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: 

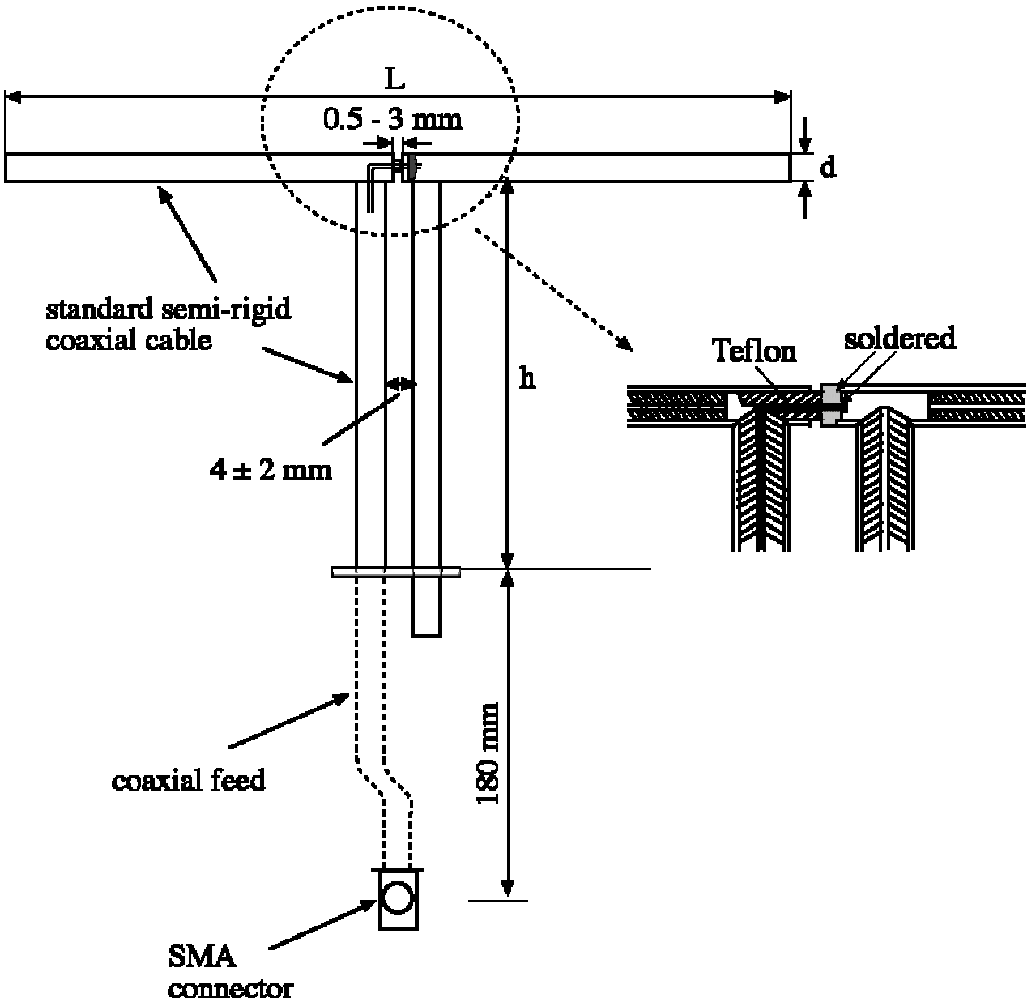
Approved by: 

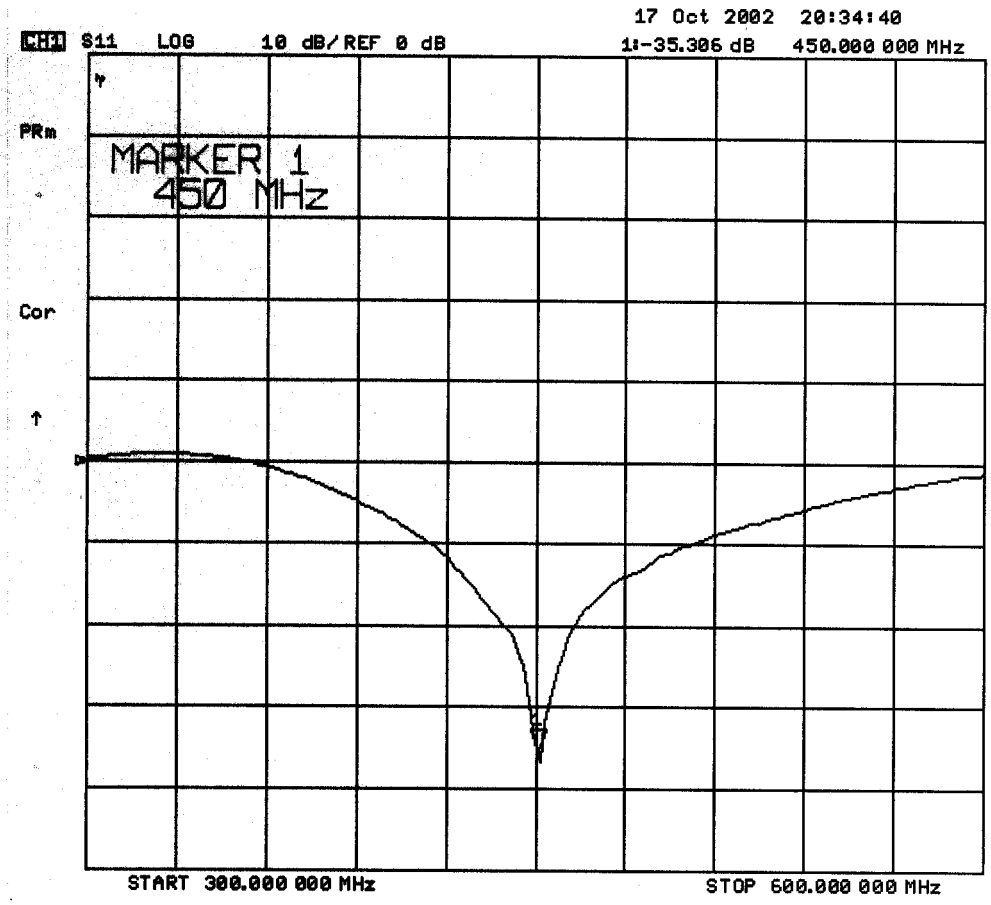
Celltech Labs Inc. 1955 Moss Court, Kelowna, B.C. Canada V1Y 9L3
Tel. 250-448-7047 • Fax. 250-448-7046 • e-mail: info@celltechlabs.com
www.celltechlabs.com

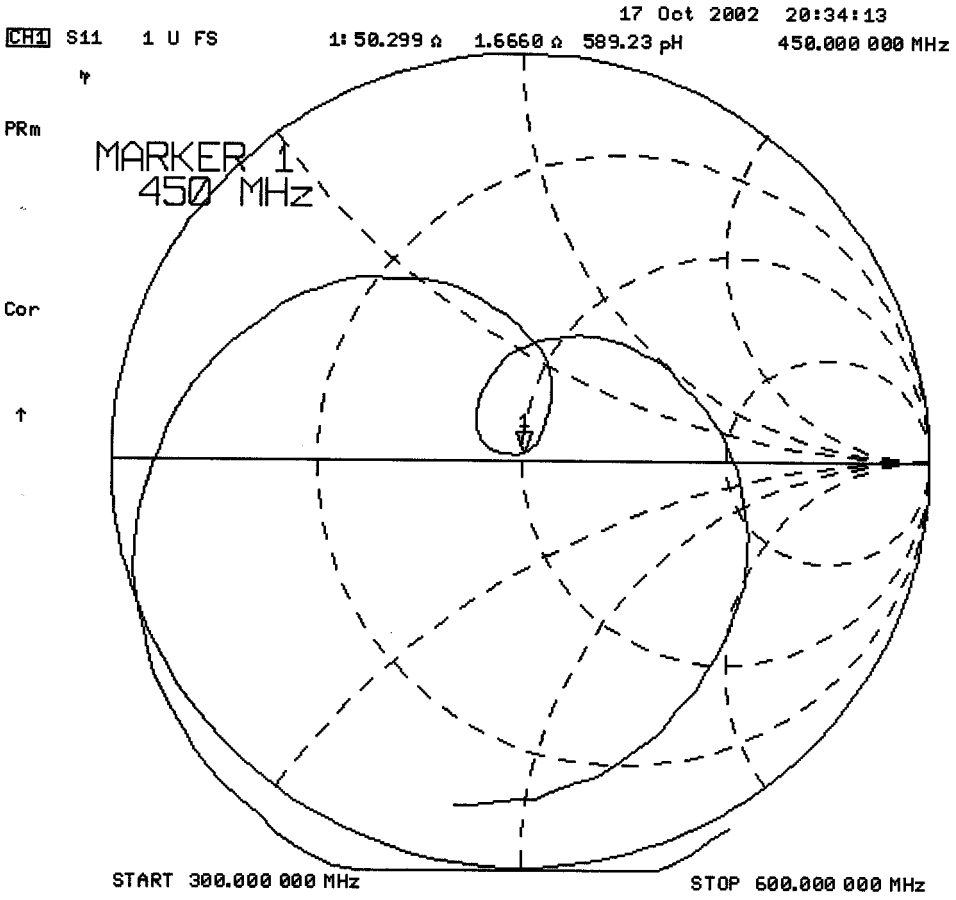
1. Dipole Construction & Electrical Characteristics

The validation dipole was constructed in accordance with the IEEE Std "Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques". The electrical properties were measured using an HP 8753E Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector feed point using an HP85032E Type N calibration kit. The dipole was placed parallel to a planar phantom at a separation distance of 15.0mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

Feed point impedance at 450MHz	Re{Z} = 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
MARKER 1
450 MHz
Cor
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
MARKER 1
450 MHz
Cor
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

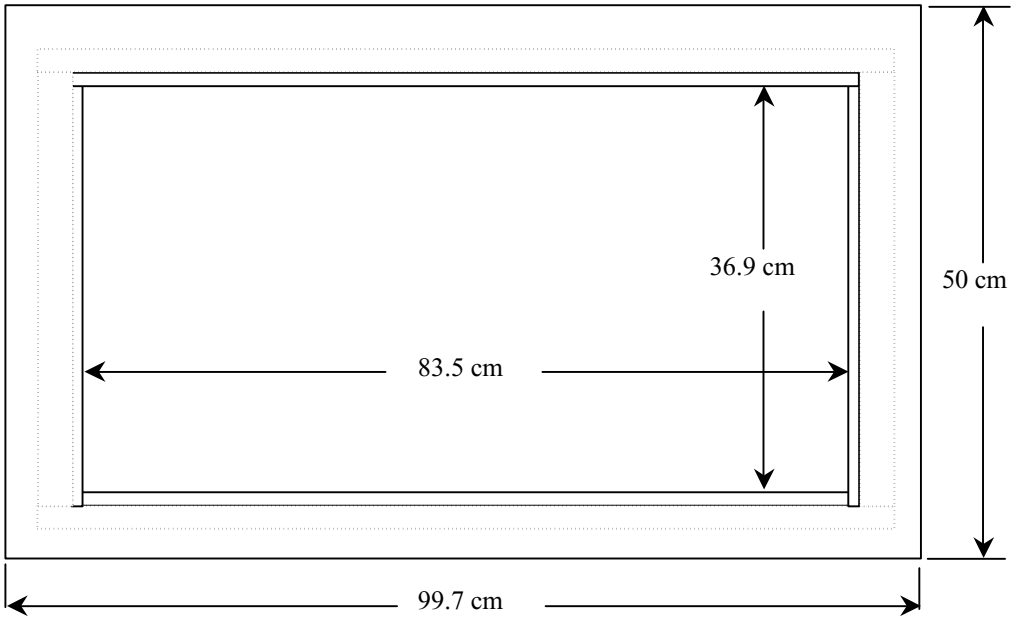
2. Validation Phantom

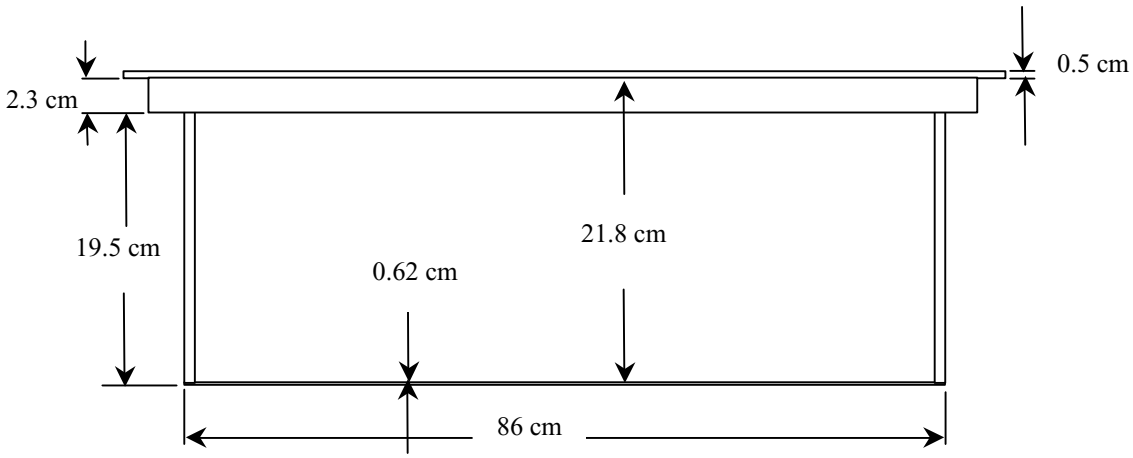
The validation phantom was constructed using relatively low-loss tangent Plexiglas material. The dimensions of the phantom are as follows:

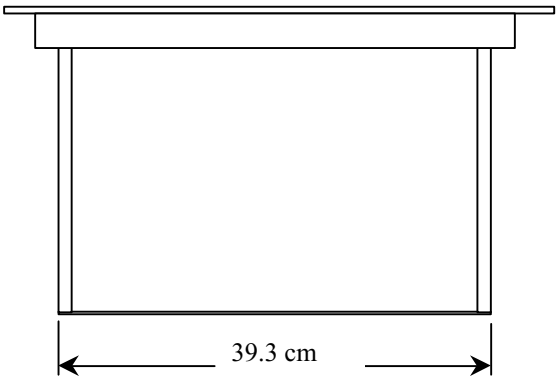
Length: 83.5 cm
Width: 36.9 cm
Height: 21.8 cm

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:

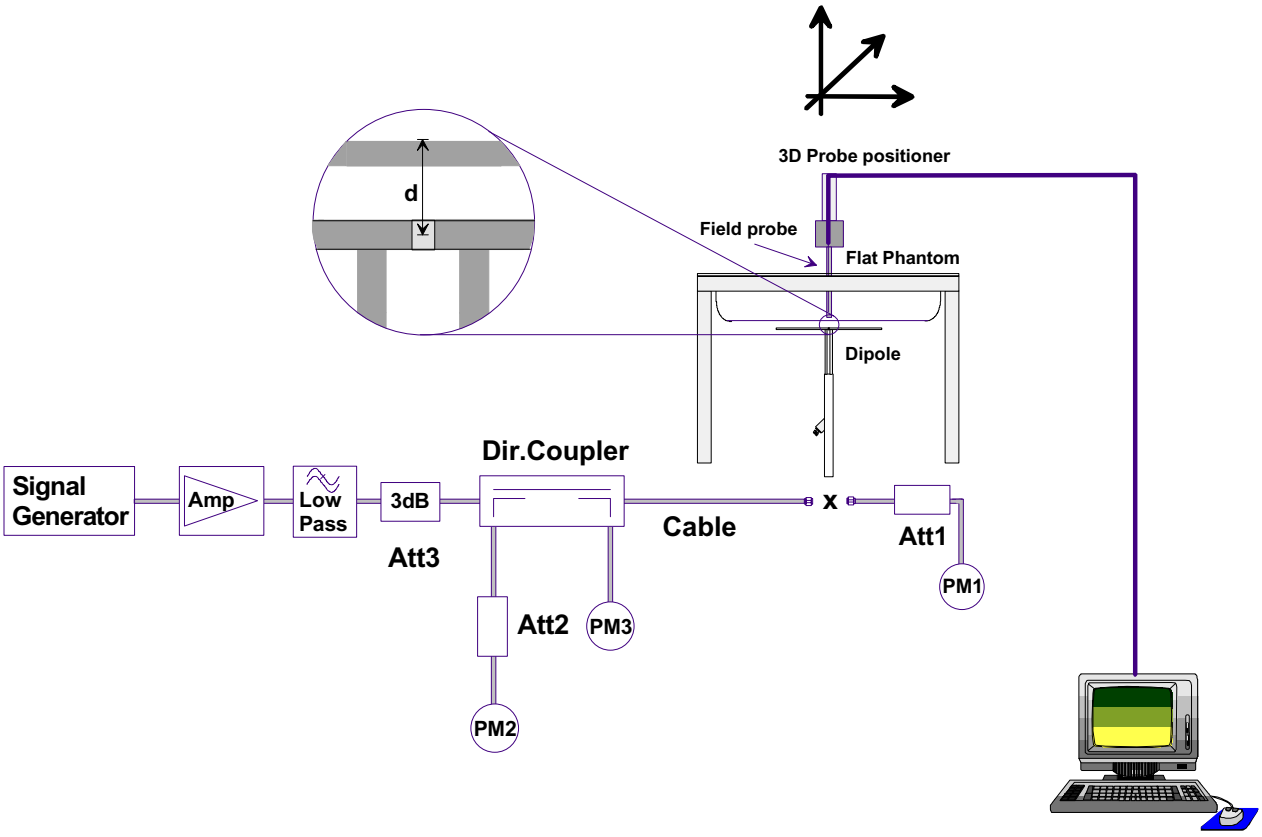
Relative Permittivity:	43.1
Conductivity:	0.84 mho/m
Ambient Temperature:	24.4 °C
Fluid Temperature:	21.6 °C
Fluid Depth:	≥ 15.0 cm

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	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	1.22	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.

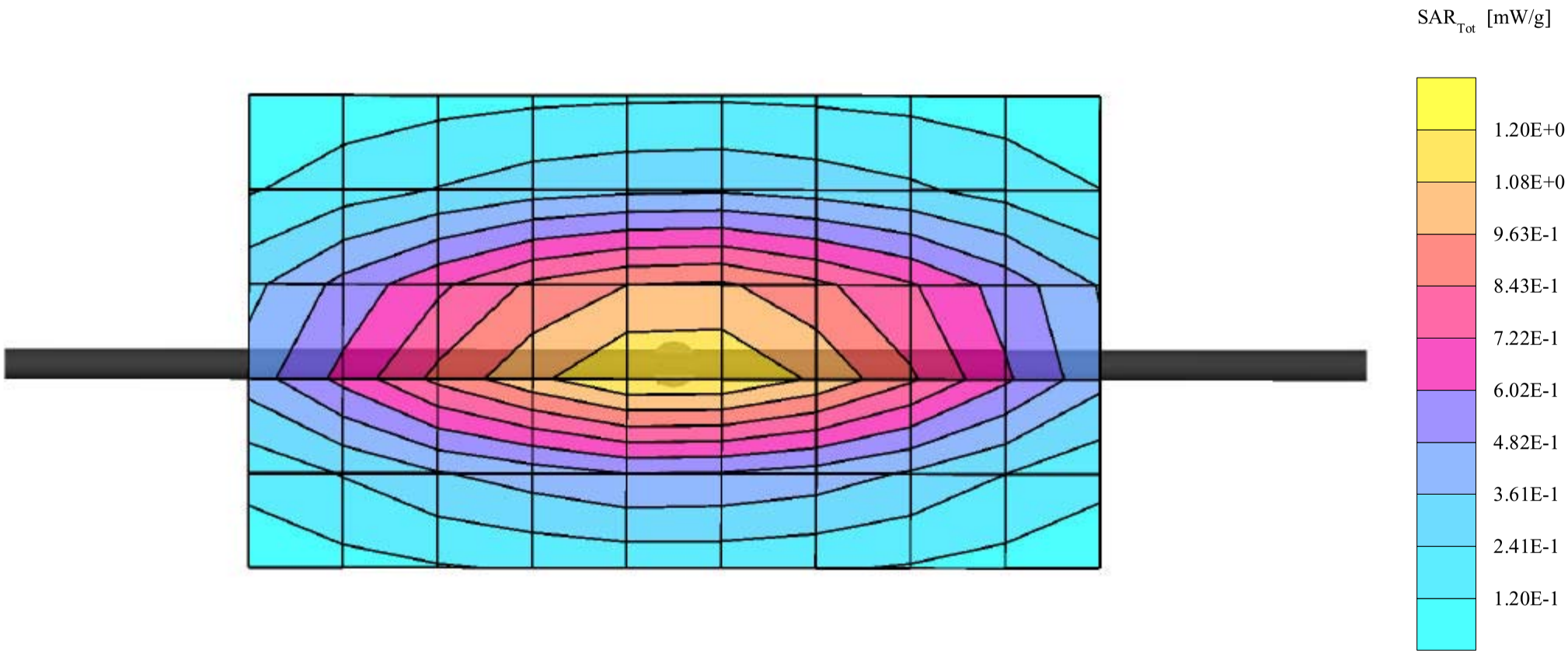
Averaged over 1cm (1g) of tissue: 4.98 mW/g

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 $\varepsilon_r = 43.1$ $\rho = 1.00$ g/cm^3
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	e'	e''
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