DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

Test Lab

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Applicant Information

GARMIN INTERNATIONAL INC.
1200 E. 151st Street
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United States

FCC IDENTIFIER:	**IPH-00861**
IC IDENTIFER:	**1792A-00861**
Model(s):	**Rino 520/530**
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 Description:	**Portable FRS/GMRS PTT Radio Transceiver with GPS**
Modulation Type:	**FM (UHF)**
Tx Frequency Range(s):	**462.5500 - 462.7250 MHz (GMRS Channels 15-22)** **467.5500 - 467.7250 MHz (GMRS Repeater Channels 15R-22R) USA only** **462.5625 - 462.7125 MHz (FRS/GMRS Channels 1-7)** **467.5625 - 467.7125 MHz (FRS Channels 8-14)**
Max. RF Output Power Tested:	**4.79 Watts ERP (GMRS 462.6375 MHz)**
Antenna Type(s) Tested:	**Fixed Stubby (¼ λ)**
Battery Type(s) Tested:	**Li-ion Battery Pack (8.4 V, 2400 mAh)**
Body-Worn Accessories Tested:	**Plastic Swivel Belt-Clip with Metal Spring (P/N: 013-00063-00)** **Earbud with PTT Microphone (P/N: 010-10347-00)** **Headset with Boom-Microphone (P/N: 010-10345-00)**
Max. SAR Level(s) Evaluated:	**1.48 W/kg - Face-held (50% duty cycle)** **1.54 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.

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

Performed By:

Spencer Watson
Compliance Technologist
Celltech Labs Inc.

Reviewed By:

Russell W. Pipe
Senior Compliance Technologist
Celltech Labs Inc.

TABLE OF CONTENTS

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1.0 INTRODUCTION

This measurement report demonstrates compliance of the Garmin International Inc. Model(s): Rino 520/530 Portable FRS/GMRS PTT Radio Transceiver with GPS FCC ID: IPH-00861 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 provisions of the rules are included within this test report.

2.0 DESCRIPTION OF DEVICE UNDER TEST (DUT)

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 Description	Portable FRS/GMRS PTT Radio Transceiver with GPS	
FCC IDENTIFIER	IPH-00861	
IC IDENTIFIER	1792A-00861	
Model(s)	Rino 520, Rino 530	
Serial No.	#5	Identical Prototype
Modulation	FM (UHF)	
Tx Frequency Range(s)	462.5500 - 462.7250 MHz	GMRS Channels 15-22
	467.5500 - 467.7250 MHz	GMRS Repeater Channels 15R-22R (USA only)
	462.5625 - 462.7125 MHz	FRS/GMRS Channels 1-7
	467.5625 - 467.7125 MHz	FRS Channels 8-14
Max. RF Output Power Tested	4.79 Watts ERP	GMRS 462.6375 MHz
Antenna Type(s) Tested	Fixed Stubby	¼ λ
Battery Type(s) Tested	Li-ion	8.4 V, 2400 mAh
Body-Worn Accessories Tested	Plastic Swivel Belt-Clip with Metal Spring	P/N: 013-00063-00
	Earbud with PTT Microphone	P/N: 010-10347-00
	Headset with Boom-Microphone	P/N: 010-10345-00

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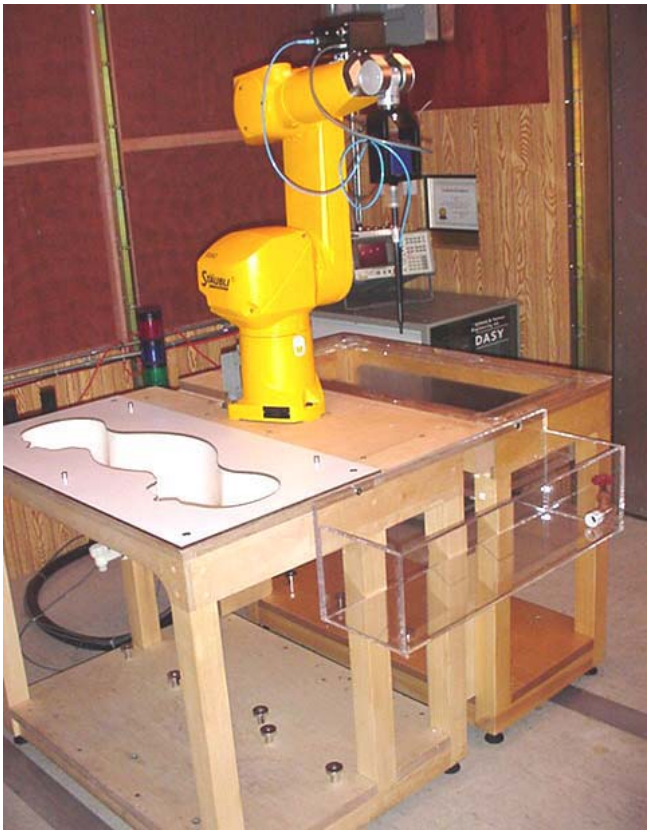
3.0 SAR MEASUREMENT SYSTEM

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

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4.0 MEASUREMENT SUMMARY

SAR EVALUATION RESULTS

Test Type	Test Date	Freq. (MHz)	Chan.	Test Mode	Battery Type	Antenna Position	Body-worn Accessory	Separation Distance to Planar Phantom (cm)	ERP Start Power (Watts)	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%
Face	Feb 17	462.6375	4	CW	Li-ion	Fixed	--	2.5	4.79	2.65	1.33	-0.473	2.95	1.48
Body	Feb 16	462.6375	4	CW	Li-ion	Fixed	Ear-Mic Belt-Clip	1.4	4.79	2.32	1.16	-0.569	2.64	1.32
Body	Feb 16	462.6375	4	CW	Li-ion	Fixed	Headset Belt-Clip	1.4	4.79	2.73	1.37	-0.529	3.08	1.54

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

Test Date(s)	February 17, 2005			February 16, 2005			Measured Fluid Type	Brain	Body	Unit
Dielectric Constant ε_r	450 MHz Brain			450 MHz Body			Atmospheric Pressure	103.4	103.5	kPa
	IEEE Target		Measured	IEEE Target		Measured	Relative Humidity	30	30	%
	43.5	± 5%	42.3	56.7	± 5%	57.0	Ambient Temperature	22.0	22.9	°C
Conductivity σ (mho/m)	450 MHz Brain			450 MHz Body			Fluid Temperature	22.0	21.3	°C
	IEEE Target		Measured	IEEE Target		Measured	Fluid Depth	≥ 15	≥ 15	cm
	0.87	± 5%	0.84	0.94	± 5%	0.89	ρ (Kg/m^3)	1000	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. 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 power drifts measured by the DASY4 system for the duration of the SAR evaluations were added to the measured SAR levels to report scaled SAR results as shown in the above test data table.
4. A SAR-versus-Time power drift evaluation was performed in the test configuration that reported the maximum-scaled SAR level (Body-worn, DUT with Headset/Boom-Microphone accessory). 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 tissues were measured prior to the evaluation using an HP 85070C Dielectric Probe Kit and an HP 8753E Network Analyzer (see Appendix C for printout of measured fluid dielectric parameters).
7. The SAR evaluations were performed within 24 hours of the system performance check.

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5.0 DETAILS OF SAR EVALUATION

The Garmin International Inc Model(s): Rino 520/530 Portable FRS/GMRS PTT Radio Transceiver with GPS FCC ID: IPH-00861 was compliant for localized Specific Absorption Rate (General Population / Uncontrolled Exposure) based on the test provisions and conditions described below. The detailed test setup photographs are shown in Appendix D.

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.
2. The DUT was tested in a body-worn configuration with the back of the radio placed parallel to the outer surface of the planar phantom. The attached swivel belt-clip accessory was touching the planar phantom and provided a 1.4 cm separation distance from the back of the DUT (battery casing) to the outer surface of the planar phantom. The DUT was evaluated for body-worn SAR with the Earbud PTT Microphone and Headset Boom-Microphone accessories consecutively.
3. The conducted output power of the DUT could not be measured for the SAR evaluations due to a non-detachable antenna. The DUT was evaluated for SAR at the maximum conducted power level preset by the manufacturer.
4. The DUT was evaluated for SAR at the maximum ERP level measured prior to the SAR evaluation at Celltech Labs 3-meter Open Area Test Site using the signal substitution method in accordance with ANSI/TIA-603-C-2004 (see reference [6]).
5. The power drifts measured by the DASY4 system during the SAR evaluations were added to the measured SAR levels to report scaled SAR results as shown in the test data table (page 5).
6. A SAR-versus-Time power drift evaluation was performed in the test configuration that reported the maximum-scaled SAR level. See Appendix A (SAR Test Plots) for SAR-versus-Time power drift evaluation plot.
7. The area scan evaluation was performed with a fully charged battery. After the area scan was completed the radio was cooled down and the battery was replaced with a fully charged battery prior to the zoom scan evaluation.
8. 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.
9. The SAR evaluations were performed using a Plexiglas planar phantom.

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 F). 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.

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7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation a system check was performed using a Plexiglas planar phantom and 450MHz dipole (see Appendix E for system validation procedures). The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using an HP 85070C Dielectric Probe Kit and HP 8753E Network Analyzer (see Appendix C for printout of measured fluid dielectric parameters). A forward power of 250 mW 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						
02/15/05	**Brain**	**1.23 (±10%)**	1.25 (+1.6%)	**43.5 ±5%**	42.8	**0.87 ±5%**	0.84	1000	22.8	20.9	≥ 15	30	103.4
02/17/05	**Brain**	**1.23 (±10%)**	1.27 (+3.3%)	**43.5 ±5%**	42.3	**0.87 ±5%**	0.84	1000	22.1	22.0	≥ 15	30	103.4

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.

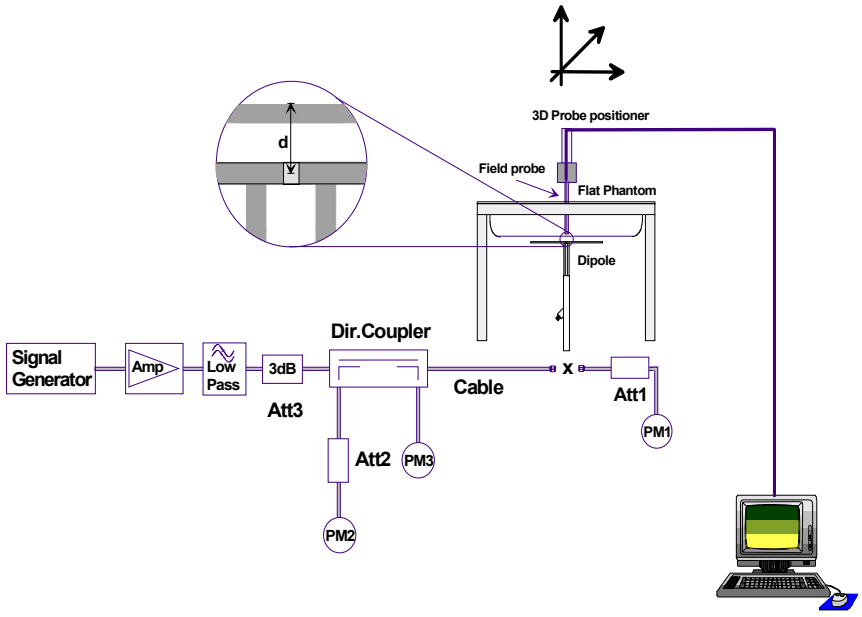
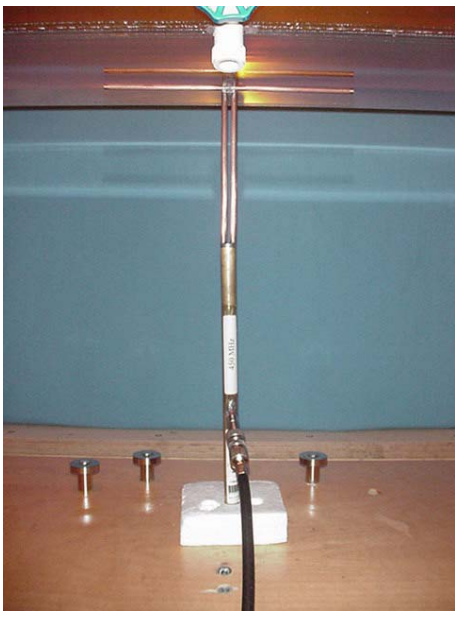


Figure 1. System Performance Check Setup Diagram



450 MHz Dipole Setup

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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 according to standardized procedures, and measured for dielectric parameters (permittivity and conductivity).

SIMULATED TISSUE MIXTURES		
INGREDIENT	**450 MHz Brain**	**450 MHz Body**
	System Check & DUT Evaluation	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.

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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)

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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 compact system table.

Plexiglas Planar Phantom

13.0 VALIDATION PLANAR PHANTOM

The validation planar phantom is constructed of Plexiglas material with a 6.0 mm shell thickness for SAR 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

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15.0 TEST EQUIPMENT LIST

TEST EQUIPMENT	SERIAL NO.	DATE CALIBRATED	CALIBRATION DUE DATE
Schmid & Partner DASY4 System	-	-	-
-DASY4 Measurement Server	1078	N/A	N/A
-Robot	599396-01	N/A	N/A
-DAE3	353	July 2004	July 2005
-DAE3	370	January 2005	January 2006
-ET3DV6 E-Field Probe	1387	March 2004	March 2005
-ET3DV6 E-Field Probe	1590	May 2004	May 2005
-EX3DV4 E-Field Probe	3547	January 2005	January 2006
-300MHz Validation Dipole	135	October 2004	October 2005
-450MHz Validation Dipole	136	November 2004	November 2005
-835MHz Validation Dipole	411	March 2004	March 2005
-900MHz Validation Dipole	054	June 2004	June 2005
-1800MHz Validation Dipole	247	June 2004	June 2005
-1900MHz Validation Dipole	151	June 2004	June 2005
-2450MHz Validation Dipole	150	September 2004	September 2005
-5000MHz Validation Dipole	1031	January 2005	January 2006
-SAM Phantom V4.0C	1033	N/A	N/A
-Barski Planar Phantom	03-01	N/A	N/A
-Plexiglas Planar Phantom	161	N/A	N/A
-Validation Planar Phantom	137	N/A	N/A
HP 85070C Dielectric Probe Kit	N/A	N/A	N/A
Gigatronics 8651A Power Meter	8650137	April 2004	April 2005
Gigatronics 8652A Power Meter	1835267	April 2004	April 2005
Gigatronics 80701A Power Sensor	1833535	April 2004	April 2005
Gigatronics 80701A Power Sensor	1833542	April 2004	April 2005
Gigatronics 80701A Power Sensor	1834350	April 2004	April 2005
HP 8594E Spectrum Analyzer	3543A02721	April 2004	April 2005
HP 8753E Network Analyzer	US38433013	April 2004	April 2005
HP 8648D Signal Generator	3847A00611	April 2004	April 2005
Amplifier Research 5S1G4 Power Amplifier	26235	N/A	N/A

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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	± 4.0	Normal	1	1	± 4.0	∞
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					**± 13.03**	
Expanded Uncertainty (k=2)					**± 26.07**	

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

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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	± 4.0	Normal	1	1	± 4.0	∞
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					**± 9.58**	
Expanded Uncertainty (k=2)					**± 19.16**	

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

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

[6] ANSI/TIA-603-C, “Land Mobile FM or PM Communications Equipment - Measurement and Performance Standards”: December 2004.

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APPENDIX A - SAR MEASUREMENT DATA

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Date Tested: 02/17/05

Face-Held SAR

DUT: Garmin Model: Rino 520; Type: Portable UHF FRS/GMRS PTT Radio Transceiver with GPS; Serial: #5

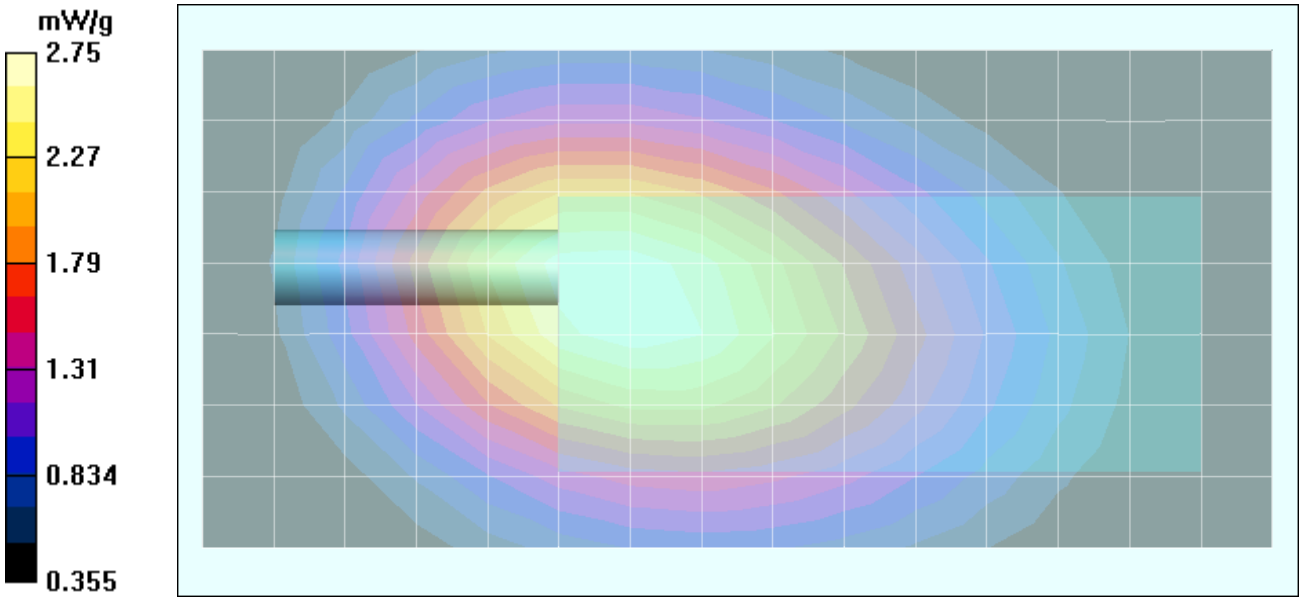
Ambient Temp: 22.0 °C; Fluid Temp: 22.0 °C; Barometric Pressure: 103.4 kPa; Humidity: 30%

Communication System: FM UHF
8.4V, 2400mAH Li-ion Battery Pack
RF Output Power: 4.79 Watts (ERP)
Frequency: 462.6375 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.84 mho/m; ε_r = 42.3; 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: 06/07/2004
- Phantom: Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

Face-Held - 2.5 cm Separation Distance to Planar Phantom/Area Scan (8x16x1):
Measurement grid: dx=15mm, dy=15mm

Face-Held - 2.5 cm Separation Distance to Planar Phantom/Zoom Scan 2 (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 56.8 V/m; Power Drift = -0.473 dB
Peak SAR (extrapolated) = 4.05 W/kg
SAR(1 g) = 2.65 mW/g; SAR(10 g) = 1.91 mW/g



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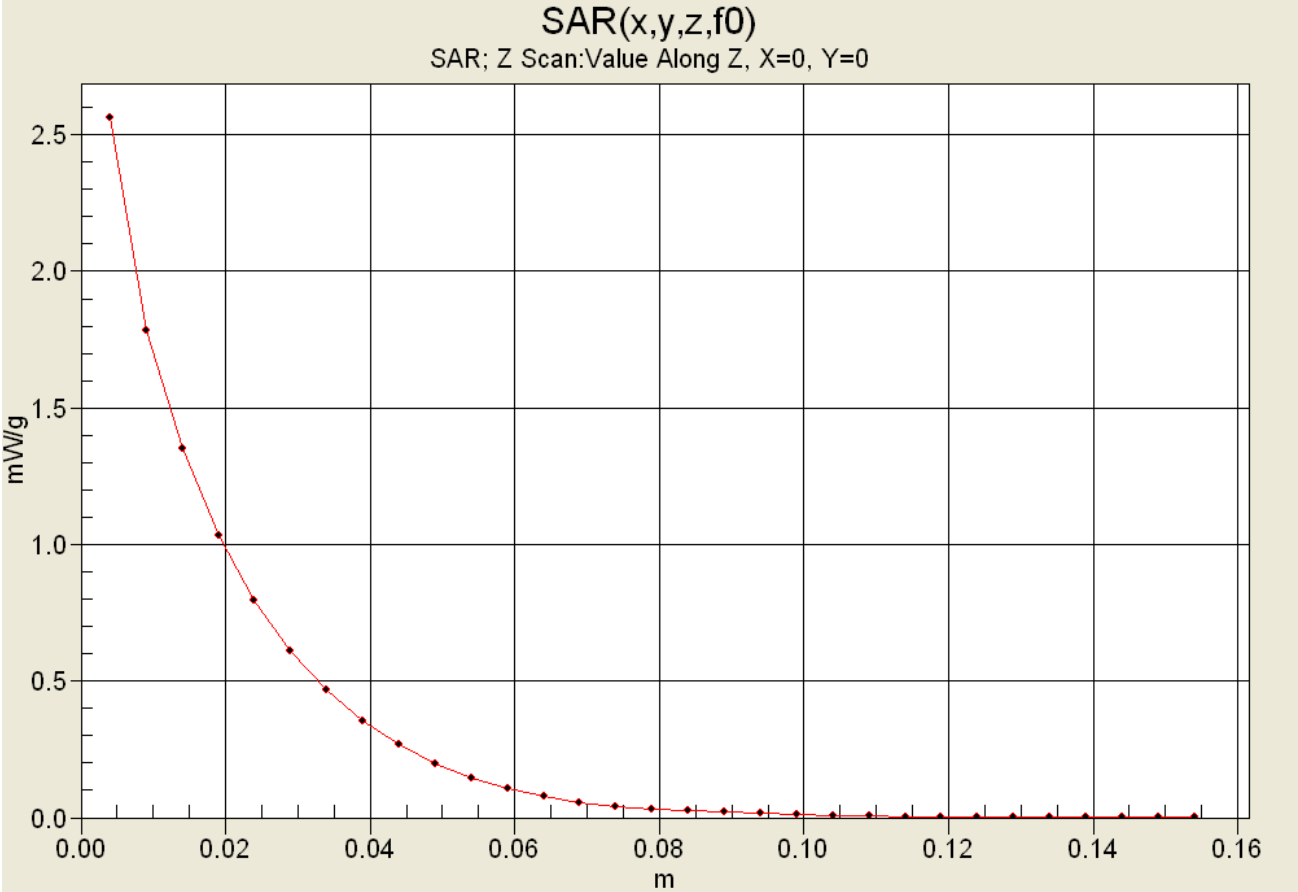
Z-Axis Scan



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Date Tested: 02/16/05

Body-Worn SAR

DUT: Garmin Model: Rino 520; Type: Portable UHF FRS/GMRS PTT Radio Transceiver with GPS; Serial: #5

Body-Worn Accessories: Swivel Belt-Clip (P/N: 013-00063-00), Ear-Bud with PTT Microphone (P/N: 010-10347-00)

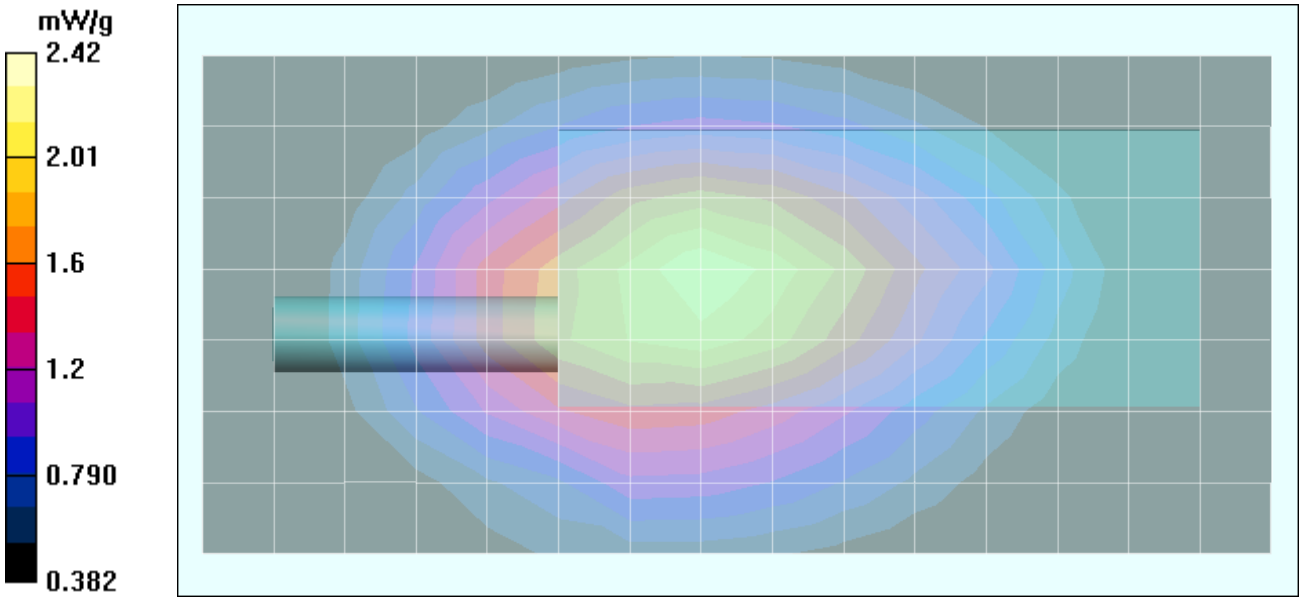
Ambient Temp: 22.9 °C; Fluid Temp: 21.3 °C; Barometric Pressure: 103.5 kPa; Humidity: 30%

Communication System: FM UHF
8.4V, 2400mAH Li-Ion Battery Pack
RF Output Power: 4.79 Watts (ERP)
Frequency: 462.6375 MHz; Duty Cycle: 1:1
Medium: M450 (σ = 0.89 mho/m; ε_r = 57.0; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1387; ConvF(7.6, 7.6, 7.6); Calibrated: 18/03/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 06/07/2004
- Phantom: Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

Body-Worn - 1.4 cm Belt-Clip Separation Distance from Battery to Planar Phantom/Area Scan (8x16x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn - 1.4 cm Belt-Clip Separation Distance from Battery to Planar Phantom/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 48.3 V/m; Power Drift = -0.569 dB
Peak SAR (extrapolated) = 3.52 W/kg
SAR(1 g) = 2.32 mW/g; SAR(10 g) = 1.67 mW/g



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Date Tested: 02/16/05

Body-Worn SAR

DUT: Garmin Model: Rino 520; Type: Portable UHF FRS/GMRS PTT Radio Transceiver with GPS; Serial: #5

Body-Worn Accessories: Swivel Belt-Clip (P/N: 013-00063-00), Headset with Boom-Microphone (P/N: 010-10345-00)

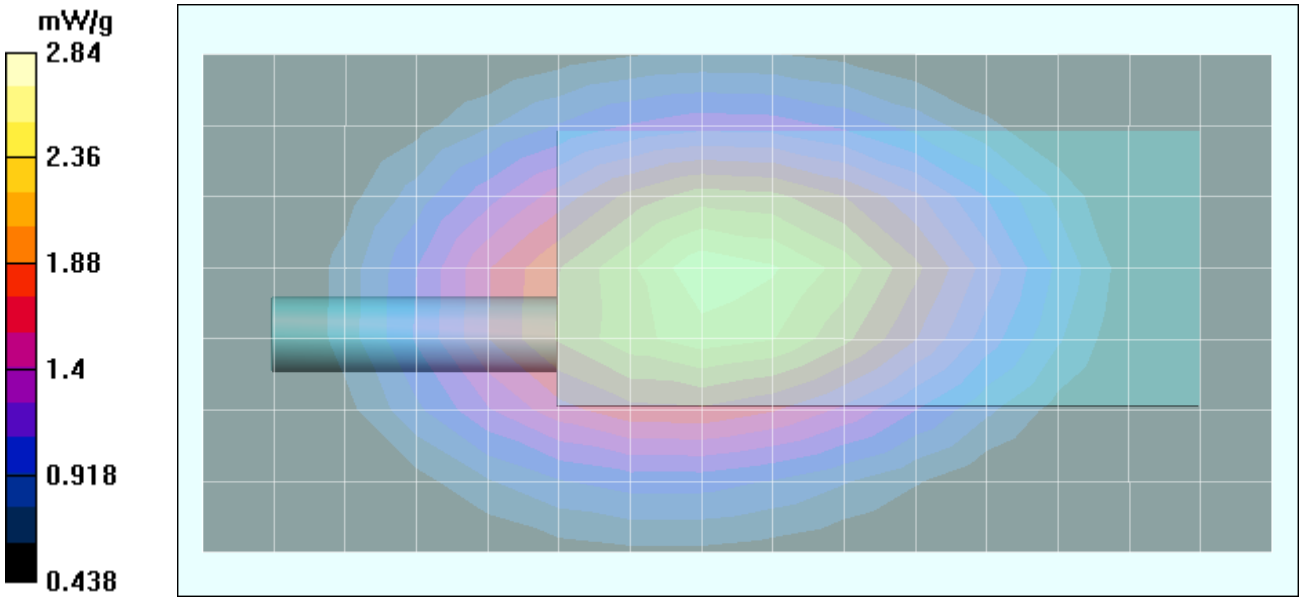
Ambient Temp: 22.9 °C; Fluid Temp: 21.3 °C; Barometric Pressure: 103.5 kPa; Humidity: 30%

Communication System: FM UHF
8.4V, 2400mAH Li-Ion Battery Pack
RF Output Power: 4.79 Watts (ERP)
Frequency: 462.6375 MHz; Duty Cycle: 1:1
Medium: M450 (σ = 0.89 mho/m; ε_r = 57.0; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1387; ConvF(7.6, 7.6, 7.6); Calibrated: 18/03/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 06/07/2004
- Phantom: Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

Body-Worn - 1.4 cm Belt-Clip Separation Distance from Battery to Planar Phantom/Area Scan (8x16x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn - 1.4 cm Belt-Clip Separation Distance from Battery to Planar Phantom/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 51.8 V/m; Power Drift = -0.529 dB
Peak SAR (extrapolated) = 4.13 W/kg
SAR(1 g) = 2.73 mW/g; SAR(10 g) = 1.98 mW/g



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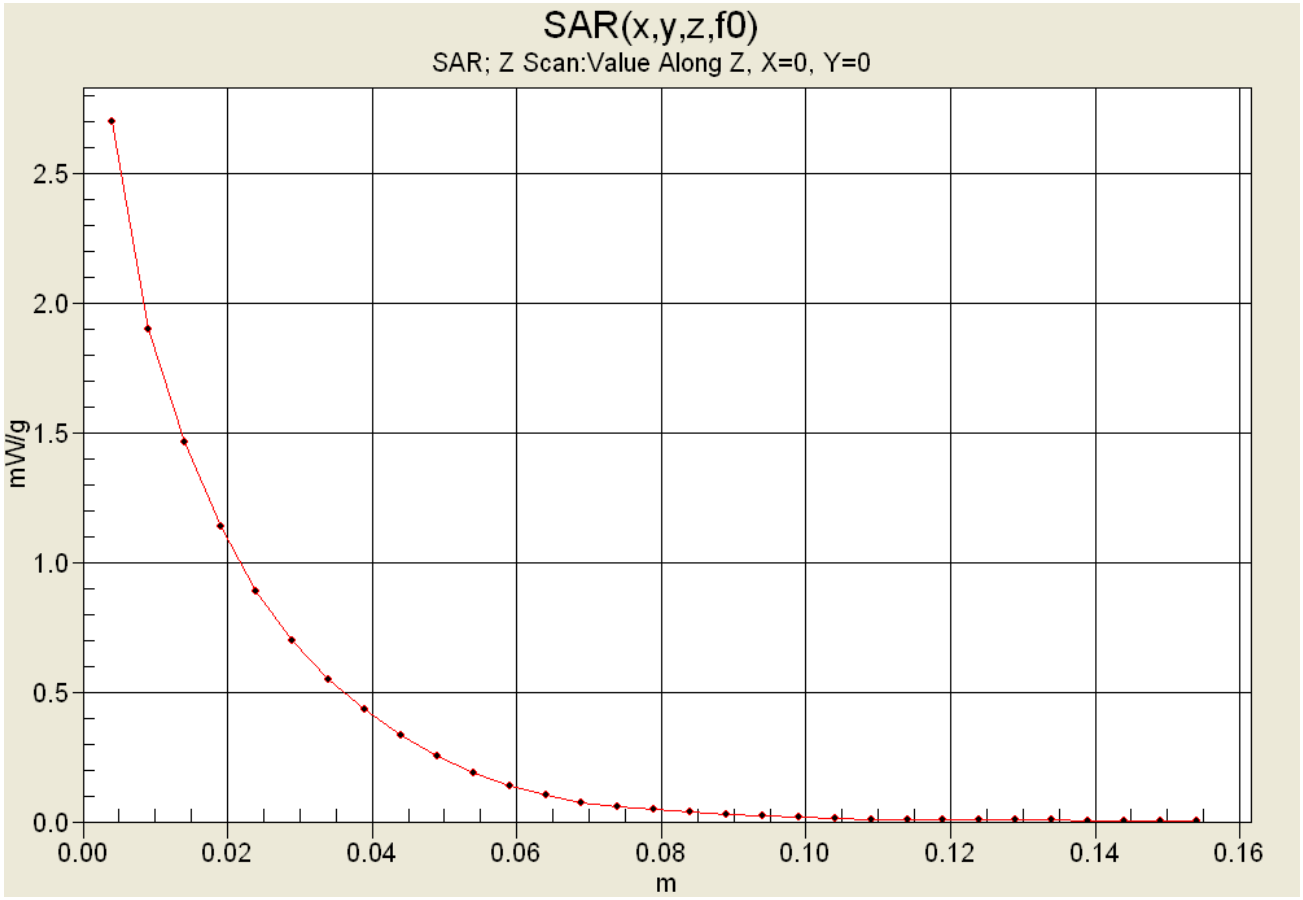
Z-Axis Scan



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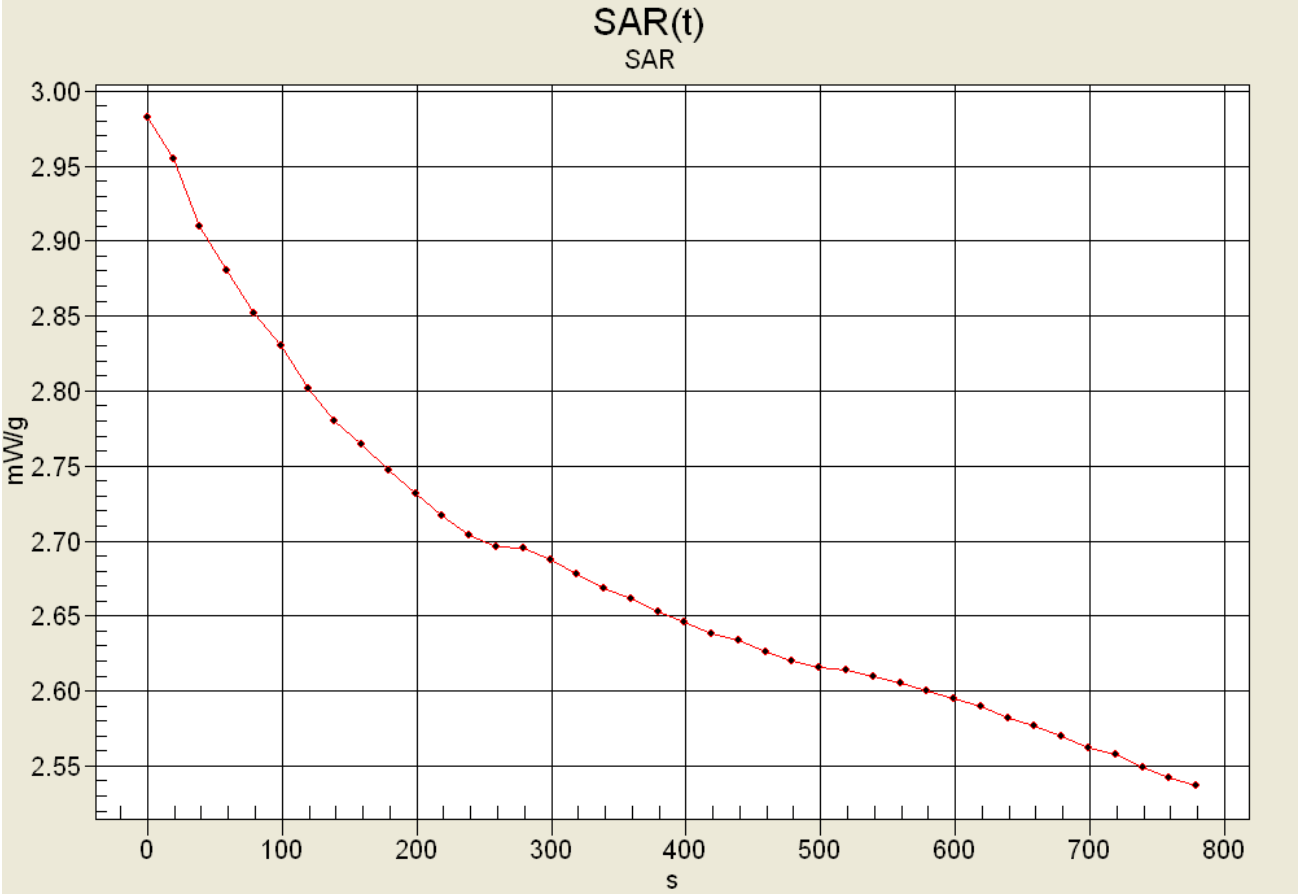
SAR-versus-Time Power Drift Evaluation

Body-Worn with Belt-Clip & Headset/Boom-Microphone
8.4V 2400mAh Li-ion Battery Pack
Channel 4 - 462.6375 MHz



Start SAR: 2.9823 mW/g
End SAR: 2.53713 mW/g (-0.702 dB)
SAR after 340s: 2.66881 mW/g (-0.482 dB)
(340s = Zoom Scan Duration)
(780s = Area Scan Duration)

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APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

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Date Tested: 02/15/05

System Performance Check - 450 MHz Dipole

DUT: Dipole 450 MHz; Model: D450V2; Type: System Performance Check; Serial: 136; Calibrated: 11/04/2004

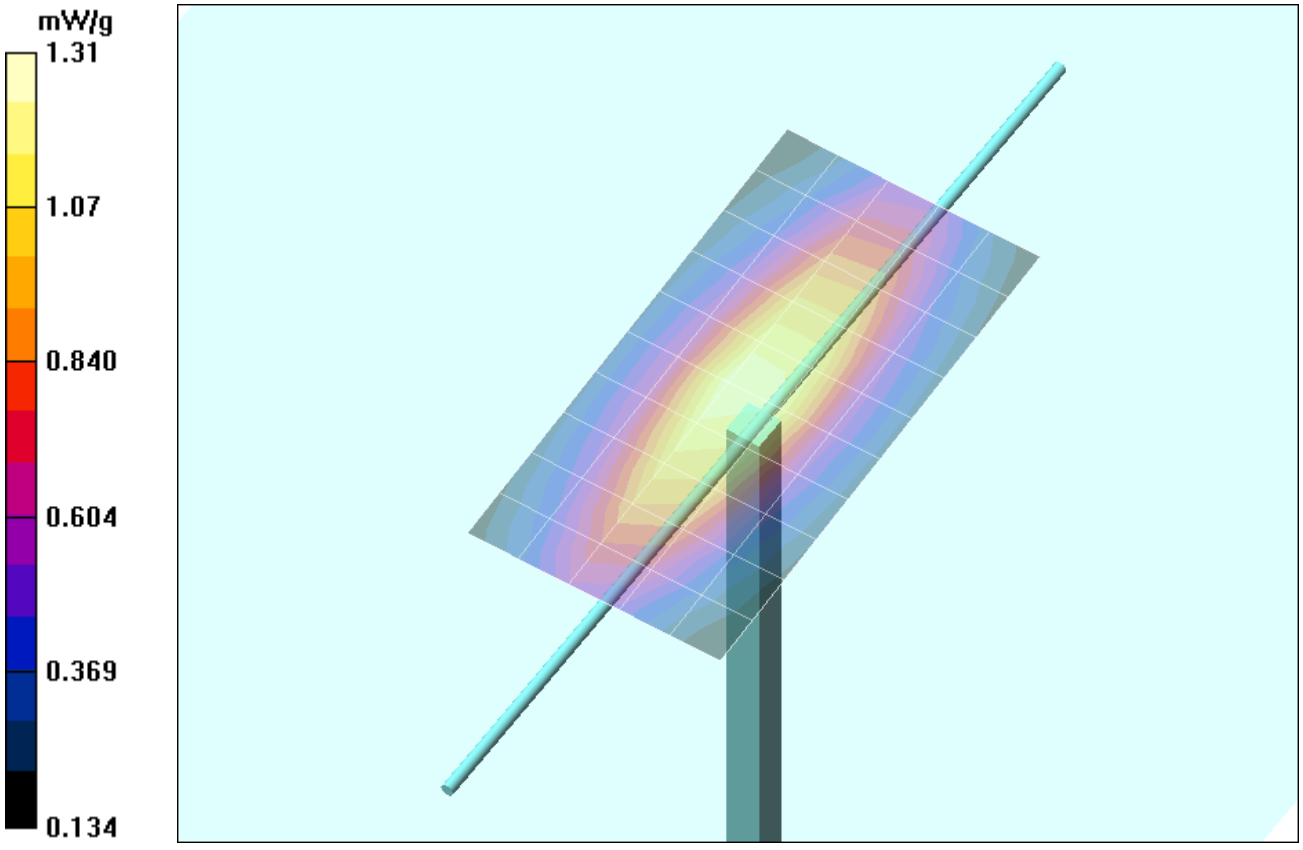
Ambient Temp: 22.8 °C; Fluid Temp: 20.9 °C; Barometric Pressure: 103.4 kPa; Humidity: 30%

Communication System: CW
Forward Conducted Power: 250 mW
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: 18/03/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 06/07/2004
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

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

450 MHz Dipole - System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.8 V/m; Power Drift = -0.003 dB
Peak SAR (extrapolated) = 2.17 W/kg
SAR(1 g) = 1.25 mW/g; SAR(10 g) = 0.805 mW/g



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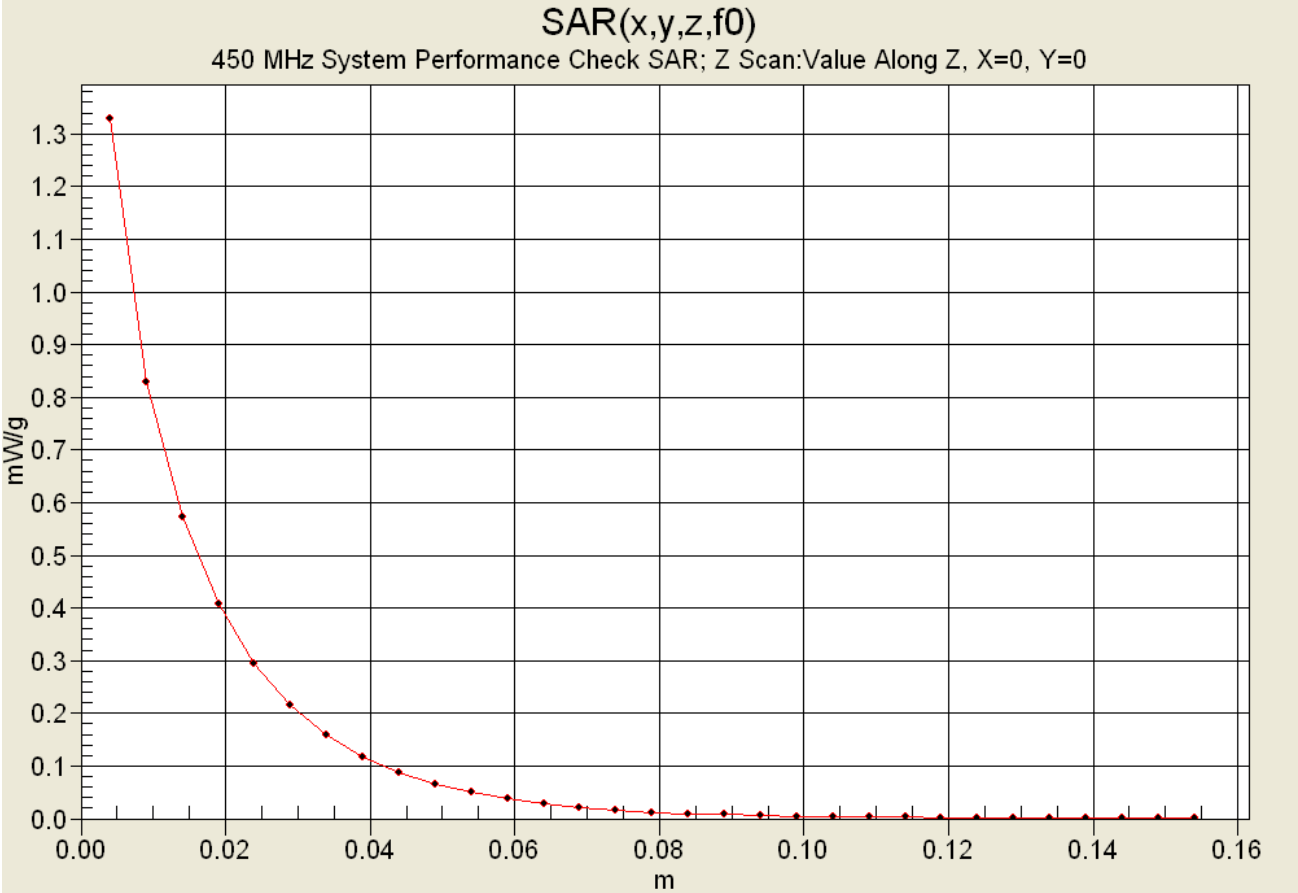
Z-Axis Scan



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Date Tested: 02/17/05

System Performance Check - 450 MHz Dipole

DUT: Dipole 450 MHz; Model: D450V2; Type: System Performance Check; Serial: 136; Calibrated: 11/04/2004

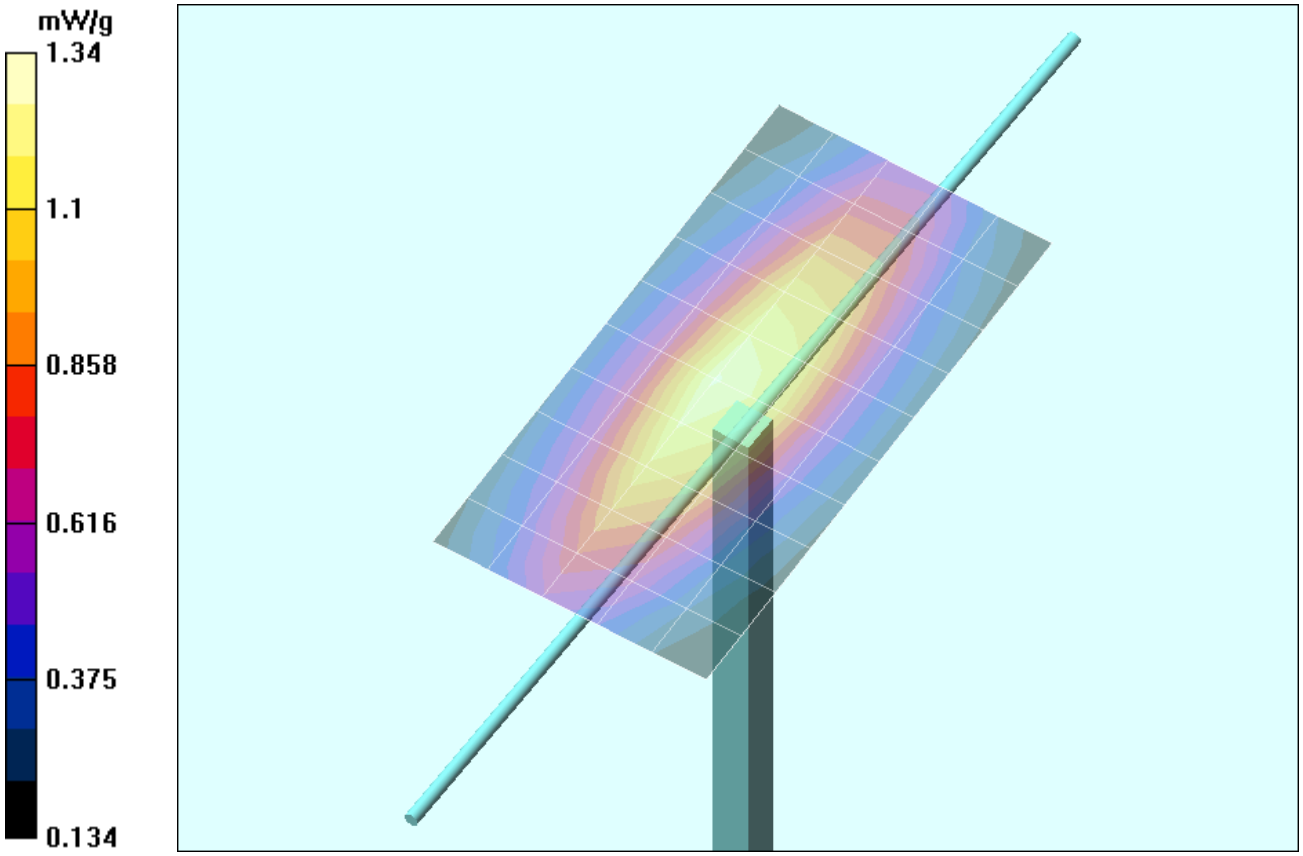
Ambient Temp: 22.1 °C; Fluid Temp: 22.0 °C; Barometric Pressure: 103.4 kPa; Humidity: 30%

Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.84 mho/m; ε_r = 42.3; 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: 06/07/2004
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

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

450 MHz Dipole - System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 40.1 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 2.23 W/kg
SAR(1 g) = 1.27 mW/g; SAR(10 g) = 0.816 mW/g



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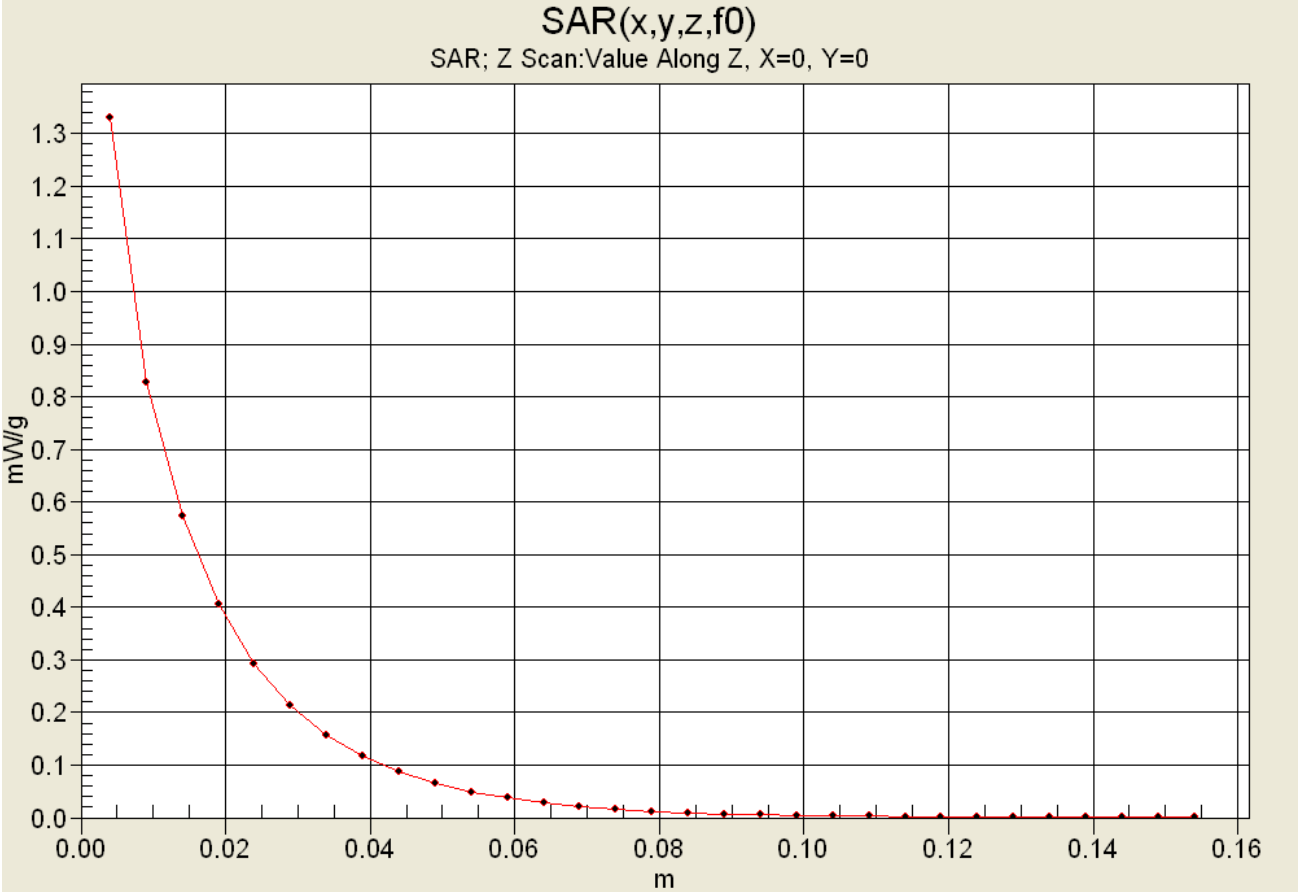
Z-Axis Scan



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APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

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450 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

February 16, 2005

Frequency	e'	e''
350.000000 MHz	58.7753	41.9422
360.000000 MHz	58.6081	41.1633
370.000000 MHz	58.6070	40.4517
380.000000 MHz	58.6418	39.8878
390.000000 MHz	58.4692	39.3849
400.000000 MHz	58.1878	38.8192
410.000000 MHz	57.8549	38.1346
420.000000 MHz	57.6163	37.4543
430.000000 MHz	57.4100	36.7483
440.000000 MHz	57.2222	36.2535
450.000000 MHz	57.0143	35.7644
460.000000 MHz	56.9266	35.4108
470.000000 MHz	56.8427	35.0509
480.000000 MHz	56.7578	34.7489
490.000000 MHz	56.6088	34.4537
500.000000 MHz	56.3428	34.0305
510.000000 MHz	56.1944	33.5206
520.000000 MHz	56.1365	33.1334
530.000000 MHz	56.0124	32.8068
540.000000 MHz	55.8110	32.3066
550.000000 MHz	55.6185	32.0212

450 MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

February 15, 2005

Frequency	e'	e''
350.000000 MHz	45.2409	38.9156
360.000000 MHz	44.9055	38.2102
370.000000 MHz	44.6599	37.6438
380.000000 MHz	44.3533	37.1046
390.000000 MHz	44.0019	36.6002
400.000000 MHz	43.7724	36.1055
410.000000 MHz	43.5765	35.6304
420.000000 MHz	43.4117	35.1733
430.000000 MHz	43.1788	34.6690
440.000000 MHz	42.9717	34.2127
450.000000 MHz	42.7532	33.7504
460.000000 MHz	42.6010	33.4264
470.000000 MHz	42.3874	32.9551
480.000000 MHz	42.1851	32.5634
490.000000 MHz	41.8665	32.1552
500.000000 MHz	41.6249	31.8368
510.000000 MHz	41.3835	31.5651
520.000000 MHz	41.2008	31.2950
530.000000 MHz	41.0083	31.0211
540.000000 MHz	40.8572	30.6716
550.000000 MHz	40.7070	30.3891

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450 MHz System Performance Check & DUT Evaluation (Face)

Measured Fluid Dielectric Parameters (Brain)

February 17, 2005

Frequency	e'	e''
350.000000 MHz	44.6697	38.5978
360.000000 MHz	44.3108	37.9644
370.000000 MHz	44.0453	37.3992
380.000000 MHz	43.7433	36.7926
390.000000 MHz	43.4897	36.2857
400.000000 MHz	43.2130	35.8287
410.000000 MHz	43.0663	35.3359
420.000000 MHz	42.8704	34.8728
430.000000 MHz	42.7398	34.3341
440.000000 MHz	42.4937	33.9504
450.000000 MHz	42.2832	33.4857
460.000000 MHz	42.0779	33.1229
470.000000 MHz	41.8419	32.6820
480.000000 MHz	41.5954	32.2881
490.000000 MHz	41.3603	31.9091
500.000000 MHz	41.1084	31.5826
510.000000 MHz	40.8731	31.3004
520.000000 MHz	40.7067	30.9858
530.000000 MHz	40.4910	30.7239
540.000000 MHz	40.3734	30.3449
550.000000 MHz	40.1921	30.1146

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APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS

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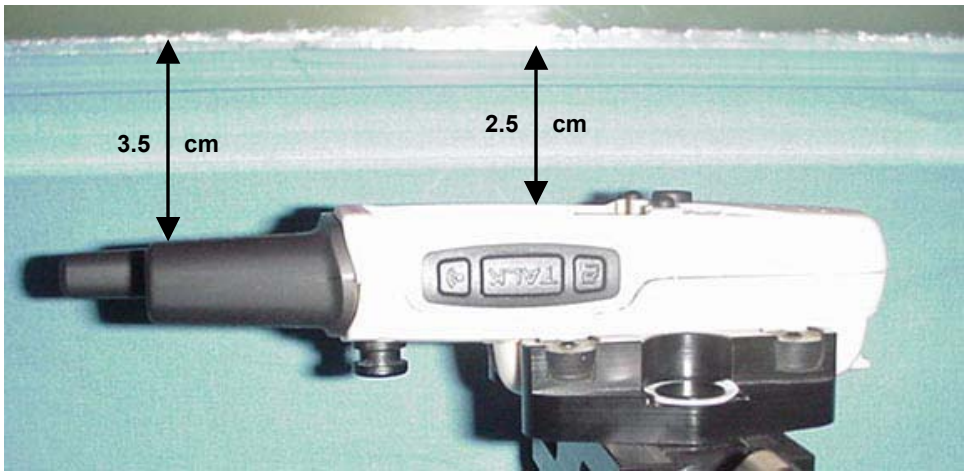
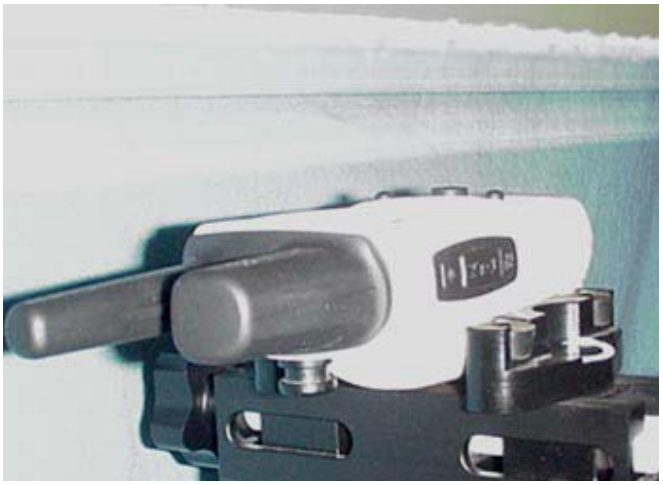
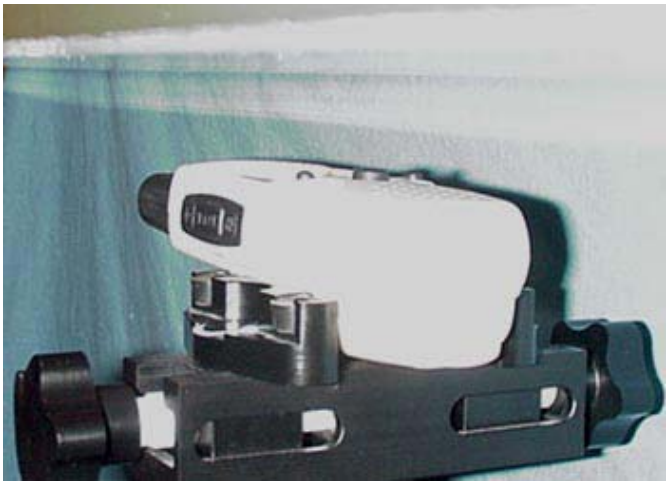
FACE-HELD SAR TEST SETUP PHOTOGRAPHS

2.5 cm Separation Distance from Front of Radio to Planar Phantom







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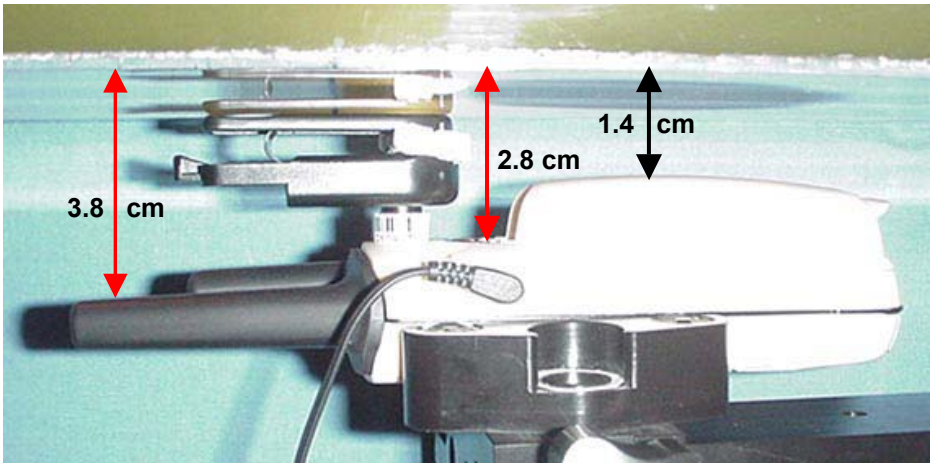
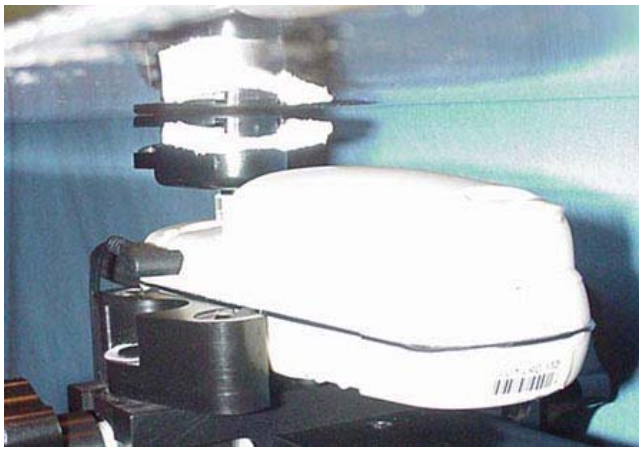
BODY-WORN SAR TEST SETUP PHOTOGRAPHS

1.4 cm Belt-Clip Separation Distance from Back of Radio (Battery Casing) to Planar Phantom
With Earbud & PTT Microphone Accessory (P/N: 010-10347-00)





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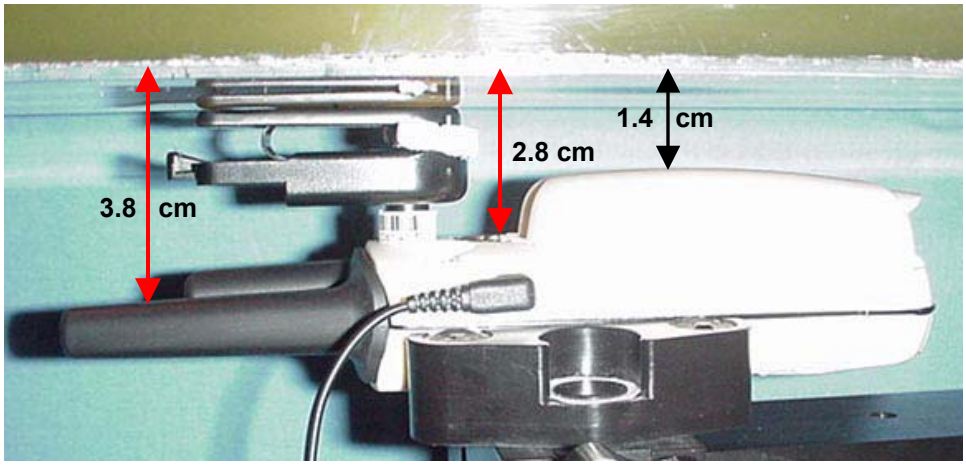
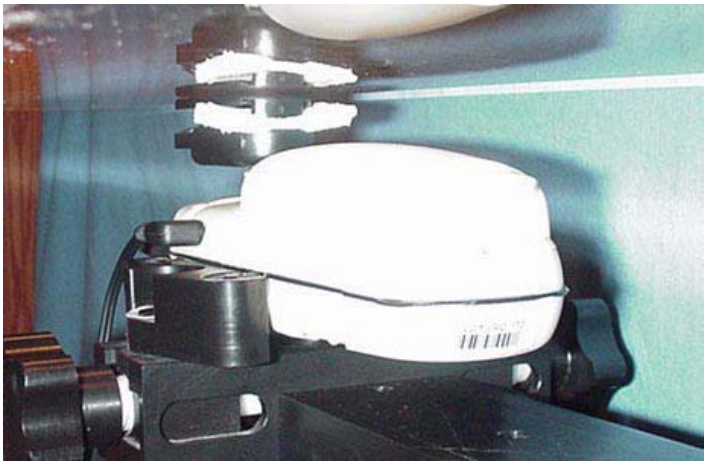
BODY-WORN SAR TEST SETUP PHOTOGRAPHS

1.4 cm Belt-Clip Separation Distance from Back of Radio (Battery Casing) to Planar Phantom With Headset & Boom-Microphone Accessory (P/N: 010-10345-00)





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SAR TEST SETUP PHOTOGRAPHS

Face-Held Setup

Body-Worn Setup

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DUT PHOTOGRAPHS

Front of DUT

Back of DUT & Battery Casing

Back of DUT with Swivel Belt-Clip

Top of DUT

Bottom of DUT

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DUT PHOTOGRAPHS

Left Side of DUT with Swivel Belt-Clip

Right Side of DUT with Swivel Belt-Clip

Swivel Belt-Clip accessory - Plastic with metal spring (P/N: 013-00063-00)

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DUT PHOTOGRAPHS

DUT with Earbud and PTT Microphone accessory (P/N: 010-10347-00)

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DUT PHOTOGRAPHS

DUT with Headset and Boom-Microphone accessory (P/N: 010-10345-00)

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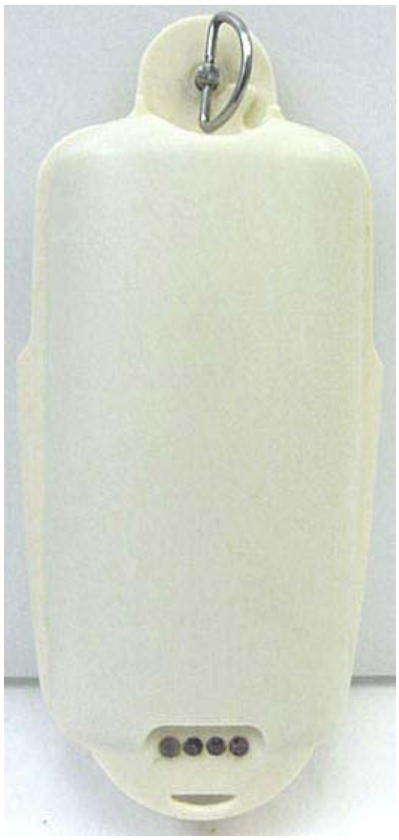
DUT PHOTOGRAPHS

DUT Battery Compartment



Li-ion Battery

Li-ion Battery

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APPENDIX E - SYSTEM VALIDATION

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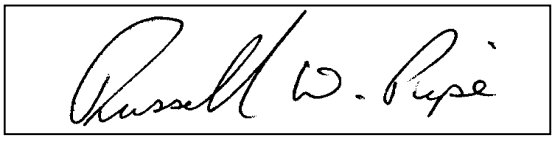
450 MHz SYSTEM VALIDATION DIPOLE

Type:	**450 MHz Validation Dipole**
Serial Number:	**136**
Place of Calibration:	**Celltech Labs Inc.**
Date of Calibration:	**November 4, 2004**

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

Calibrated by: 

Approved by: 

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

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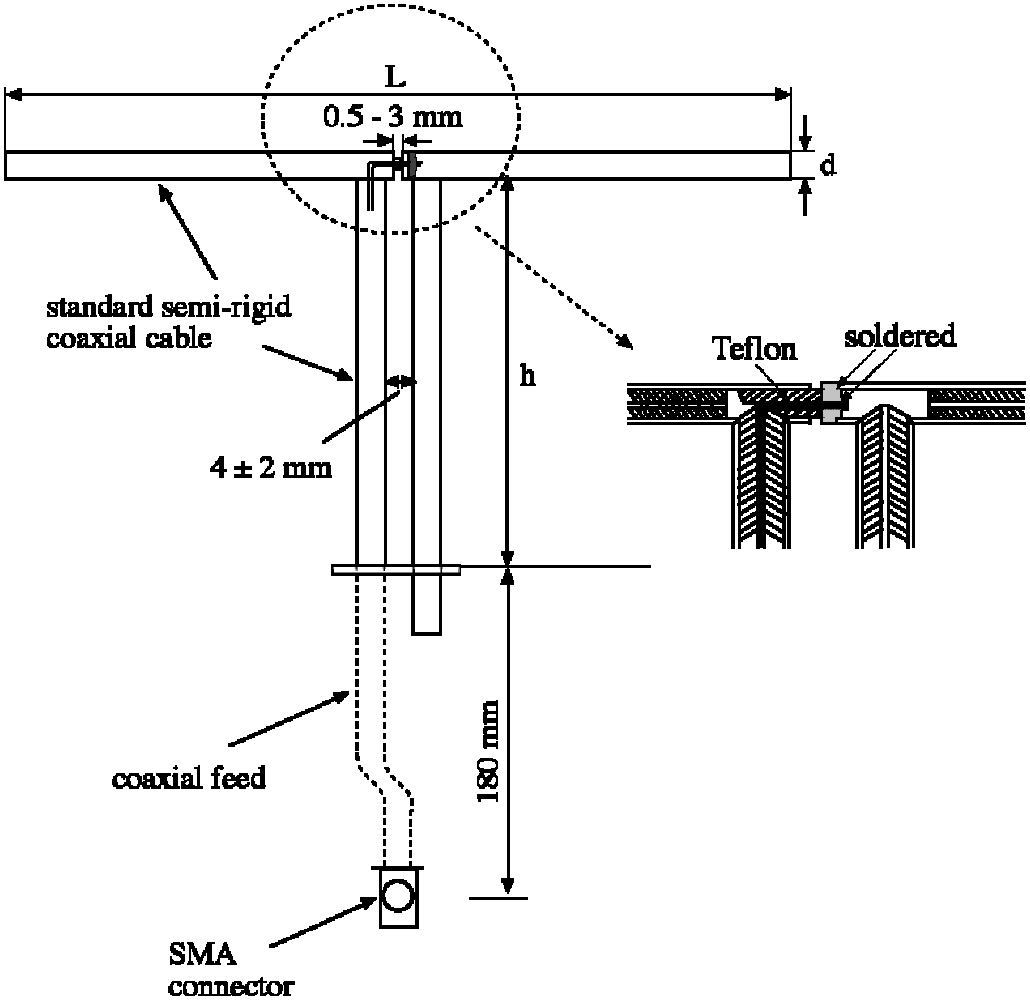
1. Dipole Construction & Electrical Characteristics

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} = 54.041Ω
	Im{Z} = 5.5258Ω
Return Loss at 450MHz	-23.744dB



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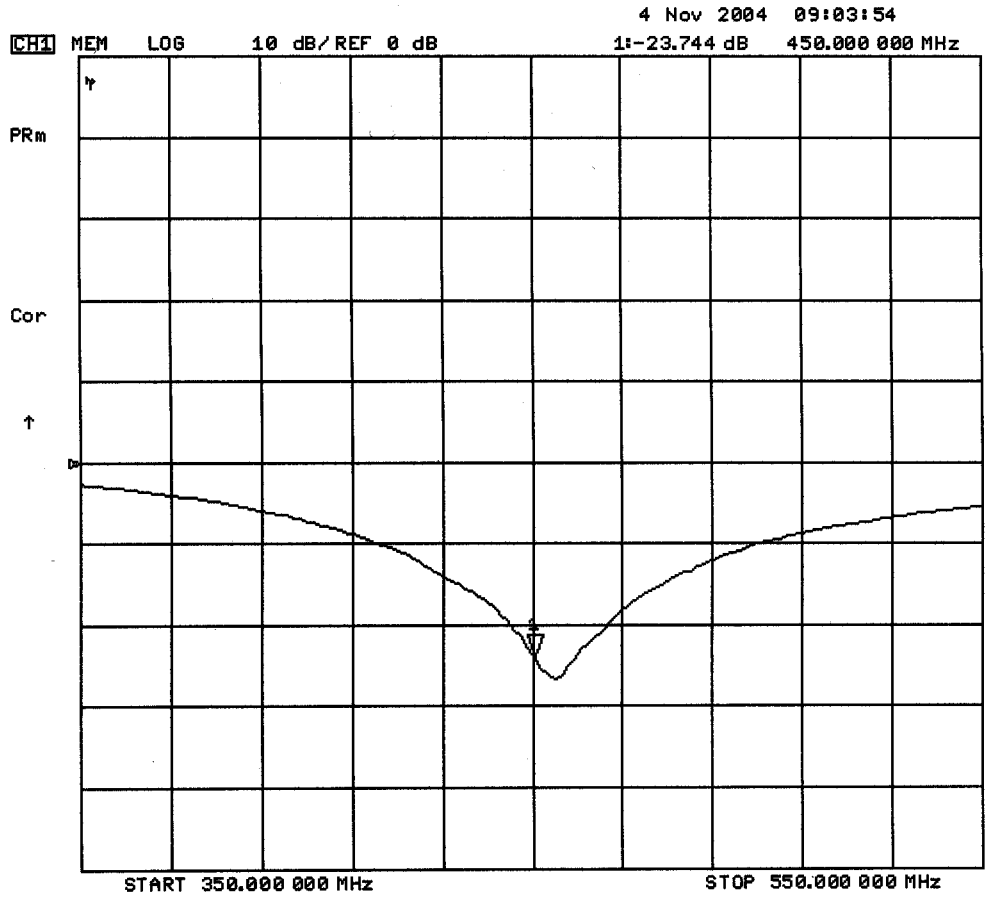
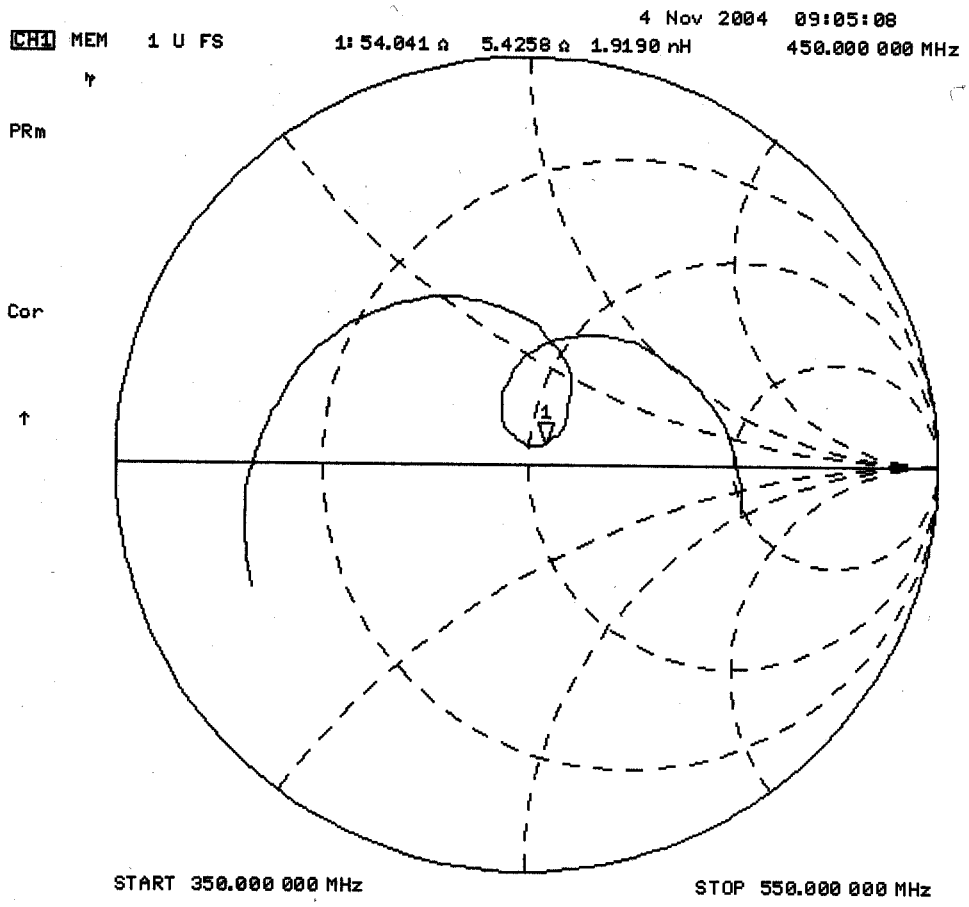

4 Nov 2004 09:03:54
CH1 MEM LOG 10 dB/ REF 0 dB
1:-23.744 dB 450.000 000 MHz
PRm
Cor
START 350.000 000 MHz
STOP 550.000 000 MHz


4 Nov 2004 09:05:08
CH1 MEM 1 U FS
1: 54.041 Ω 5.4258 Ω 1.9190 nH
450.000 000 MHz
PRm
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.

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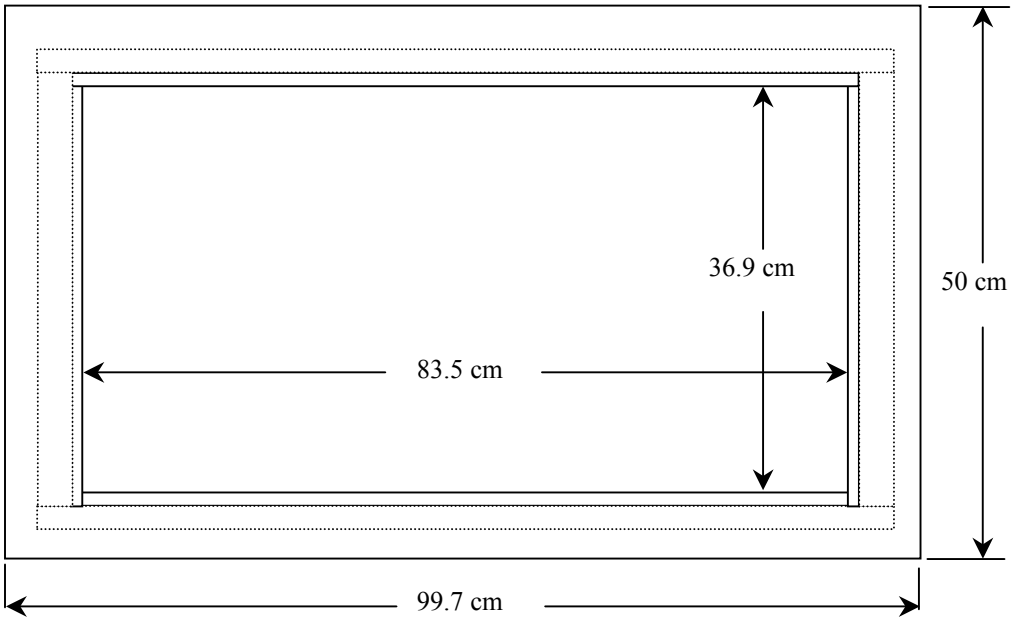
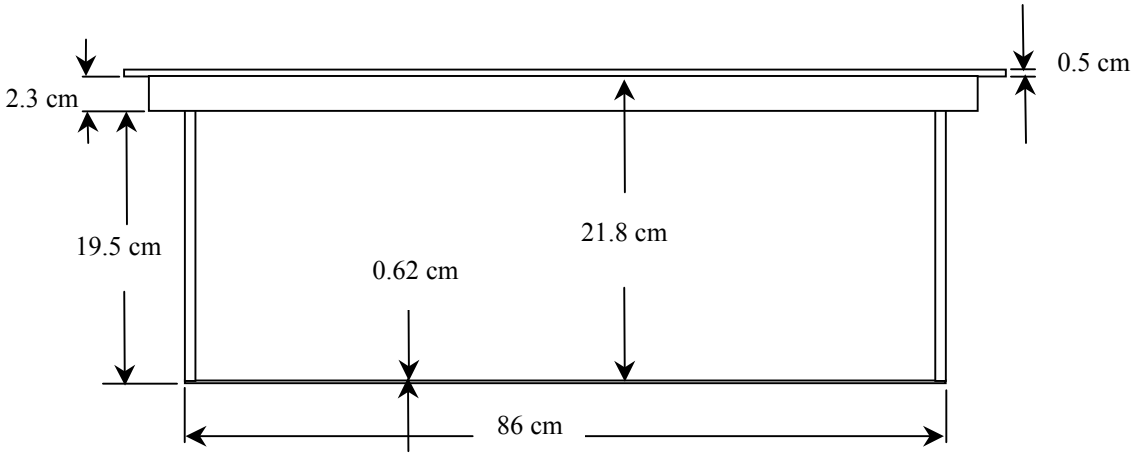
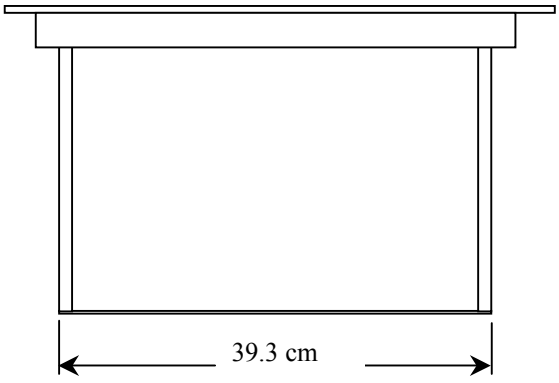
4. Dimensions of Plexiglas Planar Phantom







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5. 450 MHz System Validation Setup

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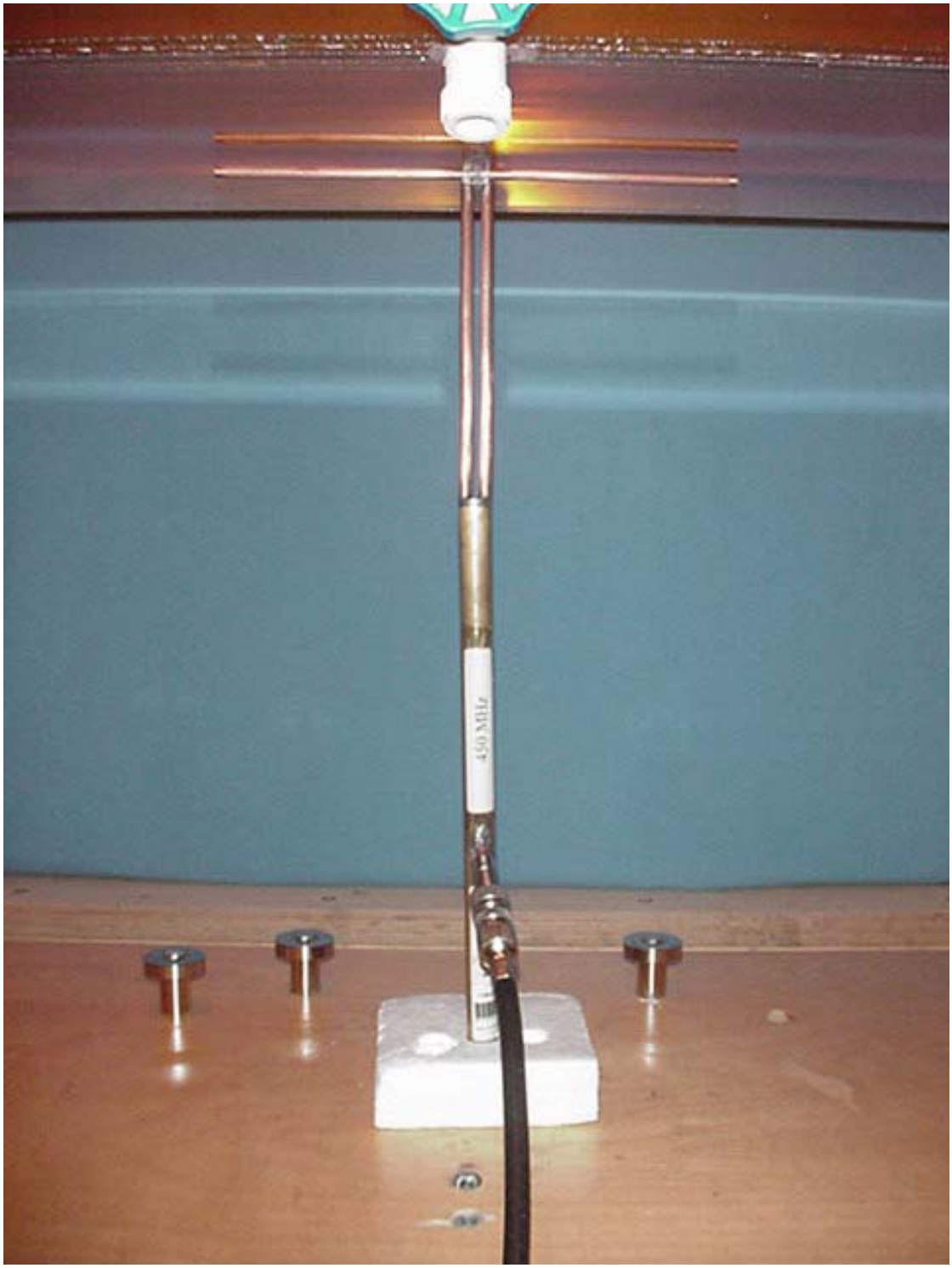
450 MHz Validation Dipole Setup



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6. Measurement Conditions

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

Relative Permittivity:	42.9
Conductivity:	0.85 mho/m
Fluid Temperature:	21.9 °C
Fluid Depth:	≥ 15.0 cm

Environmental Conditions:

Ambient Temperature:	22.4 °C
Humidity:	31 %
Barometric Pressure:	103.2 kPa

The 450 MHz 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%
450 MHz Target Dielectric Parameters at 22 °C	ε_r = 43.5 σ = 0.87 S/m

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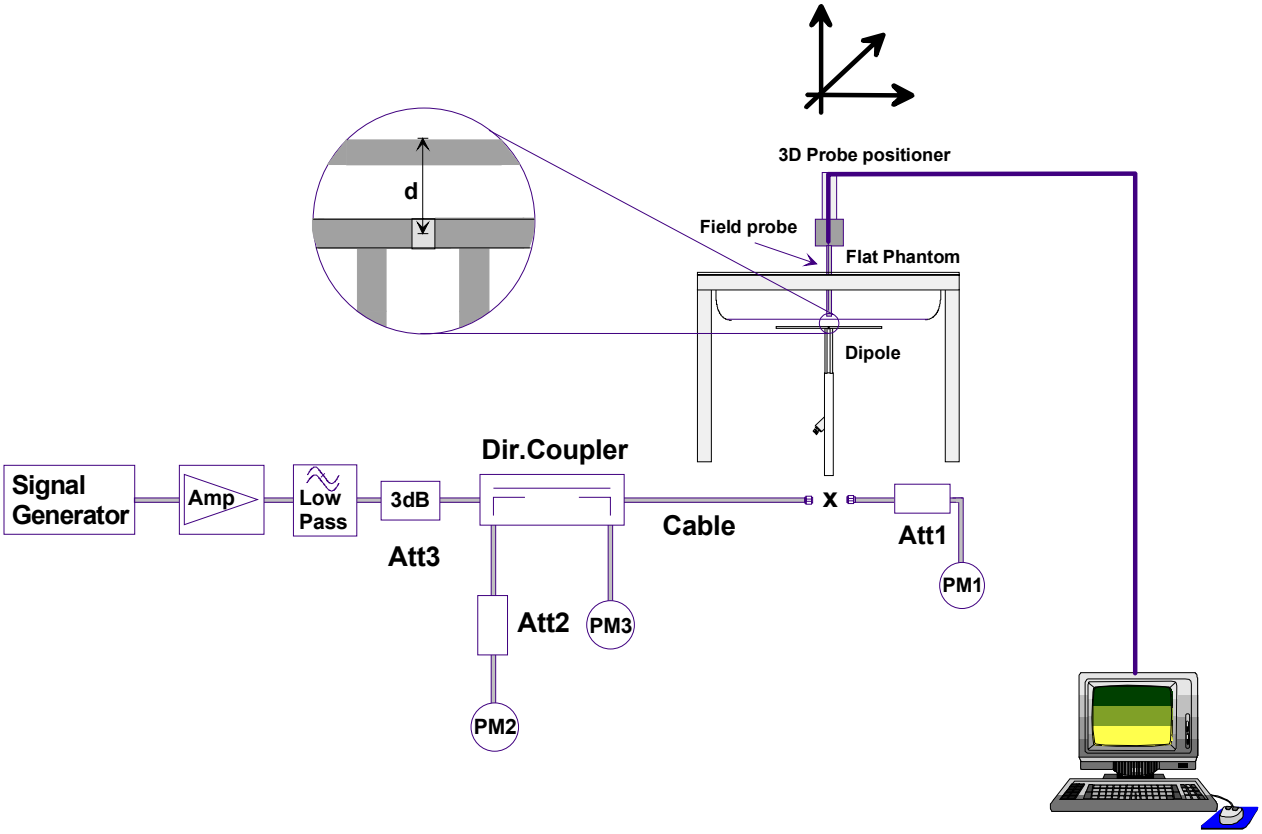
7. SAR Measurement

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.

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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	1.22	4.88	0.782	3.128	1.29
Test 2	1.23	4.92	0.791	3.164	1.30
Test 3	1.23	4.92	0.789	3.156	1.30
Test 4	1.23	4.92	0.790	3.160	1.31
Test 5	1.24	4.96	0.793	3.172	1.31
Test 6	1.24	4.96	0.792	3.168	1.31
Test 7	1.23	4.92	0.791	3.164	1.31
Test 8	1.23	4.92	0.789	3.156	1.30
Test 9	1.24	4.96	0.791	3.164	1.31
Test 10	1.23	4.92	0.789	3.156	1.31
Average Value	1.23	4.93	0.790	3.16	1.31

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

IEEE Target over $1cm^3$ (1g) of tissue: 4.9 mW/g (+/- 10%)

Averaged over 1cm (1g) of tissue: 4.93 mW/g (deviation +0.6%)

IEEE Target over $10cm^3$ (10g) of tissue: 3.3 mW/g (+/- 10%)

Averaged over 10cm (10g) of tissue: 3.16 mW/g (deviation -4.2%)

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450 MHz System Validation - November 4, 2004

DUT: Dipole 450 MHz; Model: D450V2; Serial: 136; Calibrated: 11/04/2004
Ambient Temp: 22.4 °C; Fluid Temp: 21.9 °C; Barometric Pressure: 103.2 kPa; Humidity: 31%

Communication System: CW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.85 mho/m; ε_r = 42.9; 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 Sn370; Calibrated: 14/05/2004
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

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

450 MHz System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.3 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 2.15 W/kg
SAR(1 g) = 1.22 mW/g; SAR(10 g) = 0.782 mW/g

450 MHz System Validation/Zoom Scan 2 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.2 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 2.16 W/kg
SAR(1 g) = 1.23 mW/g; SAR(10 g) = 0.791 mW/g

450 MHz System Validation/Zoom Scan 3 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.1 V/m; Power Drift = -0.004 dB
Peak SAR (extrapolated) = 2.16 W/kg
SAR(1 g) = 1.23 mW/g; SAR(10 g) = 0.789 mW/g

450 MHz System Validation/Zoom Scan 4 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.2 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 2.18 W/kg
SAR(1 g) = 1.23 mW/g; SAR(10 g) = 0.790 mW/g

450 MHz System Validation/Zoom Scan 5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.2 V/m; Power Drift = 0.009 dB
Peak SAR (extrapolated) = 2.18 W/kg
SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.793 mW/g

450 MHz System Validation/Zoom Scan 6 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.1 V/m; Power Drift = 0.007 dB
Peak SAR (extrapolated) = 2.18 W/kg
SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.792 mW/g

450 MHz System Validation/Zoom Scan 7 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.2 V/m; Power Drift = 0.004 dB
Peak SAR (extrapolated) = 2.18 W/kg
SAR(1 g) = 1.23 mW/g; SAR(10 g) = 0.791 mW/g

450 MHz System Validation/Zoom Scan 8 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.2 V/m; Power Drift = 0.0 dB
Peak SAR (extrapolated) = 2.16 W/kg
SAR(1 g) = 1.23 mW/g; SAR(10 g) = 0.789 mW/g

450 MHz System Validation/Zoom Scan 9 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.4 V/m; Power Drift = 0.0 dB
Peak SAR (extrapolated) = 2.19 W/kg
SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.791 mW/g

450 MHz System Validation/Zoom Scan 10 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.1 V/m; Power Drift = 0.007 dB
Peak SAR (extrapolated) = 2.16 W/kg
SAR(1 g) = 1.23 mW/g; SAR(10 g) = 0.789 mW/g

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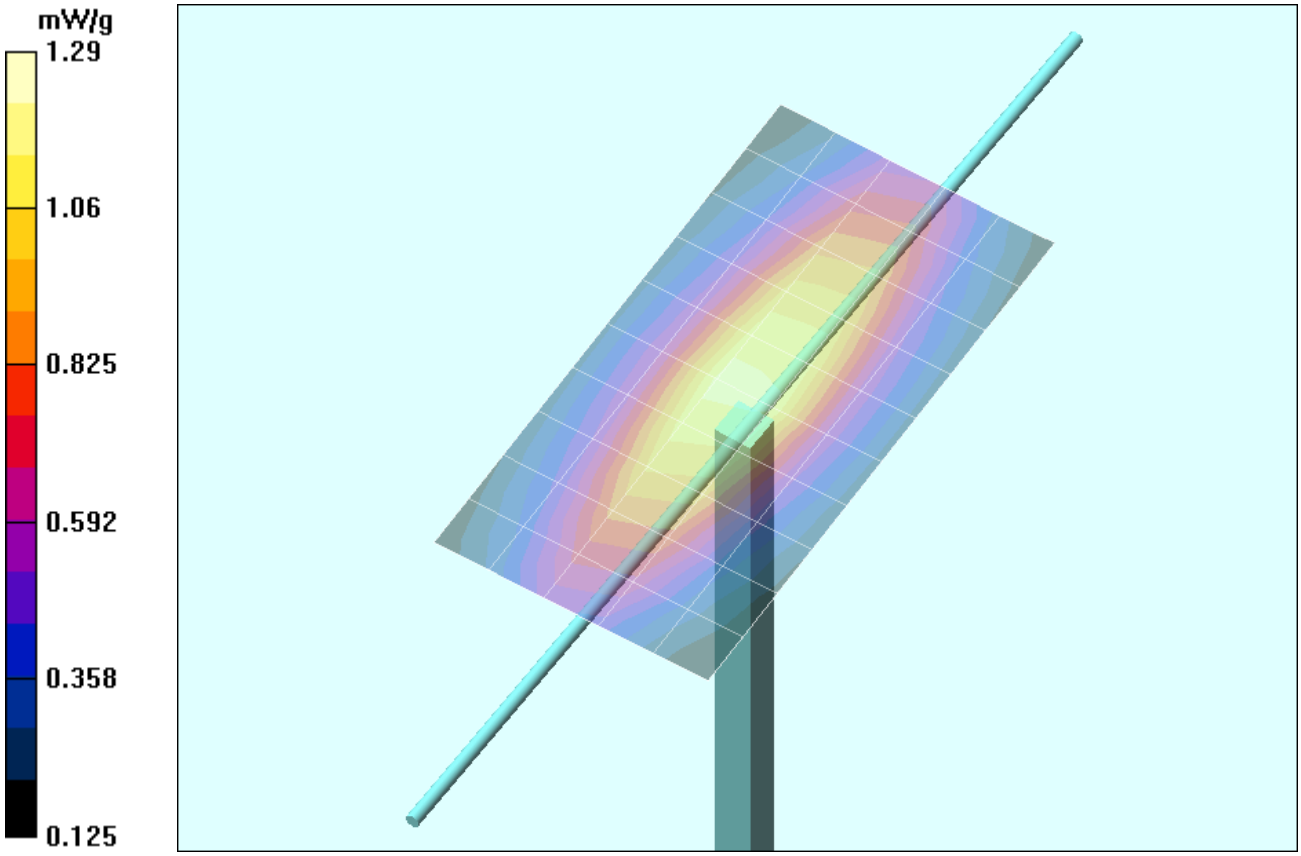
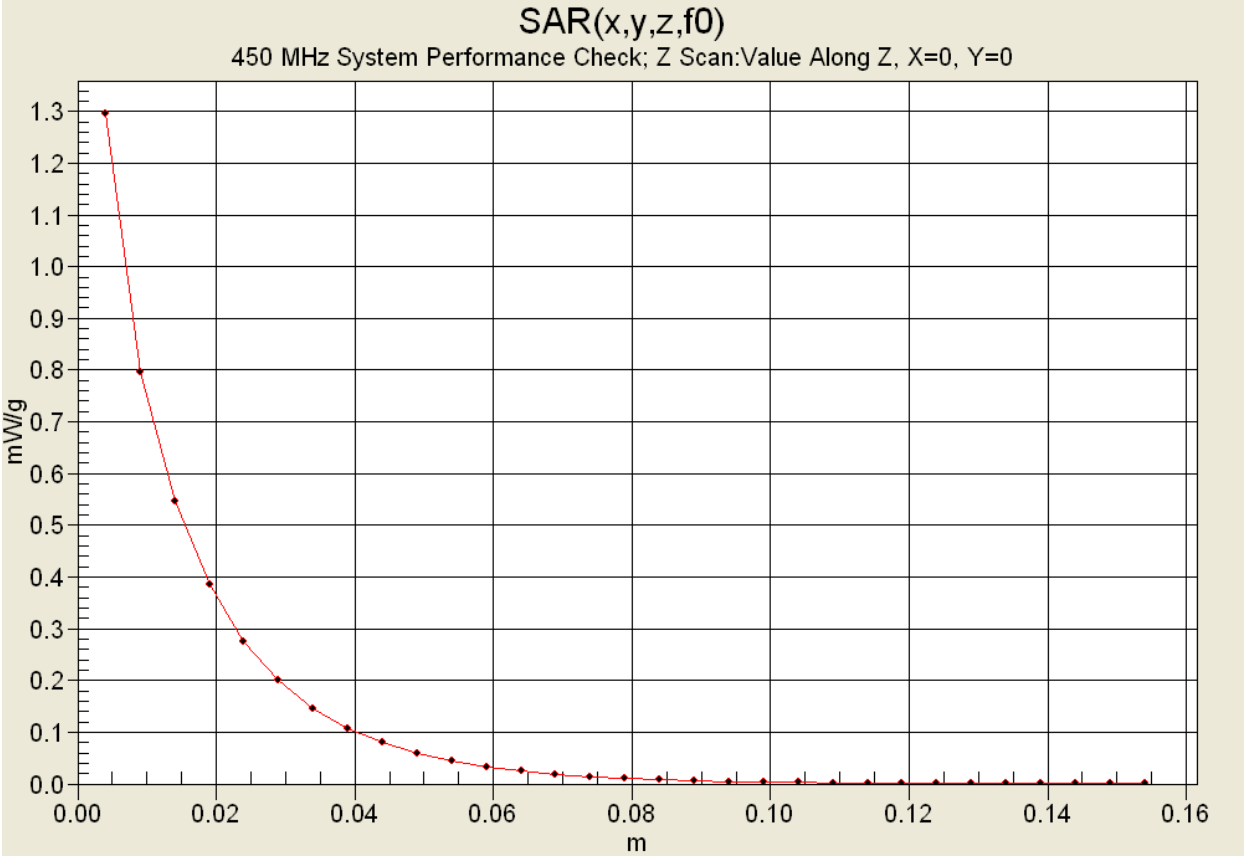


1 g average of 10 measurements: 1.23 mW/g
10 g average of 10 measurements: 0.790 mW/g



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450MHz System Validation

Measured Fluid Dielectric Parameters (Brain)

November 04, 2004

Frequency	e'	e"
350.000000 MHz	45.3974	39.4988
360.000000 MHz	45.0834	38.7858
370.000000 MHz	44.8651	38.1777
380.000000 MHz	44.6622	37.6103
390.000000 MHz	44.3761	37.1472
400.000000 MHz	44.1745	36.5919
410.000000 MHz	43.8392	36.0417
420.000000 MHz	43.6277	35.5608
430.000000 MHz	43.3443	34.9958
440.000000 MHz	43.1200	34.5629
450.000000 MHz	42.8999	34.1583
460.000000 MHz	42.7154	33.7478
470.000000 MHz	42.4773	33.4083
480.000000 MHz	42.2998	33.0563
490.000000 MHz	42.0302	32.7340
500.000000 MHz	41.8641	32.3576
510.000000 MHz	41.6518	31.9703
520.000000 MHz	41.4863	31.6232
530.000000 MHz	41.2685	31.3144
540.000000 MHz	41.1027	30.8977
550.000000 MHz	40.9455	30.6347

APPENDIX F - PROBE CALIBRATION

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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	
Approved by:	Katja Pokovic	Laboratory Director	

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

Diode Compression[A]

NormX	**1.62** $\mu V/(V/m)^2$	DCP X	**92**	mV
NormY	**1.71** $\mu V/(V/m)^2$	DCP Y	**92**	mV
NormZ	**1.71** $\mu V/(V/m)^2$	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

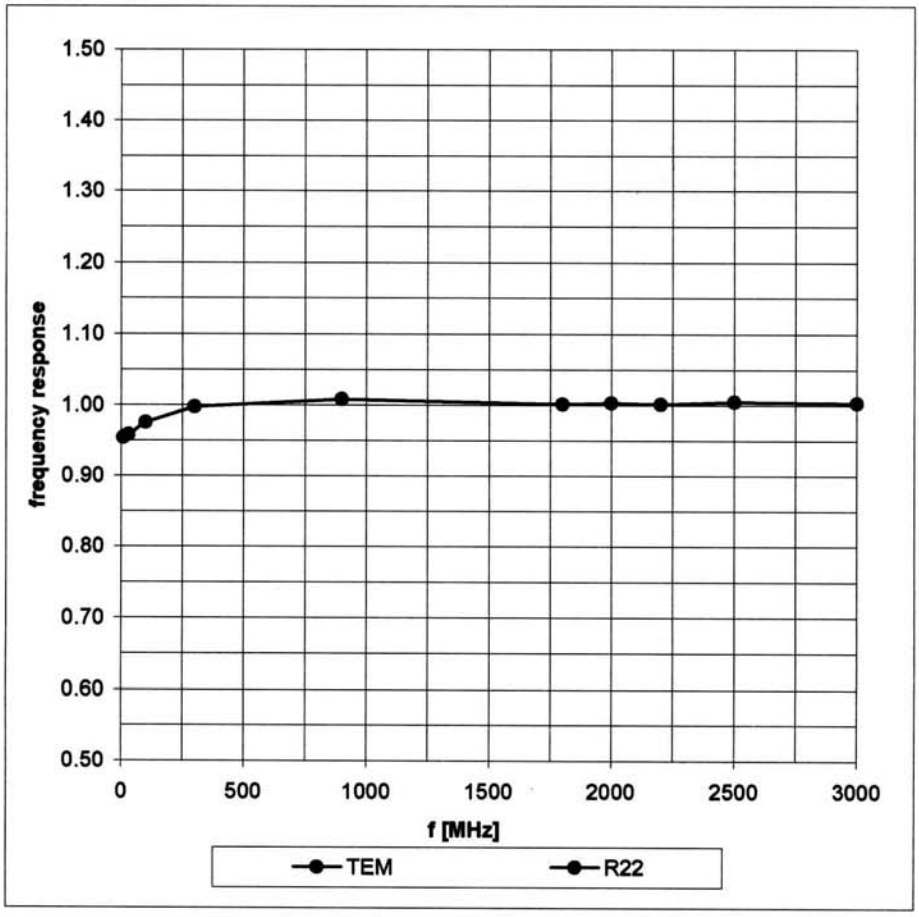
Probe Tip to Sensor Center	**2.7** mm
Optical Surface Detection	**in tolerance**

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%.

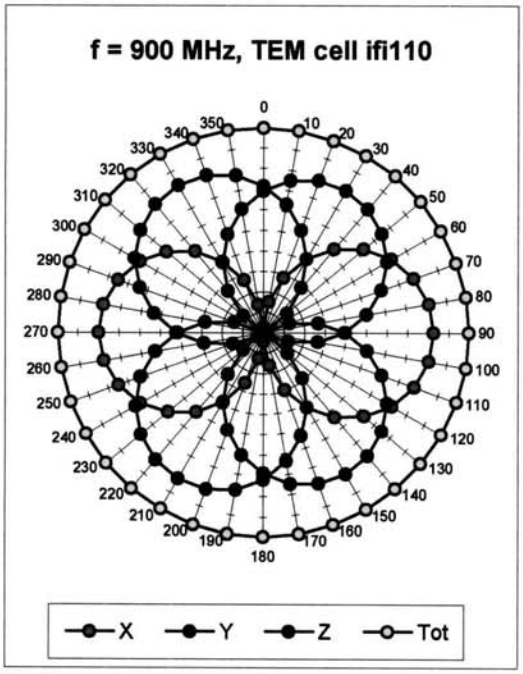
[A] numerical linearization parameter: uncertainty not required

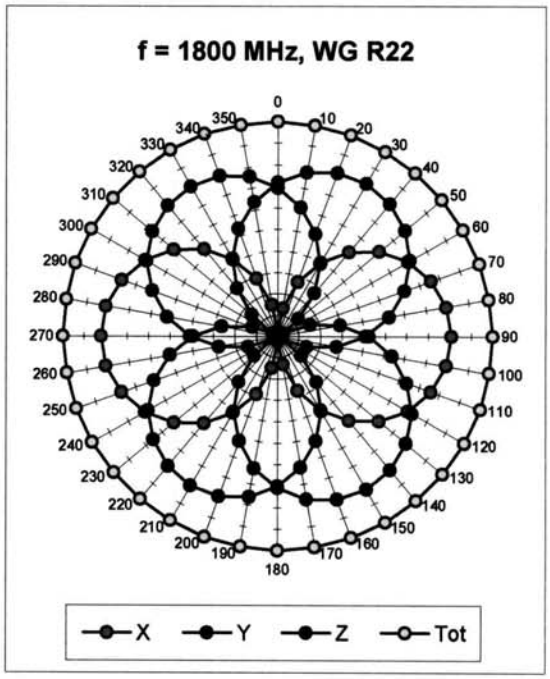
Frequency Response of E-Field

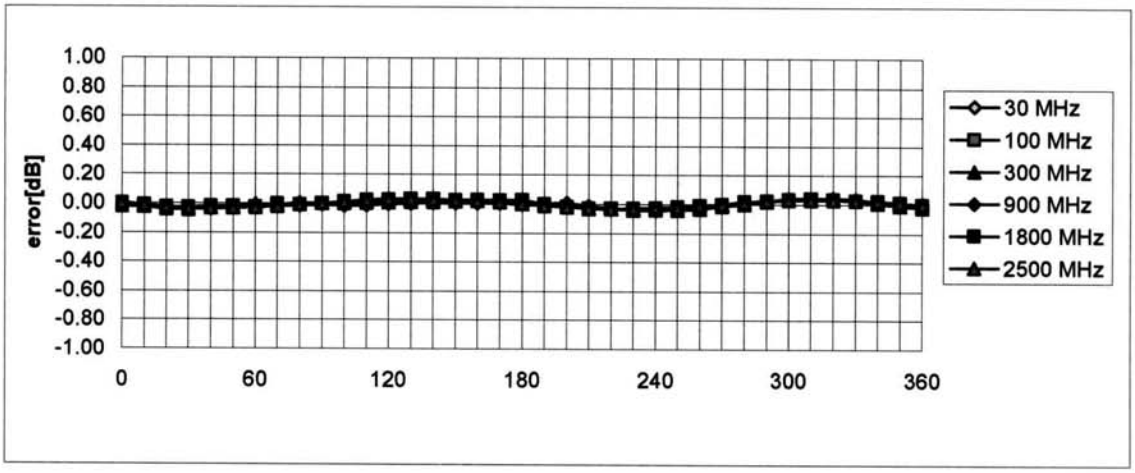
(TEM-Cell:ifi110, Waveguide R22)



Receiving Pattern (ϕ) , θ = 0°



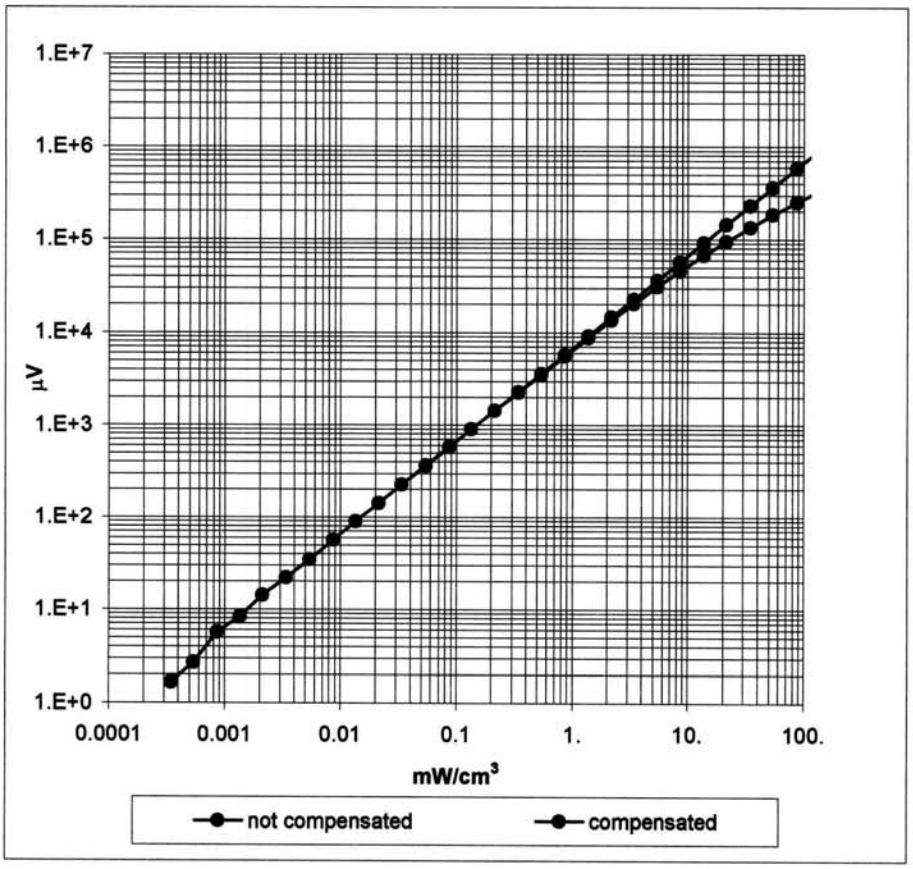


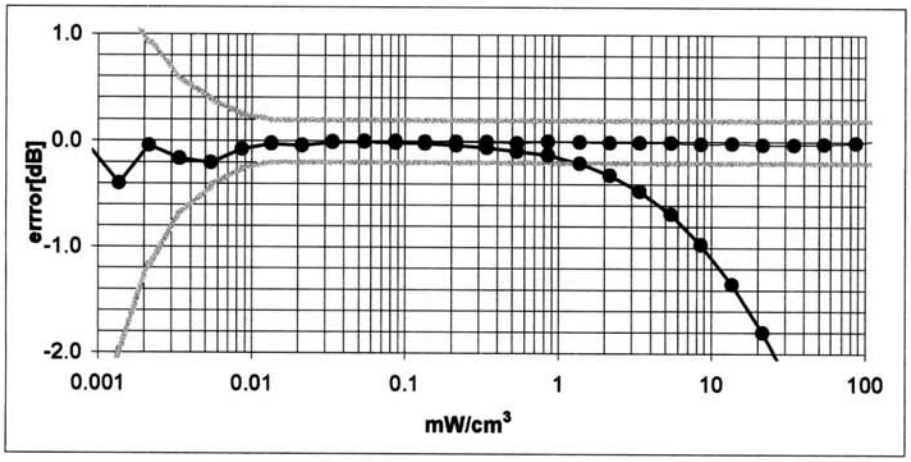


Axial Isotropy Error < ± 0.2 dB

Dynamic Range f(SAR_{head})

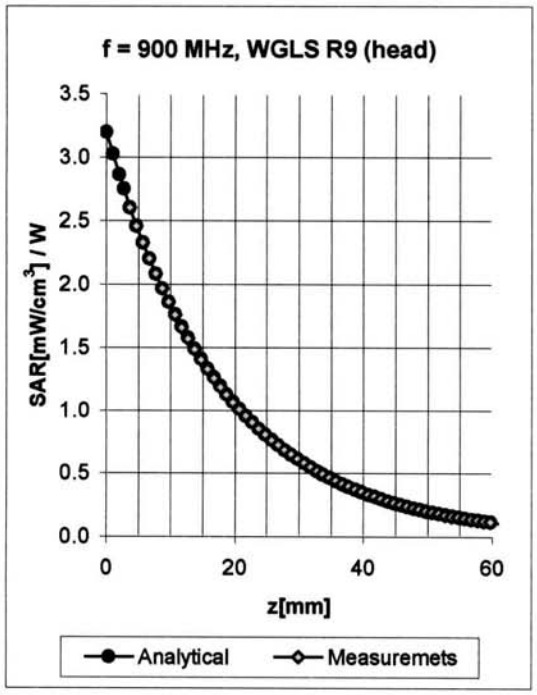
(Waveguide R22)

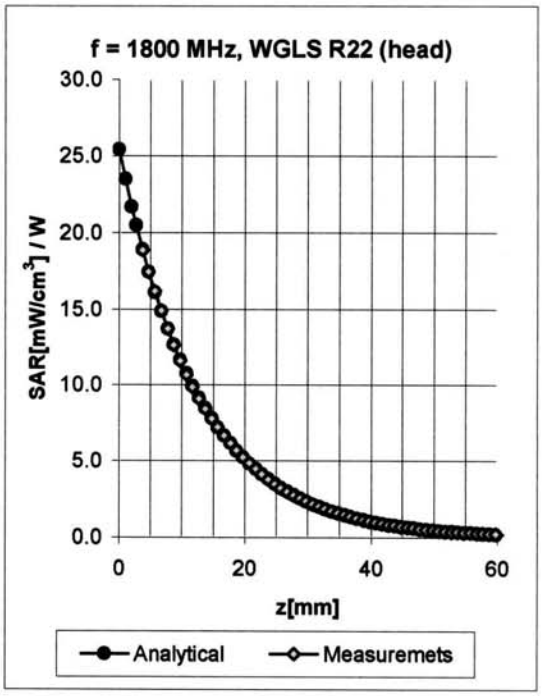




Probe Linearity < ± 0.2 dB

Conversion Factor Assessment



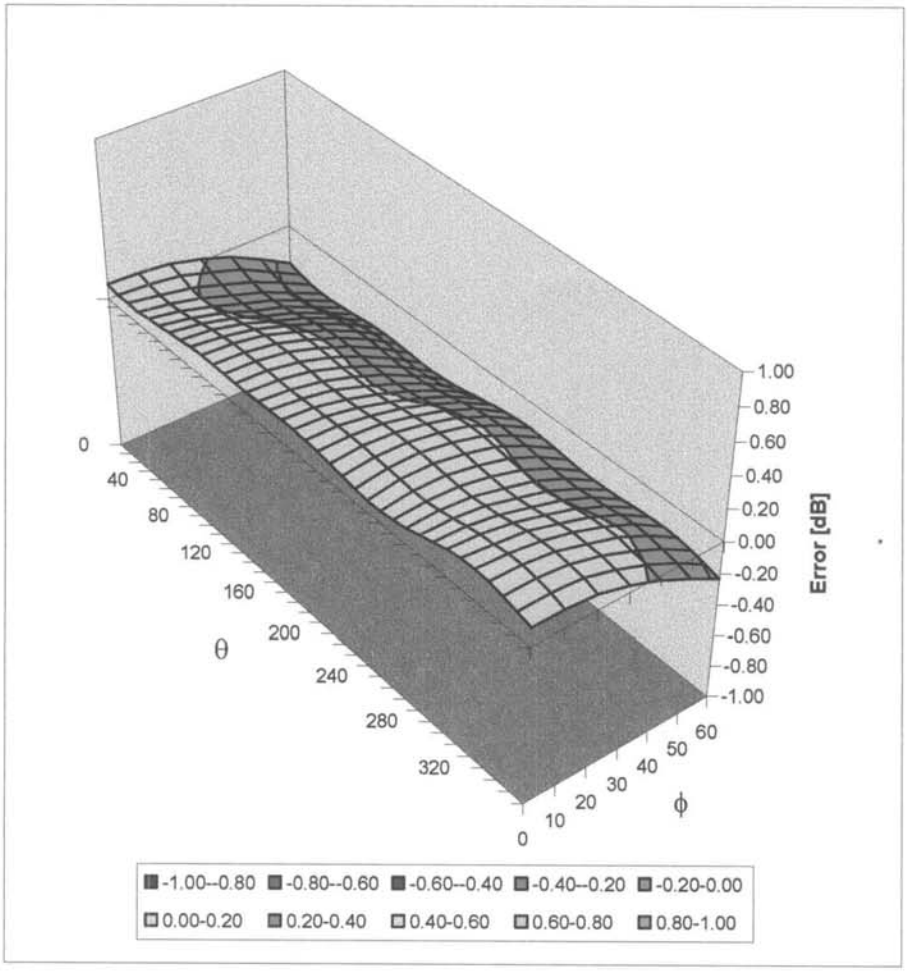


f [MHz]	Validity [MHz][B]	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	750-950	Head	41.5 ± 5%	0.90 ± 5%	0.72	1.78	6.71 ± 11.9% (k=2)
1750	1700-1800	Head	40.0 ± 5%	1.40 ± 5%	0.51	2.67	5.38 ± 9.7% (k=2)
1900	1850-1950	Head	40.0 ± 5%	1.40 ± 5%	0.55	2.66	5.25 ± 9.7% (k=2)
2450	2400-2500	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

Schmid & Partner Engineering AG

s p e a g

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Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

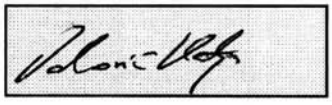
Additional Conversion Factors

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:



Schmid & Partner Engineering AG

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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.