

DECLARATION OF COMPLIANCE SAR RF EXPOSURE EVALUATION

Test Lab

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Applicant Information

ADVANCED WIRELESS COMMUNICATIONS
Northfield Telecommunications, Inc. d/b/a
Advanced Wireless Communications
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Lakeville, MN 55044-7486

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:	Q9S04032108
Model(s):	AWR2108
Modulation:	FM (UHF)
Tx Frequency Range:	450 - 470 MHz
Max. Output Power Tested:	2.73 Watts (Conducted)
Antenna Type(s):	Fixed
Battery Type(s):	Lithium-ion (8.4V, 700mAh)
Body-Worn Accessories:	1. Belt-Clip 2. Lapel Ear-Microphone
Max. SAR Measured:	0.798 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 was compliant with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC 47 CFR §2.1093 and Health Canada's Safety Code 6. The device was tested in accordance with the measurement standards and procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01) and Industry Canada RSS-102 Issue 1 (Provisional) for the Occupational / Controlled Exposure environment. All measurements were performed in accordance with the SAR system manufacturer recommendations.

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

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



Russell W. Pipe
Senior Compliance Technologist
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1.0 INTRODUCTION

This measurement report demonstrates compliance of the Advanced Wireless Communications Model: AWR2108 Portable UHF PTT Radio Transceiver FCC ID: Q9S04032108 with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]), and Health Canada’s Safety Code 6 (see reference [2]) for the Occupational / Controlled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]) and IC RSS-102 Issue 1 (Provisional) (see reference [4]), were employed. A description of the product, operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 DESCRIPTION of EQUIPMENT UNDER TEST(EUT)

FCC Rule Part(s)	47 CFR §2.1093
IC Rule Part(s)	RSS-102 Issue 1 (Provisional)
Test Procedure(s)	FCC OET Bulletin 65, Supplement C (01-01)
Device Type	Portable UHF PTT Radio Transceiver
FCC ID	Q9S04032108
Model(s)	AWR2108
Serial No.	Pre-production unit
Modulation	FM (UHF)
Tx Frequency Range	450 - 470 MHz
Max. RF Output Power Tested	2.73 Watts (Conducted)
Battery Type(s)	Lithium-ion (8.4V, 700mAh)
Antenna Type(s)	Fixed
Body-Worn Accessories Tested	1. Belt-Clip 2. Lapel Ear-Microphone

3.0 SAR MEASUREMENT SYSTEM

Celltech Labs SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY system is comprised of the robot controller, computer, near-field probe, probe alignment sensor, specific anthropomorphic mannequin (SAM) phantom, and various planar phantoms for brain and/or body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card. The DAE3 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.



DASY3 SAR Measurement System with SAM Phantom



DASY3 SAR Measurement System with validation 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													
Test Type	Fluid Type	Freq. (MHz)	Chan.	Test Mode	Conducted RF Output Power			Separation Distance to Planar Phantom (cm)	Measured SAR (W/kg)		Max. Cond. Power Drift (dB)	Scaled SAR (W/kg)	
					Before (W)	After (W)	Drift (dB)		100% Duty Cycle	50% Duty Cycle		100% Duty Cycle	50% Duty Cycle
Face	Brain	450.1	1	CW	2.70	2.32	-0.66	2.5	0.757	0.379	-1.20	0.998	0.499
Face	Brain	460.1	8	CW	2.73	2.07	-1.20	2.5	0.954	0.477	-1.20	1.26	0.629
Face	Brain	469.9	18	CW	2.72	2.16	-1.00	2.5	1.21	0.605	-1.20	1.60	0.798
Body	Body	450.1	1	CW	2.70	2.19	-0.91	1.3	1.71	0.855	-1.20	2.25	1.13
Body	Body	460.1	8	CW	2.72	2.12	-1.08	1.3	2.15	1.08	-1.20	2.83	1.42
Body	Body	469.9	18	CW	2.71	2.29	-0.73	1.3	2.33	1.17	-1.20	3.07	1.54
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak - Controlled Exposure / Occupational BRAIN / BODY: 8.0 W/kg (averaged over 1 gram)													
Dielectric Constant ϵ_r		Brain 450MHz			Body 450MHz			Atmospheric Pressure		100.2 kPa			
		IEEE Target		Measured	IEEE Target		Measured	Relative Humidity		64 %			
		43.5 (+/-5%)		43.2	56.7 (+/-5%)		58.5	Ambient Temperature		23.1 °C			
Conductivity σ (mho/m)		Brain 450MHz			Body 450MHz			Fluid Temperature		Brain: 21.4°C		Body: 21.3°C	
		IEEE Target		Measured	IEEE Target		Measured	Fluid Depth		≥ 15 cm			
		0.87 (+/-5%)		0.84	0.94 (+/-5%)		0.93	Phantom Section		Planar			

Note(s):

- The conducted power levels measured after each test were greater than 5% from the initial power measured. The maximum measured power drift was added to the measured SAR results to show scaled SAR values as shown in the above table.
- Body-worn SAR measurements were performed with belt-clip and lapel ear-microphone accessories attached to the EUT.
- 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.
- The dielectric properties of the simulated tissues were measured prior to the evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters).

5.0 DETAILS OF SAR EVALUATION

The Advanced Wireless Communications Model: AWR2108 Portable UHF PTT Radio Transceiver FCC ID: Q9S04032108 was found to be compliant for localized Specific Absorption Rate (Controlled Exposure) based on the test provisions and conditions described below. The detailed test setup photographs are shown in Appendix G.

1. The EUT was evaluated in a face-held configuration with the front of the device placed parallel to the outer surface of the SAM phantom (planar section). A 2.5 cm separation distance was maintained between the front side of the EUT and the outer surface of the SAM phantom (planar section) for the duration of the tests.
2. The EUT was tested in a body-worn configuration with the back of the device placed parallel to the outer surface of the SAM phantom (planar section). The attached belt-clip was touching the SAM phantom (planar section) and provided a 1.3 cm separation distance between the back of the EUT and the outer surface of the SAM phantom (planar section). The EUT was tested for body-worn SAR with the lapel ear-microphone accessory connected.
3. The conducted power levels were measured before and after each test according to the procedures described in FCC 47 CFR §2.1046. The conducted power levels measured after each test were greater than 5% from the initial power measured. The maximum measured power drift was added to the measured SAR results to show scaled SAR values as shown in the SAR test data table (page 5).
4. 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.
5. The EUT was tested with a fully charged battery.

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 in accordance with FCC OET Bulletin 65, Supplement C (Edition 01-01) using the SAM phantom.
(ii) For body-worn and face-held devices a planar phantom was used.
- b. The SAR was determined by a pre-defined procedure within the DASY3 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 20mm x 20mm.
- c. Based on the area scan data, the area of maximum absorption was determined by spline interpolation. Around this point, a volume of 40 x 40 x 35 mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 7 points.
- d. The 1g and 10g spatial peak SAR was determined as follows:
 1. The first step was an extrapolation to find the points between the dipole center of the probe and the surface of the phantom. This data cannot be measured, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.4 mm (see probe calibration document in Appendix D). The extrapolation was based on a least square algorithm [W. Gander, Computermathematik, p.168-180] (see reference [6]). Through the points in the first 3 cm in all z-axis, polynomials of the fourth order were calculated. This polynomial was then used to evaluate the points between the surface and the probe tip.
 2. The next step used 3D-spline interpolation to get all points within the measured volume in a 1mm grid (35000 points). The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition [W. Gander, Computermathematik, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff] (see reference [6]).
 3. The maximal interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-spline interpolation algorithm. 8000 points (20x20x20) were interpolated to calculate the average.

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 fluid 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				
04/03/03	Brain	1.23 ($\pm 10\%$)	1.26	43.5 ($\pm 5\%$)	43.2	0.87 ($\pm 5\%$)	0.84	1000	23.1 °C	21.4 °C	≥ 15 cm

Note(s):

1. The ambient and fluid temperatures were measured prior to, and during, the fluid electric parameter check and the system performance check. The temperatures listed in the table above were consistent for all measurement periods.

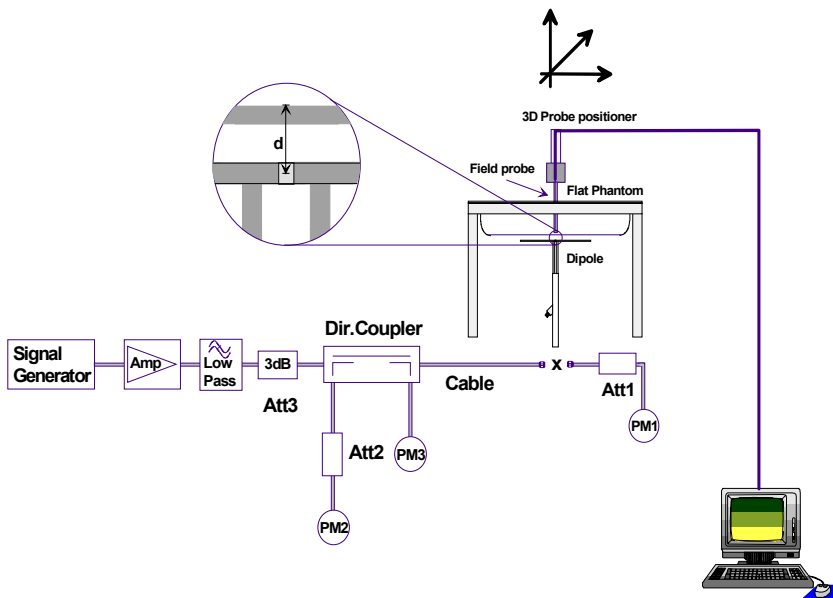


Figure 1. System Check Setup Diagram



450MHz Dipole Setup

8.0 SIMULATED 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	450MHz Brain (System Check & EUT Evaluation)	450MHz Body (EUT 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: Pentium III
Clock Speed: 450 MHz
Operating System: Windows NT
Data Card: DASY3 PC-Board

Data Converter

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

PC Interface Card

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

E-Field Probe

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

Evaluation Phantom

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

Validation Phantom (for devices ≤ 450 MHz)

Type: Planar Phantom
Shell Material: Plexiglas
Bottom Thickness: $6.2 \text{ mm} \pm 0.1 \text{ mm}$
Dimensions: 83.5 cm (L) x 36.9 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 $\pm 8\%$)
Frequency:	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity:	± 0.2 dB in brain tissue (rotation around probe axis) ± 0.4 dB in brain tissue (rotation normal to probe axis)
Dynamic Range:	$5 \mu\text{W/g}$ to $> 100 \text{ mW/g}$; 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 VALIDATION PLANAR PHANTOM

The validation planar phantom is constructed of Plexiglas material with a 6.0 mm shell thickness for SAR validations at and below 450MHz. The validation planar phantom is mounted in the DASY3 compact system in place of the SAM phantom.



Validation Planar Phantom

13.0 SAM PHANTOM V4.0C

The SAM phantom V4.0C is a fiberglass shell phantom with a 2.0mm shell thickness for left and right head and flat planar area integrated in a wooden table. The shape of the fiberglass shell corresponds to the phantom defined by SCC34-SC2. The device holder positions are adjusted to the standard measurement positions in the three sections.



SAM Phantom

14.0 DEVICE HOLDER

The DASY3 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65° . The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.



Device Holder

15.0 TEST EQUIPMENT LIST

SAR MEASUREMENT SYSTEM		
EQUIPMENT	SERIAL NO.	CALIBRATION DATE
Schmid & Partner DASY3 Compact System -Robot -ET3DV6 E-Field Probe -300MHz Validation Dipole -450MHz Validation Dipole -900MHz Validation Dipole -1800MHz Validation Dipole -2450MHz Validation Dipole -SAM Phantom V4.0C -Validation Planar Phantom	599396-01 1387 135 136 054 247 150 N/A N/A	N/A Feb 2003 Oct 2002 Oct 2002 June 2001 June 2001 Oct 2002 N/A N/A
HP 85070C Dielectric Probe Kit	N/A	N/A
Gigatronics 8652A Power Meter -Power Sensor 80701A -Power Sensor 80701A	1835272 1833535 1833542	Feb 2003 Feb 2003 Feb 2003
HP E4408B Spectrum Analyzer	US39240170	Dec 2002
HP 8594E Spectrum Analyzer	3543A02721	Feb 2003
HP 8753E Network Analyzer	US38433013	Feb 2003
HP 8648D Signal Generator	3847A00611	Feb 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 Std 1528-200X (Draft - see reference [5])

MEASUREMENT UNCERTAINTIES (Cont.)

UNCERTAINTY BUDGET FOR SYSTEM VALIDATION						
Error Description	Uncertainty Value ±%	Probability Distribution	Divisor	C_i 1g	Standard Uncertainty ±% (1g)	V_i or V_{eff}
Measurement System						
Probe calibration	± 4.8	Normal	1	1	± 4.8	∞
Axial isotropy of the probe	± 4.7	Rectangular	√3	(1- c_p)	± 1.9	∞
Spherical isotropy of the probe	± 9.6	Rectangular	√3	(c_p)	± 3.9	∞
Spatial resolution	± 0.0	Rectangular	√3	1	± 0.0	∞
Boundary effects	± 5.5	Rectangular	√3	1	± 3.2	∞
Probe linearity	± 4.7	Rectangular	√3	1	± 2.7	∞
Detection limit	± 1.0	Rectangular	√3	1	± 0.6	∞
Readout electronics	± 1.0	Normal	1	1	± 1.0	∞
Response time	± 0.8	Rectangular	√3	1	± 0.5	∞
Integration time	± 1.4	Rectangular	√3	1	± 0.8	∞
RF ambient conditions	± 3.0	Rectangular	√3	1	± 1.7	∞
Mech. constraints of robot	± 0.4	Rectangular	√3	1	± 0.2	∞
Probe positioning	± 2.9	Rectangular	√3	1	± 1.7	∞
Extrapolation & integration	± 3.9	Rectangular	√3	1	± 2.3	∞
Dipole						
Dipole Axis to Liquid Distance	± 2.0	Rectangular	√3	1	± 1.2	∞
Input Power	± 4.7	Rectangular	√3	1	± 2.7	∞
Phantom and Setup						
Phantom uncertainty	± 4.0	Rectangular	√3	1	± 2.3	∞
Liquid conductivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid conductivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					± 9.9	
Expanded Uncertainty (k=2)					± 19.8	

Measurement Uncertainty Table in accordance with IEEE Std 1528-200X (Draft - see reference [5])

17.0 REFERENCES

- [1] Federal Communications Commission, "Radiofrequency radiation exposure evaluation: portable devices", Rule Part 47 CFR §2.1093: 1999.
- [2] Health Canada, "Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz", Safety Code 6.
- [3] Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.
- [4] Industry Canada, "Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields", Radio Standards Specification RSS-102 Issue 1 (Provisional): September 1999.
- [5] IEEE Standards Coordinating Committee 34, Std 1528-200X, "DRAFT Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques".
- [6] W. Gander, *Computermathematick*, Birkhaeuser, Basel: 1992.

APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

System Performance Check - 450MHz Dipole

Planar Phantom; Planar Section

Probe: ET3DV6 - SNI387; ConvF(7.50,7.50,7.50); Crest factor: 1.0; 450 MHz Brain: $\sigma = 0.84$ mho/m $\epsilon_r = 43.2$ $\rho = 1.00$ g/cm³

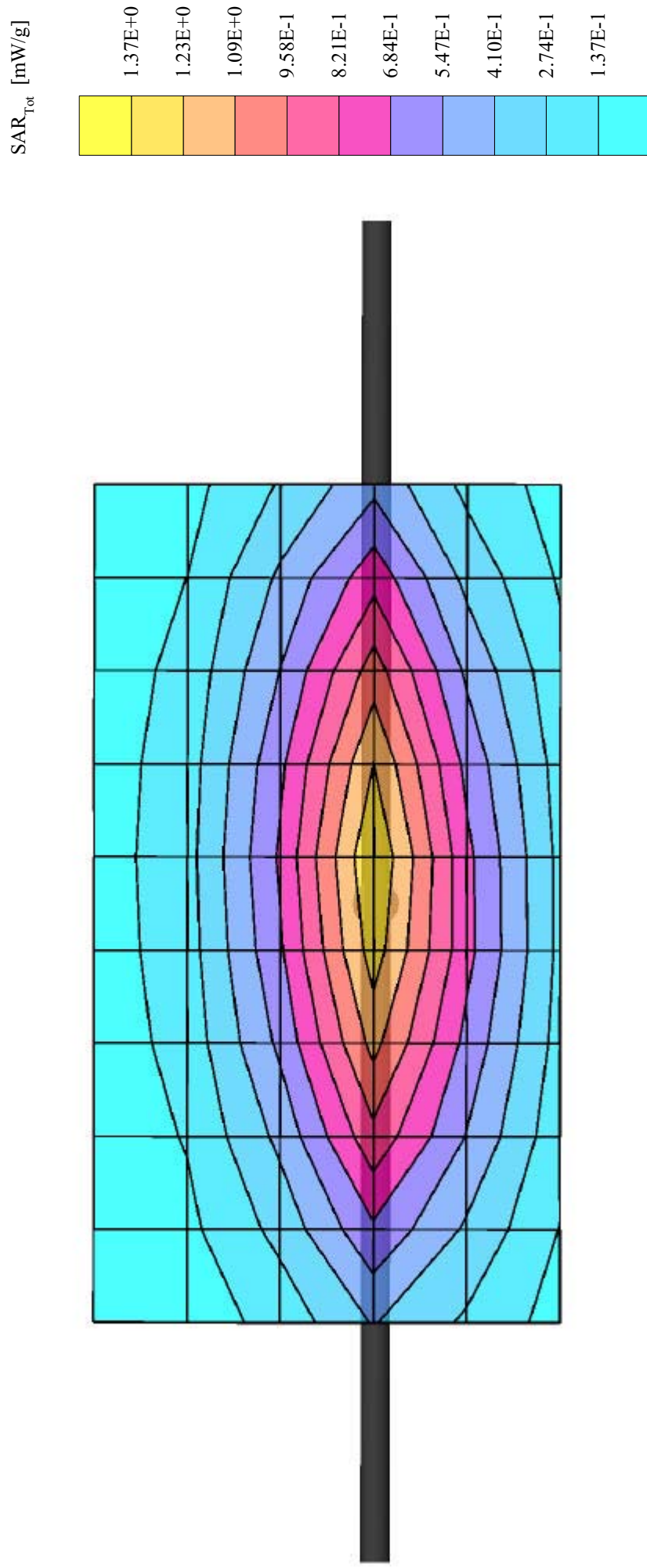
Cube 5x5x7: Peak: 2.04 mW/g, SAR (1g): 1.26 mW/g, SAR (10g): 0.817 mW/g, SAR (Advanced extrapolation)

Penetration depth: 12.1 (10.1, 14.2) [mm]; Powerdrift: -0.01 dB

Ambient Temp 23.1 °C; Fluid Temp 21.4 °C

Forward Conducted Power: 250 mW

Date Tested: April 3, 2003



APPENDIX C - SYSTEM VALIDATION

450MHz SYSTEM VALIDATION DIPOLE

Type:

450MHz Validation Dipole

Serial Number:

136

Place of Calibration:

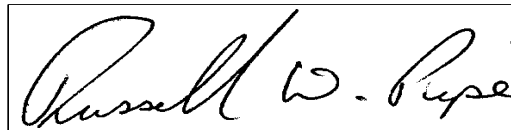
Celltech Research Inc.

Date of Calibration:

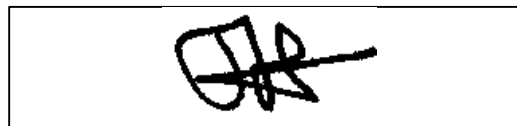
October 17, 2002

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

Calibrated by:



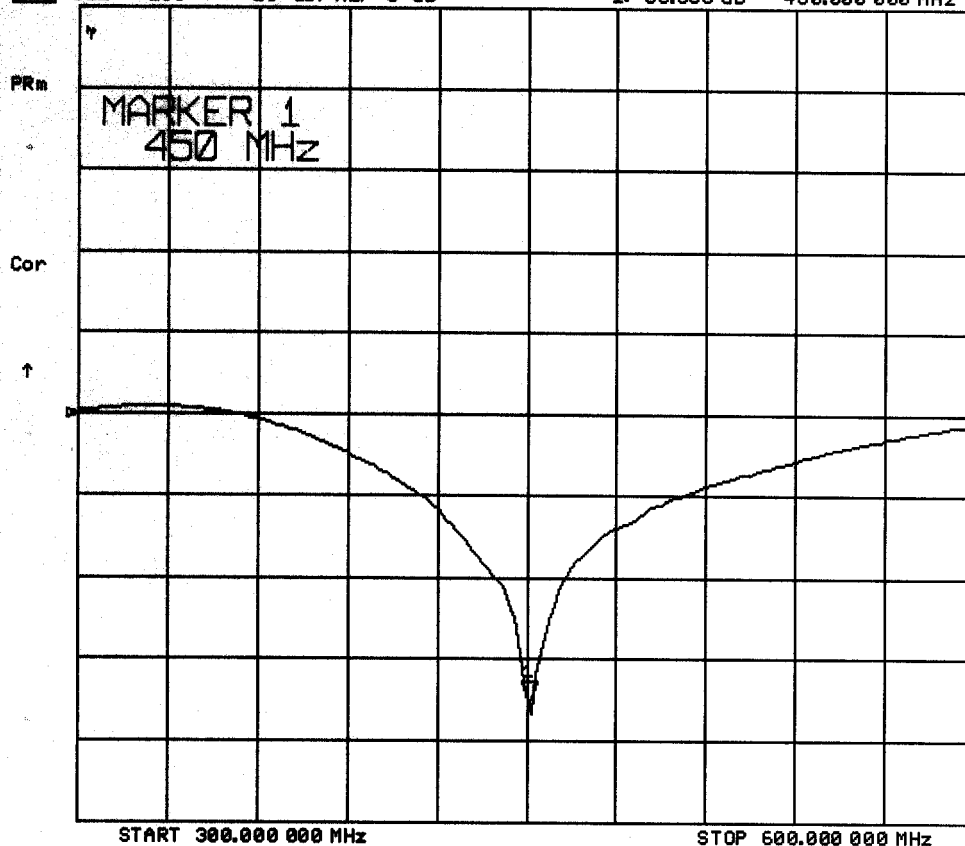
Approved by:



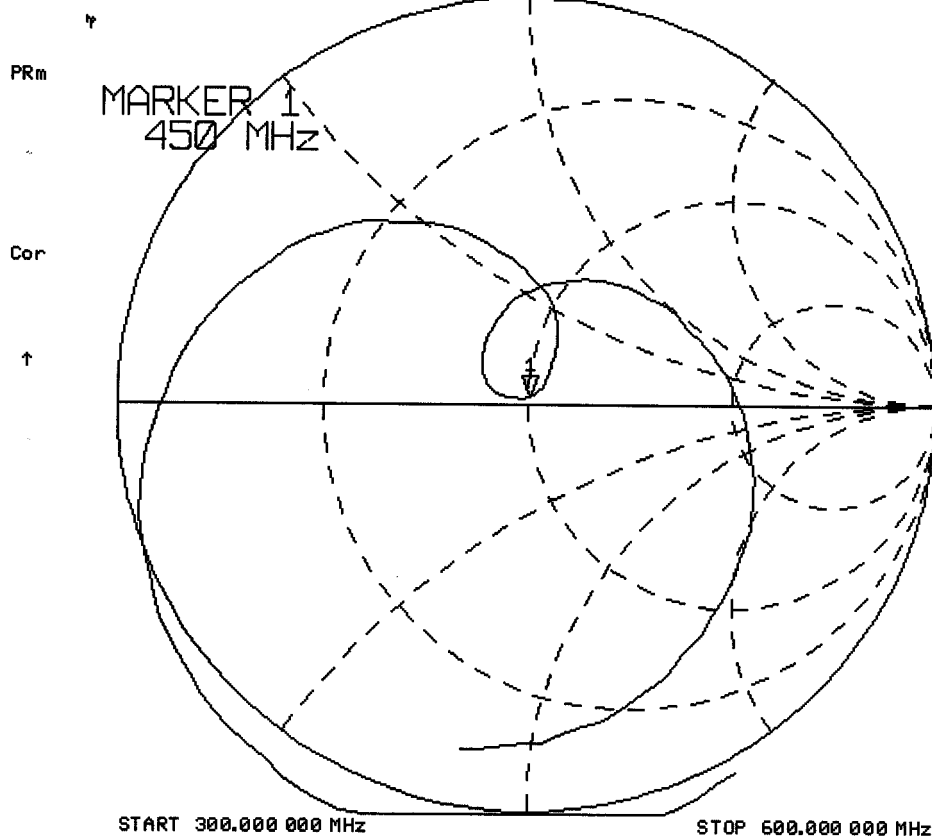
17 Oct 2002 20:34:40

S11 LOG 10 dB/REF 0 dB

1:-35.306 dB 450.000 000 MHz



17 Oct 2002 20:34:13
[CH1] S11 1 U FS 1: 50.299 Ω 1.6660 Ω 589.23 ρH 450.000 000 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

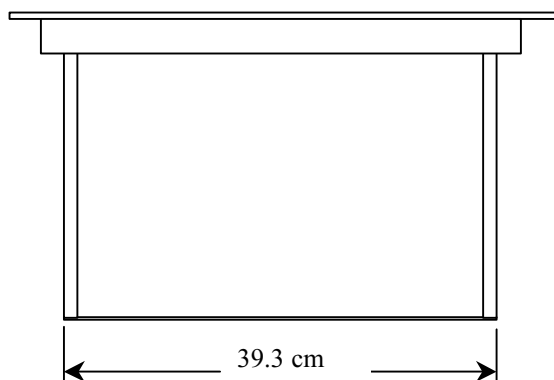
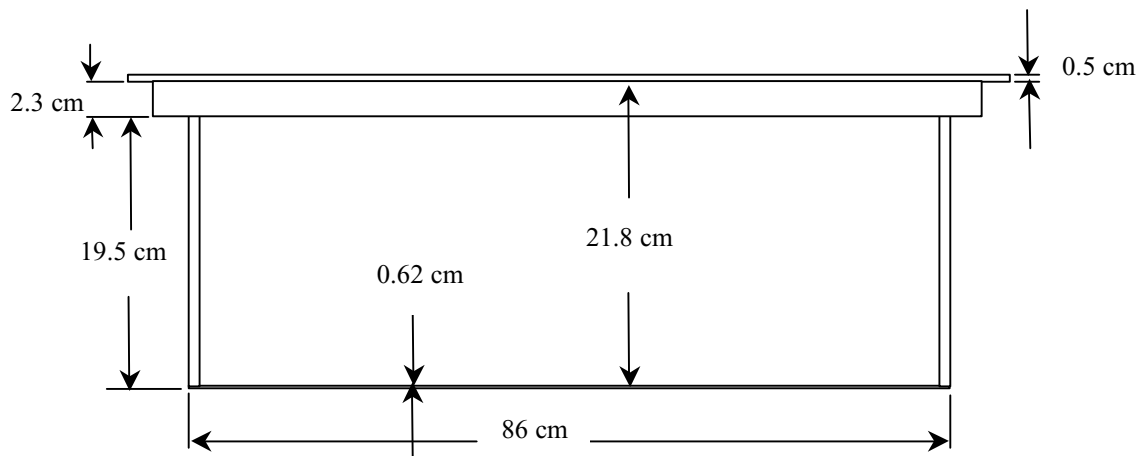
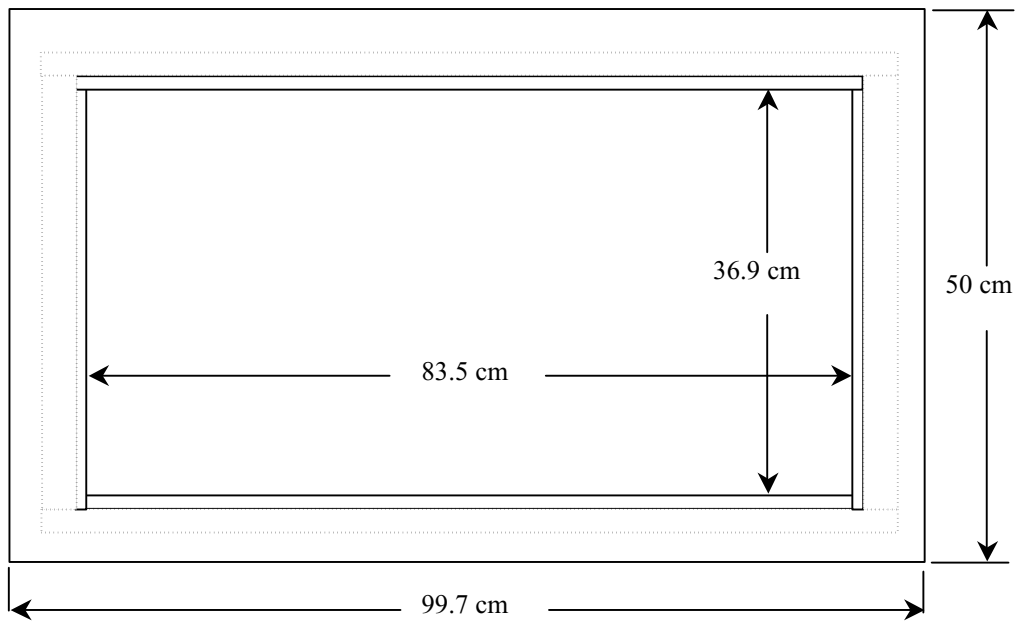
2. Validation Phantom

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 ± 0.1 mm 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:

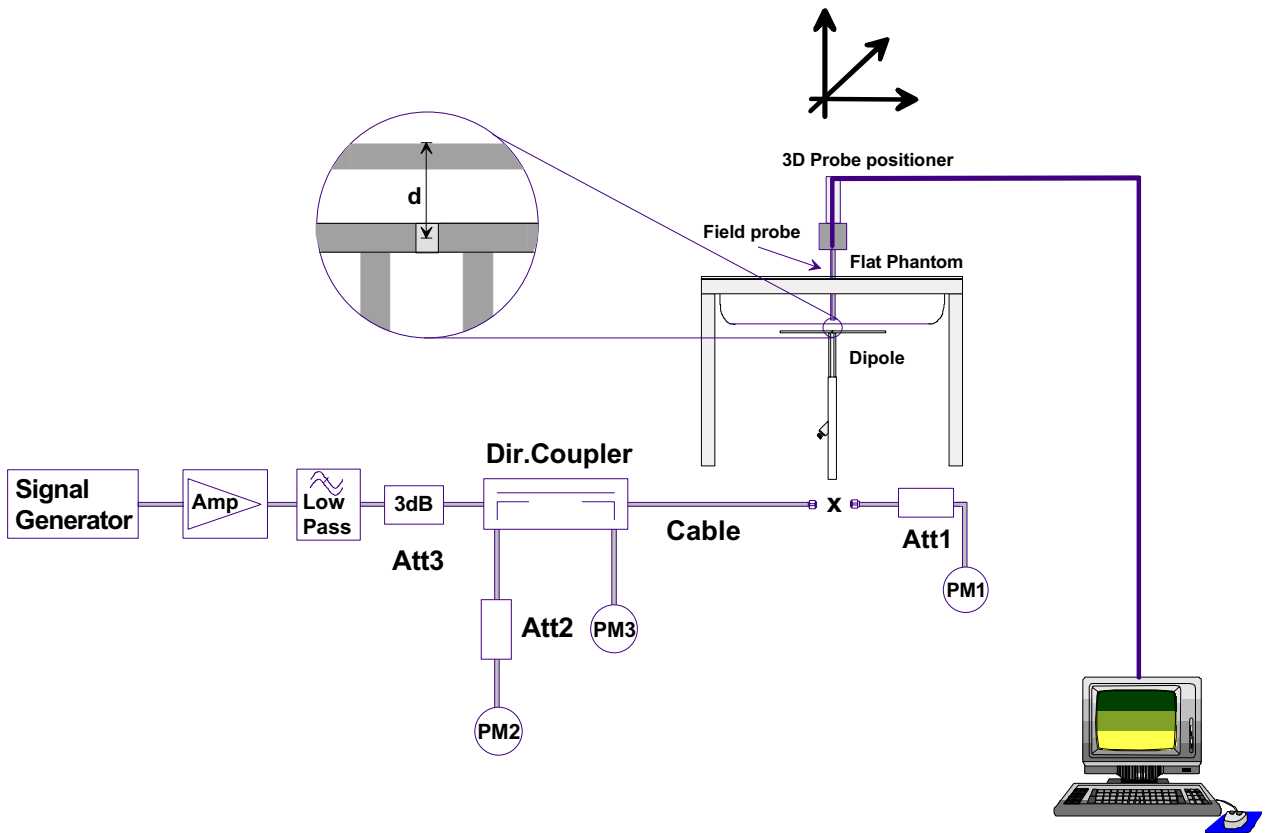
Relative Permittivity: 44.1
Conductivity: 0.88 mho/m
Ambient Temperature: 23.3 °C
Fluid Temperature: 22.2 °C
Fluid Depth: ≥ 15.0 cm

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	$\epsilon_r = 43.5$ $\sigma = 0.87$ 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

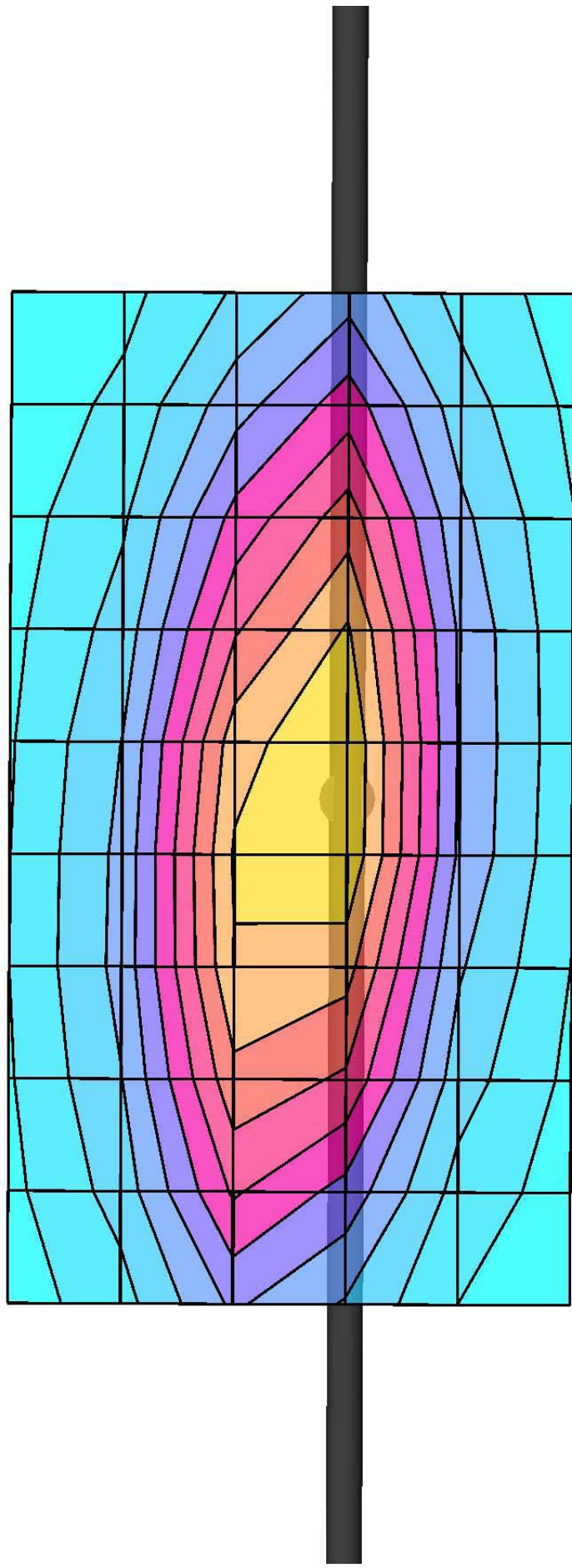
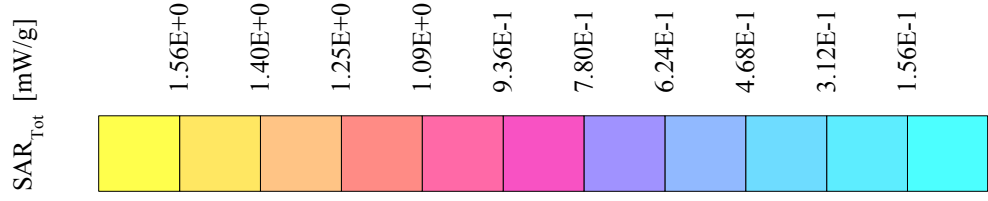
The results have been normalized to 1W (forward power) into the dipole.

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 - SNI387; ConvF(7.30,7.30,7.30); Crest factor: 1.0; 450 MHz Brain: $\sigma = 0.88$ mho/m $\epsilon_r = 44.1$ $\rho = 1.00$ g/cm³
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	ϵ'	ϵ''
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

450MHz SYSTEM VALIDATION DIPOLE

Type:

450MHz Validation Dipole

Serial Number:

136

Place of Calibration:

Celltech Labs Inc.

Date of Calibration:

August 18, 2003

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

Calibrated by:



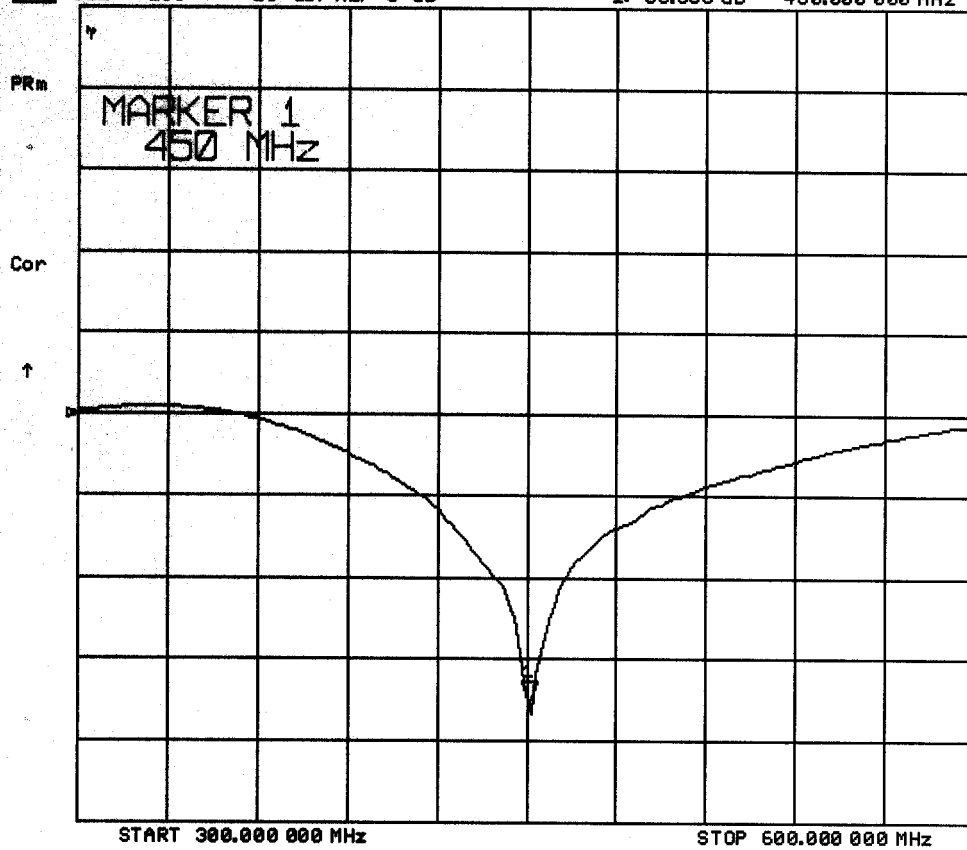
Approved by:



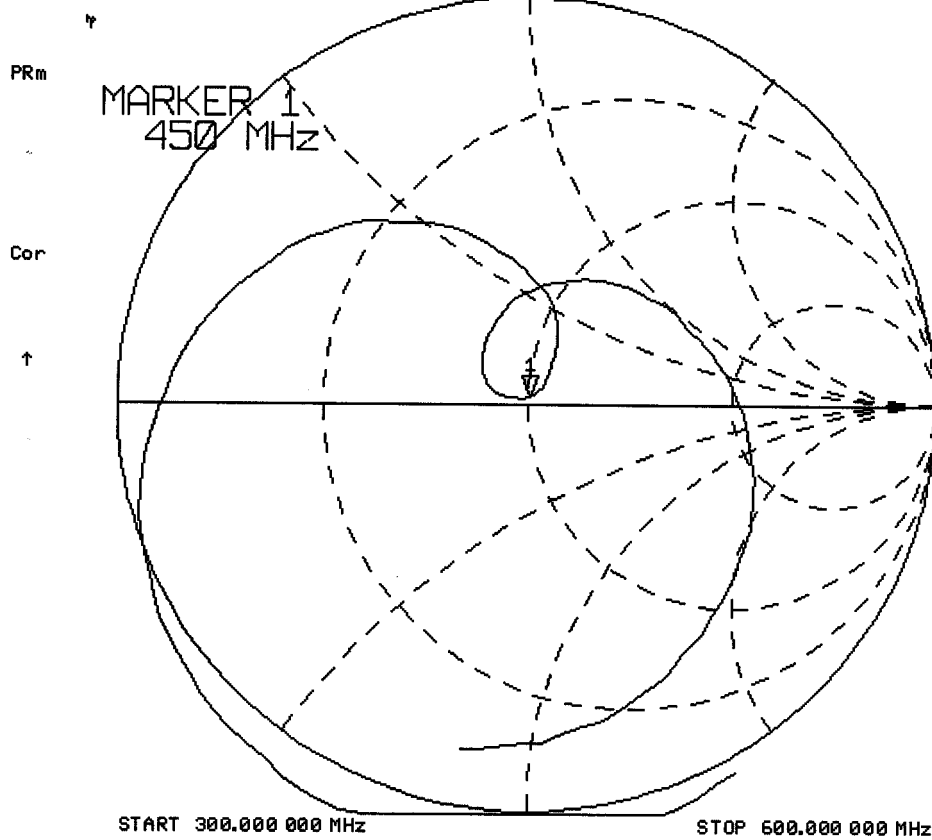
17 Oct 2002 20:34:40

CH1 S11 LOG 10 dB/REF 0 dB

1:-35.306 dB 450.000 000 MHz



17 Oct 2002 20:34:13
[CH1] S11 1 U FS 1: 50.299 Ω 1.6660 Ω 589.23 ρH 450.000 000 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

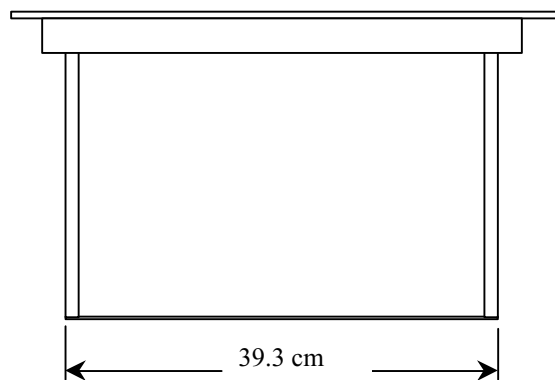
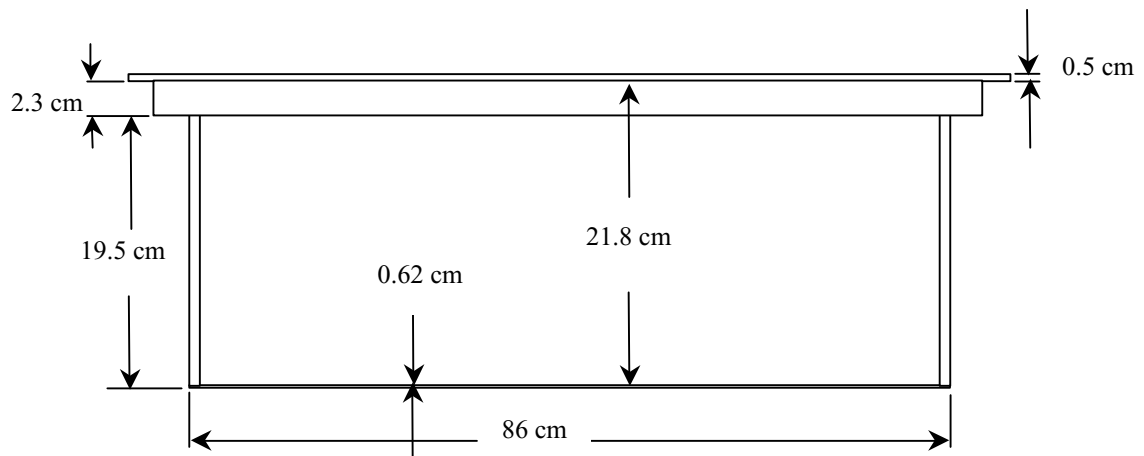
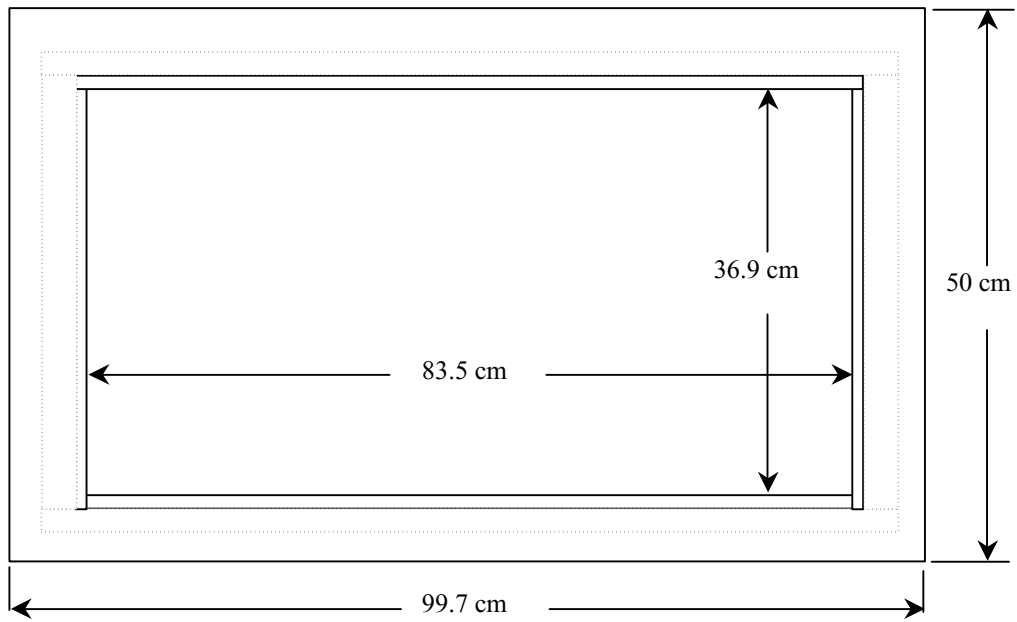
2. Validation Phantom

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 ± 0.1 mm 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:

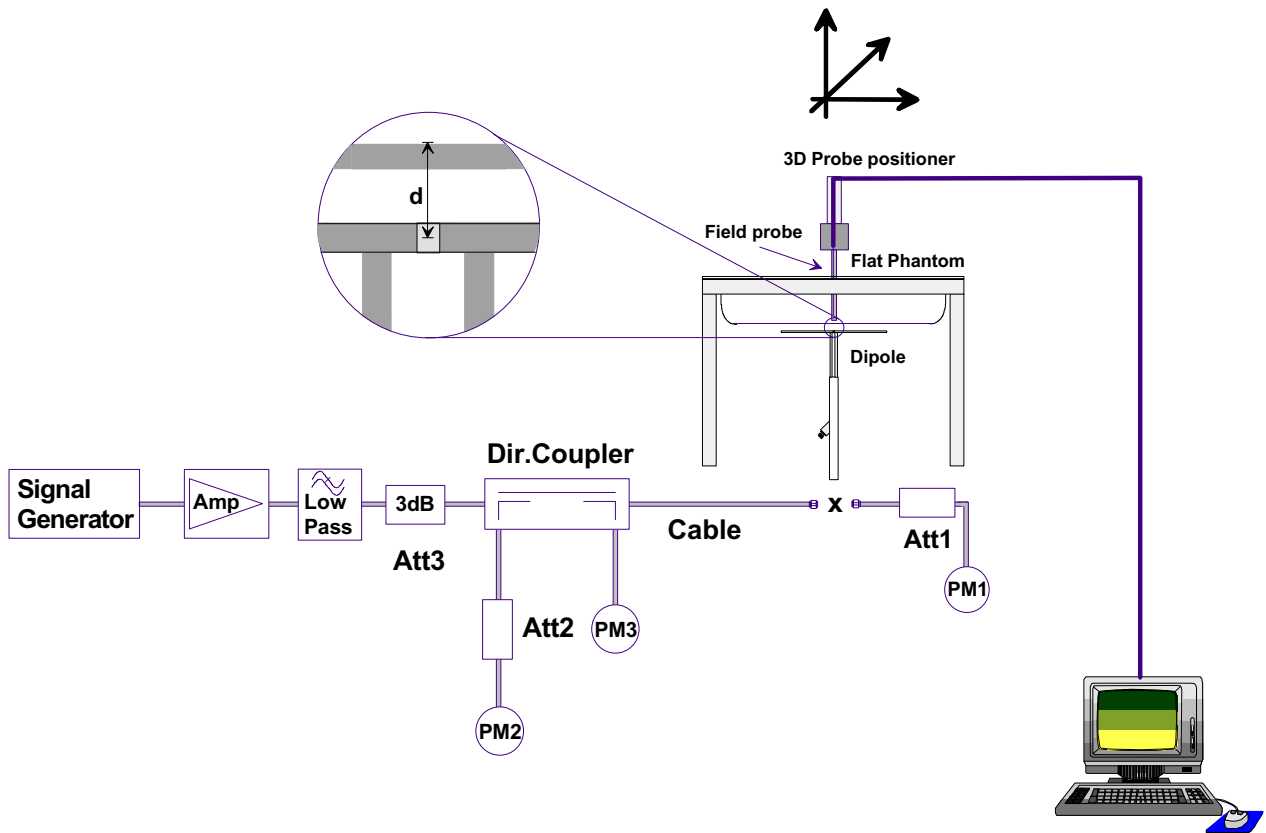
Relative Permittivity: 43.1
Conductivity: 0.84 mho/m
Ambient Temperature: 24.4 °C
Fluid Temperature: 21.6 °C
Fluid Depth: ≥ 15.0 cm

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	$\epsilon_r = 43.5$ $\sigma = 0.87$ 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	1.22	4.88	0.797	3.188	1.98
Test 2	1.25	5.00	0.808	3.232	2.03
Test 3	1.25	5.00	0.808	3.232	2.03
Test 4	1.25	5.00	0.808	3.232	2.03
Test 5	1.24	4.96	0.807	3.228	2.02
Test 6	1.25	5.00	0.811	3.244	2.03
Test 7	1.25	5.00	0.811	3.244	2.03
Test 8	1.27	5.08	0.824	3.296	2.06
Test 9	1.23	4.92	0.799	3.196	2.00
Test10	1.23	4.92	0.799	3.196	1.99
Average Value	1.24	4.98	0.807	3.229	2.02

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

Averaged over 1cm (1g) of tissue: 4.98 mW/g

Averaged over 10cm (10g) of tissue: 3.23 mW/g

System Validation - 450MHz Dipole

Large Planar Phantom; Planar Section

Probe: ET3DV6 - SN1387; ConvF(7.50,7.50,7.50); Crest factor: 1.0; Brain 450 MHz: $\sigma = 0.84$ mho/m $\epsilon_r = 43.1$ $\rho = 1.00$ g/cm³

Cube 5x5x7: Peak: 2.02 mW/g, SAR (1g): 1.24 mW/g, SAR (10g): 0.807 mW/g, (Worst-case extrapolation)

Penetration depth: 11.9 (10.1, 14.3) [mm]

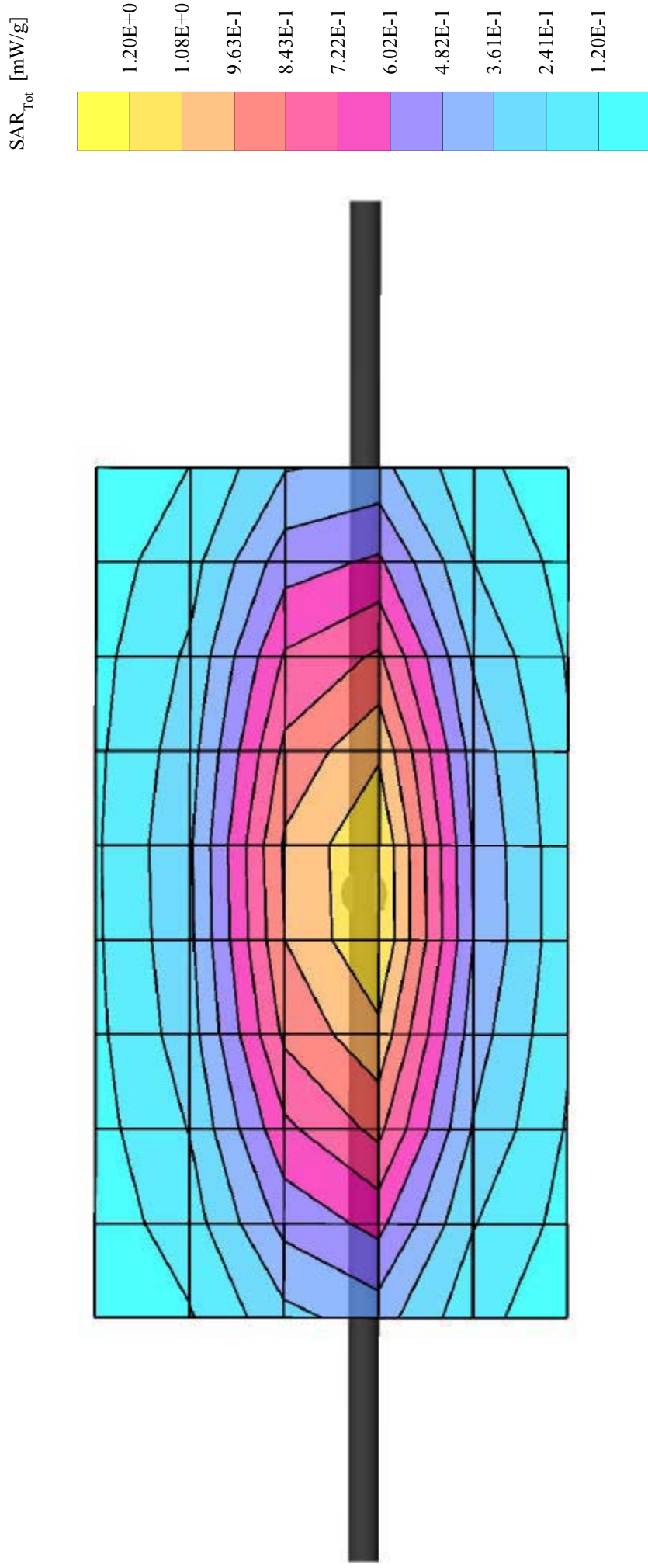
Powerdrift: 0.02 dB

450MHz System Validation

Forward Conducted Power: 250 mW

Ambient Temp 24.4 °C; Fluid Temp 21.6 °C

Date Tested: August 18, 2003



450MHz System Validation

Measured Fluid Dielectric Parameters (Brain)

August 18, 2003

Frequency	ϵ'	ϵ''
350.000000 MHz	45.7521	38.7562
360.000000 MHz	45.4509	38.0704
370.000000 MHz	45.1822	37.4401
380.000000 MHz	44.9314	36.8515
390.000000 MHz	44.7538	36.3257
400.000000 MHz	44.4593	35.8005
410.000000 MHz	44.1470	35.3449
420.000000 MHz	43.9072	34.8817
430.000000 MHz	43.6288	34.4170
440.000000 MHz	43.3826	34.0265
450.000000 MHz	43.1192	33.6381
460.000000 MHz	42.9593	33.3153
470.000000 MHz	42.7406	32.9169
480.000000 MHz	42.5800	32.4996
490.000000 MHz	42.3572	32.1957
500.000000 MHz	42.1973	31.8093
510.000000 MHz	41.9803	31.4476
520.000000 MHz	41.7785	31.1305
530.000000 MHz	41.6197	30.8343
540.000000 MHz	41.4213	30.4614
550.000000 MHz	41.2221	30.1802

APPENDIX D - PROBE CALIBRATION

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**


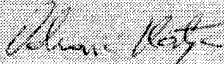
Condition of the calibrated item **In Tolerance (according to the specific calibration document)**

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	
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.

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 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.65 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.64 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

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

Sensitivity in Tissue Simulating Liquid

Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\%$ mho/m
ConvF X	6.6 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.6 $\pm 9.5\%$ (k=2)	Alpha	0.37
ConvF Z	6.6 $\pm 9.5\%$ (k=2)	Depth	2.61
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
ConvF X	5.2 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	5.2 $\pm 9.5\%$ (k=2)	Alpha	0.50
ConvF Z	5.2 $\pm 9.5\%$ (k=2)	Depth	2.73

Boundary Effect

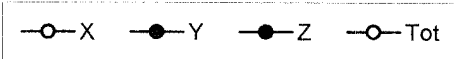
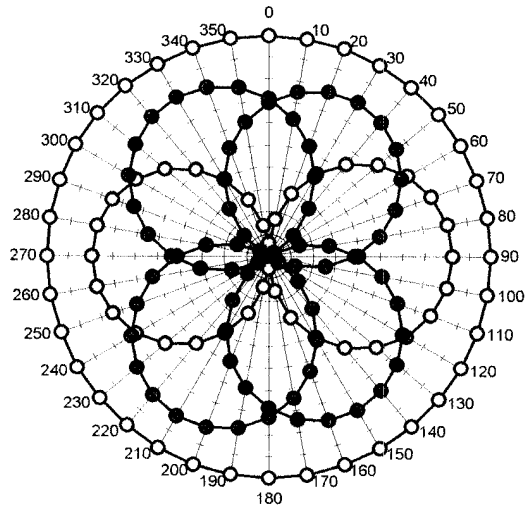
Head	900 MHz	Typical SAR gradient: 5 % per mm	
Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%]	Without Correction Algorithm	10.2	5.9
SAR _{be} [%]	With Correction Algorithm	0.4	0.6
Head	1800 MHz	Typical SAR gradient: 10 % per mm	
Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%]	Without Correction Algorithm	14.6	9.8
SAR _{be} [%]	With Correction Algorithm	0.2	0.0

Sensor Offset

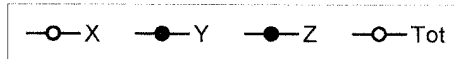
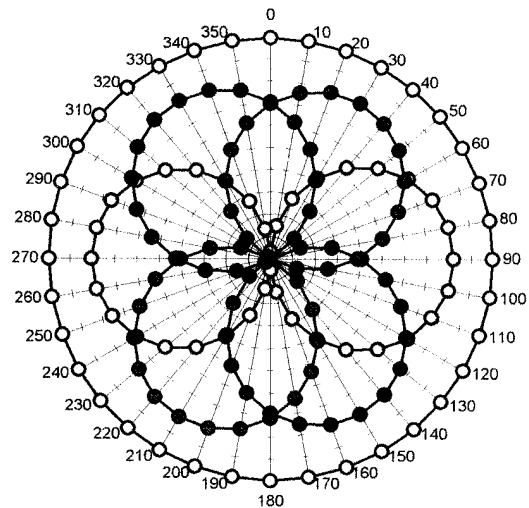
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.4 \pm 0.2	mm

Receiving Pattern (ϕ), $\theta = 0^\circ$

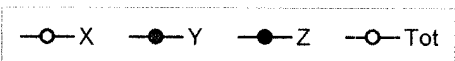
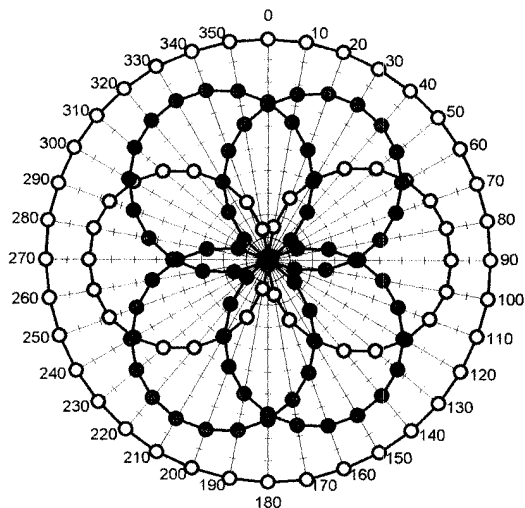
f = 30 MHz, TEM cell ifi110



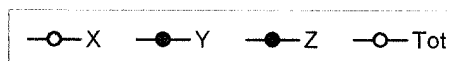
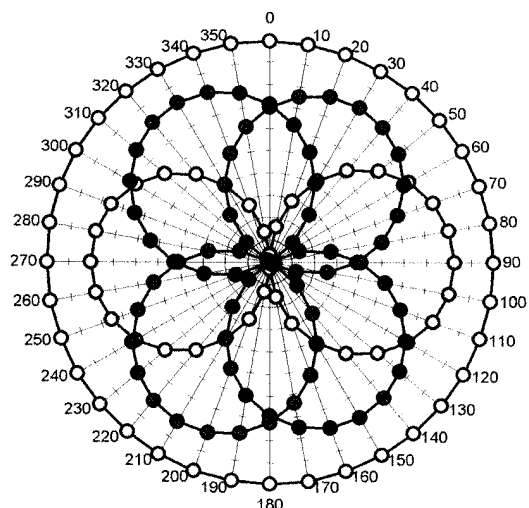
f = 100 MHz, TEM cell ifi110

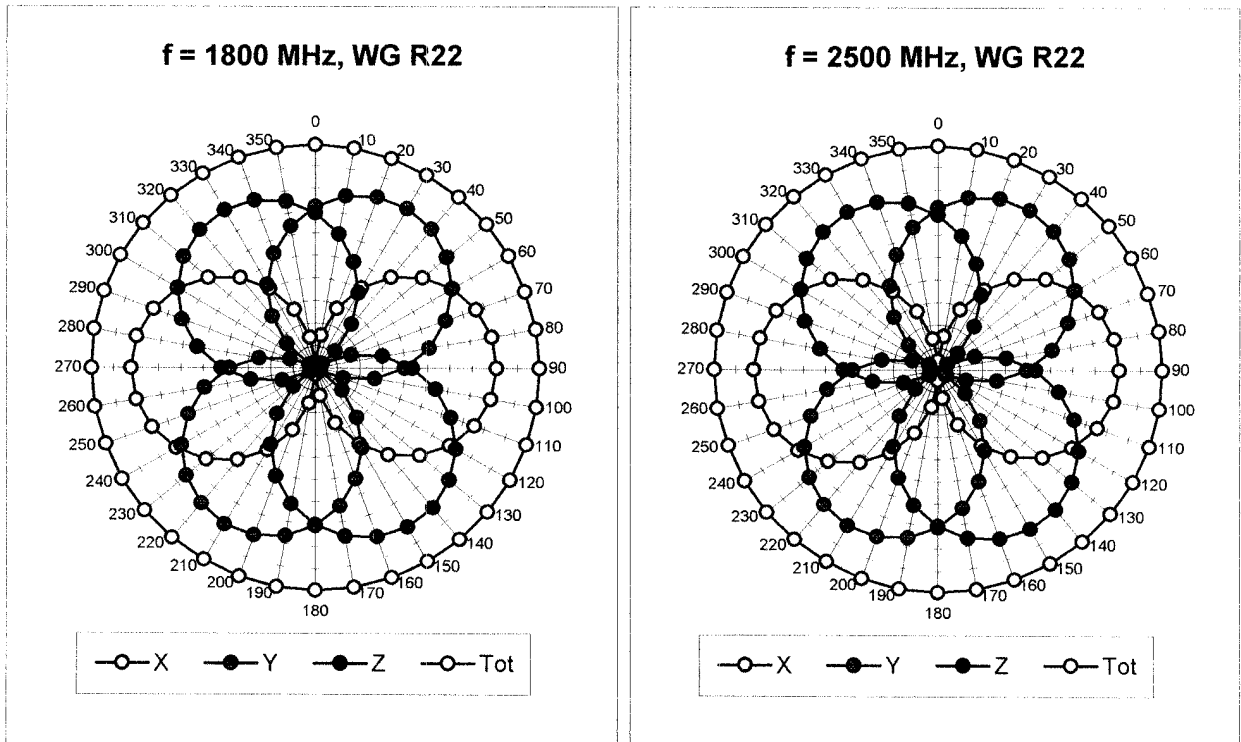


f = 300 MHz, TEM cell ifi110

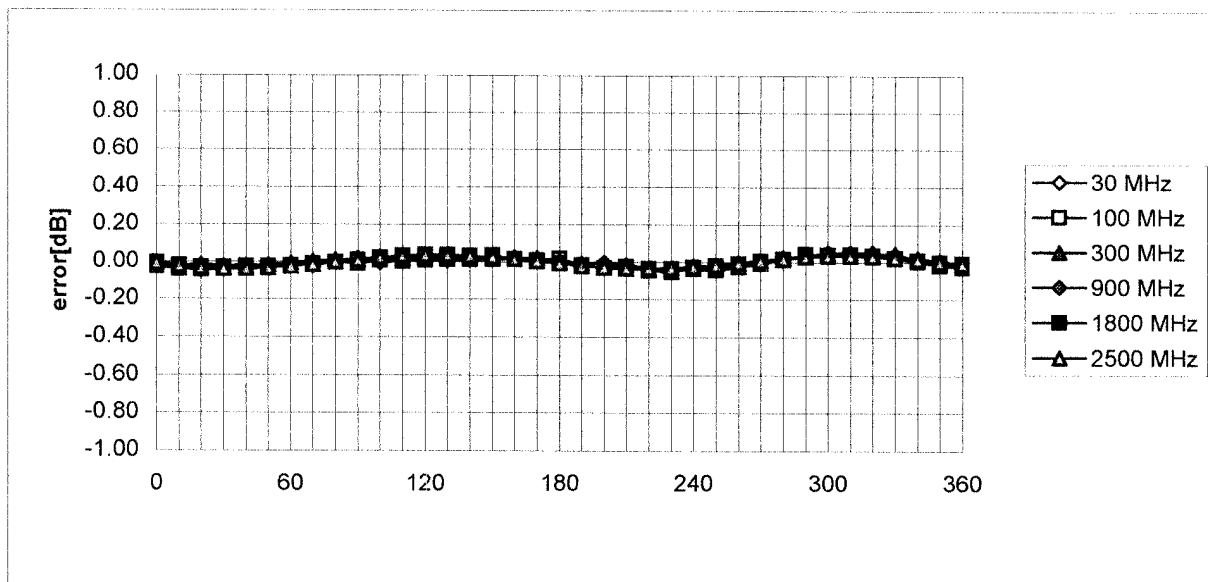


f = 900 MHz, TEM cell ifi110



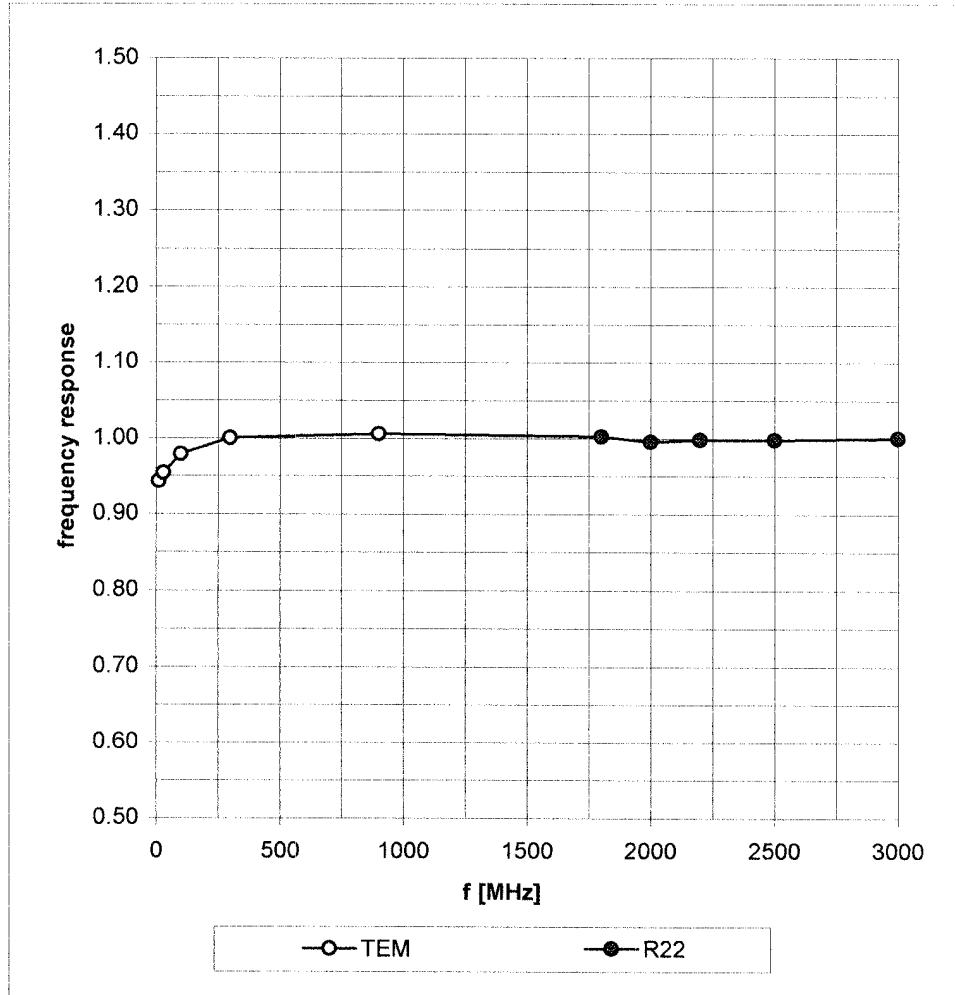


Isotropy Error (ϕ), $\theta = 0^\circ$

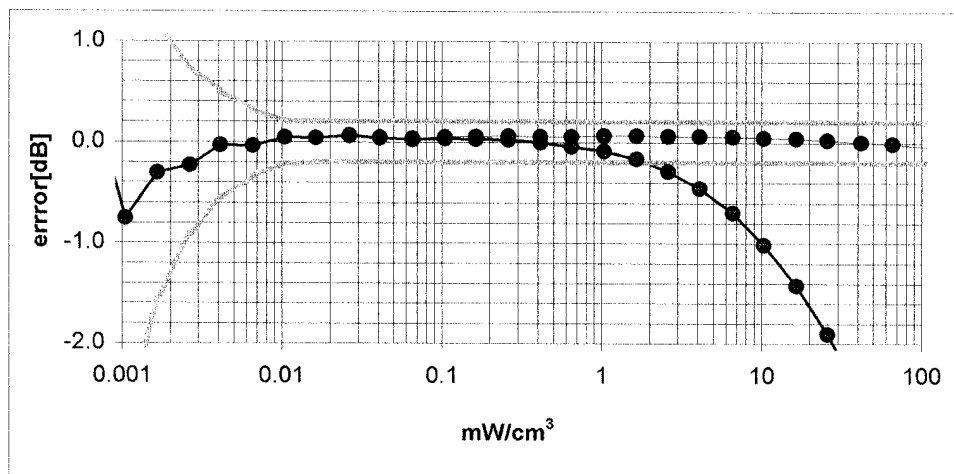
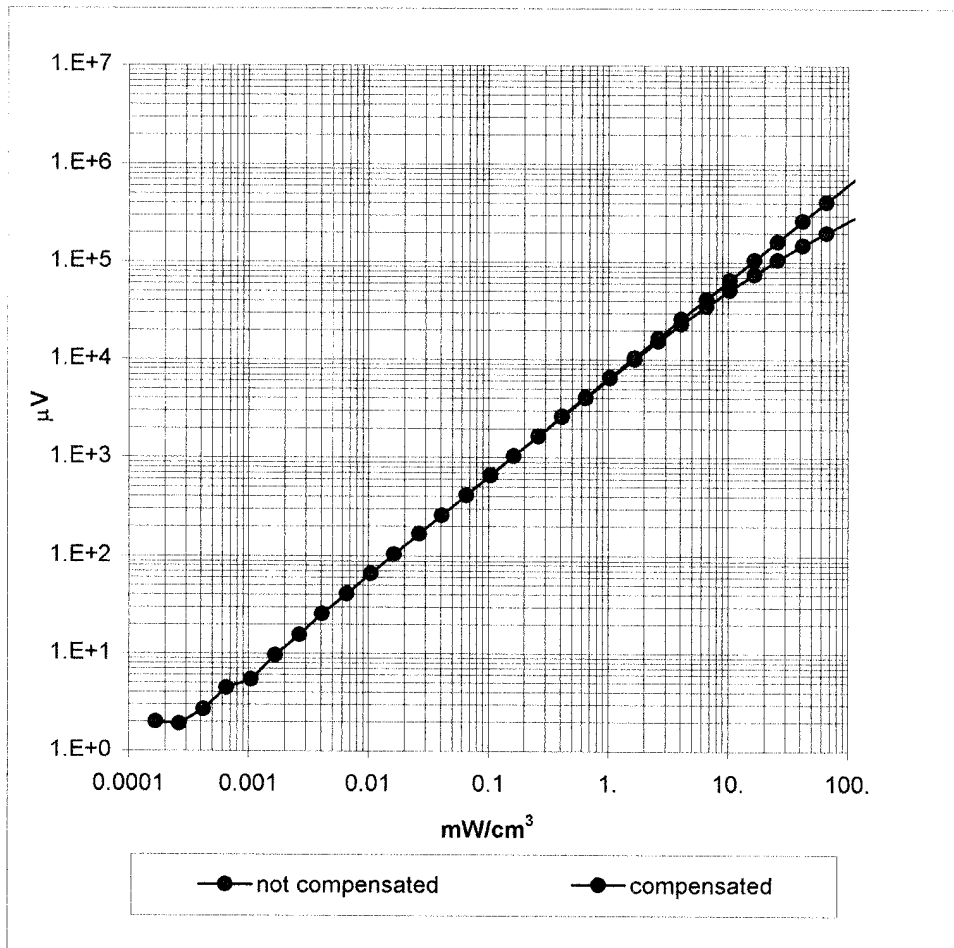


Frequency Response of E-Field

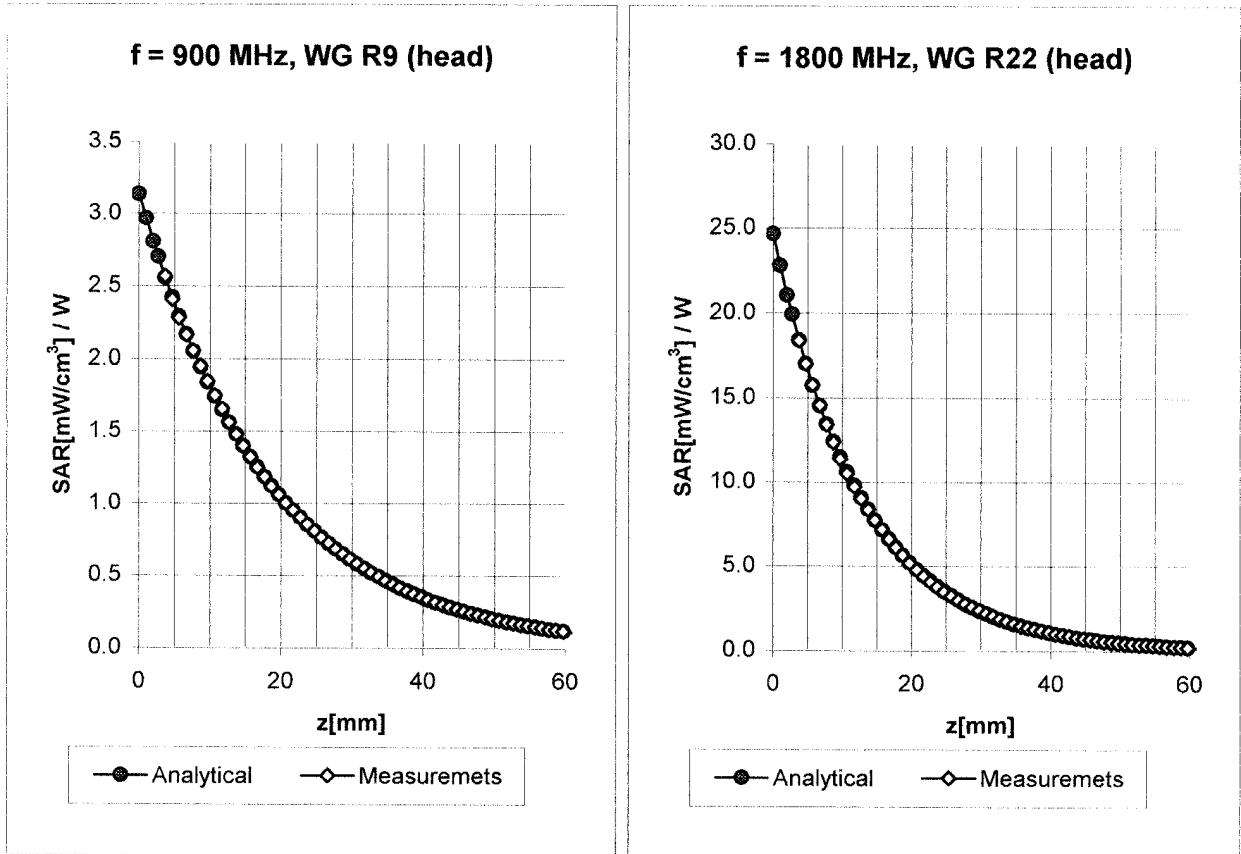
(TEM-Cell:ifi110, Waveguide R22)



Dynamic Range f(SAR_{brain}) (Waveguide R22)

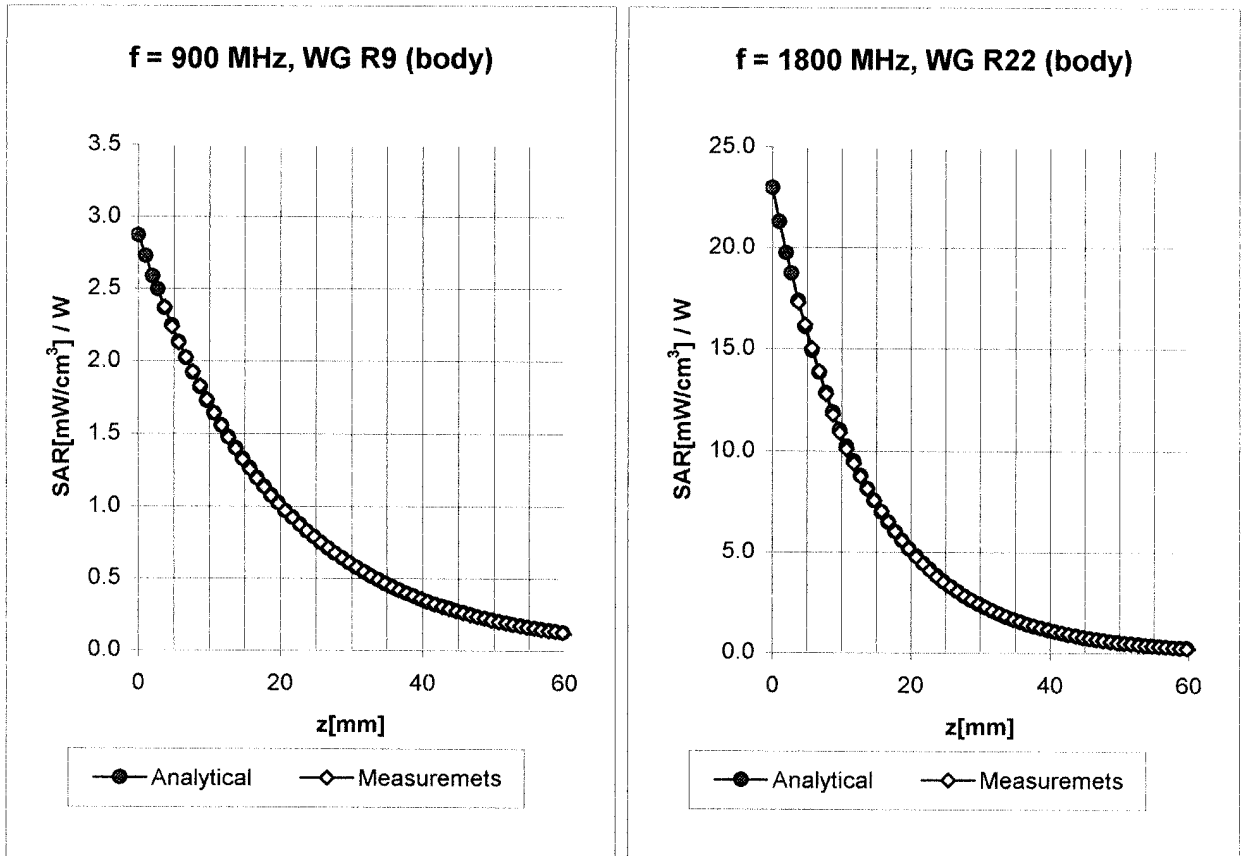


Conversion Factor Assessment



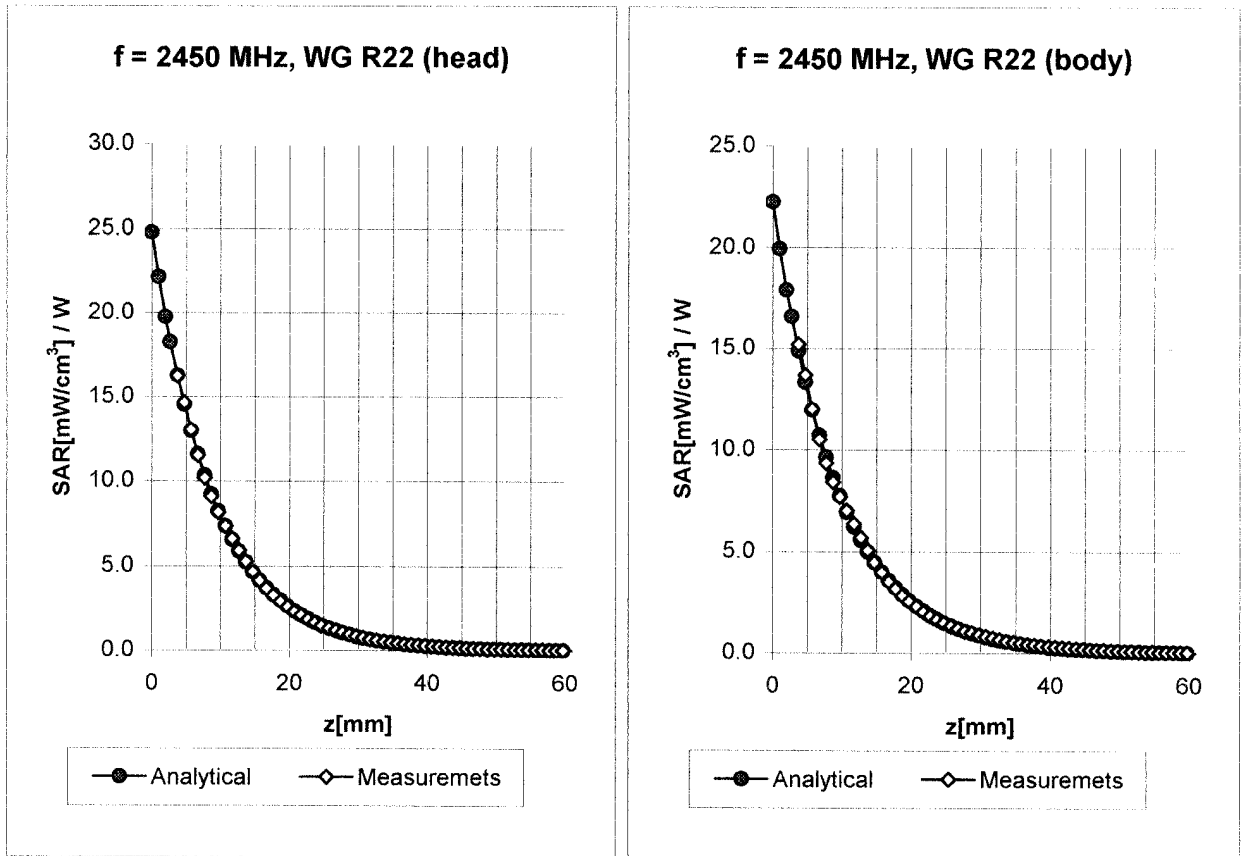
Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\%$ mho/m
	ConvF X	6.6 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	6.6 $\pm 9.5\%$ (k=2)	Alpha 0.37
	ConvF Z	6.6 $\pm 9.5\%$ (k=2)	Depth 2.61
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
	ConvF X	5.2 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	5.2 $\pm 9.5\%$ (k=2)	Alpha 0.50
	ConvF Z	5.2 $\pm 9.5\%$ (k=2)	Depth 2.73

Conversion Factor Assessment



Body	900 MHz	$\epsilon_r = 55.0 \pm 5\%$	$\sigma = 1.05 \pm 5\% \text{ mho/m}$
Body	835 MHz	$\epsilon_r = 55.2 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
	ConvF X	6.4 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	6.4 $\pm 9.5\%$ (k=2)	Alpha 0.45
	ConvF Z	6.4 $\pm 9.5\%$ (k=2)	Depth 2.35
Body	1800 MHz	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\% \text{ mho/m}$
Body	1900 MHz	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\% \text{ mho/m}$
	ConvF X	4.9 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	4.9 $\pm 9.5\%$ (k=2)	Alpha 0.60
	ConvF Z	4.9 $\pm 9.5\%$ (k=2)	Depth 2.59

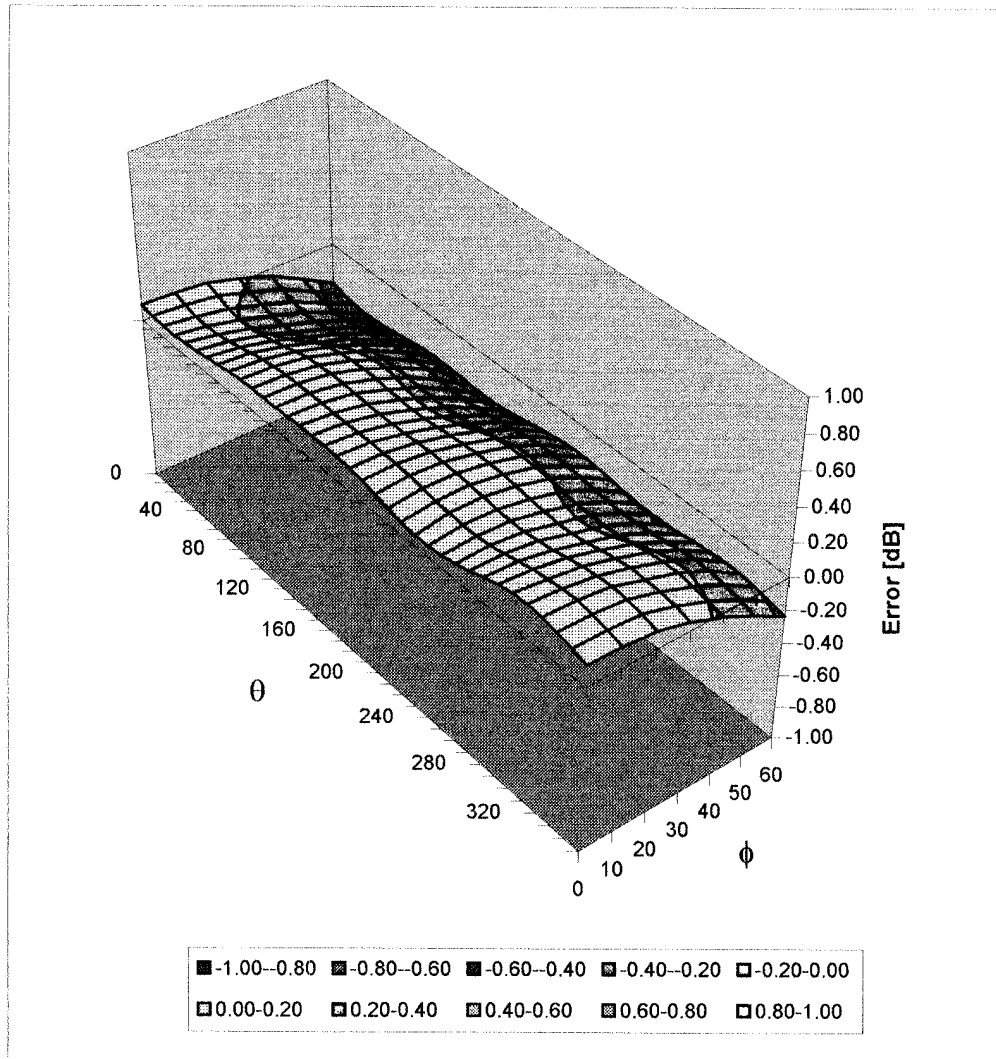
Conversion Factor Assessment



Head	2450	MHz	$\epsilon_r = 39.2 \pm 5\%$	$\sigma = 1.80 \pm 5\%$ mho/m
	ConvF X		5.0 $\pm 8.9\%$ (k=2)	Boundary effect:
	ConvF Y		5.0 $\pm 8.9\%$ (k=2)	Alpha 1.04
	ConvF Z		5.0 $\pm 8.9\%$ (k=2)	Depth 1.85
Body	2450	MHz	$\epsilon_r = 52.7 \pm 5\%$	$\sigma = 1.95 \pm 5\%$ mho/m
	ConvF X		4.6 $\pm 8.9\%$ (k=2)	Boundary effect:
	ConvF Y		4.6 $\pm 8.9\%$ (k=2)	Alpha 1.20
	ConvF Z		4.6 $\pm 8.9\%$ (k=2)	Depth 1.60

Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz

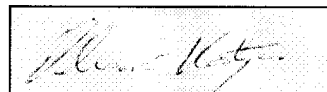


Additional Conversion Factors for Dosimetric E-Field Probe

Type:	ET3DV6
Serial Number:	1387
Place of Assessment:	Zurich
Date of Assessment:	February 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 (\pm standard deviation)

150 MHz	ConvF	$9.1 \pm 8\%$	$\epsilon_r = 52.3$ $\sigma = 0.76 \text{ mho/m}$ (head tissue)
300 MHz	ConvF	$7.9 \pm 8\%$	$\epsilon_r = 45.3$ $\sigma = 0.87 \text{ mho/m}$ (head tissue)
450 MHz	ConvF	$7.5 \pm 8\%$	$\epsilon_r = 43.5$ $\sigma = 0.87 \text{ mho/m}$ (head tissue)
150 MHz	ConvF	$8.8 \pm 8\%$	$\epsilon_r = 61.9$ $\sigma = 0.80 \text{ mho/m}$ (body tissue)
300 MHz	ConvF	$8.0 \pm 8\%$	$\epsilon_r = 58.2$ $\sigma = 0.92 \text{ mho/m}$ (body tissue)
450 MHz	ConvF	$7.7 \pm 8\%$	$\epsilon_r = 56.7$ $\sigma = 0.94 \text{ mho/m}$ (body tissue)

APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

450MHz System Performance Check & EUT Evaluation (Face)

Measured Fluid Dielectric Parameters (Brain)

April 03, 2003

Frequency	ϵ'	ϵ''
350.000000 MHz	45.7009	38.6329
360.000000 MHz	45.4077	37.9151
370.000000 MHz	45.2241	37.3336
380.000000 MHz	45.0055	36.7540
390.000000 MHz	44.7096	36.1612
400.000000 MHz	44.4448	35.6983
410.000000 MHz	44.2664	35.1851
420.000000 MHz	44.0374	34.6833
430.000000 MHz	43.7694	34.2498
440.000000 MHz	43.5227	33.8812
450.000000 MHz	43.2454	33.4878
460.000000 MHz	43.0323	33.1390
470.000000 MHz	42.8324	32.7047
480.000000 MHz	42.6207	32.3168
490.000000 MHz	42.3939	31.9995
500.000000 MHz	42.1752	31.6773
510.000000 MHz	42.0420	31.3205
520.000000 MHz	41.8650	30.9682
530.000000 MHz	41.6318	30.7196
540.000000 MHz	41.4915	30.3224
550.000000 MHz	41.3010	30.0571

450MHz EUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

April 03, 2003

Frequency	ϵ'	ϵ''
350.000000 MHz	59.9753	43.6696
360.000000 MHz	59.8613	42.8152
370.000000 MHz	59.7790	42.1918
380.000000 MHz	59.7455	41.5661
390.000000 MHz	59.4317	40.9538
400.000000 MHz	59.3191	40.3129
410.000000 MHz	59.1038	39.5525
420.000000 MHz	58.9872	38.8477
430.000000 MHz	58.8745	38.1513
440.000000 MHz	58.6778	37.6570
450.000000 MHz	58.4821	37.2215
460.000000 MHz	58.3040	36.8285
470.000000 MHz	58.1546	36.4450
480.000000 MHz	57.9831	36.0538
490.000000 MHz	57.7895	35.6112
500.000000 MHz	57.6355	35.1590
510.000000 MHz	57.5436	34.6570
520.000000 MHz	57.5164	34.2069
530.000000 MHz	57.4016	33.8745
540.000000 MHz	57.3271	33.3877
550.000000 MHz	57.1622	33.0831

APPENDIX F - SAM PHANTOM CERTIFICATE OF CONFORMITY

Schmid & Partner Engineering AG

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

Certificate of conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 BA
Series No	TP-1002 and higher
Manufacturer / Origin	Untersee Composites Hauptstr. 69 CH-8559 Fruthwilen Switzerland

Tests

The series production process used allows the limitation to test of first articles. Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series units (called samples).

Test	Requirement	Details	Units tested
Shape	Compliance with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness	Compliant with the requirements according to the standards	2mm +/- 0.2mm in specific areas	First article, Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz – 3 GHz Relative permittivity < 5 Loss tangent < 0.05.	Material sample TP 104-5
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards	Liquid type HSL 1800 and others according to the standard.	Pre-series, First article

Standards

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

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

Date 18.11.2001

Signature / Stamp



**Schmid & Partner
Engineering AG**



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