DECLARATION OF COMPLIANCE
SAR EVALUATION

Test Lab

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Applicant Information

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Rule Part(s):	**FCC 47 CFR §2.1093; IC RSS-102 Issue 1 (Provisional)**
Test Procedure(s):	**FCC OET Bulletin 65, Supplement C (Edition 01-01)**
FCC Device Classification:	**PCS Licensed Transmitter (PCB)**
IC Device Classification:	**2GHz Personal Communication Services (RSS-133 Issue 2)** **800MHz CDMA Cellular Transmitter (RSS-129 Issue 2)**
FCC ID:	**HDWAEA307**
IC Certification No.:	**4609A-AEA307**
Model(s):	**CE8640/LS**
Device Type:	**Rugged Handheld PC with Sierra Wireless AirCard 555/550** **Dual-Band PCS/Cellular CDMA PCMCIA Modem Card**
Tx Frequency Range:	**1851.25 - 1908.75 MHz (PCS CDMA)** **824.70 - 848.31 MHz (Cellular CDMA)**
Max. RF Output Power Tested:	**23.0 dBm Conducted (PCS CDMA)** **23.0 dBm Conducted (Cellular CDMA)**
Battery Type:	**7.4V Lithium-ion, 2000mAh**
Antenna Type:	**Unity Gain**
Max. SAR Measured:	**0.271 W/kg (PCS CDMA) / 0.379 W/kg (Cellular CDMA)**

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

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

Russell Pipe
Senior Compliance Technologist
Celltech Labs Inc.

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1.0 INTRODUCTION

This SAR (Specific Absorption Rate) measurement report demonstrates that the DAP Technologies Ltd. Model: CE8640/LS Rugged Handheld PC FCC ID: HDWAEA307 with internal Sierra Wireless AirCard 555/550 Dual-Band PCS/Cellular CDMA PCMCIA Modem Card complies with the RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]), and Health Canada's Safety Code 6 (see reference [2]) for the General Population environment. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]), and IC RSS-102 Issue 1 (Provisional) (see reference [4]), were employed. A description of the product, operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 DESCRIPTION of Equipment Under Test (EUT)

FCC Rule Part(s)	47 CFR §2.1093
IC Rule Part(s)	RSS-102 Issue 1 (Provisional)
Test Procedure(s)	FCC OET Bulletin 65, Supplement C (01-01)
FCC Device Classification	PCS Licensed Transmitter (PCB)
IC Device Classification	2GHz Personal Communication Services (RSS-133 Issue 2) 800MHz CDMA Cellular Transmitter (RSS-129 Issue 2)
Device Type	Rugged Handheld PC with Sierra Wireless AirCard 555/550 Dual-Band PCS/Cellular CDMA PCMCIA Modem Card
FCC ID	HDWAEA307
Model(s)	CE8640/LS
Serial No.	Pre-production unit
Mode(s) of Operation	PCS CDMA / Cellular CDMA
Tx Frequency Range(s)	1851.25 - 1908.75 MHz (PCS CDMA) 824.70 - 848.31 MHz (Cellular CDMA)
Max. RF Output Power Tested	23.0 dBm Conducted (PCS CDMA) 23.0 dBm Conducted (Cellular CDMA)
Antenna Type	Unity Gain (Length: 101 mm)
Battery Type	7.4V Lithium-ion, 2000mAh

3.0 SAR MEASUREMENT SYSTEM

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

DASY3 SAR Measurement System with SAM phantom

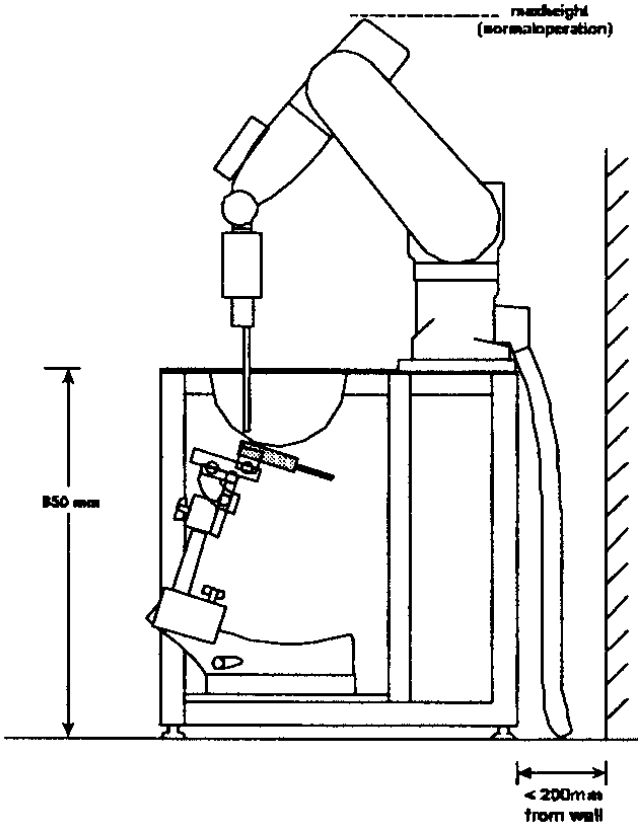


Figure 1. DASY3 Compact Version - Side View

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 SAR MEASUREMENT RESULTS - PCS CDMA

Freq. (MHz)	Channel	Test Mode	Conducted Power (dBm)		Phantom Section	Antenna Position	Handheld PC Position to Planar Phantom	Separation Distance (cm)	Measured SAR 1g (W/kg)
			Before	After					
1880.00	600	PCS CDMA	23.04	22.90	Planar	Fixed	Bottom Side	0.0	0.271
1880.00	600	PCS CDMA	23.00	22.85	Planar	Fixed	Left Side	0.0	0.0509

ANSI / IEEE C95.1 1992 - SAFETY LIMIT
BODY: 1.6 W/kg (averaged over 1 gram)
Spatial Peak - Uncontrolled Exposure / General Population

Test Date(s)	05/07/03		**Relative Humidity**	54 %
Measured Fluid Type	1900MHz Body		**Atmospheric Pressure**	101.0 kPa
Dielectric Constant ε_r	**IEEE Target**	**Measured**	**Ambient Temperature**	23.6 °C
	53.3 ±5%	51.9	**Fluid Temperature**	22.7 °C
Conductivity σ **(mho/m)**	**IEEE Target**	**Measured**	**Fluid Depth**	≥ 15 cm
	1.52 ±5%	1.59	**ρ (Kg/m^3)**	1000

Note(s):

1. If the SAR measurements performed at the middle channel were ≥ 3dB below the SAR limit, SAR evaluation for the low and high channels was optional for each test configuration (per FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]).
2. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluation. The temperatures listed in the table above were consistent for all measurement periods.
3. The dielectric properties of the simulated tissue fluid were measured prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters).

MEASUREMENT SUMMARY (Cont.)

BODY SAR MEASUREMENT RESULTS - Cellular CDMA

Freq. (MHz)	Channel	Test Mode	Conducted Power (dBm)		Phantom Section	Antenna Position	Handheld PC Position to Planar Phantom	Separation Distance (cm)	Measured SAR 1g (W/kg)
			Before	After					
835.89	363	CDMA	23.03	22.88	Planar	Fixed	Bottom Side	0.0	0.379
835.89	363	CDMA	23.01	22.86	Planar	Fixed	Left Side	0.0	0.176

ANSI / IEEE C95.1 1992 - SAFETY LIMIT
BODY: 1.6 W/kg (averaged over 1 gram)
Spatial Peak - Uncontrolled Exposure / General Population

Test Date(s)	05/07/03		**Relative Humidity**	54 %
Measured Fluid Type	835MHz Body		**Atmospheric Pressure**	101.0 kPa
Dielectric Constant ε_r	**IEEE Target**	**Measured**	**Ambient Temperature**	23.6 °C
	55.2 ±5%	56.8	**Fluid Temperature**	22.3 °C
Conductivity σ (mho/m)	**IEEE Target**	**Measured**	**Fluid Depth**	≥ 15 cm
	0.97 ±5%	1.01	**ρ (Kg/m^3)**	1000

Note(s):

1. If the SAR measurements performed at the middle channel were ≥ 3dB below the SAR limit, SAR evaluation for the low and high channels was optional for each test configuration (per FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]).
2. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluation. The temperatures listed in the table above were consistent for all measurement periods.
3. The dielectric properties of the simulated tissue fluid were measured prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters).

5.0 DETAILS OF SAR EVALUATION

The DAP TECHNOLOGIES LTD. Model: CE8640/LS Rugged Handheld PC FCC ID: HDWAEA307 with internal Sierra Wireless AirCard 555/550 Dual-Band PCS/Cellular CDMA PCMCIA Modem Card was found to be compliant for localized Specific Absorption Rate based on the following test provisions and conditions described below. The detailed test setup photographs are shown in Appendix G.

1. The EUT was tested for body (lapheld) SAR with the bottom side of the EUT placed parallel to the outer surface of the planar phantom. A 0.0 cm separation distance was maintained between the bottom side of the EUT and the outer surface of the planar phantom. Due to the dimensions of the EUT, the initial coarse scan did not cover the entire area of the bottom side. Subsequently, a second coarse scan was performed to show there were no secondary peak SAR locations within 3dB of the primary peak SAR location.
2. The EUT was tested for body (lapheld) SAR with the left side of the EUT (antenna side) placed parallel to the outer surface of the planar phantom. A 0.0 cm separation distance was maintained between the left side of the EUT (antenna side) and the outer surface of the planar phantom. Secondary peak SAR locations within 3dB of the primary peak SAR value were also evaluated (See SAR Plots - Appendix A).
3. The conducted power levels were measured before and after each test using a Gigatronics 8652A Universal Power Meter according to the procedures described in FCC 47 CFR §2.1046.
4. The EUT was controlled in test mode via internal software and the SAR measurements were performed with the EUT transmitting in the “always up” power control mode with a modulated CDMA signal.
5. The EUT was tested with a fully charged battery.
6. Due to the dimensions of the EUT, a stack of low-density, low-loss dielectric foamed polystyrene was used in place of the device holder.

6.0 EVALUATION PROCEDURES

1. (i) The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For devices held to the ear during normal operation, both the left and right ear positions were evaluated in accordance with FCC OET Bulletin 65, Supplement C (Edition 01-01) using the SAM phantom.
(ii) For body-worn and face-held devices a planar phantom was used.

2. The SAR was determined by a pre-defined procedure within the DASY3 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 20mm x 20mm.

3. Based on the area scan data, the area of maximum absorption was determined by spline interpolation. Around this point, a volume of 40 x 40 x 35 mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 7 points.

4. The 1g and 10g spatial peak SAR was determined as follows:

a. The first step was an extrapolation to find the points between the dipole center of the probe and the surface of the phantom. This data cannot be measured, since the center of the dipoles is 2.7 mm away form the tip of the probe and the distance between the surface and the lowest measuring point is 1.4 mm (see probe calibration document in Appendix D). The extrapolation was based on a least square algorithm [W. Gander, Computermathematik, p.168-180] (see reference [6]). Through the points in the first 3 cm in all z-axis, polynomials of the fourth order were calculated. This polynomial was then used to evaluate the points between the surface and the probe tip.

b. The next step used 3D-spline interpolation to get all points within the measured volume in a 1mm grid (35000 points). The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition [W. Gander, Computermathematik, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff] (see reference [6]).

c. The maximal interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-spline interpolation algorithm. 8000 points (20x20x20) were interpolated to calculate the average.

EVALUATION PROCEDURES (Cont.)

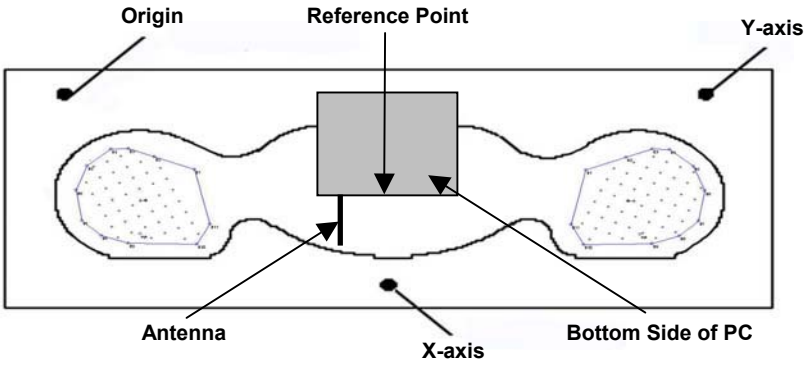


Figure 2. Phantom Reference Point & EUT Positioning - Bottom Side of PC

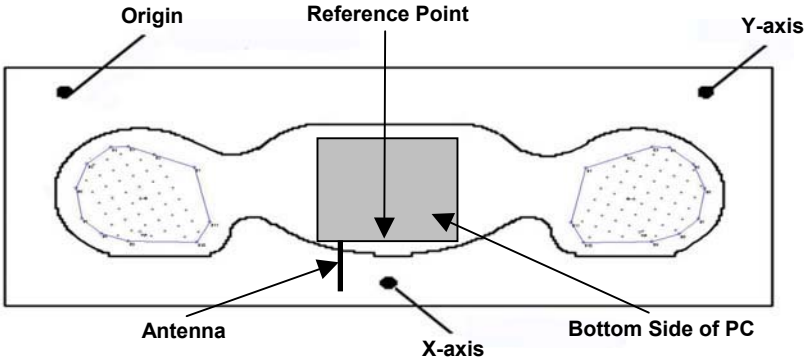


Figure 3. Phantom Reference Point & EUT Positioning - Bottom Side of PC (2nd Coarse Scan to show SAR distribution at lower bottom section of PC)

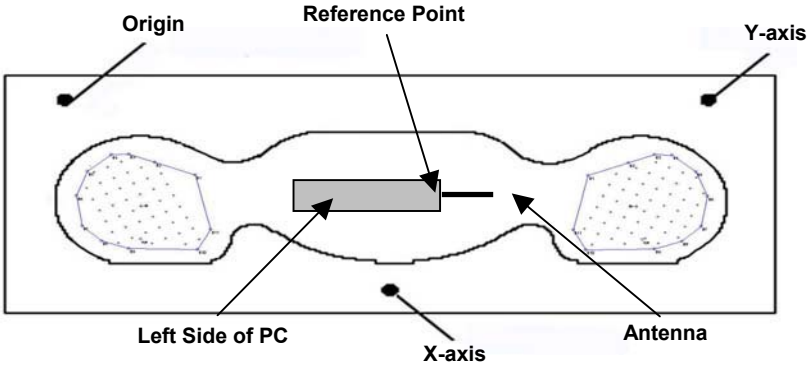


Figure 4. Phantom Reference Point & EUT Positioning - Left Side of PC (Antenna Side)

7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation a system check was performed at the planar section of the SAM phantom with an 1800MHz dipole and a 900MHz dipole (see Appendix C for system validation procedures). The fluid dielectric parameters were measured prior to the system check using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters). A forward power of 250mW was applied to the dipole and the system was verified to a tolerance of ±10% (see Appendix B for system check test plots).

SYSTEM PERFORMANCE CHECK

Test Date	Equiv. Tissue	SAR 1g (W/kg)		Dielectric Constant ε_r		Conductivity σ (mho/m)		ρ (Kg/m^3)	Ambient Temp.	Fluid Temp.	Fluid Depth
		IEEE Target	Measured	IEEE Target	Measured	IEEE Target	Measured				
05/07/03	1800MHz (Brain)	9.53 ±10%	9.16	40.0 ±5%	40.8	1.40 ±5%	1.38	1000	23.2 °C	22.5 °C	≥ 15 cm
05/07/03	900MHz (Brain)	2.70 ±10%	2.84	41.5 ±5%	39.6	0.97 ±5%	0.95	1000	23.5 °C	22.0 °C	≥ 15 cm

Note(s):
1. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the system performance check. The temperatures listed in the table above were consistent for all measurement periods.

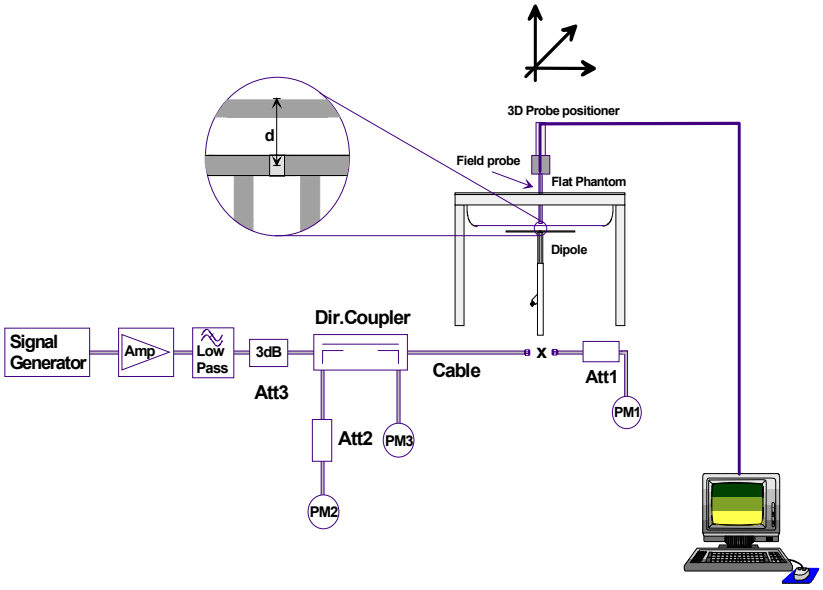


Figure 5. System Performance Check Setup Diagram

1800MHz Dipole Setup

900MHz Dipole Setup

8.0 EQUIVALENT TISSUES

The 1800MHz and 1900MHz simulated tissue fluids consist of Glycol-monobutyl, water, and salt. The 835MHz and 900MHz simulated tissues consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution. Preservation with a bactericide was added and visual inspection was made to ensure air bubbles were not trapped during the mixing process. The fluids were prepared according to standardized procedures and measured for dielectric parameters (permittivity and conductivity).

1800MHz & 1900MHz TISSUE MIXTURES (1 Liter Yields)		
INGREDIENT	**1800MHz Brain (System Check)**	**1900MHz Body (EUT Evaluation)**
Water	548.0 g	716.60 g
Glycol Monobutyl	448.5 g	300.70 g
Salt	3.20 g	3.10 g

835MHz & 900MHz TISSUE MIXTURES		
INGREDIENT	**900MHz Brain (System Check)**	**835MHz Body (EUT Evaluation)**
Water	40.71 %	53.70 %
Sugar	56.63 %	45.10 %
Salt	1.48 %	0.97 %
HEC	1.00 %	0.13%
Bactericide	0.18 %	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 1 g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	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)

Phantom

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

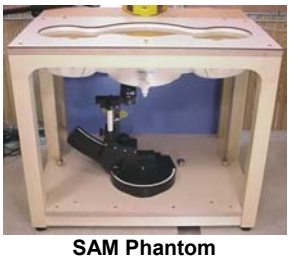
11.0 PROBE SPECIFICATION (ET3DV6)

Construction:	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g. glycol)
Calibration:	In air from 10 MHz to 2.5 GHz In brain simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy ± 8%)
Frequency:	10 MHz to >6 GHz; Linearity: ±0.2 dB (30 MHz to 3 GHz)
Directivity:	±0.2 dB in brain tissue (rotation around probe axis) ±0.4 dB in brain tissue (rotation normal to probe axis)
Dynamic Range:	5 μW/g to >100 mW/g; Linearity: ±0.2 dB
Surface Detect.	±0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Dimensions:	Overall length: 330 mm Tip length: 16 mm Body diameter: 12 mm Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 3 GHz Compliance tests of portable devices

ET3DV6 E-Field Probe

12.0 SAM PHANTOM V4.0C

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



SAM Phantom

13.0 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

14.0 TEST EQUIPMENT LIST

SAR MEASUREMENT SYSTEM		
TEST EQUIPMENT	**SERIAL NO.**	**CALIBRATION DATE**
Schmid & Partner DASY3 System	-	-
-Robot	599396-01	N/A
-ET3DV6 E-Field Probe	1387	Feb 2003
-300MHz Validation Dipole	135	Oct 2002
-450MHz Validation Dipole	136	Oct 2002
-900MHz Validation Dipole	054	June 2003
-1800MHz Validation Dipole	247	June 2003
-2450MHz Validation Dipole	150	Oct 2002
-SAM Phantom V4.0C	N/A	N/A
-Planar Phantom	N/A	N/A
-Validation Planar Phantom	N/A	N/A
HP 85070C Dielectric Probe Kit	N/A	N/A
Gigatronics 8651A Power Meter	8650137	April 2003
Gigatronics 8652A Power Meter	1835267	April 2003
Power Sensor 80701A	1833542	Feb 2003
Power Sensor 80701A	1833699	April 2003
HP E4408B Spectrum Analyzer	US39240170	Dec 2002
HP 8594E Spectrum Analyzer	3543A02721	Feb 2003
HP 8753E Network Analyzer	US38433013	Feb 2003
HP 8648D Signal Generator	3847A00611	Feb 2003
Amplifier Research 5S1G4 Power Amplifier	26235	N/A

15.0 MEASUREMENT UNCERTAINTIES

UNCERTAINTY BUDGET FOR DEVICE EVALUATION						
Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**c_i 1g**	**Standard Uncertainty ±% (1g)**	**v_i or v_{eff}**
Measurement System						
Probe calibration	± 4.8	Normal	1	1	± 4.8	∞
Axial isotropy of the probe	± 4.7	Rectangular	√3	$(1-c_p)$	± 1.9	∞
Spherical isotropy of the probe	± 9.6	Rectangular	√3	(c_p)	± 3.9	∞
Spatial resolution	± 0.0	Rectangular	√3	1	± 0.0	∞
Boundary effects	± 5.5	Rectangular	√3	1	± 3.2	∞
Probe linearity	± 4.7	Rectangular	√3	1	± 2.7	∞
Detection limit	± 1.0	Rectangular	√3	1	± 0.6	∞
Readout electronics	± 1.0	Normal	1	1	± 1.0	∞
Response time	± 0.8	Rectangular	√3	1	± 0.5	∞
Integration time	± 1.4	Rectangular	√3	1	± 0.8	∞
RF ambient conditions	± 3.0	Rectangular	√3	1	± 1.7	∞
Mech. constraints of robot	± 0.4	Rectangular	√3	1	± 0.2	∞
Probe positioning	± 2.9	Rectangular	√3	1	± 1.7	∞
Extrapolation & integration	± 3.9	Rectangular	√3	1	± 2.3	∞
Test Sample Related						
Device positioning	± 6.0	Normal	√3	1	± 6.7	12
Device holder uncertainty	± 5.0	Normal	√3	1	± 5.9	8
Power drift	± 5.0	Rectangular	√3		± 2.9	∞
Phantom and Setup						
Phantom uncertainty	± 4.0	Rectangular	√3	1	± 2.3	∞
Liquid conductivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid conductivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					**± 13.3**	
Expanded Uncertainty (k=2)					**± 26.6**	

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

MEASUREMENT UNCERTAINTIES (Cont.)

UNCERTAINTY BUDGET FOR SYSTEM VALIDATION

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

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

16.0 REFERENCES

[1] Federal Communications Commission, “Radiofrequency radiation exposure evaluation: portable devices”, Rule Part 47 CFR §2.1093: 1999.

[2] Health Canada, “Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz”, Safety Code 6.

[3] Federal Communications Commission, “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields”, OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.

[4] Industry Canada, “Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada’s Safety Code 6 for Exposure of Humans to Radio Frequency Fields”, Radio Standards Specification RSS-102 Issue 1 (Provisional): September 1999.

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

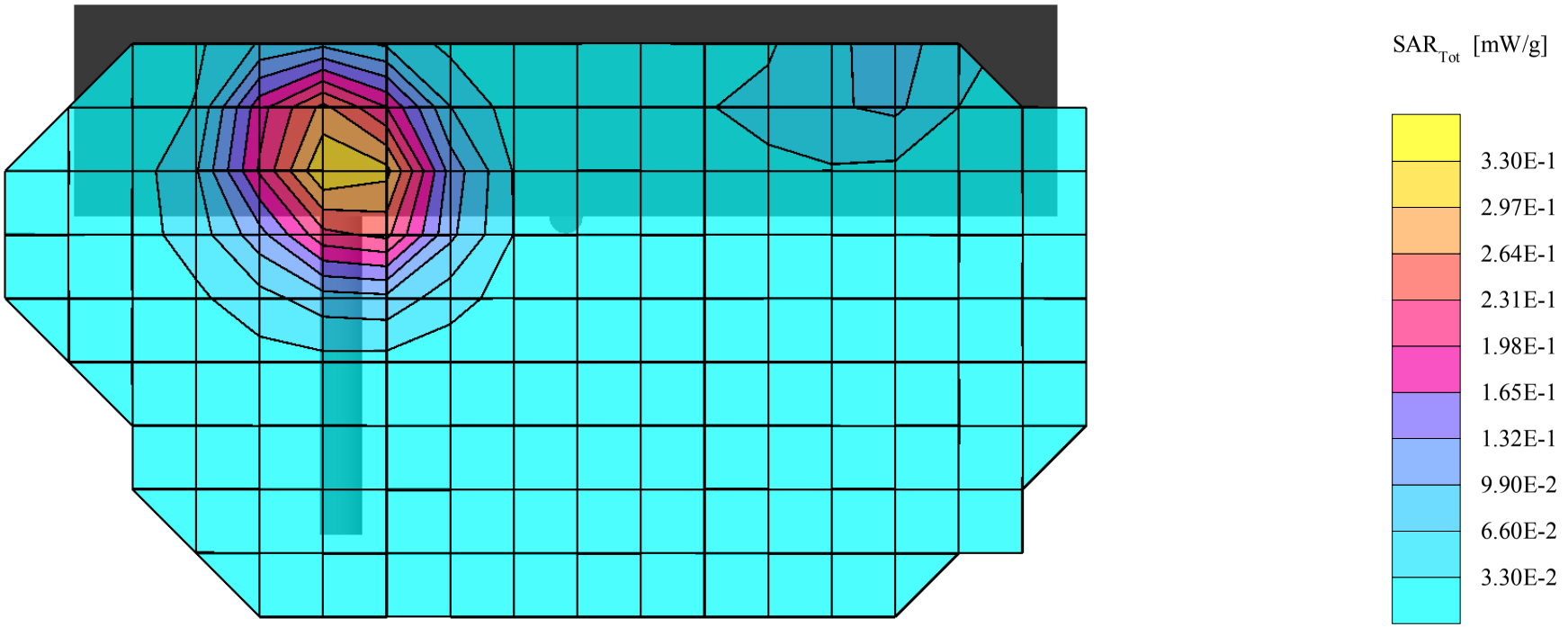
[6] W. Gander, *Computermathematick*, Birkhaeuser, Basel: 1992.

APPENDIX A - SAR MEASUREMENT DATA

DAP Technologies Ltd. FCC ID: HDWAEA307

SAM Phantom; Flat Section; Position: (270°,180°)
Probe: ET3DV6 - SN1387; ConvF(4.90,4.90,4.90); Crest factor: 1.0
Muscle 1900 MHz: σ = 1.59 mho/m ε_r = 51.9 ρ = 1.00 g/cm^3
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Cube 5x5x7
SAR (1g): 0.271 mW/g, SAR (10g): 0.171 mW/g

Body SAR - Bottom of Rugged Handheld PC - Antenna Parallel to Planar Phantom
0.0 cm Separation Distance from Bottom of Rugged Handheld PC to Planar Phantom
Model: CE8640/LS Rugged Handheld PC with 7.4V Lithium-ion Battery
with Sierra Wireless AirCard 555 PCS/Cellular CDMA Modem Card
PCS CDMA Mode
Channel 600 [1880.00 MHz]
Conducted Power: 23.04 dBm
Ambient Temp: 23.6°C; Fluid Temp: 22.7°C
Date Tested: May 7, 2003

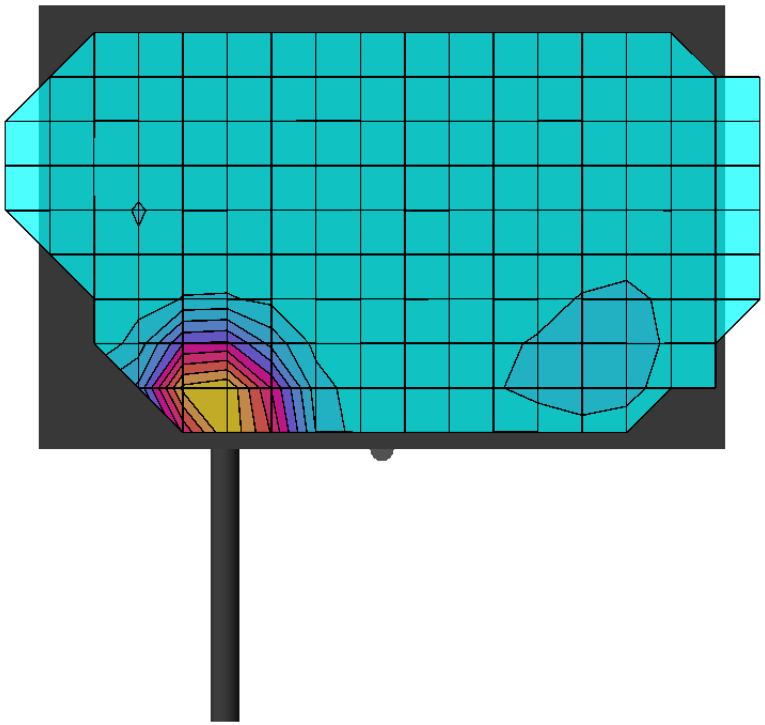


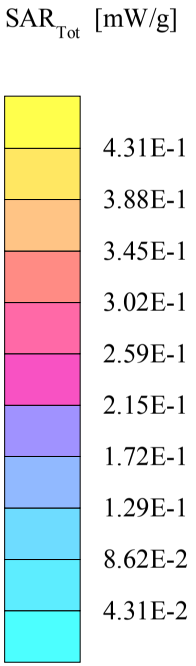
DAP Technologies Ltd. FCC ID: HDWAEA307

SAM Phantom; Flat Section; Position: (270°,180°)
Probe: ET3DV6 - SN1387; ConvF(4.90,4.90,4.90); Crest factor: 1.0
Muscle 1900 MHz: $\sigma = 1.59$ mho/m $\varepsilon_r = 51.9$ $\rho = 1.00$ g/cm^3
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Body SAR - Bottom of Rugged Handheld PC - Antenna Parallel to Planar Phantom
0.0 cm Separation Distance from Bottom of Rugged Handheld PC to Planar Phantom
Model: CE8640/LS Rugged Handheld PC with 7.4V Lithium-ion Battery
with Sierra Wireless AirCard 555 PCS/Cellular CDMA Modem Card
PCS CDMA Mode
Channel 600 [1880.00 MHz]
Conducted Power: 23.04 dBm
Ambient Temp: 23.6°C; Fluid Temp: 22.7°C
Date Tested: May 7, 2003

2nd Coarse Scan to show SAR Distribution at Lower Bottom Section of PC



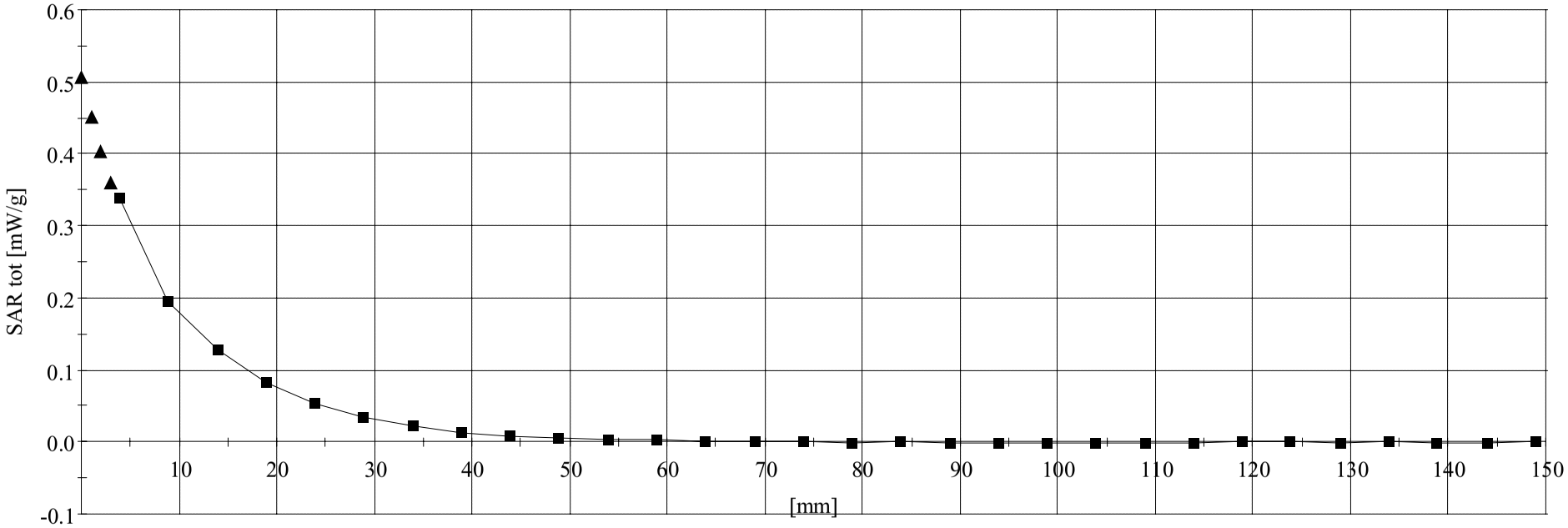


DAP Technologies Ltd. FCC ID: HDWAEA307

SAM Phantom; Flat Section
Probe: ET3DV6 - SN1387; ConvF(4.90,4.90,4.90); Crest factor: 1.0
Muscle 1900 MHz: $\sigma = 1.59$ mho/m $\varepsilon_r = 51.9$ $\rho = 1.00$ g/cm^3

Z-Axis Extrapolation at Peak SAR Location

Body SAR - Bottom of Handheld PC - Antenna Parallel to Planar Phantom
0.0 cm Separation Distance from Bottom of Handheld PC to Planar Phantom
Model: CE8640/LS Rugged Handheld PC
with Sierra Wireless AirCard 555 PCS/Cellular CDMA Modem Card
PCS CDMA Mode
Channel 600 [1880.00 MHz]
Conducted Power: 23.04 dBm
Ambient Temp: 23.6°C; Fluid Temp: 22.7°C
Date Tested: May 7, 2003

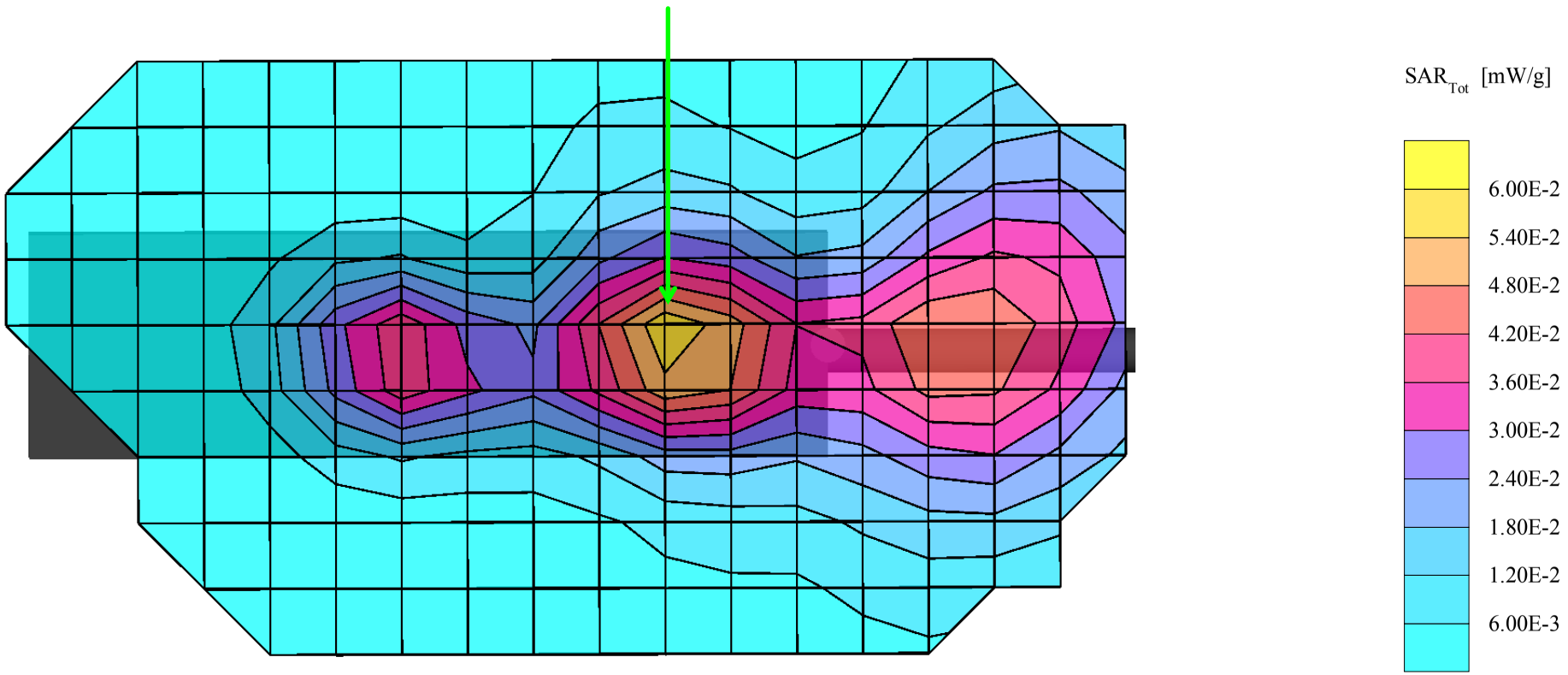


DAP Technologies Ltd. FCC ID: HDWAEA307

SAM Phantom; Flat Section; Position: (90°,90°)
Probe: ET3DV6 - SN1387; ConvF(4.90,4.90,4.90); Crest factor: 1.0
Muscle 1900 MHz: $\sigma = 1.59$ mho/m $\varepsilon_r = 51.9$ $\rho = 1.00$ g/cm^3
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Cube 5x5x7
SAR (1g): 0.0509 mW/g, SAR (10g): 0.0316 mW/g

Body SAR - Left Side of Rugged Handheld PC - Antenna Parallel to Planar Phantom
0.0 cm Separation Distance from Left Side of Rugged Handheld PC to Planar Phantom
Model: CE8640/LS Rugged Handheld PC with 7.4V Lithium-ion Battery
with Sierra Wireless AirCard 555 PCS/Cellular CDMA Modem Card
PCS CDMA Mode
Channel 600 [1880.00 MHz]
Conducted Power: 23.00 dBm
Ambient Temp: 23.6°C; Fluid Temp: 22.7°C
Date Tested: May 7, 2003

Primary Hotspot Evaluation

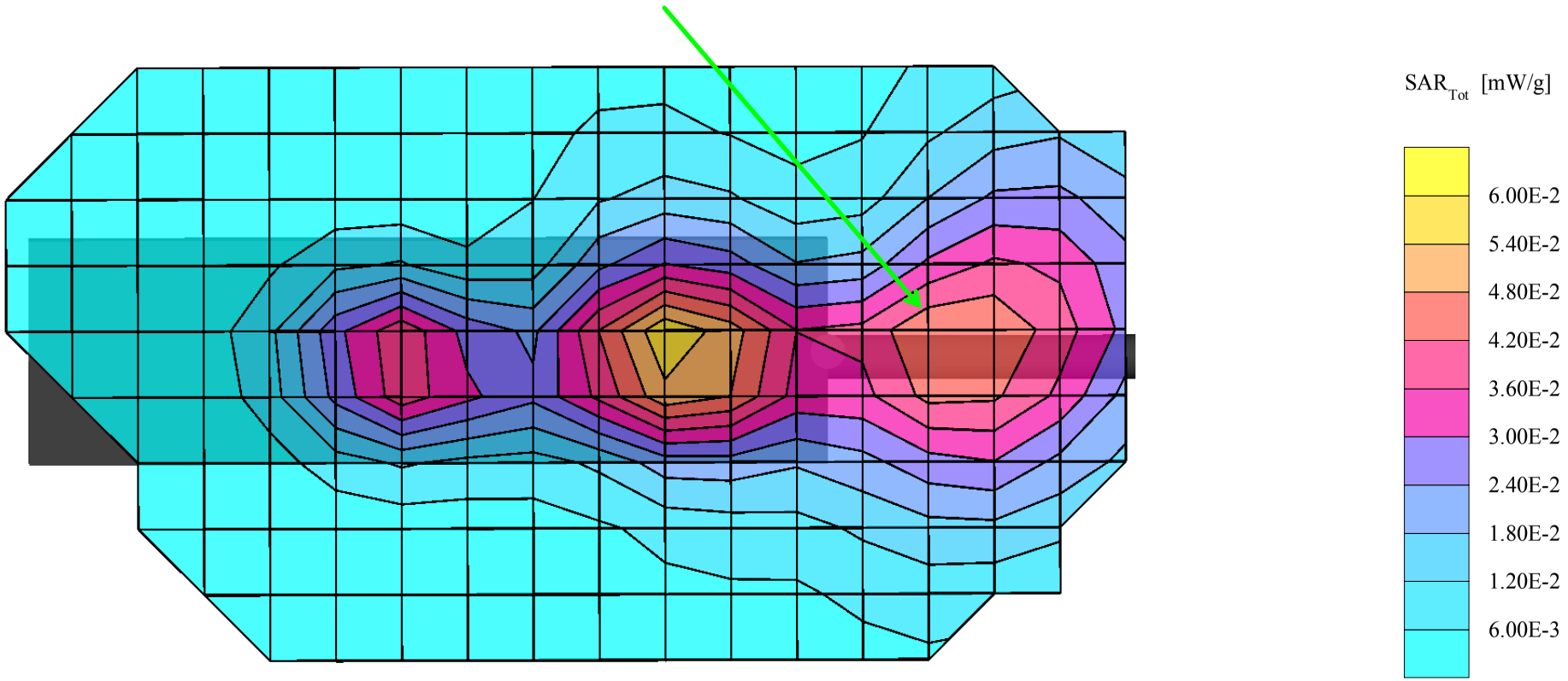


DAP Technologies Ltd. FCC ID: HDWAEA307

SAM Phantom; Flat Section; Position: (90°,90°)
Probe: ET3DV6 - SN1387; ConvF(4.90,4.90,4.90); Crest factor: 1.0
Muscle 1900 MHz: $\sigma = 1.59$ mho/m $\varepsilon_r = 51.9$ $\rho = 1.00$ g/cm^3
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Cube 5x5x7
SAR (1g): 0.0357 mW/g, SAR (10g): 0.0214 mW/g

Body SAR - Left Side of Rugged Handheld PC - Antenna Parallel to Planar Phantom
0.0 cm Separation Distance from Left Side of Rugged Handheld PC to Planar Phantom
Model: CE8640/LS Rugged Handheld PC with 7.4V Lithium-ion Battery
with Sierra Wireless AirCard 555 PCS/Cellular CDMA Modem Card
PCS CDMA Mode
Channel 600 [1880.00 MHz]
Conducted Power: 23.00 dBm
Ambient Temp: 23.6°C; Fluid Temp: 22.7°C
Date Tested: May 7, 2003

Secondary Hotspot Evaluation

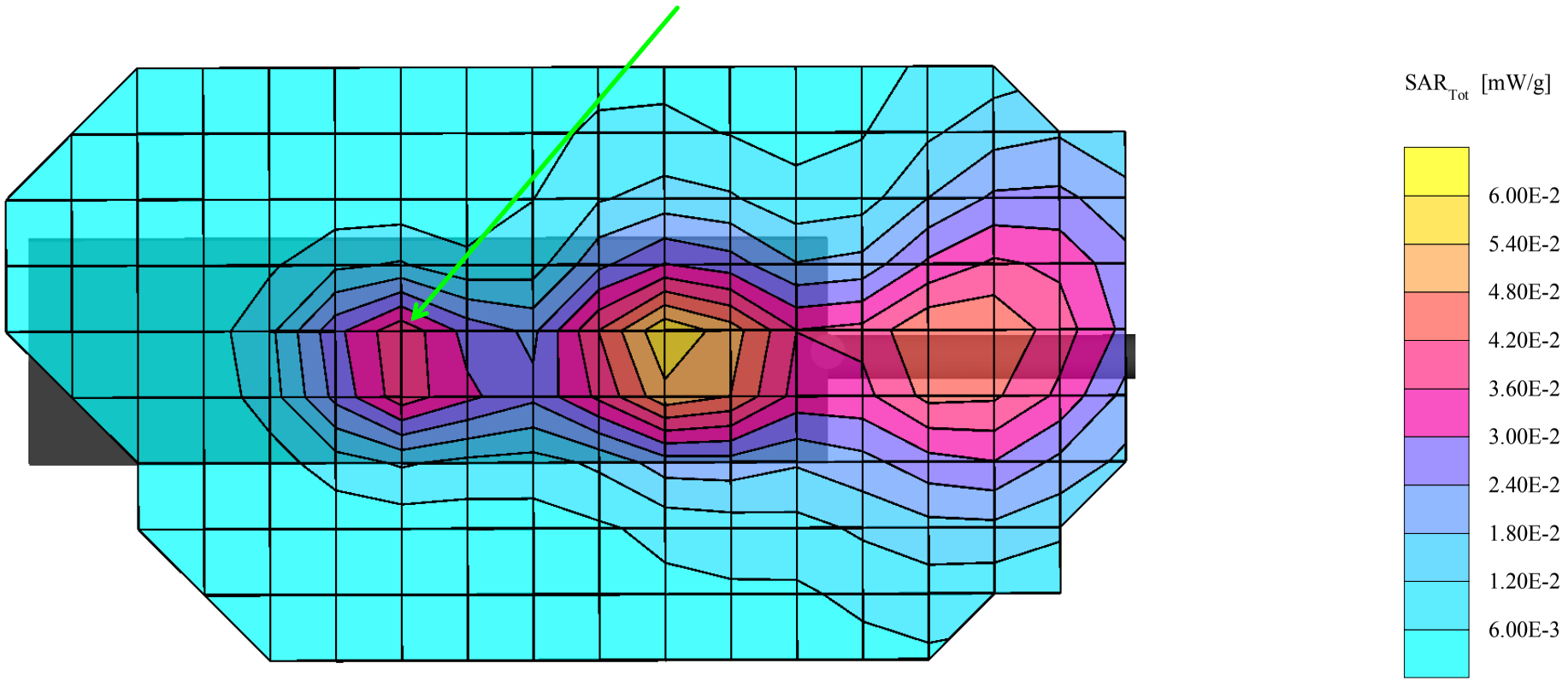


DAP Technologies Ltd. FCC ID: HDWAEA307

SAM Phantom; Flat Section; Position: (90°,90°)
Probe: ET3DV6 - SN1387; ConvF(4.90,4.90,4.90); Crest factor: 1.0
Muscle 1900 MHz: $\sigma = 1.59$ mho/m $\varepsilon_r = 51.9$ $\rho = 1.00$ g/cm^3
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Cube 5x5x7
SAR (1g): 0.0288 mW/g, SAR (10g): 0.0173 mW/g

Body SAR - Left Side of Rugged Handheld PC - Antenna Parallel to Planar Phantom
0.0 cm Separation Distance from Left Side of Rugged Handheld PC to Planar Phantom
Model: CE8640/LS Rugged Handheld PC with 7.4V Lithium-ion Battery
with Sierra Wireless AirCard 555 PCS/Cellular CDMA Modem Card
PCS CDMA Mode
Channel 600 [1880.00 MHz]
Conducted Power: 23.00 dBm
Ambient Temp: 23.6°C; Fluid Temp: 22.7°C
Date Tested: May 7, 2003

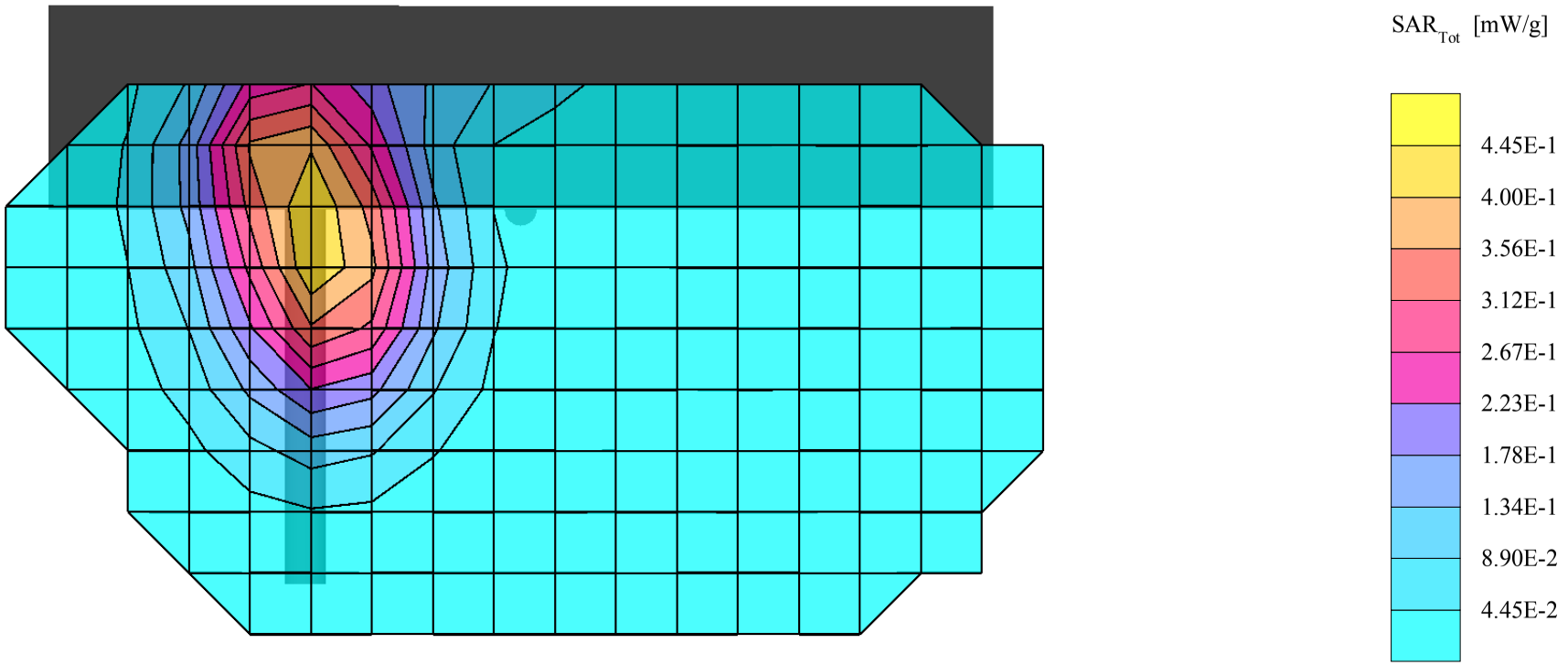
Secondary Hotspot Evaluation



DAP Technologies Ltd. FCC ID: HDWAEA307

SAM Phantom; Flat Section; Position: (270°,180°)
Probe: ET3DV6 - SN1387; ConvF(6.40,6.40,6.40); Crest factor: 1.0
Muscle 835 MHz: σ = 1.01 mho/m ε_r = 56.8 ρ = 1.00 g/cm^3
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Cube 5x5x7
SAR (1g): 0.379 mW/g, SAR (10g): 0.265 mW/g

Body SAR - Bottom of Rugged Handheld PC - Antenna Parallel to Planar Phantom
0.0 cm Separation Distance from Bottom of Rugged Handheld PC to Planar Phantom
Model: CE8640/LS Rugged Handheld PC with 7.4V Lithium-ion Battery
with Sierra Wireless AirCard 555 PCS/Cellular CDMA Modem Card
Cellular CDMA Mode
Channel 363 [835.89 MHz]
Conducted Power: 23.03 dBm
Ambient Temp: 23.6°C; Fluid Temp: 22.3°C
Date Tested: May 7, 2003

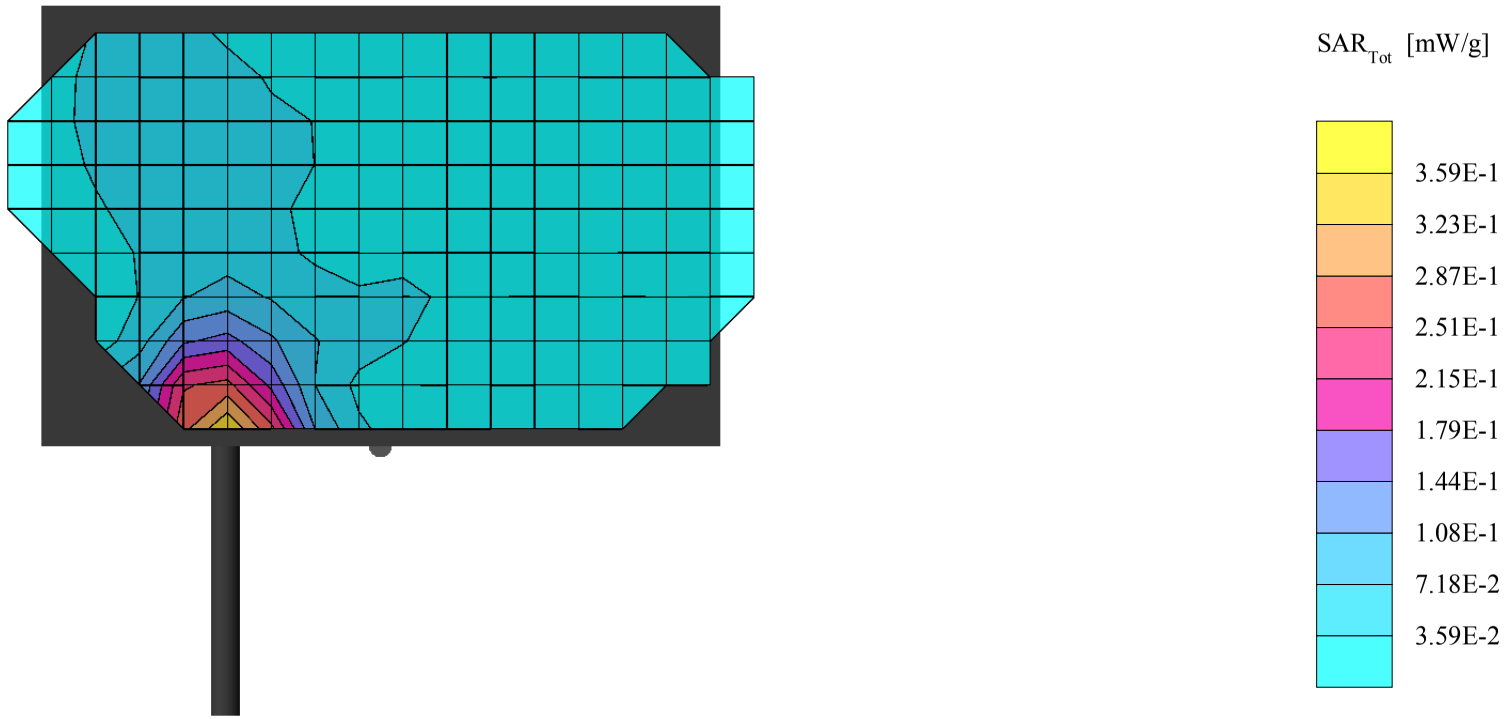


DAP Technologies Ltd. FCC ID: HDWAEA307

SAM Phantom; Flat Section; Position: (270°,180°)
Probe: ET3DV6 - SN1387; ConvF(6.40,6.40,6.40); Crest factor: 1.0
Muscle 835 MHz: $\sigma = 1.01$ mho/m $\varepsilon_r = 56.8$ $\rho = 1.00$ g/cm^3
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Body SAR - Bottom of Rugged Handheld PC - Antenna Parallel to Planar Phantom
0.0 cm Separation Distance from Bottom of Rugged Handheld PC to Planar Phantom
Model: CE8640/LS Rugged Handheld PC with 7.4V Lithium-ion Battery
with Sierra Wireless AirCard 555 PCS/Cellular CDMA Modem Card
Cellular CDMA Mode
Channel 363 [835.89 MHz]
Conducted Power: 23.03 dBm
Ambient Temp: 23.6°C; Fluid Temp: 22.3°C
Date Tested: May 7, 2003

2nd Coarse Scan to show SAR Distribution at Lower Bottom Section of PC

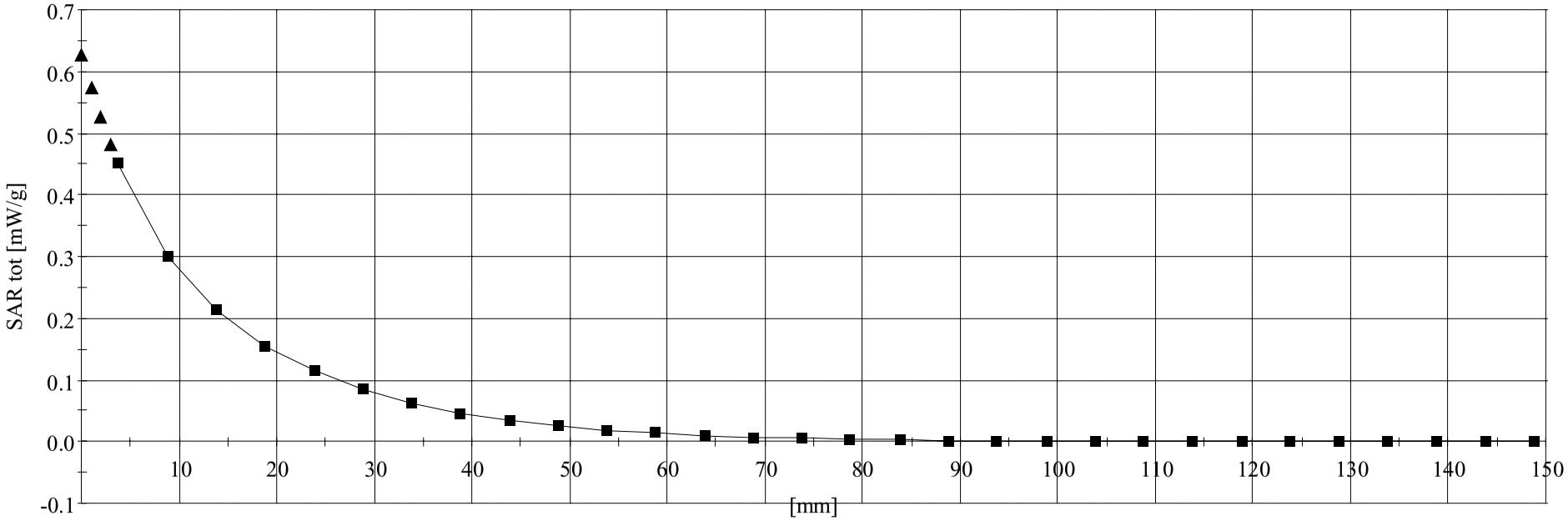


DAP Technologies Ltd. FCC ID: HDWAEA307

SAM Phantom; Flat Section
Probe: ET3DV6 - SN1387; ConvF(6.40,6.40,6.40); Crest factor: 1.0
Muscle 835 MHz: $\sigma = 1.01$ mho/m $\varepsilon_r = 56.8$ $\rho = 1.00$ g/cm^3

Z-Axis Extrapolation at Peak SAR Location

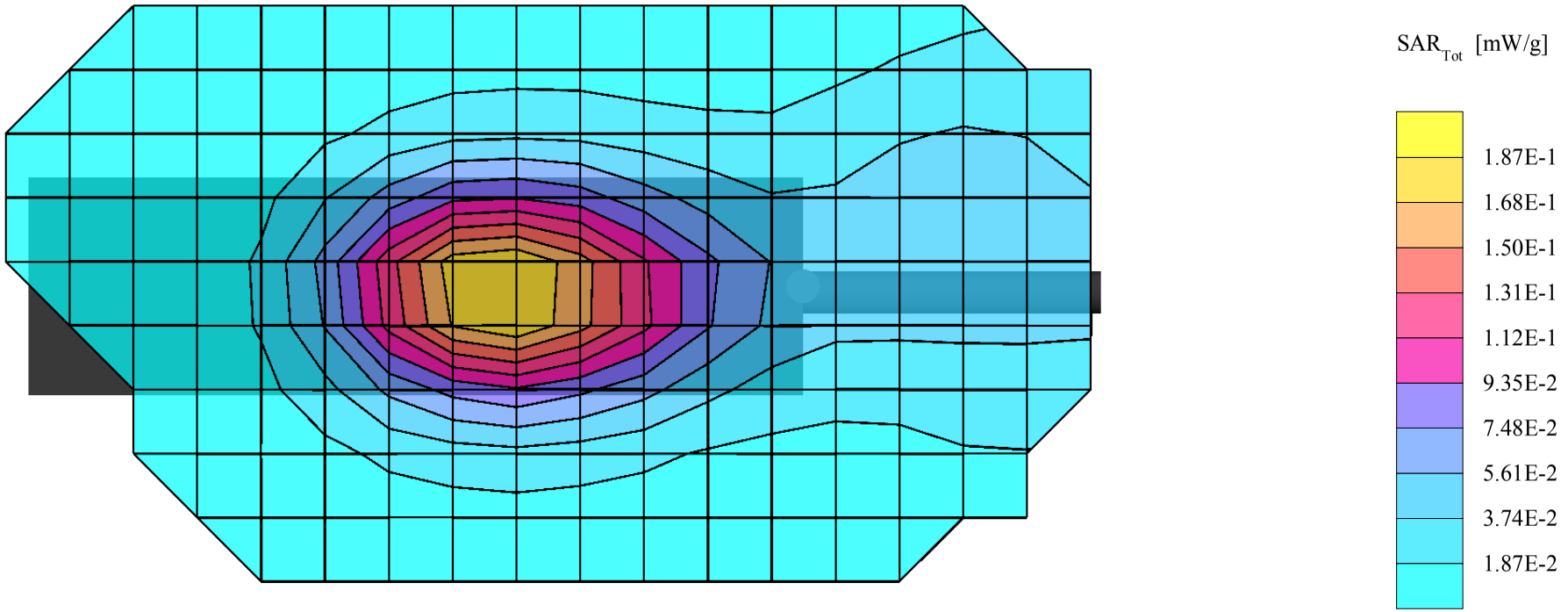
Body SAR - Bottom of Handheld PC - Antenna Parallel to Planar Phantom
0.0 cm Separation Distance from Bottom of Handheld PC to Planar Phantom
Model: CE8640/LS Rugged Handheld PC
with Sierra Wireless AirCard 555 PCS/Cellular CDMA Modem Card
Cellular CDMA Mode
Channel 363 [835.89 MHz]
Conducted Power: 23.03 dBm
Ambient Temp: 23.6°C; Fluid Temp: 22.3°C
Date Tested: May 7, 2003



DAP Technologies Ltd. FCC ID: HDWAEA307

SAM Phantom; Flat Section; Position: (90°,90°)
Probe: ET3DV6 - SN1387; ConvF(6.40,6.40,6.40); Crest factor: 1.0
Muscle 835 MHz: σ = 1.01 mho/m ε_r = 56.8 ρ = 1.00 g/cm^3
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Cube 5x5x7
SAR (1g): 0.176 mW/g, SAR (10g): 0.121 mW/g

Body SAR - Left Side of Rugged Handheld PC - Antenna Parallel to Planar Phantom
0.0 cm Separation Distance from Left Side of Rugged Handheld PC to Planar Phantom
Model: CE8640/LS Rugged Handheld PC with 7.4V Lithium-ion Battery
with Sierra Wireless AirCard 555 PCS/Cellular CDMA Modem Card
Cellular CDMA Mode
Channel 363 [835.89 MHz]
Conducted Power: 23.01 dBm
Ambient Temp: 23.6°C; Fluid Temp: 22.3°C
Date Tested: May 7, 2003



APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

05/07/03

System Performance Check - 1800MHz Dipole

SAM Phantom; Flat Section

Probe: ET3DV6 - SN1387; ConvF(5.20,5.20,5.20); Crest factor: 1.0; 1800 MHz Brain: $\sigma = 1.38$ mho/m $\varepsilon_r = 40.8$ $\rho = 1.00$ g/cm^3

Cube 5x5x7: Peak: 16.1 mW/g, SAR (1g): 9.16 mW/g, SAR (10g): 4.89 mW/g, (Worst-case extrapolation)

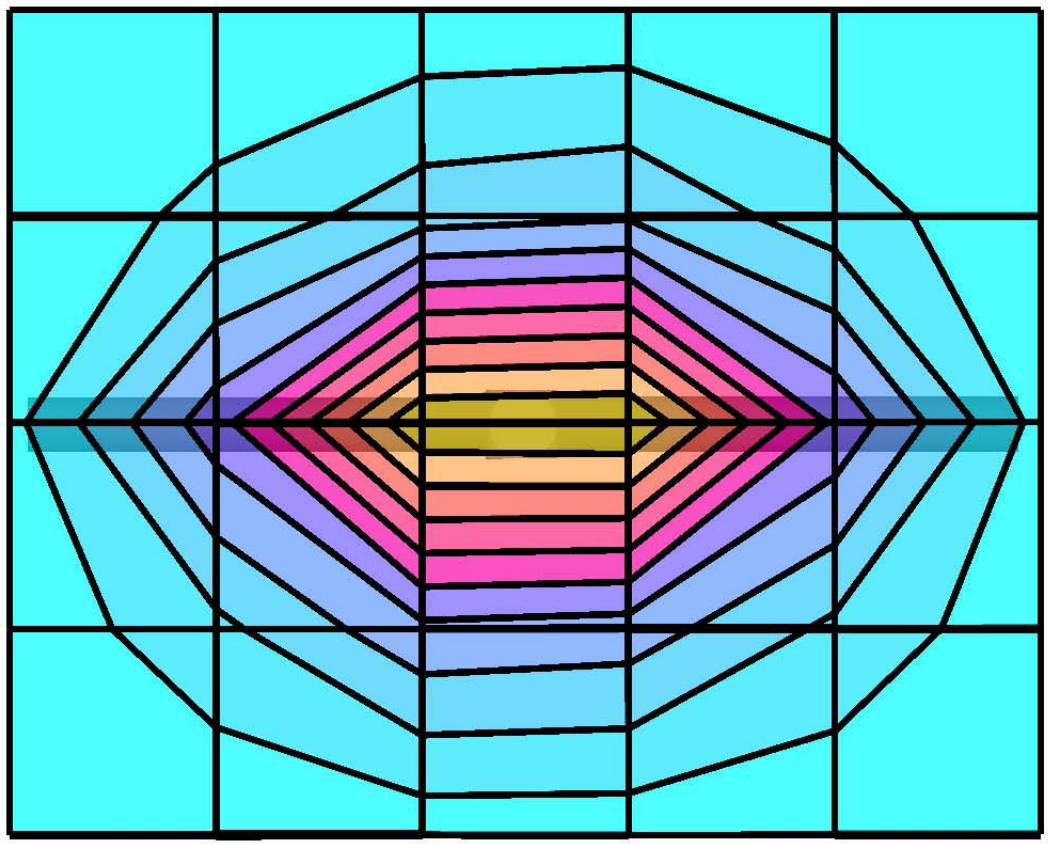
Penetration depth: 9.1 (8.9, 9.4) [mm]

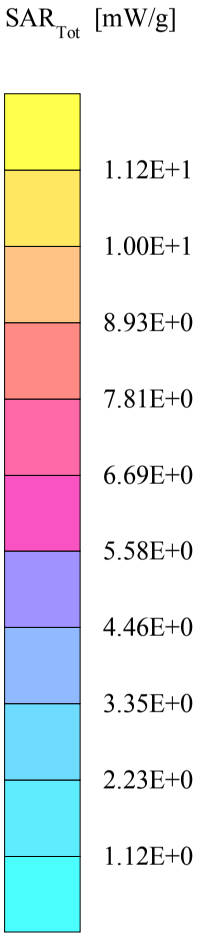
Powerdrift: -0.03 dB

Forward Conducted Power: 250 mW

Ambient Temp. 23.2°C; Fluid Temp. 22.5°C

Date Tested: May 7, 2003





System Performance Check - 900MHz Dipole

SAM Phantom; Flat Section

Probe: ET3DV6 - SN1387; ConvF(6.60,6.60,6.60); Crest factor: 1.0; 900 MHz Brain: $\sigma = 0.95$ mho/m $\varepsilon_r = 39.6$ $\rho = 1.00$ g/cm^3

Cube 5x5x7: Peak: 4.64 mW/g, SAR (1g): 2.84 mW/g, SAR (10g): 1.77 mW/g, (Worst-case extrapolation)

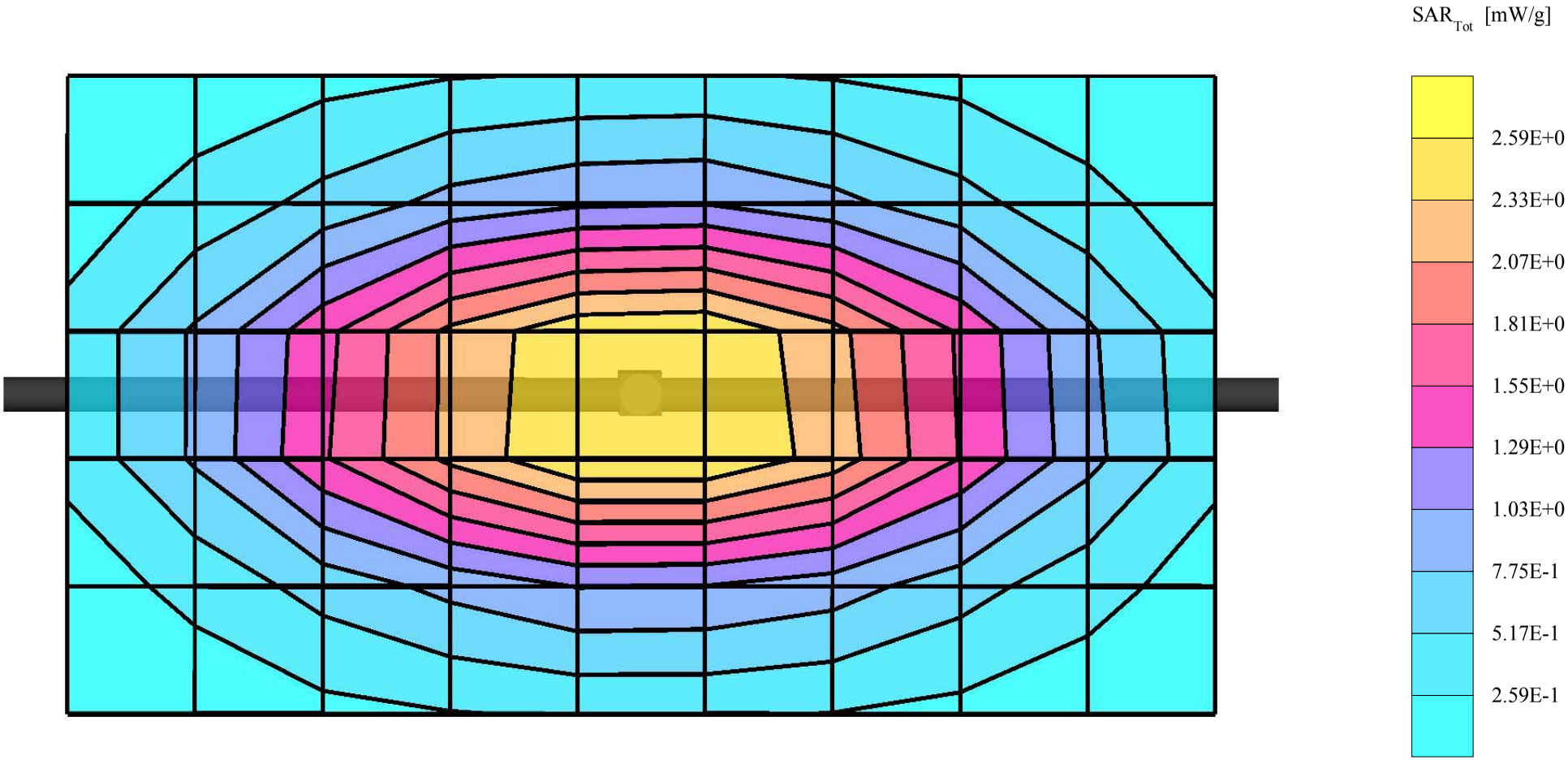
Penetration depth: 11.1 (9.9, 12.7) [mm]

Powerdrift: 0.00 dB

Conducted Power: 250mW

Ambient Temp. 23.5°C; Fluid Temp. 22.0°C

Date Tested: May 7, 2003



APPENDIX C - SYSTEM VALIDATION

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

Client Celltech Labs

CALIBRATION CERTIFICATE

Object(s)	D1800V2 - SN:247
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date:	June 4, 2003
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05
Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04
Power sensor HP 8481A	US37292783	30-Oct-02 (METAS, No. 252-0236)	Oct-03
Power meter EPM E442	GB37480704	30-Oct-02 (METAS, No. 252-0236)	Oct-03
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03

	Name	Function	Signature
Calibrated by:	Judith Mueller	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: June 4, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

DASY

Dipole Validation Kit

Type: D1800V2

Serial: 247

Manufactured: August 25, 1999
Calibrated: June 4, 2003

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with **head simulating solution** of the following electrical parameters at 1800 MHz:

Relative Dielectricity	**39.2**	± 5%
Conductivity	**1.36 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.3 at 1800 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance spacer was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**39.6 mW/g** ± 16.8 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue:	**20.9 mW/g** ± 16.2 % (k=2)[1]

[1] validation uncertainty

3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.190 ns**	(one direction)
Transmission factor:	**0.998**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance spacer was in place during impedance measurements.

Feedpoint impedance at 1800 MHz:	Re{Z} = **48.5 Ω**
	Im {Z} = **-6.5 Ω**
Return Loss at 1800 MHz	**-23.3 dB**

4. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

5. Design

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

6. Power Test

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Date/Time: 06/04/03 14:55:26

Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN247_SN1507_HSL1800_040603.da4

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN247
Program: Dipole Calibration

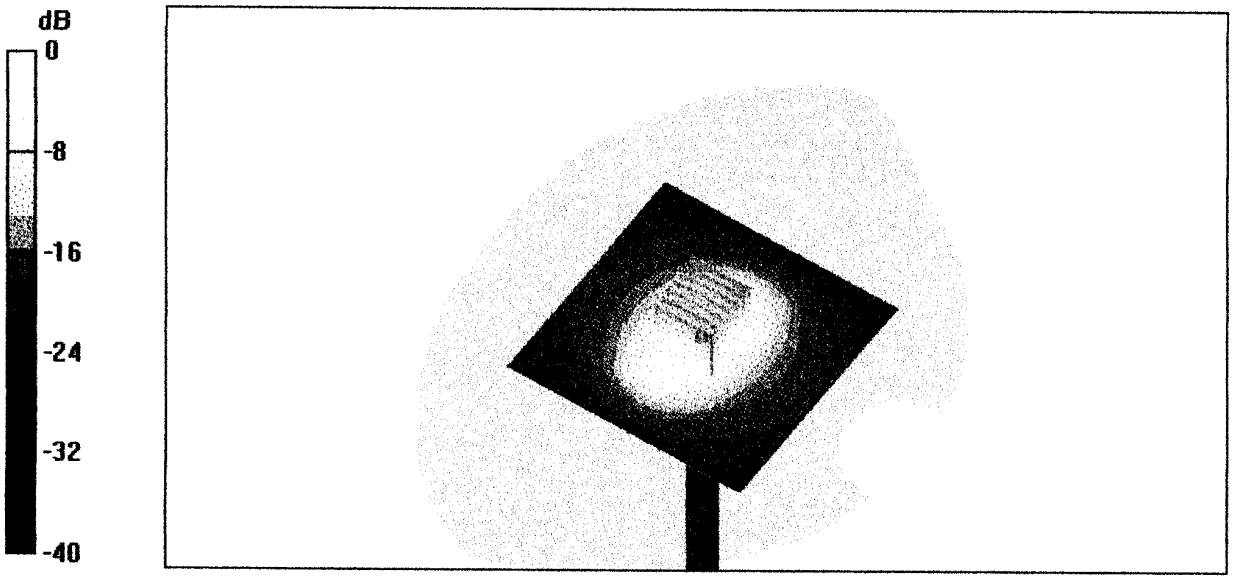
Communication System: CW-1800; Frequency: 1800 MHz;Duty Cycle: 1:1
Medium: HSL 1800 MHz (σ = 1.36 mho/m, ε_r = 39.22, ρ = 1000 kg/m^3)
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

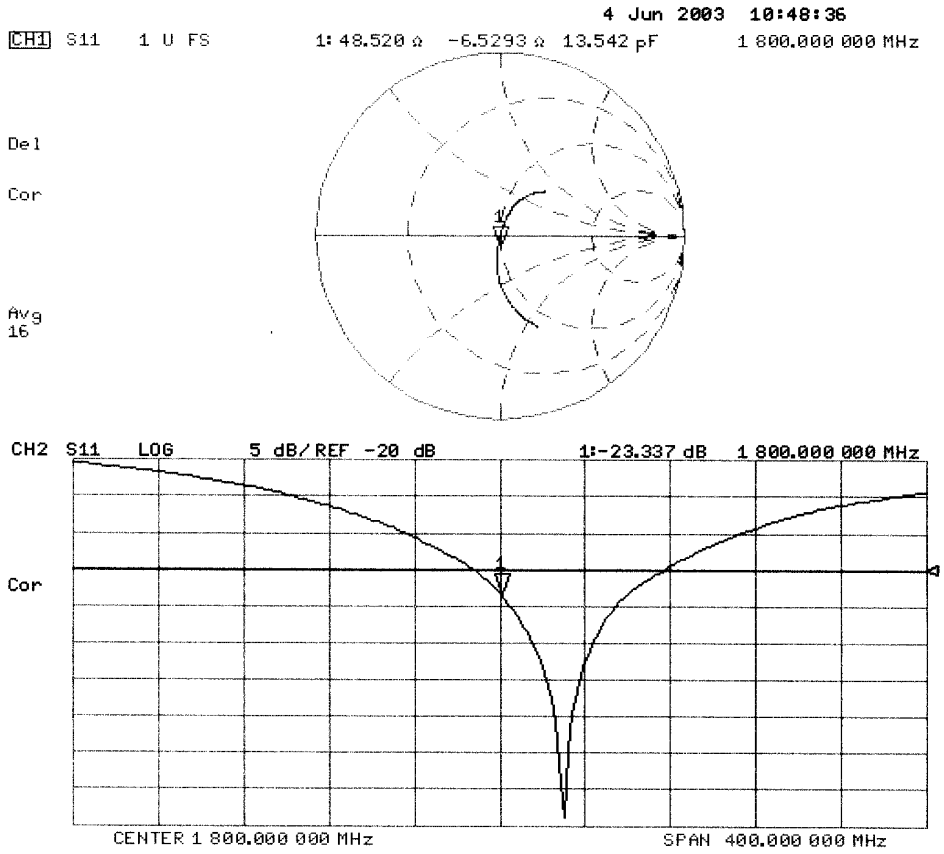
- Probe: ET3DV6 - SN1507; ConvF(5.3, 5.3, 5.3); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006
- *Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115*

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 96 V/m
Power Drift = -0.004 dB
Maximum value of SAR = 11 mW/g

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 16.9 W/kg
SAR(1 g) = 9.9 mW/g; SAR(10 g) = 5.22 mW/g
Reference Value = 96 V/m
Power Drift = -0.004 dB
Maximum value of SAR = 11.1 mW/g



0 dB = 11.1mW/g


4 Jun 2003 10:48:36
CH1 S11 1 U FS
1: 48.520 Ω -6.5293 Ω 13.542 pF
1 800.000 000 MHz
Del
Cor
Avg
16
CH2 S11 LOG
5 dB/ REF -20 dB
1:-23.337 dB 1 800.000 000 MHz
Cor
CENTER 1 800.000 000 MHz
SPAN 400.000 000 MHz

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

Client Celltech Labs

CALIBRATION CERTIFICATE

Object(s) D900V2 - SN:054

Calibration procedure(s) QA CAL-05.v2
Calibration procedure for dipole validation kits

Calibration date: June 3, 2003

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

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05
Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04
Power sensor HP 8481A	US37292783	30-Oct-02 (METAS, No. 252-0236)	Oct-03
Power meter EPM E442	GB37480704	30-Oct-02 (METAS, No. 252-0236)	Oct-03
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03

	Name	Function	Signature
Calibrated by:	Judith Mueller	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: June 3, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

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DASY

Dipole Validation Kit

Type: D900V2

Serial: 054

Manufactured: August 25, 1999
Calibrated: June 3, 2003

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with head simulating solution of the following electrical parameters at 900 MHz:

Relative Dielectricity	**42.1**	± 5%
Conductivity	**0.95 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.6 at 900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250 mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**10.6 mW/g** ± 16.8 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue:	**6.84 mW/g** ± 16.2 % (k=2)[1]

[1] validation uncertainty

3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.397 ns**	(one direction)
Transmission factor:	**0.991**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 900 MHz:	Re{Z} = **49.9 Ω**
	Im {Z} = **-2.0 Ω**
Return Loss at 900 MHz	**-33.9 dB**

4. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

5. Design

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

6. Power Test

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Date/Time: 06/03/03 12:00:32

Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN054_SN1507_HSL900_030603.da4

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN054
Program: Dipole Calibration

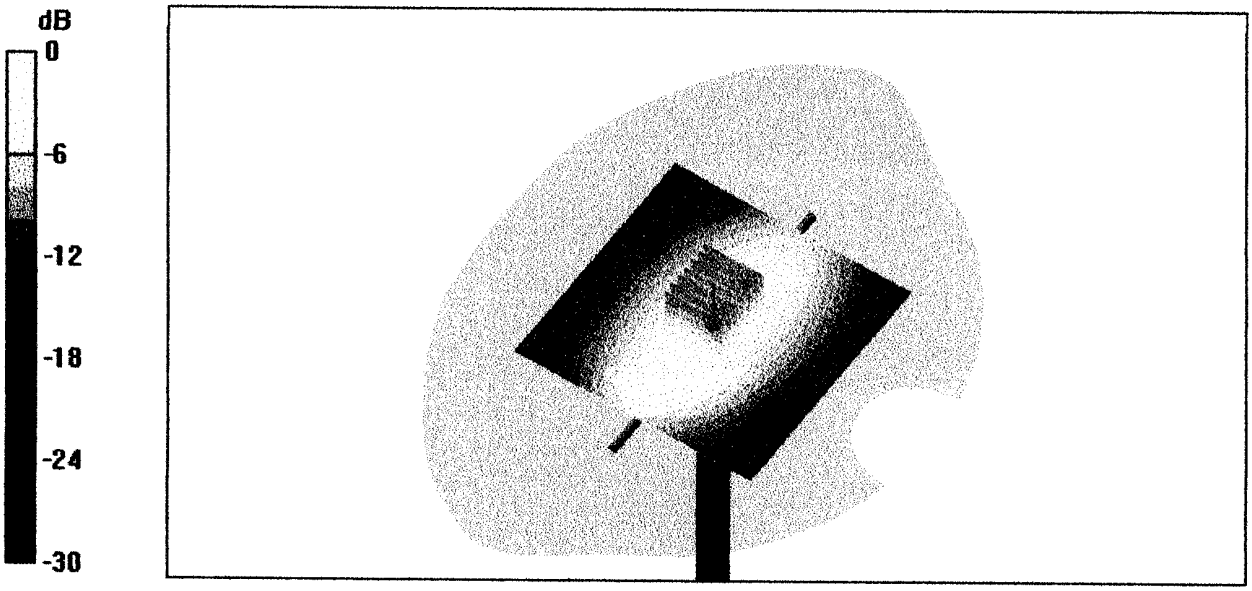
Communication System: CW-900; Frequency: 900 MHz;Duty Cycle: 1:1
Medium: HSL 900 MHz (σ = 0.95 mho/m, ε_r = 42.07, ρ = 1000 kg/m^3)
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

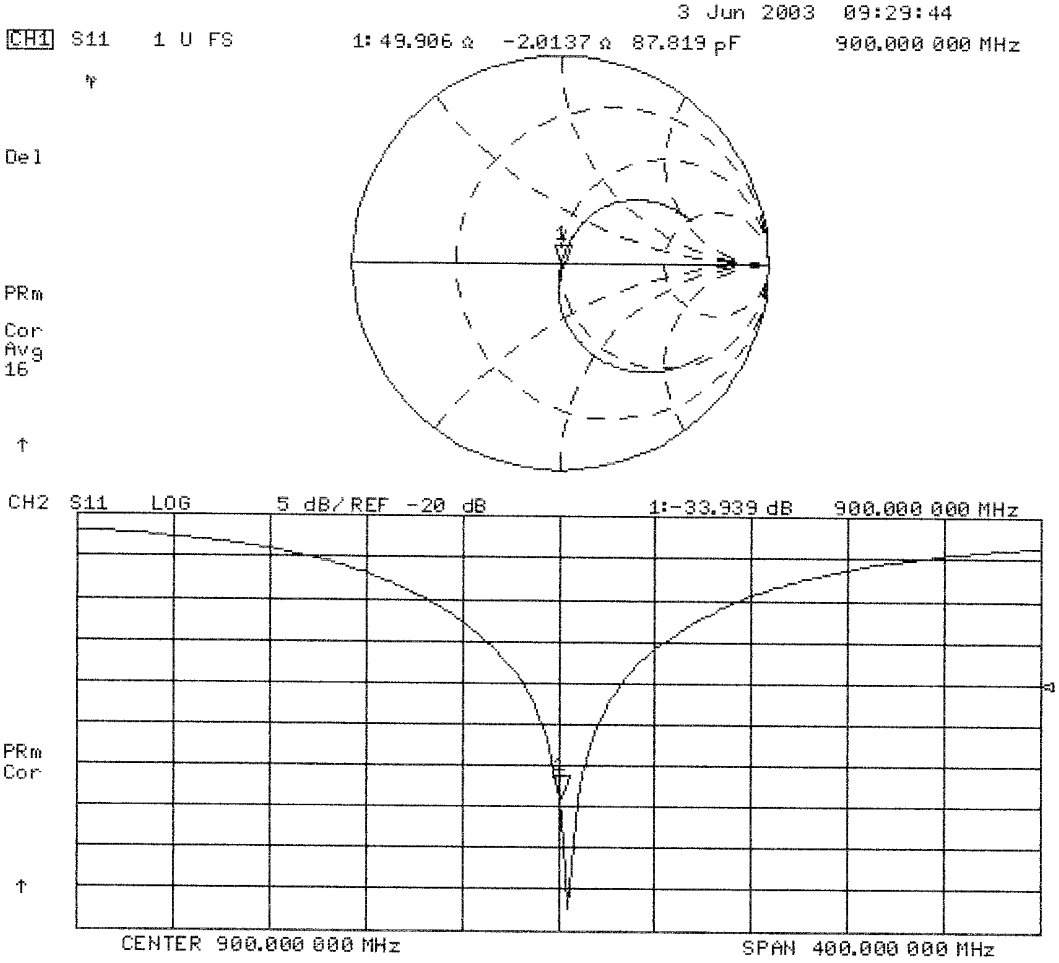
- Probe: ET3DV6 - SN1507; ConvF(6.6, 6.6, 6.6); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 56.9 V/m
Power Drift = 0.0004 dB
Maximum value of SAR = 2.84 mW/g

Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 3.92 W/kg
SAR(1 g) = 2.66 mW/g; SAR(10 g) = 1.71 mW/g
Reference Value = 56.9 V/m
Power Drift = 0.0004 dB
Maximum value of SAR = 2.85 mW/g



0 dB = 2.85mW/g


3 Jun 2003 09:29:44
CH1 S11 1 U FS
1: 49.906 Ω -2.0137 Ω 87.819 pF
900.000 000 MHz
Del
PRm
Cor
Avg
16
CH2 S11 LOG 5 dB/ REF -20 dB
1:-33.939 dB 900.000 000 MHz
PRm
Cor
CENTER 900.000 000 MHz
SPAN 400.000 000 MHz

APPENDIX D - PROBE CALIBRATION

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

Client **Celltech Labs**

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1387
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	February 26, 2003
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date	Scheduled Calibration
RF generator HP 8684C	US3642U01700	4-Aug-99 (in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	8-Mar-02	Mar-03
Power sensor HP 8481A	MY41092180	18-Sep-02	Sep-03
Power meter EPM E4419B	GB41293874	13-Sep-02	Sep-03
Network Analyzer HP 8753E	US38432426	3-May-00	In house check: May 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01	Sep-03

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: February 26, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

Schmid & Partner Engineering AG

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info@speag.com, http://www.speag.com

Probe ET3DV6

SN:1387

Manufactured:	September 21, 1999
Last calibration:	February 22, 2002
Recalibrated:	February 26, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1387

Sensitivity in Free Space

NormX	**1.55**	$\mu V/(V/m)^2$	DCP X	**92**	mV
NormY	**1.65**	$\mu V/(V/m)^2$	DCP Y	**92**	mV
NormZ	**1.64**	$\mu V/(V/m)^2$	DCP Z	**92**	mV

Sensitivity in Tissue Simulating Liquid

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

Boundary Effect

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

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	10.2	5.9
SAR_{be} [%]	With Correction Algorithm	0.4	0.6

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

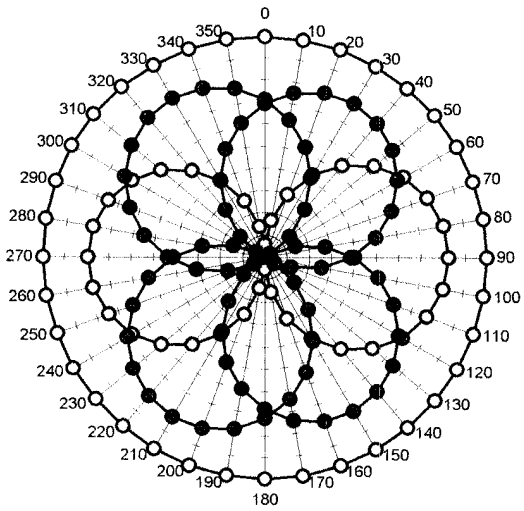
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	14.6	9.8
SAR_{be} [%]	With Correction Algorithm	0.2	0.0

Sensor Offset

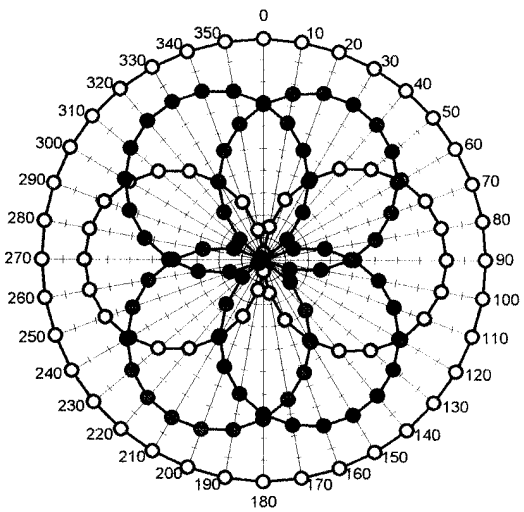
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.4 ± 0.2**	mm

Receiving Pattern (ϕ), θ = 0°

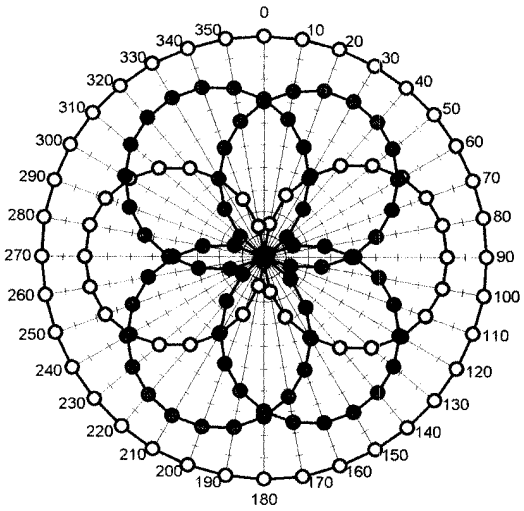
f = 30 MHz, TEM cell ifi110



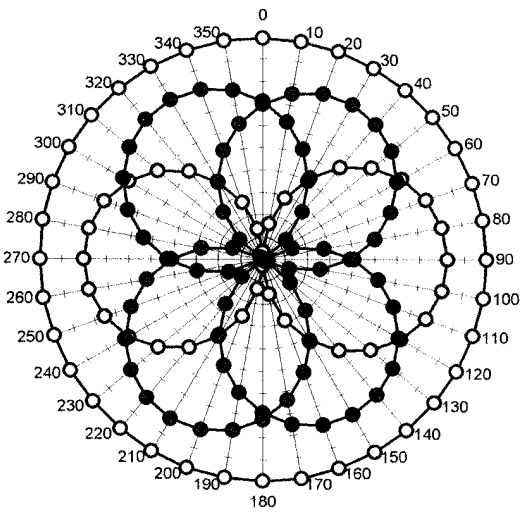
f = 100 MHz, TEM cell ifi110

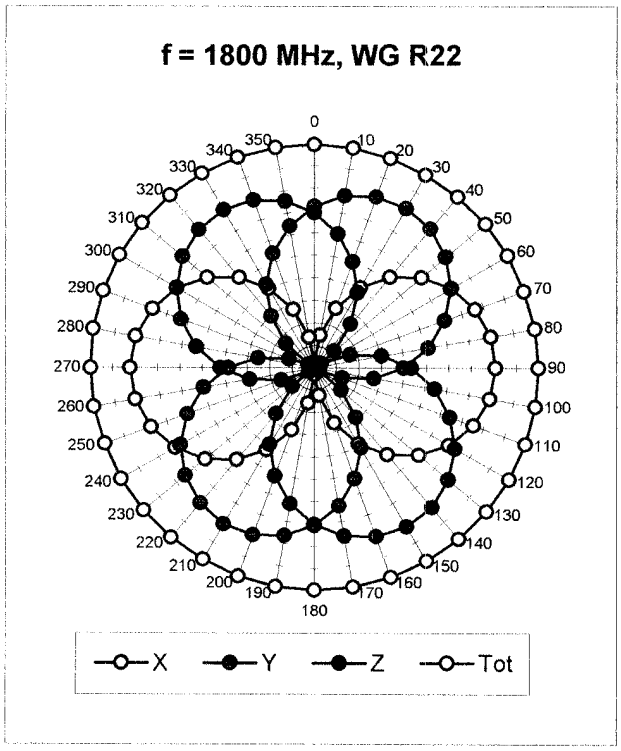


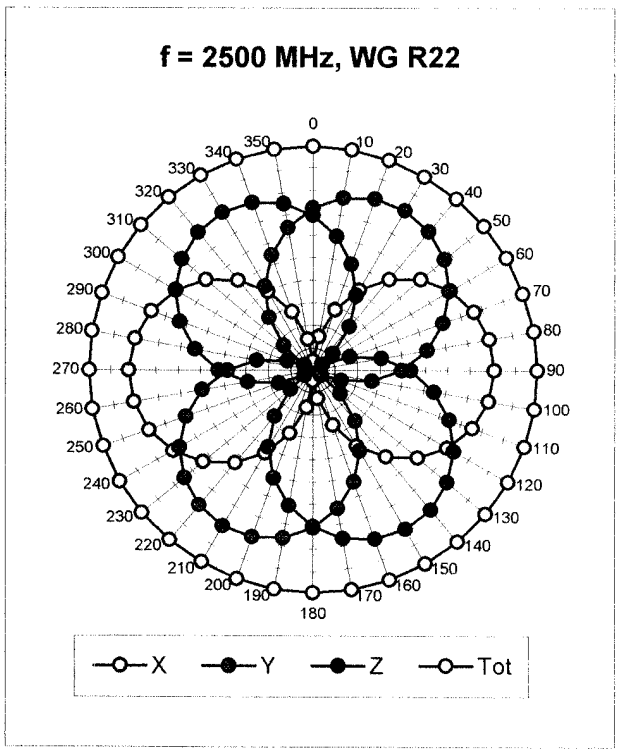
f = 300 MHz, TEM cell ifi110



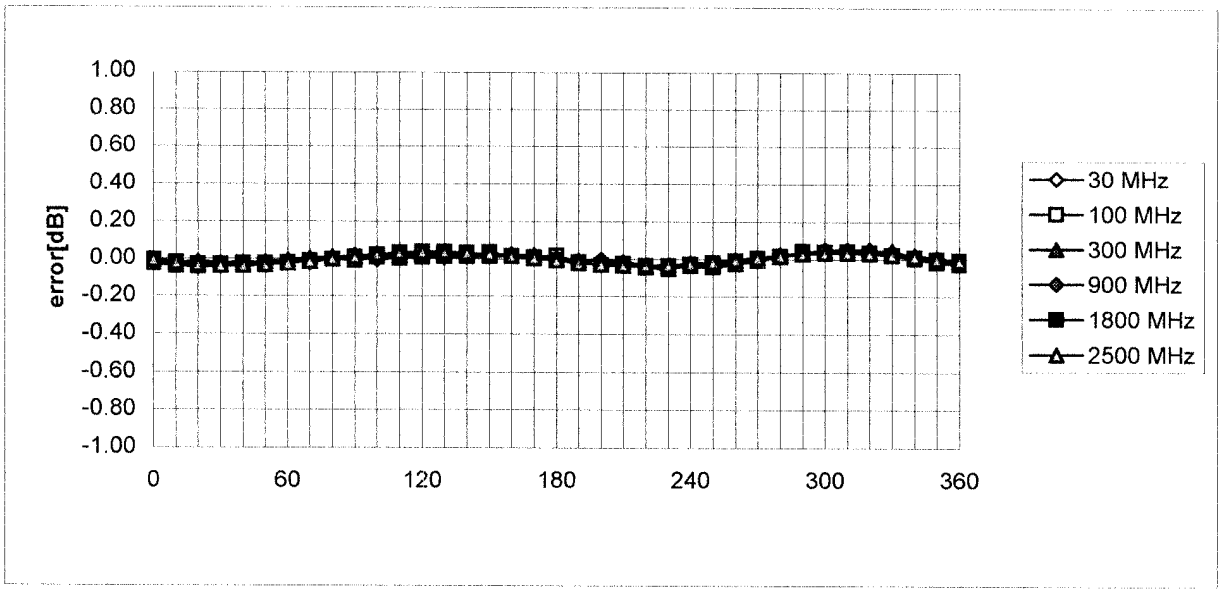
f = 900 MHz, TEM cell ifi110





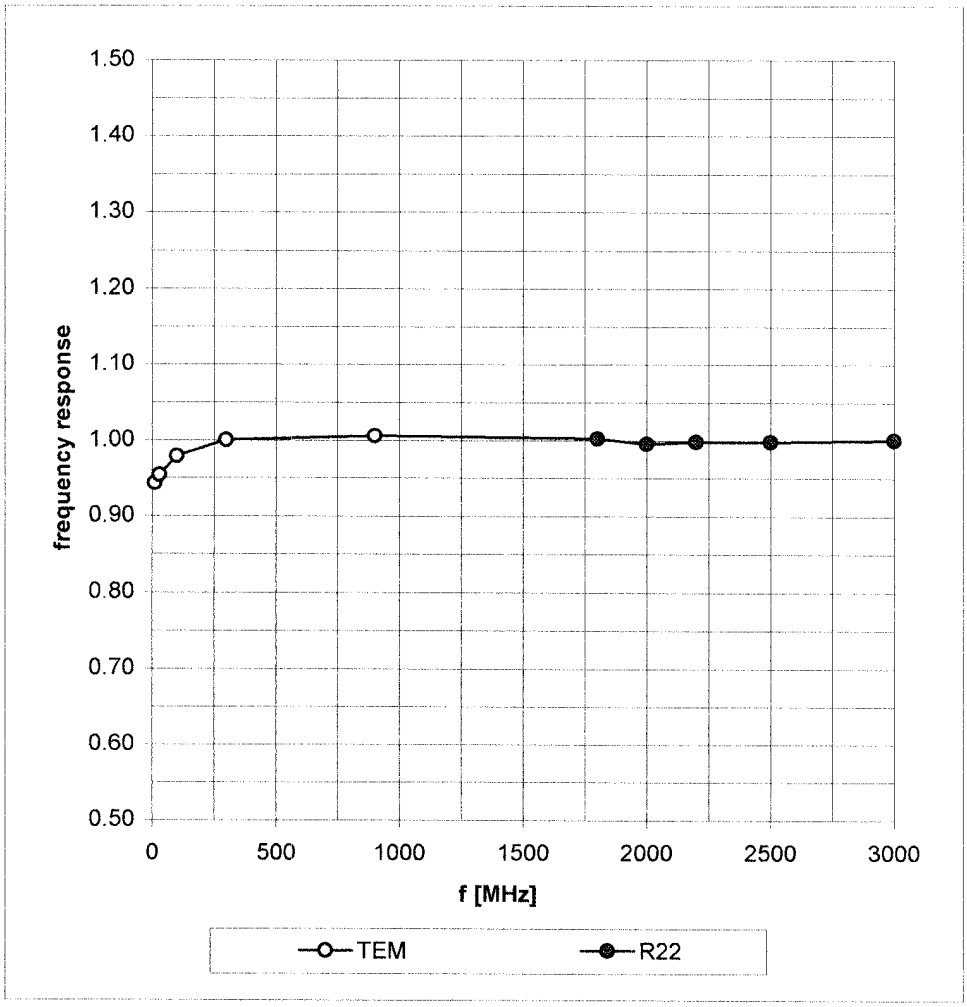


Isotropy Error (ϕ), θ = 0°



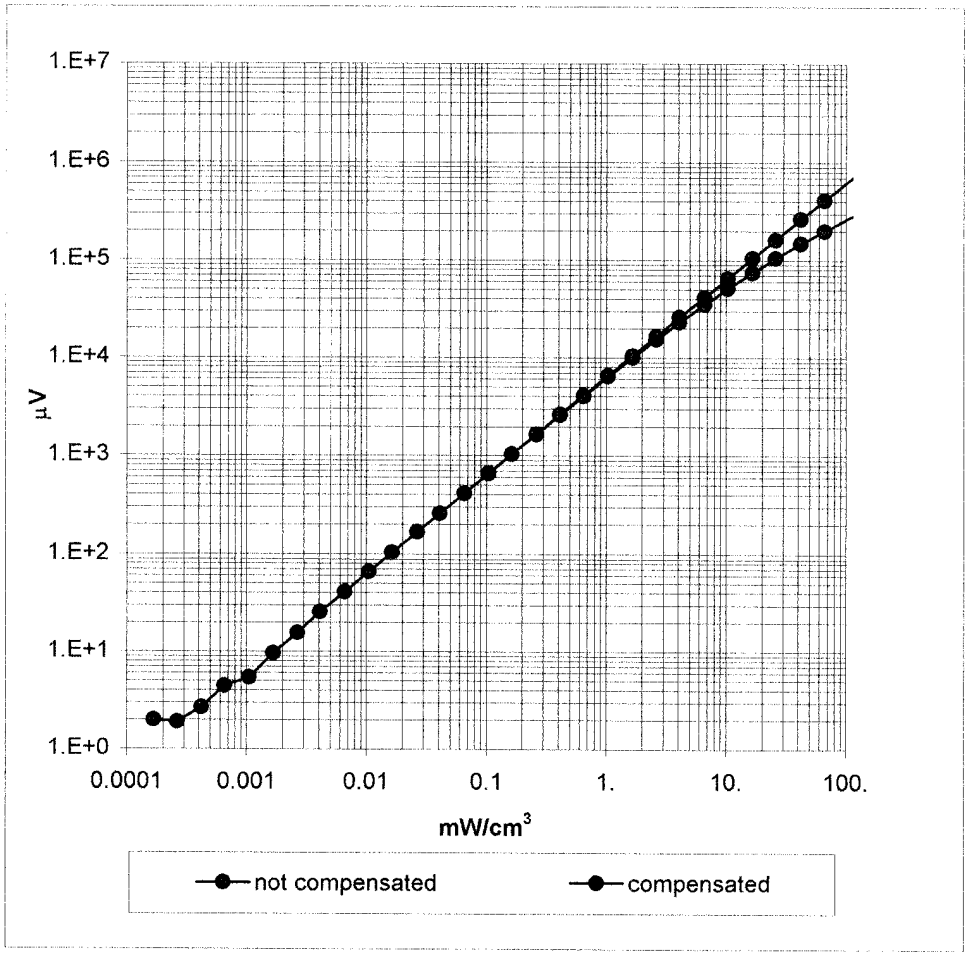
Frequency Response of E-Field

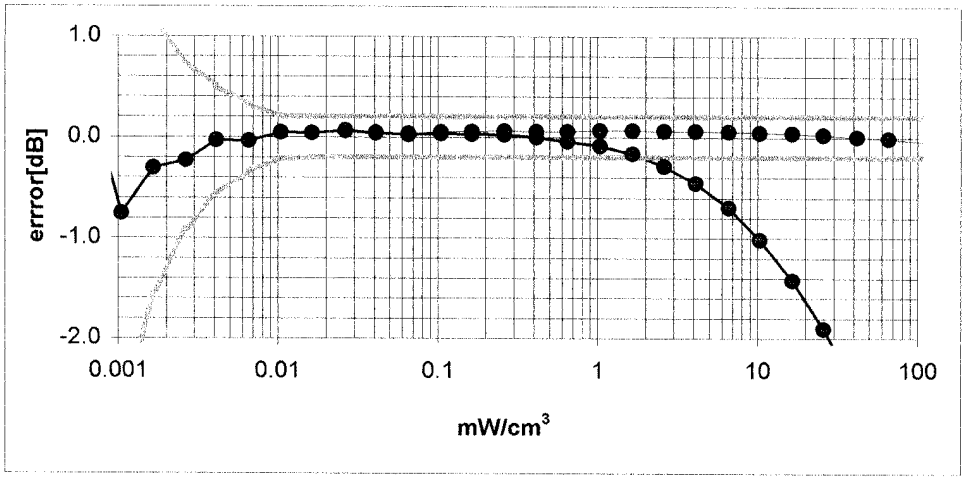
(TEM-Cell:ifi110, Waveguide R22)



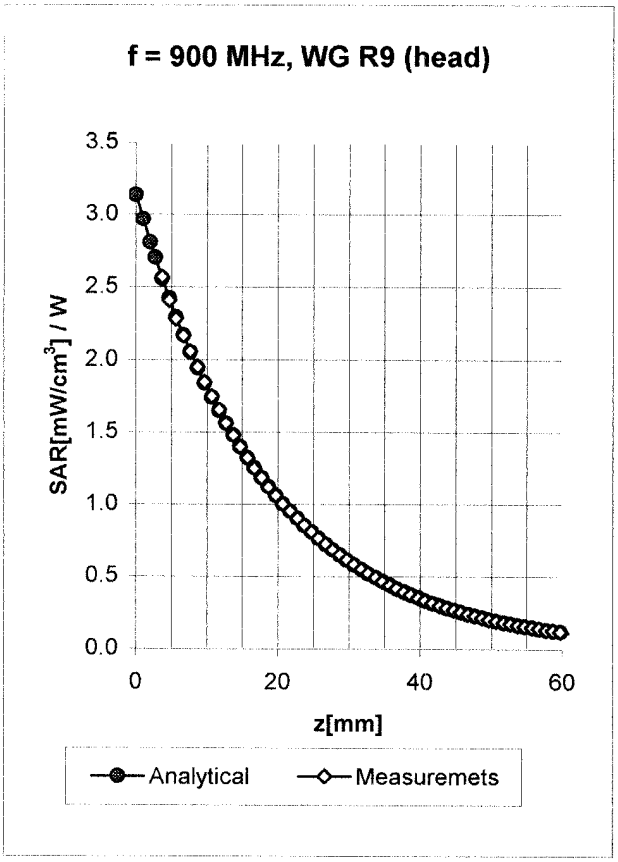
Dynamic Range f(SAR_{brain})

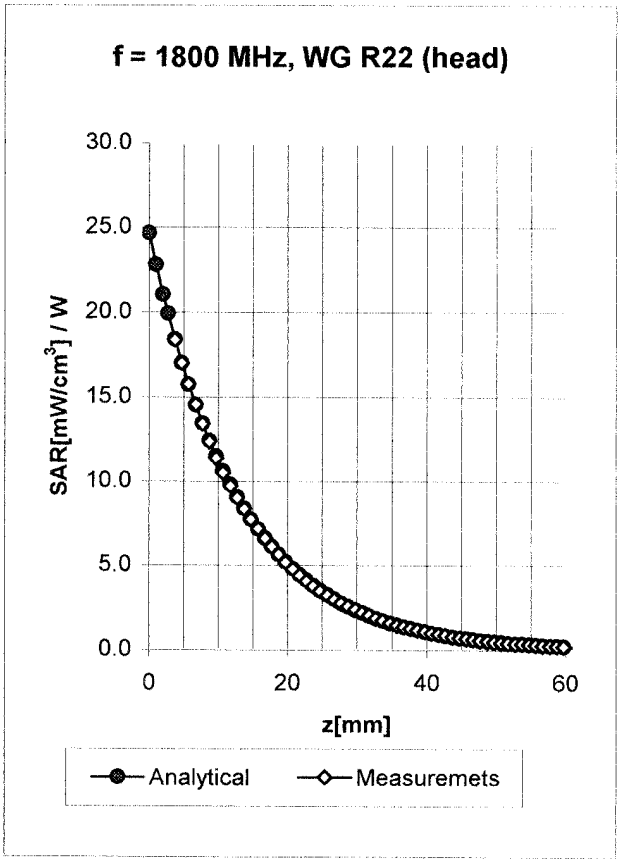
(Waveguide R22)





Conversion Factor Assessment

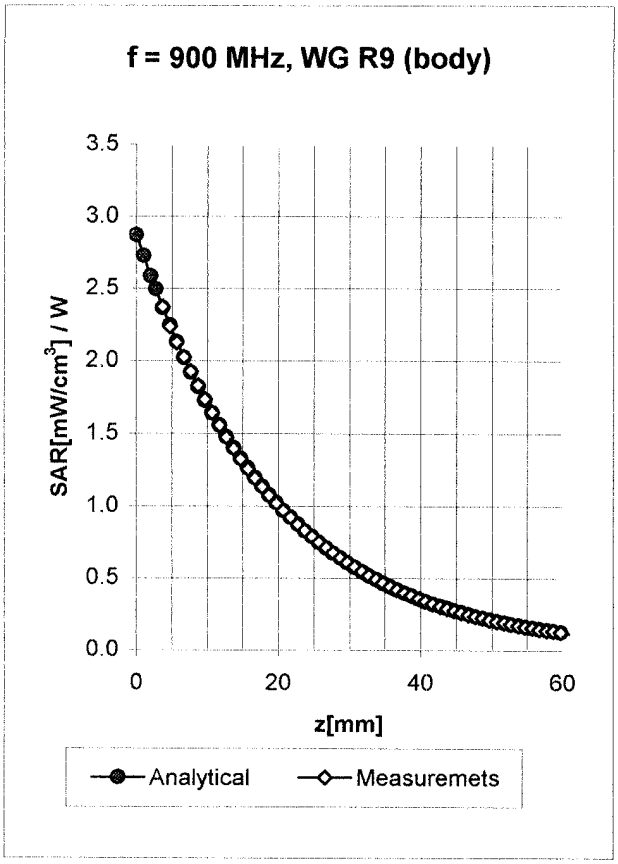


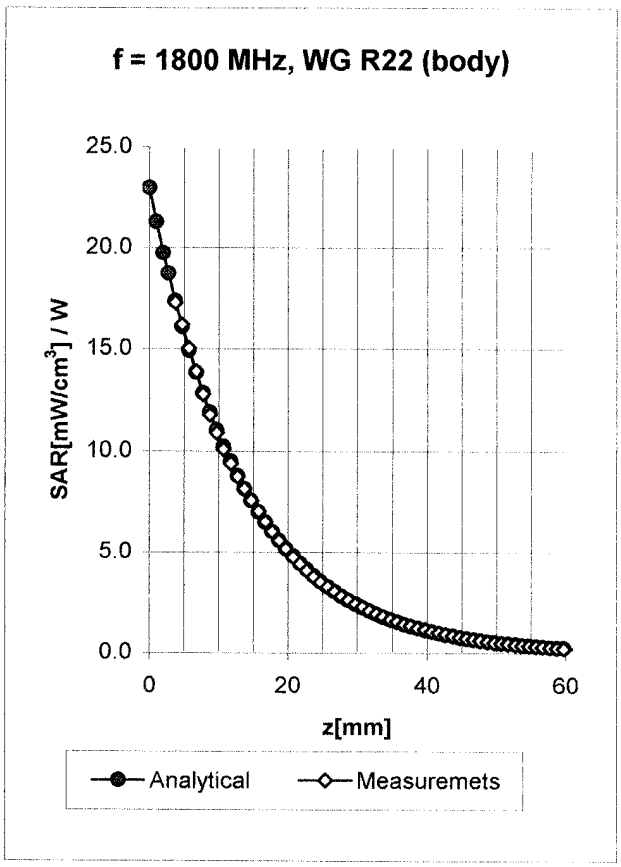


Head	**900 MHz**		ε_r = **41.5 ± 5%**	σ = **0.97 ± 5% mho/m**
Head	**835 MHz**		ε_r = **41.5 ± 5%**	σ = **0.90 ± 5% mho/m**
	ConvF X	**6.6** ± 9.5% (k=2)		Boundary effect:
	ConvF Y	**6.6** ± 9.5% (k=2)		Alpha **0.37**
	ConvF Z	**6.6** ± 9.5% (k=2)		Depth **2.61**

Head	**1800 MHz**		ε_r = **40.0 ± 5%**	σ = **1.40 ± 5% mho/m**
Head	**1900 MHz**		ε_r = **40.0 ± 5%**	σ = **1.40 ± 5% mho/m**
	ConvF X	**5.2** ± 9.5% (k=2)		Boundary effect:
	ConvF Y	**5.2** ± 9.5% (k=2)		Alpha **0.50**
	ConvF Z	**5.2** ± 9.5% (k=2)		Depth **2.73**

Conversion Factor Assessment

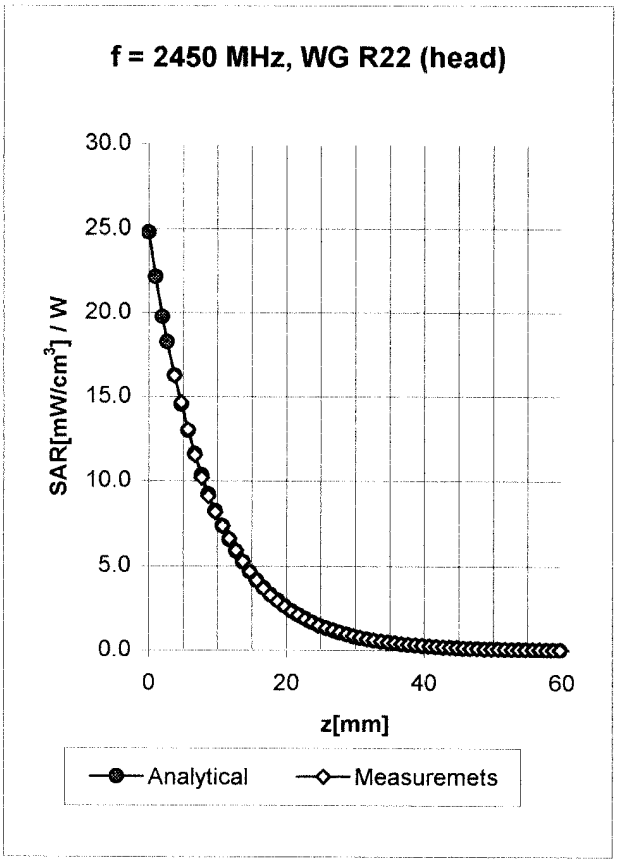


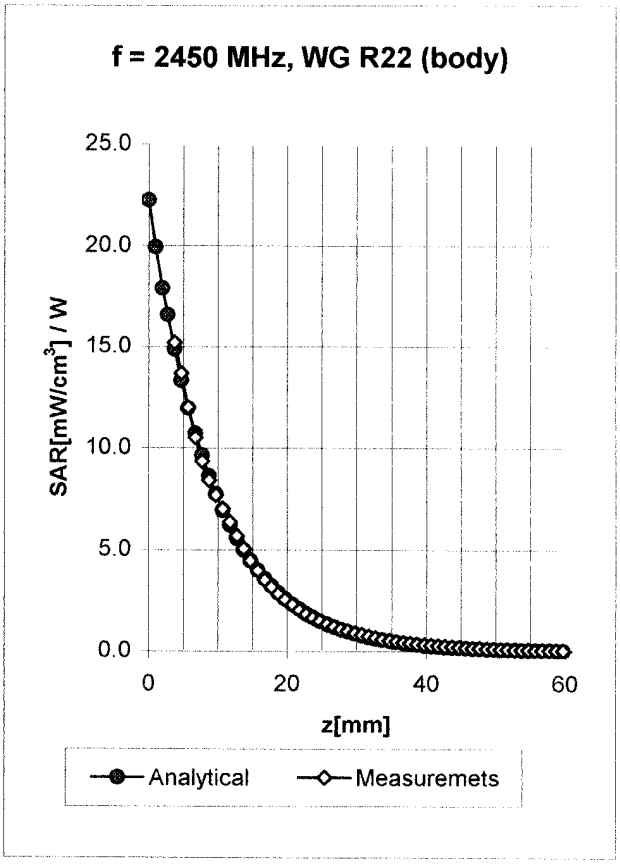


Body	**900 MHz**		ε_r = **55.0 ± 5%**	σ = **1.05 ± 5% mho/m**
Body	**835 MHz**		ε_r = **55.2 ± 5%**	σ = **0.97 ± 5% mho/m**
	ConvF X	**6.4** ± 9.5% (k=2)		Boundary effect:
	ConvF Y	**6.4** ± 9.5% (k=2)		Alpha **0.45**
	ConvF Z	**6.4** ± 9.5% (k=2)		Depth **2.35**

Body	**1800 MHz**		ε_r = **53.3 ± 5%**	σ = **1.52 ± 5% mho/m**
Body	**1900 MHz**		ε_r = **53.3 ± 5%**	σ = **1.52 ± 5% mho/m**
	ConvF X	**4.9** ± 9.5% (k=2)		Boundary effect:
	ConvF Y	**4.9** ± 9.5% (k=2)		Alpha **0.60**
	ConvF Z	**4.9** ± 9.5% (k=2)		Depth **2.59**

Conversion Factor Assessment





Head **2450** **MHz** ε_r **= 39.2 ± 5%** σ **= 1.80 ± 5% mho/m**

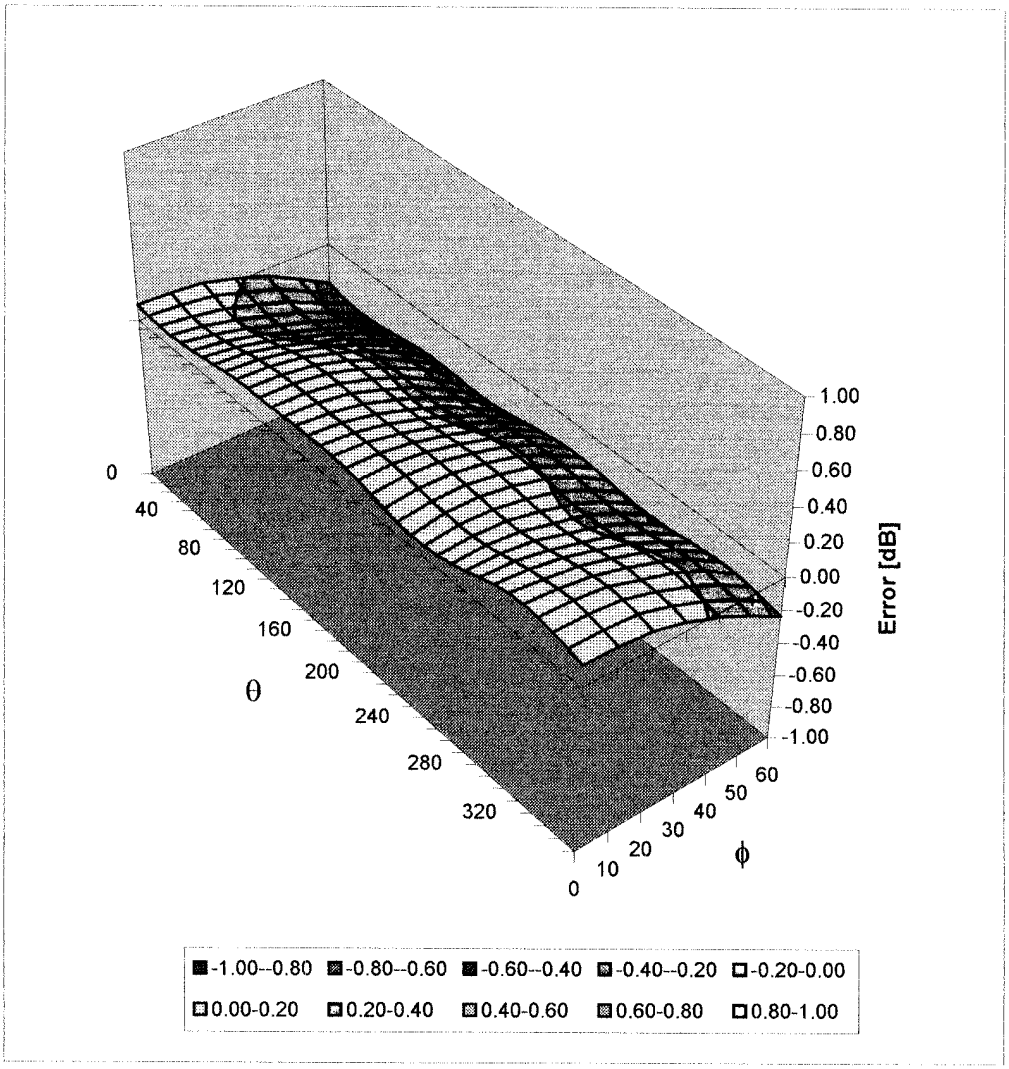
ConvF X	**5.0** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**5.0** ± 8.9% (k=2)	Alpha	**1.04**
ConvF Z	**5.0** ± 8.9% (k=2)	Depth	**1.85**

Body **2450** **MHz** ε_r **= 52.7 ± 5%** σ **= 1.95 ± 5% mho/m**

ConvF X	**4.6** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**4.6** ± 8.9% (k=2)	Alpha	**1.20**
ConvF Z	**4.6** ± 8.9% (k=2)	Depth	**1.60**

Deviation from Isotropy in HSL

Error (θ,φ), f = 900 MHz



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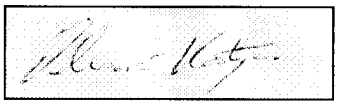
Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1387**
Place of Assessment:	**Zurich**
Date of Assessment:	**February 28, 2003**
Probe Calibration Date:	**February 26, 2003**

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by:



Dosimetric E-Field Probe ET3DV6 SN:1387

Conversion factor (± standard deviation)

150 MHz	ConvF	**9.1 ± 8%**	**ε_r = 52.3** **σ = 0.76 mho/m** (head tissue)
300 MHz	ConvF	**7.9 ± 8%**	**ε_r = 45.3** **σ = 0.87 mho/m** (head tissue)
450 MHz	ConvF	**7.5 ± 8%**	**ε_r = 43.5** **σ = 0.87 mho/m** (head tissue)
150 MHz	ConvF	**8.8 ± 8%**	**ε_r = 61.9** **σ = 0.80 mho/m** (body tissue)
300 MHz	ConvF	**8.0 ± 8%**	**ε_r = 58.2** **σ = 0.92 mho/m** (body tissue)
450 MHz	ConvF	**7.7 ± 8%**	**ε_r = 56.7** **σ = 0.94 mho/m** (body tissue)

APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

1800MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

May 07, 2003

Frequency	e'	e''
1.700000000 GHz	41.1614	13.5085
1.710000000 GHz	41.1392	13.5114
1.720000000 GHz	41.0987	13.5347
1.730000000 GHz	41.0593	13.5575
1.740000000 GHz	41.0167	13.5884
1.750000000 GHz	40.9817	13.6242
1.760000000 GHz	40.9460	13.6667
1.770000000 GHz	40.8994	13.6940
1.780000000 GHz	40.8594	13.7298
1.790000000 GHz	40.8193	13.7532
1.800000000 GHz	40.7597	13.7828
1.810000000 GHz	40.7121	13.8144
1.820000000 GHz	40.6472	13.8261
1.830000000 GHz	40.5930	13.8623
1.840000000 GHz	40.5661	13.8813
1.850000000 GHz	40.5236	13.8980
1.860000000 GHz	40.4985	13.9160
1.870000000 GHz	40.4537	13.9254
1.880000000 GHz	40.4176	13.9416
1.890000000 GHz	40.3807	13.9736
1.900000000 GHz	40.3351	13.9811

1900MHz EUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

May 07, 2003

Frequency	e'	e''
1.800000000 GHz	52.2876	14.6809
1.810000000 GHz	52.2353	14.7226
1.820000000 GHz	52.1880	14.7676
1.830000000 GHz	52.1394	14.7960
1.840000000 GHz	52.0910	14.8391
1.850000000 GHz	52.0610	14.8884
1.860000000 GHz	52.0146	14.9124
1.870000000 GHz	51.9586	14.9562
1.880000000 GHz	51.9412	15.0168
1.890000000 GHz	51.8972	15.0328
1.900000000 GHz	51.8594	15.0941
1.910000000 GHz	51.8094	15.1234
1.920000000 GHz	51.7825	15.1721
1.930000000 GHz	51.7571	15.2124
1.940000000 GHz	51.7183	15.2436
1.950000000 GHz	51.6699	15.2661
1.960000000 GHz	51.6244	15.2900
1.970000000 GHz	51.5486	15.3101
1.980000000 GHz	51.5049	15.3514
1.990000000 GHz	51.4513	15.3953
2.000000000 GHz	51.4102	15.4315

900MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

May 07, 2003

Frequency	e'	e''
800.000000 MHz	40.7601	19.3965
810.000000 MHz	40.6633	19.3759
820.000000 MHz	40.5020	19.3201
830.000000 MHz	40.3872	19.3224
840.000000 MHz	40.2114	19.2583
850.000000 MHz	40.0807	19.2670
860.000000 MHz	39.9478	19.2154
870.000000 MHz	39.8455	19.1875
880.000000 MHz	39.7398	19.1716
890.000000 MHz	39.6441	19.1438
900.000000 MHz	39.5702	19.0269
910.000000 MHz	39.4723	18.9729
920.000000 MHz	39.3474	18.9332
930.000000 MHz	39.2343	18.9058
940.000000 MHz	39.1243	18.8786
950.000000 MHz	38.9967	18.8767
960.000000 MHz	38.8905	18.8410
970.000000 MHz	38.7924	18.8227
980.000000 MHz	38.7016	18.8490
990.000000 MHz	38.5803	18.8254
1.000000000 GHz	38.4952	18.7918

835MHz EUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

May 07, 2003

Frequency	e'	e''
735.000000 MHz	57.7042	22.4744
745.000000 MHz	57.6177	22.4066
755.000000 MHz	57.5072	22.3605
765.000000 MHz	57.3904	22.2820
775.000000 MHz	57.2830	22.2492
785.000000 MHz	57.1833	22.1910
795.000000 MHz	57.0918	22.1426
805.000000 MHz	57.0545	22.0577
815.000000 MHz	56.9595	21.9783
825.000000 MHz	56.8809	21.9168
835.000000 MHz	56.7970	21.8750
845.000000 MHz	56.7034	21.8545
855.000000 MHz	56.5704	21.8060
865.000000 MHz	56.4779	21.7649
875.000000 MHz	56.3725	21.7623
885.000000 MHz	56.3137	21.7306
895.000000 MHz	56.2530	21.6201
905.000000 MHz	56.1941	21.5845
915.000000 MHz	56.0954	21.5081
925.000000 MHz	55.9797	21.4822
935.000000 MHz	55.9156	21.4457

APPENDIX F - SAM PHANTOM CERTIFICATE OF CONFORMITY

Schmid & Partner Engineering AG

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

Certificate of conformity / First Article Inspection

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

Tests

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

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

Standards

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

Conformity

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

Date 18.11.2001

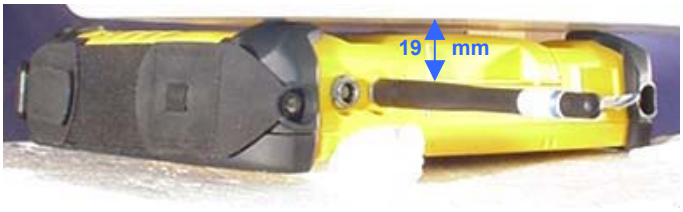
Signature / Stamp Schmid & Partner Engineering AG
Zeughausstrasse 43, CH-8004 Zurich
Tel. +41 1 245 97 00, Fax +41 1 245 97 79

APPENDIX G - SAR TEST SETUP PHOTOGRAPHS

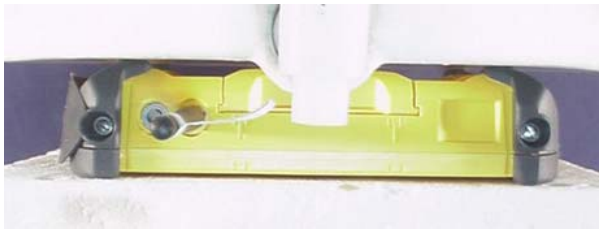
BODY SAR TEST SETUP PHOTOGRAPHS

0.0cm Separation Distance from Bottom of Handheld PC to Planar Phantom

Primary Coarse Scan Positioning



2nd Coarse Scan Positioning



BODY SAR TEST SETUP PHOTOGRAPHS

0.0cm Separation Distance from Left Side (Antenna Side) of Handheld PC to Planar Phantom