



## SAR EVALUATION REPORT

**Applicant Name:**

LG Electronics MobileComm U.S.A., Inc.  
10101 Old Grove Road,  
San Diego, CA 92131  
USA

**Date of Testing:**

03/09/12 - 03/14/12

**Test Site/Location:**

PCTEST Lab, Columbia, MD, USA

**Document Serial No.:**

0Y1203090281.ZNF

**FCC ID:**

**ZNFAS695**

**APPLICANT:**

**LG ELECTRONICS MOBILECOMM U.S.A., INC.**

**DUT Type:**

Portable Handset

**Application Type:**

Certification

**FCC Rule Part(s):**

CFR §2.1093

**Model(s):**

AS695, LG-AS695

**Test Device Serial No.:**

Pre-Production [S/N: SAR#1]

| Band & Mode                                 | Tx Frequency          | Conducted Power [dBm] | SAR              |                       |                     |
|---------------------------------------------|-----------------------|-----------------------|------------------|-----------------------|---------------------|
|                                             |                       |                       | 1 gm Head (W/kg) | 1 gm Body-Worn (W/kg) | 1 gm Hotspot (W/kg) |
| Cell. CDMA/EVDO                             | 824.70 - 848.31 MHz   | 24.22                 | 0.75             | 0.94                  | 1.27                |
| PCS CDMA/EVDO                               | 1851.25 - 1908.75 MHz | 24.65                 | 0.65             | 0.79                  | 0.94                |
| 2.4 GHz WLAN                                | 2412 - 2462 MHz       | 16.22                 | 0.48             | 0.11                  | 0.11                |
| Bluetooth                                   | 2402 - 2480 MHz       | 9.89                  | N/A              |                       |                     |
| <b>Simultaneous SAR per KDB 690783 D01:</b> |                       |                       | 1.13             | 1.05                  | 1.38                |

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.

All models are confirmed to be identical per the manufacturer.

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in FCC/OET Bulletin 65 Supplement C (2001), IEEE 1528-2003 and in applicable Industry Canada Radio Standards Specifications (RSS); for North American frequency bands only.

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

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

  
Randy Ortanez  
President



|                                          |                                                                                     |                                      |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> ZNFAS695                  |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1203090281.ZNF | <b>Test Dates:</b><br>03/09/12 - 03/14/12                                           | <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          |
|-----------------|-----------------------|
| Cell. CDMA/EVDO | 824.70 - 848.31 MHz   |
| PCS CDMA/EVDO   | 1851.25 - 1908.75 MHz |
| 2.4 GHz WLAN    | 2412 - 2462 MHz       |
| Bluetooth       | 2402 - 2480 MHz       |

## 1.2 DUT Antenna Locations

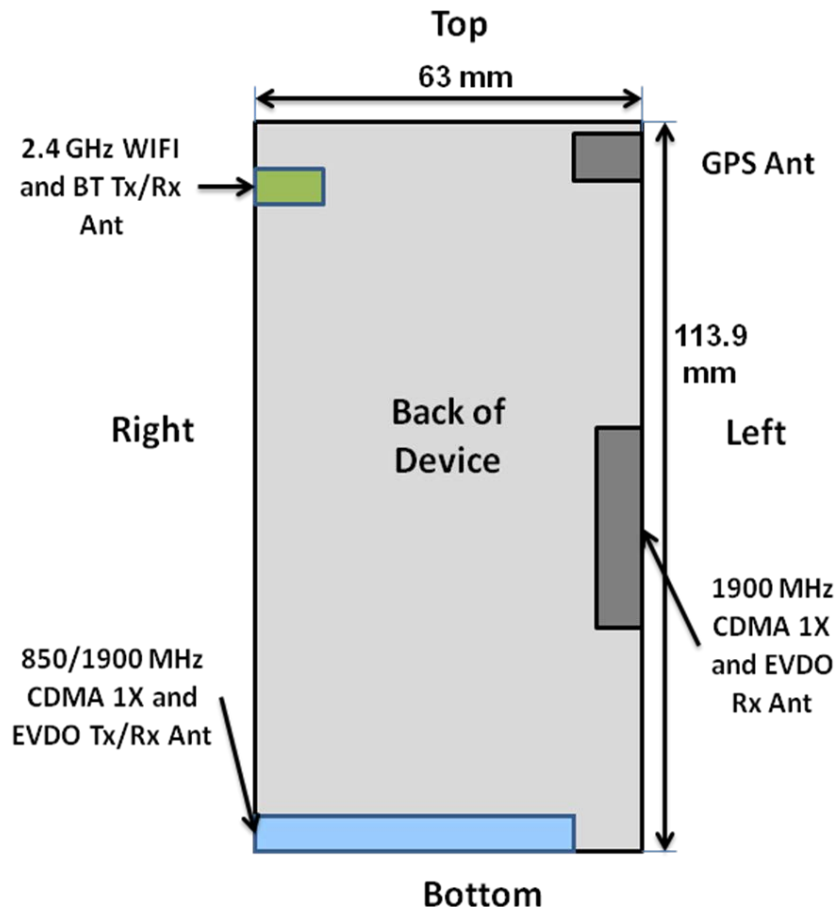


Figure 1-1  
DUT Antenna Locations

|                                   |                                                                                                                            |                               |                                                                                          |                                 |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------------------------|---------------------------------|
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**Table 1-1**  
**Mobile Hotspot Sides for SAR Testing**

| Mobile Hotspot Sides for SAR Testing |      |       |     |        |       |      |
|--------------------------------------|------|-------|-----|--------|-------|------|
| Mode                                 | Back | Front | Top | Bottom | Right | Left |
| Cell. EVDO                           | Yes  | Yes   | No  | Yes    | Yes   | Yes  |
| PCS EVDO                             | Yes  | Yes   | No  | Yes    | Yes   | Yes  |
| 2.4 GHz WLAN                         | Yes  | Yes   | Yes | No     | Yes   | No   |

Note: Particular DUT edges were not required to be evaluated for Wireless Router SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06 guidance, page 2. The antenna document shows the distances between the transmit antennas and the edges of the device.

### 1.3 SAR Test Exclusions Applied

#### (A) WIFI/BT

The separation between the main antenna and the Bluetooth and WLAN antennas is 85.7 mm. RF Conducted Power of Bluetooth Tx is 9.75 mW. RF Conducted Power of WLAN is 42.27 mW.

2.4 GHz WIFI and Bluetooth share the same antenna 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.

### 1.4 Power Reduction for SAR

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

### 1.5 FCC Guidance Applied

- FCC OET Bulletin 65 Supplement C [June 2001]
- IEEE 1528-2003
- FCC KDB 941225 (SAR Testing for 2G/3G and Hotspot Devices)
- FCC KDB 248227 (SAR Testing for 802.11 Devices)
- FCC KDB 648474 (Simultaneous SAR)

|                                   |                                                                                     |                               |                                                                                       |                                 |
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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 (kg/m<sup>3</sup>)
- E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

|                                   |                                                                                                                                   |                               |                                                                                                 |                                 |
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### 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)           | 835   | 835   | 1900  | 1900  | 2450  | 2450 |
|---------------------------|-------|-------|-------|-------|-------|------|
| Tissue                    | Head  | Body  | Head  | Body  | Head  | Body |
| Ingredients (% by weight) |       |       |       |       |       |      |
| Bactericide               | 0.1   | 0.1   |       |       |       |      |
| DGBE                      |       |       | 44.92 | 29.44 | 7.99  | 26.7 |
| HEC                       | 1     | 1     |       |       |       |      |
| NaCl                      | 1.45  | 0.94  | 0.18  | 0.39  | 0.16  | 0.1  |
| Sucrose                   | 57    | 44.9  |       |       |       |      |
| Triton X-100              |       |       |       |       | 19.97 |      |
| Water                     | 40.45 | 53.06 | 54.9  | 70.17 | 71.88 | 73.2 |

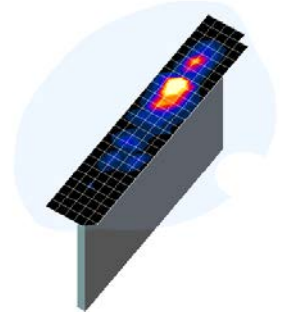
|                                   |                                                                                     |                               |                                                                                       |                                 |
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## 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.



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

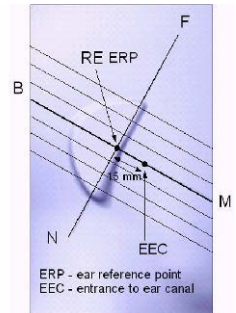
|                                   |                                                                                                                                   |                               |                                                                                                 |                                 |
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## 5

## DEFINITION OF REFERENCE POINTS

### 5.1 EAR REFERENCE POINT

Figure 8-1 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 8-1. 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].



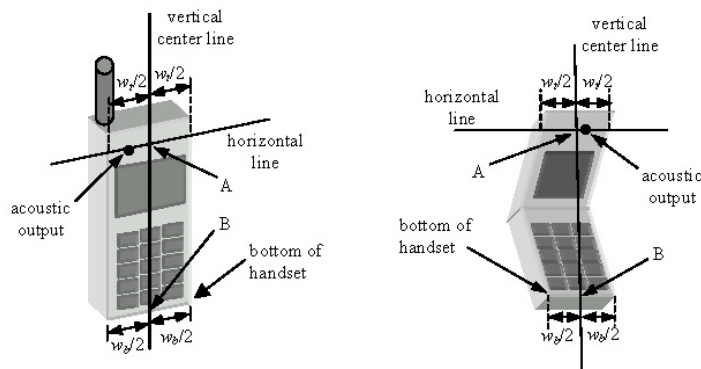
**Figure 5-1**  
Close-Up Side view  
of ERP

### 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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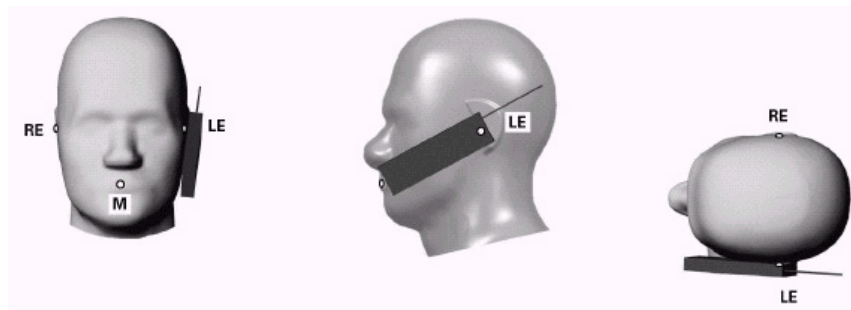
## 6 TEST CONFIGURATION POSITIONS FOR HANDSETS

### 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).

|                                   |                                                                                                                            |                               |                                                                                          |                                 |
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### 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 15 degree.
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).

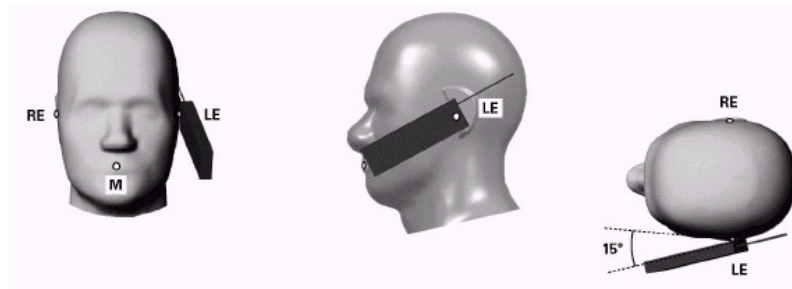


Figure 6-2 Front, Side and Top View of Ear/15° Tilt Position

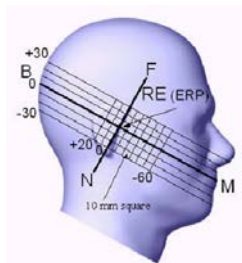


Figure 6-3  
Side view w/ relevant markings



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

|                                   |                                                                                                                            |                               |                                                                                          |                                 |
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## 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.

## 6.5 Wireless Router Configurations

Some battery-operated handsets have the capability to transmit and receive internet connectivity through simultaneous transmission of WIFI in conjunction with a separate licensed transmitter. The FCC has provided guidance in KDB Publication 941225 D06 where SAR test considerations for handsets ( $L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$ ) are based on a composite test separation distance of 10 mm from the front, back and edges of the device with antennas 2.5 cm or closer to the edge of the device, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions. Therefore, SAR must be evaluated for each frequency transmission and mode separately and summed with the WIFI transmitter according to KDB 648474 publication procedures. The "Portable Hotspot" feature on the handset was NOT activated, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal.

|                                   |                                                                                                                                   |                               |                                                                                       |                                 |
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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 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.

|                                          |                                                                                                                                   |                                      |                                                                                       |                                        |
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## 8.2.3 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.

## 8.2.4 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.

## 8.2.5 Body SAR Measurements for EVDO Hotspot

Hotspot Body SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0 per KDB Publication 941225 D01 procedures for “1x Ev-Do data Devices”. SAR for Subtype 2 Physical layer configurations is not required for Rev. A when the maximum average output of each RF channels is less than that measured in Subtype 0/1 Physical layer configurations. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for the RF channels in Rev. 0. The AT is tested with a Reverse Data Channel rate of 153.6 kbps in Subtype 0/1 Physical Layer configurations; and a Reverse Data Channel payload size of 4096 bits and Termination Target of 16 slots in Subtype 2 Physical Layer configurations. Both FTAP and FETAP are configured with a Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots. AT power control should be in “All Bits Up” conditions for TAP/ETAP

SAR is not required for 1x RTT for Ev-Do devices that also support 1x RTT voice and/or data operations, when the maximum average output of each channel is less than ¼ dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0. Otherwise, CDMA “Body-SAR Measurement” procedures for “CDMA 2000 1x Handsets” were applied.

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

Normal network operating configurations are not suitable for measuring the SAR of 802.11 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.

#### 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.

#### 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.

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] | TDSO SO32 [dBm] | TDSO SO32 [dBm] | 1x EvDO Rev. 0 [dBm] | 1x EvDO Rev. A [dBm] |
|----------|---------|-----------|------------|------------|-----------------|-----------------|----------------------|----------------------|
|          | F-RC    | MHz       | RC1        | RC3        | FCH+SCH         | FCH             | (RTAP)               | (RETAP)              |
| Cellular | 1013    | 824.7     | 24.12      | 24.14      | 24.15           | 24.12           | 24.19                | 24.16                |
|          | 384     | 836.52    | 24.07      | 23.97      | 24.22           | 24.00           | 24.22                | 24.21                |
|          | 777     | 848.31    | 24.11      | 24.08      | 24.06           | 24.01           | 24.21                | 24.18                |
| PCS      | 25      | 1851.25   | 24.53      | 24.57      | 24.47           | 24.34           | 24.64                | 24.54                |
|          | 600     | 1880      | 24.65      | 24.42      | 24.57           | 24.52           | 24.63                | 24.62                |
|          | 1175    | 1908.75   | 24.59      | 24.51      | 24.48           | 24.54           | 24.65                | 24.60                |

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.
3. CDMA Hotspot Body SAR was tested under Ev-Do Rev. 0 per FCC 3G Guidance (see Section 8.2.5). TDSO32 tests were not required since the maximum average output of each channel was less than 0.25 dB higher than that measured in Rev. 0. Rev. A tests were not required since the maximum average output of each RF channel was less than that measured in Rev. 0.



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

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

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

| Freq [MHz] | Channel | Data Rate [Mbps] | Average Power (dBm) |
|------------|---------|------------------|---------------------|
| 2412       | 1       | 1                | 15.78               |
|            |         | 2                | 15.92               |
|            |         | 5.5              | 15.99               |
|            |         | 11               | 15.76               |
| 2437       | 6       | 1                | <b>16.22</b>        |
|            |         | 2                | 16.07               |
|            |         | 5.5              | 16.13               |
|            |         | 11               | 16.26               |
| 2462       | 11      | 1                | 15.15               |
|            |         | 2                | 15.17               |
|            |         | 5.5              | 15.13               |
|            |         | 11               | 15.21               |

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

| Freq [MHz] | Channel | Data Rate [Mbps] | Average Power (dBm) |
|------------|---------|------------------|---------------------|
| 2412       | 1       | 6                | 13.62               |
|            |         | 9                | 13.51               |
|            |         | 12               | 13.25               |
|            |         | 18               | 13.35               |
|            |         | 24               | 13.36               |
|            |         | 36               | 13.60               |
|            |         | 48               | 13.61               |
|            |         | 54               | 13.04               |
| 2437       | 6       | 6                | 13.70               |
|            |         | 9                | 14.39               |
|            |         | 12               | 13.73               |
|            |         | 18               | 14.50               |
|            |         | 24               | 13.91               |
|            |         | 36               | 13.13               |
|            |         | 48               | 13.70               |
|            |         | 54               | 13.69               |
| 2462       | 11      | 6                | 12.26               |
|            |         | 9                | 12.25               |
|            |         | 12               | 12.96               |
|            |         | 18               | 12.45               |
|            |         | 24               | 12.30               |
|            |         | 36               | 12.32               |
|            |         | 48               | 12.93               |
|            |         | 54               | 12.75               |

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

| Freq [MHz] | Channel | Data Rate [Mbps] | Average Power (dBm) |
|------------|---------|------------------|---------------------|
| 2412       | 1       | 6.5/7.2          | 12.27               |
|            |         | 13/14.40         | 12.15               |
|            |         | 19.5/21.70       | 12.15               |
|            |         | 26/28.90         | 12.38               |
|            |         | 29/43.3          | 12.00               |
|            |         | 52/57.80         | 11.91               |
|            |         | 58.50/65         | 12.54               |
|            |         | 65/72.2          | 12.00               |
| 2437       | 6       | 6.5/7.2          | 13.14               |
|            |         | 13/14.40         | 13.34               |
|            |         | 19.5/21.70       | 12.74               |
|            |         | 26/28.90         | 12.83               |
|            |         | 29/43.3          | 13.21               |
|            |         | 52/57.80         | 13.16               |
|            |         | 58.50/65         | 13.21               |
|            |         | 65/72.2          | 12.80               |
| 2462       | 11      | 6.5/7.2          | 11.18               |
|            |         | 13/14.40         | 11.21               |
|            |         | 19.5/21.70       | 11.18               |
|            |         | 26/28.90         | 11.70               |
|            |         | 29/43.3          | 11.19               |
|            |         | 52/57.80         | 11.15               |
|            |         | 58.50/65         | 11.08               |
|            |         | 65/72.2          | 11.08               |

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.
- When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the 1g averaged SAR is <0.8 W/kg, SAR testing on other channels is not required. Otherwise, the other default (or corresponding required) test channels were additionally tested using the lowest data rate.
- The bolded data rate and channel above were tested for SAR.



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

|                                   |                                                                                                                                   |                               |                                                                                                 |                                 |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------|
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## 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 $\epsilon$ |
|------------------------------------|-------------|-------------------------------------|--------------------------|---------------------------------------|------------------------------------------|-------------------------------------|----------------------------------------|----------------|------------------|
| 3/9/2012                           | 835H        | 24.1                                | 820                      | 0.899                                 | 39.95                                    | 0.898                               | 41.571                                 | 0.11%          | -3.90%           |
|                                    |             |                                     | 835                      | 0.911                                 | 39.78                                    | 0.900                               | 41.500                                 | 1.22%          | -4.14%           |
|                                    |             |                                     | 850                      | 0.925                                 | 39.58                                    | 0.916                               | 41.500                                 | 0.98%          | -4.63%           |
| 3/12/2012                          | 1900H       | 24.1                                | 1850                     | 1.383                                 | 38.27                                    | 1.400                               | 40.000                                 | -1.21%         | -4.32%           |
|                                    |             |                                     | 1880                     | 1.410                                 | 38.15                                    | 1.400                               | 40.000                                 | 0.71%          | -4.63%           |
|                                    |             |                                     | 1910                     | 1.442                                 | 38.02                                    | 1.400                               | 40.000                                 | 3.00%          | -4.95%           |
| 3/14/2012                          | 2450H       | 24.0                                | 2401                     | 1.810                                 | 39.26                                    | 1.758                               | 39.298                                 | 2.96%          | -0.10%           |
|                                    |             |                                     | 2450                     | 1.855                                 | 39.07                                    | 1.800                               | 39.200                                 | 3.06%          | -0.33%           |
|                                    |             |                                     | 2499                     | 1.916                                 | 38.99                                    | 1.852                               | 39.135                                 | 3.46%          | -0.37%           |
| 3/9/2012                           | 835B        | 22.0                                | 820                      | 0.985                                 | 53.27                                    | 0.969                               | 55.284                                 | 1.65%          | -3.64%           |
|                                    |             |                                     | 835                      | 0.996                                 | 53.11                                    | 0.970                               | 55.200                                 | 2.68%          | -3.79%           |
|                                    |             |                                     | 850                      | 1.011                                 | 53.03                                    | 0.988                               | 55.154                                 | 2.33%          | -3.85%           |
| 3/12/2012                          | 1900B       | 21.8                                | 1850                     | 1.524                                 | 51.22                                    | 1.520                               | 53.300                                 | 0.26%          | -3.90%           |
|                                    |             |                                     | 1880                     | 1.558                                 | 51.11                                    | 1.520                               | 53.300                                 | 2.50%          | -4.11%           |
|                                    |             |                                     | 1910                     | 1.593                                 | 51.01                                    | 1.520                               | 53.300                                 | 4.80%          | -4.30%           |
| 3/14/2012                          | 2450B       | 23.8                                | 2401                     | 1.953                                 | 50.37                                    | 1.903                               | 52.765                                 | 2.63%          | -4.54%           |
|                                    |             |                                     | 2450                     | 2.004                                 | 50.21                                    | 1.950                               | 52.700                                 | 2.77%          | -4.72%           |
|                                    |             |                                     | 2499                     | 2.070                                 | 50.05                                    | 2.019                               | 52.638                                 | 2.53%          | -4.92%           |

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.

### 10.2 Measurement Procedure for Tissue verification

- 1) The network analyzer and probe system was configured and calibrated.
- 2) The probe was immersed in the sample which was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
- 3) The complex admittance with respect to the probe aperture was measured
- 4) The complex relative permittivity, for example 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  $j = \sqrt{-1}$ .

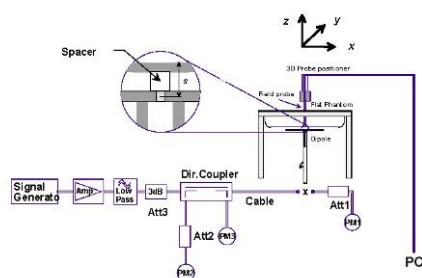
|                                   |                                                                                                                                   |                               |                                                                                                 |                                 |
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### 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 (%) |
| 835                                      | Head        | 03/09/2012 | 24.6           | 22.4             | 0.100           | 4d026     | 3258     | 0.989                             | 9.460                               | 9.890                                   | 4.55%         |
| 1900                                     | Head        | 03/12/2012 | 23.8           | 22.4             | 0.040           | 5d141     | 3022     | 1.580                             | 39.500                              | 39.500                                  | 0.00%         |
| 2450                                     | Head        | 03/14/2012 | 24.5           | 24.1             | 0.100           | 719       | 3022     | 5.300                             | 53.800                              | 53.000                                  | -1.49%        |
| 835                                      | Body        | 03/09/2012 | 24.0           | 22.3             | 0.100           | 4d026     | 3258     | 0.998                             | 9.660                               | 9.980                                   | 3.31%         |
| 1900                                     | Body        | 03/12/2012 | 23.4           | 22.3             | 0.040           | 5d141     | 3022     | 1.650                             | 41.400                              | 41.250                                  | -0.36%        |
| 2450                                     | Body        | 03/14/2012 | 24.4           | 23.8             | 0.100           | 719       | 3022     | 5.310                             | 51.300                              | 53.100                                  | 3.51%         |



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



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

|                                          |                                                                                                                                   |                                      |                                                                                                 |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------|
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| <b>Document S/N:</b><br>0Y1203090281.ZNF | <b>Test Dates:</b><br>03/09/12 - 03/14/12                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                                 | Page 19 of 31                          |

## 11 SAR DATA SUMMARY

### 11.1 Standalone Head SAR Data

Table 11-1  
Cell. CDMA Head SAR Results

| MEASUREMENT RESULTS                                                                               |     |            |                       |                  |                                                 |               |          |
|---------------------------------------------------------------------------------------------------|-----|------------|-----------------------|------------------|-------------------------------------------------|---------------|----------|
| FREQUENCY                                                                                         |     | Mode/Band  | Conducted Power [dBm] | Power Drift [dB] | Side                                            | Test Position | SAR (1g) |
| MHz                                                                                               | Ch. |            |                       |                  |                                                 |               | (W/kg)   |
| 836.52                                                                                            | 384 | Cell. CDMA | 23.97                 | -0.03            | Right                                           | Touch         | 0.746    |
| 836.52                                                                                            | 384 | Cell. CDMA | 23.97                 | -0.08            | Right                                           | Tilt          | 0.425    |
| 836.52                                                                                            | 384 | Cell. CDMA | 23.97                 | 0.07             | Left                                            | Touch         | 0.606    |
| 836.52                                                                                            | 384 | Cell. CDMA | 23.97                 | -0.06            | Left                                            | Tilt          | 0.430    |
| 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  
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)   |
| 1880.00                                                                                           | 600 | PCS CDMA  | 24.42                 | 0.05             | Right                                           | Touch         | 0.581    |
| 1880.00                                                                                           | 600 | PCS CDMA  | 24.42                 | 0.18             | Right                                           | Tilt          | 0.359    |
| 1880.00                                                                                           | 600 | PCS CDMA  | 24.42                 | 0.16             | Left                                            | Touch         | 0.651    |
| 1880.00                                                                                           | 600 | PCS CDMA  | 24.42                 | 0.01             | Left                                            | Tilt          | 0.291    |
| 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**  
**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)   |
| 2437                                                                                              | 6   | IEEE 802.11b | DSSS    | 16.22                 | 0.00             | Right                                           | Touch         | 1                | 0.249    |
| 2437                                                                                              | 6   | IEEE 802.11b | DSSS    | 16.22                 | 0.11             | Right                                           | Tilt          | 1                | 0.155    |
| 2437                                                                                              | 6   | IEEE 802.11b | DSSS    | 16.22                 | -0.03            | Left                                            | Touch         | 1                | 0.480    |
| 2437                                                                                              | 6   | IEEE 802.11b | DSSS    | 16.22                 | 0.00             | Left                                            | Tilt          | 1                | 0.272    |
| 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 |               |                  |          |

## 11.2 Standalone Body-Worn SAR Data

**Table 11-4**  
**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)   |
| 824.70                                                                                            | 1013 | Cell. CDMA | TDSO / SO32 | 24.12                 | 0.12             | 1.0 cm                                          | back | 0.812    |
| 836.52                                                                                            | 384  | Cell. CDMA | TDSO / SO32 | 24.00                 | -0.09            | 1.0 cm                                          | back | 0.897    |
| 848.31                                                                                            | 777  | Cell. CDMA | TDSO / SO32 | 24.01                 | -0.05            | 1.0 cm                                          | back | 0.941    |
| 1880.00                                                                                           | 600  | PCS CDMA   | TDSO / SO32 | 24.52                 | 0.04             | 1.0 cm                                          | back | 0.786    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |      |            |             |                       |                  | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |      |          |

**Table 11-5**  
**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)   |
| 2437                                                                                              | 6   | IEEE 802.11b | DSSS    | 16.22                 | 0.02             | 1.0 cm                                          | 1                | back | 0.107    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |     |              |         |                       |                  | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |                  |      |          |

|                                   |                                                                                                                                   |                               |  |  |  |                                                                                                 |                                 |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|--|--|--|-------------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFAS695                  |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | SAR EVALUATION REPORT         |  |  |  |  <b>LG</b> | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1203090281.ZNF | Test Dates:<br>03/09/12 - 03/14/12                                                                                                | DUT Type:<br>Portable Handset |  |  |  | Page 21 of 31                                                                                   |                                 |

## 11.3 Standalone Wireless Router SAR Data

Table 11-6  
Licensed Transmitter Hotspot SAR Data

| MEASUREMENT RESULTS                      |      |            |             |                       |                  |                      |        |          |
|------------------------------------------|------|------------|-------------|-----------------------|------------------|----------------------|--------|----------|
| FREQUENCY                                |      | Mode       | Service     | Conducted Power [dBm] | Power Drift [dB] | Spacing              | Side   | SAR (1g) |
| MHz                                      | Ch.  |            |             |                       |                  |                      |        | (W/kg)   |
| 824.70                                   | 1013 | Cell. CDMA | EVDO Rev. 0 | 24.19                 | 0.01             | 1.0 cm               | back   | 1.240    |
| 836.52                                   | 384  | Cell. CDMA | EVDO Rev. 0 | 24.22                 | 0.11             | 1.0 cm               | back   | 1.260    |
| 848.31                                   | 777  | Cell. CDMA | EVDO Rev. 0 | 24.21                 | -0.08            | 1.0 cm               | back   | 1.270    |
| 824.70                                   | 1013 | Cell. CDMA | EVDO Rev. 0 | 24.19                 | 0.09             | 1.0 cm               | front  | 0.786    |
| 836.52                                   | 384  | Cell. CDMA | EVDO Rev. 0 | 24.22                 | -0.14            | 1.0 cm               | front  | 0.855    |
| 848.31                                   | 777  | Cell. CDMA | EVDO Rev. 0 | 24.21                 | 0.01             | 1.0 cm               | front  | 0.875    |
| 836.52                                   | 384  | Cell. CDMA | EVDO Rev. 0 | 24.22                 | -0.07            | 1.0 cm               | bottom | 0.197    |
| 824.70                                   | 1013 | Cell. CDMA | EVDO Rev. 0 | 24.19                 | 0.14             | 1.0 cm               | right  | 0.757    |
| 836.52                                   | 384  | Cell. CDMA | EVDO Rev. 0 | 24.22                 | 0.03             | 1.0 cm               | right  | 0.814    |
| 848.31                                   | 777  | Cell. CDMA | EVDO Rev. 0 | 24.21                 | 0.18             | 1.0 cm               | right  | 0.900    |
| 836.52                                   | 384  | Cell. CDMA | EVDO Rev. 0 | 24.22                 | 0.10             | 1.0 cm               | left   | 0.607    |
| 1851.25                                  | 25   | PCS CDMA   | EVDO Rev. 0 | 24.64                 | 0.18             | 1.0 cm               | back   | 0.777    |
| 1880.00                                  | 600  | PCS CDMA   | EVDO Rev. 0 | 24.63                 | 0.01             | 1.0 cm               | back   | 0.804    |
| 1908.75                                  | 1175 | PCS CDMA   | EVDO Rev. 0 | 24.65                 | -0.13            | 1.0 cm               | back   | 0.943    |
| 1880.00                                  | 600  | PCS CDMA   | EVDO Rev. 0 | 24.63                 | 0.03             | 1.0 cm               | front  | 0.656    |
| 1880.00                                  | 600  | PCS CDMA   | EVDO Rev. 0 | 24.63                 | 0.01             | 1.0 cm               | bottom | 0.666    |
| 1880.00                                  | 600  | PCS CDMA   | EVDO Rev. 0 | 24.63                 | -0.16            | 1.0 cm               | right  | 0.230    |
| 1880.00                                  | 600  | PCS CDMA   | EVDO Rev. 0 | 24.63                 | 0.17             | 1.0 cm               | left   | 0.195    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |      |            |             |                       |                  | Body                 |        |          |
| Spatial Peak                             |      |            |             |                       |                  | 1.6 W/kg (mW/g)      |        |          |
| Uncontrolled Exposure/General Population |      |            |             |                       |                  | averaged over 1 gram |        |          |

|                                   |                                                                                                                            |                               |                                                                                       |                                 |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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| Document S/N:<br>0Y1203090281.ZNF | Test Dates:<br>03/09/12 - 03/14/12                                                                                         | DUT Type:<br>Portable Handset |                                                                                       | Page 22 of 31                   |

**Table 11-7**  
**WLAN Hotspot SAR Data**

| <b>MEASUREMENT RESULTS</b>                                                                                             |            |              |                |                              |                         |                                                               |                         |             |                 |
|------------------------------------------------------------------------------------------------------------------------|------------|--------------|----------------|------------------------------|-------------------------|---------------------------------------------------------------|-------------------------|-------------|-----------------|
| <b>FREQUENCY</b>                                                                                                       |            | <b>Mode</b>  | <b>Service</b> | <b>Conducted Power [dBm]</b> | <b>Power Drift [dB]</b> | <b>Spacing</b>                                                | <b>Data Rate (Mbps)</b> | <b>Side</b> | <b>SAR (1g)</b> |
| <b>MHz</b>                                                                                                             | <b>Ch.</b> |              |                |                              |                         |                                                               |                         |             | <b>(W/kg)</b>   |
| 2437                                                                                                                   | 6          | IEEE 802.11b | DSSS           | 16.22                        | 0.02                    | 1.0 cm                                                        | 1                       | back        | 0.107           |
| 2437                                                                                                                   | 6          | IEEE 802.11b | DSSS           | 16.22                        | 0.01                    | 1.0 cm                                                        | 1                       | front       | 0.070           |
| 2437                                                                                                                   | 6          | IEEE 802.11b | DSSS           | 16.22                        | -0.03                   | 1.0 cm                                                        | 1                       | top         | 0.054           |
| 2437                                                                                                                   | 6          | IEEE 802.11b | DSSS           | 16.22                        | 0.00                    | 1.0 cm                                                        | 1                       | right       | 0.087           |
| <b>ANSI / IEEE C95.1 1992 - SAFETY LIMIT</b><br><b>Spatial Peak</b><br><b>Uncontrolled Exposure/General Population</b> |            |              |                |                              |                         | <b>Body</b><br><b>1.6 W/kg (mW/g)</b><br>averaged over 1 gram |                         |             |                 |

## 11.4 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. All samples tested were electrically identical per the applicant. 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).
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was tested because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.

|                                          |                                                                                     |                                      |                                                                                       |                                        |
|------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> ZNFAS695                  |  | <b>SAR EVALUATION REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1203090281.ZNF | <b>Test Dates:</b><br>03/09/12 - 03/14/12                                           | <b>DUT Type:</b><br>Portable Handset |                                                                                       | Page 23 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 Wireless Router SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0 according to KDB 941225 D01 procedures for data devices. If the average output power of Subtype 2 for Rev. A is less than the Rev. 0 power levels, then Rev. A SAR is not required. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for that RF channel in Rev. 0. SAR is not required for 1x RTT for Ev-Do hotspot devices when the maximum average output of each channel is less than 1/4 dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0.

WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11b. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
2. WLAN transmission was verified using an uncalibrated spectrum analyzer.
3. 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.
4. Per FCC KDB Publication 941225 D06, when the same wireless modes and device transmission configurations are required for body-worn accessories and hotspot mode, it is not necessary to additionally test body-worn accessory SAR for the same device orientation. Therefore, the hotspot data for the back side configuration additionally shows body-worn compliance at the same distance.

Hotspot Notes:

1. Top Edge for the licensed transmitter was not tested since the antenna distance from the edge was greater than 2.5 cm per FCC KDB Publication 941225 D06 guidance (see Section 1.2).
2. Bottom and Left Edges for the WLAN transmitter were not tested since the antenna distance from the edges were greater than 2.5 cm per FCC KDB Publication 941225 D06 (see Section 1.2).
3. During SAR Testing for the Wireless Router conditions per KDB 941225 D06, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.5.)

|                                   |                                                                                                                                   |                               |                                                                                                 |                                 |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------|
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| Document S/N:<br>0Y1203090281.ZNF | Test Dates:<br>03/09/12 - 03/14/12                                                                                                | DUT Type:<br>Portable Handset |                                                                                                 | Page 24 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 802.11b/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>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>SAR not required:</b><br><u>Unlicensed only</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <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> | <p><u>Licensed &amp; Unlicensed</u></p> <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> <p><b>SAR required:</b><br/><u>Licensed &amp; Unlicensed</u></p> <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> |

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

### 12.3 Multiple Antenna/Transmission Information

The separation between the main antenna and the Bluetooth and WLAN antennas is 85.7 mm. RF Conducted Power of Bluetooth Tx is 9.75 mW. RF Conducted Power of WLAN is 42.27 mW.

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

Per Figures 12-1 and 12-2, 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.

|                                   |                                                                                                                            |                               |                                                                                          |                                 |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFAS695                  |  PCTEST<br>ENGINEERING LABORATORY, INC. | SAR EVALUATION REPORT         |  LG | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1203090281.ZNF | Test Dates:<br>03/09/12 - 03/14/12                                                                                         | DUT Type:<br>Portable Handset |                                                                                          | Page 25 of 31                   |

## 12.4 Head SAR Simultaneous Transmission Analysis

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

| Simult Tx | Configuration | Cell. CDMA SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | $\Sigma$ SAR (W/kg) | Simult Tx | Configuration | PCS CDMA SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | $\Sigma$ SAR (W/kg) |
|-----------|---------------|-----------------------|-------------------------|---------------------|-----------|---------------|---------------------|-------------------------|---------------------|
| Head SAR  | Right Cheek   | 0.746                 | 0.249                   | 0.995               | Head SAR  | Right Cheek   | 0.581               | 0.249                   | 0.830               |
|           | Right Tilt    | 0.425                 | 0.155                   | 0.580               |           | Right Tilt    | 0.359               | 0.155                   | 0.514               |
|           | Left Cheek    | 0.606                 | 0.480                   | <b>1.086</b>        |           | Left Cheek    | 0.651               | 0.480                   | <b>1.131</b>        |
|           | Left Tilt     | 0.430                 | 0.272                   | 0.702               |           | Left Tilt     | 0.291               | 0.272                   | 0.563               |

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

## 12.5 Body-Worn Simultaneous Transmission Analysis

**Table 12-2**  
**Simultaneous Transmission Scenario (Body-Worn at 1.0 cm)**

| Configuration | Mode       | 2G/3G SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | $\Sigma$ SAR (W/kg) |
|---------------|------------|------------------|-------------------------|---------------------|
| Back Side     | Cell. CDMA | 0.941            | 0.107                   | <b>1.048</b>        |
| Back Side     | PCS CDMA   | 0.786            | 0.107                   | 0.893               |

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

## 12.6 Hotspot SAR Simultaneous Transmission Analysis

**Table 12-3**  
**Simultaneous Transmission Scenario (Hotspot at 1.0 cm)**

| Simult Tx | Configuration | Cell. EVDO SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | $\Sigma$ SAR (W/kg) | Simult Tx | Configuration | PCS EVDO SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | $\Sigma$ SAR (W/kg) |
|-----------|---------------|-----------------------|-------------------------|---------------------|-----------|---------------|---------------------|-------------------------|---------------------|
| Body SAR  | Back          | 1.270                 | 0.107                   | <b>1.377</b>        | Body SAR  | Back          | 0.943               | 0.107                   | <b>1.050</b>        |
|           | Front         | 0.875                 | 0.070                   | 0.945               |           | Front         | 0.656               | 0.070                   | 0.726               |
|           | Top           | -                     | 0.054                   | 0.054               |           | Top           | -                   | 0.054                   | 0.054               |
|           | Bottom        | 0.197                 | -                       | 0.197               |           | Bottom        | 0.666               | -                       | 0.666               |
|           | Right         | 0.900                 | 0.087                   | 0.987               |           | Right         | 0.230               | 0.087                   | 0.317               |
|           | Left          | 0.607                 | -                       | 0.607               |           | Left          | 0.195               | -                       | 0.195               |

Note: Per FCC KDB Publication 941225 D06, the edges with antennas more than 2.5 cm are not required to be evaluated for SAR (""). The above tables represent a portable hotspot condition.

## 12.7 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.

|                                          |                                                                                                                                   |                                      |                                                                                                 |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: ZNFAS695                         |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR EVALUATION REPORT</b>         |  <b>LG</b> | <b>Reviewed by:</b><br>Quality Manager |
| <b>Document S/N:</b><br>0Y1203090281.ZNF | <b>Test Dates:</b><br>03/09/12 - 03/14/12                                                                                         | <b>DUT Type:</b><br>Portable Handset |                                                                                                 | Page 26 of 31                          |

# 13 EQUIPMENT LIST

| Manufacturer       | Model     | Description                                   | Cal Date   | Cal Interval | Cal Due    | Serial Number |
|--------------------|-----------|-----------------------------------------------|------------|--------------|------------|---------------|
| Agilent            | 8648D     | Signal Generator                              | 4/5/2011   | Annual       | 4/5/2012   | 3629U00687    |
| Agilent            | 8648D     | (9kHz-4GHz) Signal Generator                  | 10/10/2011 | Annual       | 10/10/2012 | 3613A00315    |
| Agilent            | 8753E     | (30kHz-6GHz) Network Analyzer                 | 4/21/2011  | Annual       | 4/21/2012  | JP38020182    |
| Agilent            | E5515C    | Wireless Communications Tester                | 4/21/2011  | Annual       | 4/21/2012  | US41140256    |
| Agilent            | E5515C    | Wireless Communications Test Set              | 10/10/2011 | Annual       | 10/10/2012 | GB46110872    |
| Agilent            | E5515C    | Wireless Communications Test Set              | 10/14/2011 | Annual       | 10/14/2012 | GB41450275    |
| Agilent            | E5515C    | Wireless Communications Test Set              | 10/20/2011 | Annual       | 10/20/2012 | GB46310798    |
| Agilent            | E5515C    | Wireless Communications Test Set              | 2/9/2012   | Annual       | 2/9/2013   | GB43460554    |
| 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  | GB43304447    |
| Agilent            | E5515C    | Wireless Communications Test Set              | 2/14/2012  | Annual       | 2/14/2013  | GB43163447    |
| Agilent            | E8257D    | (250kHz-20GHz) Signal Generator               | 4/8/2011   | Annual       | 4/8/2012   | MY45470194    |
| Amplifier Research | 5S1G4     | 5W, 800MHz-4.2GHz                             | N/A        |              | N/A        | 21910         |
| Anritsu            | MA2411B   | Pulse Sensor                                  | 10/13/2011 | Annual       | 10/13/2012 | 1027293       |
| Anritsu            | MA2481A   | Power Sensor                                  | 2/14/2012  | Annual       | 2/14/2013  | 5318          |
| Anritsu            | MA2481A   | Power Sensor                                  | 2/14/2012  | Annual       | 2/14/2013  | 5442          |
| Anritsu            | MA2481A   | Power Sensor                                  | 2/14/2012  | Annual       | 2/14/2013  | 5821          |
| Anritsu            | MA2481A   | Power Sensor                                  | 2/14/2012  | Annual       | 2/14/2013  | 8013          |
| Anritsu            | MA2481A   | Power Sensor                                  | 2/14/2012  | Annual       | 2/14/2013  | 2400          |
| Anritsu            | ML2438A   | Power Meter                                   | 10/13/2011 | Annual       | 10/13/2012 | 1070030       |
| 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            | ML2495A   | Power Meter                                   | 10/13/2011 | Annual       | 10/13/2012 | 1039008       |
| Anritsu            | MT8820C   | Radio Communication Tester                    | 11/11/2011 | Annual       | 11/11/2012 | 6200901190    |
| Control Company    | 61220-416 | Long-Stem Thermometer                         | 2/15/2011  | Biennial     | 2/15/2013  | 111331322     |
| 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  | 111331330     |
| Control Company    | 61220-416 | Long-Stem Thermometer                         | 2/15/2011  | Biennial     | 2/15/2013  | 111331332     |
| Control Company    | 61220-416 | Long-Stem Thermometer                         | 3/16/2011  | Biennial     | 3/16/2013  | 111391601     |
| 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       |
| Index SAR          | IXTL-010  | Dielectric Measurement Kit                    | N/A        | N/A          | N/A        | N/A           |
| Index SAR          | IXTL-030  | 30MM TEM line for 6 GHz                       | N/A        | N/A          | N/A        | N/A           |
| 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-1200+ | Low Pass Filter DC to 1000 MHz                | 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              | 4014C-6   | 4 - 8 GHz SMA 6 dB Directional Coupler        | 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           |
| Pasternack         | PE2208-6  | Bidirectional Coupler                         | 6/3/2011   | Annual       | 6/3/2012   | N/A           |
| Pasternack         | PE2209-10 | Bidirectional Coupler                         | 6/3/2011   | Annual       | 6/3/2012   | N/A           |
| Rohde & Schwarz    | CMU200    | Base Station Simulator                        | 4/19/2011  | Annual       | 4/19/2012  | 107826        |
| Rohde & Schwarz    | CMU200    | Base Station Simulator                        | 6/1/2011   | Annual       | 6/1/2012   | 833855/0010   |
| Rohde & Schwarz    | NRVD      | Dual Channel Power Meter                      | 4/8/2011   | Biennial     | 4/8/2013   | 101695        |
| Rohde & Schwarz    | SMI03B    | Signal Generator                              | 4/6/2011   | Annual       | 4/6/2012   | DE27259       |
| SPEAG              | D1900V2   | 1900 MHz SAR Dipole                           | 7/11/2011  | Annual       | 7/11/2012  | 5d141         |
| SPEAG              | D2450V2   | 2450 MHz SAR Dipole                           | 8/19/2011  | Annual       | 8/19/2012  | 719           |
| SPEAG              | D835V2    | 835 MHz SAR Dipole                            | 8/15/2011  | Annual       | 8/15/2012  | 4d026         |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 5/19/2011  | Annual       | 5/19/2012  | 859           |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 1/18/2012  | Annual       | 1/18/2013  | 1272          |
| SPEAG              | ES3DV2    | SAR Probe                                     | 8/25/2011  | Annual       | 8/25/2012  | 3022          |
| SPEAG              | ES3DV3    | SAR Probe                                     | 2/21/2012  | Annual       | 2/21/2013  | 3258          |
| VWR                | 36934-158 | Wall-Mounted Thermometer                      | 5/26/2010  | Biennial     | 5/26/2012  | 101718589     |
| VWR                | 36934-158 | Wall-Mounted Thermometer                      | 1/21/2011  | Biennial     | 1/21/2013  | 111286445     |
| VWR                | 36934-158 | Wall-Mounted Thermometer                      | 1/21/2011  | Biennial     | 1/21/2013  | 111286460     |
| VWR                | 36934-158 | Wall-Mounted Thermometer                      | 1/21/2011  | Biennial     | 1/21/2013  | 111286454     |
| VWR                | 36934-158 | Wall Thermometer                              | 9/30/2011  | Biennial     | 9/30/2013  | 111859323     |
| VWR                | 36934-158 | Wall Thermometer                              | 9/30/2011  | Biennial     | 9/30/2013  | 111859332     |
| VWR                | 61220-416 | Long Stem Thermometer                         | 7/1/2011   | Biennial     | 7/1/2013   | 111642834     |
| VWR                | 61220-416 | Long stem thermometer                         | 7/1/2011   | Biennial     | 7/1/2013   | 111642916     |
| VWR                | 61220-416 | Long Stem Thermometer                         | 7/1/2011   | Biennial     | 7/1/2013   | 111642941     |

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, attenuator, coupler 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: ZNFAS695                  |  | SAR EVALUATION REPORT         |  | Reviewed by:<br>Quality Manager |
| Document S/N:<br>0Y1203090281.ZNF | Test Dates:<br>03/09/12 - 03/14/12                                                  | DUT Type:<br>Portable Handset |                                                                                       | Page 27 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

|                                          |                                                                                                                                   |                                      |                                                                                                 |                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------|
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| <b>Document S/N:</b><br>OY1203090281.ZNF | <b>Test Dates:</b><br>03/09/12 - 03/14/12                                                                                         | <b>DUT Type:</b><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]

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

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.912 \text{ mho/m}$ ;  $\epsilon_r = 39.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 03-09-2012; Ambient Temp: 24.6°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3258; ConvF(6.01, 6.01, 6.01); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1403

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

**Mode: Cellular CDMA, Right Head, Touch, Mid.ch.**

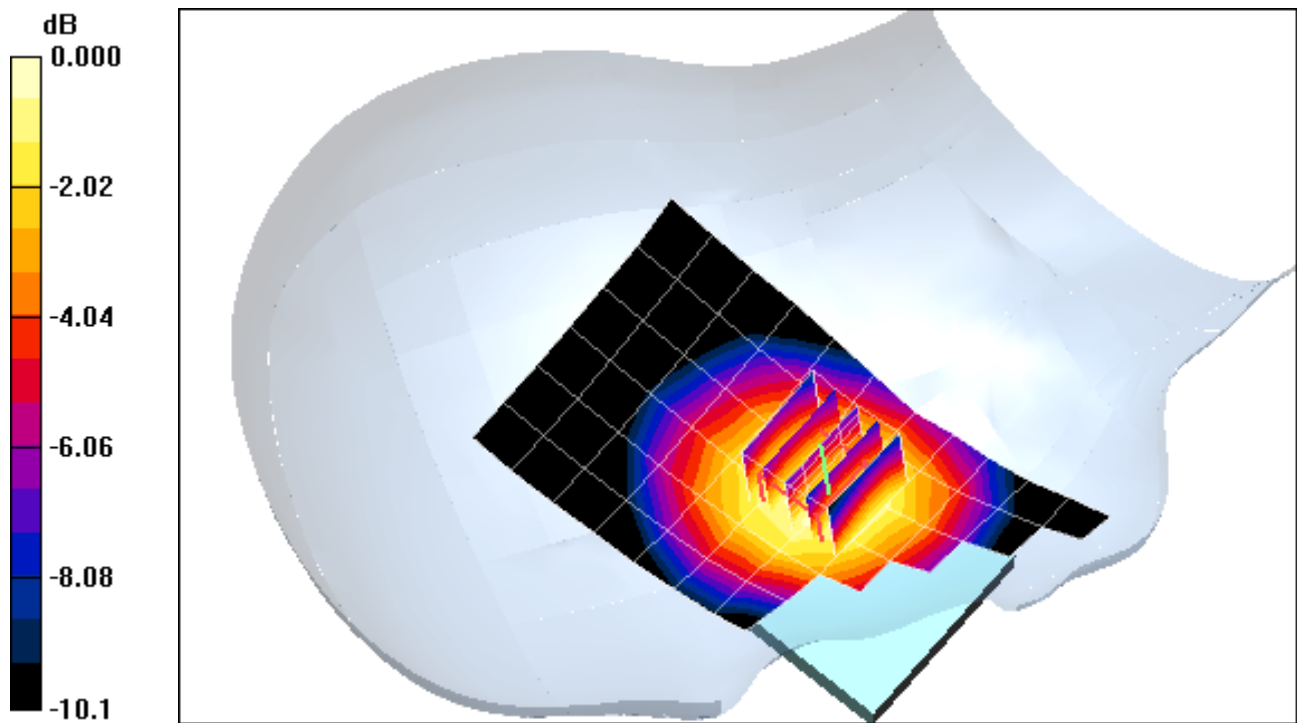
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 30.5 V/m; Power Drift = -0.034 dB

Peak SAR (extrapolated) = 0.915 W/kg

**SAR(1 g) = 0.746 mW/g; SAR(10 g) = 0.563 mW/g**



0 dB = 0.785mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.912 \text{ mho/m}$ ;  $\epsilon_r = 39.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 03-09-2012; Ambient Temp: 24.6°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3258; ConvF(6.01, 6.01, 6.01); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1403

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

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

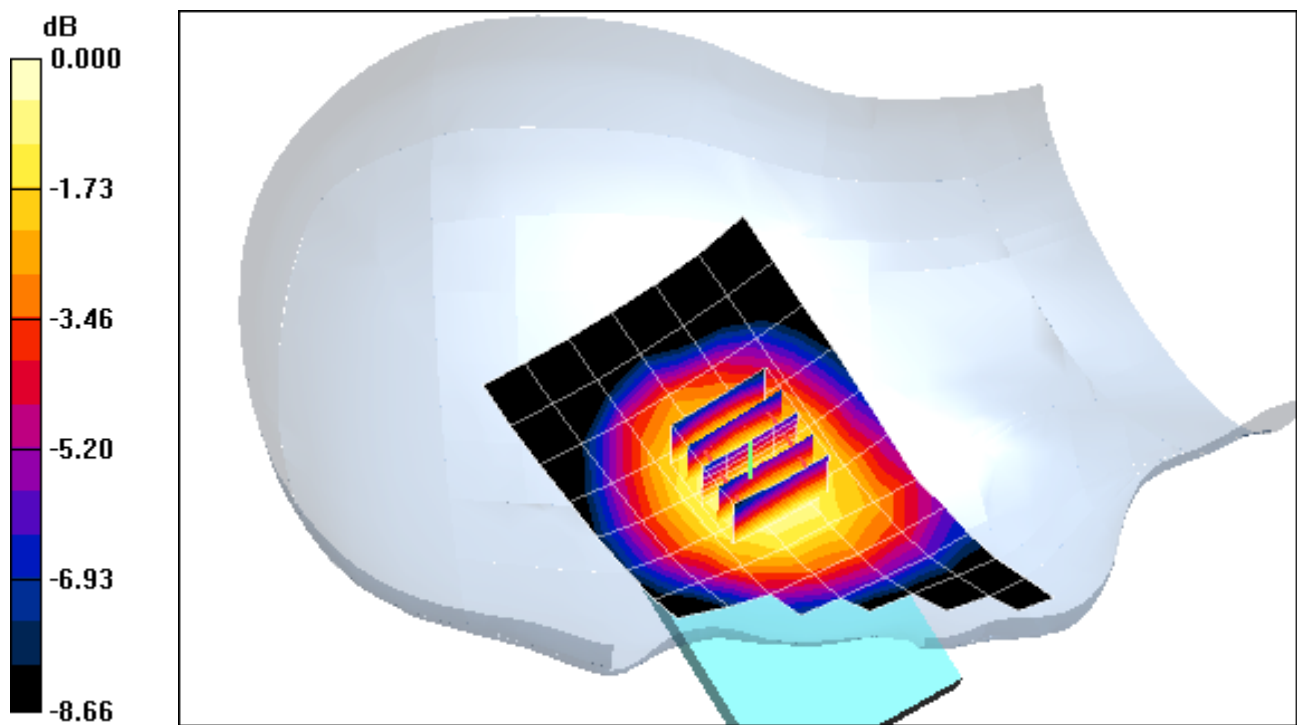
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 23.5 V/m; Power Drift = -0.084 dB

Peak SAR (extrapolated) = 0.519 W/kg

**SAR(1 g) = 0.425 mW/g; SAR(10 g) = 0.324 mW/g**



0 dB = 0.448mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.912 \text{ mho/m}$ ;  $\epsilon_r = 39.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-09-2012; Ambient Temp: 24.6°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3258; ConvF(6.01, 6.01, 6.01); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1403

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

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

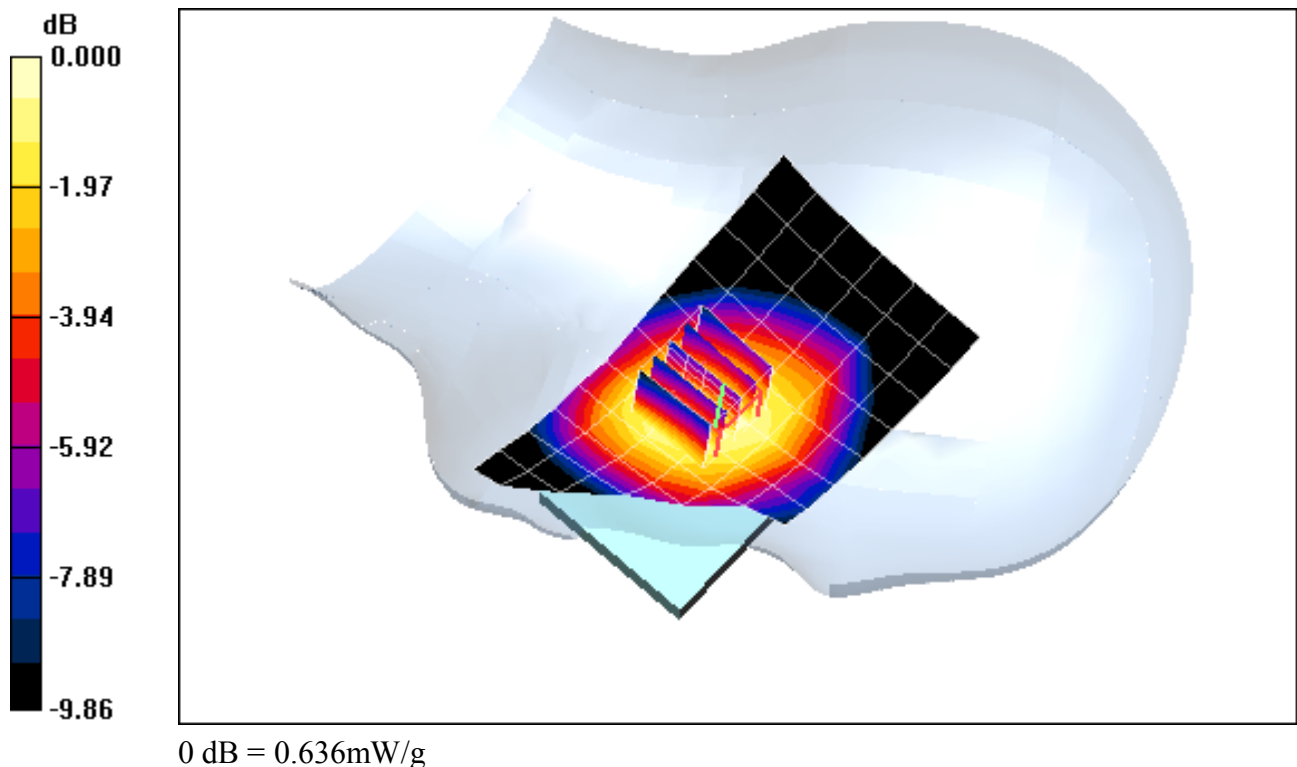
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 10.5 V/m; Power Drift = 0.073 dB

Peak SAR (extrapolated) = 0.750 W/kg

**SAR(1 g) = 0.606 mW/g; SAR(10 g) = 0.458 mW/g**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.912 \text{ mho/m}$ ;  $\epsilon_r = 39.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-09-2012; Ambient Temp: 24.6°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3258; ConvF(6.01, 6.01, 6.01); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1403

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

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

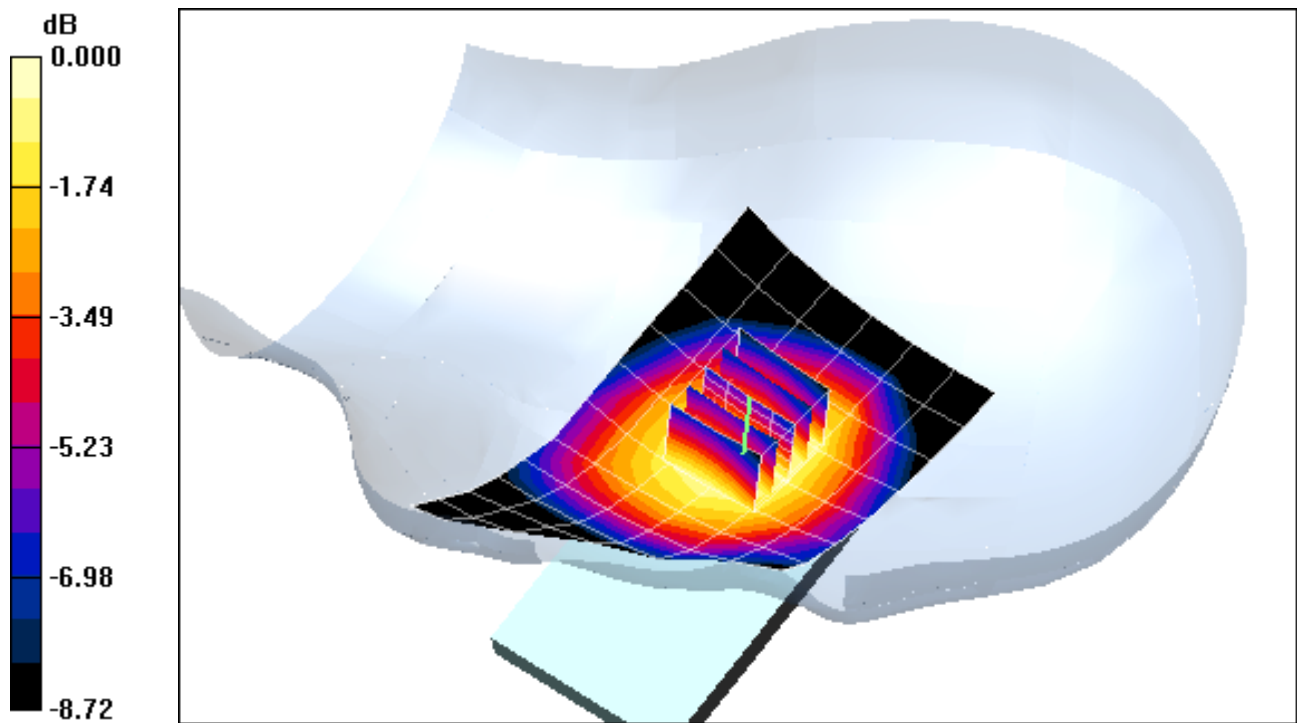
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 23.1 V/m; Power Drift = -0.063 dB

Peak SAR (extrapolated) = 0.533 W/kg

**SAR(1 g) = 0.430 mW/g; SAR(10 g) = 0.324 mW/g**



0 dB = 0.451mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.41 \text{ mho/m}$ ;  $\epsilon_r = 38.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 03-12-2012; Ambient Temp: 23.8°C; Tissue Temp: 22.4°C

Probe: ES3DV2 - SN3022; ConvF(4.98, 4.98, 4.98); Calibrated: 8/25/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

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

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

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

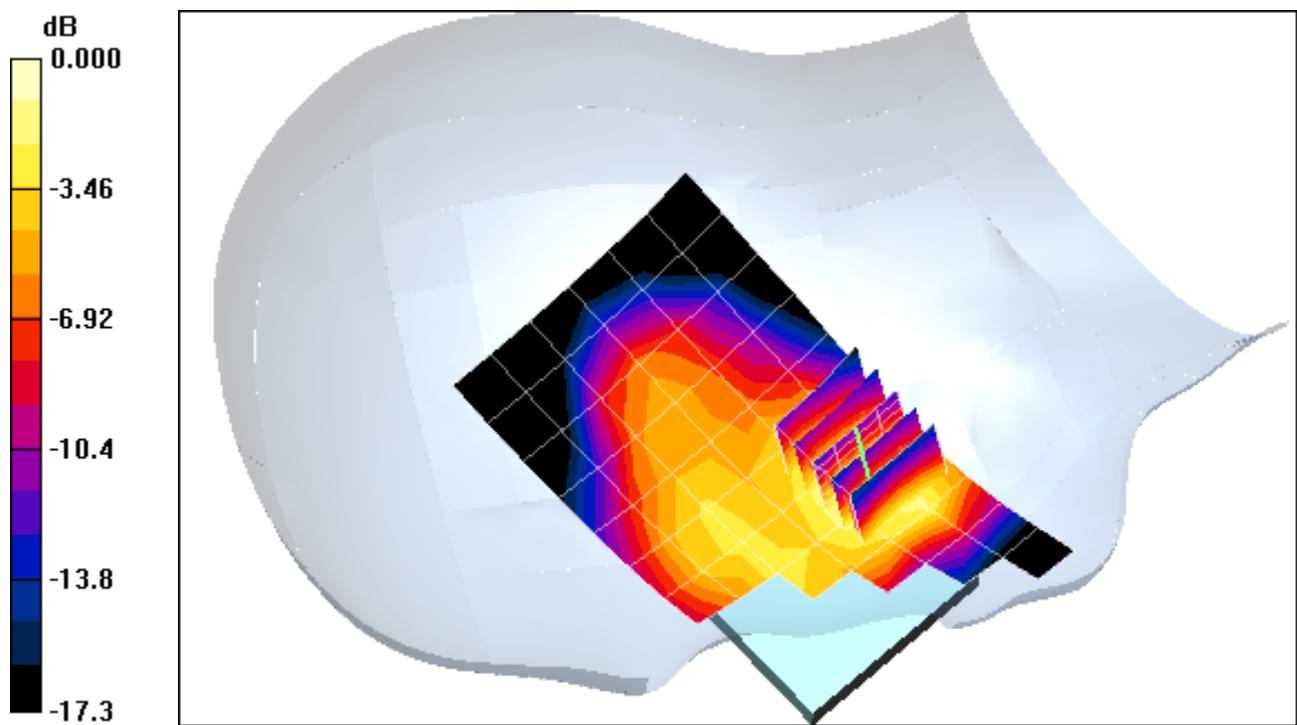
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 21.5 V/m; Power Drift = 0.054 dB

Peak SAR (extrapolated) = 0.916 W/kg

**SAR(1 g) = 0.581 mW/g; SAR(10 g) = 0.349 mW/g**



0 dB = 0.631mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.41 \text{ mho/m}$ ;  $\epsilon_r = 38.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 03-12-2012; Ambient Temp: 23.8°C; Tissue Temp: 22.4°C

Probe: ES3DV2 - SN3022; ConvF(4.98, 4.98, 4.98); Calibrated: 8/25/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

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

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

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

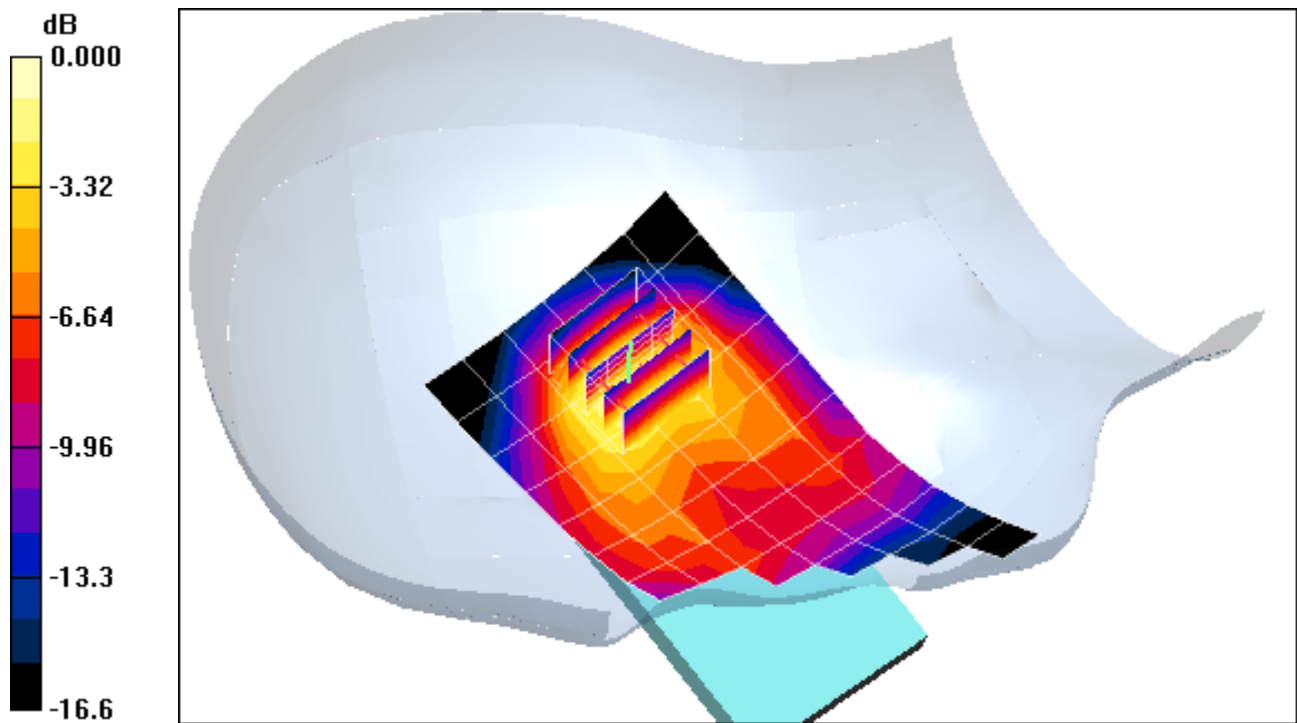
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 16.8 V/m; Power Drift = 0.184 dB

Peak SAR (extrapolated) = 0.565 W/kg

**SAR(1 g) = 0.359 mW/g; SAR(10 g) = 0.211 mW/g**



0 dB = 0.397mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.41 \text{ mho/m}$ ;  $\epsilon_r = 38.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-12-2012; Ambient Temp: 23.8°C; Tissue Temp: 22.4°C

Probe: ES3DV2 - SN3022; ConvF(4.98, 4.98, 4.98); Calibrated: 8/25/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

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

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

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

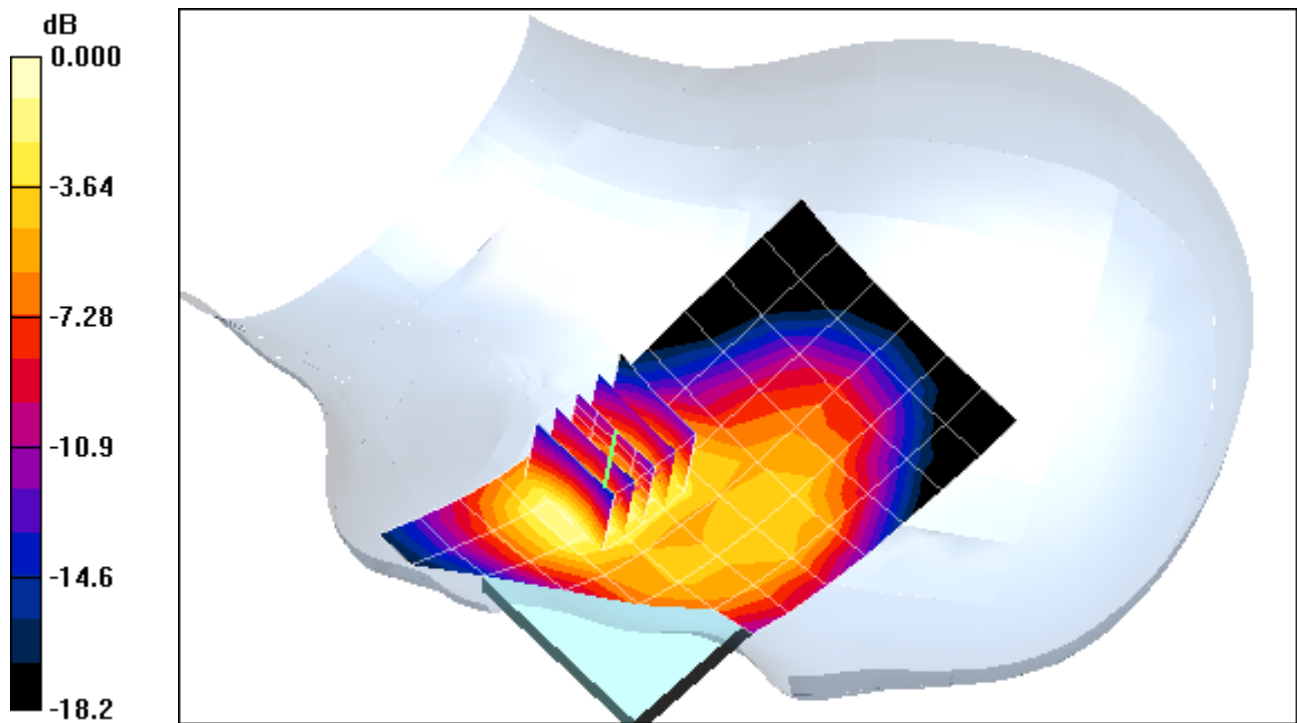
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 21.1 V/m; Power Drift = 0.159 dB

Peak SAR (extrapolated) = 1.02 W/kg

**SAR(1 g) = 0.651 mW/g; SAR(10 g) = 0.389 mW/g**



0 dB = 0.712mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.41 \text{ mho/m}$ ;  $\epsilon_r = 38.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-12-2012; Ambient Temp: 23.8°C; Tissue Temp: 22.4°C

Probe: ES3DV2 - SN3022; ConvF(4.98, 4.98, 4.98); Calibrated: 8/25/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

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

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

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

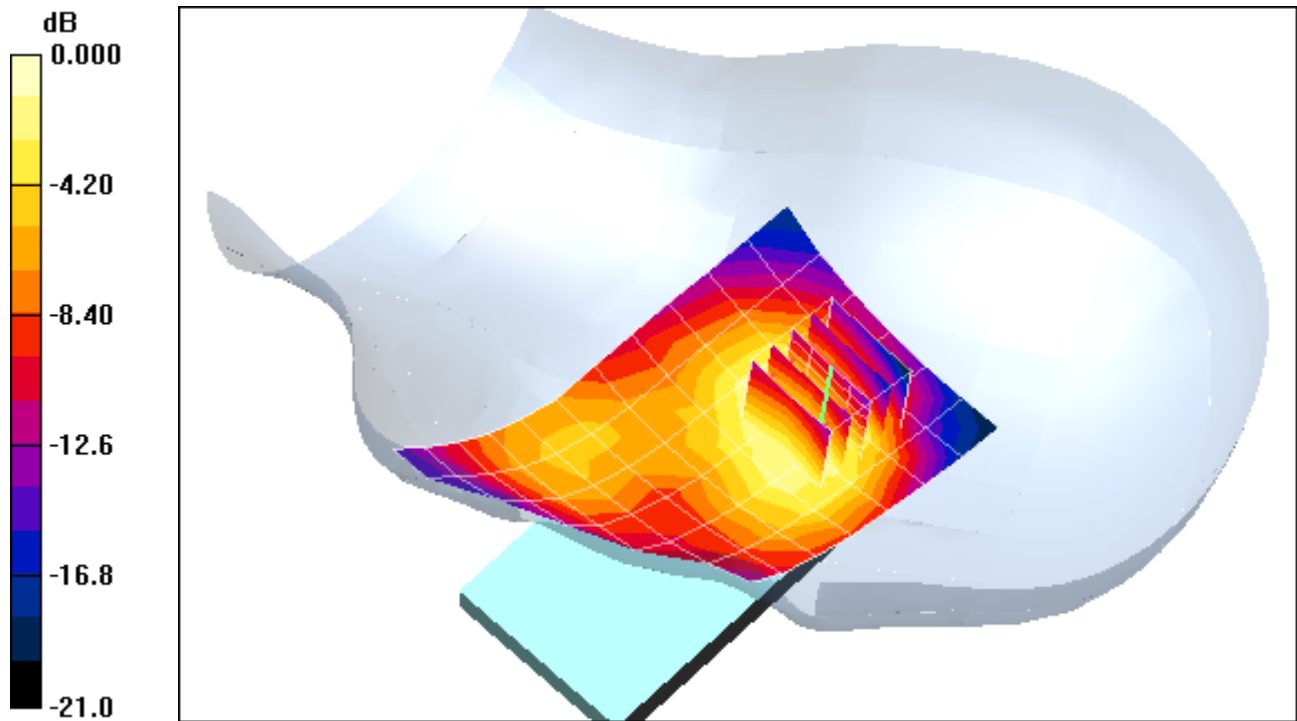
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 14.7 V/m; Power Drift = 0.005 dB

Peak SAR (extrapolated) = 0.449 W/kg

**SAR(1 g) = 0.291 mW/g; SAR(10 g) = 0.180 mW/g**



0 dB = 0.308mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$ ;  $\sigma = 1.84 \text{ mho/m}$ ;  $\epsilon_r = 39.15$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 03-14-2012; Ambient Temp: 24.5°C; Tissue Temp: 24.1°C

Probe: ES3DV2 - SN3022; ConvF(4.3, 4.3, 4.3); Calibrated: 8/25/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

**Mode: IEEE 802.11b, Right Head, Touch, Ch 06, 1 Mbps**

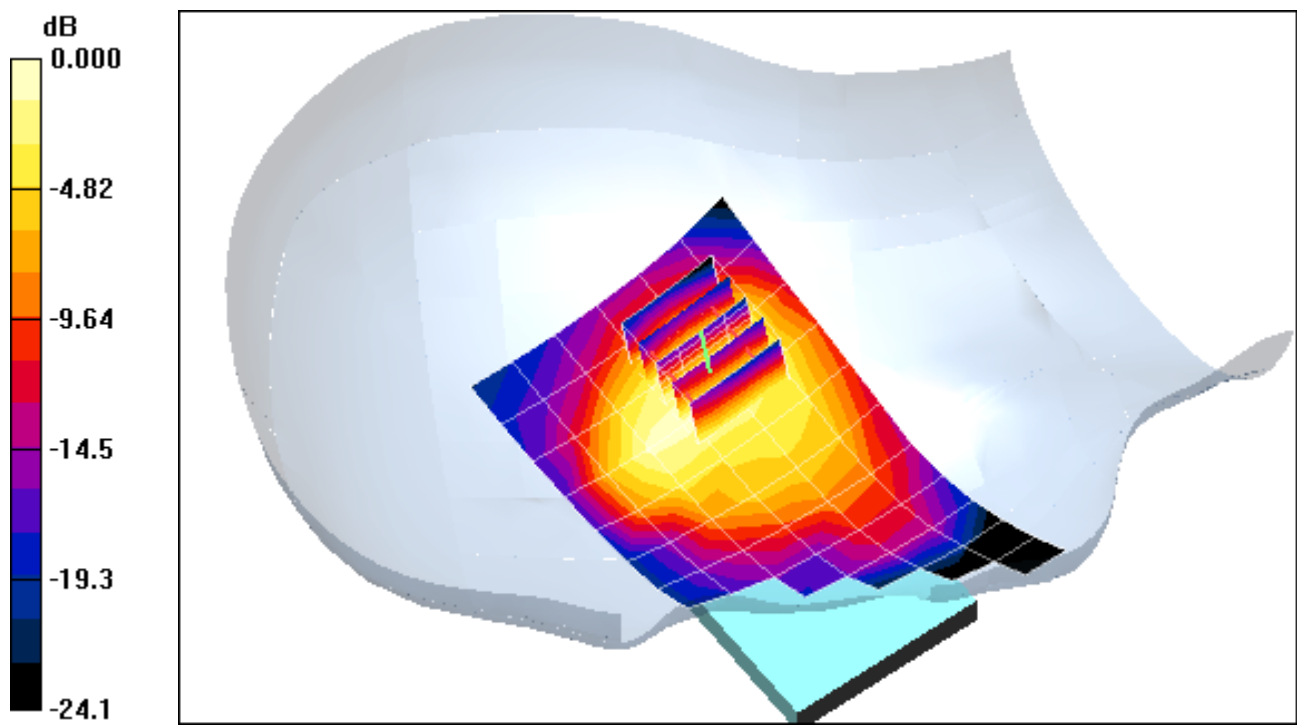
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 11.4 V/m; Power Drift = -0.001 dB

Peak SAR (extrapolated) = 0.471 W/kg

SAR(1 g) = 0.249 mW/g; SAR(10 g) = 0.132 mW/g



0 dB = 0.310mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$ ;  $\sigma = 1.84 \text{ mho/m}$ ;  $\epsilon_r = 39.15$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 03-14-2012; Ambient Temp: 24.5°C; Tissue Temp: 24.1°C

Probe: ES3DV2 - SN3022; ConvF(4.3, 4.3, 4.3); Calibrated: 8/25/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

**Mode: IEEE 802.11b, Right Head, Tilt, Ch 06, 1 Mbps**

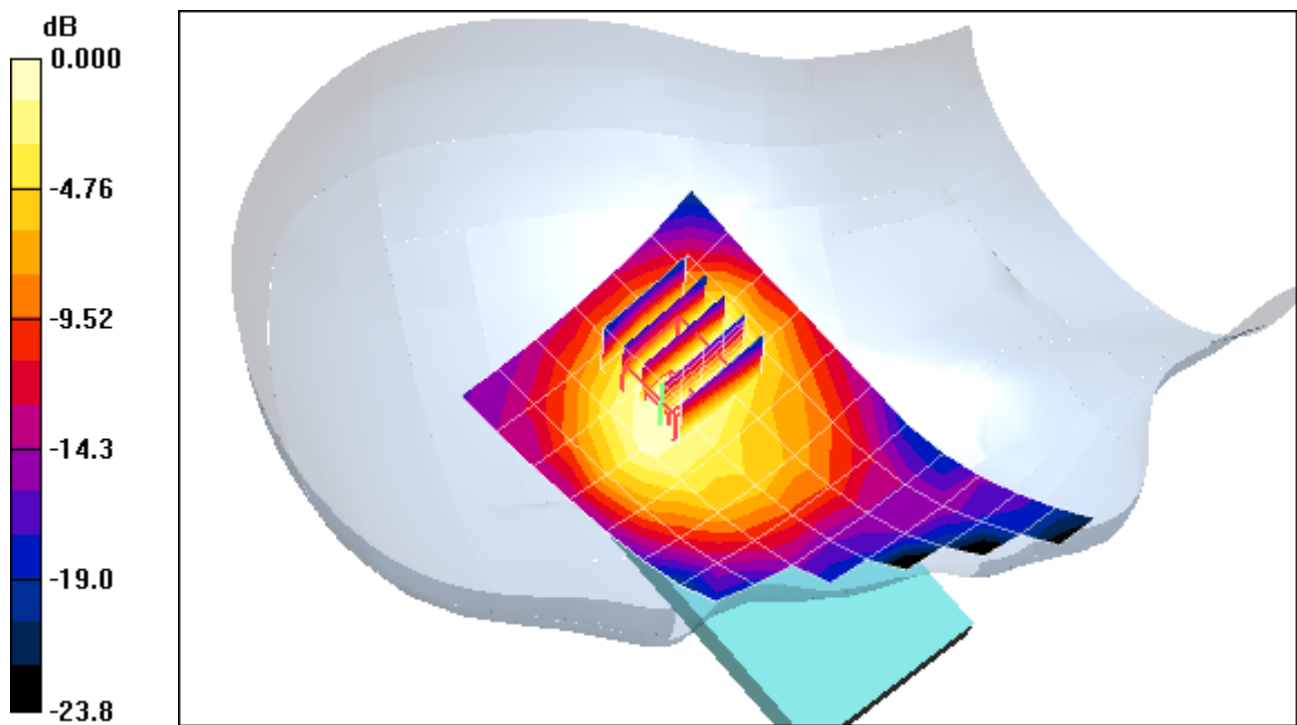
**Area Scan (7x14x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 9.32 V/m; Power Drift = 0.105 dB

Peak SAR (extrapolated) = 0.277 W/kg

**SAR(1 g) = 0.155 mW/g; SAR(10 g) = 0.087 mW/g**



0 dB = 0.187mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$ ;  $\sigma = 1.84 \text{ mho/m}$ ;  $\epsilon_r = 39.15$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-14-2012; Ambient Temp: 24.5°C; Tissue Temp: 24.1°C

Probe: ES3DV2 - SN3022; ConvF(4.3, 4.3, 4.3); Calibrated: 8/25/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

**Mode: IEEE 802.11b, Left Head, Touch, Ch 06, 1 Mbps**

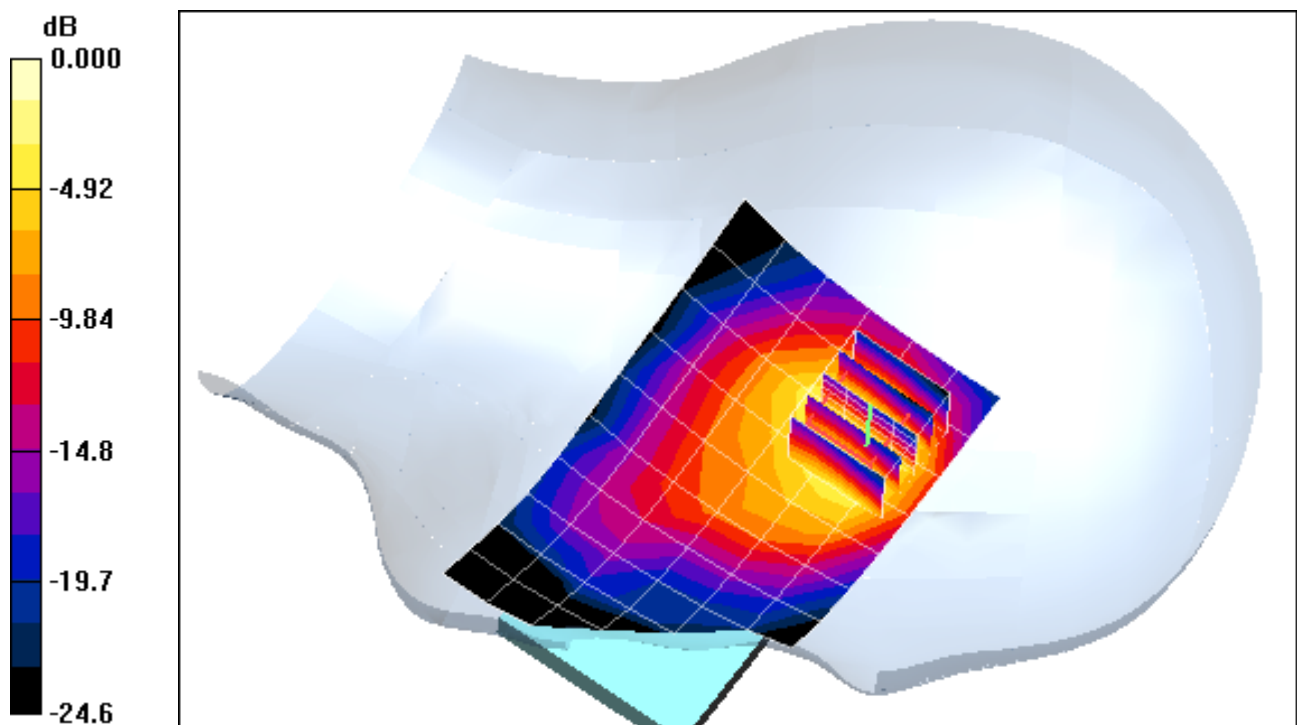
**Area Scan (7x11x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 16.5 V/m; Power Drift = -0.031 dB

Peak SAR (extrapolated) = 1.07 W/kg

**SAR(1 g) = 0.480 mW/g; SAR(10 g) = 0.227 mW/g**



0 dB = 0.582mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$ ;  $\sigma = 1.84 \text{ mho/m}$ ;  $\epsilon_r = 39.15$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-14-2012; Ambient Temp: 24.5°C; Tissue Temp: 24.1°C

Probe: ES3DV2 - SN3022; ConvF(4.3, 4.3, 4.3); Calibrated: 8/25/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

**Mode: IEEE 802.11b, Left Head, Tilt, Ch 06, 1 Mbps**

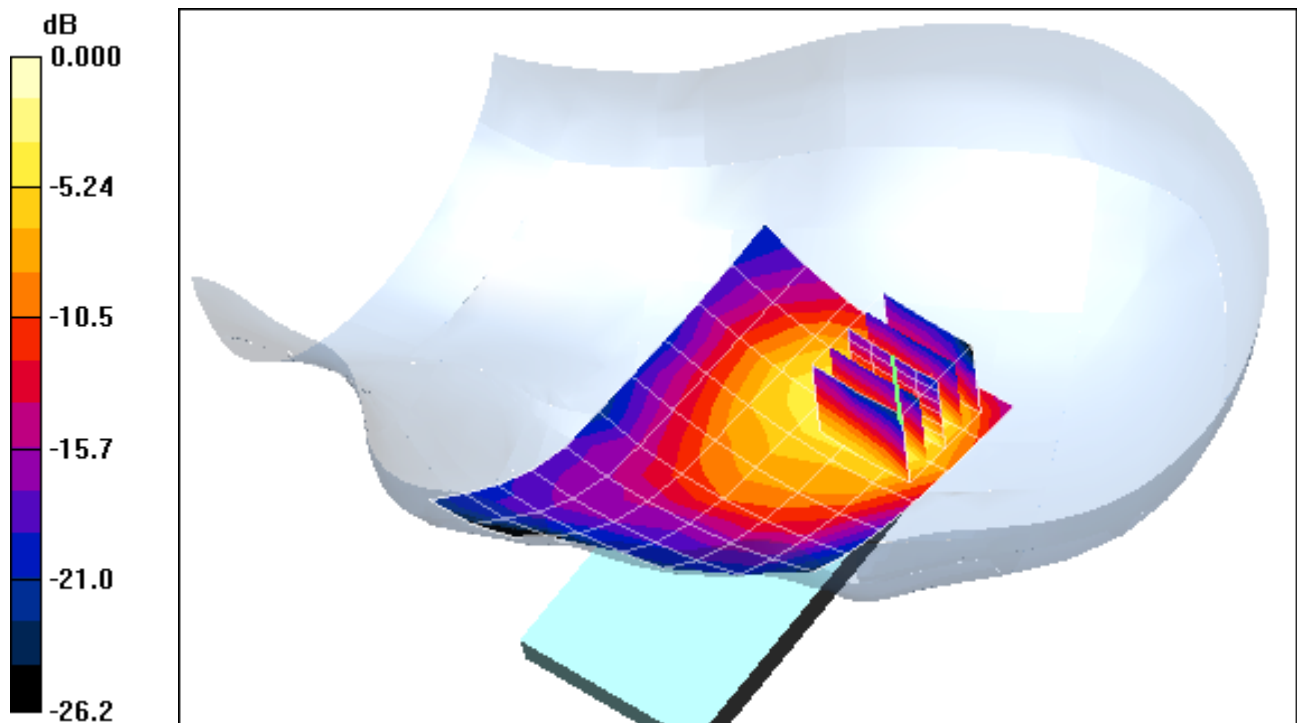
**Area Scan (7x11x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 10.8 V/m; Power Drift = 0.000 dB

Peak SAR (extrapolated) = 0.587 W/kg

**SAR(1 g) = 0.272 mW/g; SAR(10 g) = 0.129 mW/g**



0 dB = 0.365mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 835 Body Medium parameters used (interpolated):

$f = 848.31 \text{ MHz}$ ;  $\sigma = 1.01 \text{ mho/m}$ ;  $\epsilon_r = 53.04$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-09-2012; Ambient Temp: 24.0°C; Tissue Temp: 22.3°C

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

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

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

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

**Mode: Cellular EVDO, Body SAR, Back side, High.ch.**

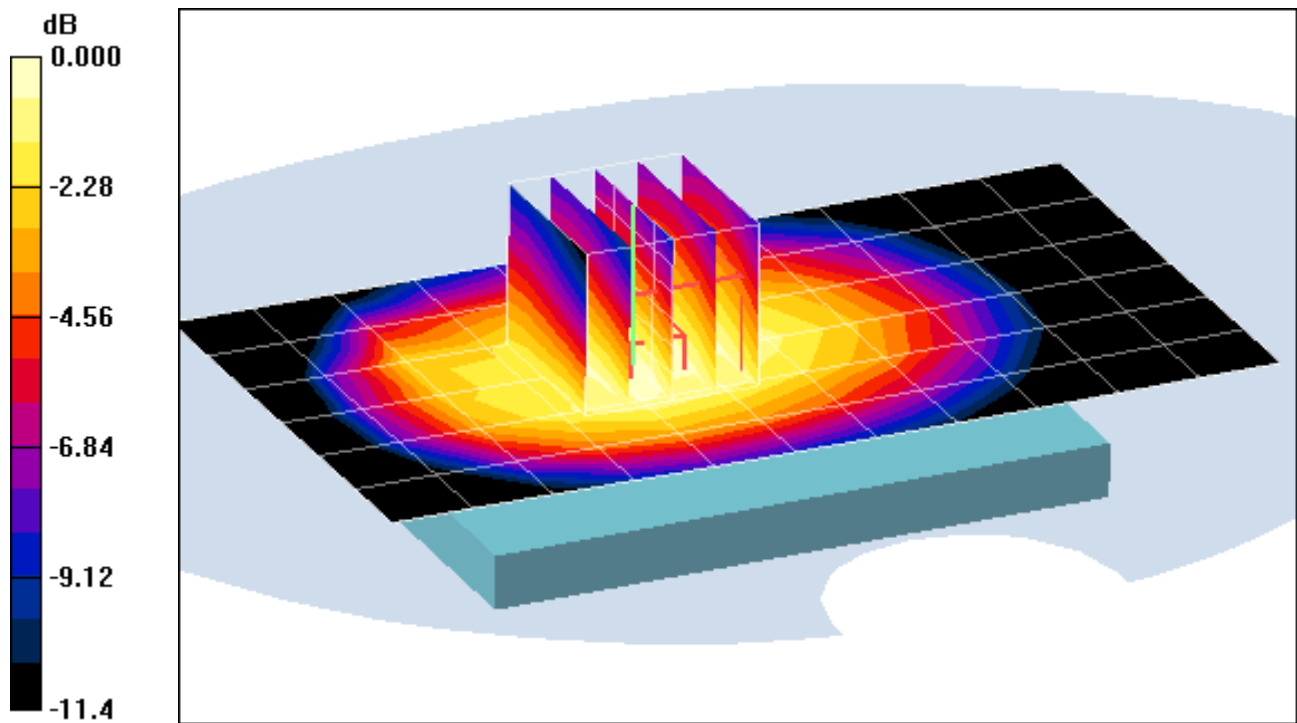
**Area Scan (7x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 39.2 V/m; Power Drift = -0.082 dB

Peak SAR (extrapolated) = 1.63 W/kg

**SAR(1 g) = 1.27 mW/g; SAR(10 g) = 0.935 mW/g**



0 dB = 1.34mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 835 Body Medium parameters used (interpolated):

$f = 848.31 \text{ MHz}$ ;  $\sigma = 1.01 \text{ mho/m}$ ;  $\epsilon_r = 53.04$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-09-2012; Ambient Temp: 24.0°C; Tissue Temp: 22.3°C

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

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

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

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

**Mode: Cellular EVDO, Body SAR, Front side, High.ch.**

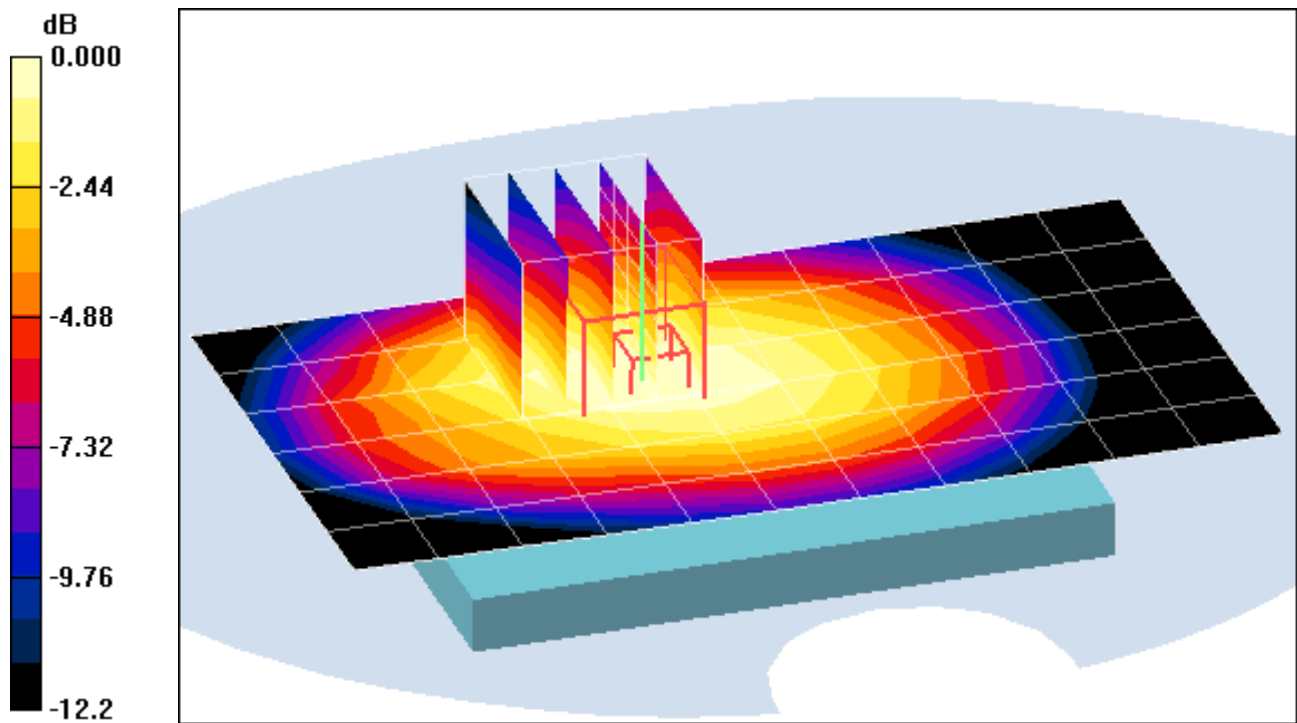
**Area Scan (7x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 31.5 V/m; Power Drift = 0.007 dB

Peak SAR (extrapolated) = 1.11 W/kg

**SAR(1 g) = 0.875 mW/g; SAR(10 g) = 0.641 mW/g**



0 dB = 0.914mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.998 \text{ mho/m}$ ;  $\epsilon_r = 53.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-09-2012; Ambient Temp: 24.0°C; Tissue Temp: 22.3°C

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

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

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

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

**Mode: Cellular EVDO, Body SAR, Bottom Edge, Mid.ch.**

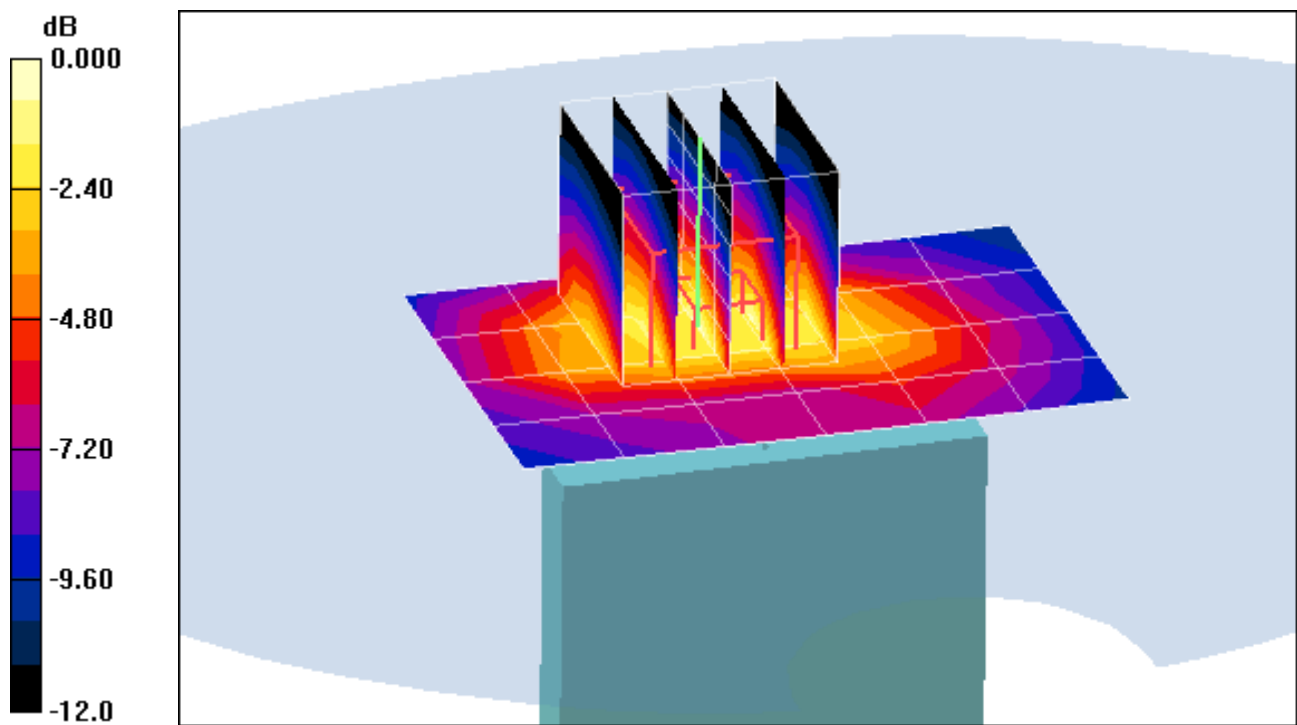
**Area Scan (5x7x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 13.6 V/m; Power Drift = -0.070 dB

Peak SAR (extrapolated) = 0.357 W/kg

**SAR(1 g) = 0.197 mW/g; SAR(10 g) = 0.108 mW/g**



0 dB = 0.222mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 835 Body Medium parameters used (interpolated):

$f = 848.31 \text{ MHz}$ ;  $\sigma = 1.01 \text{ mho/m}$ ;  $\epsilon_r = 53.04$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-09-2012; Ambient Temp: 24.0°C; Tissue Temp: 22.3°C

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

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

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

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

**Mode: Cellular EVDO, Body SAR, Right Edge, High.ch.**

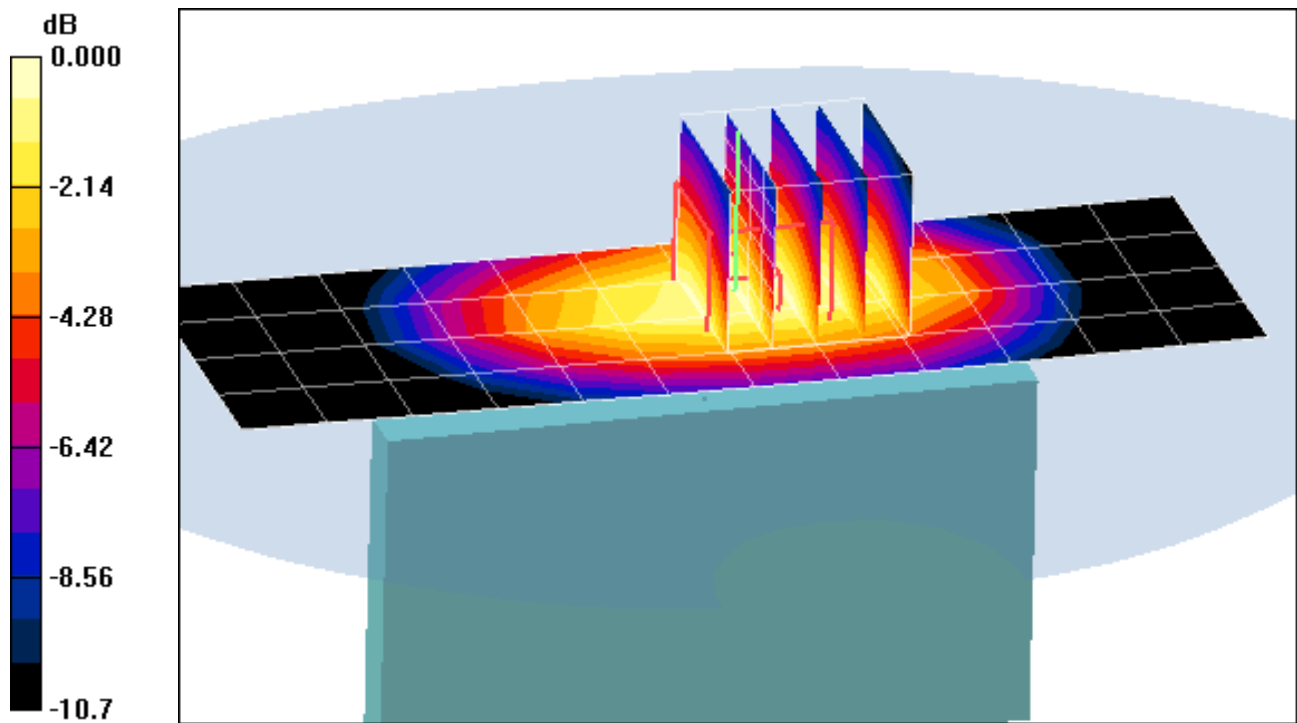
**Area Scan (5x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 31.7 V/m; Power Drift = 0.176 dB

Peak SAR (extrapolated) = 1.24 W/kg

**SAR(1 g) = 0.900 mW/g; SAR(10 g) = 0.628 mW/g**



0 dB = 0.947mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.998 \text{ mho/m}$ ;  $\epsilon_r = 53.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-09-2012; Ambient Temp: 24.0°C; Tissue Temp: 22.3°C

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

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

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

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

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

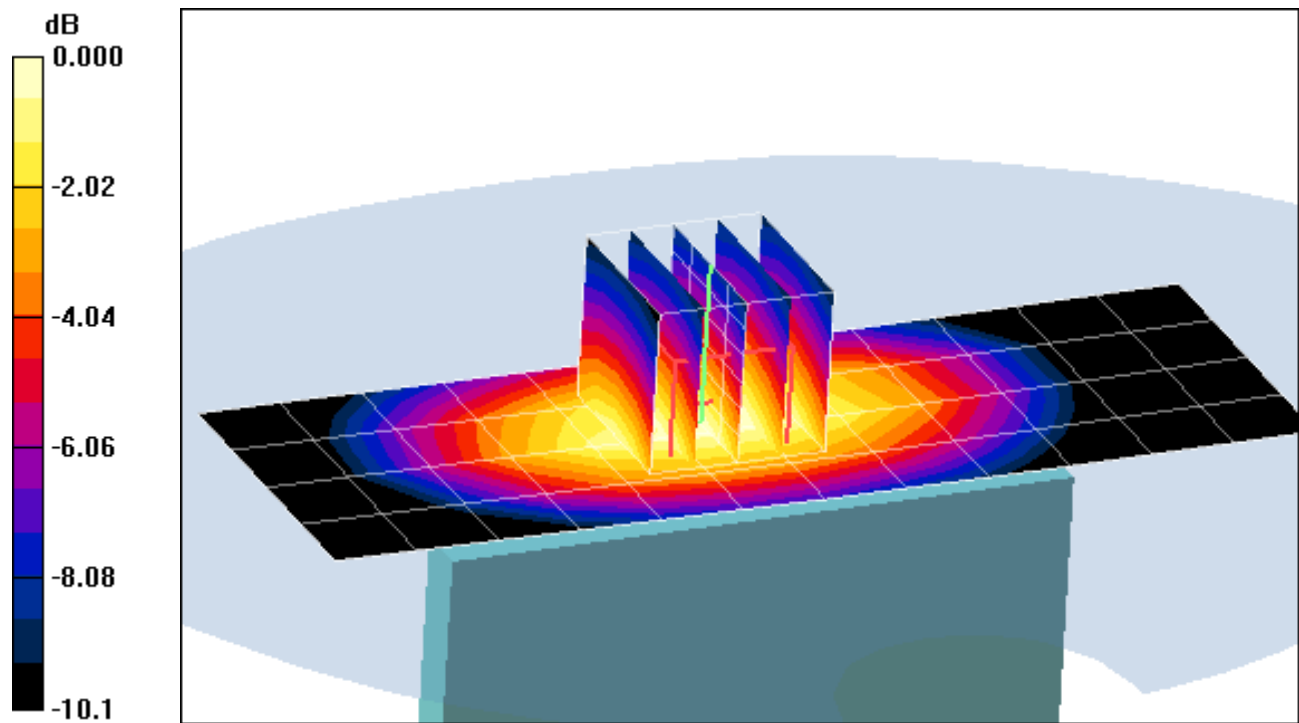
**Area Scan (5x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 26.5 V/m; Power Drift = 0.101 dB

Peak SAR (extrapolated) = 0.850 W/kg

**SAR(1 g) = 0.607 mW/g; SAR(10 g) = 0.415 mW/g**



0 dB = 0.652mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Body Medium parameters used:

$f = 1908.75 \text{ MHz}$ ;  $\sigma = 1.59 \text{ mho/m}$ ;  $\epsilon_r = 51.04$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-12-2012; Ambient Temp: 23.4°C; Tissue Temp: 22.3°C

Probe: ES3DV2 - SN3022; ConvF(4.41, 4.41, 4.41); Calibrated: 8/25/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

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

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

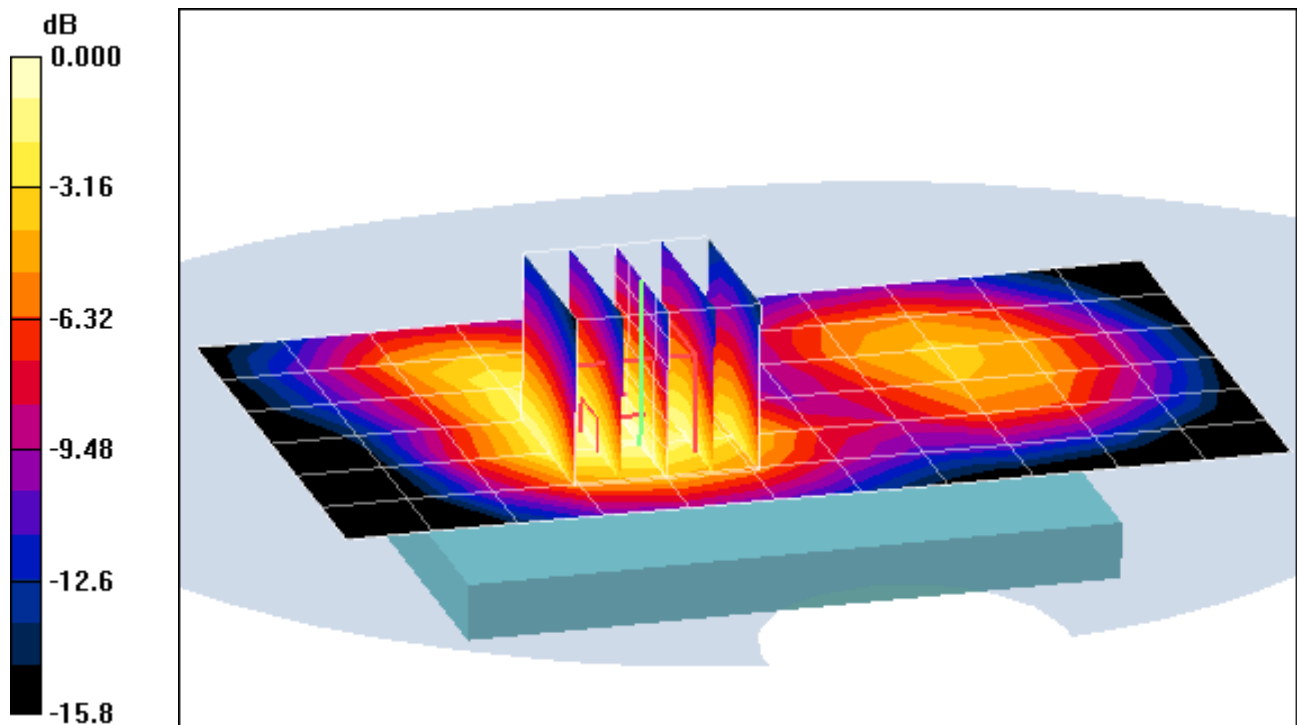
**Area Scan (7x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 27.4 V/m; Power Drift = -0.134 dB

Peak SAR (extrapolated) = 1.43 W/kg

**SAR(1 g) = 0.943 mW/g; SAR(10 g) = 0.593 mW/g**



0 dB = 1.00mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.56 \text{ mho/m}$ ;  $\epsilon_r = 51.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-12-2012; Ambient Temp: 23.4°C; Tissue Temp: 22.3°C

Probe: ES3DV2 - SN3022; ConvF(4.41, 4.41, 4.41); Calibrated: 8/25/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

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

**Mode: PCS EVDO, Body SAR, Front side, Mid.ch.**

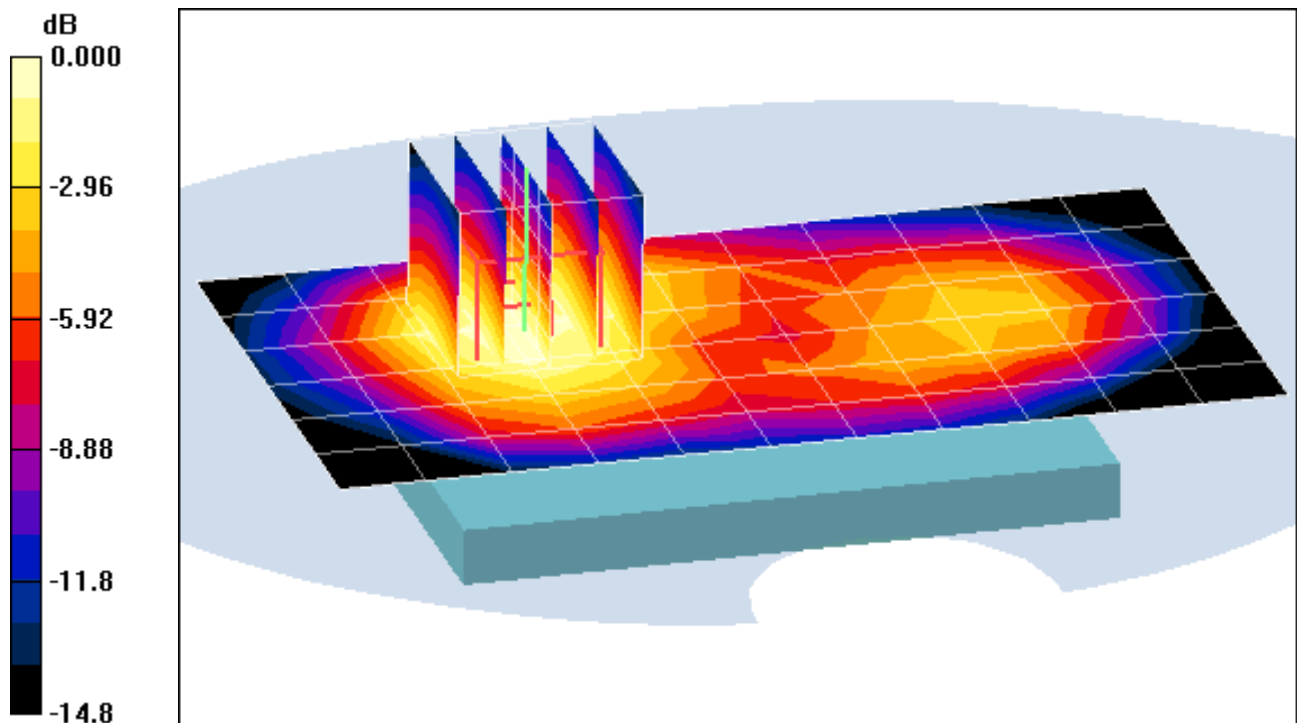
**Area Scan (7x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 22.9 V/m; Power Drift = 0.032 dB

Peak SAR (extrapolated) = 1.02 W/kg

**SAR(1 g) = 0.656 mW/g; SAR(10 g) = 0.412 mW/g**



0 dB = 0.696mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.56 \text{ mho/m}$ ;  $\epsilon_r = 51.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-12-2012; Ambient Temp: 23.4°C; Tissue Temp: 22.3°C

Probe: ES3DV2 - SN3022; ConvF(4.41, 4.41, 4.41); Calibrated: 8/25/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

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

**Mode: PCS EVDO, Body SAR, Bottom Edge, Mid.ch.**

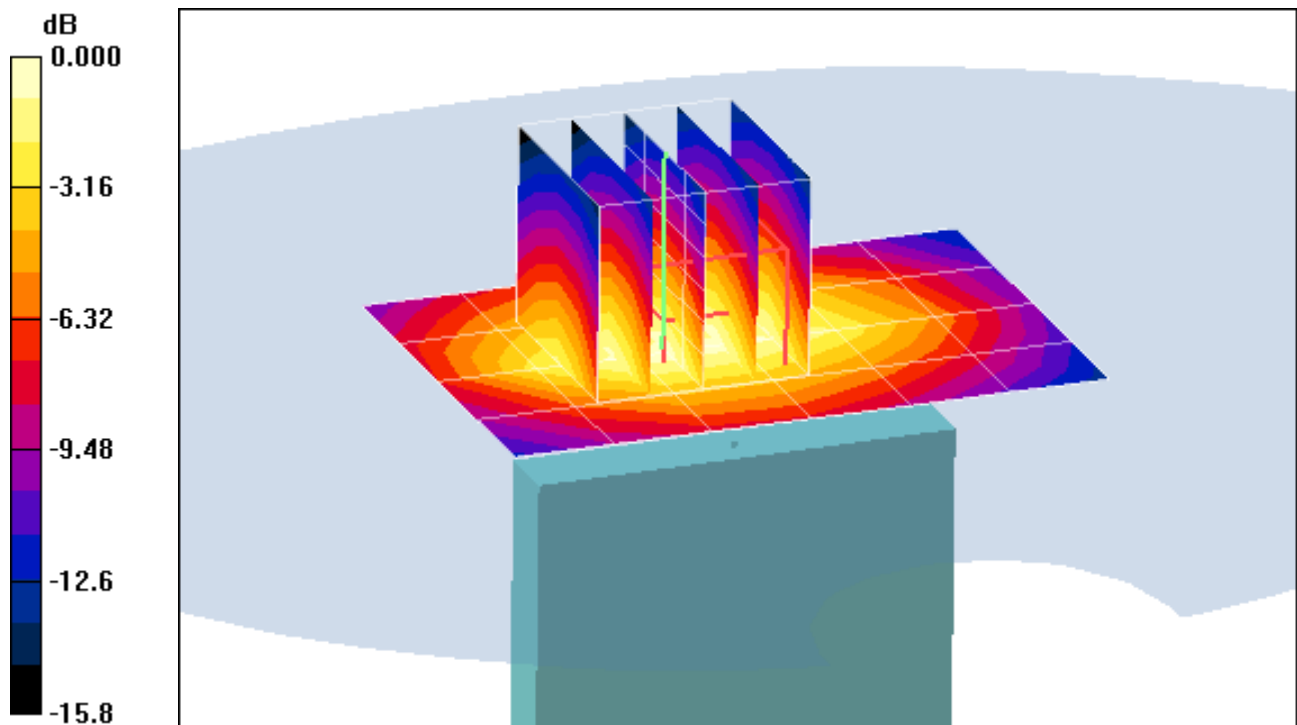
**Area Scan (5x7x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 22.7 V/m; Power Drift = 0.010 dB

Peak SAR (extrapolated) = 1.07 W/kg

**SAR(1 g) = 0.666 mW/g; SAR(10 g) = 0.389 mW/g**



0 dB = 0.738mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.56 \text{ mho/m}$ ;  $\epsilon_r = 51.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-12-2012; Ambient Temp: 23.4°C; Tissue Temp: 22.3°C

Probe: ES3DV2 - SN3022; ConvF(4.41, 4.41, 4.41); Calibrated: 8/25/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

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

**Mode: PCS EVDO, Body SAR, Right Edge, Mid.ch.**

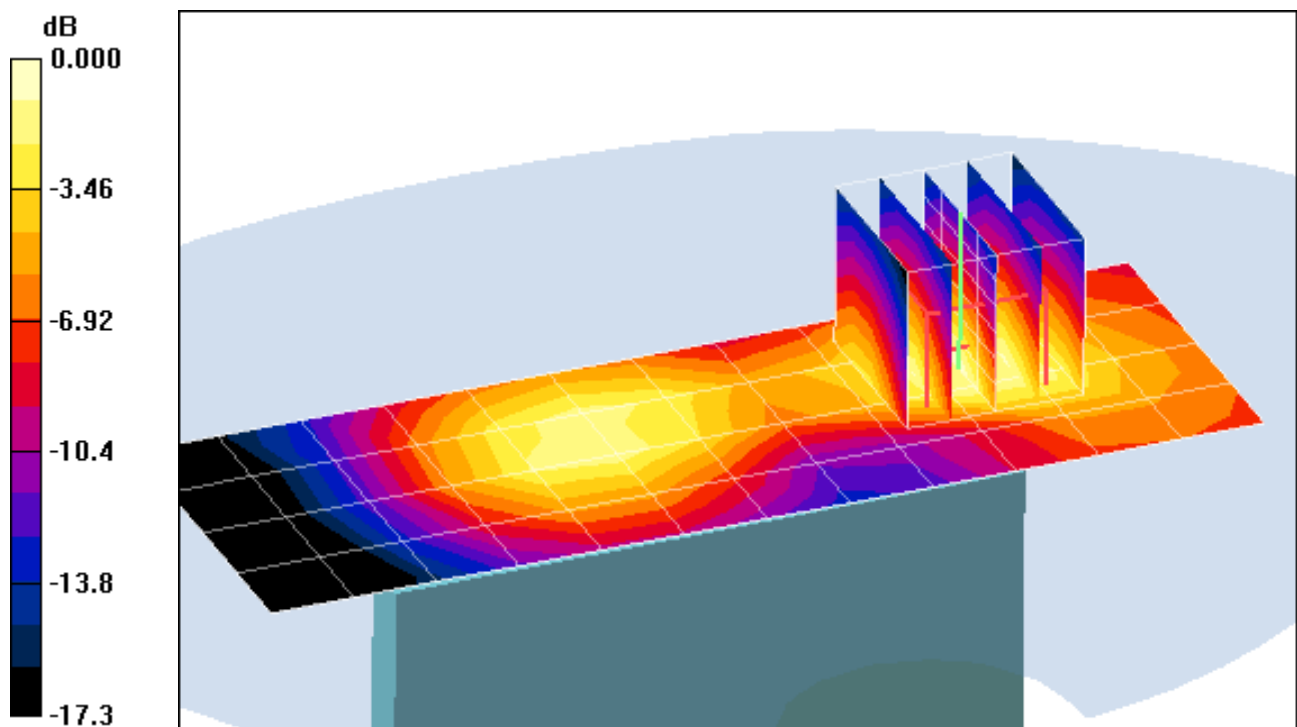
**Area Scan (5x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 11.7 V/m; Power Drift = -0.156 dB

Peak SAR (extrapolated) = 0.394 W/kg

**SAR(1 g) = 0.230 mW/g; SAR(10 g) = 0.123 mW/g**



0 dB = 0.259mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.56 \text{ mho/m}$ ;  $\epsilon_r = 51.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-12-2012; Ambient Temp: 23.4°C; Tissue Temp: 22.3°C

Probe: ES3DV2 - SN3022; ConvF(4.41, 4.41, 4.41); Calibrated: 8/25/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

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

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

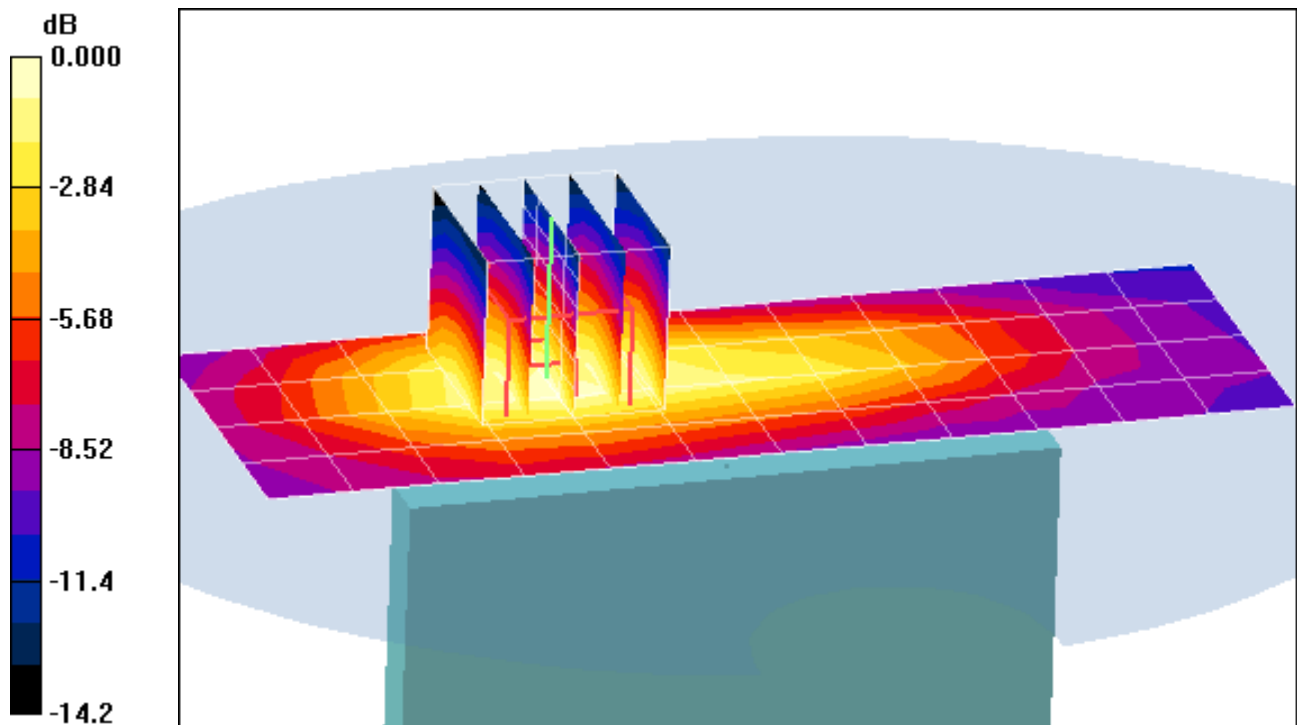
**Area Scan (5x13x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 12.0 V/m; Power Drift = 0.173 dB

Peak SAR (extrapolated) = 0.305 W/kg

**SAR(1 g) = 0.195 mW/g; SAR(10 g) = 0.118 mW/g**



0 dB = 0.212mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$ ;  $\sigma = 1.99 \text{ mho/m}$ ;  $\epsilon_r = 50.3$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.8°C

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

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

**Mode: IEEE 802.11b, Body SAR, Ch 06, 1 Mbps, Back Side**

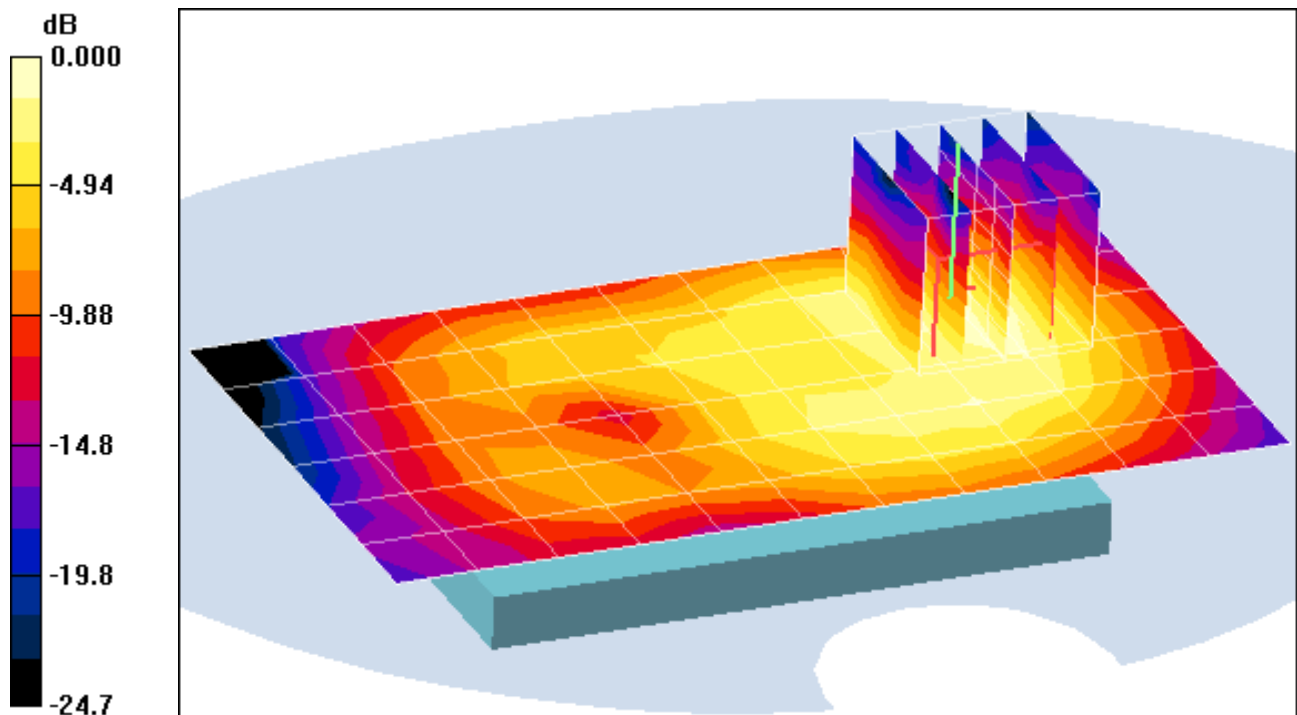
**Area Scan (7x12x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 7.54 V/m; Power Drift = 0.019 dB

Peak SAR (extrapolated) = 0.224 W/kg

**SAR(1 g) = 0.107 mW/g; SAR(10 g) = 0.054 mW/g**



0 dB = 0.133mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$ ;  $\sigma = 1.99 \text{ mho/m}$ ;  $\epsilon_r = 50.3$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.8°C

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

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

**Mode: IEEE 802.11b, Body SAR, Ch 06, 1 Mbps, Front Side**

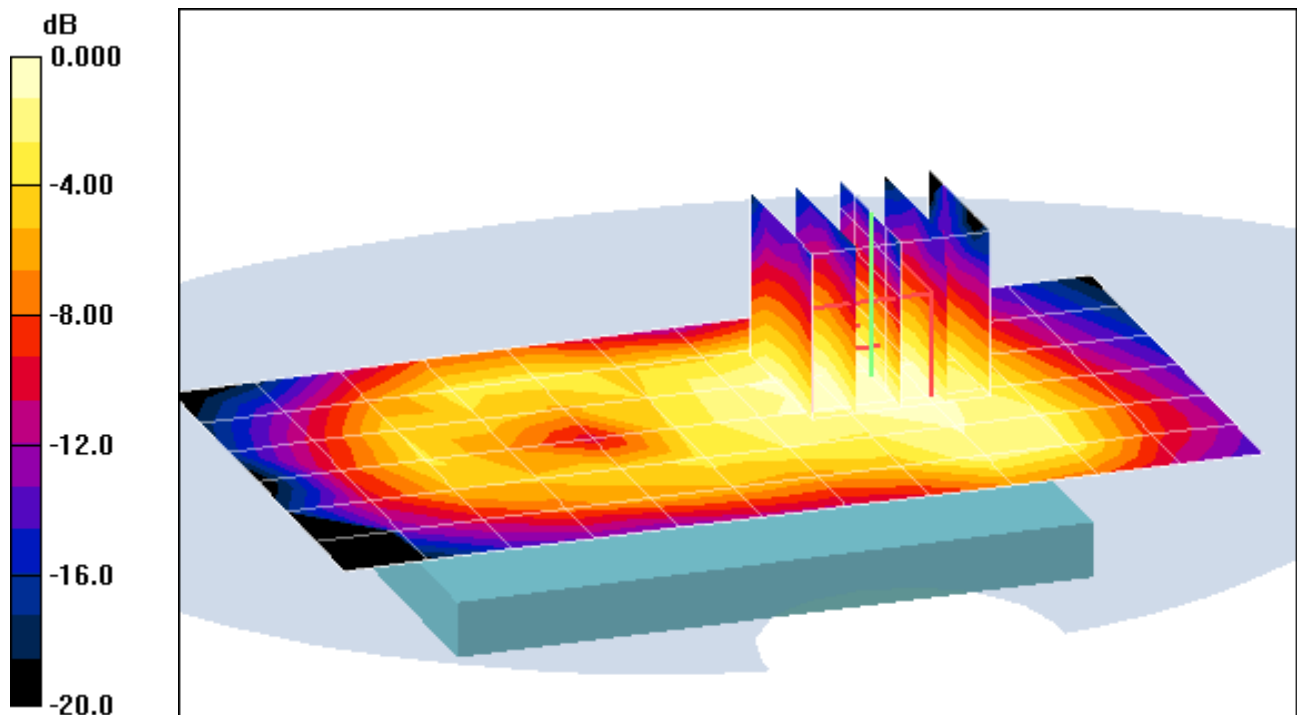
**Area Scan (7x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 6.10 V/m; Power Drift = 0.010 dB

Peak SAR (extrapolated) = 0.124 W/kg

**SAR(1 g) = 0.070 mW/g; SAR(10 g) = 0.041 mW/g**



0 dB = 0.085mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$ ;  $\sigma = 1.99 \text{ mho/m}$ ;  $\epsilon_r = 50.3$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.8°C

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

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

**Mode: IEEE 802.11b, Body SAR, Ch 06, 1 Mbps, Top Edge**

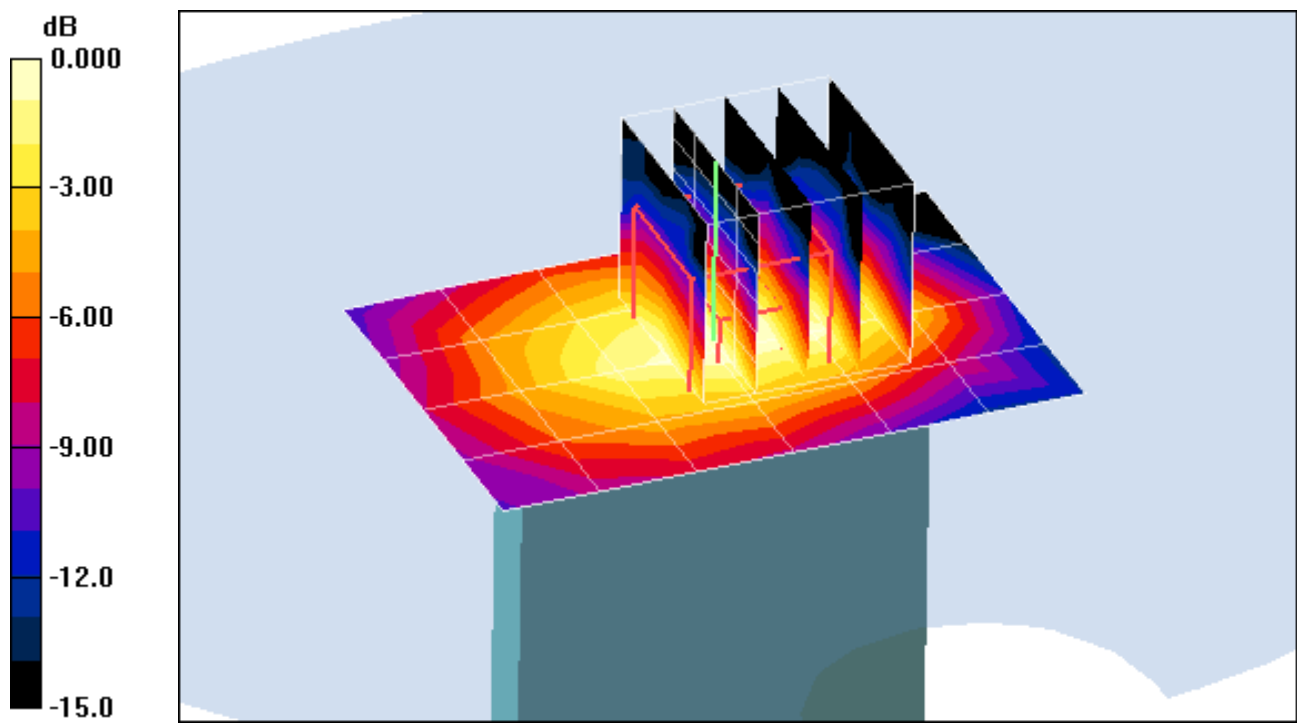
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 5.41 V/m; Power Drift = -0.034 dB

Peak SAR (extrapolated) = 0.100 W/kg

**SAR(1 g) = 0.054 mW/g; SAR(10 g) = 0.029 mW/g**



0 dB = 0.066mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFAS695; Type: Portable Handset; Serial: SAR#1**

Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$ ;  $\sigma = 1.99 \text{ mho/m}$ ;  $\epsilon_r = 50.3$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.8°C

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

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

**Mode: IEEE 802.11b, Body SAR, Ch 06, 1 Mbps, Right Edge**

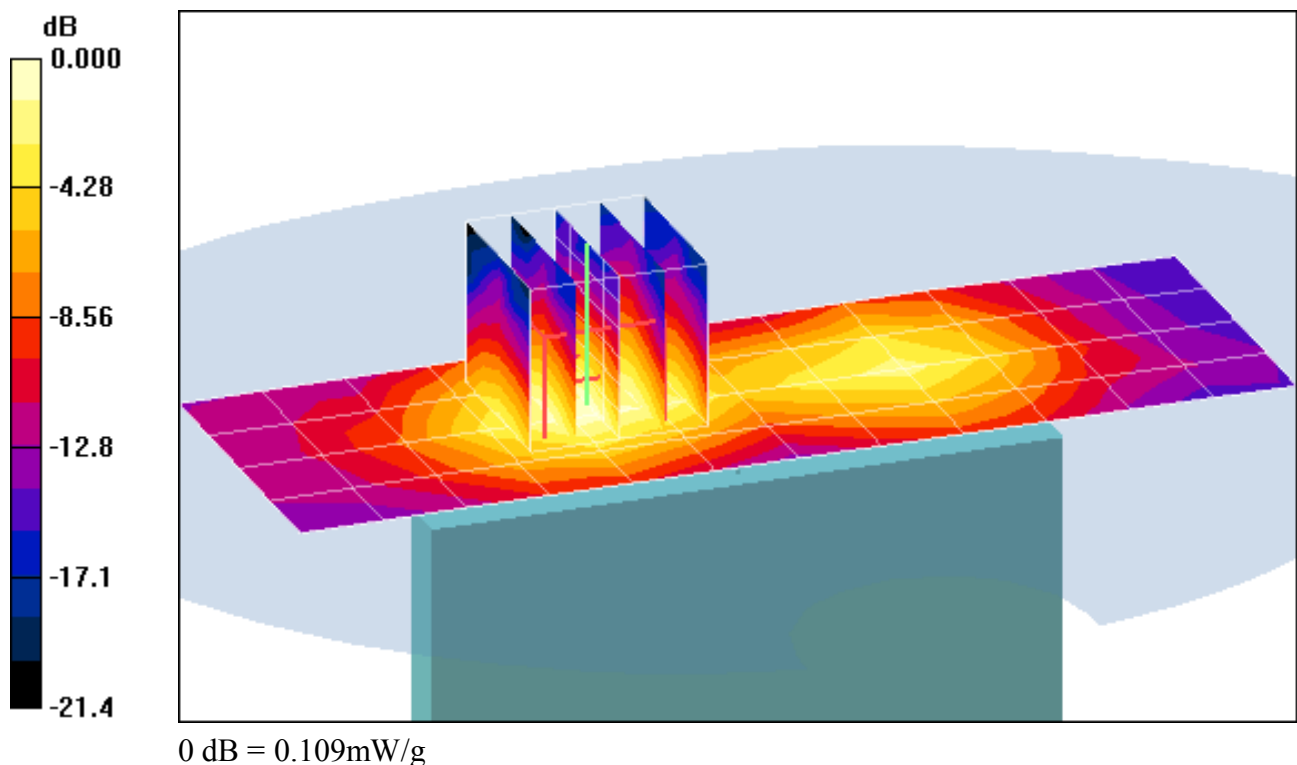
**Area Scan (5x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 6.85 V/m; Power Drift = 0.002 dB

Peak SAR (extrapolated) = 0.172 W/kg

**SAR(1 g) = 0.087 mW/g; SAR(10 g) = 0.044 mW/g**



## APPENDIX B: SYSTEM VERIFICATION

# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 835 Head Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 0.911 \text{ mho/m}$ ;  $\epsilon_r = 39.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-09-2011; Ambient Temp: 24.6 °C; Tissue Temp: 22.4 °C

Probe: ES3DV3 - SN3258; ConvF(6.01, 6.01, 6.01); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1403

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

## 835MHz System Verification

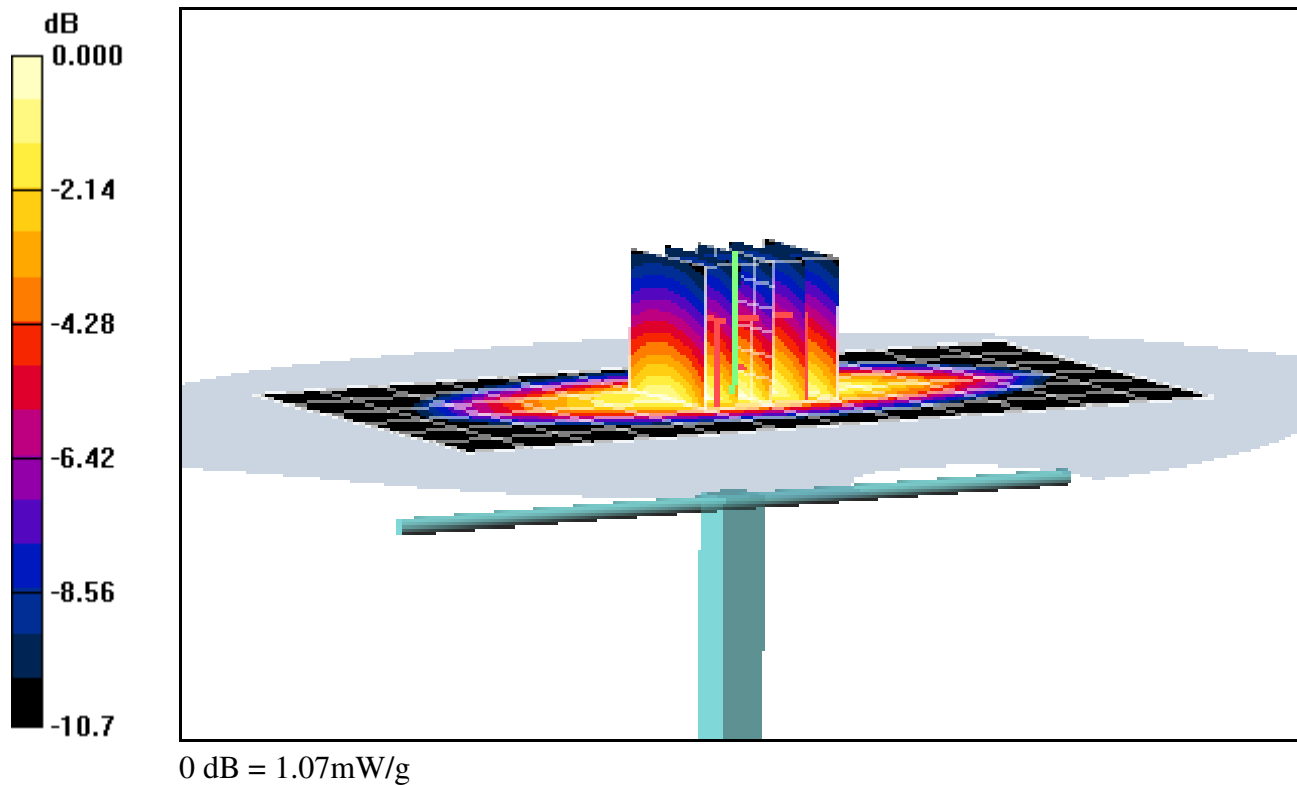
**Area Scan (7x13x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 0.989 mW/g; SAR(10 g) = 0.645 mW/g**

Deviation = 4.55 %



# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 835 Head Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 0.911 \text{ mho/m}$ ;  $\epsilon_r = 39.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-09-2011; Ambient Temp: 24.6 °C; Tissue Temp: 22.4 °C

Probe: ES3DV3 - SN3258; ConvF(6.01, 6.01, 6.01); Calibrated: 2/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1403

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

## 835MHz System Verification

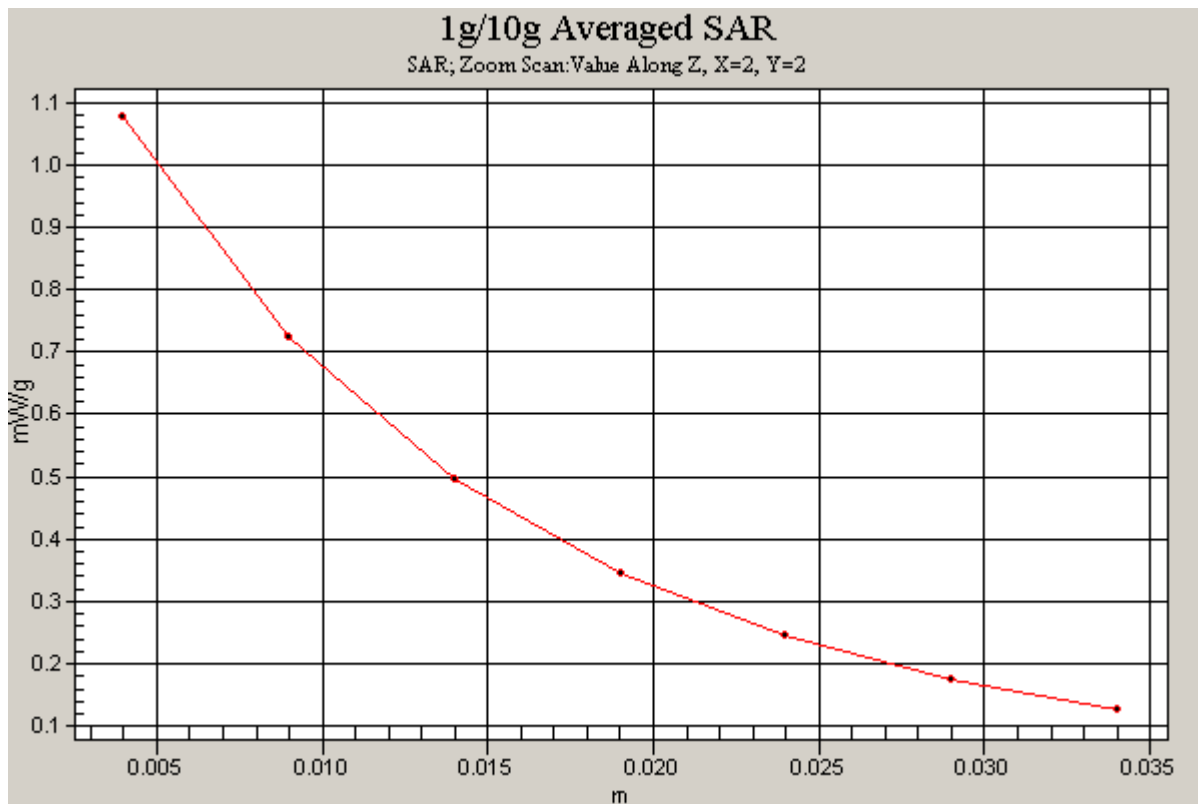
**Area Scan (7x13x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 0.989 mW/g; SAR(10 g) = 0.645 mW/g**

Deviation = 4.55 %



# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.43 \text{ mho/m}$ ;  $\epsilon_r = 38.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-12-2012; Ambient Temp: 23.8°C; Tissue Temp: 22.4°C

Probe: ES3DV2 - SN3022; ConvF(4.98, 4.98, 4.98); Calibrated: 8/25/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

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

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

## 1900MHz System Verification

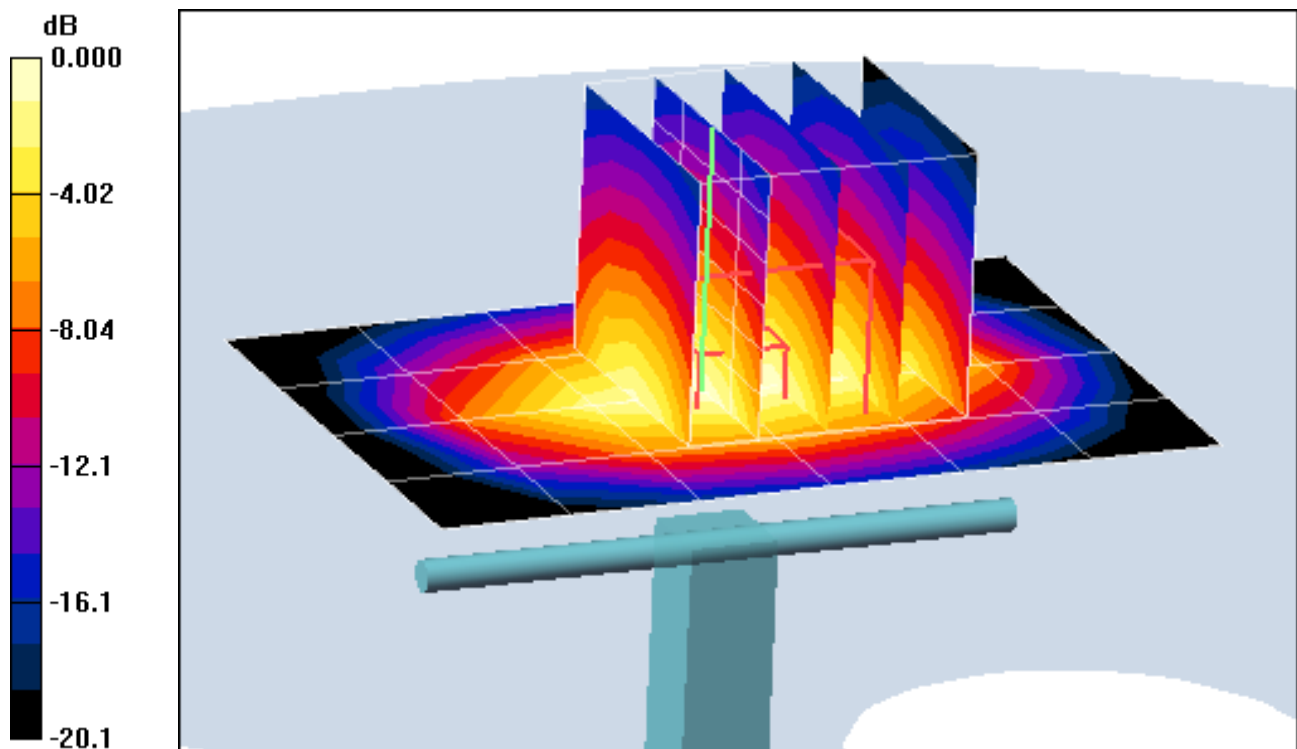
**Area Scan (5x7x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Input Power = 16.0 dBm (40 mW)

**SAR(1 g) = 1.58 mW/g; SAR(10 g) = 0.811 mW/g**

Deviation = 0.00 %



0 dB = 1.78mW/g

# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.43 \text{ mho/m}$ ;  $\epsilon_r = 38.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-12-2012; Ambient Temp: 23.8°C; Tissue Temp: 22.4°C

Probe: ES3DV2 - SN3022; ConvF(4.98, 4.98, 4.98); Calibrated: 8/25/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

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

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

## 1900MHz System Verification

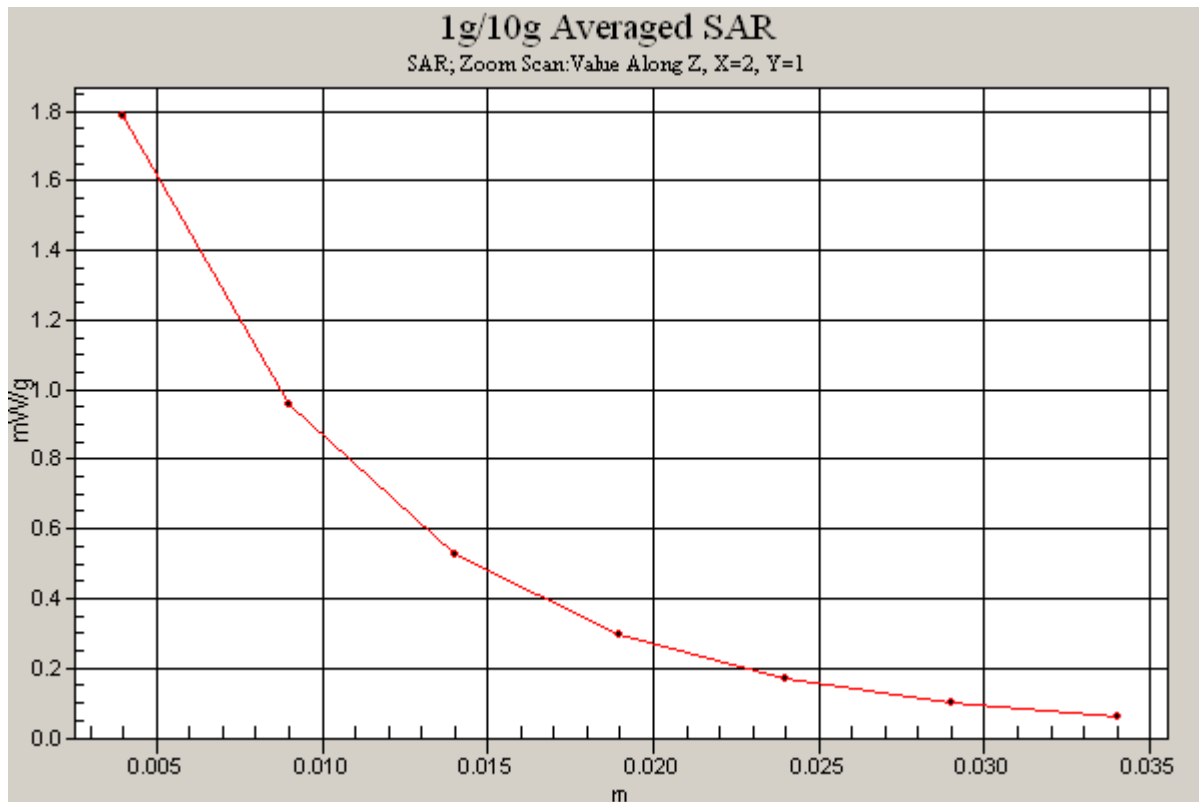
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power = 16.0 dBm (40 mW)

**SAR(1 g) = 1.58 mW/g; SAR(10 g) = 0.811 mW/g**

Deviation = 0.00 %



# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 2450 Head Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.86 \text{ mho/m}$ ;  $\epsilon_r = 39.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2012; Ambient Temp: 24.5°C; Tissue Temp: 24.1°C

Probe: ES3DV2 - SN3022; ConvF(4.3, 4.3, 4.3); Calibrated: 8/25/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

## 2450MHz System Verification

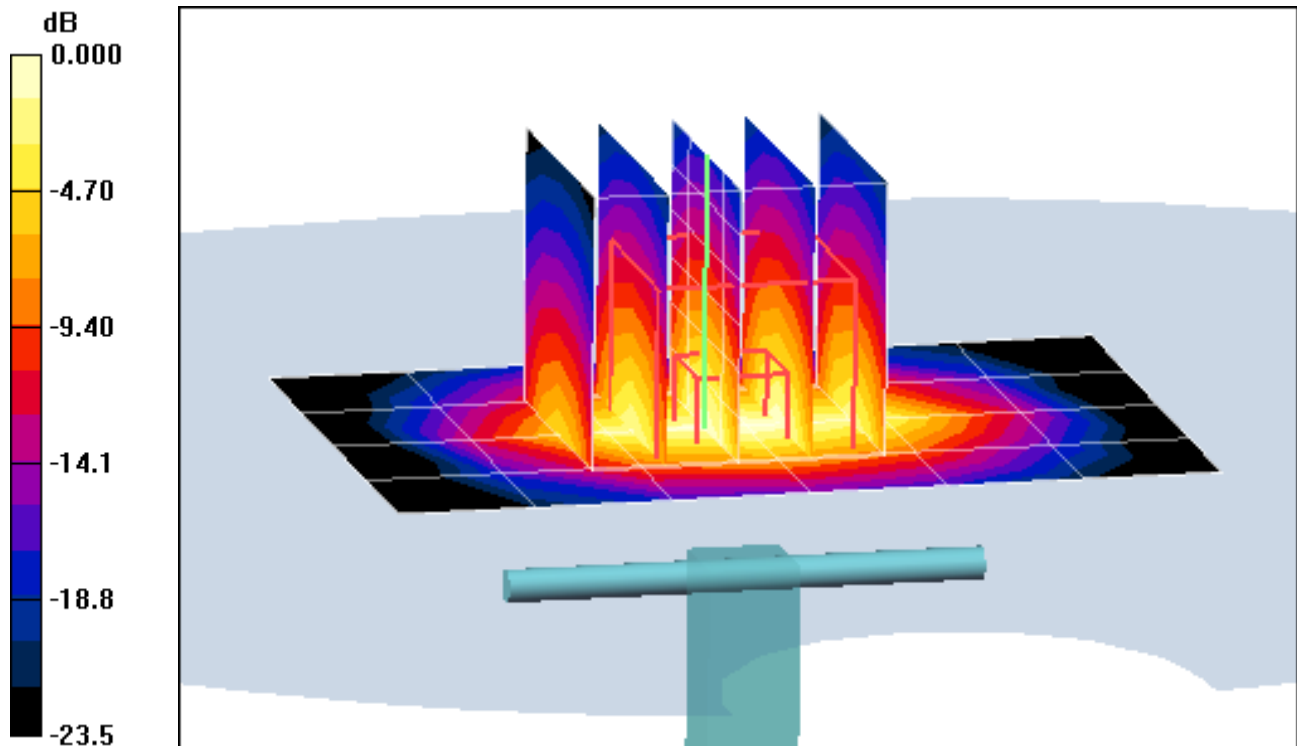
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 5.3 mW/g; SAR(10 g) = 2.46 mW/g**

Deviation = -1.49 %



0 dB = 6.85mW/g

# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 2450 Head Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.86 \text{ mho/m}$ ;  $\epsilon_r = 39.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2012; Ambient Temp: 24.5°C; Tissue Temp: 24.1°C

Probe: ES3DV2 - SN3022; ConvF(4.3, 4.3, 4.3); Calibrated: 8/25/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

## 2450MHz System Verification

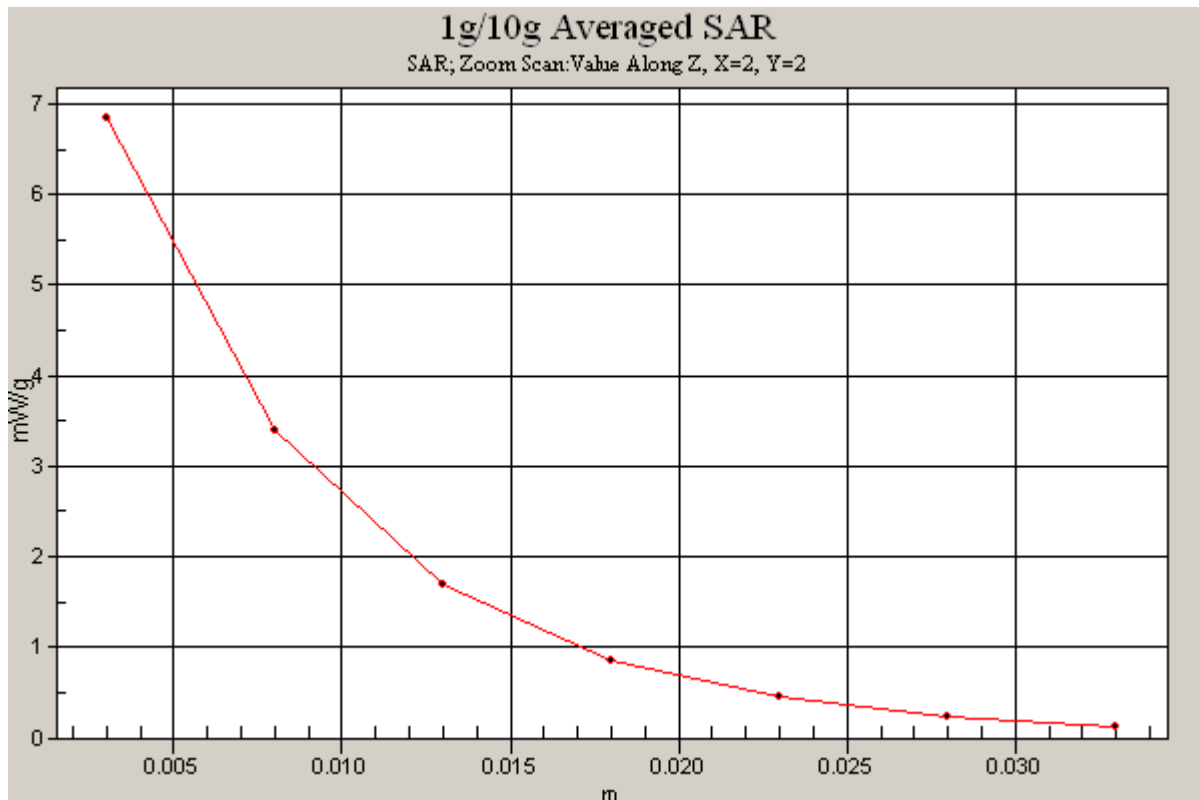
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 5.3 mW/g; SAR(10 g) = 2.46 mW/g**

Deviation = -1.49 %



# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 0.996 \text{ mho/m}$ ;  $\epsilon_r = 53.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-09-2011; Ambient Temp: 24.0 °C; Tissue Temp: 22.3 °C

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

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

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

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

## 835MHz System Verification

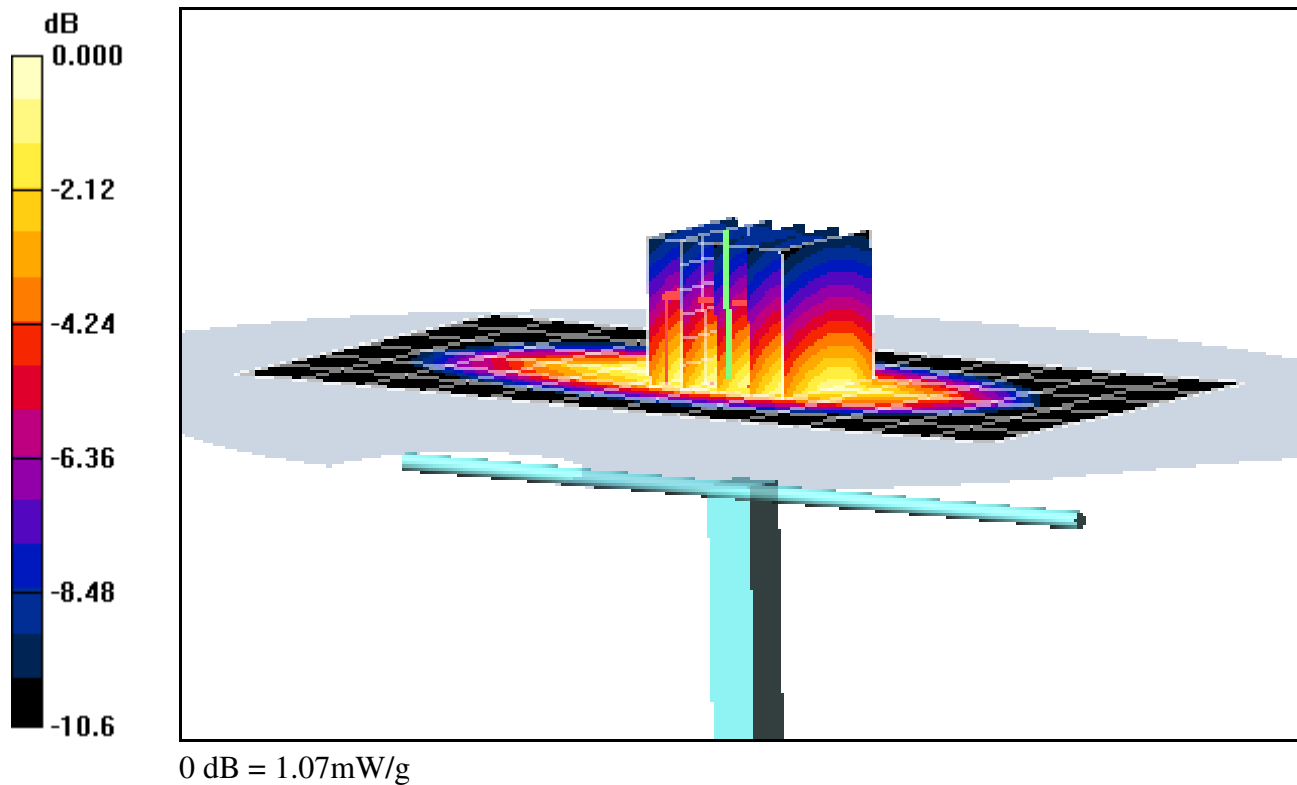
**Area Scan (7x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 0.998 mW/g; SAR(10 g) = 0.654 mW/g**

Deviation = 3.31 %



# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 0.996 \text{ mho/m}$ ;  $\epsilon_r = 53.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-09-2011; Ambient Temp: 24.0 °C; Tissue Temp: 22.3 °C

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

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

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

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

## 835MHz System Verification

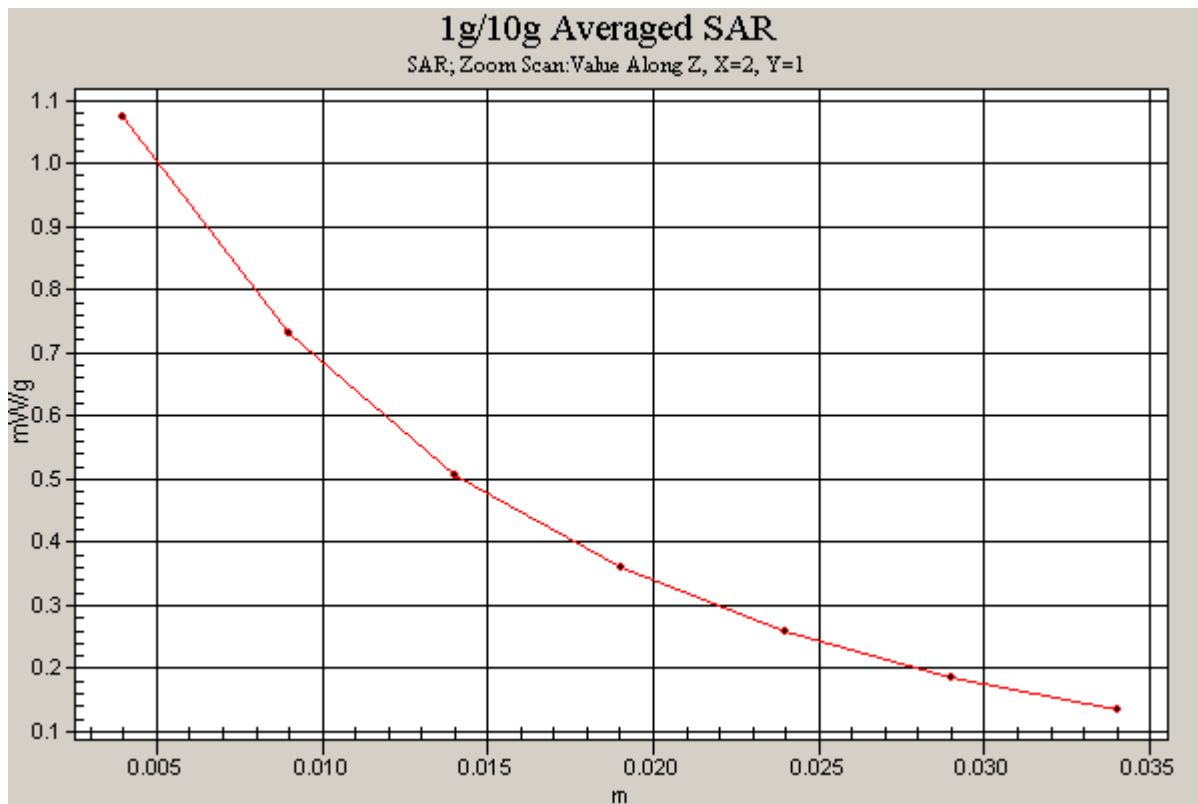
**Area Scan (7x13x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 0.998 mW/g; SAR(10 g) = 0.654 mW/g**

Deviation = 3.31 %



# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.58 \text{ mho/m}$ ;  $\epsilon_r = 51.04$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 3-12-2012; Ambient Temp: 23.4°C; Tissue Temp: 22.3°C

Probe: ES3DV2 - SN3022; ConvF(4.41, 4.41, 4.41); Calibrated: 8/25/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

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

## 1900MHz System Verification

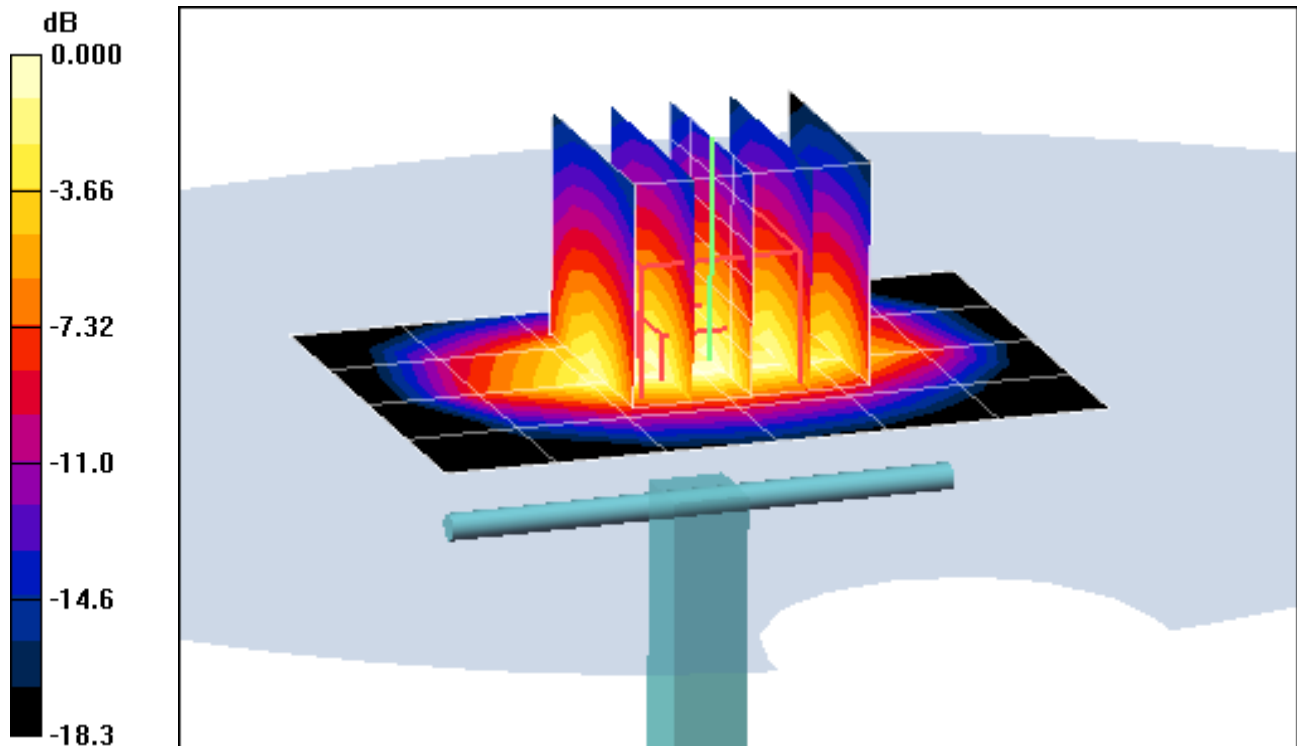
**Area Scan (5x7x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Input Power = 16 dBm (40 mW)

**SAR(1 g) = 1.65 mW/g; SAR(10 g) = 0.867 mW/g**

Deviation = -0.36 %



0 dB = 1.84mW/g

# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.58 \text{ mho/m}$ ;  $\epsilon_r = 51.04$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 3-12-2012; Ambient Temp: 23.4°C; Tissue Temp: 22.3°C

Probe: ES3DV2 - SN3022; ConvF(4.41, 4.41, 4.41); Calibrated: 8/25/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

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

## 1900MHz System Verification

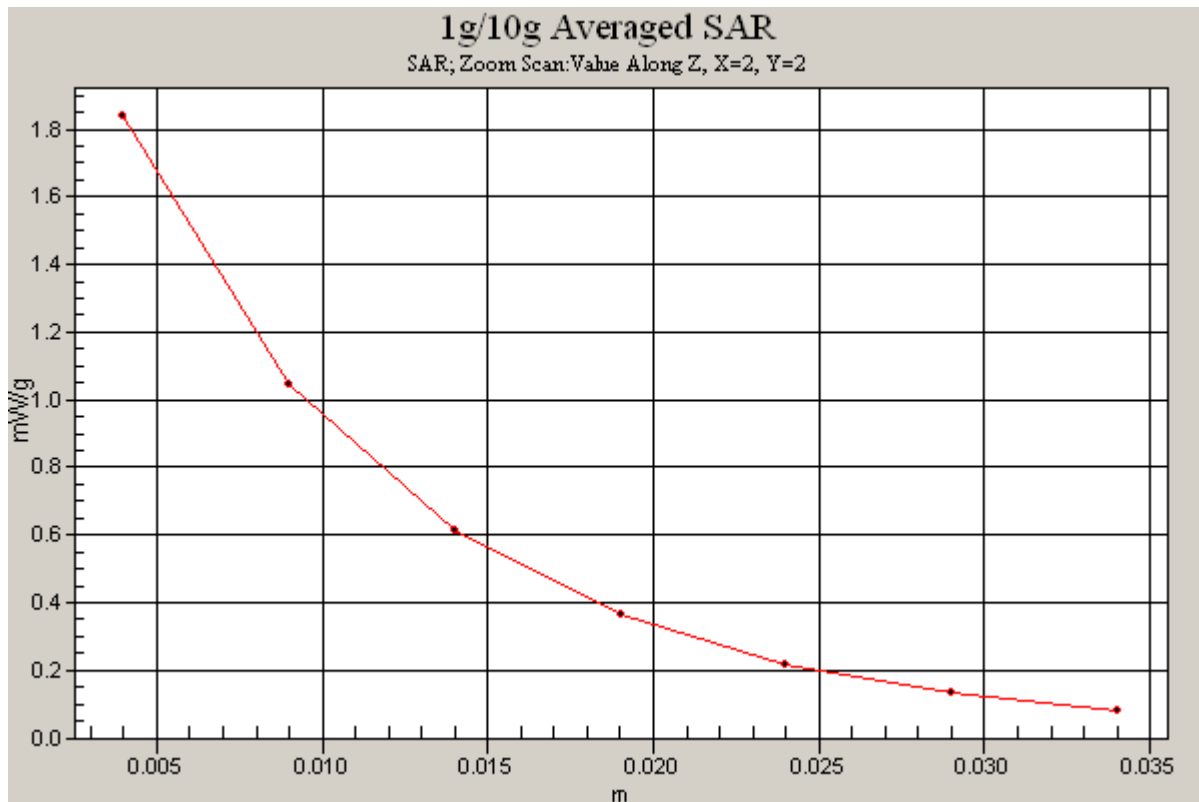
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power = 16 dBm (40 mW)

**SAR(1 g) = 1.65 mW/g; SAR(10 g) = 0.867 mW/g**

Deviation = -0.36 %



# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 2.004 \text{ mho/m}$ ;  $\epsilon_r = 50.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.8°C

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

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

## 2450MHz System Verification

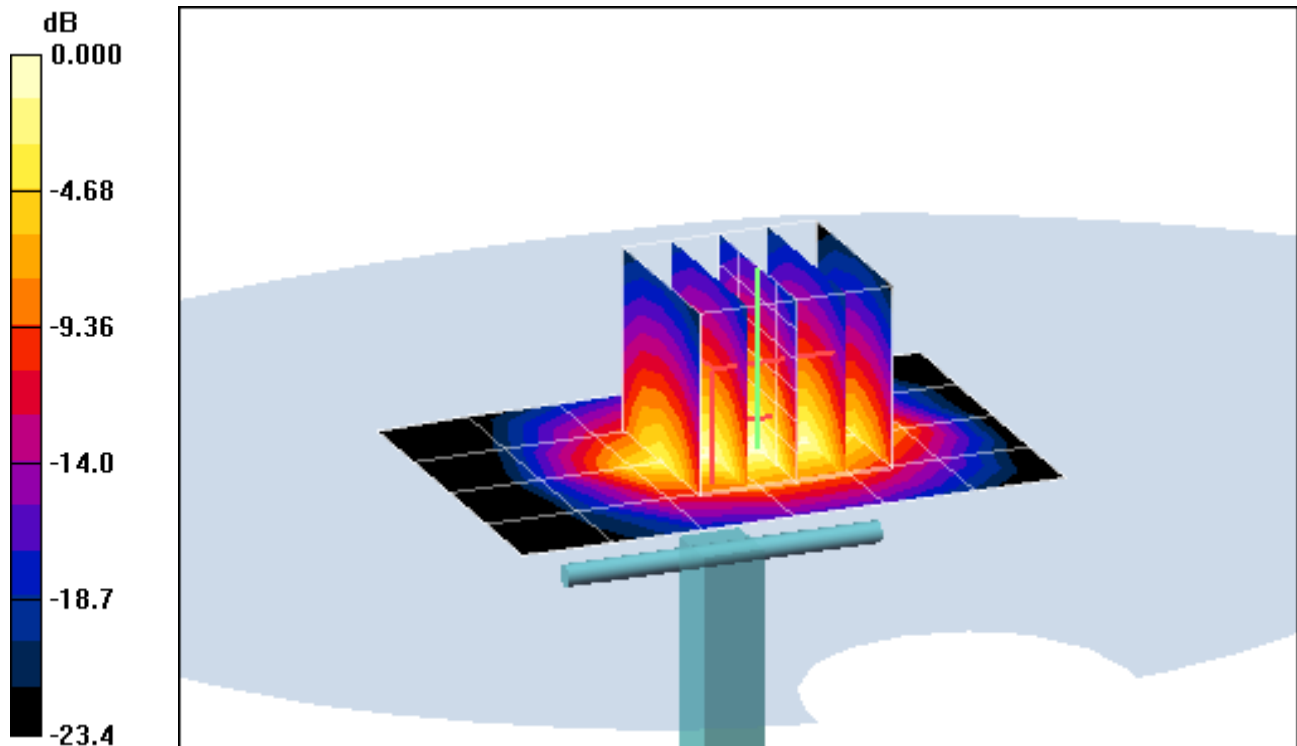
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power = 20.0 dBm (100 mw)

**SAR(1 g) = 5.31 mW/g; SAR(10 g) = 2.43 mW/g**

Deviation = 3.51 %



0 dB = 7.04mW/g

# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 2.004 \text{ mho/m}$ ;  $\epsilon_r = 50.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.8°C

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

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

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

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

## 2450MHz System Verification

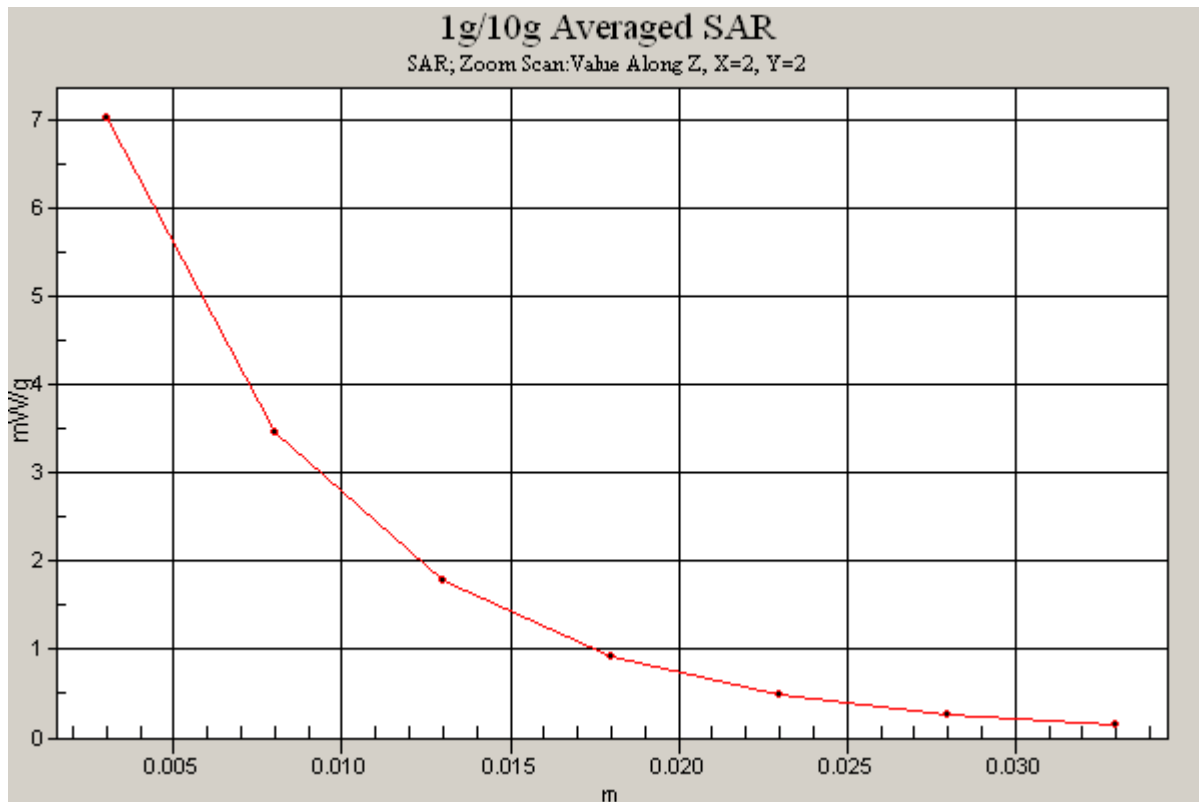
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power = 20.0 dBm (100 mw)

**SAR(1 g) = 5.31 mW/g; SAR(10 g) = 2.43 mW/g**

Deviation = 3.51 %



## 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: **D1900V2-5d141\_Jul11**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d141**

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

Calibration date: **July 11, 2011**

✓ KOK  
11/07/11

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Signature

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

Issued: July 11, 2011

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

**Glossary:**

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

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

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

**Additional Documentation:**

- d) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

## Measurement Conditions

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

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

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 40.0           | 1.40 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 39.1 $\pm$ 6 % | 1.42 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                               |
|-------------------------------------------------------|--------------------|-------------------------------|
| SAR measured                                          | 250 mW input power | 10.0 mW / g                   |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 39.5 mW /g $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                               |
|---------------------------------------------------------|--------------------|-------------------------------|
| SAR measured                                            | 250 mW input power | 5.22 mW / g                   |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 20.7 mW /g $\pm$ 16.5 % (k=2) |

## Appendix

### Antenna Parameters with Head TSL

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

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.200 ns |
|----------------------------------|----------|

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

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

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

### Additional EUT Data

|                 |                |
|-----------------|----------------|
| Manufactured by | SPEAG          |
| Manufactured on | March 11, 2011 |

## DASY5 Validation Report for Head TSL

Date: 11.07.2011

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 1900 MHz

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

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

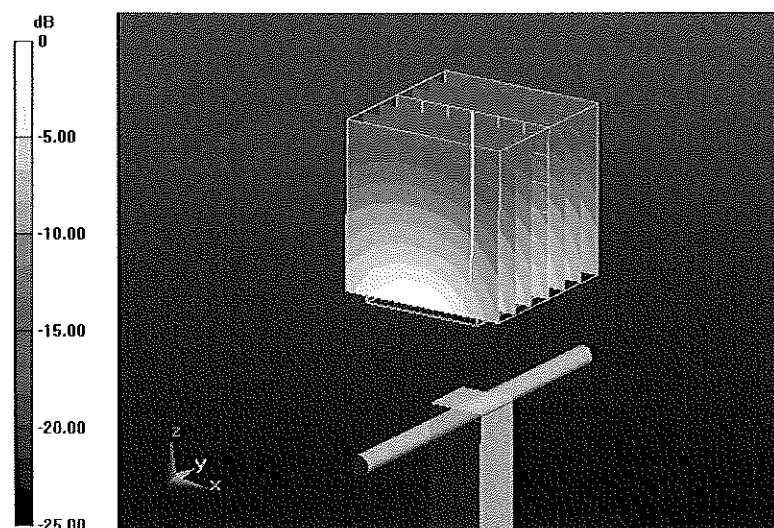
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

Peak SAR (extrapolated) = 18.201 W/kg

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

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

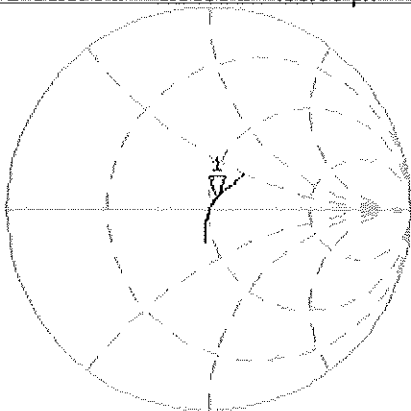


0 dB = 12.280mW/g

Impedance Measurement Plot for Head TSL

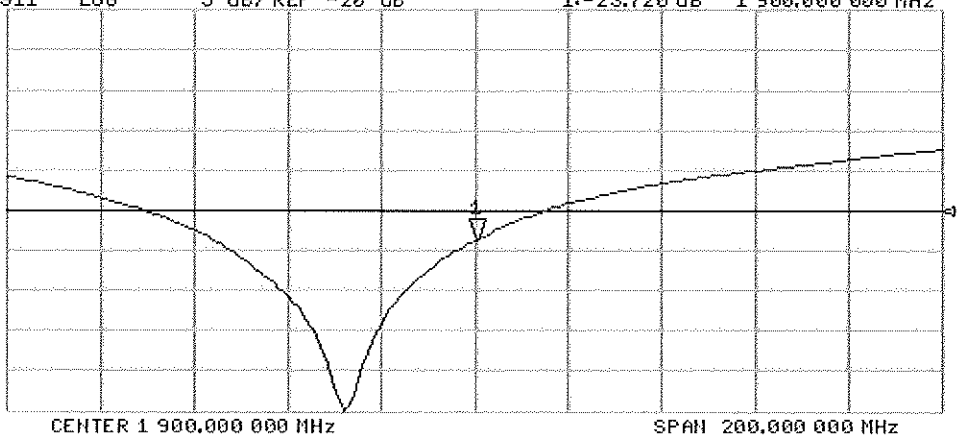
11 Jul 2011 11:49:26  
[CH3] S11 1 U FS 1: 53.375  $\phi$  5.8359  $\phi$  488.85  $\phi$ H 1 900.000 000 MHz

\*  
Del  
Cor  
Avg  
16  
H1d



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

Cor  
Avg  
16  
H1d





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Accreditation No.: **SCS 108**

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

Client **PC Test**

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

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d141**

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

Calibration date: **November 08, 2011**

✓ KOK  
11/28/11

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: November 9, 2011

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

### Glossary:

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

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

- 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.

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

## Body TSL parameters

The following parameters and calculations were applied.

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

## SAR result with Body TSL

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

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

## Appendix

### Antenna Parameters with Body TSL

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

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.199 ns |
|----------------------------------|----------|

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

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

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

### Additional EUT Data

|                 |                |
|-----------------|----------------|
| Manufactured by | SPEAG          |
| Manufactured on | March 11, 2011 |

## DASY5 Validation Report for Body TSL

Date: 08.11.2011

Test Laboratory: SPEAG, Zurich, Switzerland

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

---

Communication System: CW; Frequency: 1900 MHz

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

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

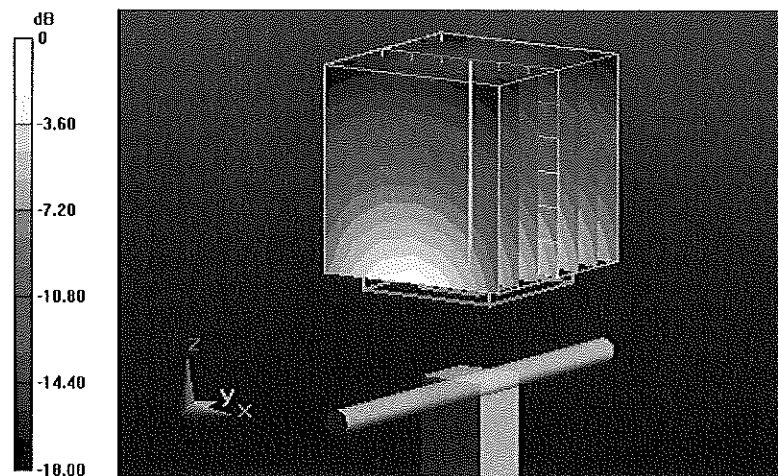
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

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

Peak SAR (extrapolated) = 18.815 W/kg

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

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



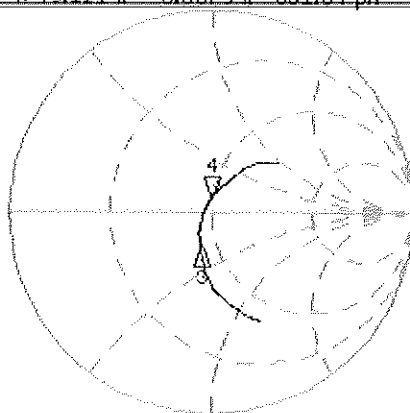
0 dB = 13.450mW/g

# Impedance Measurement Plot for Body TSL

8 Nov 2011 09:26:55

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

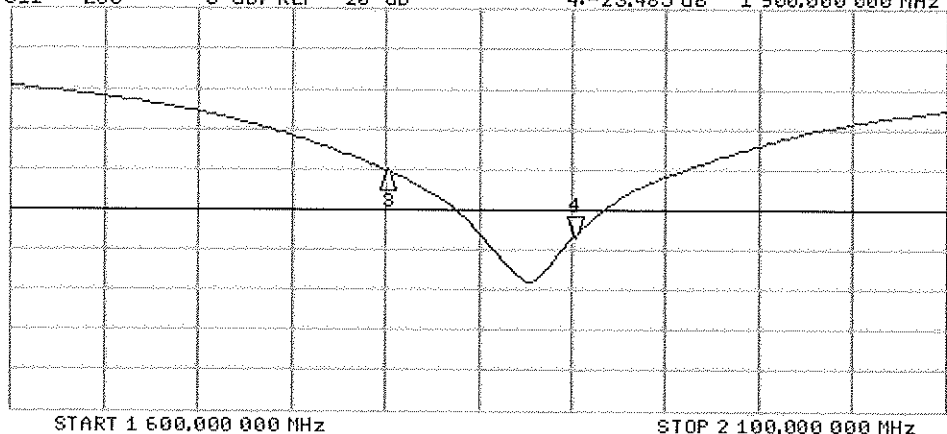
\*  
De1  
CA  
Avg  
16  
H1d



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

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

CA  
Avg  
16  
H1d



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



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Accreditation No.: **SCS 108**

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: **D2450V2-719\_Aug11**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 719**

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

Calibration date: **August 19, 2011**

✓ KOK  
9/6/11

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Signature

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

Issued: August 22, 2011

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



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Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

### Glossary:

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

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

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

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

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

## Measurement Conditions

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

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.6.2     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 2450 MHz $\pm$ 1 MHz   |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 39.2           | 1.80 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 38.4 $\pm$ 6 % | 1.85 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL

|                                                       |                    |                               |
|-------------------------------------------------------|--------------------|-------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                               |
| SAR measured                                          | 250 mW input power | 13.7 mW / g                   |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 53.8 mW /g $\pm$ 17.0 % (k=2) |

|                                                         |                    |                               |
|---------------------------------------------------------|--------------------|-------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                               |
| SAR measured                                            | 250 mW input power | 6.35 mW / g                   |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 25.2 mW /g $\pm$ 16.5 % (k=2) |

## Body TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Body TSL parameters             | 22.0 °C             | 52.7           | 1.95 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 51.8 $\pm$ 6 % | 2.02 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Body TSL

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

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

## Appendix

### Antenna Parameters with Head TSL

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

### Antenna Parameters with Body TSL

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

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.149 ns |
|----------------------------------|----------|

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

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

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

### Additional EUT Data

|                 |                    |
|-----------------|--------------------|
| Manufactured by | SPEAG              |
| Manufactured on | September 10, 2002 |

## DASY5 Validation Report for Head TSL

Date: 18.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 2450 MHz

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

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

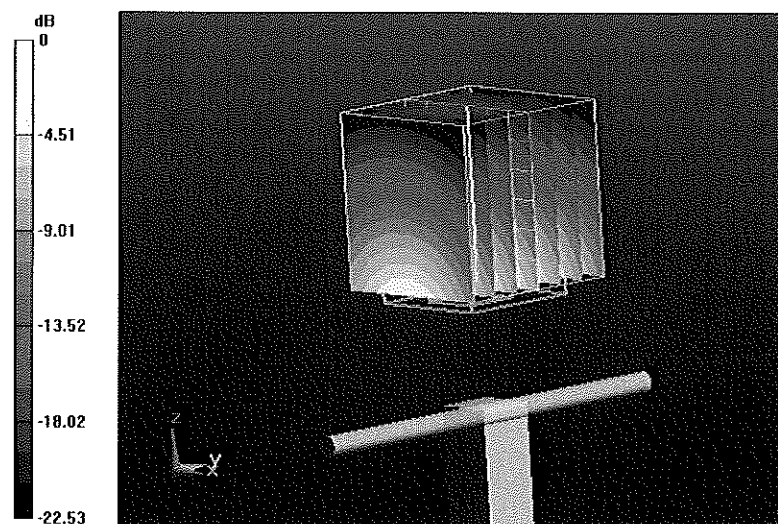
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

Peak SAR (extrapolated) = 28.234 W/kg

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

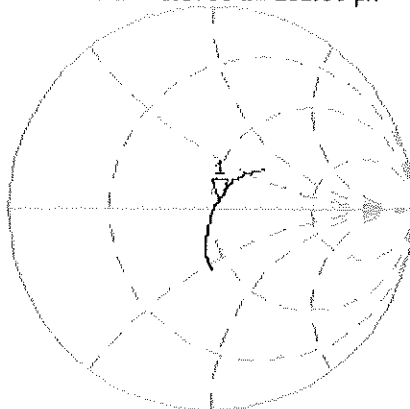
Maximum value of SAR (measured) = 17.657 mW/g



# Impedance Measurement Plot for Head TSL

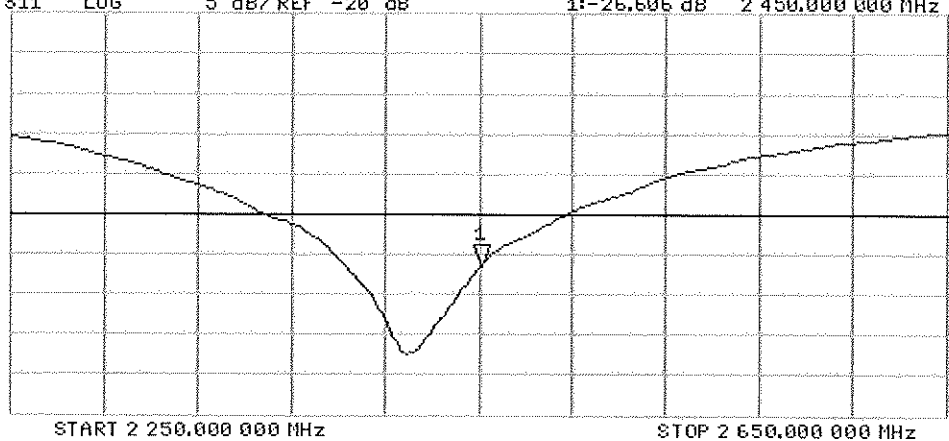
18 Aug 2011 10:43:30  
 CH1 S11 1 U FS 1:53.248 n 3.5703 n 231.93 pF 2 450.000 000 MHz

\*  
 Del  
 CA  
 Avg  
 16  
 H1 d



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

CA  
 Avg  
 16  
 H1 d



## DASY5 Validation Report for Body TSL

Date: 19.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 2450 MHz

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

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

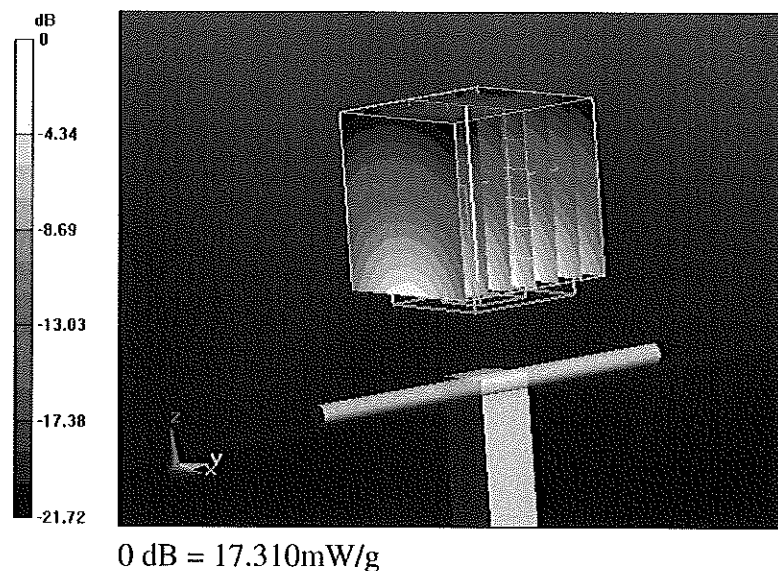
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

Peak SAR (extrapolated) = 26.876 W/kg

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

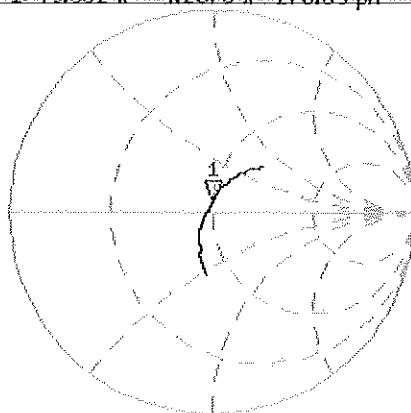
Maximum value of SAR (measured) = 17.309 mW/g



# Impedance Measurement Plot for Body TSL

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

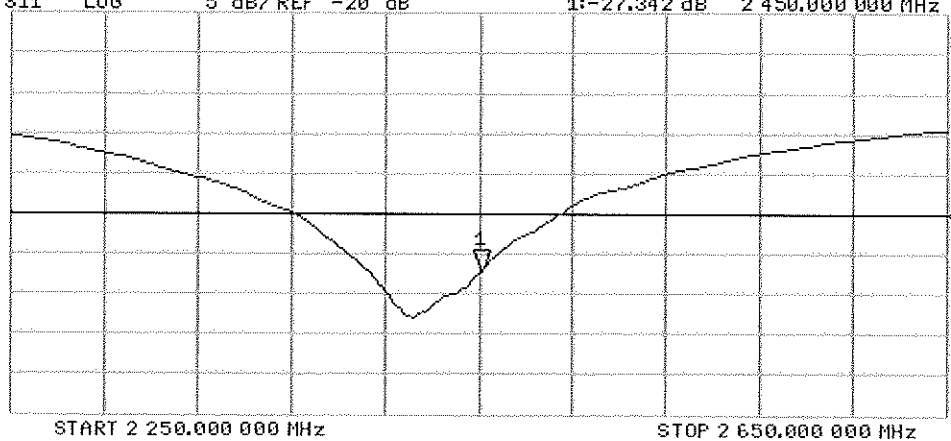
\*  
 Del  
 CA



Avg  
 16  
 H1d

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

CA  
 Avg  
 16  
 H1d





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Client **PC Test**

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

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d026**

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

Calibration date: **August 15, 2011**

✓ KOK  
 9/6/11

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Signature

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

Issued: August 15, 2011

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Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

### Glossary:

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

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

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

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

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

## Measurement Conditions

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

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.6.2     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 15 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 835 MHz $\pm$ 1 MHz    |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 41.5           | 0.90 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 41.1 $\pm$ 6 % | 0.89 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Head TSL

|                                                       |                    |                                |
|-------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                                |
| SAR measured                                          | 250 mW input power | 2.35 mW / g                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 9.46 mW / g $\pm$ 17.0 % (k=2) |

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                                |
| SAR measured                                            | 250 mW input power | 1.54 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 6.19 mW / g $\pm$ 16.5 % (k=2) |

## Body TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Body TSL parameters             | 22.0 °C             | 55.2           | 0.97 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 53.4 $\pm$ 6 % | 0.99 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

## SAR result with Body TSL

|                                                       |                    |                                |
|-------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                                |
| SAR measured                                          | 250 mW input power | 2.47 mW / g                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 9.66 mW / g $\pm$ 17.0 % (k=2) |

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

## Appendix

### Antenna Parameters with Head TSL

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

### Antenna Parameters with Body TSL

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

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.389 ns |
|----------------------------------|----------|

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

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

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

### Additional EUT Data

|                 |                   |
|-----------------|-------------------|
| Manufactured by | SPEAG             |
| Manufactured on | December 17, 2004 |

## DASY5 Validation Report for Head TSL

Date: 15.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

---

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

---

Communication System: CW; Frequency: 835 MHz

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

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

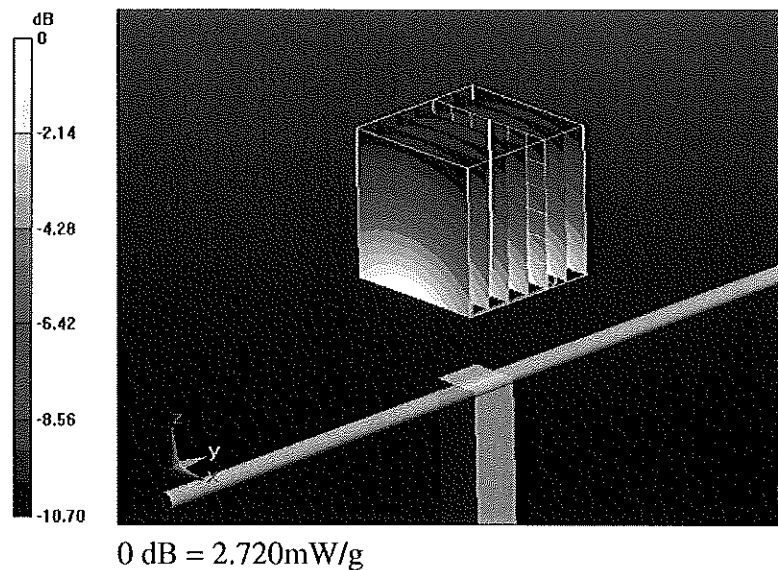
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

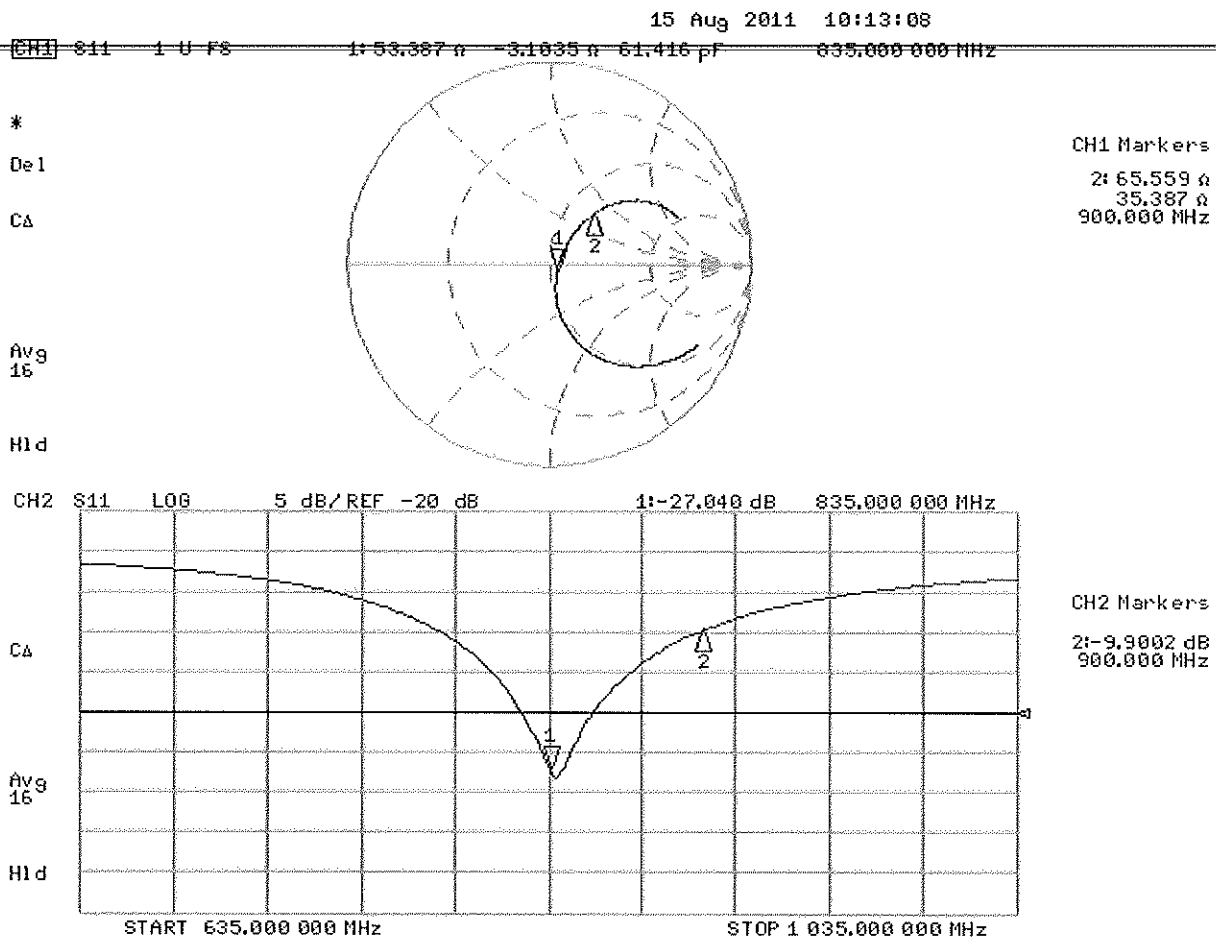
Peak SAR (extrapolated) = 3.480 W/kg

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

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



Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 15.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

---

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

---

Communication System: CW; Frequency: 835 MHz

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

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

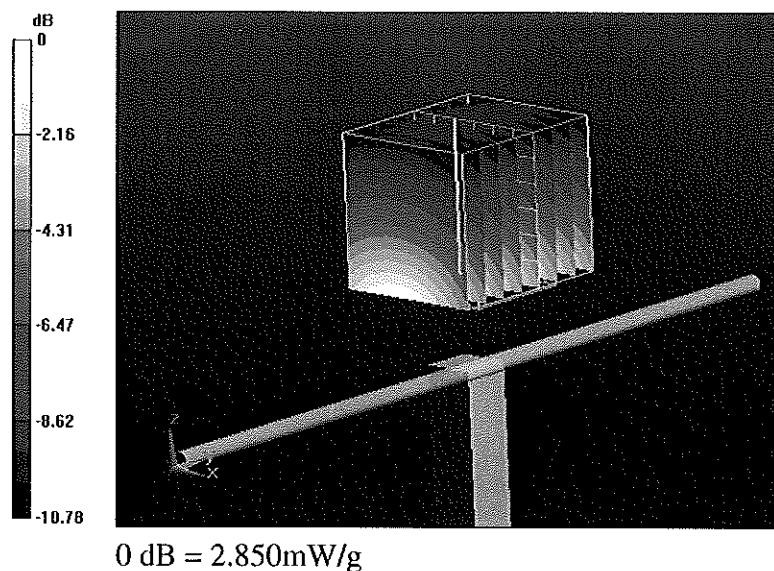
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

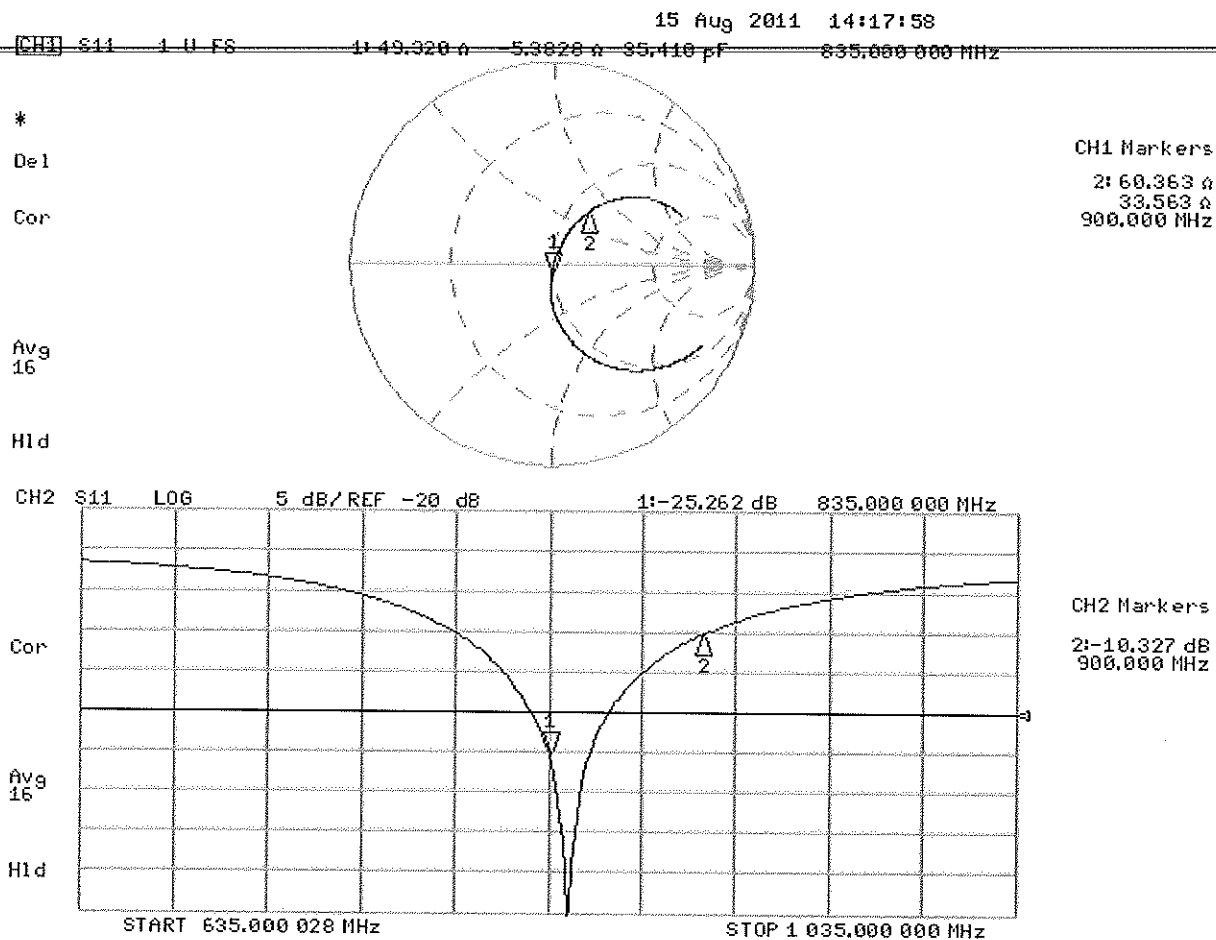
Peak SAR (extrapolated) = 3.598 W/kg

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

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



# Impedance Measurement Plot for Body TSL





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Client **PC Test**

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

## CALIBRATION CERTIFICATE

Object **ES3DV2 - SN:3022**

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

Calibration date: **August 25, 2011**

*✓KOK  
9/6/11*

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID              | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 31-Mar-11 (No. 217-01372)         | Apr-12                 |
| Power sensor E4412A        | MY41498087      | 31-Mar-11 (No. 217-01372)         | Apr-12                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 29-Mar-11 (No. 217-01369)         | Apr-12                 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 29-Mar-11 (No. 217-01367)         | Apr-12                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 29-Mar-11 (No. 217-01370)         | Apr-12                 |
| Reference Probe ES3DV2     | SN: 3013        | 29-Dec-10 (No. ES3-3013_Dec10)    | Dec-11                 |
| DAE4                       | SN: 654         | 3-May-11 (No. DAE4-654_May11)     | May-12                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Oct-09)  | In house check: Oct-11 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

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

Issued: August 27, 2011



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### Glossary:

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

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

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

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the  $E^2$ -field uncertainty inside TSL (see below *ConvF*).
- NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

---

# Probe ES3DV2

## SN:3022

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

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

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

### Basic Calibration Parameters

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

### Modulation Calibration Parameters

| UID   | Communication System Name | PAR  |   | A<br>dB | B<br>dB | C<br>dB | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-------|---------------------------|------|---|---------|---------|---------|----------|---------------------------|
| 10000 | CW                        | 0.00 | X | 0.00    | 0.00    | 1.00    | 133.2    | $\pm 2.7 \%$              |
|       |                           |      | Y | 0.00    | 0.00    | 1.00    | 130.0    |                           |
|       |                           |      | Z | 0.00    | 0.00    | 1.00    | 133.9    |                           |

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

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

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

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

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

### Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 41.9                               | 0.89                            | 6.27    | 6.27    | 6.27    | 0.80  | 1.13       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 6.05    | 6.05    | 6.05    | 0.80  | 1.14       | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 5.20    | 5.20    | 5.20    | 0.59  | 1.39       | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 4.98    | 4.98    | 4.98    | 0.66  | 1.30       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.30    | 4.30    | 4.30    | 0.58  | 1.41       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 4.20    | 4.20    | 4.20    | 0.58  | 1.43       | ± 12.0 %    |

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

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

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

### Calibration Parameter Determined in Body Tissue Simulating Media

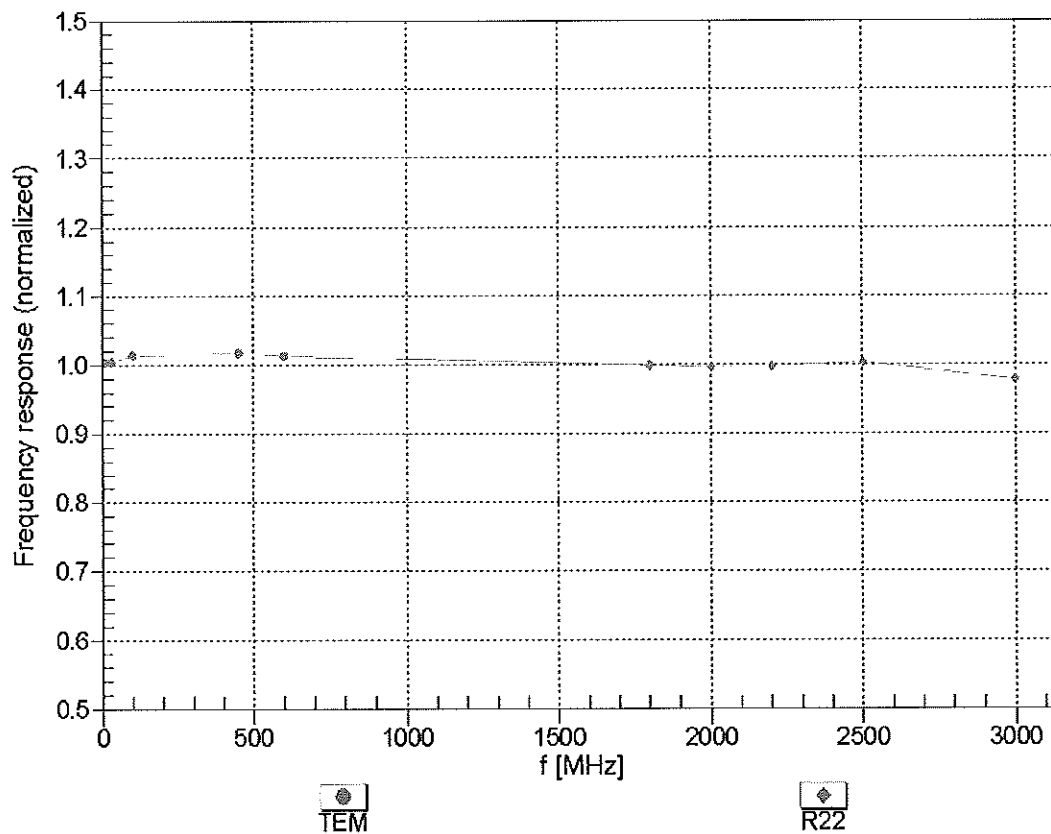
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|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

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

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

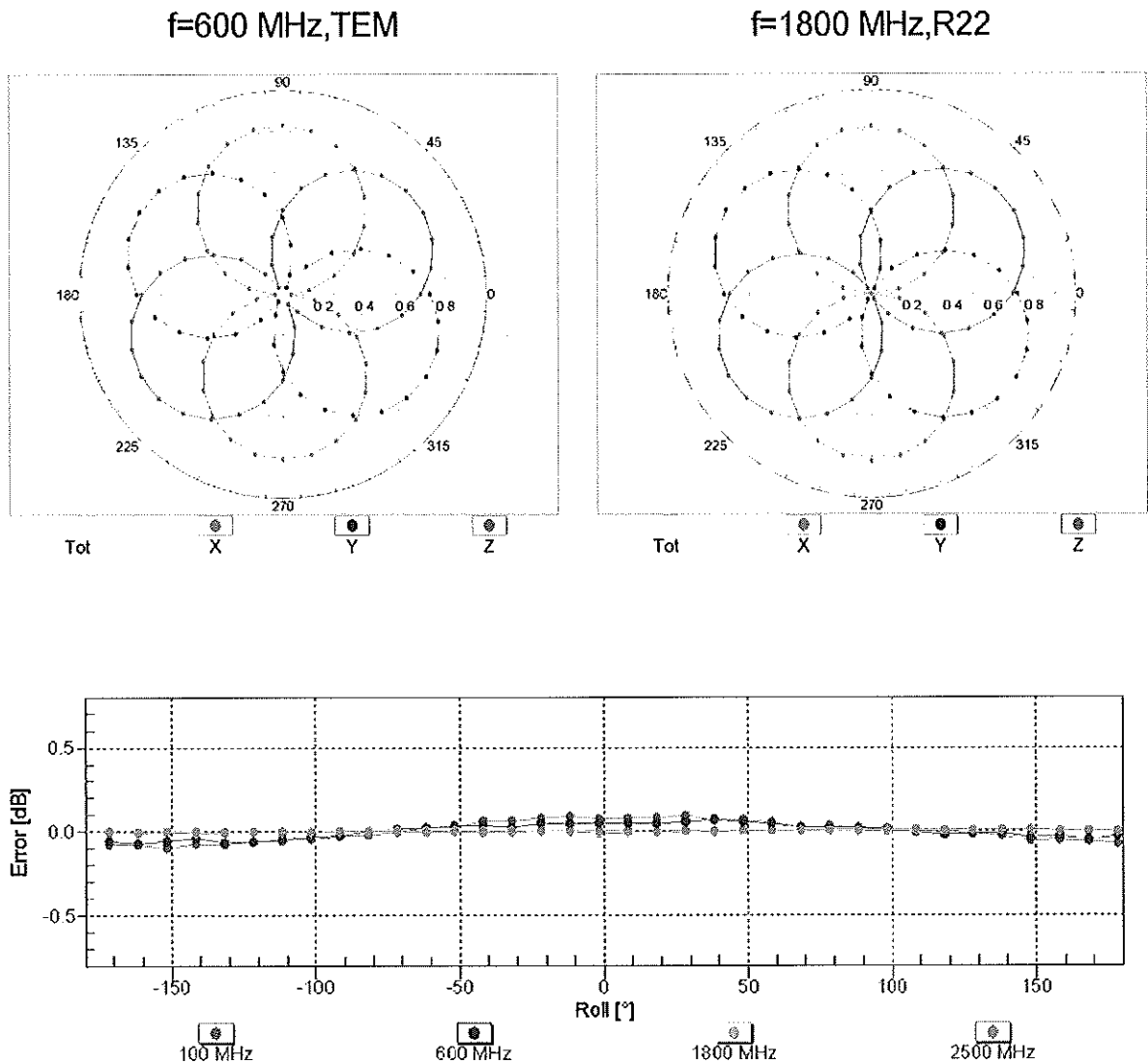
## Frequency Response of E-Field

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



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

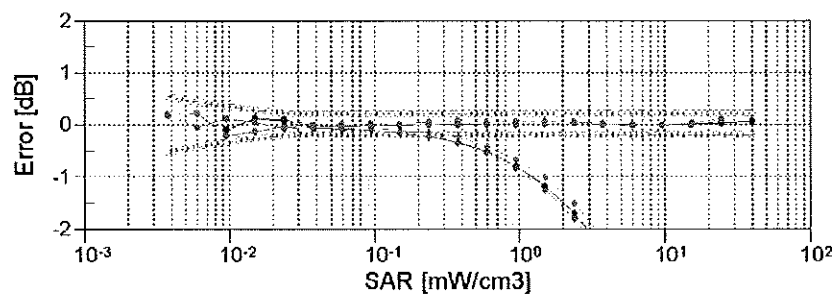
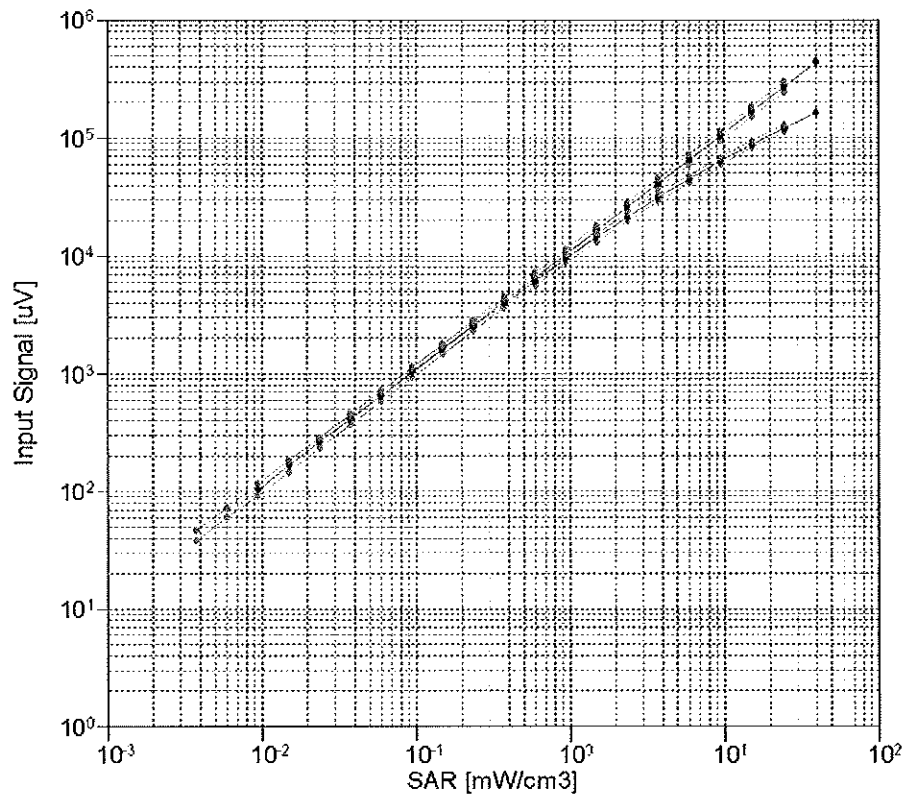
Receiving Pattern ( $\phi$ ),  $\vartheta = 0^\circ$



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

# Dynamic Range f(SAR<sub>head</sub>)

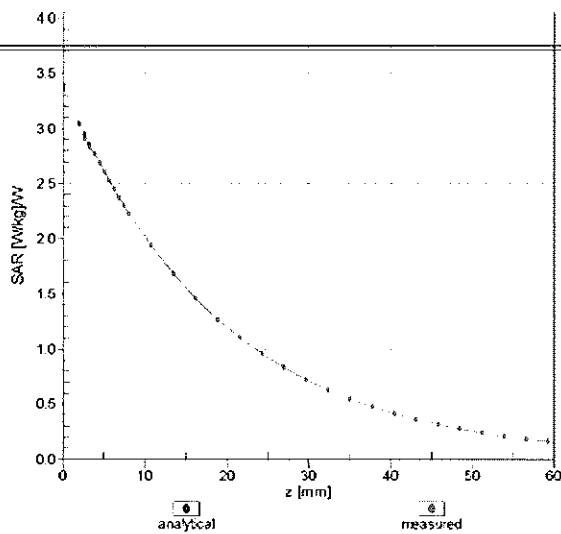
(TEM cell , f = 900 MHz)



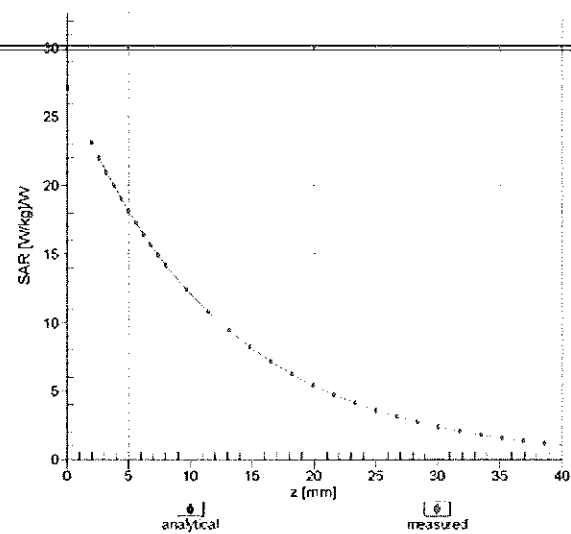
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

## Conversion Factor Assessment

$f = 835 \text{ MHz, WGLS R9 (H\_convF)}$

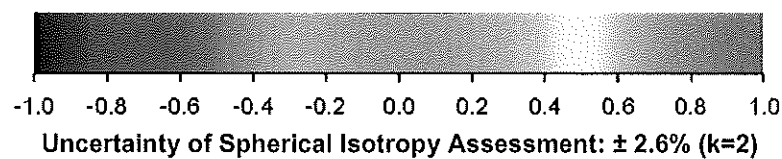
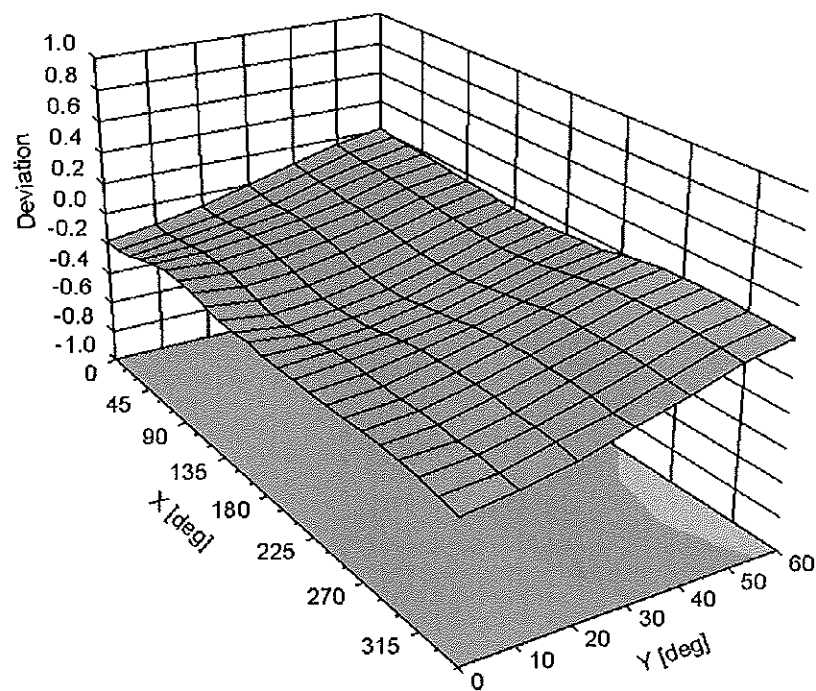


$f = 1900 \text{ MHz, WGLS R22 (H\_convF)}$



## Deviation from Isotropy in Liquid

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



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

### Other Probe Parameters

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

## **Additional Conversion Factors**

for Dosimetric E-Field Probe

Type:

**ES3DV2**

Serial Number:

**3022**

Place of Assessment:

**Zurich**

Date of Assessment:

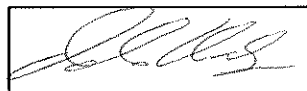
**August 29, 2011**

Probe Calibration Date:

**August 25, 2011**

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

Assessed by:



## Dosimetric E-Field Probe ES3DV2 SN:3022

Conversion factor ( $\pm$  standard deviation)

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

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

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

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

### Important Note:

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

Please see also DASY Manual.



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Client **PC Test**

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

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3258**

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

Calibration date: **February 21, 2012**

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: February 23, 2012



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Accreditation No.: **SCS 108**

### Glossary:

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

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

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

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; VR<sub>x,y,z</sub>; A, B, C** are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

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# Probe ES3DV3

## SN:3258

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

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

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

### Basic Calibration Parameters

|                                                    | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|----------------------------------------------------|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V/m})^2$ ) <sup>A</sup> | 1.29     | 1.18     | 1.23     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                              | 101.6    | 105.0    | 100.8    |               |

### Modulation Calibration Parameters

| UID   | Communication System Name | PAR  |   | A<br>dB | B<br>dB | C<br>dB | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-------|---------------------------|------|---|---------|---------|---------|----------|---------------------------|
| 10000 | CW                        | 0.00 | X | 0.00    | 0.00    | 1.00    | 115.9    | $\pm 3.0 \%$              |
|       |                           |      | Y | 0.00    | 0.00    | 1.00    | 107.9    |                           |
|       |                           |      | Z | 0.00    | 0.00    | 1.00    | 115.8    |                           |

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

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

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

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

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

### Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 41.9                               | 0.89                            | 6.26    | 6.26    | 6.26    | 0.43  | 1.49       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 6.01    | 6.01    | 6.01    | 0.45  | 1.48       | ± 12.0 %    |
| 1640                 | 40.3                               | 1.29                            | 5.46    | 5.46    | 5.46    | 0.61  | 1.30       | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 5.30    | 5.30    | 5.30    | 0.67  | 1.30       | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 5.17    | 5.17    | 5.17    | 0.79  | 1.23       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.46    | 4.46    | 4.46    | 0.67  | 1.40       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 4.31    | 4.31    | 4.31    | 0.80  | 1.33       | ± 12.0 %    |

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

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

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

### Calibration Parameter Determined in Body Tissue Simulating Media

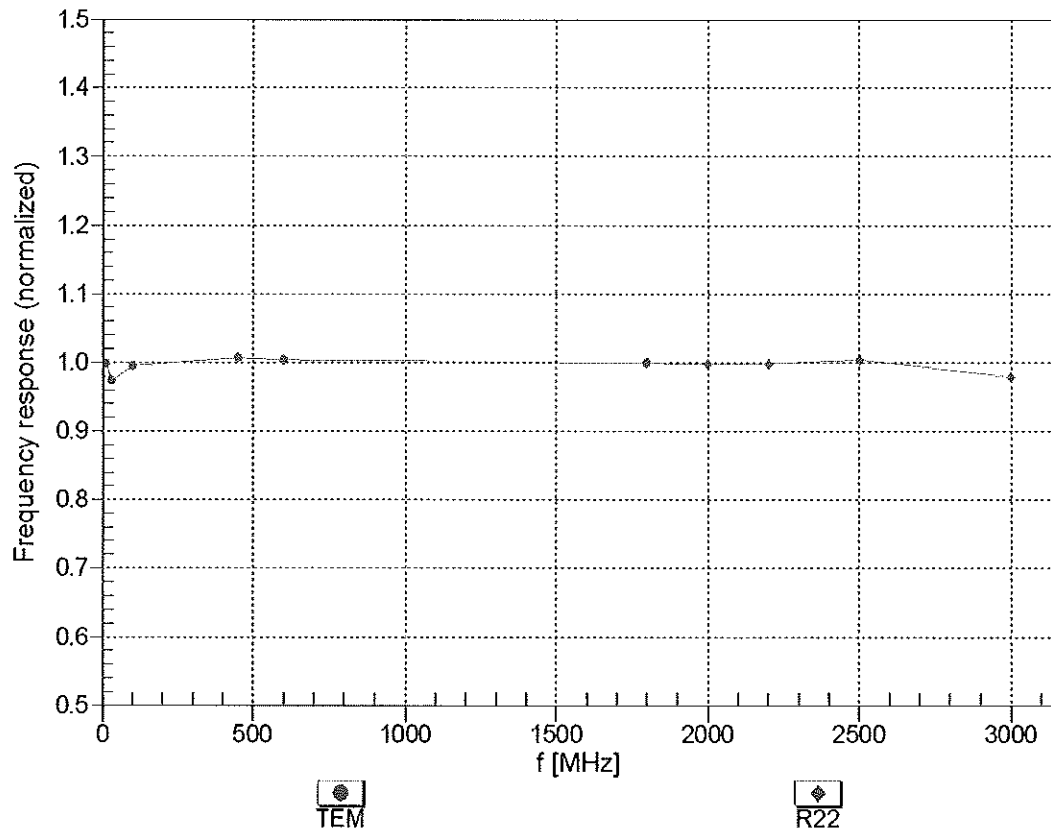
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|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

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

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

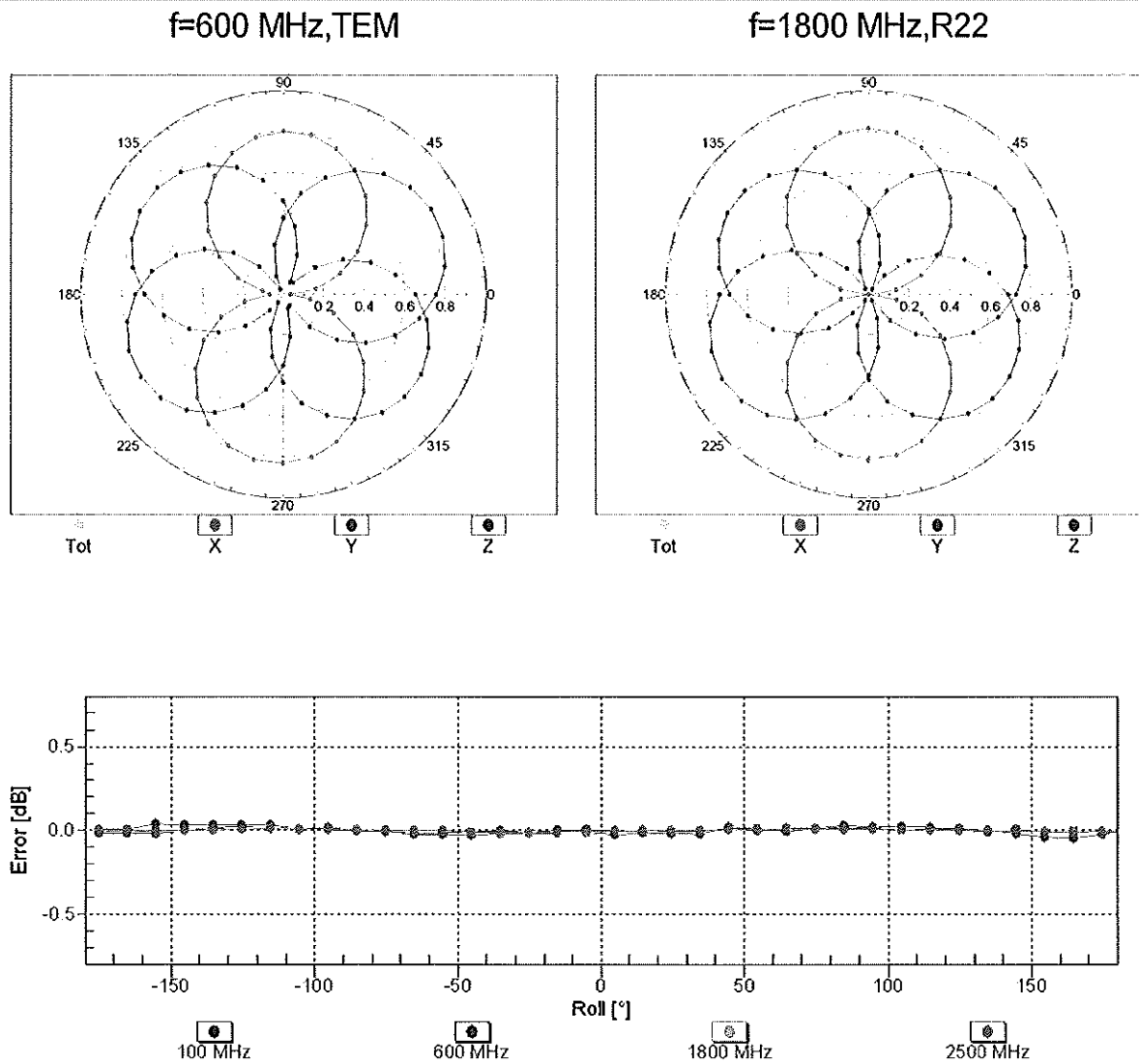
## Frequency Response of E-Field

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



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

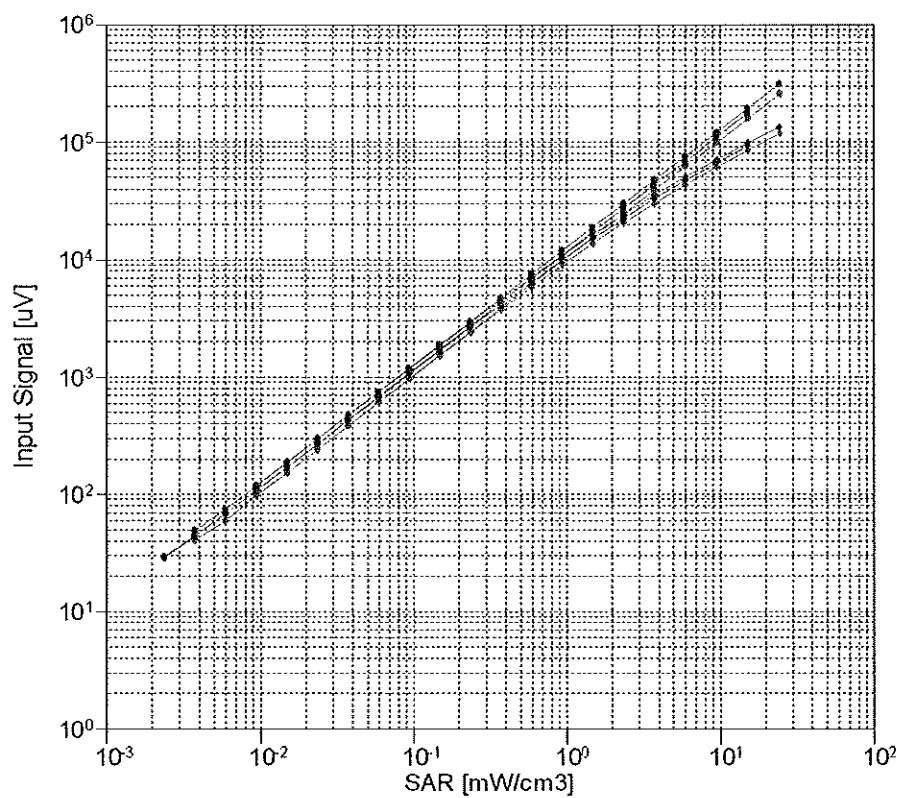
## Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$



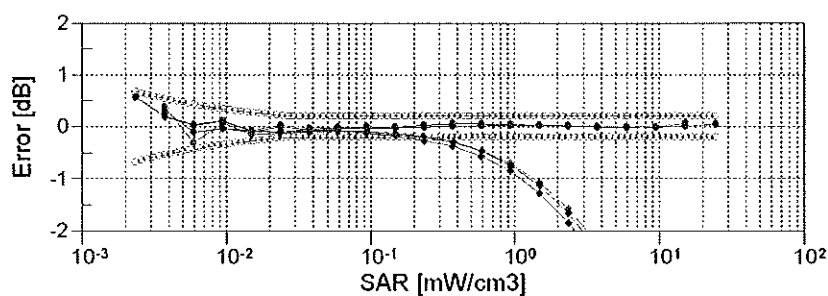
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

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

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



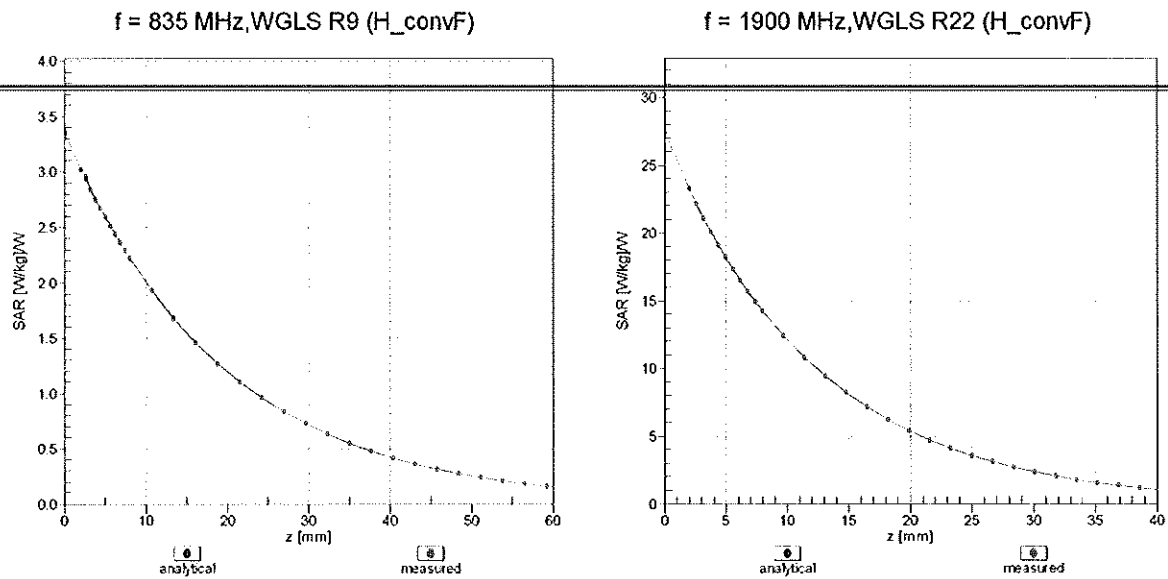
X compensated      X not compensated      Y compensated  
 Y not compensated      Z compensated      Z not compensated



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

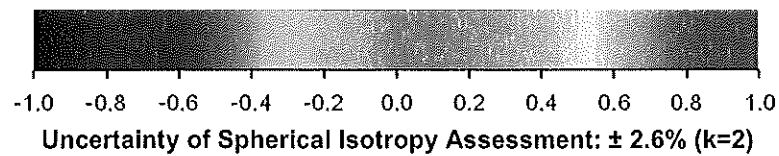
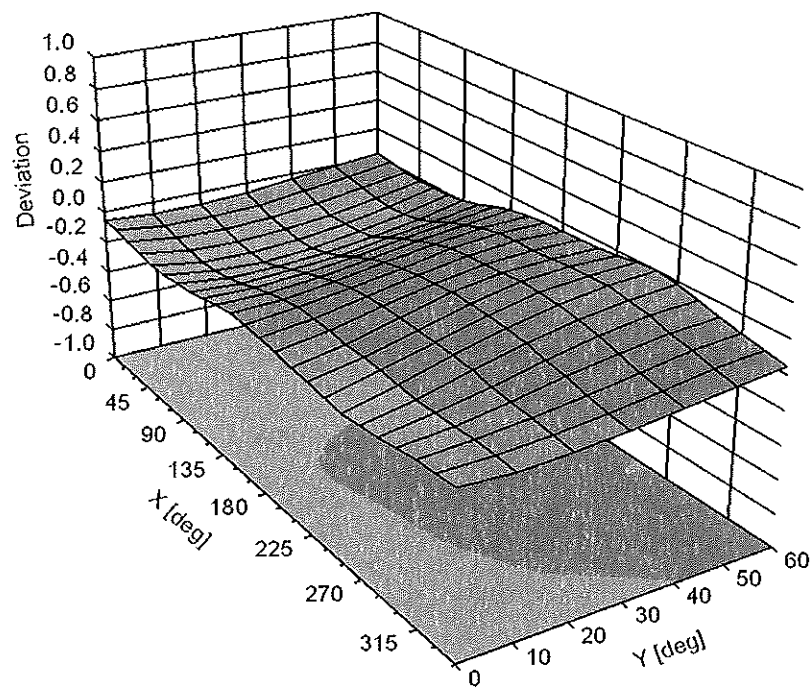
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

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



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

### Other Probe Parameters

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