DECLARATION OF COMPLIANCE
SAR EVALUATION

Test Lab

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Applicant Information

E F JOHNSON COMPANY
299 Johnson Avenue SW
Waseca, MN 56093

Rule Part(s):	**FCC §2.1093; IC RSS-102 Issue 1 (Provisional)**
Test Procedure(s):	**FCC OET Bulletin 65 Supplement C (01-01)**
FCC ID:	**ATH2427240**
Model:	**242-7243**
EUT Type:	**Portable UHF PTT Radio Transceiver**
Modulation:	**FM**
Tx Frequency Range:	**430 - 470 MHz**
RF Conducted Power Tested:	**36.4 dBm (430.0125 MHz)** **36.5 dBm (450.0000 MHz)** **36.5 dBm (469.9875 MHz)**
Antenna Type(s):	**Whip**
Battery Type(s):	**7.5V NiMH (1450mAh)**
Application Type:	**Class II Permissive Change**
Class II Change(s):	**Add (2) Body-Worn Accessories**
Body-Worn Accessories:	**Metal Belt-Clip (P/N: 585-7200-032)** **Speaker-Microphone (P/N: 589-0015-037)**

Celltech Research 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 §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 (Occupational / Controlled Exposure).

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

Russell W. Pipe
Senior Compliance Technologist
Celltech Research Inc.

TABLE OF CONTENTS

1.0 INTRODUCTION

This measurement report demonstrates that the E F JOHNSON Model: 242-7243 Portable FM UHF PTT Radio Transceiver FCC ID: ATH2427240 complies with FCC 47 CFR §2.1093 (see reference [1]) and Health Canada Safety Code 6 (see reference [2]). The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]) and IC RSS-102 Issue 1 (Provisional) (see reference [4]), were employed. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

Rule Part(s)	FCC §2.1093; IC RSS-102 Issue 1
Test Procedure(s)	FCC OET Bulletin 65, Supplement C (01-01)
EUT Type	Portable FM UHF PTT Radio Transceiver
Model No.	242-7243
Serial No.	Pre-production
Modulation	FM
Tx Frequency Range	430 - 470 MHz
Measured RF Conducted Power	36.4 dBm (430.0125 MHz) 36.5 dBm (450.0000 MHz) 36.5 dBm (469.9875 MHz)
Antenna Type	Whip
Antenna Length	128 mm
Battery Type(s)	7.5V NiMH (1450mAh)
Application Type	Class II Permissive Change
Class II Change(s)	Add (2) Body-Worn Accessories
Body-Worn Accessories	1. Metal Belt-Clip (P/N: 585-7200-032) 2. Speaker-Microphone (P/N: 589-0015-037)

3.0 SAR MEASUREMENT SYSTEM

Celltech Research SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The SAR measurement system is comprised of the robot controller, computer, near-field probe, probe alignment sensor, SAM phantom, and various planar phantoms for face and body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe in order to measure the location (points) of 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 small planar 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.

BODY-WORN SAR MEASUREMENT RESULTS									
Freq. (MHz)	Chan.	Mode	Cond. Power Before (dBm)	Cond. Power After (dBm)	Battery Type	Belt-Clip Separation Distance (cm)	Phantom Section	Measured SAR 1g (w/kg)	
								100% Duty Cycle	50% Duty Cycle
430.0125	Low	CW	36.4	36.3	NiMH	0.8	Planar	6.52	3.26
450.0000	Mid	CW	36.5	36.3	NiMH	0.8	Planar	6.46	3.23
469.9875	High	CW	36.5	36.3	NiMH	0.8	Planar	5.39	2.70

ANSI / IEEE C95.1 1992 - SAFETY LIMIT BODY: 8.0 W/kg (averaged over 1 gram) Spatial Peak - Controlled Exposure / Occupational				
Mixture Type	450MHz Body		Relative Humidity	73 %
Dielectric Constant	Target	Measured	Ambient Temperature	21.4 °C
	56.7 (+/- 5%)	57.1		
Conductivity	Target	Measured	Fluid Temperature	22.0 °C
	0.94 (+/- 5%)	0.92		
Atmospheric Pressure	101.8 kPa		Fluid Depth	≥ 15 cm

5.0 DETAILS OF SAR EVALUATION

The E F JOHNSON Model: 242-7243 Portable FM UHF PTT Radio Transceiver FCC ID: ATH2427240 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 F.

1. The EUT was evaluated for body-worn SAR with the metal belt-clip (P/N: 585-7200-032) and speaker-microphone (P/N: 589-0015-037) accessories connected. The back of the EUT was placed facing parallel to the planar phantom and the metal belt-clip was touching the planar phantom. The metal belt-clip provided a 0.8cm separation distance between the back of the radio and the outer surface of the planar phantom.
2. The EUT was operated for an appropriate period prior to the evaluation in order to minimize drift.
3. The conducted power levels were measured before and after each test according to the procedures described in FCC Rule Part 2.1046. During the entire test the conducted power was maintained to within 5% of the initial conducted power. Any unusual anomalies over the course of the test also warranted a re-evaluation.
4. The EUT was tested at maximum power with the transmit button depressed and the transmitter in unmodulated continuous transmit mode (Continuous Wave at 100% duty cycle) throughout the SAR evaluation. For a push-to-talk radio device the 50% duty cycle compensation reported assumes a transmit/receive cycle of equal time base.
5. The location of the maximum spatial SAR distribution (Hot Spot) was determined relative to the device and its antenna.
6. The EUT was tested with a fully charged NiMH 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. The positioning of the ear-held device relative to the phantom was performed in accordance with FCC OET Bulletin 65, Supplement C (Edition 01-01) using the SAM phantom.
(ii) For face-held and body-worn 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 using a uniform grid spacing.
c. A 5x5x7 matrix was performed around the greatest spatial SAR distribution found during the area scan of the applicable exposed region. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.
d. For this particular evaluation a stack of low-density, low-loss dielectric foamed polystyrene was used in place of the device holder.

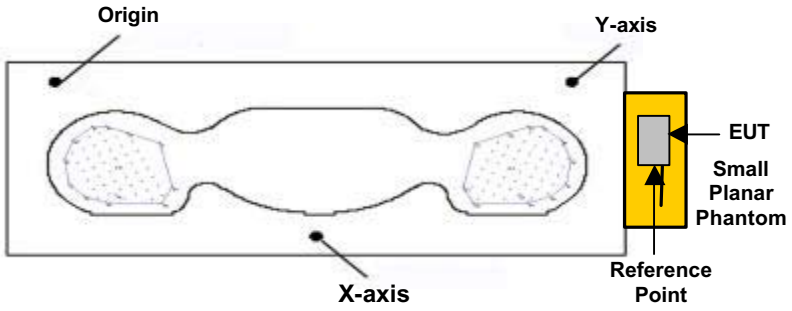


Figure 1. Phantom Reference Point & EUT Positioning

7.0 SYSTEM VALIDATION

Prior to the evaluation the system was verified using a planar phantom with a 450MHz dipole (see Appendix C for dipole calibration procedure). The simulated tissue fluids were verified prior to the validation 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 system was verified to a tolerance of ±10% (see Appendix B for system validation test plot).

SYSTEM VALIDATION											
Test Date	Equiv. Tissue	Target SAR 1g (w/kg)	Measured SAR 1g (w/kg)	Dielectric Constant ε_r		Conductivity σ (mho/m)		ρ (Kg/m^3)	Ambient Temp.	Fluid Temp.	Fluid Depth
				Target	Measured	Target	Measured				
09/06/02	450MHz (Brain)	1.44	1.30	43.5 ±5%	44.0	0.87 ±5%	0.86	1000	21.4 °C	22.0 °C	≥ 15 cm

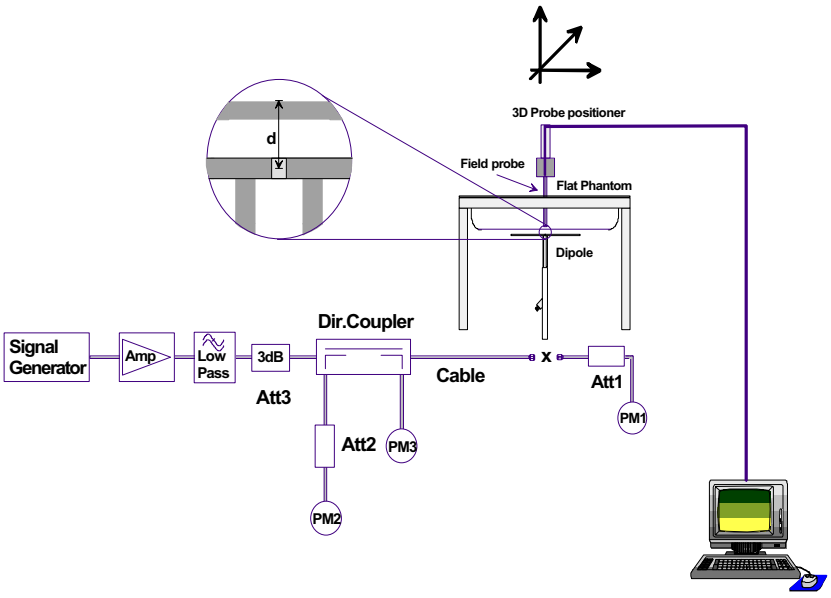


Figure 2. System Validation Setup Diagram

450MHz Dipole Validation Setup

8.0 SIMULATED TISSUES

The 450MHz brain and body 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 (permitivity and conductivity).

TISSUE MIXTURES		
INGREDIENT	**450MHz Brain (System Validation)**	**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:	Small Planar Phantom
Shell Material:	Plexiglas
Bottom Thickness:	2.0 mm ± 0.1mm
Dimensions:	Box: 36.5cm (L) x 22.5cm (W) x 20.3cm (H); Back Plane: 25.3cm (H)

Validation Phantom (≤ 450MHz)

Type:	Large Planar Phantom
Shell Material:	Plexiglas
Bottom Thickness:	6.2 mm ± 0.1mm
Dimensions:	86.0cm (L) x 39.5cm (W) x 21.8cm (H)

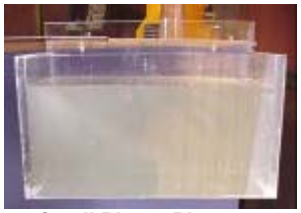
11.0 PROBE SPECIFICATION (ET3DV6)

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)
Dynam. Rnge:	5 ?W/g to > 100 mW/g; Linearity: ± 0.2 dB
Srfce. 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 SMALL PLANAR PHANTOM

The small planar phantom is constructed of Plexiglas material with a 2.0mm shell thickness for face-held and body-worn SAR evaluations. The small planar phantom is mounted onto the outside left head section of the DASY3 system.



Small Planar Phantom

13.0 LARGE PLANAR PHANTOM

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

Large Planar 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**
DASY3 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 -Small Planar Phantom -Large Planar Phantom	 599396-01 1387 135 136 054 247 150 N/A N/A N/A	 N/A Feb 2002 Oct 2001 Oct 2001 June 2001 June 2001 Oct 2001 N/A N/A N/A
85070C Dielectric Probe Kit	N/A	N/A
Gigatronics 8652A Power Meter -Power Sensor 80701A -Power Sensor 80701A	1835272 1833535 1833542	Feb 2002 Feb 2002 Mar 2002
E4408B Spectrum Analyzer	US39240170	Nov 2001
8594E Spectrum Analyzer	3543A02721	Feb 2002
8753E Network Analyzer	US38433013	Feb 2002
8648D Signal Generator	3847A00611	Feb 2002
5S1G4 Amplifier Research Power Amplifier	26235	N/A

16.0 MEASUREMENT UNCERTAINTIES

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)	± 10.0	Rectangular	√3	0.6	± 3.5	∞
Liquid permitivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permitivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					**± 13.7**	
Expanded Uncertainty (k=2) (95% Confidence Level)					**± 27.5**	

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.

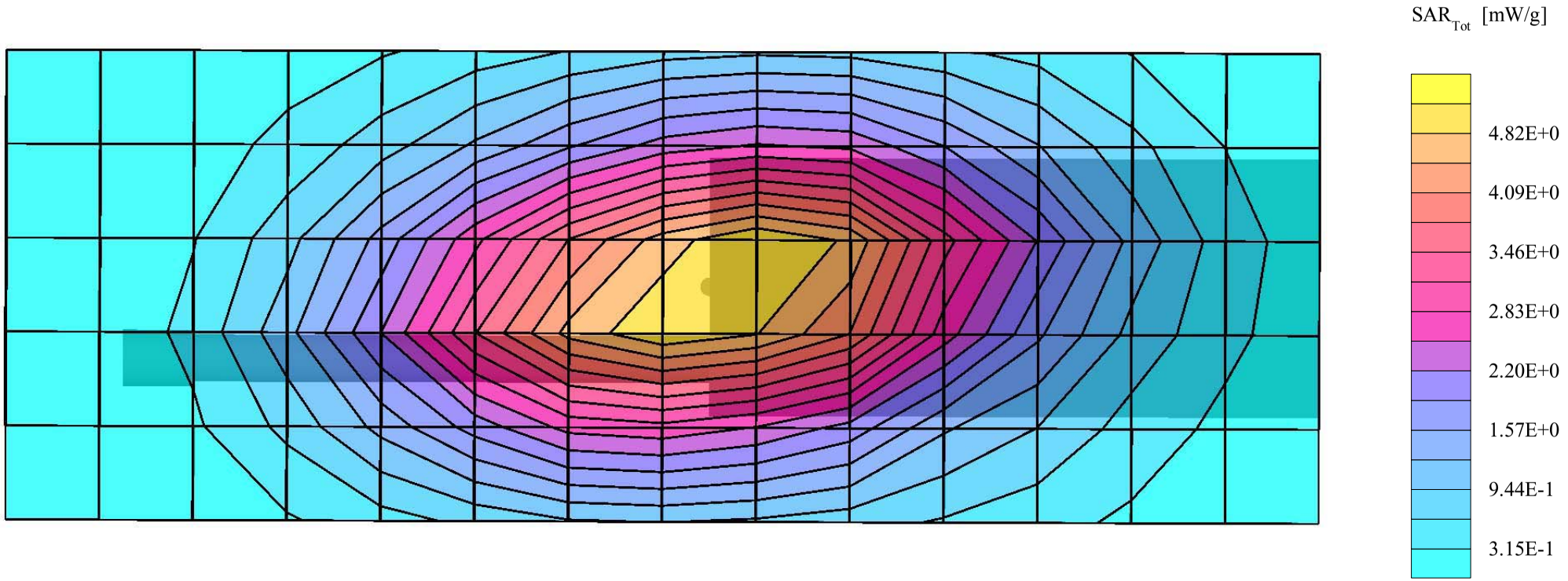
[5] IEEE Standards Coordinating Committee 34, Std 1528-200X, “DRAFT Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”.

APPENDIX A - SAR MEASUREMENT DATA

E F Johnson Co. FCC ID: ATH2427240

Small Planar Phantom; Planar Section; Position: (270°,180°)
Probe: ET3DV6 - SN1387; ConvF(7.70,7.70,7.70); Crest factor: 1.0
450 MHz Muscle: $\sigma = 0.92$ mho/m $\varepsilon_r = 57.1$ $\rho = 1.00$ g/cm^3
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 5x5x7; Powerdrift: -0.14 dB
SAR (1g): 6.52 mW/g, SAR (10g): 2.47 mW/g

Body-Worn SAR with 0.8 cm Metal Belt-Clip
UHF PTT Radio Transceiver Model: 242-7243
with Speaker-Microphone (P/N: 589-0015-037)
Continuous Wave Mode
Low Channel [430.0125 MHz]
Conducted Power: 36.4 dBm
Ambient Temp. 21.4°C; Fluid Temp. 22.0°C
Date Tested: September 6, 2002

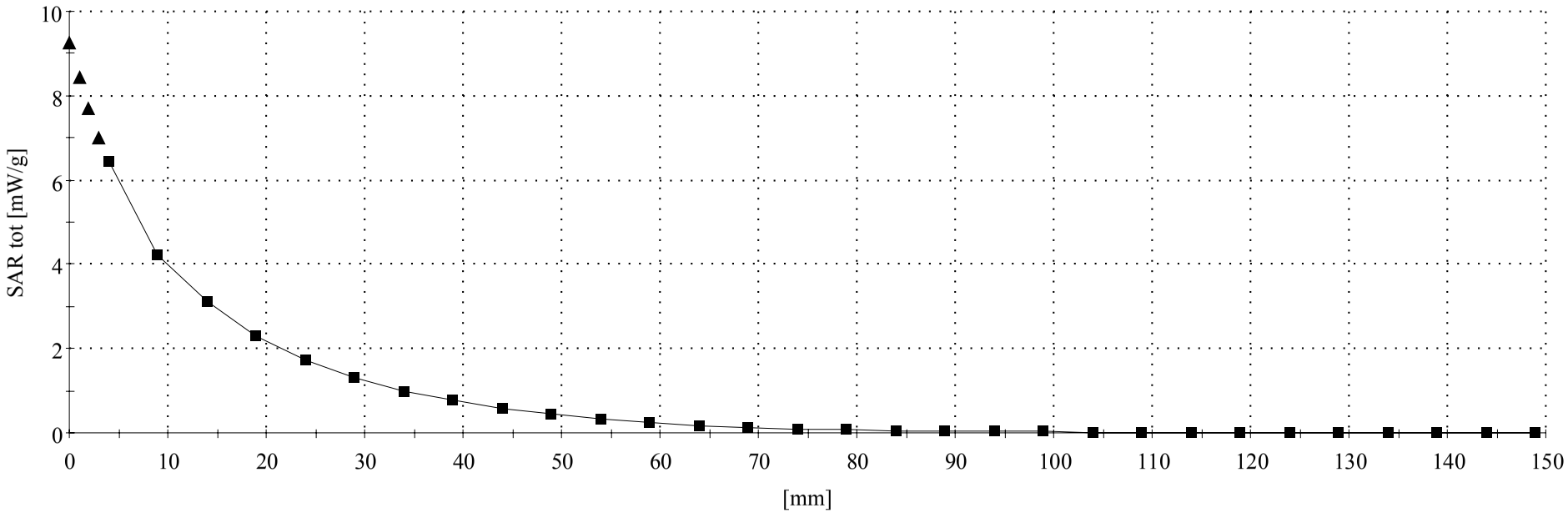


E F Johnson Co. FCC ID: ATH2427240

Small Planar Phantom
Probe: ET3DV6 - SN1387; ConvF(7.70,7.70,7.70); Crest factor: 1.0
450 MHz Muscle: σ = 0.92 mho/m ε_r = 57.1 ρ = 1.00 g/cm^3

Z-Axis Extrapolation at Peak SAR Location

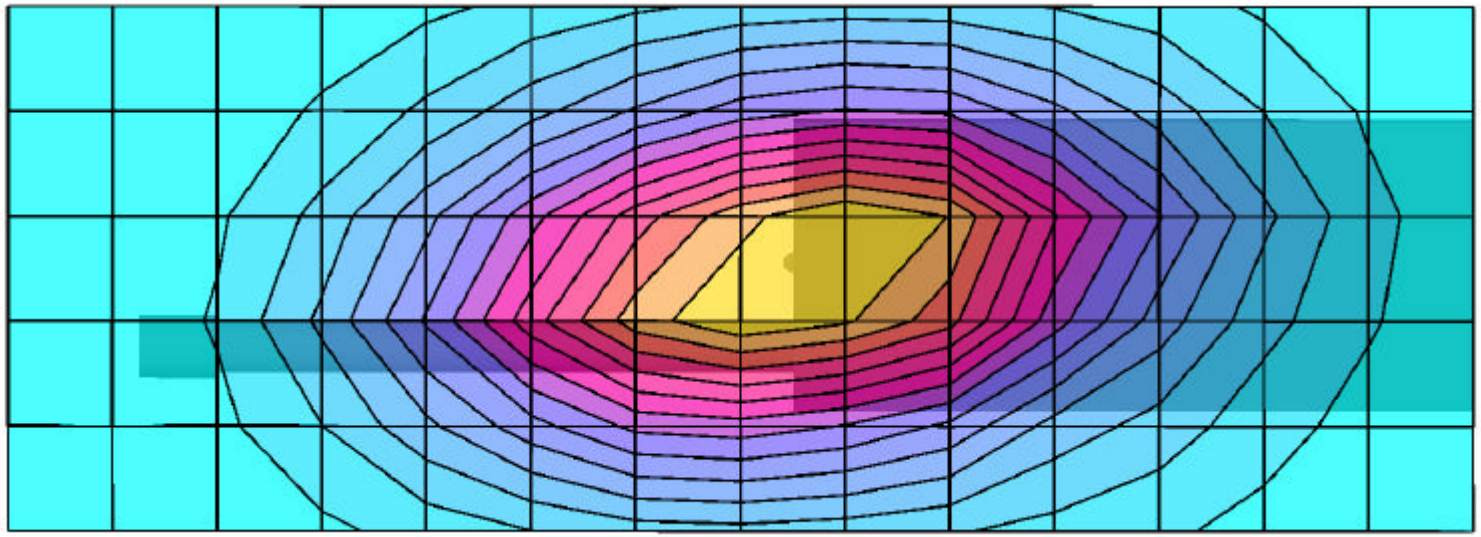
Body-Worn SAR with 0.8 cm Metal Belt-Clip
UHF PTT Radio Transceiver Model: 242-7243
with Speaker-Microphone (P/N: 589-0015-037)
Continuous Wave Mode
Low Channel [430.0125 MHz]
Conducted Power: 36.4 dBm
Ambient Temp. 21.4°C; Fluid Temp. 22.0°C
Date Tested: September 6, 2002



E F Johnson Co. FCC ID: ATH2427240

Small Planar Phantom; Planar Section; Position: (270°,180°)
Probe: ET3DV6 - SN1387; ConvF(7.70,7.70,7.70); Crest factor: 1.0
450 MHz Muscle: $\sigma = 0.92$ mho/m $\varepsilon_r = 57.1$ $\rho = 1.00$ g/cm^3
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 5x5x7; Powerdrift: -0.16 dB
SAR (1g): 6.46 mW/g, SAR (10g): 4.48 mW/g

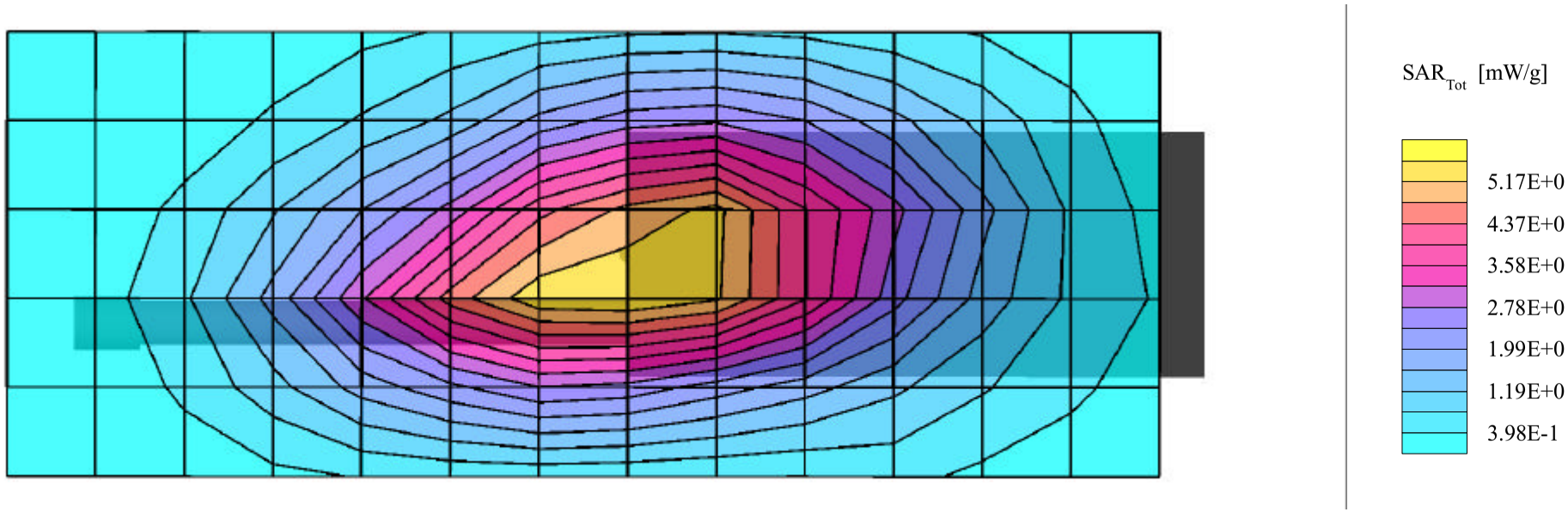
Body-Worn SAR with 0.8 cm Metal Belt-Clip
UHF PTT Radio Transceiver Model: 242-7243
with Speaker-Microphone (P/N: 589-0015-037)
Continuous Wave Mode
Mid Channel [450.0000 MHz]
Conducted Power: 36.5 dBm
Ambient Temp. 21.4°C; Fluid Temp. 22.0°C
Date Tested: September 6, 2002



E F Johnson Co. FCC ID: ATH2427240

Small Planar Phantom; Planar Section; Position: (270°,180°)
Probe: ET3DV6 - SN1387; ConvF(7.70,7.70,7.70); Crest factor: 1.0
450 MHz Muscle: σ = 0.92 mho/m ε_r = 57.1 ρ = 1.00 g/cm^3
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 5x5x7; Powerdrift: -0.18 dB
SAR (1g): 5.39 mW/g, SAR (10g): 3.73 mW/g

Body-Worn SAR with 0.8 cm Metal Belt-Clip
UHF PTT Radio Transceiver Model: 242-7243
with Speaker-Microphone (P/N: 589-0015-037)
Continuous Wave Mode
High Channel [469.9875 MHz]
Conducted Power: 36.5 dBm
Ambient Temp. 21.4°C; Fluid Temp. 22.0°C
Date Tested: September 6, 2002



APPENDIX B - SYSTEM VALIDATION

Dipole 450MHz

Large Planar Phantom; Planar Section

Probe: ET3DV6 - SN1387; ConvF(7.30,7.30,7.30); Crest factor: 1.0; 450 MHz Brain: $\sigma = 0.86$ mho/m $\varepsilon_r = 44.0$ $\rho = 1.00$ g/cm^3

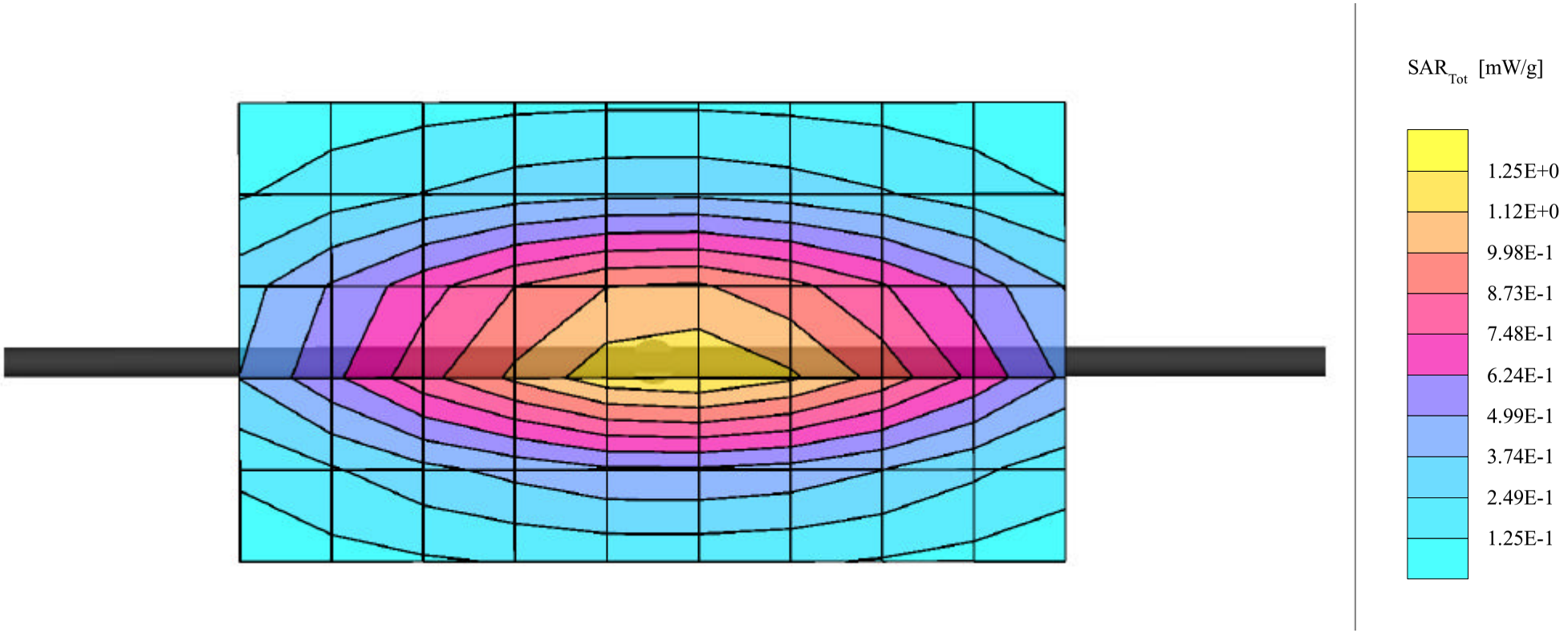
Cube 5x5x7: Peak: 2.10 mW/g, SAR (1g): 1.30 mW/g, SAR (10g): 0.844 mW/g, (Worst-case extrapolation)

Penetration depth: 11.8 (10.2, 14.1) [mm]; Ambient Temp. 21.4°C; Fluid Temp. 22.0°C

Powerdrift: -0.01 dB

Conducted Power: 250 mW

Validation Date: September 06, 2002



APPENDIX C - DIPOLE CALIBRATION

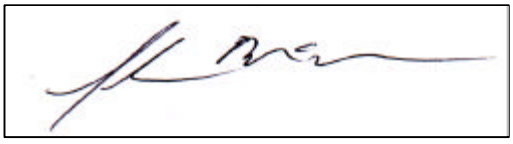
Celltech
Testing and Engineering Services Lab

450MHz SYSTEM VALIDATION DIPOLE

Type:	**450MHz Validation Dipole**
Serial Number:	**136**
Place of Calibration:	**Celltech Research Inc.**
Date of Calibration:	**October 17, 2001**

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

Calibrated by: 

Approved by: 

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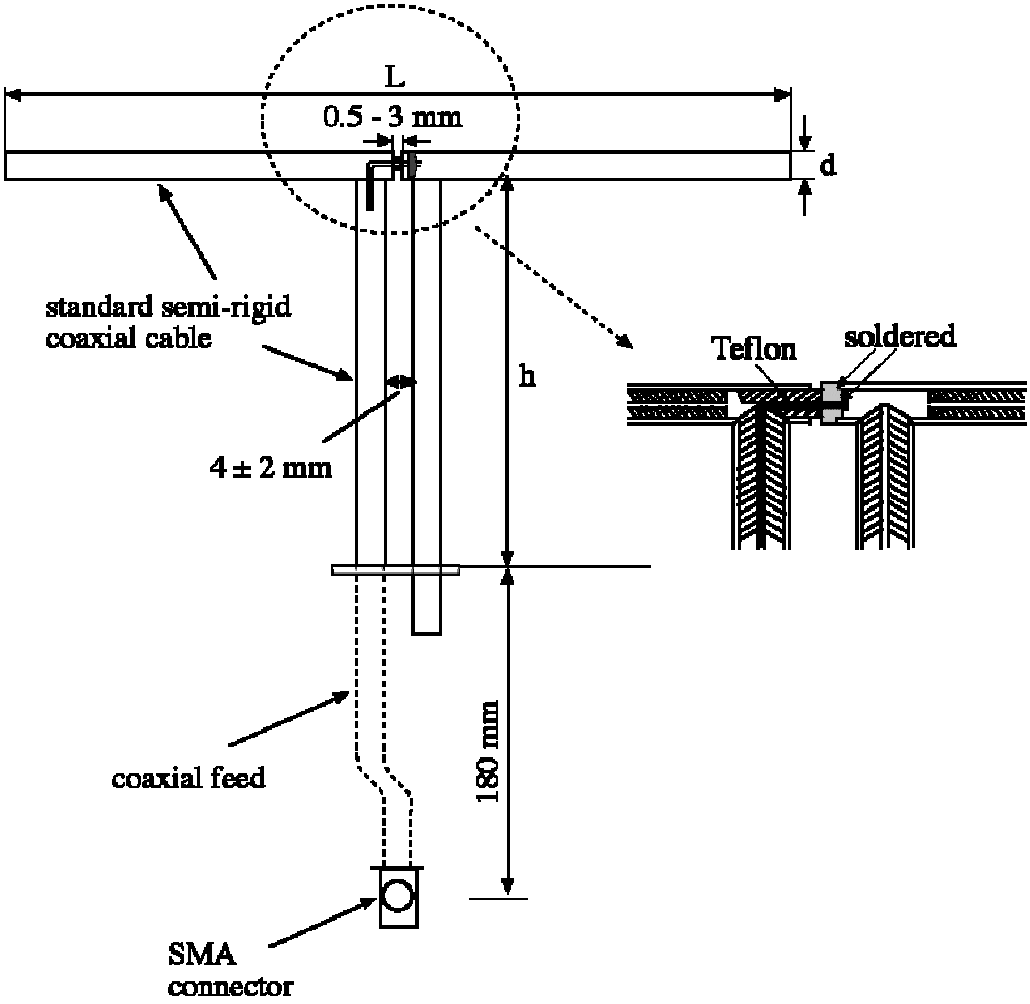
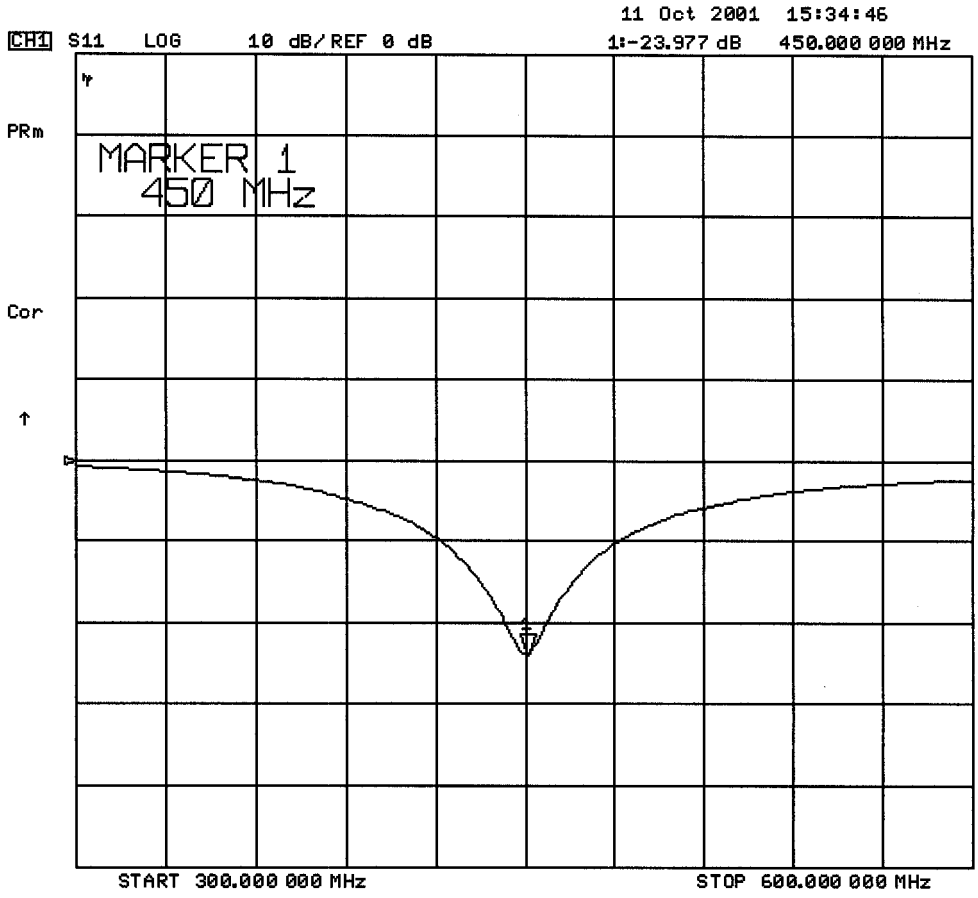
www.celltechlabs.com

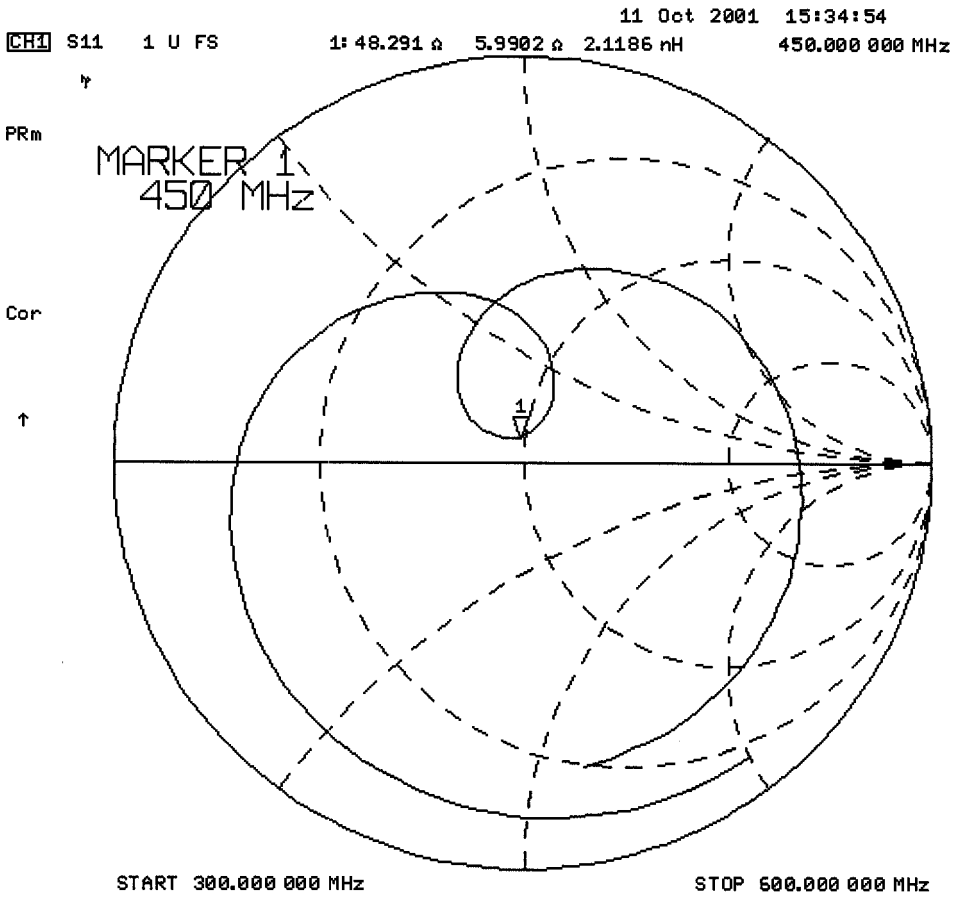
1. Dipole Construction & Electrical Characteristics

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} = 48.291Ω
	Im{Z} = 5.9902Ω
Return Loss at 450MHz	-23.9777dB




11 Oct 2001 15:34:46
CH1 S11 LOG 10 dB/ REF 0 dB
1:-23.977 dB 450.000 000 MHz
PRm
MARKER 1
450 MHz
Cor
START 300.000 000 MHz
STOP 600.000 000 MHz


11 Oct 2001 15:34:54
CH1 S11 1 U FS
1: 48.291 Ω 5.9902 Ω 2.1186 nH
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

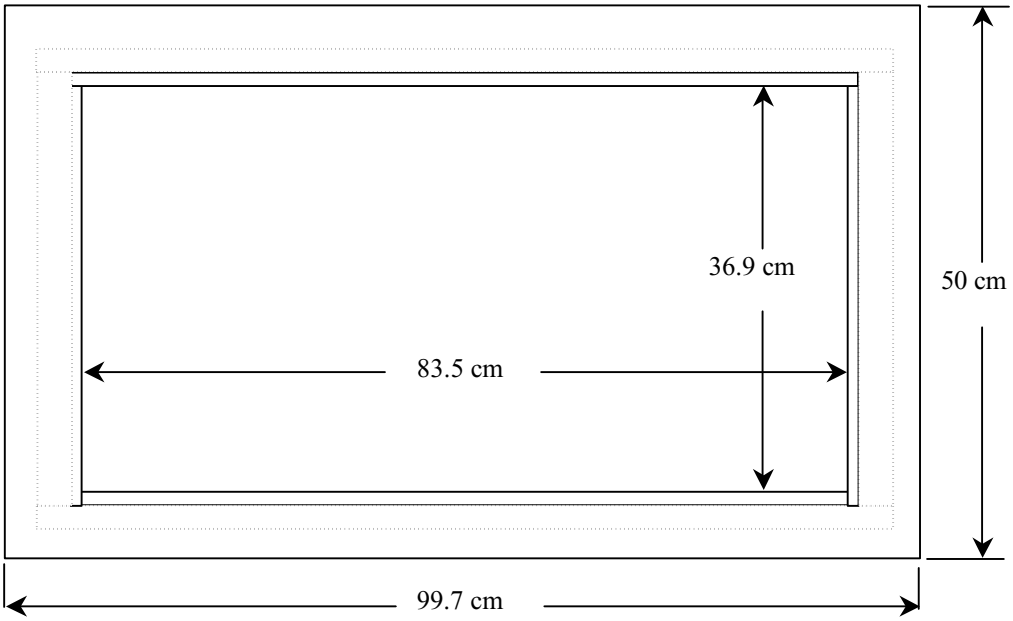
2. Validation Phantom

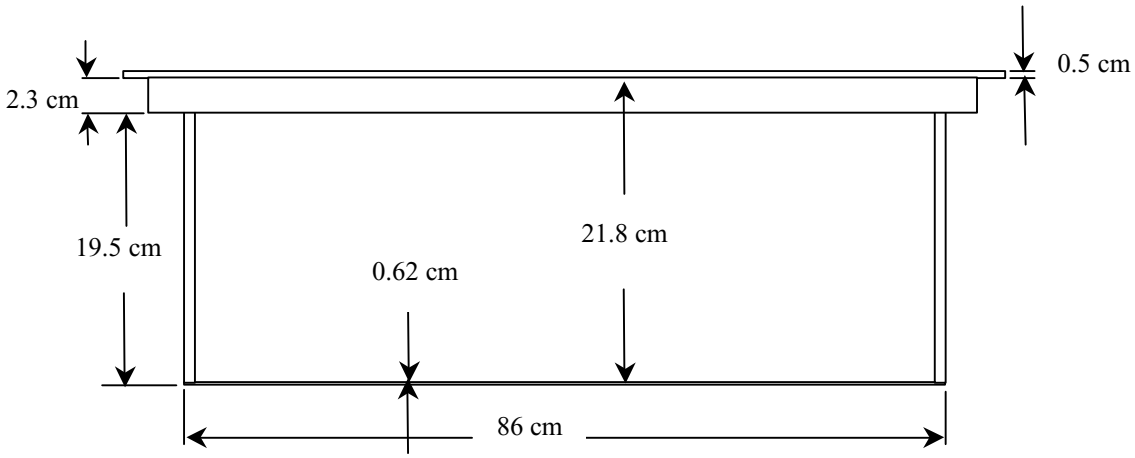
The validation phantom was constructed using relatively low-loss tangent Plexiglas material. The dimensions of the phantom are as follows:

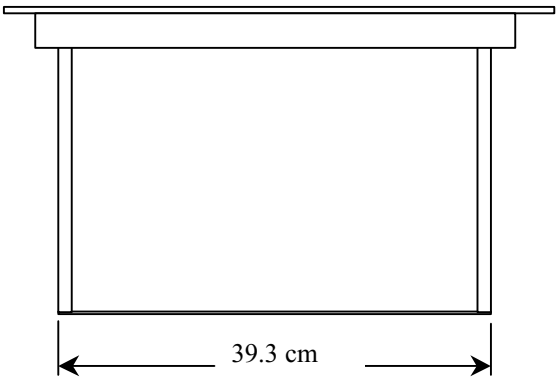
Length: 83.5 cm
Width: 36.9 cm
Height: 21.8 cm

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

Dimensions of Plexiglas Planar Phantom







450MHz Dipole Calibration Setup

450MHz Dipole Calibration Setup

3. Measurement Conditions

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

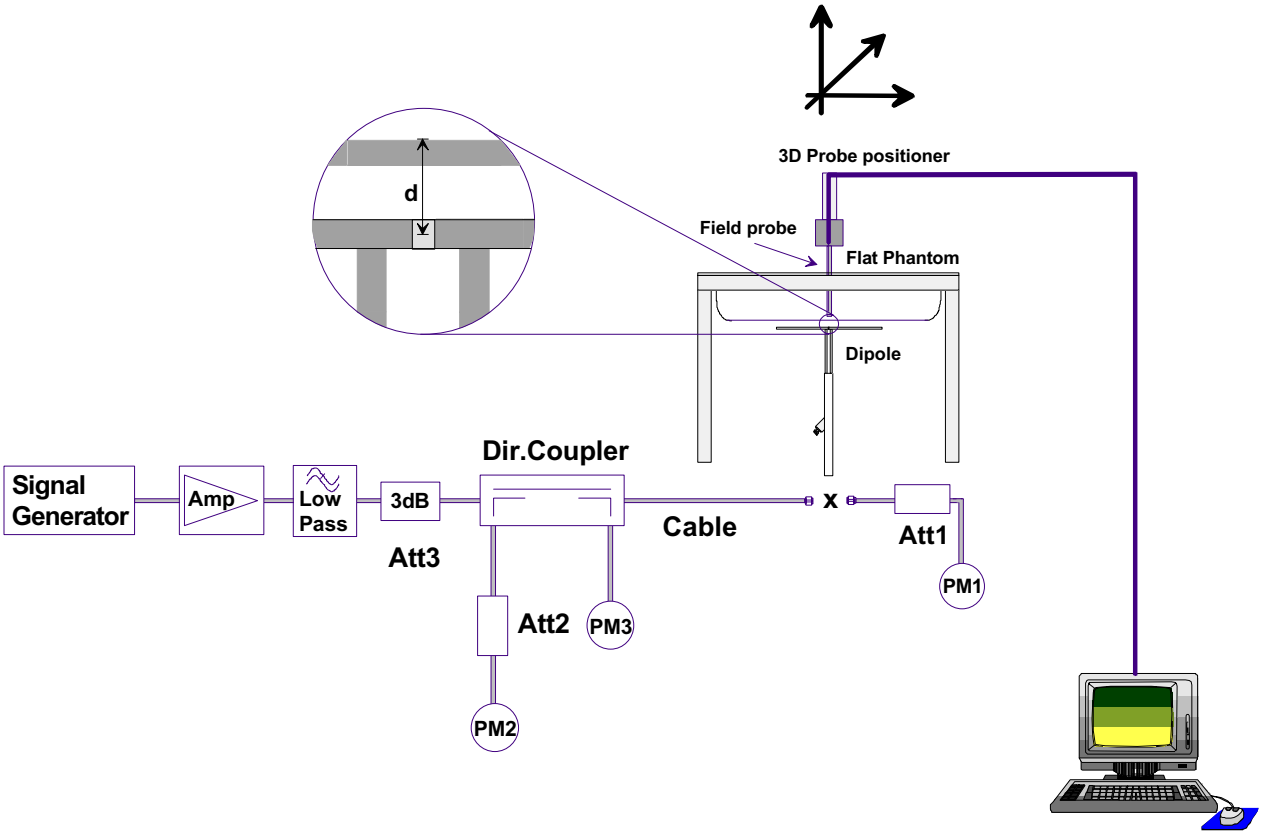
Relative Permitivity:	43.5 ± 5%
Conductivity:	0.86 mho/m ± 5%
Temperature:	23.1°C

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	1.47	5.88	0.971	3.88	2.31
Test 2	1.43	5.72	0.949	3.80	2.25
Test 3	1.45	5.80	0.961	3.84	2.27
Test 4	1.44	5.76	0.954	3.82	2.26
Test 5	1.46	5.84	0.969	3.88	2.29
Test 6	1.42	5.68	0.939	3.76	2.23
Test 7	1.45	5.80	0.960	3.84	2.27
Test 8	1.41	5.64	0.928	3.71	2.22
Test 9	1.43	5.72	0.950	3.80	2.25
Test10	1.46	5.84	0.971	3.88	2.29
Average Value	1.44	5.77	0.946	3.82	2.26

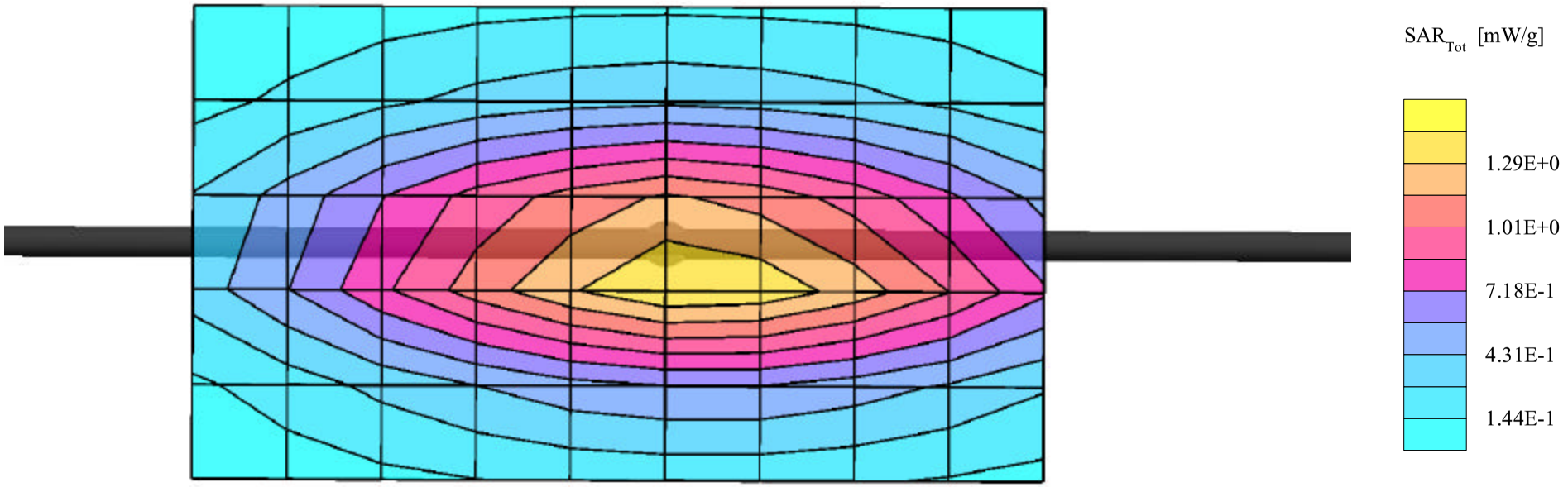
The results have been normalized to 1W (forward power) into the dipole.

Averaged over 1cm (1g) of tissue: 5.77 mW/g

Averaged over 10cm (10g) of tissue: 3.82 mW/g

Validation Dipole 450MHz, d = 15 mm

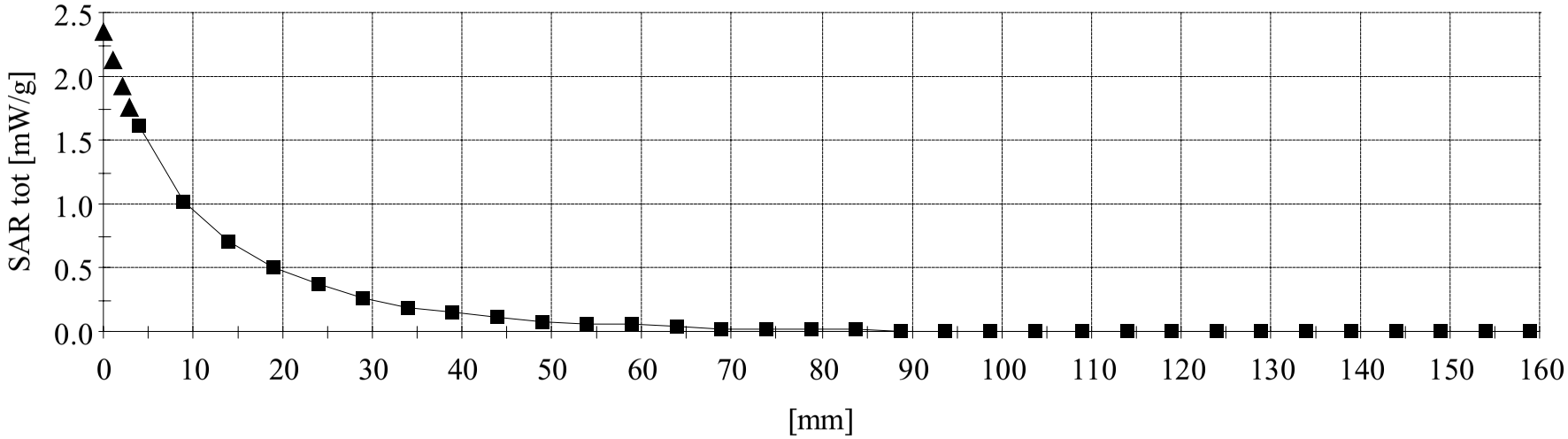
Frequency: 450 MHz; Antenna Input Power: 250 [mW]
Large Planar Phantom; Planar Section
Probe: ET3DV6 - SN1590; ConvF(7.36,7.36,7.36); Crest factor: 1.0
450 MHz Brain: $\sigma = 0.87$ mho/m $\varepsilon_r = 43.5$ $\rho = 1.00$ g/cm^3
Cube 5x5x7: Peak: 2.34 mW/g, SAR (1g): 1.47 mW/g, SAR (10g): 0.963 mW/g, (Worst-case extrapolation)
Penetration depth: 12.3 (10.7, 14.4) [mm]
Powerdrift: 0.02 dB
Calibration Date: Oct. 17, 2001



Validation Dipole 450MHz, d = 15 mm

Large Planar Phantom; Planar Section
Probe: ET3DV6 - SN1590; ConvF(7.36,7.36,7.36); Crest factor: 1.0
450 MHz Brain: σ = 0.87 mho/m ε_r = 43.5 ρ = 1.00 g/cm^3
Z-Axis: Dx = 0.0, Dy = 0.0, Dz = 5.0

Test Date: October 17, 2001
conducted power: 250 mW



APPENDIX D - PROBE CALIBRATION

Schmid & Partner
Engineering AG

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

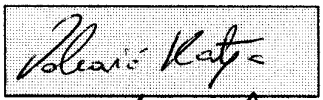
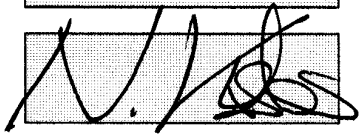
Calibration Certificate

Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1387**
Place of Calibration:	**Zurich**
Date of Calibration:	**February 22, 2002**
Calibration Interval:	**12 months**

Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by:	
Approved by:	

Probe ET3DV6

SN:1387

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

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV6 SN:1387

Sensitivity in Free Space

Diode Compression

NormX	**1.58**	$\mu V/(V/m)^2$	DCP X	**97**	mV
NormY	**1.67**	$\mu V/(V/m)^2$	DCP Y	**97**	mV
NormZ	**1.67**	$\mu V/(V/m)^2$	DCP Z	**97**	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	**0.40**
ConvF Z	**6.6**	± 9.5% (k=2)	Depth	**2.38**

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	**5.4**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**5.4**	± 9.5% (k=2)	Alpha	**0.57**
ConvF Z	**5.4**	± 9.5% (k=2)	Depth	**2.18**

Boundary Effect

Head **900 MHz** **Typical SAR gradient: 5 % per mm**

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	9.7	5.4
SAR_{be} [%]	With Correction Algorithm	0.3	0.6

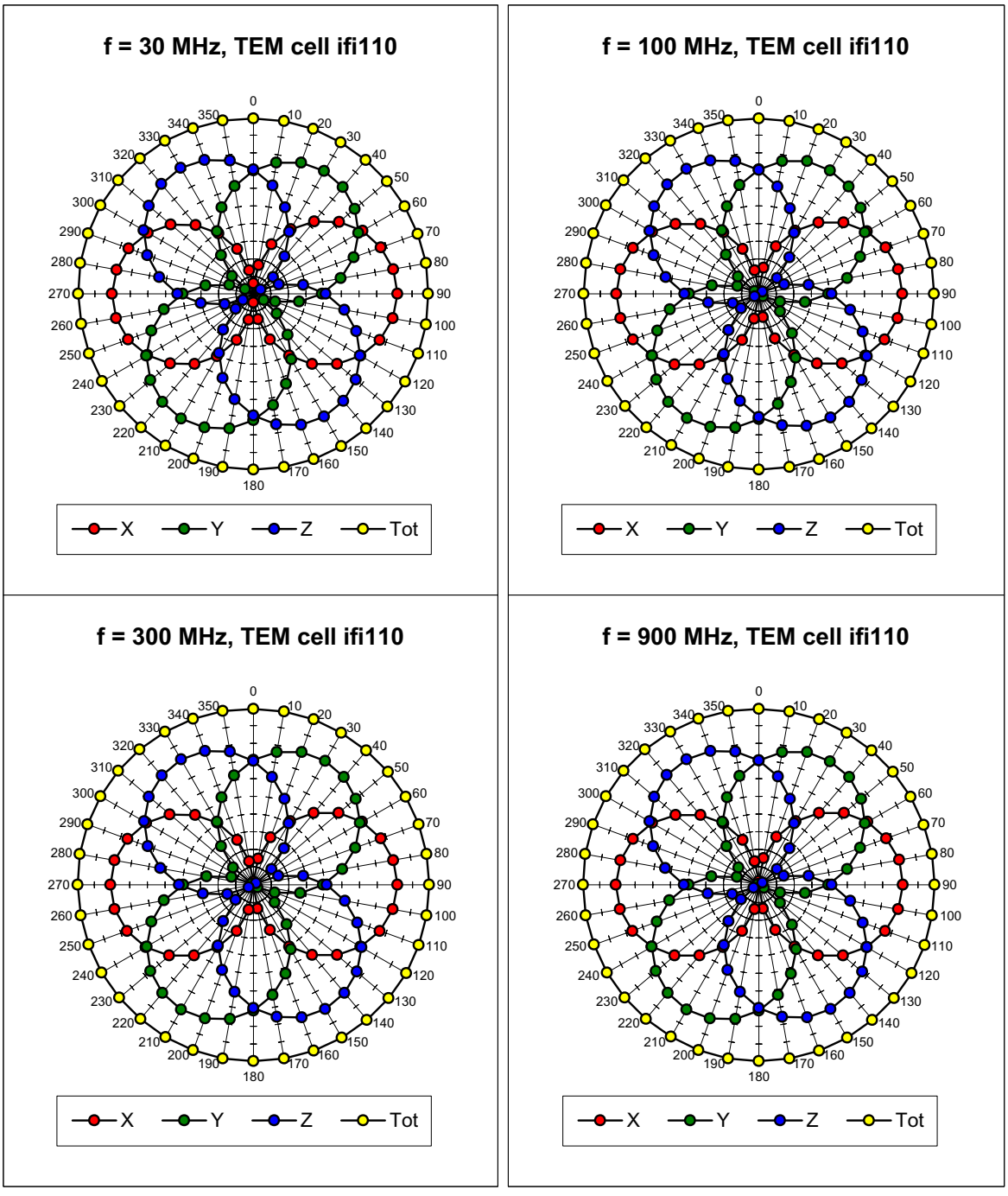
Head **1800 MHz** **Typical SAR gradient: 10 % per mm**

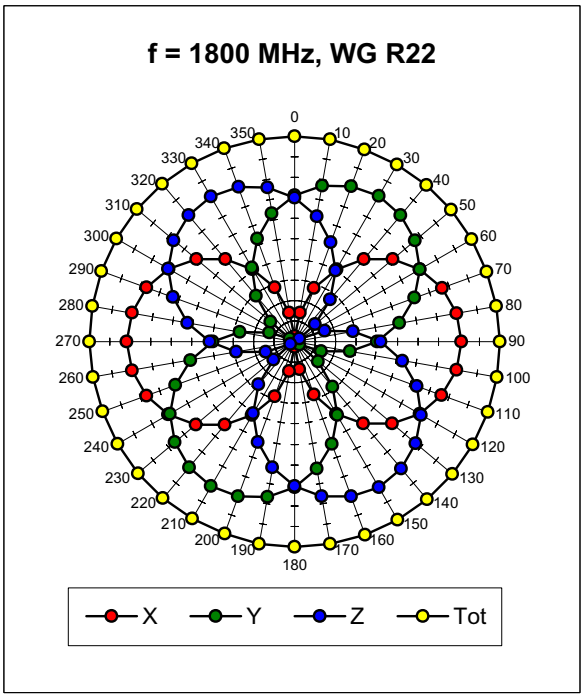
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	11.5	7.3
SAR_{be} [%]	With Correction Algorithm	0.1	0.3

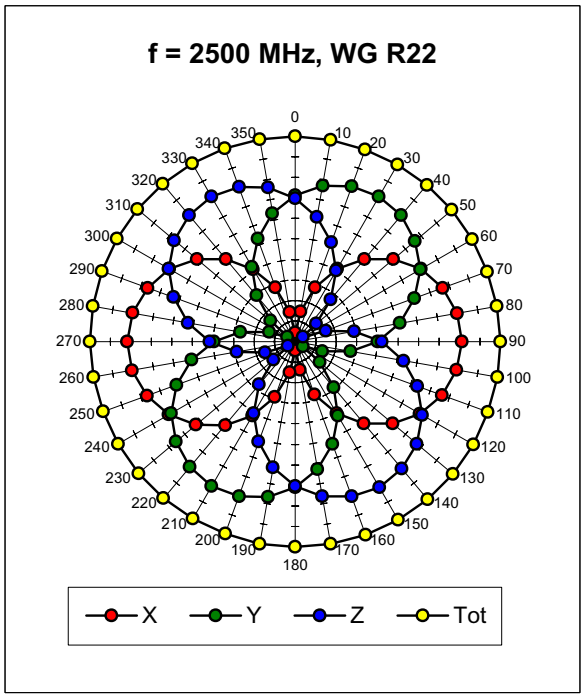
Sensor Offset

Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.3 ± 0.2**	mm

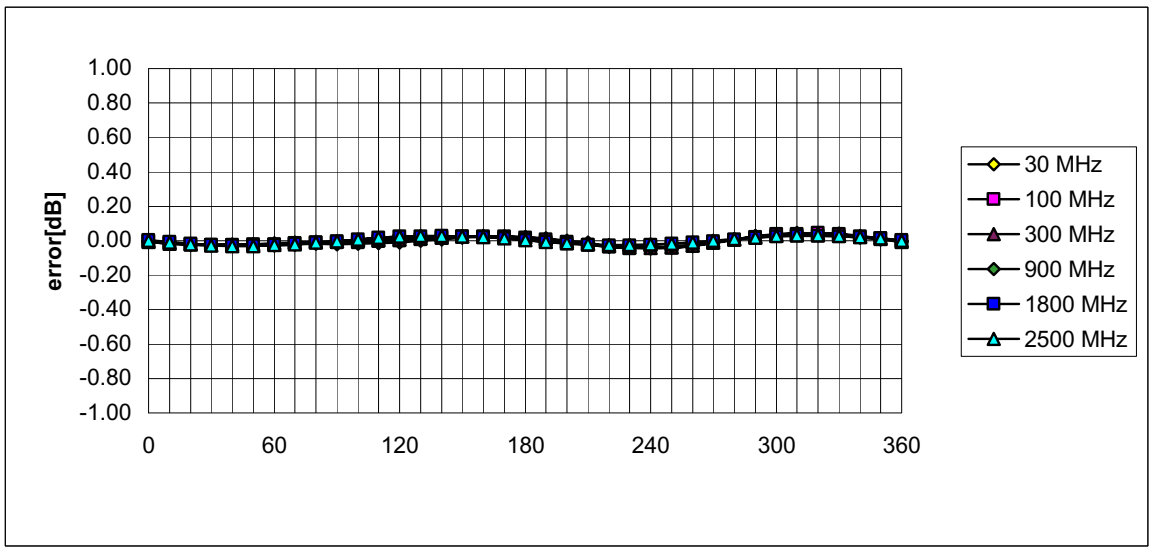
Receiving Pattern (ϕ , θ = 0°





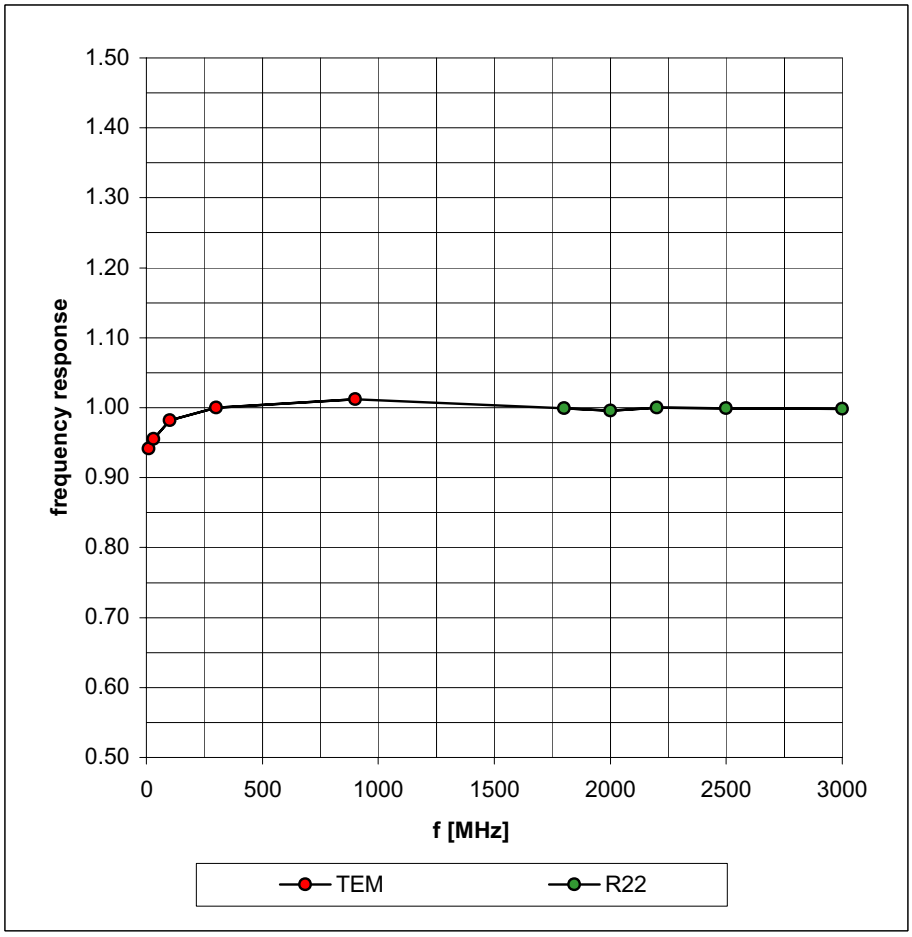


Isotropy Error (ϕ), θ = 0°



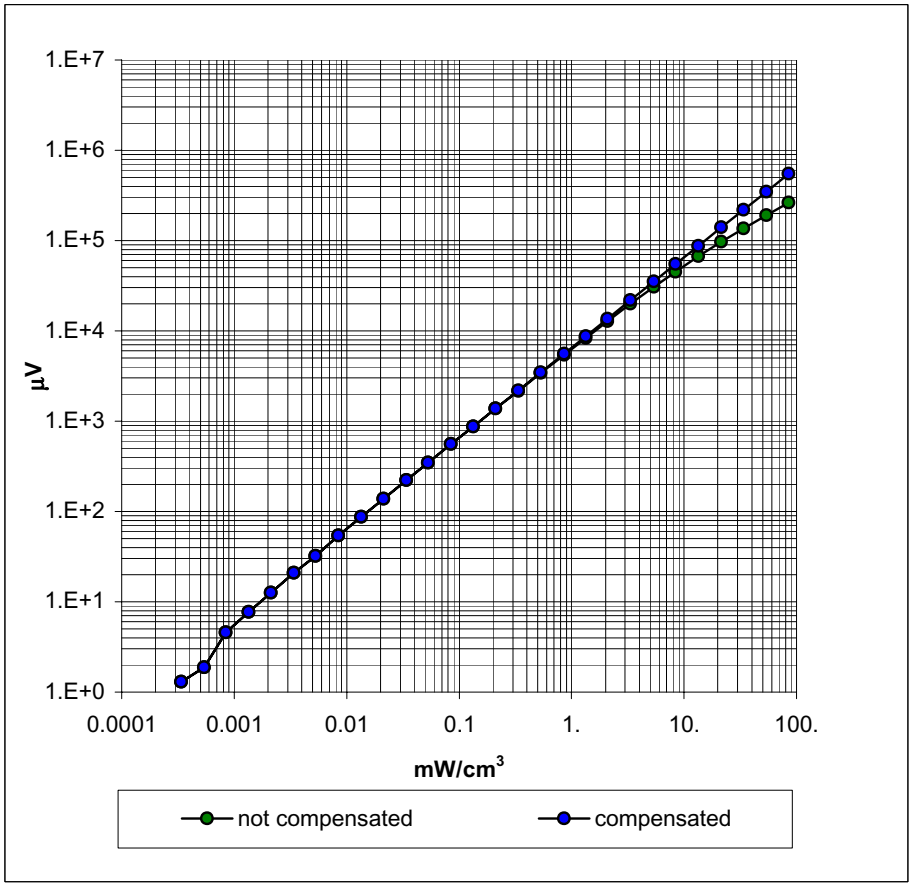
Frequency Response of E-Field

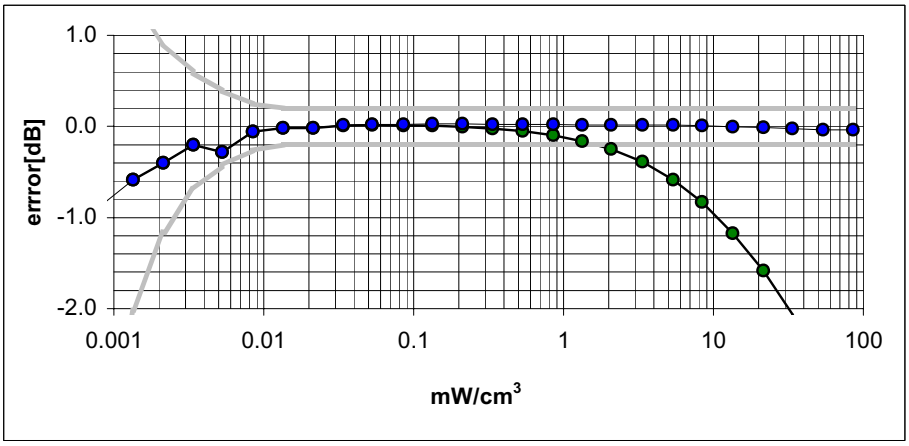
(TEM-Cell:ifi110, Waveguide R22)



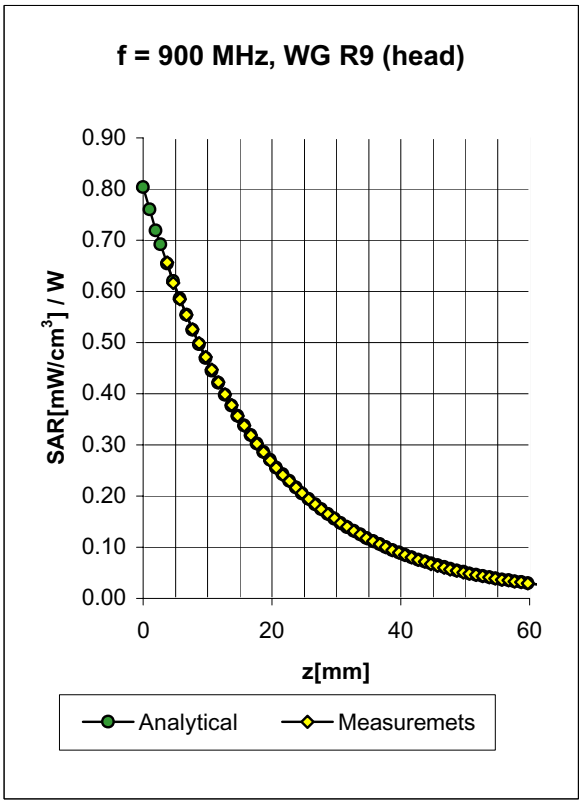
Dynamic Range f(SAR_{brain})

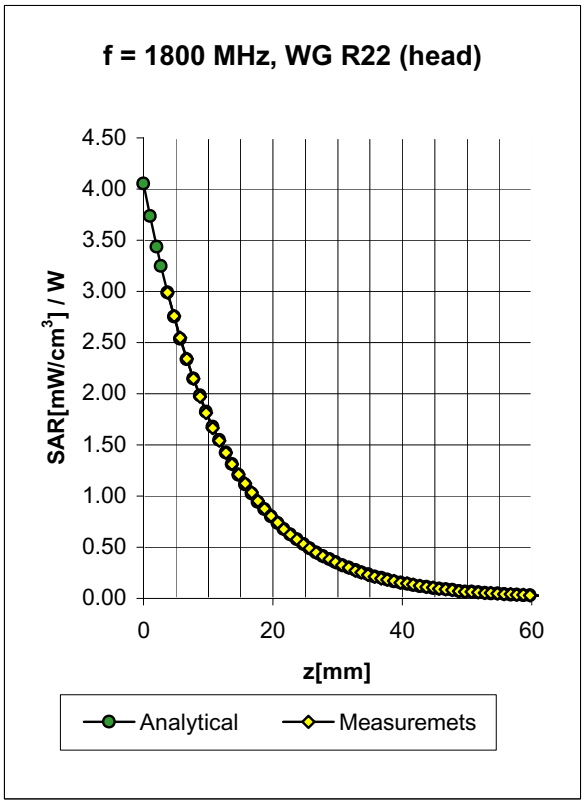
(Waveguide R22)





Conversion Factor Assessment



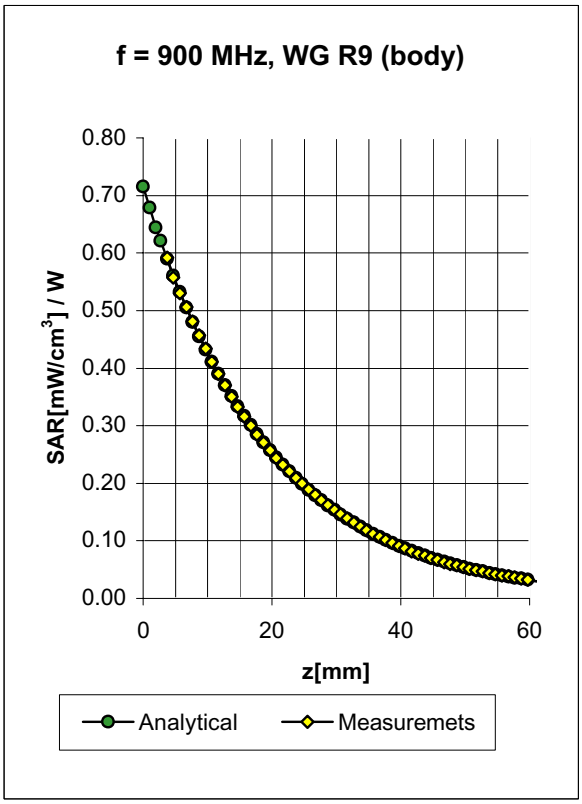


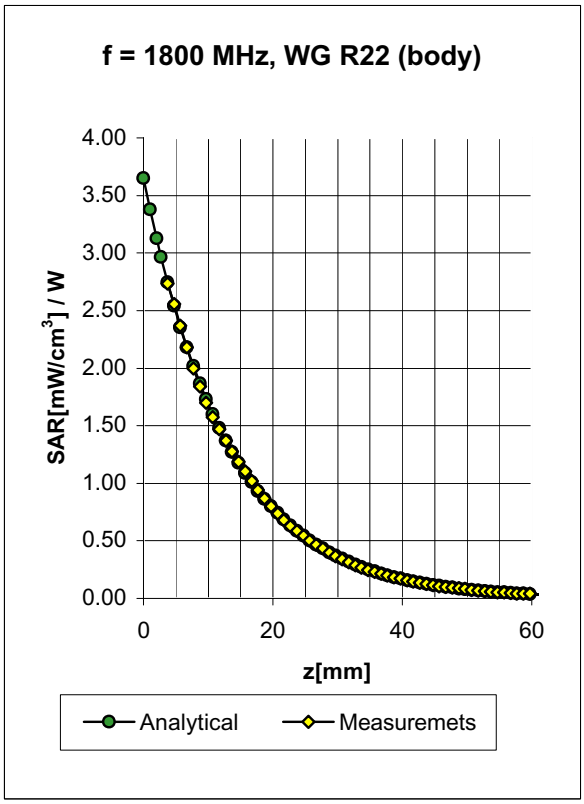
Head	**900 MHz**		**ε_r = 41.5 ± 5%**	**σ = 0.97 ± 5% mho/m**
Head	**835 MHz**		**ε_r = 41.5 ± 5%**	**σ = 0.90 ± 5% mho/m**
	ConvF X	**6.6** ± 9.5% (k=2)		Boundary effect:
	ConvF Y	**6.6** ± 9.5% (k=2)		Alpha **0.40**
	ConvF Z	**6.6** ± 9.5% (k=2)		Depth **2.38**

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	**5.4** ± 9.5% (k=2)		Boundary effect:
	ConvF Y	**5.4** ± 9.5% (k=2)		Alpha **0.57**
	ConvF Z	**5.4** ± 9.5% (k=2)		Depth **2.18**

ET3DV6 SN:1387 **February 22, 2002**

Conversion Factor Assessment





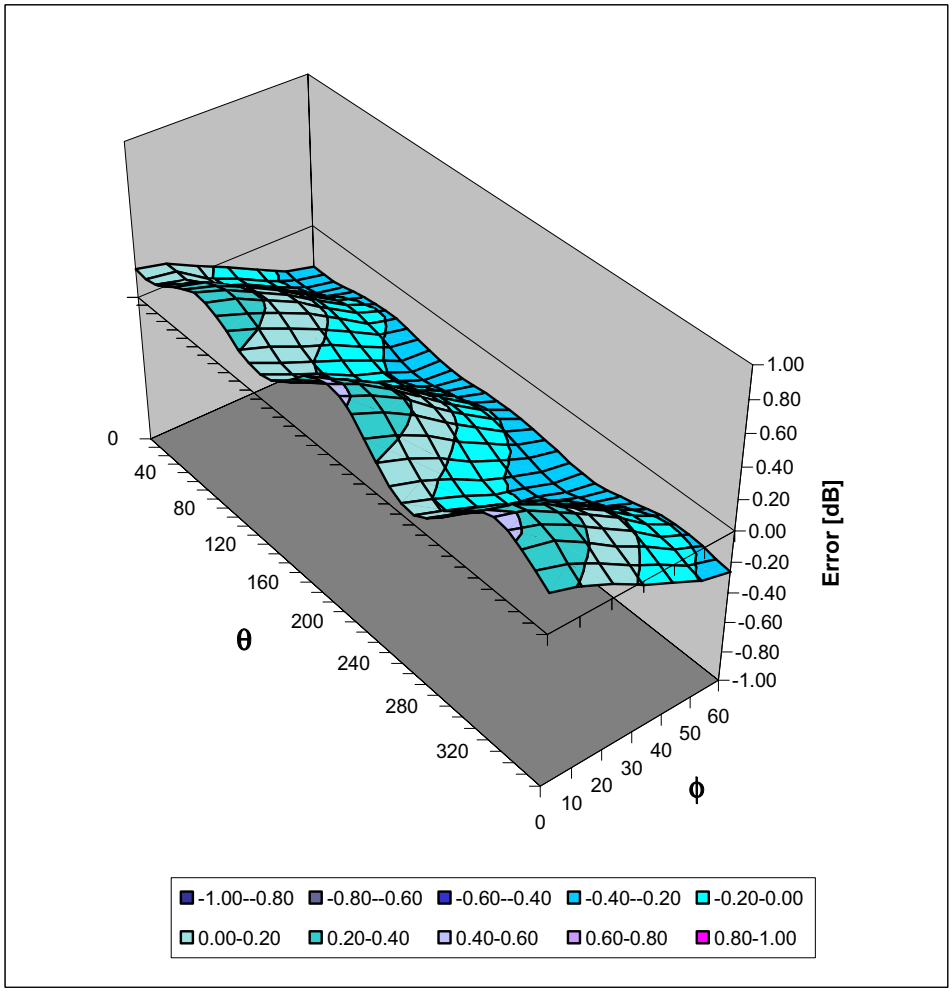
Body	**900 MHz**	ε_r **= 55.0 ± 5%**	**σ = 1.05 ± 5% mho/m**	
Body	**835 MHz**	ε_r **= 55.2 ± 5%**	**σ = 0.97 ± 5% mho/m**	
	ConvF X	**6.3** ± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**6.3** ± 9.5% (k=2)	Alpha	**0.42**
	ConvF Z	**6.3** ± 9.5% (k=2)	Depth	**2.44**

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	**5.0** ± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**5.0** ± 9.5% (k=2)	Alpha	**0.76**
	ConvF Z	**5.0** ± 9.5% (k=2)	Depth	**2.01**

ET3DV6 SN:1387 **February 22, 2002**

Deviation from Isotropy in HSL

Error ($\theta\phi$), 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 25, 2002**
Probe Calibration Date:	**February 22, 2002**

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	**9.2 ± 8%**	**ε_r = 52.3** **σ = 0.76 mho/m** (head tissue)
300 MHz	ConvF	**8.0 ± 8%**	**ε_r = 45.3** **σ = 0.87 mho/m** (head tissue)
450 MHz	ConvF	**7.3 ± 8%**	**ε_r = 43.5** **σ = 0.87 mho/m** (head tissue)
2450 MHz	ConvF	**4.7 ± 8%**	**ε_r = 39.2** **σ = 1.80 mho/m** (head tissue)
150 MHz	ConvF	**8.8 ± 8%**	**ε_r = 61.9** **σ = 0.80 mho/m** (body tissue)
450 MHz	ConvF	**7.7 ± 8%**	**ε_r = 56.7** **σ = 0.94 mho/m** (body tissue)
2450 MHz	ConvF	**4.3 ± 8%**	**ε_r = 52.7** **σ = 1.95 mho/m** (body tissue)

APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

450MHz System Validation

Measured Fluid Dielectric Parameters (Brain)

September 06, 2002

Frequency	e'	e''
400.000000 MHz	45.1723	36.5544
402.000000 MHz	45.1863	36.4419
404.000000 MHz	45.1163	36.3218
406.000000 MHz	44.9894	36.2318
408.000000 MHz	45.0103	36.1624
410.000000 MHz	44.9254	36.0682
412.000000 MHz	44.9150	35.9233
414.000000 MHz	44.8454	35.7885
416.000000 MHz	44.8080	35.7309
418.000000 MHz	44.7906	35.6708
420.000000 MHz	44.7453	35.5555
422.000000 MHz	44.7033	35.4607
424.000000 MHz	44.6202	35.3532
426.000000 MHz	44.5794	35.2601
428.000000 MHz	44.4815	35.1765
430.000000 MHz	44.4677	35.0615
432.000000 MHz	44.4050	34.9452
434.000000 MHz	44.3582	34.8663
436.000000 MHz	44.2895	34.8302
438.000000 MHz	44.2446	34.6947
440.000000 MHz	44.2102	34.6258
442.000000 MHz	44.1827	34.5374
444.000000 MHz	44.1071	34.5046
446.000000 MHz	44.0436	34.4232
448.000000 MHz	43.9672	34.3163
450.000000 MHz	43.9536	34.2475
452.000000 MHz	43.9038	34.1849
454.000000 MHz	43.8201	34.0818
456.000000 MHz	43.8166	34.0132
458.000000 MHz	43.7290	33.9955
460.000000 MHz	43.7251	33.8636
462.000000 MHz	43.7017	33.7817
464.000000 MHz	43.6846	33.6812
466.000000 MHz	43.6232	33.6431
468.000000 MHz	43.5831	33.5658

450MHz EUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

September 05, 2002

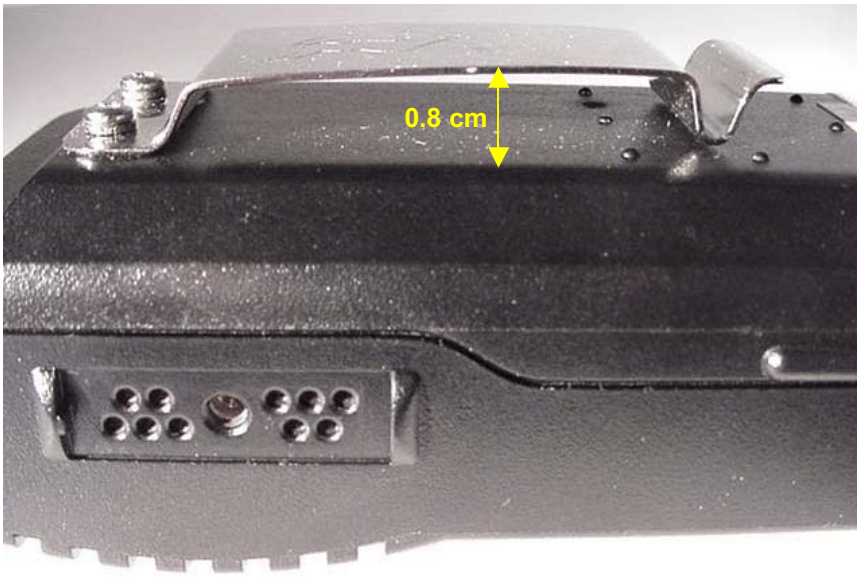
Frequency	e'	e''
350.000000 MHz	58.7196	42.9248
355.000000 MHz	58.5946	42.6195
360.000000 MHz	58.5788	42.1752
365.000000 MHz	58.4574	41.7943
370.000000 MHz	58.3938	41.4018
375.000000 MHz	58.3383	41.0512
380.000000 MHz	58.3394	40.6991
385.000000 MHz	58.1998	40.3025
390.000000 MHz	58.1792	40.0686
395.000000 MHz	58.0977	39.6140
400.000000 MHz	58.0268	39.4445
405.000000 MHz	57.9834	38.9580
410.000000 MHz	57.8825	38.7219
415.000000 MHz	57.7415	38.4782
420.000000 MHz	57.7224	38.2168
425.000000 MHz	57.6552	37.8089
430.000000 MHz	57.5201	37.6121
435.000000 MHz	57.4821	37.2923
440.000000 MHz	57.3461	37.0667
445.000000 MHz	57.2252	36.8529
450.000000 MHz	57.1388	36.6080
455.000000 MHz	57.1025	36.4145
460.000000 MHz	56.9916	36.1277
465.000000 MHz	57.0572	35.9210
470.000000 MHz	56.8364	35.7138
475.000000 MHz	56.8336	35.4831
480.000000 MHz	56.6898	35.2687
485.000000 MHz	56.7204	35.0208
490.000000 MHz	56.5461	34.8927
495.000000 MHz	56.5137	34.5957
500.000000 MHz	56.4035	34.4954
505.000000 MHz	56.3741	34.2063
510.000000 MHz	56.2815	34.0904
515.000000 MHz	56.2177	33.8684

APPENDIX F - SAR TEST SETUP & EUT PHOTOGRAPHS

BODY-WORN SAR TEST SETUP PHOTOGRAPHS
With 0.8cm Metal Belt-Clip Separation Distance

EUT PHOTOGRAPHS
Profile

EUT PHOTOGRAPHS
Metal Belt-Clip
(P/N: 585-7200-032)



EUT PHOTOGRAPHS
Speaker-Microphone
(P/N: 589-0015-037)