



## 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:**

06/27/12 - 07/02/12

**Test Site/Location:**

PCTEST Lab, Columbia, MD, USA

**Document Serial No.:**

0Y1206260868.A3L

**FCC ID:**

**A3LSPHM830**

**APPLICANT:**

**SAMSUNG ELECTRONICS CO., LTD.**

**DUT Type:**

Portable Handset

**Application Type:**

Certification

**FCC Rule Part(s):**

CFR §2.1093

**Model(s):**

SPH-M830

**Test Device Serial No.:**

Pre-Production [S/N: 73]

| Band & Mode                                 | Tx Frequency          | Conducted Power [dBm] | SAR              |                       |
|---------------------------------------------|-----------------------|-----------------------|------------------|-----------------------|
|                                             |                       |                       | 1 gm Head (W/kg) | 1 gm Body-Worn (W/kg) |
| PCS CDMA/EVDO                               | 1851.25 - 1908.75 MHz | 25.31                 | 0.92             | 0.65                  |
| 2.4 GHz WLAN                                | 2412 - 2462 MHz       | 15.62                 | 0.12             | 0.06                  |
| 5.8 GHz WLAN                                | 5745 - 5825 MHz       | 11.62                 | 0.03             | 0.07                  |
| 5.2 GHz WLAN                                | 5180 - 5240 MHz       | 11.34                 | 0.06             | 0.05                  |
| 5.3 GHz WLAN                                | 5260 - 5320 MHz       | 11.35                 | 0.07             | 0.05                  |
| 5.5 GHz WLAN                                | 5500 - 5700 MHz       | 11.44                 | 0.03             | 0.07                  |
| Bluetooth                                   | 2402 - 2480 MHz       | 9.70                  | N/A              |                       |
| <b>Simultaneous SAR per KDB 690783 D01:</b> |                       |                       | 0.98             | 0.72                  |

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



|                                          |                                                                                     |                                      |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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| <b>Document S/N:</b><br>0Y1206260868.A3L | <b>Test Dates:</b><br>06/27/12 - 07/02/12                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 1 of 31                           |

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# 1 DEVICE UNDER TEST

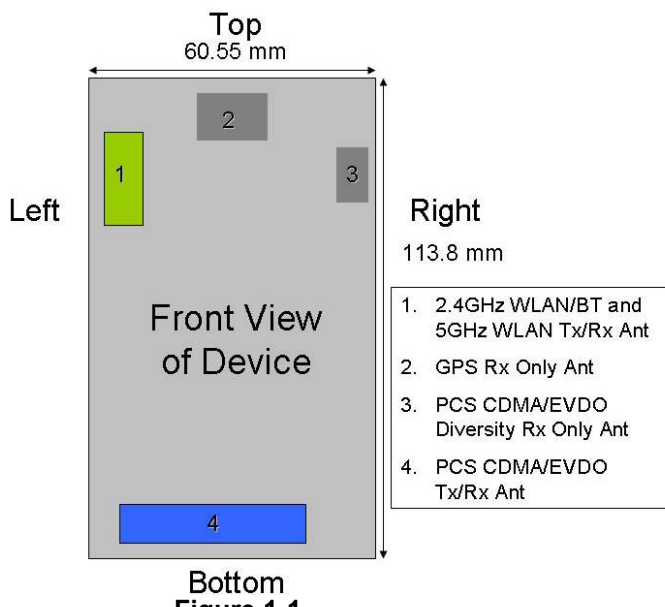
## 1.1 Device Overview

| Band & Mode   | Tx Frequency          |
|---------------|-----------------------|
| PCS CDMA/EVDO | 1851.25 - 1908.75 MHz |
| 2.4 GHz WLAN  | 2412 - 2462 MHz       |
| 5.8 GHz WLAN  | 5745 - 5825 MHz       |
| 5.2 GHz WLAN  | 5180 - 5240 MHz       |
| 5.3 GHz WLAN  | 5260 - 5320 MHz       |
| 5.5 GHz WLAN  | 5500 - 5700 MHz       |
| Bluetooth     | 2402 - 2480 MHz       |

## 1.2 Wireless Router (Hotspot) Capability

Wireless router capability for this device is disabled. Therefore, Hotspot SAR was not evaluated for this device.

## 1.3 DUT Antenna Locations



|                                   |                                        |                               |         |                                 |
|-----------------------------------|----------------------------------------|-------------------------------|---------|---------------------------------|
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## 1.4 SAR Test Exclusions Applied

### (A) WIFI/BT

The separation between the main antenna and the Bluetooth/WLAN antenna is 73 mm.  
RF Conducted Power of Bluetooth Tx is 9.333 mW (Please refer to the EMC DSS Report for a full set of Bluetooth conducted powers).

2.4 GHz and 5 GHz WIFI and Bluetooth share the same antenna path and cannot transmit simultaneously.

Per KDB Publication 648474, **Bluetooth SAR was not required** based on the maximum conducted power, the Bluetooth/WLAN to main antenna separation distance and Body-SAR of the main antenna.

### (B) Licensed Transmitter

This device supports 1x Advanced. Per October 2011 TCB Workshop Notes, **1x Advanced SAR was not required** based on the maximum conducted power and the measured SAR for all 1x mode exposure conditions.

## 1.5 Power Reduction for SAR

There is no power reduction for any band/mode implemented in this device for SAR purposes.

## 1.6 Guidance Applied

- FCC OET Bulletin 65 Supplement C [June 2001]
- IEEE 1528-2003
- FCC KDB 941225 (2G/3G)
- FCC KDB 248227 (802.11)
- FCC KDB 865664 (5 GHz)
- FCC KDB 648474 (Simultaneous)
- October 2011 TCB Workshop Notes (1x Advanced)

|                                   |                                                                                     |                               |                                                                                       |                                 |
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## 2

## 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.

### 2.1 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 2-1).

Equation 2-1  
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 ( $\text{kg/m}^3$ )
- 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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### 3 SAR MEASUREMENT SETUP

#### 3.1 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 3-1**  
**SAR Measurement System**



**Figure 3-2**  
**Near-Field Probe**

**Table 3-1**  
**Composition of the Tissue Equivalent Matter**

| Frequency (MHz)                | 1900  | 1900  | 2450  | 2450 | 5200-5800 | 5200-5800 |
|--------------------------------|-------|-------|-------|------|-----------|-----------|
| Tissue                         | Head  | Body  | Head  | Body | Head      | Body      |
| Ingredients (% by weight)      |       |       |       |      |           |           |
| DGBE                           | 44.92 | 29.44 | 7.99  | 26.7 |           |           |
| NaCl                           | 0.18  | 0.39  | 0.16  | 0.1  |           |           |
| Triton X-100                   |       |       | 19.97 |      | 17.24     |           |
| Diethylenglycol monohexylether |       |       |       |      | 17.24     |           |
| Polysorbate (Tween) 80         |       |       |       |      |           | 20        |
| Water                          | 54.9  | 70.17 | 71.88 | 73.2 | 65.52     | 80        |

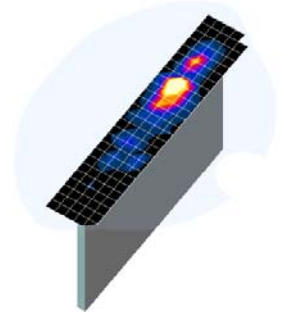
|                                          |                                                                                     |                                      |                                                                                       |                                        |
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## 4 DOSIMETRIC ASSESSMENT

### 4.1 Measurement Procedure

The evaluation was performed using the following procedure:

1. The SAR distribution at the exposed side of the head or 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.
5. For testing 5 GHz devices, finer resolution zoom scans were performed as specified by FCC SAR Measurement Requirements for 3 – 6 GHz, KDB 865664 publication. The 5 GHz zoom scan requires a minimum volume of 24mm x 24mm x 20mm and 7 x 7 x 11 points.



**Figure 4-1**  
**Sample SAR Area Scan**

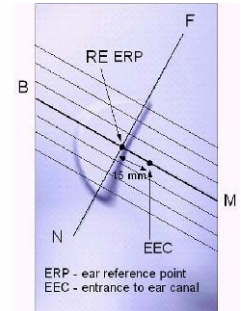
|                                          |                                                                                     |                                      |                                                                                       |                                        |
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## 5

## DEFINITION OF REFERENCE POINTS

### 5.1 EAR REFERENCE POINT

Figure 5-2 shows the front, back and side views of the SAM Twin Phantom. The point “M” is the reference point for the center of the mouth, “LE” is the left ear reference point (ERP), and “RE” is the right ERP. The ERP is 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 5-1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front) is perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Figure 5-2). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].



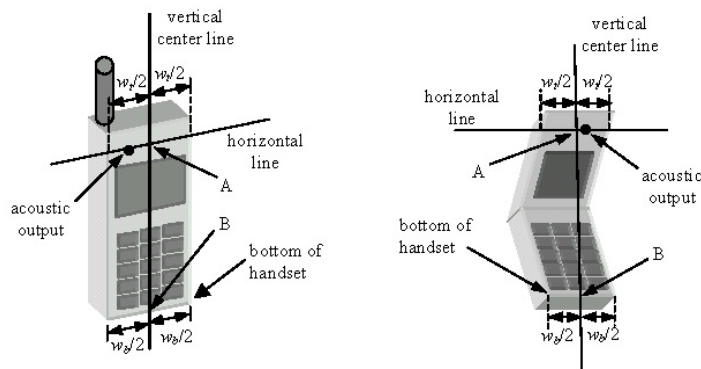
**Figure 5-1**  
Close-Up Side view  
of ERP

### 5.2 HANDSET REFERENCE POINTS

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the “test device reference point” located along the “vertical centerline” on the front of the device aligned to the “ear reference point” (See Figure 5-3). The “test device reference point” was then located at the same level as the center of the ear reference point. The test device was positioned so that the “vertical centerline” was bisecting the front surface of the handset at it’s top and bottom edges, positioning the “ear reference point” on the outer surface of the both the left and right head phantoms on the ear reference point.



**Figure 5-2**  
Front, back and side view of SAM Twin Phantom



**Figure 5-3**  
Handset Vertical Center & Horizontal Line Reference Points

|                                   |                                                                                                                            |                               |                                                                                       |                                 |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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## 6 TEST CONFIGURATION POSITIONS FOR HANDSETS

### 6.1 Device Holder

The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity  $\epsilon = 3$  and loss tangent  $\delta = 0.02$ .

### 6.2 Positioning for Cheek/Touch

1. The test device was positioned with the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 6-1), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

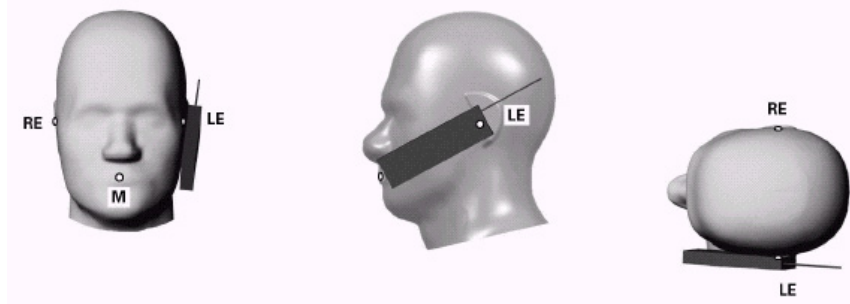


Figure 6-1 Front, Side and Top View of Cheek/Touch Position

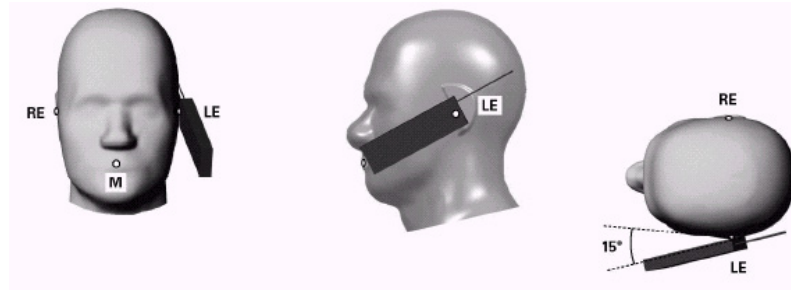
2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (reference plane).
4. The phone was then rotated around the vertical centerline until the phone (horizontal line) was symmetrical with respect to the line NF.
5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, the handset was rotated about the line NF until any point on the handset made contact with a phantom point below the ear (cheek) (See Figure 6-2).

### 6.3 Positioning for Ear / 15° Tilt

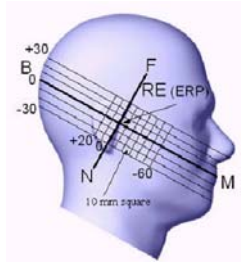
With the test device aligned in the “Cheek/Touch Position”:

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15degree.
2. The phone was then rotated around the horizontal line by 15 degree.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the phone touches the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. The tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 6-2).

|                                   |                                                                                                                            |                               |                                                                                       |                                 |
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**Figure 6-2 Front, Side and Top View of Ear/15° Tilt Position**



**Figure 6-3**  
**Side view w/ relevant markings**



**Figure 6-4 Body SAR Sample Photo**  
**(Not Actual EUT)**

## 6.4 Body-Worn Accessory Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 6-4). A device with a headset output is tested with a headset connected to the device.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented. Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

|                                          |                                                                                     |                                      |                                                                                       |                                        |
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## 7 FCC RF EXPOSURE LIMITS

### 7.1 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.

### 7.2 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 7-1**  
**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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## 8 FCC MEASUREMENT PROCEDURES

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

### 8.1 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.

### 8.2 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.

#### 8.2.1 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. SO55 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 8-1 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 SCH0 data rate.
4. Under RC3, C.S0011 Table 4.4.5.2-2, Table 8-2 was applied.
5. FCHs were configured at full rate for maximum SAR with "All Up" power control bits.

**Table 8-1**  
**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 8-2**  
**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  |

#### 8.2.2 CDMA2000 1x Advanced

This device additionally supports 1x Advanced. Conducted powers were measured using SO75 with RC8 on the uplink and RC11 on the downlink per Oct 2011 TCB Workshop notes. Smart blanking was disabled for all measurements. The EUT was configured with forward power control Mode 000 and reverse power control at 400 bps. Conducted powers were measured on an Agilent 8960 Series 10

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
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Wireless Communications Test Set, Model E5515C using the CDMA2000 1x Advanced application, Option E1962B-410.

Based on the maximum output power measured for 1x Advanced, SAR would have to be evaluated for 1x advanced if the maximum output for 1x Advanced is more than 0.25 dB higher than the maximum measured for 1x. Also, if the measured SAR in any 1x mode exposure conditions (head, body etc.) is larger than 1.2 W/kg, the highest of those configurations above 1.2 W/kg for each exposure condition in 1x Advanced has to be repeated. All measured SAR in 1x mode higher than 1.5 W/kg must be repeated for 1x Advanced.

### 8.2.3 Head SAR Measurements

SAR for head exposure configurations is measured in RC3 with the DUT configured to transmit at full rate using Loopback Service Option SO55. SAR for RC1 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel in RC1 using the exposure configuration that results in the highest SAR for that channel in RC3.

### 8.2.4 Body SAR Measurements

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 + SCH<sub>n</sub>) 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 + SCH<sub>n</sub>) with FCH at full rate and SCH<sub>0</sub> 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. Otherwise, SAR is measured on the maximum output channel in RC1; with Loopback Service Option SO55, at full rate, using the body exposure configuration that results in the highest SAR for that channel in RC3.

### 8.2.5 Handsets with EVDO

For handsets with Ev-Do capabilities, when the maximum average output of each channel in Rev. 0 is less than ¼ dB higher than that measured in RC3 (1x RTT), body SAR for EV-DO is not required. Otherwise, SAR for Rev. 0 is measured on the maximum output channel at 153.6 kbps using the body exposure configuration that results in the highest SAR for that channel in RC3. SAR for Rev. A is not required when the maximum average output of each channel is less than that measured in Rev. 0 or less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel for Rev. A using a Reverse Data Channel payload size of 4096 bits and a Termination Target of 16 slots defined for Subtype 2 Physical Layer configurations. A Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots would be configured in the downlink for both Rev. 0 and Rev. A.

## 8.3 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.

|                                   |                                                                                     |                               |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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| Document S/N:<br>0Y1206260868.A3L | Test Dates:<br>06/27/12 - 07/02/12                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 13 of 31                   |

### 8.3.1 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.

### 8.3.2 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.

For 5 GHz, the highest average RF output power channel across the default test channels at the lowest data rate was selected for SAR evaluation in 802.11a. When the adjacent channels are higher in power than the default channels, these "required channels" were considered instead of the default channels for SAR testing. 802.11n modes and higher data rates for 802.11a/n were evaluated only if the respective mode was 0.25 dB or higher than the 802.11a 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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## 9 RF CONDUCTED POWERS

### 9.1 CDMA Conducted Powers

| Band | Channel | Frequency | SO55 [dBm] | SO55 [dBm] | SO75  | TDSO SO32 [dBm] | TDSO SO32 [dBm] | 1x EvDO Rev. 0 [dBm] | 1x EvDO Rev. A [dBm] |
|------|---------|-----------|------------|------------|-------|-----------------|-----------------|----------------------|----------------------|
|      | F-RC    | MHz       | RC1        | RC3        | RC11  | FCH+SCH         | FCH             | (RTAP)               | (RETAP)              |
| PCS  | 25      | 1851.25   | 25.23      | 25.23      | 25.19 | 25.17           | 25.20           | 24.62                | 24.93                |
|      | 600     | 1880      | 25.36      | 25.31      | 25.24 | 25.29           | 25.30           | 24.73                | 24.81                |
|      | 1175    | 1908.75   | 25.31      | 25.31      | 25.23 | 25.26           | 25.28           | 24.77                | 24.85                |

Note: RC1 is only applicable for IS-95 compatibility.

Per KDB Publication 941225 D01:

1. Head SAR was tested with SO55 RC3. SO55 RC1 was not required since the average output power was not more than 0.25 dB than the SO55 RC3 powers.
2. Body-Worn SAR was tested with 1x RTT with TDSO / SO32 FCH Only. Ev-Do and TDSO / SO32 FCH+SCH SAR tests were not required since the average output power was not more than 0.25 dB higher than the TDSO / SO32 FCH only powers.

Per Oct 2011 TCB Workshop:

1. CDMA 1X Advanced technology was not required for SAR since the maximum output powers for 1x Advanced was not more than 0.25 dB higher than the maximum measured powers for other 1x modes and the measured SAR in any 1x mode exposure conditions was not greater than 1.2 W/kg. See Section 8.2.2 for 1x Advanced test set up.
2. CDMA 1x Advanced SO75 power measurement was used with RC8 on the uplink and RC11 on the downlink.



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

|                                   |                                                                                     |                               |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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## 9.2 WLAN Conducted Powers

**Table 9-1**  
**IEEE 802.11b Average RF Power**

| Mode    | Freq<br>[MHz] | Channel | Conducted Power [dBm] |       |       |       |
|---------|---------------|---------|-----------------------|-------|-------|-------|
|         |               |         | Data Rate [Mbps]      |       |       |       |
|         |               |         | 1                     | 2     | 5.5   | 11    |
| 802.11b | 2412          | 1       | 15.17                 | 15.17 | 15.11 | 15.17 |
| 802.11b | 2437          | 6       | 15.43                 | 15.42 | 15.36 | 15.40 |
| 802.11b | 2462          | 11      | 15.62                 | 15.53 | 15.51 | 15.56 |

**Table 9-2**  
**IEEE 802.11g Average RF Power**

| Mode    | Freq<br>[MHz] | Channel | Conducted Power [dBm] |       |       |       |       |       |       |       |
|---------|---------------|---------|-----------------------|-------|-------|-------|-------|-------|-------|-------|
|         |               |         | Data Rate [Mbps]      |       |       |       |       |       |       |       |
|         |               |         | 6                     | 9     | 12    | 18    | 24    | 36    | 48    | 54    |
| 802.11g | 2412          | 1       | 12.23                 | 12.30 | 12.32 | 12.34 | 12.36 | 12.33 | 12.26 | 12.43 |
| 802.11g | 2437          | 6       | 12.41                 | 12.45 | 12.46 | 12.49 | 12.58 | 12.46 | 12.48 | 12.46 |
| 802.11g | 2462          | 11      | 12.62                 | 12.64 | 12.62 | 12.66 | 12.68 | 12.70 | 12.64 | 12.59 |

**Table 9-3**  
**IEEE 802.11n Average RF Power**

| Mode    | Freq<br>[MHz] | Channel | Conducted Power [dBm] |       |       |       |       |       |       |       |
|---------|---------------|---------|-----------------------|-------|-------|-------|-------|-------|-------|-------|
|         |               |         | Data Rate [Mbps]      |       |       |       |       |       |       |       |
|         |               |         | 6.5                   | 13    | 20    | 26    | 39    | 52    | 58    | 65    |
| 802.11n | 2412          | 1       | 10.06                 | 10.12 | 10.19 | 10.16 | 10.14 | 10.12 | 10.08 | 10.10 |
| 802.11n | 2437          | 6       | 10.31                 | 10.35 | 10.33 | 10.45 | 10.31 | 10.36 | 10.37 | 10.41 |
| 802.11n | 2462          | 11      | 10.48                 | 10.50 | 10.42 | 10.44 | 10.43 | 10.46 | 10.47 | 10.45 |

**Table 9-4**  
**IEEE 802.11a Average RF Power**

| Mode    | Freq<br>[MHz] | Channel | Conducted Power [dBm] |       |       |       |       |       |       |       |
|---------|---------------|---------|-----------------------|-------|-------|-------|-------|-------|-------|-------|
|         |               |         | Data Rate [Mbps]      |       |       |       |       |       |       |       |
|         |               |         | 6                     | 9     | 12    | 18    | 24    | 36    | 48    | 54    |
| 802.11a | 5180          | 36*     | 11.18                 | 11.31 | 11.27 | 11.28 | 11.35 | 11.31 | 11.34 | 11.38 |
| 802.11a | 5200          | 40      | 11.32                 | 11.30 | 11.28 | 11.29 | 11.32 | 11.43 | 11.45 | 11.45 |
| 802.11a | 5220          | 44      | 11.27                 | 11.29 | 11.36 | 11.32 | 11.36 | 11.34 | 11.43 | 11.40 |
| 802.11a | 5240          | 48*     | 11.34                 | 11.44 | 11.34 | 11.37 | 11.39 | 11.41 | 11.45 | 11.51 |
| 802.11a | 5260          | 52*     | 11.34                 | 11.28 | 11.36 | 11.37 | 11.41 | 11.44 | 11.44 | 11.50 |
| 802.11a | 5280          | 56      | 11.32                 | 11.35 | 11.32 | 11.37 | 11.35 | 11.38 | 11.47 | 11.46 |
| 802.11a | 5300          | 60      | 11.29                 | 11.29 | 11.25 | 11.31 | 11.46 | 11.48 | 11.45 | 11.26 |
| 802.11a | 5320          | 64*     | 11.35                 | 11.37 | 11.36 | 11.38 | 11.41 | 11.37 | 11.39 | 11.45 |
| 802.11a | 5500          | 100     | 11.35                 | 11.35 | 11.43 | 11.41 | 11.44 | 11.52 | 11.57 | 11.50 |
| 802.11a | 5520          | 104*    | 11.33                 | 11.39 | 11.42 | 11.44 | 11.40 | 11.47 | 11.56 | 11.55 |
| 802.11a | 5540          | 108     | 11.40                 | 11.35 | 11.43 | 11.46 | 11.36 | 11.43 | 11.53 | 11.56 |
| 802.11a | 5560          | 112     | 11.35                 | 11.38 | 11.35 | 11.41 | 11.46 | 11.45 | 11.42 | 11.51 |
| 802.11a | 5580          | 116*    | 11.35                 | 11.38 | 11.38 | 11.40 | 11.47 | 11.46 | 11.47 | 11.54 |
| 802.11a | 5600          | 120     | N/A                   | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   |
| 802.11a | 5620          | 124     | N/A                   | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   |
| 802.11a | 5640          | 128     | N/A                   | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   |
| 802.11a | 5660          | 132     | 11.42                 | 11.40 | 11.42 | 11.51 | 11.49 | 11.45 | 11.63 | 11.56 |
| 802.11a | 5680          | 136*    | 11.42                 | 11.44 | 11.43 | 11.45 | 11.47 | 11.53 | 11.58 | 11.51 |
| 802.11a | 5700          | 140     | 11.44                 | 11.45 | 11.47 | 11.48 | 11.56 | 11.48 | 11.56 | 11.61 |
| 802.11a | 5745          | 149*    | 11.61                 | 11.57 | 11.56 | 11.60 | 11.66 | 11.65 | 11.65 | 11.69 |
| 802.11a | 5765          | 153     | 11.57                 | 11.49 | 11.56 | 11.59 | 11.74 | 11.66 | 11.64 | 11.70 |
| 802.11a | 5785          | 157*    | 11.50                 | 11.63 | 11.54 | 11.63 | 11.59 | 11.62 | 11.64 | 11.67 |
| 802.11a | 5805          | 161*    | 11.62                 | 11.59 | 11.63 | 11.67 | 11.67 | 11.70 | 11.75 | 11.76 |
| 802.11a | 5825          | 165     | 11.54                 | 11.51 | 11.52 | 11.59 | 11.63 | 11.59 | 11.55 | 11.62 |

Per FCC KDB Publication 443999 and RSS-210 A9.2(3), transmission on channels which overlap the 5600-5650 MHz is prohibited as a client. This device does not transmit any beacons or initiate any transmissions in 5.3 and 5.5 GHz Band. (\*) – indicates default channels per KDB Publication 248227. When the adjacent channels are higher in power than the default channels, these “required channels” are considered instead of the default channels for SAR testing.

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
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| <b>Document S/N:</b><br>0Y1206260868.A3L | <b>Test Dates:</b><br>06/27/12 - 07/02/12                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 16 of 31                          |

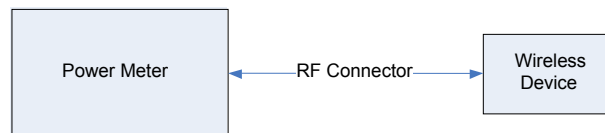
**Table 9-5**  
**IEEE 802.11n Average RF Power**

| Mode    | Freq<br>[MHz] | Channel | Conducted Power [dBm] |       |       |       |       |       |       |       |
|---------|---------------|---------|-----------------------|-------|-------|-------|-------|-------|-------|-------|
|         |               |         | Data Rate [Mbps]      |       |       |       |       |       |       |       |
|         |               |         | 6.5                   | 13    | 20    | 26    | 39    | 52    | 58    | 65    |
| 802.11n | 5180          | 36*     | 11.19                 | 11.10 | 11.19 | 11.25 | 11.20 | 11.30 | 11.32 | 11.26 |
| 802.11n | 5200          | 40      | 11.16                 | 11.11 | 11.25 | 11.16 | 11.30 | 11.34 | 11.39 | 11.36 |
| 802.11n | 5220          | 44      | 11.22                 | 11.24 | 11.23 | 11.23 | 11.34 | 11.30 | 11.28 | 11.24 |
| 802.11n | 5240          | 48*     | 11.22                 | 11.14 | 11.22 | 11.27 | 11.31 | 11.35 | 11.35 | 11.36 |
| 802.11n | 5260          | 52*     | 11.21                 | 11.21 | 11.24 | 11.27 | 11.26 | 11.32 | 11.35 | 11.34 |
| 802.11n | 5280          | 56      | 11.19                 | 11.22 | 11.24 | 11.23 | 11.28 | 11.28 | 11.33 | 11.36 |
| 802.11n | 5300          | 60      | 11.21                 | 11.24 | 11.19 | 11.30 | 11.25 | 11.22 | 11.29 | 11.34 |
| 802.11n | 5320          | 64*     | 11.26                 | 11.22 | 11.21 | 11.29 | 11.27 | 11.28 | 11.25 | 11.23 |
| 802.11n | 5500          | 100     | 11.25                 | 11.22 | 11.30 | 11.31 | 11.33 | 11.32 | 11.35 | 11.30 |
| 802.11n | 5520          | 104*    | 11.24                 | 11.32 | 11.20 | 11.37 | 11.34 | 11.35 | 11.33 | 11.33 |
| 802.11n | 5540          | 108     | 11.24                 | 11.23 | 11.24 | 11.30 | 11.28 | 11.39 | 11.37 | 11.35 |
| 802.11n | 5560          | 112     | 11.19                 | 11.23 | 11.30 | 11.22 | 11.31 | 11.37 | 11.51 | 11.34 |
| 802.11n | 5580          | 116*    | 11.18                 | 11.24 | 11.21 | 11.23 | 11.30 | 11.41 | 11.35 | 11.42 |
| 802.11n | 5600          | 120     | N/A                   | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   |
| 802.11n | 5620          | 124     | N/A                   | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   |
| 802.11n | 5640          | 128     | N/A                   | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   |
| 802.11n | 5660          | 132     | 11.22                 | 11.26 | 11.31 | 11.35 | 11.31 | 11.37 | 11.41 | 11.30 |
| 802.11n | 5680          | 136*    | 11.24                 | 11.32 | 11.28 | 11.33 | 11.34 | 11.30 | 11.40 | 11.45 |
| 802.11n | 5700          | 140     | 11.33                 | 11.34 | 11.35 | 11.39 | 11.36 | 11.38 | 11.43 | 11.46 |
| 802.11n | 5745          | 149*    | 10.46                 | 10.49 | 10.49 | 10.51 | 10.59 | 10.61 | 10.60 | 10.68 |
| 802.11n | 5765          | 153     | 10.48                 | 10.46 | 10.52 | 10.53 | 10.58 | 10.55 | 10.64 | 10.63 |
| 802.11n | 5785          | 157*    | 10.49                 | 10.47 | 10.49 | 10.50 | 10.53 | 10.54 | 10.54 | 10.62 |
| 802.11n | 5805          | 161*    | 10.53                 | 10.39 | 10.40 | 10.46 | 10.54 | 10.58 | 10.60 | 10.69 |
| 802.11n | 5825          | 165     | 10.42                 | 10.40 | 10.45 | 10.43 | 10.56 | 10.55 | 10.57 | 10.58 |

Per FCC KDB Publication 443999 and RSS-210 A9.2(3), transmission on channels which overlap the 5600-5650 MHz is prohibited as a client. This device does not transmit any beacons or initiate any transmissions in 5.3 and 5.5 GHz Bands. (\*) – indicates default channels per KDB Publication 248227. When the adjacent channels are higher in power then the default channels, these “required channels” are considered instead of the default channels for SAR testing.

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 were 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.
- For 5 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11a were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n) 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 802.11a 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 powers of the data rate and channels above were tested for SAR.



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

|                                   |                                                                                     |                               |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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| Document S/N:<br>0Y1206260868.A3L | Test Dates:<br>06/27/12 - 07/02/12                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 17 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 $\epsilon$ |
|------------------------------------|-------------|-------------------------------------|--------------------------|---------------------------------------|------------------------------------------|-------------------------------------|----------------------------------------|----------------|------------------|
| 6/27/2012                          | 1900H       | 24.2                                | 1850                     | 1.353                                 | 38.46                                    | 1.400                               | 40.000                                 | -3.36%         | -3.85%           |
|                                    |             |                                     | 1880                     | 1.400                                 | 38.45                                    | 1.400                               | 40.000                                 | 0.00%          | -3.87%           |
|                                    |             |                                     | 1910                     | 1.427                                 | 38.39                                    | 1.400                               | 40.000                                 | 1.93%          | -4.03%           |
| 6/28/2012                          | 2450H       | 22.9                                | 2401                     | 1.785                                 | 38.83                                    | 1.758                               | 39.298                                 | 1.54%          | -1.19%           |
|                                    |             |                                     | 2450                     | 1.838                                 | 38.68                                    | 1.800                               | 39.200                                 | 2.11%          | -1.33%           |
|                                    |             |                                     | 2499                     | 1.890                                 | 38.44                                    | 1.852                               | 39.135                                 | 2.05%          | -1.78%           |
| 07/02/2012                         | 5200H-5800H | 25.0                                | 5200                     | 4.553                                 | 36.69                                    | 4.660                               | 36.000                                 | -2.30%         | 1.92%            |
|                                    |             |                                     | 5240                     | 4.578                                 | 36.62                                    | 4.700                               | 35.960                                 | -2.60%         | 1.84%            |
|                                    |             |                                     | 5320                     | 4.668                                 | 36.53                                    | 4.780                               | 35.880                                 | -2.34%         | 1.81%            |
|                                    |             |                                     | 5500                     | 4.828                                 | 36.30                                    | 4.965                               | 35.650                                 | -2.76%         | 1.82%            |
|                                    |             |                                     | 5700                     | 5.048                                 | 35.94                                    | 5.170                               | 35.400                                 | -2.36%         | 1.53%            |
|                                    |             |                                     | 5800                     | 5.137                                 | 35.79                                    | 5.270                               | 35.300                                 | -2.52%         | 1.39%            |
|                                    |             |                                     | 5805                     | 5.137                                 | 35.78                                    | 5.275                               | 35.295                                 | -2.62%         | 1.37%            |
| 6/27/2012                          | 1900B       | 23.2                                | 1850                     | 1.464                                 | 52.94                                    | 1.520                               | 53.300                                 | -3.68%         | -0.68%           |
|                                    |             |                                     | 1880                     | 1.492                                 | 52.83                                    | 1.520                               | 53.300                                 | -1.84%         | -0.88%           |
|                                    |             |                                     | 1910                     | 1.528                                 | 52.72                                    | 1.520                               | 53.300                                 | 0.53%          | -1.09%           |
| 6/28/2012                          | 2450B       | 24.1                                | 2401                     | 1.934                                 | 53.77                                    | 1.903                               | 52.765                                 | 1.63%          | 1.90%            |
|                                    |             |                                     | 2450                     | 1.996                                 | 53.47                                    | 1.950                               | 52.700                                 | 2.36%          | 1.46%            |
|                                    |             |                                     | 2499                     | 2.071                                 | 53.40                                    | 2.019                               | 52.638                                 | 2.58%          | 1.45%            |
| 06/29/2012                         | 5200B-5800B | 24.9                                | 5200                     | 5.095                                 | 48.01                                    | 5.299                               | 49.014                                 | -3.85%         | -2.05%           |
|                                    |             |                                     | 5240                     | 5.094                                 | 47.43                                    | 5.346                               | 48.933                                 | -4.71%         | -3.07%           |
|                                    |             |                                     | 5320                     | 5.259                                 | 47.46                                    | 5.439                               | 48.607                                 | -3.31%         | -2.36%           |
|                                    |             |                                     | 5500                     | 5.456                                 | 46.99                                    | 5.650                               | 48.580                                 | -3.43%         | -3.27%           |
|                                    |             |                                     | 5700                     | 5.862                                 | 46.48                                    | 5.880                               | 48.275                                 | -0.31%         | -3.72%           |
|                                    |             |                                     | 5800                     | 6.022                                 | 45.88                                    | 6.000                               | 48.200                                 | 0.37%          | -4.81%           |
|                                    |             |                                     | 5805                     | 6.037                                 | 45.95                                    | 6.005                               | 48.166                                 | 0.53%          | -4.60%           |

Note: KDB Publication 450824 was ensured to be applied for probe calibration frequencies greater than or equal to 50 MHz of the DUT frequencies.

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.

Probe calibration used within  $\pm 100$  MHz of the test frequency in either 5.725 - 5.85 or 5.47-5.725 GHz is acceptable per KDB Publication 865664 since the design of the SAR probe supports the extended frequency, provided the DASY software version recommended is used for the tests, and the expanded calibration uncertainty ( $k=2$ ) is less than or equal to 15% (See SAR probe calibration certificate for this information). The dielectric and conductivities measured are within 10% and 5% respectively of the target parameters specified in Supplement C 01-01.

### 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

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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| <b>Document S/N:</b><br>0Y1206260868.A3L | <b>Test Dates:</b><br>06/27/12 - 07/02/12                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 18 of 31                          |

- 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  $j = \sqrt{-1}$ .

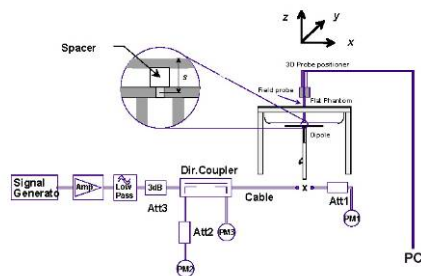
### 10.3 Test System Verification

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 (%) |
| 1900                                     | Head        | 06/27/2012 | 24.3           | 23.3             | 0.100           | 5d080     | 3209     | 3.92                              | 39.900                              | 39.200                                  | -1.75%        |
| 2450                                     | Head        | 06/28/2012 | 23.9           | 22.7             | 0.100           | 797       | 3209     | 5.41                              | 52.100                              | 54.100                                  | 3.84%         |
| 5200                                     | Head        | 07/02/2012 | 24.6           | 23.5             | 0.0182          | 1057      | 3589     | 1.45                              | 79.100                              | 79.670                                  | 0.72%         |
| 5500                                     | Head        | 07/02/2012 | 24.7           | 23.6             | 0.0182          | 1057      | 3589     | 1.48                              | 84.900                              | 81.319                                  | -4.22%        |
| 5800                                     | Head        | 07/02/2012 | 24.9           | 23.8             | 0.0182          | 1057      | 3589     | 1.43                              | 79.500                              | 78.571                                  | -1.17%        |
| 1900                                     | Body        | 06/27/2012 | 24.6           | 23.8             | 0.100           | 5d080     | 3209     | 4.18                              | 40.900                              | 41.800                                  | 2.20%         |
| 2450                                     | Body        | 06/28/2012 | 24.3           | 24.5             | 0.100           | 797       | 3209     | 5.47                              | 50.800                              | 54.700                                  | 7.68%         |
| 5200                                     | Body        | 06/29/2012 | 24.4           | 23.5             | 0.0182          | 1057      | 3589     | 1.40                              | 73.400                              | 76.923                                  | 4.80%         |
| 5500                                     | Body        | 06/29/2012 | 24.6           | 23.7             | 0.0158          | 1057      | 3589     | 1.29                              | 78.900                              | 81.646                                  | 3.48%         |
| 5800                                     | Body        | 06/29/2012 | 24.8           | 23.9             | 0.0178          | 1057      | 3589     | 1.33                              | 74.300                              | 74.719                                  | 0.56%         |

Note: Per KDB Publication 865664, when a reference dipole is not defined within  $\pm 100$  MHz of the test frequency, the system verification may be conducted within  $\pm 200$  MHz of the center frequency of the measurement frequencies if the SAR probe calibration is valid and the same tissue-equivalent matter is used for verification and test measurements.



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



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

|                                   |                                                                                                                                   |                               |                                                                                       |                                 |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSPHM830                |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR EVALUATION REPORT</b>  |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1206260868.A3L | Test Dates:<br>06/27/12 - 07/02/12                                                                                                | DUT Type:<br>Portable Handset |                                                                                       | Page 19 of 31                   |

# 11 SAR DATA SUMMARY

## 11.1 Standalone Head SAR Data

**Table 11-1**  
**PCS CDMA Head SAR Results**

| MEASUREMENT RESULTS                                                                               |      |           |                       |                  |                                                 |               |          |
|---------------------------------------------------------------------------------------------------|------|-----------|-----------------------|------------------|-------------------------------------------------|---------------|----------|
| FREQUENCY                                                                                         |      | Mode/Band | Conducted Power [dBm] | Power Drift [dB] | Side                                            | Test Position | SAR (1g) |
| MHz                                                                                               | Ch.  |           |                       |                  |                                                 |               | (W/kg)   |
| 1851.25                                                                                           | 25   | PCS CDMA  | 25.23                 | -0.09            | Right                                           | Touch         | 0.817    |
| 1880.00                                                                                           | 600  | PCS CDMA  | 25.31                 | -0.13            | Right                                           | Touch         | 0.839    |
| 1908.75                                                                                           | 1175 | PCS CDMA  | 25.31                 | 0.03             | Right                                           | Touch         | 0.917    |
| 1880.00                                                                                           | 600  | PCS CDMA  | 25.31                 | -0.02            | Right                                           | Tilt          | 0.470    |
| 1880.00                                                                                           | 600  | PCS CDMA  | 25.31                 | 0.14             | Left                                            | Touch         | 0.773    |
| 1880.00                                                                                           | 600  | PCS CDMA  | 25.31                 | -0.03            | Left                                            | Tilt          | 0.489    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |      |           |                       |                  | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |               |          |

**Table 11-2**  
**2.4 GHz WLAN Head SAR Results**

| MEASUREMENT RESULTS                                                                               |     |              |         |                       |                  |                                                 |               |                  |          |
|---------------------------------------------------------------------------------------------------|-----|--------------|---------|-----------------------|------------------|-------------------------------------------------|---------------|------------------|----------|
| FREQUENCY                                                                                         |     | Mode         | Service | Conducted Power [dBm] | Power Drift [dB] | Side                                            | Test Position | Data Rate (Mbps) | SAR (1g) |
| MHz                                                                                               | Ch. |              |         |                       |                  |                                                 |               |                  | (W/kg)   |
| 2462                                                                                              | 11  | IEEE 802.11b | DSSS    | 15.62                 | 0.12             | Right                                           | Touch         | 1                | 0.067    |
| 2462                                                                                              | 11  | IEEE 802.11b | DSSS    | 15.62                 | 0.06             | Right                                           | Tilt          | 1                | 0.062    |
| 2462                                                                                              | 11  | IEEE 802.11b | DSSS    | 15.62                 | -0.01            | Left                                            | Touch         | 1                | 0.122    |
| 2462                                                                                              | 11  | IEEE 802.11b | DSSS    | 15.62                 | 0.08             | Left                                            | Tilt          | 1                | 0.101    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |     |              |         |                       |                  | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |               |                  |          |

**Table 11-3**  
**5.8 GHz WLAN Head SAR Results**

| MEASUREMENT RESULTS                                                                               |     |              |         |                       |                  |                                                 |               |                  |          |
|---------------------------------------------------------------------------------------------------|-----|--------------|---------|-----------------------|------------------|-------------------------------------------------|---------------|------------------|----------|
| FREQUENCY                                                                                         |     | Mode         | Service | Conducted Power [dBm] | Power Drift [dB] | Side                                            | Test Position | Data Rate (Mbps) | SAR (1g) |
| MHz                                                                                               | Ch. |              |         |                       |                  |                                                 |               |                  | (W/kg)   |
| 5805                                                                                              | 161 | IEEE 802.11a | OFDM    | 11.62                 | 0.04             | Right                                           | Touch         | 6                | 0.028    |
| 5805                                                                                              | 161 | IEEE 802.11a | OFDM    | 11.62                 | -0.18            | Right                                           | Tilt          | 6                | 0.001    |
| 5805                                                                                              | 161 | IEEE 802.11a | OFDM    | 11.62                 | 0.19             | Left                                            | Touch         | 6                | 0.005    |
| 5805                                                                                              | 161 | IEEE 802.11a | OFDM    | 11.62                 | 0.08             | Left                                            | Tilt          | 6                | 0.003    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |     |              |         |                       |                  | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |               |                  |          |

|                                   |                                                                                                                                   |                               |                                                                                       |                                 |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSPHM830                |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR EVALUATION REPORT</b>  |  | Reviewed by:<br>Quality Manager |
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**Table 11-4**  
**5.2 GHz WLAN Head SAR Results**

| MEASUREMENT RESULTS                                                                               |     |              |         |                       |                  |                                                 |               |                  |          |
|---------------------------------------------------------------------------------------------------|-----|--------------|---------|-----------------------|------------------|-------------------------------------------------|---------------|------------------|----------|
| FREQUENCY                                                                                         |     | Mode         | Service | Conducted Power [dBm] | Power Drift [dB] | Side                                            | Test Position | Data Rate (Mbps) | SAR (1g) |
| MHz                                                                                               | Ch. |              |         |                       |                  |                                                 |               |                  | (W/kg)   |
| 5240                                                                                              | 48  | IEEE 802.11a | OFDM    | 11.34                 | 0.10             | Right                                           | Touch         | 6                | 0.034    |
| 5240                                                                                              | 48  | IEEE 802.11a | OFDM    | 11.34                 | 0.09             | Right                                           | Tilt          | 6                | 0.032    |
| 5240                                                                                              | 48  | IEEE 802.11a | OFDM    | 11.34                 | -0.16            | Left                                            | Touch         | 6                | 0.055    |
| 5240                                                                                              | 48  | IEEE 802.11a | OFDM    | 11.34                 | 0.08             | Left                                            | Tilt          | 6                | 0.053    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |     |              |         |                       |                  | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |               |                  |          |

**Table 11-5**  
**5.3 GHz WLAN Head SAR Results**

| MEASUREMENT RESULTS                                                                               |     |              |         |                       |                  |                                                 |               |                  |          |
|---------------------------------------------------------------------------------------------------|-----|--------------|---------|-----------------------|------------------|-------------------------------------------------|---------------|------------------|----------|
| FREQUENCY                                                                                         |     | Mode         | Service | Conducted Power [dBm] | Power Drift [dB] | Side                                            | Test Position | Data Rate (Mbps) | SAR (1g) |
| MHz                                                                                               | Ch. |              |         |                       |                  |                                                 |               |                  | (W/kg)   |
| 5320                                                                                              | 64  | IEEE 802.11a | OFDM    | 11.35                 | 0.13             | Right                                           | Touch         | 6                | 0.033    |
| 5320                                                                                              | 64  | IEEE 802.11a | OFDM    | 11.35                 | -0.13            | Right                                           | Tilt          | 6                | 0.033    |
| 5320                                                                                              | 64  | IEEE 802.11a | OFDM    | 11.35                 | 0.14             | Left                                            | Touch         | 6                | 0.060    |
| 5320                                                                                              | 64  | IEEE 802.11a | OFDM    | 11.35                 | -0.01            | Left                                            | Tilt          | 6                | 0.065    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |     |              |         |                       |                  | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |               |                  |          |

**Table 11-6**  
**5.5 - 5.7 GHz WLAN Head SAR Results**

| MEASUREMENT RESULTS                                                                               |     |              |         |                       |                  |                                                 |               |                  |          |
|---------------------------------------------------------------------------------------------------|-----|--------------|---------|-----------------------|------------------|-------------------------------------------------|---------------|------------------|----------|
| FREQUENCY                                                                                         |     | Mode         | Service | Conducted Power [dBm] | Power Drift [dB] | Side                                            | Test Position | Data Rate (Mbps) | SAR (1g) |
| MHz                                                                                               | Ch. |              |         |                       |                  |                                                 |               |                  | (W/kg)   |
| 5700                                                                                              | 140 | IEEE 802.11a | OFDM    | 11.44                 | -0.03            | Right                                           | Touch         | 6                | 0.027    |
| 5700                                                                                              | 140 | IEEE 802.11a | OFDM    | 11.44                 | -0.04            | Right                                           | Tilt          | 6                | 0.017    |
| 5700                                                                                              | 140 | IEEE 802.11a | OFDM    | 11.44                 | 0.18             | Left                                            | Touch         | 6                | 0.028    |
| 5700                                                                                              | 140 | IEEE 802.11a | OFDM    | 11.44                 | 0.08             | Left                                            | Tilt          | 6                | 0.010    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |     |              |         |                       |                  | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |               |                  |          |

|                                   |                                                                                     |                               |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSPHM830                |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
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## 11.2 Standalone Body-Worn SAR Data

**Table 11-7**  
**Licensed Transmitter Body-Worn SAR Results**

| MEASUREMENT RESULTS                      |     |          |             |                       |                  |                      |      |          |
|------------------------------------------|-----|----------|-------------|-----------------------|------------------|----------------------|------|----------|
| FREQUENCY                                |     | Mode     | Service     | Conducted Power [dBm] | Power Drift [dB] | Spacing              | Side | SAR (1g) |
| MHz                                      | Ch. |          |             |                       |                  |                      |      | (W/kg)   |
| 1880.00                                  | 600 | PCS CDMA | TDSO / SO32 | 25.30                 | -0.09            | 1.5 cm               | back | 0.650    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |     |          |             |                       |                  | Body                 |      |          |
| Spatial Peak                             |     |          |             |                       |                  | 1.6 W/kg (mW/g)      |      |          |
| Uncontrolled Exposure/General Population |     |          |             |                       |                  | averaged over 1 gram |      |          |

**Table 11-8**  
**WLAN Body-Worn SAR Results**

| MEASUREMENT RESULTS                      |     |              |         |                       |                  |                      |                  |      |          |
|------------------------------------------|-----|--------------|---------|-----------------------|------------------|----------------------|------------------|------|----------|
| FREQUENCY                                |     | Mode         | Service | Conducted Power [dBm] | Power Drift [dB] | Spacing              | Data Rate (Mbps) | Side | SAR (1g) |
| MHz                                      | Ch. |              |         |                       |                  |                      |                  |      | (W/kg)   |
| 2462                                     | 11  | IEEE 802.11b | DSSS    | 15.62                 | -0.15            | 1.5 cm               | 1                | back | 0.057    |
| 5805                                     | 161 | IEEE 802.11a | OFDM    | 11.62                 | -0.13            | 1.5 cm               | 6                | back | 0.066    |
| 5240                                     | 48  | IEEE 802.11a | OFDM    | 11.34                 | -0.01            | 1.5 cm               | 6                | back | 0.054    |
| 5320                                     | 64  | IEEE 802.11a | OFDM    | 11.35                 | -0.14            | 1.5 cm               | 6                | back | 0.045    |
| 5700                                     | 140 | IEEE 802.11a | OFDM    | 11.44                 | -0.14            | 1.5 cm               | 6                | back | 0.067    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |     |              |         |                       |                  | Body                 |                  |      |          |
| Spatial Peak                             |     |              |         |                       |                  | 1.6 W/kg (mW/g)      |                  |      |          |
| Uncontrolled Exposure/General Population |     |              |         |                       |                  | averaged over 1 gram |                  |      |          |

## 11.3 SAR Test Notes

### General Notes:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used were according to FCC/OET Bulletin 65, Supplement C [June 2001].
2. Batteries are fully charged for all readings. The standard battery was used.
3. Tissue parameters and temperatures are listed on the SAR plots.
4. 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.
5. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
6. Per FCC/OET Bulletin 65 Supplement C and Public Notice DA-02-1438, 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).
7. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 15 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.

|                                   |                                                                                                                                   |                               |                                                                                       |                                 |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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| Document S/N:<br>0Y1206260868.A3L | Test Dates:<br>06/27/12 - 07/02/12                                                                                                | DUT Type:<br>Portable Handset |                                                                                       | Page 22 of 31                   |

**CDMA Notes:**

1. Head SAR for CDMA2000 mode was tested under RC3/SO55 per KDB Publication 941225 D01.
2. Body-Worn SAR was tested with 1x RTT with TDSO / SO32 FCH Only. Ev-Do and TDSO / SO32 FCH+SCH SAR tests were not required since the average output power was not more than 0.25 dB higher than the TDSO / SO32 FCH only powers.
3. CDMA 1x Advanced technology was not required for SAR since the maximum output powers for 1x Advanced was not more than 0.25 dB higher than the maximum measured powers for 1x and the measured SAR in any 1x mode exposure condition was not greater than 1.2 W/kg. See Section 8.2.2 for 1x Advanced test set up.

**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. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes for 5 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11a. Other IEEE 802.11 modes (including 802.11n) 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 802.11a mode.
3. WLAN transmission was verified using an uncalibrated spectrum analyzer.
4. Since 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.

|                                          |                                                                                     |                                      |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
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| <b>Document S/N:</b><br>0Y1206260868.A3L | <b>Test Dates:</b><br>06/27/12 - 07/02/12                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 23 of 31                          |

## 12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

### 12.1 Introduction

The following procedures adopted from “FCC SAR Considerations for Cell Phones with Multiple Transmitters” FCC KDB Publication 648474 are applicable to handsets with built-in unlicensed transmitters such as 802.11a/b/g/n and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

### 12.2 FCC Power Tables & Conditions

|           | 2.45 | 5.15 - 5.35 | 5.47 - 5.85 | GHz |
|-----------|------|-------------|-------------|-----|
| $P_{Ref}$ | 12   | 6           | 5           | mW  |

Device output power should be rounded to the nearest mW to compare with values specified in this table.

**Figure 12-1**  
**Output Power Thresholds for Unlicensed Transmitters**

|                                | Individual Transmitter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Simultaneous Transmission                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Licensed Transmitters</b>   | <u>Routine evaluation required</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <u>SAR not required:</u><br><u>Unlicensed only</u> <ul style="list-style-type: none"> <li>when stand-alone 1-g SAR is not required and antenna is <math>\geq 5</math> cm from other antennas</li> </ul> <u>Licensed &amp; Unlicensed</u> <ul style="list-style-type: none"> <li>when the sum of the 1-g SAR is <math>&lt; 1.6</math> W/kg for all simultaneous transmitting antennas</li> <li>when SAR to peak location separation ratio of simultaneous transmitting antenna pair is <math>&lt; 0.3</math></li> </ul> <u>SAR required:</u><br><u>Licensed &amp; Unlicensed</u> <p>antenna pairs with SAR to peak location separation ratio <math>\geq 0.3</math>; test is only required for the configuration that results in the highest SAR in stand-alone configuration for each wireless mode and exposure condition</p> <p><b>Note: simultaneous transmission exposure conditions for head and body can be different for different style phones; therefore, different test requirements may apply</b></p> |
| <b>Unlicensed Transmitters</b> | <p><u>When there is no simultaneous transmission –</u></p> <ul style="list-style-type: none"> <li>output <math>\leq 60</math>/f: SAR not required</li> <li>output <math>&gt; 60</math>/f: stand-alone SAR required</li> </ul> <p><u>When there is simultaneous transmission –</u></p> <p><u>Stand-alone SAR not required when</u></p> <ul style="list-style-type: none"> <li>output <math>\leq 2 \cdot P_{Ref}</math> and antenna is <math>\geq 5.0</math> cm from other antennas</li> <li>output <math>\leq P_{Ref}</math> and antenna is <math>\geq 2.5</math> cm from other antennas</li> <li>output <math>\leq P_{Ref}</math> and antenna is <math>&lt; 2.5</math> cm from other antennas, each with either output power <math>\leq P_{Ref}</math> or 1-g SAR <math>&lt; 1.2</math> W/kg</li> </ul> <p><u>Otherwise stand-alone SAR is required</u></p> <p><u>When stand-alone SAR is required</u></p> <ul style="list-style-type: none"> <li>test SAR on highest output channel for each wireless mode and exposure condition</li> <li>if SAR for highest output channel is <math>&gt; 50\%</math> of SAR limit, evaluate all channels according to normal procedures</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

**Figure 12-2**  
**SAR Evaluation Requirements for Multiple Transmitter Handsets**

According to Figure 12-1 and Figure 12-2, simultaneous transmission analysis of SAR may be required for this device for the licensed and unlicensed transmitters. Possible simultaneous transmissions for this device were numerically summed using stand-alone SAR data and are shown in the following tables.

Per KDB Publication 648474, standalone Bluetooth SAR tests were not required. Standalone SAR tests for WLAN were required. See Section 1.4(A) for more information.

|                                   |                                                                                     |                               |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSPHM830                |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1206260868.A3L | Test Dates:<br>06/27/12 - 07/02/12                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 24 of 31                   |

## 12.3 Head SAR Simultaneous Transmission Analysis

**Table 12-1**  
**Simultaneous Transmission Scenario (Held to Ear)**

| Simult Tx   | Configuration | PCS<br>CDMA<br>SAR<br>(W/kg) | 2.4 GHz<br>WLAN<br>SAR<br>(W/kg) | $\Sigma$ SAR<br>(W/kg) |
|-------------|---------------|------------------------------|----------------------------------|------------------------|
| Head<br>SAR | Right Cheek   | 0.917                        | 0.067                            | <b>0.984</b>           |
|             | Right Tilt    | 0.470                        | 0.062                            | 0.532                  |
|             | Left Cheek    | 0.773                        | 0.122                            | 0.895                  |
|             | Left Tilt     | 0.489                        | 0.101                            | 0.590                  |

The above tables represent a held to ear voice call potentially simultaneously operating with 2.4 GHz WLAN.

**Table 12-2**  
**Simultaneous Transmission Scenario (Held to Ear)**

| Simult Tx   | Configuration | PCS<br>CDMA<br>SAR<br>(W/kg) | 5 GHz<br>WLAN<br>SAR<br>(W/kg) | $\Sigma$ SAR<br>(W/kg) |
|-------------|---------------|------------------------------|--------------------------------|------------------------|
| Head<br>SAR | Right Cheek   | 0.917                        | 0.034                          | <b>0.951</b>           |
|             | Right Tilt    | 0.470                        | 0.033                          | 0.503                  |
|             | Left Cheek    | 0.773                        | 0.060                          | 0.833                  |
|             | Left Tilt     | 0.489                        | 0.065                          | 0.554                  |

The above tables represent a held to ear voice call potentially simultaneously operating with 5 GHz WLAN.

## 12.4 Body-Worn Simultaneous Transmission Analysis

**Table 12-3**  
**Simultaneous Transmission Scenario (Body-Worn at 1.5 cm)**

| Configuration | Mode     | PCS<br>CDMA<br>SAR<br>(W/kg) | 2.4 GHz<br>WLAN<br>SAR<br>(W/kg) | $\Sigma$ SAR<br>(W/kg) |
|---------------|----------|------------------------------|----------------------------------|------------------------|
| Back Side     | PCS CDMA | 0.650                        | 0.057                            | <b>0.707</b>           |

The above tables represent a body-worn voice call potentially simultaneously operating with 2.4 GHz WLAN.

**Table 12-4**  
**Simultaneous Transmission Scenario (Body-Worn at 1.5 cm)**

| Configuration | Mode     | PCS<br>CDMA<br>SAR<br>(W/kg) | 5 GHz<br>WLAN<br>SAR<br>(W/kg) | $\Sigma$ SAR<br>(W/kg) |
|---------------|----------|------------------------------|--------------------------------|------------------------|
| Back Side     | PCS CDMA | 0.650                        | 0.067                          | <b>0.717</b>           |

The above tables represent a body-worn voice call potentially simultaneously operating with 5 GHz WLAN.

## 12.5 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.

|                                          |                                                                                     |                                      |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> A3LSPHM830                |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1206260868.A3L | <b>Test Dates:</b><br>06/27/12 - 07/02/12                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 25 of 31                          |

# 13 EQUIPMENT LIST

| Manufacturer       | Model           | Description                                   | Cal Date   | Cal Interval | Cal Due    | Serial Number |
|--------------------|-----------------|-----------------------------------------------|------------|--------------|------------|---------------|
| Agilent            | 8594A           | (9kHz-2.9GHz) Spectrum Analyzer               | N/A        | 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            | E8257D          | (250kHz-20GHz) Signal Generator               | 4/5/2012   | Annual       | 4/5/2013   | MY45470194    |
| Agilent            | 8648D           | Signal Generator                              | 4/3/2012   | Annual       | 4/3/2013   | 3629U00687    |
| Agilent            | E5515C          | Wireless Communications Test Set              | 2/14/2012  | Annual       | 2/14/2013  | GB43304447    |
| Agilent            | E5515C          | Wireless Communications Tester                | 4/4/2012   | Annual       | 4/4/2013   | US41140256    |
| 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            | 8753E           | (30kHz-6GHz) Network Analyzer                 | 4/3/2012   | Annual       | 4/3/2013   | US37390350    |
| Agilent            | 85070E          | Dielectric Probe Kit                          | 3/8/2012   | Annual       | 3/8/2013   | MY44300633    |
| Agilent            | E5515C          | Wireless Communications Test Set              | 2/9/2012   | Annual       | 2/9/2013   | GB43460554    |
| Agilent            | 85047A          | S-Parameter Test Set                          | N/A        | N/A          | N/A        | 2904A00579    |
| Amplifier Research | 5S1G4           | 5W, 800MHz-4.2GHz                             | CBT        | N/A          | N/A        | 21910         |
| 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            | 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            | 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                                  | 4/5/2012   | Annual       | 4/5/2013   | 5605          |
| Anritsu            | MA2481A         | Power Sensor                                  | 2/14/2012  | Annual       | 2/14/2013  | 2400          |
| Anritsu            | MA2411B         | Pulse Sensor                                  | 10/13/2011 | Annual       | 10/13/2012 | 1027293       |
| 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                         | CBT        | N/A          | N/A        | M3W1A00-1002  |
| COMTECH            | AR85729-5       | Solid State Amplifier                         | CBT        | N/A          | N/A        | M1S5A00-009   |
| Control Company    | 61220-416       | Long-Stem Thermometer                         | 2/15/2011  | Biennial     | 2/15/2013  | 111331323     |
| Control Company    | 61220-416       | Long-Stem Thermometer                         | 2/15/2011  | Biennial     | 2/15/2013  | 111331332     |
| 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                                | CBT        | N/A          | N/A        | 1139          |
| MiniCircuits       | SLP-2400+       | Low Pass Filter                               | CBT        | N/A          | N/A        | R8979500903   |
| MiniCircuits       | VLF-6000+       | Low Pass Filter                               | CBT        | N/A          | N/A        | N/A           |
| MiniCircuits       | VLF-6000+       | Low Pass Filter                               | CBT        | N/A          | N/A        | N/A           |
| Mini-Circuits      | BW-N20W5+       | DC to 18 GHz Precision Fixed 20 dB Attenuator | CBT        | N/A          | N/A        | N/A           |
| Mini-Circuits      | NLP-2950+       | Low Pass Filter DC to 2700 MHz                | CBT        | N/A          | N/A        | N/A           |
| Narda              | 4772-3          | Attenuator (3dB)                              | CBT        | N/A          | N/A        | 9406          |
| Narda              | BW-S3W2         | Attenuator (3dB)                              | CBT        | N/A          | N/A        | 120           |
| Narda              | 4014C-6         | 4 - 8 GHz SMA 6 dB Directional Coupler        | CBT        | N/A          | N/A        | N/A           |
| Rohde & Schwarz    | NRVD            | Dual Channel Power Meter                      | 4/8/2011   | Biennial     | 4/8/2013   | 101695        |
| Rohde & Schwarz    | SMIQ03B         | Signal Generator                              | 4/5/2012   | Annual       | 4/5/2013   | DE27259       |
| 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                           | 7/22/2011  | Annual       | 7/22/2012  | 5d080         |
| SPEAG              | D2450V2         | 2450 MHz SAR Dipole                           | 1/24/2012  | Annual       | 1/24/2013  | 797           |
| SPEAG              | D5GHzV2         | 5 GHz SAR Dipole                              | 1/19/2012  | Annual       | 1/19/2013  | 1057          |
| SPEAG              | EX3DV4          | SAR Probe                                     | 1/27/2012  | Annual       | 1/27/2013  | 3589          |
| SPEAG              | ES3DV3          | SAR Probe                                     | 3/16/2012  | Annual       | 3/16/2013  | 3209          |
| SPEAG              | DAE4            | Dasy Data Acquisition Electronics             | 2/15/2012  | Annual       | 2/15/2013  | 1323          |
| Tektronix          | RSA-6114A       | Real Time Spectrum Analyzer                   | 4/5/2012   | Annual       | 4/5/2013   | B010177       |
| 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  | 111859323     |
| VWR                | 62344-925       | Mini-Thermometer                              | 10/24/2011 | Biennial     | 10/24/2013 | 111886441     |

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.

|                                          |                                                                                     |                                      |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSPHM830                       |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1206260868.A3L | <b>Test Dates:</b><br>06/27/12 - 07/02/12                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 26 of 31                          |

## 14 MEASUREMENT UNCERTAINTIES

Applicable for frequencies less than 3000 MHz.

| 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>i</sub><br>1gm | c <sub>i</sub><br>10 gms | 1gm<br>u <sub>i</sub><br>(± %) | 10gms<br>u <sub>i</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

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: A3LSPHM830                       |  <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>0Y1206260868.A3L | <b>Test Dates:</b><br>06/27/12 - 07/02/12                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 27 of 31                          |

Applicable for frequencies up to 6 GHz.

| 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>i</sub><br>1gm | c <sub>i</sub><br>10 gms | 1gm<br>u <sub>i</sub><br>(± %) | 10gms<br>u <sub>i</sub><br>(± %) | v <sub>i</sub> |
| <b>Measurement System</b>                                                        |                      |               |                |              |                       |                          |                                |                                  |                |
| Probe Calibration                                                                | E.2.1                | 6.55          | N              | 1            | 1.0                   | 1.0                      | 6.6                            | 6.6                              | ∞              |
| 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<br>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                            | 12.4                             | 12.0           |
| <b>Expanded Uncertainty</b><br>(95% CONFIDENCE LEVEL)                            |                      |               |                |              |                       |                          | k=2                            | 24.7                             | 24.0           |

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

|                                   |                                                                                     |                               |                                                                                       |                                 |
|-----------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: A3LSPHM830                |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1206260868.A3L | Test Dates:<br>06/27/12 - 07/02/12                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 28 of 31                   |

## 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]

|                                          |                                                                                     |                                      |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> A3LSPHM830                |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1206260868.A3L | <b>Test Dates:</b><br>06/27/12 - 07/02/12                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 29 of 31                          |

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|                                          |                                                                                     |                                      |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> A3LSPHM830                |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1206260868.A3L | <b>Test Dates:</b><br>06/27/12 - 07/02/12                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 30 of 31                          |

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|                                          |                                                                                     |                                      |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> A3LSPHM830                |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1206260868.A3L | <b>Test Dates:</b><br>06/27/12 - 07/02/12                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 31 of 31                          |

## APPENDIX A: SAR TEST DATA

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

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

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1908.75 \text{ MHz}$ ;  $\sigma = 1.426 \text{ mho/m}$ ;  $\epsilon_r = 38.393$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 06-27-2012; Ambient Temp: 24.3°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3209; ConvF(5.15, 5.15, 5.15); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: PCS CDMA, Right Head, Touch, High.ch**

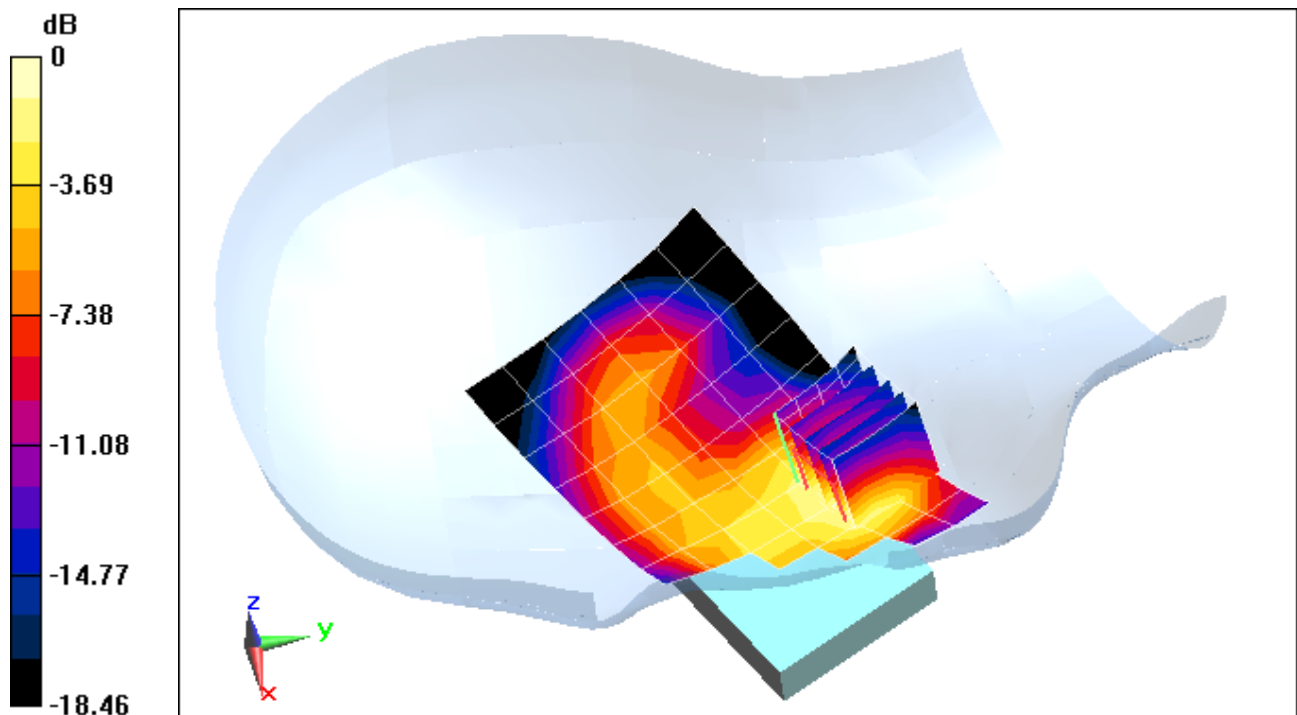
**Area Scan (7x11x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 25.588 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 1.602 mW/g

**SAR(1 g) = 0.917 mW/g; SAR(10 g) = 0.499 mW/g**



0 dB = 0.997 mW/g = -0.03 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

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

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $\epsilon_r = 38.45$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 06-27-2012; Ambient Temp: 24.3°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3209; ConvF(5.15, 5.15, 5.15); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: PCS CDMA, Right Head, Tilt, Mid.ch**

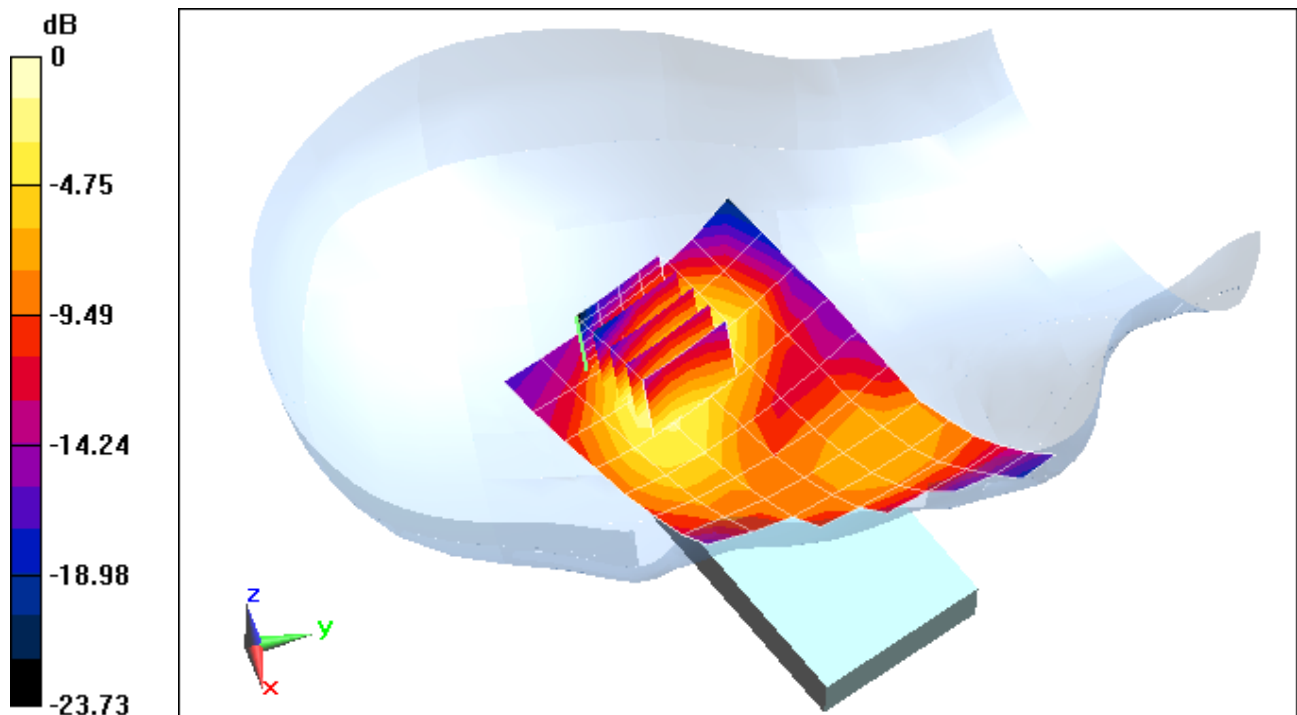
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 20.592 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.793 mW/g

**SAR(1 g) = 0.470 mW/g; SAR(10 g) = 0.264 mW/g**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

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

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $\epsilon_r = 38.45$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 06-27-2012; Ambient Temp: 24.3°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3209; ConvF(5.15, 5.15, 5.15); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: PCS CDMA, Left Head, Touch, Mid.ch**

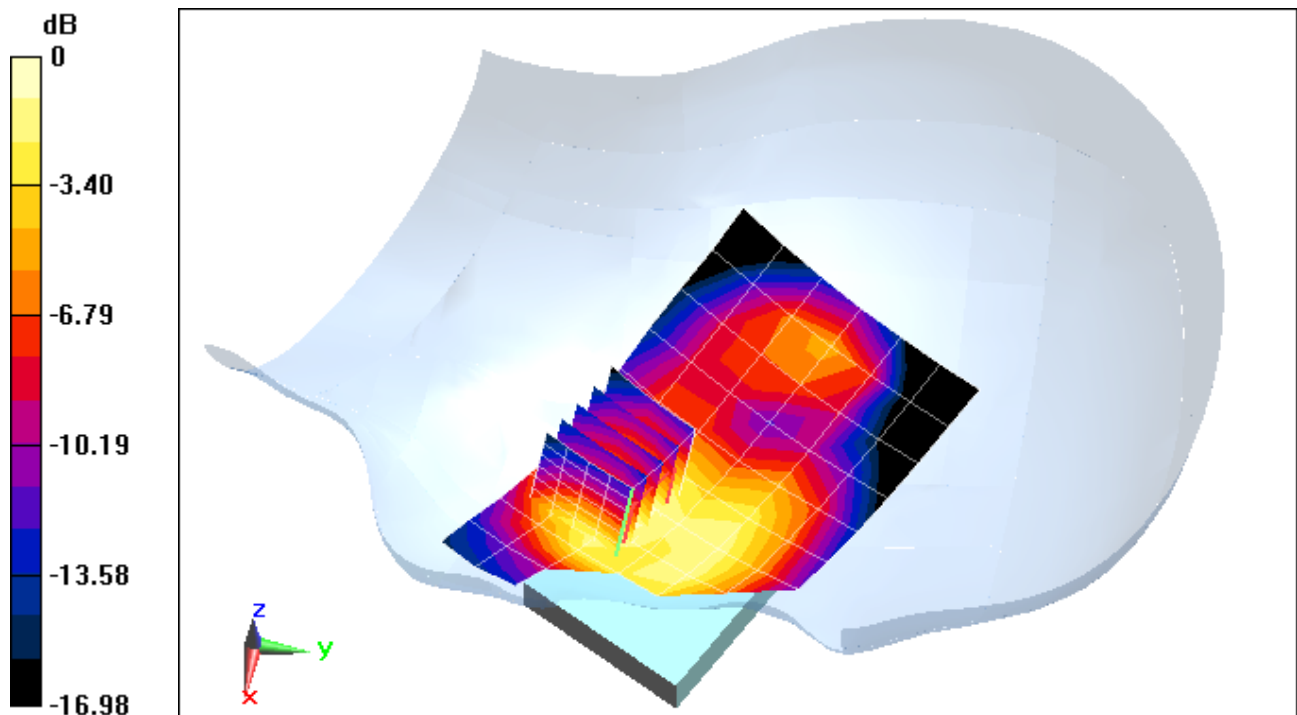
**Area Scan (7x11x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 25.028 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 1.135 mW/g

**SAR(1 g) = 0.773 mW/g; SAR(10 g) = 0.487 mW/g**



0 dB = 0.841 mW/g = -1.50 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

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

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.4 \text{ mho/m}$ ;  $\epsilon_r = 38.45$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 06-27-2012; Ambient Temp: 24.3°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3209; ConvF(5.15, 5.15, 5.15); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: PCS CDMA, Left Head, Tilt, Mid.ch**

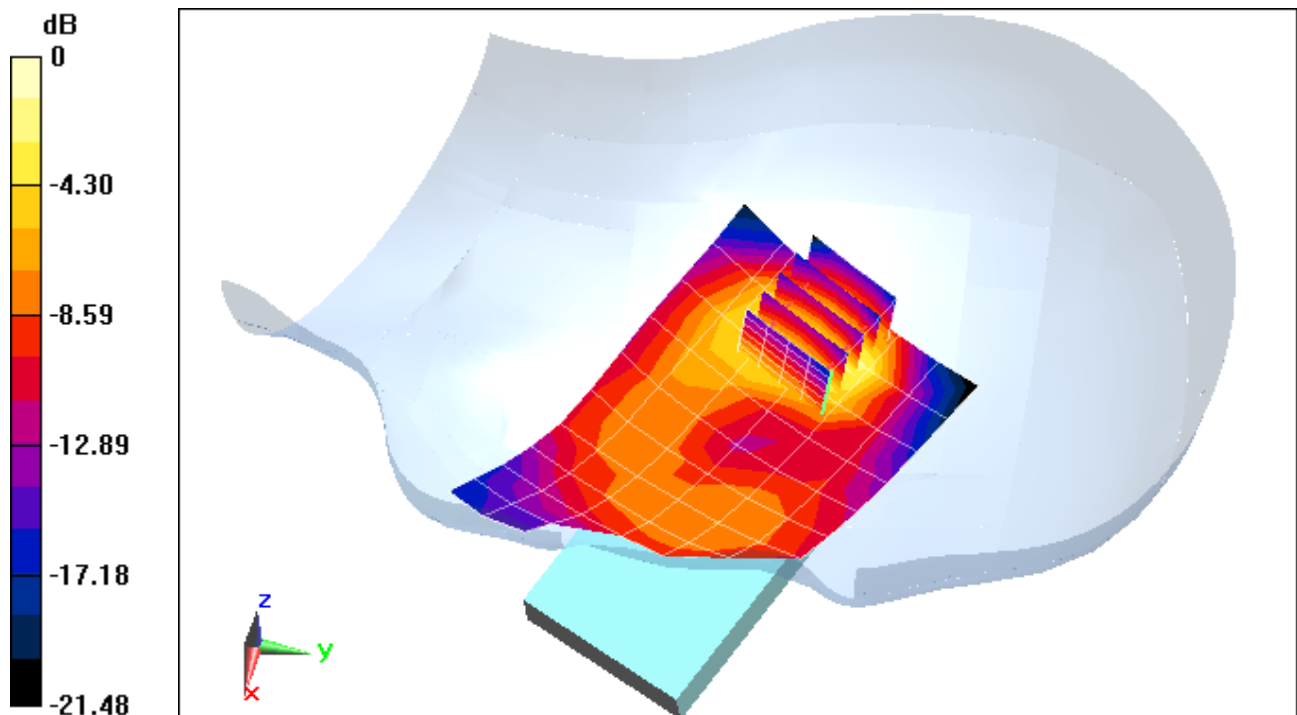
**Area Scan (7x11x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 20.750 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.827 mW/g

**SAR(1 g) = 0.489 mW/g; SAR(10 g) = 0.263 mW/g**



0 dB = 0.548 mW/g = -5.22 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

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

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 1.851 \text{ mho/m}$ ;  $\epsilon_r = 38.621$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 06-28-2012; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3209; ConvF(4.46, 4.46, 4.46); Calibrated: 3/16/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: IEEE 802.11b, Right Head, Touch, Ch 11, 1 Mbps**

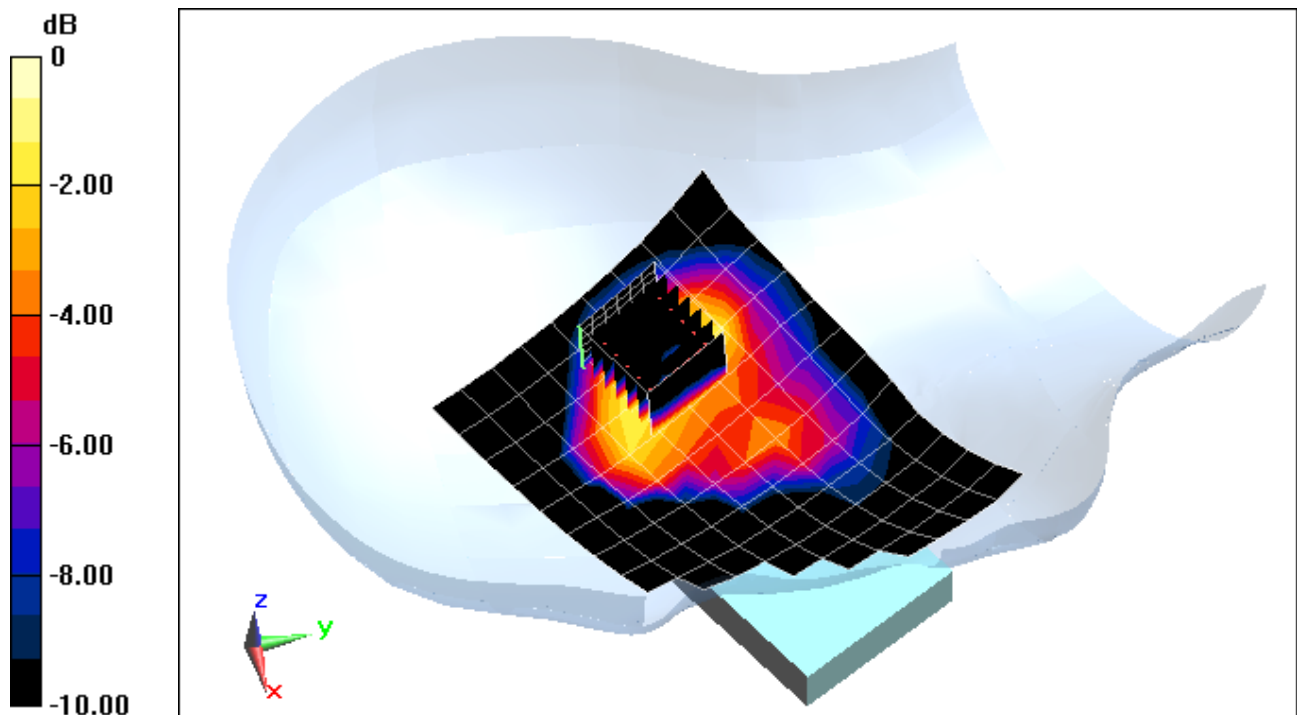
**Area Scan (10x13x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Reference Value = 6.185 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.133 mW/g

**SAR(1 g) = 0.067 mW/g; SAR(10 g) = 0.035 mW/g**



0 dB = 0.0845 mW/g = -21.46 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

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

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 1.851 \text{ mho/m}$ ;  $\epsilon_r = 38.621$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 06-28-2012; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3209; ConvF(4.46, 4.46, 4.46); Calibrated: 3/16/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: IEEE 802.11b, Right Head, Tilt, Ch 11, 1 Mbps**

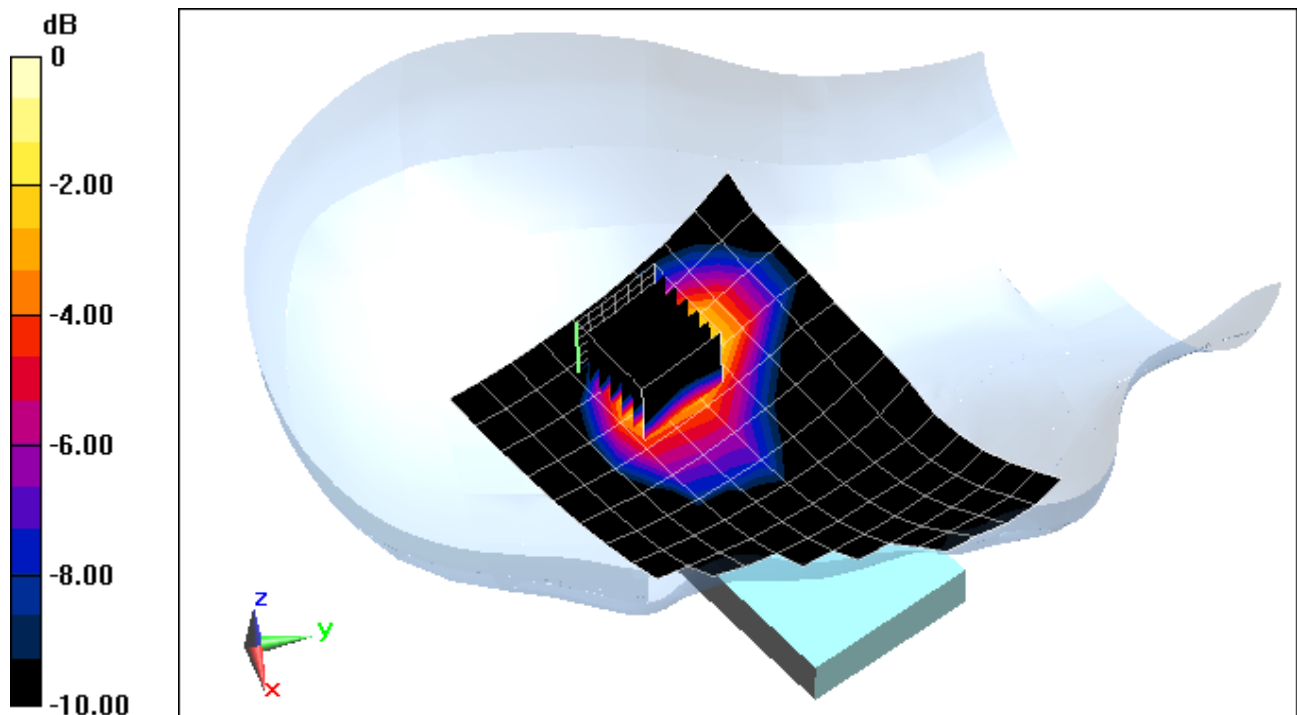
**Area Scan (10x14x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Reference Value = 5.865 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.128 mW/g

**SAR(1 g) = 0.062 mW/g; SAR(10 g) = 0.031 mW/g**



0 dB = 0.0801 mW/g = -21.93 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

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

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 1.851 \text{ mho/m}$ ;  $\epsilon_r = 38.621$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 06-28-2012; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3209; ConvF(4.46, 4.46, 4.46); Calibrated: 3/16/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: IEEE 802.11b, Left Head, Touch, Ch 11, 1 Mbps**

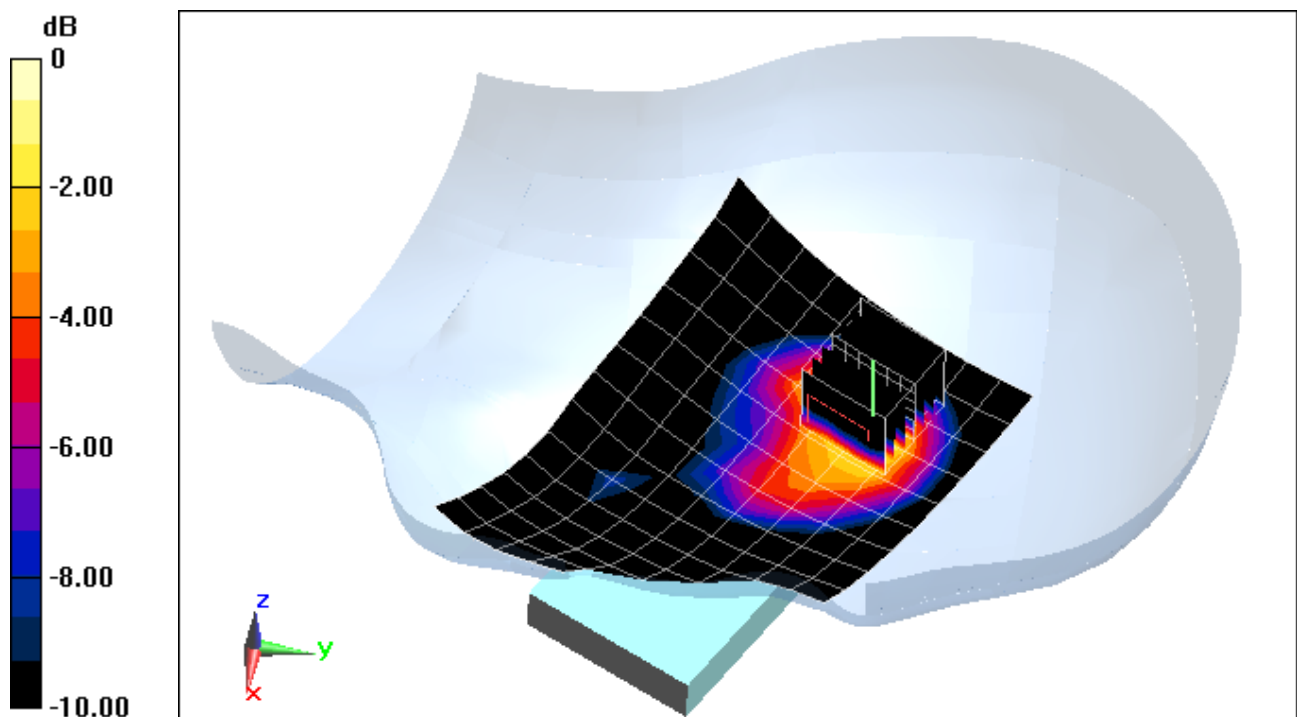
**Area Scan (10x14x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Reference Value = 8.285 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.282 mW/g

**SAR(1 g) = 0.122 mW/g; SAR(10 g) = 0.058 mW/g**



0 dB = 0.164 mW/g = -15.70 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

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

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 1.851 \text{ mho/m}$ ;  $\epsilon_r = 38.621$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 06-28-2012; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3209; ConvF(4.46, 4.46, 4.46); Calibrated: 3/16/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: IEEE 802.11b, Left Head, Tilt, Ch 11, 1 Mbps**

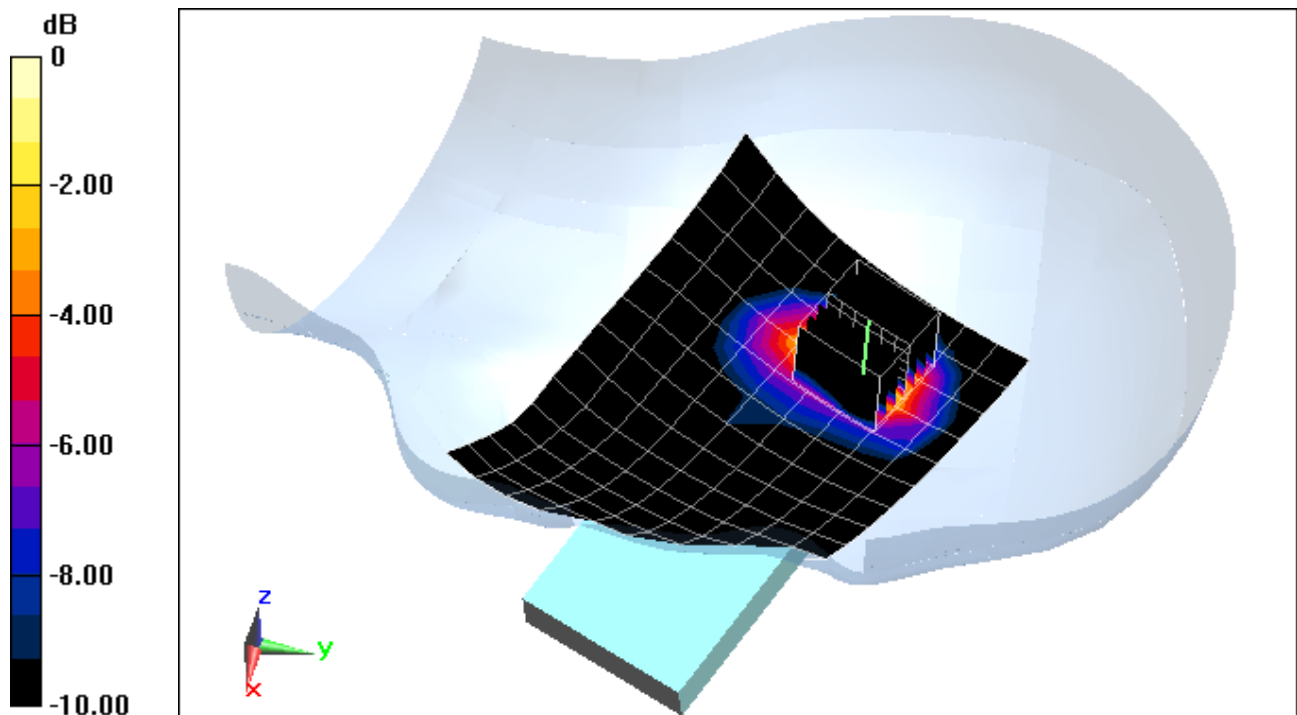
**Area Scan (10x14x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Reference Value = 7.209 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.240 mW/g

**SAR(1 g) = 0.101 mW/g; SAR(10 g) = 0.046 mW/g**



0 dB = 0.137 mW/g = -17.27 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5240 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5240 \text{ MHz}$ ;  $\sigma = 4.578 \text{ mho/m}$ ;  $\epsilon_r = 36.62$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 07-02-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.5°C

Probe: EX3DV4 - SN3589; ConvF(4.59, 4.59, 4.59); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: IEEE 802.11a 5.2 GHz, Right Head, Touch, Ch 48, 6 Mbps**

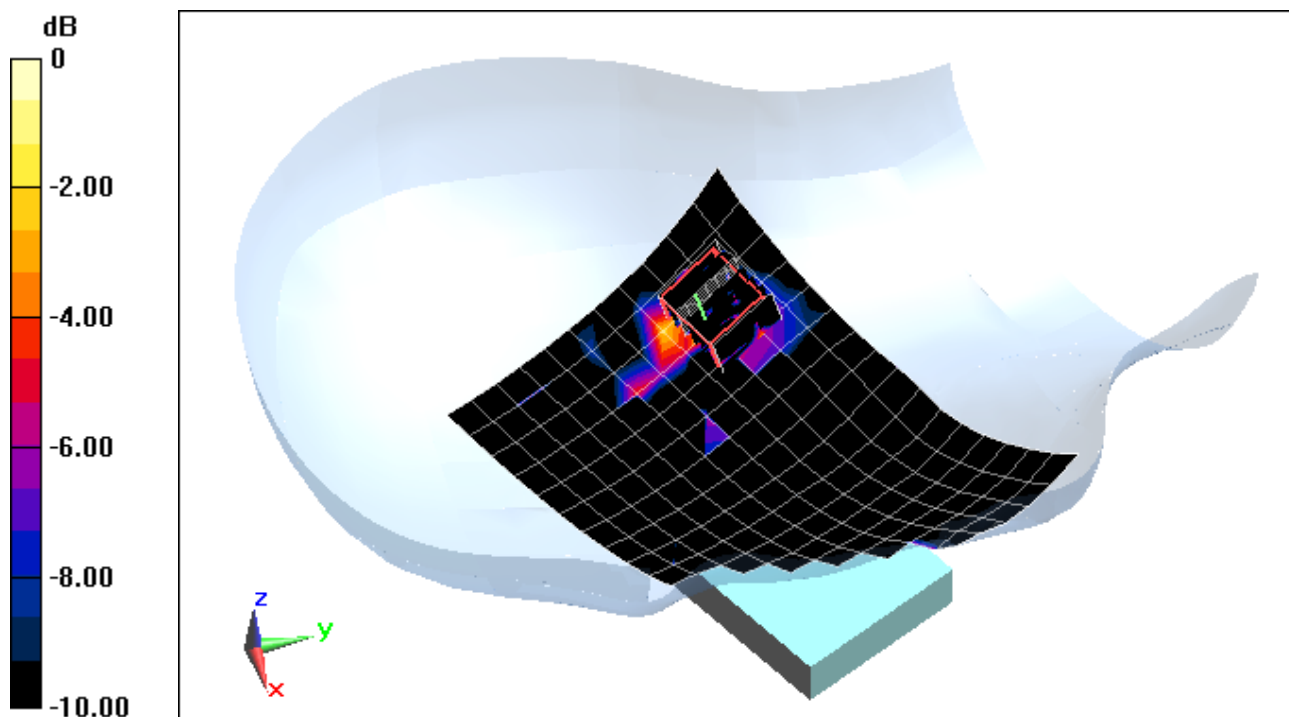
**Area Scan (12x17x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x12)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Reference Value = 3.232 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 0.196 mW/g

**SAR(1 g) = 0.034 mW/g; SAR(10 g) = 0.00999 mW/g**



0 dB = 0.102 mW/g = -19.83 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5320 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5320 \text{ MHz}$ ;  $\sigma = 4.668 \text{ mho/m}$ ;  $\epsilon_r = 36.53$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 07-02-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.5°C

Probe: EX3DV4 - SN3589; ConvF(4.36, 4.36, 4.36); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: IEEE 802.11a 5.3 GHz, Right Head, Tilt, Ch 64, 6 Mbps**

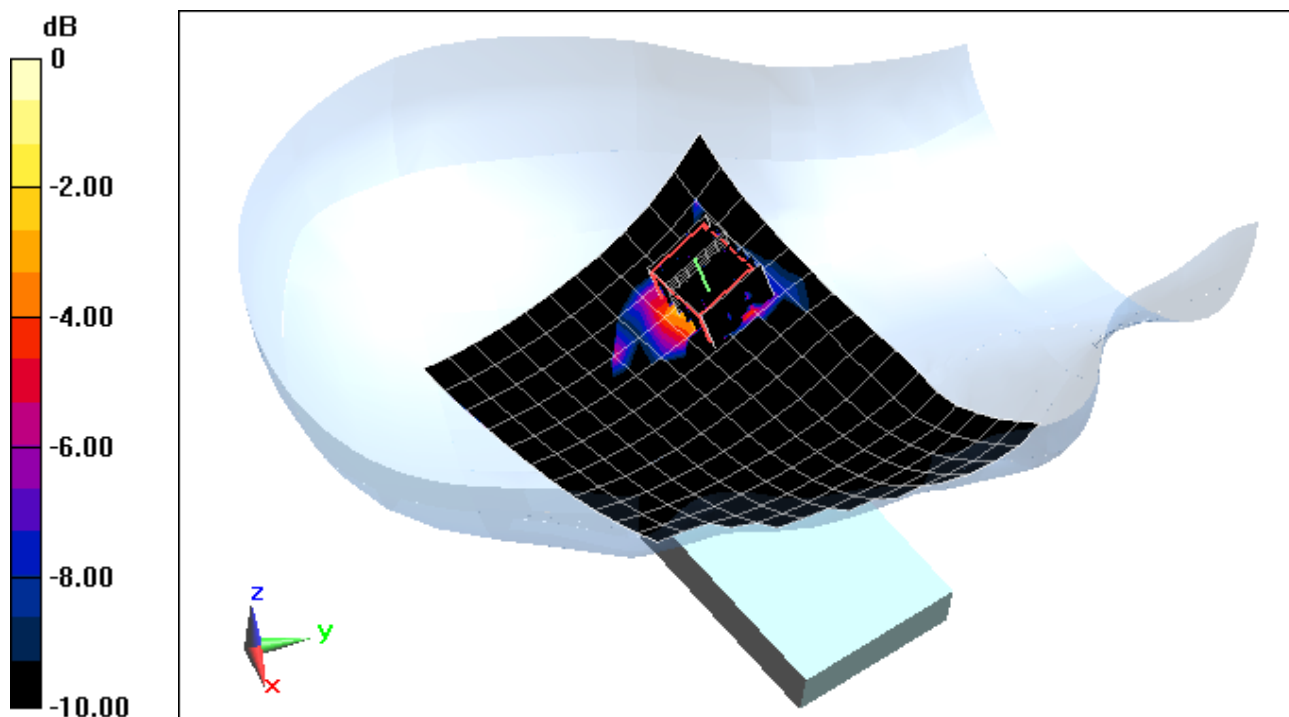
**Area Scan (12x17x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x12)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Reference Value = 3.107 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.332 mW/g

**SAR(1 g) = 0.033 mW/g; SAR(10 g) = 0.011 mW/g**



0 dB = 0.0900 mW/g = -20.92 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5320 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5320 \text{ MHz}$ ;  $\sigma = 4.668 \text{ mho/m}$ ;  $\epsilon_r = 36.53$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 07-02-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.5°C

Probe: EX3DV4 - SN3589; ConvF(4.36, 4.36, 4.36); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: IEEE 802.11a, 5.3 GHz Left Head, Touch, Ch 64, 6 Mbps**

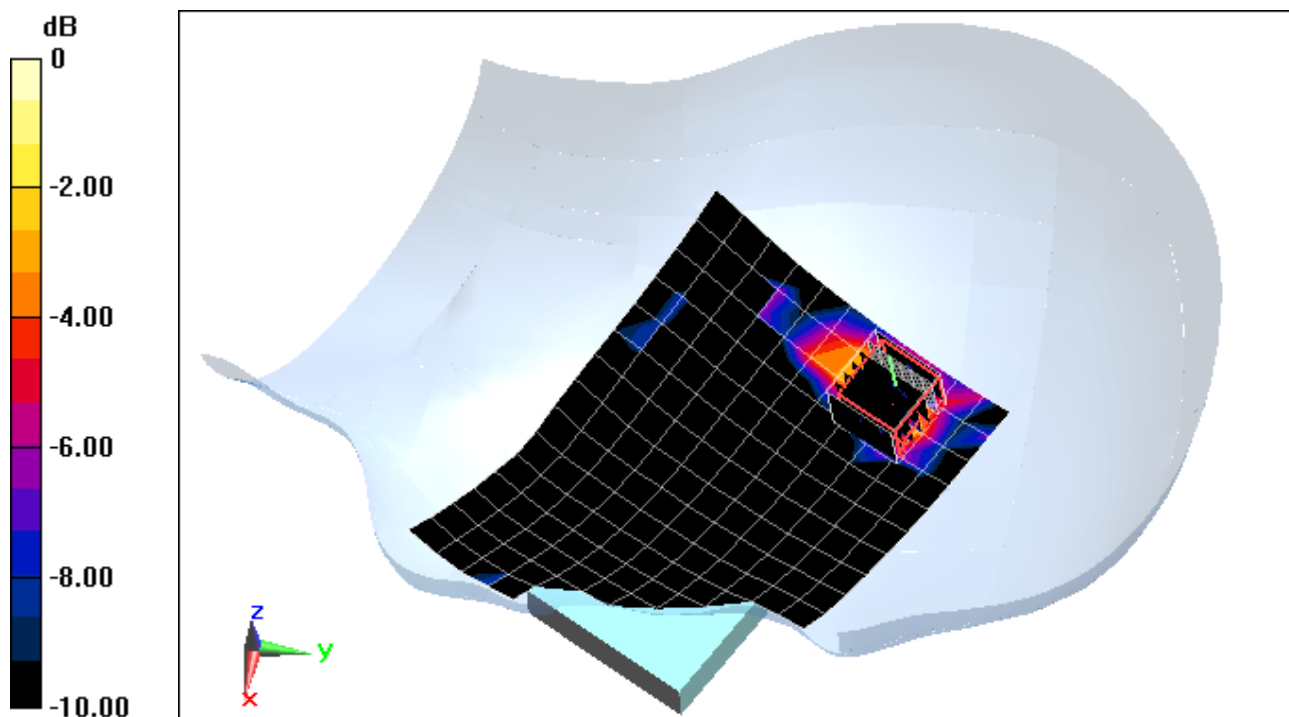
**Area Scan (12x16x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x12)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Reference Value = 3.794 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 0.630 mW/g

**SAR(1 g) = 0.060 mW/g; SAR(10 g) = 0.022 mW/g**



0 dB = 0.138 mW/g = -17.20 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5320 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5320 \text{ MHz}$ ;  $\sigma = 4.668 \text{ mho/m}$ ;  $\epsilon_r = 36.53$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 07-02-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.5°C

Probe: EX3DV4 - SN3589; ConvF(4.36, 4.36, 4.36); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: IEEE 802.11a, 5.3 GHz Left Head, Tilt, Ch 64, 6 Mbps**

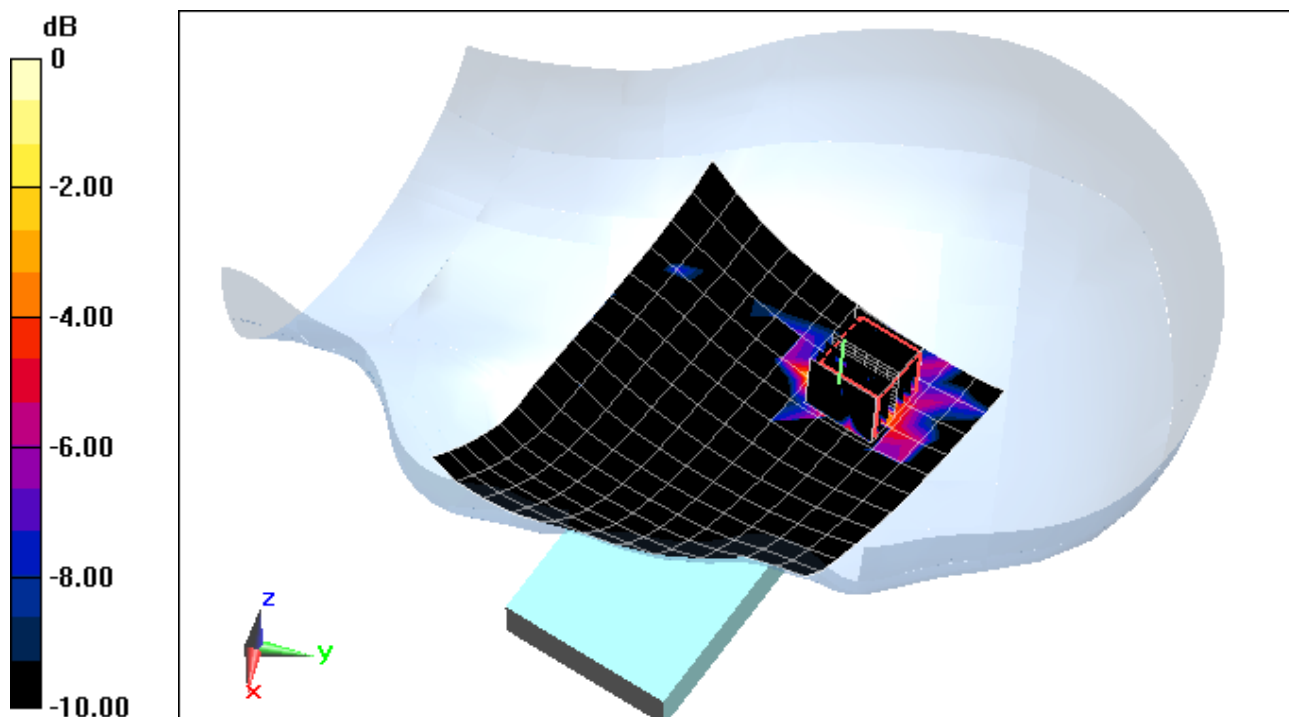
**Area Scan (12x16x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x12)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Reference Value = 3.415 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.490 mW/g

**SAR(1 g) = 0.065 mW/g; SAR(10 g) = 0.022 mW/g**



0 dB = 0.145 mW/g = -16.77 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.492 \text{ mho/m}$ ;  $\epsilon_r = 52.83$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 06-27-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.8°C

Probe: ES3DV3 - SN3209; ConvF(4.63, 4.63, 4.63); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: PCS CDMA, Body SAR, Back side, Mid.ch**

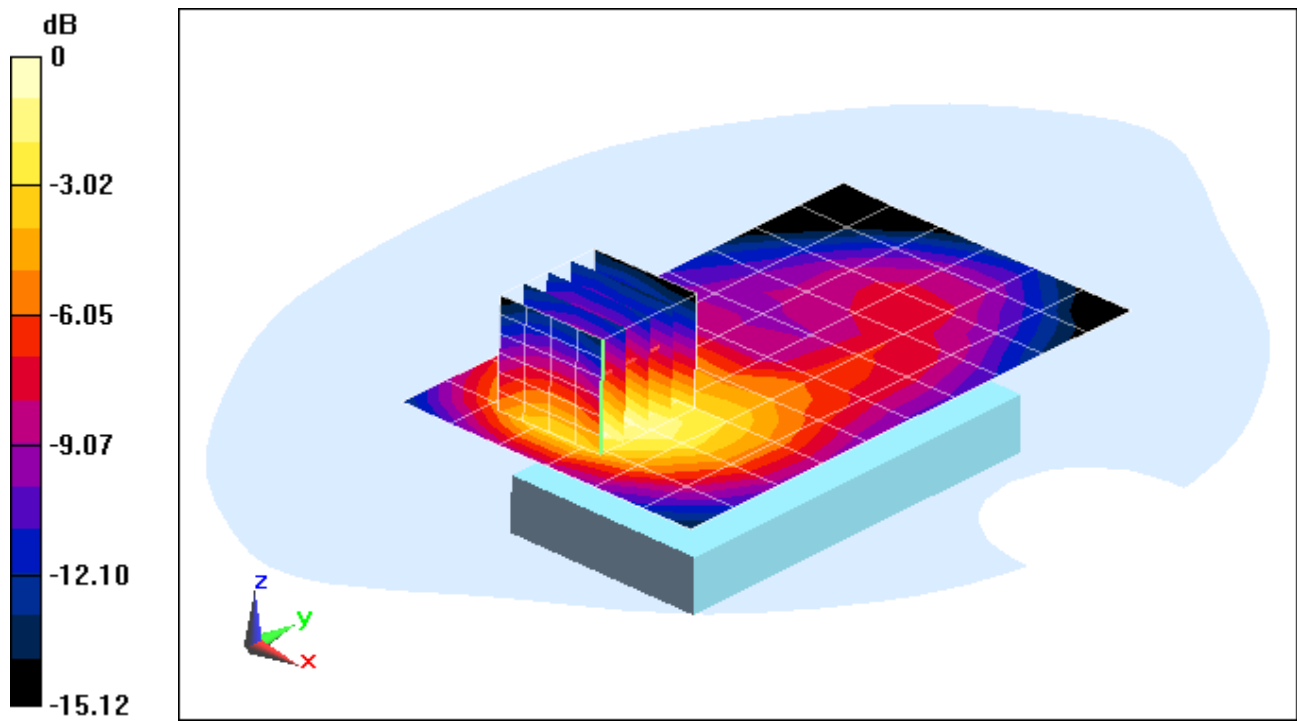
**Area Scan (7x11x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 23.411 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 1.037 mW/g

**SAR(1 g) = 0.650 mW/g; SAR(10 g) = 0.384 mW/g**



0 dB = 0.692 mW/g = -3.20 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

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

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 2.014 \text{ mho/m}$ ;  $\epsilon_r = 53.453$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 06-28-2012; Ambient Temp: 24.3°C; Tissue Temp: 24.5°C

Probe: ES3DV3 - SN3209; ConvF(4.23, 4.23, 4.23); Calibrated: 3/16/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

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

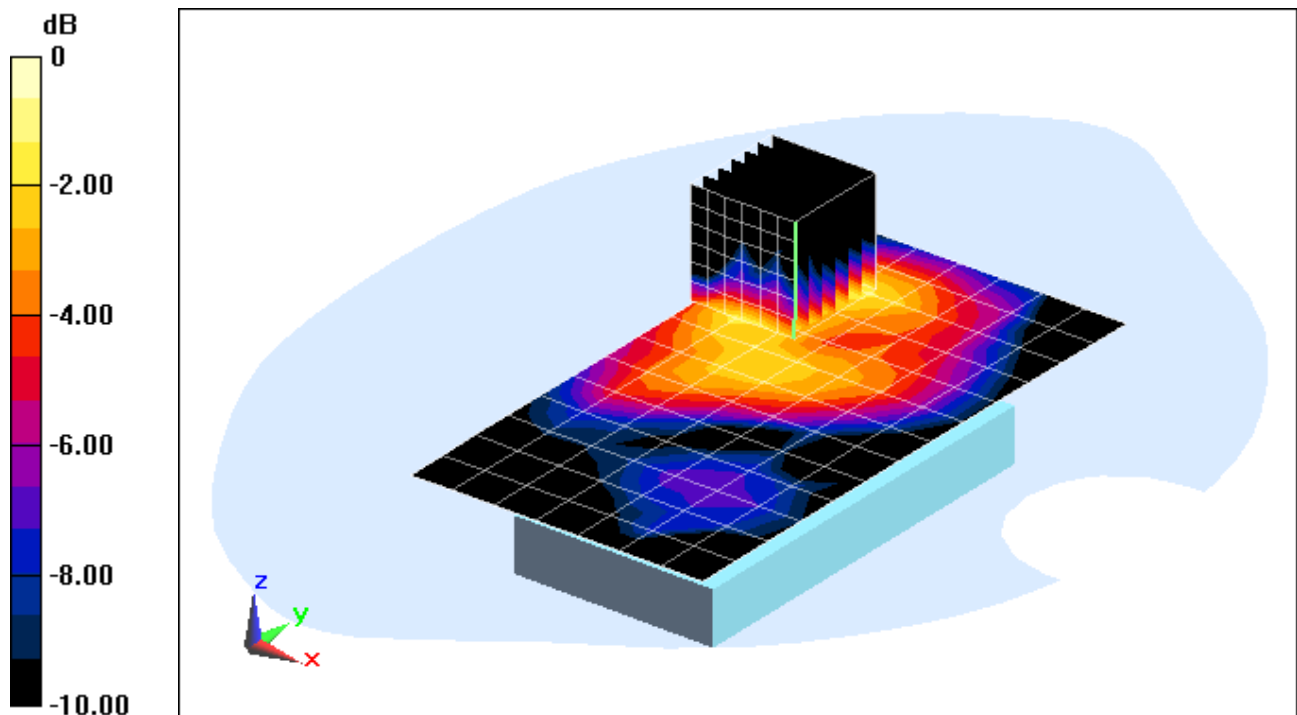
**Area Scan (8x14x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Reference Value = 5.629 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 0.120 mW/g

**SAR(1 g) = 0.057 mW/g; SAR(10 g) = 0.029 mW/g**



0 dB = 0.0742 mW/g = -22.59 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: A3LSPHM830; Type: Portable Handset; Serial: 73**

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5700 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$f = 5700 \text{ MHz}$ ;  $\sigma = 5.862 \text{ mho/m}$ ;  $\epsilon_r = 46.48$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 06-29-2012; Ambient Temp: 24.8°C; Tissue Temp: 23.9°C

Probe: EX3DV4 - SN3589; ConvF(3.25, 3.25, 3.25); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

**Mode: IEEE 802.11a, 5.5 GHz, Body SAR, Ch 140, 6 Mbps, Back Side**

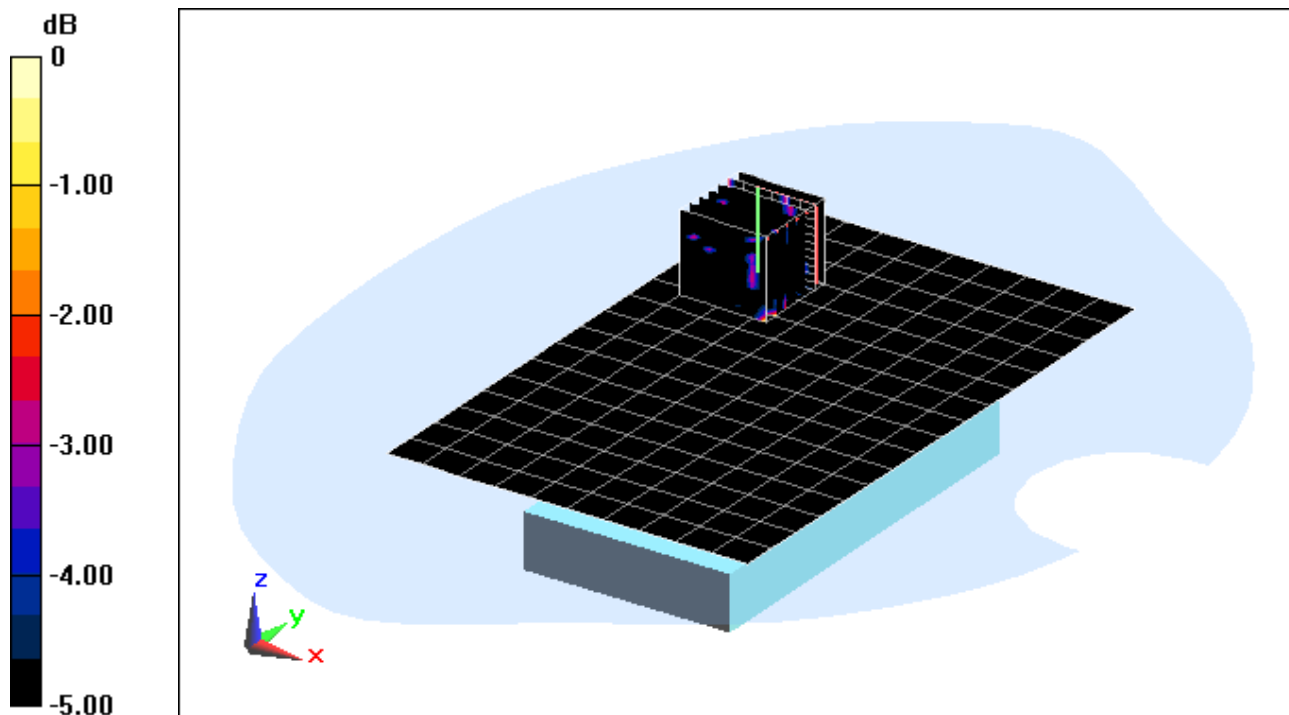
**Area Scan (11x17x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x12)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Reference Value = 3.215 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 0.957 mW/g

**SAR(1 g) = 0.067 mW/g; SAR(10 g) = 0.019 mW/g**



0 dB = 0.125 mW/g = -18.06 dB mW/g

## APPENDIX B: SYSTEM VERIFICATION

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d080**

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

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.418 \text{ mho/m}$ ;  $\epsilon_r = 38.41$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-27-2012; Ambient Temp: 24.3°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3209; ConvF(5.15, 5.15, 5.15); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 1900MHz System Verification

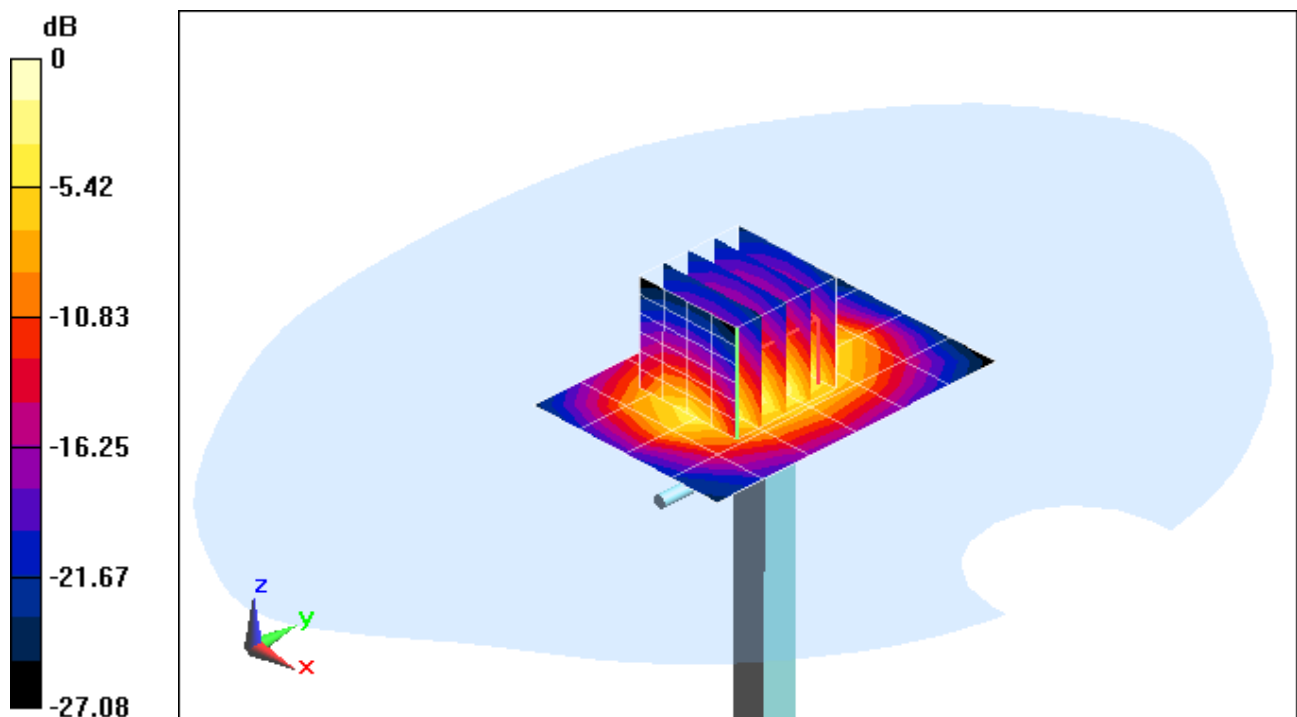
**Area Scan (5x7x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

**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) = 3.92 mW/g; SAR(10 g) = 2 mW/g**

Deviation: -1.75%



0 dB = 4.19 mW/g = 12.45 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d080**

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

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.418 \text{ mho/m}$ ;  $\epsilon_r = 38.41$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-27-2012; Ambient Temp: 24.3°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3209; ConvF(5.15, 5.15, 5.15); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 1900MHz System Verification

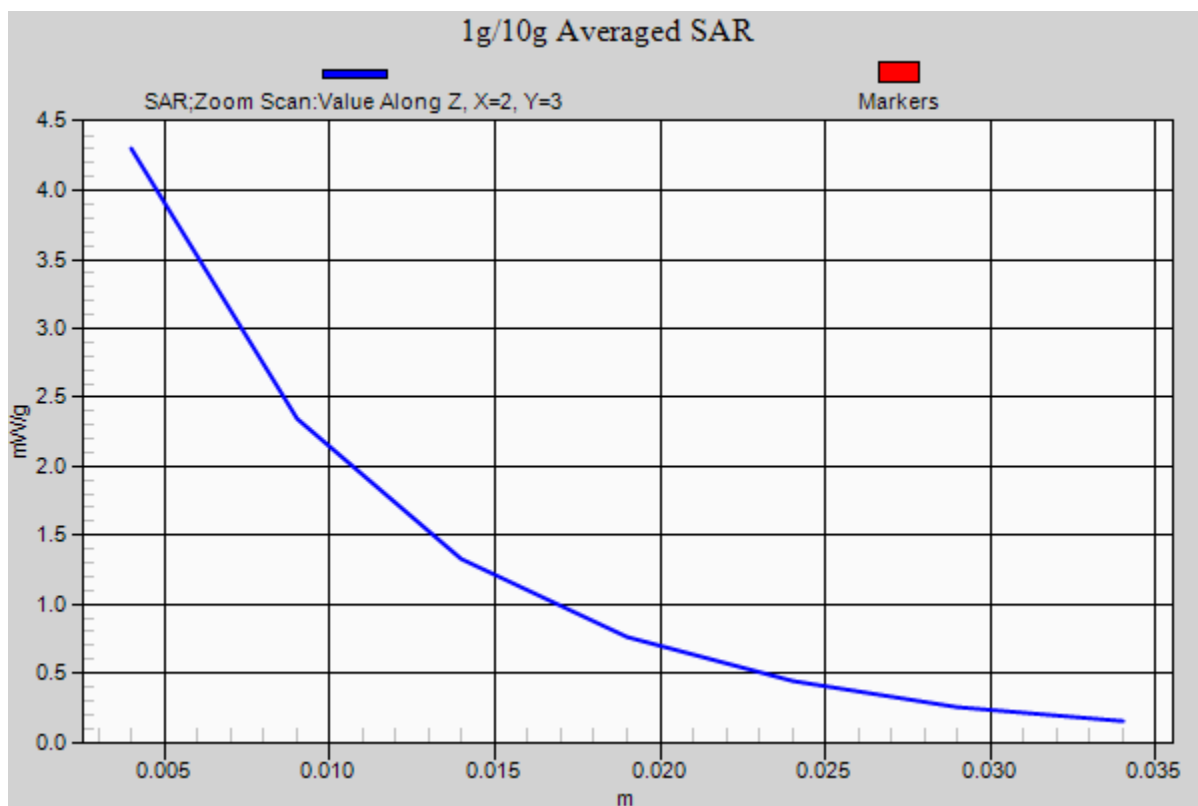
**Area Scan (5x7x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

**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) = 3.92 mW/g; SAR(10 g) = 2 mW/g**

Deviation: -1.75%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 2450 MHz; Type: D2450V2; Serial: 797**

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

Medium: 2450 Head Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.838 \text{ mho/m}$ ;  $\epsilon_r = 38.68$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-28-2012; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3209; ConvF(4.46, 4.46, 4.46); Calibrated: 3/16/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 2450MHz System Verification

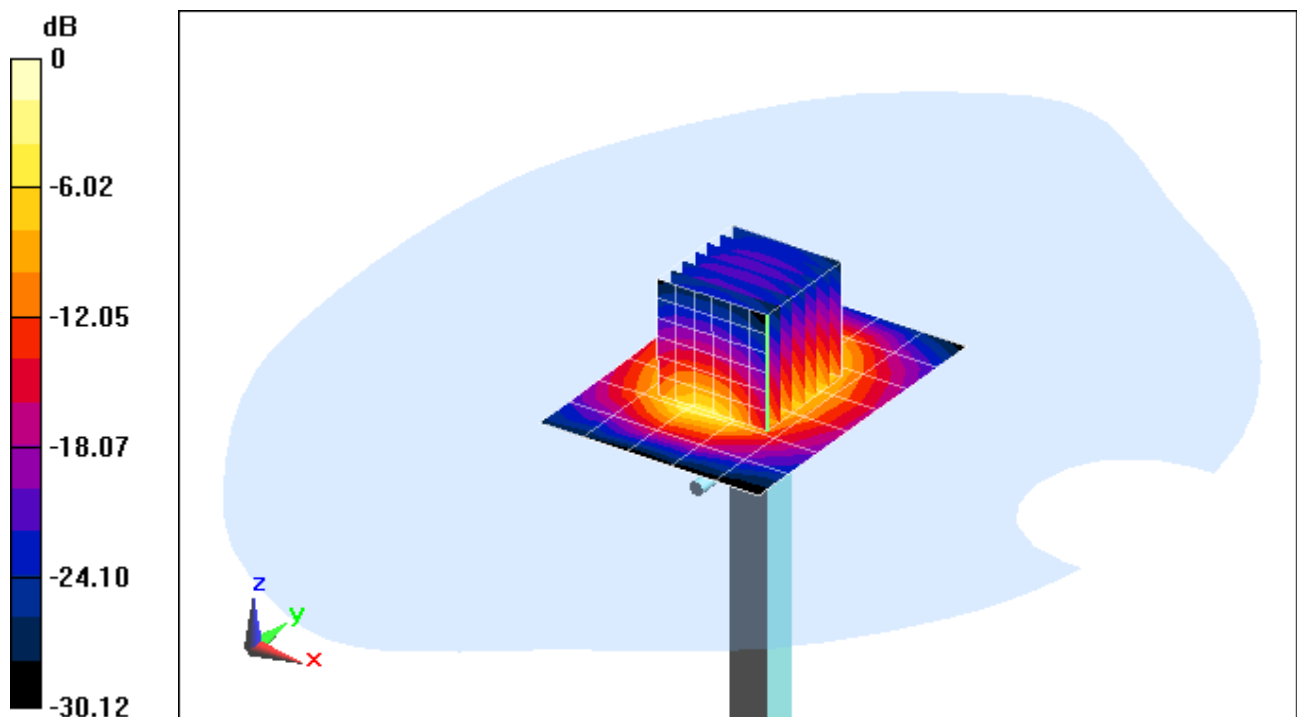
**Area Scan (6x8x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

**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) = 5.41 mW/g; SAR(10 g) = 2.53 mW/g**

Deviation: 3.84%



0 dB = 6.44 mW/g = 16.18 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 2450 MHz; Type: D2450V2; Serial: 797**

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

Medium: 2450 Head Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.838 \text{ mho/m}$ ;  $\epsilon_r = 38.68$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-28-2012; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3209; ConvF(4.46, 4.46, 4.46); Calibrated: 3/16/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 2450MHz System Verification

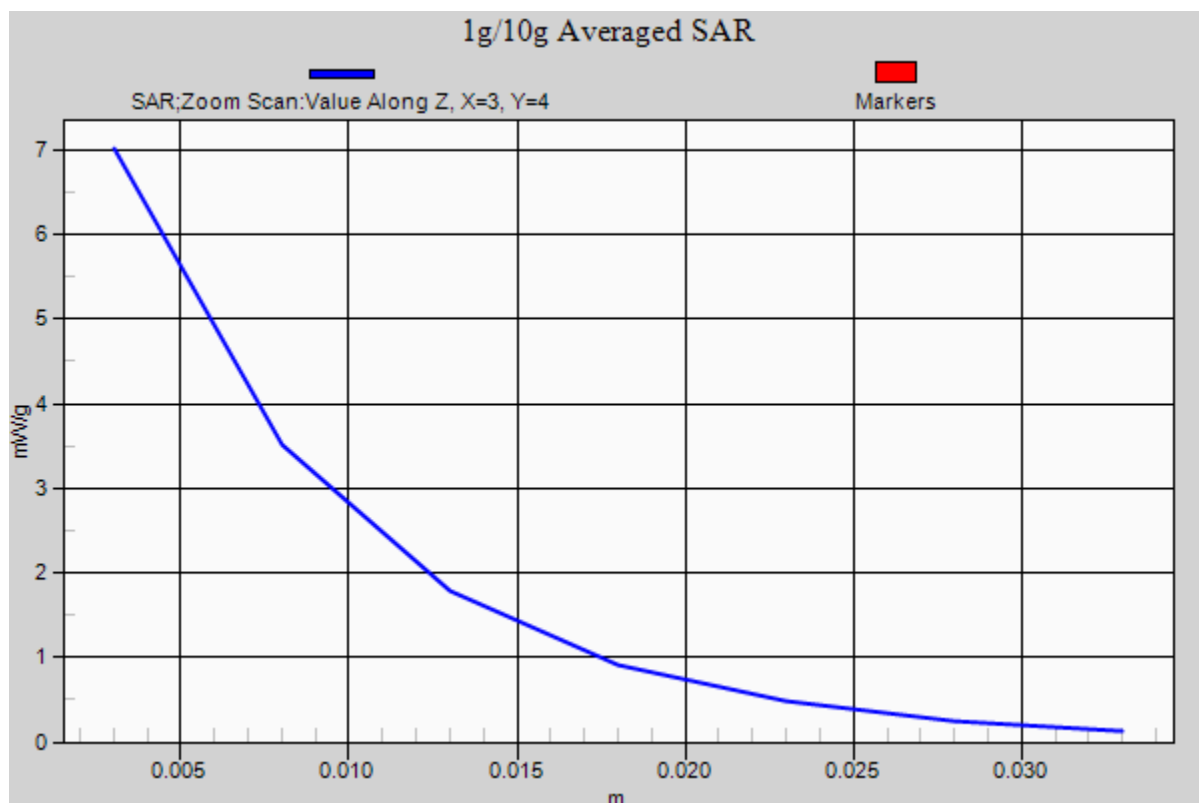
**Area Scan (6x8x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

**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) = 5.41 mW/g; SAR(10 g) = 2.53 mW/g**

Deviation: 3.84%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1057**

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5200 \text{ MHz}$ ;  $\sigma = 4.553 \text{ mho/m}$ ;  $\epsilon_r = 36.69$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-02-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.5°C

Probe: EX3DV4 - SN3589; ConvF(4.59, 4.59, 4.59); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 5200MHz System Verification

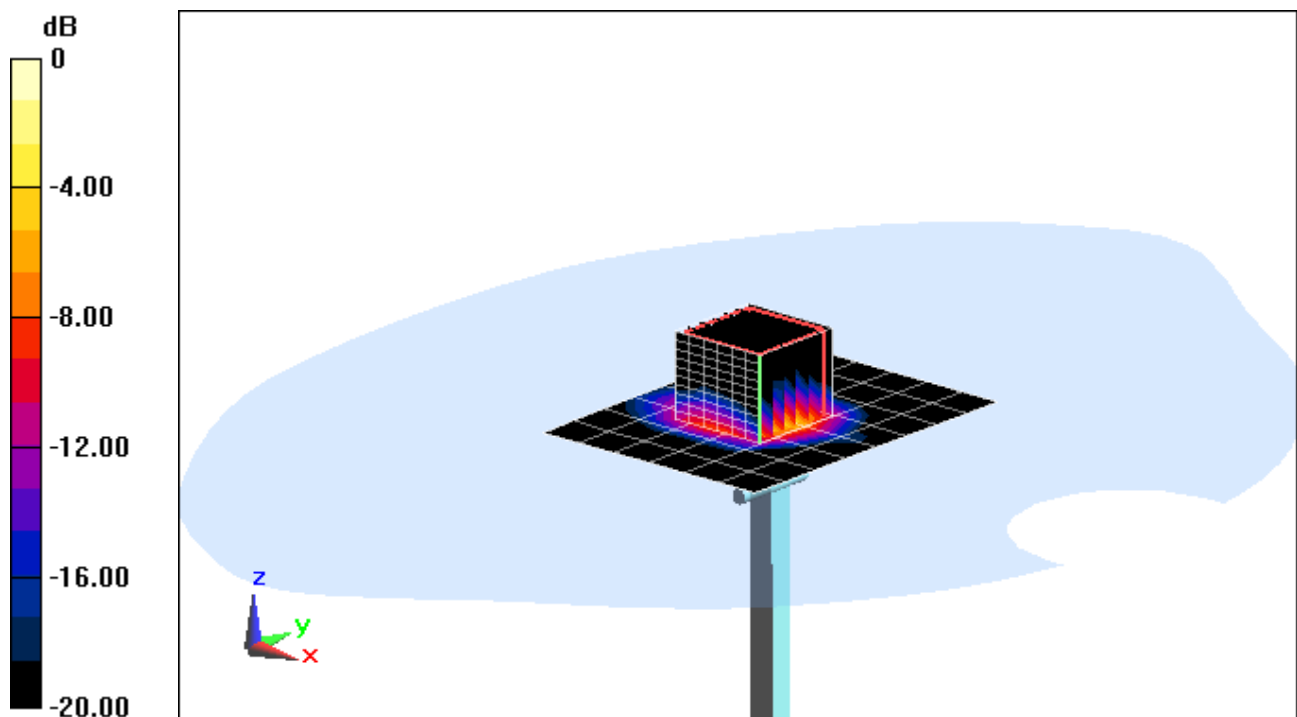
**Area Scan (7x9x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x11)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Input Power: 12.6 dBm (18.2 mW)

**SAR(1 g) = 1.45 mW/g; SAR(10 g) = 0.397 mW/g**

Deviation: 0.72%



0 dB = 3.01 mW/g = 9.57 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1057**

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5200 \text{ MHz}$ ;  $\sigma = 4.553 \text{ mho/m}$ ;  $\epsilon_r = 36.69$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-02-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.5°C

Probe: EX3DV4 - SN3589; ConvF(4.59, 4.59, 4.59); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 5200MHz System Verification

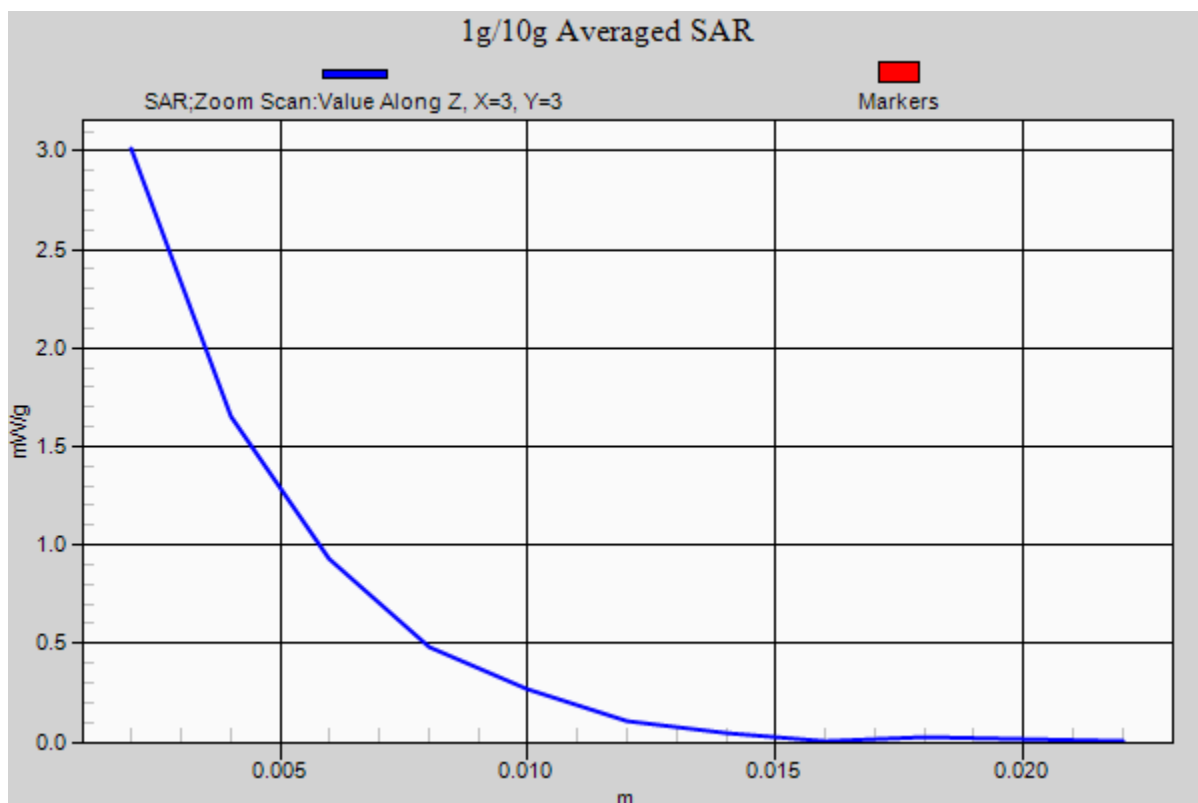
**Area Scan (7x9x1):** Measurement grid: dx=10mm, dy=10mm

**Zoom Scan (7x7x11)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Input Power: 12.6 dBm (18.2 mW)

**SAR(1 g) = 1.45 mW/g; SAR(10 g) = 0.397 mW/g**

Deviation: 0.72%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1057**

Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5500 \text{ MHz}$ ;  $\sigma = 4.828 \text{ mho/m}$ ;  $\epsilon_r = 36.3$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-02-2012; Ambient Temp: 24.7°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN3589; ConvF(4.33, 4.33, 4.33); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 5500MHz System Verification

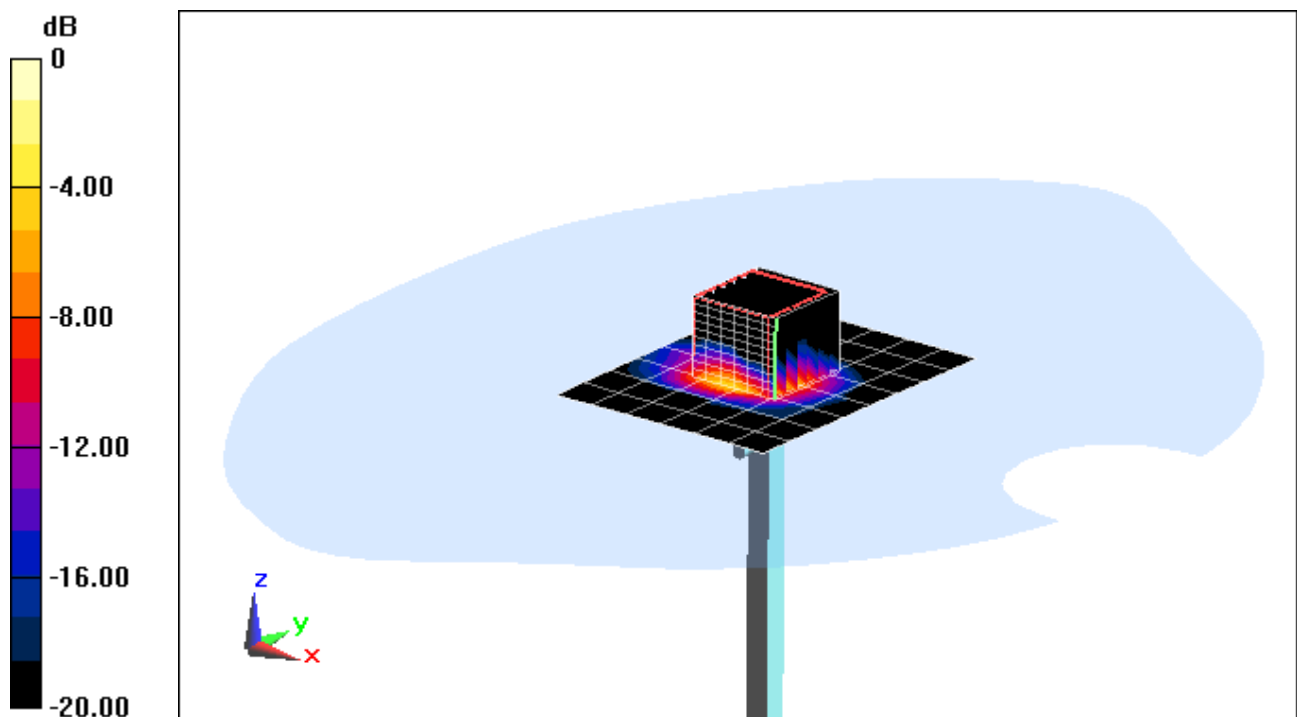
**Area Scan (7x9x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x11)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Input Power: 12.6 dBm (18.2 mW)

**SAR(1 g) = 1.48 mW/g; SAR(10 g) = 0.386 mW/g**

Deviation: -4.22%



0 dB = 2.93 mW/g = 9.34 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1057**

Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5500 \text{ MHz}$ ;  $\sigma = 4.828 \text{ mho/m}$ ;  $\epsilon_r = 36.3$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-02-2012; Ambient Temp: 24.7°C; Tissue Temp: 23.6°C

Probe: EX3DV4 - SN3589; ConvF(4.33, 4.33, 4.33); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 5500MHz System Verification

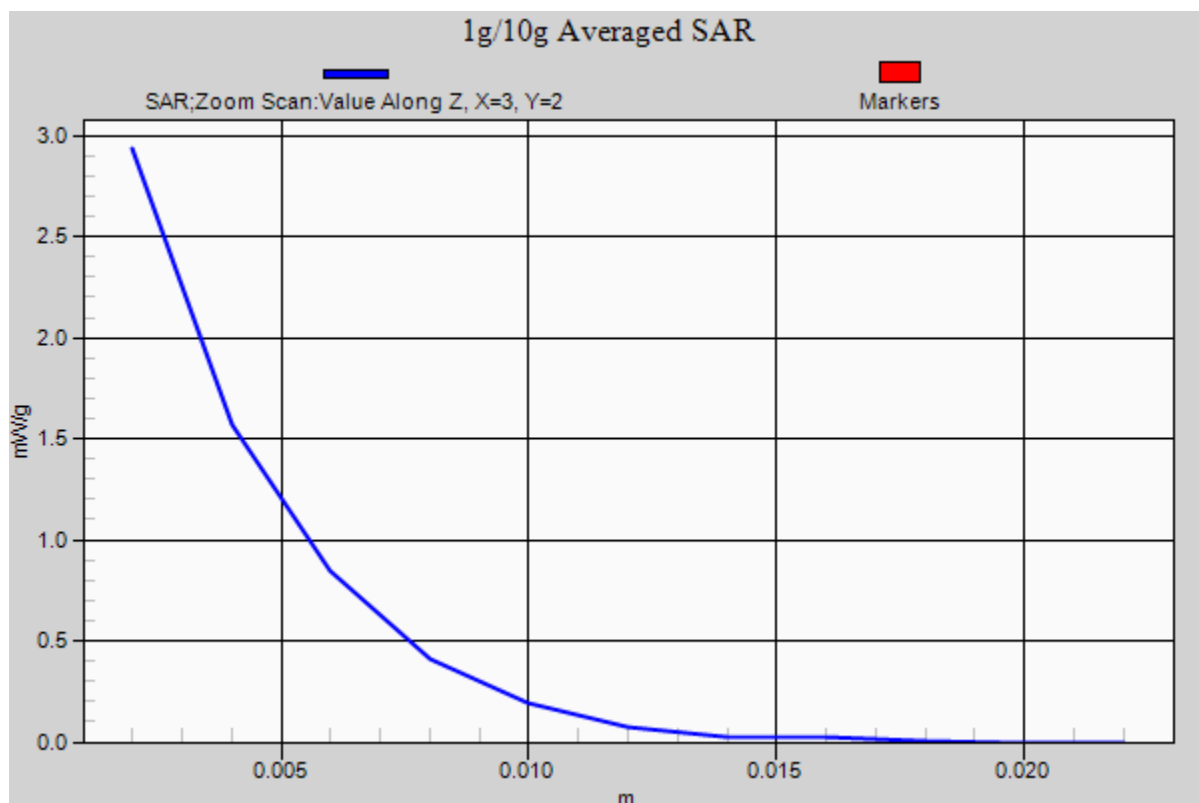
**Area Scan (7x9x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x11)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Input Power: 12.6 dBm (18.2 mW)

**SAR(1 g) = 1.48 mW/g; SAR(10 g) = 0.386 mW/g**

Deviation: -4.22%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057**

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5800 \text{ MHz}$ ;  $\sigma = 5.137 \text{ mho/m}$ ;  $\epsilon_r = 35.79$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-02-2012; Ambient Temp: 24.9°C; Tissue Temp: 23.8°C

Probe: EX3DV4 - SN3589; ConvF(4.05, 4.05, 4.05); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 5800MHz System Verification

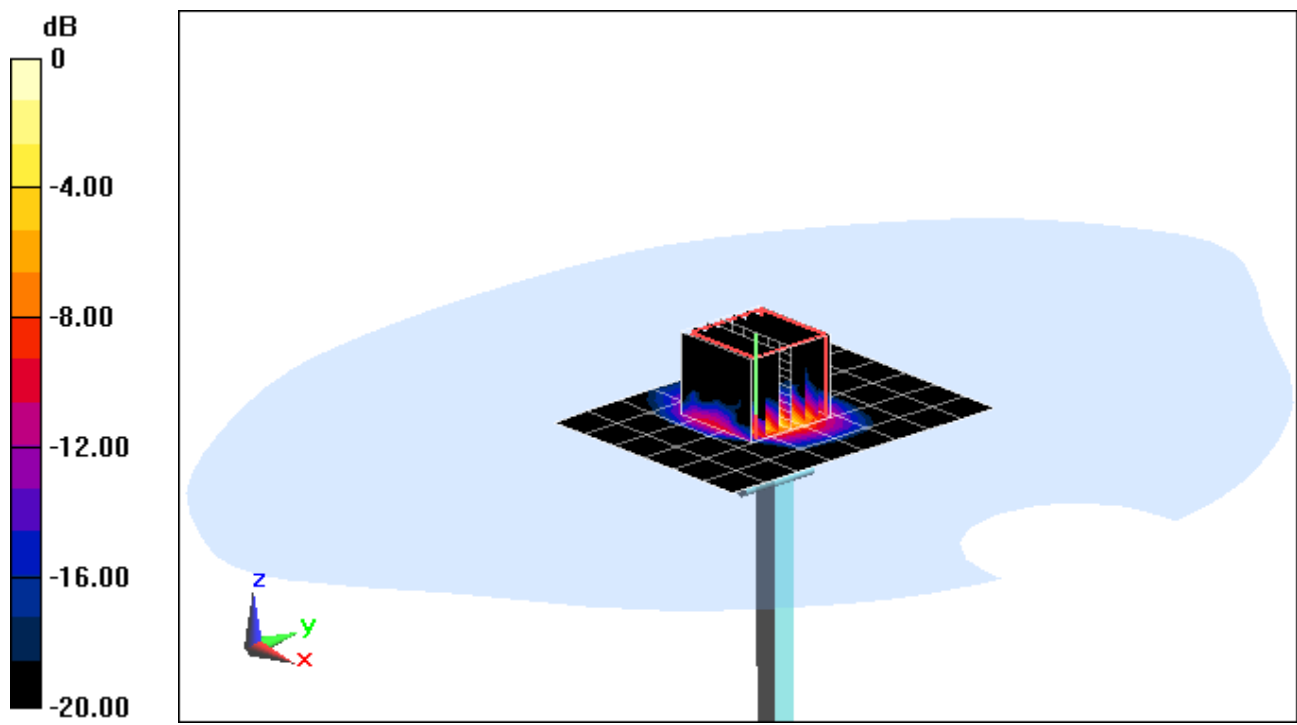
**Area Scan (7x9x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x11)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Input Power: 12.6 dBm (18.2 mW)

**SAR(1 g) = 1.43 mW/g; SAR(10 g) = 0.379 mW/g**

Deviation: -1.17%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057**

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5800 \text{ MHz}$ ;  $\sigma = 5.137 \text{ mho/m}$ ;  $\epsilon_r = 35.79$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-02-2012; Ambient Temp: 24.9°C; Tissue Temp: 23.8°C

Probe: EX3DV4 - SN3589; ConvF(4.05, 4.05, 4.05); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 5800MHz System Verification

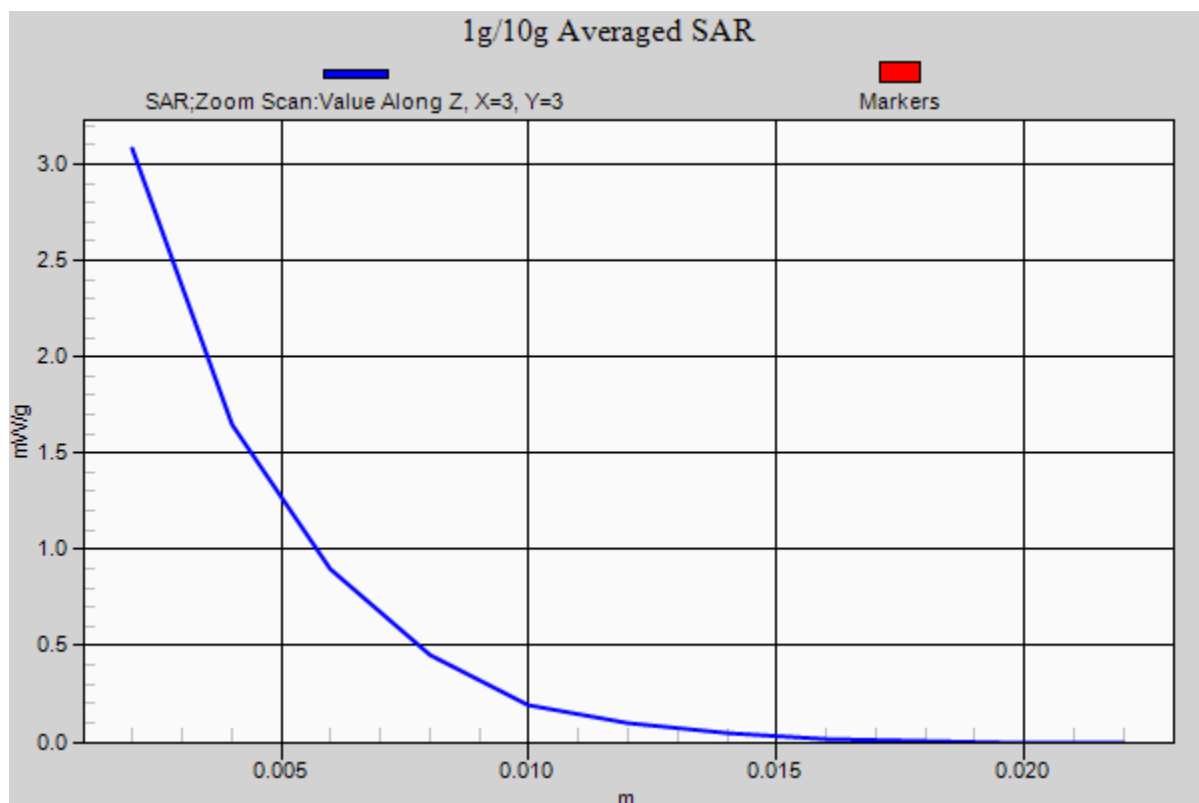
**Area Scan (7x9x1):** Measurement grid: dx=10mm, dy=10mm

**Zoom Scan (7x7x11)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Input Power: 12.6 dBm (18.2 mW)

**SAR(1 g) = 1.43 mW/g; SAR(10 g) = 0.379 mW/g**

Deviation: -1.17%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d080**

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

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.516 \text{ mho/m}$ ;  $\epsilon_r = 52.757$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-27-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.8°C

Probe: ES3DV3 - SN3209; ConvF(4.63, 4.63, 4.63); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 1900MHz System Verification

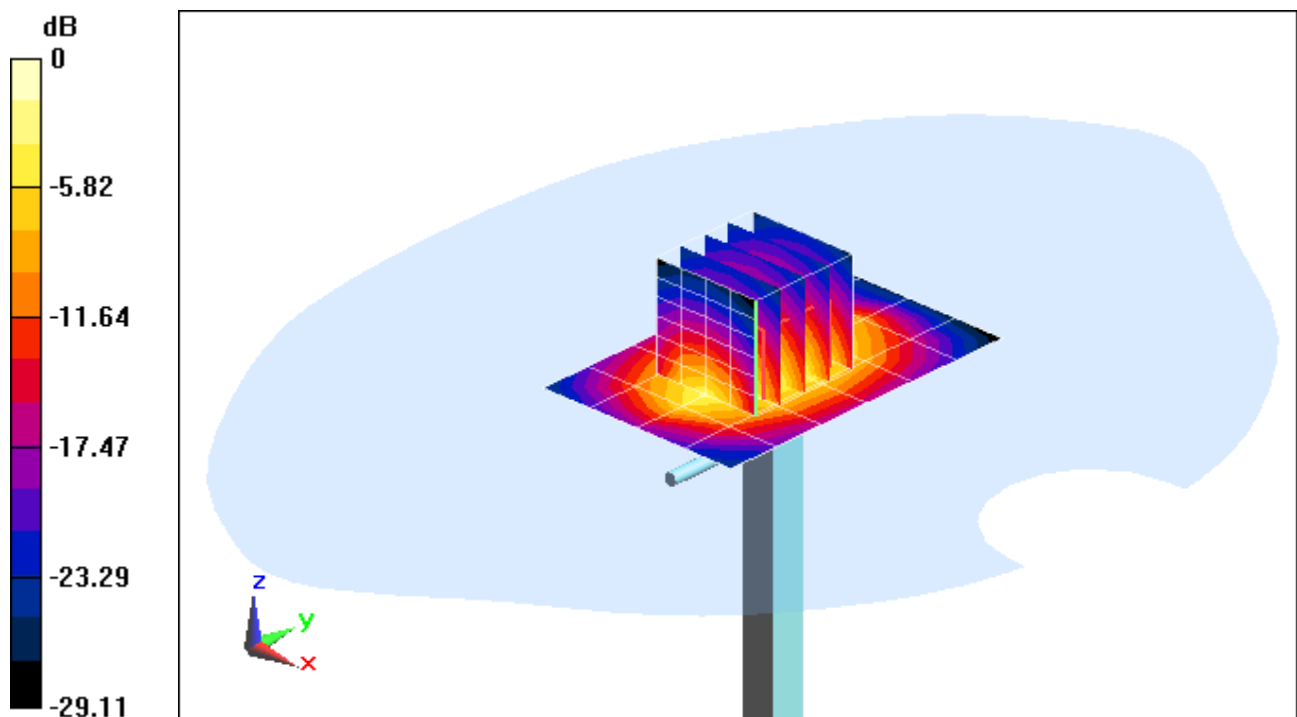
**Area Scan (5x7x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

**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) = 4.18 mW/g; SAR(10 g) = 2.17 mW/g**

Deviation: 2.20%



0 dB = 4.62 mW/g = 13.30 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d080**

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

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.516 \text{ mho/m}$ ;  $\epsilon_r = 52.757$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-27-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.8°C

Probe: ES3DV3 - SN3209; ConvF(4.63, 4.63, 4.63); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 1900MHz System Verification

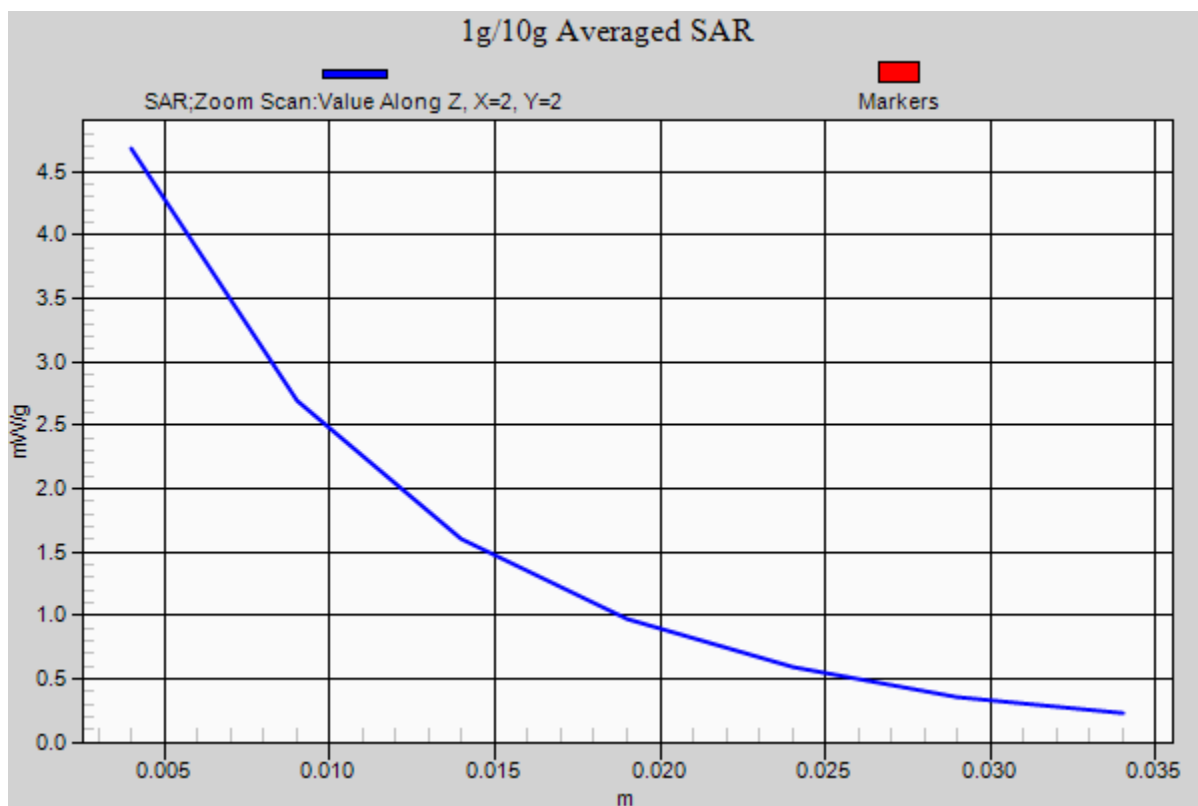
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power: 20.0 dBm (100 mW)

**SAR(1 g) = 4.18 mW/g; SAR(10 g) = 2.17 mW/g**

Deviation: 2.20%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 2450 MHz; Type: D2450V2; Serial: 797**

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

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.996 \text{ mho/m}$ ;  $\epsilon_r = 53.47$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-28-2012; Ambient Temp: 24.3°C; Tissue Temp: 24.5°C

Probe: ES3DV3 - SN3209; ConvF(4.23, 4.23, 4.23); Calibrated: 3/16/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 2450MHz System Verification

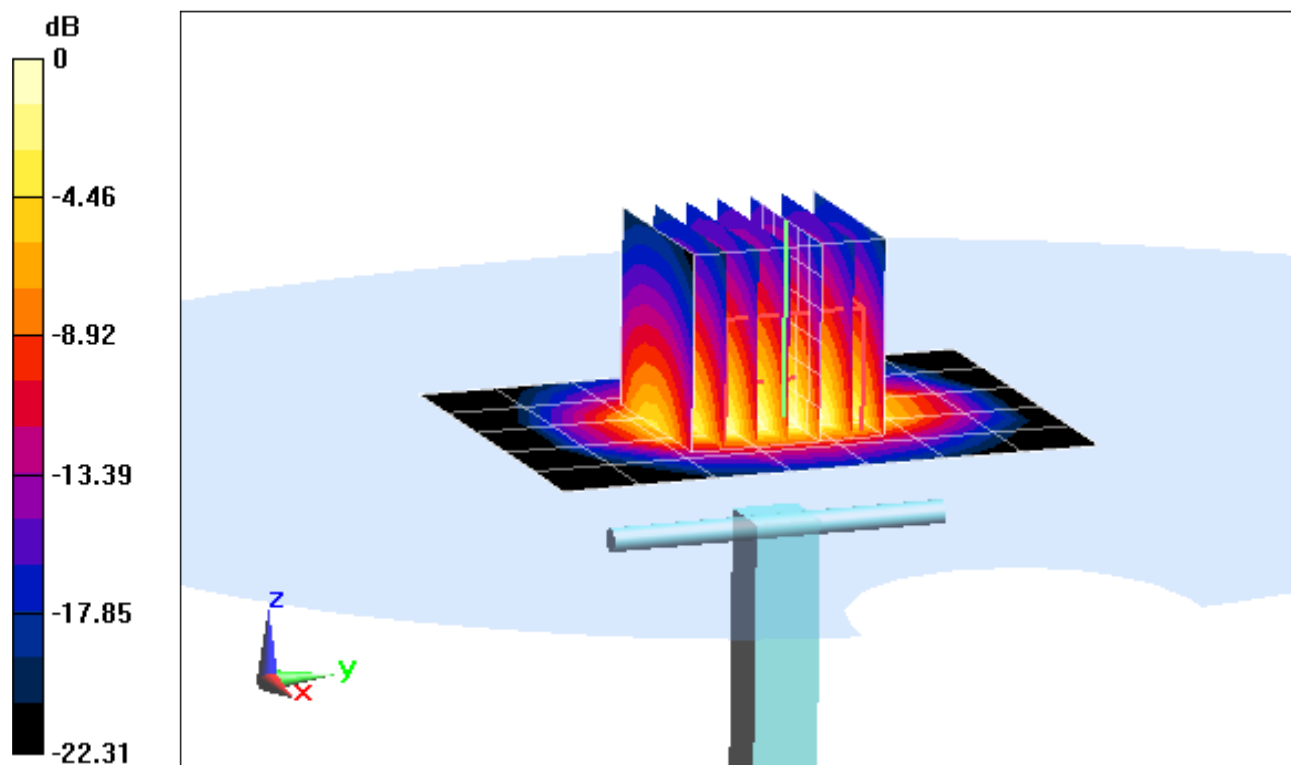
**Area Scan (6x8x1):** Measurement grid:  $dx=12\text{mm}$ ,  $dy=12\text{mm}$

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

Input Power = 20 dBm (100 mW)

**SAR(1 g) = 5.47 mW/g; SAR(10 g) = 2.55 mW/g**

Deviation = 7.68%



0 dB = 7.13 mW/g = 17.06 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 2450 MHz; Type: D2450V2; Serial: 797**

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

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.996 \text{ mho/m}$ ;  $\epsilon_r = 53.47$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-28-2012; Ambient Temp: 24.3°C; Tissue Temp: 24.5°C

Probe: ES3DV3 - SN3209; ConvF(4.23, 4.23, 4.23); Calibrated: 3/16/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 2450MHz System Verification

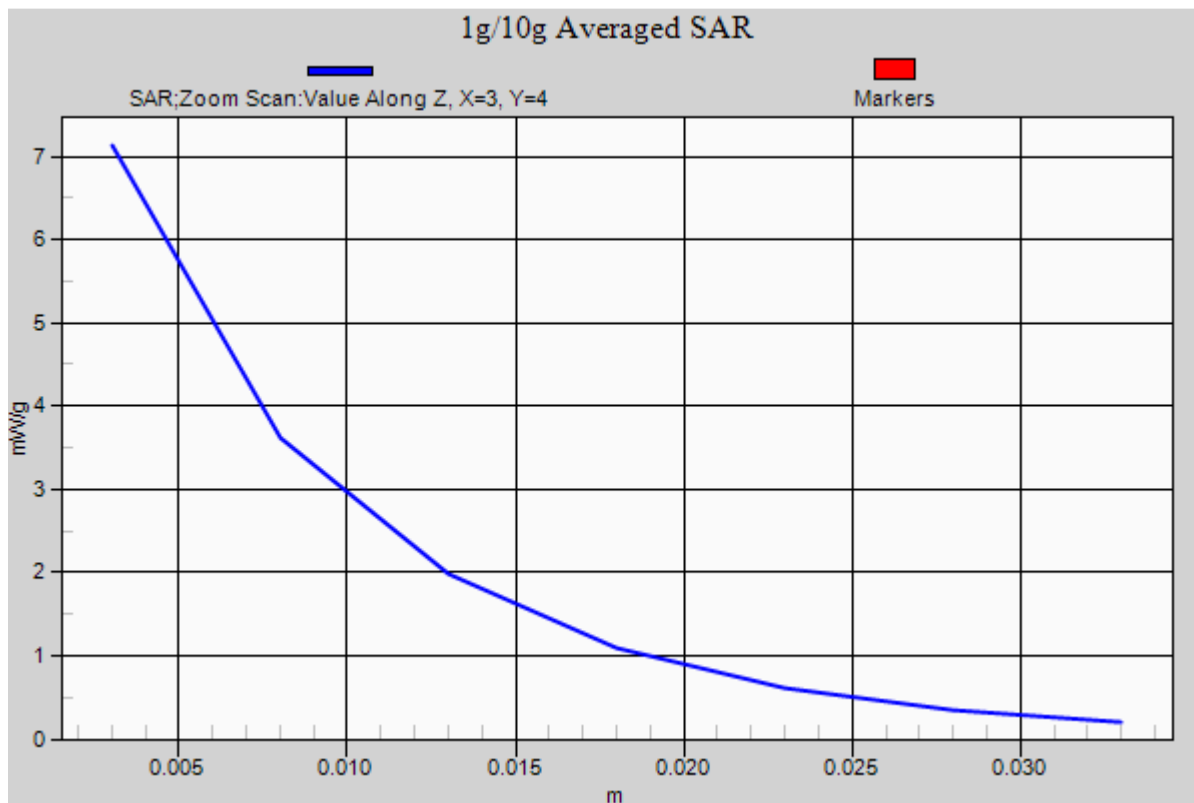
**Area Scan (6x8x1):** Measurement grid: dx=12mm, dy=12mm

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

Input Power = 20 dBm (100 mW)

**SAR(1 g) = 5.47 mW/g; SAR(10 g) = 2.55 mW/g**

Deviation = 7.68%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1057**

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$f = 5200 \text{ MHz}$ ;  $\sigma = 5.095 \text{ mho/m}$ ;  $\epsilon_r = 48.01$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-29-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.5°C

Probe: EX3DV4 - SN3589; ConvF(3.92, 3.92, 3.92); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 5200MHz System Verification

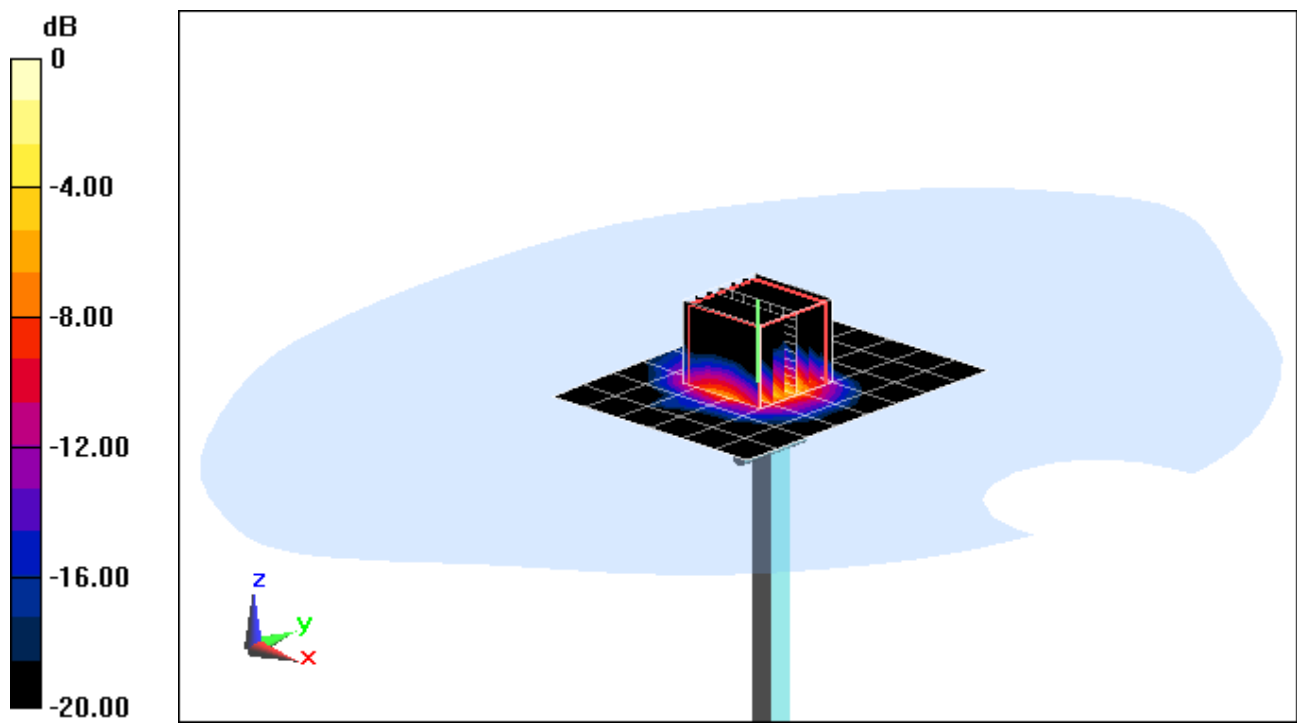
**Area Scan (7x9x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x11)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Input Power: 12.6 dBm (18.2 mW)

**SAR(1 g) = 1.4 mW/g; SAR(10 g) = 0.372 mW/g**

Deviation: 4.80%



0 dB = 2.90 mW/g = 9.25 dB mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1057**

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$f = 5200 \text{ MHz}$ ;  $\sigma = 5.095 \text{ mho/m}$ ;  $\epsilon_r = 48.01$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-29-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.5°C

Probe: EX3DV4 - SN3589; ConvF(3.92, 3.92, 3.92); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 5200MHz System Verification

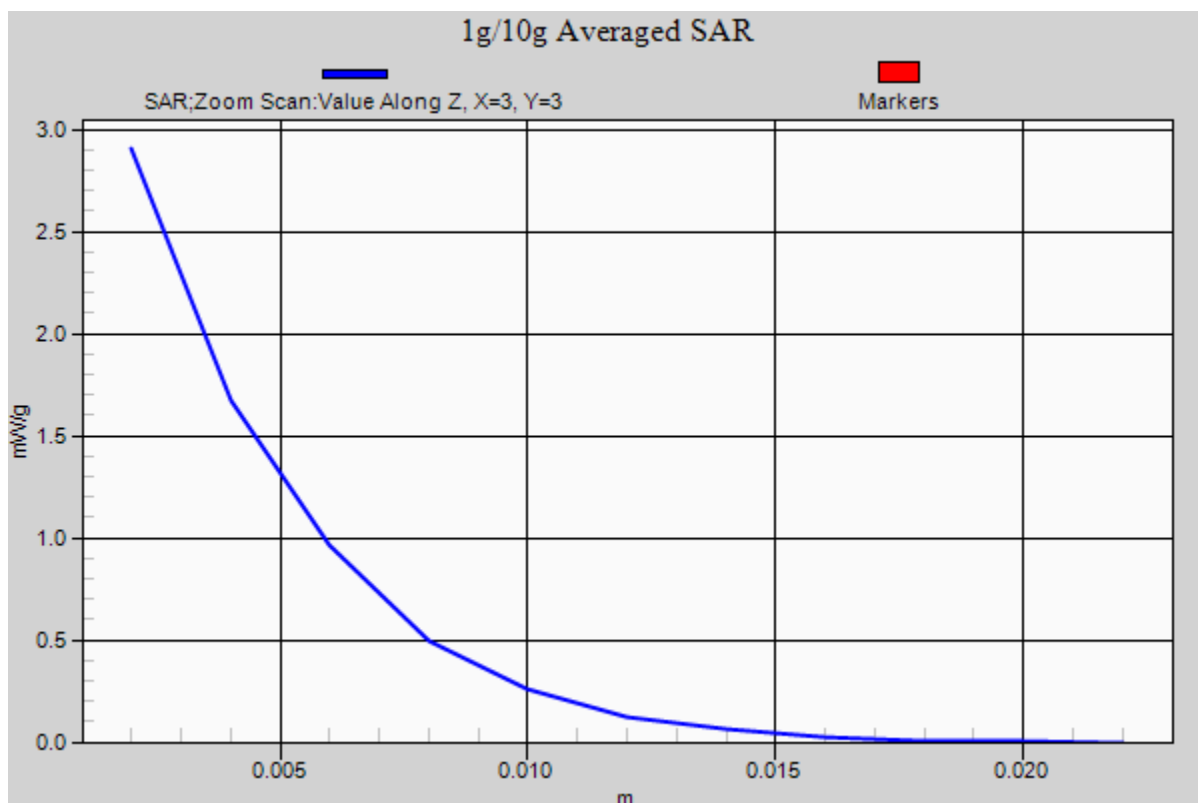
**Area Scan (7x9x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x11)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Input Power: 12.6 dBm (18.2 mW)

**SAR(1 g) = 1.4 mW/g; SAR(10 g) = 0.372 mW/g**

Deviation: 4.80%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1057**

Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$f = 5500 \text{ MHz}$ ;  $\sigma = 5.456 \text{ mho/m}$ ;  $\epsilon_r = 46.99$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-29-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.7°C

Probe: EX3DV4 - SN3589; ConvF(3.4, 3.4, 3.4); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 5500MHz System Verification

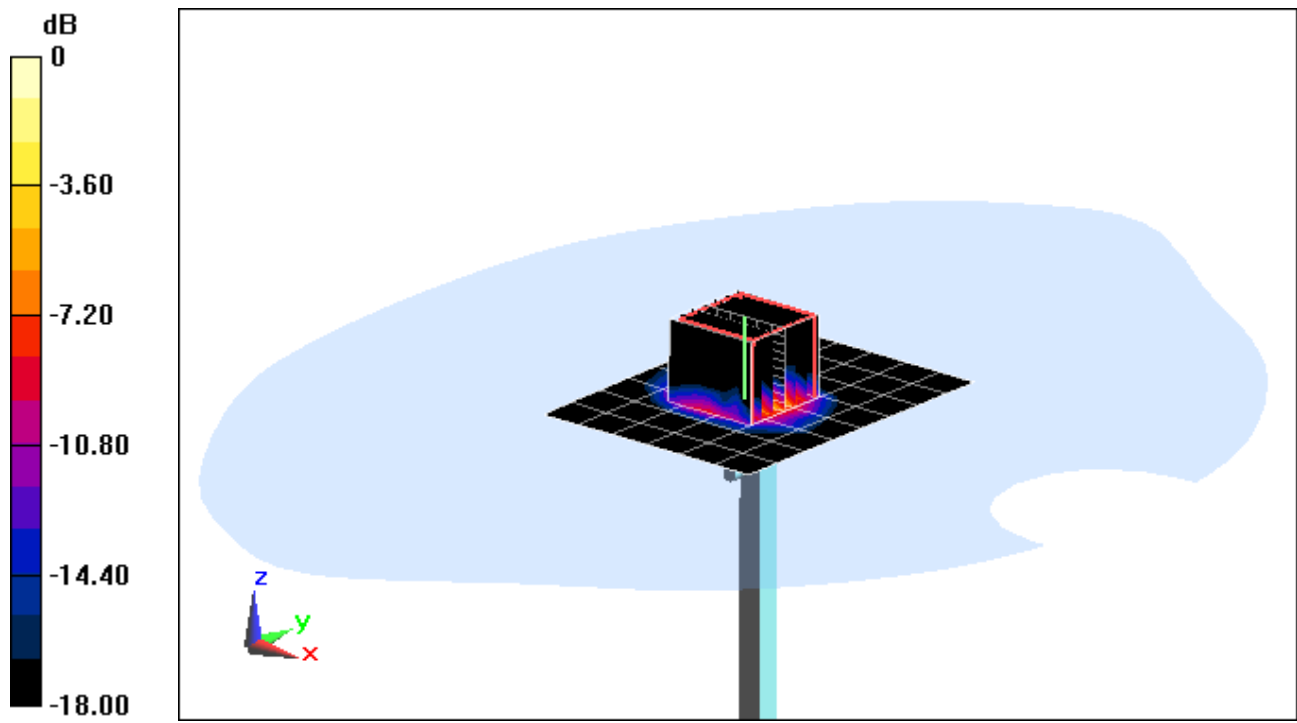
**Area Scan (7x9x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x11)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Input Power: 12.0 dBm (15.8 mW)

**SAR(1 g) = 1.29 mW/g; SAR(10 g) = 0.327 mW/g**

Deviation: 3.48%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1057**

Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$f = 5500 \text{ MHz}$ ;  $\sigma = 5.456 \text{ mho/m}$ ;  $\epsilon_r = 46.99$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-29-2012; Ambient Temp: 24.6°C; Tissue Temp: 23.7°C

Probe: EX3DV4 - SN3589; ConvF(3.4, 3.4, 3.4); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 5500MHz System Verification

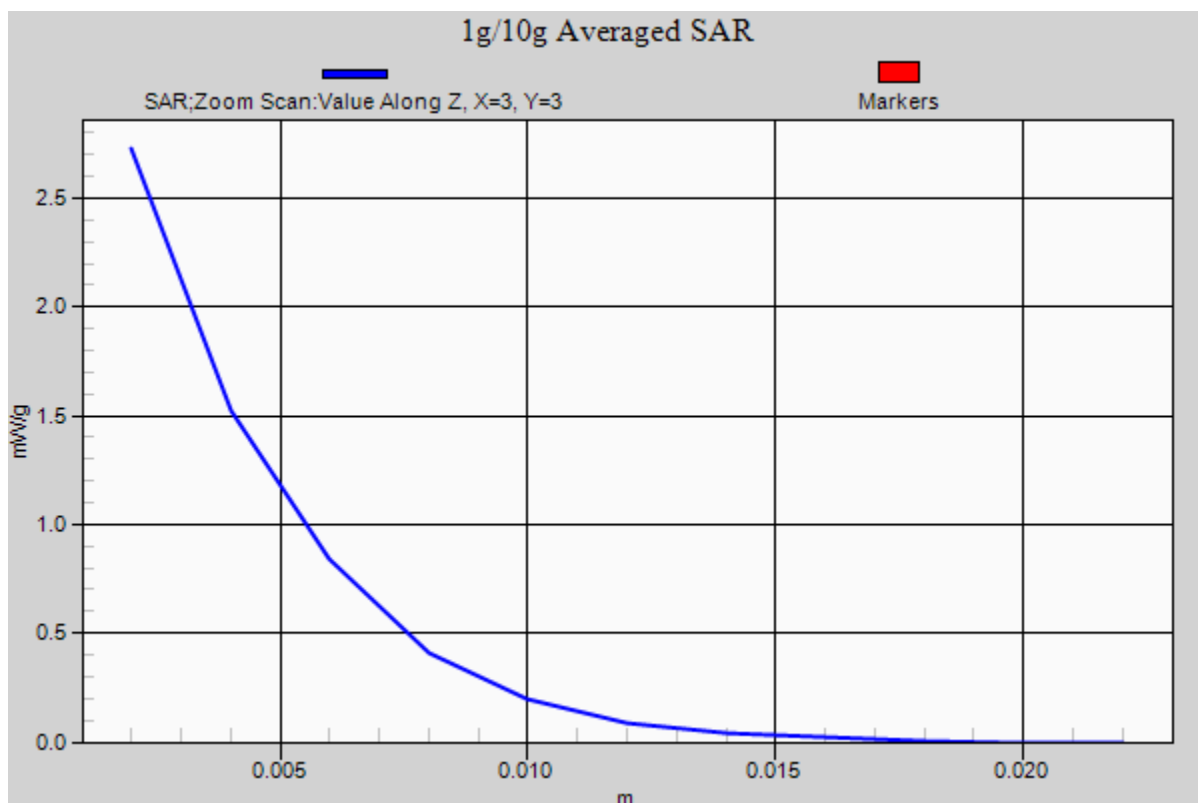
**Area Scan (7x9x1):** Measurement grid: dx=10mm, dy=10mm

**Zoom Scan (7x7x11)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Input Power: 12.0 dBm (15.8 mW)

**SAR(1 g) = 1.29 mW/g; SAR(10 g) = 0.327 mW/g**

Deviation: 3.48%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057**

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$f = 5800 \text{ MHz}$ ;  $\sigma = 6.022 \text{ mho/m}$ ;  $\epsilon_r = 45.88$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-29-2012; Ambient Temp: 24.8°C; Tissue Temp: 23.9°C

Probe: EX3DV4 - SN3589; ConvF(3.59, 3.59, 3.59); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 5800MHz System Verification

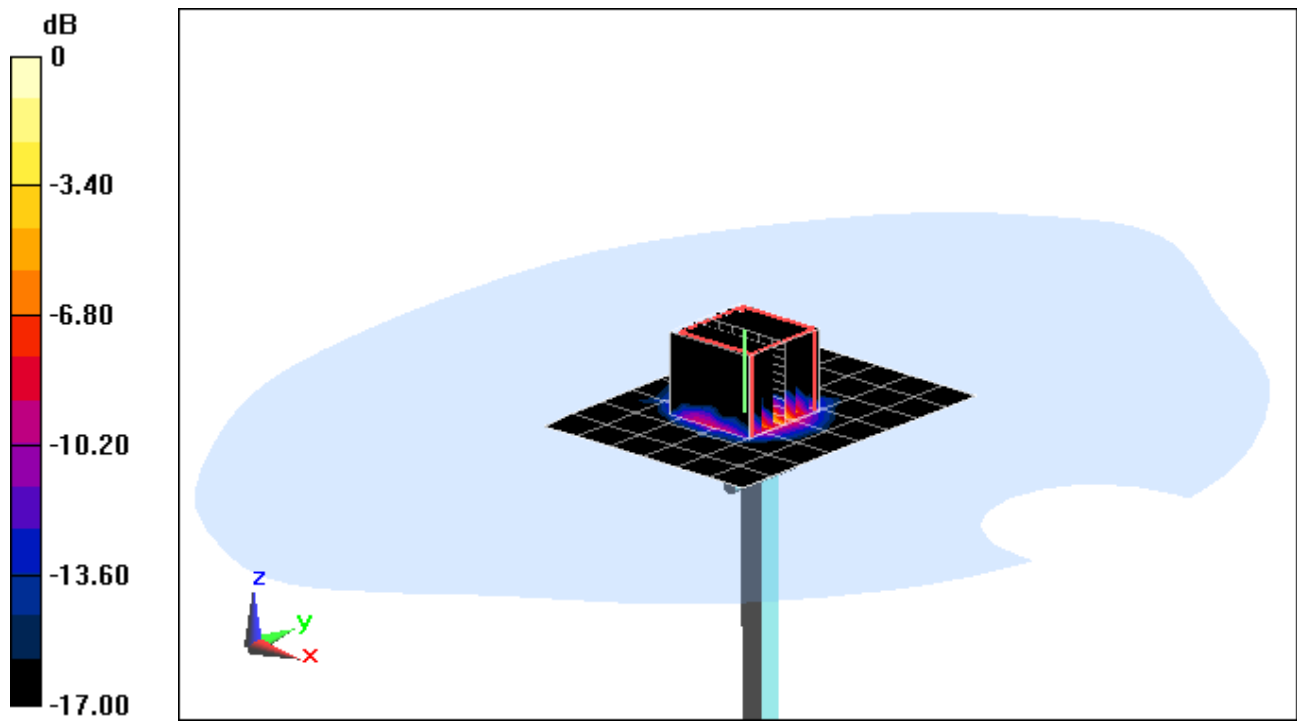
**Area Scan (7x9x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

**Zoom Scan (7x7x11)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Input Power: 12.5 dBm (17.8 mW)

**SAR(1 g) = 1.33 mW/g; SAR(10 g) = 0.342 mW/g**

Deviation: 0.56%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057**

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5 GHz Medium parameters used:

$f = 5800 \text{ MHz}$ ;  $\sigma = 6.022 \text{ mho/m}$ ;  $\epsilon_r = 45.88$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-29-2012; Ambient Temp: 24.8°C; Tissue Temp: 23.9°C

Probe: EX3DV4 - SN3589; ConvF(3.59, 3.59, 3.59); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

## 5800MHz System Verification

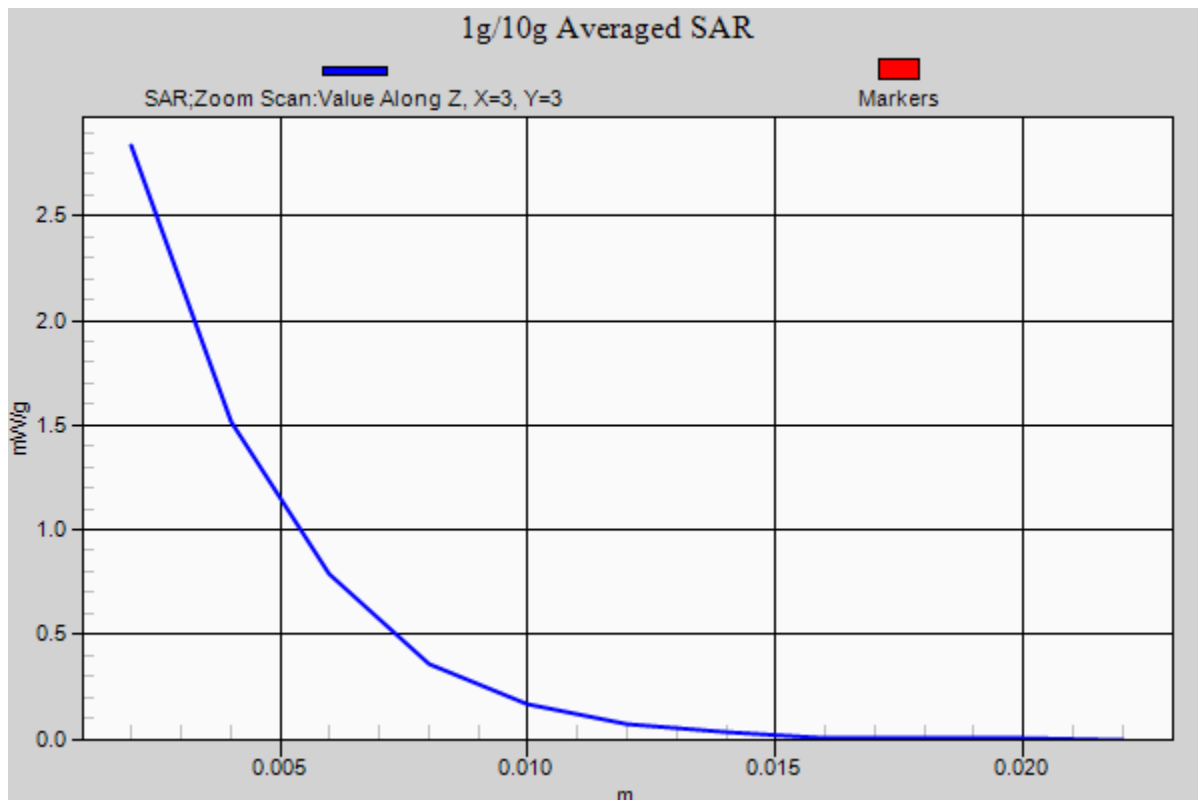
**Area Scan (7x9x1):** Measurement grid: dx=10mm, dy=10mm

**Zoom Scan (7x7x11)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Input Power: 12.5 dBm (17.8 mW)

**SAR(1 g) = 1.33 mW/g; SAR(10 g) = 0.342 mW/g**

Deviation: 0.56%



## 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: **D1900V2-5d080\_Jul11**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d080**

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

Calibration date: **July 22, 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 |

|                |                    |                              |                  |
|----------------|--------------------|------------------------------|------------------|
|                | <b>Name</b>        | <b>Function</b>              | <b>Signature</b> |
| Calibrated by: | <b>Dimce Iliev</b> | <b>Laboratory Technician</b> |                  |

|              |                      |                          |                  |
|--------------|----------------------|--------------------------|------------------|
|              | <b>Name</b>          | <b>Function</b>          | <b>Signature</b> |
| Approved by: | <b>Katja Pokovic</b> | <b>Technical Manager</b> |                  |

Issued: July 22, 2011

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



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 | 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 | 10.1 mW / g                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 39.9 mW / g $\pm$ 17.0 % (k=2) |

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                                |
| SAR measured                                            | 250 mW input power | 5.26 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 20.9 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             | 53.3           | 1.52 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 52.3 $\pm$ 6 % | 1.53 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 | 10.3 mW / g                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 40.9 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 | 5.38 mW / g                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 21.4 mW / g $\pm$ 16.5 % (k=2) |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $52.5 \Omega + 8.0 j\Omega$ |
| Return Loss                          | - 21.8 dB                   |

### Antenna Parameters with Body TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $46.7 \Omega + 7.1 j\Omega$ |
| Return Loss                          | - 21.8 dB                   |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.192 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 | June 28, 2006 |

## DASY5 Validation Report for Head TSL

Date: 20.07.2011

Test Laboratory: SPEAG, Zurich, Switzerland

---

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d080**

---

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:

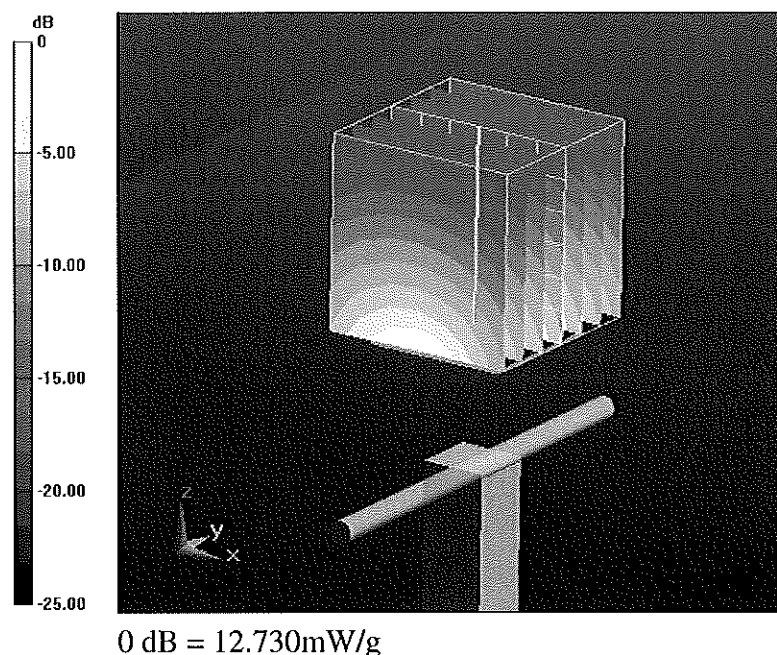
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.443 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 18.442 W/kg

**SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.26 mW/g**

Maximum value of SAR (measured) = 12.731 mW/g

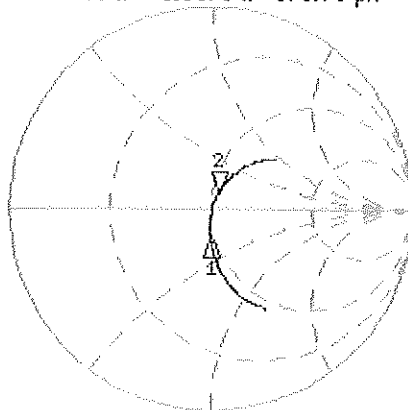


# Impedance Measurement Plot for Head TSL

20 Jul 2011 09:48:19

CH1 S11 1 U FS 2:52.539 n 0.0078 n 670.78 pF 1 900.000 000 MHz

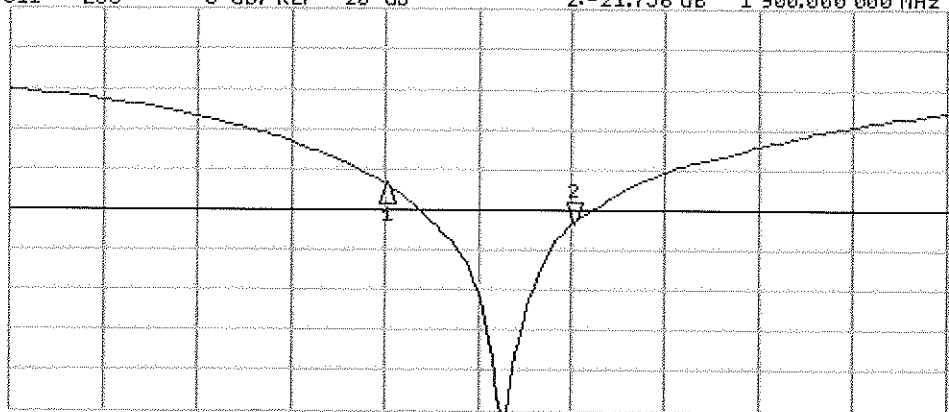
\*  
De1  
Cor  
Avg  
16  
H1d



CH1 Markers  
1: 47.551 n  
-14.164 n  
1.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 2:-21.756 dB 1 900.000 000 MHz

Cor  
Avg  
16  
H1d



CH2 Markers  
1:-16.725 dB  
1.80000 GHz

START 1 600.000 000 MHz

STOP 2 100.000 000 MHz

## DASY5 Validation Report for Body TSL

Date: 22.07.2011

Test Laboratory: SPEAG, Zurich, Switzerland

~~DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d080~~

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.53$  mho/m;  $\epsilon_r = 52.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 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:

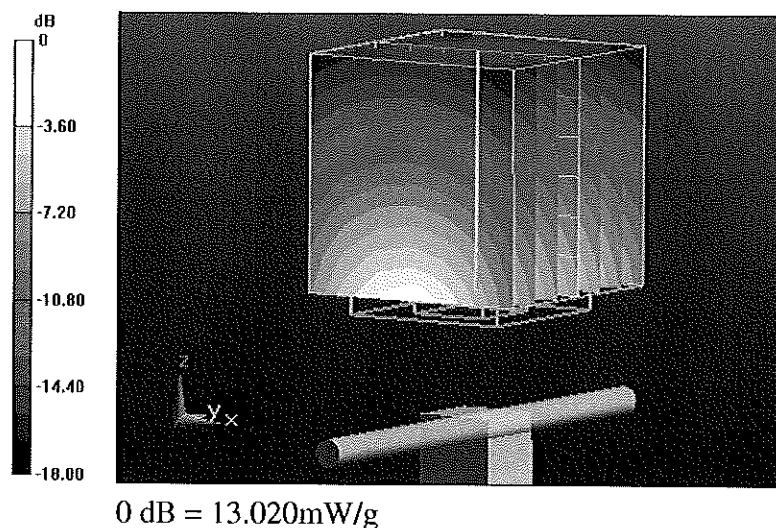
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.049 V/m; Power Drift = 0.0018 dB

Peak SAR (extrapolated) = 18.160 W/kg

**SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.38 mW/g**

Maximum value of SAR (measured) = 13.017 mW/g



# Impedance Measurement Plot for Body TSL

22 Jul 2011 09:44:35

[CH1] S11

1 U FS

2: 46.744  $\Omega$

7.1348  $\Omega$

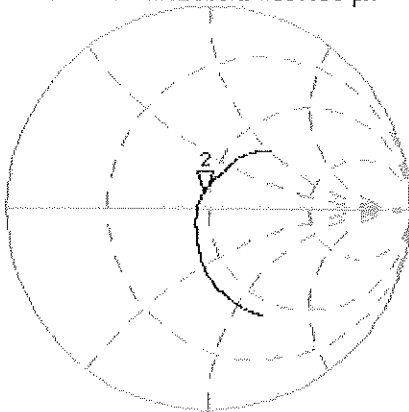
597.65 pF

1 900.000 000 MHz

\*

De1

Cor



Avg

16

H1d

CH2 S11

LOG

5 dB/REF -20 dB

2:-21.846 dB

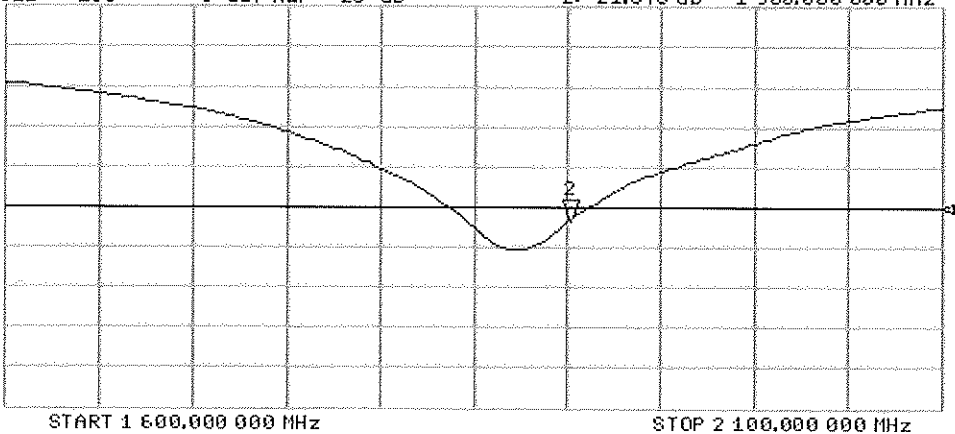
1 900.000 000 MHz

Cor

Avg

16

H1d





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Client **PC Test**

Certificate No: **D2450V2-797\_Jan12**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 797**

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

Calibration date: **January 24, 2012**

*✓ Kok  
2/6/2012*

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 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           | 30-Dec-11 (No. ES3-3205_Dec11) | Dec-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 |

|                |                |                       |                       |
|----------------|----------------|-----------------------|-----------------------|
|                | Name           | Function              | Signature             |
| Calibrated by: | Israe El-Naouq | Laboratory Technician | <i>Israe El-Naouq</i> |
| Approved by:   | Katja Pokovic  | Technical Manager     | <i>Katja Pokovic</i>  |

Issued: January 24, 2012

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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                  | V52.8.0     |
| 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 | 39.2 $\pm$ 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 | 13.2 mW / g                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 52.1 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 | 6.12 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 24.3 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 | 50.6 $\pm$ 6 % | 2.01 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 | 13.0 mW / g                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 50.8 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 | 6.01 mW / g                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 23.7 mW / g $\pm$ 16.5 % (k=2) |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                               |
|--------------------------------------|-------------------------------|
| Impedance, transformed to feed point | $54.0\ \Omega + 4.7\ j\Omega$ |
| Return Loss                          | - 24.6 dB                     |

### Antenna Parameters with Body TSL

|                                      |                               |
|--------------------------------------|-------------------------------|
| Impedance, transformed to feed point | $50.1\ \Omega + 5.4\ j\Omega$ |
| Return Loss                          | - 25.3 dB                     |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.151 ns |
|----------------------------------|----------|

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

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

### Additional EUT Data

|                 |                  |
|-----------------|------------------|
| Manufactured by | SPEAG            |
| Manufactured on | January 24, 2006 |

## DASY5 Validation Report for Head TSL

Date: 24.01.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 797**

---

Communication System: CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.85$  mho/m;  $\epsilon_r = 39.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

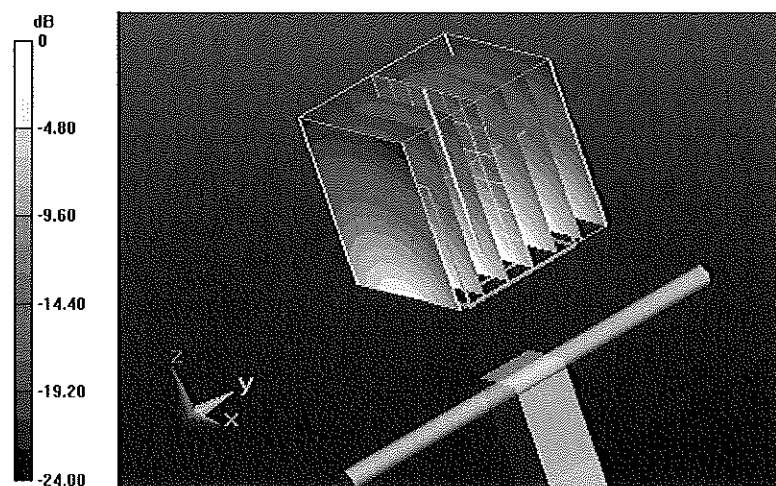
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.248 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 27.3550

**SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.12 mW/g**

Maximum value of SAR (measured) = 17.017 mW/g



0 dB = 17.020mW/g = 24.62 dB mW/g

# Impedance Measurement Plot for Head TSL

24 Jan 2012 11:11:23

[CH1] S11 1 V FS 4.53992 n 4.6569 n 382.40 pF 2 450.000 000 MHz

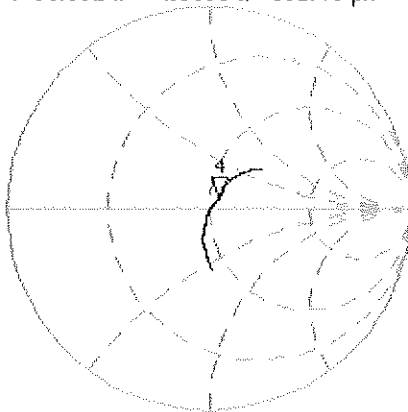
\*

De1

CA

Avg  
16

H1d

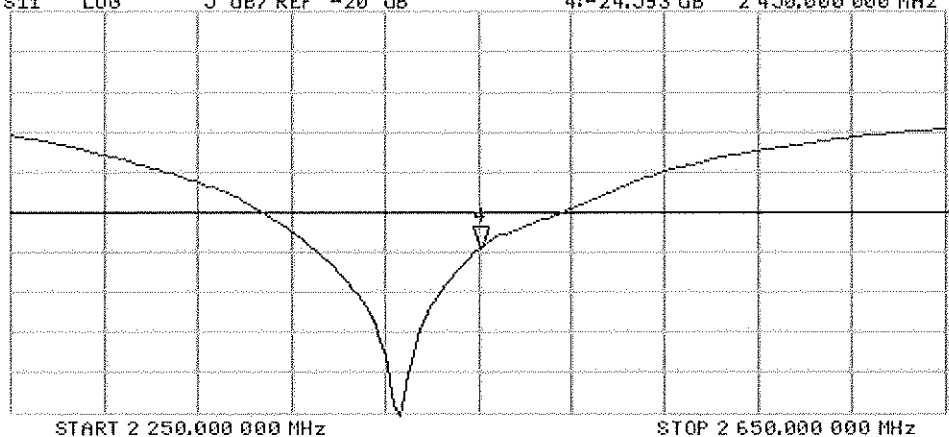


CH2 S11 LOG 5 dB/REF -20 dB 4:-24.593 dB 2 450.000 000 MHz

CA

Avg  
16

H1d



## DASY5 Validation Report for Body TSL

Date: 23.01.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 797**

---

Communication System: CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.01$  mho/m;  $\epsilon_r = 50.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

### DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

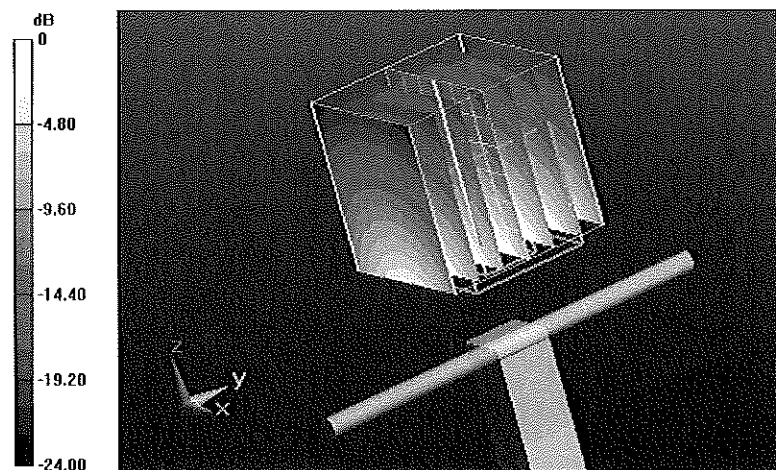
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.727 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 26.9680

**SAR(1 g) = 13 mW/g; SAR(10 g) = 6.01 mW/g**

Maximum value of SAR (measured) = 17.222 mW/g



0 dB = 17.220mW/g = 24.72 dB mW/g

# Impedance Measurement Plot for Body TSL

23 Jan 2012 11:15:12

CH1 S11 1 U FS 3:58.123 A 5:4316 A 352.05  $\mu$ H 2 450.000 000 MHz

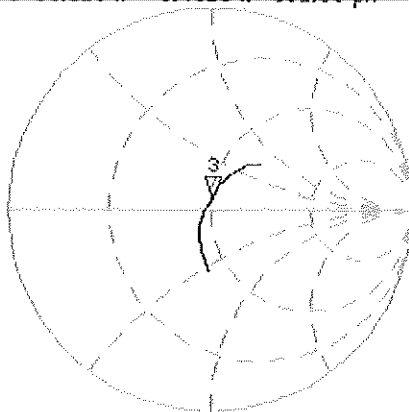
\*

De1

CA

Avg  
16

H1d

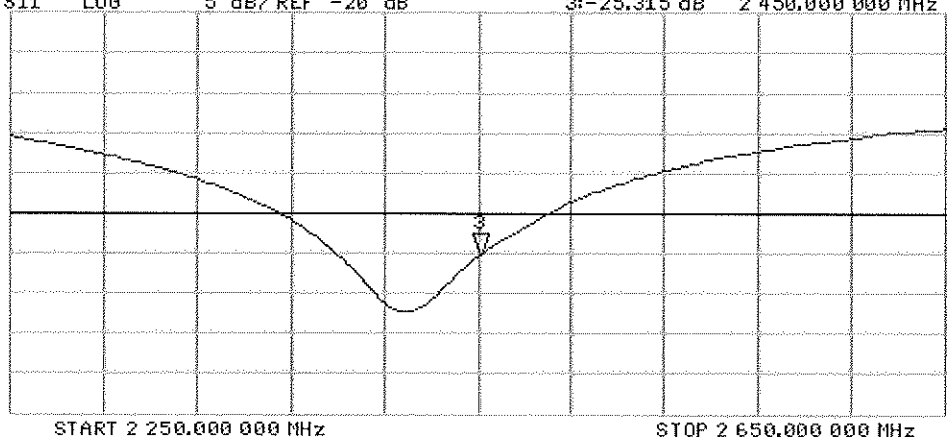


CH2 S11 LOG 5 dB/REF -20 dB 3:-25.315 dB 2 450.000 000 MHz

CA

Avg  
16

H1d





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Accreditation No.: **SCS 108**

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Client **PC Test**

Certificate No: **D5GHzV2-1057\_Jan12**

## CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1057**

Calibration procedure(s) **QA CAL-22.v1**  
**Calibration procedure for dipole validation kits between 3-6 GHz**

Calibration date: **January 19, 2012**

*✓ KOK*  
*2/6/12*

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 EX3DV4      | SN: 3503           | 30-Dec-11 (No. EX3-3503_Dec11)    | Dec-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** **Laboratory Technician** *D. Iliev*

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

Issued: January 19, 2012

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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                                                                | V52.8.0                          |
| Extrapolation                | Advanced Extrapolation                                               |                                  |
| Phantom                      | Modular Flat Phantom V5.0                                            |                                  |
| Distance Dipole Center - TSL | 10 mm                                                                | with Spacer                      |
| Zoom Scan Resolution         | dx, dy = 4.0 mm, dz = 1.4 mm                                         | Graded Ratio = 1.4 (Z direction) |
| Frequency                    | 5200 MHz $\pm$ 1 MHz<br>5500 MHz $\pm$ 1 MHz<br>5800 MHz $\pm$ 1 MHz |                                  |

## Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 36.0           | 4.66 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 36.3 $\pm$ 6 % | 4.60 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL at 5200 MHz

|                                                       |                    |                                |
|-------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                                |
| SAR measured                                          | 100 mW input power | 7.90 mW / g                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 79.1 mW / g $\pm$ 17.0 % (k=2) |

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                                |
| SAR measured                                            | 100 mW input power | 2.26 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 22.6 mW / g $\pm$ 16.5 % (k=2) |

## Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 35.6           | 4.96 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 35.8 $\pm$ 6 % | 4.90 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL at 5500 MHz

|                                                       |                    |                                |
|-------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                                |
| SAR measured                                          | 100 mW input power | 8.49 mW / g                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 84.9 mW / g $\pm$ 17.0 % (k=2) |

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                                |
| SAR measured                                            | 100 mW input power | 2.42 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 24.2 mW / g $\pm$ 16.5 % (k=2) |

## Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.3         | 5.27 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 35.3 ± 6 %   | 5.22 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | ----         | ----             |

## SAR result with Head TSL at 5800 MHz

|                                                             |                    |                                   |
|-------------------------------------------------------------|--------------------|-----------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                   |
| SAR measured                                                | 100 mW input power | 7.95 mW / g                       |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>79.5 mW / g ± 17.0 % (k=2)</b> |

|                                                               |                    |                                   |
|---------------------------------------------------------------|--------------------|-----------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                   |
| SAR measured                                                  | 100 mW input power | 2.26 mW / g                       |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>22.6 mW / g ± 16.5 % (k=2)</b> |

### Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 49.0         | 5.30 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 49.2 ± 6 %   | 5.46 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Body TSL at 5200 MHz

|                                                             |                    |                                   |
|-------------------------------------------------------------|--------------------|-----------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b> | Condition          |                                   |
| SAR measured                                                | 100 mW input power | 7.33 mW / g                       |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>73.4 mW / g ± 18.1 % (k=2)</b> |

|                                                               |                    |                                   |
|---------------------------------------------------------------|--------------------|-----------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | condition          |                                   |
| SAR measured                                                  | 100 mW input power | 2.05 mW / g                       |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>20.6 mW / g ± 17.6 % (k=2)</b> |

### Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.6         | 5.65 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 48.7 ± 6 %   | 5.86 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Body TSL at 5500 MHz

|                                                             |                    |                                   |
|-------------------------------------------------------------|--------------------|-----------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b> | Condition          |                                   |
| SAR measured                                                | 100 mW input power | 7.87 mW / g                       |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>78.9 mW / g ± 18.1 % (k=2)</b> |

|                                                               |                    |                                   |
|---------------------------------------------------------------|--------------------|-----------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | condition          |                                   |
| SAR measured                                                  | 100 mW input power | 2.19 mW / g                       |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>21.9 mW / g ± 17.6 % (k=2)</b> |

### Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

|                                         | Temperature     | Permittivity | Conductivity     |
|-----------------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.2         | 6.00 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 48.2 ± 6 %   | 6.28 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        | ----         | ----             |

### SAR result with Body TSL at 5800 MHz

|                                                             |                    |                                   |
|-------------------------------------------------------------|--------------------|-----------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b> | Condition          |                                   |
| SAR measured                                                | 100 mW input power | 7.42 mW / g                       |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>74.3 mW / g ± 18.1 % (k=2)</b> |

|                                                               |                    |                                   |
|---------------------------------------------------------------|--------------------|-----------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | condition          |                                   |
| SAR measured                                                  | 100 mW input power | 2.06 mW / g                       |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>20.6 mW / g ± 17.6 % (k=2)</b> |

## Appendix

### Antenna Parameters with Head TSL at 5200 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.6 $\Omega$ - 8.0 j $\Omega$ |
| Return Loss                          | - 21.9 dB                      |

### Antenna Parameters with Head TSL at 5500 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.5 $\Omega$ - 3.8 j $\Omega$ |
| Return Loss                          | - 27.8 dB                      |

### Antenna Parameters with Head TSL at 5800 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 52.4 $\Omega$ - 3.9 j $\Omega$ |
| Return Loss                          | - 27.0 dB                      |

### Antenna Parameters with Body TSL at 5200 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.6 $\Omega$ - 5.7 j $\Omega$ |
| Return Loss                          | - 24.9 dB                      |

### Antenna Parameters with Body TSL at 5500 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.9 $\Omega$ - 2.7 j $\Omega$ |
| Return Loss                          | - 31.4 dB                      |

### Antenna Parameters with Body TSL at 5800 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.1 $\Omega$ - 3.3 j $\Omega$ |
| Return Loss                          | - 28.2 dB                      |

## General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.202 ns |
|----------------------------------|----------|

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

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

## Additional EUT Data

|                 |                   |
|-----------------|-------------------|
| Manufactured by | SPEAG             |
| Manufactured on | November 27, 2006 |

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1057**

---

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz  
Medium parameters used:  $f = 5200 \text{ MHz}$ ;  $\sigma = 4.6 \text{ mho/m}$ ;  $\epsilon_r = 36.3$ ;  $\rho = 1000 \text{ kg/m}^3$ , Medium parameters used:  $f = 5500 \text{ MHz}$ ;  $\sigma = 4.9 \text{ mho/m}$ ;  $\epsilon_r = 35.8$ ;  $\rho = 1000 \text{ kg/m}^3$ , Medium parameters used:  $f = 5800 \text{ MHz}$ ;  $\sigma = 5.22 \text{ mho/m}$ ;  $\epsilon_r = 35.3$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Flat Section  
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

### DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41), ConvF(4.91, 4.91, 4.91), ConvF(4.81, 4.81, 4.81); Calibrated: 30.12.2011
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

### **Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:**

Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$

Reference Value = 63.590 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 29.4530

**SAR(1 g) = 7.9 mW/g; SAR(10 g) = 2.26 mW/g**

Maximum value of SAR (measured) = 18.158 mW/g

### **Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:**

Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$

Reference Value = 64.129 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 33.6870

**SAR(1 g) = 8.49 mW/g; SAR(10 g) = 2.42 mW/g**

Maximum value of SAR (measured) = 20.088 mW/g

### **Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:**

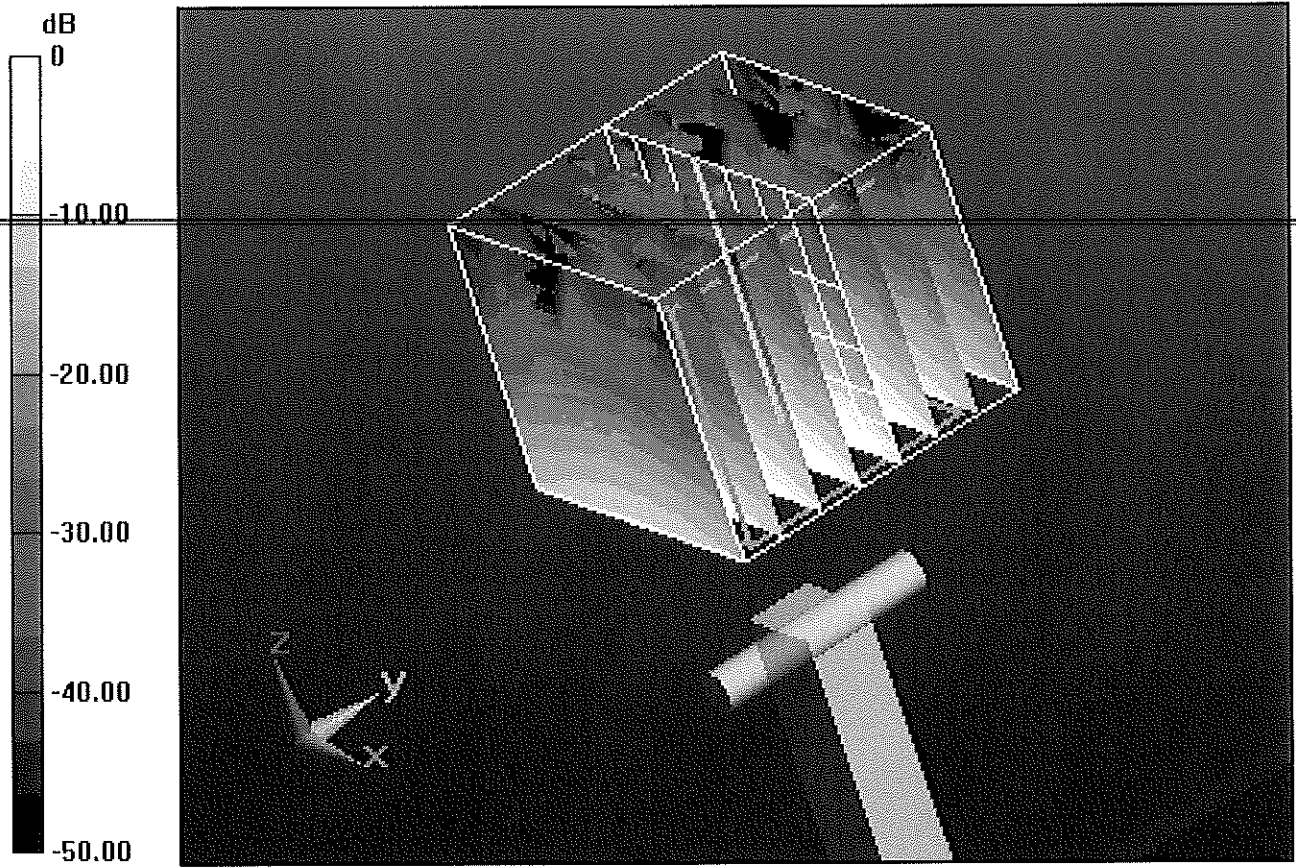
Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$

Reference Value = 60.728 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 33.3080

**SAR(1 g) = 7.95 mW/g; SAR(10 g) = 2.26 mW/g**

Maximum value of SAR (measured) = 19.277 mW/g



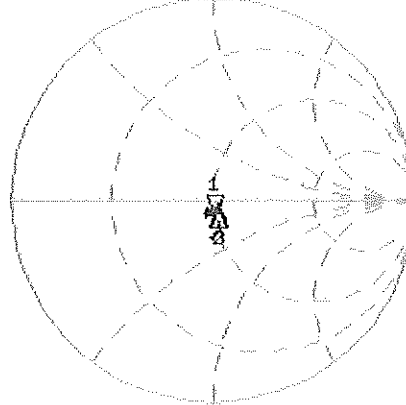
0 dB = 19.280mW/g = 25.70 dB mW/g

# Impedance Measurement Plot for Head TSL

19 Jan 2012 10:41:39

[CH1] S11 1 U FS 1: 49.551  $\Omega$  0.0020  $\Omega$  3.9249 pF 5 200.000 000 MHz

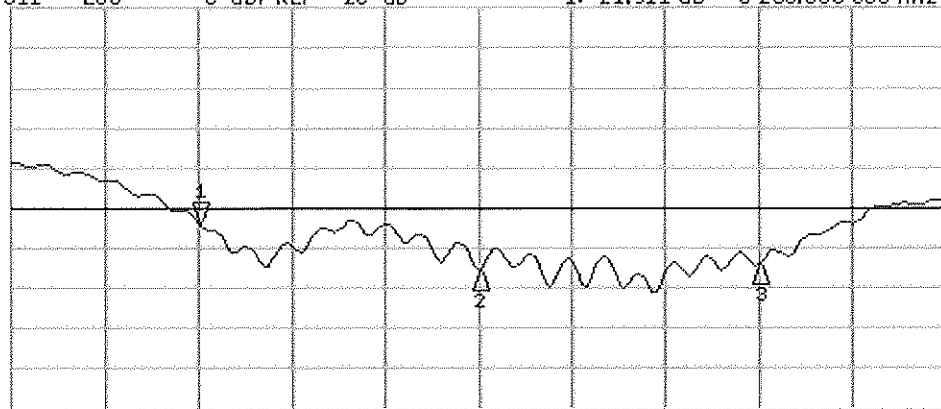
\*  
De1  
Cor  
Avg  
16  
H1d



CH1 Markers  
2: 51.461  $\Omega$   
-3.8457  $\Omega$   
5.50000 GHz  
3: 52.420  $\Omega$   
-3.9121  $\Omega$   
5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -21.911 dB 5 200.000 000 MHz

Cor  
Avg  
16  
H1d



CH2 Markers  
2: -27.845 dB  
5.50000 GHz  
3: -26.962 dB  
5.80000 GHz

START 5 000.000 000 MHz

STOP 6 000.000 000 MHz

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1057**

---

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz  
Medium parameters used:  $f = 5200$  MHz;  $\sigma = 5.46$  mho/m;  $\epsilon_r = 49.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5500$  MHz;  $\sigma = 5.86$  mho/m;  $\epsilon_r = 48.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5800$  MHz;  $\sigma = 6.28$  mho/m;  $\epsilon_r = 48.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section  
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91), ConvF(4.43, 4.43, 4.43), ConvF(4.38, 4.38, 4.38); Calibrated: 30.12.2011
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 57.280 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 28.9110

**SAR(1 g) = 7.33 mW/g; SAR(10 g) = 2.05 mW/g**

Maximum value of SAR (measured) = 17.276 mW/g

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 57.884 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 33.5680

**SAR(1 g) = 7.87 mW/g; SAR(10 g) = 2.19 mW/g**

Maximum value of SAR (measured) = 19.055 mW/g

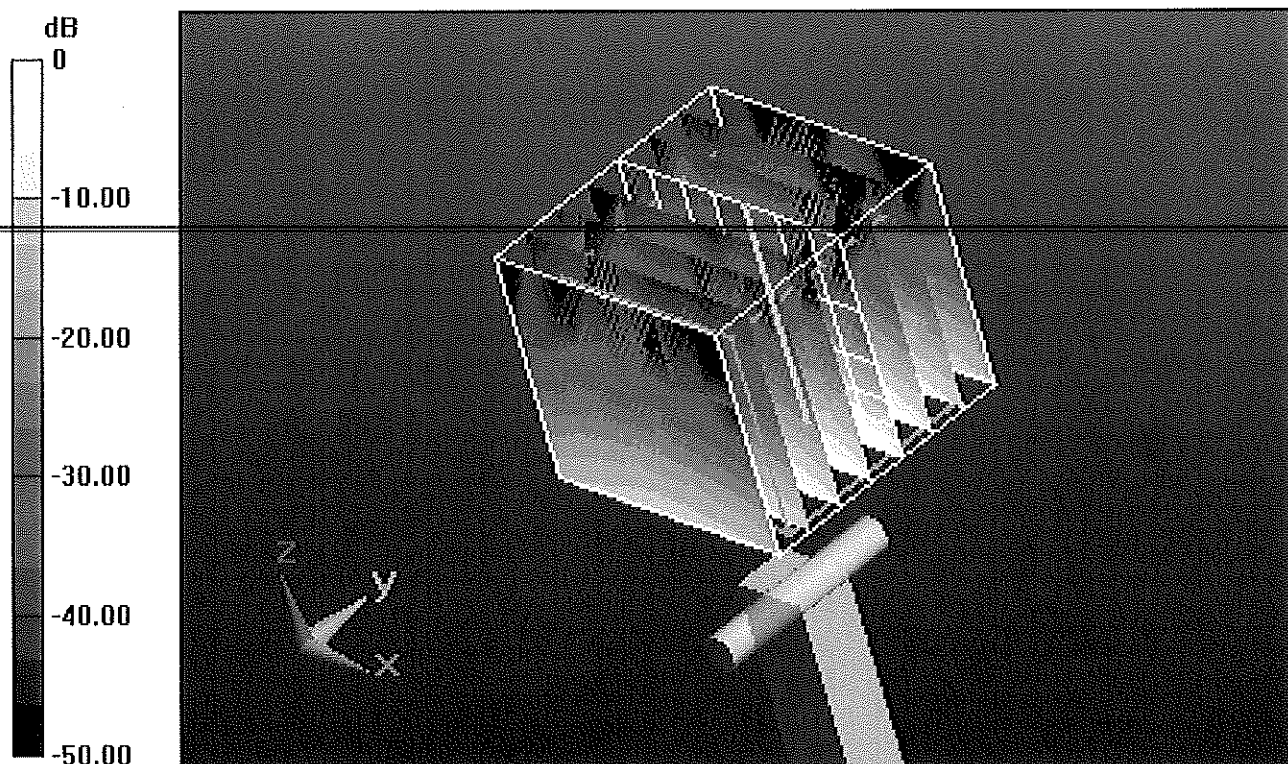
**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 54.430 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 34.4850

**SAR(1 g) = 7.42 mW/g; SAR(10 g) = 2.06 mW/g**

Maximum value of SAR (measured) = 18.495 mW/g



0 dB = 18.500mW/g = 25.34 dB mW/g

# Impedance Measurement Plot for Body TSL

18 Jan 2012 11:08:23

[CH1] S11 1 U FS 1: 50.562  $\Omega$  -5.2162  $\Omega$  5.3538 pF 5.200.000.000 MHz

\*

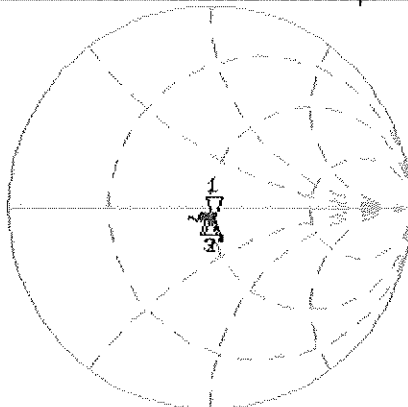
Del

Cor

Avg

16

H1d



CH1 Markers

2: 49.947  $\Omega$

-2.6934  $\Omega$

5.50000 GHz

3: 48.137  $\Omega$

-3.3438  $\Omega$

5.80000 GHz

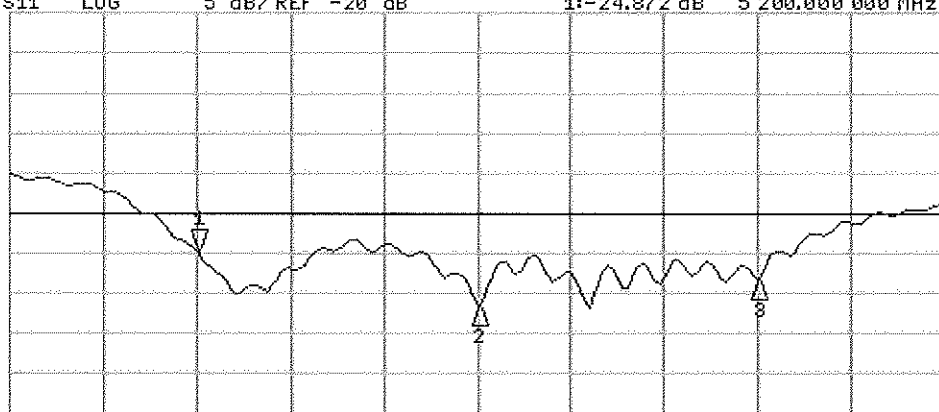
CH2 S11 LOG 5 dB/REF -20 dB 1:-24.872 dB 5.200.000.000 MHz

Cor

Avg

16

H1d



CH2 Markers

2:-31.393 dB

5.50000 GHz

3:-28.173 dB

5.80000 GHz

START 5.000.000.000 MHz

STOP 6.000.000.000 MHz



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3209\_Mar12**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3209**

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**

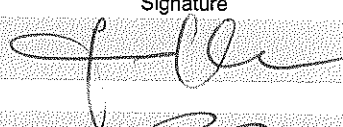
Calibration date: **March 16, 2012**

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>Jeton Kastrati</b> | Function<br><b>Laboratory Technician</b> | Signature<br> |
| Approved by:   | Name<br><b>Katja Pokovic</b>  | Function<br><b>Technical Manager</b>     | Signature<br> |

Issued: March 19, 2012

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Accreditation No.: **SCS 108**

### Glossary:

|                          |                                                                                                                                                         |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| TSL                      | tissue simulating liquid                                                                                                                                |
| NORM <sub>x,y,z</sub>    | sensitivity in free space                                                                                                                               |
| ConvF                    | sensitivity in TSL / NORM <sub>x,y,z</sub>                                                                                                              |
| DCP                      | diode compression point                                                                                                                                 |
| CF                       | crest factor (1/duty_cycle) of the RF signal                                                                                                            |
| A, B, C                  | modulation dependent linearization parameters                                                                                                           |
| Polarization $\phi$      | $\phi$ 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.
- DCPx,y,z**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; 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:3209

Manufactured: October 14, 2008  
Calibrated: March 16, 2012

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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

### Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|-----------------------------------------------------------|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 1.36     | 1.34     | 1.15     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                                     | 98.2     | 97.4     | 98.7     |               |

### 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    | 119.2    | $\pm 3.5 \%$              |
|       |                           |      | Y | 0.00    | 0.00    | 1.00    | 89.3     |                           |
|       |                           |      | Z | 0.00    | 0.00    | 1.00    | 111.5    |                           |

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

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

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

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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

### 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                            | 6.47    | 6.47    | 6.47    | 0.37  | 1.61       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 6.22    | 6.22    | 6.22    | 0.24  | 2.24       | ± 12.0 %    |
| 1640                 | 40.3                               | 1.29                            | 5.38    | 5.38    | 5.38    | 0.41  | 1.56       | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 5.26    | 5.26    | 5.26    | 0.41  | 1.60       | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 5.15    | 5.15    | 5.15    | 0.80  | 1.16       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.46    | 4.46    | 4.46    | 0.64  | 1.39       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 4.30    | 4.30    | 4.30    | 0.69  | 1.42       | ± 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:3209

### Calibration Parameter Determined in Body Tissue Simulating Media

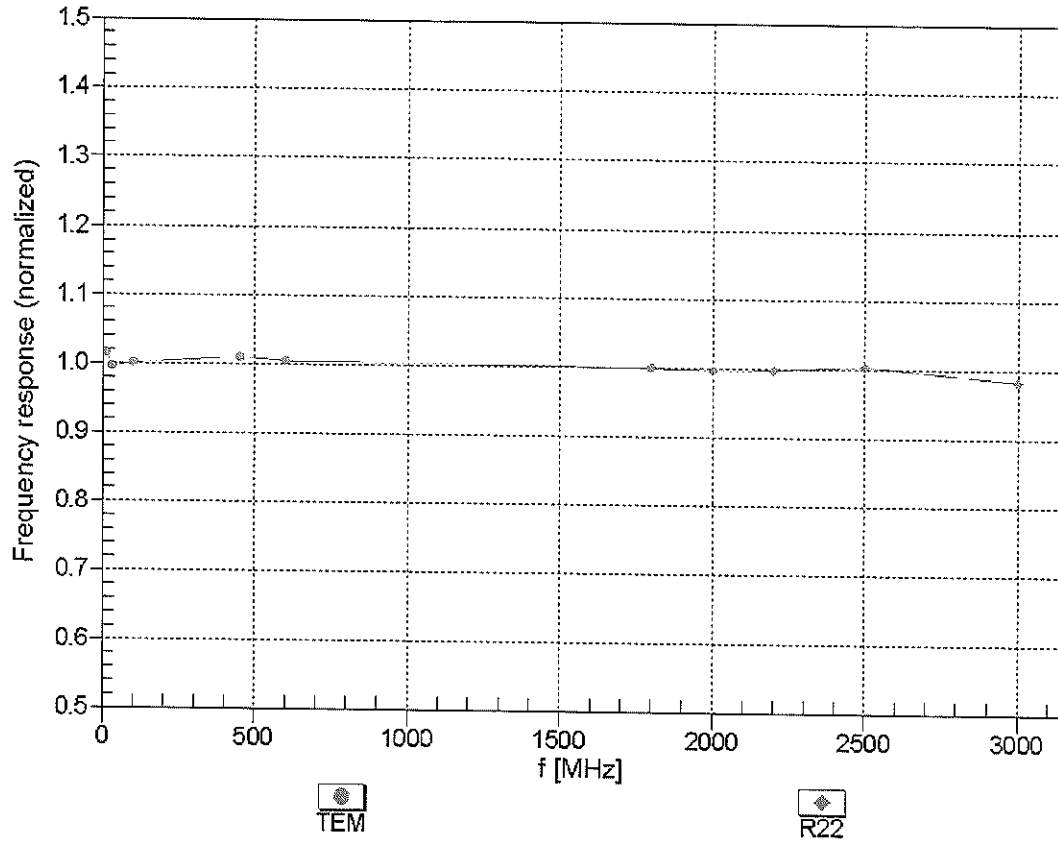
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 450                  | 56.7                               | 0.94                            | 7.11    | 7.11    | 7.11    | 0.07  | 1.00       | ± 13.4 %    |
| 750                  | 55.5                               | 0.96                            | 6.23    | 6.23    | 6.23    | 0.54  | 1.40       | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 6.13    | 6.13    | 6.13    | 0.24  | 2.27       | ± 12.0 %    |
| 1640                 | 53.8                               | 1.40                            | 5.21    | 5.21    | 5.21    | 0.72  | 1.29       | ± 12.0 %    |
| 1750                 | 53.4                               | 1.49                            | 4.83    | 4.83    | 4.83    | 0.59  | 1.44       | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 4.63    | 4.63    | 4.63    | 0.57  | 1.50       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 4.23    | 4.23    | 4.23    | 0.80  | 1.00       | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 4.02    | 4.02    | 4.02    | 0.62  | 0.90       | ± 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

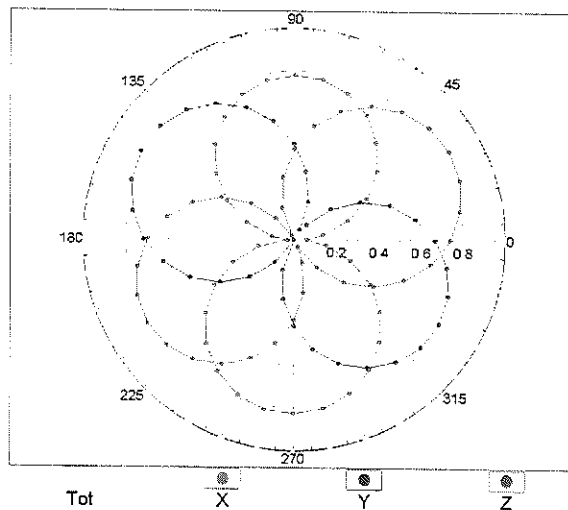
(TEM-Cell: ifi110 EXX, Waveguide: R22)



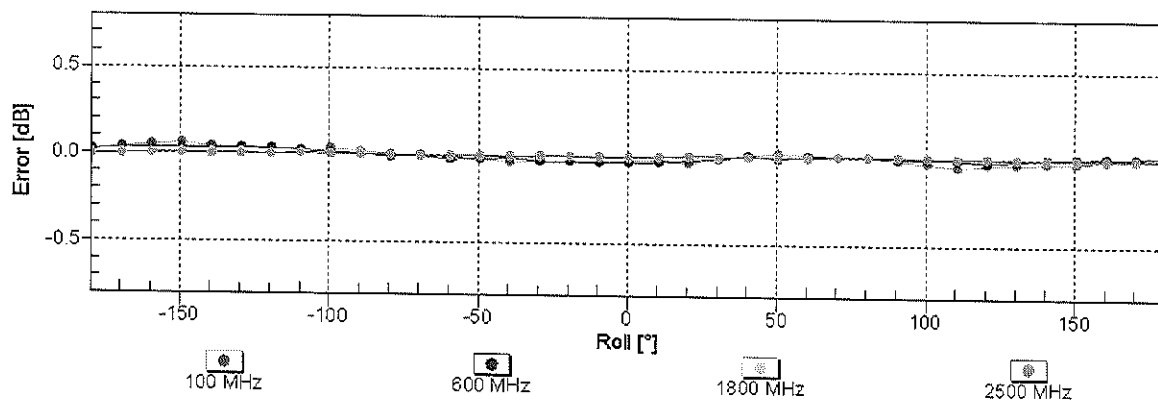
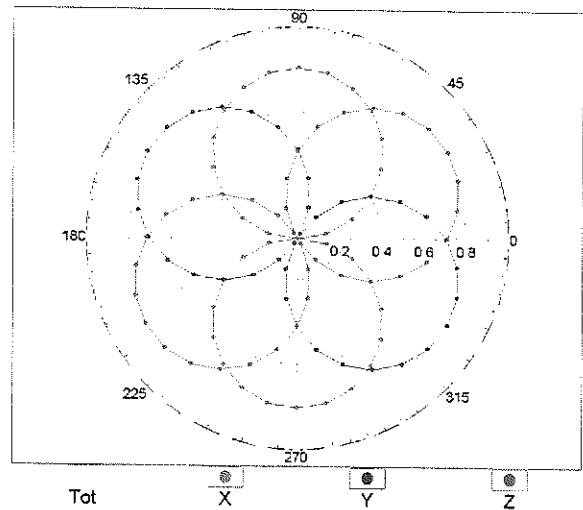
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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

f=600 MHz, TEM

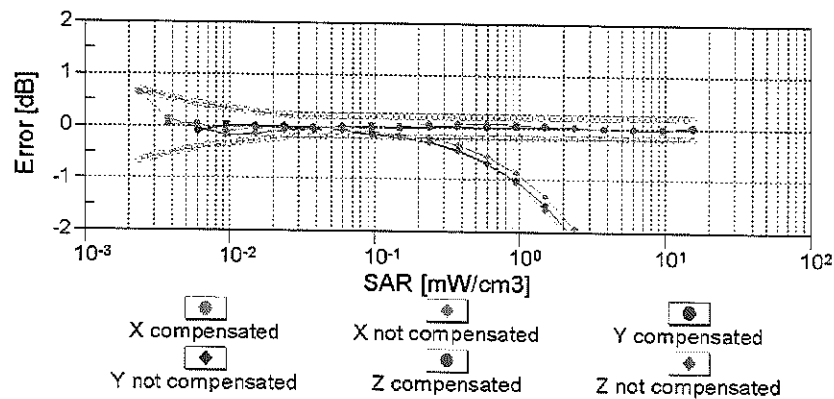
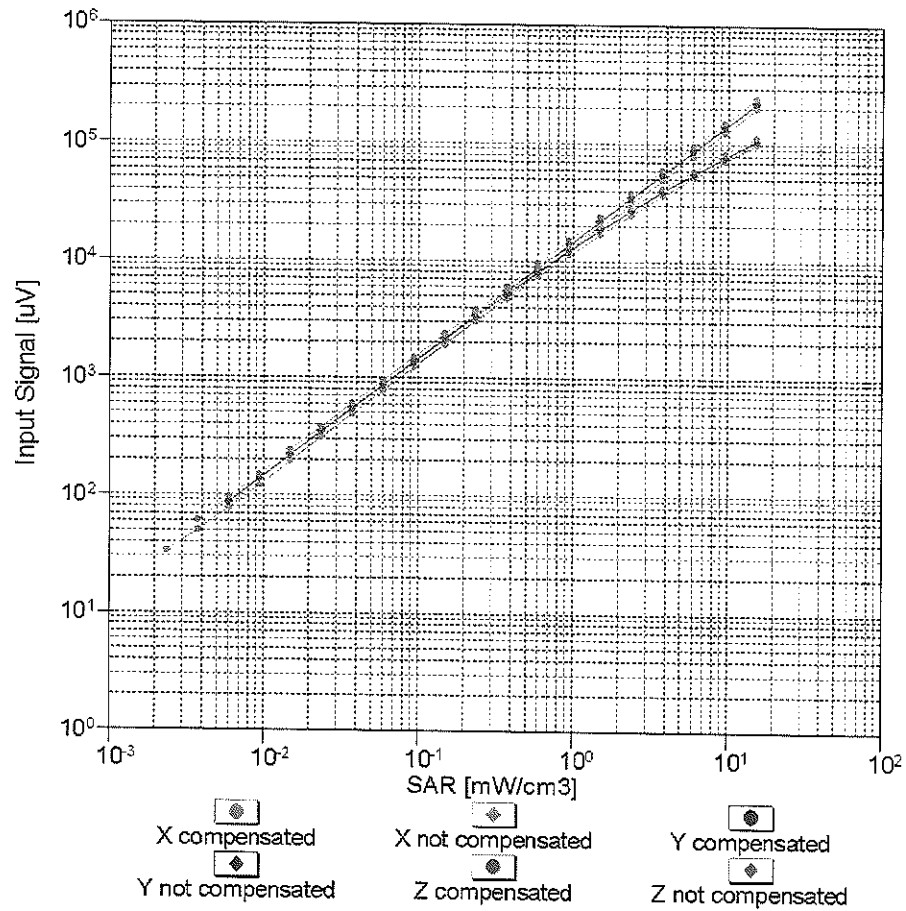


f=1800 MHz, R22



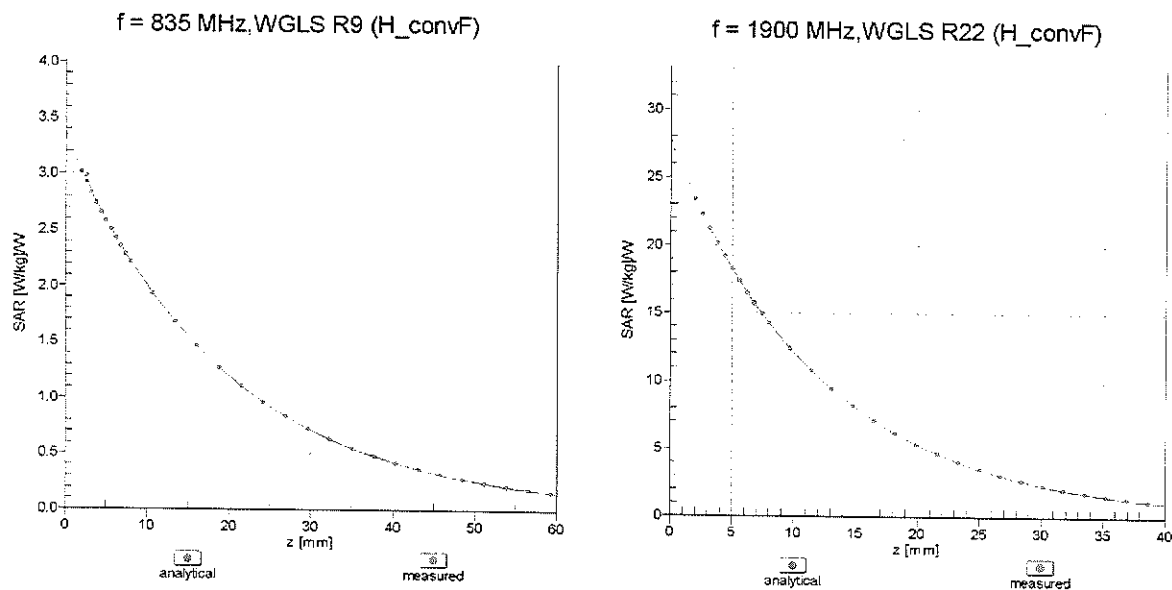
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

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



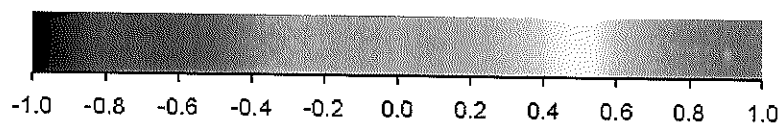
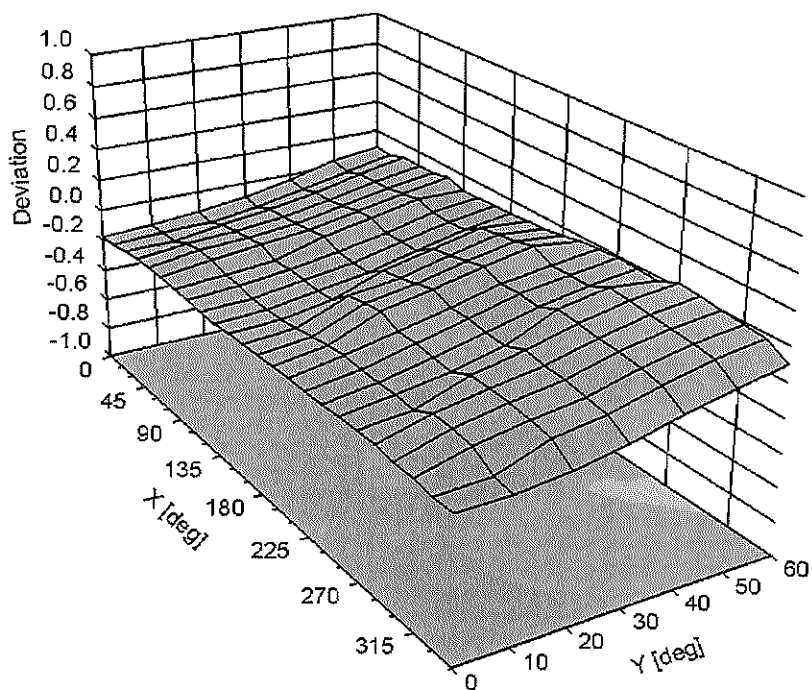
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

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



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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

### 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           |



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

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **EX3-3589 Jan12**

## CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3589**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4  
 Calibration procedure for dosimetric E-field probes**

Calibration date: **January 27, 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 ( $22 \pm 3$ )°C and humidity < 70%. ✓ KOK 2/6/12

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 |

|                                                                                                                 | Name          | Function          | Signature |
|-----------------------------------------------------------------------------------------------------------------|---------------|-------------------|-----------|
| Calibrated by:                                                                                                  | Katja Pokovic | Technical Manager |           |
| Approved by:                                                                                                    | Niels Kuster  | Quality Manager   |           |
| Issued: January 27, 2012                                                                                        |               |                   |           |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. |               |                   |           |



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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 $\phi$      | $\phi$ 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.

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# Probe EX3DV4

## SN:3589

Manufactured: March 30, 2006  
Calibrated: January 27, 2012

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589

### Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|-----------------------------------------------------------|----------|----------|----------|-----------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 0.46     | 0.40     | 0.40     | ± 10.1 %  |
| DCP (mV) <sup>B</sup>                                     | 101.1    | 102.5    | 99.3     |           |

### 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    | ±2.7 %                    |
|       |                           |      | Y | 0.00    | 0.00    | 1.00    | 95.1     |                           |
|       |                           |      | Z | 0.00    | 0.00    | 1.00    | 96.4     |                           |

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: EX3DV4 - SN:3589

### 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) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 2600                 | 39.0                               | 1.96                            | 6.56    | 6.56    | 6.56    | 0.45  | 0.84       | ± 12.0 %    |
| 5200                 | 36.0                               | 4.66                            | 4.59    | 4.59    | 4.59    | 0.35  | 1.80       | ± 13.1 %    |
| 5300                 | 35.9                               | 4.76                            | 4.36    | 4.36    | 4.36    | 0.35  | 1.80       | ± 13.1 %    |
| 5500                 | 35.6                               | 4.96                            | 4.33    | 4.33    | 4.33    | 0.35  | 1.80       | ± 13.1 %    |
| 5600                 | 35.5                               | 5.07                            | 4.04    | 4.04    | 4.04    | 0.40  | 1.80       | ± 13.1 %    |
| 5800                 | 35.3                               | 5.27                            | 4.05    | 4.05    | 4.05    | 0.45  | 1.80       | ± 13.1 %    |

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

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589

### Calibration Parameter Determined in Body Tissue Simulating Media

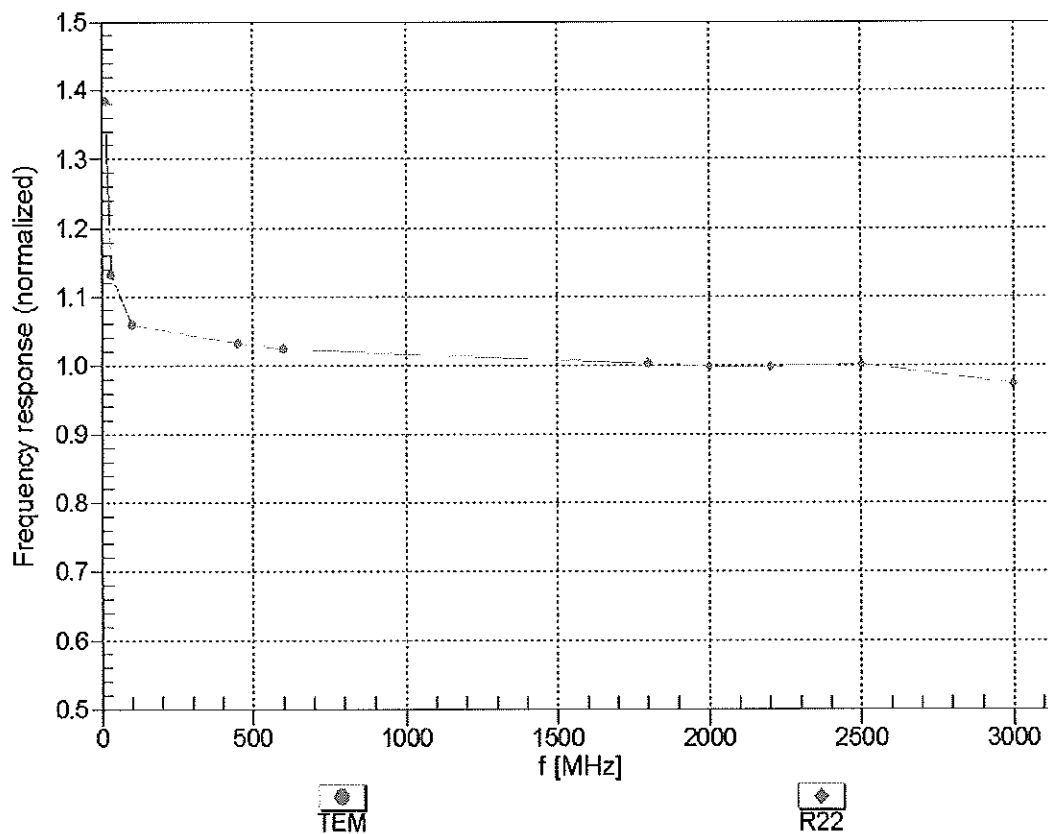
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 2600                 | 52.5                               | 2.16                            | 6.28    | 6.28    | 6.28    | 0.80  | 0.50       | ± 12.0 %    |
| 5200                 | 49.0                               | 5.30                            | 3.92    | 3.92    | 3.92    | 0.52  | 1.90       | ± 13.1 %    |
| 5300                 | 48.9                               | 5.42                            | 3.72    | 3.72    | 3.72    | 0.55  | 1.90       | ± 13.1 %    |
| 5500                 | 48.6                               | 5.65                            | 3.40    | 3.40    | 3.40    | 0.58  | 1.90       | ± 13.1 %    |
| 5600                 | 48.5                               | 5.77                            | 3.25    | 3.25    | 3.25    | 0.60  | 1.90       | ± 13.1 %    |
| 5800                 | 48.2                               | 6.00                            | 3.59    | 3.59    | 3.59    | 0.60  | 1.90       | ± 13.1 %    |

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

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

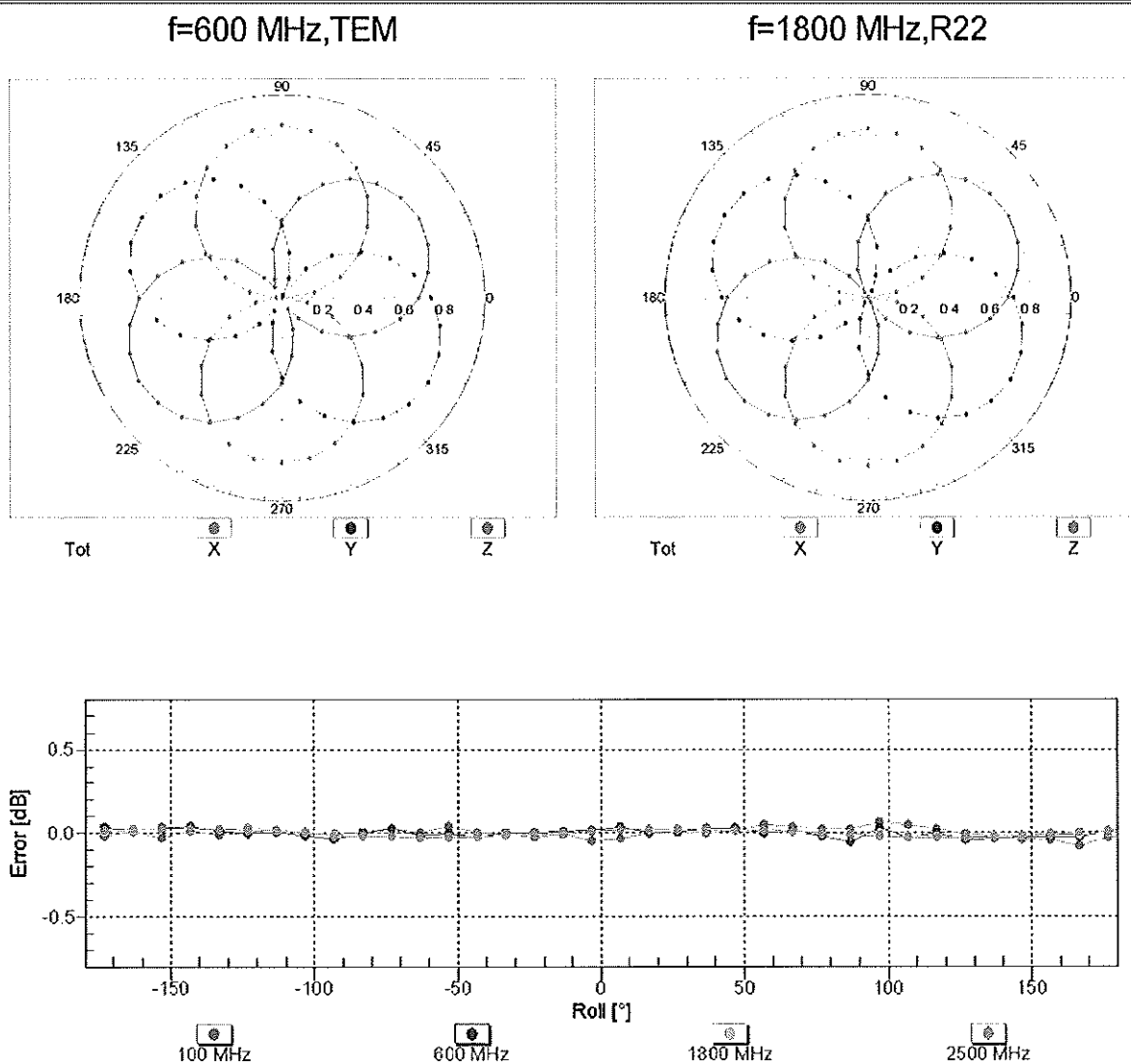
## Frequency Response of E-Field

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



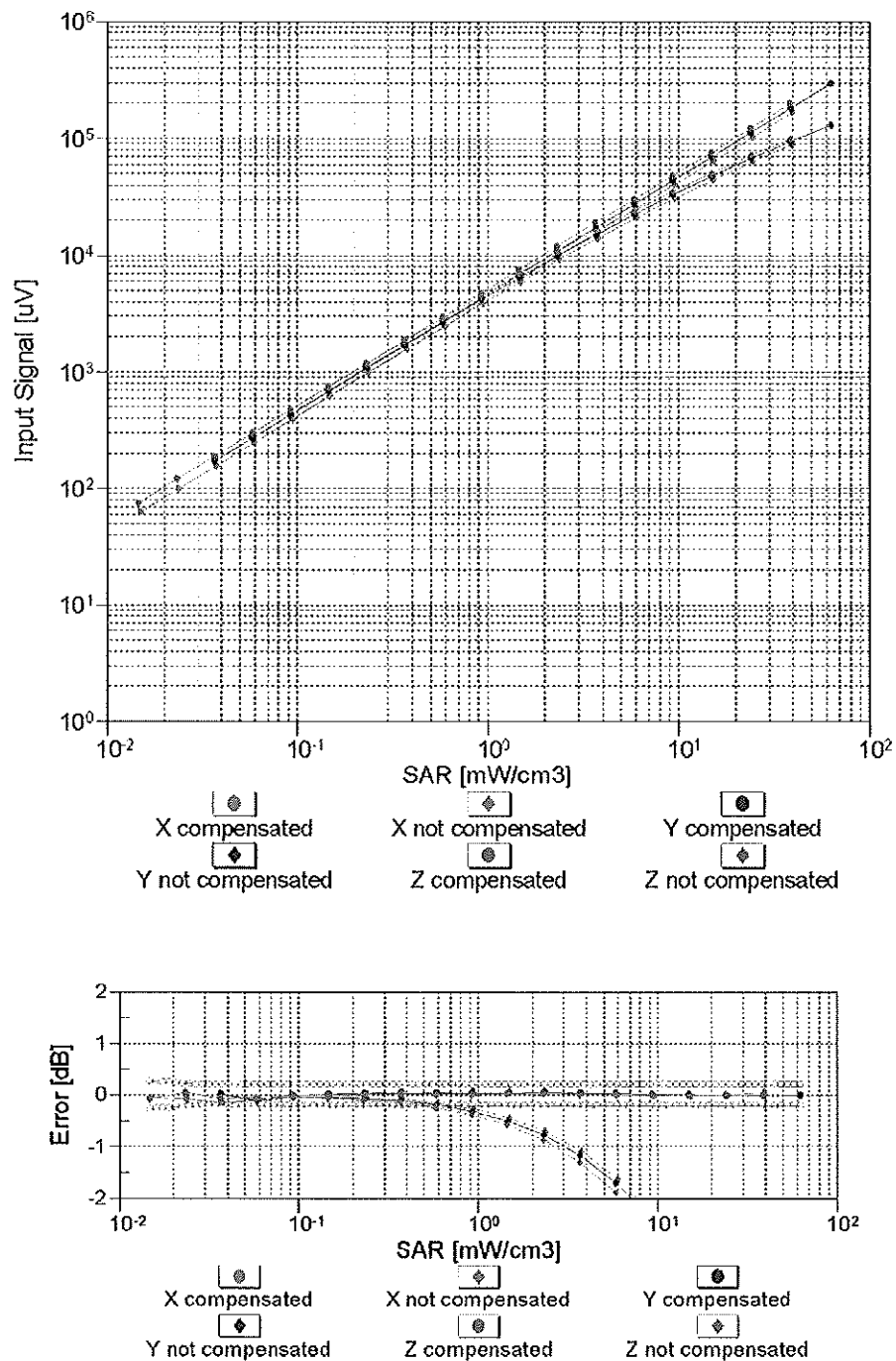
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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



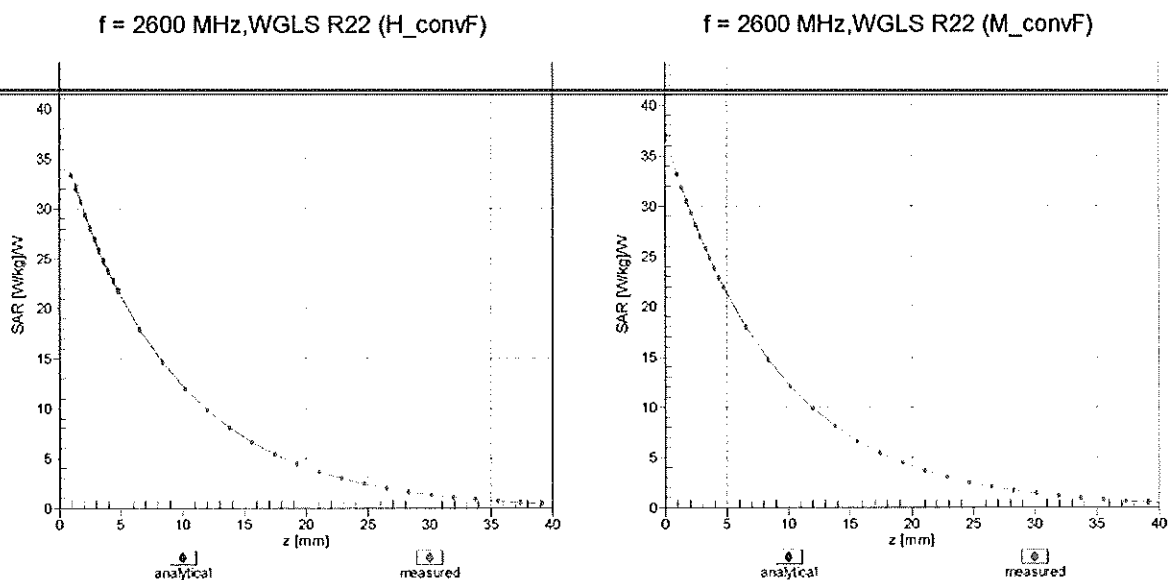
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

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



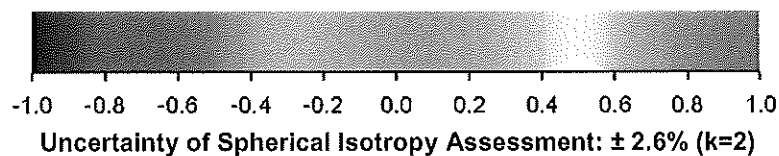
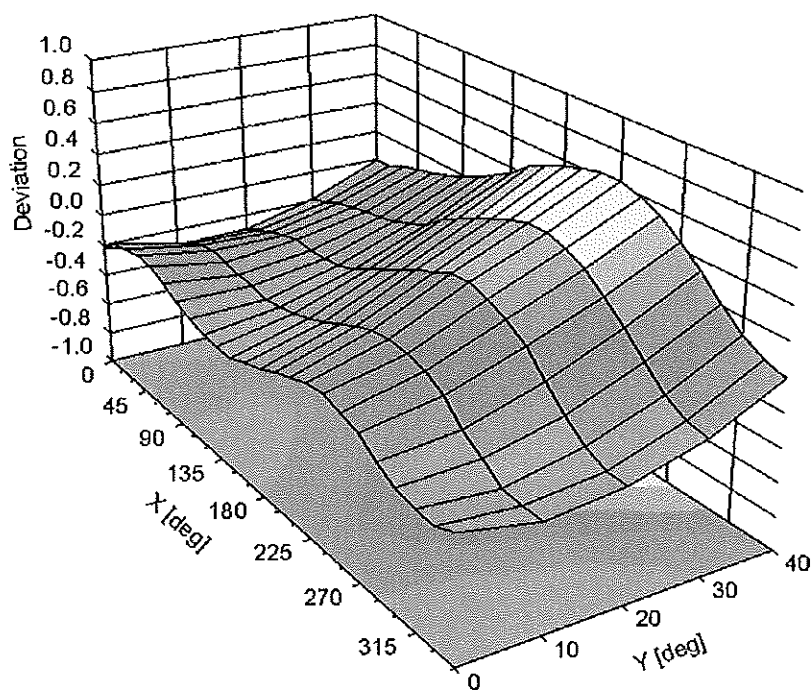
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

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



## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589

### Other Probe Parameters

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