

CERTIFICATE OF COMPLIANCE
SAR EVALUATION

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FCC Rule Part(s):	2.1093; ET Docket 93-62
FCC ID:	B3TG25RPV100
Trade Name / Model:	Guardian G25RPV100
EUT Type:	Portable VHF PTT Radio Transceiver
Modulation:	FM (VHF Band)
Tx Frequency Range:	136 - 174 MHz
Conducted Power Tested:	5.0 Watts - 136.05MHz
	3.9 Watts - 156.75MHz
	4.2 Watts - 173.84MHz
Antenna Type(s):	Helical Whip
Battery Type(s):	7.5V Nickel Cadmium (1800mAh)
Body-Worn Accessories:	Speaker-Microphone

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 OET Bulletin 65, Supplement C, Edition 01-01 (General Population/Uncontrolled Exposure), and was tested in accordance with the appropriate measurement standards, guidelines, and recommended practices specified in American National Standards Institute C95.1-1992.

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 Research Inc. The results and statements contained in this report pertain only to the device(s) evaluated.



Shawn McMillen
General Manager
Celltech Research Inc.



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1.0 INTRODUCTION

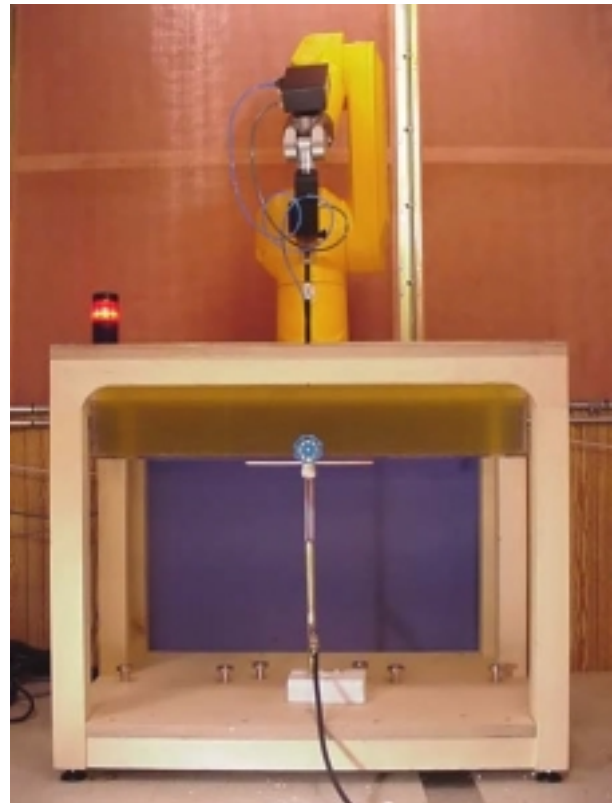
This measurement report shows that the TITAN CORPORATION Model: G25RPV100 Portable VHF PTT Radio Transceiver FCC ID: B3TG25RPV100 complies with FCC Part 2.1093, ET Docket 93-62 (see reference [1]), for mobile and portable devices (uncontrolled environment). The test procedures, as described in American National Standards Institute C95.1-1992 (see reference [2]), and FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]), 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)

FCC Rule Part(s)	2.1093; ET Docket 93-62
EUT Type	Portable VHF PTT Radio Transceiver
Trade Name / Model	Guardian G25RPV100
Serial No.	Pre-production
Modulation	FM (VHF Band)
Tx Frequency Range	136 - 174 MHz
Measured RF Conducted Power	5.0 Watts (136.05MHz) 3.9 Watts (156.75MHz) 4.2 Watts (173.84MHz)
Antenna Type	Helical Whip
Antenna Length	215 mm
Battery Type(s)	7.5V Nickel Cadmium (1800mAh)
Body-Worn Accessory	Speaker-Microphone

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 DASY system is comprised of the robot controller, computer, near-field probe, probe alignment sensor, SAM phantom, and various planar phantoms for brain 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 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.

FACE-HELD SAR MEASUREMENT RESULTS									
Freq. (MHz)	Chan.	Mode	Cond. Power Before (W)	Cond. Power After (W)	Antenna Position	Separation Distance (cm)	Phantom Section	Measured SAR 1g (w/kg)	
								100% Duty Cycle	50% Duty Cycle
136.05	Low	CW	5.03	4.88	Fixed	2.5	Planar	0.615	0.308
156.75	Mid	CW	3.92	3.75	Fixed	2.5	Planar	0.218	0.109
173.84	High	CW	4.21	4.05	Fixed	2.5	Planar	0.347	0.174
ANSI / IEEE C95.1 1992 - SAFETY LIMIT BRAIN: 1.6 W/kg (averaged over 1 gram) Spatial Peak - Uncontrolled Exposure / General Population									
Measured Mixture Type		Brain			Relative Humidity		49 %		
Dielectric Constant		52.4			Ambient Temperature		23.9 °C		
Conductivity		0.76			Fluid Temperature		≈ 23.0 °C		
Atmospheric Pressure		100.9 kPa			Fluid Depth		≥ 15 cm		

Notes:

1. The face-held SAR values measured were below the maximum limit of 8.0 w/kg (controlled exposure).
2. The highest face-held SAR value measured was 0.615 w/kg (low channel, 100% duty cycle).
3. The EUT was tested for face-held SAR with a 2.5cm separation distance between the front of the EUT and the outer surface of the planar phantom.
4. During the entire test the conducted power was maintained to within 5% of the initial conducted power.

MEASUREMENT SUMMARY (Cont.)

BODY-WORN SAR MEASUREMENT RESULTS									
Freq. (MHz)	Chan.	Mode	Cond. Power Before (W)	Cond. Power After (W)	Antenna Position	Separation Distance (cm)	Phantom Section	Measured SAR 1g (w/kg)	
								100% Duty Cycle	50% Duty Cycle
136.05	Low	CW	5.04	4.86	Fixed	1.5	Planar	1.99	0.995
156.75	Mid	CW	3.93	3.74	Fixed	1.5	Planar	0.626	0.313
173.84	High	CW	4.22	4.03	Fixed	1.5	Planar	0.672	0.336
ANSI / IEEE C95.1 1992 - SAFETY LIMIT BODY: 1.6 W/kg (averaged over 1 gram) Spatial Peak - Uncontrolled Exposure / General Population									
Measured Mixture Type		Body			Relative Humidity		49 %		
Dielectric Constant		61.8			Ambient Temperature		23.9 °C		
Conductivity		0.80			Fluid Temperature		≈ 23.0 °C		
Atmospheric Pressure		100.9 kPa			Fluid Depth		≥ 15 cm		

Notes:

1. The body-worn SAR values measured were below the maximum limit of 8.0 w/kg (controlled exposure).
2. The highest body-worn SAR value measured was 1.99 w/kg (low channel, 100% duty cycle).
3. The EUT was tested for body-worn SAR with a 1.5cm separation distance between the back of the EUT and the outer surface of the planar phantom. A speaker-microphone accessory was connected to the EUT for the duration of the body-worn evaluation.
4. During the entire test the conducted power was maintained to within 5% of the initial conducted power.

5.0 DETAILS OF SAR EVALUATION

The TITAN CORPORATION Model: G25RPV100 Portable VHF PTT Radio Transceiver FCC ID: B3TG25RPV100 was found to be compliant for localized Specific Absorption Rate (uncontrolled exposure) based on the following test provisions and conditions:

1. The EUT was evaluated for SAR in a face-held configuration with the front of the device placed parallel to the outer surface of the planar phantom. A 2.5cm separation distance was maintained between the front of the EUT and the outer surface of the planar phantom for the duration of the tests.
2. The EUT was evaluated for SAR in a body-worn configuration with the back of the device placed parallel to the outer surface of the planar phantom. A 1.5cm separation distance was maintained between the back of the EUT and the outer surface of the planar phantom. A speaker-microphone accessory was connected to the EUT for the duration of the body-worn evaluation.
3. The EUT was evaluated for SAR at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimize drift. The conducted power levels were checked before and after each test. If the conducted power level dropped more than 5% of the initial power level, then the EUT was retested. Any unusual anomalies over the course of the test also warranted a re-evaluation.
4. The conducted power was measured according to the procedures described in FCC Part 2.1046.
5. The EUT was tested with the transmitter in continuous operation (100% duty cycle) throughout the SAR evaluation. For a push-to-talk device the 50% duty cycle compensation reported assumes a transmit/receive cycle of equal time base.
6. The location of the maximum spatial SAR distribution (Hot Spot) was determined relative to the device and its antenna.
7. The EUT was tested with a fully charged battery.

6.0 EVALUATION PROCEDURES

The Specific Absorption Rate (SAR) evaluation was performed as follows:

- 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 at the low, middle, and high frequencies of the band at maximum power, and with the device antenna in both the extended and extracted positions as applicable. 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. Depending on the phantom used for the evaluation, all other phantoms were drained of fluid.
- 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. The depth of the simulating tissue in the phantom(s) used for the SAR evaluation and system validation was no less than 15.0cm.
- e. For this evaluation a stack of low-density, low-loss dielectric foamed polystyrene was used in place of the device holder.

7.0 SYSTEM VALIDATION

Prior to the assessment, the system was verified using a planar phantom with a 300MHz dipole. A forward power of 250mW was applied to the dipole and the system was verified to a tolerance of $\pm 10\%$. The applicable verifications are listed below (see Appendix B for system validation test plot and Appendix C for dipole calibration information).

Dipole Validation Kit	Target SAR 1g (w/kg)	Measured SAR 1g (w/kg)	Ambient Temp.	Fluid Temp.	Fluid Depth	Validation Date
300MHz	0.899	0.893	23.9 °C	≈23.0 °C	≥ 15cm	05/27/02

8.0 TISSUE PARAMETERS

The dielectric parameters of the fluid were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer. The dielectric parameters of the fluid are shown below (see Appendix E for printout of measured fluid dielectric parameters).

TISSUE PARAMETERS – SYSTEM VALIDATION & EUT EVALUATION			
Equivalent Tissue	Dielectric Constant ϵ_r	Conductivity σ (mho/m)	ρ (Kg/m ³)
300MHz Brain (Target)	45.3 ±5%	0.87 ±5%	1000
300MHz Brain (Measured: 05/27/02)	45.5	0.87	1000
150MHz Brain (Target)	52.3 ±5%	0.76 ±5%	1000
150MHz Brain (Measured: 05/27/02)	52.4	0.76	1000
150MHz Body (Target)	61.9 ±5%	0.80 ±5%	1000
150MHz Body (Measured: 05/27/02)	61.8	0.80	1000

9.0 SIMULATED TISSUES

The 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 (permittivity and conductivity).

TISSUE MIXTURES			
INGREDIENT	300MHz Brain (%) (System Validation)	150MHz Brain (%) (EUT Evaluation)	150MHz Body (%) (EUT Evaluation)
Water	37.56	38.35	46.6
Sugar	55.32	55.5	49.7
Salt	5.95	5.15	2.6
HEC	0.98	0.9	1.0
Bactericide	0.19	0.1	0.1

10.0 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.

11.0 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 \pm 0.1mm
Dimensions: Box: 36.5cm (L) x 22.5cm (W) x 20.3cm (H); Back Plane: 25.3cm (H)

Validation Phantom (≤ 450 MHz)

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

12.0 PROBE SPECIFICATION (ET3DV6)

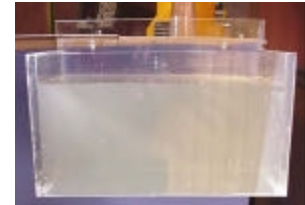
- Construction: Symmetrical design with triangular core
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g. glycol)
- Calibration: In air from 10 MHz to 2.5 GHz
In brain simulating tissue at frequencies of 900 MHz
and 1.8 GHz (accuracy $\pm 8\%$)
- Frequency: 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)
- Dynam. Rnge: $5 \mu\text{W/g}$ to $> 100 \text{ mW/g}$; 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

13.0 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 outer left hand section of the DASY3 system.



Small Planar Phantom

14.0 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

15.0 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

16.0 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

17.0 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 permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					± 13.6	
Expanded Uncertainty (k=2)					± 27.1	

Measurement Uncertainty Table in accordance with IEEE Std 1528 (Draft - see reference [6])

18.0 REFERENCES

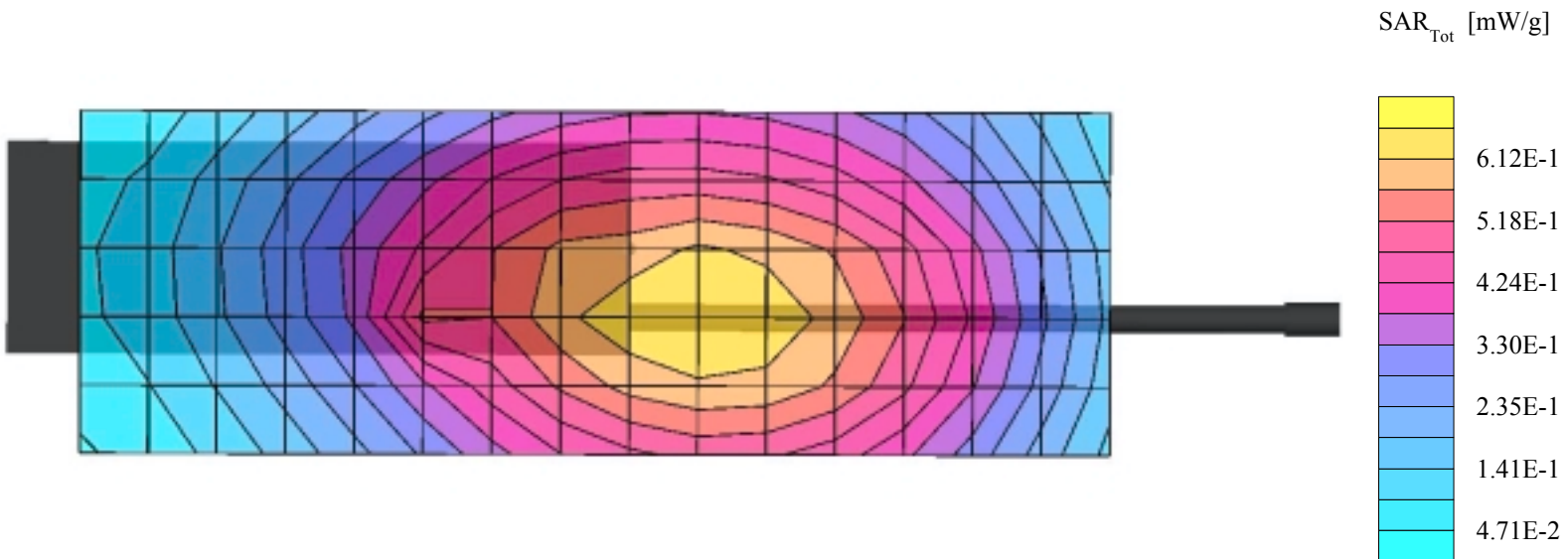
- [1] Federal Communications Commission, ET Docket 93-62, "Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation"; Aug. 1996.
- [2] ANSI, ANSI/IEEE C95.1: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY: 1992.
- [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] Thomas Schmid, Oliver Egger, and Niels Kuster, "Automated E-field scanning system for dosimetric assessments", IEEE Transaction on Microwave Theory and Techniques, Vol. 44, pp. 105 - 113: January 1996.
- [5] Niels Kuster, Ralph Kastle, and Thomas Schmid, "Dosimetric evaluation of mobile communications equipment with known precision", IEICE Transactions of Communications, vol. E80-B, no. 5, pp. 645 - 652: May 1997.
- [6] IEEE Standards Coordinating Committee 34, Std 1528, DRAFT Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques: Draft, December 2001.

APPENDIX A - SAR MEASUREMENT DATA

Titan Corporation FCC ID: B3TG25RPV100

Small Planar Phantom; Planar Section; Position: (90°,180°)
Probe: ET3DV6 - SN1387; ConvF(9.20,9.20,9.20); Crest factor: 1.0
150 MHz Brain : $\omega = 0.76$ mho/m $\kappa = 52.4$ $\psi = 1.00$ g/cm³
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 5x5x7; Powerdrift: -0.18 dB
SAR (1g): 0.615 mW/g, SAR (10g): 0.479 mW/g

Face SAR at 2.5cm Separation Distance
VHF Radio Transceiver Model: G25RPV100
Continuous Wave Mode
Low Channel [136.05 MHz]
Conducted Power: 5.03 Watts
Ambient Temp: 23.9 °C Fluid Temp: 23.0 °C
Dated Tested: May 27, 2002



Titan Corporation FCC ID: B3TG25RPV100

Small Planar Phantom; Planar Section
Probe: ET3DV6 - SN1387; ConvF(9.20,9.20,9.20); Crest factor: 1.0
150 MHz Brain : $\sigma = 0.76$ mho/m $\epsilon_r = 52.4$ $\rho = 1.00$ g/cm³

Z-Axis Extrapolation at Peak SAR Location

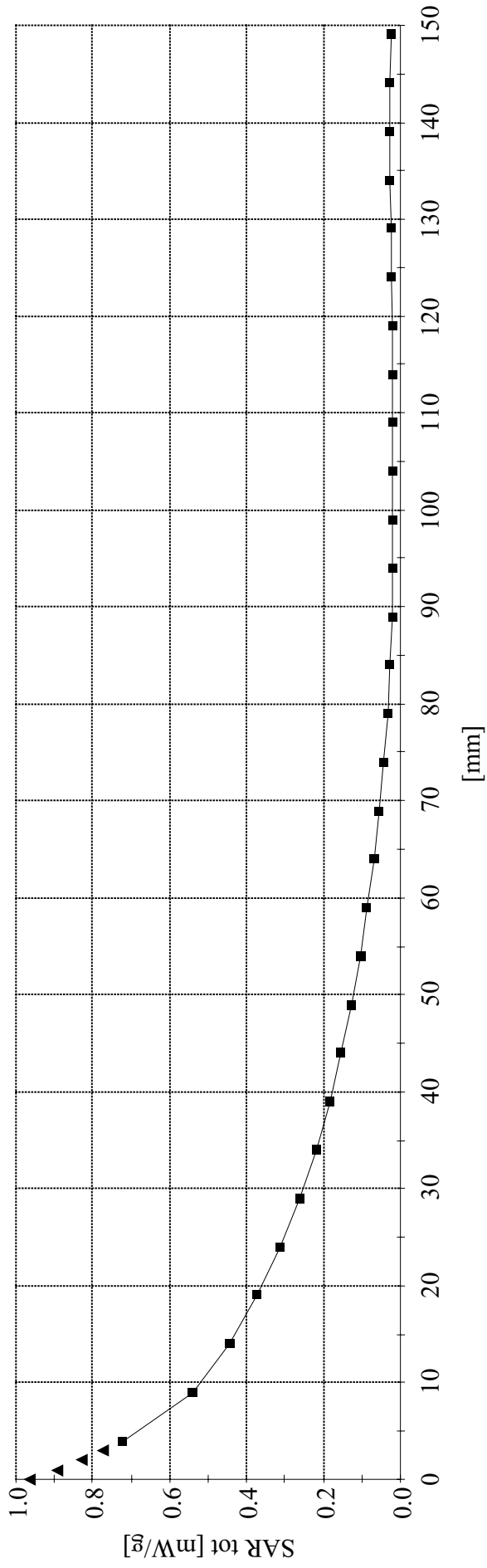
Face SAR at 2.5cm Separation Distance
VHF Radio Transceiver Model: G25RPV100
Continuous Wave Mode

Low Channel [136.05 MHz]

Conducted Power: 5.03 Watts

Ambient Temp: 23.9 °C Fluid Temp: 23.0 °C

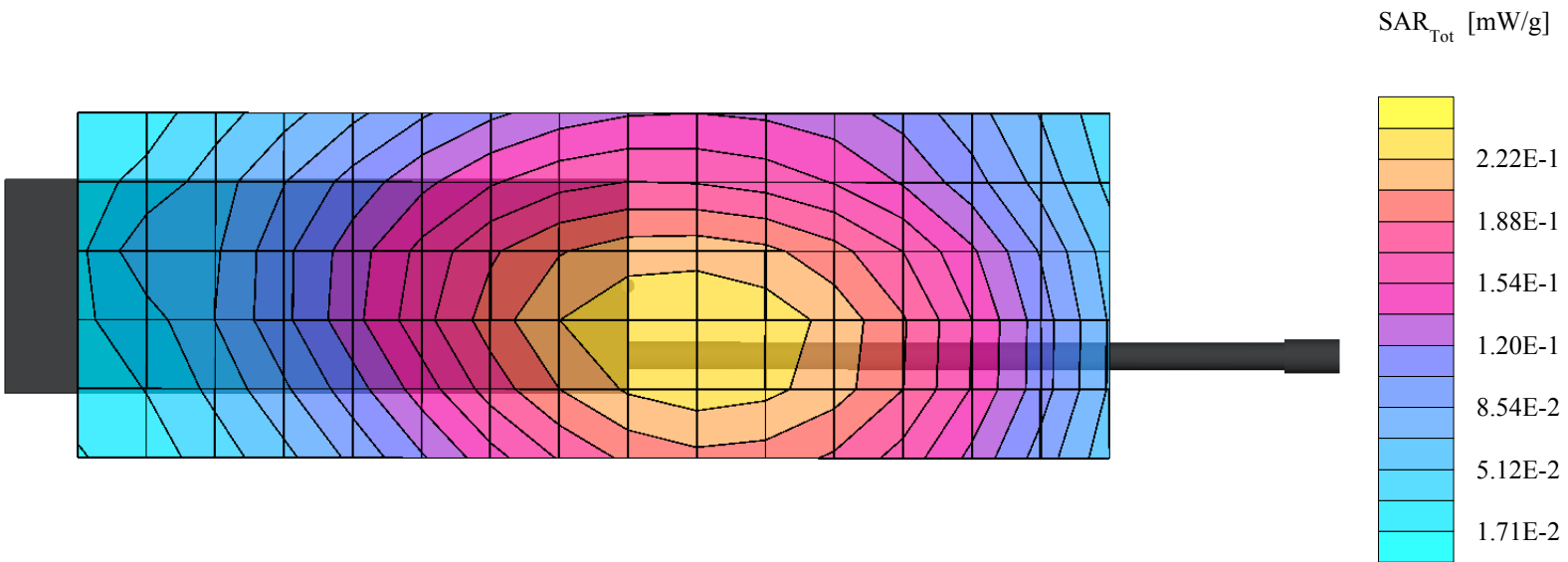
Dated Tested: May 27, 2002



Titan Corporation FCC ID: B3TG25RPV100

Small Planar Phantom; Planar Section; Position: (90°,180°)
Probe: ET3DV6 - SN1387; ConvF(9.20,9.20,9.20); Crest factor: 1.0
150 MHz Brain : $\omega = 0.76$ mho/m $\kappa = 52.4$ $\psi = 1.00$ g/cm³
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 5x5x7; Powerdrift: -0.17 dB
SAR (1g): 0.218 mW/g, SAR (10g): 0.167 mW/g

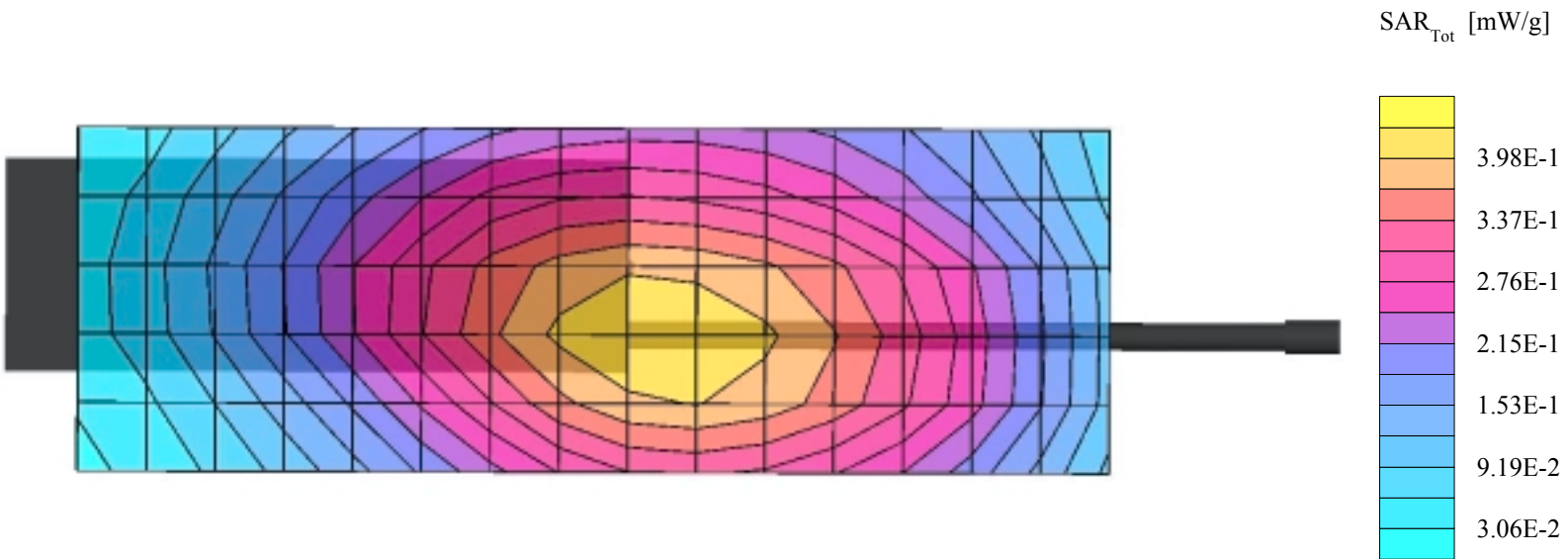
Face SAR at 2.5cm Separation Distance
VHF Radio Transceiver Model: G25RPV100
Continuous Wave Mode
Mid Channel [156.75 MHz]
Conducted Power: 3.92 Watts
Ambient Temp: 23.9 °C Fluid Temp: 23.0 °C
Dated Tested: May 27, 2002



Titan Corporation FCC ID: B3TG25RPV100

Small Planar Phantom; Planar Section; Position: (90°,180°)
Probe: ET3DV6 - SN1387; ConvF(9.20,9.20,9.20); Crest factor: 1.0
150 MHz Brain : $\omega = 0.76$ mho/m $\kappa = 52.4$ $\psi = 1.00$ g/cm³
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 5x5x7; Powerdrift: -0.20 dB
SAR (1g): 0.347 mW/g, SAR (10g): 0.261 mW/g

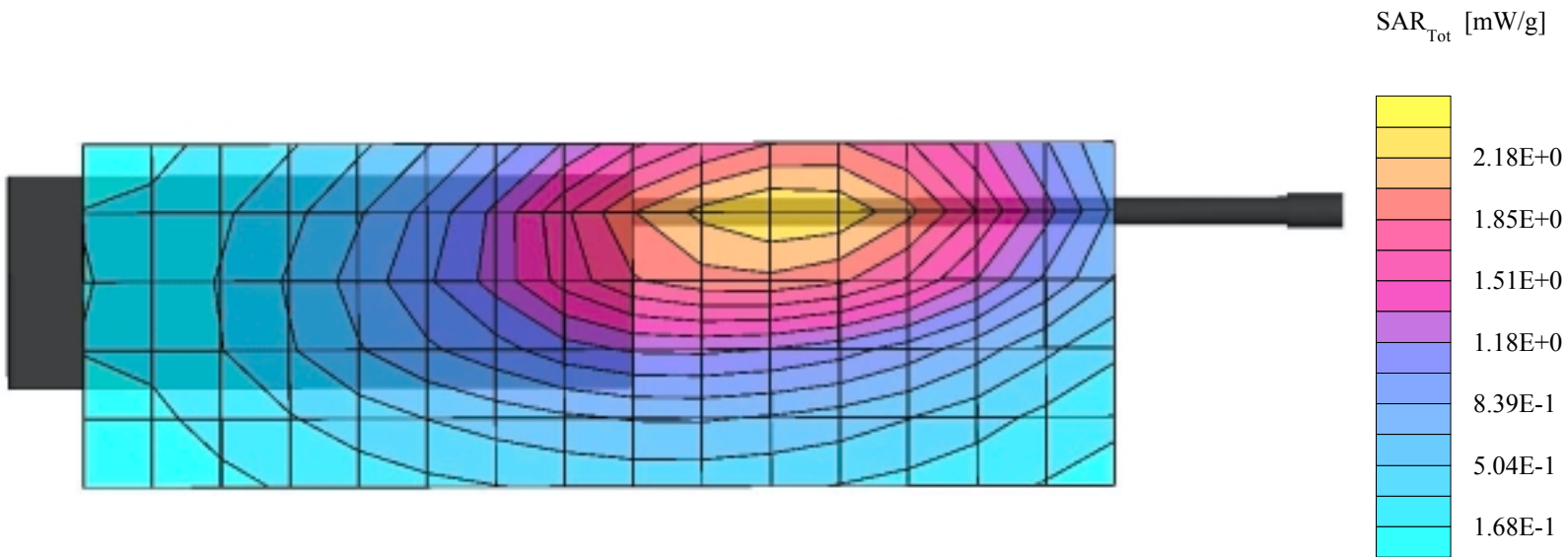
Face SAR at 2.5cm Separation Distance
VHF Radio Transceiver Model: G25RPV100
Continuous Wave Mode
High Channel [173.84 MHz]
Conducted Power: 4.21 Watts
Ambient Temp: 23.9 °C Fluid Temp: 23.0 °C
Dated Tested: May 27, 2002



Titan Corporation FCC ID: B3TG25RPV100

Small Planar Phantom; Planar Section; Position: (270°,0°)
Probe: ET3DV6 - SN1387; ConvF(8.80,8.80,8.80); Crest factor: 1.0
150 MHz Muscle: $\omega = 0.80$ mho/m $\kappa = 61.8$ $\psi = 1.00$ g/cm³
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 5x5x7; Powerdrift: -0.19 dB
SAR (1g): 1.99 mW/g, SAR (10g): 1.45 mW/g

Body-Worn SAR at 1.5cm Separation Distance
VHF Radio Transceiver Model: G25RPV100
Continuous Wave Mode
Low Channel [136.05 MHz]
Conducted Power: 5.04 Watts
Ambient Temp: 23.9 °C Fluid Temp: 23.0 °C
Dated Tested: May 27, 2002

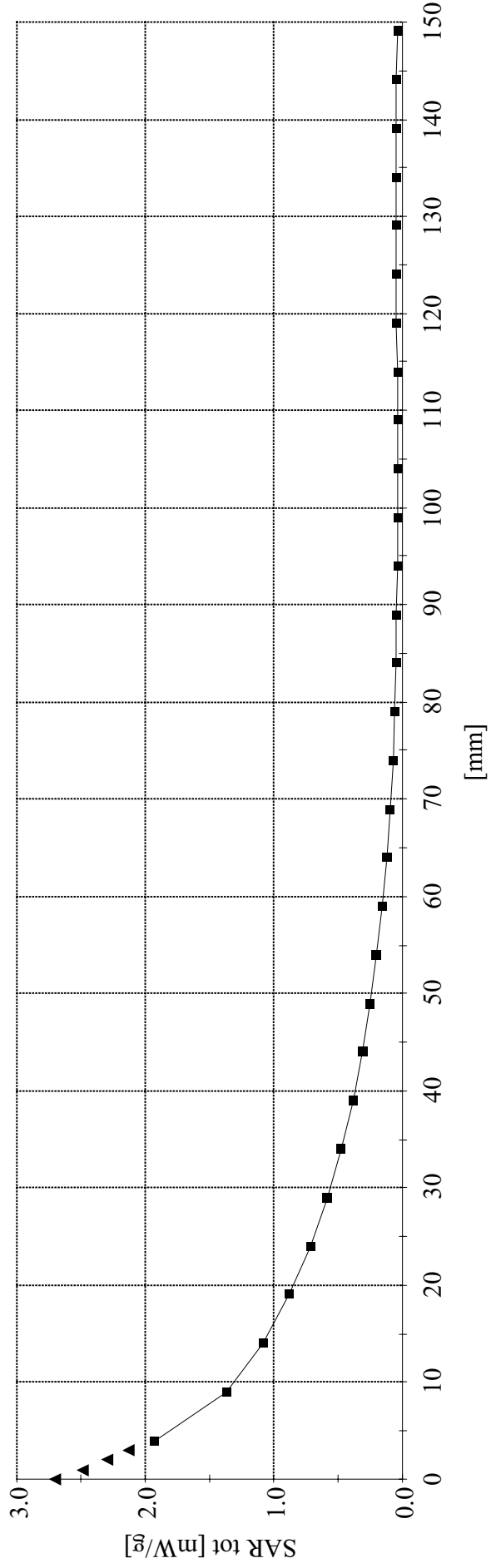


Titan Corporation FCC ID: B3TG25RPV100

Small Planar Phantom; Planar Section
Probe: ET3DV6 - SN1387; ConvF(8.80,8.80,8.80); Crest factor: 1.0
150 MHz Muscle: $\sigma = 0.80$ mho/m $\epsilon_r = 61.8$ $\rho = 1.00$ g/cm³

Z-Axis Extrapolation at Peak SAR Location

Body-Worn SAR at 1.5cm Separation Distance
VHF Radio Transceiver Model: G25RPV100
Continuous Wave Mode
Low Channel [136.05 MHz]
Conducted Power: 5.04 Watts
Ambient Temp: 23.9 °C Fluid Temp: 23.0 °C
Dated Tested: May 27, 2002

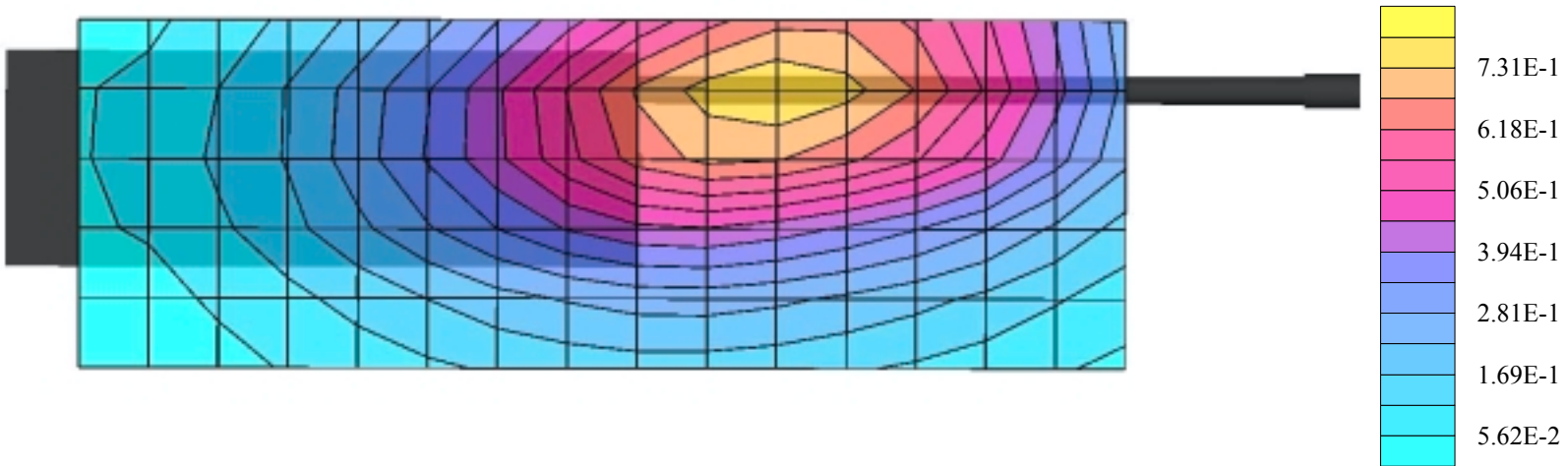


Titan Corporation FCC ID: B3TG25RPV100

Small Planar Phantom; Planar Section; Position: (270°,0°)
Probe: ET3DV6 - SN1387; ConvF(8.80,8.80,8.80); Crest factor: 1.0
150 MHz Muscle: $\omega = 0.80$ mho/m $\kappa = 61.8$ $\psi = 1.00$ g/cm³
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 5x5x7; Powerdrift: -0.20 dB
SAR (1g): 0.626 mW/g, SAR (10g): 0.448 mW/g

Body-Worn SAR at 1.5cm Separation Distance
VHF Radio Transceiver Model: G25RPV100
Continuous Wave Mode
Mid Channel [156.75 MHz]
Conducted Power: 3.93 Watts
Ambient Temp: 23.9 °C Fluid Temp: 23.0 °C
Dated Tested: May 27, 2002

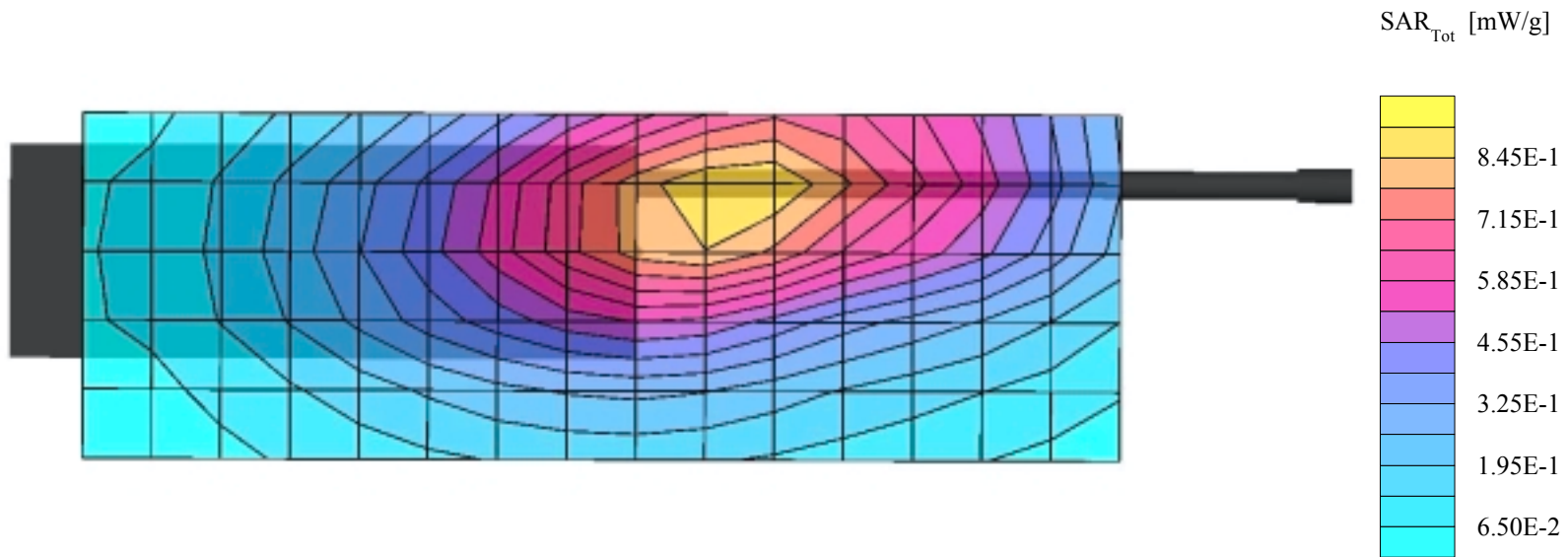
SAR_{Tot} [mW/g]



Titan Corporation FCC ID: B3TG25RPV100

Small Planar Phantom; Planar Section; Position: (270°,0°)
Probe: ET3DV6 - SN1387; ConvF(8.80,8.80,8.80); Crest factor: 1.0
150 MHz Muscle: $\omega = 0.80$ mho/m $\kappa = 61.8$ $\psi = 1.00$ g/cm³
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 5x5x7; Powerdrift: -0.18 dB
SAR (1g): 0.672 mW/g, SAR (10g): 0.476 mW/g

Body-Worn SAR at 1.5cm Separation Distance
VHF Radio Transceiver Model: G25RPV100
Continuous Wave Mode
High Channel [173.84 MHz]
Conducted Power: 4.22 Watts
Ambient Temp: 23.9 °C Fluid Temp: 23.0 °C
Dated Tested: May 27, 2002

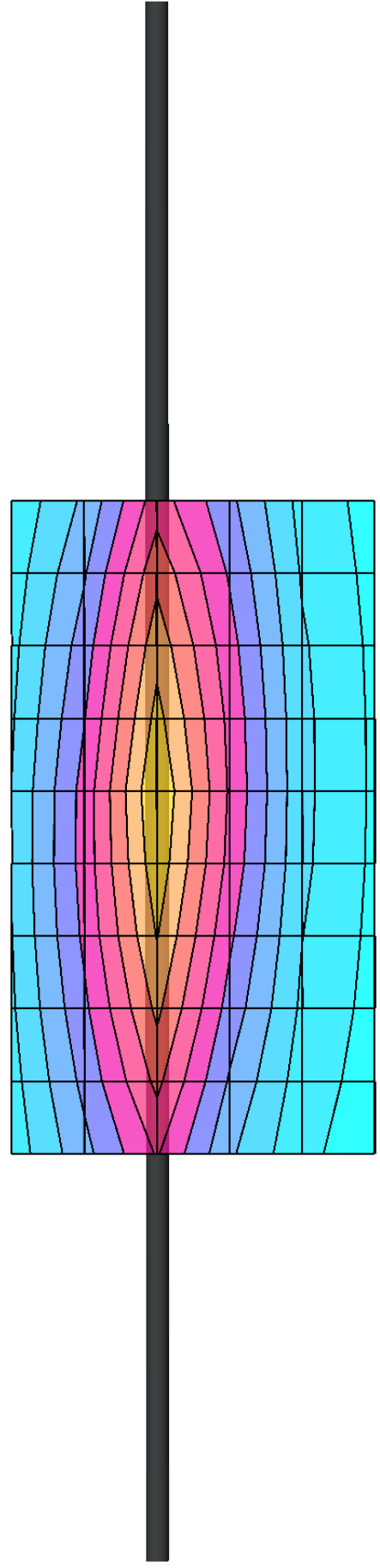
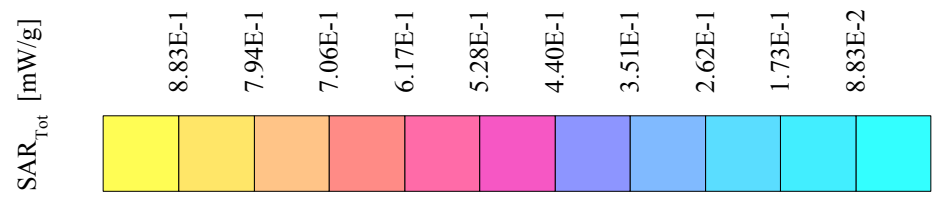


APPENDIX B - SYSTEM VALIDATION

Dipole 300 MHz

Large Planar Phantom; Planar Section
Probe: ET3DV6 - SN1387; ConvF(8.00,8.00,8.00); Crest factor: 1.0; 300 MHz Brain: $\omega = 0.87$ mho/m $\kappa_r = 45.5$ $\psi = 1.00$ g/cm³
Cube 5x5x7: Peak: 1.44 mW/g, SAR (1g): 0.893 mW/g, SAR (10g): 0.592 mW/g, (Worst-case extrapolation)
Penetration depth: 12.3 (10.5, 14.6) [mm]
Powerdrift: 0.01 dB

Validation Date: May 27, 2002
Conducted Power: 250 mW



APPENDIX C - DIPOLE CALIBRATION

300MHz SYSTEM VALIDATION DIPOLE

Type:

300MHz Validation Dipole

Serial Number:

135

Place of Calibration:

Celltech Research Inc.

Date of Calibration:

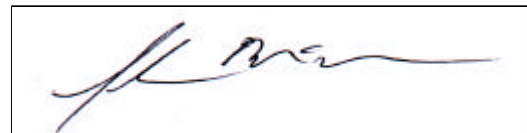
October 15, 2001

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

Calibrated by:



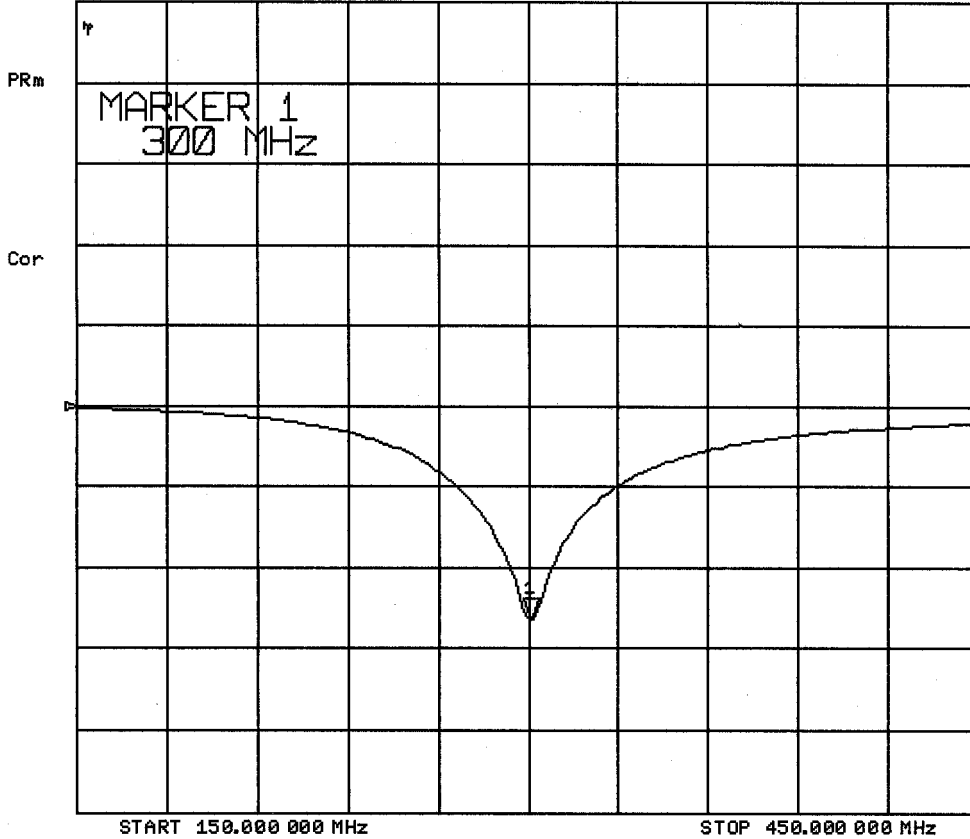
Approved by:



26 Oct 2001 12:14:26

CH1 S11 LOG 10 dB/REF 0 dB

1:-26.394 dB 300.000 000 MHz



26 Oct 2001 12:15:29

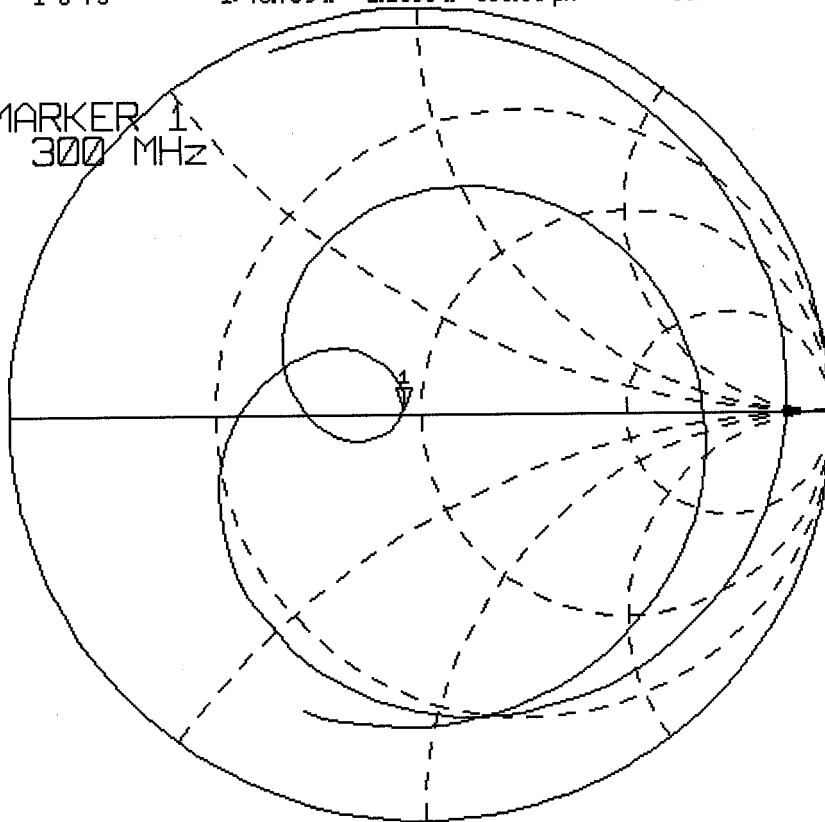
CH1 S11 1 U FS 1: 45.789 Ω 1.2598 Ω 668.33 pH 300.000 000 MHz

PRm

MARKER 1
300 MHz

Cor

↑



START 150.000 000 MHz

STOP 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

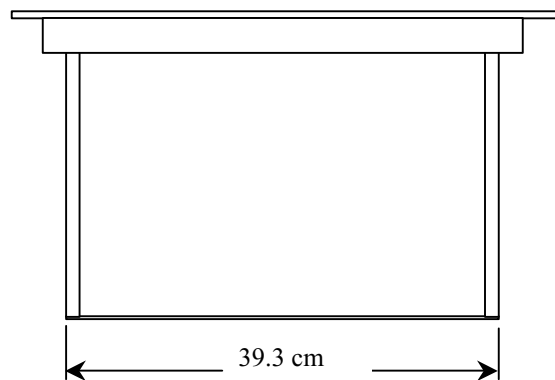
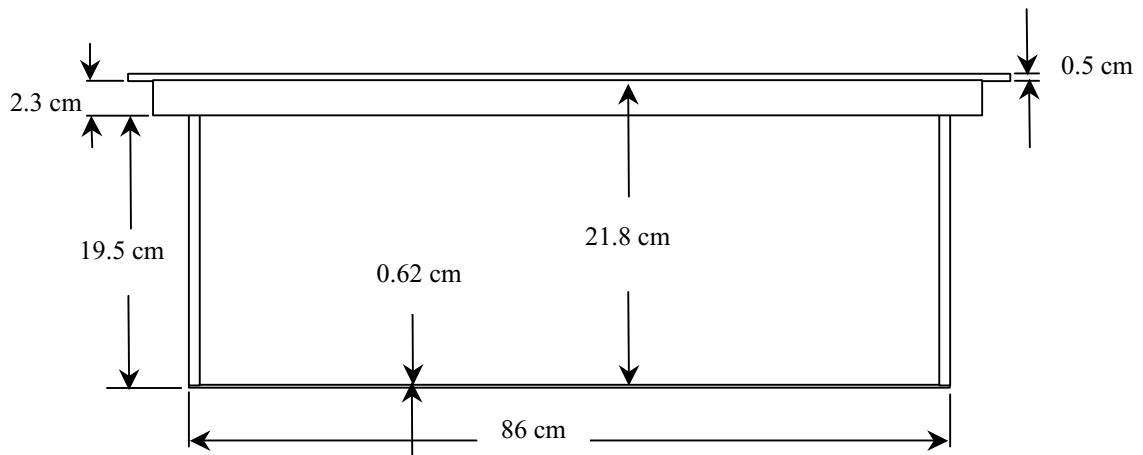
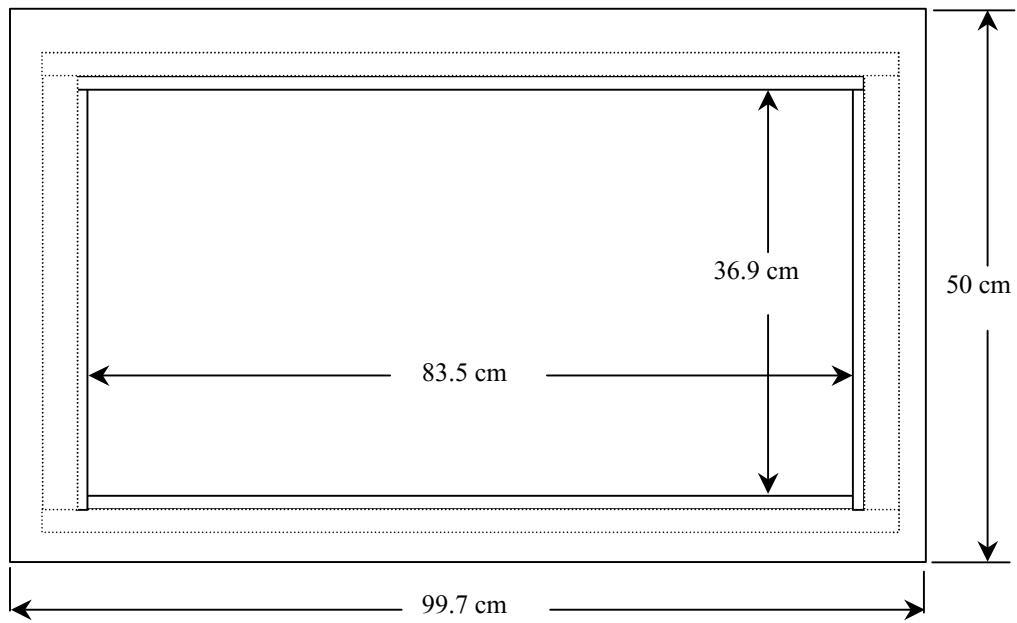
2. Validation Phantom

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

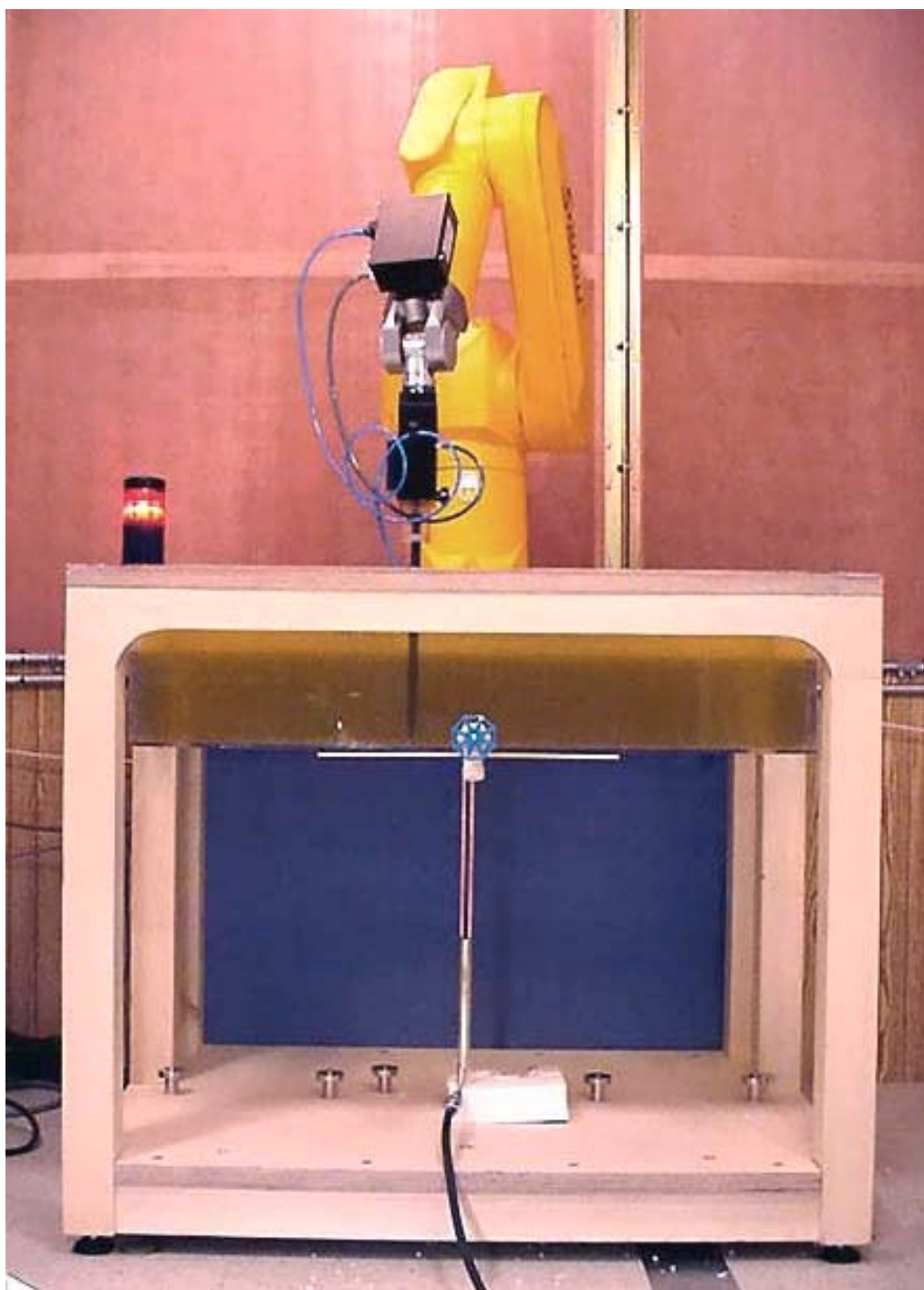
Length: 83.5 cm
Width: 36.9 cm
Height: 21.8 cm

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

Dimensions of Plexiglas Planar Phantom



300MHz Dipole Calibration Photo



300MHz Dipole Calibration Photo



3. Measurement Conditions

The planar phantom was filled with brain simulating tissue having the following electrical parameters at 300MHz:

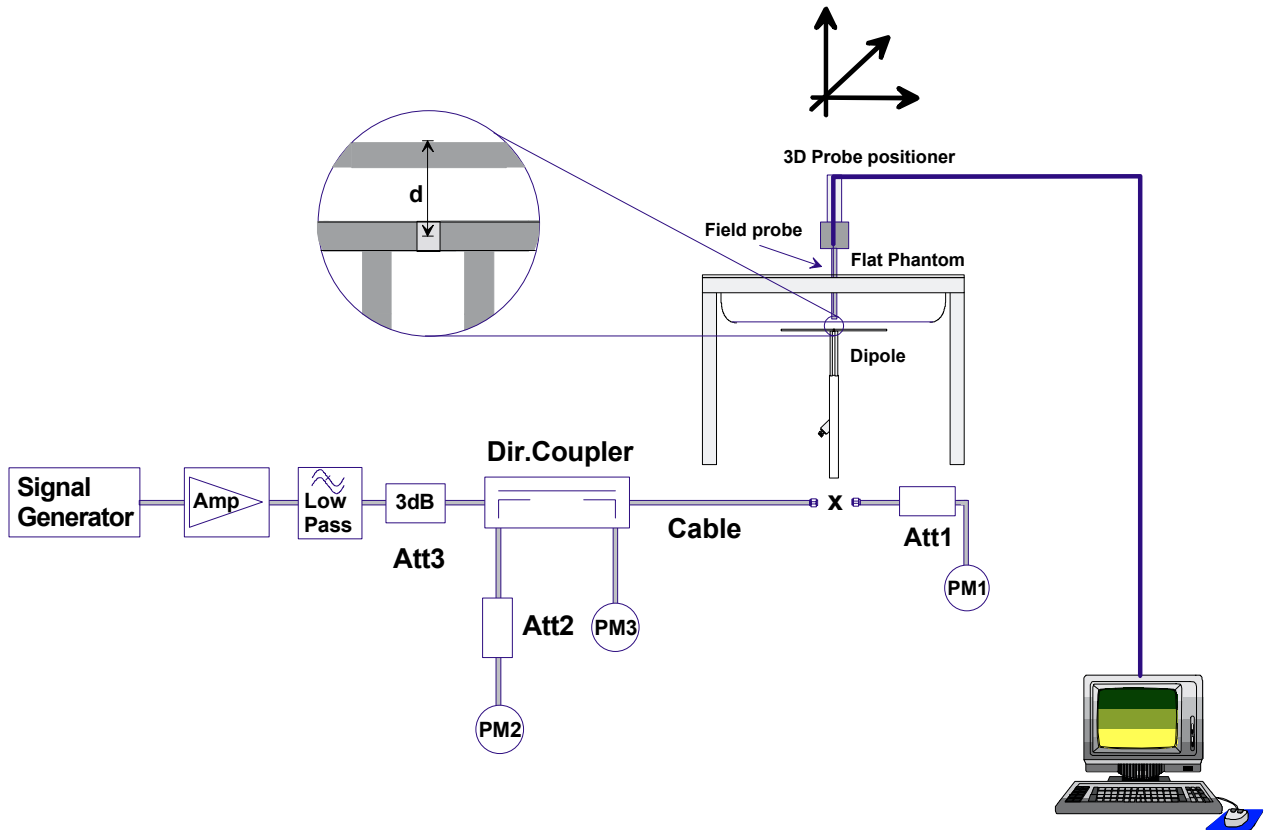
Relative Permittivity:	45.7	± 5%
Conductivity:	0.86 mho/m	± 5%
Temperature:	22.5°C	

The 300MHz simulating tissue consists of the following ingredients:

Ingredient	Percentage by weight
Water	37.56%
Sugar	55.32%
Salt	5.95%
HEC	0.98%
Dowicil 75	0.19%
Target Dielectric Parameters at 22°C	$\epsilon_r = 45.3$ $\sigma = 0.87 \text{ S/m}$

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	0.872	3.488	0.579	2.316	1.38
Test 2	0.876	3.504	0.580	2.320	1.39
Test 3	0.876	3.504	0.581	2.324	1.39
Test 4	0.878	3.512	0.583	2.332	1.39
Test 5	0.881	3.524	0.581	2.324	1.39
Test 6	0.875	3.500	0.580	2.320	1.38
Test 7	0.884	3.536	0.582	2.328	1.40
Test 8	0.879	3.516	0.581	2.324	1.39
Test 9	0.876	3.504	0.580	2.320	1.39
Test10	0.873	3.492	0.579	2.316	1.39
Average Value	0.877	3.508	0.581	2.322	1.39

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

Averaged over 1cm (1g) of tissue: 3.51 mW/g

Averaged over 10cm (10g) of tissue: 2.32 mW/g

Dipole 300 MHz

Frequency: 300 MHz; Conducted Input Power: 250 [mW]

Flat Phantom; Planar Section

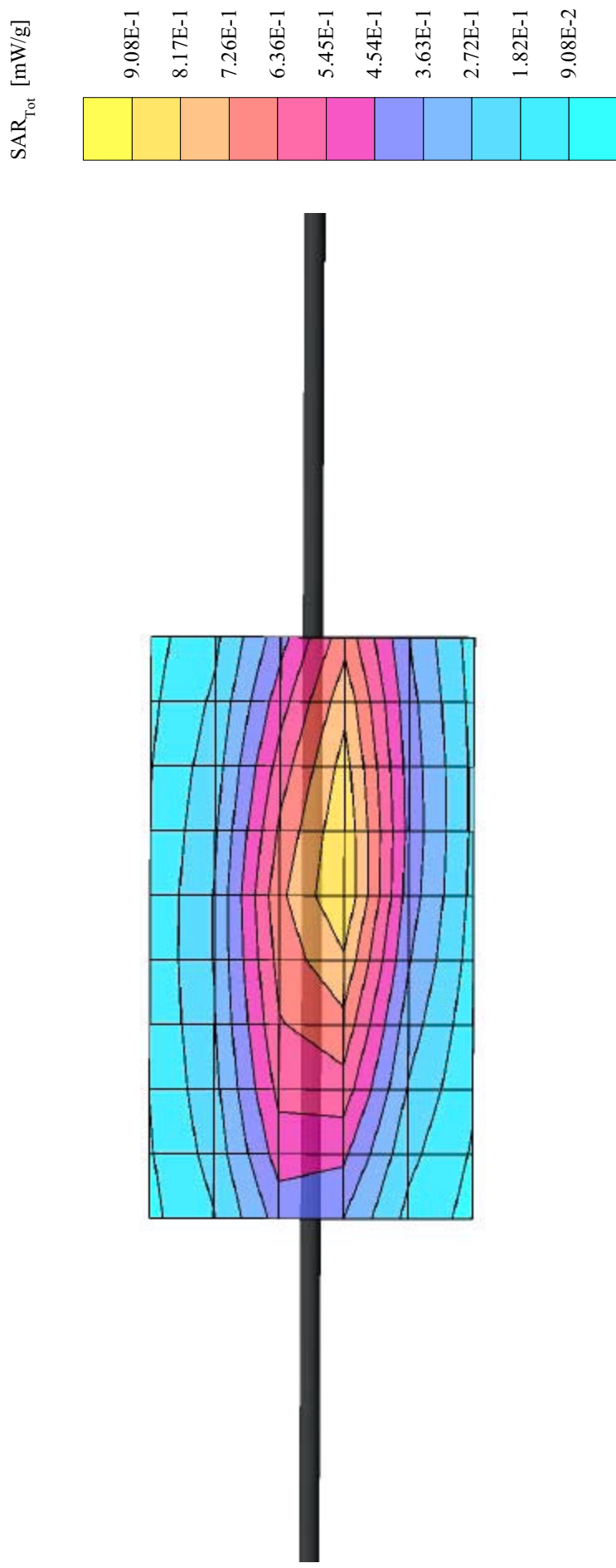
Probe: ET3DV6 - SNI590; ConvF(7.54,7.54,7.54); Crest factor: 1.0; 300 MHz Brain: $\sigma = 0.87$ mho/m $\epsilon_r = 45.3$ $\rho = 1.00$ g/cm³

Cube 5x5x7: Peak: 1.43 mW/g, SAR (1g): 0.899 mW/g, SAR (10g): 0.592 mW/g, (Worst-case extrapolation)

Penetration depth: 12.4 (10.6, 14.7) [mm]

Powerdrift: -0.08 dB

Calibration Date: Oct. 15, 2001

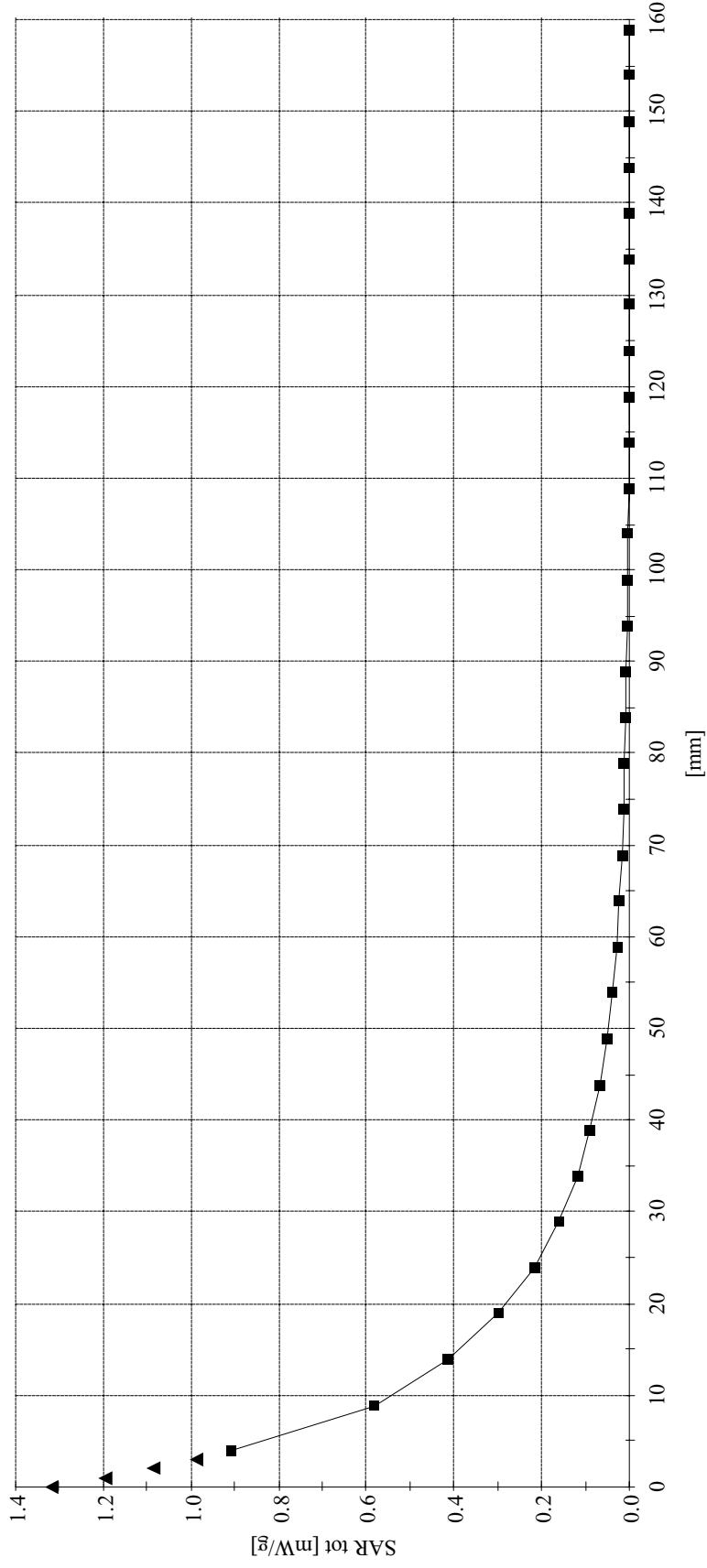


Dipole 300 MHz

Flat Phantom; Section; Position:

Probe: ET3DV6 - SN1590; ConvF(7.54,7.54,7.54); Crest factor: 1.0
300 MHz Brain: $\sigma = 0.87$ mho/m $\epsilon_r = 45.3$ $\rho = 1.00$ g/cm³
Z-Axis: Dx = 0.0, Dy = 0.0, Dz = 5.0

Date of Calibration: October 15, 2001



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

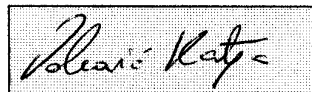
Calibration Interval:

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

NormX	1.58 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.67 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.67 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

DCP X	97	mV
DCP Y	97	mV
DCP Z	97	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 0.40
ConvF Z	6.6 $\pm 9.5\%$ (k=2)		Depth 2.38
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	5.4 $\pm 9.5\%$ (k=2)		Boundary effect:
ConvF Y	5.4 $\pm 9.5\%$ (k=2)		Alpha 0.57
ConvF Z	5.4 $\pm 9.5\%$ (k=2)		Depth 2.18

Boundary Effect

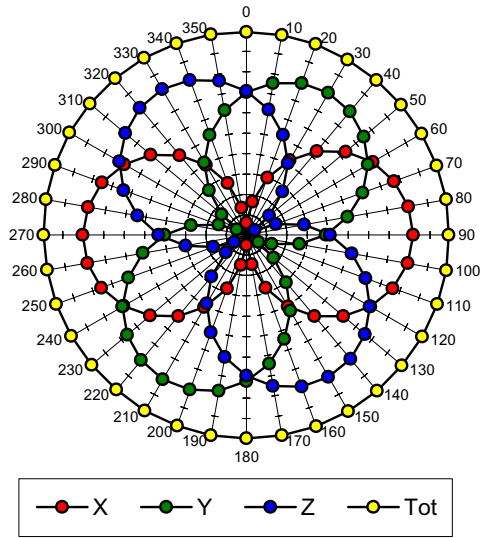
Head	900 MHz	Typical SAR gradient: 5 % per mm	
	Probe Tip to Boundary	1 mm	2 mm
	SAR _{be} [%] Without Correction Algorithm	9.7	5.4
	SAR _{be} [%] With Correction Algorithm	0.3	0.6
Head	1800 MHz	Typical SAR gradient: 10 % per mm	
	Probe Tip to Boundary	1 mm	2 mm
	SAR _{be} [%] Without Correction Algorithm	11.5	7.3
	SAR _{be} [%] With Correction Algorithm	0.1	0.3

Sensor Offset

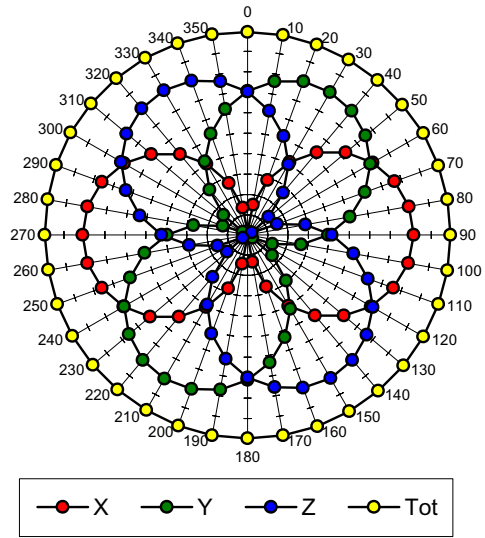
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.3 \pm 0.2	mm

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

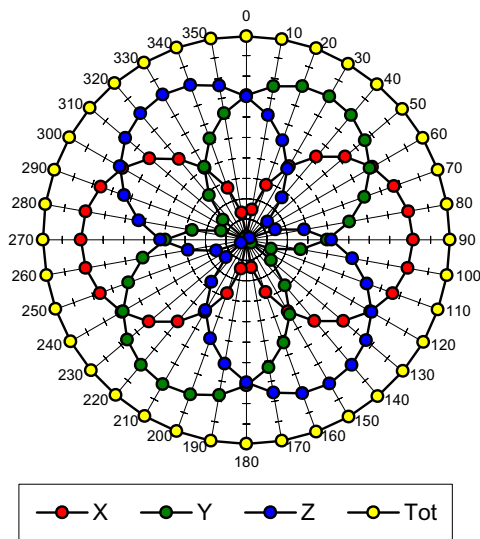
f = 30 MHz, TEM cell ifi110



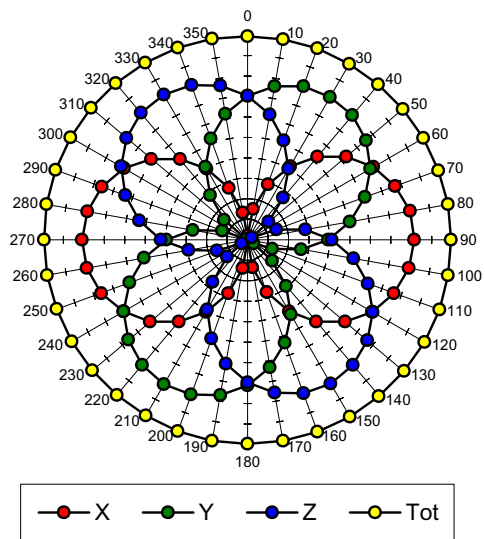
f = 100 MHz, TEM cell ifi110

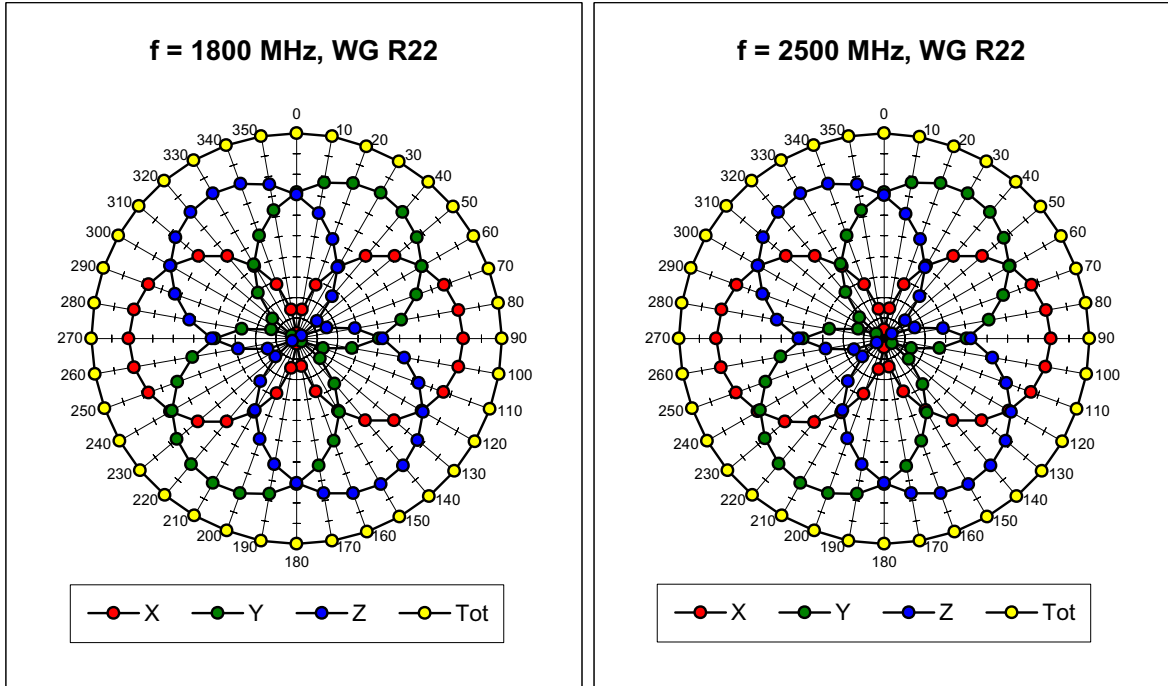


f = 300 MHz, TEM cell ifi110

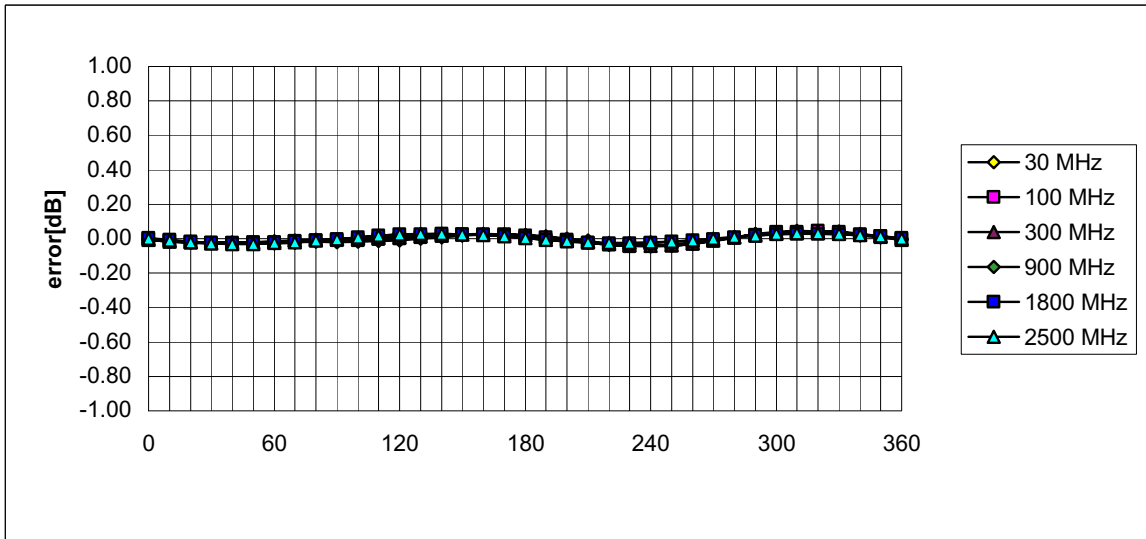


f = 900 MHz, TEM cell ifi110



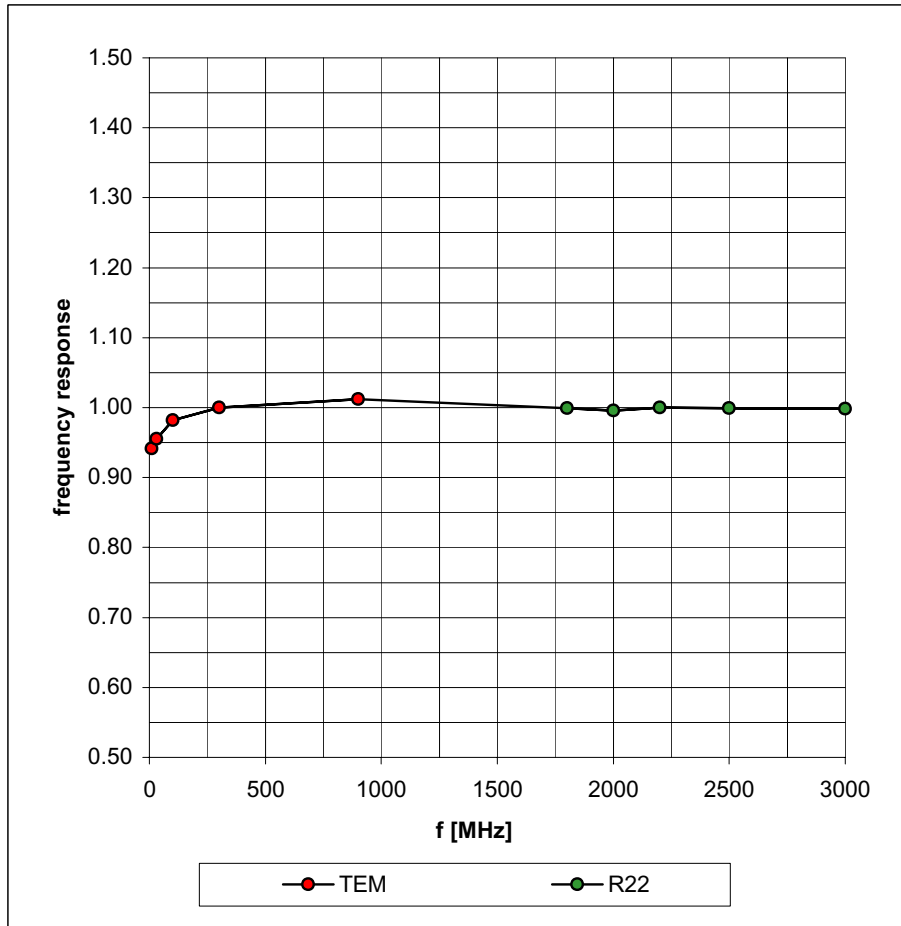


Isotropy Error (ϕ), $\theta = 0^\circ$

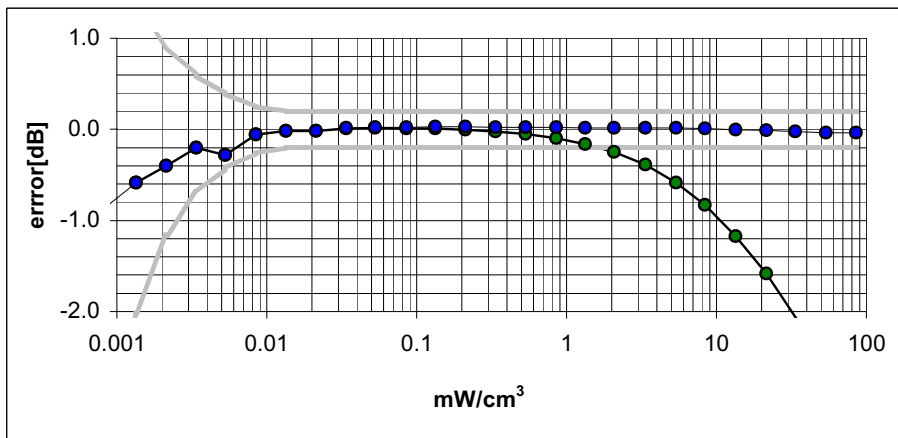
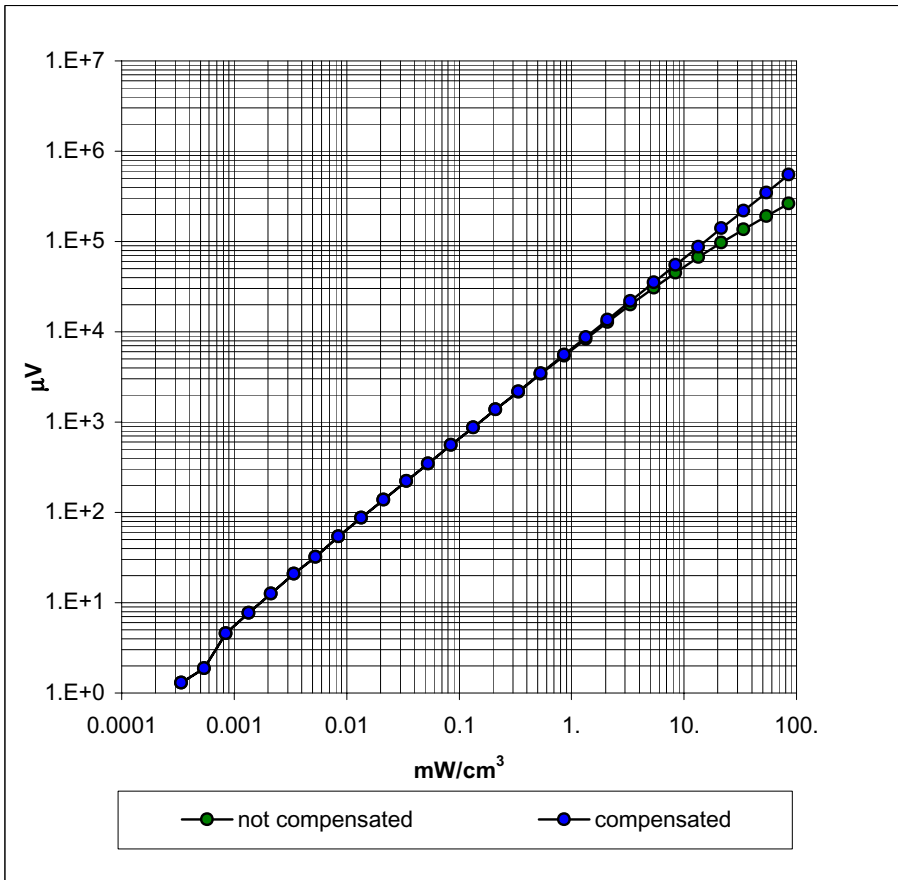


Frequency Response of E-Field

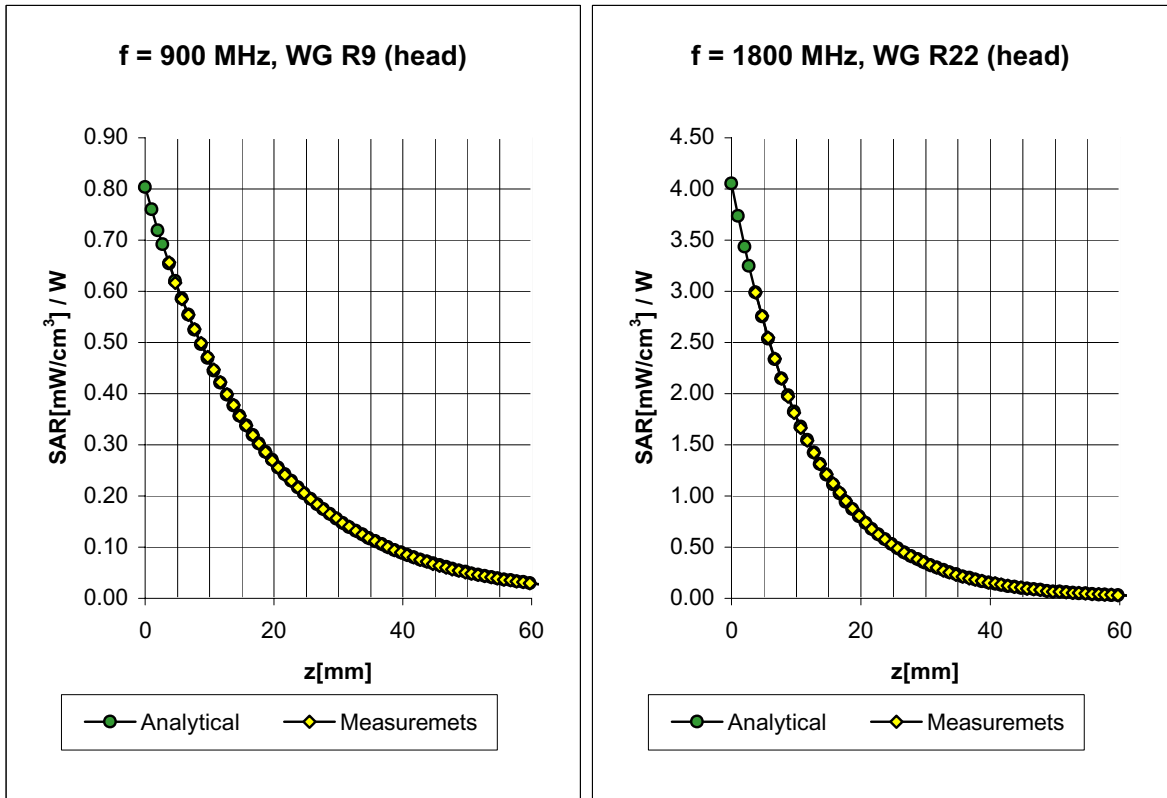
(TEM-Cell:ifi110, Waveguide R22)



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



Conversion Factor Assessment

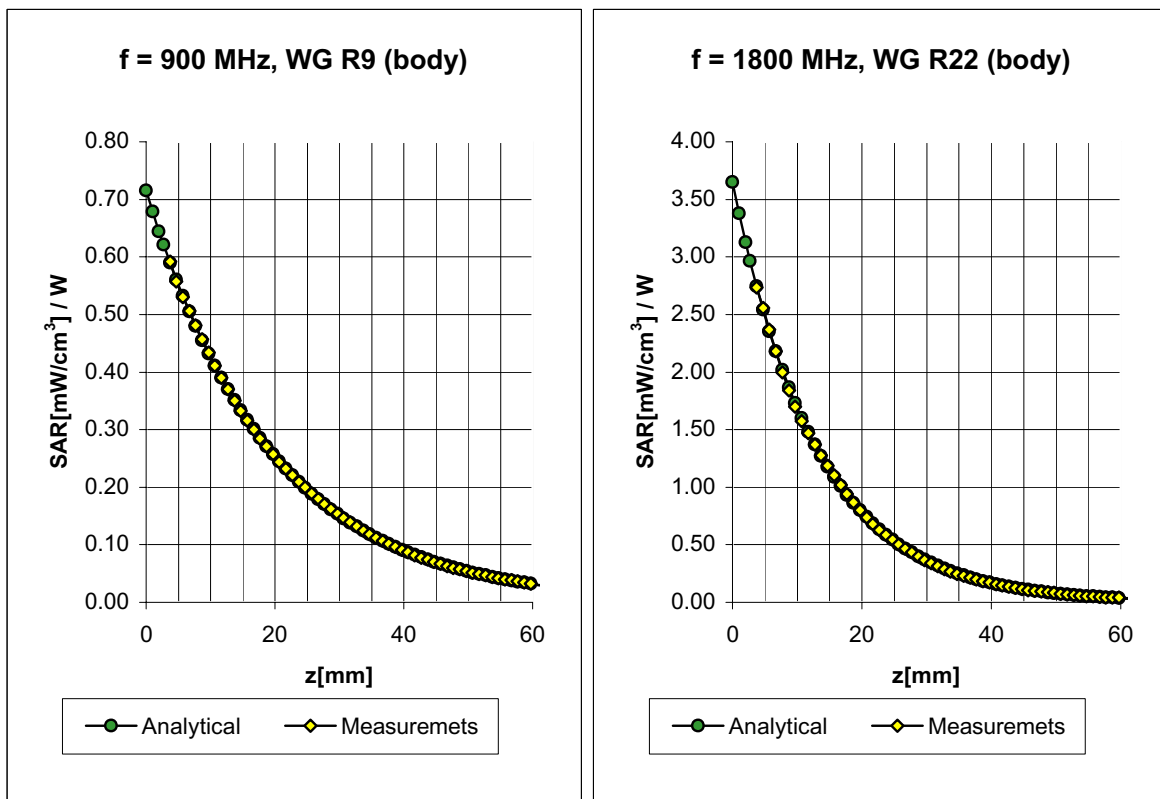


Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\% \text{ mho/m}$
	ConvF X	6.6 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	6.6 $\pm 9.5\%$ (k=2)	Alpha 0.40
	ConvF Z	6.6 $\pm 9.5\%$ (k=2)	Depth 2.38
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
	ConvF X	5.4 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	5.4 $\pm 9.5\%$ (k=2)	Alpha 0.57
	ConvF Z	5.4 $\pm 9.5\%$ (k=2)	Depth 2.18

ET3DV6 SN:1387

February 22, 2002

Conversion Factor Assessment



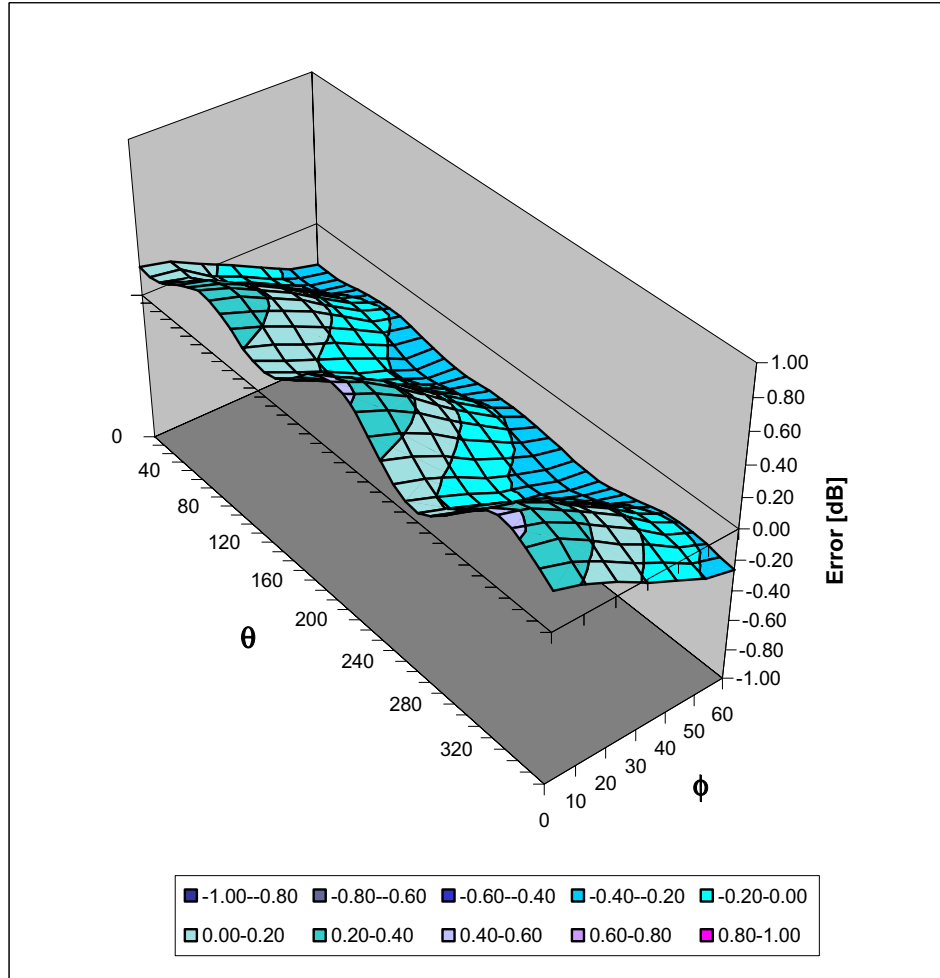
Body	900 MHz	$\epsilon_r = 55.0 \pm 5\%$	$\sigma = 1.05 \pm 5\% \text{ mho/m}$
Body	835 MHz	$\epsilon_r = 55.2 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
	ConvF X	6.3 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	6.3 $\pm 9.5\%$ (k=2)	Alpha 0.42
	ConvF Z	6.3 $\pm 9.5\%$ (k=2)	Depth 2.44
Body	1800 MHz	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\% \text{ mho/m}$
Body	1900 MHz	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\% \text{ mho/m}$
	ConvF X	5.0 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	5.0 $\pm 9.5\%$ (k=2)	Alpha 0.76
	ConvF Z	5.0 $\pm 9.5\%$ (k=2)	Depth 2.01

ET3DV6 SN:1387

February 22, 2002

Deviation from Isotropy in HSL

Error ($\theta\phi$), $f = 900$ MHz



Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1387

Place of Assessment:

Zurich

Date of Assessment:

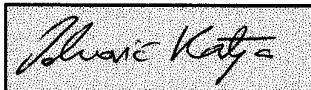
February 25, 2002

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 (\pm standard deviation)

150 MHz	ConvF	$9.2 \pm 8\%$	$\epsilon_r = 52.3$ $\sigma = 0.76 \text{ mho/m}$ (head tissue)
300 MHz	ConvF	$8.0 \pm 8\%$	$\epsilon_r = 45.3$ $\sigma = 0.87 \text{ mho/m}$ (head tissue)
450 MHz	ConvF	$7.3 \pm 8\%$	$\epsilon_r = 43.5$ $\sigma = 0.87 \text{ mho/m}$ (head tissue)
2450 MHz	ConvF	$4.7 \pm 8\%$	$\epsilon_r = 39.2$ $\sigma = 1.80 \text{ mho/m}$ (head tissue)
150 MHz	ConvF	$8.8 \pm 8\%$	$\epsilon_r = 61.9$ $\sigma = 0.80 \text{ mho/m}$ (body tissue)
450 MHz	ConvF	$7.7 \pm 8\%$	$\epsilon_r = 56.7$ $\sigma = 0.94 \text{ mho/m}$ (body tissue)
2450 MHz	ConvF	$4.3 \pm 8\%$	$\epsilon_r = 52.7$ $\sigma = 1.95 \text{ mho/m}$ (body tissue)

APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

300MHz System Validation

Measured Fluid Dielectric Parameters (Brain)

May 27, 2002

Frequency	e'	e''
200.000000 MHz	49.7584	70.8599
204.000000 MHz	49.8307	69.7692
208.000000 MHz	49.4601	68.6002
212.000000 MHz	49.3651	67.5967
216.000000 MHz	49.1333	66.7062
220.000000 MHz	48.9465	65.8627
224.000000 MHz	48.7921	64.8351
228.000000 MHz	48.5086	63.9681
232.000000 MHz	48.4225	63.1305
236.000000 MHz	48.2101	62.2991
240.000000 MHz	47.9599	61.5381
244.000000 MHz	47.7240	60.7491
248.000000 MHz	47.5997	60.0989
252.000000 MHz	47.4397	59.2789
256.000000 MHz	47.2420	58.8059
260.000000 MHz	47.1684	58.1950
264.000000 MHz	46.9273	57.6573
268.000000 MHz	46.7247	56.9578
272.000000 MHz	46.6701	56.3854
276.000000 MHz	46.5489	55.6241
280.000000 MHz	46.4398	55.1248
284.000000 MHz	46.2812	54.4652
288.000000 MHz	46.0857	54.1204
292.000000 MHz	46.0560	53.4953
296.000000 MHz	45.6378	52.7854
300.000000 MHz	45.4817	52.2304
304.000000 MHz	45.6359	51.9901
308.000000 MHz	45.4980	51.4998
312.000000 MHz	45.2542	51.0285
316.000000 MHz	45.1482	50.5189
320.000000 MHz	45.0610	50.1274
324.000000 MHz	44.8729	49.6349
328.000000 MHz	44.7785	49.2895
332.000000 MHz	44.6501	48.8862
336.000000 MHz	44.4857	48.5001

150MHz EUT Evaluation (Face)

Measured Fluid Dielectric Parameters (Brain)

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Frequency	e'	e''
100.000000 MHz	56.5030	131.7517
105.000000 MHz	56.4532	126.2097
110.000000 MHz	55.6627	121.0925
115.000000 MHz	54.9134	116.5265
120.000000 MHz	54.9121	112.3023
125.000000 MHz	54.3603	107.9163
130.000000 MHz	54.0781	103.9468
135.000000 MHz	53.4826	100.7757
140.000000 MHz	53.2169	97.1942
145.000000 MHz	52.9634	94.1981
150.000000 MHz	52.4619	91.5262
155.000000 MHz	52.2033	89.9580
160.000000 MHz	52.1904	86.4807
165.000000 MHz	51.9147	84.2943
170.000000 MHz	51.7801	82.2501
175.000000 MHz	51.5846	80.3256
180.000000 MHz	51.4799	78.0166
185.000000 MHz	51.4622	76.2940
190.000000 MHz	51.2069	74.6570
195.000000 MHz	50.9504	73.1675
200.000000 MHz	50.7016	71.6685

150MHz EUT Evaluation (Body)

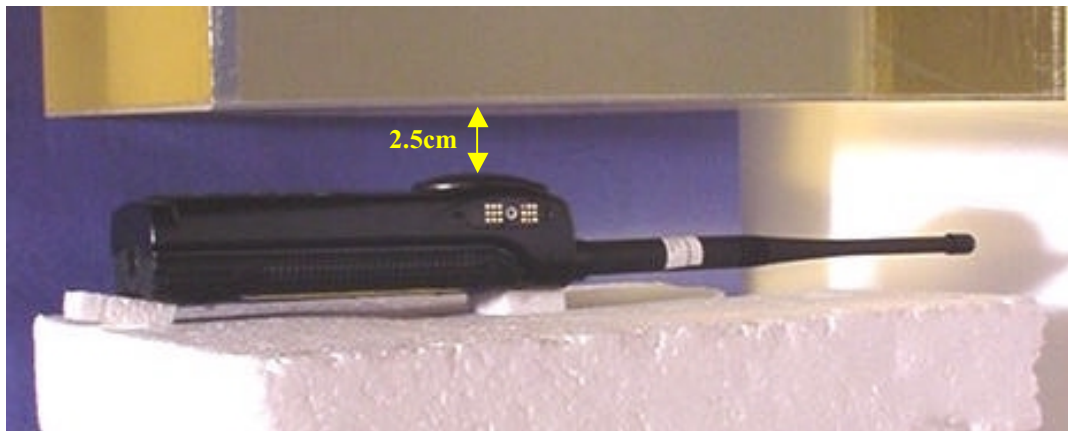
Measured Fluid Dielectric Parameters (Muscle)

May 27, 2002

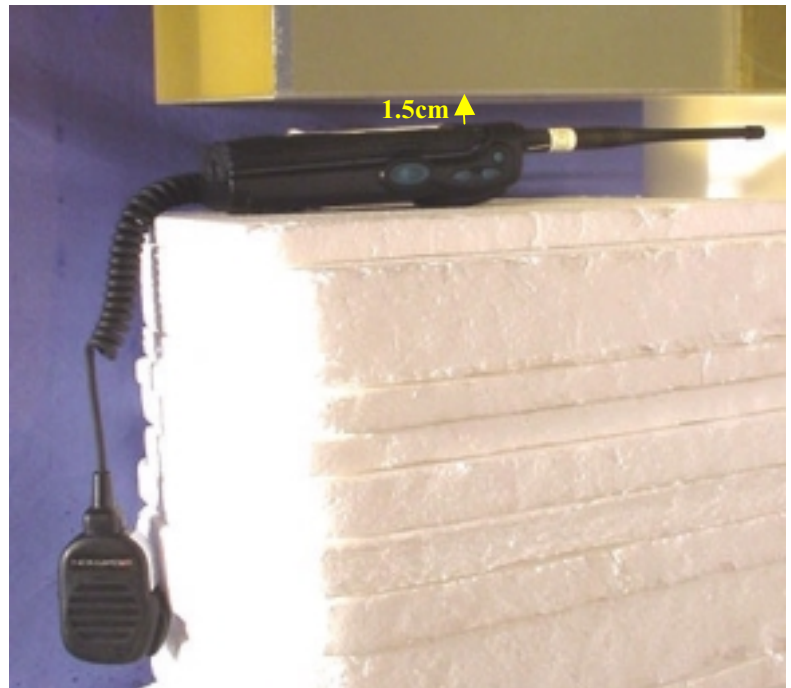
Frequency	e'	e''
100.000000 MHz	64.0344	140.2979
105.000000 MHz	64.0031	134.2271
110.000000 MHz	63.5216	128.5769
115.000000 MHz	62.9137	123.5667
120.000000 MHz	63.2161	118.9192
125.000000 MHz	62.9030	114.1115
130.000000 MHz	62.8265	110.0048
135.000000 MHz	62.4221	106.2194
140.000000 MHz	62.2398	102.4808
145.000000 MHz	62.2188	100.0706
150.000000 MHz	61.8481	96.3503
155.000000 MHz	61.5716	93.6372
160.000000 MHz	61.6970	91.0087
165.000000 MHz	61.3437	89.5978
170.000000 MHz	61.2290	86.5772
175.000000 MHz	61.1254	84.4072
180.000000 MHz	60.9765	82.0123
185.000000 MHz	61.0318	80.1760
190.000000 MHz	60.7917	78.3279
195.000000 MHz	60.7162	76.8146
200.000000 MHz	60.4577	75.1417

APPENDIX F - SAR TEST SETUP & EUT PHOTOGRAPHS

**FACE-HELD SAR TEST SETUP PHOTOGRAPHS
(2.5cm Separation Distance)**



BODY-WORN SAR TEST SETUP PHOTOGRAPHS
With Speaker-Microphone Accessory
(1.5cm Separation Distance)



EUT PHOTOGRAPHS
Profile



EUT PHOTOGRAPHS

Battery



Antenna

