



## TEST REPORT

### FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01)

Report Reference No.....: TRE13070101 R/C: 43159

FCC ID.....: 2AALJ-TMED

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Date of issue.....: July 29, 2013

Representative Laboratory Name ..: Shenzhen Huatongwei International Inspection Co., Ltd

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Applicant's name.....: TMED LLC

Address.....: 10 Wingate Way, Green Brook, NEW JERSEY, 08812, USA

#### Test specification:

Standard .....: ANSI C95.1-1999

FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01)

47CFR § 2.1093

TRF Originator.....: Shenzhen Huatongwei International Inspection CO., Ltd

Master TRF.....: Dated 2006-06

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Test item description .....: Tablet PC

Trade Mark .....: Health

Manufacturer .....: TMED LLC

Model/Type reference.....: TMED7000

Listed Models .....: /

WLAN:From 2412MHz to 2462MHz

Operation Frequency.....: GSM850:From 824MHz to 849MHz/PCS1900:From 1850MHz to 1910MHz

Modulation Type .....: WLAN:CCK,OFDM/GSM:GMSK

GPRS Multi-slot Class .....: GPRS: Multi-slot 12

Result.....: Positive

**TEST REPORT**

<b>Test Report No. :</b>	<b>TRE13070101</b>	July 29, 2013 Date of issue
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Equipment under Test : Tablet PC

Model /Type : TMED7000

Listed Models : /

**Applicant** : **TMED LLC**

Address : 10 Wingate Way, Green Brook, NEW JERSEY, 08812,  
USA

**Manufacturer** : **TMED LLC**

Address : 10 Wingate Way, Green Brook, NEW JERSEY, 08812,  
USA

<b>Test Result</b> according to the standards on page 4:	<b>Positive</b>
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The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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## 1. TEST STANDARDS

The tests were performed according to following standards:

[IEEE Std C95.1, 1999](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz.

[IEEE Std 1528™-2003](#): IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

[SUPPLEMENT C Edition 01-01 to OET BULLETIN 65 Edition 97-01 June 2001 including DA 02-1438 June 19, 2002](#): Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields Additional Information for Evaluation Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions.

[KDB 447498 D01 Mobile Portable RF Exposure v05r01](#): Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

[KDB 616217 D04 SAR for laptop and tablets v01](#): SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers

[KDB 941225 D04 v01](#): SAR for GSM E GPRS Dual Xfer Mode

## 2. SUMMARY

### 2.1. General Remarks

Date of receipt of test sample	:	July 25, 2013
Testing commenced on	:	July 25, 2013
Testing concluded on	:	July 29, 2013

### 2.2. Product Description

The TMED LLC's Model: TMED7000 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

Name of EUT	Tablet PC
Model Number	TMED7000
Modulation Type	CCK,OFDM for WLAN/GMSK for GSM
Antenna Type	Internal
GPRS Multi-slot Class	GPRS: Multi-slot 12
Operation Frequency	WLAN:2412MHz to 2462MHz GSM850: 824MHz to 849MHz/PCS1900:1850Mhz to 1910MHz
WLAN	Supported 802.11b/802.11g/802.11n
Bluetooth	Supported BDR/EDR
Maximum SAR Values	1.232 W/Kg

### Description of the test mode

IEEE 802.11b/g/n: Eleventh channels are provided to the EUT.

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	<b>2412</b>	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	<b>11</b>	<b>2462</b>
5	2432	12	2467
<b>6</b>	<b>2437</b>	13	2472
7	2442		

Frequency Band	Test Channel	Test Frequency
GSM850/GPRS850	Low (128)	824.20 MHz
	Middle (189)	836.60 MHz
	High (251)	848.80 MHz
PCS1900/GPRS1900	Low (512)	1850.20 MHz
	Middle (661)	1880.00 MHz
	High (810)	1909.80 MHz

### 2.3. Equipment under Test

#### Power supply system utilised

Power supply voltage	:	<input type="radio"/>	120V / 60 Hz	<input type="radio"/>	115V / 60Hz
		<input type="radio"/>	12 V DC	<input type="radio"/>	24 V DC
		<input checked="" type="radio"/>	Other (specified in blank below)		

DC 3.70 V

## 2.4. Short description of the Equipment under Test (EUT)

Tablet PC (Model: TMED7000).

The EUT battery must be fully charged and checked periodically during the test to ascertain maximum power output.

## 2.5. EUT operation mode

The EUT has been tested under typical operating condition and The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

## 2.6. EUT configuration

**The following peripheral devices and interface cables were connected during the measurement:**

- supplied by the manufacturer

- supplied by the lab

<input type="radio"/>	Power Cable	Length (m) :	/
		Shield :	/
		Detachable :	/
<input type="radio"/>	Multimeter	Manufacturer :	/
		Model No. :	/

**Battery:** Model: PL357090  
Output: DC 3.7V 3000mAh

## 2.7. Note

The EUT is a Tablet PC with GSM,WLAN and Bluetooth function ,The functions of the EUT listed as below:

Function	Test Standards	Reference Report
SAR	OET 65	TRE13070101

### **3. TEST ENVIRONMENT**

#### **3.1. Address of the test laboratory**

Shenzhen Huatongwei International Inspection Co., Ltd  
Keji Nan No.12 Road, Hi-tech Park, Shenzhen, China  
Phone: 86-755-26715686 Fax: 86-755-26748089

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2009) and CISPR Publication 22.

#### **3.2. Test Facility**

The test facility is recognized, certified, or accredited by the following organizations:

##### **CNAS-Lab Code: L1225**

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories, Date of Registration: Mar. 29, 2012. Valid time is until Feb. 28, 2015.

##### **A2LA-Lab Cert. No. 2243.01**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing. Valid time is until Sept. 30, 2013.

##### **FCC-Registration No.: 662850**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 662850, Renewal date June. 01, 2012, valid time is until June. 01, 2015.

##### **IC-Registration No.: 5377A**

The 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377A on Jan. 25, 2011, valid time is until Jan. 24, 2014.

##### **ACA**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

##### **VCCI**

The 3m Semi-anechoic chamber (12.2m×7.95m×6.7m) and Shielded Room (8m×4m×3m) of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-292. Date of Registration: Dec. 24, 2010. Valid time is until Dec. 23, 2013.

Main Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: C-2726. Date of Registration: Dec. 20, 2012. Valid time is until Dec. 19, 2015.

Telecommunication Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: T-1837. Date of Registration: May 07, 2013. Valid time is until May 06, 2016.

##### **DNV**

Shenzhen Huatongwei International Inspection Co., Ltd. has been found to comply with the requirements of DNV towards subcontractor of EMC and safety testing services in conjunction with the EMC and Low voltage Directives and in the voluntary field. The acceptance is based on a formal quality Audit and follow-ups

according to relevant parts of ISO/IEC Guide 17025 (2005), in accordance with the requirements of the DNV Laboratory Quality Manual towards subcontractors. Valid time is until Aug. 24, 2013.

### 3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	18-25 ° C
Humidity:	40-65 %
Atmospheric pressure:	950-1050mbar

### 3.4. SAR Limits

FCC Limit (1g Tissue)

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1 g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

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

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

### 3.5. Equipments Used during the Test

Test Equipment	Manufacturer	Type/Model	Serial Number	Calibration	
				Last Calibration	Calibration Interval
Data Acquisition Electronics DAEx	SPEAG	DAE4	1315	2013.2.27	1
E-field Probe	SPEAG	ES3DV3	3292	2013.2.24	1
System Validation Dipole 835V2	SPEAG	D835V2	4d134	2013.2.27	1
System Validation Dipole 1900V2	SPEAG	D1900V2	Sd150	2013.2.28	1
System Validation Dipole D2450V2	SPEAG	D2450V2	884	2013.2.29	1
Network analyzer	Agilent	8753E	US37390562	2012.10.27	1
Signal generator	IFR	2032	203002/100	2012.10.27	1
Amplifier	AR	75A250	302205	2012.10.27	1

## **4. SAR Measurements System configuration**

### **4.1. SAR Measurement Set-up**

The DASY5 system for performing compliance tests consists of the following items:

A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).

A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

A unit to operate the optical surface detector which is connected to the EOC.

The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.

The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003.

DASY5 software and SEMCAD data evaluation software.

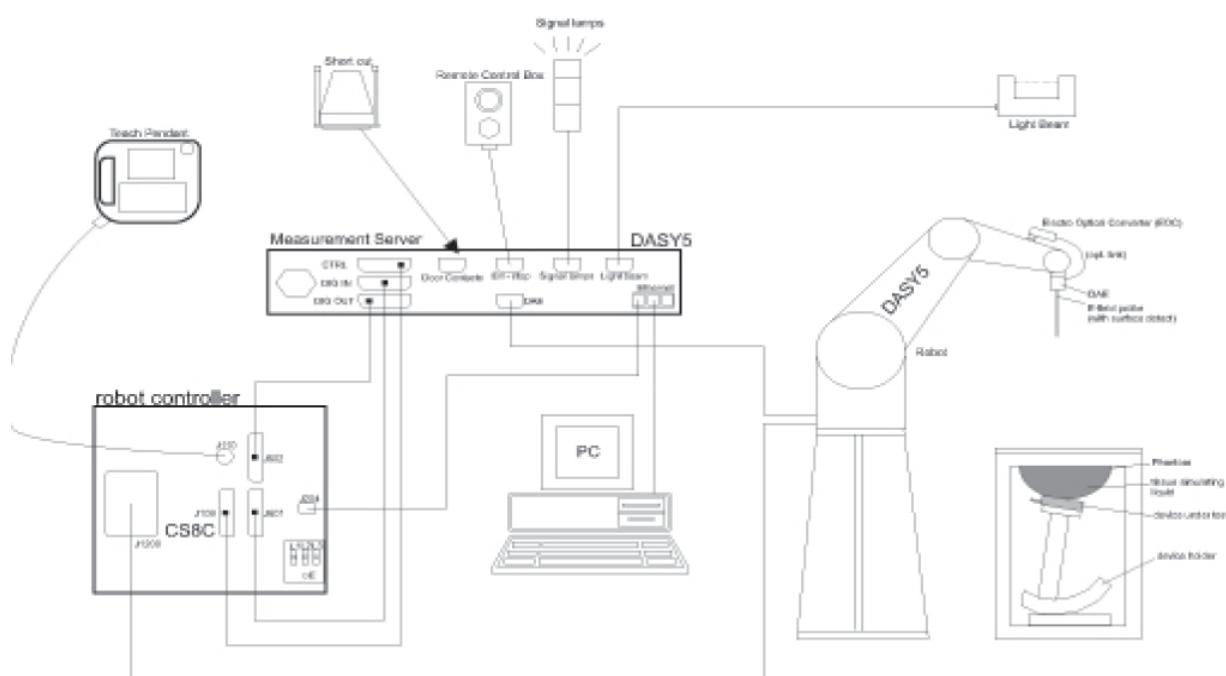
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

The generic twin phantom enabling the testing of left-hand and right-hand usage.

The device holder for handheld mobile phones.

Tissue simulating liquid mixed according to the given recipes.

System validation dipoles allowing to validate the proper functioning of the system.



## 4.2. DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe ES3DV3 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

### Probe Specification

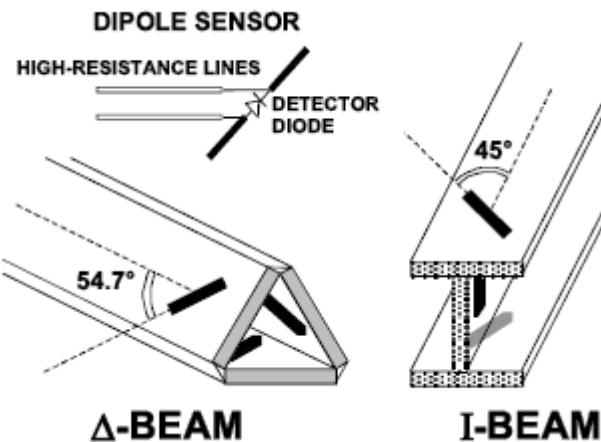
Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	10 MHz to 4 GHz; Linearity: $\pm 0.2$ dB (30 MHz to 4 GHz)
Directivity	$\pm 0.2$ dB in HSL (rotation around probe axis) $\pm 0.3$ dB in tissue material (rotation normal to probe axis)
Dynamic Range	5 $\mu$ W/g to > 100 mW/g; Linearity: $\pm 0.2$ dB
Dimensions	Overall length: 337 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
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI



### Isotropic E-Field Probe

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



### 4.3. Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm). System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.



SAM Twin Phantom

### 4.4. Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the DASY system.

The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.



Device holder supplied by SPEAG

## 4.5. Scanning Procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max.  $\pm 5\%$ .

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above  $\pm 0.1\text{mm}$ ). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe (It does not depend on the surface reflectivity or the probe angle to the surface within  $\pm 30^\circ$ .)

### Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing of 15 mm x 15 mm is set. During the scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

### Zoom Scan

Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

### Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard’s method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation.

Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard’s method for extrapolation. For a grid using 7x7x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x7 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

## 4.6. Data Storage and Evaluation

### Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DA4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm<sup>2</sup>], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

### Data Evaluation

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	Normi, ai0, ai1, ai2
	- Conversion factor	ConvFi
	- Diode compression point	Dcp <i>i</i>
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

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 as:

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

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

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

$$E - \text{fieldprobes} : \quad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$H - \text{fieldprobes} : \quad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

With  $V_i$  = compensated signal of channel  $i$  ( $i = x, y, z$ )  
 $Norm_i$  = sensor sensitivity of channel  $i$  ( $i = x, y, z$ )  
 $[mV/(V/m)^2]$  for E-field Probes  
 $ConvF$  = sensitivity enhancement in solution  
 $a_{ij}$  = sensor sensitivity factors for H-field probes  
 $f$  = carrier frequency [GHz]  
 $E_i$  = electric field strength of channel  $i$  in V/m  
 $H_i$  = magnetic field strength of channel  $i$  in A/m

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

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

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

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

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

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

#### 4.7. Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (s/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

IEEE SCC-34/SC-2 P1528 Recommended Tissue Dielectric Parameters

Frequency (MHz)	Head Tissue		Body Tissue	
	$\epsilon_r$	$\sigma$ (S/m)	$\epsilon_r$	$\sigma$ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

#### 4.8. Tissue equivalent liquid properties

Dielectric performance of Body tissue simulating liquid

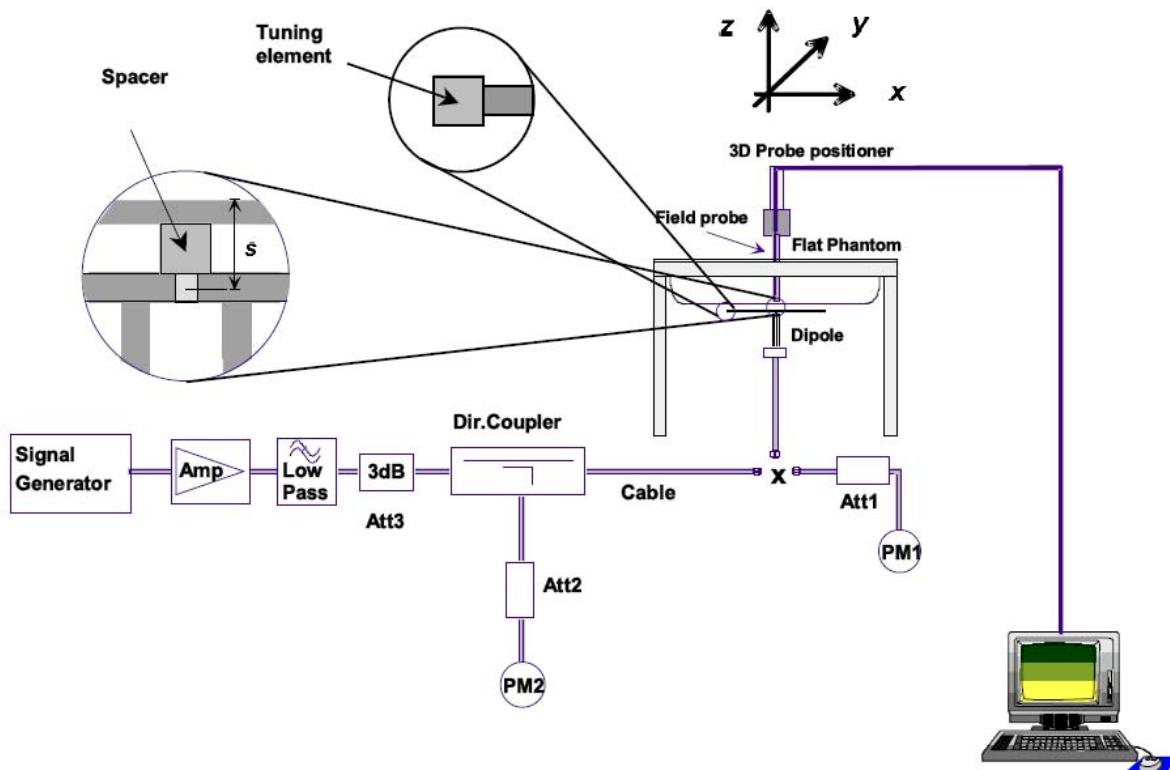
Frequency	Description	Dielectric parameters	
		$\epsilon_r$	$\sigma$
835MHz(Body)	Target Value $\pm 5\%$	56.1 (53.30-58.91)	0.95 (0.90-1.00)
	Measurement Value 2013-07-26	56.00	0.96
1900MHz(Body)	Target Value $\pm 5\%$	54.00 (51.30-56.70)	1.45 (1.38-1.52)
	Measurement Value 2013-07-26	52.60	1.49
2450MHz(Body)	Target Value $\pm 5\%$	52.70 (50.07-55.33)	1.95 (1.85-2.05)
	Measurement Value 2013-07-25	51.61	1.92

#### 4.9. System Check

The purpose of the system check is to verify that the system operates within its specifications at the device test frequency. The system check is simple check of repeatability to make sure that the system works correctly at the time of the compliance test;

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system ( $\pm 10\%$ ).

System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.



The output power on dipole port must be calibrated to 24 dBm (250mW) before dipole is connected.

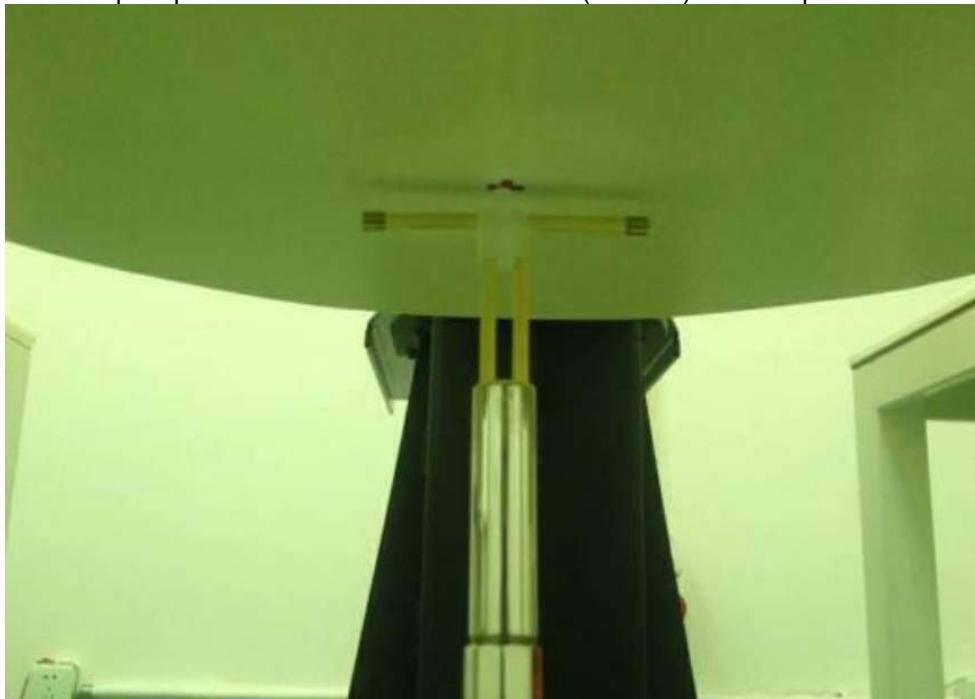


Photo of Dipole Setup

#### System Validation of Body

Measurement is made at temperature 22.0 °C and relative humidity 55%.

Measurement is made at temperature 22.0 °C and relative humidity 55%.

Measurement Date: 2450 MHz July 25<sup>th</sup>, 2013, 835 MHz July 26<sup>th</sup>, 2013, 1900 MHz July 26<sup>th</sup>, 2013

Verification results	Frequency (MHz)	Target value (W/kg)		Measured value (W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
	835	1.60	2.44	1.62	2.48	1.25%	1.64%
	1900	5.32	10.20	5.43	10.47	2.07%	1.24%
	2450	5.98	12.80	6.20	13.80	3.68%	8.42%

#### 4.10. SAR measurement procedure

The SAR test was carried out as follow:

The EUT was controlled to operate in 802.11b mode in channel 1 with the maximum output power.

After an area scan has been done at a fixed distance of 8mm from the surface of the phantom on the source side, a 3D scan is set up around the location of the maximum spot SAR. First, a point within the scan area is visited by the probe and a SAR reading taken at the start of testing. At the end of testing, the probe is returned to the same point and a second reading is taken. Comparison between these start and end readings enables the power drift during measurement to be assessed.

Above is the scanning procedure flow chart and table from the IEEEp1528 standard. This is the procedure for which all compliant testing should be carried out to ensure that all variations of the device position and transmission behaviour are tested.

The same procedure should be also executed for 802.11b in channel 6 and 11, and the mode 802.11g, 802.11n-20MHz and 802.11n-40MHz in bottom channel, middle channel and top channel, respectively.

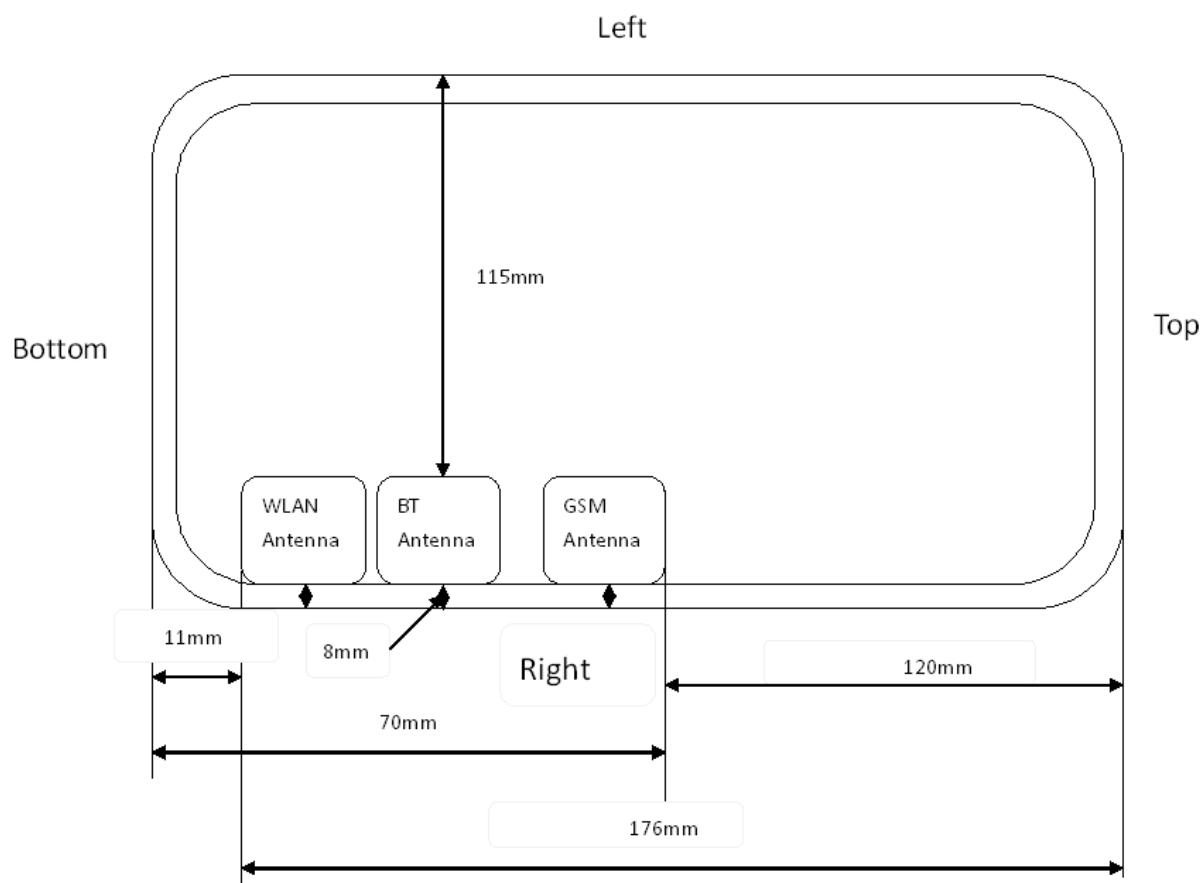
The same procedure should be also for GSM850 and PCS1900.

#### Transmitting antenna information

There's WLAN with only one antenna inside the EUT, and it is the transmitting source. The following pictures showed the diagonal dimension (22.0cm>20cm) of the EUT and position of the antenna:



Diagonal dimension of the display



Position of the antennas

**GSM850 and PCS1900(GPRS) Test Configuration**

SAR test for GSM 850/1900, a communication link is set up with a system simulator by air link. Using CMU200 the power level is set to “5” in SAR of GSM850, set to “0” in SAR of GSM 1900, The tests in the band of GSM850/1900 are performed in the mode of voice and data transfer function.

The EUT should be tested under the following positions according to KDB 941225 and KDB447498:

- (1) Back side: the back side of the EUT towards and contacted to the phantom.
- (2) Bottom side: SAR test was required. Beacuse the distance between GSM antenna and Bottom side was 70mm,maximum avager output power (including tune-up tolerance)  $24.99\text{dBm} > 24.39\text{dBm}(275\text{mW})$ ,according KDB447498 Appendix B SAR test exclusion power thresholds.
- (3) Left side: SAR test was not required. Beacuse the distance between GSM antenna and Left side was 115mm,maximum average output power (including tune-up tolerance)  $24.99\text{dBm} < 26.97\text{dBm}(498\text{mW})$ ,according KDB447498 Appendix B SAR test exclusion power thresholds.
- (4) Top side:SAR test was not required. Beacuse the distance between GSM antenna and Top side was 120mm,maximum average output power (including tune-up tolerance)  $24.99\text{dBm} < 27.743\text{dBm}(554\text{mW})$ ,according KDB447498 Appendix B SAR test exclusion power thresholds.
- (5) Right Side: SAR test was required. Beacuse the distance between GSM antenna and Right side was 8mm,maximum average output power (including tune-up tolerance) $24.99\text{dBm} > 12.04\text{dBm}(16\text{mW})$ ,according KDB447498 Appendix B SAR test exclusion power thresholds.
- (6). Front Side: SAR test was not required.
- (7). The 3/4/5/6 positions are not the most conservative antenna - to – user distance at edge mode. According to KDB 447498 4) ii) (2) –SAR is required only the edge with the most conservative exposure conditions, No SAR)

**WLAN Test Configuration**

The EUT should be tested under the following positions according to KDB 616217 and KDB447498:

- (8).Back side: the back side of the EUT towards and contacted to the phantom.
- (9).Bottom side: SAR test was required. Beacuse the distance between WLAN antenna and Bottom side was 11mm,maximum average output power (including tune-up tolerance) $17\text{dBm} > 12.78\text{dBm}(19\text{mW})$ ,according KDB447498 Appendix B SAR test exclusion power thresholds.
- (10).Left side: SAR test was not required. Beacuse the distance between WLAN antenna and Left side was 115mm,maximum output power (including tune-up tolerance)  $17\text{dBm} < 28.42\text{dBm}(696\text{mW})$ ,according KDB447498 Appendix B SAR test exclusion power thresholds.
- (11).Top side:SAR test was not required. Beacuse the distance between WLAN antenna and Top side was 176mm,maximum output power (including tune-up tolerance)  $17\text{dBm} < 31.13\text{dBm}(1296\text{mW})$ ,according KDB447498 Appendix B SAR test exclusion power thresholds.
- (12).Right Side: SAR test was required. Beacuse the distance between WLAN antenna and Right side was 7mm,maximum output power (including tune-up tolerance) $17\text{dBm} > 10\text{dBm}(10\text{mW})$ ,according KDB447498 Appendix B SAR test exclusion power thresholds.
- (13).Front Side: SAR test was not required.
- (14).The 10/11/12 positions are not the most conservative antenna - to – user distance at edge mode. According to KDB 447498 4) ii) (2) –SAR is required only the edge with the most conservative exposure conditions, No SAR)
- (15).According to KDB248227 SAR is not required for 802.11g channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

**Bluetooth Test Configuration**

The max peak ouput power is 1.86dBm.So meet KDB447498 Appendix B SAR test exclusion power thresholds.

## 5. TEST CONDITIONS AND RESULTS

### 5.1. Conducted Power Results

Max Conducted power measurement results and power drift from tune-up tolerance provide by manufacturer:

#### ***Conducted power measurement results:***

##### **WLAN**

Mode	Channel	Frequency (MHz)	Worst case Data rate of worst case	Conducted Output Power (dBm)	
				Peak	Average
802.11b	1	2412	1Mbps	16.73	14.32
	6	2437	1Mbps	16.43	14.28
	11	2442	1Mbps	16.70	14.36
802.11g	1	2412	6Mbps	13.57	10.12
	6	2437	6Mbps	12.66	10.56
	11	2442	6Mbps	13.21	10.63
802.11n(20MHz)	1	2412	6.5 Mbps	11.35	9.28
	6	2437	6.5 Mbps	10.99	9.15
	11	2442	6.5 Mbps	10.85	9.03
802.11n(40MHz)	3	2422	13.5 Mbps	9.67	7.45
	6	2437	13.5 Mbps	9.88	7.58
	9	2452	13.5 Mbps	9.41	7.32

##### **Bluetooth**

Mode	Channel	Frequency (MHz)	Conducted Output Power (dBm)	
			Peak	Average
GFSK	0	2402	1.86	1.77
	41	2441	1.83	1.74
	79	2480	1.81	1.72
$\pi/4$ DQPSK	0	2402	0.74	0.70
	40	2441	0.71	0.68
	79	2480	0.69	0.65
8DPSK	0	2402	0.81	0.75
	40	2441	0.77	0.72
	79	2480	0.75	0.70

#### ***Manufacturing tolerance (Average power)***

802.11b			
Test Channel	Channel 1	Chaanel 6	Channel 11
Target (dBm)	13.50	13.50	13.50
Tolerance $\pm$ (dB)	1.00	1.00	1.00
802.11g			
Target (dBm)	10.00	10.00	10.00
Tolerance $\pm$ (dB)	1.00	1.00	1.00
802.11n(20MHz)			
Target (dBm)	8.50	8.50	8.50
Tolerance $\pm$ (dB)	1.00	1.00	1.00
802.11n(40MHz)			
Target (dBm)	7.00	7.00	7.00
Tolerance $\pm$ (dB)	1.00	1.00	1.00

Remark:1.Power tested at difference data rate and record worst case at each data rate.

2. According to maximum output power and power drift from tune-up tolerance,we only tested 802.11b mode .

**For GSM**

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMU200) to ensure the maximum power transmission and proper modulation. This result contains conducted output power for the EUT. In all cases, the measured peak output power should be greater and within 5% than EMI measurement.

***The conducted power measurement results for GSM850/DCS1900***

Band	Test Channel	Frequency (MHz)	Conducted Output Power (dBm)
GSM 850	128	824.20	31.53
	190	836.60	31.49
	251	848.80	31.44
PCS1900	512	1850.20	28.51
	661	1880.00	28.47
	810	1909.80	28.45

***The conducted power measurement results for GPRS***

GPRS 850	Measured Power (dBm)			Calculation (dB)	Averaged Power (dBm)		
	824.20 MHz	836.60 MHz	848.80 MHz		824.20 MHz	836.60 MHz	848.80 MHz
1 Txslot	30.78	30.74	30.71	-9.03	21.75	21.71	21.68
2 Txslot	29.26	29.23	29.21	-6.02	23.24	23.21	23.19
3 Txslot	28.11	28.07	28.04	-4.26	23.85	23.81	23.78
<b>4 Txslot</b>	<b>27.87</b>	<b>27.85</b>	<b>27.81</b>	<b>-3.01</b>	<b>24.86</b>	<b>24.84</b>	<b>24.80</b>
GPRS 1900	Measured Power (dBm)			Calculation (dB)	Averaged Power (dBm)		
	1850.20 MHz	1880.00 MHz	1909.80 MHz		1850.20 MHz	1880.00 MHz	1909.80 MHz
1 Txslot	28.27	28.25	28.21	-9.03	19.24	19.22	19.18
2 Txslot	27.49	27.47	27.43	-6.02	21.47	21.45	21.41
3 Txslot	25.36	25.32	25.29	-4.26	21.10	21.06	21.03
<b>4 Txslot</b>	<b>25.31</b>	<b>25.27</b>	<b>25.24</b>	<b>-3.01</b>	<b>22.30</b>	<b>22.26</b>	<b>22.23</b>

**Note:**

## 1. Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

According to the conducted power as above, the body measurements are performed with 4Txslots for 850MHz and 4 Txslots for 1900MHz.

*Note: According to the KDB941225 D03, "when SAR tests for EDGE or EGPRS mode is necessary, GMSK modulation should be used".*

**Manufacturing tolerance****GSM Speech****GSM850**

Test Channel	Channel 1	Chaanel 6	Channel 11
Target (dBm)	32.00	32.00	32.00
Tolerance ±(dB)	1.00	1.00	1.00

**PCS1900**

Target (dBm)	28.00	28.00	28.00
Tolerance ±(dB)	1.00	1.00	1.00

**GPRS (GMSK Modulation)****GSM 850 GPRS**

Test Channel		251	190	128
1 Txslot	Target (dBm)	30.00	30.00	30.00
	Tolerance ±(dB)	1	1	1
2 Txslot	Target (dBm)	28.50	28.50	28.50
	Tolerance ±(dB)	1	1	1
3 Txslot	Target (dBm)	28.00	28.00	28.00
	Tolerance ±(dB)	1	1	1
4 Txslot	Target (dBm)	27.00	27.00	27.00
	Tolerance ±(dB)	1	1	1
<b>GSM 1900 GPRS</b>				
Test Channel		810	661	512
1 Txslot	Target (dBm)	28.50	28.50	28.50
	Tolerance ±(dB)	1	1	1
2 Txslot	Target (dBm)	27.50	27.50	27.50
	Tolerance ±(dB)	1	1	1
3 Txslot	Target (dBm)	25.50	25.50	25.50
	Tolerance ±(dB)	1	1	1
4 Txslot	Target (dBm)	24.50	24.50	24.50
	Tolerance ±(dB)	1	1	1

**5.2. SAR Measurement Result****SAR Values (GSM 850 MHz Band-Body)**

Test Frequency		Mode/Band	Test Configuration	Average SAR over1g(W/kg) (Including power drift)	Scaling Factor	Average SAR over1g(W/kg) (Including Power Drift and Scaling factor)	SAR limit 1g (W/kg)	Ref. Plot #
Channel	MHz							
190	836.60	GPRS 4TS	Back	0.500	1.03	0.515	1.60	1
128	824.20	GPRS 4TS	Back	<b>0.919</b>	<b>1.04</b>	<b>0.956</b>	1.60	2
251	848.80	GPRS 4TS	Back	0.482	1.05	0.506	1.60	3
190	836.60	GPRS 4TS	Bottom	0.494	1.03	0.509	1.60	4
128	824.20	GPRS 4TS	Bottom	0.728	1.04	0.757	1.60	5
251	848.80	GPRS 4TS	Bottom	0.365	1.05	0.383	1.60	6
190	836.60	GPRS 4TS	Right	0.205	1.03	0.211	1.60	7
128	824.20	GPRS 4TS	Right	0.398	1.04	0.414	1.60	8
251	848.80	GPRS 4TS	Right	0.105	1.05	0.110	1.60	9

**SAR Values (GSM 1900 MHz Band-Body)**

Test Frequency		Mode/Band	Test Configuration	Average SAR over1g(W/kg) (Including power drift)	Scaling Factor	Average SAR over1g(W/kg) (Including Power Drift and Scaling factor)	SAR limit 1g (W/kg)	Ref. Plot #
Channel	MHz							
512	1850.20	GPRS 4TS	Back	0.359	1.05	0.377	1.60	10
661	1880.00	GPRS 4TS	Back	<b>0.622</b>	<b>1.06</b>	<b>0.659</b>	1.60	11
810	1909.80	GPRS 4TS	Back	0.284	1.07	0.304	1.60	12
512	1850.20	GPRS 4TS	Bottom	0.341	1.05	0.358	1.60	13
661	1880.00	GPRS 4TS	Bottom	0.589	1.06	0.624	1.60	14
810	1909.80	GPRS 4TS	Bottom	0.247	1.07	0.264	1.60	15
512	1850.20	GPRS 4TS	Right	0.199	1.05	0.209	1.60	16
661	1880.00	GPRS 4TS	Right	0.322	1.06	0.341	1.60	17
810	1909.80	GPRS 4TS	Right	0.111	1.07	0.119	1.60	18

**SAR Values (WLAN2450 Band-Body)**

Test Frequency		Mode/Band	Test Configuration	Average SAR over1g(W/kg) (Including power drift)	Scaling Factor	Average SAR over1g(W/kg) (Including Power Drift and Scaling factor)	SAR limit 1g (W/kg)	Ref. Plot #
Channel	MHz							
1	2412	Body- worn	Back	0.225	1.05	0.236	1.60	19
6	2437	Body- worn	Back	<b>0.315</b>	<b>1.06</b>	<b>0.334</b>	1.60	20
11	2462	Body- worn	Back	0.112	1.04	0.116	1.60	21
1	2412	Body- worn	Bottom	0.224	1.05	0.235	1.60	22
6	2437	Body- worn	Bottom	0.261	1.06	0.277	1.60	23
11	2462	Body- worn	Bottom	0.108	1.04	0.112	1.60	24
1	2412	Body- worn	Right	0.056	1.05	0.059	1.60	25
6	2437	Body- worn	Right	0.096	1.06	0.102	1.60	26
11	2462	Body- worn	Right	0.043	1.04	0.045	1.60	27

**Evaluation for Simultaneous SAR**

Test Mode	WLAN		Main Mode SAR(1g) (W/kg) (Including Power Drift and Scaling factor)	Wi-Fi SAR(1g) (W/kg) (Including Power Drift and Scaling factor)	Summation SAR(1g) (W/kg) (Including Power Drift and Scaling factor)	SAR -to- peak-location Separation Ratio	Simultaneous Measurement Required?
GSM850	802.11b	Body	0.956	0.334	1.290<1.6	/	No
GSM1900	802.11b	Body	0.659	0.334	0.993<1.6	/	No

**5.3. SAR Measurement Variability**

SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. The following procedures are applied to determine if repeated measurements are required.

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

**SAR Measurement Variability for Body GSM 850 (1g)**

Test Frequency		Mode/Band	Test Configuration	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
Channel	MHz						
128	824.20	GPRS 4TS	Back	0.918	0.915	0.99	/

## 5.4. Measurement Uncertainty

Uncertainty Component	Tol. (%)	Prob Dist.	Div	ci (10g)	ci.ui(%) (10g)	vi
<b>Measurement System</b>						
Probe Calibration	5.9	N	1	1	5.9	$\infty$
Axial Isotropy	4.7	R	$\sqrt{3}$	0.7	1.9	$\infty$
Hemispherical Isotropy	9.6	R	$\sqrt{3}$	0.7	3.9	$\infty$
Boundary Effect	1.0	R	$\sqrt{3}$	1	0.6	$\infty$
Linearity	4.7	R	$\sqrt{3}$	1	2.7	$\infty$
System Detection Limits	1.0	R	$\sqrt{3}$	1	0.6	$\infty$
Readout Electronics	0.3	N	1	1	0.3	$\infty$
Response Time	0.8	R	$\sqrt{3}$	1	0.5	$\infty$
Integration Time	2.6	R	$\sqrt{3}$	1	1.5	$\infty$
RF Ambient Conditions - Noise	3.0	R	$\sqrt{3}$	1	1.7	$\infty$
RF Ambient Conditions - Reflections	3.0	R	$\sqrt{3}$	1	1.7	$\infty$
Probe Positioner Mechanical Tolerance	0.4	R	$\sqrt{3}$	1	0.2	$\infty$
Probe Positioning with respect to Phantom Shell	2.9	R	$\sqrt{3}$	1	1.7	$\infty$
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	1.0	R	$\sqrt{3}$	1	0.6	$\infty$
<b>Test Sample Related</b>						
Test Sample Positioning	2.9	N	1	1	2.9	145
Device Holder Uncertainty	3.6	N	1	1	3.6	5
Output Power Variation - SAR drift measurement	5.0	R	$\sqrt{3}$	1	2.9	$\infty$
<b>Phantom and Tissue Parameters</b>						
Phantom Uncertainty (shape and thickness tolerances)	4.0	R	$\sqrt{3}$	1	2.3	$\infty$
Conductivity Target - tolerance	5.0	R	$\sqrt{3}$	0.43	1.2	$\infty$
Conductivity - measurement uncertainty	2.5	N	1	0.43	1.1	$\infty$
Permittivity Target - tolerance	5.0	R	$\sqrt{3}$	0.49	1.4	$\infty$
Permittivity - measurement uncertainty	2.5	N	1	0.49	1.2	5
<b>Combined Standard Uncertainty</b>			<b>R</b>	<b>2</b>		<b>10.7</b>
<b>Expanded STD Uncertainty</b>					<b>21.4</b>	

## 5.5. System Check Results

### System Performance Check at 2450 MHz Body

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 884

Date/Time: 07/25/2013 AM

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

Medium parameters used (interpolated):  $f = 2450 \text{ MHz}$ ;  $\sigma = 1.92 \text{ S/m}$ ;  $\epsilon_r = 51.9$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x101x1):** Measurement grid:  $dx=15.00 \text{ mm}$ ,  $dy=15.00 \text{ mm}$

Maximum value of SAR (interpolated) = 14.08 W/kg

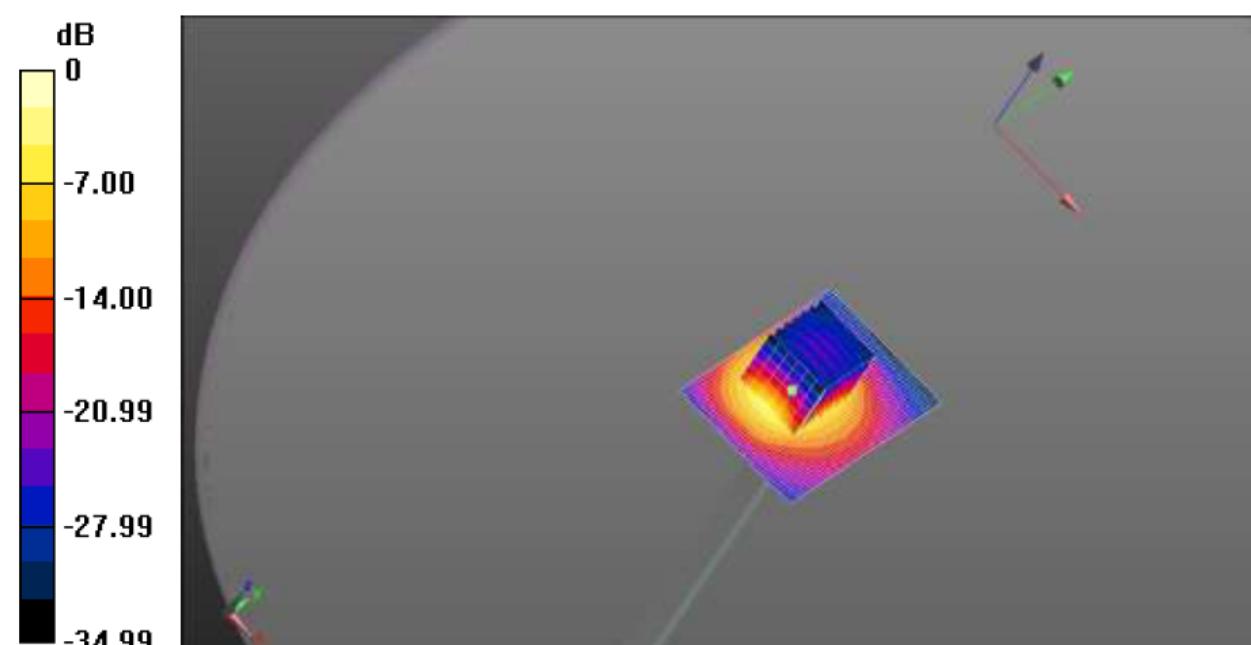
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 88.243 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 31.088 mW/g

**SAR(1 g) = 13.8 mW/g; SAR(10 g) = 6.20 mW/g**

Maximum value of SAR (measured) = 18.5 W/kg



0dB = 14.08 mW/g = 11.49 dB mW/g

**System Performance Check at 835 MHz Body**

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d134

Date/Time: 07/26/2013 AM

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

Medium parameters used (interpolated):  $f = 835 \text{ MHz}$ ;  $\sigma = 0.96 \text{ S/m}$ ;  $\epsilon_r = 54.47$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x91x1):** Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) = 2.90 mW/g

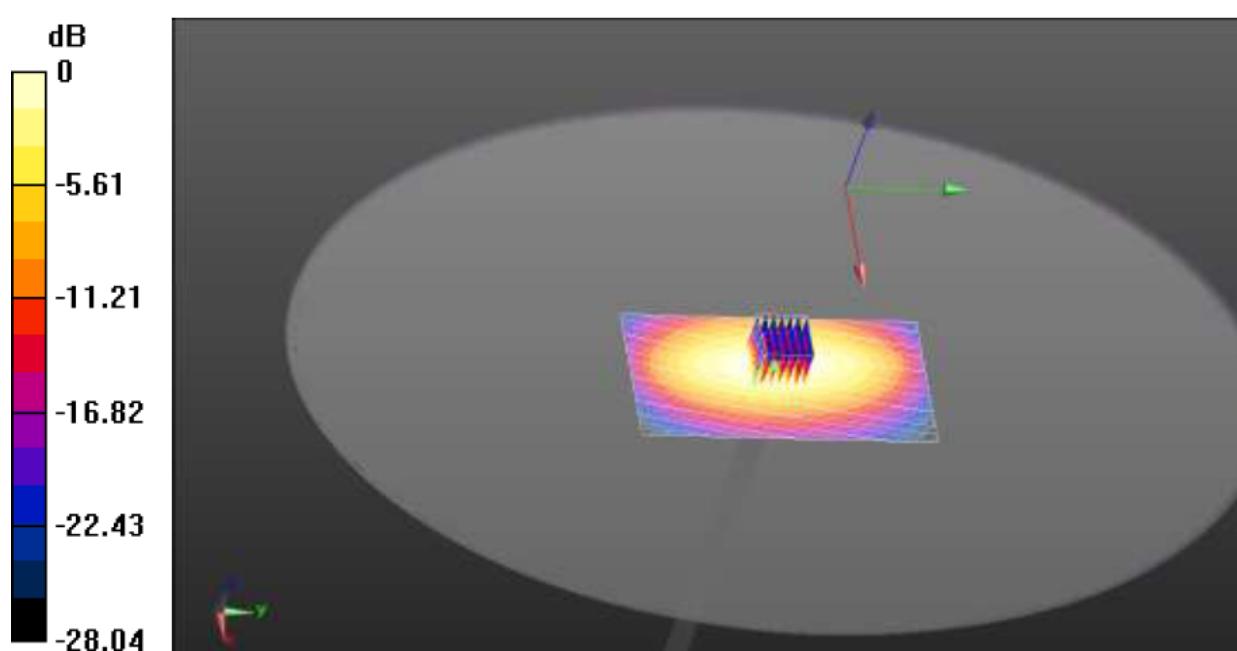
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.099 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 3.694 mW/g

**SAR(1 g) = 2.48 mW/g; SAR(10 g) = 1.62 mW/g**

Maximum value of SAR (measured) = 2.91 mW/g



0dB = 2.90 mW/g = 9.23 dB mW/g

System Performance Check 835 MHz body 250 mW

**System Performance Check at 1900 MHz Body**

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d150

Date/Time: 07/26/2013 AM

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 1900$  MHz;  $\sigma = 1.50$  S/m;  $\epsilon_r = 52.35$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x101x1):** Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) = 14.08 W/kg

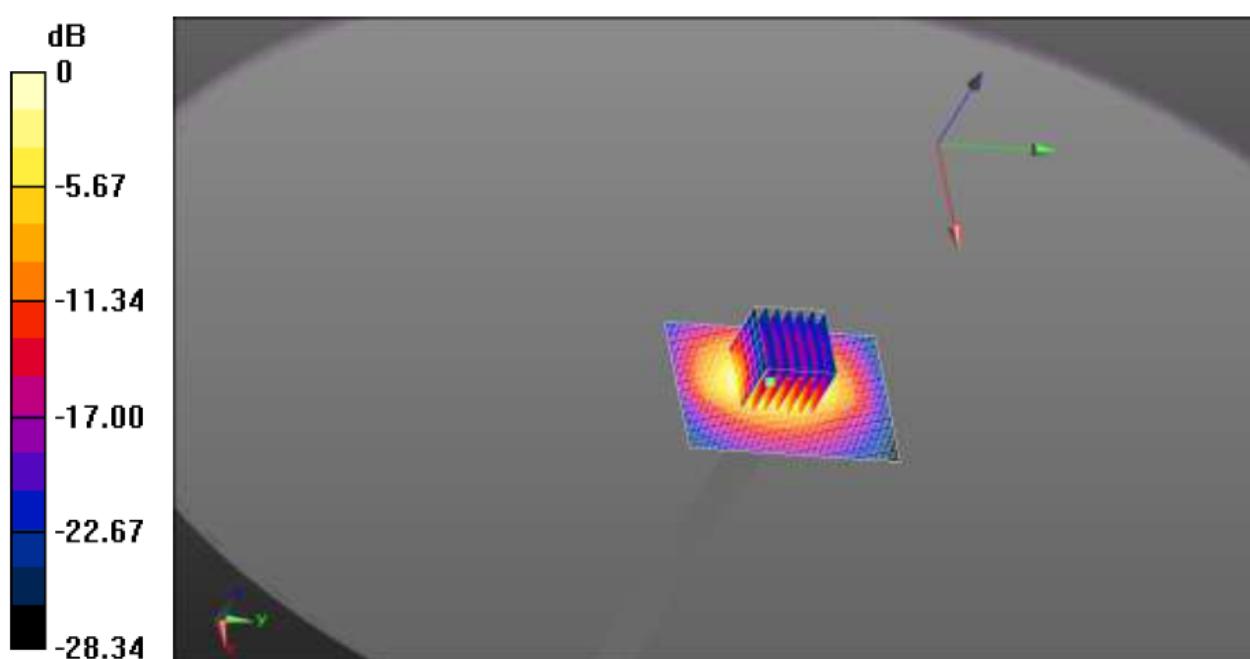
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.282 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 19.491 mW/g

**SAR(1 g) = 10.47 mW/g; SAR(10 g) = 5.43 mW/g**

Maximum value of SAR (measured) = 14.00 W/kg



0dB = 14.40 mW/g = 23.17 dB mW/g

System Performance Check 1900 MHz body 250 mW

## 5.6. SAR Test Graph Results

### GSM850 GPRS 4TS Body Toward Back Side Low Channel

Communication System: Customer System; Frequency: 824.4MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 824.4$  MHz;  $\sigma = 0.95$  S/m;  $\epsilon_r = 54.24$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.618 W/kg

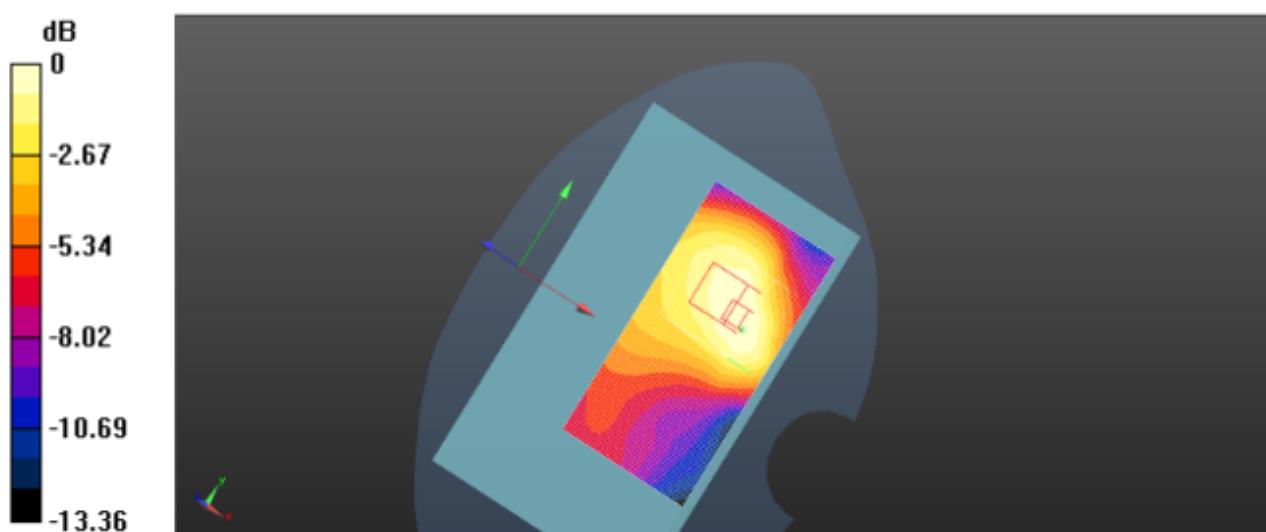
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.546 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.878 W/g

**SAR(1 g) = 0.500 W/g; SAR(10 g) = 0.283 W/g**

Maximum value of SAR (measured) = 0.543 W/kg



0dB = 0.543 W/kg = -2.65 dBW/kg

Plot 1: Body Toward Back (GSM850 GPRS 4TS Low Channel)

**GSM850 GPRS 4TS Body Toward Back Side Middle Channel**

Communication System: Customer System; Frequency: 836.6 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.95$  S/m;  $\epsilon_r = 54.24$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 1.138 W/kg

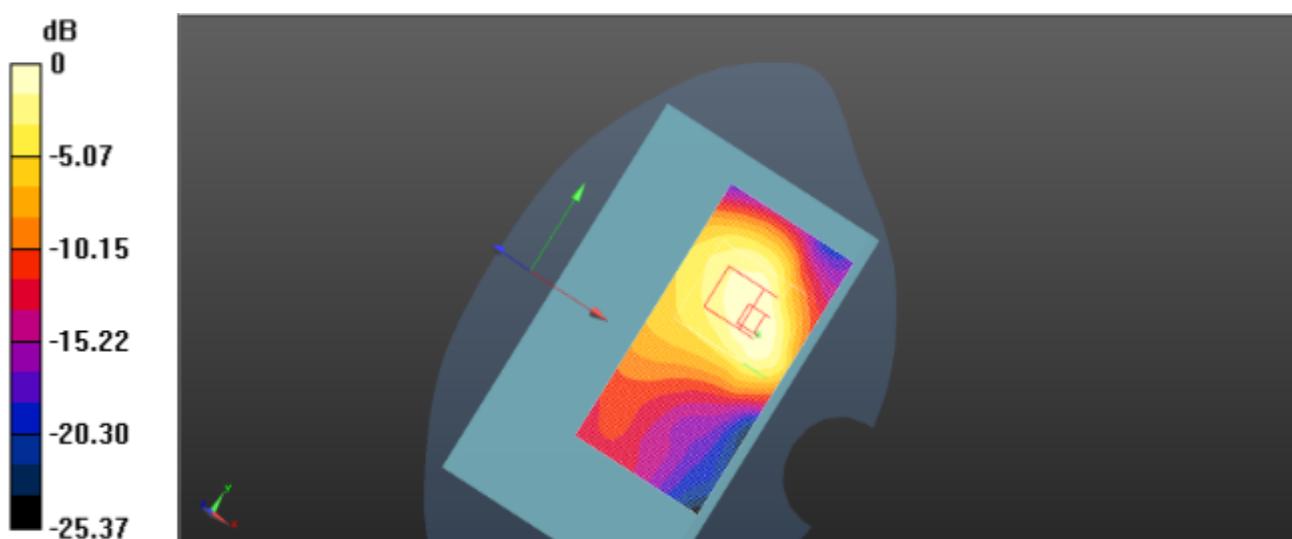
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.960 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 1.30 W/g

**SAR(1 g) = 0.919 W/g; SAR(10 g) = 0.507 W/g**

Maximum value of SAR (measured) = 1.03 W/kg



0 dB = 1.03 W/kg = 0.13 dB W/kg

Plot 2: Body Toward Back (GSM850 GPRS 4TS Middle Channel)

**GSM850 GPRS 4TS Body Toward Back Side High Channel**

Communication System: Customer System; Frequency: 848.8 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 848.8$  MHz;  $\sigma = 0.94$  S/m;  $\epsilon_r = 54.31$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (measured) = 0.520 W/kg

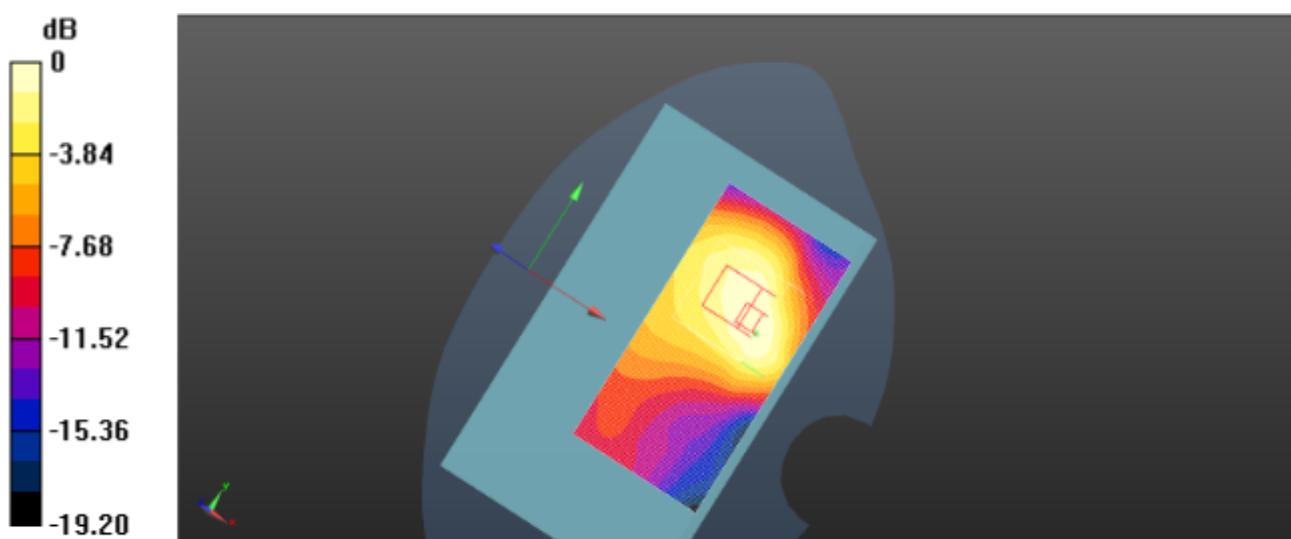
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.634 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.534 W/g

**SAR(1 g) = 0.482 W/g; SAR(10 g) = 0.215 W/g**

Maximum value of SAR (measured) = 0.530 W/kg



0dB = 0.545 W/kg = -2.64 dBW/kg

Plot 3: Body Toward Back (GSM850 GPRS 4TS High Channel)

**GSM850 GPRS 4TS Body Toward Right Side Low Channel**

Communication System: Customer System; Frequency: 824.4MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 824.4$  MHz;  $\sigma = 0.95$  S/m;  $\epsilon_r = 54.24$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.402 W/kg

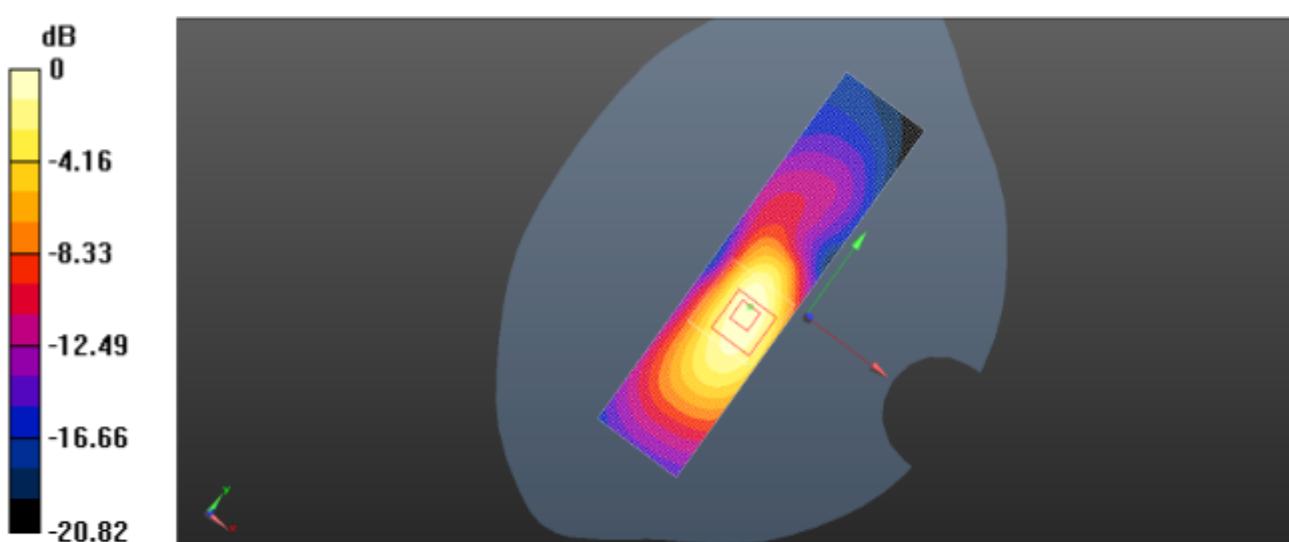
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.474 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.766 W/g

**SAR(1 g) = 0.494 W/g; SAR(10 g) = 0.292 W/g**

Maximum value of SAR (measured) = 0.545 W/kg



0dB = 0.545 W/kg = -2.64 dBW/kg

Plot 4: Body Toward Right (GSM850 GPRS 4TS Low Channel)

**GSM850 GPRS 4TS Body Toward Right Side Middle Channel**

Communication System: Customer System; Frequency: 836.6 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.95$  S/m;  $\epsilon_r = 54.24$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.813 W/kg

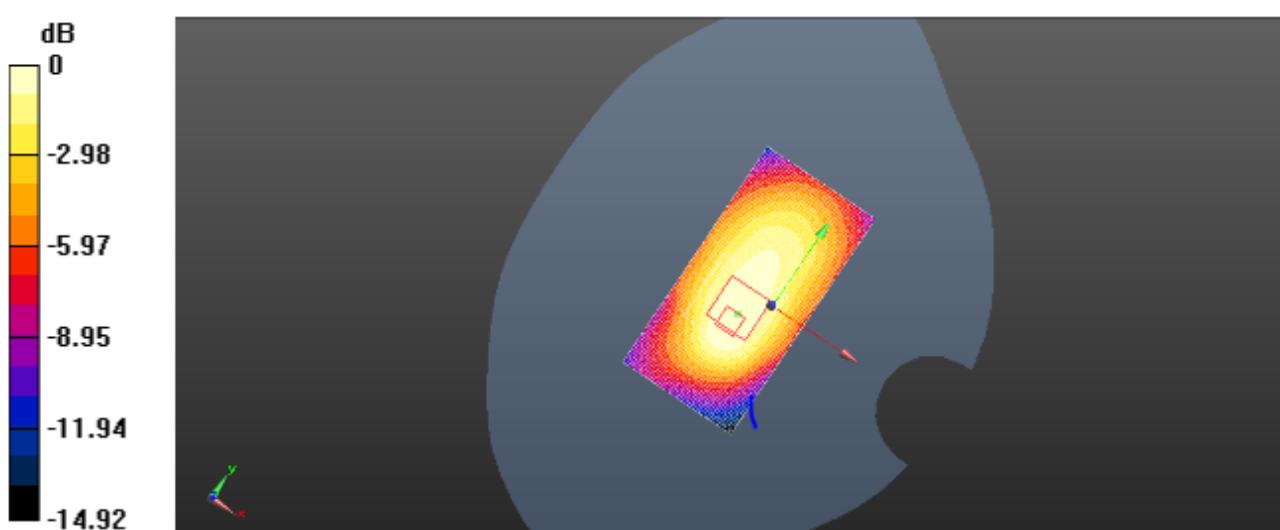
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 17.974 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.816 mW/g

**SAR(1 g) = 0.728 mW/g; SAR(10 g) = 0.590 mW/g**

Maximum value of SAR (measured) = 0.754 W/kg



0 dB = 0.827 W/kg = -1.65 dB W/kg

Plot 5: Body Toward Right (GSM850 GPRS 4TS Middle Channel)

**GSM850 GPRS 4TS Body Toward Right Side High Channel**

Communication System: Customer System; Frequency: 848.8 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 848.8$  MHz;  $\sigma = 0.94$  S/m;  $\epsilon_r = 54.31$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.503 W/kg

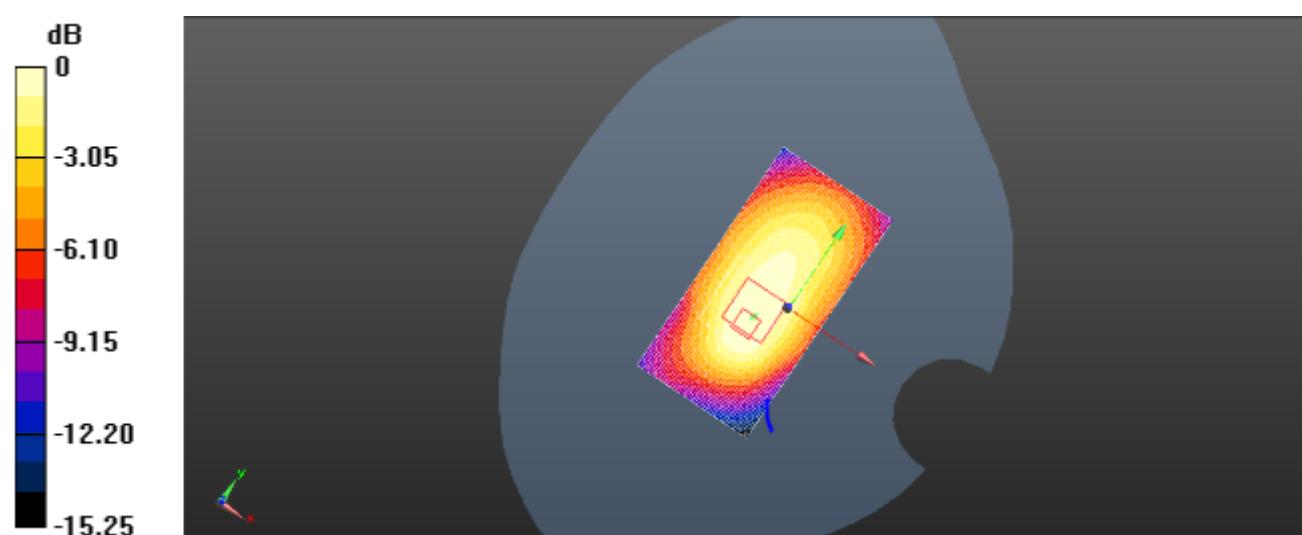
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.263 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.715 mW/g

**SAR(1 g) = 0.365 mW/g; SAR(10 g) = 0.187 mW/g**

Maximum value of SAR (measured) = 0.411 W/kg



0 dB = 0.425 W/kg = -7.43 dB W/kg

Plot 6: Body Toward Right (GSM850 GPRS 4TS High Channel)

**GSM850 GPRS 4TS Body Toward Bottom Side Low Channel**

Communication System: Customer System; Frequency: 824.4MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 824.4$  MHz;  $\sigma = 0.95$  S/m;  $\epsilon_r = 54.24$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.293 W/kg

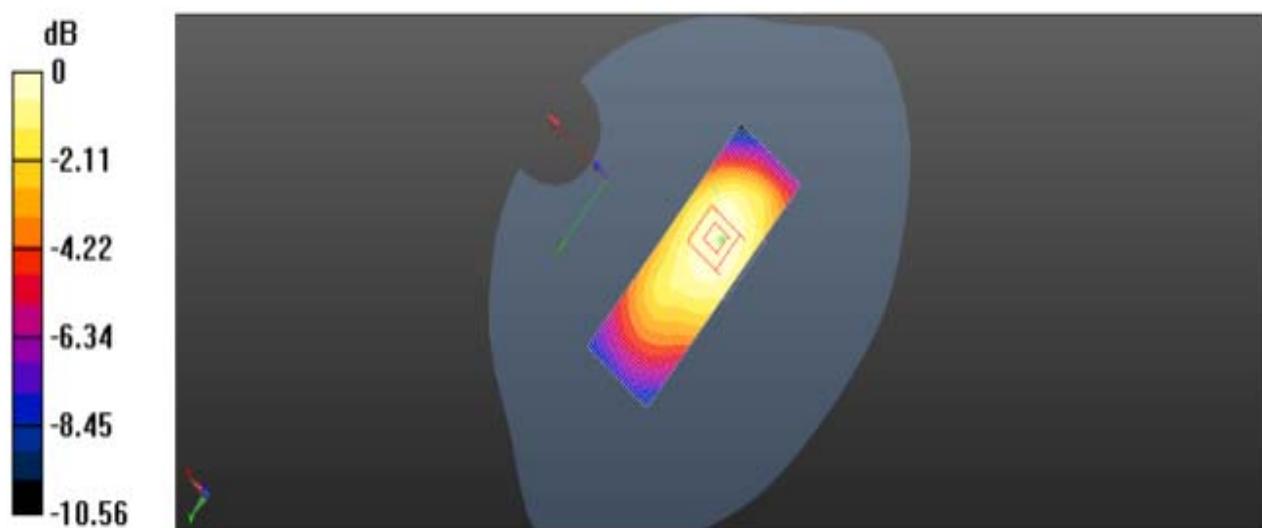
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.952 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.325 W/g

**SAR(1 g) = 0.205 W/g; SAR(10 g) = 0.125 W/g**

Maximum value of SAR (measured) = 0.223 W/kg



0 dB = 0.123 W/kg = -9.11 dB mW/kg

Plot 7: Body Toward Bottom (GSM850 GPRS 4TS Low Channel)

**GSM850 GPRS 4TS Body Toward Bottom Side Middle Channel**

Communication System: Customer System; Frequency: 836.6 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.95$  S/m;  $\epsilon_r = 54.24$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.536 W/kg

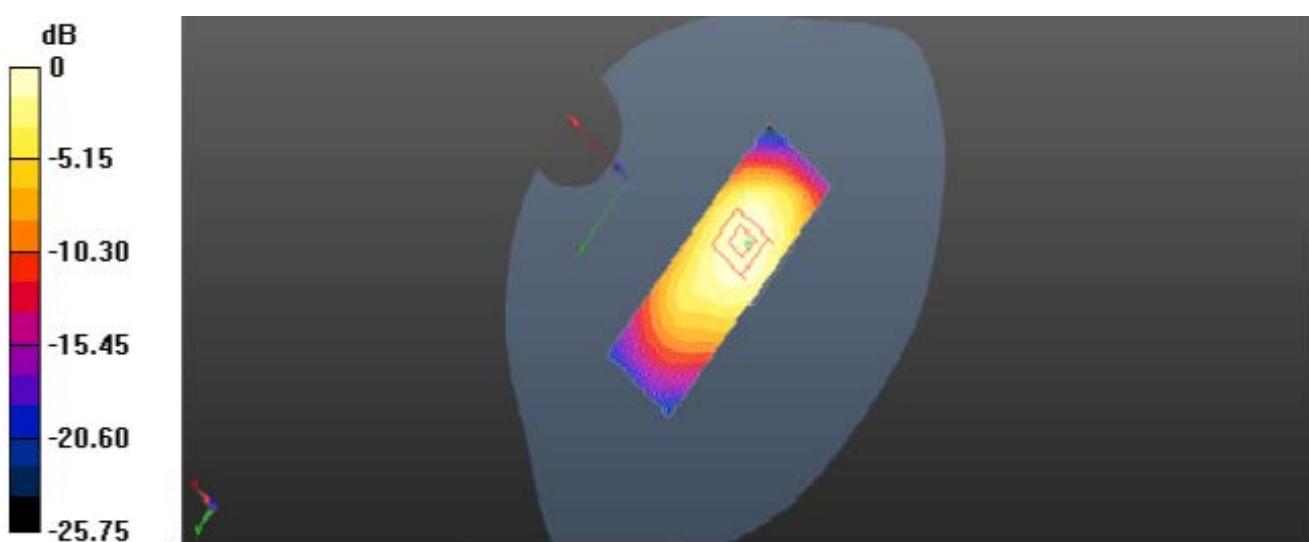
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.382 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.402 mW/g

**SAR(1 g) = 0.398 mW/g; SAR(10 g) = 0.203 mW/g**

Maximum value of SAR (measured) = 0.424 W/kg



0 dB = 0.416 W/kg = -8.85 dB W/kg

Plot 8: Body Toward Bottom (GSM850 GPRS 4TS Middle Channel)

**GSM850 GPRS 4TS Body Toward Bottom Side High Channel**

Communication System: Customer System; Frequency: 848.8 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 848.8$  MHz;  $\sigma = 0.94$  S/m;  $\epsilon_r = 54.31$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.286 W/kg

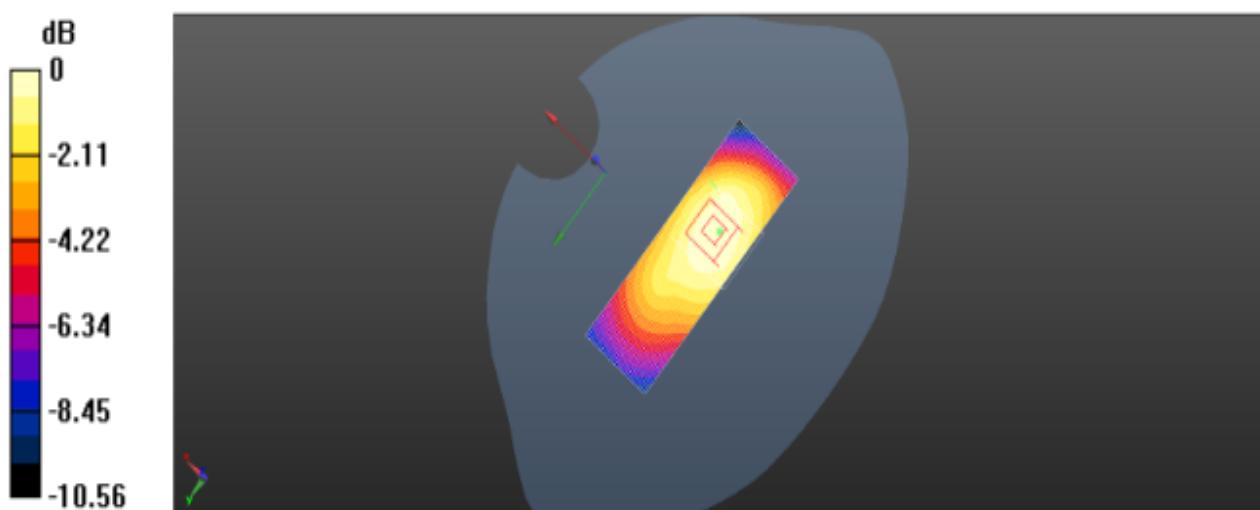
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.903 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 0.112 W/g

**SAR(1 g) = 0.105 W/g; SAR(10 g) = 0.086 W/g**

Maximum value of SAR (measured) = 0.093 W/kg



0 dB = 0.336 W/kg = -9.47 dB mW/kg

Plot 9: Body Toward Bottom (GSM850 GPRS 4TS High Channel)

**GSM1900 GPRS 4TS Body Toward Back Side Low Channel**

Communication System: Customer System; Frequency: 1850.20 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 1850.20$  MHz;  $\sigma = 1.45$  S/m;  $\epsilon_r = 52.46$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.451 W/kg

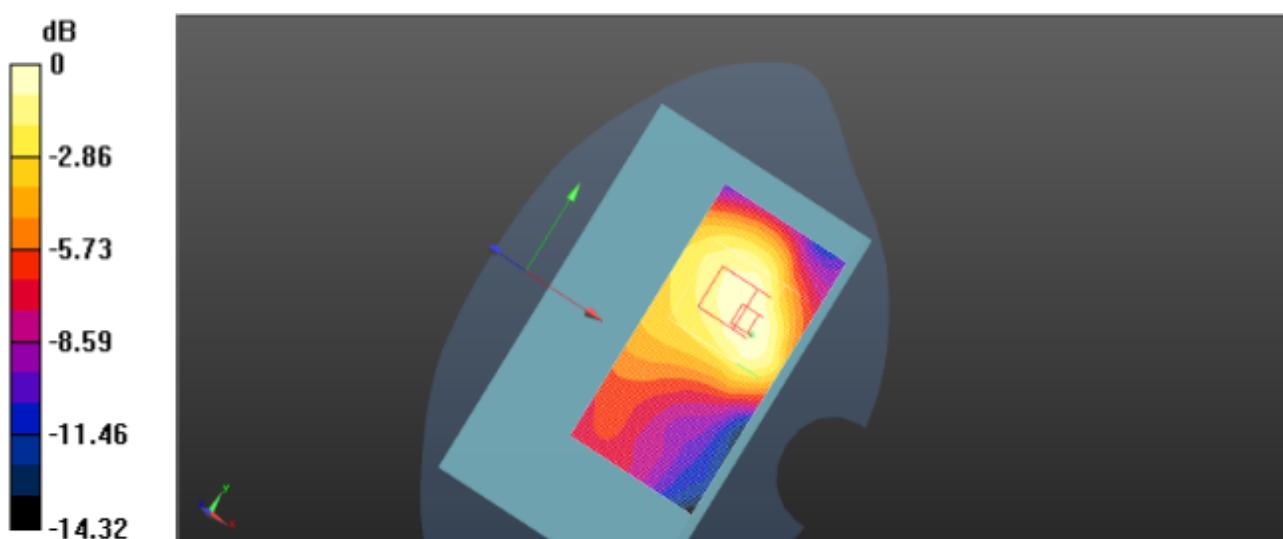
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.390 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 1.04 W/g

**SAR(1 g) = 0.359 W/g; SAR(10 g) = 0.235 W/g**

Maximum value of SAR (measured) = 0.389 W/kg



0dB = 0.398 W/kg = -4.10 dBW/kg

Plot 10: Body Toward Back (GSM1900 GPRS 4TS Low Channel)

**GSM1900 GPRS 4TS Body Toward Back Side Middle Channel**

Communication System: Customer System; Frequency: 1880.00 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 1880.00$  MHz;  $\sigma = 1.48$  S/m;  $\epsilon_r = 52.42$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.862 mW/g

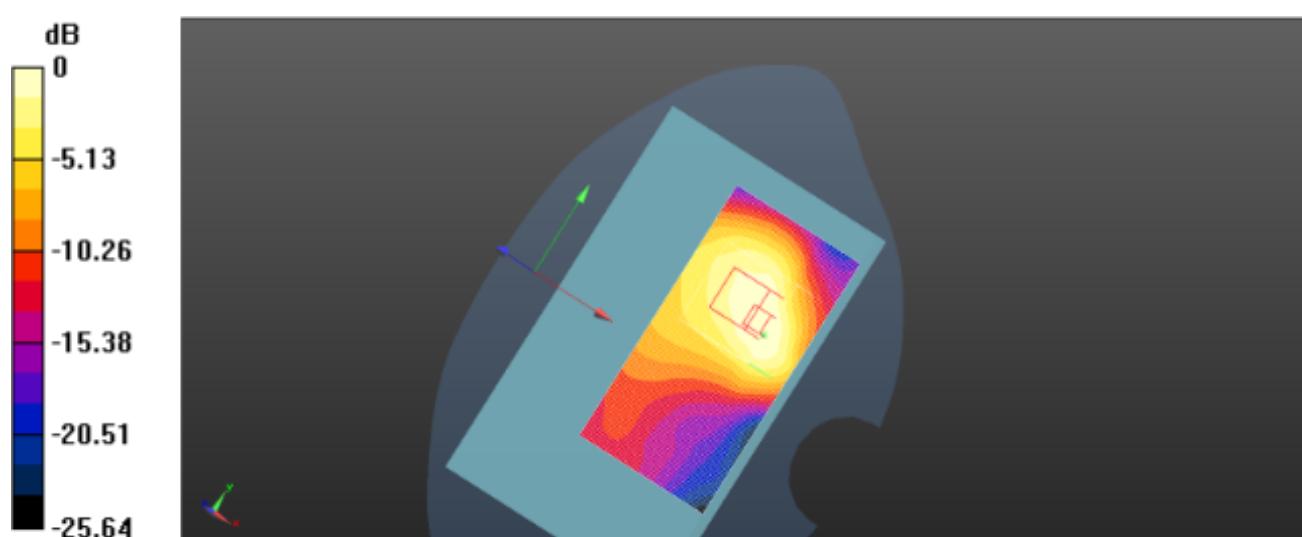
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.031 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 1.04 W/g

**SAR(1 g) = 0.622 W/g; SAR(10 g) = 0.365 W/g**

Maximum value of SAR (measured) = 0.679 W/kg



0 dB = 0.698 W/Kg = -1.62 dB W/Kg

Plot 11: Body Toward Back (GSM1900 GPRS 4TS Middle Channel)

**GSM1900 GPRS 4TS Body Toward Back Side High Channel**

Communication System: Customer System; Frequency: 1909.80 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 1909.80$  MHz;  $\sigma = 1.503$  S/m;  $\epsilon_r = 52.33$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.503 W/kg

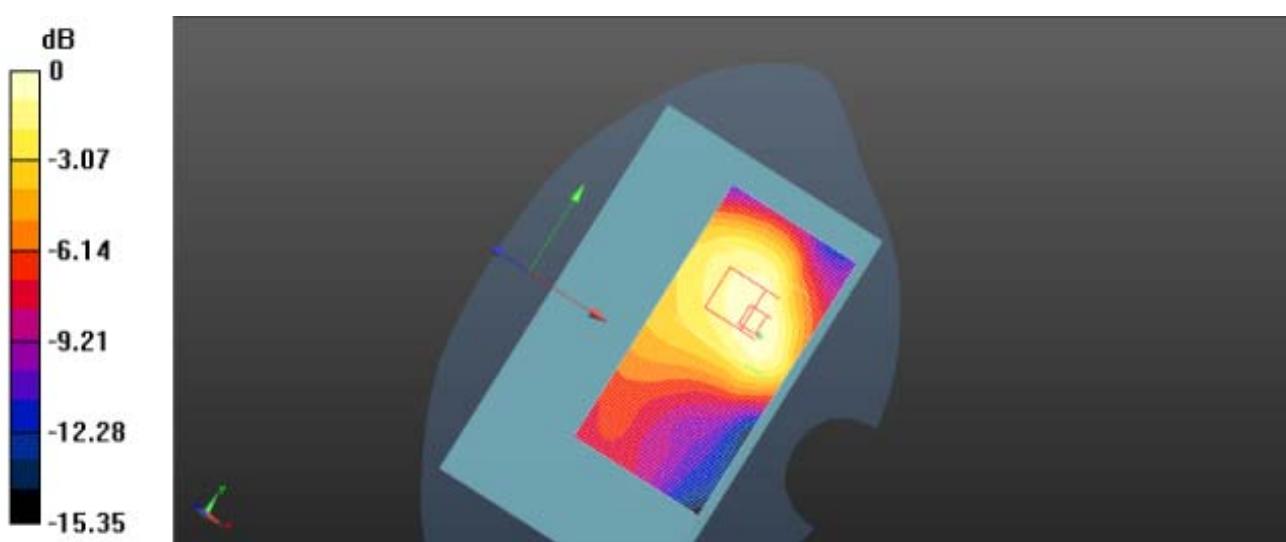
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.390 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.378 mW/g

**SAR(1 g) = 0.284 mW/g; SAR(10 g) = 0.152 mW/g**

Maximum value of SAR (measured) = 0.389 W/kg



0dB = 0.398 W/kg = -4.10 dBW/kg

Plot 12: Body Toward Back (GSM1900 GPRS 4TS High Channel)

**GSM1900 GPRS 4TS Body Toward Right Side Low Channel**

Communication System: Customer System; Frequency: 1850.20 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 1850.20$  MHz;  $\sigma = 1.45$  S/m;  $\epsilon_r = 52.46$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.451 W/kg

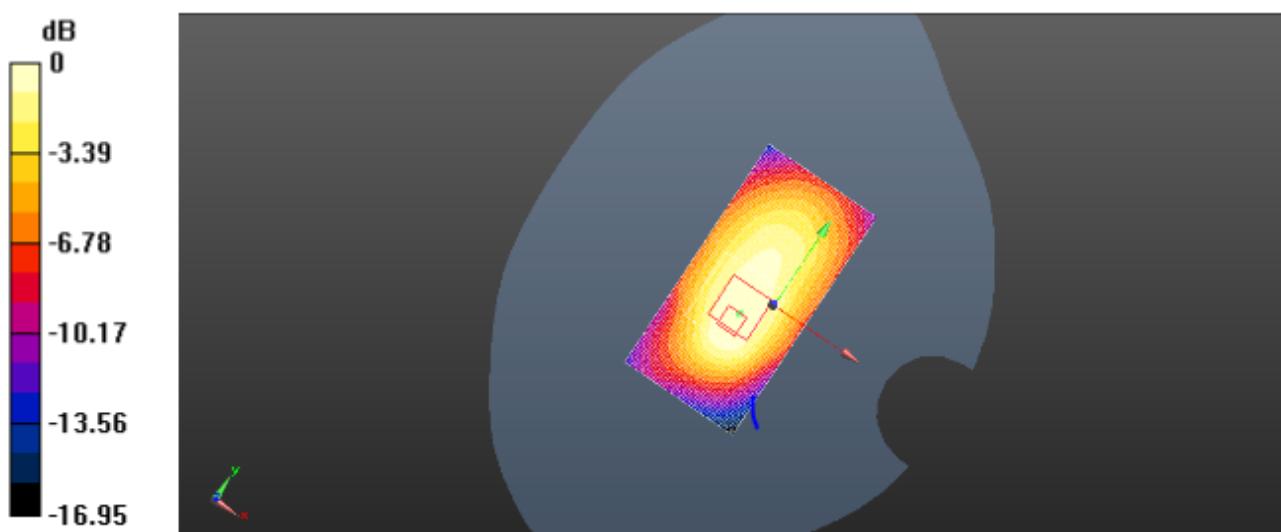
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.425 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.519 W/g

**SAR(1 g) = 0.341 W/g; SAR(10 g) = 0.210 W/g**

Maximum value of SAR (measured) = 0.353 W/kg



0 dB = 0.424 W/kg = -6.85 dB W/kg

Plot 13: Body Toward Right (GSM1900 GPRS 4TS Low Channel)

**GSM1900 GPRS 4TS Body Toward Right Side Middle Channel**

Communication System: Customer System; Frequency: 1880.00 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 1880.00$  MHz;  $\sigma = 1.48$  S/m;  $\epsilon_r = 52.42$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.805 W/kg

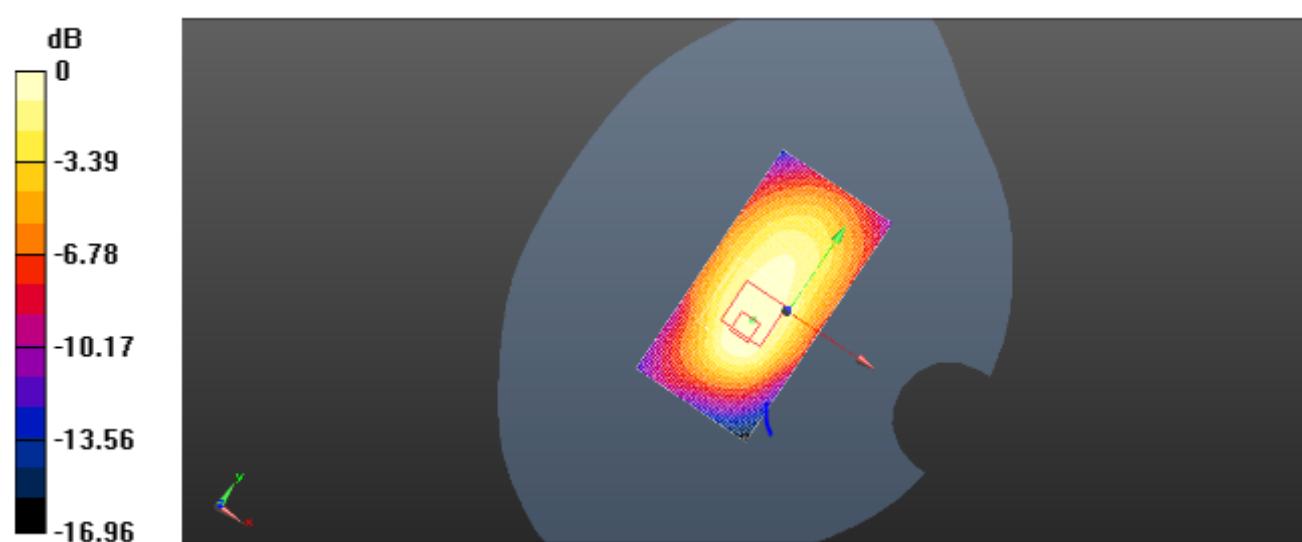
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.004 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.682 mW/g

**SAR(1 g) = 0.589 mW/g; SAR(10 g) = 0.423 mW/g**

Maximum value of SAR (measured) = 0.627 W/kg



0 dB = 0.627 W/kg = -4.05 dB W/kg

Plot 14: Body Toward Right (GSM1900 GPRS 4TS Middle Channel)

**GSM1900 GPRS 4TS Body Toward Right Side High Channel**

Communication System: Customer System; Frequency: 1909.80 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 1909.80$  MHz;  $\sigma = 1.503$  S/m;  $\epsilon_r = 52.33$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.439 W/kg

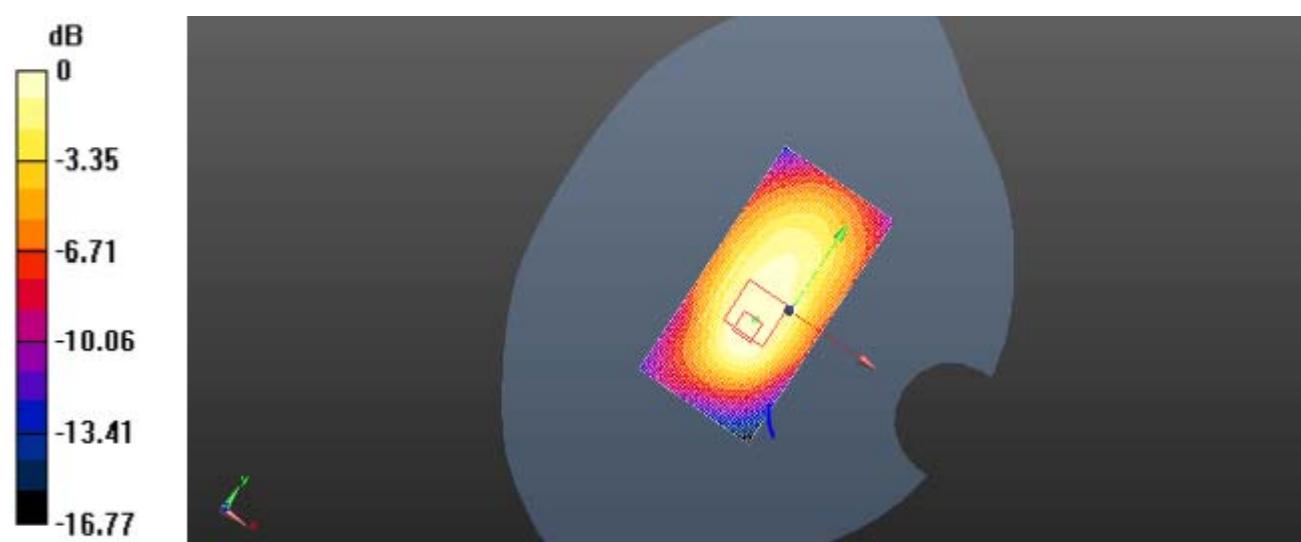
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.048 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.324 mW/g

**SAR(1 g) = 0.247 mW/g; SAR(10 g) = 0.127 mW/g**

Maximum value of SAR (measured) = 0.353 W/kg



0dB = 0.353 W/kg = -4.52 dBW/kg

Plot 15: Body Toward Right (GSM1900 GPRS 4TS High Channel)

**GSM1900 GPRS 4TS Body Toward Bottom Side Low Channel**

Communication System: Customer System; Frequency: 1850.20 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 1850.20$  MHz;  $\sigma = 1.45$  S/m;  $\epsilon_r = 52.46$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.510 W/kg

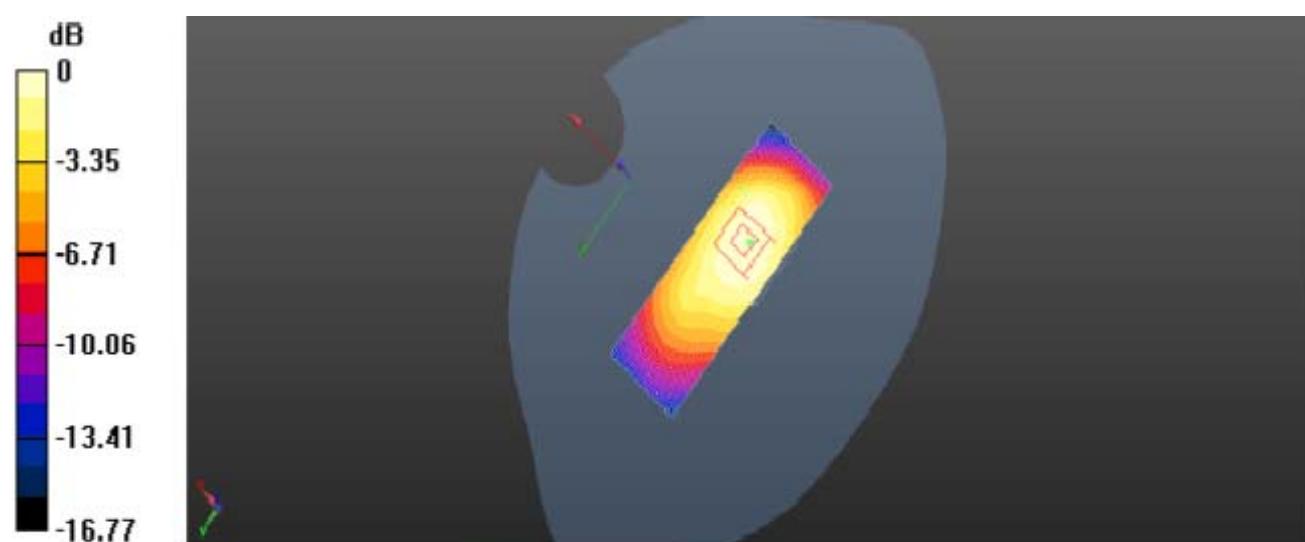
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.834 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.325 W/g

**SAR(1 g) = 0.199 W/g; SAR(10 g) = 0.151 W/g**

Maximum value of SAR (measured) = 0.229 W/kg



0dB = 0.229 W/kg = -6.48 dBW/kg

Plot 16: Body Toward Bottom (GSM1900 GPRS 4TS Low Channel)

**GSM1900 GPRS 4TS Body Toward Bottom Side Middle Channel**

Communication System: Customer System; Frequency: 1880.00 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 1880.00$  MHz;  $\sigma = 1.48$  S/m;  $\epsilon_r = 52.42$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.618 W/kg

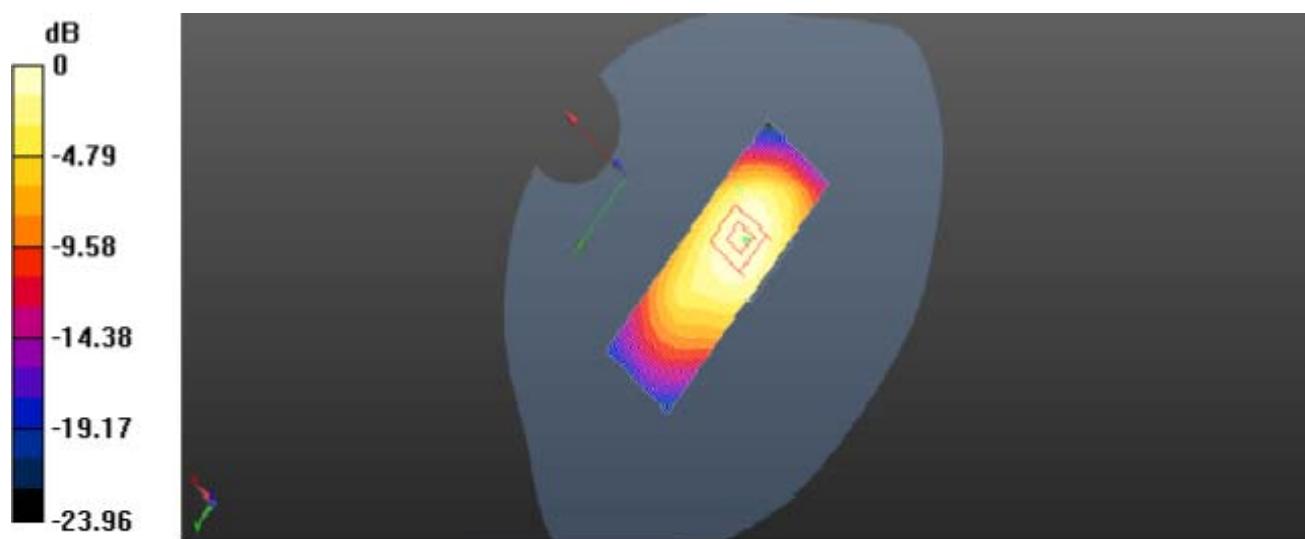
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.651 V/m; Power Drift = 0.26 dB

Peak SAR (extrapolated) = 0.932 W/g

**SAR(1 g) = 0.322 W/g; SAR(10 g) = 0.189 W/g**

Maximum value of SAR (measured) = 0.356 W/kg



0 dB = 0.348 W/kg = -4.59 dB W/kg

Plot 17: Body Toward Bottom (GSM1900 GPRS 4TS Middle Channel)

**GSM1900 GPRS 4TS Body Toward Bottom Side High Channel**

Communication System: Customer System; Frequency: 1909.80 MHz; Duty Cycle: 1:2

Medium parameters used (interpolated):  $f = 1909.80$  MHz;  $\sigma = 1.503$  S/m;  $\epsilon_r = 52.33$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (51x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.289 W/kg

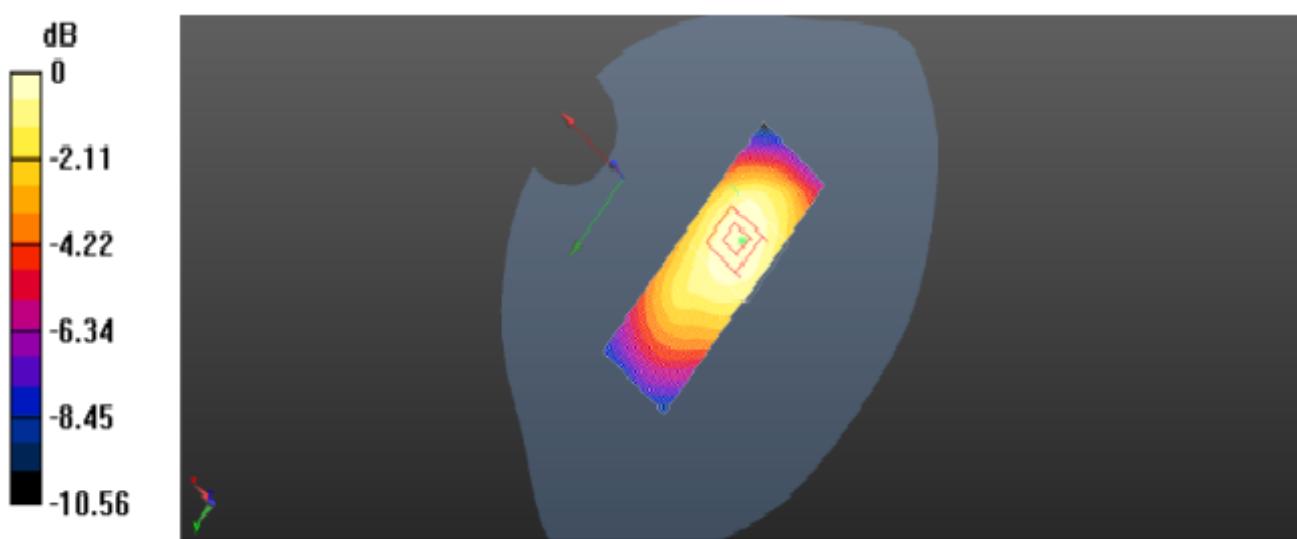
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.347 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.124 mW/g

**SAR(1 g) = 0.111 mW/g; SAR(10 g) = 0.082 mW/g**

Maximum value of SAR (measured) = 0.120 W/kg



0dB = 0.123 W/kg = -9.11 dBW/kg

Plot 18: Body Toward Bottom (GSM1900 GPRS 4TS High Channel)

**Body- worn Back side-802.11b-Channel 1-2412MHz(1Mbps)**

Communication System: Customer System; Frequency:2412 MHz; Duty Cycle:1:1

Medium parameters used (interpolated):  $f = 2412$  MHz;  $\sigma = 1.97$  S/m;  $\epsilon_r = 51.26$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) =0.105 W/kg

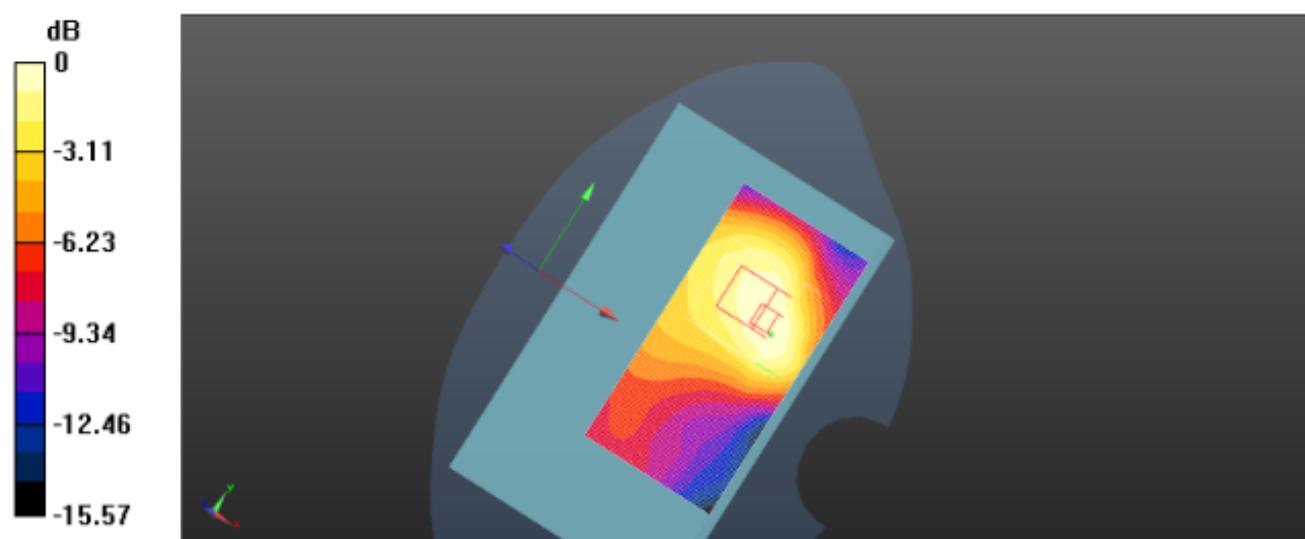
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.568 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.347 mW/g

**SAR(1 g) = 0.225 mW/g; SAR(10 g) = 0.127 mW/g**

Maximum value of SAR (measured) = 0.236 W/kg



0dB = 0.236 W/kg = -6.06 dBW/kg

Plot 19: Body- worn Back-802.11b -Channel 1-2412MHz(1Mbps)

**Body- worn Back side-802.11b-Channel 6-2437MHz(1Mbps)**

Communication System: Customer System; Frequency:2437 MHz; Duty Cycle:1:1

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 2.00$  S/m;  $\epsilon_r = 51.10$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) =0.169 W/kg

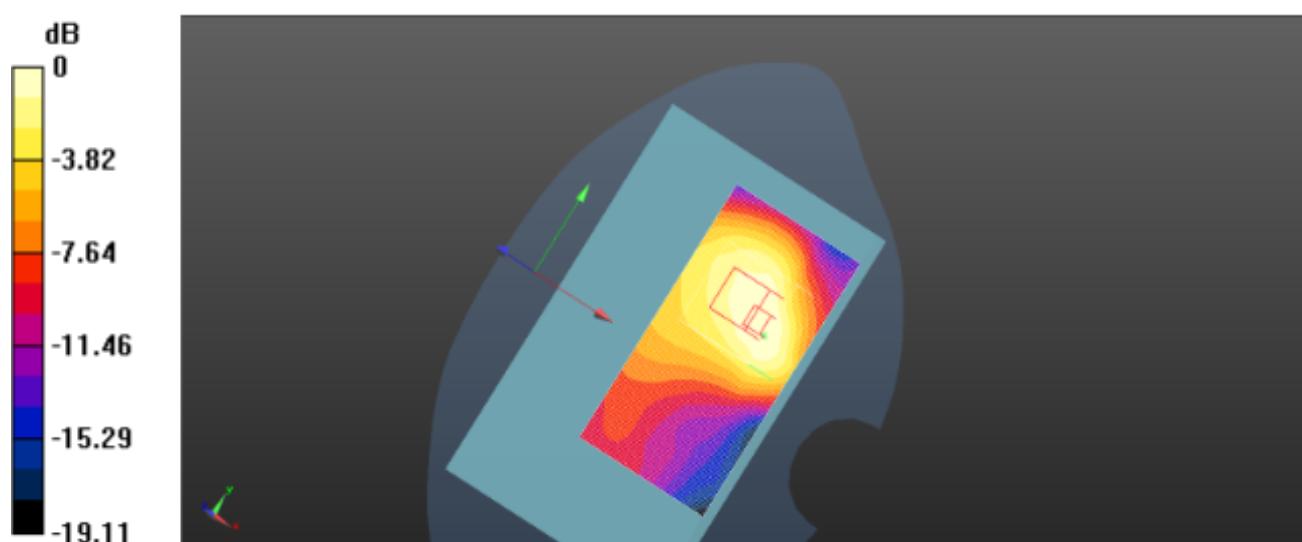
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.140 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.519 W/g

**SAR(1 g) = 0.315 W/g; SAR(10 g) = 0.177 W/g**

Maximum value of SAR (measured) = 0.453 W/kg



0 dB = 0.470 W/kg = -3.28 dB W/kg

Plot 20: Body- worn Back-802.11b-Channel 6-2437MHz(1Mbps)

**Body- worn Back side-802.11b-Channel 11-2462MHz(1Mbps)**

Communication System: Customer System; Frequency:2462 MHz; Duty Cycle:1:1

Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 1.96$  S/m;  $\epsilon_r = 51.20$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

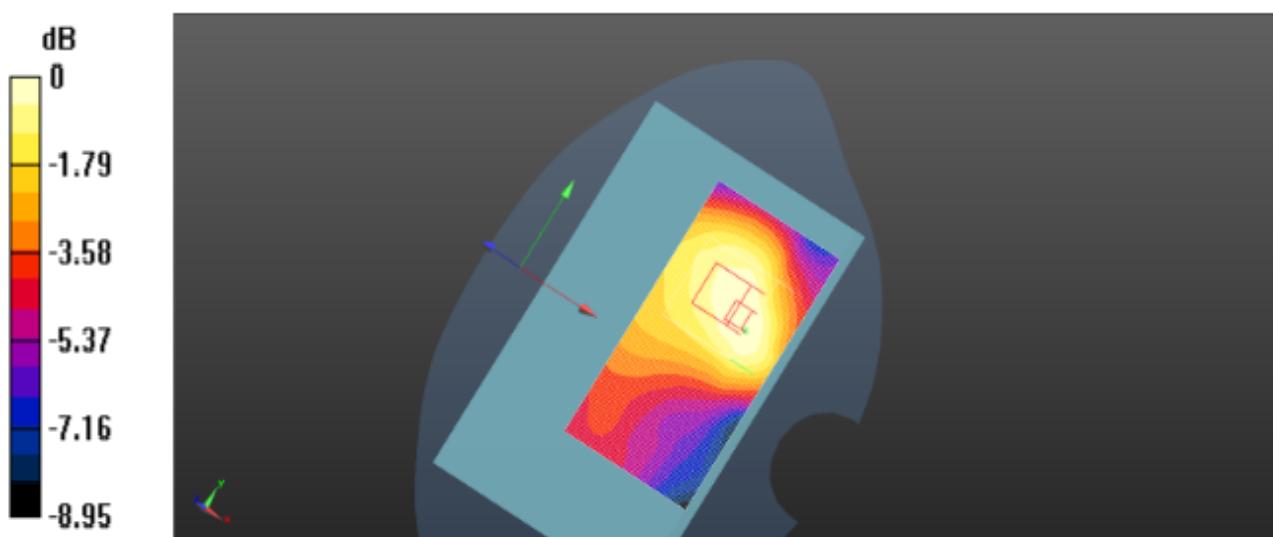
**Area Scan (61x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) =0.176 W/kg

**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

**SAR(1 g) = 0.112 W/g; SAR(10 g) = 0.079 W/g**

Maximum value of SAR (measured) = 0.120 W/kg



0 dB = 0.220 W/kg = -13.69 dB W/kg

Plot 21: Body- worn Back-802.11b-Channel 11-2462MHz(1Mbps)

**Body- worn Right side-802.11b-Channel 1-2412MHz(1Mbps)**

Communication System: Customer System; Frequency:2412 MHz; Duty Cycle:1:1

Medium parameters used (interpolated):  $f = 2412$  MHz;  $\sigma = 1.97$  S/m;  $\epsilon_r = 51.26$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.261 W/kg

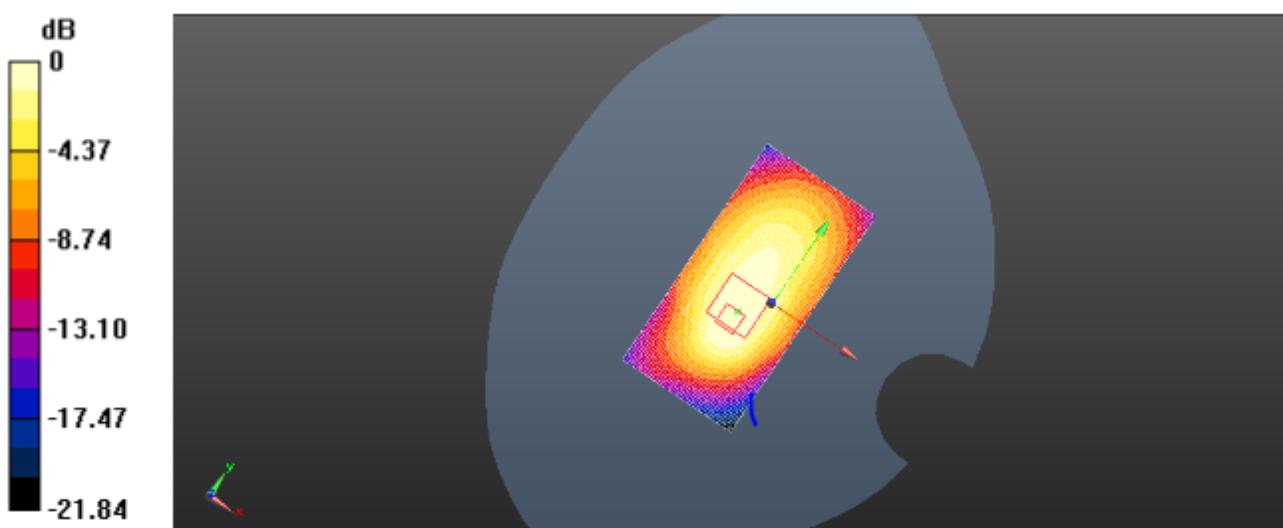
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.253 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.415 W/g

**SAR(1 g) = 0.224 W/g; SAR(10 g) = 0.120 W/g**

Maximum value of SAR (measured) = 0.245 W/kg



0dB = 0.245 W/kg = -6.07 dBW/kg

Plot 22: Body- worn Right-802.11b -Channel 1-2412MHz(1Mbps)

**Body- worn Right side-802.11b-Channel 6-2437MHz(1Mbps)**

Communication System: Customer System; Frequency:2437 MHz; Duty Cycle:1:1

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 2.00$  S/m;  $\epsilon_r = 51.10$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.281 W/kg

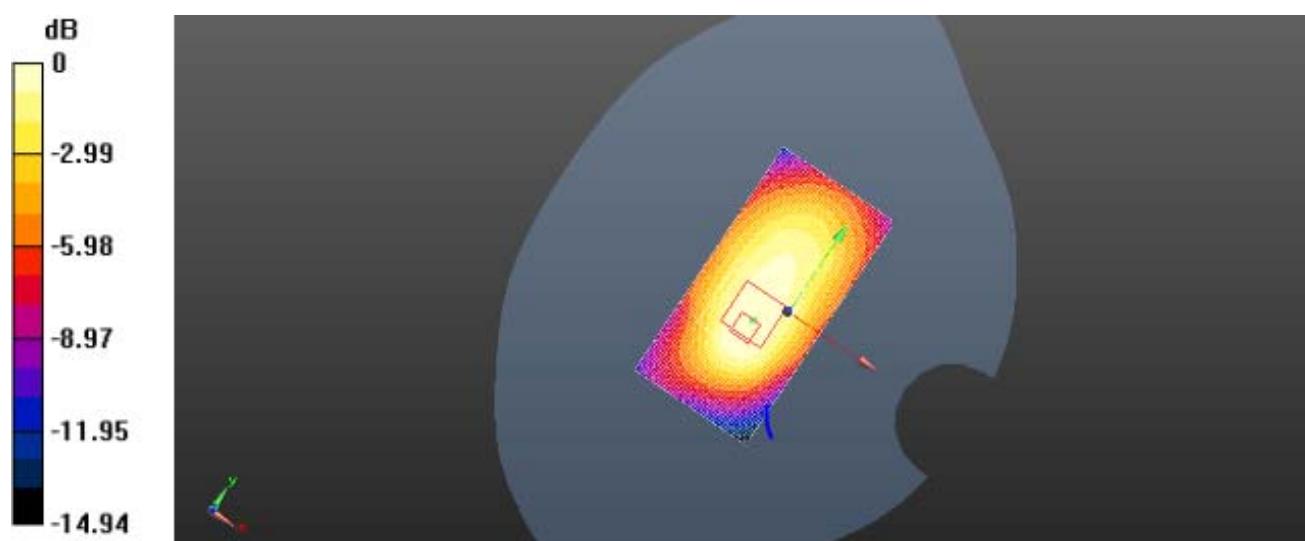
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.257 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.296 mW/g

**SAR(1 g) = 0.261 mW/g; SAR(10 g) = 0.131 mW/g**

Maximum value of SAR (measured) = 0.337 W/kg



0dB = 0.337 W/kg = -4.83 dBW/kg

Plot 23: Body- worn Right-802.11b-Channel 6-2437MHz(1Mbps)

**Body- worn Right side-802.11b-Channel 11-2462MHz(1Mbps)**

Communication System: Customer System; Frequency:2462 MHz; Duty Cycle:1:1

Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 1.96$  S/m;  $\epsilon_r = 51.20$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) =0.176 W/kg

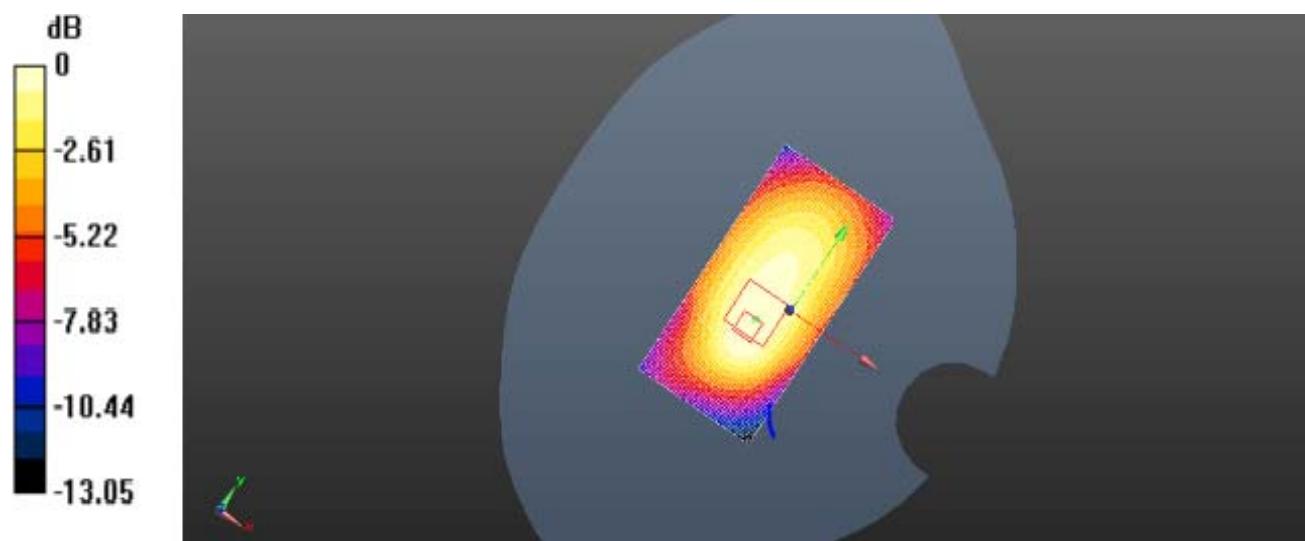
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.059 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.157 W/g

**SAR(1 g) = 0.108 W/g; SAR(10 g) = 0.077 W/g**

Maximum value of SAR (measured) = 0.114 W/kg



0dB = 0.220 W/kg = -13.15 dB W/kg

Plot 24: Body- worn Right-802.11b-Channel 11-2462MHz(1Mbps)

**Body- worn Bottom side-802.11b-Channel 1-2412MHz(1Mbps)**

Communication System: Customer System; Frequency:2412 MHz; Duty Cycle:1:1

Medium parameters used (interpolated):  $f = 2412 \text{ MHz}$ ;  $\sigma = 1.97 \text{ S/m}$ ;  $\epsilon_r = 51.26$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section : Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x81x1):** Measurement grid:  $dx=1.50 \text{ mm}$ ,  $dy=1.50 \text{ mm}$

Maximum value of SAR (interpolated) = 0.608 W/kg

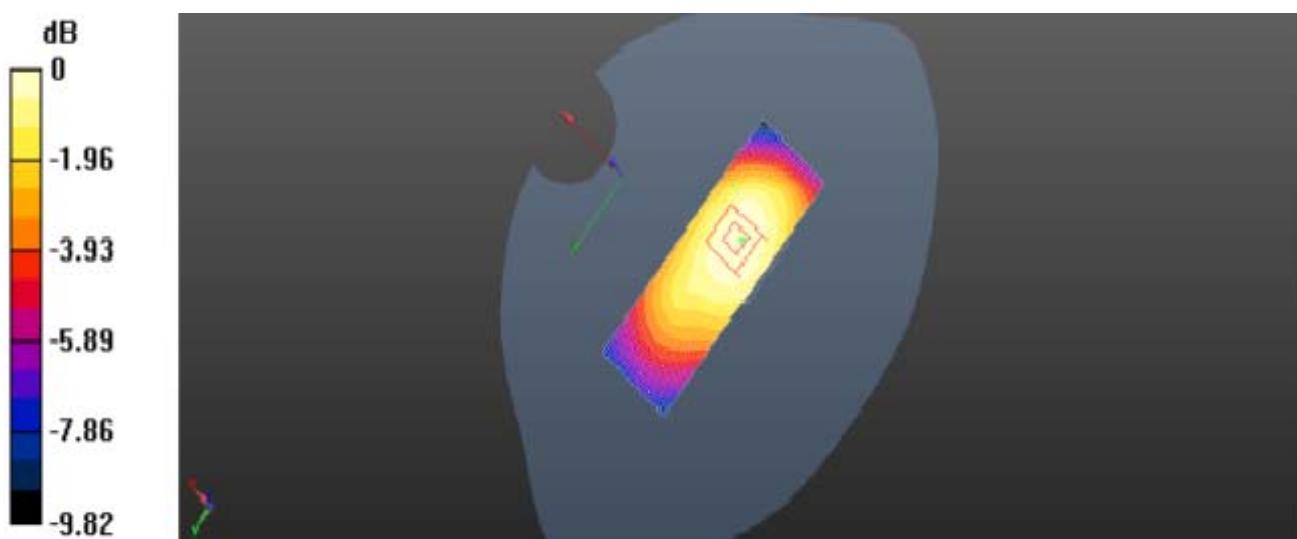
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 8.191 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.0760 W/g

**SAR(1 g) = 0.056 W/g; SAR(10 g) = 0.039 W/g**

Maximum value of SAR (measured) = 0.0592 W/kg



0 dB = 0.0591 W/kg = -12.28 dB W/kg

Plot 25: Body- worn Bottom-802.11b -Channel 1-2412MHz(1Mbps)

**Body- worn Bottom side-802.11b-Channel 6-2437MHz(1Mbps)**

Communication System: Customer System; Frequency:2437 MHz; Duty Cycle:1:1

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 2.00$  S/m;  $\epsilon_r = 51.10$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.110 W/kg

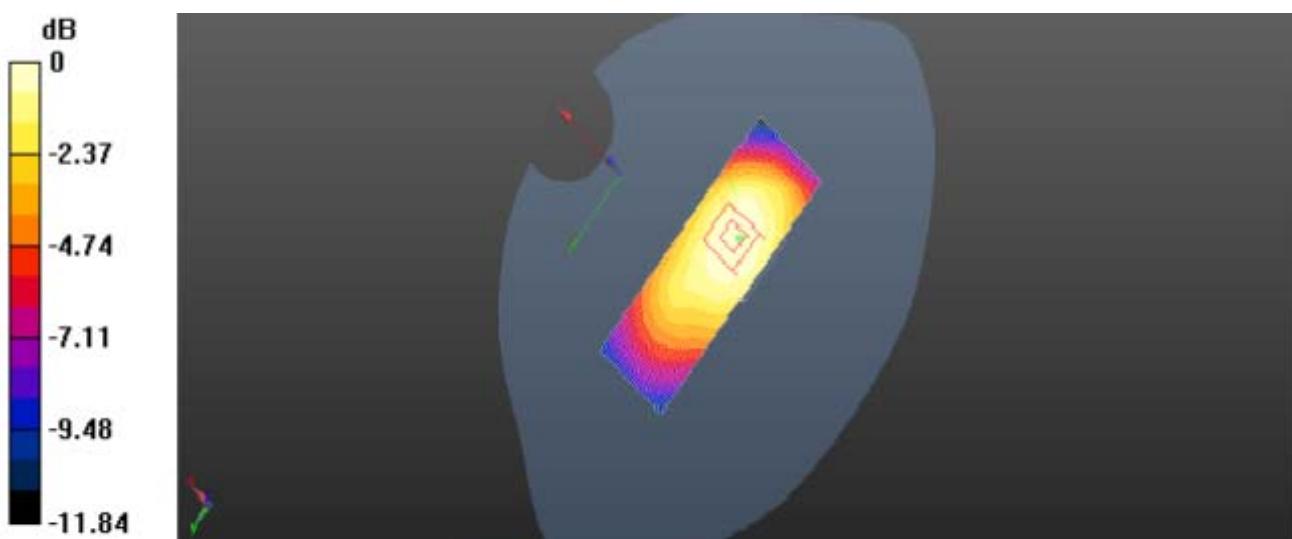
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.364 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.125 W/g

**SAR(1 g) = 0.096 W/g; SAR(10 g) = 0.062 W/g**

Maximum value of SAR (measured) = 0.102 W/kg



0dB = 0.102 W/kg = -9.51 dBW/kg

Plot 26: Body- worn Bottom-802.11b-Channel 6-2437MHz(1Mbps)

**Body- worn Right side-802.11b-Channel 11-2462MHz(1Mbps)**

Communication System: Customer System; Frequency:2462 MHz; Duty Cycle:1:1

Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 1.96$  S/m;  $\epsilon_r = 51.20$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section : Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x81x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.146 W/kg

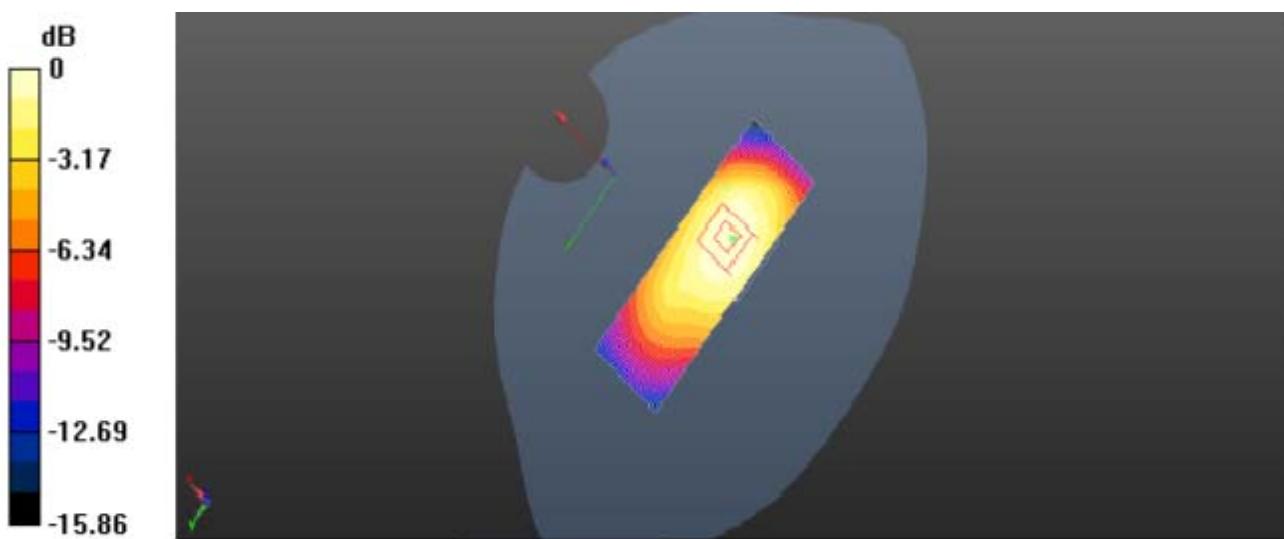
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.534 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.0534 W/g

**SAR(1 g) = 0.043 W/g; SAR(10 g) = 0.0141 W/g**

Maximum value of SAR (measured) = 0.0192 W/kg



0 dB = 0.00773 W/kg = -21.12 W/kg

Plot 27: Body- worn Bottom-802.11b-Channel 11-2462MHz(1Mbps)

## 6. Calibration Certificate

### 6.1. Probe Calibration Certificate

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



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

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

Accreditation No.: SCS 108

Client CIQ SZ (Auden)

Certificate No: ES3-3292\_Feb13

#### CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3292
Calibration procedure(s)	QA CAL-01.v8, QA CAL-14.v7, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	February 24, 2013
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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$ .	
Calibration Equipment used (M&TE critical for calibration)	

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-12 (No. 217-01372)	Apr-13
Power sensor E4412A	MY41498087	31-Mar-12 (No. 217-01372)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-12 (No. 217-01369)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-12 (No. 217-01367)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-12 (No. 217-01370)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 654	3-May-12 (No. DAE4-654_May12)	May-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-12)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: February 27, 2013

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

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



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

Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: SCS 108

#### Glossary:

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

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

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

#### Methods Applied and Interpretation of Parameters:

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

ES3DV3 – SN:3292

February 24, 2013

# Probe ES3DV3

SN:3292

Manufactured: July 6, 2010  
Calibrated: February 24, 2013

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

ES3DV3– SN:3292

February 24, 2013

**DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292****Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.81	0.90	1.18	$\pm 10.1 \%$
DCP (mV) <sup>B</sup>	105.9	104.7	102.0	

**Modulation Calibration Parameters**

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc <sup>E</sup> (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	117.3	$\pm 2.2 \%$
			Y	0.00	0.00	1.00	94.2	
			Z	0.00	0.00	1.00	108.2	

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

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

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

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

ES3DV3—SN:3292

February 24, 2013

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>c</sup>	Relative Permittivity <sup>f</sup>	Conductivity (S/m) <sup>f</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	43.5	0.87	6.71	6.71	6.71	0.15	1.80	± 13.4 %
835	41.5	0.90	6.06	6.06	6.06	0.26	2.19	± 12.0 %
900	41.5	0.97	6.03	6.03	6.03	0.29	2.00	± 12.0 %
1810	40.0	1.40	5.25	5.25	5.25	0.80	1.17	± 12.0 %
1900	40.0	1.40	5.21	5.21	5.21	0.63	1.38	± 12.0 %
2100	39.8	1.49	5.15	5.15	5.15	0.80	1.20	± 12.0 %
2450	39.2	1.80	4.47	4.47	4.47	0.63	1.50	± 12.0 %

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

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

ES3DV3– SN:3292

February 24, 2013

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	7.10	7.10	7.10	0.09	1.00	± 13.4 %
835	55.2	0.97	6.14	6.14	6.14	0.42	1.57	± 12.0 %
900	55.0	1.05	6.07	6.07	6.07	0.48	1.49	± 12.0 %
1810	53.3	1.52	4.86	4.86	4.86	0.62	1.42	± 12.0 %
1900	53.3	1.52	4.66	4.66	4.66	0.47	1.75	± 12.0 %
2100	53.2	1.62	4.76	4.76	4.76	0.70	1.39	± 12.0 %
2450	52.7	1.95	4.25	4.25	4.25	0.80	1.03	± 12.0 %

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

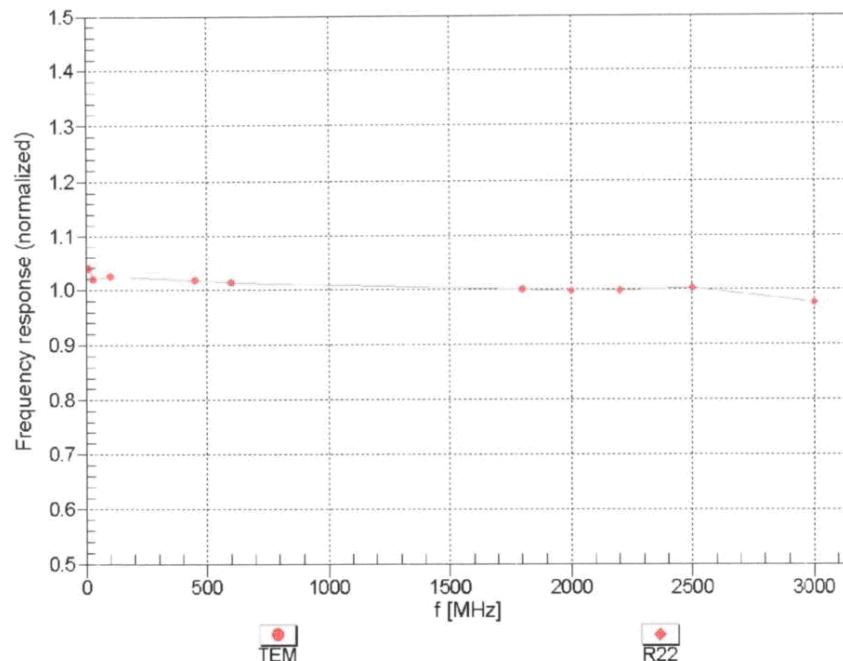
<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. A: frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted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

ES3DV3– SN:3292

February 24, 2013

## Frequency Response of E-Field

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



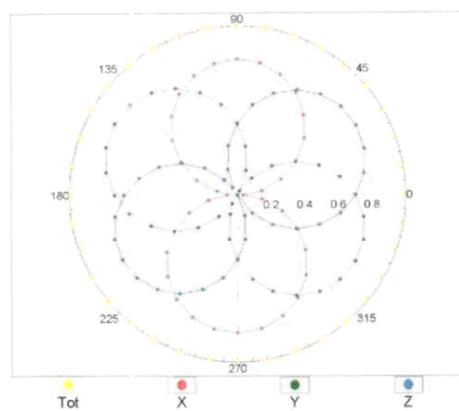
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

ES3DV3– SN:3292

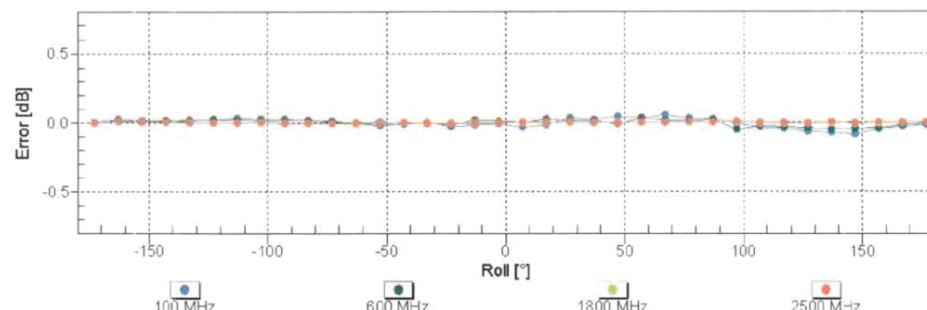
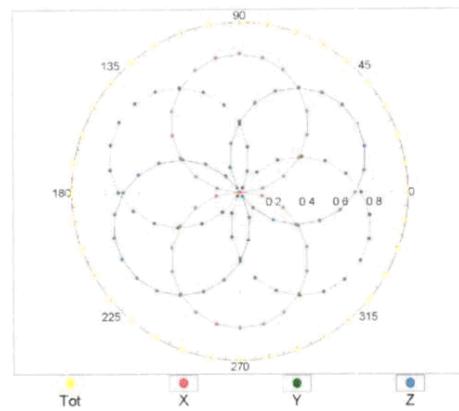
February 24, 2013

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

f=600 MHz,TEM



f=1800 MHz,R22

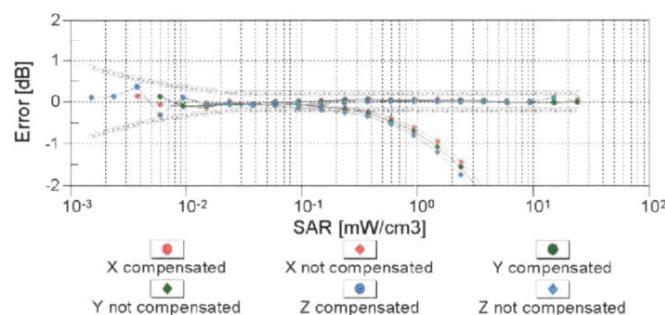
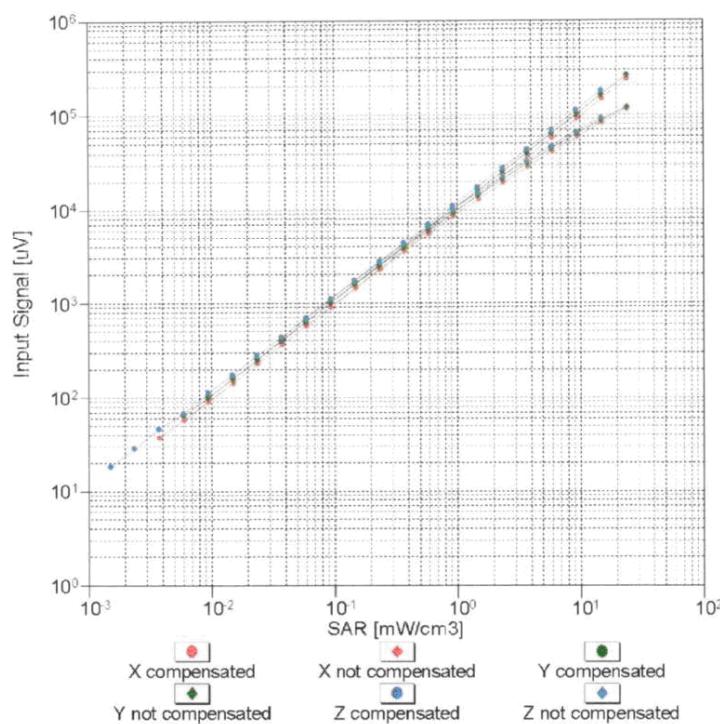


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

ES3DV3- SN:3292

February 24, 2013

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

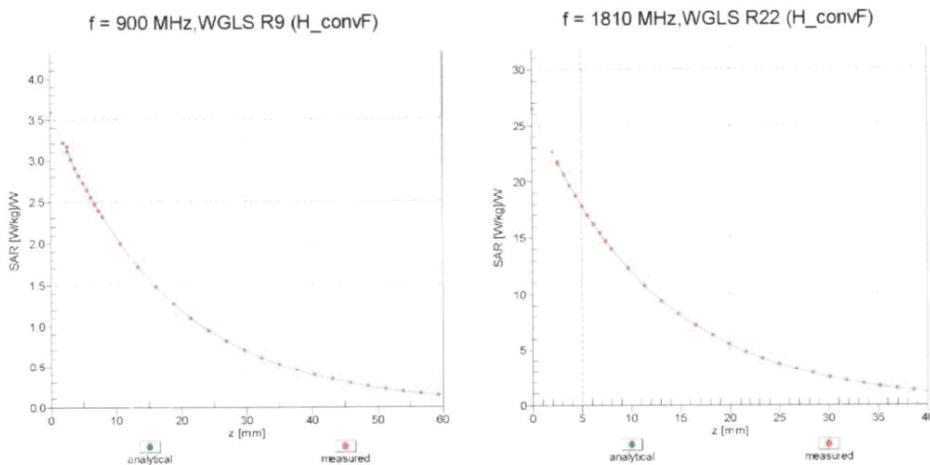


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

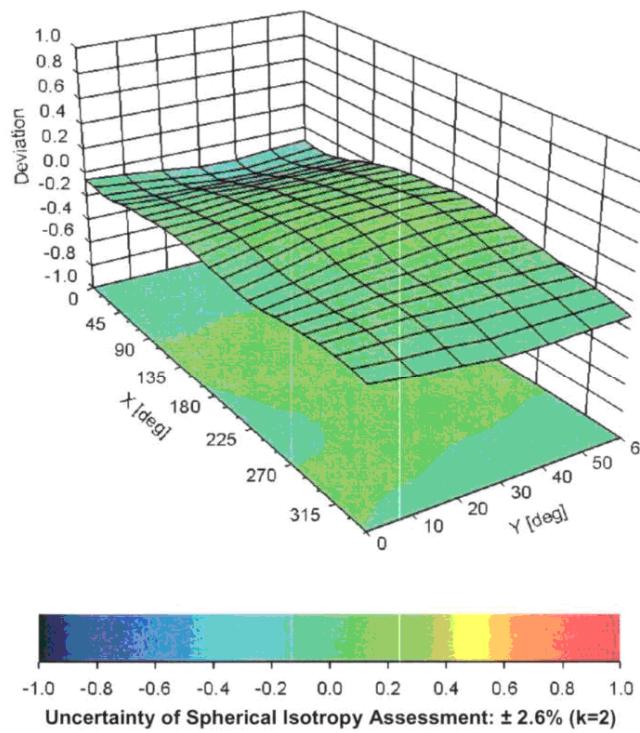
ES3DV3– SN:3292

February 24, 2013

## Conversion Factor Assessment



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



ES3DV3- SN:3292

February 24, 2013

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

## 6.2. D835V2 Dipole Calibration Certificate

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



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

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

Accreditation No.: **SCS 108**Client **CIQ SZ (Auden)**Certificate No: **D835V2-4d134\_Feb13**

### CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d134																																																										
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz																																																										
Calibration date:	February 27, 2013																																																										
<p>This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (<math>22 \pm 3</math>)°C and humidity &lt; 70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power meter EPM-442A</td> <td>GB37480704</td> <td>05-Oct-12 (No. 217-01451)</td> <td>Oct-13</td> </tr> <tr> <td>Power sensor HP 8481A</td> <td>US37292783</td> <td>05-Oct-12 (No. 217-01451)</td> <td>Oct-13</td> </tr> <tr> <td>Reference 20 dB Attenuator</td> <td>SN: 5086 (20g)</td> <td>29-Mar-12 (No. 217-01368)</td> <td>Apr-13</td> </tr> <tr> <td>Type-N mismatch combination</td> <td>SN: 5047.2 / 06327</td> <td>29-Mar-12 (No. 217-01371)</td> <td>Apr-13</td> </tr> <tr> <td>Reference Probe ES3DV3</td> <td>SN: 3205</td> <td>30-Dec-12 (No. ES3-3205_Dec11)</td> <td>Dec-13</td> </tr> <tr> <td>DAE4</td> <td>SN: 601</td> <td>04-Jul-12 (No. DAE4-601_Jul11)</td> <td>Jul-13</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Check Date (in house)</th> <th>Scheduled Check</th> </tr> </thead> <tbody> <tr> <td>Power sensor HP 8481A</td> <td>MY41092317</td> <td>18-Oct-02 (in house check Oct-11)</td> <td>In house check: Oct-13</td> </tr> <tr> <td>RF generator R&amp;S SMT-06</td> <td>100005</td> <td>04-Aug-99 (in house check Oct-11)</td> <td>In house check: Oct-13</td> </tr> <tr> <td>Network Analyzer HP 8753E</td> <td>US37390585 S4206</td> <td>18-Oct-01 (in house check Oct-11)</td> <td>In house check: Oct-13</td> </tr> </tbody> </table> <p>Calibrated by:</p> <table border="1"> <thead> <tr> <th>Name</th> <th>Function</th> <th>Signature</th> </tr> </thead> <tbody> <tr> <td>Israe El-Naouq</td> <td>Laboratory Technician</td> <td></td> </tr> </tbody> </table> <p>Approved by:</p> <table border="1"> <thead> <tr> <th>Name</th> <th>Function</th> <th>Signature</th> </tr> </thead> <tbody> <tr> <td>Katja Pokovic</td> <td>Technical Manager</td> <td></td> </tr> </tbody> </table> <p>Issued: February 27, 2013</p> <p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p>				Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration	Power meter EPM-442A	GB37480704	05-Oct-12 (No. 217-01451)	Oct-13	Power sensor HP 8481A	US37292783	05-Oct-12 (No. 217-01451)	Oct-13	Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-12 (No. 217-01368)	Apr-13	Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-12 (No. 217-01371)	Apr-13	Reference Probe ES3DV3	SN: 3205	30-Dec-12 (No. ES3-3205_Dec11)	Dec-13	DAE4	SN: 601	04-Jul-12 (No. DAE4-601_Jul11)	Jul-13	Secondary Standards	ID #	Check Date (in house)	Scheduled Check	Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13	RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13	Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-13	Name	Function	Signature	Israe El-Naouq	Laboratory Technician		Name	Function	Signature	Katja Pokovic	Technical Manager	
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**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
**Zeughausstrasse 43, 8004 Zurich, Switzerland**



<b>S</b>	Schweizerischer Kalibrierdienst
<b>C</b>	Service suisse d'étalonnage
<b>S</b>	Servizio svizzero di taratura
<b>S</b>	Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 108**

#### Glossary:

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

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

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

#### Additional Documentation:

- d) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

### Measurement Conditions

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

<b>DASY Version</b>	DASY5	V52.8.0
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom	
<b>Distance Dipole Center - TSL</b>	15 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	835 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	41.5	0.90 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	41.0 ± 6 %	0.89 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	< 0.5 °C	----	----

### SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	2.33 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.37 mW /g ± 17.0 % (k=2)

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	250 mW input power	1.52 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.11 mW /g ± 16.5 % (k=2)

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	55.2	0.97 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	55.7 ± 6 %	1.01 mho/m ± 6 %
<b>Body TSL temperature change during test</b>	< 0.5 °C	----	----

### SAR result with Body TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>	Condition	
SAR measured	250 mW input power	2.44 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.49 mW / g ± 17.0 % (k=2)

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b>	concition	
SAR measured	250 mW input power	1.60 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.26 mW / g ± 16.5 % (k=2)

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.7 $\Omega$ - 2.1 $j\Omega$
Return Loss	- 29.6 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1 $\Omega$ - 4.6 $j\Omega$
Return Loss	- 25.0 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.398 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 22, 2011

**DASY5 Validation Report for Head TSL**

Date: 27.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d134**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.89 \text{ mho/m}$ ;  $\epsilon_r = 41$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2012
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

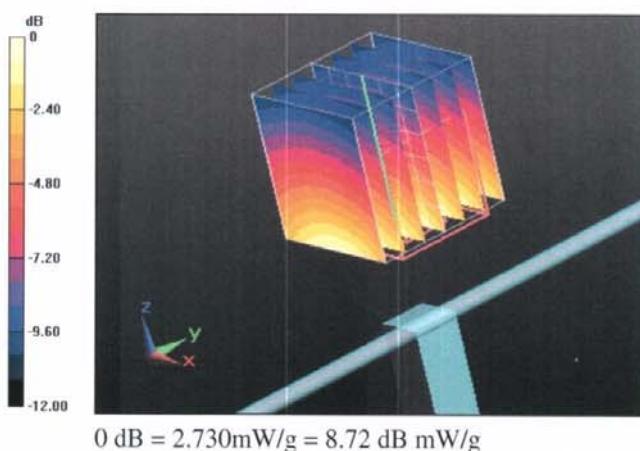
**Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:**Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

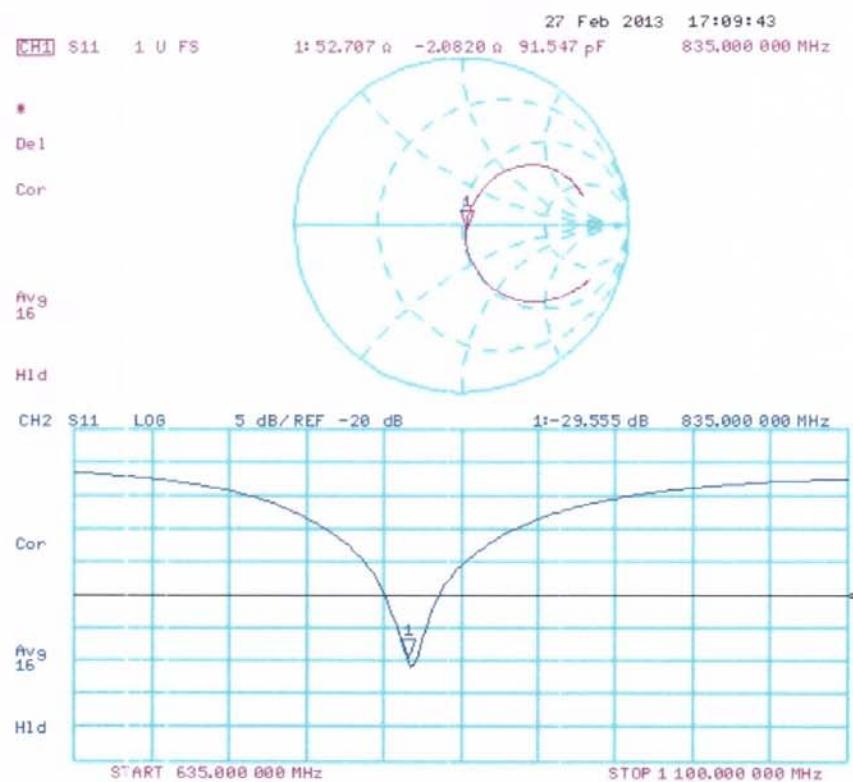
Reference Value = 57.043 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 3.4280

**SAR(1 g) = 2.33 mW/g; SAR(10 g) = 1.52 mW/g**

Maximum value of SAR (measured) = 2.725 mW/g



**Impedance Measurement Plot for Head TSL**

**DASY5 Validation Report for Body TSL**

Date: 27.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d134**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 1.01 \text{ mho/m}$ ;  $\epsilon_r = 55.7$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2012
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY5 52.8.0(692); SEMCAD X 14.6.4(4989)

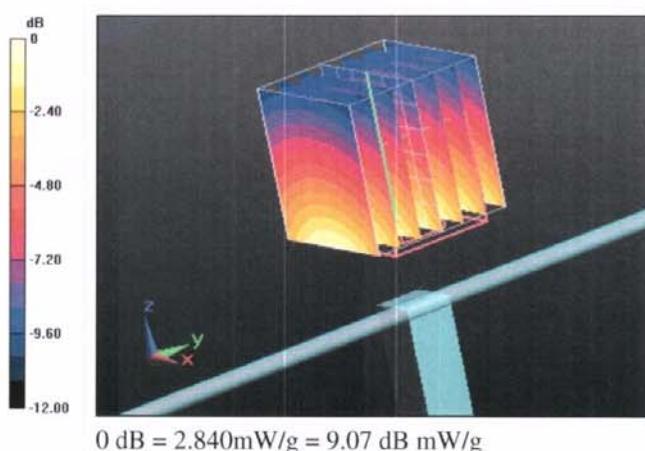
**Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:**Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

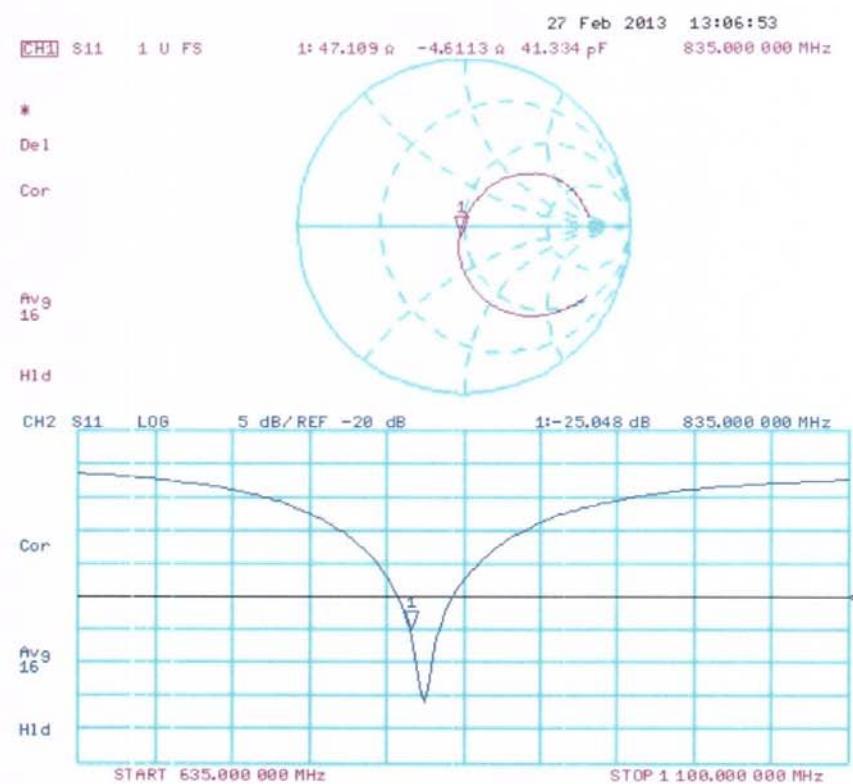
Reference Value = 54.902 V/m; Power Drift = 0.0055 dB

Peak SAR (extrapolated) = 3.5280

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

Maximum value of SAR (measured) = 2.838 mW/g



**Impedance Measurement Plot for Body TSL**

### 6.3. D1900V2 Dipole Calibration Certificate

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



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

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

Accreditation No.: **SCS 108**Client **CIQ SZ (Auden)**Certificate No: **D1900V2-5d150\_Feb13**

#### **CALIBRATION CERTIFICATE**

Object **D1900V2 - SN: 5d150**

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

Calibration date: **February 28, 2013**

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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-12 (No. 217-01451)	Oct-13
Power sensor HP 8481A	US37292783	05-Oct-12 (No. 217-01451)	Oct-13
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-12 (No. 217-01368)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-12 (No. 217-01371)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-12 (No. ES3-3205_Dec11)	Dec-13
DAE4	SN: 601	04-Jul-12 (No. DAE4-601_Jul11)	Jul-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-13

Calibrated by: Name **Claudio Leubler** Function **Laboratory Technician**

Signature

Approved by: Name **Katja Pokovic** Function **Technical Manager**

Issued: February 28, 2013

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

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



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

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

#### Glossary:

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

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

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

#### Additional Documentation:

- d) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

### Measurement Conditions

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

<b>DASY Version</b>	DASY5	V52.8.0
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	1900 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	40.0	1.40 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	40.4 ± 6 %	1.40 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	< 0.5 °C	---	---

### SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	9.94 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>39.8 mW /g ± 17.0 % (k=2)</b>
<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	250 mW input power	5.24 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>21.0 mW /g ± 16.5 % (k=2)</b>

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	53.3	1.52 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	53.0 ± 6 %	1.56 mho/m ± 6 %
<b>Body TSL temperature change during test</b>	< 0.5 °C	----	----

### SAR result with Body TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>	Condition	
SAR measured	250 mW input power	10.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>40.1 mW / g ± 17.0 % (k=2)</b>
<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b>	condition	
SAR measured	250 mW input power	5.32 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>21.1 mW / g ± 16.5 % (k=2)</b>

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.9 $\Omega$ + 6.8 $j\Omega$
Return Loss	- 22.9 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.5 $\Omega$ + 7.4 $j\Omega$
Return Loss	- 22.3 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 ns
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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 11, 2011

**DASY5 Validation Report for Head TSL**

Date: 28.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d150**

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $\epsilon_r = 40.4$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2012
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

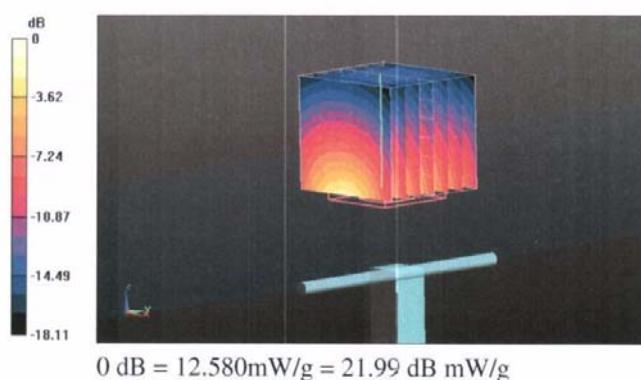
**Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (8x7x7)/Cube 0:**Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 92.182 V/m; Power Drift = 0.07 dB

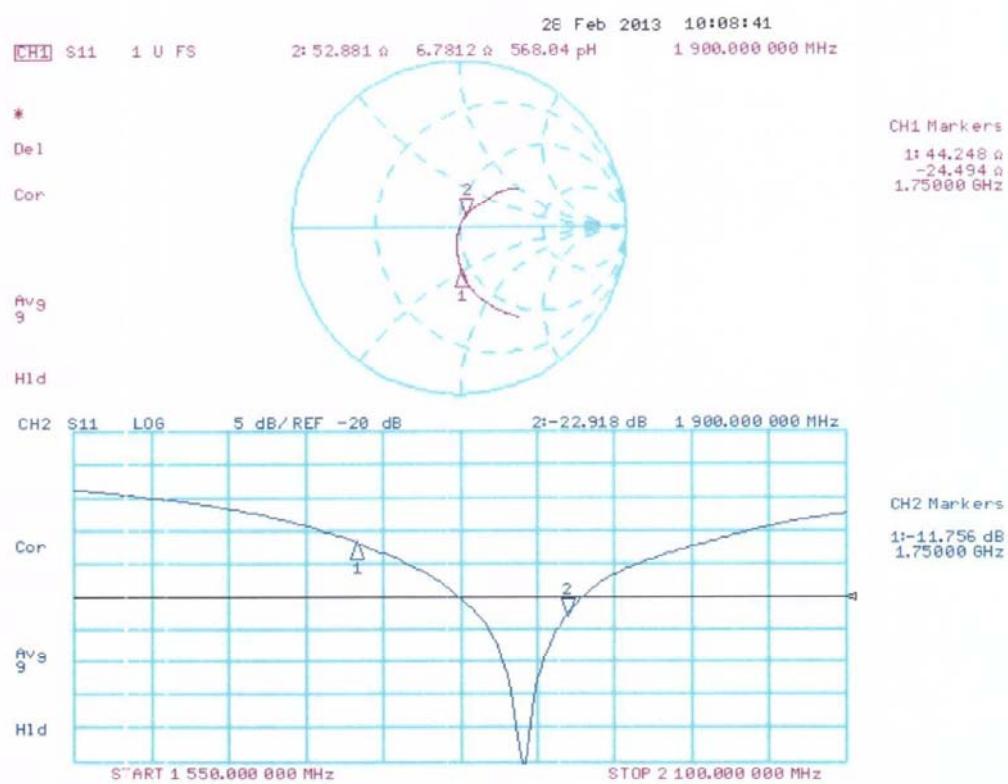
Peak SAR (extrapolated) = 17.6990

**SAR(1 g) = 9.94 mW/g; SAR(10 g) = 5.24 mW/g**

Maximum value of SAR (measured) = 12.584 mW/g



## Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 28.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d150**

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900 \text{ MHz}$ ;  $\sigma = 1.56 \text{ mho/m}$ ;  $\epsilon_r = 53$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2012
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY5 52.8.0(692); SEMCAD X 14.6.4(4989)

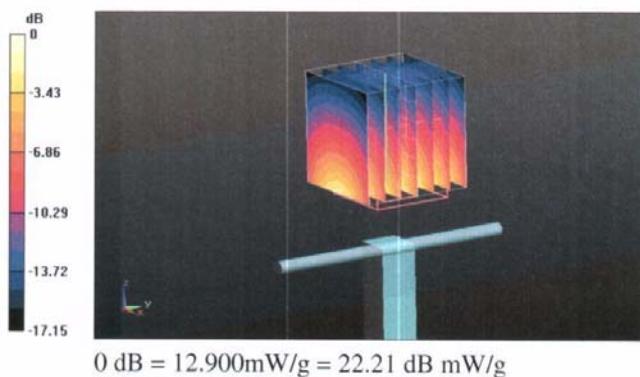
**Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 94.968 V/m; Power Drift = 0.0033 dB

Peak SAR (extrapolated) = 18.0350

**SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.32 mW/g**

Maximum value of SAR (measured) = 12.901 mW/g



**Impedance Measurement Plot for Body TSL**