DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

Test Lab

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Applicant Information

COBRA ELECTRONICS CORPORATION
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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)**
Device Type:	**Portable UHF FRS/GMRS PTT Radio Transceiver**
FCC ID:	**BBOPR245**
Model(s):	**PR245**
Modulation:	**FM (UHF)**
Tx Frequency Range(s):	**462.5500 - 462.7250 MHz (GMRS Channels 15-22)** **462.5625 - 462.7125 MHz (FRS/GMRS Channels 1-7)** **467.5625 - 467.7125 MHz (FRS Channels 8-14)**
RF Output Power Tested:	**0.891 Watts ERP (GMRS 462.7125 MHz)**
No. of Channels:	**22**
Antenna Type(s) Tested:	**Fixed Stubby**
Battery Type(s) Tested:	**1.5 V AAA Alkaline x4** **(Duracell Procell 1150 mAh, Energizer E-Squared 1375 mAh)** **4.8 V NiCd Pack (300 mAh)**
Body-Worn Accessories Tested:	**Belt-Clip, Ear-Microphone**
Max. SAR Measured:	**0.353 W/kg - Face-held (50% duty cycle)** **0.795 W/kg - Body-worn (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 General Population / Uncontrolled Exposure environment. All measurements were performed in accordance with the SAR system manufacturer recommendations.

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

Russell W. Pipe
Senior Compliance Technologist
Celltech Labs Inc.

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1.0 INTRODUCTION

This measurement report demonstrates compliance of the Cobra Electronics Corporation Model: PR245 Portable UHF FRS/GMRS PTT Radio Transceiver FCC ID: BBOPR245 with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]), and Health Canada's Safety Code 6 (see reference [2]) for the General Population / Uncontrolled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C (Edition 01-01) (see reference [3]) and IC RSS-102 Issue 1 (Provisional) (see reference [4]), were employed. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 DESCRIPTION OF DEVICE UNDER TEST (DUT)

<table>
<tr><td>Rule Part(s)</td><td colspan="2">FCC 47 CFR §2.1093</td></tr>
<tr><td>IC Rule Part(s)</td><td colspan="2">RSS-102 Issue 1 (Provisional)</td></tr>
<tr><td>Test Procedure</td><td colspan="2">FCC OET Bulletin 65, Supplement C (01-01)</td></tr>
<tr><td>Device Type</td><td colspan="2">Portable UHF FRS/GMRS PTT Radio Transceiver</td></tr>
<tr><td>FCC ID</td><td colspan="2">BBOPR245</td></tr>
<tr><td>Model(s)</td><td colspan="2">PR245</td></tr>
<tr><td>Serial No.</td><td colspan="2">#2 (Identical Prototype)</td></tr>
<tr><td>Modulation</td><td colspan="2">FM (UHF)</td></tr>
<tr><td rowspan="3">Tx Frequency Range(s)</td><td colspan="2">462.5500 - 462.7250 MHz (GMRS Channels 15-22)</td></tr>
<tr><td colspan="2">462.5625 - 462.7125 MHz (FRS/GMRS Channels 1-7)</td></tr>
<tr><td colspan="2">467.5625 - 467.7125 MHz (FRS Channels 8-14)</td></tr>
<tr><td>RF Output Power Tested</td><td colspan="2">0.891 Watts ERP (GMRS 462.7125 MHz)</td></tr>
<tr><td rowspan="3">Battery Type(s) Tested</td><td rowspan="2">1.5 V AAA Alkaline (x4)</td><td>Duracell Procell 1150 mAh</td></tr>
<tr><td>Energizer E-Squared 1375 mAh</td></tr>
<tr><td colspan="2">NiCd Pack (4.8 V, 300 mAh)</td></tr>
<tr><td>Antenna Type(s) Tested</td><td colspan="2">Fixed Stubby</td></tr>
<tr><td rowspan="2">Body-Worn Accessories Tested</td><td colspan="2">Belt-Clip</td></tr>
<tr><td colspan="2">Ear-Microphone</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

SAR EVALUATION RESULTS													
Test Type	Freq. (MHz)	Chan.	Test Mode	Start Power (ERP) Watts	Batteries Tested		Body-worn Accessory	Separation Distance to Planar Phantom (cm)	Measured SAR 1g (W/kg) Duty Cycle		Power Drift (dB)	Scaled SAR 1g (W/kg) Duty Cycle	
					Type	mAh			100%	50%		100%	50%
Face	462.7125	7	CW	0.891	Duracell Alkaline x4	1150	--	2.5	0.624	0.312	-0.534	0.706	0.353
Face	462.7125	7	CW	0.891	NiCd Pack	300	--	2.5	0.353	0.177	-0.768	0.421	0.211
Body	462.7125	7	CW	0.891	Duracell Alkaline x4	1150	Belt-Clip Ear-Mic	0.6	0.621	0.311	-0.427	0.685	0.343
Body	462.7125	7	CW	0.891	NiCd Pack	300	Belt-Clip Ear-Mic	0.6	1.29	0.645	-0.911	1.59	0.795
Body	462.7125	7	CW	0.891	Energizer Alkaline x4	1375	Belt-Clip Ear-Mic	0.6	0.855	0.428	-0.349	0.927	0.464

ANSI / IEEE C95.1 1992 - SAFETY LIMIT
BRAIN / BODY: 1.6 W/kg (averaged over 1 gram)
Spatial Peak - Uncontrolled Exposure / General Population

	450 MHz Brain		450 MHz Body				
Dielectric Constant ε_r	IEEE Target	Measured	IEEE Target	Measured	Atmospheric Pressure	101.5 KPa	
	43.5 (± 5%)	42.8	56.7 (± 5%)	57.4	Relative Humidity	41%	
					Ambient Temperature	24.2 °C	
Conductivity σ (mho/m)	450 MHz Brain		450 MHz Brain		Fluid Temperature	Brain: 20.8 °C	Body: 20.5 °C
	IEEE Target	Measured	IEEE Target	Measured	Fluid Depth	≥ 15 cm	
	0.87 (± 5%)	0.84	0.94 (± 5%)	0.91	ρ (Kg/m^3)	1000	

POWER DRIFT EVALUATIONS & COMPARISONS									
Zoom Scan Durations		Area Scan Duration	SAR v Time Duration	SAR v Time Drift (0-6 mins)	SAR v Time Drift (6-12 mins)	Shortened Zoom SAR	Power Drift (6-14 mins)	Add Drift (0-6 mins)	Scaled SAR 100%
7x7x7	5x5x7								
12 mins	8 mins	12 mins	12 mins	-0.457 dB	-0.157 dB	0.822 W/kg	-0.149 dB	-0.566 dB	0.969 W/kg

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. The transmission band of the DUT is less than 10 MHz, therefore mid channel data only is reported (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).
3. The DUT was evaluated for SAR with NiCd batteries and Duracell Procell alkaline batteries. To show a SAR comparison between alternate alkaline batteries, an additional evaluation was performed for the highest SAR level configuration (body-worn) using Energizer E-Squared batteries (see above data table).
4. The power drifts measured for the duration of the SAR evaluations was > 5%. The power drifts were subsequently added to the measured SAR levels to report scaled SAR results as shown in the above table. A SAR versus Time drift evaluation was also performed for the duration of the area scan measurement in the test configuration that produced the highest SAR level. The SAR versus Time drift evaluation showed that the power of the DUT decreased significantly during the 0-6 minute measurement period before tapering moderately. In order to report a conservative SAR level with relatively stabilized power drift, the evaluation of the highest SAR level configuration was repeated with the radio first keyed to constantly transmit for a 6-minute period, then the evaluation was performed with a shortened zoom scan. The power drift measured by the DASY system for the zoom scan duration, plus the initial 0-6 minute power drift measured prior to the evaluation, were added to the measured SAR level to report a conservative scaled SAR result as shown in the above comparison table. See Appendix A (SAR Test Plots) for SAR versus Time drift evaluation plot and shortened zoom scan test plot.
5. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluation. The temperatures listed were consistent for all measurement periods.
6. The dielectric parameters of the simulated tissue mixtures 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).

5.0 DETAILS OF SAR EVALUATION

The Cobra Electronics Corporation Model: PR245 Portable UHF FRS/GMRS PTT Radio Transceiver FCC ID: BBOPR245 was found to be compliant for localized Specific Absorption Rate (Uncontrolled 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 tested in a body-worn configuration with the back of the device placed parallel to the outer surface of the planar phantom. The attached belt-clip was touching the planar phantom and provided a 0.6 cm separation distance between the back of the DUT and the outer surface of the planar phantom. The DUT was evaluated for body-worn SAR with the ear-microphone accessory connected.
3. The conducted power level of the DUT could not be measured for the SAR evaluation due to the non-detachable antenna. The DUT was evaluated for SAR at the maximum conducted power level set by the manufacturer. The DUT was evaluated for SAR at the ERP level measured prior to the SAR evaluations on a 3-meter Open Area Test Site using the signal substitution method in accordance with ANSI TIA/EIA-603-A-2001.
4. The power drifts measured by the DASY system for the duration of the SAR evaluations was > 5%. The power drifts were subsequently added to the measured SAR levels to report scaled SAR results as shown in test data table (page 5). A SAR versus Time drift evaluation was subsequently performed for the duration of the area scan measurement in the test configuration that produced the highest SAR level. The SAR versus Time drift evaluation showed that the power of the DUT decreased significantly during the 0-6 minute measurement period before tapering moderately. In order to report a conservative SAR level with relatively stabilized power drift, the evaluation of the highest SAR level configuration was repeated with the radio first keyed to constantly transmit for a 6-minute period, then the evaluation was performed with a shortened zoom scan. The power drift measured by the DASY system for the zoom scan duration, plus the initial 0-6 minute power drift measured prior to the evaluation, were added to the measured SAR level to report a conservative scaled SAR result as shown in the comparison table (page 5). See Appendix A (SAR Test Plots) for SAR versus Time drift evaluation plot and shortened zoom scan test plot.
5. The DUT was tested with fully charged alkaline and NiCd batteries. To show a SAR comparison between alternate alkaline battery types, the evaluations were performed using Duracell Procell batteries with an additional evaluation performed for the highest SAR level configuration (body-worn) using Energizer E-Squared batteries (see data table on page 5).
6. 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.
7. The SAR evaluations were performed using a Plexiglas planar phantom. A stack of low-density, low-loss dielectric foamed polystyrene was used in place of the device holder.

6.0 EVALUATION PROCEDURES

a. 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. 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).

7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation a system check was performed with a Plexiglas planar phantom and a 450MHz dipole (see Appendix C for system validation procedures). The dielectric parameters of the simulated tissue fluid 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 plot).

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						
12/16/03	Brain	1.23 (±10%)	1.30 (+5.7%)	43.5 ±5%	42.8	0.87 ±5%	0.84	1000	24.2	20.8	≥ 15	41	101.5

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

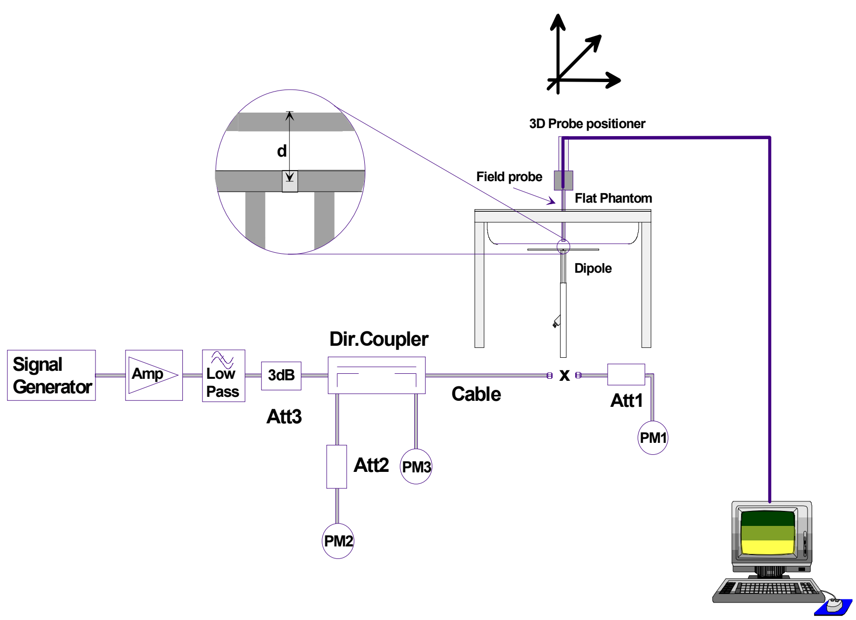


Figure 1. System Performance Check Setup Diagram

450 MHz Dipole Setup

8.0 SIMULATED EQUIVALENT TISSUES

The 450MHz brain and body simulated tissues 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 according to standardized procedures, and measured for dielectric parameters (permittivity and conductivity).

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 radio transceivers. The planar phantom is mounted on the side of the DASY4 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 to the table of the DASY4 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	Feb 2003
-300MHz Validation Dipole	135	Oct 2003
-450MHz Validation Dipole	136	Nov 2003
-900MHz Validation Dipole	054	June 2003
-1800MHz Validation Dipole	247	June 2003
-2450MHz Validation Dipole	150	Sept 2003
-Plexiglas Planar Phantom	161	N/A
-Validation Planar Phantom	137	N/A
HP 85070C Dielectric Probe Kit	N/A	N/A
Gigatronics 8651A Power Meter	8650137	April 2003
Gigatronics 8652A Power Meter	1835267	April 2003
Power Sensor 80701A	1833542	Feb 2003
Power Sensor 80701A	1833699	April 2003
HP E4408B Spectrum Analyzer	US39240170	Dec 2003
HP 8594E Spectrum Analyzer	3543A02721	April 2003
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 1528-200X (Draft - 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 1528-200X (Draft - 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 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”.

APPENDIX A - SAR MEASUREMENT DATA

Date Tested: 12/16/03

DUT: Cobra Electronics Corp. Model: PR245; Type: Portable UHF FRS/GMRS PTT Radio Transceiver; Serial: #2

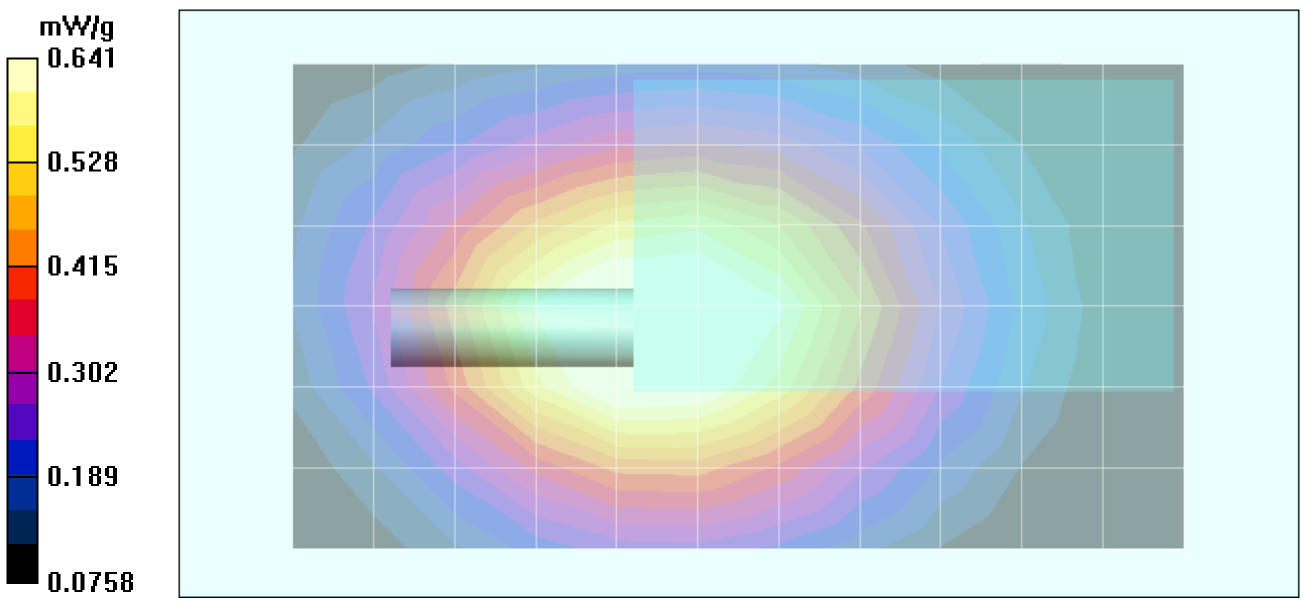
Ambient Temp: 24.2 °C; Fluid Temp: 20.8 °C; Barometric Pressure: 101.5 kPa; Humidity: 41%

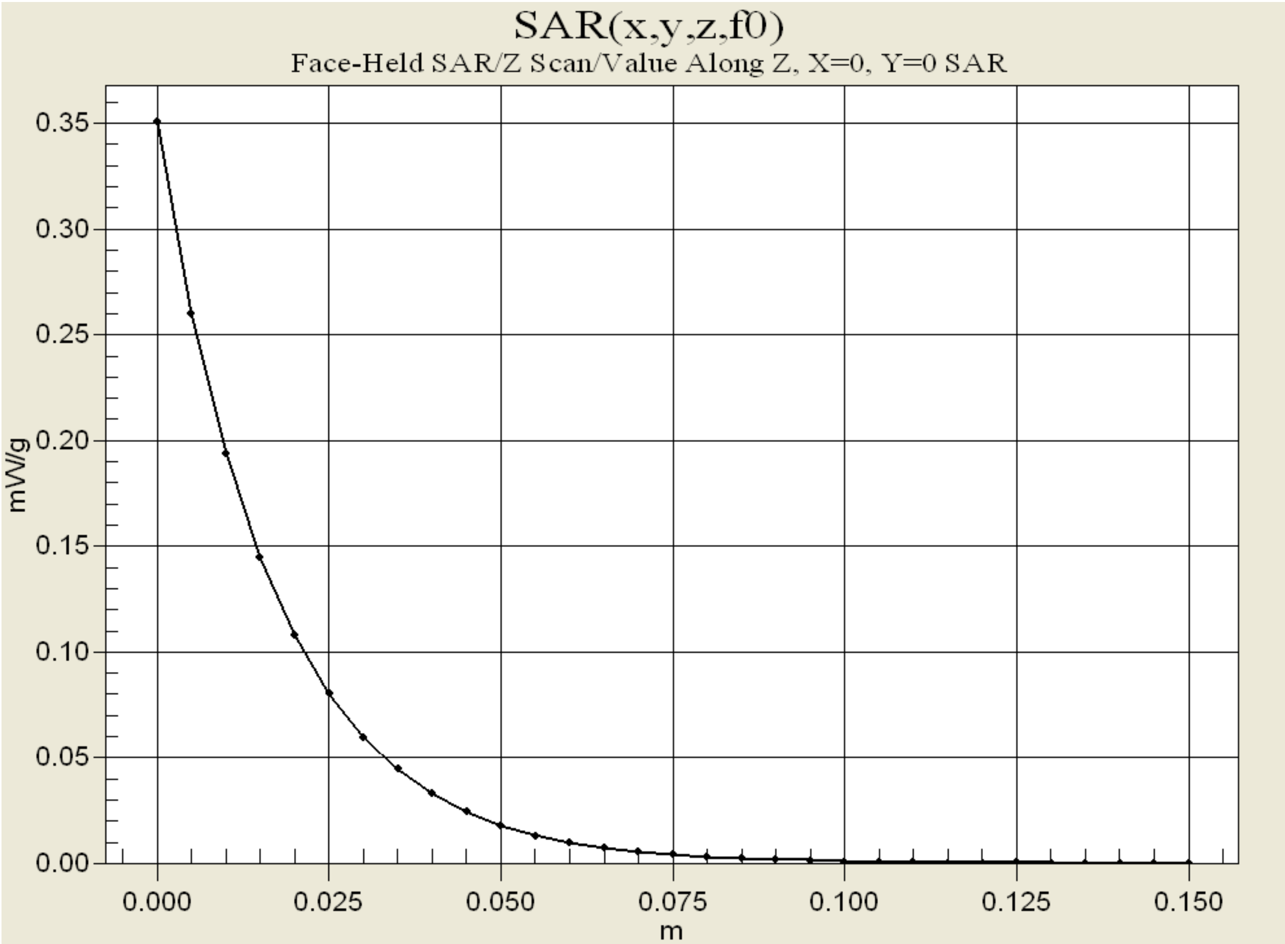
1.5 V AAA Alkaline Batteries (x4)
Duracell Procell 1150 mAh
Communication System: FM UHF
RF Output Power: 0.891 Watts (ERP)
Frequency: 462.7125 MHz; Channel 7; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.84 mho/m, ε_r = 42.8, ρ = 1000 kg/m^3)

- 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: Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

Face-Held - Duracell Alkaline Batteries - 2.5 cm Separation Distance/Area Scan (7x12x1):
Measurement grid: dx=15mm, dy=15mm

Face-Held - Duracell Alkaline Batteries - 2.5 cm Separation Distance/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.99 W/kg
SAR(1 g) = 0.624 mW/g; SAR(10 g) = 0.428 mW/g
Reference Value = 28.9 V/m
Power Drift = -0.534 dB




SAR(x,y,z,f0)
Face-Held SAR/Z Scan/Value Along Z, X=0, Y=0 SAR
mW/g
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.000
0.025
0.050
0.075
0.100
0.125
0.150
m

Date Tested: 12/16/03

DUT: Cobra Electronics Corp. Model: PR245; Type: Portable UHF FRS/GMRS PTT Radio Transceiver; Serial: #2

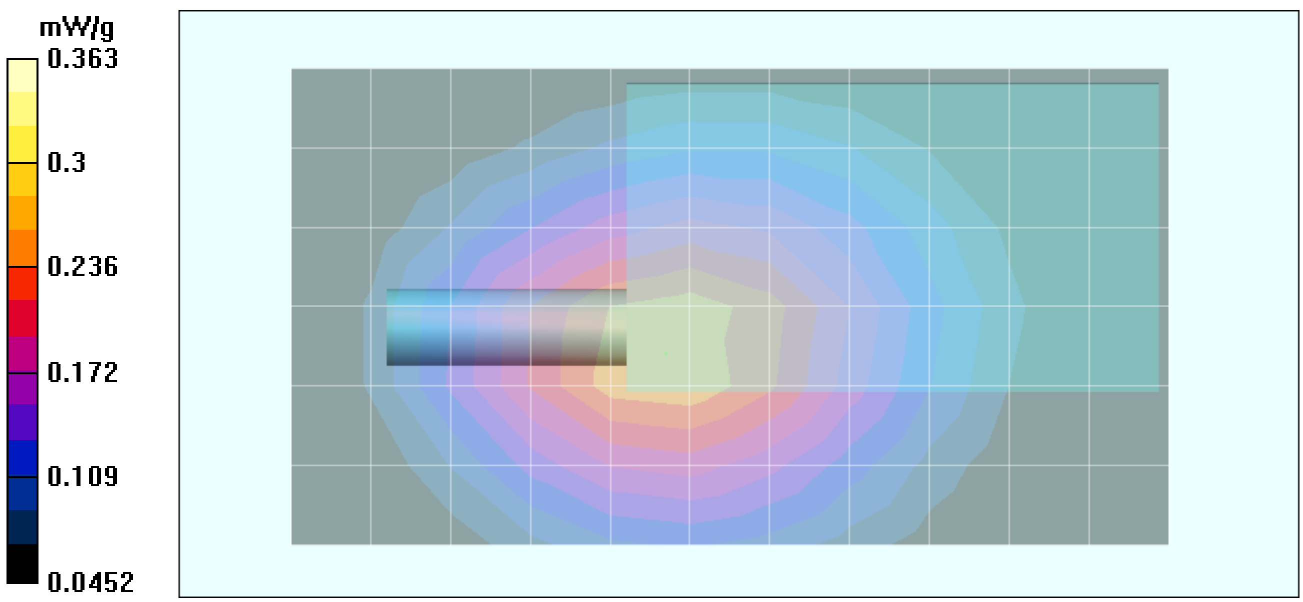
Ambient Temp: 24.2 °C; Fluid Temp: 20.8 °C; Barometric Pressure: 101.5 kPa; Humidity: 41%

4.8 V AAA NiCd Battery Pack
Communication System: FM UHF
RF Output Power: 0.891 Watts (ERP)
Frequency: 462.7125 MHz; Channel 7; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.84 mho/m, ε_r = 42.8, 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: Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

Face-Held - NiCd Batteries - 2.5 cm Separation Distance/Area Scan (7x12x1):
Measurement grid: dx=15mm, dy=15mm

Face-Held - NiCd Batteries - 2.5 cm Separation Distance/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.569 W/kg
SAR(1 g) = 0.353 mW/g; SAR(10 g) = 0.241 mW/g
Reference Value = 21.1 V/m
Power Drift = -0.768 dB



Date Tested: 12/16/03

DUT: Cobra Electronics Corp. Model: PR245; Type: Portable UHF FRS/GMRS PTT Radio Transceiver; Serial: #2

Ambient Temp: 24.2 °C; Fluid Temp: 20.5 °C; Barometric Pressure: 101.5 kPa; Humidity: 41%

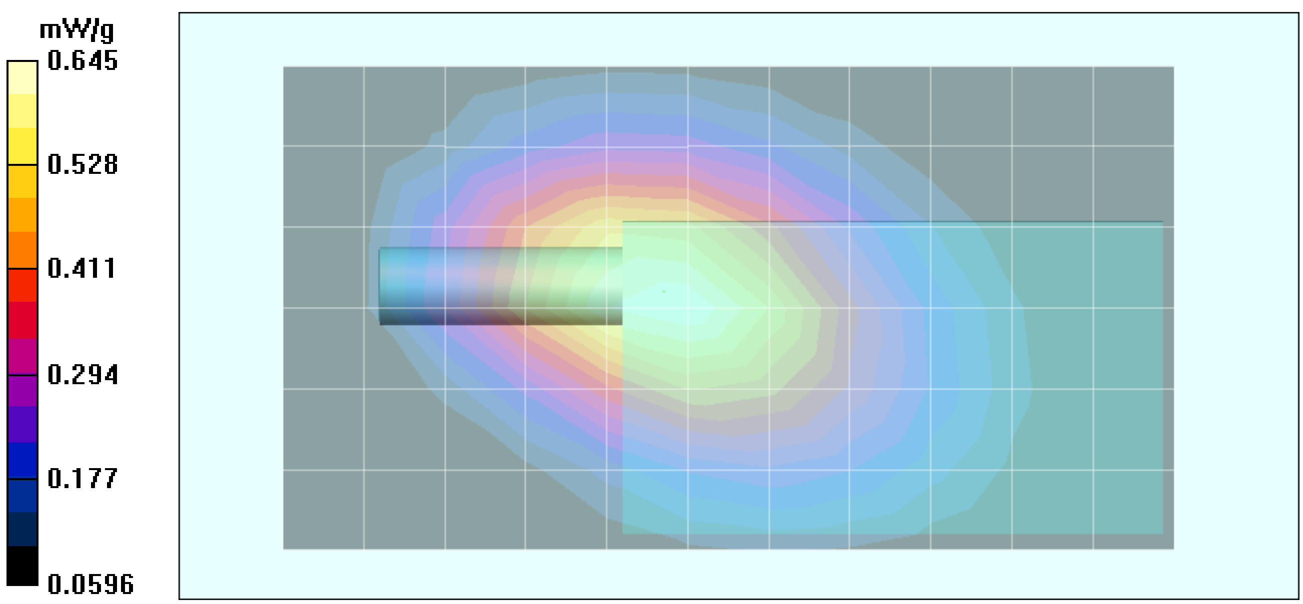
Body-worn Accessories: Belt-Clip, Ear-Microphone

1.5 V AAA Alkaline Batteries (x4)
Duracell Procell 1150 mAh
Communication System: FM UHF
RF Output Power: 0.891 Watts (ERP)
Frequency: 462.7125 MHz; Channel 7; Duty Cycle: 1:1
Medium: M450 (σ = 0.91 mho/m, ε_r = 57.4, ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1387; ConvF(7.7, 7.7, 7.7); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 19/05/2003
- Phantom: Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

Body-Worn - Duracell Alkaline Batteries - 0.6 cm Belt-Clip Separation Distance/Area Scan (7x12x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn - Duracell Alkaline Batteries - 0.6 cm Belt-Clip Separation Distance/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 1.05 W/kg
SAR(1 g) = 0.621 mW/g; SAR(10 g) = 0.403 mW/g
Reference Value = 21.7 V/m
Power Drift = -0.427 dB



Date Tested: 12/16/03

DUT: Cobra Electronics Corp. Model: PR245; Type: Portable UHF FRS/GMRS PTT Radio Transceiver; Serial: #2

Ambient Temp: 24.2 °C; Fluid Temp: 20.5 °C; Barometric Pressure: 101.5 kPa; Humidity: 41%

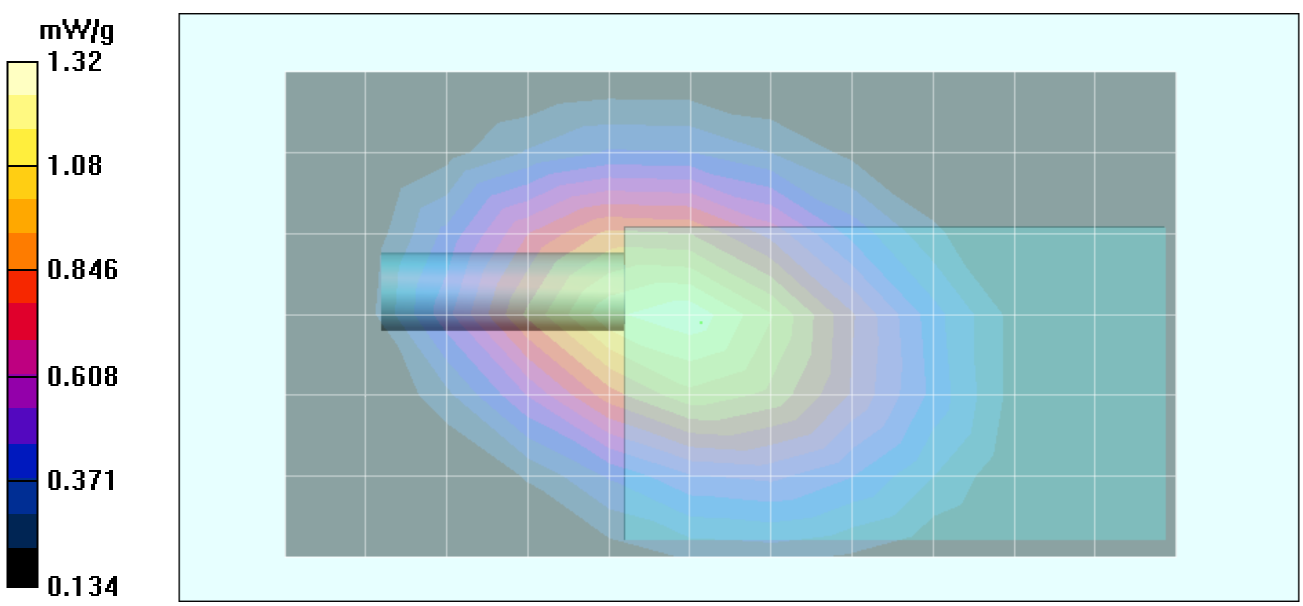
Body-worn Accessories: Belt-Clip, Ear-Microphone

4.8 V AAA NiCd Battery Pack
Communication System: FM UHF
RF Output Power: 0.891 Watts (ERP)
Frequency: 462.7125 MHz; Channel 7; Duty Cycle: 1:1
Medium: M450 (σ = 0.91 mho/m, ε_r = 57.4, ρ = 1000 kg/m^3)

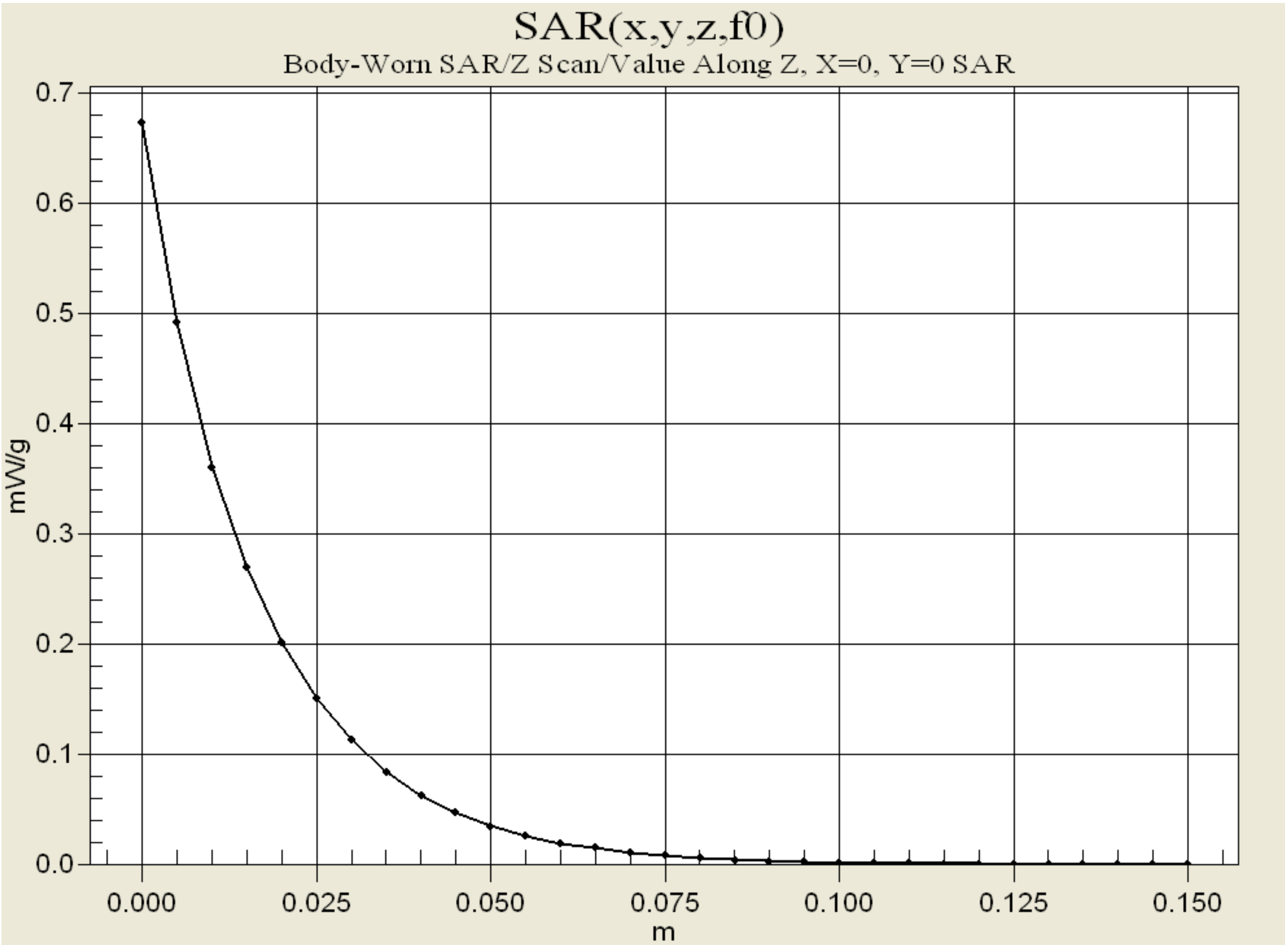
- Probe: ET3DV6 - SN1387; ConvF(7.7, 7.7, 7.7); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 19/05/2003
- Phantom: Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

Body-Worn - NiCd Batteries - 0.6 cm Belt-Clip Separation Distance/Area Scan (7x12x1):
Measurement grid: dx=15mm, dy=15mm

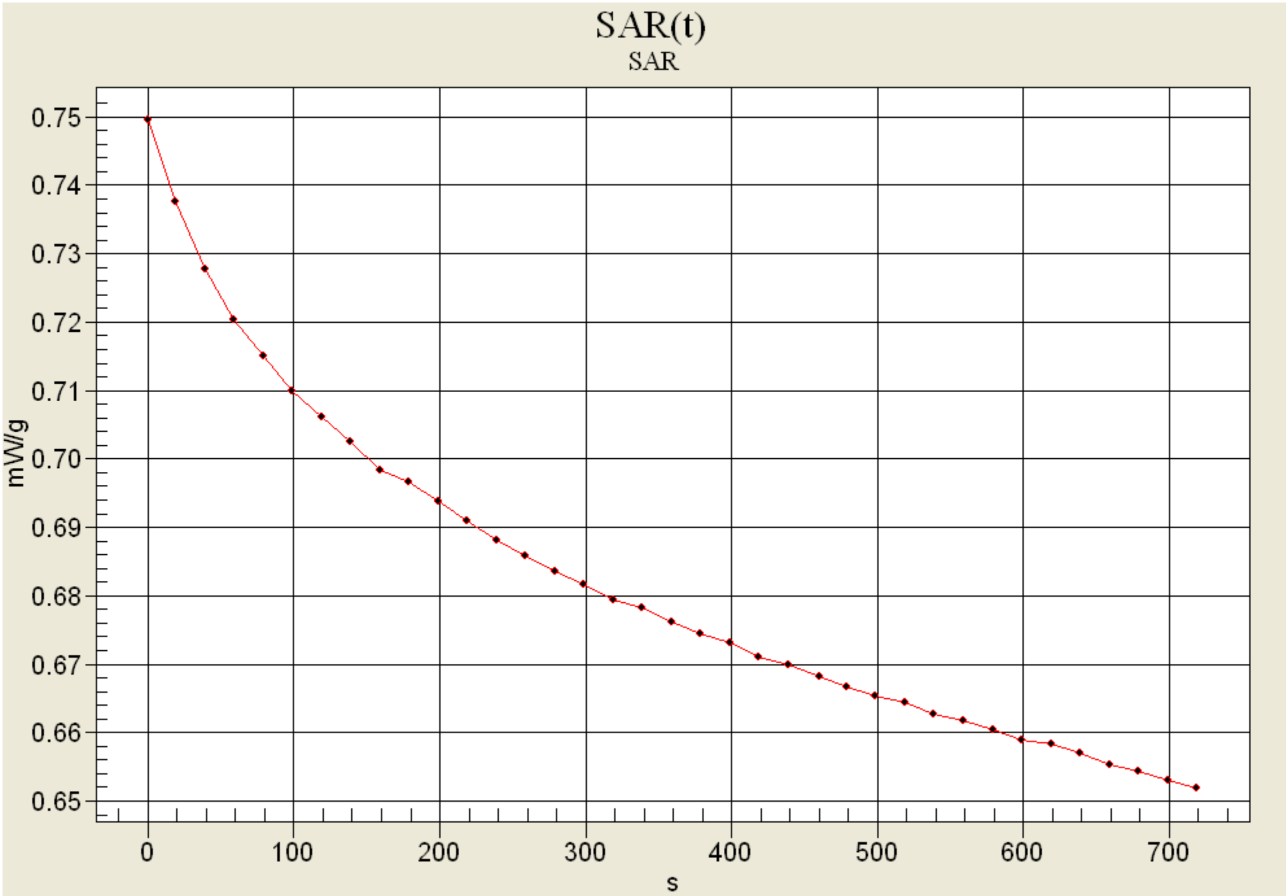
Body-Worn - NiCd Batteries - 0.6 cm Belt-Clip Separation Distance/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 2.14 W/kg
SAR(1 g) = 1.29 mW/g; SAR(10 g) = 0.85 mW/g
Reference Value = 34.1 V/m
Power Drift = -0.911 dB



Z-Axis Scan


SAR(x,y,z,f0)
Body-Worn SAR/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

SAR versus Time Evaluation



Initial SAR: 0.751 mW/g
After 6 min: 0.676 mW/g = Drift: -0.457 dB
After 12 min: 0.652 mW/g = Drift: -0.614 dB

Shortened Zoom Scan (test started after 6 minute transmit period with -0.566 dB drift)

Date Tested: 12/16/03

DUT: Cobra Electronics Corp. Model: PR245; Type: Portable UHF FRS/GMRS PTT Radio Transceiver; Serial: #2

Ambient Temp: 24.2 °C; Fluid Temp: 20.5 °C; Barometric Pressure: 101.5 kPa; Humidity: 41%

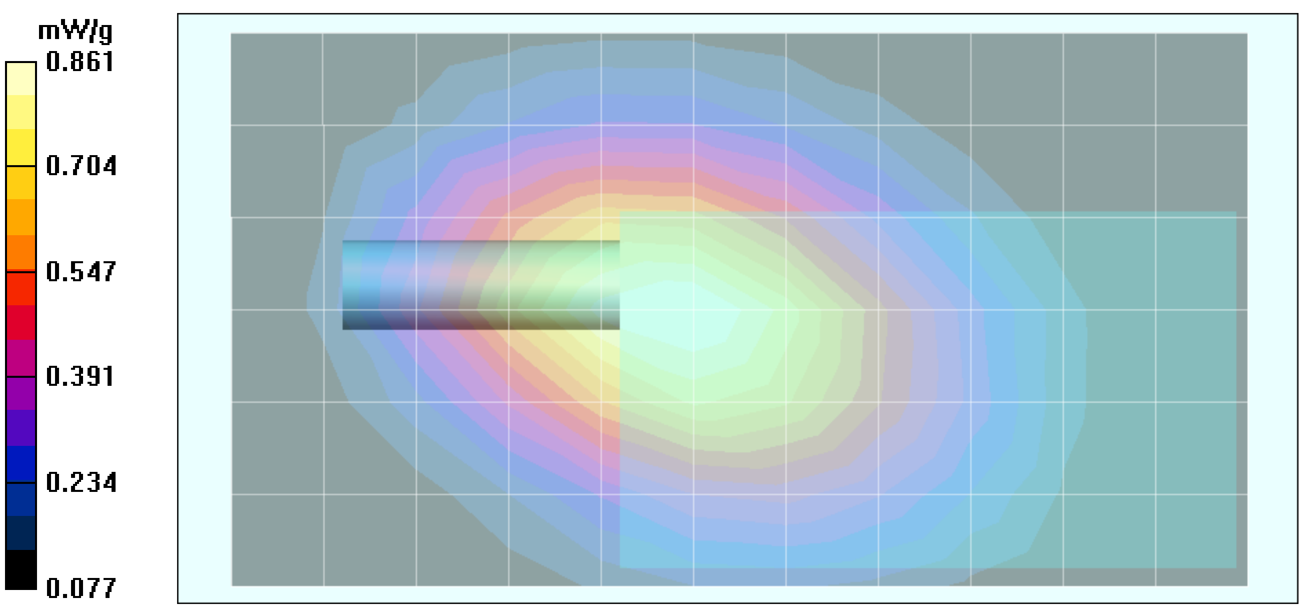
Body-worn Accessories: Belt-Clip, Ear-Microphone

4.8 V AAA NiCd Battery Pack
Communication System: FM UHF
RF Output Power: 0.891 Watts (ERP)
Frequency: 462.7125 MHz; Channel 7; Duty Cycle: 1:1
Medium: M450 (σ = 0.91 mho/m, ε_r = 57.4, ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1387; ConvF(7.7, 7.7, 7.7); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 19/05/2003
- Phantom: Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.2 Build 12; Postprocessing SW: SEMCAD, V1.8 Build 94

Body-Worn - NiCd Batteries - 0.6 cm Belt-Clip Separation Distance/Area Scan (7x12x1):
Measurement grid: dx=15mm, dy=15mm
Reference Value = 34 V/m
Power Drift = -0.1 dB

Body-Worn - NiCd Batteries - 0.6 cm Belt-Clip Separation Distance/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 1.41 W/kg
SAR(1 g) = 0.822 mW/g; SAR(10 g) = 0.540 mW/g
Reference Value = 25.7 V/m
Power Drift = -0.149 dB



Date Tested: 12/16/03

DUT: Cobra Electronics Corp. Model: PR245; Type: Portable UHF FRS/GMRS PTT Radio Transceiver; Serial: #2

Ambient Temp: 24.2 °C; Fluid Temp: 20.5 °C; Barometric Pressure: 101.5 kPa; Humidity: 41%

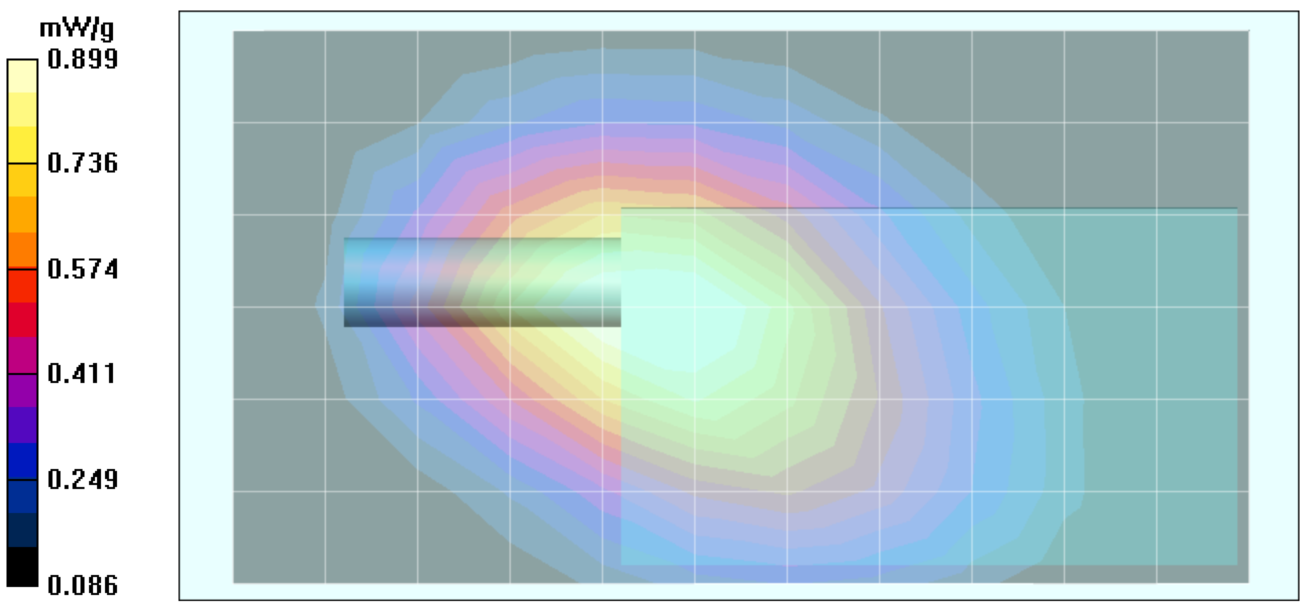
Body-worn Accessories: Belt-Clip, Ear-Microphone

1.5 V AAA Alkaline Batteries (x4)
Energizer E-Squared 1375 mAh
Communication System: FM UHF
RF Output Power: 0.891 Watts (ERP)
Frequency: 462.7125 MHz; Channel 7; Duty Cycle: 1:1
Medium: M450 (σ = 0.91 mho/m, ε_r = 57.4, ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1387; ConvF(7.7, 7.7, 7.7); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 19/05/2003
- Phantom: Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.2 Build 12; Postprocessing SW: SEMCAD, V1.8 Build 94

Body-Worn - Energizer Alkaline Batteries - 0.6 cm Belt-Clip Separation Distance/Area Scan (7x12x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn - Energizer Alkaline Batteries - 0.6 cm Belt-Clip Separation Distance/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 1.45 W/kg
SAR(1 g) = 0.855 mW/g; SAR(10 g) = 0.566 mW/g
Reference Value = 27.1 V/m
Power Drift = -0.349 dB



APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 12/16/03

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

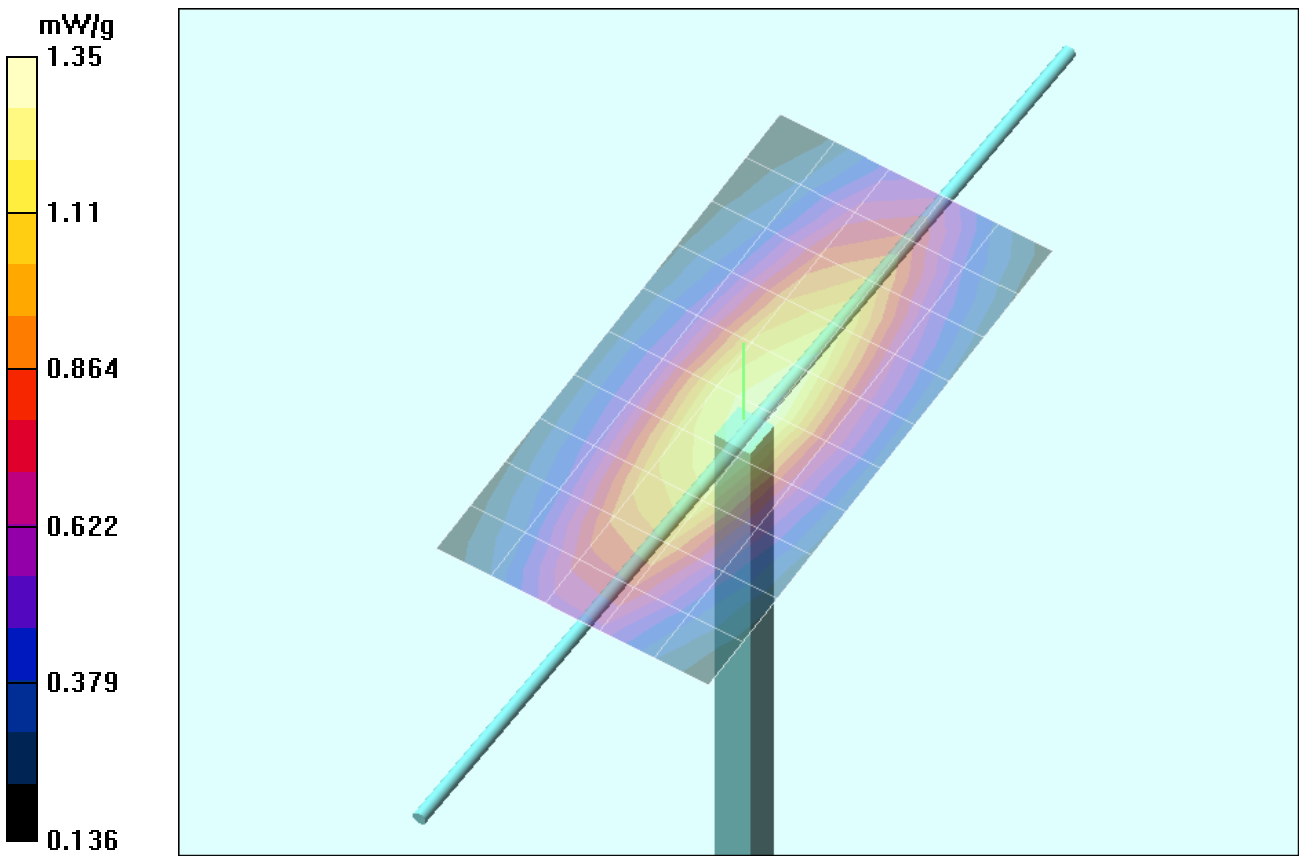
Ambient Temp: 24.2 °C; Fluid Temp: 20.8 °C; Barometric Pressure: 101.5 kPa; Humidity: 41%

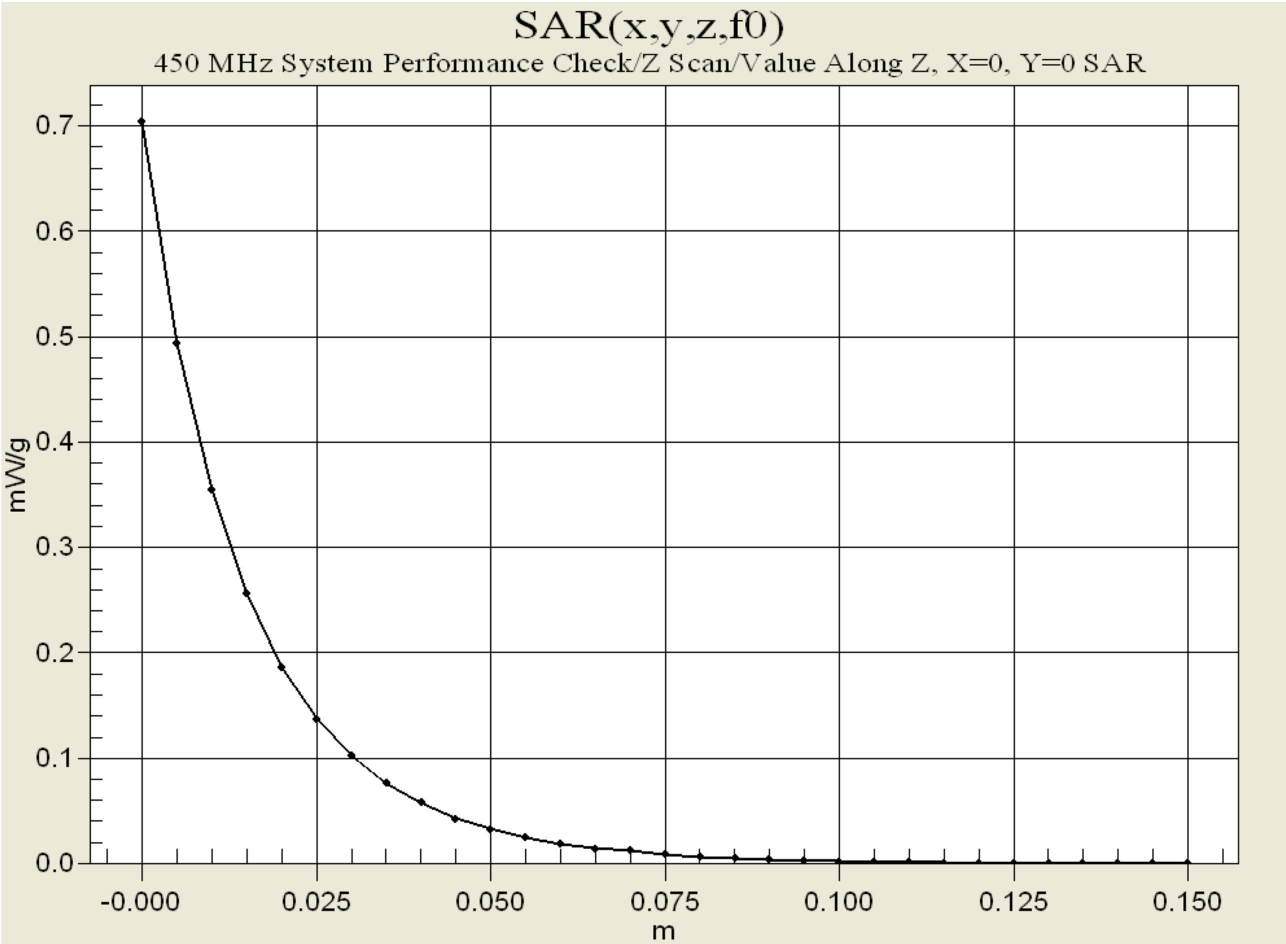
Communication System: CW
Forward Conducted Power: 250mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.84 mho/m, ε_r = 42.8, ρ = 1000 kg/m^3)

- 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 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
Peak SAR (extrapolated) = 2.26 W/kg
SAR(1 g) = 1.30 mW/g; SAR(10 g) = 0.831 mW/g
Reference Value = 40.2 V/m
Power Drift = -0.07 dB




SAR(x,y,z,f0)
450 MHz System Performance Check/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

APPENDIX C - SYSTEM VALIDATION

Celltech
Testing and Engineering Services Lab

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.

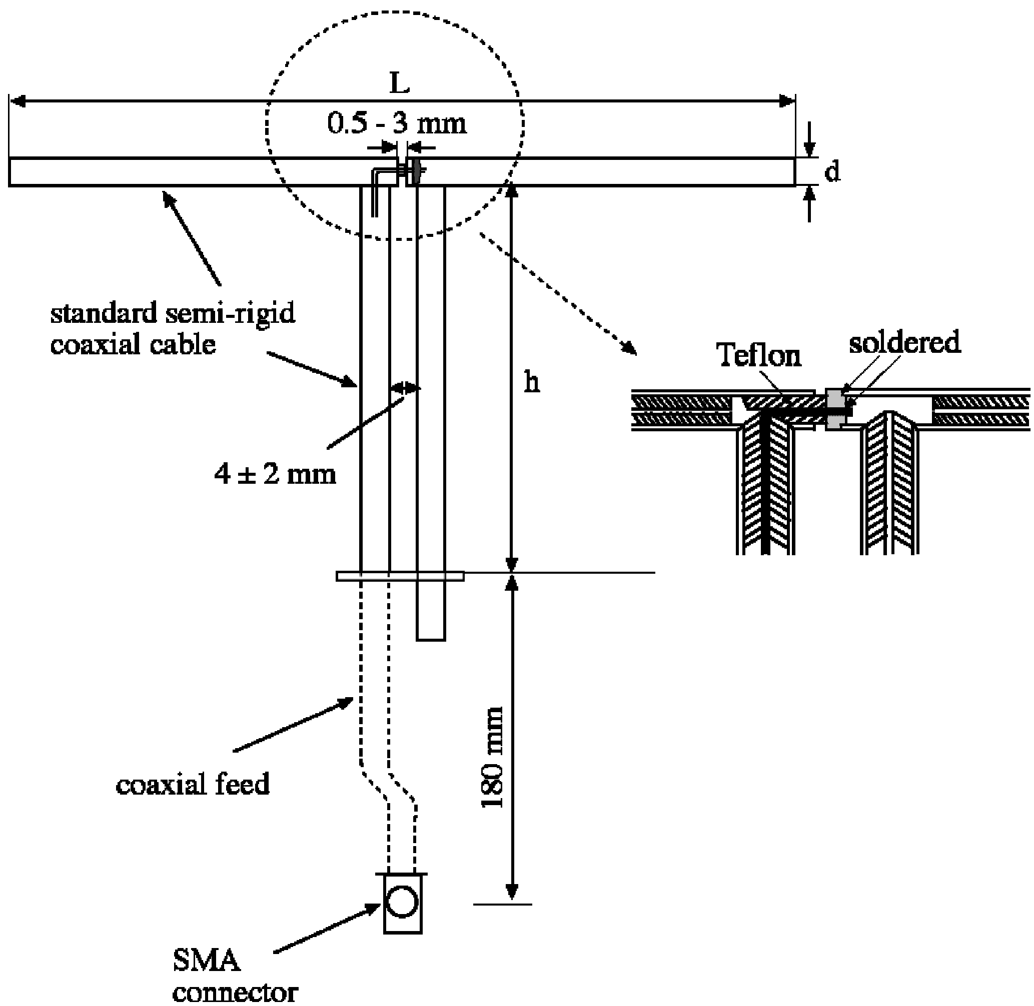
Calibrated by:	Spencer Watson
Approved by:	Russell W. Pipe

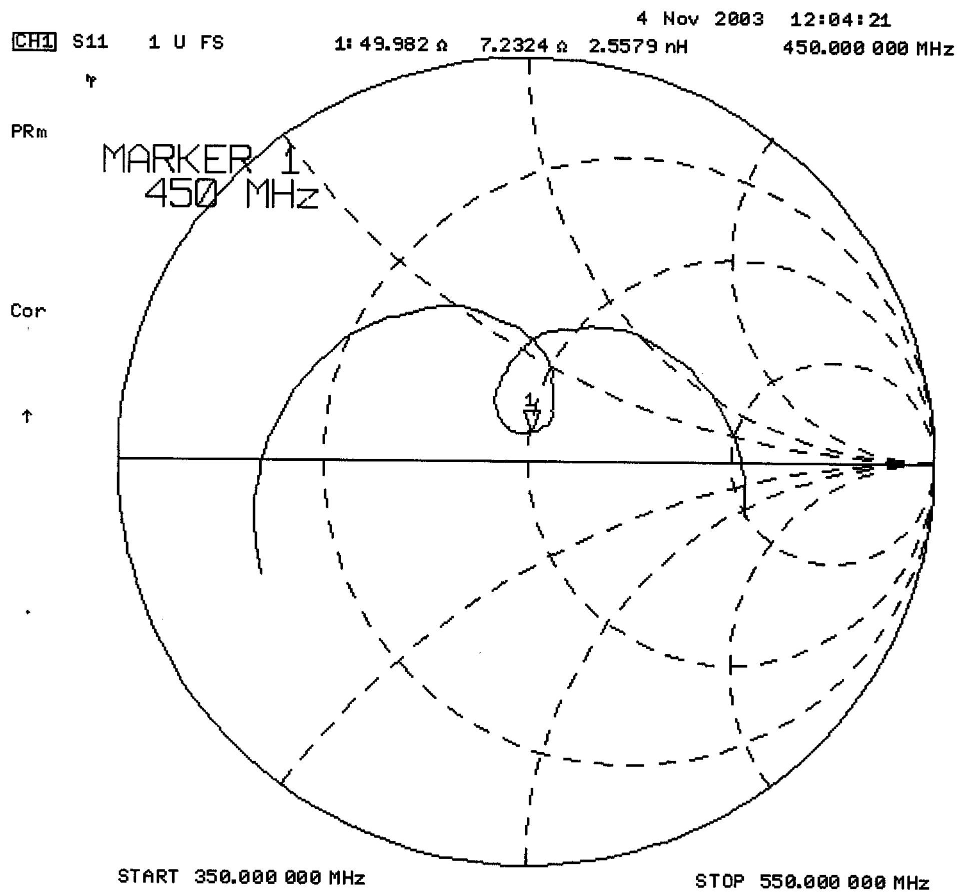
Celltech Labs Inc. 1955 Moss Court, Kelowna, B.C. Canada V1Y 9L3
Tel. 250-448-7047 • Fax. 250-448-7046 • e-mail: info@celltechlabs.com
www.celltechlabs.com

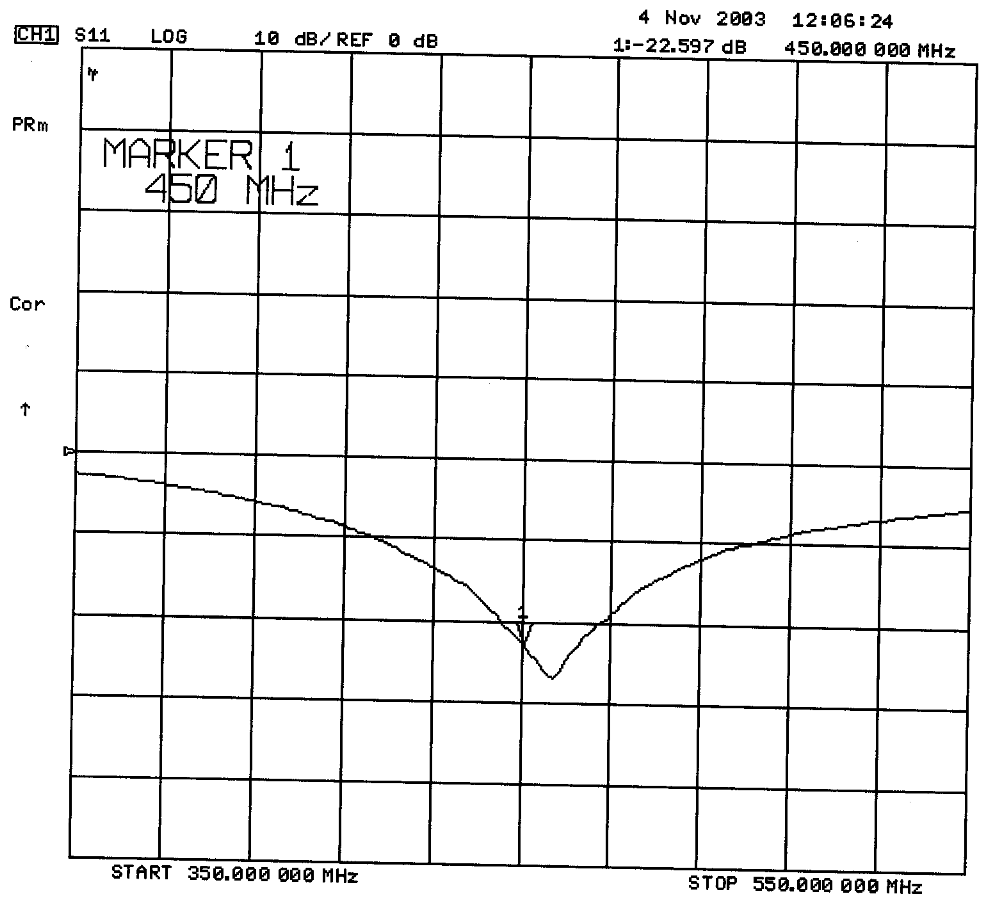
1. Dipole Construction & Electrical Characteristics

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
MARKER 1
450 MHz
Cor
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
MARKER 1
450 MHz
Cor
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

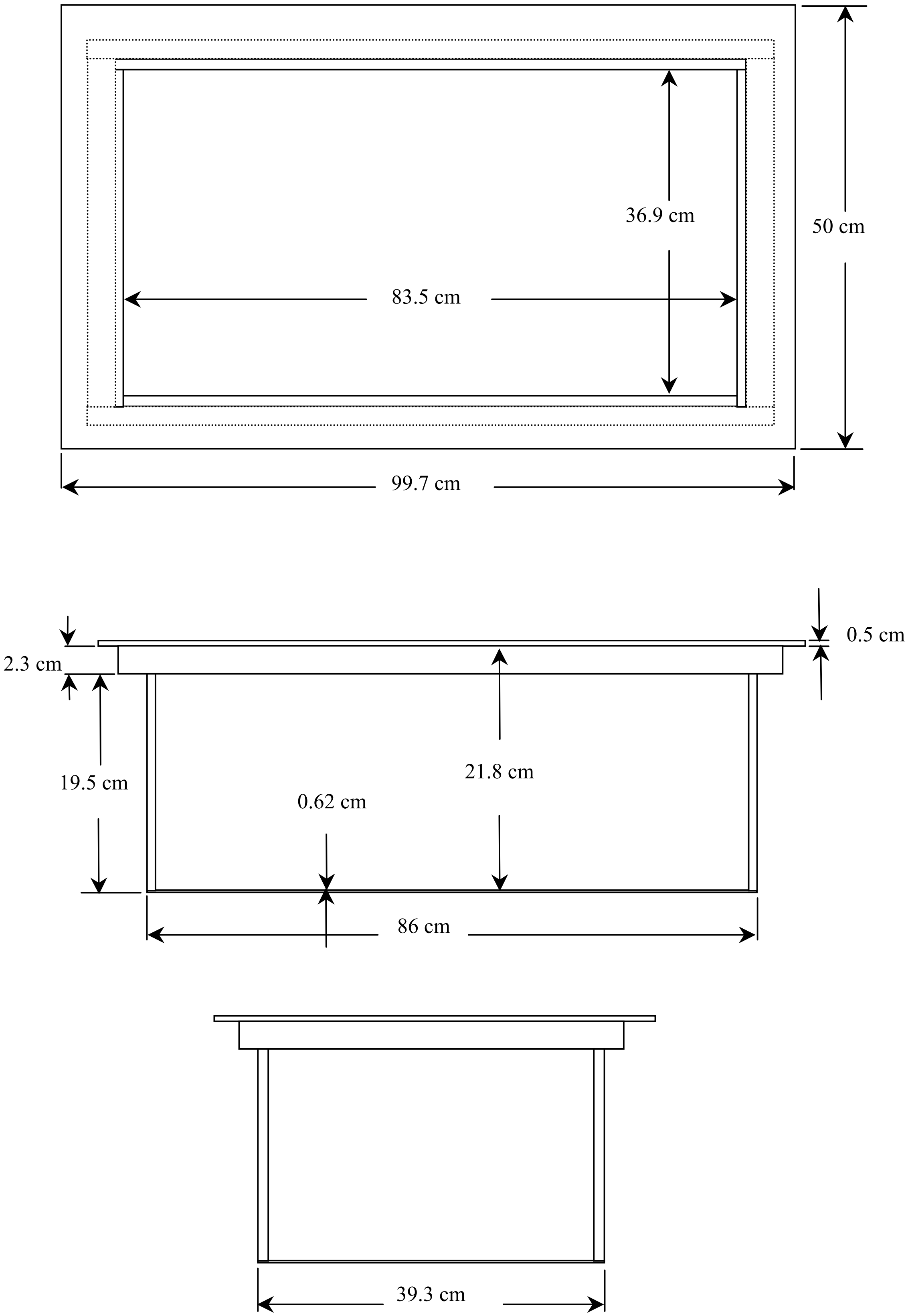
3. Validation Phantom

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:

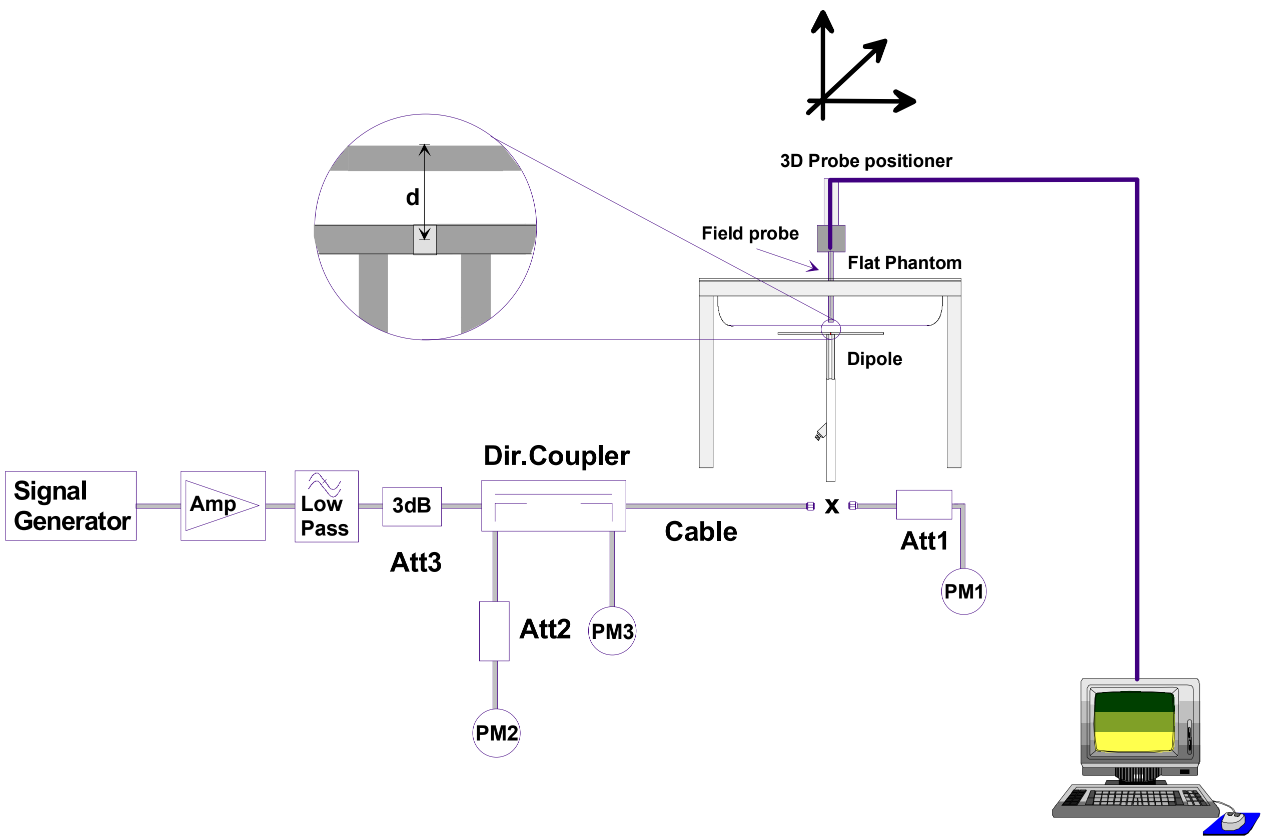
Ambient Temperature:	22.1 °C
Humidity:	49 %
Barometric Pressure:	102.8 kPa

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

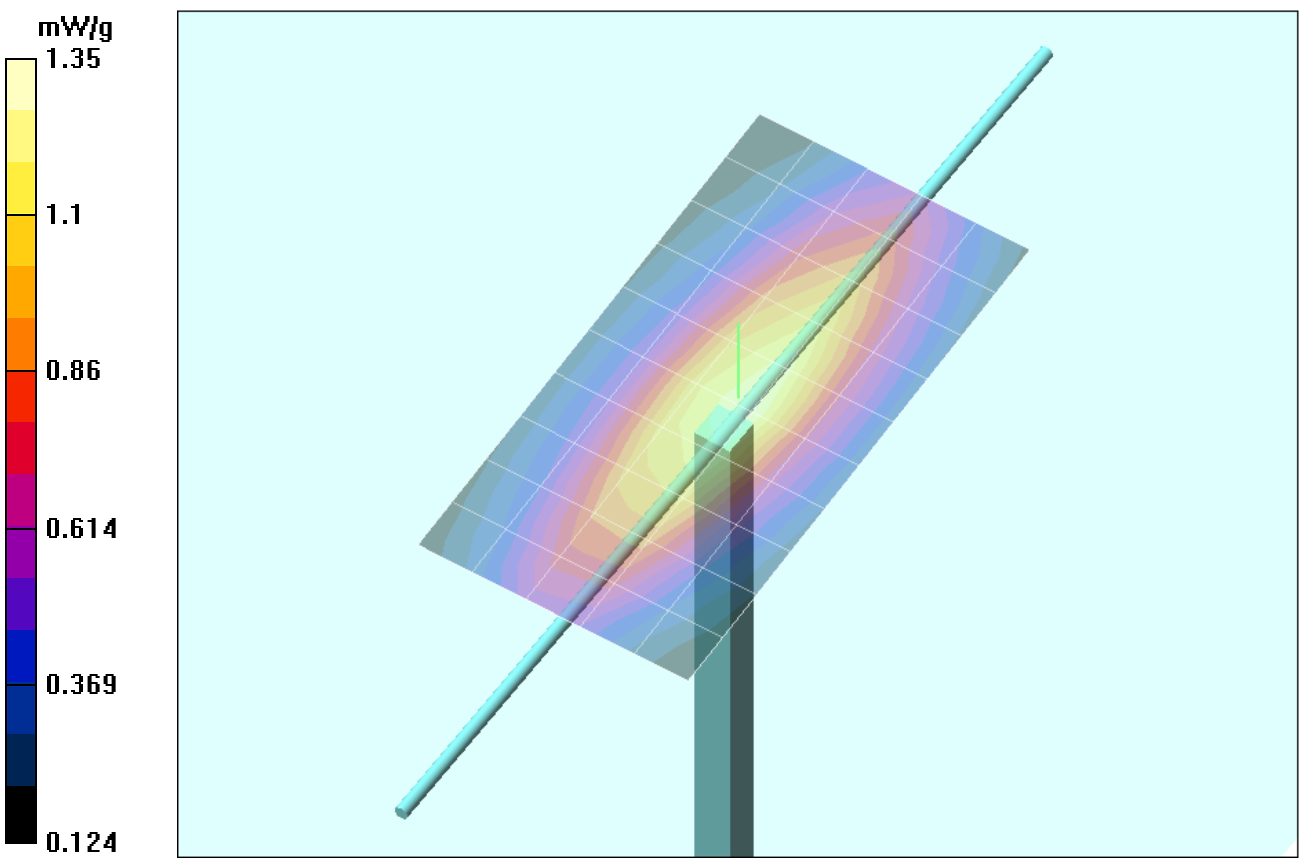
Ambient Temp: 22.1°C; Fluid Temp: 22.0°C; Barometric Pressure: 102.8 kPa; Humidity: 49%

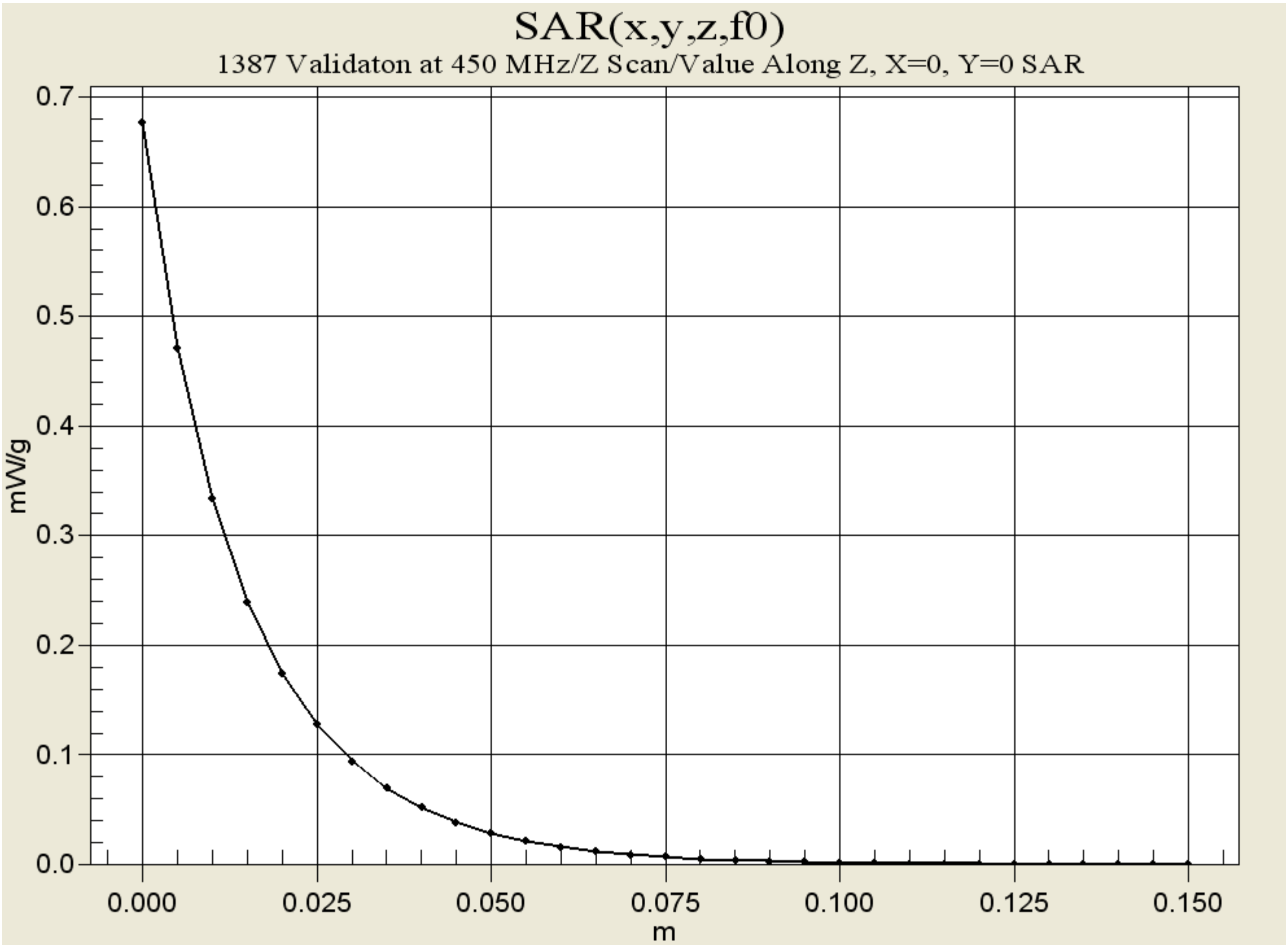
Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.88 mho/m, ε_r = 43.7, ρ = 1000 kg/m^3)

- 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 Labs

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1387
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	February 26, 2003
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

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	Scheduled Calibration
RF generator HP 8684C	US3642U01700	4-Aug-99 (in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	8-Mar-02	Mar-03
Power sensor HP 8481A	MY41092180	18-Sep-02	Sep-03
Power meter EPM E4419B	GB41293874	13-Sep-02	Sep-03
Network Analyzer HP 8753E	US38432426	3-May-00	In house check: May 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01	Sep-03

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

Date issued: February 26, 2003

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.

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

Probe ET3DV6

SN:1387

Manufactured:	September 21, 1999
Last calibration:	February 22, 2002
Recalibrated:	February 26, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1387

Sensitivity in Free Space

NormX	**1.55**	$\mu V/(V/m)^2$
NormY	**1.65**	$\mu V/(V/m)^2$
NormZ	**1.64**	$\mu V/(V/m)^2$

Diode Compression

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

Sensitivity in Tissue Simulating Liquid

Head 900 MHz ε_r **= 41.5 ± 5%** σ **= 0.97 ± 5% mho/m**
Head 835 MHz ε_r **= 41.5 ± 5%** σ **= 0.90 ± 5% mho/m**

ConvF X	**6.6**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.6**	± 9.5% (k=2)	Alpha	**0.37**
ConvF Z	**6.6**	± 9.5% (k=2)	Depth	**2.61**

Head 1800 MHz ε_r **= 40.0 ± 5%** σ **= 1.40 ± 5% mho/m**
Head 1900 MHz ε_r **= 40.0 ± 5%** σ **= 1.40 ± 5% mho/m**

ConvF X	**5.2**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**5.2**	± 9.5% (k=2)	Alpha	**0.50**
ConvF Z	**5.2**	± 9.5% (k=2)	Depth	**2.73**

Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	10.2	5.9
SAR_{be} [%]	With Correction Algorithm	0.4	0.6

Head 1800 MHz Typical SAR gradient: 10 % per mm

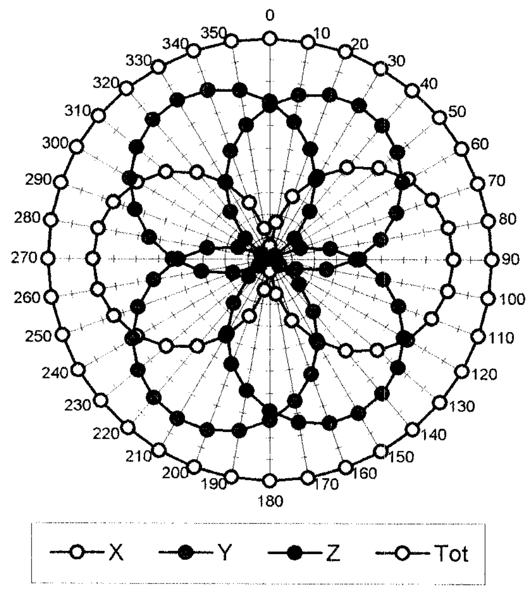
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	14.6	9.8
SAR_{be} [%]	With Correction Algorithm	0.2	0.0

Sensor Offset

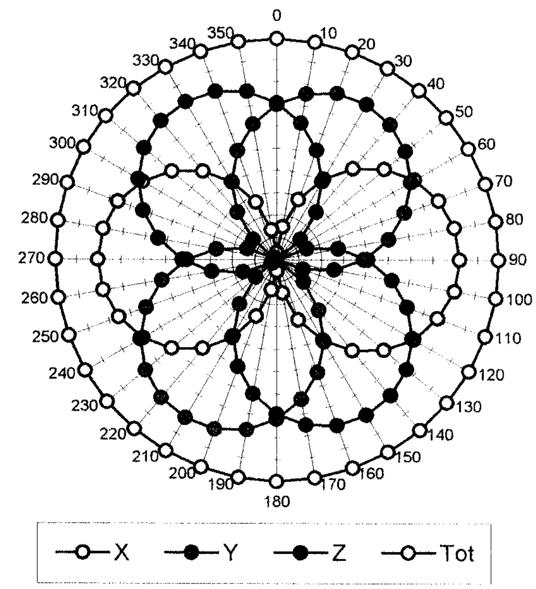
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.4 ± 0.2**	mm

Receiving Pattern (ϕ), $\theta = 0°$

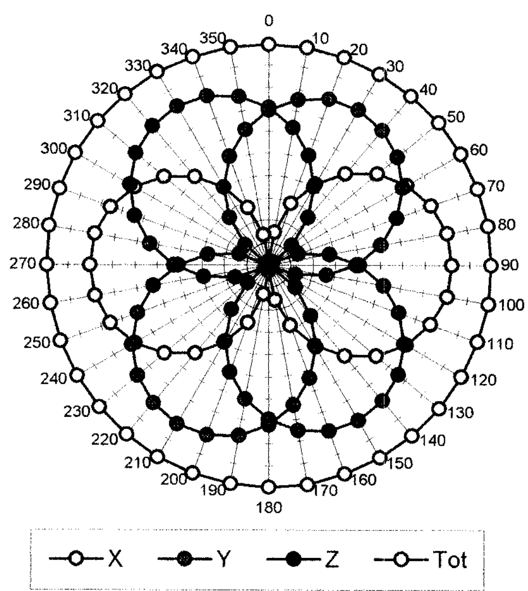
f = 30 MHz, TEM cell ifi110



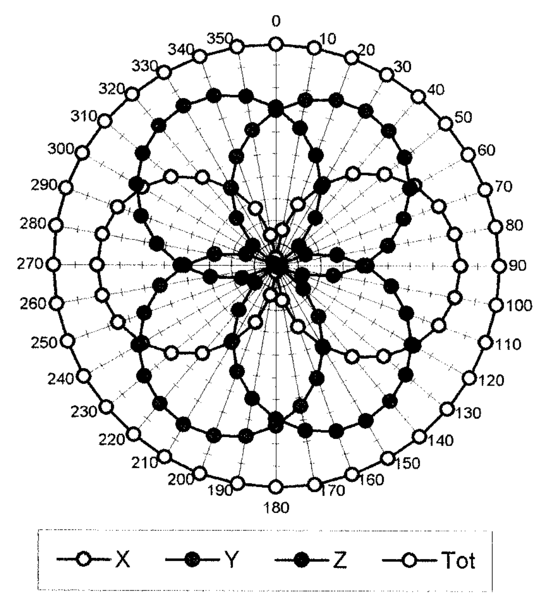
f = 100 MHz, TEM cell ifi110

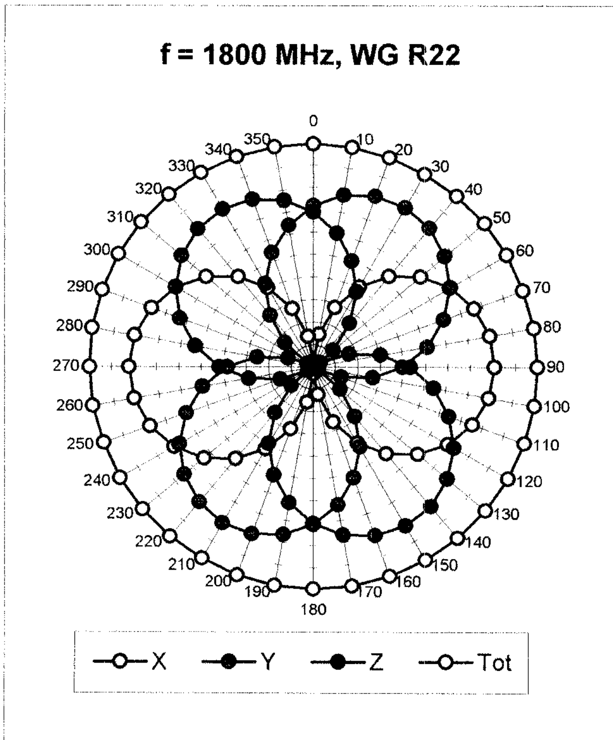


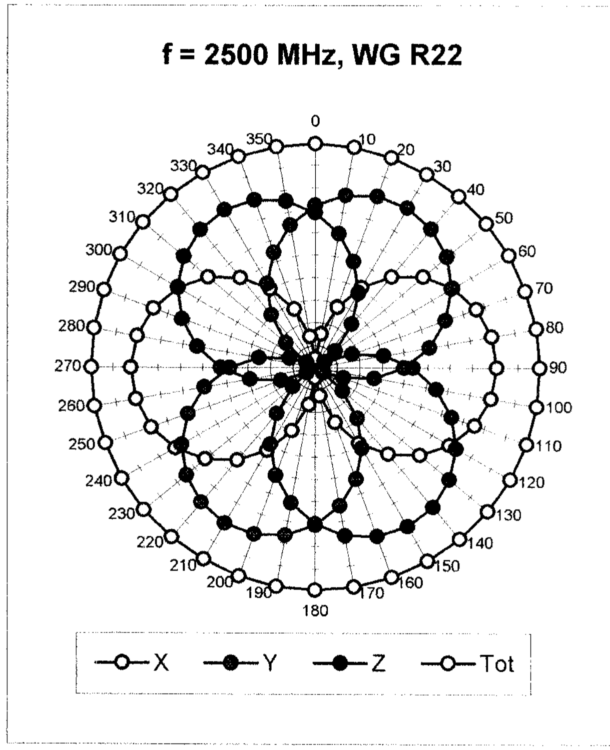
f = 300 MHz, TEM cell ifi110



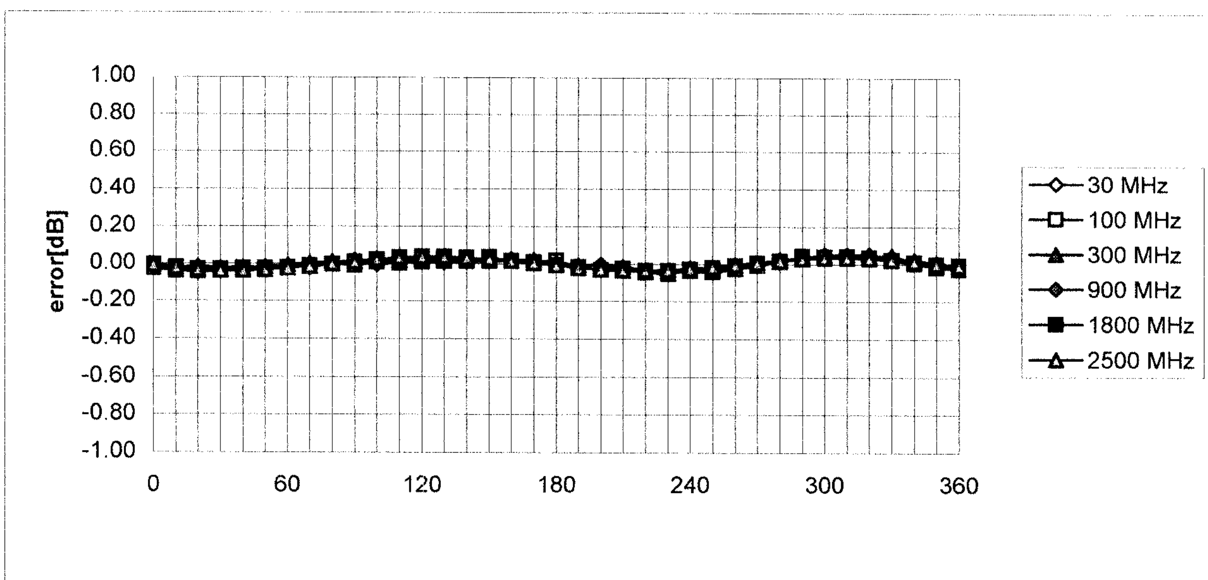
f = 900 MHz, TEM cell ifi110





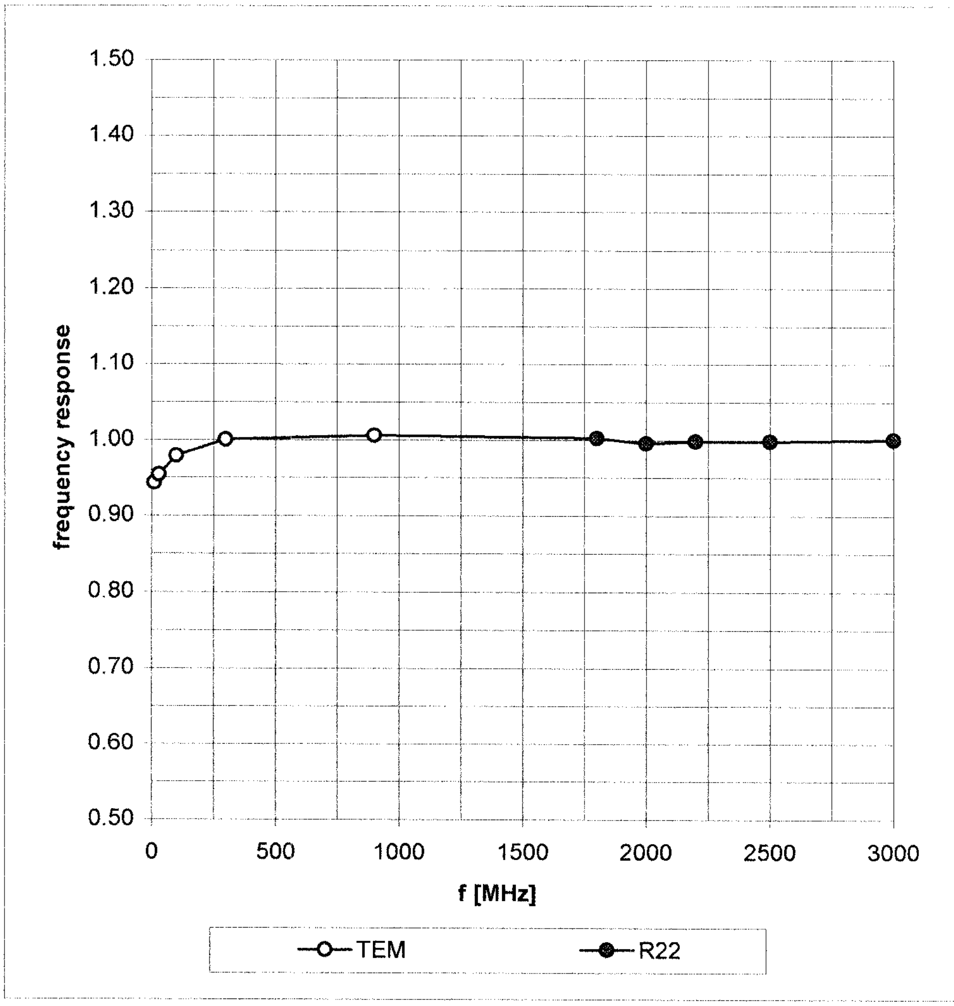


Isotropy Error (ϕ), θ = 0°



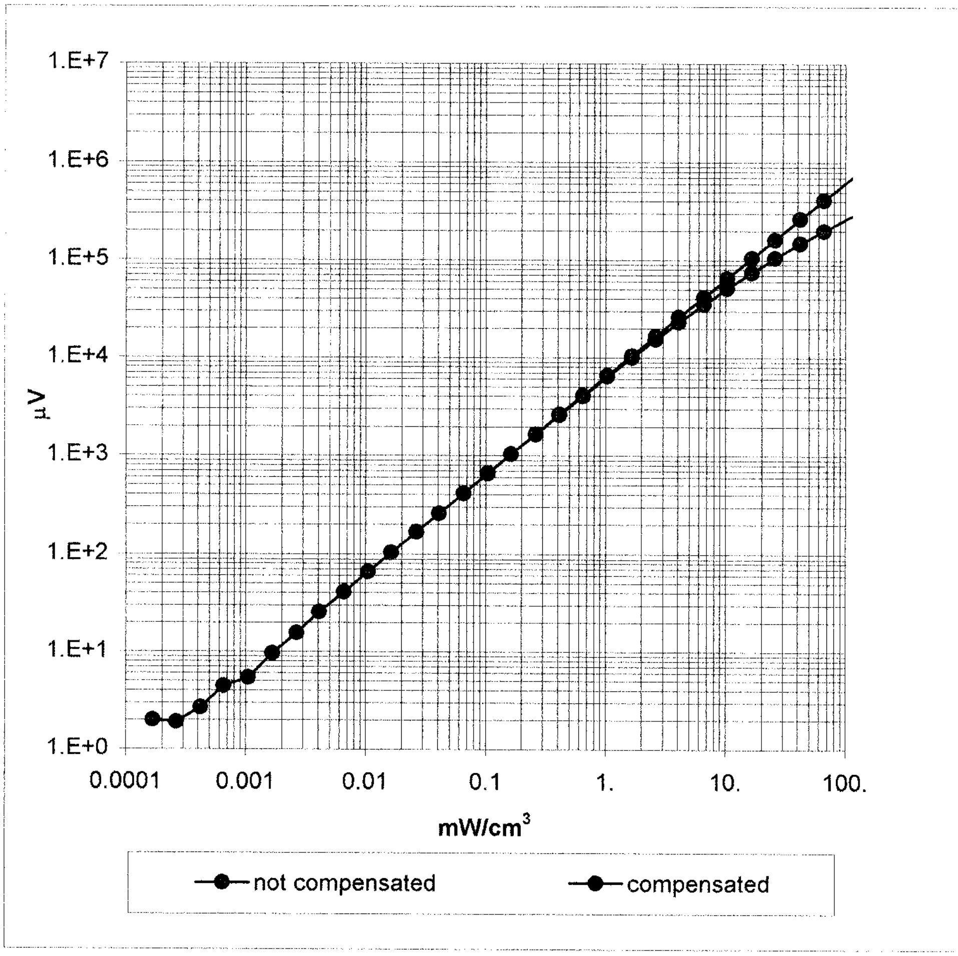
Frequency Response of E-Field

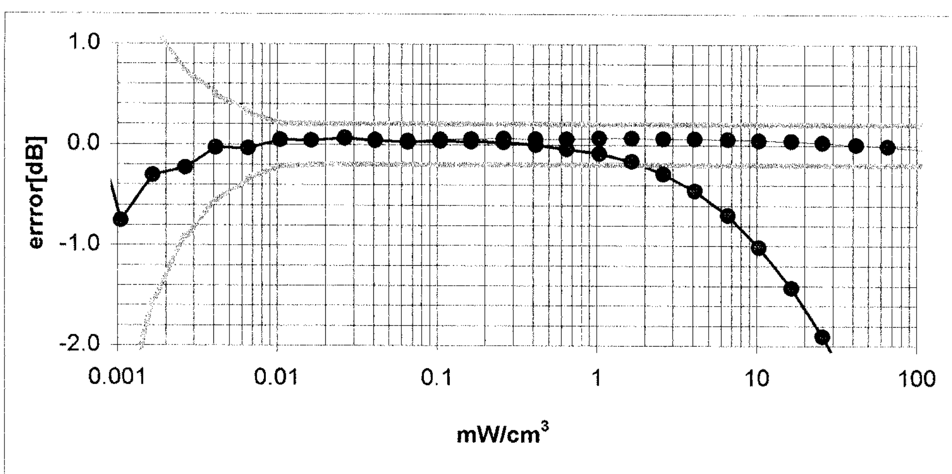
(TEM-Cell:ifi110, Waveguide R22)



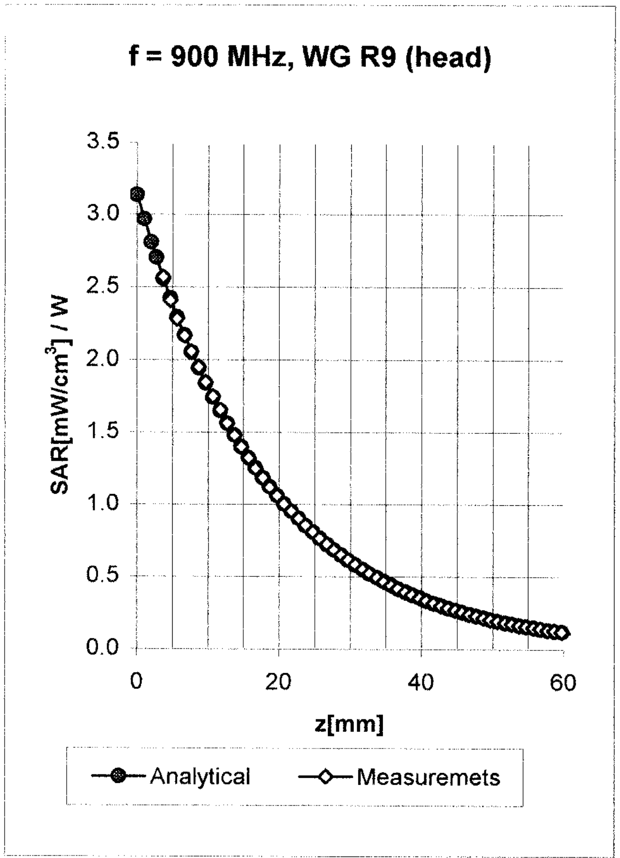
Dynamic Range f(SAR_{brain})

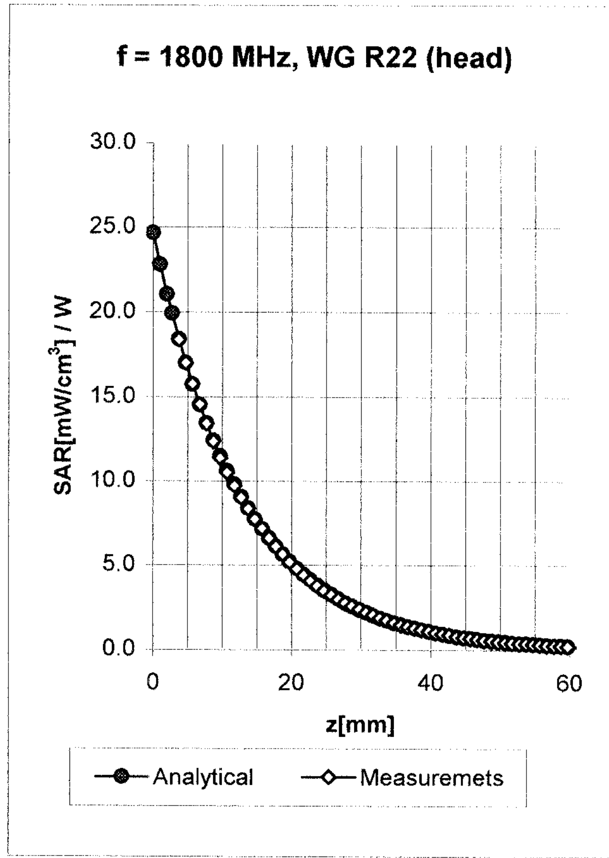
(Waveguide R22)





Conversion Factor Assessment

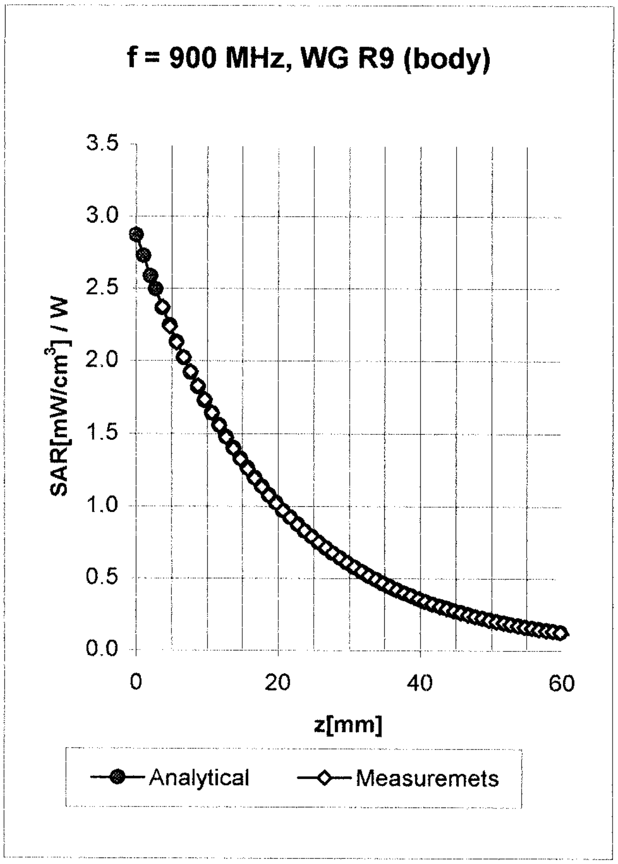


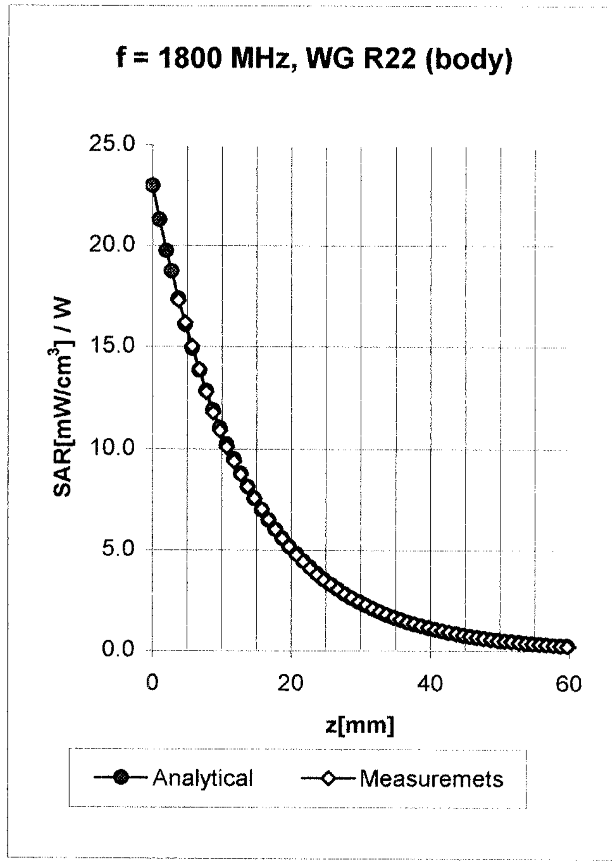


Head	**900 MHz**		ε_r = **41.5 ± 5%**	σ = **0.97 ± 5% mho/m**	
Head	**835 MHz**		ε_r = **41.5 ± 5%**	σ = **0.90 ± 5% mho/m**	
	ConvF X	**6.6**	± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**6.6**	± 9.5% (k=2)	Alpha	**0.37**
	ConvF Z	**6.6**	± 9.5% (k=2)	Depth	**2.61**

Head	**1800 MHz**		ε_r = **40.0 ± 5%**	σ = **1.40 ± 5% mho/m**	
Head	**1900 MHz**		ε_r = **40.0 ± 5%**	σ = **1.40 ± 5% mho/m**	
	ConvF X	**5.2**	± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**5.2**	± 9.5% (k=2)	Alpha	**0.50**
	ConvF Z	**5.2**	± 9.5% (k=2)	Depth	**2.73**

Conversion Factor Assessment

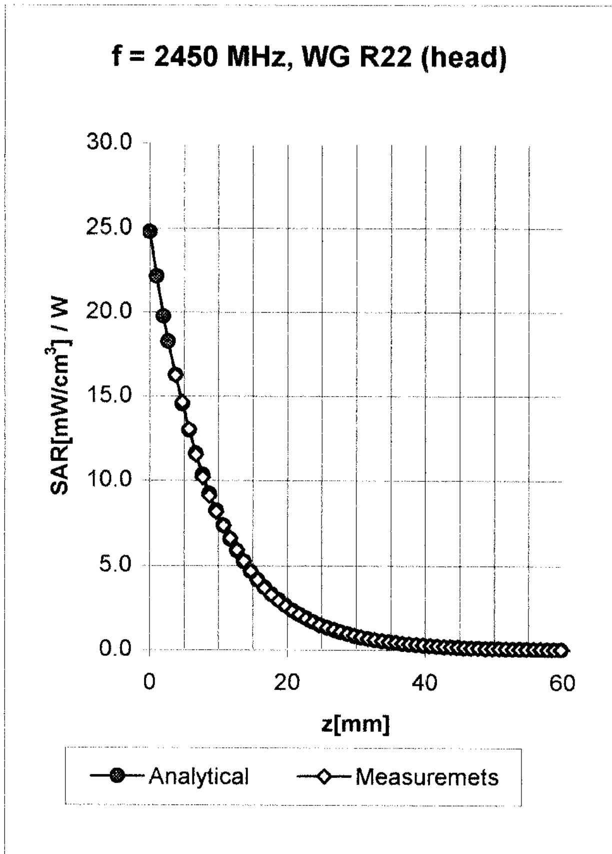


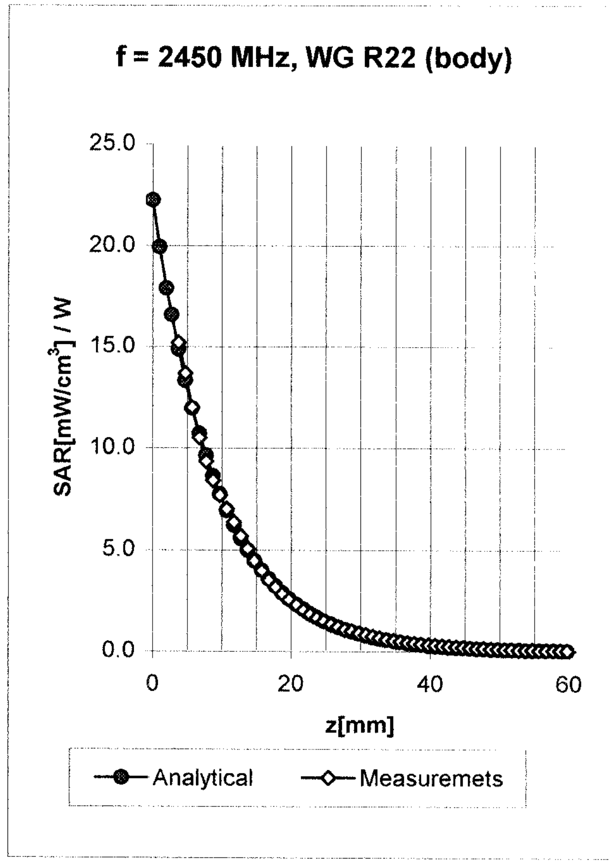


Body	**900 MHz**	ε_r **= 55.0 ± 5%**	σ **= 1.05 ± 5% mho/m**	
Body	**835 MHz**	ε_r **= 55.2 ± 5%**	σ **= 0.97 ± 5% mho/m**	
ConvF X	**6.4**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.4**	± 9.5% (k=2)	Alpha	**0.45**
ConvF Z	**6.4**	± 9.5% (k=2)	Depth	**2.35**

Body	**1800 MHz**	ε_r **= 53.3 ± 5%**	σ **= 1.52 ± 5% mho/m**	
Body	**1900 MHz**	ε_r **= 53.3 ± 5%**	σ **= 1.52 ± 5% mho/m**	
ConvF X	**4.9**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.9**	± 9.5% (k=2)	Alpha	**0.60**
ConvF Z	**4.9**	± 9.5% (k=2)	Depth	**2.59**

Conversion Factor Assessment



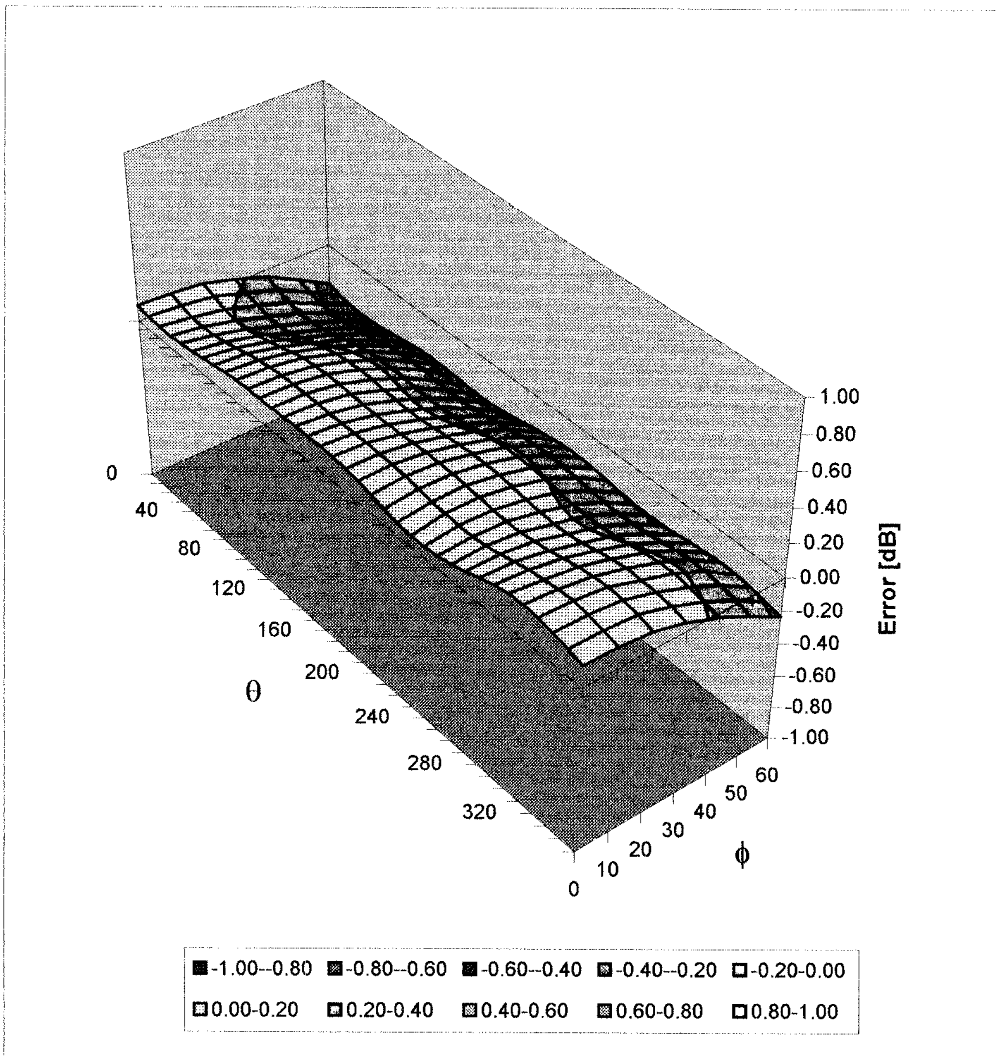


Head	**2450**	**MHz**		ε_r **= 39.2 ± 5%**	σ **= 1.80 ± 5% mho/m**	
	ConvF X		**5.0**	± 8.9% (k=2)	Boundary effect:	
	ConvF Y		**5.0**	± 8.9% (k=2)	Alpha	**1.04**
	ConvF Z		**5.0**	± 8.9% (k=2)	Depth	**1.85**

Body	**2450**	**MHz**		ε_r **= 52.7 ± 5%**	σ **= 1.95 ± 5% mho/m**	
	ConvF X		**4.6**	± 8.9% (k=2)	Boundary effect:	
	ConvF Y		**4.6**	± 8.9% (k=2)	Alpha	**1.20**
	ConvF Z		**4.6**	± 8.9% (k=2)	Depth	**1.60**

Deviation from Isotropy in HSL

Error (θ,φ), f = 900 MHz



Schmid & Partner
Engineering AG

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

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1387**
Place of Assessment:	**Zurich**
Date of Assessment:	**February 28, 2003**
Probe Calibration Date:	**February 26, 2003**

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 (± standard deviation)

150 MHz	ConvF	**9.1 ± 8%**	**ε_r = 52.3** **σ = 0.76 mho/m** (head tissue)
300 MHz	ConvF	**7.9 ± 8%**	**ε_r = 45.3** **σ = 0.87 mho/m** (head tissue)
450 MHz	ConvF	**7.5 ± 8%**	**ε_r = 43.5** **σ = 0.87 mho/m** (head tissue)
150 MHz	ConvF	**8.8 ± 8%**	**ε_r = 61.9** **σ = 0.80 mho/m** (body tissue)
300 MHz	ConvF	**8.0 ± 8%**	**ε_r = 58.2** **σ = 0.92 mho/m** (body tissue)
450 MHz	ConvF	**7.7 ± 8%**	**ε_r = 56.7** **σ = 0.94 mho/m** (body tissue)

APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

450 MHz System Performance Check & DUT Evaluation (Face)

Measured Fluid Dielectric Parameters (Brain)

December 16, 2003

Frequency	e'	e''
350.000000 MHz	45.2680	38.5698
360.000000 MHz	45.0033	37.8986
370.000000 MHz	44.7948	37.2226
380.000000 MHz	44.5502	36.6191
390.000000 MHz	44.3430	35.9774
400.000000 MHz	44.0863	35.5198
410.000000 MHz	43.8702	34.9775
420.000000 MHz	43.6082	34.6069
430.000000 MHz	43.4080	34.1771
440.000000 MHz	43.1207	33.8087
450.000000 MHz	42.8278	33.5054
460.000000 MHz	42.5598	33.1031
470.000000 MHz	42.3191	32.7505
480.000000 MHz	42.1149	32.3458
490.000000 MHz	41.8614	32.0178
500.000000 MHz	41.7296	31.6498
510.000000 MHz	41.4750	31.3165
520.000000 MHz	41.3269	30.9788
530.000000 MHz	41.1547	30.6580
540.000000 MHz	41.0064	30.3055
550.000000 MHz	40.8432	30.0615

450 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

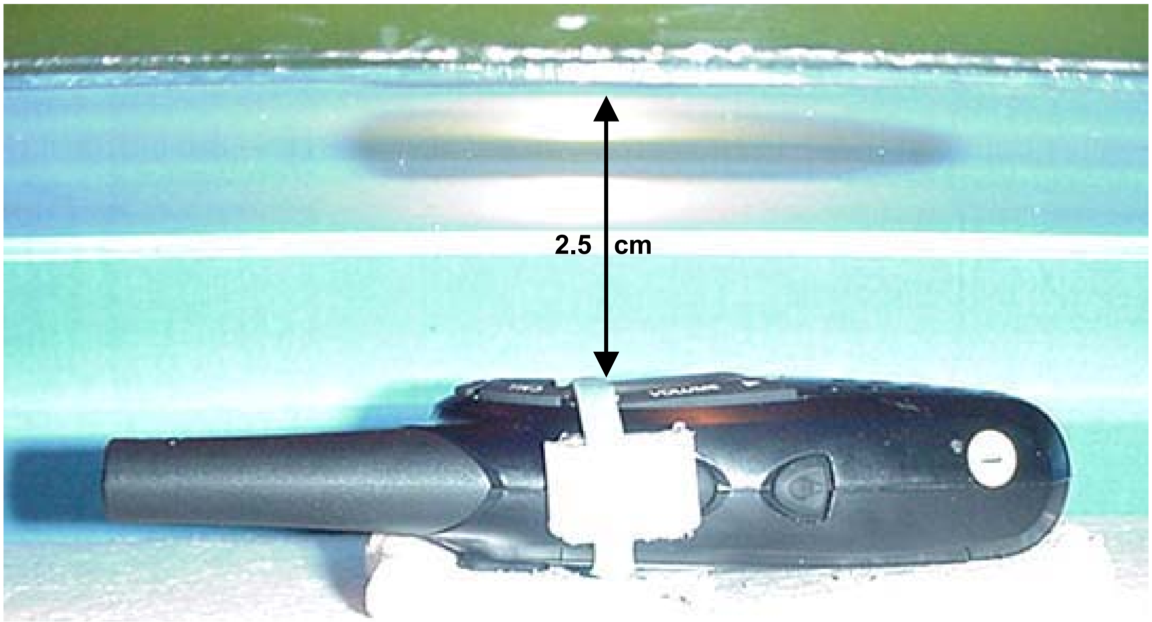
December 16, 2003

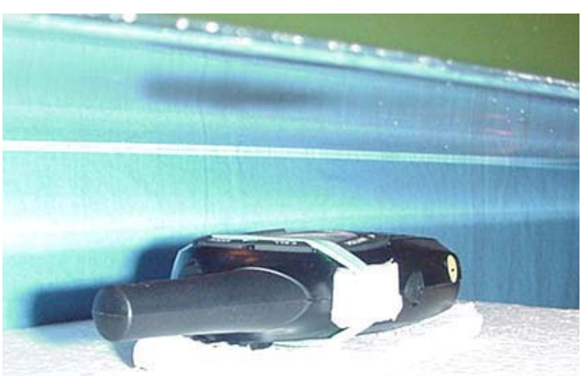
Frequency	e'	e"
350.000000 MHz	59.1747	42.8381
360.000000 MHz	58.9436	42.0436
370.000000 MHz	58.8282	41.2697
380.000000 MHz	58.7236	40.4750
390.000000 MHz	58.6357	39.7029
400.000000 MHz	58.4094	39.0971
410.000000 MHz	58.2337	38.4890
420.000000 MHz	58.0061	37.9992
430.000000 MHz	57.8252	37.4923
440.000000 MHz	57.6181	37.0121
450.000000 MHz	57.4271	36.5681
460.000000 MHz	57.2369	36.1797
470.000000 MHz	57.0487	35.7606
480.000000 MHz	56.9057	35.3484
490.000000 MHz	56.7845	34.9288
500.000000 MHz	56.6339	34.5134
510.000000 MHz	56.4804	34.0622
520.000000 MHz	56.3607	33.7368
530.000000 MHz	56.2492	33.3541
540.000000 MHz	56.1843	32.9808
550.000000 MHz	56.0387	32.7267

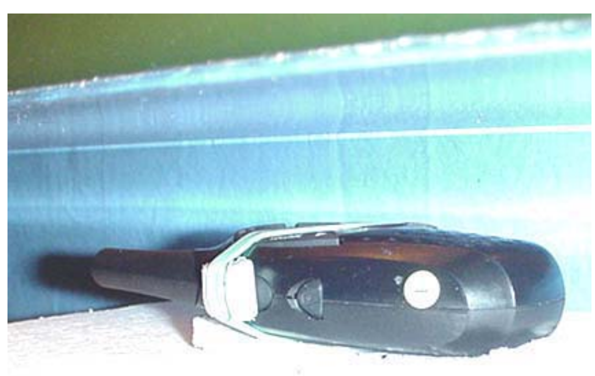
APPENDIX F - SAR TEST SETUP & DUT PHOTOGRAPHS

FACE-HELD SAR TEST SETUP PHOTOGRAPHS

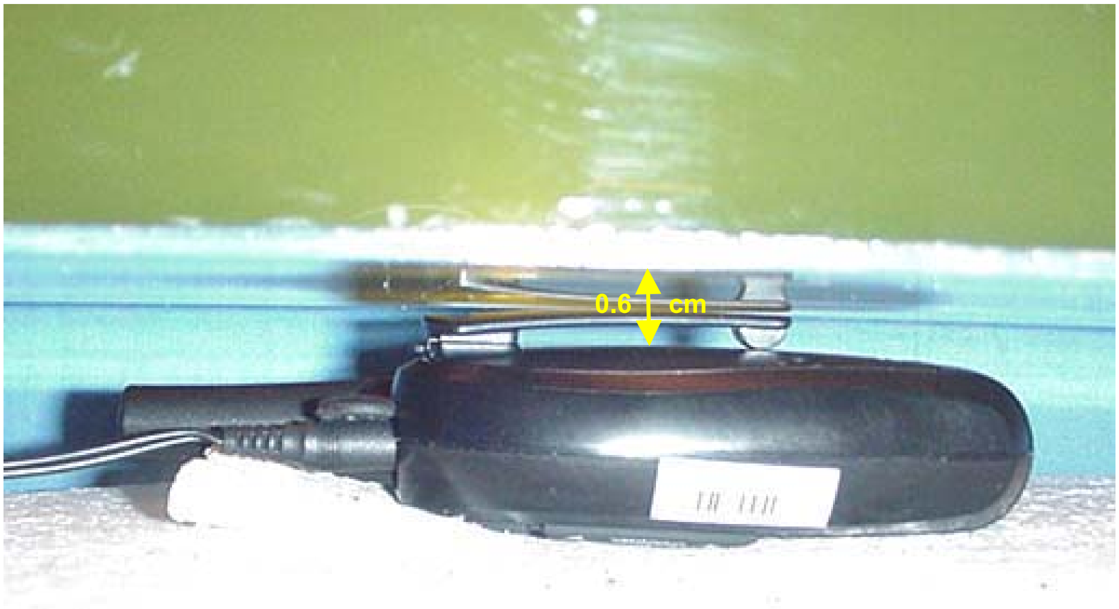
2.5 cm Separation Distance from Front of Radio to Planar Phantom

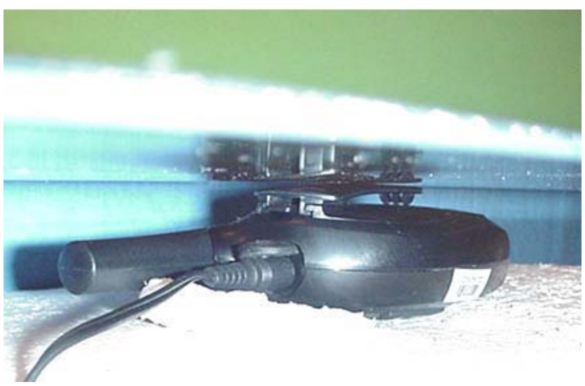






BODY-WORN SAR TEST SETUP PHOTOGRAPHS
0.6 cm Belt-Clip Separation Distance to Planar Phantom
with Ear-Microphone Accessory





DUT PHOTOGRAPHS

Front of DUT


Back of DUT with Belt-Clip


Back of DUT

Top End of DUT

Bottom End of DUT

DUT PHOTOGRAPHS

Left Side of DUT

Right Side of DUT

Belt-Clip Accessory

DUT PHOTOGRAPHS

Battery Compartment

with NiCd Battery Pack

with Duracell Procell Alkaline Batteries

with Ear-Microphone Accessory

with Energizer e^2 Alkaline Batteries