TESTING
No. L2264

TEST REPORT

Product Name	300Mbps Wireless N USB Adapter
Model	TL-WN821N
FCC ID	TE7WN821NV3
Client	TP-LINK TECHNOLOGIES CO., LTD.

TA Technology (Shanghai) Co., Ltd.

GENERAL SUMMARY

Product Name	300Mbps Wireless N USB Adapter	**Model**	TL-WN821N
FCC ID	TE7WN821NV3		
Report No.	RZA1111-1863SAR		
Client	TP-LINK TECHNOLOGIES CO., LTD.		
Manufacturer	TP-LINK TECHNOLOGIES CO., LTD.		
Reference Standard(s)	**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. **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.		
Conclusion	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. General Judgment: **Pass** (Stamp) **Date of issue: November 22nd, 2011**		
Comment	The test result only responds to the measured sample.		

Approved by__________ **Revised by**__________ **Performed by**__________

Director SAR Manager SAR Engineer

TABLE OF CONTENT

1. General Information ... 5
1.1. Notes of the Test Report ... 5
1.2. Testing Laboratory ... 5
1.3. Applicant Information ... 6
1.4. Manufacturer Information ... 6
1.5. Information of EUT ... 7
1.6. The Maximum SAR_{1g} Values ... 8
1.7. The Maximum Power of Each Tested Mode ... 8
1.8. Test Date ... 8
2. Operational Conditions during Test ... 9
2.1. General Description of Test Procedures ... 9
2.2. Position of Module in Portable Devices ... 10
2.3. Picture of Host Product ... 11
3. SAR Measurements System Configuration ... 13
3.1. SAR Measurement Set-up ... 13
3.2. DASY4 E-field Probe System ... 14
3.2.1. EX3DV4 Probe Specification ... 14
3.2.2. E-field Probe Calibration ... 15
3.3. Other Test Equipment ... 15
3.3.1. Device Holder for Transmitters ... 15
3.3.2. Phantom ... 16
3.4. Scanning Procedure ... 16
3.5. Data Storage and Evaluation ... 18
3.5.1. Data Storage ... 18
3.5.2. Data Evaluation by SEMCAD ... 18
3.6. System Check ... 21
3.7. Equivalent Tissues ... 22
4. Laboratory Environment ... 22
5. Characteristics of the Test ... 23
5.1. Applicable Limit Regulations ... 23
5.2. Applicable Measurement Standards ... 23
6. Conducted Output Power Measurement ... 24
6.1. Summary ... 24
6.2. Conducted Power Results ... 24
7. Test Results ... 30
7.1. Dielectric Performance ... 30
7.2. System Check ... 30
7.3. Summary of Measurement Results ... 31
7.3.1. 802.11b/g, Antenna #01 ... 31
7.3.2. 802.11b/g, Antenna #10 ... 32
7.3.3. 802.11n HT20, ... 33
7.3.4. 802.11n HT40 ... 33

8. Measurement Uncertainty 34
9. Main Test Instruments 35
ANNEX A: Test Layout 36
ANNEX B: System Check Results 37
ANNEX C: Graph Results 38
ANNEX D: Probe Calibration Certificate 61
ANNEX E: D2450V2 Dipole Calibration Certificate 72
ANNEX F: DAE4 Calibration Certificate 80
ANNEX G: The EUT Appearances and Test Configuration 85

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

Company:	TA Technology (Shanghai) Co., Ltd.
Address:	No.145, Jintang Rd, Tangzhen Industry Park, Pudong
City:	Shanghai
Post code:	201201
Country:	P. R. China
Contact:	Yang Weizhong
Telephone:	+86-021-50791141/2/3
Fax:	+86-021-50791141/2/3-8000
Website:	http://www.ta-shanghai.com
E-mail:	yangweizhong@ta-shanghai.com

1.3. Applicant Information

Company:	TP-LINK TECHNOLOGIES CO., LTD.
Address:	Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and Technology Park,Shennan Rd, Nanshan, Shenzhen,China
City:	Shenzhen
Postal Code:	518057
Country:	P. R. China
Contact:	Li Zhuying
Telephone:	26502509
Fax:	0755-26508930

1.4. Manufacturer Information

Company:	TP-LINK TECHNOLOGIES CO., LTD.
Address:	Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and Technology Park,Shennan Rd, Nanshan, Shenzhen,China
City:	Shenzhen
Postal Code:	518057
Country:	P. R. China
Telephone:	26502509
Fax:	0755-26508930

1.5. Information of EUT

General Information

Device Type:	Portable Device	
Exposure Category:	Uncontrolled Environment / General Population	
State of Sample:	Prototype Unit	
Product Name:	300Mbps Wireless N USB Adapter	
SN:	11962804987	
Hardware Version:	3.0	
Software Version:	3.0	
Antenna Type:	Internal Antenna	
Device Operating Configurations:		
Supporting Mode(s):	802.11b; (tested) 802.11g; (tested) 802.11n HT20; (tested) 802.11n HT40; (untested)	
Operating Frequency Range(s):	Mode	Tx (MHz)
	802.11b/g/n HT20	2412 ~ 2462MHz
	802.11n HT40	2422 ~ 2452MHz
Test Channel: (Low - Middle - High)	1-6-11 (802.11b/g/n HT20) 3-6-9 (802.11n HT40)	
Used Host Products:	IBM T61 Lenovo Y-450	

Equipment Under Test (EUT) is 300Mbps Wireless N USB Adapter. During SAR test of the EUT, it was connected to a portable computer. SAR is tested for 802.11b/g/n HT20 in this report. SAR is not required for 802.11 n HT40 channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.
The EUT has two WIFI antennas that can be used for Tx/Rx. One is Antenna #01 and the other is Antenna #10. The two antennas can not work together for 802.11b/g, that is to say the two antennas only can work individually (SISO) for 802.11b/g. However, when 802.11n is working the two antennas work together.

The sample undergoing test was selected by the Client.

Components list please refer to documents of the manufacturer.

1.6. The Maximum SAR_{1g} Values

Body Worn Configuration

Mode	Channel	Position	Separation distance	SAR_{1g} (W/kg)
802.11b (Antenna #01)	High/11	Test Position 1	5mm	**1.090**
802.11g (Antenna #01)	Middle/6	Test Position 1	5mm	**1.060**
802.11b (Antenna #10)	Low/1	Test Position 1	5mm	**0.748**
802.11g (Antenna #10)	Middle/6	Test Position 1	5mm	**0.731**
802.11n HT20	Middle/6	Test Position 1	5mm	**1.150**

1.7. The Maximum Power of Each Tested Mode

Mode	Maximum AV Power (dBm)
802.11b	**17.31**
802.11g	**17.95**
802.11n HT20	**12.95**

Note: The detail Power refer to Table 4 and Table 5 (Power Measurement Results).

1.8. Test Date

The test is performed on November 17, 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[#]		√	*		
	2.437	6	6	√	*		
	2.462	11[#]		√	*		

Note: [#]=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. Position of Module in Portable Devices

The measurements were performed in combination with two host products (IBM T61 and Lenovo Y-450). IBM T61 laptop has horizontal USB slot, Lenovo Y-450 laptop has vertical USB slot.

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

For each channel, the EUT is tested at the following 4 test positions:

- Test Position 1: The EUT is connected to the portable computer with horizontal USB slot. The back side of the EUT towards to the bottom of the flat phantom. The distance from back side of the EUT to the bottom of the flat phantom is 5mm. (ANNEX G Picture 5)

- Test Position 2: The EUT is connected to the portable computer through a 19 cm USB cable. The front side of the EUT towards the bottom of the flat phantom. The distance from front side of the EUT to the bottom of the flat phantom is 5mm. (ANNEX G Picture 6)

- Test Position 3: The EUT is connected to the portable computer through a 19 cm USB cable. The left side of the EUT towards the bottom of the flat phantom. The distance from left side of the EUT to the bottom of the flat phantom is 5mm. (ANNEX G Picture 7)

- Test Position 4: The EUT is connected to the portable computer with vertical USB slot. The right side of the EUT towards the bottom of the flat phantom. The distance from right side of the EUT to the bottom of the flat phantom is 5mm. (ANNEX G Picture 8)

2.3. Picture of Host Product

During the test, IBM T61 and Lenovo Y-450 laptop were used as an assistant to help to setup communication. (See Picture 1)

Picture 1-a: IBM T61 Close

Picture 1-b: IBM T61 Open

Picture 1-c: Lenovo Y-450 Close

Picture 1-d: Lenovo Y-450 Open

Picture 1-e: IBM T61 with horizontal USB slot

Picture 1-f: Lenovo Y-450 with Vertical USB slot

Picture 1-e: a 19 cm 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.

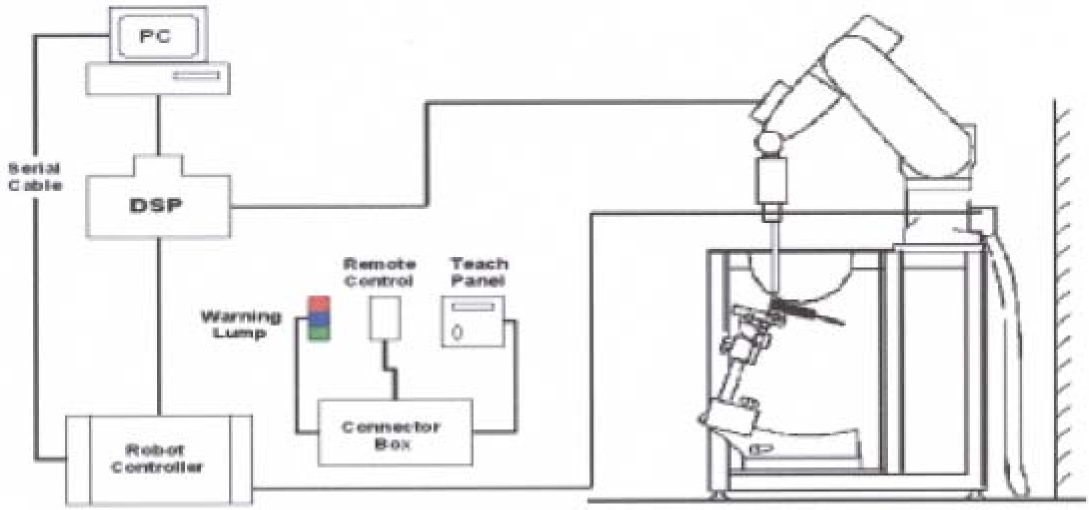


Figure 1. SAR Lab Test Measurement Set-up

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)

Figure 2.EX3DV4 E-field Probe

Calibration: ISO/IEC 17025 calibration service available

Frequency: 10 MHz to > 6 GHz
Linearity: ± 0.2 dB
(30 MHz to 6 GHz)

Directivity: ± 0.3 dB in HSL (rotation around probe axis)
± 0.5 dB in tissue material (rotation normal to probe axis)

Dynamic Range: 10 μW/g to > 100 mW/g Linearity:

± 0.2dB (noise: typically < 1 μW/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 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 ± 10%. The spherical isotropy was evaluated and found to be better than ± 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 bellow 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.

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

Where: Δt = Exposure time (30 seconds),

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

ΔT = Temperature increase due to RF exposure.

Or

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

Where:

σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m3).

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)
Aailable	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. ± 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 ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

- Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values 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 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/cm²], [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	Normi, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	Dcp_i
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.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

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

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

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

cf = crest factor of exciting field (DASY parameter)

dcp_i = diode compression point (DASY parameter)

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

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

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

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

$Norm_i$ = sensor sensitivity of channel i (i = x, y, z) $[mV/(V/m)^2]$ for E-field Probes

$ConvF$ = sensitivity enhancement in solution

a_{ij} = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

E_i = electric field strength of channel i in V/m

H_i = magnetic field strength of channel i in A/m

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

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

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

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

with SAR = local specific absorption rate in mW/g

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

. = conductivity in [mho/m] or [Siemens/m]

. = equivalent tissue density in g/cm^3

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.

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

with P_{pwe} = equivalent power density of a plane wave in mW/cm^2

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

$\boldsymbol{H_{tot}}$ = 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 7.

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

System check is performed regularly on all frequency bands where tests are performed with the DASY4 system.

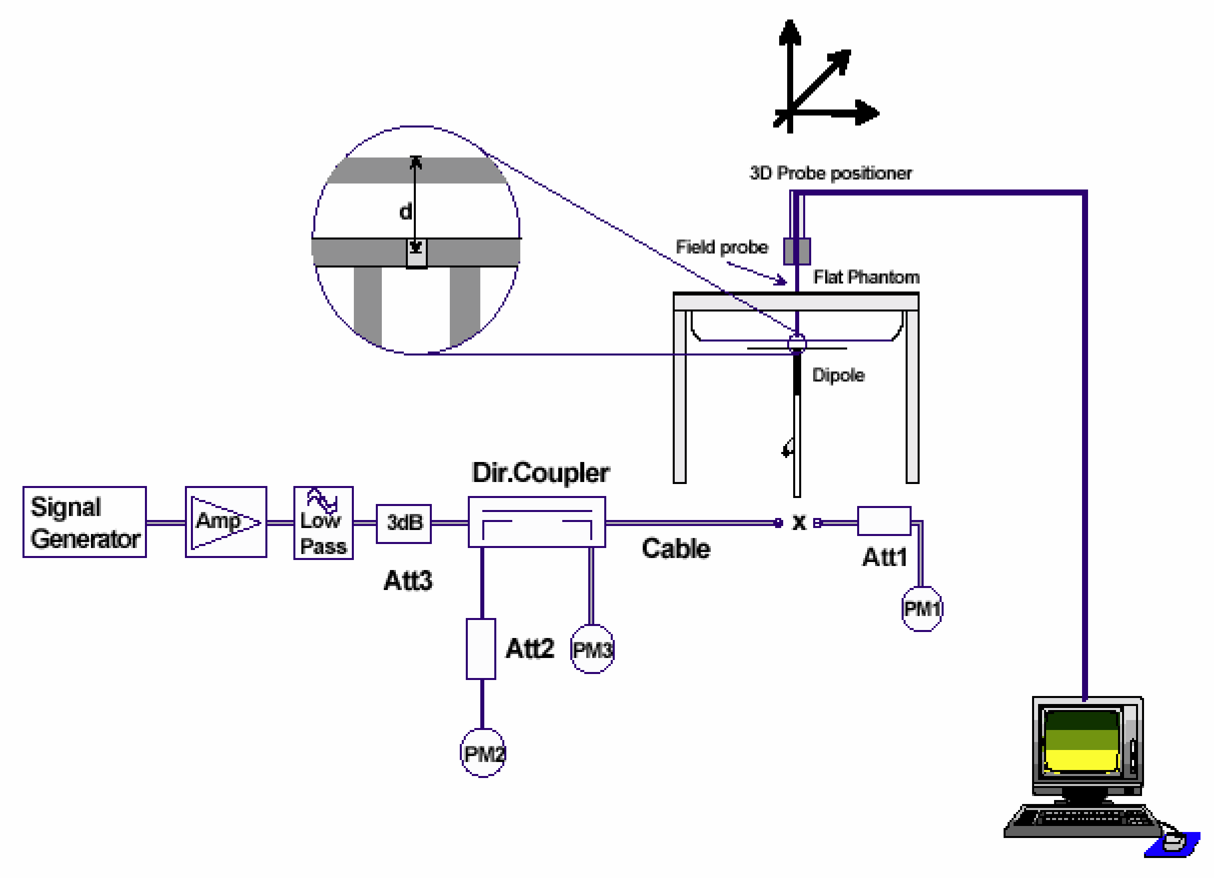


Figure 5. System Check Set-up

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 ε=52.70 σ=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 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

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 (Antenna #01)

Mode	Channel	Data rate (Mbps)	AV Power (dBm)
11b	1	1	14.34
		2	14.43
		5.5	14.41
		11	14.52
	6	1	13.98
		2	14.03
		5.5	14.09
		11	14.04
	11	1	15.39
		2	15.45
		5.5	15.48
		11	15.55
11g	1	6	10.51
		9	10.43
		12	10.37
		18	10.32
		24	10.28
		36	10.23
		48	10.15
		54	10.06
	6	6	15.65
		9	15.64
		12	15.61
		18	15.58

		24	15.66
		36	15.55
		48	15.45
		54	15.48
	11	6	12.97
		9	12.95
		12	12.89
		18	12.83
		24	12.77
		36	12.74
		48	12.67
		54	12.71
11n HT20	1	MCS0	8.23
		MCS1	8.18
		MCS2	8.12
		MCS3	8.14
		MCS4	8.09
		MCS5	8.07
		MCS6	8.04
		MCS7	8.01
	6	MCS0	11.15
		MCS1	11.14
		MCS2	11.11
		MCS3	11.06
		MCS4	11.08
		MCS5	11.04
		MCS6	10.98
		MCS7	10.85
	11	MCS0	8.49
		MCS1	8.47
		MCS2	8.42
		MCS3	8.39
		MCS4	8.22
		MCS5	8.13
		MCS6	8.11

		MCS7	8.06
11n HT40	1	MCS0	6.06
		MCS1	5.96
		MCS2	5.83
		MCS3	5.77
		MCS4	5.76
		MCS5	5.59
		MCS6	5.45
		MCS7	5.38
	6	MCS0	11.03
		MCS1	10.99
		MCS2	10.97
		MCS3	10.91
		MCS4	10.84
		MCS5	10.81
		MCS6	10.88
		MCS7	10.85
	11	MCS0	7.29
		MCS1	7.18
		MCS2	7.14
		MCS3	7.09
		MCS4	7.97
		MCS5	6.85
		MCS6	6.77
		MCS7	6.78

Note: 1. SAR is not required for 802.11n HT40 channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

Table 5: Conducted Power Measurement Results (Antenna #10)

Mode	Channel	Data rate (Mbps)	AV Power (dBm)
11b	1	1	17.31
		2	17.26
		5.5	17.30
		11	17.28
	6	1	15.05
		2	15.04
		5.5	15.17
		11	15.38
	11	1	16.87
		2	16.95
		5.5	16.91
		11	16.81
11g	1	6	13.45
		9	13.04
		12	13.14
		18	13.09
		24	13.05
		36	13.99
		48	12.97
		54	12.83
	6	6	17.95
		9	17.82
		12	17.84
		18	17.93
		24	17.91
		36	17.83
		48	17.76
		54	17.83
	11	6	14.66
		9	14.47
		12	14.32
		18	14.25
		24	14.22

		36	14.18
		48	14.17
		54	14.09
11n HT20	1	MCS0	10.44
		MCS1	10.38
		MCS2	10.29
		MCS3	10.22
		MCS4	10.19
		MCS5	10.17
		MCS6	10.08
		MCS7	10.03
	6	MCS0	12.95
		MCS1	12.93
		MCS2	12.85
		MCS3	12.84
		MCS4	12.78
		MCS5	12.81
		MCS6	12.83
		MCS7	12.74
	11	MCS0	8.87
		MCS1	8.83
		MCS2	8.76
		MCS3	8.71
		MCS4	8.93
		MCS5	9.05
		MCS6	8.99
		MCS7	8.88
11n HT40	1	MCS0	7.99
		MCS1	7.93
		MCS2	7.91
		MCS3	7.87
		MCS4	7.77
		MCS5	7.74
		MCS6	7.71
		MCS7	7.68

	6	MCS0	12.77
		MCS1	12.74
		MCS2	12.73
		MCS3	12.61
		MCS4	12.52
		MCS5	12.47
		MCS6	12.41
		MCS7	12.24
	11	MCS0	8.38
		MCS1	8.23
		MCS2	8.08
		MCS3	8.02
		MCS4	7.85
		MCS5	7.83
		MCS6	7.79
		MCS7	7.67

Note: 1. SAR is not required for 802.11n HT40 channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

7. Test Results

7.1. Dielectric Performance

Table 6: Dielectric Performance of Body Tissue Simulating Liquid

Frequency	Description	Dielectric Parameters		Temp
		ε_r	σ(s/m)	℃
2450MHz (body)	Target value ±5% window	52.70 50.07 — 55.34	1.95 1.85 — 2.05	/
	Measurement value 2011-11-17	51.97	1.97	21.5

7.2. System Check

Table 7: System Check for Body Tissue Simulating Liquid

Frequency	Description	SAR(W/kg)		Dielectric Parameters		Temp
		10g	1g	ε_r	σ(s/m)	℃
2450MHz	Recommended value ±10% window	6.1 5.49 — 6.71	13.2 11.88—14.52	51.8	2.02	/
	Measurement value 2011-11-17	6.46	14.00	51.97	1.97	21.5

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.

7.3. Summary of Measurement Results

7.3.1. 802.11b/g, Antenna #01

Table 8: SAR Values (802.11b/g, Antenna #01)

Limit of SAR		10 g Average	1g Average	Power Drift	Graph Results
		2.0 W/kg	1.6 W/kg	±0.21 dB	
Test Case Of Body		Measurement Result (W/kg)		Power Drift (dB)	
Different Test Position	Channel	10 g Average	1 g Average		
Test Position of 802.11b With IBM T61 (Distance 5mm)					
Test Position 1	High/11	0.543	1.090	0.033	Figure 7
	Middle/6	0.673	1.050	0.117	Figure 8
	Low/1	0.445	0.919	-0.110	Figure 9
Test Position 2	Middle/6	0.204	0.369	0.111	Figure 10
Test Position of 802.11b With Lenovo Y-450 (Distance 5mm)					
Test Position 3	Middle/6	0.102	0.145	-0.103	Figure 11
Test Position 4	Middle/6	0.285	0.487	-0.066	Figure 12
Worst case position of 802.11b with 802.11g (IBM T61, Distance 5mm)					
Test Position 1	Middle/6	0.516	1.060	-0.159	Figure 13

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. The EUT has two WIFI antennas that can be used for Tx/Rx. One is Antenna #01 and the other is Antenna #10. The two antennas can not work together for 802.11b/g, that is to say the two antennas only can work individually (SISO) for 802.11b/g. However, when 802.11n is woring the two antennas work together.

7.3.2. 802.11b/g, Antenna #10

Table 9: SAR Values (802.11b/g, Antenna #10)

Limit of SAR		10 g Average	1g Average	Power Drift	Graph Results
		2.0 W/kg	1.6 W/kg	±0.21 dB	
Test Case Of Body		Measurement Result (W/kg)		Power Drift (dB)	
Different Test Position	Channel	10 g Average	1 g Average		
Test Position of 802.11b With IBM T61 (Distance 5mm)					
Test Position 1	High/11	0.253	0.491	-0.038	Figure 14
	Middle/6	0.476	0.642	0.045	Figure 15
	Low/1	0.359	0.748	-0.088	Figure 16
Test Position 2	Middle/6	0.132	0.225	0.024	Figure 17
Test Position of 802.11b With Lenovo Y-450 (Distance 5mm)					
Test Position 3	Middle/6	0.130	0.200	0.059	Figure 18
Test Position 4	Middle/6	0.124	0.142	0.182	Figure 19
Worst case position of 802.11b with 802.11g (IBM T61, Distance 5mm)					
Test Position 1	Middle/6	0.357	0.731	-0.063	Figure 20

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. The EUT has two WIFI antennas that can be used for Tx/Rx. One is Antenna #01 and the other is Antenna #10. The two antennas can not work together for 802.11b/g, that is to say the two antennas only can work individually (SISO) for 802.11b/g. However, when 802.11n is woring the two antennas work together.

7.3.3. 802.11n HT20,

Table 10: SAR Values (802.11n HT20)

Limit of SAR		10 g Average	1g Average	Power Drift	Graph Results
		2.0 W/kg	1.6 W/kg	±0.21 dB	
Test Case Of Body		Measurement Result (W/kg)		Power Drift (dB)	
Different Test Position	Channel	10 g Average	1 g Average		
Test Position of 802.11n HT20 With IBM T61 (Distance 5mm)					
Test Position 1	High/11	0.205	0.376	-0.021	Figure 21
	Middle/6	0.595	1.150	0.007	Figure 22
	Low/1	0.237	0.463	0.069	Figure 23
Test Position 2	Middle/6	0.290(max.cube)	0.589(max.cube)	0.033	Figure 24
Test Position of 802.11n HT20 With Lenovo Y-450 (Distance 5mm)					
Test Position 3	Middle/6	0.123	0.228	0.089	Figure 25
Test Position 4	Middle/6	0.423	0.707	0.150	Figure 26

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. The (max.cube) labeling indicates that during the grid scanning an additional peak was found which was within 2.0dB of the highest peak. The value of the highest cube is given in the table above; the value from the second assessed cube is given in the SAR distribution plots (See ANNEX C).
5. The EUT has two WIFI antennas that can be used for Tx/Rx. One is Antenna #01 and the other is Antenna #10. The two antennas can not work together for 802.11b/g, that is to say the two antennas only can work individually (SISO) for 802.11b/g. However, when 802.11n is woring the two antennas work together.

7.3.4. 802.11n HT40

SAR is not required for 802.11n HT40 channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

8. Measurement Uncertainty

No.	source	Type	Uncertainty Value (%)	Probability Distribution	k	c_i	Standard ncertainty u_i' (%)	Degree of freedom V_{eff} or v_i
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	∞
3	-axial isotropy of the probe	B	4.7	R	$\sqrt{3}$	$\sqrt{0.5}$	1.9	∞
4	- Hemispherical isotropy of the probe	B	9.4	R	$\sqrt{3}$	$\sqrt{0.5}$	3.9	∞
6	-boundary effect	B	1.9	R	$\sqrt{3}$	1	1.1	∞
7	-probe linearity	B	4.7	R	$\sqrt{3}$	1	2.7	∞
8	- System detection limits	B	1.0	R	$\sqrt{3}$	1	0.6	∞
9	-readout Electronics	B	1.0	N	1	1	1.0	∞
10	-response time	B	0	R	$\sqrt{3}$	1	0	∞
11	-integration time	B	4.32	R	$\sqrt{3}$	1	2.5	∞
12	-noise	B	0	R	$\sqrt{3}$	1	0	∞
13	-RF Ambient Conditions	B	3	R	$\sqrt{3}$	1	1.73	∞
14	-Probe Positioner Mechanical Tolerance	B	0.4	R	$\sqrt{3}$	1	0.2	∞
15	-Probe Positioning with respect to Phantom Shell	B	2.9	R	$\sqrt{3}$	1	1.7	∞
16	-Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	B	3.9	R	$\sqrt{3}$	1	2.3	∞
				Test sample Related				
17	-Test Sample Positioning	A	2.9	N	1	1	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	∞
				Physical parameter				
20	-phantom	B	4.0	R	$\sqrt{3}$	1	2.3	∞
21	-liquid conductivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.64	1.8	∞

22	-liquid conductivity (measurement uncertainty)	B	2.5	N	1	0.64	1.6	9
23	-liquid permittivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.6	1.7	∞
24	-liquid permittivity (measurement uncertainty)	B	2.5	N	1	0.6	1.5	9
Combined standard uncertainty		$u_c' = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$					12.12	
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$		N	k=2		24.24	

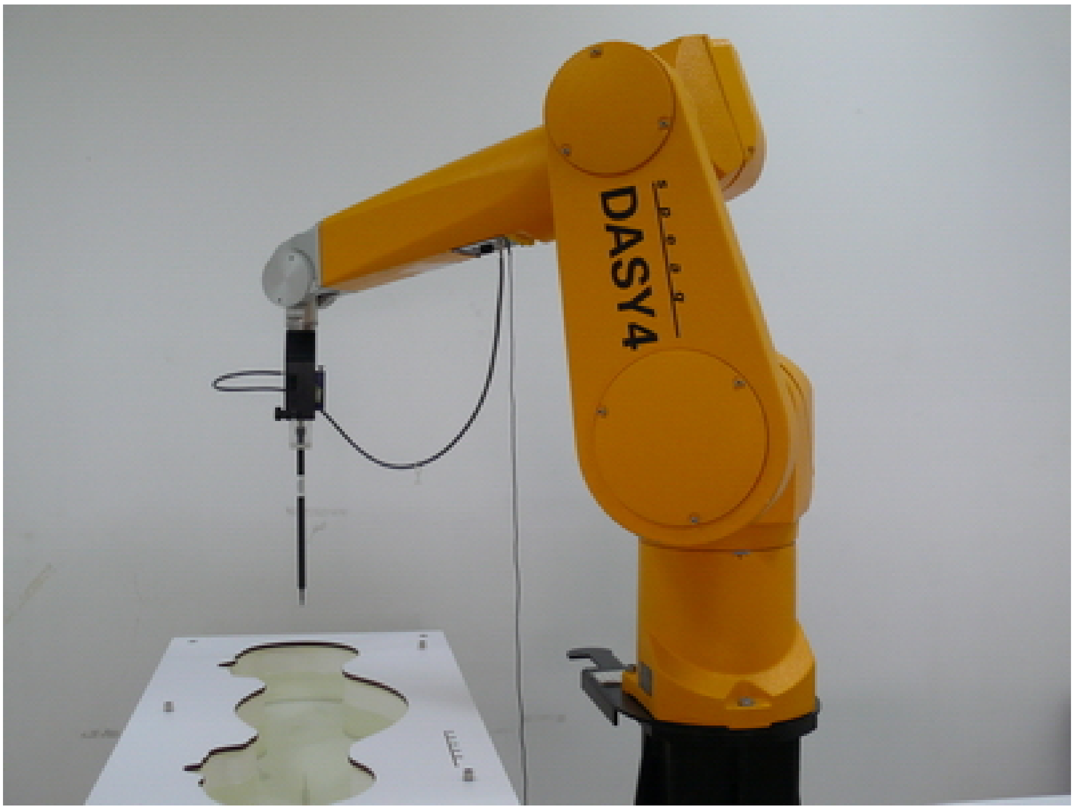
9. Main Test Instruments

Table 11: List of Main Instruments

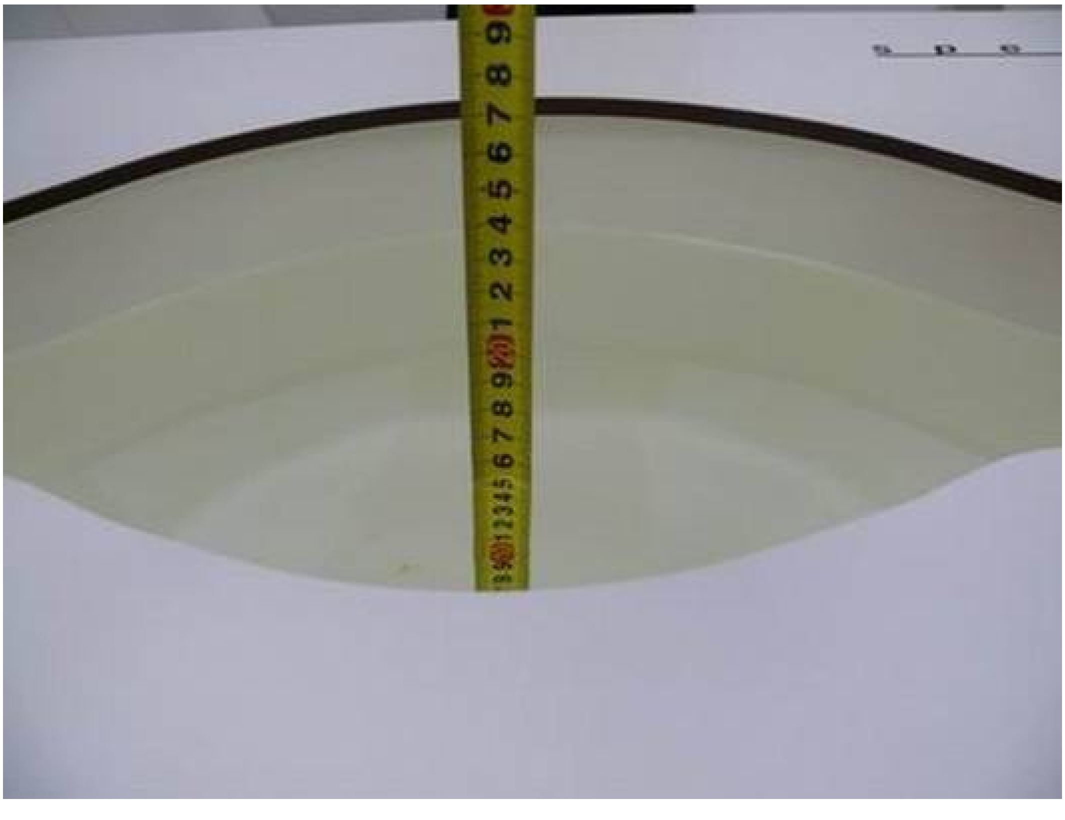
No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	Agilent 8753E	US37390326	September 12, 2011	One year
02	Dielectric Probe Kit	Agilent 85070E	US44020115	No Calibration Requested	
03	Power meter	Agilent E4417A	GB41291714	March 12, 2011	One year
04	Power sensor	Agilent 8481H	MY41091316	September 25, 2011	One year
05	Signal Generator	HP 8341B	2730A00804	September 12, 2011	One year
06	Amplifier	IXA-020	0401	No Calibration Requested	
07	E-field Probe	EX3DV4	3677	November 24, 2010	One year
08	DAE	DAE4	905	June 24, 2011	One year
09	Validation Kit 2450MHz	D2450V2	786	August 29, 2011	One year

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

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: 786

Date/Time: 11/17/2011 8:01:36 AM

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

Medium parameters used: f = 2450 MHz; σ = 1.97 mho/m; ε_r = 51.97; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liqiud Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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=10mm, dy=10mm

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

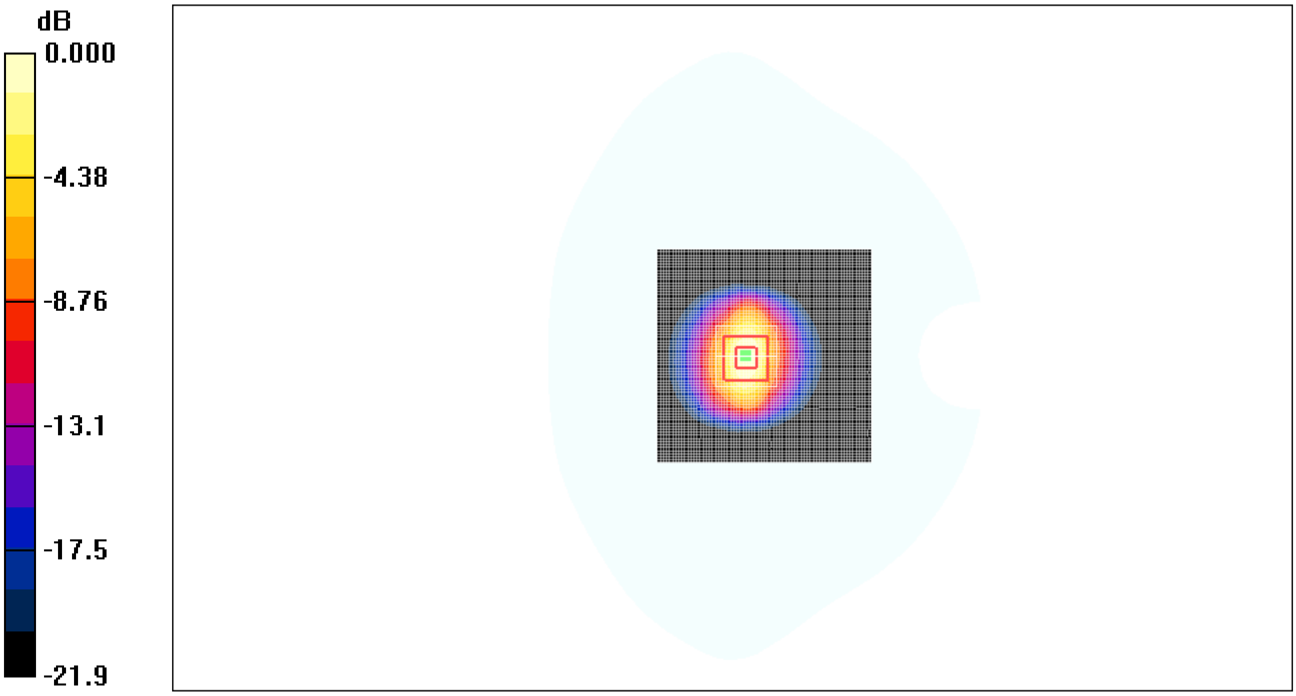
d=10mm, Pin=250mW/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

Peak SAR (extrapolated) = 28.2 W/kg

SAR(1 g) = 14.0 mW/g; SAR(10 g) = 6.46 mW/g

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



0 dB = 19.8mW/g

Figure 6 System Performance Check 2450MHz 250mW

ANNEX C: Graph Results

802.11b with IBM T61 Test Position 1 High (Antenna #01)

Date/Time: 11/17/2011 10:21:08 AM

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

Medium parameters used: f = 2462 MHz; σ = 1.98 mho/m; ε_r = 51.9; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 High/Area Scan (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.23 mW/g

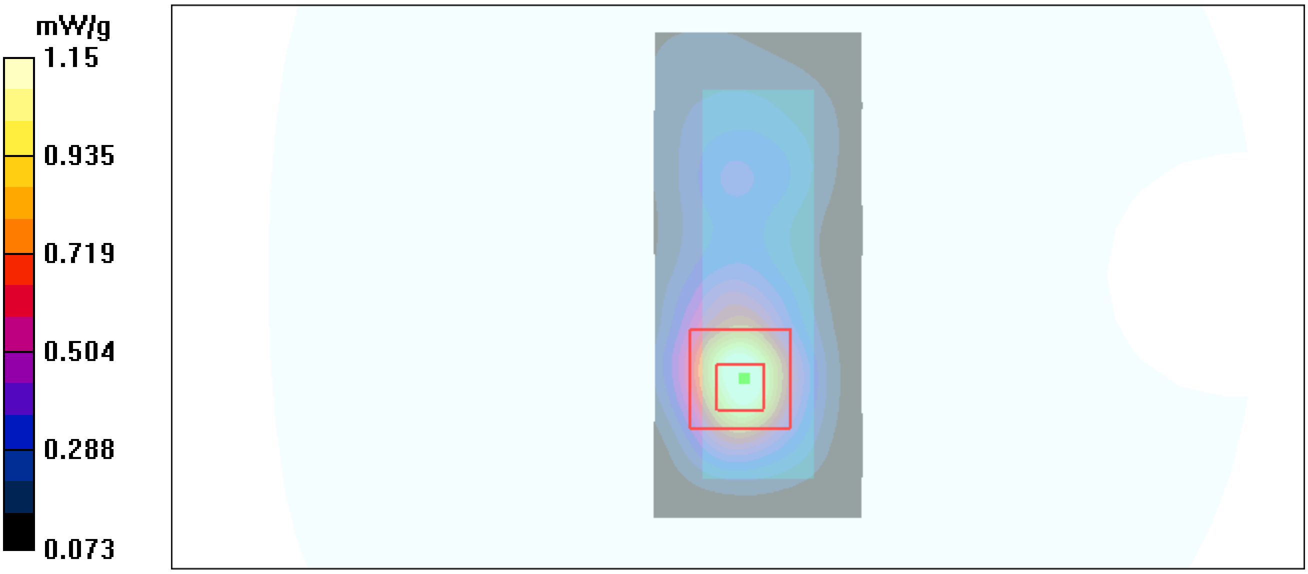
Test Position 1 High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.9 V/m; Power Drift = 0.033 dB

Peak SAR (extrapolated) = 2.47 W/kg

SAR(1 g) = 1.09 mW/g; SAR(10 g) = 0.543 mW/g

Maximum value of SAR (measured) = 1.15 mW/g



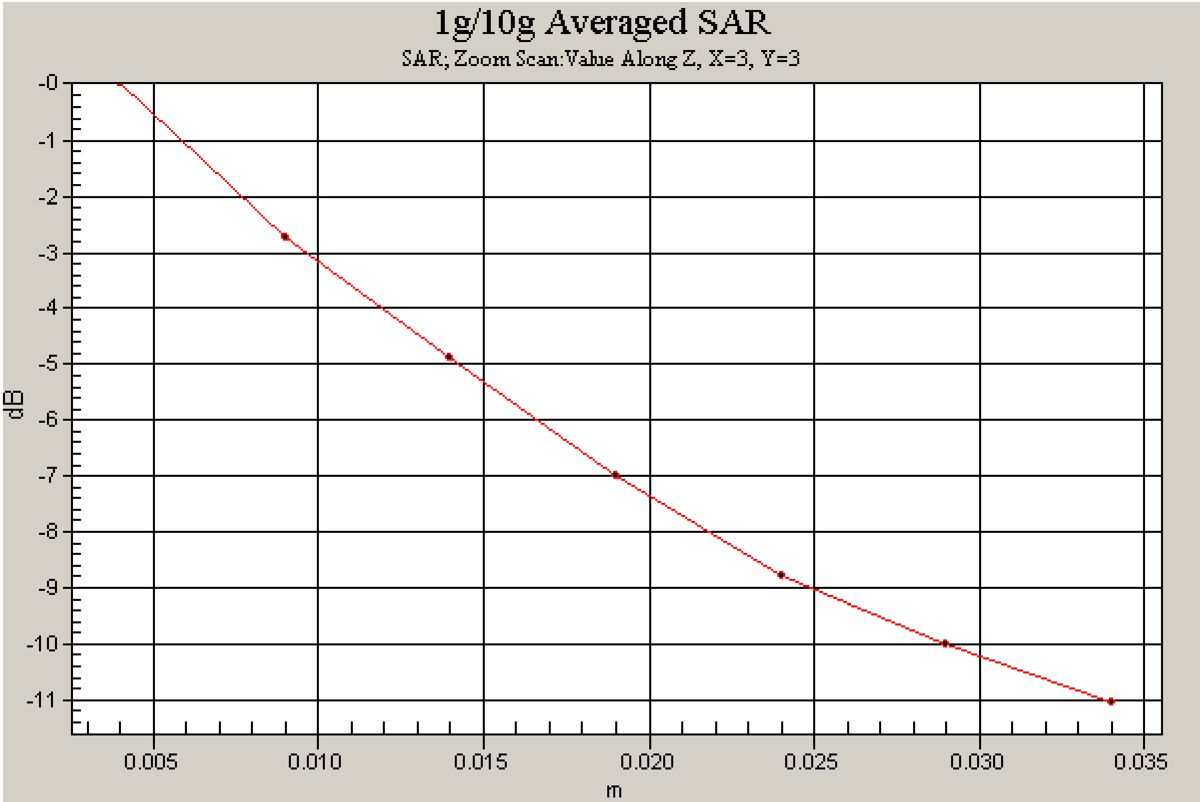


Figure 7 802.11b with IBM T61 Test Position 1 Channel 11

802.11b with IBM T61 Test Position 1 Middle (Antenna #01)

Date/Time: 11/17/2011 10:05:54 AM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.94 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.08 mW/g

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

Reference Value = 16.1 V/m; Power Drift = 0.117 dB

Peak SAR (extrapolated) = 2.42 W/kg

SAR(1 g) = 1.05 mW/g; SAR(10 g) = 0.673 mW/g

Maximum value of SAR (measured) = 1.02 mW/g

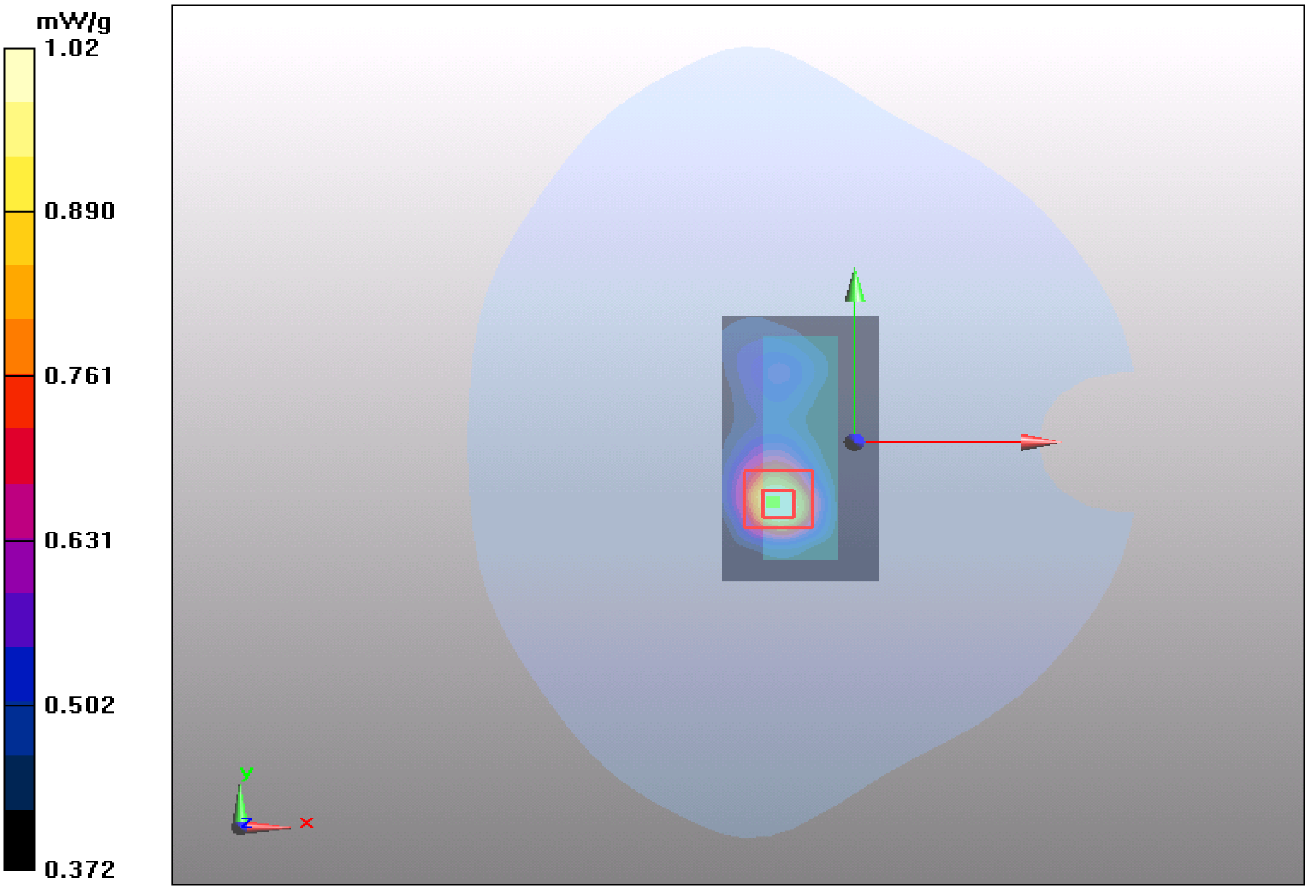


Figure 8 802.11b with IBM T61 Test Position 1 Channel 6

802.11b with IBM T61 Test Position 1 Low (Antenna #01)
Date/Time: 11/17/2011 2:16:59 PM
Communication System: 802.11b; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2412 MHz; σ = 1.92 mho/m; ε_r = 52.1; ρ = 1000 kg/m^3
Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃
Phantom section: Flat Section
DASY4 Configuration:
Probe: EX3DV4 - SN3677; ConvF(7.46, 7.46, 7.46); Calibrated: 11/24/2010
Electronics: DAE4 Sn905; Calibrated: 6/24/2011
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 Low/Area Scan (51x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.09 mW/g

Test Position 1 Low/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.6 V/m; Power Drift = -0.110 dB
Peak SAR (extrapolated) = 2.15 W/kg
SAR(1 g) = 0.919 mW/g; SAR(10 g) = 0.445 mW/g
Maximum value of SAR (measured) = 0.997 mW/g

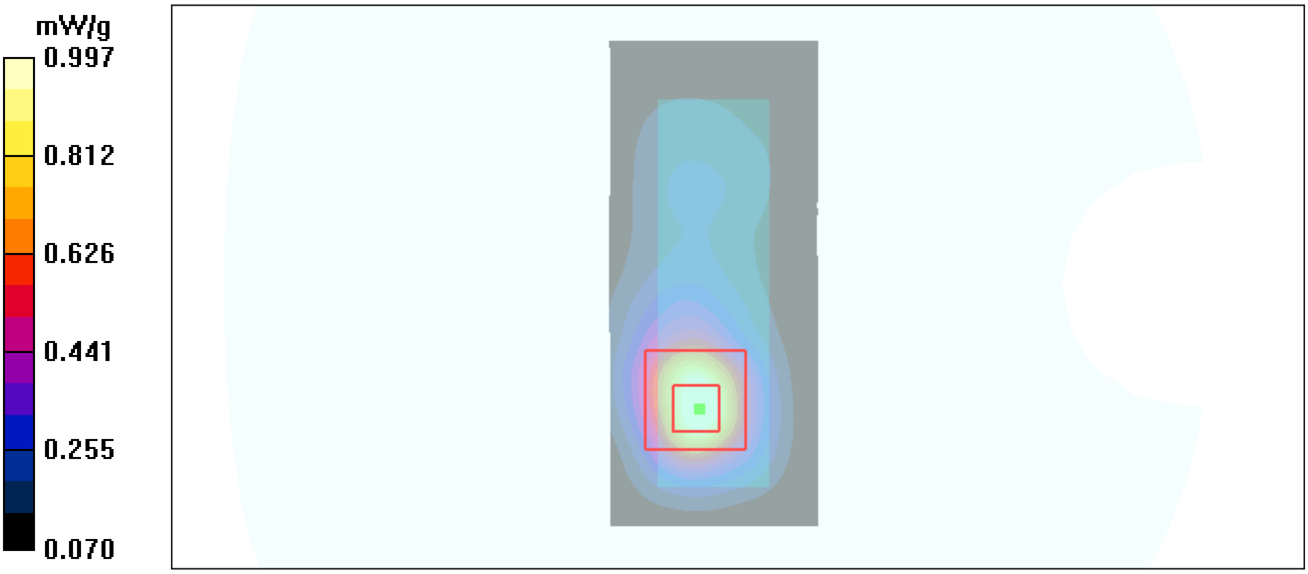


Figure 9 802.11b with IBM T61 Test Position 1 Channel 1

802.11b with IBM T61 Test Position 2 Middle (Antenna #01)

Date/Time: 11/17/2011 5:17:29 PM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.94 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.407 mW/g

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

Reference Value = 10.5 V/m; Power Drift = 0.111 dB

Peak SAR (extrapolated) = 0.706 W/kg

SAR(1 g) = 0.369 mW/g; SAR(10 g) = 0.204 mW/g

Maximum value of SAR (measured) = 0.395 mW/g

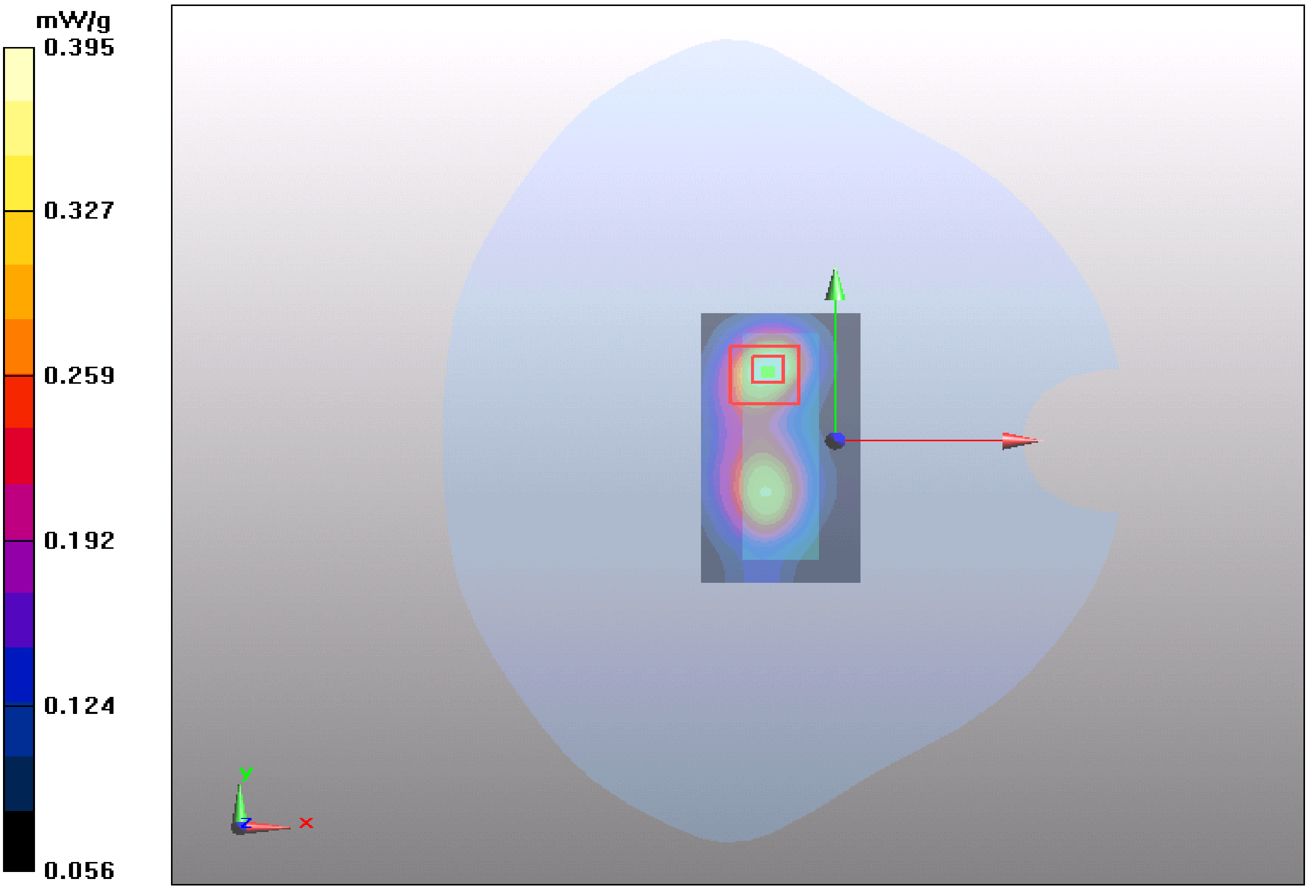


Figure 10 802.11b with IBM T61 Test Position 2 Channel 6

802.11b with Lenovo Y-450 Test Position 3 Middle (Antenna #01)

Date/Time: 11/17/2011 1:24:14 PM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.94 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (41x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.161 mW/g

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

Reference Value = 6.59 V/m; Power Drift = -0.103 dB

Peak SAR (extrapolated) = 0.236 W/kg

SAR(1 g) = 0.145 mW/g; SAR(10 g) = 0.102 mW/g

Maximum value of SAR (measured) = 0.153 mW/g

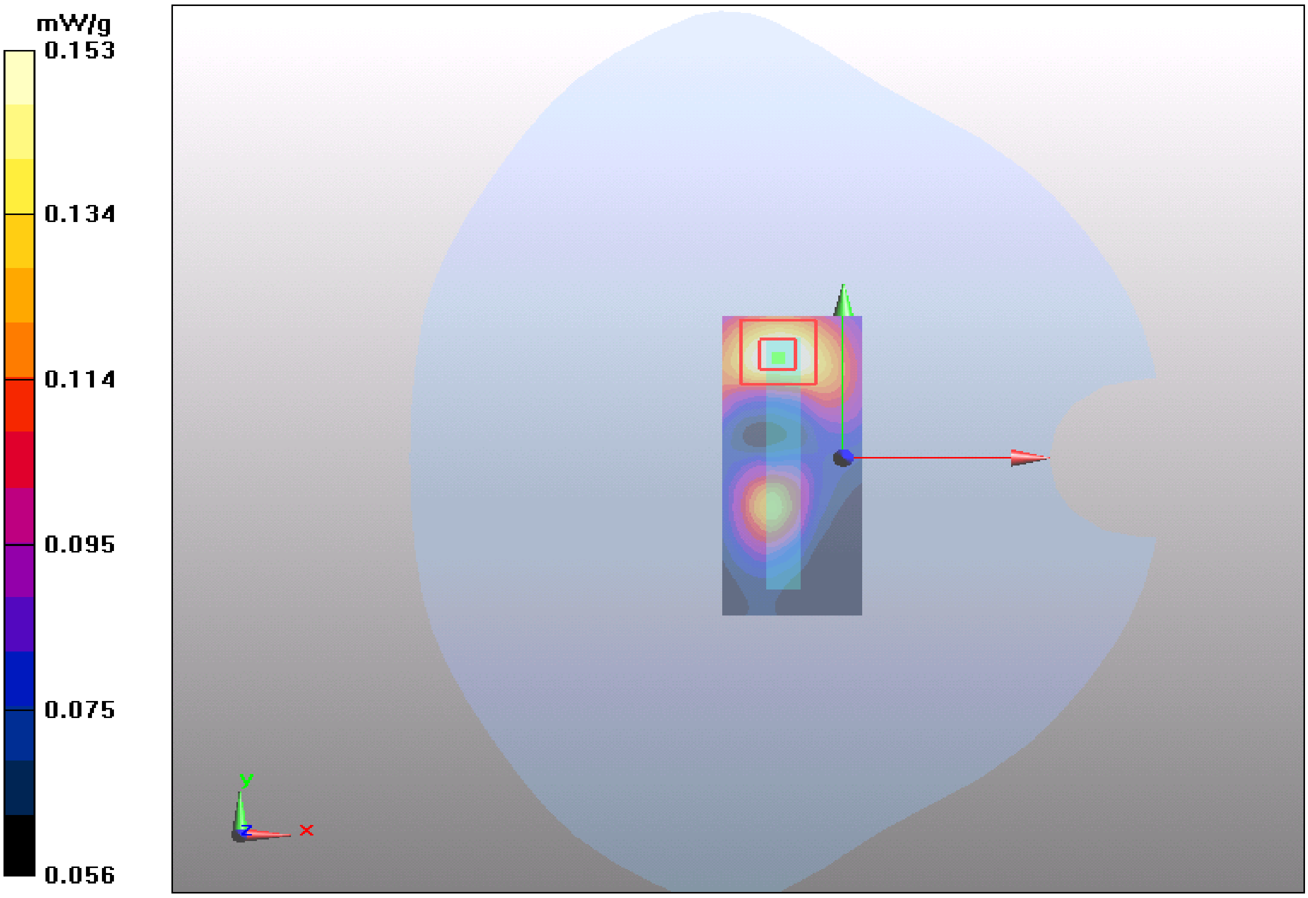


Figure 11 802.11b with Lenovo Y-450 Test Position 3 Channel 6

802.11b with Lenovo Y-450 Test Position 4 Middle (Antenna #01)

Date/Time: 11/17/2011 12:56:09 PM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.94 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (41x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.573 mW/g

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

Reference Value = 15.8 V/m; Power Drift = -0.066 dB

Peak SAR (extrapolated) = 0.970 W/kg

SAR(1 g) = 0.487 mW/g; SAR(10 g) = 0.285 mW/g

Maximum value of SAR (measured) = 0.520 mW/g

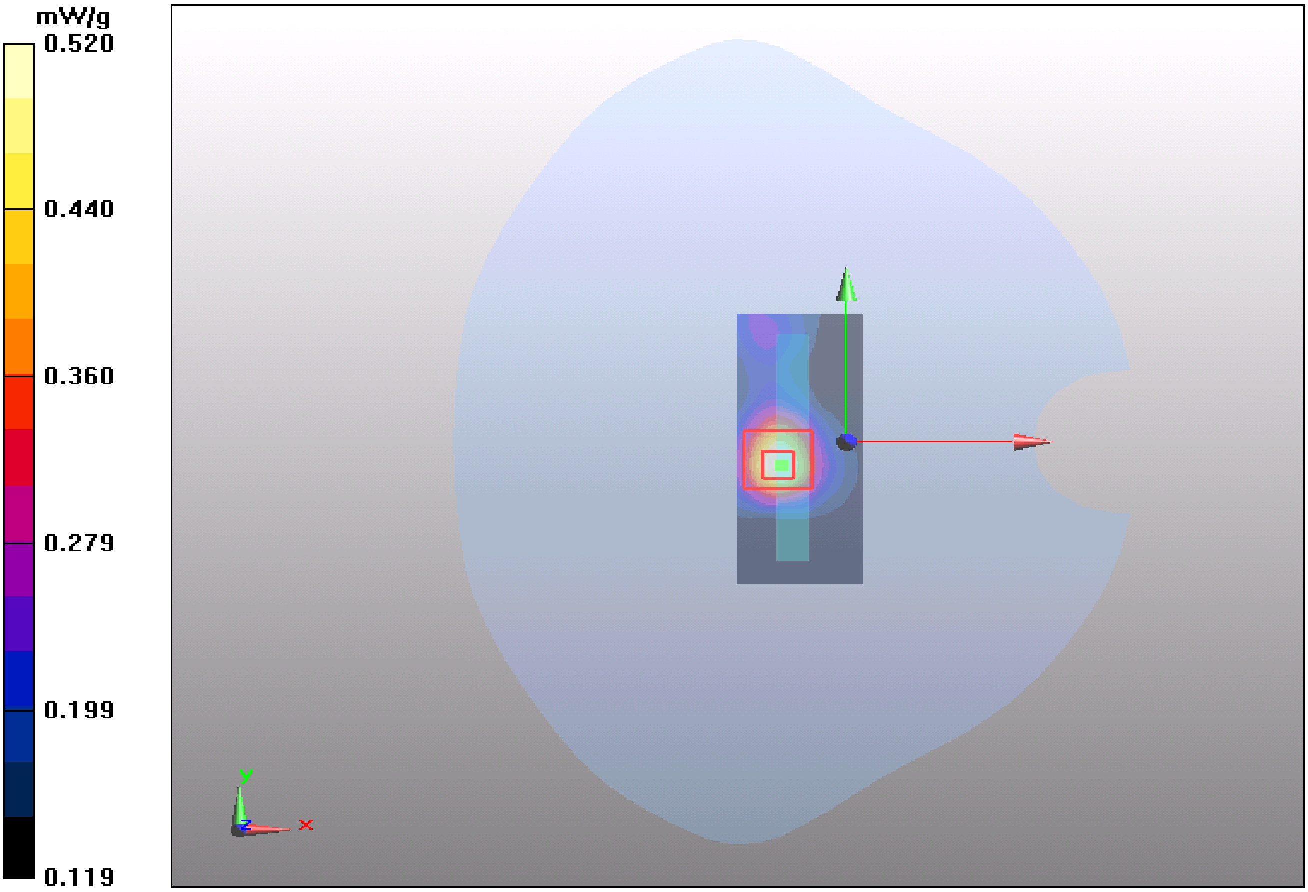


Figure 12 802.11b with Lenovo Y-450 Test Position 4 Channel 6

802.11g with IBM T61 Test Position 1 Middle (Antenna #01)

Date/Time: 11/17/2011 9:24:48 AM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.95 mho/m; ε_r = 52; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.26 mW/g

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

Reference Value = 14.3 V/m; Power Drift = -0.159 dB

Peak SAR (extrapolated) = 2.50 W/kg

SAR(1 g) = 1.06 mW/g; SAR(10 g) = 0.516 mW/g

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

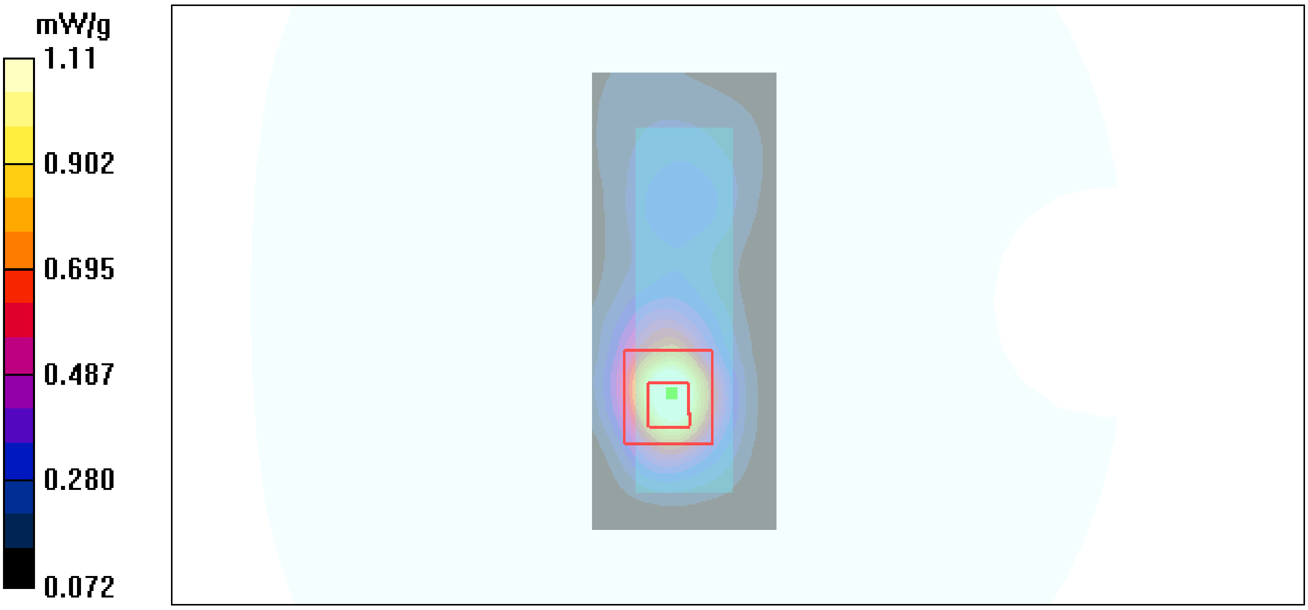


Figure 13 802.11g with IBM T61 Test Position 1 Channel 6

802.11b with IBM T61 Test Position 1 High (Antenna #10)

Date/Time: 11/17/2011 10:37:33 AM

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

Medium parameters used: f = 2462 MHz; σ = 1.98 mho/m; ε_r = 51.9; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 High/Area Scan (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.580 mW/g

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

Reference Value = 10.3 V/m; Power Drift = -0.038 dB

Peak SAR (extrapolated) = 1.26 W/kg

SAR(1 g) = 0.491 mW/g; SAR(10 g) = 0.253 mW/g

Maximum value of SAR (measured) = 0.513 mW/g

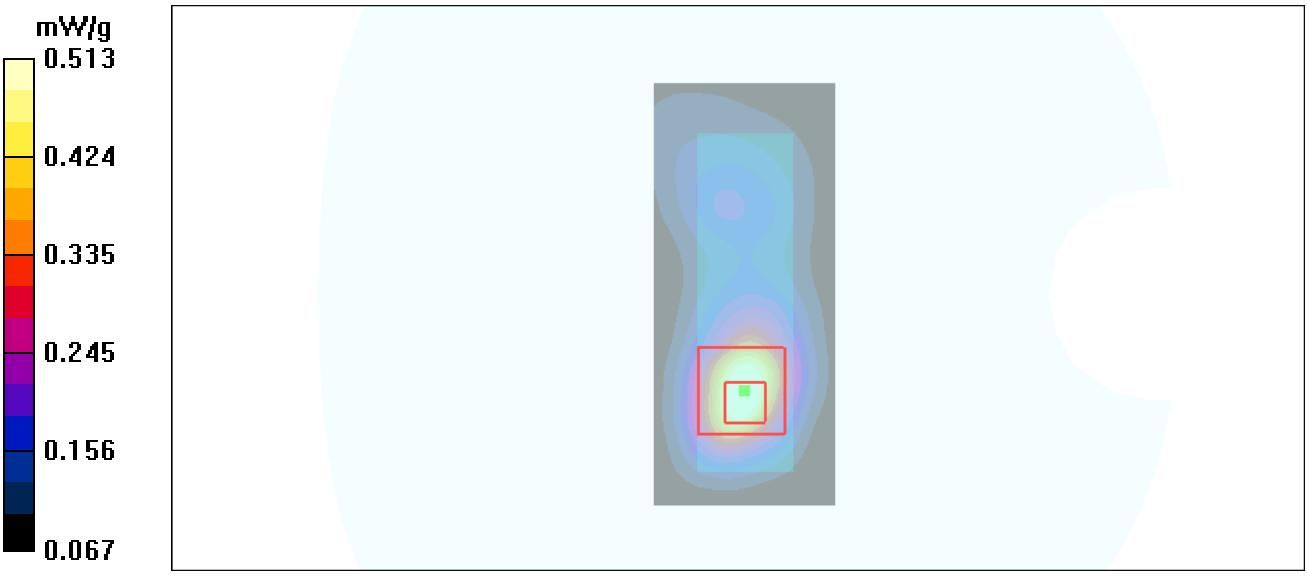


Figure 14 802.11b with IBM T61 Test Position 1 Channel 11

802.11b with IBM T61 Test Position 1 Middle (Antenna #10)

Date/Time: 11/17/2011 9:48:23 AM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.94 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.626 mW/g

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

Reference Value = 14 V/m; Power Drift = 0.045 dB

Peak SAR (extrapolated) = 1.21 W/kg

SAR(1 g) = 0.642 mW/g; SAR(10 g) = 0.476 mW/g

Maximum value of SAR (measured) = 0.639 mW/g

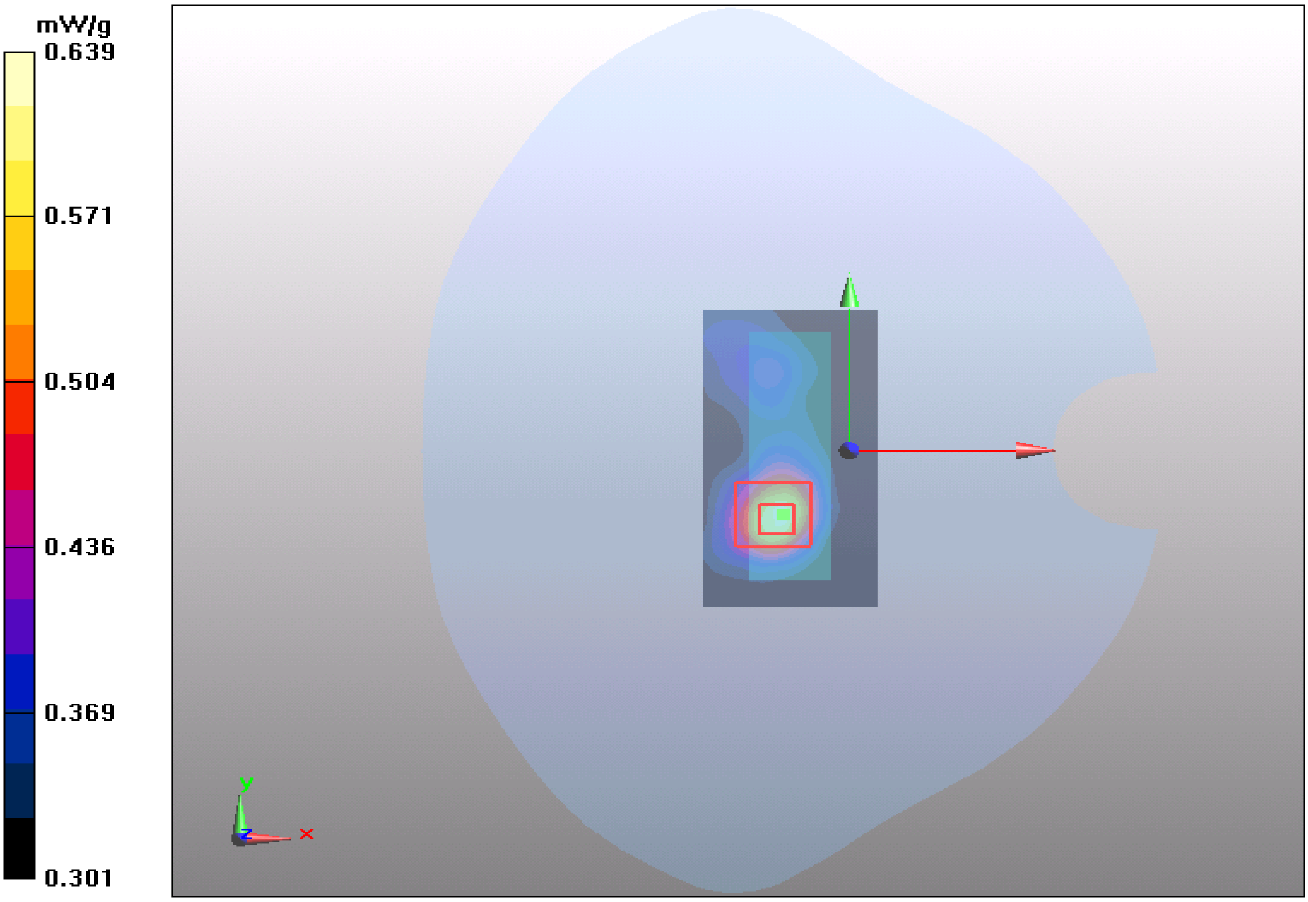


Figure 15 802.11b with IBM T61 Test Position 1 Channel 6

802.11b with IBM T61 Test Position 1 Low (Antenna #10)

Date/Time: 11/17/2011 4:17:46 PM

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

Medium parameters used: f = 2412 MHz; σ = 1.92 mho/m; ε_r = 52.1; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 Low/Area Scan (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.914 mW/g

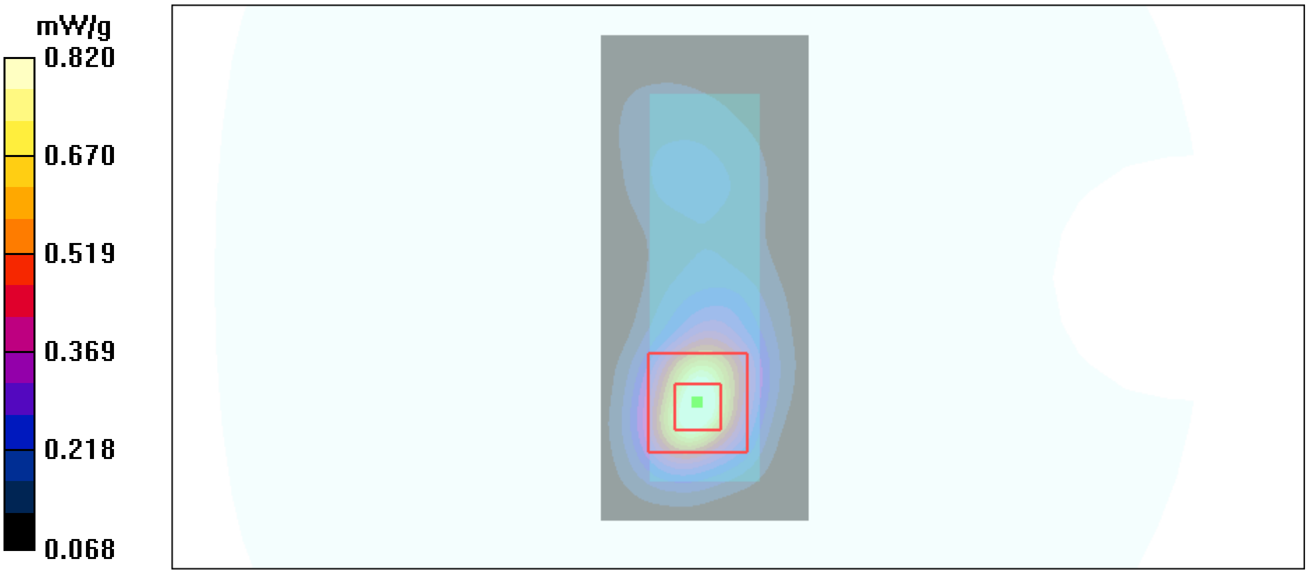
Test Position 1 Low/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.7 V/m; Power Drift = -0.088 dB

Peak SAR (extrapolated) = 1.81 W/kg

SAR(1 g) = 0.748 mW/g; SAR(10 g) = 0.359 mW/g

Maximum value of SAR (measured) = 0.820 mW/g



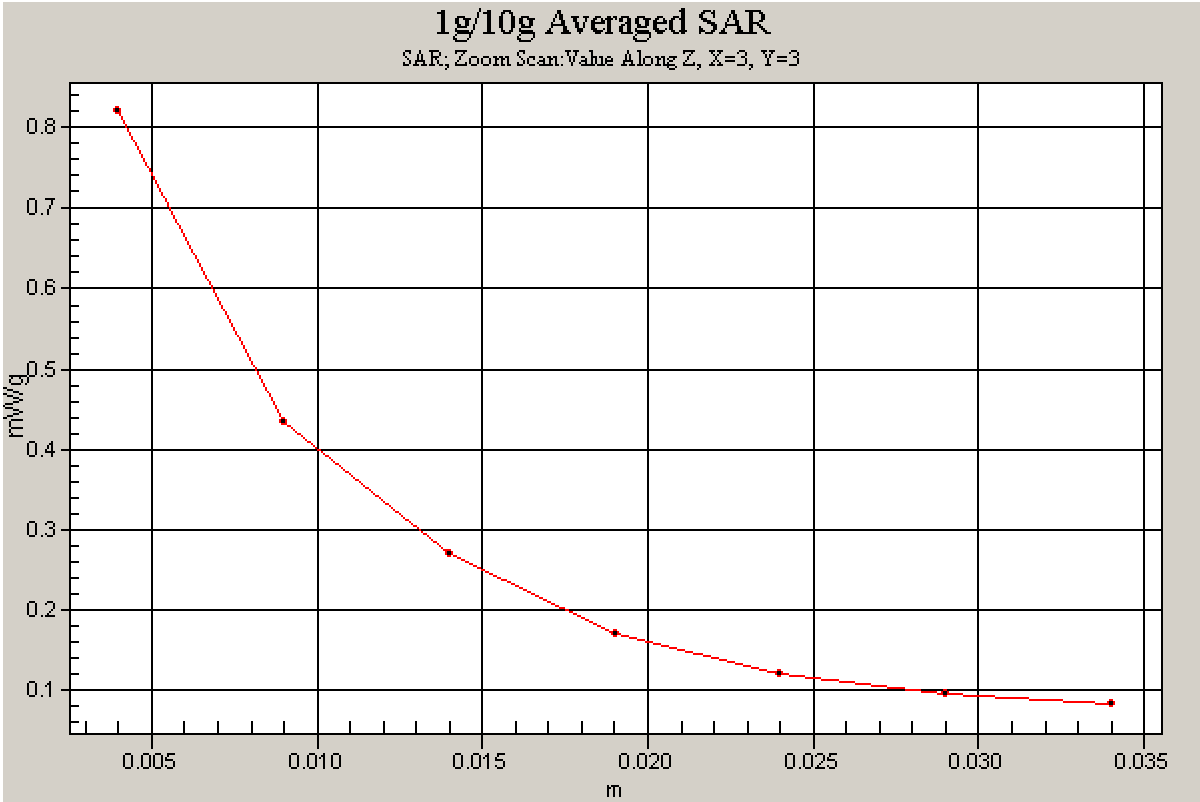


Figure 16 802.11b with IBM T61 Test Position 1 Channel 1

802.11b with IBM T61 Test Position 2 Middle (Antenna #10)

Date/Time: 11/17/2011 10:56:06 AM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.94 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.243 mW/g

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

Reference Value = 8.59 V/m; Power Drift = 0.024 dB

Peak SAR (extrapolated) = 0.450 W/kg

SAR(1 g) = 0.225 mW/g; SAR(10 g) = 0.132 mW/g

Maximum value of SAR (measured) = 0.236 mW/g

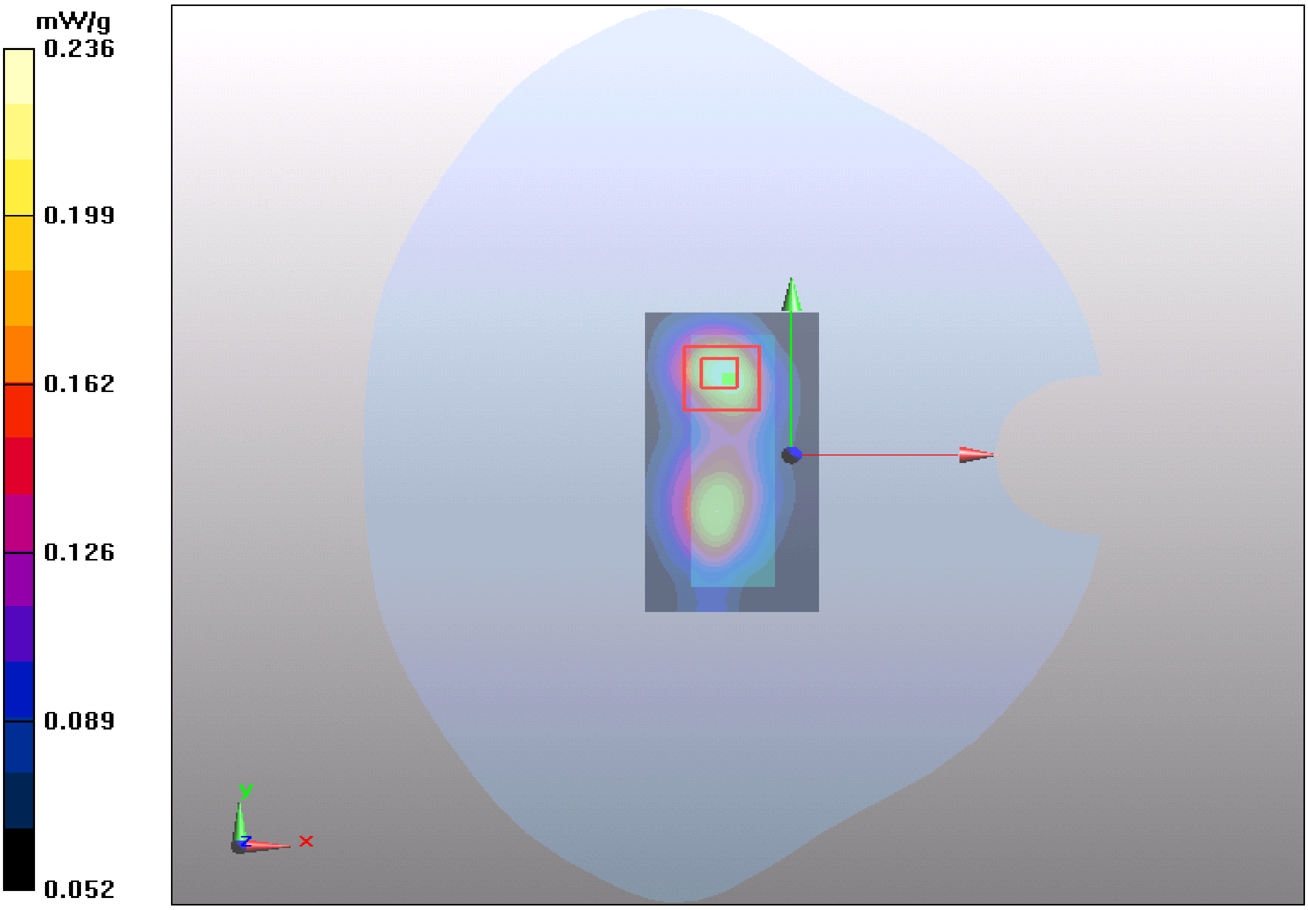


Figure 17 802.11b with IBM T61 Test Position 2 Channel 6

802.11b with Lenovo Y-450 Test Position 3 Middle (Antenna #10)

Date/Time: 11/17/2011 1:40:01 PM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.94 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (41x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.217 mW/g

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

Reference Value = 10.4 V/m; Power Drift = 0.059 dB

Peak SAR (extrapolated) = 0.345 W/kg

SAR(1 g) = 0.200 mW/g; SAR(10 g) = 0.130 mW/g

Maximum value of SAR (measured) = 0.214 mW/g

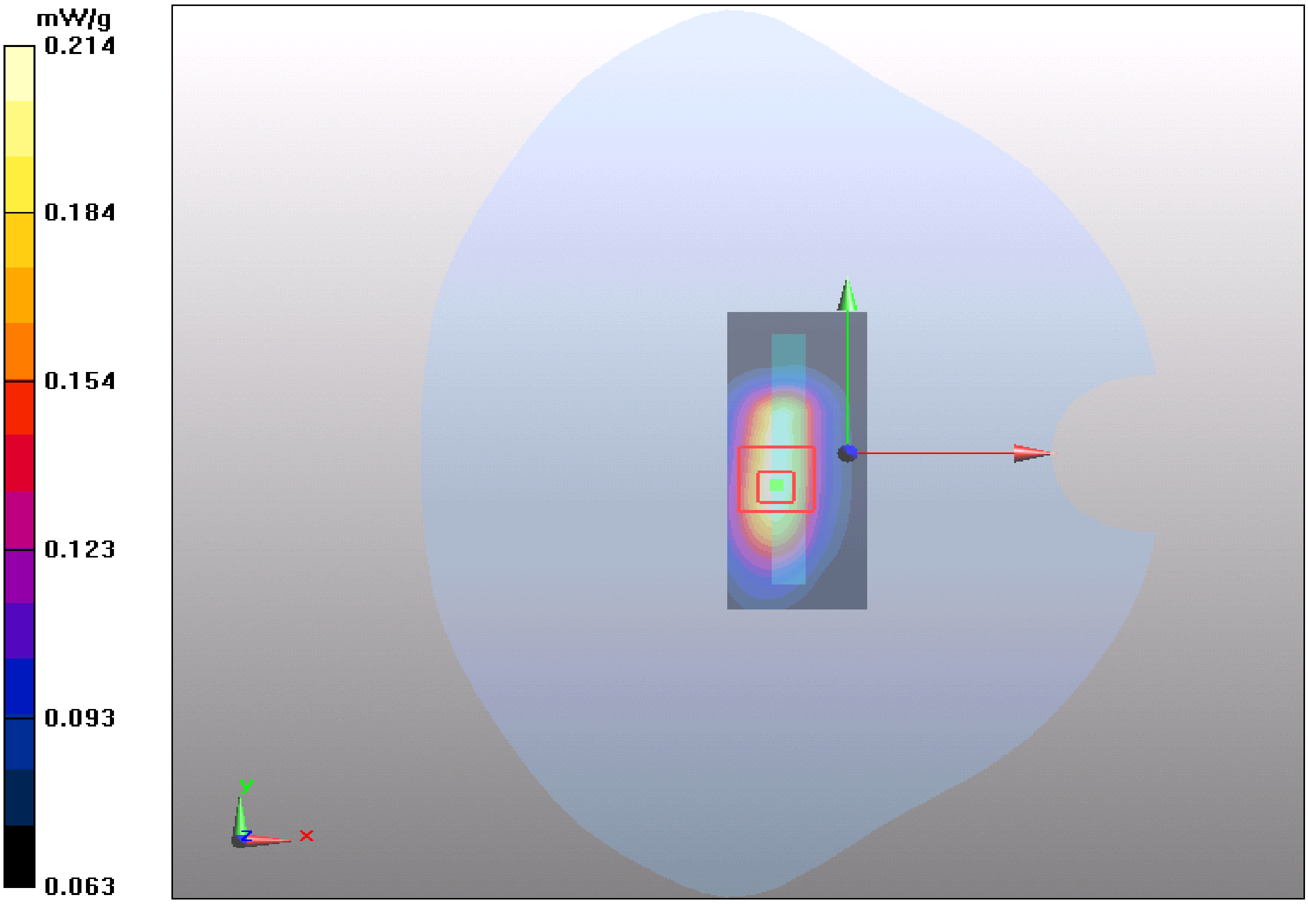


Figure 18 802.11b with Lenovo Y-450 Test Position 3 Channel 6

802.11b with Lenovo Y-450 Test Position 4 Middle (Antenna #10)

Date/Time: 11/17/2011 12:36:09 PM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.94 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (41x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.146 mW/g

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

Reference Value = 7.55 V/m; Power Drift = 0.182 dB

Peak SAR (extrapolated) = 0.192 W/kg

SAR(1 g) = 0.142 mW/g; SAR(10 g) = 0.124 mW/g

Maximum value of SAR (measured) = 0.146 mW/g

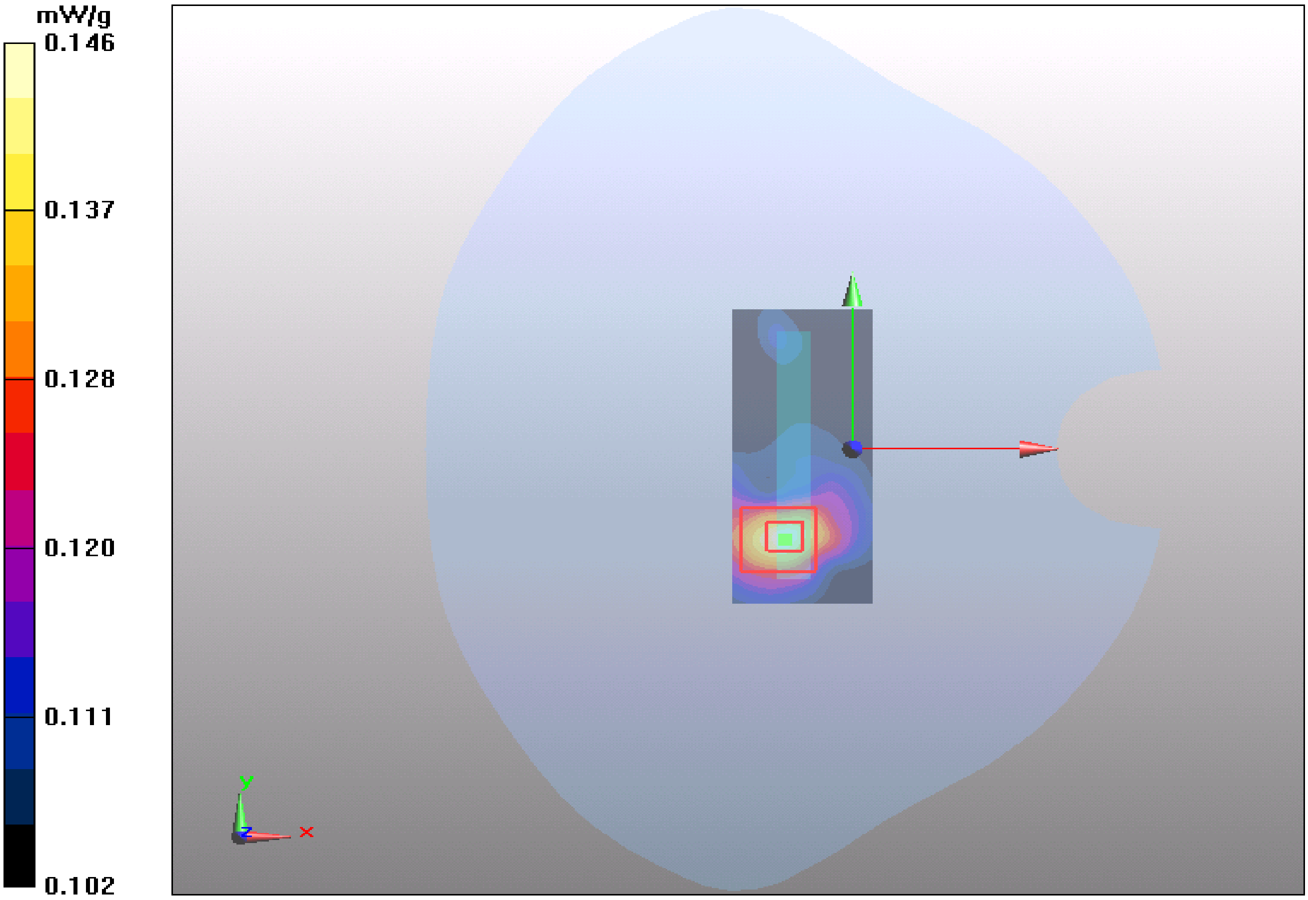


Figure 19 802.11b with Lenovo Y-450 Test Position 4 Channel 6

802.11g with IBM T61 Test Position 1 Middle (Antenna #10)

Date/Time: 11/17/2011 4:58:18 PM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.95 mho/m; ε_r = 52; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (51x101x1): Measurement grid: dx=10mm, dy=10mm

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

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

Reference Value = 11.6 V/m; Power Drift = -0.063 dB

Peak SAR (extrapolated) = 1.79 W/kg

SAR(1 g) = 0.731 mW/g; SAR(10 g) = 0.357 mW/g

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

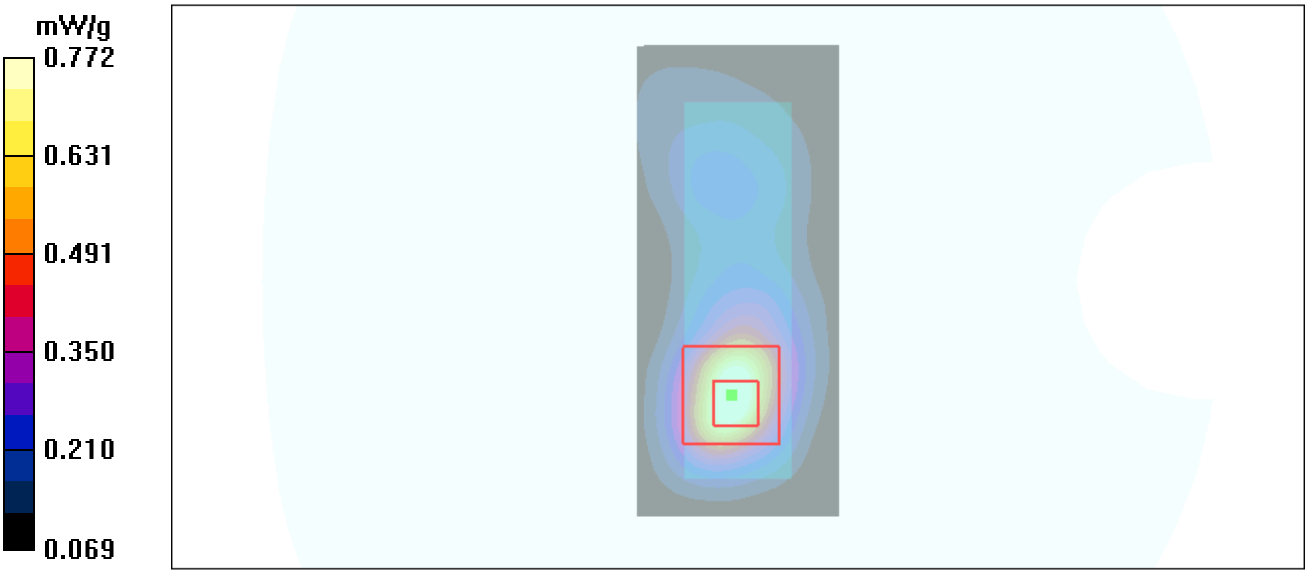


Figure 20 802.11g with IBM T61 Test Position 1 Channel 6

802.11n HT20 with IBM T61 Test Position 1 High

Date/Time: 11/17/2011 3:07:10 PM

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

Medium parameters used: f = 2462 MHz; σ = 1.98 mho/m; ε_r = 51.9; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 High/Area Scan (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.497 mW/g

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

Reference Value = 10.1 V/m; Power Drift = -0.021 dB

Peak SAR (extrapolated) = 0.845 W/kg

SAR(1 g) = 0.376 mW/g; SAR(10 g) = 0.205 mW/g

Maximum value of SAR (measured) = 0.402 mW/g

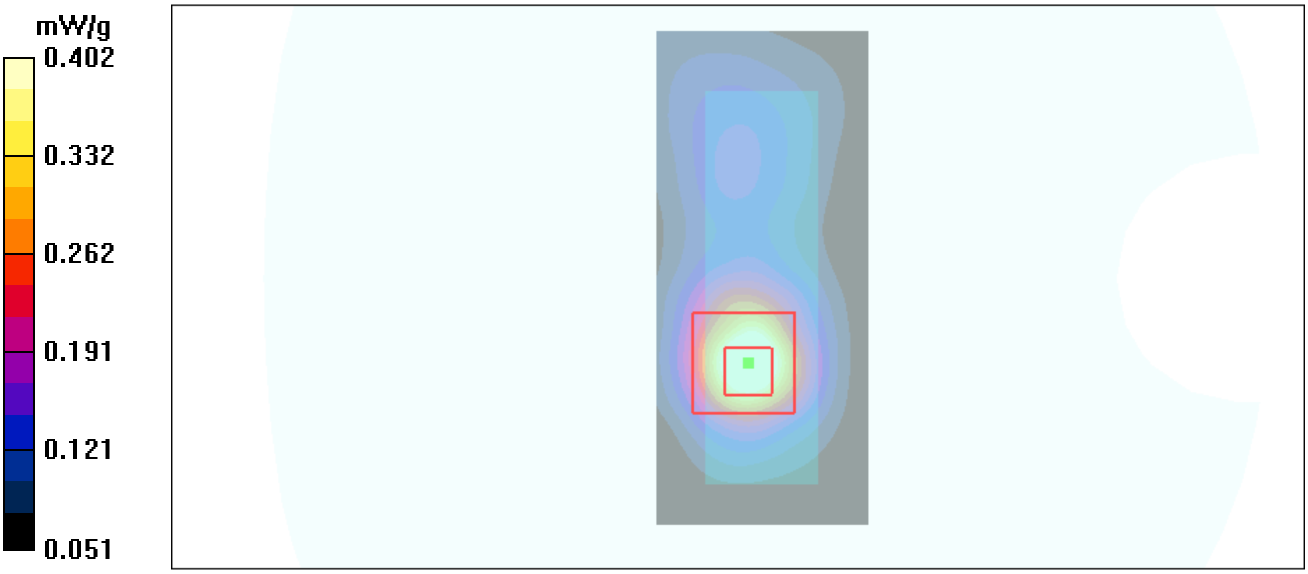


Figure 21 802.11n HT20 with IBM T61 Test Position 1 Channel 11

802.11n HT20 with IBM T61 Test Position 1 Middle

Date/Time: 11/17/2011 2:30:04 PM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.95 mho/m; ε_r = 52; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.41 mW/g

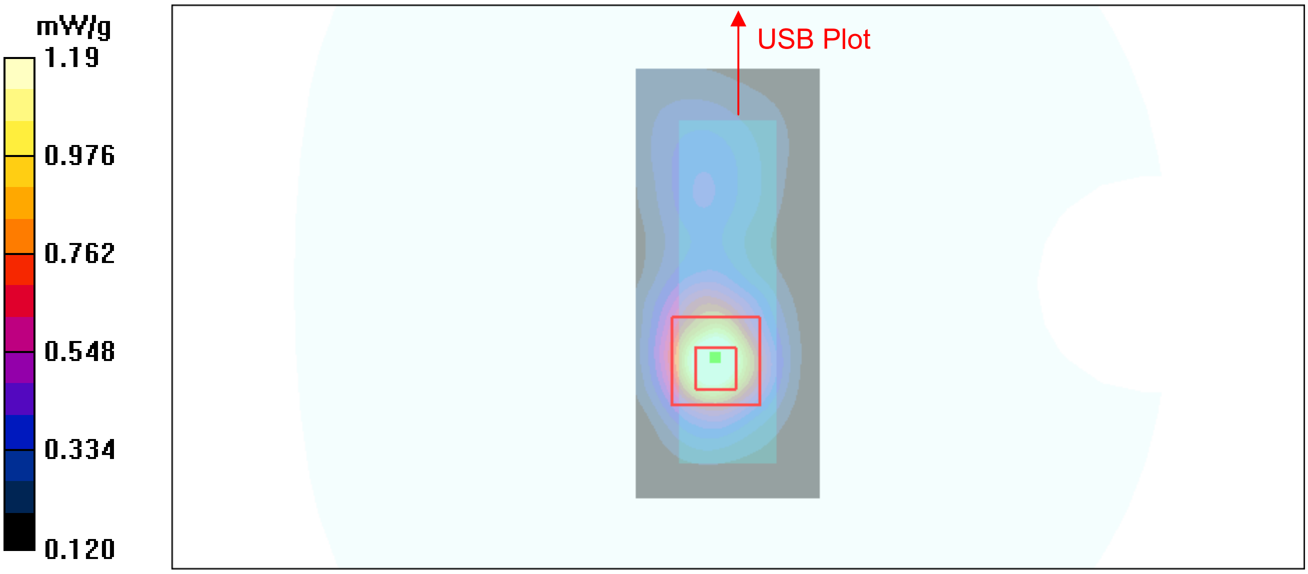
Test Position 1 Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 15.9 V/m; Power Drift = 0.007 dB

Peak SAR (extrapolated) = 2.66 W/kg

SAR(1 g) = 1.15 mW/g; SAR(10 g) = 0.595 mW/g

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



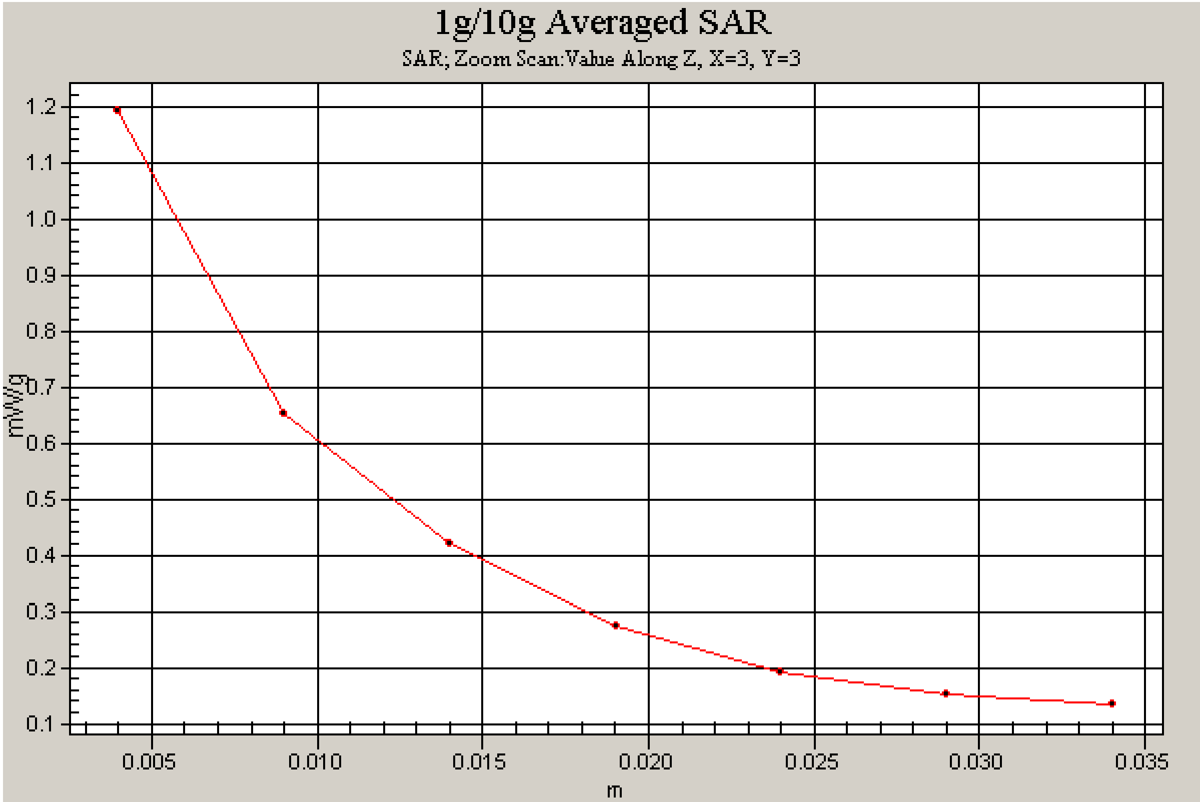


Figure 22 802.11n HT20 with IBM T61 Test Position 1 Channel 6

802.11n HT20 with IBM T61 Test Position 1 Low

Date/Time: 11/17/2011 2:48:53 PM

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

Medium parameters used: f = 2412 MHz; σ = 1.92 mho/m; ε_r = 52.1; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 Low/Area Scan (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.551 mW/g

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

Reference Value = 9.57 V/m; Power Drift = 0.069 dB

Peak SAR (extrapolated) = 1.06 W/kg

SAR(1 g) = 0.463 mW/g; SAR(10 g) = 0.237 mW/g

Maximum value of SAR (measured) = 0.481 mW/g

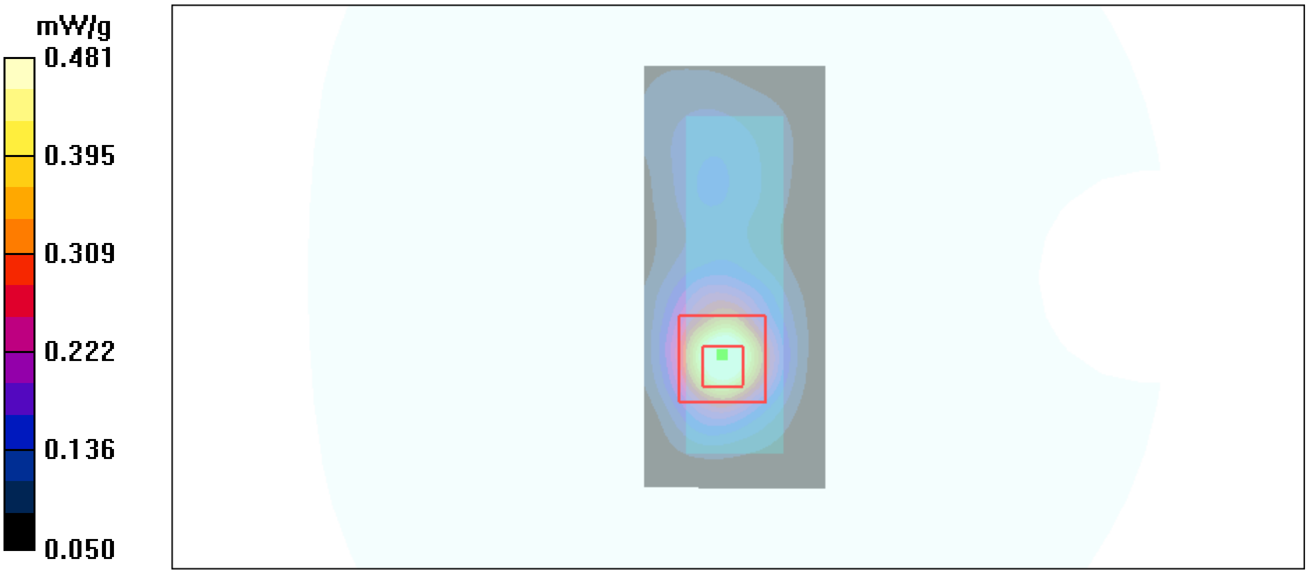


Figure 23 802.11n HT20 with IBM T61 Test Position 1 Channel 1

802.11n HT20 with IBM T61 Test Position 2 Middle

Date/Time: 11/17/2011 4:35:55 PM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.95 mho/m; ε_r = 52; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.658 mW/g

Test Position 2 Middle/Zoom Scan (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.5 V/m; Power Drift = 0.033 dB

Peak SAR (extrapolated) = 0.993 W/kg

SAR(1 g) = 0.471 mW/g; SAR(10 g) = 0.248 mW/g

Maximum value of SAR (measured) = 0.510 mW/g

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

Reference Value = 13.5 V/m; Power Drift = 0.033 dB

Peak SAR (extrapolated) = 1.33 W/kg

SAR(1 g) = 0.589 mW/g; SAR(10 g) = 0.290 mW/g

Maximum value of SAR (measured) = 0.622 mW/g

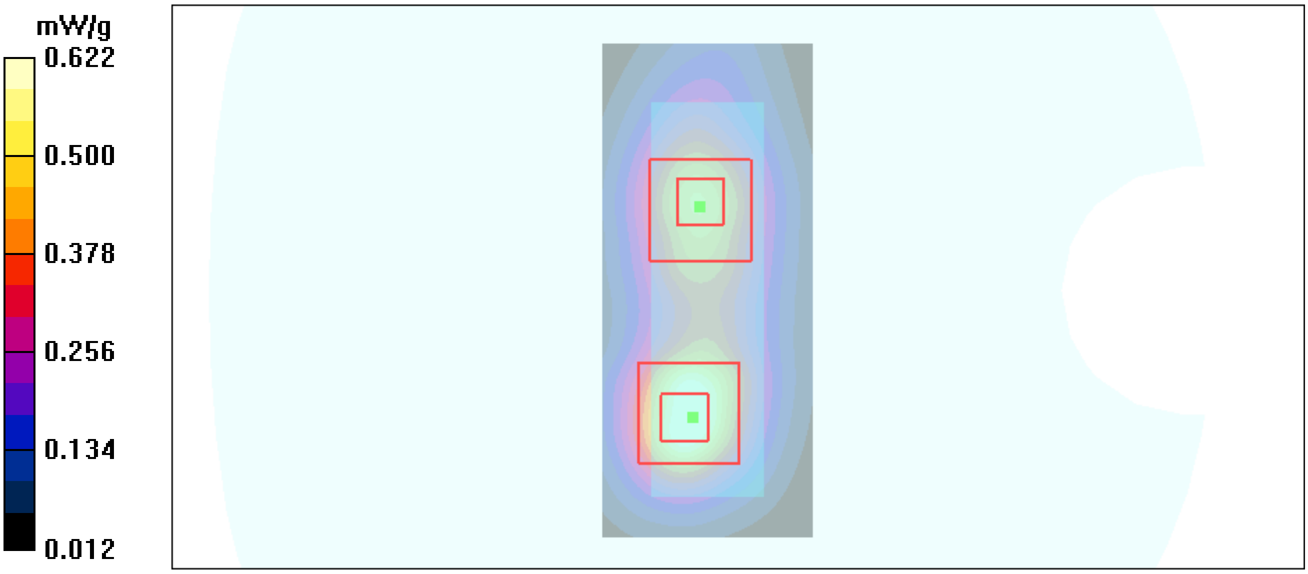


Figure 24 802.11n HT20 with IBM T61 Test Position 2 Channel 6

802.11n HT20 with Lenovo Y-450 Test Position 3 Middle

Date/Time: 11/17/2011 7:26:45 PM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.95 mho/m; ε_r = 52; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.239 mW/g

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

Reference Value = 10.2 V/m; Power Drift = 0.089 dB

Peak SAR (extrapolated) = 0.527 W/kg

SAR(1 g) = 0.228 mW/g; SAR(10 g) = 0.123 mW/g

Maximum value of SAR (measured) = 0.241 mW/g

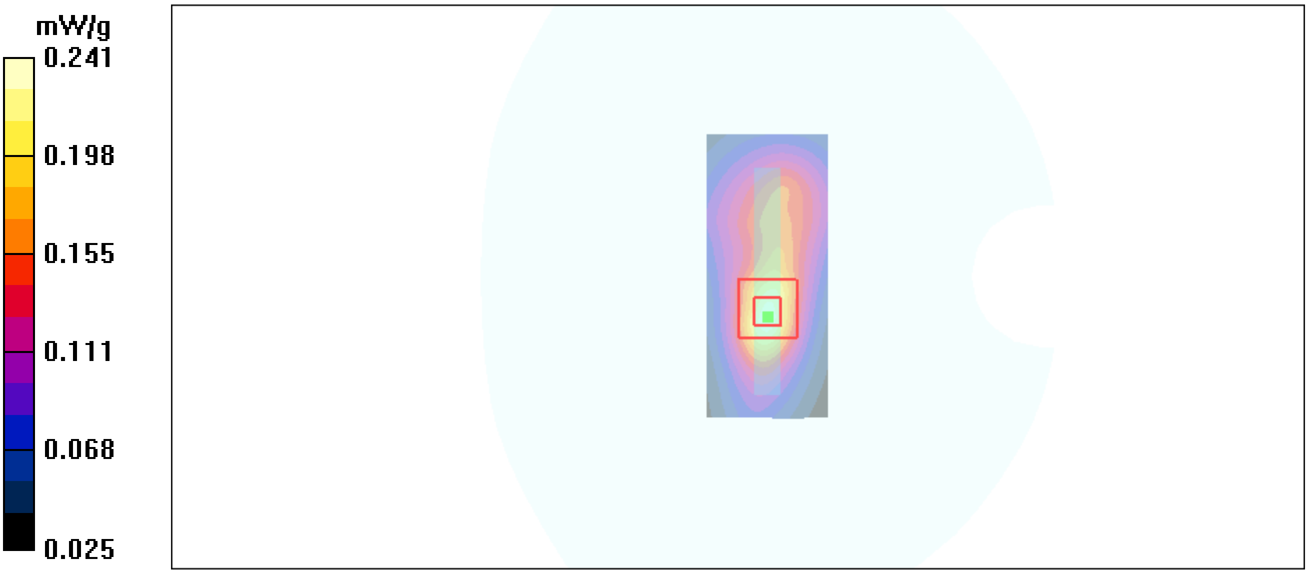


Figure 25 802.11n HT20 with Lenovo Y-450 Test Position 3 Channel 6

802.11n HT20 with Lenovo Y-450 Test Position 4 Middle

Date/Time: 11/17/2011 8:07:24 PM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.95 mho/m; ε_r = 52; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

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 (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.722 mW/g

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

Reference Value = 18.4 V/m; Power Drift = 0.150 dB

Peak SAR (extrapolated) = 1.69 W/kg

SAR(1 g) = 0.707 mW/g; SAR(10 g) = 0.423 mW/g

Maximum value of SAR (measured) = 0.724 mW/g

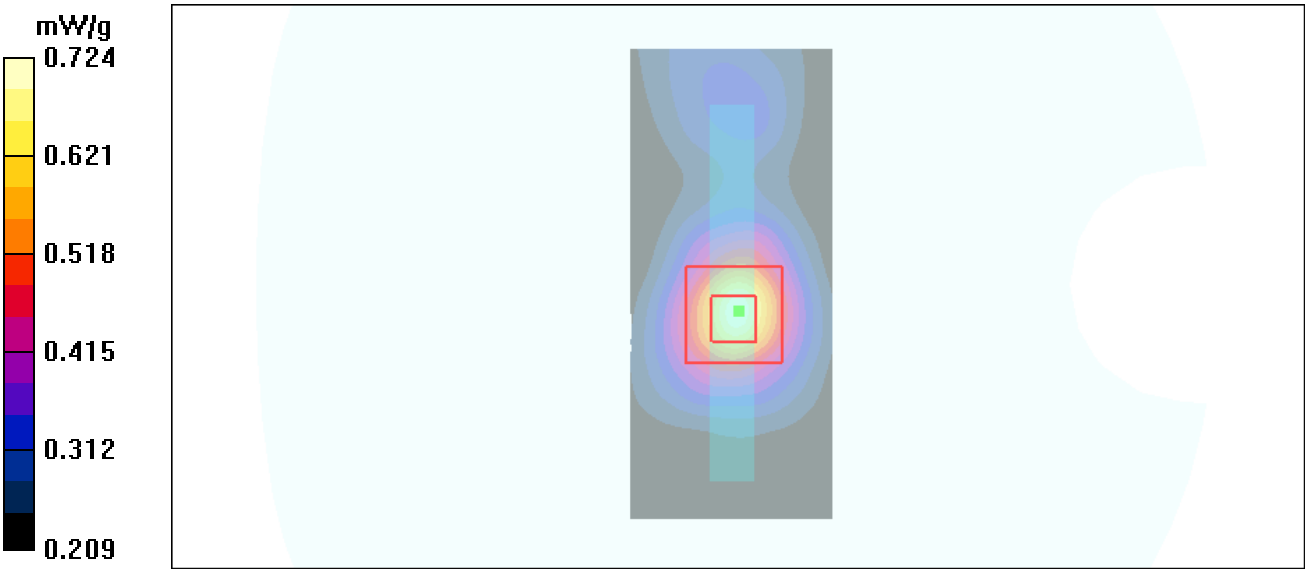


Figure 26 802.11n HT20 with Lenovo Y-450 Test Position 4 Channel 6

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

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	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

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: November 25, 2010

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

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

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

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!)

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.41	0.47	0.39	± 10.1%
DCP (mV)[B]	96.8	98.9	98.8	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	143.2	± 2.4 %
			Y	0.00	0.00	1.00	140.9	
			Z	0.00	0.00	1.00	135.8	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

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][C]	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%

[C] 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.

EX3DV4 SN:3677 November 24, 2010

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

Calibration Parameter Determined in Body Tissue Simulating Media

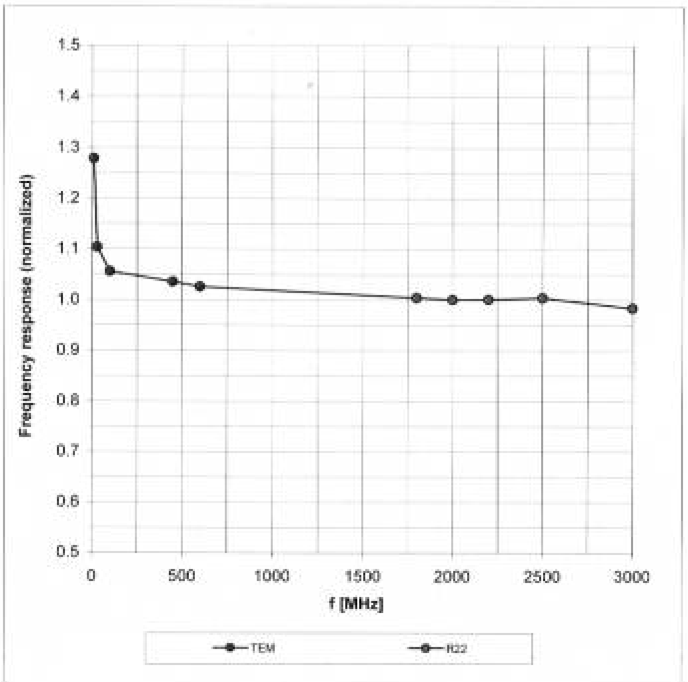
f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	56.7 ± 5%	0.94 ± 5%	10.62	10.62	10.62	0.02	1.00 ± 13.3%
750	± 50 / ± 100	55.5 ± 5%	0.96 ± 5%	10.14	10.14	10.14	0.59	0.72 ± 11.0%
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	10.33	10.33	10.33	0.20	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%

[C] 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.

EX3DV4 SN:3677 November 24, 2010

Frequency Response of E-Field

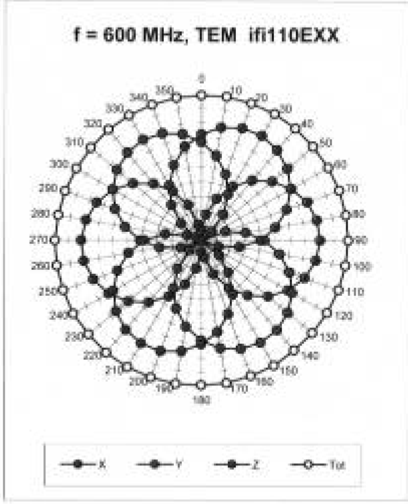
(TEM-Cell:ifi110 EXX, Waveguide: R22)

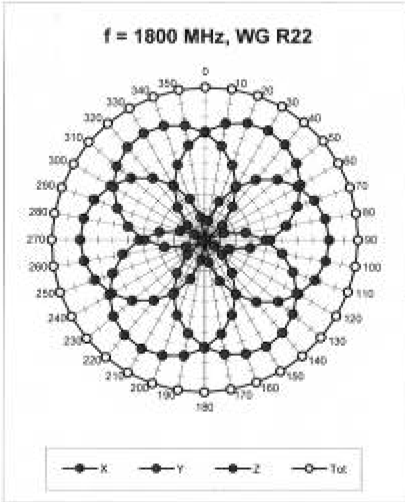


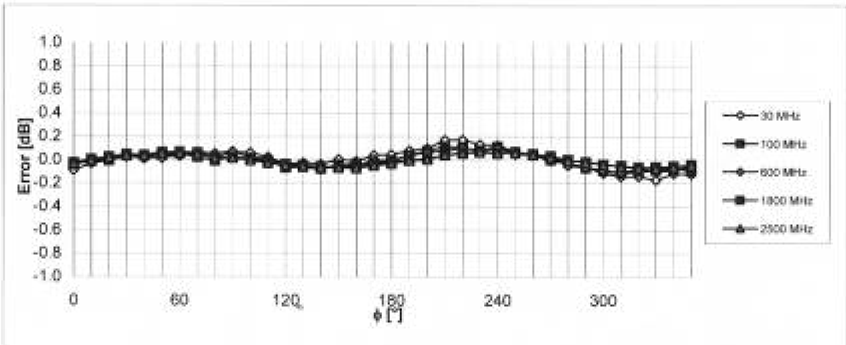
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

EX3DV4 SN:3677 November 24, 2010

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





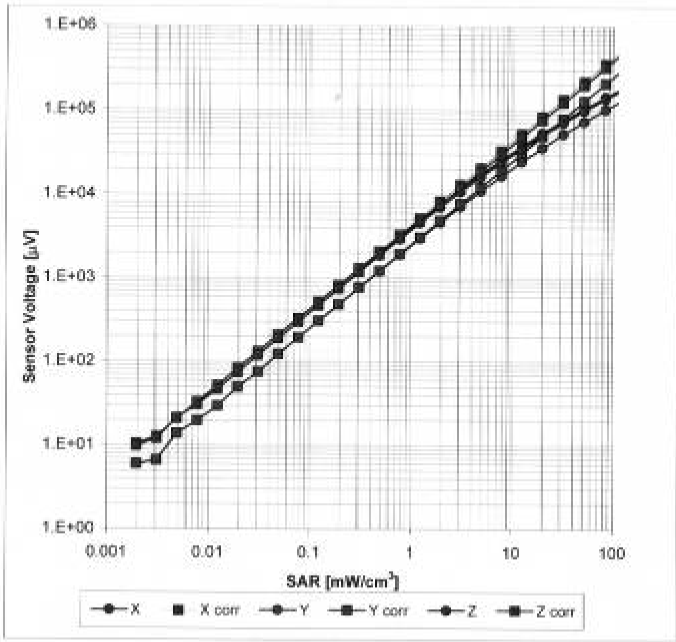


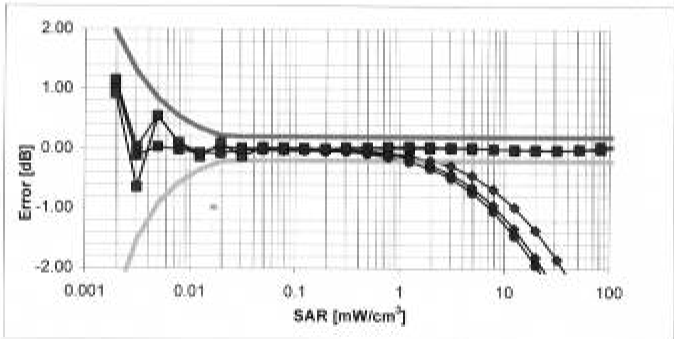
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

EX3DV4 SN:3677 November 24, 2010

Dynamic Range f(SAR_{head})

(TEM cell, f = 900 MHz)

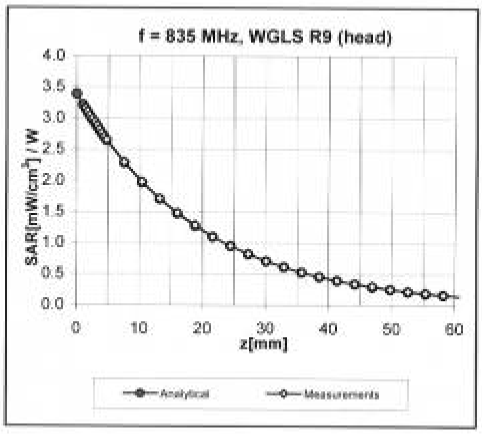


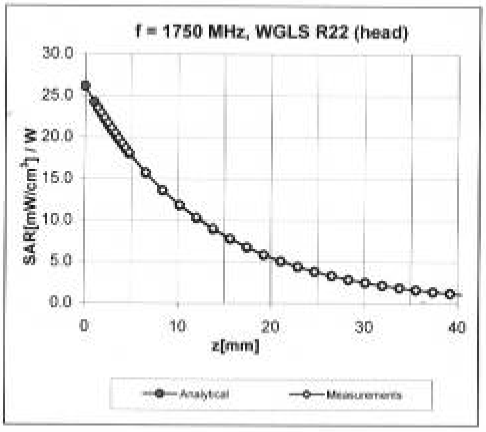


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

EX3DV4 SN:3677 November 24, 2010

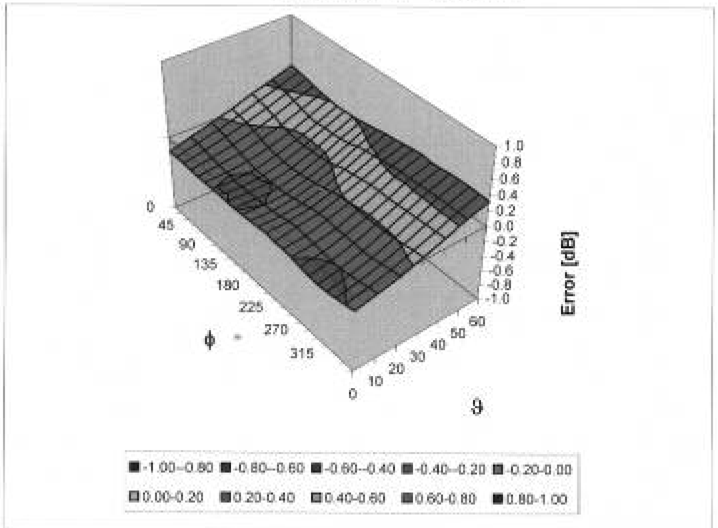
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

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

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
Servizio svizzero di taratura
S Swiss Calibration Service

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

Accreditation No.: **SCS 108**

Client **TA-Shanghai (Auden)**

Certificate No: **D2450V2-786_Aug11**

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 786

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

Calibration date: August 29, 2011

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: August 29, 2011

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

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

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.4 ± 6 %	1.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.7 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**53.8 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.41 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**25.4 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.8 ± 6 %	2.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**51.7 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.10 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**24.2 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.0 Ω + 2.4 jΩ
Return Loss	- 25.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.4 Ω + 3.5 jΩ
Return Loss	- 29.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.154 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	May 06, 2005

DASY5 Validation Report for Head TSL

Date: 29.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

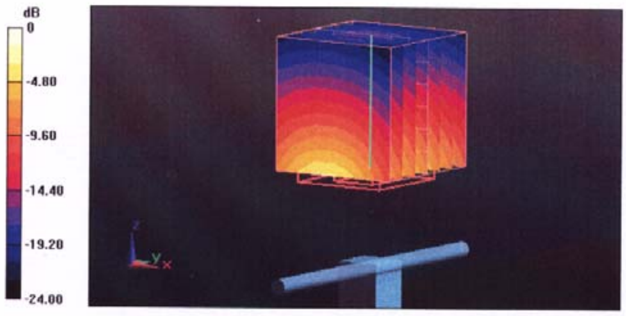
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.85 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

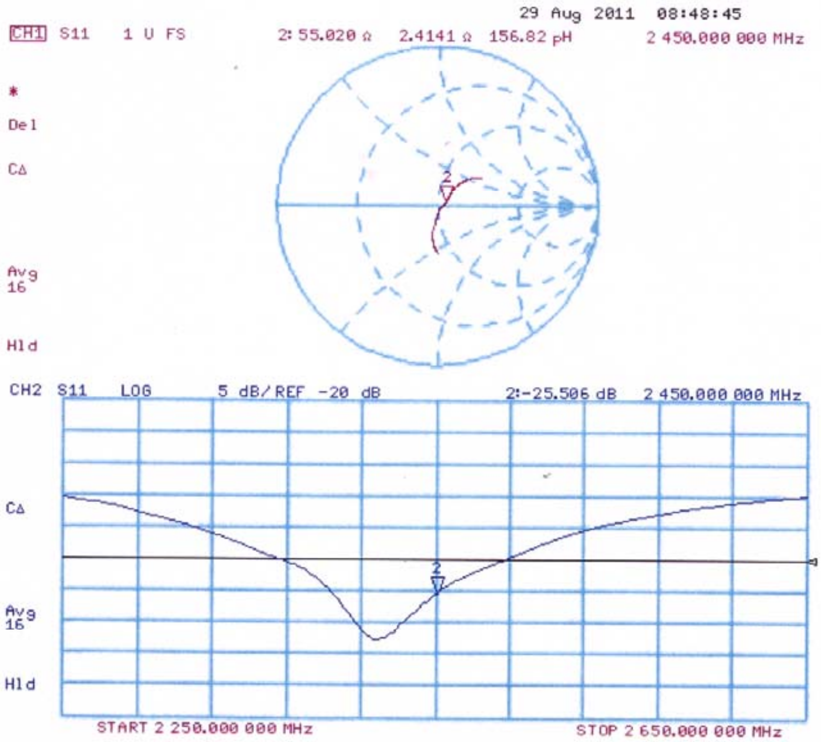
- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 101.5 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 28.303 W/kg
SAR(1 g) = 13.7 mW/g; SAR(10 g) = 6.41 mW/g
Maximum value of SAR (measured) = 17.561 mW/g



0 dB = 17.560mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 29.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786

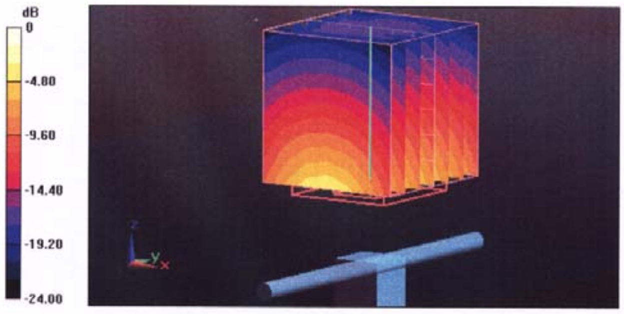
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 mho/m; ε_r = 51.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

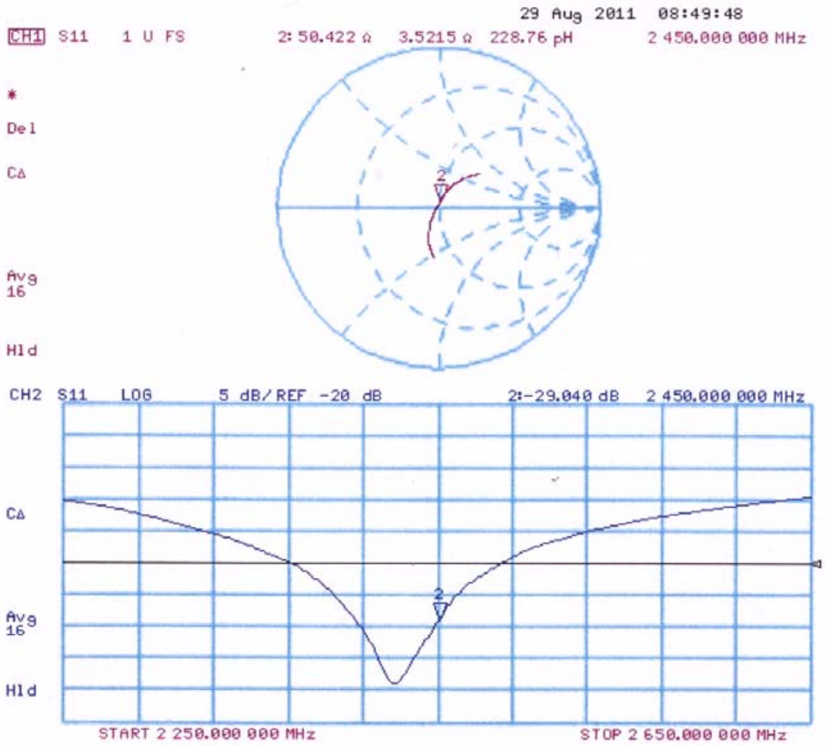
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.118 V/m; Power Drift = 0.0072 dB
Peak SAR (extrapolated) = 27.129 W/kg
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.1 mW/g
Maximum value of SAR (measured) = 17.387 mW/g



0 dB = 17.390mW/g

Impedance Measurement Plot for Body TSL



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: Auden

Certificate No: **DAE4-905_Jun11**

CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BK - SN: 905

Calibration procedure(s): QA CAL-06.v23
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: June 24, 2011

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
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	08-Jun-11 (in house check)	In house check: Jun-12

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Technician	
Approved by:	Fin Bomholt	R&D Director	i.V.

Issued: June 24, 2011

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

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
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.

DC Voltage Measurement

A/D - Converter Resolution nominal
High Range: 1LSB = 6.1μV , full range = -100...+300 mV
Low Range: 1LSB = 61nV , full range = -1.......+3mV
DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.723 ± 0.1% (k=2)	405.276 ± 0.1% (k=2)	404.851 ± 0.1% (k=2)
Low Range	3.97979 ± 0.7% (k=2)	4.00079 ± 0.7% (k=2)	3.99604 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	270.5 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	199999.3	-0.37	-0.00
Channel X	+ Input	20000.19	0.69	0.00
Channel X	- Input	-19996.51	2.99	-0.01
Channel Y	+ Input	199999.5	1.19	0.00
Channel Y	+ Input	19998.36	-1.14	-0.01
Channel Y	- Input	-19998.45	0.65	-0.00
Channel Z	+ Input	199996.8	-0.50	-0.00
Channel Z	+ Input	19998.70	-0.80	-0.00
Channel Z	- Input	-19998.46	0.84	-0.00

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2000.5	0.40	0.02
Channel X	+ Input	200.95	1.05	0.53
Channel X	- Input	-198.80	1.30	-0.65
Channel Y	+ Input	1999.8	0.03	0.00
Channel Y	+ Input	200.33	0.33	0.16
Channel Y	- Input	-199.66	0.24	-0.12
Channel Z	+ Input	1999.6	-0.40	-0.02
Channel Z	+ Input	200.48	0.58	0.29
Channel Z	- Input	-199.45	0.75	-0.37

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	9.95	8.16
	- 200	-7.20	-8.32
Channel Y	200	8.57	8.27
	- 200	-9.34	-9.57
Channel Z	200	2.10	1.81
	- 200	-2.85	-3.06

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	-	4.23	1.16
Channel Y	200	3.16	-	6.20
Channel Z	200	1.04	-1.10	-

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	15901	16812
Channel Y	16152	15842
Channel Z	16382	17155

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.02	-0.50	0.97	0.26
Channel Y	-0.92	-2.26	-0.45	0.25
Channel Z	-2.00	-3.19	-0.88	0.45

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

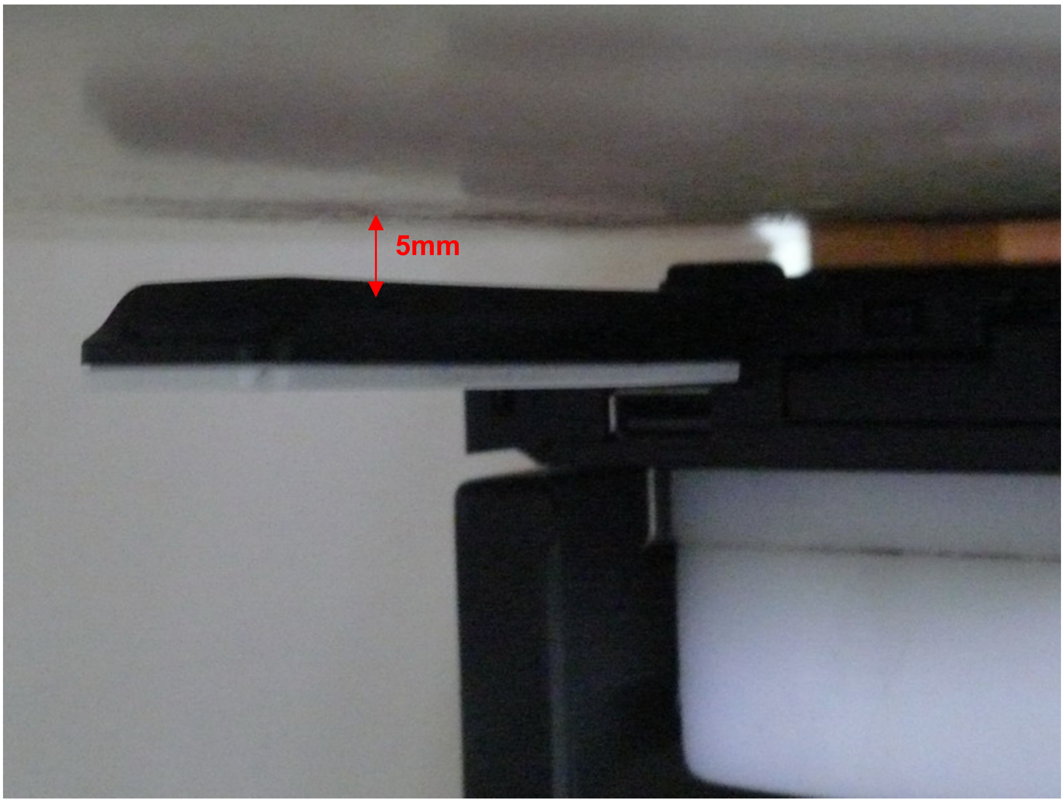
Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	−0.01	-8	-9

ANNEX G: The EUT Appearances and Test Configuration

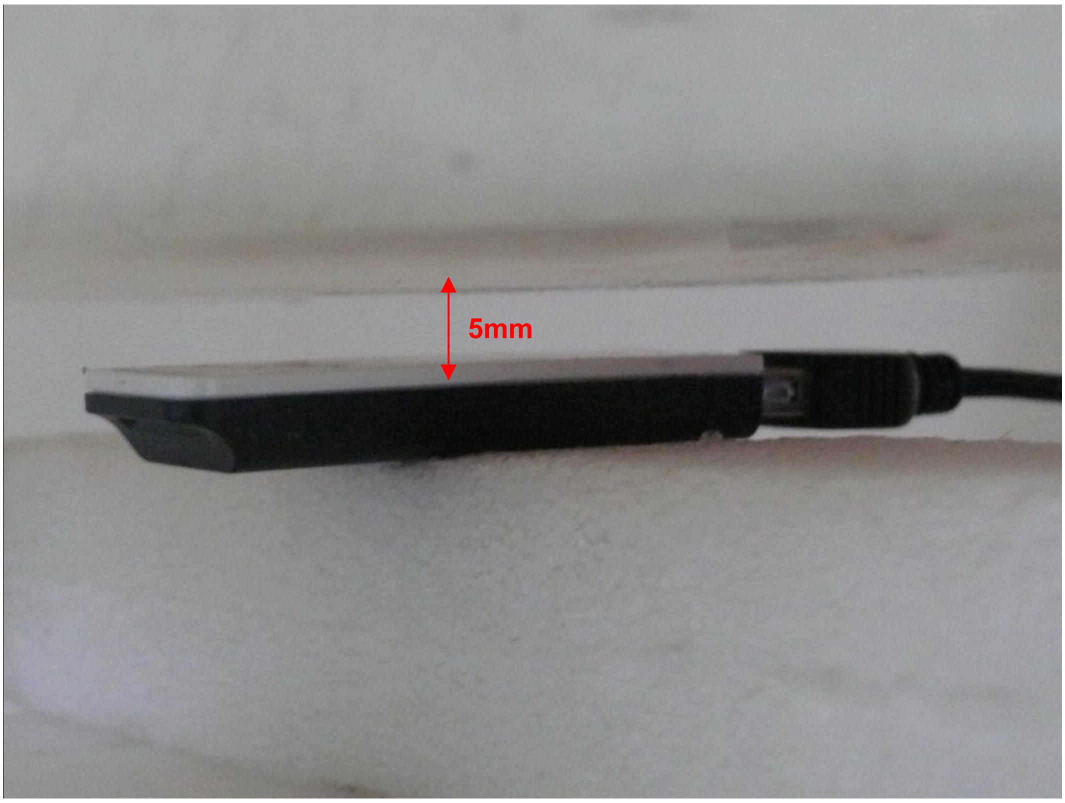
a: EUT Front

b: EUT Back

Picture 4: Constituents of the EUT

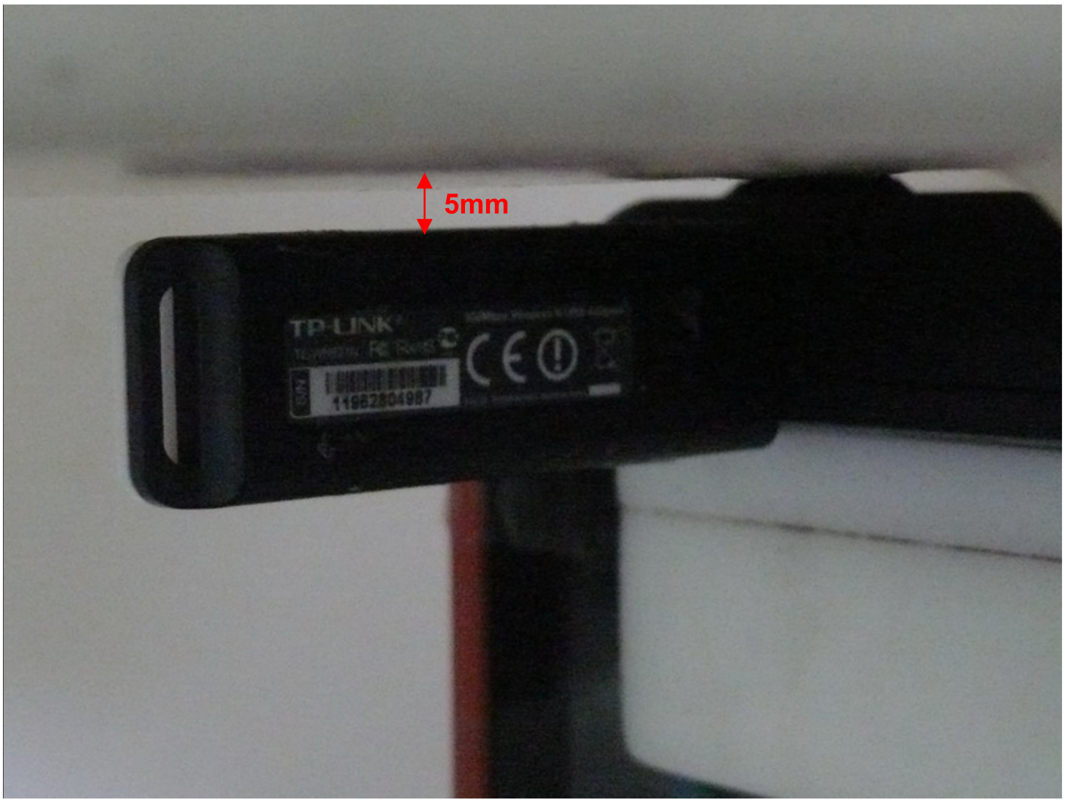


Picture 5: Test position 1



Picture 6: Test position 2

Picture 7: Test Position 3



Picture 8: Test Position 4