



# SAR TEST REPORT

<b>Product Name</b>	HSPA+ USB Stick
<b>Model</b>	K4203
<b>FCC ID</b>	QISK4203
<b>Client</b>	Huawei Technologies Co., Ltd.
<b>Manufacturer</b>	Huawei Technologies Co., Ltd.
<b>Date of issue</b>	August 9, 2013

**TA Technology (Shanghai) Co., Ltd.**

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**Test Report**

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**GENERAL SUMMARY**

<b>Reference Standard(s)</b>	<p><b>FCC 47CFR §2.1093</b> Radiofrequency Radiation Exposure Evaluation: Portable Devices</p> <p><b>ANSI C95.1, 1992:</b> Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.(IEEE Std C95.1-1991)</p> <p><b>RSS-102 Issue 4 March 2010:</b> Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands).</p> <p><b>KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r01</b> SAR Measurement Requirements for 100 MHz to 6 GHz</p> <p><b>KDB 447498 D01 Mobile Portable RF Exposure v05r01:</b> Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies</p> <p><b>KDB 941225 D03 SAR Test Reduction GSM/GPRS/EDGE v01:</b> Recommended SAR Test Reduction Procedures for GSM/GPRS/EDGE</p> <p><b>KDB 447498 D02 SAR Procedures for Dongle Xmtr v02:</b> SAR Measurement Procedures for USB Dongle Transmitters.</p>
<b>Conclusion</b>	<p>This portable wireless equipment has been measured in all cases requested by the relevant standards. Test results in Chapter 7 of this test report are below limits specified in the relevant standards for the tested bands only.</p> <p>General Judgment: <b>Pass</b></p>
<b>Comment</b>	The test result only responds to the measured sample.

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## 1. General Information

### 1.1. Notes of the Test Report

**TA Technology (Shanghai) Co., Ltd.** has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS), and accreditation number: L2264.

**TA Technology (Shanghai) Co., Ltd.** guarantees the reliability of the data presented in this test report, which is the results of measurements and tests performed for the items under test on the date and under the conditions stated in this test report and is based on the knowledge and technical facilities available at TA Technology (Shanghai) Co., Ltd. at the time of execution of the test.

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If the electrical report is inconsistent with the printed one, it should be subject to the latter.

### 1.2. Testing Laboratory

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**1.3. Applicant Information**

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City: Shenzhen  
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Country: P.R. China

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### 1.5. Information of EUT

#### General Information

Device Type:	Portable Device		
Exposure Category:	Uncontrolled Environment / General Population		
State of Sample:	Prototype Unit		
IMEI:	358567050001201		
Hardware Version:	CH1E3531SM		
Software Version:	21.313.00.02.5011		
Antenna Type:	Internal Antenna		
Device Operating Configurations:			
Operating Mode(s):	GSM 850/ GSM 1900; (tested) GSM900/ GSM1800; (untested) UMTS Band I/UMTS Band VIII; (untested)		
Test Modulation:	(GSM)GMSK;		
Device Class:	B		
GPRS Multislot Class(12):	Max Number of Timeslots in Uplink	4	
	Max Number of Timeslots in Downlink	4	
	Max Total Timeslot	5	
EGPRS Multislot Class(12):	Max Number of Timeslots in Uplink	4	
	Max Number of Timeslots in Downlink	4	
	Max Total Timeslot	5	
Power Class:	GSM 850: 4		
	GSM 1900: 1		
Power Level:	GSM 850: tested with power level 5		
	GSM 1900: tested with power level 0		
Test Channel: (Low - Middle - High)	128 -190 - 251	(GSM 850) (tested)	
	512 - 661 - 810	(GSM 1900) (tested)	
Test Frequency Range(s):	Mode	Tx (MHz)	Rx (MHz)
	GSM 850	824.2 ~ 848.8	869.2 ~ 893.8
	GSM 1900	1850.2 ~ 1909.8	1930.2 ~ 1989.8
Used Host Products:	IBM T61		

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Equipment Under Test (EUT) has a main antenna that is used for Tx/Rx. During SAR test of the EUT, it was connected to a portable computer.

The sample undergoing test was selected by the Client.

Components list please refer to documents of the manufacturer.

### 1.6. The Maximum Reported SAR<sub>1g</sub>

#### Body Worn Configuration

Mode	Test Position	Channel /Frequency(MHz)	Limit SAR <sub>1g</sub> 1.6 W/kg	
			Measured SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
GSM 850, 2Txslots	Test Position 1	190/836.6	0.624	0.795
GSM 1900, 2Txslots	Test Position 1	810/1909.8	0.765	0.903

### 1.7. Maximum Conducted Power of Each Tested Mode

Mode		Maximum Burst Conducted Power (dBm)	Maximum Average Power (dBm)
GSM 850	GPRS(GMSK), 2 Txslots	30.03	24.01
	EGPRS(GMSK), 2 Txslots	30.03	24.01
GSM 1900	GPRS(GMSK), 2 Txslots	27.42	21.40
	EGPRS(GMSK), 2 Txslots	27.42	21.40

Note: The detail Power refers to Table 6 (Conducted Power Measurement Results).

### 1.8. Test Date

The test performed from August 8, 2013 to August 9, 2013.

## 2. SAR Measurements System Configuration

### 2.1. 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.

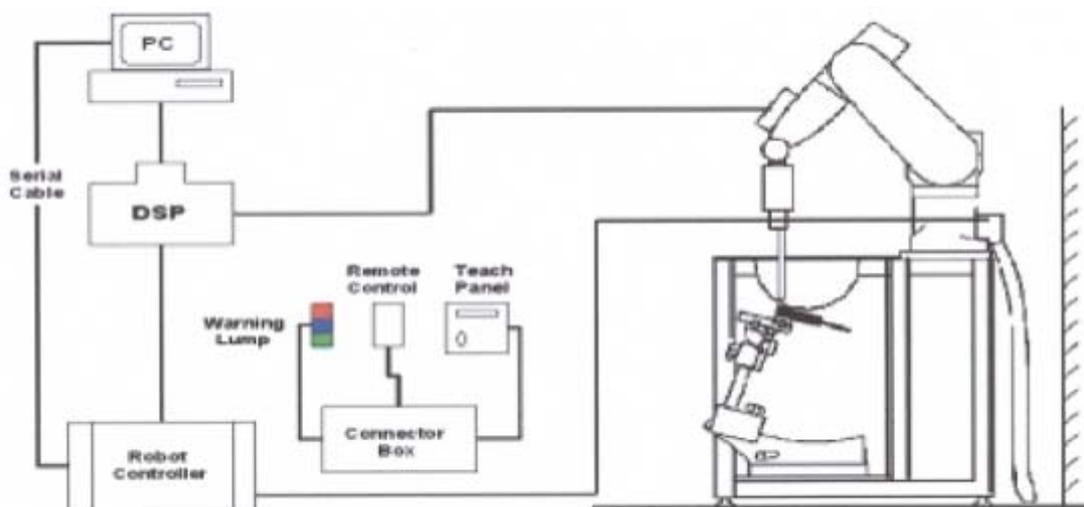


Figure 1. SAR Lab Test Measurement Set-up

## 2.2. DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

### 2.2.1. EX3DV4 Probe Specification

Construction	Symmetrical design with triangular core 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 > 6 GHz Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)
Directivity	$\pm 0.3$ dB in HSL (rotation around probe axis) $\pm 0.5$ dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 $\mu$ W/g to > 100 mW/g Linearity:  $\pm 0.2$ dB (noise: typically < 1 $\mu$ W/g)
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.



**Figure 2. EX3DV4 E-field Probe**



**Figure 3. EX3DV4 E-field probe**

### 2.2.2. E-field Probe Calibration

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

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

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

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

Where:  $\Delta t$  = Exposure time (30 seconds),  
C = Heat capacity of tissue (brain or muscle),  
 $\Delta T$  = Temperature increase due to RF exposure.  
Or

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

Where:  
 $\sigma$  = Simulated tissue conductivity,  
 $\rho$  = Tissue density (kg/m<sup>3</sup>).

## 2.3. Other Test Equipment

### 2.3.1. Device Holder for Transmitters

**Construction:** Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.) It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin SAM, ELI4 and SAM v6.0 Phantoms.

**Material:** POM, Acrylic glass, Foam

### 2.3.2. Phantom

The Generic Twin Phantom is constructed of a fiberglass shell integrated in a wooden Figure. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

Shell Thickness	2±0.1 mm
Filling Volume	Approx. 20 liters
Dimensions	810 x 1000 x 500 mm (H x L x W) Available Special



Figure 4 Generic Twin Phantom

### 2.4. 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. ± 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 ± 0.1mm). 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 ± 30°.)
- Area Scan  
The Area Scan is used as a fast scan in two dimensions to find the area of high field values

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before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing is set according to FCC KDB Publication 865664. During 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**

After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm.

- **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.

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

**Table 1: Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01**

Frequency	Maximum Area Scan Resolution (mm) ( $\Delta x_{area}, \Delta y_{area}$ )	Maximum Zoom Scan Resolution (mm) ( $\Delta x_{zoom}, \Delta y_{zoom}$ )	Maximum Zoom Scan Spatial Resolution (mm) $\Delta z_{zoom}(n)$	Minimum Zoom Scan Volume (mm) (x,y,z)
≤ 2 GHz	≤ 15	≤ 8	≤ 5	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≥ 25
5-6 GHz	≤ 10	≤ 4	≤ 2	≥ 22

## **2.5. Data Storage and Evaluation**

### **2.5.1. 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 “.DAE4”. 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.

### **2.5.2. Data Evaluation by SEMCAD**

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, a <sub>i0</sub> , a <sub>i1</sub> , a <sub>i2</sub>
	- Conversion factor	ConvF <sub>i</sub>
	- Diode compression point	Dcp <sub>i</sub>
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	
	- Density	

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.

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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:

$$V_i = U_i + U_i^2 \cdot c f / d c p_i$$

With  $V_i$  = compensated signal of channel i (i = x, y, z)

$U_i$  = input signal of channel i (i = x, y, z)

$cf$  = crest factor of exciting field (DASY parameter)

$dcp_i$  = diode compression point (DASY parameter)

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

E-field probes:  $E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$

H-field probes:  $H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f$

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)<sup>2</sup>] 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):

$$E_{tot} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

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

$$SAR = (E_{tot})^2 \cdot \sigma / (\rho \cdot 1000)$$

with  $SAR$  = local specific absorption rate in mW/g

$E_{tot}$  = total field strength in V/m

$\sigma$  = conductivity in [mho/m] or [Siemens/m]

$\rho$  = equivalent tissue density in g/cm<sup>3</sup>

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

$$P_{pwe} = E_{tot}^2 / 3770 \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with  $P_{pwe}$  = equivalent power density of a plane wave in mW/cm<sup>2</sup>

$E_{tot}$  = total electric field strength in V/m

$H_{tot}$  = total magnetic field strength in A/m

### 3. Laboratory Environment

**Table 2: The Requirements of the Ambient Conditions**

Temperature	Min. = 18°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards.	
Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

## 4. Tissue-equivalent Liquid

### 4.1. Tissue-equivalent Liquid Ingredients

The liquid is consisted of water, salt, Glycol, Sugar, Preventol and Cellulose. The liquid has previously been proven to be suited for worst-case. Table 3 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB 865664 D01.

**Table 3: Composition of the Body Tissue Equivalent Matter**

MIXTURE%	FREQUENCY(Body) 835MHz		
Water	52.5		
Sugar	45		
Salt	1.4		
Preventol	0.1		
Cellulose	1.0		
<b>Dielectric Parameters Target Value</b>	<b>f=835MHz</b>	<b>ε=55.2</b>	<b>σ=0.97</b>

MIXTURE%	FREQUENCY (Body) 1900MHz		
Water	69.91		
Glycol monobutyl	29.96		
Salt	0.13		
<b>Dielectric Parameters Target Value</b>	<b>f=1900MHz</b>	<b>ε=53.3</b>	<b>σ=1.52</b>

### 4.2. Tissue-equivalent Liquid Properties

**Table 4: Dielectric Performance of Tissue Simulating Liquid**

Frequency	Test Date	Temp °C	Measured Dielectric Parameters		Target Dielectric Parameters		Limit (Within ±5%)	
			ε <sub>r</sub>	σ(s/m)	ε <sub>r</sub>	σ(s/m)	Dev ε <sub>r</sub> (%)	Dev σ(%)
835MHz (body)	2013-08-08	21.5	55.33	0.999	55.20	0.97	0.24	3.010
1900MHz (body)	2013-08-08	21.5	53.08	1.524	53.30	1.52	-0.41	0.263

## 5. System Check

### 5.1. Description of System Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the table 5.

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 DASYS5 system.

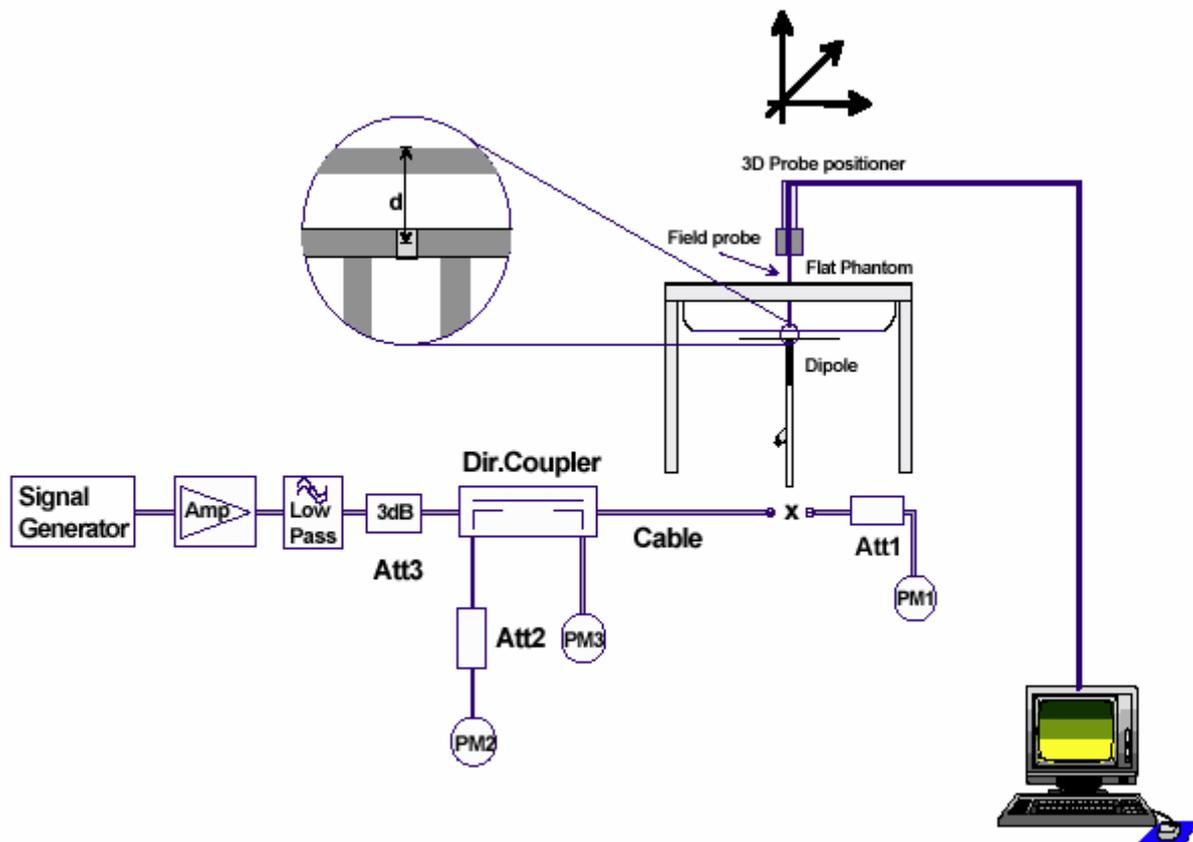


Figure 5. System Check Set-up

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### Justification for Extended SAR Dipole Calibrations

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< - 20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB 865664 D01:

Dipole D835V2 SN: 4d020				
Body Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
8/26/2011	-25.1	/	48.7	/
8/25/2012	-24.3	3.2%	50.6	1.9 $\Omega$

Dipole D1900V2 SN: 5d060				
Body Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
8/31/2011	-21.3	/	47.3	/
8/30/2012	-20.9	1.9%	45.9	1.4 $\Omega$

## 5.2. System Check Results

**Table 5: System Check in Body Tissue Simulating Liquid**

Frequency	Test Date	Dielectric Parameters		Temp ( $^{\circ}$ C)	250mW Measured SAR <sub>1g</sub>	1W Normalized SAR <sub>1g</sub>	1W Target SAR <sub>1g</sub>	Limit ( $\pm$ 10% Deviation)
		$\epsilon_r$	$\sigma$ (s/m)		(W/kg)			
<b>835MHz</b>	2013-08-08	55.33	0.999	21.5	2.50	10.00	9.46	5.71
<b>1900MHz</b>	2013-08-08	53.08	1.524	21.5	10.50	42.00	41.70	0.72

Note: 1. The graph results see ANNEX B.  
2. Target Values used derive from the calibration certificate

## 6. Operational Conditions during Test

### 6.1. General Description of Test Procedures

Connection to the EUT is established via air interface with E5515C, and the EUT is set to maximum output power by E5515C. Using E5515C the power level is set to “5” in SAR of GSM 850, set to “0” in SAR of GSM 1900. The antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the EUT. The signal transmitted by the simulator to the antenna feeding point shall be lower than the output power level of the EUT by at least 30 dB.

### 6.2. Test Configuration

#### 6.2.1. GSM Test Configuration

For the body SAR tests for GSM 850 and GSM 1900, a communication link is set up with a System Simulator (SS) by air link. The EUT is commanded to operate at maximum transmitting power. Since the GPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslot is 5. Since the EGPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslot is 5.

When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.

According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot. The allowed power reduction in the multi-slot configuration is as following:

#### **GSM 850**

GPRS (GMSK) :

<b>Number of timeslots in uplink assignment</b>	<b>reduction of maximum output power, (dB)</b>
1	0
2	2
3	4
4	6

EGPRS (8PSK):

<b>Number of timeslots in uplink assignment</b>	<b>reduction of maximum output power, (dB)</b>
1	0
2	2
3	4.5
4	6.5

EGPRS (GMSK):

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<b>Number of timeslots in uplink assignment</b>	<b>reduction of maximum output power, (dB)</b>
1	0
2	2
3	4
4	6

**GSM 1900**

GPRS (GMSK) :

<b>Number of timeslots in uplink assignment</b>	<b>reduction of maximum output power, (dB)</b>
1	0
2	2
3	4
4	6

EGPRS (8PSK):

<b>Number of timeslots in uplink assignment</b>	<b>reduction of maximum output power, (dB)</b>
1	0
2	2
3	4.5
4	7

EGPRS (GMSK):

<b>Number of timeslots in uplink assignment</b>	<b>reduction of maximum output power, (dB)</b>
1	0
2	2
3	4
4	6

### **6.3. Measurement Variability**

Per FCC KDB Publication 865664 D01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

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

#### **6.4. Test Positions**

The measurements were performed in combination with a host product (IBM T61). IBM T61 laptop has horizontal and vertical USB slot.

A test distance of 5mm or less, according to KDB 447498 D02, should be considered for the orientation that can satisfy such requirements.

For each channel, the EUT is tested at the following 5 test positions:

- Test Position 1: The EUT is connected to the portable computer with horizontal USB slot. The back side of the EUT towards to the bottom of the flat phantom. The distance from back side of the EUT to the bottom of the flat phantom is 5mm. (ANNEX H Picture 6)
- Test Position 2: The EUT is connected to the portable computer through a 19 cm USB cable. The front side of the EUT towards the bottom of the flat phantom. The distance from front side of the EUT to the bottom of the flat phantom is 5mm. (ANNEX H Picture 7)
- Test Position 3: The EUT is connected to the portable computer through a 19 cm USB cable. The left side of the EUT towards the bottom of the flat phantom. The distance from left side of the EUT to the bottom of the flat phantom is 5mm. (ANNEX H Picture 8)
- Test Position 4: The EUT is connected to the portable computer with vertical USB slot. The right side of the EUT towards the bottom of the flat phantom. The distance from right side of the EUT to the bottom of the flat phantom is 5mm. (ANNEX H Picture 9)
- Test Position 5: The EUT is connected to the portable computer with vertical USB slot. The top side of the EUT towards to the bottom of the flat phantom. The distance between the top side of the EUT and the bottom of the flat phantom is 5mm. (ANNEX H Picture 10)

### 6.5. Picture of Host Product

During the test, IBM T61 laptop were used as an assistant to help to setup communication. (See Picture 1)



Picture 1-a: IBM T61 Close



Picture 1-b: IBM T61 Open



Picture 1-c: IBM T61 with horizontal USB slot



Picture 1-d: IBM T61 with Vertical USB slot



Picture 1-d: a 19 cm USB cable

**Picture 1: Computer as a test assistant**

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**7. Test Results**

**7.1. Conducted Power Results**

**Table 6: Conducted Power Measurement Results**

GSM 850		Burst Conducted Power(dBm)			/	Average power(dBm)		
		Channel 128	Channel 190	Channel 251		Channel 128	Channel 190	Channel 251
<b>GPRS (GMSK)</b>	1Txslot	31.88	31.98	32.05	-9.03dB	22.85	22.95	23.02
	2Txslots	29.83	29.95	30.03	-6.02dB	<b>23.81</b>	<b>23.93</b>	<b>24.01</b>
	3Txslots	27.88	27.98	28.09	-4.26dB	23.62	23.72	23.83
	4Txslots	25.96	26.05	26.13	-3.01dB	22.95	23.04	23.12
<b>EGPRS (GMSK)</b>	1Txslot	31.88	31.98	32.05	-9.03dB	22.85	22.95	23.02
	2Txslots	29.83	29.95	30.03	-6.02dB	<b>23.81</b>	<b>23.93</b>	<b>24.01</b>
	3Txslots	27.88	27.98	28.09	-4.26dB	23.62	23.72	23.83
	4Txslots	25.96	26.05	26.13	-3.01dB	22.95	23.04	23.12
<b>EGPRS (8PSK)</b>	1Txslot	25.49	25.34	25.25	-9.03dB	16.46	16.31	16.22
	2Txslots	23.48	23.39	23.33	-6.02dB	17.46	17.37	17.31
	3Txslots	21.02	20.93	20.78	-4.26dB	16.76	16.67	16.52
	4Txslots	19.06	18.96	18.88	-3.01dB	16.05	15.95	15.87
GSM 1900		Burst Conducted Power(dBm)			/	Average power(dBm)		
		Channel 512	Channel 661	Channel 810		Channel 512	Channel 661	Channel 810
<b>GPRS (GMSK)</b>	1Txslot	29.38	29.28	29.17	-9.03dB	20.35	20.25	20.14
	2Txslots	27.42	27.35	27.28	-6.02dB	<b>21.40</b>	<b>21.33</b>	<b>21.26</b>
	3Txslots	25.39	25.35	25.28	-4.26dB	21.13	21.09	21.02
	4Txslots	23.43	23.39	23.32	-3.01dB	20.42	20.38	20.31
<b>EGPRS (GMSK)</b>	1Txslot	29.38	29.28	29.17	-9.03dB	20.35	20.25	20.14
	2Txslots	27.42	27.35	27.28	-6.02dB	<b>21.40</b>	<b>21.33</b>	<b>21.26</b>
	3Txslots	25.39	25.35	25.28	-4.26dB	21.13	21.09	21.02
	4Txslots	23.43	23.39	23.32	-3.01dB	20.42	20.38	20.31
<b>EGPRS (8PSK)</b>	1Txslot	24.86	24.88	24.96	-9.03dB	15.83	15.85	15.93
	2Txslots	22.68	22.78	22.75	-6.02dB	16.66	16.76	16.73
	3Txslots	20.64	20.62	20.55	-4.26dB	16.38	16.36	16.29
	4Txslots	18.13	18.02	18.37	-3.01dB	15.12	15.01	15.36

Note:

1) Division Factors

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

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1Txslot = 1 transmit time slot out of 8 time slots

=> conducted power divided by (8/1) => -9.03 dB

2Txslots = 2 transmit time slots out of 8 time slots

=> conducted power divided by (8/2) => -6.02 dB

3Txslots = 3 transmit time slots out of 8 time slots

=> conducted power divided by (8/3) => -4.26 dB

4Txslots = 4 transmit time slots out of 8 time slots

=> conducted power divided by (8/4) => -3.01 dB

2) Average power numbers

The maximum power numbers are marks in bold.

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### 7.2. SAR Test Results

#### 7.2.1. GSM 850 (GPRS/EGPRS)

**Table 7: SAR Values [GSM 850 (GPRS/EGPRS)]**

Test Position	Channel/Frequency (MHz)	Time slot	Duty Cycle	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ± 0.21dB	Limit SAR <sub>1g</sub> 1.6 W/kg			
						Drift (dB)	Measured SAR <sub>1g</sub> (W/kg)	Scaling Factor	Reported SAR <sub>1g</sub> (W/kg)	Graph Results
<b>IBM T61(Distance 5mm)</b>										
Test Position 1	190/836.6	2Txslots	1:4.15	31	29.95	0.001	0.624	1.27	0.795	Figure 8
Test Position 2	190/836.6	2Txslots	1:4.15	31	29.95	0.050	0.579	1.27	0.737	Figure 9
Test Position 3	190/836.6	2Txslots	1:4.15	31	29.95	0.110	0.187	1.27	0.238	Figure10
Test Position 4	190/836.6	2Txslots	1:4.15	31	29.95	0.020	0.370	1.27	0.471	Figure11
Test Position 5	190/836.6	2Txslots	1:4.15	31	29.95	-0.090	0.012	1.27	0.016	Figure12
<b>Worst Case Position of GPRS with EGPRS (GMSK, Distance 5mm)</b>										
Test Position 1	190/836.6	2Txslots	1:4.15	31	29.95	0.110	0.616	1.27	0.784	Figure13
<p>Note: 1.The value with blue color is the maximum SAR Value of each test band.</p> <p>2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).</p> <p>3. When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.</p> <p>4. When multiple slots are used, SAR should be tested to account for the maximum source-based time-averaged output power.</p>										

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### 7.2.2. GSM 1900 (GPRS/EGPRS)

**Table 8: SAR Values [GSM 1900 (GPRS/EGPRS)]**

Test Position	Channel/Frequency (MHz)	Time slot	Duty Cycle	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift	Limit SAR <sub>1g</sub> 1.6 W/kg			
						± 0.21dB	Measured SAR <sub>1g</sub> (W/kg)	Scaling Factor	Reported SAR <sub>1g</sub> (W/kg)	Graph Results
<b>IBM T61(Distance 5mm)</b>										
Test Position 1	810/1909.8	2Txslots	1:4.15	28	27.28	-0.010	0.765	1.18	0.903	Figure 14
	661/1880	2Txslots	1:4.15	28	27.35	-0.060	0.761	1.16	0.884	Figure 15
	512/1850.2	2Txslots	1:4.15	28	27.42	0.020	0.705	1.14	0.806	Figure 16
Test Position 2	661/1880	2Txslots	1:4.15	28	27.35	0.090	0.642	1.16	0.746	Figure 17
Test Position 3	661/1880	2Txslots	1:4.15	28	27.35	0.050	0.313	1.16	0.364	Figure 18
Test Position 4	661/1880	2Txslots	1:4.15	28	27.35	0.110	0.488	1.16	0.567	Figure 19
Test Position 5	661/1880	2Txslots	1:4.15	28	27.35	0.032	0.026	1.16	0.031	Figure 20
<b>Worst Case Position of GPRS with EGPRS (GMSK, Distance 5mm)</b>										
Test Position 1	810/1909.8	2Txslots	1:4.15	28	27.28	0.020	0.757	1.18	0.894	Figure 21

Note: 1. The value with blue color is the maximum SAR Value of each test band.

2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

3. When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.

4. When multiple slots are used, SAR should be tested to account for the maximum source-based time-averaged output power.

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**8. 700MHz to 3GHz Measurement Uncertainty**

No.	source	Type	Uncertainty Value (%)	Probability Distribution	k	c <sub>i</sub>	Standard uncertainty u <sub>i</sub> (%)	Degree of freedom V <sub>eff</sub> or v <sub>i</sub>
1	System repetivity	A	0.5	N	1	1	0.5	9
Measurement system								
2	-probe calibration	B	6.0	N	1	1	6.0	∞
3	-axial isotropy of the probe	B	4.7	R	$\sqrt{3}$	$\sqrt{0.5}$	1.9	∞
4	- Hemispherical isotropy of the probe	B	9.4	R	$\sqrt{3}$	$\sqrt{0.5}$	3.9	∞
6	-boundary effect	B	1.9	R	$\sqrt{3}$	1	1.1	∞
7	-probe linearity	B	4.7	R	$\sqrt{3}$	1	2.7	∞
8	- System detection limits	B	1.0	R	$\sqrt{3}$	1	0.6	∞
9	-readout Electronics	B	1.0	N	1	1	1.0	∞
10	-response time	B	0	R	$\sqrt{3}$	1	0	∞
11	-integration time	B	4.32	R	$\sqrt{3}$	1	2.5	∞
12	-noise	B	0	R	$\sqrt{3}$	1	0	∞
13	-RF Ambient Conditions	B	3	R	$\sqrt{3}$	1	1.73	∞
14	-Probe Positioner Mechanical Tolerance	B	0.4	R	$\sqrt{3}$	1	0.2	∞
15	-Probe Positioning with respect to Phantom Shell	B	2.9	R	$\sqrt{3}$	1	1.7	∞
16	-Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	B	3.9	R	$\sqrt{3}$	1	2.3	∞
Test sample Related								
17	-Test Sample Positioning	A	2.9	N	1	1	2.9	71
18	-Device Holder Uncertainty	A	4.1	N	1	1	4.1	5
19	-Output Power Variation - SAR drift measurement	B	5.0	R	$\sqrt{3}$	1	2.9	∞
Physical parameter								
20	-phantom	B	4.0	R	$\sqrt{3}$	1	2.3	∞
21	-liquid conductivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.64	1.8	∞

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22	-liquid conductivity (measurement uncertainty)	B	2.5	N	1	0.64	1.6	9
23	-liquid permittivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.6	1.7	$\infty$
24	-liquid permittivity (measurement uncertainty)	B	2.5	N	1	0.6	1.5	9
Combined standard uncertainty		$u_c = \sqrt{\sum_{i=1}^{24} c_i^2 u_i^2}$					11.50	
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$		N	k=2	23.00		

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**9. Main Test Instruments**

**Table 9: List of Main Instruments**

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	Agilent 8753E	US37390326	September 11, 2012	One year
02	Dielectric Probe Kit	Agilent 85070E	US44020115	No Calibration Requested	
03	Power meter	Agilent E4417A	GB41291714	March 10, 2013	One year
04	Power sensor	Agilent N8481H	MY50350004	September 24, 2012	One year
05	Power sensor	E9327A	US40441622	January 2, 2013	One year
06	Signal Generator	HP 8341B	2730A00804	September 10, 2012	One year
07	Dual directional coupler	778D-012	50519	March 25, 2013	One year
08	Amplifier	IXA-020	0401	No Calibration Requested	
09	BTS	E5515C	MY48360988	December 1, 2012	One year
10	E-field Probe	EX3DV4	3753	January 17, 2013	One year
11	DAE	DAE4	1317	January 25, 2013	One year
12	Validation Kit 835MHz	D835V2	4d020	August 26, 2011	Three years
13	Validation Kit 1900MHz	D1900V2	5d060	August 31, 2011	Three years
14	Temperature Probe	JM222	AA1009129	March 14, 2013	One year
15	Hygrothermograph	WS-1	64591	September 27, 2012	One year

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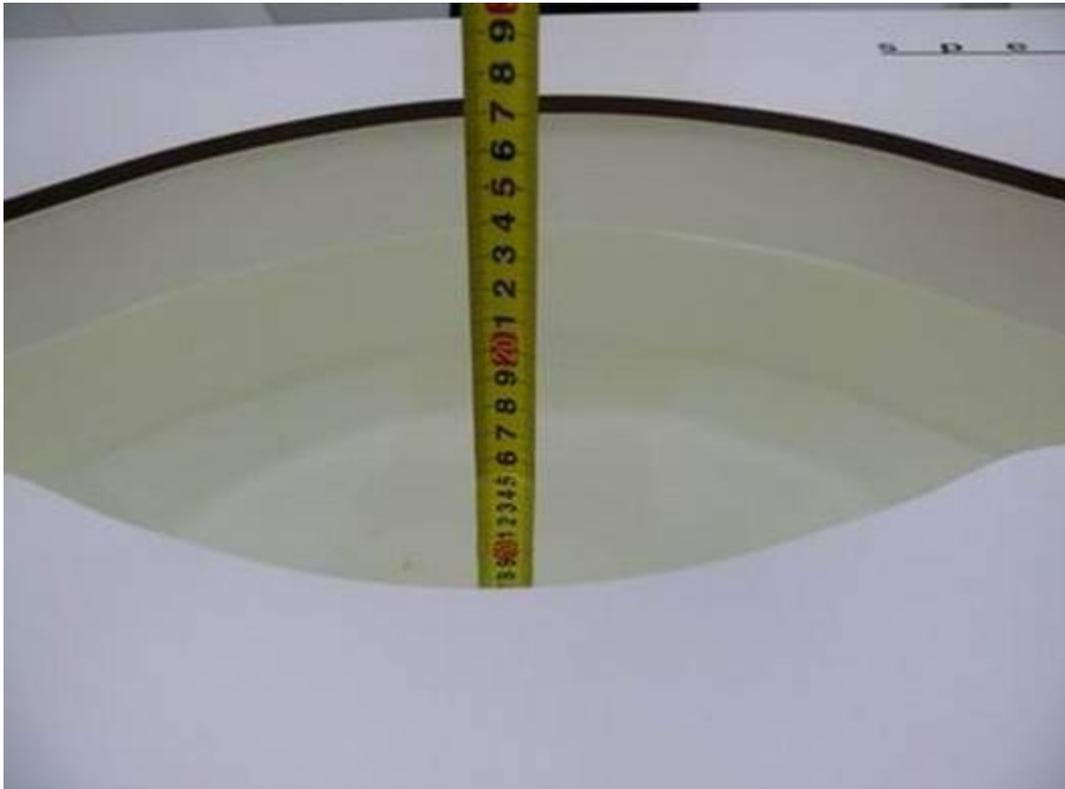
## ANNEX A: Test Layout



Picture 2: Specific Absorption Rate Test Layout



Picture 3: Liquid depth in the Flat Phantom (835 MHz, 15.4cm depth)



Picture 4: Liquid depth in the Flat Phantom (1900 MHz, 15.2cm depth)

## ANNEX B: System Check Results

### System Performance Check at 835 MHz

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d020**

Date/Time: 8/8/2013 10:05:37 AM

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

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.999$  mho/m;  $\epsilon_r = 55.33$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(9.05, 9.05, 9.05); Calibrated: 1/17/2013

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM1; Type: SAM; Serial: TP-1534

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

**d=15mm, Pin=250mW/Area Scan (41x121x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 2.61 mW/g

**d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 52.09 V/m; Power Drift = -0.032 dB

Peak SAR (extrapolated) = 3.48 W/kg

**SAR(1 g) = 2.5 mW/g; SAR(10 g) = 1.65 mW/g**

Maximum value of SAR (measured) = 2.69 mW/g

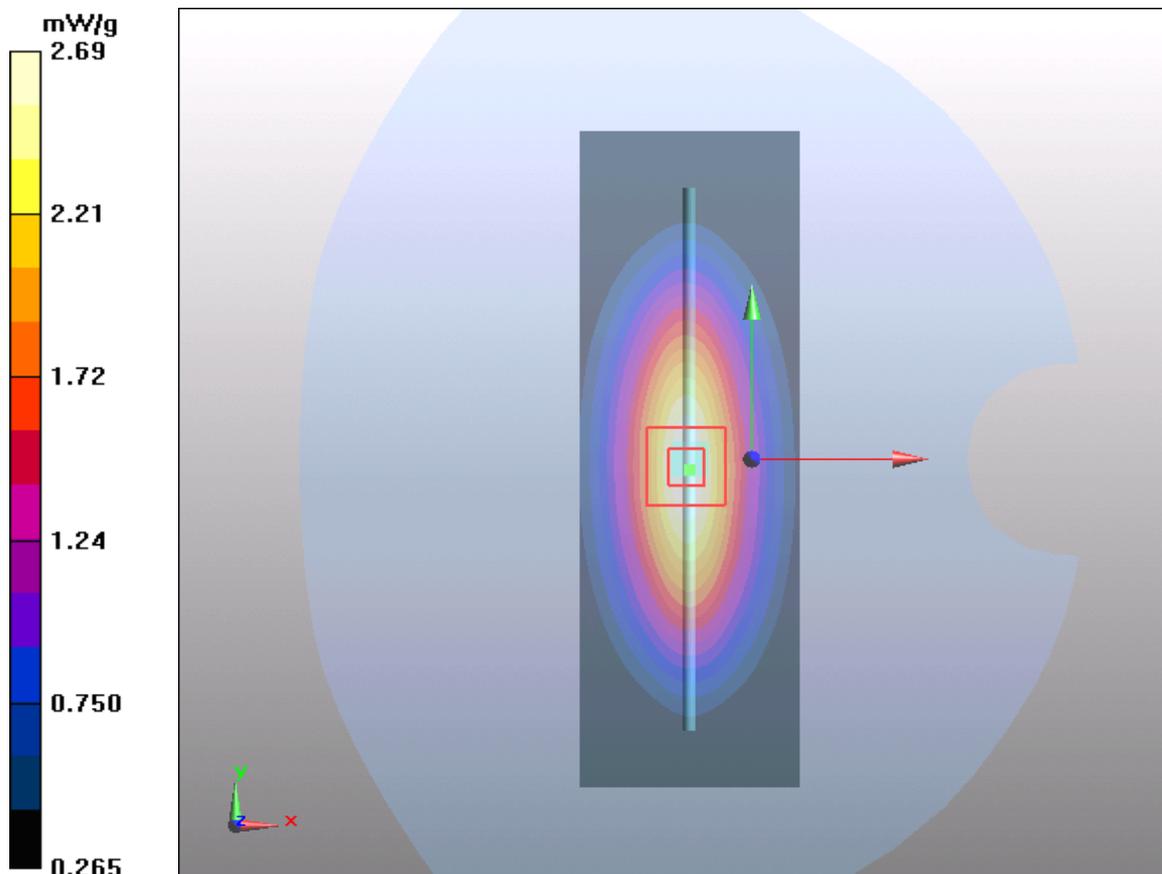


Figure 6 System Performance Check 835MHz 250mW

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## System Performance Check at 1900 MHz

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d060**

Date/Time: 8/8/2013 2:35:01 PM

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

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.524$  mho/m;  $\epsilon_r = 53.08$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(7.33, 7.33, 7.33); Calibrated: 1/17/2013

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM1; Type: SAM; Serial: TP-1534

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

**d=10mm, Pin=250mW/Area Scan (41x71x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 11.8 mW/g

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

Reference Value = 83.1 V/m; Power Drift = 0.056 dB

Peak SAR (extrapolated) = 18.1 W/kg

**SAR(1 g) = 10.5 mW/g; SAR(10 g) = 5.48 mW/g**

Maximum value of SAR (measured) = 11.8 mW/g

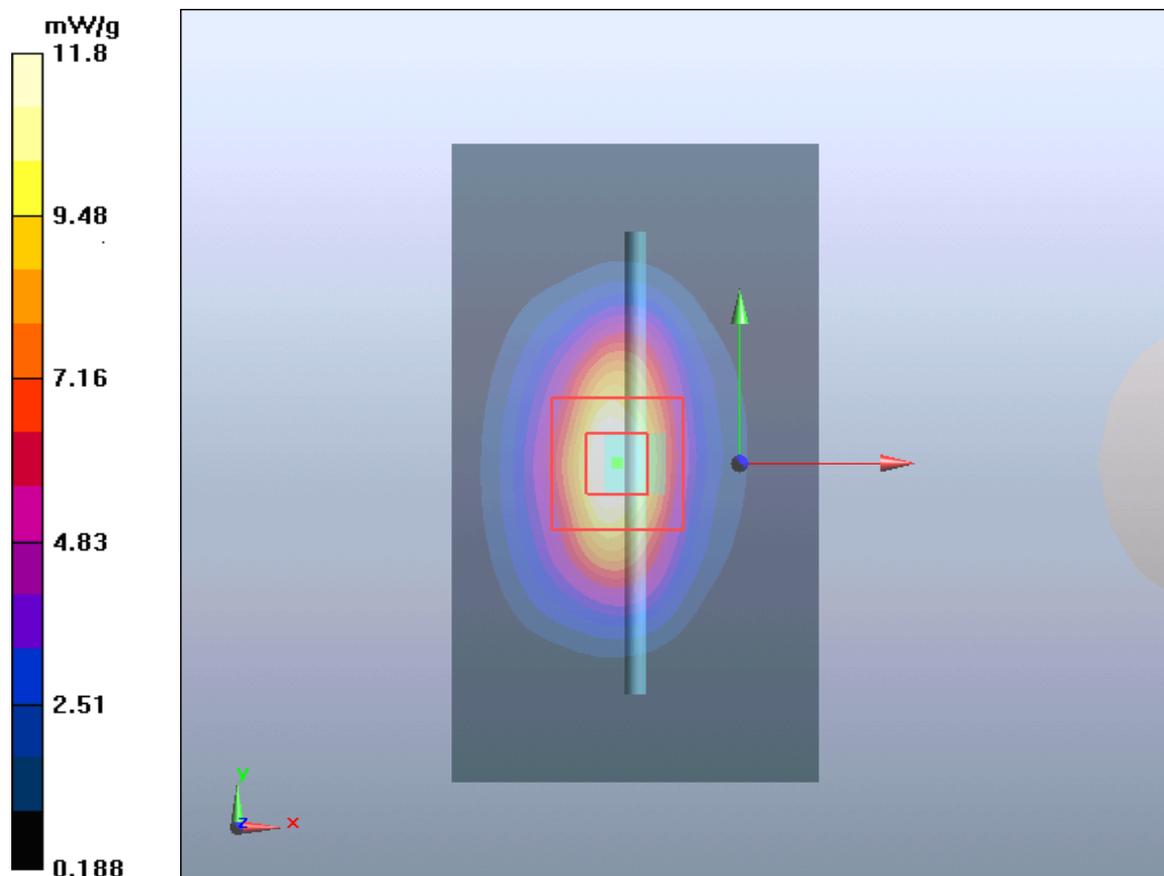


Figure 7 System Performance Check 1900MHz 250mW

## ANNEX C: Graph Results

### GSM 850 GPRS (2TXslots) with IBM T61 Test Position 1 Middle

Date/Time: 8/8/2013 11:43:58 AM

Communication System: GPRS 2TX; Frequency: 836.6 MHz; Duty Cycle: 1:4.14954

Medium parameters used:  $f = 837$  MHz;  $\sigma = 1.001$  mho/m;  $\epsilon_r = 55.318$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(9.05, 9.05, 9.05); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM1; Type: SAM; Serial: TP-1534

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

**Test Position 1 Middle/Area Scan (41x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.693 W/kg

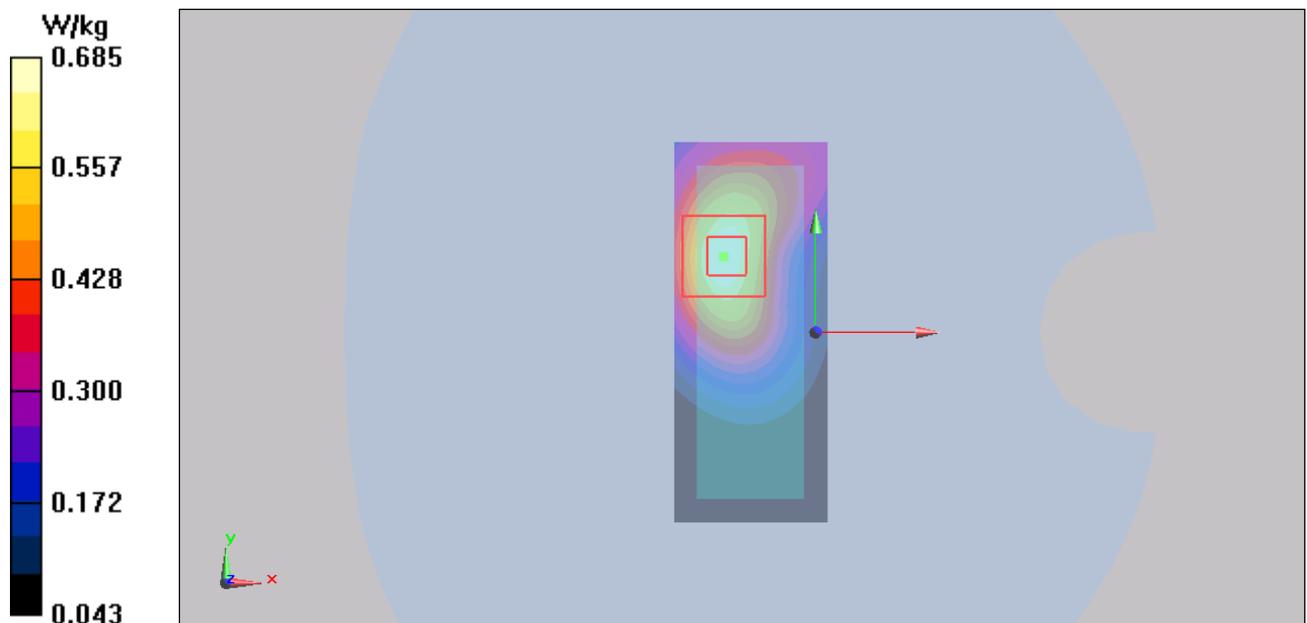
**Test Position 1 Middle/Zoom Scan(7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 21.138 V/m; Power Drift = -0.001 dB

Peak SAR (extrapolated) = 0.992 mW/g

**SAR(1 g) = 0.624 mW/g; SAR(10 g) = 0.381 mW/g**

Maximum value of SAR (measured) = 0.685 W/kg



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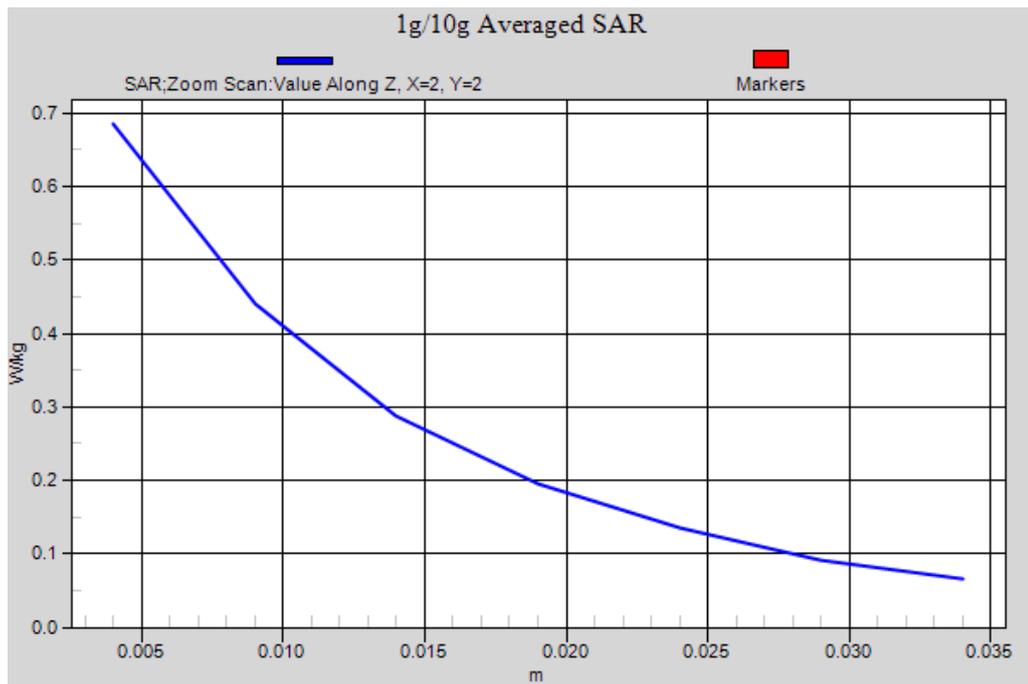


Figure 8 GSM 850 GPRS (2TXslots) with IBM T61 Test Position 1 Channel 190

**GSM 850 GPRS (2TXslots) with IBM T61 Test Position 2 Middle**

Date/Time: 8/8/2013 1:32:34 PM

Communication System: GPRS 2TX; Frequency: 836.6 MHz; Duty Cycle: 1:4.14954

Medium parameters used:  $f = 837$  MHz;  $\sigma = 1.001$  mho/m;  $\epsilon_r = 55.318$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(9.05, 9.05, 9.05); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM1; Type: SAM; Serial: TP-1534

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

**Test Position 2 Middle/Area Scan (41x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.631 W/kg

**Test Position 2 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 18.268 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.916 mW/g

**SAR(1 g) = 0.579 mW/g; SAR(10 g) = 0.358 mW/g**

Maximum value of SAR (measured) = 0.638 W/kg

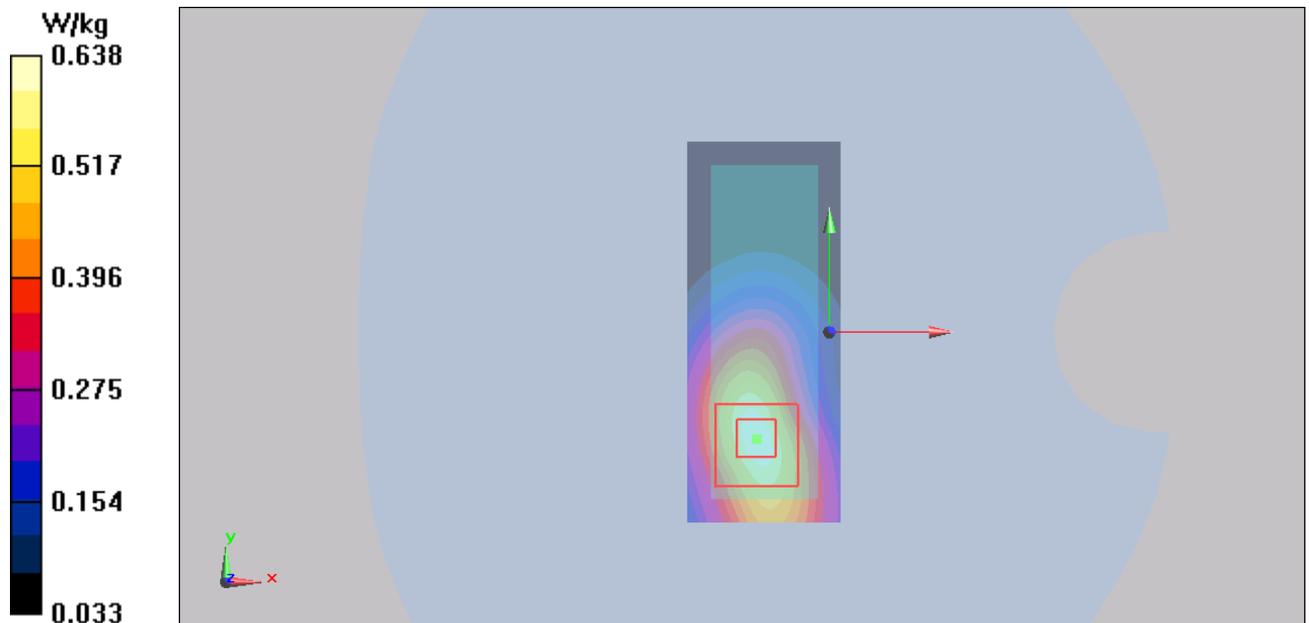


Figure 9 GSM 850 GPRS (2TXslots) with IBM T61 Test Position 2 Channel 190

**GSM 850 GPRS (2TXslots) with IBM T61 Test Position 3 Middle**

Date/Time: 8/8/2013 2:12:46 PM

Communication System: GPRS 2TX; Frequency: 836.6 MHz; Duty Cycle: 1:4.14954

Medium parameters used:  $f = 837$  MHz;  $\sigma = 1.001$  mho/m;  $\epsilon_r = 55.318$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(9.05, 9.05, 9.05); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM1; Type: SAM; Serial: TP-1534

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

**Test Position 3 Middle /Area Scan (41x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.198 W/kg

**Test Position 3 Middle /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.451 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.269 mW/g

**SAR(1 g) = 0.187 mW/g; SAR(10 g) = 0.127 mW/g**

Maximum value of SAR (measured) = 0.200 W/kg

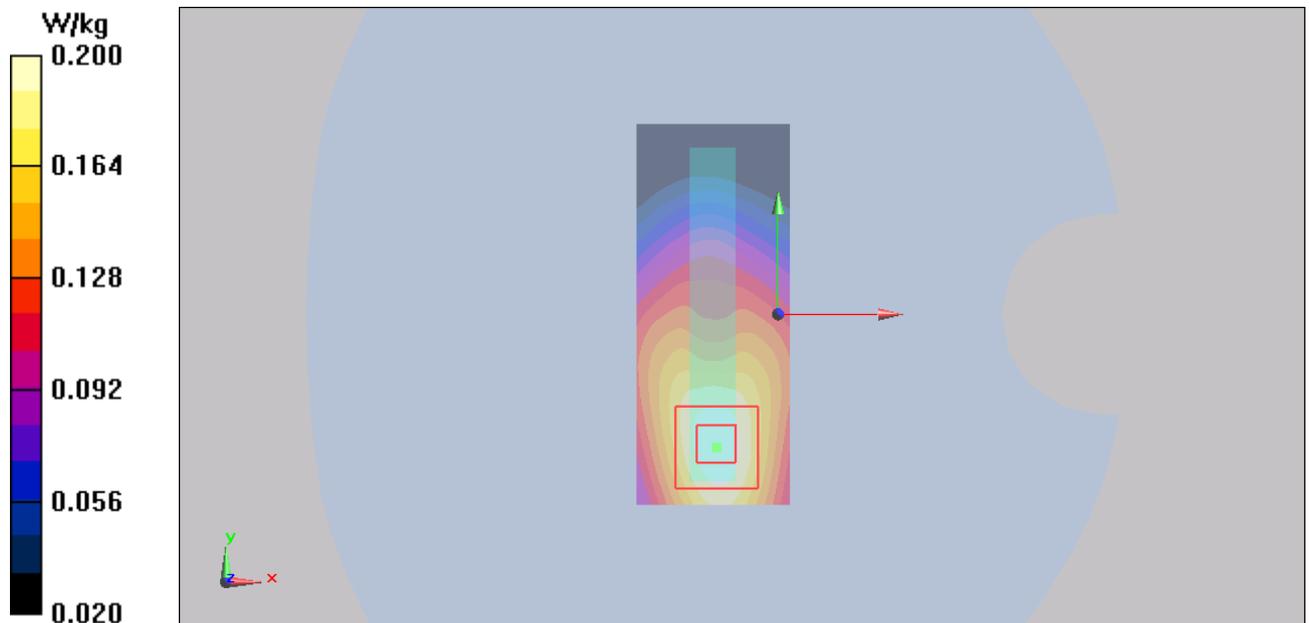


Figure 10 GSM 850 GPRS (2TXslots) with IBM T61 Test Position 3 Channel 190

**GSM 850 GPRS (2TXslots) with IBM T61 Test Position 4 Middle**

Date/Time: 8/8/2013 12:34:48 PM

Communication System: GPRS 2TX; Frequency: 836.6 MHz; Duty Cycle: 1:4.14954

Medium parameters used:  $f = 837$  MHz;  $\sigma = 1.001$  mho/m;  $\epsilon_r = 55.318$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(9.05, 9.05, 9.05); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM1; Type: SAM; Serial: TP-1534

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

**Test Position 4 Middle/Area Scan (41x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.401 W/kg

**Test Position 4 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 17.072 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.564 mW/g

**SAR(1 g) = 0.370 mW/g; SAR(10 g) = 0.234 mW/g**

Maximum value of SAR (measured) = 0.401 W/kg

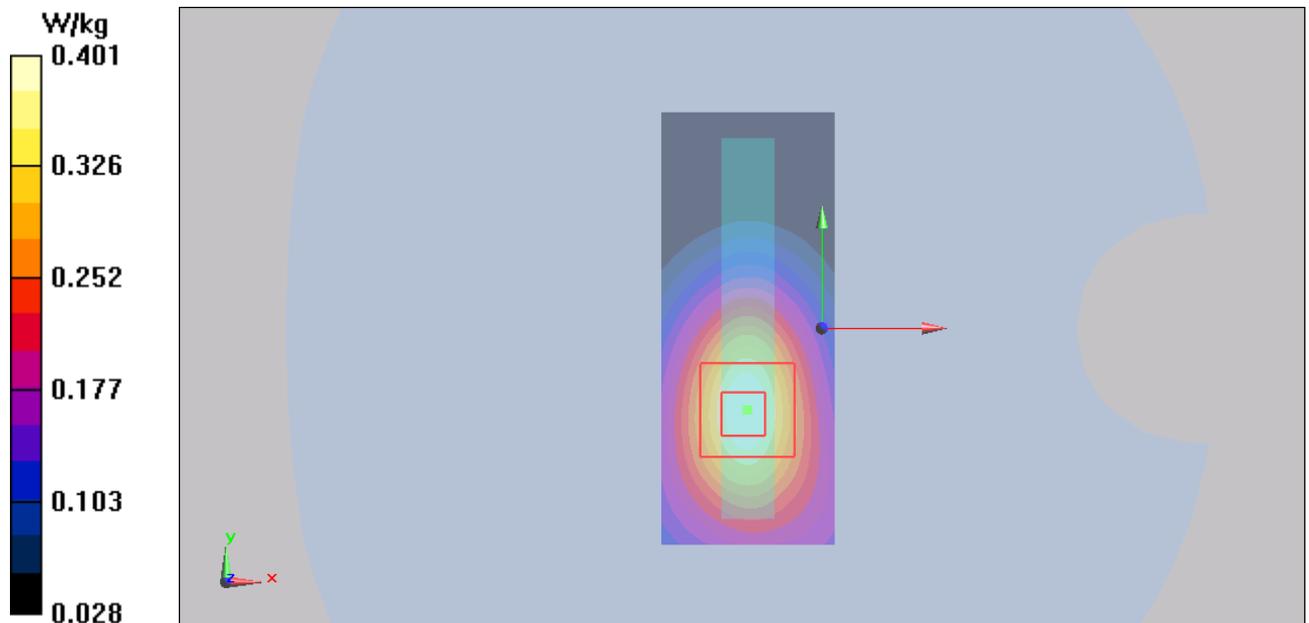


Figure 11 GSM 850 GPRS (2TXslots) with IBM T61 Test Position 4 Channel 190

**GSM 850 GPRS (2TXslots) with IBM T61 Test Position 5 Middle**

Date/Time: 8/8/2013 1:05:55 PM

Communication System: GPRS 2TX; Frequency: 836.6 MHz; Duty Cycle: 1:4.14954

Medium parameters used:  $f = 837$  MHz;  $\sigma = 1.001$  mho/m;  $\epsilon_r = 55.318$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(9.05, 9.05, 9.05); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM1; Type: SAM; Serial: TP-1534

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

**Test Position 5 Middle/Area Scan (41x51x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.0153 W/kg

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

Reference Value = 3.828 V/m; Power Drift = -0.090 dB

Peak SAR (extrapolated) = 0.027 mW/g

**SAR(1 g) = 0.012 mW/g; SAR(10 g) = 0.00794 mW/g**

Maximum value of SAR (measured) = 0.0149 W/kg

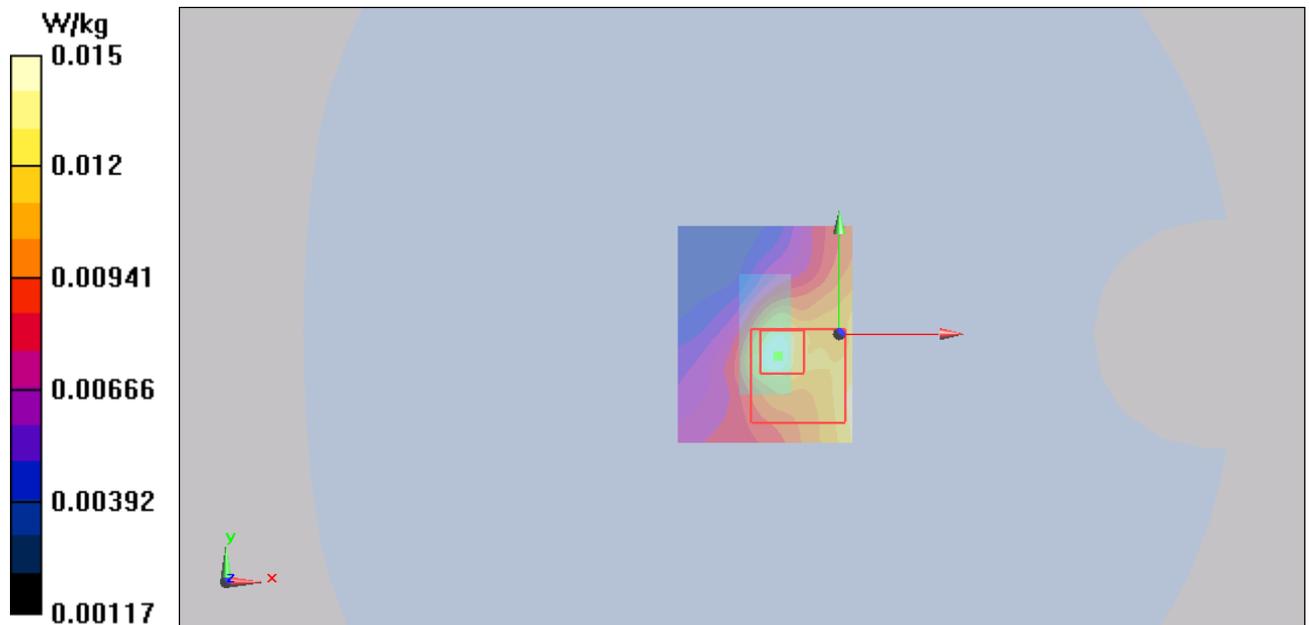


Figure 12 GSM 850 GPRS (2TXslots) with IBM T61 Test Position 5 Channel 190

**GSM 850 EGPRS (2TXslots) with IBM T61 Test Position 1 Middle**

Date/Time: 8/8/2013 12:12:33 PM

Communication System: EGPRS 2TX; Frequency: 836.6 MHz; Duty Cycle: 1:4.14954

Medium parameters used:  $f = 837$  MHz;  $\sigma = 1.001$  mho/m;  $\epsilon_r = 55.318$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(9.05, 9.05, 9.05); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM1; Type: SAM; Serial: TP-1534

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

**Test Position 1 Middle/Area Scan (41x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.677 W/kg

**Test Position 1 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 20.814 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.983 mW/g

**SAR(1 g) = 0.616 mW/g; SAR(10 g) = 0.375 mW/g**

Maximum value of SAR (measured) = 0.674 W/kg

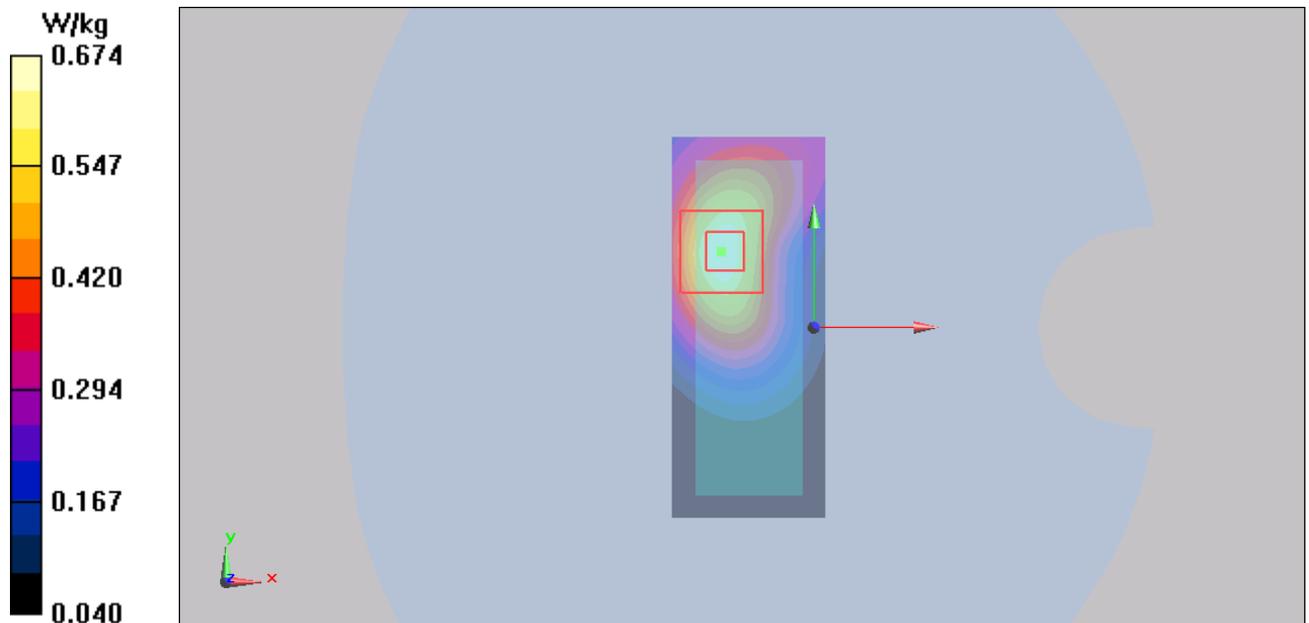


Figure 13 GSM 850 EGPRS (2TXslots) with IBM T61 Test Position 1 Channel 190

**GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 1 High**

Date/Time: 8/8/2013 4:08:13 PM

Communication System: GPRS 2TX; Frequency: 1909.8 MHz; Duty Cycle: 1:4.14954

Medium parameters used:  $f = 1910$  MHz;  $\sigma = 1.535$  mho/m;  $\epsilon_r = 52.981$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(7.33, 7.33, 7.33); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM 2; Type: SAM;

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

**Test Position 1 High/Area Scan (41x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.885 W/kg

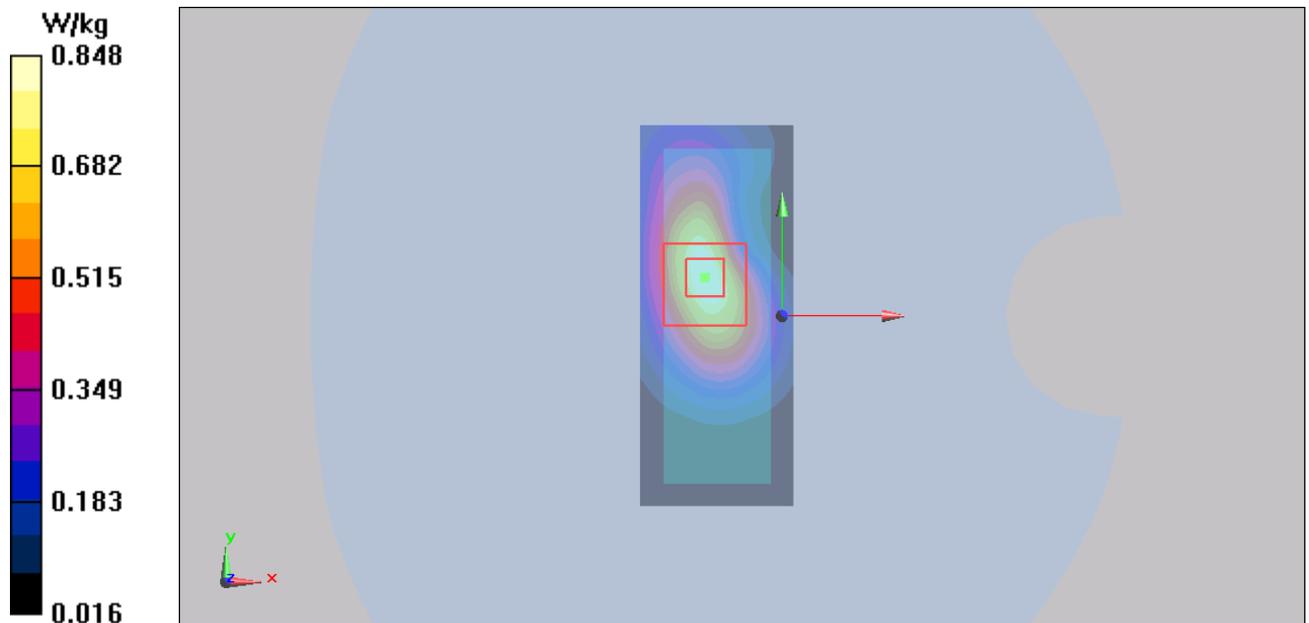
**Test Position 1 High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 22.191 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 1.320 mW/g

**SAR(1 g) = 0.765 mW/g; SAR(10 g) = 0.418 mW/g**

Maximum value of SAR (measured) = 0.848 W/kg



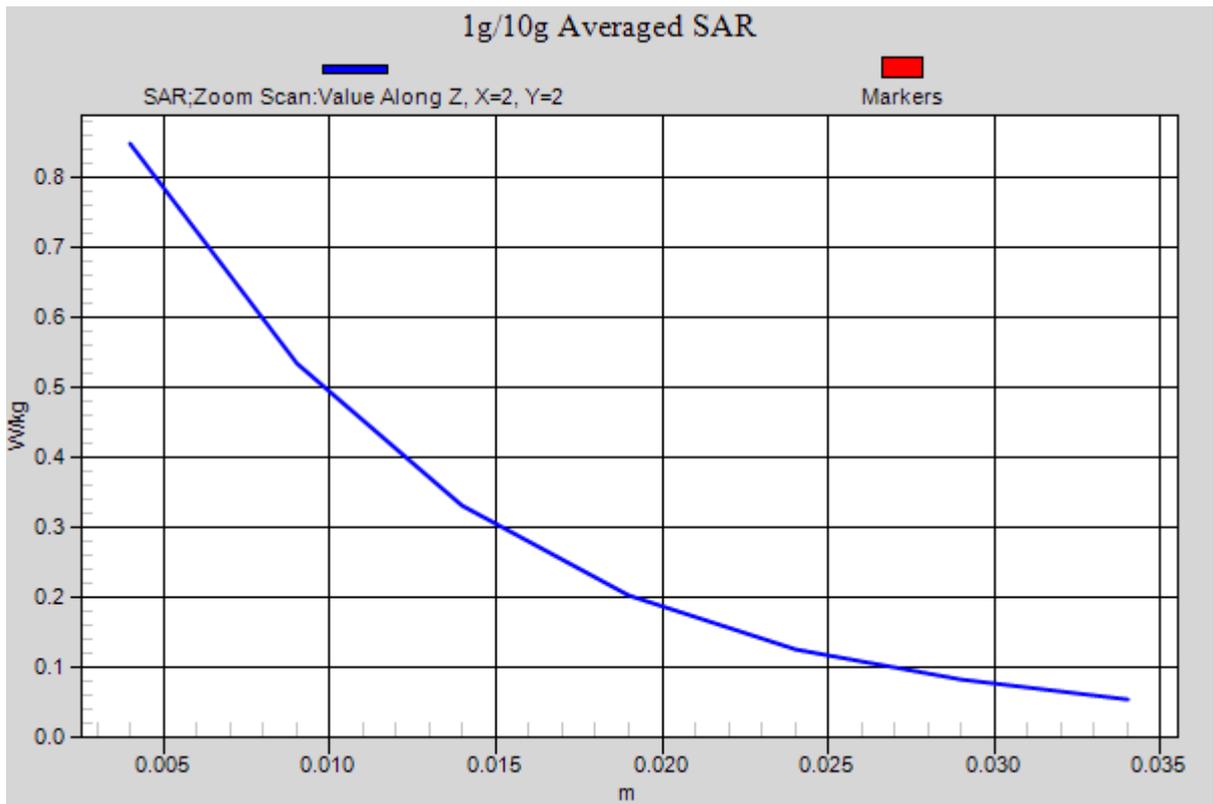


Figure 14 GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 1 Channel 810

**GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 1 Middle**

Date/Time: 8/8/2013 3:52:14 PM

Communication System: GPRS 2TX; Frequency: 1880 MHz; Duty Cycle: 1:4.14954

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.504$  mho/m;  $\epsilon_r = 53.137$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(7.33, 7.33, 7.33); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM 2; Type: SAM;

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

**Test Position 1 Middle/Area Scan (41x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.878 W/kg

**Test Position 1 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 22.415 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 1.300 mW/g

**SAR(1 g) = 0.761 mW/g; SAR(10 g) = 0.415 mW/g**

Maximum value of SAR (measured) = 0.853 W/kg

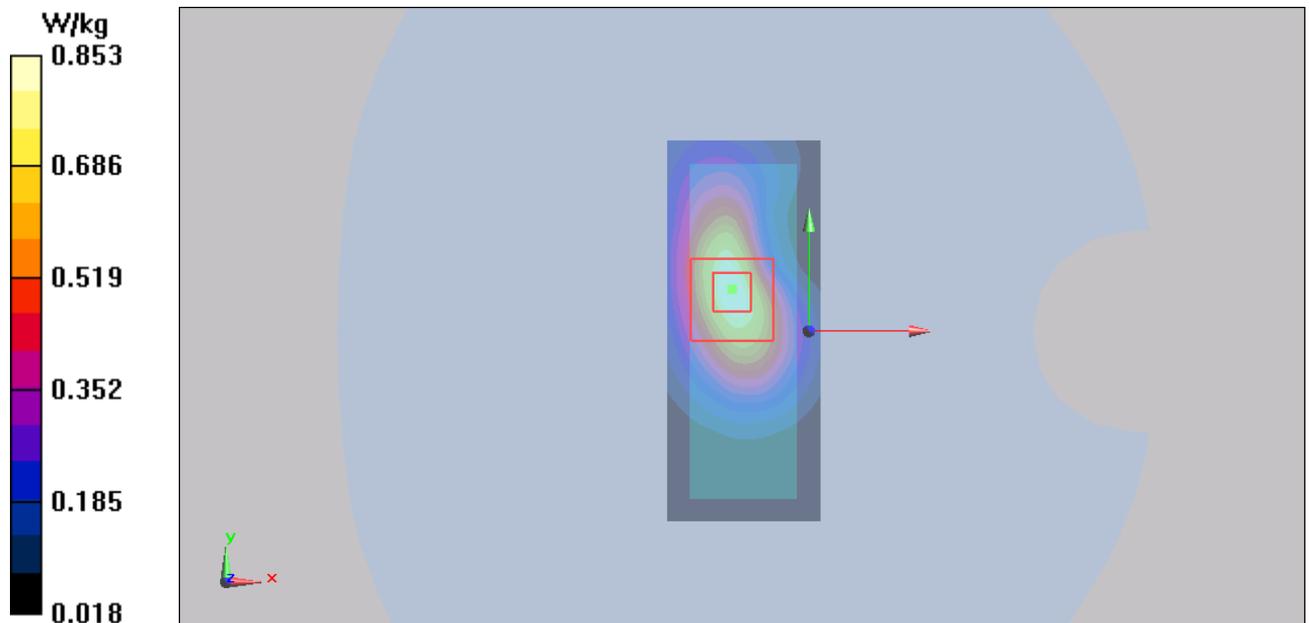


Figure 15 GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 1 Channel 661

**GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 1 Low**

Date/Time: 8/8/2013 4:24:46 PM

Communication System: GPRS 2TX; Frequency: 1850.2 MHz; Duty Cycle: 1:4.14954

Medium parameters used (interpolated):  $f = 1850.2$  MHz;  $\sigma = 1.476$  mho/m;  $\epsilon_r = 53.266$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(7.33, 7.33, 7.33); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM 2; Type: SAM;

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

**Test Position 1 Low/Area Scan (41x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.814 W/kg

**Test Position 1 Low/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 21.209 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.211 mW/g

**SAR(1 g) = 0.705 mW/g; SAR(10 g) = 0.385 mW/g**

Maximum value of SAR (measured) = 0.790 W/kg

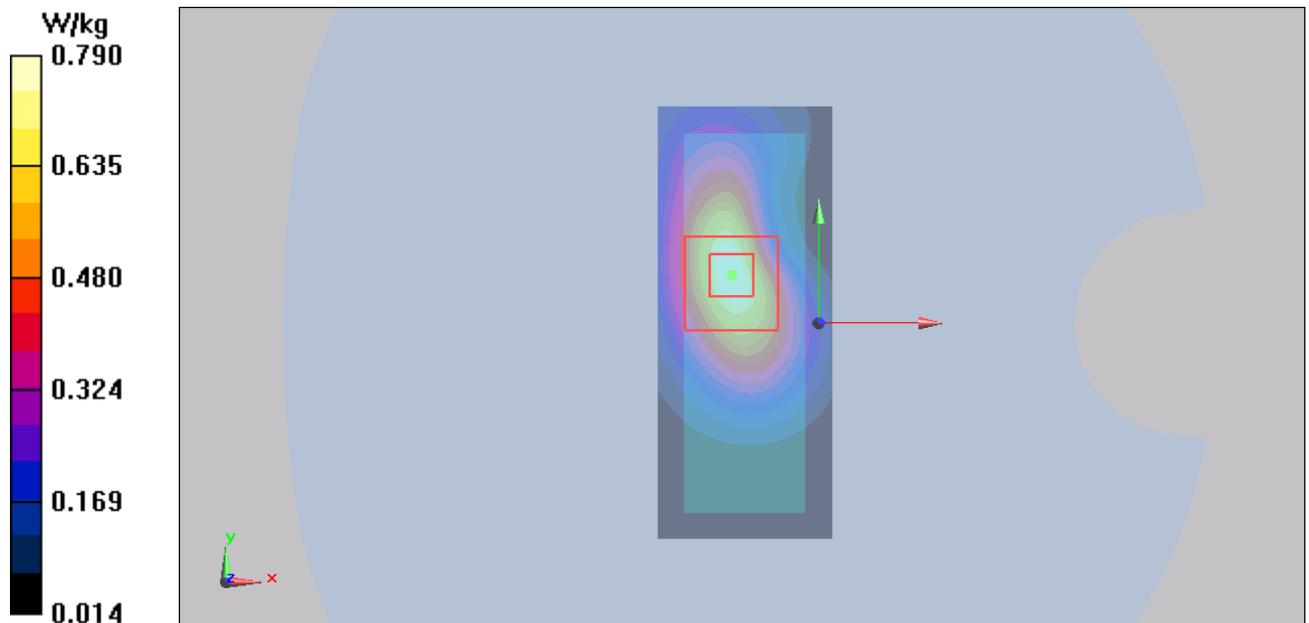


Figure 16 GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 1 Channel 512

**GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 2 Middle**

Date/Time: 8/9/2013 9:25:53 AM

Communication System: GPRS 2TX; Frequency: 1880 MHz; Duty Cycle: 1:4.14954

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.504$  mho/m;  $\epsilon_r = 53.137$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(7.33, 7.33, 7.33); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM 2; Type: SAM;

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

**Test Position 2 Middle/Area Scan (41x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.729 W/kg

**Test Position 2 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 21.160 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 1.041 mW/g

**SAR(1 g) = 0.642 mW/g; SAR(10 g) = 0.367 mW/g**

Maximum value of SAR (measured) = 0.707 W/kg

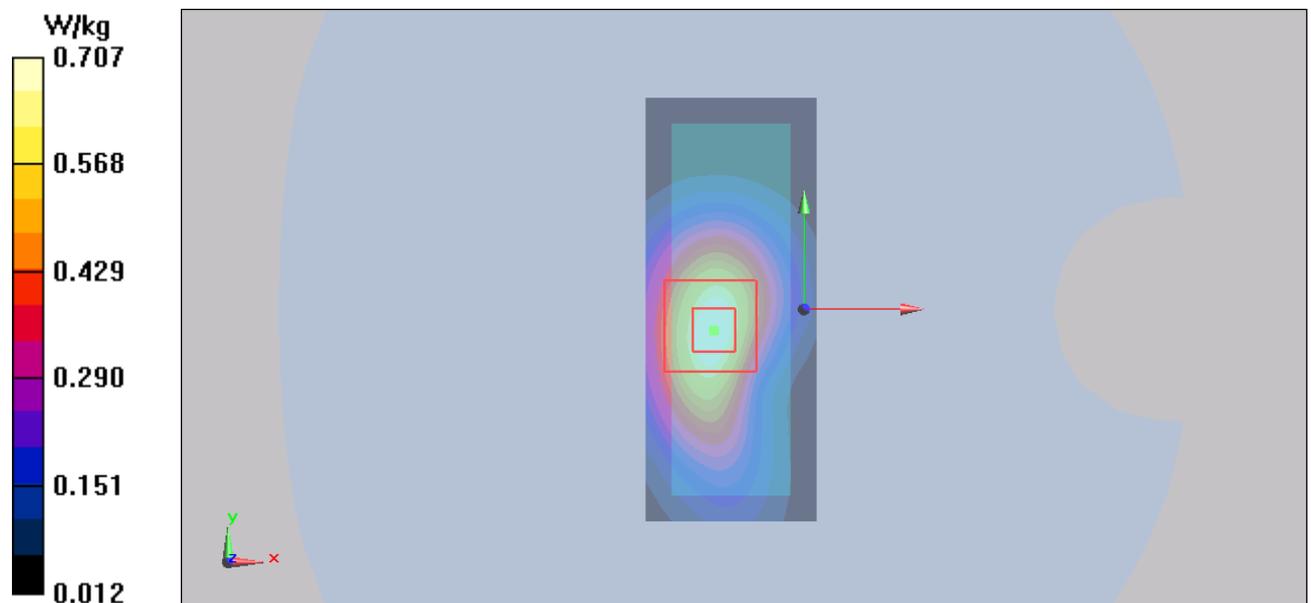


Figure 17 GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 2 Channel 661

**GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 3 Middle**

Date/Time: 8/9/2013 9:44:13 AM

Communication System: GPRS 2TX; Frequency: 1880 MHz; Duty Cycle: 1:4.14954

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.504$  mho/m;  $\epsilon_r = 53.137$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(7.33, 7.33, 7.33); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM 2; Type: SAM;

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

**Test Position 3 Middle/Area Scan (41x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.347 W/kg

**Test Position 3 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 15.119 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.515 mW/g

**SAR(1 g) = 0.313 mW/g; SAR(10 g) = 0.177 mW/g**

Maximum value of SAR (measured) = 0.344 W/kg

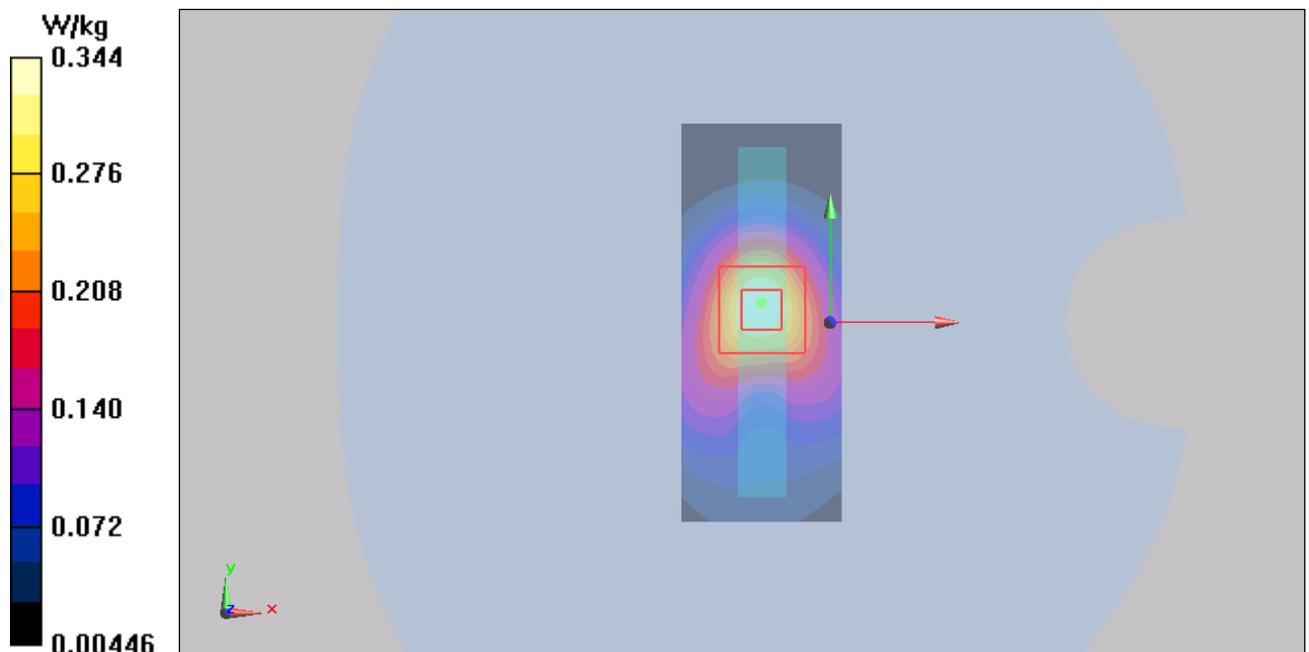


Figure 18 GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 3 Channel 661

**GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 4 Middle**

Date/Time: 8/8/2013 5:00:20 PM

Communication System: GPRS 2TX; Frequency: 1880 MHz; Duty Cycle: 1:4.14954

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.504$  mho/m;  $\epsilon_r = 53.137$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(7.33, 7.33, 7.33); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM 2; Type: SAM;

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

**Test Position 4 Middle/Area Scan (41x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.554 W/kg

**Test Position 4 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 18.908 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.810 mW/g

**SAR(1 g) = 0.488 mW/g; SAR(10 g) = 0.275 mW/g**

Maximum value of SAR (measured) = 0.537 W/kg

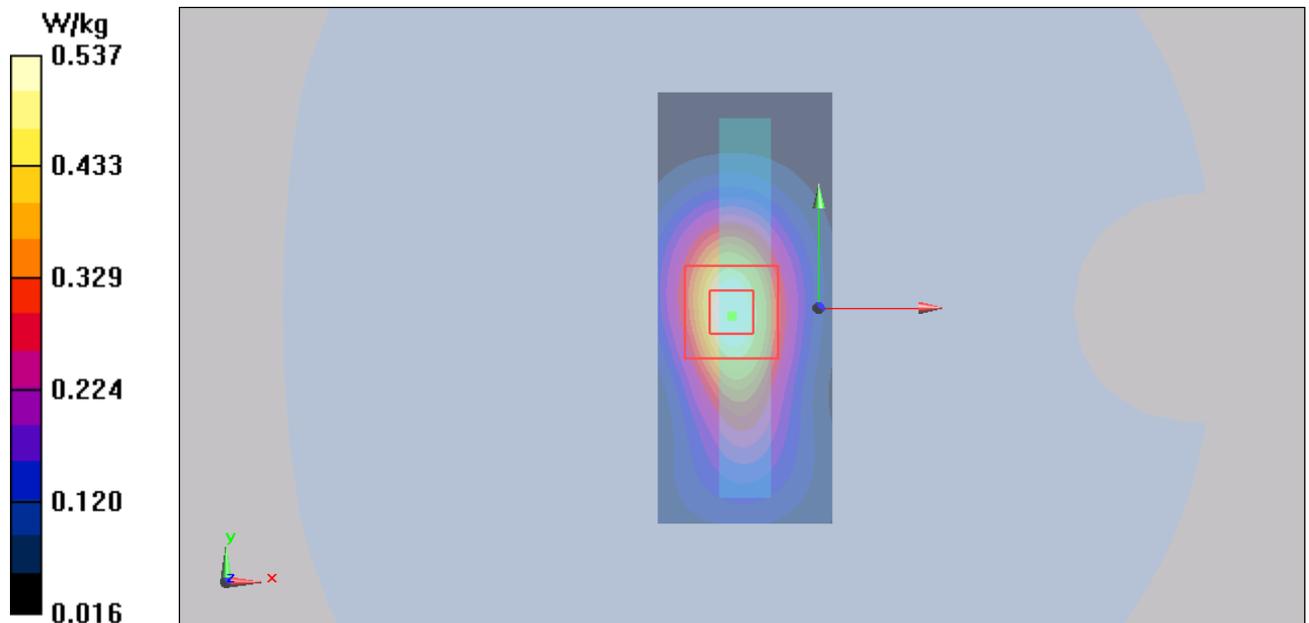


Figure 19 GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 4 Channel 661

**GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 5 Middle**

Date/Time: 8/9/2013 10:12:30 AM

Communication System: GPRS 2TX; Frequency: 1880 MHz; Duty Cycle: 1:4.14954

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.504$  mho/m;  $\epsilon_r = 53.137$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(7.33, 7.33, 7.33); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM 2; Type: SAM;

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

**Test Position 5 Middle/Area Scan (41x51x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.0306 W/kg

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

Reference Value = 4.110 V/m; Power Drift = 0.032 dB

Peak SAR (extrapolated) = 0.041 mW/g

**SAR(1 g) = 0.026 mW/g; SAR(10 g) = 0.016 mW/g**

Maximum value of SAR (measured) = 0.0298 W/kg

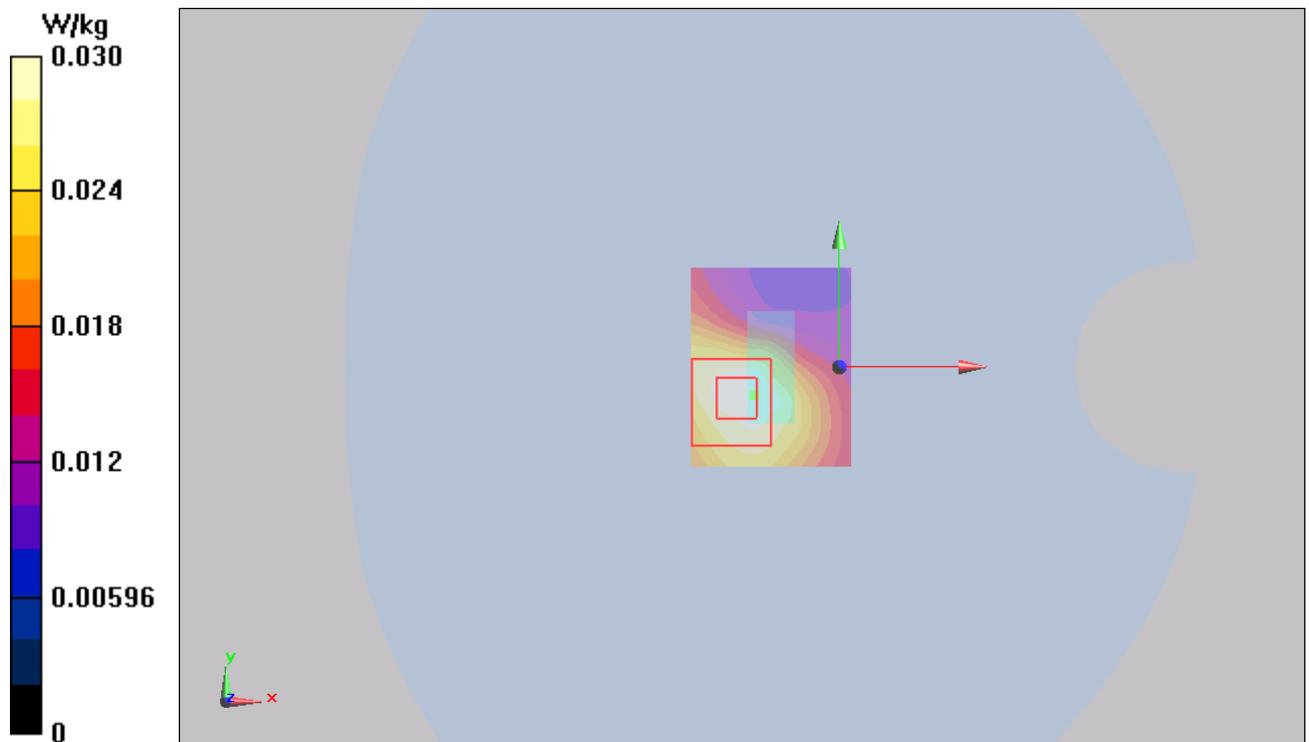


Figure 20 GSM 1900 GPRS (2TXslots) with IBM T61 Test Position 5 Channel 661

**GSM 1900 EGPRS (2TXslots) with IBM T61 Test Position 1 High**

Date/Time: 8/8/2013 4:40:59 PM

Communication System: EGPRS 2TX; Frequency: 1909.8 MHz; Duty Cycle: 1:4.14954

Medium parameters used:  $f = 1910$  MHz;  $\sigma = 1.535$  mho/m;  $\epsilon_r = 52.981$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(7.33, 7.33, 7.33); Calibrated: 1/17/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: SAM 2; Type: SAM;

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

**Test Position 1 High/Area Scan (41x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.867 W/kg

**Test Position 1 High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 21.992 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.303 mW/g

**SAR(1 g) = 0.757 mW/g; SAR(10 g) = 0.411 mW/g**

Maximum value of SAR (measured) = 0.848 W/kg

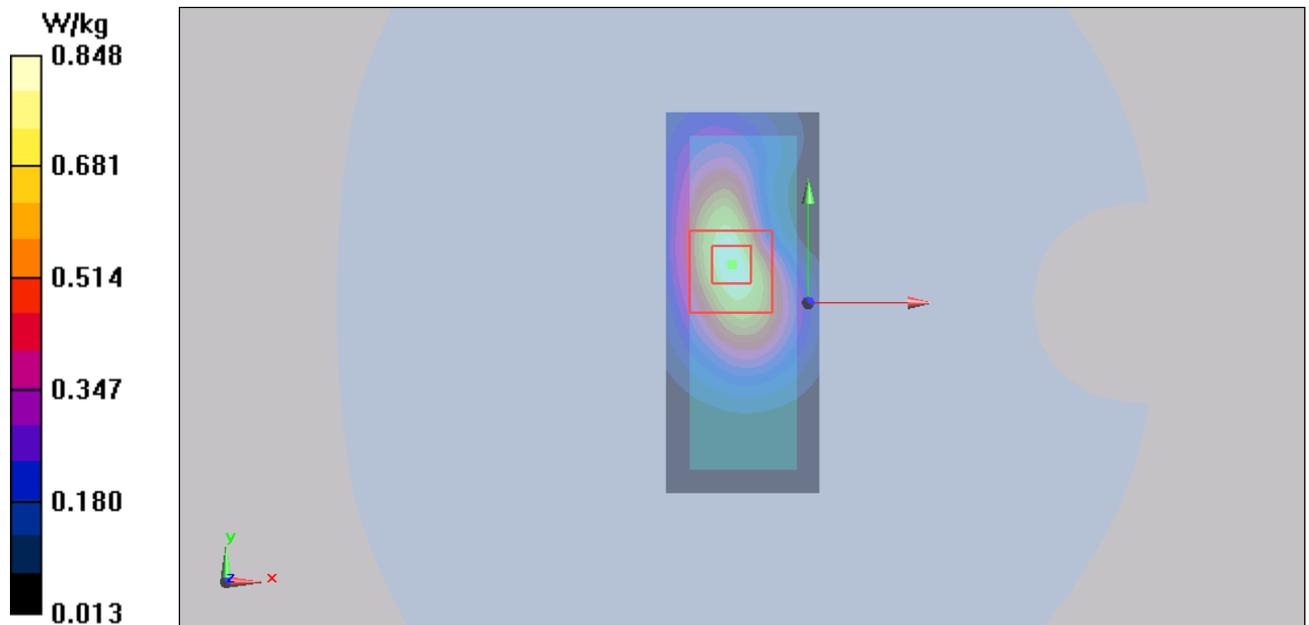


Figure 21 GSM 1900 EGPRS (2TXslots) with IBM T61 Test Position 1 Channel 810

# TA Technology (Shanghai) Co., Ltd.

## Test Report

### ANNEX D: 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  
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 **Auden**

Certificate No: **EX3-3753\_Jan13**

#### CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3753
Calibration procedure(s)	QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	January 17, 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 (22 ± 3)°C and humidity &lt; 70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p>	

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013 Dec12)	Dec-13
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
			Issued: January 17, 2013
<p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p>			

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RHA1308-0069SAR01R2

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



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

Accreditation No.: **SCS 108**

### Glossary:

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

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

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

### Methods Applied and Interpretation of Parameters:

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

EX3DV4 – SN:3753

January 17, 2013

# Probe EX3DV4

## SN:3753

Manufactured: March 16, 2010  
Calibrated: January 17, 2013

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

# TA Technology (Shanghai) Co., Ltd.

## Test Report

EX3DV4- SN:3753

January 17, 2013

### DASY/EASY - Parameters of Probe: EX3DV4 - SN:3753

**Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.47	0.31	0.45	± 10.1 %
DCP (mV) <sup>B</sup>	101.8	102.3	102.3	

**Modulation Calibration Parameters**

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	163.7	±3.5 %
		Y	0.0	0.0	1.0		168.5	
		Z	0.0	0.0	1.0		159.9	

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

<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.

# TA Technology (Shanghai) Co., Ltd. Test Report

EX3DV4- SN:3753

January 17, 2013

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3753

### 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)
750	41.9	0.89	9.46	9.46	9.46	0.45	0.83	± 12.0 %
835	41.5	0.90	8.95	8.95	8.95	0.26	1.19	± 12.0 %
1750	40.1	1.37	7.86	7.86	7.86	0.52	0.79	± 12.0 %
1900	40.0	1.40	7.63	7.63	7.63	0.54	0.73	± 12.0 %
2000	40.0	1.40	7.50	7.50	7.50	0.53	0.77	± 12.0 %
2450	39.2	1.80	6.86	6.86	6.86	0.44	0.80	± 12.0 %
5200	36.0	4.66	4.65	4.65	4.65	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.48	4.48	4.48	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.46	4.46	4.46	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.51	4.51	4.51	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.36	4.36	4.36	0.45	1.80	± 13.1 %

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

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

# TA Technology (Shanghai) Co., Ltd. Test Report

EX3DV4- SN:3753

January 17, 2013

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3753

### 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)
750	55.5	0.96	9.25	9.25	9.25	0.54	0.75	± 12.0 %
835	55.2	0.97	9.05	9.05	9.05	0.68	0.68	± 12.0 %
1750	53.4	1.49	7.82	7.82	7.82	0.50	0.84	± 12.0 %
1900	53.3	1.52	7.33	7.33	7.33	0.31	1.01	± 12.0 %
2000	53.3	1.52	7.43	7.43	7.43	0.57	0.73	± 12.0 %
2300	52.9	1.81	7.07	7.07	7.07	0.74	0.64	± 12.0 %
2450	52.7	1.95	6.90	6.90	6.90	0.80	0.50	± 12.0 %
2600	52.5	2.16	6.66	6.66	6.66	0.80	0.50	± 12.0 %
3500	51.3	3.31	6.30	6.30	6.30	0.38	1.11	± 13.1 %
5200	49.0	5.30	4.38	4.38	4.38	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.13	4.13	4.13	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.09	4.09	4.09	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.10	4.10	4.10	0.45	1.90	± 13.1 %
5800	48.2	6.00	4.02	4.02	4.02	0.55	1.90	± 13.1 %

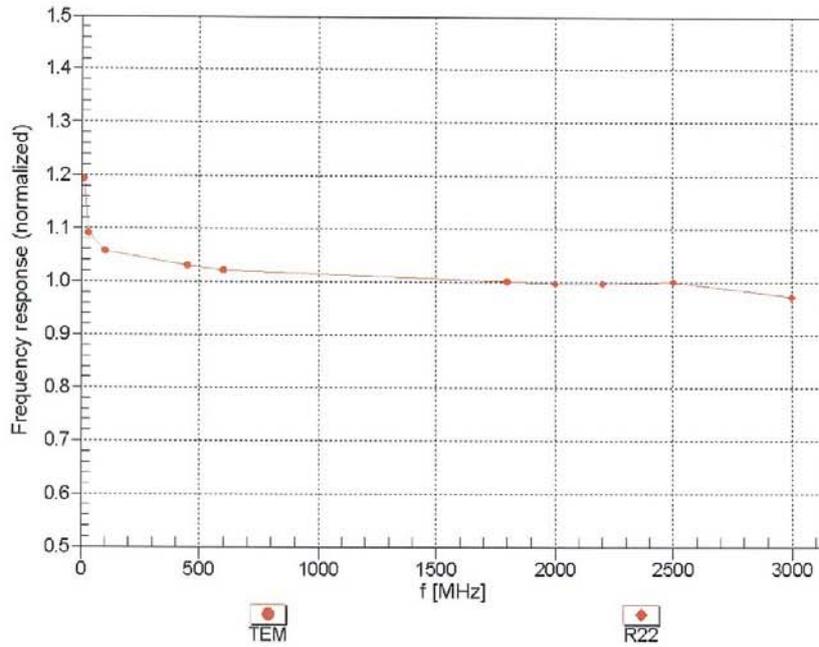
<sup>C</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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

EX3DV4-SN:3753

January 17, 2013

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

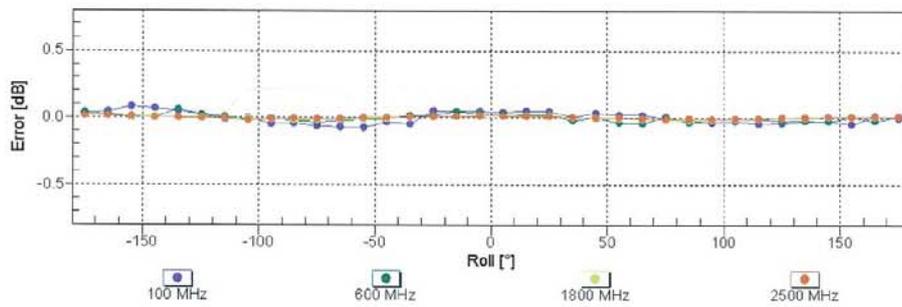
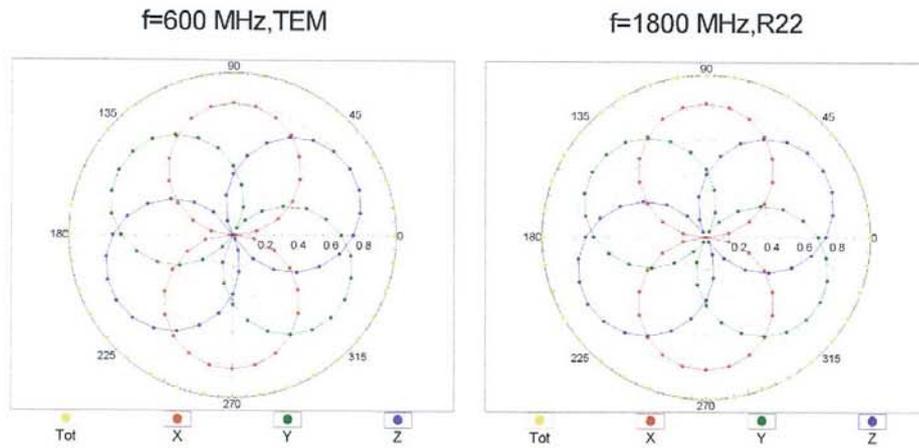


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

EX3DV4-SN:3753

January 17, 2013

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

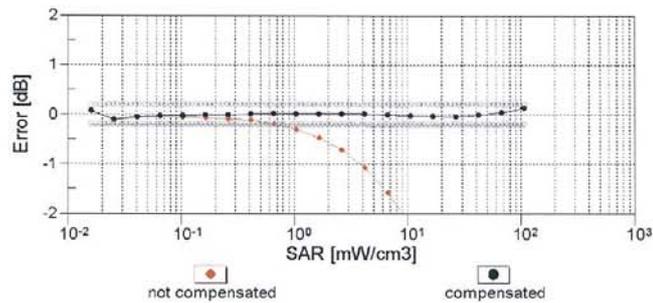
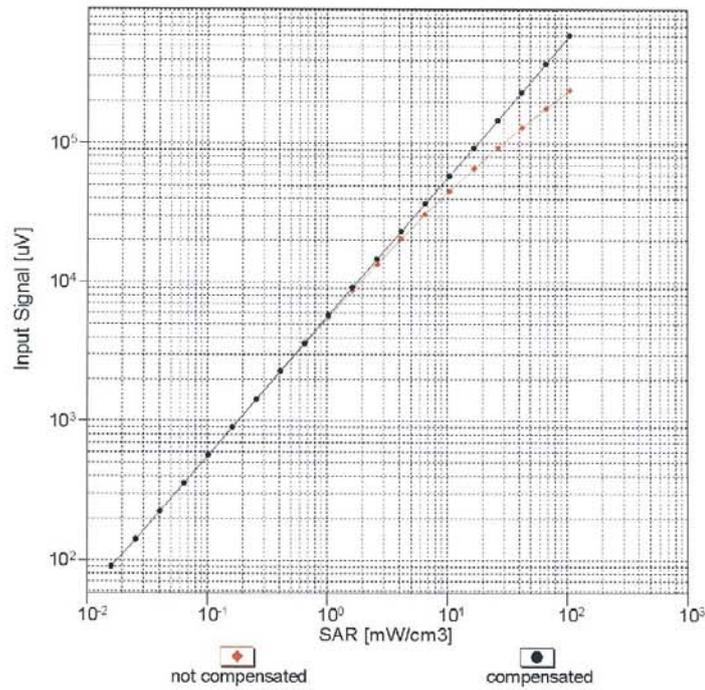


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

EX3DV4- SN:3753

January 17, 2013

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

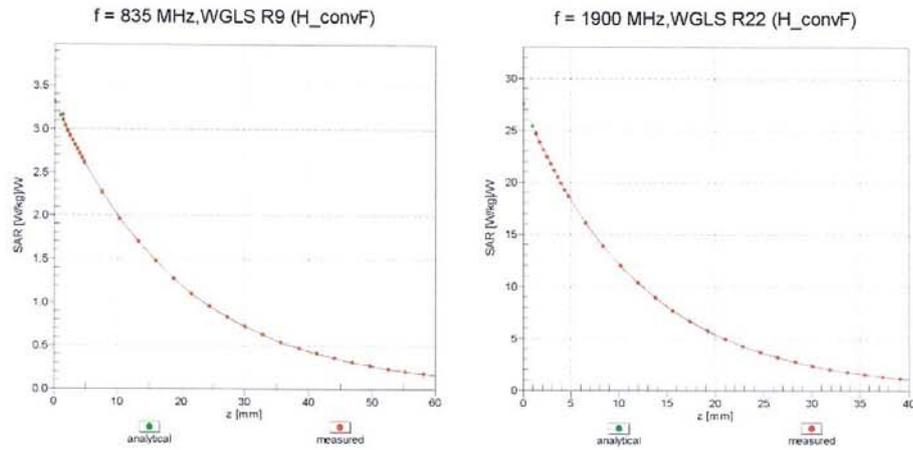


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

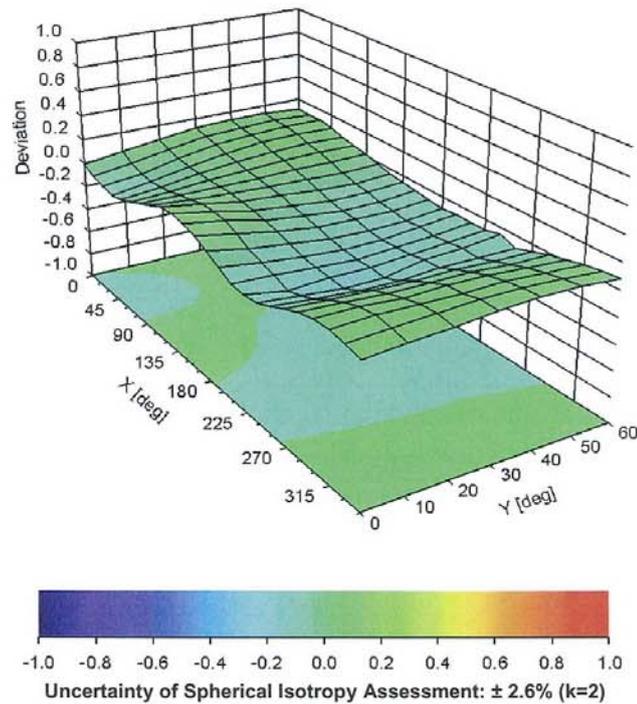
EX3DV4- SN:3753

January 17, 2013

### Conversion Factor Assessment



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



**TA Technology (Shanghai) Co., Ltd.**  
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EX3DV4- SN:3753

January 17, 2013

**DASY/EASY - Parameters of Probe: EX3DV4 - SN:3753**

**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	55.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

# TA Technology (Shanghai) Co., Ltd. Test Report

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## ANNEX E: 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 **TA-Shanghai (Auden)**

Certificate No: **D835V2-4d020\_Aug11**

### CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d020**

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

Calibration date: **August 26, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	29-Apr-11 (No. ES3-3205_Apr11)	Apr-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: August 26, 2011

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

# TA Technology (Shanghai) Co., Ltd. Test Report

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**Calibration Laboratory of  
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**S** Schweizerischer Kalibrierdienst  
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**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 108**

## Glossary:

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

## Calibration is Performed According to the Following Standards:

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

## Additional Documentation:

- DASY4/5 System Handbook

## Methods Applied and Interpretation of Parameters:

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

# TA Technology (Shanghai) Co., Ltd.

## Test Report

### Measurement Conditions

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

DASY Version	DASY5	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.1 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.32 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>9.34 mW / g ± 17.0 % (k=2)</b>

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

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.4 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.42 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>9.46 mW / g ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>6.26 mW / g ± 16.5 % (k=2)</b>

# TA Technology (Shanghai) Co., Ltd.

## Test Report

### Appendix

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.9 $\Omega$ - 3.1 $j\Omega$
Return Loss	- 27.7 dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.7 $\Omega$ - 5.4 $j\Omega$
Return Loss	- 25.1 dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.391 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.

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	April 22, 2004

**DASY5 Validation Report for Head TSL**

Date: 25.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d020**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.89$  mho/m;  $\epsilon_r = 41.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

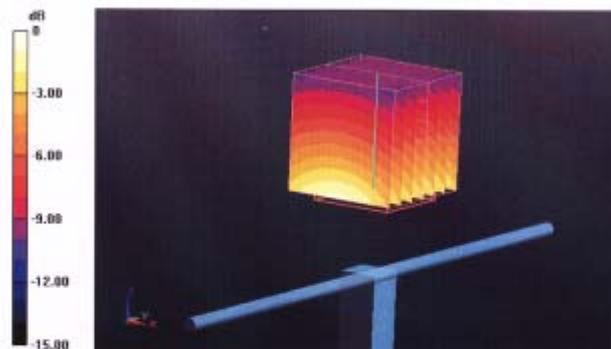
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.930 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.421 W/kg

**SAR(1 g) = 2.32 mW/g; SAR(10 g) = 1.52 mW/g**

Maximum value of SAR (measured) = 2.708 mW/g



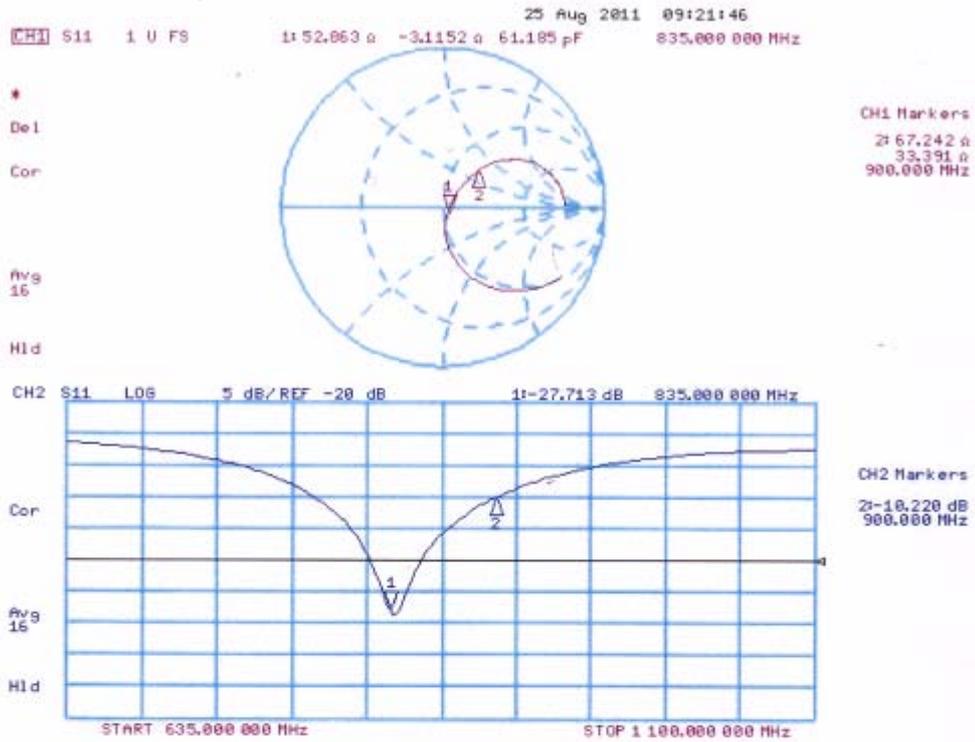
0 dB = 2.710mW/g

# TA Technology (Shanghai) Co., Ltd. Test Report

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## Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 26.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d020**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.99 \text{ mho/m}$ ;  $\epsilon_r = 53.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

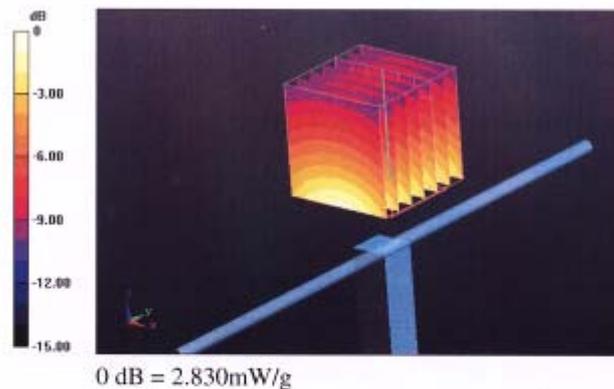
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 55.406 V/m; Power Drift = 0.02 dB

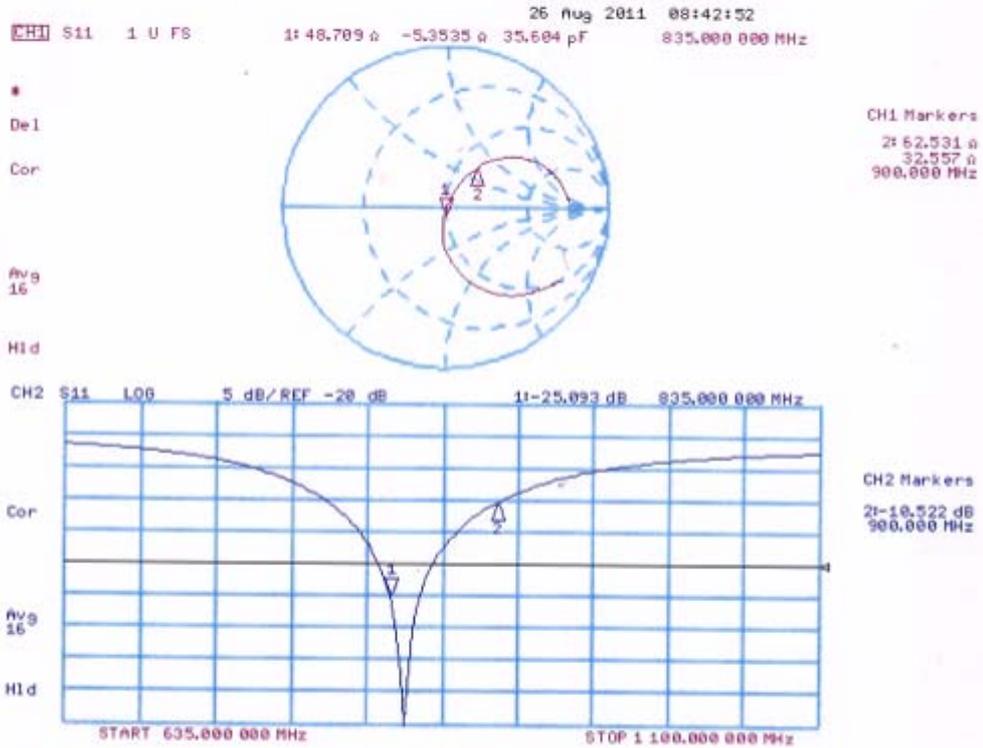
Peak SAR (extrapolated) = 3.509 W/kg

**SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.59 mW/g**

Maximum value of SAR (measured) = 2.827 mW/g



Impedance Measurement Plot for Body TSL



# TA Technology (Shanghai) Co., Ltd. Test Report

Report No. RHA1308-0069SAR01R2

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## ANNEX F: D1900V2 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 **TA-Shanghai (Auden)**

Certificate No: **D1900V2-5d060\_Aug11**

### CALIBRATION CERTIFICATE

Object: **D1900V2 - SN: 5d060**

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

Calibration date: **August 31, 2011**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature ( $22 \pm 3$ )°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	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	29-Apr-11 (No. ES3-3205_Apr11)	Apr-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: August 31, 2011

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

# TA Technology (Shanghai) Co., Ltd.

## Test Report

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



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**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 108**

### Glossary:

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

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

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

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

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

# TA Technology (Shanghai) Co., Ltd. Test Report

### Measurement Conditions

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

<b>DASY Version</b>	DASY5	V52.6.2
<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	39.5 ± 6 %	1.42 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	< 0.5 °C	----	----

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>40.3 mW / g ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.30 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>21.1 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	53.9 ± 6 %	1.57 mho/m ± 6 %
<b>Body TSL temperature change during test</b>	< 0.5 °C	----	----

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.6 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>41.7 mW / g ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.55 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>22.0 mW / g ± 16.5 % (k=2)</b>

# TA Technology (Shanghai) Co., Ltd. Test Report

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.6 $\Omega$ + 7.5 j $\Omega$
Return Loss	- 22.3 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.3 $\Omega$ + 7.9 j $\Omega$
Return Loss	- 21.3 dB

### General Antenna Parameters and Design

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

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

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

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 10, 2004

**DASY5 Validation Report for Head TSL**

Date: 30.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d060**

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.42$  mho/m;  $\epsilon_r = 39.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

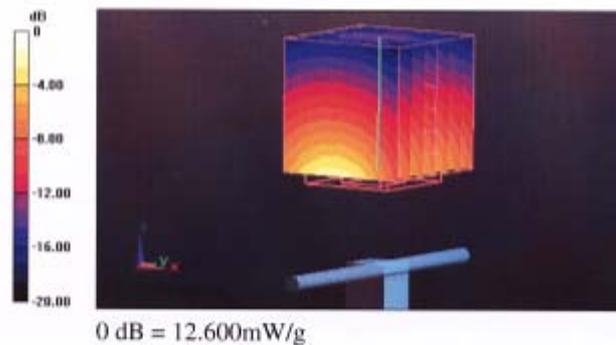
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.636 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 18.535 W/kg

**SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.3 mW/g**

Maximum value of SAR (measured) = 12.600 mW/g

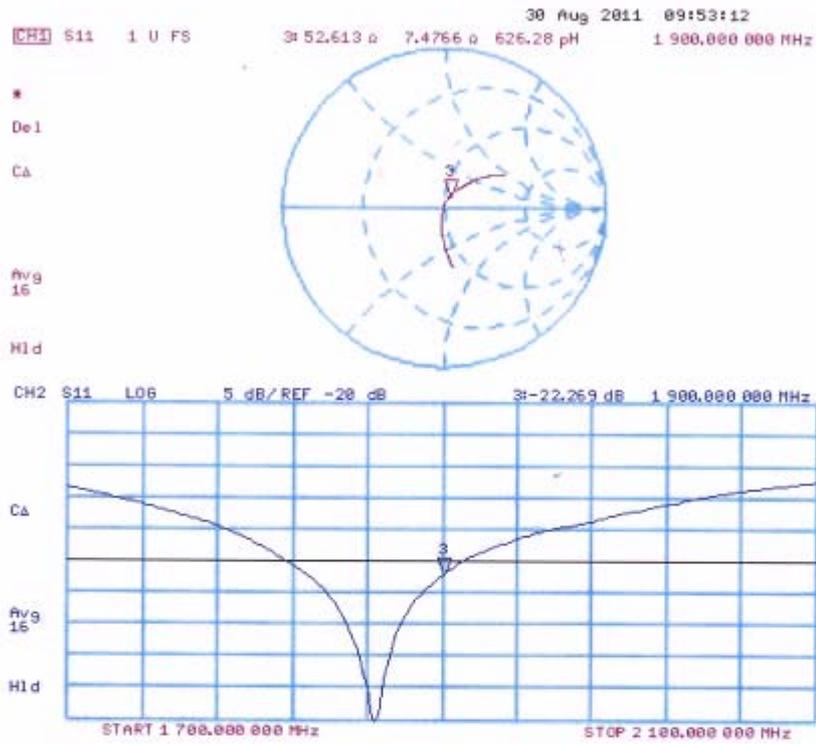


# TA Technology (Shanghai) Co., Ltd. Test Report

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## Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 31.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d060**

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.57$  mho/m;  $\epsilon_r = 53.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

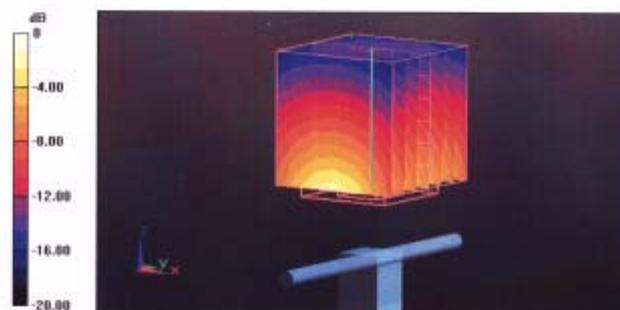
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.435 V/m; Power Drift = -0.0099 dB

Peak SAR (extrapolated) = 18.663 W/kg

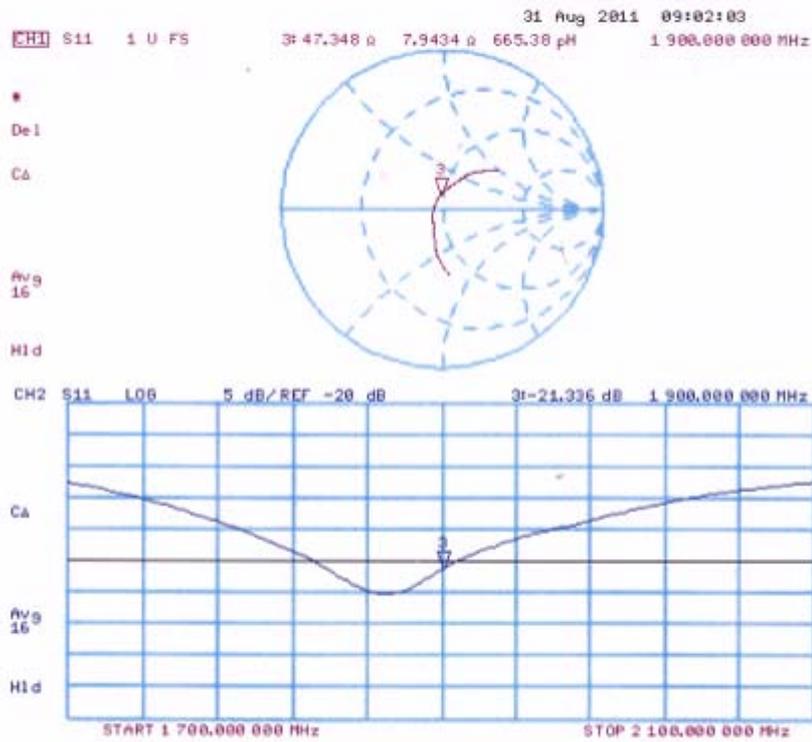
**SAR(1 g) = 10.6 mW/g; SAR(10 g) = 5.55 mW/g**

Maximum value of SAR (measured) = 13.397 mW/g



0 dB = 13.400mW/g

Impedance Measurement Plot for Body TSL



# TA Technology (Shanghai) Co., Ltd. Test Report

## ANNEX G: DAE4 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

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

Accreditation No.: **SCS 108**

Client **TA Shanghai (Auden)**

Certificate No: **DAE4-1317\_Jan13**

### CALIBRATION CERTIFICATE

Object: **DAE4 - SD 000 D04 BJ - SN: 1317**

Calibration procedure(s): **QA CAL-06.v25  
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **January 25, 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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	02-Oct-12 (No:12728)	Oct-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-13 (in house check)	In house check: Jan-14
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-13 (in house check)	In house check: Jan-14

	Name	Function	Signature
Calibrated by:	R.Mayoraz	Technician	<i>R. Mayoraz</i>
Approved by:	Fin Bornholt	Deputy Technical Manager	<i>F. Bornholt</i>

Issued: January 25, 2013

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# TA Technology (Shanghai) Co., Ltd.

## Test Report

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**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  
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Accreditation No.: **SCS 108**

### Glossary

**DAE** data acquisition electronics  
**Connector angle** information used in DASY system to align probe sensor X to the robot coordinate system.

### Methods Applied and Interpretation of Parameters

- **DC Voltage Measurement:** Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- **Connector angle:** The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - **DC Voltage Measurement Linearity:** Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - **Common mode sensitivity:** Influence of a positive or negative common mode voltage on the differential measurement.
  - **Channel separation:** Influence of a voltage on the neighbor channels not subject to an input voltage.
  - **AD Converter Values with inputs shorted:** Values on the internal AD converter corresponding to zero input voltage
  - **Input Offset Measurement:** Output voltage and statistical results over a large number of zero voltage measurements.
  - **Input Offset Current:** Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - **Input resistance:** Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - **Low Battery Alarm Voltage:** Typical value for information. Below this voltage, a battery alarm signal is generated.
  - **Power consumption:** Typical value for information. Supply currents in various operating modes.

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

**DC Voltage Measurement**

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 $\mu$ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.011 $\pm$ 0.02% (k=2)	404.006 $\pm$ 0.02% (k=2)	403.901 $\pm$ 0.02% (k=2)
Low Range	3.98819 $\pm$ 1.55% (k=2)	3.99805 $\pm$ 1.55% (k=2)	3.98192 $\pm$ 1.55% (k=2)

**Connector Angle**

Connector Angle to be used in DASY system	117 $^{\circ}$ $\pm$ 1 $^{\circ}$
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# TA Technology (Shanghai) Co., Ltd. Test Report

## Appendix

### 1. DC Voltage Linearity

High Range		Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X	+ Input	199994.16	-0.78	-0.00
Channel X	+ Input	20000.75	0.37	0.00
Channel X	- Input	-19997.98	2.89	-0.01
Channel Y	+ Input	199995.20	0.02	0.00
Channel Y	+ Input	19999.08	-1.15	-0.01
Channel Y	- Input	-20002.66	-1.68	0.01
Channel Z	+ Input	199994.67	-0.43	-0.00
Channel Z	+ Input	19997.92	-2.31	-0.01
Channel Z	- Input	-20000.66	0.26	-0.00

Low Range		Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X	+ Input	2001.23	0.59	0.03
Channel X	+ Input	201.53	0.55	0.28
Channel X	- Input	-198.20	0.62	-0.31
Channel Y	+ Input	2000.33	-0.29	-0.01
Channel Y	+ Input	200.43	-0.68	-0.34
Channel Y	- Input	-199.64	-0.69	0.35
Channel Z	+ Input	2000.78	0.22	0.01
Channel Z	+ Input	200.32	-0.69	-0.34
Channel Z	- Input	-199.27	-0.35	0.18

### 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading ( $\mu\text{V}$ )	Low Range Average Reading ( $\mu\text{V}$ )
Channel X	200	-23.69	-25.75
	- 200	28.59	26.45
Channel Y	200	-1.44	-1.70
	- 200	-0.06	-0.16
Channel Z	200	-10.76	-11.18
	- 200	9.82	9.91

### 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X ( $\mu\text{V}$ )	Channel Y ( $\mu\text{V}$ )	Channel Z ( $\mu\text{V}$ )
Channel X	200	-	1.52	-4.72
Channel Y	200	8.54	-	4.31
Channel Z	200	10.79	5.34	-

# TA Technology (Shanghai) Co., Ltd. Test Report

#### 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16104	15986
Channel Y	16111	15993
Channel Z	16217	16069

#### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M $\Omega$

	Average ( $\mu$ V)	min. Offset ( $\mu$ V)	max. Offset ( $\mu$ V)	Std. Deviation ( $\mu$ V)
Channel X	1.28	0.53	2.45	0.33
Channel Y	-1.29	-2.89	0.51	0.58
Channel Z	-0.39	-1.47	1.06	0.37

#### 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

#### 7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

#### 8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

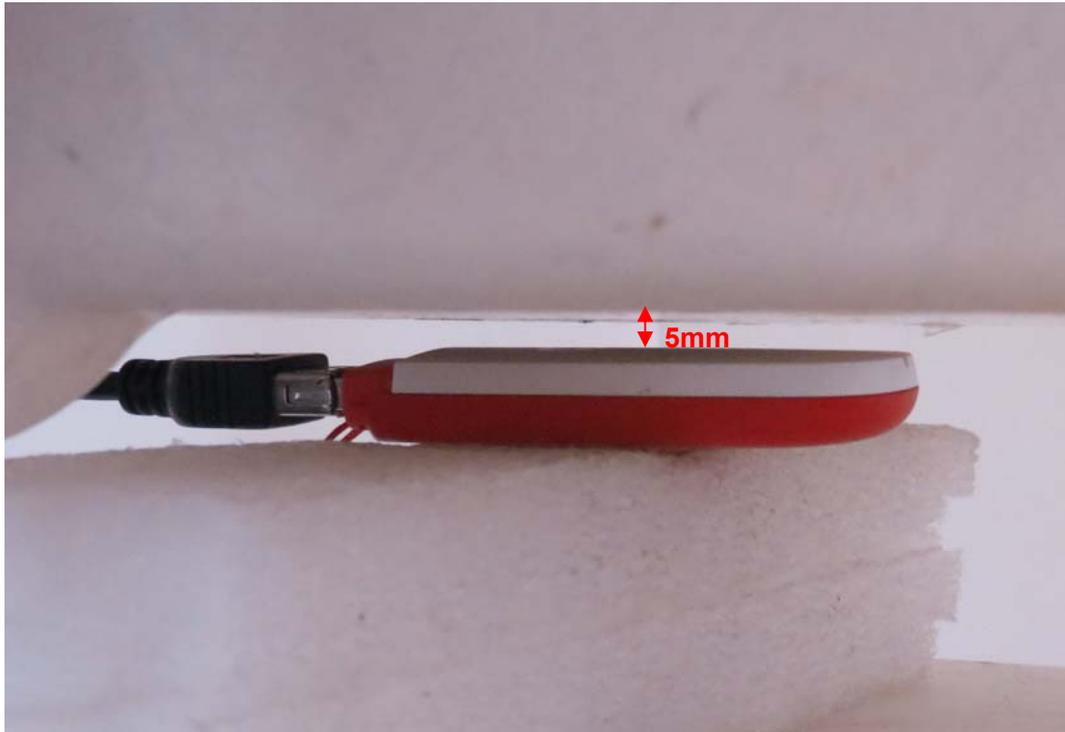
#### 9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

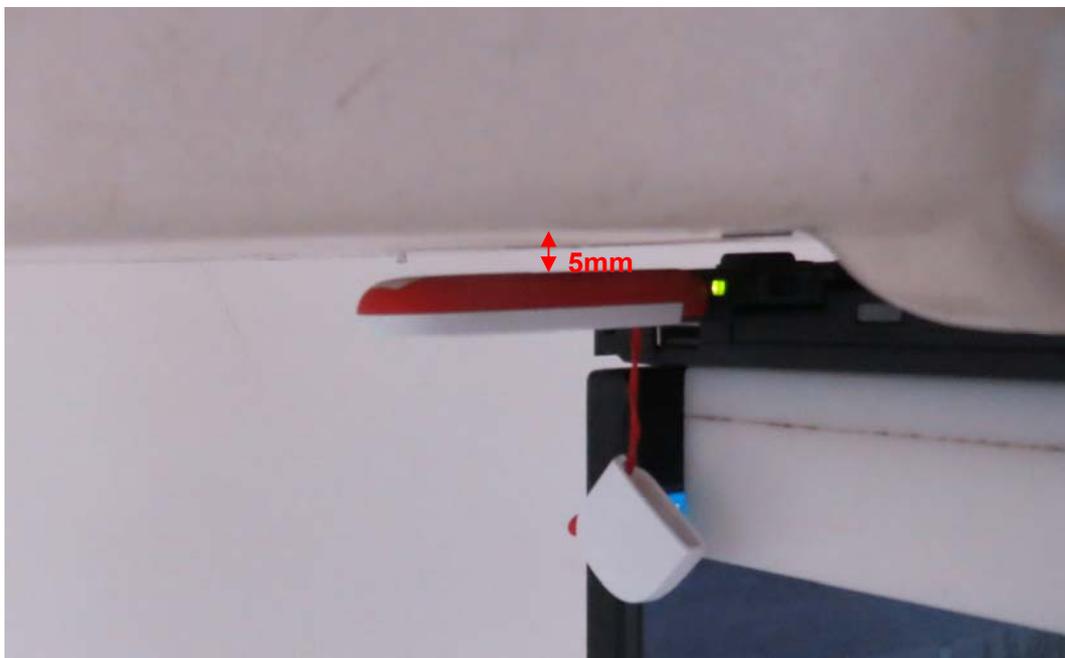
**ANNEX H: The EUT Appearances and Test Configuration**



**Picture 5: Constituents of the EUT**



Picture 6: Test position 1



Picture 7: Test position 2



Picture 8: Test Position 3



Picture 9: Test Position 4



Picture 10: Test position 5