



## SAR EVALUATION REPORT

**Applicant Name:**

Samsung Electronics Co., Ltd.  
416 Maetan 3-Dong, Yeongtong-gu  
Suwon-si, Gyeonggi-do  
443-742, Republic of Korea

**Date of Testing:**

04/12/12 - 04/30/12

**Test Site/Location:**

PCTEST Lab, Columbia, MD, USA

**Document Serial No.:**

0Y1204090437.A3L

**FCC ID:****A3LSCHI705****APPLICANT:****SAMSUNG ELECTRONICS CO., LTD.****DUT Type:**

Portable Tablet

**Application Type:**

Certification

**FCC Rule Part(s):**

CFR §2.1093

**Model(s):**

SCH-I705

| Band & Mode                                 | Tx Frequency          | Conducted Power [dBm] | Body SAR (W/kg) |
|---------------------------------------------|-----------------------|-----------------------|-----------------|
| Cell. CDMA/EVDO                             | 824.70 - 848.31 MHz   | 24.48                 | 0.54            |
| PCS CDMA/EVDO                               | 1851.25 - 1908.75 MHz | 24.62                 | 0.94            |
| LTE Band 13                                 | 782 MHz               | 23.49                 | 0.84            |
| 2.4 GHz WLAN                                | 2412 - 2462 MHz       | 13.03                 | 0.55            |
| Bluetooth                                   | 2402 - 2480 MHz       | 11.91                 | N/A             |
| <b>Simultaneous SAR per KDB 690783 D01:</b> |                       |                       | <b>1.39</b>     |

Note: Powers in the above table represent output powers for the SAR test configurations and may not represent the highest output powers for all configurations for each mode.

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 ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in FCC/OET Bulletin 65 Supplement C (2001), IEEE 1528-2003 and in applicable Industry Canada Radio Standards Specifications (RSS); for North American frequency bands only.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Test results reported herein relate only to the item(s) tested.

PCTEST certifies that no party to this application has been subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.

  
Randy Ortanez  
President

|                                          |                                                                                     |                                     |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> A3LSCHI705                |  | <b>SAR EVALUATION REPORT</b>        |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1204090437.A3L | <b>Test Dates:</b><br>04/12/12 - 04/30/12                                           | <b>DUT Type:</b><br>Portable Tablet |                                                                                       | Page 1 of 31                           |

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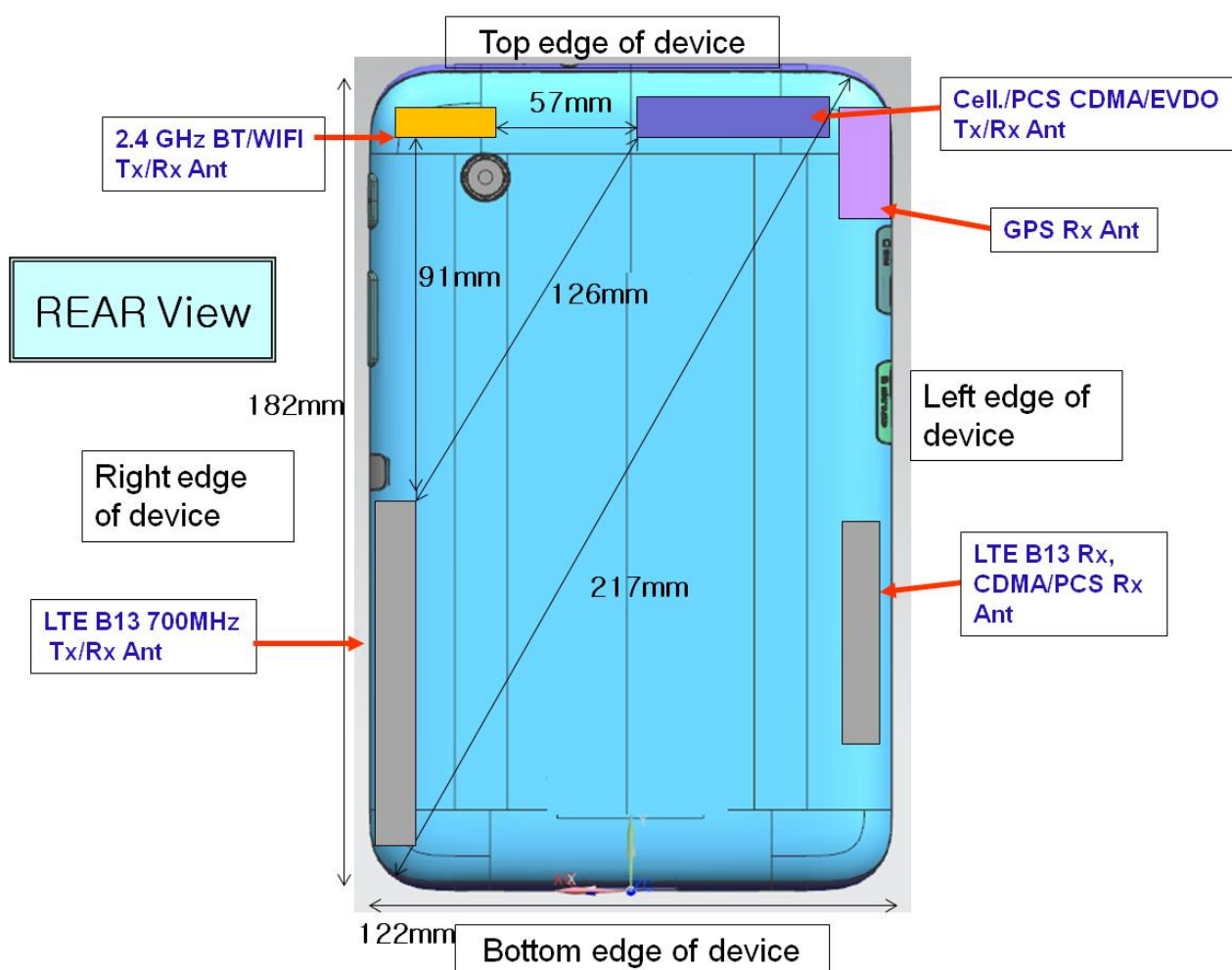
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# 1 DEVICE UNDER TEST

## 1.1 Device Overview

| Band & Mode     | Tx Frequency          |
|-----------------|-----------------------|
| Cell. CDMA/EVDO | 824.70 - 848.31 MHz   |
| PCS CDMA/EVDO   | 1851.25 - 1908.75 MHz |
| LTE Band 13     | 782 MHz               |
| 2.4 GHz WLAN    | 2412 - 2462 MHz       |
| Bluetooth       | 2402 - 2480 MHz       |

## 1.2 DUT Antenna Locations



**Figure 1-1**  
**DUT Antenna Locations**

|                                   |                                        |                              |         |                                 |
|-----------------------------------|----------------------------------------|------------------------------|---------|---------------------------------|
| FCC ID: A3LSCHI705                | PCTEST<br>ENGINEERING LABORATORY, INC. | SAR EVALUATION REPORT        | SAMSUNG | Reviewed by:<br>Quality Manager |
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### 1.3 Simultaneous Transmission Capabilities

According to KDB 648474, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the DUT are shown in Figure 1-2 and are color-coded to indicate communication modes that cannot transmit simultaneously with one another.

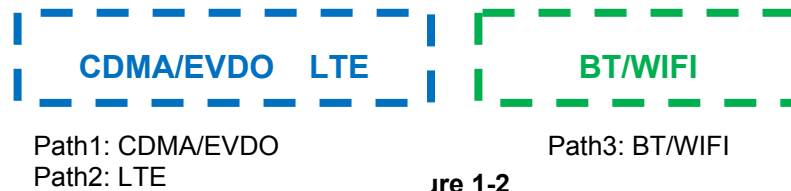


Figure 1-2

#### Simultaneous Transmission Paths

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to KDB 447498 3) procedures.

Table 1-1  
Simultaneous Transmission Scenarios Transmission

| No. | Capable Transmit Configurations                                       | Body           | Note                 | Scenario Possible? |
|-----|-----------------------------------------------------------------------|----------------|----------------------|--------------------|
|     |                                                                       | FCC KDB 447498 |                      |                    |
| 1   | 800/1900 MHz CDMA 1x data + WiFi 2.4GHz                               | Yes            | 3G Hotspot           | Yes                |
| 2   | 800/1900MHz CDMA EVDO data + WiFi 2.4GHz                              | Yes            | 3G Hotspot           | Yes                |
| 3   | 700 MHz LTE B13 Data + WiFi 2.4 GHz                                   | Yes            | 4G Hotspot           | Yes                |
| 4   | 700 MHz LTE B13 Data + 800/1900 MHz CDMA 1x data                      | N/A            | Not Supported by H/W | No                 |
| 5   | 700 MHz LTE B13 Data + 800/1900 MHz CDMA EVDO data                    | N/A            | Not Supported by H/W | No                 |
| 6   | 700 MHz LTE B13 Data + 800/1900 MHz CDMA 1x data+ WiFi 2.4 GHz data   | N/A            | Not Supported by H/W | No                 |
| 7   | 700 MHz LTE B13 Data + 800/1900 MHz CDMA EVDO data+ WiFi 2.4 GHz data | N/A            | Not Supported by H/W | No                 |

### 1.4 SAR Test Exclusions Applied

#### (A) WIFI/BT

Per KDB Publication 447498 4), SAR is not required when the antenna separation distance is greater than 5 cm and the average output power is less than 60/f.

Therefore, **Bluetooth SAR was not required** since the maximum conducted power of Bluetooth Tx is 15.524 mW<60/f. **2.4 GHz WIFI SAR was not required** since the maximum conducted power of 2.4 GHz WIFI Tx is 21.232 mW<60/f, **but was additionally tested**.

Please refer to the DSS EMC report filed for this EUT for a complete set of Bluetooth powers.

2.4 GHz WIFI and Bluetooth share the same antenna path and cannot transmit simultaneously. CDMA/EVDO and LTE share the same antenna path and cannot transmit simultaneously.

#### (B) Licensed Transmitter(s)

This model does not support Voice for licensed transmitter in any modes.

|                                   |                                                                                     |                              |                                                                                       |                                 |
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## 1.5 Power Reduction for SAR

Proximity Sensors were utilized in the device for SAR purposes. April/October 2011 TCB Workshop Notes regarding Power reduction using proximity sensors were used for guidance for SAR Testing. See Section 8.5 for more information.

## 1.6 Samples Used for SAR Testing

Four samples with identical hardware were used to facilitate SAR testing only. For maximum power device S/N: 0870-0965, power reduction was disabled via software (only available to the manufacturer - end user cannot disable power reduction) to ensure the device was always transmitting at maximum power when testing at a conservative distance. The reduced power device S/N: 0870-0967 was tuned to the reduced power levels. Power reduction was disabled via software (only available to the manufacturer) on this device to ensure the device was always transmitting at reduced power and to confirm reduced power levels.

|                          | Cell./PCS CDMA | LTE       | 2.4 GHz WIFI |
|--------------------------|----------------|-----------|--------------|
| Max Power Device S/N     | 0870-0965      | 0870-0962 | 0870-1023    |
| Reduced Power Device S/N | 0870-0967      | N/A       | N/A          |

## 1.7 Guidance Applied

- FCC KDB 941225 (2G/3G/4G)
- FCC KDB 248227 (802.11)
- FCC KDB 447498 Section 4 (Tablet SAR Considerations)
- April/Oct 2011 TCB Workshop Notes for RF Exposure and Sensors with Power Reduction
- FCC KDB 648474 (Simultaneous)

|                                   |                                                                                     |                              |                                                                                       |                                 |
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## 2

## LTE CHECKLIST PER KDB 941225 D05

| KDB 941225 Pub LTE Information |                                                                                                                   |                                              |                            |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------|
| KDB 941225<br>Section          | FCC ID: A3LSCHI705                                                                                                | A3LSCHI705                                   |                            |
|                                | Form Factor                                                                                                       | Tablet                                       |                            |
| 1)                             | Frequency Range of each LTE transmission band                                                                     | BAND13 : 782 MHz                             |                            |
| 2)                             | Channel Bandwidths                                                                                                | BAND13 : 10MHz                               |                            |
| 3)                             | Channel Numbers and Frequencies (MHz)                                                                             |                                              |                            |
|                                | LTE Band 13 and BW 10MHz                                                                                          | 782MHz(23230)                                |                            |
| 4)(a)                          | UE Category                                                                                                       | 3                                            |                            |
| (b)                            | Modulations Supported in UL                                                                                       | QPSK, 16QAM                                  |                            |
|                                | LTE Transmitter and Antenna Implementation                                                                        | CDMA and LTE have the same transmission path |                            |
| 5)                             | Description of LTE Tx and Ant. Implementation                                                                     | 1 Main TX/RX Ant and 1 Diversity RX Ant      |                            |
| 6)                             | LTE Voice available?                                                                                              | No                                           |                            |
|                                | Hotspot with LTE+WIFI                                                                                             | Yes                                          |                            |
|                                | Hotspot with LTE+WIFI active with 1X/voice sessions?                                                              | No                                           |                            |
| 7)                             | LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided) | Yes                                          |                            |
|                                | A-MPR (Additional MPR) disabled for SAR Testing?                                                                  | Yes                                          |                            |
| 8)                             | Conducted power Table provided for 1RB (low and high offset), 50% RB (centered), 100% RB                          | Yes                                          |                            |
| 9-10)                          | Non-LTE US Wireless Operating Modes/Band                                                                          | RF Output Power                              | RF Exposure Configurations |
|                                | 850 MHz CDMA                                                                                                      | See page 1                                   | Body                       |
|                                | 1900 MHz US-PCS                                                                                                   |                                              | Body                       |
|                                | 2.4GHz Bluetooth                                                                                                  |                                              | Body                       |
|                                | 2.4GHz WI-FI                                                                                                      |                                              | Body                       |
| 11)                            | Simultaneous Tx Conditions (Voice and Data Configurations)                                                        | See section 1.3                              |                            |
| 12)                            | Power Reduction used for SAR Compliance?                                                                          | for CDMA only                                |                            |
| 13)                            | Describe Power Reduction (LTE Modes)                                                                              | N/A                                          |                            |
| 14)                            | SAR Test Plan                                                                                                     | N/A                                          |                            |
| 15)                            | SAR test data, preliminary                                                                                        | N/A                                          |                            |

|                                   |                                                                                     |                              |                                                                                       |                                 |
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### 3 INTRODUCTION

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. [1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [24]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

#### 3.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) 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 Equation 3-1).

Equation 3-1  
SAR Mathematical Equation

$$SAR = \frac{d}{dt} \left( \frac{dU}{dm} \right) = \frac{d}{dt} \left( \frac{dU}{\rho dV} \right)$$

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

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

where:

- $\sigma$  = conductivity of the tissue-simulating material (S/m)
- $\rho$  = mass density of the tissue-simulating material (kg/m<sup>3</sup>)
- E = Total 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 relation 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.[6]

|                                   |                                                                                                                                   |                              |                                                                                       |                                 |
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## 4 SAR MEASUREMENT SETUP

### 4.1 Automated SAR Measurement System

Measurements are performed using the DASY automated dosimetric SAR assessment system. The DASY is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of a high precision robotics system (Staubli), robot controller, desktop computer, near-field probe, probe alignment sensor, and the SAM phantom containing the head or body equivalent material. The robot is a six-axis industrial robot, performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). See [www.speag.com](http://www.speag.com) for more information about the specification of the SAR assessment system.



**Figure 4-1**  
**SAR Measurement System**



**Figure 4-2**  
**Near-Field Probe**

**Table 4-1**  
**Composition of the Tissue Equivalent Matter**

| Frequency (MHz)           | 835   | 1900  | 2450 |
|---------------------------|-------|-------|------|
| Tissue                    | Body  | Body  | Body |
| Ingredients (% by weight) |       |       |      |
| Bactericide               | 0.1   |       |      |
| DGBE                      |       | 29.44 | 26.7 |
| HEC                       | 1     |       |      |
| NaCl                      | 0.94  | 0.39  | 0.1  |
| Sucrose                   | 44.9  |       |      |
| Water                     | 53.06 | 70.17 | 73.2 |

See next page for 750 MHz Tissue Composition

|                                          |                                                                                     |                                     |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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**Table 4-2**  
**Composition of 750 MHz Body Tissue Equivalent Matter**

| <b>2 Composition / Information on ingredients</b>                |                                                                                                                                                     |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| The Item is composed of the following ingredients:               |                                                                                                                                                     |
| H <sub>2</sub> O                                                 | Water, 35 – 58%                                                                                                                                     |
| Sucrose                                                          | Sugar, white, refined, 40 – 60%                                                                                                                     |
| NaCl                                                             | Sodium Chloride, 0 – 6%                                                                                                                             |
| Hydroxyethyl-cellulose                                           | Medium Viscosity (CAS# 9004-82-0), <0.3%                                                                                                            |
| Preventol-D7                                                     | Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyl-3(2H)-isothiazolone, 0.1 – 0.7% |
| Relevant for safety: Refer to the respective Safety Data Sheet*. |                                                                                                                                                     |

**Note:** 750MHz liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

**Measurement Certificate / Material Test**

|              |                                         |
|--------------|-----------------------------------------|
| Item Name    | Body Tissue Simulating Liquid (MSL 750) |
| Product No.  | SL AAM 075 AA (Charge: 110606-1)        |
| Manufacturer | SPEAG                                   |

**Measurement Method**

TSL dielectric parameters measured using calibrated OCP probe (type DAK).

**Target Parameters**

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

**Test Condition**

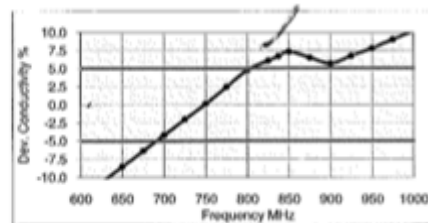
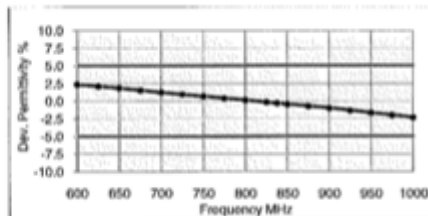
Ambient Condition 22°C ; 30% humidity  
TSL Temperature 22°C  
Test Date 8-Jun-11

**Additional Information**

TSL Density 1.212 g/cm<sup>3</sup>  
TSL Heat-capacity 3.006 kJ/(kg\*K)

**Results**

| f (MHz) | Measured |        |       | Target |       | Diff. to Target [%] |         |
|---------|----------|--------|-------|--------|-------|---------------------|---------|
|         | HP-ε'    | HP-ε'' | sigma | eps    | sigma | Δ-eps               | Δ-sigma |
| 600     | 57.4     | 24.88  | 0.83  | 56.1   | 0.95  | 2.4                 | -12.7   |
| 625     | 57.2     | 24.53  | 0.85  | 56.0   | 0.95  | 2.1                 | -10.6   |
| 650     | 57.0     | 24.18  | 0.87  | 55.9   | 0.96  | 1.8                 | -8.5    |
| 675     | 56.7     | 23.90  | 0.90  | 55.8   | 0.96  | 1.5                 | -6.3    |
| 700     | 56.4     | 23.61  | 0.92  | 55.7   | 0.96  | 1.2                 | -4.2    |
| 725     | 56.2     | 23.37  | 0.94  | 55.6   | 0.96  | 0.9                 | -2.0    |
| 750     | 55.9     | 23.12  | 0.96  | 55.5   | 0.96  | 0.7                 | 0.1     |
| 775     | 55.7     | 22.95  | 0.99  | 55.4   | 0.97  | 0.4                 | 2.5     |
| 800     | 55.4     | 22.78  | 1.01  | 55.3   | 0.97  | 0.1                 | 4.8     |
| 825     | 55.2     | 22.61  | 1.04  | 55.2   | 0.98  | -0.2                | 6.1     |
| 838     | 55.0     | 22.52  | 1.05  | 55.2   | 0.98  | -0.3                | 6.7     |
| 850     | 54.9     | 22.44  | 1.06  | 55.2   | 0.99  | -0.4                | 7.3     |
| 875     | 54.7     | 22.30  | 1.09  | 55.1   | 1.02  | -0.7                | 6.5     |
| 900     | 54.5     | 22.17  | 1.11  | 55.0   | 1.05  | -1.0                | 5.7     |
| 925     | 54.2     | 22.05  | 1.13  | 55.0   | 1.06  | -1.3                | 6.8     |
| 950     | 54.0     | 21.94  | 1.16  | 54.9   | 1.08  | -1.7                | 7.8     |
| 975     | 53.8     | 21.85  | 1.18  | 54.9   | 1.09  | -2.0                | 9.0     |
| 1000    | 53.6     | 21.75  | 1.21  | 54.8   | 1.10  | -2.3                | 10.2    |



**Figure 4-3**  
**750MHz Body Tissue Equivalent Matter**

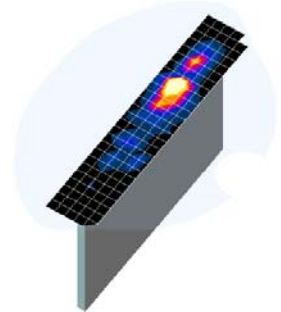
|                                   |                                        |                              |              |                                 |
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## 5 DOSIMETRIC ASSESSMENT

### 5.1 Measurement Procedure

The evaluation was performed using the following procedure:

1. The SAR distribution at the exposed side of the body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head interface and the horizontal grid resolution was 15mm and 15mm for frequencies < 3 GHz in the x and y directions respectively. When applicable, for frequencies above 3 GHz, a 10 mm by 10 mm resolution was used.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1 gram cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak area of the maximum absorption was determined by spline interpolation. Around this point, a volume of 32mm x 32mm x 30mm (fine resolution volume scan, zoom scan) was assessed by measuring at least 5 x 5 x 7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):
  - a. The data was extrapolated to the surface of the outer-shell of the phantom. The combined distance extrapolated was the combined distance from the center of the dipoles 2.7mm away from the tip of the probe housing plus the 1.2 mm distance between the surface and the lowest measuring point. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
  - b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
  - c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.



**Figure 5-1**  
**Sample SAR Area Scan**

|                                          |                                                                                                                                   |                                     |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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## 6 FCC RF EXPOSURE LIMITS

### 6.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

### 6.2 Controlled Environment

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). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

**Table 6-1**  
**SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6**

| HUMAN EXPOSURE LIMITS                           |                                                                           |                                                                   |
|-------------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------|
|                                                 | UNCONTROLLED ENVIRONMENT<br><i>General Population</i><br>(W/kg) or (mW/g) | CONTROLLED ENVIRONMENT<br><i>Occupational</i><br>(W/kg) or (mW/g) |
| SPATIAL PEAK SAR<br>Brain                       | 1.6                                                                       | 8.0                                                               |
| SPATIAL AVERAGE SAR<br>Whole Body               | 0.08                                                                      | 0.4                                                               |
| SPATIAL PEAK SAR<br>Hands, Feet, Ankles, Wrists | 4.0                                                                       | 20                                                                |

1. 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.
2. The Spatial Average value of the SAR averaged over the whole body.
3. 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.

|                                   |                                                                                     |                              |                                                                                       |                                 |
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Power measurements were performed using a base station simulator under digital average power.

### 7.1 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01 "SAR Measurement Procedures for 3G Devices" v02, October 2007.

The device was placed into a simulated call using a base station simulator in a RF shielded chamber. Establishing connections in this manner ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. Devices under test were evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device was tested throughout the SAR test at maximum output power, the SAR measurement system measures a "point SAR" at an arbitrary reference point at the start and end of the 1 gram SAR evaluation, to assess for any power drifts during the evaluation. If the power drift deviated by more than 5%, the SAR test and drift measurements were repeated.

### 7.2 SAR Measurement Conditions for CDMA2000

The following procedures were performed according to FCC KDB Publication 941225 D01 "SAR Measurement Procedures for 3G Devices" v02, October 2007.

#### 7.2.1 Output Power Verification

See 3GPP2 C.S0011/TIA-98-E as recommended by "SAR Measurement Procedures for 3G Devices" v02, October 2007. Maximum output power is verified on the High, Middle and Low channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E. Tests were measured with power control bits in the "All Up" condition.

1. If the mobile station (MS) supports Reverse TCH RC 1 and Forward TCH RC 1, set up a call using Fundamental Channel Test Mode 1 (RC=1/1) with 9600 bps data rate only.
2. Under RC1, C.S0011 Table 4.4.5.2-1, Table 7-1 parameters were applied.
3. If the MS supports the RC 3 Reverse FCH, RC3 Reverse SCH<sub>0</sub> and demodulation of RC 3,4, or 5, set up a call using Supplemental Channel Test Mode 3 (RC 3/3) with 9600 bps Fundamental Channel and 9600 bps SCH<sub>0</sub> data rate.
4. Under RC3, C.S0011 Table 4.4.5.2-2, Table 7-2 was applied.
5. FCHs were configured at full rate for maximum SAR with "All Up" power control bits.

**Table 7-1**  
**Parameters for Max. Power for RC1**

| Parameter                    | Units        | Value |
|------------------------------|--------------|-------|
| $I_{or}$                     | dBm/1.23 MHz | -104  |
| $\frac{Pilot E_c}{I_{or}}$   | dB           | -7    |
| $\frac{Traffic E_c}{I_{or}}$ | dB           | -7.4  |

**Table 7-2**  
**Parameters for Max. Power for RC3**

| Parameter                    | Units        | Value |
|------------------------------|--------------|-------|
| $I_{or}$                     | dBm/1.23 MHz | -86   |
| $\frac{Pilot E_c}{I_{or}}$   | dB           | -7    |
| $\frac{Traffic E_c}{I_{or}}$ | dB           | -7.4  |

#### 7.2.2 Body SAR Measurements for EVDO Data Devices

Body SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0. SAR for Subtype 2 Physical layer configurations is not required for Rev. A when the maximum average output of each RF channels is less than that measured in Subtype 0/1 Physical layer configurations. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for the RF channels in Rev. 0. The AT is

|                                          |                                                                                                                                   |                                     |                                                                                       |                                        |
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tested with a Reverse Data Channel rate of 153.6 kbps in Subtype 0/1 Physical Layer configurations; and a Reverse Data Channel payload size of 4096 bits and Termination Target of 16 slots in Subtype 2 Physical Layer configurations. Both FTAP and FETAP are configured with a Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots. AT power control should be in "All Bits Up" conditions for TAP/ETAP. For Ev-Do devices that also support 1x RTT data operations, SAR is not required for 1x RTT when the maximum average output of each channel is less than ¼ dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev.0. Otherwise, the body SAR measurements procedures for CDMA Handsets should be applied (See Sections 7.2.3).

### 7.2.3 Body SAR Measurements for CDMA2000 1x

SAR for body exposure configurations is measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCHn) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only. Otherwise, SAR is measured on the maximum output channel (FCH + SCHn) with FCH at full rate and SCH0 enabled at 9600 bps using the exposure configuration that results in the highest SAR for that channel with FCH only. When multiple code channels are enabled, the DUT output may shift by more than 0.5 dB and lead to higher SAR drifts and SCH dropouts. Body SAR was measured using TDSO / SO32 with power control bits in the "All Up." Body SAR in RC1 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3.

## 7.3 SAR Measurement Conditions for LTE

LTE modes were tested according to FCC KDB 941225 D05 publication. Please see notes following SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 was used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing.

### 7.3.1 MPR

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1. The differences noted are not cases of implemented MPR but rather associated with measurement uncertainty and allowable tolerances per 3GPP standard and the manufacturer. See Section 9.2 for MPR targets.

### 7.3.2 A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

### 7.3.3 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05:

- Per Page 4, 3) A), QPSK with 50% RB is required for the highest bandwidth.
- Per Page 4, 3) B), QPSK with 1 RB for both channel edges are required for the highest bandwidth.
- Per Page 4, 4) A), 16QAM with 50% RB is required for the highest bandwidth.
- Per Page 4, 4) B) and Page 5 footnote 9, 16QAM with 1RB for both channel edges are required for the highest bandwidth.
- Per Page 4, 4), A) I) and Page 5, 4), A) I), 100% RB Allocation is not required to be tested when the SAR is not > 1.45 W/kg.

|                                          |                                                                                                                                   |                                     |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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## 7.4 SAR Testing with 802.11 Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g/n 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. See KDB Publication 248227 for more details.

### 7.4.1 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.

### 7.4.2 Frequency Channel Configurations [27]

For 2.4 GHz, the highest average RF output power channel between the low, mid and high channel at the lowest data rate was selected for SAR evaluation in 802.11b mode. 802.11g/n modes and higher data rates for 802.11b were additionally evaluated for SAR if the output power of the respective mode was 0.25 dB or higher than the powers of the SAR configurations tested in the 802.11b mode.

If the maximum extrapolated peak SAR of the zoom scan for the highest output channel was less than 1.6 W/kg or if the 1g averaged SAR was less than 0.8 W/kg, SAR testing was not required for the other test channels in the band.

|                                          |                                                                                     |                                     |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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## 8

## SAR TABLET TESTING

### 8.1 SAR Testing for Tablet per KDB Publication 447498 Section 4

Lap-touching devices that have transmitting antennas located less than 20 cm from the body of the user require routine SAR evaluation. Such devices are considered portable, and are capable of being held to the body. Devices are to be setup according to KDB publication 447498 requirements and are configured with maximum output power during SAR assessment for a worst-case SAR evaluation.

Per KDB 447498 4) b) i), the bottom face (back of the device) is required to be tested touching the flat phantom.

Per KDB Publication 447498 4) b) ii) (2), SAR testing applies for the tablet edges with antennas located within 5 cm of each tablet edge closest to the user. According to KDB Publication 447498 4) b) ii) (2), for each antenna, SAR is only required for the edge with the most conservative exposure condition. Since the diagonal dimension of the device is more than 20 cm (21.7 cm), this device is a tablet.

### 8.2 Proximity Sensor Information

The sensor pad is located near the upper half of the device to cover exposure conditions to the CDMA antenna. The technical description contains information about sensor size and locations. Power reduction levels are provided in Section 8.4.

### 8.3 Display Orientation Capabilities

This device is capable of multiple display orientations supporting both portrait and landscape positions. Therefore per KDB 447498 4) b) ii) (2), SAR testing applies for the tablet edges with antennas located within 5 cm of each tablet edge closest to the user. According to KDB 447498 4) b) ii) (2), for each antenna, SAR is only required for the edge with the most conservative exposure condition.

### 8.4 Additional SAR Testing for the Back of the Device

Based on the type and implementation of the sensors, April 2011 FCC-TCB conference notes requires sensor information regarding: (1) additional SAR evaluation at a conservative distance from the device where power reduction is de-activated and (2) reliability sensor activation data. Reliability sensor activation data is provided by the manufacturer at several distances 0 degrees (normal) to the tissue-filled SAR flat phantom for each applicable side of the tablet with sensors, to cover conditions where the user would interface with the tablet sides (See Table 8-1).

Since the sensor reliability data from the manufacturer indicates a back-off sensor activation distance for the back side of 6 mm for the CDMA antenna, a conservative distance of 5 mm was tested for the back side for SAR (with maximum output power). The sensors are designed to support sufficient detection range and sensitivity to cover regions of the sensors in all applicable directions. Further details about the manufacturer's sensing mechanism and sensor coverage assessments are included in the technical descriptions.

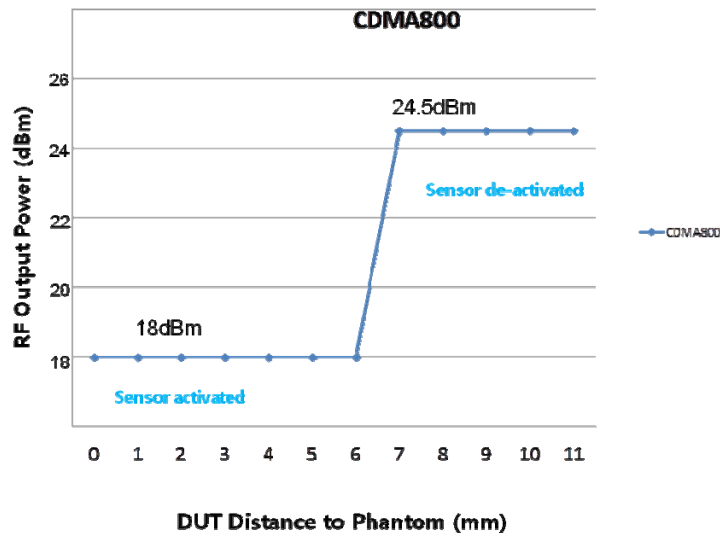
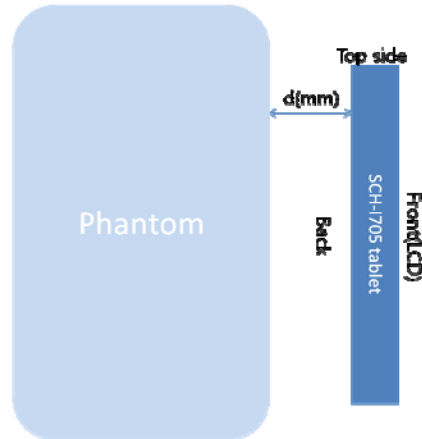
|                                   |                                                                                     |                              |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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**Table 8-1**  
**Distance from Back of Tablet for CDMA**

| distance in mm                                                  | 4  | 5  | 6  | 7   | 8   | 9   |
|-----------------------------------------------------------------|----|----|----|-----|-----|-----|
| Condition of CDMA sensor with respect to the back of the device | on | on | on | off | off | off |

Please See Figure 8-1 - Figure 8-2 for power vs. Back-off Distance plots for CDMA modes.

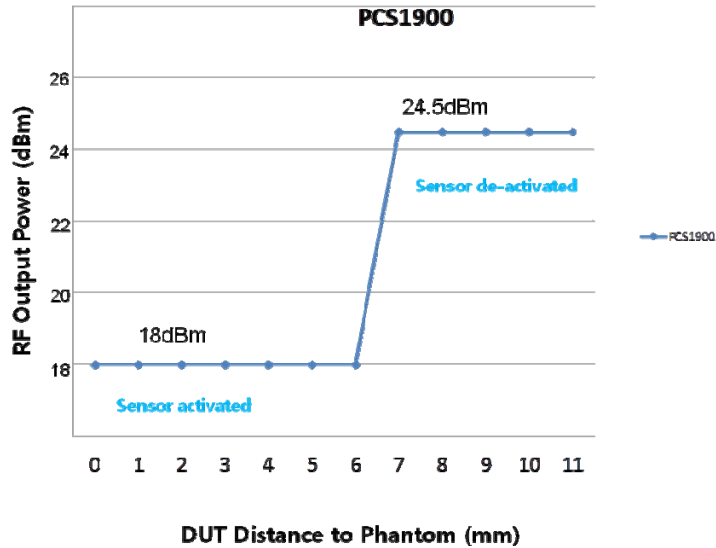
**Backoff Sensor Power Reduction (back side)**



**Figure 8-1**  
**Cell. CDMA Back off Power Reduction Graph - Back Side**

Data in Figure 8-1 demonstrates a power reduction to 18 dBm at a distance of 6 mm and less from the back, as shown in Table 8-1.

|                                   |                                        |                              |  |                                 |
|-----------------------------------|----------------------------------------|------------------------------|--|---------------------------------|
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**Figure 8-2**  
**PCS CDMA Back off Power Reduction Graph - Back Side**

Data in Figure 8-2 demonstrates a power reduction to 18 dBm at a distance of 6 mm and less from the back, as shown in Table 8-1.

## 8.5 Method of SAR Measurement with Power Reduction

This tablet was tested in accordance with April 2011 TCB workshop notes for proximity sensor and power reduction. See Section 1.6 for the configurations tested per sample.

For CDMA modes, based on the power-reduction activation vs. distance results for the sensors, the samples representative of the device with the sensors activated (reduced power, SN: 0870-0967) was tested for SAR at 0 mm from the back of the flat phantom. The device was additionally tested at a conservative 5 mm distance with the sensor de-activated (max power, no power reduction, SN: 0870-0965) from the back side;

For the additional SAR measurements with the sensors de-activated when the device is positioned away from the user, SAR evaluation is required without power back-off at 5 mm (from the back) for CDMA. Since the device sensor detection mechanism is active at these distances, the power reduction was disabled via manufacturer test software, and the device was placed in maximum power transmit mode with a base station simulator under the tissue equivalent liquid- filled flat phantom at the required distances for testing.

|                                   |                                                                                     |                              |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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## 9 RF CONDUCTED POWERS

### 9.1 CDMA Conducted Powers

**Table 9-1**  
**Maximum CDMA Average RF Power**  
**(Representing Proximity Sensor Inactive)**

| Band     | Channel | Frequency | TDSO SO32 [dBm] | TDSO SO32 [dBm] | 1x EvDO Rev. 0 [dBm] | 1x EvDO Rev. A [dBm] |
|----------|---------|-----------|-----------------|-----------------|----------------------|----------------------|
|          | F-RC    | MHz       | FCH+SCH         | FCH             | (RTAP)               | (RETAP)              |
| Cellular | 1013    | 824.7     | 24.29           | 24.30           | 24.34                | 24.33                |
|          | 384     | 836.52    | 24.39           | 24.40           | 24.40                | 24.47                |
|          | 777     | 848.31    | 24.38           | 24.37           | 24.42                | 24.48                |
| PCS      | 25      | 1851.25   | 24.53           | 24.57           | 24.39                | 24.37                |
|          | 600     | 1880      | 24.70           | 24.71           | 24.62                | 24.61                |
|          | 1175    | 1908.75   | 24.59           | 24.60           | 24.54                | 24.53                |

**Table 9-2**  
**Reduced CDMA Average RFPower**  
**(Representing Proximity Sensor Active)**

| Band     | Channel | Frequency | TDSO SO32 [dBm] | TDSO SO32 [dBm] | 1x EvDO Rev. 0 [dBm] | 1x EvDO Rev. A [dBm] |
|----------|---------|-----------|-----------------|-----------------|----------------------|----------------------|
|          | F-RC    | MHz       | FCH+SCH         | FCH             | (RTAP)               | (RETAP)              |
| Cellular | 1013    | 824.7     | 18.02           | 18.07           | 17.97                | 18.00                |
|          | 384     | 836.52    | 18.03           | 18.05           | 18.07                | 18.17                |
|          | 777     | 848.31    | 17.97           | 17.97           | 17.90                | 17.93                |
| PCS      | 25      | 1851.25   | 17.87           | 17.94           | 18.07                | 18.17                |
|          | 600     | 1880      | 17.87           | 17.84           | 18.20                | 18.27                |
|          | 1175    | 1908.75   | 18.05           | 18.04           | 18.26                | 18.30                |

Per KDB Publication 941225 D01:

1. Body SAR was evaluated with EVDO Rev 0. SAR was not required for 1x RTT, because the maximum average output of each channel is less than 1/4 dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0. SAR for Subtype 2 Physical layer configurations was required for Rev. A because the maximum average output of each RF channel is not less than that measured in Subtype 0/1 Physical layer configurations. SAR is measured on the maximum output power channel for Rev. A using the exposure configuration (side) that results in the highest SAR for that RF channel in Rev. 0. Additional Rev. A testing is included for consistency
2. The bolded modes in the Table 9-1 and Table 9-2 were tested for SAR.



**Figure 9-1**  
**Power Measurement Setup**

**Table 9-3**  
**Power Reduction Summary due to the Proximity Sensor**

| Band     | Maximum Power Target [dBm] | Reduced Power Target [dBm] |
|----------|----------------------------|----------------------------|
| Cellular | 24.5                       | 18                         |
| PCS      | 24.5                       | 18                         |

|                                   |                                        |                              |         |                                 |
|-----------------------------------|----------------------------------------|------------------------------|---------|---------------------------------|
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## 9.2 LTE Conducted Powers

### 9.2.1 LTE Band 13

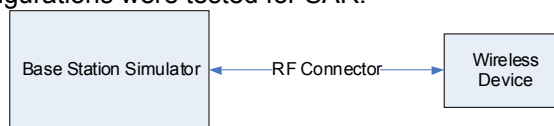
**Table 9-4**  
**LTE Band 13 Conducted Powers - 10 MHz Bandwidth**

| Frequency [MHz] | Channel | Bandwidth [MHz] | Modulation | RB Size | RB Offset | Conducted Power [dBm] | Target MPR [dB] | MPR Allowed per 3GPP [dB] |
|-----------------|---------|-----------------|------------|---------|-----------|-----------------------|-----------------|---------------------------|
| 782.0           | 23230   | 10              | QPSK       | 1       | 0         | <b>23.18</b>          | 0               | 0                         |
| 782.0           | 23230   | 10              | QPSK       | 1       | 49        | <b>23.49</b>          | 0               | 0                         |
| 782.0           | 23230   | 10              | QPSK       | 25      | 12        | <b>22.17</b>          | 1               | 0-1                       |
| 782.0           | 23230   | 10              | QPSK       | 50      | 0         | <b>22.17</b>          | 1               | 0-1                       |
| 782.0           | 23230   | 10              | 16QAM      | 1       | 0         | <b>22.50</b>          | 0               | 0-1                       |
| 782.0           | 23230   | 10              | 16QAM      | 1       | 49        | <b>22.91</b>          | 0               | 0-1                       |
| 782.0           | 23230   | 10              | 16QAM      | 25      | 12        | <b>21.30</b>          | 2               | 0-2                       |
| 782.0           | 23230   | 10              | 16QAM      | 50      | 0         | <b>21.20</b>          | 2               | 0-2                       |

### 9.2.2 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05:

- 1) Per Page 4, 3) A), QPSK with 50% RB is required for the highest bandwidth.
- 2) Per Page 4, 3) B), QPSK with 1 RB for both channel edges are required for the highest bandwidth.
- 3) Per Page 4, 4) A), 16QAM with 50% RB is required for the highest bandwidth.
- 4) Per Page 4, 4) B) and Page 5 footnote 9, 16QAM with 1RB for both channel edges are required for the highest bandwidth.
- 5) Per Page 4, 4), A) I) and Page 5, 4), A)I, 100% RB Allocation is not required to be tested when the SAR is not > 1.45 W/kg.
- 6) Bolded configurations were tested for SAR.



**Figure 9-2**  
**Power Measurement Setup**

## 9.3 WLAN Conducted Powers

**Table 9-5**  
**IEEE 802.11b Average RF Power**

| Freq [MHz] | Channel | Data Rate [Mbps] | Average Power (dBm) |
|------------|---------|------------------|---------------------|
| 2412       | 1       | 1                | 12.82               |
|            |         | 2                | 12.77               |
|            |         | 5.5              | 12.72               |
|            |         | 11               | 12.81               |
| 2437       | 6       | 1                | 12.41               |
|            |         | 2                | 12.3                |
|            |         | 5.5              | 12.36               |
|            |         | 11               | 12.15               |
| 2462       | 11      | 1                | <b>13.03</b>        |
|            |         | 2                | 13.06               |
|            |         | 5.5              | 13.21               |
|            |         | 11               | 13.27               |

|                                          |                                                                                                                                   |                                     |                                                                                       |                                        |
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| <b>Document S/N:</b><br>0Y1204090437.A3L | <b>Test Dates:</b><br>04/12/12 - 04/30/12                                                                                         | <b>DUT Type:</b><br>Portable Tablet |                                                                                       | Page 19 of 31                          |

**Table 9-6**  
**IEEE 802.11g Average RF Power**

| Freq [MHz] | Channel | Data Rate [Mbps] | Average Power (dBm) |
|------------|---------|------------------|---------------------|
| 2412       | 1       | 6                | 11.34               |
|            |         | 9                | 12.09               |
|            |         | 12               | 11.43               |
|            |         | 18               | 9.37                |
|            |         | 24               | 10.57               |
|            |         | 36               | 10.05               |
|            |         | 48               | 11.22               |
|            |         | 54               | 11.87               |
| 2437       | 6       | 6                | 11.54               |
|            |         | 9                | 12.02               |
|            |         | 12               | 11.29               |
|            |         | 18               | 9.89                |
|            |         | 24               | 10.67               |
|            |         | 36               | 10.12               |
|            |         | 48               | 10.93               |
|            |         | 54               | 12.32               |
| 2462       | 11      | 6                | 12.04               |
|            |         | 9                | 12.63               |
|            |         | 12               | 11.17               |
|            |         | 18               | 8.52                |
|            |         | 24               | 10.81               |
|            |         | 36               | 9.21                |
|            |         | 48               | 12.32               |
|            |         | 54               | 12.41               |

**Table 9-7**  
**IEEE 802.11n Average RF Power**

| Freq [MHz] | Channel | Data Rate [Mbps] | Average Power (dBm) |
|------------|---------|------------------|---------------------|
| 2412       | 1       | 6.5/ 7.2         | 10.88               |
|            |         | 13/ 14.40        | 10.78               |
|            |         | 19.5/ 21.70      | 8.94                |
|            |         | 26/ 28.90        | 9.89                |
|            |         | 29/ 43.3         | 10.09               |
|            |         | 52/ 57.80        | 10.16               |
|            |         | 58.50/ 65        | 10.59               |
|            |         | 65/ 72.2         | 10.28               |
| 2437       | 6       | 6.5/ 7.2         | 11.37               |
|            |         | 13/ 14.40        | 11.29               |
|            |         | 19.5/ 21.70      | 9.74                |
|            |         | 26/ 28.90        | 10.69               |
|            |         | 29/ 43.3         | 11.19               |
|            |         | 52/ 57.80        | 11.06               |
|            |         | 58.50/ 65        | 11.21               |
|            |         | 65/ 72.2         | 10.64               |
| 2462       | 11      | 6.5/ 7.2         | 11.23               |
|            |         | 13/ 14.40        | 11.16               |
|            |         | 19.5/ 21.70      | 9.51                |
|            |         | 26/ 28.90        | 10.36               |
|            |         | 29/ 43.3         | 10.36               |
|            |         | 52/ 57.80        | 10.71               |
|            |         | 58.50/ 65        | 11.24               |
|            |         | 65/ 72.2         | 10.58               |

Justification for reduced test configurations for WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes:

- For 2.4 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11b was selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
- When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the 1g averaged SAR is <0.8 W/kg, SAR testing on other channels is not required. Otherwise, the other default (or corresponding required) test channels were additionally tested using the lowest data rate.
- The bolded data rate and channel above were tested for SAR.



**Figure 9-3**  
**Power Measurement Setup**

|                                          |                                                                                                                                   |                                     |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSCHI705                       |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR EVALUATION REPORT</b>        |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1204090437.A3L | <b>Test Dates:</b><br>04/12/12 - 04/30/12                                                                                         | <b>DUT Type:</b><br>Portable Tablet |                                                                                       | Page 20 of 31                          |

## 10 SYSTEM VERIFICATION

### 10.1 Tissue Verification

**Table 10-1**  
**Measured Tissue Properties**

| Calibrated for Tests Performed on: | Tissue Type | Tissue Temp During Calibration (C°) | Measured Frequency (MHz) | Measured Conductivity, $\sigma$ (S/m) | Measured Dielectric Constant, $\epsilon$ | TARGET Conductivity, $\sigma$ (S/m) | TARGET Dielectric Constant, $\epsilon$ | % dev $\sigma$ | % dev $\epsilon$ |
|------------------------------------|-------------|-------------------------------------|--------------------------|---------------------------------------|------------------------------------------|-------------------------------------|----------------------------------------|----------------|------------------|
| 04/12/2012                         | 750B        | 23.3                                | 725                      | 0.959                                 | 54.76                                    | 0.96                                | 55.82                                  | -0.10%         | -1.89%           |
|                                    |             |                                     | 740                      | 0.970                                 | 54.60                                    | 0.96                                | 55.73                                  | 0.94%          | -2.03%           |
|                                    |             |                                     | 755                      | 0.984                                 | 54.46                                    | 0.96                                | 55.65                                  | 2.18%          | -2.14%           |
|                                    |             |                                     | 770                      | 0.998                                 | 54.25                                    | 0.96                                | 55.56                                  | 3.53%          | -2.36%           |
|                                    |             |                                     | 785                      | 1.012                                 | 54.07                                    | 0.97                                | 55.48                                  | 4.87%          | -2.54%           |
| 04/16/2012                         | 835B        | 22.7                                | 820                      | 0.988                                 | 53.07                                    | 0.97                                | 55.28                                  | 1.96%          | -4.00%           |
|                                    |             |                                     | 835                      | 1.004                                 | 52.92                                    | 0.97                                | 55.20                                  | 3.51%          | -4.13%           |
|                                    |             |                                     | 850                      | 1.020                                 | 52.75                                    | 0.99                                | 55.15                                  | 3.24%          | -4.36%           |
| 04/13/2012                         | 1900B       | 22.0                                | 1850                     | 1.511                                 | 50.84                                    | 1.52                                | 53.30                                  | -0.59%         | -4.62%           |
|                                    |             |                                     | 1880                     | 1.547                                 | 50.73                                    | 1.52                                | 53.30                                  | 1.78%          | -4.82%           |
|                                    |             |                                     | 1910                     | 1.580                                 | 50.65                                    | 1.52                                | 53.30                                  | 3.95%          | -4.97%           |
| 04/30/2012                         | 2450B       | 22.8                                | 2401                     | 1.937                                 | 51.01                                    | 1.90                                | 52.77                                  | 1.79%          | -3.33%           |
|                                    |             |                                     | 2450                     | 1.893                                 | 50.32                                    | 1.95                                | 52.70                                  | -2.92%         | -4.52%           |
|                                    |             |                                     | 2499                     | 2.072                                 | 50.33                                    | 2.02                                | 52.64                                  | 2.63%          | -4.38%           |

The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies (per IEEE 1528 6.6.1.2). The SAR test plots may slightly differ from the table above since the DASY software rounds to three significant digits.

### 10.2 Measurement Procedure for Tissue verification

- 1) The network analyzer and probe system was configured and calibrated.
- 2) The probe was immersed in the sample which was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
- 3) The complex admittance with respect to the probe aperture was measured
- 4) The complex relative permittivity  $\epsilon$  can be calculated from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\epsilon_r\epsilon_0}{[\ln(b/a)]^2} \int_a^b \int_a^b \int_0^\pi \cos\phi' \frac{\exp[-j\omega r(\mu_0\epsilon_r\epsilon_0)^{1/2}]}{r} d\phi' d\rho' d\rho$$

where  $Y$  is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively,  $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$ ,  $\omega$  is the angular frequency, and  $j = \sqrt{-1}$ .

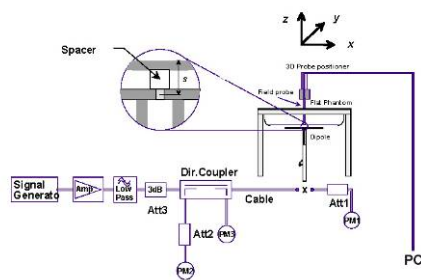
|                                          |                                                                                                                                   |                                     |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSCHI705                       |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR EVALUATION REPORT</b>        |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1204090437.A3L | <b>Test Dates:</b><br>04/12/12 - 04/30/12                                                                                         | <b>DUT Type:</b><br>Portable Tablet |                                                                                       | Page 21 of 31                          |

### 10.3 Test System Verification

Prior to assessment, the system is verified to  $\pm 10\%$  of the manufacturer SAR measurement on the reference dipole at the time of calibration.

**Table 10-2**  
**System Verification Results**

| System Verification<br>TARGET & MEASURED |             |            |                |                  |                 |           |          |                                   |                                     |                                         |               |
|------------------------------------------|-------------|------------|----------------|------------------|-----------------|-----------|----------|-----------------------------------|-------------------------------------|-----------------------------------------|---------------|
| Tissue Frequency (MHz)                   | Tissue Type | Date:      | Amb. Temp (°C) | Liquid Temp (°C) | Input Power (W) | Dipole SN | Probe SN | Measured SAR <sub>1g</sub> (W/kg) | 1 W Target SAR <sub>1g</sub> (W/kg) | 1 W Normalized SAR <sub>1g</sub> (W/kg) | Deviation (%) |
| 750                                      | Body        | 04/12/2012 | 22.8           | 21.9             | 0.100           | 1046      | 3263     | 0.904                             | 8.800                               | 9.040                                   | 2.73%         |
| 835                                      | Body        | 04/16/2012 | 23.4           | 22.0             | 0.100           | 4d026     | 3258     | 1.02                              | 9.660                               | 10.200                                  | 5.59%         |
| 1900                                     | Body        | 04/13/2012 | 23.5           | 22.3             | 0.040           | 5d141     | 3258     | 1.66                              | 41.400                              | 41.500                                  | 0.24%         |
| 2450                                     | Body        | 04/30/2012 | 23.1           | 21.3             | 0.100           | 719       | 3022     | 4.88                              | 51.300                              | 48.800                                  | -4.87%        |



**Figure 10-1**  
**System Verification Setup Diagram**



**Figure 10-2**  
**System Verification Setup Photo**

|                                   |                                    |                              |  |                                 |
|-----------------------------------|------------------------------------|------------------------------|--|---------------------------------|
| FCC ID: A3LSCHI705                |                                    | SAR EVALUATION REPORT        |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1204090437.A3L | Test Dates:<br>04/12/12 - 04/30/12 | DUT Type:<br>Portable Tablet |  | Page 22 of 31                   |

# 11 SAR DATA SUMMARY

## 11.1 Standalone Body SAR Data

Table 11-1  
CDMA Body SAR Results

| MEASUREMENT RESULTS                                                                               |      |            |             |                    |                       |                  |                                                 |                      |       |          |
|---------------------------------------------------------------------------------------------------|------|------------|-------------|--------------------|-----------------------|------------------|-------------------------------------------------|----------------------|-------|----------|
| FREQUENCY                                                                                         |      | Mode       | Service     | Target Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing                                         | Device Serial Number | Side  | SAR (1g) |
| MHz                                                                                               | Ch.  |            |             |                    |                       |                  |                                                 |                      |       | (W/kg)   |
| 836.52                                                                                            | 384  | Cell. CDMA | EVDO Rev. 0 | 18                 | 18.07                 | -0.08            | 0.0 cm                                          | 0870-0967            | back* | 0.524    |
| 836.52                                                                                            | 384  | Cell. CDMA | EVDO Rev. A | 18                 | 18.17                 | 0.05             | 0.0 cm                                          | 0870-0967            | back* | 0.521    |
| 836.52                                                                                            | 384  | Cell. CDMA | EVDO Rev. 0 | 24.5               | 24.40                 | 0.03             | 0.5 cm                                          | 0870-0965            | back  | 0.481    |
| 836.52                                                                                            | 384  | Cell. CDMA | EVDO Rev. 0 | 24.5               | 24.40                 | -0.05            | 0.0 cm                                          | 0870-0965            | top   | 0.535    |
| 848.31                                                                                            | 777  | Cell. CDMA | EVDO Rev. A | 24.5               | 24.48                 | 0.04             | 0.0 cm                                          | 0870-0965            | top   | 0.543    |
| 836.52                                                                                            | 384  | Cell. CDMA | EVDO Rev. 0 | 24.5               | 24.40                 | -0.01            | 0.0 cm                                          | 0870-0965            | left  | 0.242    |
| 1851.25                                                                                           | 25   | PCS CDMA   | EVDO Rev. 0 | 18                 | 18.07                 | -0.07            | 0.0 cm                                          | 0870-0967            | back* | 0.933    |
| 1880.00                                                                                           | 600  | PCS CDMA   | EVDO Rev. 0 | 18                 | 18.20                 | -0.15            | 0.0 cm                                          | 0870-0967            | back* | 0.854    |
| 1908.75                                                                                           | 1175 | PCS CDMA   | EVDO Rev. 0 | 18                 | 18.26                 | -0.09            | 0.0 cm                                          | 0870-0967            | back* | 0.795    |
| 1908.75                                                                                           | 1175 | PCS CDMA   | EVDO Rev. A | 18                 | 18.30                 | -0.06            | 0.0 cm                                          | 0870-0967            | back* | 0.939    |
| 1880.00                                                                                           | 600  | PCS CDMA   | EVDO Rev. 0 | 24.5               | 24.62                 | -0.05            | 0.5 cm                                          | 0870-0965            | back  | 0.468    |
| 1880.00                                                                                           | 600  | PCS CDMA   | EVDO Rev. 0 | 24.5               | 24.62                 | 0.10             | 0.0 cm                                          | 0870-0965            | top   | 0.284    |
| 1880.00                                                                                           | 600  | PCS CDMA   | EVDO Rev. 0 | 24.5               | 24.62                 | 0.02             | 0.0 cm                                          | 0870-0965            | left  | 0.748    |
| 1880.00                                                                                           | 600  | PCS CDMA   | EVDO Rev. A | 24.5               | 24.61                 | 0.01             | 0.0 cm                                          | 0870-0965            | left  | 0.756    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |      |            |             |                    |                       |                  | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |                      |       |          |

Asterisk (\*) denotes power reduction active

|                                   |                                                                                     |                              |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSCHI705                |  | SAR EVALUATION REPORT        |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1204090437.A3L | Test Dates:<br>04/12/12 - 04/30/12                                                  | DUT Type:<br>Portable Tablet |                                                                                       | Page 23 of 31                   |

**Table 11-2**  
**LTE Body SAR Results**

| MEASUREMENT RESULTS                                                                               |       |             |                 |                       |                  |          |                                                 |            |         |           |         |        |          |
|---------------------------------------------------------------------------------------------------|-------|-------------|-----------------|-----------------------|------------------|----------|-------------------------------------------------|------------|---------|-----------|---------|--------|----------|
| FREQUENCY                                                                                         |       | Mode        | Bandwidth [MHz] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Device Serial Number                            | Modulation | # of RB | RB Offset | Spacing | Side   | SAR (1g) |
| MHz                                                                                               | Ch.   |             |                 |                       |                  |          |                                                 |            |         |           |         |        | (W/kg)   |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 22.17                 | 0.03             | 1        | 0870-0962                                       | QPSK       | 25      | 12        | 0.0 cm  | back   | 0.807    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 23.18                 | 0.06             | 0        | 0870-0962                                       | QPSK       | 1       | 0         | 0.0 cm  | back   | 0.764    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 23.49                 | 0.06             | 0        | 0870-0962                                       | QPSK       | 1       | 49        | 0.0 cm  | back   | 0.839    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 21.30                 | 0.08             | 2        | 0870-0962                                       | 16 QAM     | 25      | 12        | 0.0 cm  | back   | 0.665    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 22.50                 | 0.08             | 0        | 0870-0962                                       | 16 QAM     | 1       | 0         | 0.0 cm  | back   | 0.641    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 22.91                 | 0.06             | 0        | 0870-0962                                       | 16 QAM     | 1       | 49        | 0.0 cm  | back   | 0.692    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 22.17                 | 0.09             | 1        | 0870-0962                                       | QPSK       | 25      | 12        | 0.0 cm  | bottom | 0.209    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 23.18                 | -0.03            | 0        | 0870-0962                                       | QPSK       | 1       | 0         | 0.0 cm  | bottom | 0.197    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 23.49                 | 0.01             | 0        | 0870-0962                                       | QPSK       | 1       | 49        | 0.0 cm  | bottom | 0.265    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 21.30                 | 0.03             | 2        | 0870-0962                                       | 16 QAM     | 25      | 12        | 0.0 cm  | bottom | 0.160    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 22.50                 | 0.06             | 0        | 0870-0962                                       | 16 QAM     | 1       | 0         | 0.0 cm  | bottom | 0.157    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 22.91                 | -0.01            | 0        | 0870-0962                                       | 16 QAM     | 1       | 49        | 0.0 cm  | bottom | 0.226    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 22.17                 | -0.08            | 1        | 0870-0962                                       | QPSK       | 25      | 12        | 0.0 cm  | right  | 0.508    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 23.18                 | 0.07             | 0        | 0870-0962                                       | QPSK       | 1       | 0         | 0.0 cm  | right  | 0.452    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 23.49                 | 0.12             | 0        | 0870-0962                                       | QPSK       | 1       | 49        | 0.0 cm  | right  | 0.512    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 21.30                 | 0.06             | 2        | 0870-0962                                       | 16 QAM     | 25      | 12        | 0.0 cm  | right  | 0.417    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 22.50                 | 0.09             | 0        | 0870-0962                                       | 16 QAM     | 1       | 0         | 0.0 cm  | right  | 0.381    |
| 782.00                                                                                            | 23230 | LTE Band 13 | 10              | 22.91                 | 0.06             | 0        | 0870-0962                                       | 16 QAM     | 1       | 49        | 0.0 cm  | right  | 0.431    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |       |             |                 |                       |                  |          | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |            |         |           |         |        |          |

**Table 11-3**  
**WLAN Body SAR Results**

| MEASUREMENT RESULTS                                                                               |     |              |         |                       |                  |         |                                                 |                  |       |          |
|---------------------------------------------------------------------------------------------------|-----|--------------|---------|-----------------------|------------------|---------|-------------------------------------------------|------------------|-------|----------|
| FREQUENCY                                                                                         |     | Mode         | Service | Conducted Power [dBm] | Power Drift [dB] | Spacing | Device Serial Number                            | Data Rate (Mbps) | Side  | SAR (1g) |
| MHz                                                                                               | Ch. |              |         |                       |                  |         |                                                 |                  |       | (W/kg)   |
| 2462                                                                                              | 11  | IEEE 802.11b | DSSS    | 13.03                 | -0.03            | 0.0 cm  | 0870-1023                                       | 1                | back  | 0.452    |
| 2462                                                                                              | 11  | IEEE 802.11b | DSSS    | 13.03                 | 0.12             | 0.0 cm  | 0870-1023                                       | 1                | top   | 0.549    |
| 2462                                                                                              | 11  | IEEE 802.11b | DSSS    | 13.03                 | -0.02            | 0.0 cm  | 0870-1023                                       | 1                | right | 0.277    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |     |              |         |                       |                  |         | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |                  |       |          |

## 11.2 SAR Test Notes

### General Notes:

1. The test data reported are the worst-case SAR value with the position of the device configured for SAR testing according to KDB 447498 Section 4.
2. Batteries are fully charged for all readings.
3. Tissue parameters and temperatures are listed on the SAR plots.

|                                   |                                                                                     |                              |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSCH1705                |  | SAR EVALUATION REPORT        |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1204090437.A3L | Test Dates:<br>04/12/12 - 04/30/12                                                  | DUT Type:<br>Portable Tablet | Page 24 of 31                                                                         |                                 |

4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances. See section 1.6 for more details regarding devices tested.
5. Liquid tissue depth was at least 15.0 cm. To confirm the proper SAR liquid depth, the z-axis plots from the system verifications were included since the system verifications were performed using the same liquid, probe and DAE as the SAR tests in the same time period.
6. The measured SAR when extrapolated to the maximum tune-up power tolerance levels remains compliant for all operating configurations.
7. Per KDB Publication 447498 4) b) i) the back side is required to be tested touching the flat phantom for large sized tablet devices.
8. This device is capable of multiple display orientations supporting both portrait and landscape positions. Therefore per KDB 447498 4) b) ii) (2), SAR testing applies for the tablet edges with antennas located within 5 cm of each tablet edge closest to the user. According to KDB 447498 4) b) ii) (2), for each antenna, SAR is required for the edge with the most conservative exposure condition.

CDMA Notes:

1. Per FCC KDB Publication 447498, if the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
2. CDMA Body SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0 according to KDB 941225 D01 procedures for data devices. Since the average output power of Subtype 2 for Rev. A is not less than the Rev. 0 power levels, then Rev. A SAR is required. **SAR is measured on the maximum output power channel for Rev. A using the exposure configuration (side) that results in the highest SAR for that RF channel in Rev. 0.** SAR is not required for 1x RTT for Ev-Do data devices when the maximum average output of each channel is less than 1/4 dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0 but was additionally tested for consistency.
3. Per April 2011 TCB-FCC Workshop Notes, in addition to the 0 mm test distance required for tablet devices under KDB 447498, a conservative additional test distance of 5 mm from the back was tested for SAR at maximum output power with the sensor deactivated. See Section 8.4 for more details.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Test Considerations for LTE handsets and Data Modems KDB 941225 D05 Publication. General test procedures can be found in Section 7.3.3.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1. The differences noted are not cases of implemented MPR but rather associated with measurement uncertainty and allowable tolerances per 3GPP standard and the manufacturer.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator.
4. There is no power reduction for LTE.

WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11b. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
2. WLAN transmission was verified using an uncalibrated spectrum analyzer.
3. Because the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the 1g averaged SAR is <0.8 W/kg, SAR testing on other channels is not required.
4. There is no power reduction for WIFI.

|                                          |                                                                                                                                   |                                     |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSCHI705                       |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR EVALUATION REPORT</b>        |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1204090437.A3L | <b>Test Dates:</b><br>04/12/12 - 04/30/12                                                                                         | <b>DUT Type:</b><br>Portable Tablet |                                                                                       | Page 25 of 31                          |

## 12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

Possible simultaneous transmissions for this device indicated in Table 1-1 were numerically summed using stand-alone SAR data and are shown in the following tables.

### 12.1 Body SAR Simultaneous Transmission Analysis

**Table 12-1**  
**Simultaneous Transmission Scenario (Body at 0 cm)**

| Simult Tx | Configuration | Cell. EVDO SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | Simult Tx | Configuration | PCS EVDO SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
|-----------|---------------|-----------------------|-------------------------|--------------|-----------|---------------|---------------------|-------------------------|--------------|
| Body SAR  | Back          | 0.524                 | 0.452                   | 0.976        | Body SAR  | Back          | 0.939               | 0.452                   | <b>1.391</b> |
|           | Top           | 0.543                 | 0.549                   | <b>1.092</b> |           | Top           | 0.284               | 0.549                   | 0.833        |
|           | Bottom        | -                     | -                       | 0.000        |           | Bottom        | -                   | -                       | 0.000        |
|           | Right         | -                     | 0.277                   | 0.277        |           | Right         | -                   | 0.277                   | 0.277        |
|           | Left          | 0.242                 | -                       | 0.242        |           | Left          | 0.756               | -                       | 0.756        |

| Simult Tx | Configuration | LTE Band 13 SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
|-----------|---------------|------------------------|-------------------------|--------------|
| Body SAR  | Back          | 0.839                  | 0.452                   | <b>1.291</b> |
|           | Top           | -                      | 0.549                   | 0.549        |
|           | Bottom        | 0.265                  | -                       | 0.265        |
|           | Right         | 0.512                  | 0.277                   | 0.789        |
|           | Left          | -                      | -                       | 0.000        |

**Table 12-2**  
**Simultaneous Transmission Scenario (Body at 0.5 cm)**

| Configuration | Mode       | EVDO SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
|---------------|------------|-----------------|-------------------------|--------------|
| Back Side     | Cell. CDMA | 0.481           | < 0.452                 | < 0.933      |
| Back Side     | PCS CDMA   | 0.468           | < 0.452                 | < 0.920      |

1. For SAR calculations at 0.5 cm, WLAN SAR values for 0.0 cm were used since the 0.0 cm test distance for WLAN was more conservative.
2. "<" denotes that the 0.0 cm WLAN SAR values were used for summation purposes.
3. "-" indicates configurations that were not required per KDB Publication 447498.

### 12.2 Simultaneous Transmission Conclusion

The above numerical summed SAR was below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit. No volumetric SAR summation is required per FCC KDB Publication 648474.

|                                   |                                                                                     |                              |                                                                                       |                                 |
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## 13

## EQUIPMENT LIST

| Manufacturer       | Model           | Description                                   | Cal Date   | Cal Interval | Cal Due    | Serial Number |
|--------------------|-----------------|-----------------------------------------------|------------|--------------|------------|---------------|
| Agilent            | 85070E          | Dielectric Probe Kit                          | 3/8/2012   | Annual       | 3/8/2013   | MY44300633    |
| Agilent            | 8594A           | (9kHz-2.9GHz) Spectrum Analyzer               | N/A        |              | N/A        | 3051A00187    |
| Agilent            | 8648D           | (9kHz-4GHz) Signal Generator                  | 10/10/2011 | Annual       | 10/10/2012 | 3613A00315    |
| Agilent            | 8753E           | (30kHz-6GHz) Network Analyzer                 | 4/4/2012   | Annual       | 4/4/2013   | JP38020182    |
| Agilent            | E5515C          | Wireless Communications Test Set              | 10/10/2011 | Annual       | 10/10/2012 | GB46110872    |
| Agilent            | E5515C          | Wireless Communications Test Set              | 10/20/2011 | Annual       | 10/20/2012 | GB46310798    |
| Agilent            | E5515C          | Wireless Communications Test Set              | 10/14/2011 | Annual       | 10/14/2012 | GB41450275    |
| Agilent            | E5515C          | Wireless Communications Test Set              | 2/14/2012  | Annual       | 2/14/2013  | GB43304447    |
| Agilent            | E5515C          | Wireless Communications Test Set              | 2/12/2012  | Annual       | 2/12/2013  | GB45360985    |
| Agilent            | E5515C          | Wireless Communications Test Set              | 2/14/2012  | Annual       | 2/14/2013  | GB43163447    |
| Agilent            | E5515C          | Wireless Communications Test Set              | 2/9/2012   | Annual       | 2/9/2013   | GB43460554    |
| Amplifier Research | 5S1G4           | 5W, 800MHz-4.2GHz                             | N/A        | CBT          | N/A        | 21910         |
| Anritsu            | MA2411B         | Pulse Sensor                                  | 10/13/2011 | Annual       | 10/13/2012 | 1027293       |
| Anritsu            | MA2481A         | Power Sensor                                  | 2/14/2012  | Annual       | 2/14/2013  | 5318          |
| Anritsu            | MA2481A         | Power Sensor                                  | 2/14/2012  | Annual       | 2/14/2013  | 5442          |
| Anritsu            | MA2481A         | Power Sensor                                  | 2/14/2012  | Annual       | 2/14/2013  | 5821          |
| Anritsu            | MA2481A         | Power Sensor                                  | 2/14/2012  | Annual       | 2/14/2013  | 8013          |
| Anritsu            | MA2481A         | Power Sensor                                  | 2/14/2012  | Annual       | 2/14/2013  | 2400          |
| Anritsu            | ML2438A         | Power Meter                                   | 2/14/2012  | Annual       | 2/14/2013  | 1190013       |
| Anritsu            | ML2438A         | Power Meter                                   | 2/14/2012  | Annual       | 2/14/2013  | 98150041      |
| Anritsu            | ML2438A         | Power Meter                                   | 10/13/2011 | Annual       | 10/13/2012 | 1070030       |
| Anritsu            | ML2495A         | Power Meter                                   | 10/13/2011 | Annual       | 10/13/2012 | 1039008       |
| Anritsu            | MT8820C         | Radio Communication Tester                    | 11/11/2011 | Annual       | 11/11/2012 | 6200901190    |
| COMTECH            | AR85729-5/5759B | Solid State Amplifier                         | N/A        | CBT          | N/A        | M3W1A00-1002  |
| Control Company    | 36934-158       | Wall-Mounted Thermometer                      | 1/4/2012   | Biennial     | 1/4/2014   | 122014497     |
| Control Company    | 36934-158       | Wall-Mounted Thermometer                      | 1/4/2012   | Biennial     | 1/4/2014   | 122014488     |
| Control Company    | 61220-416       | Long-Stem Thermometer                         | 2/15/2011  | Biennial     | 2/15/2013  | 111331332     |
| Control Company    | 61220-416       | Long-Stem Thermometer                         | 10/12/2011 | Biennial     | 10/12/2013 | 111860844     |
| Gigatronics        | 80701A          | (0.05-18GHz) Power Sensor                     | 10/12/2011 | Annual       | 10/12/2012 | 1833460       |
| Gigatronics        | 8651A           | Universal Power Meter                         | 10/12/2011 | Annual       | 10/12/2012 | 8650319       |
| Intelligent Weigh  | PD-3000         | Electronic Balance                            | 3/27/2012  | Annual       | 3/27/2013  | 11081534      |
| MCL                | BW-N6W5+        | 6dB Attenuator                                | N/A        | CBT          | N/A        | 1139          |
| Mini-Circuits      | SLP-2400+       | Low Pass Filter                               | N/A        | CBT          | N/A        | R8979500903   |
| Mini-Circuits      | BW-N20W5+       | DC to 18 GHz Precision Fixed 20 dB Attenuator | N/A        | CBT          | N/A        | N/A           |
| Mini-Circuits      | NLP-1200+       | Low Pass Filter DC to 1000 MHz                | N/A        | CBT          | N/A        | N/A           |
| Mini-Circuits      | NLP-2950+       | Low Pass Filter DC to 2700 MHz                | N/A        | CBT          | N/A        | N/A           |
| Narda              | 4014C-6         | 4 - 8 GHz SMA 6 dB Directional Coupler        | N/A        | CBT          | N/A        | N/A           |
| Narda              | 4772-3          | Attenuator (3dB)                              | N/A        | CBT          | N/A        | 9406          |
| Narda              | BW-53W2         | Attenuator (3dB)                              | N/A        | CBT          | N/A        | 120           |
| Pasternack         | PE2208-6        | Bidirectional Coupler                         | 6/3/2011   | Annual       | 6/3/2012   | N/A           |
| Pasternack         | PE2209-10       | Bidirectional Coupler                         | 6/3/2011   | Annual       | 6/3/2012   | N/A           |
| Rohde & Schwarz    | CMU200          | Base Station Simulator                        | 6/1/2011   | Annual       | 6/1/2012   | 833855/0010   |
| Rohde & Schwarz    | CMW500          | LTE Radio Communication Tester                | 8/25/2011  | Annual       | 8/25/2012  | 100976        |
| Rohde & Schwarz    | CMW500          | LTE Radio Communication Tester                | 10/7/2011  | Annual       | 10/7/2012  | 103962        |
| Rohde & Schwarz    | CMW500          | LTE Radio Communication Tester                | 8/5/2011   | Annual       | 8/5/2012   | 112347        |
| Rohde & Schwarz    | CMW500          | LTE Radio Communication Tester                | 11/30/2011 | Annual       | 11/30/2012 | 101699        |
| Rohde & Schwarz    | CMW500          | LTE Radio Communication Tester                | 3/5/2012   | Annual       | 3/5/2013   | 102060        |
| Rohde & Schwarz    | NRVD            | Dual Channel Power Meter                      | 4/8/2011   | Biennial     | 4/8/2013   | 101695        |
| Seekonk            | NC-100          | Torque Wrench (8" lb)                         | 11/29/2011 | Triennial    | 11/29/2014 | 21053         |
| Seekonk            | NC-100          | Torque Wrench (8" lb)                         | 3/5/2012   | Triennial    | 3/5/2015   | N/A           |
| Seekonk            | NC-100          | Torque Wrench (8" lb)                         | 3/5/2012   | Triennial    | 3/5/2015   | N/A           |
| SPEAG              | D1900V2         | 1900 MHz SAR Dipole                           | 7/11/2011  | Annual       | 7/11/2012  | 5d141         |
| SPEAG              | D2450V2         | 2450 MHz SAR Dipole                           | 8/19/2011  | Annual       | 8/19/2012  | 719           |
| SPEAG              | D750V3          | 750 MHz Dipole                                | 10/27/2011 | Annual       | 10/27/2012 | 1046          |
| SPEAG              | D835V2          | 835 MHz SAR Dipole                            | 8/15/2011  | Annual       | 8/15/2012  | 4d026         |
| SPEAG              | DAE4            | Dasy Data Acquisition Electronics             | 2/20/2012  | Annual       | 2/20/2013  | 649           |
| SPEAG              | DAE4            | Dasy Data Acquisition Electronics             | 5/19/2011  | Annual       | 5/19/2012  | 859           |
| SPEAG              | DAE4            | Dasy Data Acquisition Electronics             | 1/18/2012  | Annual       | 1/18/2013  | 1272          |
| Speag              | DAK-3.5         | Dielectric Assessment Kit                     | 12/1/2011  | Annual       | 12/1/2012  | 1031          |
| SPEAG              | ES3DV2          | SAR Probe                                     | 8/25/2011  | Annual       | 8/25/2012  | 3022          |
| SPEAG              | ES3DV3          | SAR Probe                                     | 2/21/2012  | Annual       | 2/21/2013  | 3258          |
| SPEAG              | ES3DV3          | SAR Probe                                     | 11/18/2011 | Annual       | 11/18/2012 | 3263          |
| VWR                | 36934-158       | Wall-Mounted Thermometer                      | 1/21/2011  | Biennial     | 1/21/2013  | 111286454     |
| VWR                | 36934-158       | Wall-Mounted Thermometer                      | 9/30/2011  | Biennial     | 9/30/2013  | 111859332     |

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, attenuator, coupler, amplifier, or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.

|                                   |                                                                                     |                              |                                                                                       |                                 |
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## 14 MEASUREMENT UNCERTAINTIES

| a                                                                             | b                    | c             | d              | e=<br>f(d,k) | f                     | g                        | h =<br>c x f/e                 | i =<br>c x g/e                   | k              |
|-------------------------------------------------------------------------------|----------------------|---------------|----------------|--------------|-----------------------|--------------------------|--------------------------------|----------------------------------|----------------|
| Uncertainty<br>Component                                                      | IEEE<br>1528<br>Sec. | Tol.<br>(± %) | Prob.<br>Dist. | Div.         | c <sub>f</sub><br>1gm | c <sub>g</sub><br>10 gms | 1gm<br>u <sub>f</sub><br>(± %) | 10gms<br>u <sub>g</sub><br>(± %) | v <sub>i</sub> |
| <b>Measurement System</b>                                                     |                      |               |                |              |                       |                          |                                |                                  |                |
| Probe Calibration                                                             | E.2.1                | 6.0           | N              | 1            | 1.0                   | 1.0                      | 6.0                            | 6.0                              | ∞              |
| Axial Isotropy                                                                | E.2.2                | 0.25          | N              | 1            | 0.7                   | 0.7                      | 0.2                            | 0.2                              | ∞              |
| Hemishperical Isotropy                                                        | E.2.2                | 1.3           | N              | 1            | 1.0                   | 1.0                      | 1.3                            | 1.3                              | ∞              |
| Boundary Effect                                                               | E.2.3                | 0.4           | N              | 1            | 1.0                   | 1.0                      | 0.4                            | 0.4                              | ∞              |
| Linearity                                                                     | E.2.4                | 0.3           | N              | 1            | 1.0                   | 1.0                      | 0.3                            | 0.3                              | ∞              |
| System Detection Limits                                                       | E.2.5                | 5.1           | N              | 1            | 1.0                   | 1.0                      | 5.1                            | 5.1                              | ∞              |
| Readout Electronics                                                           | E.2.6                | 1.0           | N              | 1            | 1.0                   | 1.0                      | 1.0                            | 1.0                              | ∞              |
| Response Time                                                                 | E.2.7                | 0.8           | R              | 1.73         | 1.0                   | 1.0                      | 0.5                            | 0.5                              | ∞              |
| Integration Time                                                              | E.2.8                | 2.6           | R              | 1.73         | 1.0                   | 1.0                      | 1.5                            | 1.5                              | ∞              |
| RF Ambient Conditions                                                         | E.6.1                | 3.0           | R              | 1.73         | 1.0                   | 1.0                      | 1.7                            | 1.7                              | ∞              |
| Probe Positioner Mechanical Tolerance                                         | E.6.2                | 0.4           | R              | 1.73         | 1.0                   | 1.0                      | 0.2                            | 0.2                              | ∞              |
| Probe Positioning w/ respect to Phantom                                       | E.6.3                | 2.9           | R              | 1.73         | 1.0                   | 1.0                      | 1.7                            | 1.7                              | ∞              |
| Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation | E.5                  | 1.0           | R              | 1.73         | 1.0                   | 1.0                      | 0.6                            | 0.6                              | ∞              |
| <b>Test Sample Related</b>                                                    |                      |               |                |              |                       |                          |                                |                                  |                |
| Test Sample Positioning                                                       | E.4.2                | 6.0           | N              | 1            | 1.0                   | 1.0                      | 6.0                            | 6.0                              | 287            |
| Device Holder Uncertainty                                                     | E.4.1                | 3.32          | R              | 1.73         | 1.0                   | 1.0                      | 1.9                            | 1.9                              | ∞              |
| Output Power Variation - SAR drift measurement                                | 6.6.2                | 5.0           | R              | 1.73         | 1.0                   | 1.0                      | 2.9                            | 2.9                              | ∞              |
| <b>Phantom &amp; Tissue Parameters</b>                                        |                      |               |                |              |                       |                          |                                |                                  |                |
| Phantom Uncertainty (Shape & Thickness tolerances)                            | E.3.1                | 4.0           | R              | 1.73         | 1.0                   | 1.0                      | 2.3                            | 2.3                              | ∞              |
| Liquid Conductivity - deviation from target values                            | E.3.2                | 5.0           | R              | 1.73         | 0.64                  | 0.43                     | 1.8                            | 1.2                              | ∞              |
| Liquid Conductivity - measurement uncertainty                                 | E.3.3                | 3.8           | N              | 1            | 0.64                  | 0.43                     | 2.4                            | 1.6                              | 6              |
| Liquid Permittivity - deviation from target values                            | E.3.2                | 5.0           | R              | 1.73         | 0.60                  | 0.49                     | 1.7                            | 1.4                              | ∞              |
| Liquid Permittivity - measurement uncertainty                                 | E.3.3                | 4.5           | N              | 1            | 0.60                  | 0.49                     | 2.7                            | 2.2                              | 6              |
| <b>Combined Standard Uncertainty (k=1)</b>                                    |                      |               |                |              |                       |                          | RSS                            | 12.1                             | 11.7           |
| <b>Expanded Uncertainty</b><br>(95% CONFIDENCE LEVEL)                         |                      |               |                |              |                       |                          | k=2                            | 24.2                             | 23.5           |

The above measurement uncertainties are according to IEEE Std. 1528-2003

|                                          |                                                                                                                                   |                                     |                                                                                       |                                        |
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## 15 CONCLUSION

### 15.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Industry Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

|                                   |                                                                                     |                              |                                                                                       |                                 |
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|                                          |                                                                                     |                                     |                                                                                       |                                        |
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## APPENDIX A: SAR TEST DATA

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-0962**

Communication System: LTE RF Band 13; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 770 Body Medium parameters used (interpolated):

$f = 782 \text{ MHz}$ ;  $\sigma = 1.009 \text{ mho/m}$ ;  $\epsilon_r = 54.106$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-12-2012; Ambient Temp: 22.8°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3263; ConvF(6.29, 6.29, 6.29); Calibrated: 11/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

**Mode: LTE Band 13, Body SAR, Back side, Mid.ch**  
**QPSK, 10 MHz BW, 1 RB, 49 RB Offset**

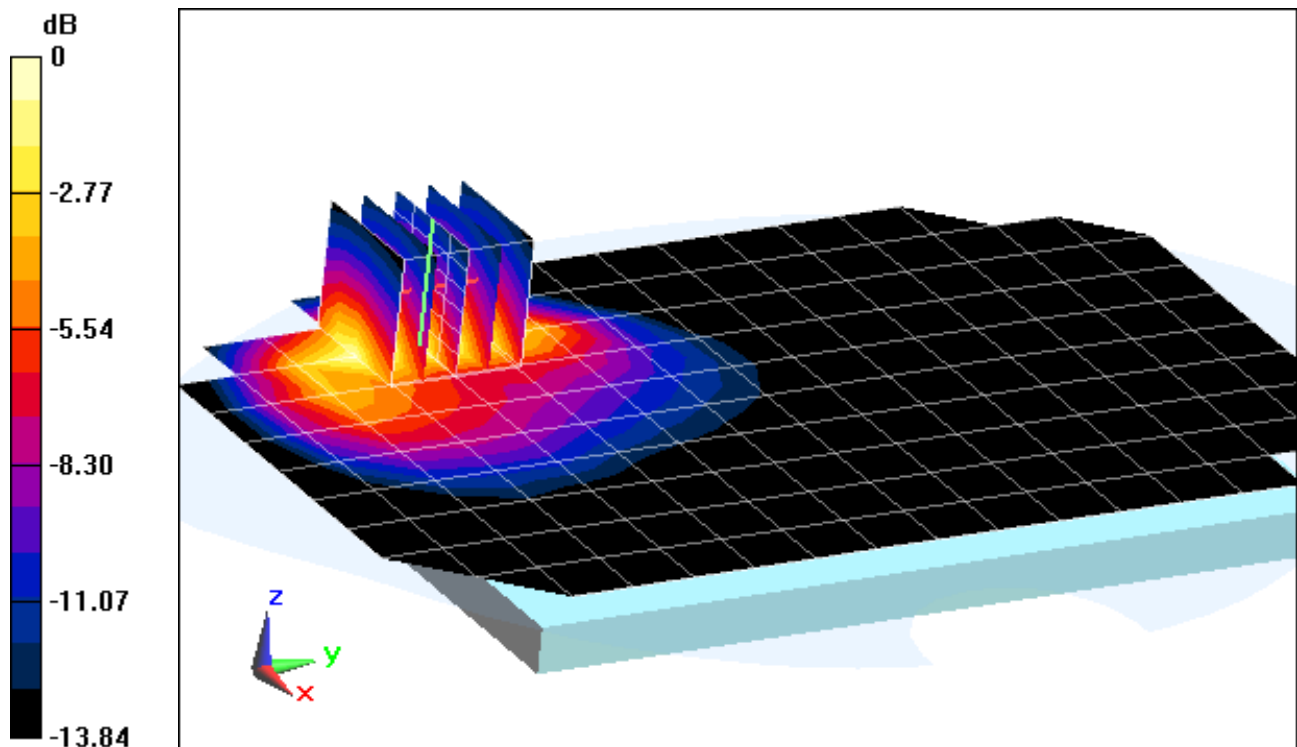
**Area Scan (11x17x1):** Measurement grid: dx=15mm, dy=15mm

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 30.754 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 1.5740 mW/g

**SAR(1 g) = 0.839 mW/g; SAR(10 g) = 0.440 mW/g**



0 dB = 0.930mW/g = -0.63 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-0962**

Communication System: LTE RF Band 13; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 770 Body Medium parameters used (interpolated):

$f = 782 \text{ MHz}$ ;  $\sigma = 1.009 \text{ mho/m}$ ;  $\epsilon_r = 54.106$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-12-2012; Ambient Temp: 22.8°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3263; ConvF(6.29, 6.29, 6.29); Calibrated: 11/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

**Mode: LTE Band 13, Body SAR, Bottom Edge, Mid.ch**  
**QPSK, 10 MHz BW, 1 RB, 49 RB Offset**

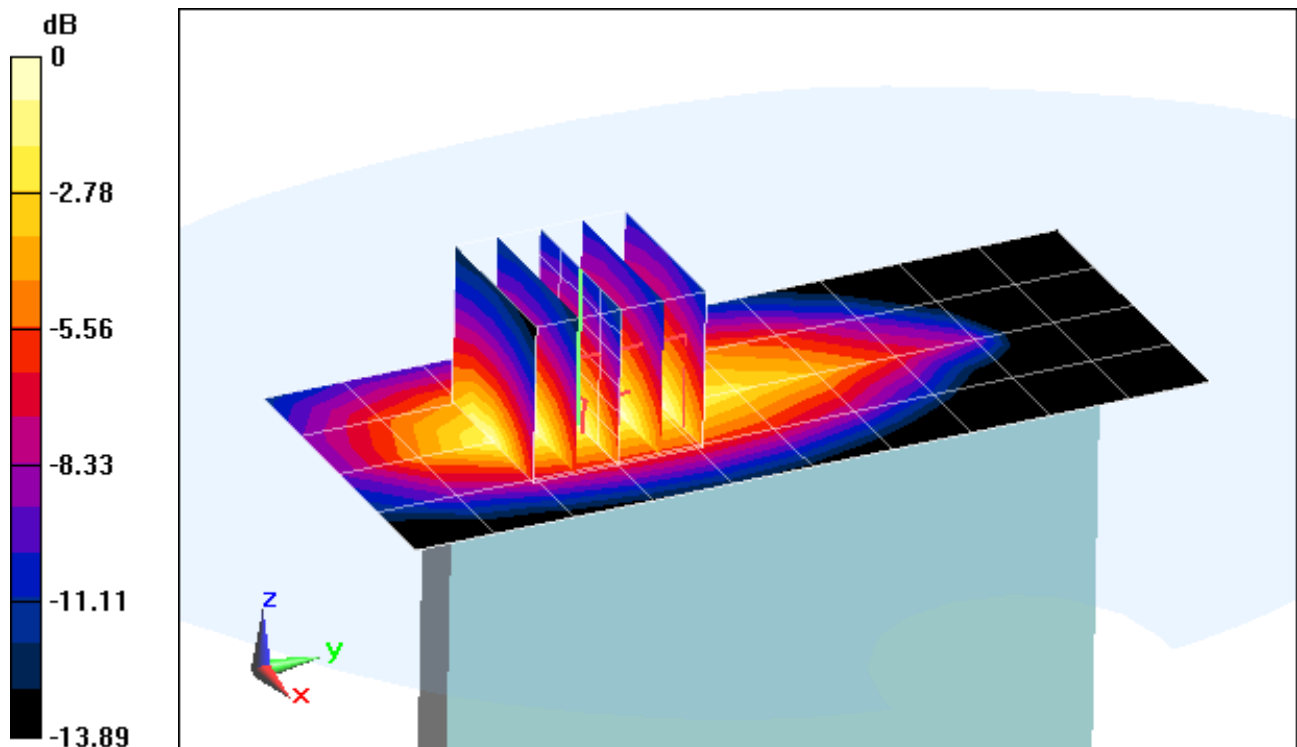
**Area Scan (5x11x1):** Measurement grid: dx=15mm, dy=15mm

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.268 V/m; Power Drift = 0.0093 dB

Peak SAR (extrapolated) = 0.4800 mW/g

**SAR(1 g) = 0.265 mW/g; SAR(10 g) = 0.157 mW/g**



0 dB = 0.290mW/g = -10.75 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-0962**

Communication System: LTE RF Band 13; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 770 Body Medium parameters used (interpolated):

$f = 782 \text{ MHz}$ ;  $\sigma = 1.009 \text{ mho/m}$ ;  $\epsilon_r = 54.106$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-12-2012; Ambient Temp: 22.8°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3263; ConvF(6.29, 6.29, 6.29); Calibrated: 11/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

**Mode: LTE Band 13, Body SAR, Right Edge, Mid.ch**  
**QPSK, 10 MHz BW, 1 RB, 49 RB Offset**

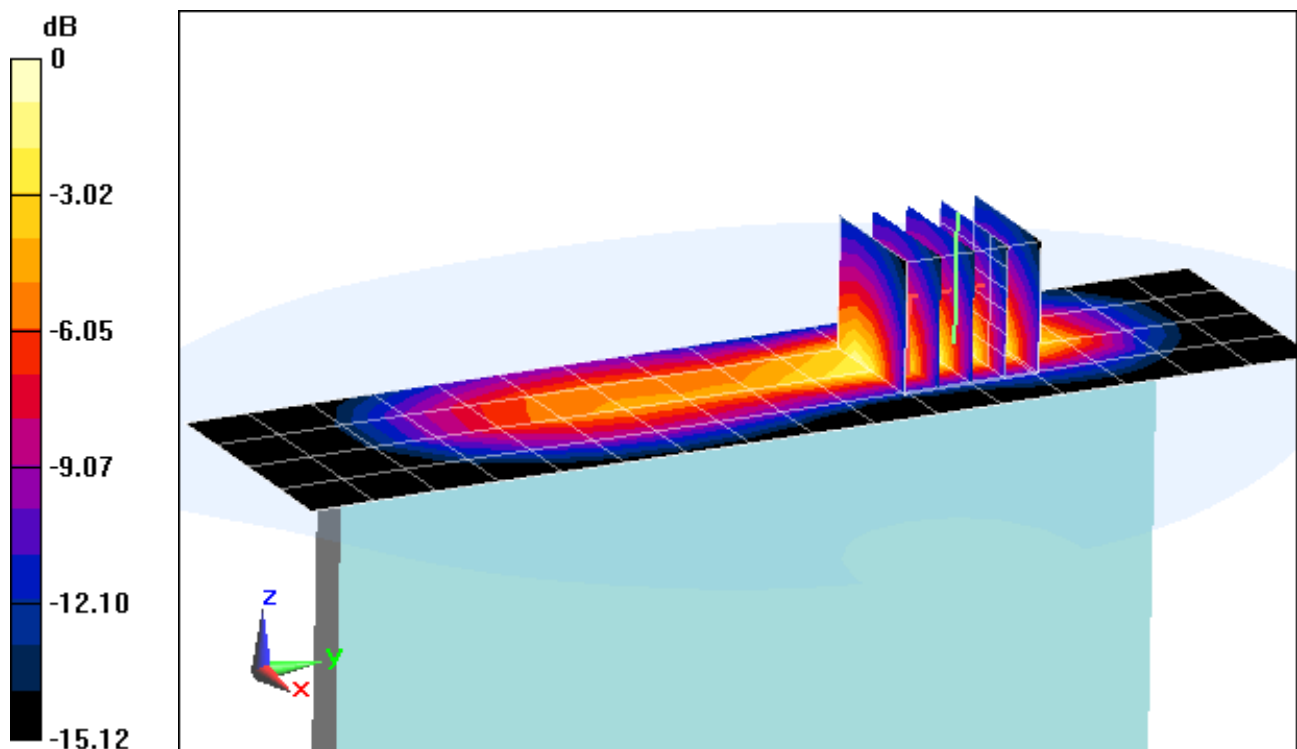
**Area Scan (5x17x1):** Measurement grid: dx=15mm, dy=15mm

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 20.952 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.9580 mW/g

**SAR(1 g) = 0.512 mW/g; SAR(10 g) = 0.269 mW/g**



0 dB = 0.550mW/g = -5.19 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-0967**

Communication System: Cellular CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 1.006 \text{ mho/m}$ ;  $\epsilon_r = 52.903$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-16-2012; Ambient Temp: 23.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3258; ConvF(6.06, 6.06, 6.06); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

**Mode: Cellular EVDO Rev.0, Body SAR, Back side, Mid.ch**

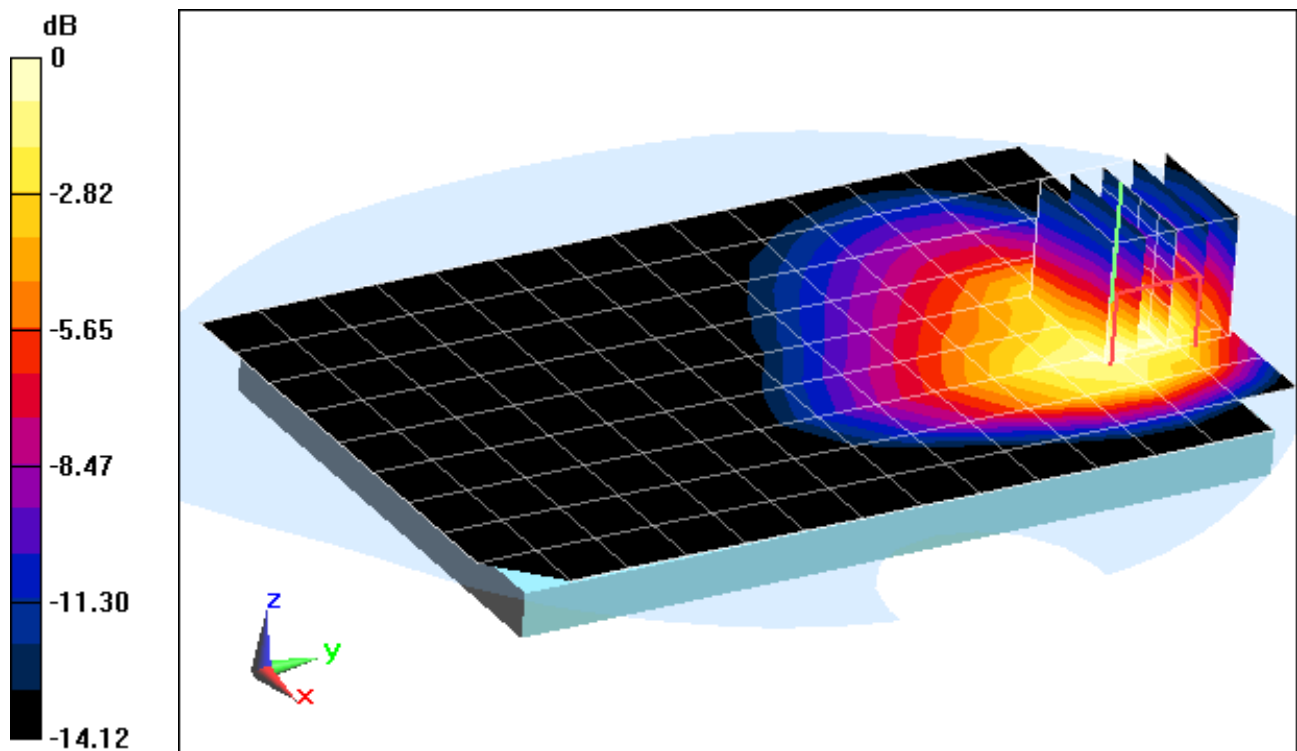
**Area Scan (10x15x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 25.508 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 1.1610 mW/g

**SAR(1 g) = 0.524 mW/g; SAR(10 g) = 0.289 mW/g**



0 dB = 0.560mW/g = -5.04 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-0965**

Communication System: Cellular CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 1.006 \text{ mho/m}$ ;  $\epsilon_r = 52.903$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.5 cm

Test Date: 04-16-2012; Ambient Temp: 23.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3258; ConvF(6.06, 6.06, 6.06); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

**Mode: Cellular EVDO Rev.0, Body SAR, Back side, Mid.ch**

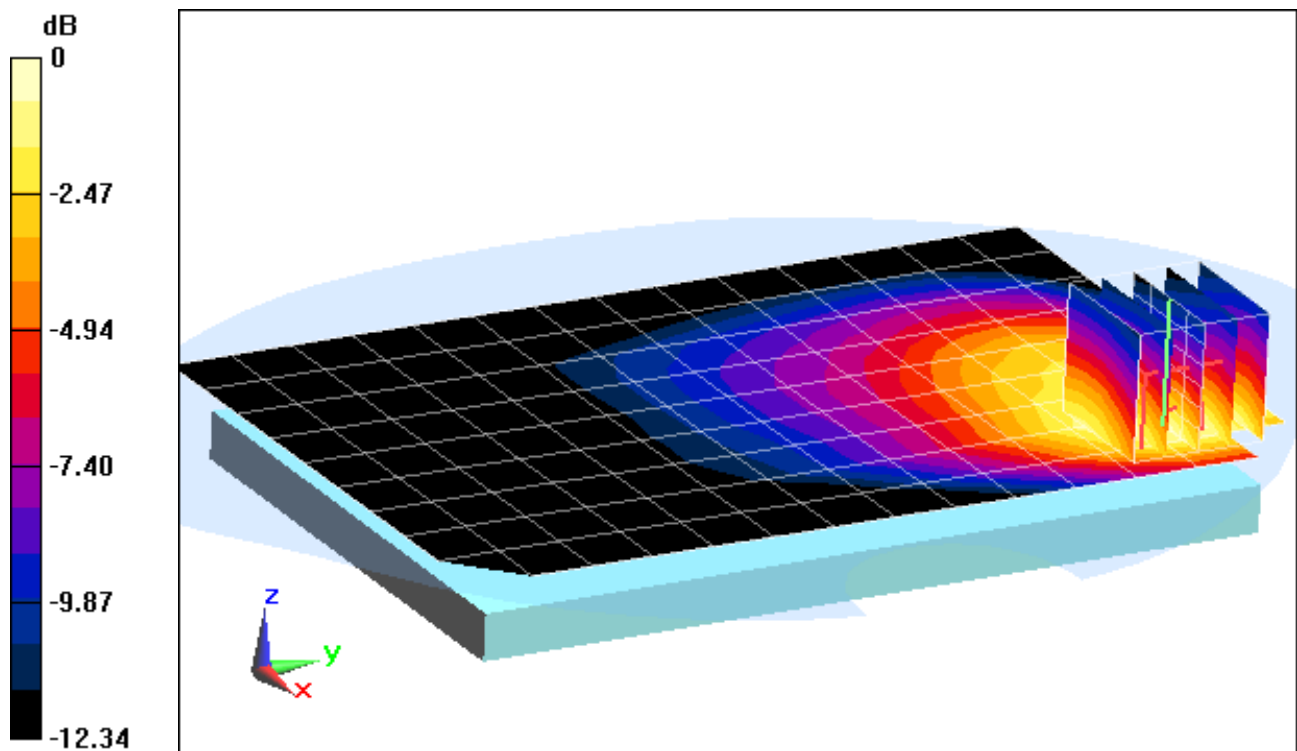
**Area Scan (10x15x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 23.402 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.7910 mW/g

**SAR(1 g) = 0.481 mW/g; SAR(10 g) = 0.296 mW/g**



0 dB = 0.530mW/g = -5.51 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-0965**

Communication System: Cellular CDMA; Frequency: 848.31 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 848.31 \text{ MHz}$ ;  $\sigma = 1.018 \text{ mho/m}$ ;  $\epsilon_r = 52.77$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-16-2012; Ambient Temp: 23.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3258; ConvF(6.06, 6.06, 6.06); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

**Mode: Cellular EVDO Rev.A, Body SAR, Top Edge, High ch**

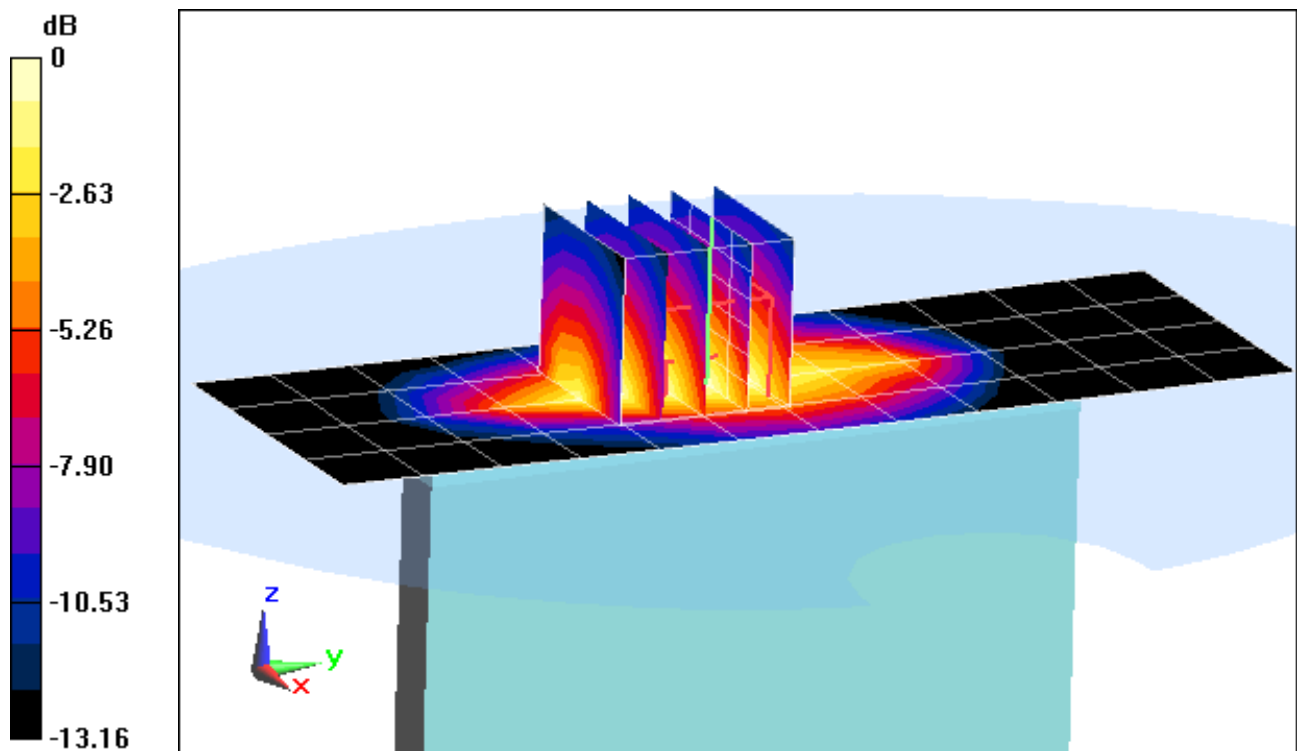
**Area Scan (5x13x1):** Measurement grid: dx=15mm, dy=15mm

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 26.147 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.8850 mW/g

**SAR(1 g) = 0.543 mW/g; SAR(10 g) = 0.321 mW/g**



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

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-0965**

Communication System: Cellular CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 1.006 \text{ mho/m}$ ;  $\epsilon_r = 52.903$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-16-2012; Ambient Temp: 23.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3258; ConvF(6.06, 6.06, 6.06); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

**Mode: Cellular EVDO Rev.0, Body SAR, Left Edge, Mid.ch**

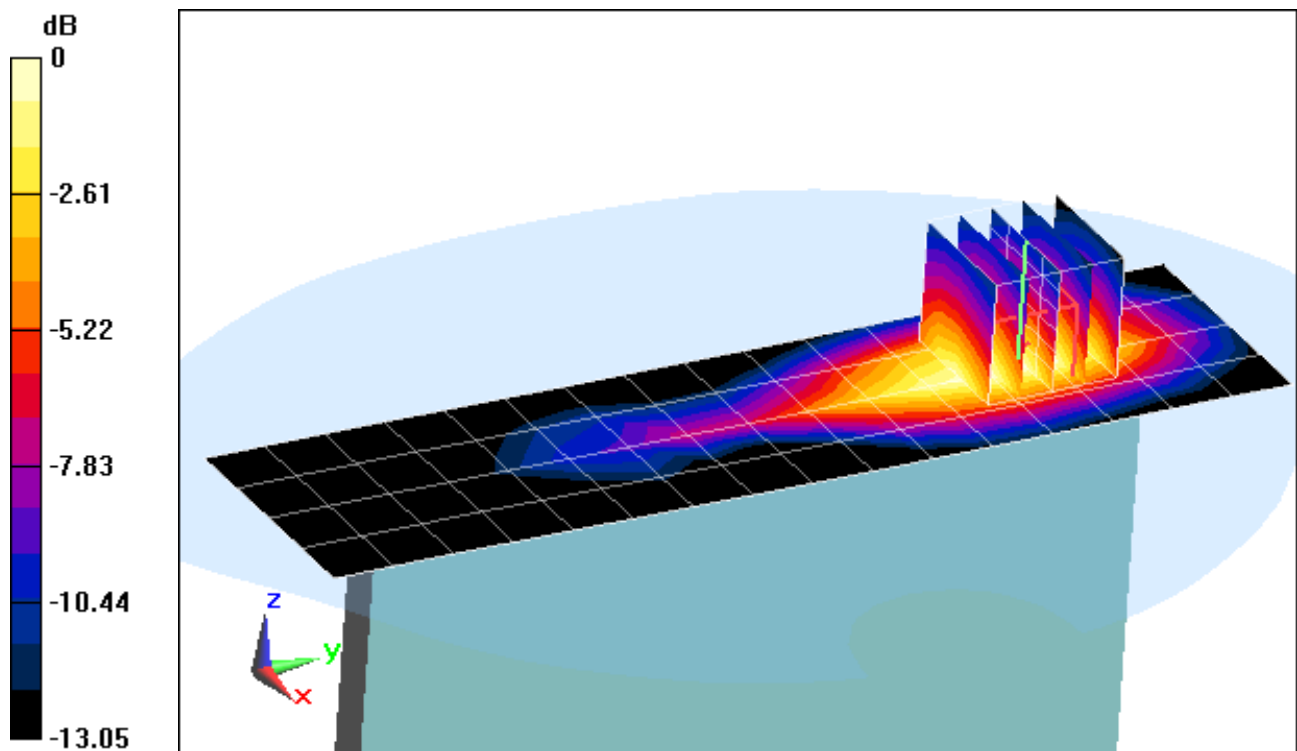
**Area Scan (5x17x1):** Measurement grid: dx=15mm, dy=15mm

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.846 V/m; Power Drift = -0.0097 dB

Peak SAR (extrapolated) = 0.3970 mW/g

**SAR(1 g) = 0.242 mW/g; SAR(10 g) = 0.145 mW/g**



0 dB = 0.270mW/g = -11.37 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-0967**

Communication System: PCS CDMA; Frequency: 1908.75 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1908.75 \text{ MHz}$ ;  $\sigma = 1.579 \text{ mho/m}$ ;  $\epsilon_r = 50.65$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-13-2012; Ambient Temp: 23.5°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3258; ConvF(4.7, 4.7, 4.7); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

**Mode: PCS EVDO Rev.A, Body SAR, Back side, High.ch**

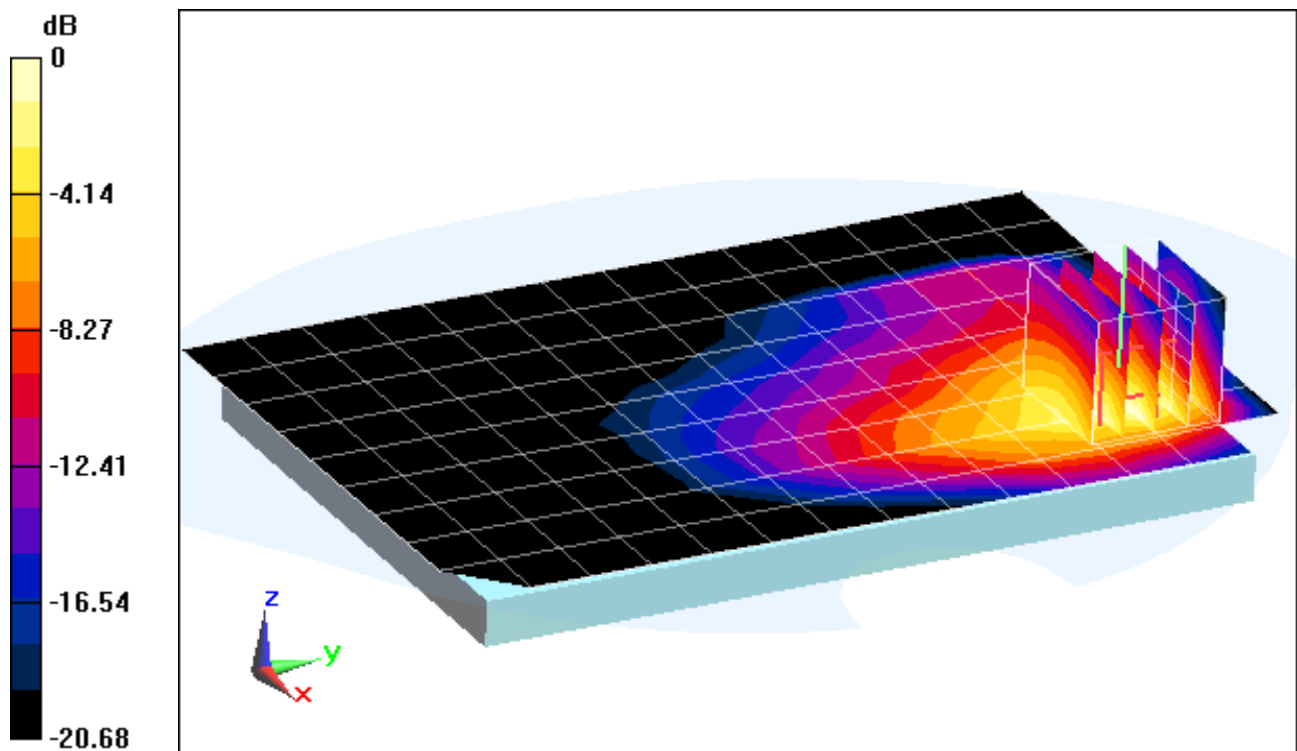
**Area Scan (10x15x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 31.058 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 1.8300 mW/g

**SAR(1 g) = 0.939 mW/g; SAR(10 g) = 0.525 mW/g**



0 dB = 1.040mW/g = 0.34 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-0965**

Communication System: PCS CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.547 \text{ mho/m}$ ;  $\epsilon_r = 50.73$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.5 cm

Test Date: 04-13-2012; Ambient Temp: 23.5°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3258; ConvF(4.7, 4.7, 4.7); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

**Mode: PCS EVDO Rev.0, Body SAR, Back side, Mid.ch**

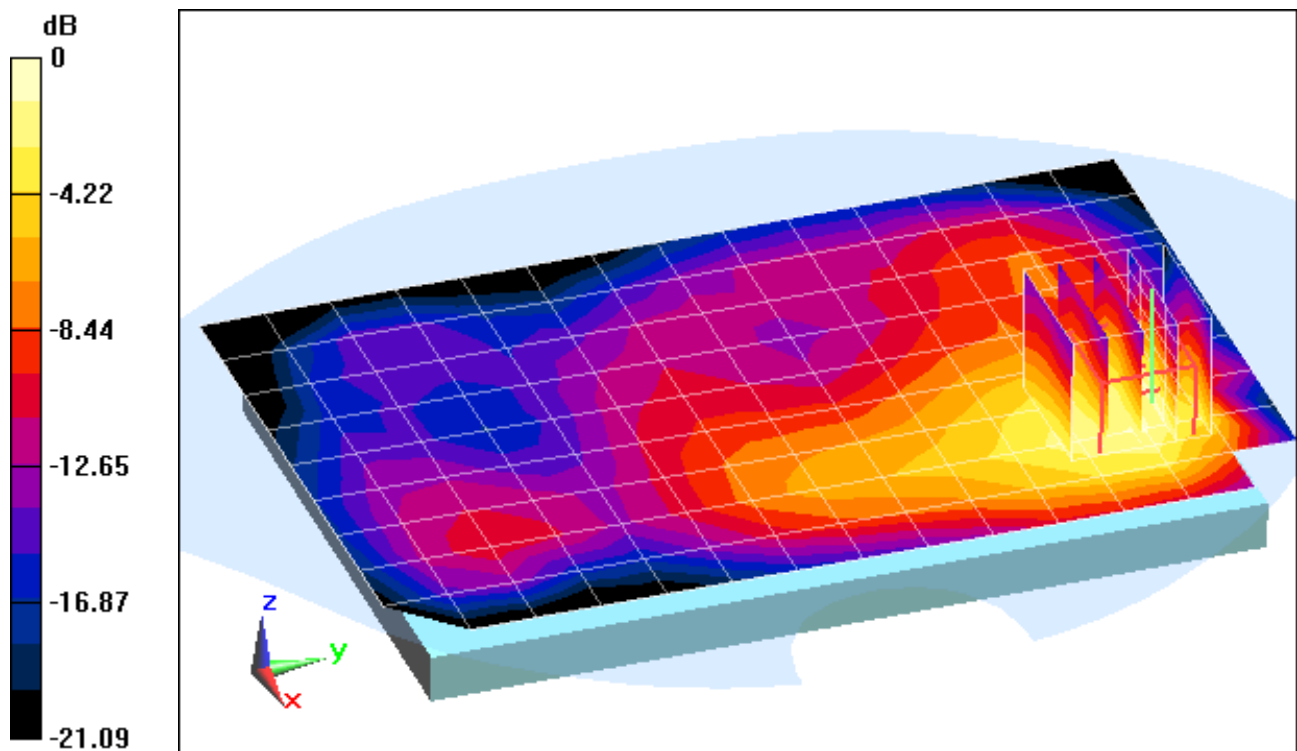
**Area Scan (10x15x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 17.936 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.8200 mW/g

**SAR(1 g) = 0.468 mW/g; SAR(10 g) = 0.270 mW/g**



0 dB = 0.560mW/g = -5.04 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-0965**

Communication System: PCS CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.547 \text{ mho/m}$ ;  $\epsilon_r = 50.73$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-13-2012; Ambient Temp: 23.5°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3258; ConvF(4.7, 4.7, 4.7); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

**Mode: PCS EVDO Rev.0, Body SAR, Top Edge, Mid.ch**

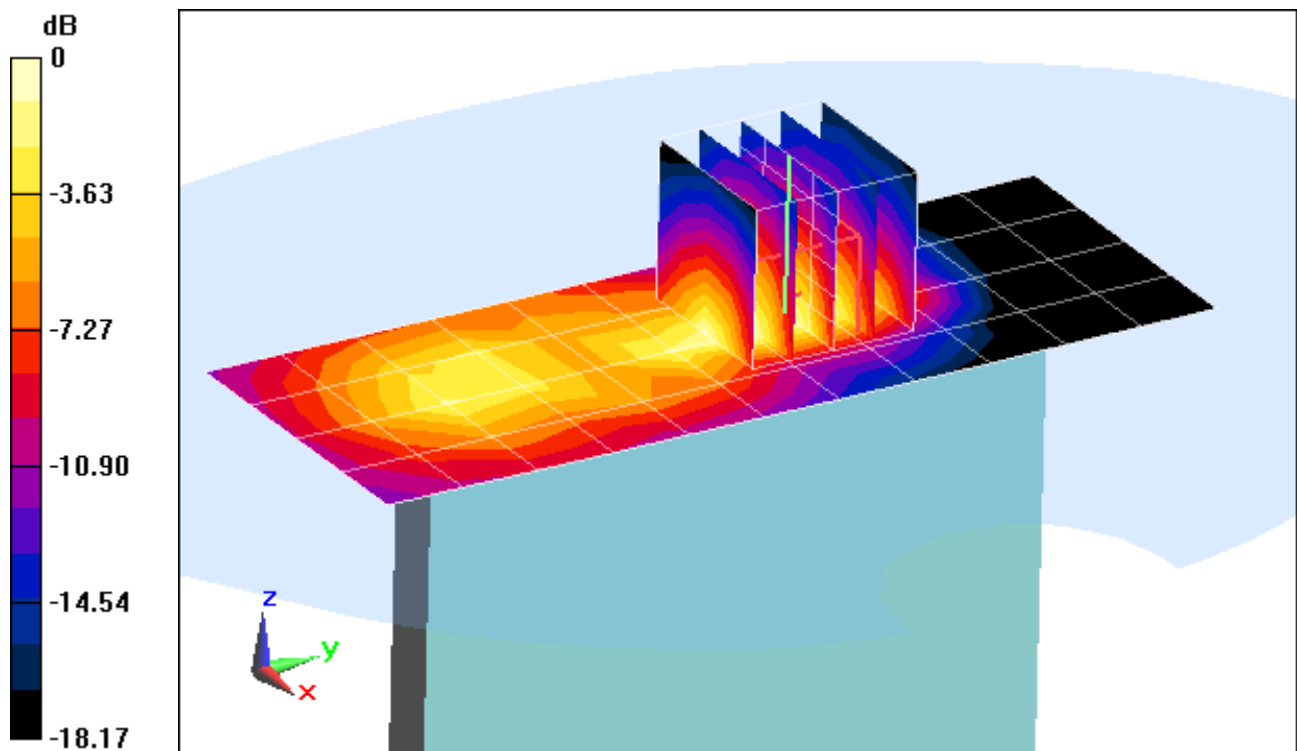
**Area Scan (5x12x1):** Measurement grid: dx=15mm, dy=15mm

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 15.766 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 0.5180 mW/g

**SAR(1 g) = 0.284 mW/g; SAR(10 g) = 0.142 mW/g**



0 dB = 0.330mW/g = -9.63 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-0965**

Communication System: PCS CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.547 \text{ mho/m}$ ;  $\epsilon_r = 50.73$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-13-2012; Ambient Temp: 23.5°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3258; ConvF(4.7, 4.7, 4.7); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

**Mode: PCS EVDO Rev.A, Body SAR, Left Edge, Mid.ch**

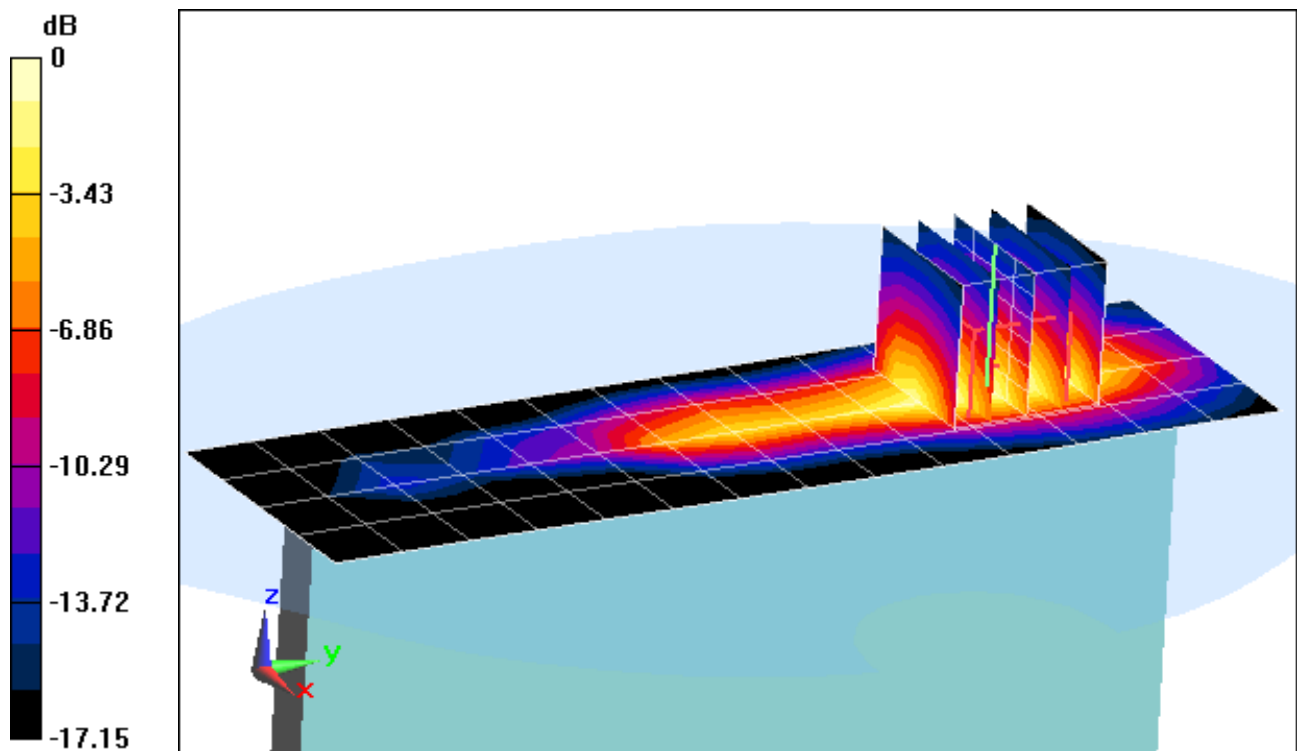
**Area Scan (5x15x1):** Measurement grid: dx=15mm, dy=15mm

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 26.850 V/m; Power Drift = 0.0135 dB

Peak SAR (extrapolated) = 1.4360 mW/g

**SAR(1 g) = 0.756 mW/g; SAR(10 g) = 0.384 mW/g**



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

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-1023**

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

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 1.937 \text{ mho/m}$ ;  $\epsilon_r = 50.322$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-30-2012; Ambient Temp: 23.1°C; Tissue Temp: 21.3°C

Probe: ES3DV2 - SN3022; ConvF(4.01, 4.01, 4.01); Calibrated: 8/25/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/19/2011

Phantom: SAM with CRP; Type: SAM; Serial: TP1375

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.4 (4989)

**Mode: IEEE 802.11b, Body SAR, Ch 11, 1 Mbps, Back Side**

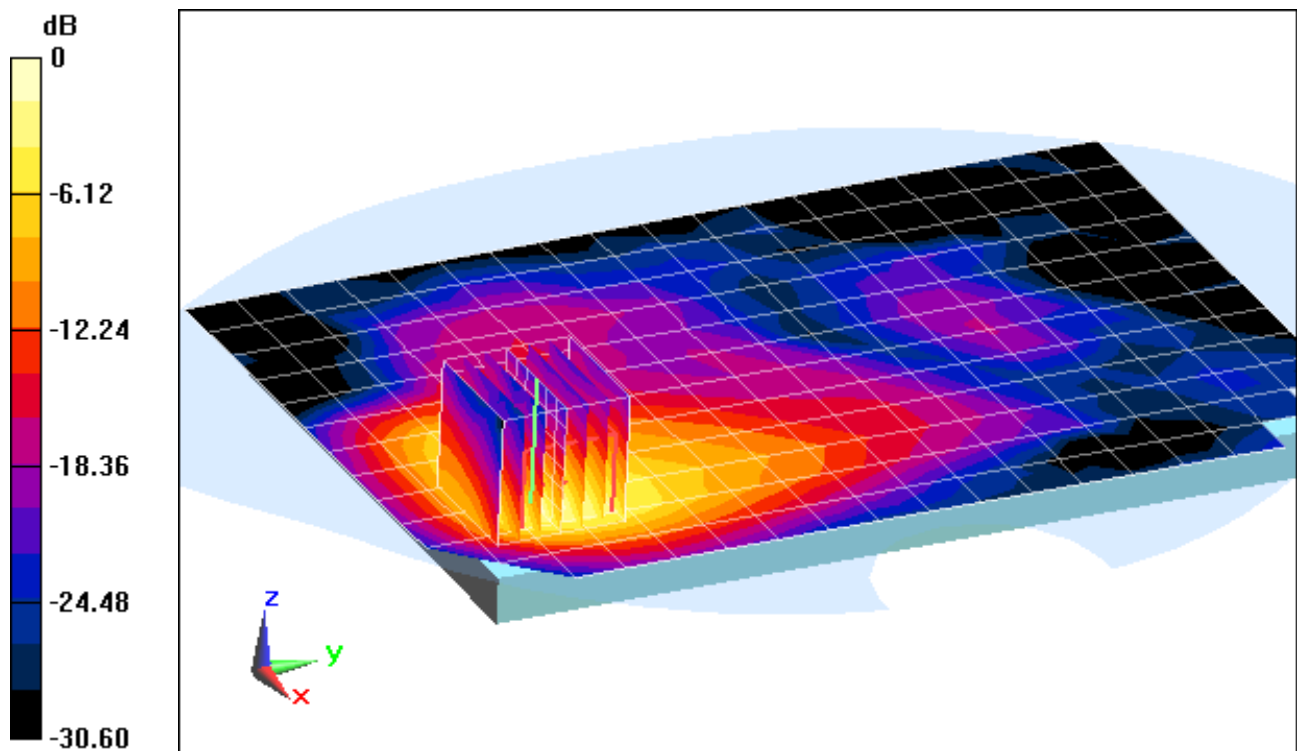
**Area Scan (13x19x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Reference Value = 15.281 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.2730 mW/g

**SAR(1 g) = 0.452 mW/g; SAR(10 g) = 0.192 mW/g**



0 dB = 0.620mW/g = -4.15 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-1023**

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

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 1.937 \text{ mho/m}$ ;  $\epsilon_r = 50.322$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-30-2012; Ambient Temp: 23.1°C; Tissue Temp: 21.3°C

Probe: ES3DV2 - SN3022; ConvF(4.01, 4.01, 4.01); Calibrated: 8/25/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/19/2011

Phantom: SAM with CRP; Type: SAM; Serial: TP1375

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.4 (4989)

**Mode: IEEE 802.11b, Body SAR, Ch 11, 1 Mbps, Top Edge**

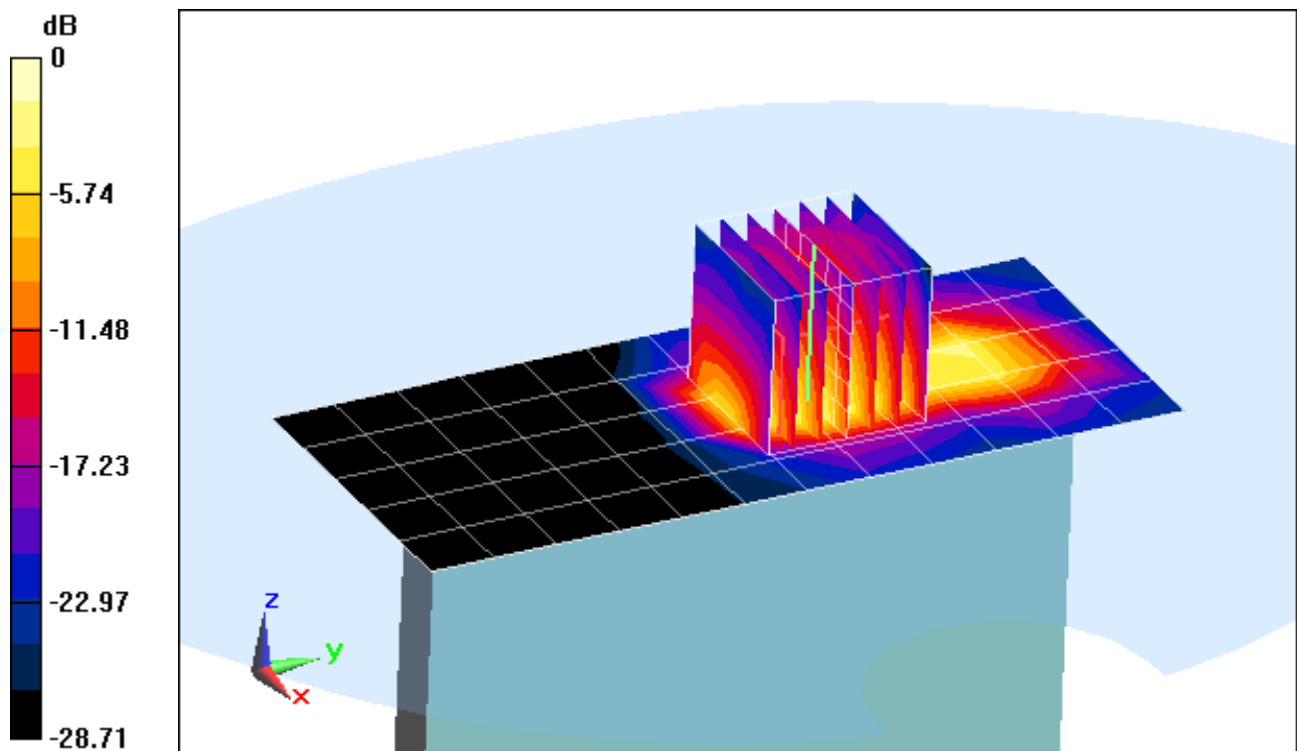
**Area Scan (6x13x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Reference Value = 15.064 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 1.1640 mW/g

**SAR(1 g) = 0.549 mW/g; SAR(10 g) = 0.225 mW/g**



0 dB = 0.730mW/g = -2.73 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSCHI705; Type: Portable Tablet; Serial: 0870-1023**

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

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 1.937 \text{ mho/m}$ ;  $\epsilon_r = 50.322$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-30-2012; Ambient Temp: 23.1°C; Tissue Temp: 21.3°C

Probe: ES3DV2 - SN3022; ConvF(4.01, 4.01, 4.01); Calibrated: 8/25/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/19/2011

Phantom: SAM with CRP; Type: SAM; Serial: TP1375

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.4 (4989)

**Mode: IEEE 802.11b, Body SAR, Ch 11, 1 Mbps, Right Edge**

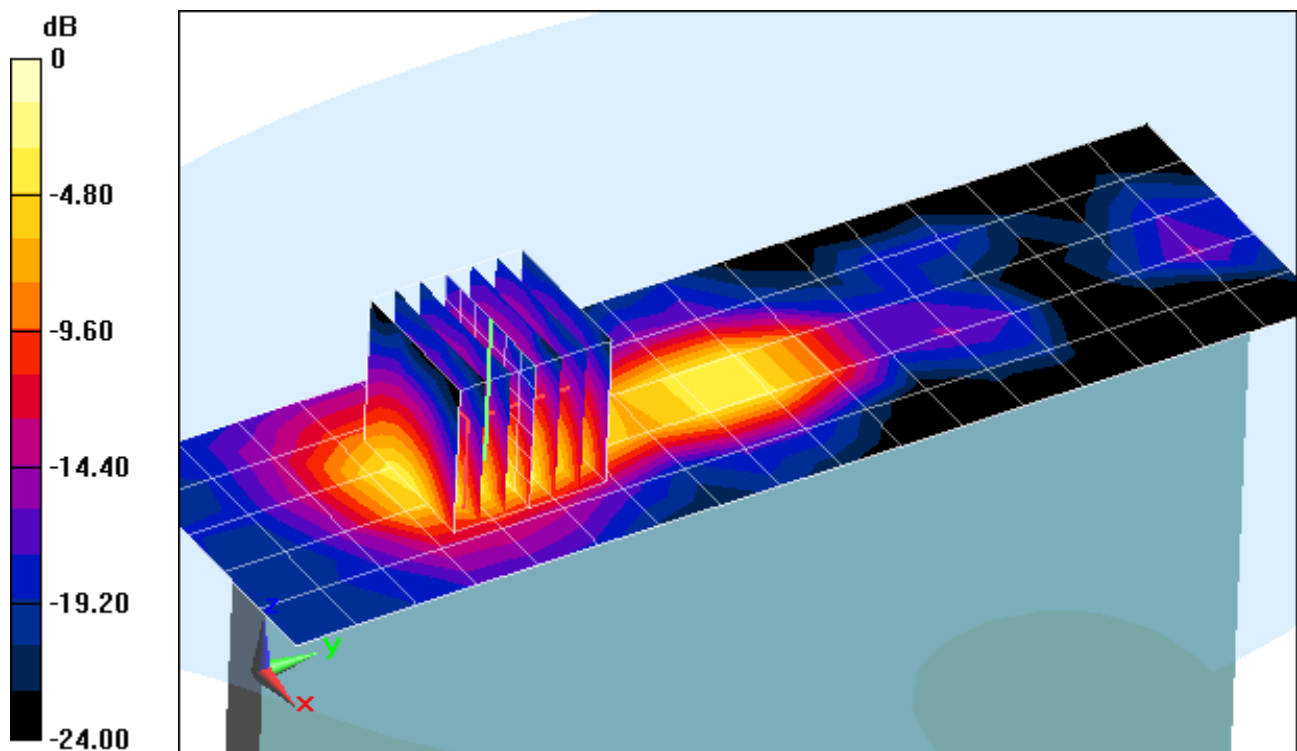
**Area Scan (6x18x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Reference Value = 11.159 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.6470 mW/g

**SAR(1 g) = 0.277 mW/g; SAR(10 g) = 0.120 mW/g**



0 dB = 0.380mW/g = -8.40 dB mW/g

## APPENDIX B: SYSTEM VERIFICATION

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 750 MHz; Type: D750V3; Serial: 1046**

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: 740 Body Medium parameters used (interpolated):

$f = 750 \text{ MHz}$ ;  $\sigma = 0.979 \text{ mho/m}$ ;  $\epsilon_r = 54.507$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 04-12-2012; Ambient Temp: 22.8°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3263; ConvF(6.29, 6.29, 6.29); Calibrated: 11/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

## 750 MHz System Verification

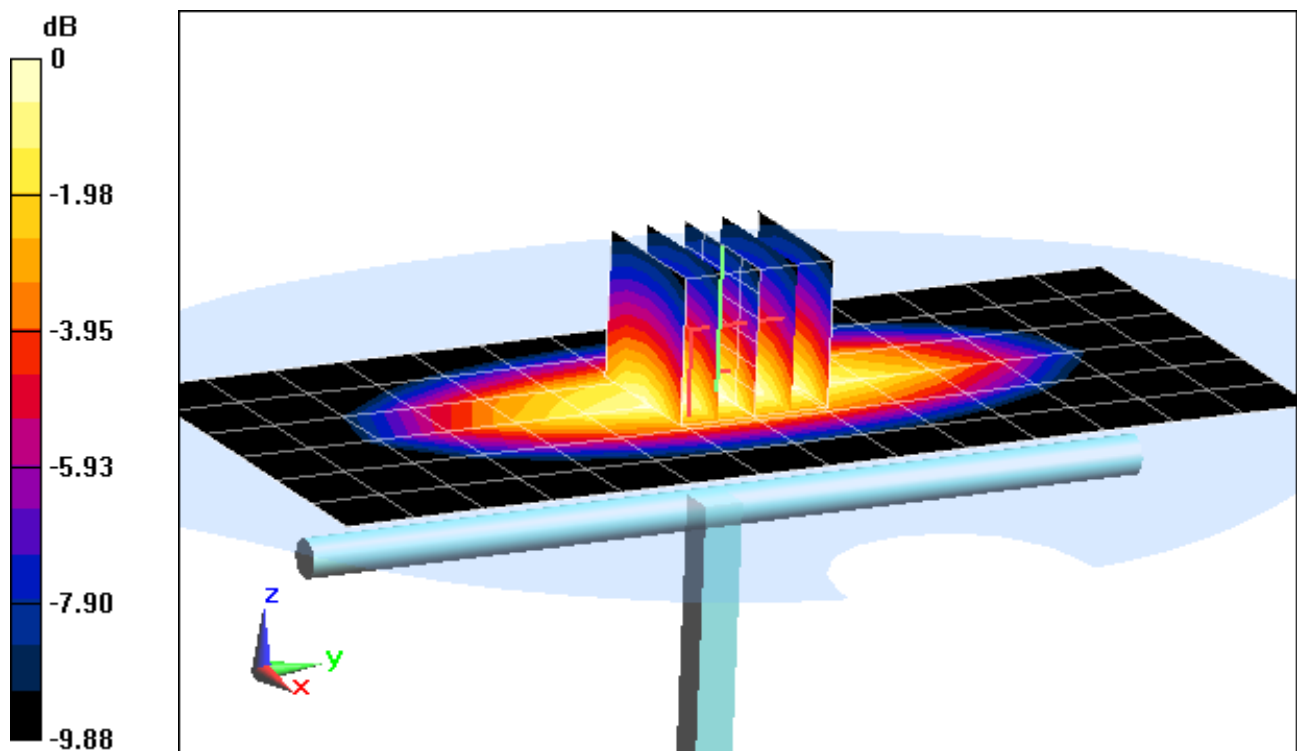
**Area Scan (7x15x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

**SAR(1 g) = 0.904 mW/g; SAR(10 g) = 0.602 mW/g**

Deviation = 2.73%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 750 MHz; Type: D750V3; Serial: 1046**

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: 740 Body Medium parameters used (interpolated):

$f = 750 \text{ MHz}$ ;  $\sigma = 0.979 \text{ mho/m}$ ;  $\epsilon_r = 54.507$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 04-12-2012; Ambient Temp: 22.8°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3263; ConvF(6.29, 6.29, 6.29); Calibrated: 11/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

## 750 MHz System Verification

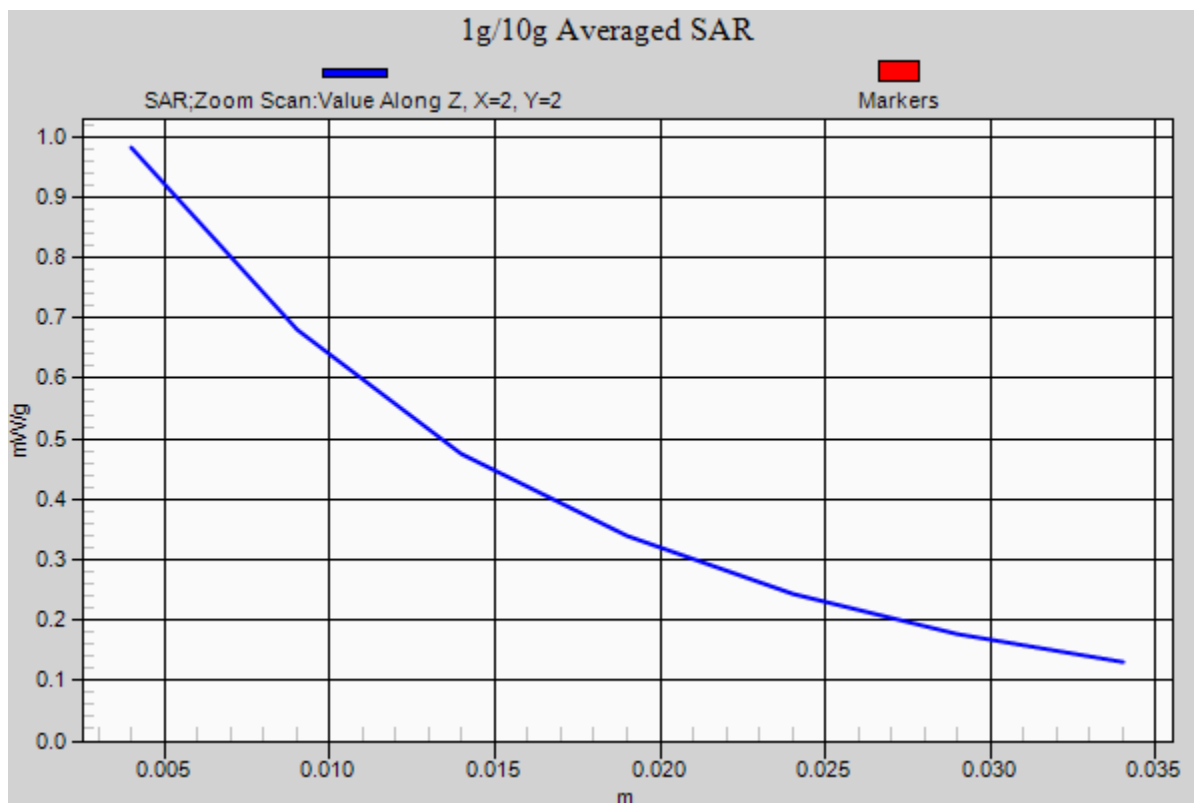
**Area Scan (7x15x1):** Measurement grid: dx=15mm, dy=15mm

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20 dBm (100 mW)

**SAR(1 g) = 0.904 mW/g; SAR(10 g) = 0.602 mW/g**

Deviation = 2.73%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: 835MHz SAR Validation Dipole; Type: D835V2; Serial: 4d026**

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 1 \text{ mho/m}$ ;  $\epsilon_r = 52.9$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 04-16-2012; Ambient Temp: 23.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3258; ConvF(6.06, 6.06, 6.06); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

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

## 835MHz System Verification

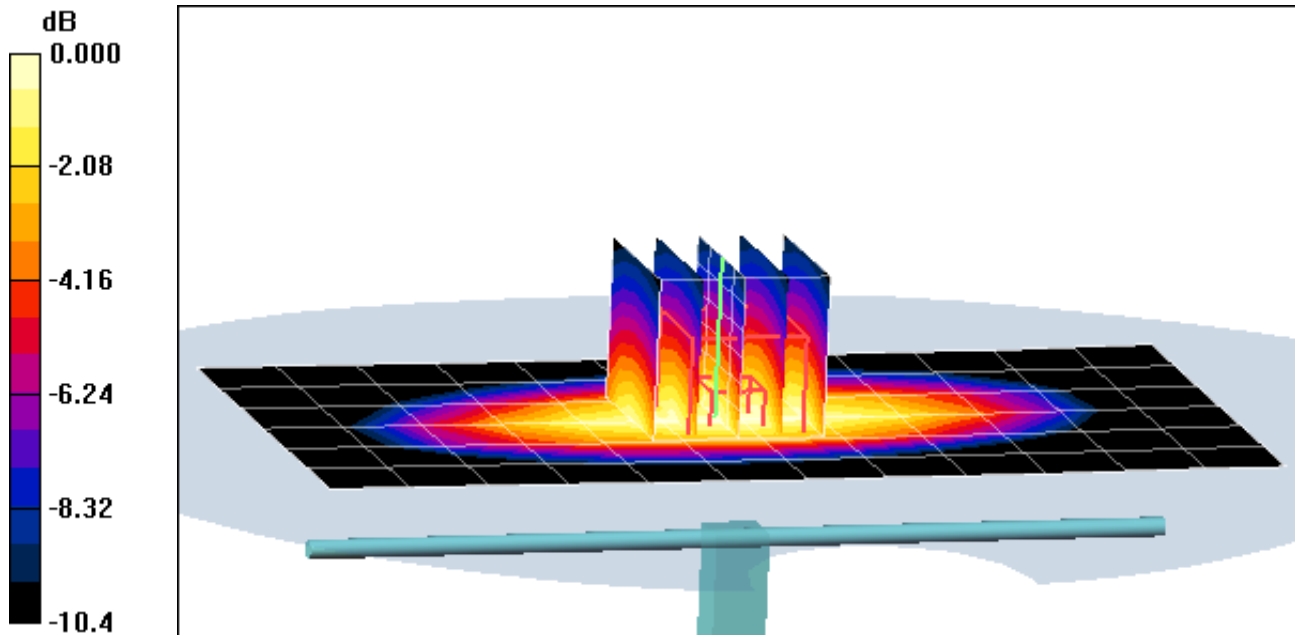
**Area Scan (7x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.672 mW/g**

Deviation = 5.59 %



0 dB = 1.10mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: 835MHz SAR Validation Dipole; Type: D835V2; Serial: 4d026**

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 1 \text{ mho/m}$ ;  $\epsilon_r = 52.9$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 04-16-2012; Ambient Temp: 23.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3258; ConvF(6.06, 6.06, 6.06); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

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

## 835MHz System Verification

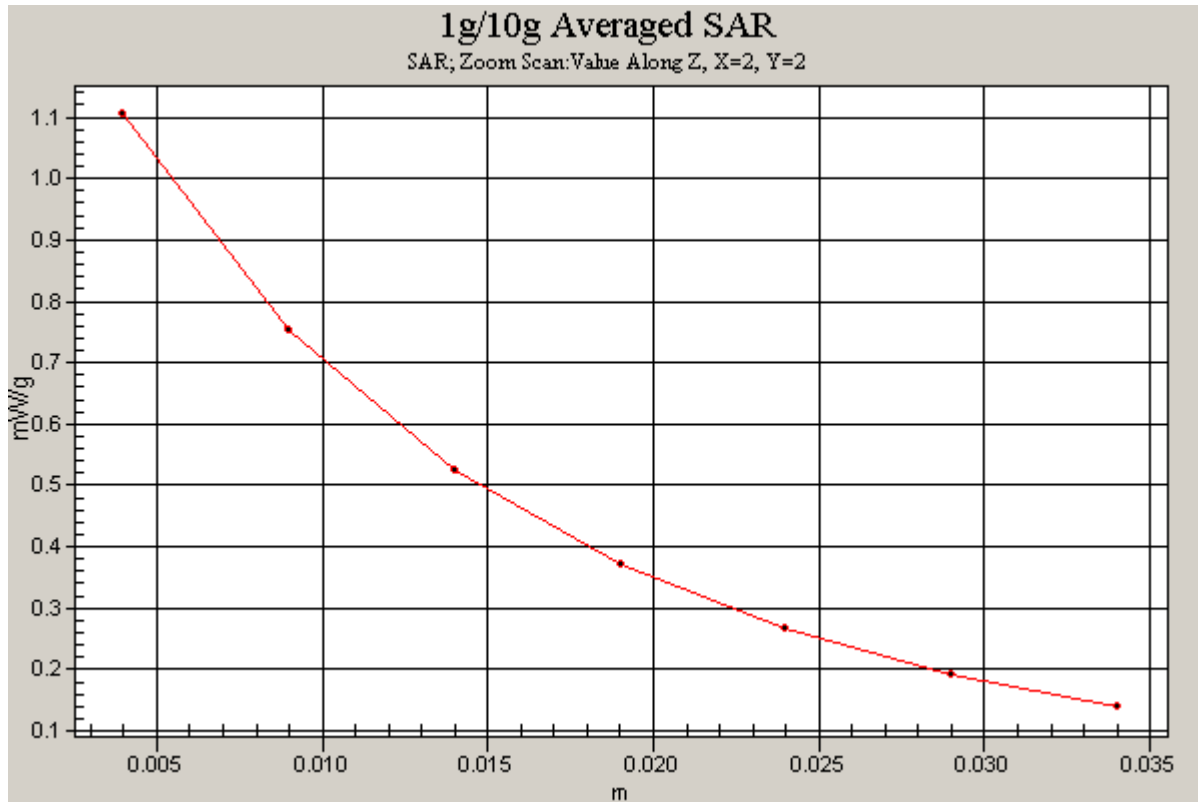
**Area Scan (7x13x1):** Measurement grid: dx=15mm, dy=15mm

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.672 mW/g**

Deviation = 5.59 %



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d141**

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.57 \text{ mho/m}$ ;  $\epsilon_r = 50.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-13-2012; Ambient Temp: 23.5°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3258; ConvF(4.7, 4.7, 4.7); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

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

## 1900MHz System Verification

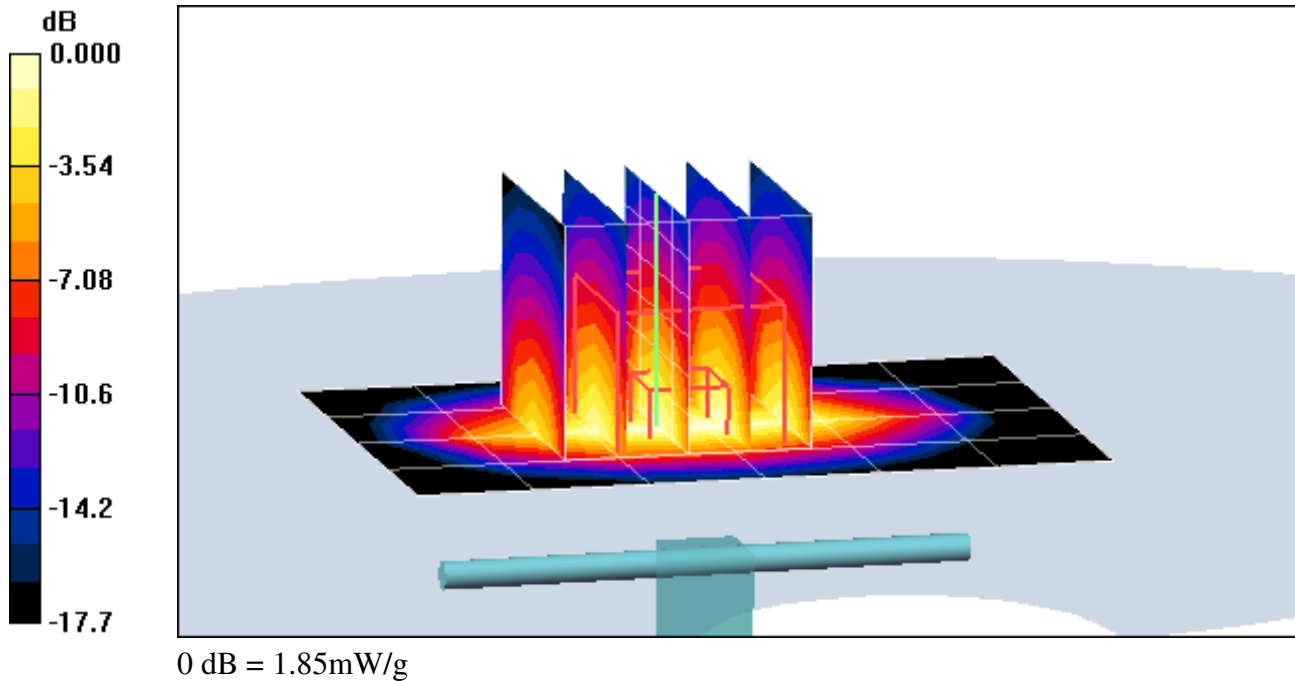
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 16.0 dBm (40 mW)

**SAR(1 g) = 1.66 mW/g; SAR(10 g) = 0.870 mW/g**

Deviation = 0.24 %



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d141**

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.57 \text{ mho/m}$ ;  $\epsilon_r = 50.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-13-2012; Ambient Temp: 23.5°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3258; ConvF(4.7, 4.7, 4.7); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

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

## 1900MHz System Verification

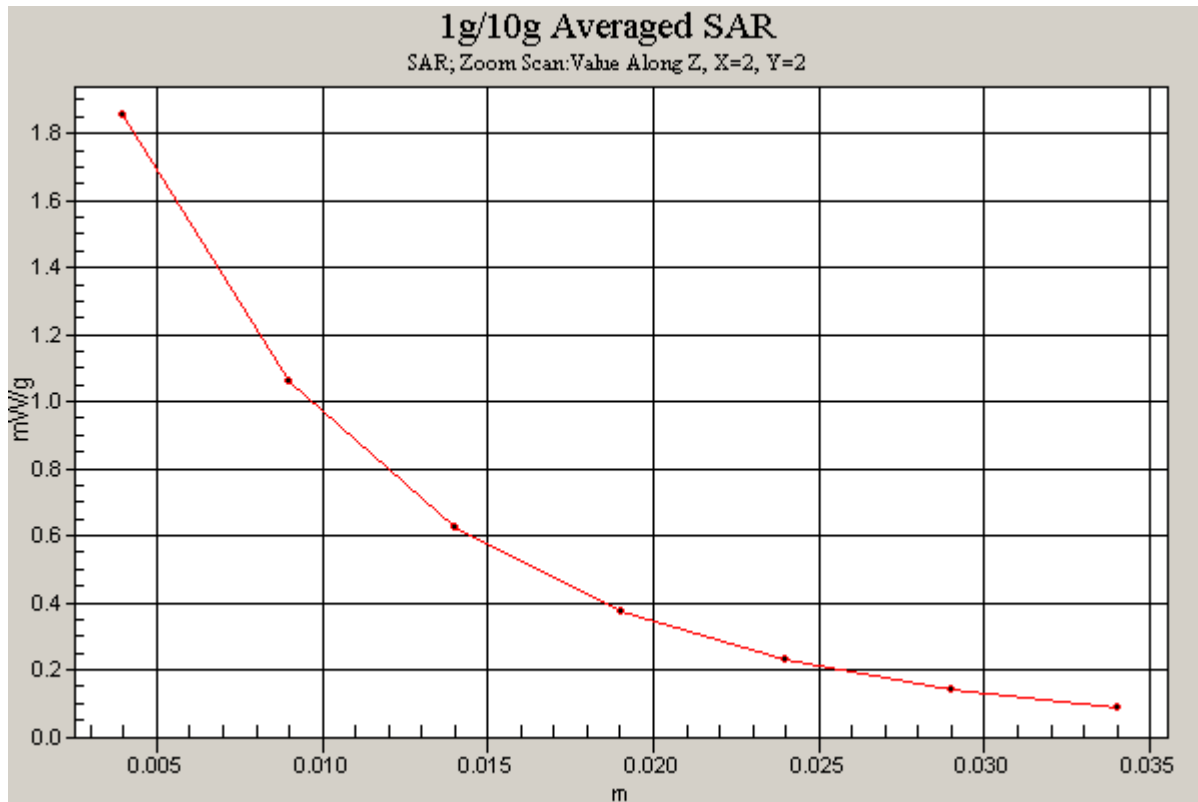
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 16.0 dBm (40 mW)

**SAR(1 g) = 1.66 mW/g; SAR(10 g) = 0.870 mW/g**

Deviation = 0.24 %



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 2450 MHz; Type: D2450V2; Serial: 719**

Communication System: 2.4GHz WLAN; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.893 \text{ mho/m}$ ;  $\epsilon_r = 50.32$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-30-2012; Ambient Temp: 23.1°C; Tissue Temp: 21.3°C

Probe: ES3DV2 - SN3022; ConvF(4.01, 4.01, 4.01); Calibrated: 8/25/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/19/2011

Phantom: SAM with CRP; Type: SAM; Serial: TP1375

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

## 2450MHz System Verification

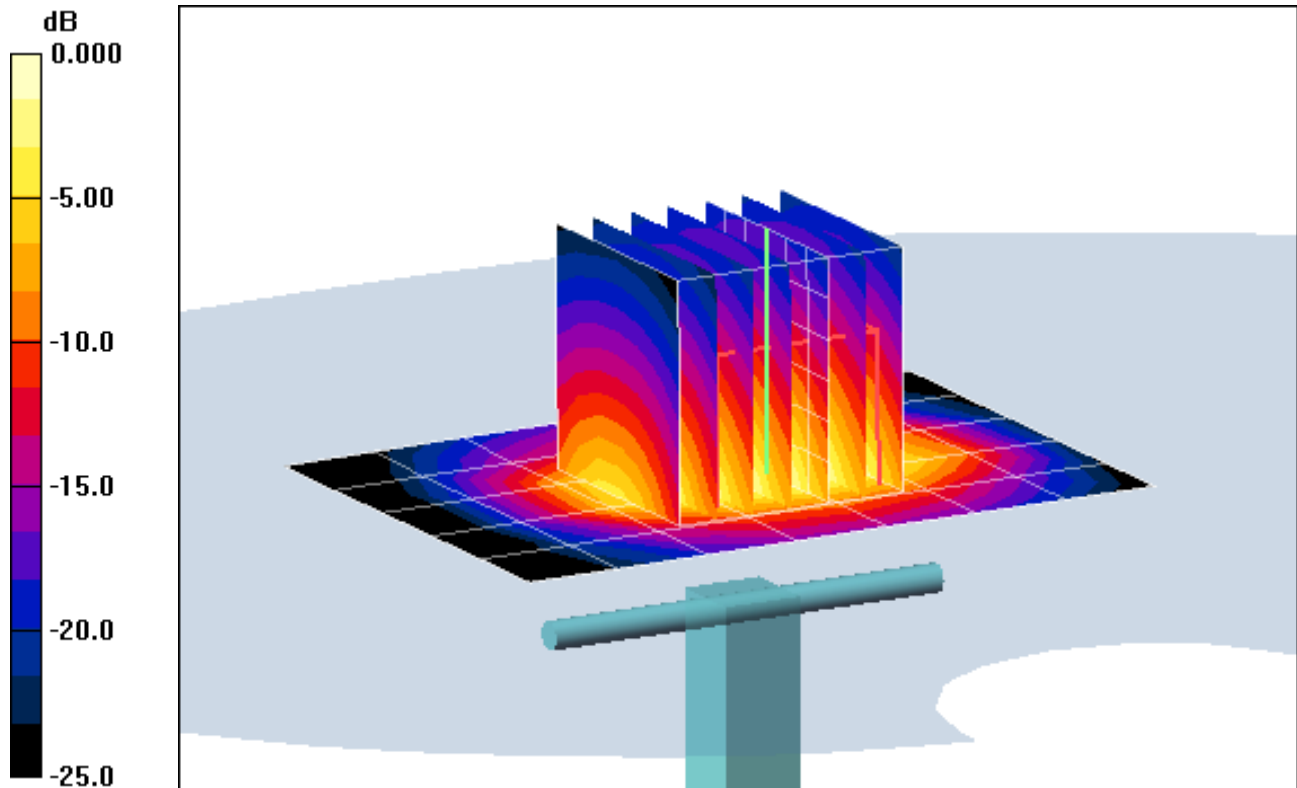
**Area Scan (6x8x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 4.88 mW/g; SAR(10 g) = 2.2 mW/g**

Deviation = -4.87 %



0 dB = 6.37mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 2450 MHz; Type: D2450V2; Serial: 719**

Communication System: 2.4GHz WLAN; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.893 \text{ mho/m}$ ;  $\epsilon_r = 50.32$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-30-2012; Ambient Temp: 23.1°C; Tissue Temp: 21.3°C

Probe: ES3DV2 - SN3022; ConvF(4.01, 4.01, 4.01); Calibrated: 8/25/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/19/2011

Phantom: SAM with CRP; Type: SAM; Serial: TP1375

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

## 2450MHz System Verification

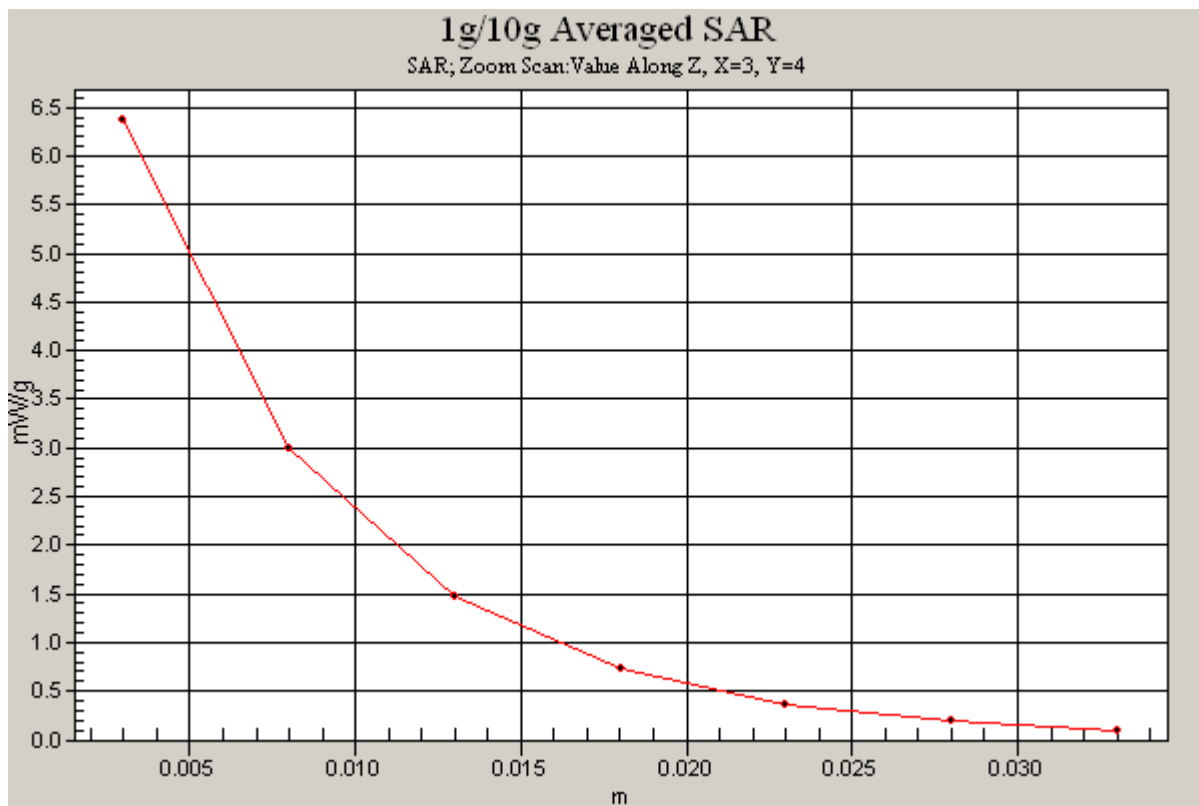
**Area Scan (6x8x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 4.88 mW/g; SAR(10 g) = 2.2 mW/g**

Deviation = -4.87 %



## APPENDIX C: PROBE CALIBRATION



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Client **PC Test**

Certificate No: **D750V3-1046\_Oct11**

## CALIBRATION CERTIFICATE

Object **D750V3 - SN: 1046**

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

Calibration date: **October 27, 2011**

✓ KOK  
11/10/11

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter EPM-442A        | GB37480704         | 05-Oct-11 (No. 217-01451)         | Oct-12                 |
| Power sensor HP 8481A       | US37292783         | 05-Oct-11 (No. 217-01451)         | Oct-12                 |
| Reference 20 dB Attenuator  | SN: 5086 (20g)     | 29-Mar-11 (No. 217-01368)         | Apr-12                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371)         | Apr-12                 |
| Reference Probe ES3DV3      | SN: 3205           | 29-Apr-11 (No. ES3-3205_Apr11)    | Apr-12                 |
| DAE4                        | SN: 601            | 04-Jul-11 (No. DAE4-601_Jul11)    | Jul-12                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-11) | In house check: Oct-12 |

Calibrated by: **Dimce Iliev** **Function: Laboratory Technician** **Signature: [Signature]**

Approved by: **Katja Pokovic** **Technical Manager**

**Signature: [Signature]**

Issued: October 27, 2011

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

**Glossary:**

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

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

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

**Additional Documentation:**

- d) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

## Measurement Conditions

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

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.6.2     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 15 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 750 MHz $\pm$ 1 MHz    |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 41.9           | 0.89 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 42.3 $\pm$ 6 % | 0.92 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °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 | 2.15 mW / g                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 8.40 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 | 1.40 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 5.49 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             | 55.5           | 0.96 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 55.6 $\pm$ 6 % | 0.96 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °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 | 2.20 mW / g                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 8.80 mW / g $\pm$ 17.0 % (k=2) |

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                                |
| SAR measured                                            | 250 mW input power | 1.45 mW / g                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 5.80 mW / g $\pm$ 16.5 % (k=2) |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $56.5 \Omega + 1.0 j\Omega$ |
| Return Loss                          | - 24.2 dB                   |

### Antenna Parameters with Body TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $51.5 \Omega - 2.0 j\Omega$ |
| Return Loss                          | - 32.1 dB                   |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.039 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 | September 02, 2011 |

## DASY5 Validation Report for Head TSL

Date: 27.10.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1046**

Communication System: CW; Frequency: 750 MHz

Medium parameters used:  $f = 750 \text{ MHz}$ ;  $\sigma = 0.92 \text{ mho/m}$ ;  $\epsilon_r = 42.3$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.33, 6.33, 6.33); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

### Dipole Calibration for Head Tissue/Pin=250mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

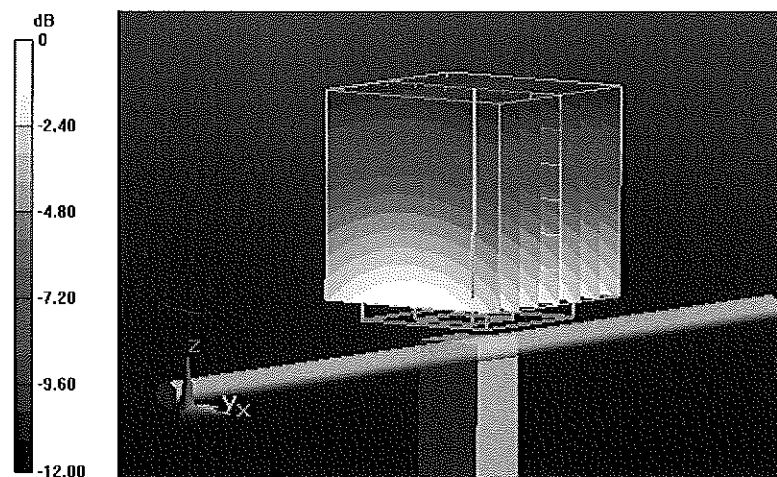
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 53.598 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.269 W/kg

**SAR(1 g) = 2.15 mW/g; SAR(10 g) = 1.4 mW/g**

Maximum value of SAR (measured) = 2.522 mW/g



0 dB = 2.520mW/g

# Impedance Measurement Plot for Head TSL

27 Oct 2011 10:51:07

CH1 S11 1-U FS 1:56.467 n 0.9590 n 203.50 pH 750.000 000 MHz

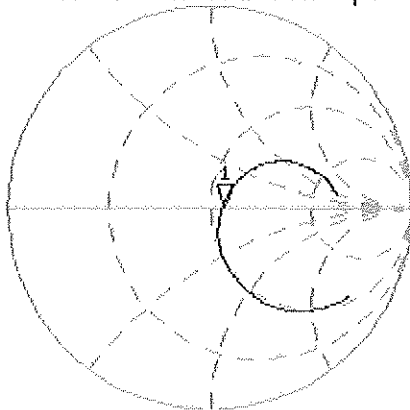
\*

De1

Cor

Avg  
16

H1d

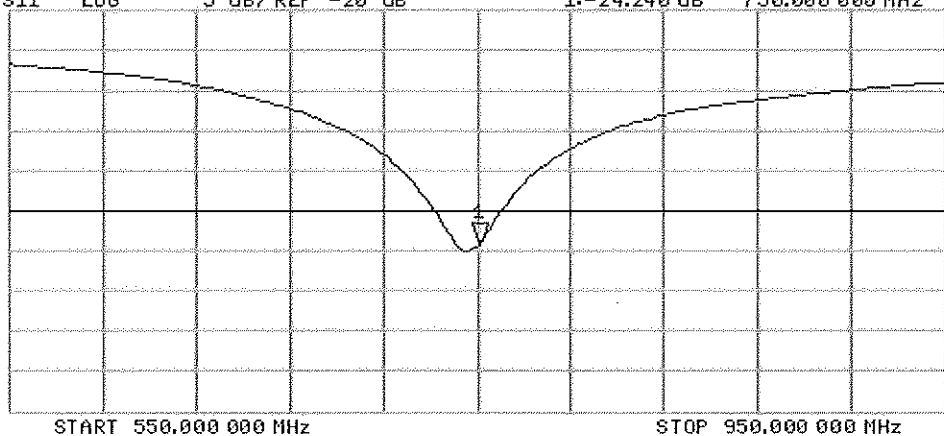


CH2 S11 LOG 5 dB/REF -20 dB 1:-24.240 dB 750.000 000 MHz

Cor

Avg  
16

H1d



## DASY5 Validation Report for Body TSL

Date: 27.10.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1046**

---

Communication System: CW; Frequency: 750 MHz

Medium parameters used:  $f = 750$  MHz;  $\sigma = 0.96$  mho/m;  $\epsilon_r = 55.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.12, 6.12, 6.12); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

### Dipole Calibration for Body Tissue/Pin=250mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

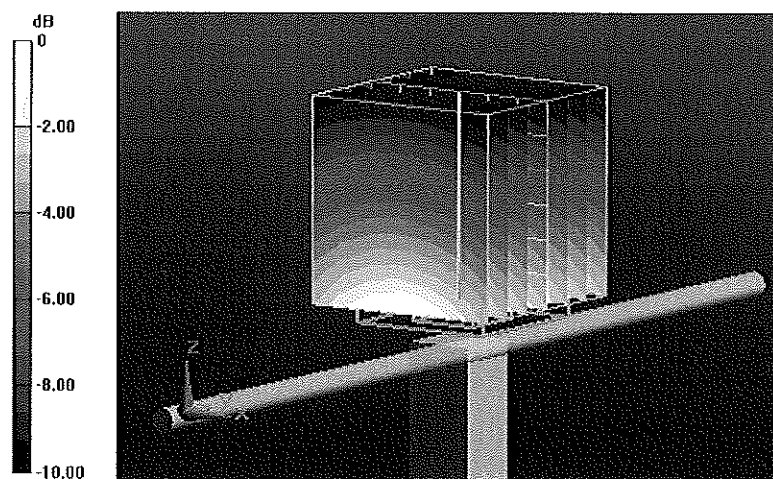
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 52.736 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 3.254 W/kg

**SAR(1 g) = 2.2 mW/g; SAR(10 g) = 1.45 mW/g**

Maximum value of SAR (measured) = 2.560 mW/g



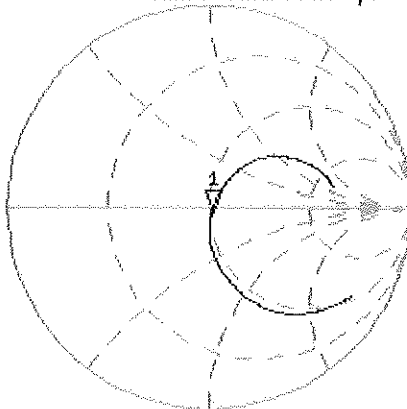
0 dB = 2.560mW/g

# Impedance Measurement Plot for Body TSL

27 Oct 2011 09:34:36

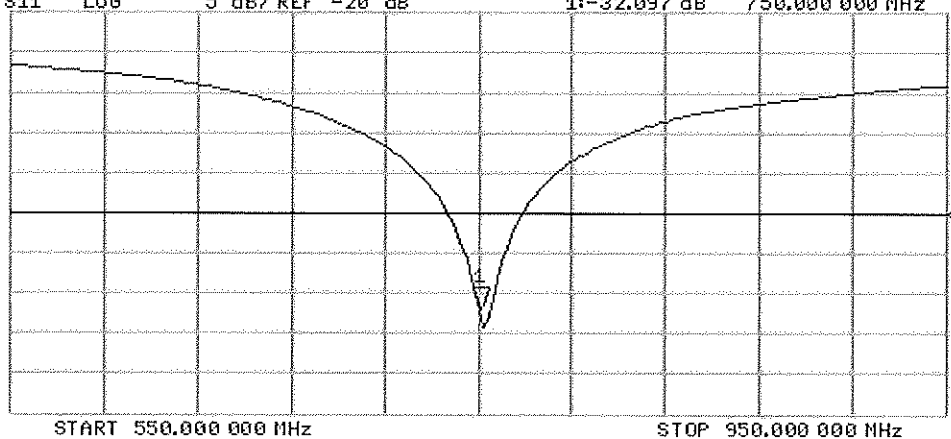
[CH1] S11 1 U FS 1:51.518  $\Omega$  -2.0078  $\Omega$  105.69 pF 750.000 000 MHz

\*  
De1  
Cor  
Avg  
16  
H1d



CH2 S11 LOG 5 dB/REF -20 dB 1:-32.097 dB 750.000 000 MHz

Cor  
Avg  
16  
H1d





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Accreditation No.: **SCS 108**

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 Multilateral Agreement for the recognition of calibration certificates

Client **PC Test**

Certificate No: **D835V2-4d026\_Aug11**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d026**

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

Calibration date: **August 15, 2011**

✓ KOK  
 9/6/11

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter EPM-442A        | GB37480704         | 06-Oct-10 (No. 217-01266)         | Oct-11                 |
| Power sensor HP 8481A       | US37292783         | 06-Oct-10 (No. 217-01266)         | Oct-11                 |
| Reference 20 dB Attenuator  | SN: S5086 (20b)    | 29-Mar-11 (No. 217-01367)         | Apr-12                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371)         | Apr-12                 |
| Reference Probe ES3DV3      | SN: 3205           | 29-Apr-11 (No. ES3-3205_Apr11)    | Apr-12                 |
| DAE4                        | SN: 601            | 04-Jul-11 (No. DAE4-601_Jul11)    | Jul-12                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

Calibrated by: **Claudio Leubler** **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** **Technical Manager**

Issued: August 15, 2011

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

### 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                  | V52.6.2     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 15 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 835 MHz $\pm$ 1 MHz    |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 41.5           | 0.90 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 41.1 $\pm$ 6 % | 0.89 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °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 | 2.35 mW / g                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 9.46 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 | 1.54 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 6.19 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             | 55.2           | 0.97 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 53.4 $\pm$ 6 % | 0.99 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °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 | 2.47 mW / g                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 9.66 mW / g $\pm$ 17.0 % (k=2) |

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                                |
| SAR measured                                            | 250 mW input power | 1.63 mW / g                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 6.42 mW / g $\pm$ 16.5 % (k=2) |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 53.4 $\Omega$ - 3.1 j $\Omega$ |
| Return Loss                          | - 27.0 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.3 $\Omega$ - 5.4 j $\Omega$ |
| Return Loss                          | - 25.3 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.389 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 | December 17, 2004 |

## DASY5 Validation Report for Head TSL

Date: 15.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

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**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d026**

---

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.89$  mho/m;  $\epsilon_r = 41.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

### Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

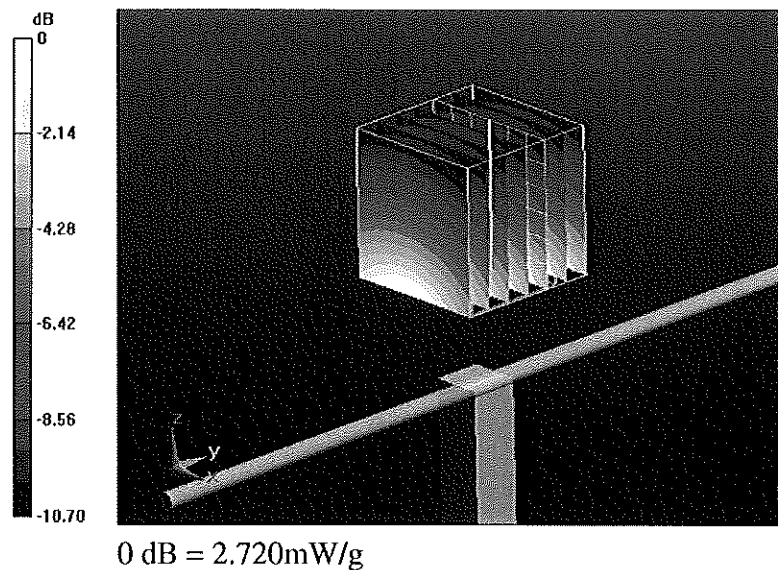
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.042 V/m; Power Drift = 0.02 dB

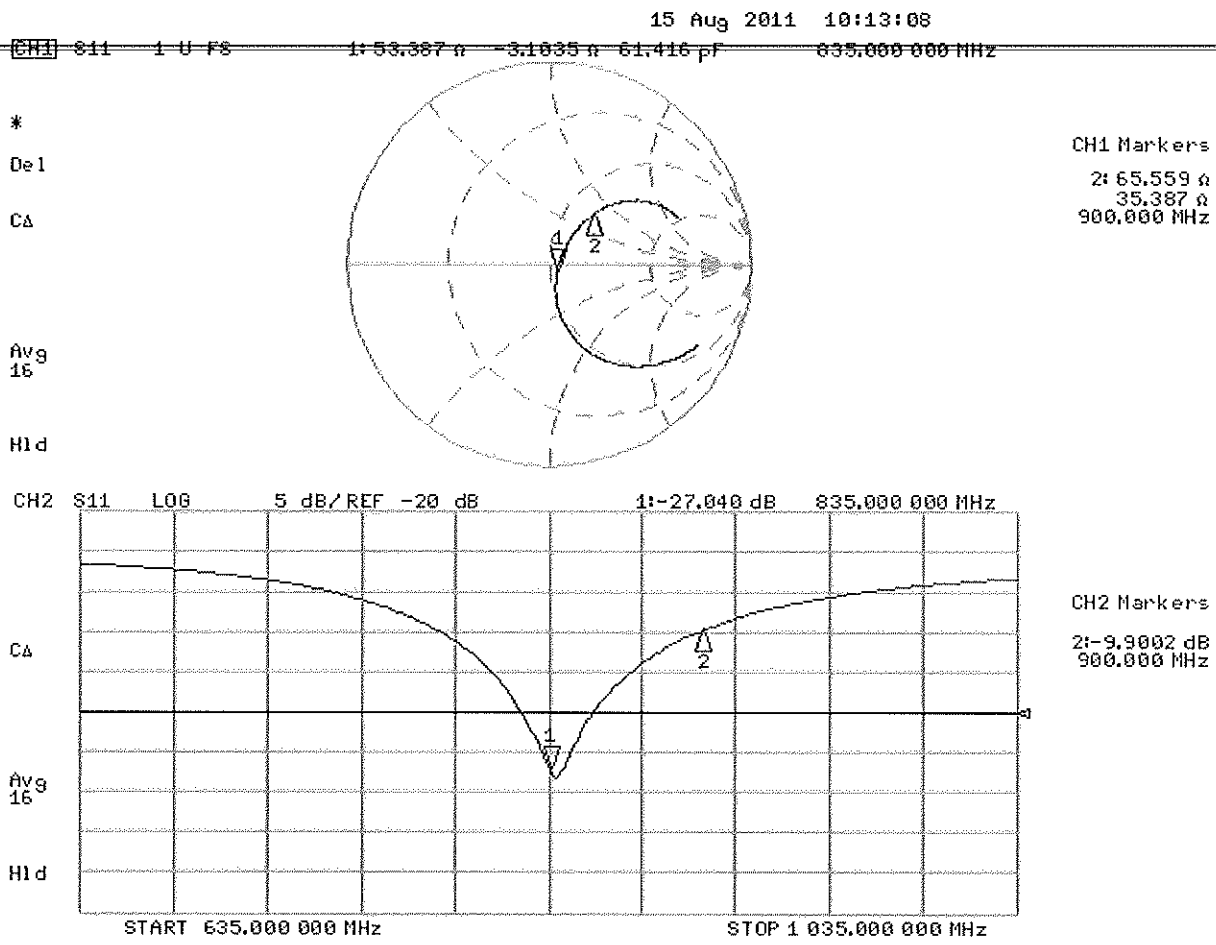
Peak SAR (extrapolated) = 3.480 W/kg

**SAR(1 g) = 2.35 mW/g; SAR(10 g) = 1.54 mW/g**

Maximum value of SAR (measured) = 2.719 mW/g



Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 15.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

---

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d026**

---

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.99$  mho/m;  $\epsilon_r = 53.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

### DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

### Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x8x7)/Cube 0:

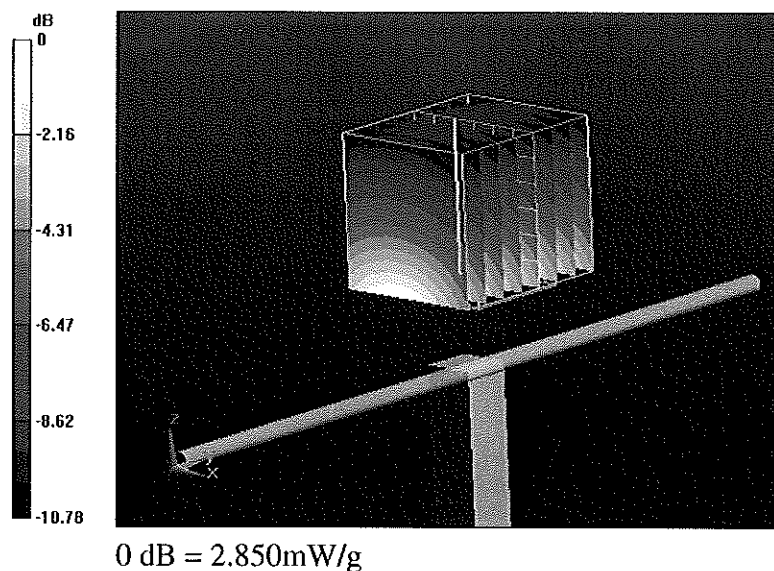
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.889 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.598 W/kg

**SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.63 mW/g**

Maximum value of SAR (measured) = 2.854 mW/g

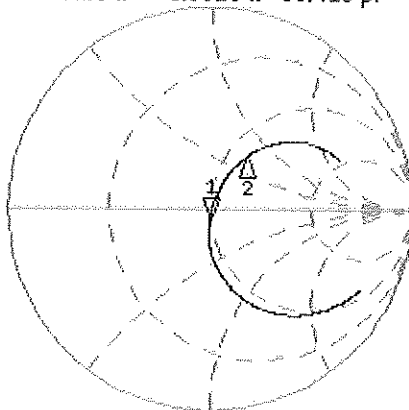


# Impedance Measurement Plot for Body TSL

15 Aug 2011 14:17:58  
 CH1 S11 1 U FS 1: 49.320  $\Omega$  5: 3828  $\Omega$  35.410 pF 835.000 000 MHz

\*  
 Del  
 Cor

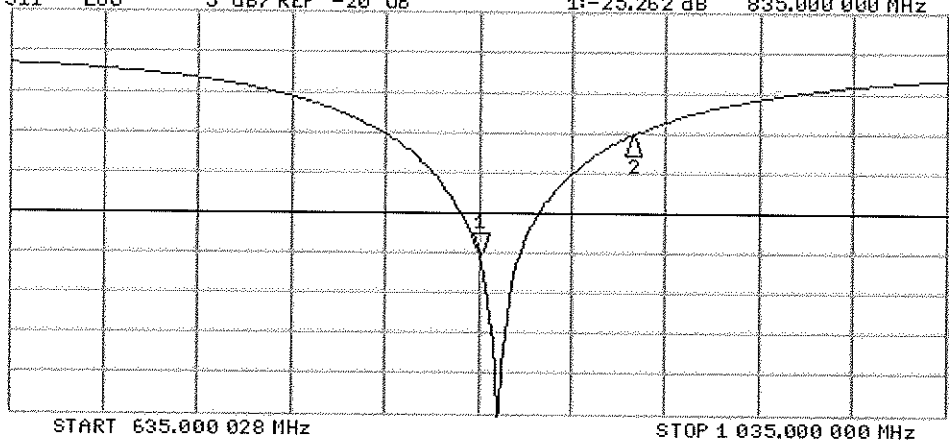
Avg  
 16  
 H1d



CH1 Markers  
 2: 60.363  $\Omega$   
 33.563  $\Omega$   
 900.000 MHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -25.262 dB 835.000 000 MHz

Cor  
 Avg  
 16  
 H1d



CH2 Markers  
 2: -10.327 dB  
 900.000 MHz



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Accreditation No.: **SCS 108**

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Client **PC Test**

Certificate No: **D1900V2-5d141\_Jul11**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d141**

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

Calibration date: **July 11, 2011**

✓ KOK  
11/07/11

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Calibrated by: **Claudio Leubler** **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** **Technical Manager**

Issued: July 11, 2011

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Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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**Glossary:**

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

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

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

**Additional Documentation:**

- d) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

## Measurement Conditions

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

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.6.2     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 1900 MHz $\pm$ 1 MHz   |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 40.0           | 1.40 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 39.1 $\pm$ 6 % | 1.42 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °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 | 10.0 mW / g                   |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 39.5 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 | 5.22 mW / g                   |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 20.7 mW /g $\pm$ 16.5 % (k=2) |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $53.4 \Omega + 5.8 j\Omega$ |
| Return Loss                          | - 23.7 dB                   |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.200 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 | March 11, 2011 |

## DASY5 Validation Report for Head TSL

Date: 11.07.2011

Test Laboratory: SPEAG, Zurich, Switzerland

~~DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d141~~

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.42$  mho/m;  $\epsilon_r = 39.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

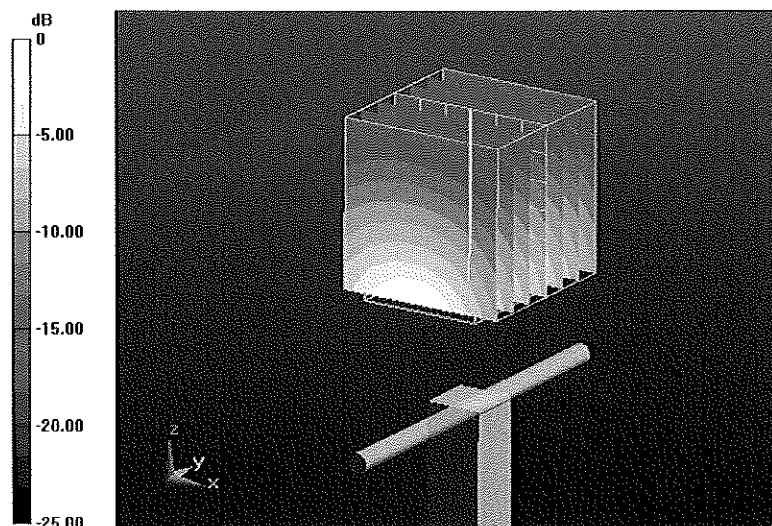
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.797 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 18.201 W/kg

**SAR(1 g) = 10 mW/g; SAR(10 g) = 5.22 mW/g**

Maximum value of SAR (measured) = 12.282 mW/g

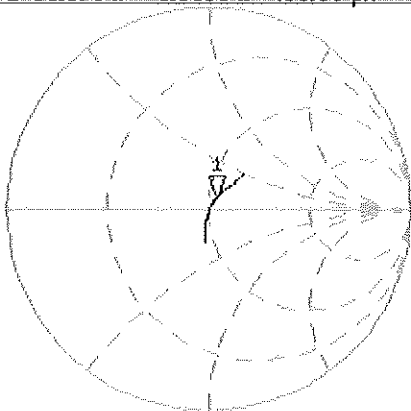


0 dB = 12.280mW/g

Impedance Measurement Plot for Head TSL

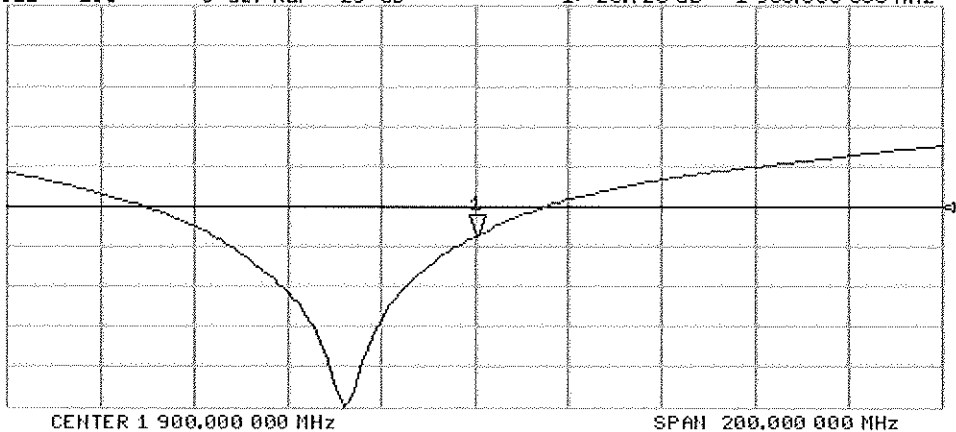
11 Jul 2011 11:49:26  
[CH3] S11 1 U FS 1:53.375  $\phi$  5.8359  $\phi$  488.85  $\mu$ H 1 900.000 000 MHz

\*  
Del  
Cor  
Avg  
16  
H1d



CH2 S11 LOG 5 dB/REF -20 dB 1:-23.720 dB 1 900.000 000 MHz

Cor  
Avg  
16  
H1d





Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Client **PC Test**

Certificate No: **D1900V2-5d141\_Nov11**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d141**

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

Calibration date: **November 08, 2011**

✓ KOK  
11/28/11

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         | 05-Oct-11 (No. 217-01451)         | Oct-12                 |
| Power sensor HP 8481A       | US37292783         | 05-Oct-11 (No. 217-01451)         | Oct-12                 |
| Reference 20 dB Attenuator  | SN: 5086 (20g)     | 29-Mar-11 (No. 217-01368)         | Apr-12                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371)         | Apr-12                 |
| Reference Probe ES3DV3      | SN: 3205           | 29-Apr-11 (No. ES3-3205_Apr11)    | Apr-12                 |
| DAE4                        | SN: 601            | 04-Jul-11 (No. DAE4-601_Jul11)    | Jul-12                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-11) | In house check: Oct-12 |

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

Issued: November 9, 2011

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**Glossary:**

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

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

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

**Additional Documentation:**

- d) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

## Measurement Conditions

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

|                                     |                        |             |
|-------------------------------------|------------------------|-------------|
| <b>DASY Version</b>                 | DASY5                  | V52.6.2     |
| <b>Extrapolation</b>                | Advanced Extrapolation |             |
| <b>Phantom</b>                      | Modular Flat Phantom   |             |
| <b>Distance Dipole Center - TSL</b> | 10 mm                  | with Spacer |
| <b>Zoom Scan Resolution</b>         | dx, dy, dz = 5 mm      |             |
| <b>Frequency</b>                    | 1900 MHz $\pm$ 1 MHz   |             |

## Body TSL parameters

The following parameters and calculations were applied.

|                                                | Temperature         | Permittivity   | Conductivity         |
|------------------------------------------------|---------------------|----------------|----------------------|
| <b>Nominal Body TSL parameters</b>             | 22.0 °C             | 53.3           | 1.52 mho/m           |
| <b>Measured Body TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 54.2 $\pm$ 6 % | 1.59 mho/m $\pm$ 6 % |
| <b>Body TSL temperature change during test</b> | < 0.5 °C            | ----           | ----                 |

## SAR result with Body TSL

|                                                             |                    |                                                  |
|-------------------------------------------------------------|--------------------|--------------------------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b> | Condition          |                                                  |
| SAR measured                                                | 250 mW input power | 10.6 mW / g                                      |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>41.4 mW / g <math>\pm</math> 17.0 % (k=2)</b> |

|                                                               |                    |                                                  |
|---------------------------------------------------------------|--------------------|--------------------------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | condition          |                                                  |
| SAR measured                                                  | 250 mW input power | 5.50 mW / g                                      |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>21.7 mW / g <math>\pm</math> 16.5 % (k=2)</b> |

## Appendix

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.1 $\Omega$ + 6.6 j $\Omega$ |
| Return Loss                          | - 23.5 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.199 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 | March 11, 2011 |

## DASY5 Validation Report for Body TSL

Date: 08.11.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d141**

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900 \text{ MHz}$ ;  $\sigma = 1.59 \text{ mho/m}$ ;  $\epsilon_r = 54.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

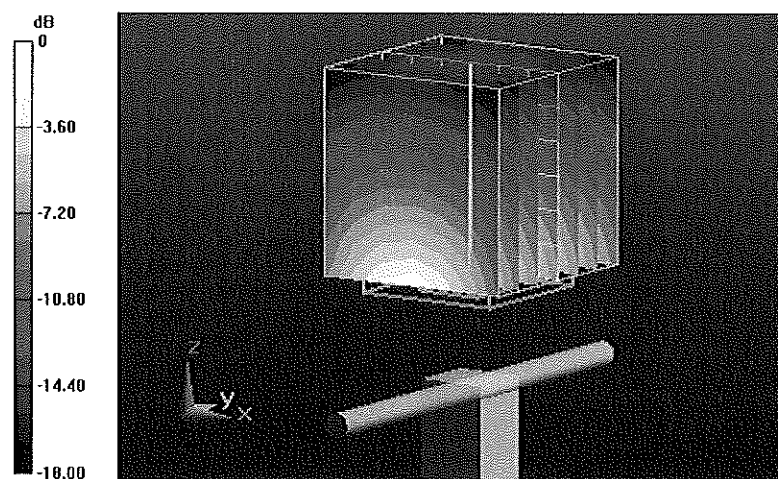
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 95.860 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 18.815 W/kg

**SAR(1 g) = 10.6 mW/g; SAR(10 g) = 5.5 mW/g**

Maximum value of SAR (measured) = 13.446 mW/g



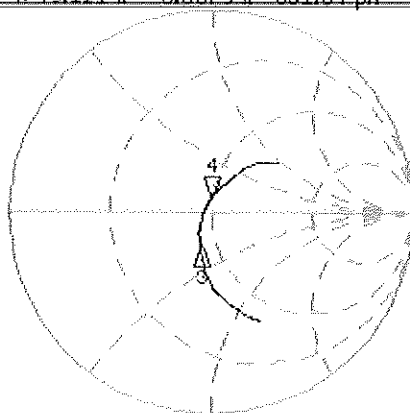
0 dB = 13.450mW/g

# Impedance Measurement Plot for Body TSL

8 Nov 2011 09:26:55

[CH1] S11 1.0 FS 4:49.111  $\Omega$  6.5879  $\Omega$  551.84  $\mu$ H 1.900.000.000 MHz

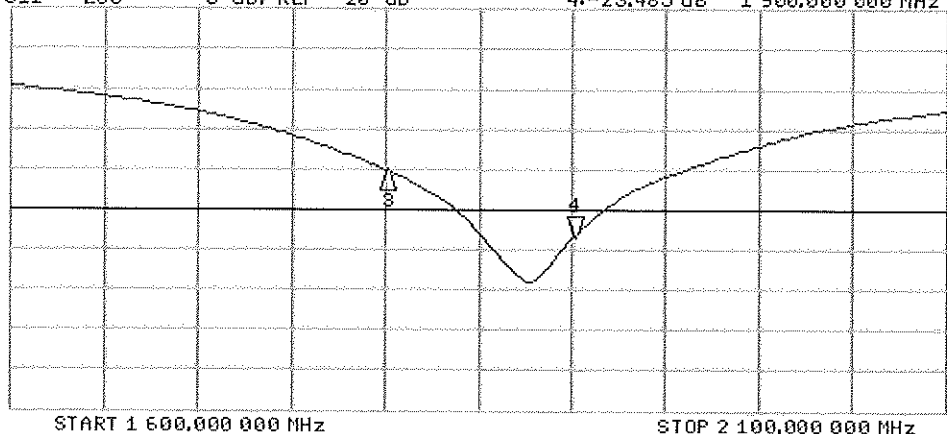
\*  
De1  
CA  
Avg  
16  
H1d



CH1 Markers  
3: 42.535  $\Omega$   
-14.977  $\Omega$   
1.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 4:-23.485 dB 1.900.000.000 MHz

CA  
Avg  
16  
H1d



CH2 Markers  
3: -14.966 dB  
-23.485 dB  
1.80000 GHz



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Accreditation No.: **SCS 108**

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 Multilateral Agreement for the recognition of calibration certificates

Client **PC Test**

Certificate No: **D2450V2-719\_Aug11**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 719**

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

Calibration date: **August 19, 2011**

✓ KOK  
 9/6/11

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: S5086 (20b)    | 29-Mar-11 (No. 217-01367)         | Apr-12                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371)         | Apr-12                 |
| Reference Probe ES3DV3      | SN: 3205           | 29-Apr-11 (No. ES3-3205_Apr11)    | Apr-12                 |
| DAE4                        | SN: 601            | 04-Jul-11 (No. DAE4-601_Jul11)    | Jul-12                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

Calibrated by: **Claudio Leubler** **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** **Technical Manager**

Issued: August 22, 2011

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### 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                  | V52.6.2     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 2450 MHz $\pm$ 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 | 38.4 $\pm$ 6 % | 1.85 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °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 | 13.7 mW / g                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 53.8 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 | 6.35 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 25.2 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 $\pm$ 0.2) °C | 51.8 $\pm$ 6 % | 2.02 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Body TSL

|                                                       |                    |                                |
|-------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                                |
| SAR measured                                          | 250 mW input power | 13.1 mW / g                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 51.3 mW / g $\pm$ 17.0 % (k=2) |

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                                |
| SAR measured                                            | 250 mW input power | 6.07 mW / g                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 24.1 mW / g $\pm$ 16.5 % (k=2) |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $53.2 \Omega + 3.6 j\Omega$ |
| Return Loss                          | - 26.6 dB                   |

### Antenna Parameters with Body TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $49.6 \Omega + 4.3 j\Omega$ |
| Return Loss                          | - 27.3 dB                   |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.149 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 | September 10, 2002 |

## DASY5 Validation Report for Head TSL

Date: 18.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

~~DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719~~

Communication System: CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.85$  mho/m;  $\epsilon_r = 38.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

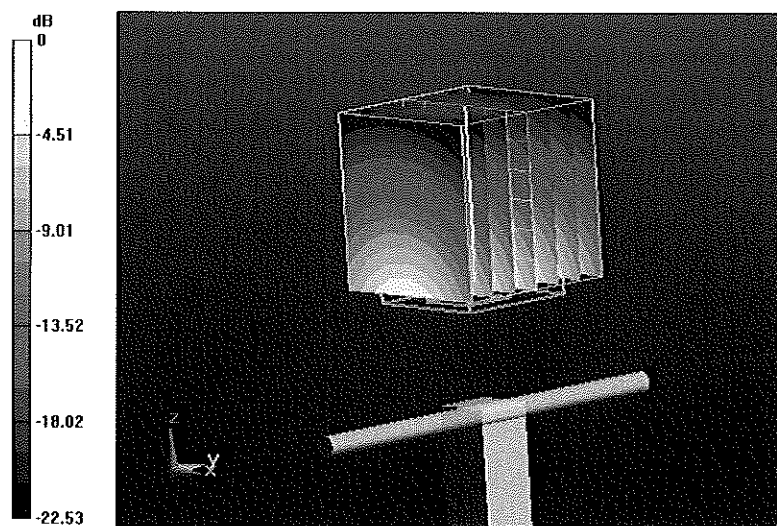
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 101.4 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 28.234 W/kg

**SAR(1 g) = 13.7 mW/g; SAR(10 g) = 6.35 mW/g**

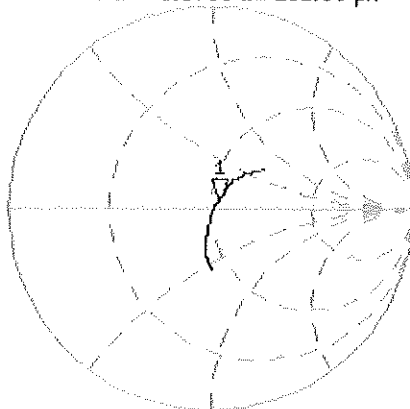
Maximum value of SAR (measured) = 17.657 mW/g



# Impedance Measurement Plot for Head TSL

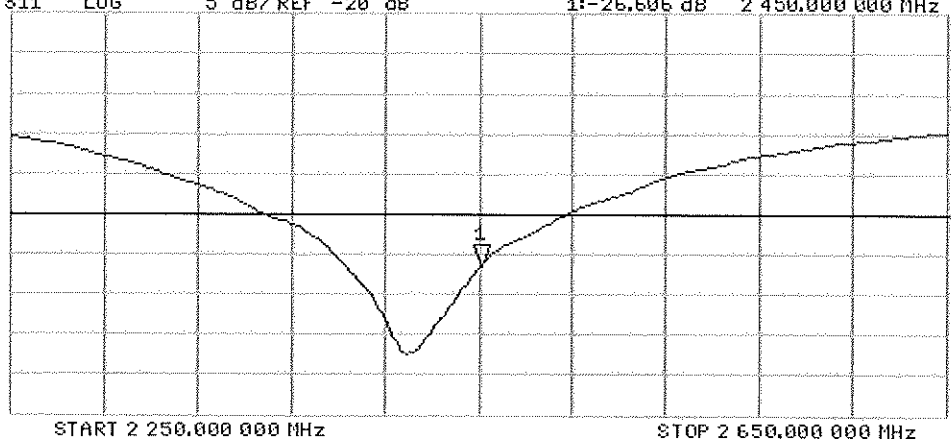
18 Aug 2011 10:43:30  
 CH1 S11 1 U FS 1:53.248 n 3.5703 n 231.93 pF 2 450.000 000 MHz

\*  
 Del  
 CA  
 Avg  
 16  
 H1 d



CH2 S11 LOG 5 dB/REF -20 dB 1:-26.606 dB 2 450.000 000 MHz

CA  
 Avg  
 16  
 H1 d



## DASY5 Validation Report for Body TSL

Date: 19.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

~~DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719~~

Communication System: CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.02$  mho/m;  $\epsilon_r = 51.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

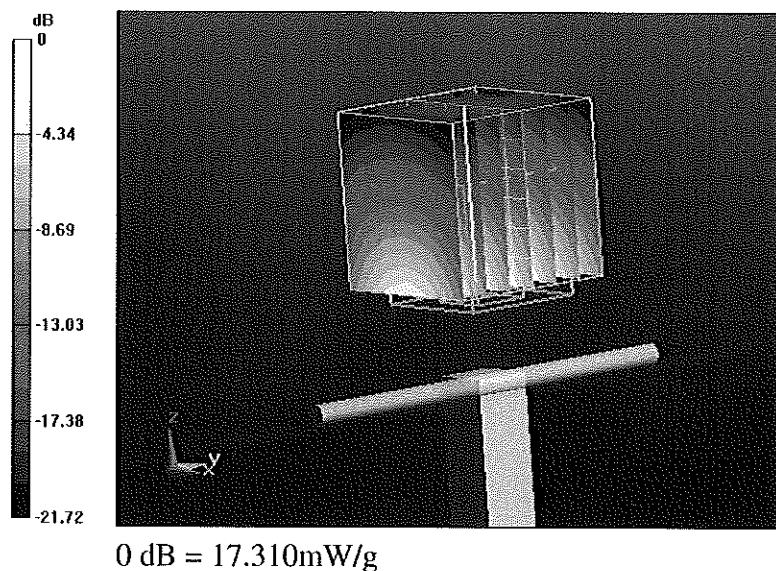
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.948 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 26.876 W/kg

**SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.07 mW/g**

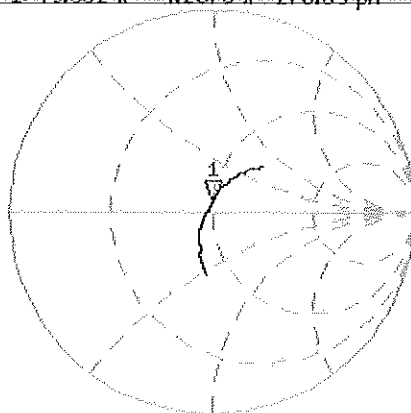
Maximum value of SAR (measured) = 17.309 mW/g



# Impedance Measurement Plot for Body TSL

18 Aug 2011 10:49:46  
 [CH1] S11 1 U FS 1:49.582  $\Omega$  4.2578  $\Omega$  276.59  $\mu\text{H}$  2 450.000 000 MHz

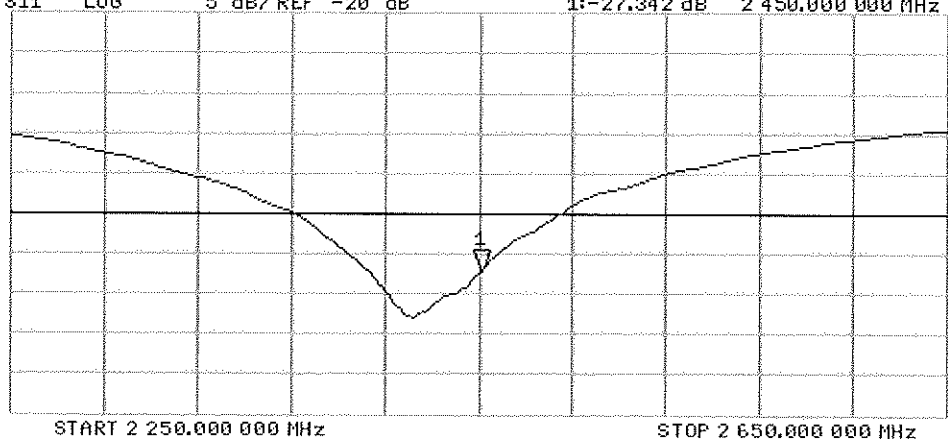
\*  
 De1  
 CA



Avg  
 16  
 H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-27.342 dB 2 450.000 000 MHz

CA  
 Avg  
 16  
 H1d





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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3022\_Aug11**

## CALIBRATION CERTIFICATE

Object **ES3DV2 - SN:3022**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4  
Calibration procedure for dosimetric E-field probes**

Calibration date: **August 25, 2011**

*✓KOK  
9/6/11*

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID              | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 31-Mar-11 (No. 217-01372)         | Apr-12                 |
| Power sensor E4412A        | MY41498087      | 31-Mar-11 (No. 217-01372)         | Apr-12                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 29-Mar-11 (No. 217-01369)         | Apr-12                 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 29-Mar-11 (No. 217-01367)         | Apr-12                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 29-Mar-11 (No. 217-01370)         | Apr-12                 |
| Reference Probe ES3DV2     | SN: 3013        | 29-Dec-10 (No. ES3-3013_Dec10)    | Dec-11                 |
| DAE4                       | SN: 654         | 3-May-11 (No. DAE4-654_May11)     | May-12                 |
| 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 |

|                                                                                                                 |                                |                                          |               |
|-----------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------|---------------|
| Calibrated by:                                                                                                  | Name<br><b>Claudio Leubler</b> | Function<br><b>Laboratory Technician</b> | Signature<br> |
| Approved by:                                                                                                    | <b>Katja Pokovic</b>           | <b>Technical Manager</b>                 |               |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. |                                |                                          |               |

Issued: August 27, 2011



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### 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 $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center),<br>i.e., $\vartheta = 0$ 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  $\vartheta = 0$  ( $f \leq 900$  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*.
- DCP<sub>x,y,z</sub>**: 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>; VR<sub>x,y,z</sub>**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<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.

---

# Probe ES3DV2

## SN:3022

Manufactured: April 15, 2003  
Calibrated: August 25, 2011

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

## DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

### Basic Calibration Parameters

|                                                    | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|----------------------------------------------------|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V/m})^2$ ) <sup>A</sup> | 1.00     | 1.04     | 0.99     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                              | 99.5     | 97.7     | 99.2     |               |

### 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    | 133.2    | $\pm 2.7 \%$              |
|       |                           |      | Y | 0.00    | 0.00    | 1.00    | 130.0    |                           |
|       |                           |      | Z | 0.00    | 0.00    | 1.00    | 133.9    |                           |

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: ES3DV2 - SN:3022

### 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) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 41.9                               | 0.89                            | 6.27    | 6.27    | 6.27    | 0.80  | 1.13       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 6.05    | 6.05    | 6.05    | 0.80  | 1.14       | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 5.20    | 5.20    | 5.20    | 0.59  | 1.39       | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 4.98    | 4.98    | 4.98    | 0.66  | 1.30       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.30    | 4.30    | 4.30    | 0.58  | 1.41       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 4.20    | 4.20    | 4.20    | 0.58  | 1.43       | ± 12.0 %    |

<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: ES3DV2- SN:3022

### Calibration Parameter Determined in Body Tissue Simulating Media

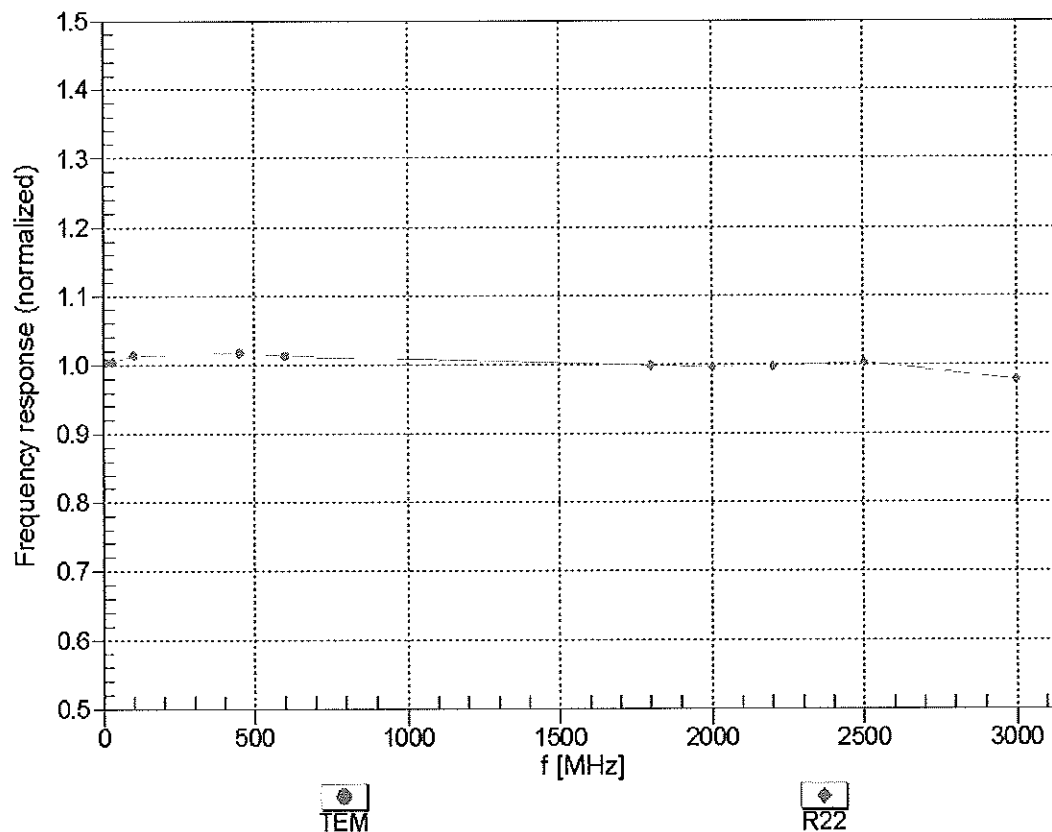
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 450                  | 56.7                               | 0.94                            | 6.93    | 6.93    | 6.93    | 0.07  | 1.00       | ± 13.4 %    |
| 750                  | 55.5                               | 0.96                            | 6.11    | 6.11    | 6.11    | 0.80  | 1.18       | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 6.06    | 6.06    | 6.06    | 0.80  | 1.20       | ± 12.0 %    |
| 1640                 | 53.8                               | 1.40                            | 5.07    | 5.07    | 5.07    | 0.70  | 1.32       | ± 12.0 %    |
| 1750                 | 53.4                               | 1.49                            | 4.64    | 4.64    | 4.64    | 0.67  | 1.35       | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 4.41    | 4.41    | 4.41    | 0.54  | 1.56       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 4.01    | 4.01    | 4.01    | 0.66  | 1.19       | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 3.90    | 3.90    | 3.90    | 0.54  | 1.45       | ± 12.0 %    |

<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.

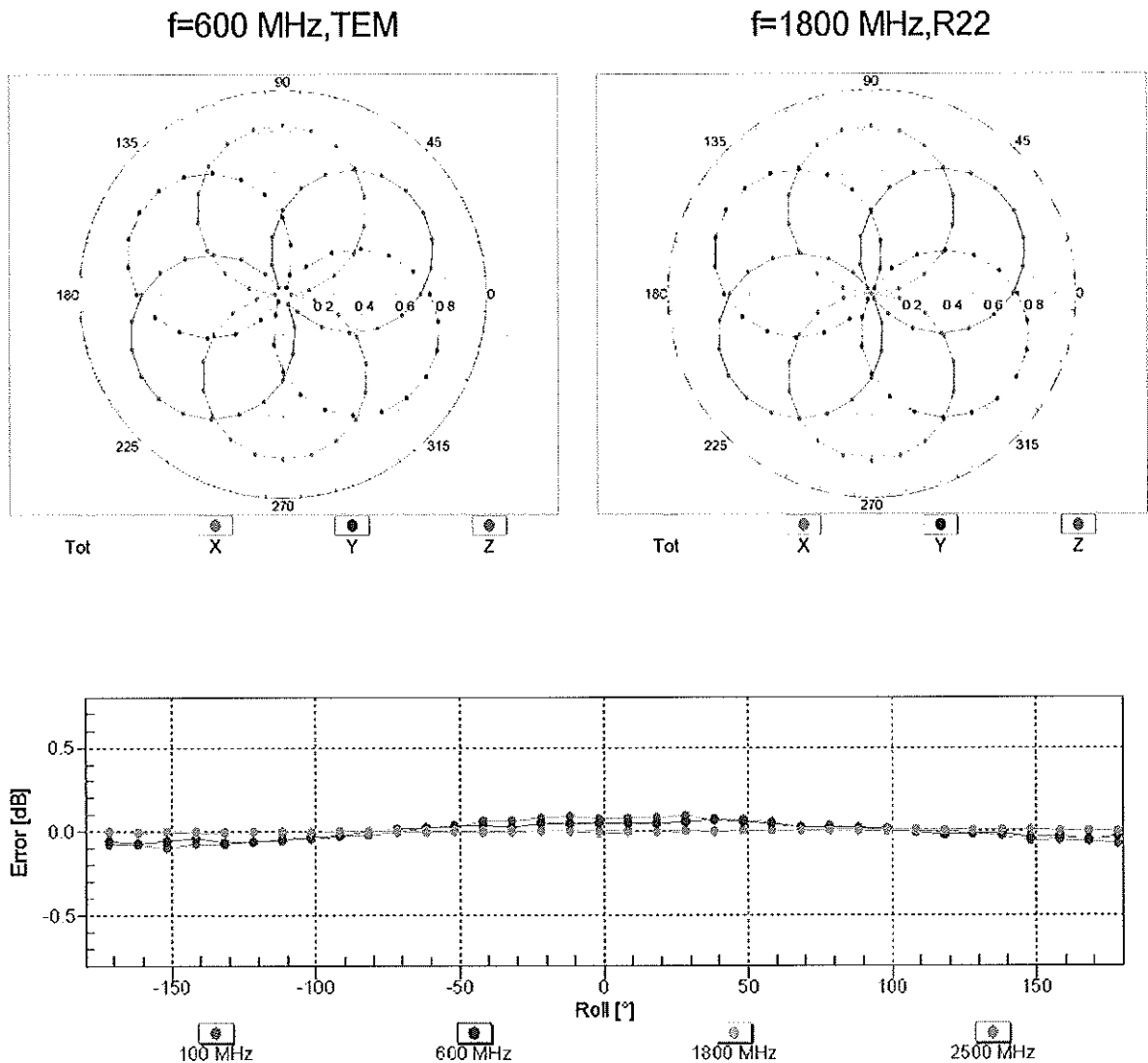
## Frequency Response of E-Field

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



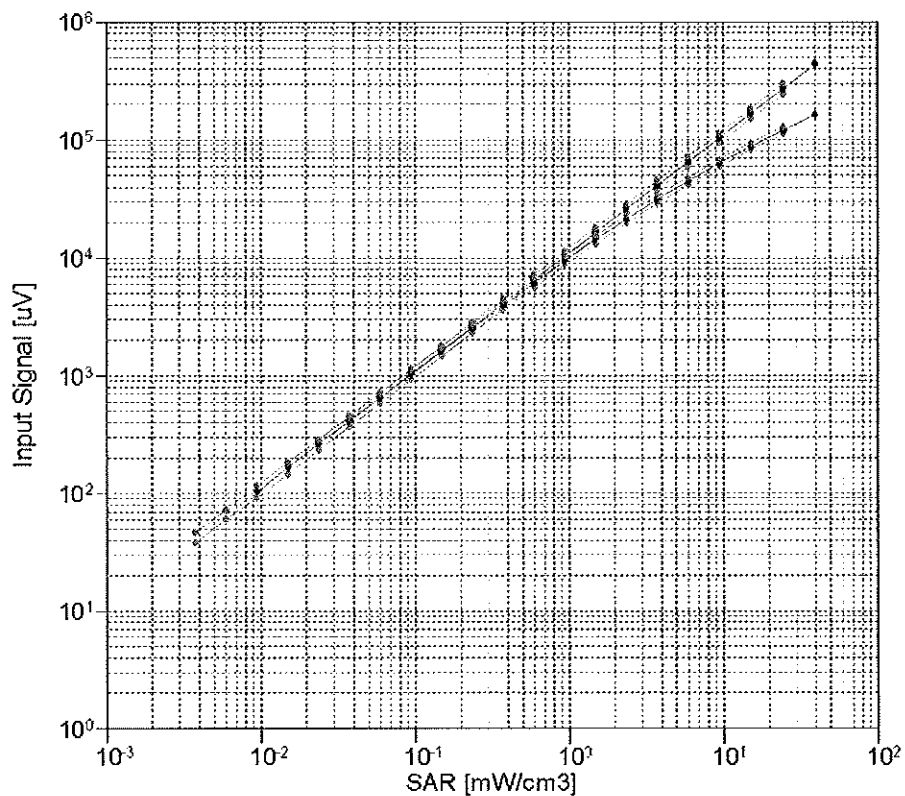
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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

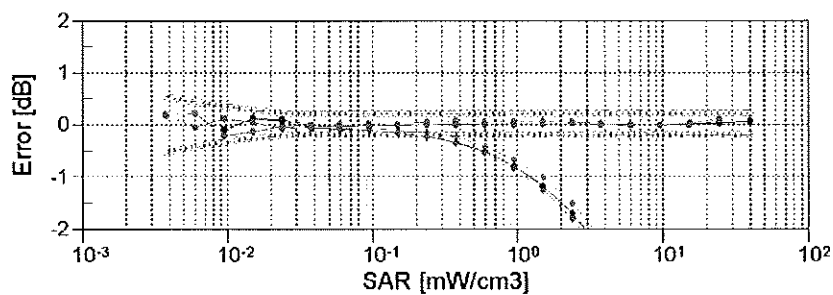


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

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



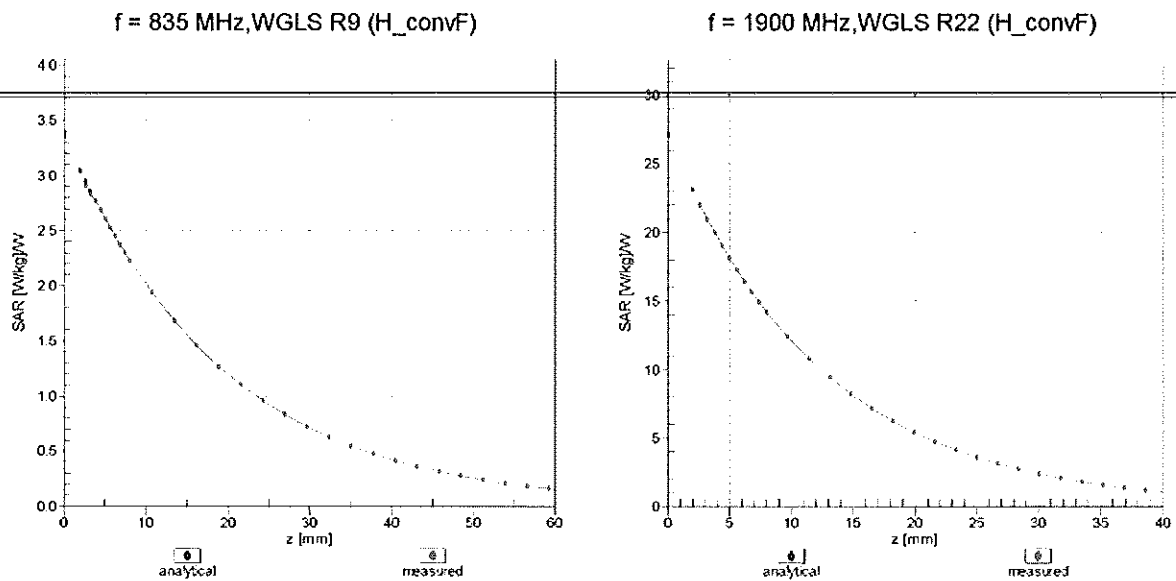
X compensated  
 X not compensated  
 Y compensated  
 Y not compensated  
 Z compensated  
 Z not compensated



X compensated  
 X not compensated  
 Y compensated  
 Y not compensated  
 Z compensated  
 Z not compensated

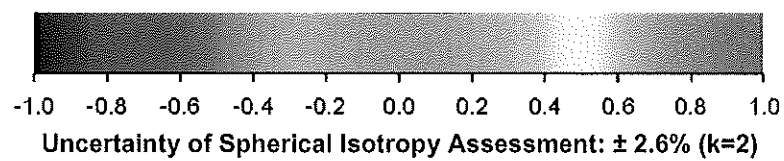
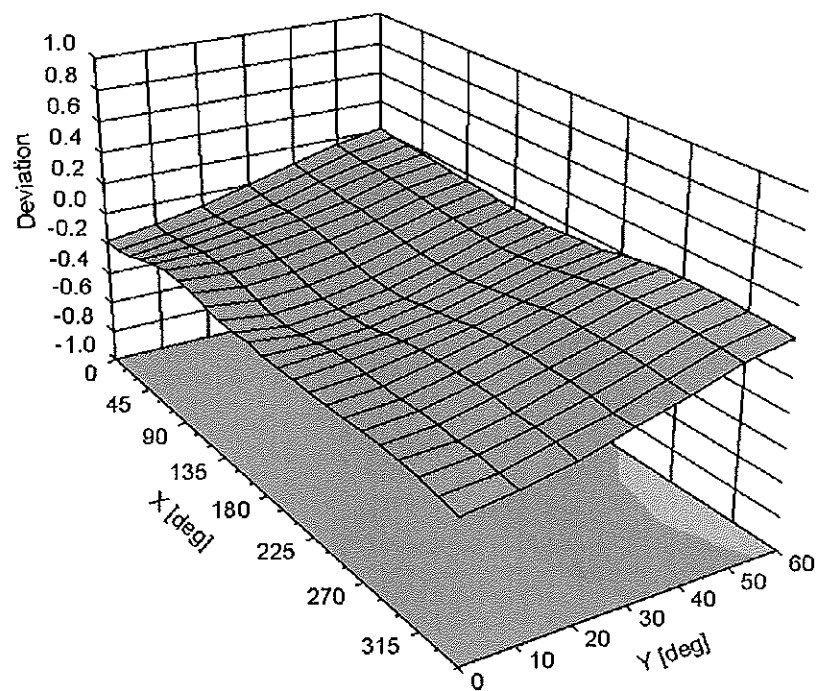
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

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



## DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

### Other Probe Parameters

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

## **Additional Conversion Factors**

for Dosimetric E-Field Probe

Type:

**ES3DV2**

Serial Number:

**3022**

Place of Assessment:

**Zurich**

Date of Assessment:

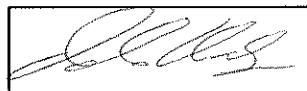
**August 29, 2011**

Probe Calibration Date:

**August 25, 2011**

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. The evaluation is coupled with measured conversion factors (probe calibration date indicated above). The uncertainty of the numerical assessment is based on the extrapolation from measured value at 835 MHz or at 1750 MHz.

Assessed by:



## Dosimetric E-Field Probe ES3DV2 SN:3022

Conversion factor ( $\pm$  standard deviation)

550  $\pm$  50 MHz      *ConvF*      6.57  $\pm$  7%

$\epsilon_r = 56.3 \pm 5\%$   
 $\sigma = 0.95 \pm 5\%$  mho/m  
(body tissue)

650  $\pm$  50 MHz      *ConvF*      6.16  $\pm$  7%

$\epsilon_r = 55.9 \pm 5\%$   
 $\sigma = 0.95 \pm 5\%$  mho/m  
(body tissue)

### Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

**Please see also DASY Manual.**



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Client **PC Test**

Certificate No: **ES3-3258\_Feb12**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3258**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4  
Calibration procedure for dosimetric E-field probes**

Calibration date: **February 21, 2012**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID              | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 31-Mar-11 (No. 217-01372)         | Apr-12                 |
| Power sensor E4412A        | MY41498087      | 31-Mar-11 (No. 217-01372)         | Apr-12                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 29-Mar-11 (No. 217-01369)         | Apr-12                 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 29-Mar-11 (No. 217-01367)         | Apr-12                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 29-Mar-11 (No. 217-01370)         | Apr-12                 |
| Reference Probe ES3DV2     | SN: 3013        | 29-Dec-11 (No. ES3-3013_Dec11)    | Dec-12                 |
| DAE4                       | SN: 654         | 3-May-11 (No. DAE4-654_May11)     | May-12                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Apr-11)  | In house check: Apr-13 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-11) | In house check: Oct-12 |

|                                                                                                                 |                                |                                          |               |
|-----------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------|---------------|
| Calibrated by:                                                                                                  | Name<br><b>Claudio Leubler</b> | Function<br><b>Laboratory Technician</b> | Signature<br> |
| Approved by:                                                                                                    | <b>Katja Pokovic</b>           | <b>Technical Manager</b>                 |               |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. |                                |                                          |               |

Issued: February 23, 2012



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Multilateral Agreement for the recognition of calibration certificates

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 $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center),<br>i.e., $\vartheta = 0$ 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  $\vartheta = 0$  ( $f \leq 900$  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.
- DCP<sub>x,y,z</sub>**: 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>; VR<sub>x,y,z</sub>**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<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.

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# Probe ES3DV3

## SN:3258

Manufactured: January 25, 2010  
Calibrated: February 21, 2012

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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3258

### Basic Calibration Parameters

|                                                    | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|----------------------------------------------------|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V/m})^2$ ) <sup>A</sup> | 1.29     | 1.18     | 1.23     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                              | 101.6    | 105.0    | 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    | 115.9    | $\pm 3.0 \%$              |
|       |                           |      | Y | 0.00    | 0.00    | 1.00    | 107.9    |                           |
|       |                           |      | Z | 0.00    | 0.00    | 1.00    | 115.8    |                           |

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

<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: ES3DV3 - SN:3258

### 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) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 41.9                               | 0.89                            | 6.26    | 6.26    | 6.26    | 0.43  | 1.49       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 6.01    | 6.01    | 6.01    | 0.45  | 1.48       | ± 12.0 %    |
| 1640                 | 40.3                               | 1.29                            | 5.46    | 5.46    | 5.46    | 0.61  | 1.30       | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 5.30    | 5.30    | 5.30    | 0.67  | 1.30       | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 5.17    | 5.17    | 5.17    | 0.79  | 1.23       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.46    | 4.46    | 4.46    | 0.67  | 1.40       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 4.31    | 4.31    | 4.31    | 0.80  | 1.33       | ± 12.0 %    |

<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: ES3DV3 - SN:3258

### Calibration Parameter Determined in Body Tissue Simulating Media

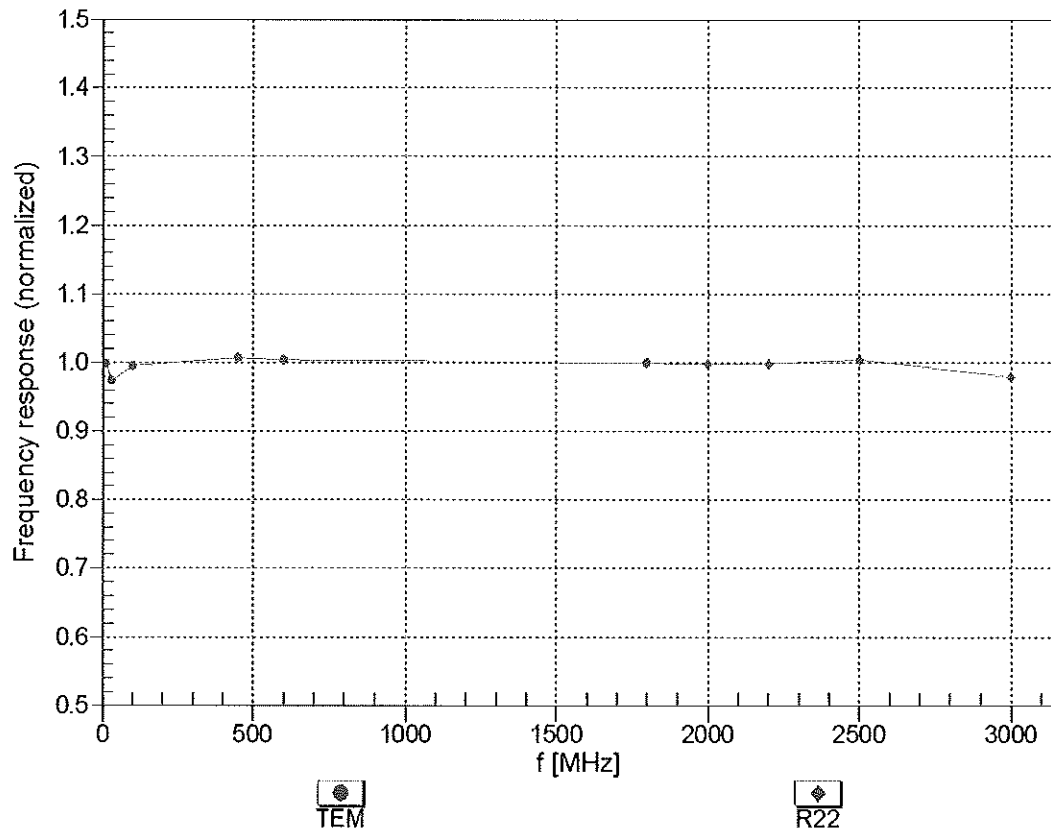
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 55.5                               | 0.96                            | 6.21    | 6.21    | 6.21    | 0.80  | 1.13       | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 6.06    | 6.06    | 6.06    | 0.50  | 1.46       | ± 12.0 %    |
| 1640                 | 53.8                               | 1.40                            | 5.45    | 5.45    | 5.45    | 0.80  | 1.23       | ± 12.0 %    |
| 1750                 | 53.4                               | 1.49                            | 4.99    | 4.99    | 4.99    | 0.60  | 1.48       | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 4.70    | 4.70    | 4.70    | 0.56  | 1.57       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 4.28    | 4.28    | 4.28    | 0.80  | 1.08       | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 4.05    | 4.05    | 4.05    | 0.80  | 1.02       | ± 12.0 %    |

<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.

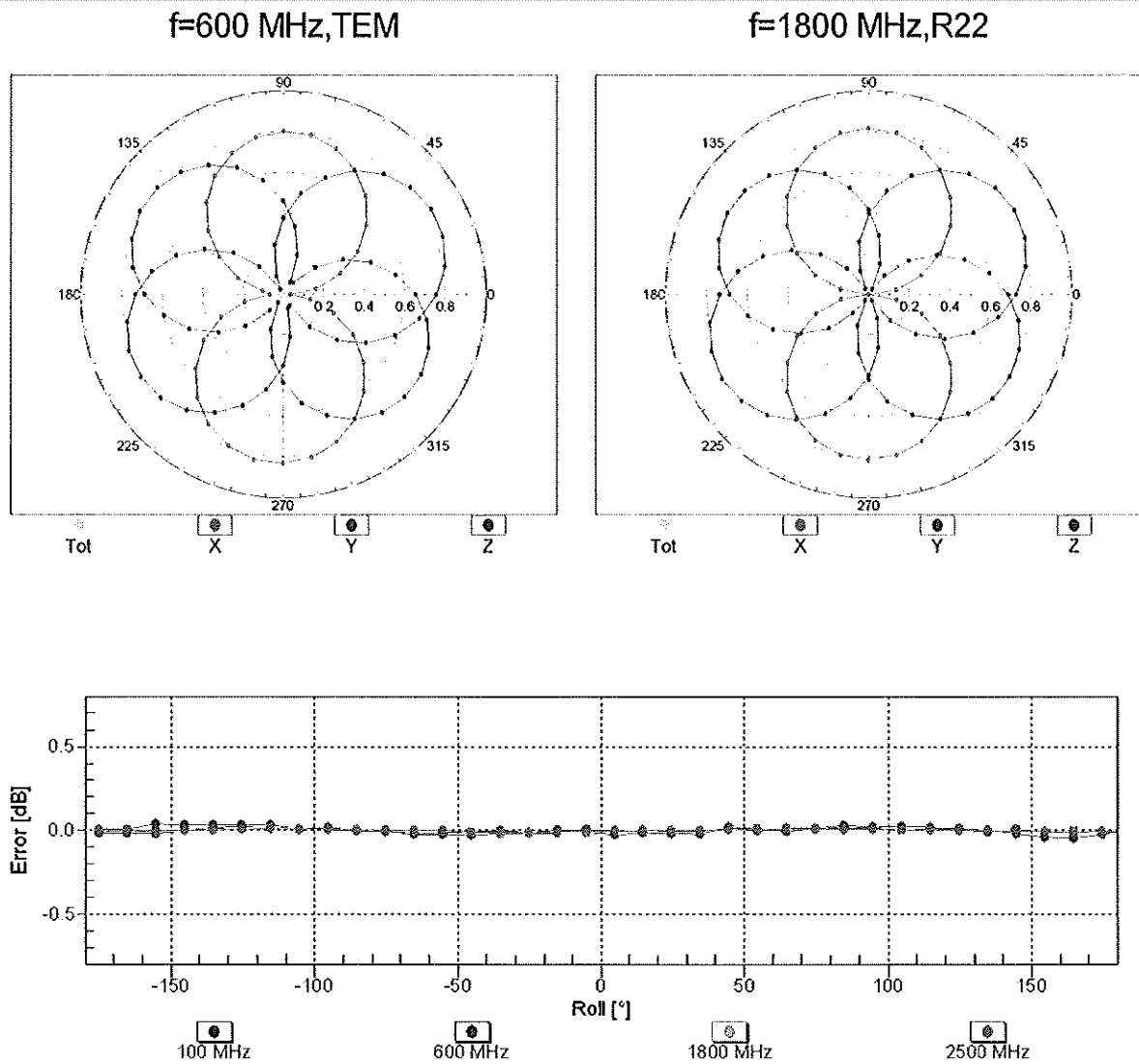
## Frequency Response of E-Field

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



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

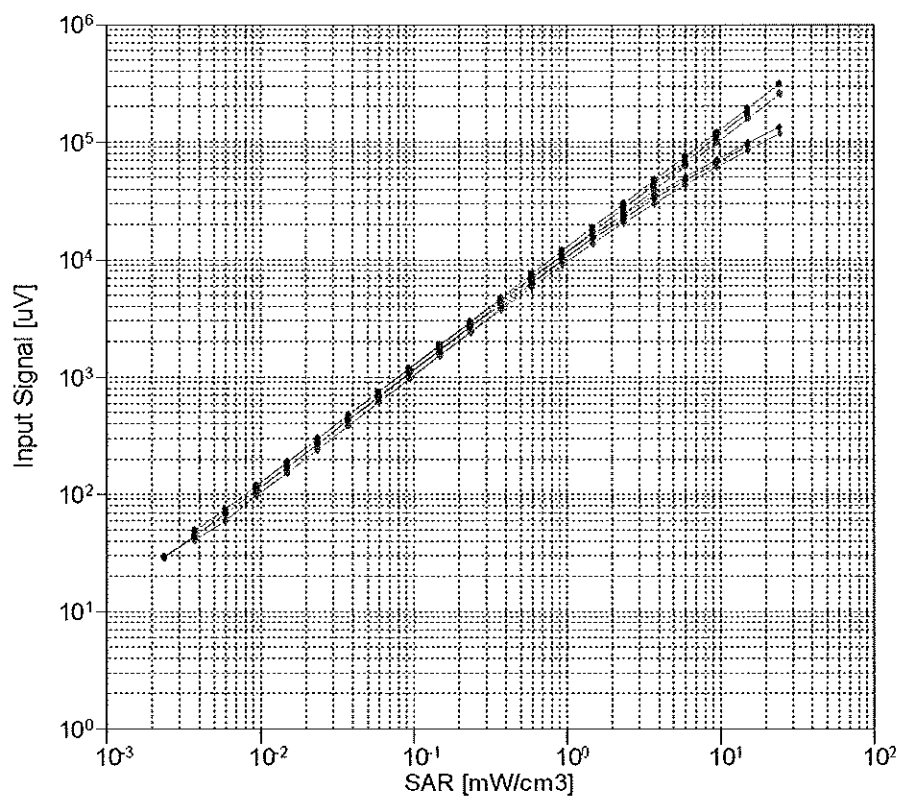
## Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$



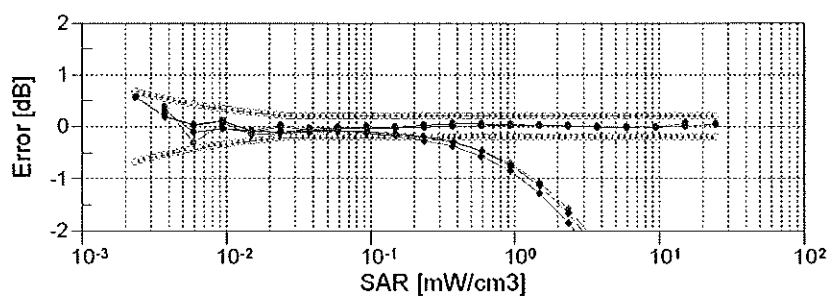
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

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

(TEM cell ,  $f = 900 \text{ MHz}$ )



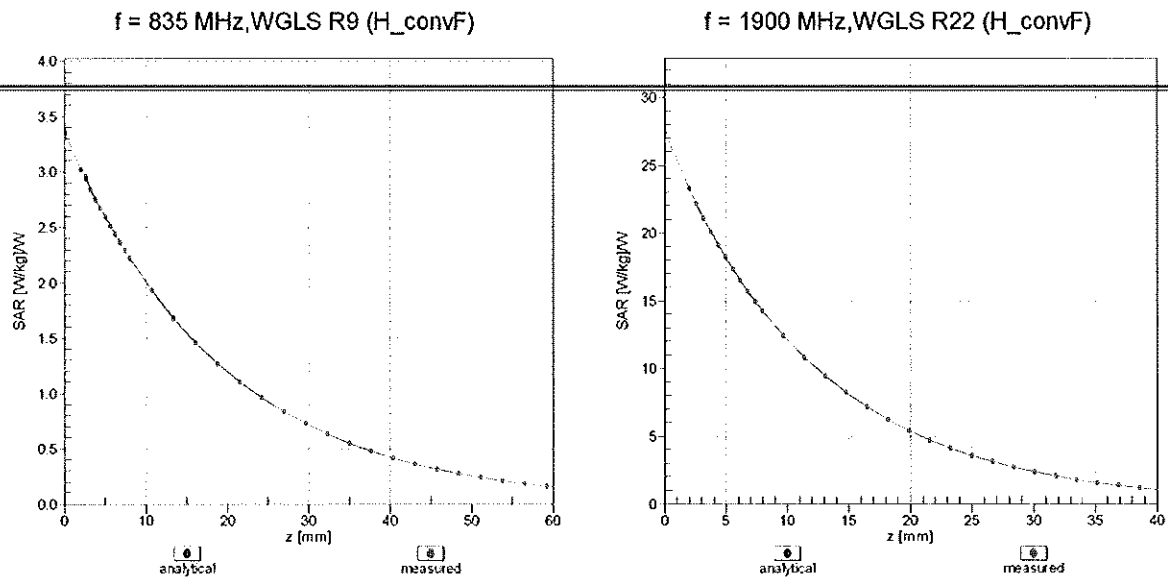
X compensated      X not compensated      Y compensated  
 Y not compensated      Z compensated      Z not compensated



X compensated      X not compensated      Y compensated  
 Y not compensated      Z compensated      Z not compensated

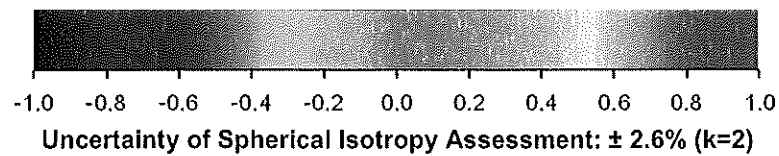
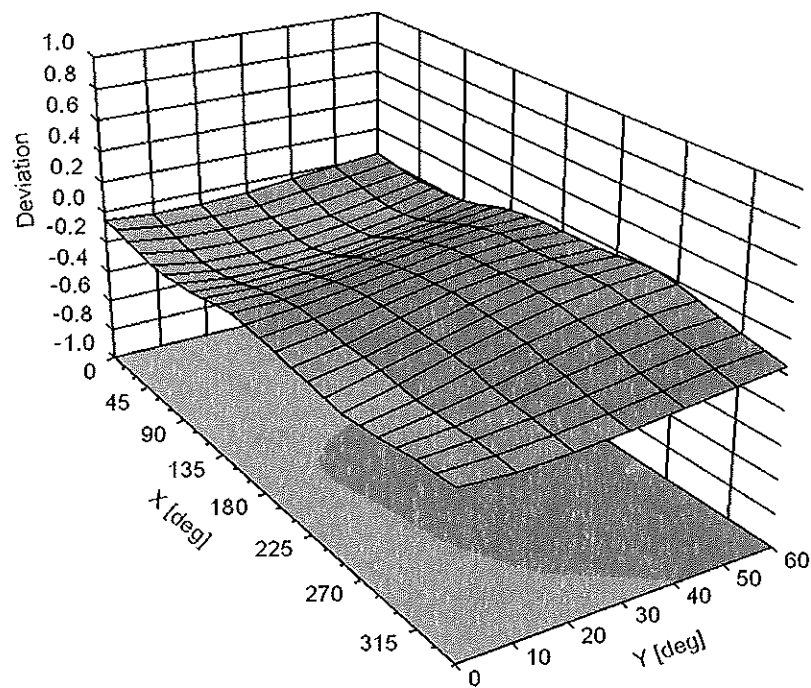
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

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



## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3258

### Other Probe Parameters

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



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Client **PC Test**

Certificate No: **ES3-3263\_Jul11**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3263**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4**  
**Calibration procedure for dosimetric E-field probes**

Calibration date: **July 11, 2011**

✓ KOK  
11/07/11

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID              | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 31-Mar-11 (No. 217-01372)         | Apr-12                 |
| Power sensor E4412A        | MY41498087      | 31-Mar-11 (No. 217-01372)         | Apr-12                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 29-Mar-11 (No. 217-01369)         | Apr-12                 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 29-Mar-11 (No. 217-01367)         | Apr-12                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 29-Mar-11 (No. 217-01370)         | Apr-12                 |
| Reference Probe ES3DV2     | SN: 3013        | 29-Dec-10 (No. ES3-3013_Dec10)    | Dec-11                 |
| DAE4                       | SN: 654         | 3-May-11 (No. DAE4-654_May11)     | May-12                 |
| 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 |

|                                                                                                                 |                              |                                   |                       |
|-----------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------------------|-----------------------|
| Calibrated by:                                                                                                  | Name<br><b>Jeton Kasrati</b> | Function<br>Laboratory Technician | Signature<br>         |
| Approved by:                                                                                                    | Name<br><b>Katja Pokovic</b> | Function<br>Technical Manager     | Signature<br>         |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. |                              |                                   | Issued: July 20, 2011 |



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### 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 $\phi$      | $\phi$ rotation around probe axis                                                                                                                       |
| Polarization $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center),<br>i.e., $\vartheta = 0$ 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  $\vartheta = 0$  ( $f \leq 900$  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*.
- DCP<sub>x,y,z</sub>**: 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>; VR<sub>x,y,z</sub>**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<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.

---

# Probe ES3DV3

## SN:3263

Manufactured: January 25, 2010  
Calibrated: July 11, 2011

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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3263

### Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|-----------------------------------------------------------|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 1.22     | 1.25     | 1.12     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                                     | 101.4    | 98.6     | 106.1    |               |

### 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    | 110.6    | $\pm 2.2 \%$              |
|       |                           |      | Y | 0.00    | 0.00    | 1.00    | 109.0    |                           |
|       |                           |      | Z | 0.00    | 0.00    | 1.00    | 105.9    |                           |

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: ES3DV3 - SN:3263

### Calibration Parameter Determined in Head Tissue Simulating Media

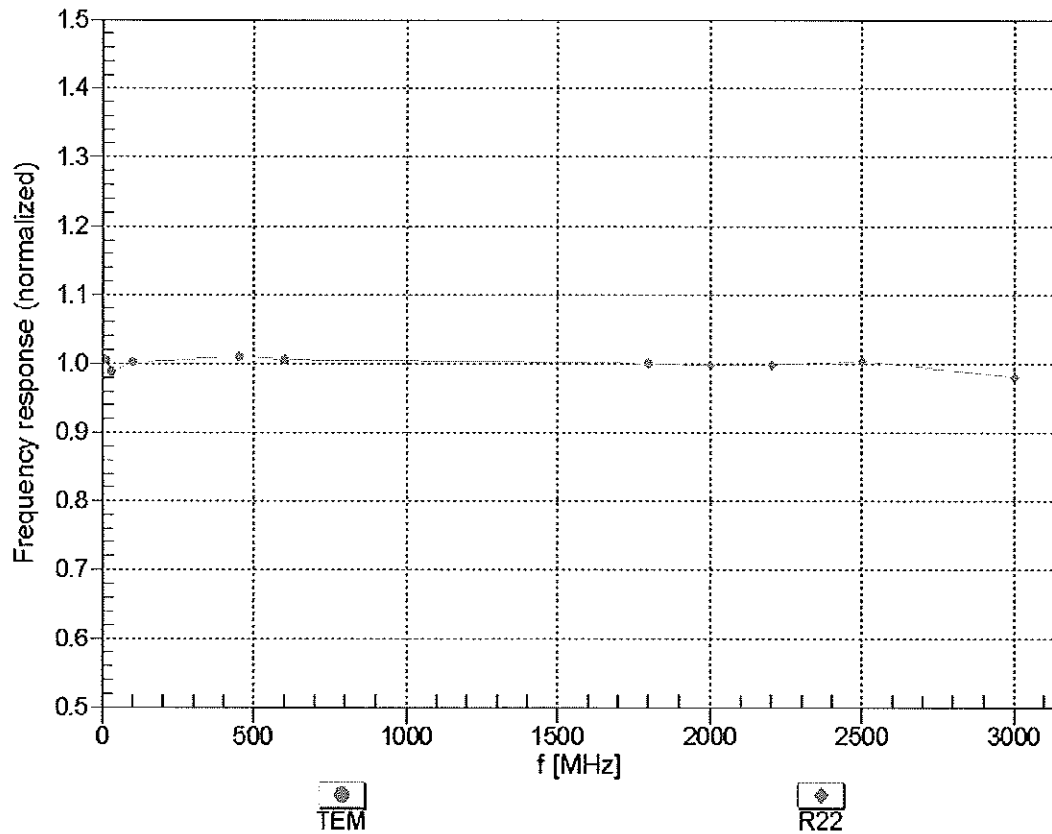
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 1900                 | 40.0                               | 1.40                            | 5.21    | 5.21    | 5.21    | 0.92  | 1.13       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 6.28    | 6.28    | 6.28    | 0.99  | 1.13       | ± 12.0 %    |

<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.

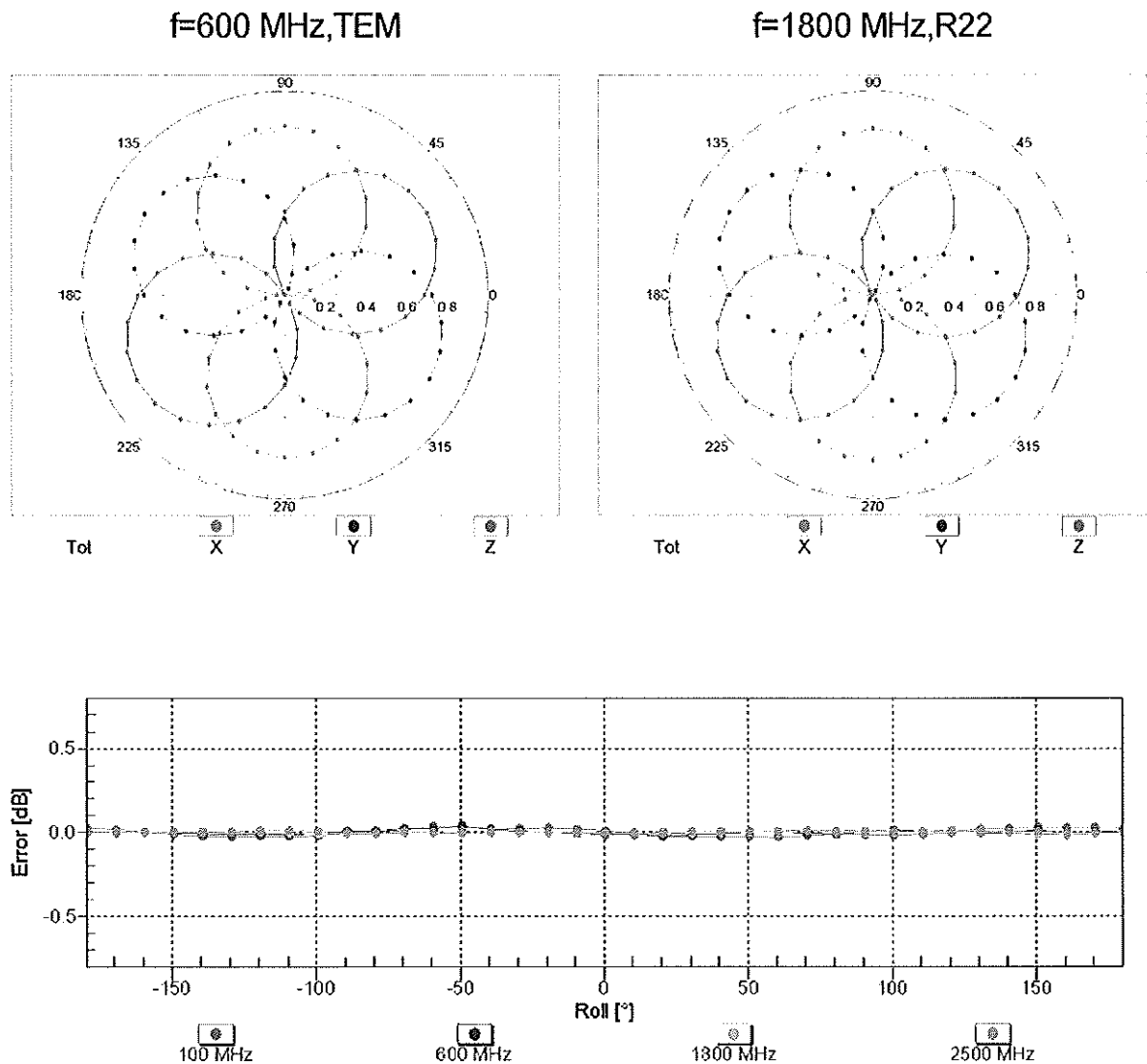
## Frequency Response of E-Field

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



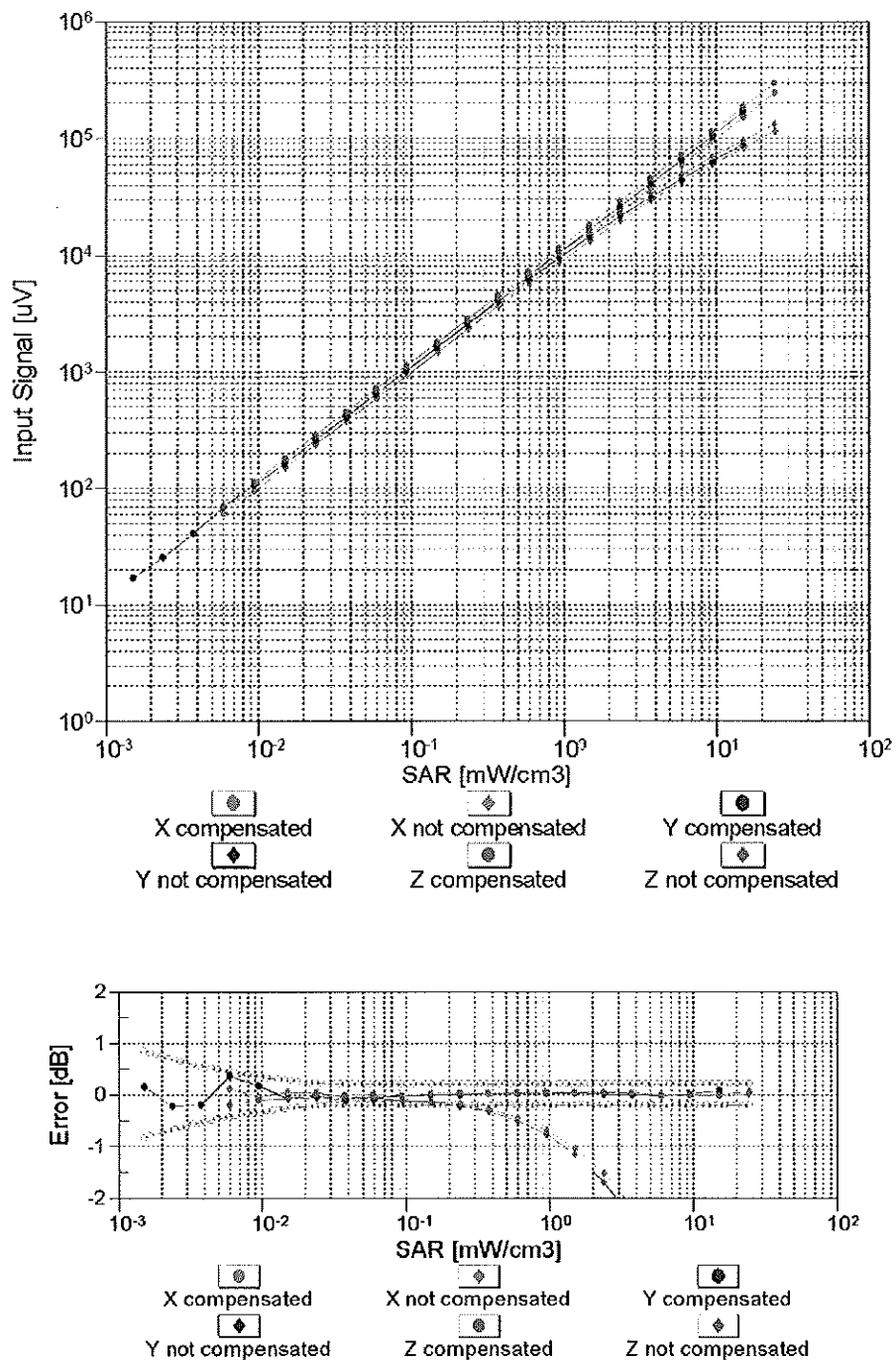
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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



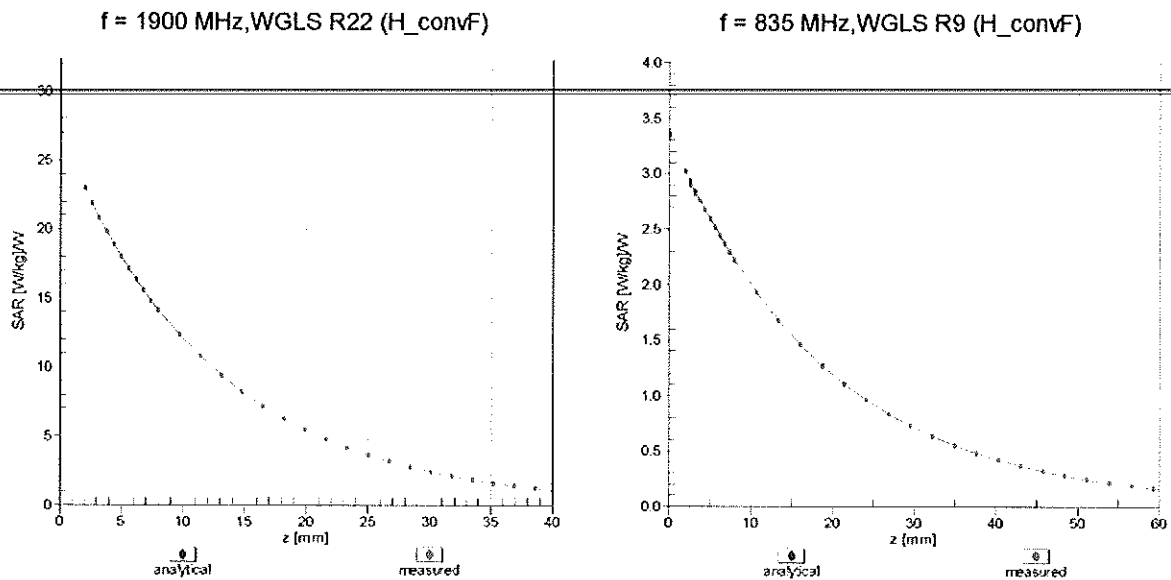
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

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



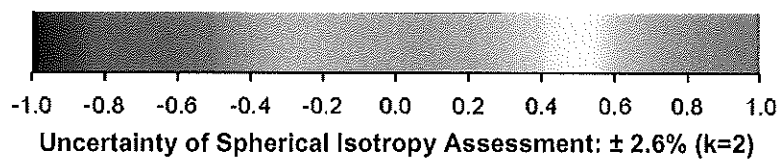
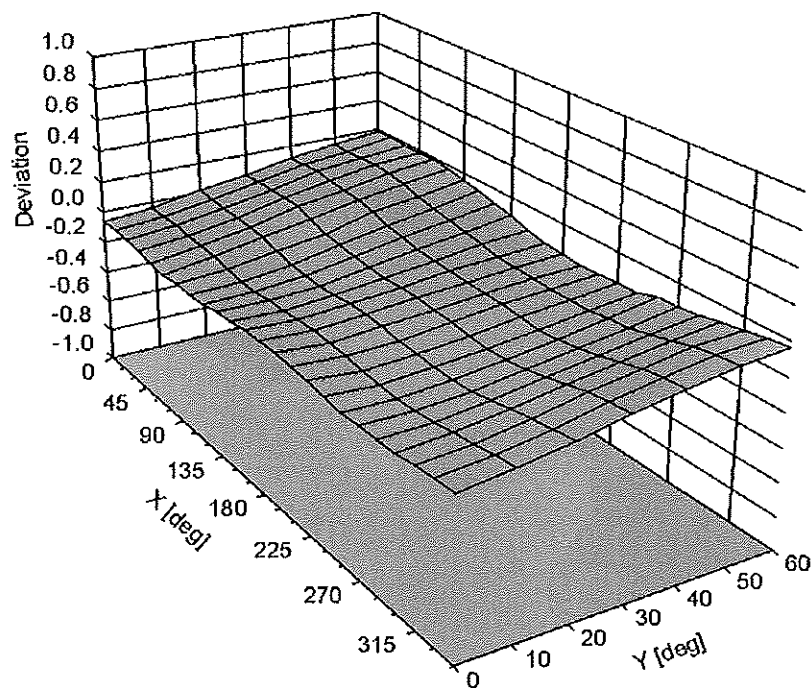
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

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



## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3263

### Other Probe Parameters

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



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3263\_Nov11**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3263**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4  
Calibration procedure for dosimetric E-field probes**

Calibration date: **November 18, 2011 (Additional Conversion Factors)**

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      | 31-Mar-11 (No. 217-01372)         | Apr-12                 |
| Power sensor E4412A        | MY41498087      | 31-Mar-11 (No. 217-01372)         | Apr-12                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 29-Mar-11 (No. 217-01369)         | Apr-12                 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 29-Mar-11 (No. 217-01367)         | Apr-12                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 29-Mar-11 (No. 217-01370)         | Apr-12                 |
| Reference Probe ES3DV2     | SN: 3013        | 29-Dec-10 (No. ES3-3013_Dec10)    | Dec-11                 |
| DAE4                       | SN: 654         | 3-May-11 (No. DAE4-654_May11)     | May-12                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Apr-11)  | In house check: Apr-13 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-11) | In house check: Oct-12 |

|                                                                                                                 | Name           | Function              | Signature |
|-----------------------------------------------------------------------------------------------------------------|----------------|-----------------------|-----------|
| Calibrated by:                                                                                                  | Jeton Kastrali | Laboratory Technician |           |
| Approved by:                                                                                                    | Katja Pokovic  | Technical Manager     |           |
| Issued: November 19, 2011                                                                                       |                |                       |           |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. |                |                       |           |



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### Glossary:

|                          |                                                                                                                                                         |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| TSL                      | tissue simulating liquid                                                                                                                                |
| 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 $\phi$      | $\phi$ rotation around probe axis                                                                                                                       |
| Polarization $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center),<br>i.e., $\vartheta = 0$ 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  $\vartheta = 0$  ( $f \leq 900$  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  $E^2$ -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**.
- DCP<sub>x,y,z</sub>**: 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>; VR<sub>x,y,z</sub>**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<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.

---

# Probe ES3DV3

## SN:3263

### **Additional Conversion Factors**

Manufactured: January 25, 2010  
Calibrated: November 18, 2011

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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3263

### Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|-----------------------------------------------------------|----------|----------|----------|-----------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 1.22     | 1.25     | 1.12     | ± 10.1 %  |
| DCP (mV) <sup>B</sup>                                     | 101.4    | 98.6     | 106.1    |           |

### 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    | 110.6    | ±2.2 %                    |
|       |                           |      | Y | 0.00    | 0.00    | 1.00    | 109.0    |                           |
|       |                           |      | Z | 0.00    | 0.00    | 1.00    | 105.9    |                           |

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<sup>2</sup>-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: ES3DV3 - SN:3263

### 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) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 41.9                               | 0.89                            | 6.41    | 6.41    | 6.41    | 0.80  | 1.00       | ± 12.0 %    |
| 1640                 | 40.3                               | 1.29                            | 5.49    | 5.49    | 5.49    | 0.80  | 1.00       | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 5.38    | 5.38    | 5.38    | 0.80  | 1.00       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.55    | 4.55    | 4.55    | 0.80  | 1.25       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 4.39    | 4.39    | 4.39    | 0.80  | 1.29       | ± 12.0 %    |

<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: ES3DV3- SN:3263

### Calibration Parameter Determined in Body Tissue Simulating Media

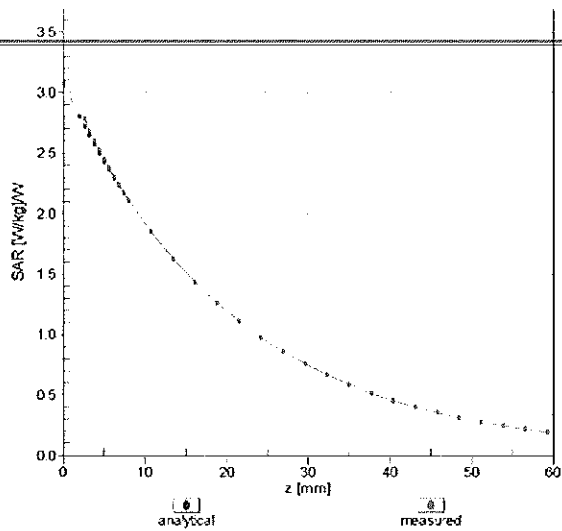
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 55.5                               | 0.96                            | 6.29    | 6.29    | 6.29    | 0.80  | 1.28       | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 6.22    | 6.22    | 6.22    | 0.80  | 1.00       | ± 12.0 %    |
| 1640                 | 53.8                               | 1.40                            | 5.40    | 5.40    | 5.40    | 0.80  | 1.29       | ± 12.0 %    |
| 1750                 | 53.4                               | 1.49                            | 5.02    | 5.02    | 5.02    | 0.80  | 1.35       | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 4.81    | 4.81    | 4.81    | 0.80  | 1.33       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 4.43    | 4.43    | 4.43    | 0.80  | 1.00       | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 4.28    | 4.28    | 4.28    | 0.80  | 1.00       | ± 12.0 %    |

<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.

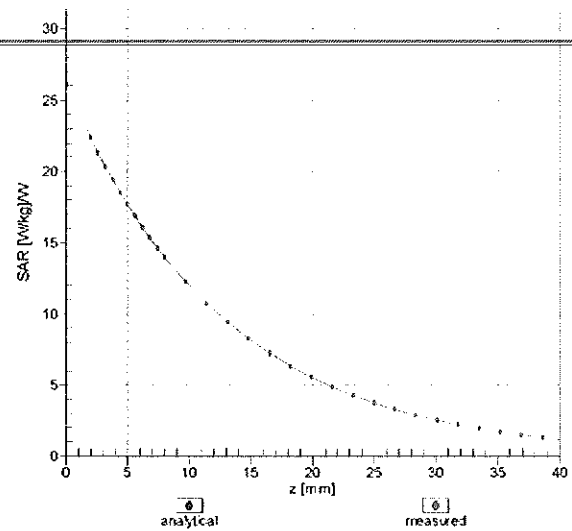
<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted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

## Conversion Factor Assessment

$f = 750 \text{ MHz}$ , WGLS R9 ( $H_{\text{convF}}$ )

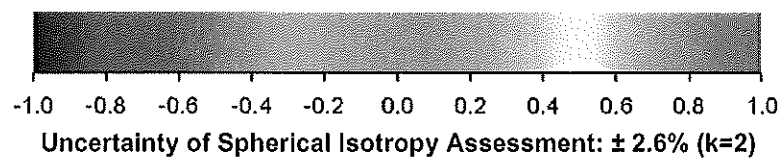
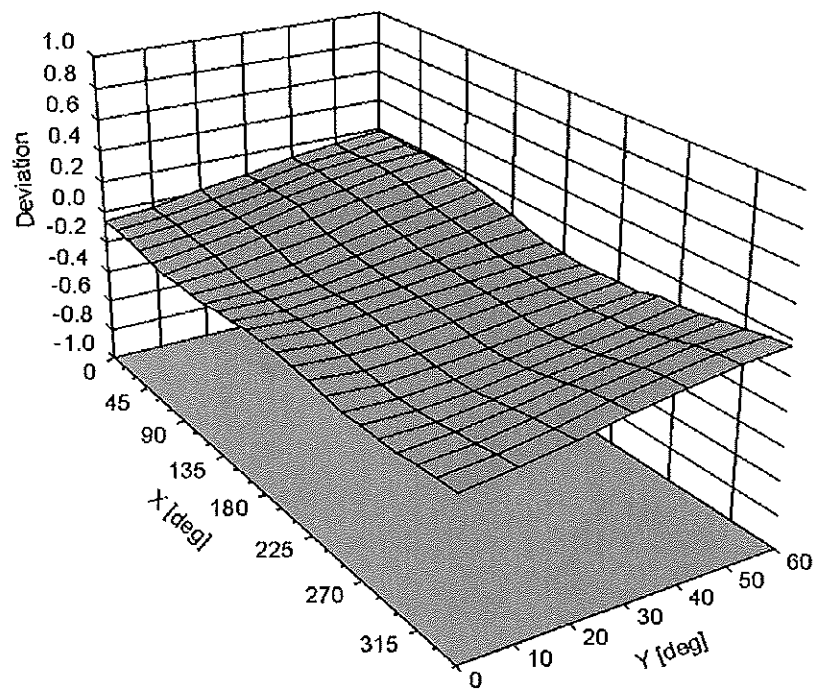


$f = 1750 \text{ MHz}$ , WGLS R22 ( $H_{\text{convF}}$ )



## Deviation from Isotropy in Liquid

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



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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3263

### Other Probe Parameters

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