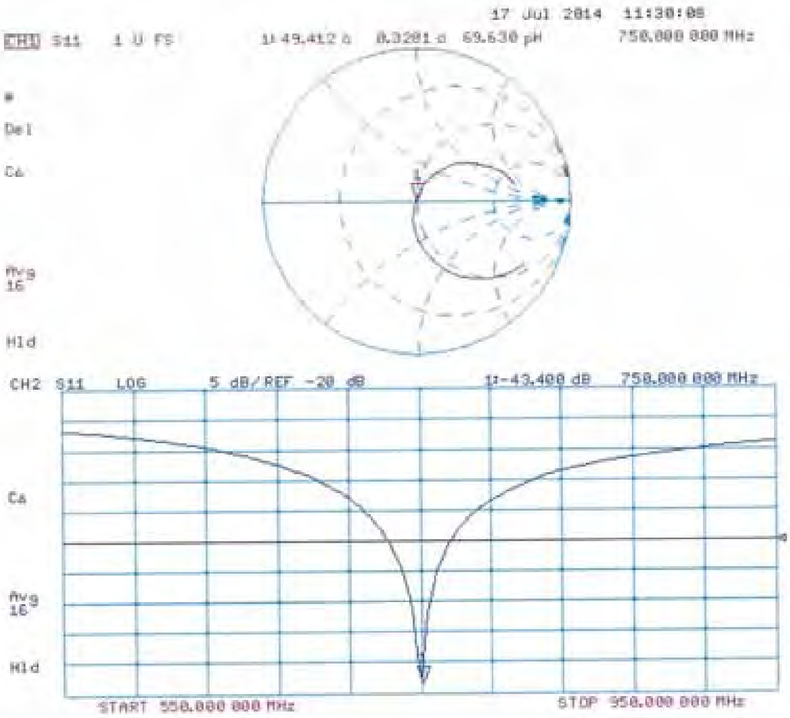
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.83 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.28 W/kg
SAR(1 g) = 2.24 W/kg; SAR(10 g) = 1.48 W/kg
Maximum value of SAR (measured) = 2.61 W/kg



0 dB = 2.61 W/kg = 4.17 dBW/kg

Certificate No: D750V3-1014_Jul14 Page 7 of 8

Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 108**

Client **HCT (Dymstec)**

Certificate No: **D835V2-4d165_Jan14**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d165
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	January 07, 2014

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	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: January 9, 2014

Certificate No: D835V2-4d165_Jan14 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 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
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) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

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: D835V2-4d165_Jan14 Page 2 of 8

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
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	40.7 ± 6 %	0.91 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	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.24 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.52 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.02 W/kg ± 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	56.8 ± 6 %	1.01 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	2.46 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.58 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.60 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.26 W/kg ± 16.5 % (k=2)**

Certificate No: D835V2-4d165_Jan14 Page 3 of 8

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.6 Ω - 3.8 jΩ
Return Loss	- 28.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.2 Ω - 5.7 jΩ
Return Loss	- 23.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.440 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 28, 2012

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74, Seoicheon-ro 578 beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea 467-811
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DASY5 Validation Report for Head TSL

Date: 07.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

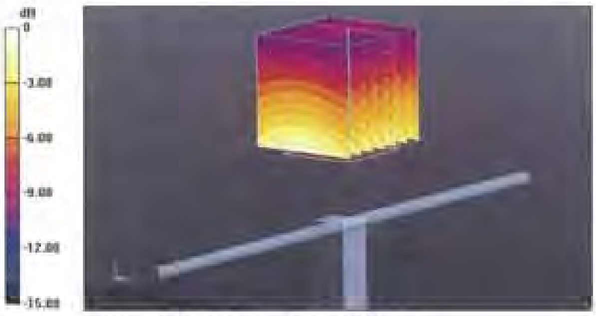
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d165

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 0.91$ S/m; $\varepsilon_r = 40.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.22, 6.22, 6.22); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

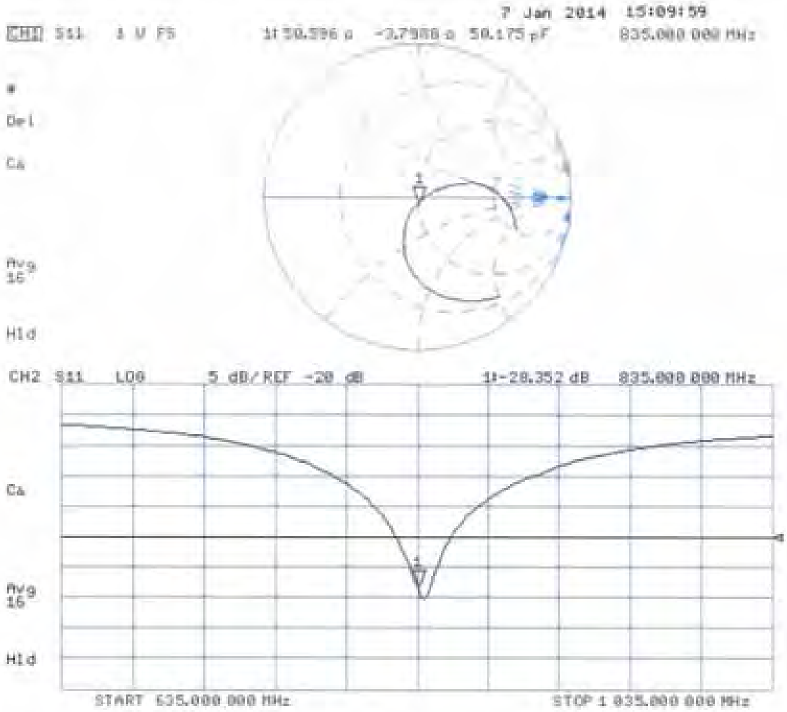
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 60.874 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.54 W/kg
SAR(1 g) = 2.34 W/kg; SAR(10 g) = 1.52 W/kg
Maximum value of SAR (measured) = 2.73 W/kg



0 dB = 2.73 W/kg = 4.36 dBW/kg

Certificate No: D835V2-4d165_Jan14 Page 5 of 8

Impedance Measurement Plot for Head TSL



Certificate No: D835V2-4d165_Jan14 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 07.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

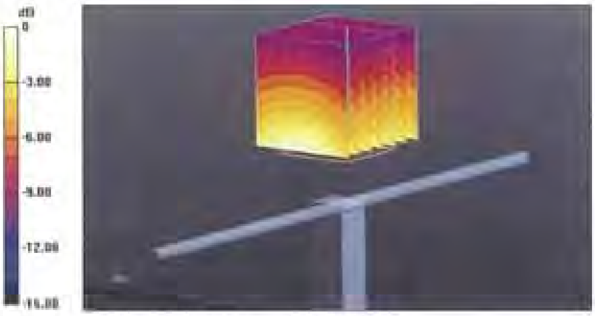
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d165

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.013 S/m; ε_r = 56.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.09, 6.09, 6.09); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

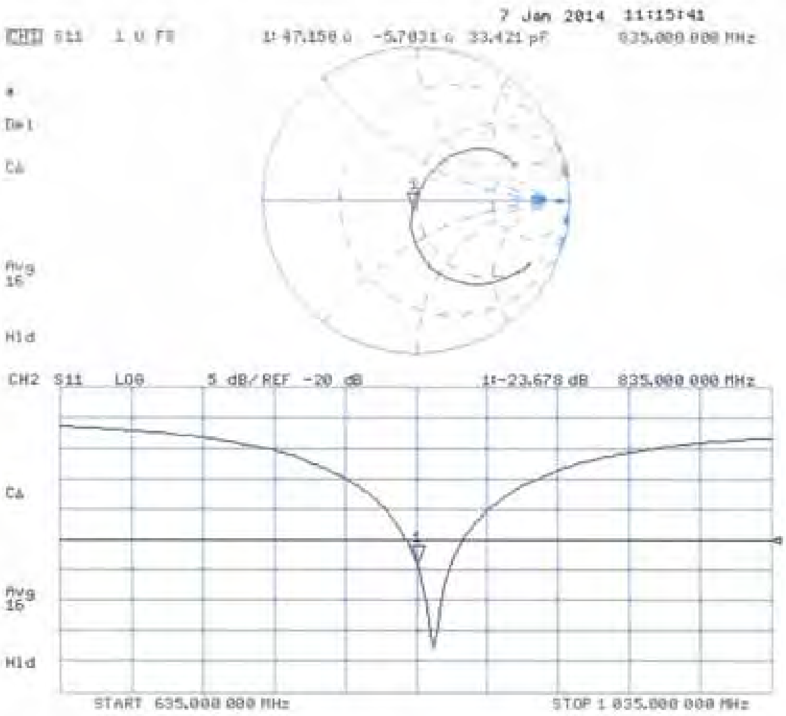
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 60.874 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.66 W/kg
SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.6 W/kg
Maximum value of SAR (measured) = 2.86 W/kg



0 dB = 2.86 W/kg = 4.56 dBW/kg

Certificate No: D835V2-4d165_Jan14 Page 7 of 8

Impedance Measurement Plot for Body TSL



Certificate No: D835V2-4d165_Jan14 Page 8 of 8

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Accreditation No.: **SCS 108**

Client **HCT (Dymstec)**

Certificate No: **D1800V2-2d006_Mar14**

CALIBRATION CERTIFICATE

Object: D1800V2 - SN: 2d006

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: March 24, 2014

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	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: March 24, 2014

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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 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
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) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

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	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1800 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	38.7 ± 6 %	1.40 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	9.60 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**38.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.0 W/kg ± 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	52.5 ± 6 %	1.55 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	9.67 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**38.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.2 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.7 Ω - 7.0 jΩ
Return Loss	- 22.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	43.7 Ω - 6.9 jΩ
Return Loss	- 20.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.208 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	July 23, 2001

HCT CO., LTD.
74, Seoicheon-ro 578 beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea 467-811
TEL: +82 31 645 6300 FAX: +82 31 645 6401

DASY5 Validation Report for Head TSL

Date: 24.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

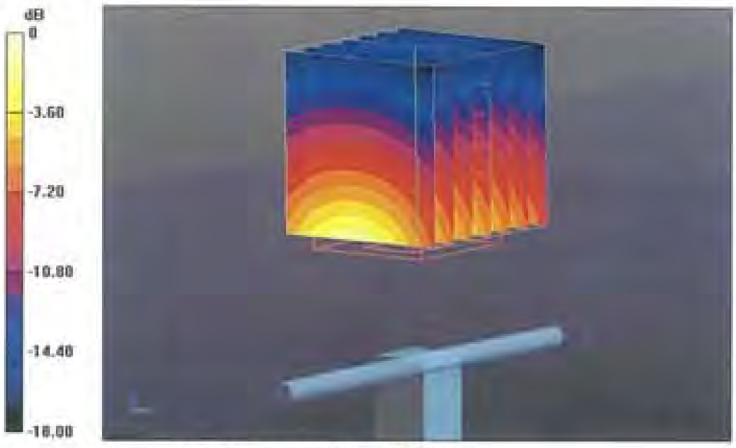
DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d006

Communication System: UID 0 - CW; Frequency: 1800 MHz
Medium parameters used: f = 1800 MHz; σ = 1.4 S/m; ε_r = 38.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

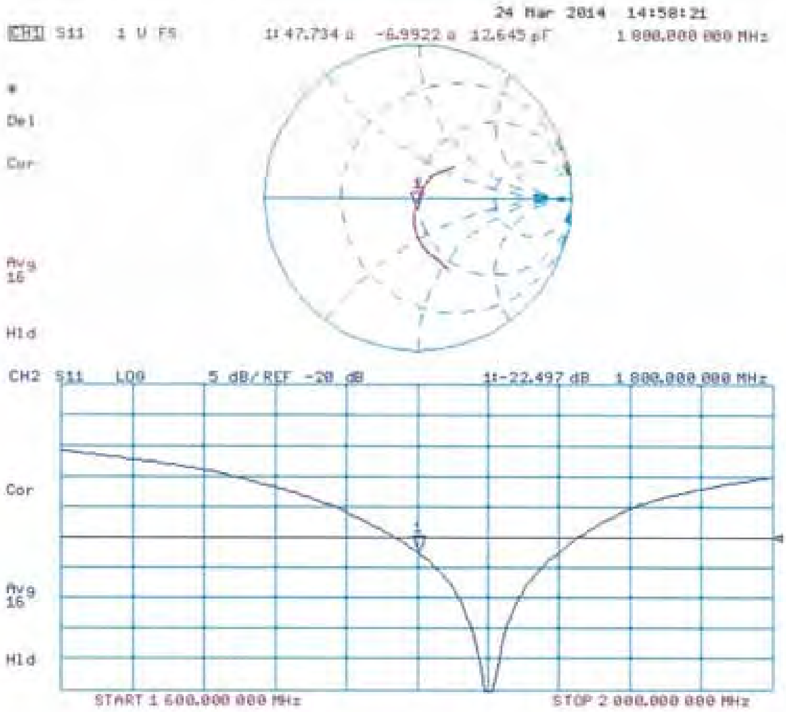
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.691 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 17.7 W/kg
SAR(1 g) = 9.6 W/kg; SAR(10 g) = 5.02 W/kg
Maximum value of SAR (measured) = 11.9 W/kg



0 dB = 11.9 W/kg = 10.76 dBW/kg

Certificate No: D1800V2-2d006_Mar14 Page 5 of 8

Impedance Measurement Plot for Head TSL



Certificate No: D1800V2-2d006_Mar14 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 24.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

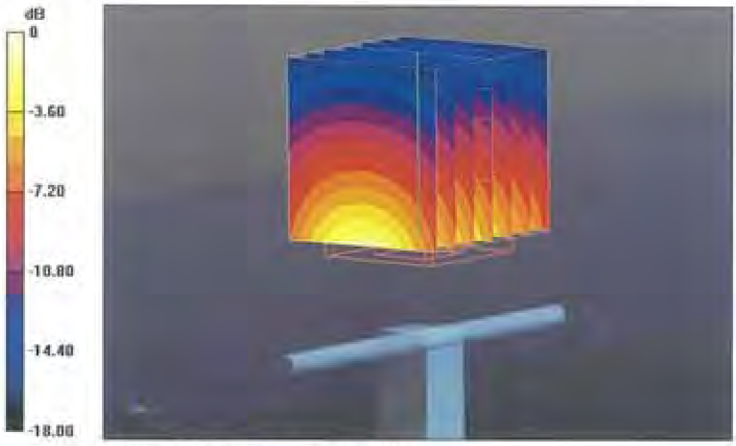
DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d006

Communication System: UID 0 - CW; Frequency: 1800 MHz
Medium parameters used: f = 1800 MHz; σ = 1.55 S/m; ε_r = 52.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.86, 4.86, 4.86); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

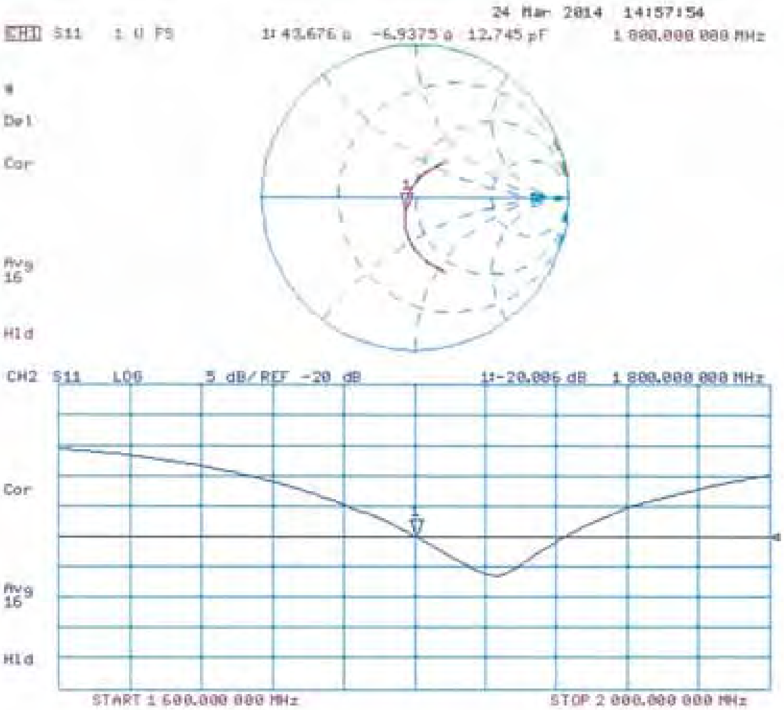
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.723 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 17.0 W/kg
SAR(1 g) = 9.67 W/kg; SAR(10 g) = 5.11 W/kg
Maximum value of SAR (measured) = 12.3 W/kg



0 dB = 12.3 W/kg = 10.90 dBW/kg

Certificate No: D1800V2-2d006_Mar14 Page 7 of 8

Impedance Measurement Plot for Body TSL



Certificate No: D1800V2-2d006_Mar14 Page 8 of 8

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Accreditation No.: **SCS 108**

Client **HCT (Dymstec)**

Certificate No: **D1900V2-5d061_Jul14**

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d061
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date	July 23, 2014

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	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: July 23, 2014

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Certificate No: D1900V2-5d061_Jul14 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 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
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) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

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: D1900V2-5d061_Jul14 Page 2 of 8

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
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	39.5 ± 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	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.2 W/kg ± 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	52.5 ± 6 %	1.51 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	10.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.39 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.1 Ω + 6.2 jΩ
Return Loss	- 24.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.2 Ω + 7.0 jΩ
Return Loss	- 22.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.193 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 10, 2004

DASY5 Validation Report for Head TSL

Date: 23.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

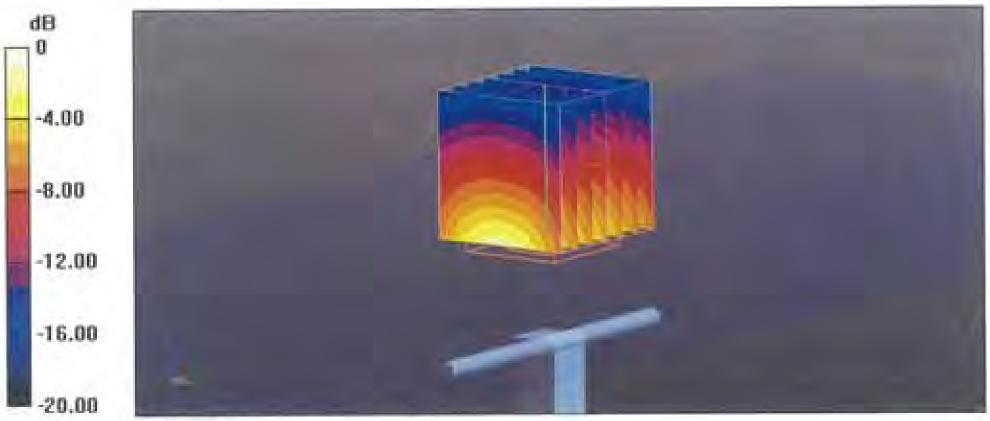
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d061

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 S/m; ε_r = 39.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.06, 5.06, 5.06); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

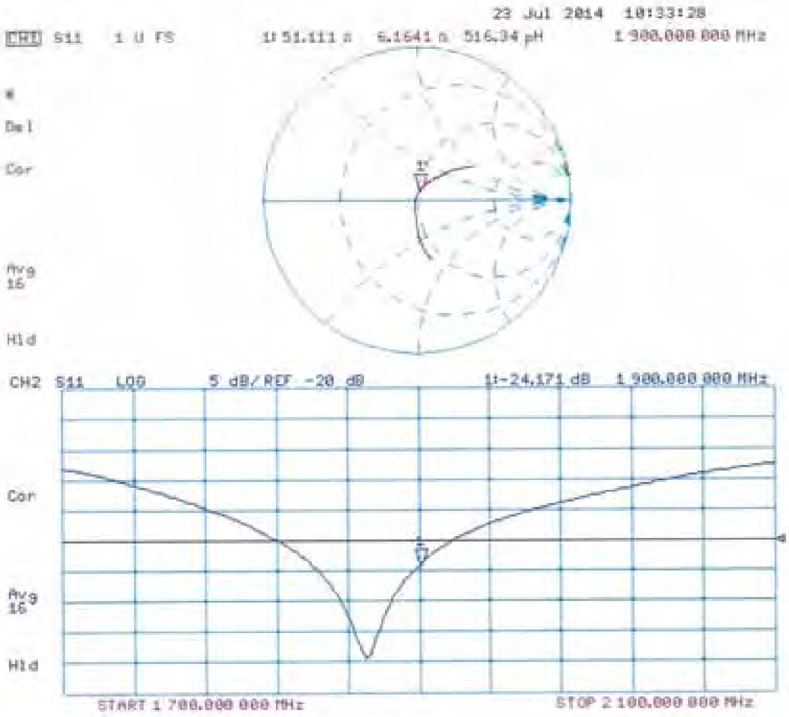
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.40 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 18.6 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.29 W/kg
Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 11.11 dBW/kg

Certificate No: D1900V2-5d061_Jul14 Page 5 of 8

Impedance Measurement Plot for Head TSL



Certificate No: D1900V2-5d061_Jul14 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 23.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

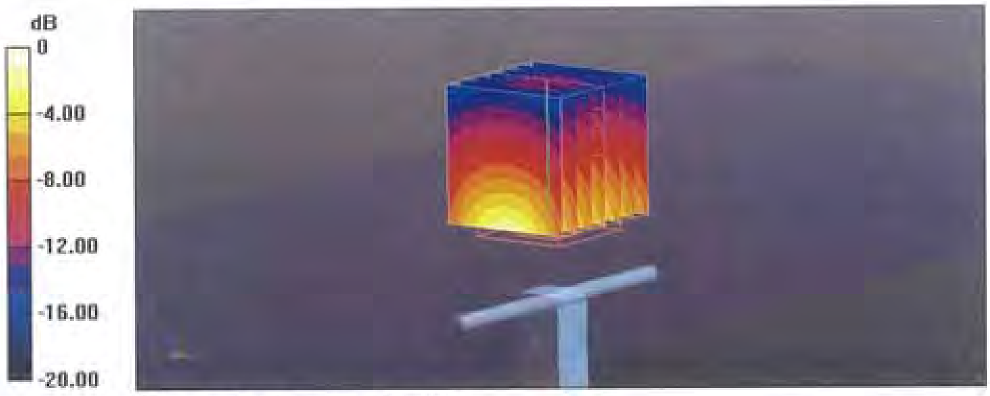
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d061

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.51 S/m; ε_r = 52.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

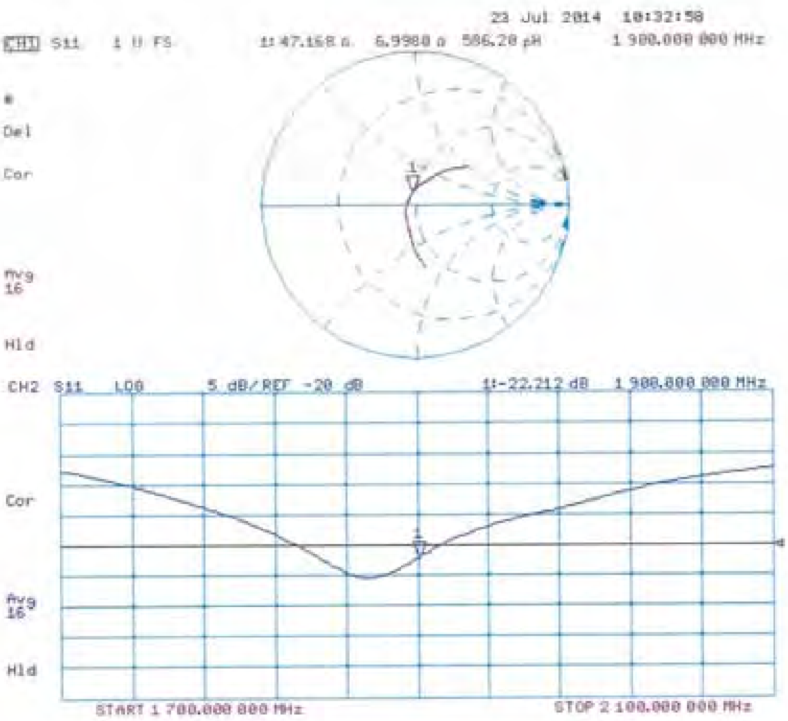
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.22 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 17.8 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.39 W/kg
Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 11.11 dBW/kg

Certificate No: D1900V2-5d061_Jul14 Page 7 of 8

Impedance Measurement Plot for Body TSL



Certificate No: D1900V2-5d061_Jul14 Page 8 of 8

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Accreditation No.: **SCS 108**

Client **HCT (Dymstec)**

Certificate No: **D2450V2-743_Jul14**

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 743

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: July 24, 2014

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	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 25, 2014

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Certificate No: D2450V2-743_Jul14 Page 1 of 8

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S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) Accreditation No.: **SCS 108**
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

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 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
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) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

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	V52.8.8
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	37.8 ± 6 %	1.85 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	13.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**53.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.8 W/kg ± 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	50.6 ± 6 %	2.03 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	13.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.9 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.2 Ω + 4.5 jΩ
Return Loss	- 25.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.8 Ω + 6.3 jΩ
Return Loss	- 24.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.160 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: 24.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma = 1.85$ S/m; $\varepsilon_r = 37.8$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

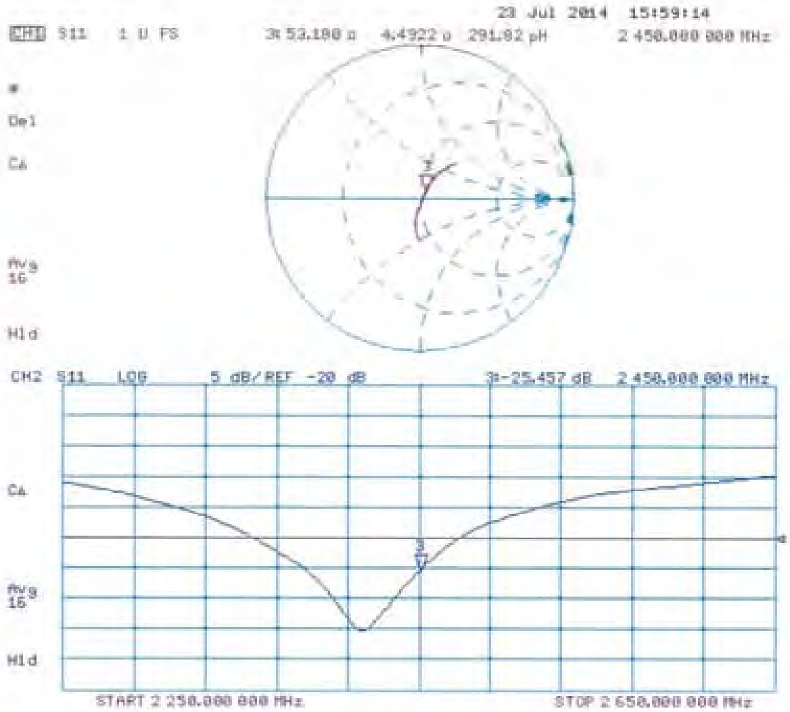
- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 102.3 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 28.0 W/kg
SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.28 W/kg
Maximum value of SAR (measured) = 17.8 W/kg

0 dB = 17.8 W/kg = 12.50 dBW/kg

Certificate No: D2450V2-743_Jul14 Page 5 of 8

Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 16.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

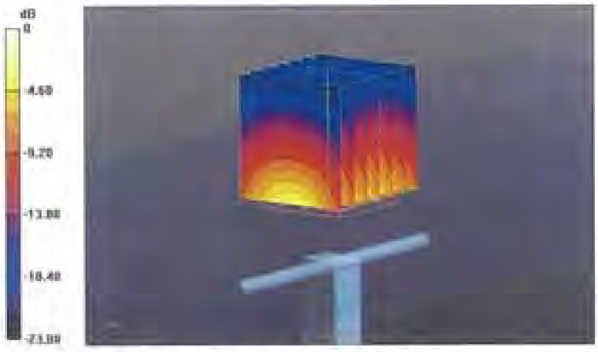
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 743

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 50.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 95.80 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 27.7 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.07 W/kg
Maximum value of SAR (measured) = 17.5 W/kg



0 dB = 17.5 W/kg = 12.43 dBW/kg

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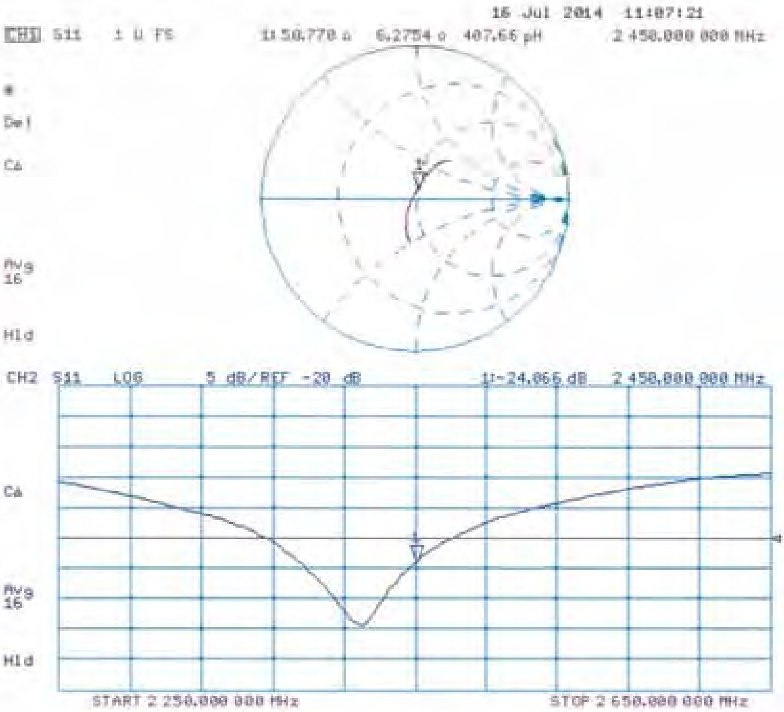
Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client HCT (Dymstec)

Certificate No: D2600V2-1015_Apr14

CALIBRATION CERTIFICATE

Object: D2600V2 - SN: 1015

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: April 23, 2014

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	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: April 23, 2014

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Certificate No: D2600V2-1015_Apr14 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 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
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) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

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: D2600V2-1015_Apr14 Page 2 of 8

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.7 ± 6 %	1.98 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	14.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**57.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.51 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.8 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.2 ± 6 %	2.19 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	14.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**55.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.7 W/kg ± 16.5 % (k=2)**

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.1 Ω - 3.2 jΩ
Return Loss	- 29.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.6 Ω - 2.0 jΩ
Return Loss	- 27.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.150 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	October 30, 2007

DASY5 Validation Report for Head TSL

Date: 23.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

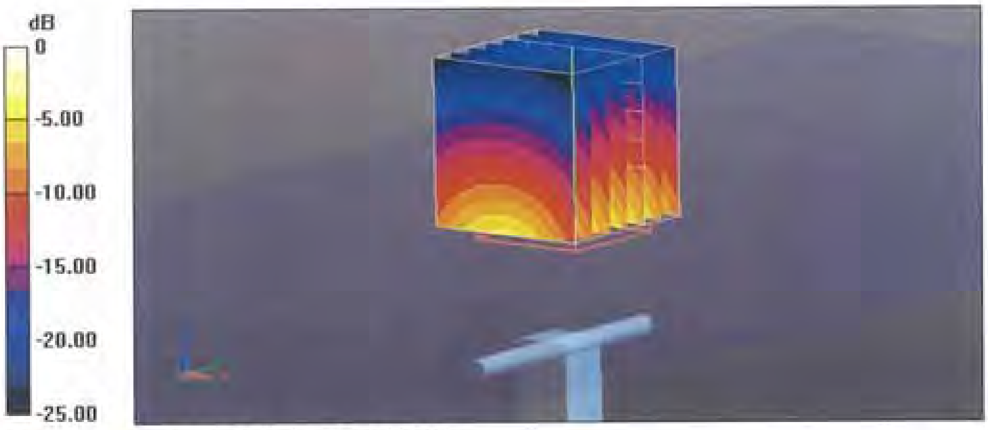
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1015

Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 1.98 S/m; ε_r = 37.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.46, 4.46, 4.46); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

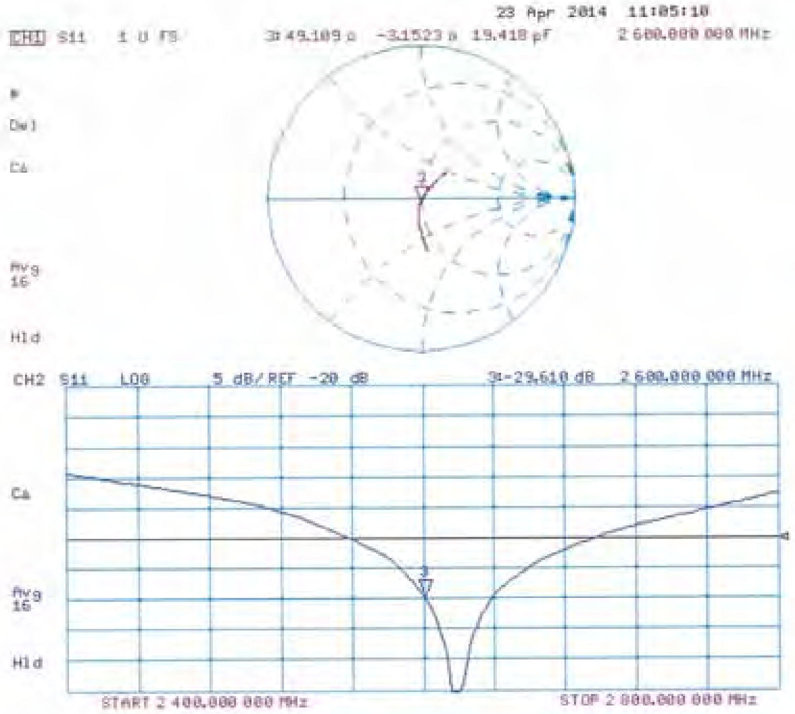
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.6 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 31.2 W/kg
SAR(1 g) = 14.6 W/kg; SAR(10 g) = 6.51 W/kg
Maximum value of SAR (measured) = 19.2 W/kg



0 dB = 19.2 W/kg = 12.83 dBW/kg

Certificate No: D2600V2-1015_Apr14 Page 5 of 8

Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1015_Apr14 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 23.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

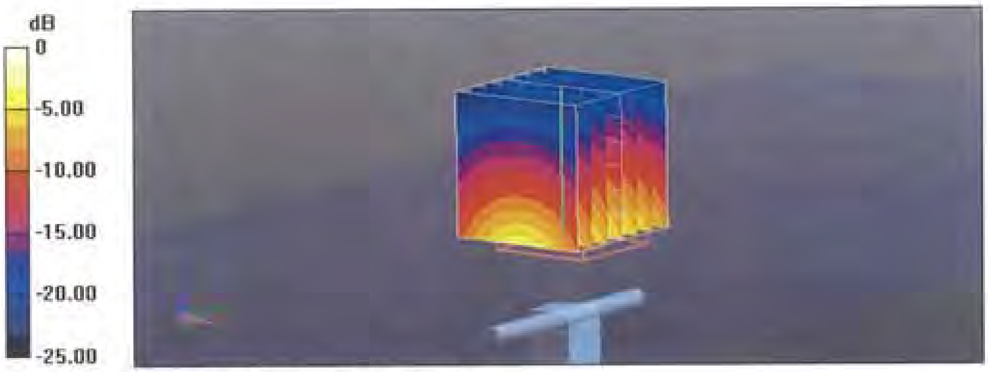
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1015

Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.19 S/m; ε_r = 50.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.24, 4.24, 4.24); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

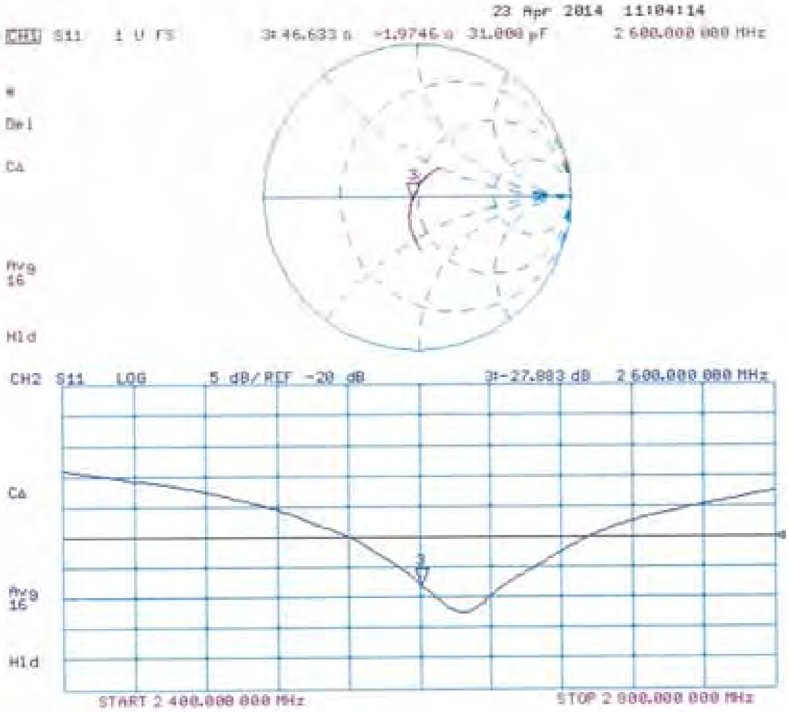
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.718 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 30.7 W/kg
SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.25 W/kg
Maximum value of SAR (measured) = 18.9 W/kg



0 dB = 18.9 W/kg = 12.76 dBW/kg

Certificate No: D2600V2-1015_Apr14 Page 7 of 8

Impedance Measurement Plot for Body TSL



Certificate No: D2600V2-1015_Apr14 Page 8 of 8