DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

Test Lab

CELLTECH LABS INC.
Testing and Engineering Services
1955 Moss Court
Kelowna, B.C.
Canada V1Y 9L3
Phone: 250-448-7047
Fax: 250-448-7046
e-mail: info@celltechlabs.com
web site: www.celltechlabs.com

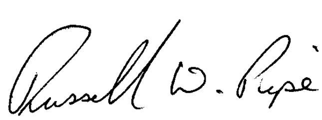
Applicant Information

KENWOOD USA CORPORATION
3975 John Creek Court, Suite 300
Suwanee, GA 30024

Rule Part(s):	**FCC 47 CFR §2.1093; IC RSS-102 Issue 1 (Provisional)**
Test Procedure(s):	**FCC OET Bulletin 65, Supplement C (Edition 01-01)**
Device Classification:	**Licensed Non-Broadcast Transmitter Held to Face (TNF)**
Device Type:	**Portable FM UHF PTT Radio Transceiver**
FCC IDENTIFER:	**ALH37333110**
Model(s):	**TK-3180**
Modulation:	**FM (UHF)**
Tx Frequency Range:	**450 - 520 MHz**
Max. RF Output Power Measured:	**5.36 Watts Conducted (485.05 MHz)**
Antenna Type(s) Tested:	**Stubby 440 - 490 MHz (P/N: KRA-23M)** **Stubby 470 - 520 MHz (P/N: KRA-23M2)** **Whip 440 - 490 MHz (P/N: KRA-27M)** **Whip 470 - 520 MHz (P/N: KRA-27M2)** **Stubby 450 - 490 MHz (P/N: KRA-17M)** **Stubby 470 - 512 MHz (P/N: KRA-17M2)**
Battery Type(s) Tested:	**Li-ion 7.5 V, 1700 mAh (P/N: KNB-33L)** **NiCd 7.5 V, 1700 mAh (P/N: KNB-31A)** **NiMH 7.5 V, 2500 mAh (P/N: KNB-32N)**
Body-Worn Accessories Tested:	**Speaker-Microphone (P/N: KMC-25)** **Plastic Belt-Clip (P/N: KBH-11)**
Max. SAR Levels Measured:	**Face-held: 3.43 W/kg (50% Duty Cycle)** **Body-worn: 5.34 W/kg (50% Duty Cycle)**

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) and Industry Canada RSS-102 Issue 1 (Provisional) for the Occupational / Controlled 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.



Russell W. Pipe
Senior Compliance Technologist
Celltech Labs Inc.

TABLE OF CONTENTS

1.0 INTRODUCTION

This measurement report demonstrates compliance of the Kenwood USA Corporation Model: TK-3180 Portable FM UHF PTT Radio Transceiver FCC ID: ALH37333110 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 Occupational / Controlled Exposure environment. The measurement 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.

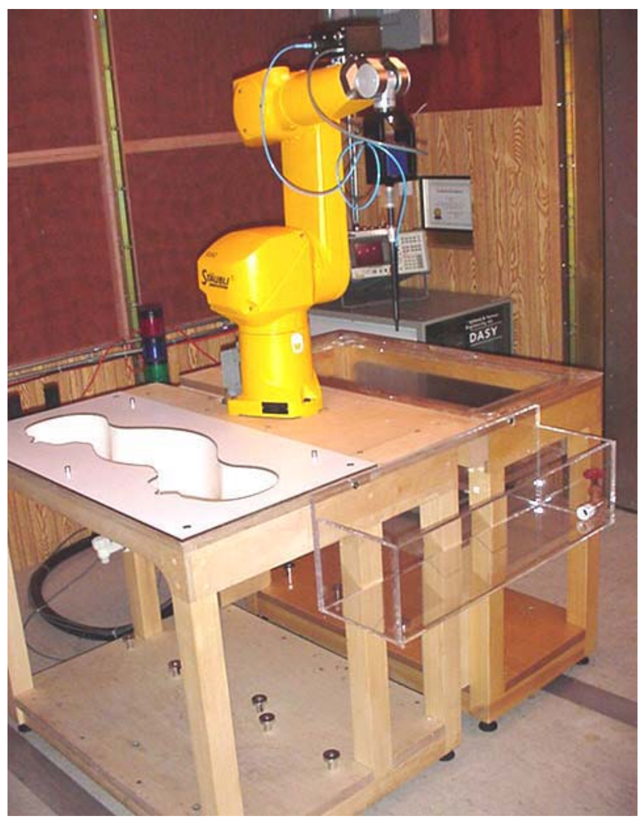
2.0 DESCRIPTION OF DEVICE UNDER TEST (DUT)

<table>
<tr><td>FCC Rule Part(s)</td><td colspan="4">47 CFR §2.1093</td></tr>
<tr><td>IC Rule Part(s)</td><td colspan="4">RSS-102 Issue 1 (Provisional)</td></tr>
<tr><td>Test Procedure(s)</td><td colspan="4">FCC OET Bulletin 65, Supplement C (Edition 01-01)</td></tr>
<tr><td>Device Classification</td><td colspan="4">Licensed Non-Broadcast Transmitter Held to Face (TNF)</td></tr>
<tr><td>Device Type</td><td colspan="4">Portable FM UHF PTT Radio Transceiver</td></tr>
<tr><td>FCC IDENTIFIER</td><td colspan="4">ALH37333110</td></tr>
<tr><td>Model(s)</td><td colspan="4">TK-3180</td></tr>
<tr><td>Serial No.</td><td colspan="4">U01 (Identical Prototype)</td></tr>
<tr><td>Modulation</td><td colspan="4">FM (UHF)</td></tr>
<tr><td>Tx Frequency Range</td><td colspan="4">450 - 520 MHz</td></tr>
<tr><td>Max. RF Output Power Measured</td><td>5.36 Watts</td><td colspan="2">Conducted</td><td>485.05 MHz</td></tr>
<tr><td rowspan="6">Antenna Type(s) Tested</td><td>Stubby</td><td>440 - 490 MHz</td><td>Length: 84 mm</td><td>P/N: KRA-23M</td></tr>
<tr><td>Stubby</td><td>470 - 520 MHz</td><td>Length: 84 mm</td><td>P/N: KRA-23M2</td></tr>
<tr><td>Whip</td><td>440 - 490 MHz</td><td>Length: 153 mm</td><td>P/N: KRA-27M</td></tr>
<tr><td>Whip</td><td>470 - 520 MHz</td><td>Length: 143 mm</td><td>P/N: KRA-27M2</td></tr>
<tr><td>Stubby</td><td>450 - 490 MHz</td><td>Length: 79 mm</td><td>P/N: KRA-17M</td></tr>
<tr><td>Stubby</td><td>470 - 512 MHz</td><td>Length: 78 mm</td><td>P/N: KRA-17M2</td></tr>
<tr><td rowspan="3">Battery Type(s) Tested</td><td>Li-ion</td><td colspan="2">7.5 V, 1700 mAh</td><td>P/N: KNB-33L</td></tr>
<tr><td>NiCd</td><td colspan="2">7.5 V, 1700 mAh</td><td>P/N: KNB-31A</td></tr>
<tr><td>NiMH</td><td colspan="2">7.5 V, 2500 mAh</td><td>P/N: KNB-32N</td></tr>
<tr><td rowspan="2">Body-Worn Accessories Tested</td><td colspan="4">Plastic Belt-Clip (P/N: KBH-11)</td></tr>
<tr><td colspan="4">Speaker-Microphone (P/N: KMC-25)</td></tr>
</table>

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 SAR Measurement System with validation phantom



DASY4 SAR Measurement System with Plexiglas planar phantom

4.0 MEASUREMENT SUMMARY

FACE-HELD SAR EVALUATION RESULTS

Freq. (MHz)	Chan.	Test Mode	Conducted Power Before Test (Watts)	Antenna Type	Antenna Part. No.	Battery Type	Separation Distance to Planar Phantom (cm)	Measured SAR 1g (W/kg) Duty Cycle 100%	Measured SAR 1g (W/kg) Duty Cycle 50%	SAR Drift During Test (dB)	Scaled SAR 1g (W/kg) Duty Cycle 100%	Scaled SAR 1g (W/kg) Duty Cycle 50%
485.05	Mid	CW	5.20	Stubby	KRA-23M	Li-ion	2.5	2.96	1.48	-0.457	3.29	1.64
485.05	Mid	CW	5.13	Stubby	KRA-23M	NiCd	2.5	2.74	1.37	-0.383	2.99	1.50
485.05	Mid	CW	5.13	Stubby	KRA-23M	NiMH	2.5	2.77	1.39	-0.446	3.07	1.53
485.05	Mid	CW	5.15	Stubby	KRA-23M2	Li-ion	2.5	4.90	2.45	-0.444	5.43	2.71
485.05	Mid	CW	5.20	Stubby	KRA-23M2	NiCd	2.5	4.61	2.31	-0.582	5.27	2.64
485.05	Mid	CW	5.16	Stubby	KRA-23M2	NiMH	2.5	4.71	2.36	-0.526	5.32	2.66
485.05	Mid	CW	5.23	Whip	KRA-27M	Li-ion	2.5	4.15	2.08	-0.172	4.32	2.16
485.05	Mid	CW	5.11	Whip	KRA-27M	NiCd	2.5	3.79	1.90	-0.192	3.96	1.98
485.05	Mid	CW	5.14	Whip	KRA-27M	NiMH	2.5	3.88	1.94	-0.200	4.06	2.03
485.05	Mid	CW	5.13	Whip	KRA-27M2	Li-ion	2.5	6.03	3.02	-0.129	6.21	3.11
485.05	Mid	CW	5.17	Whip	KRA-27M2	NiCd	2.5	5.69	2.85	-0.367	6.19	3.10
485.05	Mid	CW	5.17	Whip	KRA-27M2	NiMH	2.5	5.83	2.92	-0.337	6.30	3.15

ANSI / IEEE C95.1 1992 - SAFETY LIMIT
Spatial Peak - Controlled Exposure / Occupational
BRAIN: 8.0 W/kg (averaged over 1 gram)

Test Date	04/12/04		Ambient Temperature	23.8 °C
Measured Fluid Type	450 MHz Brain		Fluid Temperature	23.4 °C
Dielectric Constant ε_r	IEEE Target	Measured	Fluid Depth	≥ 15 cm
	43.5 (+ 5%)	44.3	Relative Humidity	32%
Conductivity σ (mho/m)	IEEE Target	Measured	Atmospheric Pressure	101.5 kPa
	0.87 (+ 5%)	0.91	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 at the mid channel were ≥ 3dB 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 DASY system for the duration of the SAR evaluations were >5% from the start power. The power drifts were subsequently added to the measured SAR levels to report scaled SAR results as shown in the above table.
4. A SAR versus time power drift evaluation was performed for the duration of the area scan measurement in the test configuration that reported the highest scaled SAR level. See Appendix A (SAR Test Plots) for SAR versus Time power drift evaluation plot.
5. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluation. The temperatures reported were consistent for all measurement periods.
6. The dielectric parameters of the simulated tissue mixture were measured prior to the evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters).
7. The SAR evaluations were performed within 24 hours of the system performance check.

4.0 MEASUREMENT SUMMARY

FACE-HELD SAR EVALUATION RESULTS

Freq. (MHz)	Chan.	Test Mode	Conducted Power Before Test (Watts)	Antenna Type	Antenna Part. No.	Battery Type	Separation Distance to Planar Phantom (cm)	Measured SAR 1g (W/kg) Duty Cycle 100%	Measured SAR 1g (W/kg) Duty Cycle 50%	SAR Drift During Test (dB)	Scaled SAR 1g (W/kg) Duty Cycle 100%	Scaled SAR 1g (W/kg) Duty Cycle 50%
485.05	Mid	CW	5.30	Stubby	KRA-17M	Li-ion	2.5	4.64	2.32	-0.389	5.07	2.54
485.05	Mid	CW	5.14	Stubby	KRA-17M	NiCd	2.5	4.26	2.13	-0.504	4.78	2.39
485.05	Mid	CW	5.16	Stubby	KRA-17M	NiMH	2.5	4.28	2.14	-0.516	4.82	2.41
485.05	Mid	CW	5.19	Stubby	KRA-17M2	Li-ion	2.5	6.37	3.19	-0.324	6.86	3.43
485.05	Mid	CW	5.16	Stubby	KRA-17M2	NiCd	2.5	5.83	2.92	-0.447	6.46	3.23
485.05	Mid	CW	5.18	Stubby	KRA-17M2	NiMH	2.5	5.72	2.86	-0.491	6.40	3.20

ANSI / IEEE C95.1 1992 - SAFETY LIMIT
Spatial Peak - Controlled Exposure / Occupational
BRAIN: 8.0 W/kg (averaged over 1 gram)

Test Date	04/13/04		Ambient Temperature	23.8 °C
Measured Fluid Type	450 MHz Brain		Fluid Temperature	21.8 °C
Dielectric Constant ε_r	IEEE Target	Measured	Fluid Depth	≥ 15 cm
	43.5 (± 5%)	45.6	Relative Humidity	32%
Conductivity σ (mho/m)	IEEE Target	Measured	Atmospheric Pressure	101.9 kPa
	0.87 (± 5%)	0.91	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 at the mid channel were ≥ 3dB 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 DASY system for the duration of the SAR evaluations were >5% from the start power. The power drifts were subsequently added to the measured SAR levels to report scaled SAR results as shown in the above table.
4. A SAR versus time power drift evaluation was performed for the duration of the area scan measurement in the test configuration that reported the highest scaled SAR level. See Appendix A (SAR Test Plots) for SAR versus Time power drift evaluation plot.
5. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluation. The temperatures reported were consistent for all measurement periods.
6. The dielectric parameters of the simulated tissue mixture were measured prior to the evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters).
7. The SAR evaluations were performed within 24 hours of the system performance check.

MEASUREMENT SUMMARY (Cont.)

BODY-WORN SAR EVALUATION RESULTS

Freq. (MHz)	Chan.	Test Mode	Cond. Power Before Test (Watts)	Antenna Type	Antenna Part No.	Battery Type	Body-Worn Accessories	Separation Distance to Planar Phantom (cm)	Measured SAR 1g (W/kg) Duty Cycle 100%	Measured SAR 1g (W/kg) Duty Cycle 50%	SAR Drift During Test (dB)	Scaled SAR 1g (W/kg) Duty Cycle 100%	Scaled SAR 1g (W/kg) Duty Cycle 50%
485.05	Mid	CW	5.31	Stubby	KRA-23M	Li-ion	Speaker-Mic Belt-Clip	1.7	4.60	2.30	0.0926	4.60	2.30
485.05	Mid	CW	5.25	Stubby	KRA-23M	NiCd	Speaker-Mic Belt-Clip	1.2	4.69	2.35	0.0479	4.69	2.35
485.05	Mid	CW	5.30	Stubby	KRA-23M	NiMH	Speaker-Mic Belt-Clip	1.2	4.62	2.31	0.353	4.62	2.31
485.05	Mid	CW	5.32	Stubby	KRA-23M2	Li-ion	Speaker-Mic Belt-Clip	1.7	7.74	3.87	0.304	7.74	3.87
485.05	Mid	CW	5.36	Stubby	KRA-23M2	NiCd	Speaker-Mic Belt-Clip	1.2	7.55	3.78	0.413	7.55	3.78
485.05	Mid	CW	5.27	Stubby	KRA-23M2	NiMH	Speaker-Mic Belt-Clip	1.2	7.45	3.73	0.290	7.45	3.73

ANSI / IEEE C95.1 1992 - SAFETY LIMIT
Spatial Peak - Controlled Exposure / Occupational
BODY: 8.0 W/kg (averaged over 1 gram)

Test Date	04/07/04		**Ambient Temperature**	24.8 °C
Measured Fluid Type	450 MHz Body		**Fluid Temperature**	21.7 °C
Dielectric Constant ε_r	**IEEE Target**	**Measured**	**Fluid Depth**	≥ 15 cm
	56.7 (± 5%)	57.5	**Relative Humidity**	30%
Conductivity σ **(mho/m)**	**IEEE Target**	**Measured**	**Atmospheric Pressure**	101.8 kPa
	0.94 (± 5%)	0.92	**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 at the mid channel were ≥ 3dB 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. A SAR versus time power drift evaluation was performed for the duration of the area scan measurement in the test configuration that reported the highest scaled SAR level. See Appendix A (SAR Test Plots) for SAR versus Time drift evaluation plot.
4. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluation. The temperatures reported were consistent for all measurement periods.
5. The dielectric parameters of the simulated tissue mixture were measured prior to the evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters).
6. The SAR evaluations were performed within 24 hours of the system performance check.

MEASUREMENT SUMMARY (Cont.)

BODY-WORN SAR EVALUATION RESULTS

Freq. (MHz)	Chan.	Test Mode	Cond. Power Before Test (Watts)	Antenna Type	Antenna Part No.	Battery Type	Body-Worn Accessories	Separation Distance to Planar Phantom (cm)	Measured SAR 1g (W/kg) Duty Cycle 100%	Measured SAR 1g (W/kg) Duty Cycle 50%	SAR Drift During Test (dB)	Scaled SAR 1g (W/kg) Duty Cycle 100%	Scaled SAR 1g (W/kg) Duty Cycle 50%
485.05	Mid	CW	5.22	Whip	KRA-27M	Li-ion	Speaker-Mic Belt-Clip	1.7	7.15	3.58	0.758	7.15	3.58
485.05	Mid	CW	5.26	Whip	KRA-27M	NiCd	Speaker-Mic Belt-Clip	1.2	P 7.02	3.51	0.0738	P 7.02	3.51
			5.29						S 4.89	2.45	-0.104	S 5.01	2.50
485.05	Mid	CW	5.16	Whip	KRA-27M	NiMH	Speaker-Mic Belt-Clip	1.2	P 6.90	3.45	0.196	P 6.90	3.45
			5.16						S 4.85	2.43	-0.268	S 5.16	2.58
485.05	Mid	CW	5.22	Whip	KRA-27M2	Li-ion	Speaker-Mic Belt-Clip	1.7	9.28	4.64	0.607	9.28	4.64
485.05	Mid	CW	5.25	Whip	KRA-27M2	NiCd	Speaker-Mic Belt-Clip	1.2	9.49	4.75	-0.314	10.2	5.10
485.05	Mid	CW	5.31	Whip	KRA-27M2	NiMH	Speaker-Mic Belt-Clip	1.2	9.07	4.54	-0.602	10.4	5.21
519.95	High	CW	5.13	Whip	KRA-27M2	NiMH	Speaker-Mic Belt-Clip	1.2	9.92	4.96	-0.323	10.7	5.34
			5.21						9.81	4.91	-0.348	10.6	5.31
485.05	Mid	CW	5.26	Stubby	KRA-17M	Li-ion	Speaker-Mic Belt-Clip	1.7	5.74	2.87	-0.488	6.42	3.21
485.05	Mid	CW	5.24	Stubby	KRA-17M	NiCd	Speaker-Mic Belt-Clip	1.2	5.80	2.90	-0.516	6.53	3.27
485.05	Mid	CW	5.20	Stubby	KRA-17M	NiMH	Speaker-Mic Belt-Clip	1.2	6.04	3.02	-0.401	6.62	3.31
485.05	Mid	CW	5.23	Stubby	KRA-17M2	Li-ion	Speaker-Mic Belt-Clip	1.7	9.34	4.67	-0.229	9.85	4.92
485.05	Mid	CW	5.24	Stubby	KRA-17M2	NiCd	Speaker-Mic Belt-Clip	1.2	9.14	4.57	-0.373	9.96	4.98
485.05	Mid	CW	5.30	Stubby	KRA-17M2	NiMH	Speaker-Mic Belt-Clip	1.2	9.26	4.63	-0.393	10.1	5.07
519.95	High	CW	5.16	Stubby	KRA-17M2	NiMH	Speaker-Mic Belt-Clip	1.2	10.0	5.00	-0.258	10.6	5.31

ANSI / IEEE C95.1 1992 - SAFETY LIMIT
Spatial Peak - Controlled Exposure / Occupational
BODY: 8.0 W/kg (averaged over 1 gram)

Test Date	04/08/04		**Ambient Temperature**	25.6 °C
Measured Fluid Type	450 MHz Body		**Fluid Temperature**	22.3 °C
Dielectric Constant ε_r	**IEEE Target**	**Measured**	**Fluid Depth**	≥ 15 cm
	56.7 (± 5%)	56.6	**Relative Humidity**	30%
Conductivity **σ (mho/m)**	**IEEE Target**	**Measured**	**Atmospheric Pressure**	102.1 kPa
	0.94 (± 5%)	0.92	**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 at the mid channel were ≥ 3dB 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. Secondary hotspots were evaluated to report SAR levels within 3 dB of the primary (P = Primary, S = Secondary).
4. The power drifts measured by the DASY system for the duration of the SAR evaluations were >5% from the start power. The power drifts were subsequently added to the measured SAR levels to report scaled SAR results as shown in the above table.
5. The SAR evaluations were performed within 24 hours of the system performance check.

5.0 DETAILS OF SAR EVALUATION

The Kenwood USA Corporation Model: TK-3180 Portable FM UHF PTT Radio Transceiver FCC ID: ALH37333110 was found to be compliant for localized Specific Absorption Rate (Occupational / Controlled Exposure) based on the test provisions and conditions described below. The detailed test setup photographs are shown in Appendix F.

1. The DUT was evaluated in a face-held configuration with the front of the radio placed parallel to the outer surface of the planar phantom. A 2.5 cm separation distance was maintained between the front side of the DUT and the outer surface of the planar phantom for the duration of the tests.
2. The DUT was evaluated in a body-worn configuration with the back of the radio placed parallel to the outer surface of the planar phantom. The attached plastic belt-clip accessory was touching the planar phantom. With the Li-ion battery, the belt-clip accessory provided a 1.7 cm separation distance between the back of the DUT and the outer surface of the planar phantom. With the NiCd and NiMH batteries, the belt-clip accessory provided a 1.2 cm separation distance between the back of the DUT and the outer surface of the planar phantom. The DUT was tested for body-worn SAR with the speaker-microphone accessory connected.
3. The conducted power levels were measured before each test using a Gigatronics 8652A Universal Power Meter according to the procedures described in FCC 47 CFR §2.1046.
4. The power drifts measured by the DASY system during the SAR evaluations were >5% from the start power. The power drifts were subsequently added to the measured SAR levels to report scaled SAR results as shown in the test data table (pages 5-8).
5. A SAR versus time power drift evaluation was performed for the duration of the area scan measurement in the test configuration that reported the highest scaled SAR level. See Appendix A (SAR Test Plots) for SAR versus Time power drift evaluation plot.
6. The area scan evaluation was performed with a fully charged battery. After the area scan was completed the radio was cooled down to room temperature and the battery was replaced with a fully charged battery prior to the zoom scan evaluation.
7. The DUT was tested in unmodulated continuous transmit operation (Continuous Wave mode at 100% duty cycle) with the transmit key constantly depressed. For a push-to-talk device the 50% duty cycle compensation reported assumes a transmit/receive cycle of equal time base.
8. The SAR evaluations were performed using a Plexiglas planar phantom.
9. A stack of low-density, low-loss dielectric foamed polystyrene was used in place of the device holder.

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 (5 x 5 x 7 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 (7 x 7 x 7) to ensure complete capture of the peak spatial-average SAR.

7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation a system check was performed using a planar phantom with a 450MHz dipole (see Appendix C for system validation procedure). The dielectric parameters of the simulated tissue mixture were measured prior to the system performance 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 ±10% (see Appendix B for system performance check test plots).

SYSTEM PERFORMANCE CHECK

Test Date	450MHz Equiv. Tissue	SAR 1g (W/kg)		Dielectric Constant ε_r		Conductivity σ (mho/m)		ρ (Kg/m^3)	Amb. Temp. (°C)	Fluid Temp. (°C)	Fluid Depth (cm)	Humid. (%)	Barom. Press. (kPa)
		IEEE Target	Measured	IEEE Target	Measured	IEEE Target	Measured						
04/07/04	Brain	1.23 (±10%)	1.26 (+2.4%)	43.5 ±5%	43.0	0.87 ±5%	0.85	1000	25.3	21.8	≥ 15	30	101.6
04/08/04	Brain	1.23 (±10%)	1.28 (+4.1%)	43.5 ±5%	43.2	0.87 ±5%	0.87	1000	25.5	22.8	≥ 15	30	102.1
04/12/04	Brain	1.23 (±10%)	1.31 (+6.5%)	43.5 ±5%	44.3	0.87 ±5%	0.91	1000	21.9	23.4	≥ 15	32	101.5
04/13/04	Brain	1.23 (±10%	1.31 (+6.5%)	43.5 ±5%	45.6	0.87 ±5%	0.91	1000	22.8	21.8	≥ 15	33	101.9

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.

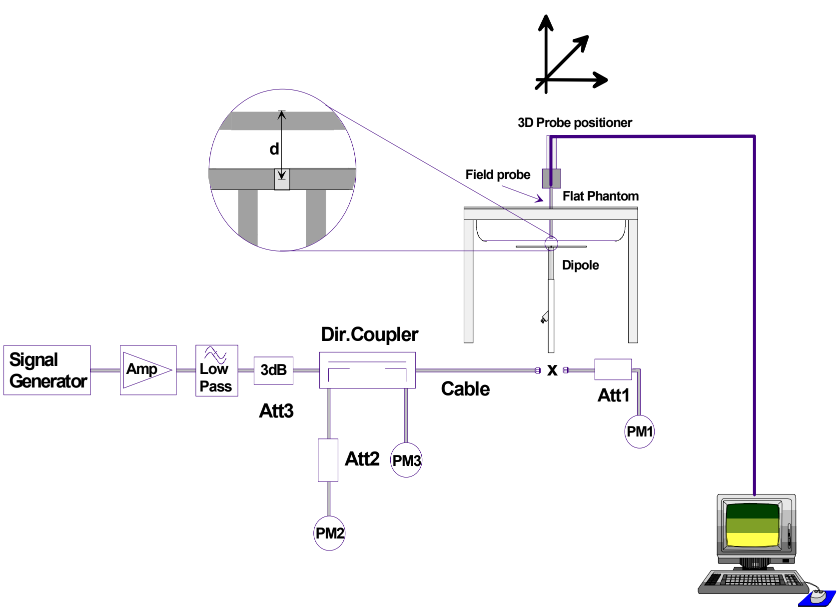


Figure 1. System Performance Check Setup Diagram

450MHz Dipole Setup

8.0 SIMULATED EQUIVALENT TISSUES

The 450MHz brain and body simulated tissue mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution. Preservation with a bactericide is added and visual inspection is made to ensure air bubbles are not trapped during the mixing process. The fluid was prepared and measured for dielectric parameters (permittivity and conductivity) according to standardized procedures.

SIMULATED TISSUE MIXTURES		
INGREDIENT	**450MHz Brain (System Check & DUT Evaluation)**	**450MHz Body (DUT Evaluation)**
Water	38.56 %	52.00 %
Sugar	56.32 %	45.65 %
Salt	3.95 %	1.75 %
HEC	0.98 %	0.50 %
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 1g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10g)	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.: 1387
Construction: Triangular core fiber optic detection system
Frequency: 10 MHz to 6 GHz
Linearity: ±0.2 dB (30 MHz to 3 GHz)

Phantom(s)

Evaluation Phantom
Type: Planar Phantom
Shell Material: Plexiglas
Bottom Thickness: 2.0 mm ± 0.1 mm
Outer Dimensions: 75.0 cm (L) x 22.5 cm (W) x 20.5 cm (H); Back Plane: 25.7 cm (H)

Validation Phantom (≤ 450MHz)
Type: Planar Phantom
Shell Material: Plexiglas
Bottom Thickness: 6.2 mm ± 0.1 mm
Outer Dimensions: 86.0 cm (L) x 39.5 cm (W) x 21.8 cm (H)

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 ± 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)
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 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 PLANAR PHANTOM

The planar phantom is constructed of Plexiglas material with a 2.0 mm shell thickness for face-held and body-worn SAR evaluations of handheld and body-worn radio transceivers. The planar phantom is mounted on the side of the DASY4 compact system table.


Planar Phantom

13.0 VALIDATION PLANAR PHANTOM

The validation planar phantom is constructed of Plexiglas material with a 6.0 mm shell thickness for system validations at 450MHz and below. The validation planar phantom is mounted in the table of the DASY4 compact system.


Validation Planar Phantom

14.0 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

15.0 TEST EQUIPMENT LIST

TEST EQUIPMENT	SERIAL NO.	CALIBRATION DATE
Schmid & Partner DASY4 System	-	-
DASY4 Measurement Server	1078	N/A
-Robot	599396-01	N/A
-ET3DV6 E-Field Probe	1387	March 2004
-300MHz Validation Dipole	135	Oct 2003
-450MHz Validation Dipole	136	Nov 2003
-835MHz Validation Dipole	411	Mar 2004
-900MHz Validation Dipole	054	June 2003
-1800MHz Validation Dipole	247	June 2003
-2450MHz Validation Dipole	150	Sept 2003
-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
Power Sensor 80701A	1833542	April 2004
Power Sensor 80701A	1834350	April 2004
HP E4408B Spectrum Analyzer	US39240170	Dec 2003
HP 8594E Spectrum Analyzer	3543A02721	April 2004
HP 8753E Network Analyzer	US38433013	May 2003
HP 8648D Signal Generator	3847A00611	May 2003
Amplifier Research 5S1G4 Power Amplifier	26235	N/A

16.0 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	± 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					**± 13.3**	
Expanded Uncertainty (k=2)					**± 26.6**	

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	± 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	∞
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					**± 9.9**	
Expanded Uncertainty (k=2)					**± 19.8**	

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

17.0 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

System Performance Check - 450 MHz Dipole

Date Tested: 04/07/04

DUT: Dipole 450 MHz; Model: D450V2; Type: System Performance Check; Serial: 136

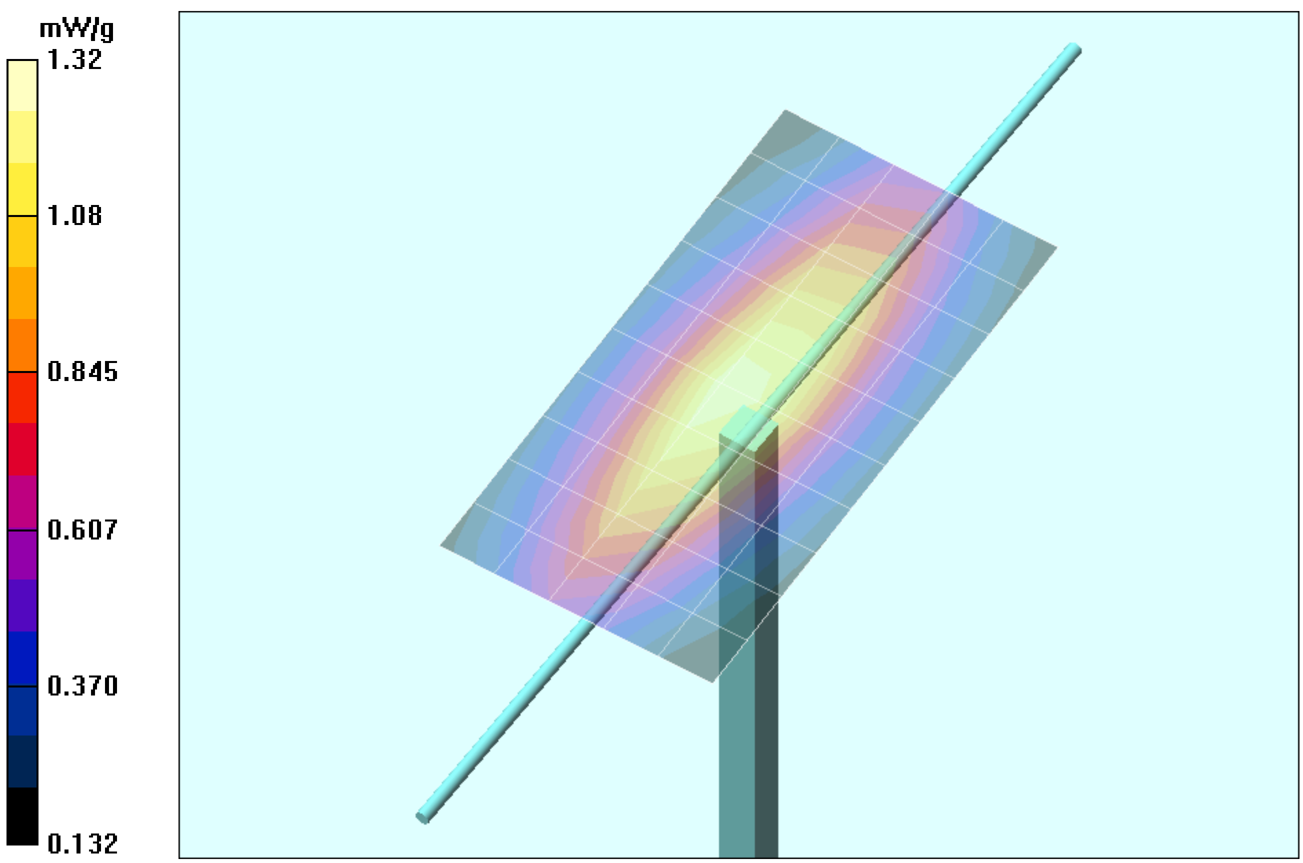
Ambient Temp: 25.3 °C; Fluid Temp: 21.8 °C; Barometric Pressure: 101.6 kPa; Humidity: 30%

Communication System: CW
Forward Conducted Power: 250mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.85 mho/m; ε_r = 43.0; ρ = 1000 kg/m^3)

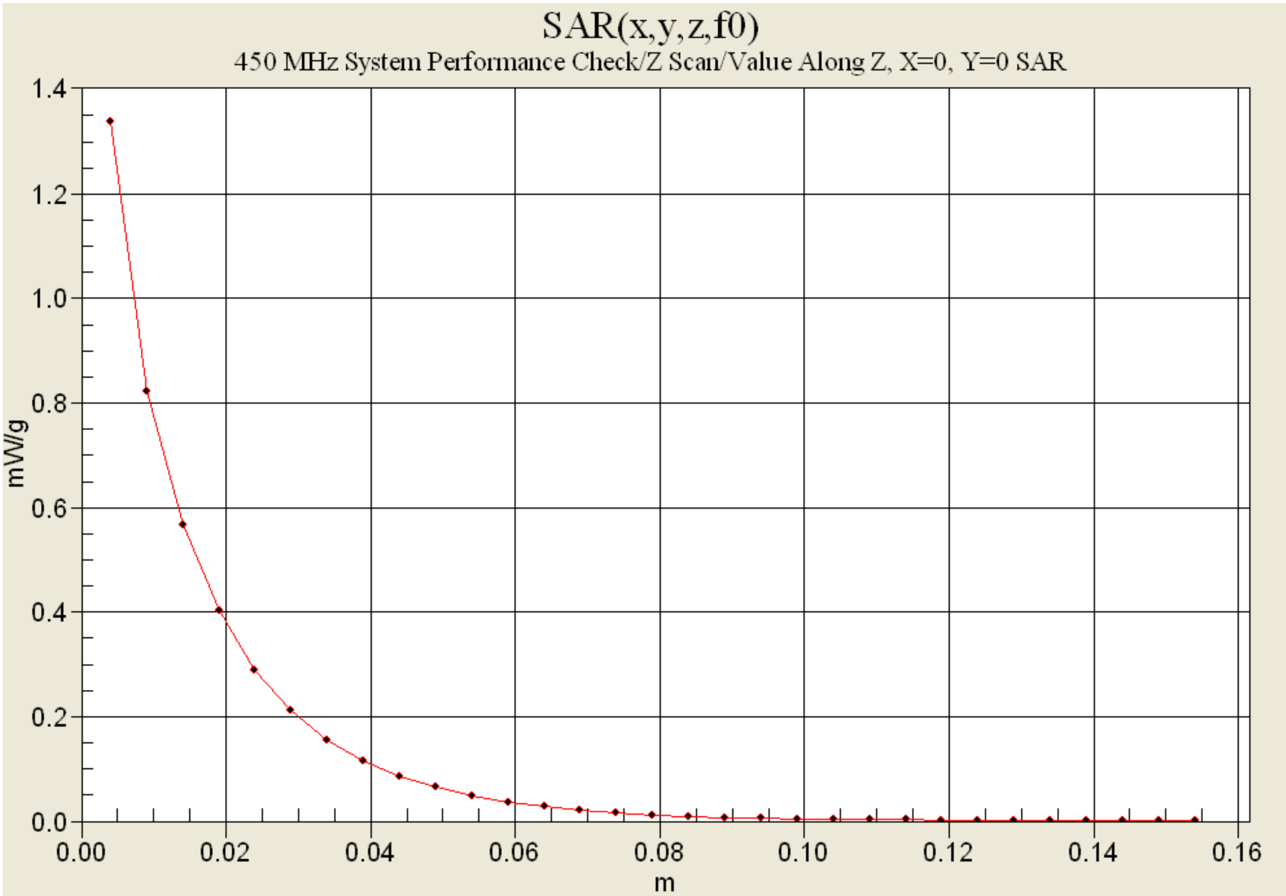
- Probe: ET3DV6 - SN1387; ConvF(7.5, 7.5, 7.5); Calibrated: 18/03/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 19/12/2003
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.2 Build 37; Postprocessing SW: SEMCAD, V1.8 Build 109

450 MHz System Performance Check/Area Scan (6x11x1):
Measurement grid: dx=15mm, dy=15mm

450 MHz System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.8 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 2.23 W/kg
SAR(1 g) = 1.26 mW/g; SAR(10 g) = 0.808 mW/g



Z-Axis Scan


SAR(x,y,z,f0)
450 MHz System Performance Check/Z Scan/Value Along Z, X=0, Y=0 SAR
mW/g
m
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16

System Performance Check - 450 MHz Dipole

Date Tested: 04/08/04

DUT: Dipole 450 MHz; Model: D450V2; Type: System Performance Check; Serial: 136

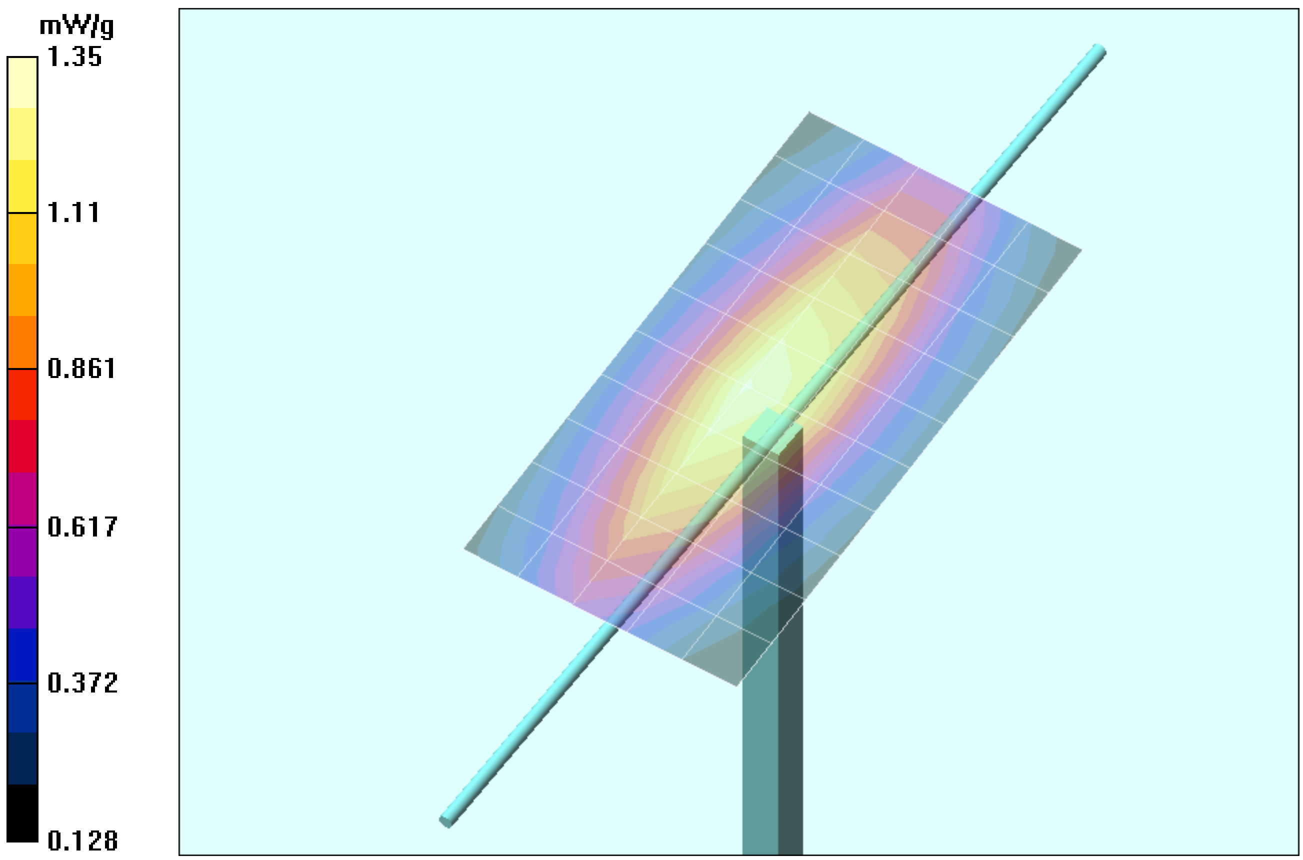
Ambient Temp: 25.5 °C; Fluid Temp: 22.8 °C; Barometric Pressure: 102.1 kPa; Humidity: 30%

Communication System: CW
Forward Conducted Power: 250mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.87 mho/m; ε_r = 43.2; ρ = 1000 kg/m^3)

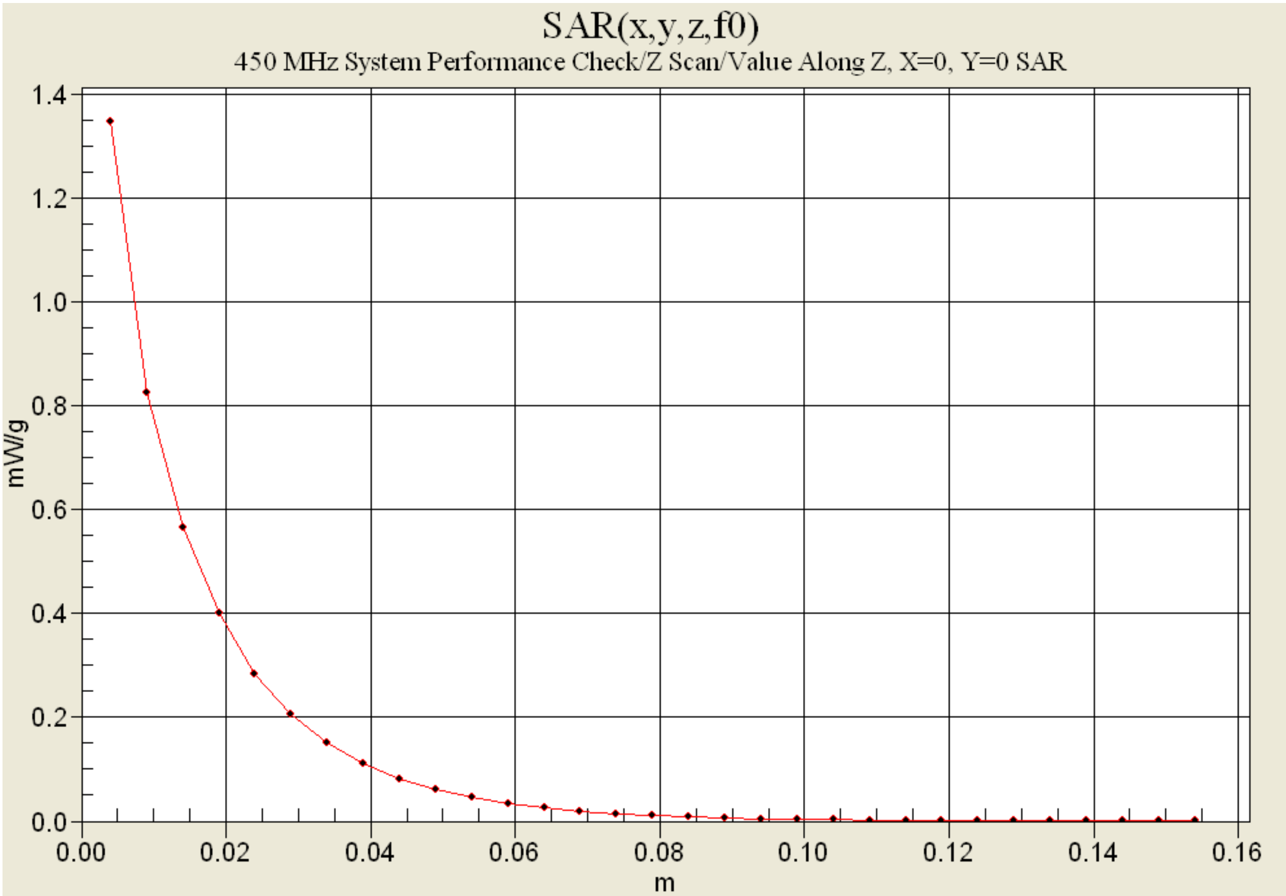
- Probe: ET3DV6 - SN1387; ConvF(7.5, 7.5, 7.5); Calibrated: 18/03/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 19/12/2003
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.2 Build 37; Postprocessing SW: SEMCAD, V1.8 Build 109

450 MHz System Performance Check/Area Scan (6x11x1):
Measurement grid: dx=15mm, dy=15mm

450 MHz System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 41.5 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 2.3 W/kg
SAR(1 g) = 1.28 mW/g; SAR(10 g) = 0.820 mW/g



Z-Axis Scan



SAR(x,y,z,f0)
450 MHz System Performance Check/Z Scan/Value Along Z, X=0, Y=0 SAR
mW/g
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

System Performance Check - 450 MHz Dipole

Date Tested: 04/12/04

DUT: Dipole 450 MHz; Model: D450V2; Type: System Performance Check; Serial: 136

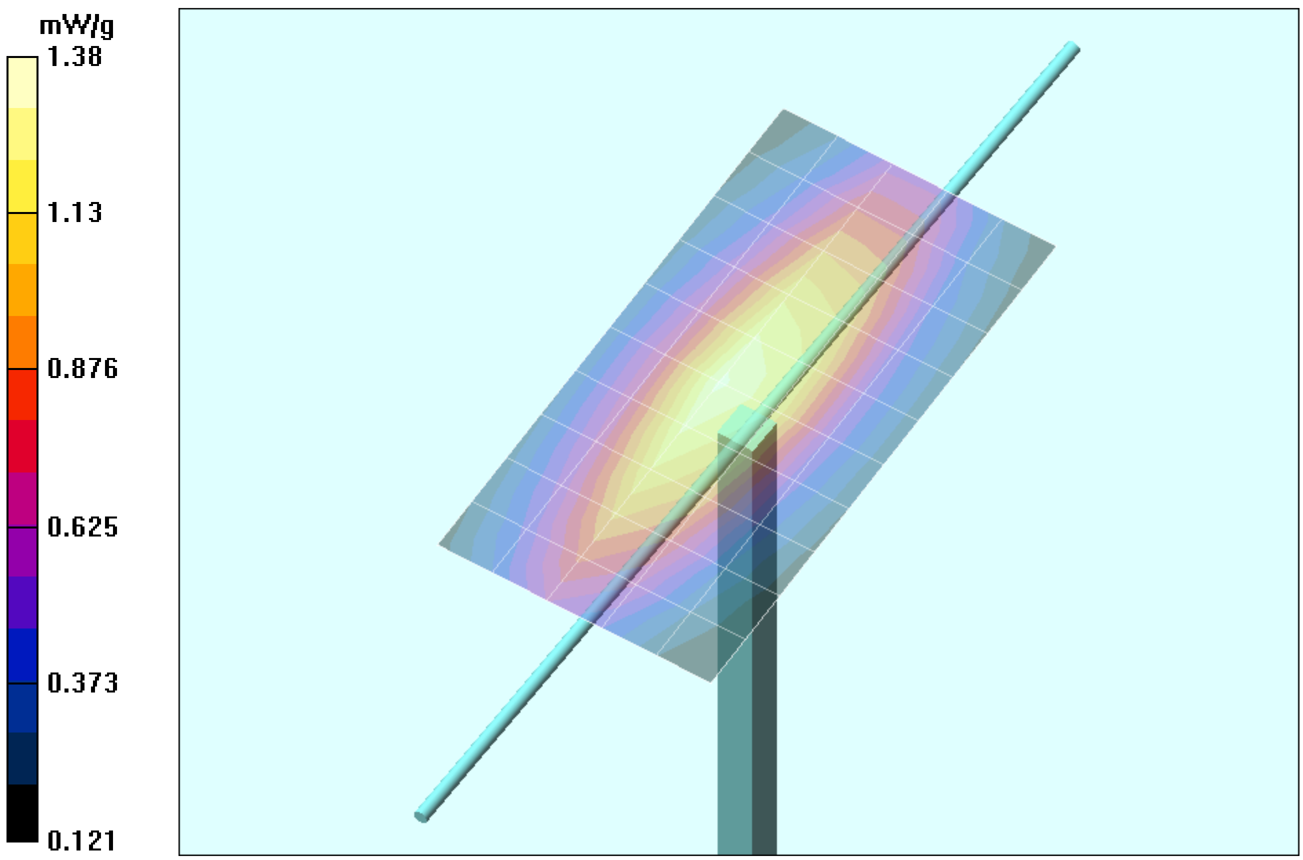
Ambient Temp: 21.9 °C; Fluid Temp: 23.4 °C; Barometric Pressure: 101.5 kPa; Humidity: 32%

Communication System: CW
Forward Conducted Power: 250mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.91 mho/m; ε_r = 44.3; ρ = 1000 kg/m^3)

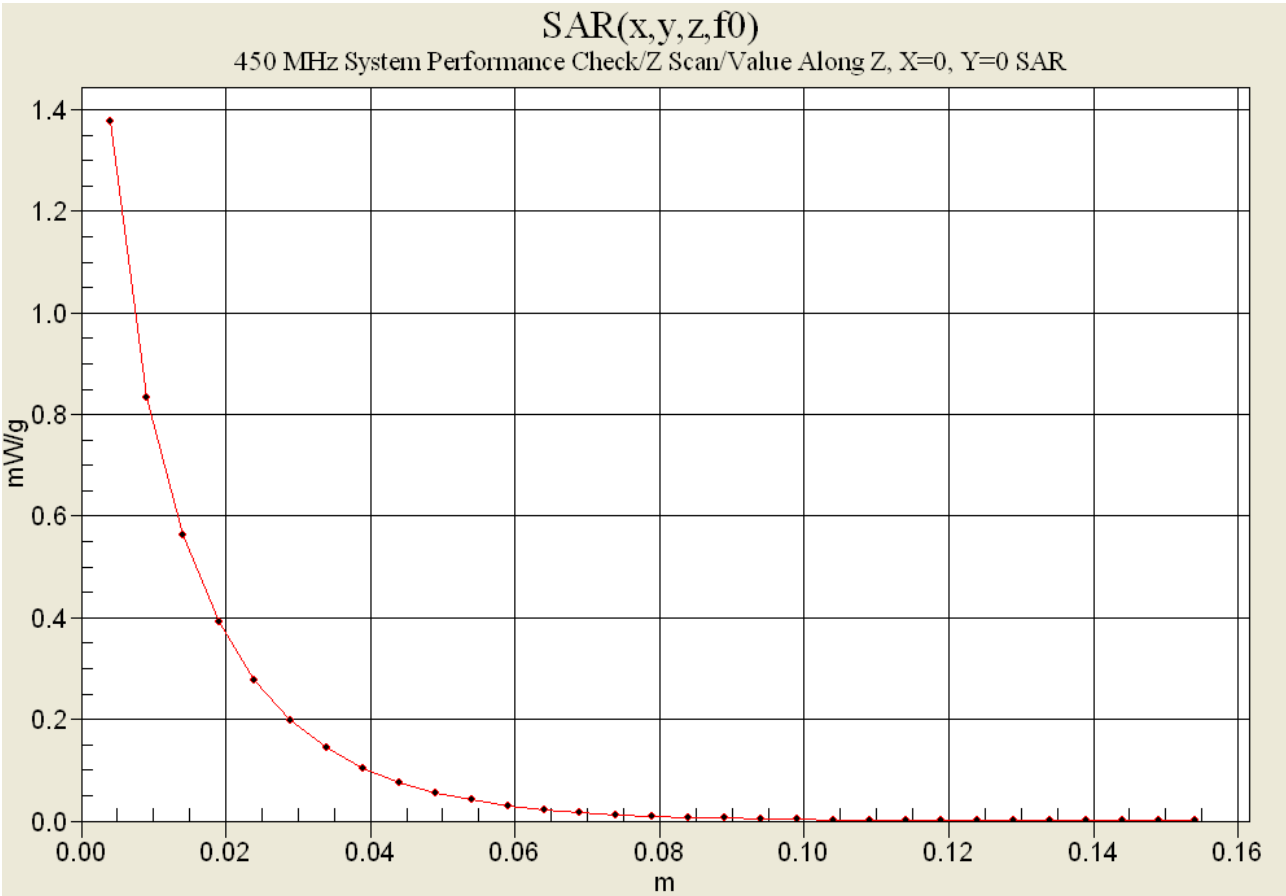
- Probe: ET3DV6 - SN1387; ConvF(7.5, 7.5, 7.5); Calibrated: 18/03/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 19/12/2003
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.2 Build 37; Postprocessing SW: SEMCAD, V1.8 Build 109

450 MHz System Performance Check/Area Scan (6x11x1):
Measurement grid: dx=15mm, dy=15mm

450 MHz System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 38.7 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 2.35 W/kg
SAR(1 g) = 1.31 mW/g; SAR(10 g) = 0.826 mW/g



Z-Axis Scan


SAR(x,y,z,f0)
450 MHz System Performance Check/Z Scan/Value Along Z, X=0, Y=0 SAR
mW/g
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

System Performance Check - 450 MHz Dipole

Date Tested: 04/13/04

DUT: Dipole 450 MHz; Model: D450V2; Type: System Performance Check; Serial: 136

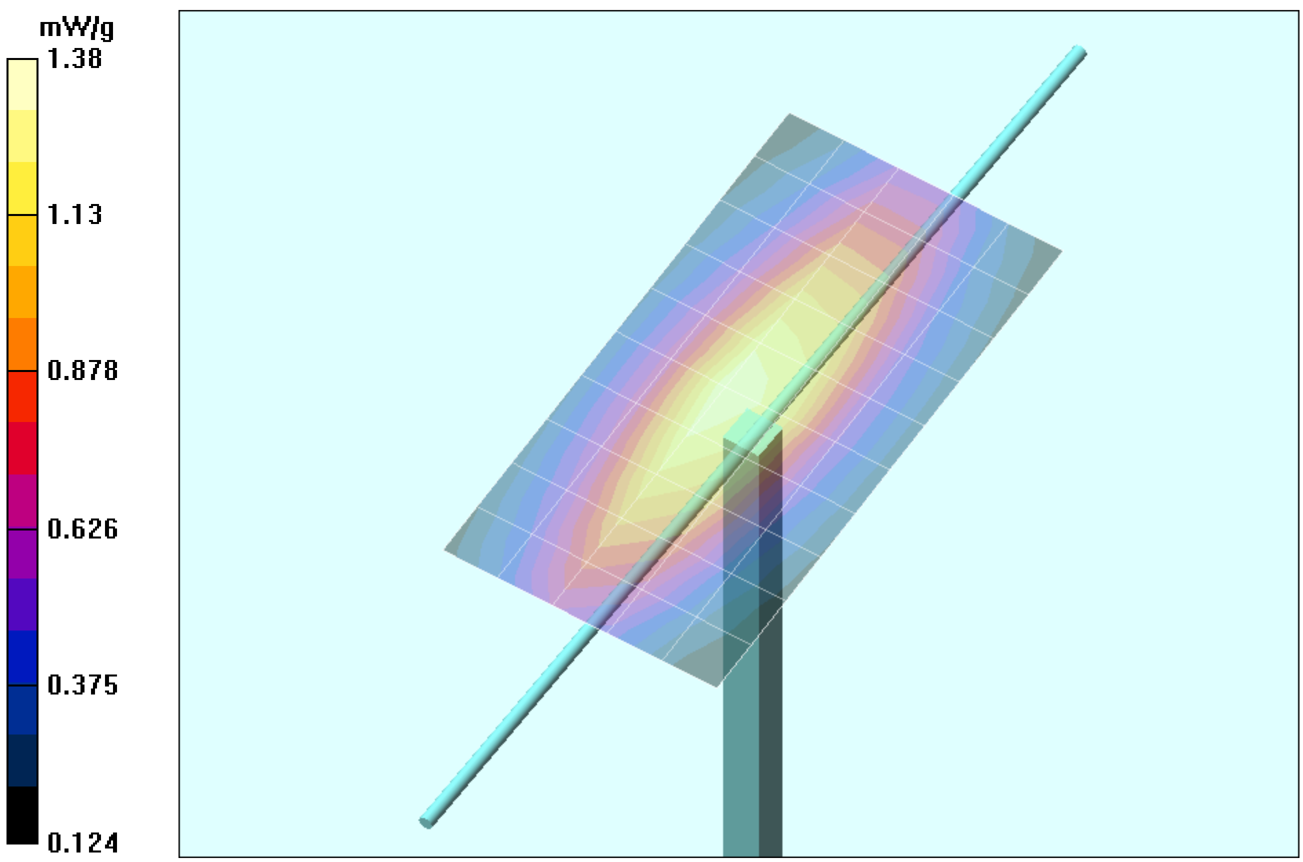
Ambient Temp: 22.8 °C; Fluid Temp: 21.8 °C; Barometric Pressure: 101.9 kPa; Humidity: 33%

Communication System: CW
Forward Conducted Power: 250mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.91 mho/m; ε_r = 45.6; ρ = 1000 kg/m^3)

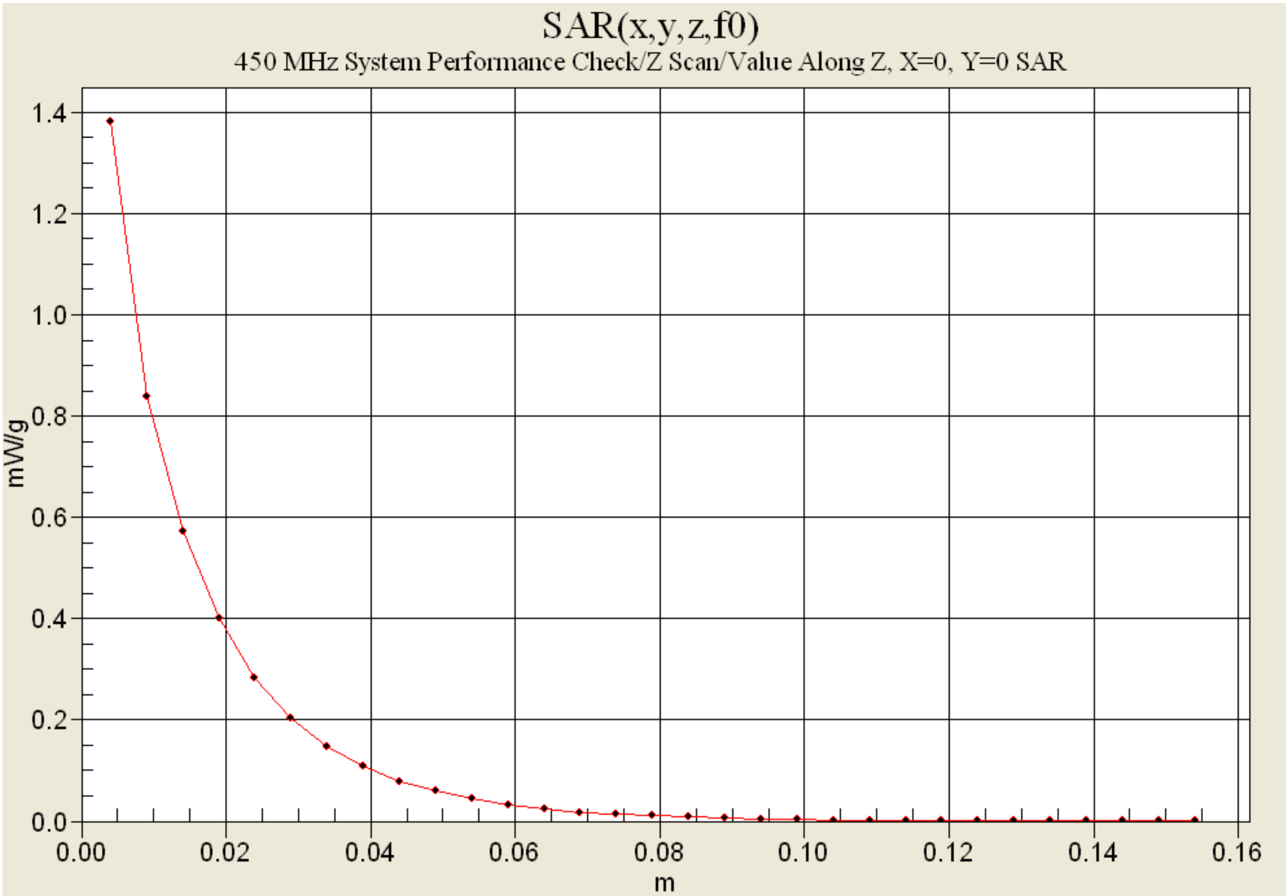
- Probe: ET3DV6 - SN1387; ConvF(7.5, 7.5, 7.5); Calibrated: 18/03/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 19/12/2003
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.2 Build 37; Postprocessing SW: SEMCAD, V1.8 Build 109

450 MHz System Performance Check/Area Scan (6x11x1):
Measurement grid: dx=15mm, dy=15mm

450 MHz System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.1 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 2.37 W/kg
SAR(1 g) = 1.31 mW/g; SAR(10 g) = 0.830 mW/g



Z-Axis Scan


SAR(x,y,z,f0)
450 MHz System Performance Check/Z Scan/Value Along Z, X=0, Y=0 SAR
mW/g
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

APPENDIX C - SYSTEM VALIDATION

450MHz SYSTEM VALIDATION DIPOLE

Type:	**450MHz Validation Dipole**
Serial Number:	**136**
Place of Calibration:	**Celltech Labs Inc.**
Date of Calibration:	**November 4, 2003**

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

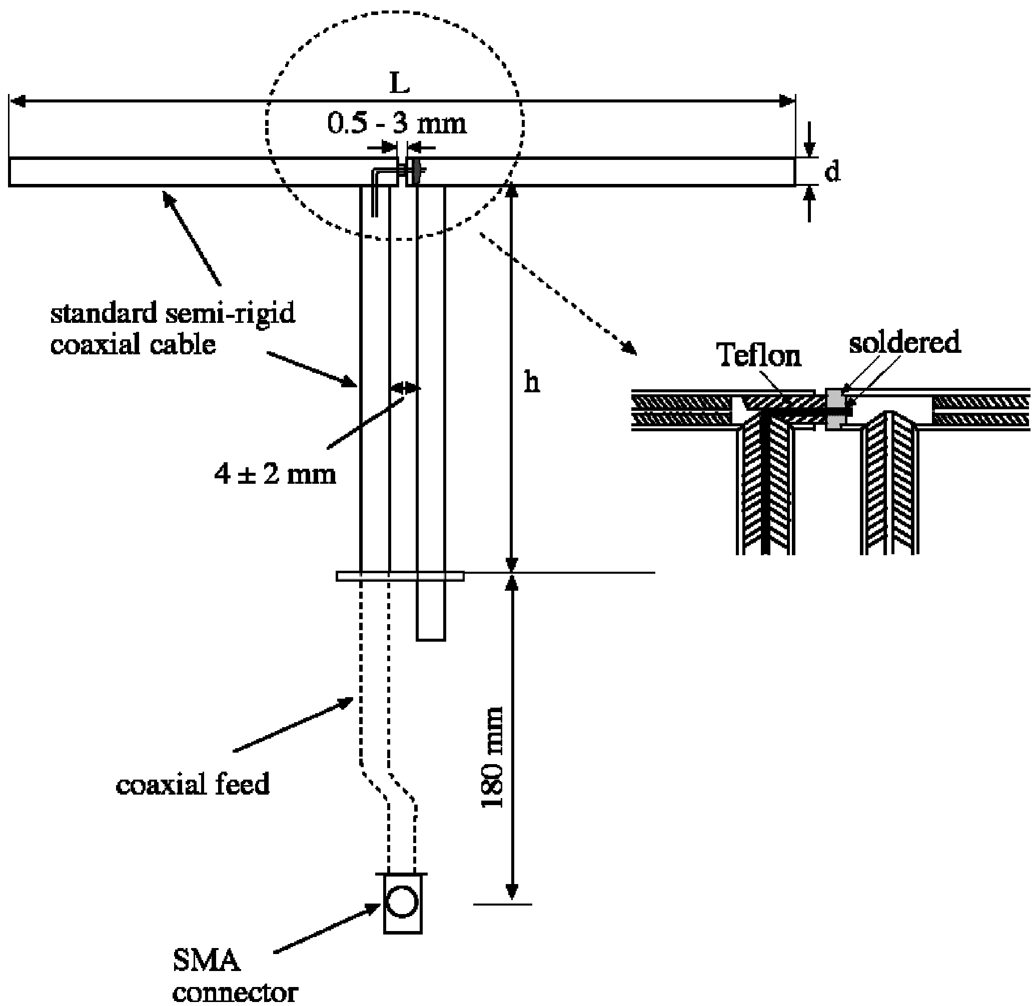
Calibrated by:	Spencer Watson
Approved by:	Russell W. Pipe

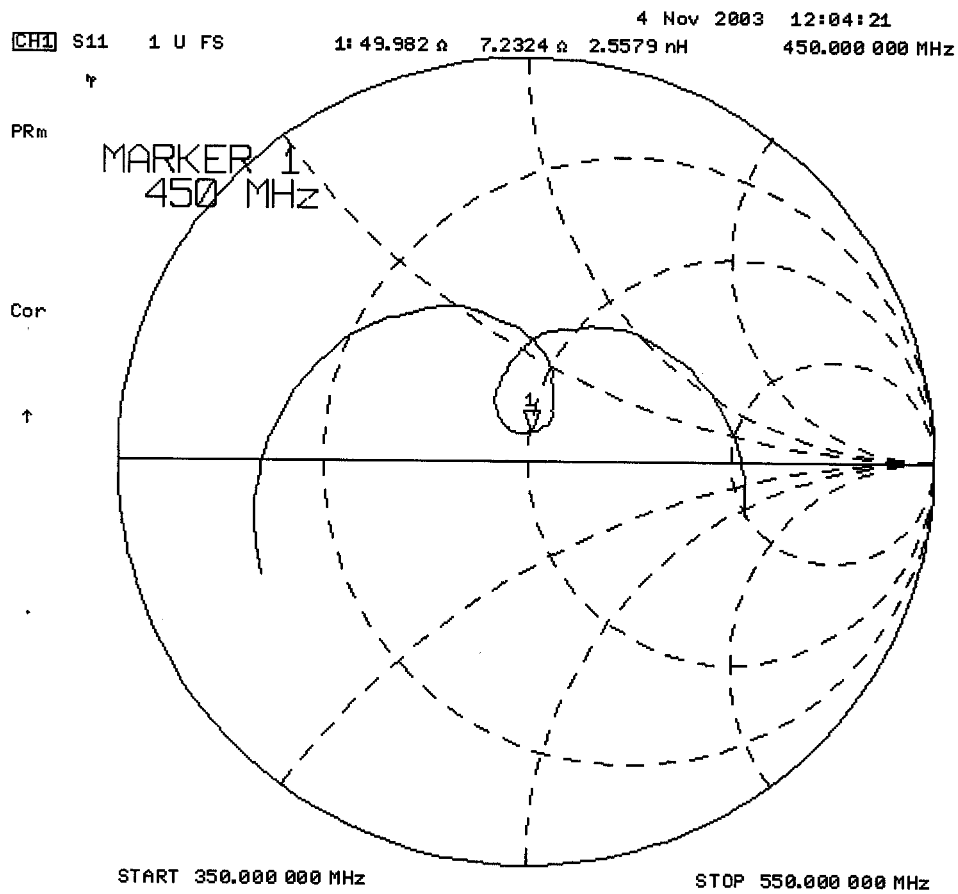
Celltech Labs Inc. 1955 Moss Court, Kelowna, B.C. Canada V1Y 9L3
Tel. 250-448-7047 • Fax. 250-448-7046 • e-mail: info@celltechlabs.com
www.celltechlabs.com

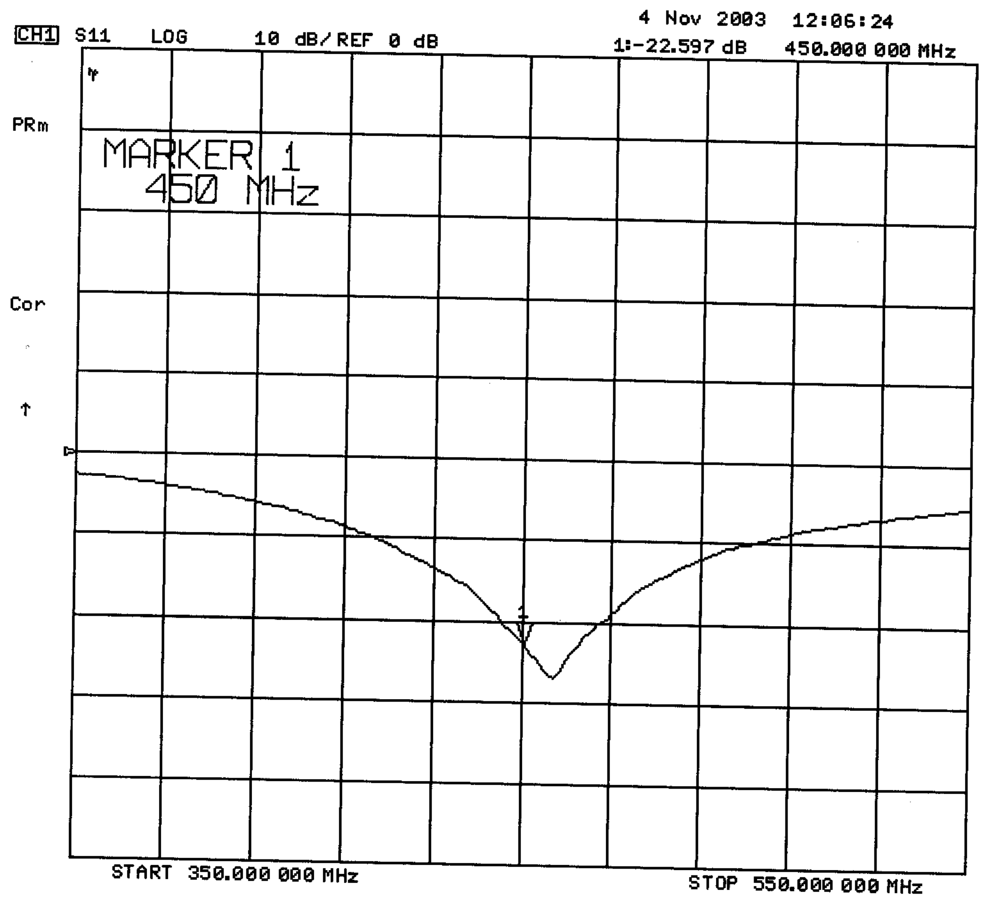
1. Dipole Construction & Electrical Characteristics

The validation dipole was constructed in accordance with the IEEE Std "Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques". 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 450MHz	Re{Z} = 49.982Ω
	Im{Z} = 7.2324Ω
Return Loss at 450MHz	-22.597dB




4 Nov 2003 12:04:21
CH1 S11 1 U FS
1: 49.982 Ω 7.2324 Ω 2.5579 nH
450.000 000 MHz
PRm
Cor
MARKER 1
450 MHz
START 350.000 000 MHz
STOP 550.000 000 MHz


CH1 S11 LOG 10 dB/ REF 0 dB
4 Nov 2003 12:06:24
1:-22.597 dB 450.000 000 MHz
PRm
Cor
MARKER 1
450 MHz
START 350.000 000 MHz
STOP 550.000 000 MHz

2. 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

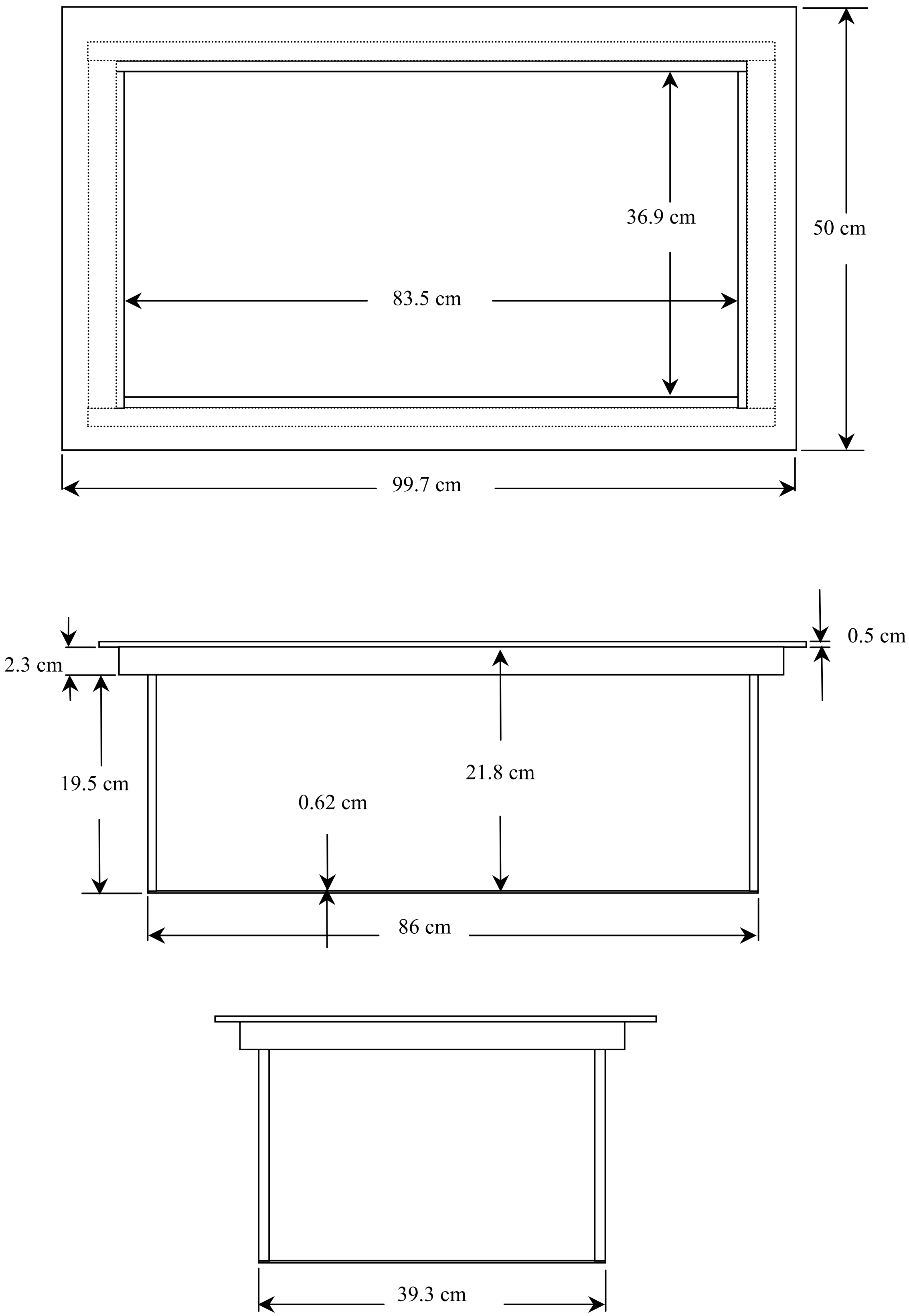
3. Validation Phantom

The validation phantom was constructed using relatively low-loss tangent Plexiglas material. The inner dimensions of the phantom are as follows:

Length: 83.5 cm
Width: 36.9 cm
Height: 21.8 cm

The bottom section of the validation phantom is constructed of 6.2 ± 0.1mm Plexiglas.

4. Dimensions of Plexiglas Planar Phantom



5. 450MHz System Validation Setup

450MHz System Validation Setup

6. Measurement Conditions

The planar phantom was filled with brain simulating tissue having the following parameters at 450MHz:

Relative Permittivity:	43.7
Conductivity:	0.88 mho/m
Fluid Temperature:	22.0 °C
Fluid Depth:	≥ 15.0 cm

Environmental Conditions:

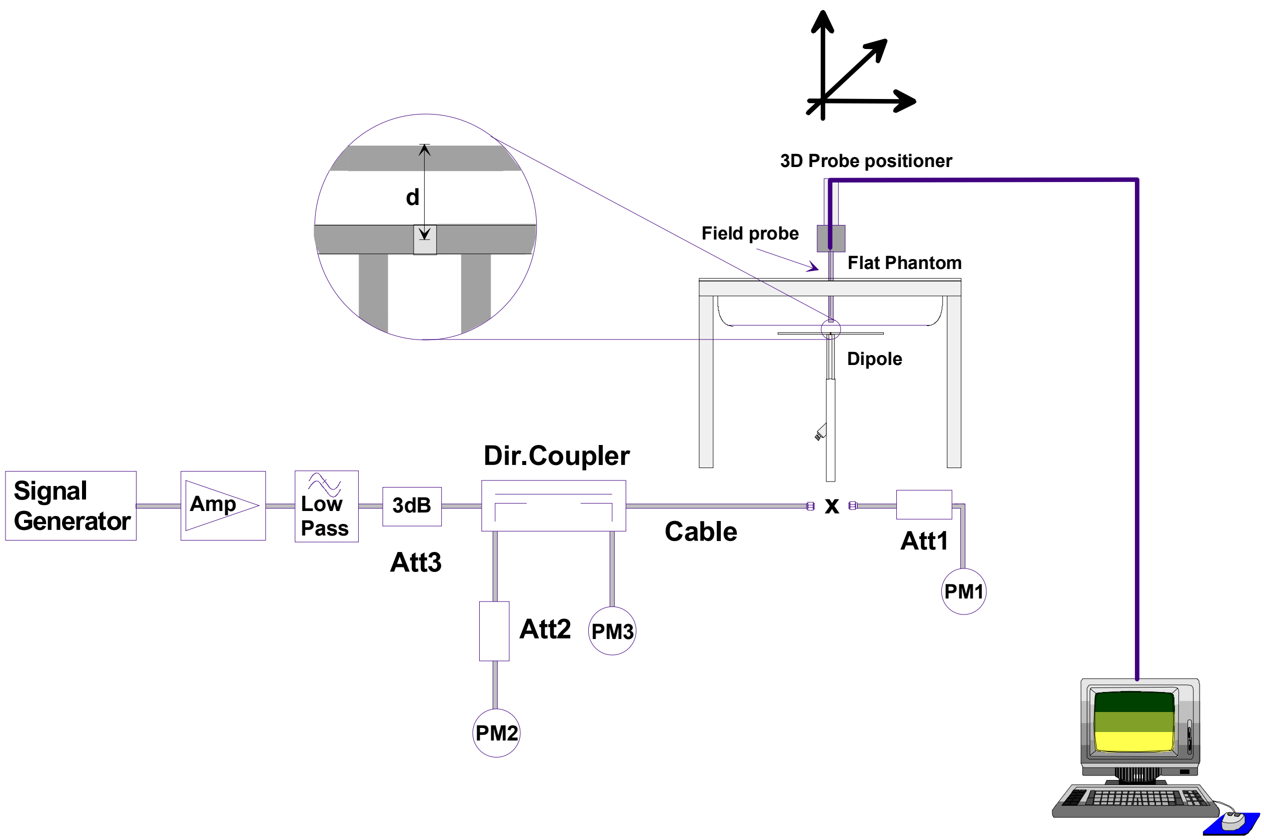
Ambient Temperature:	22.1 °C
Humidity:	49 %
Barometric Pressure:	102.8 kPa

The 450MHz simulated brain tissue mixture consists of the following ingredients:

Ingredient	Percentage by weight
Water	38.56%
Sugar	56.32%
Salt	3.95%
HEC	0.98%
Dowicil 75	0.19%
450MHz Target Dielectric Parameters at 22 °C	ε_r = 43.5 σ = 0.87 S/m

7. 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.

8. Validation Dipole SAR Test Results

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

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	1.29	5.16	0.810	3.24	2.28
Test 2	1.31	5.24	0.827	3.31	2.31
Test 3	1.30	5.20	0.823	3.29	2.29
Test 4	1.30	5.20	0.822	3.29	2.29
Test 5	1.29	5.16	0.819	3.28	2.28
Test 6	1.30	5.20	0.826	3.30	2.28
Test 7	1.31	5.24	0.826	3.30	2.30
Test 8	1.31	5.24	0.829	3.32	2.30
Test 9	1.30	5.20	0.822	3.29	2.28
Test 10	1.31	5.24	0.822	3.29	2.33
Average Value	1.30	5.21	0.823	3.29	2.29

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

IEEE Target over 1cm^3 (1g) of tissue: 1.23 mW/g (+/- 10%)

Averaged over 1cm (1g) of tissue: 5.21 mW/g

Averaged over 10cm (10g) of tissue: 3.29 mW/g

Test Date: 11/04/03

DUT: Dipole 450MHz; Model: D450V2; Type: System Performance Check; Serial: 136

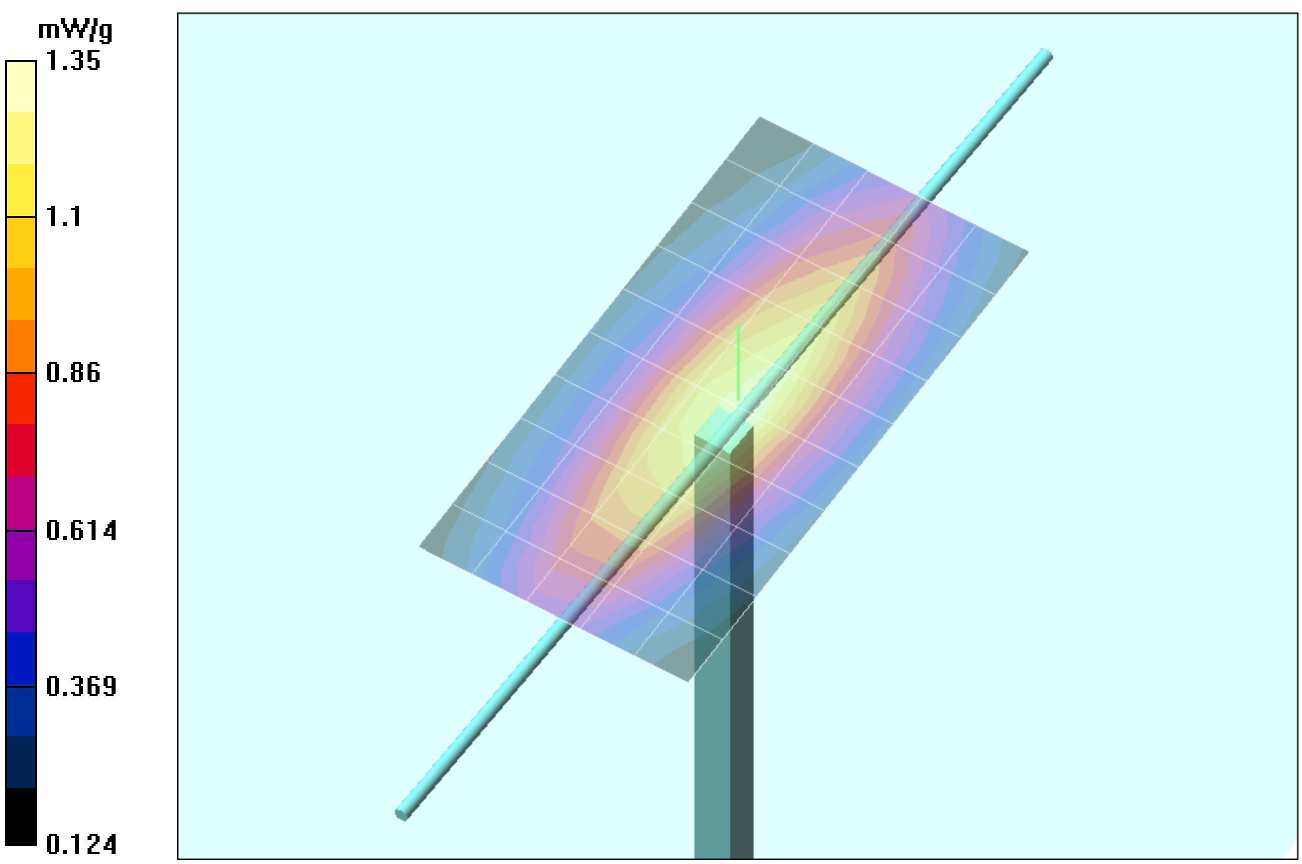
Ambient Temp: 22.1°C; Fluid Temp: 22.0°C; Barometric Pressure: 102.8 kPa; Humidity: 49%

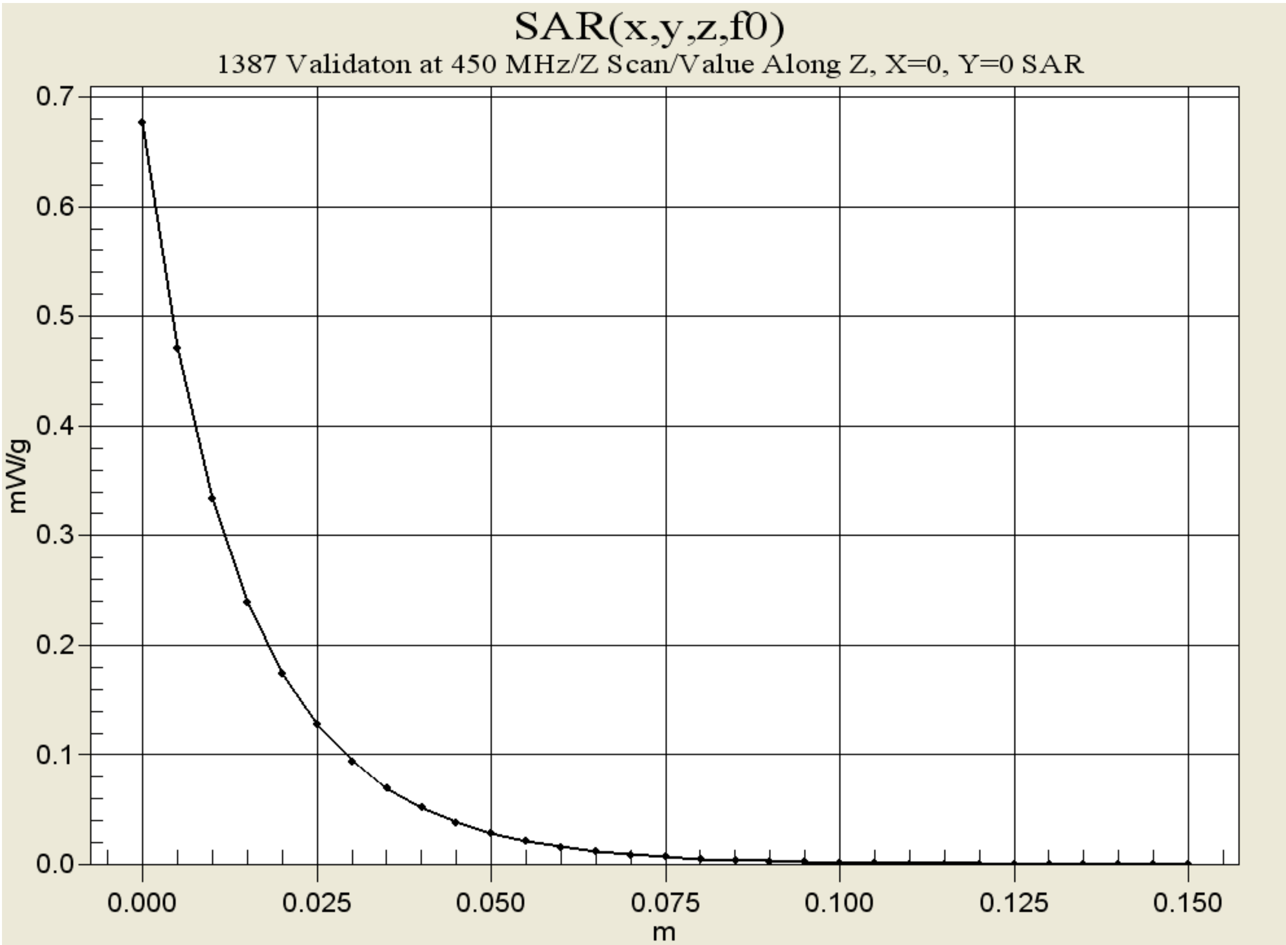
Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.88 mho/m, ε_r = 43.7, ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1387; ConvF(7.5, 7.5, 7.5); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 19/05/2003
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

450 MHz Validation/Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 39 V/m
Power Drift = -0.08 dB
Maximum value of SAR = 1.3 mW/g

450 MHz Validation/Zoom Scan 8 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 2.28 W/kg
SAR(1 g) = 1.3 mW/g; SAR(10 g) = 0.822 mW/g
Reference Value = 39 V/m
Power Drift = 0.08 dB




SAR(x,y,z,f0)
1387 Validaton at 450 MHz/Z Scan/Value Along Z, X=0, Y=0 SAR
mW/g
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.000
0.025
0.050
0.075
0.100
0.125
0.150
m

450MHz System Validation

Measured Fluid Dielectric Parameters (Brain)

November 04, 2003

Frequency	e'	e"
350.000000 MHz	46.2660	40.8224
360.000000 MHz	45.9937	40.0986
370.000000 MHz	45.7556	39.4543
380.000000 MHz	45.5625	38.7387
390.000000 MHz	45.2820	38.1140
400.000000 MHz	45.0146	37.4981
410.000000 MHz	44.7508	36.9734
420.000000 MHz	44.5046	36.4917
430.000000 MHz	44.2494	35.9460
440.000000 MHz	43.9621	35.5647
450.000000 MHz	43.7384	35.2106
460.000000 MHz	43.5513	34.7930
470.000000 MHz	43.2846	34.3970
480.000000 MHz	43.0654	33.9576
490.000000 MHz	42.8566	33.6391
500.000000 MHz	42.6744	33.2270
510.000000 MHz	42.5036	32.8459
520.000000 MHz	42.3492	32.5261
530.000000 MHz	42.1783	32.1727
540.000000 MHz	41.9985	31.7385
550.000000 MHz	41.8097	31.4862

APPENDIX D - PROBE CALIBRATION

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

Client **Celltech**

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1387
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	March 18, 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: environment 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	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Reference 20 dB Attenuator	SN: 5086 (20b)	3-Apr-03 (METAS, No. 251-0340)	Apr-04
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	[signature]
Approved by:	Katja Pokovic	Laboratory Director	[signature]

Date issued: March 18, 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:1387

Manufactured:	September 21, 1999
Last calibrated:	February 26, 2003
Recalibrated:	March 18, 2004

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1387

Sensitivity in Free Space

NormX	**1.62** $\mu V/(V/m)^2$
NormY	**1.71** $\mu V/(V/m)^2$
NormZ	**1.71** $\mu V/(V/m)^2$

Diode Compression[A]

DCP X	**92**	mV
DCP Y	**92**	mV
DCP Z	**92**	mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Plese see Page 7.

Boundary Effect

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

Sensor Cener to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	9.3	4.4
SAR_{be} [%]	With Correction Algorithm	0.0	0.1

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

Sensor to Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	14.8	10.0
SAR_{be} [%]	With Correction Algorithm	0.2	0.0

Sensor Offset

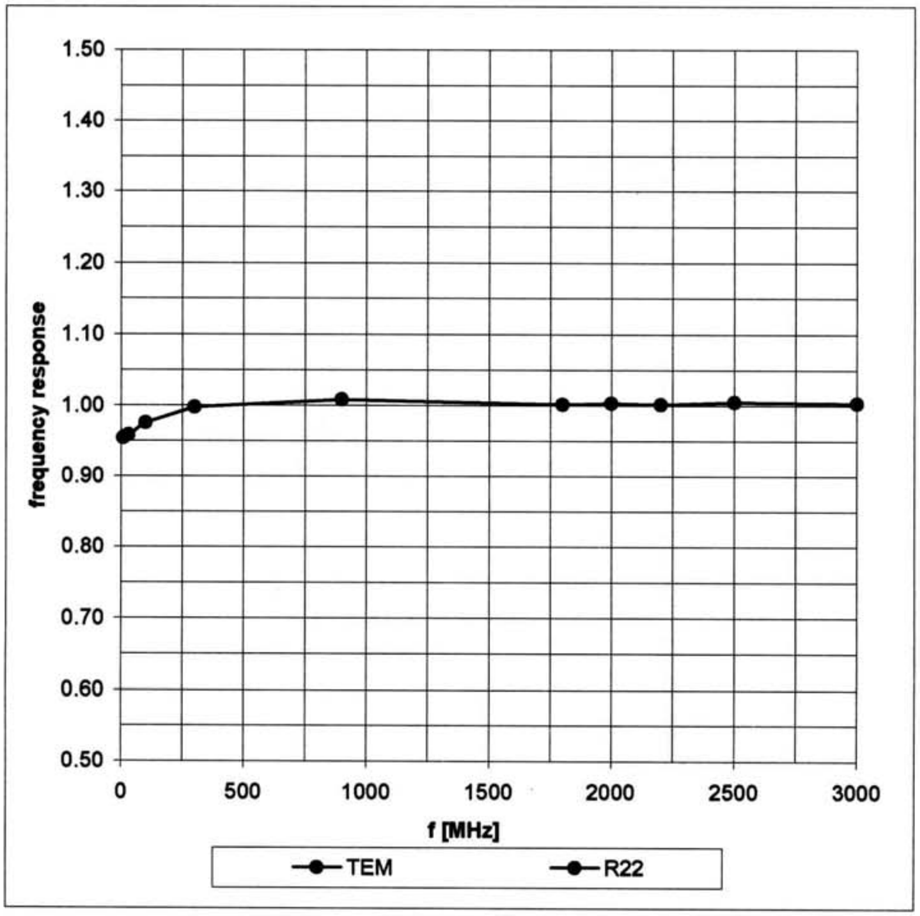
Probe Tip to Sensor Center	**2.7** mm
Optical Surface Detection	**in tolerance**

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%.

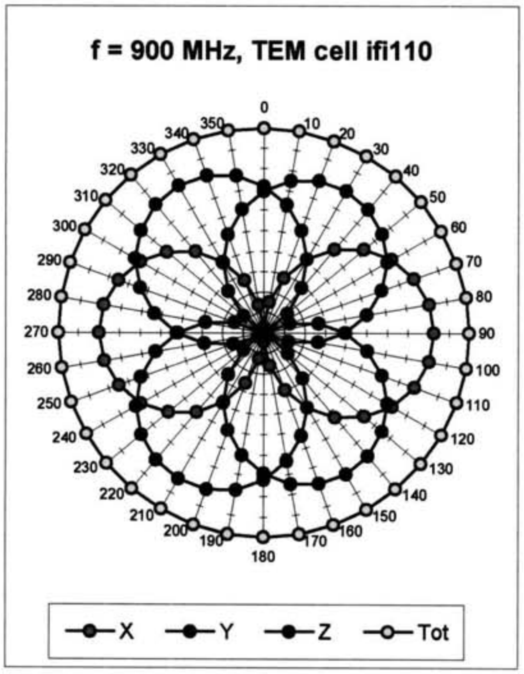
[A] numerical linearization parameter: uncertainty not required

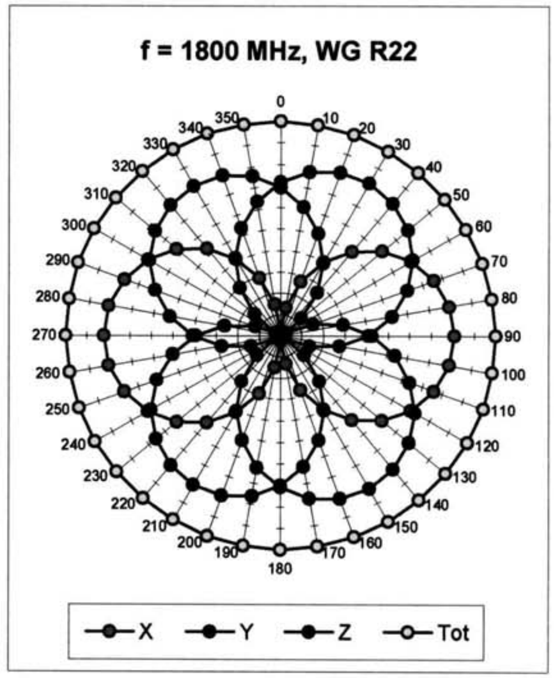
Frequency Response of E-Field

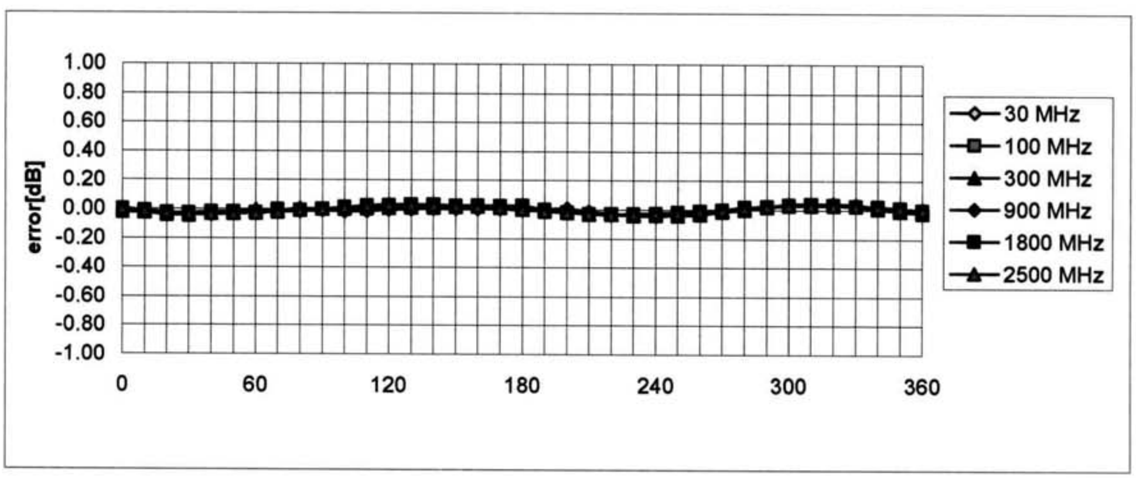
(TEM-Cell:ifi110, Waveguide R22)



Receiving Pattern (ϕ) , θ = 0°



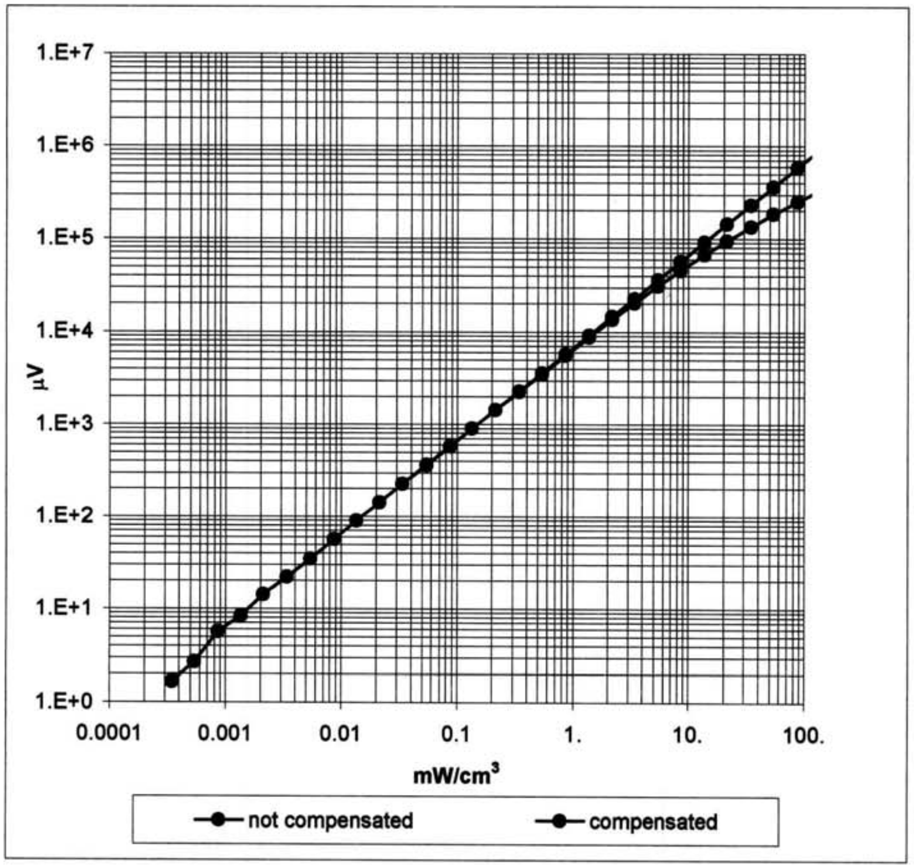


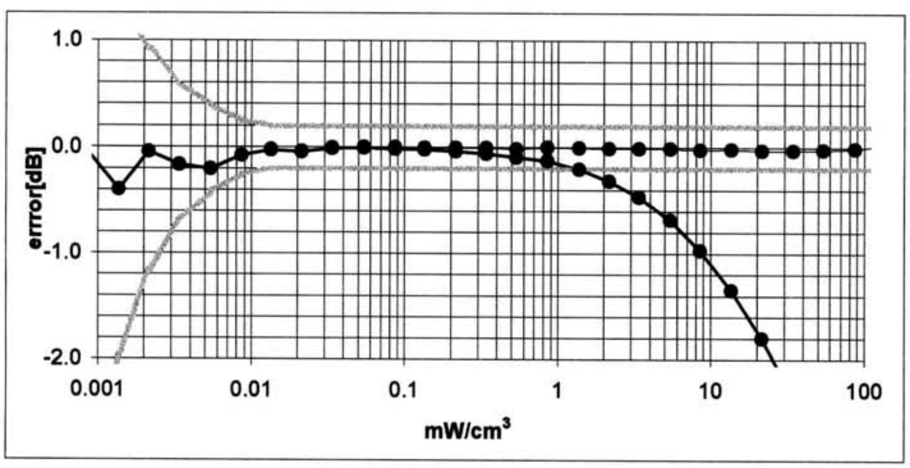


Axial Isotropy Error < ± 0.2 dB

Dynamic Range f(SAR_{head})

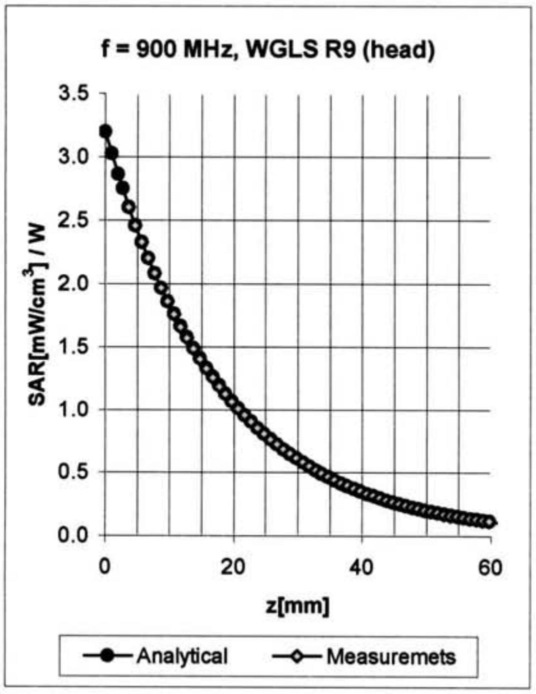
(Waveguide R22)

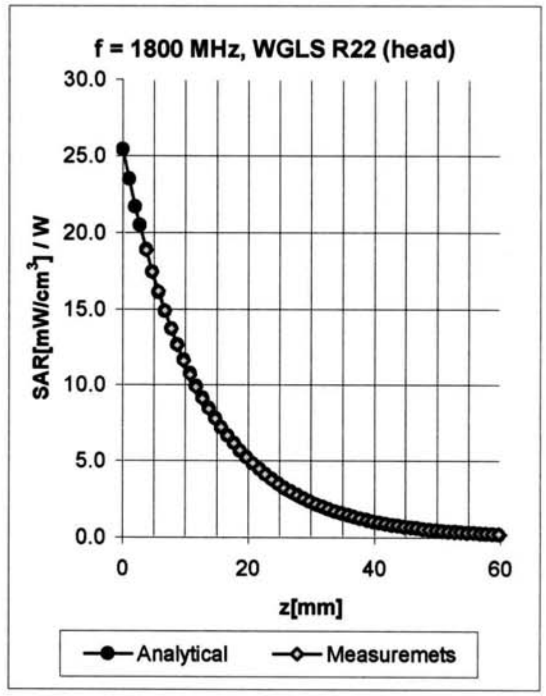




Probe Linearity < ± 0.2 dB

Conversion Factor Assessment



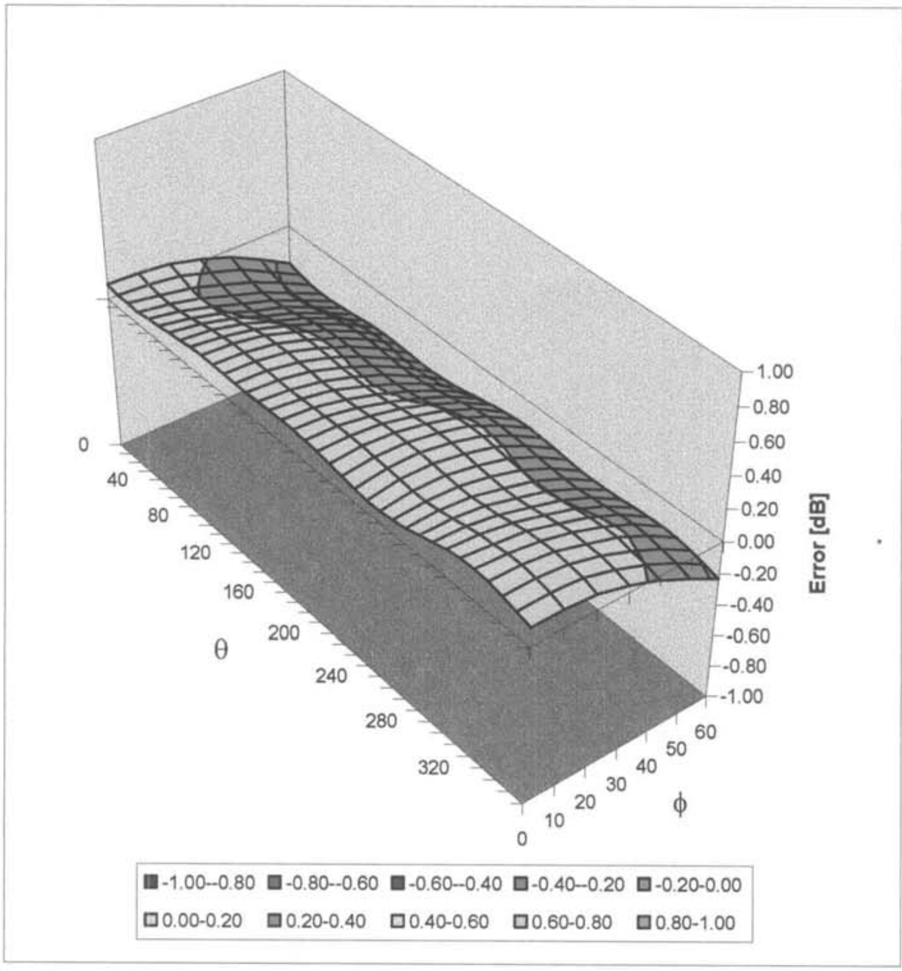


f [MHz]	Validity [MHz][B]	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
835	750-950	Head	41.5 ± 5%	0.90 ± 5%	0.72	1.78	6.71	± 11.9% (k=2)
1750	1700-1800	Head	40.0 ± 5%	1.40 ± 5%	0.51	2.67	5.38	± 9.7% (k=2)
1900	1850-1950	Head	40.0 ± 5%	1.40 ± 5%	0.55	2.66	5.25	± 9.7% (k=2)
2450	2400-2500	Head	39.2 ± 5%	1.80 ± 5%	0.99	1.89	4.77	± 9.7% (k=2)
835	750-950	Body	55.2 ± 5%	0.97 ± 5%	0.56	2.04	6.24	± 11.9% (k=2)
1750	1700-1800	Body	53.3 ± 5%	1.52 ± 5%	0.58	2.82	4.68	± 9.7% (k=2)
1900	1850-1950	Body	53.3 ± 5%	1.52 ± 5%	0.62	2.77	4.57	± 9.7% (k=2)
2450	2400-2500	Body	52.7 ± 5%	1.95 ± 5%	1.75	1.28	4.50	± 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

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:	**1387**
Place of Assessment:	**Zurich**
Date of Assessment:	**March 22, 2004**
Probe Calibration Date:	**March 18, 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: [signature]

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

Dosimetric E-Field Probe ET3DV6 SN:1387

Conversion factor (± standard deviation)

150 MHz	ConvF	**9.1 ± 8%**	**ε_r = 52.3 ± 5%** **σ = 0.76 ± 5% mho/m** (head tissue)
300 MHz	ConvF	**7.8 ± 8%**	**ε_r = 45.3 ± 5%** **σ = 0.87 ± 5% mho/m** (head tissue)
450 MHz	ConvF	**7.5 ± 8%**	**ε_r = 43.5 ± 5%** **σ = 0.87 ± 5% mho/m** (head tissue)
150 MHz	ConvF	**8.7 ± 8%**	**ε_r = 61.9 ± 5%** **σ = 0.80 ± 5% mho/m** (body tissue)
450 MHz	ConvF	**7.6 ± 8%**	**ε_r = 56.7 ± 5%** **σ = 0.94 ± 5% mho/m** (body tissue)

Important Note:

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

Please see also Section 4.7 of the DASY4 Manual.

APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

450 MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

April 07, 2004

Frequency	e'	e"
350.000000 MHz	45.4815	39.3225
360.000000 MHz	45.1426	38.7090
370.000000 MHz	44.9240	38.1138
380.000000 MHz	44.6076	37.5300
390.000000 MHz	44.3949	36.9735
400.000000 MHz	44.1953	36.4427
410.000000 MHz	43.9420	35.9045
420.000000 MHz	43.7140	35.4683
430.000000 MHz	43.4408	34.9229
440.000000 MHz	43.2177	34.5768
450.000000 MHz	42.9752	34.0999
460.000000 MHz	42.7545	33.7050
470.000000 MHz	42.5224	33.2392
480.000000 MHz	42.2638	32.8328
490.000000 MHz	41.9971	32.5316
500.000000 MHz	41.8559	32.2060
510.000000 MHz	41.6761	31.9162
520.000000 MHz	41.4676	31.6100
530.000000 MHz	41.2712	31.3300
540.000000 MHz	41.1072	30.9682
550.000000 MHz	40.8910	30.7223

450 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

April 07, 2004

Frequency	e'	e''
400.000000 MHz	58.4012	39.3965
405.000000 MHz	58.2414	39.0992
410.000000 MHz	58.2469	38.7778
415.000000 MHz	58.0820	38.5367
420.000000 MHz	58.0992	38.1644
425.000000 MHz	57.9377	37.9149
430.000000 MHz	57.8767	37.6016
435.000000 MHz	57.7551	37.3760
440.000000 MHz	57.6464	37.1040
445.000000 MHz	57.5707	36.8891
450.000000 MHz	57.5064	36.6283
455.000000 MHz	57.4540	36.4650
460.000000 MHz	57.3542	36.2021
465.000000 MHz	57.3002	35.9719
470.000000 MHz	57.1795	35.7696
475.000000 MHz	57.1099	35.4966
480.000000 MHz	57.0130	35.3431
485.000000 MHz	56.9381	35.1163
490.000000 MHz	56.8972	34.9571
495.000000 MHz	56.7314	34.7054
500.000000 MHz	56.7227	34.5979

450 MHz System Performance Check

Measured Fluid Parameters (Brain)

April 08, 2004

Frequency	e'	e"
400.000000 MHz	44.3259	37.0723
405.000000 MHz	44.2560	36.7738
410.000000 MHz	44.0396	36.5851
415.000000 MHz	43.9703	36.2590
420.000000 MHz	43.8810	36.0632
425.000000 MHz	43.7414	35.7806
430.000000 MHz	43.6782	35.5324
435.000000 MHz	43.5261	35.2644
440.000000 MHz	43.4482	35.0872
445.000000 MHz	43.3442	34.8516
450.000000 MHz	43.1894	34.6385
455.000000 MHz	43.0676	34.3788
460.000000 MHz	42.9850	34.2382
465.000000 MHz	42.8525	33.9994
470.000000 MHz	42.8134	33.8230
475.000000 MHz	42.6021	33.6242
480.000000 MHz	42.5392	33.3355
485.000000 MHz	42.4233	33.2537
490.000000 MHz	42.2826	33.0046
495.000000 MHz	42.2173	32.8857
500.000000 MHz	42.0655	32.6474

450 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

April 08, 2004

Frequency	e'	e"
350.000000 MHz	58.1977	43.0457
360.000000 MHz	57.8867	42.2436
370.000000 MHz	57.7141	41.4378
380.000000 MHz	57.5704	40.7667
390.000000 MHz	57.3967	40.0780
400.000000 MHz	57.2665	39.4773
410.000000 MHz	57.1827	38.8738
420.000000 MHz	57.0350	38.3484
430.000000 MHz	56.9170	37.7898
440.000000 MHz	56.7491	37.2540
450.000000 MHz	56.5677	36.8101
460.000000 MHz	56.4038	36.2776
470.000000 MHz	56.2162	35.8262
480.000000 MHz	56.0267	35.3750
490.000000 MHz	55.8582	34.9899
500.000000 MHz	55.6826	34.6209
510.000000 MHz	55.5454	34.2400
520.000000 MHz	55.4072	33.9062
530.000000 MHz	55.2842	33.6136
540.000000 MHz	55.1888	33.2429
550.000000 MHz	55.0549	32.9652

450 MHz System Performance Check & DUT Evaluation (Face)

Measured Fluid Dielectric Parameters (Brain)

April 12, 2004

Frequency	e'	e''
350.000000 MHz	46.5589	42.2607
360.000000 MHz	46.2371	41.5039
370.000000 MHz	45.9463	40.7845
380.000000 MHz	45.7406	40.1909
390.000000 MHz	45.5802	39.6211
400.000000 MHz	45.3834	39.0422
410.000000 MHz	45.1740	38.4620
420.000000 MHz	44.9729	37.9484
430.000000 MHz	44.7917	37.4456
440.000000 MHz	44.5347	36.9676
450.000000 MHz	44.3047	36.5356
460.000000 MHz	44.0802	35.9646
470.000000 MHz	43.7705	35.4953
480.000000 MHz	43.4723	35.0273
490.000000 MHz	43.2358	34.6565
500.000000 MHz	43.0437	34.2937
510.000000 MHz	42.8688	33.8921
520.000000 MHz	42.6974	33.5715
530.000000 MHz	42.6094	33.2728
540.000000 MHz	42.4211	32.9307
550.000000 MHz	42.3021	32.6753

450 MHz System Performance Check & DUT Evaluation (Face)

Measured Fluid Dielectric Parameters (Brain)

April 13, 2004

Frequency	e'	e''
350.000000 MHz	48.0851	42.6091
360.000000 MHz	47.7311	41.9778
370.000000 MHz	47.4763	41.1979
380.000000 MHz	47.2541	40.5758
390.000000 MHz	46.9912	39.8291
400.000000 MHz	46.7380	39.2237
410.000000 MHz	46.6174	38.6072
420.000000 MHz	46.4063	38.0325
430.000000 MHz	46.2046	37.4039
440.000000 MHz	45.9076	36.9827
450.000000 MHz	45.6447	36.5193
460.000000 MHz	45.3770	36.1331
470.000000 MHz	45.1522	35.7209
480.000000 MHz	44.8535	35.2943
490.000000 MHz	44.5831	34.9691
500.000000 MHz	44.3864	34.6109
510.000000 MHz	44.2011	34.1807
520.000000 MHz	44.0359	33.8298
530.000000 MHz	43.8542	33.4462
540.000000 MHz	43.7099	32.9739
550.000000 MHz	43.5443	32.6640