FCC SAR TEST REPORT

for

BYD Precision Manufacture Co., Ltd.

Tablet PC

Brand Name	Model No.
TOSHIBA	AT7-C

FCC ID : ZW9-PDA0M

Prepared for : BYD Precision Manufacture Co., Ltd.
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Report Number : ACS-SF14003
Date of Test : Apr.10, 2014
Date of Report : May.13, 2014

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SAR TEST REPORT

Applicant : BYD Precision Manufacture Co., Ltd.

Manufacturer : TOSHIBA CORPORATION

EUT Description : Tablet PC

FCC ID : ZW9-PDA0M

(A) MODEL NO.& BRAND NAME :

Brand Name	Model No.
TOSHIBA	AT7-C

(B) SERIAL NO. : N/A

(C) TEST VOLTAGE : DC 3.7V

Measurement Standard Used:

- FCC 47 CFR Part 2 (2.1093)
- IEEE C95.1-1999
- IEEE 1528-2003
- FCC OET Bulletin 65 Supplement C (Edition 01-01)
- FCC KDB 447498 D01 v05r01
- FCC KDB 248227 D01 v01r02
- FCC KDB 865664 D01
- FCC KDB 616217 D04
- FCC KDB 865664 D02
- FCC KDB 616217 D04 SAR for laptop and tablets v01 r01

The device described above is tested by Audix Technology (Shenzhen) Co., Ltd. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The test results are contained in this test report and Audix Technology (Shenzhen) Co., Ltd. is assumed full responsibility for the accuracy and completeness of test. This report contains data that are not covered by the NVLAP accreditation. Also, this report shows that the EUT is technically compliant with the OET 65 Supplement C.

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Date of Test : Apr.10, 2014 Report of date: May.13, 2014

Prepared by : Lisa Liang
Lisa Liang / Assistant

Reviewed by :
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信華科技（深圳）有限公司
Audix Technology (Shenzhen) Co., Ltd.
EMC 部門報告專用章
Stamp only for EMC Dept. Report
Signature: David Jin 5.13

Approved & Authorized Signer :
David Jin / Manager

1. GENERAL INFORMATION

1.1.Description of Device (EUT)

Product Name : Tablet PC

Model Number& Brand Name :

Brand Name	Model No.
TOSHIBA	AT7-C

Note: This device has two versions, one has rear camera and another one without.

FCC ID : SF14003

Radio : Bluetooth V3.0+EDR; IEEE 802.11b/g/n
Bluetooth V4.0

Operation Frequency : IEEE 802.11b: 2412MHz—2462MHz
IEEE 802.11g: 2412MHz—2462MHz
IEEE802.11nHT20: 2412MHz—2462MHz
IEEE802.11nHT40: 2422MHz—2452MHz
Bluetooth: 2402-2480MHz

Channel Number : IEEE 802.11b/g, IEEE 802.11n HT20: 11 Channels,
IEEE 802.11n HT40: 7 Channels
Bluetooth V3.0+EDR:79
Bluetooth V4.0: 40

Modulation Technology : IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)
IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11n HT20/ HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
Bluetooth V3.0+EDR: GFSK, π /4DQPSK, 8DPSK
Bluetooth V4.0: GFSK

Antenna Assembly Gain : IFA, 2.68dBi PK Gain

Applicant : BYD Precision Manufacture Co., Ltd.
No.3001, Baohe Road, Baolong Industrial, Longgang, Shenzhen, P. R., China

Manufacturer : TOSHIBA CORPORATION
1-1, Shibaura 1-Chome, Minato-ku, Tokyo, Japan

Power Adapter : Manufacturer: Meic Model No.: MN-A208-L120

USB Cable : Shielded, Detachable, 900mm

Date of Test : Apr.10, 2014

Date of Receipt : Apr.01, 2014

Sample Type : Prototype production

2. GENERAL DESCRIPTION

2.1.Product Description For EUT

[None]

2.2.Applied Standards

The Specific Absorption Rate (SAR) testing specification, method and procedure for this device is in accordance with the following standards:

· FCC 47 CFR Part 2 (2.1093)
· IEEE C95.1-1999
· IEEE 1528-2003
· FCC OET Bulletin 65 Supplement C (Edition 01-01)
· FCC KDB 447498 D01 v05r01
· FCC KDB 248227 D01 v01r02
· FCC KDB 865664 D01
· FCC KDB 865664 D02
· FCC KDB 616217 D04 SAR for laptop and tablets v01 r01

2.3.Device Category and SAR Limits

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

2.4.Test Conditions

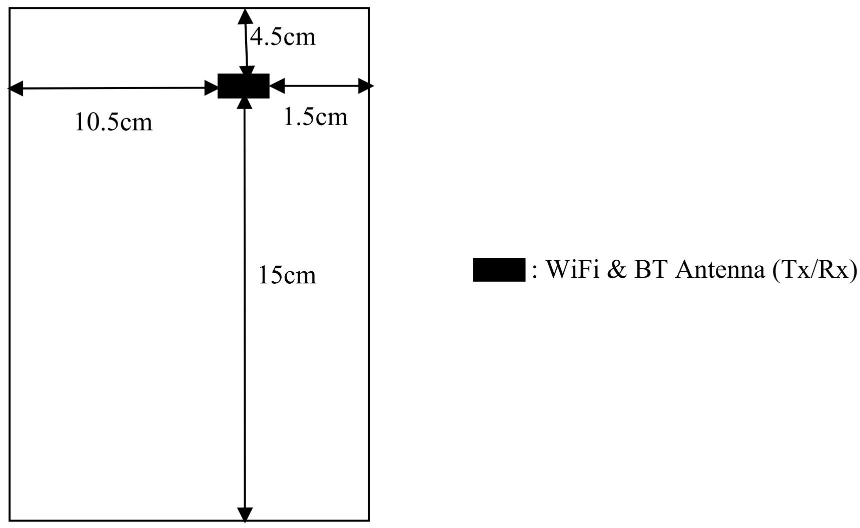
2.4.1. **Ambient Condition**

Ambient Temperature	20 to 24 ℃
Humidity	< 60 %

2.4.2. **Test Configuration**

The distance between the EUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30Db smaller than the output power of EUT. The EUT was set from the emulator to radiate maximum output power during all tests.

2.5.Exposure Positions Consideration



(Front View)

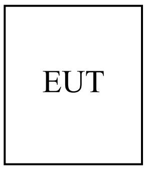
Antenna	Description
WiFi Antenna (Tx/Rx)	**802.11 /b/g/nHT20/nHT40**

Note:
1. The distance from the WLAN antenna to the back surface is 4mm.
2. The distance from the WLAN antenna to the Front surface is 6mm.
3. The length of the diagonal dimension of the EUT is larger than 20cm.

Sides for Body SAR tests Test distance: 0 mm						
Band	Back	Front	Top	Bottom	Right	Left
WLAN 2.4GHz	✓	X	✓	X	✓	X

Note:
1. **As the length of the diagonal dimension of the EUT is larger than 20cm. So, the front side can be excluded from SAR test.**
2. **The side which have a distance larger than 5cm from antenna can be excluded from SAR test.**

2.6.Block Diagram of connection between EUT and simulators



(EUT: Tablet PC)

2.7.Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal Date	Cal. Interval
1.	DASY5 SAR Test System	Speag	TX60 L speag	F09/5B1H1/01	July.12,13	1Year
2.	Wireless Communication Test Set	Agilent	E5515C	GB44300243	May.18, 13	1Year
3.	Power Meter	Anritsu	ML2487A	6K00002472	May.08, 13	1 Year
4.	Power Sensor	Anritsu	MA2491A	032516	May.08, 13	1 Year
5	Signal Generator	HP	83732B	VS34490501	May.08, 13	1 Year
6	Amplifier	Milmega	ZHL-42W	C620601316	NCR	N/A
7.	Dipole Validation Kits	Speag	D900V2	043	Mar.13,14	3Year
8.	Dipole Validation Kits	Speag	D1900V2	5d018	June.10,13	3Year
9.	Dipole Validation Kits	Speag	D2000V2	1023	June.11,13	3Year
10	Dipole Validation Kits	Speag	D2450V2	835	Mar.14,14	3Year
11	Dipole Validation Kits	Speag	D5GHzV2	1040	July.02,13	3Year
12.	Attenuator	Agilent	8491A 3dB	MY39262001	May.08, 13	1Year
13	Attenuator	Agilent	8491A 10dB	MY39264375	May.08, 13	1Year
14.	Data Acquisition Electronics	Speag	DAE4	899	July.25,12	2Year
15.	E-Field Probe	Speag	ES3DV3	3139	July.25,12	2Year
16.	E-Field Probe	Speag	EX3DV4	3767	July.27,12	2Year
17	Network Analyzer	Agilent	E5071B	MY42403549	May.08.13	1Year

Note:

Dipole antenna calibration interval is 3 year, annual check result to be follow (Refer to KDB 865664, Dipole calibration):

2.8.Laboratory Environment

Temperature	Min:20℃,Max.25℃
Relative humidity	Min. = 30%, Max. = 70%
Note: Ambient noise is checked and found very low and in compliance with requirement of standards.	

2.9.Measurement Uncertainty

Test Item	Uncertainty
Uncertainty for SAR test	1g: 21.14
	10g: 20.64
Uncertainty for test site temperature and humidity	0.6℃

Source	Type	Uncertainly Value (%)	Probability Distribution	K	C1(1g)	C1(10g)	Standard uncertainty ul(%)1g	Standard uncertainty ul(%)10g	Degree of freedom Veff or Vi
Measurement system repetivity	A	0.5	N	1		1	0.5	0.5	9
Probe calibration	B	5.9	N	1	1	1	5.9	5.9	∞
Isotropy	B	4.7	R	√3	1	1	2.7	2.7	∞
Linearity	B	4.7	R	√3	1	1	2.7	2.7	∞
Probe modulation response	B	0	R	√3	1	1	0	0	∞
Detection limits	B	1.0	R	√3	1	1	0.6	0.6	∞
Boundary effect	B	1.9	R	√3	1	1	1.1	1.1	∞
Readout electronics	B	1.0	N	1	1	1	1.0	1.0	∞
Response time	B	0	R	√3	1	1	0	0	∞
Integration time	B	4.32	R	√3	1	1	2.5	2.5	∞
RF ambient conditions – noise	B	0	R	√3	1	1	0	0	∞
RF ambient conditions – reflections	B	3	R	√3	1	1	1.73	1.73	∞
Probe positioner mech. restrictions	B	0.4	R	√3	1	1	0.2	0.2	∞
Probe positioning with respect to phantom shell	B	2.9	R	√3	1	1	1.7	1.7	∞
Post-processing	B	0	R	√3	1	1	0	0	∞
Test sample related									
Device holder uncertainty	A	2.94	N	1	1	1	2.94	2.94	M-1
Test sample positioning	A	4.1	N	1	1	1	4.1	4.1	M-1
Power scaling	B	5.0	R	√3	1	1	2.9	2.9	∞
Drift of output power (measured SAR drift)	B	5.0	R	√3	1	1	2.9	2.9	∞
Phantom and set-up									
Phantom uncertainty (shape and thickness tolerances)	B	4.0	R	√3	1	1	2.3	2.1	∞
Algorithm for correcting SAR for deviations in permittivity and conductivity	B	1.9	N	1	1	0,84	1,9	1,6	∞
Liquid conductivity (meas.)	A	0.55	N	1	0.78	0.71	0.24	0.21	M-1
Liquid permittivity (meas.)	A	0.19	N	1	0.23	0.26	0.09	0.06	M
Liquid permittivity – temperature uncertainty	A	5.0	R	√3	0,78	0,71	1.4	1.1	∞
Liquid conductivity – temperature uncertainty	A	5.0	R	√3	0.23	0,26	1.2	0.8	∞
Combined standard uncertainty	$u_c' = \sqrt{\sum_{i=1}^{23} c_i^2 u_i^2}$						**10.57**	**10.32**	
Expanded uncertainty (95 % conf. interval)	$u_e = 2u_c$		N	K=2			**21.14**	**20.64**	

2.10. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for the product Tablet PC (M/N: AT7-C) are as below:

Max. Reported SAR (1g)

Band	Position	Measured SAR	Scaled SAR
		SAR_{1g} (W/kg)	SAR_{1g} (W/kg)
WIFI 2.4GHz	Body	0.636	0.708

The SAR values found for this device are below the maximum recommended levels of 1.6 W/Kg as averaged over any 1g tissue according to the ANSI C95.1-1999.

For body worn operation, this device has been tested and meets FCC RF exposure guidelines when used with any accessory that contains no metal and which provides a minimum separation distance of 0 mm between this device and the body of the user. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

3. MEASURE PROCEDURES

3.1.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 Radiofrequency 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. 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 channels1,6,11;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.

Mode	GHz	Channel	Turbo Channel	"Default Test Channels"	
				15.247	
				802.11b	802.11g
802.11b/g 2.4GHz	2.412	1#	1#	√	▽
	2.437	6	6	√	▽
	2.462	11#	11#	√	▽

Note:

√ = "default test channels"
* = possible 802.11a channels with maximum average output > the "default test channels"
∇ = possible 802.11g channels with maximum average output ¼ dB ≥ the "default test channels"
= when output power is reduced for channel 1 and/or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested

3.2. Position of module in Portable devices

SAR is required for Front, back, edge, Top and bottom with the most conservative exposure conditions, The EUT is tested at the following test positions:

WiFi 2.4GHz:

(1) Test Position Back Side: The Back Side of the EUT towards and directed tightly to touch the flat phantom.
(2) Test Position Top Side: The Top Side of the EUT towards and directed tightly to touch the flat phantom.
(3) Test Position Right Side: The Right Side of the EUT towards and directed tightly to touch the flat phantom.

4. SAR MEASUREMENTS SYSTEM

4.1.SAR Measurement Set-up

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

(1) A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
(2) A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage It issue simulating liquid. The probe is equipped with an optical surface detector system.
(3) 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.
(4) A unit to operate the optical surface detector which is connected to the EOC.
(5) The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
(6) The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003.
(7) DASY5 software and SEMCAD data evaluation software.
(8) Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
(9) The generic twin phantom enabling the testing of left-hand and right-hand usage.
(10) The device holder for handheld mobile phones.
(11) Tissue simulating liquid mixed according to the given recipes.
(12) System validation dipoles allowing to validate the proper functioning of the system.

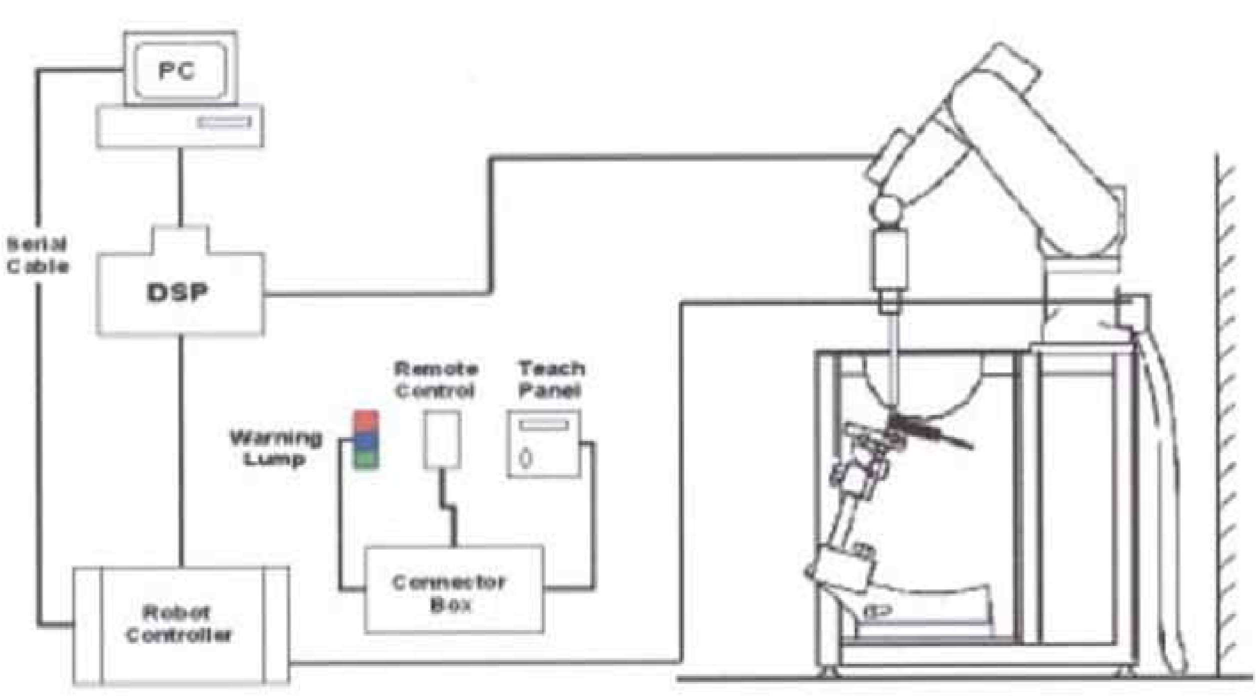


Figure 4.1 SAR Lab Test Measurement Set-up

4.2. ELI Phantom

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.

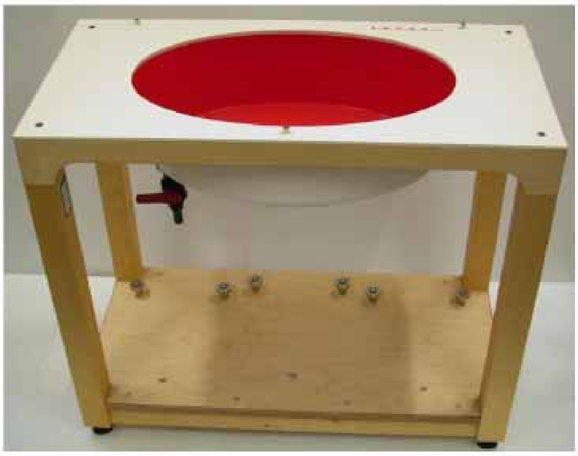


Figure 4.2 Top View of Twin Phantom

Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
Shell Thickness	2.0 ± 0.2 mm (bottom plate)
Dimensions	Major axis: 600 mm Minor axis: 400 mm
Filling Volume	approx. 30 liters
Wooden Support	SPEAG standard phantom table

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters.

On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

The phantom can be used with the following tissue simulating liquids:

*Water-sugar based liquid
*Glycol based liquids

4.3.Device Holder for SAM Twin Phantom

The SAR in the Phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source in 5 mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ± 20%. An accurate device position is therefore crucial for accurate and repeatable measurement. The position in which the devices must be measured, are defined by the standards.

The DASY5 device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (EPR).

Thus the device needs no repositioning when changing the angles.

The DASY5 device holder has been r $\varepsilon_r$le out of low-loss POδI material having the following dielectric parameters: relative permittivity =3 and loss tangent = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

Figure 4.3 Device Holder

4.4.DASY5 E-field Probe System

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

Figu e

4.4.1. EX3DV4 Probe Specification

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to > 6 GHz Linearity: ± 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: PRS-T2 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%.

4.5.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).

4.6.Scanning procedure

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

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

The ”surface check“ measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles.

The difference between the optical surface detection and the actual surface depends on the Probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing of 15 mm x 15 mm is set. During the scan the distance of the probe to the phantom remains unchanged.

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

Zoom Scan

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

Spatial Peak Detection

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

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

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

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

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

5. DATA STORAGE AND EVALUATION

5.1.Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for thedata 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.

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, ai0, ai1, ai2
	- Conversion factor	ConvFi
	- Diode compression point	Dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	
	- Density	

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

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

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:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

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

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

cf = crest factor of exciting field (DASY parameter)

dcpi = diode compression point (DASY parameter)

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

E-field probes: ***Ei = (Vi / Normi · ConvF)1/2***

H-field probes: ***Hi = (Vi)1/2 · (ai0 + ai1 f + ai2f2) / f***

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

Normi = sensor sensitivity of channel i (i = x, y, z)

ConvF = sensitivity enhancement in solution

aij = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

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

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

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

Etot = (Ex2+ EY2+ Ez2)1/2

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

SAR = (Etot2·) / (· 1000)

with

SAR = local specific absorption rate in mW/g

Etot = total field strength in V/m

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

= equivalent tissue density in g/cm3

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.

Ppwe = *Etot2 / 3770* or ***Ppwe = Htot2 · 37.7***

with ***Ppwe*** = equivalent power density of a plane wave in mW/cm2

Etot = total electric field strength in V/m

Htot = total magnetic field strength in A/m

6. SYSTEM CHECK

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulates 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 simulates, 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 ANNEX A.

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 DASY5 system.

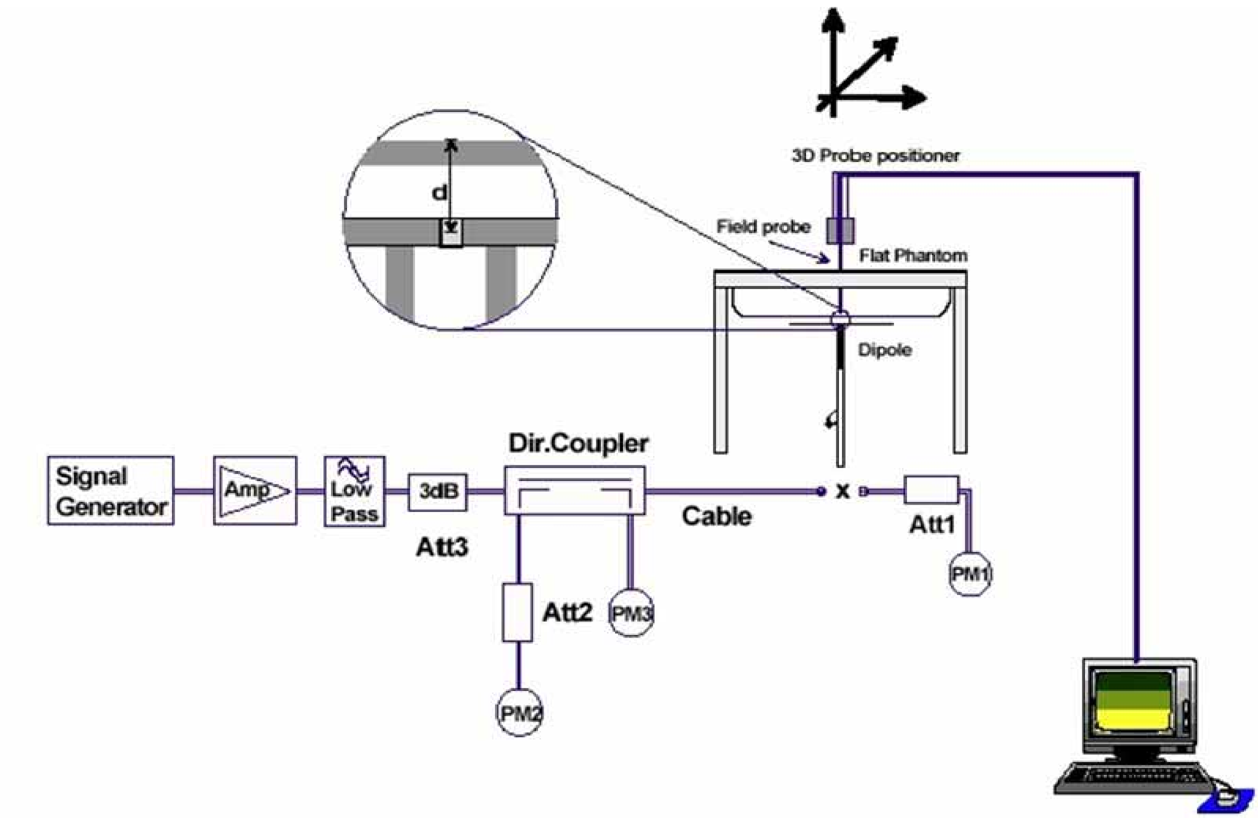


Figure 6.1: System Check Set-up

7. TEST RESULTS

7.1.Exposure to Radio Frequency Energy

ATT-C contains radio transmitters and receivers. When on, ATT-C sends and receives radio frequency (RF) energy through its antenna. The WLAN and Bluetooth® antenna is located 11 in back view of "Get to know your ATT-C". ATT-C has been tested and meets the SAR exposure requirements for WLAN and Bluetooth operation. ATT-C is designed and manufactured to comply with the limits for exposure to RF energy set by the Federal Communications Commission (FCC) of the United State. The exposure standard employs a unit of measurement known as the specific absorption rate, or SAR. The SAR limit applicable to ATT-C set by the FCC is 1.6 watts per kilogram (W/kg). Tests for SAR are conducted using standard operating positions specified by these agencies, with ATT-C transmitting at its highest certified power level in all tested frequency bands. Although SAR is determined at the highest certified power level in each frequency band, the actual SAR level of ATT-C while in operation can be well below the maximum value because ATT-C adjusts its WLAN transmitting power based in part on orientation and proximity to the wireless network. In general, the closer you are to a WLAN Router, the lower the WLAN transmitting power level. ATT-C has been tested, and meets the FCC RF exposure guidelines for WLAN and Bluetooth operation. When tested at direct body contact, ATT-C's maximum SAR value for each frequency band is outlined below:

7.2.Average power VS Data Rate(WIFI 2.4GHz & Bluetooth)

BT 2.1+EDR

Mode	CH (MHz)	Output power (dBm)
GFSK	2402	5.317
	2441	5.280
	2480	5.106
8-DPSK	2402	4.640
	2441	4.706
	2480	4.308

BT4.0

Mode	CH (MHz)	Output power (dBm)
GFSK	2402	8.678
	2440	8.365
	2480	7.624

Note: The power of the Bluetooth is less than the SAR exclusion thresholds limit, so the SAR measurement for Bluetooth can be excluded.

WiFi 2.4GHz

Mode	Rate	CH	Peak power (dBm)	AV Power (dBm)
11b	1Mbps	CH1	17.78	14.70
		CH6	17.86	14.89
		CH11	17.51	14.54
11g	6 Mbps	CH1	22.57	13.49
		CH6	21.51	13.71
		CH11	21.05	13.37
11nHT20	6.5 Mbps	CH1	19.93	12.26
		CH6	20.73	12.90
		CH11	20.49	12.70
11nHT40	13 Mbps	CH1	20.94	12.79
		CH4	20.27	12.26
		CH7	20.06	12.14
Note: SAR test was conducted at the data rate which has maximum output level.				

Note1 :Those data rate has the maximum power output.
Note2 : Per KDB 248227, 11g/n output power is less than 1/4 dB higher than 11b mode, thus the SAR can be excluded.
Note3: The WIFI and Bluetooth can not transmit simultaneously.

7.3.System Check for Body Tissue simulating liquid

Frequency	Description	SAR(W/kg)		Dielectric Parameters		Temp
		1g	10g	εr	σ(s/m)	℃
2450MHz	Recommended value ±10% window	12.8 11.52 — 14.08	5.86 5.27 — 6.45	52.7	1.95	/
	Measurement value 2014-04-10	12.836	5.574	55.954	1.958	20.05

Note: Recommended Values used derive from the calibration certificate and 250 mW is used as feeding power to the calibrated dipole.

7.4.Test Results (WiFi IEEE802.11b 2.4GHz)

Test Position	CH	Output Power		Measured Results		Scaled		Power Drift (dBm)
		Max. Target AV Power (dBm)	Measured AV Power (dBm)	SAR1g (W/kg)	SAR10g (W/kg)	SAR1g (W/kg)	SAR10g (W/kg)	
CH1	Back	15	14.70	0.527	0.224	0.565	0.240	-0.18
	Top	15	14.70	0.042	0.019	0.045	0.020	0.05
	Right	15	14.70	0.222	0.094	0.238	0.101	-0.15
CH6	Back	15	14.89	0.650	0.261	0.667	0.268	-0.18
	Top	15	14.89	0.049	0.022	0.050	0.023	0.04
	Right	15	14.89	0.217	0.093	0.223	0.095	0.16
CH11	Back	15	14.54	0.636	0.252	0.708	0.280	-0.13
	Top	15	14.54	0.051	0.023	0.057	0.026	0.19
	Right	15	14.54	0.220	0.094	0.245	0.105	0.14
Conclusion: PASS								

Note :
Factor= Max.Target AV Power/Measured Power
Scaled SAR= Measured SAR*Factor
The Max.Reported SAR : **0.708W/kg for 1g SAR**

7.5. Composition of Ingredients for Tissue Simulating Liquids

The following tissue formulations are provided for reference only as some of The parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue Parameters required for routine SAR evaluation.

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

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

Simulating Liquids for 5 GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	78
Mineral Oil	11
Emulsifiers	9
Additives and Salt	2

7.6.Dielectric Performance for Body Tissue simulating liquid

Frequency	Description	Dielectric Parameters		Temp
		εr	σ(s/m)	℃
2450MHz	Target value ±5% window	52.7 50.07-55.34	1.95 1.85-2.05	/
	Measurement value 2014-04-10	55.954	1.958	**20.05**

Figure 4.4: Liquid depth in the Flat Phantom

8. ANNEX A: SYSTEM CHECK RESULTS

Test Laboratory: Audix SAR Lab Date: 10/04/2014

CW_2450MHz

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:862

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: f = 2450 MHz; σ = 1.958 mho/m; ε_r = 55.954; ρ = 1000 kg/m^3

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4.16, 4.16, 4.16); Calibrated: 25/07/2012;
- Sensor-Surface: 4mm (Mechanical SurfaceDetection)
- Electronics: DAE4 Sn899; Calibrated: 07/02/2014
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/CW_2450/Area Scan (41x61x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 16.014 mW/g

Configuration/CW_2450/Zoom Scan (7x7x7)/Cube 0:

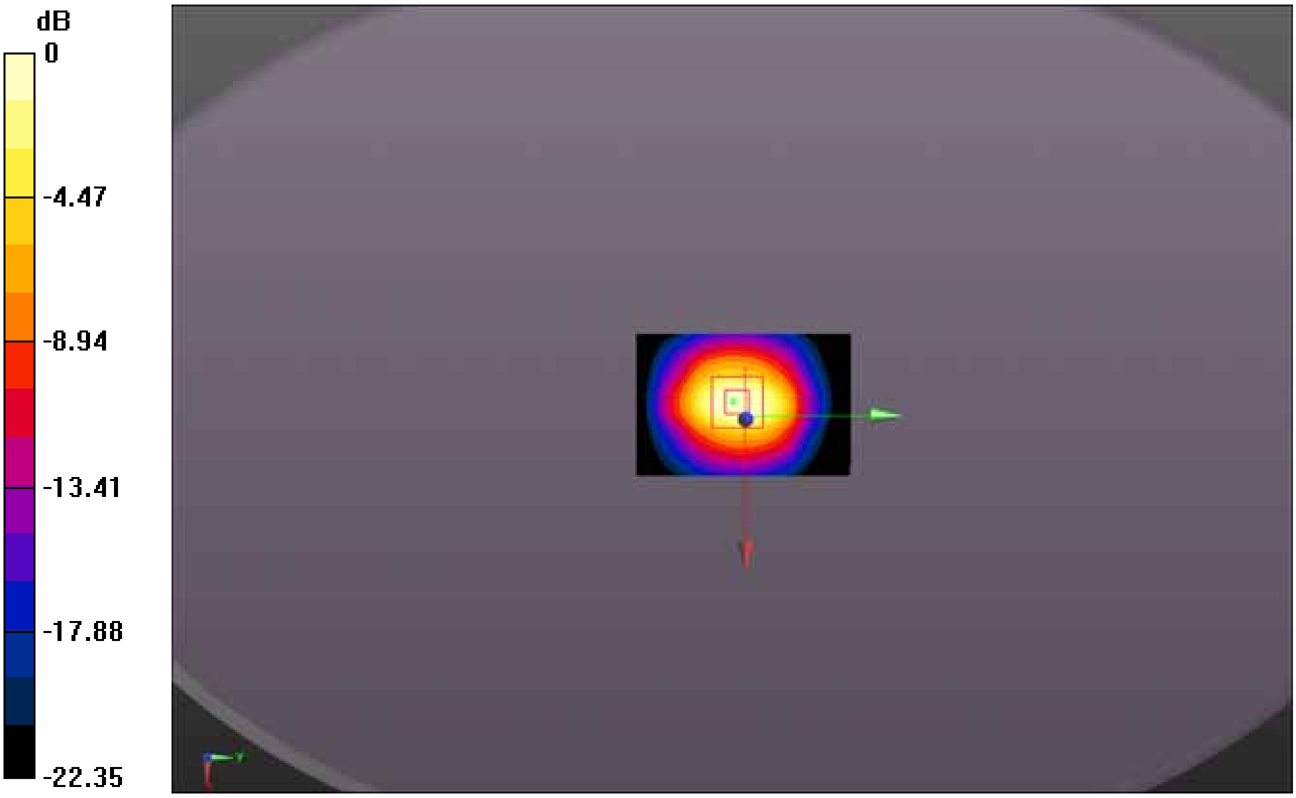
Measurement grid: dx=5mm, dy=5mm, dz=5mm

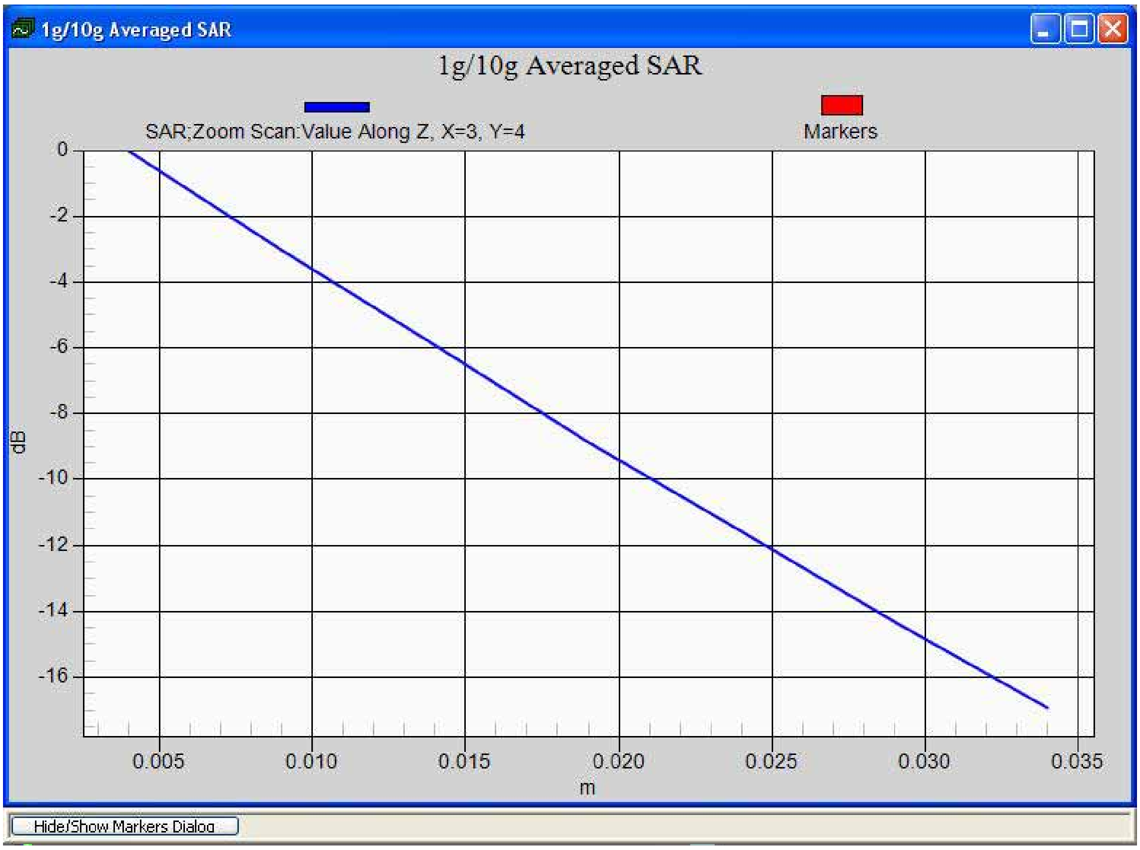
Reference Value = 85.011 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 25.689

SAR(1 g) = 12.836 mW/g; SAR(10 g) = 5.574 mW/g

Maximum value of SAR (measured) = 14.186 mW/g




1g/10g Averaged SAR
1g/10g Averaged SAR
SAR;Zoom Scan:Value Along Z, X=3, Y=4
Markers
dB
0
-2
-4
-6
-8
-10
-12
-14
-16
0.005
0.010
0.015
0.020
0.025
0.030
0.035
m
Hide/Show Markers Dialog

9. ANNEX B: GRAPH RESULTS

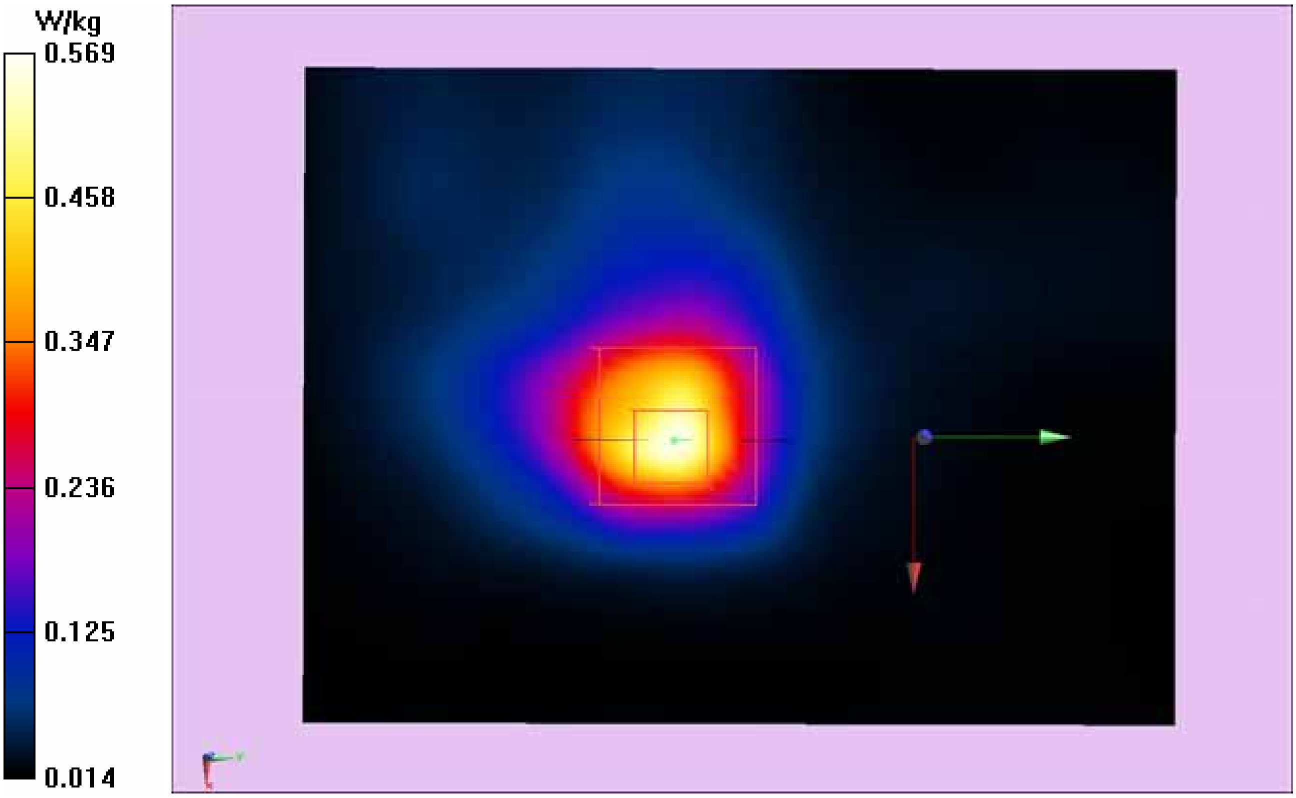
Test Laboratory: Audix SAR Lab Date: 10/04/2014

802.11b_CH1-Back(2412MHz)

DUT: Tablet PC **M/N:AT7-C**
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0); Frequency: 2412 MHz;Medium parameters used: f = 2412 MHz; σ = 2.011 S/m; ε_r = 50.951; ρ = 1000 kg/m^3 ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4.16, 4.16, 4.16); Calibrated: 25/07/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn899; Calibrated: 07/02/2014
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/802.11b_CH1-Back/Area Scan (61x81x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.569 W/kg
Configuration/802.11b_CH1-Back/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.390 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 1.49 W/kg
SAR(1 g) = 0.527 W/kg; SAR(10 g) = 0.224 W/kg
Maximum value of SAR (measured) = 0.608 W/kg



Test Laboratory: Audix SAR Lab Date: 10/04/2014

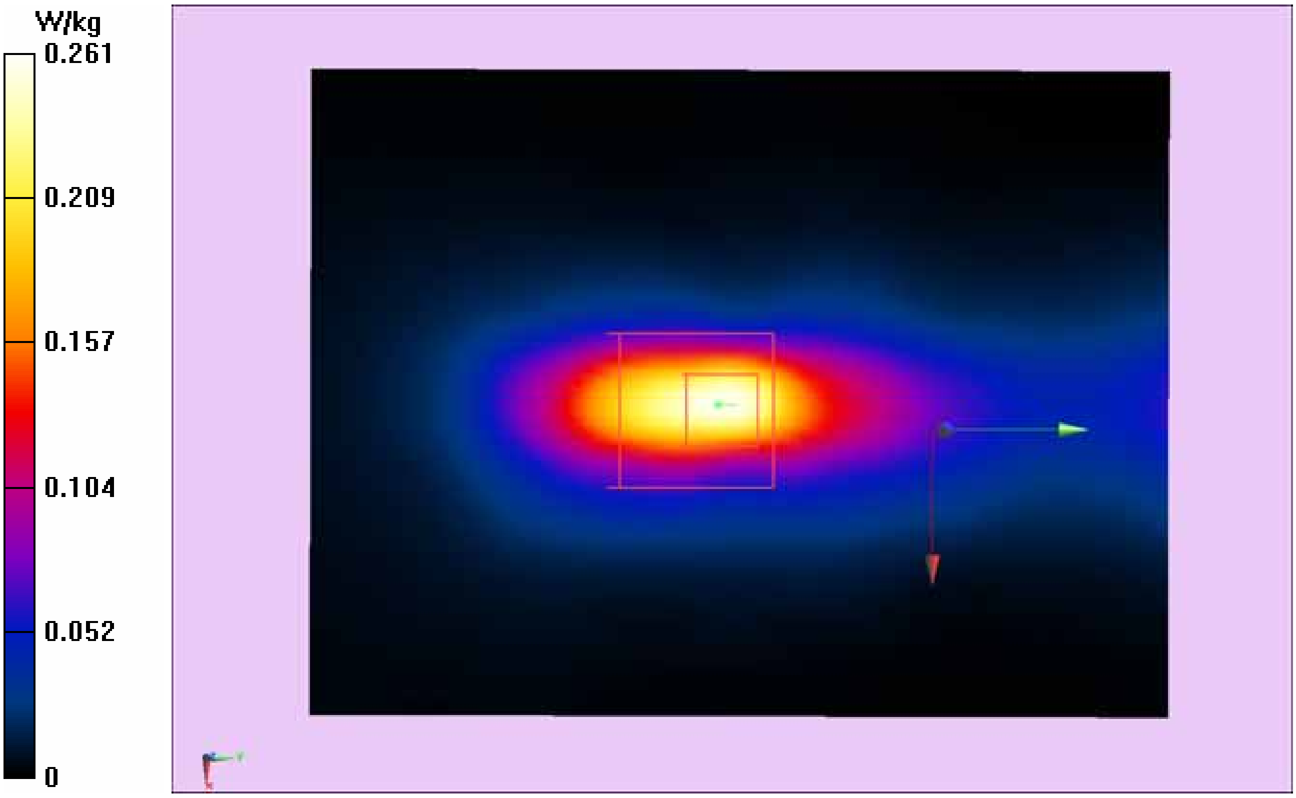
802.11b_CH1-Right(2412MHz)

DUT: Tablet PC **M/N:AT7-C**
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0); Frequency: 2412 MHz;Medium parameters used: f = 2412 MHz; σ = 2.011 S/m; ε_r = 50.951; ρ = 1000 kg/m^3 ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4.16, 4.16, 4.16); Calibrated: 25/07/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn899; Calibrated: 07/02/2014
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/802.11b_CH1-Right/Area Scan (61x81x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.261 W/kg

Configuration/802.11b_CH1-Right/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.405 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 0.591 W/kg
SAR(1 g) = 0.222 W/kg; SAR(10 g) = 0.094 W/kg
Maximum value of SAR (measured) = 0.263 W/kg



Test Laboratory: Audix SAR Lab Date: 10/04/2014

802.11b_CH1-Top(2412MHz)

DUT: Tablet PC **M/N:AT7-C**
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0); Frequency: 2412 MHz;Medium parameters used: f = 2412 MHz; σ = 2.011 S/m; ε_r = 50.951; ρ = 1000 kg/m^3 ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

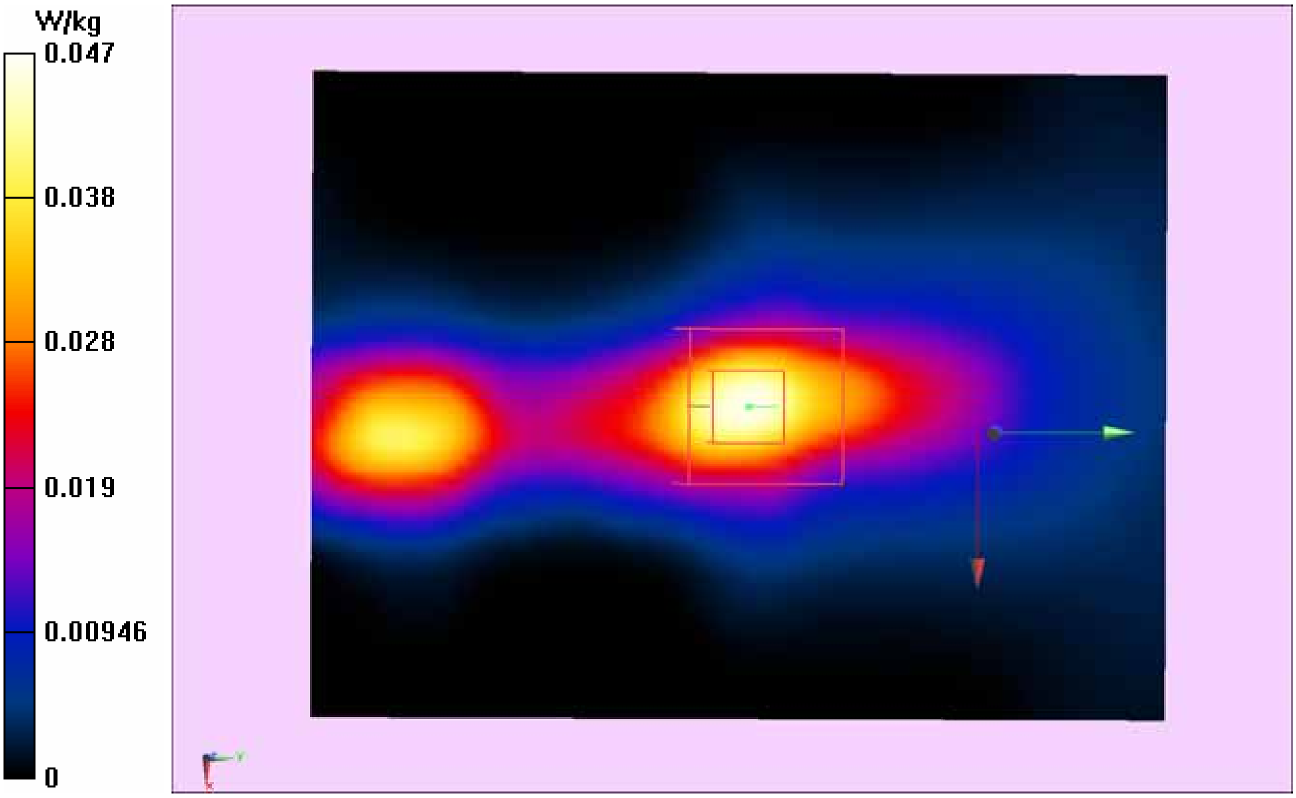
- Probe: ES3DV3 - SN3139; ConvF(4.16, 4.16, 4.16); Calibrated: 25/07/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn899; Calibrated: 07/02/2014
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/802.11b_CH1-Top/Area Scan (61x81x1):

Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.0473 W/kg

Configuration/802.11b_CH1-Top/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.283 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.0950 W/kg
SAR(1 g) = 0.042 W/kg; SAR(10 g) = 0.019 W/kg
Maximum value of SAR (measured) = 0.0483 W/kg



Test Laboratory: Audix SAR Lab Date: 10/04/2014

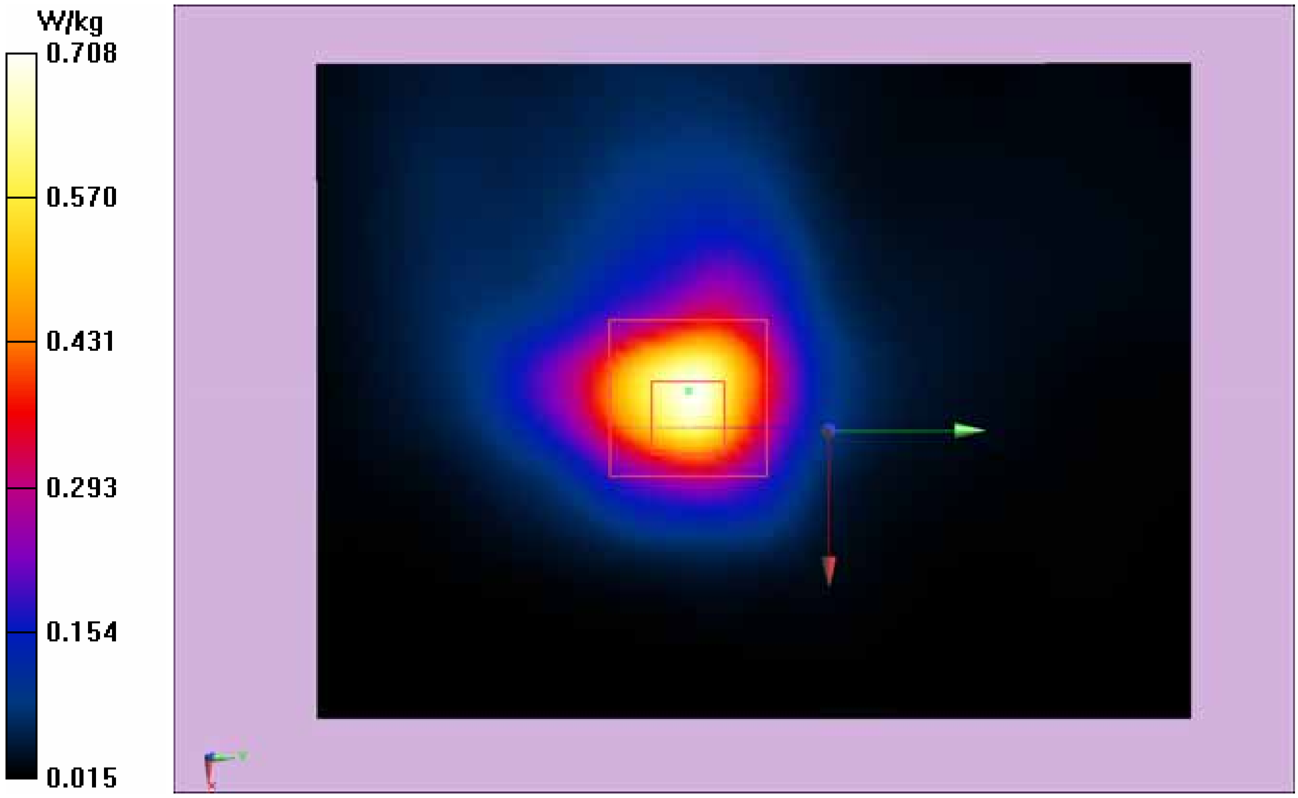
802.11b_CH6-Back(2437MHz)

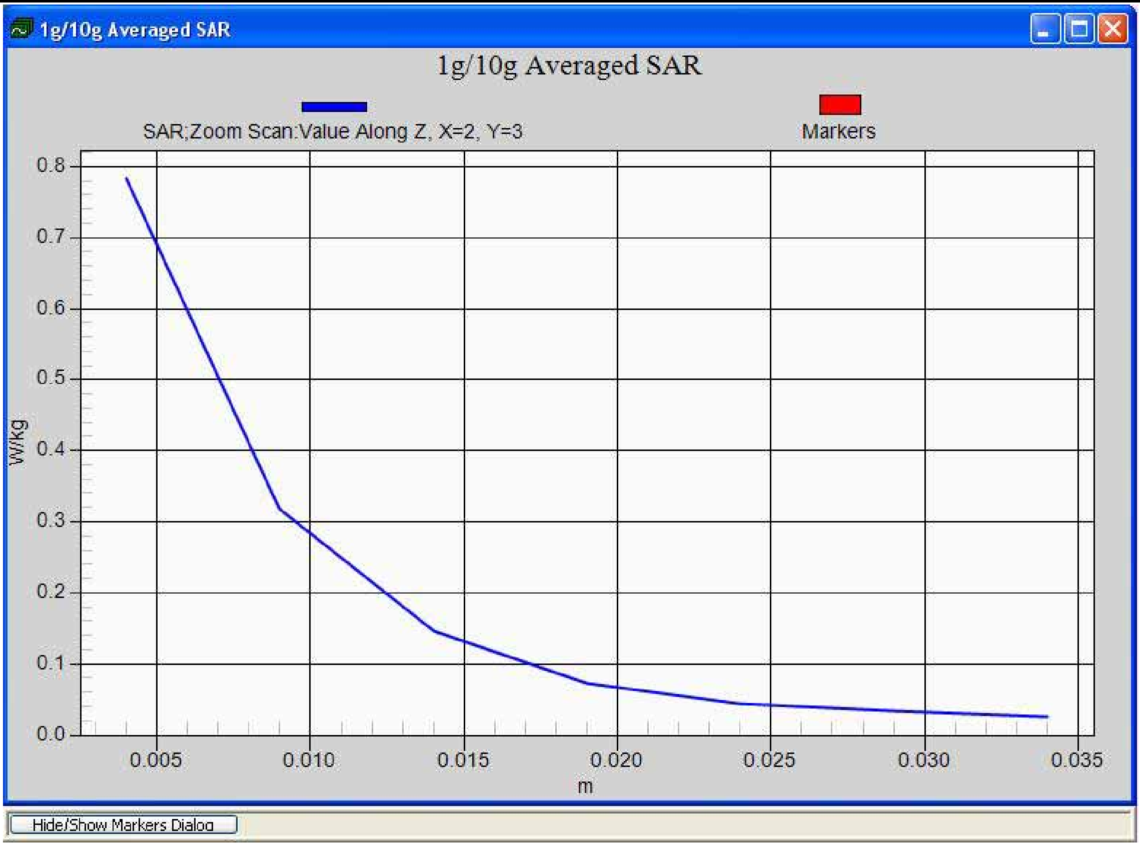
DUT: Tablet PC **M/N:AT7-C**
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0); Frequency: 2437 MHz;Medium parameters used (interpolated): f = 2437 MHz; σ = 2.034 S/m; ε_r = 50.912; ρ = 1000 kg/m^3 ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4.16, 4.16, 4.16); Calibrated: 25/07/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn899; Calibrated: 07/02/2014
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/802.11b_CH6-Back/Area Scan (61x81x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.708 W/kg

Configuration/802.11b_CH6-Back/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.360 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 1.99 W/kg
SAR(1 g) = 0.650 W/kg; SAR(10 g) = 0.261 W/kg
Maximum value of SAR (measured) = 0.784 W/kg




1g/10g Averaged SAR
1g/10g Averaged SAR
SAR;Zoom Scan:Value Along Z, X=2, Y=3
Markers
W/kg
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.005
0.010
0.015
0.020
0.025
0.030
0.035
m
Hide/Show Markers Dialog

Test Laboratory: Audix SAR Lab Date: 10/04/2014

802.11b_CH6-Right(2437MHz)

DUT: Tablet PC **M/N:AT7-C**

Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0); Frequency: 2437 MHz;Medium parameters used (interpolated): f = 2437 MHz; σ = 2.034 S/m; ε_r = 50.912; ρ = 1000 kg/m^3 ;Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4.16, 4.16, 4.16); Calibrated: 25/07/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn899; Calibrated: 07/02/2014
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/802.11b_CH6-Right/Area Scan (61x81x1):

Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.259 W/kg

Configuration/802.11b_CH6-Right/Zoom Scan (7x7x7)/Cube 0:

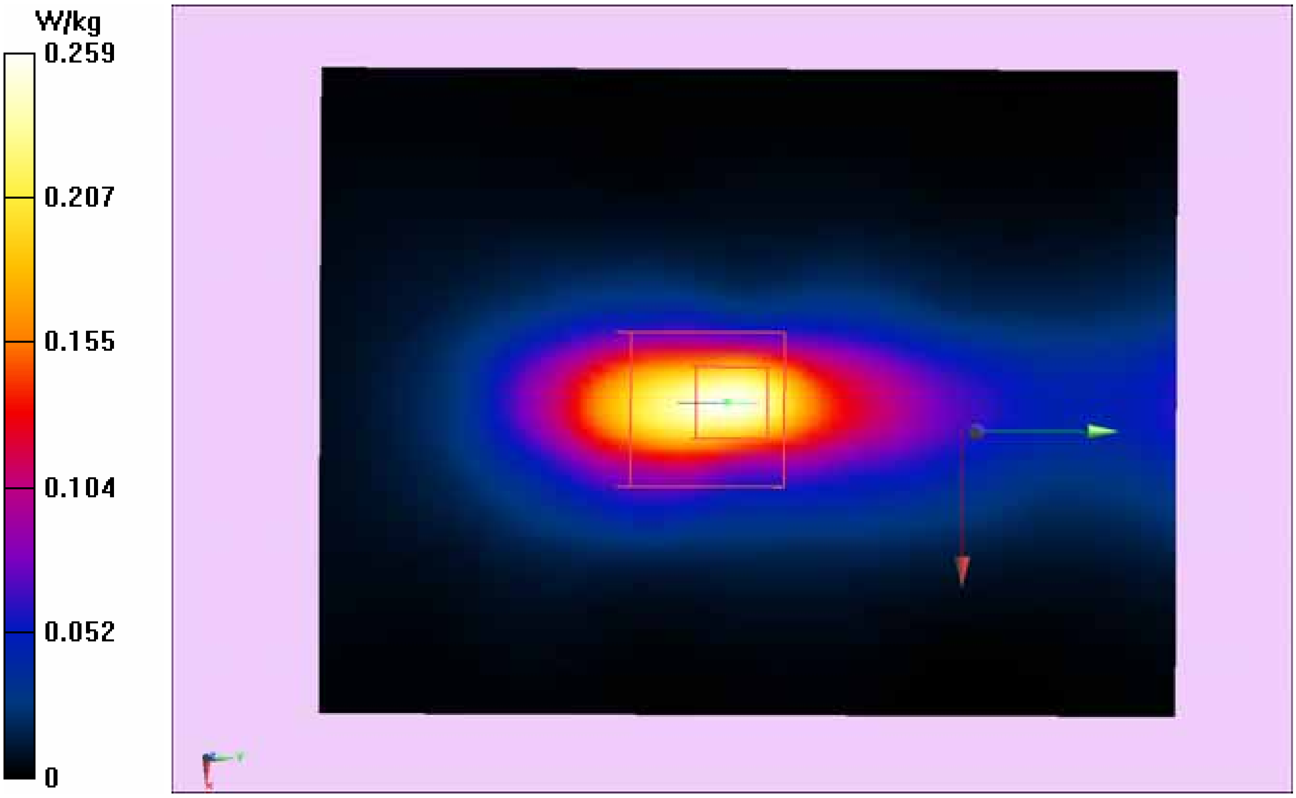
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.914 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 0.556 W/kg

SAR(1 g) = 0.217 W/kg; SAR(10 g) = 0.093 W/kg

Maximum value of SAR (measured) = 0.264 W/kg



Test Laboratory: Audix SAR Lab Date: 10/04/2014

802.11b_CH6-Top(2437MHz)

DUT: Tablet PC **M/N:AT7-C**
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0); Frequency: 2437 MHz;Medium parameters used (interpolated): f = 2437 MHz; σ = 2.034 S/m; ε_r = 50.912; ρ = 1000 kg/m^3 ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

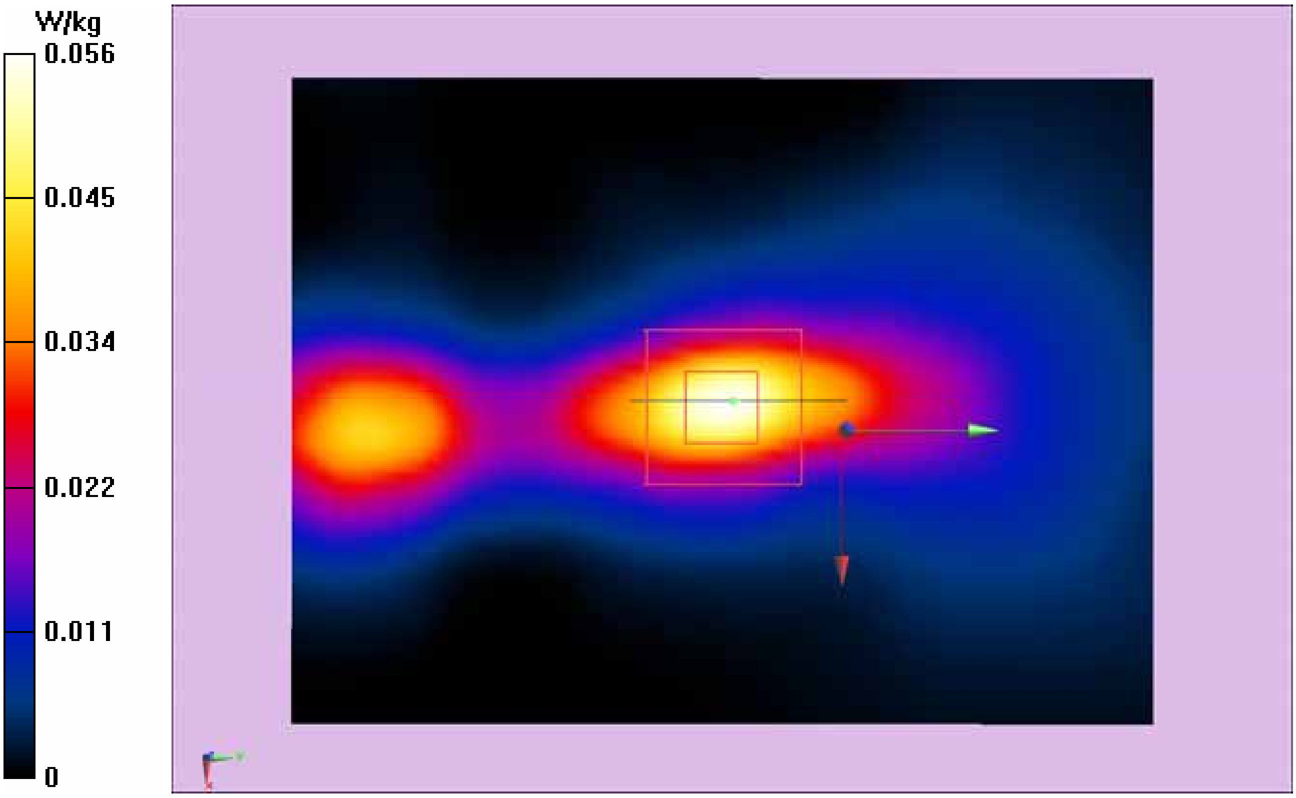
- Probe: ES3DV3 - SN3139; ConvF(4.16, 4.16, 4.16); Calibrated: 25/07/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn899; Calibrated: 07/02/2014
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/802.11b_CH6-Top/Area Scan (61x81x1):

Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.0559 W/kg

Configuration/802.11b_CH6-Top/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.454 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.106 W/kg
SAR(1 g) = 0.049 W/kg; SAR(10 g) = 0.022 W/kg
Maximum value of SAR (measured) = 0.0551 W/kg



Test Laboratory: Audix SAR Lab Date: 10/04/2014

802.11b_CH11-Back(2462MHz)

DUT: Tablet PC **M/N:AT7-C**
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0); Frequency: 2462 MHz;Medium parameters used: f = 2462 MHz; $\sigma = 2.06$ S/m; $\varepsilon_r = 50.855$; $\rho = 1000$ kg/m^3 ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

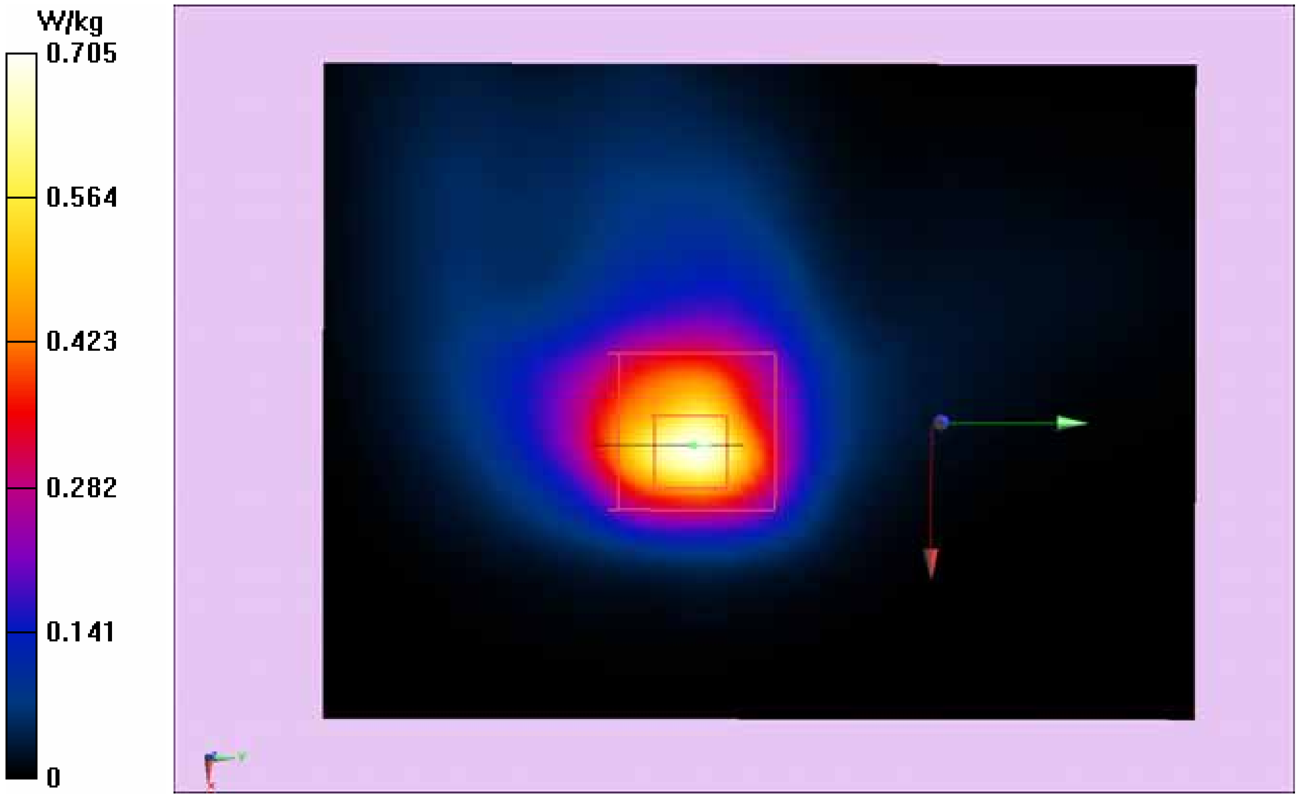
- Probe: ES3DV3 - SN3139; ConvF(4.16, 4.16, 4.16); Calibrated: 25/07/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn899; Calibrated: 07/02/2014
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/802.11b_CH11-Back/Area Scan (61x81x1):

Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.705 W/kg

Configuration/802.11b_CH11-Back/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.817 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 1.84 W/kg
SAR(1 g) = 0.636 W/kg; SAR(10 g) = 0.252 W/kg
Maximum value of SAR (measured) = 0.765 W/kg



Test Laboratory: Audix SAR Lab Date: 10/04/2014

802.11b_CH11-Right(2462MHz)

DUT: Tablet PC **M/N:AT7-C**
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0); Frequency: 2462 MHz;Medium parameters used: f = 2462 MHz; σ = 2.06 S/m; ε_r = 50.855; ρ = 1000 kg/m^3 ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

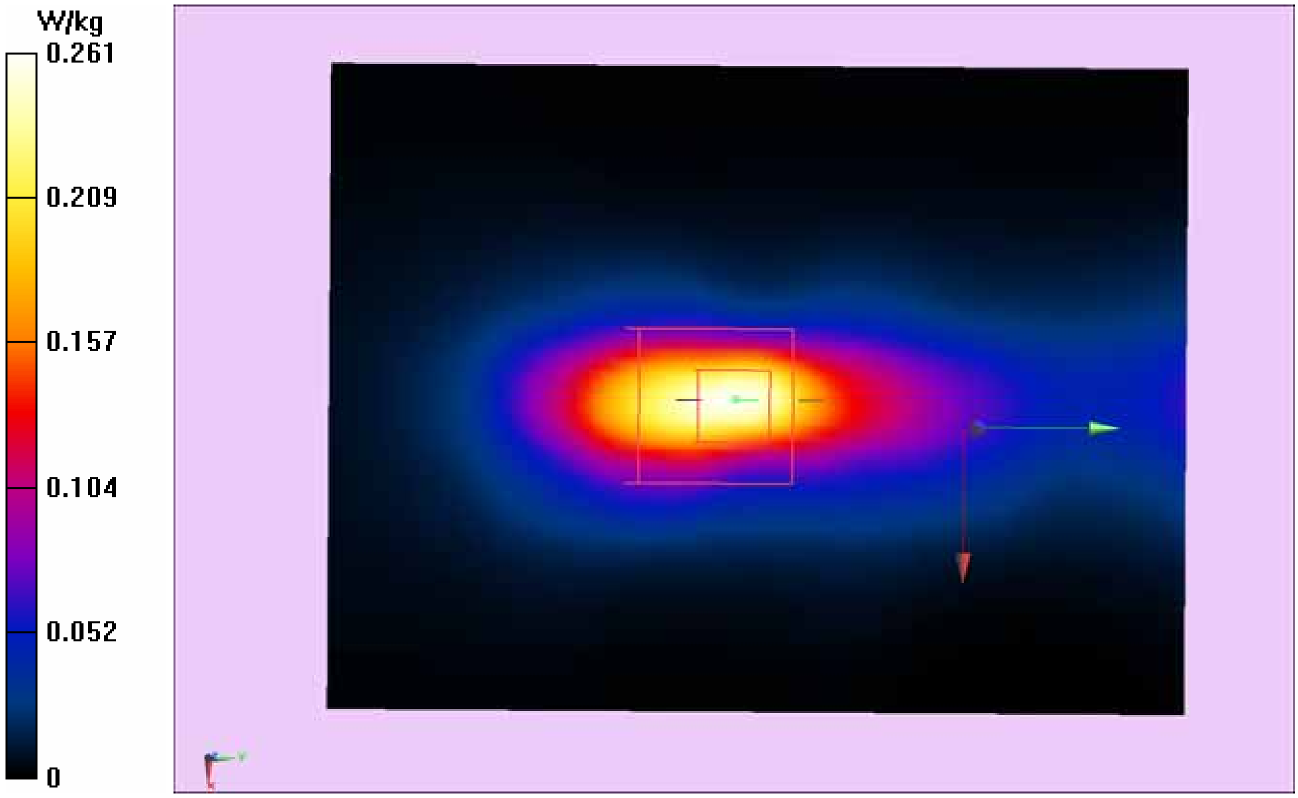
- Probe: ES3DV3 - SN3139; ConvF(4.16, 4.16, 4.16); Calibrated: 25/07/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn899; Calibrated: 07/02/2014
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/802.11b_CH11-Right/Area Scan (61x81x1):

Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.261 W/kg

Configuration/802.11b_CH11-Right/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.770 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 0.585 W/kg
SAR(1 g) = 0.220 W/kg; SAR(10 g) = 0.094 W/kg
Maximum value of SAR (measured) = 0.259 W/kg



Test Laboratory: Audix SAR Lab Date: 10/04/2014

802.11b_CH11-Top(2462MHz)

DUT: Tablet PC **M/N:AT7-C**
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0); Frequency: 2462 MHz;Medium parameters used: f = 2462 MHz; σ = 2.06 S/m; ε_r = 50.855; ρ = 1000 kg/m^3 ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

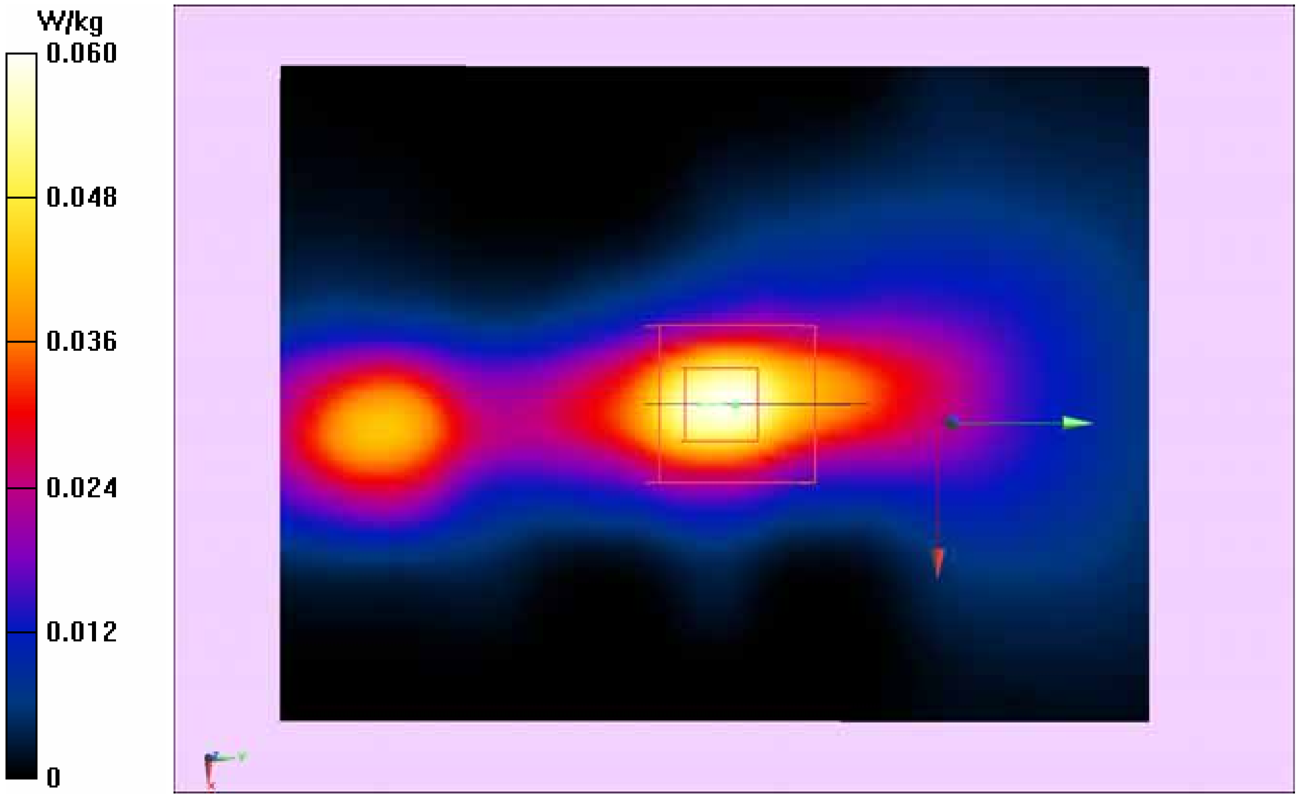
- Probe: ES3DV3 - SN3139; ConvF(4.16, 4.16, 4.16); Calibrated: 25/07/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn899; Calibrated: 07/02/2014
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/802.11b_CH11-Top/Area Scan (61x81x1):

Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.0603 W/kg

Configuration/802.11b_CH11-Top/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.721 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 0.108 W/kg
SAR(1 g) = 0.051 W/kg; SAR(10 g) = 0.023 W/kg
Maximum value of SAR (measured) = 0.0578 W/kg



10. ANNEX C: DASY CABLIBRATION CERTIFICATE

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

IMPORTANT NOTICE

USAGE OF THE DAE 4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:
Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:
Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:
To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

Schmid & Partner Engineering

TN_BR040315AD DAE4.doc 11.12.2009

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Accreditation No.: **SCS 108**

Client **Audix - CN (Auden)**

Certificate No: **DAE4-899_Jul12**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BJ - SN: 899
Calibration procedure(s)	QA CAL-06.v24 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	July 25, 2012

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-11 (No:11450)	Sep-12
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V2.1	SE UWS 053 AA 1001	05-Jan-12 (in house check)	In house check: Jan-13

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

Issued: July 25, 2012

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Accreditation No.: **SCS 108**

Glossary

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

Methods Applied and Interpretation of Parameters

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

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	402.461 ± 0.1% (k=2)	403.037 ± 0.1% (k=2)	403.027 ± 0.1% (k=2)
Low Range	3.97886 ± 0.7% (k=2)	3.97416 ± 0.7% (k=2)	3.98171 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	350 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199994.26	-3.60	-0.00
Channel X	+ Input	20000.44	-0.45	-0.00
Channel X	- Input	-19998.64	1.65	-0.01
Channel Y	+ Input	199995.43	-2.58	-0.00
Channel Y	+ Input	20000.07	-0.93	-0.00
Channel Y	- Input	-20000.18	0.13	-0.00
Channel Z	+ Input	199994.36	-3.84	-0.00
Channel Z	+ Input	19999.80	-1.14	-0.01
Channel Z	- Input	-20002.23	-1.82	0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2001.03	0.29	0.01
Channel X	+ Input	201.51	0.39	0.19
Channel X	- Input	-198.31	0.39	-0.20
Channel Y	+ Input	2001.31	0.49	0.02
Channel Y	+ Input	200.62	-0.65	-0.32
Channel Y	- Input	-198.08	0.47	-0.23
Channel Z	+ Input	2000.80	0.02	0.00
Channel Z	+ Input	200.54	-0.71	-0.35
Channel Z	- Input	-199.80	-1.26	0.64

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	8.64	6.85
	- 200	-7.03	-8.70
Channel Y	200	13.52	13.38
	- 200	-14.82	-14.74
Channel Z	200	-7.05	-7.41
	- 200	5.47	5.70

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	-	0.57	-4.30
Channel Y	200	6.63	-	0.60
Channel Z	200	9.91	6.53	-

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	16013	16362
Channel Y	15643	16338
Channel Z	15800	13916

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	0.47	-1.07	1.68	0.45
Channel Y	0.32	-1.08	1.30	0.46
Channel Z	-0.66	-1.86	0.41	0.40

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

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Accreditation No.: SCS 108

Client **Audix-CN (Auden)**

Certificate No: ES3-3139_Jul12

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3139
Calibration procedure(s)	QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	July 25, 2012

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: July 25, 2012

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

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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 affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z, 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 ES3DV3

SN:3139

Manufactured: February 12, 2007
Calibrated: July 25, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3139

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.28	1.32	1.35	± 10.1 %
DCP (mV)[B]	106.6	102.5	104.0	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	117.7	±3.0 %
			Y	0.00	0.00	1.00	117.9	
			Z	0.00	0.00	1.00	118.7	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3139

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	41.5	0.90	5.92	5.92	5.92	0.36	1.73	± 12.0 %
900	41.5	0.97	5.88	5.88	5.88	0.51	1.36	± 12.0 %
1450	40.5	1.20	5.20	5.20	5.20	0.30	1.96	± 12.0 %
1750	40.1	1.37	5.24	5.24	5.24	0.53	1.50	± 12.0 %
1900	40.0	1.40	5.02	5.02	5.02	0.48	1.57	± 12.0 %
2000	40.0	1.40	4.98	4.98	4.98	0.80	1.20	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3139

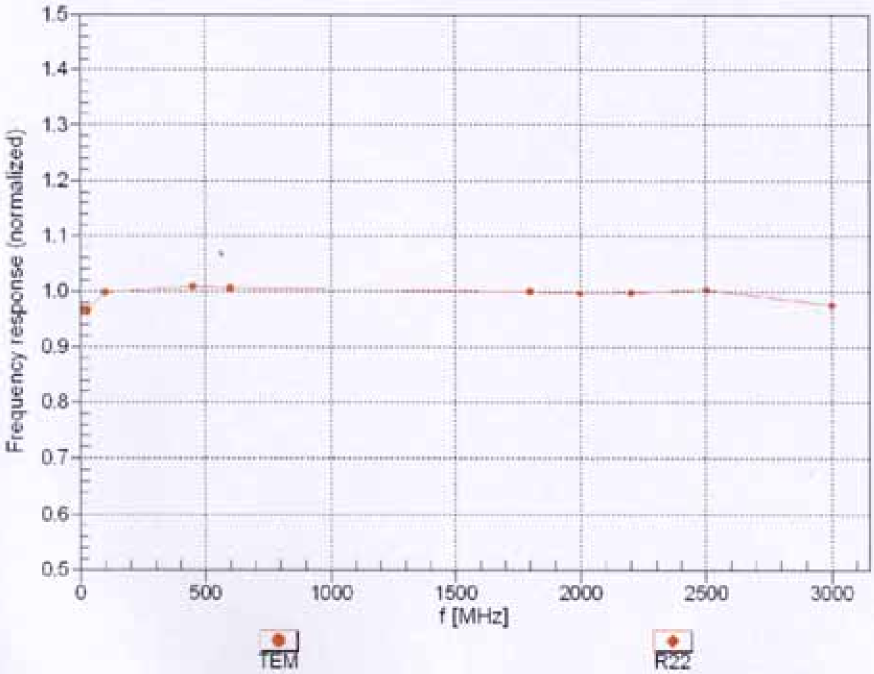
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	55.2	0.97	5.91	5.91	5.91	0.74	1.23	± 12.0 %
900	55.0	1.05	5.87	5.87	5.87	0.80	1.09	± 12.0 %
1450	54.0	1.30	5.16	5.16	5.16	0.80	1.13	± 12.0 %
1750	53.4	1.49	4.79	4.79	4.79	0.40	1.79	± 12.0 %
1900	53.3	1.52	4.53	4.53	4.53	0.45	1.68	± 12.0 %
2000	53.3	1.52	4.64	4.64	4.64	0.80	1.04	± 12.0 %
2450	52.7	1.95	4.16	4.16	4.16	0.71	1.14	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field

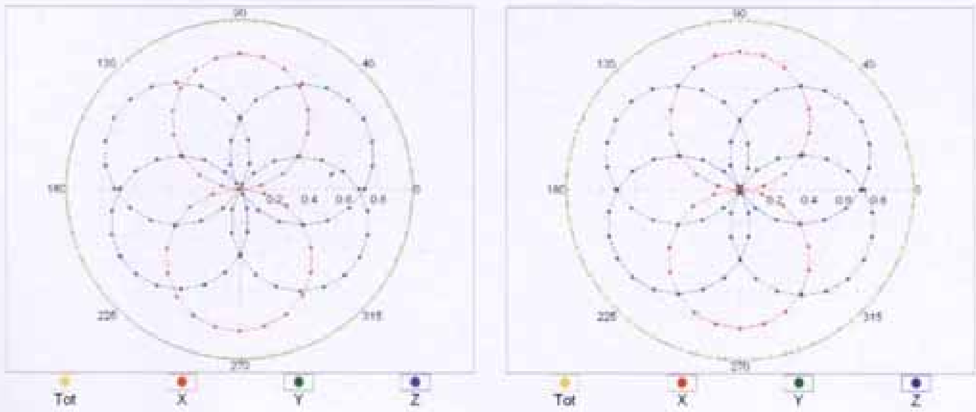
(TEM-Cell:ifi110 EXX, Waveguide: R22)

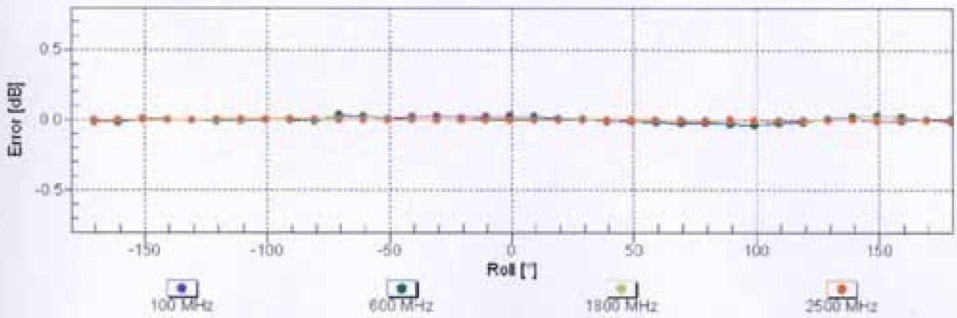


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

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

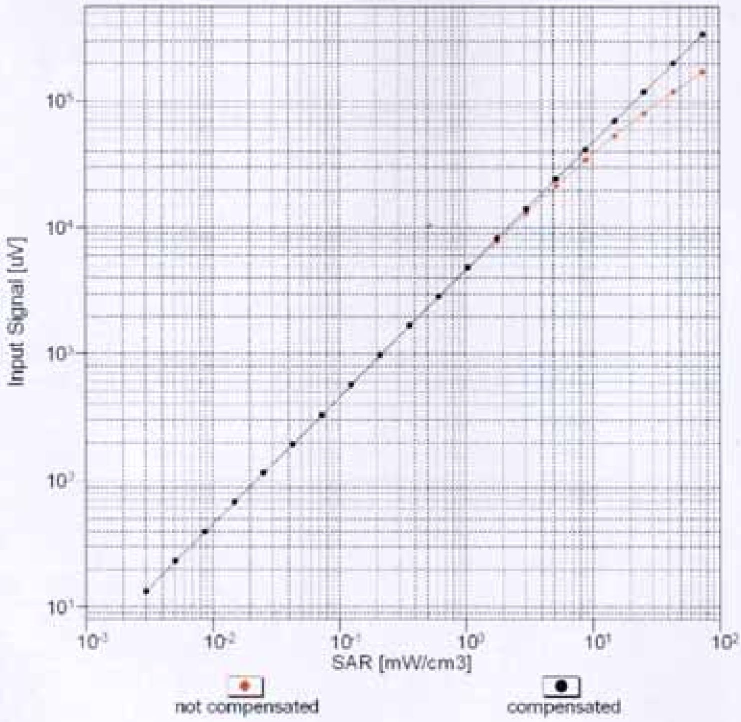


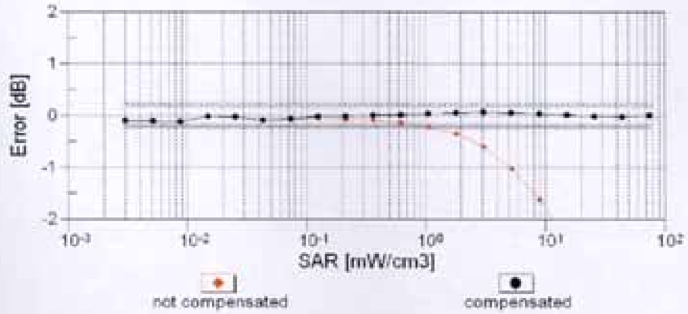


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR$_{head}$)

(TEM cell , f = 900 MHz)

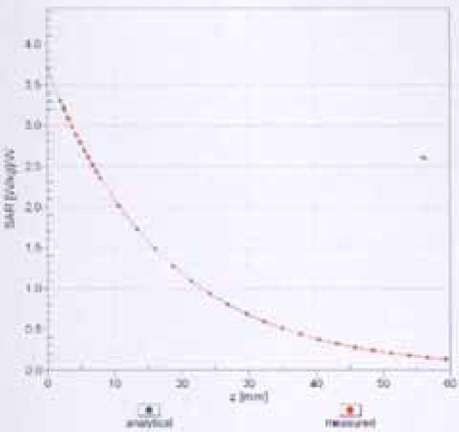




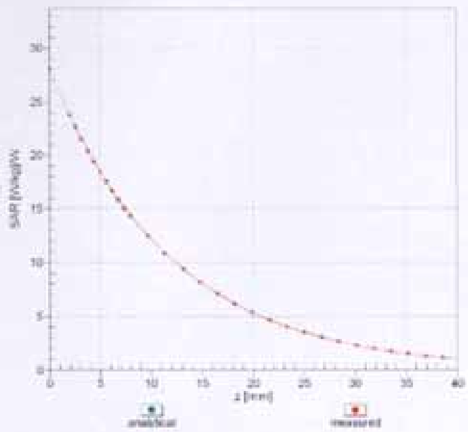
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

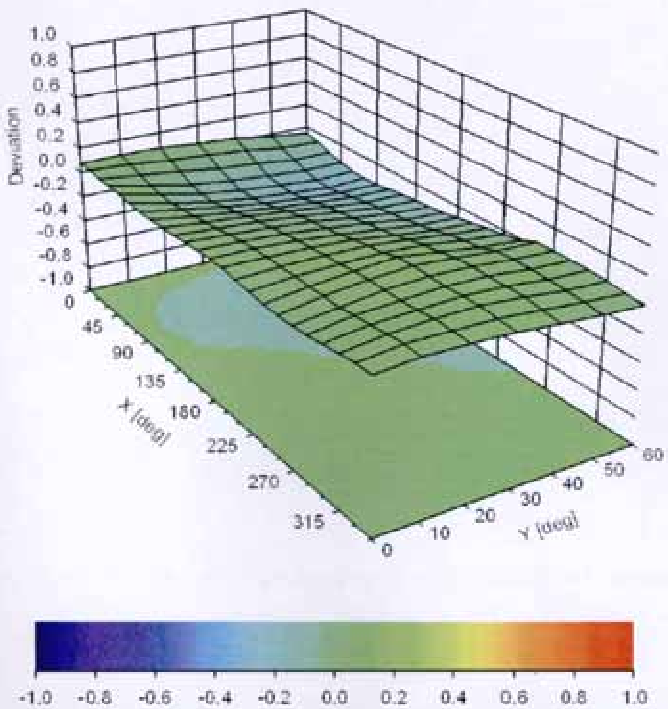


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3139

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	89.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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

S Schweizerischer Kalibrierdienst
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Accreditation No.: SCS 108

Client **Auden**

Certificate No: D2450V2-735_Jun13

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 735
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	June 11, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 11, 2013

Calibration Laboratory of
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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "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.

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.8 ± 6 %	1.81 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	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.6 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.9 ± 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	13.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.2 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.5 Ω + 4.3 jΩ
Return Loss	- 23.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.5 Ω + 5.5 jΩ
Return Loss	- 25.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	May 07, 2003

DASY5 Validation Report for Head TSL

Date: 11.06.2013

Test Laboratory: SPEAG, Zurich, Switzerland

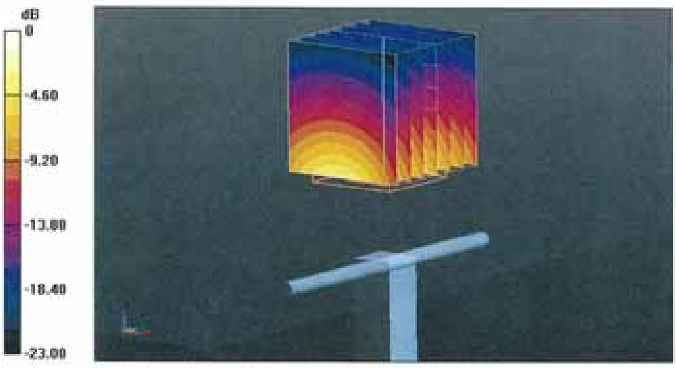
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 735

Communication System: UID 0 - CW ; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.81 S/m; ε_r = 37.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

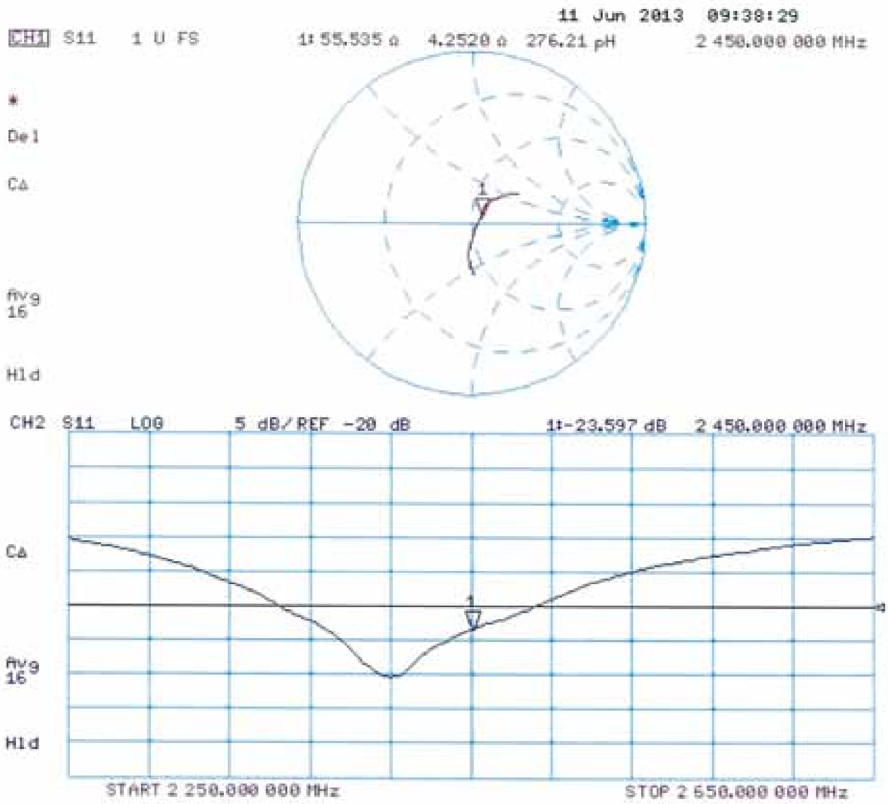
- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.127 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 27.7 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.19 W/kg
Maximum value of SAR (measured) = 16.9 W/kg



0 dB = 16.9 W/kg = 12.28 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 11.06.2013

Test Laboratory: SPEAG, Zurich, Switzerland

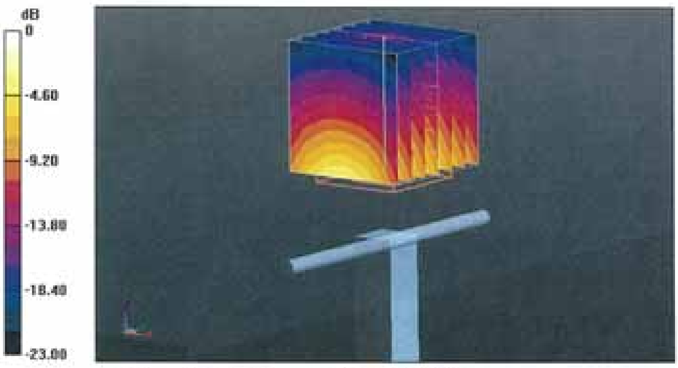
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 735

Communication System: UID 0 - CW ; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma = 2.02$ S/m; $\varepsilon_r = 50.9$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.127 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.13 W/kg
Maximum value of SAR (measured) = 17.3 W/kg



0 dB = 17.3 W/kg = 12.38 dBW/kg

Impedance Measurement Plot for Body TSL