



**MOTOROLA**

**Portable Cellular Phone SAR Test Report**

**Tests Requested By:** Motorola Mobility, Inc.  
600 N. US Highway 45  
Libertyville, IL 60048

**Test Report #:** 25153-1F  
**Date of Report:** Aug 31, 2012  
**Date of Test:** Aug 14, 2012 – Aug 29, 2012  
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**Test Laboratory:** Motorola Mobility, Inc. - ADR Test Services Laboratory  
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This laboratory is accredited to ISO/IEC 17025-2005 to perform the following tests:

**Accreditation:**



|  |   |
|--|---|
| <u>Tests:</u>                            | <u>Procedures:</u>                                    |
| Electromagnetic Specific Absorption Rate | IEC 62209-1   |
|  | RSS-102   |
|  | IEEE 1528 - 2003                                      |
|  | FCC OET Bulletin 65 ( <i>including Supplement C</i> ) |
|  | Australian Communications Authority Radio             |
|  | Communications (Electromagnetic Radiation –           |
|  | Human Exposure) Standard 2003                         |
|  | CENELEC EN 50360                                      |
|  | ARIB Std. T-56 (2002)                                 |

On the following products or types of products:  
Wireless Communications Devices (Examples): Two Way Radios; Portable Phones (including Cellular, Licensed Non-Broadcast and PCS); Low Frequency Readers; and Pagers

**Statement of Compliance:**

Motorola declares under its sole responsibility that the portable cellular telephone 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 IEEE 1528 / CENELEC EN62209-1 (2006), 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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This test report shall not be reproduced except in full, without written approval of the laboratory. 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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### Revision History

| Revision Version | Date        | Notes                  |
|------------------|-------------|------------------------|
| Rev. 0           | 31-Aug-2011 | Initial report release |

## 1. Introduction

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

For ANSI / IEEE C95.1 (1 g), the final stand-alone SAR readings for this phone are given in the table below. These measurements were performed using a DASY4™ v4.7 or DASY52™ system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich Switzerland.

| <b>Transmit Band</b> | <b>Head SAR (1 g<sup>w</sup>/kg)</b> | <b>Dispatch/<br/>Push-to-Talk<br/>SAR (1 g<sup>w</sup>/kg)</b> | <b>Body SAR (1 g<sup>w</sup>/kg)</b> |
|----------------------|--------------------------------------|--|--------------------------------------|
| <b>iDEN 800</b>      | <b>0.83</b>                          | <b>0.13</b>  | <b>1.13</b>                          |
| <b>iDEN 900</b>      | <b>1.02</b>                          | <b>0.18</b>  | <b>0.64</b>                          |

## 2. Description of the Device Under Test

### 2.1 Antenna description

#### Main (813/898 MHz) Antenna

|                   |                       |          |
|-------------------|-----------------------|----------|
| <b>Type</b>       | Internal              |          |
| <b>Location</b>   | Bottom of Transceiver |          |
| <b>Dimensions</b> | Width                 | 17.11 mm |
|                   | Length                | 45.45    |

#### Bluetooth 2 GHz Antenna

|                   |                                |         |
|-------------------|--------------------------------|---------|
| <b>Type</b>       | Internal                       |         |
| <b>Location</b>   | Right-Side Rear of Transceiver |         |
| <b>Dimensions</b> | Width                          | 10.5 mm |
|                   | Length                         | 1.4 mm  |

## 2.2 Device Signaling

|   |  |
|---|--|
| <b>Serial Number(s)<br/>(Functional Use)</b>                          | 364BNN09SR (iDEN conducted power measurements, iDEN head/body SAR testing) |
| <b>Production Unit or<br/>Identical Prototype<br/>(47 CFR §2.908)</b> | Identical Prototype  |
| <b>Device Category</b>  | Portable (Mobile Station Class B)  |
| <b>RF Exposure Limits</b>   | General Population / Uncontrolled  |

| Mode(s) of Operation                  | Modulation Mode(s)           | Maximum Output<br>Power Setting | Duty Cycle | Transmitting Frequency<br>Range(s) |
|---------------------------------------|------------------------------|---------------------------------|------------|------------------------------------|
| iDEN 800<br>(Interconnect / Dispatch) | M16-QAM                      | 28.06 dBm                       | 2:6 / 1:6  | 806.0125 - 824.9875 MHz            |
| iDEN 800<br>(Packet Data)             | M64-QAM,<br>M16-QAM,<br>QPSK | 28.06 dBm                       | 81:120     | 806.0125 - 824.9875 MHz            |
| iDEN 900<br>(Interconnect / Dispatch) | M16-QAM                      | 28.06 dBm                       | 2:6 / 1:6  | 896.01875 - 901.98125 MHz          |
| iDEN 900<br>(Packet Data)             | M64-QAM,<br>M16-QAM,<br>QPSK | 28.06 dBm                       | 81:120     | 896.01875 - 901.98125 MHz          |
| Bluetooth                             | GFSK                         | 9.5 dBm                         | 1:1        | 2402.0 – 2480.0 MHz                |

### 2.3 Device Conducted Power Measurements

#### 2.3.1 iDEN modes

| Conducted power for iDEN modes (dBm) |                 |              |                       |             |
|--------------------------------------|-----------------|--------------|-----------------------|-------------|
| Band                                 | Frequency (MHz) | Interconnect | Interconnect/Dispatch | Packet Data |
|                                      |                 | 2:6          | 1:6                   | 81:120      |
| iDEN 800                             | 806.0125        | 27.90        | 27.99                 | 27.94       |
|                                      | 815.5125        | 28.04        | 28.03                 | 28.06       |
|                                      | 824.9875        | 27.99        | 28.01                 | 28.05       |
| iDEN 900                             | 896.01875       | 28.03        | 28.01                 | 28.10       |
|                                      | 898.99375       | 28.00        | 27.99                 | 28.05       |
|                                      | 901.98125       | 27.98        | 27.98                 | 28.05       |

#### 2.3.2 Bluetooth modes and test exclusion

The Bluetooth transmitter of the device under test can be excluded from stand-alone and simultaneous SAR evaluation per the highlighted requirements from FCC KDB 648474 D01 as described below.

1. The highest output conducted power measured for Bluetooth on the device under test is 8.91 mW [ $\leq 12$  mW]
2. The separation distance between the Bluetooth antenna and the main voice antenna is 2.38 cm. [ $< 2.5$  cm]
3. The highest 1-g Body-Worn SAR values for primary transmitters are:  
 iDEN 800 (1.13 W/kg); iDEN 900 (0.64 W/kg) [ $< 1.2$  W/kg]

Pictorial representation of the antenna locations and separation distances are given in Exhibit 7d.

### 3. Test Equipment Used

#### 3.1 Dosimetric System

The Motorola Mobility ADR Test Services Laboratory utilizes a Dosimetric Assessment System (DASY4™ v4.7 or DASY52™) manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. All the SAR measurements are taken within a shielded enclosure. The overall 10 g RSS uncertainty of the measurement system is  $\pm 10.8\%$  (K=1) with an expanded uncertainty of  $\pm 21.6\%$  (K=2). The overall 1 g 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 5. Per IEEE 1528, this uncertainty budget is applicable to the SAR range of 0.4 W/kg to 10 W/kg.

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

| Description                         | Serial Number | Cal Date    | Cal Due Date |
|-------------------------------------|---------------|-------------|--------------|
| DASY4™ DAE V1                       | 387           | Jan-11-2012 | Jan-11-2013  |
| E-Field Probe ES3DV3                | 3184          | Apr-25-2012 | Apr-25-2013  |
| DASY4™ DAE V1                       | 1311          | Jul-12-2012 | Jul-12-2013  |
| E-Field Probe ES3DV3                | 3115          | Jan-11-2012 | Jan-11-2013  |
| S.A.M. Phantom used for 800/900 MHz | TP-1156       |             |              |
| Dipole Validation Kit, DV835V2      | 436tr         | Mar-18-2011 | Mar-18-2013  |

#### 3.2 Additional Equipment

| Description                  | Serial Number | Cal Date     | Cal Due Date |
|------------------------------|---------------|--------------|--------------|
| Signal Generator HP8648C     | 3847A04810    | Sept-26-2011 | Sept-26-2013 |
| Power Meter E4419B           | GB39511090    | Aug-12-2011  | Aug-12-2013  |
| Power Sensor #1 - E9301A     | US39210917    | Nov-16-2011  | Nov-16-2012  |
| Power Sensor #2 - E9301A     | US39210918    | Nov-16-2011  | Nov-16-2012  |
| Network Analyzer HP8753ES    | MY46212851    | May-10-2012  | May-10-2013  |
| Dielectric Probe Kit DAK-3.5 | 1030          |              |              |

#### 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 (MHz) | Tissue type | Limits / Measured     | Dielectric Parameters |                |           |
|---------|-------------|-----------------------|-----------------------|----------------|-----------|
|         |             |                       | $\epsilon_r$          | $\sigma$ (S/m) | Temp (°C) |
| 815     | Head        | Measured, Aug-14-2012 | 41.5                  | 0.91           | 19.1      |
|         |             | Measured, Aug-15-2012 | 41.5                  | 0.91           | 19.5      |
|         |             | Recommended Limits    | 41.6 ±5%              | 0.898 ±5%      | 18-25     |
|         | Body        | Measured, Aug-29-2012 | 53.6                  | 0.99           | 19.1      |
|         |             | Recommended Limits    | 55.3 ±5%              | 0.968 ±5%      | 18-25     |
|         |             |                       |                       |                |           |
| 898     | Head        | Measured, Aug-14-2012 | 40.4                  | 0.99           | 19.1      |
|         |             | Measured, Aug-15-2012 | 41.5                  | 0.91           | 19.5      |
|         |             | Recommended Limits    | 41.5 ±5%              | 0.97 ±5%       | 18-25     |
|         | Body        | Measured, Aug-29-2012 | 52.8                  | 1.06           | 19.1      |
|         |             | Recommended Limits    | 55.0 ±5%              | 1.05 ±5%       | 18-25     |
|         |             |                       |                       |                |           |

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

| Ingredient | 782 / 835 / 900 MHz Head | 782 / 835 / 900 MHz Body |
|------------|--------------------------|--------------------------|
| Sugar      | 57                       | 44.9                     |
| DGBE       | --                       | --                       |
| Diacetin   | --                       | --                       |
| Water      | 40.45                    | 53.06                    |
| Salt       | 1.45                     | 0.94                     |
| HEC        | 1                        | 1                        |
| Bact.      | 0.1                      | 0.1                      |

## 5. System Accuracy Verifications

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 Appendix 7. 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 1 W 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). For frequencies below 3 GHz, the simulated tissue depth was verified to be  $15.0 \text{ cm} \pm 0.5 \text{ cm}$ . Z-axis scans showing the SAR penetration are also included in Appendix 1.

| System Accuracy Verification Measurements for Head SAR Measurements |                           |        |                             |                               |                       |                |                   |                  |
|---|---------------------------|--------|-----------------------------|-------------------------------|-----------------------|----------------|-------------------|------------------|
| f (MHz)   | Description               | Dipole | Measured SAR (W/kg), 1 gram | Normalized SAR (W/kg), 1 gram | Dielectric Parameters |                | Ambient Temp (°C) | Tissue Temp (°C) |
|   |                           |        |                             |                               | $\epsilon_r$          | $\sigma$ (S/m) |                   |                  |
| 835   | Measured, Aug-14-2012     | 436tr  | 2.07                        | 10.4                          | 41.2                  | 0.93           | 20.8              | 19.3             |
|   | Measured, Aug-15-2012     | 436tr  | 2.04                        | 10.2                          | 41.3                  | 0.93           | 21.0              | 19.7             |
|   | <b>Recommended Limits</b> |        |                             | 9.73                          | 41.5 $\pm 5\%$        | 0.90 $\pm 5\%$ | 18-25             | 18-25            |

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

| Description          | Serial Number | f (MHz) | Conversion Factor | Cal Cert pg # |
|----------------------|---------------|---------|-------------------|---------------|
| E-Field Probe ES3DV3 | 3184          | 835     | 6.15              | 5 of 11       |

| System Accuracy Verification Measurements for Body SAR Measurements |                           |        |                             |                               |                       |                |                   |                  |
|---|---------------------------|--------|-----------------------------|-------------------------------|-----------------------|----------------|-------------------|------------------|
| f (MHz)   | Description               | Dipole | Measured SAR (W/kg), 1 gram | Normalized SAR (W/kg), 1 gram | Dielectric Parameters |                | Ambient Temp (°C) | Tissue Temp (°C) |
|   |                           |        |                             |                               | $\epsilon_r$          | $\sigma$ (S/m) |                   |                  |
| 835   | Measured, Aug-29-2012     | 436tr  | 2.05                        | 10.3                          | 53.6                  | 0.99           | 20.4              | 19.3             |
|   | <b>Recommended Limits</b> |        |                             | 10.1                          | 55.2 $\pm 5\%$        | 0.97 $\pm 5\%$ | 18-25             | 18-25            |

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

| Description          | Serial Number | f (MHz) | Conversion Factor | Cal Cert pg # |
|----------------------|---------------|---------|-------------------|---------------|
| E-Field Probe ES3DV3 | 3115          | 835     | 5.89              | 6 of 11       |

## 6. Test Results

The DUT is capable of iDEN operation in a test mode that allows control of the transmitter without the need to place actual phone calls. This guarantees that the unit does not change its transmitter power, and that the resultant measured field values will not be affected by external connections.

The phone was tested in the configurations stipulated in [1], [4] and [5]. The phone was positioned into these configurations using the device holder supplied with the DASY4™ SAR measurement system. The default settings for the “coarse” and “cube” scans were chosen and used for measurements. The grid spacing of the coarse scan was set to 15 mm or less as shown in the SAR plots included in Appendices 2 through 4. Please refer to the DASY4™ manual for additional information on SAR scanning procedures and algorithms used.

The DUT tested in this report has the following battery options:

Model SNN5837A - 1170 mAH battery

This battery was used to do all of the SAR testing. The phone was placed in the SAR measurement system with a fully charged battery.

### 6.1 Head Adjacent Test Results

The SAR results shown in tables 1 through 4 are maximum SAR values averaged over 1 gram of phantom tissue, to demonstrate compliance to [3] and also over 10 grams of phantom tissue, to demonstrate compliance to the [6]. Also shown are the temperature of the simulated tissue after the test, the measured drift and the extrapolated SAR. The exact method of extrapolation is:

$$\text{Extrapolated SAR} = (\text{Measured SAR}) * 10^{(-\text{drift}/10)}$$

The SAR reported at the end of the measurement process by the DASY4™ 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 left head and right head SAR contour distributions are similar. Because of this similarity, the cheek/touch and 15° tilt test conditions with the highest SAR values in each band are indicated as bold numbers in the following tables and are included in Appendix 2. All other test conditions measured lower SAR values than those included in Appendix 2.

The SAR measurements were performed using the SAM phantoms listed in section 3.1. Since the same phantoms and simulated tissue were used for the system accuracy verification and the device SAR measurements, the Z-axis scans included in Appendix 1 are applicable for verification of simulated tissue depth.

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

| Description          | Serial Number | f (MHz) | Conversion Factor | Cal Cert pg # |
|----------------------|---------------|---------|-------------------|---------------|
| E-Field Probe ES3DV3 | 3184          | 835     | 6.15              | 5 of 11       |

**Left Head Cheek Position**

| f (MHz) | Mode                         | Channel or Freq. (MHz) | Temp (°C)   | Drift (dB)   | 10 g SAR value  |                     | 1 g SAR value   |                     | Test Plot |           |
|---------|------------------------------|------------------------|-------------|--------------|-----------------|---------------------|-----------------|---------------------|-----------|-----------|
|         |                              |                        |             |              | Measured (W/kg) | Extrapolated (W/kg) | Measured (W/kg) | Extrapolated (W/kg) | Grid      | Plot Page |
| 815     | iDEN 800<br>Interconnect 2:6 | 806.0125               | 18.8        | -0.08        | 0.545           | 0.56                | 0.796           | 0.81                |           |           |
|         |                              | 815.5125               | <b>18.8</b> | <b>-0.04</b> | <b>0.559</b>    | <b>0.56</b>         | <b>0.826</b>    | <b>0.83</b>         | 5x5x7     | A-11      |
|         |                              | 824.9875               | 18.8        | -0.15        | 0.511           | 0.53                | 0.754           | 0.78                |           |           |
| 898     | iDEN 900<br>Interconnect 2:6 | 896.01875              | 19.1        | 0.02         | 0.656           | 0.66                | 0.959           | 0.96                |           |           |
|         |                              | 898.99375              | <b>18.9</b> | <b>0.05</b>  | <b>0.683</b>    | <b>0.68</b>         | <b>1.02</b>     | <b>1.02</b>         | 5x5x7     | A-12      |
|         |                              | 901.98125              | 19.2        | -0.08        | 0.667           | 0.68                | 0.979           | 1.00                |           |           |

**Table 1: SAR measurement results at the highest possible output power, measured in a head cheek position against the ICNIRP and ANSI SAR Limit.**

**Right Head Cheek Position**

| f (MHz) | Mode                         | Channel or Freq. (MHz) | Temp (°C) | Drift (dB) | 10 g SAR value  |                     | 1 g SAR value   |                     | Test Plot |           |
|---------|------------------------------|------------------------|-----------|------------|-----------------|---------------------|-----------------|---------------------|-----------|-----------|
|         |                              |                        |           |            | Measured (W/kg) | Extrapolated (W/kg) | Measured (W/kg) | Extrapolated (W/kg) | Grid      | Plot Page |
| 815     | iDEN 800<br>Interconnect 2:6 | 806.0125               |           |            |                 |                     |                 |                     |           |           |
|         |                              | 815.5125               | 19.1      | 0.10       | 0.523           | 0.52                | 0.739           | 0.74                |           |           |
|         |                              | 824.9875               |           |            |                 |                     |                 |                     |           |           |
| 898     | iDEN 900<br>Interconnect 2:6 | 896.01875              | 19.3      | -0.02      | 0.644           | 0.65                | 0.901           | 0.91                |           |           |
|         |                              | 898.99375              | 19.0      | 0.02       | 0.651           | 0.65                | 0.920           | 0.92                |           |           |
|         |                              | 901.98125              | 19.2      | 0.03       | 0.650           | 0.65                | 0.907           | 0.91                |           |           |

**Table 2: SAR measurement results at the highest possible output power, measured in a head cheek position against the ICNIRP and ANSI SAR Limit.**

**Left Head 15° Tilt Position**

| f (MHz) | Mode                         | Channel or Freq. (MHz) | Temp (°C)   | Drift (dB)   | 10 g SAR value  |                     | 1 g SAR value   |                     | Test Plot |           |
|---------|------------------------------|------------------------|-------------|--------------|-----------------|---------------------|-----------------|---------------------|-----------|-----------|
|         |                              |                        |             |              | Measured (W/kg) | Extrapolated (W/kg) | Measured (W/kg) | Extrapolated (W/kg) | Grid      | Plot Page |
| 815     | iDEN 800<br>Interconnect 2:6 | 806.0125               |             |              |                 |                     |                 |                     |           |           |
|         |                              | 815.5125               | <b>19.5</b> | <b>-0.03</b> | <b>0.229</b>    | <b>0.23</b>         | <b>0.307</b>    | <b>0.31</b>         | 5x5x7     | A-13      |
|         |                              | 824.9875               |             |              |                 |                     |                 |                     |           |           |
| 898     | iDEN 900<br>Interconnect 2:6 | 896.01875              |             |              |                 |                     |                 |                     |           |           |
|         |                              | 898.99375              | <b>19.3</b> | <b>0.07</b>  | <b>0.286</b>    | <b>0.29</b>         | <b>0.385</b>    | <b>0.39</b>         | 5x5x7     | A-14      |
|         |                              | 901.98125              |             |              |                 |                     |                 |                     |           |           |

**Table 3: SAR measurement results at the highest possible output power, measured in a head tilt position against the ICNIRP and ANSI SAR Limit.**

**Right Head 15° Tilt Position**

| f (MHz) | Mode                         | Channel or Freq. (MHz) | Temp (°C) | Drift (dB) | 10 g SAR value  |                     | 1 g SAR value   |                     | Test Plot |           |
|---------|------------------------------|------------------------|-----------|------------|-----------------|---------------------|-----------------|---------------------|-----------|-----------|
|         |                              |                        |           |            | Measured (W/kg) | Extrapolated (W/kg) | Measured (W/kg) | Extrapolated (W/kg) | Grid      | Plot Page |
| 815     | iDEN 800<br>Interconnect 2:6 | 806.0125               |           |            |                 |                     |                 |                     |           |           |
|         |                              | 815.5125               | 19.0      | 0.07       | 0.228           | 0.23                | 0.301           | 0.30                |           |           |
|         |                              | 824.9875               |           |            |                 |                     |                 |                     |           |           |
| 898     | iDEN 900<br>Interconnect 2:6 | 896.01875              |           |            |                 |                     |                 |                     |           |           |
|         |                              | 898.99375              | 18.9      | 0.12       | 0.278           | 0.28                | 0.372           | 0.37                |           |           |
|         |                              | 901.98125              |           |            |                 |                     |                 |                     |           |           |

**Table 4: SAR measurement results at the highest possible output power, measured in a head tilt position against the ICNIRP and ANSI SAR Limit.**

## 6.2 Dispatch/Push-to-Talk Test Results

The SAR results shown in table 5 are maximum SAR values averaged over 1 gram of phantom tissue, to demonstrate compliance to [3] and also over 10 grams of phantom tissue, to demonstrate compliance to the [6]. Also shown are the measured conducted output powers, the temperature of the simulated tissue after the test, the measured drift and the extrapolated SAR. The exact method of extrapolation is:

$$\text{Extrapolated SAR} = \text{Measured SAR} * 10^{(-\text{drift}/10)}$$

The SAR reported at the end of the measurement process by the DASY4™ 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 in each band are indicated as bold numbers in the following tables and are included in Appendix 3.

The SAR measurements were performed using the SAM phantoms listed in section 3.1. Since the same phantoms and simulated tissue were used for the system accuracy verification and the device SAR measurements, the Z-axis scans included in Appendix 1 are applicable for verification of simulated tissue depth to be 15.0 cm ± 0.5 cm.

For the purposes of these tests the DUT is commanded to the proper channel, transmitter power level and transmit mode of operation. The DUT was then placed in the SAR measurement system with a fully charged battery. The DUT was placed with the front of the device positioned at 2.5 cm from the flat portion of the SAM phantom, as per Supplement C 01-01.

The following probe conversion factors were used on the E-Field probe(s) used for the Dispatch/Push-To-Talk measurements:

| Description          | Serial Number | f (MHz) | Conversion Factor | Cal Cert pg # |
|----------------------|---------------|---------|-------------------|---------------|
| E-Field Probe ES3DV3 | 3184          | 835     | 6.15              | 5 of 11       |

### Dispatch/Push-To-Talk, Front of Phone 25 mm from Phantom

| f (MHz)    | Mode                                   | Channel or Freq. (MHz) | Temp (°C)   | Drift (dB)   | 10 g SAR value  |                     | 1 g SAR value   |                     | Test Plot    |             |
|------------|--|------------------------|-------------|--------------|-----------------|---------------------|-----------------|---------------------|--------------|-------------|
|            |  |                        |             |              | Measured (W/kg) | Extrapolated (W/kg) | Measured (W/kg) | Extrapolated (W/kg) | Grid         | Plot Page   |
| <b>815</b> | <b>iDEN 800</b><br><i>Dispatch 1:6</i> | 806.0125               |             |              |                 |                     |                 |                     |              |             |
|            |  | 815.5125               | <b>19.3</b> | <b>-0.01</b> | <b>0.091</b>    | <b>0.09</b>         | <b>0.126</b>    | <b>0.13</b>         | <b>5x5x7</b> | <b>A-16</b> |
|            |  | 824.9875               |             |              |                 |                     |                 |                     |              |             |
| <b>898</b> | <b>iDEN 900</b><br><i>Dispatch 1:6</i> | 896.01875              |             |              |                 |                     |                 |                     |              |             |
|            |  | 898.99375              | <b>19.3</b> | <b>-0.02</b> | <b>0.128</b>    | <b>0.13</b>         | <b>0.179</b>    | <b>0.18</b>         | <b>5x5x7</b> | <b>A-17</b> |
|            |  | 901.98125              |             |              |                 |                     |                 |                     |              |             |

**Table 5: SAR measurement results at the highest possible output power, measured in a Push-to-Talk position against the ICNIRP and ANSI SAR Limit.**

### 6.3 Body Worn Test Results

The SAR results shown in tables 6 through 11 are maximum SAR values averaged over 1 gram of phantom tissue, to demonstrate compliance to [3] and also over 10 grams of phantom tissue, to demonstrate compliance to [6]. Also shown are the temperature of the simulated tissue after the test, the measured drift and the extrapolated SAR. The exact method of extrapolation is:

$$\text{Extrapolated SAR} = (\text{Measured SAR}) * 10^{(-\text{drift}/10)}$$

The SAR reported at the end of the measurement process by the DASY4™ 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 that produced the highest SAR values in each band are indicated as bold numbers in the following tables and are included in Appendix 4. All other test conditions measured lower SAR values than those included in Appendix 4.

A SPEAG™ MFP V5.1 C Triple Modular Phantom was used for the body-worn tests. The triple modular phantom consists of three identical modules that can be installed and removed separately without emptying the liquid. Each module of the triple phantom is constructed of glass-fiber reinforced vinylester (VG-GF) with a thickness at the bottom of 2.0 mm. It measures 29.2 cm(long) by 17.8 cm(wide) by 17.8 cm(tall).

The simulated tissue depth was verified to be 15.0 cm ± 0.5 cm for frequencies less than 3 GHz, or 10.0 cm ± 0.5 cm for frequencies greater than 3 GHz. The same device holder described in section 6 was used for positioning the phone. Functional accessories were divided into two categories, the ones with metal components and the ones with non-metal components. For non-metallic component accessories, testing was performed on the accessory that displayed the closest proximity to the flat phantom. Each metallic component accessory, if any, was checked for uniqueness of metal component so that each is tested with the device. If multiple accessories shared an identical metal component, only the accessory that dictates the closest spacing to the body was tested. The cellular phone was tested with a headset connected to the device for all body-worn SAR measurements.

There is one Body-Worn Accessory available for this phone:

Holster: Model # 01017393001

In addition to the holster, a separation distance of 25 mm between the device and the flat phantom was used for testing body-worn SAR. The chosen separation distance of 25 mm is utilized in order to support any case or holder accessories offered or to be offered by Motorola for this product. The device was tested with the front and back of the device facing the phantom. Both sides of the device were tested for Body SAR for the purpose of including the SAR evaluation for body-worn accessories that support the device with the front side facing the user.

The cellular phone was also tested in data mode operations. For these tests, a separation distance of 25 mm between the device and the flat phantom was used. The data mode was also tested in a holster.

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 | 3115          | 835     | 5.89              | 6 of 11       |

**Body-Worn, Front of Phone 25 mm from Phantom**

| f (MHz) | Mode                         | Channel or Freq. (MHz) | Temp (°C) | Drift (dB) | 10 g SAR value  |                     | 1 g SAR value   |                     | Test Plot |           |
|---------|------------------------------|------------------------|-----------|------------|-----------------|---------------------|-----------------|---------------------|-----------|-----------|
|         |                              |                        |           |            | Measured (W/kg) | Extrapolated (W/kg) | Measured (W/kg) | Extrapolated (W/kg) | Grid      | Plot Page |
| 815     | iDEN 800<br>Interconnect 2:6 | 806.0125               |           |            |                 |                     |                 |                     |           |           |
|         |                              | 815.5125               | 19.0      | -0.24      | 0.132           | 0.14                | 0.185           | 0.20                |           |           |
|         |                              | 824.9875               |           |            |                 |                     |                 |                     |           |           |
| 898     | iDEN 900<br>Interconnect 2:6 | 896.01875              |           |            |                 |                     |                 |                     |           |           |
|         |                              | 898.99375              | 18.9      | 0.04       | 0.135           | 0.14                | 0.188           | 0.19                |           |           |
|         |                              | 901.98125              |           |            |                 |                     |                 |                     |           |           |

**Table 6: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.**

**Body-Worn, Back of Phone 25 mm from Phantom**

| f (MHz) | Mode                         | Channel or Freq. (MHz) | Temp (°C) | Drift (dB) | 10 g SAR value  |                     | 1 g SAR value   |                     | Test Plot |           |
|---------|------------------------------|------------------------|-----------|------------|-----------------|---------------------|-----------------|---------------------|-----------|-----------|
|         |                              |                        |           |            | Measured (W/kg) | Extrapolated (W/kg) | Measured (W/kg) | Extrapolated (W/kg) | Grid      | Plot Page |
| 815     | iDEN 800<br>Interconnect 2:6 | 806.0125               |           |            |                 |                     |                 |                     |           |           |
|         |                              | 815.5125               | 18.9      | -0.09      | 0.178           | 0.18                | 0.246           | 0.25                |           |           |
|         |                              | 824.9875               |           |            |                 |                     |                 |                     |           |           |
| 898     | iDEN 900<br>Interconnect 2:6 | 896.01875              |           |            |                 |                     |                 |                     |           |           |
|         |                              | 898.99375              | 19.0      | -0.07      | 0.179           | 0.18                | 0.254           | 0.26                |           |           |
|         |                              | 901.98125              |           |            |                 |                     |                 |                     |           |           |

**Table 7: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.**

**Body-Worn, Packet Data, Front of Phone 25 mm from Phantom**

| f (MHz) | Mode                           | Channel or Freq. (MHz) | Temp (°C) | Drift (dB) | 10 g SAR value  |                     | 1 g SAR value   |                     | Test Plot |           |
|---------|--------------------------------|------------------------|-----------|------------|-----------------|---------------------|-----------------|---------------------|-----------|-----------|
|         |                                |                        |           |            | Measured (W/kg) | Extrapolated (W/kg) | Measured (W/kg) | Extrapolated (W/kg) | Grid      | Plot Page |
| 815     | iDEN 800<br>Packet Data 81:120 | 806.0125               |           |            |                 |                     |                 |                     |           |           |
|         |                                | 815.5125               | 18.8      | -0.38      | 0.281           | 0.31                | 0.401           | 0.44                |           |           |
|         |                                | 824.9875               |           |            |                 |                     |                 |                     |           |           |
| 898     | iDEN 900<br>Packet Data 81:120 | 896.01875              |           |            |                 |                     |                 |                     |           |           |
|         |                                | 898.99375              | 19.0      | -0.38      | 0.243           | 0.27                | 0.343           | 0.37                |           |           |
|         |                                | 901.98125              |           |            |                 |                     |                 |                     |           |           |

**Table 8: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.**

**Body-Worn, Packet Data, Back of Phone 25 mm from Phantom**

| f (MHz) | Mode                           | Channel or Freq. (MHz) | Temp (°C) | Drift (dB) | 10 g SAR value  |                     | 1 g SAR value   |                     | Test Plot |           |
|---------|--------------------------------|------------------------|-----------|------------|-----------------|---------------------|-----------------|---------------------|-----------|-----------|
|         |                                |                        |           |            | Measured (W/kg) | Extrapolated (W/kg) | Measured (W/kg) | Extrapolated (W/kg) | Grid      | Plot Page |
| 815     | iDEN 800<br>Packet Data 81:120 | 806.0125               |           |            |                 |                     |                 |                     |           |           |
|         |                                | 815.5125               | 18.9      | -0.38      | 0.307           | 0.34                | 0.435           | 0.47                |           |           |
|         |                                | 824.9875               |           |            |                 |                     |                 |                     |           |           |
| 898     | iDEN 900<br>Packet Data 81:120 | 896.01875              |           |            |                 |                     |                 |                     |           |           |
|         |                                | 898.99375              | 19.0      | -0.44      | 0.351           | 0.39                | 0.495           | 0.55                |           |           |
|         |                                | 901.98125              |           |            |                 |                     |                 |                     |           |           |

**Table 9: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.**

**Body-Worn, Packet Data, Front of Phone in Holster**

| f (MHz) | Mode                           | Channel or Freq. (MHz) | Temp (°C) | Drift (dB) | 10 g SAR value  |                     | 1 g SAR value   |                     | Test Plot |           |
|---------|--------------------------------|------------------------|-----------|------------|-----------------|---------------------|-----------------|---------------------|-----------|-----------|
|         |                                |                        |           |            | Measured (W/kg) | Extrapolated (W/kg) | Measured (W/kg) | Extrapolated (W/kg) | Grid      | Plot Page |
| 815     | iDEN 800<br>Packet Data 81:120 | 806.0125               |           |            |                 |                     |                 |                     |           |           |
|         |                                | 815.5125               | 19.3      | -0.29      | 0.500           | 0.53                | 0.702           | 0.75                |           |           |
|         |                                | 824.9875               |           |            |                 |                     |                 |                     |           |           |
| 898     | iDEN 900<br>Packet Data 81:120 | 896.01875              |           |            |                 |                     |                 |                     |           |           |
|         |                                | 898.99375              | 19.3      | -0.27      | 0.431           | 0.46                | 0.598           | 0.64                | 5x5x7     | A-20      |
|         |                                | 901.98125              |           |            |                 |                     |                 |                     |           |           |

**Table 10: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.**

**Body-Worn, Packet Data, Back of Phone in Holster**

| f (MHz) | Mode                           | Channel or Freq. (MHz) | Temp (°C) | Drift (dB) | 10 g SAR value  |                     | 1 g SAR value   |                     | Test Plot |           |
|---------|--------------------------------|------------------------|-----------|------------|-----------------|---------------------|-----------------|---------------------|-----------|-----------|
|         |                                |                        |           |            | Measured (W/kg) | Extrapolated (W/kg) | Measured (W/kg) | Extrapolated (W/kg) | Grid      | Plot Page |
| 815     | iDEN 800<br>Packet Data 81:120 | 806.0125               | 19.0      | -0.43      | 0.674           | 0.74                | 0.936           | 1.03                |           |           |
|         |                                | 815.5125               | 19.3      | -0.21      | 0.790           | 0.83                | 1.08            | 1.13                | 5x5x7     | A-19      |
|         |                                | 824.9875               | 19.0      | -0.52      | 0.693           | 0.78                | 0.962           | 1.08                |           |           |
| 898     | iDEN 900<br>Packet Data 81:120 | 896.01875              |           |            |                 |                     |                 |                     |           |           |
|         |                                | 898.99375              | 19.0      | -0.38      | 0.336           | 0.37                | 0.463           | 0.51                |           |           |
|         |                                | 901.98125              |           |            |                 |                     |                 |                     |           |           |

**Table 11: 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, en62209-1:2006 “Human Exposure to Radio Frequency Fields From Hand - Held and Body - Mounted Wireless Communication Devices – Human Models, Instrumentation, and Procedures”
- [2] CENELEC, en50360:2001 “Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz – 3 GHz)”.
- [3] ANSI / IEEE, C95.1 1992 Edition “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”
- [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 comparisons for System Accuracy Verifications**

## **System Accuracy Verification Measurements for Head SAR Measurements**

Date/Time: 8/14/2012 8:23:01 AM

**DUT: Dipole 835 MHz; Type: D835V2;** Procedure Notes: 835 MHz System Performance Check / Dipole Sn# 436(TR); PM1 Power = 200 mW; Sim.Temp@ meas = 19.0\*C; Sim.Temp@ SPC = 19.3\*C; Room Temp@ SPC = 20.8\*C

Communication System: CW - Dipole; Frequency: 835 MHz; Communication System Channel Number: 3; Duty Cycle: 1:1  
Medium: Validation \*HEAD Tissue\* ; Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.93 \text{ mho/m}$ ;  $\epsilon_r = 41.2$ ;  $\rho = 1000 \text{ kg/m}^3$

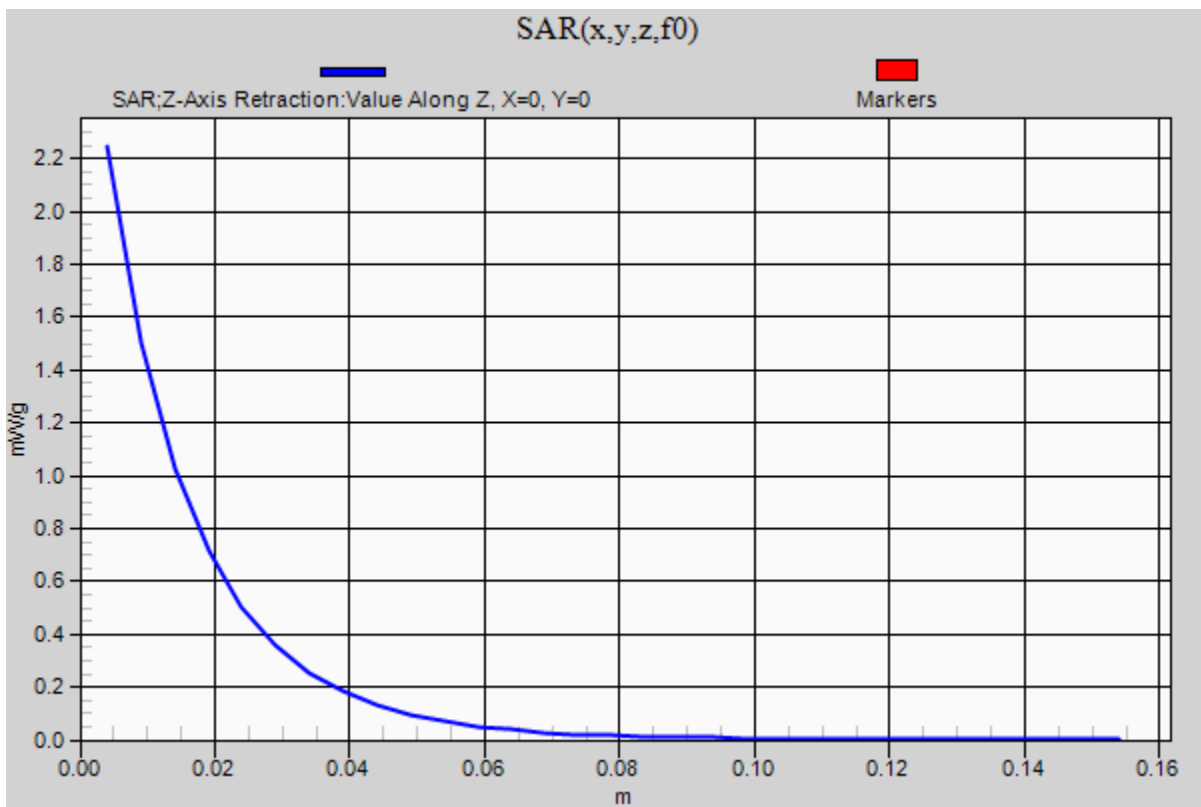
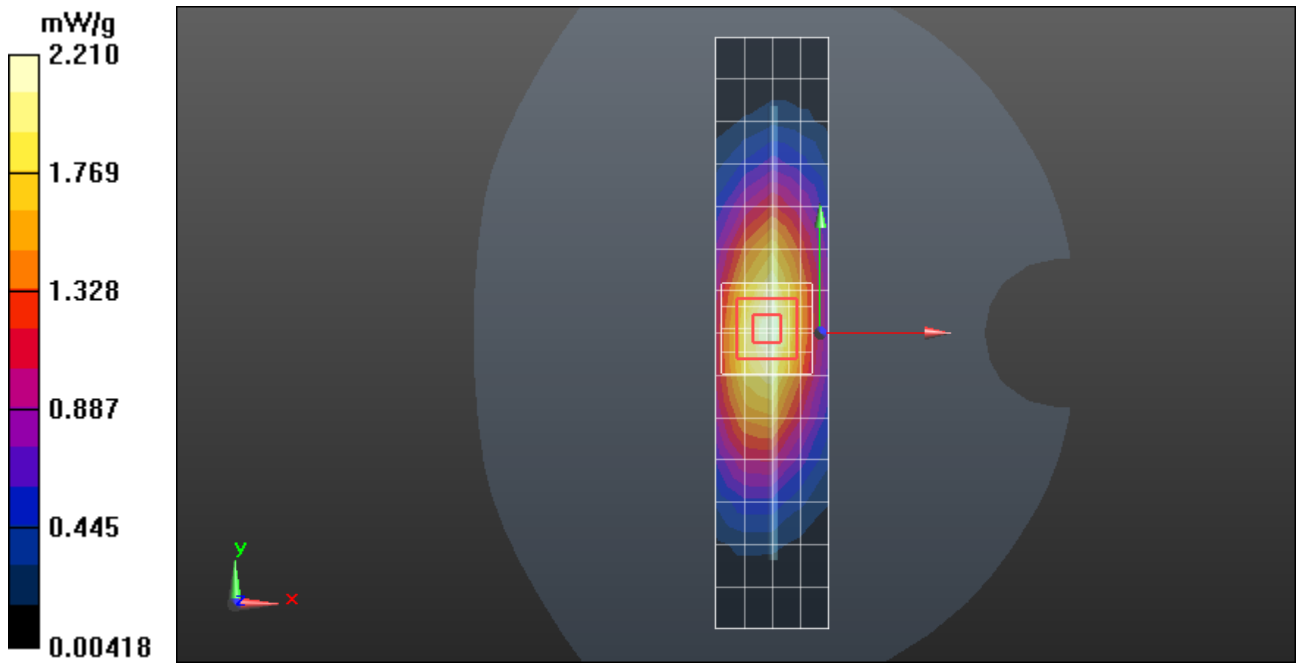
DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(6.15, 6.15, 6.15); Calibrated: 4/25/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Sugar SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1156;
- ; SEMCAD X Version 14.6.5 (6469)

**Daily SPC Check/Dipole Area Scan (5x15x1):** Measurement grid: dx=10mm, dy=15mm  
Maximum value of SAR (measured) = 2.21 mW/g

**Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 49.277 V/m; Power Drift = 0.01 dB  
Peak SAR (extrapolated) = 3.093 mW/g  
**SAR(1 g) = 2.07 mW/g; SAR(10 g) = 1.35 mW/g**  
Maximum value of SAR (measured) = 2.24 mW/g

**Daily SPC Check/Z-Axis Retraction (1x1x31):** Measurement grid: dx=20mm, dy=20mm, dz=5mm



Date/Time: 8/15/2012 7:52:59 AM

**DUT: Dipole 835 MHz; Type: D835V2;** Procedure Notes: 835 MHz System Performance Check /  
Dipole Sn# 436TR; PM1 Power = 200 mW  
Sim.Temp@ meas = 20.2\*C; Sim.Temp@ SPC = 19.7\*C; Room Temp@ SPC = 21.0\*C

Communication System: CW - Dipole; Frequency: 835 MHz; Communication System Channel  
Number: 3; Duty Cycle: 1:1  
Medium: Validation \*HEAD Tissue\* ; Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.93 \text{ mho/m}$ ;  $\epsilon_r = 41.3$ ;  $\rho = 1000 \text{ kg/m}^3$

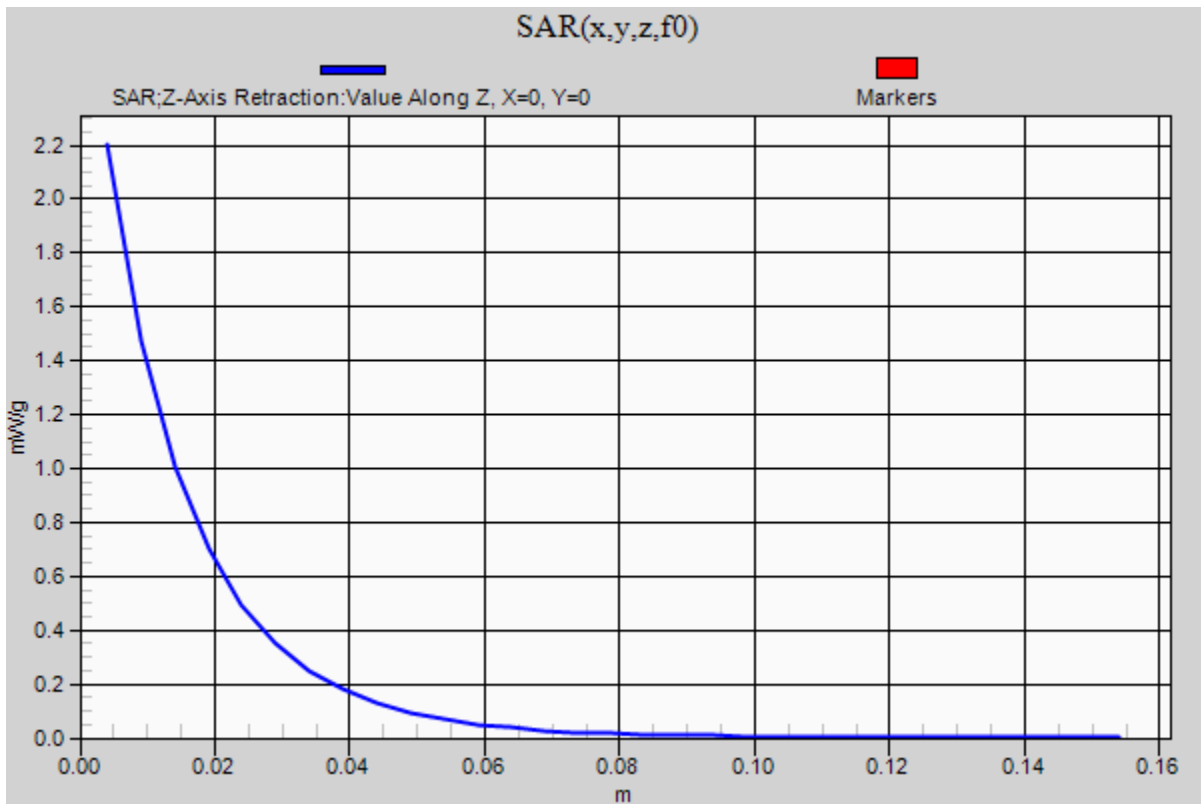
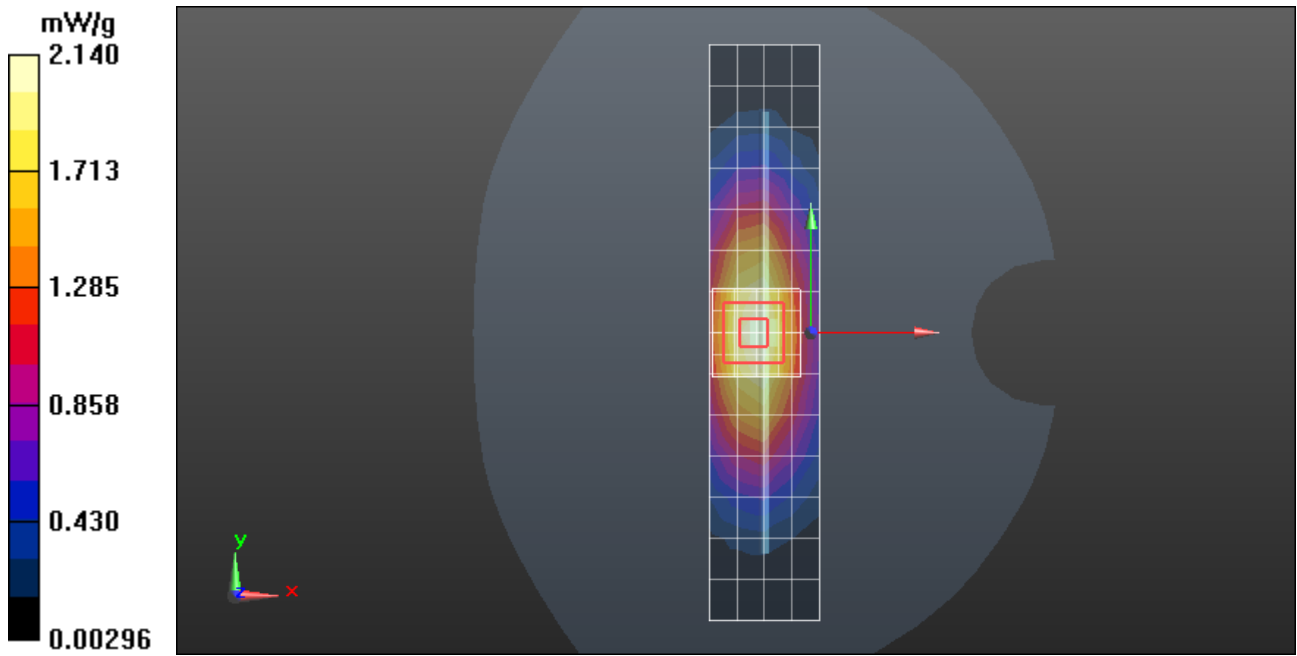
DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(6.15, 6.15, 6.15); Calibrated: 4/25/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Sugar SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1156;
- ; SEMCAD X Version 14.6.5 (6469)

**Daily SPC Check/Dipole Area Scan (5x15x1):** Measurement grid: dx=10mm, dy=15mm  
Maximum value of SAR (measured) = 2.14 mW/g

**Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0:** Measurement grid: dx=8mm,  
dy=8mm, dz=5mm  
Reference Value = 48.756 V/m; Power Drift = -0.04 dB  
Peak SAR (extrapolated) = 3.034 mW/g  
**SAR(1 g) = 2.04 mW/g; SAR(10 g) = 1.33 mW/g**  
Maximum value of SAR (measured) = 2.21 mW/g

**Daily SPC Check/Z-Axis Retraction (1x1x31):** Measurement grid: dx=20mm, dy=20mm,  
dz=5mm  
Maximum value of SAR (measured) = 2.20 mW/g



## **System Accuracy Verification Measurements for Body SAR Measurements**

Date/Time: 8/29/2012 3:21:07 PM

**DUT: Dipole 835 MHz; Type: D835V2;** Procedure Notes: 835 MHz System Performance Check /  
 Dipole Sn# 436TR; PM1 Power = 200 mW  
 Sim.Temp@ meas = 19.2°C; Sim.Temp@ SPC = 19.3°C; Room Temp@ SPC = 20.4°C

Communication System: CW - Dipole; Frequency: 835 MHz; Communication System Channel  
 Number: 3; Duty Cycle: 1:1  
 Medium: Validation \*BODY Tissue\* ; Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.99 \text{ mho/m}$ ;  $\epsilon_r = 53.6$ ;  $\rho = 1000 \text{ kg/m}^3$

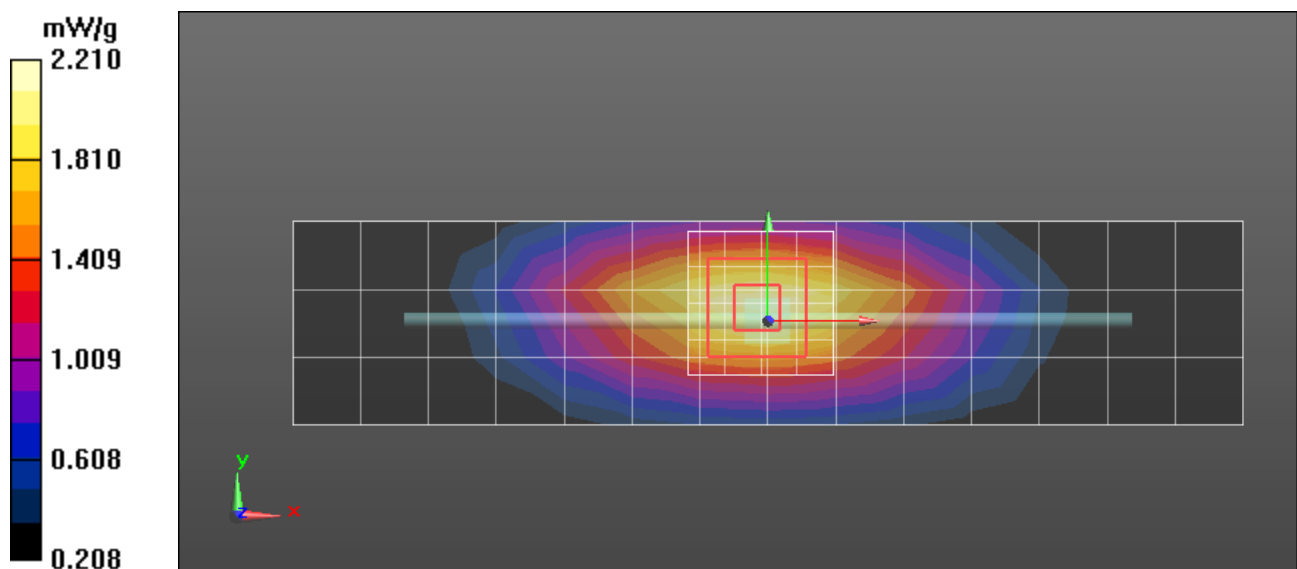
DASY4 Configuration:

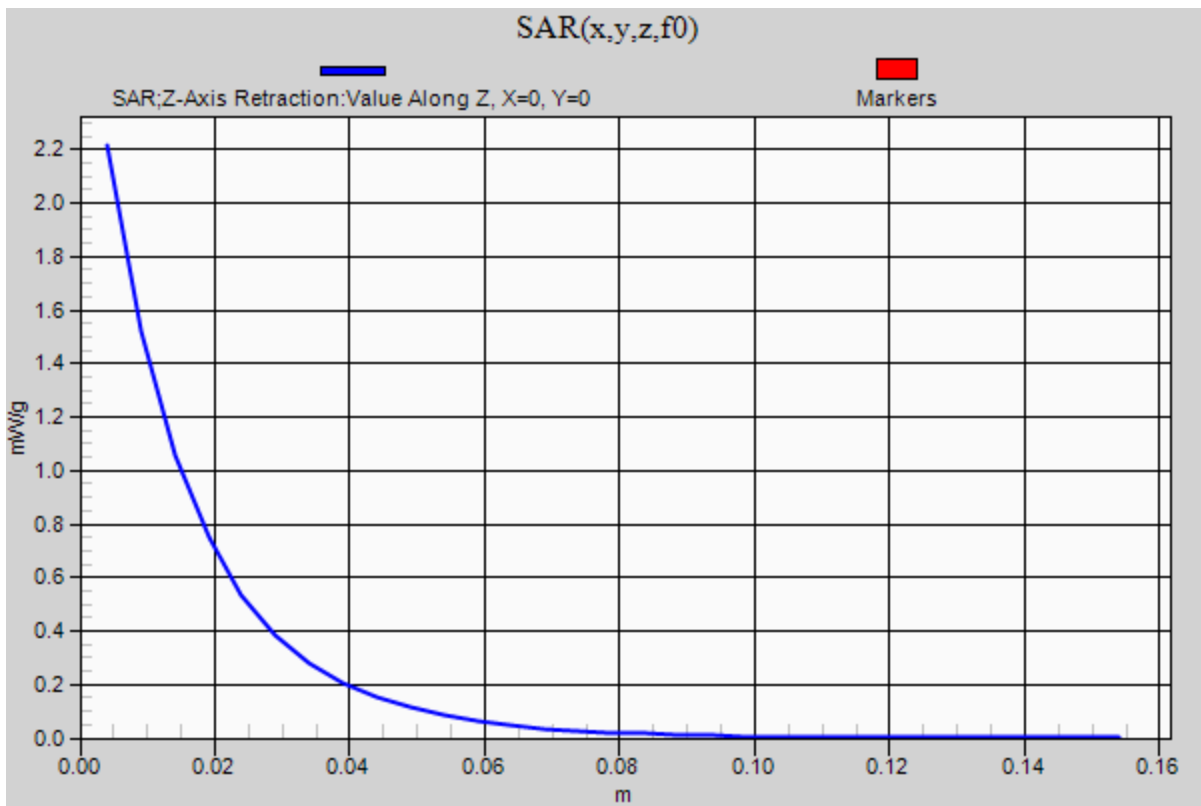
- Probe: ES3DV3 - SN3115; ConvF(5.89, 5.89, 5.89); Calibrated: 1/11/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 7/19/2012
- Phantom: R#2 Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a;
- ; SEMCAD X Version 14.6.5 (6469)

**Daily SPC Check/Dipole Area Scan (4x15x1):** Measurement grid: dx=15mm, dy=15mm  
 Maximum value of SAR (measured) = 2.11 mW/g

**Daily SPC Check/0-Degree 5x5x7 Cube (5x5x7)/Cube 0:** Measurement grid: dx=8mm,  
 dy=8mm, dz=5mm  
 Reference Value = 47.378 V/m; Power Drift = 0.01 dB  
 Peak SAR (extrapolated) = 2.958 mW/g  
**SAR(1 g) = 2.05 mW/g; SAR(10 g) = 1.35 mW/g**  
 Maximum value of SAR (measured) = 2.21 mW/g

**Daily SPC Check/Z-Axis Retraction (1x1x31):** Measurement grid: dx=20mm, dy=20mm,  
 dz=5mm





## **Appendix 2**

### **SAR distribution plots for Head Adjacent Test Results**

Date/Time: 8/14/2012 10:19:52 AM

**Serial: 364BNN09SR;** Procedure Notes: Pwr Step: 3:1; Battery Model #: SNN5837A; DEVICE POSITION: Cheek

Communication System: iDEN 1:3 or 2:6; Frequency: 815.51 MHz; Communication System Channel Number: 2; Duty Cycle: 1:2.99985

Medium: iDEN Sugar Head; Medium parameters used:  $f = 815$  MHz;  $\sigma = 0.91$  mho/m;  $\epsilon_r = 41.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(6.15, 6.15, 6.15); Calibrated: 4/25/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Sugar SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1156;
- ; SEMCAD X Version 14.6.5 (6469)

**Left Head Template/Area Scan - Normal (15mm) (7x17x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.854 mW/g

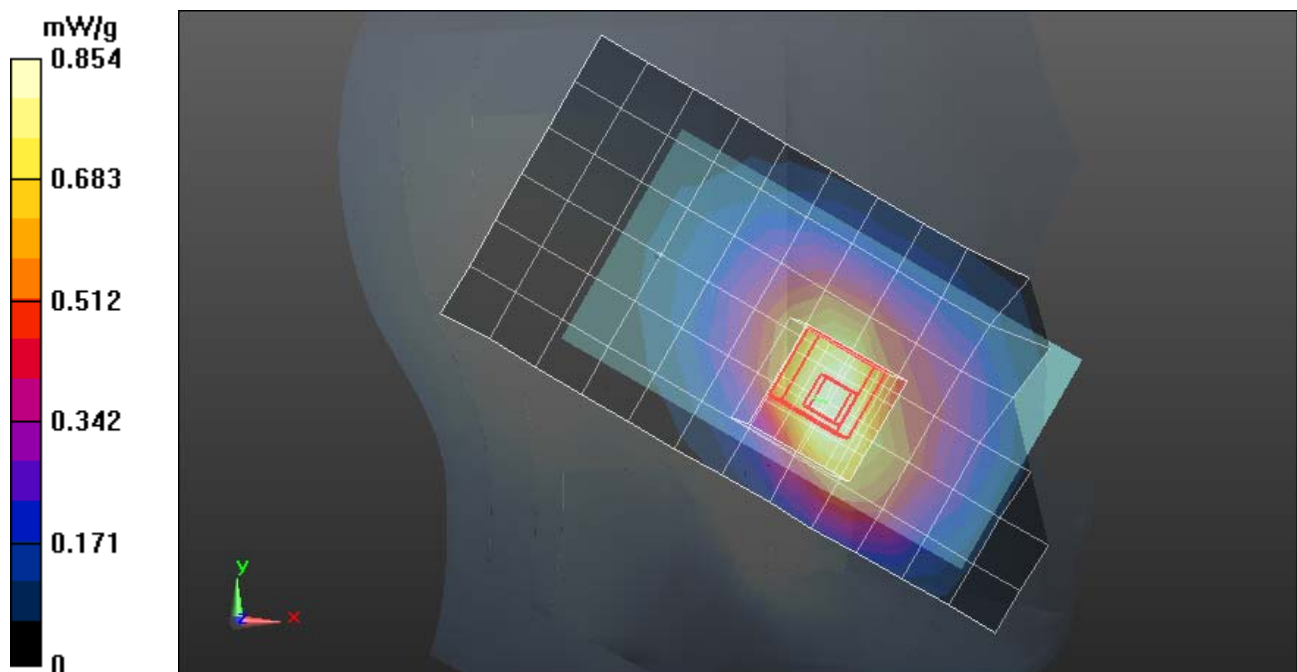
**Left Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 31.641 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 1.279 mW/g

**SAR(1 g) = 0.826 mW/g; SAR(10 g) = 0.559 mW/g**

Maximum value of SAR (measured) = 0.874 mW/g



Date/Time: 8/15/2012 2:29:15 AM

**Serial: 364BNN09SR;** Procedure Notes: Battery Model #: BN70 SNN5837A; DEVICE POSITION: CHEEK

Communication System: iDEN 1:3 or 2:6; Frequency: 898.99 MHz; Communication System Channel Number: 2; Duty Cycle: 1:2.99985

Medium: iDEN Sugar Head; Medium parameters used:  $f = 899$  MHz;  $\sigma = 0.99$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(6.15, 6.15, 6.15); Calibrated: 4/25/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Sugar SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1156;
- ; SEMCAD X Version 14.6.5 (6469)

**Left Head Template/Area Scan - Normal (15mm) (7x17x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 1.05 mW/g

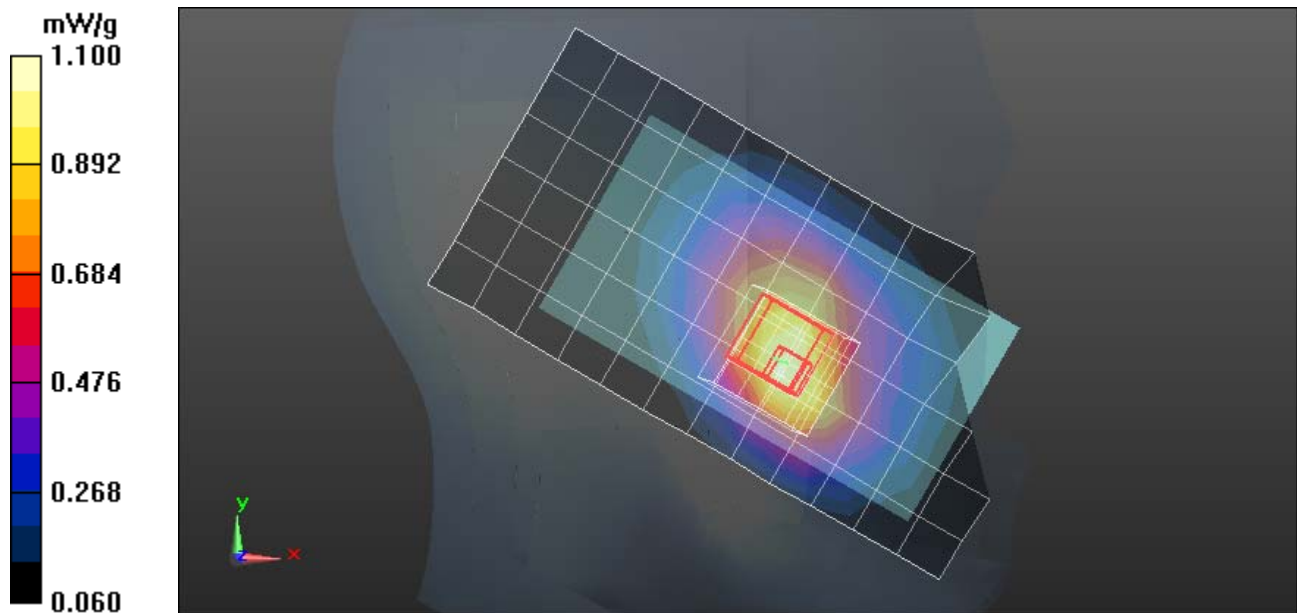
**Left Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 33.012 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.525 mW/g

**SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.683 mW/g**

Maximum value of SAR (measured) = 1.10 mW/g



Date/Time: 8/15/2012 12:01:23 AM

**Serial: 364BNN09SR;** Procedure Notes: Battery Model #: BN70 SNN5837A; DEVICE POSITION: TILT

Communication System: \_iDEN 1:3 or 2:6; Frequency: 815.51 MHz; Communication System Channel Number: 2; Duty Cycle: 1:2.99985

Medium: iDEN Sugar Head; Medium parameters used:  $f = 815$  MHz;  $\sigma = 0.91$  mho/m;  $\epsilon_r = 41.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(6.15, 6.15, 6.15); Calibrated: 4/25/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Sugar SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1156;
- ; SEMCAD X Version 14.6.5 (6469)

**Left Head Template/Area Scan - Normal (15mm) (7x17x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.333 mW/g

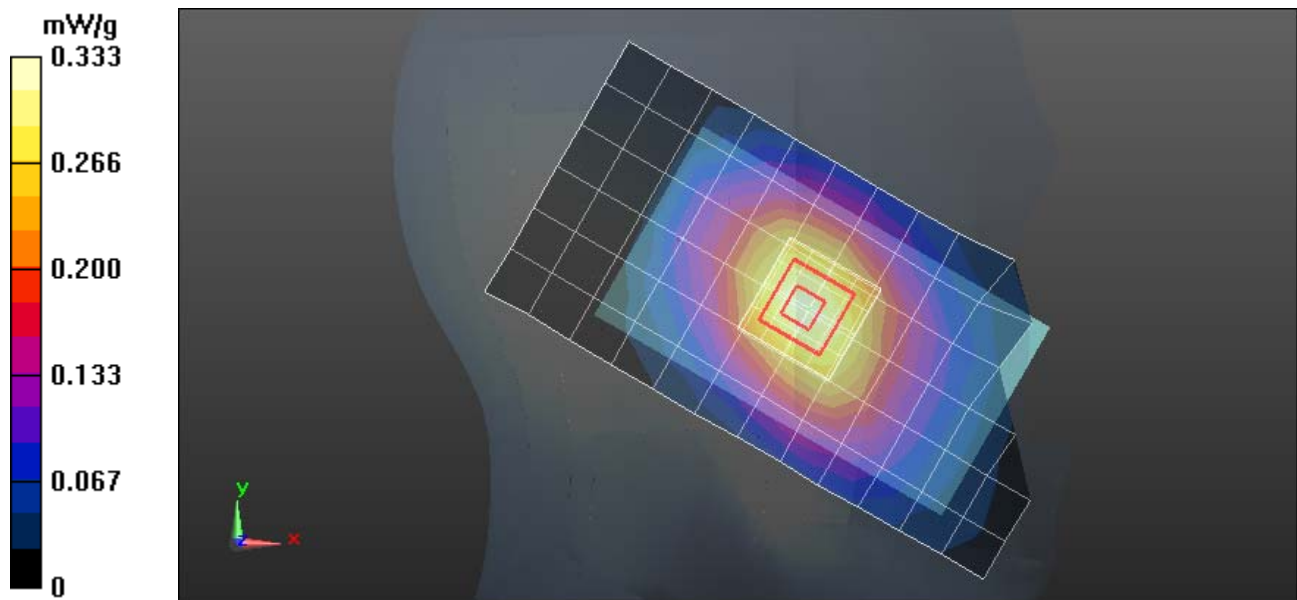
**Left Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 18.052 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.390 mW/g

**SAR(1 g) = 0.307 mW/g; SAR(10 g) = 0.229 mW/g**

Maximum value of SAR (measured) = 0.323 mW/g



Date/Time: 8/15/2012 4:58:59 PM

**Serial: 364BNN09SR;** Procedure Notes: Battery Model #: BN70 SNN5837A; DEVICE POSITION:  
Tilt

Communication System: iDEN 1:3 or 2:6; Frequency: 898.99 MHz; Communication System Channel  
Number: 2; Duty Cycle: 1:2.99985

Medium: iDEN Sugar Head; Medium parameters used:  $f = 899$  MHz;  $\sigma = 0.99$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho =$   
 $1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(6.15, 6.15, 6.15); Calibrated: 4/25/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Sugar SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1156;
- ; SEMCAD X Version 14.6.5 (6469)

**Left Head Template/Area Scan - Normal (15mm) (7x17x1):** Measurement grid: dx=15mm,  
dy=15mm

Maximum value of SAR (measured) = 0.410 mW/g

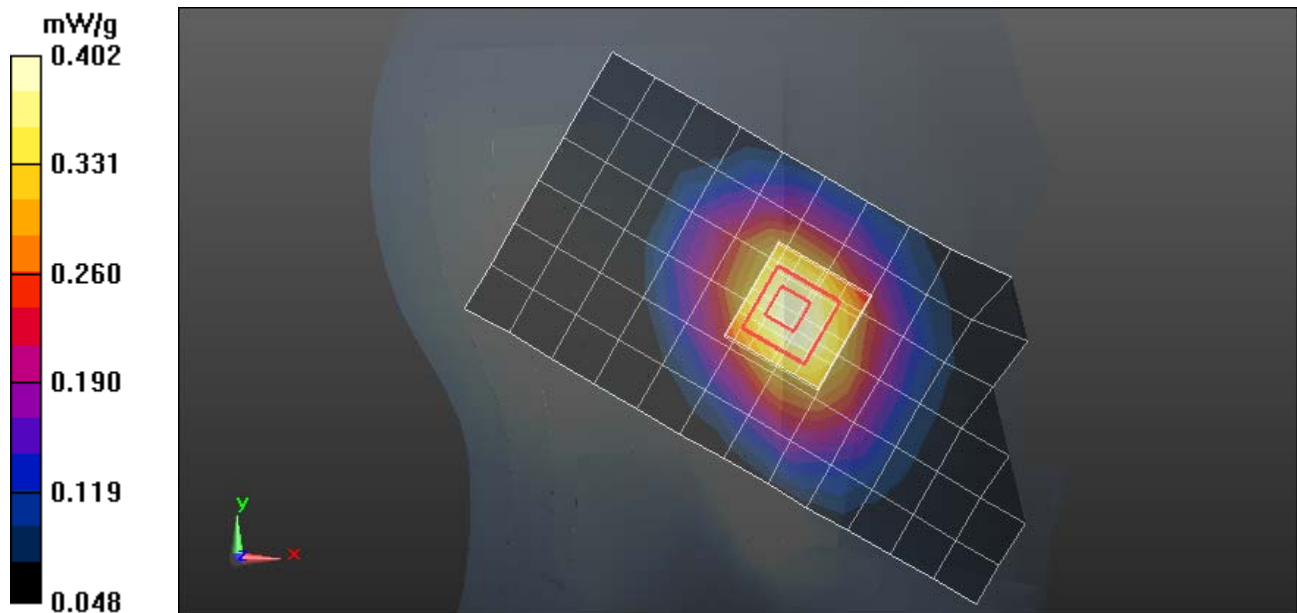
**Left Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:** Measurement grid:  
dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.545 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.476 mW/g

**SAR(1 g) = 0.385 mW/g; SAR(10 g) = 0.286 mW/g**

Maximum value of SAR (measured) = 0.402 mW/g



## **Appendix 3**

### **SAR distribution plots for Dispatch / Push-to-Talk Results**

Date/Time: 8/15/2012 7:14:01 PM

**Serial: 364BNN09SR;** Procedure Notes: Battery Model #: BN70 SNN5837A; DEVICE POSITION: PUSH TO TALK, FRONT OF PHONE 25MM FROM FLAT PHANTOM

Communication System: iDEN 1:6; Frequency: 815.51 MHz; Communication System Channel Number: 2; Duty Cycle: 1:6.00067

Medium: iDEN Sugar Head; Medium parameters used:  $f = 815 \text{ MHz}$ ;  $\sigma = 0.91 \text{ mho/m}$ ;  $\epsilon_r = 41.5$ ;  $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(6.15, 6.15, 6.15); Calibrated: 4/25/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Sugar SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1156;
- ; SEMCAD X Version 14.6.5 (6469)

### **SAM Phone Against Flat Section/Area Scan - Normal Body (15mm) (13x7x1):**

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

Maximum value of SAR (measured) = 0.133 mW/g

### **SAM Phone Against Flat Section/5x5x7 Zoom Scan ( $\leq 3\text{GHz}$ ) (5x5x7)/Cube 0:**

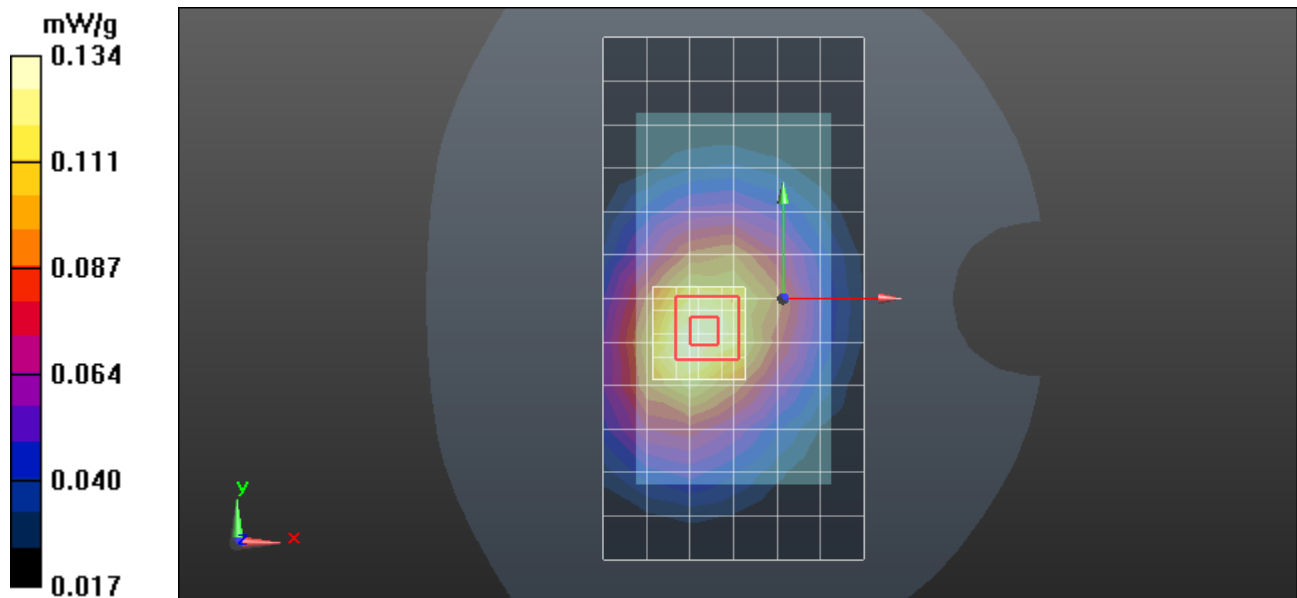
Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 11.489 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.164 mW/g

**SAR(1 g) = 0.126 mW/g; SAR(10 g) = 0.091 mW/g**

Maximum value of SAR (measured) = 0.134 mW/g



Date/Time: 8/15/2012 6:48:33 PM

**Serial: 364BNN09SR;** Procedure Notes: Battery Model #: BN70 SNN5837A; DEVICE POSITION: PUSH TO TALK, FRONT OF PHONE 25MM FROM FLAT PHANTOM

Communication System: iDEN 1:6; Frequency: 898.99 MHz; Communication System Channel Number: 2; Duty Cycle: 1:6.00067

Medium: iDEN Sugar Head; Medium parameters used:  $f = 899$  MHz;  $\sigma = 0.99$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(6.15, 6.15, 6.15); Calibrated: 4/25/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Sugar SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1156;
- ; SEMCAD X Version 14.6.5 (6469)

### SAM Phone Against Flat Section/Area Scan - Normal Body (15mm) (13x7x1):

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

Maximum value of SAR (measured) = 0.179 mW/g

### SAM Phone Against Flat Section/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:

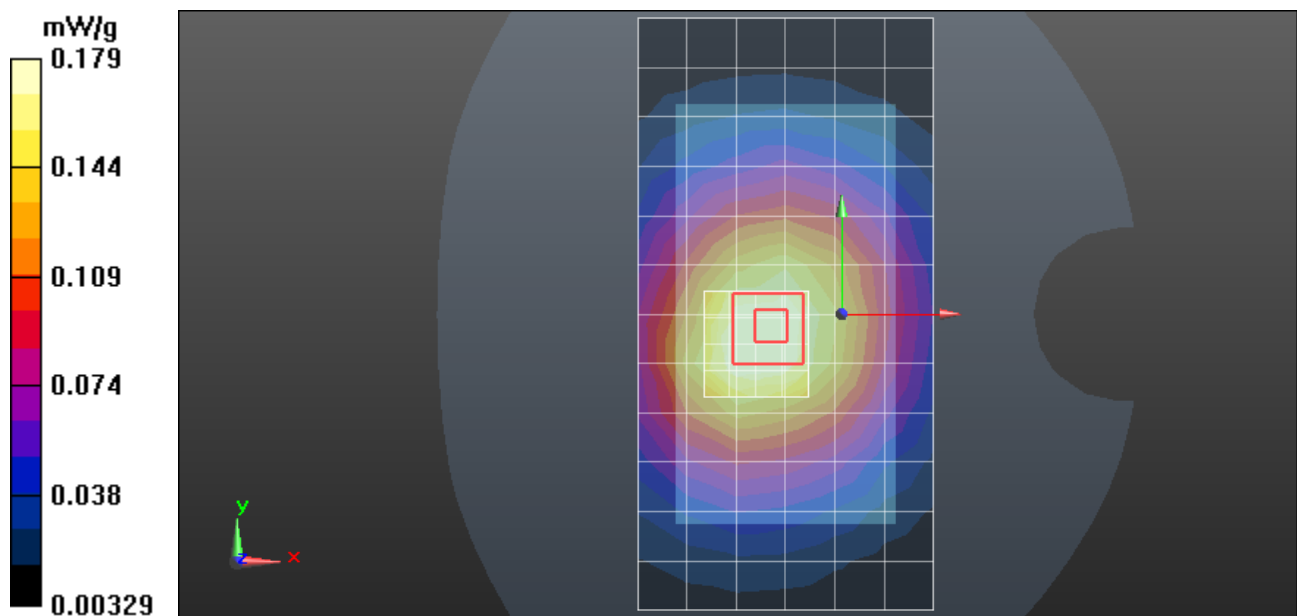
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 13.163 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.240 mW/g

**SAR(1 g) = 0.179 mW/g; SAR(10 g) = 0.128 mW/g**

Maximum value of SAR (measured) = 0.189 mW/g



## **Appendix 4**

### **SAR distribution plots for Body Worn Test Results**

Date/Time: 8/29/2012 4:29:54 PM

**Serial: 364BNN0B14;** Procedure Notes: Pwr Step: Battery Model #: BN70 SNN5837A; DEVICE POSITION: Back of Phone in HOLDSTER

Communication System: iDEN Data; Frequency: 815.51 MHz; Communication System Channel Number: 2; Duty Cycle:  $\bar{1}$ :1.50003

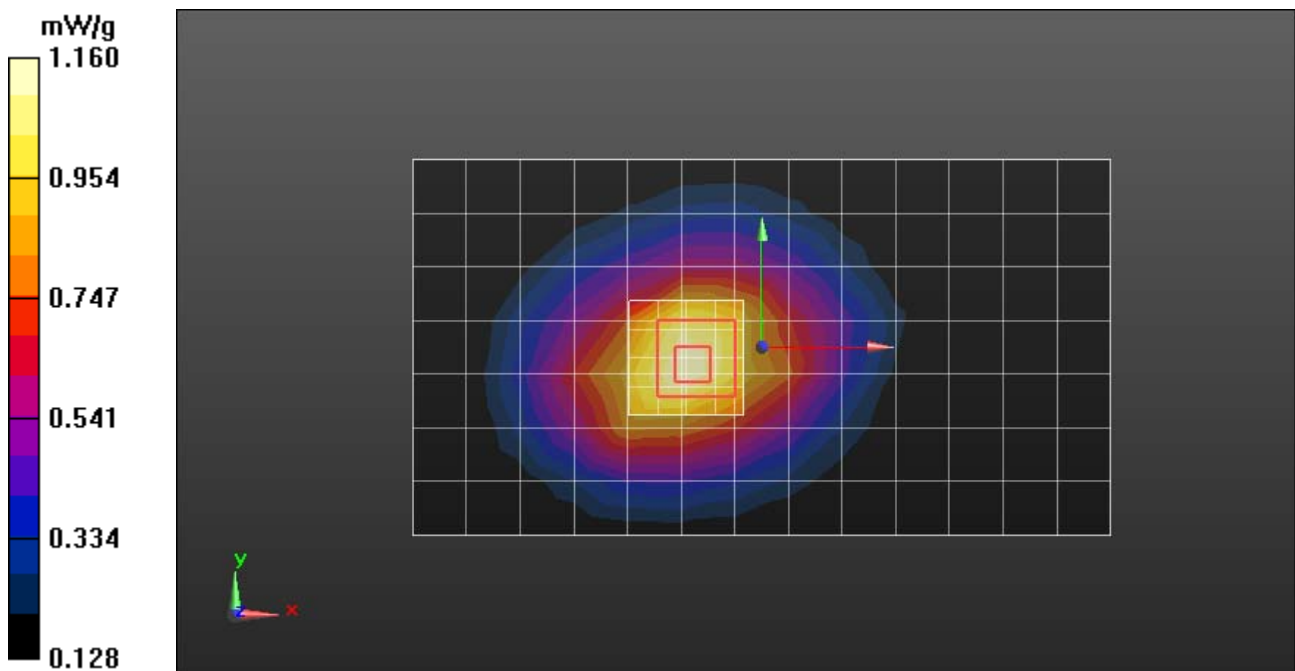
Medium: Low Freq Body; Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.99$  mho/m;  $\epsilon_r = 53.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3115; ConvF(5.89, 5.89, 5.89); Calibrated: 1/11/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 7/19/2012
- Phantom: R#2 Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a;
- ; SEMCAD X Version 14.6.5 (6469)

**Triple Flat Phone Template/Area Scan - Normal Body (15mm) (14x8x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (measured) = 1.18 mW/g

**Triple Flat Phone Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 34.804 V/m; Power Drift = -0.21 dB  
Peak SAR (extrapolated) = 1.396 mW/g  
**SAR(1 g) = 1.08 mW/g; SAR(10 g) = 0.790 mW/g**  
Maximum value of SAR (measured) = 1.16 mW/g



Date/Time: 8/29/2012 4:58:52 PM

**Serial: 364BNN0B14;** Procedure Notes: Battery Model #: BN70 SNN5837A; DEVICE POSITION: In Holster, PACKET DATA MODE BODY WORN, FRONT OF PHONE

Communication System: iDEN Data; Frequency: 898.99 MHz; Communication System Channel Number: 2; Duty Cycle: 1:1.50003

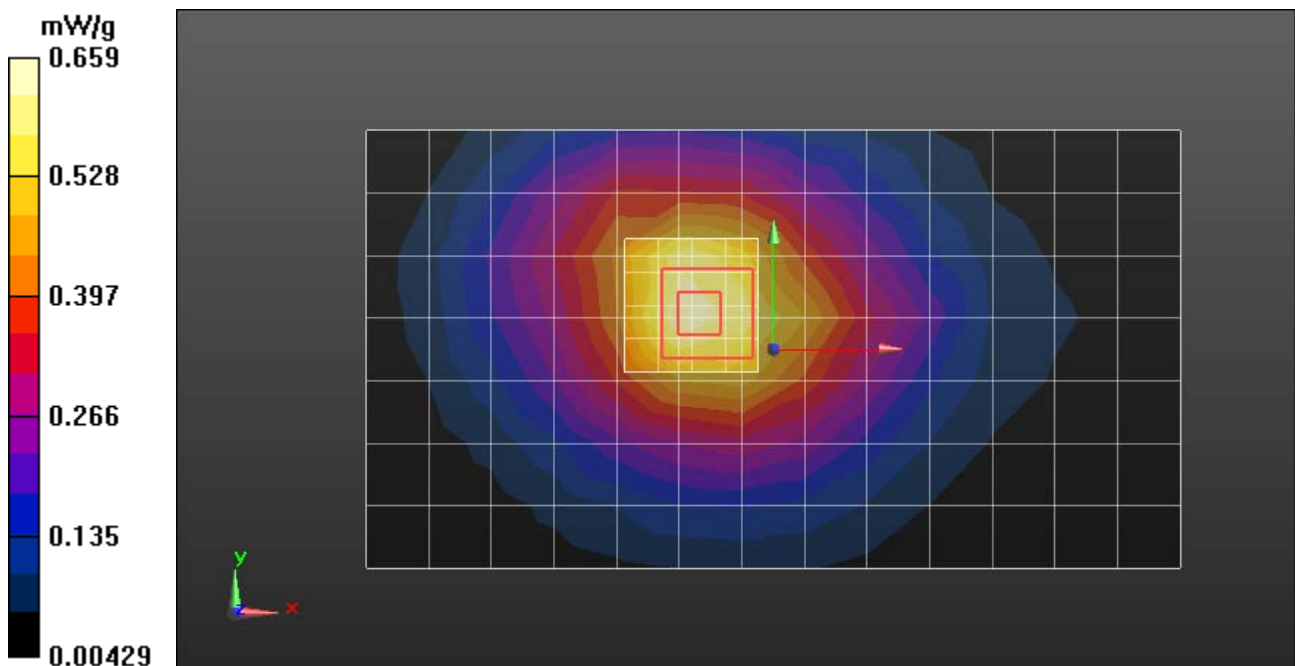
Medium: Low Freq Body; Medium parameters used:  $f = 900$  MHz;  $\sigma = 1.06$  mho/m;  $\epsilon_r = 52.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3115; ConvF(5.89, 5.89, 5.89); Calibrated: 1/11/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 7/19/2012
- Phantom: R#2 Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a;
- ; SEMCAD X Version 14.6.5 (6469)

**Triple Flat Phone Template/Area Scan - Normal Body (15mm) (14x8x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (measured) = 0.659 mW/g

**Triple Flat Phone Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 24.272 V/m; Power Drift = -0.27 dB  
Peak SAR (extrapolated) = 0.795 mW/g  
**SAR(1 g) = 0.598 mW/g; SAR(10 g) = 0.431 mW/g**  
Maximum value of SAR (measured) = 0.633 mW/g



## **Appendix 5**

### **Measurement Uncertainty Budget**

{note: SAR drift = 0% due to correction for drift in SAR results,  
fcd being updated}

**Uncertainty Budget for Device Under Test, for 735 MHz to 3 GHz**

| <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>             |
|--|---|------------------|--------------|-----------------------|-------------------------------|--------------------------------|-------------------------------------|--------------------------------------|----------------------|
| <b>Uncertainty Component</b>                               | Description<br>IEEE1528(2003) /<br>IEC62209-1(2005) | Tol.<br>(±<br>%) | Prob<br>Dist | Div.                  | <i>c<sub>i</sub></i><br>(1 g) | <i>c<sub>i</sub></i><br>(10 g) | 1 g<br><i>u<sub>i</sub></i><br>(±%) | 10 g<br><i>u<sub>i</sub></i><br>(±%) | <i>v<sub>i</sub></i> |
| <b>Measurement System</b>                                  |   |                  |              |                       |                               |                                |                                     |                                      |                      |
| Probe Calibration [ES3DV3]                                 | E.2.1 / 7.2.1                                       | 6.0              | N            | 1.00                  | 1                             | 1                              | 6.0                                 | 6.0                                  | ∞                    |
| Axial Isotropy   | E.2.2 / 7.2.1.2                                     | 4.7              | R            | 1.73                  | 0.707                         | 0.707                          | 1.9                                 | 1.9                                  | ∞                    |
| Hemispherical Isotropy                                     | E.2.2 / 7.2.1.2                                     | 9.6              | R            | 1.73                  | 0.707                         | 0.707                          | 3.9                                 | 3.9                                  | ∞                    |
| Boundary Effect  | E.2.3 / 7.2.1.5                                     | 1.0              | R            | 1.73                  | 1                             | 1                              | 0.6                                 | 0.6                                  | ∞                    |
| Linearity  | E.2.4 / 7.2.1.3                                     | 4.7              | R            | 1.73                  | 1                             | 1                              | 2.7                                 | 2.7                                  | ∞                    |
| System Detection Limits                                    | E.2.5 / 7.2.1.4                                     | 1.0              | R            | 1.73                  | 1                             | 1                              | 0.6                                 | 0.6                                  | ∞                    |
| Readout Electronics  | E.2.6 / 7.2.1.6                                     | 0.3              | N            | 1.00                  | 1                             | 1                              | 0.3                                 | 0.3                                  | ∞                    |
| Response Time  | E.2.7 / 7.2.1.7                                     | 1.1              | R            | 1.73                  | 1                             | 1                              | 0.6                                 | 0.6                                  | ∞                    |
| Integration Time   | E.2.8 / 7.2.1.8                                     | 1.1              | R            | 1.73                  | 1                             | 1                              | 0.6                                 | 0.6                                  | ∞                    |
| RF Ambient Conditions -<br>Noise                           | E.6.1 / 7.2.3.6                                     | 3.0              | R            | 1.73                  | 1                             | 1                              | 1.7                                 | 1.7                                  | ∞                    |
| RF Ambient Conditions -<br>Reflections                     | E.6.1 / 7.2.3.6                                     | 3.0              | R            | 1.73                  | 1                             | 1                              | 1.7                                 | 1.7                                  | ∞                    |
| Probe Positioner Mech.<br>Tolerance                        | E.6.2 / 7.2.2.1                                     | 0.4              | R            | 1.73                  | 1                             | 1                              | 0.2                                 | 0.2                                  | ∞                    |
| Probe Positioning w.r.t<br>Phantom                         | E.6.3 / 7.2.2.3                                     | 1.4              | R            | 1.73                  | 1                             | 1                              | 0.8                                 | 0.8                                  | ∞                    |
| Max. SAR Evaluation (ext.,<br>int., avg.)                  | E.5 / 7.2.4   | 3.4              | R            | 1.73                  | 1                             | 1                              | 2.0                                 | 2.0                                  | ∞                    |
| <b>Test sample Related</b>                                 |   |                  |              |                       |                               |                                |                                     |                                      |                      |
| Test Sample Positioning                                    | E.4.2 / 7.2.2.4                                     | 3.4              | N            | 1.00                  | 1                             | 1                              | 3.4                                 | 3.4                                  | 79                   |
| Device Holder Uncertainty                                  | E.4.1 / 7.2.2.4.2                                   | 4.5              | N            | 1.00                  | 1                             | 1                              | 4.5                                 | 4.5                                  | 11                   |
| SAR drift  | 6.6.2 / 7.2.3.5                                     | 0.0              | R            | 1.73                  | 1                             | 1                              | 0.0                                 | 0.0                                  | ∞                    |
| <b>Phantom and Tissue Parameters</b>                       |   |                  |              |                       |                               |                                |                                     |                                      |                      |
| Phantom Uncertainty  | E.3.1 / 7.2.2.2                                     | 4.0              | R            | 1.73                  | 1                             | 1                              | 2.3                                 | 2.3                                  | ∞                    |
| Liquid Conductivity (target)                               | E.3.2 / 7.2.3.3                                     | 5.0              | R            | 1.73                  | 0.64                          | 0.43                           | 1.8                                 | 1.2                                  | ∞                    |
| Liquid Conductivity<br>(measurement)                       | E.3.3 / 7.2.3.3                                     | 2.5              | N            | 1.00                  | 0.64                          | 0.43                           | 1.6                                 | 1.1                                  | 6                    |
| Liquid Permittivity (target)                               | E.3.2 / 7.2.3.4                                     | 5.0              | R            | 1.73                  | 0.6                           | 0.49                           | 1.7                                 | 1.4                                  | ∞                    |
| Liquid Permittivity<br>(measurement)                       | E.3.2 / 7.2.3.4                                     | 2.3              | N            | 1.00                  | 0.6                           | 0.49                           | 1.4                                 | 1.1                                  | 6                    |
| <b>Combined Standard<br/>Uncertainty</b>                   |   |                  | RSS          |                       |                               |                                | 11                                  | 11                                   | 372                  |
| <b>Expanded Uncertainty<br/>(95% CONFIDENCE<br/>LEVEL)</b> |   |                  | k=2          |                       |                               |                                | 22                                  | 22                                   |                      |

### Uncertainty Budget for Device Under Test for 3 to 6 GHz

| <i>a</i>   | <i>b</i>                     | <i>c</i>   | <i>d</i>    | $e = f(d,k)$ | <i>f</i>                   | <i>g</i>                    | $h = c \times f / e$          | $i = c \times g / e$           | <i>k</i>             |
|--|------------------------------|------------|-------------|--------------|----------------------------|-----------------------------|-------------------------------|--------------------------------|----------------------|
| <b>Uncertainty Component</b>                       | Description IEC62209-2(2010) | Tol. (± %) | Prob Dist   | Div.         | <i>c<sub>i</sub></i> (1 g) | <i>c<sub>i</sub></i> (10 g) | 1 g <i>u<sub>i</sub></i> (±%) | 10 g <i>u<sub>i</sub></i> (±%) | <i>v<sub>i</sub></i> |
| <b>Measurement System</b>                          |                              |            |             |              |                            |                             |                               |                                |                      |
| Probe Calibration [EX3DV4]                         | 7.2.2.1                      | 6.6        | N           | 1.00         | 1                          | 1                           | 6.6                           | 6.6                            | ∞                    |
| Axial Isotropy                                     | 7.2.2.2                      | 4.7        | R           | 1.73         | 0.707                      | 0.707                       | 1.9                           | 1.9                            | ∞                    |
| Hemispherical Isotropy                             | 7.2.2.2                      | 9.6        | R           | 1.73         | 0.707                      | 0.707                       | 3.9                           | 3.9                            | ∞                    |
| Boundary Effect                                    | 7.2.2.6                      | 2.0        | R           | 1.73         | 1                          | 1                           | 1.2                           | 1.2                            | ∞                    |
| Linearity  | 7.2.2.5                      | 4.7        | R           | 1.73         | 1                          | 1                           | 2.7                           | 2.7                            | ∞                    |
| System Detection Limits                            | 7.2.2                        | 1.0        | R           | 1.73         | 1                          | 1                           | 0.6                           | 0.6                            | ∞                    |
| Readout Electronics                                | 7.2.2.7                      | 0.3        | N           | 1.00         | 1                          | 1                           | 0.3                           | 0.3                            | ∞                    |
| Response Time                                      | 7.2.2.8                      | 1.1        | R           | 1.73         | 1                          | 1                           | 0.6                           | 0.6                            | ∞                    |
| Integration Time                                   | 7.2.2.9                      | 1.1        | R           | 1.73         | 1                          | 1                           | 0.6                           | 0.6                            | ∞                    |
| RF Ambient Conditions - Noise                      | 7.2.4.5                      | 3.0        | R           | 1.73         | 1                          | 1                           | 1.7                           | 1.7                            | ∞                    |
| RF Ambient Conditions - Reflections                | 7.2.4.5                      | 3.0        | R           | 1.73         | 1                          | 1                           | 1.7                           | 1.7                            | ∞                    |
| Probe Positioner Mech. Tolerance                   | 7.2.3.1                      | 1.0        | R           | 1.73         | 1                          | 1                           | 0.6                           | 0.6                            | ∞                    |
| Probe Positioning w.r.t Phantom                    | 7.2.3.3                      | 4.0        | R           | 1.73         | 1                          | 1                           | 2.3                           | 2.3                            | ∞                    |
| Max. SAR Evaluation (ext., int., avg.)             | 7.2.5.3                      | 4.0        | R           | 1.73         | 1                          | 1                           | 2.3                           | 2.3                            | ∞                    |
| <b>Test sample Related</b>                         |                              |            |             |              |                            |                             |                               |                                |                      |
| Test Sample Positioning                            | 7.2.3.4                      | 3.4        | N           | 1.00         | 1                          | 1                           | 3.4                           | 3.4                            | 79                   |
| Device Holder Uncertainty                          | 7.2.3.4                      | 4.5        | N           | 1.00         | 1                          | 1                           | 4.5                           | 4.5                            | 11                   |
| SAR drift  | 7.2.2.10                     | 0.0        | R           | 1.73         | 1                          | 1                           | 0.0                           | 0.0                            | ∞                    |
| <b>Phantom and Tissue Parameters</b>               |                              |            |             |              |                            |                             |                               |                                |                      |
| Phantom Uncertainty                                | 7.2.3.2                      | 4.0        | R           | 1.73         | 1                          | 1                           | 2.3                           | 2.3                            | ∞                    |
| Liquid Conductivity (target)                       |                              | 5.0        | R           | 1.73         | 0.64                       | 0.43                        | 1.8                           | 1.2                            | ∞                    |
| Liquid Conductivity (measurement)                  | 7.2.4.3                      | 3.4        | N           | 1.00         | 0.64                       | 0.43                        | 2.2                           | 1.5                            | 6                    |
| Liquid Permittivity (target)                       |                              | 10.0       | R           | 1.73         | 0.6                        | 0.49                        | 3.5                           | 2.8                            | ∞                    |
| Liquid Permittivity (measurement)                  | 7.2.4.3                      | 2.6        | N           | 1.00         | 0.6                        | 0.49                        | 1.6                           | 1.3                            | 6                    |
| <b>Combined Standard Uncertainty</b>               |                              |            |             |              |                            |                             |                               |                                |                      |
|  |                              |            | RSS         |              |                            |                             | 12                            | 12                             | 508                  |
| <b>Expanded Uncertainty (95% CONFIDENCE LEVEL)</b> |                              |            |             |              |                            |                             |                               |                                |                      |
|  |                              |            | <i>k</i> =2 |              |                            |                             | 24                            | 24                             |                      |

## **Appendix 6**

### **Probe Calibration Certificate**

**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
 Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**S** Service suisse d'étalonnage  
**C** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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 **Motorola MDB**

Certificate No: **ES3-3115\_Jan12**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3115**

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

Calibration date: **January 11, 2012**

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

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

Calibration Equipment used (M&TE critical for calibration)

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

|                | Name           | Function              | Signature |
|----------------|----------------|-----------------------|-----------|
| Calibrated by: | Jeton Kastrati | Laboratory Technician |           |
| Approved by:   | Katja Pokovic  | Technical Manager     |           |

Issued: January 12, 2012

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

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
Swiss Calibration Service

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 $\varphi$   | $\varphi$ rotation around probe axis  |
| Polarization $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center),<br>i.e., $\vartheta = 0$ is normal to probe axis |

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

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

### Methods Applied and Interpretation of Parameters:

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

# Probe ES3DV3

## SN:3115

Manufactured: March 6, 2006  
Calibrated: January 11, 2012

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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3115

### Basic Calibration Parameters

|   | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|---|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 1.30     | 1.26     | 1.17     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                                     | 105.1    | 102.3    | 102.4    |               |

### Modulation Calibration Parameters

| UID   | Communication System Name | PAR  |   | A<br>dB | B<br>dB | C<br>dB | VR<br>mV | Unc <sup>C</sup><br>(k=2) |
|-------|---------------------------|------|---|---------|---------|---------|----------|---------------------------|
| 10000 | CW                        | 0.00 | X | 0.00    | 0.00    | 1.00    | 118.8    | $\pm 3.0 \%$              |
|       |                           |      | Y | 0.00    | 0.00    | 1.00    | 107.0    |                           |
|       |                           |      | Z | 0.00    | 0.00    | 1.00    | 110.1    |                           |

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>C</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:3115

### 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                            | 6.05    | 6.05    | 6.05    | 0.35  | 1.73       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 5.83    | 5.83    | 5.83    | 0.69  | 1.20       | ± 12.0 %    |
| 1810                 | 40.0                               | 1.40                            | 5.17    | 5.17    | 5.17    | 0.80  | 1.19       | ± 12.0 %    |
| 1950                 | 40.0                               | 1.40                            | 4.81    | 4.81    | 4.81    | 0.72  | 1.26       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.35    | 4.35    | 4.35    | 0.80  | 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:3115

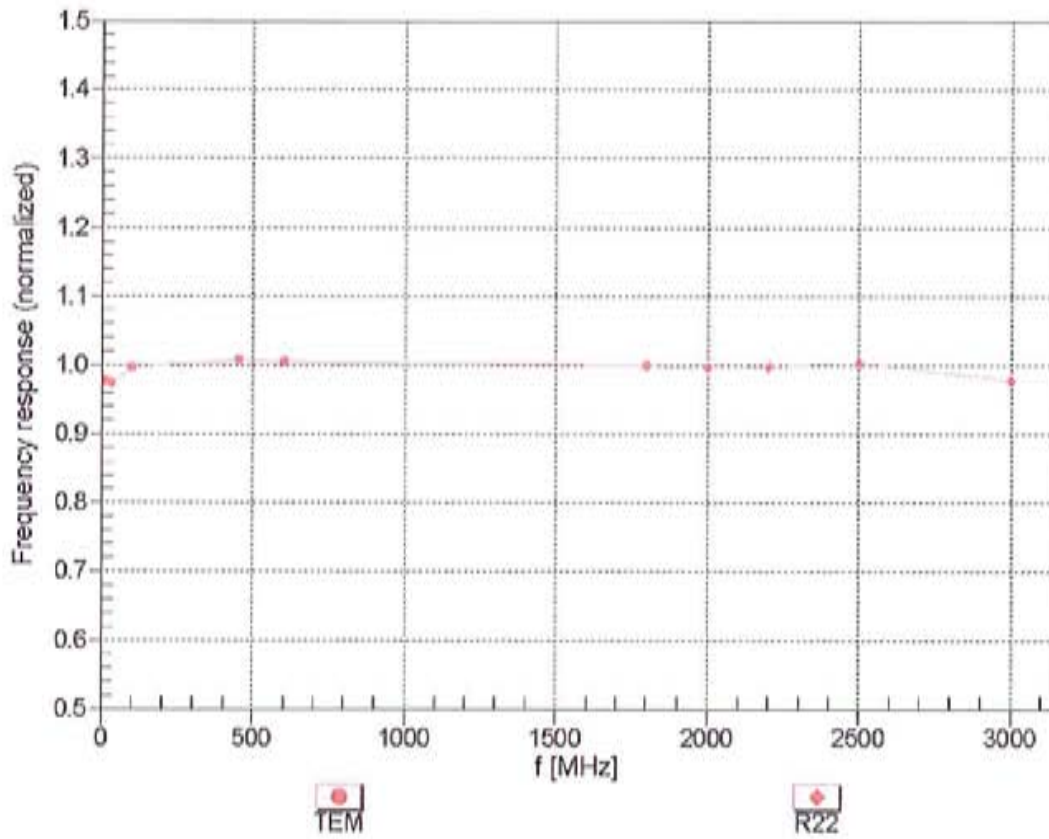
### Calibration Parameter Determined in Body Tissue Simulating Media

| 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                            | 5.97    | 5.97    | 5.97    | 0.43  | 1.57       | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 5.89    | 5.89    | 5.89    | 0.67  | 1.27       | ± 12.0 %    |
| 1810                 | 53.3                               | 1.52                            | 4.72    | 4.72    | 4.72    | 0.56  | 1.49       | ± 12.0 %    |
| 1950                 | 53.3                               | 1.52                            | 4.67    | 4.67    | 4.67    | 0.37  | 1.87       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 4.12    | 4.12    | 4.12    | 0.80  | 1.05       | ± 12.0 %    |

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

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

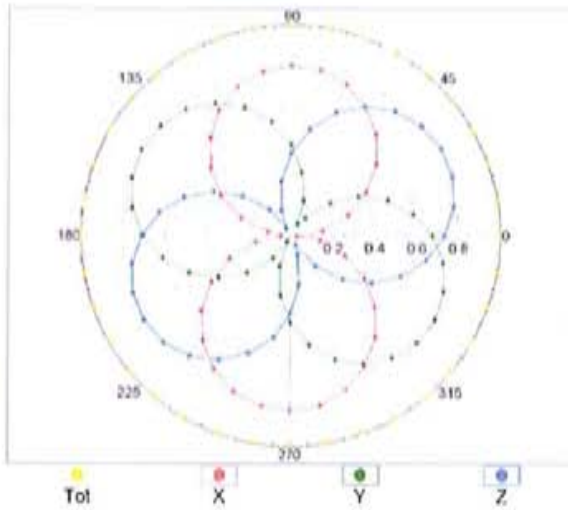
### Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



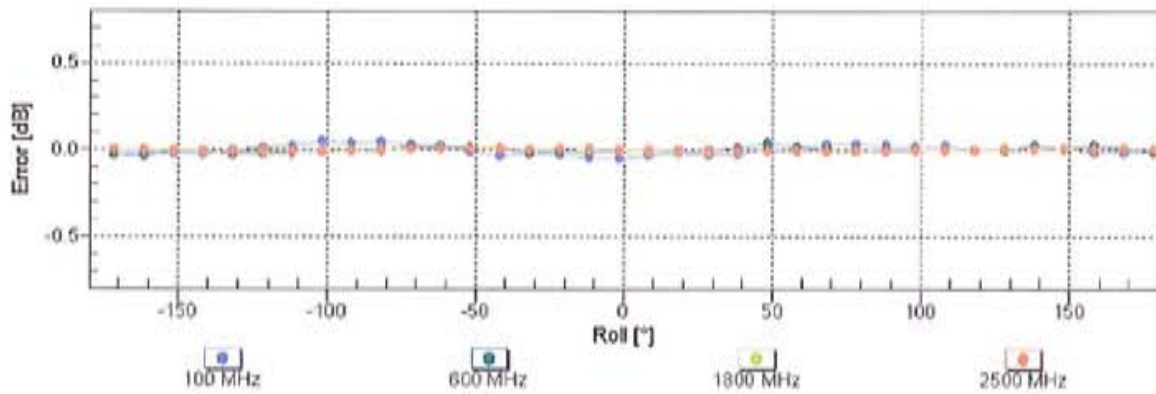
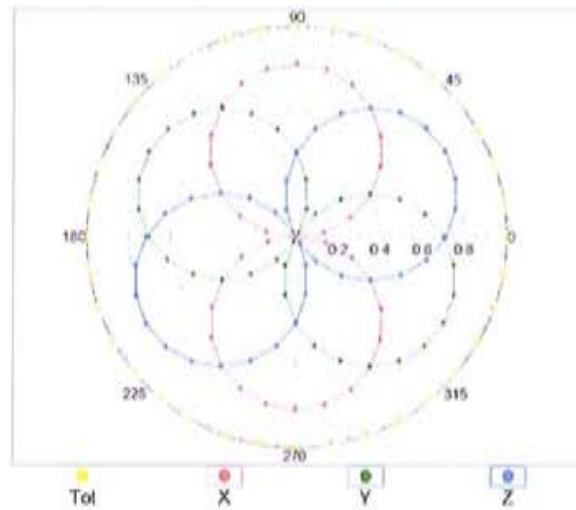
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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

f=600 MHz,TEM

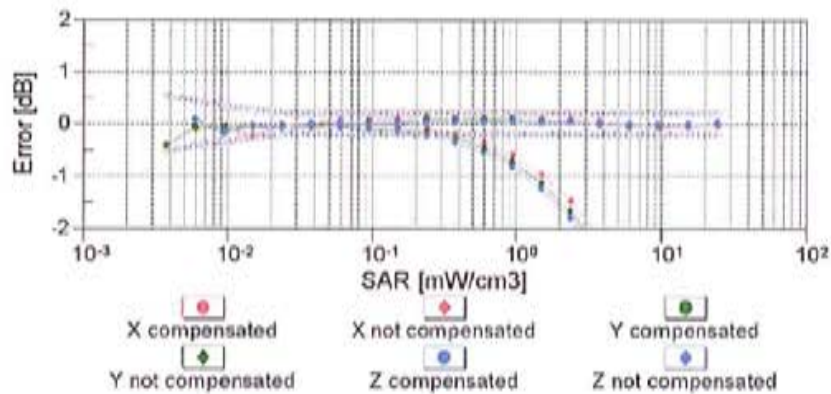
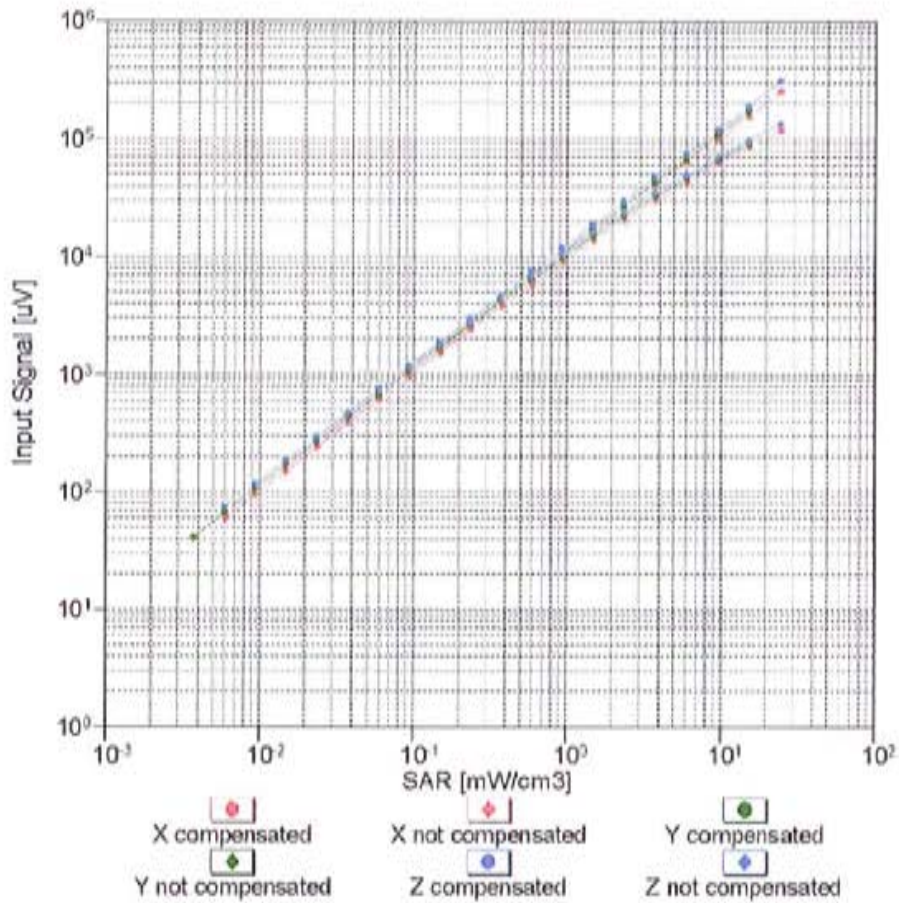


f=1800 MHz,R22



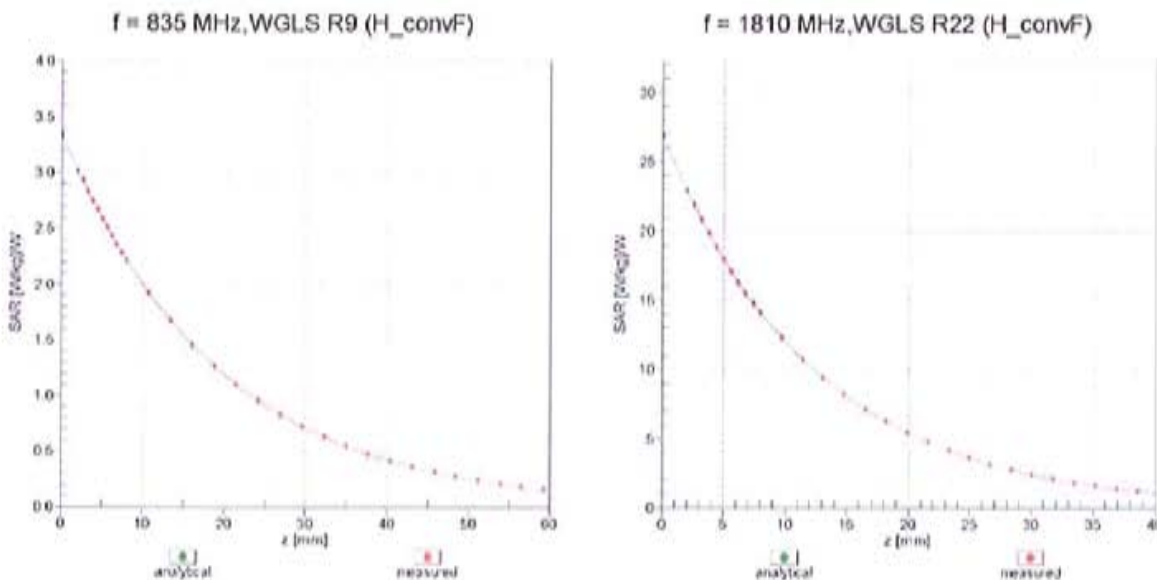
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f = 900 MHz)

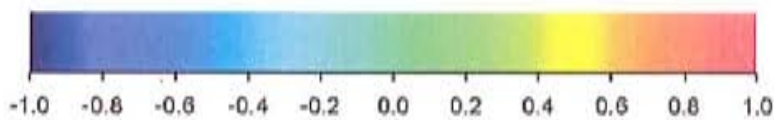
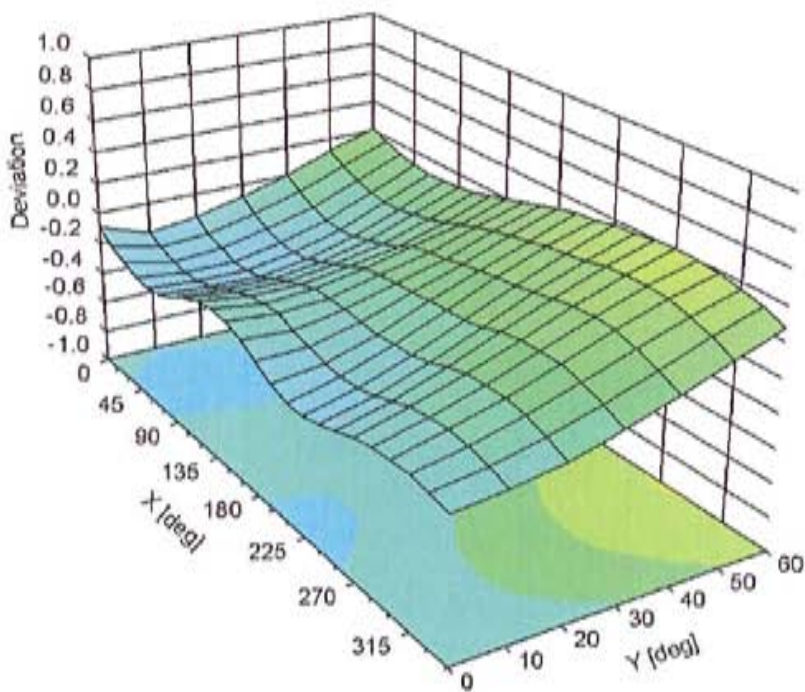


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

### Conversion Factor Assessment



### Deviation from Isotropy in Liquid Error ( $\phi, \theta$ ), f = 900 MHz



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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3115

### 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           |

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



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S** Schweizerischer Kalibrierdienst  
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Motorola MDb**

Certificate No: **ES3-3184\_Apr12**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3184**

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

Calibration date: **April 25, 2012**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID              | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 29-Mar-12 (No. 217-01508)         | Apr-13                 |
| Power sensor E4412A        | MY41498087      | 29-Mar-12 (No. 217-01508)         | Apr-13                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 27-Mar-12 (No. 217-01531)         | Apr-13                 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 27-Mar-12 (No. 217-01529)         | Apr-13                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 27-Mar-12 (No. 217-01532)         | Apr-13                 |
| Reference Probe ES3DV2     | SN: 3013        | 29-Dec-11 (No. ES3-3013_Dec11)    | Dec-12                 |
| DAE4                       | SN: 660         | 10-Jan-12 (No. DAE4-660_Jan12)    | Jan-13                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Apr-11)  | In house check: Apr-13 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-11) | In house check: Oct-12 |

|                | Name            | Function              | Signature |
|----------------|-----------------|-----------------------|-----------|
| Calibrated by: | Claudio Leubler | Laboratory Technician |           |
| Approved by:   | Katja Pokovic   | Technical Manager     |           |

Issued: April 25, 2012

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

**Calibration Laboratory of  
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Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**S** Service suisse d'étalonnage  
**C** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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 $\varphi$   | $\varphi$ rotation around probe axis  |
| Polarization $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center),<br>i.e., $\vartheta = 0$ is normal to probe axis |

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

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

### Methods Applied and Interpretation of Parameters:

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

# Probe ES3DV3

## SN:3184

Manufactured: August 19, 2008  
Calibrated: April 25, 2012

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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3184

### Basic Calibration Parameters

|   | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|---|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 1.24     | 1.38     | 1.25     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                                     | 101.9    | 99.5     | 100.6    |               |

### 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) |
|-----|---------------------------|------|---|---------|---------|---------|----------|---------------------------|
| 0   | CW                        | 0.00 | X | 0.00    | 0.00    | 1.00    | 158.6    | $\pm 3.0 \%$              |
|     |                           |      | Y | 0.00    | 0.00    | 1.00    | 163.2    |                           |
|     |                           |      | Z | 0.00    | 0.00    | 1.00    | 156.8    |                           |

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:3184

### 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                            | 6.38    | 6.38    | 6.38    | 0.24  | 2.29       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 6.15    | 6.15    | 6.15    | 0.70  | 1.20       | ± 12.0 %    |
| 1810                 | 40.0                               | 1.40                            | 5.48    | 5.48    | 5.48    | 0.80  | 1.28       | ± 12.0 %    |
| 1950                 | 40.0                               | 1.40                            | 5.19    | 5.19    | 5.19    | 0.65  | 1.38       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 4.61    | 4.61    | 4.61    | 0.80  | 1.32       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 4.40    | 4.40    | 4.40    | 0.80  | 1.35       | ± 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:3184

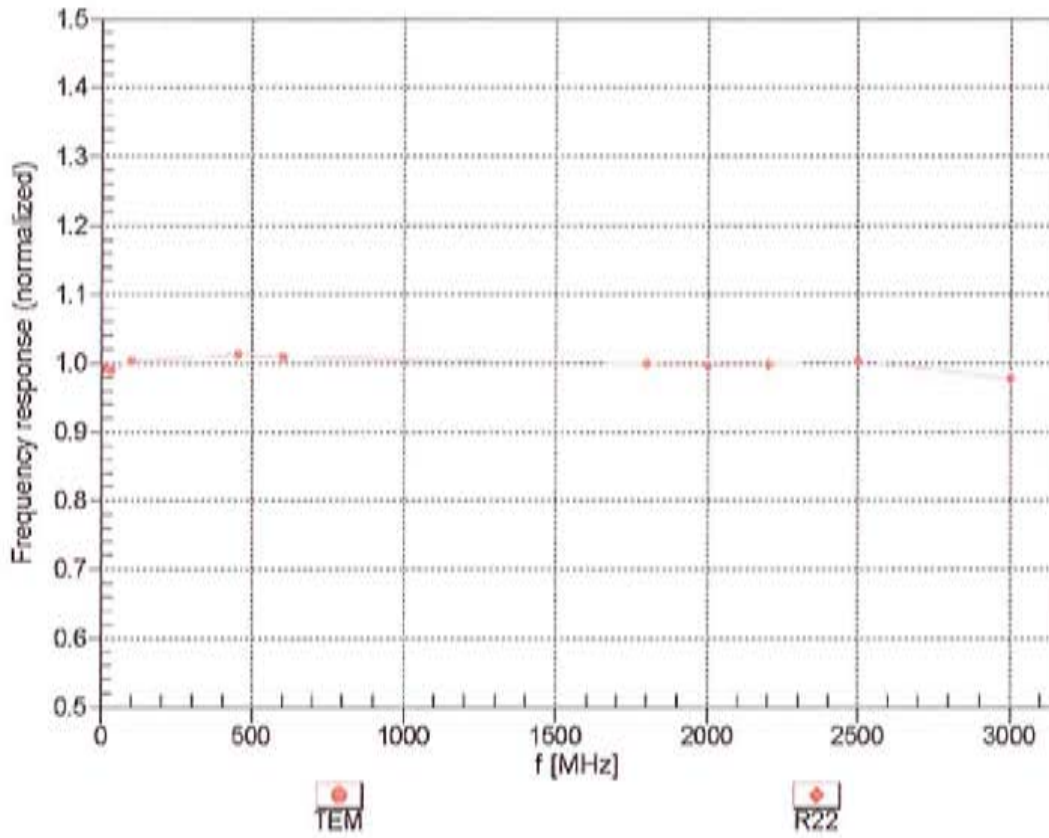
### Calibration Parameter Determined in Body Tissue Simulating Media

| f (MHz) <sup>c</sup> | Relative Permittivity <sup>f</sup> | Conductivity (S/m) <sup>f</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 55.5                               | 0.96                            | 6.28    | 6.28    | 6.28    | 0.53  | 1.40       | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 6.19    | 6.19    | 6.19    | 0.53  | 1.40       | ± 12.0 %    |
| 1810                 | 53.3                               | 1.52                            | 4.88    | 4.88    | 4.88    | 0.55  | 1.49       | ± 12.0 %    |
| 1950                 | 53.3                               | 1.52                            | 4.87    | 4.87    | 4.87    | 0.53  | 1.57       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 4.33    | 4.33    | 4.33    | 0.80  | 0.96       | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 4.13    | 4.13    | 4.13    | 0.80  | 0.99       | ± 12.0 %    |

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

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

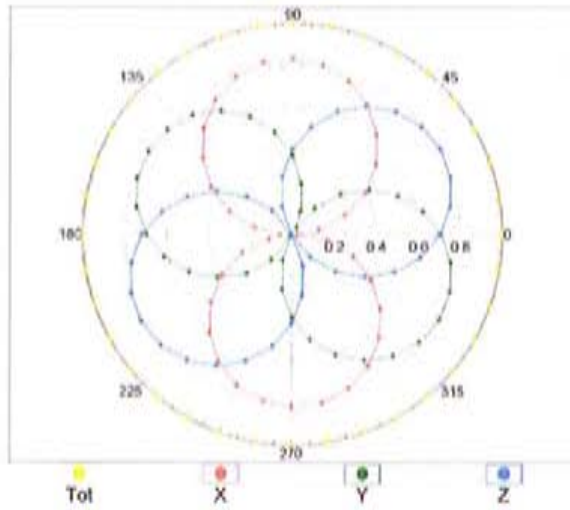
### Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



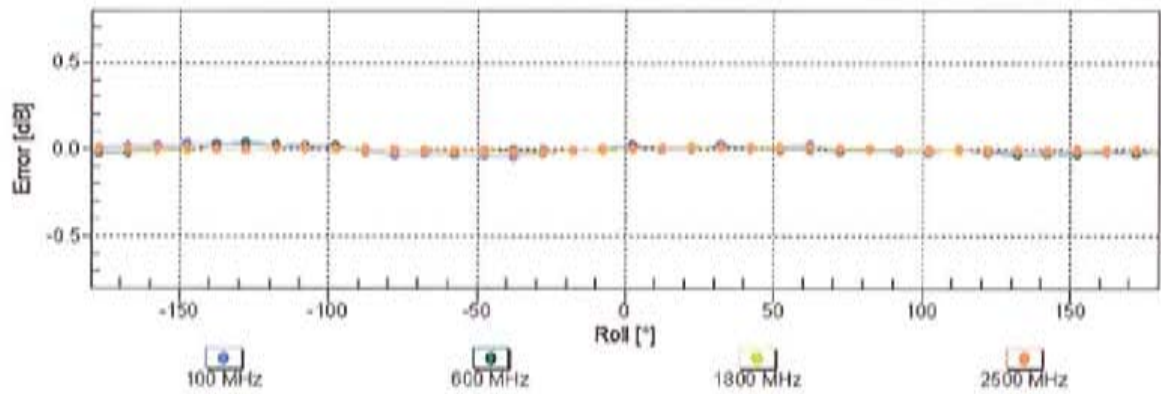
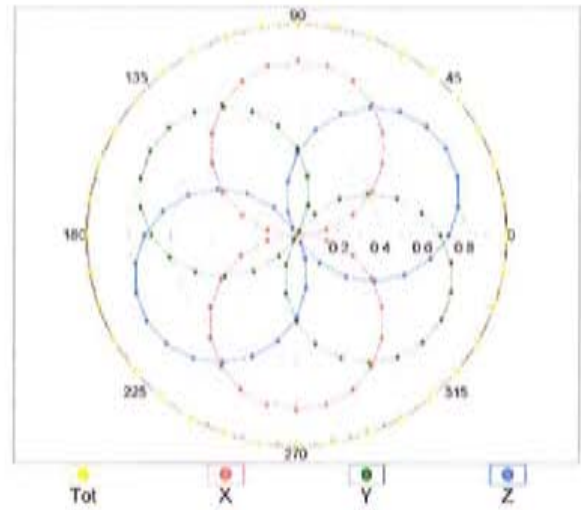
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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

f=600 MHz,TEM

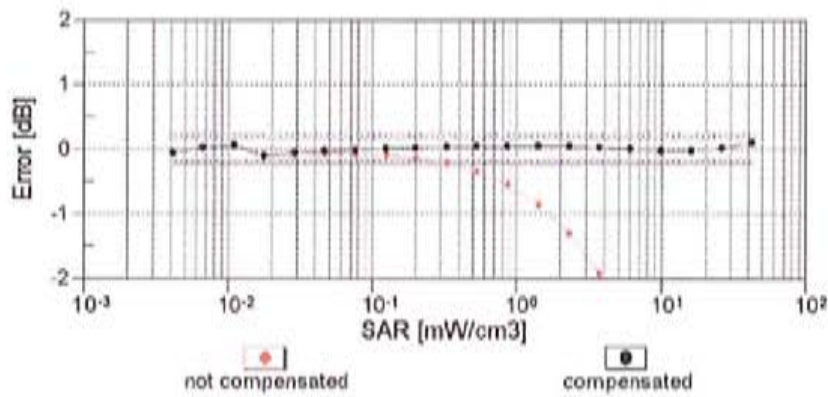
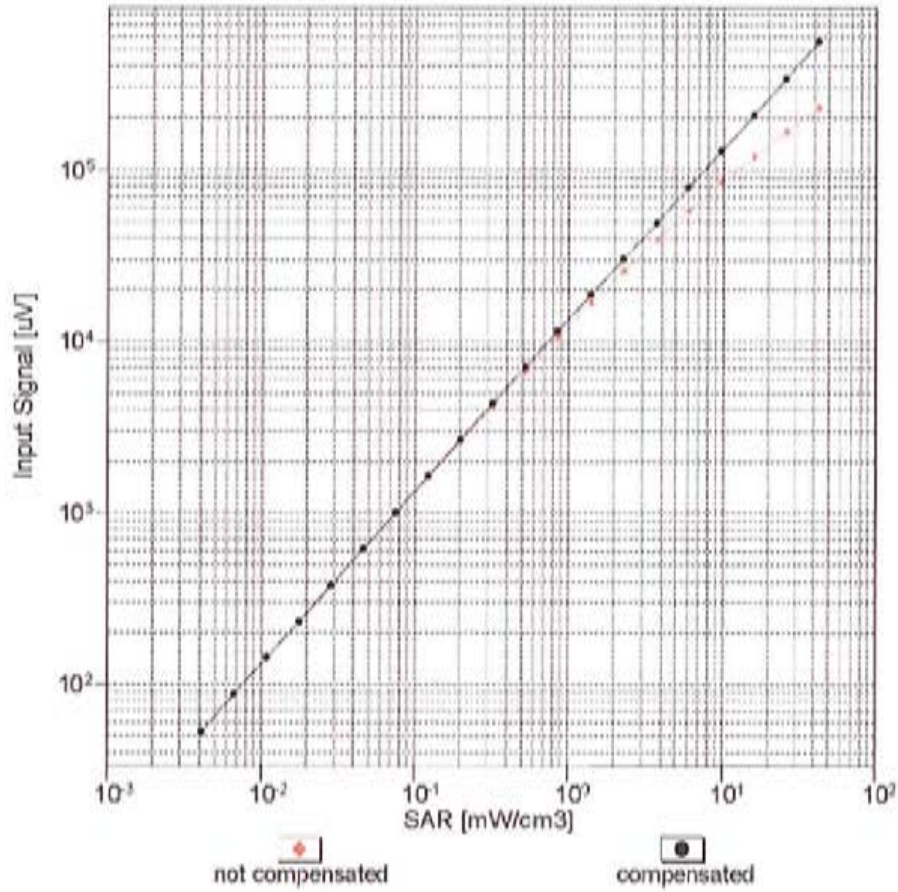


f=1800 MHz,R22



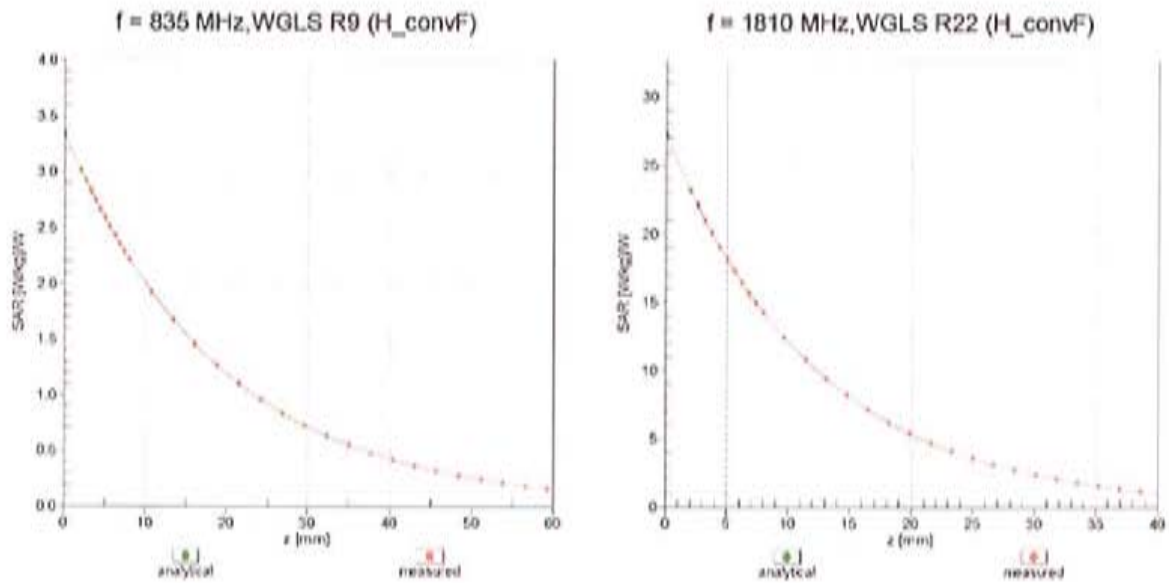
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f = 900 MHz)

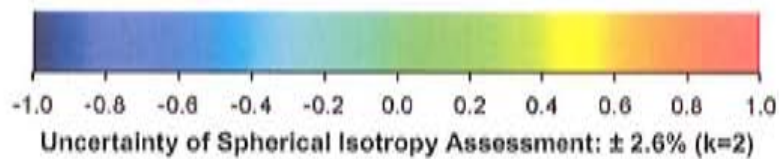
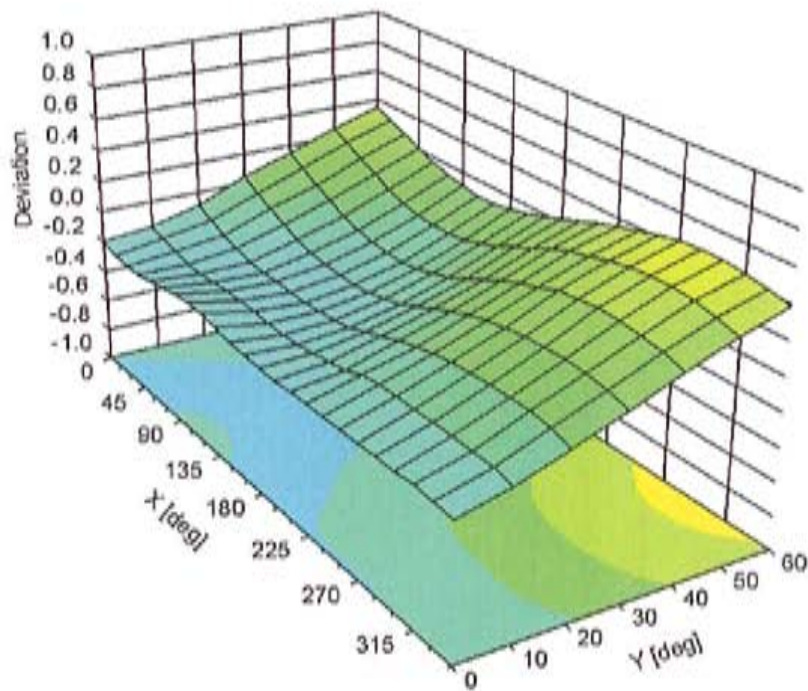


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

### Conversion Factor Assessment



### Deviation from Isotropy in Liquid Error ( $\phi, \theta$ ), f = 900 MHz



**DASY/EASY - Parameters of Probe: ES3DV3 - SN:3184****Other Probe Parameters**

|   |            |
|---|------------|
| Sensor Arrangement                            | Triangular |
| Connector Angle (°)                           | 132.3      |
| 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       |

## **Appendix 7**

### **Dipole Characterization Certificate**

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**S** Service suisse d'étalonnage  
**C** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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 **Motorola MDB**

Certificate No: **D835V2-436\_Mar11**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 436**

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

Calibration date: **March 18, 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)

| 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**      Name: **Dimce Iliev**      Function: **Laboratory Technician**      Signature: *D. Iliev*

Approved by: **Katja Pokovic**      Name: **Katja Pokovic**      Function: **Technical Manager**      Signature: *K. Pokovic*

Issued: March 18, 2011

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

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**S** Service suisse d'étalonnage  
**C** Servizio svizzero di taratura  
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Accredited by the Swiss Accreditation Service (SAS)  
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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:

- 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 V4.9 |             |
| 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 % | 0.89 mho/m $\pm$ 6 % |
| Head TSL temperature during test | (22.0 $\pm$ 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 | 2.42 mW / g                                      |
| SAR normalized  | normalized to 1W   | 9.68 mW / g                                      |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | <b>9.73 mW / g <math>\pm</math> 17.0 % (k=2)</b> |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |  |
|---|--------------------|--|
| SAR measured  | 250 mW input power | 1.58 mW / g                                      |
| SAR normalized  | normalized to 1W   | 6.32 mW / g                                      |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | <b>6.35 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 | 54.3 ± 6 %   | 0.99 mho/m ± 6 % |
| Body TSL temperature during test | (22.2 ± 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 | 2.56 mW / g                       |
| SAR normalized  | normalized to 1W   | 10.2 mW / g                       |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | <b>10.1 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 | 1.68 mW / g                       |
| SAR normalized  | normalized to 1W   | 6.72 mW / g                       |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | <b>6.63 mW / g ± 16.5 % (k=2)</b> |

## Appendix

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.4 $\Omega$ - 2.5 j $\Omega$ |
| Return Loss                          | - 31.1 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 47.5 $\Omega$ - 4.0 j $\Omega$ |
| Return Loss                          | - 26.4 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.379 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.

### Design Modification by End User

The dipole has been modified with Teflon Rings (TR) placed within identified markings close to the end of each dipole arm. Calibration has been performed with TR attached to the dipole.

### Additional EUT Data

|                 |                   |
|-----------------|-------------------|
| Manufactured by | SPEAG             |
| Manufactured on | December 15, 2000 |

**DASY5 Validation Report for Head TSL**

Date/Time: 18.03.2011 10:48:36

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:436**Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1  
Medium: HSL900Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.89$  mho/m;  $\epsilon_r = 41$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(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, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

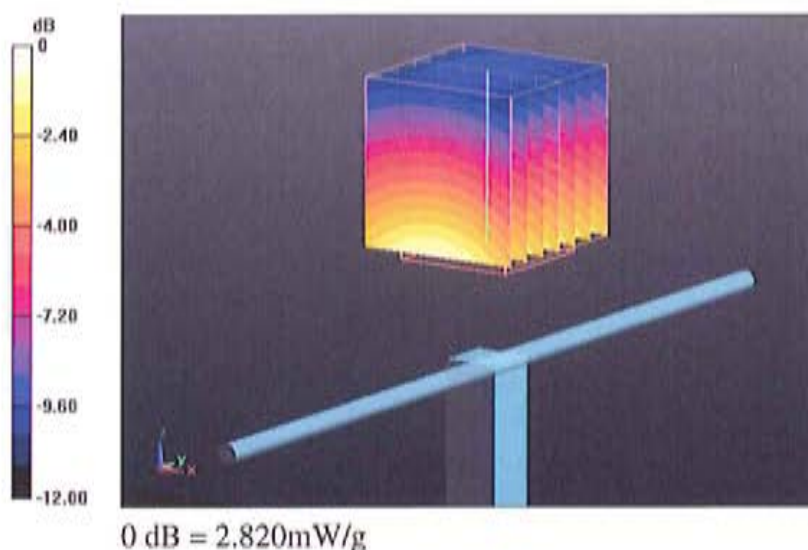
**Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement**  
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.928 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.620 W/kg

**SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.58 mW/g**

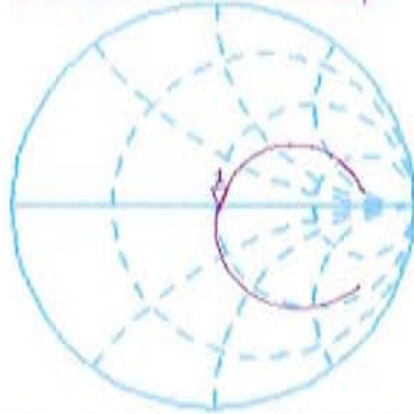
Maximum value of SAR (measured) = 2.816 mW/g



### Impedance Measurement Plot for Head TSL

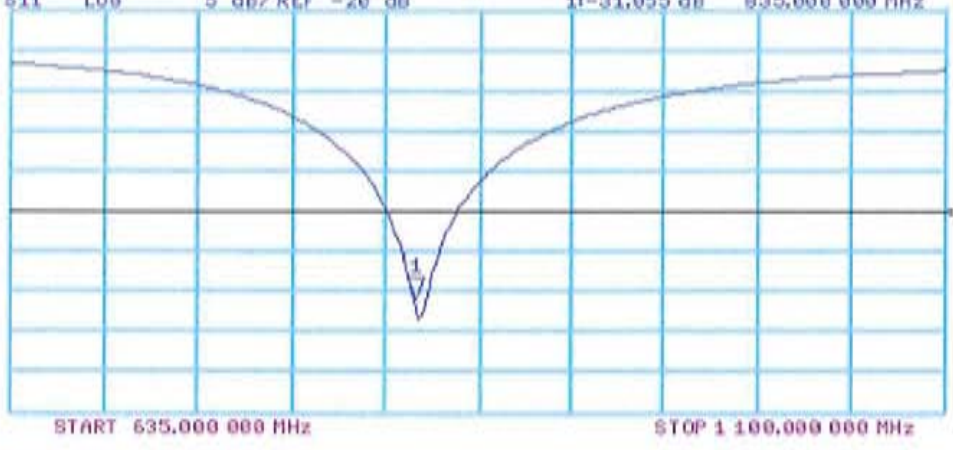
18 Mar 2011 10:25:19  
 [CH1] S11 1 U FS 1i 51.352 a -2.4941 a 76.421 pF 835.000 000 MHz

\*  
 Del  
 Cor  
 avg  
 16  
 †



CH2 S11 LOG 5 dB/REF -20 dB 1i -31.055 dB 835.000 000 MHz

Cor  
 avg  
 16  
 †



**DASY5 Validation Report for Body TSL**

Date/Time: 16.03.2011 16:11:52

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:436**

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

Medium: MSL900

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.99$  mho/m;  $\epsilon_r = 54.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(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, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

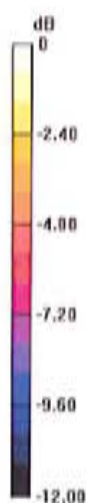
**Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement**  
 grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.649 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.789 W/kg

**SAR(1 g) = 2.56 mW/g; SAR(10 g) = 1.68 mW/g**

Maximum value of SAR (measured) = 2.988 mW/g

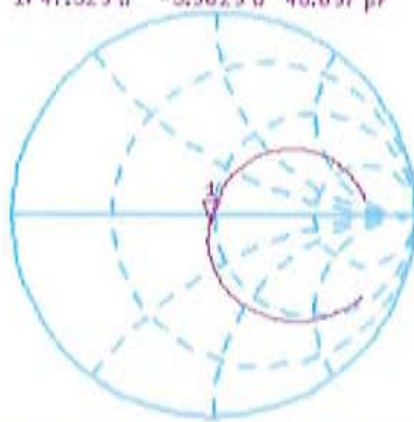


0 dB = 2.990mW/g

### Impedance Measurement Plot for Body TSL

16 Mar 2011 16:17:09  
 [CH1] S11 1 U FS 1: 47.529  $\Omega$  -3.9629  $\Omega$  48.097  $\mu F$  835.000 000 MHz

\*  
 De1  
 Cor



avg  
 16

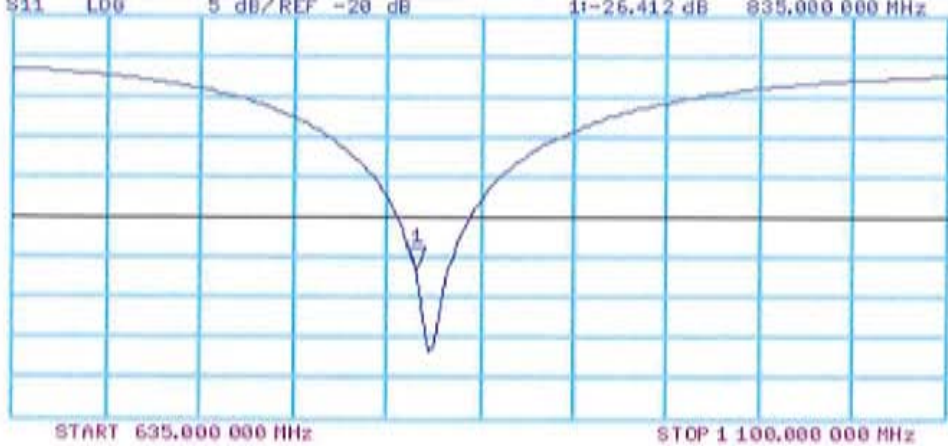
↑

CH2 S11 LOG 5 dB/REF -20 dB 1: -26.412 dB 835.000 000 MHz

Cor

avg  
 16

↑



**Extension of Dipole Calibration Interval**

FCD-1954, Rev.1

**Dipole SN:** 436tr

**Date of last external calibration:** 3/18/2011

**External calibration performed by:** SPEAG

|   | 1st Extension                           |                                    |
|---|---|------------------------------------|
|   | Original Calibration Data:<br><3/18/11> | Internal Verification:<br><3/8/12> |
| <b>Return loss (dB):</b><br><i>Verify &lt; -20dB</i>  | -31.1                                   | Verified                           |
| <b>Impedance, Real (<math>\Omega</math>):</b><br><i>Verify within +/-5 <math>\Omega</math> of original</i>      | 51.4                                    | 50.4                               |
| <b>Impedance, Imaginary (<math>\Omega</math>):</b><br><i>Verify within +/-5 <math>\Omega</math> of original</i> | -2.5                                    | -1.3                               |

**Conclusion:**

*Based on the requirements of KDB 50824 D02 Dipole SAR Validation Verification v01, it has been concluded that the dipole identified above has qualified for extension of its calibration interval for one additional year. This review shall be repeated annually, but not to exceed a maximum 3 years from the most recent manufacturer's calibration.*

**First Extension Period:**

Approved extension period: **1 year**

Previous due date: 3/18/2012

**NEW DUE DATE: 3/18/2013**

*2 years from date of last external calibration*

**END OF REPORT**