# SAR TEST REPORT

for

Shenzhen Contel Electronics Technology Co., Ltd.

7" Digix Tablet

Model No.: Tab-720; Tab-710

FCC ID: YAPTAB720

Prepared for : Shenzhen Contel Electronics Technology Co., Ltd.
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| | | |
|---|---|---|
| Report Number | : | ACS-SF11011 |
| Date of Test | : | Dec.27, 2011~Jan.14, 2012 |
| Date of Report | : | Jan.16, 2012 |

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# SAR TEST REPORT

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|---|---|---|
| Applicant | : | Shenzhen Contel Electronics Technology Co., Ltd. |
| Manufacturer | : | Dong Guan Contel Electronics Co., Ltd. |
| EUT Description | : | 7" Digix Tablet |
| FCC ID | : | YAPTAB720 |
| | | (A)Model NO. : Tab-720; Tab-710 |
| | | (B) SERIAL NO. : N/A |
| | | (C) TEST VOLTAGE : DC 3.7V |

Measurement Standard Used:

OET 65 Supplement C
IEEE Std C95.1-1999
IEEE Std C95.3-2002
IEEE 1528-2003
47 CFR Part 2(2.1093)
KDB 447498 D01 Mobile Portable RF Exposure v04
KDB 248227 D01 SAR means for 80211 a/b/g v01r02

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, IEEE Std C95.1-1999, IEEE Std C95.3-2002, IEEE 1528-2003, 47 CFR Part 2(2.1093).

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Date of Test : Dec.27, 2011~Jan.14, 2012 Report of date: Jan.16, 2012

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Signature: Ken Lu 1/16 12

Approved & Authorized Signer :
Ken Lu / Manager

# 1. GENERAL INFORMATION

## 1.1. Description of Device (EUT)

| | | |
|---|---|---|
| Description | : | 7" Digix Tablet |
| Model Number | : | Tab-720; Tab-710<br>Above models are only different in model number. Model Number Tab-720 was tested in this report. |
| FCC ID | : | YAPTAB720 |
| Applicant | : | Shenzhen Contel Electronics Technology Co., Ltd.<br>13/F, Dawning BLDG, 12Ke ji Nan Rd., SHIP, Shenzhen, China |
| Manufacturer | : | Dong Guan Contel Electronics Co., Ltd.<br>2nd Industrial Park, DiChong District, GaoBu Town, Dong Guan City, Guang Dong Province, China |
| Operation frequency | : | IEEE 802.11b: 2412 MHz—2462 MHz<br>IEEE 802.11g: 2412 MHz—2462 MHz<br>IEEE802.11n HT20: 2412MHz—2462MHz<br>IEEE802.11n HT40: 2422MHz—2452MHz |
| Modulation | : | IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)<br>IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11n HT20, HT40: OFDM (64QAM, 16QAM, QPSK,BPSK) |
| Antenna | : | Integrated PCB antenna |
| Antenna Gain | : | 1.6dBi |
| Adapter | : | M/N: GQ15-050200-AU<br>Input: AC 100-240V, 50/60Hz, 0.5A<br>Output: DC 5.0V, 2.0A<br>Cord: Non-Shielded, Undetachable, 1.5m |
| Date of Test | : | Dec.27, 2011~Jan.14, 2012 |
| Date of Receipt | : | Dec.27, 2011 |
| Sample Type | : | Prototype production |

## 1.2. The Maximum SAR Level

| Test Position | | Channel | Results | | Limit | |
|---|---|---|---|---|---|---|
| | | | 1g SAR Average | 10g SAR Average | 1g SAR (1.6W/Kg) | 10g SAR (2.0W/Kg) |
| 11b | Back | CH1 | 0.774 | 0.349 | PASS | |
| 11b | Back | CH6 | 0.715 | 0.324 | PASS | |
| 11b | Back | CH11 | 0.545 | 0.249 | PASS | |

## 1.3. The Maximum Conducted Power Level

| Test Mode | Max Average Power (dBm) |
|---|---|
| 11b | 15.45 |
| 11g | 12.62 |
| 11n HT20 | 12.05 |
| 11n HT40 | 11.00 |

# 2. OPERATIONAL CONDITIONS

## 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 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 channels**1,6,11;** however, if output power reduction is necessary for channel**s 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 Radiofrequency Channel Number (ARFCN) is firstly allocated to 2437 respectively in the case of 802.11b/g.

| Mode | GHz | CH | Turbo Channel | "Default Test Channels" 15.247 | |
|---|---|---|---|---|---|
| | | | | 802.11b | 802.11g |
| 802.11b/g | 2.412 | 1 | 1 | √ | * |
| | 2.437 | 6 | 6 | √ | * |
| | 2.462 | 11 | 11 | √ | * |

Table 1

Note: √= " default test channels"
* = possible 802.11g channels with maximum average output 0.25dB>=the "default test channels"

## 2.2. Block Diagram of connection between EUT and Base Station Simulators

EUT

**(Full charged battery)**

***( EUT:* 7" Digix Tablet *)***

## 2.3. Test Equipment

| Item | Equipment | Manufacturer | Model No. | S/N | Last Cal Date | Cal. Interval |
|---|---|---|---|---|---|---|
| 1. | SAR Test System | Speag | DASY5 TX60L SAR | N/A | June.04,11 | 1 Year |
| 2. | Wireless Communication Test Set | Agilent | E5515C | GB44300243 | May.08, 11 | 1Year |
| 3. | Power Meter | Anritsu | ML2487A | 6K00002472 | May.08, 11 | 1 Year |
| 4. | Power Sensor | Anritsu | MA2491A | 032516 | May.08, 11 | 1 Year |
| 5 | Signal Generator | Marconi | 2031B | 119606/058 | May.08, 11 | 1 Year |
| 6 | Amplifier | Milmega | AS0206-50 | 1036253 | NCR | N/A |
| 7. | Dipole Antenna | Speag | D900V2 | 1d088 | Mar.23,11 | 1 Year |
| 8. | Dipole Antenna | Speag | D1800V2 | 2d186 | Mar.22,11 | 1 Year |
| 9. | Dipole Antenna | Speag | D2000V2 | 1055 | Mar.24,11 | 1 Year |
| 10 | Dipole Antenna | Speag | D2450V2 | 862 | Mar.22,11 | 1 Year |
| 11 | Dipole Antenna | Speag | D5GHzV2 | 1102 | Mar.14,11 | 1 Year |
| 12. | Attenuator | Agilent | 8491A 3dB | MY39262001 | May.08, 11 | 1 Year |
| 13 | Attenuator | Agilent | 8491A 10dB | MY39264375 | May.08, 11 | 1 Year |
| 14. | DAE | Speag | DAE4 | 899 | Mar.18,11 | 1 Year |
| 15. | E-Field Probe | Speag | ES3DV3 | 3139 | Mar.23,11 | 1 Year |
| 16. | E-Field Probe | Speag | EX3DV4 | 3767 | Mar.21,11 | 1Year |

## 2.4. Measurement Uncertainty

| Test Item | Uncertainty |
|---|---|
| Uncertainty for SAR test | 1g: 21.14 |
| | 10g: 20.64 |
| Uncertainty for test site temperature and humidity | 0.6℃ |
| | 3% |

## 2.5. 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. | |

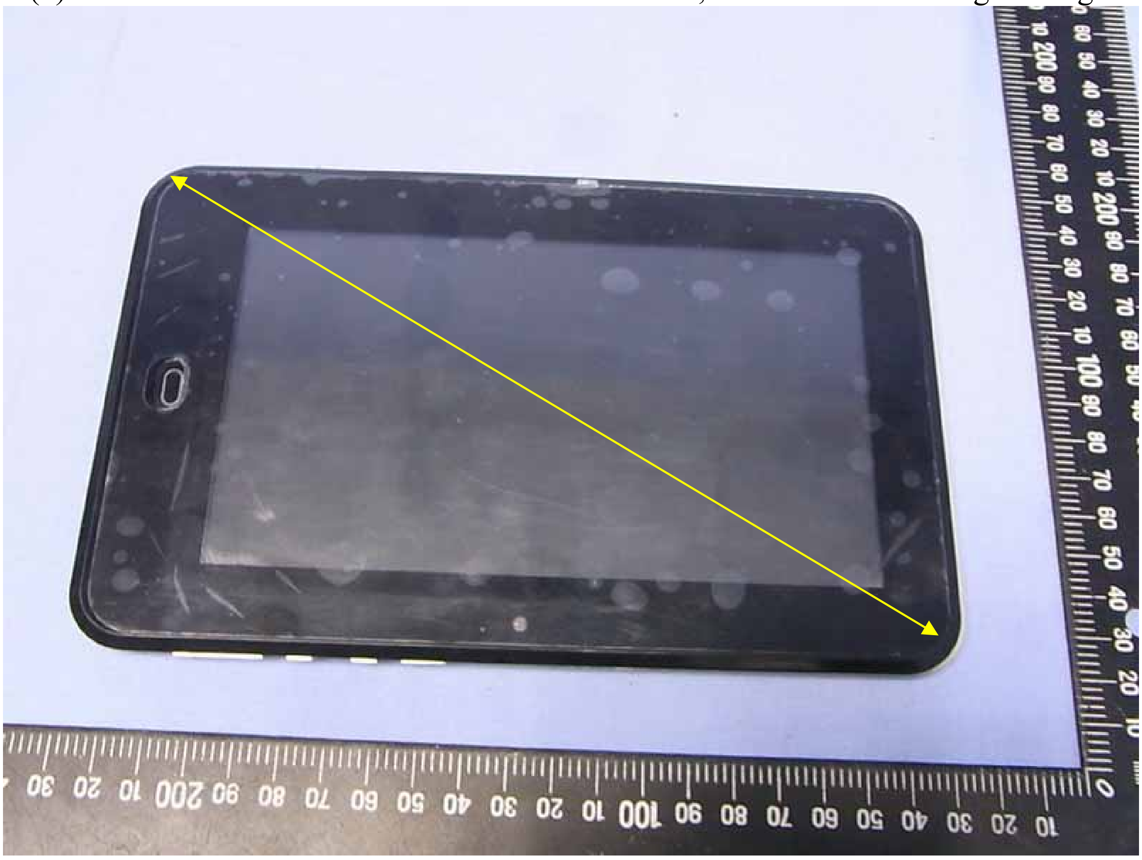
# 3. TEST POSITION

## 3.1. Test Setup of EUT

Due to the display or overall diagonal dimension 22.5 cm＞20 cm, according to KDB447498 D01 Mobile Portable RF Exposure v04 SAR is tested for back and edge with most conservative exposure conditions, the EUT is tested at the following test positions.

(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 Bottom Side: The SAR is not required.
(Because the distance is more than 2.5 cm between antenna and Bottom side)
(4) Test Position Left Side: The Left Side of the EUT towards and directed tightly to touch the flat phantom.
(Because the distance is more than 2.5 cm between antenna and Left side)
(5) Test Position Right Side: The SAR is not required.
(Because the distance is more than 2.5 cm between antenna and Right side)
(6) Test Position Front Side: The SAR is not required.
(Because the distance is more than 2.5 cm between antenna and front side.)
The 3/4/5/6 positions are not the most conservative antenna - to – user distance at edge mode. According to KDB 447498 4) ii) (2) –SAR is required only the edge with the most conservative exposure conditions, No SAR)
(7) This device have no tablet mode in 447498 D01,so No need to test edge configuration

22.5cm





（The diagonal dimension of EUT）

# 4. SPECIFIC ABSORPTION RATE (SAR)

## 4.1. Specific Absorption Rate SAR Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

## 4.2. Specific Absorption Rate SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density. ρ). The equation description is as below:

$$\mathbf{SAR} = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dv}\right)$$

*SAR is expressed in units of Watts per Kilogram (W/Kg)*

SAR measurement can be either related to the temperature elevation in tissue by

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

where C is the specific head capacity, $\delta T$ the temperature rise and $\delta t$ is the exposure duration, or related to the electrical field in the tissue by

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

where σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the rms electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

# 5. SAR MEASUREMENTS SYSTEM CONFIGURATION

## 5.1. 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.

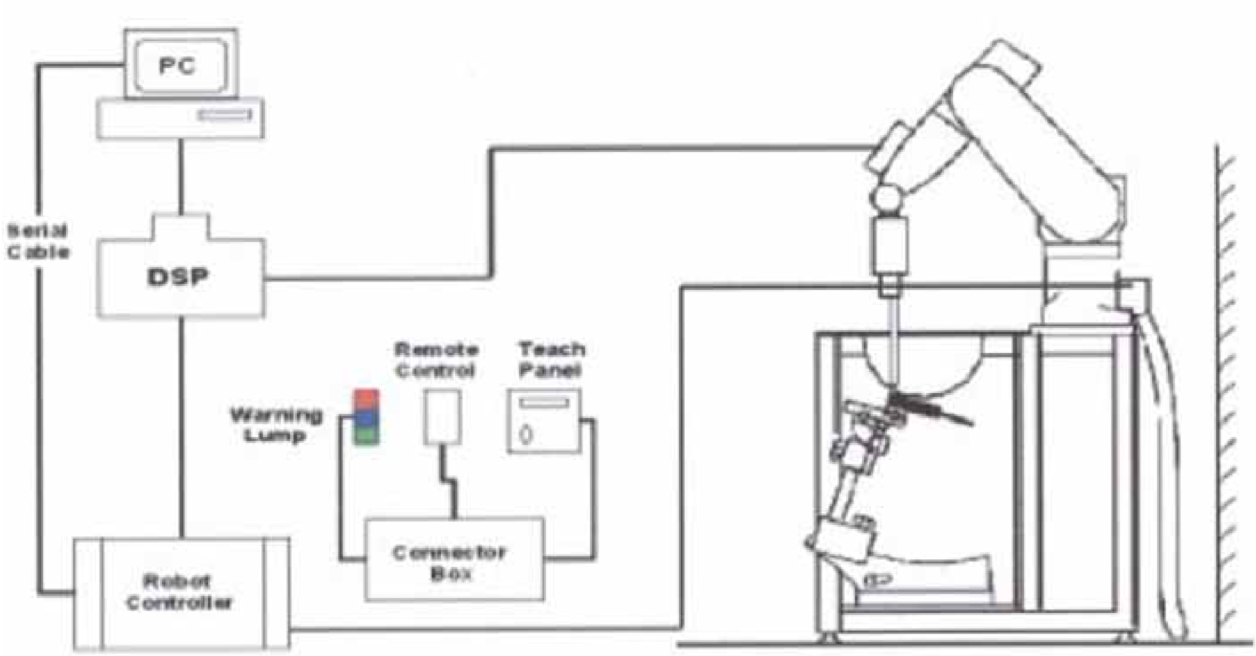
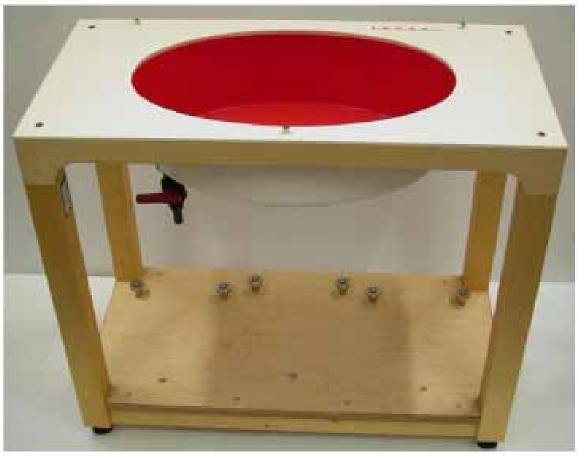



**Figure 6.1 SAR Lab Test Measurement Set-up**

## 5.2. 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.



| | |
|---|---|
| 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<br>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.

**Figure 6.2 Top View of Twin Phantom**

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

## 5.3. ES3DV3 Isotropic E-Field Probe for Dosimetric Measurements

Symmetrical design with triangular core
Interleaved sensors
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

| | |
|---|---|
| Calibration | ISO/IEC 17025 calibration service available. |
| Frequency | 10MHz to 4GHz  Linearity:0.2dB (30MHz to 4GHz) |
| Directivity | ±0.2dB in HSL (rotation around probe axis)<br>±0.3dB in tissue material (rotation normal to probe axis) |
| Dynamic Range | 5uW/g to ＞ 100 mW/g;<br>Linearity: 0.2dB |
| Dimensions | Overall length: 337 mm (Tip:20 mm)<br>Tip diameter: 3.9mm (Body:12mm)<br>Distance from probe tip to dipole centers: 2.0mm |
| Application | General dosimetry up to 4 GHz<br>Dosimetry in strong gradient fields<br>Compliance tests of mobile phones |
| Compatibility | DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI |

## 5.4. 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 made out of low-loss POM material having the following dielectric parameters: relative permittivity $\varepsilon_r$=3 and loss tangent $\delta$= 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 6.4 Device Holder**

## 5.5. 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.

$$\mathbf{SAR=C*(\Delta T/\Delta t)}$$

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

$$\mathbf{SAR= (E^2 *\sigma)/ \rho}$$

Where:
$\sigma$ = Simulated tissue conductivity,
$\rho$ = Tissue density (kg/m3).

## 5.6. 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 DUT’s output power and should vary max. ± 5 %.

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

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

**Area Scan**

The Area Scan is used as a fast scan in two dimensions to find the area of high field values 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.

# 6. DATA STORAGE AND EVALUATION

## 6.1. 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.

## 6.2. 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:

$$Vi = Ui + Ui2 \cdot c\,f / d\,c\,pi$$

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)

***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: ***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

# 7. TISSUE SIMULATING LIQUIDS

For the measurement of the field distribution inside the SAM phantom with DASY5, the phantom must be filled with around 25 liters of homogeneous tissue simulating liquid. The liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is (head SAR)or from the flat phantom to the liquid top surface (body SAR) is 15.2cm.

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 8 shows the detail solution.

The following ingredients for tissue simulating liquid are used:
Water: deionized water, resistivity ≥16MΩ - as basis for the liquid
Sugar: refined sugar in crystals, as available in food shops-to reduce relative permittivity
Salt: pure NaCl-to increase conductivity
Cellulose: Hydroxyethyl-cellulose medium viscosity(75-125mPa.s, 2% in water, 20℃)，CAS#54290-to increase viscosity and to keep sugar in solution.
Preservative: Preventol D-7 Bayer
Deithlenglycol-monobuthyl ether (DGMBE), Fluka Chemie GmbH, CAS#112-34-5-to reduce relative permittivity.

Table 6.1 gives the recipes for one liter of head and body tissue simulating liquid for frequency band 2450 MHz.

| Ingredient | MSL 2450MHz |
|---|---|
| Water | 698.3 ml |
| DGMBE | 301.7 ml |
| Total Amount | 1 L |
| Dielectric Parameters at 22℃ | F=2450MHz ε =52.5±5%<br>σ =2.00±10% S/m |

Table 8.1 Ingredient for Tissue Simulating Liquid

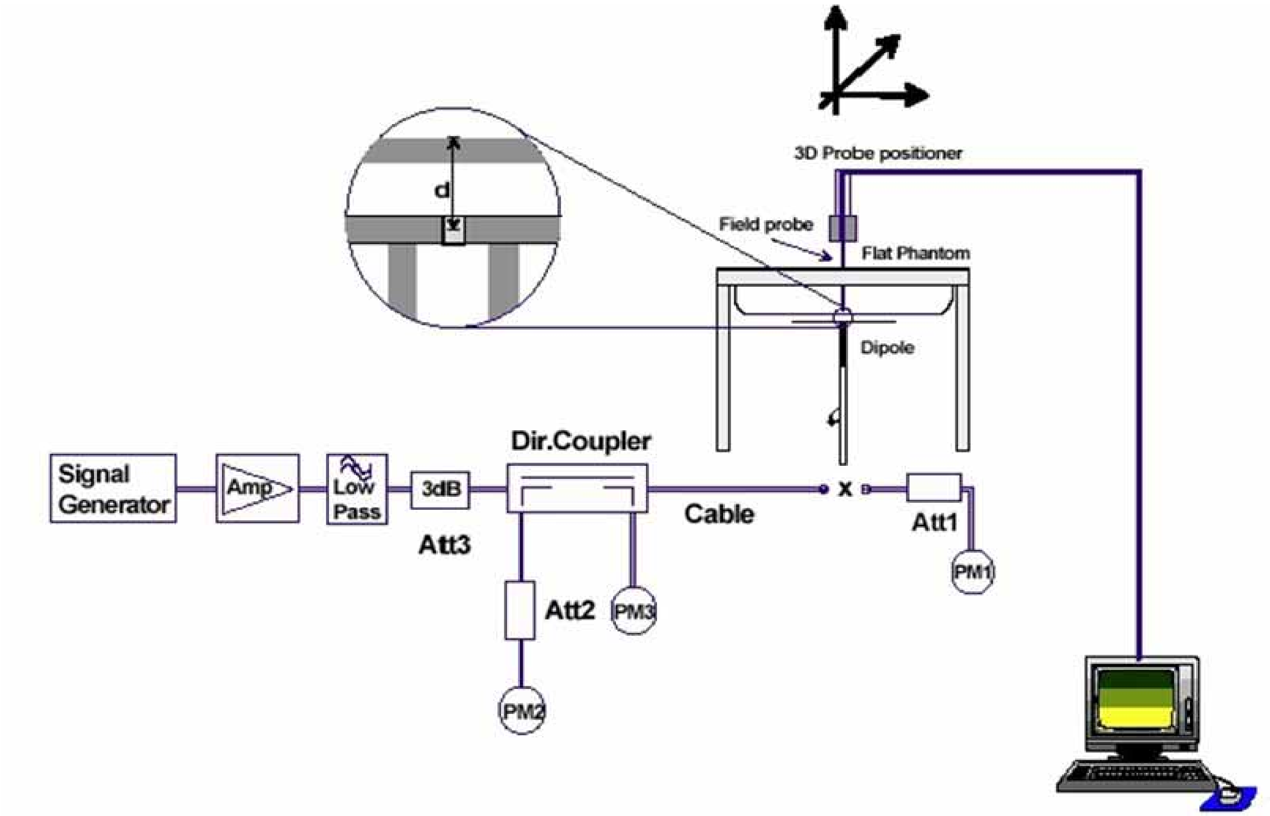
The dielectric parameters of the liquids were verified prior to the SAR evaluation using an Agilent 85070E Dielectric Probe Kit and an Agilent Network Analyzer.

# 8. 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 Table 6.

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.




**System Check Set-up**

# 9. TEST RESULTS

## 9.1. Table 10.1 System Check for Body Tissue simulating liquid

| Frequency | Description | SAR(W/kg) | | Temp |
|---|---|---|---|---|
| | | 1g | 10g | ℃ |
| 2450MHz | Recommended value<br>±10% window | 13<br>11.7 — 14.3 | 5.97<br>5.37 — 6.57 | / |
| | Measurement value<br>2011-12-27 | 13.65 | 6.44 | 22.0 |
| | Measurement value<br>2012-01-14 | 13.66 | 6.46 | 22.0 |

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

## 9.2. Table 10.2 Dielectric Performance for Body Tissue simulating liquid

| Frequency | Description | Dielectric Parameters | | Temp |
|---|---|---|---|---|
| | | εr | σ(s/m) | ℃ |
| 2450MHz | Target value<br>±5% window | 52.7<br>50.07-55.34 | 1.95<br>1.85-2.05 | / |
| | Measurement value<br>2011-12-27 | 52.40 | 1.92 | 22.3 |
| | Measurement value<br>2012-01-14 | 52.46 | 1.96 | 22.3 |

**Figure 10.2: Liquid depth in the Flat Phantom (2450MHz, 15.2 depth)**

# 10. TEST RESULTS

## 10.1. Conducted Output Average Power (WIFI)

| Test Mode | Data Rate (Mbps) | Output power | | |
|---|---|---|---|---|
| | | CH1 | CH6 | CH11 |
| 11b | 1 | 15.45 | 15.37 | 15.29 |
| | 2 | 15.43 | 15.25 | 15.26 |
| | 5. 5 | 15.42 | 15.32 | 15.28 |
| | 11 | 15.40 | 15.34 | 15.25 |
| 11g | 6 | 12.62 | 12.50 | 12.24 |
| | 9 | 12.60 | 12.48 | 12.20 |
| | 12 | 12.51 | 12.45 | 12.21 |
| | 18 | 12.56 | 12.42 | 12.19 |
| | 24 | 12.54 | 12.43 | 12.23 |
| | 36 | 12.52 | 12.46 | 12.18 |
| | 48 | 12.51 | 12.39 | 12.16 |
| | 54 | 12.48 | 12.43 | 12.17 |
| 11n HT20 | 6.5 | 11.95 | 12.05 | 11.98 |
| | 13.5 | 11.92 | 12.03 | 11.94 |
| | 27 | 11.90 | 12.01 | 11.96 |
| | 40.5 | 11.85 | 11.96 | 11.92 |
| | 54 | 11.89 | 11.94 | 11.90 |
| | 81 | 11.87 | 11.98 | 11.89 |
| | 108 | 11.92 | 11.97 | 11.85 |
| | 121.5 | 11.90 | 12.04 | 11.82 |
| | 135 | 11.87 | 11.92 | 11.83 |
| | | CH1 | CH4 | CH7 |
| 11n HT40 | 6.5 | 10.99 | 11.00 | 10.95 |
| | 13.5 | 10.97 | 10.96 | 10.92 |
| | 27 | 10.96 | 10.94 | 10.90 |
| | 40.5 | 10.92 | 10.92 | 10.89 |
| | 54 | 10.90 | 10.89 | 10.86 |
| | 81 | 10.89 | 10.93 | 10.85 |
| | 108 | 10.90 | 10.90 | 10.82 |
| | 121.5 | 10.87 | 10.89 | 10.79 |
| | 135 | 10.85 | 10.87 | 10.76 |

## 10.2.The SAR Test Results

| Test Position | | Channel | Results | | Power Drift | Limit | |
|---|---|---|---|---|---|---|---|
| | | | 1g SAR Average | 10g SAR Average | ±0.2 | 1g SAR (1.6W/Kg) | 10g SAR (2.0W/Kg) |
| 11b | Back | 1 | 0.774 | 0.349 | 0.12 | PASS | |
| | Top | 1 | 0.526 | 0.250 | 0.05 | PASS | |
| | Left | 1 | 0.187 | 0.094 | 0.13 | PASS | |
| 11b | Back | 6 | 0.715 | 0.324 | 0.18 | PASS | |
| | Top | 6 | 0.315 | 0.147 | 0.14 | PASS | |
| | Left | 6 | 0.119 | 0.057 | -0.09 | PASS | |
| 11b | Back | 11 | 0.545 | 0.249 | 0.20 | PASS | |
| | Top | 11 | 0.208 | 0.101 | 0.20 | PASS | |
| | Left | 11 | 0.066 | 0.033 | 0.15 | PASS | |

Note: 1. 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 lower than the SAR limit, testing at the high and low channels is optional.

## 10.3.System Check Results

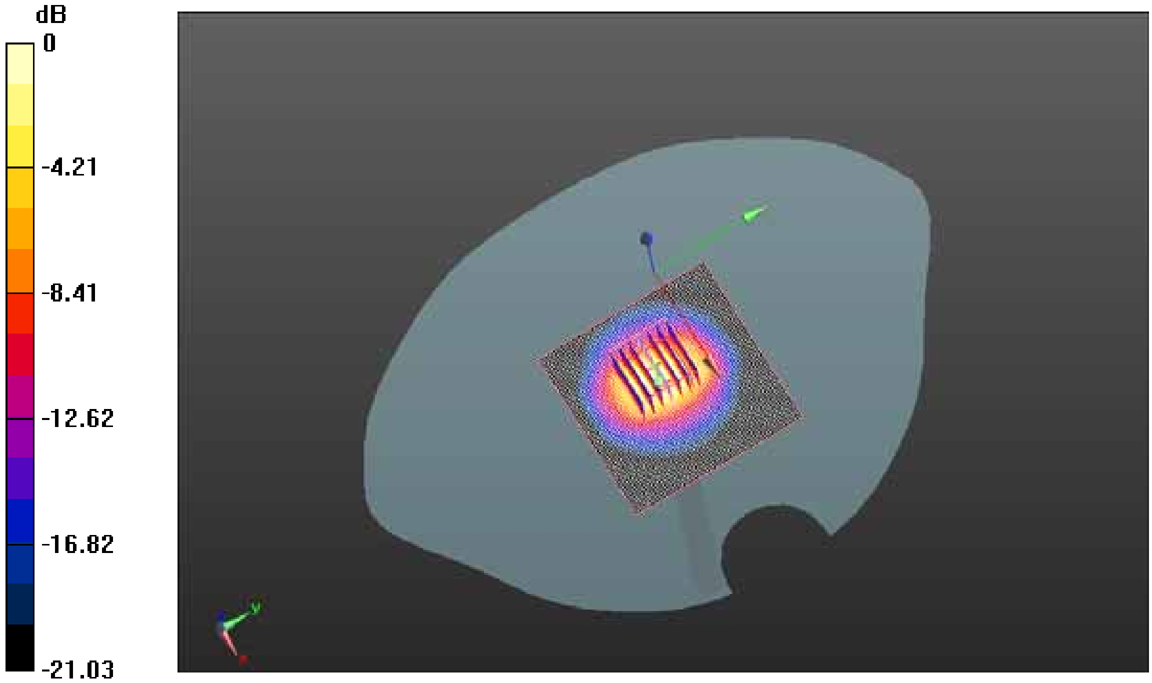
**Date: 27/12/2011 Time: 09:30:20 AM**
**DUT: Dipole 2450 MHz; Serial: D2450V2 S/N: 3139**
Communication System: CW; Communication System Band: D2450 (2450.0 MHz);
Frequency: 2450 MHz; Communication System **PAR: 0 dB; Crest factor=1:**

Medium parameters used: f = 2450 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 52.33; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4, 4, 4); Calibrated: 23/03/2011
- Electronics: DAE4 Sn899; Calibrated: 18/03/2011
- Phantom: SAM1; Type: SAM; Serial: TP-1543
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=xx mW, dist=3.0mm (ES-Probe)/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 17.500 mW/g

**System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=xx mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.979 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 28.640 W/kg
**SAR(1 g) = 13.65mW/g; SAR(10 g) = 6.44 mW/g**
Maximum value of SAR (measured) = 15.742 mW/g




0 dB = 15.740mW/g

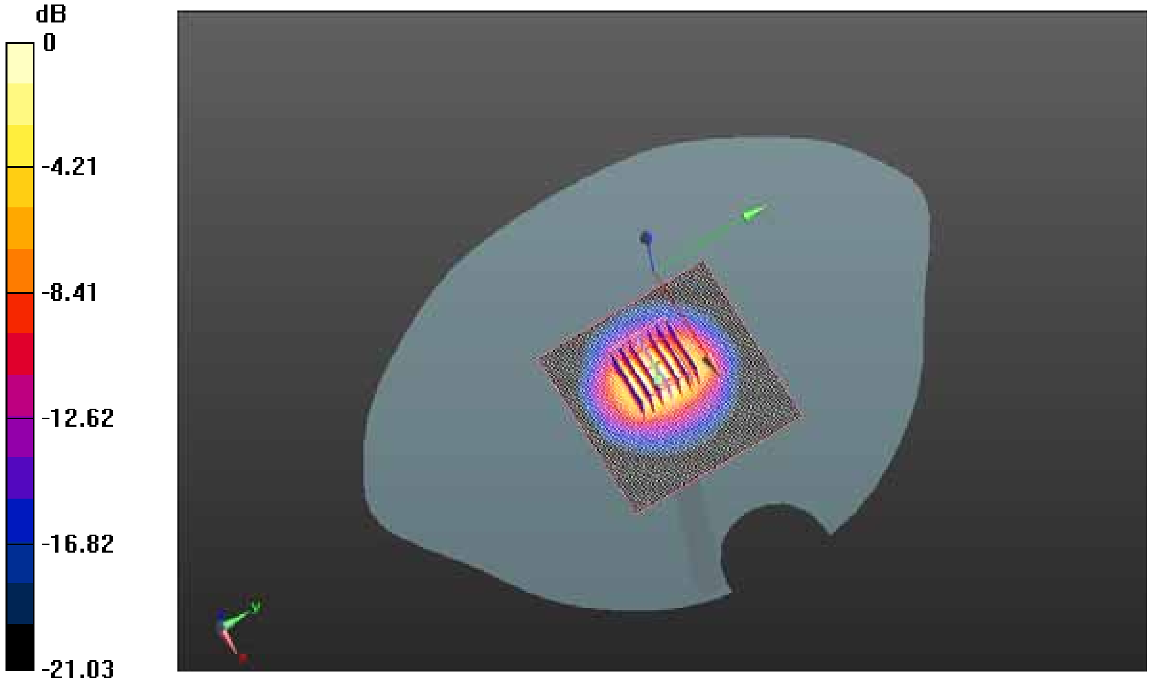
**Date: 14/01/2012 Time: 08:56:20 AM**
**DUT: Dipole 2450 MHz; Serial: D2450V2 S/N: 3139**
Communication System: CW; Communication System Band: D2450 (2450.0 MHz);
Frequency: 2450 MHz; Communication System **PAR: 0 dB; Crest factor=1:**

Medium parameters used: f = 2450 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 52.33; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4, 4, 4); Calibrated: 23/03/2011
- Electronics: DAE4 Sn899; Calibrated: 18/03/2011
- Phantom: SAM1; Type: SAM; Serial: TP-1543
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=xx mW, dist=3.0mm (ES-Probe)/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 17.500 mW/g

**System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=xx mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.979 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 28.642 W/kg
**SAR(1 g) = 13.66mW/g; SAR(10 g) = 6.46 mW/g**
Maximum value of SAR (measured) = 15.744 mW/g




0 dB = 15.740mW/g

## 10.4.Graph Results

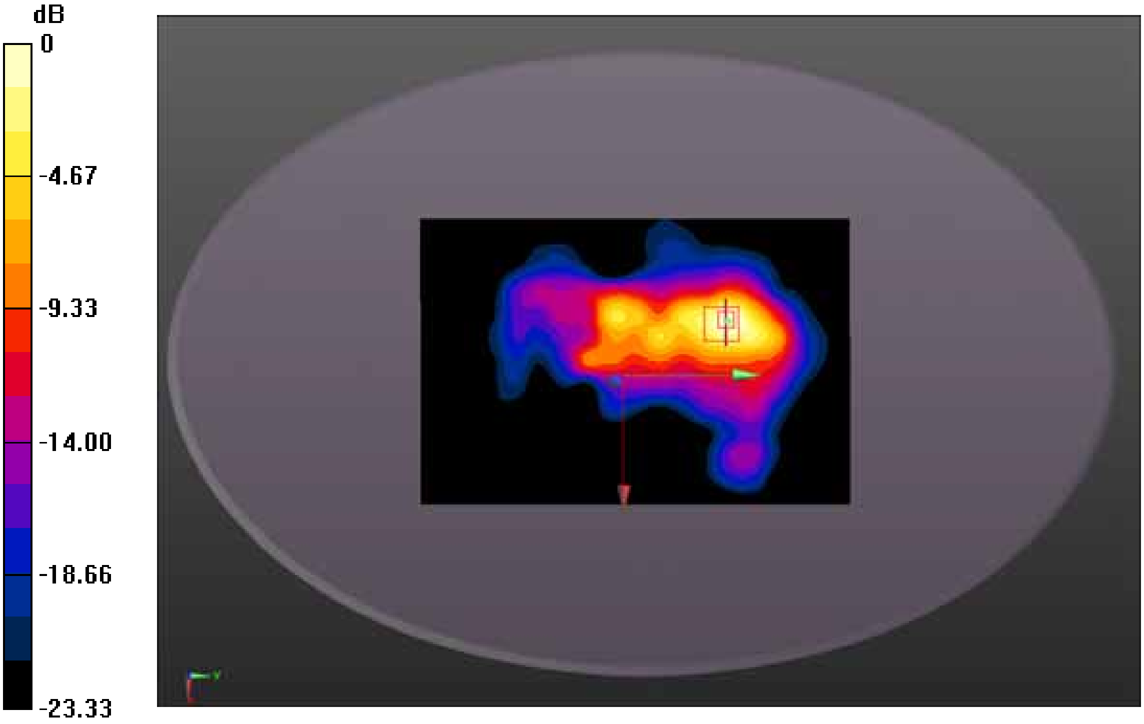
**Channel 1 (Back)**

Date/Time: 14/01/2012 9:25:31
EUT:7" Digix Tablet M/N:Tab-720
Communication System: IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps); Frequency: 2412 MHz;Medium parameters used (interpolated): f = 2412 MHz; σ = 1.968 mho/m; $\varepsilon_r$ = 50.861; ρ = 1000 kg/m$^3$ ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

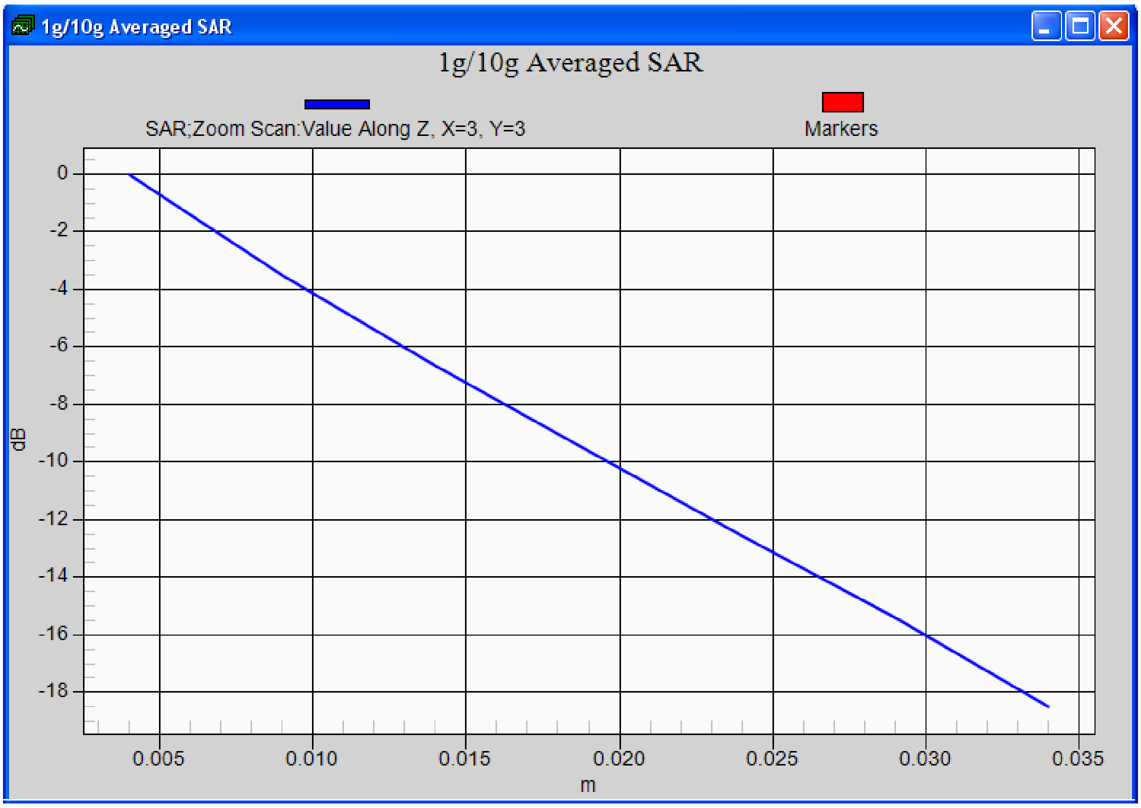
DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4, 4, 4); Calibrated: 23/03/2011
- Electronics: DAE4 Sn899; Calibrated: 18/03/2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

**Configuration/Back/Area Scan (121x181x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.998 mW/g
**Configuration/Back/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.829 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 1.8800
**SAR(1 g) = 0.774 mW/g; SAR(10 g) = 0.349 mW/g**
Maximum value of SAR (measured) = 0.861 mW/g




0 dB = 0.860mW/g = -1.31 dB mW/g

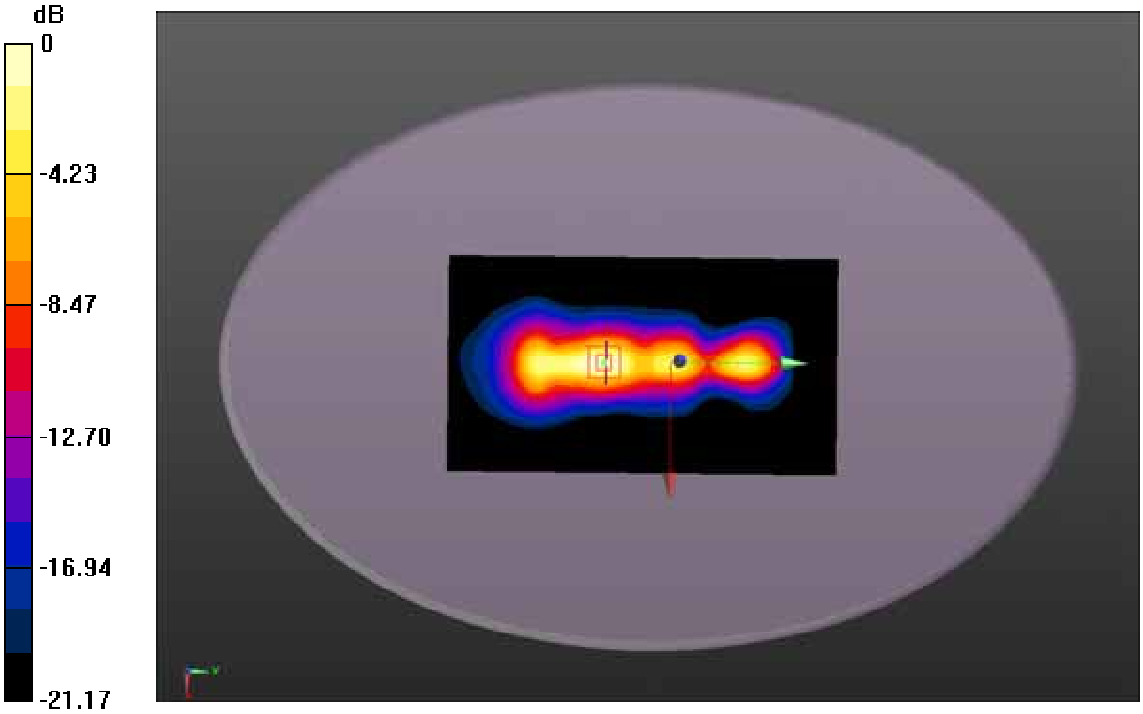

1g/10g Averaged SAR
1g/10g Averaged SAR
SAR;Zoom Scan:Value Along Z, X=3, Y=3
Markers
dB
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
0.005
0.010
0.015
0.020
0.025
0.030
0.035
m

**Channel 1 (TOP)**

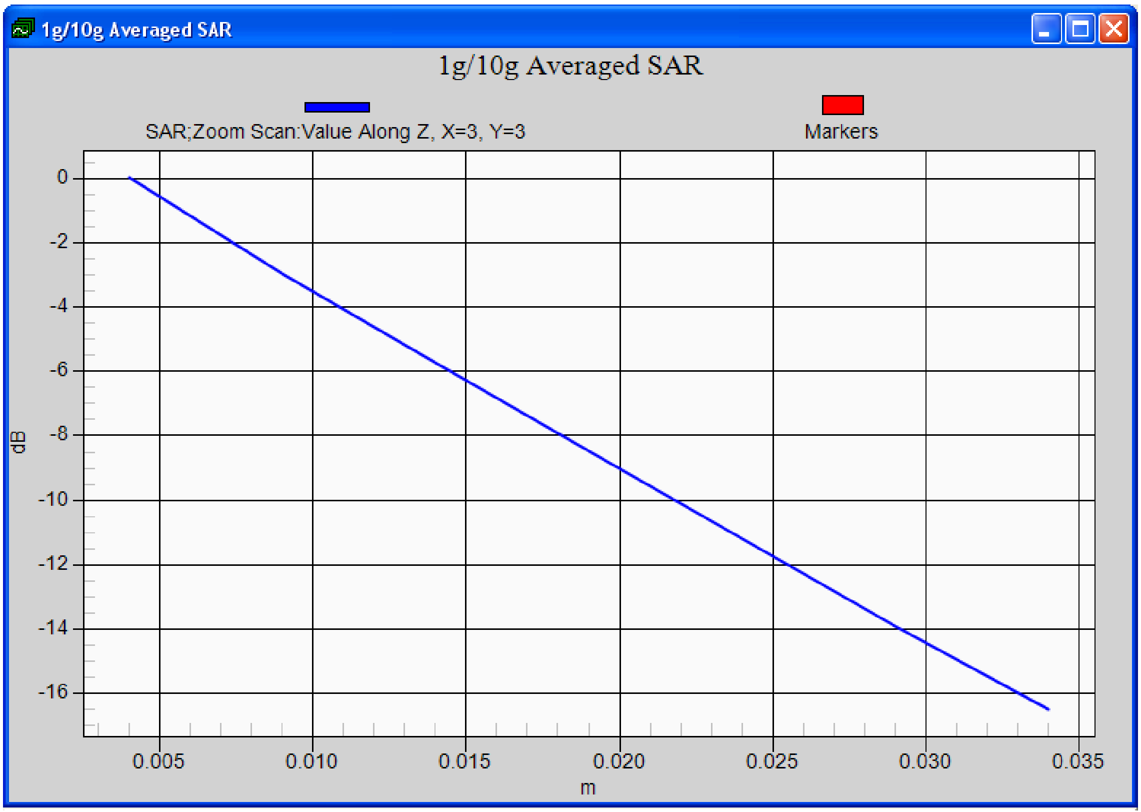
Date/Time: 14/01/2012 13:18:57
EUT:7" Digix Tablet M/N:Tab-720
Communication System: IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps); Frequency: 2412 MHz;Medium parameters used (interpolated): f = 2412 MHz; σ = 1.968 mho/m; εr = 50.861; ρ = 1000 kg/m3 ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4, 4, 4); Calibrated: 23/03/2011
- Electronics: DAE4 Sn899; Calibrated: 18/03/2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Configuration/TOP **CH1/Area Scan (101x181x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.587 mW/g
**Configuration/TOP CH1/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.243 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 1.1150
**SAR(1 g) = 0.526 mW/g; SAR(10 g) = 0.250 mW/g**
Maximum value of SAR (measured) = 0.595 mW/g




0 dB = 0.590mW/g = -4.58 dB mW/g

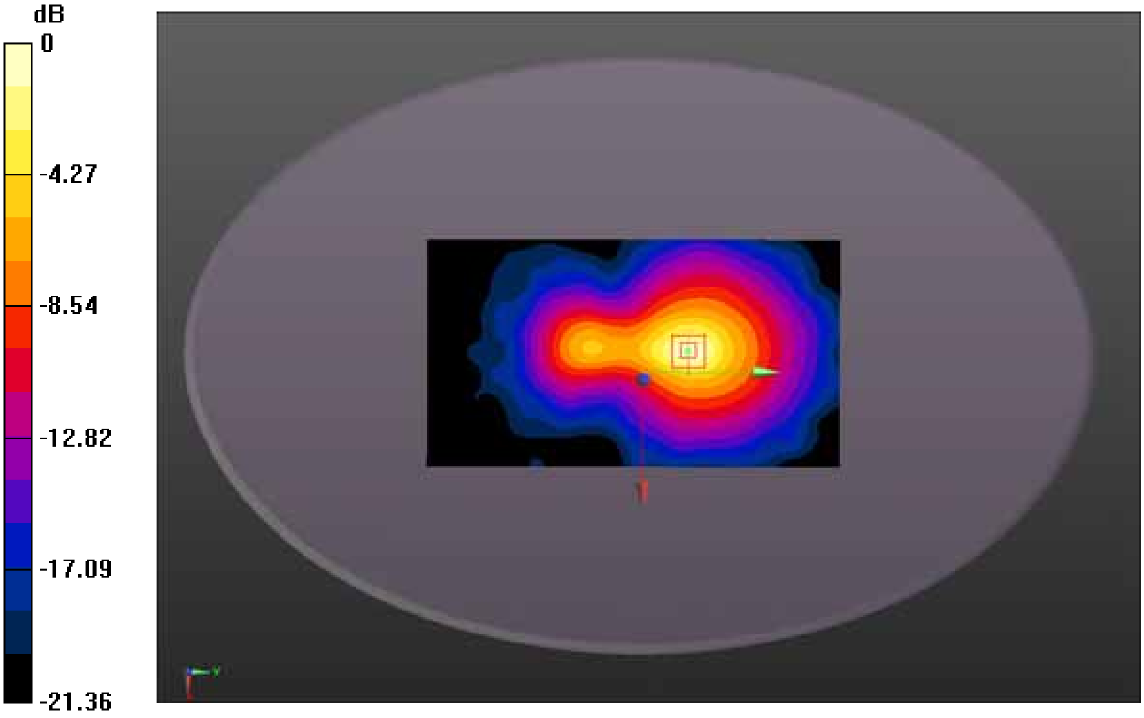

1g/10g Averaged SAR
1g/10g Averaged SAR
SAR;Zoom Scan:Value Along Z, X=3, Y=3
Markers
dB
0
-2
-4
-6
-8
-10
-12
-14
-16
0.005
0.010
0.015
0.020
0.025
0.030
0.035
m

**Channel 1 (Left)**

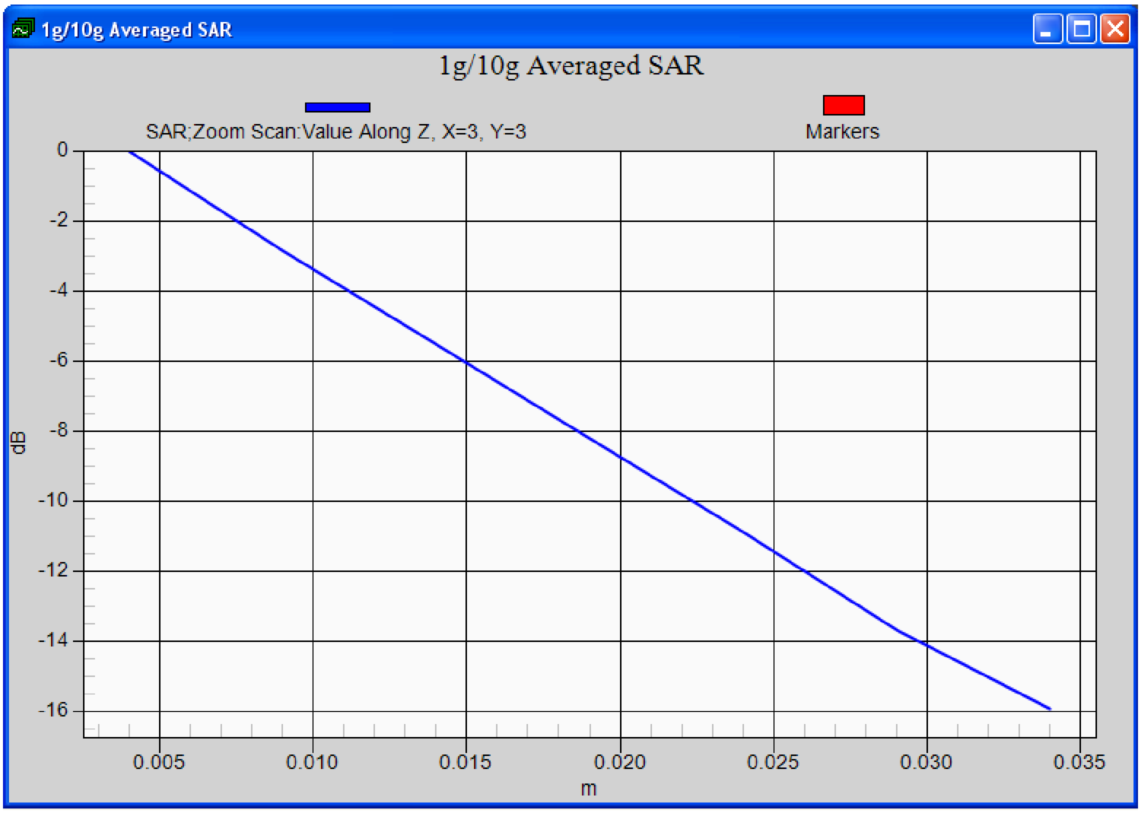
Date/Time: 14/01/2012 11:20:12
EUT:7" Digix Tablet M/N:Tab-720
Communication System: IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps); Frequency: 2412 MHz;Medium parameters used (interpolated): f = 2412 MHz; σ = 1.968 mho/m; εr = 50.861; ρ = 1000 kg/m3 ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
**DASY5 Configuration:**

- Probe: ES3DV3 - SN3139; ConvF(4, 4, 4); Calibrated: 23/03/2011
- Electronics: DAE4 Sn899; Calibrated: 18/03/2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Configuration/LEFT CH **1/Area Scan (101x181x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.192 mW/g
**Configuration/LEFT CH 1/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.368 V/m; Power Drift = 0.33 dB
Peak SAR (extrapolated) = 0.3710
**SAR(1 g) = 0.187 mW/g; SAR(10 g) = 0.094 mW/g**
Maximum value of SAR (measured) = 0.209 mW/g




0 dB = 0.210mW/g = -13.56 dB mW/g

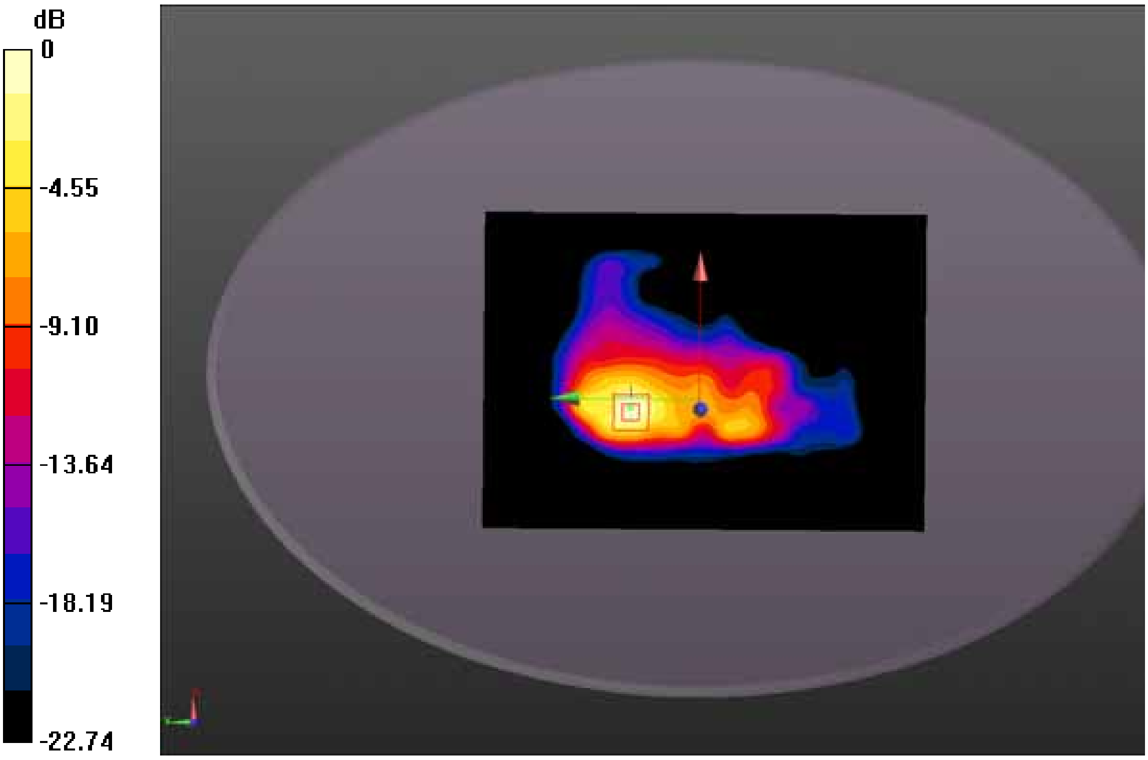

1g/10g Averaged SAR
1g/10g Averaged SAR
SAR;Zoom Scan:Value Along Z, X=3, Y=3
Markers
dB
0
-2
-4
-6
-8
-10
-12
-14
-16
0.005
0.010
0.015
0.020
0.025
0.030
0.035
m

**Channel 6 (Back)**

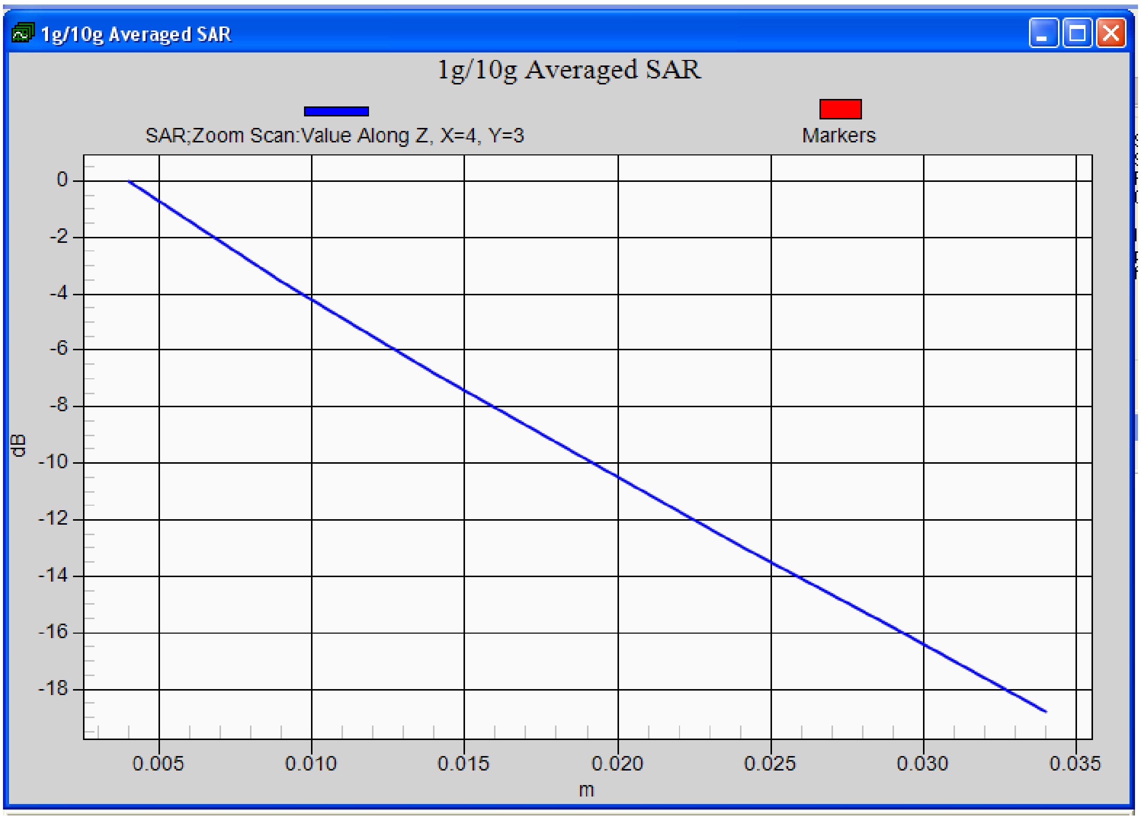
Date/Time: 27/12/2011 19:26:33
EUT: 7'' Digix Tablet M/N: Tab-720
Communication System: IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps); Frequency: 2412 MHz;Medium parameters used (interpolated): f = 2412 MHz; $\sigma$ = 1.968 mho/m; $\varepsilon_r$ = 50.861; $\rho$ = 1000 kg/m$^3$ ; **PAR= 0 dB; Crest factor=1;** Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4, 4, 4); Calibrated: 23/03/2011
- Electronics: DAE4 Sn899; Calibrated: 18/03/2011
- Phantom: ELI 4.0; Type: QDOVA001BA;
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**Configuration/Back/Area Scan (131x201x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.601 mW/g
**Configuration/Back/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.902 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 1.759 W/kg
**SAR(1 g) = 0.715 mW/g; SAR(10 g) = 0.324 mW/g**
Maximum value of SAR (measured) = 0.791 mW/g




0 dB = 0.790mW/g

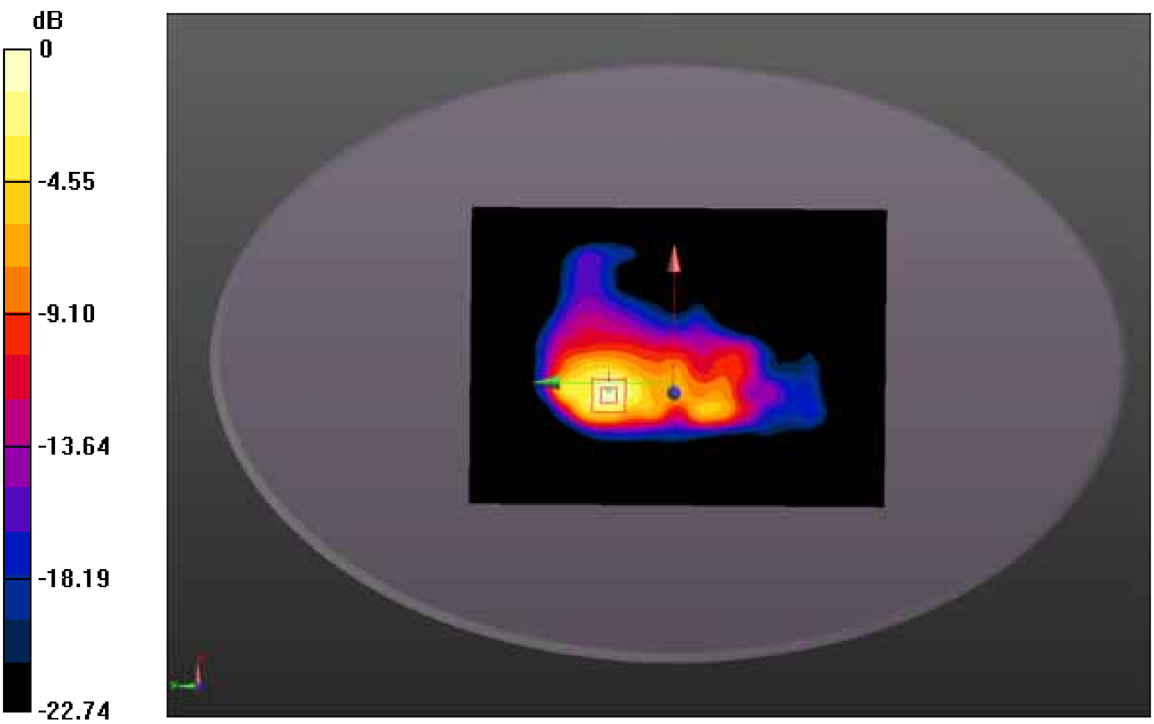

1g/10g Averaged SAR
1g/10g Averaged SAR
SAR;Zoom Scan:Value Along Z, X=4, Y=3
Markers
dB
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
0.005
0.010
0.015
0.020
0.025
0.030
0.035
m

**Channel 6 (Top)**

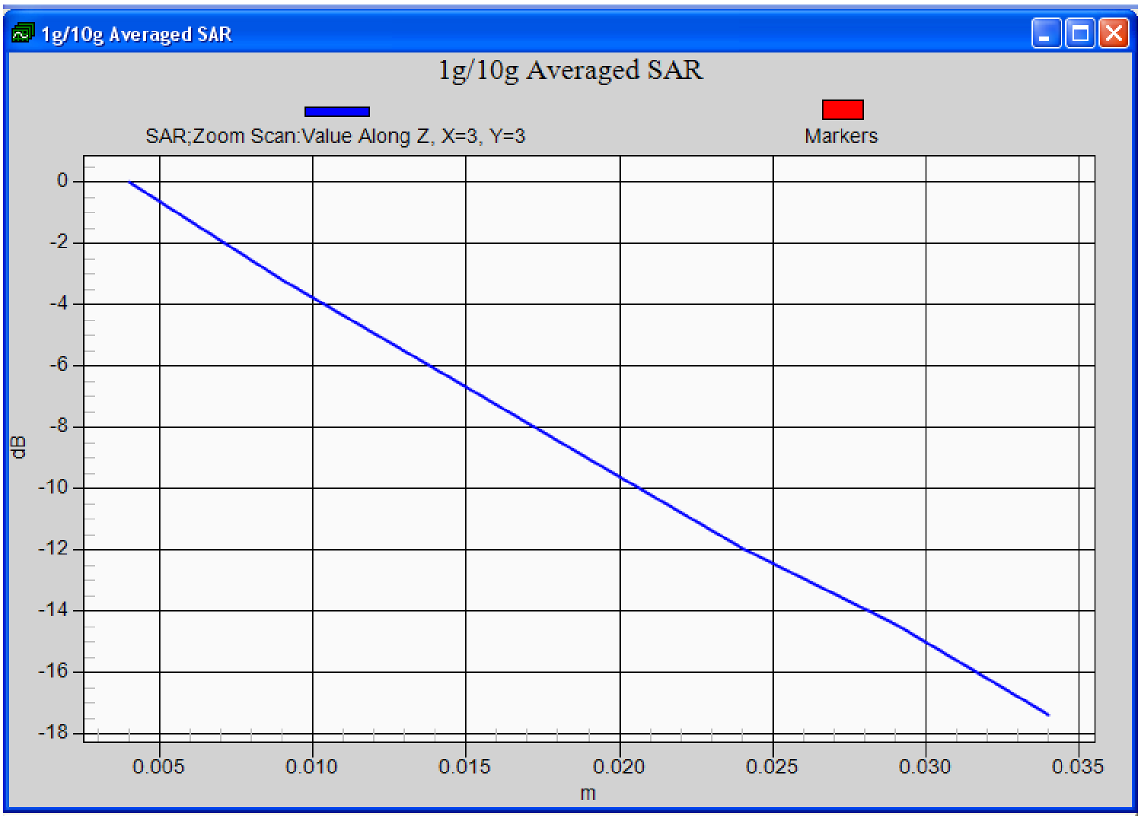
Date/Time: 27/12/2011 20:35:23
EUT: 7'' Digix Tablet M/N: Tab-720
Communication System: IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps); Frequency: 2412 MHz;Medium parameters used (interpolated): f = 2412 MHz; σ = 1.968 mho/m; $\varepsilon_r$ = 50.861; ρ = 1000 kg/m$^3$ ; **PAR= 0 dB; Crest factor=1**; Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4, 4, 4); Calibrated: 23/03/2011
- Electronics: DAE4 Sn899; Calibrated: 18/03/2011
- Phantom: ELI 4.0; Type: QDOVA001BA;
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**Configuration/TOP/Area Scan (81x201x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.330 mW/g
**Configuration/TOP/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.568 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 0.699 W/kg
**SAR(1 g) = 0.315 mW/g; SAR(10 g) = 0.147 mW/g**
Maximum value of SAR (measured) = 0.351 mW/g




0 dB = 0.350mW/g

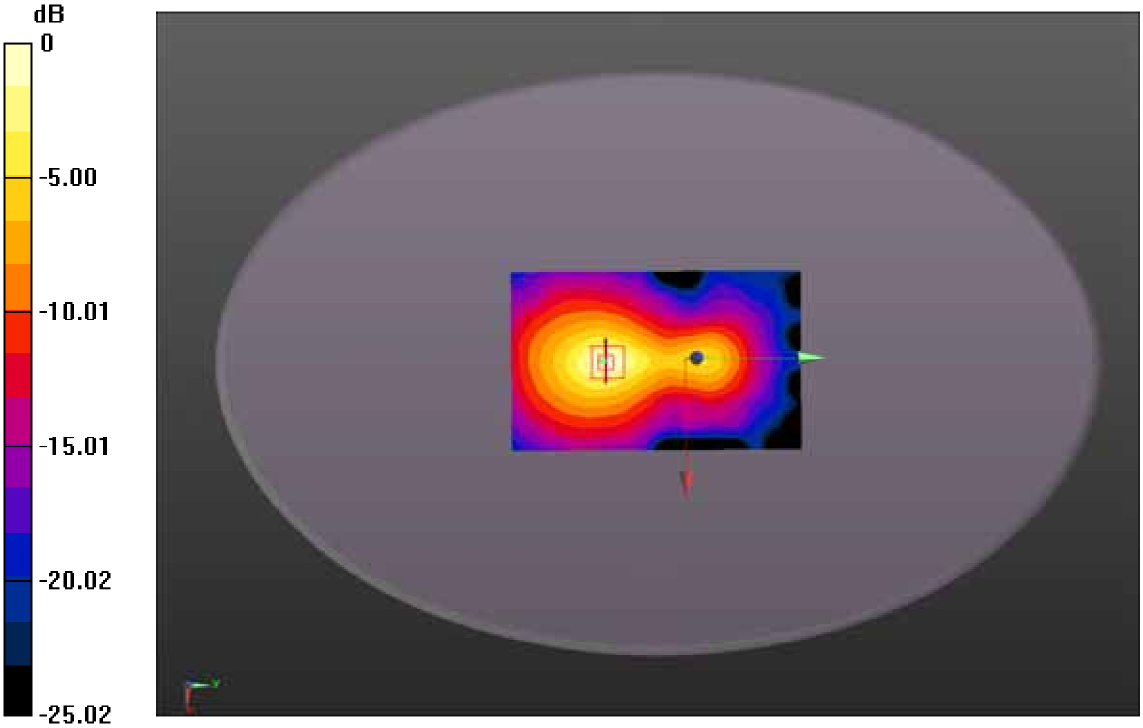

1g/10g Averaged SAR
1g/10g Averaged SAR
SAR;Zoom Scan:Value Along Z, X=3, Y=3
Markers
dB
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
0.005
0.010
0.015
0.020
0.025
0.030
0.035
m

**Channel 6 (Left)**

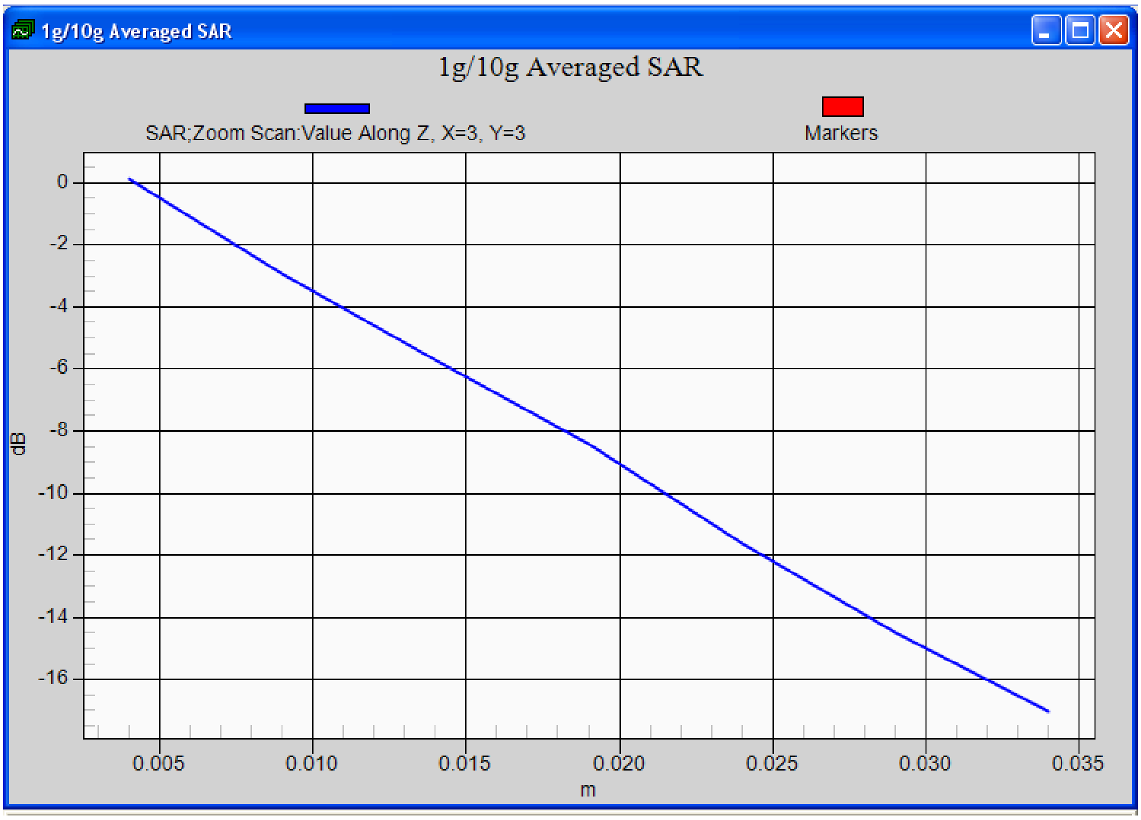
Date/Time: 27/12/2011 23:11:22
EUT:7'' Digix Tablet M/N:Tab-720
Communication System: IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps); Frequency: 2437 MHz;Medium parameters used (interpolated): f = 2437 MHz; σ = 2.013 mho/m; $\varepsilon_r$ = 50.739; ρ = 1000 kg/m$^3$ ; **PAR=0dB; Crest factor=1**; Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4, 4, 4); Calibrated: 23/03/2011
- Electronics: DAE4 Sn899; Calibrated: 18/03/2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**Configuration/Left/Area Scan (81x131x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.132 mW/g
**Configuration/Left/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.133 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.255 W/kg
**SAR(1 g) = 0.119 mW/g; SAR(10 g) = 0.057 mW/g**
Maximum value of SAR (measured) = 0.134 mW/g




0 dB = 0.130mW/g



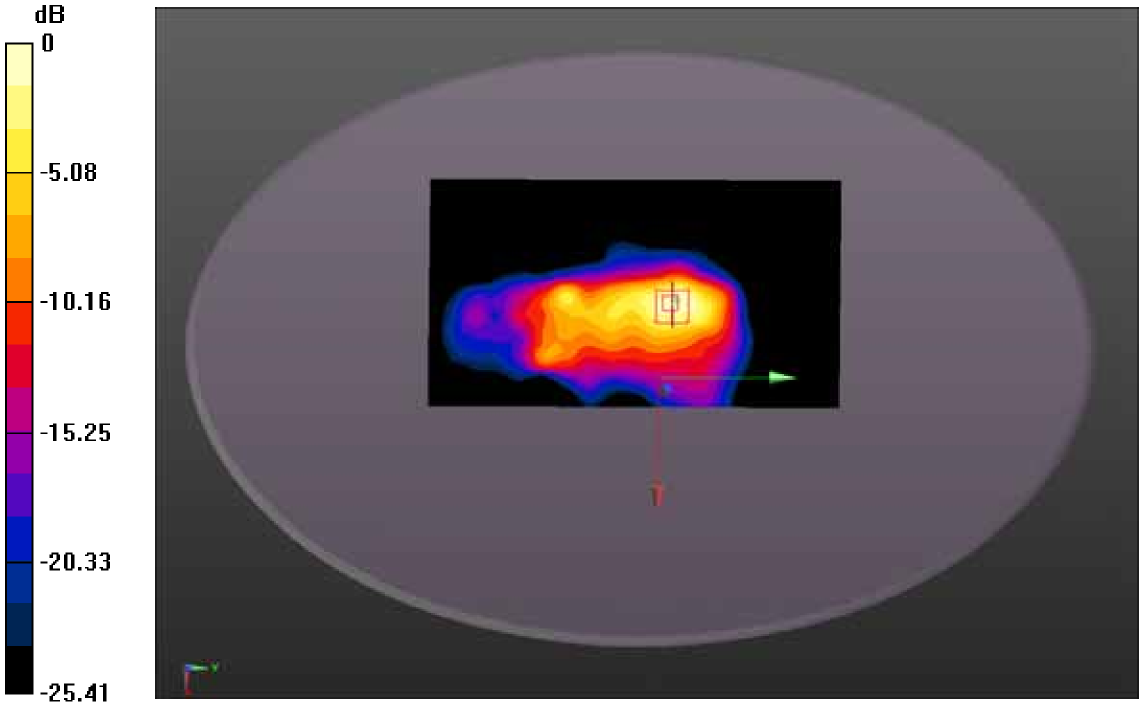
1g/10g Averaged SAR
1g/10g Averaged SAR
SAR;Zoom Scan:Value Along Z, X=3, Y=3
Markers
dB
0
-2
-4
-6
-8
-10
-12
-14
-16
0.005
0.010
0.015
0.020
0.025
0.030
0.035
m

**Channel 11 (Back)**

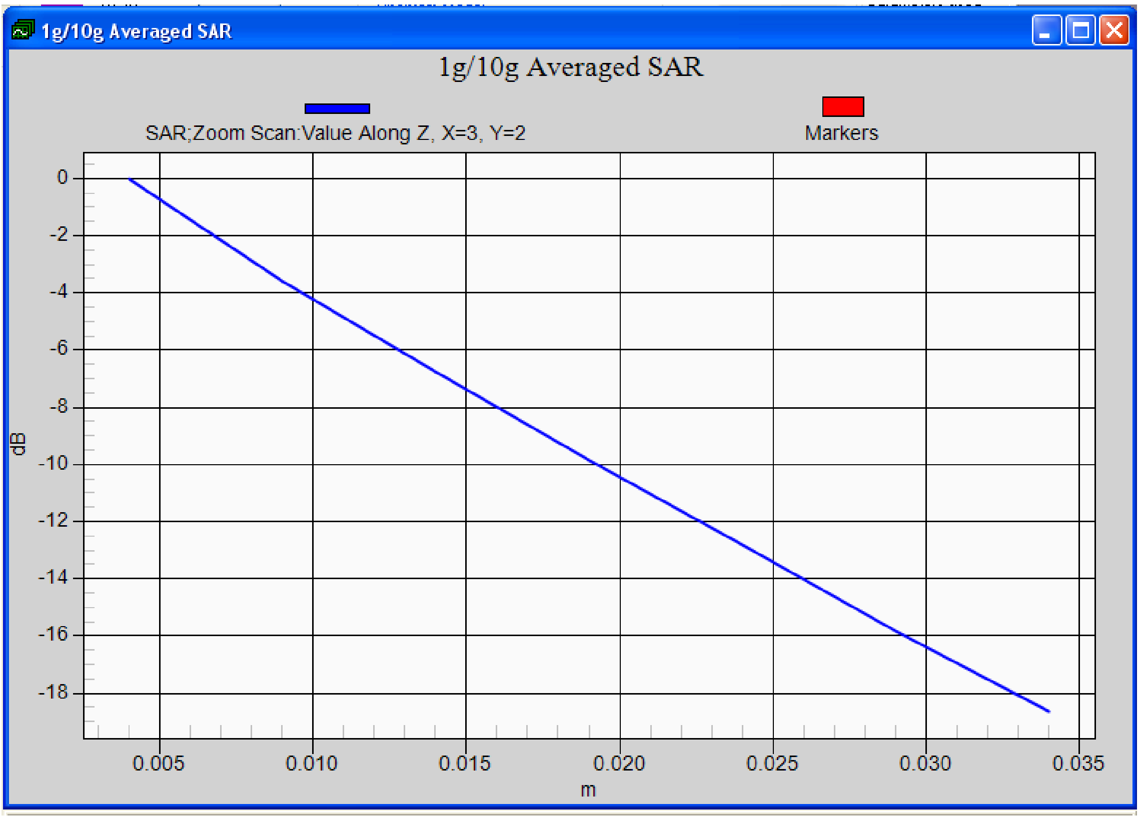
Date/Time: 14/01/2012 10:31:33
EUT:7" Digix Tablet M/N:Tab-720
Communication System: IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps); Frequency: 2462 MHz;Medium parameters used (interpolated): f = 2462 MHz; σ = 2.048 mho/m; εr = 50.622; ρ = 1000 kg/m3 ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4, 4, 4); Calibrated: 23/03/2011
- Electronics: DAE4 Sn899; Calibrated: 18/03/2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.6.4 (4989)

**Configuration/Back/Area Scan (101x181x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.714 mW/g
**Configuration/Back/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.551 V/m; Power Drift = 0.20 dB
Peak SAR (extrapolated) = 1.3120
**SAR(1 g) = 0.545 mW/g; SAR(10 g) = 0.249 mW/g**
Maximum value of SAR (measured) = 0.610 mW/g




0 dB = 0.610mW/g = -4.29 dB mW/g

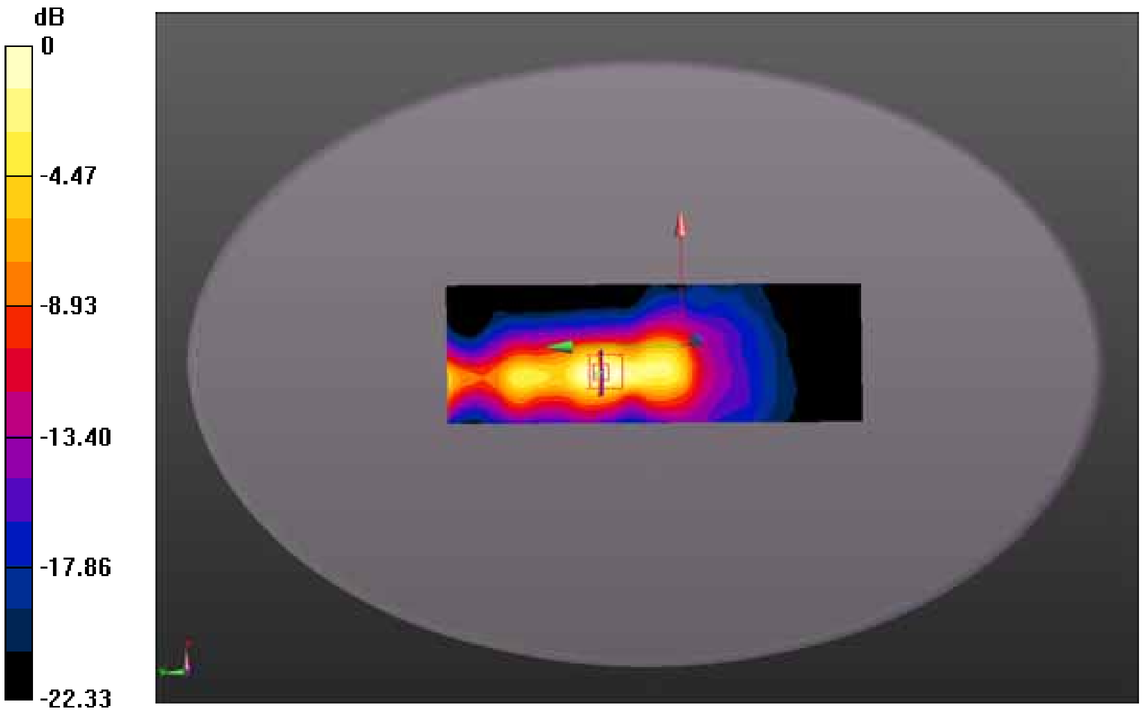

1g/10g Averaged SAR
1g/10g Averaged SAR
SAR;Zoom Scan:Value Along Z, X=3, Y=2
Markers
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
dB
0.005
0.010
0.015
0.020
0.025
0.030
0.035
m

**Channel 11 (TOP)**

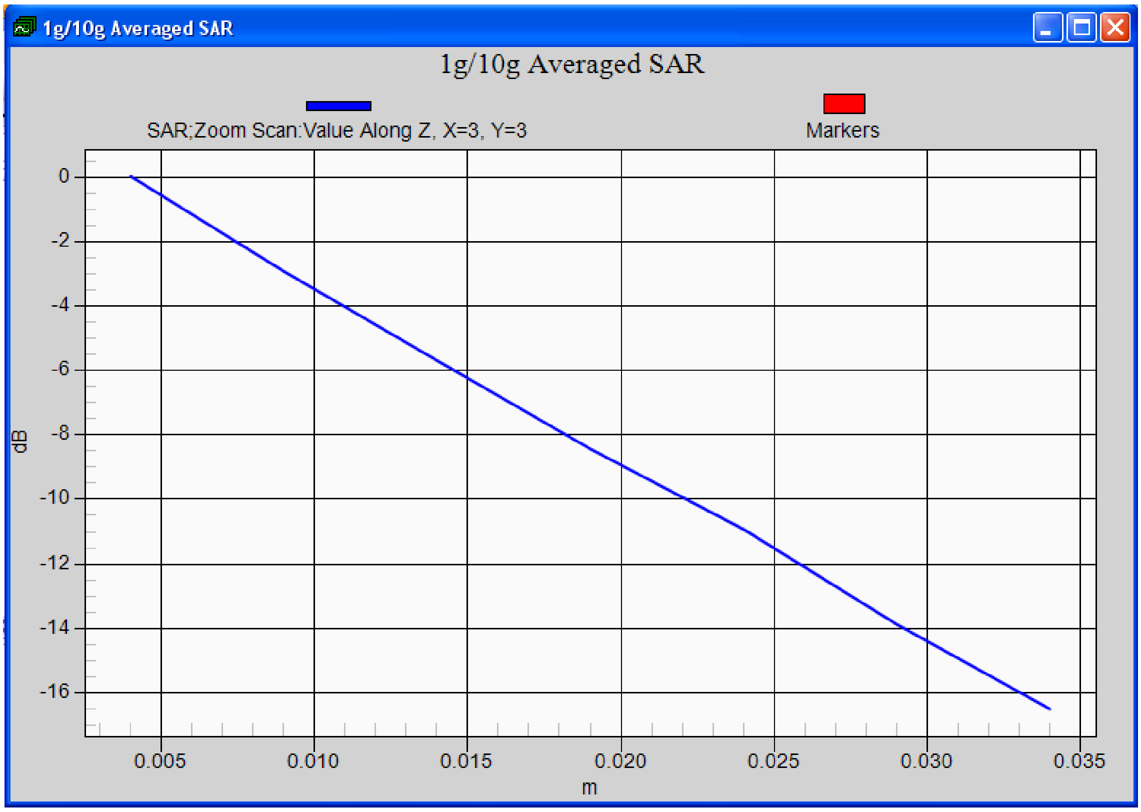
Date/Time: 14/01/2012 14:31:28
EUT:7" Digix Tablet M/N:Tab-720
Communication System: IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps); Frequency: 2462 MHz;Medium parameters used (interpolated): f = 2462 MHz; σ = 2.048 mho/m; εr = 50.622; ρ = 1000 kg/m3 ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4, 4, 4); Calibrated: 23/03/2011
- Electronics: DAE4 Sn899; Calibrated: 18/03/2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Configuration/TOP **CH11/Area Scan (61x181x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.231 mW/g
**Configuration/TOP CH11/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.189 V/m; Power Drift = 0.20 dB
Peak SAR (extrapolated) = 0.4280
**SAR(1 g) = 0.208 mW/g; SAR(10 g) = 0.101 mW/g**
Maximum value of SAR (measured) = 0.232 mW/g




0 dB = 0.230mW/g = -12.77 dB mW/g

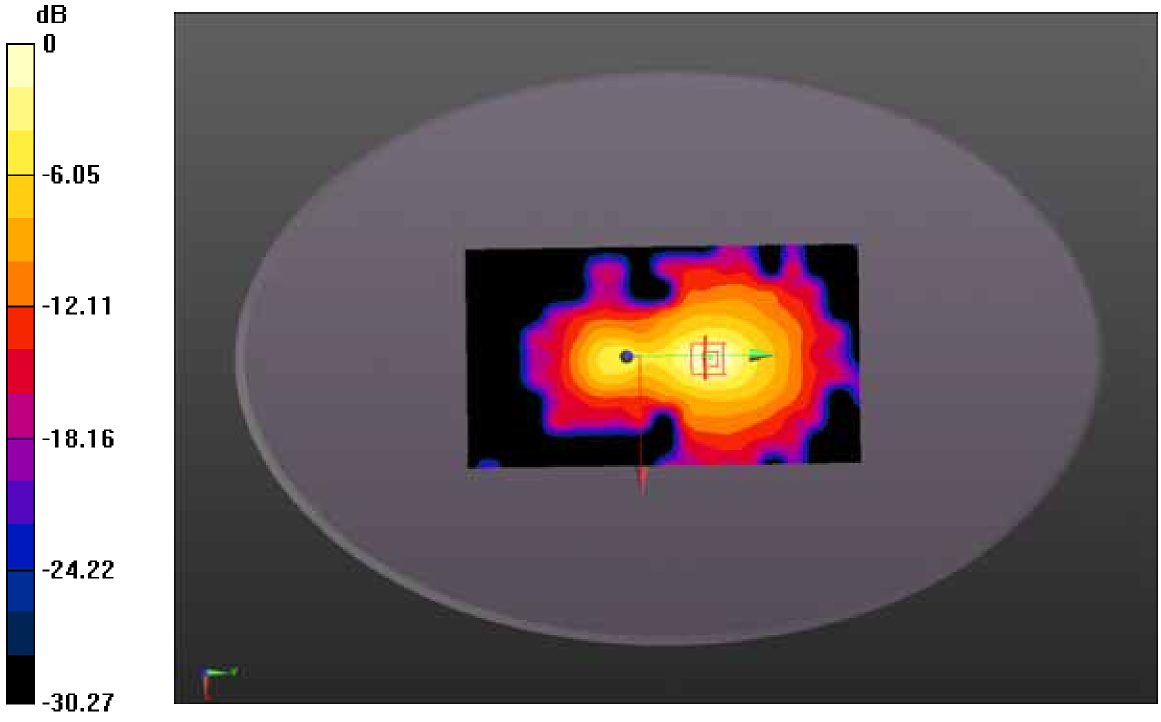

1g/10g Averaged SAR
1g/10g Averaged SAR
SAR;Zoom Scan:Value Along Z, X=3, Y=3
Markers
dB
0
-2
-4
-6
-8
-10
-12
-14
-16
0.005
0.010
0.015
0.020
0.025
0.030
0.035
m

**Channel 11 (Left)**

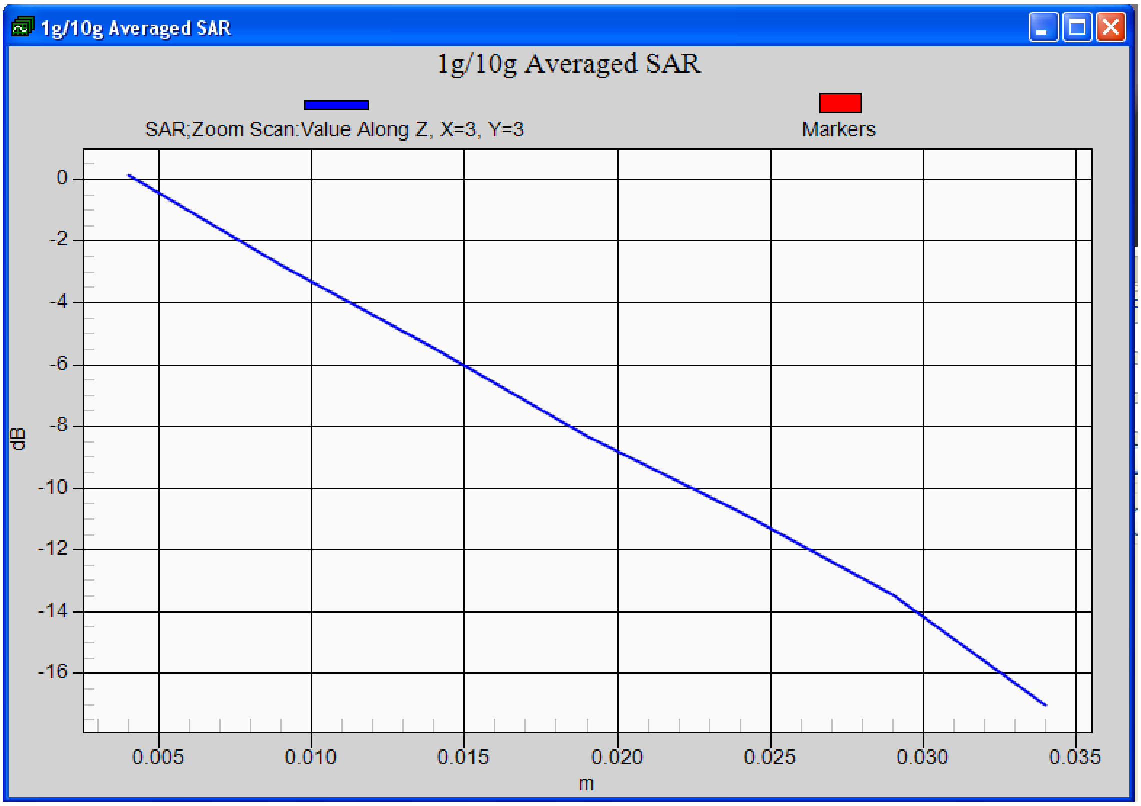
Date/Time: 14/01/2012 12:25:07
EUT:7'' Digix Tablet M/N:Tab-720
Communication System: IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps); Frequency: 2462 MHz;Medium parameters used (interpolated): f = 2462 MHz; σ = 1.968 mho/m; εr = 50.861; ρ = 1000 kg/m3 ;Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: ES3DV3 - SN3139; ConvF(4, 4, 4); Calibrated: 23/03/2011
- Electronics: DAE4 Sn899; Calibrated: 18/03/2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Configuration/LEFT CH 11/Area Scan (101x181x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.070 mW/g
**Configuration/LEFT CH 11/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.671 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 0.1340
**SAR(1 g) = 0.066 mW/g; SAR(10 g) = 0.033 mW/g**
Maximum value of SAR (measured) = 0.072 mW/g




0 dB = 0.070mW/g = -23.10 dB mW/g


1g/10g Averaged SAR
1g/10g Averaged SAR
SAR;Zoom Scan:Value Along Z, X=3, Y=3
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

# 11. DIPOLE CALIBRATION CERTIFICATE

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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.

## 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 V5.0 | |
| **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 | 38.7 ± 6 % | 1.72 mho/m ± 6 % |
| **Head TSL temperature during test** | (21.3 ± 0.2) °C | ---- | ---- |

## SAR result with Head TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 13.1 mW / g |
| SAR normalized | normalized to 1W | 52.4 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **53.3 mW /g ± 17.0 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (10 g) of Head TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 6.12 mW / g |
| SAR normalized | normalized to 1W | 24.5 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **24.6 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 | 51.5 ± 6 % | 1.92 mho/m ± 6 % |
| **Body TSL temperature during test** | (22.0 ± 0.2) °C | ---- | ---- |

## SAR result with Body TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Body TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 12.8 mW / g |
| SAR normalized | normalized to 1W | 51.2 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **51.3 mW / g ± 17.0 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (10 g) of Body TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 5.86 mW / g |
| SAR normalized | normalized to 1W | 23.4 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **23.4 mW / g ± 16.5 % (k=2)** |

## Appendix

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 54.6 Ω + 3.6 jΩ |
| Return Loss | - 25.0 dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 50.3 Ω + 4.9 jΩ |
| Return Loss | - 26.3 dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.160 ns |

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

| | |
|---|---|
| Manufactured by | SPEAG |
| Manufactured on | April 23, 2010 |

## DASY5 Validation Report for Head TSL

Date/Time: 22.03.2011 14:07:14

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL U12 BB
Medium parameters used: f = 2450 MHz; $\sigma$ = 1.72 mho/m; $\varepsilon_r$ = 38.8; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

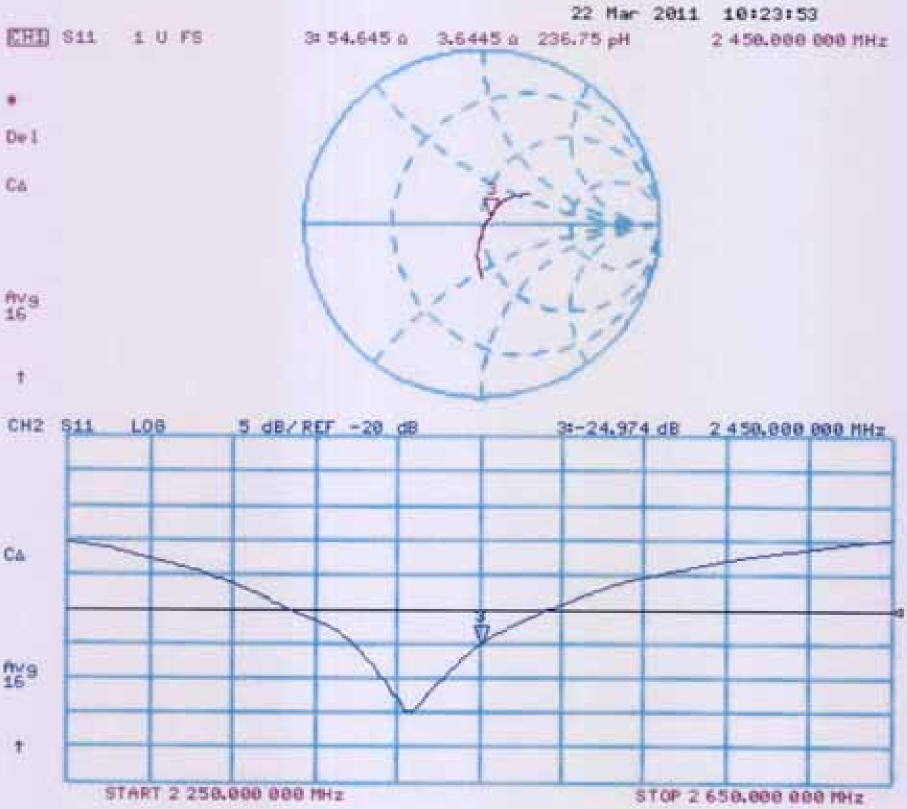
DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 101.7 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 26.808 W/kg
**SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.12 mW/g**
Maximum value of SAR (measured) = 16.641 mW/g


0 dB = 16.640mW/g

## Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date/Time: 21.03.2011 14:22:38

Test Laboratory: SPEAG, Zurich, Switzerland

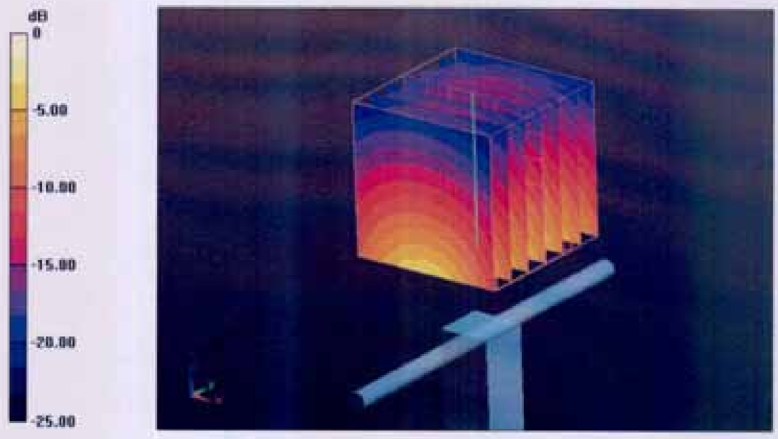
**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:862**

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL U12 BB
Medium parameters used: f = 2450 MHz; $\sigma$ = 1.92 mho/m; $\varepsilon_r$ = 51.5; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

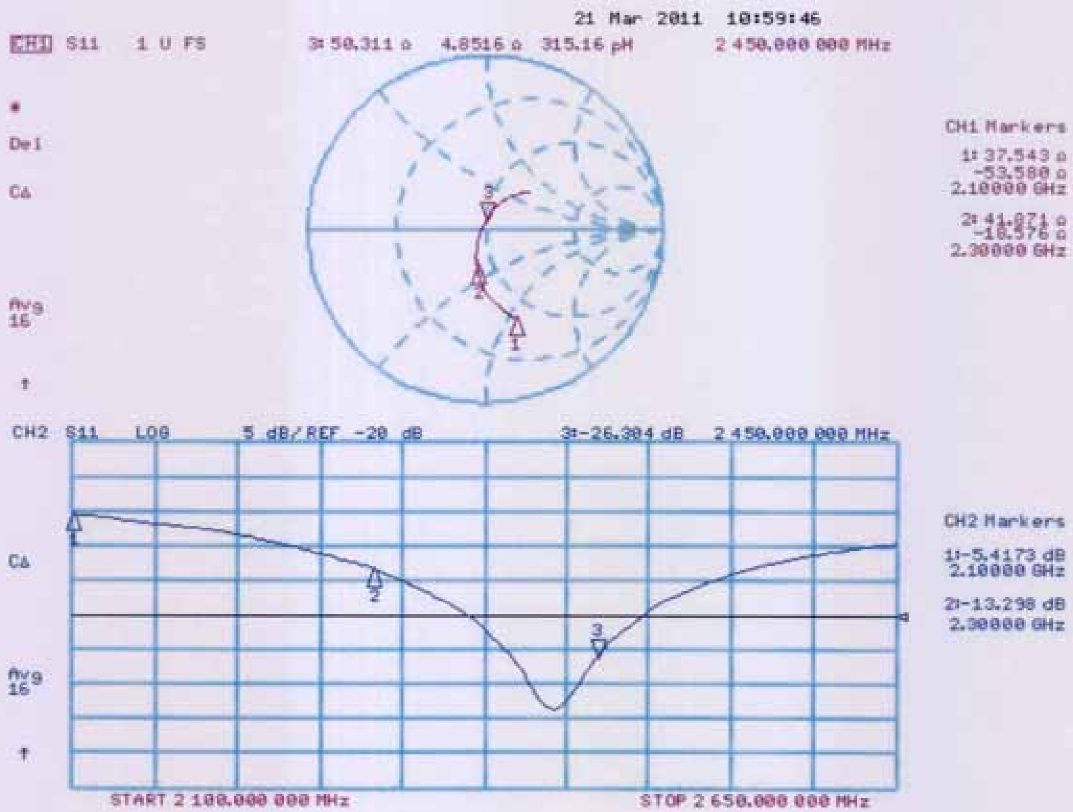
- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.402 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 27.156 W/kg
**SAR(1 g) = 12.8 mW/g; SAR(10 g) = 5.86 mW/g**
Maximum value of SAR (measured) = 16.826 mW/g




0 dB = 16.830mW/g

## Impedance Measurement Plot for Body TSL



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**Accreditation No.: SCS 108**

Client **Audix (Auden)**

**Certificate No: D2450V2-862_Mar11**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D2450V2 - SN: 862 |
| Calibration procedure(s) | QA CAL-05.v8<br>Calibration procedure for dipole validation kits |
| Calibration date: | March 22, 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: 5086 (20g) | 30-Mar-10 (No. 217-01158) | Mar-11 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 30-Mar-10 (No. 217-01162) | Mar-11 |
| Reference Probe ES3DV3 | SN: 3205 | 30-Apr-10 (No. ES3-3205_Apr10) | Apr-11 |
| DAE4 | SN: 601 | 10-Jun-10 (No. DAE4-601_Jun10) | Jun-11 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06 | 100005 | 4-Aug-99 (in house check Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E | 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: March 23, 2011

# 12. E-FIELD PROBES DIPOLE CALIBRATION CERTIFICATE

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**Accreditation No.: SCS 108**

**Client** **Audix (Auden)**

**Certificate No: ES3-3139_Mar11**

## CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3139

Calibration procedure(s): QA CAL-01.v7, QA CAL-23.v4, QA CAL-25.v3
Calibration procedure for dosimetric E-field probes

Calibration date: March 23, 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 E4419B | GB41293874 | 01-Apr-10 (No. 217-01136) | Apr-11 |
| Power sensor E4412A | MY41495277 | 01-Apr-10 (No. 217-01136) | Apr-11 |
| Power sensor E4412A | MY41498087 | 01-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 | 29-Dec-10 (No. ES3-3013_Dec10) | Dec-11 |
| DAE4 | SN: 654 | 23-Apr-10 (No. DAE4-654_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: | Claudio Leubler | Laboratory Technician | |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: March 25, 2011

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

Certificate No: ES3-3139_Mar11 Page 1 of 11

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**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 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* are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- *VR:* VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- *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: March 23, 2011

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] | 1.31 | 1.35 | 1.38 | ± 10.1 % |
| DCP (mV)[B] | 104.0 | 99.4 | 101.7 | |

## Modulation Calibration Parameters

| UID | Communication System Name | PAR | | A dB | B dB | C dB | VR mV | Unc[E] (k=2) |
|---|---|---|---|---|---|---|---|---|
| 10000 | CW | 0.00 | X | 0.00 | 0.00 | 1.00 | 119.4 | ±2.5 % |
| | | | Y | 0.00 | 0.00 | 1.00 | 114.8 | |
| | | | Z | 0.00 | 0.00 | 1.00 | 121.6 | |

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 | 5.87 | 5.87 | 5.87 | 0.99 | 1.09 | ± 12.0 % |
| 900 | 41.5 | 0.97 | 5.79 | 5.79 | 5.79 | 0.99 | 1.10 | ± 12.0 % |
| 1810 | 40.0 | 1.40 | 4.94 | 4.94 | 4.94 | 0.99 | 1.13 | ± 12.0 % |
| 2000 | 40.0 | 1.40 | 4.85 | 4.85 | 4.85 | 0.99 | 1.11 | ± 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

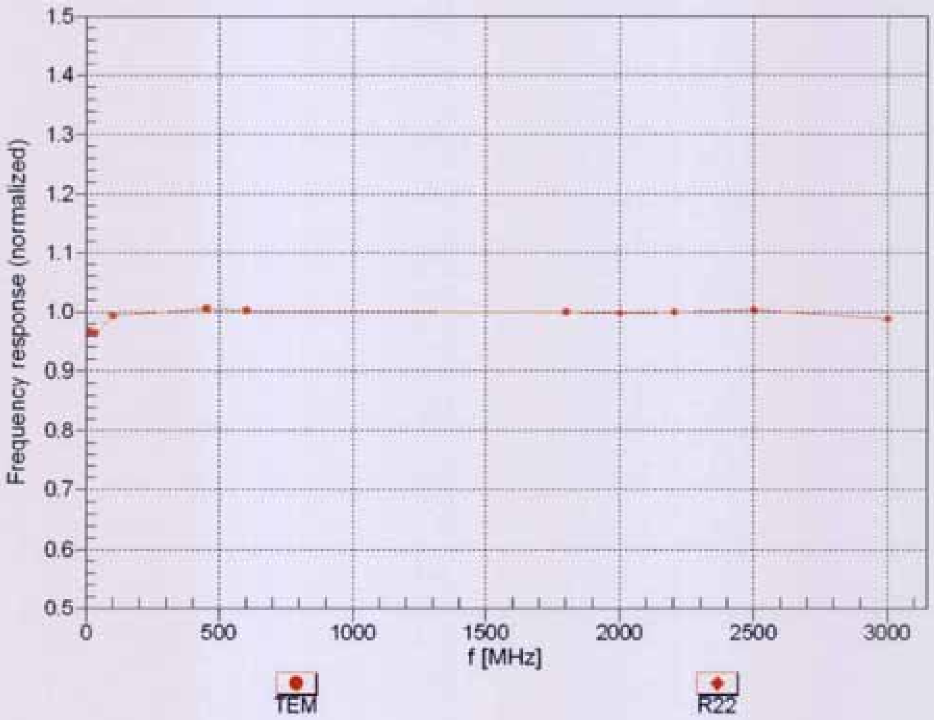
| f (MHz) [C] | Relative Permittivity [F] | Conductivity (S/m) [F] | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|---|---|---|---|---|---|---|---|---|
| 835 | 55.2 | 0.97 | 5.83 | 5.83 | 5.83 | 0.99 | 1.17 | ± 12.0 % |
| 900 | 55.0 | 1.05 | 5.76 | 5.76 | 5.76 | 0.99 | 1.15 | ± 12.0 % |
| 1810 | 53.3 | 1.52 | 4.61 | 4.61 | 4.61 | 0.93 | 1.23 | ± 12.0 % |
| 2000 | 53.3 | 1.52 | 4.45 | 4.45 | 4.45 | 0.80 | 1.28 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 4.00 | 4.00 | 4.00 | 0.99 | 1.04 | ± 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)**

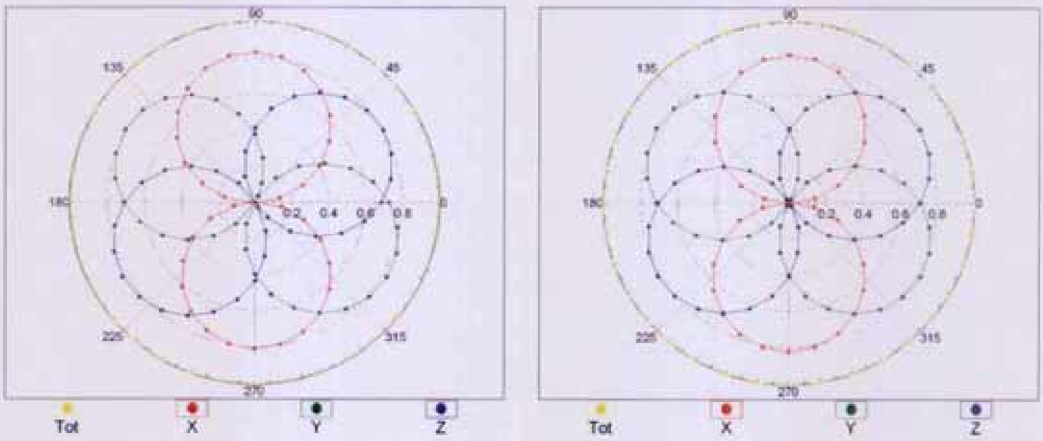


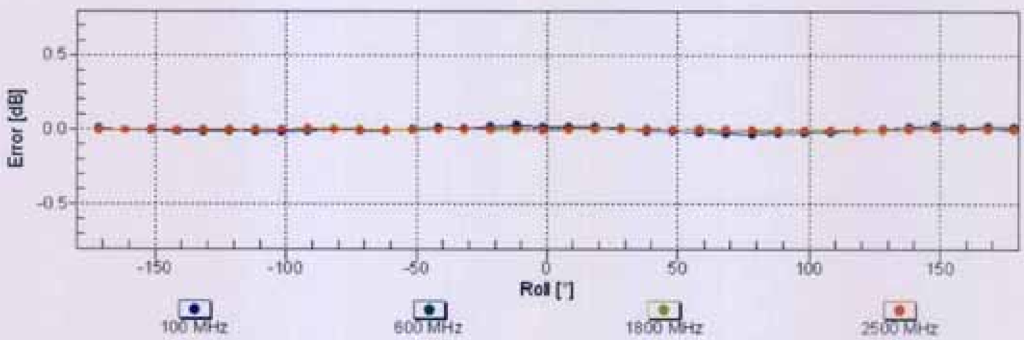

**Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)**

# Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM

f=1800 MHz,R22

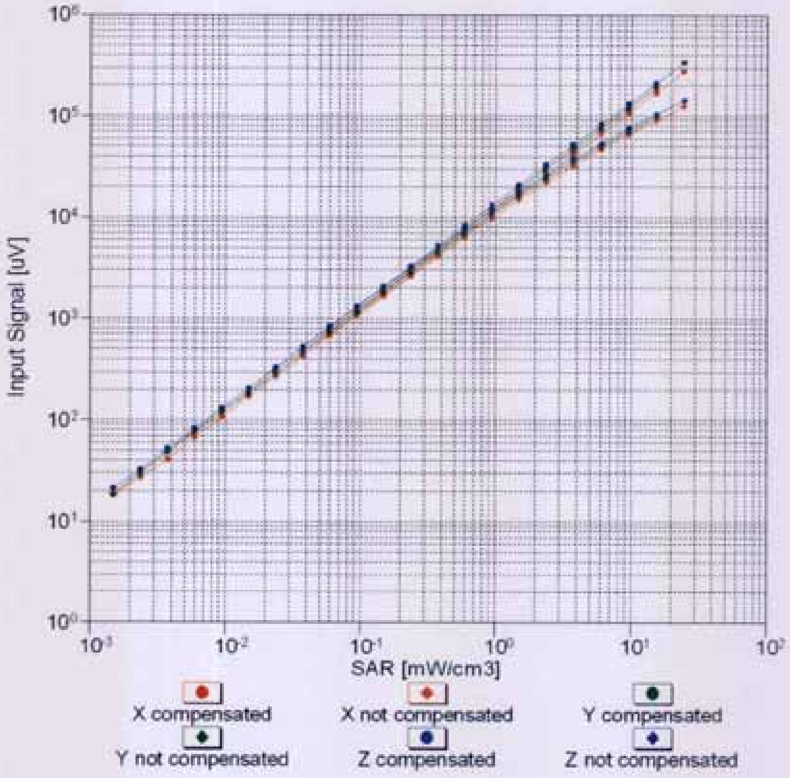


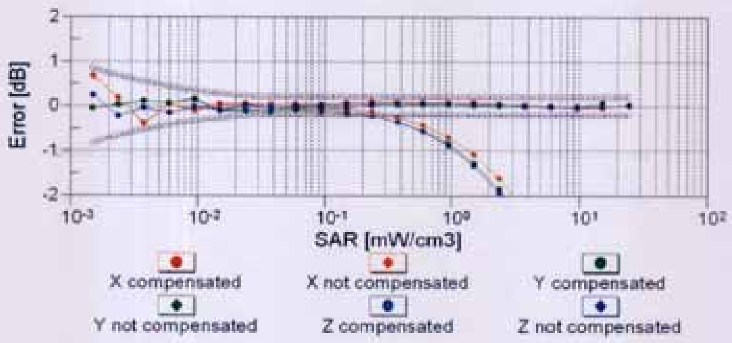




**Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)**

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

(TEM cell , f = 900 MHz)



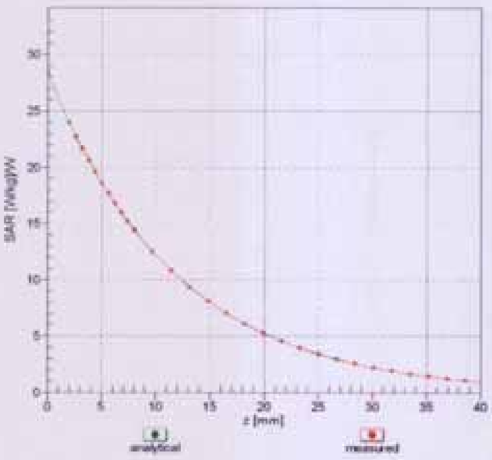




**Uncertainty of Linearity Assessment: ± 0.6% (k=2)**

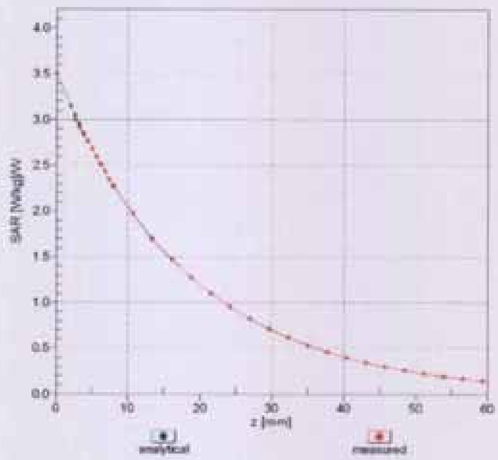
ES3DV3– SN:3139 March 23, 2011

# Conversion Factor Assessment

f = 2000 MHz,WGLS R22 (H_convF)

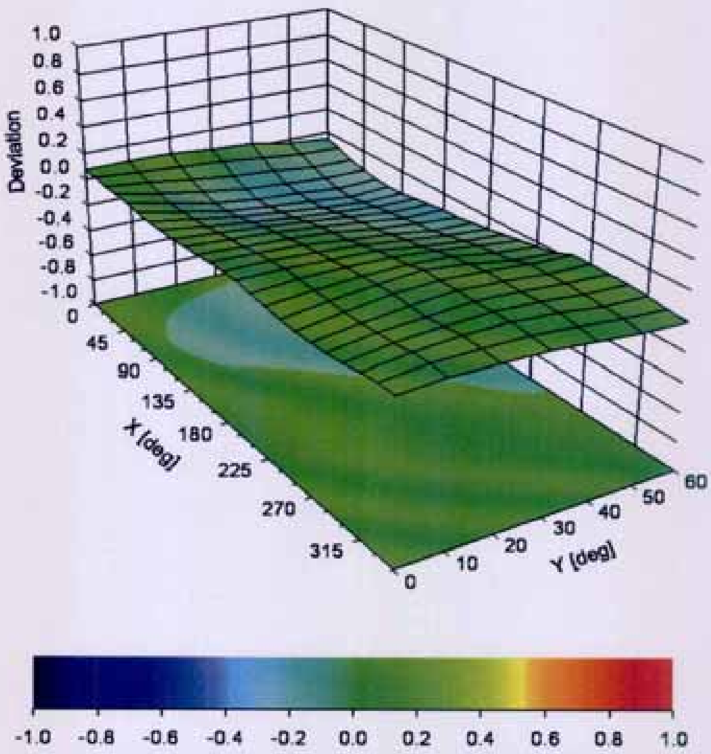



f = 900 MHz,WGLS R9 (M_convF)




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

# 13. DAE CALIBRATION 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

**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 **Audix (Auden)**

**Certificate No: DAE4-899_Mar11**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | DAE4 - SD 000 D04 BJ - SN: 899 |
| Calibration procedure(s) | QA CAL-06.v22<br>Calibration procedure for the data acquisition electronics (DAE) |
| Calibration date: | March 18, 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 | 07-Jun-10 (in house check) | In house check: Jun-11 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Dominique Steffen | Technician | [signature] |
| Approved by: | Fin Bomholt | R&D Director | i.V. [signature] |

Issued: March 18, 2011

**Calibration Laboratory of**
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**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 | 402.471 ± 0.1% (k=2) | 403.052 ± 0.1% (k=2) | 403.039 ± 0.1% (k=2) |
| Low Range | 3.98081 ± 0.7% (k=2) | 3.95588 ± 0.7% (k=2) | 3.98377 ± 0.7% (k=2) |

## Connector Angle

| | |
|---|---|
| **Connector Angle** to be used in DASY system | 348.5 ° ± 1 ° |

## Appendix

### 1. DC Voltage Linearity

| High Range | | Reading (µV) | Difference (µV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 200005.3 | -3.18 | -0.00 |
| Channel X | + Input | 19999.58 | 0.28 | 0.00 |
| Channel X | - Input | -19998.40 | 1.80 | -0.01 |
| Channel Y | + Input | 199993.2 | -4.06 | -0.00 |
| Channel Y | + Input | 20000.38 | 0.08 | 0.00 |
| Channel Y | - Input | -20001.20 | -0.80 | 0.00 |
| Channel Z | + Input | 199994.6 | -1.77 | -0.00 |
| Channel Z | + Input | 19998.79 | -1.71 | -0.01 |
| Channel Z | - Input | -20001.20 | -1.00 | 0.00 |

| Low Range | | Reading (µV) | Difference (µV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 2000.3 | 0.36 | 0.02 |
| Channel X | + Input | 199.90 | -0.10 | -0.05 |
| Channel X | - Input | -200.05 | -0.05 | 0.03 |
| Channel Y | + Input | 2000.6 | 0.40 | 0.02 |
| Channel Y | + Input | 198.61 | -1.29 | -0.65 |
| Channel Y | - Input | -200.62 | -0.62 | 0.31 |
| Channel Z | + Input | 2000.2 | 0.07 | 0.00 |
| Channel Z | + Input | 198.61 | -1.29 | -0.65 |
| Channel Z | - Input | -200.71 | -0.81 | 0.41 |

### 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 | 8.14 | 7.31 |
| | - 200 | -6.04 | -7.82 |
| Channel Y | 200 | 12.77 | 13.21 |
| | - 200 | -14.98 | -14.77 |
| Channel Z | 200 | -7.28 | -7.24 |
| | - 200 | 5.94 | 5.68 |

### 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 | - | 4.08 | -0.12 |
| Channel Y | 200 | 3.16 | - | 5.26 |
| Channel Z | 200 | 1.92 | -0.07 | - |

## 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 | 16020 | 17047 |
| Channel Y | 15654 | 13539 |
| Channel Z | 15817 | 15639 |

## 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 | -0.25 | -1.34 | 1.03 | 0.47 |
| Channel Y | -0.29 | -0.95 | 0.53 | 0.36 |
| Channel Z | -0.68 | -1.67 | 0.05 | 0.36 |

## 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 |