DECLARATION OF COMPLIANCE
SAR EVALUATION

Test Lab

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Applicant Information

KENWOOD USA 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 (Edition 01-01)**
Device Type:	**Portable UHF PTT Radio Transceiver**
FCC ID:	**ALH36423120**
Model(s):	**TK-3160-2**
Modulation:	**FM (UHF)**
Tx Frequency Range:	**470-512 MHz**
Max. RF Output Power Tested:	**4.28 Watts (Conducted)**
Antenna Type(s):	**1. Whip (P/N: KRA-27 (M2))** **2. Stubby (P/N: KRA-23 (M2))**
Battery Type(s):	**NiMH, 7.2V, 2000mAh (P/N: KNB-26N)**
Body-Worn Accessories:	**Belt-Clip, Speaker-Microphone (P/N: KMC-17)**
Max. SAR Measured:	**3.51 W/kg - Face-held (50% Duty Cycle)** **6.43 W/kg - Body-worn (50% Duty Cycle)**

Celltech Labs Inc. declares under its sole responsibility that this device was found to be in compliance with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC 47 CFR §2.1093 and Health Canada's Safety Code 6. The device was tested in accordance with the measurement standards and procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01) and Industry Canada RSS-102 Issue 1 (Provisional) for the Occupational / Controlled Exposure environment.

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
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1.0 INTRODUCTION

This measurement report demonstrates compliance of the Kenwood USA Corp. Model: TK-3160-2 Portable UHF PTT Radio Transceiver FCC ID: ALH36423120 with the RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]), and Health Canada's Safety Code 6 (see reference [2]) for the Occupational / Controlled Exposure environment. The measurement procedures described in FCC OET Bulletin 65, Supplement C (Edition 01-01) (see reference [3]) and IC RSS-102 Issue 1 (Provisional) (see reference [4]), were employed. A description of the product, operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

FCC Rule Part(s)	47 CFR §2.1093
IC Rule Part(s)	RSS-102 Issue 1 (Provisional)
Test Procedure(s)	FCC OET Bulletin 65, Supplement C (Edition 01-01)
Device Type	Portable UHF PTT Radio Transceiver
FCC ID	ALH36423120
Model(s)	TK-3160-2
Serial No.	Pre-production unit
Modulation	FM (UHF)
Tx Frequency Range	470-512 MHz
Max. RF Output Power Tested	4.28 Watts (Conducted)
Antenna Type(s)	Whip - 140 mm (P/N: KRA-27(M2)) Stubby - 82 mm (P/N: KRA-23M2)
Battery Type(s)	NiMH, 7.2V, 2000mAh (P/N: KNB-26N)
Body-Worn Accessories Tested	Belt-Clip, Speaker-Microphone (P/N: KMC-17)

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

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

SAR EVALUATION RESULTS

Freq. (MHz)	Chan.	Measured Conducted RF Output Power			Antenna Type	Accessory Type	Sep. Dist. (cm)	Test Type	Measured SAR (W/kg)		SAR versus Time Drift (dB)	Scaled SAR (W/kg)	
		Before (W)	After (W)	Drift (dB)					100% Duty Cycle	50% Duty Cycle		100% Duty Cycle	50% Duty Cycle
491	Mid	4.22	3.81	-0.44	Stubby	--	2.5	Face	5.51	2.76	-0.66	6.41	3.21
491	Mid	4.08	3.73	-0.39	Whip	--	2.5	Face	6.03	3.02	-0.66	7.02	3.51
491	Mid	4.15	3.92	-0.25	Stubby	Belt-Clip Speaker-Mic	0.9	Body	7.80	3.9	-0.66	9.08	4.54
470	Low	4.17	3.90	-0.29	Stubby	Belt-Clip Speaker-Mic	0.9	Body	11.1	5.55	-0.66	12.92	6.46
512	High	4.28	3.68	-0.66	Stubby	Belt-Clip Speaker-Mic	0.9	Body	4.07	2.04	-0.66	4.74	2.36
491	Mid	4.20	3.82	-0.41	Whip	Belt-Clip Speaker-Mic	0.9	Body	9.58	4.79	-0.66	11.15	5.58
470	Low	4.17	3.76	-0.45	Whip	Belt-Clip Speaker-Mic	0.9	Body	9.57	4.79	-0.66	11.14	5.57
512	High	3.87	3.37	-0.60	Whip	Belt-Clip Speaker-Mic	0.9	Body	8.83	4.42	-0.66	10.28	5.14

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

	Brain 450MHz			Body 450MHz		
	IEEE Target	Measured		IEEE Target	Measured	
Dielectric Constant ε_r	**43.5 (+/-5%)**	Sept. 30	43.1	**56.7 (+/-5%)**	Oct. 1	58.2
	43.5 (+/-5%)	Oct. 14	42.8	**56.7 (+/-5%)**	Oct. 14	58.2
Conductivity σ (mho/m)	**0.87 (+/-5%)**	Sept. 30	0.84	**0.94 (+/-5%)**	Oct. 1	0.97
	0.87 (+/-5%)	Oct.14	0.85	**0.94 (+/-5%)**	Oct. 14	0.97

	Sept. 30	Oct. 1	Oct. 14
Atmospheric Pressure	102.3 kPa	101.2 kPa	101.8 kPa
Relative Humidity	57%	63%	68%
Ambient Temperature	22.2°C	21.9°C	20.6°C
Fluid Temperature	Brain: 22.1°C	Body: 22.1°C	Brain: 22.0°C Body: 21.9°C
Fluid Depth	≥ 15 cm		
Phantom Section	Planar		

Note(s):

1. If the SAR measurements performed at the middle channel were ≥ 3dB below the SAR limit, SAR evaluation for the low and high channels was optional (per FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]).
2. The power drift measured by the SAR measurement system was > 5%. The maximum power drift was added to the measured SAR levels to show scaled SAR results as listed in the above table.
3. 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.
4. The dielectric properties of the simulated tissue mixtures were verified 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 Kenwood USA Corporation Model: TK-3160-2 Portable UHF PTT Radio Transceiver FCC ID: ALH36423120 was found to be compliant for localized Specific Absorption Rate (Occupational / Controlled Exposure) based on the test provisions and conditions described below. The detailed test setup photographs are shown in Appendix F.

1. The EUT 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 EUT and the outer surface of the planar phantom for the duration of the tests. The EUT was evaluated for face-held SAR with both whip and stubby type antennas.
2. The EUT was evaluated in a body-worn configuration with the back of the radio placed parallel to the outer surface of the planar phantom. The attached belt-clip was touching the planar phantom and provided a 0.9 cm separation distance between the back of the EUT and the outer surface of the planar phantom. The EUT was tested for body-worn SAR with the speaker-microphone accessory connected, and with both whip and stubby type antennas.
3. The conducted power levels were measured before and after each test according to the procedures described in FCC 47 CFR §2.1046.
4. The power drift of the EUT measured by the SAR measurement system was > 5%. The maximum power drift was added to the measured SAR levels to show scaled SAR results, as shown in the test data table (page 5).
5. The EUT 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.
6. The EUT was tested with a fully charged battery.
7. Due to the size of the EUT, a Plexiglas planar phantom was used in place of the SAM phantom. There is currently no approved phantom available that is twice the dimensions of this device.
8. A stack of low-density, low-loss dielectric foamed polystyrene was used in place of the device holder.

6.0 EVALUATION PROCEDURES

a. (i) The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For devices held to the ear during normal operation, both the left and right ear positions were evaluated using the SAM phantom.
   (ii) For body-worn and face-held devices a planar phantom was used.
b. The SAR was determined by a pre-defined procedure within the DASY4 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 15mm x 15mm.

An area scan was determined as follows:

c. Based on the defined area scan grid, a more detailed grid is created to increase the points by a factor of 10. The interpolation function then evaluates all field values between corresponding measurement points.
d. A linear search is applied to find all the candidate maxima. Subsequently, all maxima are removed that are >2 dB from the global maximum. The remaining maxima are then used to position the cube scans.

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

1. 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.
2. 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 using a planar phantom with a 450MHz dipole (see Appendix C for system validation procedure). The dielectric parameters of the simulated tissue fluids were measured prior to the system check using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters). A forward power of 250mW was applied to the dipole and the system was verified to a tolerance of $\pm$10% (see Appendix B for system check test 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)	Ambient Temp.	Fluid Temp.	Fluid Depth
		IEEE Target	Measured	IEEE Target	Measured	IEEE Target	Measured				
09/30/03	Brain	1.23 (±10%)	1.32	43.5 (±5%)	43.1	0.87 (±5%)	0.84	1000	22.2 °C	22.1 °C	≥ 15 cm
10/01/03	Brain	1.23 (±10%)	1.32	43.5 (±5%)	42.8	0.87 (±5%)	0.83	1000	21.9°C	21.9°C	≥ 15 cm
10/14/03	Brain	1.23 (±10%)	1.32	43.5 (±5%)	42.8	0.87 (±5%)	0.85	1000	20.6°C	22.0°C	≥ 15 cm

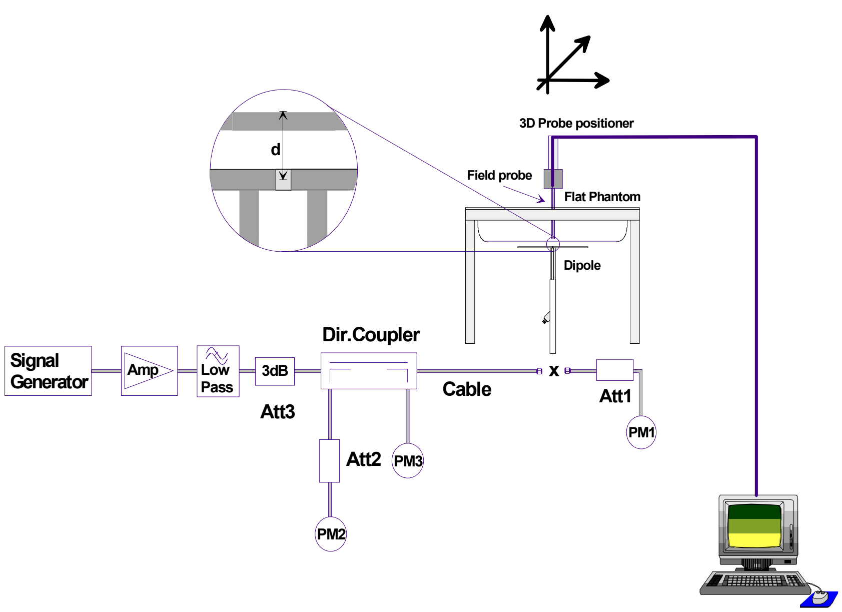


Figure 3. System Check Setup Diagram

450MHz System Check Setup

8.0 SIMULATED EQUIVALENT TISSUES

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

TISSUE SIMULANT 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: Large 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 Detect.	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Dimensions:	Overall length: 330 mm Tip length: 16 mm Body diameter: 12 mm Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 3 GHz Compliance tests of mobile phone


ET3DV6 E-Field Probe

12.0 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 system.


Planar Phantom

13.0 VALIDATION PLANAR PHANTOM

The validation planar phantom is constructed of Plexiglas material with a 6.0 mm shell thickness for system validations at 450MHz and below. The validation planar phantom is mounted in the 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 2002
-450MHz Validation Dipole	136	Oct 2002
-900MHz Validation Dipole	054	June 2003
-1800MHz Validation Dipole	247	June 2003
-2450MHz Validation Dipole	150	Sept 2003
-Planar Phantom	161	N/A
-Validation Planar Phantom	137	N/A
HP 85070C Dielectric Probe Kit	N/A	N/A
Gigatronics 8651A Power Meter	8650137	April 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 2002
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 [3])

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 [3])

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”.

[6] W. Gander, *Computermathematick*, Birkhaeuser, Basel: 1992.

APPENDIX A - SAR MEASUREMENT DATA

Date Tested: 10/14/03

EUT: Kenwood Model: Tk-3160-2; Type: UHF PTT Radio Transceiver; Serial: Pre-production unit

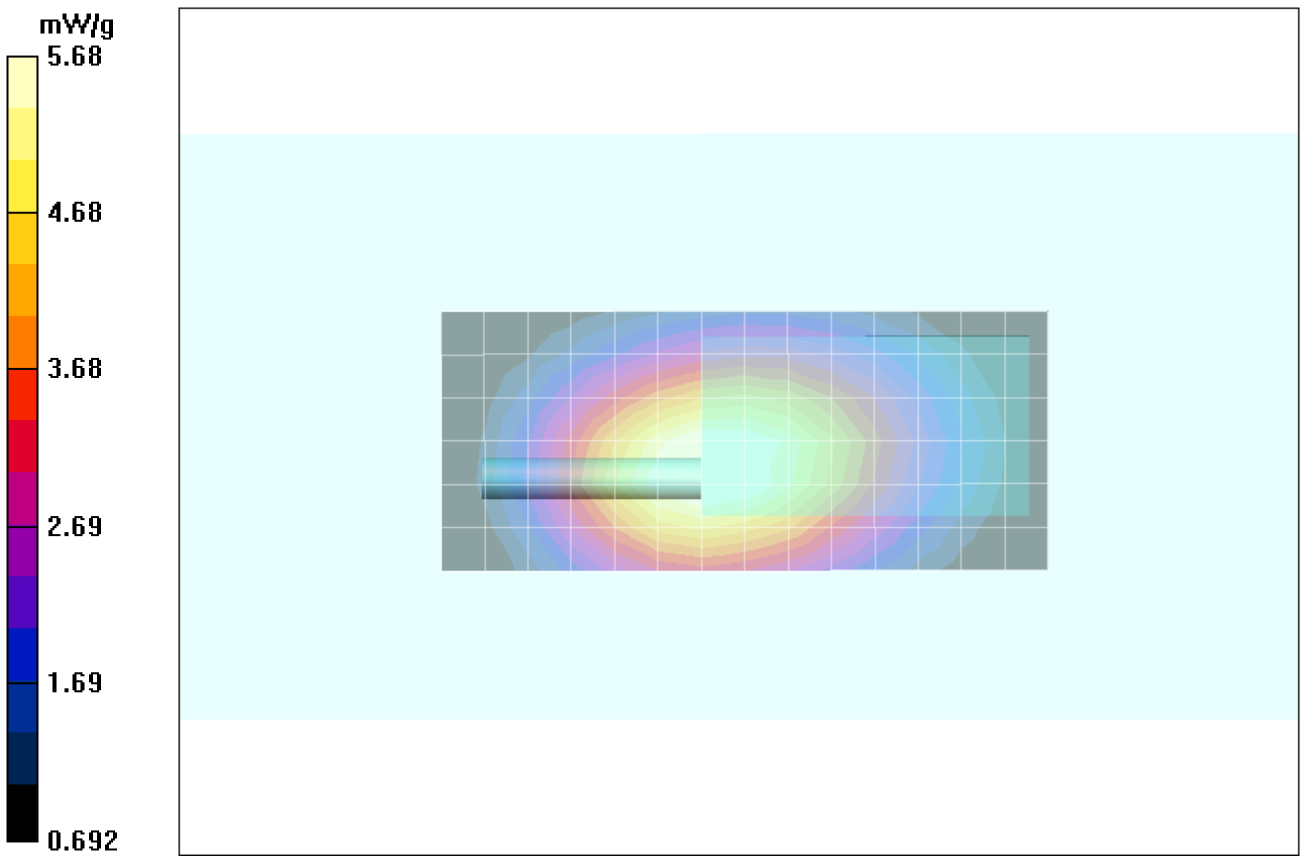
Ambient Temp: 20.6°C; Fluid Temp: 22.0°C; Barometric Pressure: 102.3 kPa; Humidity: 68%

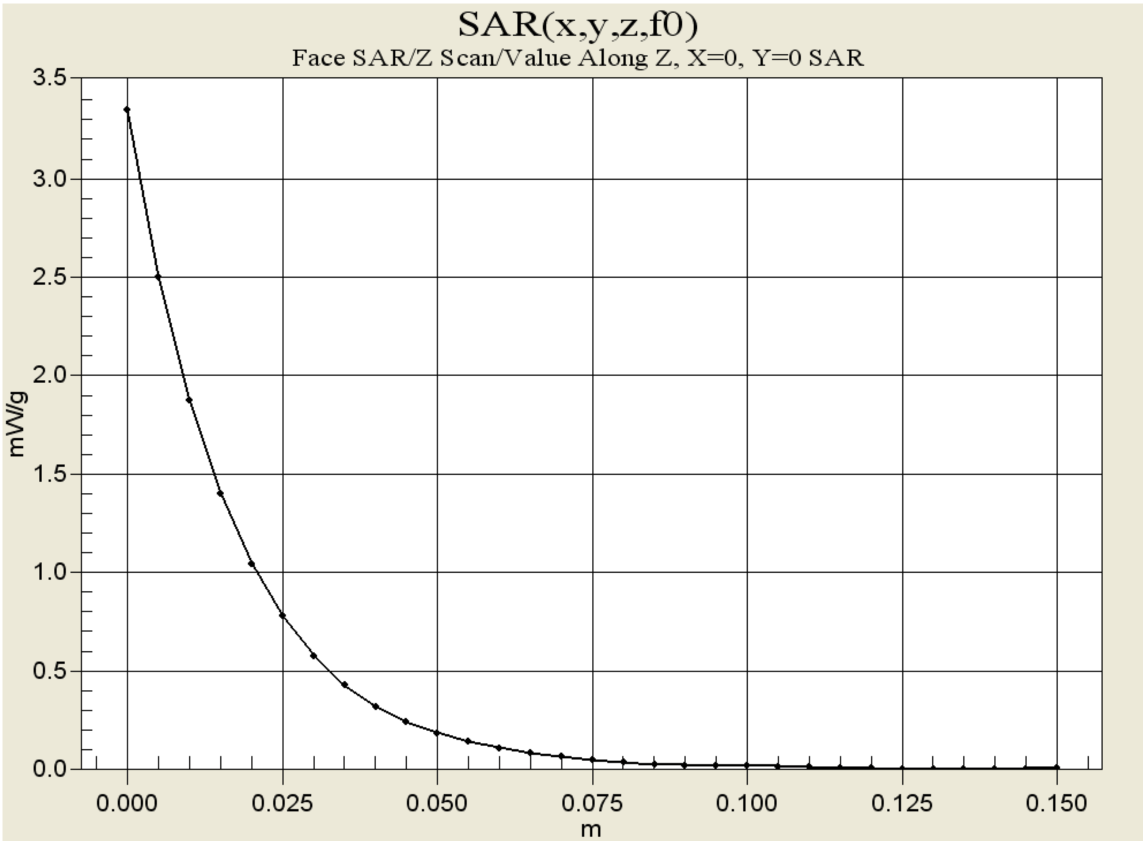
Communication System: UHF-H
Frequency: 491 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.85 mho/m, ε_r = 42.8, ρ = 1000 kg/m^3)

- 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; Post processing SW: SEMCAD, V1.6 Build 116

Face-Held with Stubby Antenna - Mid Channel/Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm

Stubby Antenna - Mid Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 8.63 W/kg
SAR(1 g) = 5.51 mW/g; SAR(10 g) = 3.85 mW/g
Reference Value = 85.5 V/m
Power Drift = -0.44 dB





Face-Held with Stubby Antenna - Mid Channel

Date Tested: 09/30/03

EUT: Kenwood Model: TK-3160-2; Type: UHF PTT Radio Transceiver; Serial: Pre-production unit

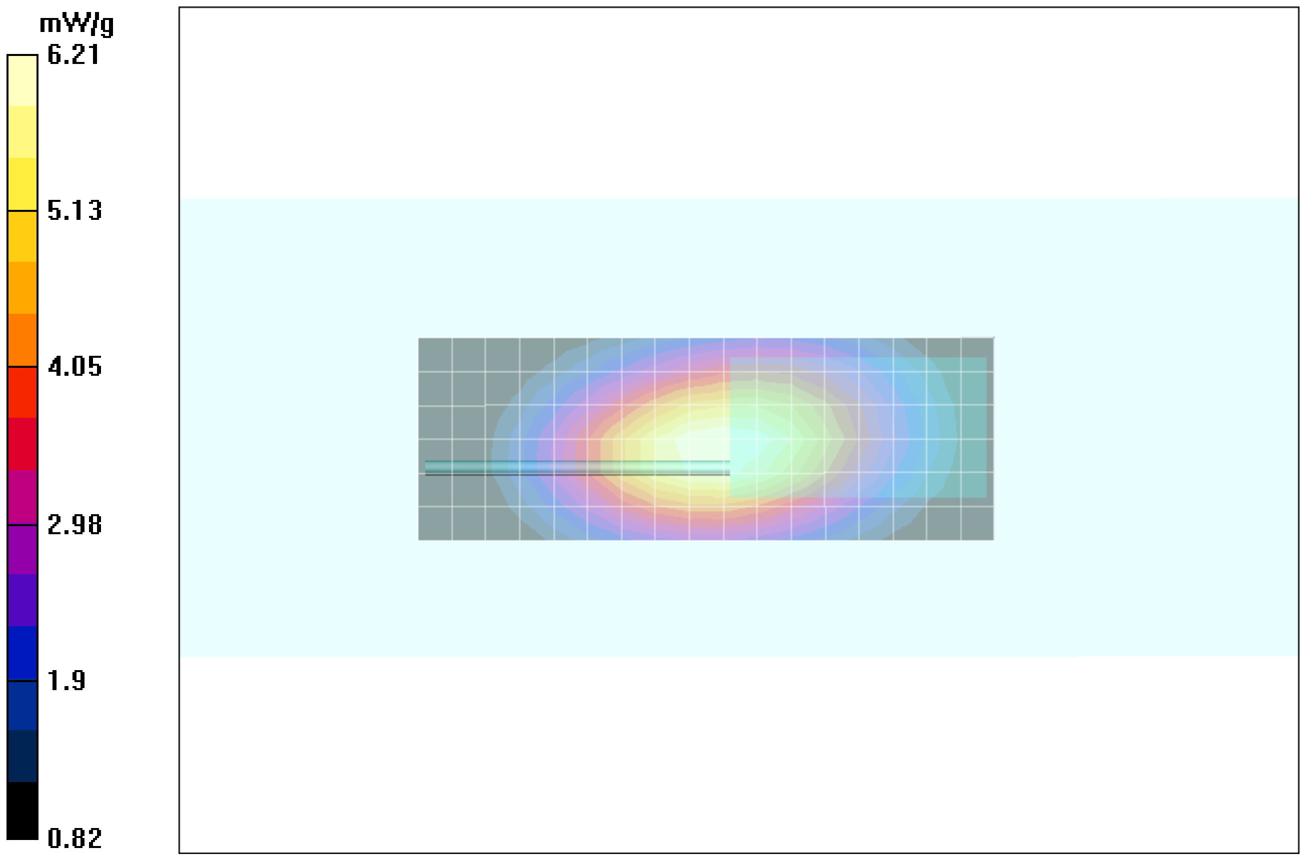
Ambient Temp: 22.2°C; Fluid Temp: 22.1°C; Barometric Pressure: 102.3 kPa; Humidity: 57%

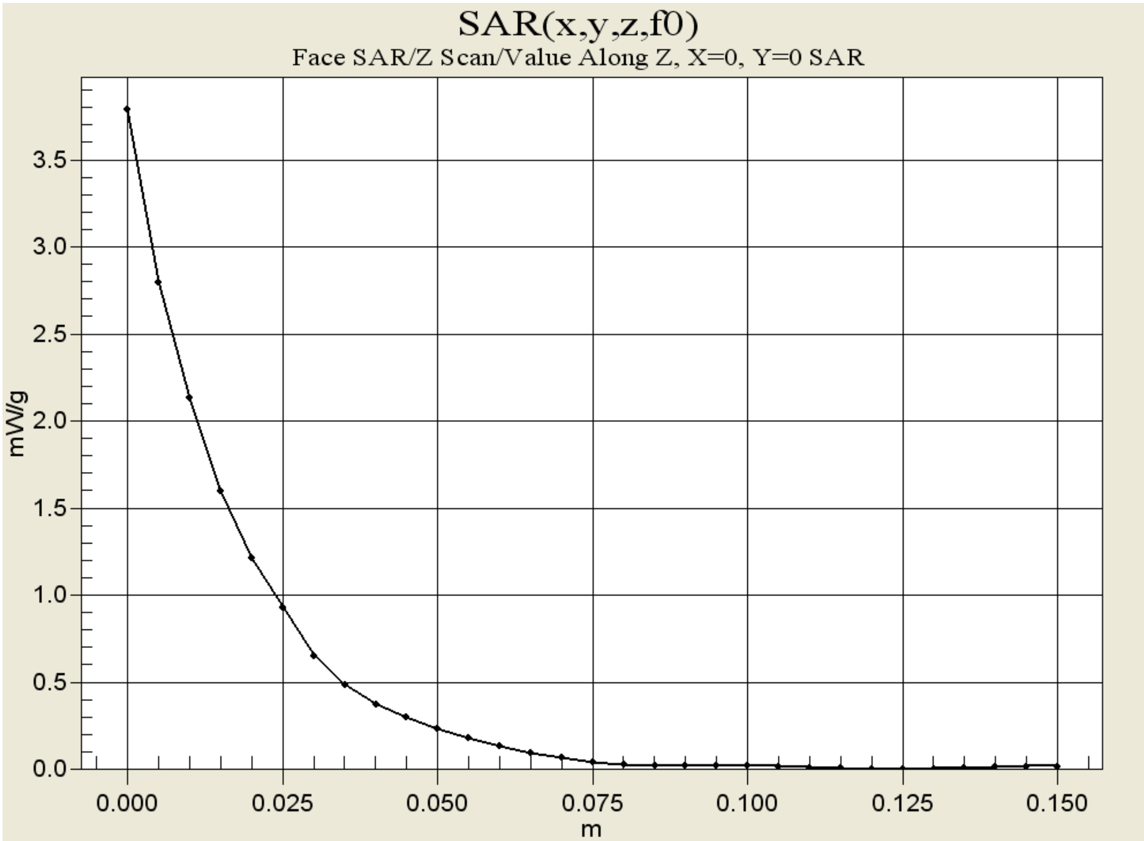
Communication System: UHF-H
Frequency: 491 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.84 mho/m, ε_r = 43.1, ρ = 1000 kg/m^3)

- 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; Post processing SW: SEMCAD, V1.6 Build 116

Face-Held with Whip Antenna - Mid Channel/Area Scan (7x18x1): Measurement grid: dx=15mm, dy=15mm

Whip Antenna - Mid Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 9.39 W/kg
SAR(1 g) = 6.03 mW/g; SAR(10 g) = 4.25 mW/g
Reference Value = 85.8 V/m
Power Drift = -0.39 dB





Face-Held with Whip Antenna - Mid Channel

Date Tested: 10/14/03

EUT: Kenwood Model: TK-3160-2; Type: UHF PTT Radio Transceiver; Serial: Pre-production unit

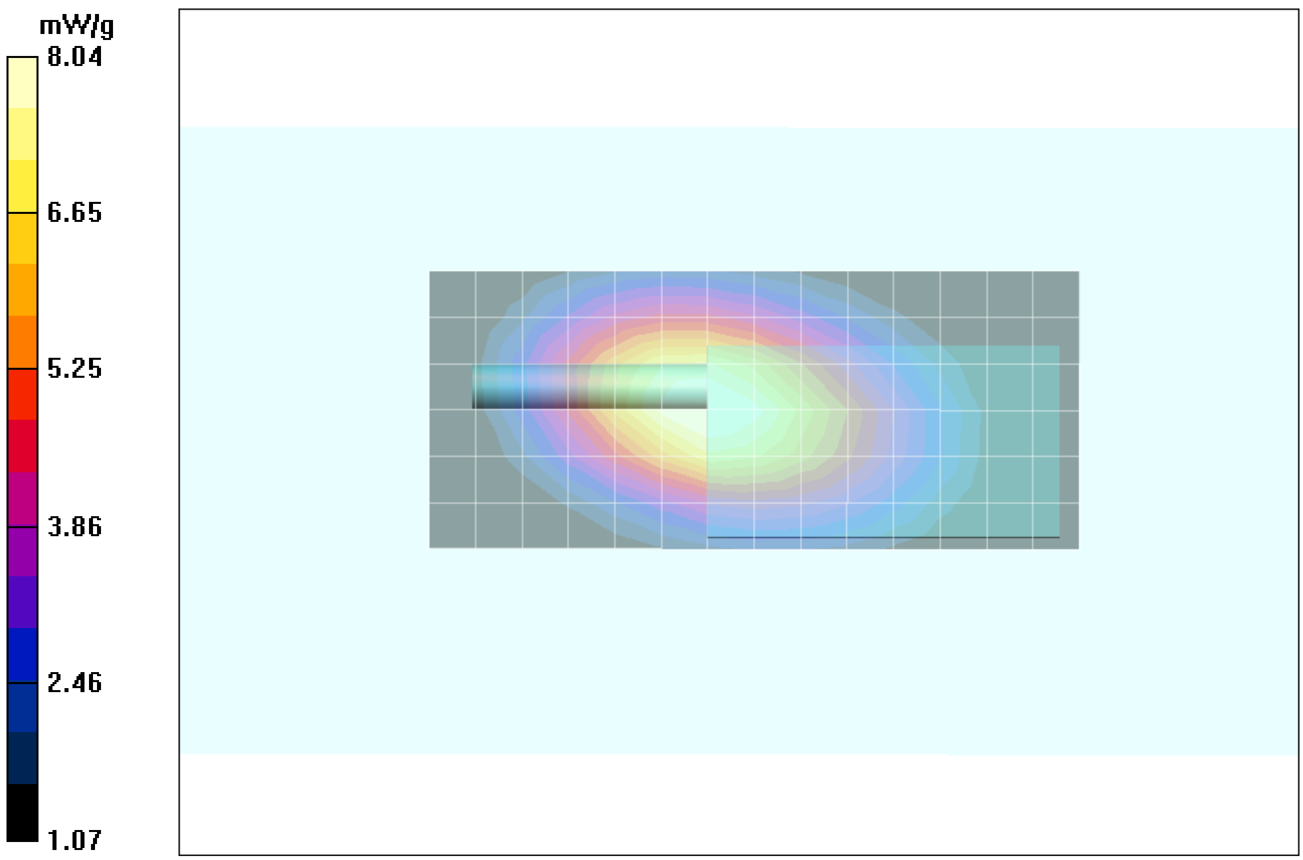
Ambient Temp: 20.6°C; Fluid Temp: 21.9°C; Barometric Pressure: 102.3 kPa; Humidity: 68%

Communication System: UHF-H
Frequency: 491 MHz; Duty Cycle: 1:1
Medium: M450 (σ = 0.97 mho/m, ε_r = 58.2, 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; Post processing SW: SEMCAD, V1.6 Build 116

Body-Worn with Stubby Antenna - Mid Channel/Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm

Stubby Antenna - Mid Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 12.5 W/kg
SAR(1 g) = 7.8 mW/g; SAR(10 g) = 5.38 mW/g
Reference Value = 96.7 V/m
Power Drift = -0.25 dB



Date/ Tested: 10/14/03

EUT: Kenwood Model TK-2160-2; Type: UHF PTT Radio Transceiver; Serial: Pre-production unit

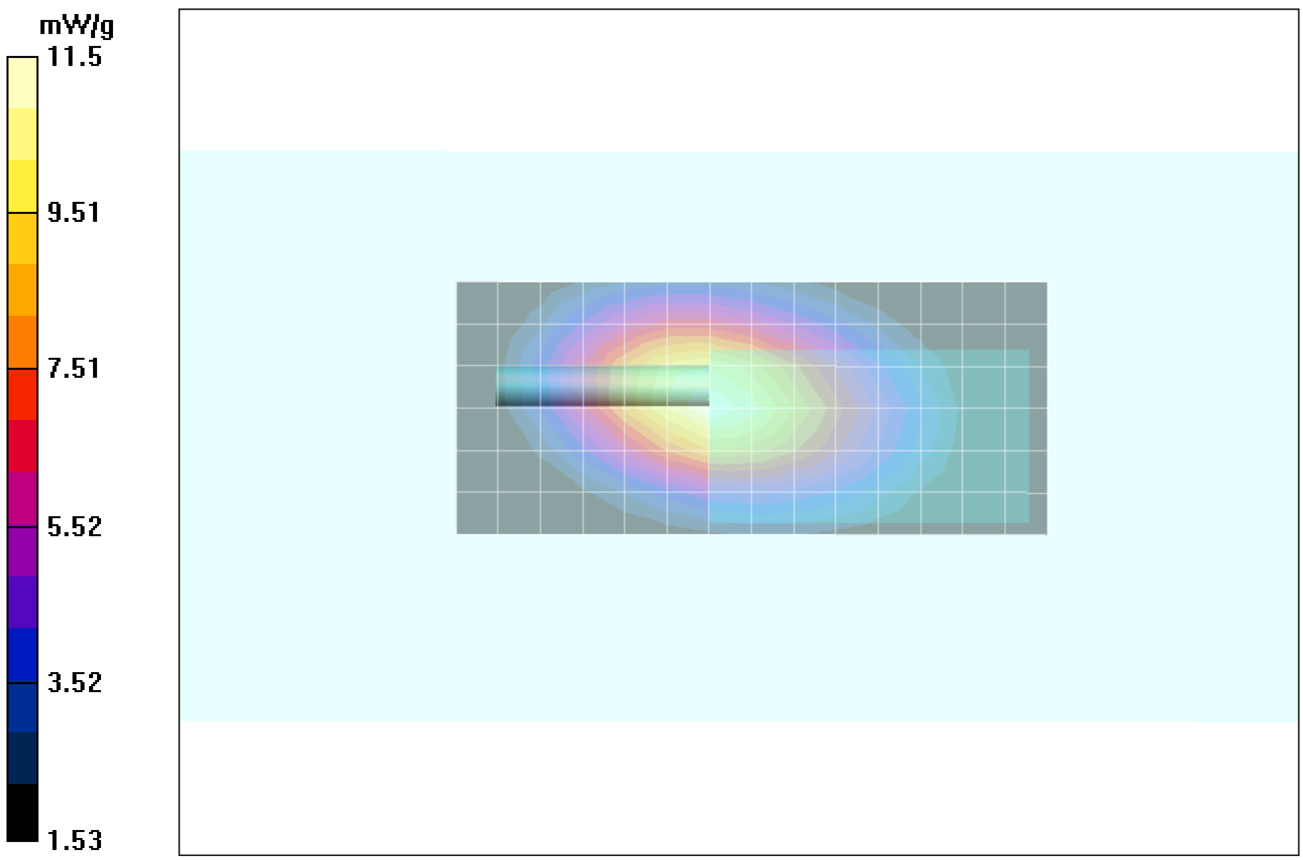
Ambient Temp: 20.6°C; Fluid Temp: 21.9°C; Barometric Pressure: 102.3 kPa; Humidity: 68%

Communication System: UHF-H
Frequency: 470 MHz; Duty Cycle: 1:1
Medium: M450 (σ = 0.97 mho/m, ε_r = 58.2, 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; Post processing SW: SEMCAD, V1.6 Build 116

Body-Worn with Stubby Antenna - Low Channel/Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm

Stubby Antenna - Low Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 17.5 W/kg
SAR(1 g) = 11.1 mW/g; SAR(10 g) = 7.71 mW/g
Reference Value = 99 V/m
Power Drift = -0.29 dB



Date Tested: 10/14/03

EUT: Kenwood Model: TK-3160-2; Type: UHF PTT Radio Transceiver; Serial: Pre-production unit

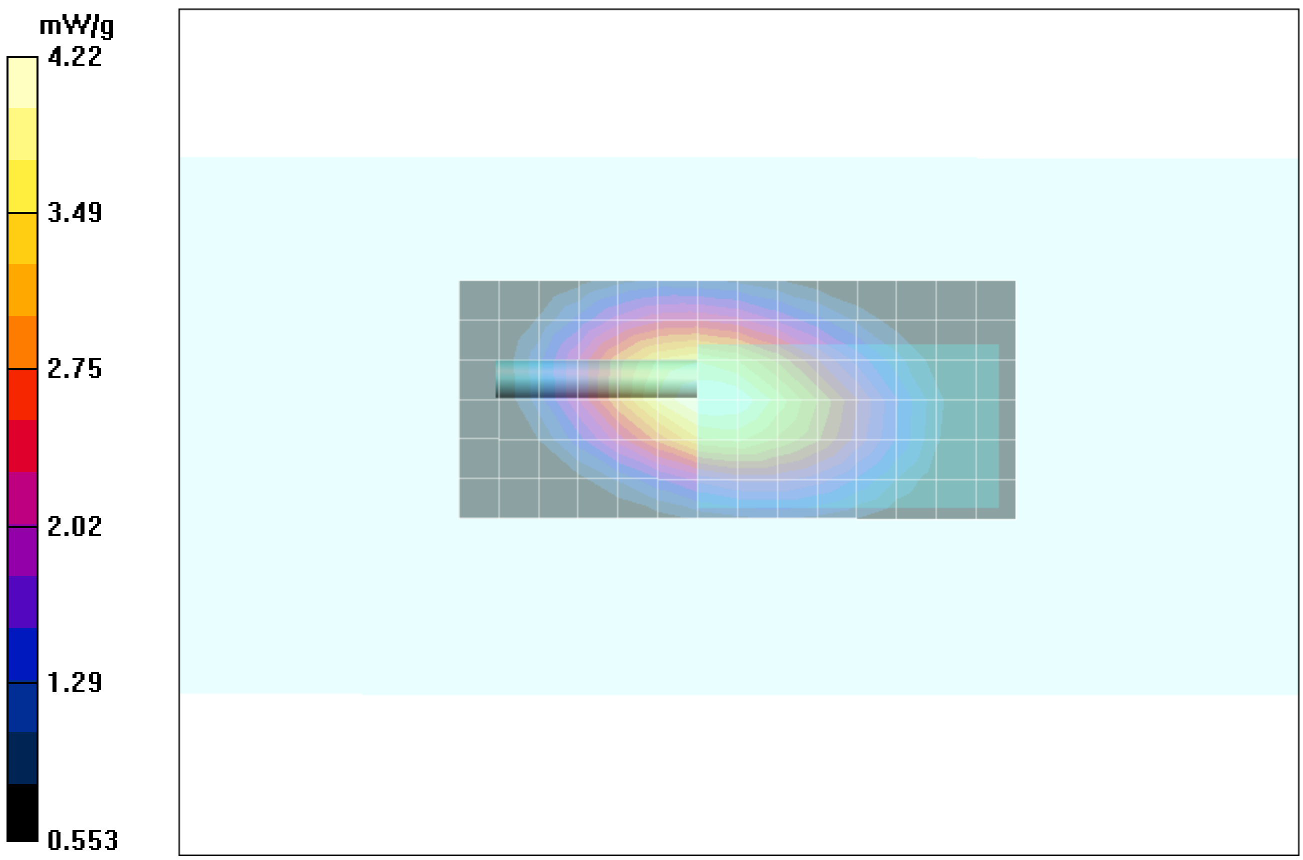
Ambient Temp: 20.6°C; Fluid Temp: 21.9°C; Barometric Pressure: 102.3 kPa; Humidity: 68%

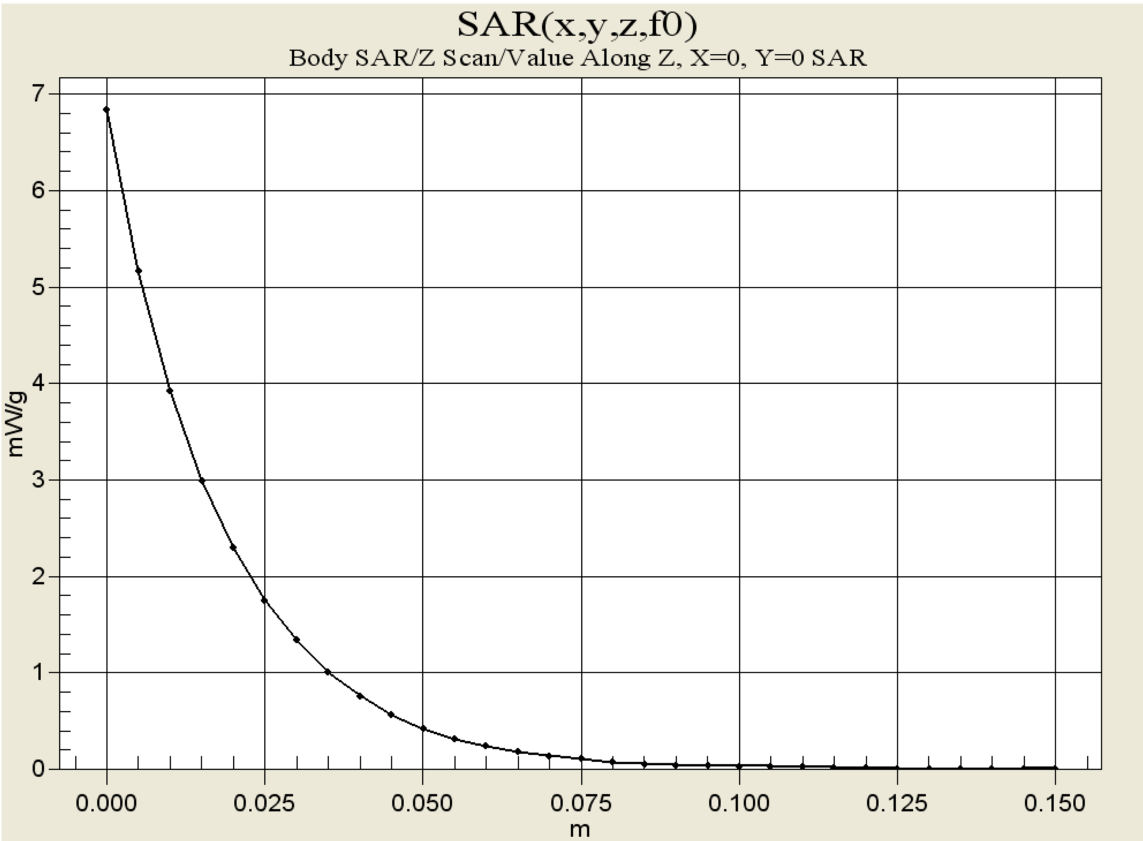
Communication System: UHF-H
Frequency: 512 MHz; Duty Cycle: 1:1
Medium: M450 (σ = 0.97 mho/m, ε_r = 58.2, ρ = 1000 kg/m^3)

- 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; Post processing SW: SEMCAD, V1.6 Build 116

Body-Worn with Stubby Antenna - High Channel/Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm

Stubby Antenna - High Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 6.49 W/kg
SAR(1 g) = 4.07 mW/g; SAR(10 g) = 2.8 mW/g
Reference Value = 65.2 V/m
Power Drift = -0.66 dB





Body-Worn with Stubby Antenna - Low Channel

Date Tested: 10/01/03

EUT: Kenwood Model: TK-3160-2; Type: UHF PTT Radio Transceiver; Serial: Pre-production unit

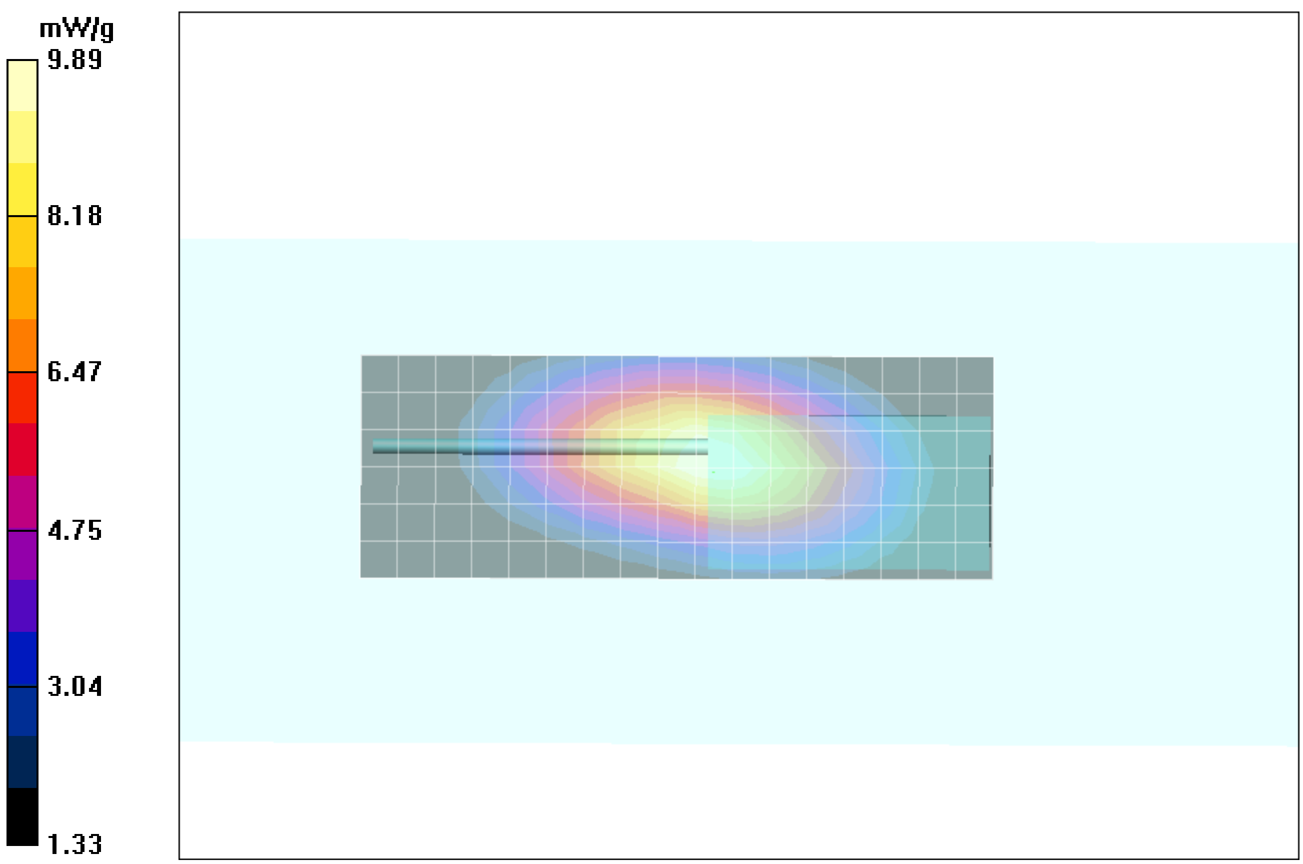
Ambient Temp: 21.9°C; Fluid Temp: 22.1°C; Barometric Pressure: 102.3 kPa; Humidity: 63%

Communication System: UHF-H
Frequency: 491 MHz; Duty Cycle: 1:1
Medium: M450 (σ = 0.97 mho/m, ε_r = 58.2, 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; Post processing SW: SEMCAD, V1.6 Build 116

Body-Worn with Whip Antenna - Mid Channel/Area Scan (7x18x1): Measurement grid: dx=15mm, dy=15mm

Whip Antenna - Mid Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 15 W/kg
SAR(1 g) = 9.58 mW/g; SAR(10 g) = 6.65 mW/g
Reference Value = 97.9 V/m
Power Drift = -0.41 dB



Date Tested: 10/01/03

EUT: Kenwood Model: TK-3160-2; Type: UHF PTT Radio Transceiver; Serial: Pre-production unit

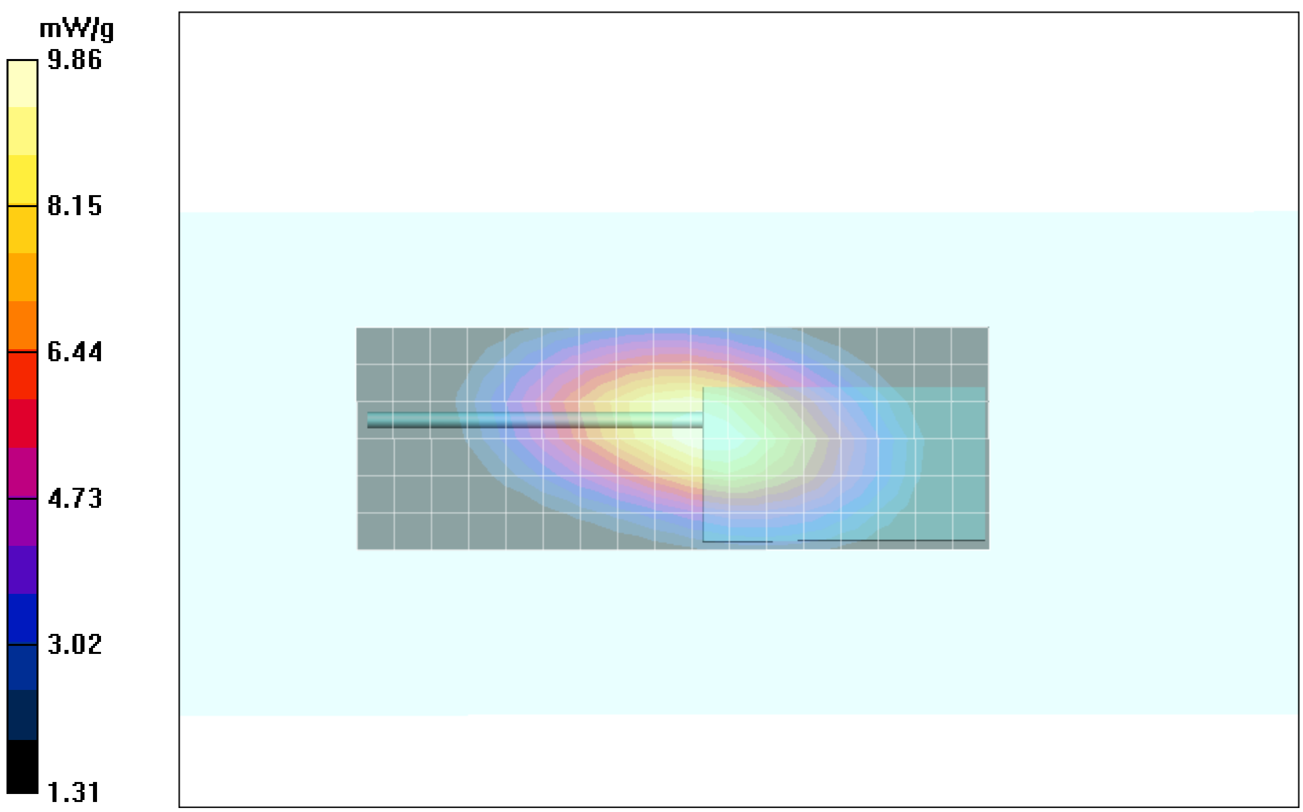
Ambient Temp: 21.9°C; Fluid Temp: 22.1°C; Barometric Pressure: 102.3 kPa; Humidity: 63%

Communication System: UHF-H
Frequency: 470 MHz; Duty Cycle: 1:1
Medium: M450 (σ = 0.97 mho/m, ε_r = 58.2, 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; Post processing SW: SEMCAD, V1.6 Build 116

Body-Worn with Whip Antenna - Low Channel/Area Scan (7x18x1): Measurement grid: dx=15mm, dy=15mm

Whip Antenna - Low Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 15.1 W/kg
SAR(1 g) = 9.57 mW/g; SAR(10 g) = 6.65 mW/g
Reference Value = 100.1 V/m
Power Drift = -0.45 dB



Date/Time: 10/01/03

EUT: Kenwood Model: TK-3160-2; Type: UHF PTT Radio Transceiver; Serial: Pre-production unit

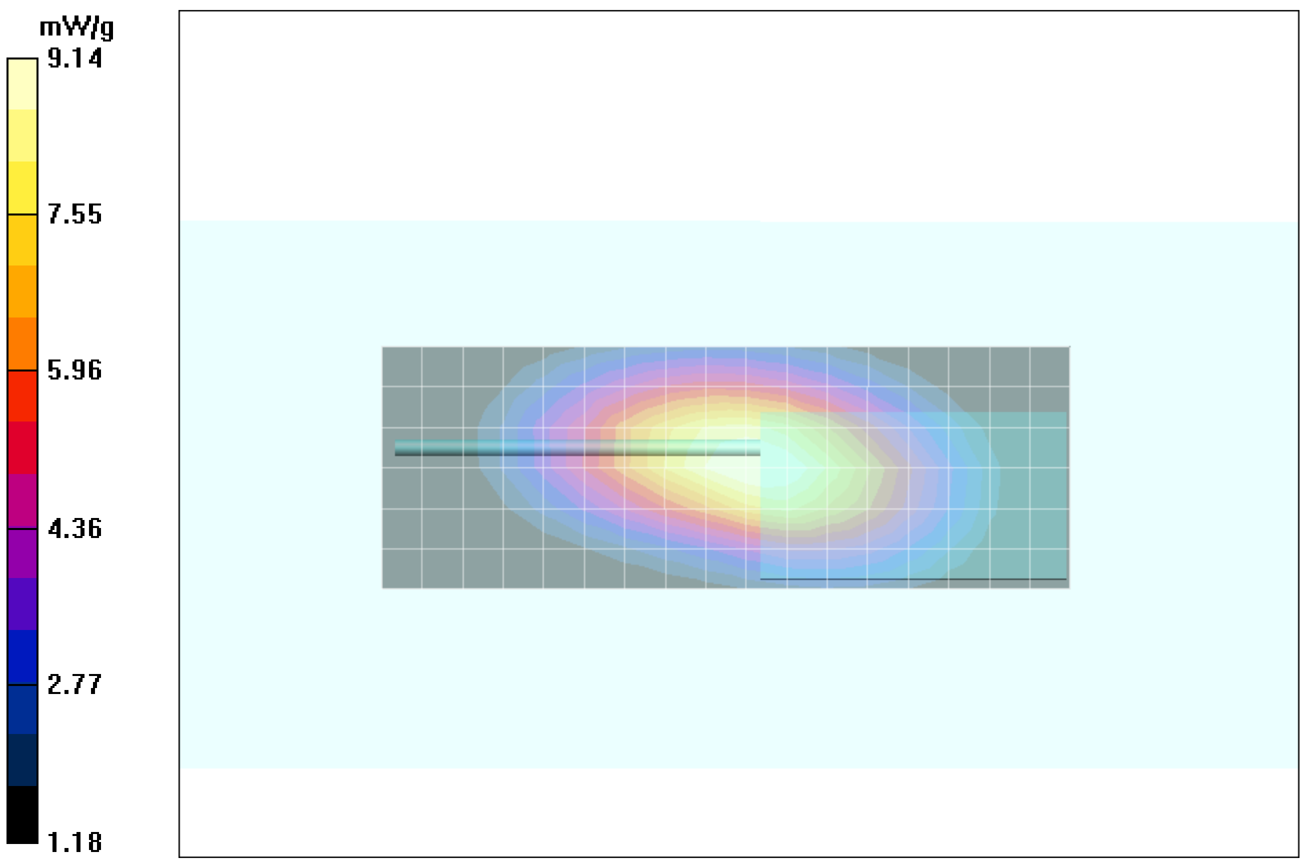
Ambient Temp: 21.9°C; Fluid Temp: 22.1°C; Barometric Pressure: 101.2 kPa; Humidity: 63%

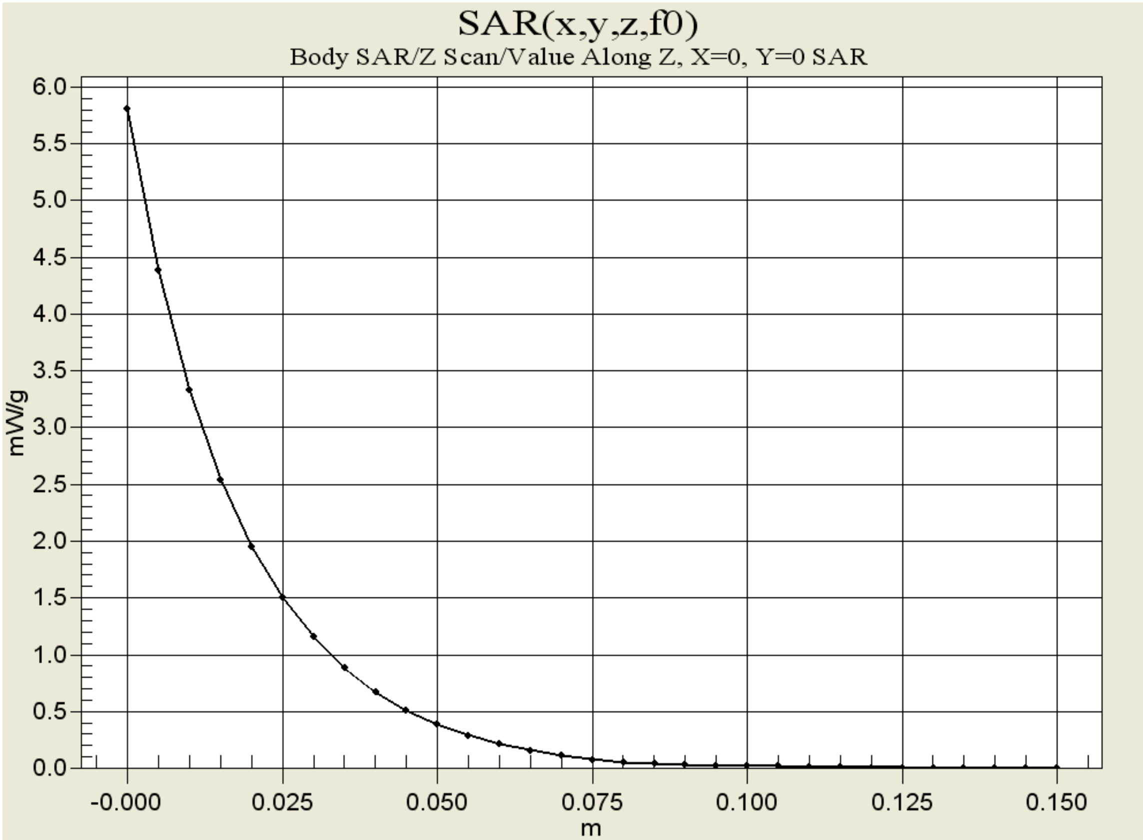
Communication System: UHF-H
Frequency: 491 MHz; Duty Cycle: 1:1
Medium: M450 (σ = 0.95 mho/m, ε_r = 57.8, ρ = 1000 kg/m^3)

- 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; Post processing SW: SEMCAD, V1.6 Build 116

Whip Antenna - High Channel/Area Scan (7x18x1): Measurement grid: dx=15mm, dy=15mm

Whip Antenna - High Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 13.9 W/kg
SAR(1 g) = 8.83 mW/g; SAR(10 g) = 6.1 mW/g
Reference Value = 97.4 V/m
Power Drift = -0.6 dB
Maximum value of SAR = 9.14 mW/g





Body-Worn with Whip Antenna - Mid Channel

APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 09/30/03

EUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - TE#136

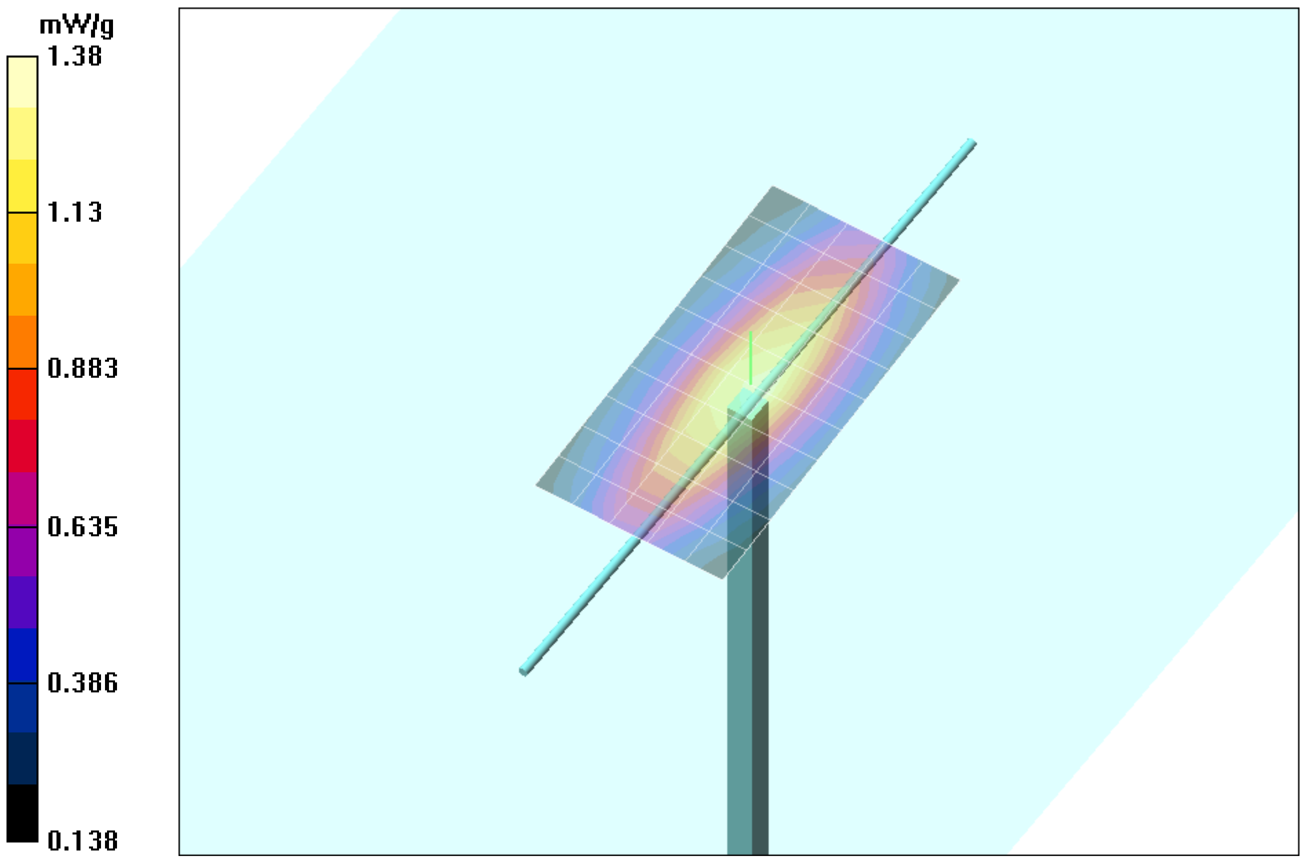
Ambient Temp: 22.2°C; Fluid Temp: 22.1°C; Barometric Pressure: 102.3 kPa; Humidity: 57%

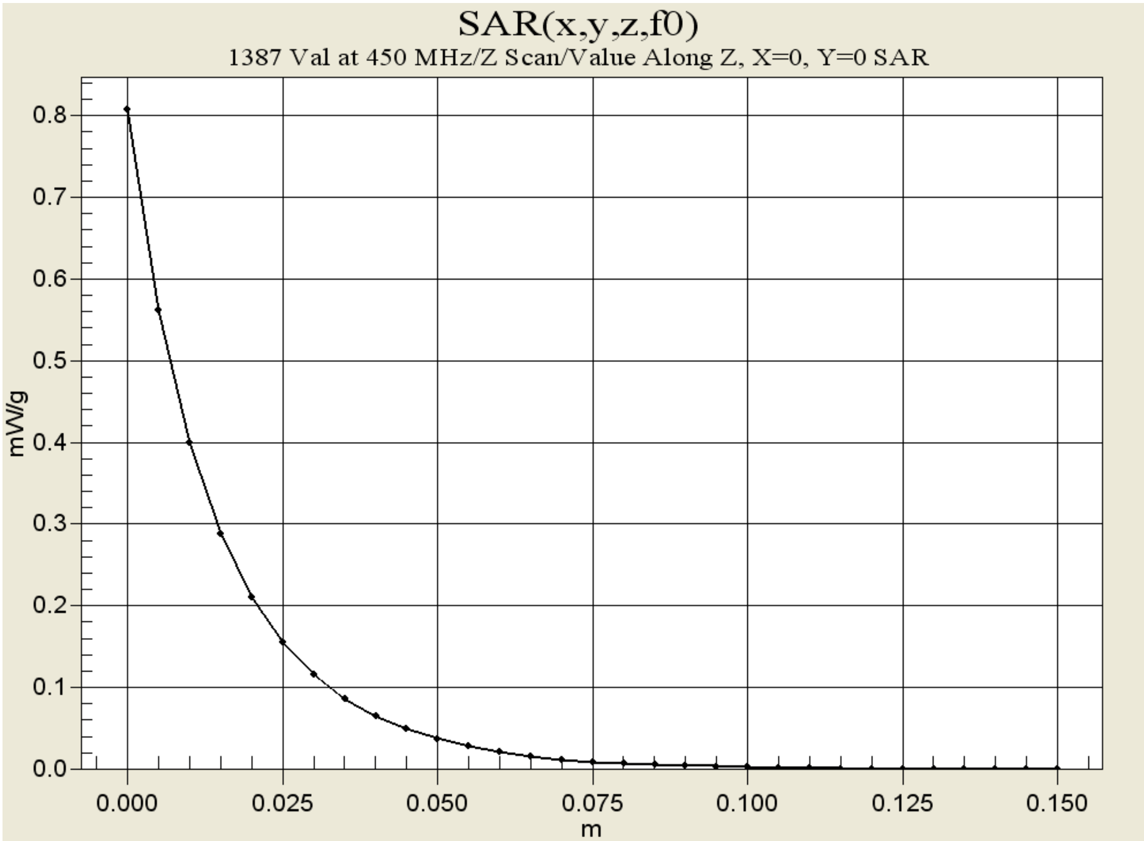
Communication System: CW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.84 mho/m, ε_r = 43.1, ρ = 1000 kg/m^3)

- 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: Planar; Serial: TE#137
- Measurement SW: DASY4, V4.1 Build 47; Post processing SW: SEMCAD, V1.6 Build 116

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

450 MHz Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 2.31 W/kg
SAR(1 g) = 1.32 mW/g; SAR(10 g) = 0.838 mW/g
Reference Value = 40.5 V/m
Power Drift = -0.1 dB




SAR(x,y,z,f0)
1387 Val at 450 MHz/Z Scan/Value Along Z, X=0, Y=0 SAR
mW/g
0.8
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

Date Tested: 10/01/03

EUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - TE#136

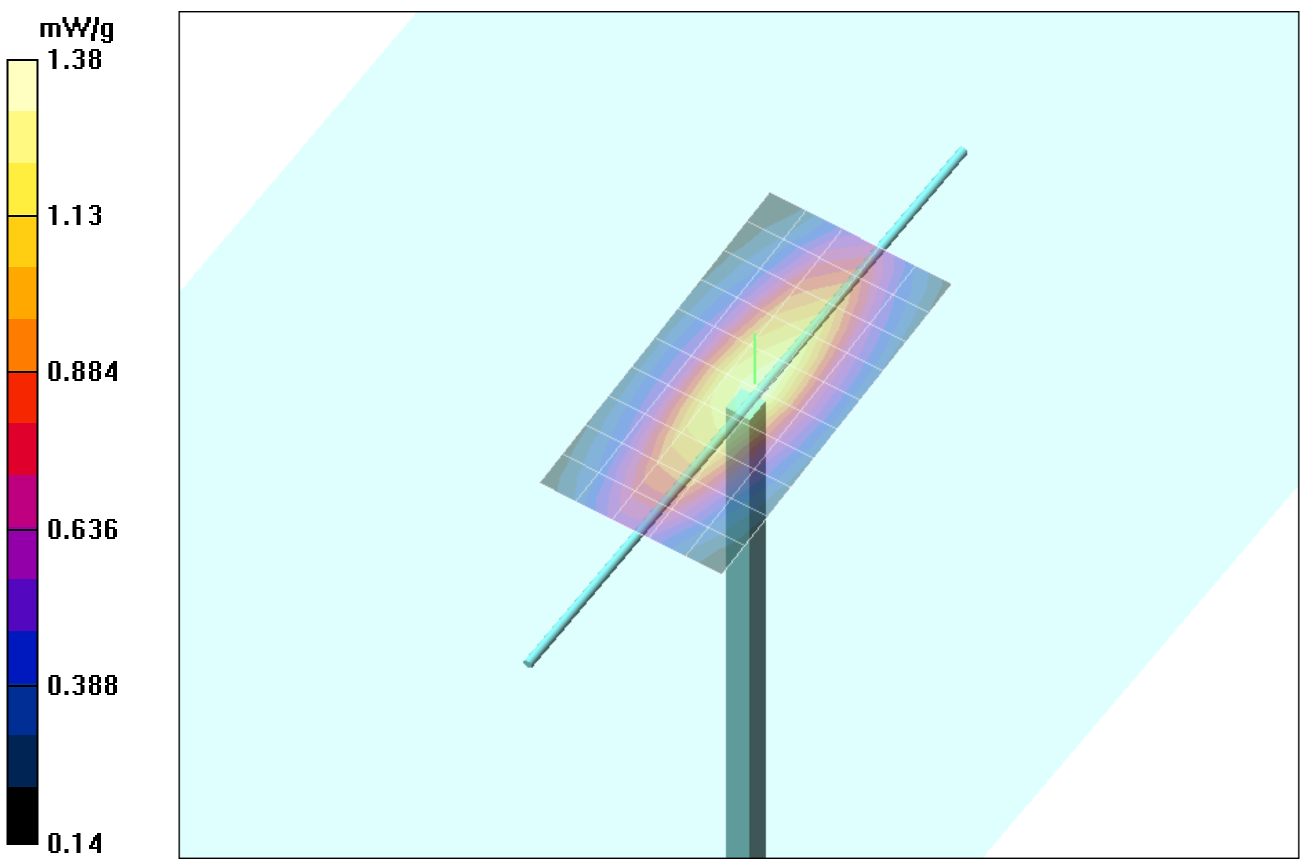
Ambient Temp: 21.9°C; Fluid Temp: 21.9°C; Barometric Pressure: 101.2 kPa; Humidity: 63%

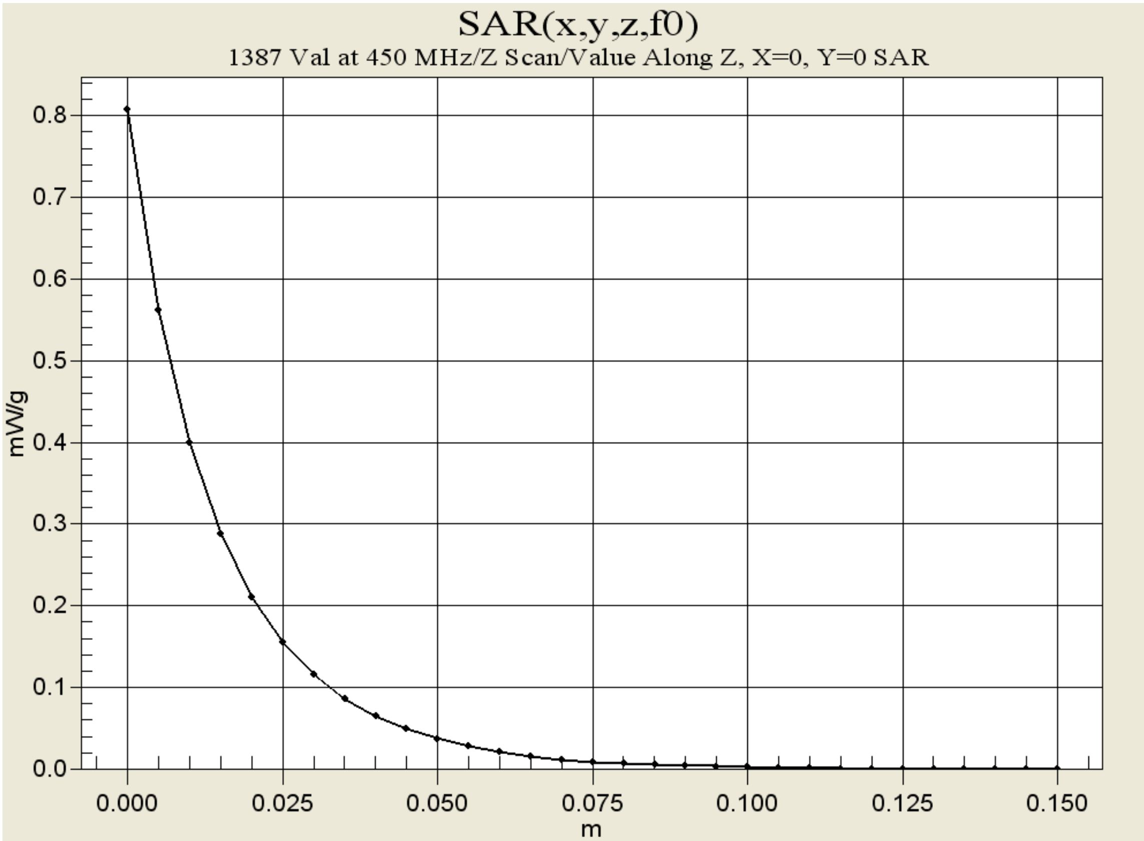
Communication System: CW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.83 mho/m, ε_r = 42.8, ρ = 1000 kg/m^3)

- 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: Planar; Serial: TE#137
- Measurement SW: DASY4, V4.1 Build 47; Post processing SW: SEMCAD, V1.6 Build 116

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

450 MHz Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 2.3 W/kg
SAR(1 g) = 1.32 mW/g; SAR(10 g) = 0.845 mW/g
Reference Value = 41.1 V/m
Power Drift = -0.1 dB




SAR(x,y,z,f0)
1387 Val at 450 MHz/Z Scan/Value Along Z, X=0, Y=0 SAR
mW/g
0.8
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

Date Tested: 10/14/03

EUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - TE#136

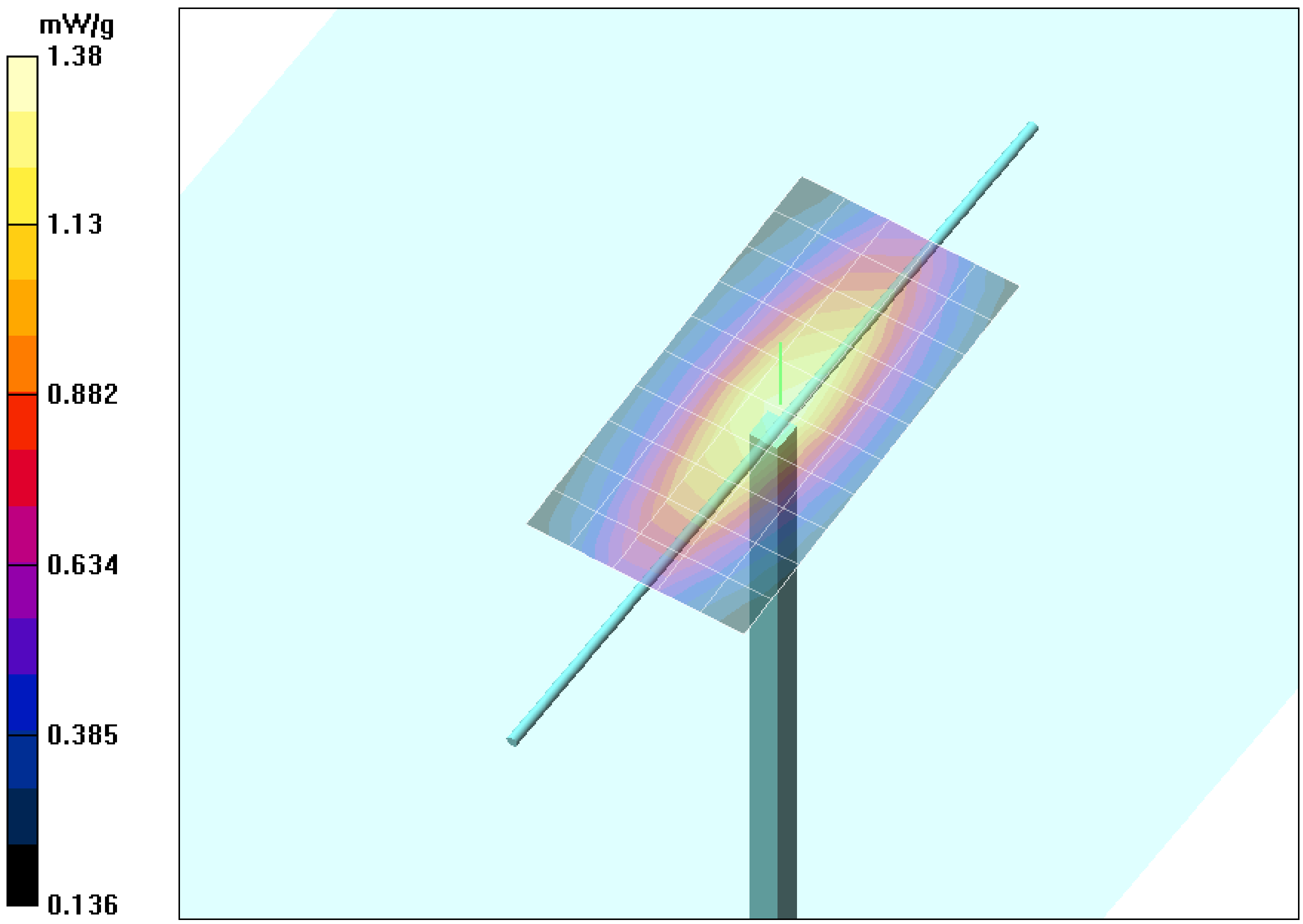
Ambient Temp: 20.6°C; Fluid Temp: 22.0°C; Barometric Pressure: 101.8 kPa; Humidity: 68%

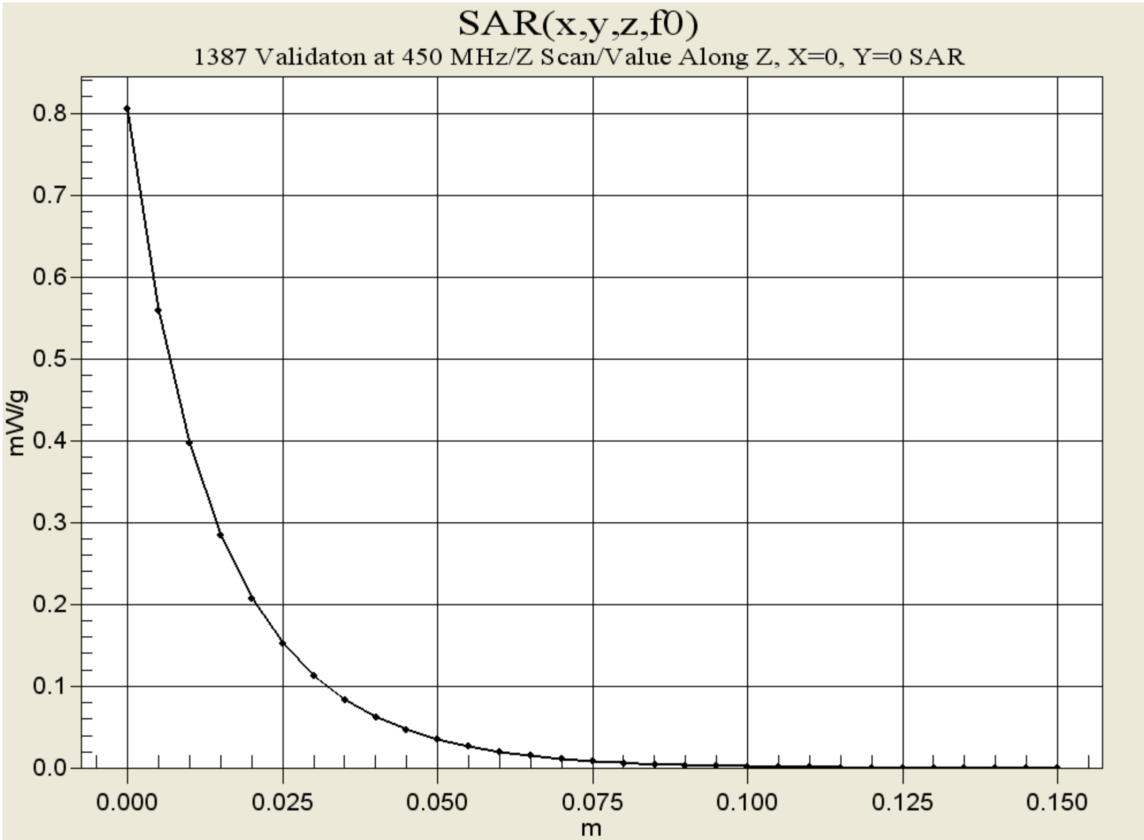
Communication System: CW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.85 mho/m, ε_r = 42.8, ρ = 1000 kg/m^3)

- 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: Planar; Serial: TE#137
- Measurement SW: DASY4, V4.1 Build 47; Post processing SW: SEMCAD, V1.6 Build 116

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

450 MHz Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 2.3 W/kg
SAR(1 g) = 1.32 mW/g; SAR(10 g) = 0.84 mW/g
Reference Value = 40.8 V/m
Power Drift = -0.2 dB




SAR(x,y,z,f0)
1387 Validaton at 450 MHz/Z Scan/Value Along Z, X=0, Y=0 SAR
mW/g
0.8
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

450MHz SYSTEM VALIDATION DIPOLE

Type:	**450MHz Validation Dipole**
Serial Number:	**136**
Place of Calibration:	**Celltech Research Inc.**
Date of Calibration:	**October 17, 2002**

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

Calibrated by: Russell W. Pipe

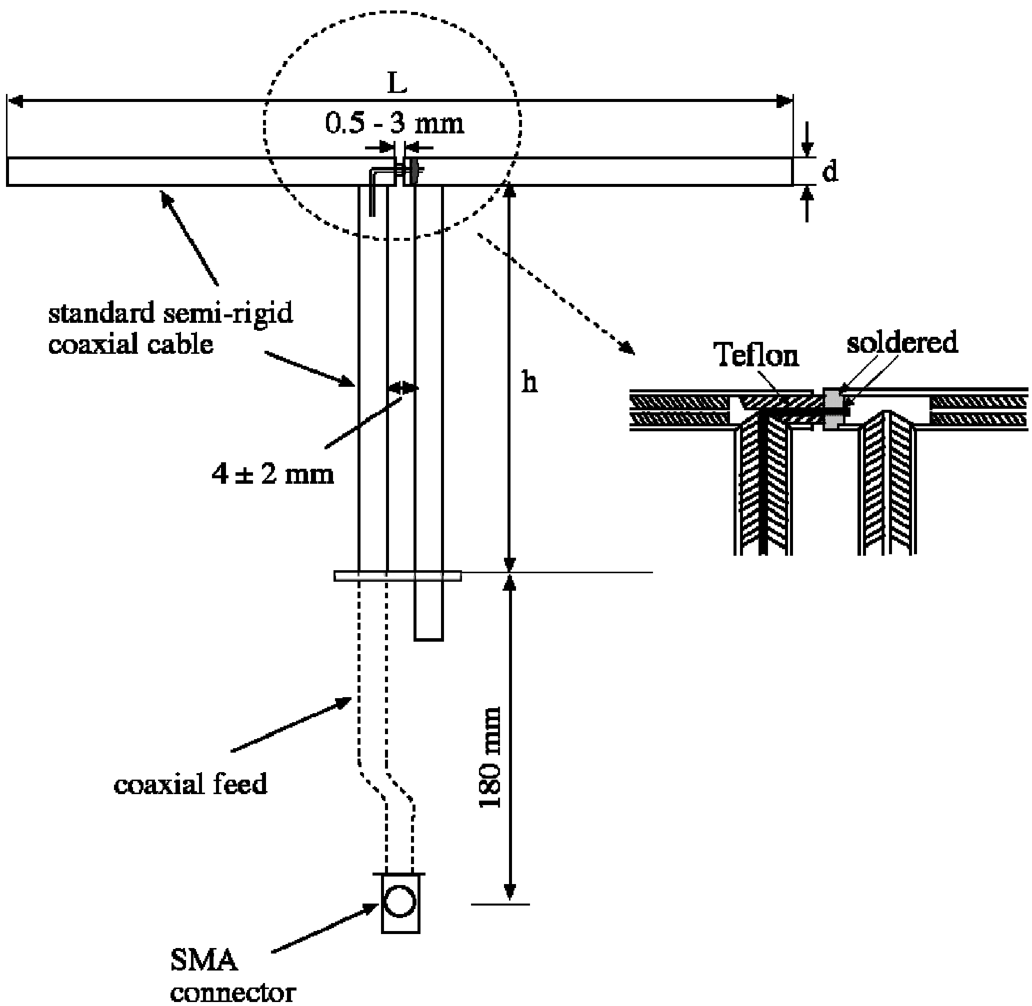
Approved by:

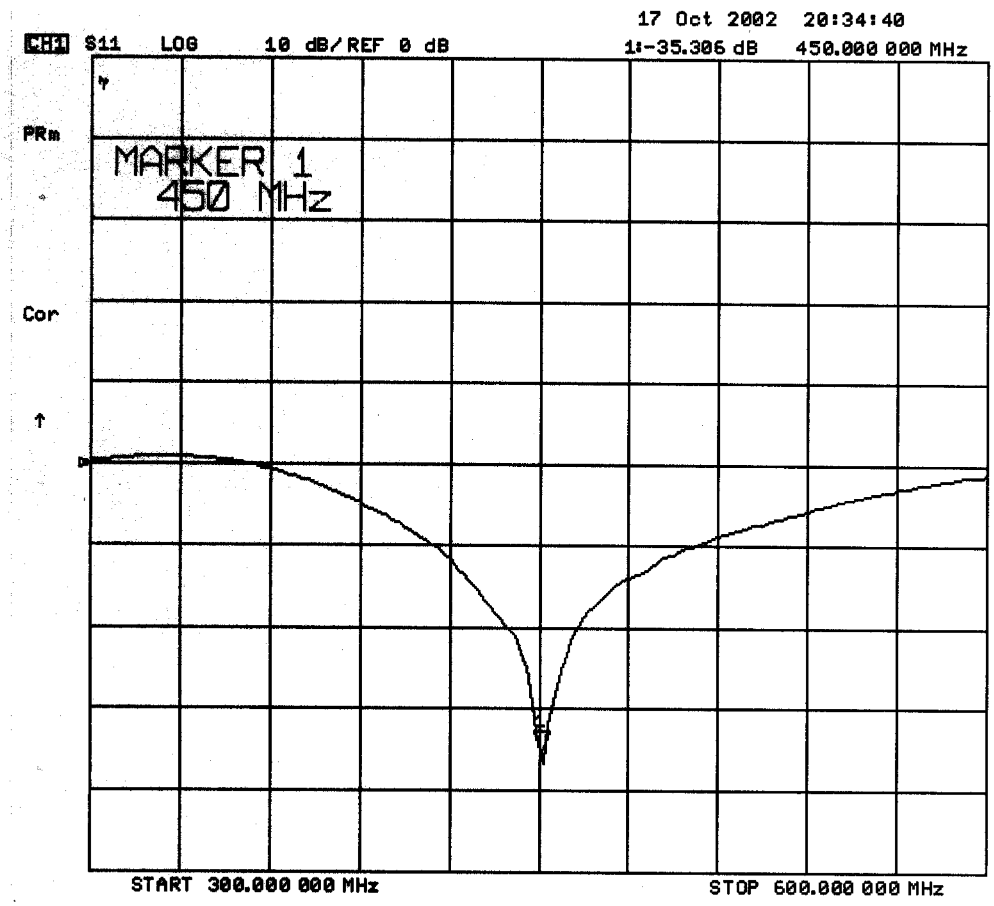
Celltech Research Inc. 1955 Moss Court, Kelowna, B.C. Canada V1Y 9L3
Tel. 250-448-7047 • Fax. 250-448-7046 • e-mail: info@celltechlabs.com
www.celltechlabs.com

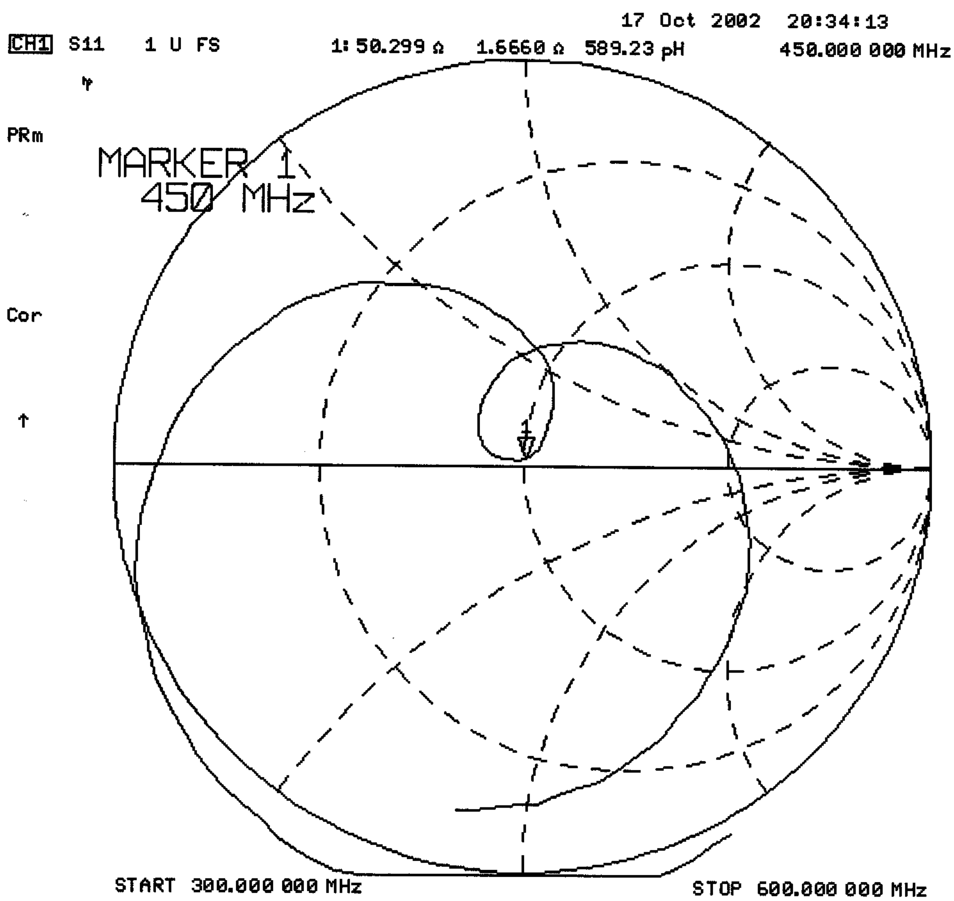
1. Dipole Construction & Electrical Characteristics

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} = 50.299Ω
	Im{Z} = 1.6660Ω
Return Loss at 450MHz	-35.306dB




17 Oct 2002 20:34:40
CH1 S11 LOG 10 dB/ REF 0 dB
1:-35.306 dB 450.000 000 MHz
PRm
Cor
MARKER 1
450 MHz
START 300.000 000 MHz
STOP 600.000 000 MHz


17 Oct 2002 20:34:13
CH1 S11 1 U FS
1: 50.299 Ω 1.6660 Ω 589.23 pH
450.000 000 MHz
PRm
Cor
MARKER 1
450 MHz
START 300.000 000 MHz
STOP 600.000 000 MHz

Validation Dipole Dimensions

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

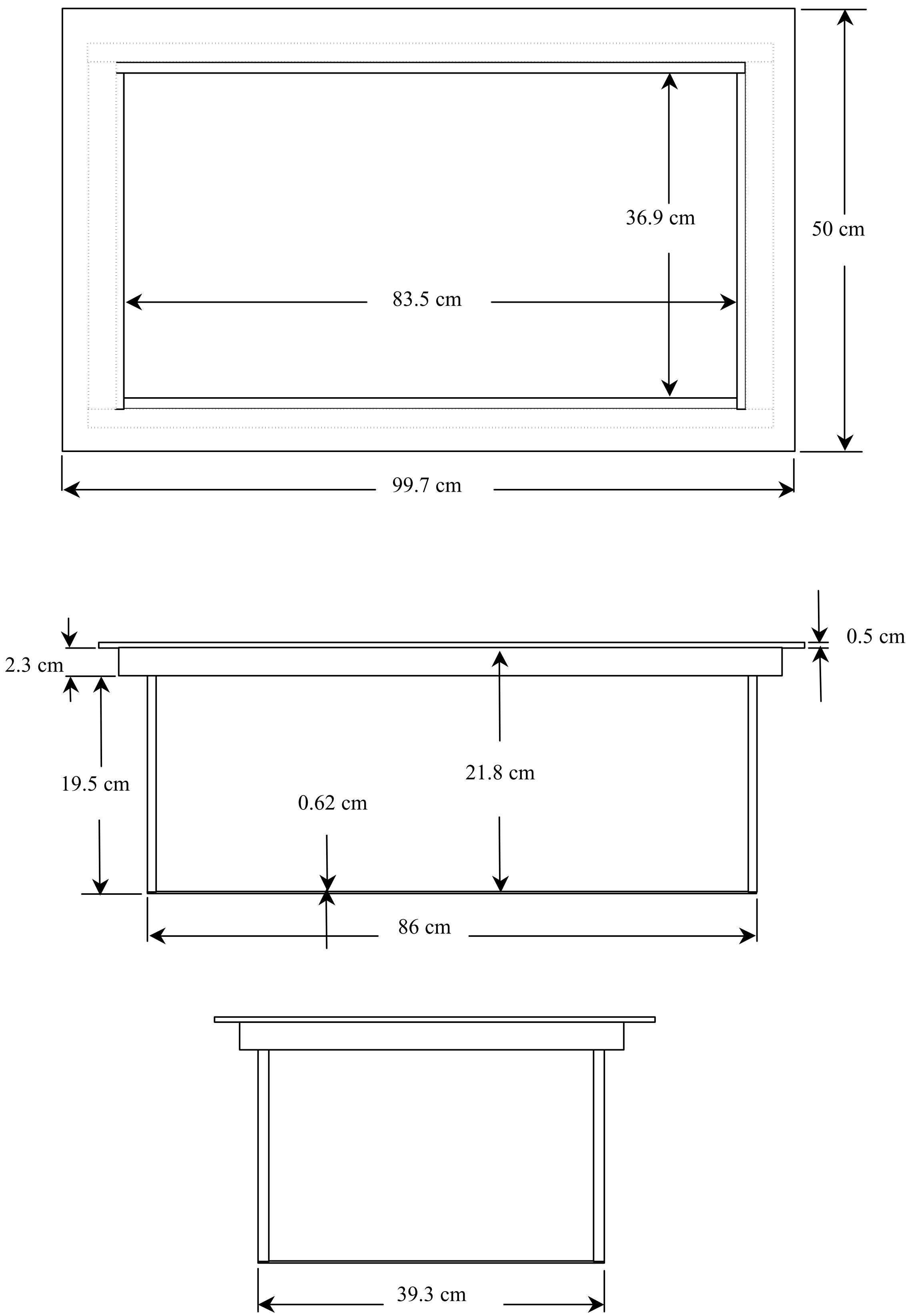
2. Validation Phantom

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

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

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

Dimensions of Plexiglas Planar Phantom



450MHz System Validation Setup

450MHz System Validation Setup

3. Measurement Conditions

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

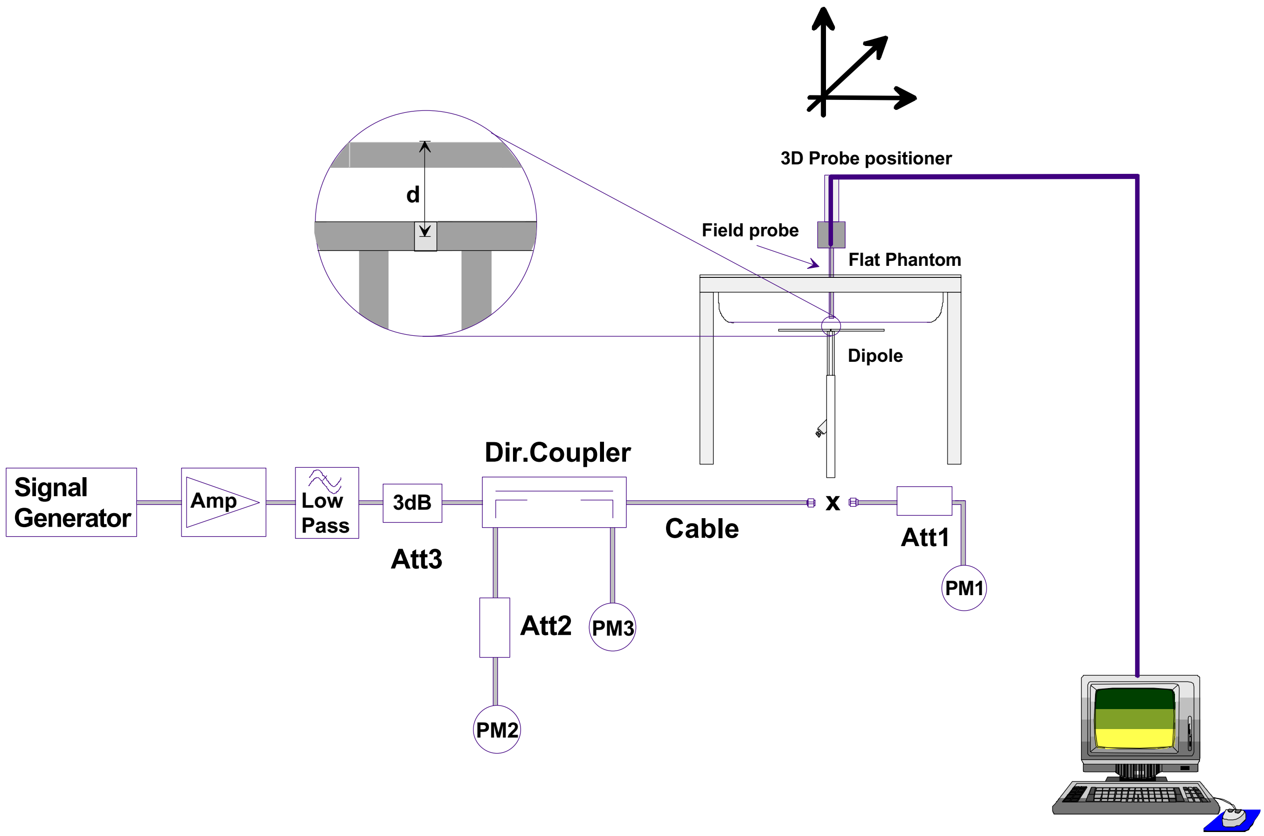
Relative Permittivity: 44.1
Conductivity: 0.88 mho/m
Ambient Temperature: 23.3 °C
Fluid Temperature: 22.2 °C
Fluid Depth: ≥ 15.0 cm

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

4. SAR Measurement

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



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

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

Validation Dipole SAR Test Results

Validation Measurement	SAR @ 0.25W Input averaged over 1g	SAR @ 1W Input averaged over 1g	SAR @ 0.25W Input averaged over 10g	SAR @ 1W Input averaged over 10g	Peak SAR @ 0.25W Input
Test 1	1.32	5.28	0.887	3.55	2.20
Test 2	1.26	5.04	0.856	3.42	2.09
Test 3	1.38	5.52	0.931	3.72	2.30
Test 4	1.36	5.44	0.917	3.67	2.27
Test 5	1.37	5.48	0.922	3.69	2.28
Test 6	1.33	5.32	0.896	3.58	2.22
Test 7	1.34	5.36	0.902	3.61	2.24
Test 8	1.33	5.32	0.895	3.58	2.21
Test 9	1.39	5.56	0.931	3.72	2.31
Test10	1.36	5.44	0.917	3.67	2.27
Average Value	1.34	5.38	0.905	3.62	2.24

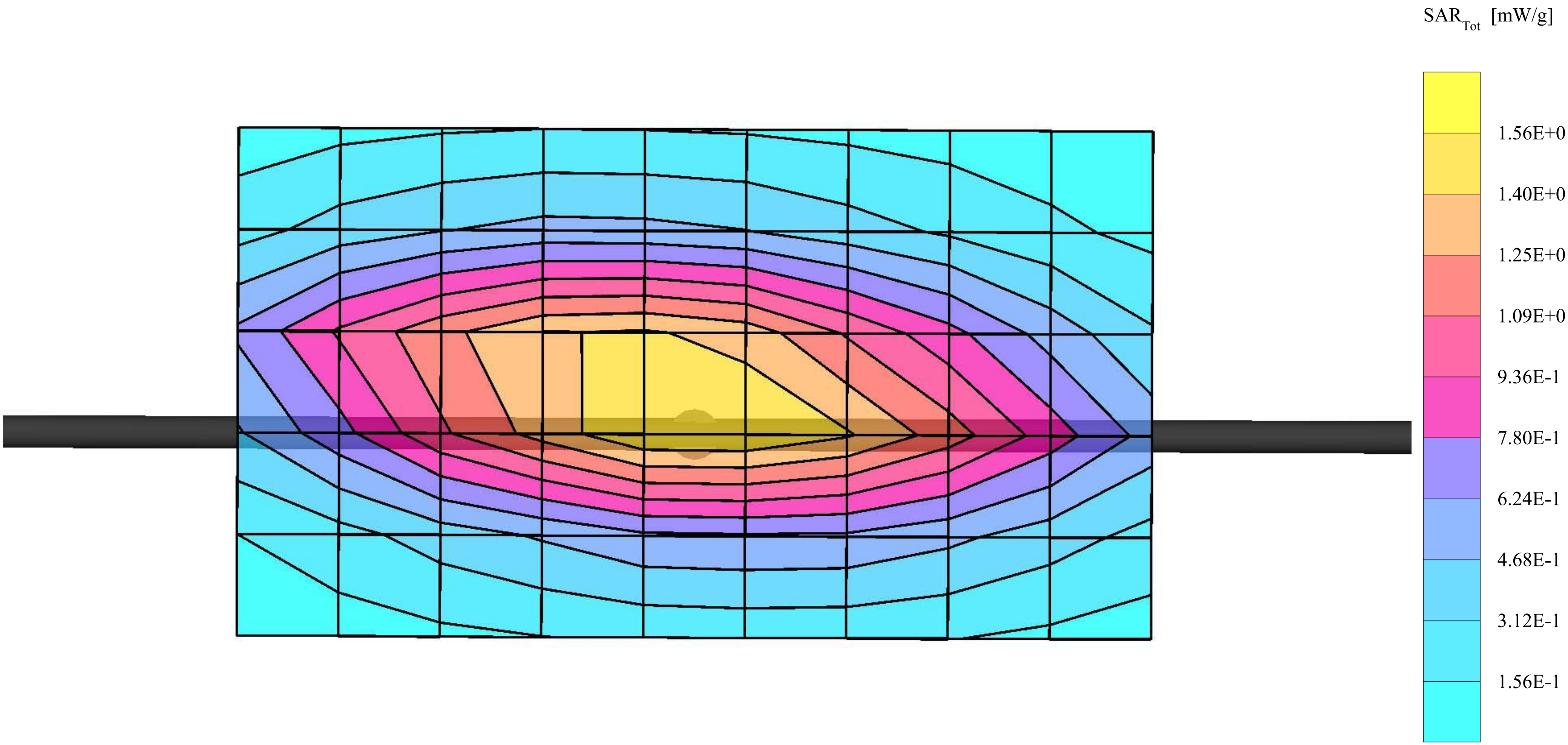
The results have been normalized to 1W (forward power) into the dipole.

Averaged over 1cm (1g) of tissue: 5.38 mW/g

Averaged over 10cm (10g) of tissue: 3.62 mW/g

Dipole 450MHz, d = 15 mm

Frequency: 450 MHz; Antenna Input Power: 250 [mW]
Large Planar Phantom; Planar Section
Probe: ET3DV6 - SN1387; ConvF(7.30,7.30,7.30); Crest factor: 1.0; 450 MHz Brain: σ = 0.88 mho/m ε_r = 44.1 ρ = 1.00 g/cm^3
Cube 5x5x7: Peak: 2.24 mW/g, SAR (1g): 1.34 mW/g, SAR (10g): 0.905 mW/g, (Worst-case extrapolation)
Penetration depth: 12.0 (10.5, 14.0) [mm]; Powerdrift: 0.01 dB; Ambient Temp.: 23.3°C; Fluid Temp.: 22.2°C
Calibration Date: October 17, 2002



450MHz System Validation

Measured Fluid Dielectric Parameters (Brain)

October 17, 2002

Frequency	e'	e''
350.000000 MHz	46.6334	40.6323
360.000000 MHz	46.3629	40.0034
370.000000 MHz	46.1498	39.3672
380.000000 MHz	45.8833	38.6723
390.000000 MHz	45.5947	38.0484
400.000000 MHz	45.3226	37.4538
410.000000 MHz	45.0977	36.9636
420.000000 MHz	44.8241	36.4841
430.000000 MHz	44.5839	35.9541
440.000000 MHz	44.3183	35.5098
450.000000 MHz	44.0572	35.0854
460.000000 MHz	43.8600	34.7069
470.000000 MHz	43.6544	34.3371
480.000000 MHz	43.4507	33.9296
490.000000 MHz	43.2880	33.5147
500.000000 MHz	43.0921	33.1731
510.000000 MHz	42.8781	32.7813
520.000000 MHz	42.6765	32.4193
530.000000 MHz	42.5864	32.1000
540.000000 MHz	42.4644	31.7180
550.000000 MHz	42.3042	31.4503

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

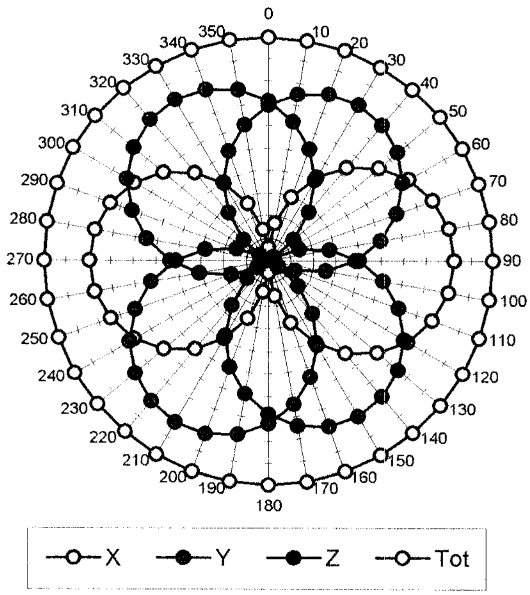
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	14.6	9.8
SAR_{be} [%]	With Correction Algorithm	0.2	0.0

Sensor Offset

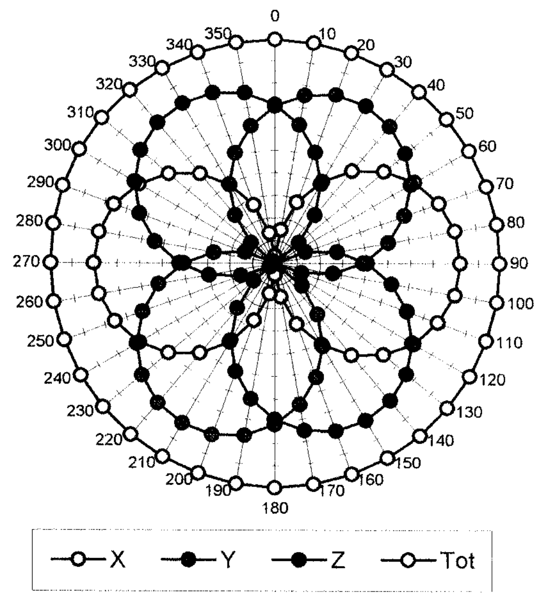
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.4 ± 0.2**	mm

Receiving Pattern (ϕ), θ = 0°

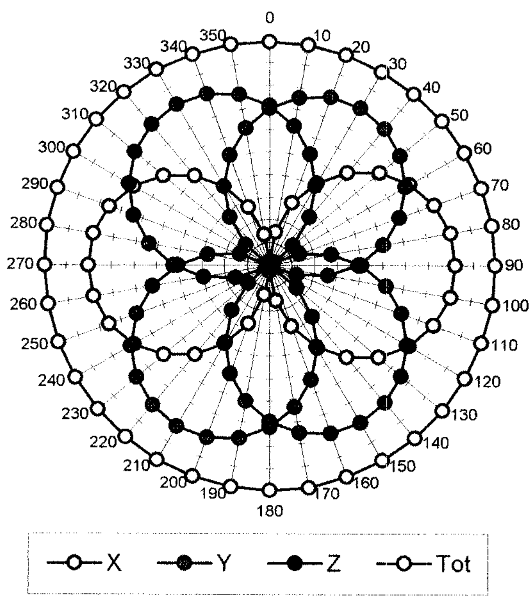
f = 30 MHz, TEM cell ifi110



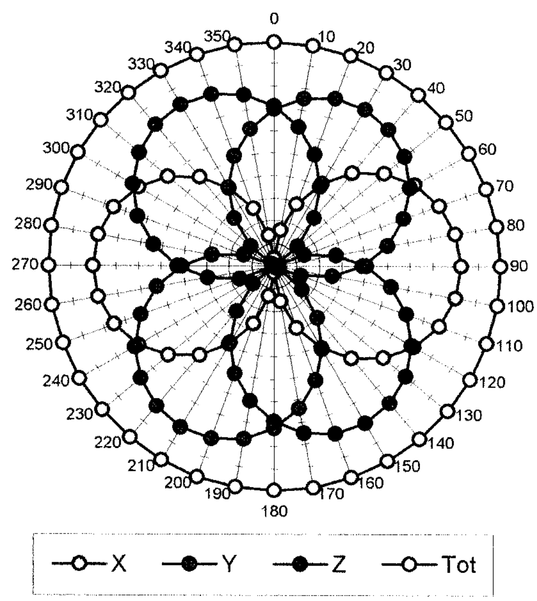
f = 100 MHz, TEM cell ifi110

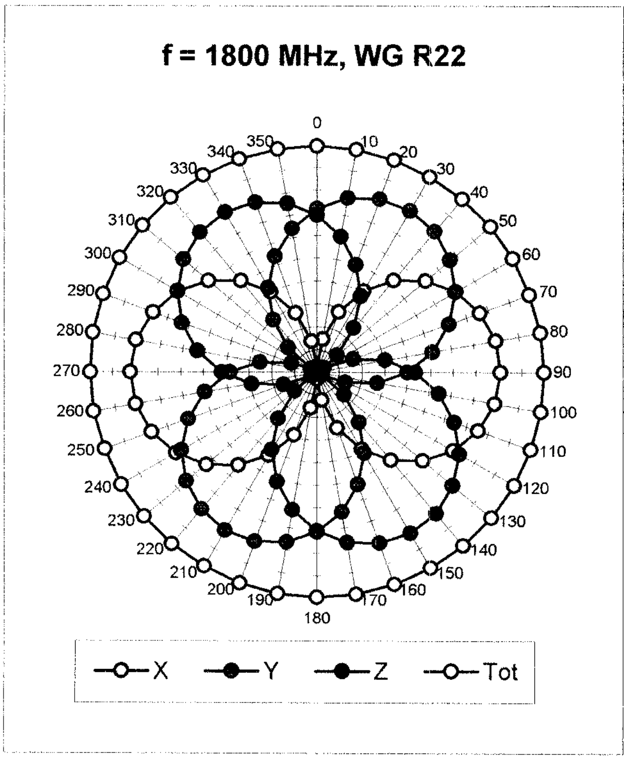


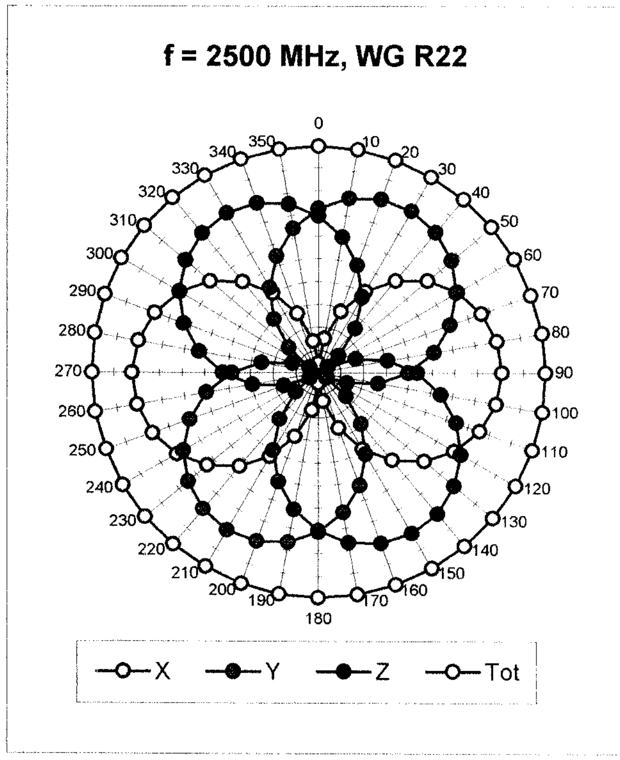
f = 300 MHz, TEM cell ifi110



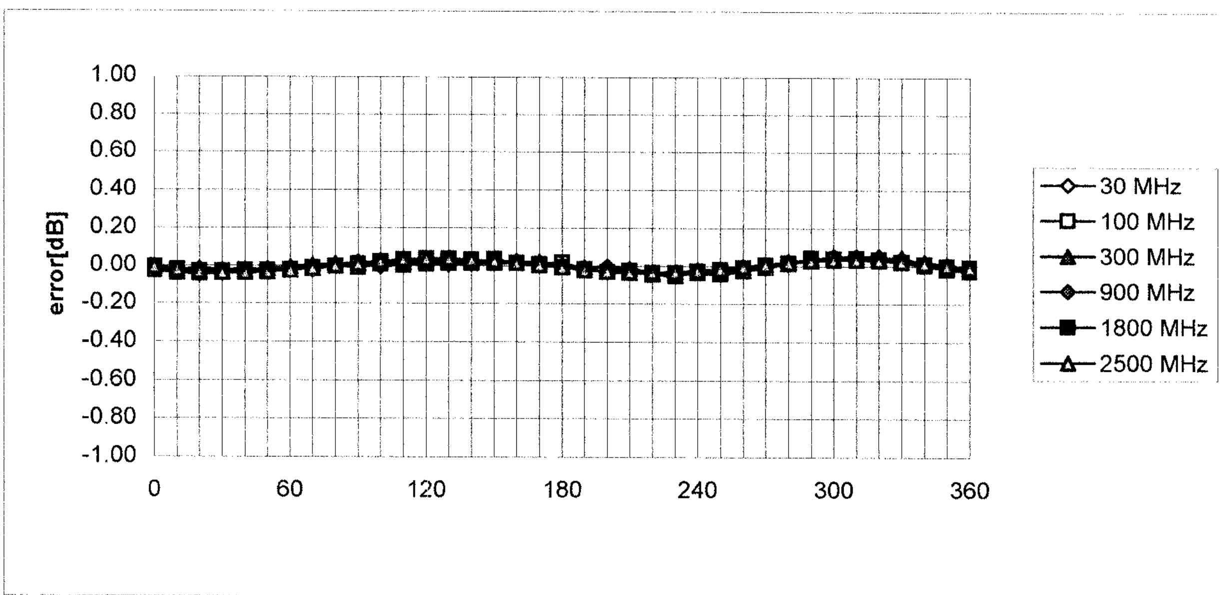
f = 900 MHz, TEM cell ifi110





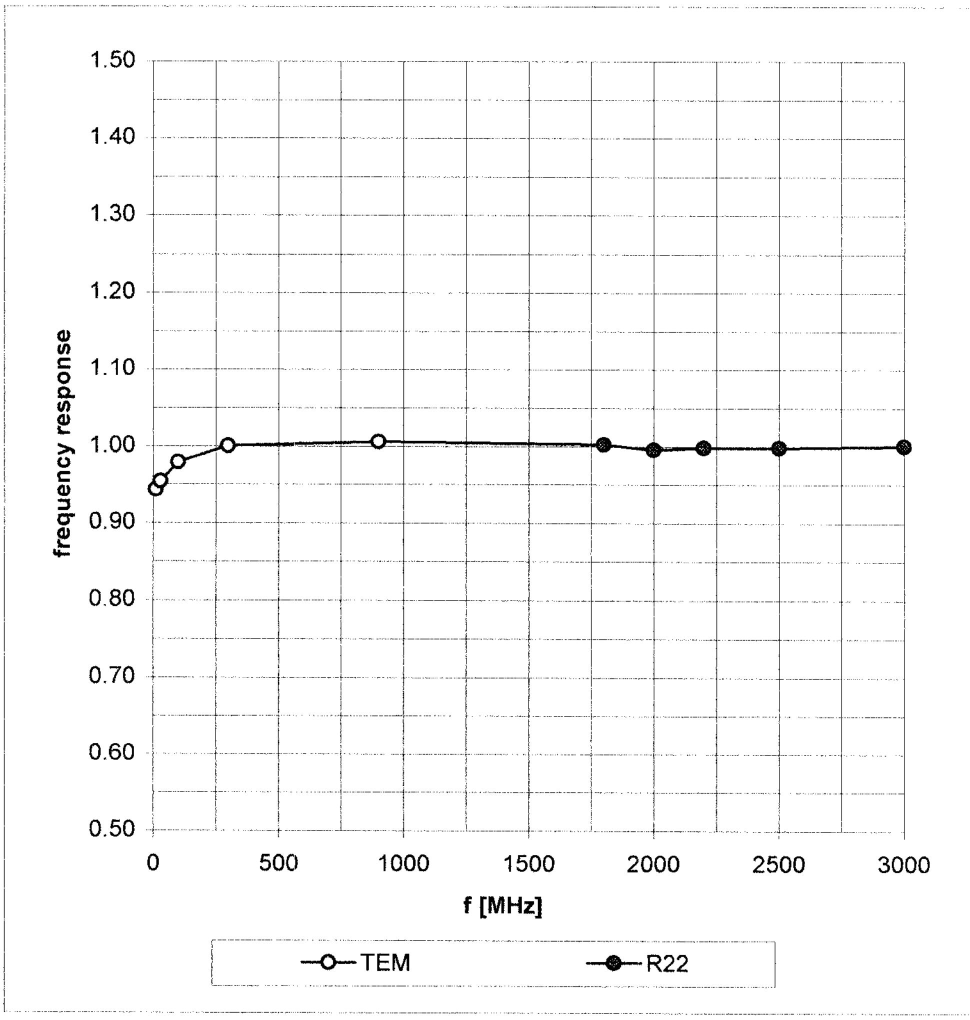


Isotropy Error (ϕ), θ = 0°



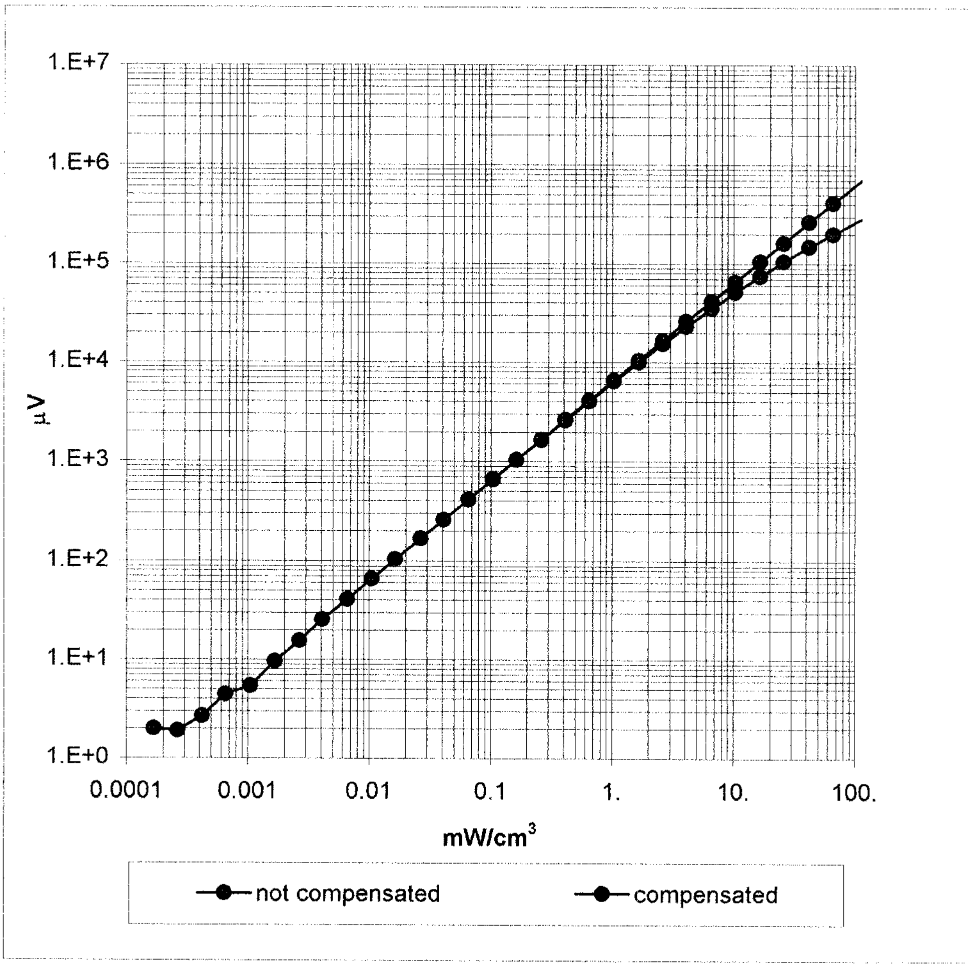
Frequency Response of E-Field

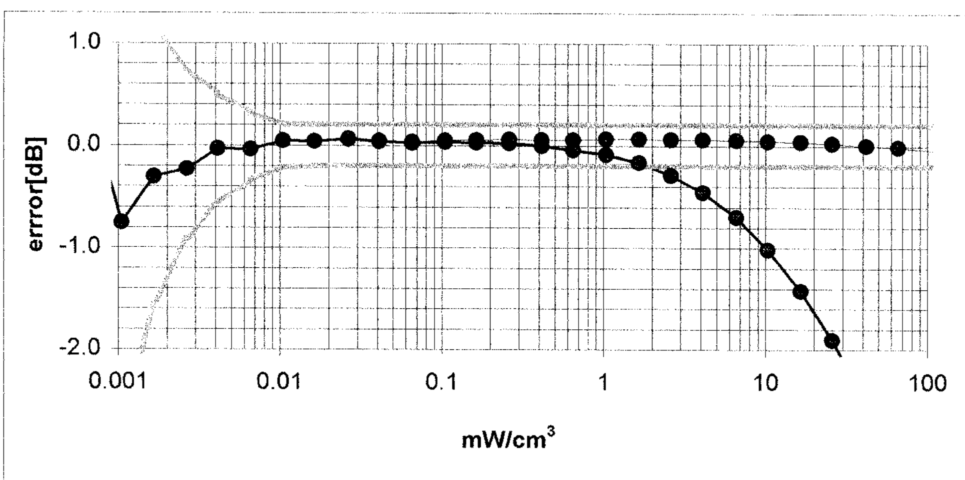
(TEM-Cell:ifi110, Waveguide R22)



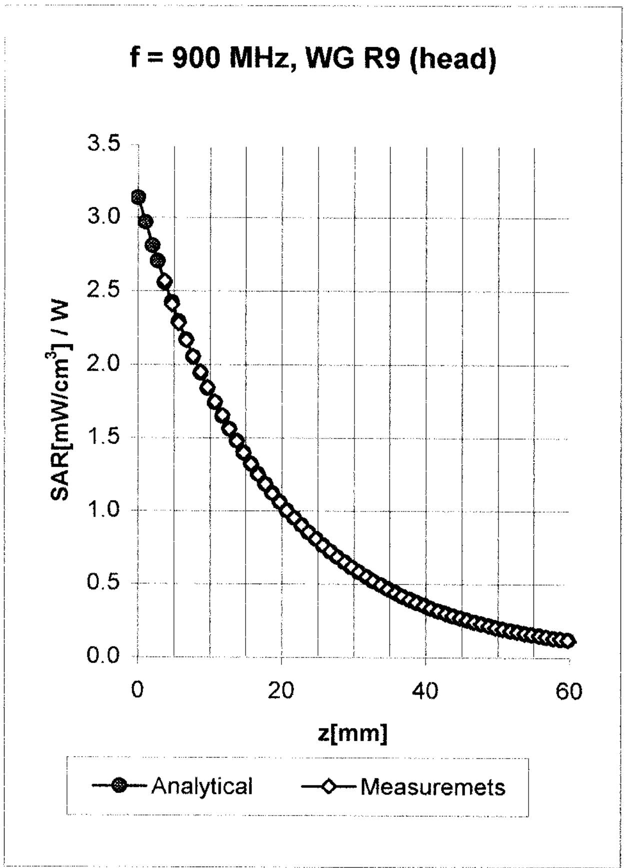
Dynamic Range f(SAR$_{brain}$)

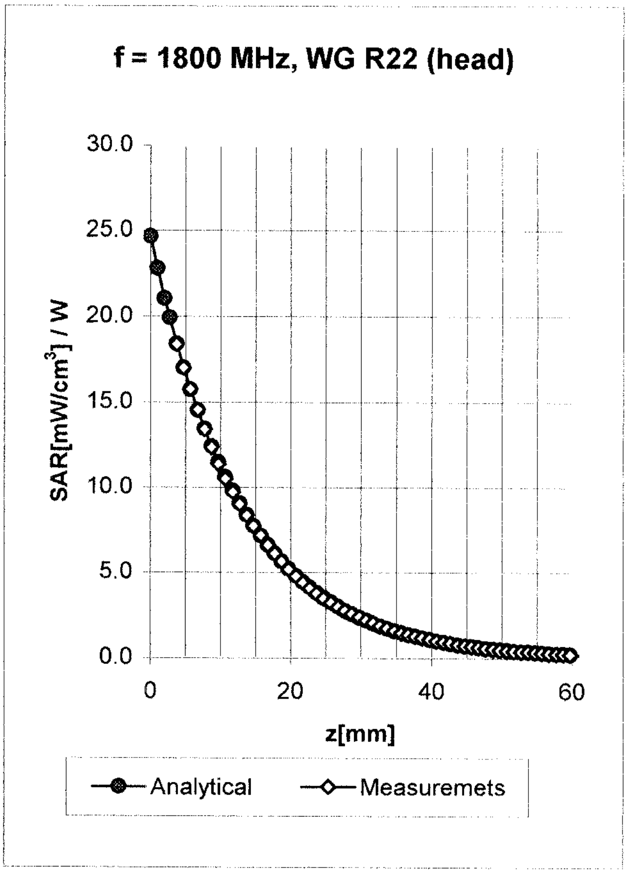
(Waveguide R22)





Conversion Factor Assessment

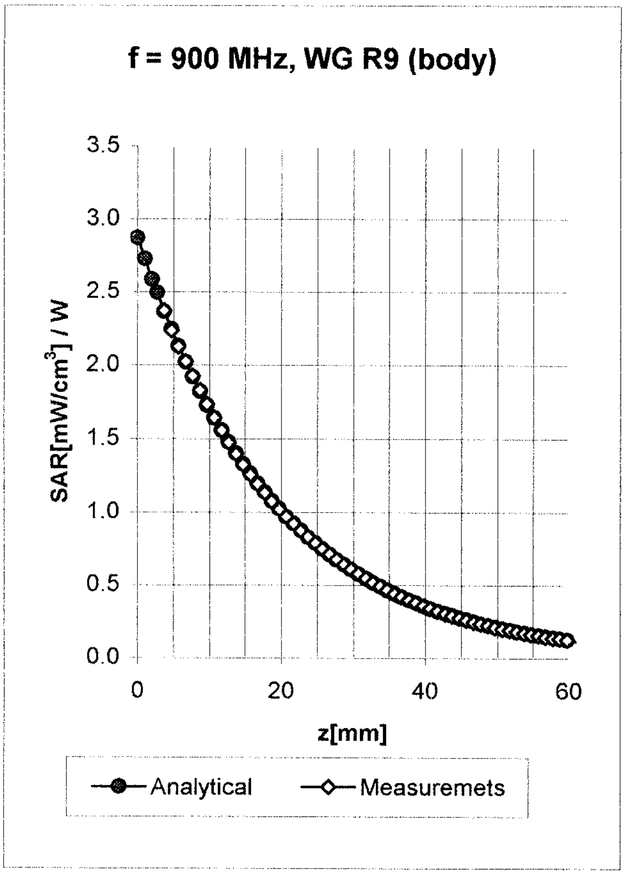


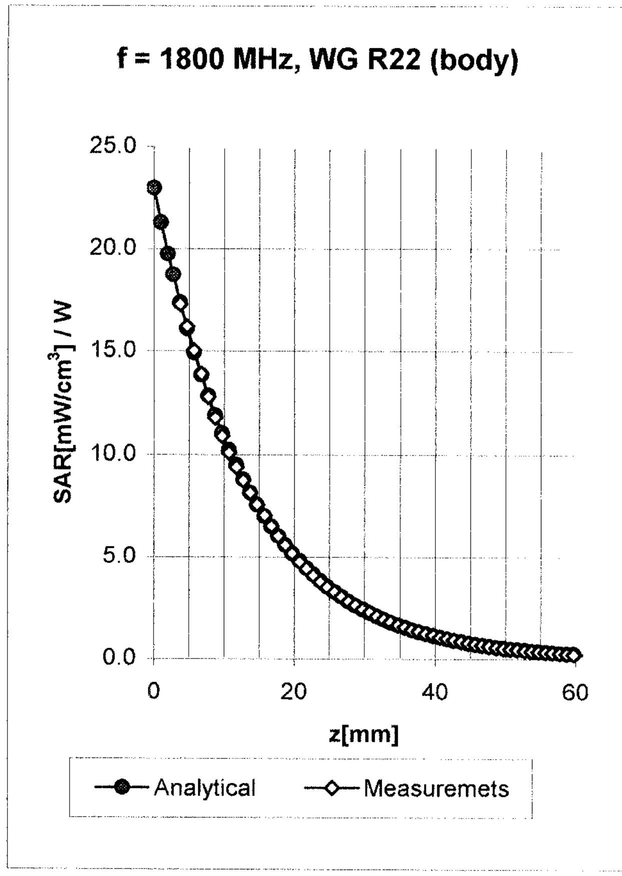


Head	**900 MHz**		ε_r = **41.5 ± 5%**	σ = **0.97 ± 5% mho/m**	
Head	**835 MHz**		ε_r = **41.5 ± 5%**	σ = **0.90 ± 5% mho/m**	
	ConvF X	**6.6**	± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**6.6**	± 9.5% (k=2)	Alpha	**0.37**
	ConvF Z	**6.6**	± 9.5% (k=2)	Depth	**2.61**

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

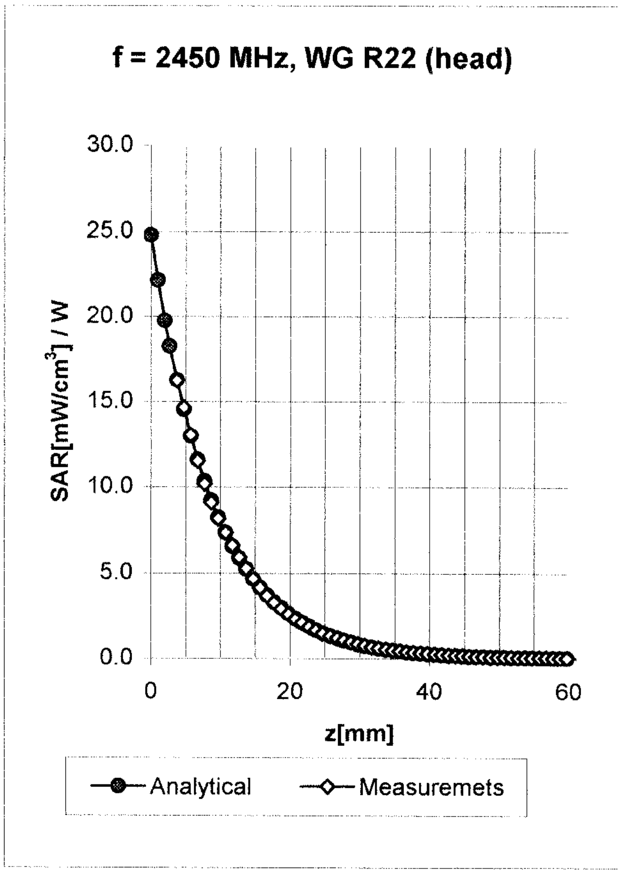


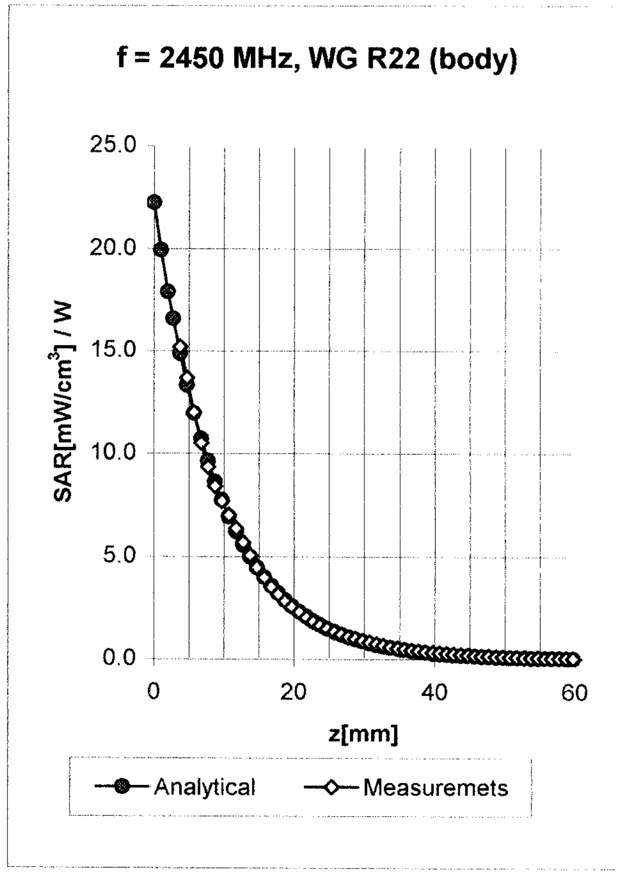


Body	**900 MHz**		ε_r = **55.0 ± 5%**	σ = **1.05 ± 5% mho/m**	
Body	**835 MHz**		ε_r = **55.2 ± 5%**	σ = **0.97 ± 5% mho/m**	
	ConvF X	**6.4**	± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**6.4**	± 9.5% (k=2)	Alpha	**0.45**
	ConvF Z	**6.4**	± 9.5% (k=2)	Depth	**2.35**

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**

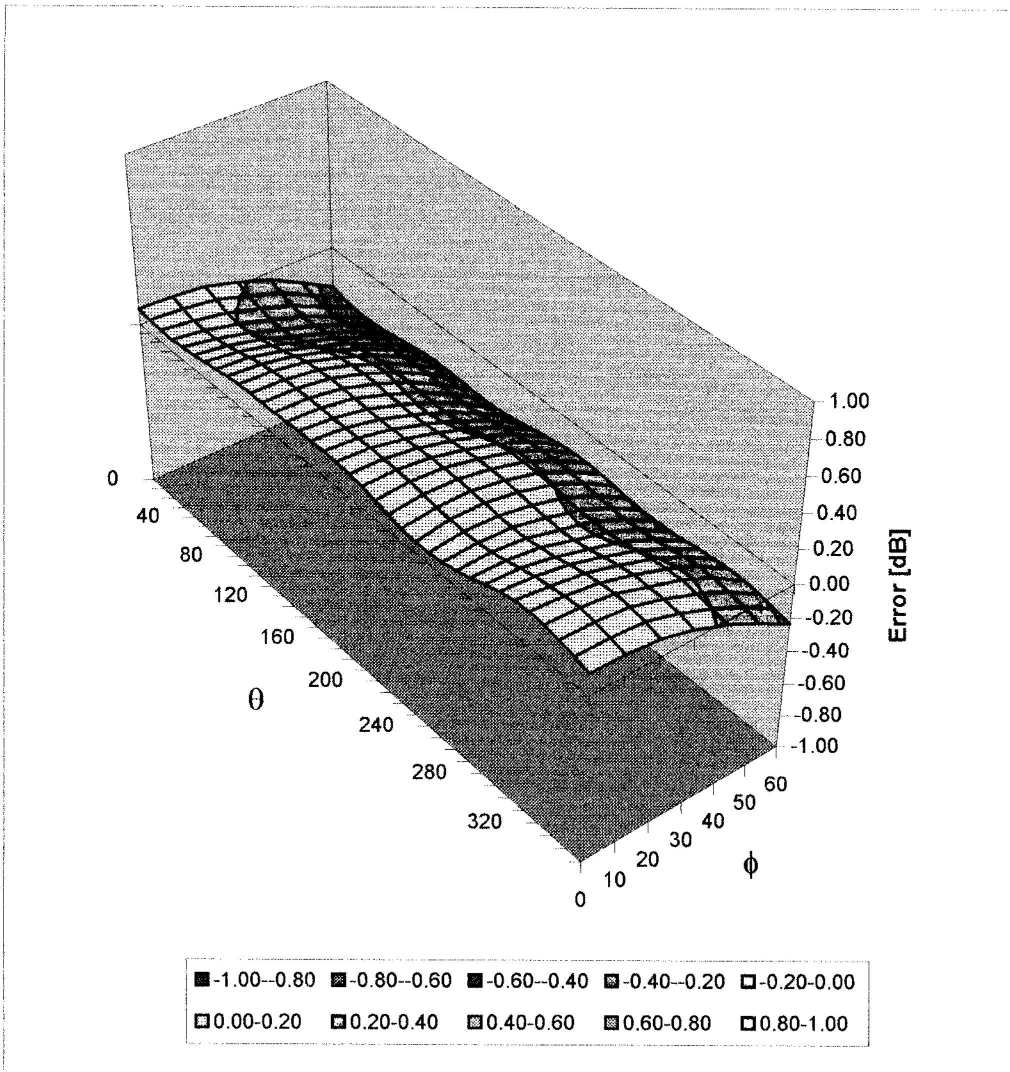
ConvF X	**5.0**	± 8.9% (k=2)	Boundary effect:	
ConvF Y	**5.0**	± 8.9% (k=2)	Alpha	**1.04**
ConvF Z	**5.0**	± 8.9% (k=2)	Depth	**1.85**

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 & EUT Evaluation (Face)

Measured Fluid Dielectric Parameters (Brain)

September 30, 2003

Frequency	e'	e''
350.000000 MHz	45.6621	38.7913
360.000000 MHz	45.3787	38.0453
370.000000 MHz	45.1448	37.4114
380.000000 MHz	44.8855	36.8359
390.000000 MHz	44.6137	36.2385
400.000000 MHz	44.4097	35.7449
410.000000 MHz	44.1097	35.2281
420.000000 MHz	43.8568	34.8094
430.000000 MHz	43.5917	34.3641
440.000000 MHz	43.3439	34.0229
450.000000 MHz	43.1009	33.6409
460.000000 MHz	42.9015	33.2969
470.000000 MHz	42.7056	32.9225
480.000000 MHz	42.5257	32.4908
490.000000 MHz	42.3069	32.1003
500.000000 MHz	42.0707	31.7626
510.000000 MHz	41.9128	31.4424
520.000000 MHz	41.7653	31.1491
530.000000 MHz	41.5748	30.7617
540.000000 MHz	41.4438	30.4099
550.000000 MHz	41.2509	30.1673

450 MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

October 01, 2003

Frequency	e'	e''
350.000000 MHz	45.2675	38.1924
360.000000 MHz	44.9900	37.4409
370.000000 MHz	44.7124	36.8529
380.000000 MHz	44.3910	36.2476
390.000000 MHz	44.1117	35.6896
400.000000 MHz	43.9356	35.1872
410.000000 MHz	43.7278	34.6929
420.000000 MHz	43.4459	34.3123
430.000000 MHz	43.2252	33.8637
440.000000 MHz	43.0105	33.5204
450.000000 MHz	42.7754	33.1028
460.000000 MHz	42.6127	32.7382
470.000000 MHz	42.3310	32.3720
480.000000 MHz	42.1145	31.9062
490.000000 MHz	41.8487	31.6229
500.000000 MHz	41.6695	31.2870
510.000000 MHz	41.4933	30.9307
520.000000 MHz	41.3176	30.6372
530.000000 MHz	41.1006	30.3461
540.000000 MHz	40.9804	29.9784
550.000000 MHz	40.7991	29.7277

450 MHz EUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

October 01, 2003

Frequency	e'	e''
350.000000 MHz	59.8235	45.5944
360.000000 MHz	59.6410	44.6324
370.000000 MHz	59.4697	43.7746
380.000000 MHz	59.3453	42.9615
390.000000 MHz	59.1637	42.1201
400.000000 MHz	59.0207	41.4606
410.000000 MHz	58.8284	40.7351
420.000000 MHz	58.6430	40.2251
430.000000 MHz	58.5145	39.6057
440.000000 MHz	58.3384	39.1197
450.000000 MHz	58.1571	38.6646
460.000000 MHz	58.0337	38.1782
470.000000 MHz	57.9256	37.6978
480.000000 MHz	57.6767	37.1385
490.000000 MHz	57.6026	36.6877
500.000000 MHz	57.4842	36.2623
510.000000 MHz	57.3491	35.8211
520.000000 MHz	57.2254	35.4095
530.000000 MHz	57.0300	35.0291
540.000000 MHz	56.9991	34.5894
550.000000 MHz	56.8212	34.2394

450 MHz System Performance Check & EUT Evaluation (Face)

Measured Fluid Dielectric Parameters (Brain)

October 14, 2003

Frequency	e'	e''
350.000000 MHz	45.3302	39.3417
360.000000 MHz	45.0541	38.5592
370.000000 MHz	44.8396	37.9005
380.000000 MHz	44.6070	37.2017
390.000000 MHz	44.2829	36.6257
400.000000 MHz	44.0236	36.1121
410.000000 MHz	43.7221	35.6504
420.000000 MHz	43.5069	35.2791
430.000000 MHz	43.2601	34.8228
440.000000 MHz	43.0270	34.4527
450.000000 MHz	42.7600	34.0393
460.000000 MHz	42.5500	33.7461
470.000000 MHz	42.3728	33.3169
480.000000 MHz	42.2088	32.9298
490.000000 MHz	41.9748	32.5007
500.000000 MHz	41.8063	32.1123
510.000000 MHz	41.5621	31.7351
520.000000 MHz	41.4376	31.4348
530.000000 MHz	41.2414	31.1579
540.000000 MHz	41.0910	30.7414
550.000000 MHz	40.9355	30.5352

450 MHz EUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

October 14, 2003

Frequency	e'	e''
350.000000 MHz	59.6859	45.4960
360.000000 MHz	59.4819	44.6004
370.000000 MHz	59.4202	43.8869
380.000000 MHz	59.3243	43.3476
390.000000 MHz	59.0946	42.7036
400.000000 MHz	58.9323	41.9062
410.000000 MHz	58.7244	41.0694
420.000000 MHz	58.6343	40.3909
430.000000 MHz	58.5222	39.6945
440.000000 MHz	58.3725	39.1422
450.000000 MHz	58.1721	38.6904
460.000000 MHz	58.0457	38.2797
470.000000 MHz	57.9169	37.8295
480.000000 MHz	57.7165	37.4029
490.000000 MHz	57.5025	36.9603
500.000000 MHz	57.3293	36.5082
510.000000 MHz	57.2156	35.9900
520.000000 MHz	57.2321	35.5097
530.000000 MHz	57.1555	35.0657
540.000000 MHz	57.0765	34.5705
550.000000 MHz	56.9314	34.2605

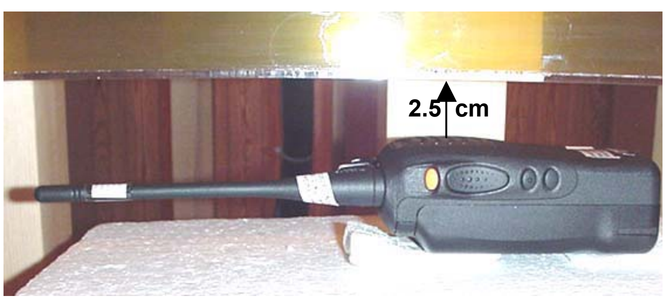
APPENDIX F - SAR TEST SETUP & DUT PHOTOGRAPHS

FACE-HELD SAR TEST SETUP PHOTOGRAPHS

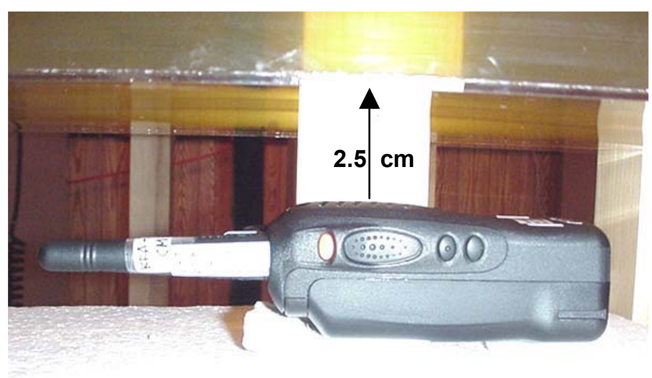
2.5 cm Separation Distance from Front of Radio to Planar Phantom

with Whip Antenna (KRA-27(M2))

with Stubby Antenna (KRA-23M2)



with Whip Antenna (KRA-27(M2))



with Stubby Antenna (KRA-23M2)

BODY-WORN SAR TEST SETUP PHOTOGRAPHS

0.9 cm Belt-Clip Separation Distance to Planar Phantom
with Speaker-Microphone Accessory

with Whip Antenna (KRA-27(M2))

with Stubby Antenna (KRA-23M2)

with Whip Antenna (KRA-27(M2))

with Stubby Antenna (KRA-23M2)

EUT PHOTOGRAPHS

Front of Radio with Whip Antenna

Front of Radio with Stubby Antenna

Back of Radio with Belt-Clip

Back of Radio Battery Removed


Left Side of Radio with Belt-Clip


Right Side of Radio with Belt-Clip

NiMH Battery (KNB-26N)

NiMH Battery (KNB-26N)

EUT PHOTOGRAPHS

Front of Radio with Speaker-Microphone Accessory

Speaker-Microphone (KMC-17) - Front

Whip Antenna (KRA-27M)

Stubby Antenna (KRA-23M)

Speaker-Microphone (KMC-17) - Back