# DECLARATION OF COMPLIANCE
# SAR RF EXPOSURE EVALUATION


**Test Lab**

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**Applicant Information**

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| | |
|---|---|
| **FCC IDENTIFIER:** | **O8FCAGEMS** |
| **IC IDENTIFIER:** | **3959A-CAGEMS** |
| **Model(s):** | **Treo 650** |
| **FCC Rule Part(s):** | **47 CFR §2.1093; IC RSS-102 Issue 1 (Provisional)** |
| **Test Procedure(s):** | **FCC OET Bulletin 65, Supplement C (01-01)**<br>**IEEE Standard 1528-2003** |
| **Device Type:** | **Portable Dual-Band PCS/Cellular GSM/GPRS Phone with Bluetooth** |
| **FCC Classification:** | **PCS Licensed Transmitter held to ear (PCE)** |
| **Mode(s) of Operation:** | **PCS/Cellular GSM (Voice) & GPRS (Data)** |
| **Tx Frequency Range(s):** | **1850.2 - 1909.8 MHz (PCS GSM/GPRS)**<br>**824.2 - 848.8 MHz (Cellular GSM/GPRS)** |
| **Max. RF Output Power Tested:** | **30.2 dBm - Peak Conducted (PCS Band)**<br>**32.2 dBm - Peak Conducted (Cellular Band)**<br>**-5.1 dBm - Peak Conducted (Bluetooth)** |
| **Antenna Type(s) Tested:** | **External Fixed Stubby (Dual-Band GSM/GPRS)**<br>**Internal (Broadcom BCM-2035 Bluetooth)** |
| **Battery Type(s) Tested:** | **Lithium-ion 3.7 V, 1900 mAh (P/N: 167-10165-00)** |
| **Body-Worn Accessories Tested:** | **Leather Side Case with Belt-Clip (SKU#3180WW)**<br>**Leather Pouch and Swivel Belt-Clip (SKU#3179WW)**<br>**Aluminum Case and Swivel Belt-Clip (SKU#3202WW)**<br>**Generic Ear-Microphone** |
| **Max. SAR Levels Evaluated:** | **PCS Band: 0.943 W/kg (Head) / 0.688 W/kg (Body)**<br>**Cellular Band: 1.51 W/kg (Head) / 1.46 W/kg (Body)** |

**Celltech Labs Inc. declares under its sole responsibility that this wireless portable device has demonstrated compliance with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC 47 CFR §2.1093 and Health Canada's Safety Code 6. The device was tested in accordance with the measurement standards and procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01), Industry Canada RSS-102 Issue 1 (Provisional) and IEEE Standard 1528-2003 for the General Population / Uncontrolled Exposure environment. All measurements were performed in accordance with the SAR system manufacturer recommendations.**

**I attest to the accuracy of data. All measurements were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.**


This test report shall not be reproduced partially, or in full, without the prior written approval of Celltech Labs Inc. The results and statements contained in this report pertain only to the device(s) evaluated.


**Russell W. Pipe**
**Senior Compliance Technologist**
**Celltech Labs Inc.**

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## 1.0 INTRODUCTION

This measurement report demonstrates that the palmOne Model: Treo 650 Dual-Band PCS/Cellular GSM/GPRS Phone (with internal co-located Broadcom BCM-2035 Bluetooth Transmitter) FCC ID: O8FCAGEMS complies with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]) and Health Canada's Safety Code 6 (see reference [2]) for the General Population / Uncontrolled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]), IC RSS-102 Issue 1 (Provisional) (see reference [4]), and IEEE Standard 1528-2003 (see reference [5]) were employed. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

## 2.0 DESCRIPTION of Device Under Test (DUT)

| | | | | |
|---|---|---|---|---|
| **FCC Rule Part(s)** | 47 CFR §2.1093 | | | |
| **IC Rule Part(s)** | RSS-102 Issue 1 (Provisional) | | | |
| **Device Classification** | PCS Licensed Transmitter held to ear (PCE) | | | |
| **Test Procedure(s)** | FCC OET Bulletin 65, Supplement C (01-01) | | | |
| | IC RSS-102 Issue 1 (Provisional) | | | |
| | IEEE Standard 1528-2003 | | | |
| **Device Type** | Dual-Band PCS/Cellular GSM/GPRS Phone (with internal co-located Bluetooth Transmitter) | | | |
| **FCC IDENTIFIER** | O8FCAGEMS | | | |
| **IC IDENTIFIER** | 3959A-CAGEMS | | | |
| **Model(s)** | Treo 650 | | | |
| **Serial No.** | SGXW07D4H00P | | Identical Prototype | |
| **Tx Frequency Range(s)** | 1850.2 - 1909.8 MHz | | PCS Band | |
| | 824.2 - 848.8 MHz | | Cellular Band | |
| **Mode(s) of Operation** | PCS GSM (Voice) | 1 Time Slot | PCS GPRS (Data) | 2 Time Slots |
| | Cellular GSM (Voice) | 1 Time Slot | Cellular GPRS (Data) | 2 Time Slots |
| **Max. RF Output Power Tested** | 30.2 dBm | Peak Conducted | 1850.2 MHz | PCS Band |
| | 30.1 dBm | Peak Conducted | 1880.0 MHz | |
| | 29.7 dBm | Peak Conducted | 1909.8 MHz | |
| | 31.9 dBm | Peak Conducted | 824.2 MHz | Cellular Band |
| | 32.1 dBm | Peak Conducted | 836.6 MHz | |
| | 32.2 dBm | Peak Conducted | 848.8 MHz | |
| | -5.1 dBm | Peak Conducted | 2441 MHz | Bluetooth |
| **Battery Type(s) Tested** | Lithium-ion | 3.7 V, 1900 mAh | | P/N: 167-10165-00 |
| **Antenna Type(s) Tested** | External Fixed Stubby | | Dual-Band GSM/GPRS | |
| | Internal | | Broadcom BCM-2035 Bluetooth | |
| **Body-Worn Accessories Tested** | Leather Side Case with Belt-Clip (No metal) | | | SKU#3180WW |
| | Leather Pouch and Swivel Belt-Clip (Plastic with Metal Spring) | | | SKU#3179WW |
| | Aluminum Case and Swivel Belt-Clip (Plastic with Metal Spring) | | | SKU#3202WW |
| | Generic Ear-Microphone | | | n/a |
| **Additional Accessories** Testing Not Required | Leather Latch Case (No metal with > 1.5 cm separation distance) | | | SKU#3196WW |

## 3.0 SAR MEASUREMENT SYSTEM

Celltech Labs Inc. SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY4 measurement system is comprised of the measurement server, robot controller, computer, near-field probe, probe alignment sensor, specific anthropomorphic mannequin (SAM) phantom, and various planar phantoms for brain and/or body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the DASY4 measurement server. The DAE4 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the DASY4 measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

**DASY4 Measurement System with SAM Phantom**

**DASY4 Measurement System with SAM Phantom**

# 4.0 MEASUREMENT SUMMARY

## HEAD SAR EVALUATION RESULTS (Cellular GSM Voice Mode)

| Test Date | Test Mode | | Freq. (MHz) | Chan. | Antenna Type | Accessory Type | Phantom Section | Test Position | Cond. Power Before Test (dBm) | SAR Drift During Test (dB) | Measured SAR 1g (W/kg) | Scaled SAR 1g (W/kg) by drift |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07/28/04 | Cellular GSM | 1 Slot | 836.6 | 190 | Stubby | -- | Right Ear | Cheek/Touch | 32.1 | -0.0708 | 1.45 | 1.47 |
| 07/28/04 | Cellular GSM | 1 Slot | 824.2 | 128 | Stubby | -- | Right Ear | Cheek/Touch | 31.9 | -0.0393 | 1.42 | 1.43 |
| 07/28/04 | Cellular GSM | 1 Slot | 848.8 | 251 | Stubby | -- | Right Ear | Cheek/Touch | 32.2 | -0.0404 | 1.38 | 1.39 |
| 07/28/04 | Cellular GSM | 1 Slot | 836.6 | 190 | Stubby | -- | Right Ear | Ear/Tilt (15°) | 32.1 | -0.0169 | 1.00 | 1.00 |
| 07/28/04 | Cellular GSM | 1 Slot | 824.2 | 128 | Stubby | -- | Right Ear | Ear/Tilt (15°) | 31.9 | -0.0311 | 1.01 | 1.02 |
| 07/28/04 | Cellular GSM | 1 Slot | 848.8 | 251 | Stubby | -- | Right Ear | Ear/Tilt (15°) | 32.2 | 0.00886 | 0.945 | 0.945 |
| 07/28/04 | Cellular GSM | 1 Slot | 836.6 | 190 | Stubby | -- | Left Ear | Cheek/Touch | 32.1 | -0.133 | 1.35 | 1.39 |
| 07/28/04 | Cellular GSM | 1 Slot | 824.2 | 128 | Stubby | -- | Left Ear | Cheek/Touch | 31.9 | -0.143 | 1.31 | 1.35 |
| 07/28/04 | Cellular GSM | 1 Slot | 848.8 | 251 | Stubby | -- | Left Ear | Cheek/Touch | 32.2 | -0.0673 | 1.28 | 1.30 |
| 07/28/04 | Cellular GSM | 1 Slot | 836.6 | 190 | Stubby | Aluminum Case | Right Ear | Cheek/Touch | 32.1 | -0.0148 | P 0.359<br>S 0.361<br>S 0.335 | P 0.360<br>S 0.362<br>S 0.336 |
| 07/28/04 | Cellular GSM | 1 Slot | 836.6 | 190 | Stubby | -- | Right Ear | Cheek/Touch | 32.1 | -0.0188 | 1.50 | 1.51 |
| 07/28/04 | Bluetooth - Modulated Fixed Frequency | | 2441 | Mid | Internal | | | | -5.1 | | | |
| 07/29/04 | Cellular GSM | 1 Slot | 836.6 | 190 | Stubby | -- | Left Ear | Ear/Tilt (15°) | 32.1 | -0.0844 | 0.805 | 0.821 |
| 07/29/04 | Cellular GSM | 1 Slot | 824.2 | 128 | Stubby | -- | Left Ear | Ear/Tilt (15°) | 31.9 | -0.0469 | 0.785 | 0.794 |
| 07/29/04 | Cellular GSM | 1 Slot | 848.8 | 251 | Stubby | -- | Left Ear | Ear/Tilt (15°) | 32.2 | -0.0311 | 0.786 | 0.792 |
| 07/29/04 | Cellular GSM | 1 Slot | 836.6 | 190 | Stubby | Aluminum Case | Right Ear | Ear/Tilt (15°) | 32.1 | 0.00365 | 0.573 | 0.573 |

**ANSI / IEEE C95.1 1999 - SAFETY LIMIT**
**BRAIN: 1.6 W/kg (averaged over 1 gram)**
**Spatial Peak - Uncontrolled Exposure / General Population**

| Test Date(s) | July 28, 2004 | | | July 29, 2004 | | | Test Date(s) | July 28, 2004 | July 29, 2004 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| Measured Fluid Type | 835 MHz Brain | | | 835 MHz Brain | | | Relative Humidity | 43 | 38 | % |
| Dielectric Constant $\varepsilon_r$ | IEEE Target | | Measured | IEEE Target | | Measured | Atmospheric Pressure | 102.1 | 102.1 | kPa |
| | 41.5 | ± 5% | 40.5 | 41.5 | ± 5% | 40.4 | Ambient Temperature | 23.8 | 23.8 | °C |
| Conductivity σ (mho/m) | 835 MHz Brain | | | 835 MHz Brain | | | Fluid Temperature | 23.6 | 22.5 | °C |
| | IEEE Target | | Measured | IEEE Target | | Measured | Fluid Depth | ≥ 15 | ≥ 15 | cm |
| | 0.90 | ± 5% | 0.90 | 0.90 | ± 5% | 0.90 | ρ (Kg/m$^3$) | 1000 | | |

Note(s):
1. The measurement results were obtained with the DUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
2. If the SAR levels measured at the mid channel were ≥ 3 dB below the SAR limit, SAR evaluation for the low and high channels was optional (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).
3. The power drifts measured by the DASY4 system were within 5% of the start power and were subsequently added to the measured SAR levels to report scaled SAR results as shown in the above table.
4. Secondary peak SAR levels within 2 dB of the primary were reported (P = Primary, S = Secondary).
5. A co-located transmit test was performed with the GSM and Bluetooth transmitting simultaneously in the worst-case single-transmit Cellular GSM configuration as shown in the above table. The Bluetooth transmitter was tested at maximum power setting with a modulated signal on a fixed frequency and the frequency hopping disabled.
6. The DUT was evaluated inside the Aluminum Case accessory for the worst-case Touch and Tilt positions evaluated without the accessory.
1. The DUT was tested with a fully charged Lithium-ion battery.
2. The SAR measurements were performed within 24 hours of the system performance check.

# MEASUREMENT SUMMARY (Cont.)

## HEAD SAR EVALUATION RESULTS (PCS GSM Voice Mode)

| Test Date | Test Mode | | Freq. (MHz) | Chan. | Antenna Type | Accessory Type | Phantom Section | Test Position | Cond. Power Before Test (dBm) | SAR Drift During Test (dB) | Measured SAR 1g (W/kg) | | Scaled SAR 1g (W/kg) by drift | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7/29/04 | PCS GSM | 1 Slot | 1880.0 | 661 | Stubby | -- | Right Ear | Cheek/Touch | 30.1 | -0.0438 | P | 0.708 | P | 0.715 |
| | | | | | | | | | | | S | 0.649 | S | 0.656 |
| 7/29/04 | PCS GSM | 1 Slot | 1880.0 | 661 | Stubby | -- | Right Ear | Ear/Tilt (15°) | 30.1 | 0.0435 | 0.859 | | 0.859 | |
| 7/29/04 | PCS GSM | 1 Slot | 1850.2 | 512 | Stubby | -- | Right Ear | Ear/Tilt (15°) | 30.2 | 0.0463 | 0.784 | | 0.784 | |
| 7/29/04 | PCS GSM | 1 Slot | 1909.8 | 810 | Stubby | -- | Right Ear | Ear/Tilt (15°) | 29.7 | 0.0395 | 0.904 | | 0.904 | |
| 7/29/04 | PCS GSM | 1 Slot | 1880.0 | 661 | Stubby | -- | Left Ear | Cheek/Touch | 30.1 | -0.0657 | P | 0.753 | P | 0.764 |
| | | | | | | | | | | | S | 0.565 | S | 0.574 |
| 7/29/04 | PCS GSM | 1 Slot | 1880.0 | 661 | Stubby | -- | Left Ear | Ear/Tilt (15°) | 30.1 | -0.0351 | 0.843 | | 0.850 | |
| 7/29/04 | PCS GSM | 1 Slot | 1850.2 | 512 | Stubby | -- | Left Ear | Ear/Tilt (15°) | 30.2 | 0.0183 | 0.780 | | 0.780 | |
| 7/29/04 | PCS GSM | 1 Slot | 1909.8 | 810 | Stubby | -- | Left Ear | Ear/Tilt (15°) | 29.7 | -0.0874 | 0.922 | | 0.941 | |
| 7/29/04 | PCS GSM | 1 Slot | 1909.8 | 810 | Stubby | -- | Left Ear | Ear/Tilt (15°) | 29.7 | -0.100 | 0.922 | | 0.943 | |
| 7/29/04 | Bluetooth - Modulated Fixed Frequency | | 2441 | Mid | Internal | | | | -5.1 | | | | | |
| 7/30/04 | PCS GSM | 1 Slot | 1880.0 | 661 | Stubby | Aluminum Case | Left Ear | Cheek/Touch | 30.1 | -0.154 | P | 0.180 | P | 0.186 |
| | | | | | | | | | | | S | 0.130 | S | 0.135 |
| 7/30/04 | PCS GSM | 1 Slot | 1909.8 | 810 | Stubby | Aluminum Case | Left Ear | Ear/Tilt (15°) | 29.7 | -0.0360 | 0.256 | | 0.258 | |

**ANSI / IEEE C95.1 1999 - SAFETY LIMIT**
**BRAIN: 1.6 W/kg (averaged over 1 gram)**
**Spatial Peak - Uncontrolled Exposure / General Population**

| Test Date(s) | July 29, 2004 | | | July 30, 2004 | | | Test Date(s) | July 29, 2004 | July 30, 2004 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| Measured Fluid Type | 1880 MHz Brain | | | 1880 MHz Brain | | | Relative Humidity | 41 | 39 | % |
| Dielectric Constant $\varepsilon_r$ | IEEE Target | | Measured | IEEE Target | | Measured | Atmospheric Pressure | 101.7 | 101.9 | kPa |
| | 40.0 | ± 5% | 38.1 | 40.0 | ± 5% | 38.1 | Ambient Temperature | 24.5 | 24.8 | °C |
| Conductivity σ (mho/m) | 1880 MHz Brain | | | 1880 MHz Brain | | | Fluid Temperature | 23.5 | 23.0 | °C |
| | IEEE Target | | Measured | IEEE Target | | Measured | Fluid Depth | ≥ 15 | ≥ 15 | cm |
| | 1.40 | ± 5% | 1.39 | 1.40 | ± 5% | 1.40 | ρ (Kg/m$^3$) | 1000 | | |

Note(s):

1. The measurement results were obtained with the DUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
2. If the SAR levels measured at the mid channel were ≥ 3 dB below the SAR limit, SAR evaluation for the low and high channels was optional (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).
3. The power drifts measured by the DASY4 system were within 5% of the start power and were subsequently added to the measured SAR levels to report scaled SAR results as shown in the above table.
4. Secondary peak SAR levels within 2 dB of the primary were reported (P = Primary, S = Secondary).
5. A co-located transmit test was performed with the GSM and Bluetooth transmitting simultaneously in the worst-case single-transmit PCS GSM configuration as shown in the above table. The Bluetooth transmitter was tested at maximum power setting with a modulated signal on a fixed frequency and the frequency hopping disabled.
6. The DUT was evaluated inside the Aluminum Case accessory for the worst-case Touch and Tilt positions evaluated without the accessory.
7. The DUT was tested with a fully charged Lithium-ion battery.
8. The SAR measurements were performed within 24 hours of the system performance check.

# MEASUREMENT SUMMARY (Cont.)

## BODY-WORN SAR EVALUATION RESULTS (Cellular GPRS Data Mode)

| Test Mode | | Freq. (MHz) | Chan. | Antenna Type | Body-worn Accessories | DUT Position to Planar Phantom | Separation Distance to Planar Phantom (cm) | Cond. Power Before Test (dBm) | SAR Drift During Test (dB) | Measured SAR 1g (W/kg) | Scaled SAR 1g (W/kg) by drift |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cellular GPRS | 2 Slots | 836.6 | 190 | Stubby | Side Case with Belt-Clip and Ear-Mic | Front Side | 1.4 | 32.1 | -0.102 | 1.43 | 1.46 |
| Cellular GPRS | 2 Slots | 824.2 | 128 | Stubby | Side Case with Belt-Clip and Ear-Mic | Front Side | 1.4 | 31.9 | -0.155 | 1.26 | 1.31 |
| Cellular GPRS | 2 Slots | 848.8 | 251 | Stubby | Side Case with Belt-Clip and Ear-Mic | Front Side | 1.4 | 32.2 | -0.0230 | 1.36 | 1.37 |
| Cellular GPRS | 2 Slots | 836.6 | 190 | Stubby | Air Gap Spacing with Ear-Mic | Front Side | 1.5 | 32.1 | -0.161 | 1.12 | 1.16 |
| Cellular GPRS | 2 Slots | 824.2 | 128 | Stubby | Air Gap Spacing with Ear-Mic | Front Side | 1.5 | 31.9 | -0.0144 | 0.607 | 0.609 |
| Cellular GPRS | 2 Slots | 848.8 | 251 | Stubby | Air Gap Spacing with Ear-Mic | Front Side | 1.5 | 32.2 | -0.115 | 0.747 | 0.767 |
| Cellular GPRS | 2 Slots | 836.6 | 190 | Stubby | Air Gap Spacing with Ear-Mic | Back Side | 1.5 | 32.1 | -0.101 | 0.882 | 0.903 |
| Cellular GPRS | 2 Slots | 824.2 | 128 | Stubby | Air Gap Spacing with Ear-Mic | Back Side | 1.5 | 31.9 | -0.129 | 0.853 | 0.879 |
| Cellular GPRS | 2 Slots | 848.8 | 251 | Stubby | Air Gap Spacing with Ear-Mic | Back Side | 1.5 | 32.2 | -0.0346 | 0.952 | 0.960 |
| Cellular GPRS | 2 Slots | 836.6 | 190 | Stubby | Fitted Pouch with Belt-Clip and Ear-Mic | Back Side | 2.5 | 32.1 | -0.116 | 0.592 | 0.608 |
| Cellular GPRS | 2 Slots | 836.6 | 190 | Stubby | Aluminum Case with Belt-Clip and Ear-Mic | Back Side | 2.5 | 32.1 | -0.120 | 0.383 | 0.394 |
| Cellular GPRS | 2 Slots | 836.6 | 190 | Stubby | Side Case with Belt-Clip and Ear-Mic | Front Side | 1.4 | 32.1 | -0.101 | 1.41 | 1.44 |
| Bluetooth - Modulated Fixed Frequency | | 2441 | Mid | Internal | | | | -5.1 | | | |

**ANSI / IEEE C95.1 1999 - SAFETY LIMIT**
**BODY: 1.6 W/kg (averaged over 1 gram)**
**Spatial Peak - Uncontrolled Exposure / General Population**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Test Date(s)** | July 31, 2004 | | | **Relative Humidity** | 37 | **%** |
| **Measured Fluid Type** | **835 MHz Body** | | | **Atmospheric Pressure** | 101.5 | **kPa** |
| **Dielectric Constant** $\varepsilon_r$ | **IEEE Target** | | **Measured** | **Ambient Temperature** | 24.3 | **°C** |
| | **55.2** | **± 5%** | 54.1 | **Fluid Temperature** | 23.3 | **°C** |
| **Conductivity** σ (mho/m) | **IEEE Target** | | **Measured** | **Fluid Depth** | ≥ 15 | **cm** |
| | **0.97** | **± 5%** | 1.00 | **ρ (Kg/m³)** | 1000 | |

Note(s):

3. The measurement results were obtained with the DUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
4. If the SAR levels measured at the mid channel were ≥ 3 dB below the SAR limit, SAR evaluation for the low and high channels was optional (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).
5. The power drifts measured by the DASY4 system were within 5% of the start power and were subsequently added to the measured SAR levels to report scaled SAR results as shown in the above table.
6. A co-located transmit test was performed with the GPRS and Bluetooth transmitting simultaneously in the worst-case single-transmit Cellular GPRS configuration as shown in the above table. The Bluetooth transmitter was tested at maximum power setting with a modulated signal on a fixed frequency and the frequency hopping disabled.
7. The DUT was tested with a fully charged Lithium-ion battery.
8. The SAR measurements were performed within 24 hours of the system performance check.

## MEASUREMENT SUMMARY (Cont.)

### BODY-WORN SAR EVALUATION RESULTS (PCS GPRS Data Mode)

| Test Mode | | Freq. (MHz) | Chan. | Antenna Type | Body-worn Accessories | DUT Position to Planar Phantom | Separation Distance to Planar Phantom (cm) | Cond. Power Before Test (dBm) | SAR Drift During Test (dB) | Measured SAR 1g (W/kg) | | Scaled SAR 1g (W/kg) by drift | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PCS GPRS | 2 Slots | 1880.0 | 661 | Stubby | Side Case with Belt-Clip and Ear-Mic | Front Side | 1.4 | 30.1 | 0.161 | P | 0.450 | P | 0.450 |
| | | | | | | | | | | S | 0.389 | S | 0.389 |
| PCS GPRS | 2 Slots | 1880.0 | 661 | Stubby | Air Gap Spacing with Ear-Mic | Front Side | 1.5 | 30.1 | -0.0927 | 0.533 | | 0.544 | |
| PCS GPRS | 2 Slots | 1880.0 | 661 | Stubby | Air Gap Spacing with Ear-Mic | Back Side | 1.5 | 30.1 | -0.129 | 0.628 | | 0.647 | |
| PCS GPRS | 2 Slots | 1880.0 | 661 | Stubby | Fitted Pouch with Belt-Clip and Ear-Mic | Back Side | 2.5 | 30.1 | -0.124 | 0.312 | | 0.321 | |
| PCS GPRS | 2 Slots | 1880.0 | 661 | Stubby | Aluminum Case with Belt-Clip and Ear-Mic | Back Side | 2.5 | 30.1 | 0.115 | 0.0960 | | 0.0960 | |
| PCS GPRS | 2 Slots | 1880.0 | 661 | Stubby | Air Gap Spacing with Ear-Mic | Back Side | 1.5 | 30.1 | -0.168 | 0.662 | | 0.688 | |
| Bluetooth - Modulated Fixed Frequency | | 2441 | Mid | Internal | | | | -5.1 | | | | | |

**ANSI / IEEE C95.1 1999 - SAFETY LIMIT**
**BODY: 1.6 W/kg (averaged over 1 gram)**
**Spatial Peak - Uncontrolled Exposure / General Population**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Test Date(s)** | August 03, 2004 | | | **Relative Humidity** | 40 | **%** |
| **Measured Fluid Type** | **1880 MHz Body** | | | **Atmospheric Pressure** | 102.1 | **kPa** |
| **Dielectric Constant** $\varepsilon_r$ | **IEEE Target** | | **Measured** | **Ambient Temperature** | 23.9 | **°C** |
| | **53.3** | **± 5%** | 52.0 | **Fluid Temperature** | 23.1 | **°C** |
| **Conductivity** $\sigma$ **(mho/m)** | **IEEE Target** | | **Measured** | **Fluid Depth** | ≥ 15 | **cm** |
| | **1.52** | **± 5%** | 1.55 | **$\rho$ (Kg/m$^3$)** | 1000 | |

Note(s):

1. The measurement results were obtained with the DUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
2. If the SAR levels measured at the mid channel were ≥ 3 dB below the SAR limit, SAR evaluation for the low and high channels was optional (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).
3. The power drifts measured by the DASY4 system were within 5% of the start power and were subsequently added to the measured SAR levels to report scaled SAR results as shown in the above table.
4. Secondary peak SAR levels within 2 dB of the primary were reported (P = Primary, S = Secondary).
5. A co-located transmit test was performed with the GPRS and Bluetooth transmitting simultaneously in the worst-case single-transmit PCS GPRS configuration as shown in the above table. The Bluetooth transmitter was tested at maximum power setting with a modulated signal on a fixed frequency and the frequency hopping disabled.
6. The DUT was tested with a fully charged Lithium-ion battery.
7. The SAR measurements were performed within 24 hours of the system performance check.

# 5.0 DETAILS OF SAR EVALUATION

The palmOne Model: Treo 650 Dual-Band PCS/Cellular GSM/GPRS Phone (with internal co-located Broadcom BCM-2035 Bluetooth Transmitter) FCC ID: O8FCAGEMS was compliant for localized Specific Absorption Rate (SAR) based on the test provisions and conditions described below. The detailed test setup photographs are shown in Appendix G.

**Ear-held Configuration**

1) The DUT was tested in an ear-held configuration on both the left and right sections of the SAM phantom at the mid channel of the operating band. If the SAR level measured at the mid channel of the frequency band for each test configuration (left ear, right ear, cheek/touch, ear/tilt) was ≥ 3 dB below the SAR limit, measurements at the low and high channels were optional (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).

a) The handset was placed in the device holder in a normal operating position with the test device reference point located along the vertical centerline on the front of the device aligned to the ear reference point, with the center of the earpiece touching the center of the ear spacer of the SAM phantom.

b) With the handset positioned parallel to the cheek, the test device reference point was aligned to the ear reference point on the head phantom, and the vertical centerline was aligned to the phantom reference plane (initial ear position).

c) While maintaining the three alignments, the body of the handset was gradually adjusted to each of the following test positions:

- Cheek/Touch Position: the handset was brought toward the mouth of the head phantom by pivoting against the ear reference point until any point of the mouthpiece or keypad touched the phantom.

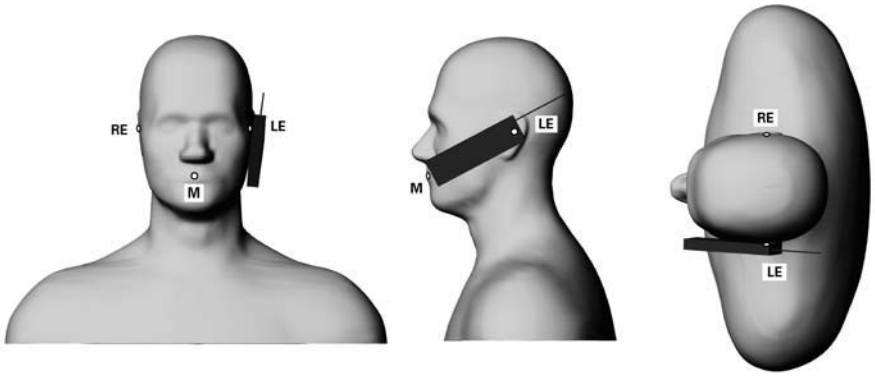



**Figure 1. Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated (Shoulders are shown for illustration only).**

- Ear/Tilt Position: With the phone aligned in the Cheek/Touch position, the handset was tilted away from the mouth with respect to the test device reference point by 15 degrees.

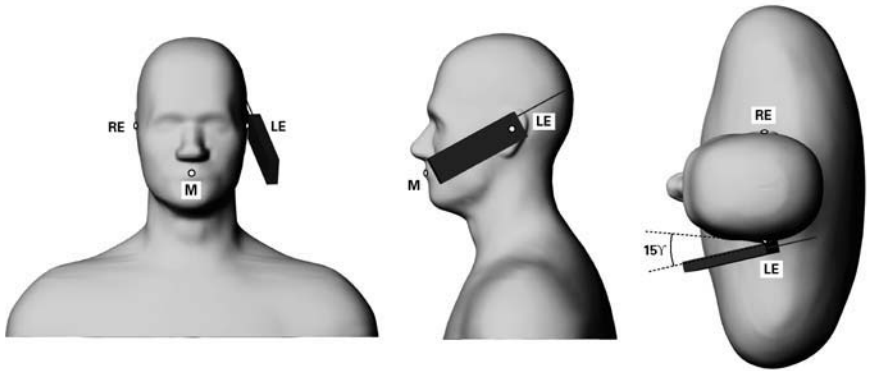



**Figure 2. Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated (Shoulders are shown for illustration only).**

## DETAILS OF SAR EVALUATION (Cont.)

2) The DUT was tested in an ear-held configuration with the Aluminum Case accessory in the worst-case Cheek/Touch and Ear/Tilt positions for both the PCS and Cellular bands.
3) Co-located transmit tests were performed with the GSM and Bluetooth transmitting simultaneously in the worst-case single-transmit configuration for both the PCS and Cellular GSM bands.

**Body-worn Configuration**

4) The DUT was tested in a body-worn configuration placed inside the Leather Side Case with Belt-Clip accessory (SKU#3180WW). The front side of the DUT (keypad side) was placed facing parallel to the outer surface of the SAM phantom (planar section) with the attached belt-clip accessory touching the phantom surface (the leather side case accessory is designed so that the DUT is positioned with the keypad side facing the user's body). The leather side case with belt-clip accessory provided a 1.4 cm separation distance between the front side of the DUT (keypad side) and the outer surface of the SAM phantom (planar section). A generic ear-microphone accessory was connected to the DUT for the duration of the tests.
5) The DUT was tested in a body-worn configuration placed inside the Fitted Leather Pouch with Swivel Belt-Clip accessory (SKU#3179WW). The back side of the DUT was placed facing parallel to the outer surface of the SAM phantom (planar section) with the attached belt-clip accessory touching the phantom surface (the fitted leather pouch accessory is designed so that the DUT is positioned with the back side facing the user's body). The fitted leather pouch with swivel belt-clip accessory provided a 2.5 cm separation distance between the back side of the DUT and the outer surface of the SAM phantom (planar section). A generic ear-microphone accessory was connected to the DUT for the duration of the tests.
6) The DUT was tested in a body-worn configuration placed inside the Aluminum Case with Swivel Belt-Clip accessory (SKU#3202WW). The back side of the DUT was placed facing parallel to the outer surface of the SAM phantom (planar section) with the attached belt-clip accessory touching the phantom surface (the aluminum case accessory is designed so that the DUT is positioned with the back side facing the user's body). The aluminum case with swivel belt-clip accessory provided a 2.5 cm separation distance between the back side of the DUT and the outer surface of the SAM phantom (planar section). A generic ear-microphone accessory was connected to the DUT for the duration of the tests.
7) The DUT was tested in a body-worn configuration with an "air gap" spacing of 1.5 cm between the front side (keypad side) and the outer surface of the SAM phantom (planar section). The DUT was also tested with an "air gap" spacing of 1.5 cm between the back side and the outer surface of the SAM phantom (planar section). No body-worn accessories were used with the DUT in the "air gap" spacing configurations (except generic ear-microphone accessory connected) for the purpose that the option of generic body-worn holster/case accessories that do not contain any metallic components and provide a minimum separation distance of 1.5 cm between the phone and the user's body could be used.
8) Co-located transmit tests were performed with both GPRS and Bluetooth transmitting simultaneously in the worst-case single-transmit configuration for both the PCS and Cellular GPRS bands.
9) The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter checks and the SAR evaluations. The temperatures reported were consistent for all measurement periods.
10) The dielectric properties of the simulated tissue mixtures were measured prior to the SAR evaluation using an HP 85070C Dielectric Probe Kit and an HP 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters).
11) The SAR measurements were performed within 24 hours of the system performance check.

**DUT Test Modes & Power Settings**

12) The DUT was placed in test mode using a base station simulator (Wavetek 4202S). SAR measurements were performed with the DUT transmitting at maximum power in 1 time slot for GSM voice mode (crest factor: 8.3), and in 2 time slots for GPRS data mode (Crest factor: 4.16). The Bluetooth transmitter was tested at maximum power setting with a modulated signal on a fixed frequency and the frequency hopping disabled.
13) The conducted power levels were measured prior to each test according to the procedures described in FCC 47 CFR §2.1046 using a Gigatronics 8652A Universal Power Meter.
14) The power drifts measured by the DASY4 system were within 5% of the start power and were subsequently added to the measured SAR levels to report scaled SAR results as shown in the test data tables.
15) The DUT was tested with a fully charged Lithium-ion battery.

## 6.0 EVALUATION PROCEDURES

a. (i) The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For devices held to the ear during normal operation, both the left and right ear positions were evaluated using the SAM phantom.
(ii) For body-worn and face-held devices a planar phantom was used.

b. The SAR was determined by a pre-defined procedure within the DASY4 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 15mm x 15mm.

An area scan was determined as follows:

c. Based on the defined area scan grid, a more detailed grid is created to increase the points by a factor of 10. The interpolation function then evaluates all field values between corresponding measurement points.

d. A linear search is applied to find all the candidate maxima. Subsequently, all maxima are removed that are >2 dB from the global maximum. The remaining maxima are then used to position the cube scans.

A 1g and 10g spatial peak SAR was determined as follows:

e. Extrapolation is used to find the points between the dipole center of the probe and the surface of the phantom. This data cannot be measured, since the center of the dipoles is 2.7 mm away form the tip of the probe and the distance between the surface and the lowest measuring point is 1.4 mm (see probe calibration document in Appendix D). The extrapolation was based on trivariate quadratics computed from the previously calculated 3D interpolated points nearest the phantom surface.

f. Interpolated data is used to calculate the average SAR over 1g and 10g cubes by spatially discretizing the entire measured cube. The volume used to determine the averaged SAR is a 1mm grid (42875 interpolated points).

g. A zoom scan volume of 32 mm x 32 mm x 30 mm (5x5x7 points) centered at the peak SAR location determined from the area scan is used for all zoom scans for devices with a transmit frequency < 800 MHz. Zoom scans for frequencies ≥ 800 MHz are determined with a scan volume of 30 mm x 30 mm x 30 mm (7x7x7 points) to ensure complete capture of the peak spatial-average SAR.

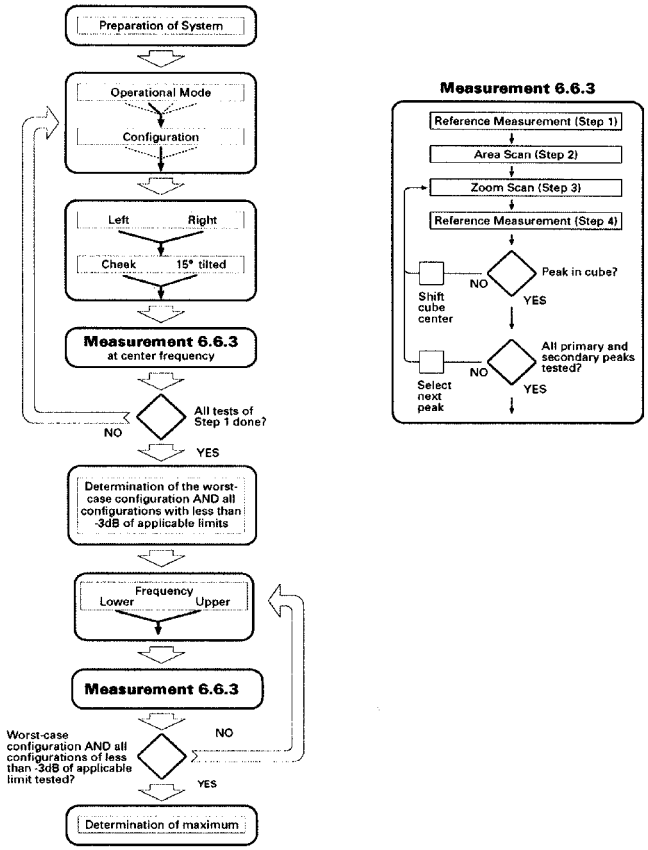



**Figure 3. Flow Chart for determining the largest peak spatial-average SAR from all device configurations per IEEE Standard 1528-2003 (see reference [5]).**

# 7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluations a system check was performed at the planar section of the SAM phantom with an 835MHz dipole and a 1900MHz dipole (see Appendix C for system validation procedures). The dielectric parameters of the simulated brain tissue mixture were measured prior to the system performance check using an HP 85070C Dielectric Probe Kit and an HP 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters). A forward power of 250mW was applied to the dipole and the system was verified to a tolerance of ±10% (see Appendix B for system performance check test plots).

**SYSTEM PERFORMANCE CHECK**

| Test Date | Brain Mixture | SAR 1g (W/kg) | | Dielectric Constant $\varepsilon_r$ | | Conductivity σ (mho/m) | | ρ (Kg/m$^3$) | Amb. Temp. (°C) | Fluid Temp. (°C) | Fluid Depth (cm) | Humid. (%) | Barom. Press. (kPa) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Freq. (MHz) | IEEE Target | Measured | IEEE Target | Measured | IEEE Target | Measured | | | | | | |
| 07/28/04 | **835** | **2.38 ±10%** | 2.51 (+5.5%) | **41.5 ±5%** | 40.5 | **0.90 ±5%** | 0.90 | 1000 | 23.8 | 23.6 | ≥ 15 | 43 | 102.2 |
| 07/29/04 | **1900** | **9.93 ±10%** | 10.3 (+3.7%) | **40.0 ±5%** | 38.1 | **1.40 ±5%** | 1.41 | 1000 | 24.6 | 23.5 | ≥ 15 | 42 | 101.8 |
| 07/31/04 | **835** | **2.38 ±10%** | 2.50 (+5.0%) | **41.5 ±5%** | 41.0 | **0.90 ±5%** | 0.92 | 1000 | 24.0 | 23.5 | ≥ 15 | 39 | 101.9 |
| 08/03/04 | **1900** | **9.93 ±10%** | 10.3 (+3.7%) | **40.0 ±5%** | 38.2 | **1.40 ±5%** | 1.41 | 1000 | 24.4 | 22.9 | ≥ 15 | 36 | 101.5 |

Note(s):
1. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the system performance check. The temperatures listed in the table above were consistent for all measurement periods.

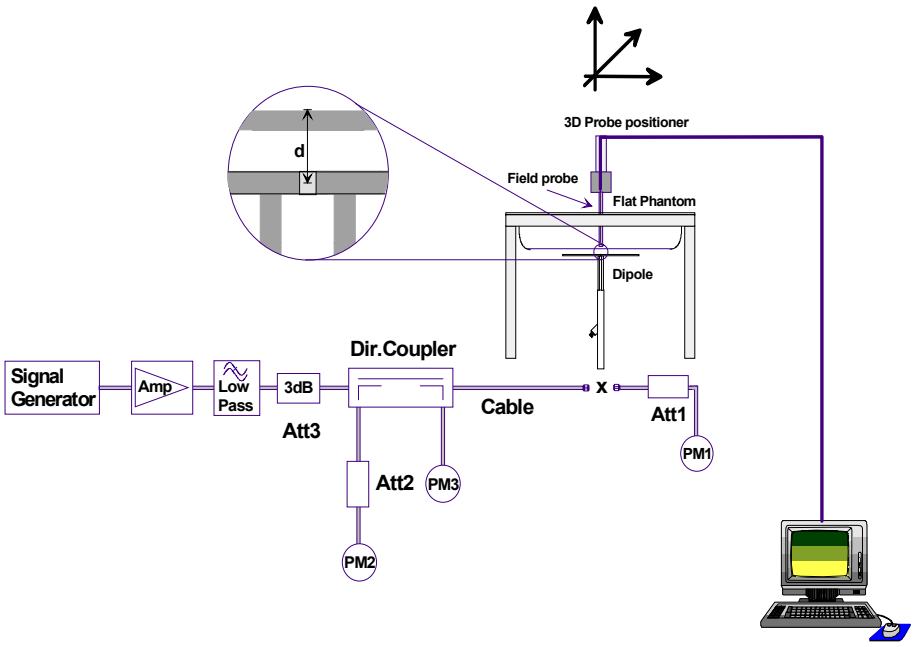



**Figure 4. System Performance Check Setup Diagram**

**1900MHz Dipole Setup**

**835MHz Dipole Setup**

## 8.0 SIMULATED EQUIVALENT TISSUES

The 1880/1900MHz simulated equivalent tissue mixtures consist of Glycol-monobutyl, water, and salt. The 835MHz simulated tissue mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution. Preservation with a bactericide was added and visual inspection was made to ensure air bubbles were not trapped during the mixing process. The fluids were prepared according to standardized procedures and measured for dielectric parameters (permittivity and conductivity).

| 1880/1900MHz TISSUE MIXTURES | | | |
|---|---|---|---|
| INGREDIENT | 1900MHz Brain | 1880MHz Brain | 1880MHz Body |
| | System Check | DUT Evaluation | DUT Evaluation |
| Water | 55.85 % | 55.85 % | 69.85 % |
| Glycol Monobutyl | 44.00 % | 44.00 % | 29.89 % |
| Salt | 0.15 % | 0.15 % | 0.26 % |

| 835MHz TISSUE MIXTURES | | |
|---|---|---|
| INGREDIENT | 835MHz Brain | 835MHz Body |
| | System Check & DUT Evaluation | DUT Evaluation |
| Water | 40.71 % | 53.79 % |
| Sugar | 56.63 % | 45.13 % |
| Salt | 1.48 % | 0.98 % |
| HEC | 0.99 % | -- |
| Bactericide | 0.19 % | 0.10 % |

## 9.0 SAR SAFETY LIMITS

| EXPOSURE LIMITS | SAR (W/kg) | |
|---|---|---|
| | (General Population / Uncontrolled Exposure Environment) | (Occupational / Controlled Exposure Environment) |
| Spatial Average (averaged over the whole body) | 0.08 | 0.4 |
| Spatial Peak (averaged over any 1 g of tissue) | 1.60 | 8.0 |
| Spatial Peak (hands/wrists/feet/ankles averaged over 10 g) | 4.0 | 20.0 |

Notes:
1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

# 10.0 ROBOT SYSTEM SPECIFICATIONS

**Specifications**

**POSITIONER:** Stäubli Unimation Corp. Robot Model: RX60L
**Repeatability:** 0.02 mm
**No. of axis:** 6

**Data Acquisition Electronic (DAE) System**

**Cell Controller**
**Processor:** AMD Athlon XP 2400+
**Clock Speed:** 2.0 GHz
**Operating System:** Windows XP Professional

**Data Converter**
**Features:** Signal Amplifier, multiplexer, A/D converter, and control logic
**Software:** DASY4 software
**Connecting Lines:** Optical downlink for data and status info.
Optical uplink for commands and clock

**DASY4 Measurement Server**

**Function:** Real-time data evaluation for field measurements and surface detection
**Hardware:** PC/104 166MHz Pentium CPU; 32 MB chipdisk; 64 MB RAM
**Connections:** COM1, COM2, DAE, Robot, Ethernet, Service Interface

**E-Field Probe**

**Model:** ET3DV6
**Serial No.:** 1590
**Construction:** Triangular core fiber optic detection system
**Frequency:** 10 MHz to 6 GHz
**Linearity:** ±0.2 dB (30 MHz to 3 GHz)

**Phantom(s)**

**Type:** SAM V4.0C
**Shell Material:** Fiberglas
**Thickness:** 2.0 ±0.1 mm
**Volume:** Approx. 20 liters

## 11.0 PROBE SPECIFICATION (ET3DV6)

| | |
| --- | --- |
| Construction: | Symmetrical design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g. glycol) |
| Calibration: | In air from 10 MHz to 2.5 GHz<br>In brain simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy ± 8%) |
| Frequency: | 10 MHz to >6 GHz; Linearity: ±0.2 dB (30 MHz to 3 GHz) |
| Directivity: | ±0.2 dB in brain tissue (rotation around probe axis)<br>±0.4 dB in brain tissue (rotation normal to probe axis) |
| Dynamic Range: | 5 μW/g to >100 mW/g; Linearity: ±0.2 dB |
| Surface Detection | ±0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces |
| Dimensions: | Overall length: 330 mm<br>Tip length: 16 mm<br>Body diameter: 12 mm<br>Tip diameter: 6.8 mm<br>Distance from probe tip to dipole centers: 2.7 mm |
| Application: | General dosimetry up to 3 GHz<br>Compliance tests of portable phone |

**ET3DV6 E-Field Probe**

## 12.0 SAM PHANTOM V4.0C

The SAM phantom V4.0C is a fiberglass shell phantom with a 2.0 mm (+/-0.2 mm) shell thickness for left and right head and flat planar area integrated in a wooden table. The shape of the fiberglass shell corresponds to the phantom defined by SCC34-SC2. The device holder positions are adjusted to the standard measurement positions in the three sections (see Appendix F for specifications of the SAM phantom V4.0C).

**SAM Phantom V4.0C**

## 13.0 DEVICE HOLDER

The DASY4 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.

**Device Holder**

# 14.0 TEST EQUIPMENT LIST

| TEST EQUIPMENT | SERIAL NO. | CALIBRATION DATE |
|---|---|---|
| Schmid & Partner DASY4 System | - | - |
| -DASY4 Measurement Server | 1078 | N/A |
| -Robot | 599396-01 | N/A |
| -DAE3 | 353 | Dec 2003 |
| -DAE3 | 370 | May 2004 |
| -ET3DV6 E-Field Probe | 1387 | Mar 2004 |
| -ET3DV6 E-Field Probe | 1590 | May 2004 |
| -300MHz Validation Dipole | 135 | Oct 2003 |
| -450MHz Validation Dipole | 136 | Nov 2003 |
| -835MHz Validation Dipole | 411 | Mar 2004 |
| -900MHz Validation Dipole | 054 | June 2004 |
| -1800MHz Validation Dipole | 247 | June 2004 |
| -1900MHz Validation Dipole | 151 | June 2004 |
| -2450MHz Validation Dipole | 150 | Sept 2003 |
| -SAM Phantom V4.0C | 1033 | N/A |
| -Barski Planar Phantom | 03-01 | N/A |
| -Plexiglas Planar Phantom | 161 | N/A |
| -Validation Planar Phantom | 137 | N/A |
| HP 85070C Dielectric Probe Kit | N/A | N/A |
| Gigatronics 8651A Power Meter | 8650137 | April 2004 |
| Gigatronics 8652A Power Meter | 1835267 | April 2004 |
| Gigatronics 80701A Power Sensor | 1833535 | April 2004 |
| Gigatronics 80701A Power Sensor | 1833542 | April 2004 |
| Gigatronics 80701A Power Sensor | 1834350 | April 2004 |
| HP E4408B Spectrum Analyzer | US39240170 | Dec 2003 |
| HP 8594E Spectrum Analyzer | 3543A02721 | April 2004 |
| HP 8753E Network Analyzer | US38433013 | April 2004 |
| HP 8648D Signal Generator | 3847A00611 | April 2004 |
| Amplifier Research 5S1G4 Power Amplifier | 26235 | N/A |
| Will'Tek Wavetek 4202S GSM/GPRS Test Set | 0313573 | July 2004 |

# 15.0 MEASUREMENT UNCERTAINTIES

| UNCERTAINTY BUDGET FOR DEVICE EVALUATION | | | | | | |
|---|---|---|---|---|---|---|
| **Error Description** | **Uncertainty Value ±%** | **Probability Distribution** | **Divisor** | **$c_i$ 1g** | **Standard Uncertainty ±% (1g)** | **$v_i$ or $v_{eff}$** |
| **Measurement System** | | | | | | |
| Probe calibration (835 MHz) | ± 5.95 | Normal | 1 | 1 | ± 5.95 | ∞ |
| Probe calibration (1900 MHz) | ± 4.85 | Normal | 1 | 1 | ± 4.85 | ∞ |
| Axial isotropy of the probe | ± 4.7 | Rectangular | √3 | $(1-c_p)$ | ± 1.9 | ∞ |
| Spherical isotropy of the probe | ± 9.6 | Rectangular | √3 | $(c_p)$ | ± 3.9 | ∞ |
| Spatial resolution | ± 0.0 | Rectangular | √3 | 1 | ± 0.0 | ∞ |
| Boundary effects | ± 5.5 | Rectangular | √3 | 1 | ± 3.2 | ∞ |
| Probe linearity | ± 4.7 | Rectangular | √3 | 1 | ± 2.7 | ∞ |
| Detection limit | ± 1.0 | Rectangular | √3 | 1 | ± 0.6 | ∞ |
| Readout electronics | ± 1.0 | Normal | 1 | 1 | ± 1.0 | ∞ |
| Response time | ± 0.8 | Rectangular | √3 | 1 | ± 0.5 | ∞ |
| Integration time | ± 1.4 | Rectangular | √3 | 1 | ± 0.8 | ∞ |
| RF ambient conditions | ± 3.0 | Rectangular | √3 | 1 | ± 1.7 | ∞ |
| Mech. constraints of robot | ± 0.4 | Rectangular | √3 | 1 | ± 0.2 | ∞ |
| Probe positioning | ± 2.9 | Rectangular | √3 | 1 | ± 1.7 | ∞ |
| Extrapolation & integration | ± 3.9 | Rectangular | √3 | 1 | ± 2.3 | ∞ |
| **Test Sample Related** | | | | | | |
| Device positioning | ± 6.0 | Normal | √3 | 1 | ± 6.7 | 12 |
| Device holder uncertainty | ± 5.0 | Normal | √3 | 1 | ± 5.9 | 8 |
| Power drift | ± 5.0 | Rectangular | √3 | | ± 2.9 | ∞ |
| **Phantom and Setup** | | | | | | |
| Phantom uncertainty | ± 4.0 | Rectangular | √3 | 1 | ± 2.3 | ∞ |
| Liquid conductivity (target) | ± 5.0 | Rectangular | √3 | 0.6 | ± 1.7 | ∞ |
| Liquid conductivity (measured) | ± 5.0 | Rectangular | √3 | 0.6 | ± 1.7 | ∞ |
| Liquid permittivity (target) | ± 5.0 | Rectangular | √3 | 0.6 | ± 1.7 | ∞ |
| Liquid permittivity (measured) | ± 5.0 | Rectangular | √3 | 0.6 | ± 1.7 | ∞ |
| | | | | | | |
| **Combined Standard Uncertainty** | | | | | | |
| **835 MHz** | | | | | **± 13.76** | |
| **1900 MHz** | | | | | **± 13.32** | |
| **Expanded Uncertainty (k=2)** | | | | | | |
| **835 MHz** | | | | | **± 27.51** | |
| **1900 MHz** | | | | | **± 26.64** | |

**Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 (see reference [5])**

# MEASUREMENT UNCERTAINTIES (Cont.)

| UNCERTAINTY BUDGET FOR SYSTEM VALIDATION | | | | | | |
|---|---|---|---|---|---|---|
| **Error Description** | **Uncertainty Value ±%** | **Probability Distribution** | **Divisor** | **$c_i$ 1g** | **Standard Uncertainty ±% (1g)** | **$v_i$ or $v_{eff}$** |
| **Measurement System** | | | | | | |
| Probe calibration (835 MHz) | ± 5.95 | Normal | 1 | 1 | ± 5.95 | ∞ |
| Probe calibration (1900 MHz) | ± 4.85 | Normal | 1 | 1 | ± 4.85 | ∞ |
| Axial isotropy of the probe | ± 4.7 | Rectangular | √3 | $(1-c_p)$ | ± 1.9 | ∞ |
| Spherical isotropy of the probe | ± 9.6 | Rectangular | √3 | $(c_p)$ | ± 3.9 | ∞ |
| Spatial resolution | ± 0.0 | Rectangular | √3 | 1 | ± 0.0 | ∞ |
| Boundary effects | ± 5.5 | Rectangular | √3 | 1 | ± 3.2 | ∞ |
| Probe linearity | ± 4.7 | Rectangular | √3 | 1 | ± 2.7 | ∞ |
| Detection limit | ± 1.0 | Rectangular | √3 | 1 | ± 0.6 | ∞ |
| Readout electronics | ± 1.0 | Normal | 1 | 1 | ± 1.0 | ∞ |
| Response time | ± 0.8 | Rectangular | √3 | 1 | ± 0.5 | ∞ |
| Integration time | ± 1.4 | Rectangular | √3 | 1 | ± 0.8 | ∞ |
| RF ambient conditions | ± 3.0 | Rectangular | √3 | 1 | ± 1.7 | ∞ |
| Mech. constraints of robot | ± 0.4 | Rectangular | √3 | 1 | ± 0.2 | ∞ |
| Probe positioning | ± 2.9 | Rectangular | √3 | 1 | ± 1.7 | ∞ |
| Extrapolation & integration | ± 3.9 | Rectangular | √3 | 1 | ± 2.3 | ∞ |
| **Dipole** | | | | | | |
| Dipole Axis to Liquid Distance | ± 2.0 | Rectangular | √3 | 1 | ± 1.2 | ∞ |
| Input Power | ± 4.7 | Rectangular | √3 | 1 | ± 2.7 | ∞ |
| **Phantom and Setup** | | | | | | |
| Phantom uncertainty | ± 4.0 | Rectangular | √3 | 1 | ± 2.3 | ∞ |
| Liquid conductivity (target) | ± 5.0 | Rectangular | √3 | 0.6 | ± 1.7 | ∞ |
| Liquid conductivity (measured) | ± 5.0 | Rectangular | √3 | 0.6 | ± 1.7 | ∞ |
| Liquid permittivity (target) | ± 5.0 | Rectangular | √3 | 0.6 | ± 1.7 | ∞ |
| Liquid permittivity (measured) | ± 5.0 | Rectangular | √3 | 0.6 | ± 1.7 | ∞ |
| | | | | | | |
| **Combined Standard Uncertainty** | | | | | | |
| **835 MHz** | | | | | **± 10.54** | |
| **1900 MHz** | | | | | **± 9.97** | |
| **Expanded Uncertainty (k=2)** | | | | | | |
| **835 MHz** | | | | | **± 21.09** | |
| **1900 MHz** | | | | | **± 19.93** | |

**Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 (see reference [5])**

# 16.0 REFERENCES

[1] Federal Communications Commission, “Radiofrequency radiation exposure evaluation: portable devices”, Rule Part 47 CFR §2.1093: 1999.

[2] Health Canada, “Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz”, Safety Code 6.

[3] Federal Communications Commission, “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields”, OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.

[4] Industry Canada, “Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada’s Safety Code 6 for Exposure of Humans to Radio Frequency Fields”, Radio Standards Specification RSS-102 Issue 1 (Provisional): September 1999.

[5] IEEE Std 1528-2003, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”.

# APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 07/28/04

## System Performance Check - 835 MHz Dipole

**DUT: Dipole 835 MHz; Model: D835V2; Type: System Performance Check; Serial: 411; Calibrated: 03/16/2004**

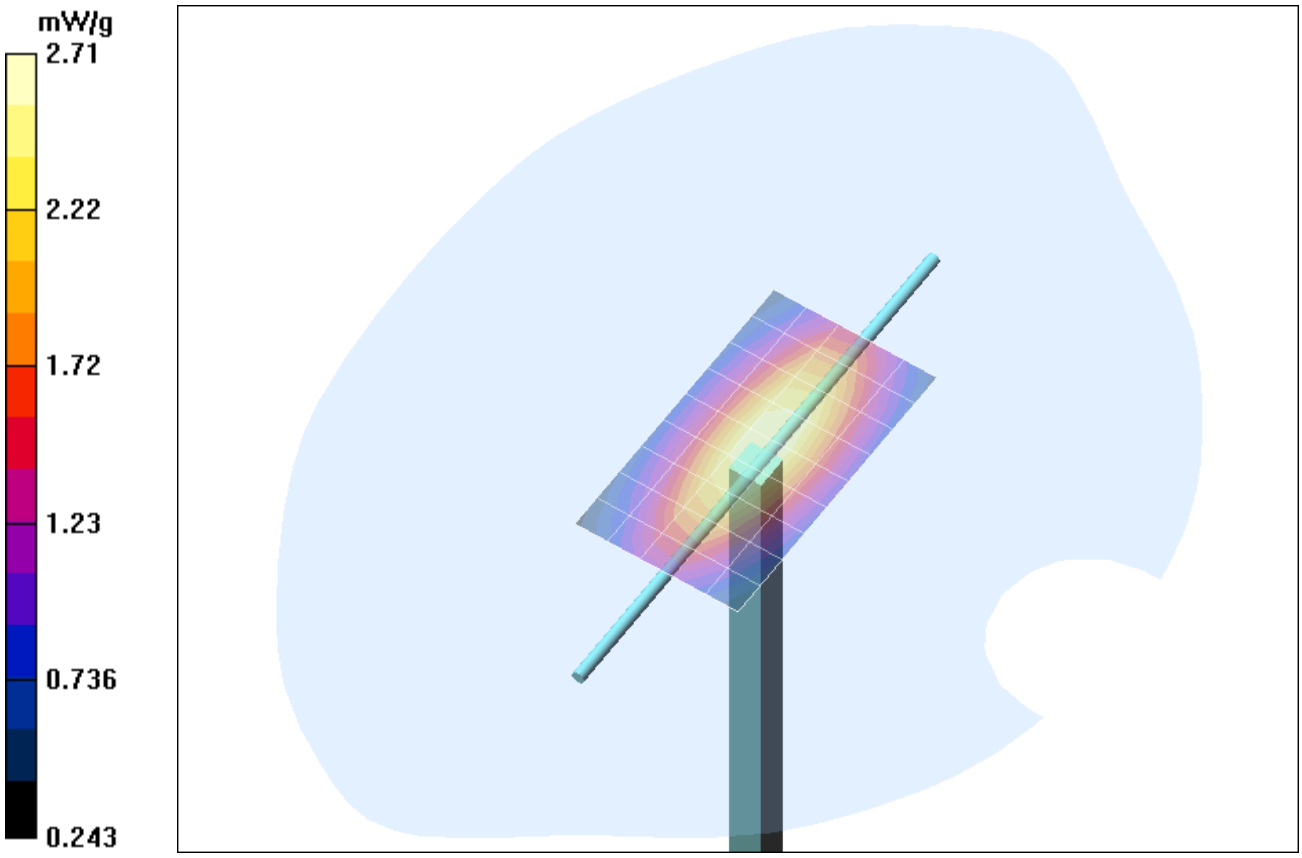
Ambient Temp: 23.8 °C; Fluid Temp: 23.6 °C; Barometric Pressure: 102.2 kPa; Humidity: 43%

Communication System: CW
Forward Conducted Power: 250mW
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL835 ($\sigma$ = 0.90 mho/m; $\varepsilon_r$ = 40.5; $\rho$ = 1000 kg/m$^3$)

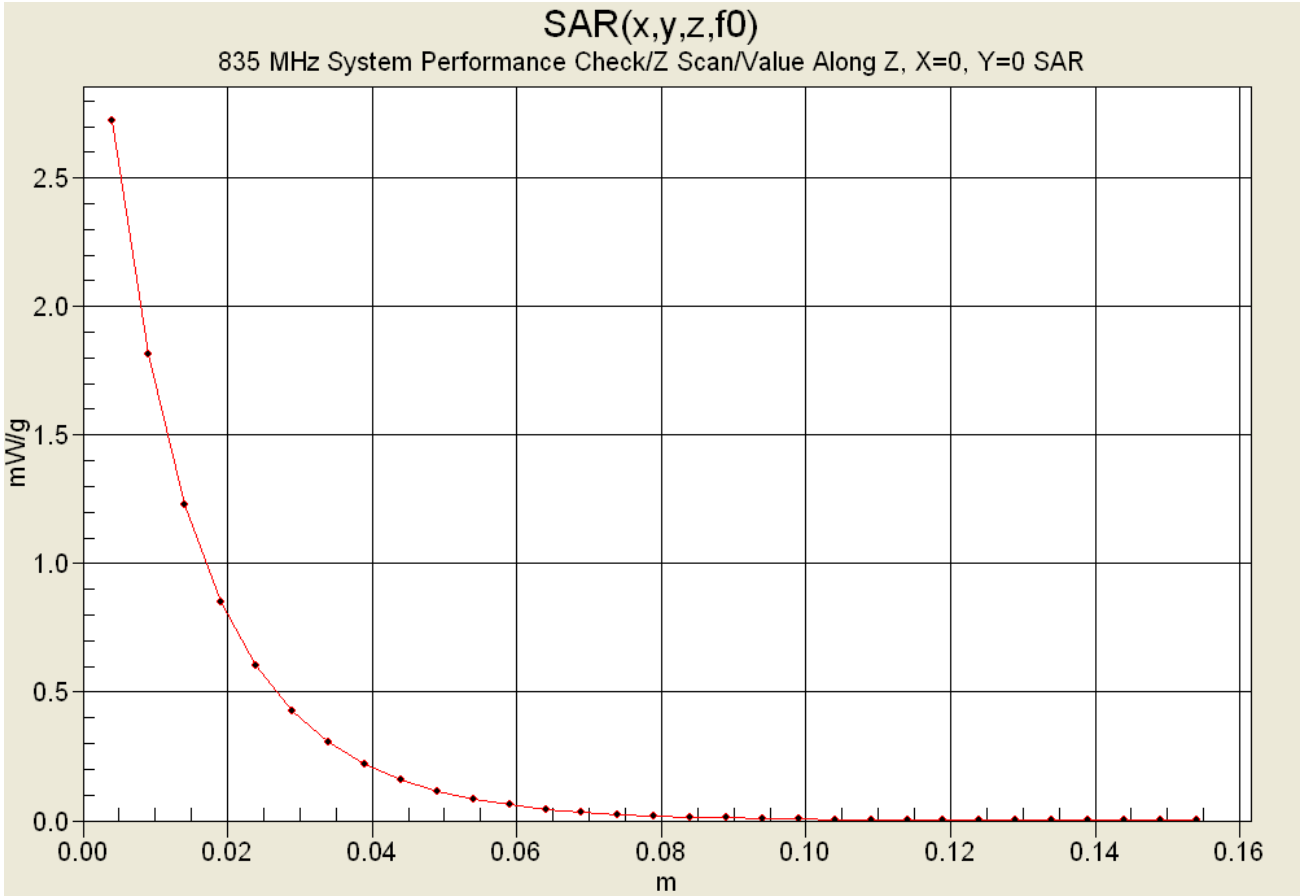
- Probe: ET3DV6 - SN1590; ConvF(6.71, 6.71, 6.71); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112

**835 MHz System Performance Check/Area Scan (6x10x1):**
Measurement grid: dx=10mm, dy=10mm

**835 MHz System Performance Check/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.8 V/m; Power Drift = 0.009 dB
Peak SAR (extrapolated) = 3.77 W/kg
**SAR(1 g) = 2.51 mW/g; SAR(10 g) = 1.64 mW/g**



## Z-Axis Scan


SAR(x,y,z,f0)
835 MHz System Performance Check/Z Scan/Value Along Z, X=0, Y=0 SAR
mW/g
2.5
2.0
1.5
1.0
0.5
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

Date Tested: 07/29/04

## System Performance Check - 1900 MHz Dipole

**DUT: Dipole 1900 MHz; Model: D1900V2; Type: System Performance Check; Serial: 151; Calibrated: 06/18/2004**

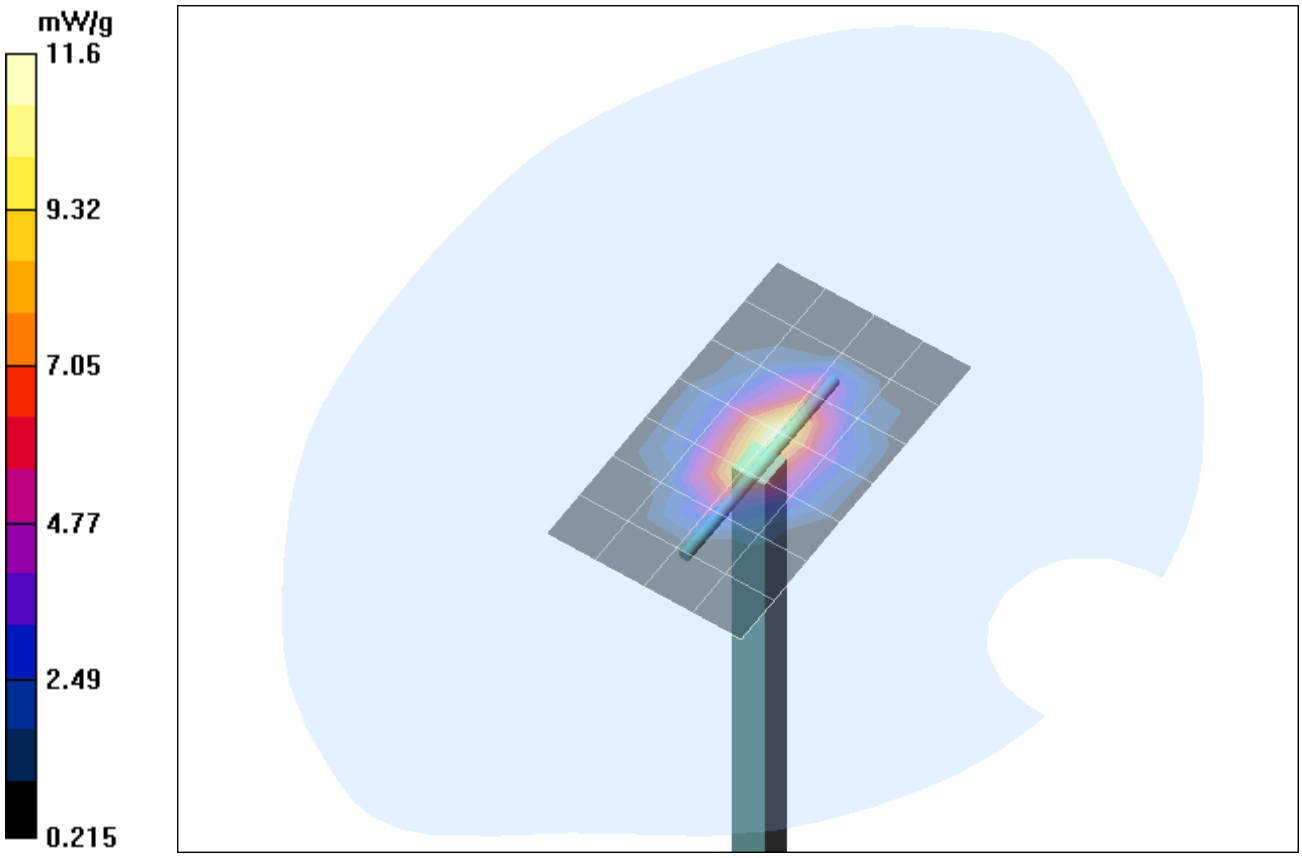
Ambient Temp: 24.6 °C; Fluid Temp: 23.5 °C; Barometric Pressure: 101.8 kPa; Humidity: 42%

Communication System: CW
Forward Conducted Power: 250mW
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL1900 ($\sigma$ = 1.41 mho/m; $\varepsilon_r$ = 38.1; $\rho$ = 1000 kg/m$^3$)

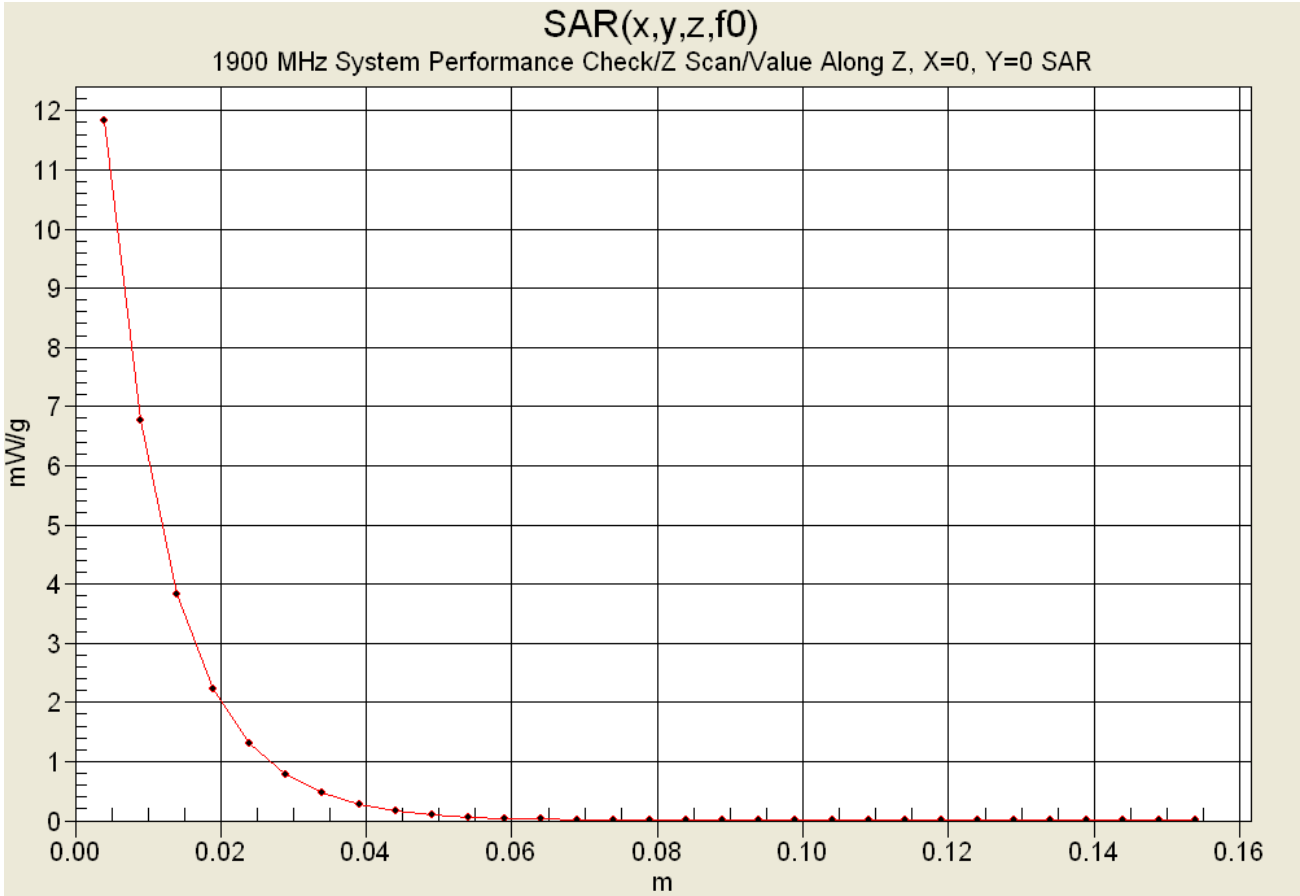
- Probe: ET3DV6 - SN1590; ConvF(5.03, 5.03, 5.03); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112

**1900 MHz System Performance Check/Area Scan (5x8x1):**
Measurement grid: dx=15mm, dy=15mm

**1900 MHz System Performance Check/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.5 V/m; Power Drift = 0.0 dB
Peak SAR (extrapolated) = 17.7 W/kg
**SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.45 mW/g**



## Z-Axis Scan


SAR(x,y,z,f0)
1900 MHz System Performance Check/Z Scan/Value Along Z, X=0, Y=0 SAR
mW/g
m
0
1
2
3
4
5
6
7
8
9
10
11
12
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16

Date Tested: 07/31/04

## System Performance Check - 835 MHz Dipole

**DUT: Dipole 835 MHz; Model: D835V2; Type: System Performance Check; Serial: 411; Calibrated: 03/16/2004**

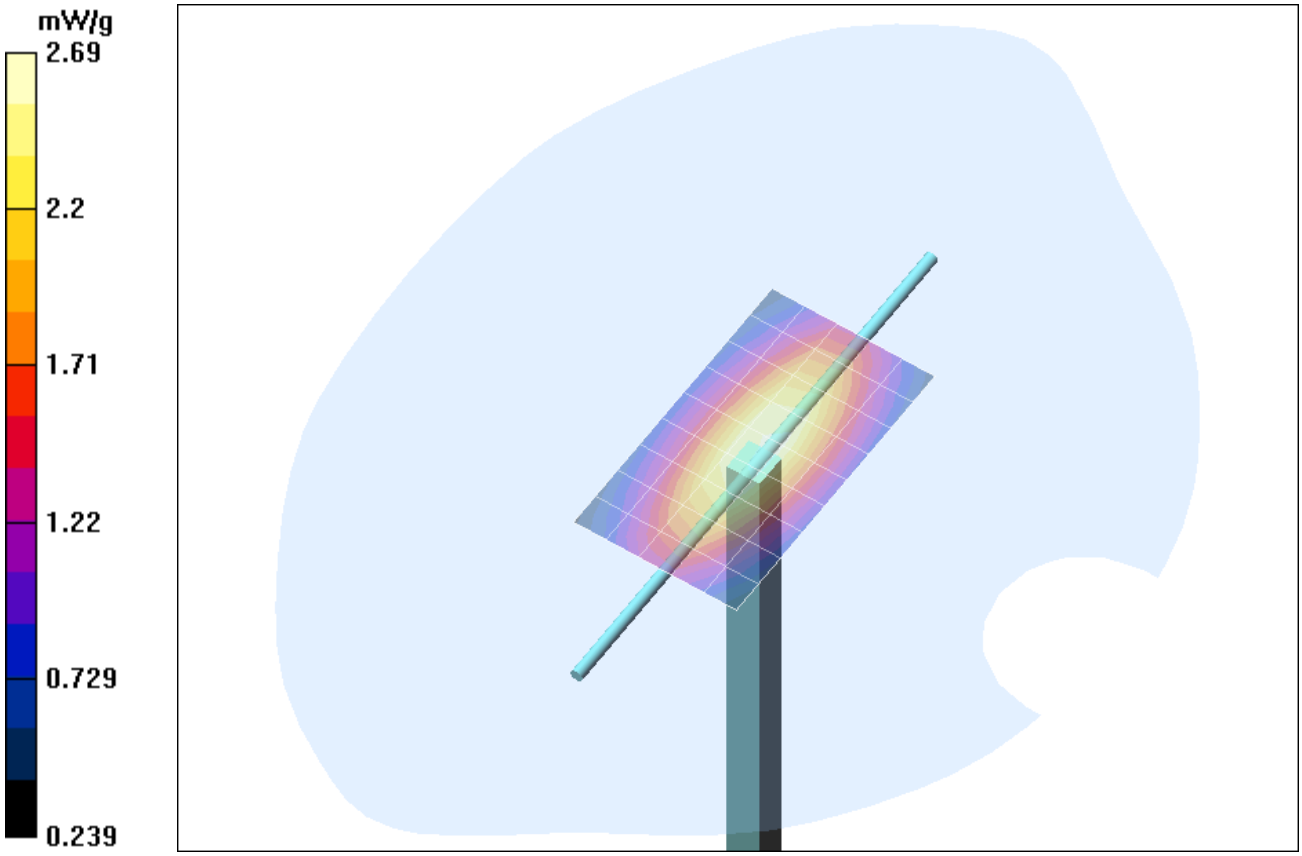
Ambient Temp: 24.0 °C; Fluid Temp: 23.5 °C; Barometric Pressure: 101.9 kPa; Humidity: 39%

Communication System: CW
Forward Conducted Power: 250mW
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL835 ($\sigma$ = 0.92 mho/m; $\varepsilon_r$ = 41.0; $\rho$ = 1000 kg/m$^3$)

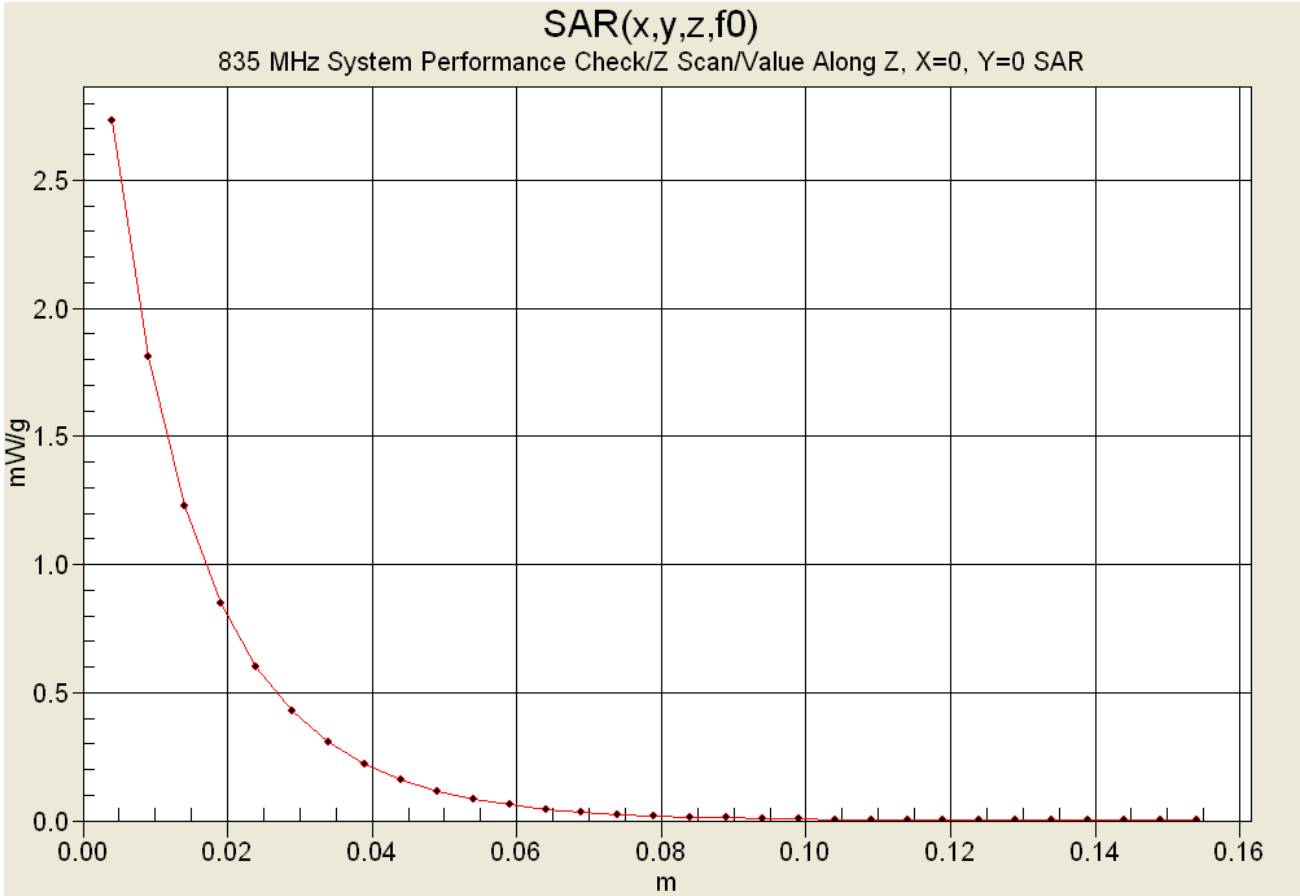
- Probe: ET3DV6 - SN1590; ConvF(6.71, 6.71, 6.71); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112

**835 MHz System Performance Check/Area Scan (6x10x1):**
Measurement grid: dx=10mm, dy=10mm

**835 MHz System Performance Check/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 3.75 W/kg
**SAR(1 g) = 2.50 mW/g; SAR(10 g) = 1.62 mW/g**



## Z-Axis Scan


SAR(x,y,z,f0)
835 MHz System Performance Check/Z Scan/Value Along Z, X=0, Y=0 SAR
mW/g
2.5
2.0
1.5
1.0
0.5
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

Date Tested: 08/03/04

## System Performance Check - 1900 MHz Dipole

**DUT: Dipole 1900 MHz; Model: D1900V2; Type: System Performance Check; Serial: 151; Calibrated: 06/18/2004**

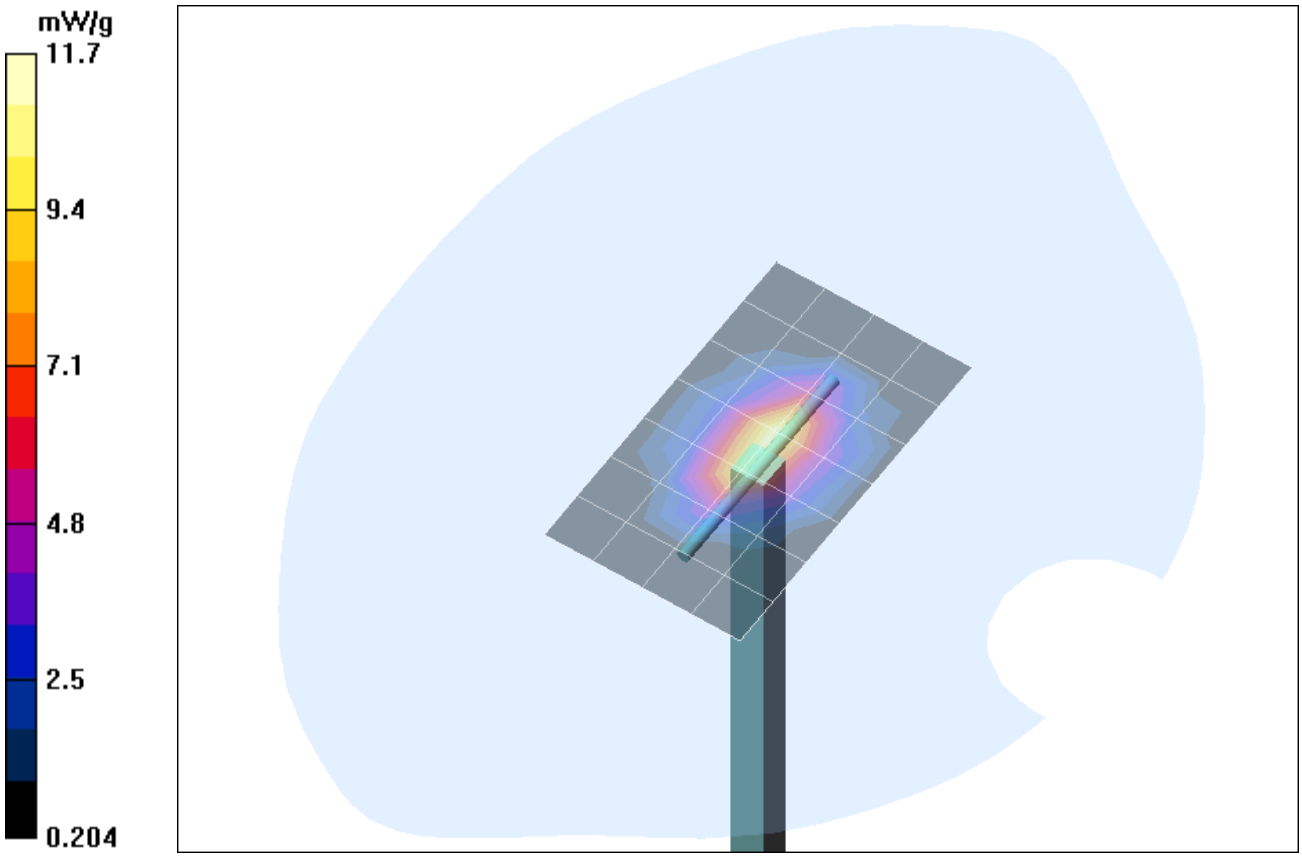
Ambient Temp: 24.4 °C; Fluid Temp: 22.9 °C; Barometric Pressure: 101.5 kPa; Humidity: 36%

Communication System: CW
Forward Conducted Power: 250mW
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL1900 ($\sigma$ = 1.41 mho/m; $\varepsilon_r$ = 38.2; $\rho$ = 1000 kg/m$^3$)

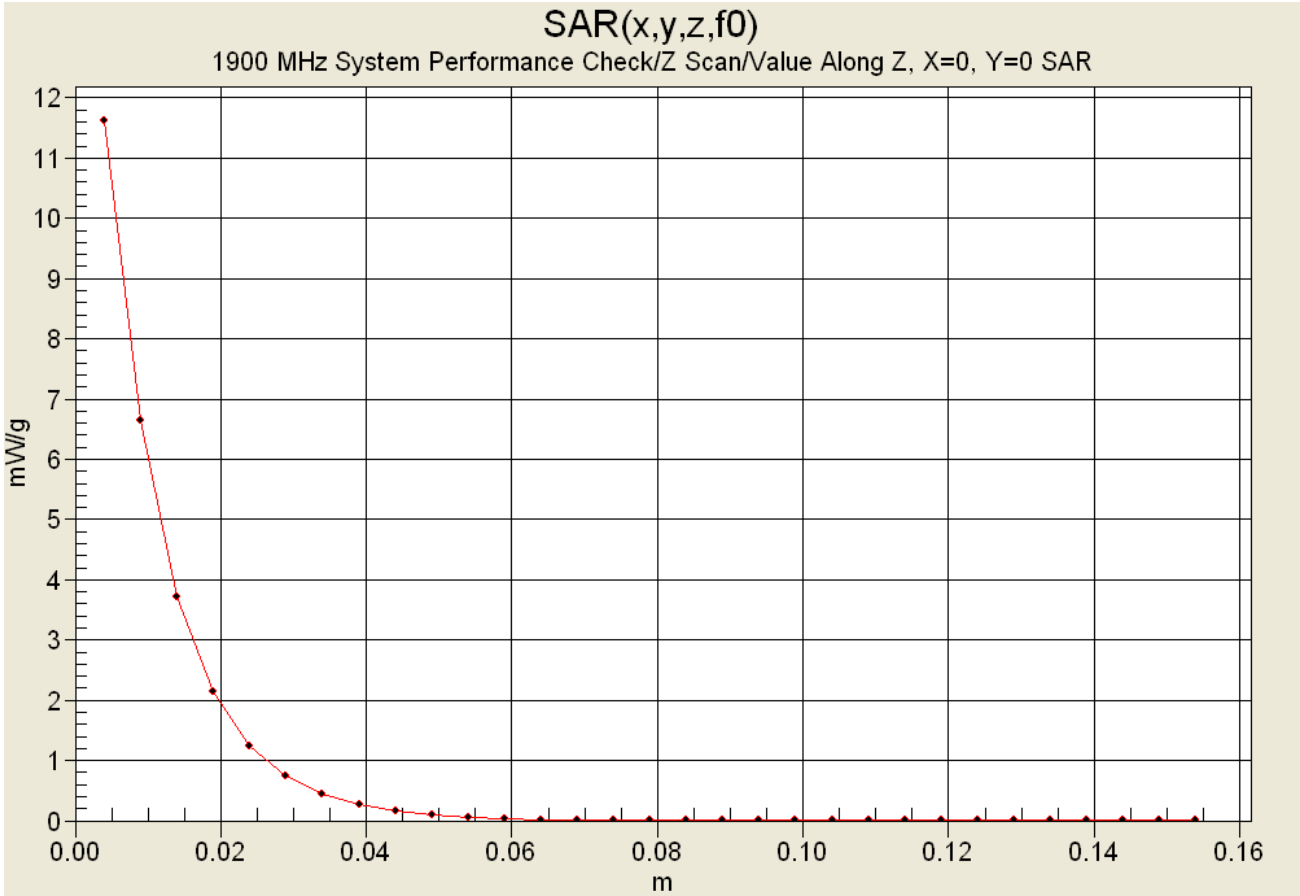
- Probe: ET3DV6 - SN1590; ConvF(5.03, 5.03, 5.03); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112

**1900 MHz System Performance Check/Area Scan (5x8x1):**
Measurement grid: dx=15mm, dy=15mm

**1900 MHz System Performance Check/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.5 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 17.8 W/kg
**SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.43 mW/g**



## Z-Axis Scan


SAR(x,y,z,f0)
1900 MHz System Performance Check/Z Scan/Value Along Z, X=0, Y=0 SAR
mW/g
m
0
1
2
3
4
5
6
7
8
9
10
11
12
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16

# APPENDIX C - SYSTEM VALIDATION

Celltech
Testing and Engineering Services Lab

# 835 MHz SYSTEM VALIDATION DIPOLE

| | |
|---|---|
| Type: | **835 MHz Validation Dipole** |
| Serial Number: | **411** |
| Place of Calibration: | **Celltech Labs Inc.** |
| Date of Calibration: | **March 16, 2004** |

**Celltech Labs Inc. hereby certifies that this device has been calibrated on the date indicated above.**

Calibrated by: Spencer Watson

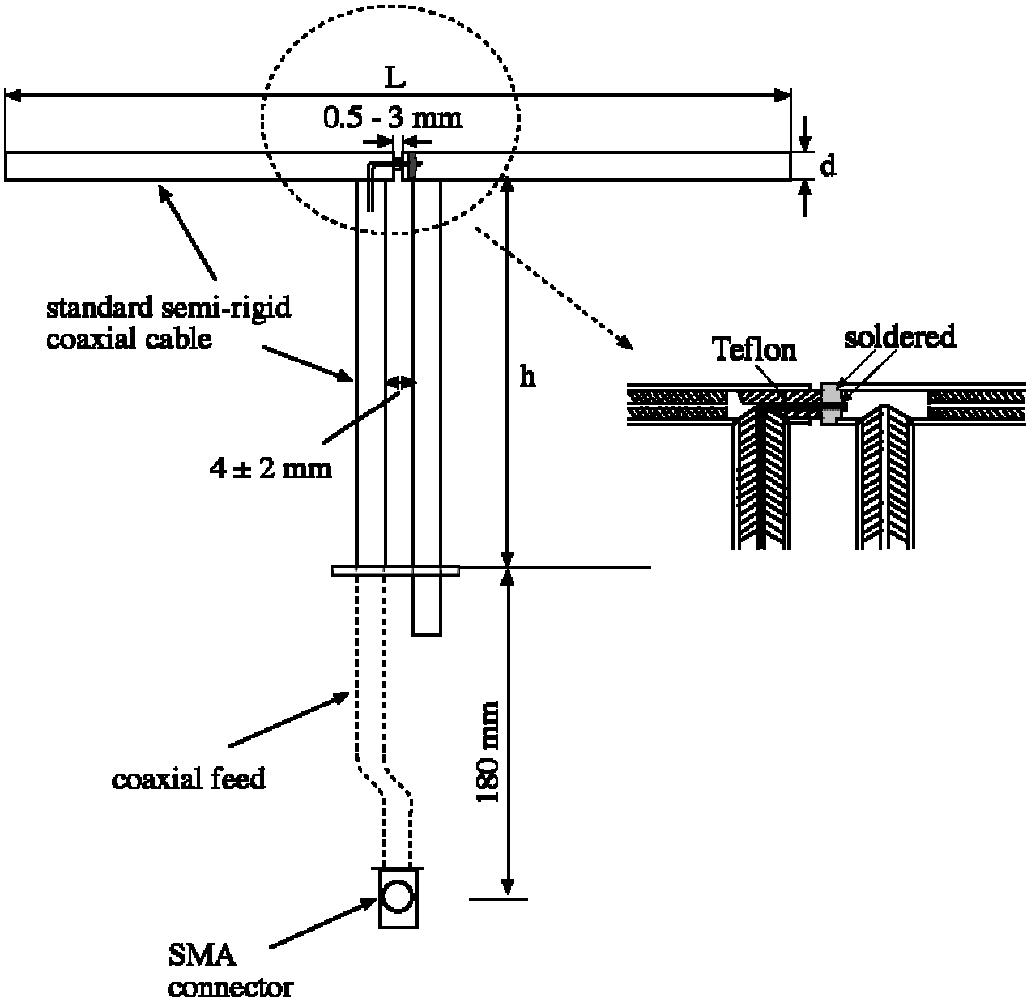
Approved by: Russell W. Pope

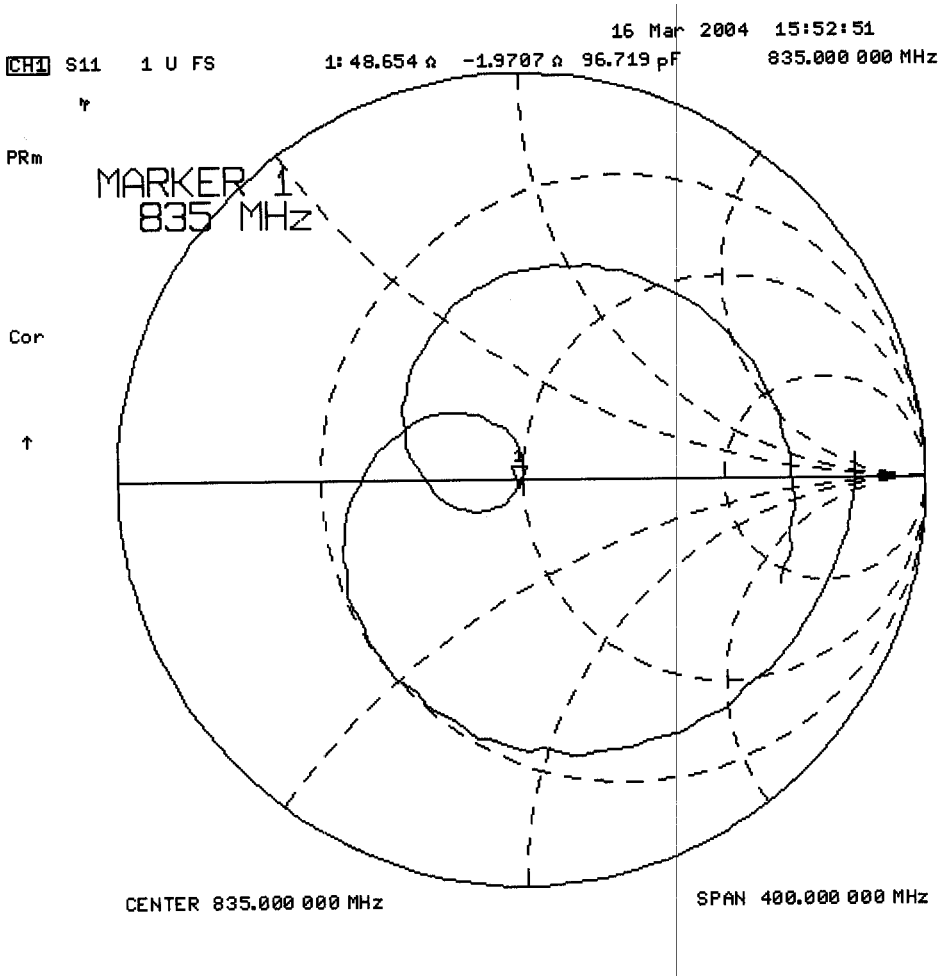
**Celltech Labs Inc. 1955 Moss Court, Kelowna, B.C. Canada V1Y 9L3**
**Tel. 250-448-7047 • Fax. 250-448-7046 • e-mail: info@celltechlabs.com**
**www.celltechlabs.com**

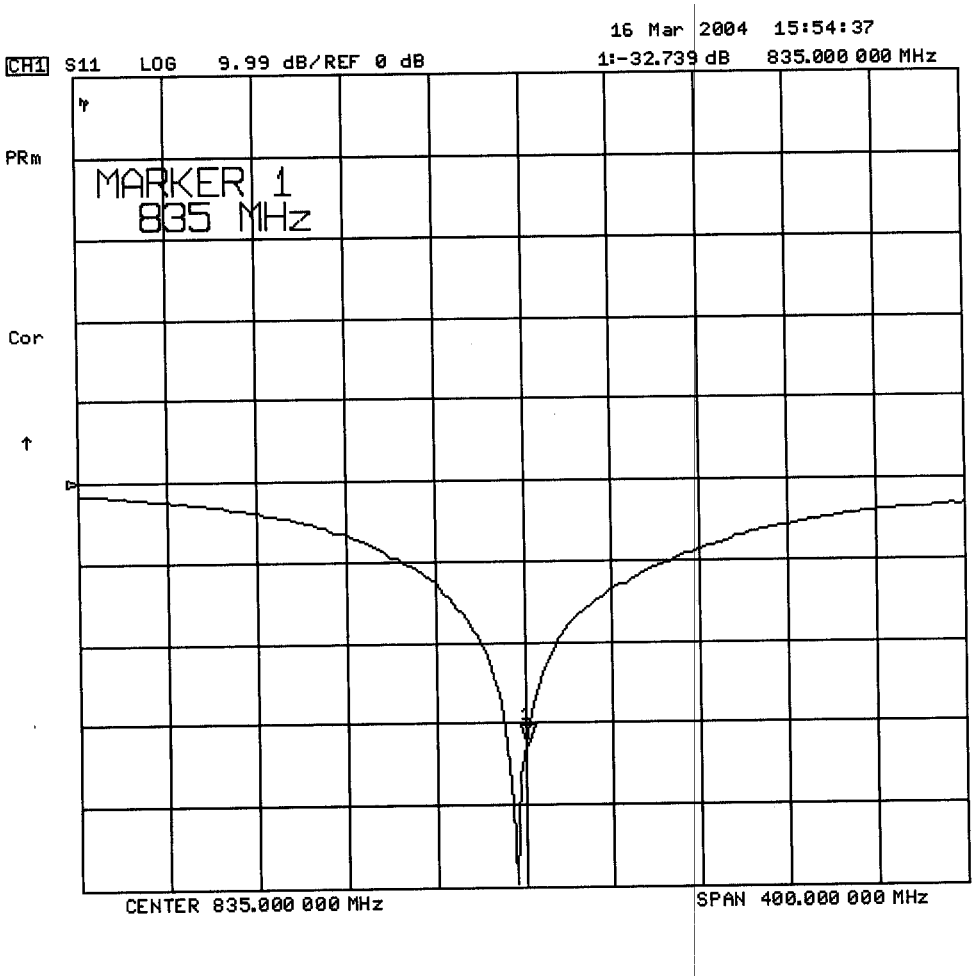
## 1. Dipole Construction & Electrical Characteristics

The validation dipole was constructed in accordance with the IEEE Standard "Annex G (informative) Reference dipoles for use in system validation". The electrical properties were measured using an HP 8753E Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector feed point using an HP85032E Type N calibration kit. The dipole was placed parallel to a planar phantom at a separation distance of 15.0mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

| | |
|---|---|
| Feed point impedance at 835MHz | Re{Z} = 48.654Ω |
| | Im{Z} = -1.9707Ω |
| Return Loss at 835MHz | -32.739dB |




16 Mar 2004 15:52:51
CH1 S11 1 U FS
1: 48.654 Ω -1.9707 Ω 96.719 pF
835.000 000 MHz
PRm
MARKER 1
835 MHz
Cor
CENTER 835.000 000 MHz
SPAN 400.000 000 MHz


16 Mar 2004 15:54:37
CH1 S11 LOG 9.99 dB/REF 0 dB
1:-32.739 dB 835.000 000 MHz
PRm
MARKER 1
835 MHz
Cor
CENTER 835.000 000 MHz
SPAN 400.000 000 MHz

### Validation Dipole Dimensions

| Frequency (MHz) | L (mm) | h (mm) | d (mm) |
|---|---|---|---|
| 300 | 420.0 | 250.0 | 6.2 |
| 450 | 288.0 | 167.0 | 6.2 |
| 835 | 161.0 | 89.8 | 3.6 |
| 900 | 149.0 | 83.3 | 3.6 |
| 1450 | 89.1 | 51.7 | 3.6 |
| 1800 | 72.0 | 41.7 | 3.6 |
| 1900 | 68.0 | 39.5 | 3.6 |
| 2000 | 64.5 | 37.5 | 3.6 |
| 2450 | 51.8 | 30.6 | 3.6 |
| 3000 | 41.5 | 25.0 | 3.6 |

## 2. Validation Phantom

The validation phantom is the SAM (Specific Anthropomorphic Mannequin) phantom manufactured by Schmid & Partner Engineering AG. The SAM phantom is a Fiberglass shell integrated in a wooden table. The shape of the shell corresponds to the phantom defined by SCC34-SC2. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

**Shell Thickness:** 2.0 ± 0.1 mm
**Filling Volume:** Approx. 20 liters
**Dimensions:** 50 cm (W) x 100 cm (L)

## 835 MHz System Validation Setup

## 835 MHz System Validation Setup

## 3. Measurement Conditions

The SAM phantom was filled with 835 MHz brain simulating tissue.

| | |
|---|---|
| Relative Permittivity: | 42.6 |
| Conductivity: | 0.94 mho/m |
| Ambient Temperature: | 24.6 °C |
| Fluid Temperature: | 21.9 °C |
| Fluid Depth: | ≥ 15.0 cm |
| Barometric Pressure: | 101.6 kPa |
| Humidity: | 31% |

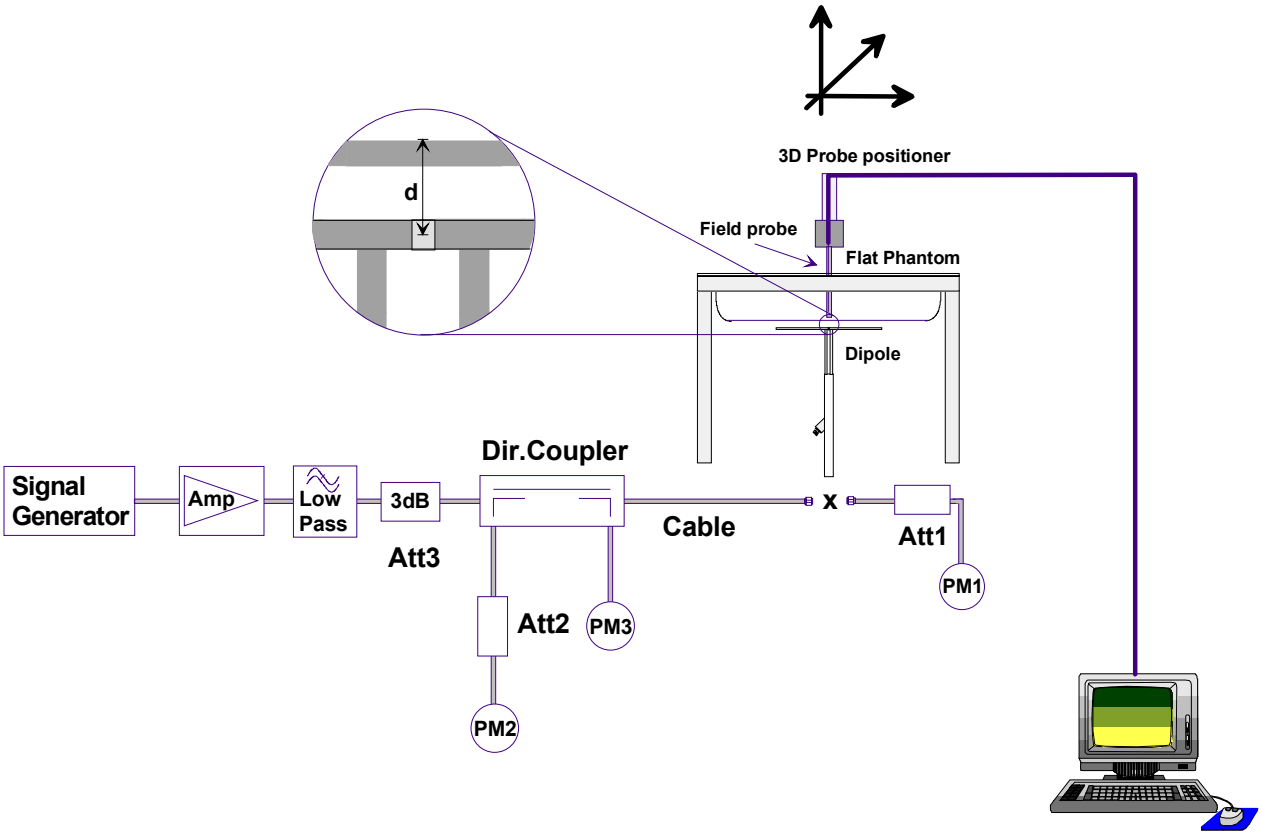
The 835 MHz simulating tissue consists of the following ingredients:

| Ingredient | Percentage by weight |
|---|---|
| Water | 40.71% |
| Sugar | 56.63% |
| Salt | 1.48% |
| HEC | 0.99% |
| Dowicil 75 | 0.19% |
| Target Dielectric Parameters at 22 °C | $\varepsilon_r$ = 41.5<br>$\sigma$ = 0.90 S/m |

Measurements were taken in the flat section of the SAM phantom using a dosimetric E-field probe ET3DV6 (s/n: 1590, conversion factor 7.0).

## 4. SAR Measurement

The SAR measurement was performed with the E-field probe in mechanical detection mode only. The setup and determination of the forward power into the dipole was performed using the following procedures.




First the power meter PM1 (including attenuator Att1) is connected to the cable to measure the forward power at the location of the dipole connector (X). The signal generator is adjusted for the desired forward power at the dipole connector (taking into account the attenuation of Att1) as read by power meter PM2. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2. If the signal generator does not allow adjustment in 0.01dB steps, the remaining difference at PM2 must be taken into consideration. PM3 records the reflected power from the dipole to ensure that the value is not changed from the previous value. The reflected power should be 20dB below the forward power.

Ten SAR measurements were performed in order to achieve repeatability and to establish an average target value.

## Validation Dipole SAR Test Results

| Validation Measurement | SAR @ 0.25W Input averaged over 1g | SAR @ 1W Input averaged over 1g | SAR @ 0.25W Input averaged over 10g | SAR @ 1W Input averaged over 10g | Peak SAR @ 0.25W Input |
|---|---|---|---|---|---|
| Test 1 | 2.46 | 9.84 | 1.61 | 6.44 | 3.56 |
| Test 2 | 2.45 | 9.80 | 1.60 | 6.40 | 3.56 |
| Test 3 | 2.45 | 9.80 | 1.61 | 6.44 | 3.56 |
| Test 4 | 2.44 | 9.76 | 1.60 | 6.40 | 3.55 |
| Test 5 | 2.43 | 9.72 | 1.60 | 6.40 | 3.53 |
| Test 6 | 2.44 | 9.76 | 1.60 | 6.40 | 3.53 |
| Test 7 | 2.44 | 9.76 | 1.60 | 6.40 | 3.55 |
| Test 8 | 2.44 | 9.76 | 1.60 | 6.40 | 3.54 |
| Test 9 | 2.47 | 9.88 | 1.62 | 6.48 | 3.58 |
| Test10 | 2.47 | 9.88 | 1.62 | 6.48 | 3.62 |
| Average Value | 2.45 | 9.80 | 1.61 | 6.42 | 3.56 |

The results have been normalized to 1W (forward power) into the dipole.

Averaged over 1cm (1g) of tissue: 9.80 mW/g

Averaged over 10cm (10g) of tissue: 6.42 mW/g

# 835 MHz System Validation - March 16, 2004

DUT: Dipole 835 MHz; Type: D835V2; Serial: 411
Ambient Temp: 24.6°C; Fluid Temp: 21.9°C; Barometric Pressure: 101.6 kPa; Humidity: 31%

Communication System: CW
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL835 ($\sigma$ = 0.94 mho/m; $\varepsilon_r$ = 42.6; $\rho$ = 1000 kg/m$^3$)

- Probe: ET3DV6 - SN1590; ConvF(7, 7, 7); Calibrated: 15/05/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 19/12/2003
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.2 Build 37; Postprocessing SW: SEMCAD, V1.8 Build 109

**835 MHz System Validation/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB

**835 MHz System Validation/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.56 W/kg
**SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.61 mW/g**

**835 MHz System Validation/Zoom Scan 2 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.56 W/kg
**SAR(1 g) = 2.45 mW/g; SAR(10 g) = 1.6 mW/g**

**835 MHz System Validation/Zoom Scan 3 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.56 W/kg
**SAR(1 g) = 2.45 mW/g; SAR(10 g) = 1.61 mW/g**

**835 MHz System Validation/Zoom Scan 5 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.55 W/kg
**SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g**

**835 MHz System Validation/Zoom Scan 6 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.53 W/kg
**SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.6 mW/g**

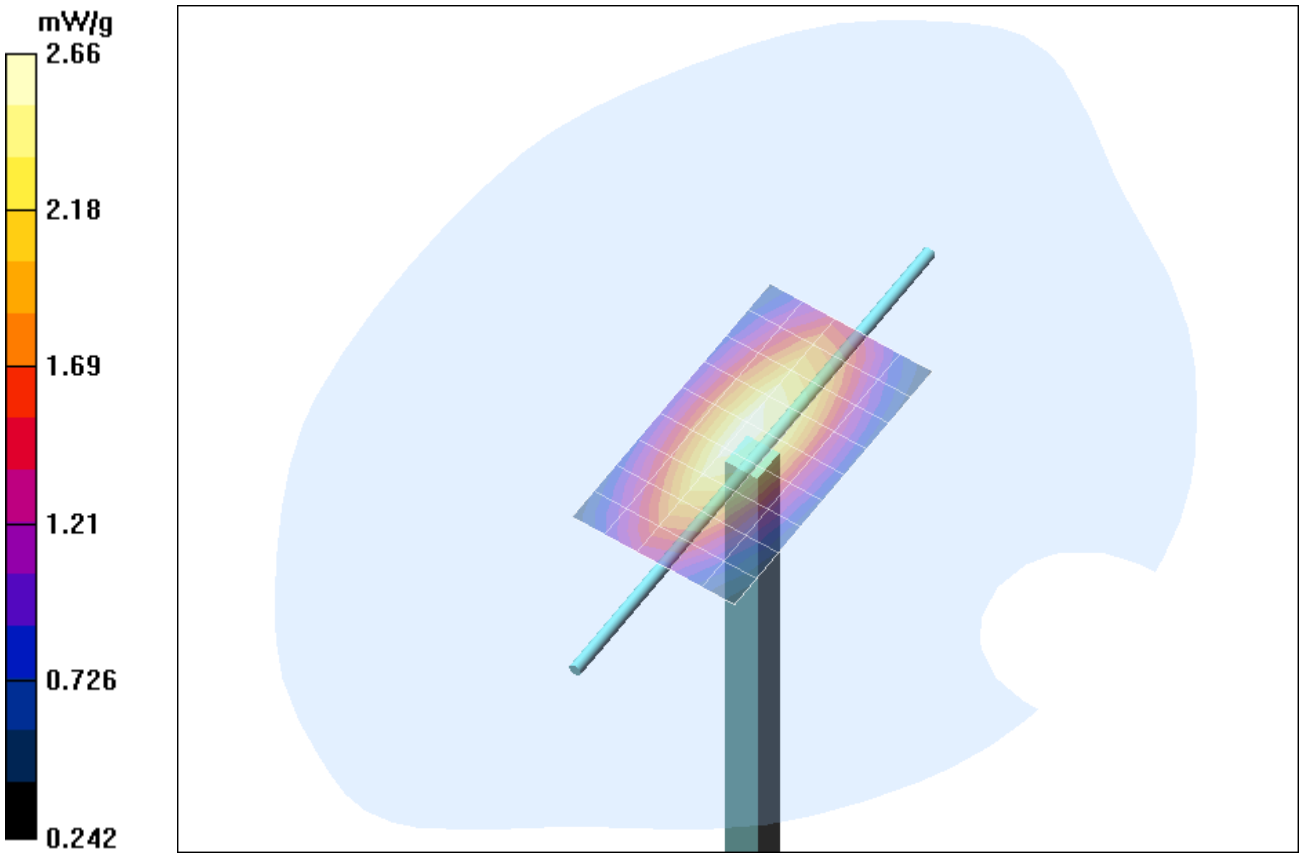
**835 MHz System Validation/Zoom Scan 7 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.53 W/kg
**SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g**

**835 MHz System Validation/Zoom Scan 8 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.55 W/kg
**SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g**

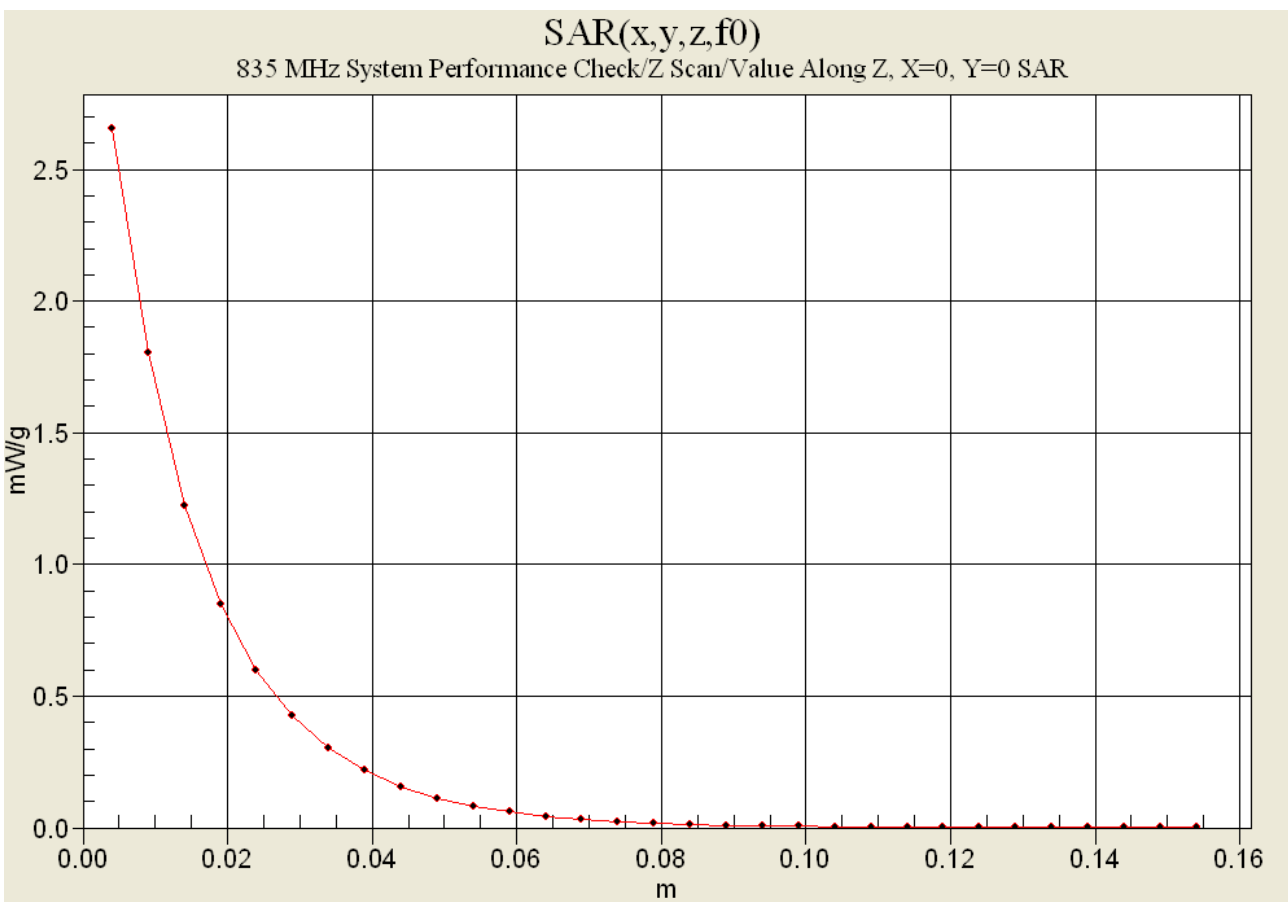
**835 MHz System Validation/Zoom Scan 9 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.54 W/kg
**SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g**

**835 MHz System Validation/Zoom Scan 11 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.58 W/kg
**SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g**

**835 MHz System Validation/Zoom Scan 12 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.62 W/kg
**SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g**




**1 g average of 10 measurements: 2.449 mW/g**
**10 g average of 10 measurements: 1.606 mW/g**



# 835 MHz System Performance Check

## Measured Fluid Dielectric Parameters (Brain)

March 16, 2004

| Frequency | e' | e" |
|---|---|---|
| 735.000000 MHz | 43.8577 | 20.6938 |
| 745.000000 MHz | 43.6899 | 20.6481 |
| 755.000000 MHz | 43.5341 | 20.5840 |
| 765.000000 MHz | 43.4161 | 20.5576 |
| 775.000000 MHz | 43.3026 | 20.5312 |
| 785.000000 MHz | 43.2065 | 20.5122 |
| 795.000000 MHz | 43.1067 | 20.5061 |
| 805.000000 MHz | 43.0154 | 20.4762 |
| 815.000000 MHz | 42.8927 | 20.4182 |
| 825.000000 MHz | 42.7420 | 20.3806 |
| 835.000000 MHz | 42.6206 | 20.2993 |
| 845.000000 MHz | 42.4357 | 20.2595 |
| 855.000000 MHz | 42.2984 | 20.1872 |
| 865.000000 MHz | 42.1422 | 20.1432 |
| 875.000000 MHz | 42.0082 | 20.1253 |
| 885.000000 MHz | 41.8996 | 20.1110 |
| 895.000000 MHz | 41.8514 | 20.0192 |
| 905.000000 MHz | 41.7550 | 20.0083 |
| 915.000000 MHz | 41.6535 | 19.9701 |
| 925.000000 MHz | 41.5521 | 19.9380 |
| 935.000000 MHz | 41.4477 | 19.9175 |

Celltech
Testing and Engineering Services Lab

# 1900 MHz SYSTEM VALIDATION DIPOLE

| | |
|---|---|
| Type: | **1900 MHz Validation Dipole** |
| Serial Number: | **151** |
| Place of Calibration: | **Celltech Labs Inc.** |
| Date of Calibration: | **June 18, 2004** |

**Celltech Labs Inc. hereby certifies that this device has been calibrated on the date indicated above.**

Calibrated by: Spencer Watson

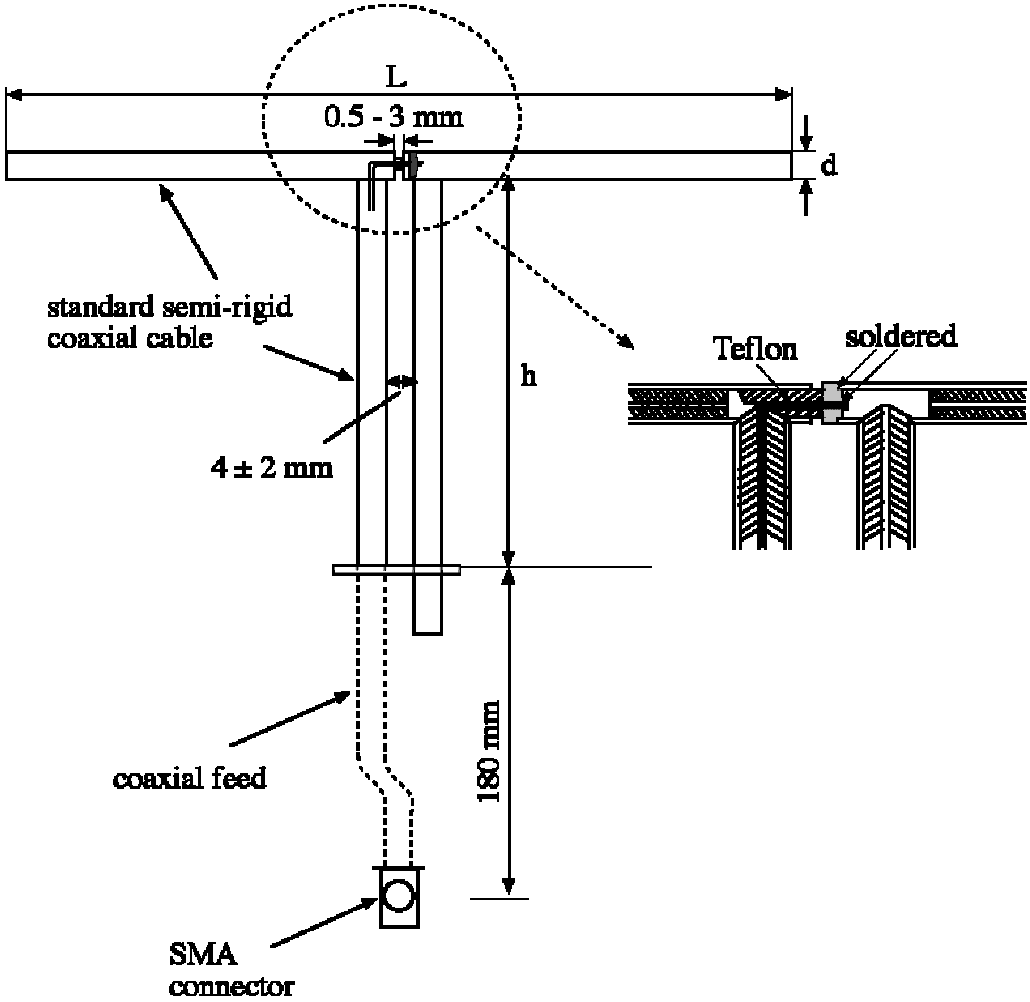
Approved by: Russell W. Pope

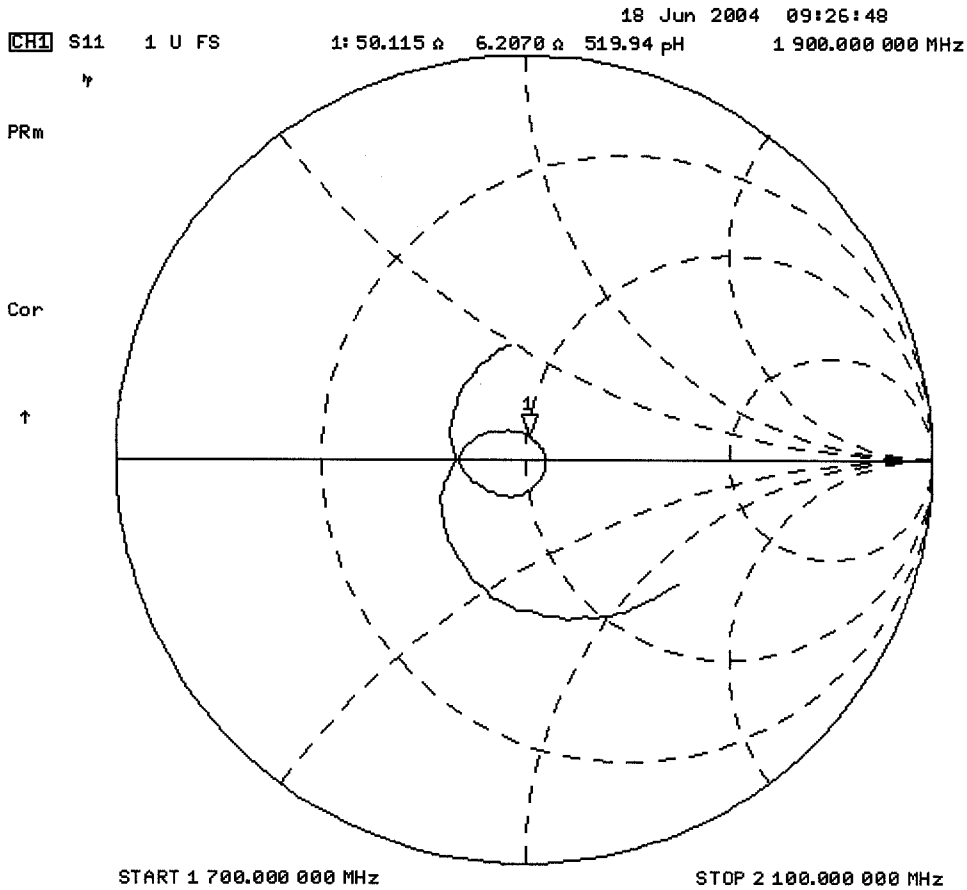
**Celltech Labs Inc. 1955 Moss Court, Kelowna, B.C. Canada V1Y 9L3**
**Tel. 250-448-7047 • Fax. 250-448-7046 • e-mail: info@celltechlabs.com**
**www.celltechlabs.com**

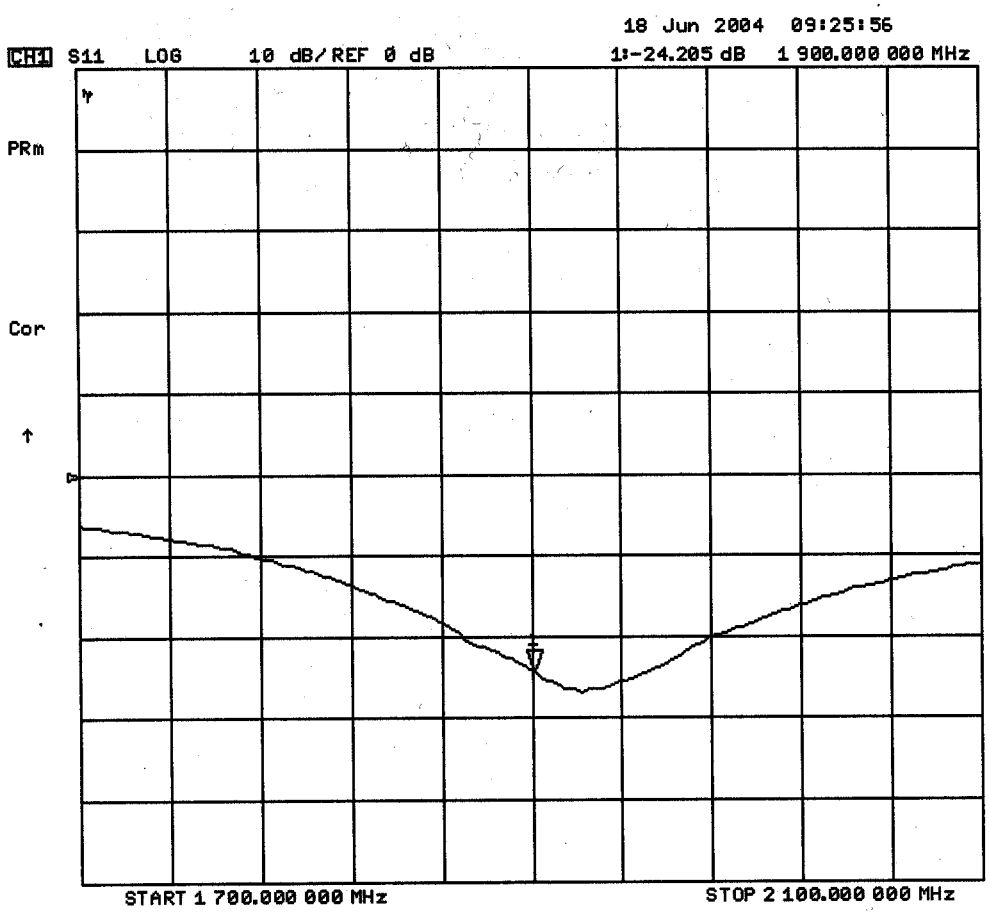
## 1. Dipole Construction & Electrical Characteristics

The validation dipole was constructed in accordance with the IEEE Standard "Annex G (informative) Reference dipoles for use in system validation". The electrical properties were measured using an HP 8753E Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector feed point using an HP85032E Type N calibration kit. The dipole was placed parallel to a planar phantom at a separation distance of 10.0mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

| | |
|---|---|
| Feed point impedance at 1900MHz | Re{Z} = 50.115Ω |
| | Im{Z} = 6.2070Ω |
| Return Loss at 1900MHz | -24.205dB |




18 Jun 2004 09:26:48
CH1 S11 1 U FS
1: 50.115 Ω 6.2070 Ω 519.94 pH
1 900.000 000 MHz
PRm
Cor
1
START 1 700.000 000 MHz
STOP 2 100.000 000 MHz


18 Jun 2004 09:25:56
CH1 S11 LOG 10 dB/ REF 0 dB
1:-24.205 dB 1 900.000 000 MHz
PRm
Cor
START 1 700.000 000 MHz
STOP 2 100.000 000 MHz

### Validation Dipole Dimensions

| Frequency (MHz) | L (mm) | h (mm) | d (mm) |
|---|---|---|---|
| 300 | 420.0 | 250.0 | 6.2 |
| 450 | 288.0 | 167.0 | 6.2 |
| 835 | 161.0 | 89.8 | 3.6 |
| 900 | 149.0 | 83.3 | 3.6 |
| 1450 | 89.1 | 51.7 | 3.6 |
| 1800 | 72.0 | 41.7 | 3.6 |
| 1900 | 68.0 | 39.5 | 3.6 |
| 2000 | 64.5 | 37.5 | 3.6 |
| 2450 | 51.8 | 30.6 | 3.6 |
| 3000 | 41.5 | 25.0 | 3.6 |

## 2. Validation Phantom

The validation phantom is the SAM (Specific Anthropomorphic Mannequin) phantom manufactured by Schmid & Partner Engineering AG. The SAM phantom is a Fiberglass shell integrated in a wooden table. The shape of the shell corresponds to the phantom defined by SCC34-SC2. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

**Shell Thickness:** 2.0 ± 0.1 mm
**Filling Volume:** Approx. 20 liters
**Dimensions:** 50 cm (W) x 100 cm (L)

## 1900 MHz System Validation Setup

## 1900 MHz System Validation Setup

## 3. Measurement Conditions

The SAM phantom was filled with 1900 MHz brain simulating tissue.

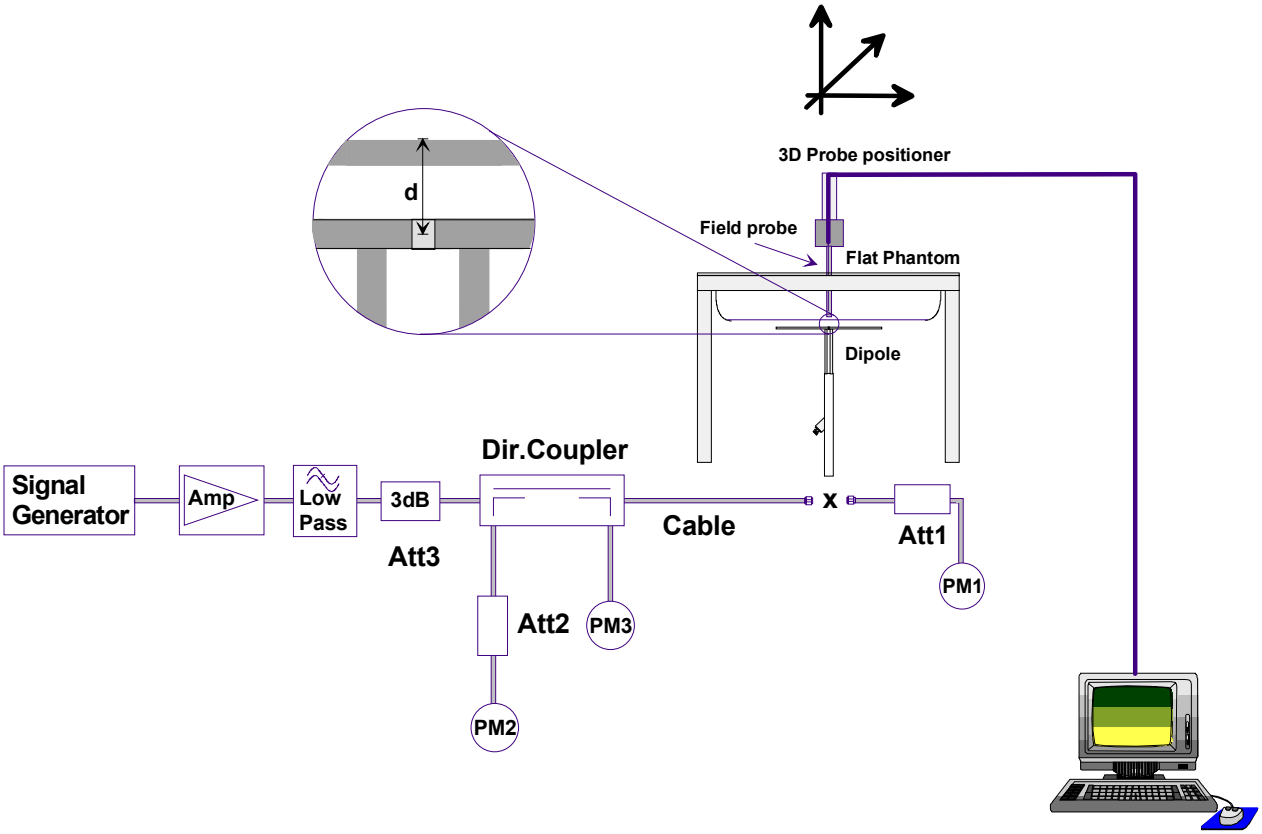
| | |
|---|---|
| Relative Permittivity: | 38.3 |
| Conductivity: | 1.43 mho/m |
| Ambient Temperature: | 24.0 °C |
| Fluid Temperature: | 22.6 °C |
| Fluid Depth: | ≥ 15.0 cm |
| Barometric Pressure: | 103.0 kPa |
| Humidity: | 37% |

The 1900 MHz tissue simulant consists of the following ingredients:

| Ingredient | Percentage by weight |
|---|---|
| Water | 55.85% |
| Glycol | 44.00% |
| Salt | 0.15% |
| Target Dielectric Parameters at 22 °C | $\varepsilon_r$ = 40.0<br>$\sigma$ = 1.40 S/m |

## 4. SAR Measurement

The SAR measurement was performed with the E-field probe in mechanical detection mode only. The setup and determination of the forward power into the dipole was performed using the following procedures.




First the power meter PM1 (including attenuator Att1) is connected to the cable to measure the forward power at the location of the dipole connector (X). The signal generator is adjusted for the desired forward power at the dipole connector (taking into account the attenuation of Att1) as read by power meter PM2. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2. If the signal generator does not allow adjustment in 0.01dB steps, the remaining difference at PM2 must be taken into consideration. PM3 records the reflected power from the dipole to ensure that the value is not changed from the previous value. The reflected power should be 50dB below the forward power.

Ten SAR measurements were performed in order to achieve repeatability and to establish an average target value.

## Validation Dipole SAR Test Results

| Validation Measurement | SAR @ 0.25W Input averaged over 1g | SAR @ 1W Input averaged over 1g | SAR @ 0.25W Input averaged over 10g | SAR @ 1W Input averaged over 10g | Peak SAR @ 0.25W Input |
|---|---|---|---|---|---|
| Test 1 | 10.1 | 40.40 | 5.30 | 21.20 | 17.4 |
| Test 2 | 9.93 | 39.72 | 5.21 | 20.84 | 17.2 |
| Test 3 | 9.98 | 39.92 | 5.23 | 20.92 | 17.3 |
| Test 4 | 9.99 | 39.96 | 5.21 | 20.84 | 17.4 |
| Test 5 | 9.97 | 39.88 | 5.22 | 20.88 | 17.4 |
| Test 6 | 9.90 | 39.60 | 5.20 | 20.80 | 17.1 |
| Test 7 | 9.93 | 39.72 | 5.21 | 20.84 | 17.2 |
| Test 8 | 9.96 | 39.84 | 5.20 | 20.80 | 17.3 |
| Test 9 | 9.94 | 39.76 | 5.20 | 20.80 | 17.2 |
| Test 10 | 9.96 | 39.84 | 5.21 | 20.84 | 17.2 |
| Average | 9.966 | 39.864 | 5.219 | 20.876 | 17.27 |

The results have been normalized to 1W (forward power) into the dipole.

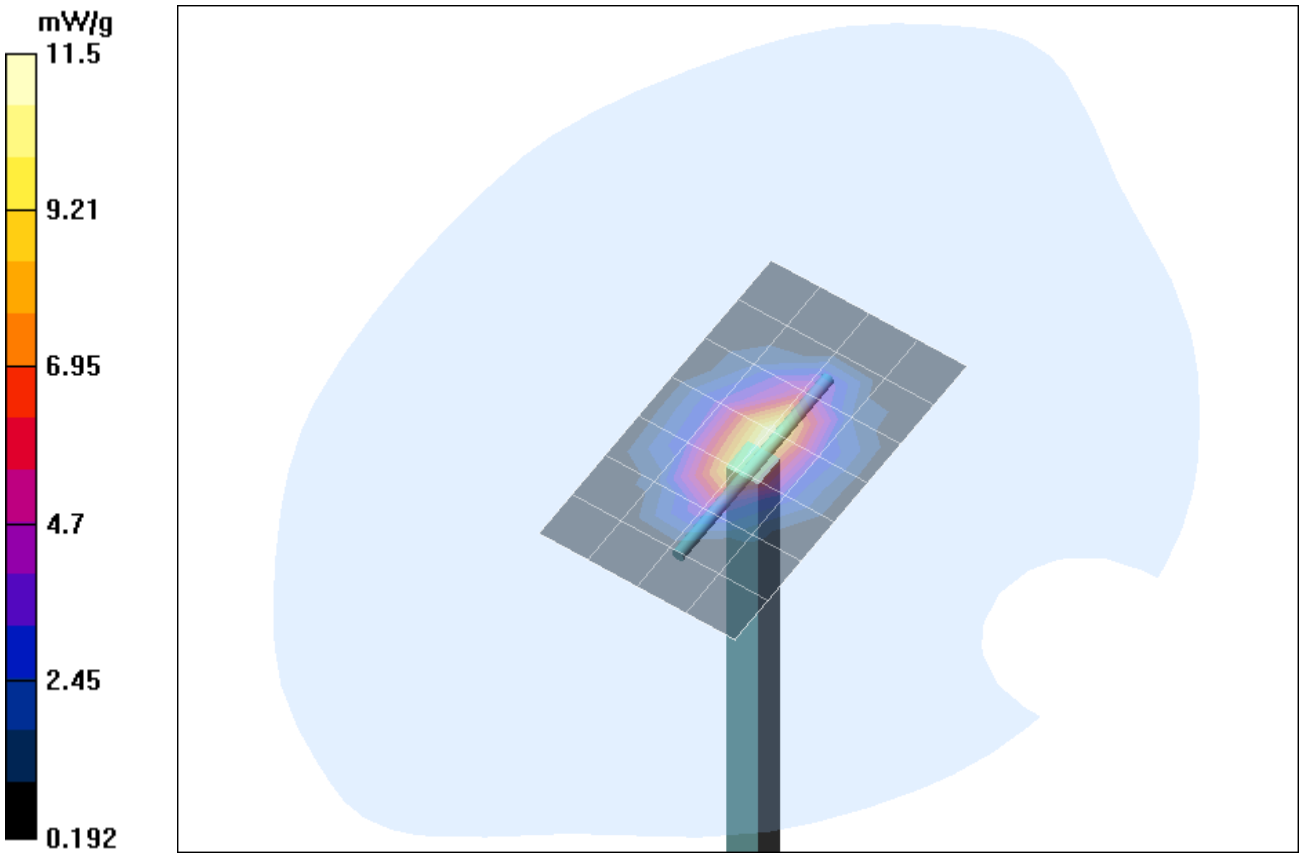
| 1g/10g Averaged | Average Measured SAR @ 1W Input | IEEE Target SAR @ 1W Input | Deviation (%) |
|---|---|---|---|
| 1 gram | 39.864 | 39.7 | + 0.413 |
| 10 gram | 20.876 | 20.5 | + 1.835 |

## 1900 MHz System Validation - June 18, 2004

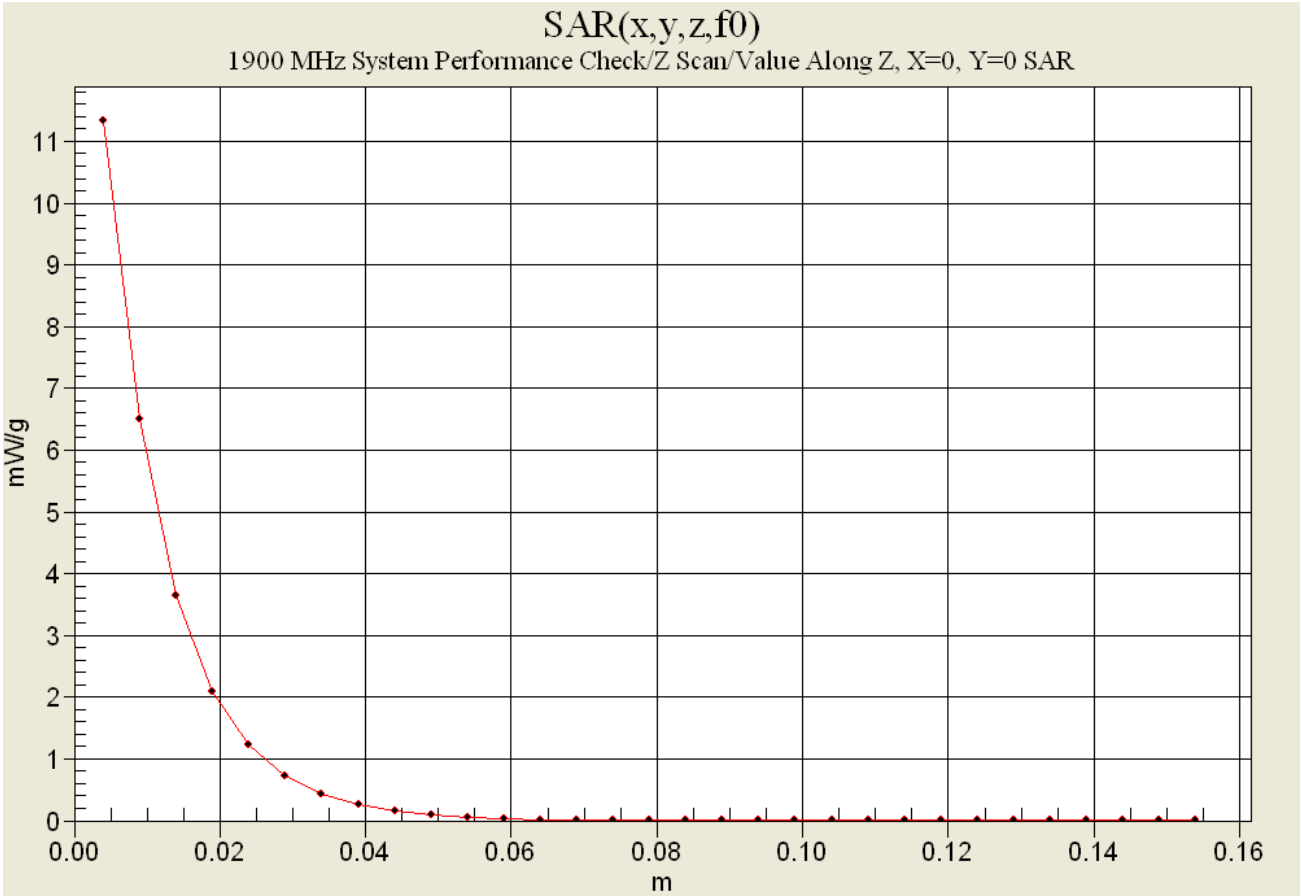
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 151
Ambient Temp: 24.0°C; Fluid Temp: 22.6°C; Barometric Pressure: 103.0 kPa; Humidity: 37%
Communication System: CW
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL1900 ($\sigma$ = 1.43 mho/m; $\varepsilon_r$ = 38.3; $\rho$ = 1000 kg/m$^3$ )

- Probe: ET3DV6 - SN1387; ConvF(5.25, 5.25, 5.25); Calibrated: 18/03/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112

**1900 MHz System Validation/Area Scan (5x8x1):** Measurement grid: dx=15mm, dy=15mm
Reference Value = 96.9 V/m; Power Drift = 0.1 dB
**1900 MHz System Validation/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.9 V/m; Power Drift = 0.1 dB
Peak SAR (extrapolated) = 17.4 W/kg
**SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.3 mW/g**
**1900 MHz System Validation/Zoom Scan 2 (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.8 V/m; Power Drift = 0.0 dB
Peak SAR (extrapolated) = 17.2 W/kg
**SAR(1 g) = 9.93 mW/g; SAR(10 g) = 5.21 mW/g**
**1900 MHz System Validation/Zoom Scan 3 (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.2 V/m; Power Drift = 0.009 dB
Peak SAR (extrapolated) = 17.3 W/kg
**SAR(1 g) = 9.98 mW/g; SAR(10 g) = 5.23 mW/g**
**1900 MHz System Validation/Zoom Scan 4 (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.9 V/m; Power Drift = 0.001 dB
Peak SAR (extrapolated) = 17.4 W/kg
**SAR(1 g) = 9.99 mW/g; SAR(10 g) = 5.21 mW/g**
**1900 MHz System Validation/Zoom Scan 5 (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.2 V/m; Power Drift = -0.003 dB
Peak SAR (extrapolated) = 17.4 W/kg
**SAR(1 g) = 9.97 mW/g; SAR(10 g) = 5.22 mW/g**
**1900 MHz System Validation/Zoom Scan 6 (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.8 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 17.1 W/kg
**SAR(1 g) = 9.9 mW/g; SAR(10 g) = 5.2 mW/g**
**1900 MHz System Validation/Zoom Scan 7 (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.8 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 17.2 W/kg
**SAR(1 g) = 9.93 mW/g; SAR(10 g) = 5.21 mW/g**
**1900 MHz System Validation/Zoom Scan 8 (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.1 V/m; Power Drift = -0.007 dB
Peak SAR (extrapolated) = 17.3 W/kg
**SAR(1 g) = 9.96 mW/g; SAR(10 g) = 5.2 mW/g**
**1900 MHz System Validation/Zoom Scan 9 (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.7 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 17.2 W/kg
**SAR(1 g) = 9.94 mW/g; SAR(10 g) = 5.2 mW/g**
**1900 MHz System Validation/Zoom Scan 10 (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.1 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 17.2 W/kg
**SAR(1 g) = 9.96 mW/g; SAR(10 g) = 5.21 mW/g**




**1 g average of 10 measurements: 9.966 mW/g**
**10 g average of 10 measurements: 5.219 mW/g**



# 1900 MHz System Validation

## Measured Fluid Dielectric Parameters (Brain)

June 18, 2004

| Frequency | e' | e" |
|---|---|---|
| 1.800000000 GHz | 38.7685 | 13.2945 |
| 1.810000000 GHz | 38.7232 | 13.3253 |
| 1.820000000 GHz | 38.6647 | 13.3519 |
| 1.830000000 GHz | 38.6047 | 13.3737 |
| 1.840000000 GHz | 38.5593 | 13.4078 |
| 1.850000000 GHz | 38.5136 | 13.4244 |
| 1.860000000 GHz | 38.4736 | 13.4289 |
| 1.870000000 GHz | 38.4328 | 13.4399 |
| 1.880000000 GHz | 38.3934 | 13.4856 |
| 1.890000000 GHz | 38.3637 | 13.4872 |
| 1.900000000 GHz | 38.3205 | 13.5178 |
| 1.910000000 GHz | 38.2981 | 13.5327 |
| 1.920000000 GHz | 38.2590 | 13.5755 |
| 1.930000000 GHz | 38.2344 | 13.5976 |
| 1.940000000 GHz | 38.2172 | 13.6297 |
| 1.950000000 GHz | 38.1838 | 13.6574 |
| 1.960000000 GHz | 38.1575 | 13.6807 |
| 1.970000000 GHz | 38.1070 | 13.6962 |
| 1.980000000 GHz | 38.0516 | 13.7296 |
| 1.990000000 GHz | 38.0093 | 13.7634 |
| 2.000000000 GHz | 37.9485 | 13.7978 |

# APPENDIX D - PROBE CALIBRATION

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

**Client** **Celltech Labs**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object(s) | ET3DV6 - SN:1590 |
| Calibration procedure(s) | QA CAL-01.v2<br>Calibration procedure for dosimetric E-field probes |
| Calibration date: | May 24, 2004 |
| Condition of the calibrated item | In Tolerance (according to the specific calibration document) |

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: environ ment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

| Model Type | ID # | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power meter EPM E4419B | GB41293874 | 5-May-04 (METAS, No 251-00388) | May-05 |
| Power sensor E4412A | MY41495277 | 5-May-04 (METAS, No 251-00388) | May-05 |
| Reference 20 dB Attenuator | SN: 5086 (20b) | 3-May-04 (METAS, No 251-00389) | May-05 |
| Fluke Process Calibrator Type 702 | SN: 6295803 | 8-Sep-03 (Sintrel SCS No. E-030020) | Sep-04 |
| Power sensor HP 8481A | MY41092180 | 18-Sep-02 (SPEAG, in house check Oct-03) | In house check: Oct 05 |
| RF generator HP 8684C | US3642U01700 | 4-Aug-99 (SPEAG, in house check Aug-02) | In house check: Aug-05 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (SPEAG, in house check Oct-03) | In house check: Oct 05 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Nico Vetterli | Technician | N. Vetterli |
| Approved by: | Katja Pokovic | Laboratory Director | |

Date issued: May 24, 2004

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

# Probe ET3DV6

## SN:1590

| | |
|---|---|
| Manufactured: | March 19, 2001 |
| Last calibrated: | May 15, 2003 |
| Recalibrated: | May 24, 2004 |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

# DASY - Parameters of Probe: ET3DV6 SN:1590

## Sensitivity in Free Space

| | | |
|---|---|---|
| NormX | **1.85** $\mu V/(V/m)^2$ | |
| NormY | **2.01** $\mu V/(V/m)^2$ | |
| NormZ | **1.73** $\mu V/(V/m)^2$ | |

## Diode Compression[A]

| | | |
|---|---|---|
| DCP X | **91** | mV |
| DCP Y | **91** | mV |
| DCP Z | **91** | mV |

## Sensitivity in Tissue Simulating Liquid (Conversion Factors)

**Plese see Page 7.**

## Boundary Effect

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

| Sensor Center to Phantom Surface Distance | | **3.7 mm** | **4.7 mm** |
|---|---|---|---|
| $SAR_{be}$ [%] | Without Correction Algorithm | 8.0 | 4.4 |
| $SAR_{be}$ [%] | With Correction Algorithm | 0.1 | 0.2 |

**Head** **1800 MHz** **Typical SAR gradient: 10 % per mm**

| Sensor Center to Phantom Surface Distance | | **3.7 mm** | **4.7 mm** |
|---|---|---|---|
| $SAR_{be}$ [%] | Without Correction Algorithm | 12.2 | 8.5 |
| $SAR_{be}$ [%] | With Correction Algorithm | 0.2 | 0.1 |

## Sensor Offset

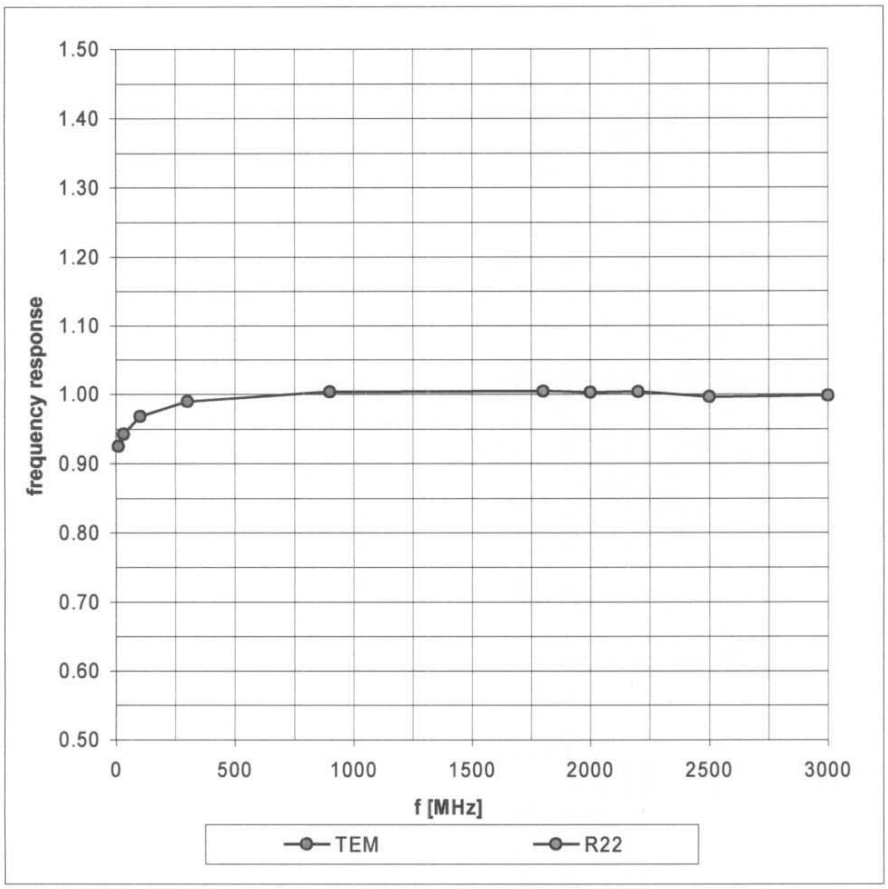
| | |
|---|---|
| Probe Tip to Sensor Center | **2.7** mm |
| Optical Surface Detection | **in tolerance** |

**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%.**

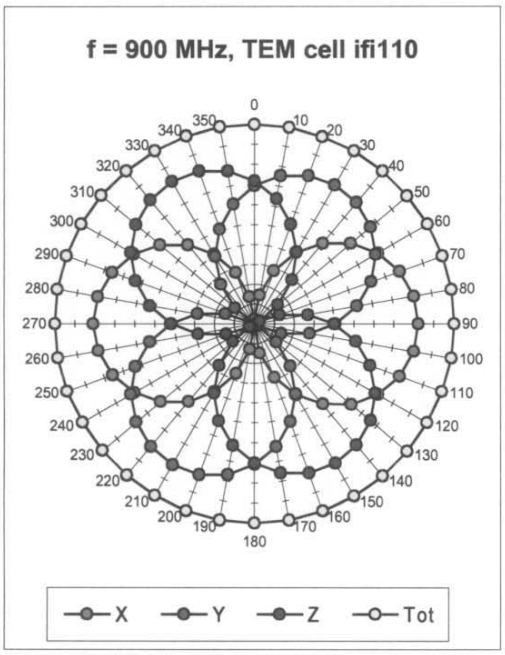
[A] numerical linearization parameter: uncertainty not required

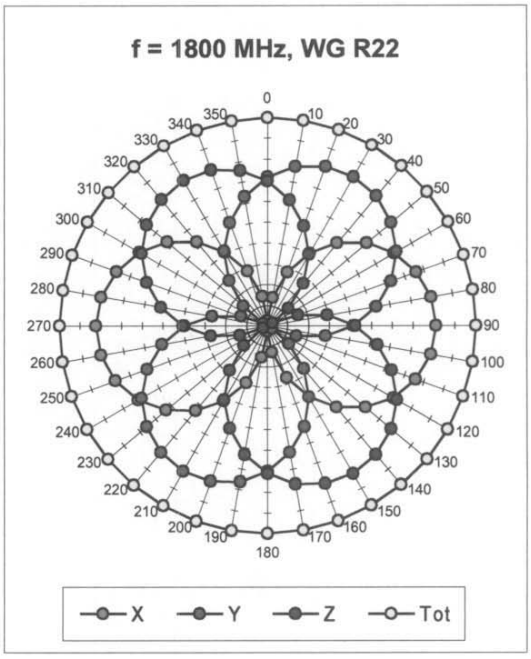
# Frequency Response of E-Field

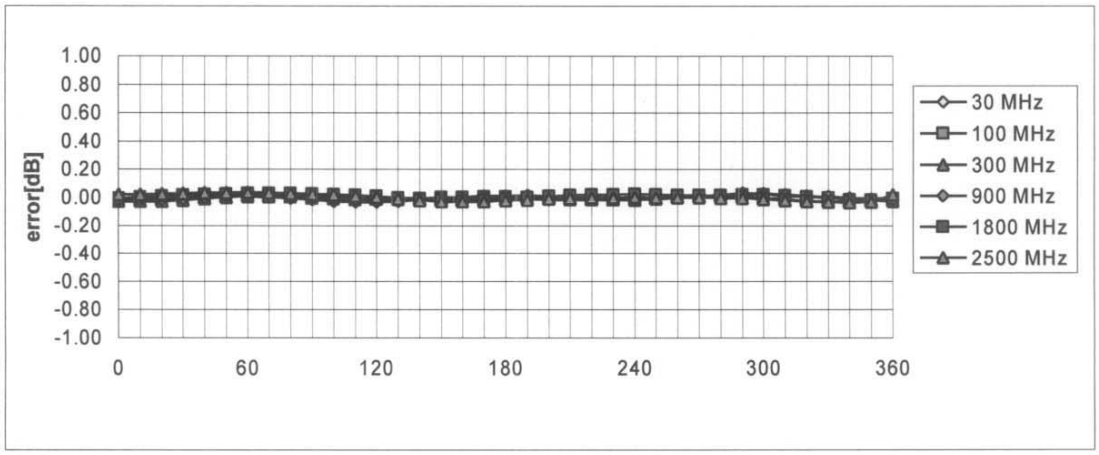
**( TEM-Cell:ifi110, Waveguide R22)**



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



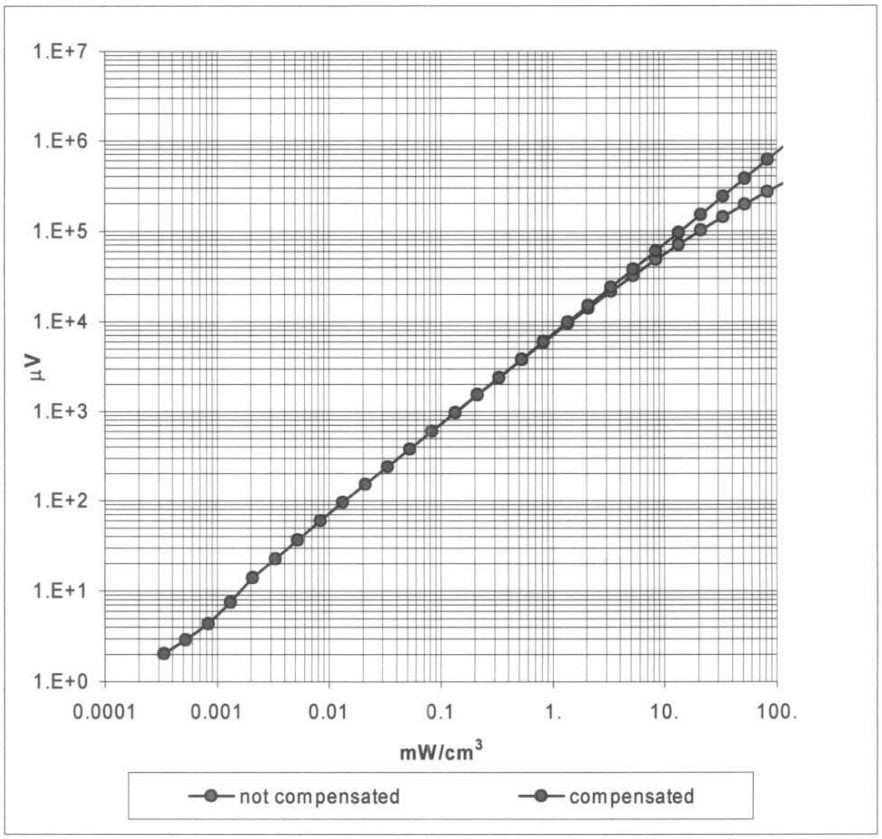



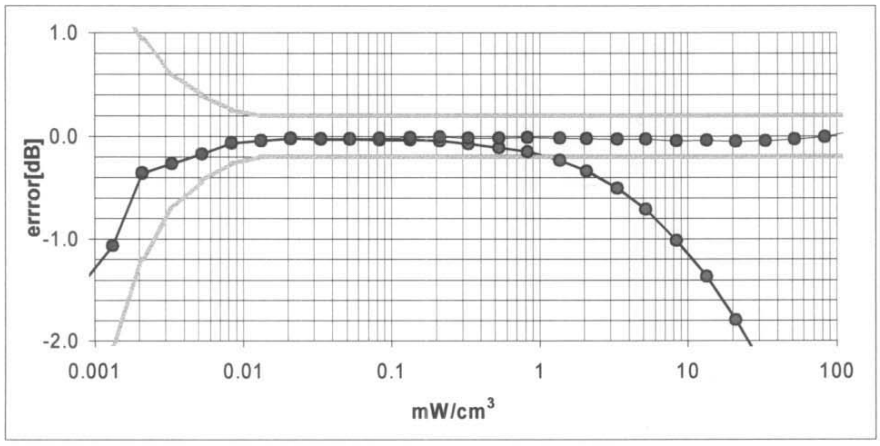




**Axial Isotropy Error < ± 0.2 dB**

# Dynamic Range f($SAR_{head}$)

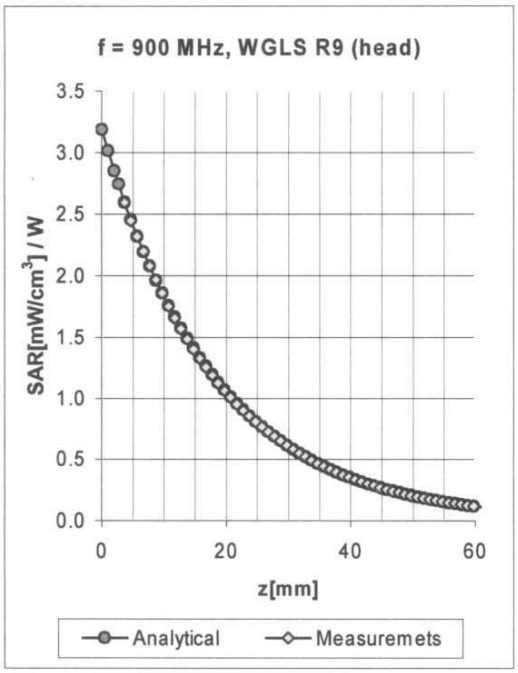
( Waveguide R22 )

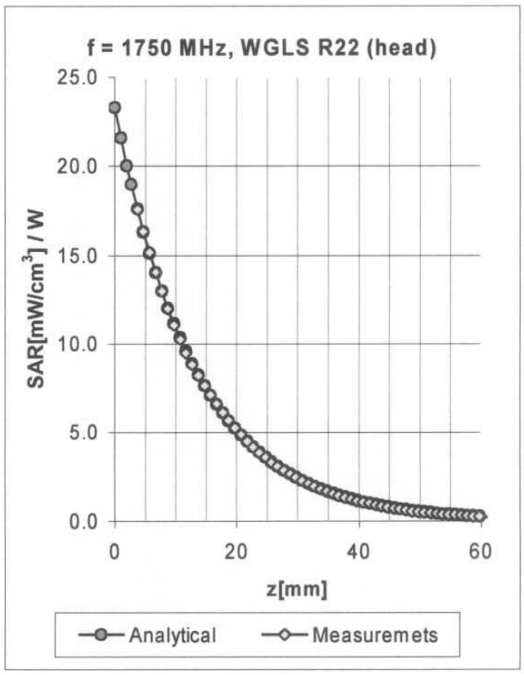



**Probe Linearity Error < ± 0.2 dB**

# Conversion Factor Assessment



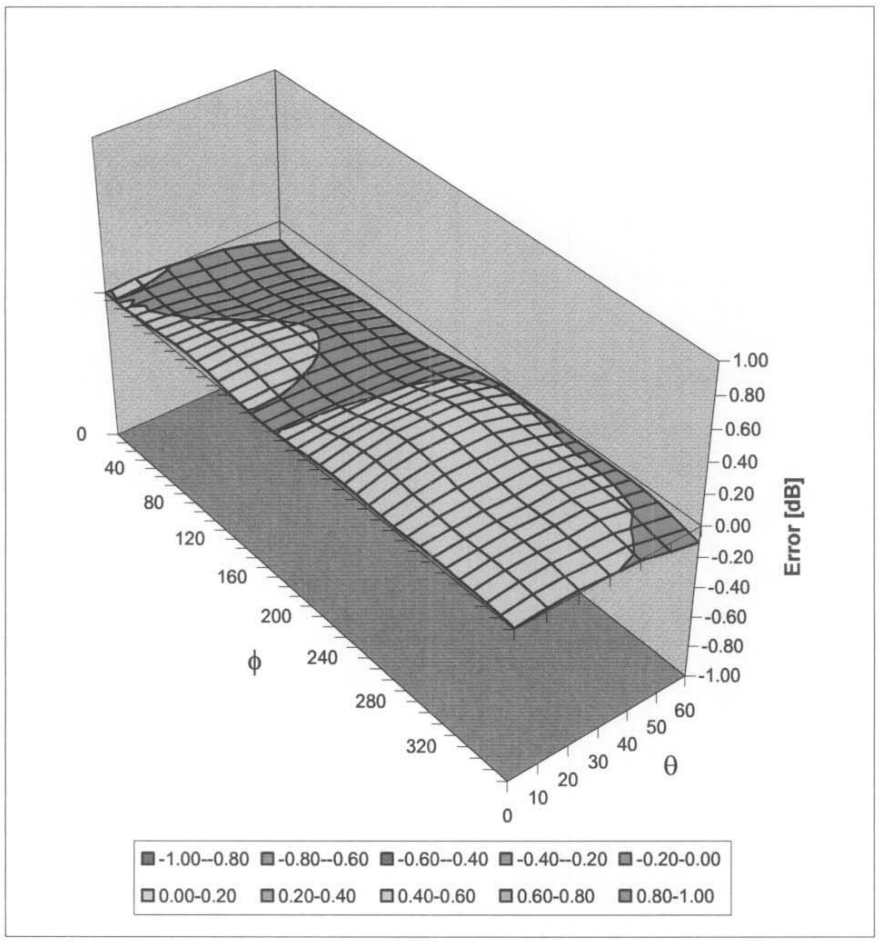




| f [MHz] | Validity [MHz][B] | Tissue | Permittivity | Conductivity | Alpha | Depth | ConvF Uncertainty |
|---|---|---|---|---|---|---|---|
| 835 | 750-950 | Head | 41.5 ± 5% | 0.90 ± 5% | 0.68 | 1.64 | 6.71 ± 11.9% (k=2) |
| 1750 | 1700-1800 | Head | 40.0 ± 5% | 1.40 ± 5% | 0.43 | 2.67 | 5.28 ± 9.7% (k=2) |
| 1900 | 1850-1950 | Head | 40.0 ± 5% | 1.40 ± 5% | 0.46 | 2.81 | 5.03 ± 9.7% (k=2) |
| 2450 | 2400-2500 | Head | 39.2 ± 5% | 1.80 ± 5% | 0.81 | 1.95 | 4.44 ± 9.7% (k=2) |
| | | | | | | | |
| 835 | 750-950 | Body | 55.2 ± 5% | 0.97 ± 5% | 0.49 | 1.99 | 6.54 ± 11.9% (k=2) |
| 1750 | 1700-1800 | Body | 53.3 ± 5% | 1.52 ± 5% | 0.50 | 2.87 | 4.68 ± 9.7% (k=2) |
| 1900 | 1850-1950 | Body | 53.3 ± 5% | 1.52 ± 5% | 0.52 | 2.93 | 4.58 ± 9.7% (k=2) |
| 2450 | 2400-2500 | Body | 52.7 ± 5% | 1.95 ± 5% | 0.91 | 1.78 | 4.22 ± 9.7% (k=2) |

[B] The total standard uncertainty is calculated as root-sum-square of standard uncertainty of the Conversion Factor at calibration frequency and the standard uncertainty for the indicated frequency band.

# Deviation from Isotropy in HSL

**Error (θ, ϕ), f = 900 MHz**




**Spherical Isotropy Error < ± 0.4 dB**

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

# Additional Conversion Factors

**for Dosimetric E-Field Probe**

| | |
|---|---|
| Type: | **ET3DV6** |
| Serial Number: | **1590** |
| Place of Assessment: | **Zurich** |
| Date of Assessment: | **May 25, 2004** |
| Probe Calibration Date: | **May 24, 2004** |

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by:

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# Dosimetric E-Field Probe ET3DV6 SN:1590

Conversion factor (± standard deviation)

| | | | |
|---|---|---|---|
| **150 MHz** | ConvF | **9.1 ± 8%** | $\varepsilon_r$ **= 52.3 ± 5%**<br>$\sigma$ **= 0.76 ± 5% mho/m**<br>(head tissue) |
| **300 MHz** | ConvF | **7.9 ± 8%** | $\varepsilon_r$ **= 45.3 ± 5%**<br>$\sigma$ **= 0.87 ± 5% mho/m**<br>(head tissue) |
| **450 MHz** | ConvF | **7.5 ± 8%** | $\varepsilon_r$ **= 43.5 ± 5%**<br>$\sigma$ **= 0.87 ± 5% mho/m**<br>(head tissue) |
| **150 MHz** | ConvF | **8.8 ± 8%** | $\varepsilon_r$ **= 61.9 ± 5%**<br>$\sigma$ **= 0.80 ± 5% mho/m**<br>(body tissue) |
| **450 MHz** | ConvF | **7.7 ± 8%** | $\varepsilon_r$ **= 56.7 ± 5%**<br>$\sigma$ **= 0.94 ± 5% mho/m**<br>(body tissue) |

**Important Note:**

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

**Please see also Section 4.7 of the DASY4 Manual.**

# APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

# 835 MHz System Performance Check & DUT Evaluation (Head)

## Measured Fluid Dielectric Parameters (Brain)

July 28, 2004

| Frequency | e' | e" |
|---|---|---|
| 735.000000 MHz | 41.7385 | 19.7591 |
| 745.000000 MHz | 41.5868 | 19.7253 |
| 755.000000 MHz | 41.4644 | 19.6743 |
| 765.000000 MHz | 41.2880 | 19.6161 |
| 775.000000 MHz | 41.1382 | 19.5981 |
| 785.000000 MHz | 41.0451 | 19.5667 |
| 795.000000 MHz | 40.9351 | 19.5407 |
| 805.000000 MHz | 40.8337 | 19.4917 |
| 815.000000 MHz | 40.7629 | 19.4842 |
| 825.000000 MHz | 40.6202 | 19.4540 |
| 835.000000 MHz | 40.5023 | 19.4027 |
| 845.000000 MHz | 40.3226 | 19.3596 |
| 855.000000 MHz | 40.2010 | 19.3231 |
| 865.000000 MHz | 40.0494 | 19.2760 |
| 875.000000 MHz | 39.9366 | 19.2804 |
| 885.000000 MHz | 39.8421 | 19.2301 |
| 895.000000 MHz | 39.7662 | 19.1659 |
| 905.000000 MHz | 39.6488 | 19.1200 |
| 915.000000 MHz | 39.5458 | 19.0958 |
| 925.000000 MHz | 39.4483 | 19.0468 |
| 935.000000 MHz | 39.3154 | 19.0145 |

# 835 MHz DUT Evaluation (Head)

## Measured Fluid Dielectric Parameters (Brain)

July 29, 2004

| Frequency | e' | e" |
|---|---|---|
| 735.000000 MHz | 41.5982 | 19.7821 |
| 745.000000 MHz | 41.4755 | 19.7415 |
| 755.000000 MHz | 41.3088 | 19.6450 |
| 765.000000 MHz | 41.1634 | 19.6139 |
| 775.000000 MHz | 41.0241 | 19.5883 |
| 785.000000 MHz | 40.9286 | 19.5858 |
| 795.000000 MHz | 40.8226 | 19.5701 |
| 805.000000 MHz | 40.7433 | 19.5589 |
| 815.000000 MHz | 40.6276 | 19.4989 |
| 825.000000 MHz | 40.5039 | 19.4747 |
| 835.000000 MHz | 40.3673 | 19.4079 |
| 845.000000 MHz | 40.2207 | 19.3668 |
| 855.000000 MHz | 40.0401 | 19.3367 |
| 865.000000 MHz | 39.9281 | 19.2792 |
| 875.000000 MHz | 39.7872 | 19.2516 |
| 885.000000 MHz | 39.6689 | 19.2191 |
| 895.000000 MHz | 39.6183 | 19.1685 |
| 905.000000 MHz | 39.5063 | 19.1366 |
| 915.000000 MHz | 39.4117 | 19.1202 |
| 925.000000 MHz | 39.3354 | 19.0896 |
| 935.000000 MHz | 39.2124 | 19.0544 |

# 1900 MHz System Performance Check & 1880 MHz DUT Evaluation (Head)

## Measured Fluid Dielectric Parameters (Brain)

July 29, 2004

| Frequency | e' | e" |
|---|---|---|
| 1.800000000 GHz | 38.5122 | 13.1237 |
| 1.810000000 GHz | 38.4600 | 13.1480 |
| 1.820000000 GHz | 38.4102 | 13.1740 |
| 1.830000000 GHz | 38.3772 | 13.1813 |
| 1.840000000 GHz | 38.3279 | 13.2192 |
| 1.850000000 GHz | 38.2801 | 13.2326 |
| 1.860000000 GHz | 38.2155 | 13.2357 |
| 1.870000000 GHz | 38.1808 | 13.2622 |
| 1.880000000 GHz | 38.1484 | 13.3051 |
| 1.890000000 GHz | 38.1126 | 13.3354 |
| 1.900000000 GHz | 38.0790 | 13.3819 |
| 1.910000000 GHz | 38.0505 | 13.4107 |
| 1.920000000 GHz | 38.0140 | 13.4531 |
| 1.930000000 GHz | 37.9900 | 13.4761 |
| 1.940000000 GHz | 37.9515 | 13.4880 |
| 1.950000000 GHz | 37.9215 | 13.5120 |
| 1.960000000 GHz | 37.8752 | 13.5175 |
| 1.970000000 GHz | 37.8042 | 13.5187 |
| 1.980000000 GHz | 37.7543 | 13.5472 |
| 1.990000000 GHz | 37.6852 | 13.5795 |
| 2.000000000 GHz | 37.6260 | 13.6030 |

# 1880 MHz DUT Evaluation (Head)

## Measured Fluid Dielectric Parameters (Brain)

July 30, 2004

| Frequency | e' | e" |
|---|---|---|
| 1.780000000 GHz | 38.5424 | 13.2058 |
| 1.790000000 GHz | 38.5119 | 13.2292 |
| 1.800000000 GHz | 38.4657 | 13.2647 |
| 1.810000000 GHz | 38.4077 | 13.2982 |
| 1.820000000 GHz | 38.3733 | 13.3239 |
| 1.830000000 GHz | 38.3218 | 13.3389 |
| 1.840000000 GHz | 38.2731 | 13.3763 |
| 1.850000000 GHz | 38.2271 | 13.3914 |
| 1.860000000 GHz | 38.1716 | 13.4035 |
| 1.870000000 GHz | 38.1193 | 13.4288 |
| 1.880000000 GHz | 38.0856 | 13.4488 |
| 1.890000000 GHz | 38.0409 | 13.4874 |
| 1.900000000 GHz | 38.0035 | 13.5215 |
| 1.910000000 GHz | 37.9576 | 13.5493 |
| 1.920000000 GHz | 37.9296 | 13.5807 |
| 1.930000000 GHz | 37.8858 | 13.5987 |
| 1.940000000 GHz | 37.8546 | 13.6351 |
| 1.950000000 GHz | 37.8211 | 13.6615 |
| 1.960000000 GHz | 37.7697 | 13.6529 |
| 1.970000000 GHz | 37.7161 | 13.6806 |
| 1.980000000 GHz | 37.6678 | 13.6966 |

# 835 MHz System Performance Check

## Measured Fluid Dielectric Parameters (Brain)

July 31, 2004

| Frequency | e' | e" |
|---|---|---|
| 735.000000 MHz | 42.1920 | 20.1491 |
| 745.000000 MHz | 42.0711 | 20.0891 |
| 755.000000 MHz | 41.8820 | 20.0141 |
| 765.000000 MHz | 41.7893 | 19.9850 |
| 775.000000 MHz | 41.6265 | 19.9303 |
| 785.000000 MHz | 41.5184 | 19.8967 |
| 795.000000 MHz | 41.4482 | 19.9089 |
| 805.000000 MHz | 41.3347 | 19.8676 |
| 815.000000 MHz | 41.2354 | 19.8452 |
| 825.000000 MHz | 41.0979 | 19.8448 |
| 835.000000 MHz | 40.9829 | 19.7758 |
| 845.000000 MHz | 40.8334 | 19.7393 |
| 855.000000 MHz | 40.6556 | 19.6606 |
| 865.000000 MHz | 40.5244 | 19.6227 |
| 875.000000 MHz | 40.3797 | 19.5597 |
| 885.000000 MHz | 40.2589 | 19.5322 |
| 895.000000 MHz | 40.2190 | 19.4625 |
| 905.000000 MHz | 40.1149 | 19.4374 |
| 915.000000 MHz | 40.0275 | 19.4084 |
| 925.000000 MHz | 39.9212 | 19.3714 |
| 935.000000 MHz | 39.7871 | 19.3439 |

# 835 MHz DUT Evaluation (Body)

## Measured Fluid Dielectric Parameters (Muscle)

July 31, 2004

| Frequency | e' | e" |
|---|---|---|
| 735.000000 MHz | 55.0041 | 22.0205 |
| 745.000000 MHz | 54.8820 | 21.9534 |
| 755.000000 MHz | 54.7685 | 21.8613 |
| 765.000000 MHz | 54.6596 | 21.7698 |
| 775.000000 MHz | 54.5485 | 21.7279 |
| 785.000000 MHz | 54.5010 | 21.6882 |
| 795.000000 MHz | 54.4465 | 21.6512 |
| 805.000000 MHz | 54.3883 | 21.5930 |
| 815.000000 MHz | 54.2830 | 21.5355 |
| 825.000000 MHz | 54.1927 | 21.5074 |
| 835.000000 MHz | 54.0634 | 21.4666 |
| 845.000000 MHz | 53.9579 | 21.4184 |
| 855.000000 MHz | 53.8340 | 21.3675 |
| 865.000000 MHz | 53.7013 | 21.3106 |
| 875.000000 MHz | 53.5944 | 21.3098 |
| 885.000000 MHz | 53.5215 | 21.2752 |
| 895.000000 MHz | 53.4689 | 21.1756 |
| 905.000000 MHz | 53.3961 | 21.1114 |
| 915.000000 MHz | 53.3155 | 21.0461 |
| 925.000000 MHz | 53.2283 | 21.0206 |
| 935.000000 MHz | 53.1532 | 20.9909 |

# 1900 MHz System Performance Check

## Measured Fluid Dielectric Parameters (Brain)

August 03, 2004

| Frequency | e' | e" |
|---|---|---|
| 1.800000000 GHz | 38.6454 | 13.1925 |
| 1.810000000 GHz | 38.6014 | 13.2053 |
| 1.820000000 GHz | 38.5486 | 13.2115 |
| 1.830000000 GHz | 38.5032 | 13.2433 |
| 1.840000000 GHz | 38.4589 | 13.2597 |
| 1.850000000 GHz | 38.4163 | 13.2723 |
| 1.860000000 GHz | 38.3673 | 13.2771 |
| 1.870000000 GHz | 38.3196 | 13.2873 |
| 1.880000000 GHz | 38.2823 | 13.3031 |
| 1.890000000 GHz | 38.2455 | 13.3276 |
| 1.900000000 GHz | 38.2208 | 13.3652 |
| 1.910000000 GHz | 38.1815 | 13.3913 |
| 1.920000000 GHz | 38.1742 | 13.4296 |
| 1.930000000 GHz | 38.1507 | 13.4634 |
| 1.940000000 GHz | 38.1381 | 13.4758 |
| 1.950000000 GHz | 38.1112 | 13.5145 |
| 1.960000000 GHz | 38.0580 | 13.5235 |
| 1.970000000 GHz | 38.0138 | 13.5359 |
| 1.980000000 GHz | 37.9566 | 13.5624 |
| 1.990000000 GHz | 37.9121 | 13.6070 |
| 2.000000000 GHz | 37.8699 | 13.6531 |

# 1880 MHz DUT Evaluation (Body)

## Measured Fluid Dielectric Parameters (Muscle)

August 03, 2004

| Frequency | e' | e" |
|---|---|---|
| 1.780000000 GHz | 52.3500 | 14.5652 |
| 1.790000000 GHz | 52.3116 | 14.6201 |
| 1.800000000 GHz | 52.2869 | 14.6671 |
| 1.810000000 GHz | 52.2467 | 14.7275 |
| 1.820000000 GHz | 52.2154 | 14.7659 |
| 1.830000000 GHz | 52.1567 | 14.7740 |
| 1.840000000 GHz | 52.1171 | 14.8023 |
| 1.850000000 GHz | 52.0835 | 14.7896 |
| 1.860000000 GHz | 52.0377 | 14.8024 |
| 1.870000000 GHz | 51.9975 | 14.8359 |
| 1.880000000 GHz | 51.9576 | 14.8514 |
| 1.890000000 GHz | 51.9201 | 14.8797 |
| 1.900000000 GHz | 51.9212 | 14.9493 |
| 1.910000000 GHz | 51.8892 | 14.9875 |
| 1.920000000 GHz | 51.8677 | 15.0668 |
| 1.930000000 GHz | 51.8357 | 15.0768 |
| 1.940000000 GHz | 51.8421 | 15.0952 |
| 1.950000000 GHz | 51.8455 | 15.1164 |
| 1.960000000 GHz | 51.8129 | 15.1241 |
| 1.970000000 GHz | 51.7548 | 15.1450 |
| 1.980000000 GHz | 51.7063 | 15.1898 |

# APPENDIX F - SAM PHANTOM CERTIFICATE OF CONFORMITY

**Schmid & Partner Engineering AG**

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## Certificate of conformity / First Article Inspection

| | |
|---|---|
| Item | SAM Twin Phantom V4.0 |
| Type No | QD 000 P40 BA |
| Series No | TP-1002 and higher |
| Manufacturer / Origin | Untersee Composites<br>Hauptstr. 69<br>CH-8559 Fruthwilen<br>Switzerland |

### Tests

The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series units (called samples).

| Test | Requirement | Details | Units tested |
|---|---|---|---|
| Shape | Compliance with the geometry according to the CAD model. | IT'IS CAD File (*) | First article, Samples |
| Material thickness | Compliant with the requirements according to the standards | 2mm +/- 0.2mm in specific areas | First article, Samples |
| Material parameters | Dielectric parameters for required frequencies | 200 MHz – 3 GHz<br>Relative permittivity < 5<br>Loss tangent < 0.05. | Material sample TP 104-5 |
| Material resistivity | The material has been tested to be compatible with the liquids defined in the standards | Liquid type HSL 1800 and others according to the standard. | Pre-series, First article |

### Standards

[1] CENELEC EN 50361
[2] IEEE P1528-200x draft 6.5
[3] IEC PT 62209 draft 0.9
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

### Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

**Date** 18.11.2001

**Signature / Stamp**

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