



# A Test Lab Techno Corp.

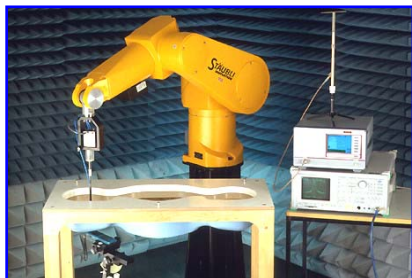
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## SAR EVALUATION REPORT



|                   |   |  |
|-------------------|---|--|
| Test Report No.   | : | 1110FS18-01  |
| Applicant         | : | Microlink Communications Inc.  |
| Product Type      | : | Blank Slate Tablet   |
| Trade Name        | : | MOGO   |
| Model Number      | : | ID8-BS1000   |
| Dates of Received | : | Aug. 18, 2011  |
| Dates of Test     | : | Aug. 22, 2011  |
| Date of Issued    | : | Nov. 21, 2011  |
| Test Environment  | : | Ambient Temperature : $22 \pm 2^{\circ} \text{C}$<br>Relative Humidity : 40 - 70 %   |
| Standard          | : | ANSI/IEEE C95.1-1999<br>IEEE Std. 1528-2003<br>47 CFR Part §2.1093<br>FCC/OET Bulletin 65 Supplement C [July 2001]<br>RSS-102 Issue 4 (March 2010)<br>KDB 248227 D01 SAR meas for 802.11 a b g v01r02<br>KDB 447498 "RF Exposure Procedures and Equipment Authorization Policies"<br>KDB616217: 616217 SAR for Laptop with Screen Ant v01r01 |
| Max. SAR          | : | 0.058 W/kg Body SAR  |
| Test Lab Location | : | Chang-an Lab   |



1. The test operations have to be performed with cautious behavior, the test results are as attached.
2. The test results are under chamber environment of A Test Lab Techno Corp. A Test Lab Techno Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples.
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Approved By

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Tested By

*Alex Wu*

(Alex Wu)



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**1. Description of Equipment under Test (EUT)**

|                           |   |                         |
|---------------------------|---|-------------------------|
| Applicant                 | Microlink Communications Inc.   |                         |
| Applicant Address         | No. 49, Sec. 4, Jhongyang Rd., Tucheng City, Taipei County 236, Taiwan (R.O.C.) |                         |
| Manufacturer              | FUGANG ELECTRIC (KUNSHAN) CO., LTD  |                         |
| Manufacturer Address      | No.6, Zheng Wei Road, Jin Xi Town, Kun Shan City, Jiang Su Province, China      |                         |
| Product Type              | Blank Slate Tablet  |                         |
| Trade Name                | MOGO  |                         |
| Model Number              | ID8-BS1000  |                         |
| FCC ID                    | ZUJ-MTP1122   |                         |
| Tx Frequency              | Band  | Operate Frequency (MHz) |
|                           | IEEE 802.11b / IEEE 802.11g   | 2412 - 2462             |
|                           | Draft 802.11n 2.4GHz Standard-20MHz   | 2412 - 2462             |
| RF Conducted Power (Avg.) | Band  | Power (W / dBm)         |
|                           | IEEE 802.11b  | 0.035 / 15.43           |
|                           | IEEE 802.11g  | 0.044 / 16.48           |
|                           | Draft 802.11n 2.4GHz Standard-20MHz   | 0.041 / 16.10           |
| Max. SAR Measurement      | 0.058 W/kg Body SAR   |                         |
| Antenna Type              | Chip Antenna  |                         |
| Device Category           | Mobile Device   |                         |
| RF Exposure Environment   | General Population / Uncontrolled   |                         |
| Battery Option            | Standard  |                         |
| Application Type          | Certification   |                         |

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment / general population exposure limits specified in Standard C95.1-1999 and had been tested in accordance with the measurement procedures specified in IEEE Std. 1528-2003.

## 2. Introduction

The A Test Lab Techno Corp. has performed measurements of the maximum potential exposure to the user of **Microlink Communications Inc. Trade Name : MOGO Model(s) : ID8-BS1000**. The test procedures, as described in American National Standards, Institute C95.1-1999 [ 1 ] , FCC/OET Bulletin 65 Supplement C [July 2001] were employed and they specify the maximum exposure limit of 1.6mW/g as averaged over any 1 gram of tissue for portable devices being used within 20cm between user and EUT in the uncontrolled environment. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the equipment used are included within this test report.

### 2.1 SAR Definition

Specific Absorption Rate (SAR) is defined as 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 ( $\rho$ ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Figure 2).

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

Figure 2. SAR Mathematical Equation

SAR is expressed in units of Watts per kilogram (W/kg)

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

Where :

$\sigma$  = conductivity of the tissue (S/m)

$\rho$  = mass density of the tissue (kg/m<sup>3</sup>)

$E$  = RMS electric field strength (V/m)

\* Note :

The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane [ 2 ]

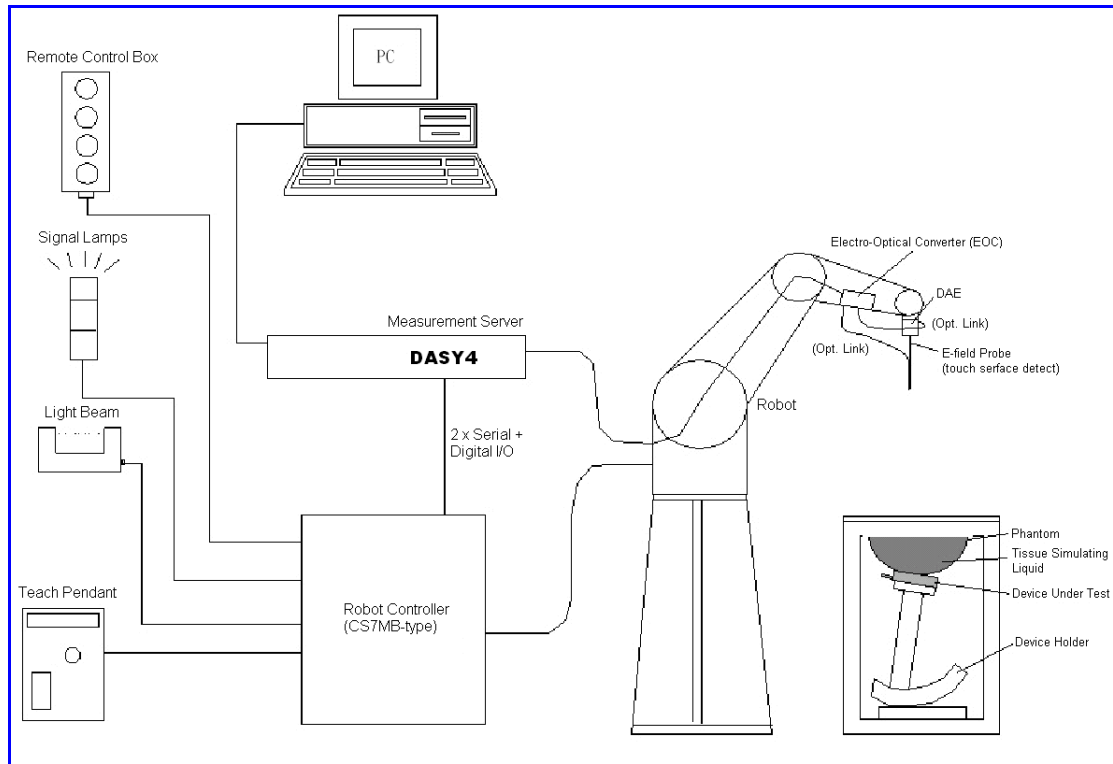


### 3. **SAR Measurement Setup**

These measurements were performed with the automated near-field scanning system DASY4 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than  $\pm 0.025\text{mm}$ . Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines (length = 300mm) to the data acquisition unit.

A cell controller system contains the power supply, robot controller, teaches pendant (Joystick) and remote control, and is used to drive the robot motors. The Measurement Server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chipdisk and 64MB RAM. The necessary circuits for communication with either the DAE3 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4 I/O-board, which is directly connected to the PC/104 bus of the CPU board. The PC consists of the Intel Pentium 4 2.4GHz computer with Windows XP system and SAR Measurement Software DASY4, Post Processor SEMCAD, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection...etc. is connected to the Electro-optical converter (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the Measurement Server.

The DAE4 (or DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in [ 3 ] .



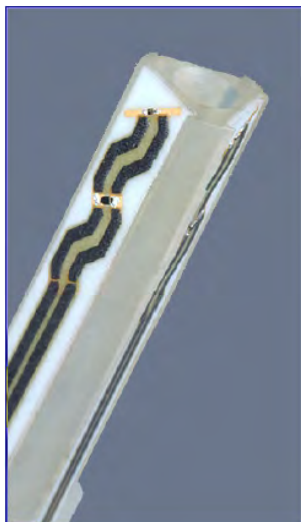
**Figure 1. SAR Lab Test Measurement Setup**

### 3.1 DASY4 E-Field Probe System

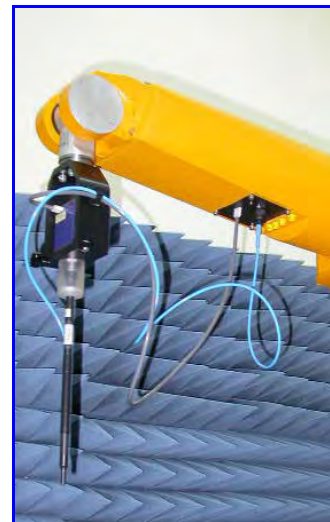
The SAR measurements were conducted with the dosimetric probe ES3DV3 or ET3DV6 (manufactured by SPEAG), designed in the classical triangular configuration [3] and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.

### 3.1.1 E-Field Probe Specification

|               |   |
|---------------|---|
| Construction  | <p>Symmetrical design with triangular core</p> <p>Built-in optical fiber for surface detection System</p> <p>Built-in shielding against static charges</p> <p>PEEK enclosure material (resistant to organic solvents, e.q., glycol)</p> |
| Calibration   | <p>In air from 10 MHz to 6 GHz</p> <p>In brain and muscle simulating tissue at frequencies of 2450MHz (accuracy <math>\pm 8\%</math>)</p> <p>Calibration for other liquids and frequencies upon request</p>                             |
| Frequency     | <p><math>\pm 0.2</math> dB (30 MHz to 6 GHz) for EX3DV4</p> <p><math>\pm 0.2</math> dB (30 MHz to 4 GHz) for ES3DV3</p>   |
| Directivity   | <p><math>\pm 0.3</math> dB in brain tissue (rotation around probe axis)</p> <p><math>\pm 0.5</math> dB in brain tissue (rotation normal probe axis)</p>   |
| Dynamic Range | <p>10 <math>\mu</math> W/g to &gt; 100mW/g; Linearity: <math>\pm 0.2</math>dB</p>   |
| Dimensions    | <p>Overall length: 337mm</p> <p>Tip length: 20mm</p> <p>Body diameter: 12mm</p> <p>Tip diameter: 2.5mm for EX3DV4, 3.9mm for ES3DV3</p> <p>Distance from probe tip to dipole centers: 1.0mm for EX3DV4, 2.0mm for ES3DV3</p>            |
| Application   | <p>General dosimetry up to 6GHz</p> <p>Compliance tests of mobile phones</p> <p>Fast automatic scanning in arbitrary phantoms</p>   |



**Figure 3. E-field Probe**



**Figure 4. Probe setup on robot**



### 3.1.2 E-Field Probe Calibration process

#### Dosimetric Assessment Procedure

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm<sup>2</sup>) using an RF Signal generator, TEM cell, and RF Power Meter.

#### Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies 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 rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm<sup>2</sup>.

#### Temperature Assessment

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

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

Where :

$\Delta t$  = Exposure time (30 seconds),

$C$  = Heat capacity of tissue (head or body),

$\Delta T$  = Temperature increase due to RF exposure.

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

Where :

$\sigma$  = Simulated tissue conductivity,

$\rho$  = Tissue density (kg/m<sup>3</sup>).





### 3.2 Data Acquisition Electronic (DAE) System

#### Cell Controller

|                    |                         |
|--------------------|-------------------------|
| Processor :        | Intel Pentium 4         |
| Clock Speed :      | 2.4GHz                  |
| Operating System : | Windows XP Professional |

#### Data Converter

|                    |  |
|--------------------|--|
| Features :         | Signal Amplifier, multiplexer, A/D converter, and control logic                    |
| Software :         | DASY4 v4.7 (Build 80) & SEMCAD v1.8 (Build 186)                                    |
| Connecting Lines : | Optical downlink for data and status info<br>Optical uplink for commands and clock |

### 3.3 Robot

|                 |  |
|-----------------|--|
| Positioner :    | Stäubli Unimation Corp. Robot Model: RX90L |
| Repeatability : | $\pm 0.025$ mm                             |
| No. of Axis :   | 6  |

### 3.4 Measurement Server

|             |  |
|-------------|--|
| Processor : | PC/104 with a 166MHz low-power Pentium   |
| I/O-board : | Link to DAE4 (or DAE3)<br>16-bit A/D converter for surface detection system<br>Digital I/O interface<br>Serial link to robot<br>Direct emergency stop output for robot |

### 3.5 Device Holder

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity  $\epsilon=3$  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.

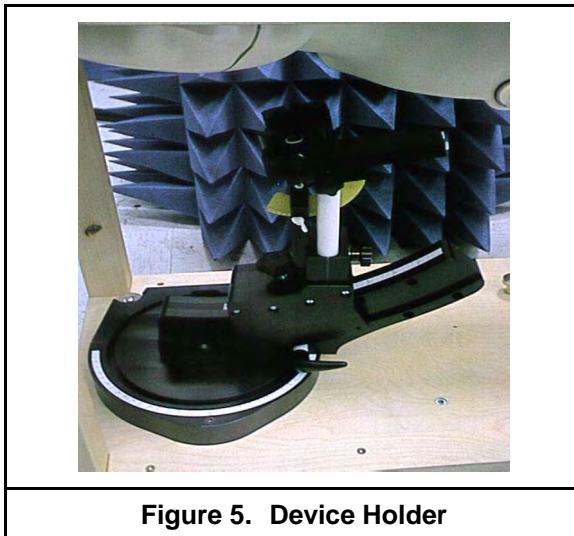


Figure 5. Device Holder

### 3.6 Phantom - SAM v4.0

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

|   |                   |
|---|-------------------|
| Shell Thickness                           | $2 \pm 0.2$ mm    |
| Filling Volume                            | Approx. 25 liters |
| Dimensions                                | 1000x500 mm (LxW) |
| <b>Table 1. Specification of SAM v4.0</b> |                   |



Figure 6. SAM Twin Phantom

### 3.7 Oval Flat Phantom - ELI 4.0

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (Oval Flat) phantom defined in IEEE 1528-2003, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of wireless portable device usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

|  |                           |
|--|---------------------------|
| <b>Shell Thickness</b>                   | 2 $\pm$ 0.2 mm            |
| <b>Filling Volume</b>                    | Approx. 30 liters         |
| <b>Dimensions</b>                        | 190x600x400 mm<br>(HxLxW) |
| <b>Table 2. Specification of ELI 4.0</b> |                           |

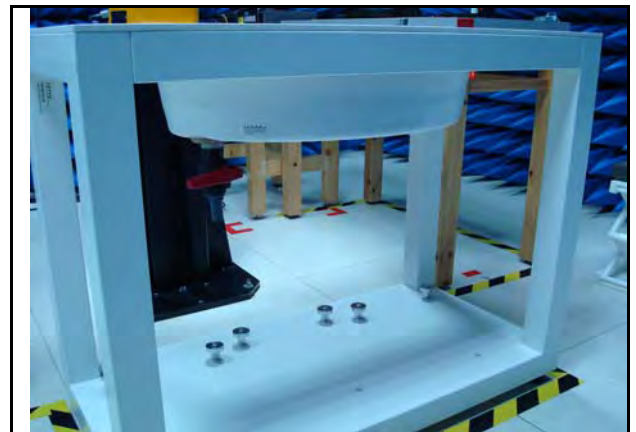


Figure 7. Oval Flat Phantom

### 3.8 Data Storage and Evaluation

#### 3.8.1 Data Storage

The DASY4 software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension .DA4. The post processing 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 erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

### 3.8.2 Data Evaluation

The DASY4 post processing software (SEMCAD) 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 :

|                            |                           |                      |
|----------------------------|---------------------------|----------------------|
| <b>Probe parameters :</b>  | - Sensitivity             | Normi, ai0, ai1, ai2 |
|                            | - Conversion factor       | ConvFi               |
|                            | - Diode compression point | dcpi                 |
| <b>Device parameters :</b> | - Frequency               | f                    |
|                            | - Crest factor            | cf                   |
| <b>Media parameters :</b>  | - Conductivity            | $\sigma$             |
|                            | - Density                 | $\rho$               |

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 DASY 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 :

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

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

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

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

$dcp_i$  = diode compression point (DASY parameter)

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

**E-field probes :**

$$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

**H-field probes :**

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

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

$\mu V/(V/m)^2$  for E-field Probes

$ConvF$  = sensitivity enhancement in solution

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

$f$  = carrier frequency [GHz]

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

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

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

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

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

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

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

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

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

$\rho$  = equivalent tissue density in  $g/cm^3$

**\*Note :** That the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

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

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

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

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

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

#### 4. Tissue Simulating Liquids

The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the tissue. The dielectric parameters of the liquids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an E5071B Network Analyzer.

##### IEEE SCC-34/SC-2 in 1528 recommended Tissue Dielectric Parameters

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in 1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in human head. Other head and body tissue parameters that have not been specified in 1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equation and extrapolated according to the head parameter specified in 1528.

| Target Frequency  | Head         |                | Body         |                |
|---|--------------|----------------|--------------|----------------|
| (MHz)   | $\epsilon_r$ | $\sigma$ (S/m) | $\epsilon_r$ | $\sigma$ (S/m) |
| 150   | 52.3         | 0.76           | 61.9         | 0.80           |
| 300   | 45.3         | 0.87           | 58.2         | 0.92           |
| 450   | 43.5         | 0.87           | 56.7         | 0.94           |
| 835   | 41.5         | 0.90           | 55.2         | 0.97           |
| 900   | 41.5         | 0.97           | 55.0         | 1.05           |
| 915   | 41.5         | 0.98           | 55.0         | 1.06           |
| 1450  | 40.5         | 1.20           | 54.0         | 1.30           |
| 1610  | 40.3         | 1.29           | 53.8         | 1.40           |
| 1800 - 2000   | 40.0         | 1.40           | 53.3         | 1.52           |
| 2450  | 39.2         | 1.80           | 52.7         | 1.95           |
| 3000  | 38.5         | 2.40           | 52.0         | 2.73           |
| 5800  | 35.3         | 5.27           | 48.2         | 6.00           |
| ( $\epsilon_r$ = relative permittivity, $\sigma$ = conductivity and $\rho$ = 1000 kg/m <sup>3</sup> ) |              |                |              |                |

Table 3. Tissue dielectric parameters for head and body phantoms



## 4.1 Ingredients

The following ingredients are used:

- Water: deionized water (pure H<sub>2</sub>O), resistivity  $\geq 16 \text{ M } \Omega$  -as basis for the liquid
- Sugar: refined white sugar (typically 99.7 % sucrose, available as crystal sugar in food shops)  
-to reduce relative permittivity
- Salt: pure NaCl -to increase conductivity
- Cellulose: Hydroxyethyl-cellulose, medium viscosity (75-125 mPa.s, 2% in water, 20 °C), CAS # 54290 -to increase viscosity and to keep sugar in solution.
- Preservative: Preventol D-7 Bayer AG, D-51368 Leverkusen, CAS # 55965-84-9 -to prevent the spread of bacteria and molds
- DGBE: Diethylenglycol-monobutyl ether (DGBE), Fluka Chemie GmbH, CAS # 112-34-5 -to reduce relative permittivity

## 4.2 Recipes

The following tables give the recipes for tissue simulating liquids to be used in different frequency bands.

Note: The goal dielectric parameters (at 22 °C) must be achieved within a tolerance of  $\pm 5\%$  for  $\epsilon$  and  $\pm 5\%$  for  $\sigma$ .

| Ingredients<br>(% 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,  $16 \text{ M } \Omega$  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

### 4.3 Liquid Confirmation

#### 4.3.1 Parameters

| Liquid Verify   |           |           |              |              |                |               |           |               |
|---|-----------|-----------|--------------|--------------|----------------|---------------|-----------|---------------|
| Ambient Temperature : 22 $\pm$ 2 °C ; Relative Humidity : 40 -70% |           |           |              |              |                |               |           |               |
| Liquid Type   | Frequency | Temp (°C) | Parameters   | Target Value | Measured Value | Deviation (%) | Limit (%) | Measured Date |
| 2450MHz Body  | 2400MHz   | 22.0      | $\epsilon_r$ | 52.70        | 51.40          | -2.47         | $\pm$ 5   | 08/22/2011    |
|   |           |           | $\sigma$     | 1.95         | 1.89           | -3.08         | $\pm$ 5   |               |
|   | 2450MHz   | 22.0      | $\epsilon_r$ | 52.70        | 51.30          | -2.66         | $\pm$ 5   |               |
|   |           |           | $\sigma$     | 1.95         | 1.96           | 0.51          | $\pm$ 5   |               |
|   | 2500MHz   | 22.0      | $\epsilon_r$ | 52.70        | 51.13          | -2.98         | $\pm$ 5   |               |
|   |           |           | $\sigma$     | 1.95         | 2.02           | 3.59          | $\pm$ 5   |               |

Table 4. Measured Tissue dielectric parameters for body phantoms

#### 4.3.2 Liquid Depth

The liquid level was during measurement 15cm  $\pm$ 0.5cm.

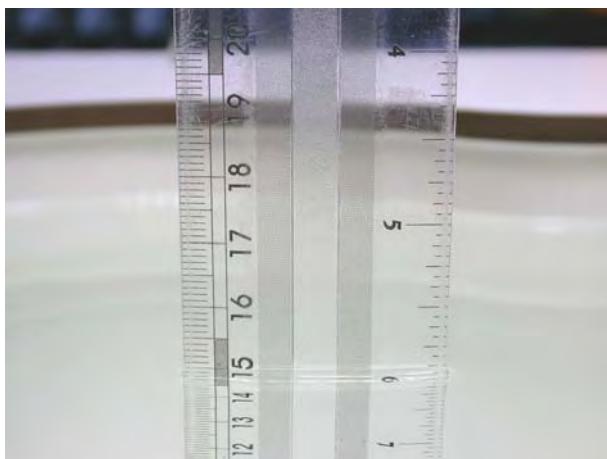


Figure 8. Head-Tissue-Simulating-Liquid

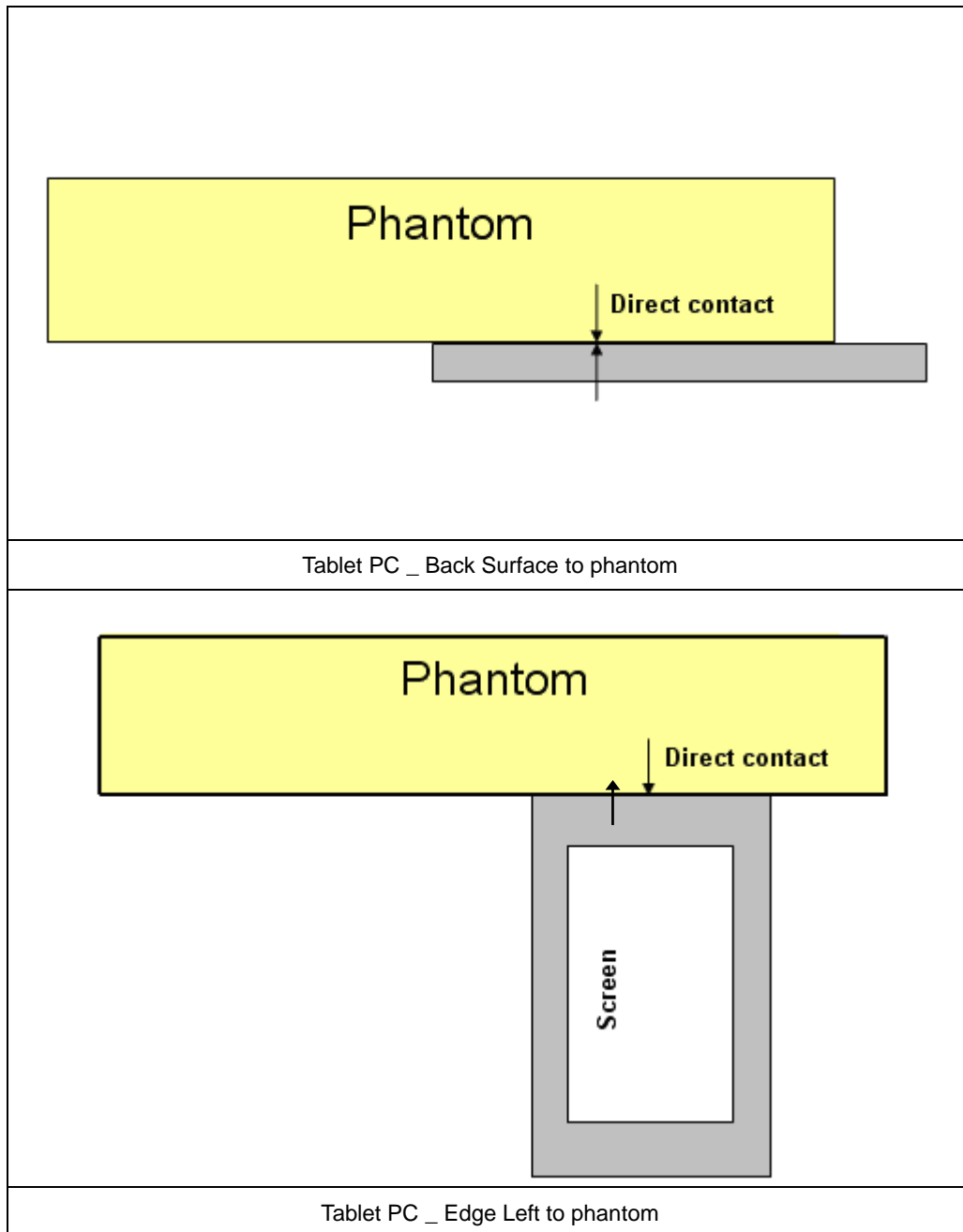


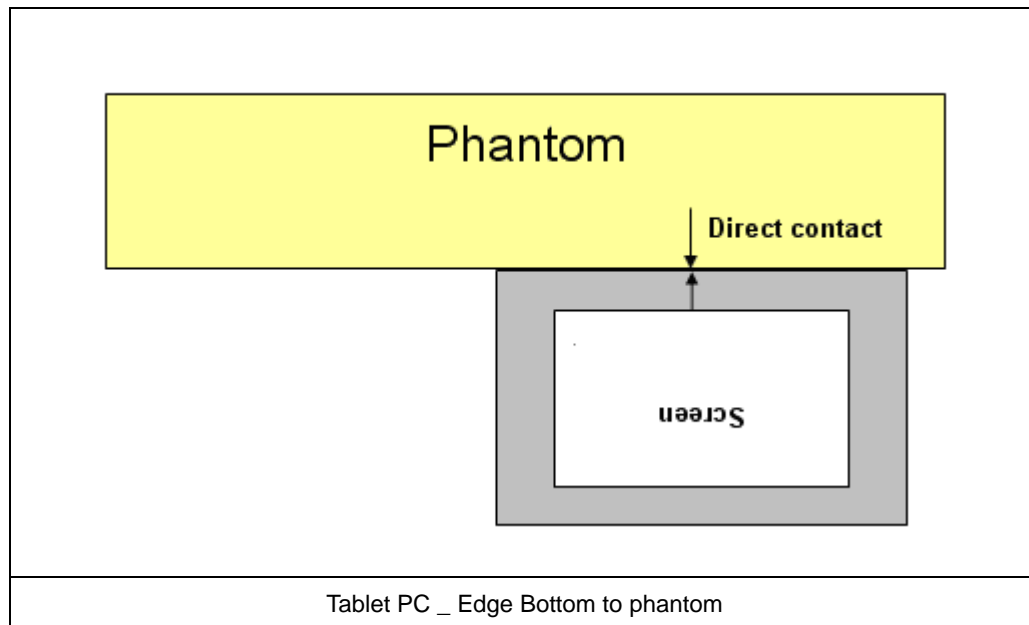
Figure 9. Body-Tissue-Simulating-Liquid



## 5. Test Configuration Position

This DUT was tested in two positions. It is tablet PC back and top touching with 0 cm air gap. Please refer to “SAR Test Setup Photographs” file for the test setup photos.

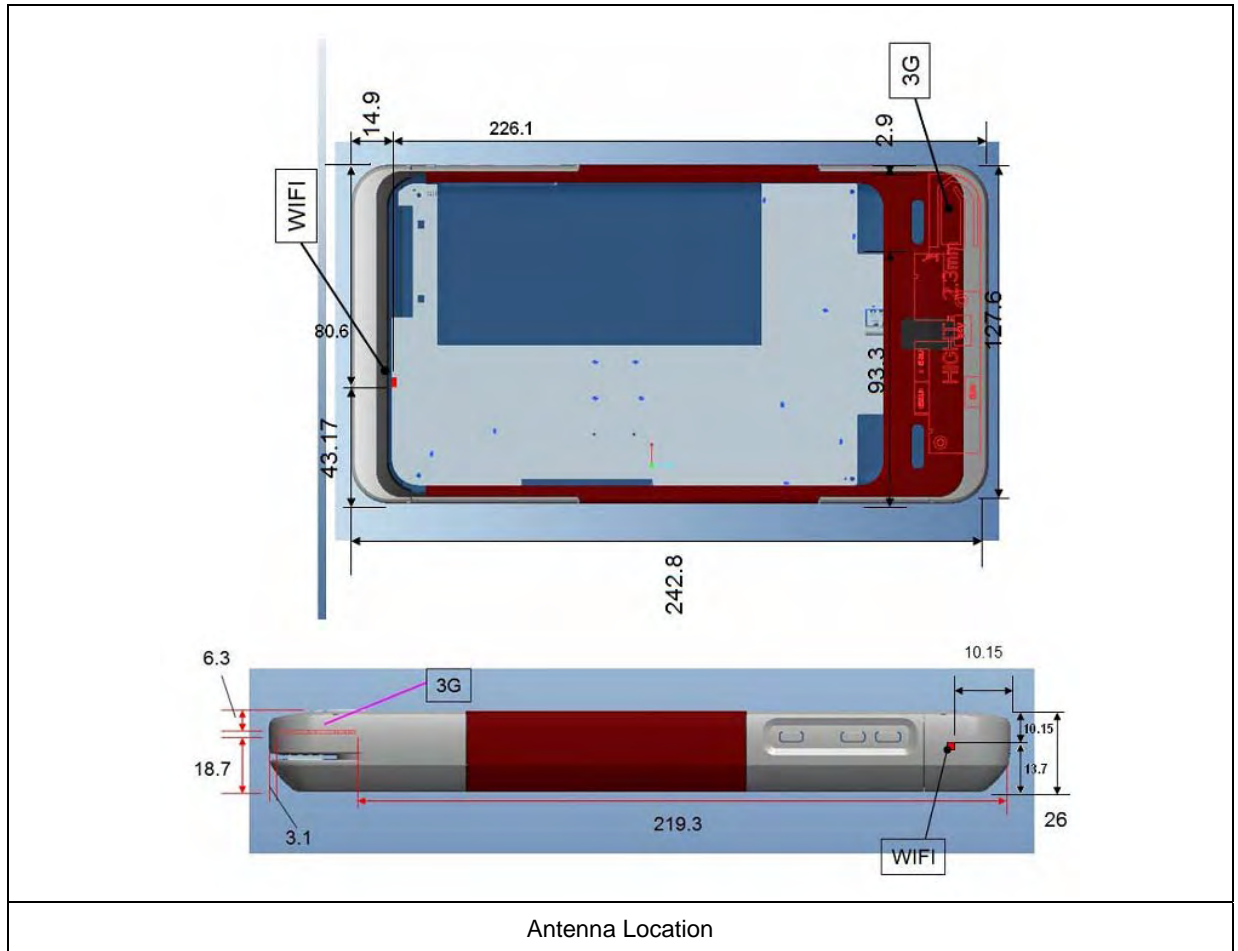




## 6. Antenna Location

|                         | Side  |      |      |     |        |
|-------------------------|-------|------|------|-----|--------|
|                         | Right | Left | Back | Top | Bottom |
| WLAN Ant. Distance (cm) | >5    | 1.49 | 1.37 | >5  | >5     |

Note: The EUT's each side please refers to SAR Test Setup Photographs for detail information.





## **7. SAR Testing with RF Transmitters**

### **7.1 SAR Testing with 802.11 Transmitters**

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable.

#### **7.1.1 General Device Setup**

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined

for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate.

The same data pattern should be used for all measurements.

#### **7.1.2 Frequency Channel Configurations**

802.11 a/b/g and 4.9 GHz operating modes are tested independently according to the service requirements in each frequency band. 802.11 b/g modes are tested on channels 1, 6 and 11. 802.11a is tested for UNII operations on channels 36 and 48 in the 5.15-5.25 GHz band; channels 52 and 64 in the 5.25-5.35 GHz band; channels 104, 116, 124 and 136 in the 5.470-5.725 GHz band; and channels 149 and 161 in the 5.8 GHz band. When 5.8 GHz §15.247 is also available, channels 149, 157 and 165 should be tested instead of the UNII channels. 4.9 GHz is tested on channels 1, 10 and 5 or 6, whichever has the higher output power, for 5 MHz channels; channels 11, 15 and 19 for 10 MHz channels; and channels 21 and 25 for 20 MHz channels. These are referred to as the “default test channels”. 802.11g mode was evaluated only if the output power was 0.25 dB higher than the 802.11b mode.



## 802.11 Test Channels per FCC Requirement

| Mode       |                       | GHz   | Channel | Turbo Channel  | Default Test "Channels" |         |      |   |
|------------|-----------------------|-------|---------|----------------|-------------------------|---------|------|---|
|            |                       |       |         |                | §15.247                 |         | UNII |   |
|            |                       |       |         |                | 802.11b                 | 802.11g |      |   |
| 802.11 b/g |                       | 2412  | 1       |                | ✓                       | ▽       |      |   |
|            |                       | 2437  | 6       | 6              | ✓                       | ▽       |      |   |
|            |                       | 2462  | 11      |                | ✓                       | ▽       |      |   |
| 802.11a    | UNII                  | 5.18  | 36      |                |                         |         | ✓    |   |
|            |                       | 5.20  | 40      | 42 (5.21 GHz)  |                         |         |      | * |
|            |                       | 5.22  | 44      |                |                         |         |      | * |
|            |                       | 5.24  | 48      |                |                         |         |      |   |
|            |                       | 5.26  | 52      | 50 (5.25 GHz)  |                         |         | ✓    |   |
|            |                       | 5.28  | 56      |                |                         |         |      | * |
|            |                       | 5.30  | 60      | 58 (5.29 GHz)  |                         |         |      | * |
|            |                       | 5.32  | 64      |                |                         |         | ✓    |   |
|            |                       | 5.500 | 100     | Unknown        |                         |         |      | * |
|            |                       | 5.520 | 104     |                |                         |         | ✓    |   |
|            |                       | 5.540 | 108     |                |                         |         |      | * |
|            |                       | 5.560 | 112     |                |                         |         |      | * |
|            |                       | 5.580 | 116     |                |                         |         | ✓    |   |
|            |                       | 5.600 | 120     |                |                         |         |      | * |
|            |                       | 5.620 | 124     |                |                         |         | ✓    |   |
|            |                       | 5.640 | 128     |                |                         |         |      | * |
|            |                       | 5.660 | 132     |                |                         |         |      | * |
|            |                       | 5.680 | 136     |                |                         |         | ✓    |   |
|            |                       | 5.700 | 140     |                |                         |         |      | * |
|            | UNII<br>or<br>§15.247 | 5.745 | 149     |                | ✓                       |         | ✓    |   |
|            |                       | 5.765 | 153     | 152 (5.76 GHz) |                         | *       |      | * |
|            |                       | 5.785 | 157     |                | ✓                       |         |      | * |
|            |                       | 5.805 | 161     | 160 (5.80 GHz) |                         | *       | ✓    |   |
|            | §15.247               | 5.825 | 165     |                | ✓                       |         |      |   |



## 7.2 Conducted Power

| Band    | Data Rate | CH | Frequency (MHz) | Average Power (dBm) |
|---------|-----------|----|-----------------|---------------------|
| 802.11b | 1M        | 1  | 2412.0          | 14.75               |
|         |           | 6  | 2437.0          | 15.01               |
|         |           | 11 | 2462.0          | <b>15.43</b>        |
|         | 2M        | 1  | 2412.0          | 14.51               |
|         |           | 6  | 2437.0          | 15.02               |
|         |           | 11 | 2462.0          | 15.22               |
|         | 5.5M      | 1  | 2412.0          | 14.38               |
|         |           | 6  | 2437.0          | 15.07               |
|         |           | 11 | 2462.0          | 14.82               |
|         | 11M       | 1  | 2412.0          | 14.38               |
|         |           | 6  | 2437.0          | 14.95               |
|         |           | 11 | 2462.0          | 14.79               |
| 802.11g | 6M        | 1  | 2412.0          | 16.04               |
|         |           | 6  | 2437.0          | 16.09               |
|         |           | 11 | 2462.0          | <b>16.48</b>        |
|         | 9M        | 1  | 2412.0          | 16.03               |
|         |           | 6  | 2437.0          | 15.81               |
|         |           | 11 | 2462.0          | 16.29               |
|         | 12M       | 1  | 2412.0          | 15.84               |
|         |           | 6  | 2437.0          | 16.02               |
|         |           | 11 | 2462.0          | 16.22               |
|         | 18M       | 1  | 2412.0          | 15.92               |
|         |           | 6  | 2437.0          | 15.84               |
|         |           | 11 | 2462.0          | 16.14               |
|         | 24M       | 1  | 2412.0          | 15.70               |
|         |           | 6  | 2437.0          | 15.25               |
|         |           | 11 | 2462.0          | 16.02               |
|         | 36M       | 1  | 2412.0          | 15.79               |
|         |           | 6  | 2437.0          | 15.21               |
|         |           | 11 | 2462.0          | 15.79               |
|         | 48M       | 1  | 2412.0          | 14.19               |
|         |           | 6  | 2437.0          | 14.72               |
|         |           | 11 | 2462.0          | 14.60               |
|         | 54M       | 1  | 2412.0          | 13.23               |
|         |           | 6  | 2437.0          | 13.67               |
|         |           | 11 | 2462.0          | 13.54               |

| Band            | Data Rate | CH | Frequency (MHz) | Average Power (dBm) |
|-----------------|-----------|----|-----------------|---------------------|
| 802.11n<br>HT20 | 6.5M      | 1  | 2412.0          | 14.92               |
|                 |           | 6  | 2437.0          | <b>16.10</b>        |
|                 |           | 11 | 2462.0          | 15.86               |
|                 | 13M       | 1  | 2412.0          | 15.04               |
|                 |           | 6  | 2437.0          | 15.72               |
|                 |           | 11 | 2462.0          | 15.47               |
|                 | 19.5M     | 1  | 2412.0          | 14.61               |
|                 |           | 6  | 2437.0          | 15.78               |
|                 |           | 11 | 2462.0          | 15.71               |
|                 | 26M       | 1  | 2412.0          | 14.74               |
|                 |           | 6  | 2437.0          | 15.23               |
|                 |           | 11 | 2462.0          | 15.19               |
|                 | 39M       | 1  | 2412.0          | 13.73               |
|                 |           | 6  | 2437.0          | 14.22               |
|                 |           | 11 | 2462.0          | 14.14               |
|                 | 52M       | 1  | 2412.0          | 13.74               |
|                 |           | 6  | 2437.0          | 13.98               |
|                 |           | 11 | 2462.0          | 14.05               |
|                 | 58.5M     | 1  | 2412.0          | 12.62               |
|                 |           | 6  | 2437.0          | 13.23               |
|                 |           | 11 | 2462.0          | 13.02               |
|                 | 65M       | 1  | 2412.0          | 12.32               |
|                 |           | 6  | 2437.0          | 13.03               |
|                 |           | 11 | 2462.0          | 12.93               |

### 7.3 Simultaneous Transmitting Evaluate

| RF Conducted Power           |       |       |
|------------------------------|-------|-------|
| Band                         | dBm   | W     |
| 1xEvdo R0/RA /1xRTT Cellular | 23.89 | 0.245 |
| 1xEvdo R0/RA /1xRTT PCS      | 24.02 | 0.252 |
| Wi-Fi 802.11b                | 15.43 | 0.035 |
| Wi-Fi 802.11g                | 16.48 | 0.044 |
| Wi-Fi 802.11n                | 16.10 | 0.041 |
| BT 2.0                       | 0.46  | 0.001 |

| Antenna Distance       |               |
|------------------------|---------------|
| Antenna Account        | Distance (cm) |
| BT to WLAN             | 0             |
| BT to WWAN(License)    | 20.92         |
| WLAN to WWAN (License) | 20.92         |

#### BT and GSM/WCDMA and WLAN simultaneously SAR Description

(1) Antenna Distance

1a.BT & WWAN 20.92 cm

1b.BT & WLAN 0cm

1c. WLAN & WWAN 20.92 cm

(2) 1xEvdo/Cell/PCS/WLAN Stand-alone SAR is required due to routine evaluation requirements.

BT power <60/f, therefore BT Stand-alone SAR is not required.

(3) WWAN/BT – with antenna separation distance greater than 5cm – BT power is less than  $2 \times P_{ref}$ ,  
Than both stand alone for BT and simultaneous SAR of WWAN/BT is not required.

(4) WLAN/BT – Antenna can simultaneously transmission, because BT Stand-alone SAR is not required,  
 $\Sigma SAR = BT + Wifi\ 802.11g = 0.058 < SAR\ limit: 1.6mW/g$ , Therefore Simultaneous SAR is not required.

(5) Highest Simultaneous SAR Evaluation:

Body SAR :  $\Sigma SAR = WWAN + Wifi\ 802.11g = 1.438\ mW/g < SAR\ limit: 1.6mW/g$

Therefore, the Simultaneous SAR is not required.

Note:

1. Simultaneous Transmitting Summery, please find the table 5 as below.

2. Simultaneous Transmission Summation of SAR, please find the table 6 as below.

2.1 For (Edge Top & Edge Right) mode, that WLAN antenna to edge >5cm, therefore the WLAN Stand-alone SAR is not required.

2.2 For (Edge Bottom mode& Edge Left mode), that WWAN antenna to edge >5cm, therefore the WWAN Stand-alone SAR is not required.



**Table 5.**

| Simultaneous Transmitting Summary |         |         |         |
|-----------------------------------|---------|---------|---------|
| Simultaneous transmitting         | 802.11b | 802.11g | 802.11n |
| 1xEvdo R0/RA /1xRTT Cellular      | Y       | Y       | Y       |
| 1xEvdo R0/RA /1xRTT PCS           | Y       | Y       | Y       |
| BT                                | Y       | Y       | Y       |

**Table 6.**

| Back Surface mode      |               |                            |                  |                      |              |
|------------------------|---------------|----------------------------|------------------|----------------------|--------------|
| The sum of the 1-g SAR |               |                            |                  |                      |              |
| Simult Tx              | Configuration | 1xEVDO Cell R0<br>SAR mW/g | WLAN SAR<br>mW/g | $\Sigma$ SAR<br>mW/g | $\Sigma$ SAR |
| Body SAR               | Flat          | 1.380                      | 0.058            | 1.438                | <1.6         |
| Simult Tx              | Configuration | 1xEVDO PCS R0<br>SAR mW/g  | WLAN SAR<br>mW/g | $\Sigma$ SAR<br>mW/g | $\Sigma$ SAR |
| Body SAR               | Flat          | 0.422                      | 0.058            | 0.480                | <1.6         |
| Simult Tx              | Configuration | 1xEVDO PCS RA<br>SAR mW/g  | WLAN SAR<br>mW/g | $\Sigma$ SAR<br>mW/g | $\Sigma$ SAR |
| Body SAR               | Flat          | 0.435                      | 0.058            | 0.493                | <1.6         |
| Simult Tx              | Configuration | BT<br>SAR mW/g             | WLAN SAR<br>mW/g | $\Sigma$ SAR<br>mW/g | $\Sigma$ SAR |
| Body SAR               | Flat          | 0.000                      | 0.058            | 0.058                | <1.6         |
| Simult Tx              | Configuration | 1xEVDO Cell R0<br>SAR mW/g | BT SAR<br>mW/g   | $\Sigma$ SAR<br>mW/g | $\Sigma$ SAR |
| Body SAR               | Flat          | 1.380                      | 0.000            | 1.380                | <1.6         |
| Simult Tx              | Configuration | 1xEVDO PCS R0<br>SAR mW/g  | BT SAR<br>mW/g   | $\Sigma$ SAR<br>mW/g | $\Sigma$ SAR |
| Body SAR               | Flat          | 0.422                      | 0.000            | 0.422                | <1.6         |
| Simult Tx              | Configuration | 1xEVDO PCS RA<br>SAR mW/g  | BT SAR<br>mW/g   | $\Sigma$ SAR<br>mW/g | $\Sigma$ SAR |
| Body SAR               | Flat          | 0.435                      | 0.000            | 0.435                | <1.6         |

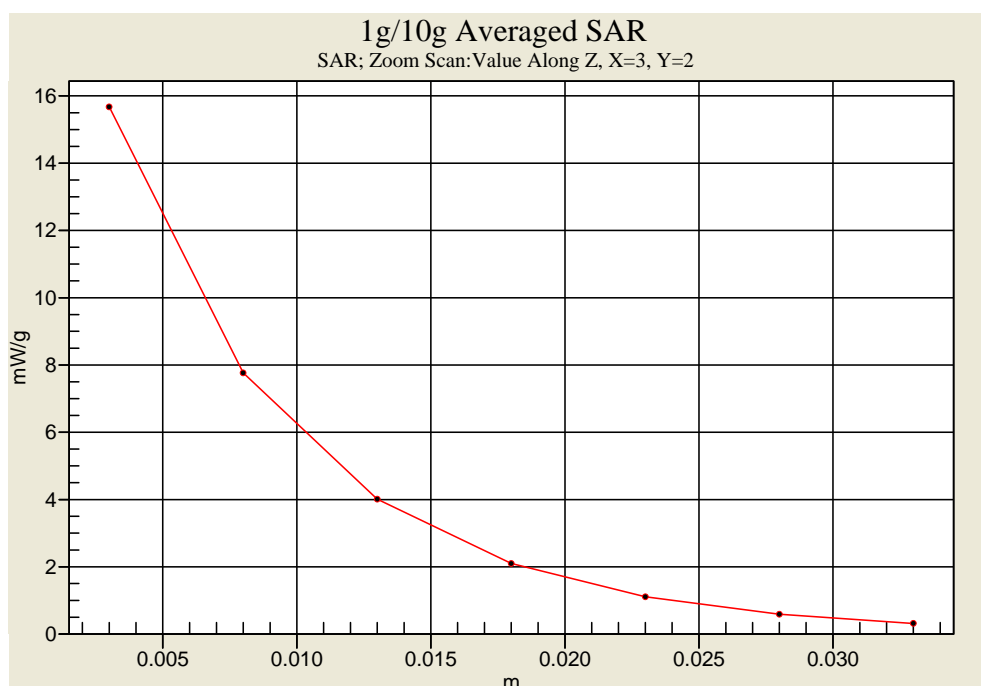


## 8.2 Validation

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of  $\pm 7\%$ . The validation was performed at 2450 MHz.

| Validation kit  |                     | Mixture Type             | SAR <sub>1g</sub> [mW/g]  |            | SAR <sub>10g</sub> [mW/g] |        | Date of Calibration |
|-----------------|---------------------|--------------------------|---------------------------|------------|---------------------------|--------|---------------------|
| D2450V2-SN712   |                     | Body                     | 50.4                      |            | 23.3                      |        | 02/23/2011          |
| Frequency (MHz) | Power (dBm)         | SAR <sub>1g</sub> (mW/g) | SAR <sub>10g</sub> (mW/g) | Drift (dB) | Difference percentage     |        | Date                |
|                 |                     |                          |                           |            | 1g                        | 10g    |                     |
| 2450 (Body)     | 250mW               | 12                       | 5.59                      | -0.093     | -4.8%                     | -4.0 % | 08/22/2011          |
|                 | Normalize to 1 Watt | 48                       | 22.36                     |            |                           |        |                     |

### Z-axis Plot of System Performance Check



Body-Tissue-Simulating-Liquid 2450MHz



## 9. Test Equipment List

| Manufacturer  | Name of Equipment             | Type/Model            | Serial Number        | Calibration |            |
|---------------|-------------------------------|-----------------------|----------------------|-------------|------------|
|               |                               |                       |                      | Last Cal.   | Due Date   |
| SPEAG         | Dosimetric E-Field Probe      | EX3DV3                | 3519                 | 02/25/2011  | 02/25/2012 |
| SPEAG         | 2450MHz System Validation Kit | D2450V2               | 712                  | 02/23/2011  | 02/23/2012 |
| SPEAG         | Data Acquisition Electronics  | DAE4                  | 541                  | 07/21/2011  | 07/21/2012 |
| SPEAG         | Measurement Server            | SE UMS 011 AA         | 1025                 | NCR         |            |
| SPEAG         | Device Holder                 | N/A                   | N/A                  | NCR         |            |
| SPEAG         | Phantom                       | SAM V4.0              | TP-1150              | NCR         |            |
| SPEAG         | Robot                         | Staubli TX90XL        | F07/564ZA1/C/01      | NCR         |            |
| SPEAG         | Software                      | DASY4 V4.7 Build 80   | N/A                  | NCR         |            |
| SPEAG         | Software                      | SEMCAD V1.8 Build 186 | N/A                  | NCR         |            |
| Agilent       | Dielectric Probe Kit          | 85070C                | US99360094           | NCR         |            |
| Agilent       | ENA Series Network Analyzer   | E5071B                | MY42404655           | 04/14/2010  | 04/14/2012 |
| R&S           | Power Sensor                  | NRP-Z22               | 100179               | 05/27/2011  | 05/27/2012 |
| Agilent       | MXG Vector Signal Generator   | N5182A                | MY47420962           | 05/16/2011  | 05/16/2012 |
| Agilent       | Dual Directional Coupler      | 778D                  | 50334                | NCR         |            |
| Mini-Circuits | Power Amplifier               | ZHL-42W-SMA           | D111103#5            | NCR         |            |
| Mini-Circuits | Power Amplifier               | ZVE-8G-SMA            | D042005<br>671800514 | NCR         |            |

**Table 7. Test Equipment List**



## **10. Measurement Uncertainty**

Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environmental. However, we estimate the measurement uncertainties in SAR to be less than  $\pm 20.10\%$  [ 8 ] .

According to Std. C95.3 [ 9 ], the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy's of  $\pm 1$  to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least  $\pm 2$  dB can be expected.

According to CENELEC [ 10 ] , typical worst-case uncertainty of field measurements is  $\pm 5$  dB. For well-defined modulation characteristics the uncertainty can be reduced to  $\pm 3$  dB.

| Item  | Uncertainty Component   | Uncertainty Value | Prob. Dist  | Div.       | $c_i$ (1g) | $c_i$ (10g) | Std. Unc. (1-g) | Std. Unc. (10-g) | $v_i$ or $v_{eff}$ |
|---|---|-------------------|-------------|------------|------------|-------------|-----------------|------------------|--------------------|
| <b>Measurement System</b>                           |   |                   |             |            |            |             |                 |                  |                    |
| u1  | Probe Calibration ( $k=1$ )   | $\pm 5.5\%$       | Normal      | 1          | 1          | 1           | $\pm 5.5\%$     | $\pm 5.5\%$      | $\infty$           |
| u2  | Probe Isotropy  | $\pm 7.6\%$       | Rectangular | $\sqrt{3}$ | 0.7        | 0.7         | $\pm 3.1\%$     | $\pm 3.1\%$      | $\infty$           |
| u3  | Boundary Effect   | $\pm 1.0\%$       | Rectangular | $\sqrt{3}$ | 1          | 1           | $\pm 0.6\%$     | $\pm 0.6\%$      | $\infty$           |
| u4  | Linearity   | $\pm 4.7\%$       | Rectangular | $\sqrt{3}$ | 1          | 1           | $\pm 2.7\%$     | $\pm 2.7\%$      | $\infty$           |
| u5  | System Detection Limit  | $\pm 1.0\%$       | Rectangular | $\sqrt{3}$ | 1          | 1           | $\pm 0.58\%$    | $\pm 0.58\%$     | $\infty$           |
| u6  | Readout Electronics   | $\pm 0.3\%$       | Normal      | 1          | 1          | 1           | $\pm 0.3\%$     | $\pm 0.3\%$      | $\infty$           |
| u7  | Response Time   | $\pm 0.8\%$       | Rectangular | $\sqrt{3}$ | 1          | 1           | $\pm 0.5\%$     | $\pm 0.5\%$      | $\infty$           |
| u8  | Integration Time  | $\pm 2.6\%$       | Rectangular | $\sqrt{3}$ | 1          | 1           | $\pm 1.5\%$     | $\pm 1.5\%$      | $\infty$           |
| u9  | RF Ambient Conditions   | $\pm 0\%$         | Rectangular | $\sqrt{3}$ | 1          | 1           | $\pm 0\%$       | $\pm 0\%$        | $\infty$           |
| u10   | RF Ambient Reflections  | $\pm 0\%$         | Rectangular | $\sqrt{3}$ | 1          | 1           | $\pm 0\%$       | $\pm 0\%$        | $\infty$           |
| u11   | Probe Positioner Mechanical Tolerance   | $\pm 0.4\%$       | Rectangular | $\sqrt{3}$ | 1          | 1           | $\pm 0.2\%$     | $\pm 0.2\%$      | $\infty$           |
| u12   | Probe Positioning with respect to Phantom Shell                                 | $\pm 2.9\%$       | Rectangular | $\sqrt{3}$ | 1          | 1           | $\pm 1.7\%$     | $\pm 1.7\%$      | $\infty$           |
| u13   | Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation | $\pm 1.0\%$       | Rectangular | $\sqrt{3}$ | 1          | 1           | $\pm 0.6\%$     | $\pm 0.6\%$      | $\infty$           |
| <b>Test sample Related</b>                          |   |                   |             |            |            |             |                 |                  |                    |
| u14   | Test sample Positioning   | $\pm 3.6\%$       | Normal      | 1          | 1          | 1           | $\pm 3.6\%$     | $\pm 3.6\%$      | 89                 |
| u15   | Device Holder Uncertainty   | $\pm 3.5\%$       | Normal      | 1          | 1          | 1           | $\pm 3.5\%$     | $\pm 3.5\%$      | 5                  |
| u16   | Output Power Variation - SAR drift measurement                                  | $\pm 5.0\%$       | Rectangular | $\sqrt{3}$ | 1          | 1           | $\pm 2.9\%$     | $\pm 2.9\%$      | $\infty$           |
| <b>Phantom and Tissue Parameters</b>                |   |                   |             |            |            |             |                 |                  |                    |
| u17   | Phantom Uncertainty ( shape and thickness tolerances)                           | $\pm 4.0\%$       | Rectangular | $\sqrt{3}$ | 1          | 1           | $\pm 2.3\%$     | $\pm 2.3\%$      | $\infty$           |
| u18   | Liquid Conductivity - deviation from target values                              | $\pm 5.0\%$       | Rectangular | $\sqrt{3}$ | 0.64       | 0.43        | $\pm 1.8\%$     | $\pm 1.2\%$      | $\infty$           |
| u19   | Liquid Conductivity - measurement uncertainty                                   | $\pm 1.93\%$      | Normal      | 1          | 0.64       | 0.43        | $\pm 1.24\%$    | $\pm 0.83\%$     | 69                 |
| u20   | Liquid Permittivity - deviation from target values                              | $\pm 5.0\%$       | Rectangular | $\sqrt{3}$ | 0.6        | 0.49        | $\pm 1.7\%$     | $\pm 1.4\%$      | $\infty$           |
| u21   | Liquid Permittivity - measurement uncertainty                                   | $\pm 1.4\%$       | Normal      | 1          | 0.6        | 0.49        | $\pm 0.84\%$    | $\pm 1.69\%$     | 69                 |
| <b>Combined standard uncertainty</b>                |   |                   | RSS         |            |            |             | $\pm 10.05\%$   | $\pm 9.98\%$     | 313                |
| <b>Expanded uncertainty (95% CONFIDENCE LEVEL )</b> |   |                   | $k=2$       |            |            |             | $\pm 20.10\%$   | $\pm 19.96\%$    |                    |

**Table 8. Uncertainty Budget of DASY**

## **11. Measurement Procedure**

The measurement procedures are as follows:

1. For WLAN function, engineering testing software installed on Notebook can provide continuous transmitting signal.
2. Measure output power through RF cable and power meter
3. Set scan area, grid size and other setting on the DASY software
4. Find out the largest SAR result on these testing positions of each band
5. Measure SAR results for other channels in worst SAR testing position if the SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

1. Power reference measurement
2. Area scan
3. Zoom scan
4. Power drift measurement

### **11.1 Spatial Peak SAR Evaluation**

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages

1. Extraction of the measured data (grid and values) from the Zoom Scan
2. Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. Generation of a high-resolution mesh within the measured volume
4. Interpolation of all measured values from the measurement grid to the high-resolution grid
5. Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. Calculation of the averaged SAR within masses of 1g and 10g



## **11.2 Area & Zoom Scan Procedures**

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures 7x7x9 points with step size 5, 5 and 3 mm for 300 MHz to 3 GHz, and 7x7x9 points with step size 5, 5 and 3 mm for 3 GHz to 6 GHz. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

## **11.3 Volume Scan Procedures**

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the DUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing (step-size is 4, 4 and 2.5 mm). When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

## **11.4 SAR Averaged Methods**

In DASy, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation. 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. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.





## **11.5 Power Drift Monitoring**

All SAR testing is under the DUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of DUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

## 12. SAR Test Results Summary

### 12.1 Body SAR

| Measurement Results   |    |  |             |               |          |   |                          |                  |                         |
|---|----|--|-------------|---------------|----------|---|--------------------------|------------------|-------------------------|
| Frequency   |    | Band   | Power (dBm) | Test Position | Antenna  | Spacing (mm)                            | SAR <sub>1g</sub> [mW/g] | Power Drift (dB) | Remark                  |
| MHz   | CH |  |             |               |          |   |                          |                  |                         |
| 2462  | 11 | IEEE 802.11b<br>Rate 1M                      | 15.43       | Tablet        | Internal | 0                                       | 0.046                    | -0.110           | Back Surface to phantom |
| 2462  | 11 |  | 15.43       | Tablet        | Internal | 0                                       | 0.040                    | -0.188           | Edge Left to phantom    |
| 2462  | 11 |  | 15.43       | Tablet        | Internal | 0                                       | 0.023                    | 0.128            | Edge Bottom to phantom  |
| 2462  | 11 | IEEE 802.11g<br>Rate 6M                      | 16.48       | Tablet        | Internal | 0                                       | <b>0.058</b>             | 0.135            | Back Surface to phantom |
| 2462  | 11 |  | 16.48       | Tablet        | Internal | 0                                       | 0.049                    | 0.161            | Edge Left to phantom    |
| 2462  | 11 |  | 16.48       | Tablet        | Internal | 0                                       | 0.030                    | 0.168            | Edge Bottom to phantom  |
| 2437  | 06 | draft 802.11n<br>Standard-20MHz<br>Rate 6.5M | 16.10       | Tablet        | Internal | 0                                       | 0.045                    | -0.129           | Back Surface to phantom |
| 2437  | 06 |  | 16.10       | Tablet        | Internal | 0                                       | 0.030                    | 0.059            | Edge Left to phantom    |
| 2437  | 06 |  | 16.10       | Tablet        | Internal | 0                                       | 0.019                    | -0.168           | Edge Bottom to phantom  |
| Std. C95.1-1999 - Safety Limit Spatial Peak<br>Uncontrolled Exposure/General Population |    |  |             |               |          | 1.6 W/kg (mW/g)<br>Averaged over 1 gram |                          |                  |                         |

Notes:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used were according to FCC/OET Bulletin 65, Supplement C [June 2001], IEEE1528-2003 and RSS-102.
2. All modes of operation were investigated, and worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plots.
4. Batteries are fully charged for all readings.
5. Base on power table (section 7.2), the worst case is 802.11b CH1 rate 1M and therefore the test sample was investigated on this configuration.
6. If the Channel's SAR 1g of maximum conducted power is > 0.8 mW/g, low, middle and high channel are supposed to be tested.
7. If the conducted power of (802.11g or 802.11n) is higher than 802.11b 0.25dB, (802.11g or 802.11n) is supposed to be tested.
8. For WLAN, the antenna location to edge <5 cm, therefore should be test three mode (Edge Left and Edge Bottom and Back surface).

## 12.2 Std. C95.1-1999 RF Exposure Limit

| Human Exposure  | Population<br>Uncontrolled<br>Exposure<br>( W/kg ) or (mW/g) | Occupational<br>Controlled<br>Exposure<br>( W/kg ) or (mW/g) |
|---|--|--|
| Spatial Peak SAR*<br>(head)                             | 1.60   | 8.00   |
| Spatial Peak SAR**<br>(Whole Body)                      | 0.08   | 0.40   |
| Spatial Peak SAR***<br>(Partial-Body)                   | 1.60   | 8.00   |
| Spatial Peak SAR****<br>(Hands / Feet / Ankle / Wrist ) | 4.00   | 20.00  |

Table 9. Safety Limits for Partial Body Exposure

### Notes :

- \* The Spatial Peak value of the SAR averaged over any 1 gram of tissue.  
( defined as a tissue volume in the shape of a cube ) and over the appropriate averaging time.
- \*\* The Spatial Average value of the SAR averaged over the whole – body.
- \*\*\* The Spatial Average value of the SAR averaged over the partial – body.
- \*\*\*\* The Spatial Peak value of the SAR averaged over any 10 grams of tissue.  
( defined as a tissue volume in the shape of a cube ) and over the appropriate averaging time.

**Population / Uncontrolled Environments :** are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

**Occupational / Controlled Environments :** are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation).



### 13. Conclusion

The SAR test values found for the portable mobile phone **Microlink Communications Inc. Trade Name: MOGO Model(s): ID8-BS1000** is below the maximum recommended level of 1.6 W/kg (mW/g).

### 14. References

- [1] Std. C95.1-1999, "*American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300KHz to 100GHz*", New York.
- [2] NCRP, National Council on Radiation Protection and Measurements, "*Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields*", NCRP report NO. 86, 1986.
- [3] T. Schmid, O. Egger, and N. Kuster, "*Automatic E-field scanning system for dosimetric assessments*", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp, 105-113, Jan. 1996.
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- [5] K. Poković, T. Schmid, and N. Kuster, "*E-field probe with improved isotropy in brain simulating liquids*", in Proceedings of the ELMAR, Zadar, Croatia, 23-25 June, 1996, pp.172-175.
- [6] N. Kuster, and Q. Balzano, "*Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz*", IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.
- [7] Robert J. Renka, "*Multivariate Interpolation Of Large Sets Of Scattered Data*", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988 , pp. 139-148.
- [8] N. Kuster, R. Kastle, T. Schmid, "*Dosimetric evaluation of mobile communications equipment with known precision*", IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.
- [9] Std. C95.3-1991, "*IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave*", New York: IEEE, Aug. 1992.
- [10] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), *Human Exposure to Electromagnetic Fields High-frequency: 10KHz-300GHz*, Jan. 1995.
- [11] KDB248227 D01 SAR meas for 802 11 a b g v01r02.
- [12] KDB 447498 D01 v04
- [13] KDB 616217 D01 v01r01
- [14] KDB 616217 D03 v01



## Appendix A - System Performance Check

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/8/22 AM 10:14:05

### System Performance Check at 2450MHz\_20110822\_Body

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

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.96$  mho/m;  $\epsilon_r = 51.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(8.17, 8.17, 8.17); Calibrated: 2011/2/25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2011/7/21
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

### System Performance Check at 2450MHz/Area Scan (61x61x1):

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

Maximum value of SAR (interpolated) = 16.0 mW/g

### System Performance Check at 2450MHz/Zoom Scan (7x7x7)/Cube 0:

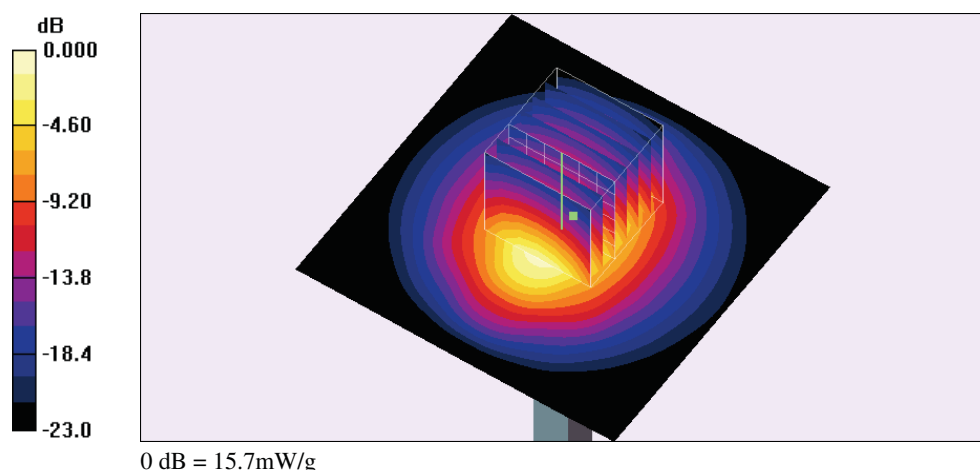
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 90.5 V/m; Power Drift = -0.093 dB

Peak SAR (extrapolated) = 24.9 W/kg

**SAR(1 g) = 12 mW/g; SAR(10 g) = 5.59 mW/g**

Maximum value of SAR (measured) = 15.7 mW/g



## Appendix B - SAR Measurement Data

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/8/22 PM 12:42:14

### Flat\_802.11b CH11\_Back Surface to phantom 0mm\_1M

**DUT: ID8-BS1000; Type: Blank Slate Tablet; FCC ID: ZUJ-MTP1122**

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

Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.97$  mho/m;  $\epsilon_r = 51.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(8.17, 8.17, 8.17); Calibrated: 2011/2/25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2011/7/21
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

### Flat/Area Scan (101x61x1):

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

Maximum value of SAR (interpolated) = 0.058 mW/g

### Flat/Zoom Scan (7x7x9)/Cube 0:

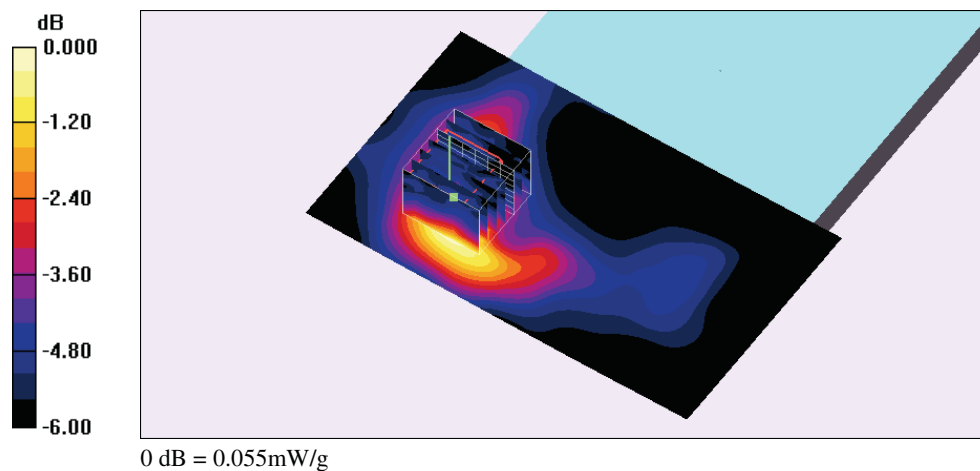
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=3$ mm

Reference Value = 2.46 V/m; Power Drift = -0.110 dB

Peak SAR (extrapolated) = 0.088 W/kg

**SAR(1 g) = 0.046 mW/g; SAR(10 g) = 0.031 mW/g**

Maximum value of SAR (measured) = 0.055 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/8/22 PM 03:27:02

### **Flat\_802.11b CH11\_Edge Left to phantom 0mm\_1M**

**DUT: ID8-BS1000; Type: Blank Slate Tablet; FCC ID: ZUJ-MTP1122**

Communication System: IEEE 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.97$  mho/m;  $\epsilon_r = 51.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section  
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

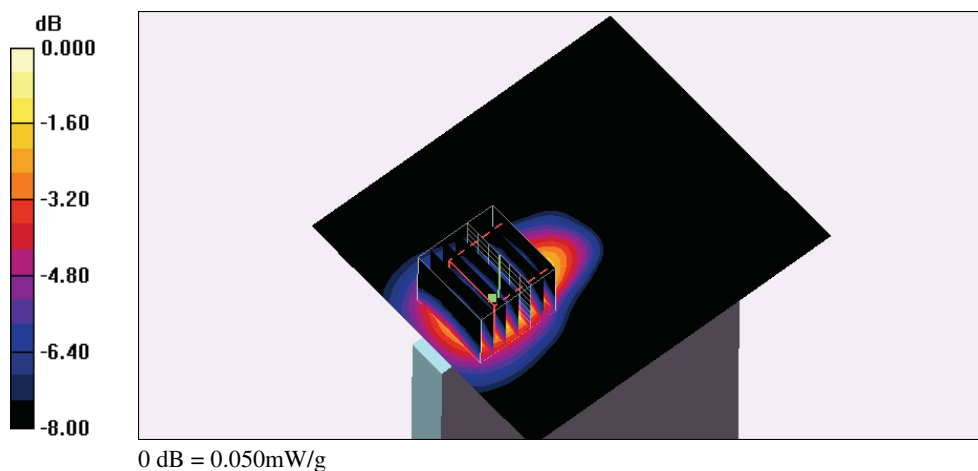
- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(8.17, 8.17, 8.17); Calibrated: 2011/2/25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2011/7/21
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

### **Flat/Area Scan (71x81x1):**

Measurement grid:  $dx=15$ mm,  $dy=15$ mm  
Maximum value of SAR (interpolated) = 0.051 mW/g

### **Flat/Zoom Scan (7x7x9)/Cube 0:**

Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=3$ mm  
Reference Value = 2.88 V/m; Power Drift = -0.188 dB  
Peak SAR (extrapolated) = 0.075 W/kg  
**SAR(1 g) = 0.040 mW/g; SAR(10 g) = 0.022 mW/g**  
Maximum value of SAR (measured) = 0.050 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/8/22 PM 03:57:00

### Flat\_802.11b CH11\_Edge Bottom to phantom 0mm\_1M

**DUT: ID8-BS1000; Type: Blank Slate Tablet; FCC ID: ZUJ-MTP1122**

Communication System: IEEE 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.97$  mho/m;  $\epsilon_r = 51.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section  
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

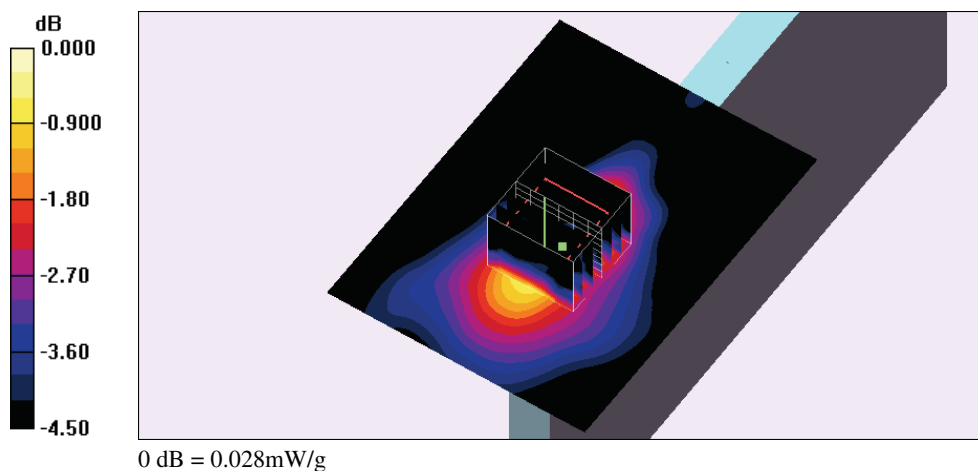
- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(8.17, 8.17, 8.17); Calibrated: 2011/2/25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2011/7/21
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

### Flat/Area Scan (61x81x1):

Measurement grid:  $dx=15$ mm,  $dy=15$ mm  
Maximum value of SAR (interpolated) = 0.028 mW/g

### Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=3$ mm  
Reference Value = 2.53 V/m; Power Drift = 0.128 dB  
Peak SAR (extrapolated) = 0.043 W/kg  
**SAR(1 g) = 0.023 mW/g; SAR(10 g) = 0.016 mW/g**  
Maximum value of SAR (measured) = 0.028 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/8/22 PM 01:25:59

### Flat\_802.11g CH11\_Back Surface to phantom 0mm\_6M

**DUT: ID8-BS1000; Type: Blank Slate Tablet; FCC ID: ZUJ-MTP1122**

Communication System: IEEE 802.11g; Frequency: 2462 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $f = 2462 \text{ MHz}$ ;  $\sigma = 1.97 \text{ mho/m}$ ;  $\epsilon_r = 51.3$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

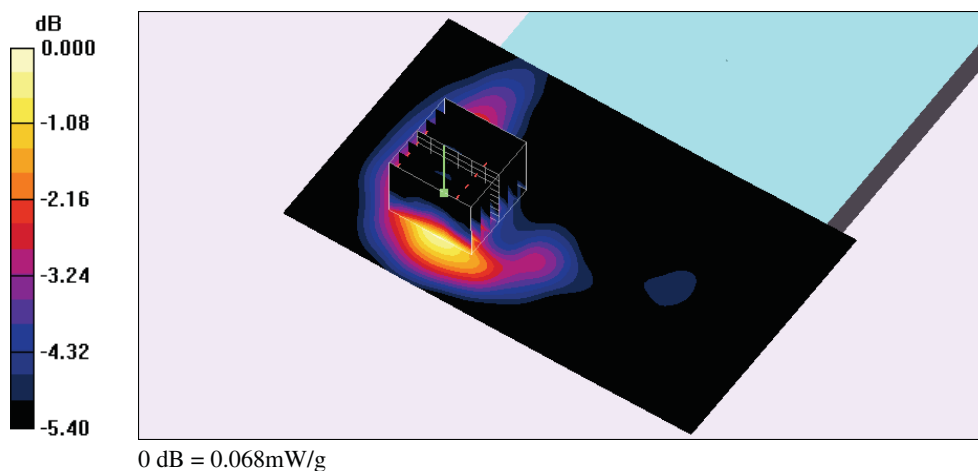
- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(8.17, 8.17, 8.17); Calibrated: 2011/2/25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2011/7/21
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

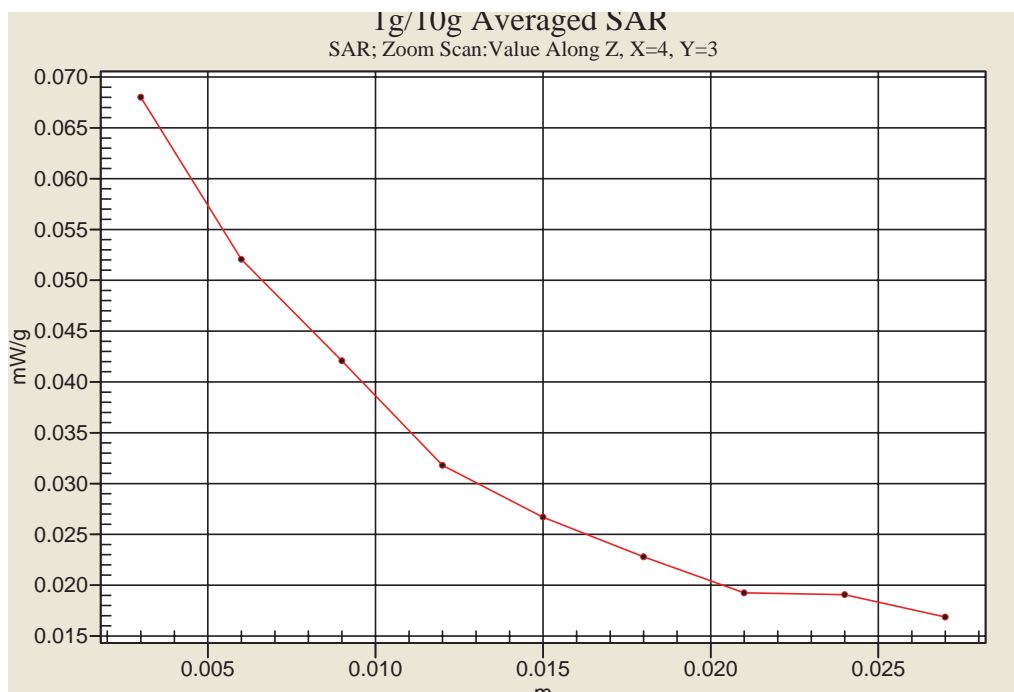
### Flat/Area Scan (101x61x1):

Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$   
 Maximum value of SAR (interpolated) = 0.074 mW/g

### Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=3\text{mm}$   
 Reference Value = 2.51 V/m; Power Drift = 0.135 dB  
 Peak SAR (extrapolated) = 0.101 W/kg  
**SAR(1 g) = 0.058 mW/g; SAR(10 g) = 0.037 mW/g**  
 Maximum value of SAR (measured) = 0.068 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/8/22 PM 02:55:16

### Flat\_802.11g CH11\_Edge Left to phantom 0mm\_6M

**DUT: ID8-BS1000; Type: Blank Slate Tablet; FCC ID: ZUJ-MTP1122**

Communication System: IEEE 802.11g; Frequency: 2462 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.97$  mho/m;  $\epsilon_r = 51.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section  
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

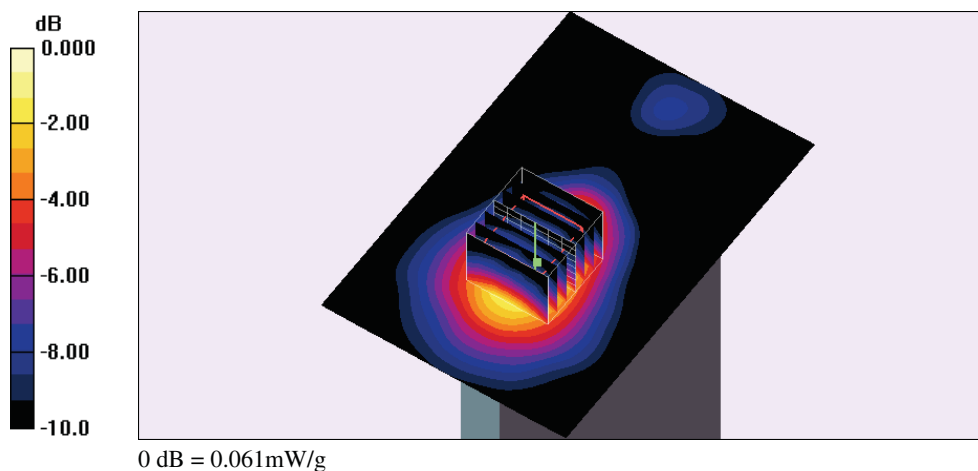
- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(8.17, 8.17, 8.17); Calibrated: 2011/2/25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2011/7/21
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

### Flat/Area Scan (61x91x1):

Measurement grid:  $dx=15$ mm,  $dy=15$ mm  
Maximum value of SAR (interpolated) = 0.062 mW/g

### Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=3$ mm  
Reference Value = 3.12 V/m; Power Drift = 0.161 dB  
Peak SAR (extrapolated) = 0.094 W/kg  
**SAR(1 g) = 0.049 mW/g; SAR(10 g) = 0.027 mW/g**  
Maximum value of SAR (measured) = 0.061 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/8/22 PM 01:54:35

### Flat\_802.11g CH11\_Edge Bottom to phantom 0mm\_6M

**DUT: ID8-BS1000; Type: Blank Slate Tablet; FCC ID: ZUJ-MTP1122**

Communication System: IEEE 802.11g; Frequency: 2462 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.97$  mho/m;  $\epsilon_r = 51.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

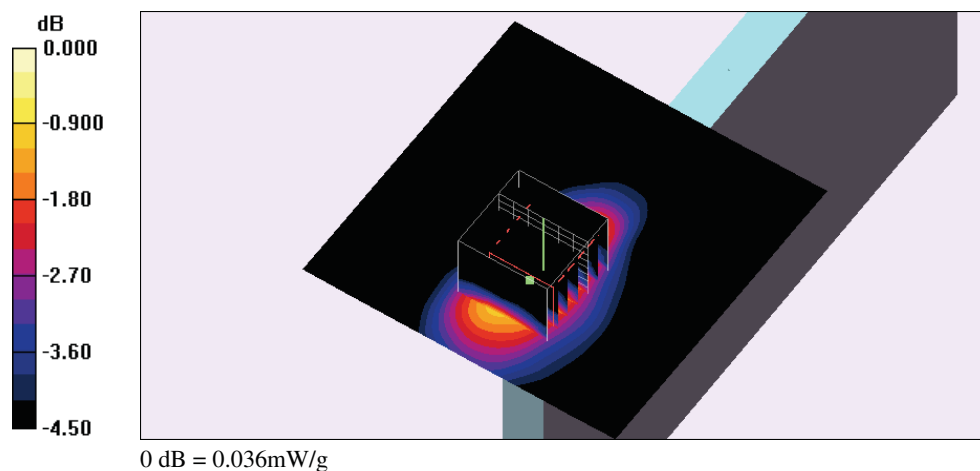
- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(8.17, 8.17, 8.17); Calibrated: 2011/2/25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2011/7/21
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

### Flat/Area Scan (71x71x1):

Measurement grid:  $dx=15$ mm,  $dy=15$ mm  
 Maximum value of SAR (interpolated) = 0.032 mW/g

### Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=3$ mm  
 Reference Value = 2.48 V/m; Power Drift = 0.168 dB  
 Peak SAR (extrapolated) = 0.054 W/kg  
**SAR(1 g) = 0.030 mW/g; SAR(10 g) = 0.019 mW/g**  
 Maximum value of SAR (measured) = 0.036 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/8/22 PM 07:33:31

### **Flat\_802.11n CH6\_Edge Back Surface to phantom 0mm\_HT20\_6.5M**

**DUT: ID8-BS1000; Type: Blank Slate Tablet; FCC ID: ZUJ-MTP1122**

Communication System: IEEE 802.11n(2.4GHz); Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.94$  mho/m;  $\epsilon_r = 51.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(8.17, 8.17, 8.17); Calibrated: 2011/2/25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2011/7/21
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY4, V4.7 Build 80;Postprocessing SW: SEMCAD, V1.8 Build 186

### **Flat/Area Scan (101x61x1):**

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

Maximum value of SAR (interpolated) = 0.050 mW/g

### **Flat/Zoom Scan (7x7x9)/Cube 0:**

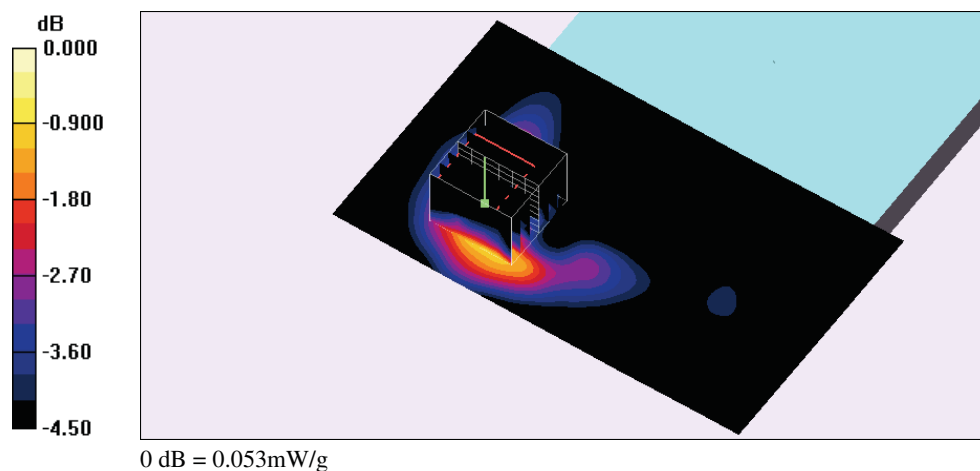
Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 2.62 V/m; Power Drift = -0.129 dB

Peak SAR (extrapolated) = 0.078 W/kg

**SAR(1 g) = 0.045 mW/g; SAR(10 g) = 0.030 mW/g**

Maximum value of SAR (measured) = 0.053 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/8/22 PM 07:06:11

### **Flat\_802.11n CH6\_Edge Left to phantom 0mm\_HT20\_6.5M**

**DUT: ID8-BS1000; Type: Blank Slate Tablet; FCC ID: ZUJ-MTP1122**

Communication System: IEEE 802.11n(2.4GHz); Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.94$  mho/m;  $\epsilon_r = 51.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(8.17, 8.17, 8.17); Calibrated: 2011/2/25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2011/7/21
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY4, V4.7 Build 80;Postprocessing SW: SEMCAD, V1.8 Build 186

### **Flat/Area Scan (61x91x1):**

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

Maximum value of SAR (interpolated) = 0.038 mW/g

### **Flat/Zoom Scan (7x7x9)/Cube 0:**

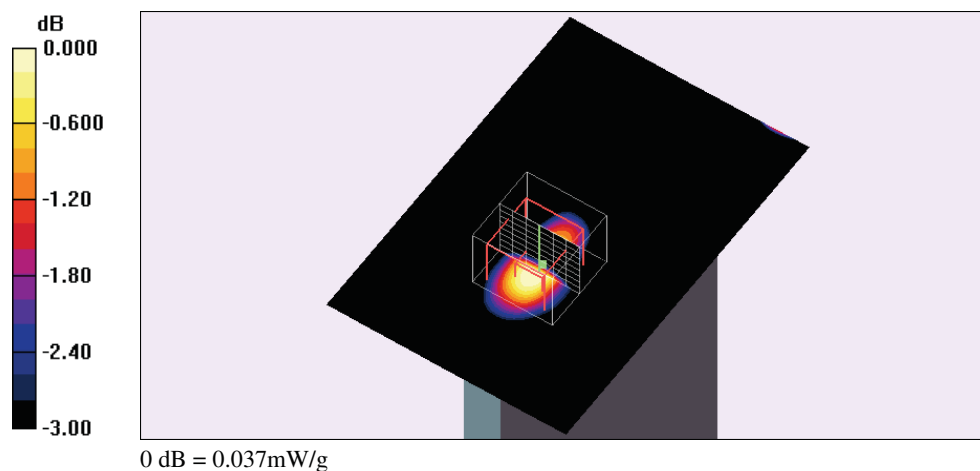
Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 2.42 V/m; Power Drift = 0.059 dB

Peak SAR (extrapolated) = 0.053 W/kg

**SAR(1 g) = 0.030 mW/g; SAR(10 g) = 0.017 mW/g**

Maximum value of SAR (measured) = 0.037 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/8/22 PM 04:53:16

### **Flat\_802.11n CH6\_Edge Bottom to phantom 0mm\_HT20\_6.5M**

**DUT: ID8-BS1000; Type: Blank Slate Tablet; FCC ID: ZUJ-MTP1122**

Communication System: IEEE 802.11n(2.4GHz); Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used:  $f = 2437 \text{ MHz}$ ;  $\sigma = 1.94 \text{ mho/m}$ ;  $\epsilon_r = 51.3$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(8.17, 8.17, 8.17); Calibrated: 2011/2/25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2011/7/21
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY4, V4.7 Build 80;Postprocessing SW: SEMCAD, V1.8 Build 186

### **Flat/Area Scan (71x71x1):**

Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.020 mW/g

### **Flat/Zoom Scan (7x7x9)/Cube 0:**

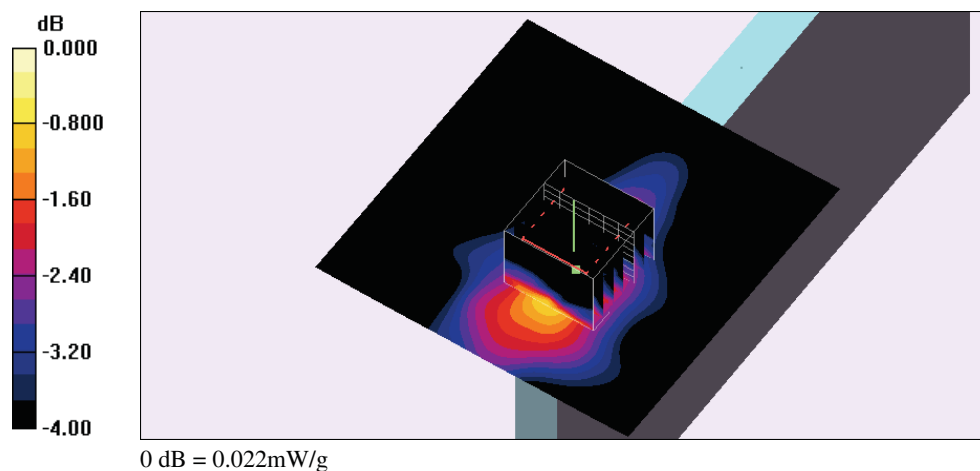
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=3\text{mm}$

Reference Value = 2.33 V/m; Power Drift = -0.168 dB

Peak SAR (extrapolated) = 0.038 W/kg

**SAR(1 g) = 0.019 mW/g; SAR(10 g) = 0.013 mW/g**

Maximum value of SAR (measured) = 0.022 mW/g





## ***Appendix C - Calibration***

All of the instruments Calibration information are listed below.

- Dipole \_ D2450V2 SN:712 Calibration No.D2450V2-712\_Feb11
- Probe \_ EX3DV3 SN:3519 Calibration No.EX3-3519\_Feb11
- DAE \_ DAE4 SN:541 Calibration No.DAE4-541\_Jul11



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Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **D2450V2-712\_Feb11**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 712**

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

Calibration date: **February 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  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| 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 |

|                |                     |                                   |  |
|----------------|---------------------|-----------------------------------|--|
| Calibrated by: | Name<br>Dimce Iliev | Function<br>Laboratory Technician | Signature<br> |
| Approved by:   | Katja Pokovic       | Technical Manager                 |               |

Issued: February 24, 2011

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

Accreditation No.: **SCS 108**

#### Glossary:

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

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

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

#### Additional Documentation:

- DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

## Measurement Conditions

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

|                              |                           |             |
|------------------------------|---------------------------|-------------|
| DASY Version                 | DASY5                     | V52.6       |
| 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 $\pm$ 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 $\pm$ 0.2) °C | 39.1 $\pm$ 6 % | 1.73 mho/m $\pm$ 6 % |
| Head TSL temperature during test | (21.2 $\pm$ 0.2) °C | ----           | ----                 |

## SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                                |
|---|--------------------|--------------------------------|
| SAR measured  | 250 mW input power | 13.0 mW / g                    |
| SAR normalized  | normalized to 1W   | 52.0 mW / g                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 52.9 mW / g $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                                |
|---|--------------------|--------------------------------|
| SAR measured  | 250 mW input power | 6.08 mW / g                    |
| SAR normalized  | normalized to 1W   | 24.3 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 24.5 mW / g $\pm$ 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 | 52.2 ± 6 %   | 1.94 mho/m ± 6 % |
| Body TSL temperature during test | (21.8 ± 0.2) °C | ----         | ----             |

### SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                                   |
|---|--------------------|-----------------------------------|
| SAR measured  | 250 mW input power | 12.6 mW / g                       |
| SAR normalized  | normalized to 1W   | 50.4 mW / g                       |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | <b>50.4 mW / g ± 17.0 % (k=2)</b> |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                                   |
|---|--------------------|-----------------------------------|
| SAR measured  | 250 mW input power | 5.83 mW / g                       |
| SAR normalized  | normalized to 1W   | 23.3 mW / g                       |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | <b>23.3 mW / g ± 16.5 % (k=2)</b> |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $54.3 \Omega + 1.7 j\Omega$ |
| Return Loss                          | - 27.0 dB                   |

### Antenna Parameters with Body TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $50.8 \Omega + 5.5 j\Omega$ |
| Return Loss                          | - 25.1 dB                   |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.146 ns |
|----------------------------------|----------|

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

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

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

### Additional EUT Data

|                 |               |
|-----------------|---------------|
| Manufactured by | SPEAG         |
| Manufactured on | July 05, 2002 |



## DASY5 Validation Report for Head TSL

Date/Time: 23.02.2011 12:42:01

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium: HSL U12 BB

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.73$  mho/m;  $\epsilon_r = 39.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 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, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

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

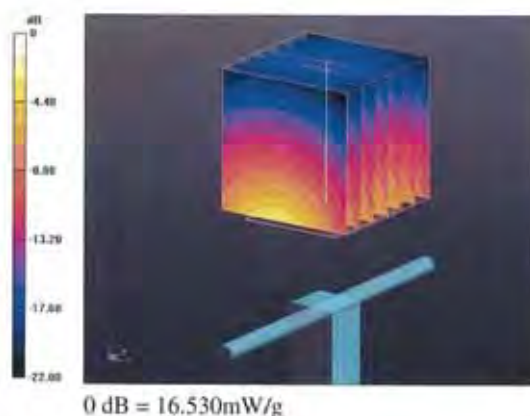
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 101.5 V/m; Power Drift = 0.06 dB

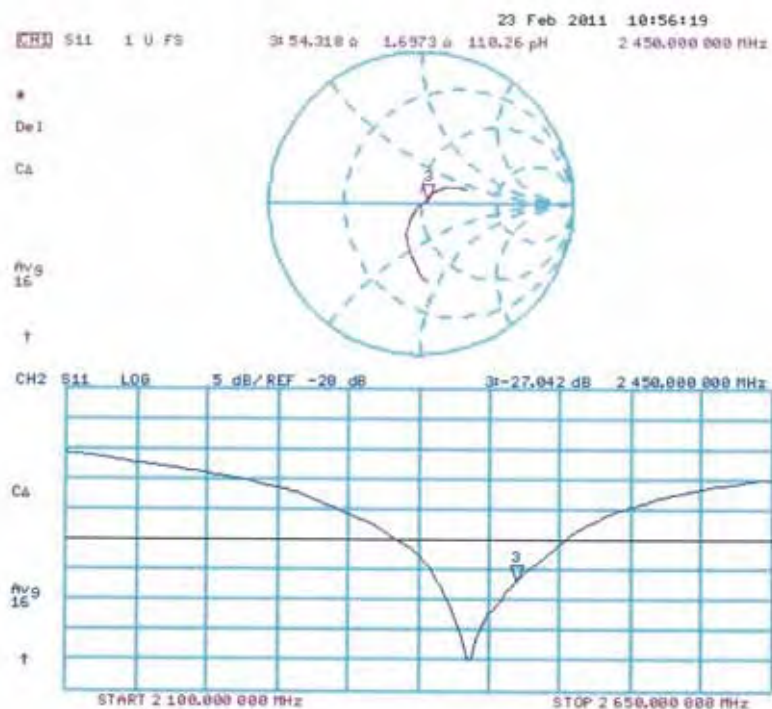
Peak SAR (extrapolated) = 26.439 W/kg

**SAR(1 g) = 13 mW/g; SAR(10 g) = 6.08 mW/g**

Maximum value of SAR (measured) = 16.525 mW/g



# Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date/Time: 18.02.2011 14:36:14

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium: MSL U12 BB

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.94$  mho/m;  $\epsilon_r = 52.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 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, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

**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 = 95.420 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 26.751 W/kg

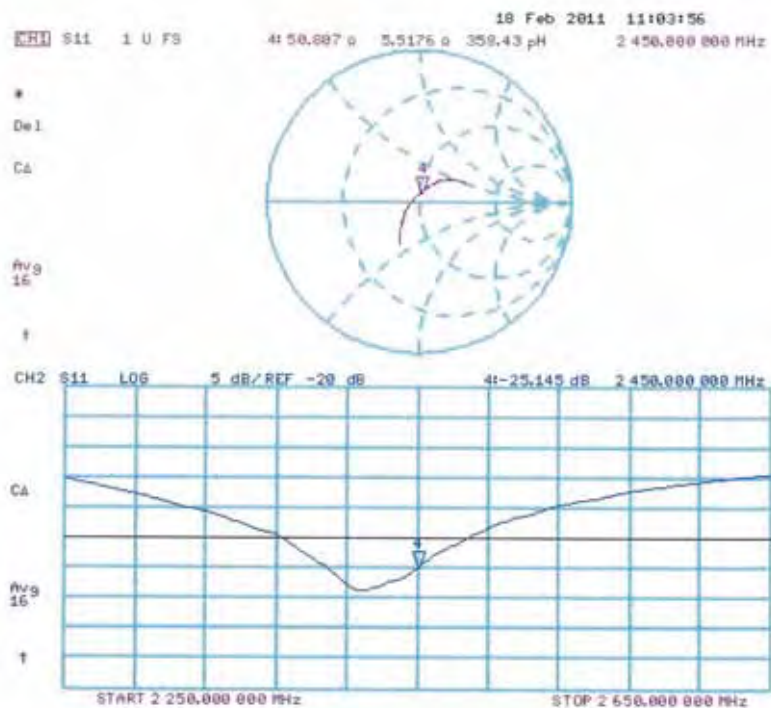
**SAR(1 g) = 12.6 mW/g; SAR(10 g) = 5.83 mW/g**

Maximum value of SAR (measured) = 16.714 mW/g





# Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **EX3-3519\_Feb11**

## CALIBRATION CERTIFICATE

Object **EX3DV3 - SN:3519**

Calibration procedure(s) **QA CAL-01.v7, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v3  
Calibration procedure for dosimetric E-field probes**



Calibration date: **February 25, 2011**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^{\circ}\text{C}$  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:  | Katja Pokovic | Technical Manager |  |
| Approved by:  | Niels Kuster  | Quality Manager   |   |
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|   |               |                   | Issued: February 25, 2011   |

Certificate No: EX3-3519\_Feb11

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Accreditation No.: **SCS 108**

#### Glossary:

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

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

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

#### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\theta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- 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
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>** 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  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.



EX3DV3 – SN:3519

February 25, 2011

# Probe EX3DV3

## SN:3519

Manufactured: March 8, 2004  
Calibrated: February 25, 2011

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

## DASY/EASY - Parameters of Probe: EX3DV3 - SN:3519

### Basic Calibration Parameters

|  | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|--|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V/m})^2$ ) <sup>A</sup> | 0.82     | 0.71     | 0.72     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                              | 99.0     | 98.5     | 100.8    |               |

### Modulation Calibration Parameters

| UID   | Communication System Name | PAR  |   | A<br>dB | B<br>dB | C<br>dB | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-------|---------------------------|------|---|---------|---------|---------|----------|---------------------------|
| 10000 | CW                        | 0.00 | X | 0.00    | 0.00    | 1.00    | 107.3    | $\pm 1.9 \%$              |
|       |                           |      | Y | 0.00    | 0.00    | 1.00    | 110.4    |                           |
|       |                           |      | Z | 0.00    | 0.00    | 1.00    | 136.5    |                           |

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

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

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

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



## DASY/EASY - Parameters of Probe: EX3DV3 - SN:3519

### Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) <sup>c</sup> | Relative Permittivity <sup>f</sup> | Conductivity (S/m) <sup>f</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 2000                 | 40.0                               | 1.40                            | 9.25    | 9.25    | 9.25    | 0.53  | 0.78       | ± 12.0 %    |
| 5200                 | 36.0                               | 4.66                            | 5.08    | 5.08    | 5.08    | 0.30  | 1.80       | ± 13.1 %    |
| 5500                 | 35.6                               | 4.96                            | 4.60    | 4.60    | 4.60    | 0.40  | 1.80       | ± 13.1 %    |
| 5800                 | 35.3                               | 5.27                            | 4.13    | 4.13    | 4.13    | 0.50  | 1.80       | ± 13.1 %    |

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

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

## DASY/EASY - Parameters of Probe: EX3DV3- SN:3519

### Calibration Parameter Determined in Body Tissue Simulating Media

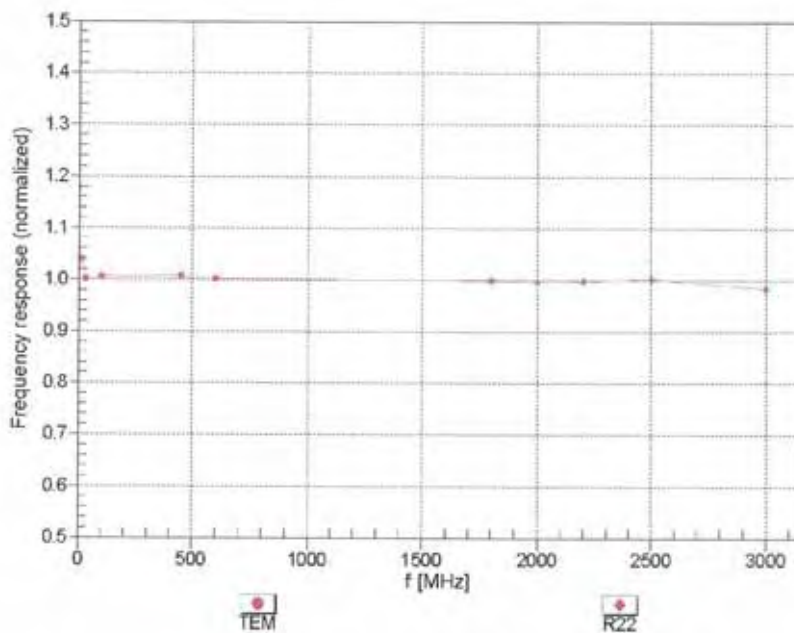
| f (MHz) <sup>c</sup> | Relative Permittivity <sup>f</sup> | Conductivity (S/m) <sup>f</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 2000                 | 53.3                               | 1.52                            | 9.31    | 9.31    | 9.31    | 0.72  | 0.68       | ± 12.0 %    |
| 2300                 | 52.9                               | 1.81                            | 8.67    | 8.67    | 8.67    | 0.69  | 0.67       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 8.17    | 8.17    | 8.17    | 0.79  | 0.58       | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 7.75    | 7.75    | 7.75    | 0.79  | 0.54       | ± 12.0 %    |
| 3500                 | 51.3                               | 3.31                            | 7.11    | 7.11    | 7.11    | 0.31  | 1.34       | ± 13.1 %    |
| 5200                 | 49.0                               | 5.30                            | 4.36    | 4.36    | 4.36    | 0.52  | 1.95       | ± 13.1 %    |
| 5300                 | 48.9                               | 5.42                            | 4.14    | 4.14    | 4.14    | 0.55  | 1.95       | ± 13.1 %    |
| 5500                 | 48.6                               | 5.65                            | 3.88    | 3.88    | 3.88    | 0.55  | 1.95       | ± 13.1 %    |
| 5600                 | 48.5                               | 5.77                            | 3.56    | 3.56    | 3.56    | 0.65  | 1.95       | ± 13.1 %    |
| 5800                 | 48.2                               | 6.00                            | 3.94    | 3.94    | 3.94    | 0.58  | 1.95       | ± 13.1 %    |

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

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

## Frequency Response of E-Field

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

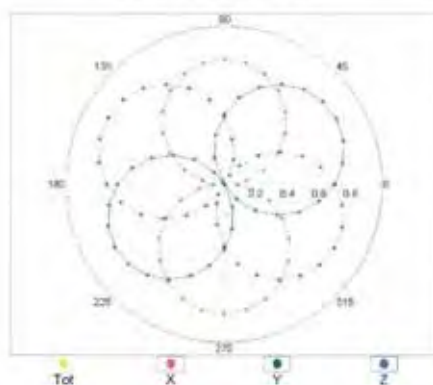


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

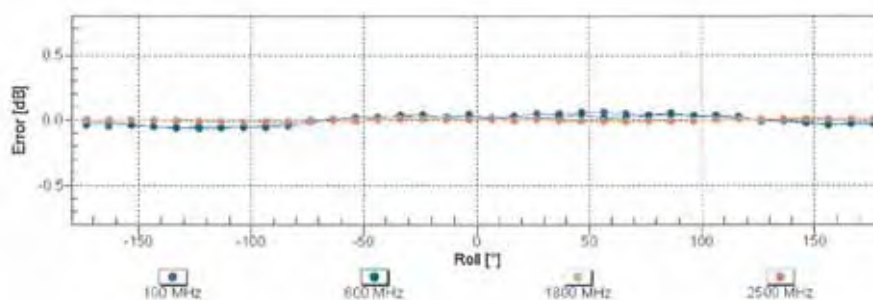
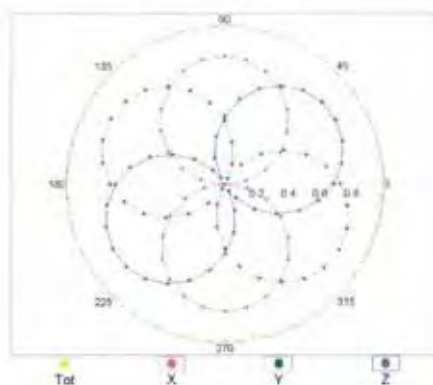


# Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$

f=600 MHz,TEM

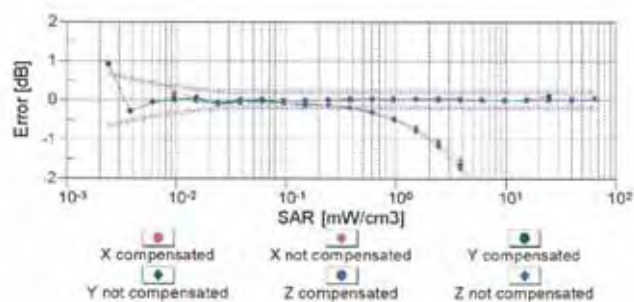
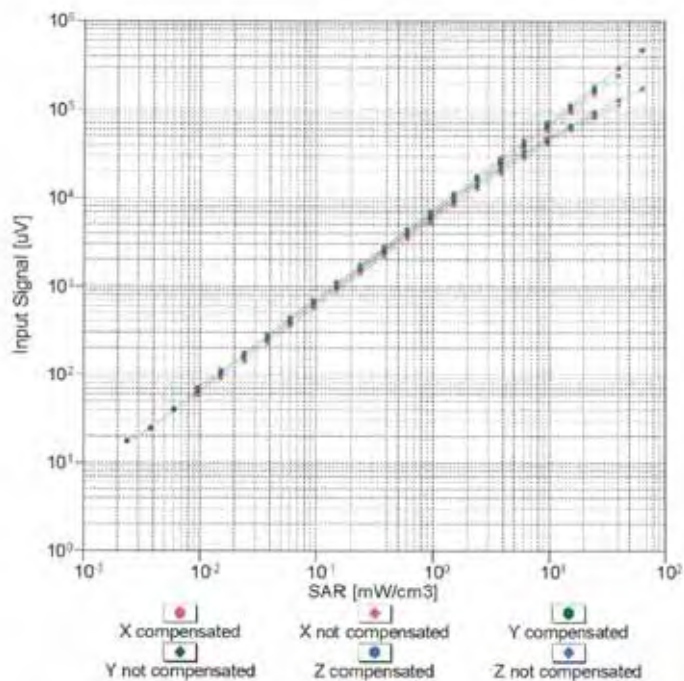


f=1800 MHz,R22



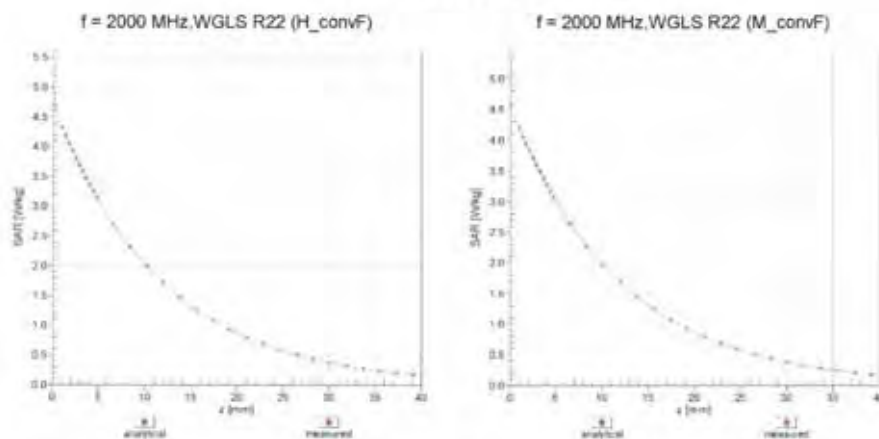
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

# Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f = 900 MHz)

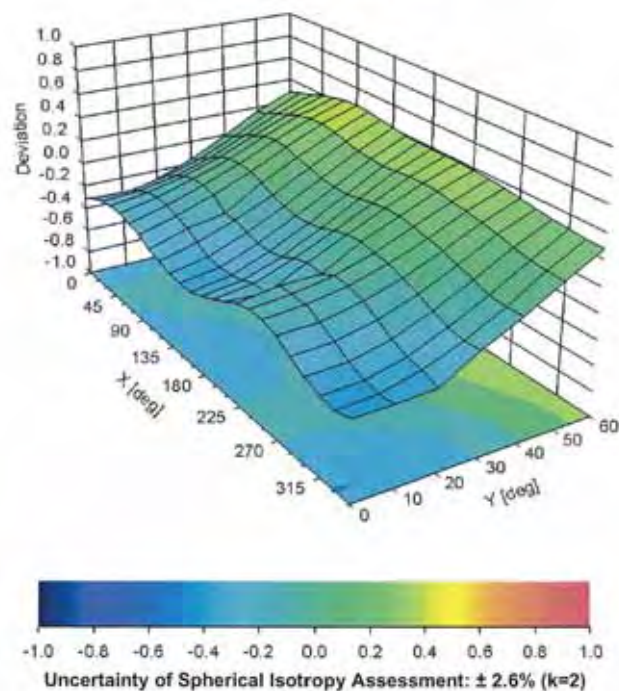


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment



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





EX3DV3- SN:3519

February 25, 2011

## DASY/EASY - Parameters of Probe: EX3DV3 - SN:3519

### Other Probe Parameters

|   |                |
|---|----------------|
| Sensor Arrangement                            | Triangular     |
| Connector Angle (°)                           | Not applicable |
| Mechanical Surface Detection Mode             | enabled        |
| Optical Surface Detection Mode                | disabled       |
| Probe Overall Length                          | 337 mm         |
| Probe Body Diameter                           | 10 mm          |
| Tip Length                                    | 9 mm           |
| Tip Diameter                                  | 2.5 mm         |
| Probe Tip to Sensor X Calibration Point       | 1 mm           |
| Probe Tip to Sensor Y Calibration Point       | 1 mm           |
| Probe Tip to Sensor Z Calibration Point       | 1 mm           |
| Recommended Measurement Distance from Surface | 2 mm           |

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



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
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 The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **DAE4-541\_Jul11**

## CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BJ - SN: 541**

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

Calibration date: **July 21, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards             | ID #               | Cal Date (Certificate No.) | Scheduled Calibration  |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278        | 28-Sep-10 (No:10376)       | Sep-11                 |
| Secondary Standards           | ID #               | Check Date (in house)      | Scheduled Check        |
| Calibrator Box V1.1           | SE UMS 006 AB 1004 | 08-Jun-11 (in house check) | In house check: Jun-12 |

|                |                       |                        |  |
|----------------|-----------------------|------------------------|--|
| Calibrated by: | Name<br>Andrea Guntli | Function<br>Technician | Signature<br> |
| Approved by:   | Fin Bomholt           | R&D Director           |               |

Issued: July 21, 2011

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



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Accredited by the Swiss Accreditation Service (SAS)  
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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 = 6.1 $\mu$ V , full range = -100...+300 mV

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

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

| Calibration Factors | X                        | Y                        | Z                        |
|---------------------|--------------------------|--------------------------|--------------------------|
| High Range          | 404.582 $\pm$ 0.1% (k=2) | 404.459 $\pm$ 0.1% (k=2) | 404.224 $\pm$ 0.1% (k=2) |
| Low Range           | 3.96870 $\pm$ 0.7% (k=2) | 3.93611 $\pm$ 0.7% (k=2) | 3.97524 $\pm$ 0.7% (k=2) |

### Connector Angle

|   |                                     |
|---|-------------------------------------|
| Connector Angle to be used in DASY system | 289.5 $^{\circ}$ $\pm$ 1 $^{\circ}$ |
|---|-------------------------------------|

## Appendix

### 1. DC Voltage Linearity

| High Range        | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 200008.1                  | -0.88                        | -0.00     |
| Channel X + Input | 20002.50                  | 3.10                         | 0.02      |
| Channel X - Input | -19996.27                 | 4.53                         | -0.02     |
| Channel Y + Input | 199996.8                  | -1.55                        | -0.00     |
| Channel Y + Input | 19997.00                  | -2.30                        | -0.01     |
| Channel Y - Input | -19998.95                 | 1.65                         | -0.01     |
| Channel Z + Input | 199999.3                  | 1.60                         | 0.00      |
| Channel Z + Input | 20001.15                  | 1.75                         | 0.01      |
| Channel Z - Input | -19996.29                 | 3.21                         | -0.02     |

| Low Range         | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 2000.5                    | 0.58                         | 0.03      |
| Channel X + Input | 200.06                    | -0.04                        | -0.02     |
| Channel X - Input | -200.23                   | -0.23                        | 0.11      |
| Channel Y + Input | 2000.2                    | 0.25                         | 0.01      |
| Channel Y + Input | 199.49                    | -0.51                        | -0.25     |
| Channel Y - Input | -200.76                   | -0.76                        | 0.38      |
| Channel Z + Input | 2000.0                    | -0.07                        | -0.00     |
| Channel Z + Input | 198.95                    | -0.95                        | -0.47     |
| Channel Z - Input | -200.96                   | -0.76                        | 0.38      |

### 2. Common mode sensitivity

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

|           | Common mode Input Voltage (mV) | High Range Average Reading ( $\mu\text{V}$ ) | Low Range Average Reading ( $\mu\text{V}$ ) |
|-----------|--------------------------------|--|---|
| Channel X | 200                            | 12.21  | 10.17                                       |
|           | - 200                          | -8.92  | -10.93                                      |
| Channel Y | 200                            | 1.33   | 1.31  |
|           | - 200                          | -3.20  | -2.56                                       |
| Channel Z | 200                            | 1.32   | 0.71  |
|           | - 200                          | -1.57  | -2.26                                       |

### 3. Channel separation

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

|           | Input Voltage (mV) | Channel X ( $\mu\text{V}$ ) | Channel Y ( $\mu\text{V}$ ) | Channel Z ( $\mu\text{V}$ ) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200                | -                           | 2.77                        | -0.01                       |
| Channel Y | 200                | 1.35                        | -                           | 4.90                        |
| Channel Z | 200                | 0.02                        | 0.12                        | -                           |



#### 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 | 16012            | 16048           |
| Channel Y | 15790            | 15279           |
| Channel Z | 15978            | 16594           |

#### 5. Input Offset Measurement

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

Input 10M $\Omega$

|           | Average ( $\mu$ V) | min. Offset ( $\mu$ V) | max. Offset ( $\mu$ V) | Std. Deviation ( $\mu$ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | -0.14              | -1.06                  | 0.50                   | 0.27                      |
| Channel Y | -0.69              | -2.35                  | 0.18                   | 0.36                      |
| Channel Z | -0.84              | -1.32                  | -0.29                  | 0.23                      |

#### 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                |