



# TEST REPORT

**Product Name** Wireless High Gain USB Adapter

**Model** PW-DN4210D

**FCC ID** WWMDN4210DV1

**Client** Proware Technologies Co., Ltd.

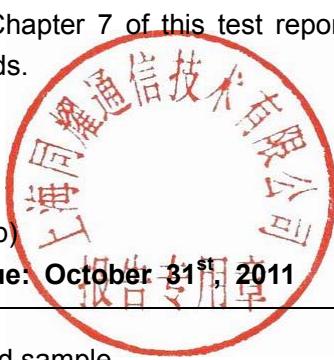
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**GENERAL SUMMARY**

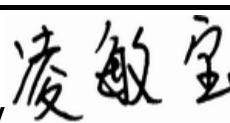
<b>Product Name</b>	Wireless High Gain USB Adapter	<b>Model</b>	PW-DN4210D
<b>FCC ID</b>	WWMDN4210DV1		
<b>Report No.</b>	RZA1106-1059SAR01R3		
<b>Client</b>	Proware Technologies Co., Ltd.		
<b>Manufacturer</b>	Proware Technologies Co., Ltd.		
<b>Reference Standard(s)</b>	<p><b>IEEE Std C95.1, 1999:</b> IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.</p> <p><b>SUPPLEMENT C Edition 01-01 to OET BULLETIN 65 Edition 97-01 June 2001 including DA 02-1438, published June 2002:</b> Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields Additional Information for Evaluation Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radio frequency Emissions.</p> <p><b>KDB 248227 D01 SAR meas for 802 11 a b g v01r02:</b> SAR Measurement Procedures for 802.11a/b/g Transmitters.</p> <p><b>KDB 447498 D02 SAR Procedures for Dongle Xmtr v02:</b> SAR Measurement Procedures for USB Dongle Transmitters.</p> <p><b>Tracking Number 258142</b></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.</p> <p>General Judgment: <b>Pass</b></p> <p style="text-align: right;">(Stamp) </p> <p style="text-align: right;"><b>Date of issue: October 31<sup>st</sup>, 2011</b></p>		
<b>Comment</b>	The test result only responds to the measured sample.		

Approved by



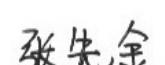
Director

Revised by



SAR Manager

Performed by



SAR Engineer

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### 1. General Information

#### 1.1. Notes of the Test Report

**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.

**TA Technology (Shanghai) Co., Ltd.** is liable to the client for the maintenance by its personnel of the confidentiality of all information related to the items under test and the results of the test. This report only refers to the item that has undergone the test.

This report standalone dose not constitute or imply by its own an approval of the product by the certification Bodies or competent Authorities. This report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of **TA Technology (Shanghai) Co., Ltd.** and the Accreditation Bodies, if it applies.

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

Company: Proware Technologies Co., Ltd.  
Address: 2nd F1 East Wing, South Section, Factory Building 24, Science&Technology Park, Shennan Rd, Nanshan District, Shenzhen  
City: Shenzhen  
Postal Code: 518000  
Country: P. R. China  
Contact: /  
Telephone: 0755-26525554  
Fax: 0755-26508930

### 1.4. Manufacturer Information

Company: Proware Technologies Co., Ltd.  
Address: 2nd F1 East Wing, South Section, Factory Building 24, Science&Technology Park, Shennan Rd, Nanshan District, Shenzhen  
City: Shenzhen  
Postal Code: 518000  
Country: P. R. China  
Telephone: 0755-26525554  
Fax: 0755-26508930

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## 1.5. Information of EUT

### General Information

Device Type:	Portable Device	
Exposure Category:	Uncontrolled Environment / General Population	
Product Name:	Wireless High Gain USB Adapter	
Antenna Type:	External Antenna	
Device Operating Configurations:		
Supporting Mode(s):	802.11b; (tested) 802.11g; (untested) 802.11n HT20/ HT40; (untested)	
Operating Frequency Range(s):	Mode	Tx (MHz)
	802.11b	2412 ~ 2462MHz
Test Channel: (Low - Middle - High)	1-6-11 (802.11b)	
Used Host Products:	BenQ Joybook R55V	

Equipment Under Test (EUT) is Wireless High Gain USB Adapter. During SAR test of the EUT, it was connected to a portable computer. SAR is tested for 802.11b in this report. The EUT has a WIFI antenna that is used for Tx/Rx.

The sample undergoing test was selected by the Client.

Components list please refer to documents of the manufacturer.

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**1.6. The Maximum SAR<sub>1g</sub> Values**

**Body Worn Configuration**

Mode	Channel	Position	Separation distance	SAR <sub>1g</sub> (W/kg)
802.11b	High/11	Test Position 5	5mm	1.090

**1.7. Power of Each Tested Mode**

Mode	Maximum AV Power (dBm)
802.11b	15.76

Note: The detail Power refer to Table 4 (Power Measurement Results).

**1.8. Test Date**

The test is performed on September 15, 2011.

## 2. Operational Conditions during Test

### 2.1. General Description of Test Procedures

For the 802.11b/g SAR body tests, a communication link is set up with the test mode software for WIFI mode test. The Absolute Radio Frequency Channel Number (ARFCN) is allocated to 1, 6 and 11 respectively in the case of 2450 MHz. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate in each mode. Testing at higher data rates is not required when the maximum average output power is less than 0.25dB higher than those measured at the lowest data rate.

802.11b/g operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g modes are tested on channels 1,6 and 11; however, if output power reduction is necessary for channels 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels must be tested instead.

SAR is not required for 802.11g channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels. When the maximum average output channel in each frequency band is not included in the “default test channels”, the maximum channel should be tested instead of an adjacent “default test channels”, these are referred to as the “required test channels” and are illustrated in Table 1.

Then The Absolute Radio Frequency Channel Number (ARFCN) is firstly allocated to 2437 respectively in the case of 802.11b/g.

**Table 1: “Default Test Channels”**

Mode	GHz	Channel	Turbo Channel	“Default Test Channels”		
				15.247		UNII
				802.11b	802.11g	
802.11b/g	2.412	1 <sup>#</sup>		√	*	
	2.437	6	6	√	*	
	2.462	11 <sup>#</sup>		√	*	

Note: <sup>#</sup>=when output power is reduced for channel 1 and /or 11to meet restricted band requirements the highest out put channels closet to each of these channels should be tested.

√= “default test channels”

\* =possible 802.11g channels with maximum average output 0.25dB>=the “default test channels”

## **2.2. Test Position of Portable Devices**

The measurements were performed in one host product (BenQ Joybook R55V). BenQ Joybook R55V laptop has vertical USB slot and horizontal USB slot.

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

For each channel, the EUT is tested at the following 6 test positions:

- Test Position 1: The EUT is connected to the portable computer with horizontal USB slot. The back side of the EUT towards the bottom of the flat phantom. The EUT horizontal up with phantom is 5mm gap and the antenna of the EUT is in Vertical mode. (ANNEX G Picture 5)
- Test Position 2: The EUT is connected to the portable computer with horizontal USB slot. The back side of the EUT towards the bottom of the flat phantom. The EUT horizontal up with phantom is 5mm gap and the antenna of the EUT is 180 degrees from USB connector. (ANNEX G Picture 6)
- Test Position 3: The EUT is connected to the portable computer with horizontal USB slot. The front side of the EUT towards the bottom of the flat phantom. The EUT horizontal up with phantom is 5mm gap and the antenna of the EUT is 180 degrees from USB connector. (ANNEX G Picture 7)
- Test Position 4: The EUT is connected to the portable computer through a 19cm USB cable. The left side of the EUT towards the bottom of the flat phantom. The EUT horizontal up with phantom is 5mm gap and the antenna of the EUT is 180 degrees from USB connector. (ANNEX G Picture 8)
- Test Position 5: 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 EUT and the phantom is horizontal. The antenna of the EUT horizontal up with phantom is 5mm gap and the antenna of the EUT is 180 degrees from USB connector. (ANNEX G Picture 9)
- Test Position 6: The EUT is connected to the portable computer with vertical USB slot. The top side of the EUT directly towards the bottom of the flat phantom. (ANNEX G Picture 10)

### **2.3. Picture of Host Product**

During the test, BenQ Joybook R55V laptop was used as an assistant to help to setup communication. (See Picture 1)



Picture 1-a: BenQ Joybook R55V Close



Picture 1-b: BenQ Joybook R55V Open



Picture 1-c: BenQ Joybook R55V with horizontal USB slot



Picture 1-d: BenQ Joybook R55V with vertical USB slot



Picture 1-e: a 19cm USB cable  
Picture 1: Computer as a test assistant

### 3. SAR Measurements System Configuration

#### 3.1. SAR Measurement Set-up

The DASY4 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 DASY4 measurement server.
- The DASY4 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
- DASY4 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.

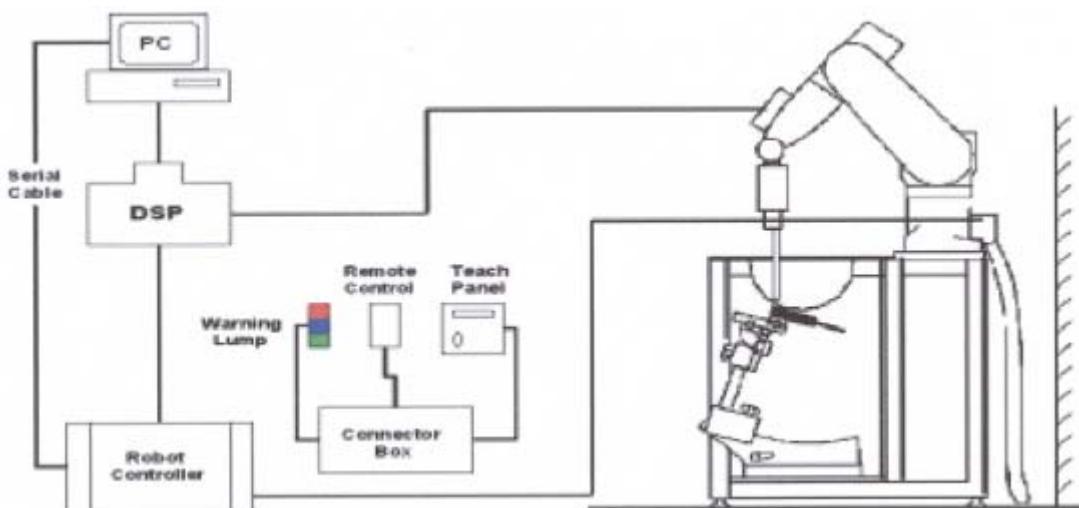


Figure 1. SAR Lab Test Measurement Set-up

### 3.2. DASY4 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.

### 3.2.1. 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 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**

### **3.2.2. 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  $\pm$  0.25dB. 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>).

### **3.3. Other Test Equipment**

#### **3.3.1. 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

### 3.3.2. 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

### 3.4. Scanning Procedure

The DASY4 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

- The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max.  $\pm 5\%$ .
- The “surface check” measurement tests the optical surface detection system of the DASY4 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above  $\pm 0.1\text{mm}$ ). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within  $\pm 30^\circ$ .)
- Area Scan  
The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing of 10 mm x 10 mm is set. During the scan the distance of the probe to the phantom remains

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unchanged.

After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

- **Zoom Scan**

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

- **Spatial Peak Detection**

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY4 system allows evaluations that combine measured data and robot positions, such as:

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

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

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space.

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

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

### **3.5. Data Storage and Evaluation**

#### **3.5.1. Data Storage**

The DASY4 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DA4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

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

#### **3.5.2. 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	Norm <sub>i</sub> , 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 DASY4 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:

$$V_i = U_i + U_i^2 \cdot c_f / d_{cp_i}$$

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

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

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

$d_{cp_i}$  = 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.

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

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

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**$E_{tot}$**  = 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

### 3.6. 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 6.

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 DASY4 system.

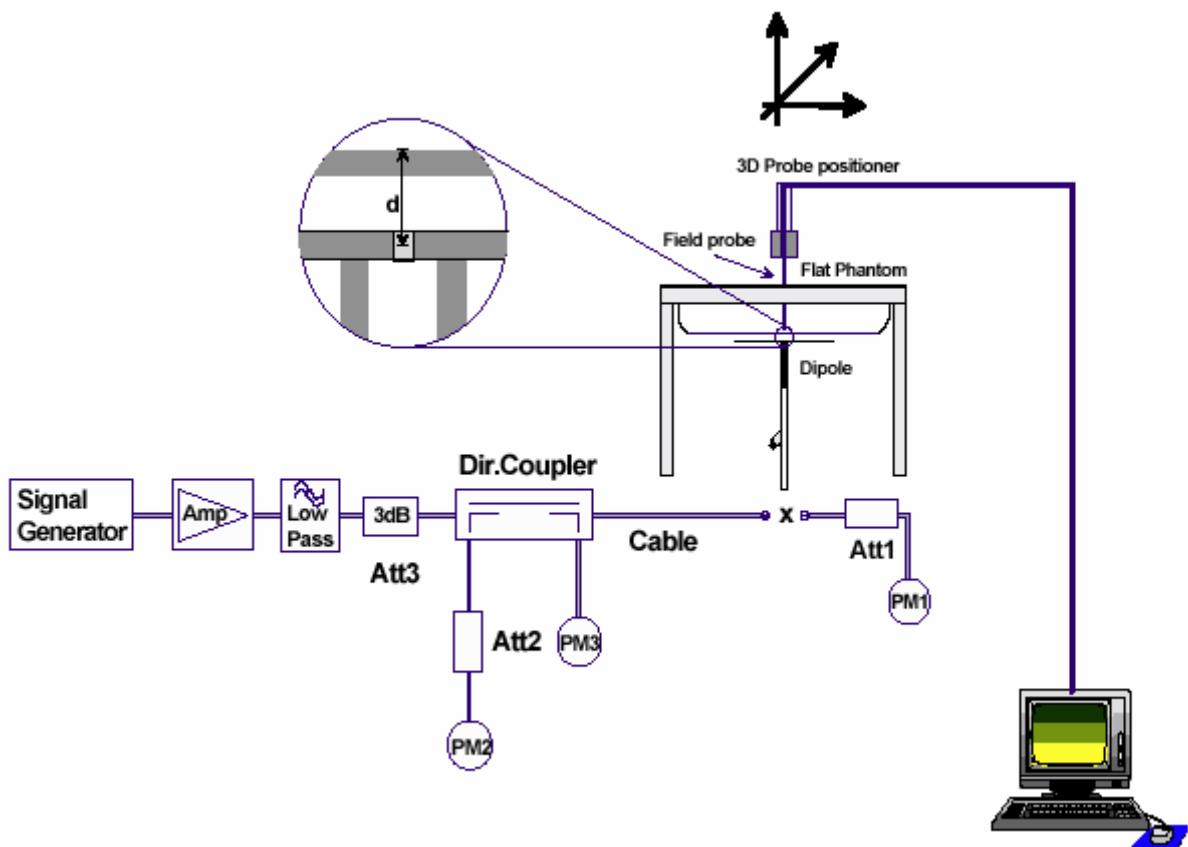


Figure 5. System Check Set-up

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**Justification for Extended SAR Dipole Calibrations**

Usage of SAR dipoles calibrated less than 2 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 Publication 450824:

Dipole D2450V2 SN: 712				
Body				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2/19/2010	-25.7	3.1%	50.1	1.7 $\Omega$
2/18/2011	-26.5		51.8	

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### 3.7. Equivalent Tissues

The liquid is consisted of water, sugar, salt, Glycol monobutyl, Preventol and Cellulose. The liquid has previously been proven to be suited for worst-case. The Table 2 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the OET 65.

**Table 2: Composition of the Body Tissue Equivalent Matter**

MIXTURE%	FREQUENCY(Body) 2450MHz
Water	73.2
Glycol	26.7
Salt	0.1
Dielectric Parameters Target Value	f=2450MHz $\epsilon=52.70$ $\sigma=1.95$

### 4. Laboratory Environment

**Table 3: The Ambient Conditions during Test**

Temperature	Min. = 20°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 $\Omega$
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.	

## **5. Characteristics of the Test**

### **5.1. Applicable Limit Regulations**

**IEEE Std C95.1, 1999:** IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

### **5.2. Applicable Measurement Standards**

**SUPPLEMENT C Edition 01-01 to OET BULLETIN 65 Edition 97-01 June 2001 including DA 02-1438, published June 2002:** Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields Additional Information for Evaluation Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radio frequency Emissions.

**KDB 248227 D01 SAR meas for 802 11 a b g v01r02:** SAR Measurement Procedures for 802.11a/b/g Transmitters.

**KDB 447498 D02 SAR Procedures for Dongle Xmtr v02:** SAR Measurement Procedures for USB Dongle Transmitters.

## 6. Conducted Output Power Measurement

### 6.1. Summary

The following procedures had been used to prepare the EUT for the SAR test. The client provided a special driver and program, which enable engineer to control the frequency and output power of the module.

### 6.2. Conducted Power Results

Table 4: Conducted Power Measurement Results

Mode	Channel	Data rate (Mbps)	AV Power (dBm)
11b	1	1	15.56
		2	15.65
		5.5	15.71
		11	15.76
	6	1	15.23
		2	15.12
		5.5	15.03
		11	15.09
	11	1	14.78
		2	14.67
		5.5	14.53
		11	14.46
11g	1	6	15.26
		9	15.39
		12	15.19
		18	15.37
		24	15.31
		36	15.28
		48	15.12
		54	15.06
	6	6	15.01
		9	14.98
		12	14.84
		18	14.78
		24	14.67

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11n HT20	11	36	14.56
		48	14.51
		54	14.48
	11	6	14.56
		9	14.48
		12	14.46
		18	14.27
		24	14.13
		36	14.22
		48	14.27
		54	14.12
	1	MCS0	15.12
		MCS1	15.04
		MCS2	15.18
		MCS3	15.03
		MCS4	15.08
		MCS5	15.08
		MCS6	14.92
		MCS7	14.96
	6	MCS0	14.92
		MCS1	14.67
		MCS2	14.82
		MCS3	14.72
		MCS4	14.73
		MCS5	14.74
		MCS6	14.56
		MCS7	14.75
	11	MCS0	14.66
		MCS1	14.47
		MCS2	14.26
		MCS3	14.32
		MCS4	14.43
		MCS5	14.45
		MCS6	14.57
		MCS7	14.43

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11n HT40	3	MCS0	9.04
		MCS1	8.96
		MCS2	8.82
		MCS3	8.76
		MCS4	8.65
		MCS5	8.56
		MCS6	8.43
		MCS7	8.35
	6	MCS0	14.34
		MCS1	13.16
		MCS2	13.17
		MCS3	13.07
		MCS4	13.02
		MCS5	12.86
		MCS6	13.03
		MCS7	13.15
	9	MCS0	9.13
		MCS1	9.03
		MCS2	8.92
		MCS3	8.91
		MCS4	8.67
		MCS5	8.74
		MCS6	8.56
		MCS7	8.46

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## 7. Test Results

### 7.1. Dielectric Performance

**Table 5: Dielectric Performance of Body Tissue Simulating Liquid**

Frequency	Description	Dielectric Parameters		Temp °C
		$\epsilon_r$	$\sigma(\text{s/m})$	
2450MHz (body)	Target value ±5% window	52.70 50.07 — 55.34	1.95 1.85 — 2.05	/
	Measurement value 2011-9-15	51.73	1.95	
				21.8

### 7.2. System Check

**Table 6: System Check for Body Tissue Simulating Liquid**

Frequency	Description	SAR(W/kg)		Dielectric Parameters		Temp °C
		10g	1g	$\epsilon_r$	$\sigma(\text{s/m})$	
2450MHz	Recommended value ±10% window	5.97 5.37 — 6.57	13 11.7 — 14.3	51.8	2.01	/
	Measurement value 2011-9-15	6.16	14.00	51.73	1.95	
						21.8

Note: 1. The graph results see ANNEX B.

2. Target Values used derive from the calibration certificate and 250 mW is used as feeding power to the Calibrated dipole.

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### 7.3. Summary of Measurement Results

#### 7.3.1. 802.11b

**Table 7: SAR Values (802.11b)**

Limit of SAR (W/kg)		10 g Average	1 g Average	Power Drift (dB)	Graph Results	
		2.0	1.6	± 0.21		
Test Case Of Body		Measurement Result(W/kg)		Power Drift (dB)		
		10 g Average	1 g Average			
Different Test Position	Channel	<b>BenQ Joybook R55V</b>				
Test Position 1	Middle/6	0.010	0.020	0.170	Figure 7	
Test Position 2	High/11	0.511	1.060	-0.062	Figure 8	
	Middle/6	0.392	0.834	-0.157	Figure 9	
Test Position 3	Low/1	0.337	0.715	0.062	Figure 10	
	High/11	0.439	0.938	-0.014	Figure 11	
	Middle/6	0.396	0.852	0.121	Figure 12	
Test Position 4	Low/1	0.313	0.668	0.021	Figure 13	
	Middle/6	0.014	0.024	-0.038	Figure 14	
	High/11	0.514	<b>1.090</b>	-0.101	Figure 15	
Test Position 5	Middle/6	0.423	0.884	0.144	Figure 16	
	Low/1	0.339	0.707	0.035	Figure 17	
Test Position 6	Middle/6	0.137	0.264	0.177	Figure 18	

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

2. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is at least 3.0 dB (< 0.8W/kg) lower than the SAR limit, testing at the high and low channels is optional.
3. Upper and lower frequencies were measured at the worst case.
4. KDB 248227-SAR is not required for 802.11g/n channels when the maximum average output power is less than 1/4 dB higher than measured on the corresponding 802.11b channels.

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## 8. 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	5.9	N	1	1	5.9	$\infty$
3	-axial isotropy of the probe	B	4.7	R	$\sqrt{3}$	$\sqrt{0.5}$	1.9	$\infty$
4	- Hemispherical isotropy of the probe	B	9.4	R	$\sqrt{3}$	$\sqrt{0.5}$	3.9	$\infty$
6	-boundary effect	B	1.9	R	$\sqrt{3}$	1	1.1	$\infty$
7	-probe linearity	B	4.7	R	$\sqrt{3}$	1	2.7	$\infty$
8	- System detection limits	B	1.0	R	$\sqrt{3}$	1	0.6	$\infty$
9	-readout Electronics	B	1.0	N	1	1	1.0	$\infty$
10	-response time	B	0	R	$\sqrt{3}$	1	0	$\infty$
11	-integration time	B	4.32	R	$\sqrt{3}$	1	2.5	$\infty$
12	-noise	B	0	R	$\sqrt{3}$	1	0	$\infty$
13	-RF Ambient Conditions	B	3	R	$\sqrt{3}$	1	1.73	$\infty$
14	-Probe Positioner Mechanical Tolerance	B	0.4	R	$\sqrt{3}$	1	0.2	$\infty$
15	-Probe Positioning with respect to Phantom Shell	B	2.9	R	$\sqrt{3}$	1	1.7	$\infty$
16	-Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	B	3.9	R	$\sqrt{3}$	1	2.3	$\infty$
Test sample Related								
17	-Test Sample Positioning	A	2.9	N	1	1	4.92	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	$\infty$
Physical parameter								
20	-phantom	B	4.0	R	$\sqrt{3}$	1	2.3	$\infty$
21	-liquid conductivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.64	1.8	$\infty$

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22	-liquid conductivity (measurement uncertainty)	B	0.77	N	1	0.64	0.493	9
23	-liquid permittivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.6	1.7	$\infty$
24	-liquid permittivity (measurement uncertainty )	B	0.29	N	1	0.6	0.174	9
Combined standard uncertainty		$u_c = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$					11.36	
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$		N	k=2		22.72	

## 9. Main Test Instruments

**Table 8: List of Main Instruments**

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	Agilent 8753E	US37390326	September 12, 2011	One year
02	Dielectric Probe Kit	Agilent 85070E	US44020115	No Calibration Requested	
03	Power meter	Agilent E4417A	GB41291714	March 12, 2011	One year
04	Power sensor	Agilent N8481H	MY50350004	September 26, 2010	One year
05	Signal Generator	HP 8341B	2730A00804	September 12, 2011	One year
06	Amplifier	IXA-020	0401	No Calibration Requested	
07	BTS	E5515C	MY48360988	December 3, 2010	One year
08	E-field Probe	EX3DV4	3677	November 24, 2010	One year
09	DAE	DAE4	871	November 18, 2010	One year
10	Validation Kit 2450MHz	D2450V2	712	February 19, 2010	Two years

**\*\*\*END OF REPORT BODY\*\*\***

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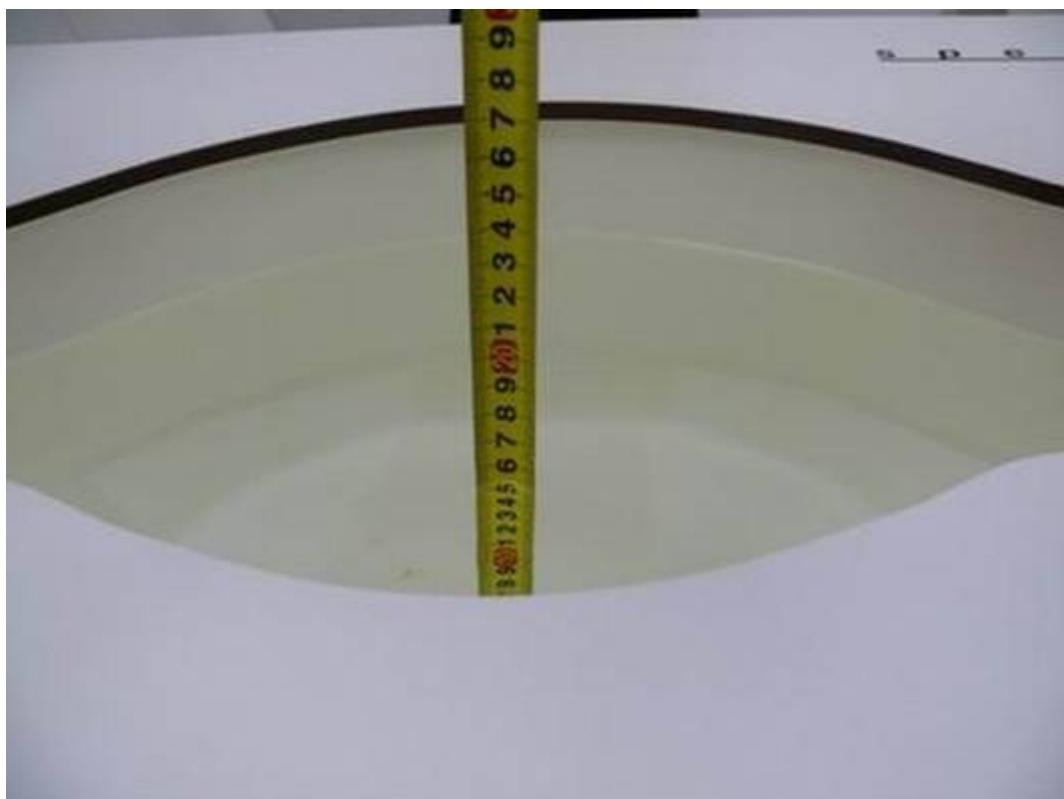
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**ANNEX A: Test Layout**



**Picture 2: Specific Absorption Rate Test Layout**



**Picture 3: Liquid depth in the flat Phantom (2450 MHz, 15.2cm depth)**

## ANNEX B: System Check Results

### System Performance Check at 2450 MHz Body TSL

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 712

Date/Time: 9/15/2011 1:10:36 PM

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.95$  mho/m;  $\epsilon_r = 51.73$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.8 °C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010

Electronics: DAE4 Sn871; Calibrated: 11/18/2010

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**d=10mm, Pin=250mW/Area Scan (71x71x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 21.5 mW/g

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

Reference Value = 71.0 V/m; Power Drift = 0.011 dB

Peak SAR (extrapolated) = 28.2 W/kg

**SAR(1 g) = 14 mW/g; SAR(10 g) = 6.16 mW/g**

Maximum value of SAR (measured) = 19.8 mW/g

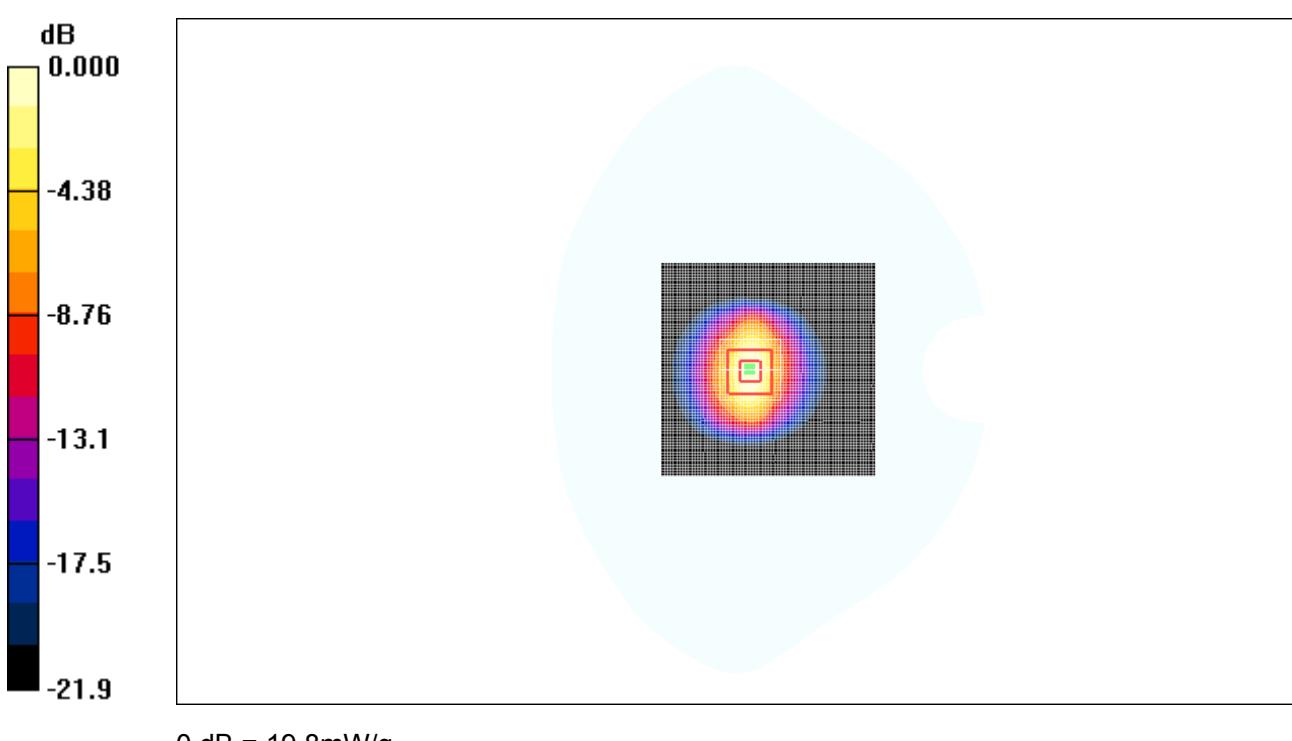


Figure 6 System Performance Check 2450MHz 250mW

## ANNEX C: Graph Results

### 802.11b with BenQ Joybook R55V Test Position 1 Middle

Date/Time: 9/15/2011 2:35:36 PM

Communication System: 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.98$  mho/m;  $\epsilon_r = 51.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010

Electronics: DAE4 Sn871; Calibrated: 11/18/2010

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Test Position 1 Middle/Area Scan (61x61x1):** Measurement grid: dx=10mm, dy=10mm

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

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

Reference Value = 3.07 V/m; Power Drift = 0.170 dB

Peak SAR (extrapolated) = 0.044 W/kg

**SAR(1 g) = 0.020 mW/g; SAR(10 g) = 0.010 mW/g**

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

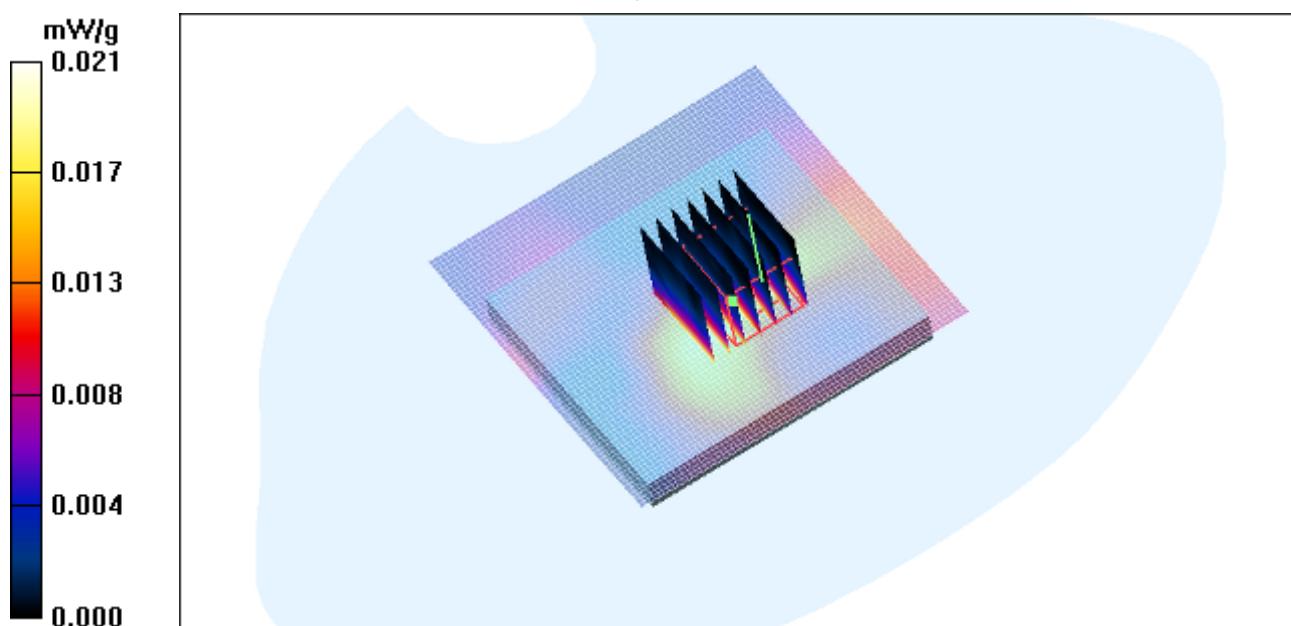


Figure 7 802.11b with BenQ Joybook R55V Test Position 1 Channel 6

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**802.11b with BenQ Joybook R55V Test Position 2 High**

Date/Time: 9/15/2011 2:59:36 PM

Communication System: 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.98$  mho/m;  $\epsilon_r = 51.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010

Electronics: DAE4 Sn871; Calibrated: 11/18/2010

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Test Position 2 High /Area Scan (61x141x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.19 mW/g

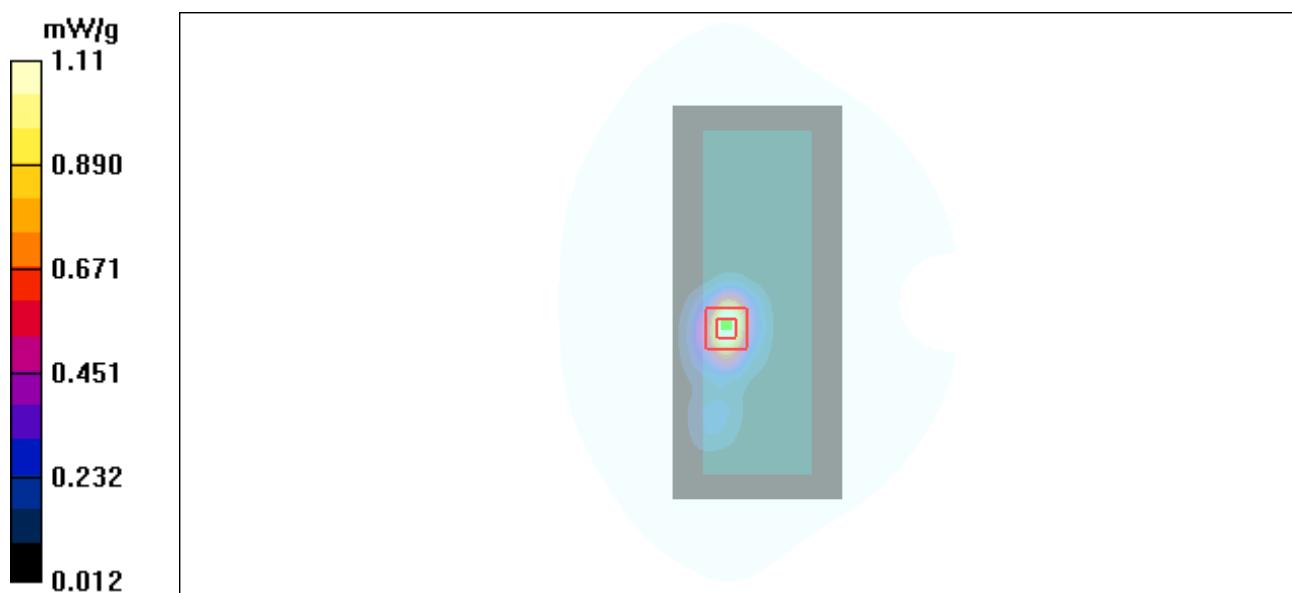
**Test Position 2 High /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.2 V/m; Power Drift = -0.062 dB

Peak SAR (extrapolated) = 2.55 W/kg

**SAR(1 g) = 1.06 mW/g; SAR(10 g) = 0.511 mW/g**

Maximum value of SAR (measured) = 1.11 mW/g



**Figure 8 802.11b with BenQ Joybook R55V Test Position 2 Channel 11**

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**802.11b with BenQ Joybook R55V Test Position 2 Middle**

Date/Time: 9/15/2011 3:16:09 PM

Communication System: 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.98$  mho/m;  $\epsilon_r = 51.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010

Electronics: DAE4 Sn871; Calibrated: 11/18/2010

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Test Position 2 Middle/Area Scan (61x121x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.922 mW/g

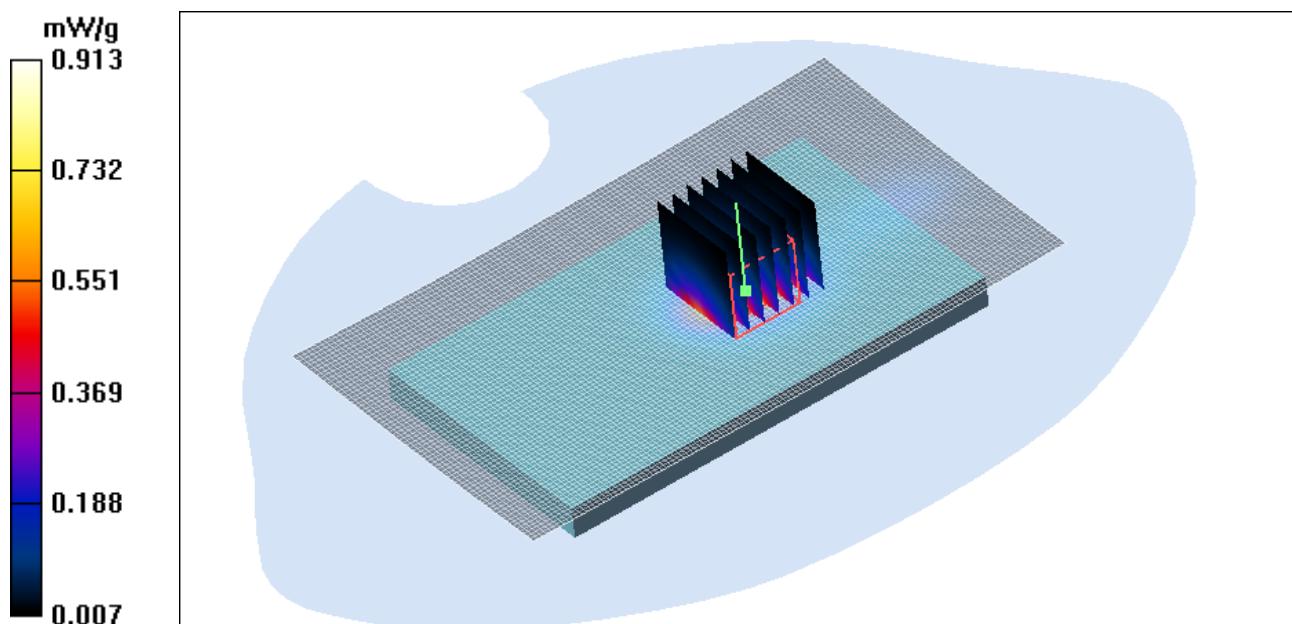
**Test Position 2 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 15.1 V/m; Power Drift = -0.157 dB

Peak SAR (extrapolated) = 1.97 W/kg

**SAR(1 g) = 0.834 mW/g; SAR(10 g) = 0.392 mW/g**

Maximum value of SAR (measured) = 0.913 mW/g



**Figure 9 802.11b with BenQ Joybook R55V Test Position 2 Channel 6**

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**802.11b with BenQ Joybook R55V Test Position 2 Low**

Date/Time: 9/15/2011 3:31:16 PM

Communication System: 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2412$  MHz;  $\sigma = 1.95$  mho/m;  $\epsilon_r = 51.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010

Electronics: DAE4 Sn871; Calibrated: 11/18/2010

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Test Position 2 Low/Area Scan (61x121x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.867 mW/g

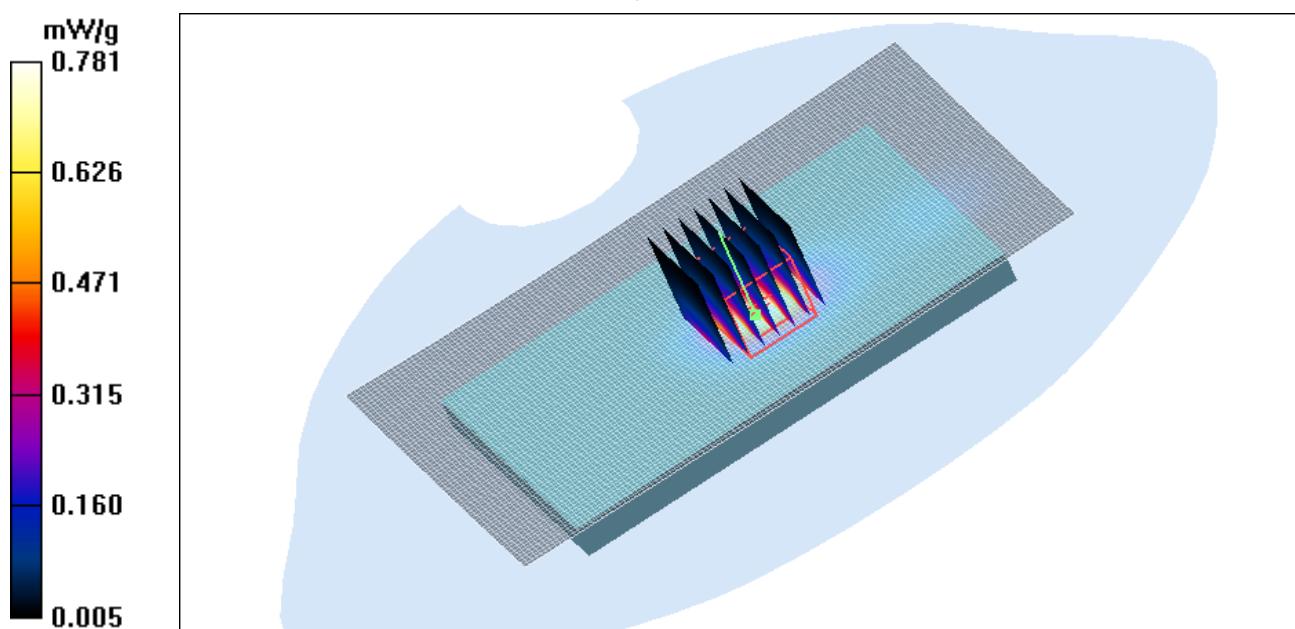
**Test Position 2 Low/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.1 V/m; Power Drift = 0.062 dB

Peak SAR (extrapolated) = 1.66 W/kg

**SAR(1 g) = 0.715 mW/g; SAR(10 g) = 0.337 mW/g**

Maximum value of SAR (measured) = 0.781 mW/g



**Figure 10 802.11b with BenQ Joybook R55V Test Position 2 Channel 1**

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**802.11b with BenQ Joybook R55V Test Position 3 High**

Date/Time: 9/15/2011 3:47:15 PM

Communication System: 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2462$  MHz;  $\sigma = 2.02$  mho/m;  $\epsilon_r = 51.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010

Electronics: DAE4 Sn871; Calibrated: 11/18/2010

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Test Position 3 High/Area Scan (61x121x1):** Measurement grid: dx=10mm, dy=10mm

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

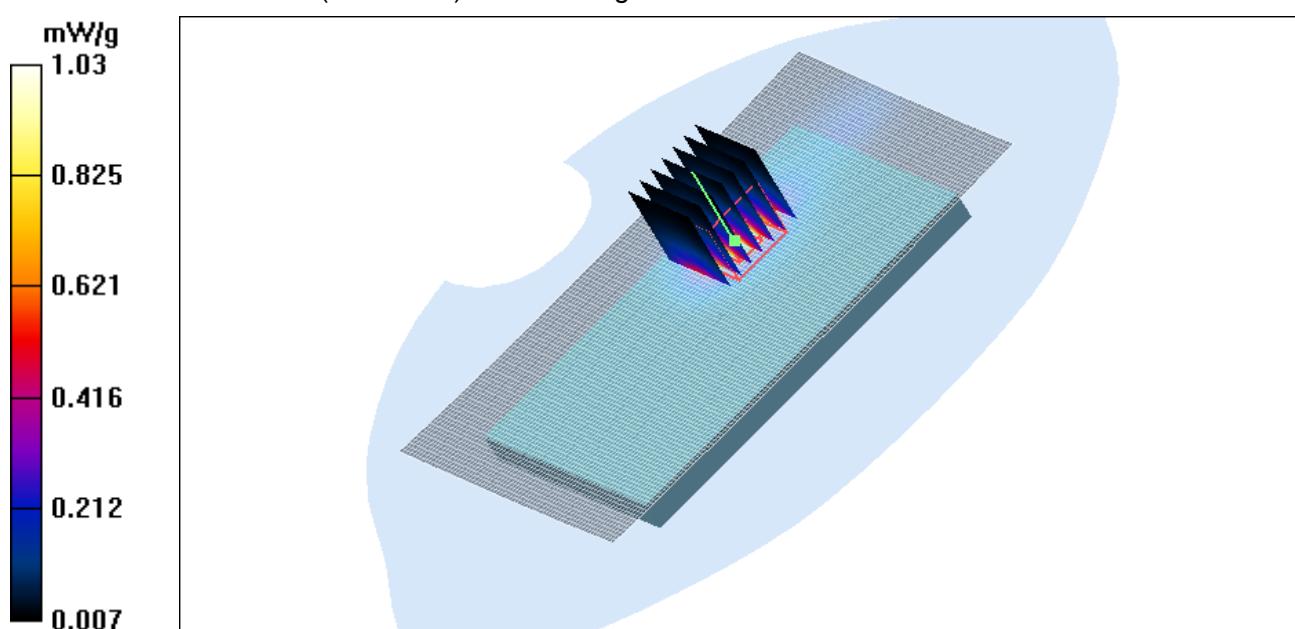
**Test Position 3 High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.42 V/m; Power Drift = -0.014 dB

Peak SAR (extrapolated) = 2.26 W/kg

**SAR(1 g) = 0.938 mW/g; SAR(10 g) = 0.439 mW/g**

Maximum value of SAR (measured) = 1.03 mW/g



**Figure 11 802.11b with BenQ Joybook R55V Test Position 3 Channel 11**

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**802.11b with BenQ Joybook R55V Test Position 3 Middle**

Date/Time: 9/15/2011 4:09:38 PM

Communication System: 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.98$  mho/m;  $\epsilon_r = 51.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010

Electronics: DAE4 Sn871; Calibrated: 11/18/2010

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Test Position 3 Middle/Area Scan (61x121x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.905 mW/g

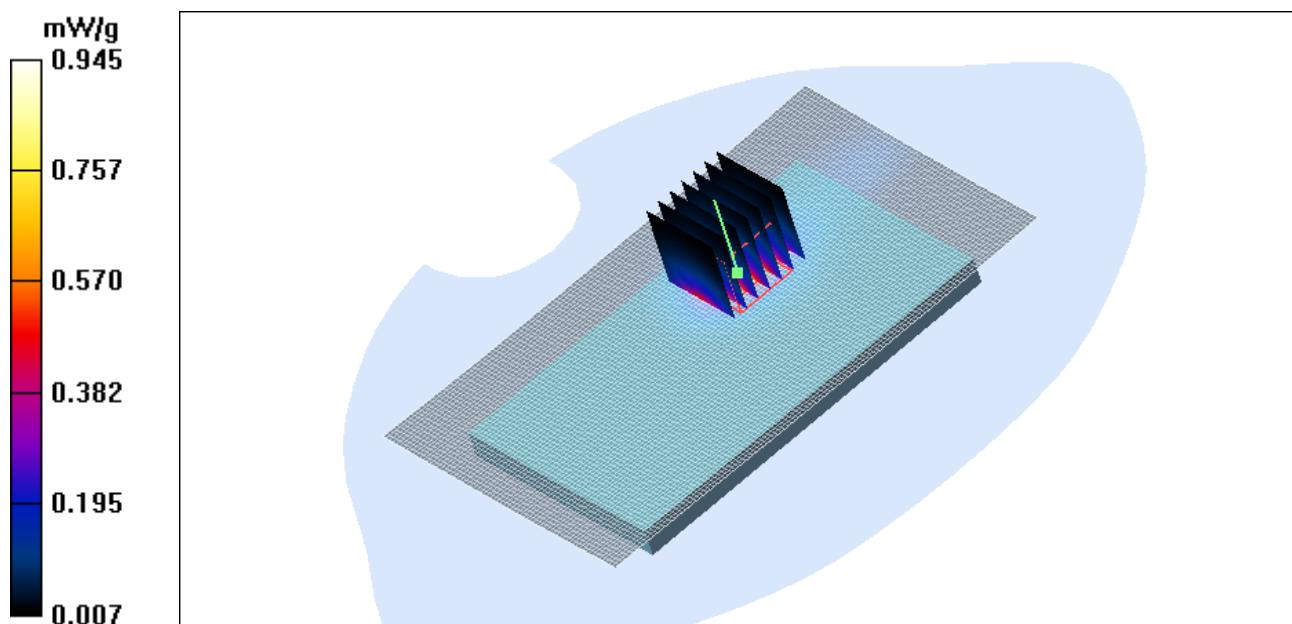
**Test Position 3 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.80 V/m; Power Drift = 0.121 dB

Peak SAR (extrapolated) = 2.03 W/kg

**SAR(1 g) = 0.852 mW/g; SAR(10 g) = 0.396 mW/g**

Maximum value of SAR (measured) = 0.945 mW/g



**Figure 12 802.11b with BenQ Joybook R55V Test Position 3 Channel 6**

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**802.11b with BenQ Joybook R55V Test Position 3 Low**

Date/Time: 9/15/2011 4:24:59 PM

Communication System: 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2412$  MHz;  $\sigma = 1.95$  mho/m;  $\epsilon_r = 51.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010

Electronics: DAE4 Sn871; Calibrated: 11/18/2010

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Test Position 3 Low/Area Scan (61x121x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.789 mW/g

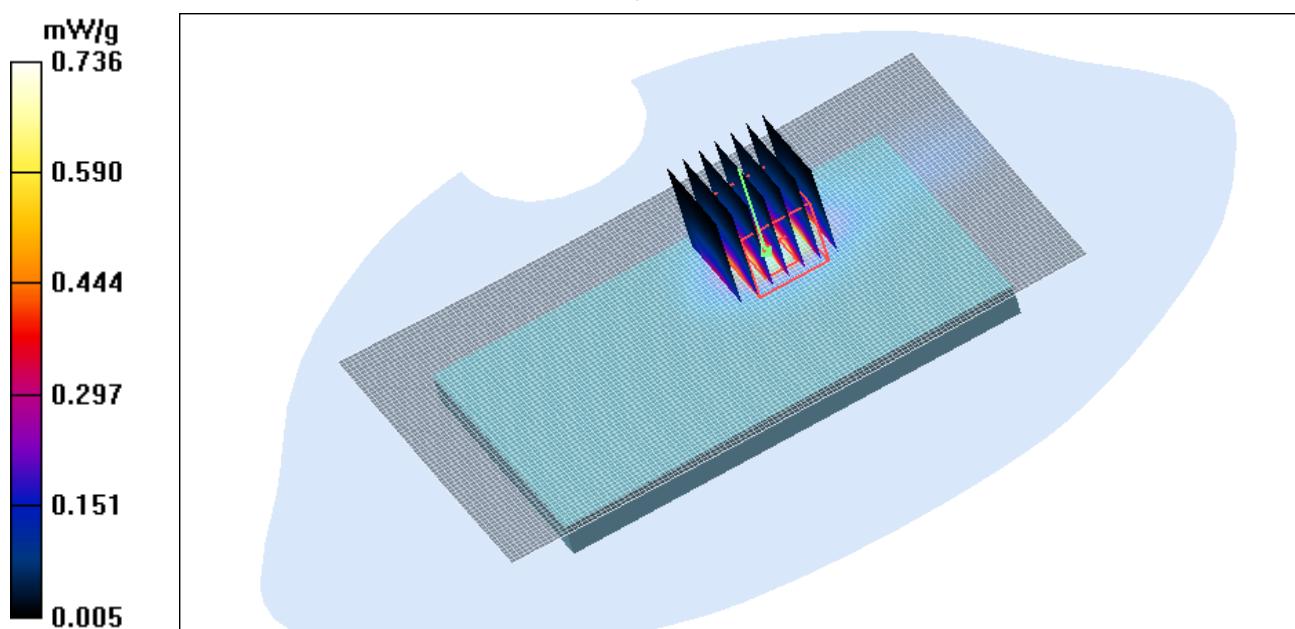
**Test Position 3 Low/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.90 V/m; Power Drift = 0.021 dB

Peak SAR (extrapolated) = 1.54 W/kg

**SAR(1 g) = 0.668 mW/g; SAR(10 g) = 0.313 mW/g**

Maximum value of SAR (measured) = 0.736 mW/g



**Figure 13 802.11b with BenQ Joybook R55V Test Position 3 Channel 1**

### 802.11b with BenQ Joybook R55V Test Position 4 Middle

Date/Time: 9/15/2011 4:39:47 PM

Communication System: 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.98$  mho/m;  $\epsilon_r = 51.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010

Electronics: DAE4 Sn871; Calibrated: 11/18/2010

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Test Position 4 Middle/Area Scan (31x121x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.023 mW/g

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

Reference Value = 3.41 V/m; Power Drift = -0.038 dB

Peak SAR (extrapolated) = 0.049 W/kg

**SAR(1 g) = 0.024 mW/g; SAR(10 g) = 0.014 mW/g**

Maximum value of SAR (measured) = 0.025 mW/g

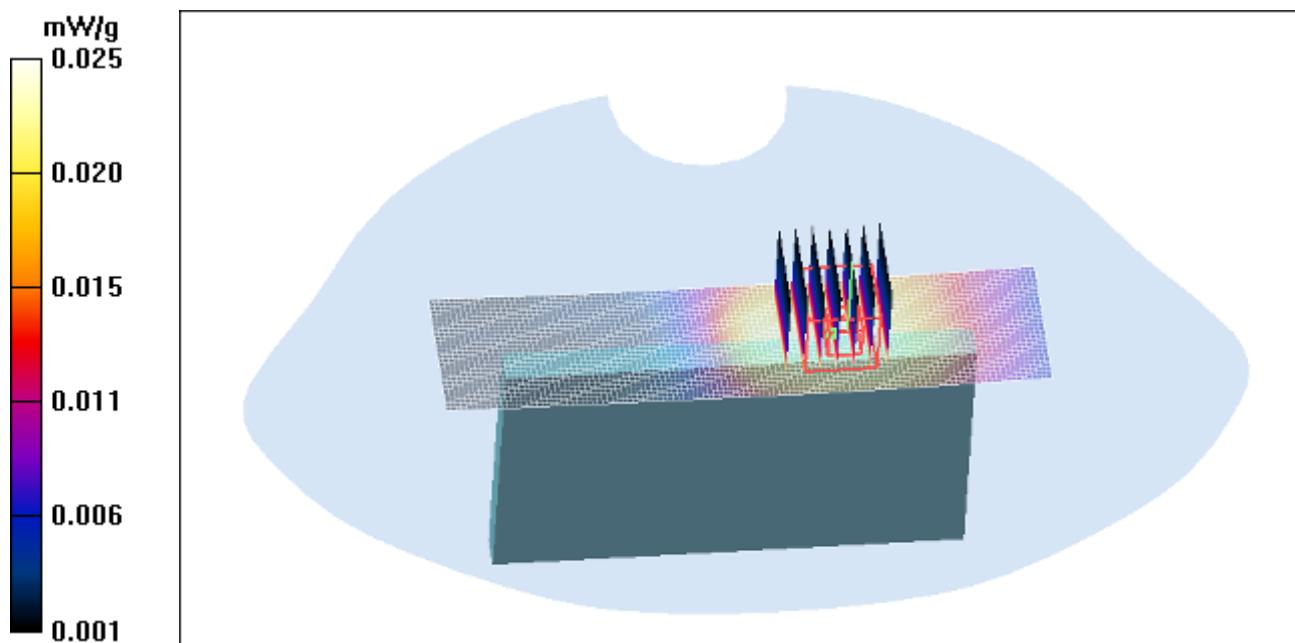


Figure 14 802.11b with BenQ Joybook R55V Test Position 4 Channel 6

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**802.11b with BenQ Joybook R55V Test Position 5 High**

Date/Time: 9/15/2011 4:54:59 PM

Communication System: 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.98$  mho/m;  $\epsilon_r = 51.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010

Electronics: DAE4 Sn871; Calibrated: 11/18/2010

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Test Position 5 High/Area Scan (41x121x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.38 mW/g

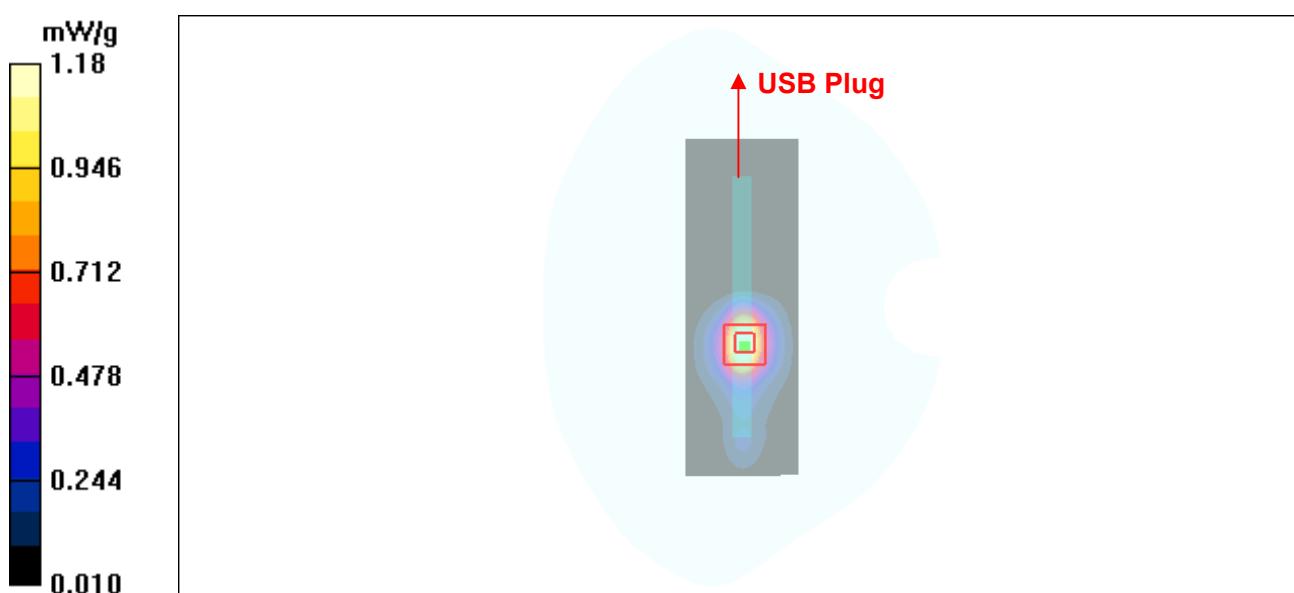
**Test Position 5 High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 15.4 V/m; Power Drift = -0.101 dB

Peak SAR (extrapolated) = 2.63 W/kg

**SAR(1 g) = 1.09 mW/g; SAR(10 g) = 0.514 mW/g**

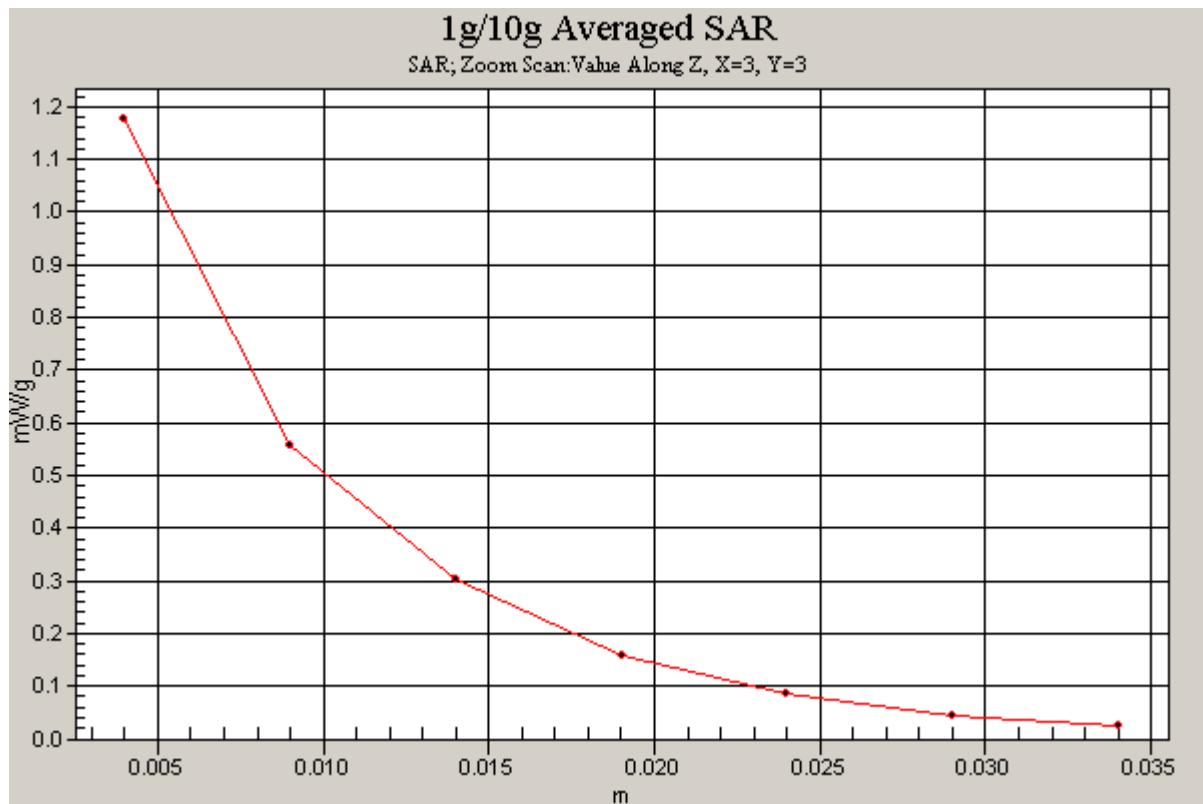
Maximum value of SAR (measured) = 1.18 mW/g



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**Figure 15 802.11b with BenQ Joybook R55V Test Position 5 Channel 11**

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**802.11b with BenQ Joybook R55V Test Position 5 Middle**

Date/Time: 9/15/2011 5:12:05 PM

Communication System: 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.98$  mho/m;  $\epsilon_r = 51.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010

Electronics: DAE4 Sn871; Calibrated: 11/18/2010

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Test Position 5 Middle/Area Scan (41x121x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.902 mW/g

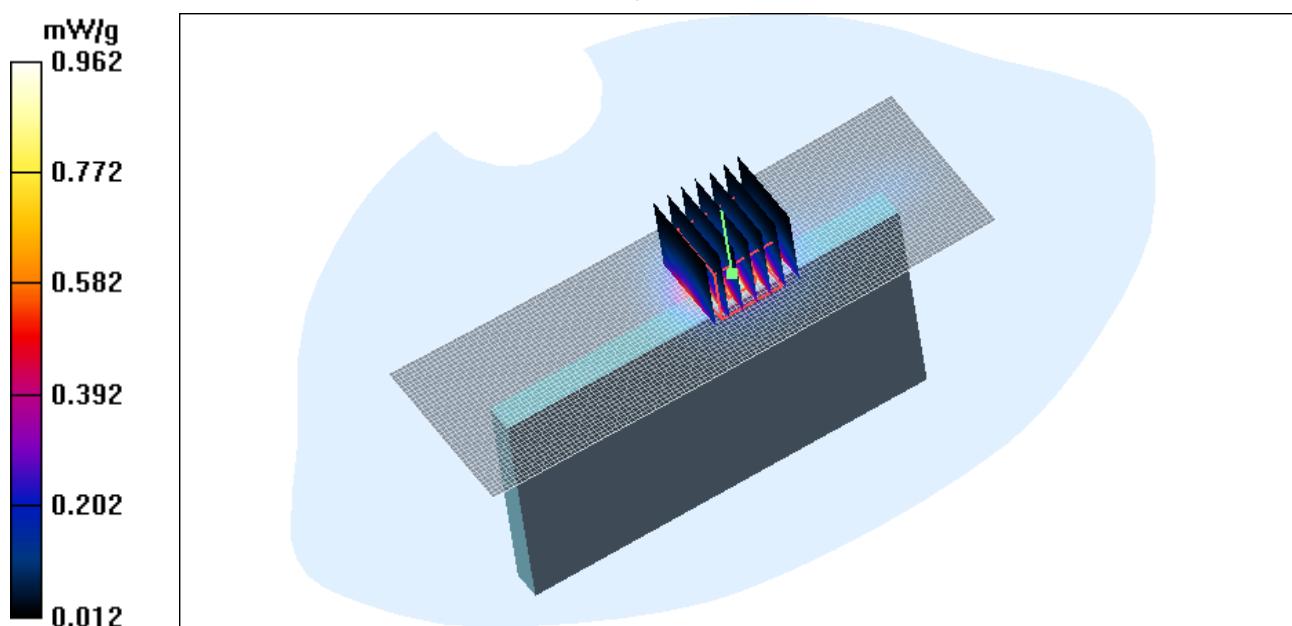
**Test Position 5 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 16.7 V/m; Power Drift = 0.144 dB

Peak SAR (extrapolated) = 2.08 W/kg

**SAR(1 g) = 0.884 mW/g; SAR(10 g) = 0.423 mW/g**

Maximum value of SAR (measured) = 0.962 mW/g



**Figure 16 802.11b with BenQ Joybook R55V Test Position 5 Channel 6**

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**802.11b with BenQ Joybook R55V Test Position 5 Low**

Date/Time: 9/15/2011 5:27:15 PM

Communication System: 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2412 \text{ MHz}$ ;  $\sigma = 1.95 \text{ mho/m}$ ;  $\epsilon_r = 51.9$ ;  $\rho = 1000 \text{ kg/m}^3$

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

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010

Electronics: DAE4 Sn871; Calibrated: 11/18/2010

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Test Position 5 Low/Area Scan (41x121x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

Maximum value of SAR (interpolated) = 0.788 mW/g

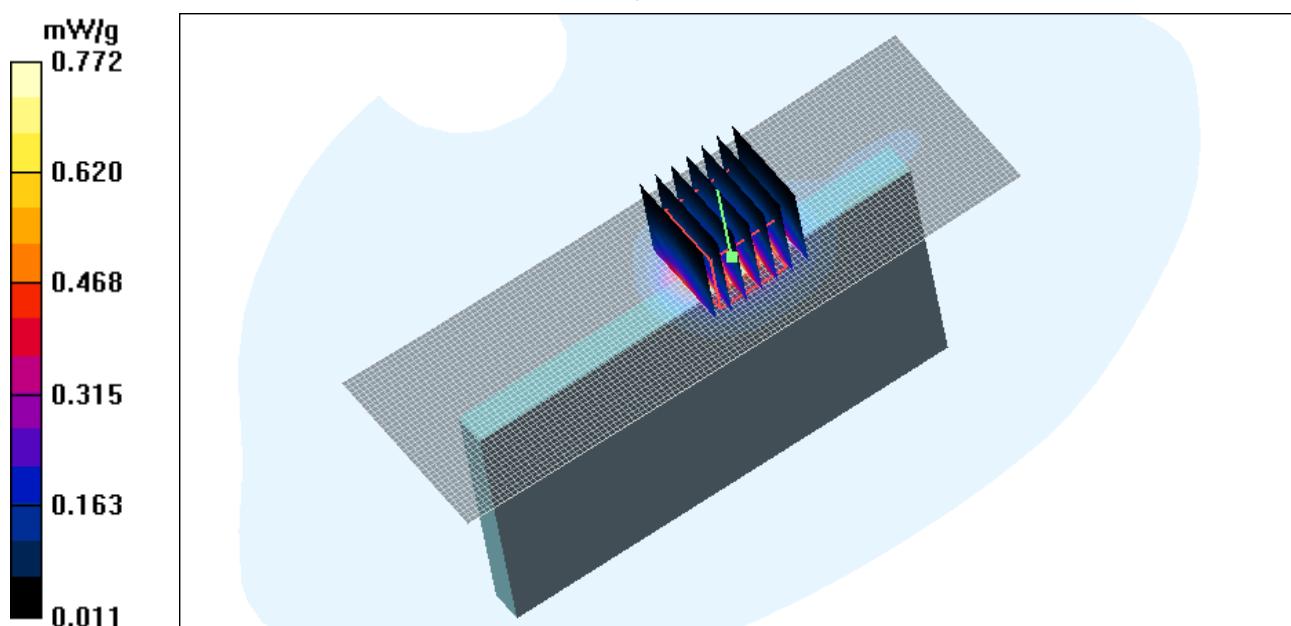
**Test Position 5 Low/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 14.7 V/m; Power Drift = 0.035 dB

Peak SAR (extrapolated) = 1.64 W/kg

**SAR(1 g) = 0.707 mW/g; SAR(10 g) = 0.339 mW/g**

Maximum value of SAR (measured) = 0.772 mW/g



**Figure 17 802.11b with BenQ Joybook R55V Test Position 5 Channel 1**

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**802.11b with BenQ Joybook R55V Test Position 6 Middle**

Date/Time: 9/15/2011 5:45:11 PM

Communication System: 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.98$  mho/m;  $\epsilon_r = 51.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010

Electronics: DAE4 Sn871; Calibrated: 11/18/2010

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Test Position 6 Middle/Area Scan (41x131x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.326 mW/g

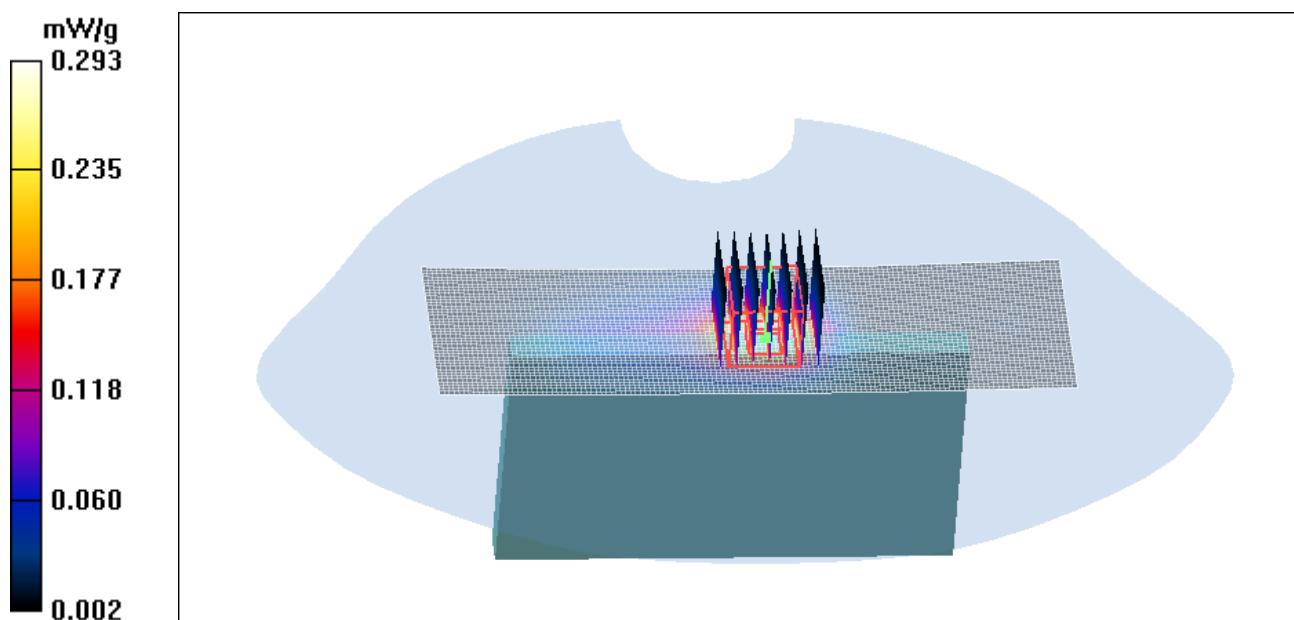
**Test Position 6 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.4 V/m; Power Drift = 0.177 dB

Peak SAR (extrapolated) = 0.492 W/kg

**SAR(1 g) = 0.264 mW/g; SAR(10 g) = 0.137 mW/g**

Maximum value of SAR (measured) = 0.293 mW/g



**Figure 18 802.11b with BenQ Joybook R55V Test Position 6 Channel 6**

# TA Technology (Shanghai) Co., Ltd.

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### 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  
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-SH (Auden)

Certificate No: EX3-3677\_Nov10

#### CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3677																																																		
Calibration procedure(s)	QA CAL-01.v6, QA CAL-14.v3, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes																																																		
Calibration date:	November 24, 2010																																																		
<p>This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature <math>(22 \pm 3)^\circ\text{C}</math> and humidity <math>&lt; 70\%</math>.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p>																																																			
<table border="1"><thead><tr><th>Primary Standards</th><th>ID #</th><th>Cal Date (Certificate No.)</th><th>Scheduled Calibration</th></tr></thead><tbody><tr><td>Power meter E4419B</td><td>GB41293874</td><td>1-Apr-10 (No. 217-01136)</td><td>Apr-11</td></tr><tr><td>Power sensor E4412A</td><td>MY41495277</td><td>1-Apr-10 (No. 217-01136)</td><td>Apr-11</td></tr><tr><td>Power sensor E4412A</td><td>MY41498087</td><td>1-Apr-10 (No. 217-01136)</td><td>Apr-11</td></tr><tr><td>Reference 3 dB Attenuator</td><td>SN: S5054 (3c)</td><td>30-Mar-10 (No. 217-01159)</td><td>Mar-11</td></tr><tr><td>Reference 20 dB Attenuator</td><td>SN: S5086 (20b)</td><td>30-Mar-10 (No. 217-01161)</td><td>Mar-11</td></tr><tr><td>Reference 30 dB Attenuator</td><td>SN: S5129 (30b)</td><td>30-Mar-10 (No. 217-01160)</td><td>Mar-11</td></tr><tr><td>Reference Probe ES3DV2</td><td>SN: 3013</td><td>30-Dec-09 (No. ES3-3013_Dec09)</td><td>Dec-10</td></tr><tr><td>DAE4</td><td>SN: 660</td><td>20-Apr-10 (No. DAE4-660_Apr10)</td><td>Apr-11</td></tr><tr><th>Secondary Standards</th><th>ID #</th><th>Check Date (in house)</th><th>Scheduled Check</th></tr><tr><td>RF generator HP 8648C</td><td>US3642U01700</td><td>4-Aug-99 (in house check Oct-09)</td><td>In house check: Oct-11</td></tr><tr><td>Network Analyzer HP 8753E</td><td>US37390585</td><td>18-Oct-01 (in house check Oct-10)</td><td>In house check: Oct-11</td></tr></tbody></table>				Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration	Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11	Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11	Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11	Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11	Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11	Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11	Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10	DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11	Secondary Standards	ID #	Check Date (in house)	Scheduled Check	RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11	Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11
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Calibrated by:	Name Katja Pokovic	Function Technical Manager	Signature 																																																
Approved by:	Niels Kuster	Quality Manager																																																	
Issued: November 25, 2010 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.																																																			

Certificate No: EX3-3677\_Nov10

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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  
**S** Swiss Calibration Service

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

Accreditation No.: SCS 108

### Glossary:

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

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

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

**TA Technology (Shanghai) Co., Ltd.**  
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**EX3DV4 SN:3677**

**November 24, 2010**

# **Probe EX3DV4**

## **SN:3677**

Manufactured:	September 9, 2008
Last calibrated:	September 23, 2009
Recalibrated:	November 24, 2010

**Calibrated for DASY/EASY Systems**

(Note: non-compatible with DASY2 system!)

# TA Technology (Shanghai) Co., Ltd.

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EX3DV4 SN:3677

November 24, 2010

### DASY/EASY - Parameters of Probe: EX3DV4 SN:3677

#### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.41	0.47	0.39	$\pm 10.1\%$
DCP (mV) <sup>B</sup>	96.8	98.9	98.8	

#### Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc <sup>E</sup> (k=2)
10000	CW	0.00	X Y Z	0.00 0.00 0.00	0.00 0.00 0.00	1.00 1.00 1.00	143.2 140.9 135.8	$\pm 2.4\%$

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

<sup>A</sup> The uncertainties of NormX, Y, Z do not affect the  $E^2$ -field uncertainty inside TSL (see Pages 5 and 8).

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

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

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EX3DV4 SN:3677

November 24, 2010

**DASY/EASY - Parameters of Probe: EX3DV4 SN:3677**

**Calibration Parameter Determined in Head Tissue Simulating Media**

f [MHz]	Validity [MHz] <sup>c</sup>	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	43.5 ± 5%	0.87 ± 5%	10.04	10.04	10.04	0.09	1.00 ± 13.3%
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	9.50	9.50	9.50	0.72	0.64 ± 11.0%
1750	± 50 / ± 100	40.1 ± 5%	1.37 ± 5%	8.22	8.22	8.22	0.72	0.59 ± 11.0%
1900	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	7.94	7.94	7.94	0.81	0.57 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	7.32	7.32	7.32	0.47	0.75 ± 11.0%

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

**TA Technology (Shanghai) Co., Ltd.**  
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EX3DV4 SN:3677

November 24, 2010

**DASY/EASY - Parameters of Probe: EX3DV4 SN:3677**

**Calibration Parameter Determined in Body Tissue Simulating Media**

f [MHz]	Validity [MHz] <sup>c</sup>	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	56.7 ± 5%	0.94 ± 5%	10.62	10.62	10.62	0.02	1.00 ± 13.3%
750	± 50 / ± 100	55.5 ± 5%	0.96 ± 5%	10.14	10.14	10.14	0.59	0.72 ± 11.0%
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	10.33	10.33	10.33	0.20	2.06 ± 11.0%
1450	± 50 / ± 100	54.0 ± 5%	1.30 ± 5%	8.47	8.47	8.47	0.99	0.53 ± 11.0%
1750	± 50 / ± 100	53.4 ± 5%	1.49 ± 5%	8.02	8.02	8.02	0.63	0.67 ± 11.0%
1900	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	7.77	7.77	7.77	0.69	0.67 ± 11.0%
2100	± 50 / ± 100	53.2 ± 5%	1.62 ± 5%	8.04	8.04	8.04	0.16	1.44 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	7.46	7.46	7.46	0.99	0.49 ± 11.0%
3500	± 50 / ± 100	51.3 ± 5%	3.31 ± 5%	6.61	6.61	6.61	0.28	1.40 ± 13.1%

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

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

Report No. RZA1106-1059SAR01R3

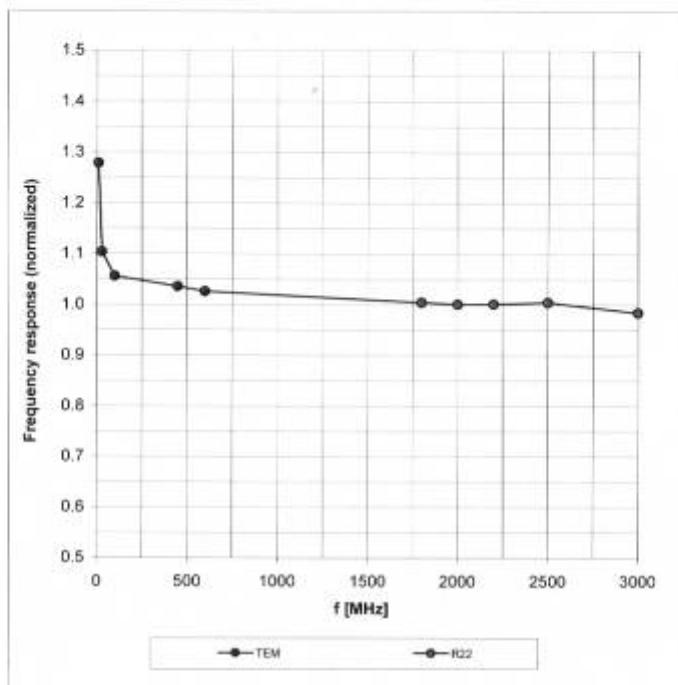
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EX3DV4 SN:3677

November 24, 2010

**Frequency Response of E-Field**

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



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

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

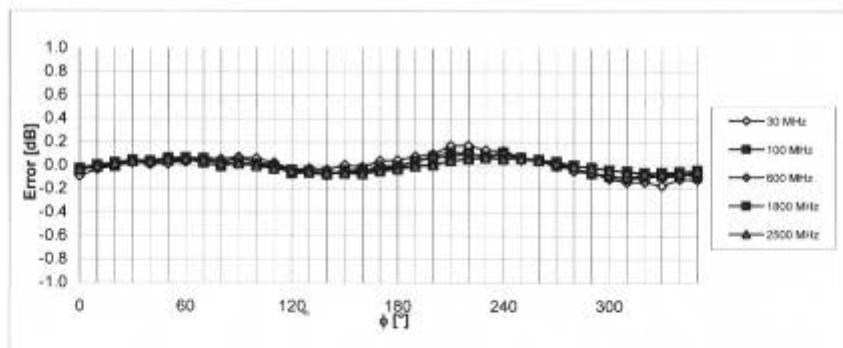
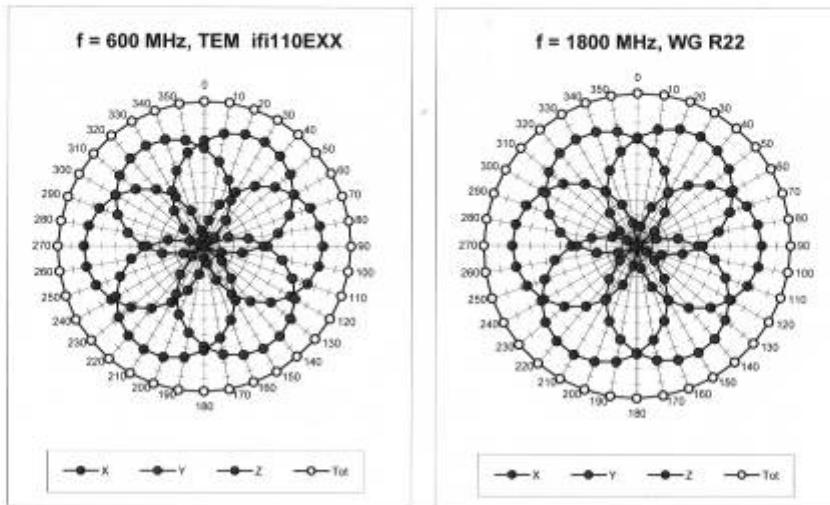
Report No. RZA1106-1059SAR01R3

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EX3DV4 SN:3677

November 24, 2010

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



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

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

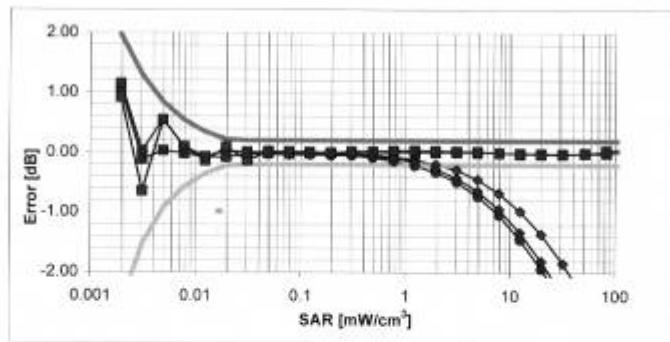
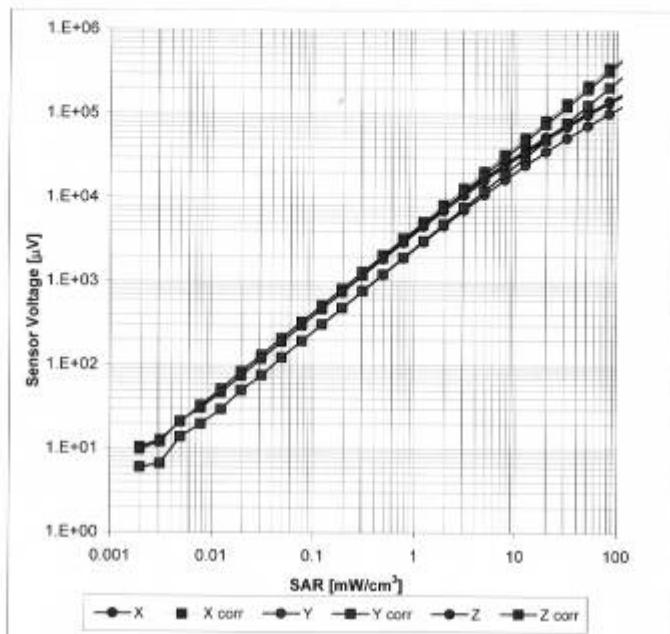
Report No. RZA1106-1059SAR01R3

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EX3DV4 SN:3677

November 24, 2010

**Dynamic Range  $f(\text{SAR}_{\text{head}})$**   
(TEM cell,  $f = 900 \text{ MHz}$ )



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

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

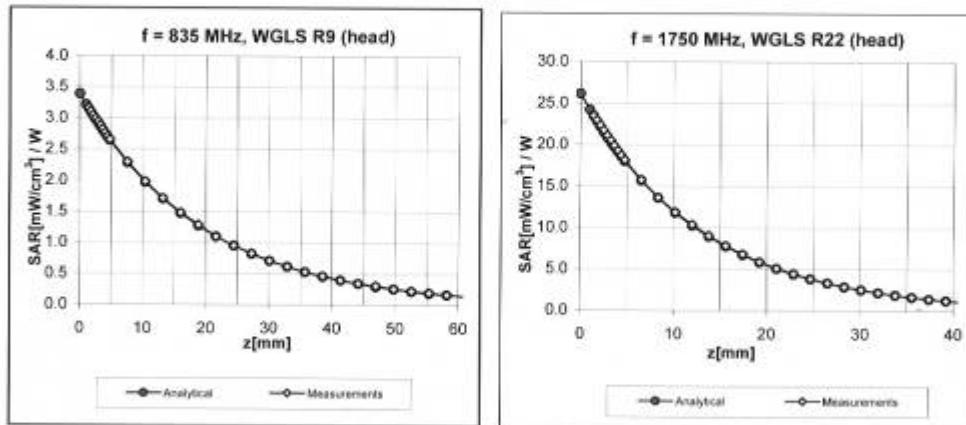
Report No. RZA1106-1059SAR01R3

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EX3DV4 SN:3677

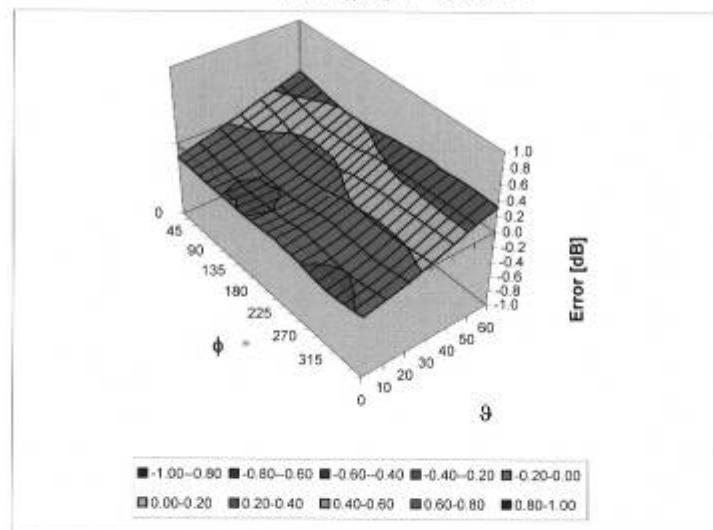
November 24, 2010

### Conversion Factor Assessment



### Deviation from Isotropy in HSL

Error ( $\phi, \theta$ ),  $f = 900$  MHz



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

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

Report No. RZA1106-1059SAR01R3

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EX3DV4 SN:3677

November 24, 2010

**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	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**

Report No. RZA1106-1059SAR01R3

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**ANNEX E: D2450V2 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 **ATL (Auden)**

Certificate No: **D2450V2-712\_Feb10**

**CALIBRATION CERTIFICATE**

Object **D2450V2 - SN: 712**

Calibration procedure(s) **QA CAL-05.v7**  
Calibration procedure for dipole validation kits

Calibration date: **February 19, 2010**

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-09 (No. 217-01086)	Oct-10
Power sensor HP 8481A	US37292783	06-Oct-09 (No. 217-01086)	Oct-10
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 08327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV3	SN: 3205	26-Jun-09 (No. ES3-3205_Jun09)	Jun-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10

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	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37380585 54206	18-Oct-01 (in house check Oct-09)	In house check: Oct-10

Calibrated by:	Name	Function	Signature
	Jeton Kastrati	Laboratory Technician	

Approved by:	Name	Function	Signature
	Katja Pokovic	Technical Manager	

Issued: February 19, 2010

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  
Schmid & Partner  
Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst  
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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
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

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

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

### Additional Documentation:

- d) DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

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

# TA Technology (Shanghai) Co., Ltd.

## Test Report

### Measurement Conditions

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

DASY Version	DASY5	V5.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.5 ± 6 %	1.76 mho/m ± 6 %
Head TSL temperature during test	(21.0 ± 0.2) °C	----	----

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 mW / g
SAR normalized	normalized to 1W	53.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	53.5 mW / g ± 17.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.24 mW / g
SAR normalized	normalized to 1W	25.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	25.0 mW / g ± 16.5 % (k=2)

# TA Technology (Shanghai) Co., Ltd.

## Test Report

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.7 ± 6 %	2.00 mho/m ± 6 %
Body TSL temperature during test	(21.2 ± 0.2) °C	---	---

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 mW / g
SAR normalized	normalized to 1W	52.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	51.1 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.97 mW / g
SAR normalized	normalized to 1W	23.9 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	23.7 mW / g ± 16.5 % (k=2)

# TA Technology (Shanghai) Co., Ltd.

## Test Report

### Appendix

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	$54.2 \Omega + 1.9 j\Omega$
Return Loss	- 27.1 dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	$50.1 \Omega + 5.2 j\Omega$
Return Loss	- 25.7 dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.144 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	July 05, 2002

# TA Technology (Shanghai) Co., Ltd.

## Test Report

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### DASY5 Validation Report for Head TSL

Date/Time: 17.02.2010 13:12:38

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:712**

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

Medium: HSL U11 BB

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.77$  mho/m;  $\epsilon_r = 38.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

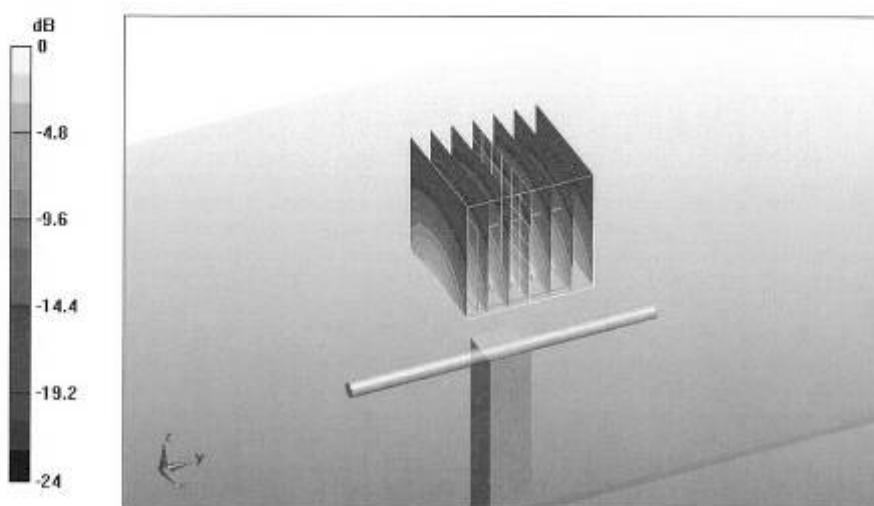
**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.1 V/m; Power Drift = 0.032 dB

Peak SAR (extrapolated) = 27.2 W/kg

**SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.24 mW/g**

Maximum value of SAR (measured) = 17.1 mW/g



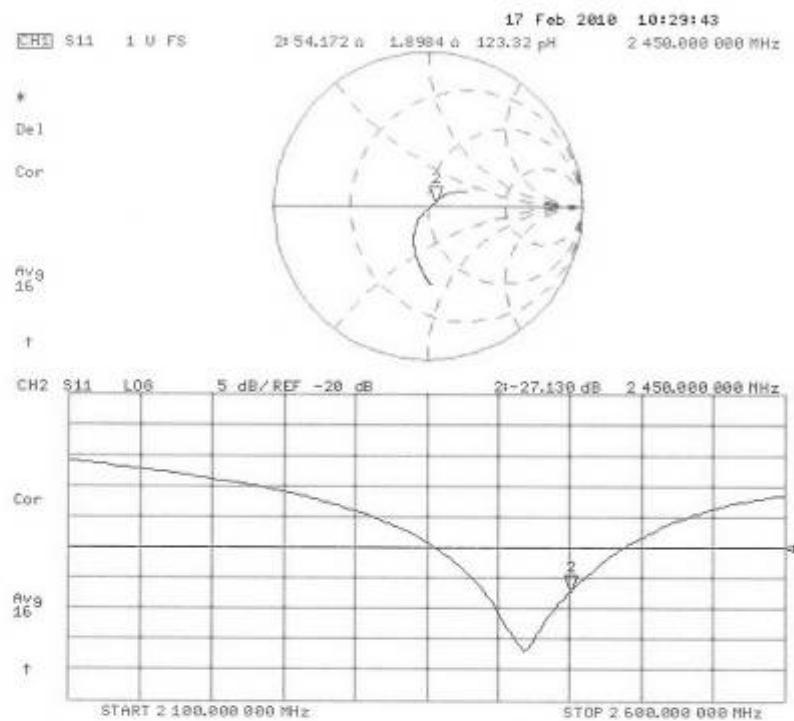
0 dB = 17.1mW/g

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

Report No. RZA1106-1059SAR01R3

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**Impedance Measurement Plot for Head TSL**



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

Report No. RZA1106-1059SAR01R3

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**DASY5 Validation Report for Body**

Date/Time: 19.02.2010 13:05:49

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:712**

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

Medium: MSL U10 BB

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.01$  mho/m;  $\epsilon_r = 51.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

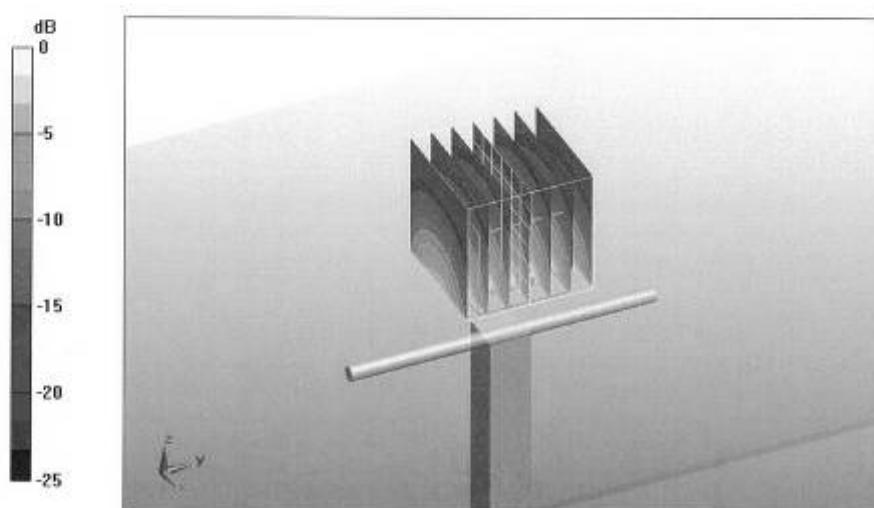
**Pin250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.5 V/m; Power Drift = 0.015 dB

Peak SAR (extrapolated) = 29.5 W/kg

**SAR(1 g) = 13 mW/g; SAR(10 g) = 5.97 mW/g**

Maximum value of SAR (measured) = 17 mW/g

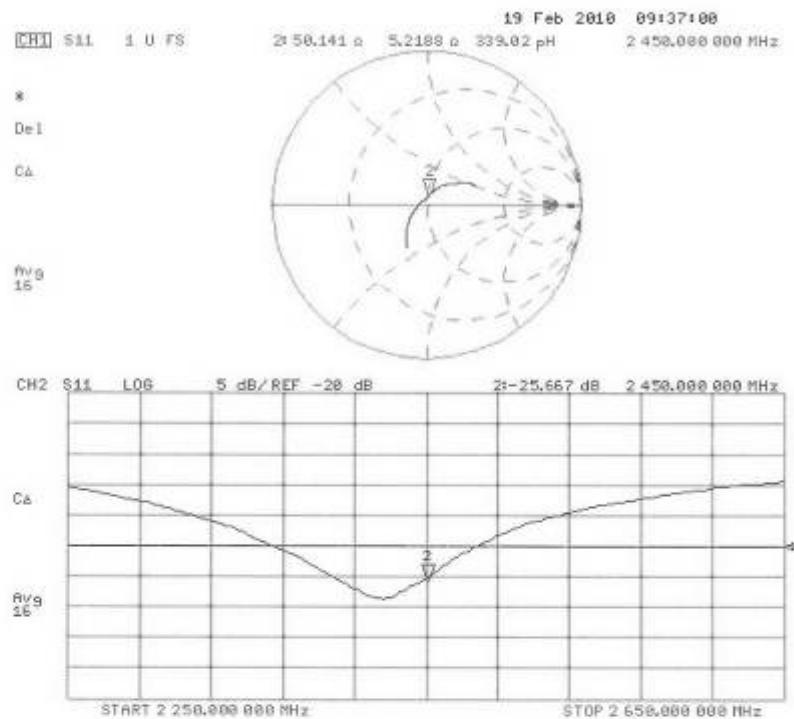


**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA1106-1059SAR01R3

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**Impedance Measurement Plot for Body TSL**



# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1106-1059SAR01R3

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### ANNEX F: 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

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 - SH (Auden)

Certificate No.: DAE4-871\_Nov10

#### CALIBRATION CERTIFICATE

Object DAE4 - SD 000 D04 BJ - SN: 871

Calibration procedure(s) QA CAL-06.v22  
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: November 18, 2010

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

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	28-Sep-10 (No:10376)	Sep-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	07-Jun-10 (in house check)	In house check: Jun-11

Calibrated by: Name Andrea Guntli Function Technician Signature

Approved by: Name Finn Bornholt Function R&D Director Signature

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

Issued: November 18, 2010

# 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  
**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

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

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### DC Voltage Measurement

A/D - Converter Resolution nominal

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

Low Range: 1LSB =  $61\text{nV}$ , full range =  $-1.....+3\text{mV}$

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

Calibration Factors	X	Y	Z
High Range	$404.757 \pm 0.1\% \text{ (k=2)}$	$404.740 \pm 0.1\% \text{ (k=2)}$	$405.181 \pm 0.1\% \text{ (k=2)}$
Low Range	$3.98219 \pm 0.7\% \text{ (k=2)}$	$3.93489 \pm 0.7\% \text{ (k=2)}$	$3.96831 \pm 0.7\% \text{ (k=2)}$

### Connector Angle

Connector Angle to be used in DASY system	$90.0^\circ \pm 1^\circ$
-------------------------------------------	--------------------------

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

**Appendix**

**1. DC Voltage Linearity**

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	200001.2	-1.56	-0.00
Channel X	+ Input	20000.71	0.71	0.00
Channel X	- Input	-19997.87	1.63	-0.01
Channel Y	+ Input	199994.3	1.99	0.00
Channel Y	+ Input	19998.92	-1.08	-0.01
Channel Y	- Input	-20000.26	-0.76	0.00
Channel Z	+ Input	200009.2	-1.04	-0.00
Channel Z	+ Input	19998.70	-1.10	-0.01
Channel Z	- Input	-20000.16	-0.76	0.00

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2000.1	0.16	0.01
Channel X	+ Input	199.58	-0.52	-0.26
Channel X	- Input	-200.79	-0.89	0.45
Channel Y	+ Input	1999.9	-0.03	-0.00
Channel Y	+ Input	199.45	-0.55	-0.27
Channel Y	- Input	-200.31	-0.41	0.21
Channel Z	+ Input	2000.1	0.33	0.02
Channel Z	+ Input	199.13	-0.77	-0.38
Channel Z	- Input	-201.47	-1.37	0.69

**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 (µV)	Low Range Average Reading (µV)
Channel X	200	14.25	12.86
	-200	-12.68	-14.21
Channel Y	200	-10.04	-10.39
	-200	9.20	9.17
Channel Z	200	-0.85	-1.40
	-200	-0.34	-0.31

**3. Channel separation**

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

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	2.85	0.69
Channel Y	200	2.41	-	2.73
Channel Z	200	2.54	0.73	-

# 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	15920	15517
Channel Y	16171	16732
Channel Z	15803	16474

### 5. Input Offset Measurement

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

Input 10MΩ

	Average ( $\mu$ V)	min. Offset ( $\mu$ V)	max. Offset ( $\mu$ V)	Std. Deviation ( $\mu$ V)
Channel X	0.03	-2.35	0.86	0.43
Channel Y	-0.50	-1.49	-0.49	0.38
Channel Z	-0.92	-2.21	0.14	0.44

### 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

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

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



Picture 4: Constituents of the EUT

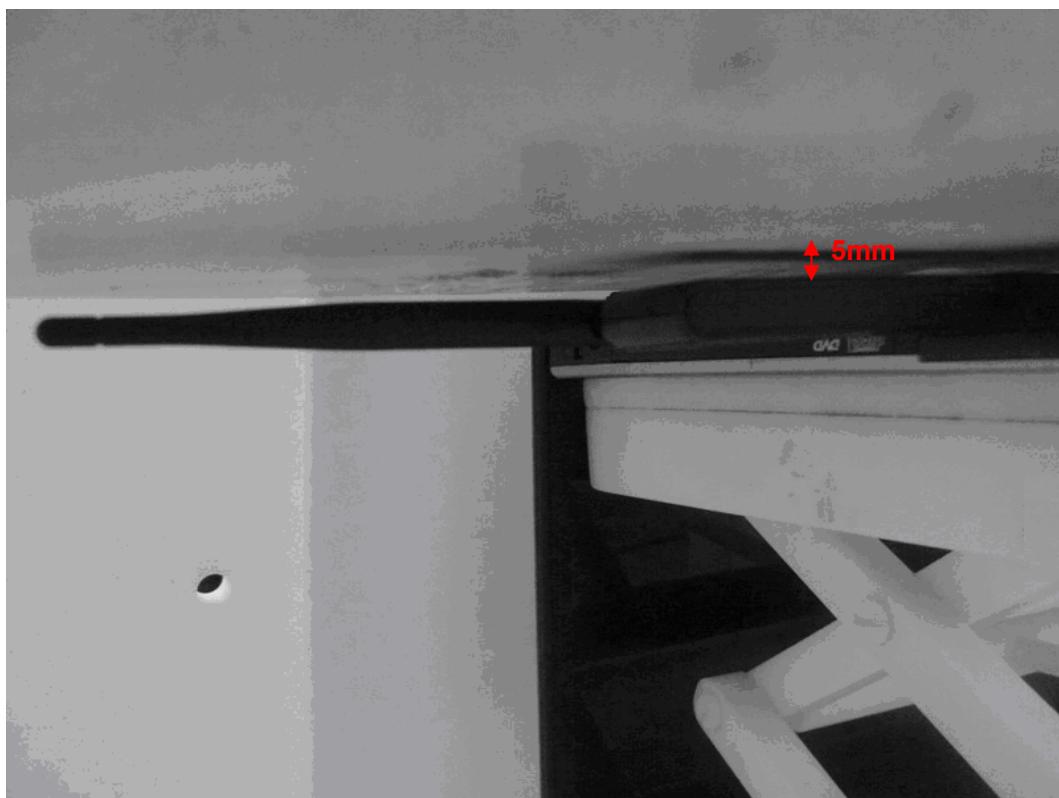
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Picture 5:Test position 1

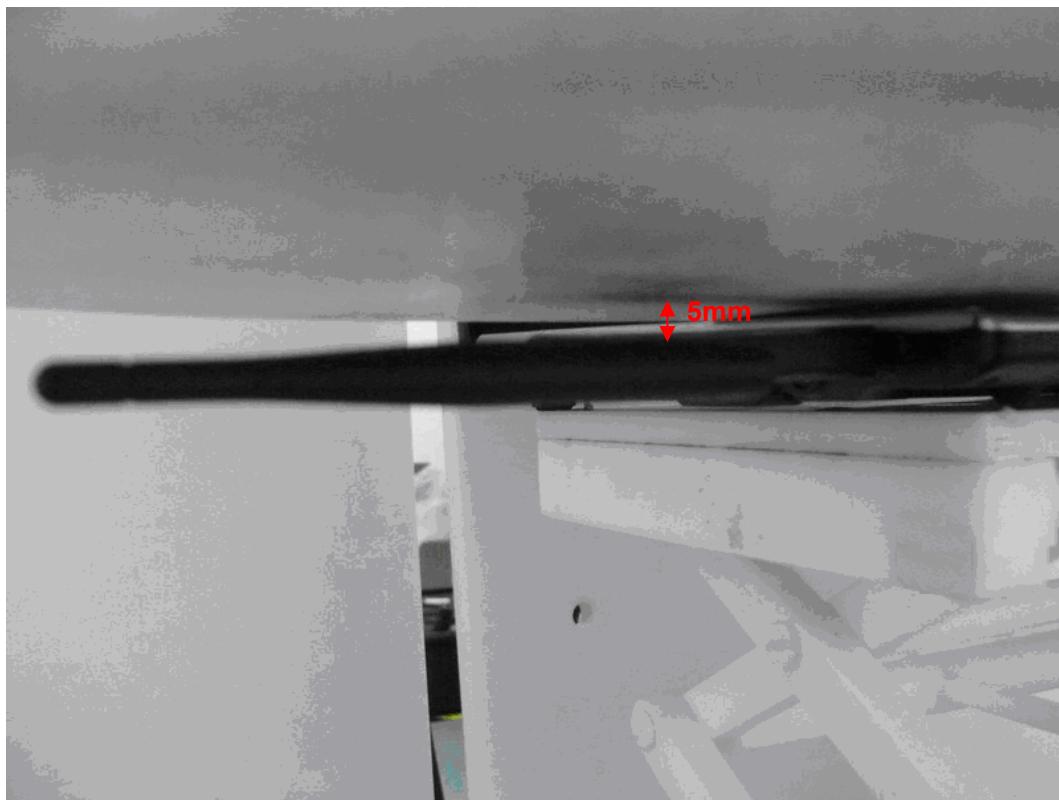


Picture 6:Test position 2

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Picture 7:Test position 3

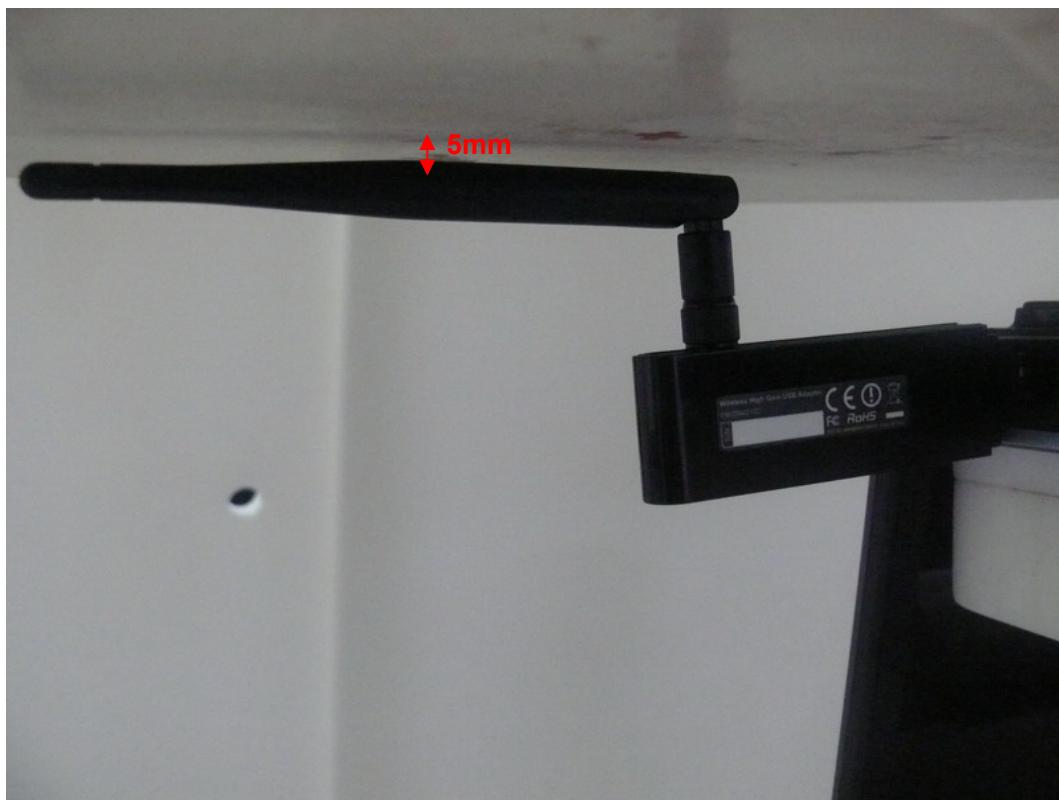


Picture 8:Test position 4

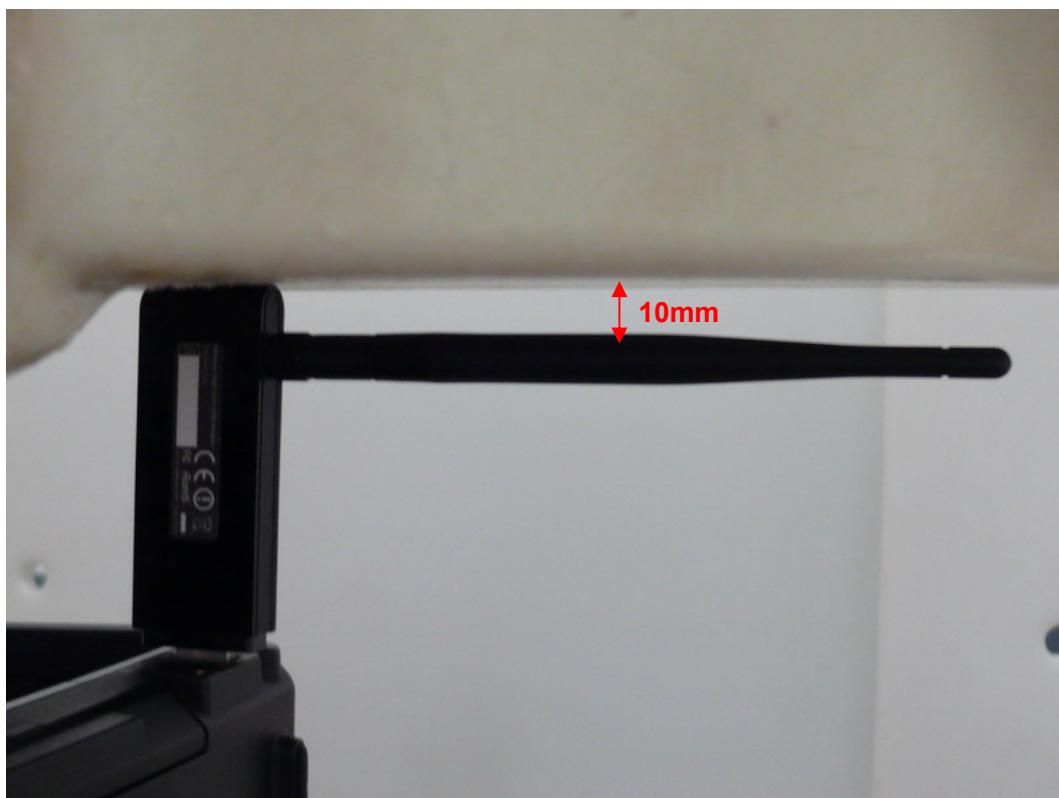
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Picture 9: Test position 5



Picture 10: Test position 6

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## **ANNEX H: The Process of Submiting the PBA**

Dear Sir or Madam:

Please help provide PBA guidance for SAR evaluation of WIFI USB dongle with an rotatable antenna. This project is a Part15C portable device. The FCC ID is WWMDN4210DV1. The USB dongle supports 802.11b/g/n with operating in 2.400GHz to 2.484GHz, 802.11b/g bands SAR will be follow KDB 248227, and about 802.11n, because the conducted power of 802.11n is less than 0.25dB higher than that measured on the corresponding 802.11b channels, so SAR is not required for 802.11n. And according to KDB 447498 D02, the EUT will be tested five positions. Please kindly confirm whether the test procedure is OK?

**--OET response sent on Sep 6 2011 2:48PM--**

We cannot provide specific SAR test guidance without photos of the device showing the antenna location and range of motion.

As for 802.11n procedures, you can use KDB 248227 with some adaptation, but because 802.11n has 40 MHz channels, the channel numbers will be off. For 2.4 GHz only, if the maximum average conducted power for all channels in 802.11n are no more than  $\frac{1}{4}$  dB higher than measured in any of the channels in 802.11b, then test reduction/exclusion is okay. This is an interim procedure because we are not comparing exact channels. 802.11n standards have not yet been finalized by IEEE and ad-hoc implementations have to suffice at this time.

Dear Sir or madam,

Thank you for your fast reply.

Now, I have update the photos of the device showing the antenna location and range of motion.

**--OET response sent on Sep 14 2011 3:34PM--**

Please see the JPEG file entitled *KDB 258142 Attachment Response* located beneath the attachment list at the bottom of this page for the response to your inquiry. There are a total of 6 positions to evaluate for SAR.

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**FCC SAR Test Positions**

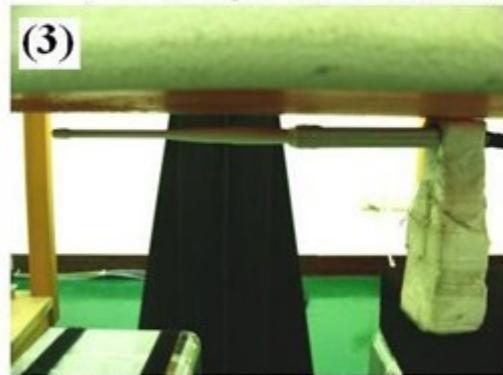
**KDB 258142**



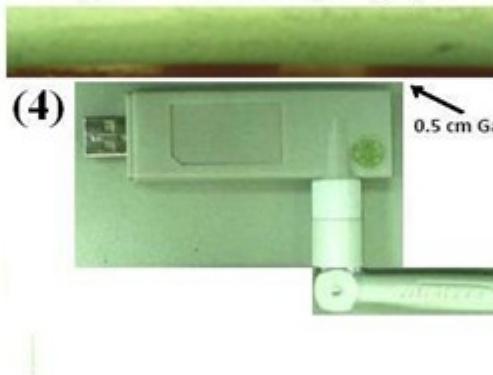
USB Horizontal Up with Phantom 0.5 cm Gap  
(Antenna 180 degrees from USB connector )



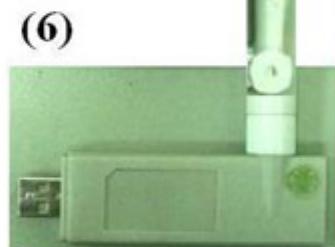
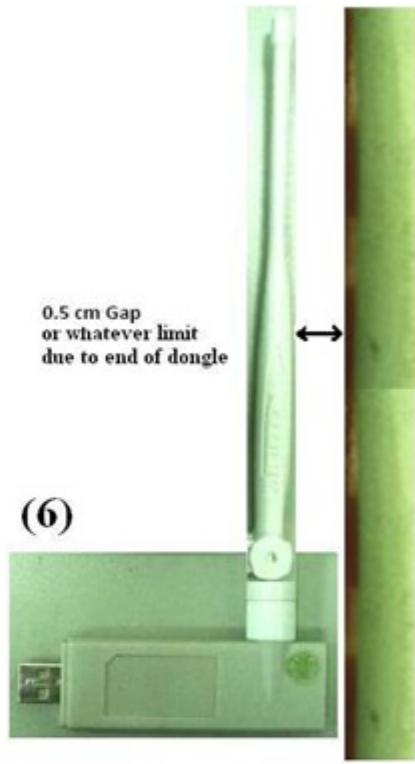
USB Horizontal Up with Phantom 0.5 cm Gap  
(Antenna in Vertical mode, 90 degree)



USB Horizontal Down with Phantom 0.5 cm Gap  
(Antenna 180 degrees from USB connector )



0.5 cm Gap



0.5 cm Gap

**A total of 6 positions to  
test for SAR compliance**