

DECLARATION OF COMPLIANCE SAR EVALUATION

Test Lab

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Applicant Information

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| | |
|-----------------------------------|---|
| Rule Part(s): | FCC 47 CFR §2.1093; IC RSS-102 Issue 1 (Provisional) |
| Test Procedure(s): | FCC OET Bulletin 65, Supplement C (01-01) |
| FCC Device Classification: | Licensed Base Station for Part 24 (PCB) |
| IC Device Classification: | 2GHz Personal Communication Services (RSS-133 Issue 2) 800MHz CDMA Cellular Transmitter (RSS-129 Issue 2) |
| FCC ID: | KBCIX260AC555-MPI |
| Model(s): | IX260 |
| Device Type: | Rugged Laptop PC with Sierra Wireless AirCard 555/550 Dual-Band PCS/Cellular CDMA PCMCIA Modem Card (Co-located with Cisco Systems MPI-350 Mini-PCI DSSS WLAN Card) |
| Tx Frequency Range: | 1851.25 - 1908.75 MHz (PCS CDMA) 824.70 - 848.31 MHz (Cellular CDMA) |
| RF Output Power Tested: | 23.0 dBm Conducted (PCS CDMA) 23.0 dBm Conducted (Cellular CDMA) |
| Antenna Type(s): | External Dipole (Dual-Band CDMA Modem) Dual Internal (Co-located DSSS WLAN Card) |
| Battery Type: | 11.1V Lithium-Ion, 6.0Ah (Model: A2121-2) |
| Max. SAR Measured: | 1.15 W/kg (PCS CDMA) / 0.522 W/kg (Cellular CDMA) |

Celltech Labs Inc. declares under its sole responsibility that this device was found to be in 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 and Industry Canada RSS-102 Issue 1 - Provisional (General Population / Uncontrolled Exposure).

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 Pipe
Senior Compliance Technologist
Celltech Labs Inc.



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1.0 INTRODUCTION

This measurement report demonstrates that the ITRONIX CORPORATION Model: IX260 Rugged Laptop PC with Sierra Wireless AirCard 555/550 Dual-Band PCS/Cellular CDMA PCMCIA Modem Card (co-located with Cisco Systems MPI-350 Mini-PCI DSSS WLAN Card) FCC ID: KBCIX260AC555-MPI complies with the RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]), and Health Canada Safety Code 6 (see reference [2]) for the General Population environment. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]) and IC RSS-102 Issue 1 (Provisional) (see reference [4]), were employed. A description of the product, 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 Equipment Under Test (EUT)

| | |
|----------------------------------|---|
| FCC Rule Part(s) | 47 CFR §2.1093 |
| IC Rule Part(s) | IC RSS-102 Issue 1 (Provisional) |
| Test Procedure | FCC OET Bulletin 65, Supplement C (01-01) |
| FCC Device Classification | Licensed Base Station for Part 24 (PCB) |
| IC Device Classification | 2GHz Personal Communication Services (RSS-133 Issue 2) 800MHz CDMA Cellular Transmitter (RSS-129 Issue 2) |
| Device Type | Rugged Laptop PC with Sierra Wireless AirCard 555/550 Dual-Band PCS/Cellular CDMA PCMCIA Modem Card (Co-located with Cisco MPI-350 Mini-PCI DSSS WLAN Card) |
| FCC ID | KBCIX260AC555-MPI |
| Model(s) | IX260 |
| Serial No. | Pre-production |
| Operating Mode(s) | PCS CDMA / Cellular CDMA |
| Tx Frequency Range | 1851.25 - 1908.75 MHz (PCS CDMA) 824.70 - 848.31 MHz (Cellular CDMA) |
| RF Output Power Tested | 23.0 dBm Conducted (PCS CDMA) 23.0 dBm Conducted (Cellular CDMA) |
| Antenna Type(s) | External Dipole (Length: 4.3 inches) Dual Internal (Co-located DSSS WLAN Card) |
| Battery Type | 11.1V Lithium-Ion, 6.0Ah (Model: A2121-2) |

3.0 SAR MEASUREMENT SYSTEM

Celltech Labs SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY system is comprised of the 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 PC plug-in card. The DAE3 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 PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.



DASY3 SAR Measurement System with SAM phantom

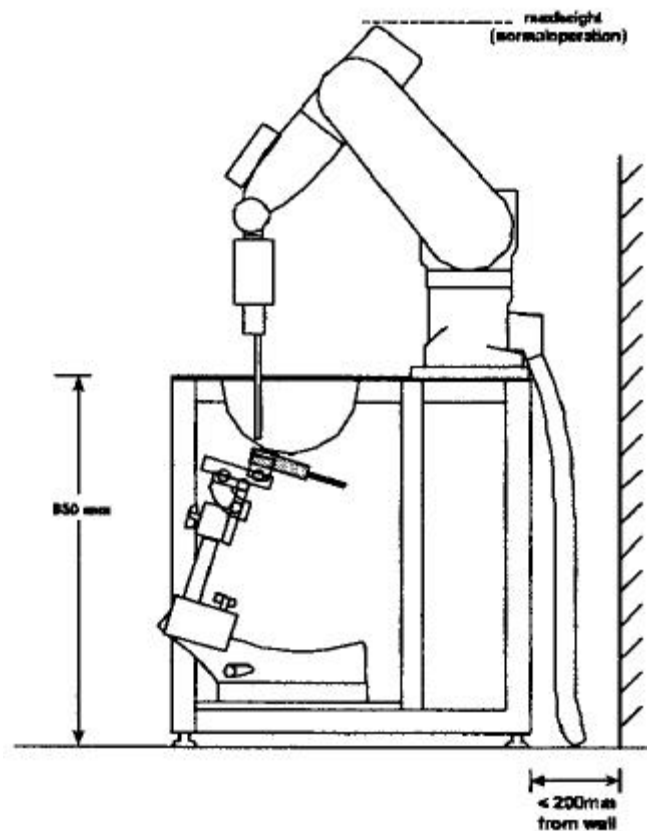


Figure 1. DASY3 Compact Version - Side View

4.0 MEASUREMENT SUMMARY

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the EUT are reported in Appendix A.

| BODY SAR MEASUREMENT RESULTS - PCS CDMA | | | | | | | | | |
|--|-------------|----------------|-----------|-----------------------------|-------|------------------------------------|--------------------------------------|--------------------------|------------------------|
| Transmit Mode | Freq. (MHz) | Channel | Test Mode | Conducted Power (dBm) | | Antenna Position to Planar Phantom | Laptop PC Position to Planar Phantom | Separation Distance (cm) | Measured SAR 1g (W/kg) |
| | | | | Before | After | | | | |
| CDMA | 1880.00 | 600 | PCS CDMA | 23.0 | 22.9 | Parallel (Stowed) | Back of LCD (LCD Closed) | 0.0 | 1.05 |
| CDMA & DSSS | 1880.00 | 600 | PCS CDMA | 23.0 | 22.8 | Parallel (Stowed) | Back of LCD (LCD Closed) | 0.0 | 1.15 |
| CDMA | 1880.00 | 600 | PCS CDMA | 23.0 | 22.8 | Perpendicular (Extended) | Bottom Side (LCD Closed) | 0.0 | 0.0342 |
| CDMA & DSSS | 1880.00 | 600 | PCS CDMA | 23.0 | 22.8 | Perpendicular (Extended) | Bottom Side (LCD Closed) | 0.0 | 0.0249 |
| CDMA | 1880.00 | 600 | PCS CDMA | 23.0 | 22.8 | Parallel (Stowed) | Right Side of LCD (LCD Closed) | 1.5 | 0.212 |
| CDMA & DSSS | 1880.00 | 600 | PCS CDMA | 23.0 | 22.9 | Parallel (Stowed) | Right Side of LCD (LCD Closed) | 1.5 | 0.150 |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT BODY: 1.6 W/kg (averaged over 1 gram) Spatial Peak - Uncontrolled Exposure / General Population | | | | | | | | | |
| Test Date(s) | | 10/31/02 | | Relative Humidity | | 68 % | | | |
| Measured Mixture Type | | 1900MHz Muscle | | Atmospheric Pressure | | 103.4 kPa | | | |
| Dielectric Constant ϵ_r | | IEEE Target | Measured | Ambient Temperature | | 22.2 °C | | | |
| | | 53.3 ±5% | 53.3 | Fluid Temperature | | 21.4 °C | | | |
| Conductivity σ (mho/m) | | IEEE Target | Measured | Fluid Depth | | ≥ 15 cm | | | |
| | | 1.52 ±5% | 1.51 | ρ (Kg/m ³) | | 1000 | | | |

Note(s):

1. If the SAR measurements performed at the middle channel were ≥ 3dB below the SAR limit, SAR evaluation for the low and high channels was optional for each test configuration (per FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3])).
2. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluation. The temperatures listed in the table above were consistent for all measurement periods.
3. The co-located Cisco MPI-350 DSSS WLAN Card was set to the maximum conducted power level (21.1 dBm) at the mid channel (2437MHz) with a CW signal and the right side internal antenna transmitting for the simultaneous transmit tests.

MEASUREMENT SUMMARY (Cont.)

| BODY SAR MEASUREMENT RESULTS - Cellular CDMA | | | | | | | | | |
|--|-------------|---------------|-----------|-----------------------------|-------|------------------------------------|--------------------------------------|--------------------------|------------------------|
| Transmit Mode | Freq. (MHz) | Channel | Test Mode | Conducted Power (dBm) | | Antenna Position to Planar Phantom | Laptop PC Position to Planar Phantom | Separation Distance (cm) | Measured SAR 1g (W/kg) |
| | | | | Before | After | | | | |
| CDMA | 835.89 | 363 | CDMA | 23.0 | 23.0 | Parallel (Stowed) | Back of LCD (LCD Closed) | 0.0 | 0.493 |
| CDMA & DSSS | 835.89 | 363 | CDMA | 23.0 | 22.9 | Parallel (Stowed) | Back of LCD (LCD Closed) | 0.0 | 0.522 |
| CDMA | 835.89 | 363 | CDMA | 23.0 | 22.8 | Perpendicular (Extended) | Bottom Side of PC (LCD Closed) | 0.0 | 0.0175 |
| CDMA & DSSS | 835.89 | 363 | CDMA | 23.0 | 22.8 | Perpendicular (Extended) | Bottom Side of PC (LCD Closed) | 0.0 | 0.0197 |
| CDMA | 835.89 | 363 | CDMA | 23.0 | 22.9 | Parallel (Extended) | Right Side of LCD (LCD Closed) | 0.0 | 0.231 |
| CDMA & DSSS | 835.89 | 363 | CDMA | 23.0 | 22.9 | Parallel (Extended) | Right side of LCD (LCD Closed) | 0.0 | 0.207 |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT BODY: 1.6 W/kg (averaged over 1 gram) Spatial Peak - Uncontrolled Exposure / General Population | | | | | | | | | |
| Test Date(s) | | 11/01/02 | | Relative Humidity | | 66 % | | | |
| Measured Mixture Type | | 835MHz Muscle | | Atmospheric Pressure | | 103.3 kPa | | | |
| Dielectric Constant ϵ_r | | IEEE Target | Measured | Ambient Temperature | | 22.2 °C | | | |
| | | 55.2 ±5% | 53.3 | Fluid Temperature | | 22.0 °C | | | |
| Conductivity σ (mho/m) | | IEEE Target | Measured | Fluid Depth | | ≥ 15 cm | | | |
| | | 0.97 ±5% | 0.96 | ρ (Kg/m ³) | | 1000 | | | |

Note(s):

1. If the SAR measurements performed at the middle channel were ≥ 3 dB below the SAR limit, SAR evaluation for the low and high channels was optional for each test configuration (per FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3])).
2. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluation. The temperatures listed in the table above were consistent for all measurement periods.
3. The co-located Cisco MPI-350 DSSS WLAN Card was set to the maximum conducted power level (21.1 dBm) at the mid channel (2437MHz) with a CW signal and the right side internal antenna transmitting for the simultaneous transmit tests.

5.0 DETAILS OF SAR EVALUATION

The ITRONIX CORPORATION Model: IX260 Rugged Laptop PC with Sierra Wireless AirCard 555/550 Dual-Band PCS/Cellular CDMA PCMCIA Modem Card (co-located with Cisco Systems MPI-350 Mini-PCI DSSS WLAN Card) FCC ID: KBCIX260AC555-MPI was found to be compliant for localized Specific Absorption Rate based on the following test provisions and conditions described below. The detailed test setup photographs are shown in Appendix G.

1. The EUT was tested for body SAR with the LCD display closed and the back of the LCD display facing parallel to, and touching, the outer surface of the planar phantom. The EUT was tested with the antenna in both the parallel (stowed) and perpendicular (180°) positions to the outer surface of the planar phantom, and the worst-case position was reported.
2. The EUT was tested for body SAR with the LCD display closed and the bottom of the Laptop PC facing parallel to, and touching, the outer surface of the planar phantom. The EUT was tested with the antenna in both the parallel (stowed) and perpendicular (extended) positions to the outer surface of the planar phantom, and the worst-case position was reported.
3. The EUT was tested for body SAR with the LCD display closed and the right side of the LCD display (antenna side) facing parallel to the outer surface of the planar phantom and a 1.5 cm separation distance between the antenna and the planar phantom. The EUT was tested with the antenna parallel to the outer surface of the planar phantom in both the stowed and extended positions, and the worst-case position was reported.
4. The EUT was tested at the highest SAR configurations for both PCS and cellular CDMA bands with the co-located Mini-PCI DSSS WLAN Card transmitting simultaneously at maximum power (21.1 dBm), mid channel (2437MHz), in CW mode.
5. The conducted power levels were measured before and after each test using a Gigatronics 8652A Universal Power Meter according to the procedures described in FCC 47 CFR §2.1046. If the conducted power levels measured after each evaluation varied more than 5% from the initial power level, then the EUT was retested. Any unusual anomalies over the course of the test also warranted a re-evaluation.
6. The EUT was controlled in test mode via internal software. SAR measurements were performed with the EUT transmitting continuously with no turn-on delay at maximum power using a modulated CDMA signal.
7. The location of the maximum spatial SAR distribution (Hot Spot) was determined relative to the device and antenna.
8. The EUT was tested with a fully charged battery.
9. Due to the dimensions of the EUT, a stack of low-density, low-loss dielectric foamed polystyrene was used in place of the device holder.
10. Due to the dimensions of the EUT the initial coarse scans did not cover the entire area of the Laptop PC. Subsequently, a second coarse scan was performed for the highest SAR configurations to show there were no secondary peak SAR locations within 3dB of the primary peak values. At this time there is no recognized flat phantom available that is twice the dimensions of the Laptop PC.

6.0 EVALUATION PROCEDURES

- (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 in accordance with FCC OET Bulletin 65, Supplement C (Edition 01-01) 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 DASY3 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 20mm x 20mm.
- c. Based on the area scan data, the area of maximum absorption was determined by spline interpolation. Around this point, a volume of 40 x 40 x 35 mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 7 points.
- d. The 1g and 10g spatial peak SAR was determined as follows:
 1. The first step was an extrapolation 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 from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm (see probe calibration document in Appendix D). The extrapolation was based on a least square algorithm [W. Gander, Computermathematik, p.168-180] (see reference [6]). Through the points in the first 3 cm in all z-axis, polynomials of the fourth order were calculated. This polynomial was then used to evaluate the points between the surface and the probe tip.
 2. The next step used 3D-spline interpolation to get all points within the measured volume in a 1mm grid (35000 points). The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition [W. Gander, Computermathematik, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff] (see reference [6]).
 3. The maximal interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-spline interpolation algorithm. 8000 points (20x20x20) were interpolated to calculate the average.

EVALUATION PROCEDURES (Cont.)

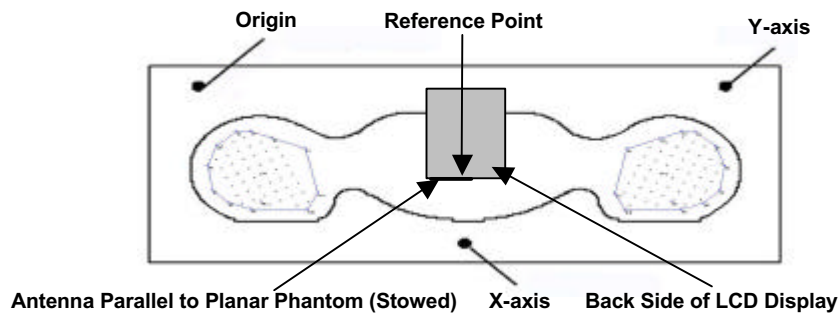


Figure 2. Phantom Reference Point & EUT Positioning
Back Side of LCD Display (Closed)

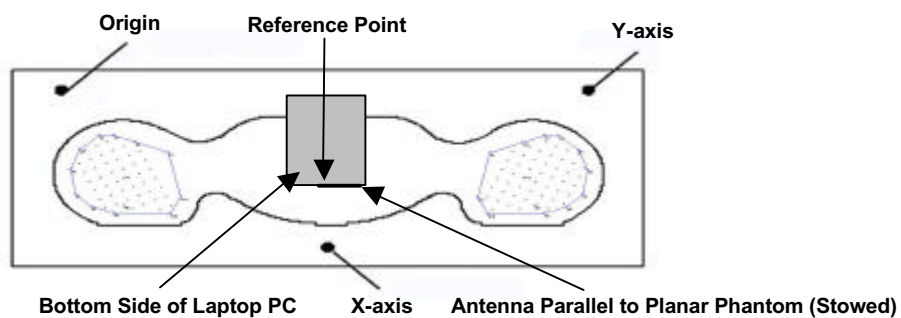


Figure 3. Phantom Reference Point & EUT Positioning
Bottom Side of Laptop PC (LCD Display Closed)

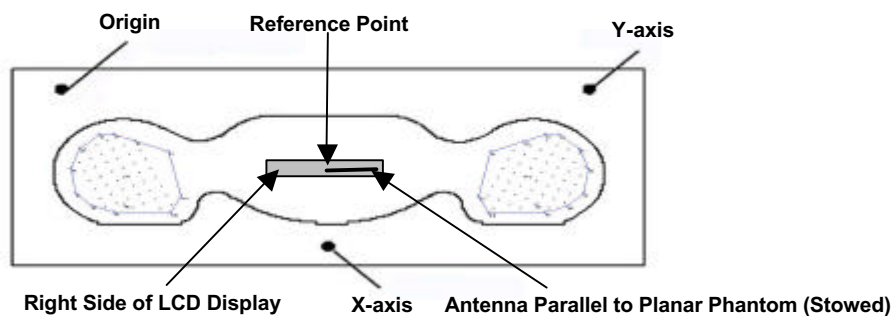


Figure 4. Phantom Reference Point & EUT Positioning
Right Side of LCD Display (Closed)

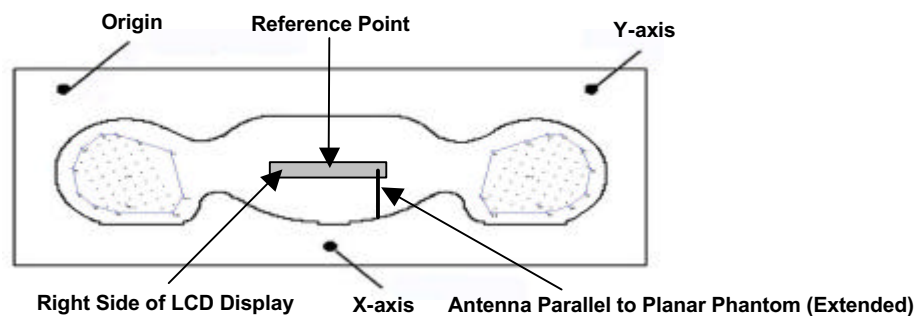


Figure 5. Phantom Reference Point & EUT Positioning
Right Side of LCD Display (Closed)

7.0 SYSTEM PERFORMANCE CHECK

Prior to the assessment a system check was performed in the planar section of the SAM phantom with an 1800MHz dipole and a 900MHz dipole (see Appendix C for system validation procedures). The fluid dielectric parameters were measured prior to the system check using an 85070C Dielectric Probe Kit and an 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 $\pm 10\%$ (see Appendix B for system check test plots).

| SYSTEM PERFORMANCE CHECK | | | | | | | | | | | |
|--------------------------|-----------------|-----------------|----------|----------------------------------|----------|-------------------------------|----------|-----------------------------|---------------|-------------|--------------|
| Test Date | Equiv. Tissue | SAR 1g (W/kg) | | Dielectric Constant ϵ_r | | Conductivity σ (mho/m) | | ρ (Kg/m ³) | Ambient Temp. | Fluid Temp. | Fluid Depth |
| | | IEEE Target | Measured | IEEE Target | Measured | IEEE Target | Measured | | | | |
| 10/31/02 | 1800MHz (Brain) | 9.53 $\pm 10\%$ | 9.61 | 40.0 $\pm 5\%$ | 40.9 | 1.40 $\pm 5\%$ | 1.35 | 1000 | 22.2 °C | 21.4 °C | ≥ 15 cm |
| 11/01/02 | 900MHz (Brain) | 2.70 $\pm 10\%$ | 2.64 | 41.5 $\pm 5\%$ | 40.1 | 0.97 $\pm 5\%$ | 0.96 | 1000 | 22.2 °C | 22.0 °C | ≥ 15 cm |

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.

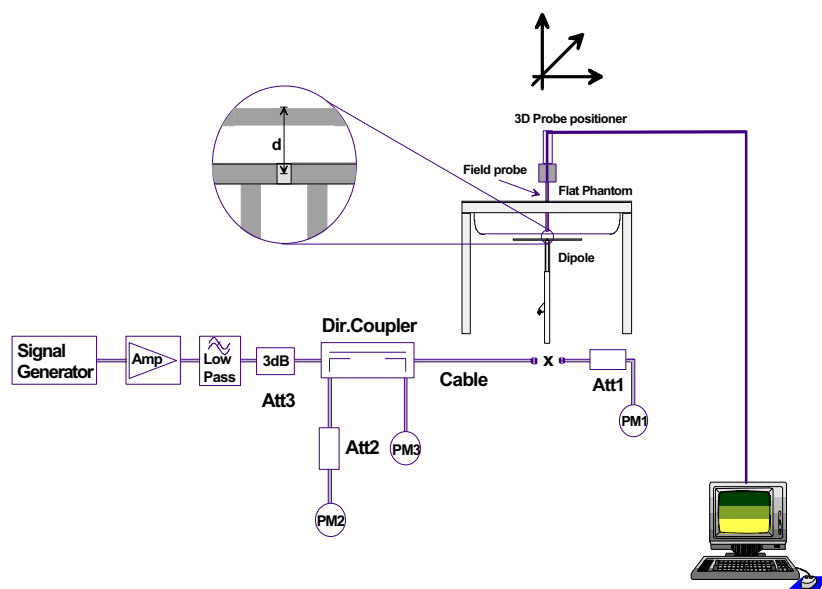


Figure 6. System Check Setup Diagram



1800MHz System Check Setup



900MHz System Check Setup

8.0 EQUIVALENT TISSUES

The 1800-2000MHz simulated tissues consist of Glycol-monobutyl, water, and salt. The 835MHz and 900MHz simulated tissues consist of a viscous gel using hydroxyethylcellulose (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).

| 1800/1900MHz TISSUE MIXTURES (1 Liter Yields) | | |
|---|---------------------------------|----------------------------------|
| INGREDIENT | 1800MHz Brain (System Check) | 1900MHz Body (EUT Evaluation) |
| Water | 548.0 g | 716.60 g |
| Glycol Monobutyl | 448.5 g | 300.70 g |
| Salt | 3.20 g | 3.10 g |

| 835/900MHz TISSUE MIXTURES | | |
|----------------------------|--------------------------------|---------------------------------|
| INGREDIENT | 900MHz Brain (System Check) | 835MHz Body (EUT Evaluation) |
| Water | 40.71 % | 53.70 % |
| Sugar | 56.63 % | 45.10 % |
| Salt | 1.48 % | 0.97 % |
| HEC | 1.00 % | 0.13% |
| Bactericide | 0.18 % | 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: Pentium III
Clock Speed: 450 MHz
Operating System: Windows NT
Data Card: DASY3 PC-Board

Data Converter

Features: Signal Amplifier, multiplexer, A/D converter, and control logic
Software: DASY3 software
Connecting Lines: Optical downlink for data and status info.
Optical uplink for commands and clock

PC Interface Card

Function: 24 bit (64 MHz) DSP for real time processing
Link to DAE3
16-bit A/D converter for surface detection system
serial link to robot
direct emergency stop output for robot

E-Field Probe

Model: ET3DV6
Serial No.(s): 1387
Construction: Triangular core fiber optic detection system
Frequency: 10 MHz to 6 GHz
Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Phantom

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

11.0 PROBE SPECIFICATION (ET3DV6)

| | |
|----------------|--|
| Construction: | Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g. glycol) |
| Calibration: | In air from 10 MHz to 2.5 GHz In brain simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy $\pm 8\%$) |
| 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) ± 0.4 dB in brain tissue (rotation normal to probe axis) |
| Dynam. Rnge: | 5 μ W/g to >100 mW/g; Linearity: ± 0.2 dB |
| Srfce. Detect. | ± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces |
| Dimensions: | Overall length: 330 mm Tip length: 16 mm Body diameter: 12 mm Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm |
| Application: | General dosimetry up to 3 GHz Compliance tests of mobile 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 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.



SAM Phantom

13.0 DEVICE HOLDER

The DASY3 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

| SAR MEASUREMENT SYSTEM | | |
|---|--|---|
| EQUIPMENT | SERIAL NO. | CALIBRATION DATE |
| DASY3 System -Robot -ET3DV6 E-Field Probe -300MHz Validation Dipole -450MHz Validation Dipole -900MHz Validation Dipole -1800MHz Validation Dipole -2450MHz Validation Dipole -SAM Phantom V4.0C -Small Planar Phantom -Medium Planar Phantom -Large Planar Phantom | 599396-01 1387 135 136 054 247 150 N/A N/A N/A N/A | N/A Feb 2002 Oct 2002 Oct 2002 June 2001 June 2001 Oct 2002 N/A N/A N/A N/A |
| 85070C Dielectric Probe Kit | N/A | N/A |
| Gigatronics 8652A Power Meter -Power Sensor 80701A -Power Sensor 80701A | 1835272 1833535 1833542 | Feb 2002 Feb 2002 Mar 2002 |
| Pasternack Attenuator (30dB, 2W) | PE7014-30 | N/A |
| E4408B Spectrum Analyzer | US39240170 | Nov 2002 |
| 8594E Spectrum Analyzer | 3543A02721 | Feb 2002 |
| 8753E Network Analyzer | US38433013 | Feb 2002 |
| 8648D Signal Generator | 3847A00611 | Feb 2002 |
| 5S1G4 Amplifier Research Power Amplifier | 26235 | N/A |

15.0 MEASUREMENT UNCERTAINTIES

| Error Description | Uncertainty Value ±% | Probability Distribution | Divisor | C_i 1g | Standard Uncertainty ±% (1g) | v_i or v_{eff} |
|--------------------------------------|-------------------------|--------------------------|---------|-------------|---------------------------------|--------------------|
| Measurement System | | | | | | |
| Probe calibration | ± 4.8 | Normal | 1 | 1 | ± 4.8 | ∞ |
| 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 | | | | | ± 13.7 | |
| Expanded Uncertainty (k=2) | | | | | ± 27.5 | |

Measurement Uncertainty Table in accordance with IEEE Std 1528 (Draft - 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 Standards Coordinating Committee 34, Std 1528-200X, "DRAFT Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques".
- [6] W. Gander, *Computermathematick*, Birkhaeuser, Basel: 1992.

APPENDIX A - SAR MEASUREMENT DATA

APPENDIX B - SYSTEM CHECK DATA

System Performance Check - 1800MHz Dipole

SAM Phantom; Flat Section

Probe: ET3DV6 - SNI387; ConvF(5.40,5.40,5.40); Crest factor: 1.0; 1800 MHz Brain: $\sigma = 1.35 \text{ mho/m}$ $\epsilon_r = 40.9$ $\rho = 1.00 \text{ g/cm}^3$

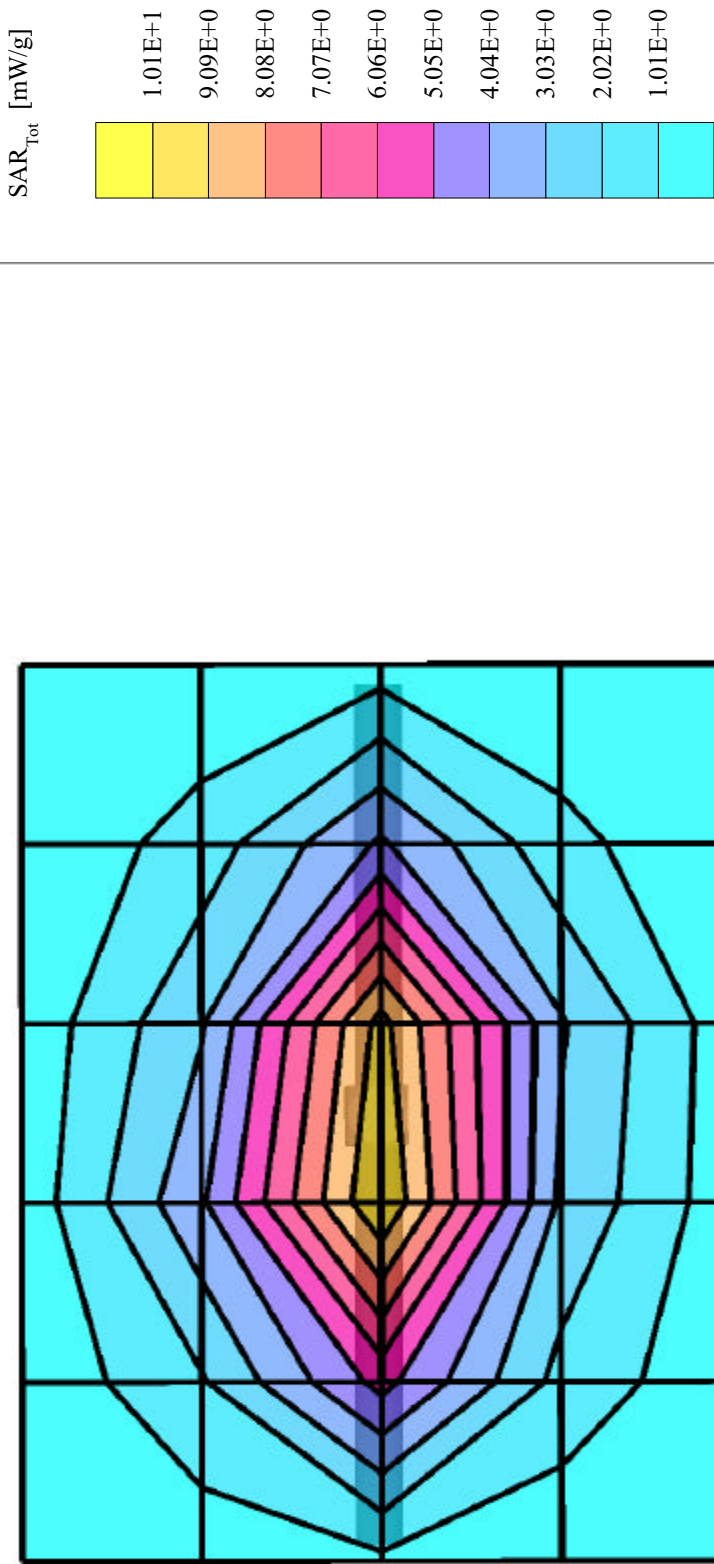
Cube 5x5x7; Peak: 18.2 mW/g, SAR (1g): 9.61 mW/g, SAR (10g): 5.00 mW/g, (Worst-case extrapolation)

Penetration depth: 8.3 (7.7, 9.5) [mm]; Powerdrift: 0.04 dB

Ambient Temp: 22.2°C; Fluid Temp: 21.4°C

Forward Conducted Power: 250 mW

Date Tested: October 31, 2002



System Performance Check - 900MHz Dipole

SAM Phantom; Flat Section

Probe: ET3DV6 - SNI1387; ConvF(6.60,6.60,6.60); Crest factor: 1.0; 900 MHz Brain: $\sigma = 0.96 \text{ mho/m}$ $\epsilon_r = 40.1$ $\rho = 1.00 \text{ g/cm}^3$

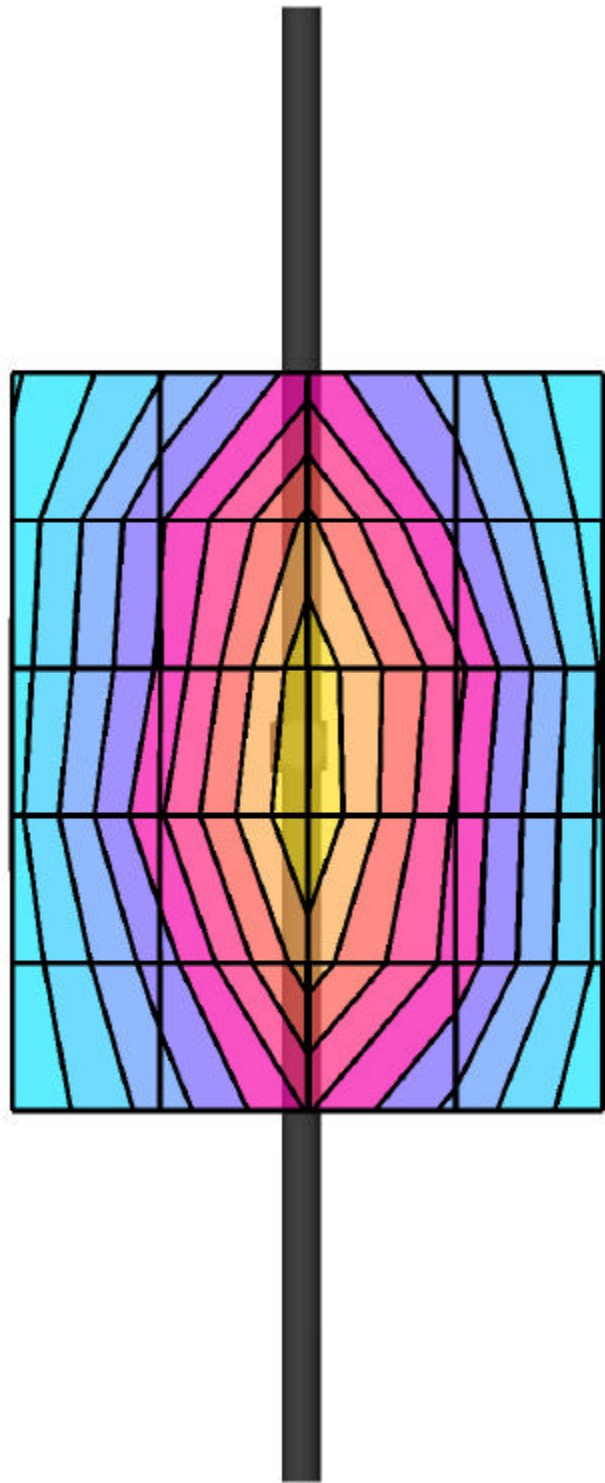
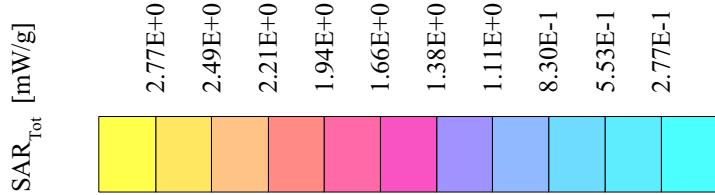
Cube 5x5x7; Peak: 4.32 mW/g, SAR (1g): 2.64 mW/g, SAR (10g): 1.65 mW/g, (Worst-case extrapolation)

Penetration depth: 11.0 (10.1, 12.6) [mm]; Powerdrift: -0.01 dB

Ambient Temp: 22.2°C; Fluid Temp: 22.0°C

Forward Conducted Power: 250 mW

Date Tested: November 01, 2002



APPENDIX C - SYSTEM VALIDATION

Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Calibration Certificate

1800 MHz System Validation Dipole

Type:

D1800V2

Serial Number:

247

Place of Calibration:

Zurich

Date of Calibration:

June 20, 2001

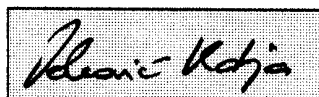
Calibration Interval:

24 months

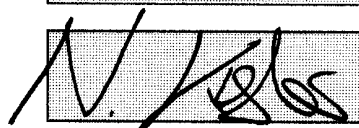
Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by:



Approved by:



DASY

Dipole Validation Kit

Type: D1800V2

Serial: 247

Manufactured: August 25, 1999
Calibrated: June 20, 2001

1. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with head simulating glycol solution of the following electrical parameters at 1800 MHz:

| | | |
|------------------------|-------------------|-----------|
| Relative Dielectricity | 40.0 | $\pm 5\%$ |
| Conductivity | 1.36 mho/m | $\pm 5\%$ |

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.57 at 1800 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging.

The dipole input power (forward power) was 250mW $\pm 3\%$. The results are normalized to 1W input power.

2. SAR Measurement

Standard SAR-measurements were performed with the phantom according to the measurement conditions described in section 1. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm³ (1 g) of tissue: **38.64 mW/g**

averaged over 10 cm³ (10 g) of tissue: **20.08 mW/g**

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well. The estimated sensitivities of SAR-values and penetration depths to the liquid parameters are listed in the DASY Application Note 4: 'SAR Sensitivities'.

3. Dipole Impedance and return loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

| | | |
|----------------------|-----------------|---------------------------------------|
| Electrical delay: | 1.208 ns | (one direction) |
| Transmission factor: | 0.995 | (voltage transmission, one direction) |

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

| | | |
|----------------------------------|---------------------|---------------------------------|
| Feedpoint impedance at 1800 MHz: | $\text{Re}\{Z\} = $ | 52.4 Ω |
|----------------------------------|---------------------|---------------------------------|

| | | |
|--|---------------------|--------------------------------|
| | $\text{Im}\{Z\} = $ | 0.7 Ω |
|--|---------------------|--------------------------------|

| | |
|-------------------------|-----------------|
| Return Loss at 1800 MHz | -32.1 dB |
|-------------------------|-----------------|

4. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with brain sugar-water solution of the following electrical parameters at 1800 MHz:

| | | |
|------------------------|-------------------|-----------|
| Relative Dielectricity | 40.1 | $\pm 5\%$ |
| Conductivity | 1.71 mho/m | $\pm 5\%$ |

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.63 at 1800 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging.

The dipole input power (forward power) was 250mW $\pm 3\%$. The results are normalized to 1W input power.

5. SAR Measurement

Standard SAR-measurements were performed with the phantom according to the measurement conditions described in section 4. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm³ (1 g) of tissue: **43.6 mW/g**

averaged over 10 cm³ (10 g) of tissue: **21.6 mW/g**

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well. The estimated sensitivities of SAR-values and penetration depths to the liquid parameters are listed in the DASY Application Note 4: 'SAR Sensitivities'.

6. Handling

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

Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

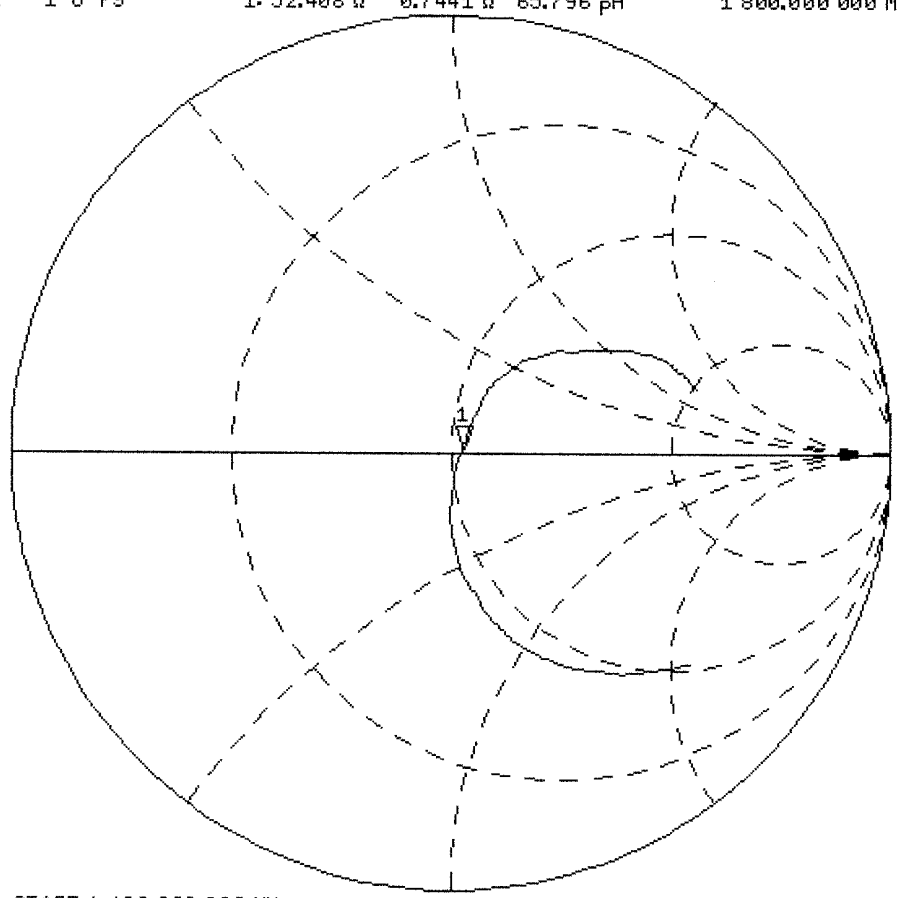
After prolonged use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

20 Jun 2001 15:31:17
[CH1] S11 1 U FS 1: 52.408 Ω 0.7441 Ω 65.796 pH 1 800.000 000 MHz

PRm
Del

Cor

↑

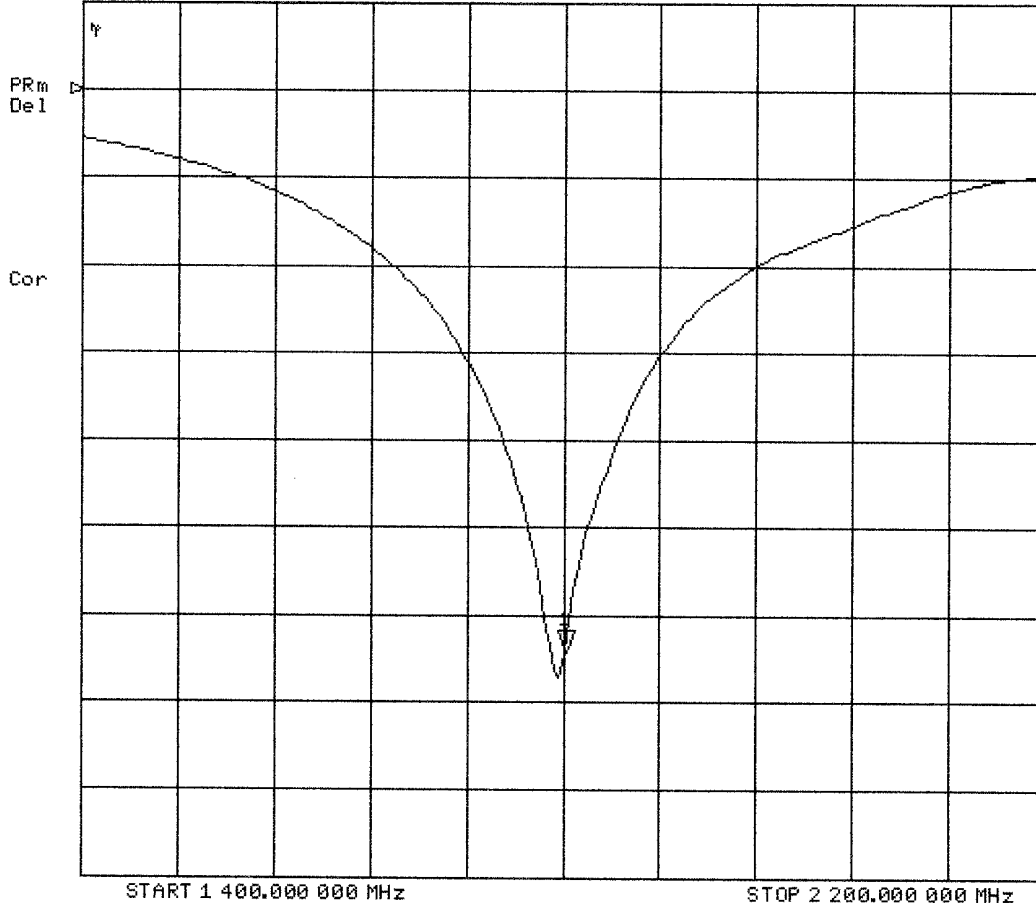


START 1 400.000 000 MHz

STOP 2 200.000 000 MHz

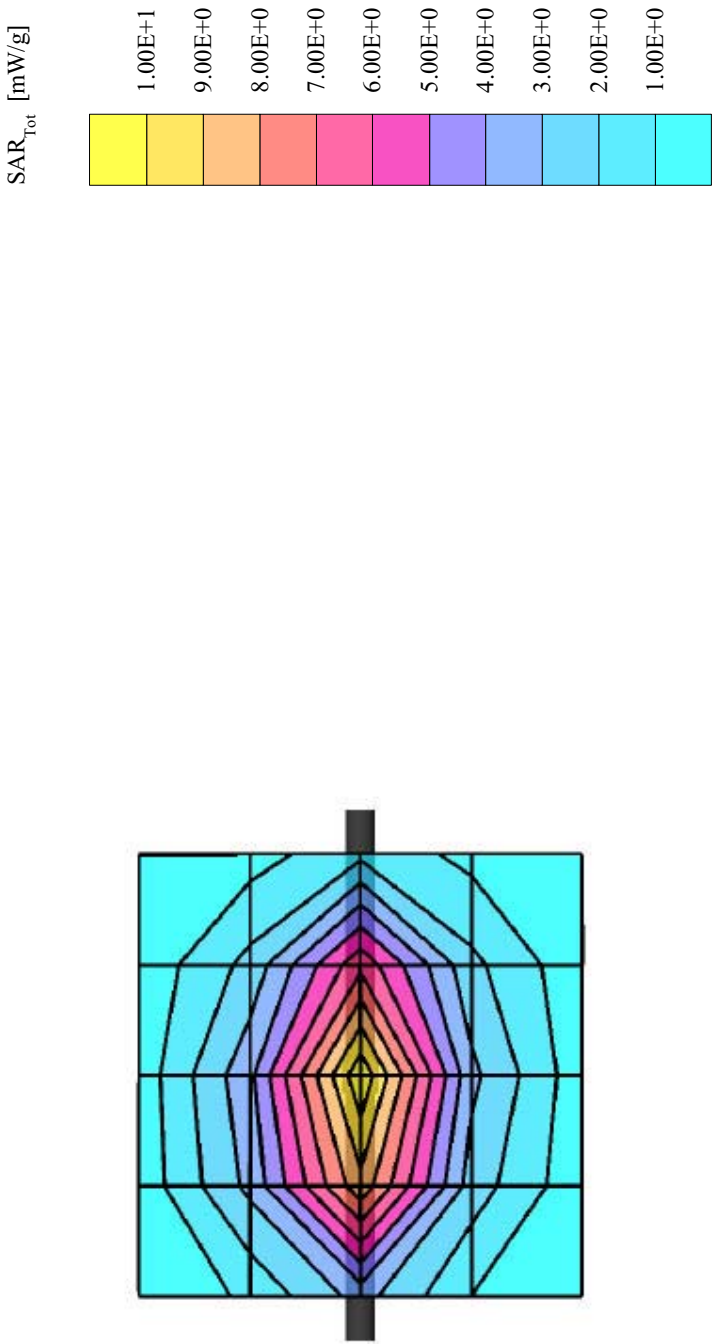
20 Jun 2001 15:31:04

[CH1] S11 LOG 5 dB/REF 0 dB 1:-32.107 dB 1 800.000 000 MHz



Validation Dipole D1800V2 SN:247, d = 10 mm

Frequency: 1800 MHz; Antenna Input Power: 250 [mW]
Generic Twin Phantom; Flat Section; Grid Spacing: Dx = 15.0, Dy = 15.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(5.57,5.57,5.57); Crest factor: 1.0; IEEE1528 1800 MHz : $\sigma = 1.36 \text{ mho/m}$ $\epsilon_r = 40.0$ $\rho = 1.00 \text{ g/cm}^3$
Cubes (2): Peak: 18.2 mW/g $\pm 0.04 \text{ dB}$, SAR (1g): 9.66 mW/g $\pm 0.03 \text{ dB}$, SAR (10g): 5.02 mW/g $\pm 0.03 \text{ dB}$, (Worst-case extrapolation)
Penetration depth: 8.2 (7.6, 9.4) [mm]
Powerdrift: -0.01 dB



Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Calibration Certificate

900 MHz System Validation Dipole

Type:

D900V2

Serial Number:

054

Place of Calibration:

Zurich

Date of Calibration:

June 20, 2001

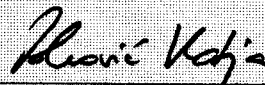
Calibration Interval:

24 months

Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by:



Approved by:



DASY

Dipole Validation Kit

Type: D900V2

Serial: 054

Manufactured: August 25, 1999
Calibrated: June 20, 2001

1. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with head simulating solution of the following electrical parameters at 900 MHz:

| | | |
|------------------------|-------------------|-----------|
| Relative Dielectricity | 42.4 | $\pm 5\%$ |
| Conductivity | 0.97 mho/m | $\pm 5\%$ |

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.27 at 900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging.

The dipole input power (forward power) was 250mW $\pm 3\%$. The results are normalized to 1W input power.

2. SAR Measurement

Standard SAR-measurements were performed with the phantom according to the measurement conditions described in section 1. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

| | |
|--|-------------------|
| averaged over 1 cm ³ (1 g) of tissue: | 11.12 mW/g |
| averaged over 10 cm ³ (10 g) of tissue: | 7.04 mW/g |

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well.

3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

| | | |
|----------------------|-----------------|---------------------------------------|
| Electrical delay: | 1.413 ns | (one direction) |
| Transmission factor: | 0.989 | (voltage transmission, one direction) |

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

| | |
|---------------------------------|---|
| Feedpoint impedance at 900 MHz: | $\text{Re}\{Z\} = $ 51.3 Ω |
| | $\text{Im}\{Z\} = $ -0.5 Ω |
| Return Loss at 900 MHz | -36.9 dB |

4. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with brain simulating solution of the following electrical parameters at 900 MHz:

| | | |
|------------------------|-------------------|-----------|
| Relative Dielectricity | 41.0 | $\pm 5\%$ |
| Conductivity | 0.86 mho/m | $\pm 5\%$ |

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.22 at 900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging.

The dipole input power (forward power) was 250mW $\pm 3\%$. The results are normalized to 1W input power.

5. SAR Measurement

Standard SAR-measurements were performed with the phantom according to the measurement conditions described in section 4. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm³ (1 g) of tissue: **10.12 mW/g**

averaged over 10 cm³ (10 g) of tissue: **6.52 mW/g**

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well.

6. Handling

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

Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

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

19 Jun 2001 21:44:16

CH1 S11 1 U FS

1: 51.324 Ω -478.52 m Ω 369.56 pF

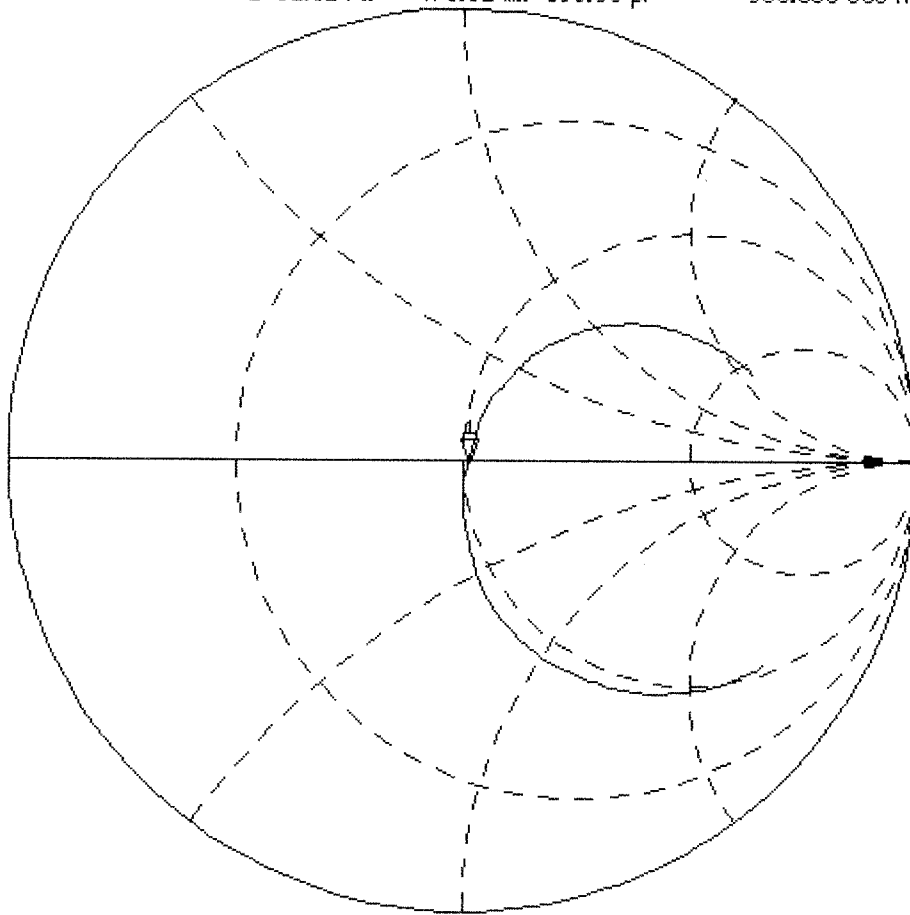
900.000 000 MHz

γ

PRm
Del

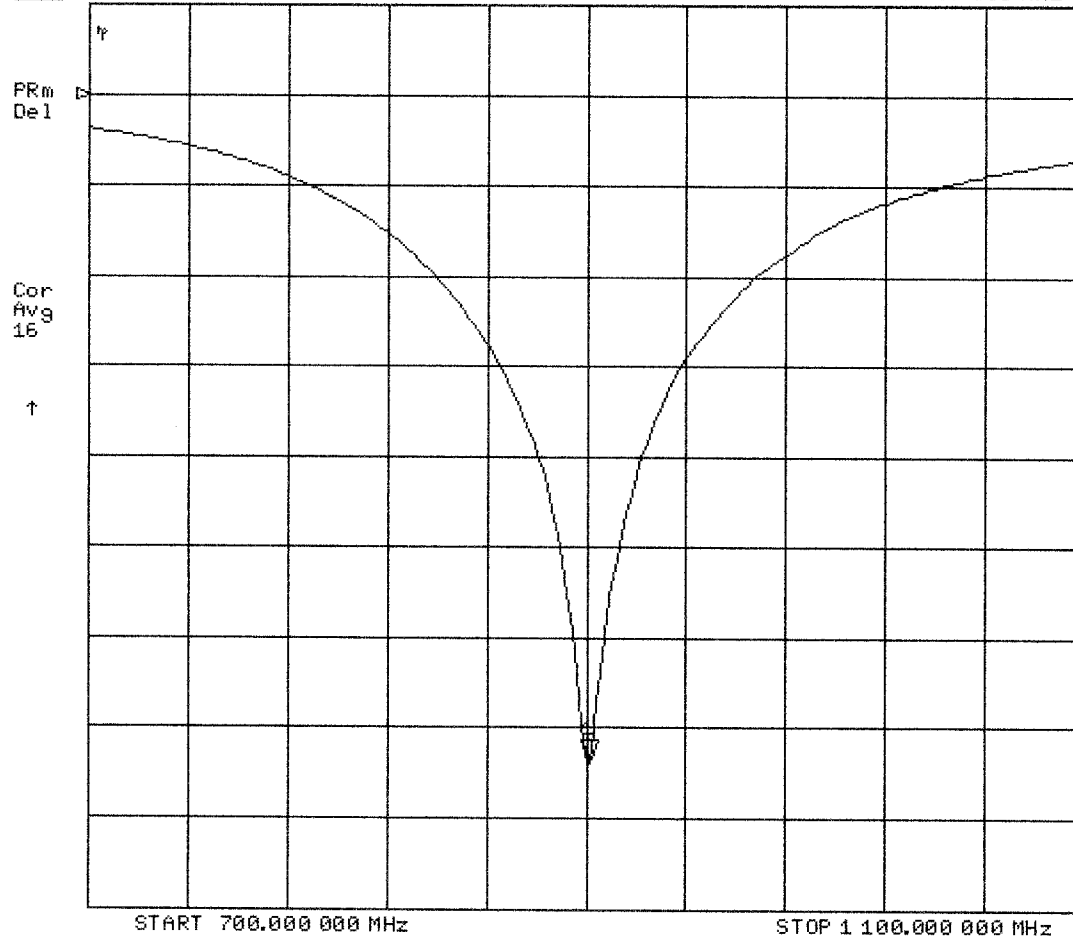
Cor
Avg
16

↑



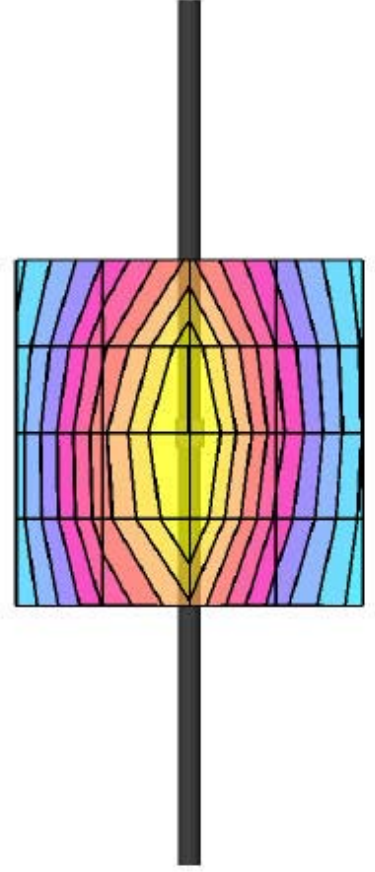
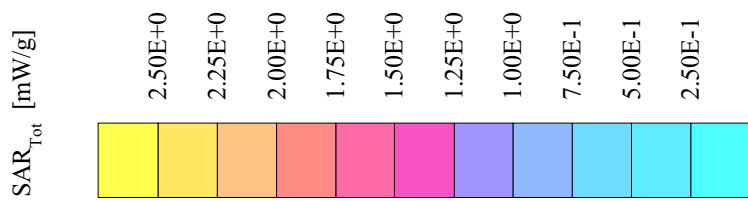
[CH1] S11 LOG 5 dB/REF 0 dB

1:-36.921 dB 900.000 000 MHz



Validation Dipole D900V2 SN:054, d = 15 mm

Frequency: 900 MHz; Antenna Input Power: 250 [mW]
Generic Twin Phantom; Flat Section; Grid Spacing: Dx = 15.0, Dy = 15.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(6.27,6.27,6.27); Crest factor: 1.0; IEEE1528 900 MHz: $\sigma = 0.97 \text{ mho/m}$ $\epsilon_r = 42.4$ $\rho = 1.00 \text{ g/cm}^3$
Cubes (2): Peak: 4.47 mW/g $\pm 0.05 \text{ dB}$, SAR (1g): 2.78 mW/g $\pm 0.04 \text{ dB}$, SAR (10g): 1.76 mW/g $\pm 0.02 \text{ dB}$, (Worst-case extrapolation)
Penetration depth: 11.5 (10.3, 13.2) [mm]
Powerdrift: -0.00 dB



APPENDIX D - PROBE CALIBRATION

Calibration Certificate

Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1387

Place of Calibration:

Zurich

Date of Calibration:

February 22, 2002

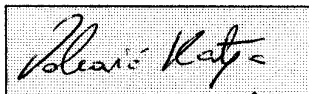
Calibration Interval:

12 months

Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by:



Approved by:



Probe ET3DV6

SN:1387

| | |
|-------------------|--------------------|
| Manufactured: | September 21, 1999 |
| Last calibration: | September 22, 1999 |
| Recalibrated: | February 22, 2002 |

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV6 SN:1387

Sensitivity in Free Space

| | |
|-------|---|
| NormX | 1.58 $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormY | 1.67 $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormZ | 1.67 $\mu\text{V}/(\text{V}/\text{m})^2$ |

Diode Compression

| | | |
|-------|-----------|----|
| DCP X | 97 | mV |
| DCP Y | 97 | mV |
| DCP Z | 97 | mV |

Sensitivity in Tissue Simulating Liquid

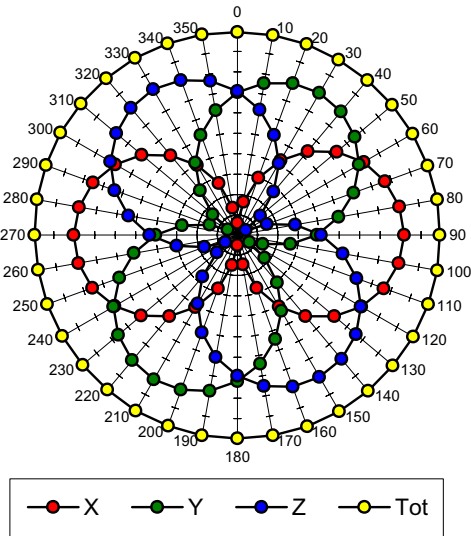
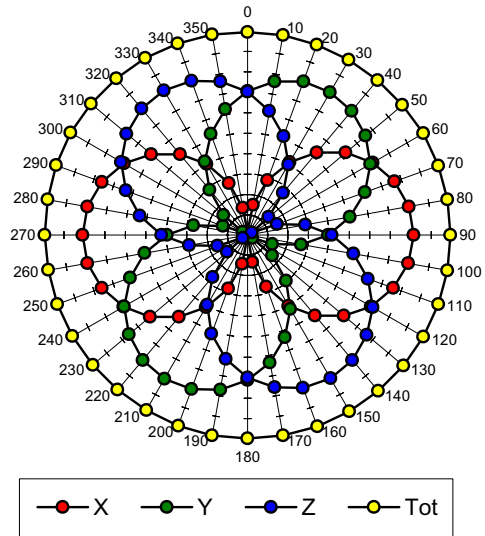
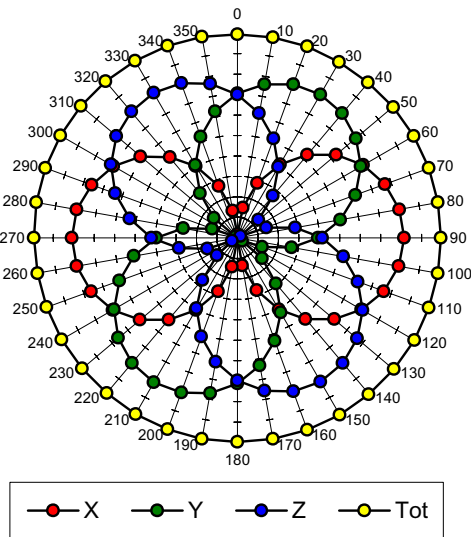
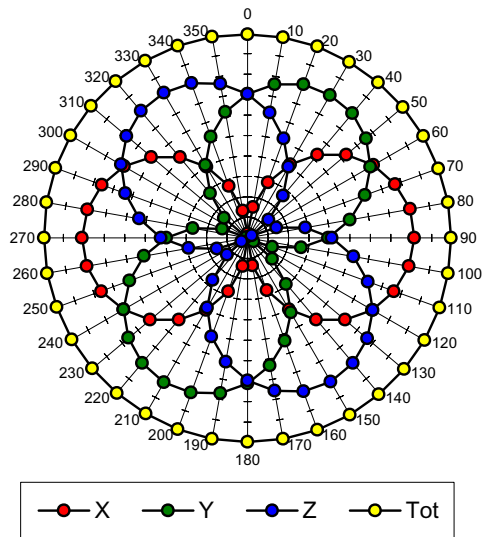
| | | | |
|---------|------------------------------|-----------------------------|---------------------------------------|
| Head | 900 MHz | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.97 \pm 5\% \text{ mho/m}$ |
| Head | 835 MHz | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.90 \pm 5\% \text{ mho/m}$ |
| ConvF X | 6.6 $\pm 9.5\%$ (k=2) | Boundary effect: | |
| ConvF Y | 6.6 $\pm 9.5\%$ (k=2) | Alpha | 0.40 |
| ConvF Z | 6.6 $\pm 9.5\%$ (k=2) | Depth | 2.38 |
| Head | 1800 MHz | $\epsilon_r = 40.0 \pm 5\%$ | $\sigma = 1.40 \pm 5\% \text{ mho/m}$ |
| Head | 1900 MHz | $\epsilon_r = 40.0 \pm 5\%$ | $\sigma = 1.40 \pm 5\% \text{ mho/m}$ |
| ConvF X | 5.4 $\pm 9.5\%$ (k=2) | Boundary effect: | |
| ConvF Y | 5.4 $\pm 9.5\%$ (k=2) | Alpha | 0.57 |
| ConvF Z | 5.4 $\pm 9.5\%$ (k=2) | Depth | 2.18 |

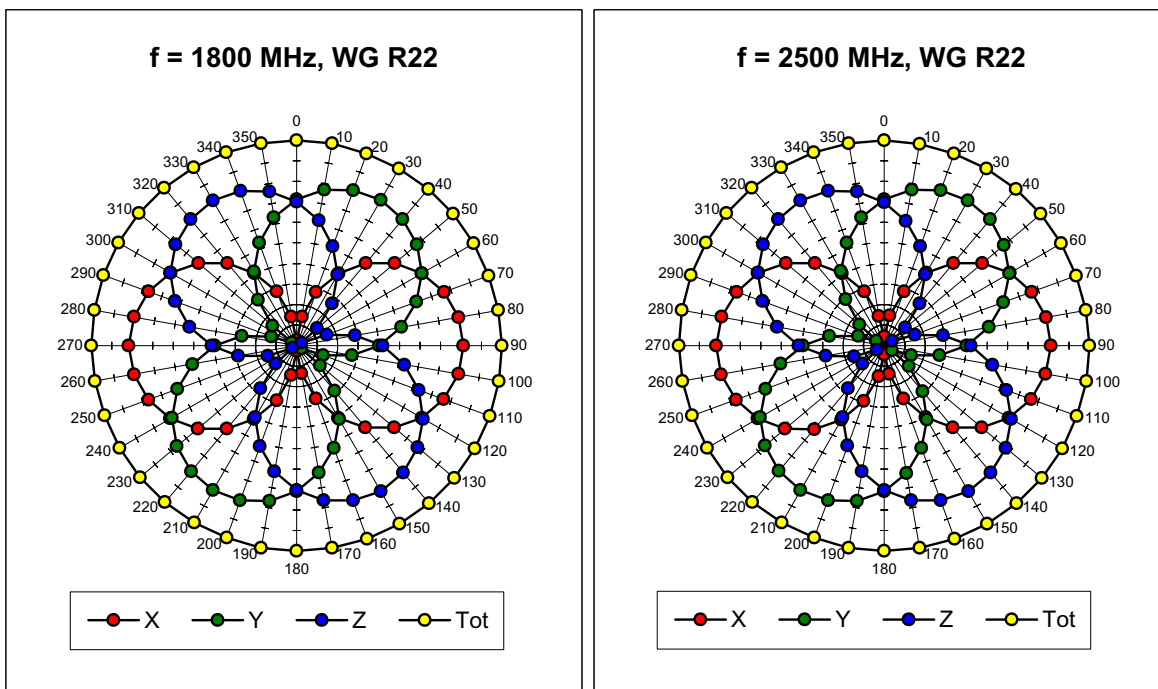
Boundary Effect

| | | | |
|--|-----------------|-----------------------------------|-------------|
| Head | 900 MHz | Typical SAR gradient: 5 % per mm | |
| Probe Tip to Boundary | | 1 mm | 2 mm |
| SAR _{be} [%] Without Correction Algorithm | | 9.7 | 5.4 |
| SAR _{be} [%] With Correction Algorithm | | 0.3 | 0.6 |
| Head | 1800 MHz | Typical SAR gradient: 10 % per mm | |
| Probe Tip to Boundary | | 1 mm | 2 mm |
| SAR _{be} [%] Without Correction Algorithm | | 11.5 | 7.3 |
| SAR _{be} [%] With Correction Algorithm | | 0.1 | 0.3 |

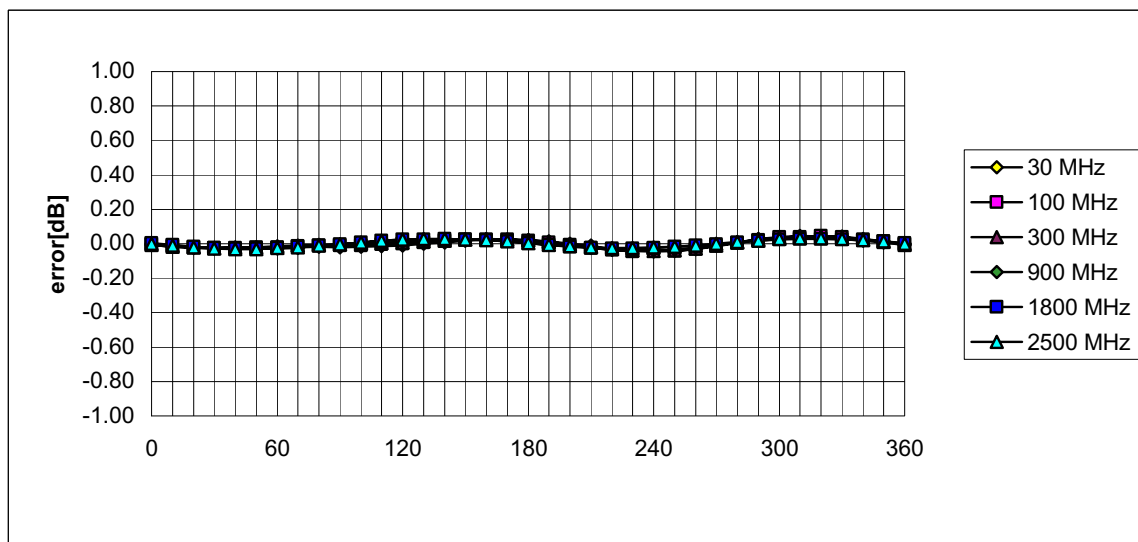
Sensor Offset

| | | |
|----------------------------|---------------------------------|----|
| Probe Tip to Sensor Center | 2.7 | mm |
| Optical Surface Detection | 1.3 \pm 0.2 | mm |

Receiving Pattern (ϕ , $\theta = 0^\circ$)**f = 30 MHz, TEM cell ifi110****f = 100 MHz, TEM cell ifi110****f = 300 MHz, TEM cell ifi110****f = 900 MHz, TEM cell ifi110**

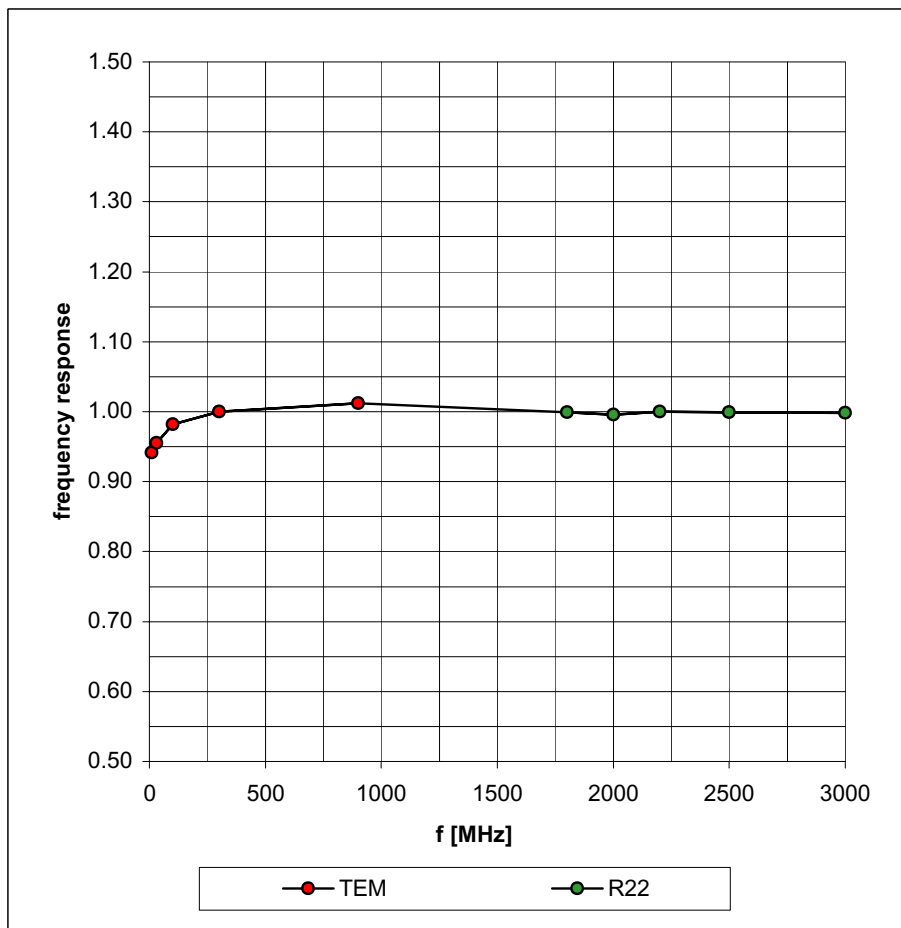


Isotropy Error (ϕ), $\theta = 0^\circ$

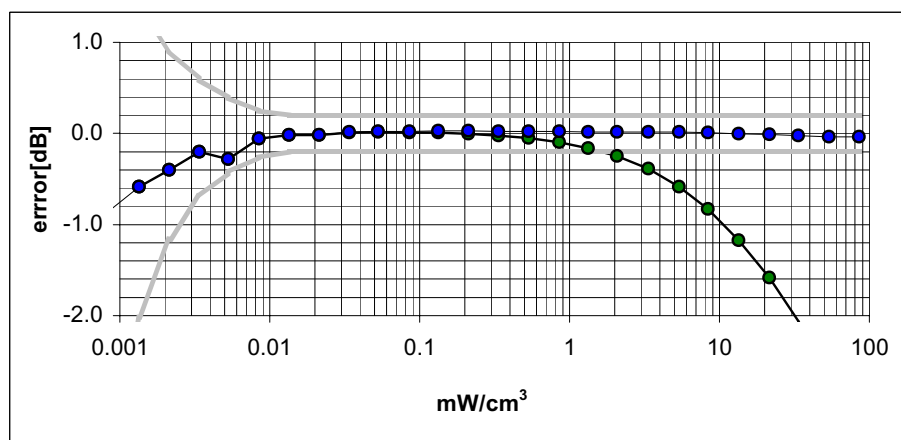
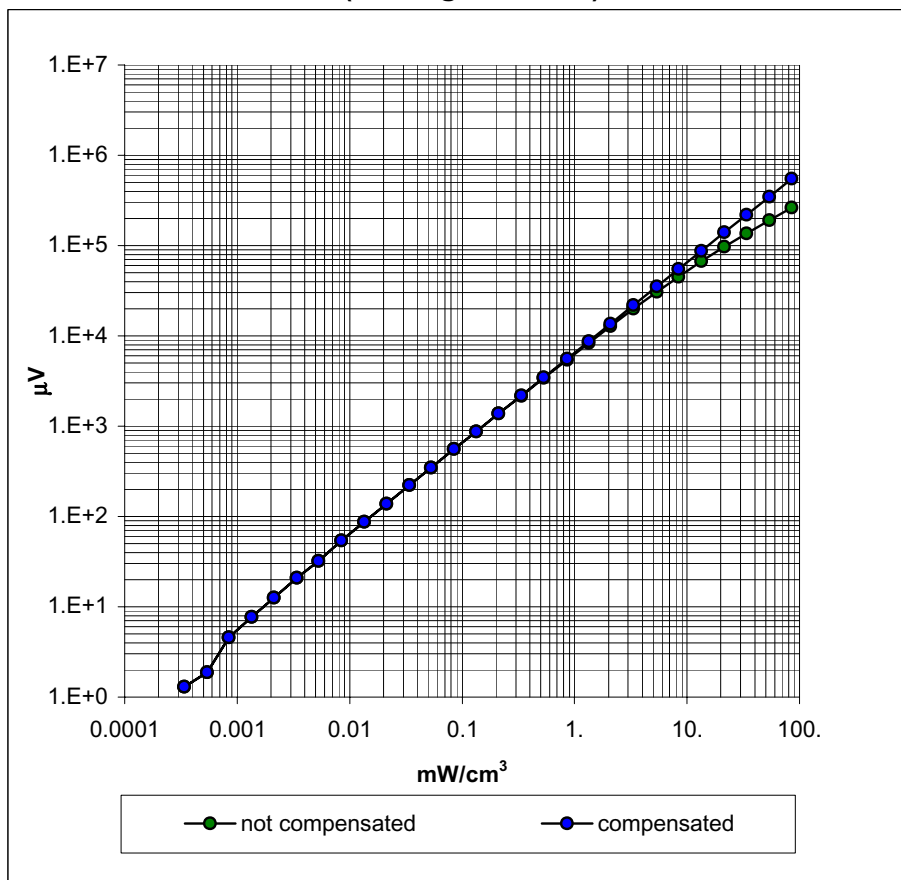


Frequency Response of E-Field

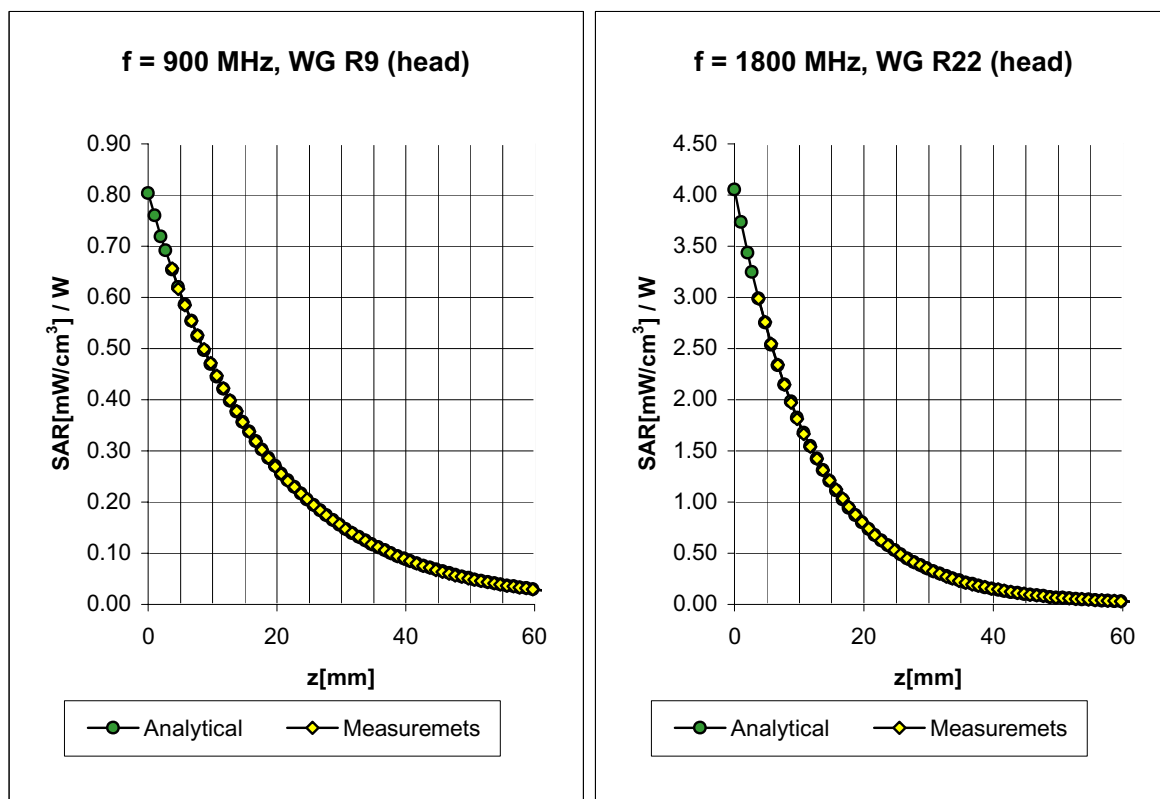
(TEM-Cell:ifi1110, Waveguide R22)



Dynamic Range $f(\text{SAR}_{\text{brain}})$ (Waveguide R22)



Conversion Factor Assessment

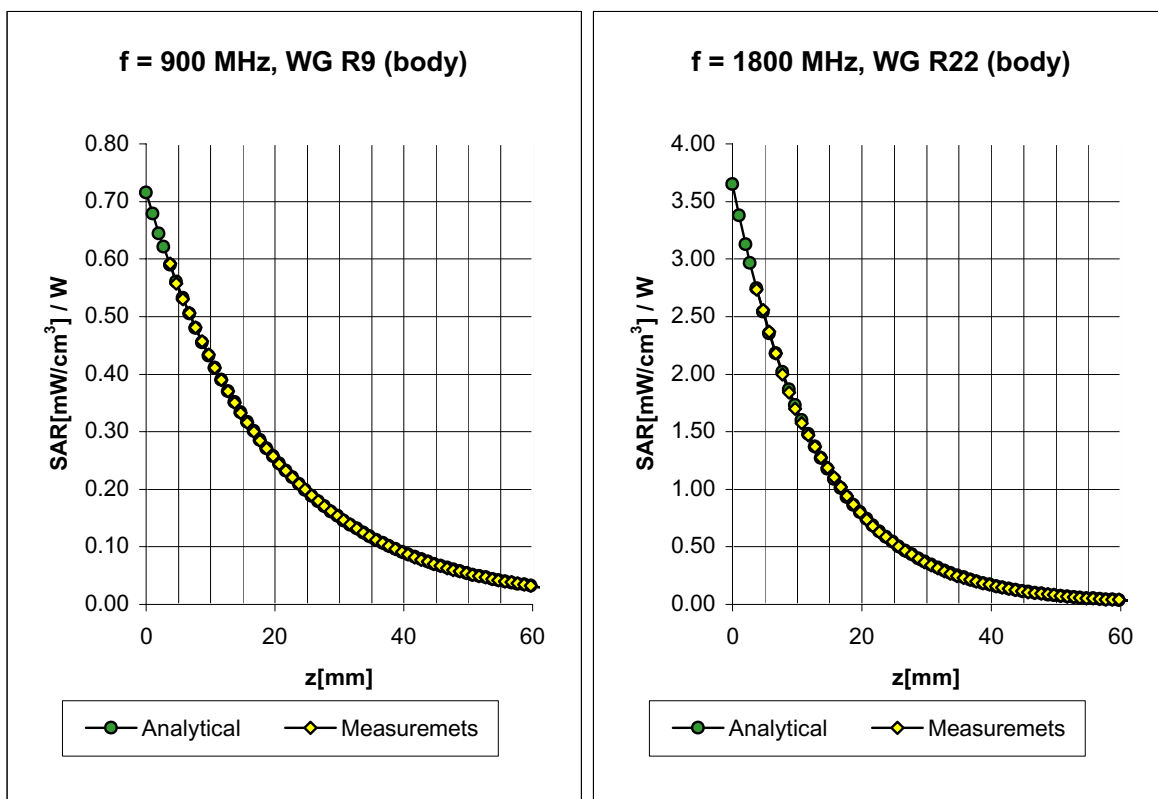


| | | | |
|------|----------|------------------------------|---------------------------------------|
| Head | 900 MHz | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.97 \pm 5\% \text{ mho/m}$ |
| Head | 835 MHz | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.90 \pm 5\% \text{ mho/m}$ |
| | ConvF X | 6.6 $\pm 9.5\%$ (k=2) | Boundary effect: |
| | ConvF Y | 6.6 $\pm 9.5\%$ (k=2) | Alpha 0.40 |
| | ConvF Z | 6.6 $\pm 9.5\%$ (k=2) | Depth 2.38 |
| Head | 1800 MHz | $\epsilon_r = 40.0 \pm 5\%$ | $\sigma = 1.40 \pm 5\% \text{ mho/m}$ |
| Head | 1900 MHz | $\epsilon_r = 40.0 \pm 5\%$ | $\sigma = 1.40 \pm 5\% \text{ mho/m}$ |
| | ConvF X | 5.4 $\pm 9.5\%$ (k=2) | Boundary effect: |
| | ConvF Y | 5.4 $\pm 9.5\%$ (k=2) | Alpha 0.57 |
| | ConvF Z | 5.4 $\pm 9.5\%$ (k=2) | Depth 2.18 |

ET3DV6 SN:1387

February 22, 2002

Conversion Factor Assessment



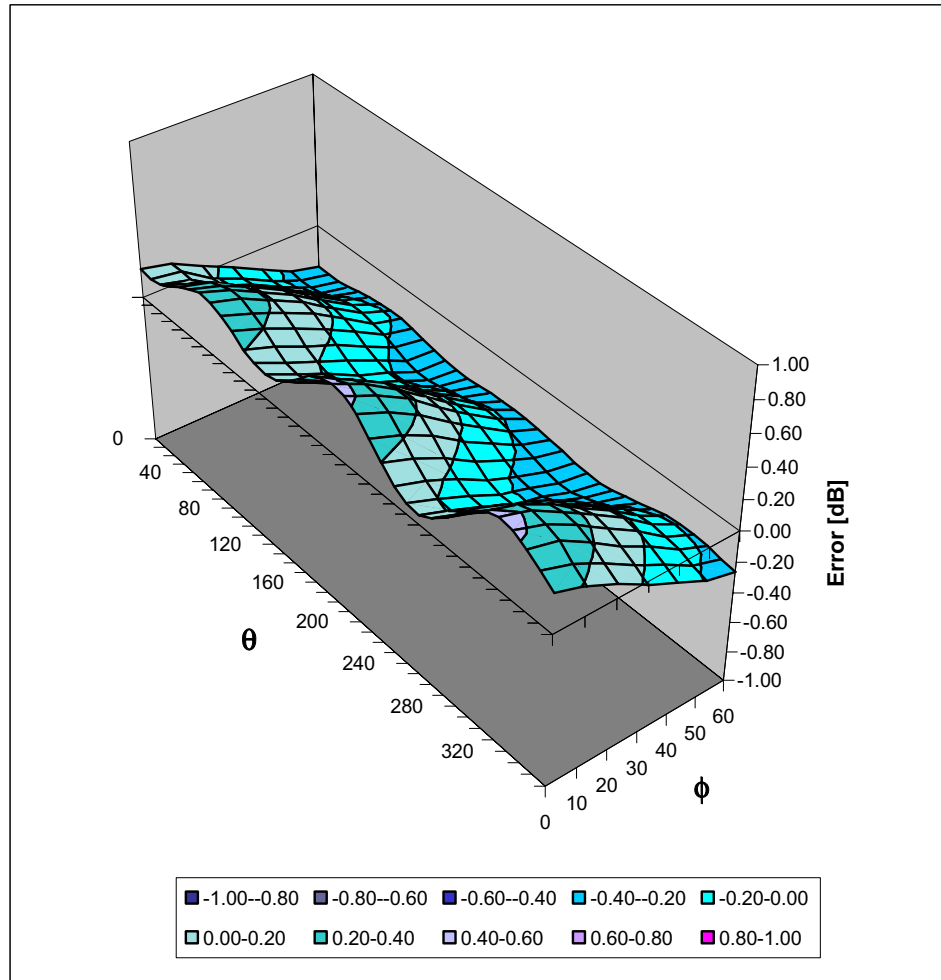
| | | | |
|------|----------|------------------------------|---------------------------------------|
| Body | 900 MHz | $\epsilon_r = 55.0 \pm 5\%$ | $\sigma = 1.05 \pm 5\% \text{ mho/m}$ |
| Body | 835 MHz | $\epsilon_r = 55.2 \pm 5\%$ | $\sigma = 0.97 \pm 5\% \text{ mho/m}$ |
| | ConvF X | 6.3 $\pm 9.5\%$ (k=2) | Boundary effect: |
| | ConvF Y | 6.3 $\pm 9.5\%$ (k=2) | Alpha 0.42 |
| | ConvF Z | 6.3 $\pm 9.5\%$ (k=2) | Depth 2.44 |
| Body | 1800 MHz | $\epsilon_r = 53.3 \pm 5\%$ | $\sigma = 1.52 \pm 5\% \text{ mho/m}$ |
| Body | 1900 MHz | $\epsilon_r = 53.3 \pm 5\%$ | $\sigma = 1.52 \pm 5\% \text{ mho/m}$ |
| | ConvF X | 5.0 $\pm 9.5\%$ (k=2) | Boundary effect: |
| | ConvF Y | 5.0 $\pm 9.5\%$ (k=2) | Alpha 0.76 |
| | ConvF Z | 5.0 $\pm 9.5\%$ (k=2) | Depth 2.01 |

ET3DV6 SN:1387

February 22, 2002

Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz



Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1387

Place of Assessment:

Zurich

Date of Assessment:

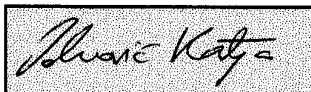
February 25, 2002

Probe Calibration Date:

February 22, 2002

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:



Dosimetric E-Field Probe ET3DV6 SN:1387

Conversion Factor (\pm standard deviation)

| | | | |
|----------|-------|---------------|---|
| 150 MHz | ConvF | $9.2 \pm 8\%$ | $\epsilon_r = 52.3$ $\sigma = 0.76 \text{ mho/m}$ (head tissue) |
| 300 MHz | ConvF | $8.0 \pm 8\%$ | $\epsilon_r = 45.3$ $\sigma = 0.87 \text{ mho/m}$ (head tissue) |
| 450 MHz | ConvF | $7.3 \pm 8\%$ | $\epsilon_r = 43.5$ $\sigma = 0.87 \text{ mho/m}$ (head tissue) |
| 2450 MHz | ConvF | $4.7 \pm 8\%$ | $\epsilon_r = 39.2$ $\sigma = 1.80 \text{ mho/m}$ (head tissue) |
| 150 MHz | ConvF | $8.8 \pm 8\%$ | $\epsilon_r = 61.9$ $\sigma = 0.80 \text{ mho/m}$ (body tissue) |
| 450 MHz | ConvF | $7.7 \pm 8\%$ | $\epsilon_r = 56.7$ $\sigma = 0.94 \text{ mho/m}$ (body tissue) |
| 2450 MHz | ConvF | $4.3 \pm 8\%$ | $\epsilon_r = 52.7$ $\sigma = 1.95 \text{ mho/m}$ (body tissue) |

APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

1800MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

October 31, 2002

| Frequency | ϵ' | ϵ'' |
|-----------------|-------------|--------------|
| 1.700000000 GHz | 41.2798 | 13.0837 |
| 1.710000000 GHz | 41.2602 | 13.0951 |
| 1.720000000 GHz | 41.2428 | 13.1239 |
| 1.730000000 GHz | 41.2332 | 13.1635 |
| 1.740000000 GHz | 41.1970 | 13.2033 |
| 1.750000000 GHz | 41.1597 | 13.2594 |
| 1.760000000 GHz | 41.1399 | 13.3108 |
| 1.770000000 GHz | 41.0942 | 13.3531 |
| 1.780000000 GHz | 41.0424 | 13.3931 |
| 1.790000000 GHz | 41.0023 | 13.4196 |
| 1.800000000 GHz | 40.9392 | 13.4514 |
| 1.810000000 GHz | 40.8723 | 13.5044 |
| 1.820000000 GHz | 40.8305 | 13.5262 |
| 1.830000000 GHz | 40.7701 | 13.5601 |
| 1.840000000 GHz | 40.7256 | 13.6024 |
| 1.850000000 GHz | 40.6963 | 13.6136 |
| 1.860000000 GHz | 40.6578 | 13.6371 |
| 1.870000000 GHz | 40.6143 | 13.6698 |
| 1.880000000 GHz | 40.5860 | 13.7051 |
| 1.890000000 GHz | 40.5368 | 13.7388 |
| 1.900000000 GHz | 40.4979 | 13.7539 |
| 1.910000000 GHz | 40.4361 | 13.7782 |
| 1.920000000 GHz | 40.3913 | 13.8216 |
| 1.930000000 GHz | 40.3420 | 13.8382 |
| 1.940000000 GHz | 40.2957 | 13.8799 |
| 1.950000000 GHz | 40.2504 | 13.8943 |
| 1.960000000 GHz | 40.2068 | 13.9137 |
| 1.970000000 GHz | 40.1537 | 13.9220 |
| 1.980000000 GHz | 40.1066 | 13.9680 |
| 1.990000000 GHz | 40.0705 | 13.9890 |
| 2.000000000 GHz | 40.0110 | 14.0174 |
| 2.010000000 GHz | 39.9634 | 14.0526 |
| 2.020000000 GHz | 39.9454 | 14.0734 |
| 2.030000000 GHz | 39.9005 | 14.0836 |
| 2.040000000 GHz | 39.8735 | 14.0757 |
| 2.050000000 GHz | 39.8261 | 14.0793 |
| 2.060000000 GHz | 39.7697 | 14.0897 |
| 2.070000000 GHz | 39.7324 | 14.1132 |
| 2.080000000 GHz | 39.6860 | 14.1142 |
| 2.090000000 GHz | 39.6347 | 14.1394 |
| 2.100000000 GHz | 39.6010 | 14.1757 |

1900MHz EUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

October 31, 2002

| Frequency | ϵ' | ϵ'' |
|-----------------|-------------|--------------|
| 1.780000000 GHz | 53.7799 | 14.1634 |
| 1.790000000 GHz | 53.7451 | 14.1811 |
| 1.800000000 GHz | 53.6851 | 14.2061 |
| 1.810000000 GHz | 53.6466 | 14.2278 |
| 1.820000000 GHz | 53.5981 | 14.2401 |
| 1.830000000 GHz | 53.5462 | 14.2632 |
| 1.840000000 GHz | 53.5197 | 14.2792 |
| 1.850000000 GHz | 53.4766 | 14.2954 |
| 1.860000000 GHz | 53.4572 | 14.2945 |
| 1.870000000 GHz | 53.4243 | 14.3098 |
| 1.880000000 GHz | 53.3928 | 14.3204 |
| 1.890000000 GHz | 53.3722 | 14.3288 |
| 1.900000000 GHz | 53.3463 | 14.3497 |
| 1.910000000 GHz | 53.3347 | 14.3760 |
| 1.920000000 GHz | 53.3135 | 14.3820 |
| 1.930000000 GHz | 53.3075 | 14.4182 |
| 1.940000000 GHz | 53.3146 | 14.4349 |
| 1.950000000 GHz | 53.3167 | 14.4599 |
| 1.960000000 GHz | 53.2951 | 14.4929 |
| 1.970000000 GHz | 53.2730 | 14.5118 |
| 1.980000000 GHz | 53.2137 | 14.5745 |

900MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

November 01, 2002

| Frequency | ϵ' | ϵ'' |
|-----------------|-------------|--------------|
| 800.000000 MHz | 41.2662 | 19.6652 |
| 810.000000 MHz | 41.2314 | 19.7088 |
| 820.000000 MHz | 41.1038 | 19.7337 |
| 830.000000 MHz | 40.9247 | 19.7465 |
| 840.000000 MHz | 40.7396 | 19.6991 |
| 850.000000 MHz | 40.5885 | 19.6444 |
| 860.000000 MHz | 40.4447 | 19.5281 |
| 870.000000 MHz | 40.2887 | 19.4286 |
| 880.000000 MHz | 40.2284 | 19.3349 |
| 890.000000 MHz | 40.1639 | 19.3241 |
| 900.000000 MHz | 40.0967 | 19.2946 |
| 910.000000 MHz | 39.9764 | 19.3598 |
| 920.000000 MHz | 39.7993 | 19.3830 |
| 930.000000 MHz | 39.6051 | 19.3158 |
| 940.000000 MHz | 39.5146 | 19.2297 |
| 950.000000 MHz | 39.4518 | 19.1656 |
| 960.000000 MHz | 39.3739 | 19.1074 |
| 970.000000 MHz | 39.2703 | 19.0490 |
| 980.000000 MHz | 39.1973 | 18.9920 |
| 990.000000 MHz | 39.1346 | 18.9467 |
| 1.000000000 GHz | 39.0321 | 18.9421 |

835MHz EUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

November 01, 2002

| Frequency | e' | e'' |
|----------------|---------|---------|
| 735.000000 MHz | 54.3563 | 21.0114 |
| 745.000000 MHz | 54.2502 | 20.9616 |
| 755.000000 MHz | 54.0917 | 20.9181 |
| 765.000000 MHz | 54.0164 | 20.8607 |
| 775.000000 MHz | 53.9204 | 20.8343 |
| 785.000000 MHz | 53.8288 | 20.8070 |
| 795.000000 MHz | 53.7482 | 20.7992 |
| 805.000000 MHz | 53.6311 | 20.7704 |
| 815.000000 MHz | 53.5235 | 20.7392 |
| 825.000000 MHz | 53.4250 | 20.7056 |
| 835.000000 MHz | 53.3029 | 20.6705 |
| 845.000000 MHz | 53.1899 | 20.6332 |
| 855.000000 MHz | 53.0621 | 20.6024 |
| 865.000000 MHz | 52.9515 | 20.5772 |
| 875.000000 MHz | 52.8425 | 20.5735 |
| 885.000000 MHz | 52.7526 | 20.5528 |
| 895.000000 MHz | 52.6987 | 20.4932 |
| 905.000000 MHz | 52.6232 | 20.4374 |
| 915.000000 MHz | 52.5281 | 20.4157 |
| 925.000000 MHz | 52.4357 | 20.3785 |
| 935.000000 MHz | 52.3238 | 20.3598 |

APPENDIX F - SAM PHANTOM CERTIFICATE OF CONFORMITY

Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

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 Hauptstr. 69 CH-8559 Fruthwilen 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 Relative permittivity < 5 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

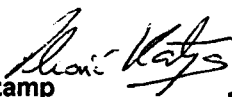
- [1] CENELEC EN 50361
- [2] IEEE P1528-200x draft 6.5
- [3] IEC PT 62209 draft 0.9
- (*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

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



**Schmid & Partner
Engineering AG**



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APPENDIX G - SAR TEST SETUP PHOTOGRAPHS