



## SAR COMPLIANCE EVALUATION REPORT

**Applicant Name:**

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

**Date of Testing:**

11/28/11 - 11/30/11

**Test Site/Location:**

PCTEST Lab, Columbia, MD, USA

**Test Report Serial No.:**

0Y1111232031.ZNF

**FCC ID:**

**ZNFLS696**

**APPLICANT:**

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

**EUT Type:**

Portable Handset

**Application Type:**

Certification

**FCC Rule Part(s):**

CFR §2.1093; FCC/OET Bulletin 65 Supplement C [June 2001]

**Model(s):**

LS696, LG-LS696

**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 - FCC Rule Part 90S         | 817.90 - 823.10 MHz   | 24.60                 | 0.68             | 0.78                  | 0.72                |
| Cell. CDMA/EVDO - FCC Rule Part 22H         | 824.70 - 848.31 MHz   | 25.49                 | 0.85             | 0.99                  | 0.82                |
| PCS CDMA/EVDO - FCC Rule Part 24E           | 1851.25 - 1908.75 MHz | 24.88                 | 0.79             | 0.64                  | 0.72                |
| 2.4 GHz WLAN - FCC Rule Part 15C            | 2412 - 2462 MHz       | 14.78                 | 0.51             | 0.05                  | 0.13                |
| Bluetooth - FCC Rule Part 15C               | 2402 - 2480 MHz       | 4.19                  | N/A              |                       |                     |
| <b>Simultaneous SAR per KDB 690783 D01:</b> |                       |                       | 1.36             | 1.04                  | 0.94                |

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

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> ZNFLS696              |  | <b>SAR COMPLIANCE REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                           | <b>EUT Type:</b><br>Portable Handset |                                                                                       | Page 1 of 39                           |

# T A B L E O F C O N T E N T S

|    |                                                  |    |
|----|--------------------------------------------------|----|
| 1  | INTRODUCTION .....                               | 3  |
| 2  | TEST SITE LOCATION .....                         | 4  |
| 3  | SAR MEASUREMENT SETUP .....                      | 5  |
| 4  | DASY E-FIELD PROBE SYSTEM .....                  | 7  |
| 5  | PROBE CALIBRATION PROCESS .....                  | 8  |
| 6  | PHANTOM AND EQUIVALENT TISSUES.....              | 9  |
| 7  | DOSIMETRIC ASSESSMENT & PHANTOM SPECS.....       | 10 |
| 8  | DEFINITION OF REFERENCE POINTS .....             | 11 |
| 9  | TEST CONFIGURATION POSITIONS .....               | 12 |
| 10 | FCC RF EXPOSURE LIMITS.....                      | 15 |
| 11 | FCC MEASUREMENT PROCEDURES.....                  | 16 |
| 12 | RF CONDUCTED POWERS.....                         | 19 |
| 13 | FCC PERSONAL WIRELESS ROUTER CONFIGURATIONS..... | 22 |
| 14 | SYSTEM VERIFICATION.....                         | 24 |
| 15 | SAR DATA SUMMARY .....                           | 26 |
| 16 | FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS..... | 32 |
| 17 | EQUIPMENT LIST .....                             | 35 |
| 18 | MEASUREMENT UNCERTAINTIES .....                  | 36 |
| 19 | CONCLUSION.....                                  | 37 |
| 20 | REFERENCES .....                                 | 38 |

|                                      |                                                                                     |                                      |                                                                                       |                                        |
|--------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> ZNFLS696              |  | <b>SAR COMPLIANCE REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                           | <b>EUT Type:</b><br>Portable Handset |                                                                                       | Page 2 of 39                           |

# 1 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.

## 1.1 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 Fig. 1-1).

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

Figure 1-1  
SAR Mathematical Equation

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

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

where:

- $\sigma$  = conductivity of the tissue-simulating material (S/m)
- $\rho$  = mass density of the tissue-simulating material ( $\text{kg/m}^3$ )
- E = Total RMS electric field strength (V/m)

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

|                               |                                                                                                                                   |                               |                                                                                                 |                                 |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | SAR COMPLIANCE REPORT         |  <b>LG</b> | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                                                                | EUT Type:<br>Portable Handset |                                                                                                 | Page 3 of 39                    |

## 2 TEST SITE LOCATION

### 2.1 INTRODUCTION

The map at the right shows the location of the PCTEST LABORATORY in Columbia, Maryland. It is in proximity to the FCC Laboratory, the Baltimore-Washington International (BWI) airport, the city of Baltimore and Washington, DC.

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49' 38" W longitude. The facility is 1.5 miles north of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on January 27, 2006 and Industry Canada.

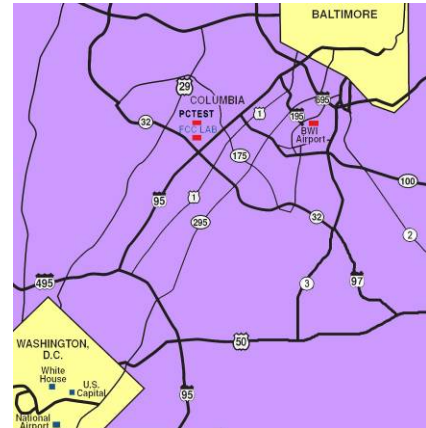
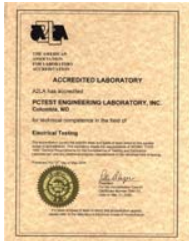


**Figure 2-1**

Map of the Greater Baltimore and Metropolitan Washington, D.C. area

### 2.2 Test Facility / Accreditations:

Measurements were performed at an independent accredited PCTEST Engineering Lab located in Columbia, MD 21045, U.S.A.



- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing-Aid Compatibility (HAC), Battery Safety, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST facility is an FCC registered (PCTEST Reg. No. 90864) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (IC-2451).
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and all Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (IC-2451) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS and CDMA, and EvDO mobile phones.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO Data, CDMA 1xRTT Data

|                                      |                                                                                     |                                      |                                                                                       |                                        |
|--------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> ZNFLS696              |  | <b>SAR COMPLIANCE REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                           | <b>EUT Type:</b><br>Portable Handset |                                                                                       | Page 4 of 39                           |

## 3 SAR MEASUREMENT SETUP

### 3.1 Robotic System

Measurements are performed using the DASY4 automated dosimetric assessment system. The DASY4 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 Figure 3-1).

### 3.2 System Hardware

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and a remote control used to drive the robot motors. The PC consists of the SAR Measurement Software DASY4, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit that performs the signal amplification, signal multiplexing, A/D conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal from the DAE and transfers data to the PC card.

### 3.3 System Electronics

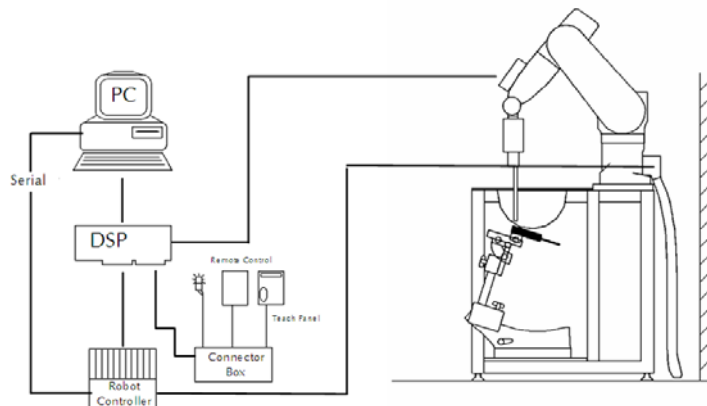


**Figure 3-1**  
**SAR Measurement System Setup**

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

|                               |                                                                                                                                   |                               |                                                                                                 |                                 |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | SAR COMPLIANCE REPORT         |  <b>LG</b> | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                                                                | EUT Type:<br>Portable Handset |                                                                                                 | Page 5 of 39                    |

### 3.4 Automated Test System Specifications

Test Software: SPEAG DASY4 version 4.7 Measurement Software  
Robot: Stäubli Unimation Corp. Robot RX60L  
Repeatability: 0.02 mm  
No. of Axes: 6

#### Data Acquisition Electronic System (DAE)

##### Data Converter

Features: Signal Amplifier, multiplexer, A/D converter & control logic  
Software: SEMCAD software  
Connecting Lines: Optical Downlink for data and status info  
Optical upload for commands and clock

##### PC Interface Card

Function: Link to DAE  
16-bit A/D converter for surface detection system  
Two Serial & Ethernet link to robotics  
Direct emergency stop output for robot

##### Phantom

Type: SAM Twin Phantom (V4.0)  
Shell Material: Composite  
Thickness:  $2.0 \pm 0.2$  mm



**Figure 3-2**  
**SAR Measurement System**

|                               |                                                                                     |                               |                                                                                       |                                 |
|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                  | EUT Type:<br>Portable Handset |                                                                                       | Page 6 of 39                    |

### 4.1 Probe Measurement System



**Figure 4-1  
SAR System**

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration (see Figure 4-3) and optimized for dosimetric evaluation [9]. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the

maximum using a 2nd order curve fitting (see Figure 5-1). The approach is stopped at reaching the maximum.

### 4.2 Probe Specifications

|                          |                                                                                                   |
|--------------------------|---------------------------------------------------------------------------------------------------|
| <b>Model(s):</b>         | ES3DV2, ES3DV3, EX3DV4                                                                            |
| <b>Frequency</b>         | 10 MHz – 6.0 GHz (EX3DV4)                                                                         |
| <b>Range:</b>            | 10 MHz – 4 GHz (ES3DV3, ES3DV2)                                                                   |
| <b>Calibration:</b>      | In head and body simulating tissue at Frequencies from 300 up to 6000MHz                          |
| <b>Linearity:</b>        | ± 0.2 dB (30 MHz to 6 GHz) for EX3DV4<br>± 0.2 dB (30 MHz to 4 GHz) for ES3DV3, ES3DV2            |
| <b>Dynamic Range:</b>    | 10 mW/kg – 100 W/kg                                                                               |
| <b>Probe Length:</b>     | 330 mm                                                                                            |
| <b>Probe Tip Length:</b> | 20 mm                                                                                             |
| <b>Body Diameter:</b>    | 12 mm                                                                                             |
| <b>Tip Diameter:</b>     | 2.5 mm (3.9mm for ES3DV3)                                                                         |
| <b>Tip-Center:</b>       | 1 mm (2.0 mm for ES3DV3)                                                                          |
| <b>Application:</b>      | SAR Dosimetry Testing<br>Compliance tests of mobile phones<br>Dosimetry in strong gradient fields |



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



**Figure 4-3  
Triangular Probe Configuration**

|                               |                                                                                                                                   |                               |                                                                                                 |                                 |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | SAR COMPLIANCE REPORT         |  <b>LG</b> | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                                                                | EUT Type:<br>Portable Handset |                                                                                                 | Page 7 of 39                    |

## 5 PROBE CALIBRATION PROCESS

### 5.1 Dosimetric Assessment Procedure

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

### 5.2 Free Space Assessment

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

### 5.3 Temperature Assessment

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

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

where:

$\Delta t$  = exposure time (30 seconds),  
 $C$  = heat capacity of tissue (brain or muscle),  
 $\Delta T$  = temperature increase due to RF exposure.

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

where:

$\sigma$  = simulated tissue conductivity,  
 $\rho$  = Tissue density (1.25 g/cm<sup>3</sup> for brain tissue)

SAR is proportional to  $\Delta T/\Delta t$ , the initial rate of tissue heating, before thermal diffusion takes place. The electric field in the simulated tissue can be used to estimate SAR by equating the thermally derived SAR to that with the E- field component.

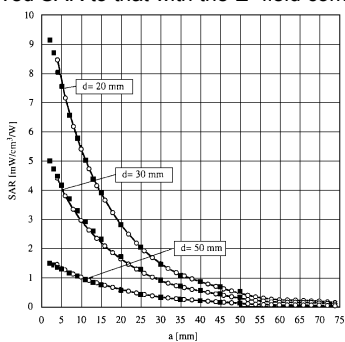


Figure 5-1 E-Field and Temperature measurements at 900MHz [9]

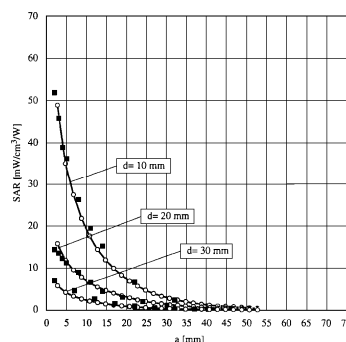


Figure 5-2 E-Field and temperature measurements at 1.9GHz [9]

|                               |                                                                                                                            |                               |                                                                                          |                                 |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  PCTEST<br>ENGINEERING LABORATORY, INC. | SAR COMPLIANCE REPORT         |  LG | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                                                         | EUT Type:<br>Portable Handset |                                                                                          | Page 8 of 39                    |

## 6 PHANTOM AND EQUIVALENT TISSUES

### 6.1 SAM Phantoms



**Figure 6-1**  
**SAM Phantoms**

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a table. The shape of the shell is based on data from an anatomical study designed to represent the 90<sup>th</sup> percentile of the population [12][13]. The phantom enables the dosimetric evaluation of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

### 6.2 Tissue Simulating Mixture Characterization



**Figure 6-2**  
**SAM Phantom with**  
**Simulating Tissue**

**Table 6-1**  
**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 |

|                               |                                                                                     |                               |                                                                                       |                                 |
|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                  | EUT Type:<br>Portable Handset |                                                                                       | Page 9 of 39                    |

## 7 DOSIMETRIC ASSESSMENT & PHANTOM SPECS

### 7.1 Measurement Procedure

The evaluation was performed using the following procedure:

1. The SAR distribution at the exposed side of the head 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 head and the horizontal grid spacing was 15mm x 15mm.
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 testing the 1 gram cube. This fixed point was measured and used as a reference value.
3. Based on the area scan data, the 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 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 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 completed. If the value deviated by more than 5%, the SAR test and drift measurement were repeated.

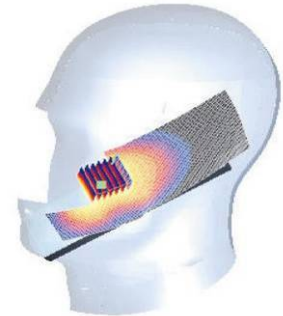


**Figure 7-1**  
**Sample SAR Area Scan**

### 7.2 Specific Anthropomorphic Mannequin (SAM) Specifications

The phantom for handset SAR assessment testing is a low-loss dielectric shell, with shape and dimensions derived from the anthropometric data of the 90th percentile adult male head dimensions as tabulated by the US Army. The SAM Twin Phantom shell is bisected along the mid-sagittal plane into right and left halves (see Figure 7-2). The perimeter sidewalls of each phantom halves are extended to allow filling with liquid to a depth that is sufficient to minimize reflections from the upper surface. The liquid depth is maintained at a minimum depth of 15 cm.



**Figure 7-2**  
**SAM Twin Phantom Shell**

|                               |                                                                                                                                   |                               |                                                                                       |                                 |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                                                                | EUT Type:<br>Portable Handset |                                                                                       | Page 10 of 39                   |

## 8

## DEFINITION OF REFERENCE POINTS

### 8.1 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 8-2). 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].

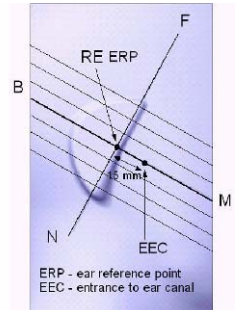


**Figure 8-1**  
Close-Up Side view  
of ERP

### 8.2 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 8-3). 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 its 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 8-2**  
Front, back and side view of SAM Twin Phantom

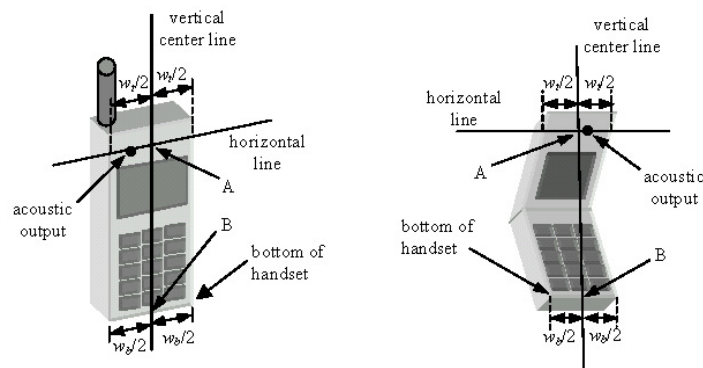


**Figure 8-3**  
Handset Vertical Center & Horizontal Line Reference Points

|                               |                                                                                                                            |                               |                                                                                          |                                 |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  PCTEST<br>ENGINEERING LABORATORY, INC. | SAR COMPLIANCE REPORT         |  LG | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                                                         | EUT Type:<br>Portable Handset |                                                                                          | Page 11 of 39                   |

## 9 TEST CONFIGURATION POSITIONS

### 9.1 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  $\delta = 0.02$ .

### 9.2 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 9-1), 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.

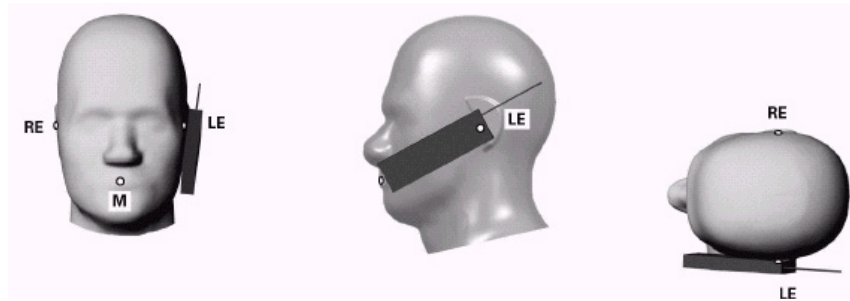


Figure 9-1 Front, Side and Top View of Cheek/Touch Position

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 9-2).

### 9.3 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 9-2).

|                               |                                                                                                                            |                               |                                                                                          |                                 |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  PCTEST<br>ENGINEERING LABORATORY, INC. | SAR COMPLIANCE REPORT         |  LG | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                                                         | EUT Type:<br>Portable Handset |                                                                                          | Page 12 of 39                   |

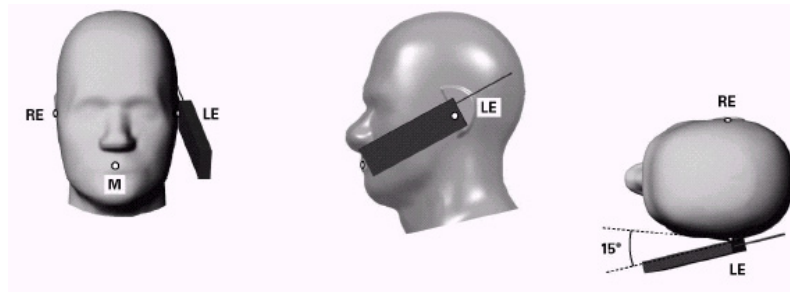


**Figure 9-2 Front, Side and Top View of Ear/15° Tilt Position**

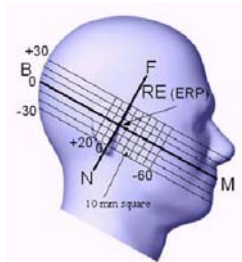


**Figure 9-3**  
**Side view w/ relevant markings**



**Figure 9-4 Body SAR Sample Photo**  
**(Not Actual EUT)**

## 9.4 SAR Evaluations near the Mouth/Jaw Regions of the SAM Phantom

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jaw regions of the SAM head phantom. This typically applies to clam-shell style phones that are generally longer in the unfolded normal use positions or to certain older style long rectangular phones. It has been known for some time that there are SAR measurement difficulties in these regions of the SAM phantom. SAR probes are calibrated in tissue equivalent liquids with sufficient separation between the probe sensors and nearby physical boundaries to ensure scattering does not affect probe calibration. When the probe tip is moved into tight regions with multiple boundaries surrounding its sensors, probe calibration and measurement accuracy can become questionable. In addition, these measurement locations often require a probe to be tilted at steep angles, where it may no longer comply with calibration requirements and measurement protocols, or satisfy the required measurement uncertainty. In some situations it is not feasible to tilt the probe or rotate the phantom, as suggested by measurement standards, to conduct these measurements.

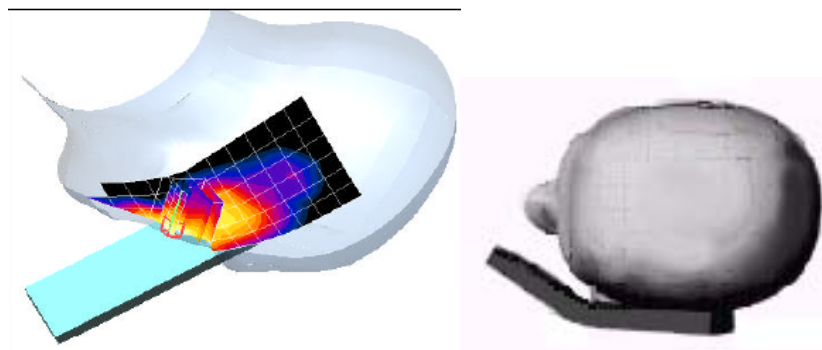


**Figure 9-5**  
**SAR Scans near the Jaw/Mouth**

In order to ensure there is sufficient conservativeness for ensuring compliance until practical solutions are available, additional measurement considerations are necessary to address these technical difficulties. When measurements are required near the mouth, nose, jaw or similar tight regions of the SAM phantom,

|                               |                                                                                                                                   |                               |                                                                                                 |                                 |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | SAR COMPLIANCE REPORT         |  <b>LG</b> | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                                                                | EUT Type:<br>Portable Handset |                                                                                                 | Page 13 of 39                   |

area or zoom scans are often unable to fully enclose the peak SAR location as required by IEEE 1528 and Supplement C, due to probe orientation and positioning difficulties. Even when limited measurements are possible, the test results could be questionable due to probe calibration and measurement uncertainty issues. Under these circumstances, the following procedures apply, adopted from the FCC guidance on SAR handsets document publication 648474. The SAR required in these regions of SAM should be measured using a flat phantom. **Rectangular shaped phones** should be positioned with its bottom edge positioned from the flat phantom with the same distance provided by the cheek touching position using SAM. The ear reference point (ERP, as defined for SAM) of the phone should be positioned ½ cm from the flat phantom shell. **Clam-shell phones** should be positioned with the hinge against a smooth edge of the flat phantom where the upper half of the phone is unfolded and extended beyond the phantom side wall. The lower half of the phone is secured in the test device holder at a fixed distance below the flat phantom determined by the minimum separation along the lower edge of the phone in the cheek touching position using SAM. Any case with substantial variation in separation distance along the lower edge of a clam shell is discussed with the FCC for best-to-use methodology.

The flat phantom data should allow test results to be compared uniformly across measurement systems, until suitable solutions are available in measurement standards to address certain probe calibration and positioning issues, due to implementation differences between horizontal and upright SAM configurations. These flat phantom procedures are only applicable for stand-alone SAR evaluation in tight regions of the SAM phantom, where measurement is not feasible or test results can be questionable due to probe calibration and accessibility issues. Details on device positioning and photos showing how separation distances are determined are included in the SAR report Photographs. SAR for other regions of the head must be evaluated using SAM; therefore, a phone with antennas at different locations may require flat and SAM phantom evaluation for the different antennas.

## 9.5 Body Holster /Belt Clip 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 9-4). 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.

|                                      |                                                                                                                                   |                                      |                                                                                       |                                        |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: ZNFLS696                     |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR COMPLIANCE REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                                                                         | <b>EUT Type:</b><br>Portable Handset |                                                                                       | Page 14 of 39                          |

## 10 FCC RF EXPOSURE LIMITS

### 10.1 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.

### 10.2 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 10-1**  
**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.

|                               |                                                                                                                                   |                               |                                                                                       |                                 |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                                                                | EUT Type:<br>Portable Handset |                                                                                       | Page 15 of 39                   |

## 11 FCC MEASUREMENT PROCEDURES

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

### 11.1 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. When the power drift was more than 5%, the SAR test was repeated.

### 11.2 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.

#### 11.2.1 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 11-1 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 13-2 was applied.
5. FCHs were configured at full rate for maximum SAR with "All Up" power control bits.

**Table 11-1**  
**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 11-2**  
**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  |

|                               |                                                                                     |                               |                                                                                       |                                 |
|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                  | EUT Type:<br>Portable Handset |                                                                                       | Page 16 of 39                   |

### 11.2.2 CDMA2000 1x Advanced

This device additionally supports 1x Advanced. Conducted powers were measured according to KDB publication 941225 using SO75 with RC8 on the uplink and RC11 on the downlink (please see KDB Inquiry 464812). Smart blanking was disabled for all measurements. The EUT was configured with forward power control Mode 000 and reverse power control at 400 bps. Conducted powers were measured on an Agilent 8960 Series 10 Wireless Communications Test Set, Model E5515C using the CDMA2000 1x Advanced application, Model E1962B-410.

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

### 11.2.3 Head SAR Measurements

SAR for head exposure configurations is measured in RC3 with the DUT configured to transmit at full rate using Loopback Service Option SO55. SAR for RC1 is not required when the maximum average output of each channel is less than  $\frac{1}{4}$  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.

### 11.2.4 Body SAR Measurements

SAR for body exposure configurations is measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCH<sub>n</sub>) is not required when the maximum average output of each RF channel is less than  $\frac{1}{4}$  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  $\frac{1}{4}$  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.

### 11.2.5 Handsets with EVDO

For handsets with Ev-Do capabilities, when the maximum average output of each channel in Rev. 0 is less than  $\frac{1}{4}$  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  $\frac{1}{4}$  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.

|                               |                                                                                     |                               |                                                                                       |                                 |
|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                  | EUT Type:<br>Portable Handset |                                                                                       | Page 17 of 39                   |

### 11.2.6 Body SAR Measurements for EVDO Hotspot

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

### 11.2.7 Hotspot Power Reduction Mode

This device utilizes a power reduction scheme during mobile hotspot mode operation. When hotspot mode is active on the device, the firmware applies power reduction in order to limit RF exposure levels. The mobile hotspot mode and power reduction software are programmed into the firmware at the factory and cannot be changed by the end-user or third-party applications, as described in the Operational Description.

## 11.3 SAR Measurements for 802.11 modes

The SAR test procedures for devices with 802.11 modes are adopted from FCC KDB 248227 publication.

Per FCC KDB 248227 publication, 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.

### 11.3.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

### 11.3.2 Frequency Channel Configurations [27]

802.11 b/g/n operating modes are tested independently according to the service requirements in each frequency band. 802.11 b/g/n modes are tested on channels 1, 6 and 11. These are referred to as the "default test channels". For 2.4 GHz, 802.11g/n modes were evaluated only if the output power was 0.25 dB higher than the 802.11b mode.

Table 11-3 IEEE 802.11 Default Test Channels

| Mode         | GHz   | Channel | Turbo Channel | "Default Test Channels" |         | UNII |
|--------------|-------|---------|---------------|-------------------------|---------|------|
|              |       |         |               | \$15.247<br>802.11b     | 802.11g |      |
| 802.11 b/g/n | 2.412 | 1       |               | ✓                       | ▽       |      |
|              | 2.437 | 6       | 6             | ✓                       | ▽       |      |
|              | 2.462 | 11      |               | ✓                       | ▽       |      |

|                                      |                                                                                                                                   |                                      |                                                                                       |                                        |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: ZNFLS696                     |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR COMPLIANCE REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                                                                         | <b>EUT Type:</b><br>Portable Handset |                                                                                       | Page 18 of 39                          |

## 12 RF CONDUCTED POWERS

### 12.1 CDMA Conducted Powers

Table 12-1  
CDMA RF Conducted Powers with Hotspot Disabled

| Band     | Channel | Frequency | FCC Rule Part | SO55 [dBm] | SO55 [dBm] | SO75 [dBm]             | TDSO SO32 [dBm] | TDSO SO32 [dBm] | 1x EvDO Rev. 0 [dBm] | 1x EvDO Rev. A [dBm] |
|----------|---------|-----------|---------------|------------|------------|------------------------|-----------------|-----------------|----------------------|----------------------|
|          | F-RC    | MHz       |               | RC1        | RC3        | RC8 (up) / RC11 (down) | FCH+SCH         | FCH             | (RTAP)               | (RETAP)              |
| Cellular | 564     | 820.1     | 90S           | 24.79      | 24.60      | 24.49                  | 24.55           | 24.58           | 24.79                | 24.77                |
|          | 1013    | 824.7     | 22H           | 25.31      | 25.27      | 24.83                  | 25.23           | 25.23           | 25.26                | 25.32                |
|          | 384     | 836.52    |               | 25.49      | 25.49      | 25.26                  | 25.30           | 25.35           | 25.45                | 25.46                |
|          | 777     | 848.31    |               | 25.21      | 25.15      | 25.15                  | 25.19           | 25.25           | 25.43                | 25.43                |
| PCS      | 25      | 1851.25   | 24E           | 24.66      | 24.68      | 24.51                  | 24.66           | 24.56           | 24.44                | 24.35                |
|          | 600     | 1880      |               | 24.88      | 24.87      | 24.85                  | 24.89           | 24.88           | 24.64                | 24.57                |
|          | 1175    | 1908.75   |               | 24.57      | 24.58      | 24.62                  | 24.59           | 24.58           | 24.52                | 24.48                |

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

Table 12-2  
CDMA RF Conducted Powers with Hotspot Enabled

| Band     | Channel | Frequency | FCC Rule Part | TDSO SO32 [dBm] | TDSO SO32 [dBm] | 1x EvDO Rev. 0 [dBm] | 1x EvDO Rev. A [dBm] |
|----------|---------|-----------|---------------|-----------------|-----------------|----------------------|----------------------|
|          | F-RC    | MHz       |               | FCH+SCH         | FCH             | (RTAP)               | (RETAP)              |
| Cellular | 564     | 820.1     | 90S           | 22.46           | 22.45           | 22.79                | 22.75                |
|          | 1013    | 824.7     | 22H           | 23.10           | 23.09           | 23.37                | 23.28                |
|          | 384     | 836.52    |               | 23.11           | 23.10           | 23.43                | 23.27                |
|          | 777     | 848.31    |               | 23.23           | 23.25           | 23.49                | 23.47                |
| PCS      | 25      | 1851.25   | 24E           | 22.57           | 22.62           | 22.69                | 22.62                |
|          | 600     | 1880      |               | 22.55           | 22.60           | 22.73                | 22.70                |
|          | 1175    | 1908.75   |               | 22.59           | 22.59           | 22.83                | 22.79                |

Table 12-3  
Summary of CDMA Power Reduction with Hotspot Enabled

| Band     | Channel | Frequency | FCC Rule Part | TDSO SO32 [dBm] | TDSO SO32 [dBm] | 1x EvDO Rev. 0 [dBm] | 1x EvDO Rev. A [dBm] |
|----------|---------|-----------|---------------|-----------------|-----------------|----------------------|----------------------|
|          | F-RC    | MHz       |               | FCH+SCH         | FCH             | (RTAP)               | (RETAP)              |
| Cellular | 564     | 820.1     | 90S           | 2.09            | 2.13            | 2.03                 | 2.02                 |
|          | 1013    | 824.7     | 22H           | 2.13            | 2.14            | 1.89                 | 2.04                 |
|          | 384     | 836.52    |               | 2.19            | 2.25            | 2.03                 | 2.19                 |
|          | 777     | 848.31    |               | 1.96            | 2.00            | 1.90                 | 1.96                 |
| PCS      | 25      | 1851.25   | 24E           | 2.09            | 1.94            | 1.75                 | 1.73                 |
|          | 600     | 1880      |               | 2.34            | 2.28            | 1.91                 | 1.87                 |
|          | 1175    | 1908.75   |               | 2.00            | 1.99            | 1.69                 | 1.69                 |

|                                      |                                                                                                                                   |                                      |                                                                                       |                                        |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: ZNFLS696                     |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR COMPLIANCE REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                                                                         | <b>EUT Type:</b><br>Portable Handset |                                                                                       | Page 19 of 39                          |

Notes:

1. Per KDB Publication 941225 D01, Head SAR was tested with SO55 RC3. SO55 RC1 was not required since the average output power was not more than 0.25 dB higher than the SO55 RC3 powers.
2. Per KDB Publication 941225 D01, Body-Worn SAR was tested with TDSO32 FCH. EVDO and TDSO32 FCH+SCH SAR tests were not required since the average output power was not more than 0.25 dB higher than the TDSO32 FCH powers.
3. Per April 2011 TCB Workshop guidelines for power reduction, All hotspot SAR testing was performed at reduced power levels tuned by the manufacturer. Held-to Ear and Body-Worn SAR tests were evaluated at maximum output power levels. Please see Section 11.2.7 regarding Hotspot Power Reduction Mode.
4. Hotspot SAR was tested with EVDO Rev 0. EVDO Rev A SAR tests were not required since the average output power was not higher than the EVDO Rev. 0 powers; and TDSO32 SAR tests were not required since the average output power was not more than 0.25 dB higher than the EVDO Rev. 0 powers.
5. SO55 and SO75 powers are not applicable to Hotspot configurations and were not measured when Hotspot was enabled.
6. CDMA 1x Advanced SO75 power measurement was used with RC8 on the uplink and RC11 on the downlink.
7. CDMA 1X Advanced technology was not required for SAR since the maximum output powers for 1x Advanced was not more than 0.25 dB higher than the maximum measured powers for 1x and the measured SAR in any 1x mode exposure conditions was not greater than 1.2 W/kg. See Section 11.2.2 for 1x Advanced test set up.
8. For FCC Rule Part 90S, Per FCC KDB Publication 447498 6)c), only one channel is required since the transmission band is from 817.90 – 823.10 MHz.



**Figure 12-1**  
**Power Measurement Setup**

|                               |                                                                                     |                               |                                                                                       |                                 |
|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                  | EUT Type:<br>Portable Handset |                                                                                       | Page 20 of 39                   |

## 12.2 WLAN Conducted Powers

**Table 12-4**  
**IEEE 802.11b Average RF**  
**Power**

| Freq [MHz]  | Channel   | Data Rate [Mbps] | Average Power (dBm) |
|-------------|-----------|------------------|---------------------|
| 2412        | 1         | 1                | 14.15               |
|             |           | 2                | 14.01               |
|             |           | 5.5              | 14.72               |
|             |           | 11               | 14.52               |
| 2437        | 6         | 1                | 14.3                |
|             |           | 2                | 14.27               |
|             |           | 5.5              | 14.11               |
|             |           | 11               | 14.07               |
| <b>2462</b> | <b>11</b> | <b>1</b>         | <b>14.78</b>        |
|             |           | 2                | 14.04               |
|             |           | 5.5              | 14.38               |
|             |           | 11               | 14.45               |

**Table 12-5**  
**IEEE 802.11g Average RF**  
**Power**

| Freq [MHz] | Channel | Data Rate [Mbps] | Average Power (dBm) |
|------------|---------|------------------|---------------------|
| 2412       | 1       | 6                | 13.42               |
|            |         | 9                | 12.92               |
|            |         | 12               | 13.63               |
|            |         | 18               | 13.32               |
|            |         | 24               | 12.93               |
|            |         | 36               | 13.76               |
|            |         | 48               | 13.39               |
|            |         | 54               | 13.37               |
| 2437       | 6       | 6                | 13.38               |
|            |         | 9                | 13.39               |
|            |         | 12               | 12.45               |
|            |         | 18               | 13.49               |
|            |         | 24               | 12.15               |
|            |         | 36               | 13.75               |
|            |         | 48               | 13.62               |
|            |         | 54               | 13.49               |
| 2462       | 11      | 6                | 13.26               |
|            |         | 9                | 13.4                |
|            |         | 12               | 13.08               |
|            |         | 18               | 13.11               |
|            |         | 24               | 13.8                |
|            |         | 36               | 13.34               |
|            |         | 48               | 11.45               |
|            |         | 54               | 12.92               |

**Table 12-6**  
**IEEE 802.11n Average RF**  
**Power**

| Freq [MHz] | Channel | Data Rate [Mbps] | Average Power (dBm) |
|------------|---------|------------------|---------------------|
| 2412       | 1       | 6.5/7.2          | 12.75               |
|            |         | 13/14.40         | 10.75               |
|            |         | 19.5/21.70       | 12.65               |
|            |         | 26/28.90         | 11.02               |
|            |         | 29/43.3          | 11.07               |
|            |         | 52/57.80         | 10.59               |
|            |         | 58.50/65         | 10.71               |
|            |         | 65/72.2          | 10.36               |
| 2437       | 6       | 6.5/7.2          | 12.62               |
|            |         | 13/14.40         | 11.41               |
|            |         | 19.5/21.70       | 12.49               |
|            |         | 26/28.90         | 12.25               |
|            |         | 29/43.3          | 10.92               |
|            |         | 52/57.80         | 11.09               |
|            |         | 58.50/65         | 12.48               |
|            |         | 65/72.2          | 10.3                |
| 2462       | 11      | 6.5/7.2          | 10.88               |
|            |         | 13/14.40         | 10.64               |
|            |         | 19.5/21.70       | 12.14               |
|            |         | 26/28.90         | 12.19               |
|            |         | 29/43.3          | 10.26               |
|            |         | 52/57.80         | 11.69               |
|            |         | 58.50/65         | 10.29               |
|            |         | 65/72.2          | 10.36               |

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. IEEE 802.11 g/n modes were not investigated since the average output powers were not greater than 0.25 dB than that of the corresponding channel in the lowest data rate IEEE 802.11b mode.
- The bolded data rate and channel above were tested for SAR.



**Figure 12-2**  
**Power Measurement Setup**

|                                      |                                                                                                                                   |                                      |                                                                                                 |                                        |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: ZNFLS696                     |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR COMPLIANCE REPORT</b>         |  <b>LG</b> | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                                                                         | <b>EUT Type:</b><br>Portable Handset |                                                                                                 | Page 21 of 39                          |

## 13 FCC PERSONAL WIRELESS ROUTER CONFIGURATIONS

### 13.1 Personal Wireless Router Considerations

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.

### 13.2 SAR Test Setup for Personal Wireless Router Features

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.

### 13.3 Power Reduction for Portable Hotspot Mode

All Hotspot SAR testing was performed at reduced power tuned by the manufacturer. WIFI was disabled via a manufacturer software patch (not available to end-users) for all hotspot SAR testing to ensure a single transmitter was active during hotspot modes. The reduced powers were confirmed via conducted power measurements at the RF port when the user interface selection "Portable WIFI hotspot" was selected. Detailed description of the Hotspot power reduction implementation is included in the operational description. Powers are reduced immediately when hotspot is activated via the user interface. Powers will stay permanently reduced until hotspot is deactivated. This was confirmed prior to SAR tests.

|                               |                                                                                     |                               |                                                                                       |                                 |
|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                  | EUT Type:<br>Portable Handset |                                                                                       | Page 22 of 39                   |

## 13.4 SAR Test Configurations

**Table 13-1**  
**Mobile Hotspot Sides for SAR Testing**

| Mobile Hotspot Sides for SAR Testing |      |       |     |        |       |      |
|--------------------------------------|------|-------|-----|--------|-------|------|
| Mode                                 | Back | Front | Top | Bottom | Right | Left |
| Cell. CDMA –FCC Rule Part 90S        | Yes  | Yes   | No  | Yes    | Yes   | Yes  |
| Cell. CDMA –FCC Rule Part 22H        | Yes  | Yes   | No  | Yes    | Yes   | Yes  |
| PCS CDMA –FCC Rule Part 24E          | Yes  | Yes   | No  | Yes    | Yes   | Yes  |
| 2.4 GHz WLAN –FCC Rule Part 15C      | Yes  | Yes   | Yes | No     | No    | Yes  |

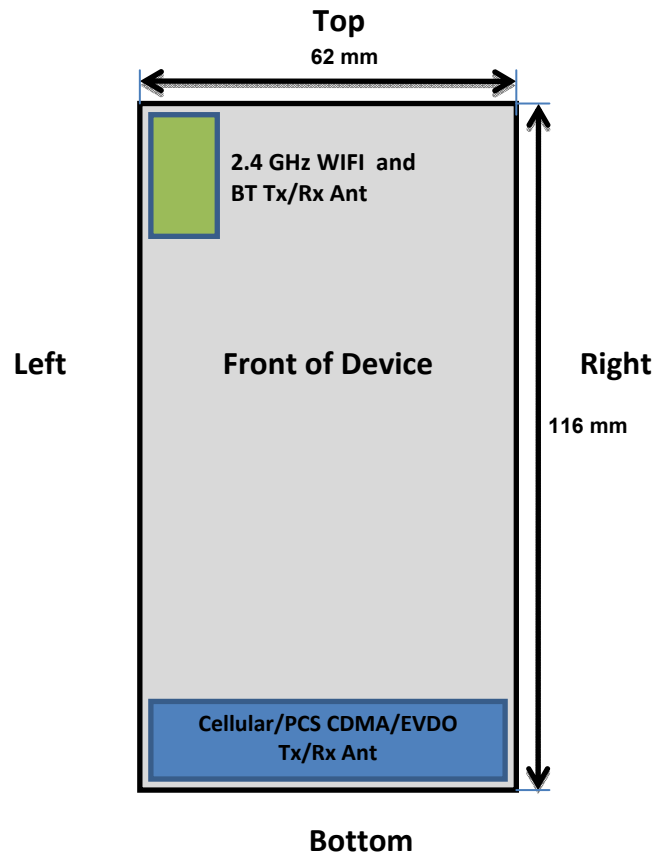


**Figure 13-1 Identification of Sides for SAR Testing**

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.

|                               |                                                                                                                                   |                               |                                                                                                 |                                 |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | SAR COMPLIANCE REPORT         |  <b>LG</b> | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                                                                | EUT Type:<br>Portable Handset |                                                                                                 | Page 23 of 39                   |

## 14 SYSTEM VERIFICATION

### 14.1 Tissue Verification

**Table 14-1**  
**Measured Tissue Properties**

| Tissue Type | Calibrated for Tests Performed on: | 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 $\epsilon$ |
|-------------|------------------------------------|-------------------------------------|--------------------------|---------------------------------------|------------------------------------------|-------------------------------------|----------------------------------------|----------------|------------------|
| 835H        | 11/28/2011                         | 22.8                                | 820                      | 0.867                                 | 41.82                                    | 0.898                               | 41.571                                 | -3.45%         | 0.60%            |
|             |                                    |                                     | 835                      | 0.881                                 | 41.47                                    | 0.900                               | 41.500                                 | -2.11%         | -0.07%           |
|             |                                    |                                     | 850                      | 0.889                                 | 41.25                                    | 0.916                               | 41.500                                 | -2.95%         | -0.60%           |
| 1900H       | 11/29/2011                         | 23.0                                | 1850                     | 1.352                                 | 39.06                                    | 1.400                               | 40.000                                 | -3.43%         | -2.35%           |
|             |                                    |                                     | 1880                     | 1.385                                 | 38.87                                    | 1.400                               | 40.000                                 | -1.07%         | -2.83%           |
|             |                                    |                                     | 1910                     | 1.422                                 | 38.88                                    | 1.400                               | 40.000                                 | 1.57%          | -2.80%           |
| 2450H       | 11/29/2011                         | 23.0                                | 2401                     | 1.825                                 | 38.93                                    | 1.758                               | 39.298                                 | 3.81%          | -0.94%           |
|             |                                    |                                     | 2450                     | 1.881                                 | 38.78                                    | 1.800                               | 39.200                                 | 4.50%          | -1.07%           |
|             |                                    |                                     | 2499                     | 1.941                                 | 38.52                                    | 1.852                               | 39.135                                 | 4.81%          | -1.57%           |
| 835B        | 11/30/2011                         | 23.1                                | 820                      | 0.949                                 | 54.15                                    | 0.969                               | 55.284                                 | -2.06%         | -2.05%           |
|             |                                    |                                     | 835                      | 0.974                                 | 53.81                                    | 0.970                               | 55.200                                 | 0.41%          | -2.52%           |
|             |                                    |                                     | 850                      | 0.983                                 | 53.76                                    | 0.988                               | 55.154                                 | -0.51%         | -2.53%           |
| 1900B       | 11/29/2011                         | 22.8                                | 1850                     | 1.459                                 | 52.43                                    | 1.520                               | 53.300                                 | -4.01%         | -1.63%           |
|             |                                    |                                     | 1880                     | 1.495                                 | 52.19                                    | 1.520                               | 53.300                                 | -1.64%         | -2.08%           |
|             |                                    |                                     | 1910                     | 1.537                                 | 52.20                                    | 1.520                               | 53.300                                 | 1.12%          | -2.06%           |
| 2450B       | 11/29/2011                         | 22.9                                | 2401                     | 1.967                                 | 50.77                                    | 1.903                               | 52.765                                 | 3.36%          | -3.78%           |
|             |                                    |                                     | 2450                     | 1.998                                 | 50.66                                    | 1.950                               | 52.700                                 | 2.46%          | -3.87%           |
|             |                                    |                                     | 2499                     | 2.089                                 | 50.33                                    | 2.019                               | 52.638                                 | 3.47%          | -4.38%           |

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.

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

|                                      |                                                                                                                                   |                                      |                                                                                                 |                                        |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: ZNFLS696                     |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR COMPLIANCE REPORT</b>         |  <b>LG</b> | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                                                                         | <b>EUT Type:</b><br>Portable Handset |                                                                                                 | Page 24 of 39                          |

### 14.3 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 14-2**  
**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        | 11/28/2011 | 24.5           | 22.8             | 0.100           | 4d047     | 3550     | 0.913                             | 9.530                               | 9.130                                   | -4.20%        |
| 1900                                     | Head        | 11/29/2011 | 23.9           | 22.4             | 0.100           | 502       | 3209     | 4.12                              | 40.200                              | 41.200                                  | 2.49%         |
| 2450                                     | Head        | 11/29/2011 | 22.8           | 21.0             | 0.020           | 797       | 3209     | 1.15                              | 53.300                              | 57.500                                  | 7.88%         |
| 835                                      | Body        | 11/30/2011 | 21.8           | 21.8             | 0.100           | 4d119     | 3209     | 0.89                              | 9.460                               | 8.900                                   | -5.92%        |
| 1900                                     | Body        | 11/29/2011 | 23.9           | 22.4             | 0.100           | 502       | 3209     | 4.3                               | 41.100                              | 43.000                                  | 4.62%         |
| 2450                                     | Body        | 11/29/2011 | 23.2           | 21.4             | 0.020           | 797       | 3209     | 1.11                              | 52.300                              | 55.500                                  | 6.12%         |

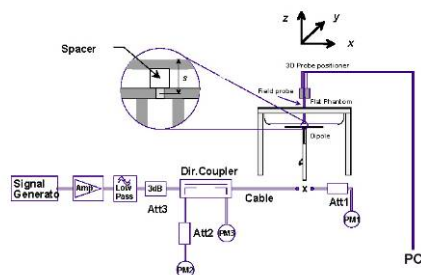


**Figure 14-1**  
**System Verification Setup Diagram**



**Figure 14-2**  
**System Verification Setup Photo**

|                               |                                                                                                                                   |                               |                                                                                                 |                                 |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | SAR COMPLIANCE REPORT         |  <b>LG</b> | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                                                                | EUT Type:<br>Portable Handset |                                                                                                 | Page 25 of 39                   |

## 15 SAR DATA SUMMARY

### 15.1 Head SAR Data

**Table 15-1**  
**Cell. CDMA - FCC Rule Part 90S Head SAR Results**

| MEASUREMENT RESULTS                                                                               |     |                                |                       |                  |                                                 |               |          |
|---------------------------------------------------------------------------------------------------|-----|--------------------------------|-----------------------|------------------|-------------------------------------------------|---------------|----------|
| FREQUENCY                                                                                         |     | Mode/Band                      | Conducted Power [dBm] | Power Drift [dB] | Side                                            | Test Position | SAR (1g) |
| MHz                                                                                               | Ch. |                                |                       |                  |                                                 |               | (W/kg)   |
| 820.10                                                                                            | 564 | Cell. CDMA - FCC Rule Part 90S | 24.60                 | -0.03            | Right                                           | Touch         | 0.676    |
| 820.10                                                                                            | 564 | Cell. CDMA - FCC Rule Part 90S | 24.60                 | 0.07             | Right                                           | Tilt          | 0.339    |
| 820.10                                                                                            | 564 | Cell. CDMA - FCC Rule Part 90S | 24.60                 | 0.21             | Left                                            | Touch         | 0.664    |
| 820.10                                                                                            | 564 | Cell. CDMA - FCC Rule Part 90S | 24.60                 | 0.00             | Left                                            | Tilt          | 0.394    |
| 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 15-2**  
**Cell. CDMA - FCC Rule Part 22H Head SAR Results**

| MEASUREMENT RESULTS                                                                               |      |                                |                       |                  |                                                 |               |          |
|---------------------------------------------------------------------------------------------------|------|--------------------------------|-----------------------|------------------|-------------------------------------------------|---------------|----------|
| FREQUENCY                                                                                         |      | Mode/Band                      | Conducted Power [dBm] | Power Drift [dB] | Side                                            | Test Position | SAR (1g) |
| MHz                                                                                               | Ch.  |                                |                       |                  |                                                 |               | (W/kg)   |
| 824.70                                                                                            | 1013 | Cell. CDMA - FCC Rule Part 22H | 25.27                 | 0.01             | Right                                           | Touch         | 0.660    |
| 836.52                                                                                            | 384  | Cell. CDMA - FCC Rule Part 22H | 25.49                 | -0.14            | Right                                           | Touch         | 0.851    |
| 848.31                                                                                            | 777  | Cell. CDMA - FCC Rule Part 22H | 25.15                 | -0.15            | Right                                           | Touch         | 0.791    |
| 836.52                                                                                            | 384  | Cell. CDMA - FCC Rule Part 22H | 25.49                 | -0.21            | Right                                           | Tilt          | 0.413    |
| 824.70                                                                                            | 1013 | Cell. CDMA - FCC Rule Part 22H | 25.27                 | 0.05             | Left                                            | Touch         | 0.682    |
| 836.52                                                                                            | 384  | Cell. CDMA - FCC Rule Part 22H | 25.49                 | 0.15             | Left                                            | Touch         | 0.821    |
| 848.31                                                                                            | 777  | Cell. CDMA - FCC Rule Part 22H | 25.15                 | -0.03            | Left                                            | Touch         | 0.732    |
| 836.52                                                                                            | 384  | Cell. CDMA - FCC Rule Part 22H | 25.49                 | -0.05            | Left                                            | Tilt          | 0.459    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |      |                                |                       |                  | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |               |          |

|                               |                                                                                                                            |                               |                                                                                          |                                 |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  PCTEST<br>ENGINEERING LABORATORY, INC. | SAR COMPLIANCE REPORT         |  LG | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                                                         | EUT Type:<br>Portable Handset |                                                                                          | Page 26 of 39                   |

**Table 15-3**  
**PCS CDMA - FCC Rule Part 24E 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 - FCC Rule Part 24E | 24.87                 | 0.06             | Right                                           | Touch         | 0.675    |
| 1880.00                                                                                           | 600 | PCS CDMA - FCC Rule Part 24E | 24.87                 | -0.02            | Right                                           | Tilt          | 0.462    |
| 1880.00                                                                                           | 600 | PCS CDMA - FCC Rule Part 24E | 24.87                 | -0.17            | Left                                            | Touch         | 0.791    |
| 1880.00                                                                                           | 600 | PCS CDMA - FCC Rule Part 24E | 24.87                 | 0.01             | Left                                            | Tilt          | 0.491    |
| 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 15-4**  
**2.4 GHz WLAN - FCC Rule Part 15C**

| MEASUREMENT RESULTS                                                                               |     |              |         |                       |                  |                                                 |               |                  |          |
|---------------------------------------------------------------------------------------------------|-----|--------------|---------|-----------------------|------------------|-------------------------------------------------|---------------|------------------|----------|
| FREQUENCY                                                                                         |     | Mode         | Service | Conducted Power [dBm] | Power Drift [dB] | Side                                            | Test Position | Data Rate (Mbps) | SAR (1g) |
| MHz                                                                                               | Ch. |              |         |                       |                  |                                                 |               |                  | (W/kg)   |
| 2462                                                                                              | 11  | IEEE 802.11b | DSSS    | 14.78                 | 0.20             | Right                                           | Touch         | 1                | 0.511    |
| 2462                                                                                              | 11  | IEEE 802.11b | DSSS    | 14.78                 | 0.14             | Right                                           | Tilt          | 1                | 0.210    |
| 2462                                                                                              | 11  | IEEE 802.11b | DSSS    | 14.78                 | 0.00             | Left                                            | Touch         | 1                | 0.203    |
| 2462                                                                                              | 11  | IEEE 802.11b | DSSS    | 14.78                 | -0.05            | Left                                            | Tilt          | 1                | 0.157    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population |     |              |         |                       |                  | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram |               |                  |          |

|                               |                                                                                     |                               |                                                                                       |                                 |
|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                  | EUT Type:<br>Portable Handset | Page 27 of 39                                                                         |                                 |

## 15.2 Body-Worn SAR Data

**Table 15-5**  
**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)   |
| 820.10                                   | 564  | Cell. CDMA - FCC Rule Part 90S | TDSO32  | 24.58                 | 0.00             | 1.5 cm               | back | 0.784    |
| 824.70                                   | 1013 | Cell. CDMA - FCC Rule Part 22H | TDSO32  | 25.23                 | 0.06             | 1.5 cm               | back | 0.774    |
| 836.52                                   | 384  | Cell. CDMA - FCC Rule Part 22H | TDSO32  | 25.35                 | 0.02             | 1.5 cm               | back | 0.991    |
| 848.31                                   | 777  | Cell. CDMA - FCC Rule Part 22H | TDSO32  | 25.25                 | -0.01            | 1.5 cm               | back | 0.861    |
| 1880.00                                  | 600  | PCS CDMA - FCC Rule Part 24E   | TDSO32  | 24.88                 | -0.04            | 1.5 cm               | back | 0.641    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |      |                                |         |                       |                  | Body                 |      |          |
| Spatial Peak                             |      |                                |         |                       |                  | 1.6 W/kg (mW/g)      |      |          |
| Uncontrolled Exposure/General Population |      |                                |         |                       |                  | averaged over 1 gram |      |          |

**Table 15-6**  
**WLAN Body-Worn SAR Results**

| MEASUREMENT RESULTS                                                                               |     |              |         |                       |                  |                                                 |                  |      |          |
|---------------------------------------------------------------------------------------------------|-----|--------------|---------|-----------------------|------------------|-------------------------------------------------|------------------|------|----------|
| FREQUENCY                                                                                         |     | Mode         | Service | Conducted Power [dBm] | Power Drift [dB] | Spacing                                         | Data Rate (Mbps) | Side | SAR (1g) |
| MHz                                                                                               | Ch. |              |         |                       |                  |                                                 |                  |      | (W/kg)   |
| 2462                                                                                              | 11  | IEEE 802.11b | DSSS    | 14.78                 | 0.00             | 1.5 cm                                          | 1                | back | 0.051    |
| 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: ZNFLS696              |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | SAR COMPLIANCE REPORT         |  |  |  <b>LG</b> | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                                                                | EUT Type:<br>Portable Handset |  |  | Page 28 of 39                                                                                   |                                 |

## 15.3 Hotspot SAR Data

**Table 15-7**  
**Licensed Transmitter Hotspot SAR Data – Back-off Active**

| MEASUREMENT RESULTS                      |      |                                |         |                      |                       |                  |                      |        |          |
|------------------------------------------|------|--------------------------------|---------|----------------------|-----------------------|------------------|----------------------|--------|----------|
| FREQUENCY                                |      | Mode                           | Service | Power Reduction [dB] | Conducted Power [dBm] | Power Drift [dB] | Spacing              | Side   | SAR (1g) |
| MHz                                      | Ch.  |                                |         |                      |                       |                  |                      |        | (W/kg)   |
| 820.10                                   | 564  | Cell. CDMA - FCC Rule Part 90S | EVDO    | 2                    | 22.79                 | -0.07            | 1.0 cm               | back   | 0.723    |
| 820.10                                   | 564  | Cell. CDMA - FCC Rule Part 90S | EVDO    | 2                    | 22.79                 | -0.06            | 1.0 cm               | front  | 0.396    |
| 820.10                                   | 564  | Cell. CDMA - FCC Rule Part 90S | EVDO    | 2                    | 22.79                 | 0.09             | 1.0 cm               | bottom | 0.058    |
| 820.10                                   | 564  | Cell. CDMA - FCC Rule Part 90S | EVDO    | 2                    | 22.79                 | -0.10            | 1.0 cm               | right  | 0.376    |
| 820.10                                   | 564  | Cell. CDMA - FCC Rule Part 90S | EVDO    | 2                    | 22.79                 | 0.01             | 1.0 cm               | left   | 0.295    |
| 824.70                                   | 1013 | Cell. CDMA - FCC Rule Part 22H | EVDO    | 2                    | 23.37                 | -0.03            | 1.0 cm               | back   | 0.793    |
| 836.52                                   | 384  | Cell. CDMA - FCC Rule Part 22H | EVDO    | 2                    | 23.43                 | -0.02            | 1.0 cm               | back   | 0.817    |
| 848.31                                   | 777  | Cell. CDMA - FCC Rule Part 22H | EVDO    | 2                    | 23.49                 | 0.18             | 1.0 cm               | back   | 0.779    |
| 836.52                                   | 384  | Cell. CDMA - FCC Rule Part 22H | EVDO    | 2                    | 23.43                 | 0.05             | 1.0 cm               | front  | 0.567    |
| 836.52                                   | 384  | Cell. CDMA - FCC Rule Part 22H | EVDO    | 2                    | 23.43                 | 0.16             | 1.0 cm               | bottom | 0.096    |
| 836.52                                   | 384  | Cell. CDMA - FCC Rule Part 22H | EVDO    | 2                    | 23.43                 | 0.10             | 1.0 cm               | right  | 0.565    |
| 836.52                                   | 384  | Cell. CDMA - FCC Rule Part 22H | EVDO    | 2                    | 23.43                 | -0.10            | 1.0 cm               | left   | 0.460    |
| 1880.00                                  | 600  | PCS CDMA - FCC Rule Part 24E   | EVDO    | 2                    | 22.73                 | -0.02            | 1.0 cm               | back   | 0.716    |
| 1880.00                                  | 600  | PCS CDMA - FCC Rule Part 24E   | EVDO    | 2                    | 22.73                 | 0.06             | 1.0 cm               | front  | 0.446    |
| 1880.00                                  | 600  | PCS CDMA - FCC Rule Part 24E   | EVDO    | 2                    | 22.73                 | 0.11             | 1.0 cm               | bottom | 0.493    |
| 1880.00                                  | 600  | PCS CDMA - FCC Rule Part 24E   | EVDO    | 2                    | 22.73                 | -0.06            | 1.0 cm               | right  | 0.281    |
| 1880.00                                  | 600  | PCS CDMA - FCC Rule Part 24E   | EVDO    | 2                    | 22.73                 | 0.13             | 1.0 cm               | left   | 0.267    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |      |                                |         |                      |                       |                  | Body                 |        |          |
| Spatial Peak                             |      |                                |         |                      |                       |                  | 1.6 W/kg (mW/g)      |        |          |
| Uncontrolled Exposure/General Population |      |                                |         |                      |                       |                  | averaged over 1 gram |        |          |

**Table 15-8**  
**WLAN Hotspot SAR Data**

| MEASUREMENT RESULTS                      |     |                                  |         |                       |                  |         |                      |       |          |
|------------------------------------------|-----|----------------------------------|---------|-----------------------|------------------|---------|----------------------|-------|----------|
| FREQUENCY                                |     | Mode                             | Service | Conducted Power [dBm] | Power Drift [dB] | Spacing | Data Rate (Mbps)     | Side  | SAR (1g) |
| MHz                                      | Ch. |                                  |         |                       |                  |         |                      |       | (W/kg)   |
| 2462                                     | 11  | 2.4 GHz WLAN - FCC Rule Part 15C | DSSS    | 14.78                 | -0.06            | 1.0 cm  | 1                    | back  | 0.125    |
| 2462                                     | 11  | 2.4 GHz WLAN - FCC Rule Part 15C | DSSS    | 14.78                 | 0.04             | 1.0 cm  | 1                    | front | 0.075    |
| 2462                                     | 11  | 2.4 GHz WLAN - FCC Rule Part 15C | DSSS    | 14.78                 | -0.21            | 1.0 cm  | 1                    | top   | 0.020    |
| 2462                                     | 11  | 2.4 GHz WLAN - FCC Rule Part 15C | DSSS    | 14.78                 | 0.08             | 1.0 cm  | 1                    | left  | 0.059    |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT    |     |                                  |         |                       |                  |         | Body                 |       |          |
| Spatial Peak                             |     |                                  |         |                       |                  |         | 1.6 W/kg (mW/g)      |       |          |
| Uncontrolled Exposure/General Population |     |                                  |         |                       |                  |         | averaged over 1 gram |       |          |

|                               |                                                                                     |                               |                                                                                       |                                 |
|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                  | EUT Type:<br>Portable Handset | Page 29 of 39                                                                         |                                 |

## 15.4 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. 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.
5. Device was tested using a fixed spacing for body-worn testing. A separation distance of 15 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.
6. 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.
7. The battery cover contains a near field communications (NFC) antenna, and is the only battery cover that comes with the device. All tests were performed using the standard NFC battery cover. The technical description contains detailed information about the near field communications antenna. As described in Operational Description, the device does not allow for any other battery cover to be used other than the one included with the device.

### CDMA Notes:

1. Justification for FCC Rule Part 22H and 24E reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration (left, right, cheek/touch, tilt/ear, extended and retracted) is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
2. Head SAR for CDMA2000 mode was tested under RC3/SO55 per KDB Publication 941225 D01.
3. CDMA 1X Advanced technology was not required for SAR since the maximum output powers for 1x Advanced was not more than 0.25 dB higher than the maximum measured powers for 1x and the measured SAR in any 1x mode exposure conditions was not greater than 1.2 W/kg. See Section 12.1.
4. Body-Worn SAR was tested under RC3/SO32 with FCH only since the maximum average output power of FCH+SCH and EVDO modes are not greater than 0.25 dB of the RC3/SO32 FCH only mode per KDB Publication 941225 D01.
5. Per FCC KDB Publication 941225 D01, CDMA Hotspot Body SAR was tested under EVDO Rev. 0 per FCC 3G Guidance (See Section 11.2.6). Rev. A and TDSO32 RC3 tests were not required since the maximum average output of each channel in Rev. A was not higher than that measured for Rev0; and RC3 (1x RTT) was not more than ¼ dB higher than that measured Rev 0.

|                               |                                                                                     |                               |                                                                                       |                                 |
|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                  | EUT Type:<br>Portable Handset |                                                                                       | Page 30 of 39                   |

**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 were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers were not greater than 0.25 dB than that of the corresponding channel in the lowest data rate IEEE 802.11b mode.
2. WLAN transmission was verified using a spectrum analyzer.

**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 13.4).
2. Bottom and Right Edges for the WLAN transmitter were not tested since the antenna distance from each edge was greater than 2.5 cm per FCC KDB Publication 941225 D06 (see Section 13.4).
3. Hotspot SAR testing was performed at reduced power tuned by the manufacturer (See Section 13.3). Reduced powers for Hotspot were used to meet internal SAR limits set by manufacturer, as described in the Operational Description.

|                                      |                                                                                     |                                      |                                                                                       |                                        |
|--------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> ZNFLS696              |  | <b>SAR COMPLIANCE REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                           | <b>EUT Type:</b><br>Portable Handset |                                                                                       | Page 31 of 39                          |

## 16 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

### 16.1 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.

### 16.2 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 16-1**  
**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> <ul style="list-style-type: none"> <li>when stand-alone 1-g SAR is not required and antenna is <math>\geq 5</math> cm from other antennas</li> </ul> <b>Licensed &amp; Unlicensed</b> <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> <b>SAR required:</b><br><u>Licensed &amp; Unlicensed</u> <p>antenna pairs with SAR to peak location separation ratio <math>\geq 0.3</math>; test is only required for the configuration that results in the highest SAR in stand-alone configuration for each wireless mode and exposure condition</p> <p><b>Note: simultaneous transmission exposure conditions for head and body can be different for different style phones; therefore, different test requirements may apply</b></p> |
| <b>Unlicensed Transmitters</b> | <p><u>When there is no simultaneous transmission –</u></p> <ul style="list-style-type: none"> <li>output <math>\leq 60</math> f: SAR not required</li> <li>output <math>&gt; 60</math> f: stand-alone SAR required</li> </ul> <p><u>When there is simultaneous transmission –</u></p> <p><u>Stand-alone SAR not required when</u></p> <ul style="list-style-type: none"> <li>output <math>\leq 2 \cdot P_{Ref}</math> and antenna is <math>\geq 5.0</math> cm from other antennas</li> <li>output <math>\leq P_{Ref}</math> and antenna is <math>\geq 2.5</math> cm from other antennas</li> <li>output <math>\leq P_{Ref}</math> and antenna is <math>&lt; 2.5</math> cm from other antennas, each with either output power <math>\leq P_{Ref}</math> or 1-g SAR <math>&lt; 1.2</math> W/kg</li> </ul> <p><u>Otherwise stand-alone SAR is required</u></p> <p><u>When stand-alone SAR is required</u></p> <ul style="list-style-type: none"> <li>test SAR on highest output channel for each wireless mode and exposure condition</li> <li>if SAR for highest output channel is <math>&gt; 50\%</math> of SAR limit, evaluate all channels according to normal procedures</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

**Figure 16-2**  
**SAR Evaluation Requirements for Multiple Transmitter Handsets**

### 16.3 Multiple Antenna/Transmission Information

The separation between the main antenna and the Bluetooth and WLAN antennas is 66.3 mm. RF Conducted Power of Bluetooth Tx is 2.624 mW. RF Conducted Power of WLAN is 30.06 mW.

Based on the output power, antenna separation distance and the Body SAR of the dominant transmitter, a stand-alone Bluetooth SAR test is not required while for WLAN it is required.

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

|                                      |                                                                                                                                   |                                      |                                                                                       |                                        |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: ZNFLS696                     |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR COMPLIANCE REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                                                                         | <b>EUT Type:</b><br>Portable Handset |                                                                                       | Page 32 of 39                          |

## 16.4 Head SAR Simultaneous Transmission Analysis

**Table 16-1**  
**Simultaneous Transmission Scenario (Held to Ear)**

| Simult Tx | Configuration | Cell. CDMA -<br>FCC Rule<br>Part 90S SAR<br>(W/kg) | 2.4 GHz<br>WIFI SAR<br>(W/kg) | $\Sigma$ SAR<br>(W /kg) |
|-----------|---------------|----------------------------------------------------|-------------------------------|-------------------------|
| Head SAR  | Right Cheek   | 0.676                                              | 0.511                         | <b>1.187</b>            |
|           | Right Tilt    | 0.339                                              | 0.210                         | 0.549                   |
|           | Left Cheek    | 0.664                                              | 0.203                         | 0.867                   |
|           | Left Tilt     | 0.394                                              | 0.157                         | 0.551                   |
| Simult Tx | Configuration | Cell. CDMA -<br>FCC Rule<br>Part 22H<br>SAR (W/kg) | 2.4 GHz<br>WIFI SAR<br>(W/kg) | $\Sigma$ SAR<br>(W /kg) |
| Head SAR  | Right Cheek   | 0.851                                              | 0.511                         | <b>1.362</b>            |
|           | Right Tilt    | 0.413                                              | 0.210                         | 0.623                   |
|           | Left Cheek    | 0.821                                              | 0.203                         | 1.024                   |
|           | Left Tilt     | 0.459                                              | 0.157                         | 0.616                   |
| Simult Tx | Configuration | PCS CDMA -<br>FCC Rule<br>Part 24E<br>SAR (W/kg)   | 2.4 GHz<br>WIFI SAR<br>(W/kg) | $\Sigma$ SAR<br>(W /kg) |
| Head SAR  | Right Cheek   | 0.675                                              | 0.511                         | <b>1.186</b>            |
|           | Right Tilt    | 0.462                                              | 0.210                         | 0.672                   |
|           | Left Cheek    | 0.791                                              | 0.203                         | 0.994                   |
|           | Left Tilt     | 0.491                                              | 0.157                         | 0.648                   |

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

## 16.5 Body-Worn Simultaneous Transmission Analysis

**Table 16-2**  
**Simultaneous Transmission Scenario (Body-Worn)**

| Configuration | Mode                           | 2G/3G SAR<br>(W/kg) | 2.4 GHz<br>WIFI SAR<br>(W/kg) | $\Sigma$ SAR<br>(W /kg) |
|---------------|--------------------------------|---------------------|-------------------------------|-------------------------|
| Back Side     | Cell. CDMA - FCC Rule Part 90S | 0.784               | 0.051                         | 0.835                   |
| Back Side     | Cell. CDMA - FCC Rule Part 22H | 0.991               | 0.051                         | <b>1.042</b>            |
| Back Side     | PCS CDMA - FCC Rule Part 24E   | 0.641               | 0.051                         | 0.692                   |

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

|                               |                                                                                     |                               |                                                                                       |                                 |
|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                  | EUT Type:<br>Portable Handset |                                                                                       | Page 33 of 39                   |

## 16.6 Hotspot SAR Simultaneous Transmission Analysis

**Table 16-3**  
**Simultaneous Transmission Scenario (Hotspot)**

| Simult Tx | Configuration | Cell. CDMA -<br>FCC Rule<br>Part 90S SAR<br>(W/kg) | 2.4 GHz<br>WIFI SAR<br>(W/kg) | $\Sigma$ SAR<br>(W /kg) |
|-----------|---------------|----------------------------------------------------|-------------------------------|-------------------------|
| Body SAR  | Back          | 0.723                                              | 0.125                         | <b>0.848</b>            |
|           | Front         | 0.396                                              | 0.075                         | 0.471                   |
|           | Top           | -                                                  | 0.020                         | 0.020                   |
|           | Bottom        | 0.058                                              | -                             | 0.058                   |
|           | Right         | 0.376                                              | -                             | 0.376                   |
|           | Left          | 0.295                                              | 0.059                         | 0.354                   |
| Simult Tx | Configuration | Cell. CDMA -<br>FCC Rule<br>Part 22H<br>SAR (W/kg) | 2.4 GHz<br>WIFI SAR<br>(W/kg) | $\Sigma$ SAR<br>(W /kg) |
| Body SAR  | Back          | 0.817                                              | 0.125                         | <b>0.942</b>            |
|           | Front         | 0.567                                              | 0.075                         | 0.642                   |
|           | Top           | -                                                  | 0.020                         | 0.020                   |
|           | Bottom        | 0.096                                              | -                             | 0.096                   |
|           | Right         | 0.565                                              | -                             | 0.565                   |
|           | Left          | 0.460                                              | 0.059                         | 0.519                   |
| Simult Tx | Configuration | PCS CDMA -<br>FCC Rule<br>Part 24E<br>SAR (W/kg)   | 2.4 GHz<br>WIFI SAR<br>(W/kg) | $\Sigma$ SAR<br>(W /kg) |
| Body SAR  | Back          | 0.716                                              | 0.125                         | <b>0.841</b>            |
|           | Front         | 0.446                                              | 0.075                         | 0.521                   |
|           | Top           | -                                                  | 0.020                         | 0.020                   |
|           | Bottom        | 0.493                                              | -                             | 0.493                   |
|           | Right         | 0.281                                              | -                             | 0.281                   |
|           | Left          | 0.267                                              | 0.059                         | 0.326                   |

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.

## 16.7 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: ZNFLS696                     |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR COMPLIANCE REPORT</b>         |  <b>LG</b> | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                                                                         | <b>EUT Type:</b><br>Portable Handset |                                                                                                 | Page 34 of 39                          |

# 17 EQUIPMENT LIST

| Manufacturer       | Model     | Description                                   | Cal Date   | Cal Interval | Cal Due    | Serial Number |
|--------------------|-----------|-----------------------------------------------|------------|--------------|------------|---------------|
| 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 Test Set              | 10/10/2011 | Annual       | 10/10/2012 | GB46110872    |
| Agilent            | E5515C    | Wireless Communications Test Set              | 7/6/2011   | Annual       | 7/6/2012   | GB41450275    |
| Agilent            | E8257D    | (250kHz-20GHz) Signal Generator               | 4/8/2011   | Annual       | 4/8/2012   | MY45470194    |
| 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           |
| Index SAR          | IXTL-030  | 30MM TEM line for 6 GHz                       | N/A        |              | N/A        | N/A           |
| Pasternack         | PE2208-6  | Bidirectional Coupler                         | N/A        |              | N/A        | N/A           |
| Pasternack         | PE2209-10 | Bidirectional Coupler                         | N/A        |              | N/A        | N/A           |
| Rohde & Schwarz    | CMU200    | Base Station Simulator                        | 6/1/2011   | Annual       | 6/1/2012   | 833855/0010   |
| Rohde & Schwarz    | CMU200    | Base Station Simulator                        | 4/19/2011  | Annual       | 4/19/2012  | 107826        |
| Rohde & Schwarz    | NRVD      | Dual Channel Power Meter                      | 4/8/2011   | Biennial     | 4/8/2013   | 101695        |
| SPEAG              | D1900V2   | 1900 MHz SAR Dipole                           | 2/17/2011  | Annual       | 2/17/2012  | 502           |
| SPEAG              | D2450V2   | 2450 MHz SAR Dipole                           | 2/8/2011   | Annual       | 2/8/2012   | 797           |
| SPEAG              | D835V2    | 835 MHz SAR Dipole                            | 2/9/2011   | Annual       | 2/9/2012   | 4d047         |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 2/21/2011  | Annual       | 2/21/2012  | 649           |
| SPEAG              | EX3DV4    | SAR Probe                                     | 2/14/2011  | Annual       | 2/14/2012  | 3550          |
| SPEAG              | DAE4      | Dasy Data Acquisition Electronics             | 5/19/2011  | Annual       | 5/19/2012  | 859           |
| SPEAG              | ES3DV3    | SAR Probe                                     | 4/18/2011  | Annual       | 4/18/2012  | 3209          |
| Rohde & Schwarz    | SMIQ03B   | Signal Generator                              | 4/6/2011   | Annual       | 4/6/2012   | DE27259       |
| Rohde & Schwarz    | CMW500    | LTE Radio Communication Tester                | 8/25/2011  | Annual       | 8/25/2012  | 100976        |
| Anritsu            | MA2481A   | Power Sensor                                  | 2/7/2011   | Annual       | 2/7/2012   | 5318          |
| Anritsu            | MA2481A   | Power Sensor                                  | 2/7/2011   | Annual       | 2/7/2012   | 5442          |
| Anritsu            | ML2438A   | Power Meter                                   | 2/7/2011   | Annual       | 2/7/2012   | 1190013       |
| Anritsu            | ML2438A   | Power Meter                                   | 2/7/2011   | Annual       | 2/7/2012   | 98150041      |
| Agilent            | 8648D     | Signal Generator                              | 4/5/2011   | Annual       | 4/5/2012   | 3629U00687    |
| Anritsu            | ML2438A   | Power Meter                                   | 2/7/2011   | Annual       | 2/7/2012   | 1070030       |
| Anritsu            | MA2481A   | Power Sensor                                  | 2/7/2011   | Annual       | 2/7/2012   | 5821          |
| Anritsu            | MA2481A   | Power Sensor                                  | 2/7/2011   | Annual       | 2/7/2012   | 8013          |
| Anritsu            | MA2481A   | Power Sensor                                  | 2/7/2011   | Annual       | 2/7/2012   | 5605          |
| Anritsu            | MA2481A   | Power Sensor                                  | 2/7/2011   | Annual       | 2/7/2012   | 2400          |
| Agilent            | E5515C    | Wireless Communications Test Set              | 7/6/2011   | Annual       | 7/6/2012   | GB43304447    |
| Agilent            | E5515C    | Wireless Communications Tester                | 4/21/2011  | Annual       | 4/21/2012  | US41140256    |
| Amplifier Research | SS1G4     | 5W, 800MHz-4.2GHz                             | N/A        |              | N/A        | 21910         |
| Mini-Circuits      | BW-N20W5+ | DC to 18 GHz Precision Fixed 20 dB Attenuator | N/A        |              | N/A        | N/A           |
| Agilent            | E5515C    | Wireless Communications Test Set              | 2/8/2011   | Annual       | 2/8/2012   | GB45360985    |
| 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     |
| 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                      | 5/26/2010  | Biennial     | 5/26/2012  | 101718589     |
| VWR                | 36934-158 | Wall-Mounted Thermometer                      | 1/21/2011  | Biennial     | 1/21/2013  | 111286454     |
| VWR                | 36934-158 | Wall-Mounted Thermometer                      | 2/26/2010  | Biennial     | 2/26/2012  | 101536273     |
| MiniCircuits       | SLP-2400+ | Low Pass Filter                               | N/A        |              | N/A        | R8979500903   |
| Narda              | 4772-3    | Attenuator (3dB)                              | N/A        |              | N/A        | 9406          |
| Narda              | BW-S3W2   | Attenuator (3dB)                              | N/A        |              | N/A        | 120           |
| Mini-Circuits      | NLP-2950+ | Low Pass Filter DC to 2700 MHz                | N/A        |              | N/A        | N/A           |
| Mini-Circuits      | NLP-1200+ | Low Pass Filter DC to 1000 MHz                | N/A        |              | N/A        | N/A           |
| SPEAG              | D835V2    | 835 MHz SAR Dipole                            | 7/8/2011   | Annual       | 7/8/2012   | 4d119         |
| Anritsu            | MT8820C   | Radio Communication Tester                    | 11/11/2011 | Annual       | 11/11/2012 | 6200901190    |

|                               |                                                                                     |                               |                                                                                       |                                 |
|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                  | EUT Type:<br>Portable Handset |                                                                                       | Page 35 of 39                   |

## 18 MEASUREMENT UNCERTAINTIES

Applicable for 750 – 3000 MHz.

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

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

|                                      |                                                                                                                                   |                                      |                                                                                                 |                                        |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------|
| FCC ID: ZNFS696                      |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | <b>SAR COMPLIANCE REPORT</b>         |  <b>LG</b> | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                                                                         | <b>EUT Type:</b><br>Portable Handset |                                                                                                 | Page 36 of 39                          |

## 19 CONCLUSION

### 19.1 Measurement Conclusion

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

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

|                                      |                                                                                     |                                      |                                                                                       |                                        |
|--------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> ZNFLS696              |  | <b>SAR COMPLIANCE REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                           | <b>EUT Type:</b><br>Portable Handset |                                                                                       | Page 37 of 39                          |

- [1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Aug. 1996.
- [2] ANSI/IEEE C95.1-2005, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300kHz to 100GHz, New York: IEEE, 2006.
- [3] ANSI/IEEE C95.1-1992, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300kHz to 100GHz, New York: IEEE, Sept. 1992.
- [4] ANSI/IEEE C95.3-2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, New York: IEEE, December 2002.
- [5] Federal Communications Commission, OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, June 2001.
- [6] IEEE Standards Coordinating Committee 34 – IEEE Std. 1528-2003, Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices.
- [7] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for RadioFrequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.
- [8] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.
- [9] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. 120-124.
- [10] K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.
- [11] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.
- [12] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Head Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.
- [13] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.
- [14] G. Hartsgrrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36.
- [15] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.
- [16] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.
- [17] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.

|                               |                                                                                     |                               |                                                                                       |                                 |
|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFLS696              |  | SAR COMPLIANCE REPORT         |  | Reviewed by:<br>Quality Manager |
| Filename:<br>0Y1111232031.ZNF | Test Dates:<br>11/28/11 - 11/30/11                                                  | EUT Type:<br>Portable Handset |                                                                                       | Page 38 of 39                   |

- [18] Federal Communications Commission, OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields. Supplement C, Dec. 1997.
- [19] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.
- [20] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.
- [21] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hochschule Zürich, Dosimetric Evaluation of the Cellular Phone.
- [22] IEC 62209-1, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz), Feb. 2005.
- [23] Industry Canada RSS-102 Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 4, March 2010.
- [24] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2009
- [25] FCC Public Notice DA-02-1438. Office of Engineering and Technology Announces a Transition Period for the Phantom Requirements of Supplement C to OET Bulletin 65, June 19, 2002
- [26] FCC SAR Measurement Procedures for 3G Devices KDB Publication 941225
- [27] SAR Measurement procedures for IEEE 802.11a/b/g KDB Publication 248227
- [28] FCC SAR Considerations for Handsets with Multiple Transmitters and Antennas, KDB Publication 648474
- [29] FCC Application Note for SAR Probe Calibration and System Verification Consideration for Measurements at 150 MHz – 3 GHz, KDB Publication 450824
- [30] FCC SAR Evaluation Considerations for Laptop Computers with Antennas Built-in on Display Screens, KDB Publication 616217
- [31] FCC SAR Measurement Requirements for 3 – 6 GHz, KDB Publication 865664
- [32] FCC Mobile Portable RF Exposure Procedure, KDB Publication 447498
- [33] FCC SAR Procedures for Dongle Transmitters, KDB Publication 447498
- [34] Anexo à Resolução No. 533, de 10 de Setembro de 2009.
- [35] FCC SAR Test Considerations for LTE Handsets and Data Modems, KDB Publication 941225.
- [36] IEC 62209-2, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz), Mar. 2010.
- [37] FCC Hot Spot SAR v01, KDB Publication 941225 D06.

|                                      |                                                                                     |                                      |                                                                                       |                                        |
|--------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> ZNFLS696              |  | <b>SAR COMPLIANCE REPORT</b>         |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Filename:</b><br>0Y1111232031.ZNF | <b>Test Dates:</b><br>11/28/11 - 11/30/11                                           | <b>EUT Type:</b><br>Portable Handset |                                                                                       | Page 39 of 39                          |

## APPENDIX A: SAR TEST DATA

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

Communication System: Cellular CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used (interpolated):

$f = 820.1 \text{ MHz}$ ;  $\sigma = 0.867 \text{ mho/m}$ ;  $\epsilon_r = 41.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-28-2011; Ambient Temp: 24.5 °C ; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(8.04, 8.04, 8.04); Calibrated: 2/14/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/21/2011

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, Part 90S, Right Head, Touch, Mid.ch**

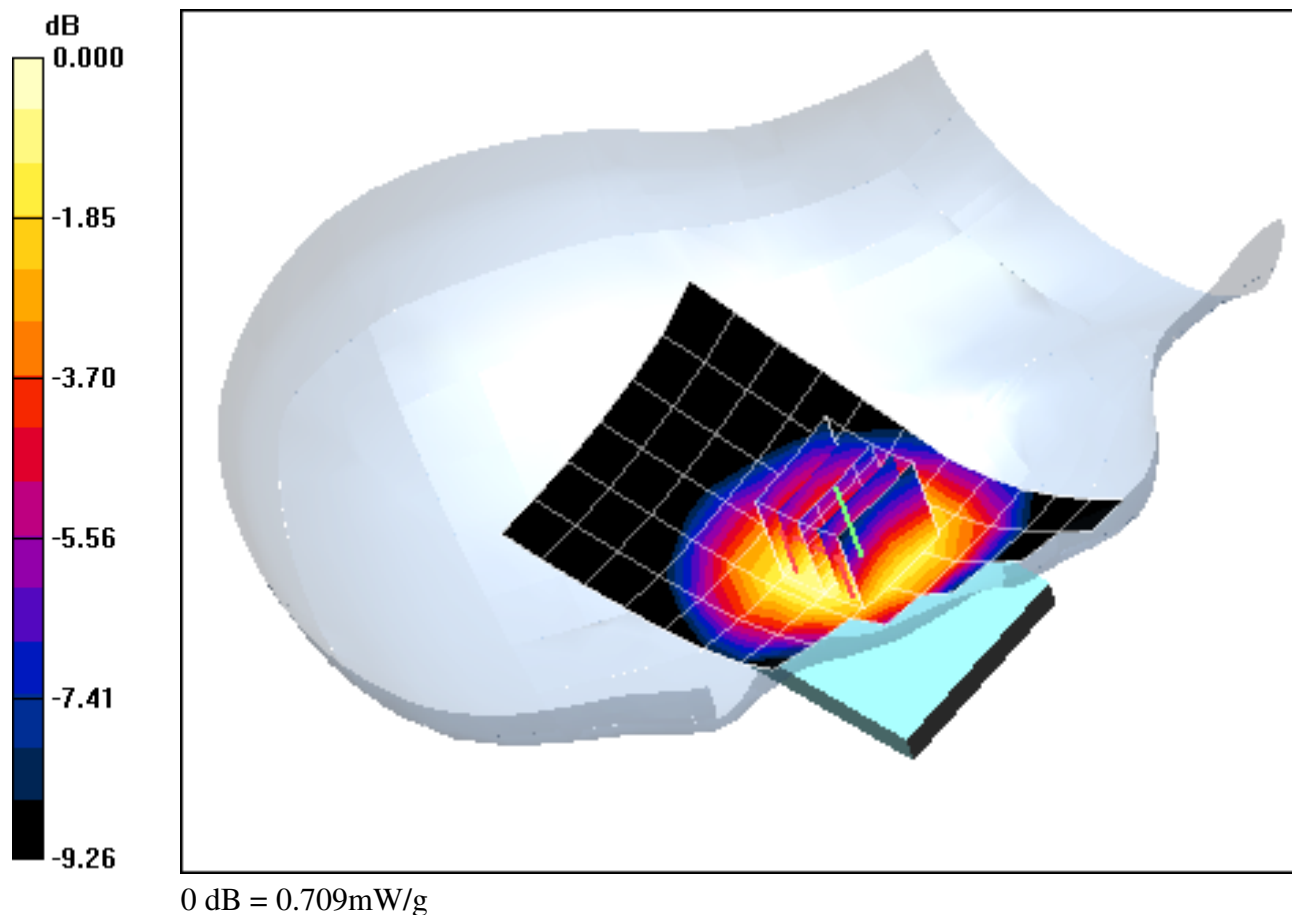
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 29.0 V/m; Power Drift = -0.028 dB

Peak SAR (extrapolated) = 0.838 W/kg

**SAR(1 g) = 0.676 mW/g; SAR(10 g) = 0.514 mW/g**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

Communication System: Cellular CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used (interpolated):

$f = 820.1 \text{ MHz}$ ;  $\sigma = 0.867 \text{ mho/m}$ ;  $\epsilon_r = 41.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-28-2011; Ambient Temp: 24.5 °C ; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(8.04, 8.04, 8.04); Calibrated: 2/14/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/21/2011

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, Part 90S, Right Head, Tilt, Mid.ch**

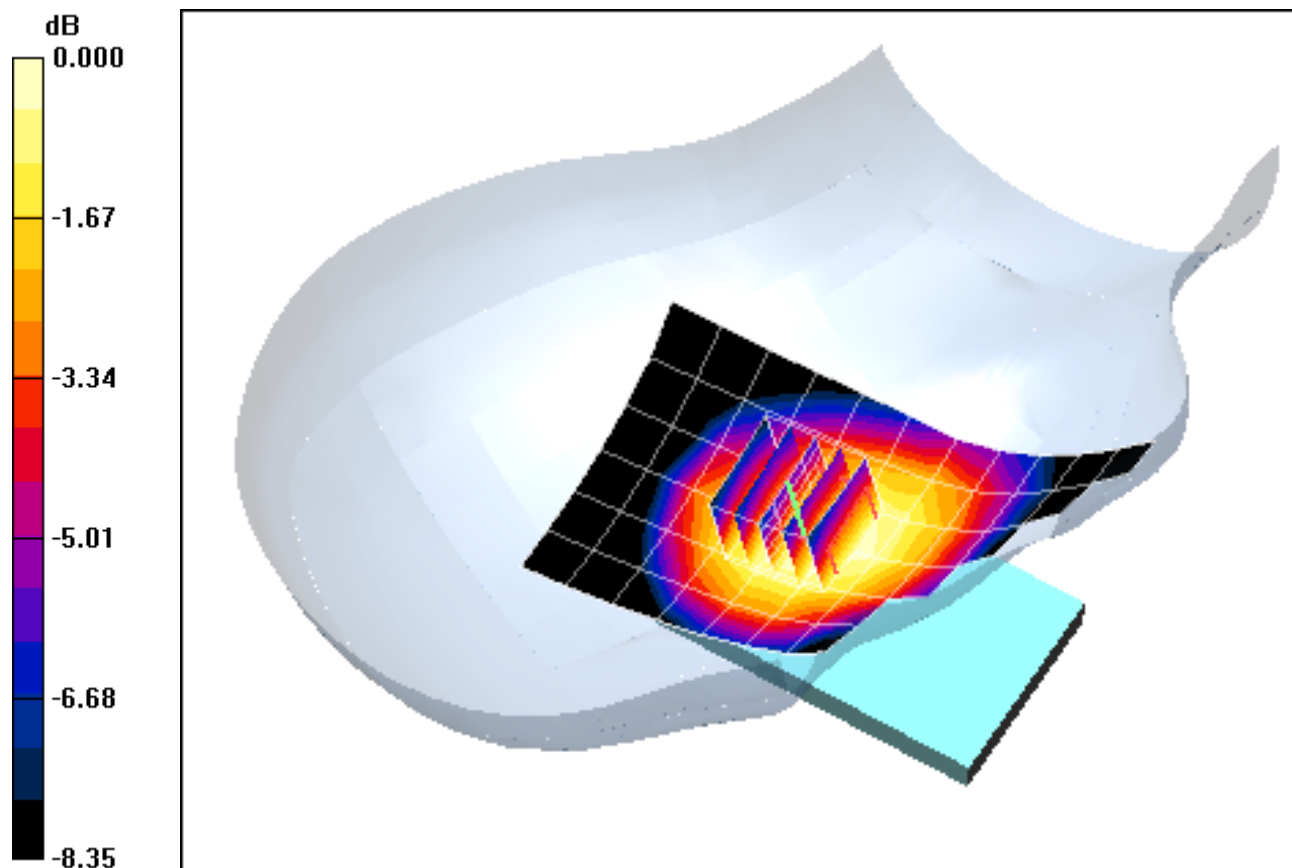
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 20.7 V/m; Power Drift = 0.068 dB

Peak SAR (extrapolated) = 0.413 W/kg

**SAR(1 g) = 0.339 mW/g; SAR(10 g) = 0.264 mW/g**



0 dB = 0.355mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

Communication System: Cellular CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used (interpolated):

$f = 820.1 \text{ MHz}$ ;  $\sigma = 0.867 \text{ mho/m}$ ;  $\epsilon_r = 41.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-28-2011; Ambient Temp: 24.5 °C ; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(8.04, 8.04, 8.04); Calibrated: 2/14/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/21/2011

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, Part 90S, Left Head, Touch, Mid.ch**

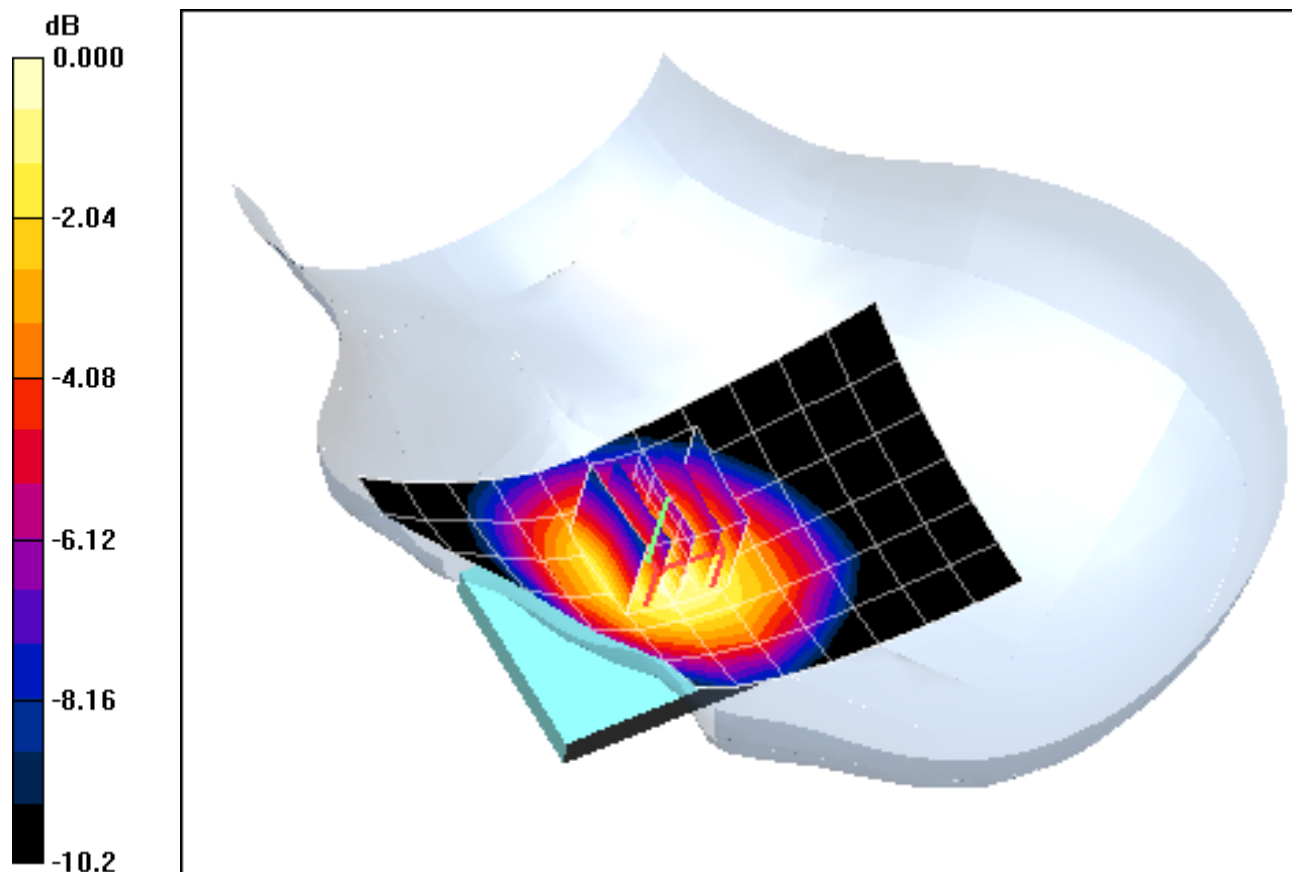
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 6.64 V/m; Power Drift = 0.213 dB

Peak SAR (extrapolated) = 0.818 W/kg

**SAR(1 g) = 0.664 mW/g; SAR(10 g) = 0.495 mW/g**



0 dB = 0.696mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

Communication System: Cellular CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used (interpolated):

$f = 820.1 \text{ MHz}$ ;  $\sigma = 0.867 \text{ mho/m}$ ;  $\epsilon_r = 41.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-28-2011; Ambient Temp: 24.5 °C ; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(8.04, 8.04, 8.04); Calibrated: 2/14/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/21/2011

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, Part 90S, Left Head, Tilt, Mid.ch**

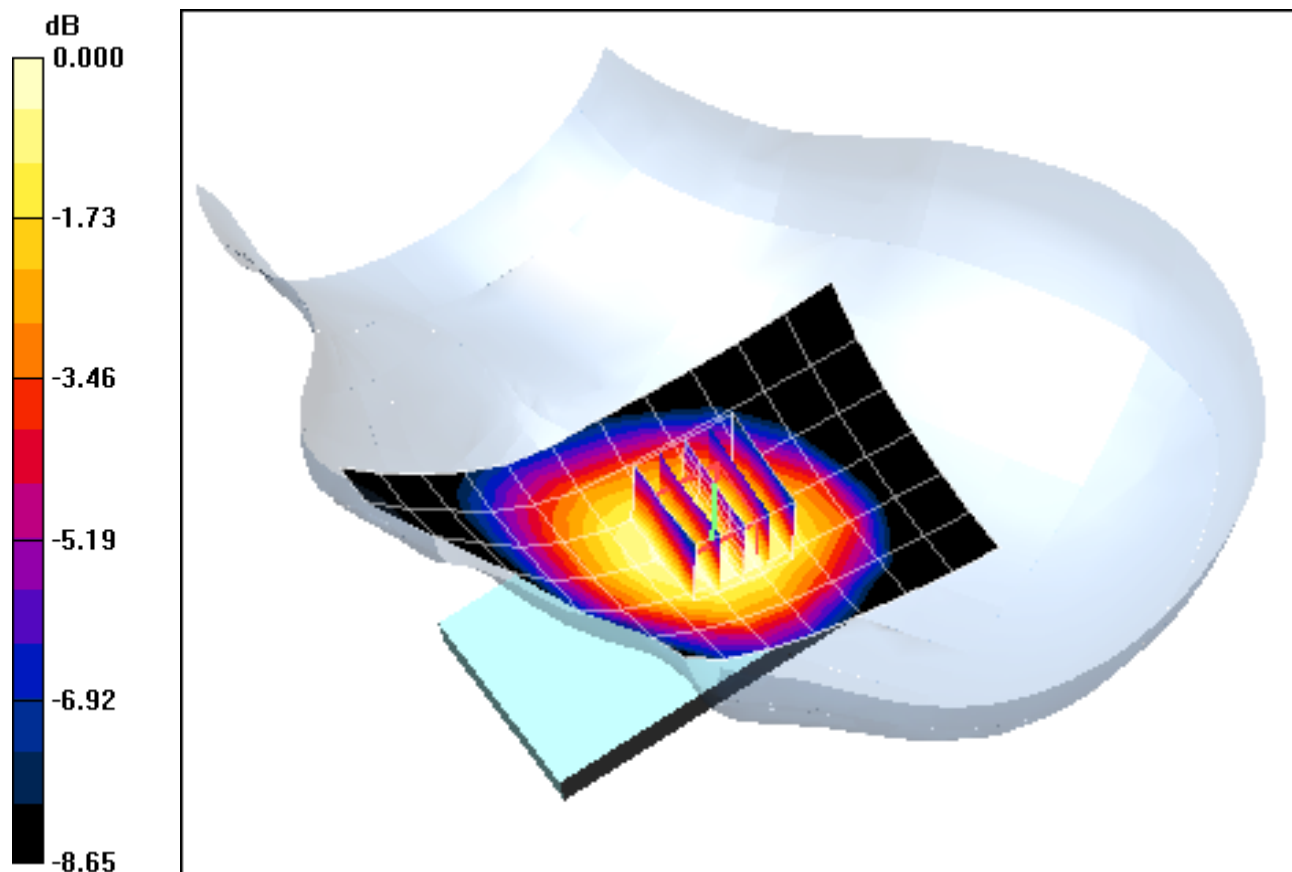
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 13.2 V/m; Power Drift = 0.001 dB

Peak SAR (extrapolated) = 0.474 W/kg

**SAR(1 g) = 0.394 mW/g; SAR(10 g) = 0.310 mW/g**



0 dB = 0.407mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; 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):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.882 \text{ mho/m}$ ;  $\epsilon_r = 41.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-28-2011; Ambient Temp: 24.5 °C ; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(8.04, 8.04, 8.04); Calibrated: 2/14/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/21/2011

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, Part 22H, Right Head, Touch, Mid.ch**

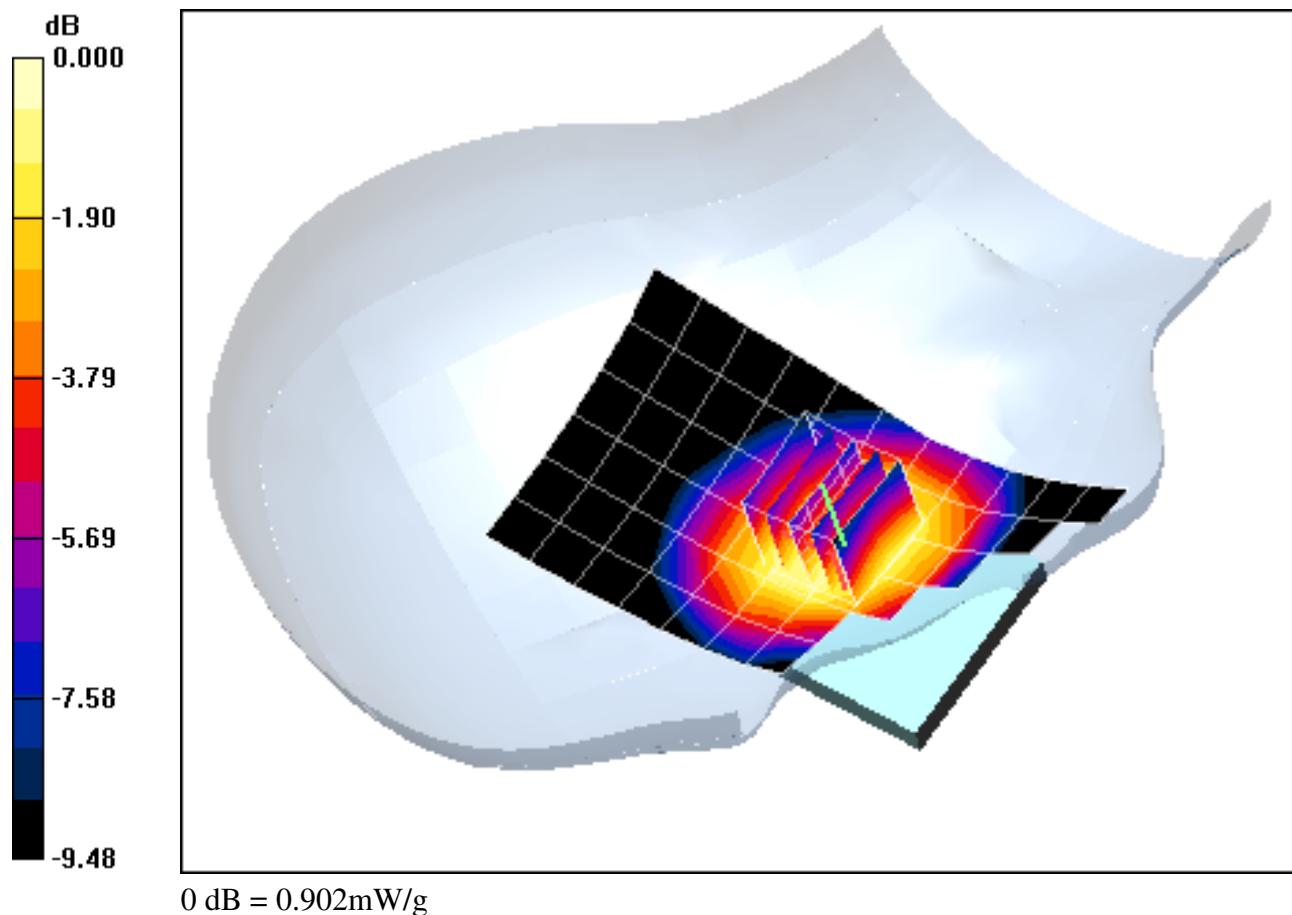
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 32.7 V/m; Power Drift = -0.141 dB

Peak SAR (extrapolated) = 1.05 W/kg

**SAR(1 g) = 0.851 mW/g; SAR(10 g) = 0.640 mW/g**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; 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):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.882 \text{ mho/m}$ ;  $\epsilon_r = 41.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-28-2011; Ambient Temp: 24.5 °C ; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(8.04, 8.04, 8.04); Calibrated: 2/14/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/21/2011

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, Part 22H, Right Head, Tilt, Mid.ch**

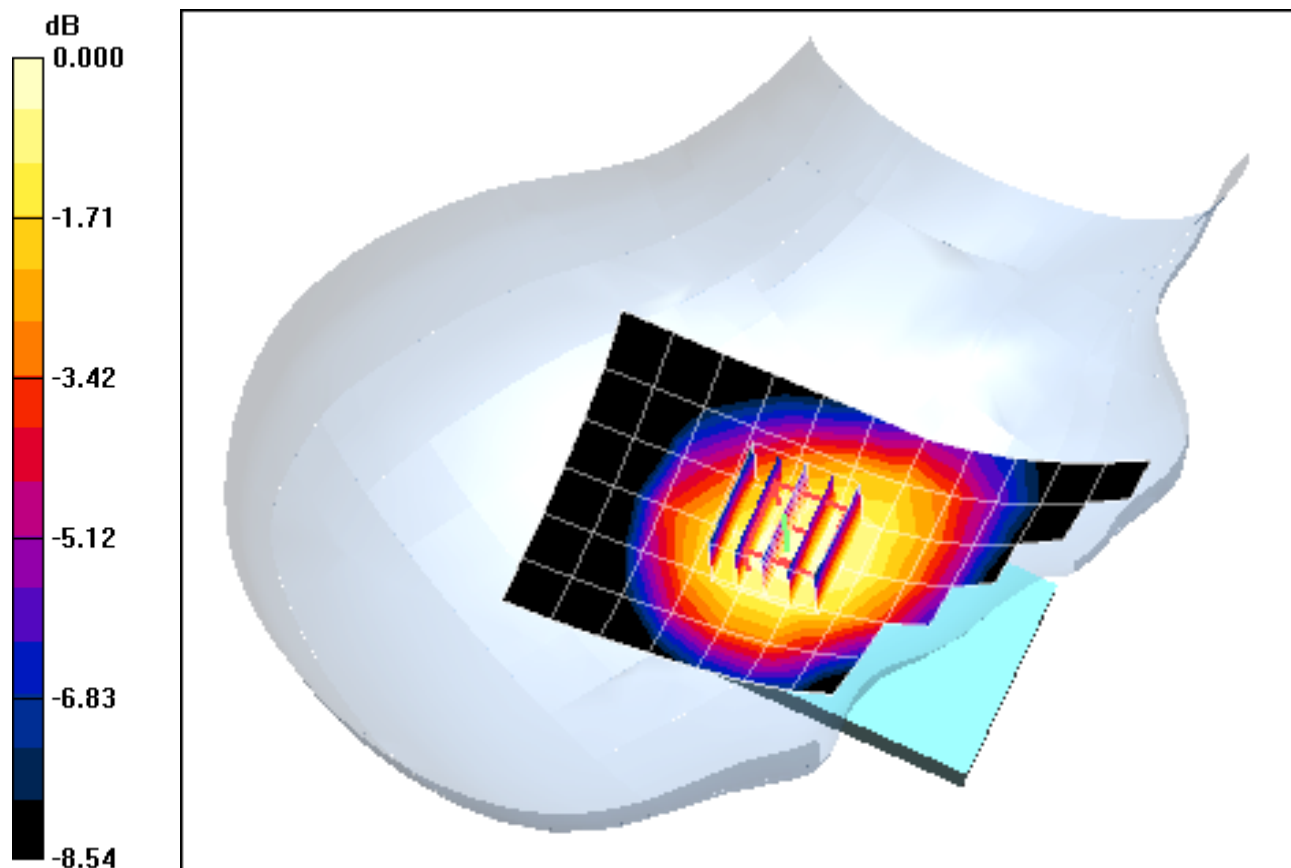
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 22.8 V/m; Power Drift = -0.205 dB

Peak SAR (extrapolated) = 0.500 W/kg

**SAR(1 g) = 0.413 mW/g; SAR(10 g) = 0.318 mW/g**



0 dB = 0.435mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; 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):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.882 \text{ mho/m}$ ;  $\epsilon_r = 41.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-28-2011; Ambient Temp: 24.5 °C ; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(8.04, 8.04, 8.04); Calibrated: 2/14/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/21/2011

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, Part 22H, Left Head, Touch, Mid.ch**

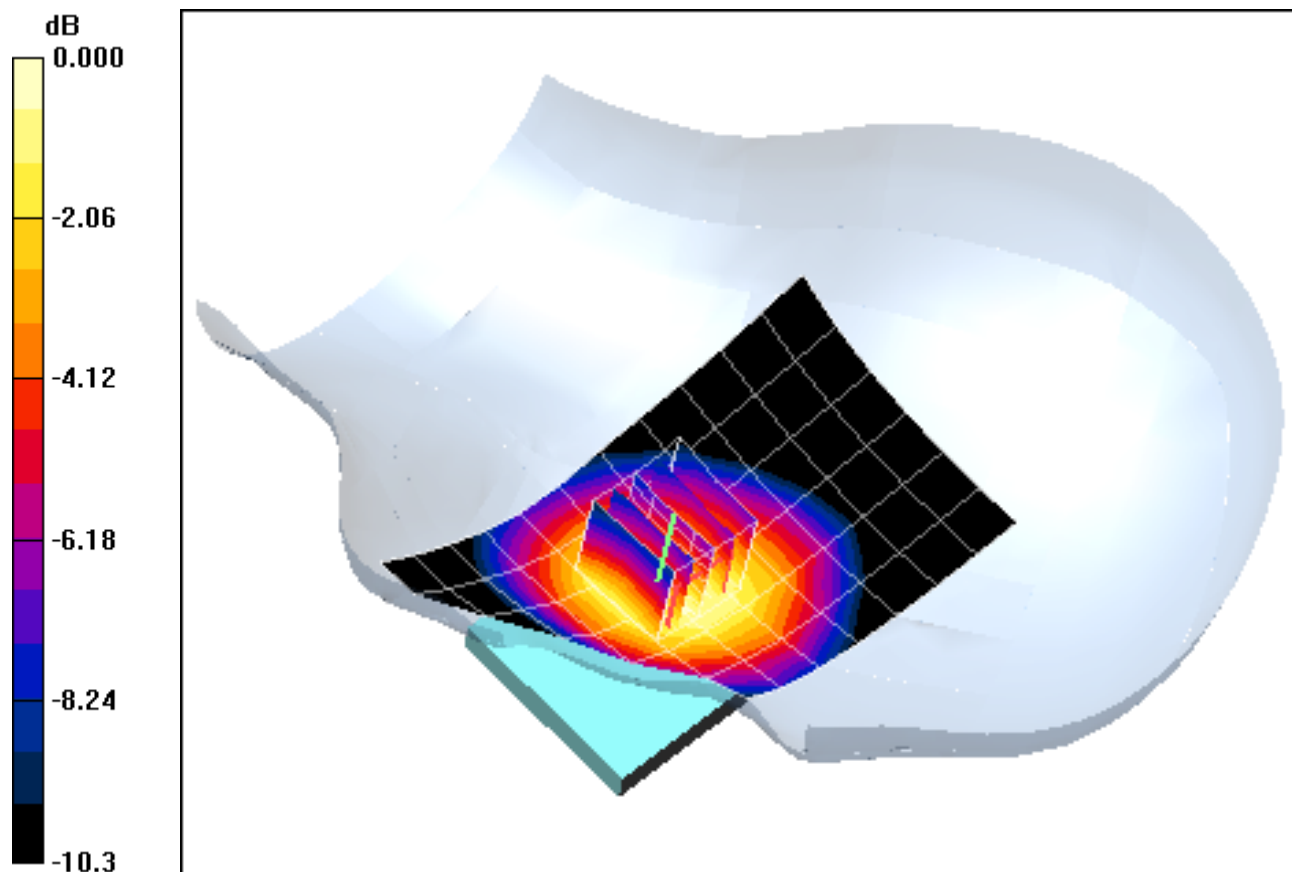
**Area Scan (7x14x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 7.68 V/m; Power Drift = 0.147 dB

Peak SAR (extrapolated) = 1.01 W/kg

**SAR(1 g) = 0.821 mW/g; SAR(10 g) = 0.613 mW/g**



0 dB = 0.864mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; 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):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.882 \text{ mho/m}$ ;  $\epsilon_r = 41.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-28-2011; Ambient Temp: 24.5 °C ; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(8.04, 8.04, 8.04); Calibrated: 2/14/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/21/2011

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, Part 22H, Left Head, Tilt, Mid.ch**

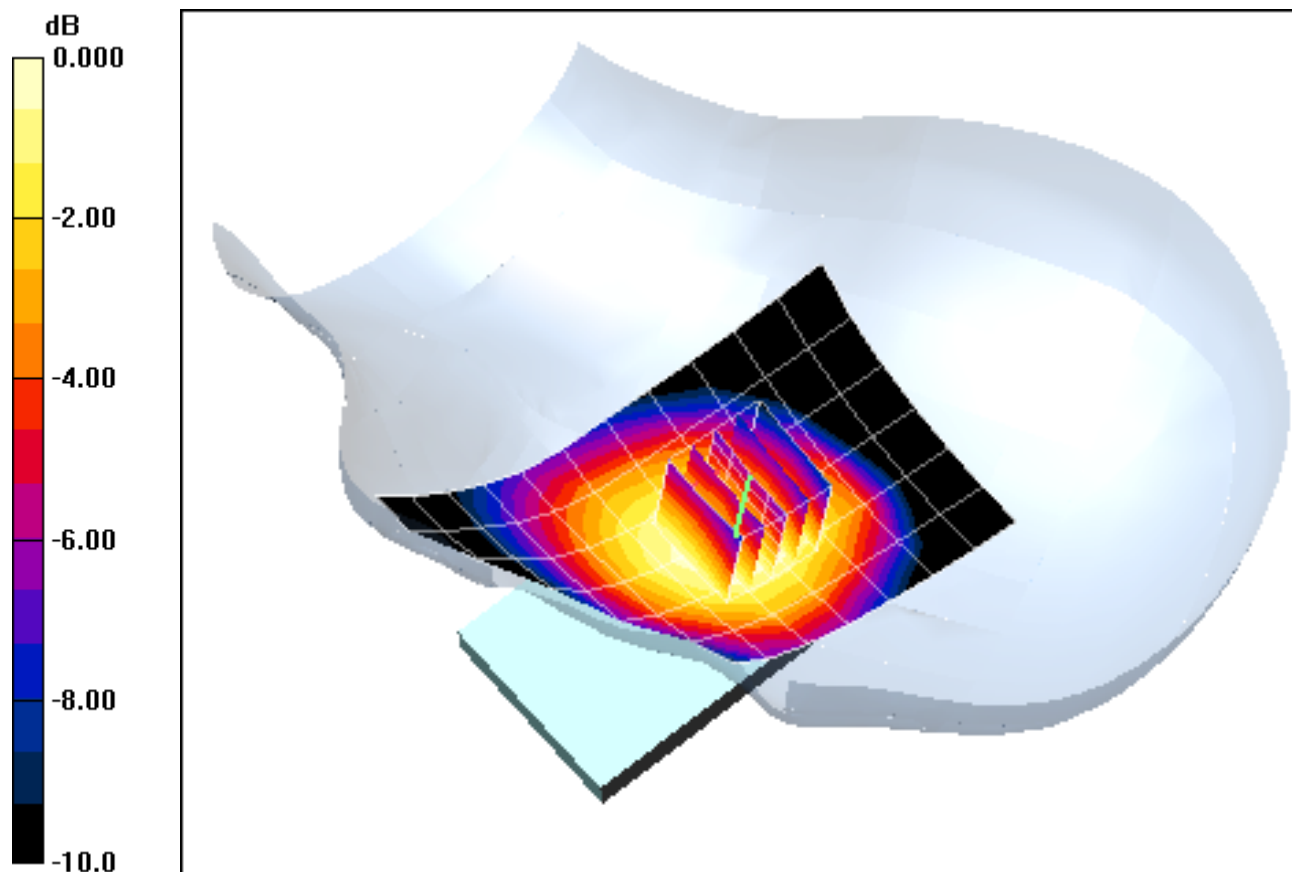
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 13.5 V/m; Power Drift = -0.054 dB

Peak SAR (extrapolated) = 0.562 W/kg

**SAR(1 g) = 0.459 mW/g; SAR(10 g) = 0.355 mW/g**



0 dB = 0.479mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.39 \text{ mho/m}$ ;  $\epsilon_r = 38.88$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-29-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.4 °C

Probe: ES3DV3 - SN3209; ConvF(5.11, 5.11, 5.11); Calibrated: 4/18/2011

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, Part 24E, Right Head, Touch, Mid.ch**

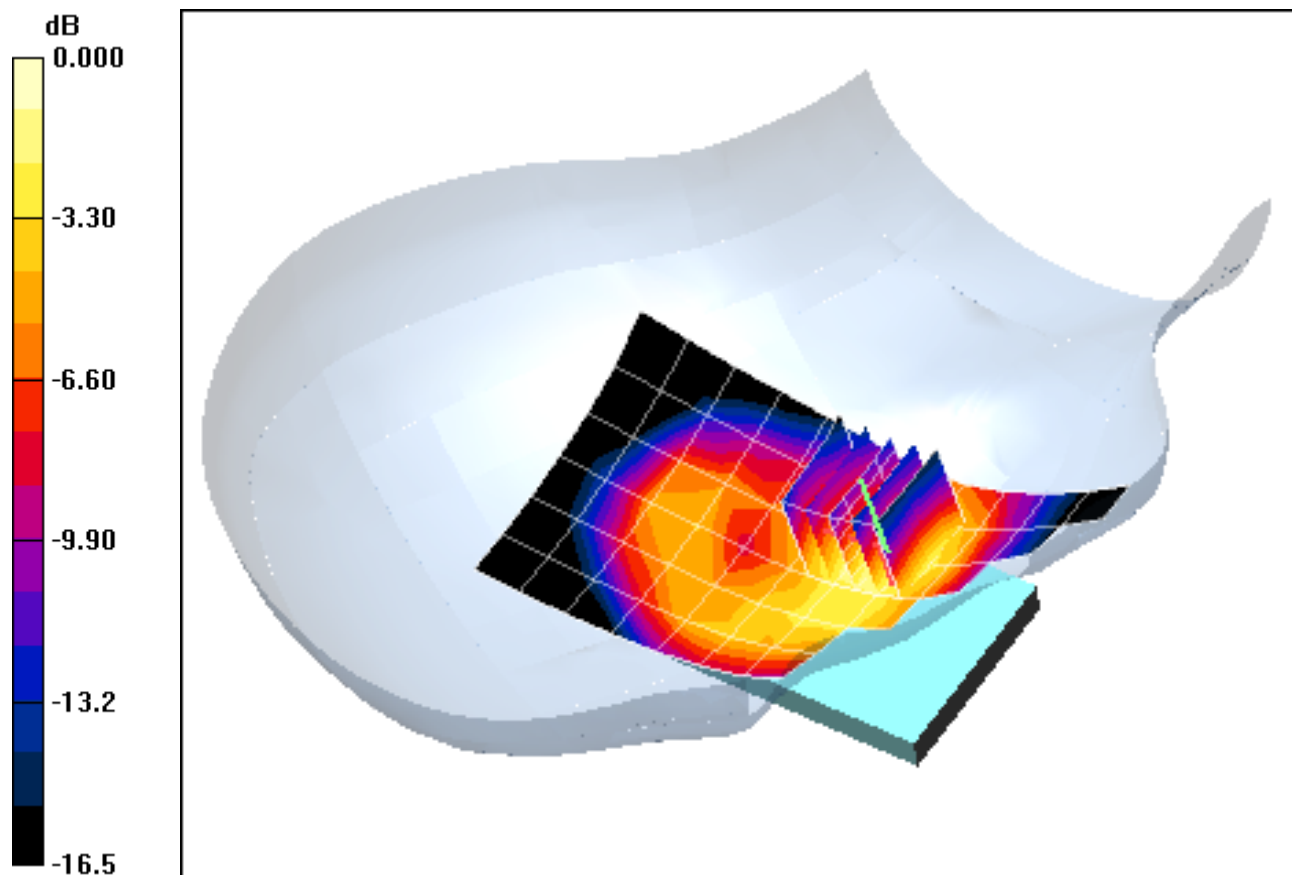
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 23.3 V/m; Power Drift = 0.055 dB

Peak SAR (extrapolated) = 1.05 W/kg

**SAR(1 g) = 0.675 mW/g; SAR(10 g) = 0.412 mW/g**



0 dB = 0.741mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.39 \text{ mho/m}$ ;  $\epsilon_r = 38.88$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-29-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.4 °C

Probe: ES3DV3 - SN3209; ConvF(5.11, 5.11, 5.11); Calibrated: 4/18/2011

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, Part 24E, Right Head, Tilt, Mid.ch**

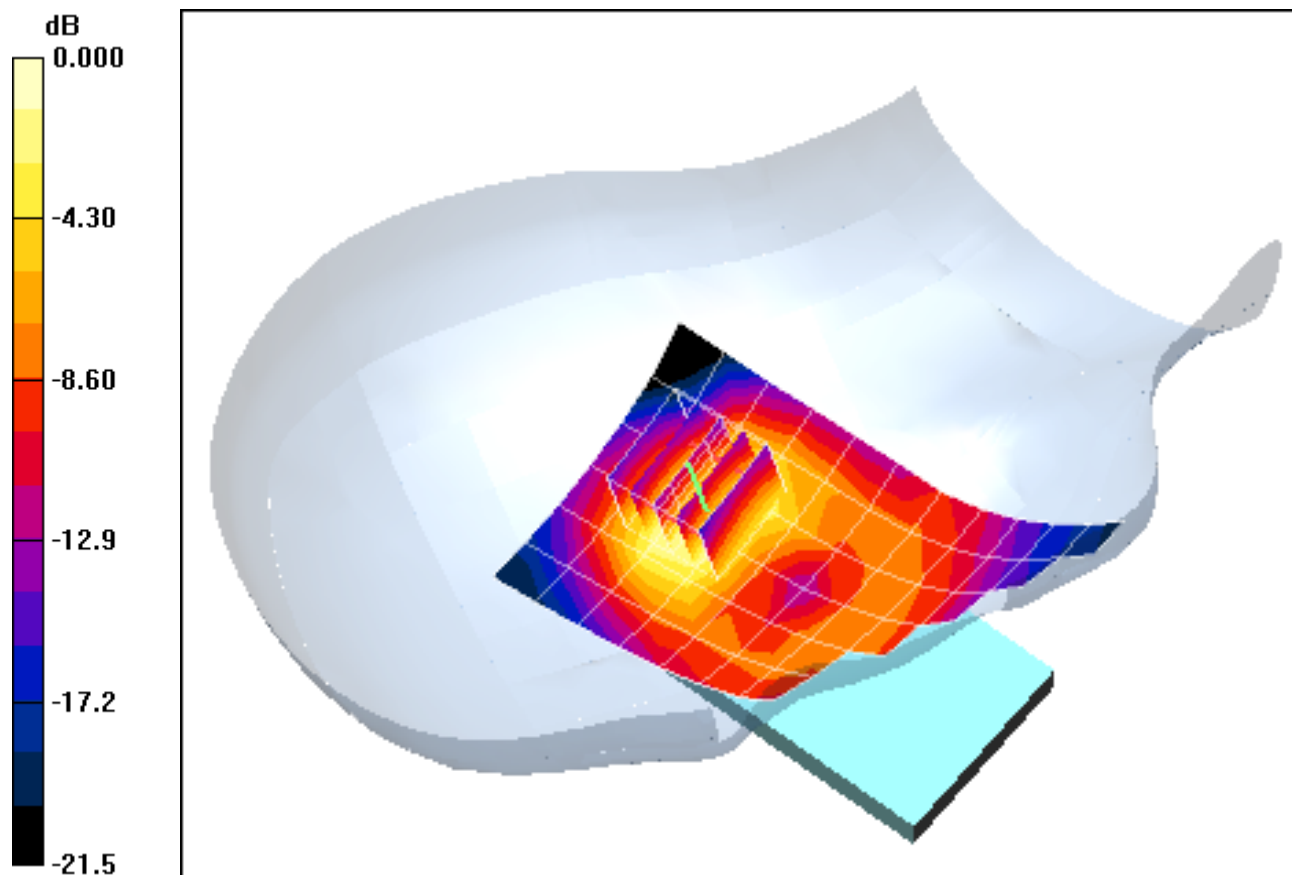
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 19.2 V/m; Power Drift = -0.020 dB

Peak SAR (extrapolated) = 0.762 W/kg

**SAR(1 g) = 0.462 mW/g; SAR(10 g) = 0.265 mW/g**



0 dB = 0.503mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.39 \text{ mho/m}$ ;  $\epsilon_r = 38.88$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-29-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.4 °C

Probe: ES3DV3 - SN3209; ConvF(5.11, 5.11, 5.11); Calibrated: 4/18/2011

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, Part 24E, Left Head, Touch, Mid.ch**

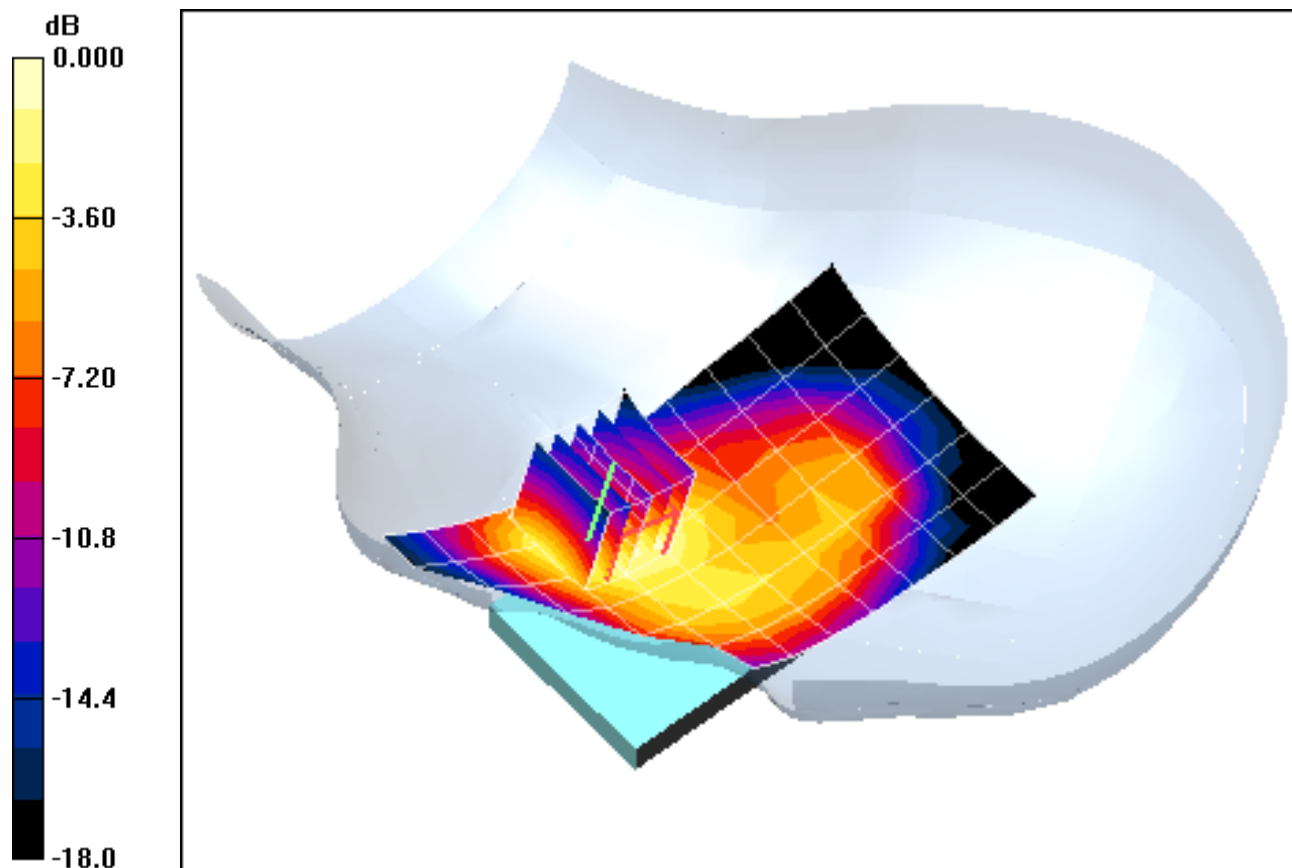
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 25.0 V/m; Power Drift = -0.169 dB

Peak SAR (extrapolated) = 1.30 W/kg

**SAR(1 g) = 0.791 mW/g; SAR(10 g) = 0.460 mW/g**



0 dB = 0.843mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.39 \text{ mho/m}$ ;  $\epsilon_r = 38.88$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-29-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.4 °C

Probe: ES3DV3 - SN3209; ConvF(5.11, 5.11, 5.11); Calibrated: 4/18/2011

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, Part 24E, Left Head, Tilt, Mid.ch**

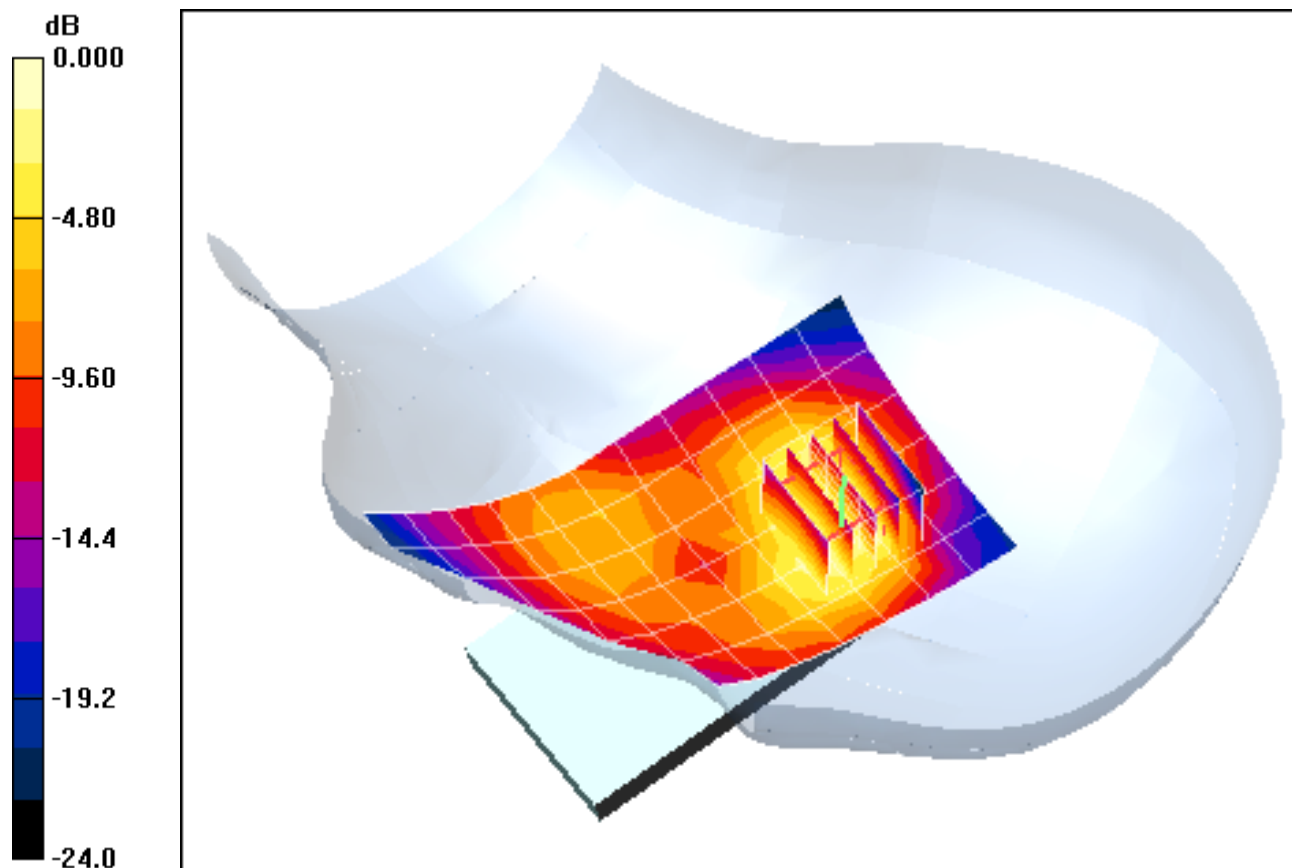
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 19.6 V/m; Power Drift = 0.012 dB

Peak SAR (extrapolated) = 0.809 W/kg

**SAR(1 g) = 0.491 mW/g; SAR(10 g) = 0.286 mW/g**



0 dB = 0.532mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 2450 Head; Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 1.896 \text{ mho/m}$ ;  $\epsilon_r = 38.72$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-29-2011; Ambient Temp: 22.8 °C; Tissue Temp: 21.0 °C

Probe: ES3DV3 - SN3209; ConvF(4.52, 4.52, 4.52); Calibrated: 4/18/2011

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 11, 1 Mbps**

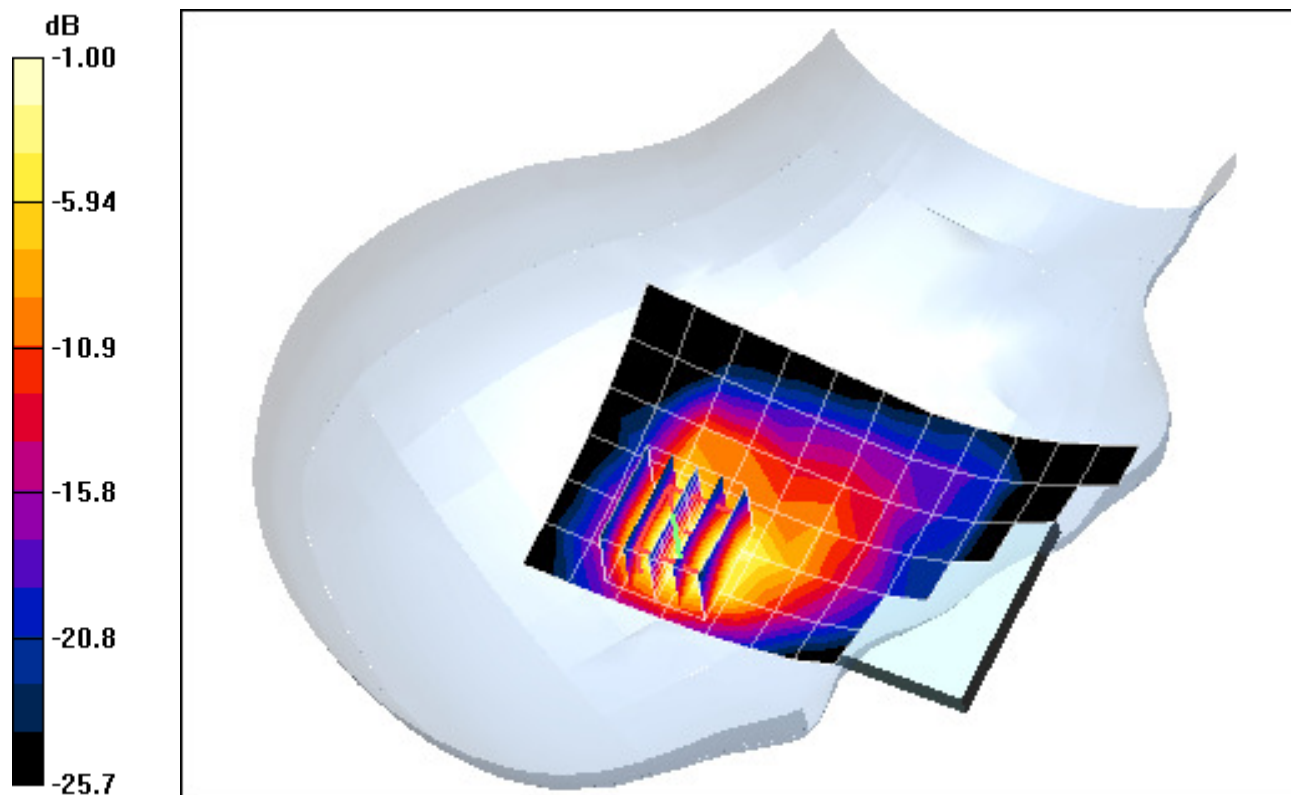
**Area Scan (7x14x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 14.5 V/m; Power Drift = 0.203 dB

Peak SAR (extrapolated) = 1.20 W/kg

**SAR(1 g) = 0.511 mW/g; SAR(10 g) = 0.211 mW/g**



0 dB = 0.696mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 2450 Head; Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 1.896 \text{ mho/m}$ ;  $\epsilon_r = 38.72$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-29-2011; Ambient Temp: 22.8 °C; Tissue Temp: 21.0 °C

Probe: ES3DV3 - SN3209; ConvF(4.52, 4.52, 4.52); Calibrated: 4/18/2011

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 11, 1 Mbps**

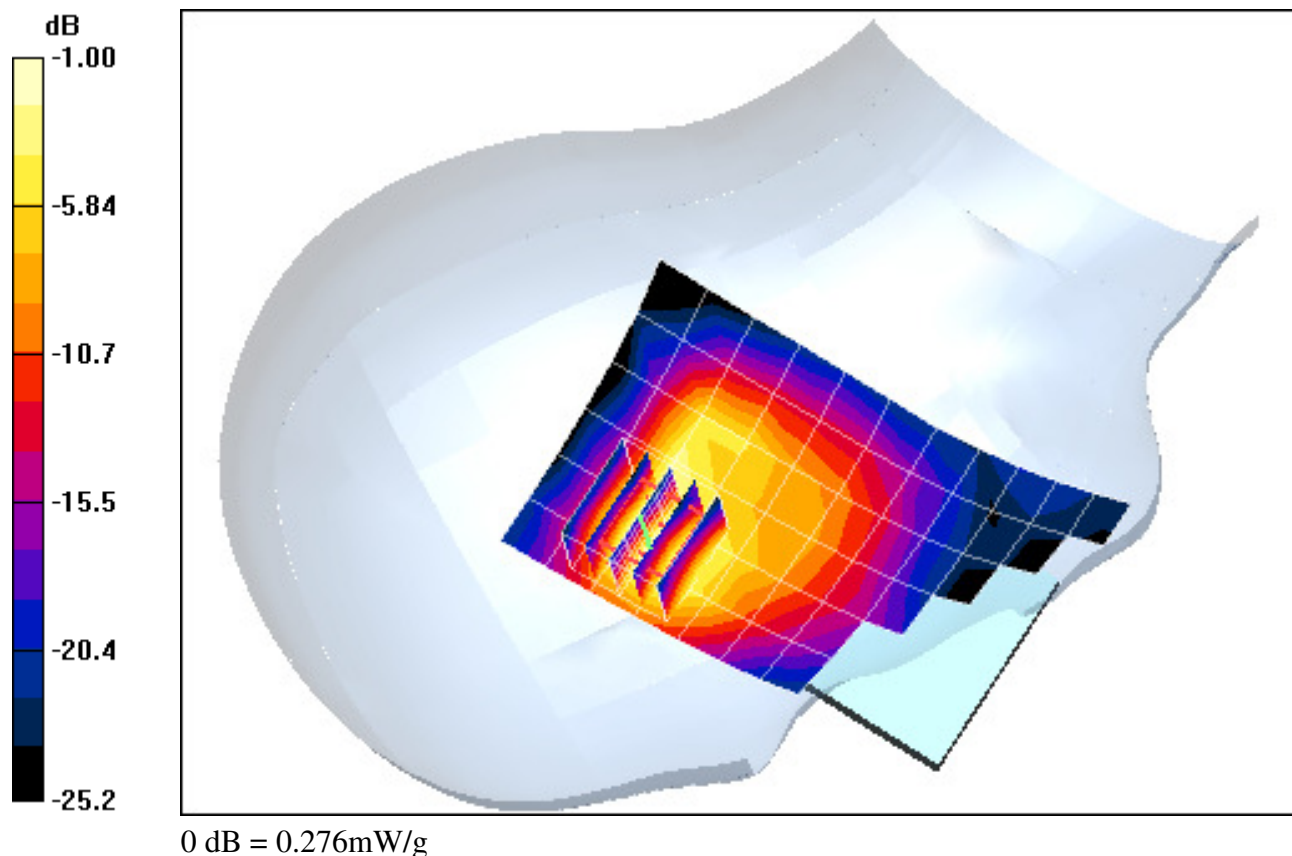
**Area Scan (7x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 9.62 V/m; Power Drift = 0.143 dB

Peak SAR (extrapolated) = 0.467 W/kg

**SAR(1 g) = 0.210 mW/g; SAR(10 g) = 0.090 mW/g**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 2450 Head; Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 1.896 \text{ mho/m}$ ;  $\epsilon_r = 38.72$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-29-2011; Ambient Temp: 22.8 °C; Tissue Temp: 21.0 °C

Probe: ES3DV3 - SN3209; ConvF(4.52, 4.52, 4.52); Calibrated: 4/18/2011

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 11, 1 Mbps**

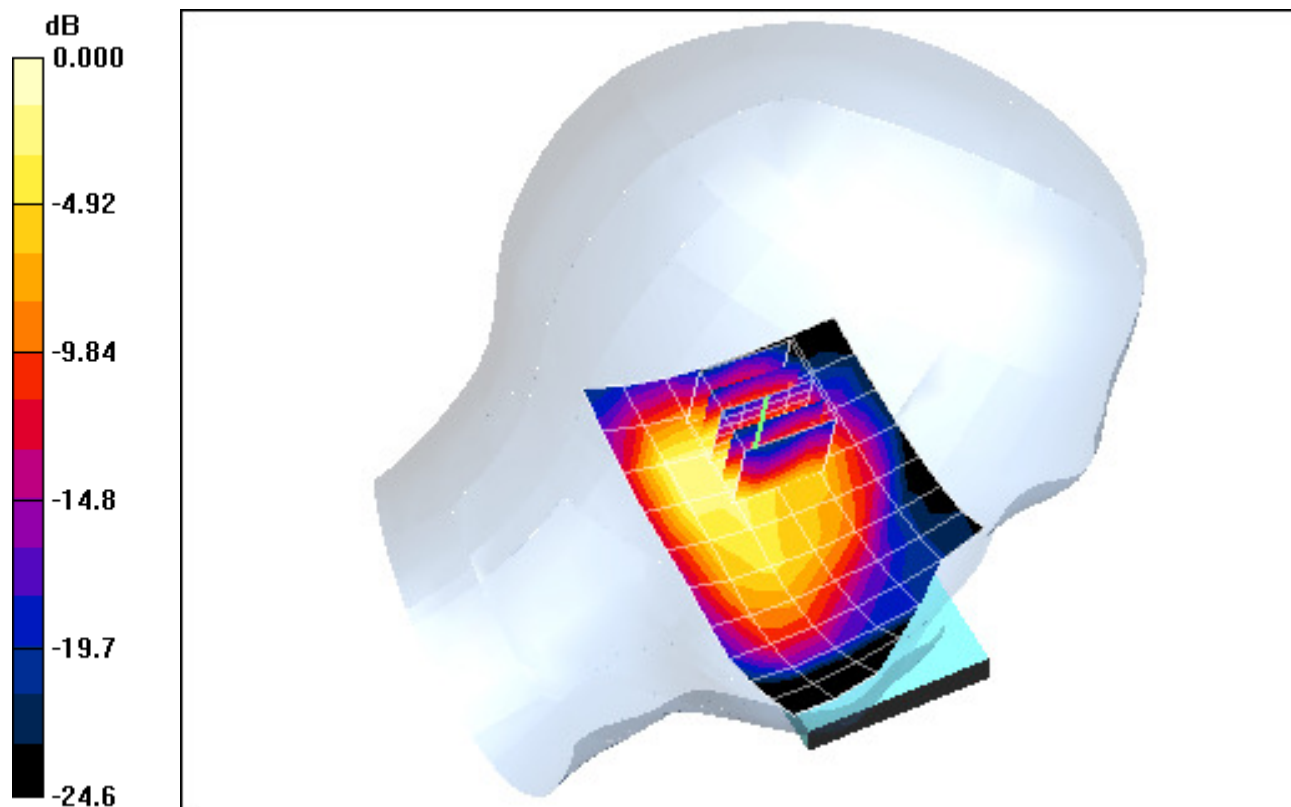
**Area Scan (7x11x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 11.4 V/m; Power Drift = -0.002 dB

Peak SAR (extrapolated) = 0.410 W/kg

**SAR(1 g) = 0.203 mW/g; SAR(10 g) = 0.088 mW/g**



0 dB = 0.258mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 2450 Head; Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 1.896 \text{ mho/m}$ ;  $\epsilon_r = 38.72$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-29-2011; Ambient Temp: 22.8 °C; Tissue Temp: 21.0 °C

Probe: ES3DV3 - SN3209; ConvF(4.52, 4.52, 4.52); Calibrated: 4/18/2011

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 11, 1 Mbps**

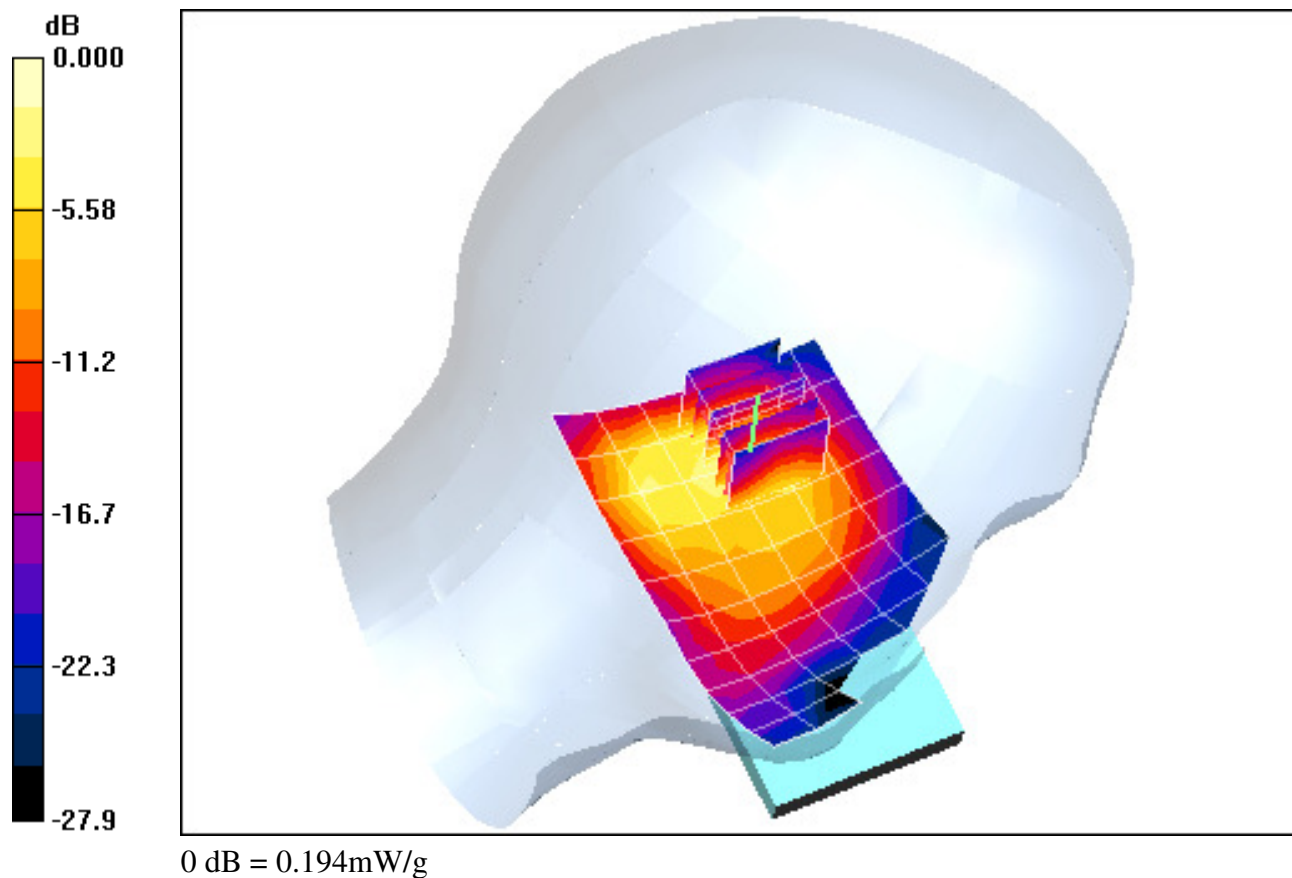
**Area Scan (7x11x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 8.35 V/m; Power Drift = -0.045 dB

Peak SAR (extrapolated) = 0.314 W/kg

**SAR(1 g) = 0.157 mW/g; SAR(10 g) = 0.069 mW/g**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

Communication System: Cellular CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 820.1 \text{ MHz}$ ;  $\sigma = 0.949 \text{ mho/m}$ ;  $\epsilon_r = 54.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-30-2011; Ambient Temp: 21.8 °C ; Tissue Temp: 21.8 °C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: Cellular CDMA, Part 90S, Body SAR, Back side, Mid.ch**

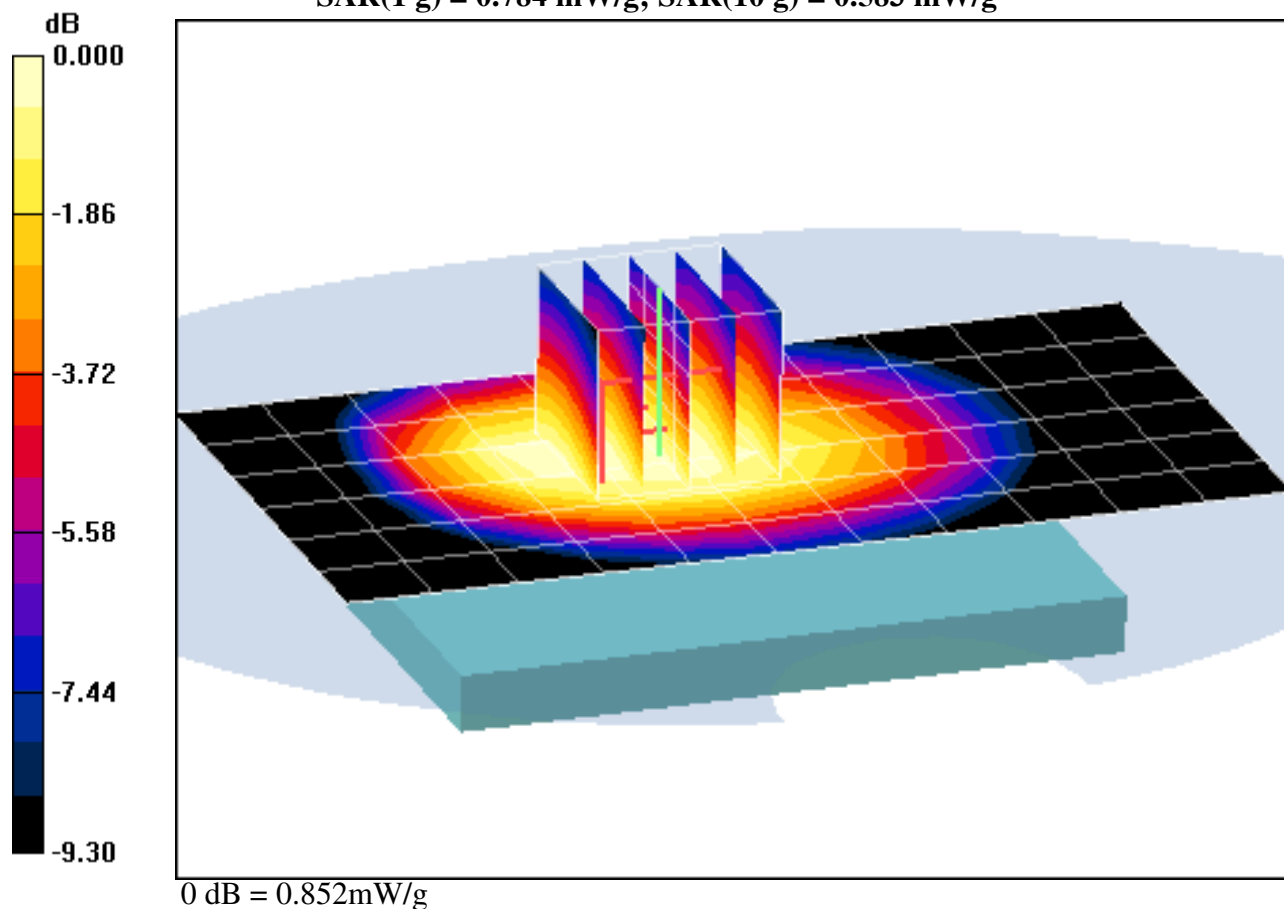
**Area Scan (7x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 31.0 V/m; Power Drift = -0.005 dB

Peak SAR (extrapolated) = 0.993 W/kg

**SAR(1 g) = 0.784 mW/g; SAR(10 g) = 0.583 mW/g**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

Communication System: Cellular CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 820.1 \text{ MHz}$ ;  $\sigma = 0.949 \text{ mho/m}$ ;  $\epsilon_r = 54.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-30-2011; Ambient Temp: 21.8 °C ; Tissue Temp: 21.8 °C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: Cellular EVDO, Part 90S, Body SAR, Back side, Mid.ch**

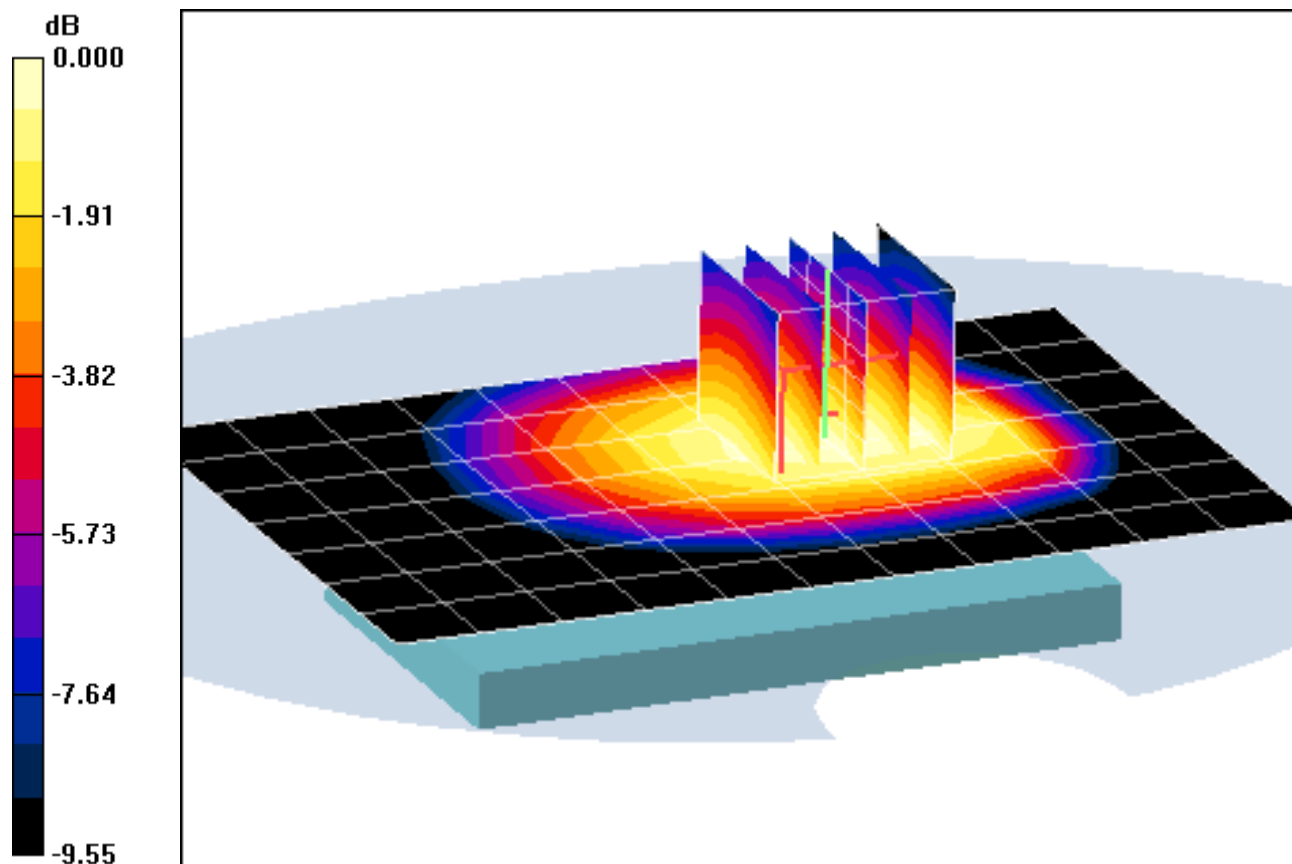
**Area Scan (8x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 30.1 V/m; Power Drift = -0.067 dB

Peak SAR (extrapolated) = 0.904 W/kg

**SAR(1 g) = 0.723 mW/g; SAR(10 g) = 0.542 mW/g**



0 dB = 0.762mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

Communication System: Cellular CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 820.1 \text{ MHz}$ ;  $\sigma = 0.949 \text{ mho/m}$ ;  $\epsilon_r = 54.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-30-2011; Ambient Temp: 21.8 °C ; Tissue Temp: 21.8 °C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: Cellular EVDO, Part 90S, Body SAR, Front side, Mid.ch**

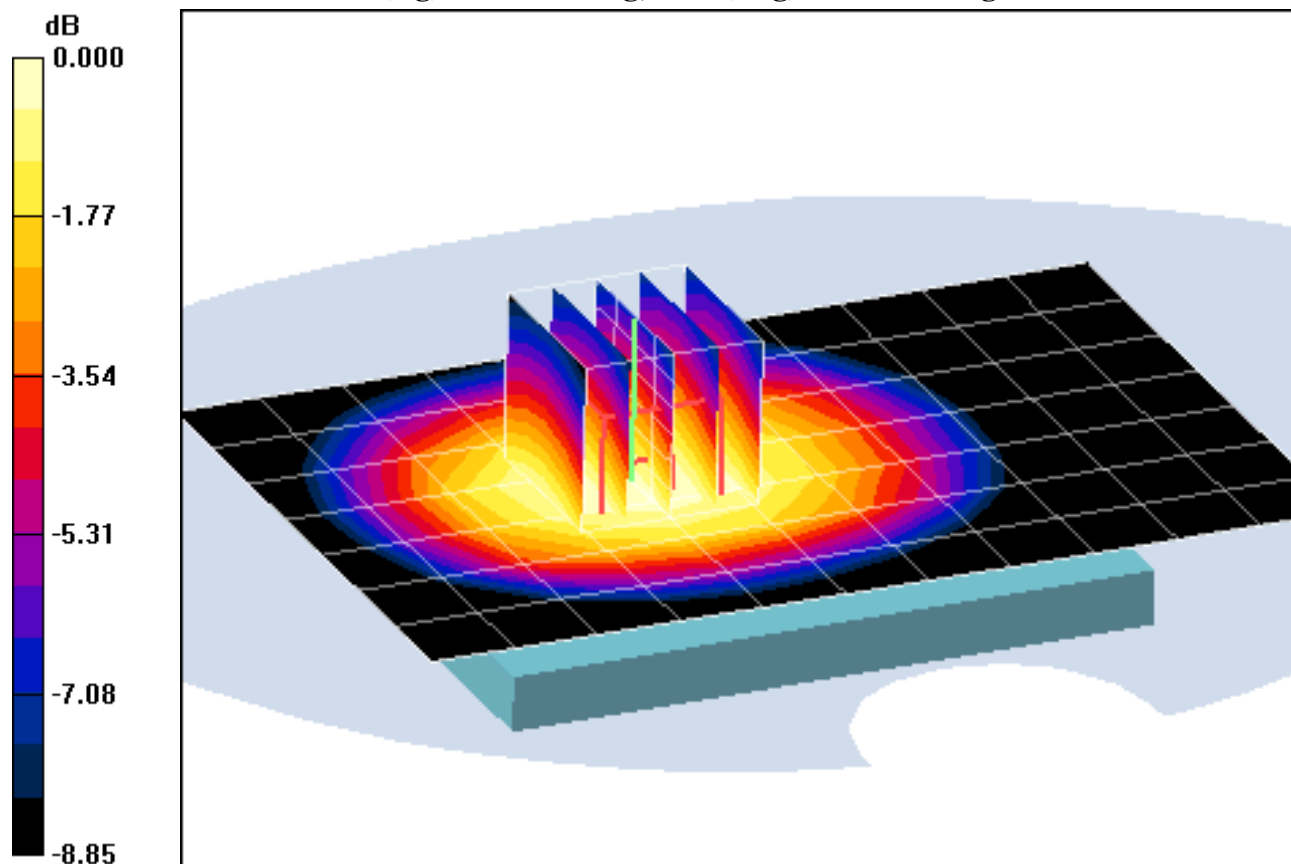
**Area Scan (8x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 22.1 V/m; Power Drift = -0.055 dB

Peak SAR (extrapolated) = 0.509 W/kg

**SAR(1 g) = 0.396 mW/g; SAR(10 g) = 0.299 mW/g**



0 dB = 0.430mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

Communication System: Cellular CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 820.1 \text{ MHz}$ ;  $\sigma = 0.949 \text{ mho/m}$ ;  $\epsilon_r = 54.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-30-2011; Ambient Temp: 21.8 °C ; Tissue Temp: 21.8 °C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: Cellular EVDO, Part 90S, Body SAR, Bottom Edge, Mid.ch**

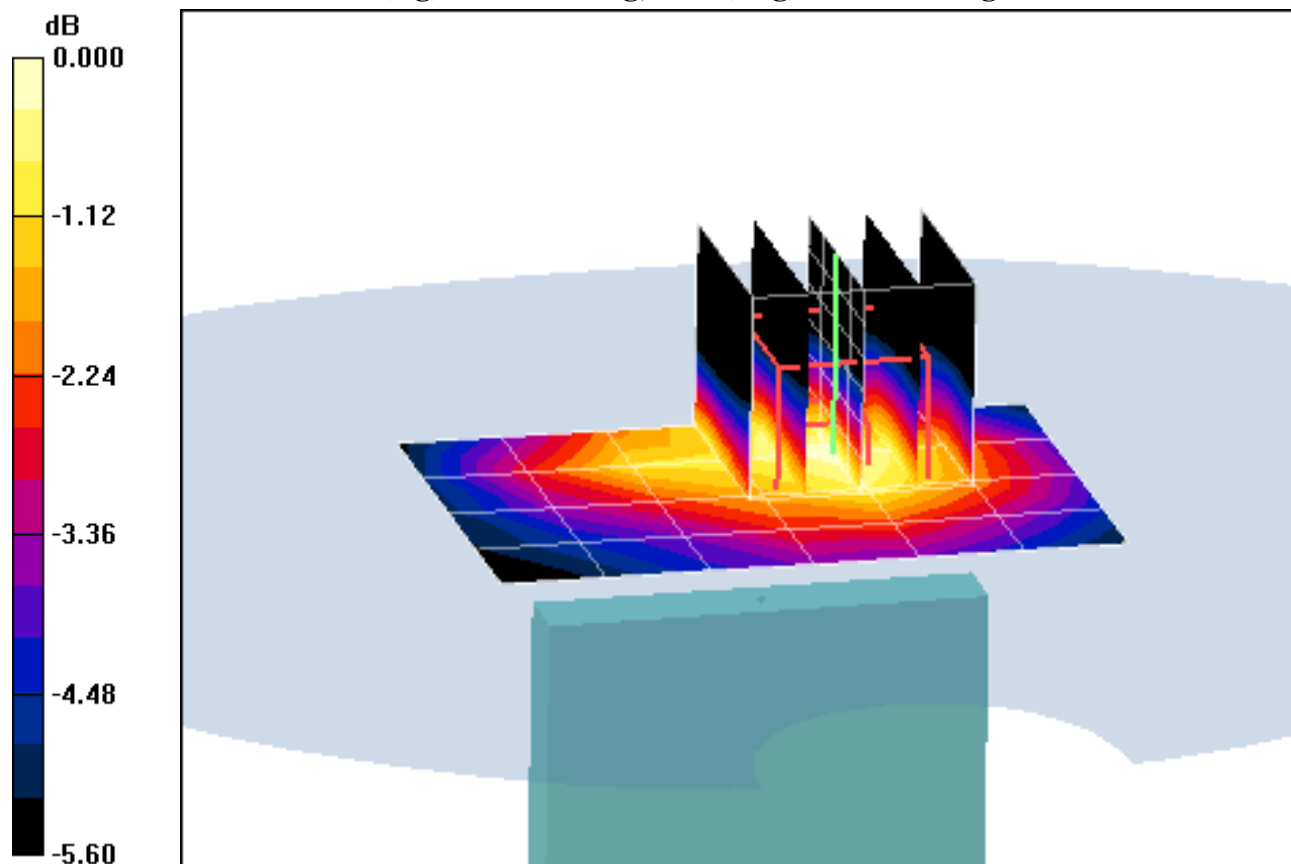
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 8.73 V/m; Power Drift = 0.094 dB

Peak SAR (extrapolated) = 0.093 W/kg

**SAR(1 g) = 0.058 mW/g; SAR(10 g) = 0.038 mW/g**



0 dB = 0.064mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

Communication System: Cellular CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 820.1 \text{ MHz}$ ;  $\sigma = 0.949 \text{ mho/m}$ ;  $\epsilon_r = 54.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-30-2011; Ambient Temp: 21.8 °C ; Tissue Temp: 21.8 °C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: Cellular EVDO, Part 90S, Body SAR, Right Edge, Mid.ch**

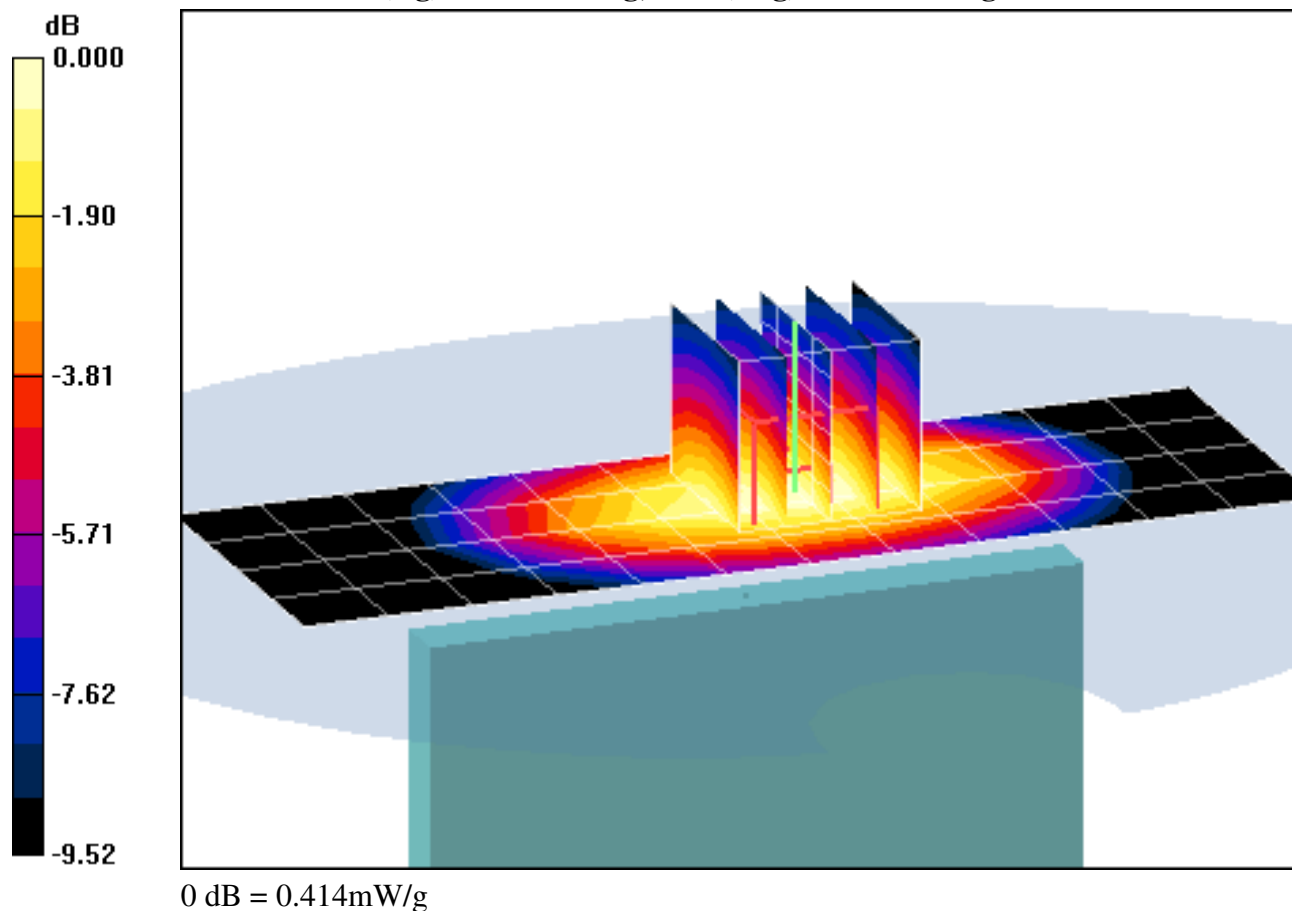
**Area Scan (5x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 22.0 V/m; Power Drift = -0.095 dB

Peak SAR (extrapolated) = 0.532 W/kg

**SAR(1 g) = 0.376 mW/g; SAR(10 g) = 0.263 mW/g**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

Communication System: Cellular CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 820.1 \text{ MHz}$ ;  $\sigma = 0.949 \text{ mho/m}$ ;  $\epsilon_r = 54.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-30-2011; Ambient Temp: 21.8 °C ; Tissue Temp: 21.8 °C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: Cellular EVDO, Part 90S Body SAR, Left Edge, Mid.ch**

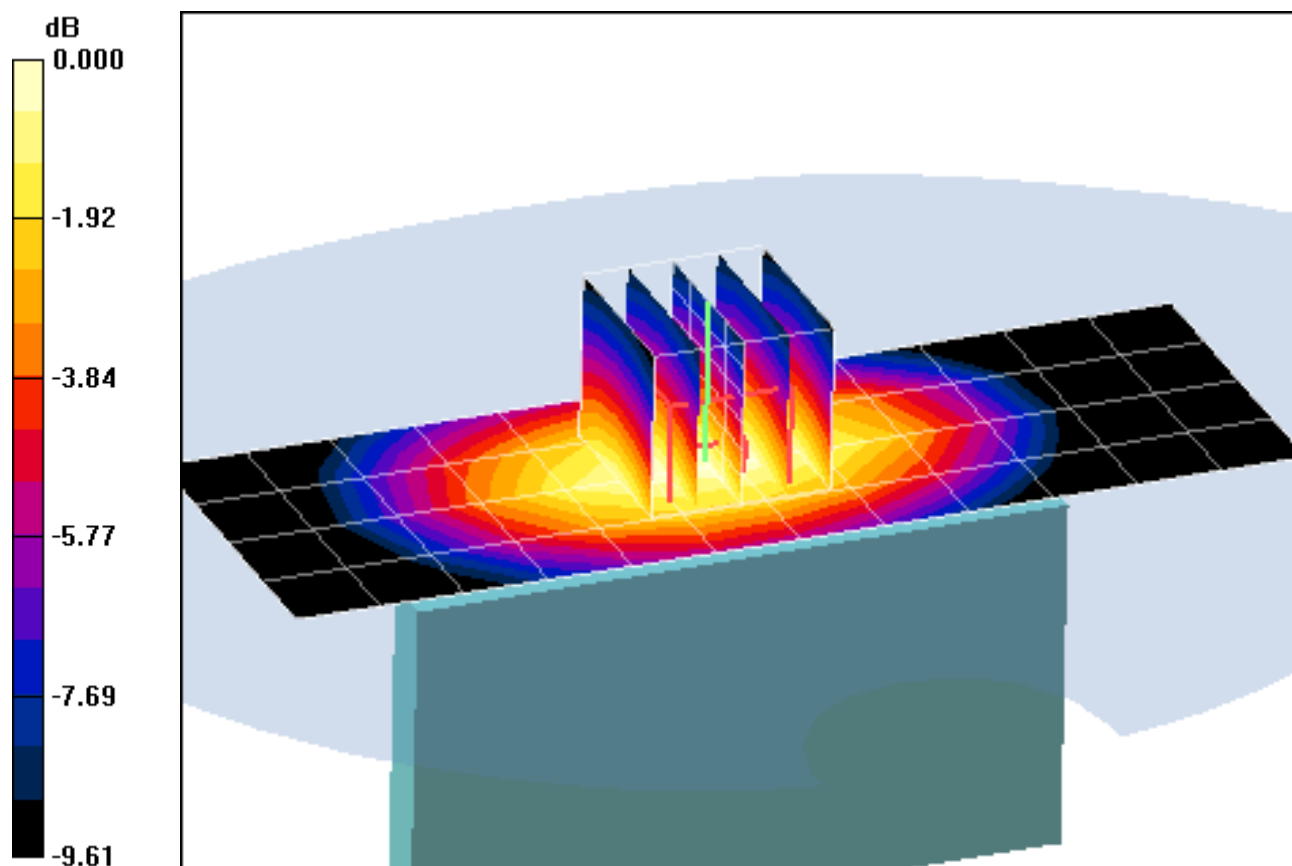
**Area Scan (5x13x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 19.4 V/m; Power Drift = 0.006 dB

Peak SAR (extrapolated) = 0.414 W/kg

**SAR(1 g) = 0.295 mW/g; SAR(10 g) = 0.202 mW/g**



0 dB = 0.317mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; 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):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.975 \text{ mho/m}$ ;  $\epsilon_r = 53.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-30-2011; Ambient Temp: 21.8 °C ; Tissue Temp: 21.8 °C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: Cellular CDMA, Part 22H, Body SAR, Back side, Mid.ch**

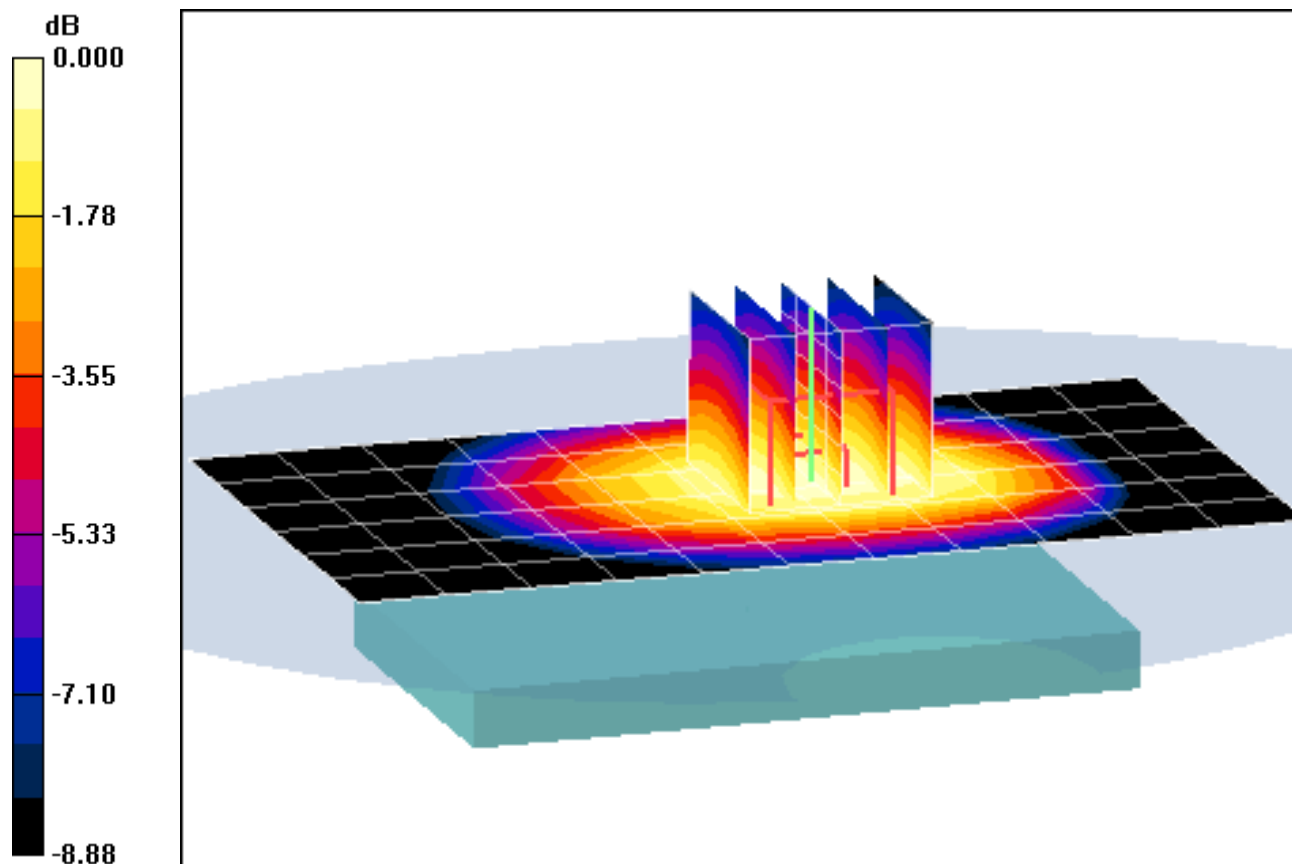
**Area Scan (7x12x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 34.2 V/m; Power Drift = 0.017 dB

Peak SAR (extrapolated) = 1.25 W/kg

**SAR(1 g) = 0.991 mW/g; SAR(10 g) = 0.739 mW/g**



0 dB = 1.04mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; 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):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.975 \text{ mho/m}$ ;  $\epsilon_r = 53.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-30-2011; Ambient Temp: 21.8 °C ; Tissue Temp: 21.8 °C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: Cellular EVDO, Part 22H, Body SAR, Back side, Mid.ch**

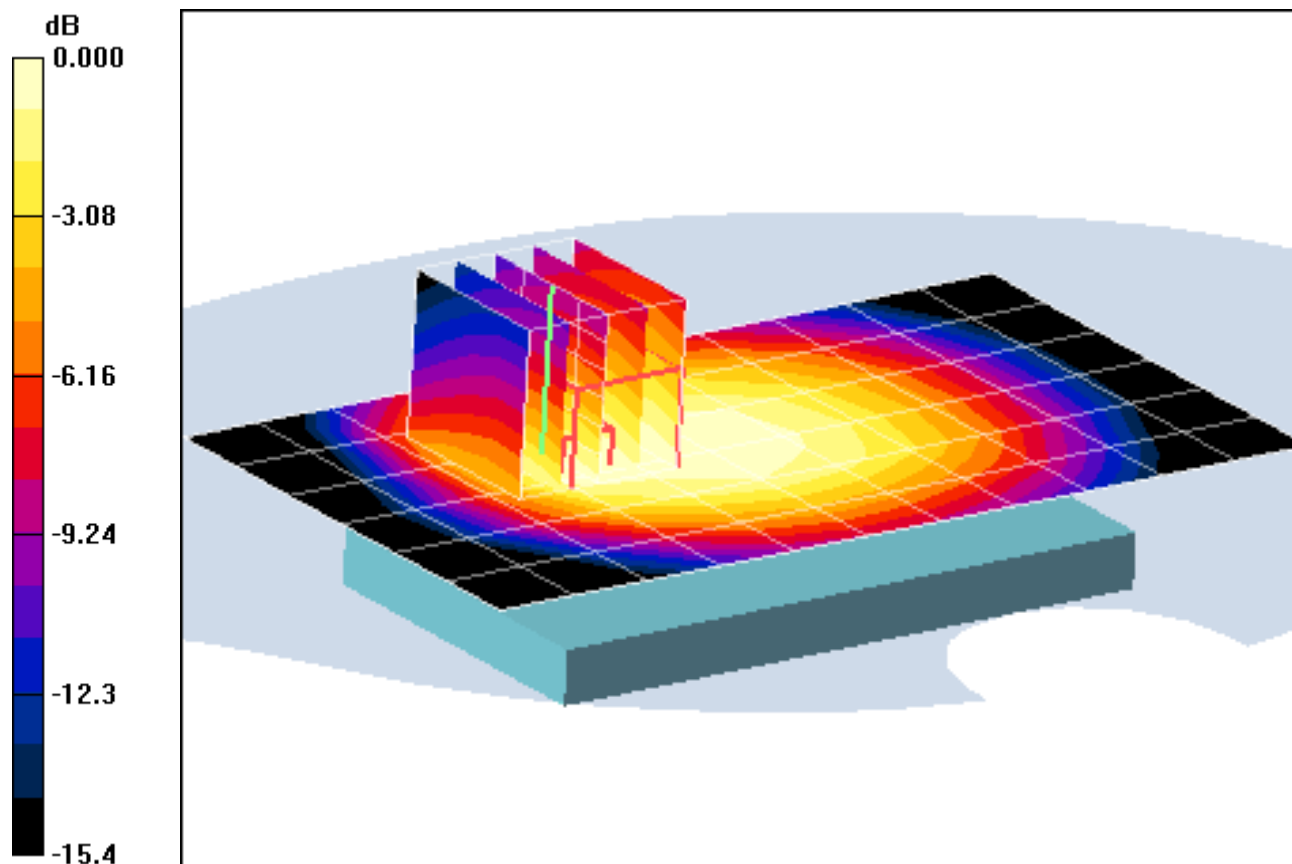
**Area Scan (7x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 31.5 V/m; Power Drift = -0.024 dB

Peak SAR (extrapolated) = 1.24 W/kg

**SAR(1 g) = 0.817 mW/g; SAR(10 g) = 0.579 mW/g**



0 dB = 0.863mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; 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):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.975 \text{ mho/m}$ ;  $\epsilon_r = 53.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-30-2011; Ambient Temp: 21.8 °C ; Tissue Temp: 21.8 °C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: Cellular EVDO, Part 22H, Body SAR, Front side, Mid.ch**

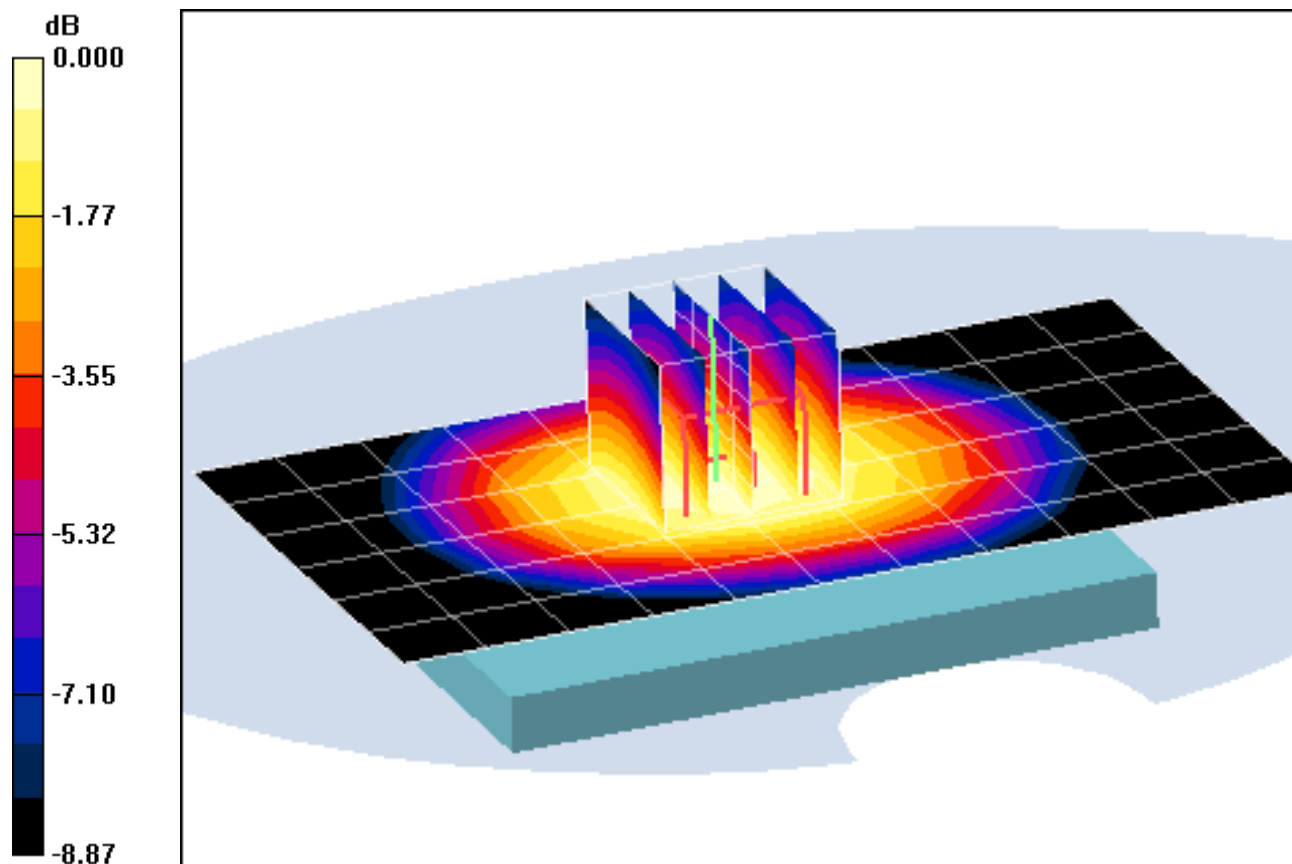
**Area Scan (7x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 26.1 V/m; Power Drift = 0.048 dB

Peak SAR (extrapolated) = 0.708 W/kg

**SAR(1 g) = 0.567 mW/g; SAR(10 g) = 0.427 mW/g**



0 dB = 0.596mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; 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):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.975 \text{ mho/m}$ ;  $\epsilon_r = 53.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-30-2011; Ambient Temp: 21.8 °C ; Tissue Temp: 21.8 °C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: Cellular EVDO, Part 22H, Body SAR, Bottom Edge, Mid.ch**

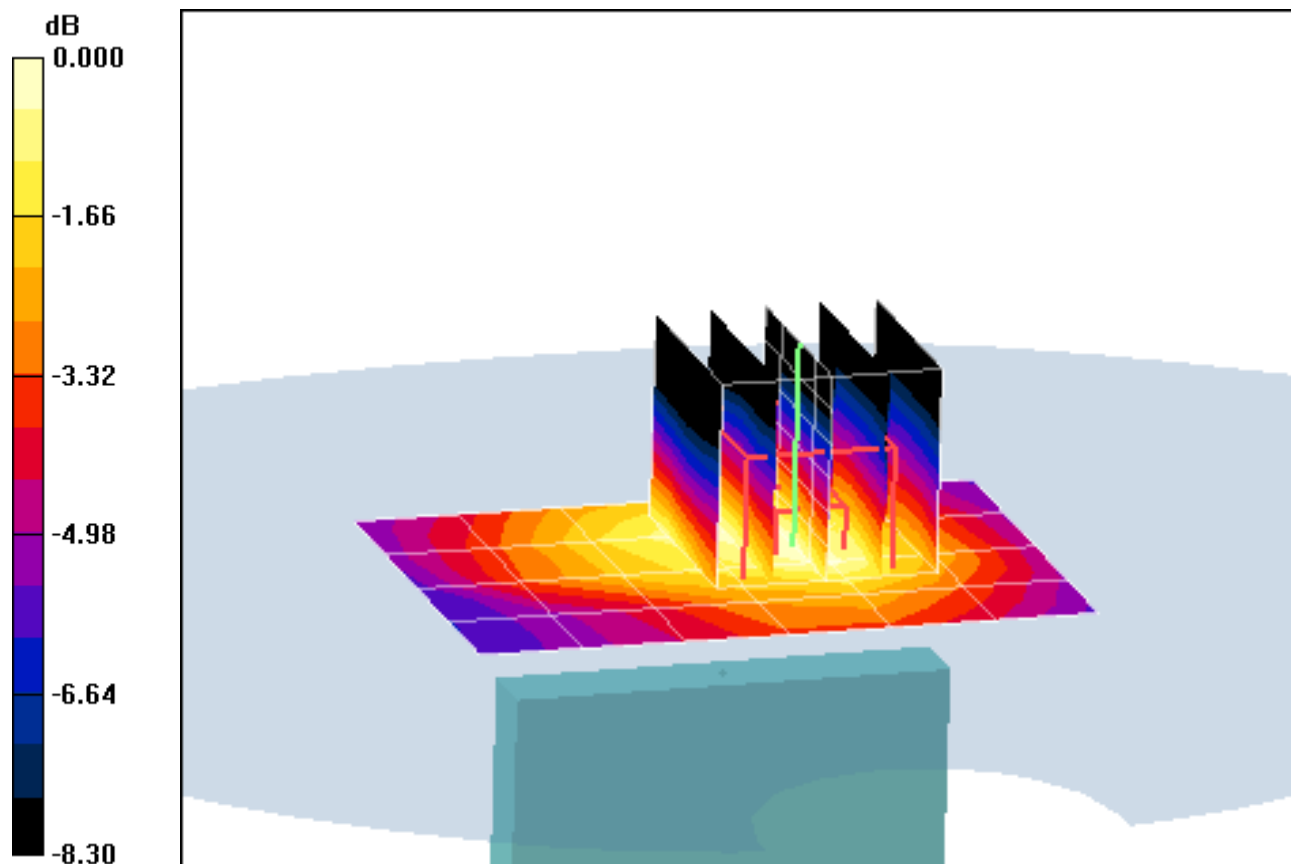
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 5.70 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 0.170 W/kg

**SAR(1 g) = 0.096 mW/g; SAR(10 g) = 0.058 mW/g**



0 dB = 0.095mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; 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):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.975 \text{ mho/m}$ ;  $\epsilon_r = 53.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; space: 1.0 cm

Test Date: 11-30-2011; Ambient Temp: 21.8 °C ; Tissue Temp: 21.8 °C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: Cellular EVDO, Part 22H, Body SAR, Right Edge, Mid.ch**

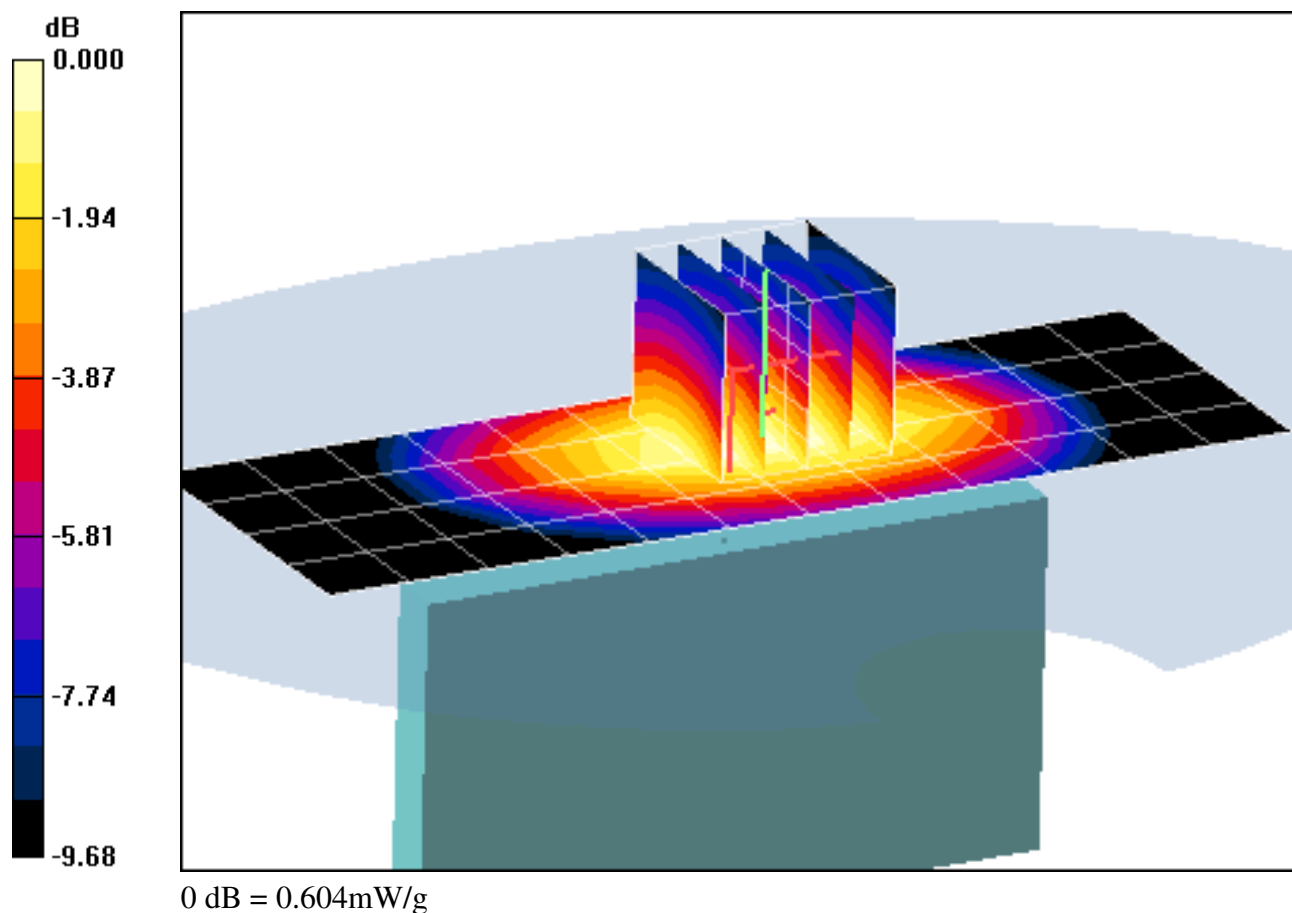
**Area Scan (5x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 26.0 V/m; Power Drift = 0.095 dB

Peak SAR (extrapolated) = 0.779 W/kg

**SAR(1 g) = 0.565 mW/g; SAR(10 g) = 0.392 mW/g**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; 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):

$f = 836.52 \text{ MHz}$ ;  $\sigma = 0.975 \text{ mho/m}$ ;  $\epsilon_r = 53.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-30-2011; Ambient Temp: 21.8°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mode: Cellular EVDO, Part 22H, Body SAR, Left Edge, Mid.ch**

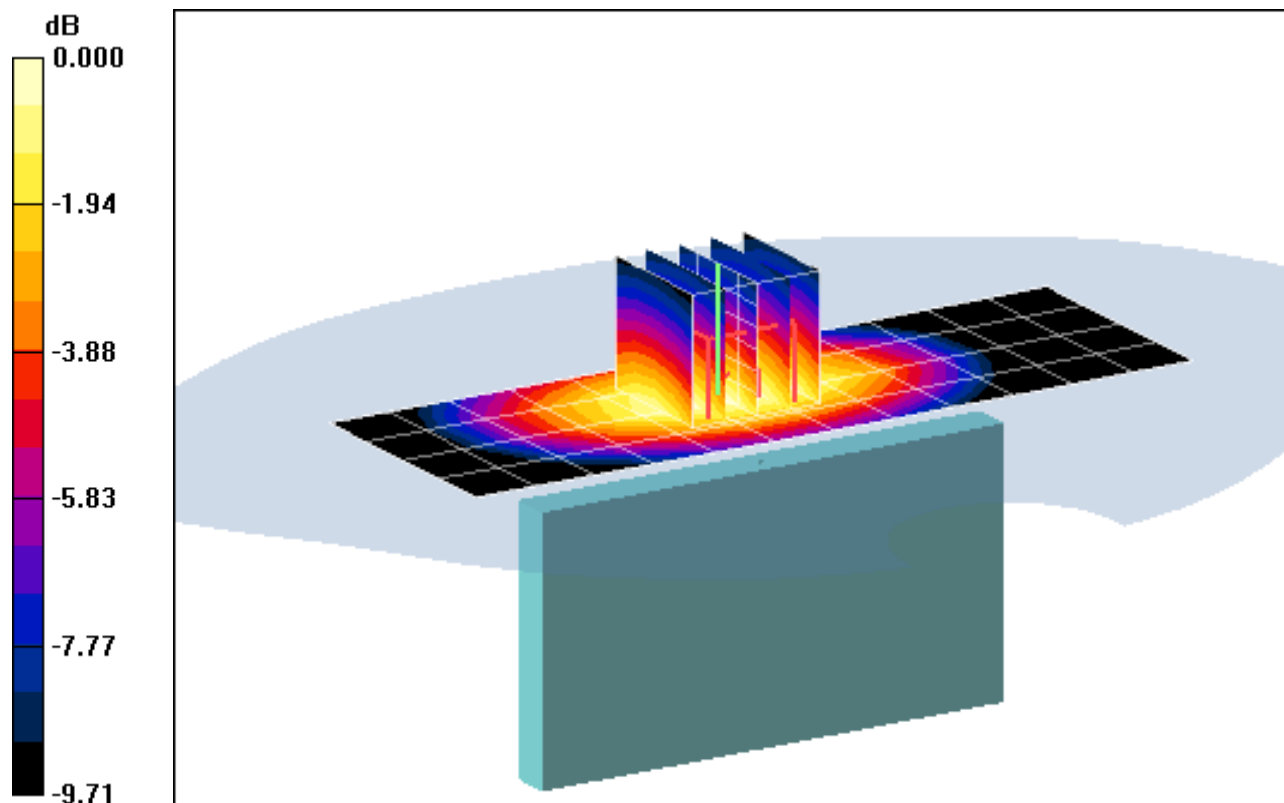
**Area Scan (5x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 23.8 V/m; Power Drift = -0.099 dB

Peak SAR (extrapolated) = 0.646 W/kg

**SAR(1 g) = 0.460 mW/g; SAR(10 g) = 0.316 mW/g**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.5 \text{ mho/m}$ ;  $\epsilon_r = 52.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-29-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.4 °C

Probe: ES3DV3 - SN3209; ConvF(4.48, 4.48, 4.48); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: PCS CDMA, Part 24E, Body SAR, Back side, Mid.ch**

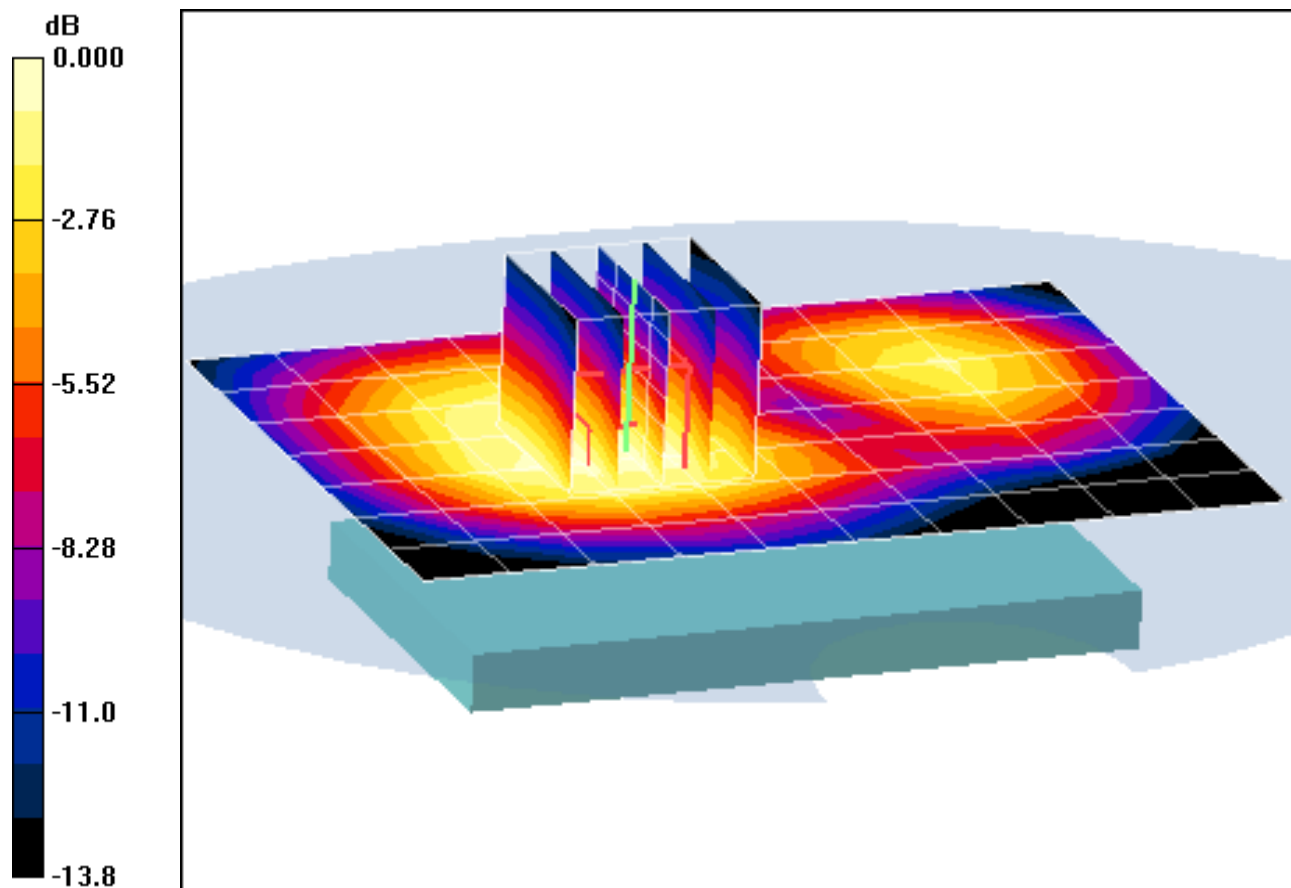
**Area Scan (8x11x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 22.7 V/m; Power Drift = -0.037 dB

Peak SAR (extrapolated) = 1.00 W/kg

**SAR(1 g) = 0.641 mW/g; SAR(10 g) = 0.408 mW/g**



0 dB = 0.683mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.5 \text{ mho/m}$ ;  $\epsilon_r = 52.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.4 °C

Probe: ES3DV3 - SN3209; ConvF(4.48, 4.48, 4.48); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: PCS EVDO, Part 24E, Body SAR, Back side, Mid.ch**

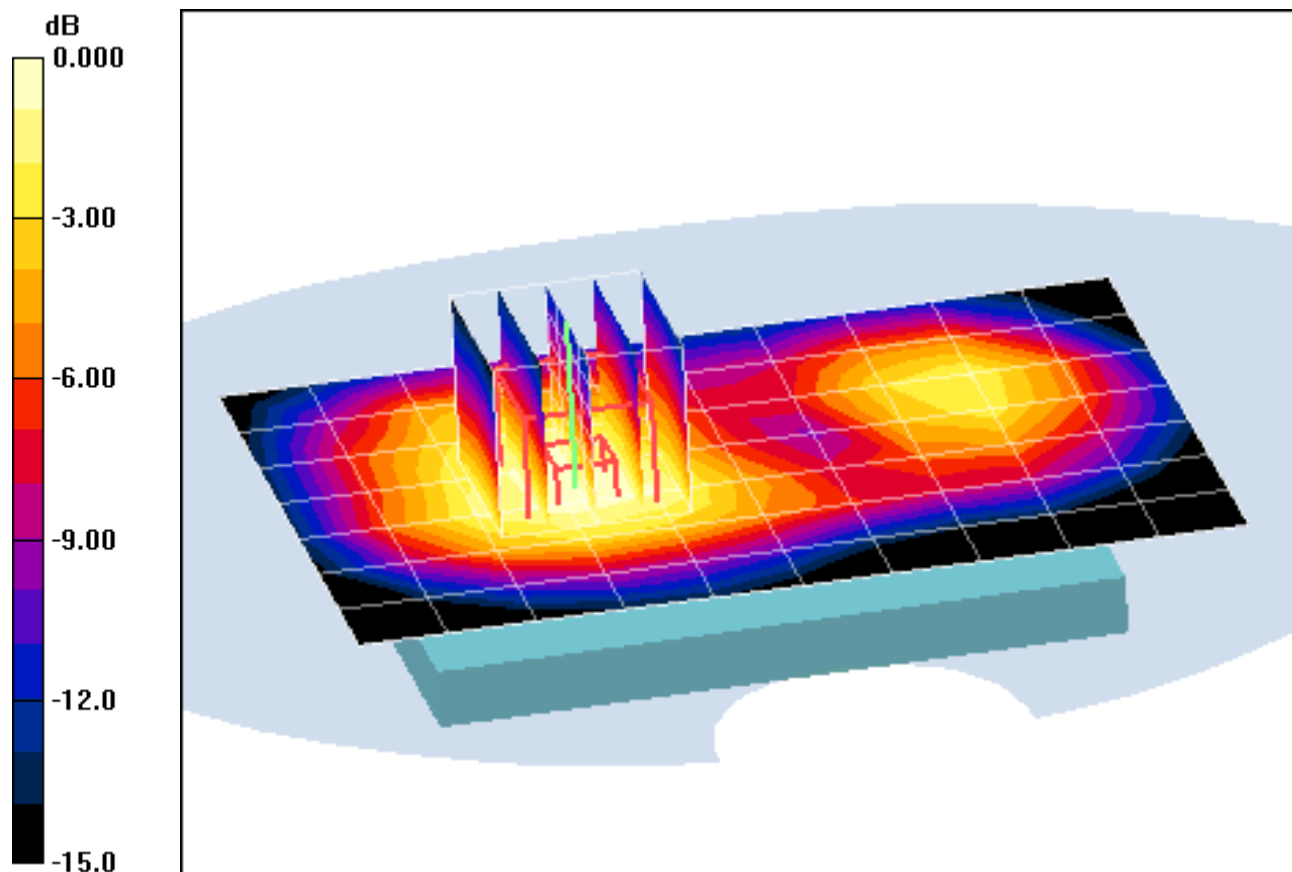
**Area Scan (8x11x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 24.4 V/m; Power Drift = -0.016 dB

Peak SAR (extrapolated) = 1.13 W/kg

**SAR(1 g) = 0.716 mW/g; SAR(10 g) = 0.448 mW/g**



0 dB = 0.768mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.5 \text{ mho/m}$ ;  $\epsilon_r = 52.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.4 °C

Probe: ES3DV3 - SN3209; ConvF(4.48, 4.48, 4.48); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: PCS EVDO, Part 24E, Body SAR, Front side, Mid.ch**

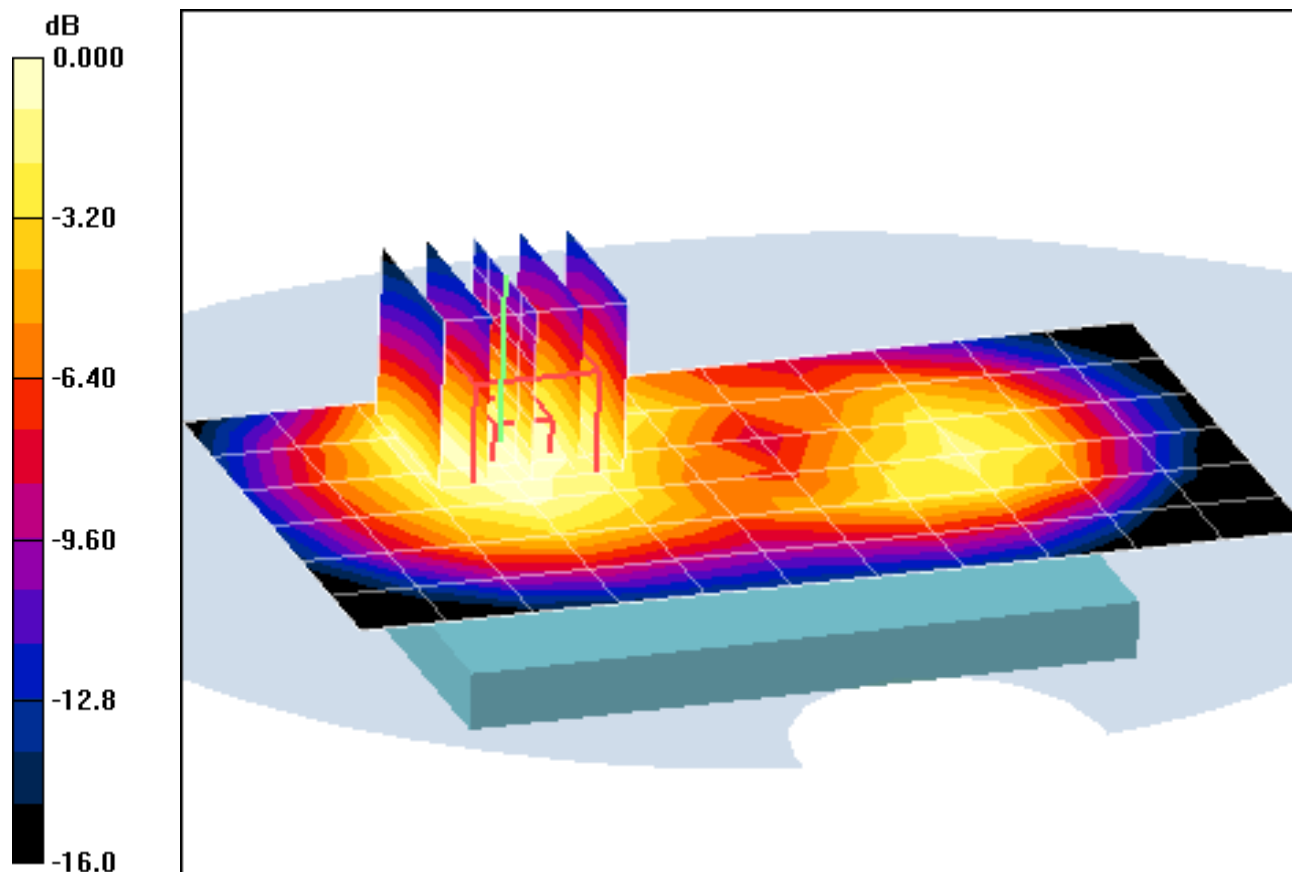
**Area Scan (7x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 19.0 V/m; Power Drift = 0.059 dB

Peak SAR (extrapolated) = 0.707 W/kg

**SAR(1 g) = 0.446 mW/g; SAR(10 g) = 0.284 mW/g**



0 dB = 0.477mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.5 \text{ mho/m}$ ;  $\epsilon_r = 52.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.4 °C

Probe: ES3DV3 - SN3209; ConvF(4.48, 4.48, 4.48); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: PCS EVDO, Part 24E, Body SAR, Bottom Edge, Mid.ch**

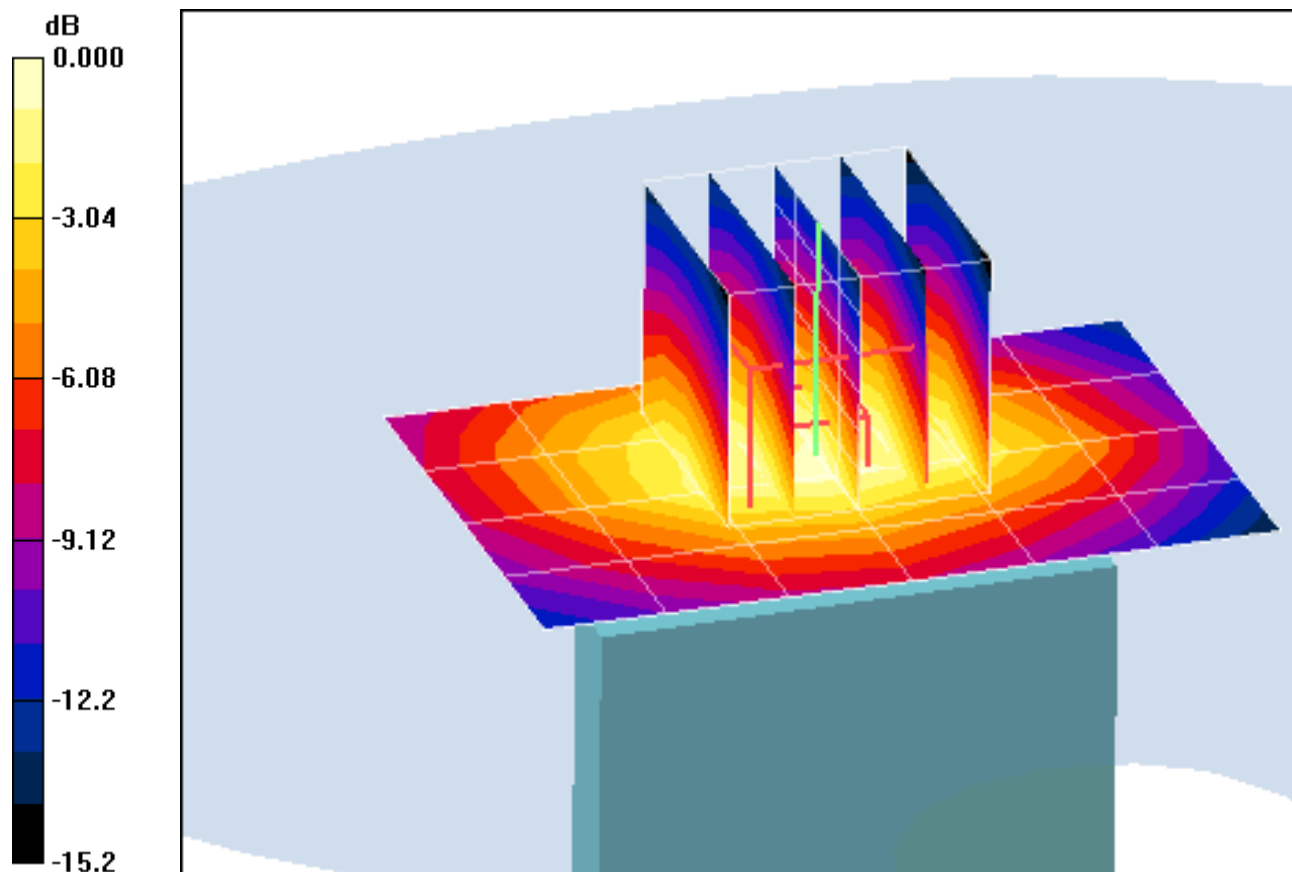
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 18.9 V/m; Power Drift = 0.114 dB

Peak SAR (extrapolated) = 0.815 W/kg

**SAR(1 g) = 0.493 mW/g; SAR(10 g) = 0.288 mW/g**



0 dB = 0.546mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.5 \text{ mho/m}$ ;  $\epsilon_r = 52.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.4 °C

Probe: ES3DV3 - SN3209; ConvF(4.48, 4.48, 4.48); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: PCS EVDO, Part 24E, Body SAR, Right Edge, Mid.ch**

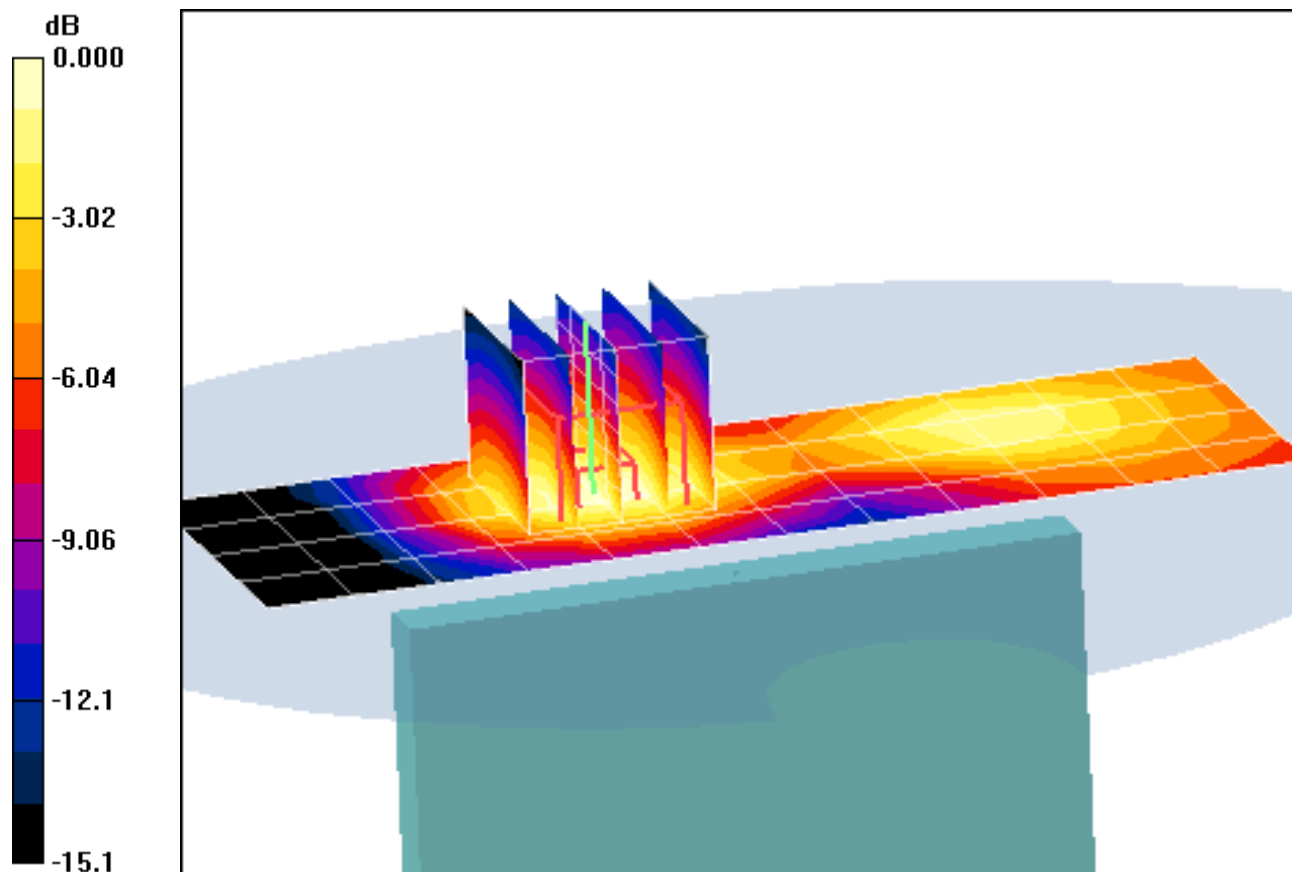
**Area Scan (5x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 14.9 V/m; Power Drift = -0.055 dB

Peak SAR (extrapolated) = 0.445 W/kg

**SAR(1 g) = 0.281 mW/g; SAR(10 g) = 0.170 mW/g**



0 dB = 0.305mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$ ;  $\sigma = 1.5 \text{ mho/m}$ ;  $\epsilon_r = 52.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.4 °C

Probe: ES3DV3 - SN3209; ConvF(4.48, 4.48, 4.48); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

**Mode: PCS EVDO, Part 24E, Body SAR, Left Edge, Mid.ch**

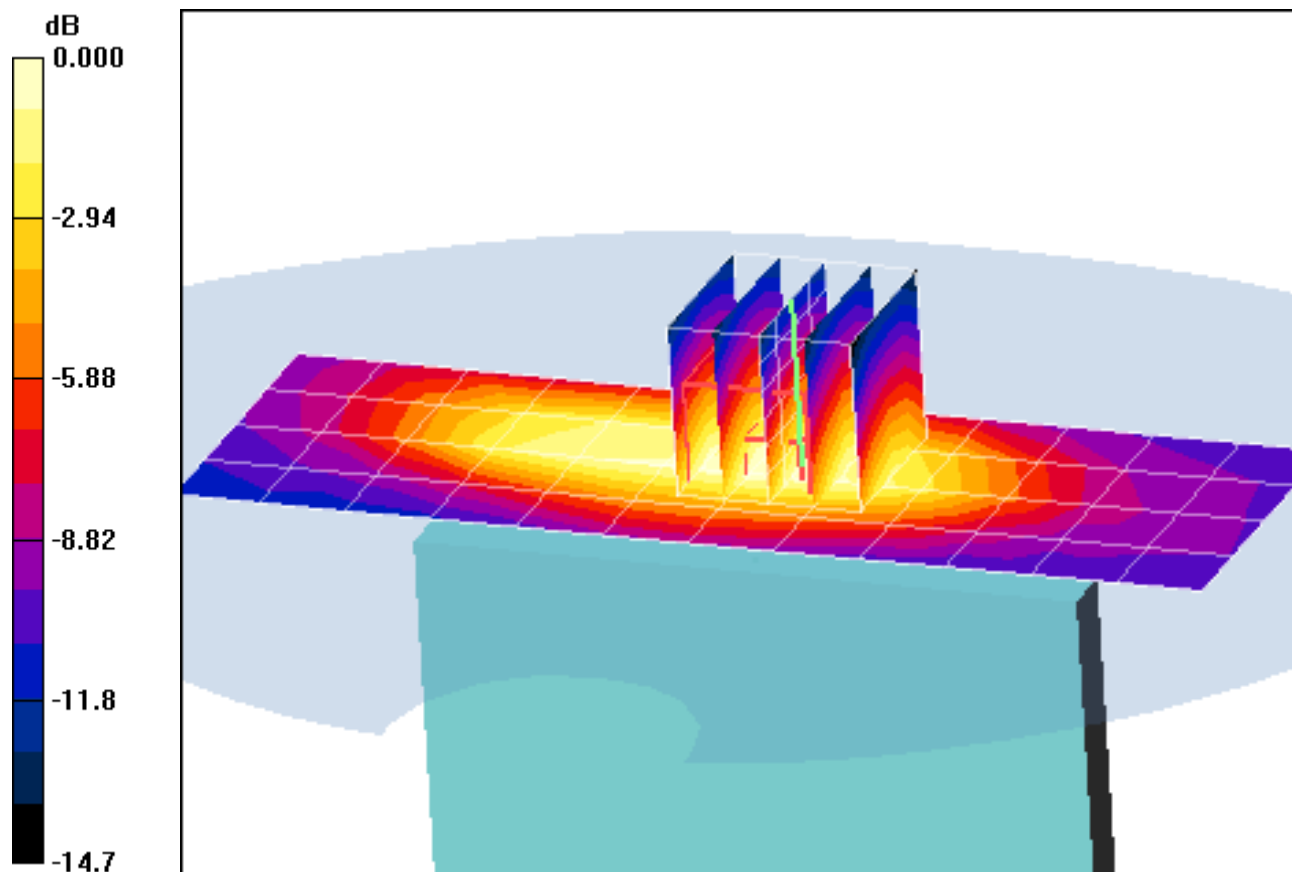
**Area Scan (5x13x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 14.6 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.427 W/kg

**SAR(1 g) = 0.267 mW/g; SAR(10 g) = 0.161 mW/g**



0 dB = 0.292mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 2450 Body; Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 2.02 \text{ mho/m}$ ;  $\epsilon_r = 50.58$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-29-2011; Ambient Temp: 23.2 °C; Tissue Temp: 21.4 °C

Probe: ES3DV3 - SN3209; ConvF(4.15, 4.15, 4.15); Calibrated: 4/18/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

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

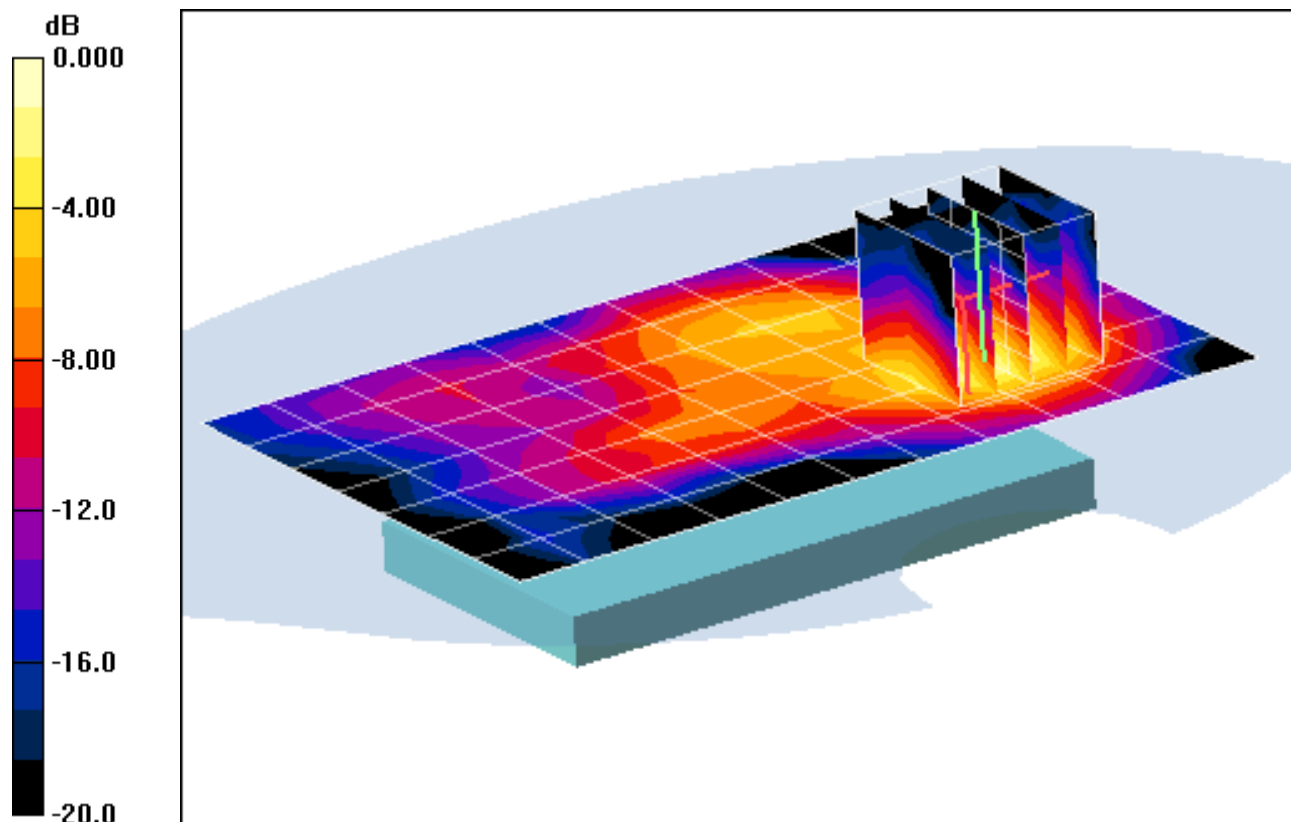
**Area Scan (8x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 5.04 V/m; Power Drift = -0.004 dB

Peak SAR (extrapolated) = 0.108 W/kg

**SAR(1 g) = 0.051 mW/g; SAR(10 g) = 0.023 mW/g**



0 dB = 0.065mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 2450 Body; Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 2.02 \text{ mho/m}$ ;  $\epsilon_r = 50.58$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.2 °C; Tissue Temp: 21.4 °C

Probe: ES3DV3 - SN3209; ConvF(4.15, 4.15, 4.15); Calibrated: 4/18/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

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

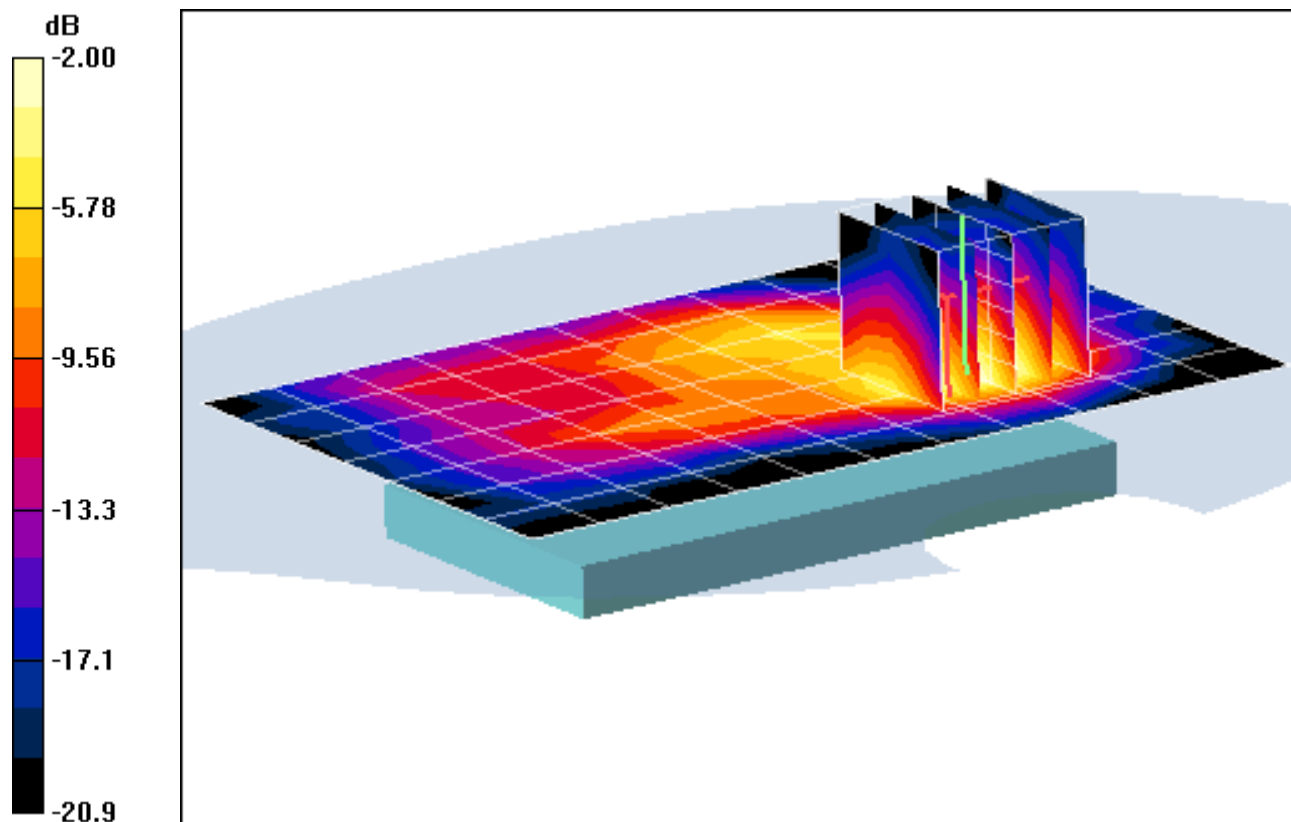
**Area Scan (8x12x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 7.924 V/m; Power Drift = -0.061 dB

Peak SAR (extrapolated) = 0.285 W/kg

**SAR(1 g) = 0.125 mW/g; SAR(10 g) = 0.053 mW/g**



0 dB = 0.159mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 2450 Body; Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 2.02 \text{ mho/m}$ ;  $\epsilon_r = 50.58$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.2 °C; Tissue Temp: 21.4 °C

Probe: ES3DV3 - SN3209; ConvF(4.15, 4.15, 4.15); Calibrated: 4/18/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

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

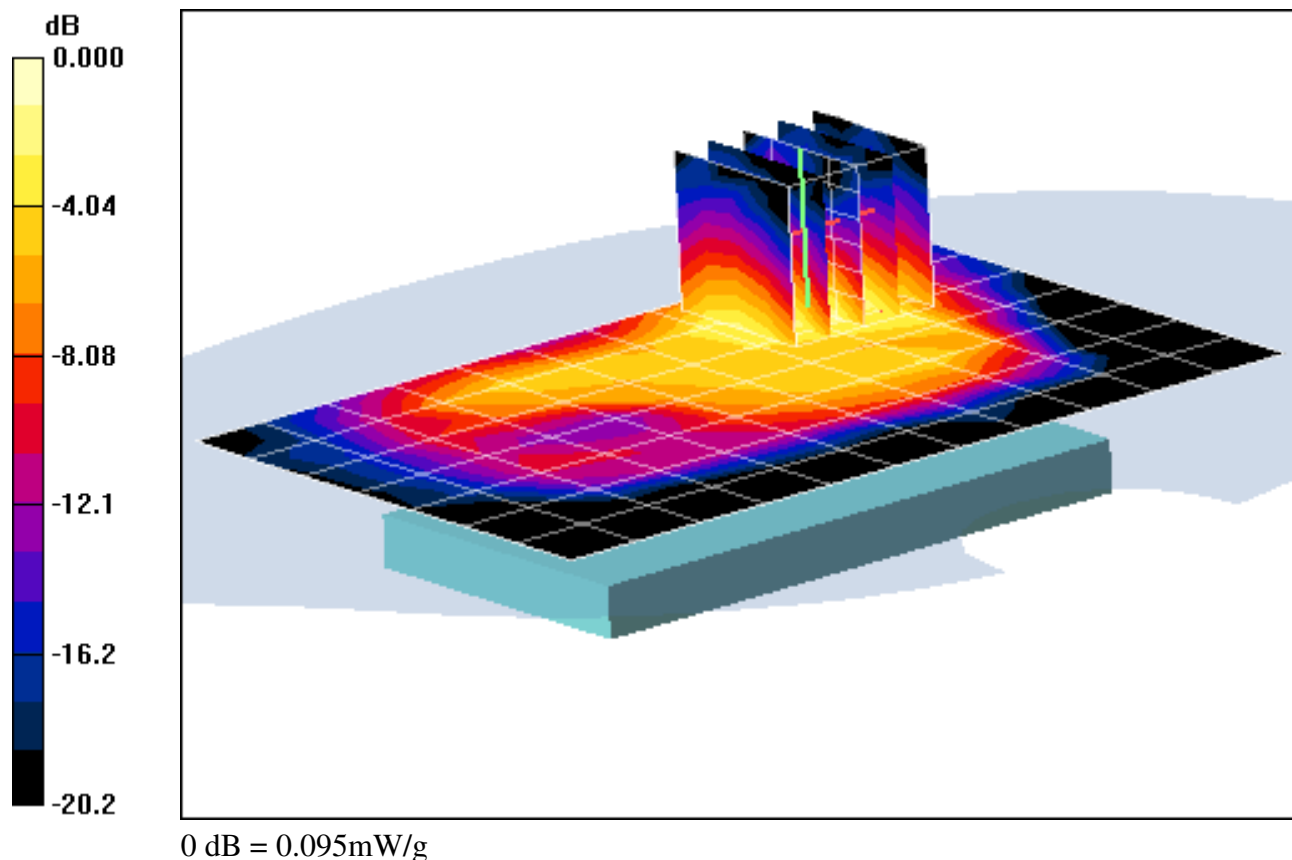
**Area Scan (8x12x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 6.222 V/m; Power Drift = 0.035 dB

Peak SAR (extrapolated) = 0.151 W/kg

**SAR(1 g) = 0.075 mW/g; SAR(10 g) = 0.036 mW/g**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 2450 Body; Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 2.02 \text{ mho/m}$ ;  $\epsilon_r = 50.58$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.2 °C; Tissue Temp: 21.4 °C

Probe: ES3DV3 - SN3209; ConvF(4.15, 4.15, 4.15); Calibrated: 4/18/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

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

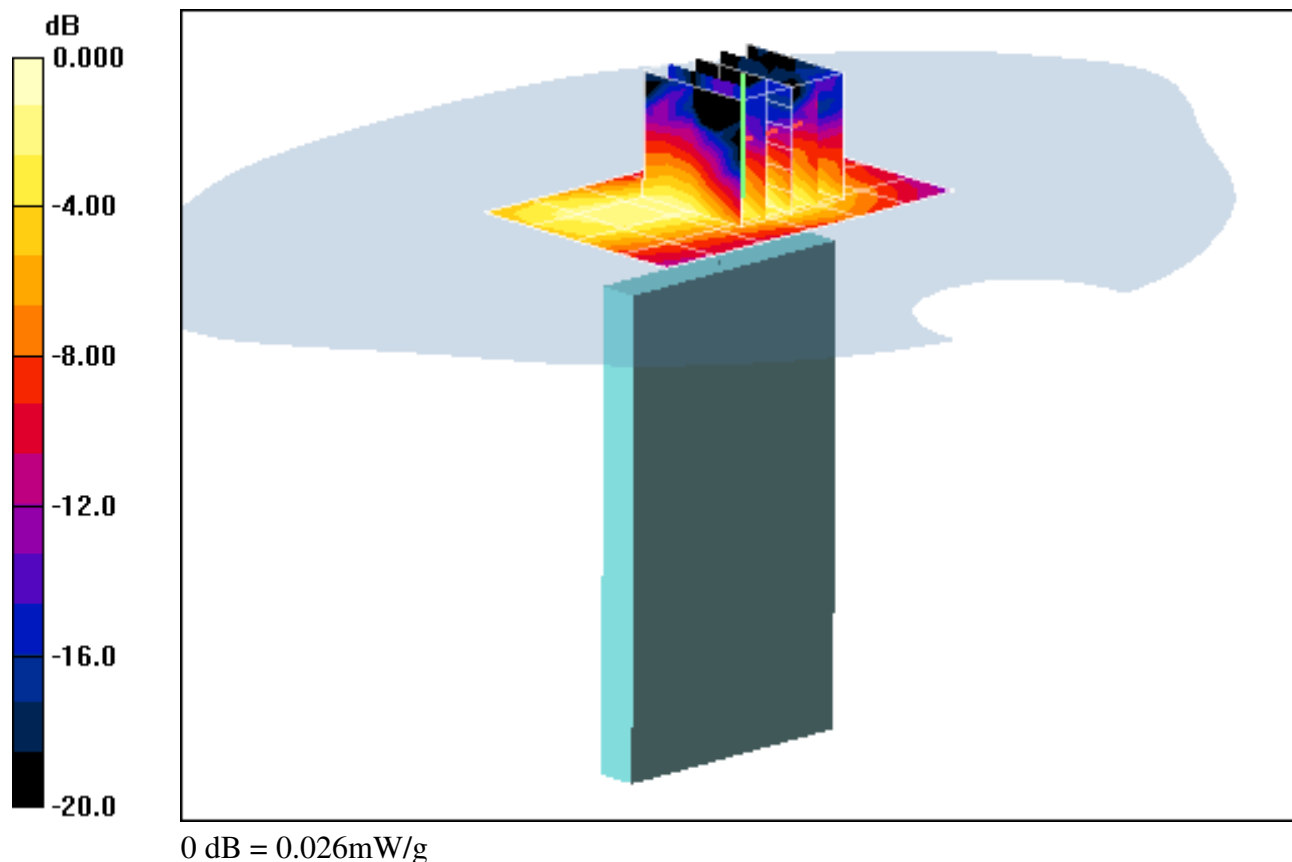
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 3.45 V/m; Power Drift = -0.206 dB

Peak SAR (extrapolated) = 0.039 W/kg

**SAR(1 g) = 0.020 mW/g; SAR(10 g) = 0.00996 mW/g**



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFLS696; Type: Portable Handset; Serial: SAR#1**

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

Medium: 2450 Body; Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$ ;  $\sigma = 2.02 \text{ mho/m}$ ;  $\epsilon_r = 50.58$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.2 °C; Tissue Temp: 21.4 °C

Probe: ES3DV3 - SN3209; ConvF(4.15, 4.15, 4.15); Calibrated: 4/18/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

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

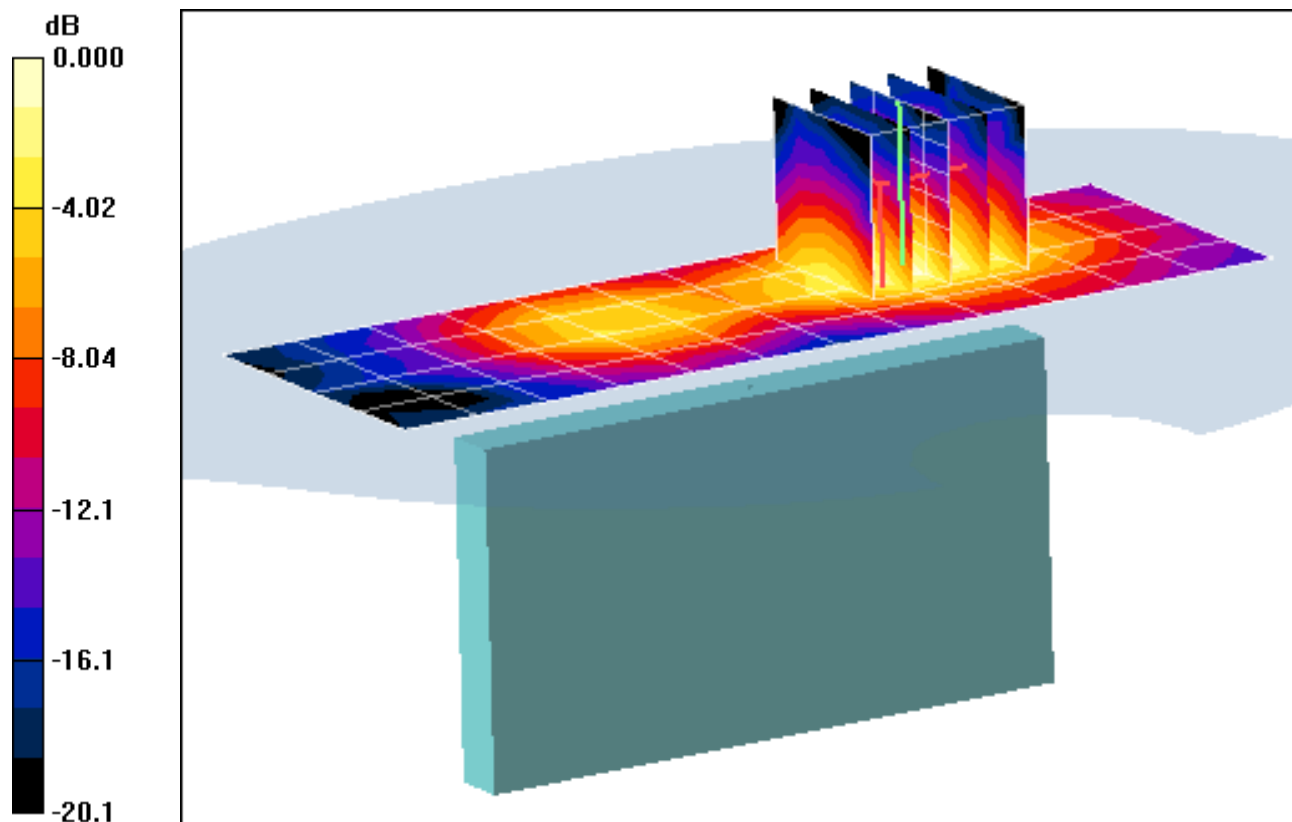
**Area Scan (5x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Reference Value = 5.05 V/m; Power Drift = 0.077 dB

Peak SAR (extrapolated) = 0.114 W/kg

**SAR(1 g) = 0.059 mW/g; SAR(10 g) = 0.029 mW/g**



0 dB = 0.072mW/g

## APPENDIX B: DIPOLE VALIDATION

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d047**

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

Medium: 835 Head Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 0.881 \text{ mho/m}$ ;  $\epsilon_r = 41.5$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-28-2011; Ambient Temp: 24.5°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3550; ConvF(8.04, 8.04, 8.04); Calibrated: 2/14/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/21/2011

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

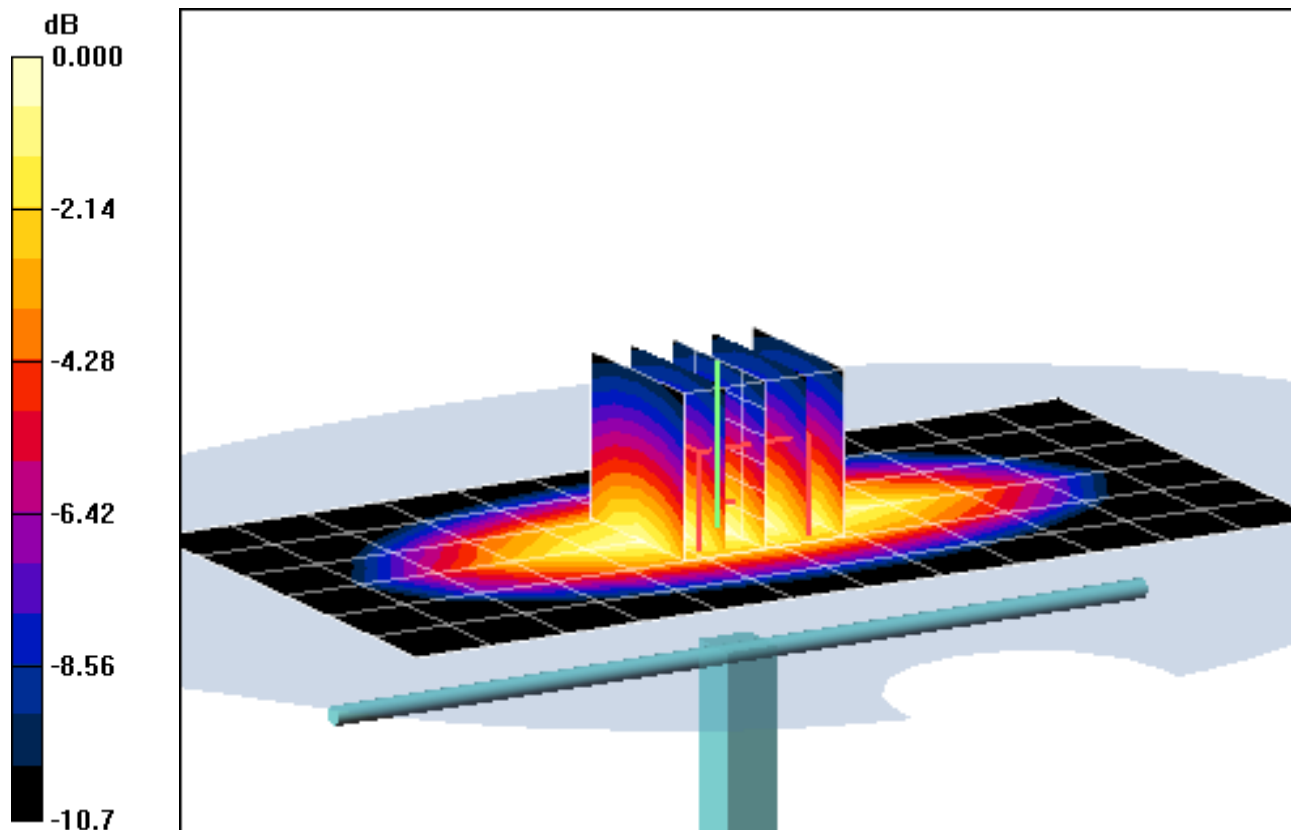
**Area Scan (7x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Input Power = 20 dBm (100mW)

**SAR(1 g) = 0.913 mW/g; SAR(10 g) = 0.596 mW/g**

Deviation = -4.20%



0 dB = 0.988mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d047**

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

Medium: 835 Head Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 0.881 \text{ mho/m}$ ;  $\epsilon_r = 41.5$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-28-2011; Ambient Temp: 24.5°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3550; ConvF(8.04, 8.04, 8.04); Calibrated: 2/14/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/21/2011

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

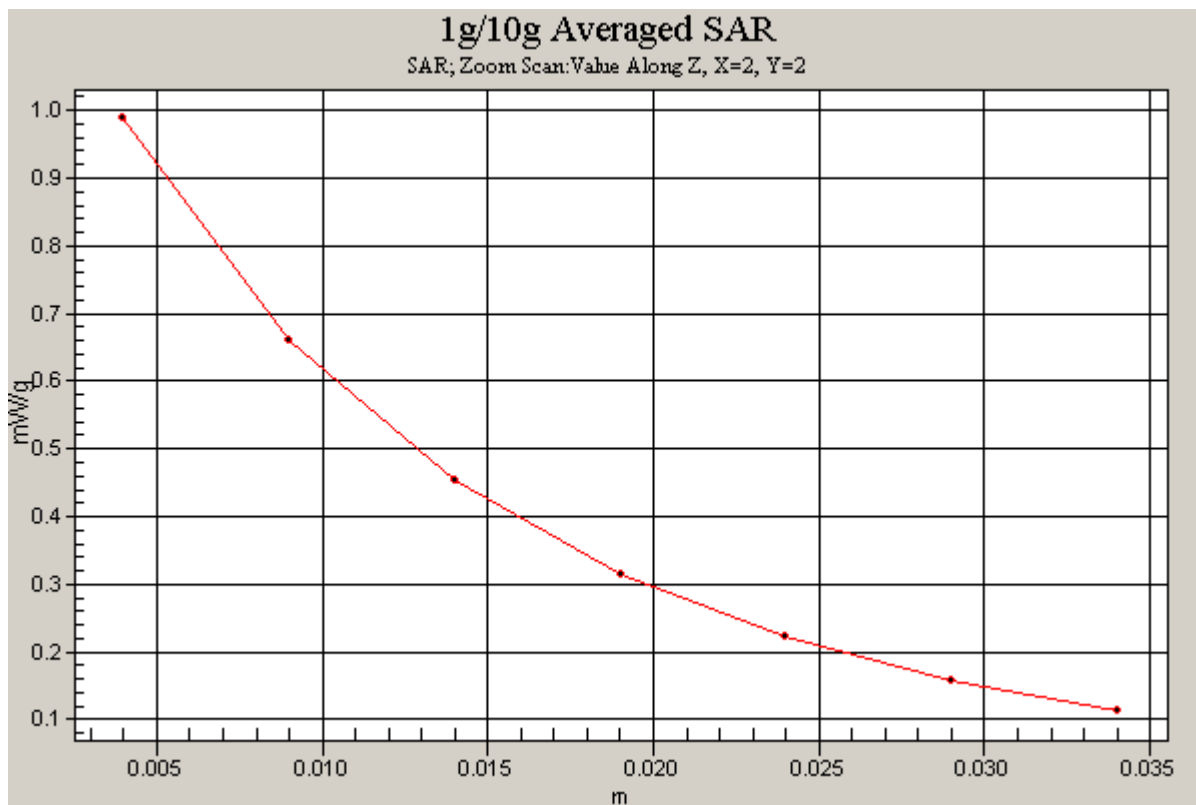
**Area Scan (7x13x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power = 20 dBm (100mW)

**SAR(1 g) = 0.913 mW/g; SAR(10 g) = 0.596 mW/g**

Deviation = -4.20%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 502**

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

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.41 \text{ mho/m}$ ;  $\epsilon_r = 38.88$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.9°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3209; ConvF(5.11, 5.11, 5.11); Calibrated: 4/18/2011

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

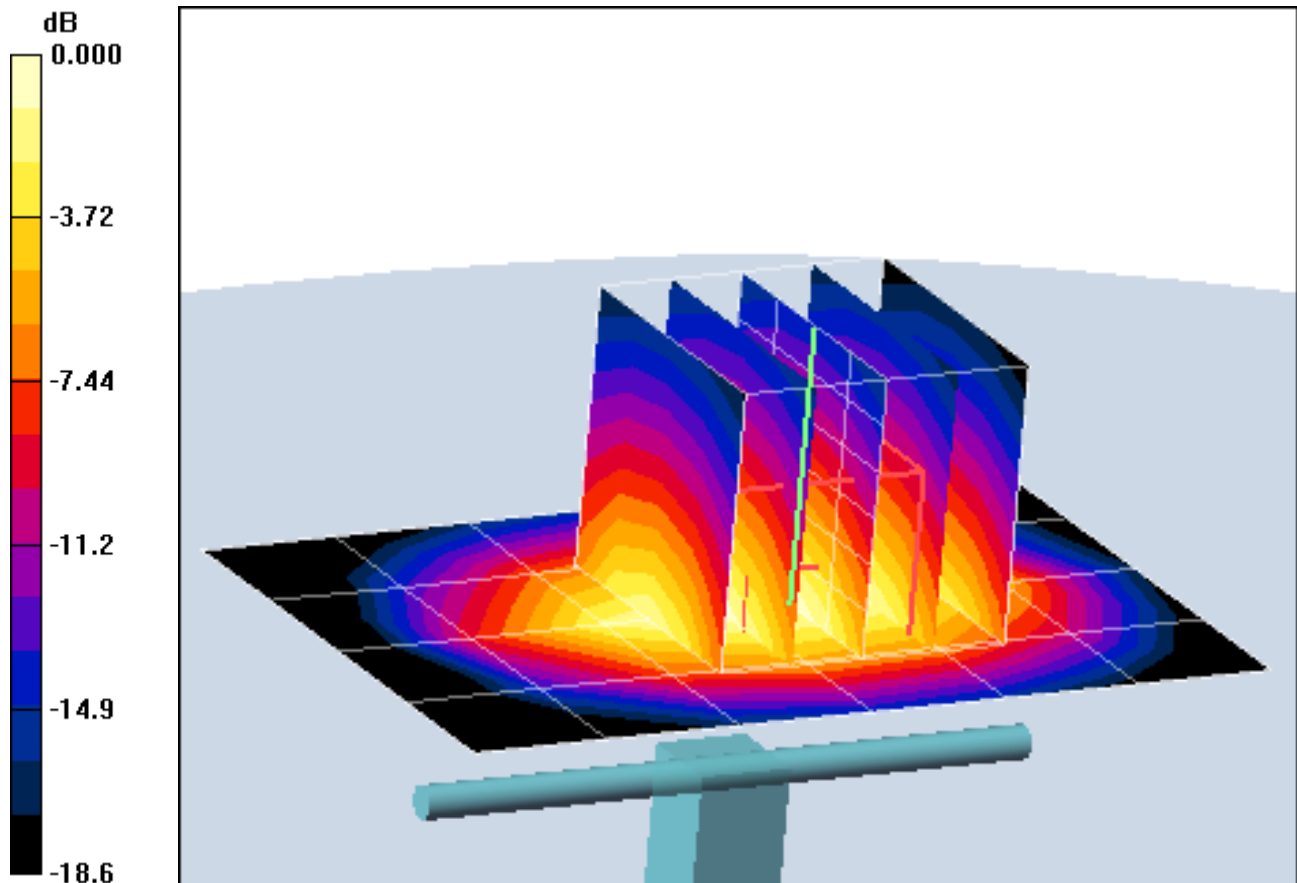
**Area Scan (5x7x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 4.12 mW/g; SAR(10 g) = 2.11 mW/g**

Deviation = 2.49 %



0 dB = 4.58mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 502**

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

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.41 \text{ mho/m}$ ;  $\epsilon_r = 38.88$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.9°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3209; ConvF(5.11, 5.11, 5.11); Calibrated: 4/18/2011

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

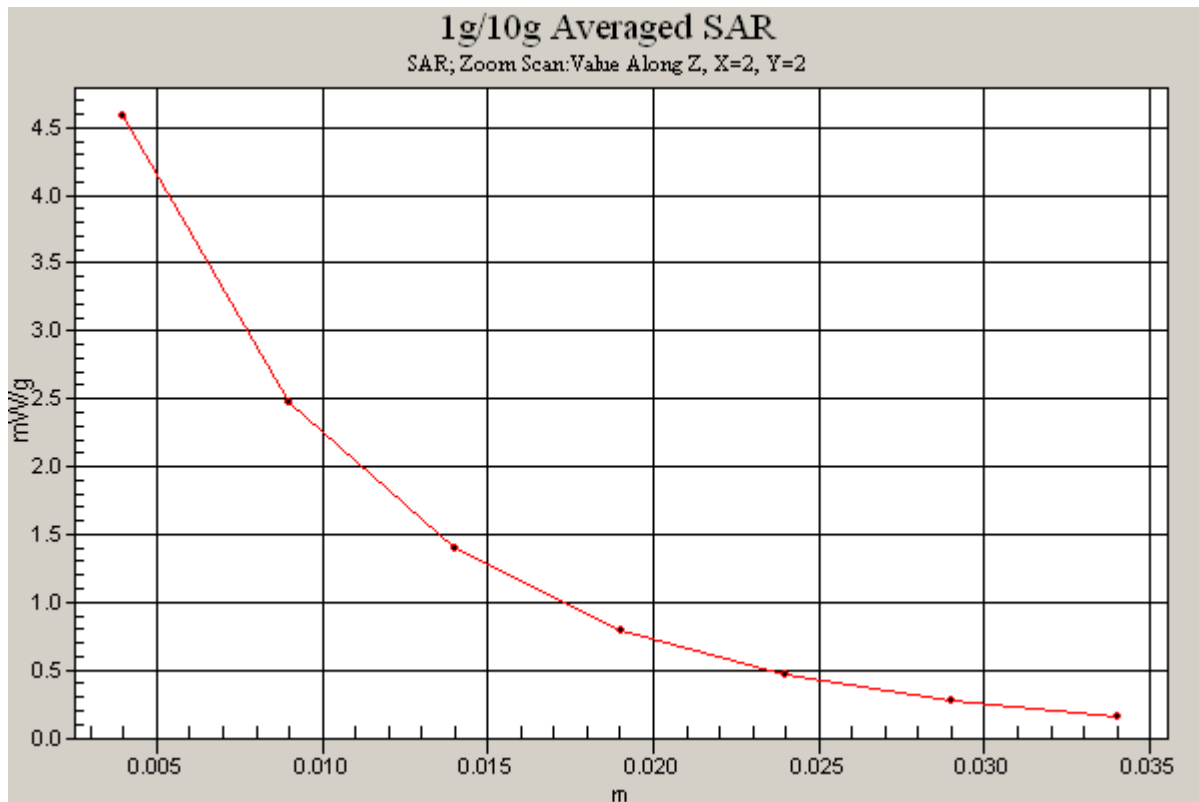
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 4.12 mW/g; SAR(10 g) = 2.11 mW/g**

Deviation = 2.49 %



# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 2450 Head Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.88 \text{ mho/m}$ ;  $\epsilon_r = 38.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 22.8°C; Tissue Temp: 21.0°C

Probe: ES3DV3 - SN3209; ConvF(4.52, 4.52, 4.52); Calibrated: 4/18/2011

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

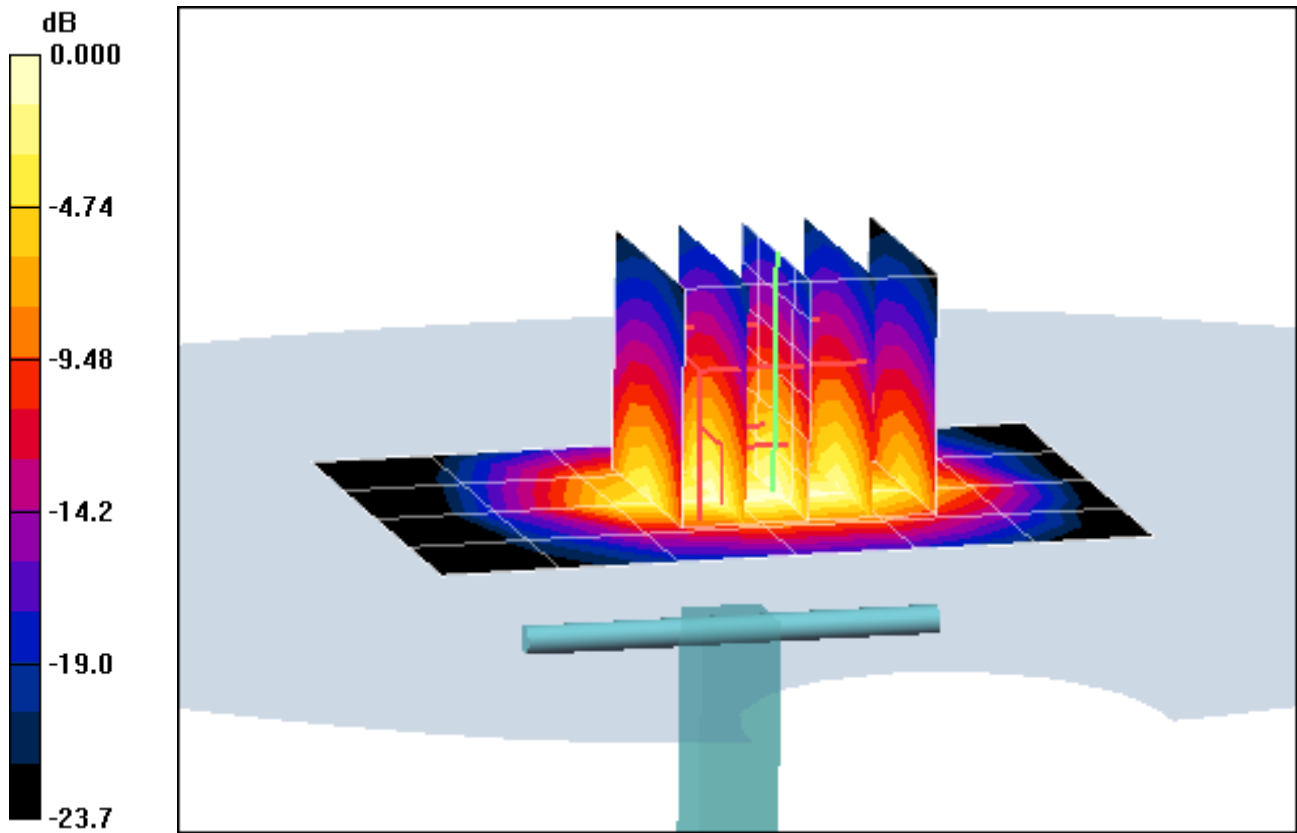
**Area Scan (5x7x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Input Power = 13 dBm (20 mW)

**SAR(1 g) = 1.15 mW/g; SAR(10 g) = 0.526 mW/g**

Deviation = 7.88%



0 dB = 1.51mW/g

# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 2450 Head Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 1.88 \text{ mho/m}$ ;  $\epsilon_r = 38.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 22.8°C; Tissue Temp: 21.0°C

Probe: ES3DV3 - SN3209; ConvF(4.52, 4.52, 4.52); Calibrated: 4/18/2011

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

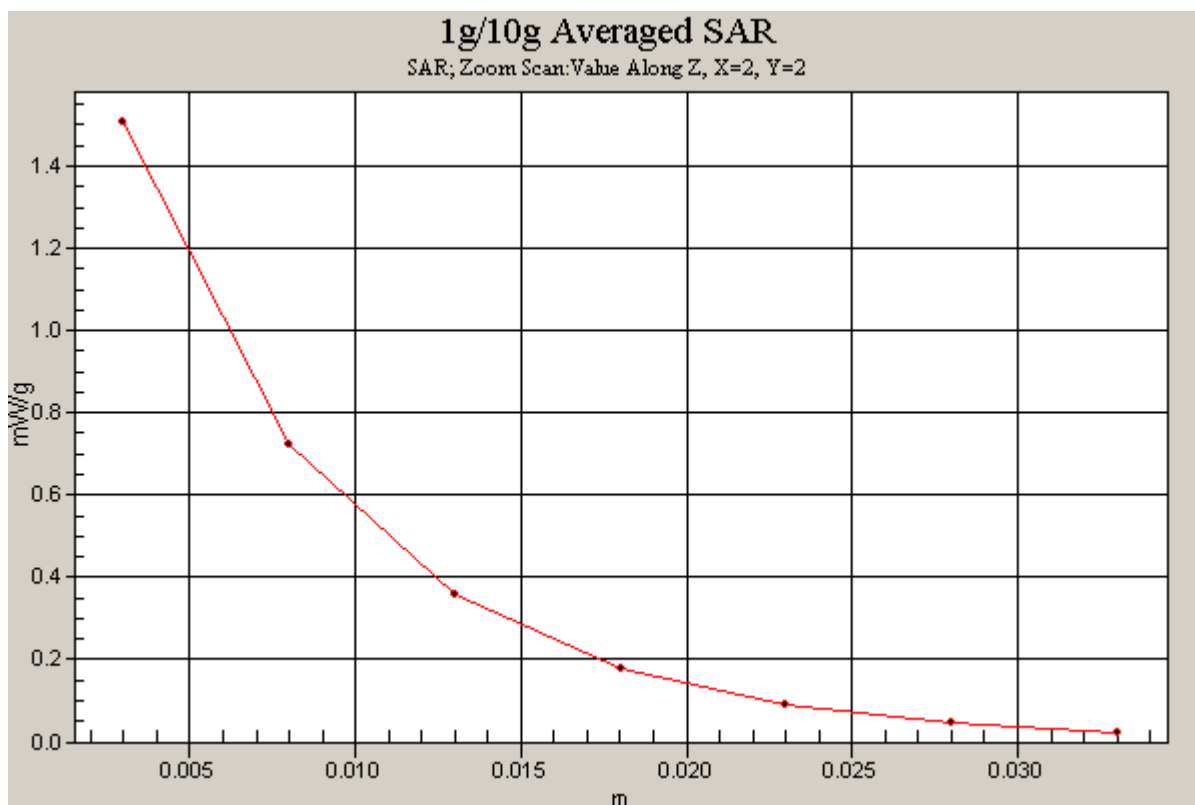
**Area Scan (5x7x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Input Power = 13 dBm (20 mW)

**SAR(1 g) = 1.15 mW/g; SAR(10 g) = 0.526 mW/g**

Deviation = 7.88%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d119**

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

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 0.974 \text{ mho/m}$ ;  $\epsilon_r = 53.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-30-2011; Ambient Temp: 21.8°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

## 835MHz System Verification

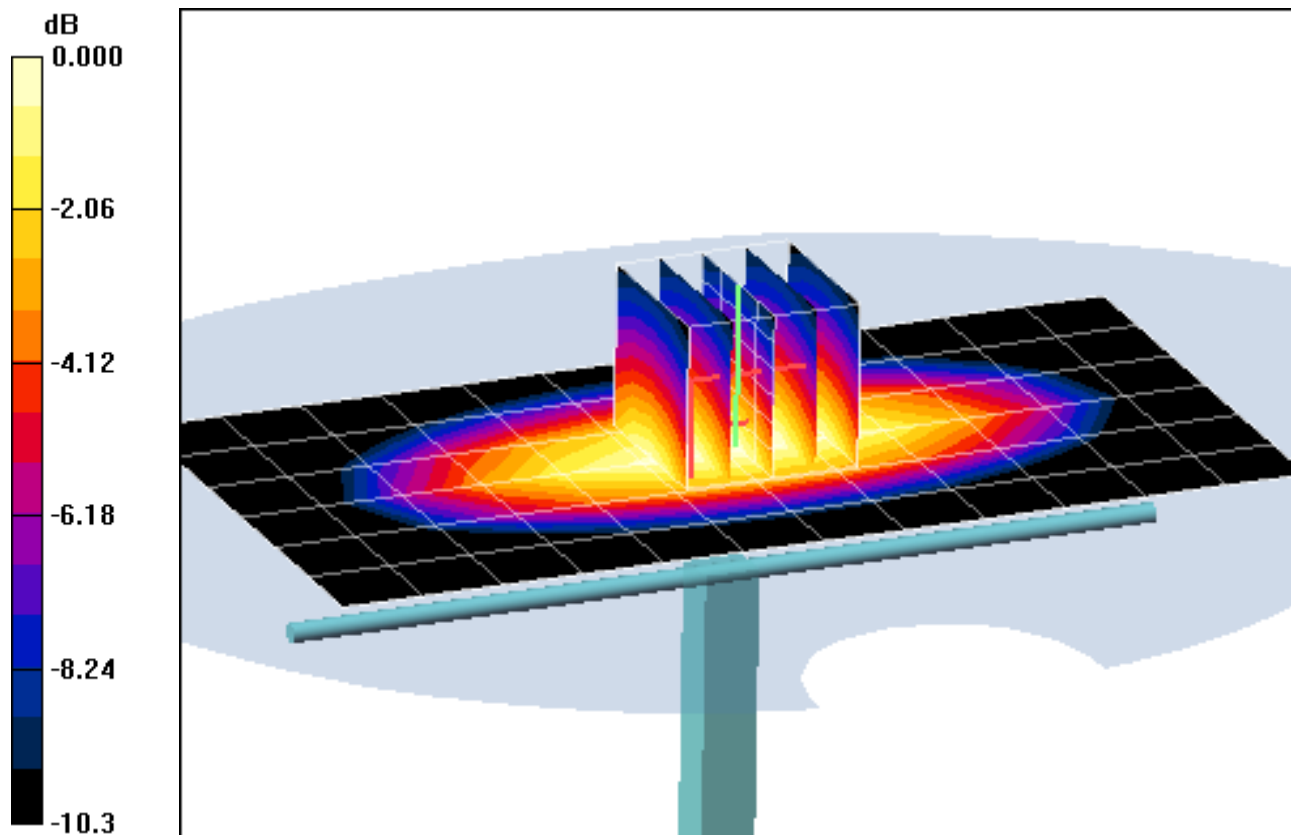
**Area Scan (7x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Input Power = 20 dBm (100 mW)

**SAR(1 g) = 0.890 mW/g; SAR(10 g) = 0.588 mW/g**

Deviation = -5.92%



0 dB = 0.956mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d119**

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

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$ ;  $\sigma = 0.974 \text{ mho/m}$ ;  $\epsilon_r = 53.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-30-2011; Ambient Temp: 21.8°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3209; ConvF(6.15, 6.15, 6.15); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

## 835MHz System Verification

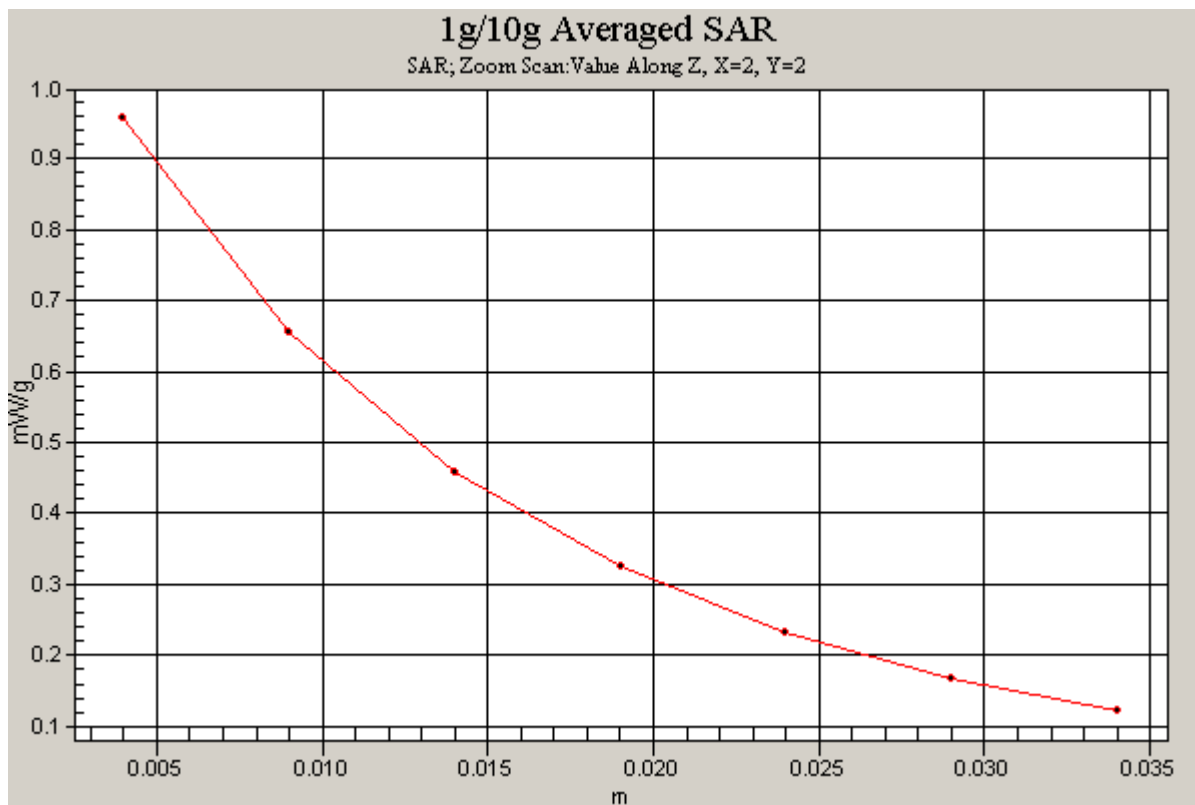
**Area Scan (7x13x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Input Power = 20 dBm (100 mW)

**SAR(1 g) = 0.890 mW/g; SAR(10 g) = 0.588 mW/g**

Deviation = -5.92%



# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 502**

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

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.52 \text{ mho/m}$ ;  $\epsilon_r = 52.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.9°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3209; ConvF(4.48, 4.48, 4.48); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

## 1900MHz System Verification

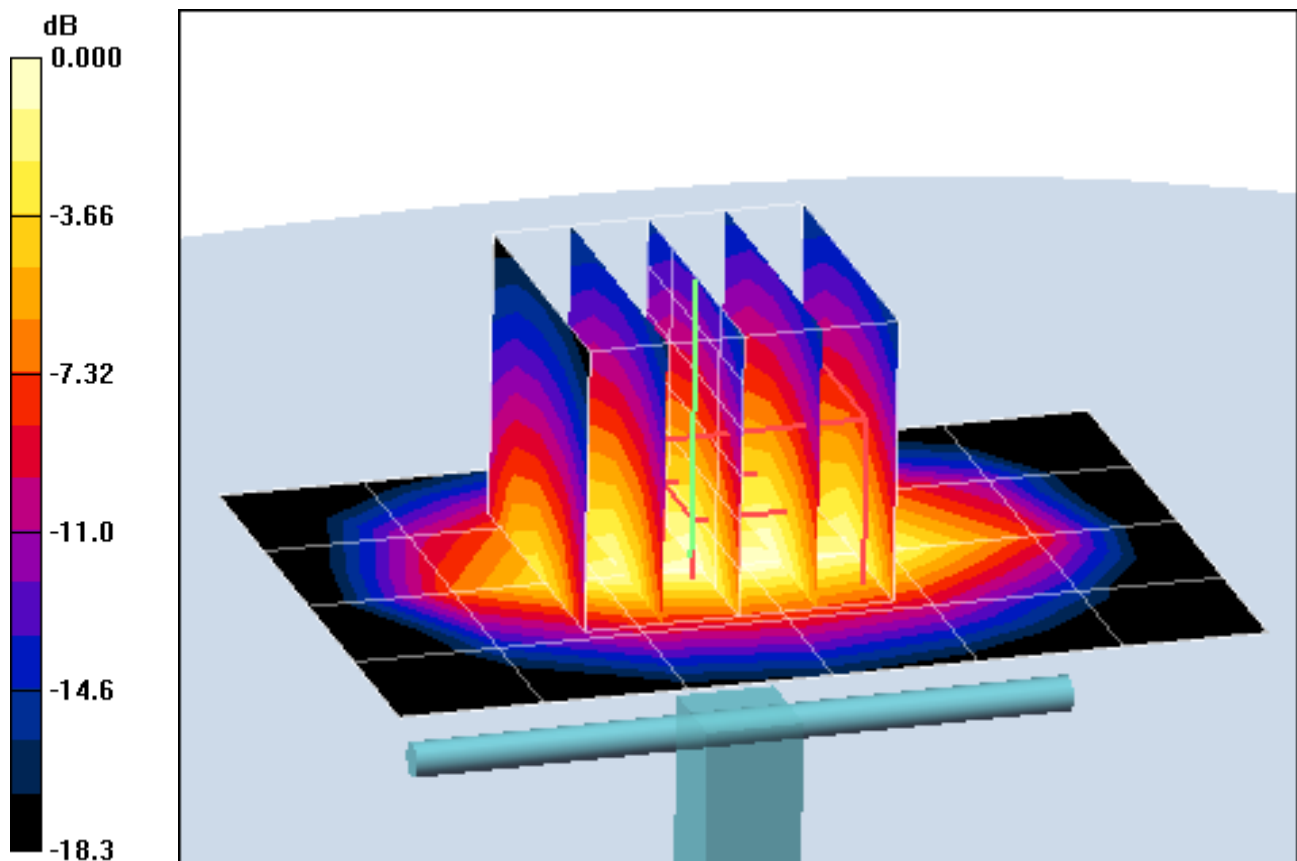
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 4.3 mW/g; SAR(10 g) = 2.25 mW/g**

Deviation = 4.62 %



0 dB = 4.74mW/g

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 502**

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

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$ ;  $\sigma = 1.52 \text{ mho/m}$ ;  $\epsilon_r = 52.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.9°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3209; ConvF(4.48, 4.48, 4.48); Calibrated: 4/18/2011

Sensor-Surface: 4mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

## 1900MHz System Verification

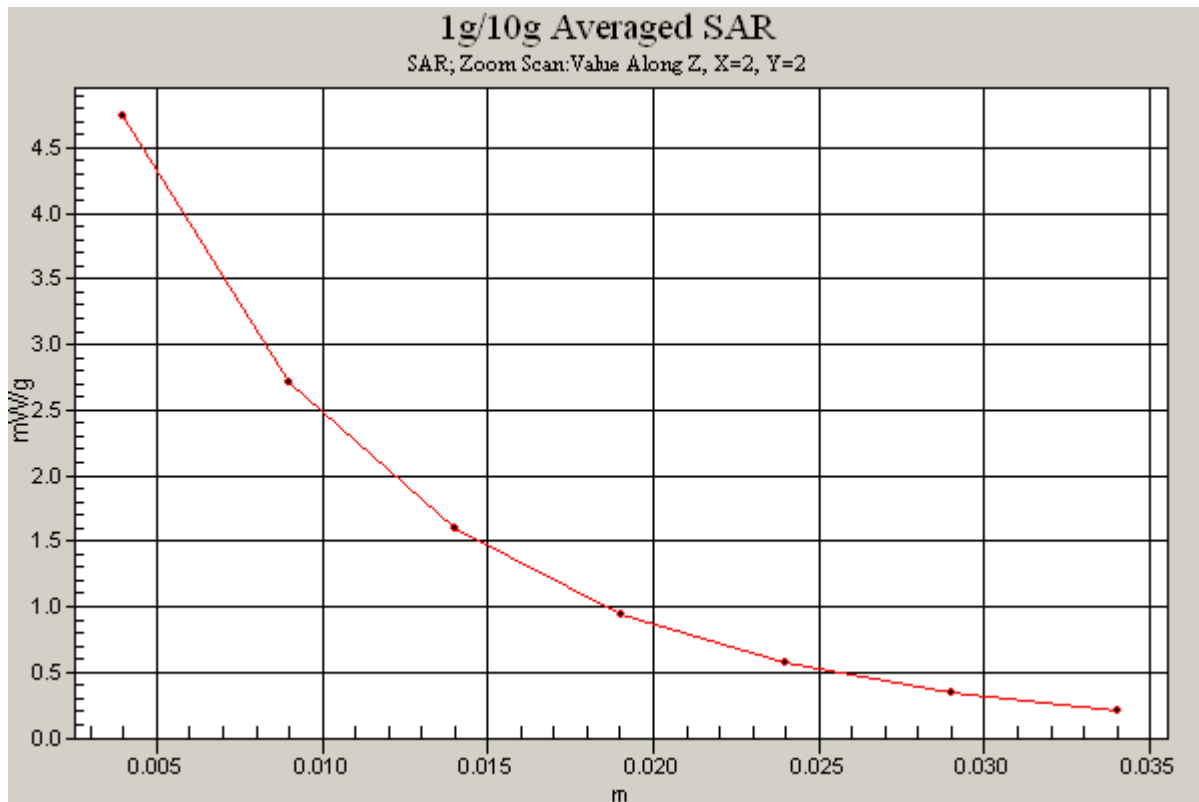
**Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

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

Input Power = 20.0 dBm (100 mW)

**SAR(1 g) = 4.3 mW/g; SAR(10 g) = 2.25 mW/g**

Deviation = 4.62 %



# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 2 \text{ mho/m}$ ;  $\epsilon_r = 50.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.2°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3209; ConvF(4.15, 4.15, 4.15); Calibrated: 4/18/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

## 2450MHz System Verification

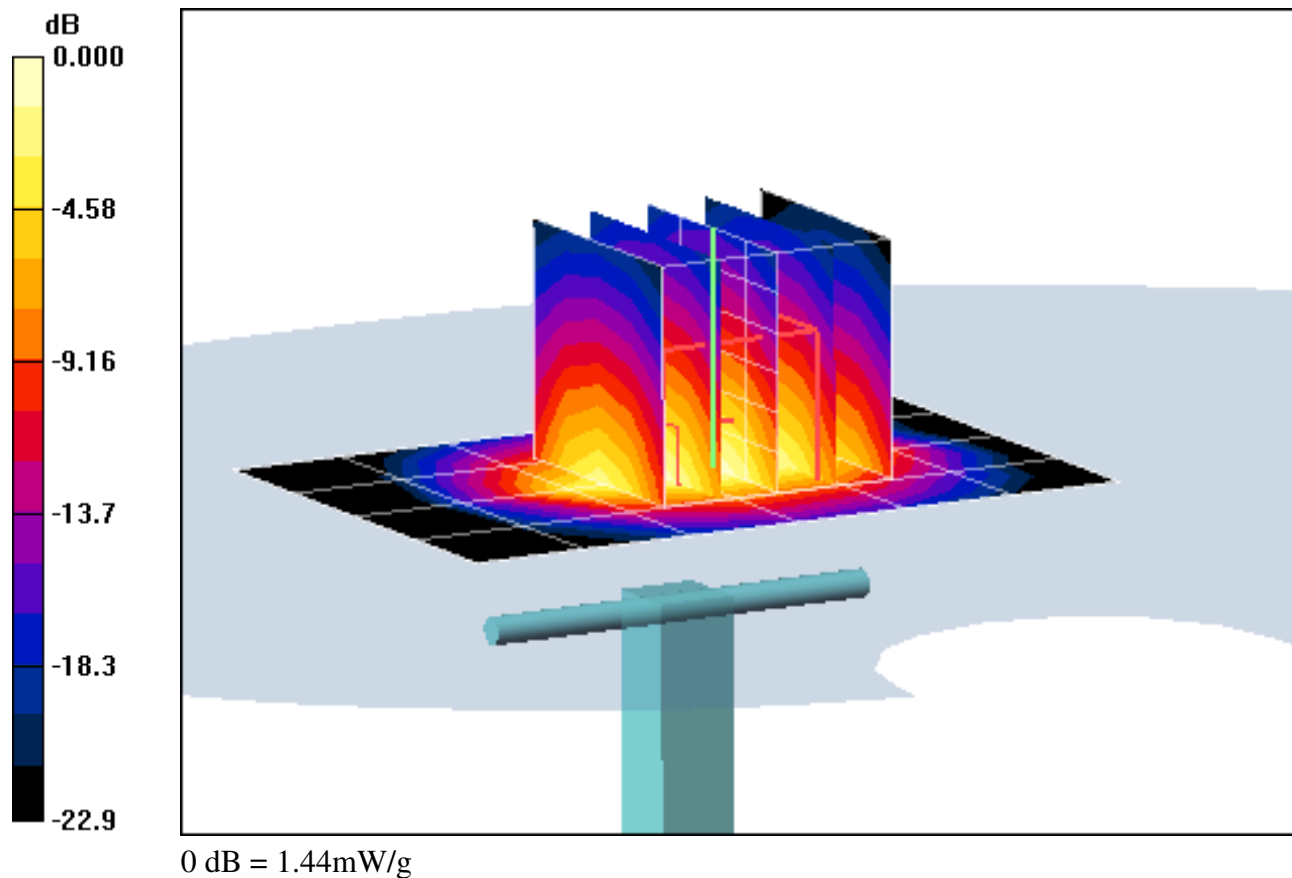
**Area Scan (5x7x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Input Power = 13 dBm (20 mW)

**SAR(1 g) = 1.11 mW/g; SAR(10 g) = 0.512 mW/g**

Deviation = 6.12%



# PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$ ;  $\sigma = 2 \text{ mho/m}$ ;  $\epsilon_r = 50.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-29-2011; Ambient Temp: 23.2°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3209; ConvF(4.15, 4.15, 4.15); Calibrated: 4/18/2011

Sensor-Surface: 3mm (Mechanical Surface Detection)

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

Phantom: SAM Sub Dasy B; Type: SAM 4.0; Serial: TP-1626

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

## 2450MHz System Verification

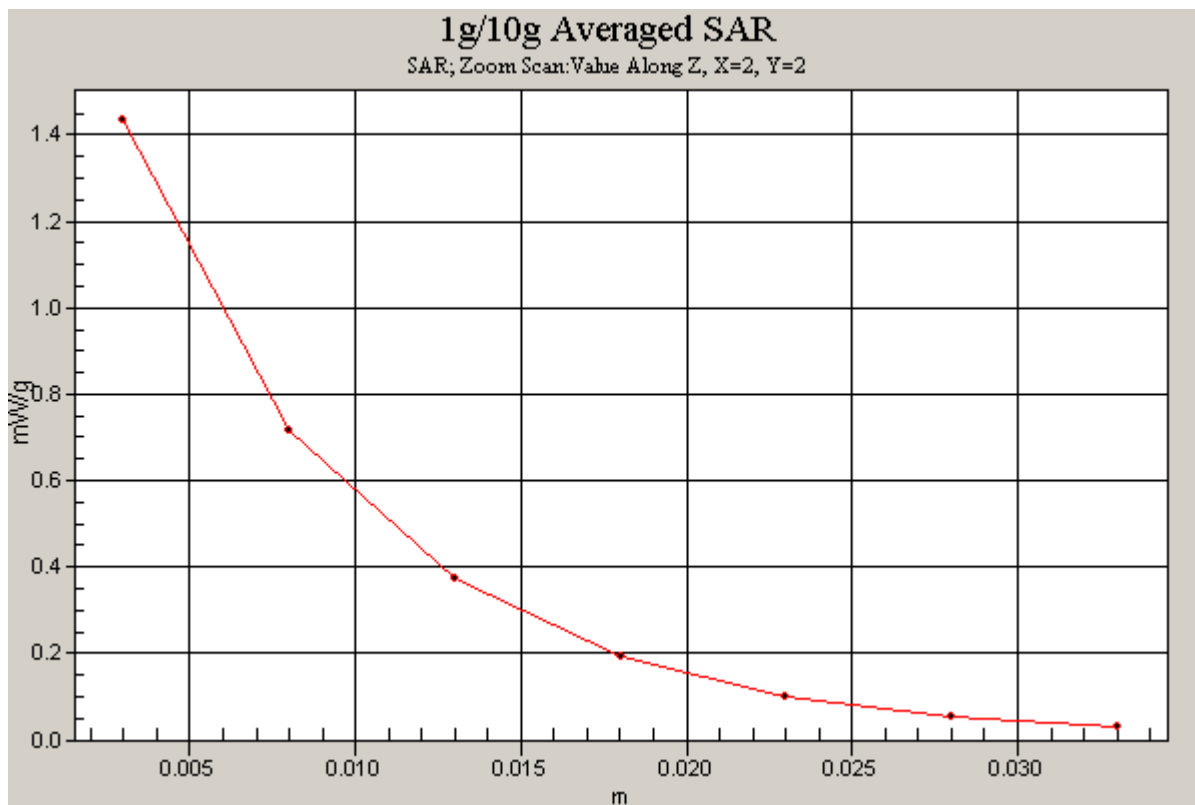
**Area Scan (5x7x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

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

Input Power = 13 dBm (20 mW)

**SAR(1 g) = 1.11 mW/g; SAR(10 g) = 0.512 mW/g**

Deviation = 6.12%



## APPENDIX C: PROBE CALIBRATION



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

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D835V2-4d047\_Feb11**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d047**

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

Calibration date: **February 09, 2011**

✓  
2/24/11  
KOK

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)     | Scheduled Calibration |
|-----------------------------|--------------------|--------------------------------|-----------------------|
| Power meter EPM-442A        | GB37480704         | 06-Oct-10 (No. 217-01266)      | Oct-11                |
| Power sensor HP 8481A       | US37292783         | 06-Oct-10 (No. 217-01266)      | Oct-11                |
| Reference 20 dB Attenuator  | SN: 5086 (20g)     | 30-Mar-10 (No. 217-01158)      | Mar-11                |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 30-Mar-10 (No. 217-01162)      | Mar-11                |
| Reference Probe ES3DV3      | SN: 3205           | 30-Apr-10 (No. ES3-3205_Apr10) | Apr-11                |
| DAE4                        | SN: 601            | 10-Jun-10 (No. DAE4-601_Jun10) | Jun-11                |

| Secondary Standards       | ID #             | Check Date (in house)             | Scheduled Check        |
|---------------------------|------------------|-----------------------------------|------------------------|
| Power sensor HP 8481A     | MY41092317       | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06   | 100005           | 4-Aug-99 (in house check Oct-09)  | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

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

Issued: February 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       |
| <b>Extrapolation</b>                | Advanced Extrapolation    |             |
| <b>Phantom</b>                      | Modular Flat Phantom V4.9 |             |
| <b>Distance Dipole Center - TSL</b> | 15 mm                     | with Spacer |
| <b>Zoom Scan Resolution</b>         | dx, dy, dz = 5 mm         |             |
| <b>Frequency</b>                    | 835 MHz $\pm$ 1 MHz       |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| <b>Nominal Head TSL parameters</b>      | 22.0 °C             | 41.5           | 0.90 mho/m           |
| <b>Measured Head TSL parameters</b>     | (22.0 $\pm$ 0.2) °C | 41.1 $\pm$ 6 % | 0.89 mho/m $\pm$ 6 % |
| <b>Head TSL temperature during test</b> | (21.8 $\pm$ 0.2) °C | ----           | ----                 |

## SAR result with Head TSL

| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                                 |
|-------------------------------------------------------------|--------------------|-------------------------------------------------|
| SAR measured                                                | 250 mW input power | 2.37 mW / g                                     |
| SAR normalized                                              | normalized to 1W   | 9.48 mW / g                                     |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>9.53 mW /g <math>\pm</math> 17.0 % (k=2)</b> |

| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                                 |
|---------------------------------------------------------------|--------------------|-------------------------------------------------|
| SAR measured                                                  | 250 mW input power | 1.54 mW / g                                     |
| SAR normalized                                                | normalized to 1W   | 6.16 mW / g                                     |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>6.19 mW /g <math>\pm</math> 16.5 % (k=2)</b> |

## 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 ± 0.2) °C | 54.2 ± 6 %   | 0.99 mho/m ± 6 % |
| Body TSL temperature during test | (22.0 ± 0.2) °C | ----         | ----             |

## SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                            |
|-------------------------------------------------------|--------------------|----------------------------|
| SAR measured                                          | 250 mW input power | 2.51 mW / g                |
| SAR normalized                                        | normalized to 1W   | 10.0 mW / g                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 9.85 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                            |
|---------------------------------------------------------|--------------------|----------------------------|
| SAR measured                                            | 250 mW input power | 1.64 mW / g                |
| SAR normalized                                          | normalized to 1W   | 6.56 mW / g                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 6.47 mW / g ± 16.5 % (k=2) |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.1 $\Omega$ - 6.2 j $\Omega$ |
| Return Loss                          | - 24.2 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 45.9 $\Omega$ - 8.2 j $\Omega$ |
| Return Loss                          | - 20.4 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.387 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 | August 16, 2006 |

## DASY5 Validation Report for Head TSL

Date/Time: 09.02.2011 10:54:37

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d047**

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

Medium: HSL900

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.89 \text{ mho/m}$ ;  $\epsilon_r = 41$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.03, 6.03, 6.03); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

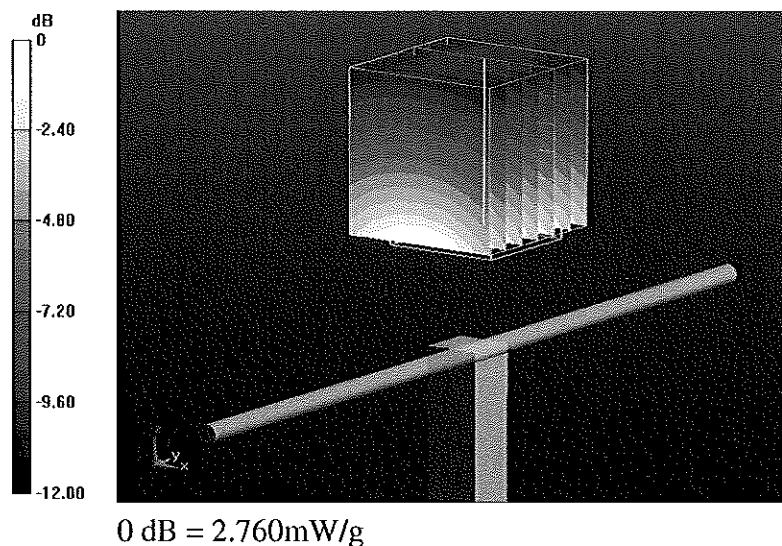
**Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement**  
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.212 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 3.567 W/kg

**SAR(1 g) = 2.37 mW/g; SAR(10 g) = 1.54 mW/g**

Maximum value of SAR (measured) = 2.763 mW/g

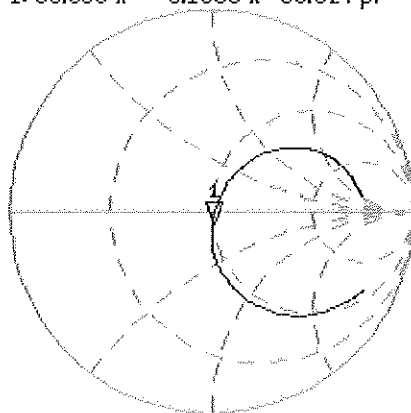


# Impedance Measurement Plot for Head TSL

9 Feb 2011 10:16:52  
 [CH1] S11 1 U FS 1: 50.000  $\Omega$  -6.1836  $\Omega$  30.824 pF 835.000 000 MHz

\*  
 Del  
 Cor

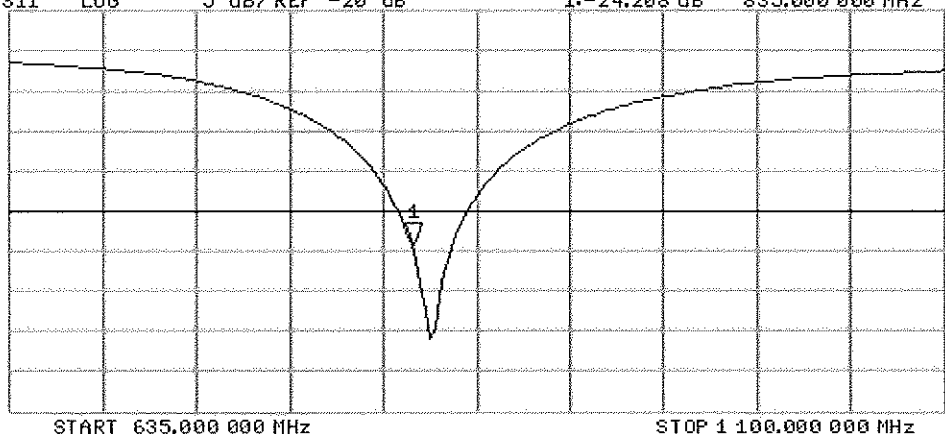
Avg  
 16



CH2 S11 LOG 5 dB/REF -20 dB 1:-24.208 dB 835.000 000 MHz

Cor

Avg  
 16



## DASY5 Validation Report for Body TSL

Date/Time: 09.02.2011 13:56:30

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d047**

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

Medium: MSL900

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.99 \text{ mho/m}$ ;  $\epsilon_r = 54.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.86, 5.86, 5.86); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

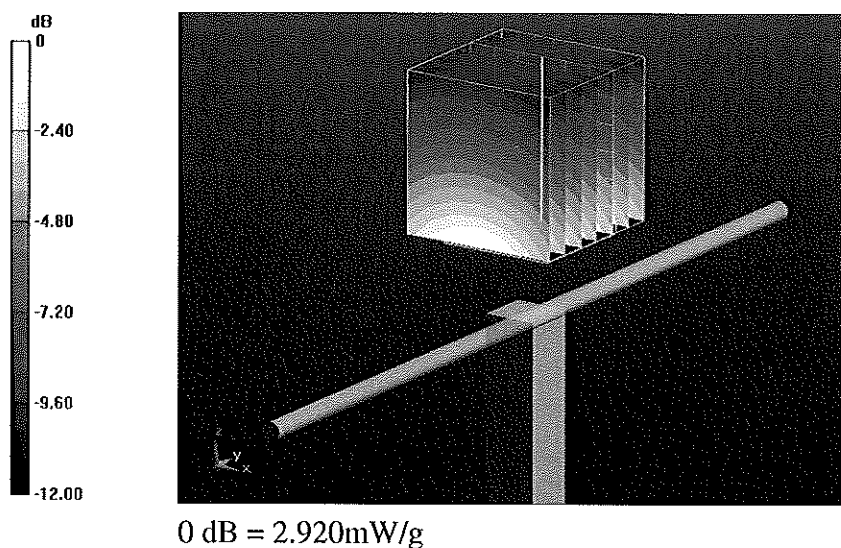
**Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement**  
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.092 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 3.714 W/kg

**SAR(1 g) = 2.51 mW/g; SAR(10 g) = 1.64 mW/g**

Maximum value of SAR (measured) = 2.921 mW/g



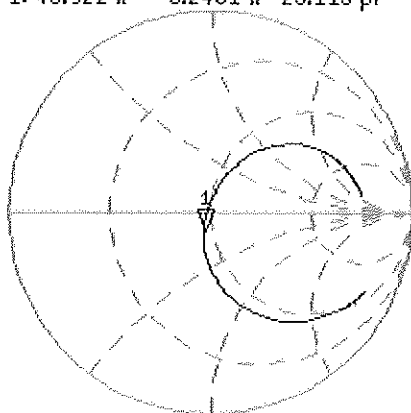
# Impedance Measurement Plot for Body TSL

9 Feb 2011 14:20:21  
 CH1 S11 1 U FS 1: 45.922  $\Omega$  -8.2461  $\Omega$  23.115 pF 835.000 000 MHz

\*  
 Del  
 Cor

Avg  
 16

↑

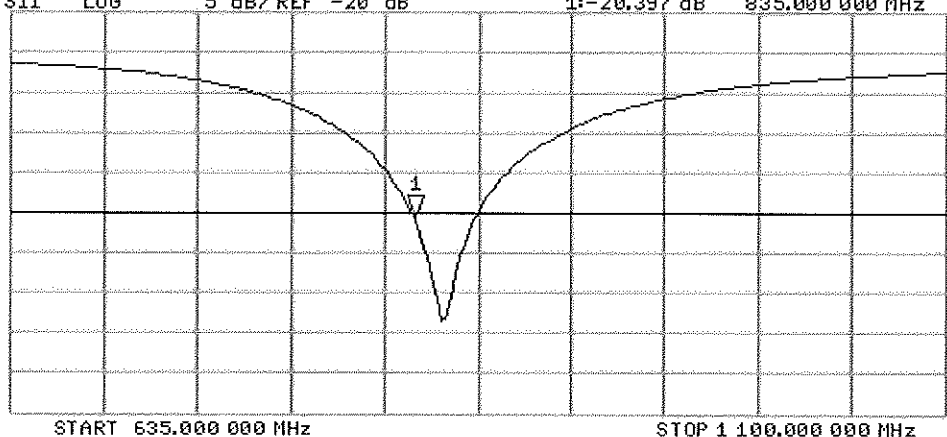


CH2 S11 LOG 5 dB/REF -20 dB 1: -20.397 dB 835.000 000 MHz

Cor

Avg  
 16

↑





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

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1900V2-502\_Feb11**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 502**

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

Calibration date: **February 17, 2011**

✓  
 KOK  
 2/24/11

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter EPM-442A        | GB37480704         | 06-Oct-10 (No. 217-01266)         | Oct-11                 |
| Power sensor HP 8481A       | US37292783         | 06-Oct-10 (No. 217-01266)         | Oct-11                 |
| Reference 20 dB Attenuator  | SN: 5086 (20g)     | 30-Mar-10 (No. 217-01158)         | Mar-11                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 30-Mar-10 (No. 217-01162)         | Mar-11                 |
| Reference Probe ES3DV3      | SN: 3205           | 30-Apr-10 (No. ES3-3205_Apr10)    | Apr-11                 |
| DAE4                        | SN: 601            | 10-Jun-10 (No. DAE4-601_Jun10)    | Jun-11                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06     | 100005             | 4-Aug-99 (in house check Oct-09)  | In house check: Oct-11 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

Calibrated by: **Dimce Iliev** **Laboratory Technician** *D. Iliev*

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

Issued: February 17, 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.

|                              |                           |             |
|------------------------------|---------------------------|-------------|
| DASY Version                 | DASY5                     | V52.6       |
| Extrapolation                | Advanced Extrapolation    |             |
| Phantom                      | Modular Flat Phantom V5.0 |             |
| Distance Dipole Center - TSL | 10 mm                     | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm         |             |
| Frequency                    | 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 | 39.8 $\pm$ 6 % | 1.41 mho/m $\pm$ 6 % |
| Head TSL temperature during test | (21.5 $\pm$ 0.2) °C | ----           | ----                 |

## SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                               |
|-------------------------------------------------------|--------------------|-------------------------------|
| SAR measured                                          | 250 mW input power | 10.1 mW / g                   |
| SAR normalized                                        | normalized to 1W   | 40.4 mW / g                   |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 40.2 mW /g $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                               |
|---------------------------------------------------------|--------------------|-------------------------------|
| SAR measured                                            | 250 mW input power | 5.26 mW / g                   |
| SAR normalized                                          | normalized to 1W   | 21.0 mW / g                   |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 21.0 mW /g $\pm$ 16.5 % (k=2) |

## Body TSL parameters

The following parameters and calculations were applied.

|                                  | Temperature     | Permittivity | Conductivity     |
|----------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters      | 22.0 °C         | 53.3         | 1.52 mho/m       |
| Measured Body TSL parameters     | (22.0 ± 0.2) °C | 52.8 ± 6 %   | 1.55 mho/m ± 6 % |
| Body TSL temperature during test | (21.5 ± 0.2) °C | ----         | ----             |

## SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                            |
|-------------------------------------------------------|--------------------|----------------------------|
| SAR measured                                          | 250 mW input power | 10.4 mW / g                |
| SAR normalized                                        | normalized to 1W   | 41.6 mW / g                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 41.1 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                            |
|---------------------------------------------------------|--------------------|----------------------------|
| SAR measured                                            | 250 mW input power | 5.48 mW / g                |
| SAR normalized                                          | normalized to 1W   | 21.9 mW / g                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 21.8 mW / g ± 16.5 % (k=2) |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $51.3 \Omega + 6.4 j\Omega$ |
| Return Loss                          | - 23.8 dB                   |

### Antenna Parameters with Body TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $47.3 \Omega + 6.7 j\Omega$ |
| Return Loss                          | - 22.5 dB                   |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.206 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 | November 14, 1998 |

## DASY5 Validation Report for Head TSL

Date/Time: 17.02.2011 10:13:23

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:502**

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

Medium: HSL U12 BB

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.41$  mho/m;  $\epsilon_r = 39.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

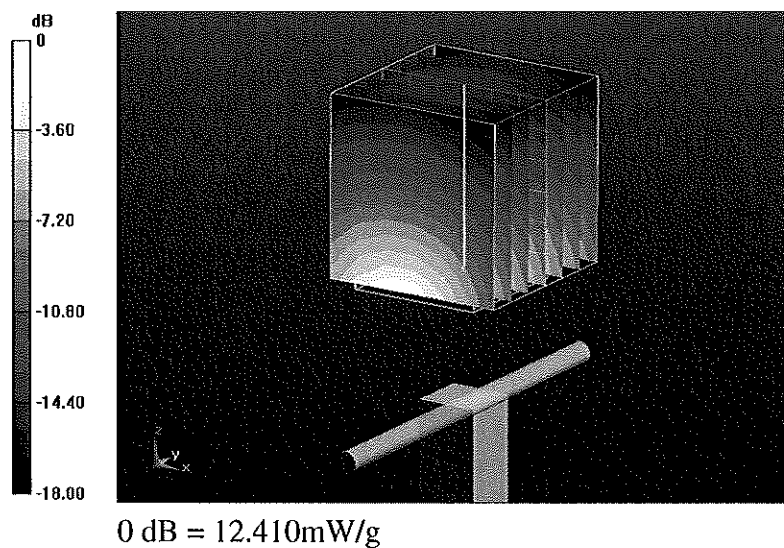
**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement**  
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.159 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 18.519 W/kg

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

Maximum value of SAR (measured) = 12.407 mW/g

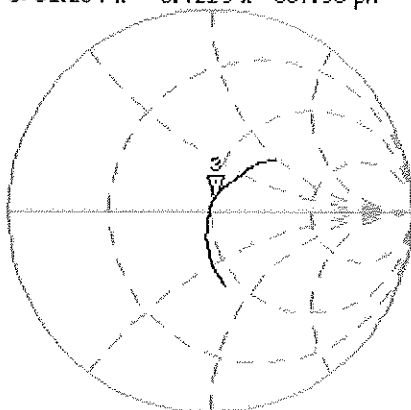


# Impedance Measurement Plot for Head TSL

17 Feb 2011 10:39:46  
 [CH1] S11 1 U FS 3: 51.264  $\Omega$  6.4219  $\Omega$  537.93  $\mu$ H 1 900.000 000 MHz

\*  
 Del  
 CA

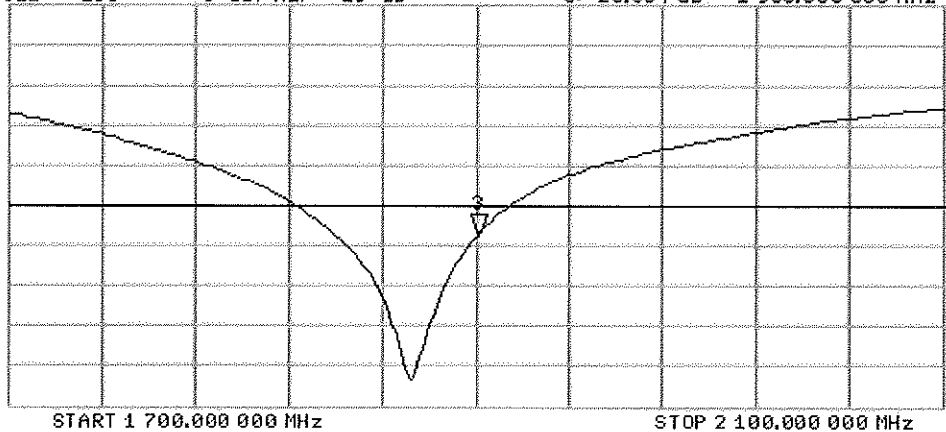
Avg  
 16



CH2 S11 LOG 5 dB/REF -20 dB 3:-23.804 dB 1 900.000 000 MHz

CA

Avg  
 16



## DASY5 Validation Report for Body TSL

Date/Time: 17.02.2011 10:55:26

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:502**

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

Medium: MSL U12 BB

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.55$  mho/m;  $\epsilon_r = 52.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

### DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.59, 4.59, 4.59); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

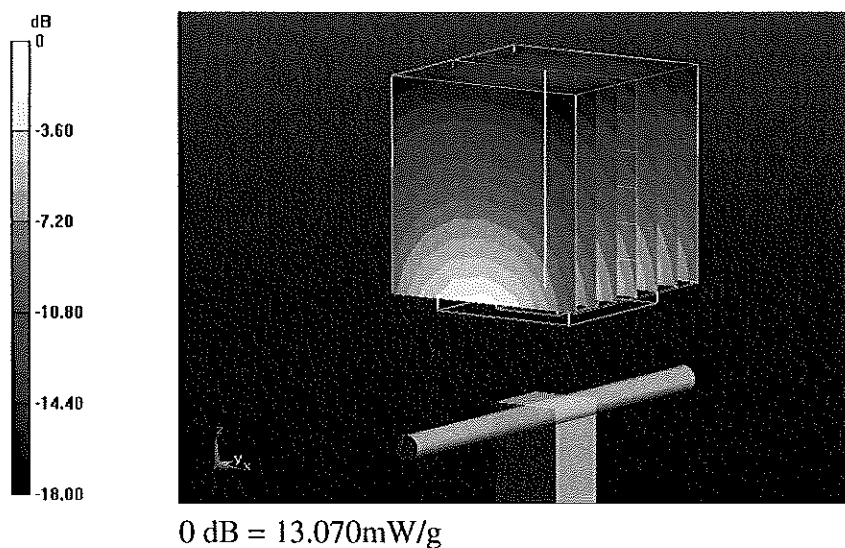
**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement**  
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.636 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 17.829 W/kg

**SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.48 mW/g**

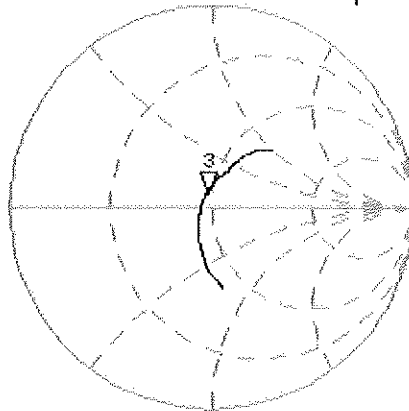
Maximum value of SAR (measured) = 13.070 mW/g



# Impedance Measurement Plot for Body TSL

17 Feb 2011 10:40:17  
 [CH1] S11 1 U FS 3: 47.260  $\Omega$  6.7480  $\Omega$  565.26  $\mu$ H 1 900.000 000 MHz

\*  
 De1  
 CA



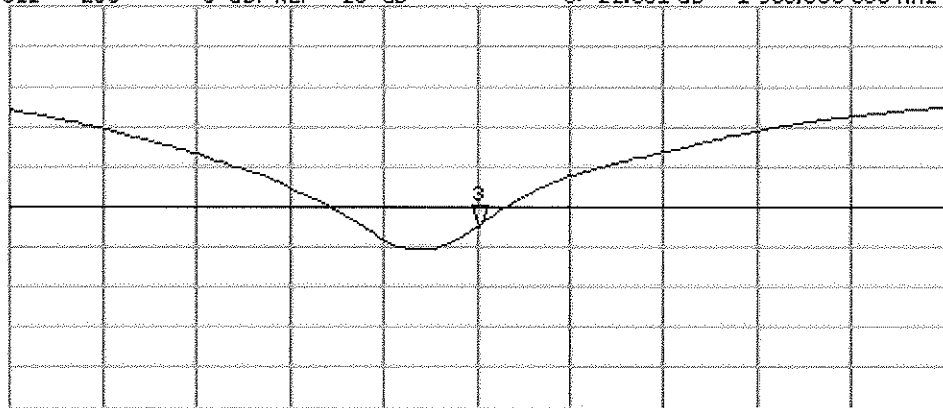
Avg  
 16  
 ↑

CH2 S11 LOG 5 dB/REF -20 dB 3: -22.531 dB 1 900.000 000 MHz

CA

Avg  
 16

↑



START 1 700.000 000 MHz

STOP 2 100.000 000 MHz



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

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D2450V2-797\_Feb11**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 797**

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

Calibration date: **February 08, 2011**

✓ KOK  
2/24/11

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: 5086 (20g)     | 30-Mar-10 (No. 217-01158)      | Mar-11                |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 30-Mar-10 (No. 217-01162)      | Mar-11                |
| Reference Probe ES3DV3      | SN: 3205           | 30-Apr-10 (No. ES3-3205_Apr10) | Apr-11                |
| DAE4                        | SN: 601            | 10-Jun-10 (No. DAE4-601_Jun10) | Jun-11                |

| Secondary Standards       | ID #             | Check Date (in house)             | Scheduled Check        |
|---------------------------|------------------|-----------------------------------|------------------------|
| Power sensor HP 8481A     | MY41092317       | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06   | 100005           | 4-Aug-99 (in house check Oct-09)  | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

|                |             |                       |           |
|----------------|-------------|-----------------------|-----------|
|                | Name        | Function              | Signature |
| Calibrated by: | Dimce Iliev | Laboratory Technician |           |

|              |               |                   |  |
|--------------|---------------|-------------------|--|
| Approved by: | Katja Pokovic | Technical Manager |  |
|--------------|---------------|-------------------|--|

Issued: February 8, 2011

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



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

Accreditation No.: **SCS 108**

### Glossary:

|       |                                 |
|-------|---------------------------------|
| 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       |
| Extrapolation                | Advanced Extrapolation    |             |
| Phantom                      | Modular Flat Phantom V5.0 |             |
| Distance Dipole Center - TSL | 10 mm                     | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm         |             |
| Frequency                    | 2450 MHz $\pm$ 1 MHz      |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                  | Temperature         | Permittivity   | Conductivity         |
|----------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters      | 22.0 °C             | 39.2           | 1.80 mho/m           |
| Measured Head TSL parameters     | (22.0 $\pm$ 0.2) °C | 39.1 $\pm$ 6 % | 1.73 mho/m $\pm$ 6 % |
| Head TSL temperature during test | (21.0 $\pm$ 0.2) °C | ----           | ----                 |

## SAR result with Head TSL

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

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                               |
|---------------------------------------------------------|--------------------|-------------------------------|
| SAR measured                                            | 250 mW input power | 6.14 mW / g                   |
| SAR normalized                                          | normalized to 1W   | 24.6 mW / g                   |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 24.7 mW /g $\pm$ 16.5 % (k=2) |

## Body TSL parameters

The following parameters and calculations were applied.

|                                  | Temperature     | Permittivity | Conductivity     |
|----------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters      | 22.0 °C         | 52.7         | 1.95 mho/m       |
| Measured Body TSL parameters     | (22.0 ± 0.2) °C | 52.2 ± 6 %   | 1.94 mho/m ± 6 % |
| Body TSL temperature during test | (21.0 ± 0.2) °C | ----         | ----             |

## SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                                   |
|-------------------------------------------------------|--------------------|-----------------------------------|
| SAR measured                                          | 250 mW input power | 13.1 mW / g                       |
| SAR normalized                                        | normalized to 1W   | 52.4 mW / g                       |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | <b>52.3 mW / g ± 17.0 % (k=2)</b> |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                                   |
|---------------------------------------------------------|--------------------|-----------------------------------|
| SAR measured                                            | 250 mW input power | 6.05 mW / g                       |
| SAR normalized                                          | normalized to 1W   | 24.2 mW / g                       |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | <b>24.2 mW / g ± 16.5 % (k=2)</b> |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                               |
|--------------------------------------|-------------------------------|
| Impedance, transformed to feed point | $53.9\ \Omega + 3.9\ j\Omega$ |
| Return Loss                          | - 25.5 dB                     |

### Antenna Parameters with Body TSL

|                                      |                               |
|--------------------------------------|-------------------------------|
| Impedance, transformed to feed point | $49.0\ \Omega + 5.2\ j\Omega$ |
| Return Loss                          | - 25.5 dB                     |

### General Antenna Parameters and Design

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

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

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

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

### Additional EUT Data

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

## DASY5 Validation Report for Head TSL

Date/Time: 07.02.2011 13:51:58

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium: HSL U12 BB

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.74$  mho/m;  $\epsilon_r = 39.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

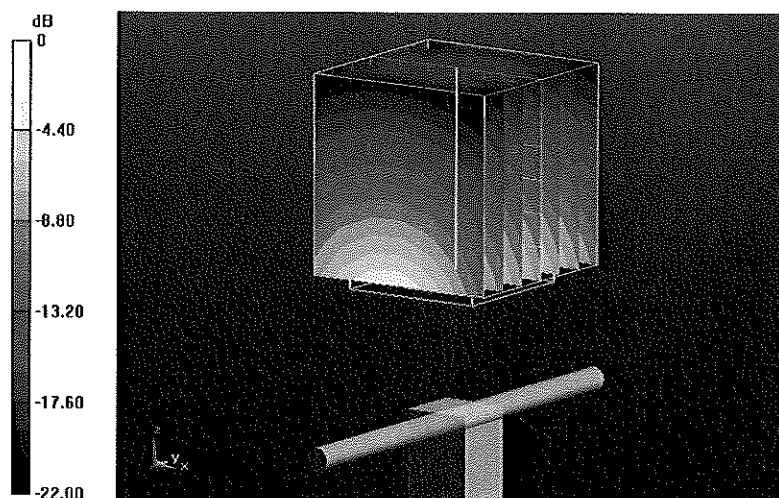
**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement**  
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 101.6 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 26.650 W/kg

**SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.14 mW/g**

Maximum value of SAR (measured) = 16.664 mW/g



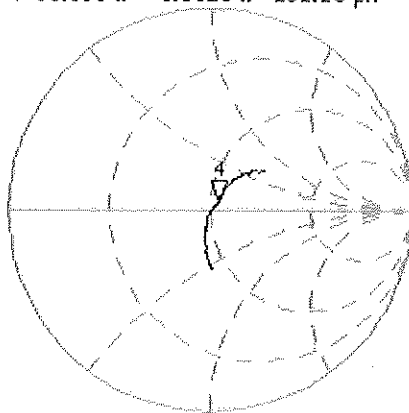
0 dB = 16.660mW/g

# Impedance Measurement Plot for Head TSL

7 Feb 2011 10:40:17  
 [CH1] S11 1 U FS 4: 53.889  $\Omega$  3.8828  $\Omega$  252.23  $\mu\text{H}$  2 450.000 000 MHz

\*  
 De1  
 CA

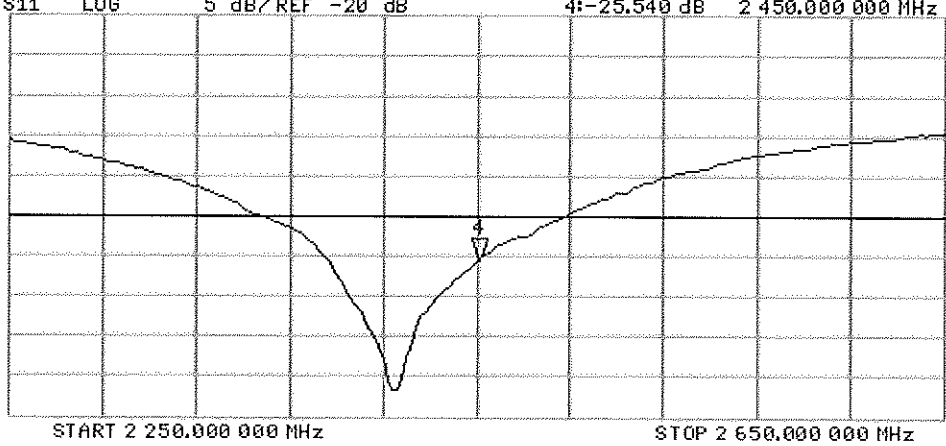
Avg  
 16



CH2 S11 LOG 5 dB/REF -20 dB 4:-25.540 dB 2 450.000 000 MHz

CA

Avg  
 16



## DASY5 Validation Report for Body TSL

Date/Time: 08.02.2011 13:24:09

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium: MSL U12 BB

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.95$  mho/m;  $\epsilon_r = 52.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

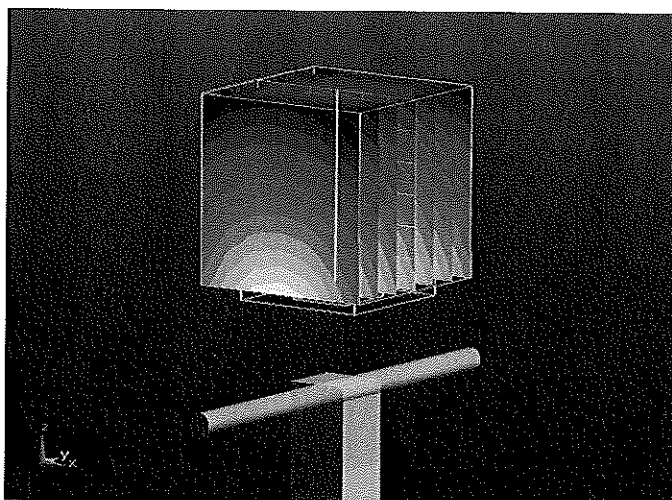
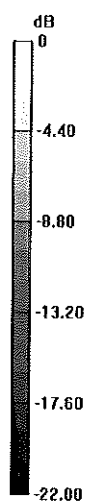
**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement**  
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.699 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 27.483 W/kg

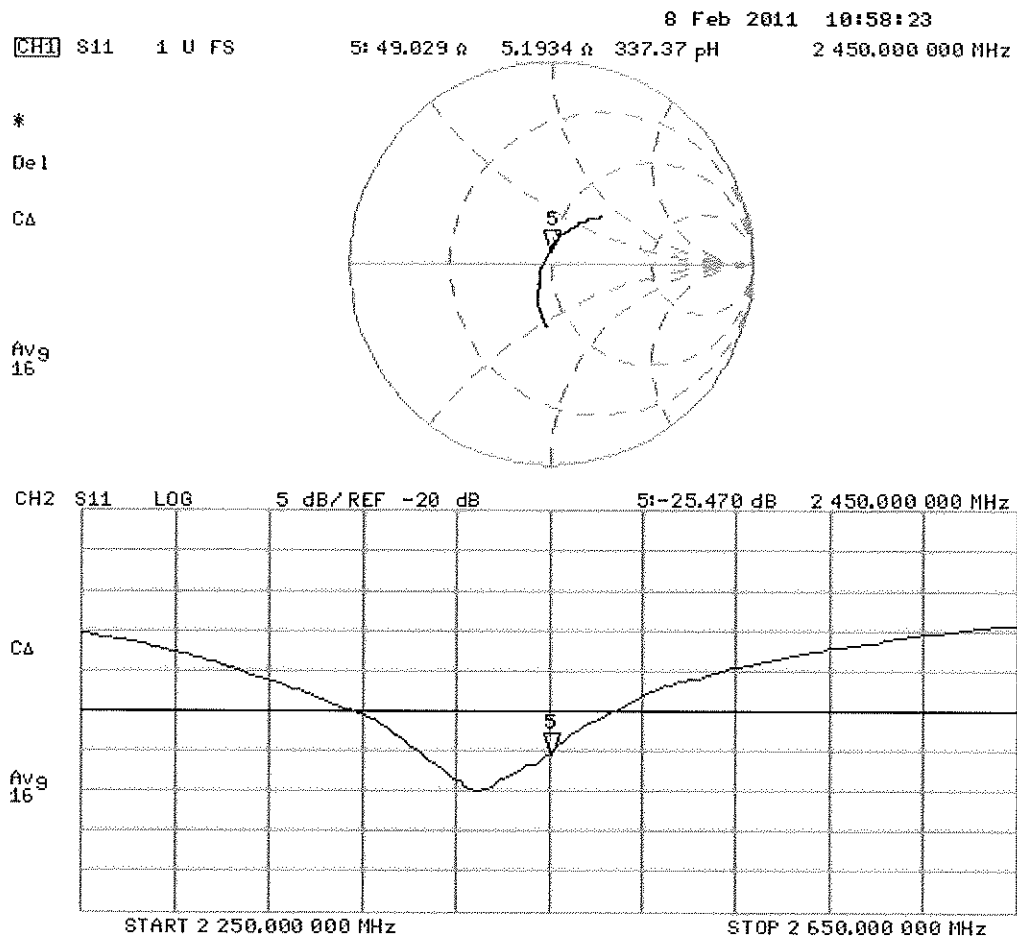
**SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.05 mW/g**

Maximum value of SAR (measured) = 17.122 mW/g



0 dB = 17.120mW/g

# Impedance Measurement Plot for Body TSL





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: **D835V2-4d119\_Jul11**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d119**

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

Calibration date: **July 08, 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: **Name** **Function**  
**Jeton Kastrali** **Laboratory Technician**

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

Signature

Issued: July 13, 2011

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

### **Glossary:**

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

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

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

### **Additional Documentation:**

- d) DASY4/5 System Handbook

### **Methods Applied and Interpretation of Parameters:**

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

## Measurement Conditions

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

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.6.2     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 15 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 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 | 41.0 $\pm$ 6 % | 0.88 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 | 2.30 mW / g                   |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 9.33 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 | 1.51 mW / g                   |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 6.11 mW /g $\pm$ 16.5 % (k=2) |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 52.4 $\Omega$ - 1.7 j $\Omega$ |
| Return Loss                          | - 30.8 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.378 ns |
|----------------------------------|----------|

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

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

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

### Additional EUT Data

|                 |               |
|-----------------|---------------|
| Manufactured by | SPEAG         |
| Manufactured on | June 29, 2010 |

## DASY5 Validation Report for Head TSL

Date: 08.07.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d119**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.88 \text{ mho/m}$ ;  $\epsilon_r = 41$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 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:

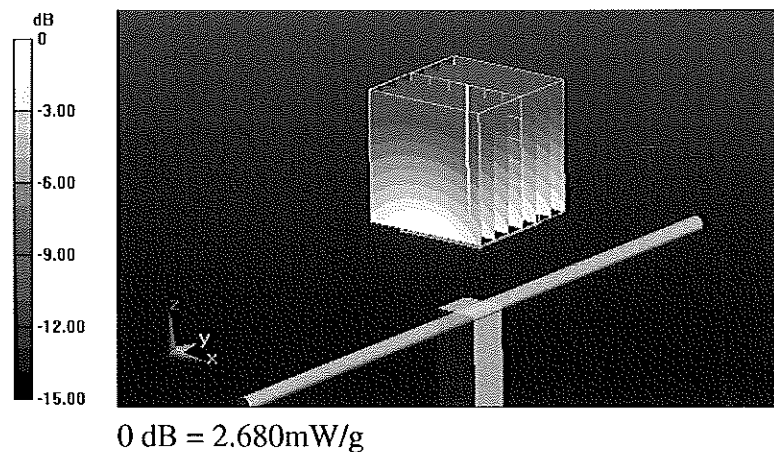
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 56.897 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.366 W/kg

**SAR(1 g) = 2.3 mW/g; SAR(10 g) = 1.51 mW/g**

Maximum value of SAR (measured) = 2.682 mW/g

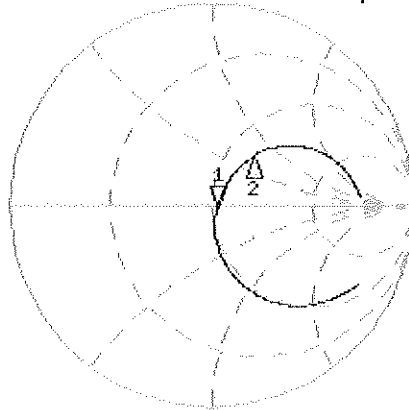


# Impedance Measurement Plot for Head TSL

8 Jul 2011 14:07:48

[CH1] S11 1 U FS 1:52.432  $\Omega$  -1.6875  $\Omega$  112.95 pF 835.000 000 MHz

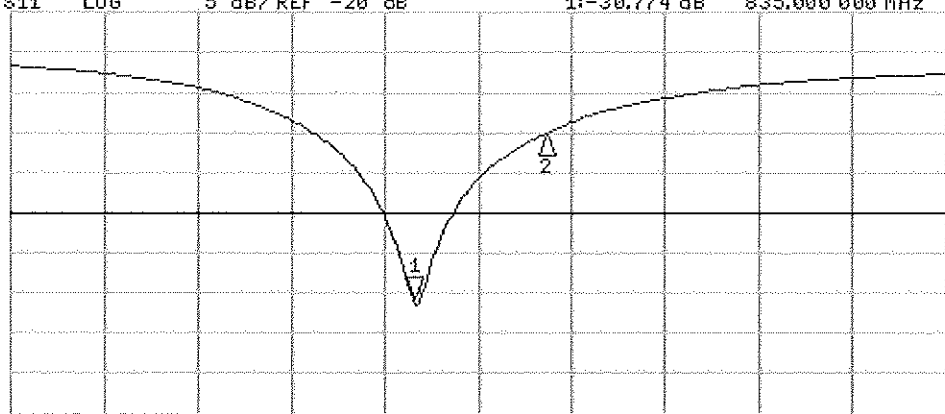
\*  
Del  
Cor  
Avg  
16  
H1d



CH1 Markers  
2: 64.355  $\Omega$   
33.906  $\Omega$   
900.000 MHz

CH2 S11 LOG 5 dB/REF -20 dB 1:-30.774 dB 835.000 000 MHz

Cor  
Avg  
16  
H1d



CH2 Markers  
2:-10.210 dB  
900.000 MHz

START 635.000 000 MHz

STOP 1 100.000 000 MHz



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: **D835V2-4d119\_Nov11**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d119**

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

Calibration date: **November 07, 2011**

✓ KOK  
11/26/11

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)     | Scheduled Calibration |
|-----------------------------|--------------------|--------------------------------|-----------------------|
| Power meter EPM-442A        | GB37480704         | 05-Oct-11 (No. 217-01451)      | Oct-12                |
| Power sensor HP 8481A       | US37292783         | 05-Oct-11 (No. 217-01451)      | Oct-12                |
| Reference 20 dB Attenuator  | SN: 5086 (20g)     | 29-Mar-11 (No. 217-01368)      | Apr-12                |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371)      | Apr-12                |
| Reference Probe ES3DV3      | SN: 3205           | 29-Apr-11 (No. ES3-3205_Apr11) | Apr-12                |
| DAE4                        | SN: 601            | 04-Jul-11 (No. DAE4-601_Jul11) | Jul-12                |

| Secondary Standards       | ID #             | Check Date (in house)             | Scheduled Check        |
|---------------------------|------------------|-----------------------------------|------------------------|
| Power sensor HP 8481A     | MY41092317       | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06   | 100005           | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-11) | In house check: Oct-12 |

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

Approved by: **Katja Pokovic** **Technical Manager** *[Signature]*

Issued: November 7, 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.

|                              |                        |             |
|------------------------------|------------------------|-------------|
| 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    |             |

## 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 | 53.3 $\pm$ 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 | 2.42 mW / g                    |
| SAR for nominal Body 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 Body TSL | condition          |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR measured                                            | 250 mW input power | 1.59 mW / g                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 6.25 mW / g $\pm$ 16.5 % (k=2) |

## Appendix

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 47.4 $\Omega$ - 5.2 j $\Omega$ |
| Return Loss                          | - 24.5 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.395 ns |
|----------------------------------|----------|

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

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

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

### Additional EUT Data

|                 |               |
|-----------------|---------------|
| Manufactured by | SPEAG         |
| Manufactured on | June 29, 2010 |

## DASY5 Validation Report for Body TSL

Date: 07.11.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d119**

---

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.99 \text{ mho/m}$ ;  $\epsilon_r = 53.3$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 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 (7x7x7)/Cube 0:

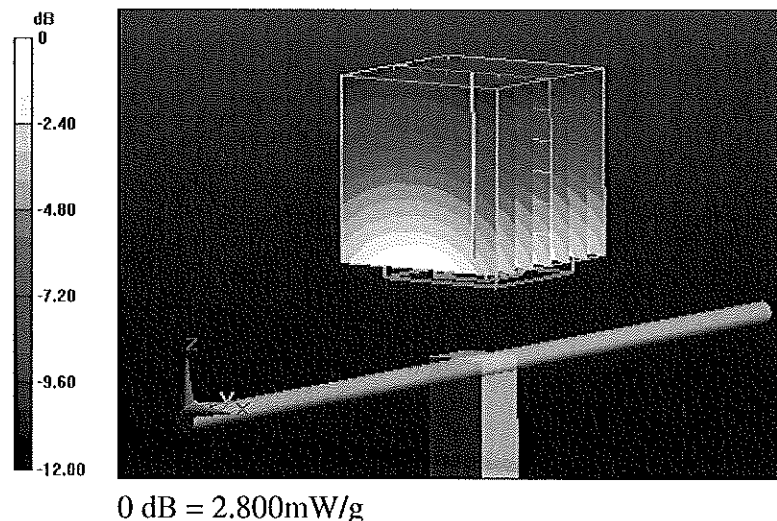
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 55.205 V/m; Power Drift = 0.0076 dB

Peak SAR (extrapolated) = 3.510 W/kg

**SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.59 mW/g**

Maximum value of SAR (measured) = 2.805 mW/g



# Impedance Measurement Plot for Body TSL

7 Nov 2011 12:56:11

[CH1] S11 1 U FS 1: 47.486  $\Omega$  -5.1875  $\Omega$  36.743 pF 835.000 000 MHz

\*

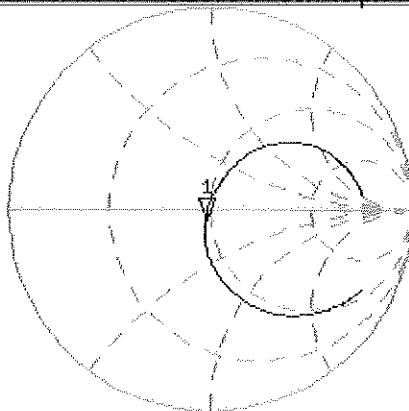
De1

Cor

Avg

16

H1d



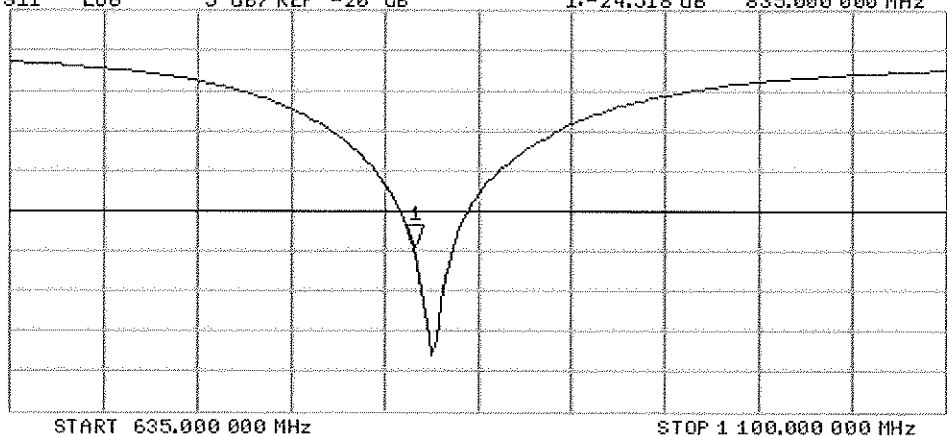
CH2 S11 LOG 5 dB/REF -20 dB 1:-24.518 dB 835.000 000 MHz

Cor

Avg

16

H1d





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

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **EX-3550\_Feb11**

## CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3550**

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

Calibration date: **February 14, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

✓  
KOK  
2/22/11

| Primary Standards          | ID              | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 01-Apr-10 (No. 217-01136)         | Apr-11                 |
| Power sensor E4412A        | MY41495277      | 01-Apr-10 (No. 217-01136)         | Apr-11                 |
| Power sensor E4412A        | MY41498087      | 01-Apr-10 (No. 217-01136)         | Apr-11                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 30-Mar-10 (No. 217-01159)         | Mar-11                 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 30-Mar-10 (No. 217-01161)         | Mar-11                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 30-Mar-10 (No. 217-01160)         | Mar-11                 |
| Reference Probe ES3DV2     | SN: 3013        | 29-Dec-10 (No. ES3-3013_Dec10)    | Dec-11                 |
| DAE4                       | SN: 654         | 23-Apr-10 (No. DAE4-654_Apr10)    | Apr-11                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Oct-09)  | In house check: Oct-11 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

|                                                                                                                 | Name          | Function          | Signature |
|-----------------------------------------------------------------------------------------------------------------|---------------|-------------------|-----------|
| Calibrated by:                                                                                                  | Katja Pokovic | Technical Manager |           |
| Approved by:                                                                                                    | Niels Kuster  | Quality Manager   |           |
| Issued: February 14, 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                                                                                                                                |
| 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 $\alpha$    | $\alpha$ 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>** are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- VR**: VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

# Probe EX3DV4

## SN:3550

Manufactured: May 19, 2004  
Calibrated: February 14, 2011

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3550

### Basic Calibration Parameters

|                                                    | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|----------------------------------------------------|----------|----------|----------|-----------|
| Norm ( $\mu\text{V}/(\text{V/m})^2$ ) <sup>A</sup> | 0.52     | 0.45     | 0.50     | ± 10.1 %  |
| DCP (mV) <sup>B</sup>                              | 100.3    | 98.8     | 99.0     |           |

### Modulation Calibration Parameters

| UID   | Communication System Name | PAR  |   | A<br>dB | B<br>dB | C<br>dB | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-------|---------------------------|------|---|---------|---------|---------|----------|---------------------------|
| 10000 | CW                        | 0.00 | X | 0.00    | 0.00    | 1.00    | 110.7    | ±2.2 %                    |
|       |                           |      | Y | 0.00    | 0.00    | 1.00    | 145.7    |                           |
|       |                           |      | Z | 0.00    | 0.00    | 1.00    | 148.8    |                           |

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<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

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

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3550

### 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                            | 8.42    | 8.42    | 8.42    | 0.48  | 0.69       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 8.04    | 8.04    | 8.04    | 0.33  | 0.84       | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 7.33    | 7.33    | 7.33    | 0.46  | 0.65       | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 7.01    | 7.01    | 7.01    | 0.42  | 0.72       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 6.29    | 6.29    | 6.29    | 0.13  | 1.57       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 6.13    | 6.13    | 6.13    | 0.20  | 1.32       | ± 12.0 %    |
| 4950                 | 36.3                               | 4.40                            | 4.37    | 4.37    | 4.37    | 0.35  | 1.80       | ± 13.1 %    |
| 5200                 | 36.0                               | 4.66                            | 4.06    | 4.06    | 4.06    | 0.35  | 1.80       | ± 13.1 %    |
| 5300                 | 35.9                               | 4.76                            | 3.92    | 3.92    | 3.92    | 0.35  | 1.80       | ± 13.1 %    |
| 5500                 | 35.6                               | 4.96                            | 3.77    | 3.77    | 3.77    | 0.35  | 1.80       | ± 13.1 %    |
| 5600                 | 35.5                               | 5.07                            | 3.50    | 3.50    | 3.50    | 0.40  | 1.80       | ± 13.1 %    |
| 5800                 | 35.3                               | 5.27                            | 3.64    | 3.64    | 3.64    | 0.40  | 1.80       | ± 13.1 %    |

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

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

## DASY/EASY - Parameters of Probe: EX3DV4- SN:3550

### Calibration Parameter Determined in Body Tissue Simulating Media

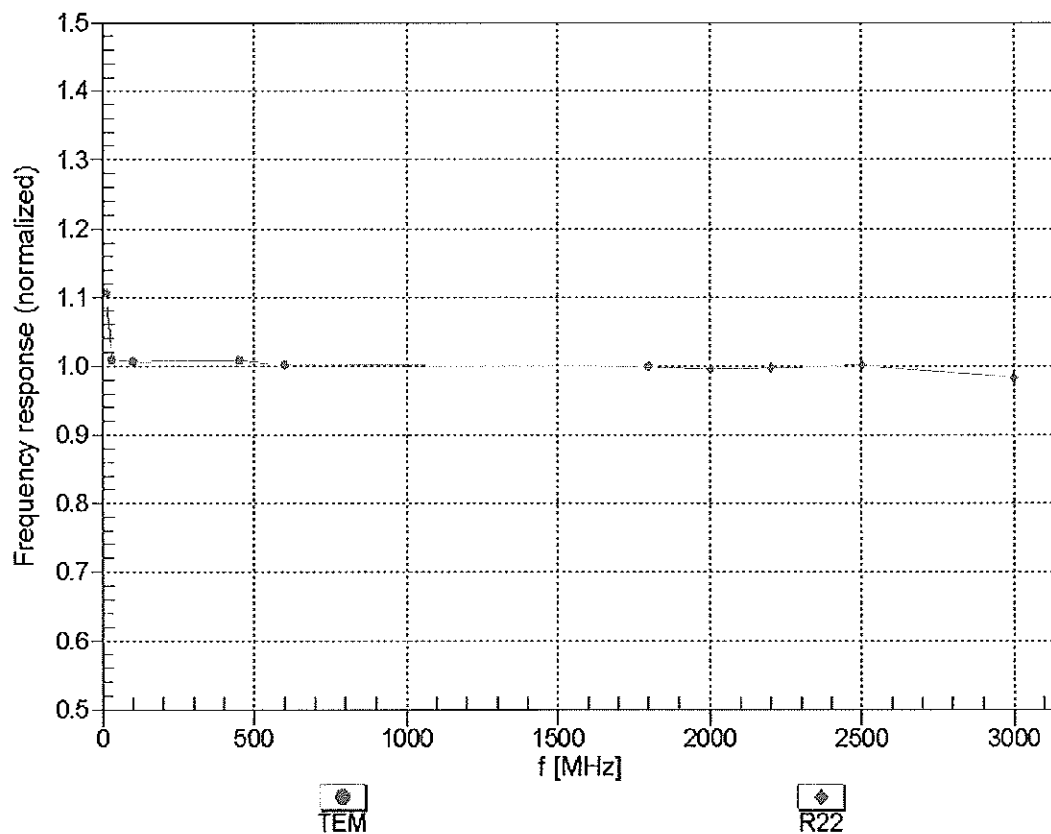
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 55.5                               | 0.96                            | 8.18    | 8.18    | 8.18    | 0.23  | 1.09       | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 8.11    | 8.11    | 8.11    | 0.25  | 1.05       | ± 12.0 %    |
| 1750                 | 53.4                               | 1.49                            | 7.21    | 7.21    | 7.21    | 0.42  | 0.89       | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 6.77    | 6.77    | 6.77    | 0.35  | 0.84       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 6.25    | 6.25    | 6.25    | 0.30  | 0.86       | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 5.98    | 5.98    | 5.98    | 0.21  | 1.03       | ± 12.0 %    |
| 3700                 | 51.0                               | 3.55                            | 5.42    | 5.42    | 5.42    | 0.20  | 1.95       | ± 13.1 %    |
| 4950                 | 49.4                               | 5.01                            | 3.72    | 3.72    | 3.72    | 0.45  | 1.90       | ± 13.1 %    |
| 5200                 | 49.0                               | 5.30                            | 3.58    | 3.58    | 3.58    | 0.45  | 1.90       | ± 13.1 %    |
| 5300                 | 48.9                               | 5.42                            | 3.31    | 3.31    | 3.31    | 0.48  | 1.90       | ± 13.1 %    |
| 5500                 | 48.6                               | 5.65                            | 3.21    | 3.21    | 3.21    | 0.47  | 1.90       | ± 13.1 %    |
| 5600                 | 48.5                               | 5.77                            | 3.19    | 3.19    | 3.19    | 0.45  | 1.90       | ± 13.1 %    |
| 5800                 | 48.2                               | 6.00                            | 3.29    | 3.29    | 3.29    | 0.50  | 1.90       | ± 13.1 %    |

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

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

## Frequency Response of E-Field

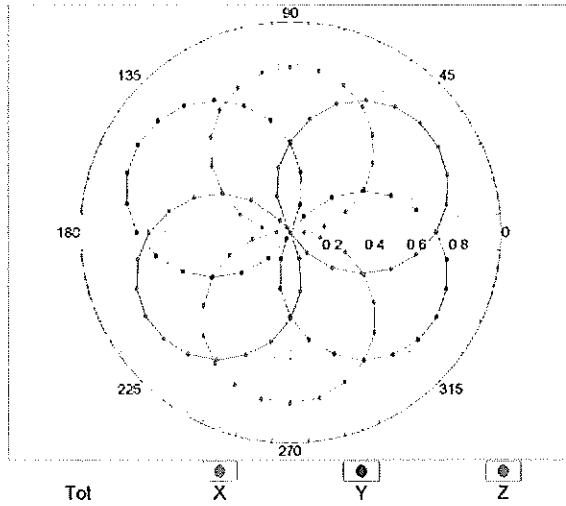
(TEM-Cell:ifi1110 EXX, Waveguide: R22)



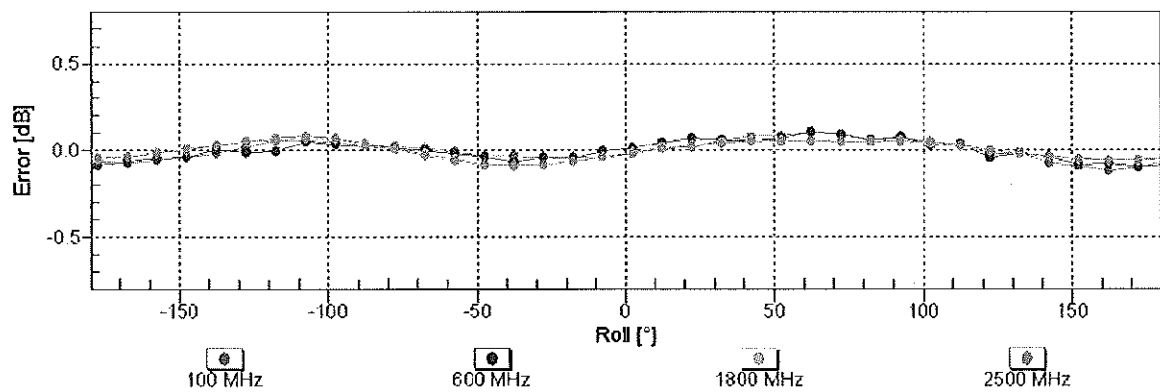
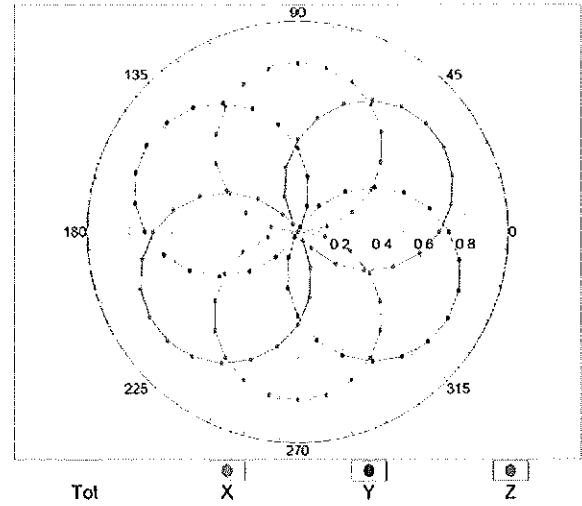
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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

f=600 MHz,TEM



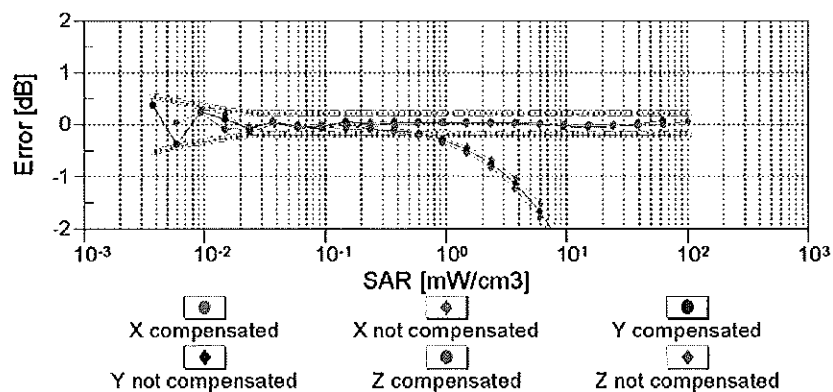
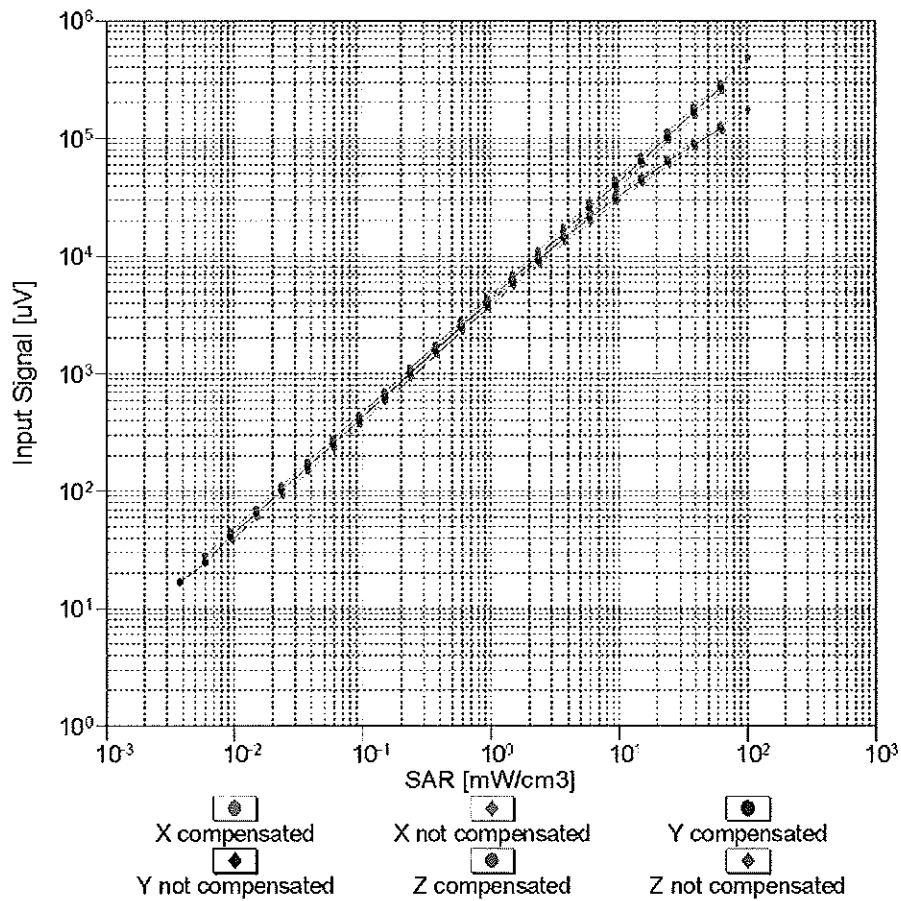
f=1800 MHz,R22



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

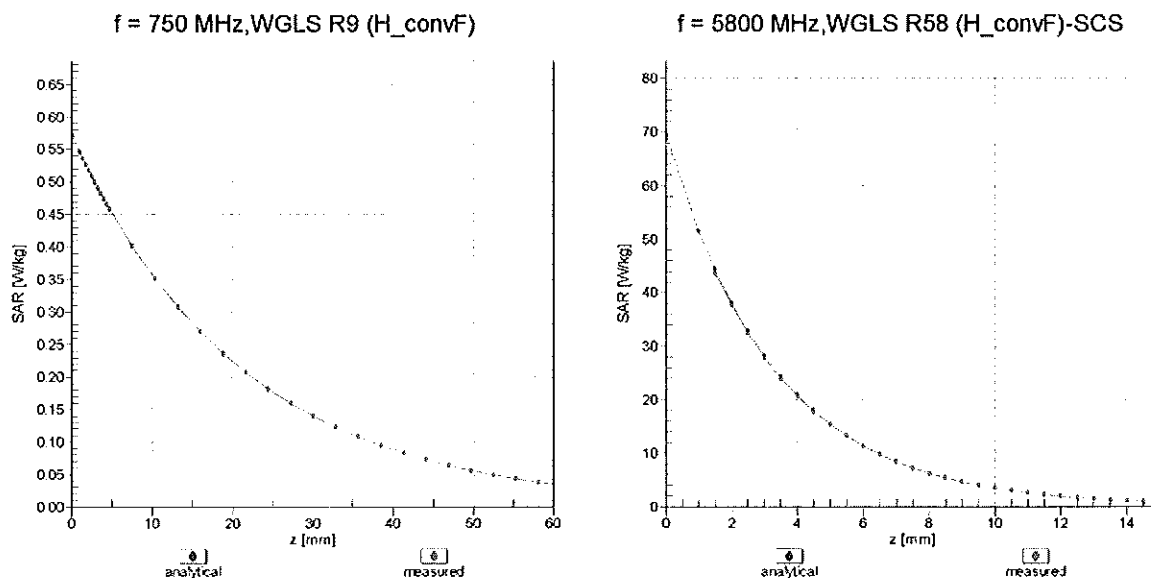
# Dynamic Range f(SAR<sub>head</sub>)

(TEM cell , f = 900 MHz)



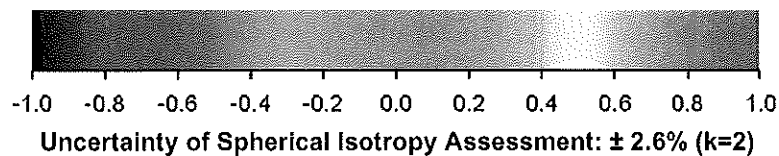
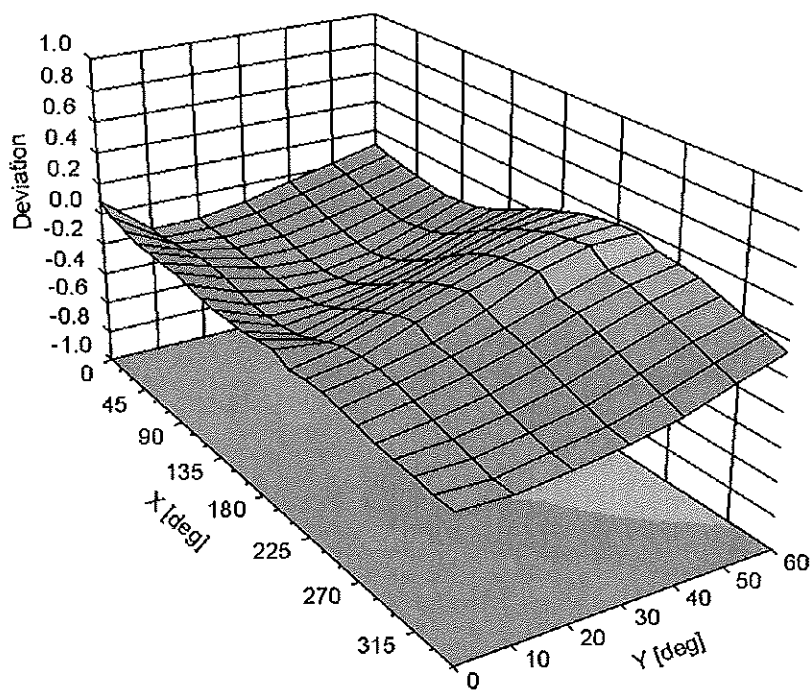
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

## Conversion Factor Assessment



## Deviation from Isotropy in Air

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



## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3550

### Other Probe Parameters

|                                               |                |
|-----------------------------------------------|----------------|
| Sensor Arrangement                            | Triangular     |
| Connector Angle (°)                           | Not applicable |
| Mechanical Surface Detection Mode             | enabled        |
| Optical Surface Detection Mode                | disabled       |
| Probe Overall Length                          | 337 mm         |
| Probe Body Diameter                           | 10 mm          |
| Tip Length                                    | 9 mm           |
| Tip Diameter                                  | 3 mm           |
| Probe Tip to Sensor X Calibration Point       | 1 mm           |
| Probe Tip to Sensor Y Calibration Point       | 1 mm           |
| Probe Tip to Sensor Z Calibration Point       | 1 mm           |
| Recommended Measurement Distance from Surface | 2 mm           |



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

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3209\_Apr11**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3209**

Calibration procedure(s) **QA CAL-01.v7, QA CAL-12.v6, QA CAL-23.v4, QA CAL-25.v3  
Calibration procedure for dosimetric E-field probes**

Calibration date: **April 18, 2011**

✓ KOK  
4/12/11

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID              | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 31-Mar-11 (No. 217-01372)         | Apr-12                 |
| Power sensor E4412A        | MY41495277      | 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         | 23-Apr-10 (No. DAE4-654_Apr10)    | Apr-11                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Oct-09)  | In house check: Oct-11 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

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

Issued: April 18, 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                                                                                                                                |
| NORM <sub>x,y,z</sub>    | sensitivity in free space                                                                                                                               |
| ConvF                    | sensitivity in TSL / NORM <sub>x,y,z</sub>                                                                                                              |
| DCP                      | diode compression point                                                                                                                                 |
| CF                       | crest factor (1/duty_cycle) of the RF signal                                                                                                            |
| A, B, C                  | modulation dependent linearization parameters                                                                                                           |
| Polarization $\phi$      | $\phi$ rotation around probe axis                                                                                                                       |
| Polarization $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center),<br>i.e., $\vartheta = 0$ is normal to probe axis |

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

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

### Methods Applied and Interpretation of Parameters:

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

# Probe ES3DV3

## SN:3209

Manufactured: October 14, 2008  
Calibrated: April 18, 2011

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

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

### Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|-----------------------------------------------------------|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 1.37     | 1.34     | 1.15     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                                     | 97.0     | 100.4    | 100.0    |               |

### 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    | 116.0    | $\pm 3.0 \%$              |
|       |                           |      | Y | 0.00    | 0.00    | 1.00    | 118.9    |                           |
|       |                           |      | Z | 0.00    | 0.00    | 1.00    | 103.8    |                           |

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:3209

### Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 41.9                               | 0.89                            | 6.42    | 6.42    | 6.42    | 0.99  | 1.10       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 6.17    | 6.17    | 6.17    | 0.99  | 1.10       | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 5.33    | 5.33    | 5.33    | 0.99  | 1.12       | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 5.11    | 5.11    | 5.11    | 0.99  | 1.09       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.52    | 4.52    | 4.52    | 0.84  | 1.21       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 4.35    | 4.35    | 4.35    | 0.74  | 1.32       | ± 12.0 %    |

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

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

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

### Calibration Parameter Determined in Body Tissue Simulating Media

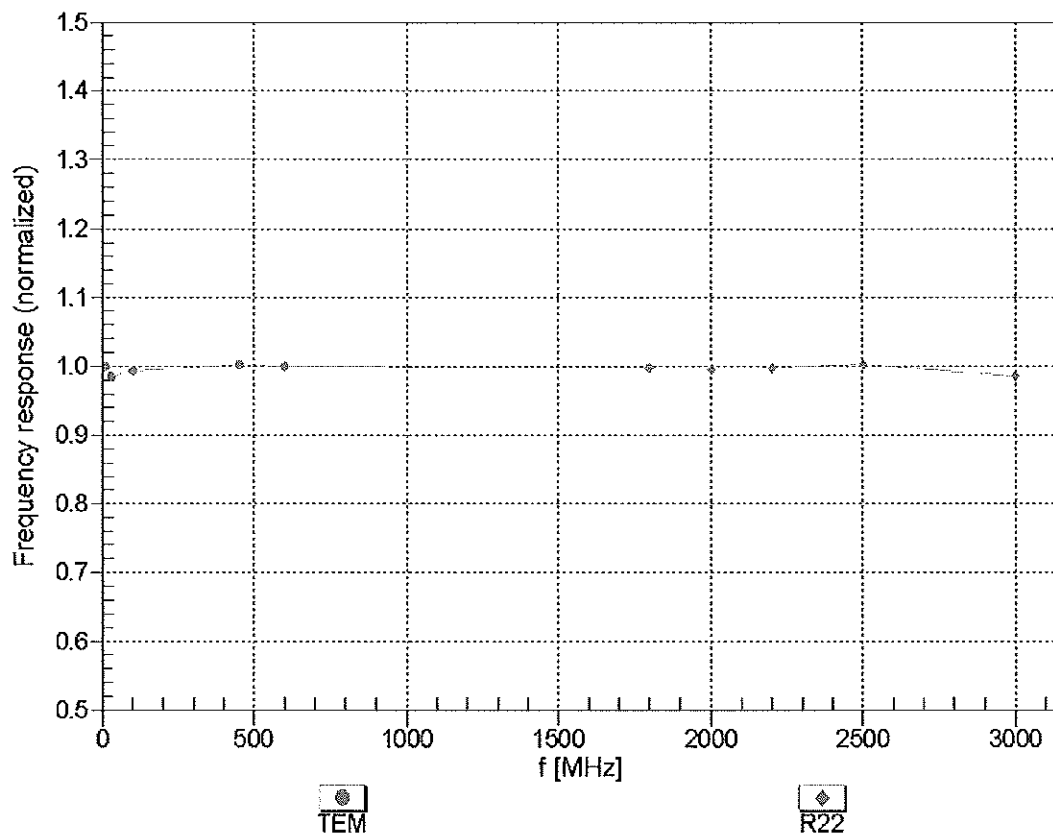
| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 450                  | 56.7                               | 0.94                            | 7.06    | 7.06    | 7.06    | 0.11  | 1.00       | ± 13.4 %    |
| 750                  | 55.5                               | 0.96                            | 6.18    | 6.18    | 6.18    | 0.99  | 1.15       | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 6.15    | 6.15    | 6.15    | 0.99  | 1.12       | ± 12.0 %    |
| 1640                 | 53.8                               | 1.40                            | 5.18    | 5.18    | 5.18    | 0.89  | 1.25       | ± 12.0 %    |
| 1750                 | 53.4                               | 1.49                            | 4.75    | 4.75    | 4.75    | 0.81  | 1.31       | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 4.48    | 4.48    | 4.48    | 0.95  | 1.19       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 4.15    | 4.15    | 4.15    | 0.99  | 1.04       | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 4.00    | 4.00    | 4.00    | 0.88  | 1.15       | ± 12.0 %    |

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

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

## Frequency Response of E-Field

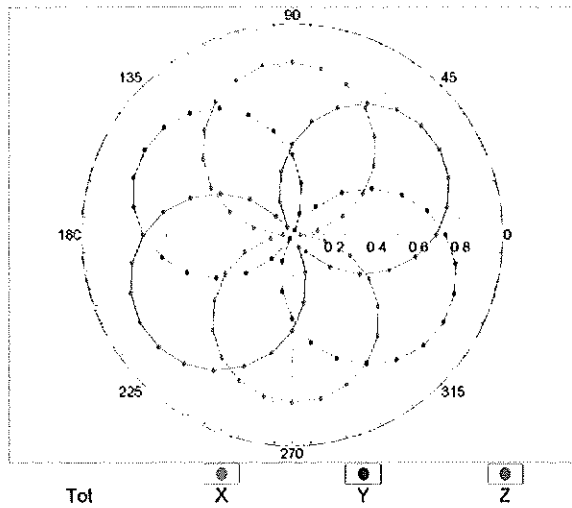
(TEM-Cell:ifi110 EXX, Waveguide: R22)



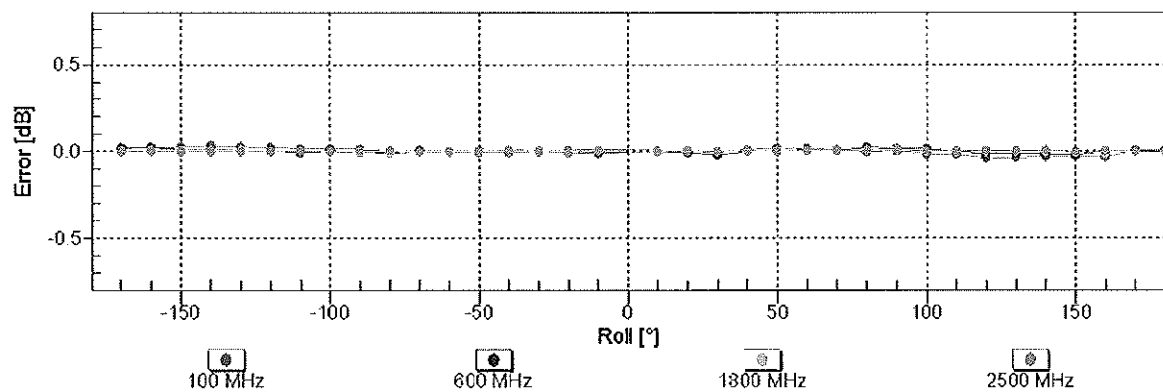
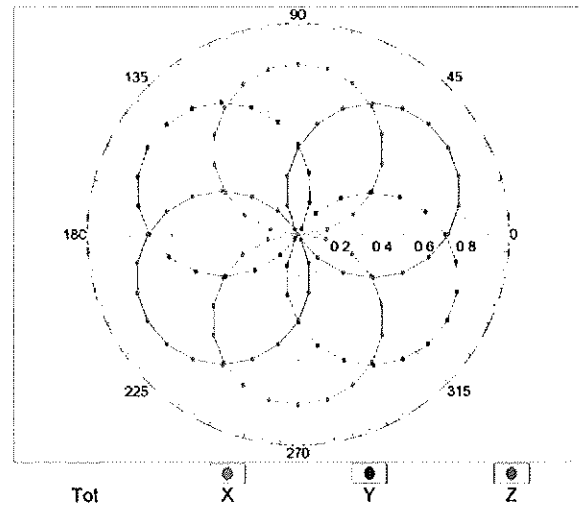
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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

f=600 MHz,TEM

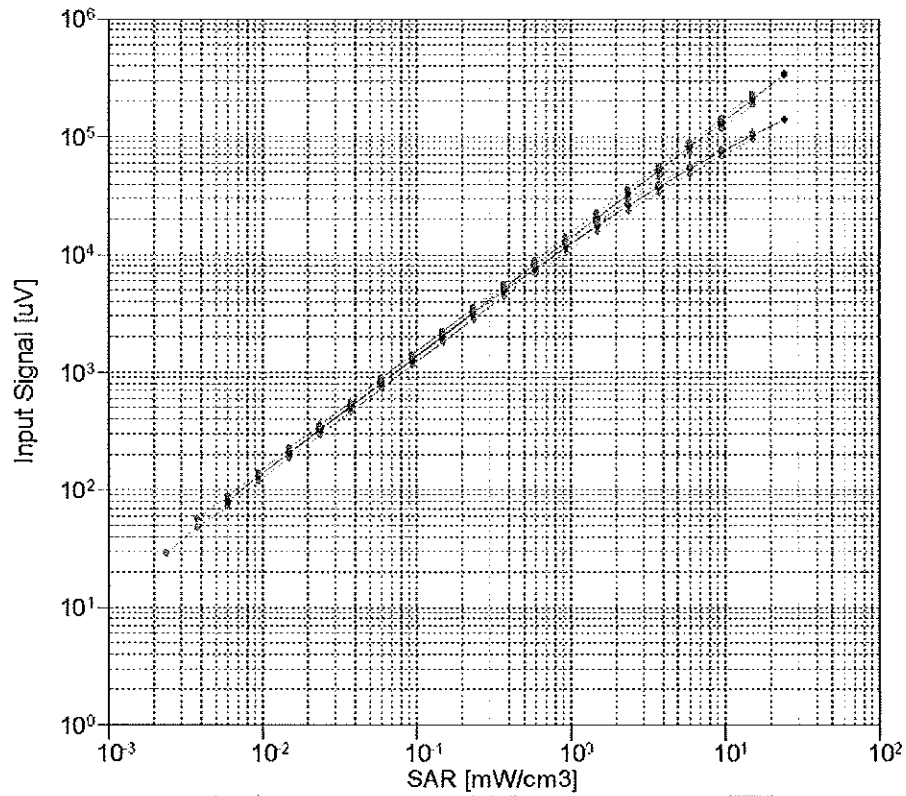


f=1800 MHz,R22

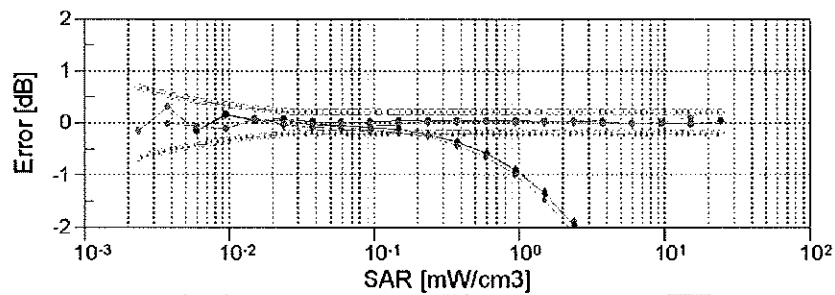


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

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



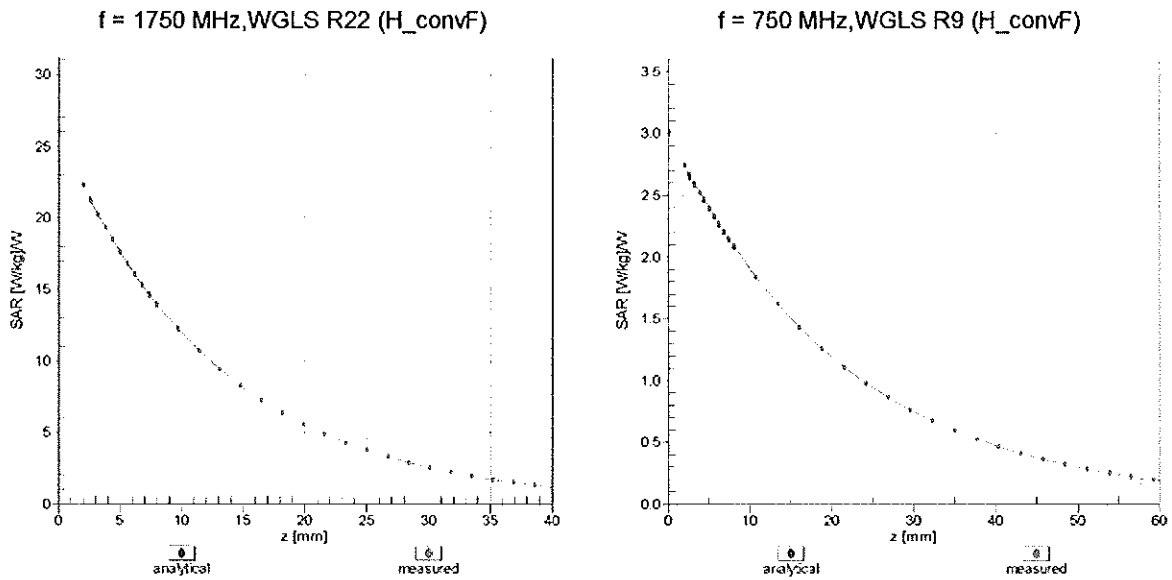
X compensated      X not compensated      Y compensated  
 Y not compensated      Z compensated      Z not compensated



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

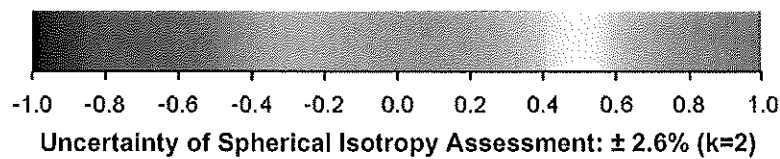
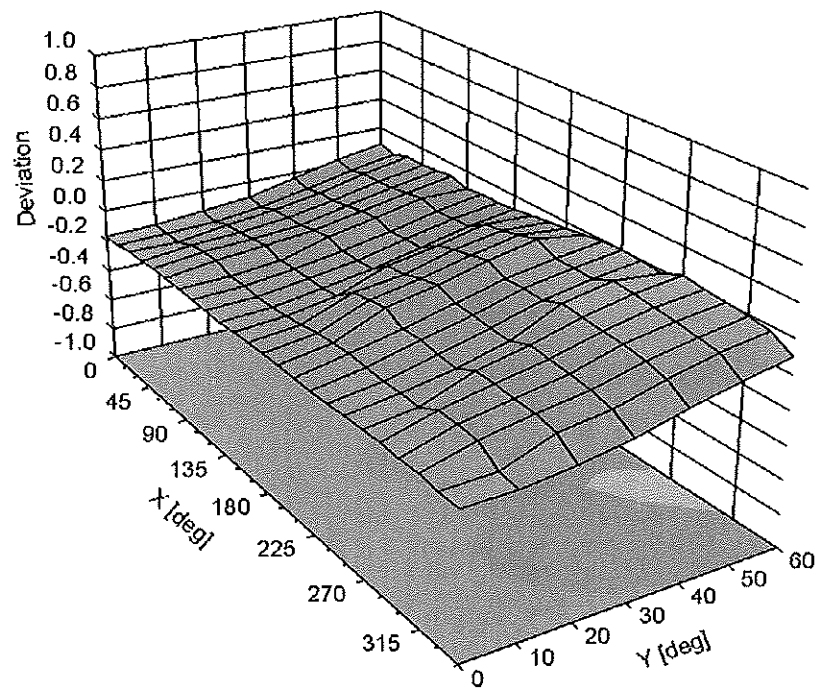
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

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



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

### Other Probe Parameters

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

## **Additional Conversion Factors**

**for Dosimetric E-Field Probe**

Type:

**ES3DV3**

Serial Number:

**3209**

Place of Assessment:

**Zurich**

Date of Assessment:

**April 20, 2011**

Probe Calibration Date:

**April 18, 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 ES3DV3 SN:3209

Conversion factor ( $\pm$  standard deviation)

550  $\pm$  50 MHz      *ConvF*      6.7  $\pm$  7%

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

650  $\pm$  50 MHz      *ConvF*      6.3  $\pm$  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.