



# MOTOROLA

## Data Card SAR Test Report

**Test Report #:** 18697-1F  
**Date of Report:** 8/30/2006  
**Date of Test:** 7/7/2006-7/13/2006  
**FCC ID #:** **IHDT6FL1**  
**Generic Name:** **MJT6-33411A11**  
**Laboratory:** Motorola Mobile Devices Business Product Safety & Compliance Laboratory  
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This laboratory is accredited to ISO/IEC 17025-1999 to perform the following tests:

Tests:

Electromagnetic Specific Absorption Rate

Procedures:

ANSI / IEEE C95.1-1992, 1999

(SAR) IEEE C95.3-1991

IEEE 1528, IEC 62209-1

FCC OET Bulletin 65 (*including Supplements A, B, C*)

Australian Communications Authority Radio

Communications (Electromagnetic Radiation – Human Exposure) Standard 2003

CENELEC EN 50361 (2001)

WI-0247

WI-1847

**Accreditation:**



Simulated Tissue Preparation

RF Power Measurement

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A2LA certificate #1651-01

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Motorola declares under its sole responsibility that the data card model to which this declaration relates, is in conformity with the appropriate General Population/Uncontrolled RF exposure standards, recommendations and guidelines (FCC 47 CFR §2.1093) as well as with CENELEC en50360:2001 and ANSI / IEEE C95.1. It also declares that the product was tested in accordance with CENELEC en50361:2001, IEEE 1528, as well as other appropriate measurement standards, guidelines and recommended practices. Any deviations from these standards, guidelines and recommended practices are noted below:

(none)

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The results and statements contained herein relate only to the items tested. The names of individuals involved may be mentioned only in connection with the statements or results from this report.

Motorola encourages all feedback, both positive and negative, on this test report.

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## 1. Introduction

The Motorola Mobile Devices Business Product Safety Laboratory has performed measurements of the maximum potential exposure to the user of the data card covered by this test report. The Specific Absorption Rate (SAR) of this product was measured. The data card was tested in accordance with [1], [4] and [5]. The SAR values measured for the data card are below the maximum recommended levels of 1.6 W/kg in a 1g average set in [3] and 2.0W/kg in a 10g average set in [2].

For ANSI / IEEE C95.1 (1g), the final SAR reading for this phone is 0.55 W/kg for body worn use. These measurements were performed using a Dasy4™ v4.6 system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich Switzerland.

## 2. Description of the Device Under Test

### 2.1 Antenna description

Antenna #1

|                      |                  |       |
|----------------------|------------------|-------|
| <b>Type</b>          | Internal         |       |
| <b>Location</b>      | End of Unit, Top |       |
| <b>Dimensions</b>    | Length           | 44 mm |
|                      | Width            | 24 mm |
| <b>Configuration</b> | Planar           |       |

Antenna #2

|                      |                     |         |
|----------------------|---------------------|---------|
| <b>Type</b>          | Internal            |         |
| <b>Location</b>      | End of Unit, Bottom |         |
| <b>Dimensions</b>    | Length              | 14.5 mm |
|                      | Width               | 32.5 mm |
| <b>Configuration</b> | Inverted F          |         |

### 2.2 Device description

|                                                                |                                   |                  |                  |                |                  |
|----------------------------------------------------------------|-----------------------------------|------------------|------------------|----------------|------------------|
| <b>FCC ID Number</b>                                           | IHDT6FL1                          |                  |                  |                |                  |
| <b>Serial number</b>                                           | LEL03Q0015, Y6012222WS            |                  |                  |                |                  |
| <b>Mode(s) of Operation</b>                                    | EGSM900                           | GSM 1800         | GSM 1900         | WCDMA 800      | WCDMA 2100       |
| <b>Modulation Mode(s)</b>                                      | GMSK                              | GMSK             | GMSK             | QPSK           | QPSK             |
| <b>Maximum Output Power Setting</b>                            | 33.00dBm                          | 30.00dBm         | 29.00dBm         | 24.00dBm       | 24.00dBm         |
| <b>Duty Cycle</b>                                              | 1:8                               | 1:8              | 1:8              | 1:1            | 1:1              |
| <b>Transmitting Frequency Rang(s)</b>                          | 880.2-914.8MHz                    | 1710.2-1784.8MHz | 1850.2-1909.8MHz | 830.5-839.7MHz | 1920.3-1979.7MHz |
| <b>Production Unit or Identical Prototype (47 CFR §2..908)</b> | Identical Prototype               |                  |                  |                |                  |
| <b>Device Category</b>                                         | Portable                          |                  |                  |                |                  |
| <b>RF Exposure Limits</b>                                      | General Population / Uncontrolled |                  |                  |                |                  |

### 3. Test Equipment Used

#### 3.1 Dosimetric System

The Motorola Mobile Devices Business Product Safety & Compliance Laboratory utilizes a Dosimetric Assessment System (Dasy4™ v4.6) manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. All the SAR measurements are taken within a shielded enclosure. The overall 10g RSS uncertainty of the measurement system is  $\pm 10.8\%$  (K=1) with an expanded uncertainty of  $\pm 21.6\%$  (K=2). The overall 1g RSS uncertainty of the measurement system is  $\pm 11.1\%$  (K=1) with an expanded uncertainty of  $\pm 22.2\%$  (K=2). The measurement uncertainty budget is given in Appendix 6. Per IEEE 1528, this uncertainty budget is applicable to the SAR range of 0.4W/kg to 10W/kg.

The list of calibrated equipment used for the measurements is shown in the following table.

| Description                               | Serial Number | Cal Due Date |
|-------------------------------------------|---------------|--------------|
| DASY4™ DAE4                               | 376           | 9/5/2006     |
| DASY4™ DAE3                               | 437           | 7/18/2007    |
| E-Field Probe ES3DV3                      | 3037          | 11/17/2006   |
| Dipole Validation Kit, DV900V2            | 096           |              |
| S.A.M. Phantom used for 800/900MHz        | TP-1131       |              |
| Dipole Validation Kit, DV1800V2           | 272TR         |              |
| S.A.M. Phantom used for 1800/1900/2450MHz | TP-1250       |              |
| Dipole Validation Kit, DV1900V2           | 533TR         |              |

#### 3.2 Additional Equipment

| Description                   | Serial Number | Cal Due Date |
|-------------------------------|---------------|--------------|
| Signal Generator HP8648C      | 3847A04632    | 9/20/2006    |
| Power Meter E4419B            | GB39511084    | 8/19/2006    |
| Power Sensor #1 – E9301A      | US39210918    | 9/21/2006    |
| Power Sensor #2 - E9301A      | US39210934    | 9/21/2006    |
| Network Analyzer HP8753ES     | US39171846    | 8/22/2006    |
| Dielectric Probe Kit HP85070C | US99360070    |              |

#### 4. Electrical parameters of the tissue simulating liquid

Prior to conducting SAR measurements, the relative permittivity,  $\epsilon_r$ , and the conductivity,  $\sigma$ , of the tissue simulating liquids were measured with a HP85070 Dielectric Probe Kit. These values, along with the temperature of the simulated tissue are shown in the table below. The recommended limits for permittivity and conductivity are also shown. A mass density of  $\rho=1\text{g/cm}^3$  was entered into the system in all the cases. It can be seen that the measured parameters are within tolerance of the recommended limits specified in [1] and [5].

| $f$<br>(MHz) | Tissue<br>type | Limits / Measured   | Dielectric Parameters |                |              |
|--------------|----------------|---------------------|-----------------------|----------------|--------------|
|              |                |                     | $\epsilon_r$          | $\sigma$ (S/m) | Temp<br>(°C) |
| 835          | Body           | Measured, 7/11/2005 | 55.4                  | 0.98           | 20.0         |
|              |                | Measured, 7/12/2005 | 55.4                  | 0.98           | 19.8         |
|              |                | Recommended Limits  | 55.2 $\pm$ 5%         | 0.97 $\pm$ 5%  | 18-25        |
| 900          | Body           | Measured, 7/10/2006 | 55.1                  | 1.04           | 20.0         |
|              |                | Measured, 7/11/2006 | 54.8                  | 1.05           | 20.5         |
|              |                | Measured, 7/13/2006 | 54.4                  | 1.03           | 19.8         |
|              |                | Recommended Limits  | 55.0 $\pm$ 5%         | 1.05 $\pm$ 5%  | 18-25        |
| 1750         | Body           | Measured, 7/8/2006  | 51.2                  | 1.44           | 20.0         |
|              |                | Recommended Limits  | 53.4 $\pm$ 5%         | 1.49 $\pm$ 5%  | 18-25        |
| 1880         | Body           | Measured, 7/8/2006  | 50.7                  | 1.59           | 20.0         |
|              |                | Recommended Limits  | 53.3 $\pm$ 5%         | 1.52 $\pm$ 5%  | 18-25        |
| 2100         | Body           | Measured, 7/13/2006 | 52.8                  | 1.56           | 19.5         |
|              |                | Recommended Limits  | 53.3 $\pm$ 5%         | 1.52 $\pm$ 5%  | 18-25        |

The list of ingredients and the percent composition used for the tissue simulates are indicated in the table below.

| Ingredient | 835MHz /<br>900 MHz<br>Head | 835MHz /<br>900 MHz<br>Body | 1800MHz /<br>1900 MHz<br>Head | 1800 MHz /<br>1900 MHz<br>Body | 2450MHz<br>Head | 2450 MHz<br>Body |
|------------|-----------------------------|-----------------------------|-------------------------------|--------------------------------|-----------------|------------------|
| Sugar      | 57                          | 44.9                        | --                            | --                             | --              | --               |
| DGBE       | --                          | --                          | 47                            | 30.8                           | --              | 30               |
| Diacetin   | --                          | --                          | --                            | --                             | 51              | --               |
| Water      | 40.45                       | 53.06                       | 52.62                         | 68.8                           | 48.75           | 70               |
| Salt       | 1.45                        | 0.94                        | 0.38                          | 0.4                            | 0.15            | --               |
| HEC        | 1                           | 1                           | --                            | --                             | --              | --               |
| Bact.      | 0.1                         | 0.1                         | --                            | --                             | 0.1             | --               |

## 5. System Accuracy Verification

A system accuracy verification of the DASY4™ was performed using the measurement equipment listed in Section 3.1. The daily system accuracy verification occurs within the flat section of the SAM phantom.

A SAR measurement was performed to verify the measured SAR was within  $\pm 10\%$  from the target SAR indicated in Section 8.3.7 Reference SAR Values in [5] or Appendix 6 for the 900MHz and/or 1900MHz target reference SAR value. These tests were done at 900MHz and/or 1800MHz. These frequencies are within  $\pm 10\%$  of the compliance test mid-band frequency as required in [1] and [5]. The test was conducted on the same days as the measurement of the DUT. Recommended limits for permittivity and conductivity, specified in [5], are shown in the table below. The obtained results from the system accuracy verification are also displayed in the table below. SAR values are normalized to 1W forward power delivered to the dipole. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values. The distributions of SAR compare well with those of the reference measurements (see Appendix 1). The tissue stimulant depth was verified to be 15.0cm  $\pm 0.5$ cm. Z-axis scans showing the SAR penetration are also included in Appendix 1.

| $f$<br>(MHz) | Description         | SAR (W/kg),<br>1gram | Dielectric Parameters |                | Ambient<br>Temp (°C) | Tissue<br>Temp (°C) |
|--------------|---------------------|----------------------|-----------------------|----------------|----------------------|---------------------|
|              |                     |                      | $\epsilon_r$          | $\sigma$ (S/m) |                      |                     |
| 900          | Measured, 7/10/2006 | 11.9                 | 41.9                  | 0.98           | 20.3                 | 20.0                |
|              | Measured, 7/11/2006 | 11.9                 | 42.0                  | 0.99           | 20.1                 | 20.0                |
|              | Measured, 7/12/2006 | 11.3                 | 41.2                  | 0.96           | 20.5                 | 19.6                |
|              | Recommended Limits  | 11.3                 | 41.5 $\pm 5\%$        | 0.97 $\pm 5\%$ | 18-25                | 18-25               |
| 1800         | Measured, 7/8/2006  | 41.05                | 39.4                  | 1.37           | 20.7                 | 20.0                |
|              | Recommended Limits  | 38.1                 | 40.0 $\pm 5\%$        | 1.4 $\pm 5\%$  | 18-25                | 18-25               |
| 1900         | Measured, 7/13/2006 | 41.4                 | 38.8                  | 1.47           | 20.5                 | 19.8                |
|              | Recommended Limits  | 40.9                 | 40.0 $\pm 5\%$        | 1.4 $\pm 5\%$  | 18-25                | 18-25               |

The following probe conversion factors were used on the E-Field probe(s) used for the system accuracy verification measurements:

| Description             | Serial Number | $f$<br>(MHz) | Conversion Factor | Cal Cert<br>pg # |
|-------------------------|---------------|--------------|-------------------|------------------|
| E-Field Probe<br>ES3DV3 | SN3037        | 900          | 6.07              | 8 of 9           |
|                         |               | 1800         | 5.01              | 8 of 9           |

## 6. Test Results

The test samples were configured in three different laptop PCs. In each laptop PC tests were performed with the bottom of PC parallel to, and touching the phantom (lap position). The EUT was tested in both the upper and the lower PCMCIA slots (were applicable) of the PC. The distance from the bottom of the EUT to the phantom was measured and entered into the tables below.

The DASY v4.6 SAR measurement system specified in section 3.1 was utilized within the intended operations as set by the SPEAG™ setup. The test samples were positioned into the measurement configurations using the positioner supplied with the DASY 4.6 SAR measurement system along with the Styrofoam for additional laptop support.. The measured dielectric constant of the material used for the positioner is less than 2.9 and the loss tangent is less than 0.02 ( $\pm 30\%$ ) at 850MHz. The default settings for the “coarse” and “cube” scans were chosen and use for measurements. The grid spacing of the course scan was set to 15cm as shown in the SAR plots included in appendix 2. Please refer to the DASY manual for additional information on SAR scanning procedures and algorithms used.

### 6.1 Body Worn Test Results

The SAR results shown in tables 1 - 4 are the maximum SAR values averaged over 1 gram of phantom tissue. Also shown are the measured conducted output powers, the temperature of the test facility during the test, the temperature of the tissue simulate after the test, the measured drift and the extrapolated SAR. The exact method of extrapolation is  $\text{New SAR} = \text{Old SAR} * 10^{(-\text{drift}/10)}$ . The SAR reported at the end of the measurement process by the DASY™ measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process. This is the most conservative SAR because it corresponds to the average output power at the beginning of the SAR test. This extrapolation has been done because when the DUT is operating properly it may exhibit a slump in radiated power and SAR over time. This is verified by measuring the SAR drift after the test. The test conditions indicated as bold numbers in the following table are included in Appendix 2. All other test conditions measured lower SAR values than those included in Appendix 2.

The following probe conversion factors were used on the E-Field probe(s) used for the body worn measurements:

| Description          | Serial Number | f (MHz) | Conversion Factor | Cal Cert pg # |
|----------------------|---------------|---------|-------------------|---------------|
| E-Field Probe ES3DV3 | SN3037        | 900     | 5.93              | 8 of 9        |
|                      |               | 1800    | 4.65              | 8 of 9        |

| Computer Model Used: Dell D620 Laptop (14mm from Bottom of Card to Phantom) |             |                                       |              |               |                    |                        |                    |                        |
|-----------------------------------------------------------------------------|-------------|---------------------------------------|--------------|---------------|--------------------|------------------------|--------------------|------------------------|
| $f$<br>(MHz)                                                                | Description | Conducted<br>Output<br>Power<br>(dBm) | Temp<br>(°C) | Drift<br>(dB) | 10g SAR value      |                        | 1g SAR value       |                        |
|                                                                             |             |                                       |              |               | Measured<br>(W/kg) | Extrapolated<br>(W/kg) | Measured<br>(W/kg) | Extrapolated<br>(W/kg) |
| 1900MHz                                                                     | Channel 512 | 29.01                                 |              |               |                    |                        |                    |                        |
|                                                                             | Channel 661 | 28.98                                 | 20.0         | 0.01          | 0.16               | 0.16                   | 0.24               | 0.24                   |
|                                                                             | Channel 810 | 29.01                                 |              |               |                    |                        |                    |                        |

Table 1: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

| Computer Model Used: IBM T41 Laptop (6mm from Bottom of Card to Phantom) |             |                                       |              |               |                    |                        |                    |                        |
|--------------------------------------------------------------------------|-------------|---------------------------------------|--------------|---------------|--------------------|------------------------|--------------------|------------------------|
| $f$<br>(MHz)                                                             | Description | Conducted<br>Output<br>Power<br>(dBm) | Temp<br>(°C) | Drift<br>(dB) | 10g SAR value      |                        | 1g SAR value       |                        |
|                                                                          |             |                                       |              |               | Measured<br>(W/kg) | Extrapolated<br>(W/kg) | Measured<br>(W/kg) | Extrapolated<br>(W/kg) |
| 1900MHz                                                                  | Channel 512 | 29.01                                 |              |               |                    |                        |                    |                        |
|                                                                          | Channel 661 | 28.98                                 | 20.0         | -0.1          | 0.27               | 0.27                   | 0.47               | 0.49                   |
|                                                                          | Channel 810 | 29.01                                 |              |               |                    |                        |                    |                        |

Table 2: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

| Computer Model Used: Fujitsu S7010 Laptop (7mm from Bottom of Card to Phantom) |             |                                       |              |               |                    |                        |                    |                        |
|--------------------------------------------------------------------------------|-------------|---------------------------------------|--------------|---------------|--------------------|------------------------|--------------------|------------------------|
| $f$<br>(MHz)                                                                   | Description | Conducted<br>Output<br>Power<br>(dBm) | Temp<br>(°C) | Drift<br>(dB) | 10g SAR value      |                        | 1g SAR value       |                        |
|                                                                                |             |                                       |              |               | Measured<br>(W/kg) | Extrapolated<br>(W/kg) | Measured<br>(W/kg) | Extrapolated<br>(W/kg) |
| 1900MHz                                                                        | Channel 512 | 29.01                                 |              |               |                    |                        |                    |                        |
|                                                                                | Channel 661 | 28.98                                 | 20.0         | -0.18         | 0.28               | 0.29                   | 0.5                | 0.52                   |
|                                                                                | Channel 810 | 29.01                                 |              |               |                    |                        |                    |                        |

Table 3: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

| Computer Model Used: Fujitsu S7010 Laptop GPRS Class 10 (7mm from Bottom of Card to Phantom) |             |                                       |              |               |                    |                        |                    |                        |
|----------------------------------------------------------------------------------------------|-------------|---------------------------------------|--------------|---------------|--------------------|------------------------|--------------------|------------------------|
| $f$<br>(MHz)                                                                                 | Description | Conducted<br>Output<br>Power<br>(dBm) | Temp<br>(°C) | Drift<br>(dB) | 10g SAR value      |                        | 1g SAR value       |                        |
|                                                                                              |             |                                       |              |               | Measured<br>(W/kg) | Extrapolated<br>(W/kg) | Measured<br>(W/kg) | Extrapolated<br>(W/kg) |
| 1900MHz                                                                                      | Channel 512 | 28.81                                 |              |               |                    |                        |                    |                        |
|                                                                                              | Channel 661 | 28.83                                 | 19.7         | -0.05         | 0.32               | 0.33                   | 0.55               | 0.55                   |
|                                                                                              | Channel 810 | 29.16                                 |              |               |                    |                        |                    |                        |

Table 4: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

## References

- [1] CENELEC, en50361:2001 “Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300MHz – 3GHz)”
- [2] CENELEC, en50360:2001 “Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300MHz – 3GHz)”.
- [3] ANSI / IEEE, C95.1 1999 Edition “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz”
- [4] FCC OET Bulletin 65 Supplement C 01-01
- [5] IEEE 1528 2003 Edition “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”
- [6] ICNIRP Guidelines “Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)”

## **Appendix 1**

### **SAR distribution comparison for the system accuracy verification**

## Test Laboratory: Motorola

**070806 1800MHz Good at +7.7%**

**DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:272tr**

Procedure Notes: 1800 MHz System Performance Check / Dipole Sn# 272tr PM1 Power = 200mW

Sim.Temp@meas = 20°C Sim.Temp@SPC = 20°C Room Temp @ SPC = 20.7°C

Communication System: CW - Dipole; Frequency: 1800 MHz; Channel Number: 8; Duty Cycle: 1:1

Medium: VALIDATION Only; Medium parameters used:  $f = 1800$  MHz;  $\sigma = 1.37$  mho/m;  $\epsilon_r = 39.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3037; ConvF(5.01, 5.01, 5.01); Calibrated: 11/17/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/5/2005
- Phantom: R4 : Sect.2, Amy Twin; Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

### Daily SPC Check/Dipole Area Scan (9x4x1):

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

Maximum value of SAR (measured) = 6.57 mW/g

### Daily SPC Check/0-Degree 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 83.8 V/m; Power Drift = -0.019 dB

Peak SAR (extrapolated) = 14.4 W/kg

**SAR(1 g) = 8.19 mW/g; SAR(10 g) = 4.36 mW/g**

Maximum value of SAR (measured) = 9.20 mW/g

### Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 83.8 V/m; Power Drift = -0.019 dB

Peak SAR (extrapolated) = 14.4 W/kg

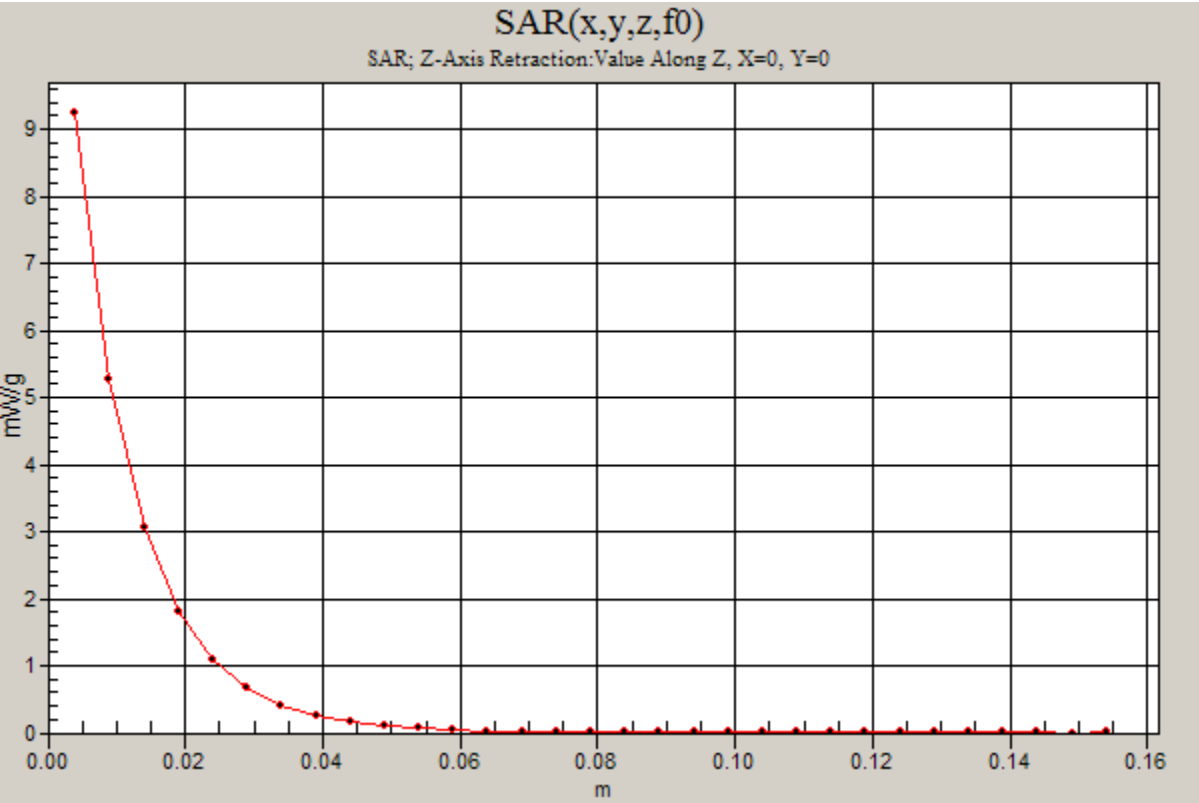
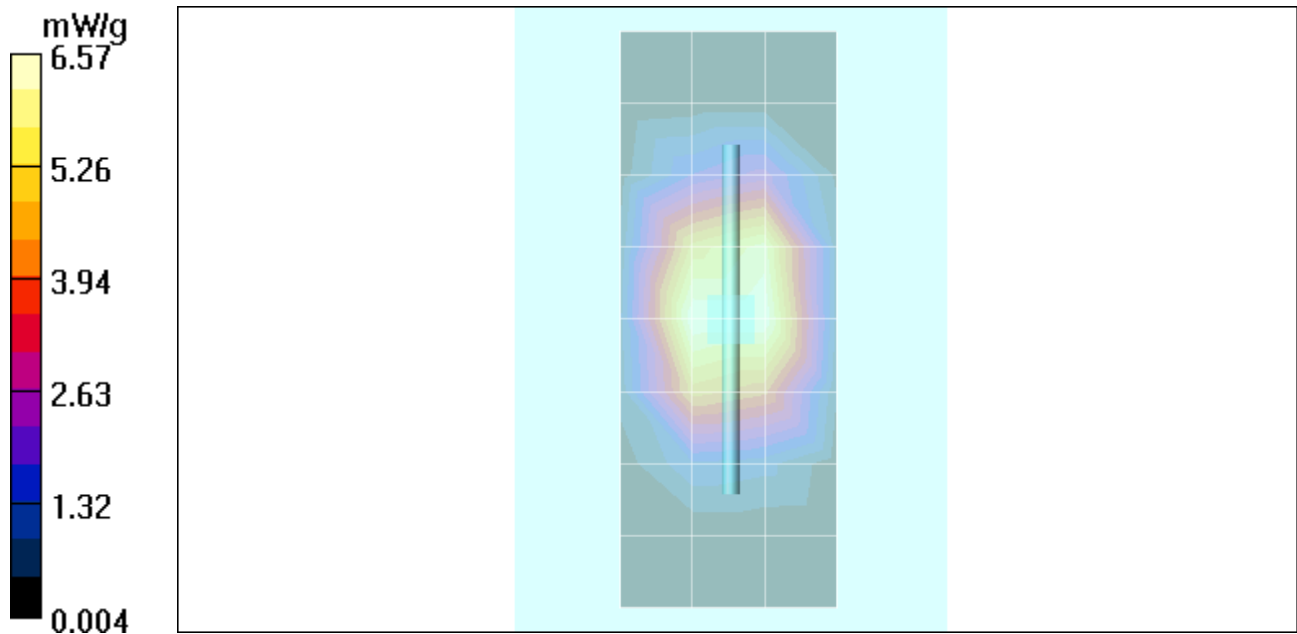
**SAR(1 g) = 8.23 mW/g; SAR(10 g) = 4.39 mW/g**

Maximum value of SAR (measured) = 9.17 mW/g

### Daily SPC Check/Z-Axis Retraction (1x1x31):

Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 9.25 mW/g



## Test Laboratory: Motorola

**071006 900MHz Good at +5.5%**

**DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:096**

Procedure Notes: 900MHz System Performance Check / Dipole Sn#096 PM1 Power =200mW

Sim.Temp@meas = 20°C Sim.Temp@SPC = 20°C Room Temp @ SPC = 20.3°C

Communication System: CW - Dipole; Frequency: 900 MHz; Channel Number: 4; Duty Cycle: 1:1

Medium: VALIDATION Only; Medium parameters used:  $f = 900 \text{ MHz}$ ;  $\sigma = 0.98 \text{ mho/m}$ ;  $\epsilon_r = 41.9$ ;  $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

- Probe: ES3DV3 - SN3037; ConvF(6.07, 6.07, 6.07); Calibrated: 11/17/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/5/2005
- Phantom: R4: Sugar Water SAM; Type: SAM; Serial: TP-1131;
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

### Daily SPC Check/Dipole Area Scan (4x9x1):

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

Maximum value of SAR (measured) = 2.20 mW/g

### Daily SPC Check/0-Degree 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 51.5 V/m; Power Drift = -0.006 dB

Peak SAR (extrapolated) = 3.62 W/kg

**SAR(1 g) = 2.38 mW/g; SAR(10 g) = 1.52 mW/g**

Maximum value of SAR (measured) = 2.58 mW/g

### Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 51.5 V/m; Power Drift = -0.006 dB

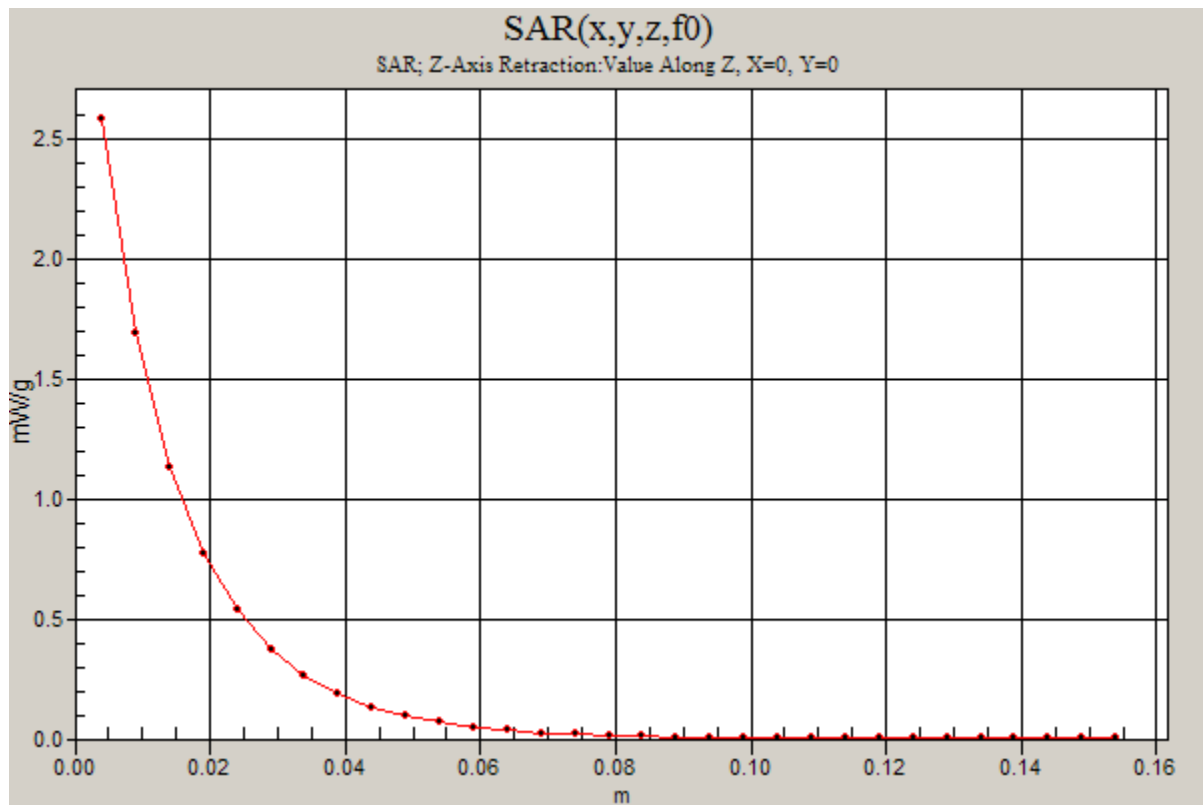
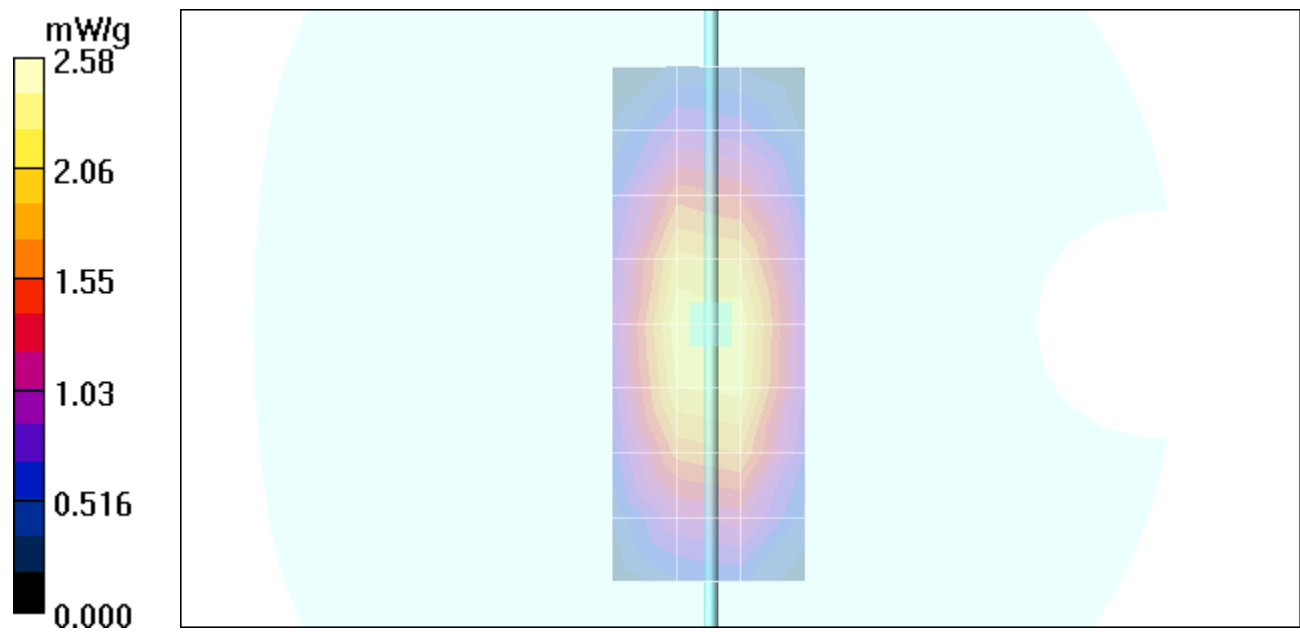
Peak SAR (extrapolated) = 3.65 W/kg

**SAR(1 g) = 2.39 mW/g; SAR(10 g) = 1.53 mW/g**

Maximum value of SAR (measured) = 2.60 mW/g

### Daily SPC Check/Z-Axis Retraction (1x1x31):

Measurement grid:  $dx=20\text{mm}$ ,  $dy=20\text{mm}$ ,  $dz=5\text{mm}$



## Test Laboratory: Motorola

**071106 900MHz Good at +5.5%**

**DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:096**

Procedure Notes: 900MHz System Performance Check / Dipole Sn#096 PM1 Power =200mW

Sim.Temp@meas = 20°C Sim.Temp@SPC = 20°C Room Temp @ SPC = 20.1°C

Communication System: CW - Dipole; Frequency: 900 MHz; Channel Number: 4; Duty Cycle: 1:1

Medium: VALIDATION Only; Medium parameters used:  $f = 900 \text{ MHz}$ ;  $\sigma = 0.99 \text{ mho/m}$ ;  $\epsilon_r = 42$ ;  $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

- Probe: ES3DV3 - SN3037; ConvF(6.07, 6.07, 6.07); Calibrated: 11/17/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/5/2005
- Phantom: R4: Sugar Water SAM; Type: SAM; Serial: TP-1131;
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 160

### Daily SPC Check/Dipole Area Scan (4x9x1):

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

Maximum value of SAR (measured) = 2.24 mW/g

### Daily SPC Check/0-Degree 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 51.7 V/m; Power Drift = -0.028 dB

Peak SAR (extrapolated) = 3.62 W/kg

**SAR(1 g) = 2.38 mW/g; SAR(10 g) = 1.52 mW/g**

Maximum value of SAR (measured) = 2.58 mW/g

### Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

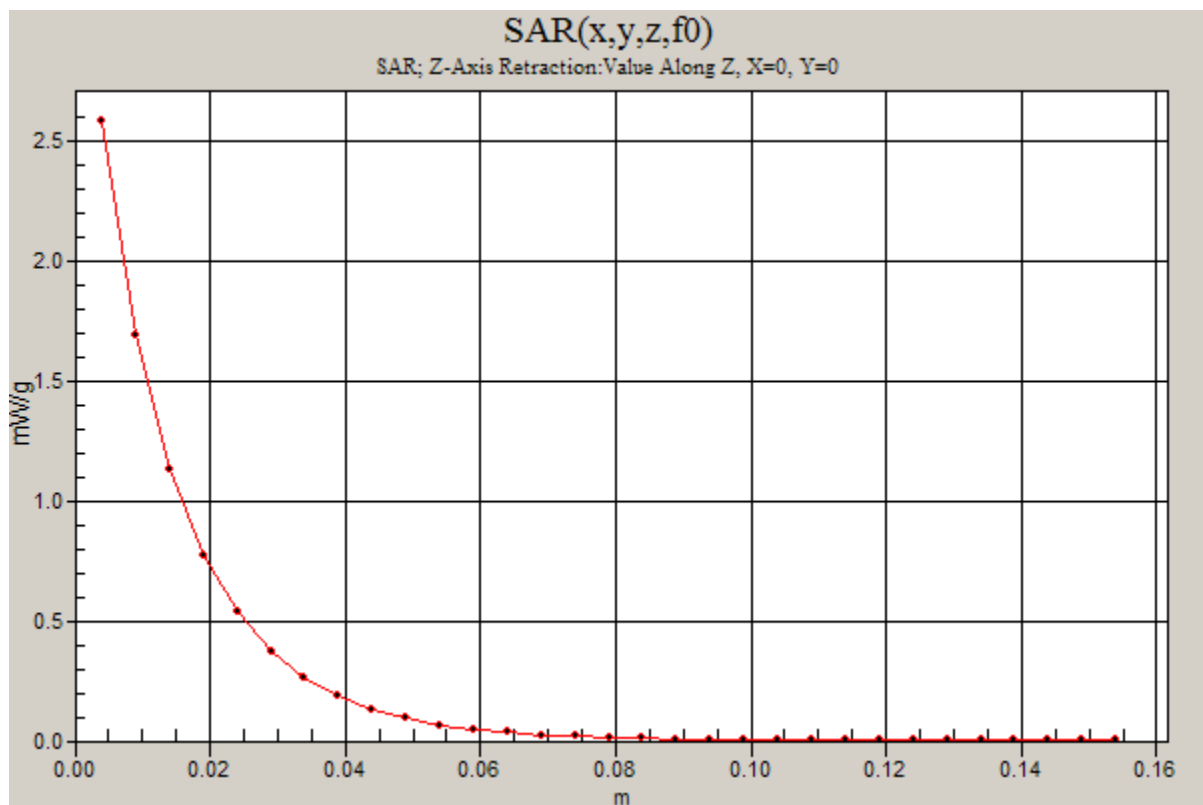
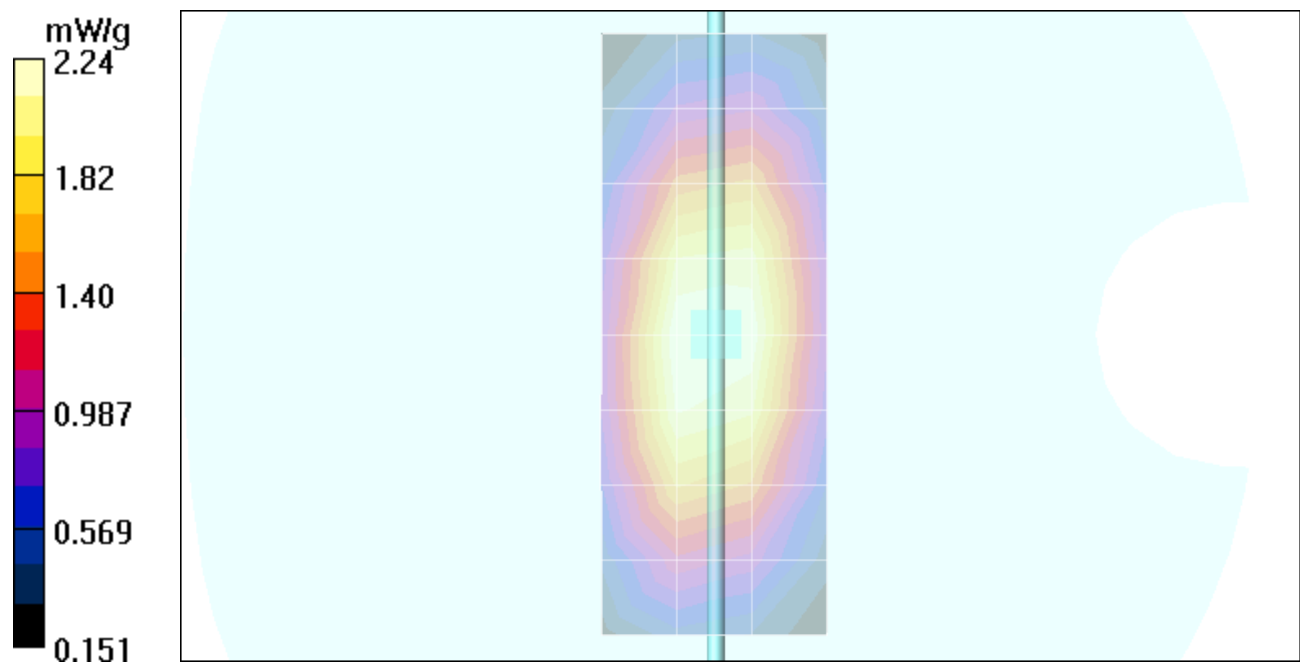
Reference Value = 51.7 V/m; Power Drift = -0.028 dB

Peak SAR (extrapolated) = 3.62 W/kg

**SAR(1 g) = 2.39 mW/g; SAR(10 g) = 1.53 mW/g**

### Daily SPC Check/Z-Axis Retraction (1x1x31):

Measurement grid:  $dx=20\text{mm}$ ,  $dy=20\text{mm}$ ,  $dz=5\text{mm}$



## Test Laboratory: Motorola

**071206 900MHz Good at +0.0%**

**DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:096**

Procedure Notes: 900MHz System Performance Check / Dipole Sn#096 PM1 Power =200mW

Sim.Temp@meas = 19.5°C Sim.Temp@SPC = 19.6°C Room Temp @ SPC = 20.5°C

Communication System: CW - Dipole; Frequency: 900 MHz; Channel Number: 4; Duty Cycle: 1:1

Medium: VALIDATION Only; Medium parameters used:  $f = 900 \text{ MHz}$ ;  $\sigma = 0.96 \text{ mho/m}$ ;  $\epsilon_r = 41.2$ ;  $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

- Probe: ES3DV3 - SN3037; ConvF(6.07, 6.07, 6.07); Calibrated: 11/17/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/5/2005
- Phantom: R4: Sugar Water SAM; Type: SAM; Serial: TP-1131;
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 160

### Daily SPC Check/Dipole Area Scan (4x9x1):

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

Maximum value of SAR (measured) = 2.11 mW/g

### Daily SPC Check/0-Degree 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 50.9 V/m; Power Drift = 0.017 dB

Peak SAR (extrapolated) = 3.41 W/kg

**SAR(1 g) = 2.25 mW/g; SAR(10 g) = 1.44 mW/g**

Maximum value of SAR (measured) = 2.45 mW/g

### Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 50.9 V/m; Power Drift = 0.017 dB

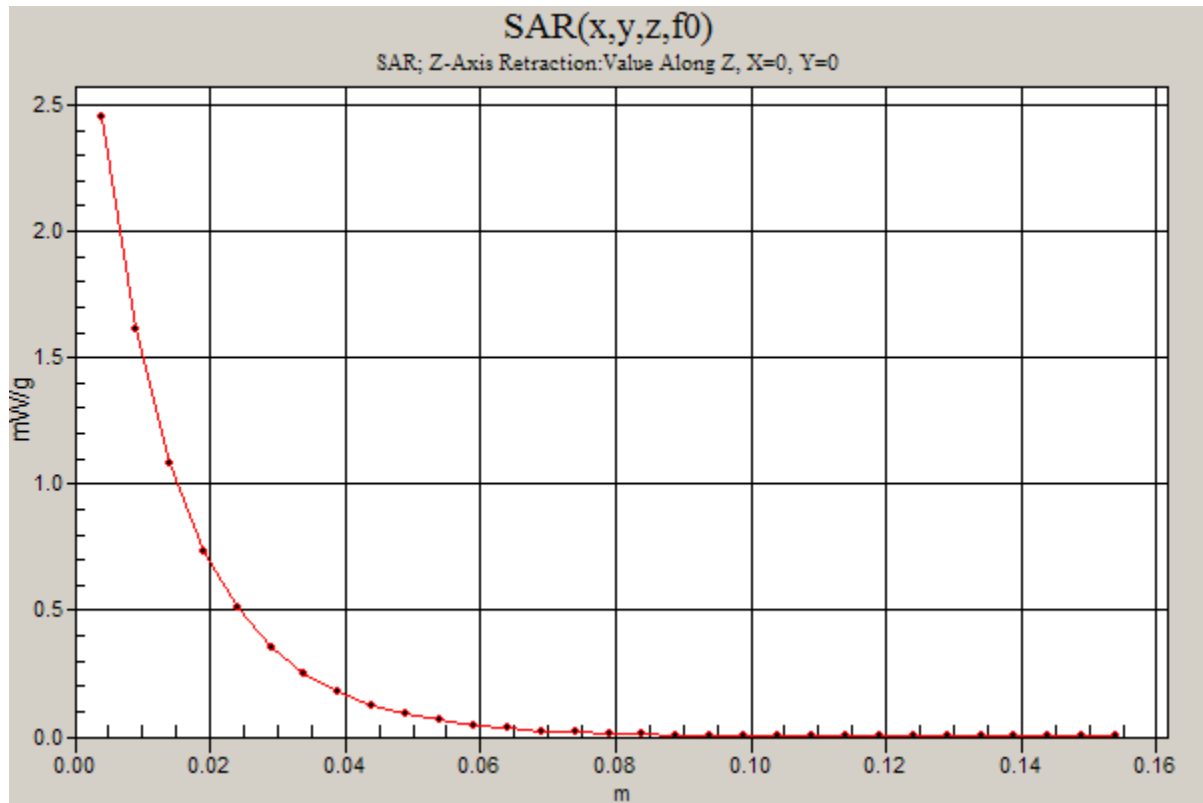
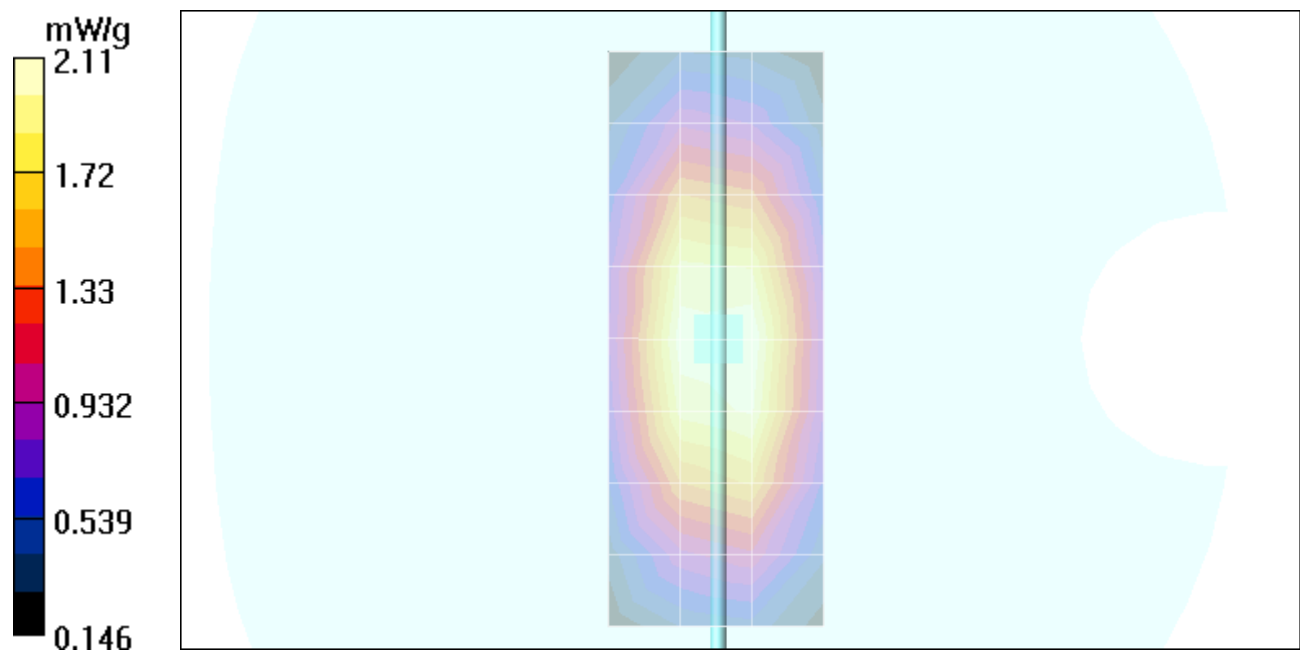
Peak SAR (extrapolated) = 3.43 W/kg

**SAR(1 g) = 2.27 mW/g; SAR(10 g) = 1.46 mW/g**

Maximum value of SAR (measured) = 2.46 mW/g

### Daily SPC Check/Z-Axis Retraction (1x1x31):

Measurement grid:  $dx=20\text{mm}$ ,  $dy=20\text{mm}$ ,  $dz=5\text{mm}$



## Test Laboratory: Motorola

### 071306 1900MHz Good at +1.2%open

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:533TR**

Procedure Notes: 1900 MHz System Performance Check / Dipole Sn# 533tr PM1 Power = 200mW

Sim.Temp@meas = 19.8\*C Sim.Temp@SPC = 19.8\*C Room Temp @ SPC = 20.5\*C

Communication System: CW - Dipole; Frequency: 1900 MHz; Channel Number: 10; Duty Cycle: 1:1

Medium: VALIDATION Only; Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.47$  mho/m;  $\epsilon_r = 38.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3037; ConvF(5.01, 5.01, 5.01); Calibrated: 11/17/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/5/2005
- Phantom: R4 : Sect.2, Amy Twin; Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 160

### Daily SPC Check/Dipole Area Scan (9x4x1):

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

Maximum value of SAR (measured) = 7.38 mW/g

### Daily SPC Check/0-Degree 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 79.8 V/m; Power Drift = 0.037 dB

Peak SAR (extrapolated) = 15.0 W/kg

**SAR(1 g) = 8.23 mW/g; SAR(10 g) = 4.25 mW/g**

Maximum value of SAR (measured) = 9.26 mW/g

### Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 79.8 V/m; Power Drift = 0.037 dB

Peak SAR (extrapolated) = 15.2 W/kg

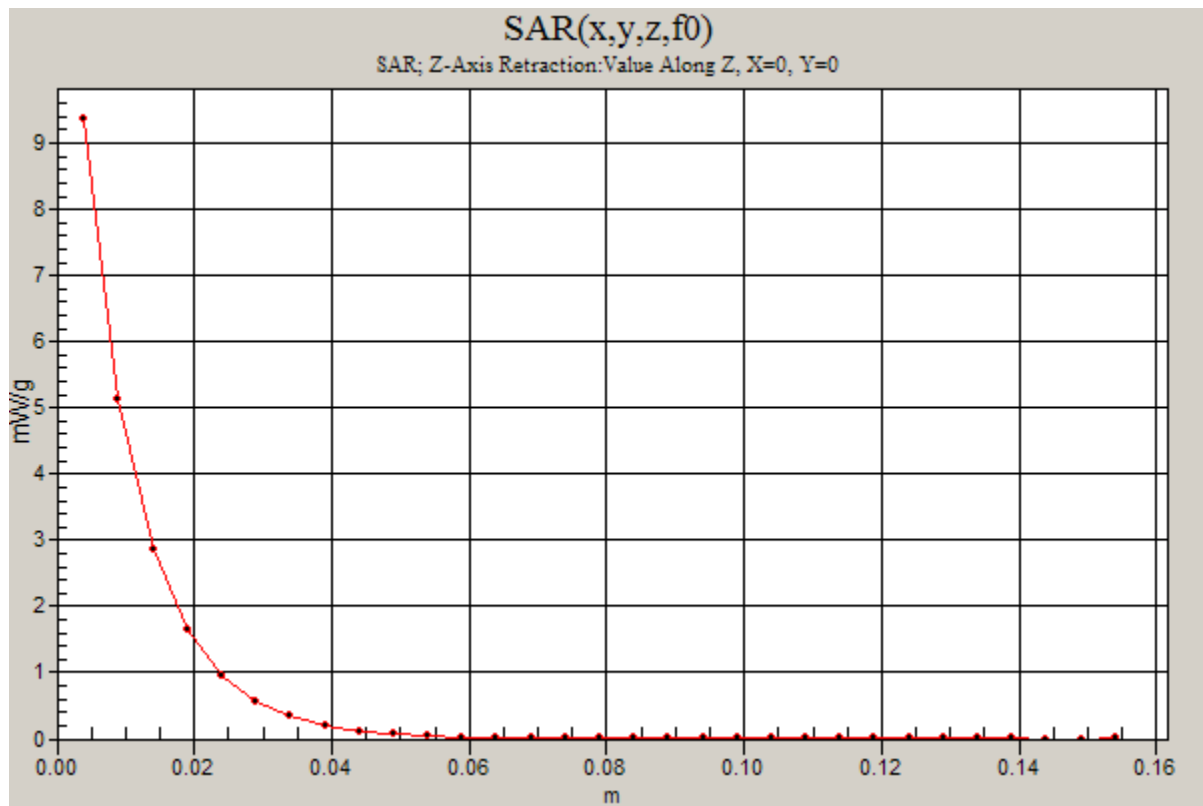
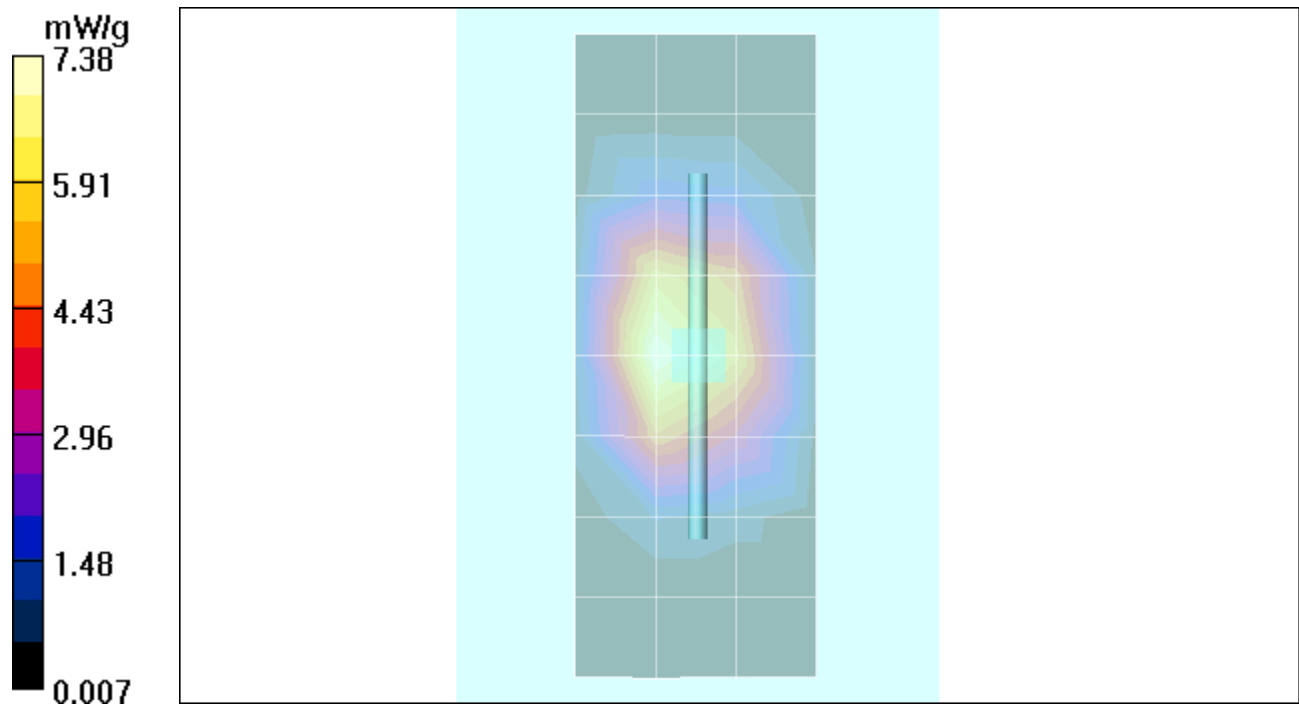
**SAR(1 g) = 8.33 mW/g; SAR(10 g) = 4.3 mW/g**

Maximum value of SAR (measured) = 9.21 mW/g

### Daily SPC Check/Z-Axis Retraction (1x1x31):

Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 9.37 mW/g



## **Appendix 2**

### **SAR distribution plots for Body Worn Configuration**

## Test Laboratory: Motorola

1900 Dell

Serial: DELL Laptop

**Procedure Notes: Pwr Step: 0 (radio com)      Antenna Position: INTERNAL**

Communication System: GSM 1900; Frequency: 1880 MHz; Channel Number: 661; Duty Cycle: 1:8

Medium: Regular Glycol Body; Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.59 \text{ mho/m}$ ;  $\epsilon_r = 50.7$ ;  $\rho = 1000 \text{ kg/m}^3$ 

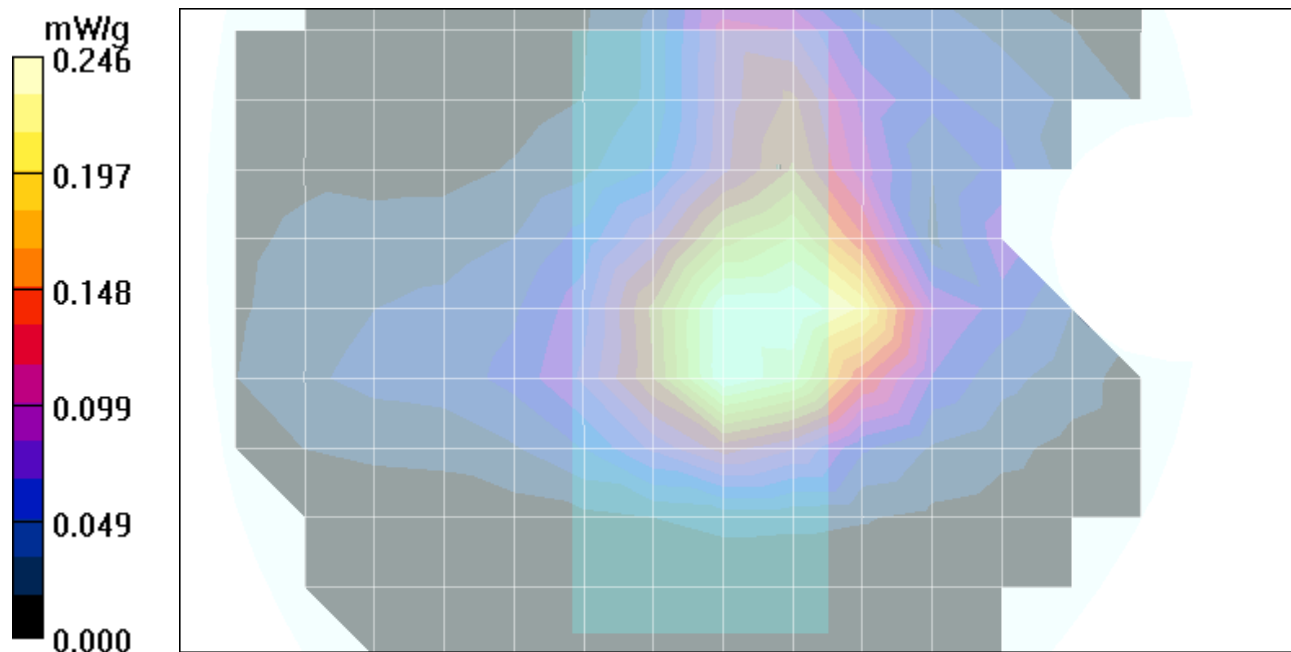
DASY4 Configuration:

- Probe: ES3DV3 - SN3037; ConvF(4.65, 4.65, 4.65); Calibrated: 11/17/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/5/2005
- Phantom: R4: Glycol SAM; Type: SAM; Serial: TP-1250;
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

### SAM Phone Against Flat Section/Area Scan - Full Body (15mm) (21x14x1):

Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$ Maximum value of SAR (measured) =  $0.246 \text{ mW/g}$ 

### SAM Phone Against Flat Section/Zoom Scan (7x7x7)/Cube 0:

Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ Reference Value =  $12.6 \text{ V/m}$ ; Power Drift =  $0.007 \text{ dB}$ Peak SAR (extrapolated) =  $0.363 \text{ W/kg}$ **SAR(1 g) =  $0.244 \text{ mW/g}$ ; SAR(10 g) =  $0.158 \text{ mW/g}$** Maximum value of SAR (measured) =  $0.263 \text{ mW/g}$ 

**Test Laboratory: Motorola****1900 Fujitsu**

Serial: Fujitsu Laptop

**Procedure Notes: Pwr Step: 0 (radio com)****Antenna Position: INTERNAL**

Communication System: GSM 1900; Frequency: 1880 MHz; Channel Number: 661; Duty Cycle: 1:8

Medium: Regular Glycol Body; Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.59$  mho/m;  $\epsilon_r = 50.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3037; ConvF(4.65, 4.65, 4.65); Calibrated: 11/17/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/5/2005
- Phantom: R4: Glycol SAM; Type: SAM; Serial: TP-1250;
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**SAM Phone Against Flat Section/Area Scan - Full Body (15mm) (21x14x1):**

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

Maximum value of SAR (measured) = 0.503 mW/g

**SAM Phone Against Flat Section/Zoom Scan (7x7x7)/Cube 0:**

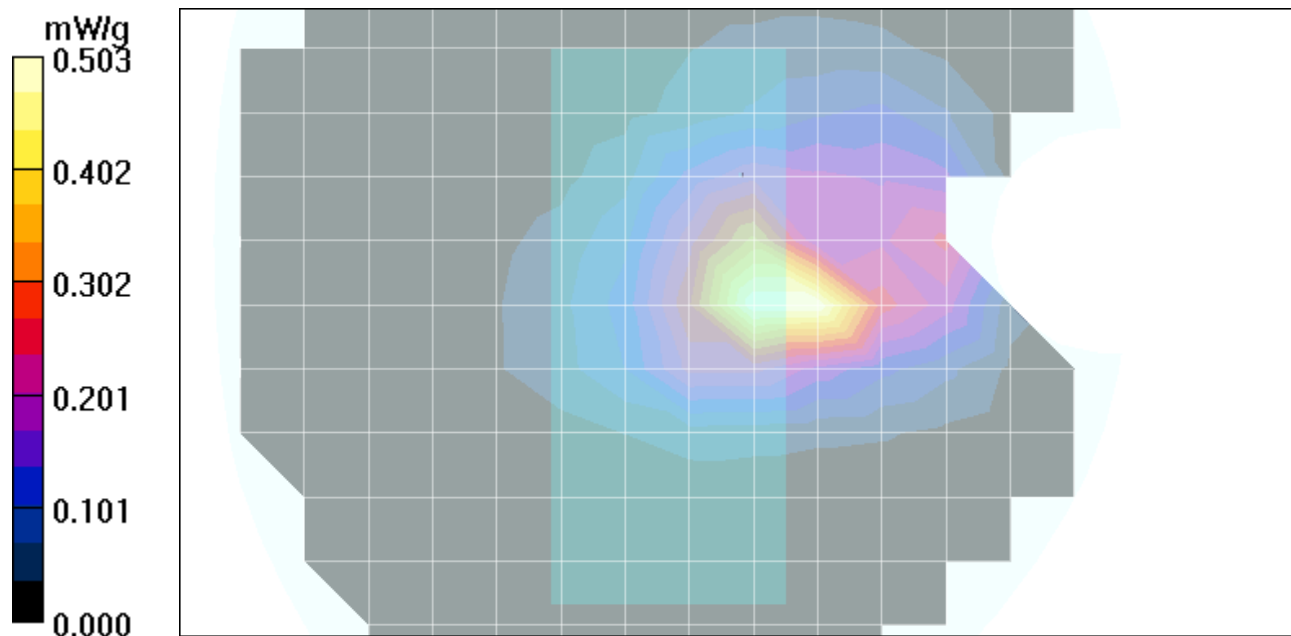
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 19.4 V/m; Power Drift = -0.176 dB

Peak SAR (extrapolated) = 0.800 W/kg

**SAR(1 g) = 0.497 mW/g; SAR(10 g) = 0.280 mW/g**

Maximum value of SAR (measured) = 0.559 mW/g



## Test Laboratory: Motorola

1900 Fujitsu GPRS

Serial: Fujitsu Laptop

**Procedure Notes: Pwr Step: burst1and2=0    Antenna Position: INTERNAL****Accessory Model # = Fujitsu Laptop**

Communication System: GPRS 1900 - Class 10; Frequency: 1880 MHz; Channel Number: 661; Duty Cycle: 1:4  
Medium: Regular Glycol Body; Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.59$  mho/m;  $\epsilon_r = 50.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3037; ConvF(4.65, 4.65, 4.65); Calibrated: 11/17/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn437; Calibrated: 7/18/2006
- Phantom: R4: Glycol SAM; Type: SAM; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 160

### SAM Phone Against Flat Section/Area Scan - Full Body (15mm) (21x14x1):

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

Maximum value of SAR (measured) = 0.517 mW/g

### SAM Phone Against Flat Section/Zoom Scan (7x7x7)/Cube 0:

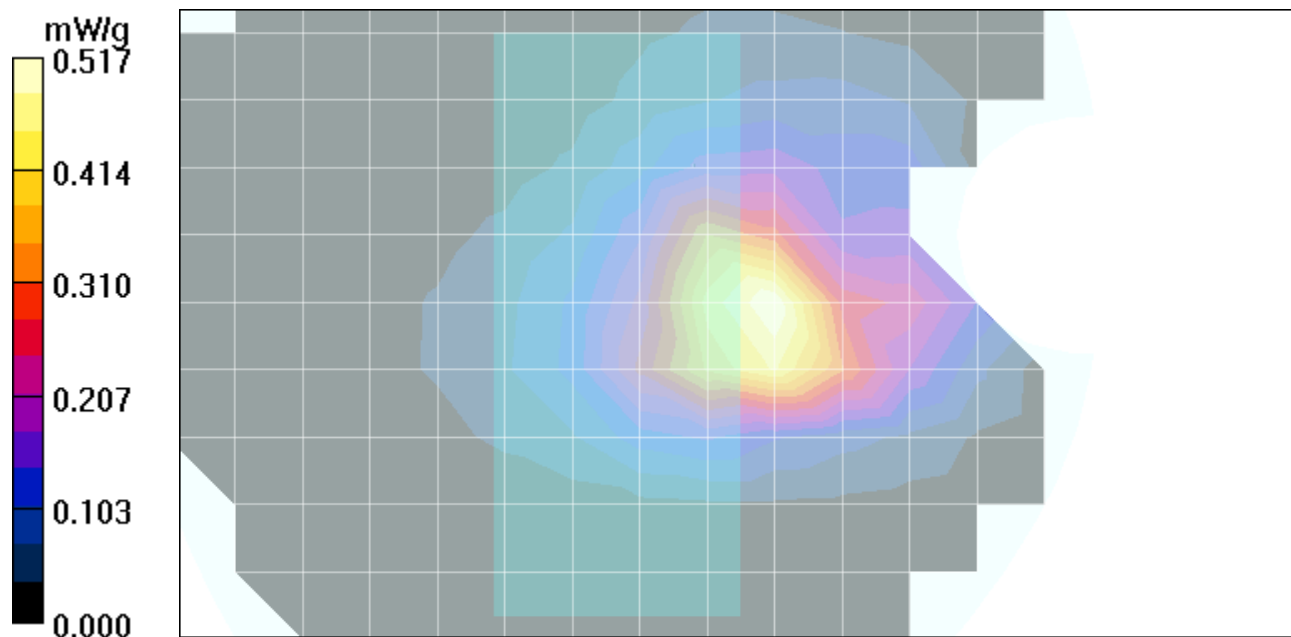
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 18.9 V/m; Power Drift = -0.050 dB

Peak SAR (extrapolated) = 0.822 W/kg

**SAR(1 g) = 0.546 mW/g; SAR(10 g) = 0.322 mW/g**

Maximum value of SAR (measured) = 0.603 mW/g



## Test Laboratory: Motorola

1900 IBM

Serial: IBM Laptop

**Procedure Notes: Pwr Step: 0 (radio com)****Antenna Position: INTERNAL**

Communication System: GSM 1900; Frequency: 1880 MHz; Channel Number: 661; Duty Cycle: 1:8

Medium: Regular Glycol Body; Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.59$  mho/m;  $\epsilon_r = 50.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3037; ConvF(4.65, 4.65, 4.65); Calibrated: 11/17/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/5/2005
- Phantom: R4: Glycol SAM; Type: SAM; Serial: TP-1250;
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

### SAM Phone Against Flat Section/Area Scan - Full Body (15mm) (21x14x1):

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

Maximum value of SAR (measured) = 0.491 mW/g

### SAM Phone Against Flat Section/Zoom Scan (7x7x7)/Cube 0:

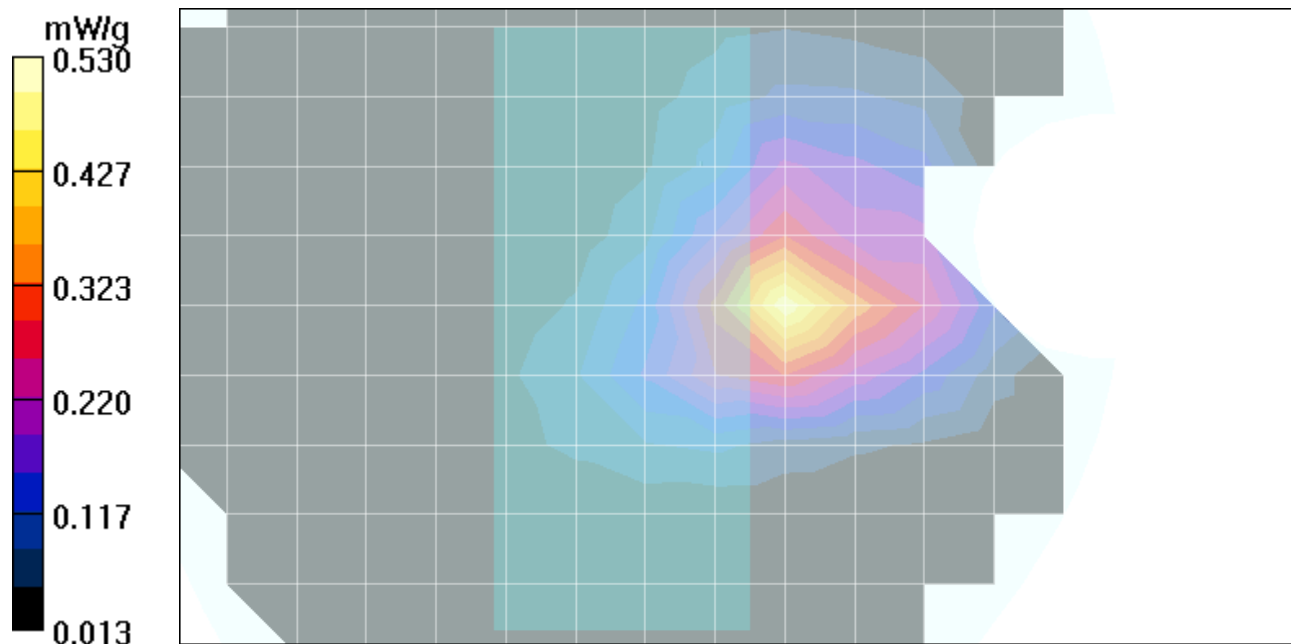
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 17.3 V/m; Power Drift = -0.123 dB

Peak SAR (extrapolated) = 0.750 W/kg

**SAR(1 g) = 0.474 mW/g; SAR(10 g) = 0.267 mW/g**

Maximum value of SAR (measured) = 0.530 mW/g



### **Appendix 3**

#### **Probe Calibration Certificate**



Accredited by the Swiss Federal Office of Metrology and Accreditation  
**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** **Motorola MDb**

**Certificate No: ES3-3037\_Nov05**

## CALIBRATION CERTIFICATE

**Object** **ES3DV3 - SN:3037**

**Calibration procedure(s)** **QA CAL-01.v5**  
**Calibration procedure for dosimetric E-field probes**

**Calibration date:** **November 17, 2005**

**Condition of the calibrated item** **In Tolerance**

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 (Calibrated by, Certificate No.) | Scheduled Calibration |
|----------------------------|-----------------|-------------------------------------------|-----------------------|
| Power meter E4419B         | GB41293874      | 3-May-05 (METAS, No. 251-00466)           | May-06                |
| Power sensor E4412A        | MY41495277      | 3-May-05 (METAS, No. 251-00466)           | May-06                |
| Power sensor E4412A        | MY41498087      | 3-May-05 (METAS, No. 251-00466)           | May-06                |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 11-Aug-05 (METAS, No. 251-00499)          | Aug-06                |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 3-May-05 (METAS, No. 251-00467)           | May-06                |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 11-Aug-05 (METAS, No. 251-00500)          | Aug-06                |
| Reference Probe ES3DV2     | SN: 3013        | 7-Jan-05 (SPEAG, No. ES3-3013_Jan05)      | Jan-06                |
| DAE4                       | SN: 654         | 27-Oct-05 (SPEAG, No. DAE4-654_Oct05)     | Oct-06                |

| Secondary Standards       | ID #         | Check Date (in house)                    | Scheduled Check        |
|---------------------------|--------------|------------------------------------------|------------------------|
| RF generator HP 8648C     | US3642U01700 | 4-Aug-99 (SPEAG, in house check Dec-03)  | In house check: Dec-05 |
| Network Analyzer HP 8753E | US37390585   | 18-Oct-01 (SPEAG, in house check Nov-04) | In house check: Nov 05 |

**Calibrated by:** **Name** **Nico Vetterli** **Function** **Laboratory Technician**

**Signature**

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

**Issued: November 17, 2005**

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



Accredited by the Swiss Federal Office of Metrology and Accreditation  
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                                                                                                                             |
| NORM <sub>x,y,z</sub>    | sensitivity in free space                                                                                                                            |
| ConF                     | sensitivity in TSL / NORM <sub>x,y,z</sub>                                                                                                           |
| DCP                      | diode compression point                                                                                                                              |
| 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), 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
- CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

### 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 effect 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 (no uncertainty required). DCP does not depend on frequency nor media.
- 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:3037

|                  |                   |
|------------------|-------------------|
| Manufactured:    | August 21, 2003   |
| Last calibrated: | November 25, 2005 |
| Recalibrated:    | November 17, 2005 |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

## DASY - Parameters of Probe: ES3DV3 SN:3037

### Sensitivity in Free Space<sup>A</sup>

|       |                     |                                     |
|-------|---------------------|-------------------------------------|
| NormX | <b>1.15</b> ± 10.1% | $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormY | <b>0.84</b> ± 10.1% | $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormZ | <b>0.95</b> ± 10.1% | $\mu\text{V}/(\text{V}/\text{m})^2$ |

### Diode Compression<sup>B</sup>

|       |              |
|-------|--------------|
| DCP X | <b>97</b> mV |
| DCP Y | <b>97</b> mV |
| DCP Z | <b>97</b> mV |

### Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

### Boundary Effect

**TSL                      900 MHz      Typical SAR gradient: 5 % per mm**

|                                           |                              |               |               |
|-------------------------------------------|------------------------------|---------------|---------------|
| Sensor Center to Phantom Surface Distance |                              | <b>3.0 mm</b> | <b>4.0 mm</b> |
| SAR <sub>be</sub> [%]                     | Without Correction Algorithm | 5.1           | 2.3           |
| SAR <sub>be</sub> [%]                     | With Correction Algorithm    | 0.0           | 0.1           |

**TSL                      1810 MHz      Typical SAR gradient: 10 % per mm**

|                                           |                              |               |               |
|-------------------------------------------|------------------------------|---------------|---------------|
| Sensor Center to Phantom Surface Distance |                              | <b>3.0 mm</b> | <b>4.0 mm</b> |
| SAR <sub>be</sub> [%]                     | Without Correction Algorithm | 8.4           | 5.2           |
| SAR <sub>be</sub> [%]                     | With Correction Algorithm    | 0.0           | 0.1           |

### Sensor Offset

Probe Tip to Sensor Center                      **2.0 mm**

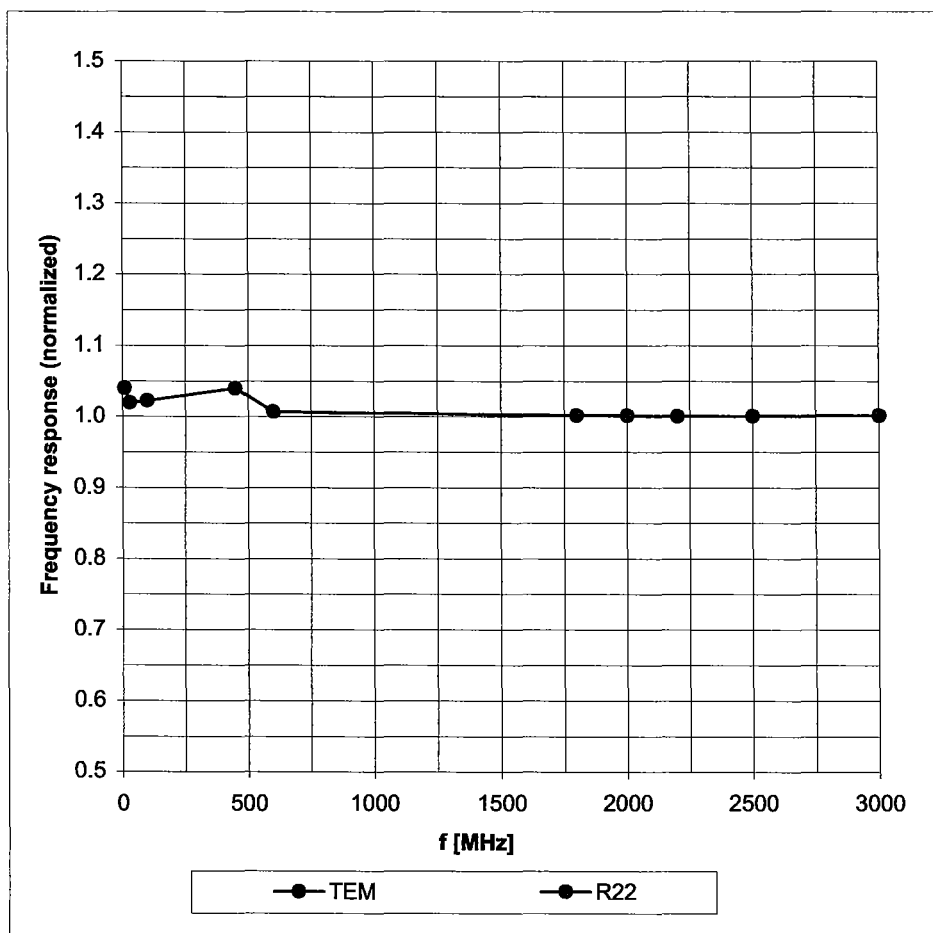
**The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.**

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 8).

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

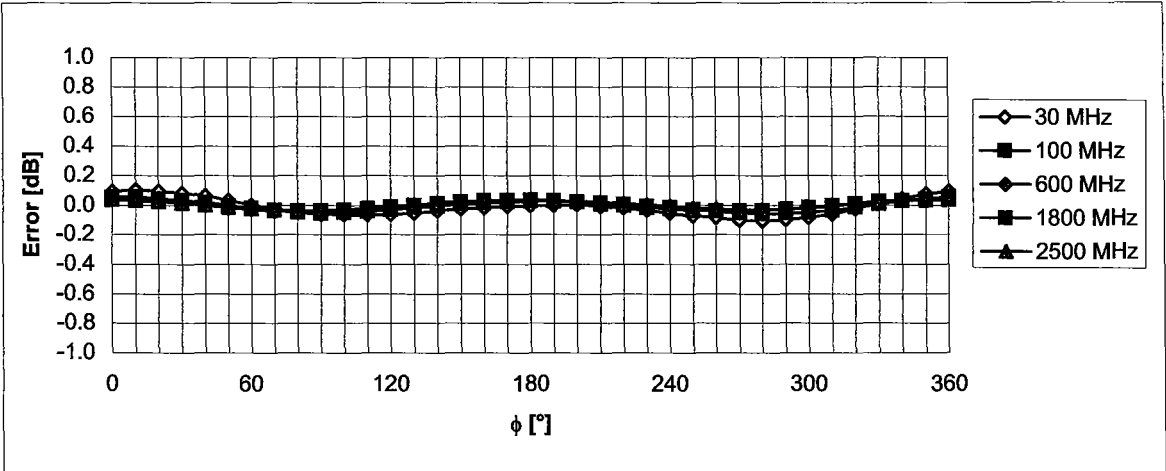
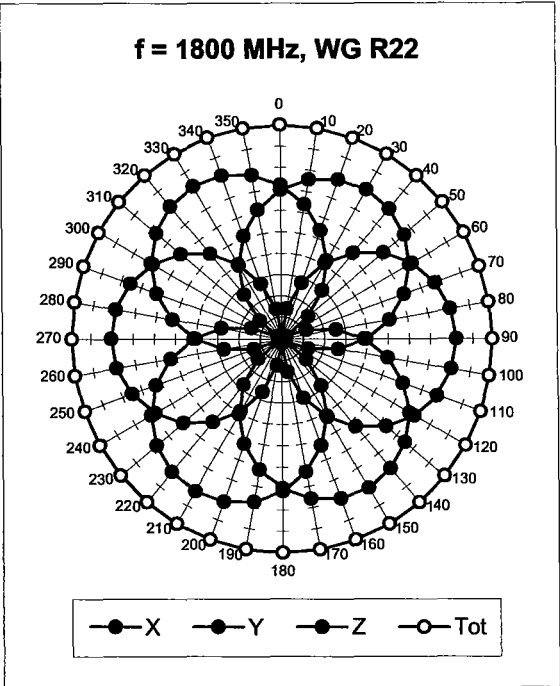
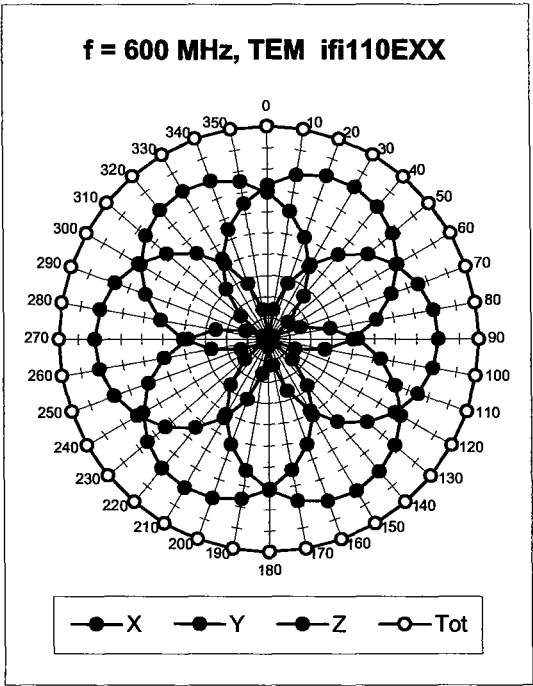
## Frequency Response of E-Field

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



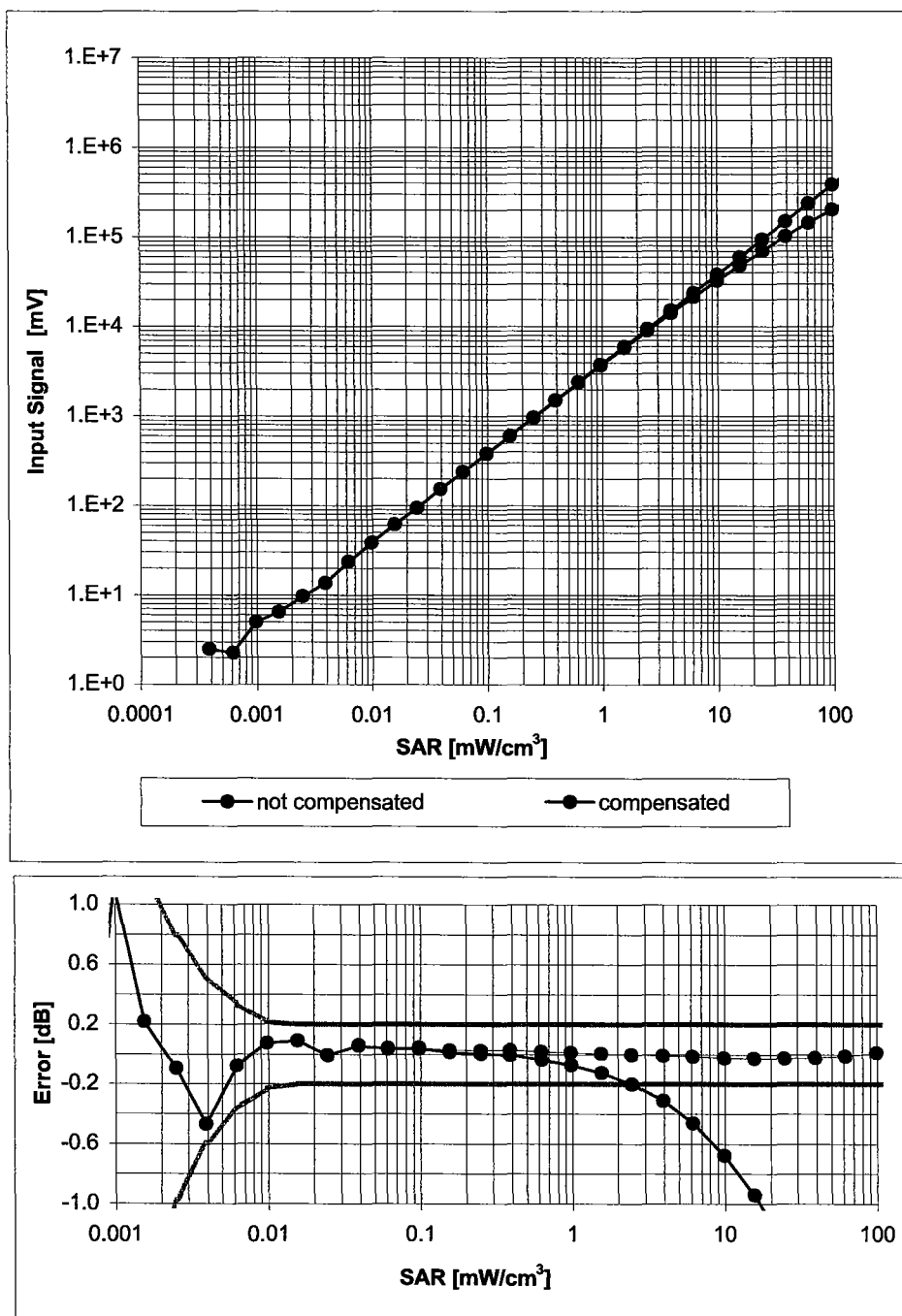
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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



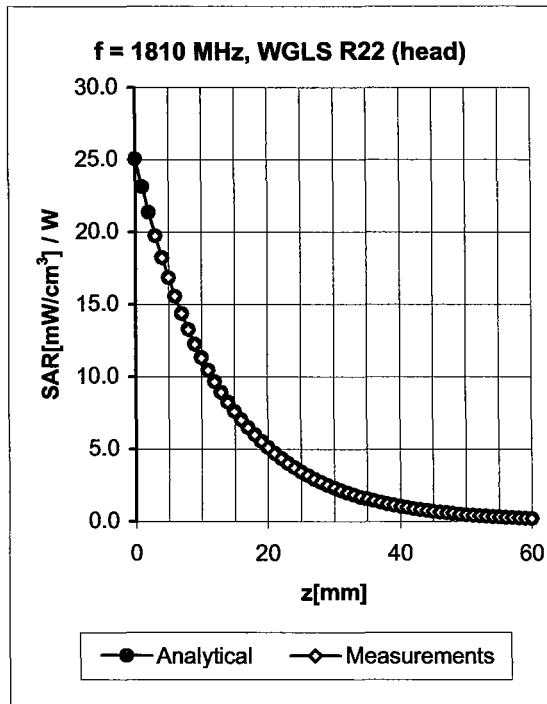
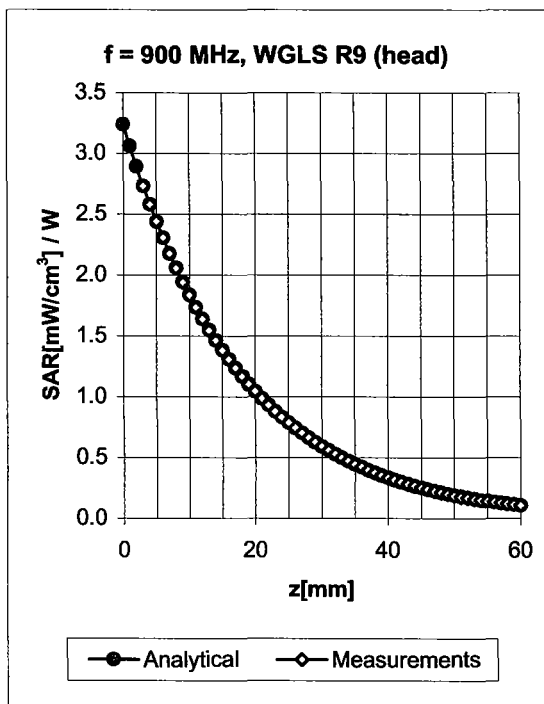
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

# Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide R22, $f = 1800 \text{ MHz}$ )



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

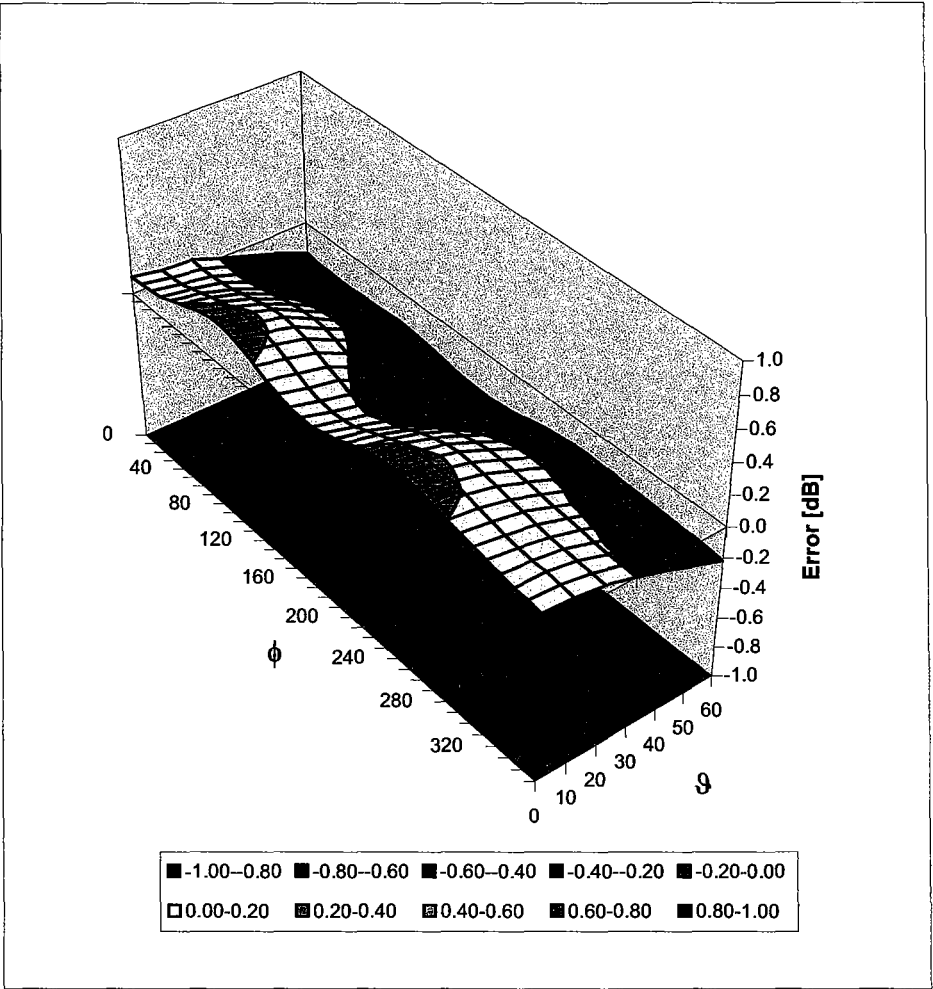
## Conversion Factor Assessment



| f [MHz] | Validity [MHz] <sup>c</sup> | TSL  | Permittivity | Conductivity | Alpha | Depth | ConvF Uncertainty  |
|---------|-----------------------------|------|--------------|--------------|-------|-------|--------------------|
| 900     | ± 50 / ± 100                | Head | 41.5 ± 5%    | 0.97 ± 5%    | 0.44  | 1.35  | 6.07 ± 11.0% (k=2) |
| 1810    | ± 50 / ± 100                | Head | 40.0 ± 5%    | 1.40 ± 5%    | 0.27  | 2.38  | 5.01 ± 11.0% (k=2) |
| 1950    | ± 50 / ± 100                | Head | 40.0 ± 5%    | 1.40 ± 5%    | 0.28  | 2.21  | 4.66 ± 11.0% (k=2) |
| 2450    | ± 50 / ± 100                | Head | 39.2 ± 5%    | 1.80 ± 5%    | 0.48  | 1.52  | 4.31 ± 11.8% (k=2) |
| 900     | ± 50 / ± 100                | Body | 55.0 ± 5%    | 1.05 ± 5%    | 0.52  | 1.27  | 5.93 ± 11.0% (k=2) |
| 1810    | ± 50 / ± 100                | Body | 53.3 ± 5%    | 1.52 ± 5%    | 0.27  | 2.51  | 4.65 ± 11.0% (k=2) |
| 1950    | ± 50 / ± 100                | Body | 53.3 ± 5%    | 1.52 ± 5%    | 0.33  | 2.04  | 4.44 ± 11.0% (k=2) |
| 2450    | ± 50 / ± 100                | Body | 52.7 ± 5%    | 1.95 ± 5%    | 0.49  | 1.53  | 4.30 ± 11.8% (k=2) |

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

Deviation from Isotropy in HSL  
Error ( $\phi$ ,  $\vartheta$ ),  $f = 900 \text{ MHz}$



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

## **Appendix 4**

### **Measurement Uncertainty Budget**

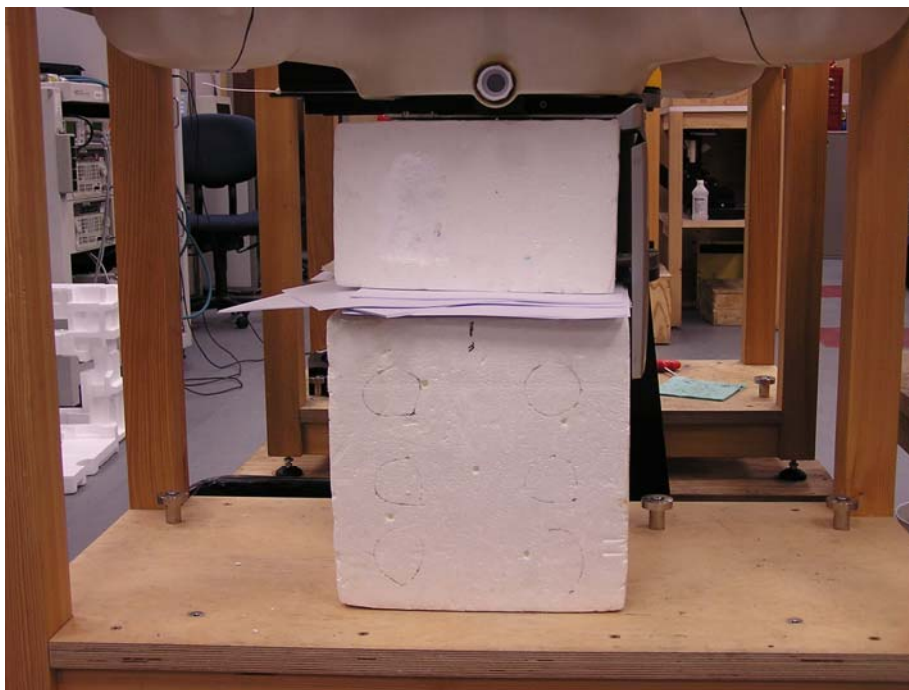
| <i>a</i>                                           | <i>b</i>                | <i>c</i>      | <i>d</i>         | <i>e =<br/>f(d,k)</i> | <i>f</i>                      | <i>g</i>                       | <i>h =<br/>c x f<br/>/ e</i>            | <i>i =<br/>c x g<br/>/ e</i>             | <i>k</i>             |
|----------------------------------------------------|-------------------------|---------------|------------------|-----------------------|-------------------------------|--------------------------------|-----------------------------------------|------------------------------------------|----------------------|
| Uncertainty Component                              | IEEE<br>1528<br>section | Tol.<br>(± %) | Prob<br><br>Dist | Div.                  | <i>c<sub>i</sub></i><br>(1 g) | <i>c<sub>i</sub></i><br>(10 g) | 1 g<br><br><i>u<sub>i</sub></i><br>(±%) | 10 g<br><br><i>u<sub>i</sub></i><br>(±%) | <i>v<sub>i</sub></i> |
| <b>Measurement System</b>                          |                         |               |                  |                       |                               |                                |                                         |                                          |                      |
| Probe Calibration                                  | E.2.1                   | 5.9           | N                | 1.00                  | 1                             | 1                              | 5.9                                     | 5.9                                      | ∞                    |
| Axial Isotropy                                     | E.2.2                   | 4.7           | R                | 1.73                  | 0.707                         | 0.707                          | 1.9                                     | 1.9                                      | ∞                    |
| Hemispherical Isotropy                             | E.2.2                   | 9.6           | R                | 1.73                  | 0.707                         | 0.707                          | 3.9                                     | 3.9                                      | ∞                    |
| Boundary Effect                                    | E.2.3                   | 1.0           | R                | 1.73                  | 1                             | 1                              | 0.6                                     | 0.6                                      | ∞                    |
| Linearity                                          | E.2.4                   | 4.7           | R                | 1.73                  | 1                             | 1                              | 2.7                                     | 2.7                                      | ∞                    |
| System Detection Limits                            | E.2.5                   | 1.0           | R                | 1.73                  | 1                             | 1                              | 0.6                                     | 0.6                                      | ∞                    |
| Readout Electronics                                | E.2.6                   | 0.3           | N                | 1.00                  | 1                             | 1                              | 0.3                                     | 0.3                                      | ∞                    |
| Response Time                                      | E.2.7                   | 1.1           | R                | 1.73                  | 1                             | 1                              | 0.6                                     | 0.6                                      | ∞                    |
| Integration Time                                   | E.2.8                   | 1.1           | R                | 1.73                  | 1                             | 1                              | 0.6                                     | 0.6                                      | ∞                    |
| RF Ambient Conditions - Noise                      | E.6.1                   | 3.0           | R                | 1.73                  | 1                             | 1                              | 1.7                                     | 1.7                                      | ∞                    |
| RF Ambient Conditions - Reflections                | E.6.1                   | 0.0           | R                | 1.73                  | 1                             | 1                              | 0.0                                     | 0.0                                      | ∞                    |
| Probe Positioner Mech. Tolerance                   | E.6.2                   | 0.4           | R                | 1.73                  | 1                             | 1                              | 0.2                                     | 0.2                                      | ∞                    |
| Probe Positioning w.r.t Phantom                    | E.6.3                   | 1.4           | R                | 1.73                  | 1                             | 1                              | 0.8                                     | 0.8                                      | ∞                    |
| Max. SAR Evaluation (ext., int., avg.)             | E.5                     | 3.4           | R                | 1.73                  | 1                             | 1                              | 2.0                                     | 2.0                                      | ∞                    |
| <b>Test sample Related</b>                         |                         |               |                  |                       |                               |                                |                                         |                                          |                      |
| Test Sample Positioning                            | E.4.2                   | 3.2           | N                | 1.00                  | 1                             | 1                              | 3.2                                     | 3.2                                      | 29                   |
| Device Holder Uncertainty                          | E.4.1                   | 4.0           | N                | 1.00                  | 1                             | 1                              | 4.0                                     | 4.0                                      | 8                    |
| SAR drift                                          | 6.6.2                   | 5.0           | R                | 1.73                  | 1                             | 1                              | 2.9                                     | 2.9                                      | ∞                    |
| <b>Phantom and Tissue Parameters</b>               |                         |               |                  |                       |                               |                                |                                         |                                          |                      |
| Phantom Uncertainty                                | E.3.1                   | 4.0           | R                | 1.73                  | 1                             | 1                              | 2.3                                     | 2.3                                      | ∞                    |
| Liquid Conductivity (target)                       | E.3.2                   | 5.0           | R                | 1.73                  | 0.64                          | 0.43                           | 1.8                                     | 1.2                                      | ∞                    |
| Liquid Conductivity (measurement)                  | E.3.3                   | 3.3           | N                | 1.00                  | 0.64                          | 0.43                           | 2.1                                     | 1.4                                      | ∞                    |
| Liquid Permittivity (target)                       | E.3.2                   | 5.0           | R                | 1.73                  | 0.6                           | 0.49                           | 1.7                                     | 1.4                                      | ∞                    |
| Liquid Permittivity (measurement)                  | E.3.3                   | 1.9           | N                | 1.00                  | 0.6                           | 0.49                           | 1.1                                     | 0.9                                      | ∞                    |
| <b>Combined Standard Uncertainty</b>               |                         |               | RSS              |                       |                               |                                | 11.1                                    | 10.8                                     | 411                  |
| <b>Expanded Uncertainty (95% CONFIDENCE LEVEL)</b> |                         |               | <i>k</i> =2      |                       |                               |                                | 22.2                                    | 21.6                                     |                      |

## **Appendix 5**

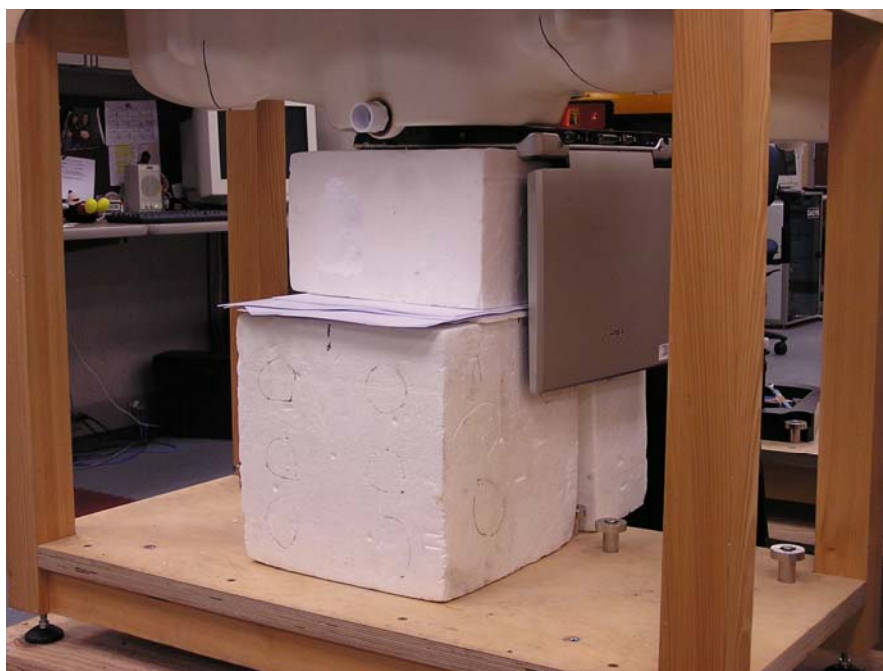
### **Photographs of the device under test**



**Figure 1. Data Card**



**Figure 2. Laptop Setup (Front View)**



**Figure 3. Laptop Setup (Quarter Right View)**



**Figure 4. Right Side of Laptop/Data Card**



**Figure 5. Right Side of Data Card**

## **Appendix 6**

### **Dipole Characterization Certificate**

# Certification of System Performance Check Targets

Based on WI-0396

-Historical Data-

|                                                                      |                                                                                     |        |
|----------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------|
|                                                                      | 900MHz                                                                              |        |
| IEEE1528 Target:                                                     | 10.8                                                                                | (W/kg) |
| Measurement Uncertainty (k=1):                                       | 9.0%                                                                                |        |
|                                                                      |                                                                                     |        |
| Measurement Period:                                                  | 3-June-05 to 10-May-06                                                              |        |
| # of tests performed:                                                | 1571                                                                                |        |
| Grand Average:                                                       | 11.3                                                                                | (W/kg) |
| % Delta (Average - IEEE1528 Target)                                  | 4.3%                                                                                |        |
|                                                                      |                                                                                     |        |
| Is % Delta <= Expanded Measurement Uncertainty (k=2)?                | Yes                                                                                 |        |
|                                                                      |                                                                                     |        |
| Accept/Reject <u>Average</u> as new system performance check target? | ACCEPT                                                                              |        |
|                                                                      | Applies to Dipole SN's:<br>55, 69, 77, 78, 79,<br>80, 91, 92, 93, 94,<br>95, 96, 97 |        |

-New System Performance Check Targets- per WI-0396  
(based on analysis of historical data)

| Frequency | SAR Target (W/kg) | Permittivity | Conductivity (S/m) |
|-----------|-------------------|--------------|--------------------|
| 900MHz    | 11.3              | 41.5 ± 5%    | 0.97 ± 5%          |

-Approvals-

Submitted by:

Marge Kaunas

Date:

12-May-06

Signed:



Comments:

Spreadsheet detailing referenced historical measurements is available upon request.

Approved by:

Mark Douglas

Date:

22-May-06

Signed:



Comments:

