

DECLARATION OF COMPLIANCE SAR RF EXPOSURE EVALUATION

Test Lab

CELLTECH LABS INC.
Testing and Engineering Services
1955 Moss Court
Kelowna, B.C.
Canada V1Y 9L3
Phone: 250-448-7047
Fax: 250-448-7046
e-mail: info@celltechlabs.com
web site: www.celltechlabs.com

Applicant Information

VOCERA COMMUNICATIONS
20600 Lazaneo Drive, 3rd Floor
Cupertino, CA 95014

FCC Rule Part(s): FCC Test Procedure(s): Device Classification: DUT Type: Modulation: FCC ID: Model No.: Product Name: Tx Frequency Range: Max. RF Output Power Tested: Antenna Type: Battery Type(s): Body-Worn Accessories: Max. SAR Measured:	47 CFR §2.1093 OET Bulletin 65, Supplement C (01-01) Digital Transmission System (DTS) Body-Worn Wireless Communications Device Direct Sequence Spread Spectrum (DSSS) QGZB1000A B1000A Vocera Communications Badge 2412 - 2462 MHz 16.70 dBm EIRP (2437 MHz) Internal 3.7V Lithium-ion, 660 mAh 3.7V Lithium-ion, 900 mAh 1. Lanyard (P/N: 230-00536) 2. Pocket Clip (P/N: 230-00535) 3. Universal Clip (P/N: 230-00538) 4. Holster & Belt-Clip (P/N: 230-00537) 5. Speaker Horn (P/N: 230-01011) 6. Headset-Mic (Plantronics Model: M170) 0.0535 W/kg (1g average)
---	---

Celltech Labs Inc. declares under its sole responsibility that this wireless portable device has demonstrated compliance with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC 47 CFR §2.1093. The device was tested in accordance with the measurement standards and procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01) 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.

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



Russell Pipe
Senior Compliance Technologist
Celltech Labs Inc.



TABLE OF CONTENTS		
1.0	INTRODUCTION.....	3
2.0	DESCRIPTION OF DUT.....	3
3.0	SAR MEASUREMENT SYSTEM	4
4.0	MEASUREMENT SUMMARY.....	5
5.0	DETAILS OF SAR EVALUATION.....	6
6.0	EVALUATION PROCEDURES.....	6
7.0	SYSTEM PERFORMANCE CHECK.....	7
8.0	SIMULATED EQUIVALENT TISSUES.....	8
9.0	SAR SAFETY LIMITS.....	8
10.0	ROBOT SYSTEM SPECIFICATIONS.....	9
11.0	PROBE SPECIFICATION.....	10
12.0	SAM PHANTOM	10
13.0	DEVICE HOLDER.....	10
14.0	TEST EQUIPMENT LIST.....	11
15.0	MEASUREMENT UNCERTAINTIES.....	12-13
16.0	REFERENCES.....	14
APPENDIX A - SAR MEASUREMENT DATA.....		15
APPENDIX B - SYSTEM PERFORMANCE CHECK DATA.....		16
APPENDIX C - SYSTEM VALIDATION.....		17
APPENDIX D - PROBE CALIBRATION.....		18
APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS.....		19
APPENDIX F - SAM PHANTOM CERTIFICATE OF CONFORMITY.....		20
APPENDIX G - SAR TEST SETUP & DUT PHOTOGRAPHS.....		21

1.0 INTRODUCTION

This measurement report demonstrates that the Vocera Communications Body-worn Transmitter Model: B1000A FCC ID: QGZB1000A complies with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]) for the General Population / Uncontrolled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [2]) 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 DEVICE UNDER TEST (DUT)

FCC Rule Part(s)	47 CFR §2.1093
Test Procedure(s)	FCC OET Bulletin 65, Supplement C (01-01)
FCC Device Classification	Digital Transmission System (DTS)
Device Type	Body-Worn Wireless Communications Device
FCC ID	QGZB1000A
Model(s)	B1000A
Product Name	Vocera Communications Badge
Serial No.	XXK0300031S (Identical Prototype)
Modulation	Direct Sequence Spread Spectrum (DSSS)
Tx Frequency Range	2412 - 2462 MHz
Max. RF Output Power Measured	16.70 dBm EIRP (2437 MHz)
Antenna Type(s)	Internal
Battery Type(s)	3.7V Lithium-ion, 660 mAh (Standard) 3.7V Lithium-ion, 900 mAh (Extended)
Body-Worn Accessories Tested	1. Lanyard (P/N: 230-00536) 2. Pocket Clip (P/N: 230-00535) 3. Universal Clip (P/N: 230-00538) 4. Holster & Belt-Clip (P/N: 230-00537) 5. Speaker Horn (P/N: 230-01011) 6. Headset-Mic (Plantronics Model: M170)

3.0 SAR MEASUREMENT SYSTEM

Celltech Labs Inc. SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY4 measurement system is comprised of the measurement server, 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 DASY4 measurement server. The DAE4 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 DASY4 measurement server 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. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.



DASY4 SAR Measurement System with SAM phantom



DASY4 SAR Measurement System with SAM Phantom

4.0 MEASUREMENT SUMMARY

BODY SAR MEASUREMENT RESULTS

Freq. (MHz)	Chan.	Test Mode	EIRP before Test (dBm)	Power Drift During Test (dB)	Battery Type	DUT Position	Body-Worn Accessory Type	Separation Distance to Planar Phantom (cm)	Max. Power Drift (dB)	SAR 1g (W/kg)			
										Measured		Scaled	
2437	6	DSSS	16.70	-0.32	Standard	Back Side	Lanyard	0.0	-1.58	0.0179		0.0258	
2437	6	DSSS	16.70	-0.49	Standard	Back Side	Lanyard & Speaker Horn	0.0	-1.58	P	0.0205	P	0.0295
										S	0.0240	S	0.0345
2437	6	DSSS	16.70	-1.58	Standard	Back Side	Universal Clip	0.0	-1.58	0.0201		0.0289	
2437	6	DSSS	16.70	-1.20	Standard	Back Side	Universal Clip & Speaker Horn	0.0	-1.58	0.0203		0.0292	
2437	6	DSSS	16.70	-1.39	Standard	Back Side	Holster/Belt-Clip & Headset-Mic	2.5	-1.58	0.00631		0.00908	
2437	6	DSSS	16.70	-1.21	Standard	Back Side	Pocket Clip	0.0	-1.58	0.0320		0.0460	
2437	6	DSSS	16.70	-1.07	Extended	Back Side	Pocket Clip	0.0	-1.58	P	0.0372	P	0.0535
										S	0.0233	S	0.0335

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)	11/25/03		Relative Humidity	61 %
Measured Mixture Type	2450MHz Muscle		Atmospheric Pressure	102.1 kPa
Dielectric Constant ϵ_r	IEEE Target	Measured	Ambient Temperature	23.6 °C
	52.7 ±5%	51.1	Fluid Temperature	23.8 °C
Conductivity σ (mho/m)	IEEE Target	Measured	Fluid Depth	≥ 15 cm
	1.95 ±5%	2.02	ρ (Kg/m ³)	1000

Note(s):

- The measurement results were obtained with the DUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
- SAR measurements performed at the mid channel were ≥ 3dB below the SAR limit; therefore, SAR evaluation for the low and high channels was optional (per FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3])).
- The extended-life battery is thicker than the standard-life battery, and therefore provides increased separation distance between the device and the user's body. The DUT was evaluated for SAR with the extended-life battery in the test configuration that produced the highest SAR level with the standard-life battery (DUT with Pocket Clip accessory).
- Secondary peak SAR locations within 2dB of the maximum were evaluated and reported as shown in the table above table and Appendix A (SAR Test Plots) - P = Primary, S = Secondary.
- The power drift measured by the SAR measurement system was > 5%. The maximum measured power drift was added to the measured SAR levels to show scaled SAR results as listed in the above table.
- The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluation. The temperatures listed were consistent for all measurement periods.
- The dielectric properties of the simulated body tissue were measured prior to the evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters).

5.0 DETAILS OF SAR EVALUATION

The Vocera Communications Body-worn Transmitter Model: B1000A FCC ID: QGZB1000A was found to be compliant for localized Specific Absorption Rate (Uncontrolled Exposure) based on the test provisions and conditions described below. Detailed photographs of the measurement setup are shown in Appendix G.

1. The DUT was tested for body SAR with the Lanyard accessory. The back of the DUT was positioned parallel to the outer surface of the SAM phantom (planar section) with a 0.0 cm separation distance.
2. The DUT was tested for body SAR with the Lanyard accessory and the Speaker Horn accessory. The back of the DUT was positioned parallel to the outer surface of the SAM phantom (planar section) with a 0.0 cm separation distance.
3. The DUT was tested for body SAR with the Universal Clip accessory. The back of the DUT was positioned parallel to the outer surface of the SAM phantom (planar section) with a 0.0 cm separation distance.
4. The DUT was tested for body SAR with the Universal Clip accessory and the Speaker Horn accessory. The back of the DUT was positioned parallel to the outer surface of the SAM phantom (planar section) with a 0.0 cm separation distance.
5. The DUT was tested for body SAR with the Holster and Belt-Clip accessory, and Headset-Mic accessory. The back of the DUT was positioned parallel to the outer surface of the SAM phantom (planar section). The Holster and Belt-Clip accessory provided a 2.5 cm separation distance between the back of the DUT and the outer surface of the SAM phantom (planar section).
6. The DUT was tested for body SAR with the Pocket Clip accessory. The back of the DUT was positioned parallel to the outer surface of the SAM phantom (planar section) with a 0.0 cm separation distance.
7. The extended-life battery is thicker than the standard-life battery, and therefore provides increased separation distance between the device and the user's body. The DUT was evaluated for SAR with the extended-life battery in the test configuration that produced the highest SAR level with the standard-life battery (DUT with Pocket Clip accessory). The DUT was tested with fully charged batteries.
8. The conducted power level could not be measured for the SAR evaluation. The DUT was evaluated for SAR at the maximum conducted power level set by the manufacturer. EIRP measurements were performed using the signal substitution method in accordance with ANSI TIA/EIA-603-A-2001.
9. The power drift of the DUT measured by the SAR measurement system was > 5%. The maximum measured power drift was added to the measured SAR levels to show scaled SAR results, as reported in the test data table (page 5).
10. The DUT was controlled via internal software and was tested at maximum power in modulated DSSS continuous transmit mode.
11. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluation. The temperatures listed were consistent for all measurement periods.
12. The dielectric properties of the simulated body tissue were measured prior to the evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters).

6.0 EVALUATION PROCEDURES

- (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 using the SAM phantom.
- (ii) For body-worn and face-held devices a planar phantom was used.
- The SAR was determined by a pre-defined procedure within the DASY4 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 15mm x 15mm.

An area scan was determined as follows:

- Based on the defined area scan grid, a more detailed grid is created to increase the points by a factor of 10. The interpolation function then evaluates all field values between corresponding measurement points.
- A linear search is applied to find all the candidate maxima. Subsequently, all maxima are removed that are >2 dB from the global maximum. The remaining maxima are then used to position the cube scans.

A 1g and 10g spatial peak SAR was determined as follows:

- Extrapolation is used to find the points between the dipole center of the probe and the surface of the phantom. This data cannot be measured, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.4 mm (see probe calibration document in Appendix D). The extrapolation was based on trivariate quadratics computed from the previously calculated 3D interpolated points nearest the phantom surface.
- Interpolated data is used to calculate the average SAR over 1g and 10g cubes by spatially discretizing the entire measured cube. The volume used to determine the averaged SAR is a 1mm grid (42875 interpolated points).

7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation, a system check was performed in the planar section of the SAM phantom with a 2450MHz dipole (see Appendix C for detailed system validation procedures). The dielectric parameters of the simulated brain tissue mixture were measured 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 250 mW was applied to the dipole and the system was verified to a tolerance of $\pm 10\%$ (see Appendix B for system performance check test plot).

SYSTEM PERFORMANCE CHECK													
Test Date	2450MHz Equiv. Tissue	SAR 1g (W/kg)		Dielectric Constant ϵ_r		Conductivity σ (mho/m)		ρ (Kg/m ³)	Amb. Temp. (°C)	Fluid Temp. (°C)	Fluid Depth (cm)	Humid. (%)	Barom. Press. (kPa)
		IEEE Target	Measured	IEEE Target	Measured	IEEE Target	Measured						
11/25/03	Brain	13.1 $\pm 10\%$	13.7 $+4.6\%$	39.2 $\pm 5\%$	37.6	1.80 $\pm 5\%$	1.89	1000	23.9	24.0	≥ 15	61	102.1

Note(s):

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

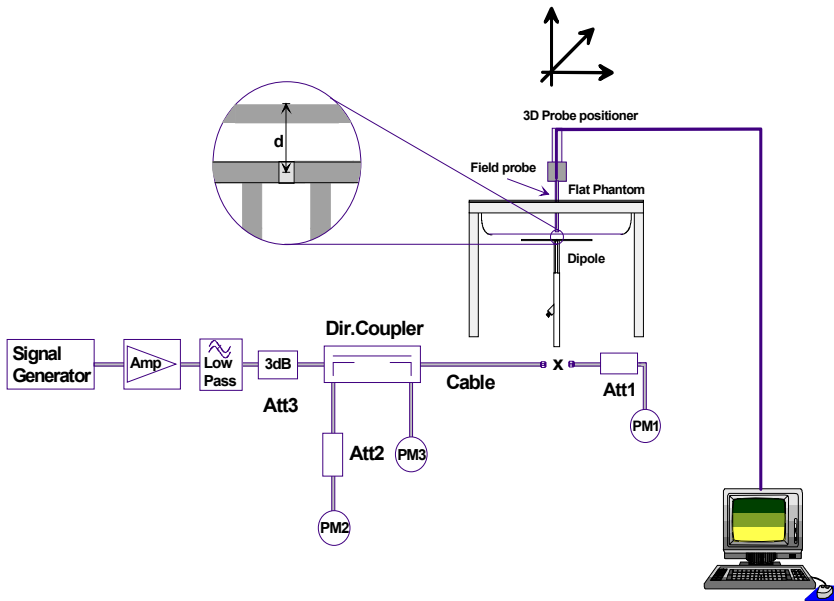


Figure 1. System Performance Check Setup Diagram



2450MHz Dipole Setup

8.0 SIMULATED TISSUE MIXTURES

The 2450MHz brain and body simulated tissue mixtures consist of Glycol-monobutyl, water, and salt (body mixture only). The fluid was prepared according to standardized procedures and measured for dielectric parameters (permittivity and conductivity).

TISSUE MIXTURES		
INGREDIENT	2450MHz Brain (System Check)	2450MHz Body (DUT Evaluation)
Water	55.20 %	69.95 %
Glycol Monobutyl	44.80 %	30.00 %
Salt	-	0.05 %

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: AMD Athlon XP 2400+
Clock Speed: 2.0 GHz
Operating System: Windows XP Professional

Data Converter

Features: Signal Amplifier, multiplexer, A/D converter, and control logic
Software: DASY4 software
Connecting Lines: Optical downlink for data and status info.
 Optical uplink for commands and clock

DASY4 Measurement Server

Function: Real-time data evaluation for field measurements and surface detection
Hardware: PC/104 166MHz Pentium CPU; 32 MB chipdisk; 64 MB RAM
Connections: COM1, COM2, DAE, Robot, Ethernet, Service Interface

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(s)

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

11.0 PROBE SPECIFICATION (ET3DV6)

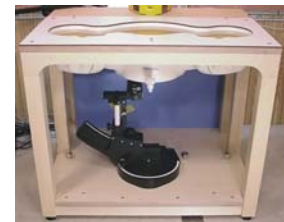
Construction:	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g. glycol)
Calibration:	In air from 10 MHz to 2.5 GHz In brain simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy $\pm 8\%$)
Frequency: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



ET3DV6 E-Field Probe

12.0 SAM PHANTOM V4.0C

The SAM phantom V4.0C is a fiberglass shell phantom with a 2.0 mm (+/-0.2 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 (see Appendix F for specifications of the SAM phantom V4.0C).



SAM Phantom

13.0 DEVICE HOLDER

The DASY4 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

TEST EQUIPMENT	SERIAL NO.	CALIBRATION DATE
Schmid & Partner DASY4 System	-	-
DASY4 Measurement Server	1078	N/A
-Robot	599396-01	N/A
-ET3DV6 E-Field Probe	1387	Feb 2003
-300MHz Validation Dipole	135	Oct 2003
-450MHz Validation Dipole	136	Nov 2003
-900MHz Validation Dipole	054	June 2003
-1800MHz Validation Dipole	247	June 2003
-2450MHz Validation Dipole	150	Sept 2003
-SAM Phantom V4.0C	1033	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	April 2003
HP 8753E Network Analyzer	US38433013	May 2003
HP 8648D Signal Generator	3847A00611	May 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 Standard 1528-200X (Draft - see reference [3])

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 Standard 1528-200X (Draft - see reference [3])

16.0 REFERENCES

- [1] Federal Communications Commission, "Radiofrequency radiation exposure evaluation: portable devices", Rule Part 47 CFR §2.1093: 1999.
- [2] 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.
- [3] IEEE Standards Coordinating Committee 34, Std 1528-200X, "DRAFT Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques".

APPENDIX A - SAR MEASUREMENT DATA

Date Tested: 11/25/03

DUT: Vocera Communications Model: B1000A; Type: Body-Worn Communications Device; Serial: XXK0300031S

Ambient Temp: 23.6°C; Fluid Temp: 23.8°C; Barometric Pressure: 102.1 kPa; Humidity: 61%

With Lanyard Accessory
0.0 cm Separation Distance to Planar Phantom
3.7V Lithium-ion Battery (Standard)
RF Output Power: 16.70 dBm (EIRP)

Communication System: DSSS
Frequency: 2437 MHz; Channel 6; Duty Cycle: 1:1
Medium: M2450 ($\sigma = 2.02$ mho/m, $\epsilon_r = 51.1$, $\rho = 1000$ kg/m³)

- Probe: ET3DV6 - SN1387; ConvF(4.6, 4.6, 4.6); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 13/10/2003
- Phantom: SAM front; Type: SAM 4.0; Serial: 1033
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

Body-worn - Back of DUT with Lanyard - Standard Battery/Area Scan (7x13x1):

Measurement grid: dx=10mm, dy=10mm

Body-worn - Back of DUT with Lanyard - Standard Battery/Zoom Scan (7x7x7)/Cube 0:

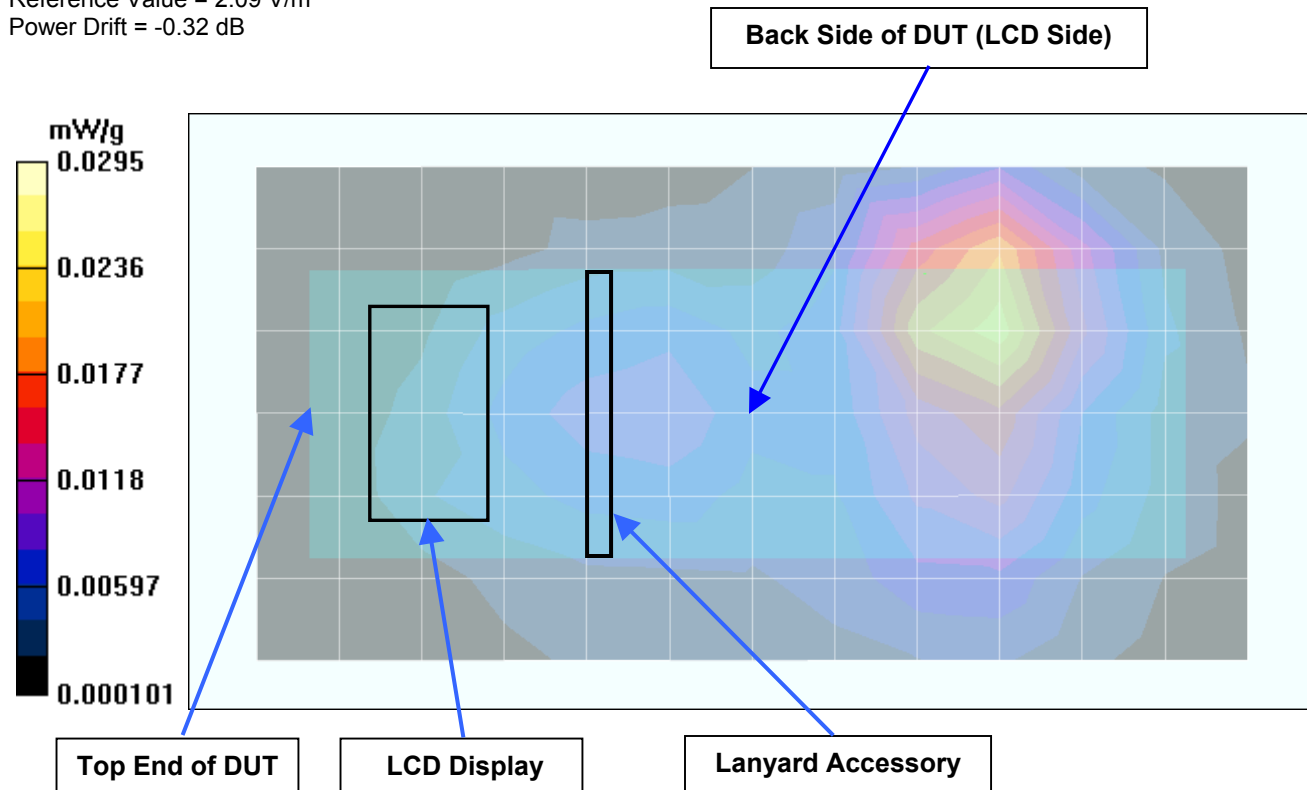
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Peak SAR (extrapolated) = 0.0374 W/kg

SAR(1 g) = 0.0179 mW/g; SAR(10 g) = 0.00959 mW/g

Reference Value = 2.09 V/m

Power Drift = -0.32 dB



Date Tested: 11/25/03

DUT: Vocera Communications Model: B1000A; Type: Body-Worn Communications Device; Serial: XXK0300031S

Ambient Temp: 23.6°C; Fluid Temp: 23.8°C; Barometric Pressure: 102.1 kPa; Humidity: 61%

With Lanyard & Speaker Horn Accessories

0.0 cm Separation Distance to Planar Phantom

3.7V Lithium-ion Battery (Standard)

RF Output Power: 16.70 dBm (EIRP)

Communication System: DSSS

Frequency: 2437 MHz; Channel 6; Duty Cycle: 1:1

Medium: M2450 ($\sigma = 2.02$ mho/m, $\epsilon_r = 51.1$, $\rho = 1000$ kg/m³)

- Probe: ET3DV6 - SN1387; ConvF(4.6, 4.6, 4.6); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 13/10/2003
- Phantom: SAM front; Type: SAM 4.0; Serial: 1033
- Measurement SW: DAS4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

Body-worn - Back of DUT with Lanyard & Speaker Horn - Standard Battery/Area Scan (7x13x1):

Measurement grid: dx=10mm, dy=10mm

Body-worn - Back of DUT with Lanyard & Speaker Horn - Standard Battery/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Peak SAR (extrapolated) = 0.0806 W/kg

SAR(1 g) = 0.0205 mW/g; SAR(10 g) = 0.0115 mW/g

Reference Value = 2.46 V/m

Power Drift = -0.49 dB

Body-worn - Back of DUT with Lanyard & Speaker Horn - Standard Battery/Zoom Scan (7x7x7)/Cube 1:

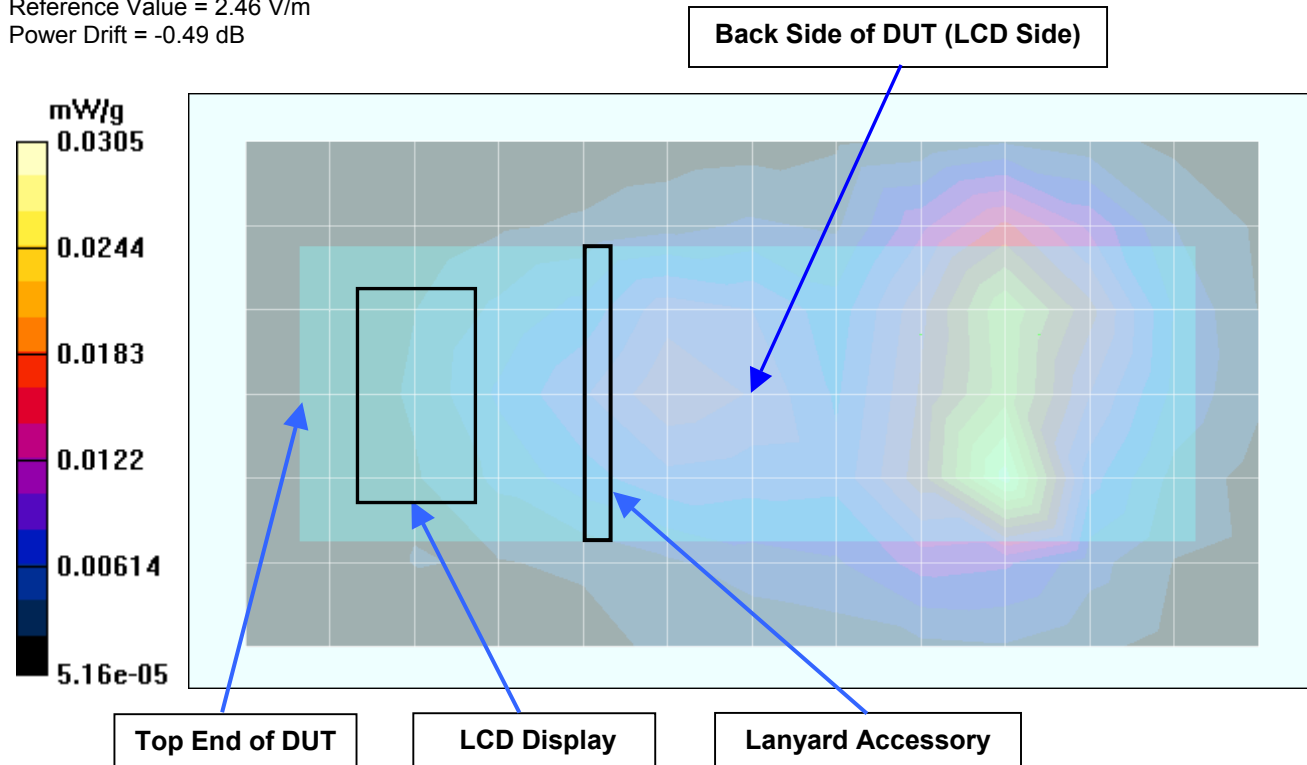
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Peak SAR (extrapolated) = 0.0986 W/kg

SAR(1 g) = 0.0240 mW/g; SAR(10 g) = 0.0127 mW/g

Reference Value = 2.46 V/m

Power Drift = -0.49 dB



Date Tested: 11/25/03

DUT: Vocera Communications Model: B1000A; Type: Body-Worn Communications Device; Serial: XXK0300031S

Ambient Temp: 23.6°C; Fluid Temp: 23.8°C; Barometric Pressure: 102.1 kPa; Humidity: 61%

With Universal Clip Accessory
0.0 cm Separation Distance to Planar Phantom
3.7V Lithium-ion Battery (Standard)
RF Output Power: 16.70 dBm (EIRP)

Communication System: DSSS
Frequency: 2437 MHz; Channel 6; Duty Cycle: 1:1
Medium: M2450 ($\sigma = 2.02 \text{ mho/m}$, $\epsilon_r = 51.1$, $\rho = 1000 \text{ kg/m}^3$)

- Probe: ET3DV6 - SN1387; ConvF(4.6, 4.6, 4.6); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 13/10/2003
- Phantom: SAM front; Type: SAM 4.0; Serial: 1033
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

Body-worn - Back of DUT with Universal Clip - Standard Battery/Area Scan (7x13x1):

Measurement grid: dx=10mm, dy=10mm

Body-worn - Back of DUT with Universal Clip - Standard Battery/Zoom Scan (7x7x7)/Cube 0:

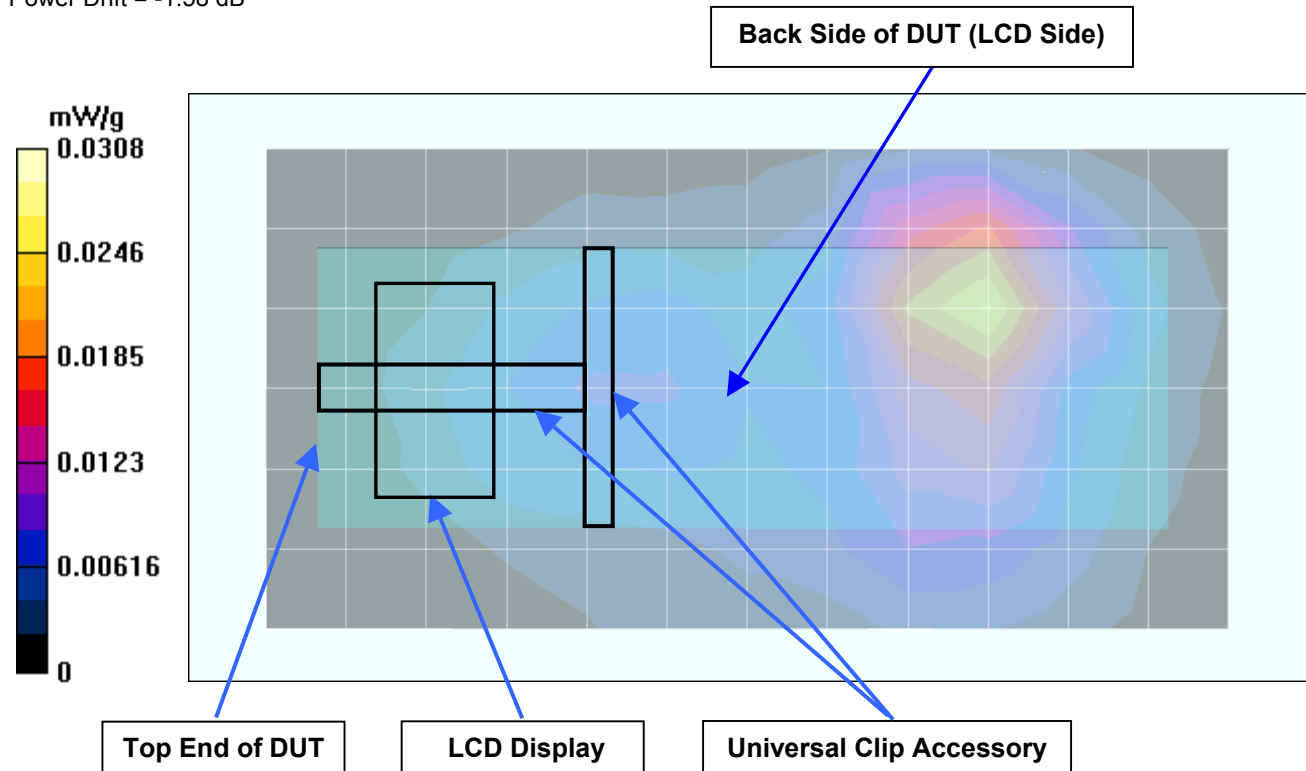
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Peak SAR (extrapolated) = 0.0463 W/kg

SAR(1 g) = 0.0201 mW/g; SAR(10 g) = 0.0103 mW/g

Reference Value = 2.4 V/m

Power Drift = -1.58 dB



Date Tested: 11/25/03

DUT: Vocera Communications Model: B1000A; Type: Body-Worn Communications Device; Serial: XXK0300031S

Ambient Temp: 23.6°C; Fluid Temp: 23.8°C; Barometric Pressure: 102.1 kPa; Humidity: 61%

With Universal Clip & Speaker Horn Accessories
0.0 cm Separation Distance to Planar Phantom
3.7V Lithium-ion Battery (Standard)
RF Output Power: 16.70 dBm (EIRP)

Communication System: DSSS
Frequency: 2437 MHz; Channel 6; Duty Cycle: 1:1
Medium: M2450 ($\sigma = 2.02$ mho/m, $\epsilon_r = 51.1$, $\rho = 1000$ kg/m³)

- Probe: ET3DV6 - SN1387; ConvF(4.6, 4.6, 4.6); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 13/10/2003
- Phantom: SAM front; Type: SAM 4.0; Serial: 1033
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

Body-worn - Back of DUT with Universal Clip & Speaker Horn - Standard Battery/Area Scan (7x13x1):

Measurement grid: dx=10mm, dy=10mm

Body-worn - Back of DUT with Universal Clip & Speaker Horn - Standard Battery/Zoom Scan (7x7x7)/Cube 0:

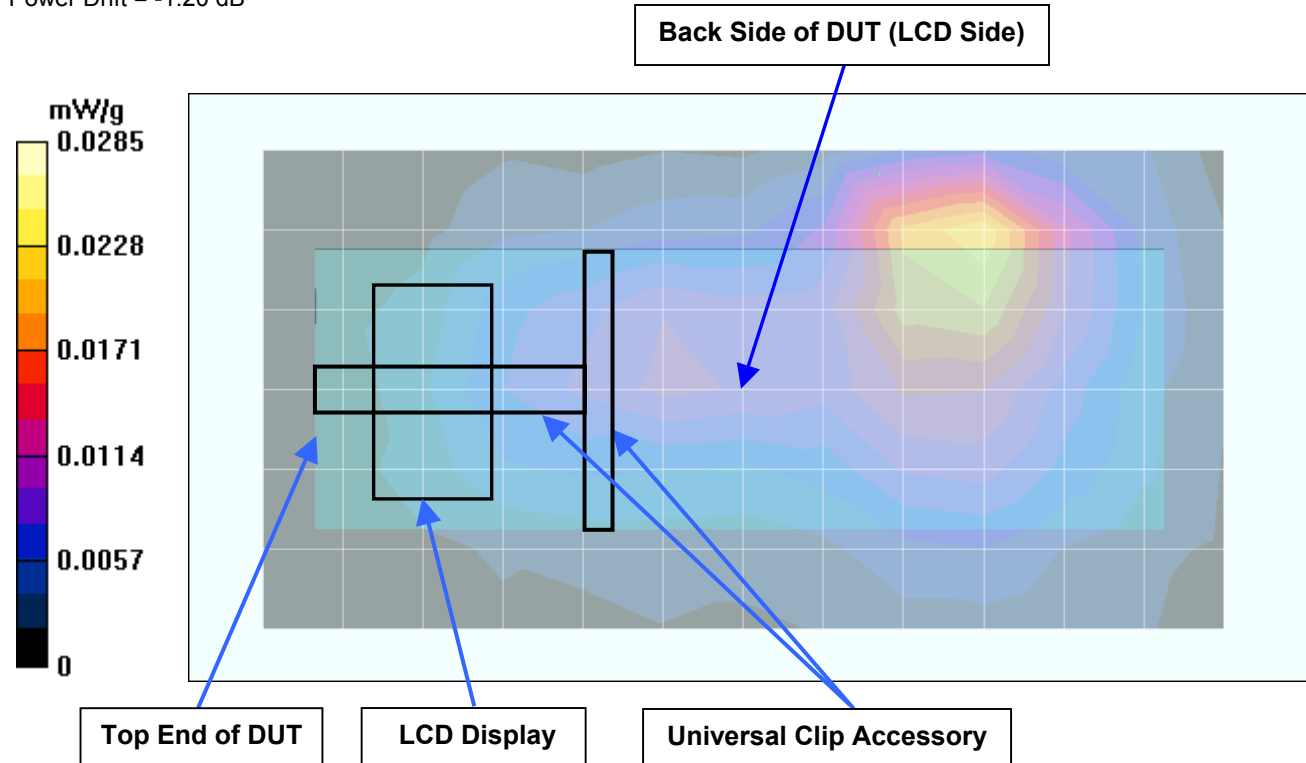
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Peak SAR (extrapolated) = 0.0711 W/kg

SAR(1 g) = 0.0203 mW/g; SAR(10 g) = 0.0116 mW/g

Reference Value = 2.59 V/m

Power Drift = -1.20 dB



Date Tested: 11/25/03

DUT: Vocera Communications Model: B1000A; Type: Body-Worn Communications Device; Serial: XXK0300031S

Ambient Temp: 23.6°C; Fluid Temp: 23.8°C; Barometric Pressure: 102.1 kPa; Humidity: 61%

With Holster, Belt-Clip, & Headset-Mic Accessories
2.5 cm Holster/Belt-Clip Separation Distance to Planar Phantom
3.7V Lithium-ion Battery (Standard)
RF Output Power: 16.70 dBm (EIRP)

Communication System: DSSS
Frequency: 2437 MHz; Channel 6; Duty Cycle: 1:1
Medium: M2450 ($\sigma = 2.02 \text{ mho/m}$, $\epsilon_r = 51.1$, $\rho = 1000 \text{ kg/m}^3$)

- Probe: ET3DV6 - SN1387; ConvF(4.6, 4.6, 4.6); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 13/10/2003
- Phantom: SAM front; Type: SAM 4.0; Serial: 1033
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

Body-worn - Back of DUT with Holster, Belt-Clip, & Headset-Mic - Standard Battery/Area Scan (7x13x1):

Measurement grid: dx=10mm, dy=10mm

Body-worn - Back of DUT with Holster, Belt-Clip, & Headset-Mic - Standard Battery/Zoom Scan (7x7x7)/Cube 0:

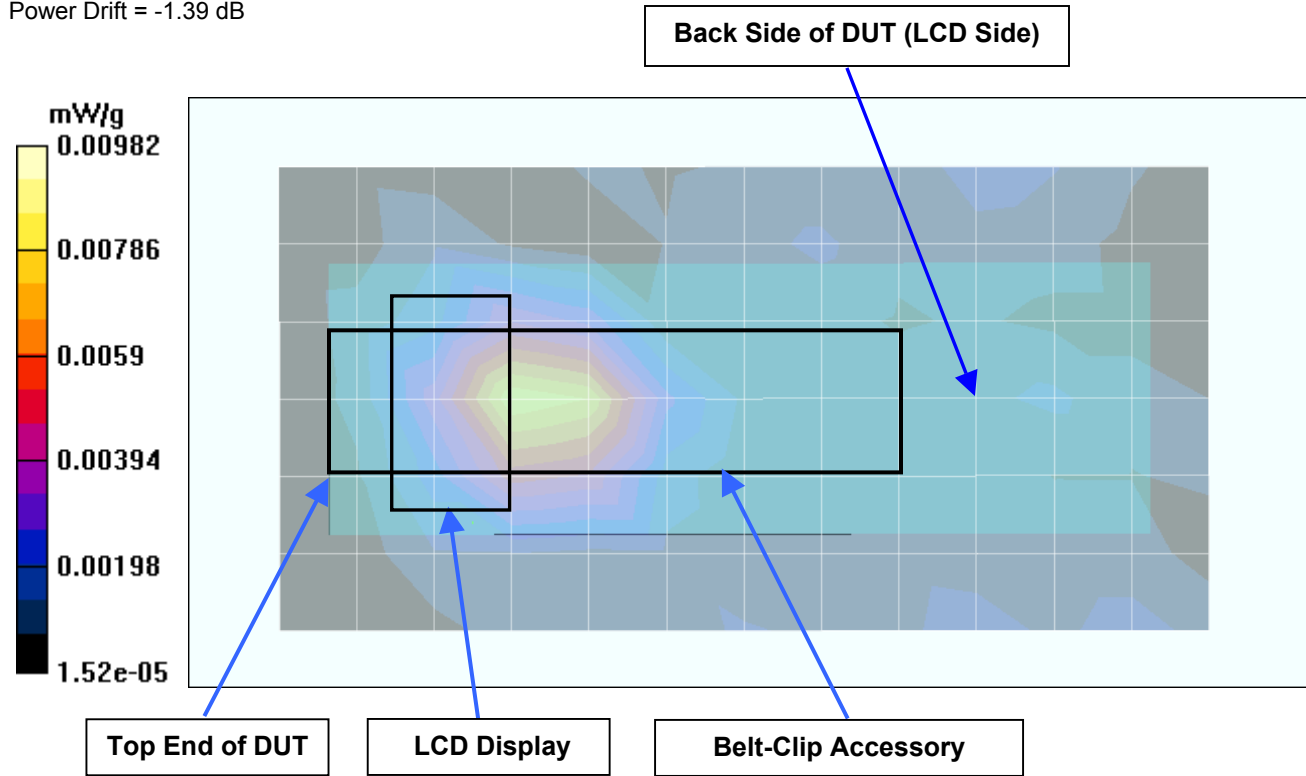
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Peak SAR (extrapolated) = 0.0743 W/kg

SAR(1 g) = 0.00631 mW/g; SAR(10 g) = 0.00352 mW/g

Reference Value = 2.2 V/m

Power Drift = -1.39 dB



Date Tested: 11/25/03

DUT: Vocera Communications Model: B1000A; Type: Body-Worn Communications Device; Serial: XXK0300031S

Ambient Temp: 23.6°C; Fluid Temp: 23.8°C; Barometric Pressure: 102.1 kPa; Humidity: 61%

With Pocket Clip Accessory
0.0 cm Separation Distance to Planar Phantom
3.7V Lithium-ion Battery (Standard)
RF Output Power: 16.70 dBm (EIRP)

Communication System: DSSS
Frequency: 2437 MHz; Channel 6; Duty Cycle: 1:1
Medium: M2450 ($\sigma = 2.02$ mho/m, $\epsilon_r = 51.1$, $\rho = 1000$ kg/m³)

- Probe: ET3DV6 - SN1387; ConvF(4.6, 4.6, 4.6); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 13/10/2003
- Phantom: SAM front; Type: SAM 4.0; Serial: 1033
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

Body-worn - Back of DUT with Pocket Clip - Standard Battery/Area Scan (7x13x1):

Measurement grid: dx=10mm, dy=10mm

Body-worn - Back of DUT with Pocket Clip - Standard Battery/Zoom Scan (7x7x7)/Cube 0:

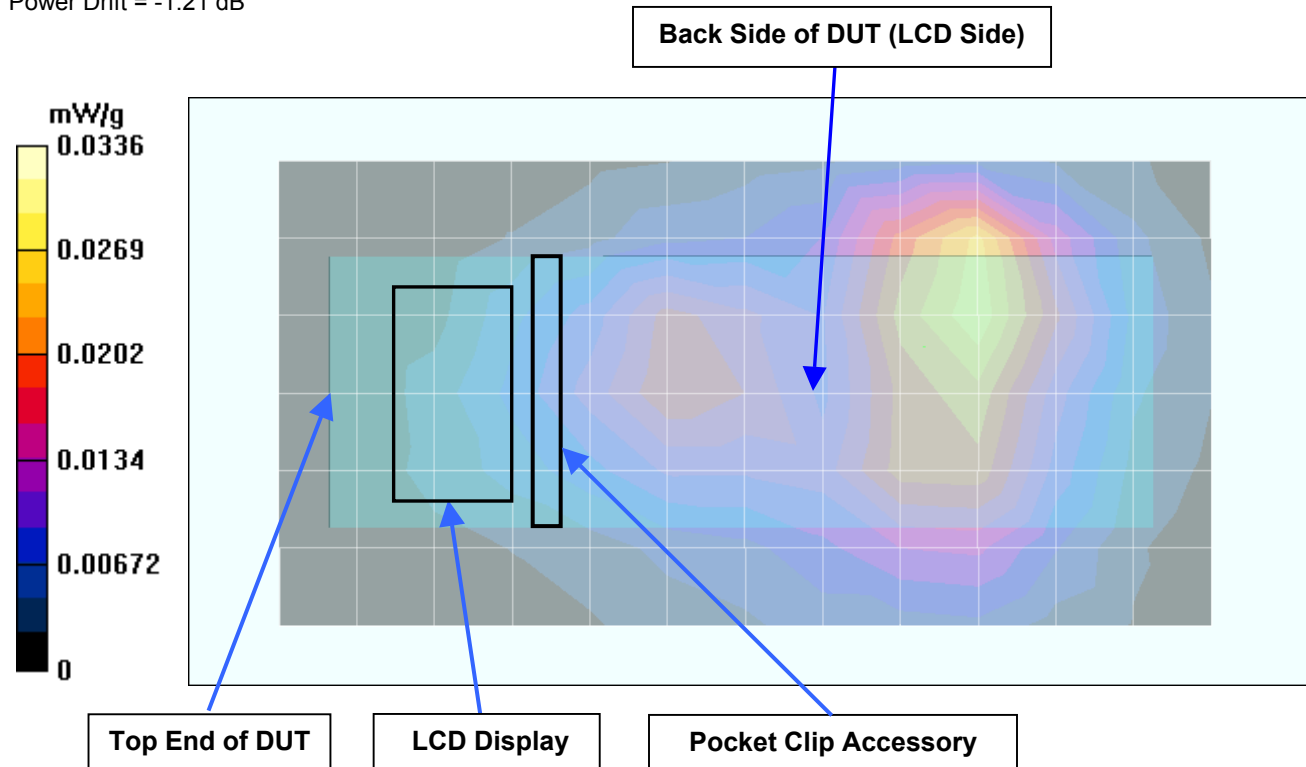
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Peak SAR (extrapolated) = 0.0842 W/kg

SAR(1 g) = 0.032 mW/g; SAR(10 g) = 0.0166 mW/g

Reference Value = 2.79 V/m

Power Drift = -1.21 dB



Date Tested: 11/25/03

DUT: Vocera Communications Model: B1000A; Type: Body-Worn Communications Device; Serial: XXK0300031S

Ambient Temp: 23.6°C; Fluid Temp: 23.8°C; Barometric Pressure: 102.1 kPa; Humidity: 61%

With Pocket Clip Accessory
0.0 cm Separation Distance to Planar Phantom
3.7V Lithium-ion Battery (Extended)
RF Output Power: 16.70 dBm (EIRP)

Communication System: DSSS
Frequency: 2437 MHz; Channel 6; Duty Cycle: 1:1
Medium: M2450 ($\sigma = 2.02$ mho/m, $\epsilon_r = 51.1$, $\rho = 1000$ kg/m³)

- Probe: ET3DV6 - SN1387; ConvF(4.6, 4.6, 4.6); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 13/10/2003
- Phantom: SAM front; Type: SAM 4.0; Serial: 1033
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

Body-worn - Back of DUT with Pocket Clip - Extended Battery/Area Scan (7x13x1):

Measurement grid: dx=10mm, dy=10mm

Body-worn - Back of DUT with Pocket Clip - Extended Battery/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Peak SAR (extrapolated) = 0.29 W/kg

SAR(1 g) = 0.0372 mW/g; SAR(10 g) = 0.0162 mW/g

Reference Value = 4.04 V/m

Power Drift = -1.07 dB

Body-worn - Back of DUT with Pocket Clip - Extended Battery/Zoom Scan (7x7x7)/Cube 1:

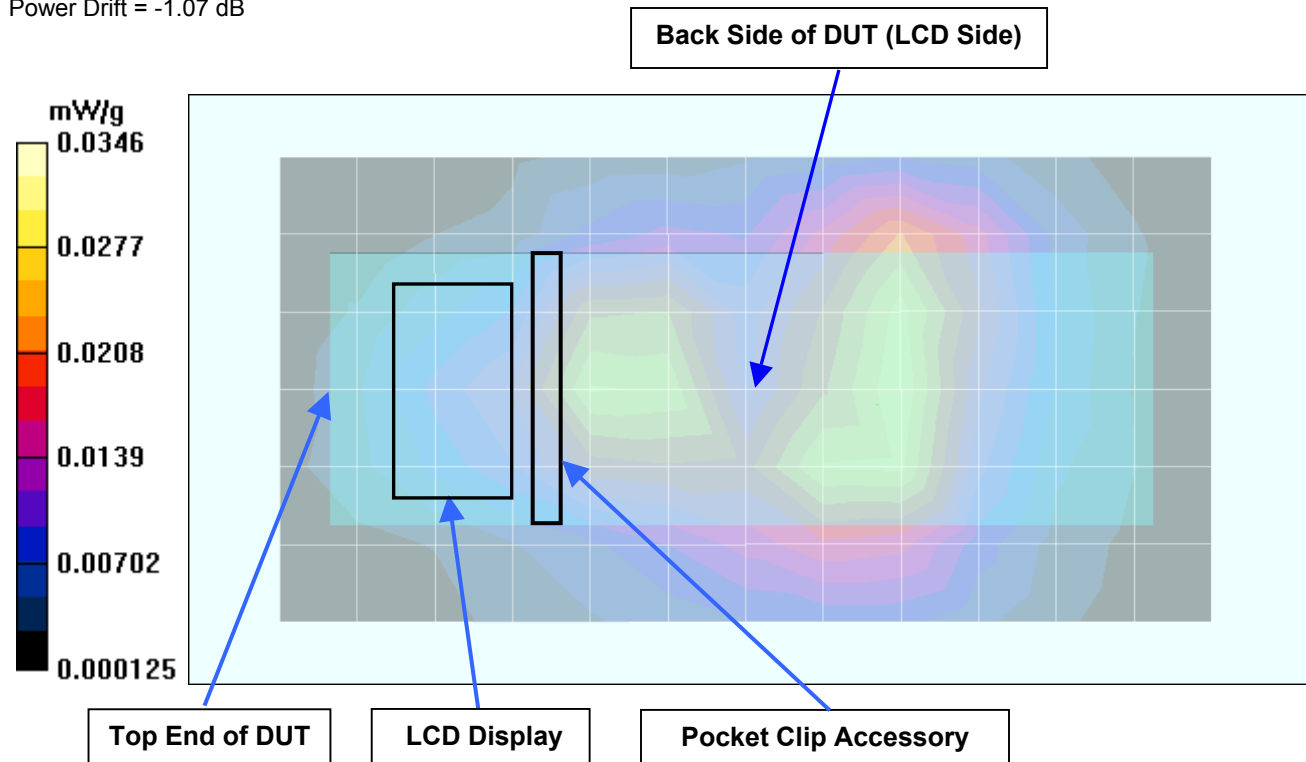
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Peak SAR (extrapolated) = 0.0628 W/kg

SAR(1 g) = 0.0233 mW/g; SAR(10 g) = 0.0128 mW/g

Reference Value = 4.04 V/m

Power Drift = -1.07 dB



APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 11/25/03

DUT: Dipole 2450 MHz; Model: D2450V2; Type: System Performance Check; Serial: 150

Ambient Temp: 23.9°C; Fluid Temp: 24.0°C Barometric Pressure: 102.1 kPa; Humidity: 61%

Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL2450 ($\sigma = 1.89 \text{ mho/m}$, $\epsilon_r = 37.6$, $\rho = 1000 \text{ kg/m}^3$)

- Probe: ET3DV6 - SN1387; ConvF(5, 5, 5); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 13/10/2003
- Phantom: SAM front; Type: SAM 4.0; Serial: 1033
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

System Validation at 2450 MHz/Area Scan (6x10x1): Measurement grid: dx=10mm, dy=10mm

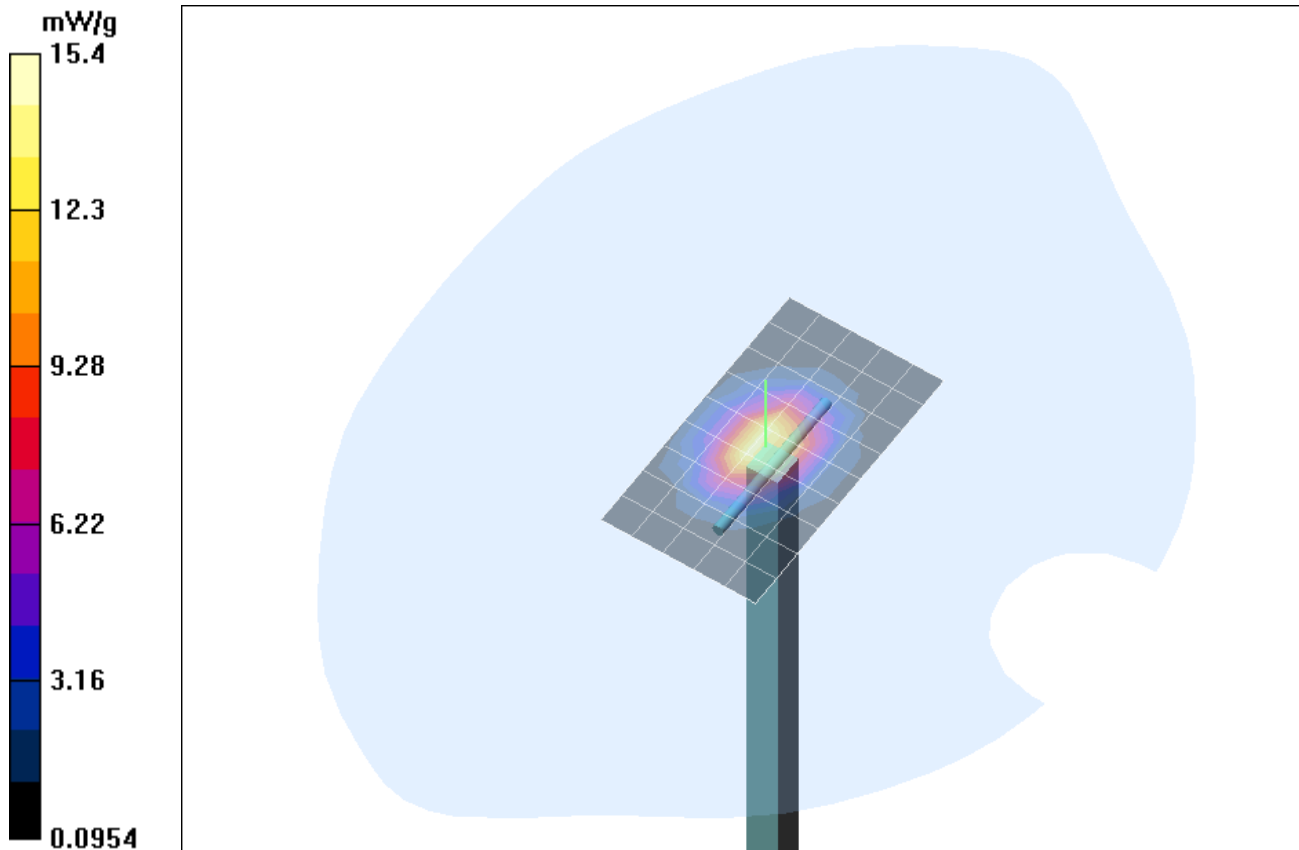
System Validation at 2450 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

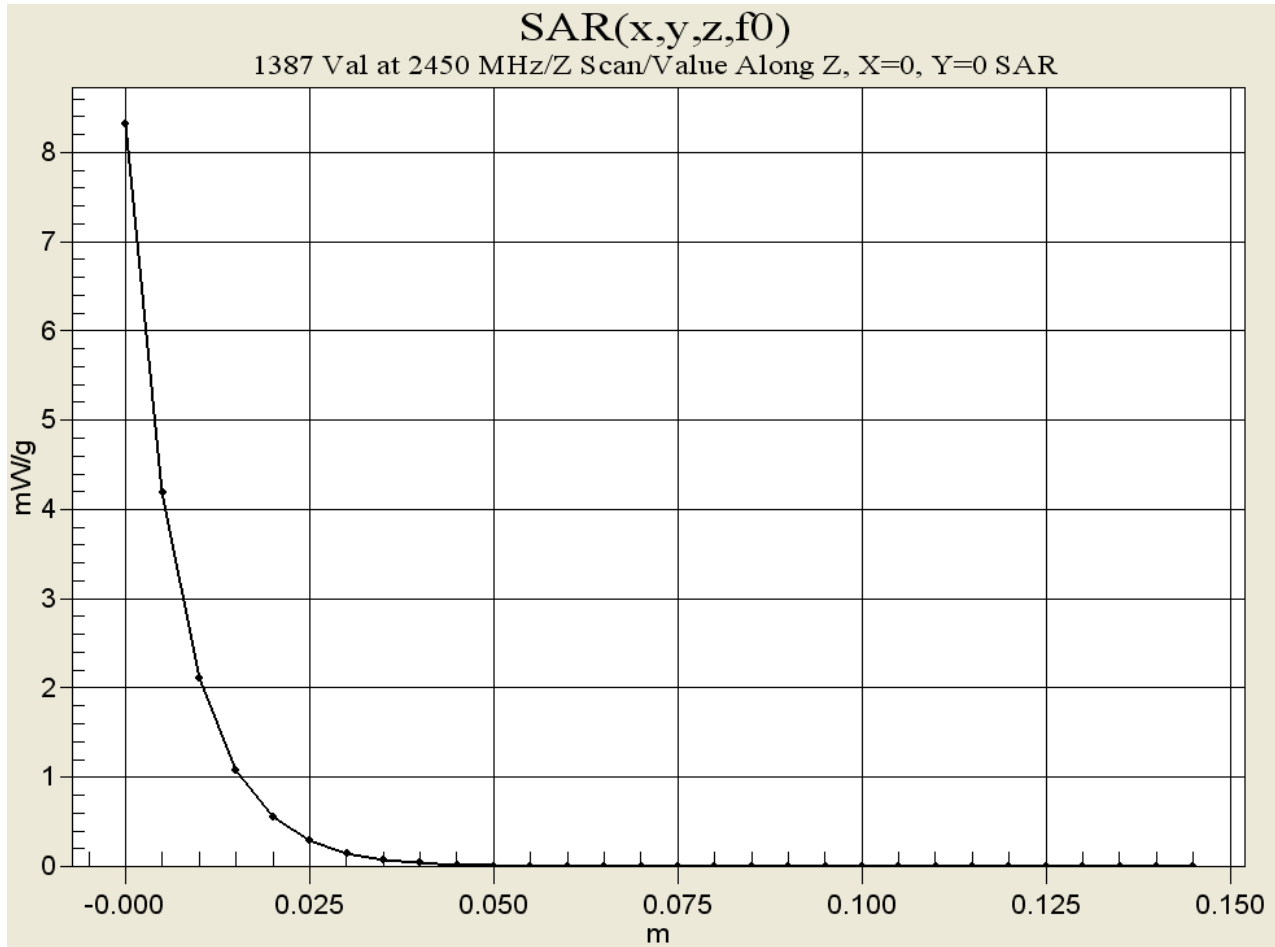
Peak SAR (extrapolated) = 28.2 W/kg

SAR(1 g) = 13.7 mW/g; SAR(10 g) = 6.25 mW/g

Reference Value = 93.9 V/m

Power Drift = -0.005 dB





APPENDIX C - SYSTEM VALIDATION

2450MHz SYSTEM VALIDATION DIPOLE

Type:

2450MHz Validation Dipole

Serial Number:

150

Place of Calibration:

Celltech Labs Inc.

Date of Calibration:

September 17, 2003

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

Calibrated by:

Spencer Watson

Approved by:

Russell W. Pipe

1. Dipole Construction & Electrical Characteristics

The validation dipole was constructed in accordance with the IEEE Std “Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”. The electrical properties were measured using an HP 8753E Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector feed point using an HP85032E Type N calibration kit. The dipole was placed parallel to a planar phantom at a separation distance of 10.0mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

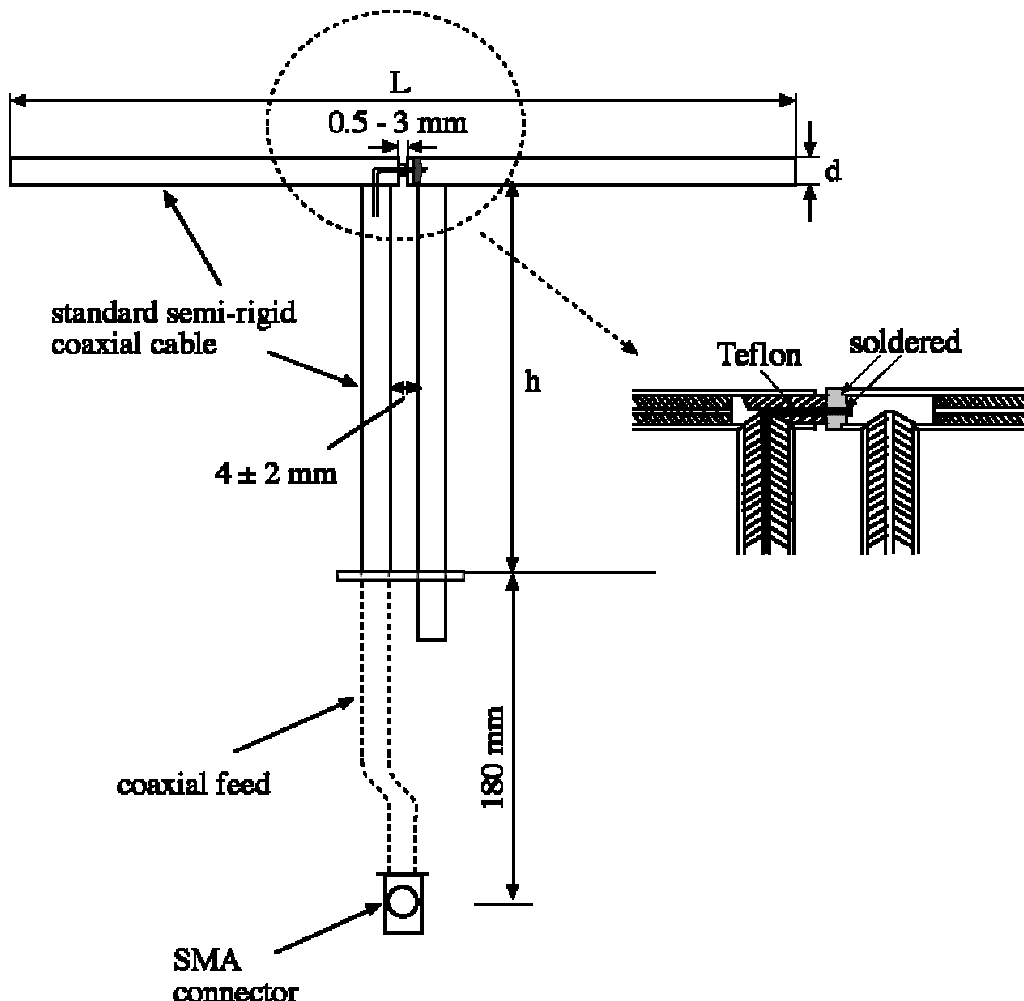
Feed point impedance at 2450MHz

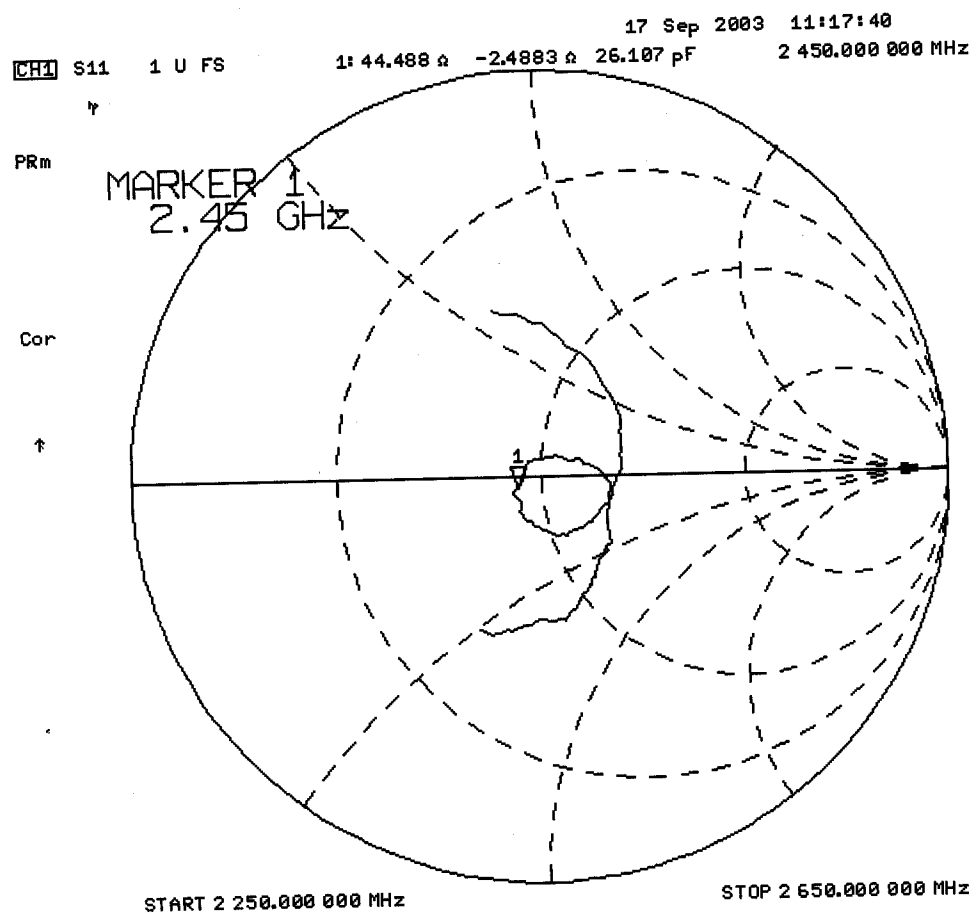
$$\text{Re}\{Z\} = 44.488\Omega$$

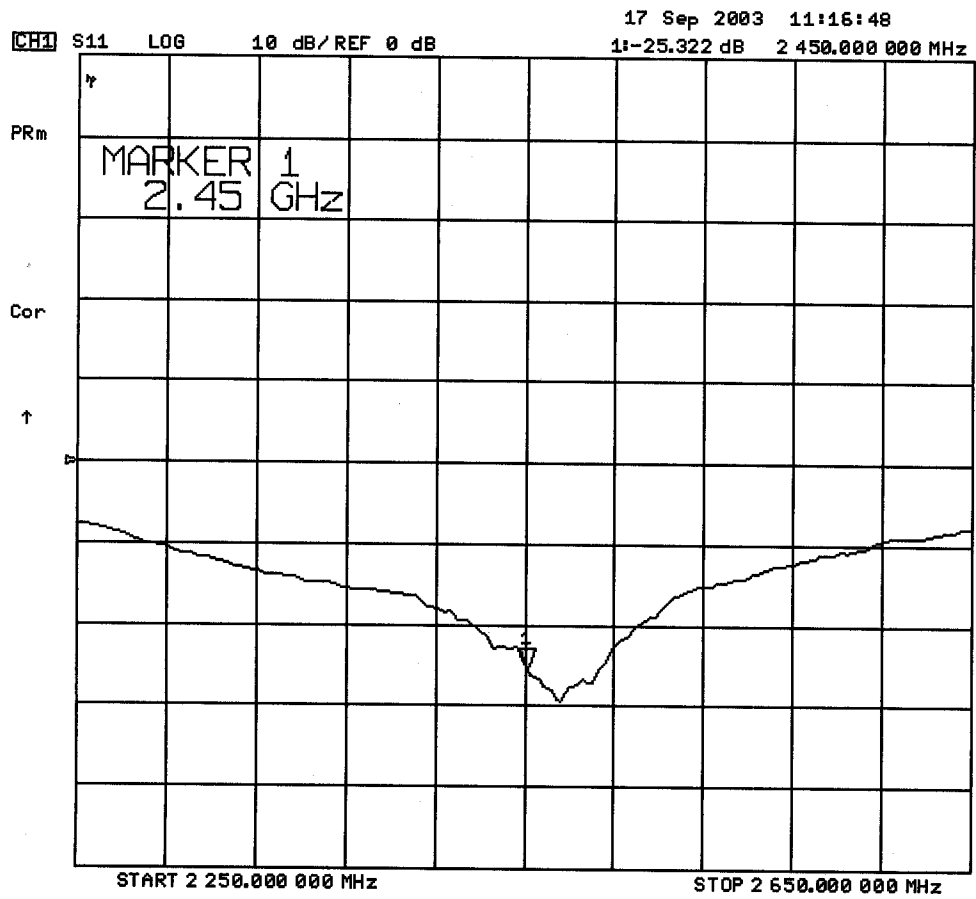
$$\text{Im}\{Z\} = -2.4883\Omega$$

Return Loss at 2450MHz

$$-25.322 \text{ dB}$$







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 is the SAM (Specific Anthropomorphic Mannequin) phantom manufactured by Schmid & Partner Engineering AG. The SAM phantom is a Fiberglass shell integrated in a wooden table. The shape of the shell corresponds to the phantom defined by SCC34-SC2. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

Shell Thickness: 2.0 ± 0.1 mm
Filling Volume: Approx. 20 liters
Dimensions: 50 cm (W) x 100 cm (L)

2450MHz Dipole Calibration



2450MHz Dipole Calibration



3. Measurement Conditions

The planar phantom was filled with brain simulating tissue having the following electrical parameters at 2450MHz:

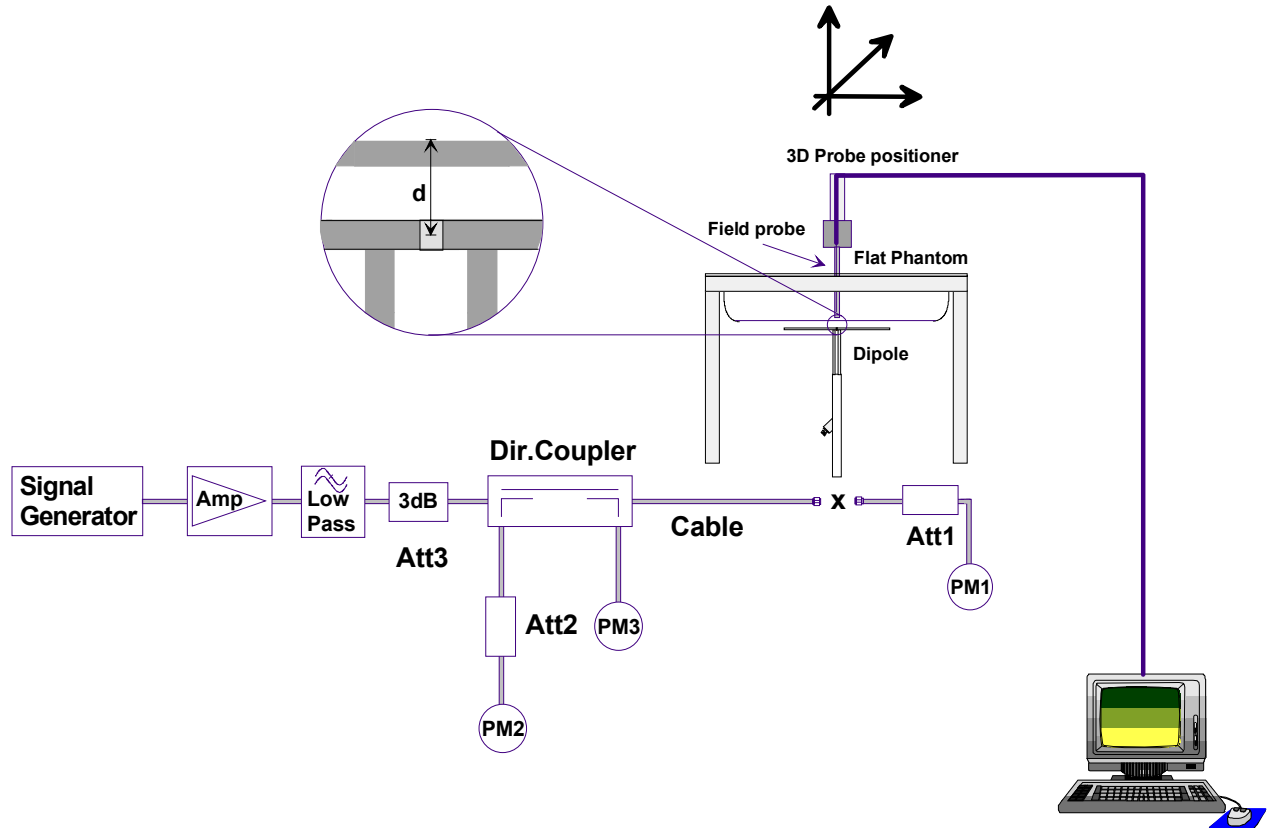
Relative Permittivity:	37.3
Conductivity:	1.88 mho/m
Ambient Temperature:	21.6°C
Fluid Temperature:	23.9°C
Fluid Depth:	≥ 15cm

The 2450MHz simulating tissue consists of the following ingredients:

Ingredient	Percentage by weight
Water	52.00%
Glycol Monobutyl	48.00%
Target Dielectric Parameters at 22°C	$\epsilon_r = 39.2$ (+/-5%) $\sigma = 1.80$ S/m (+/-5%)

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	13.9	55.6	6.27	25.08	29.5
Test 2	13.9	55.6	6.25	25.00	29.1
Test 3	13.9	55.6	6.24	24.96	28.9
Test 4	14.0	56.0	6.31	25.24	29.1
Test 5	14.0	56.0	6.27	25.08	29.7
Test 6	13.8	55.2	6.25	25.00	29.3
Test 7	13.9	55.6	6.22	24.88	29.3
Test 8	13.9	55.6	6.24	24.96	29.4
Test 9	14.0	56.0	6.29	25.16	30.0
Test10	13.8	55.2	6.17	24.68	29.3
Average Value	13.91	55.64	6.251	25.00	29.36

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

Averaged over 1cm (1g) of tissue: 55.64 mW/g

Averaged over 10cm (10g) of tissue: 25.00 mW/g

Test Date: 09/17/03

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:150

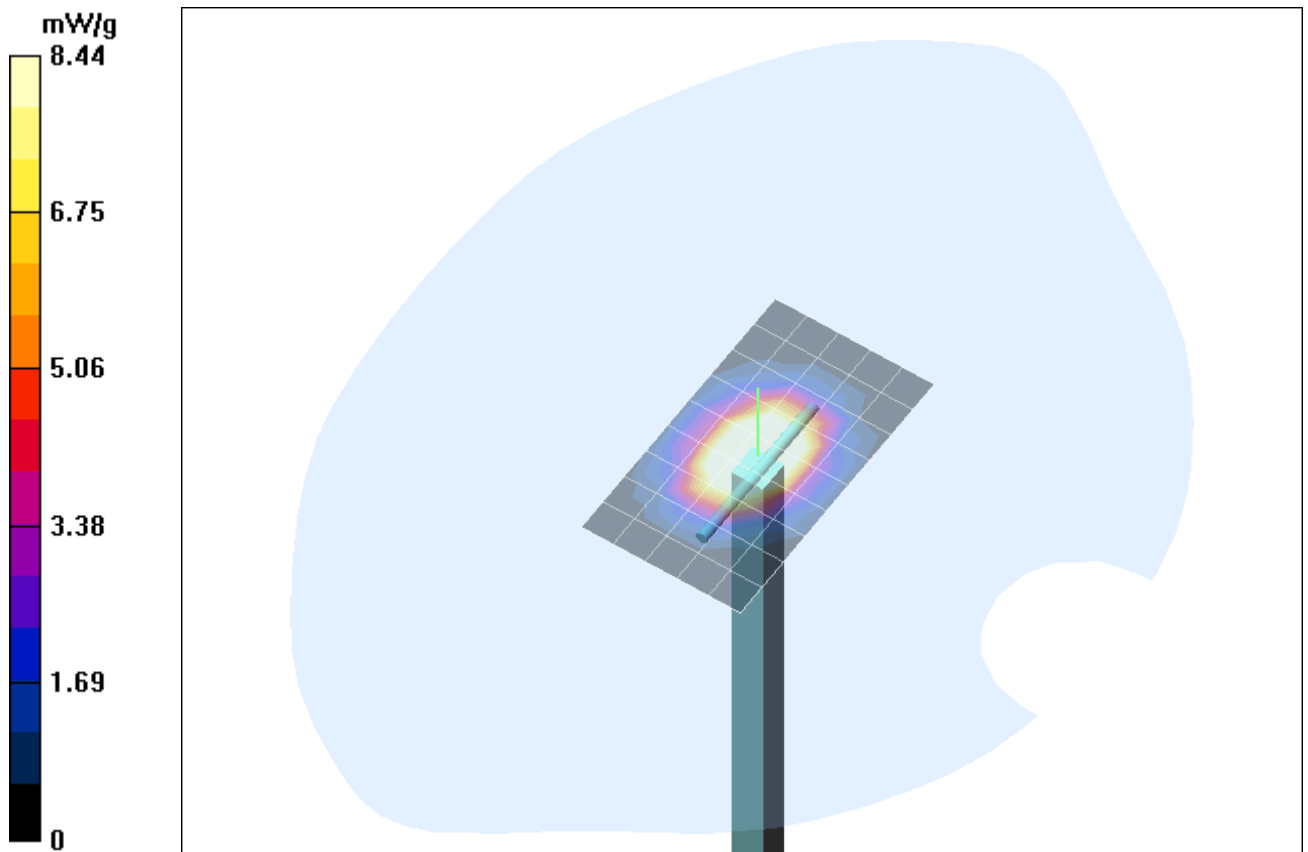
Ambient Temp: 22.2C; Fluid Temp: 23.8C
Barometric Pressure: 101.9 kPa; Humidity: 52%

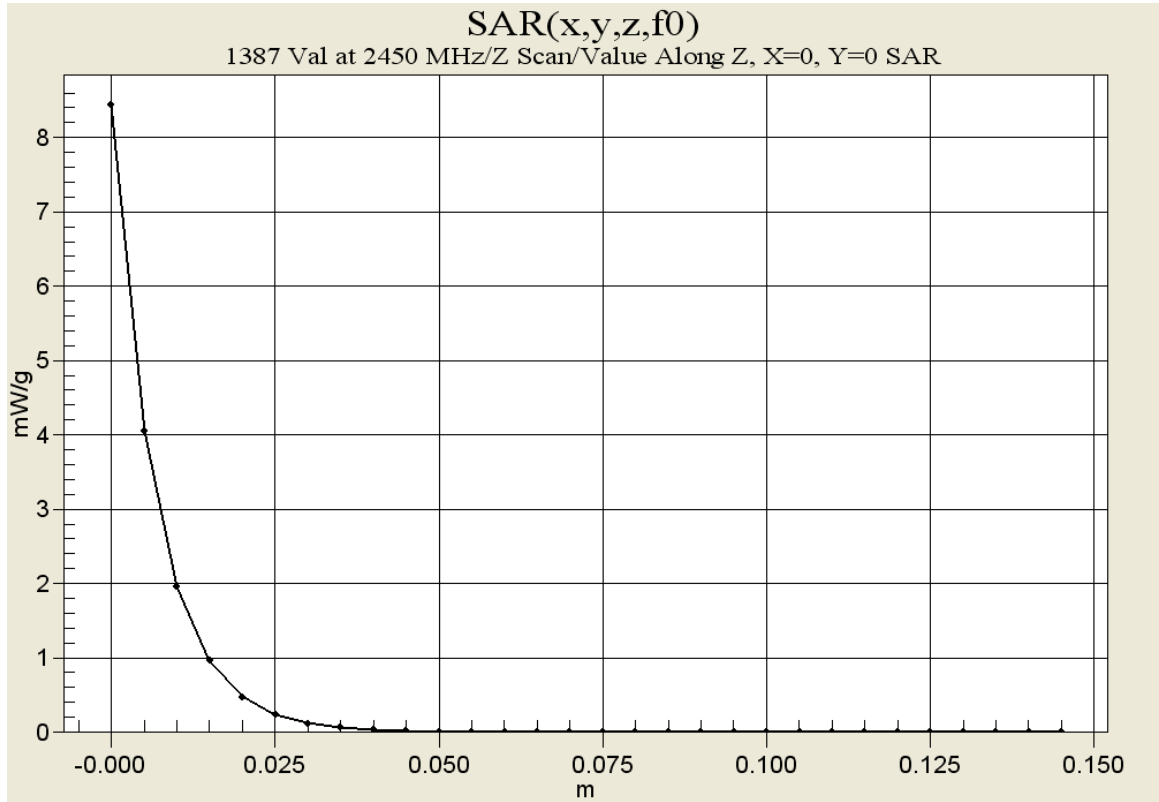
Communication System: CW
Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL2450 ($\sigma = 1.88$ mho/m, $\epsilon_r = 37.3$, $\rho = 1000$ kg/m³)

- Probe: ET3DV6 - SN1387; ConvF(5, 5, 5); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 19/05/2003
- Phantom: SAM front; Type: SAM 4.0; Serial: 1033
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

Probe SN1387 Validation at 2450 MHz/Area Scan (6x10x1): Measurement grid: dx=10mm, dy=10mm

Probe SN1387 Validation at 2450 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 29.5 W/kg
SAR(1 g) = 13.9 mW/g; SAR(10 g) = 6.27 mW/g
Reference Value = 96.7 V/m
Power Drift = -0.08 dB





2450MHz System Validation

Measured Fluid Dielectric Parameters (Brain)

September 17, 2003

Frequency	e'	e''
2.350000000 GHz	37.7457	13.5170
2.360000000 GHz	37.7101	13.5534
2.370000000 GHz	37.6951	13.5903
2.380000000 GHz	37.6613	13.6228
2.390000000 GHz	37.6411	13.6368
2.400000000 GHz	37.5853	13.6598
2.410000000 GHz	37.5236	13.6742
2.420000000 GHz	37.4573	13.7091
2.430000000 GHz	37.4063	13.7484
2.440000000 GHz	37.3419	13.7798
2.450000000 GHz	37.2875	13.8226
2.460000000 GHz	37.2447	13.8618
2.470000000 GHz	37.2198	13.8951
2.480000000 GHz	37.1940	13.9293
2.490000000 GHz	37.1679	13.9423
2.500000000 GHz	37.1333	13.9571
2.510000000 GHz	37.0990	13.9745
2.520000000 GHz	37.0410	14.0116
2.530000000 GHz	36.9938	14.0375
2.540000000 GHz	36.9185	14.0546
2.550000000 GHz	36.8657	14.0912

APPENDIX D - PROBE CALIBRATION

Client

Celltech Labs

CALIBRATION CERTIFICATE

Object(s)

ET3DV6 - SN: 1387

Calibration procedure(s)

QA CAL-01.v2
Calibration procedure for dosimetric E-field probes

Calibration date:

February 26, 2003

Condition of the calibrated item

In Tolerance (according to the specific calibration document)

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

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

Calibration Equipment used (M&TE critical for calibration)

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

Calibrated by:

Name

Nico Vetterli

Function

Technician

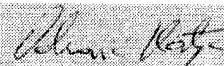
Signature



Approved by:

Katja Pokovic

Laboratory Director



Date issued: February 26, 2003

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

Probe ET3DV6

SN:1387

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

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1387

Sensitivity in Free Space

NormX	1.55 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.65 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.64 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

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

Sensitivity in Tissue Simulating Liquid

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

Boundary Effect

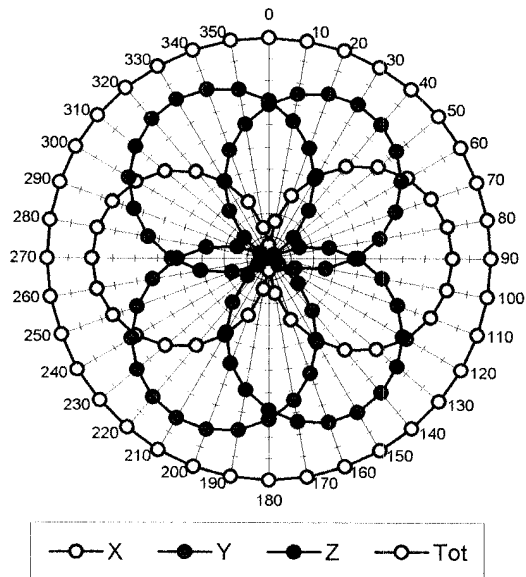
Head	900 MHz	Typical SAR gradient: 5 % per mm	
Probe Tip to Boundary		1 mm	2 mm
SAR _{pe} [%]	Without Correction Algorithm	10.2	5.9
SAR _{pe} [%]	With Correction Algorithm	0.4	0.6
Head	1800 MHz	Typical SAR gradient: 10 % per mm	
Probe Tip to Boundary		1 mm	2 mm
SAR _{pe} [%]	Without Correction Algorithm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

Sensor Offset

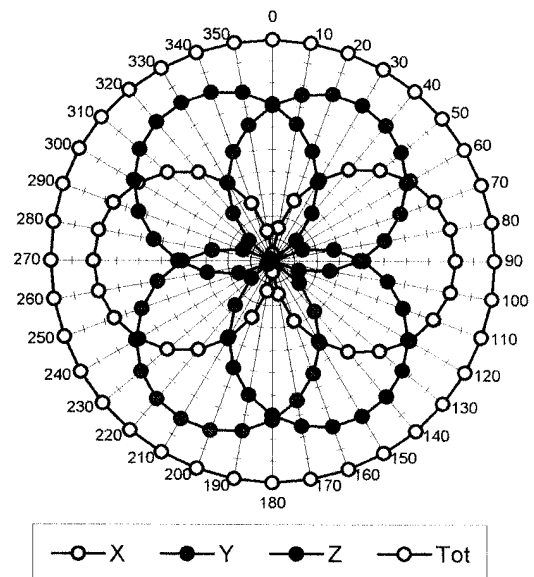
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.4 $\pm$ 0.2	mm

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

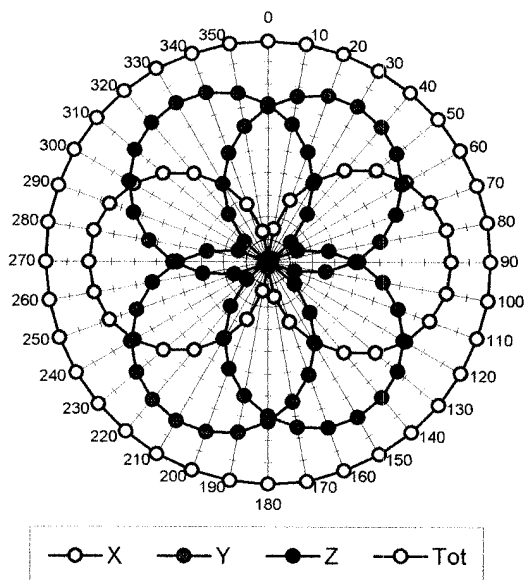
f = 30 MHz, TEM cell ifi110



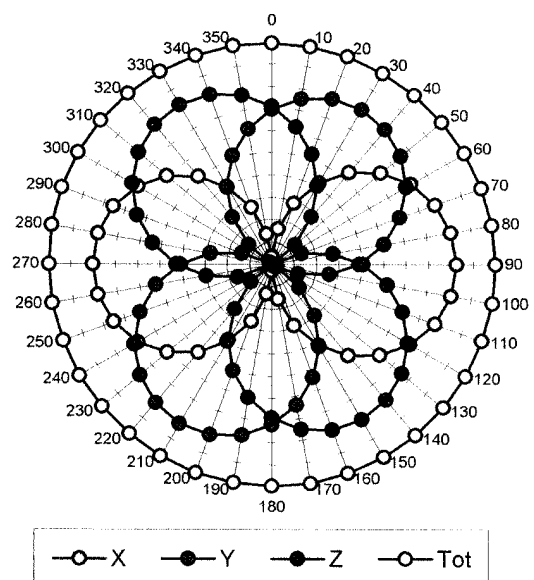
f = 100 MHz, TEM cell ifi110

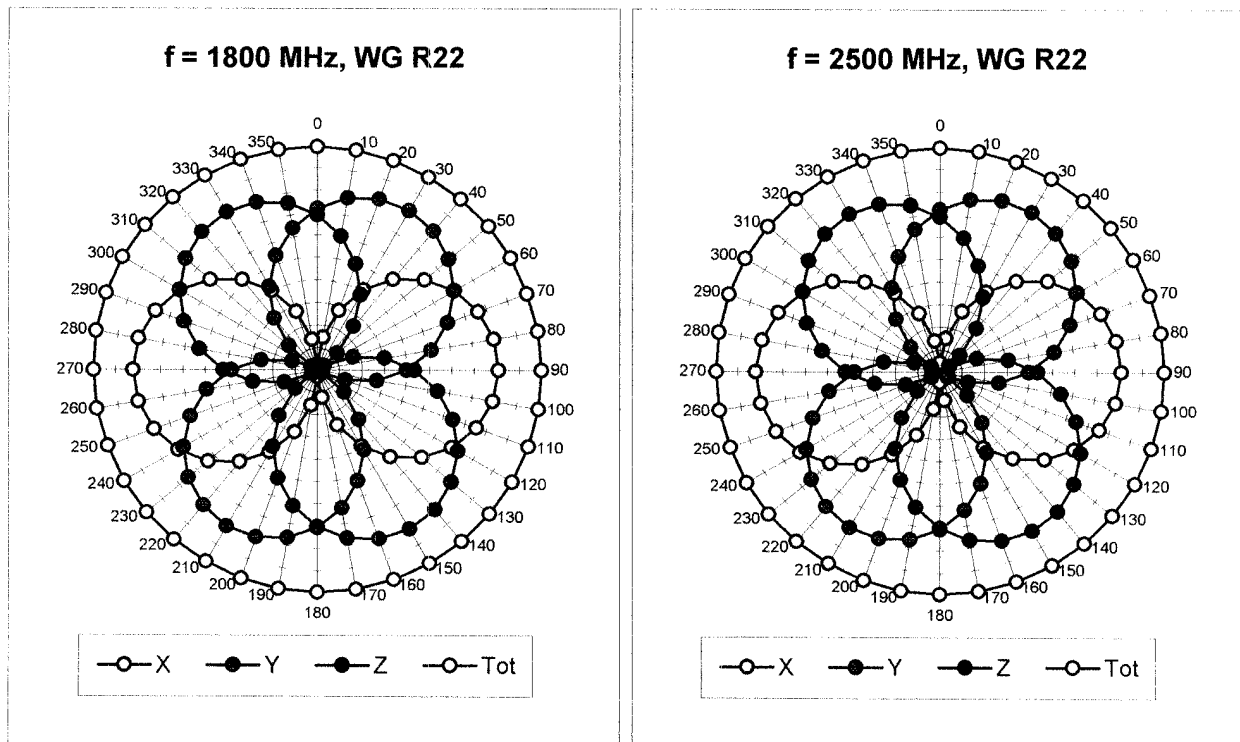


f = 300 MHz, TEM cell ifi110

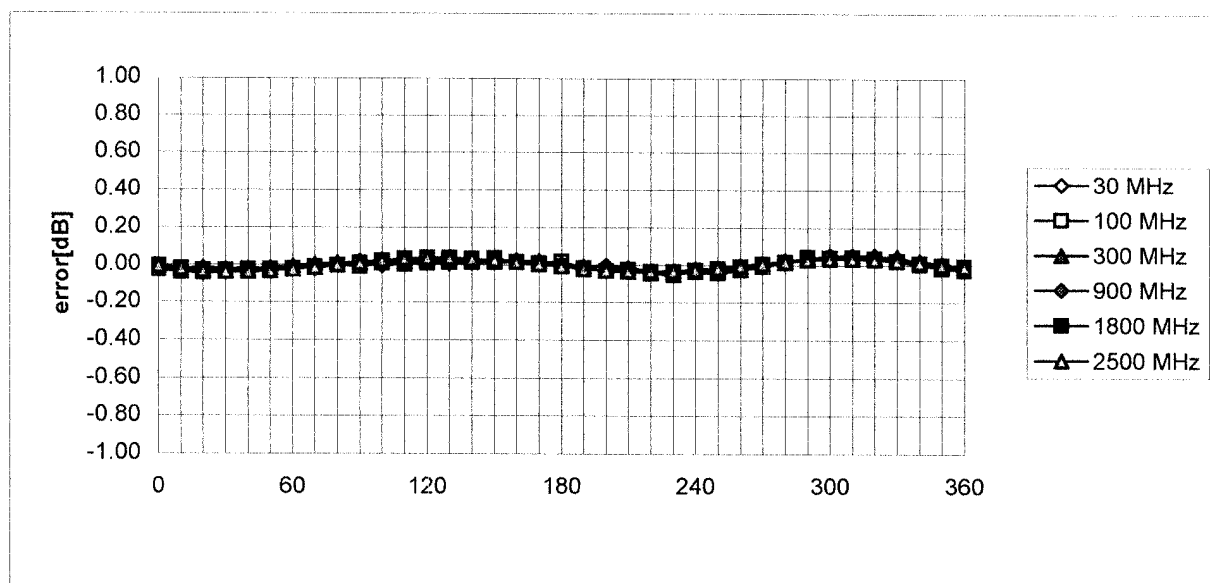


f = 900 MHz, TEM cell ifi110



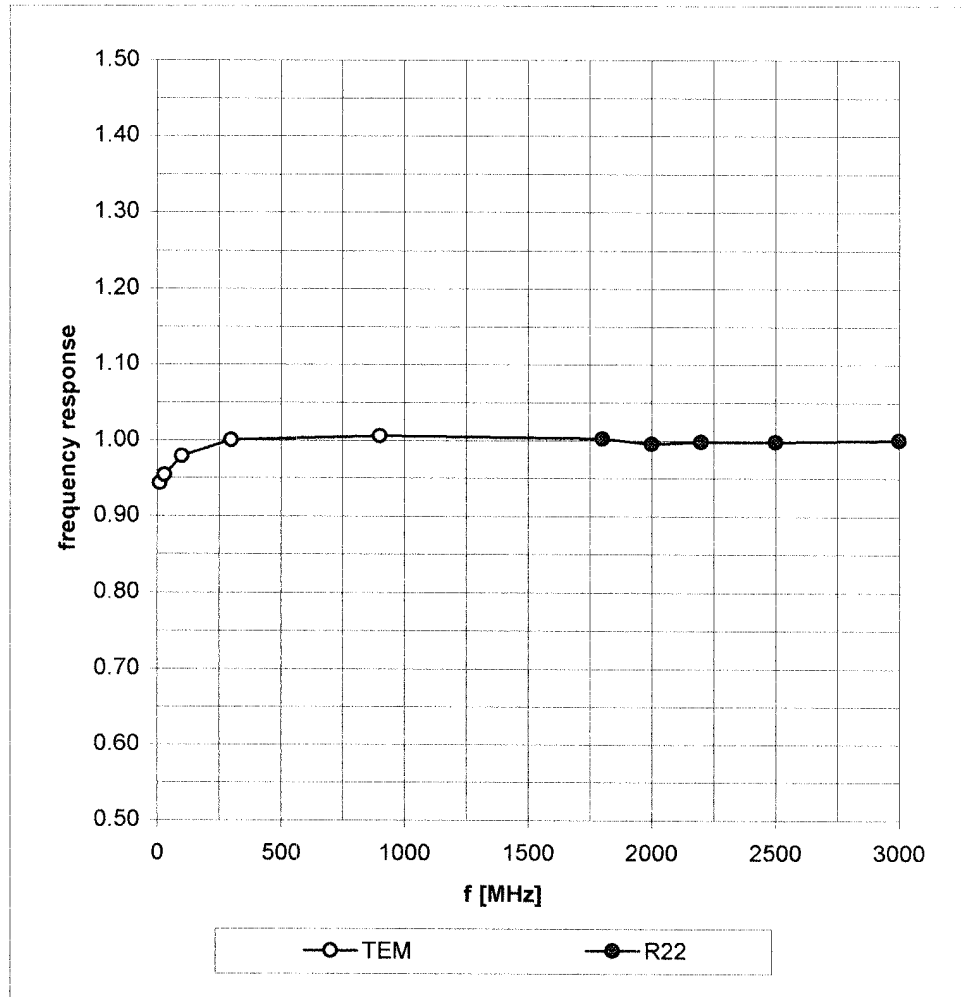


Isotropy Error (ϕ), $\theta = 0^\circ$

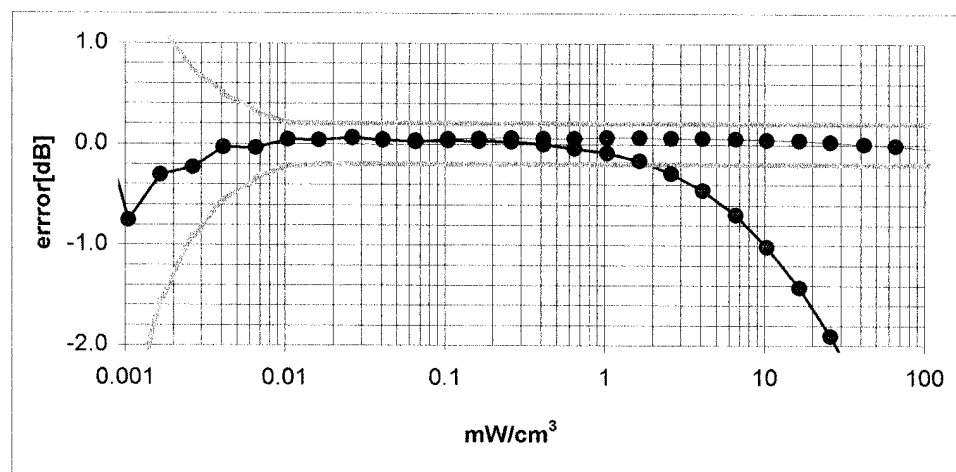
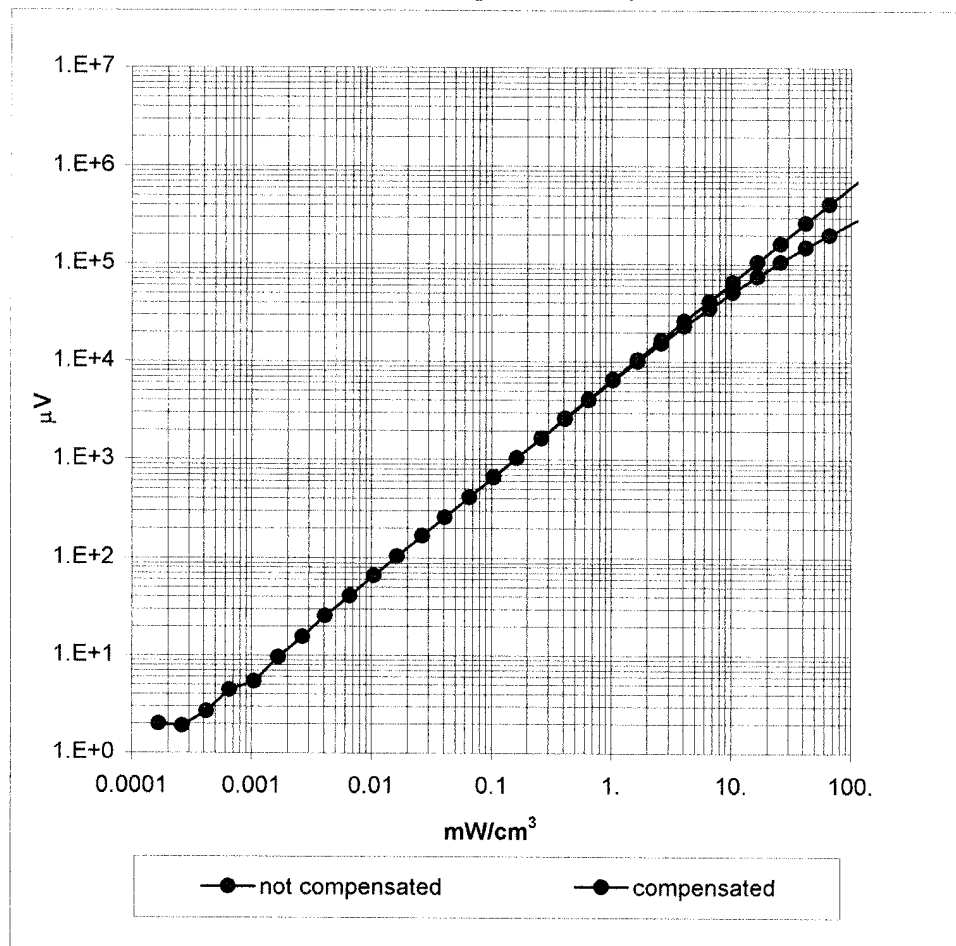


Frequency Response of E-Field

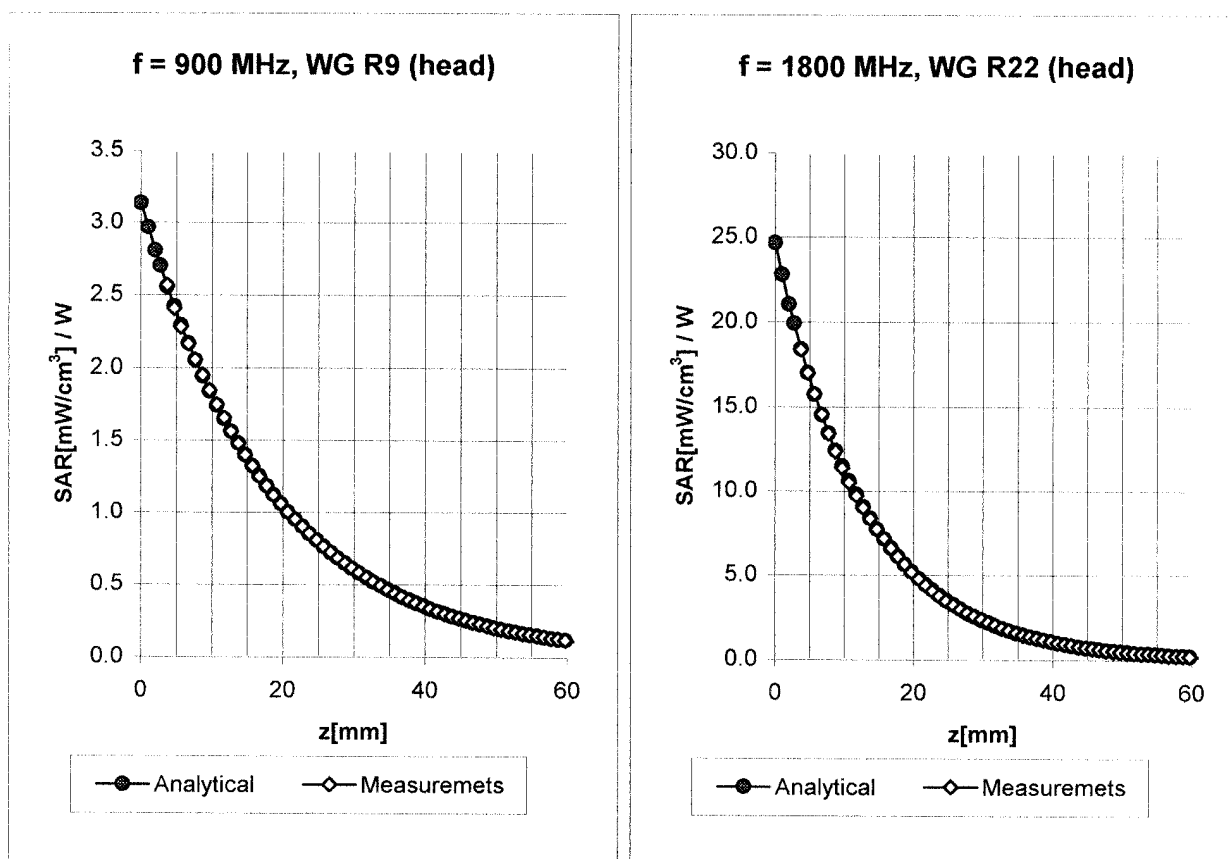
(TEM-Cell:ifi110, Waveguide R22)



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

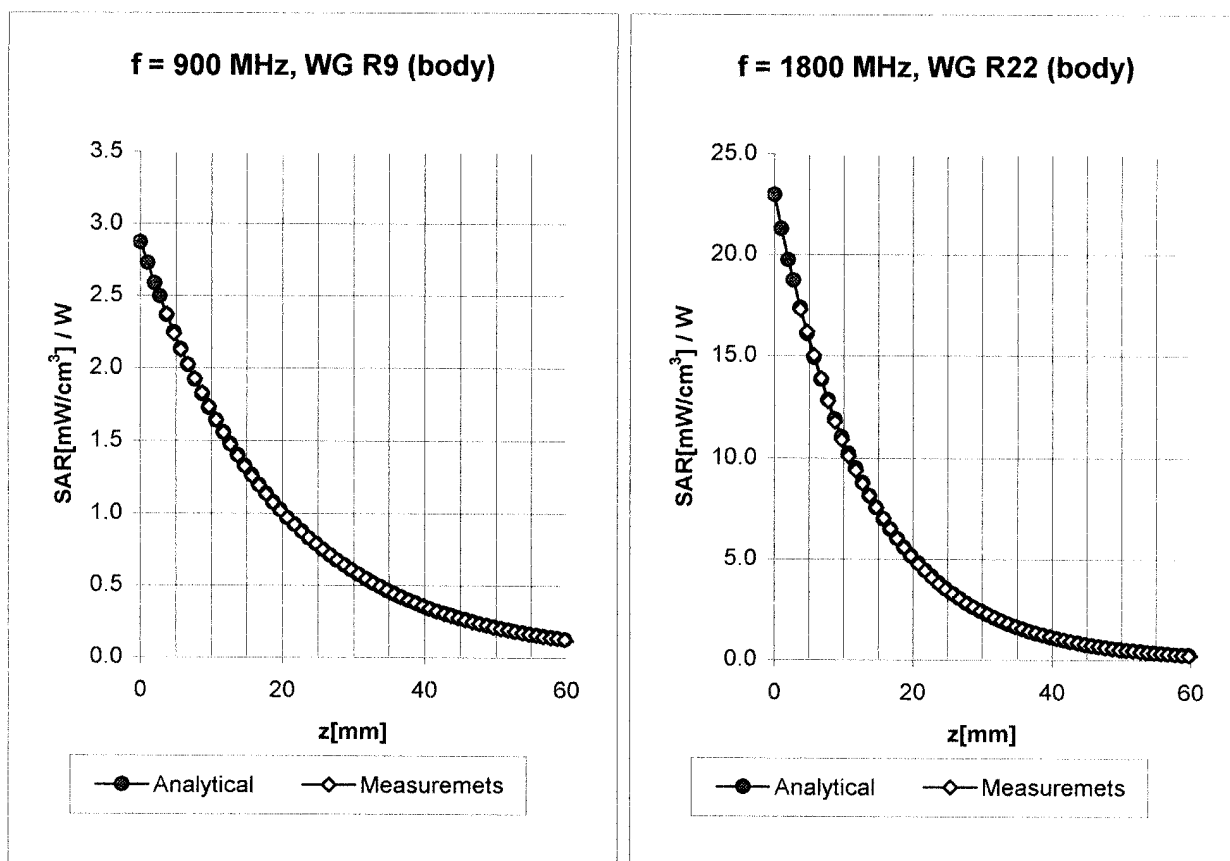


Conversion Factor Assessment



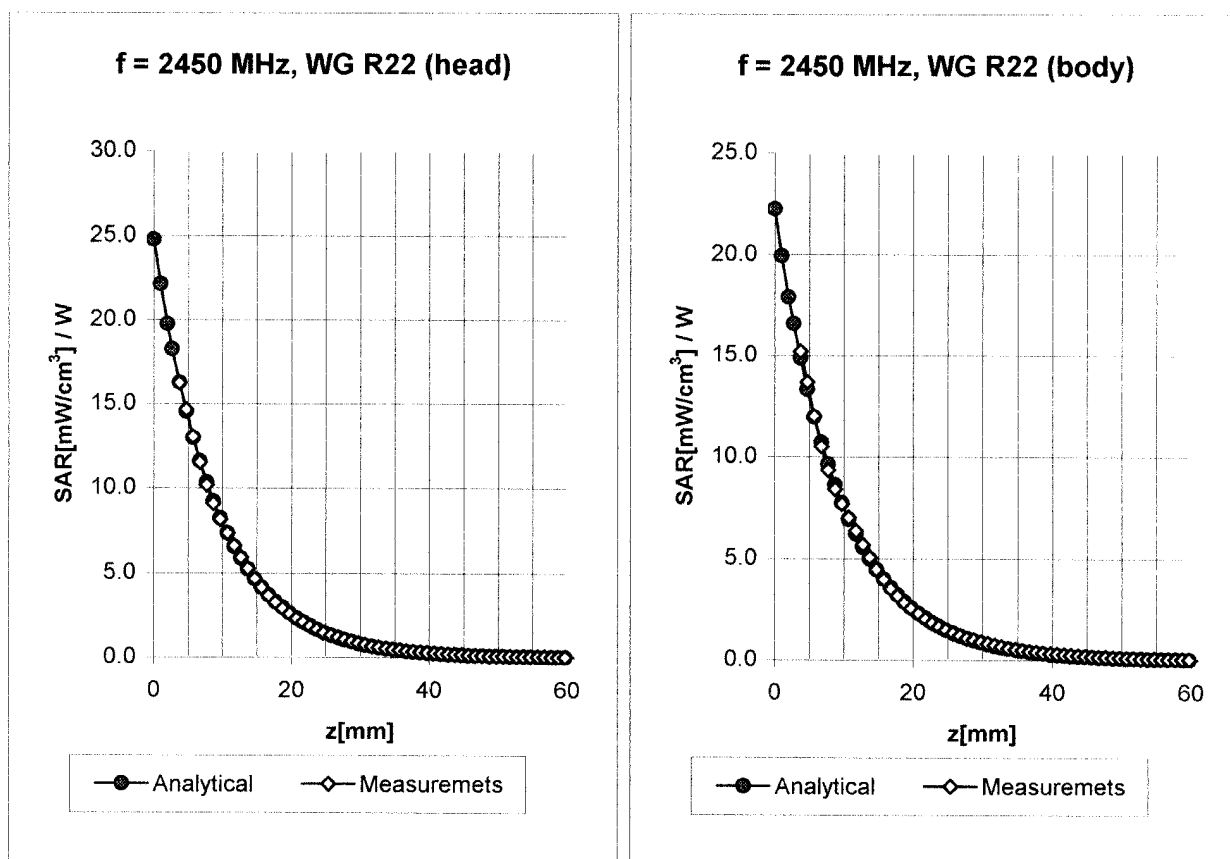
Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\% \text{ mho/m}$
	ConvF X	6.6 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	6.6 $\pm 9.5\%$ (k=2)	Alpha 0.37
	ConvF Z	6.6 $\pm 9.5\%$ (k=2)	Depth 2.61
Head	1800 MHz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

Conversion Factor Assessment



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

Conversion Factor Assessment



Head 2450 MHz $\epsilon_r = 39.2 \pm 5\%$ $\sigma = 1.80 \pm 5\%$ mho/m

ConvF X **5.0** $\pm 8.9\%$ (k=2)

Boundary effect:

ConvF Y **5.0** $\pm 8.9\%$ (k=2)

Alpha **1.04**

ConvF Z **5.0** $\pm 8.9\%$ (k=2)

Depth **1.85**

Body 2450 MHz $\epsilon_r = 52.7 \pm 5\%$ $\sigma = 1.95 \pm 5\%$ mho/m

ConvF X **4.6** $\pm 8.9\%$ (k=2)

Boundary effect:

ConvF Y **4.6** $\pm 8.9\%$ (k=2)

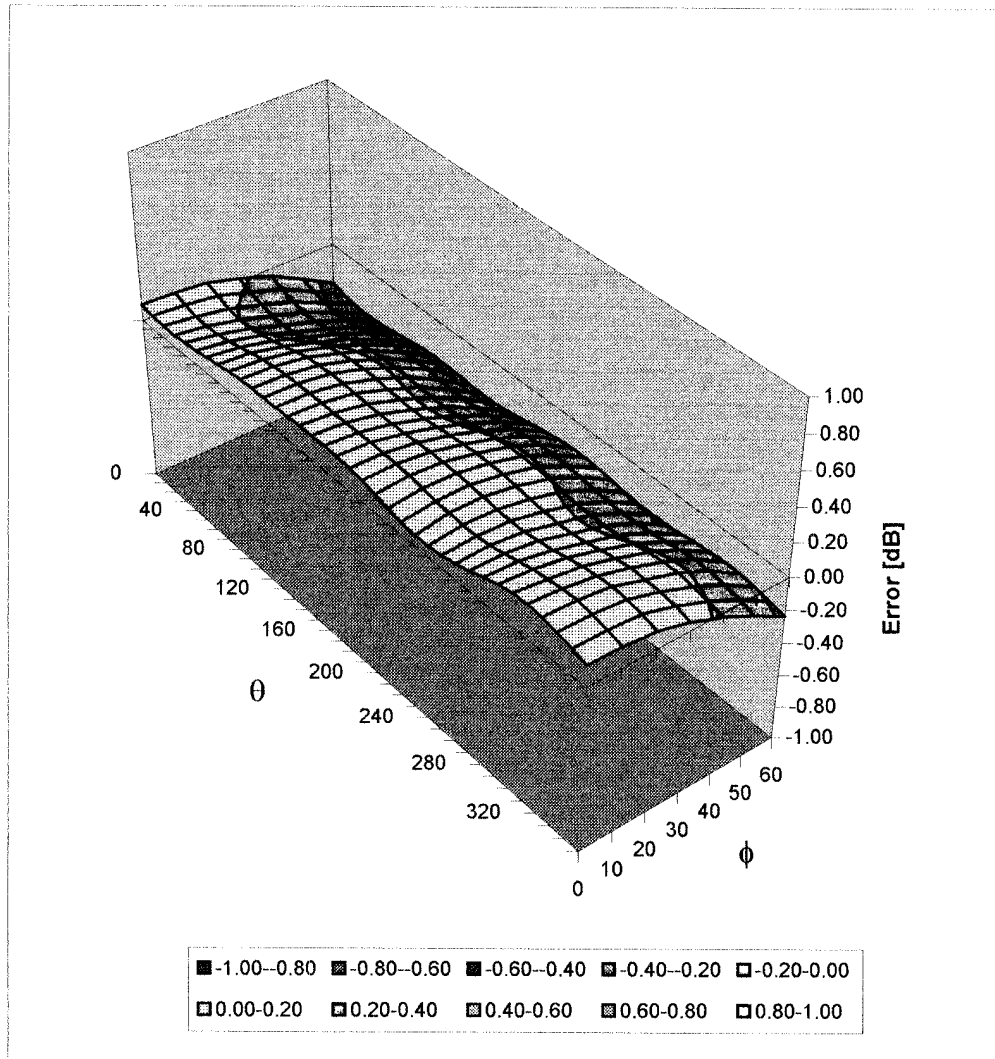
Alpha **1.20**

ConvF Z **4.6** $\pm 8.9\%$ (k=2)

Depth **1.60**

Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz



Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1387

Place of Assessment:

Zurich

Date of Assessment:

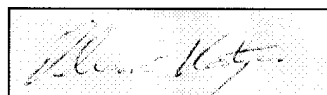
February 28, 2003

Probe Calibration Date:

February 26, 2003

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

Assessed by:



Dosimetric E-Field Probe ET3DV6 SN:1387

Conversion factor ($\pm$ standard deviation)

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

APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

2450 MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

November 25, 2003

Frequency	e'	e''
2.350000000 GHz	38.0099	13.5290
2.360000000 GHz	37.9729	13.5601
2.370000000 GHz	37.9311	13.5979
2.380000000 GHz	37.9089	13.6314
2.390000000 GHz	37.8723	13.6491
2.400000000 GHz	37.8292	13.6886
2.410000000 GHz	37.7799	13.7224
2.420000000 GHz	37.7277	13.7889
2.430000000 GHz	37.6839	13.8134
2.440000000 GHz	37.6365	13.8493
2.450000000 GHz	37.5991	13.8693
2.460000000 GHz	37.5502	13.9043
2.470000000 GHz	37.5141	13.9239
2.480000000 GHz	37.4883	13.9516
2.490000000 GHz	37.4547	13.9588
2.500000000 GHz	37.4105	13.9885
2.510000000 GHz	37.3751	13.9950
2.520000000 GHz	37.3313	14.0494
2.530000000 GHz	37.2791	14.0893
2.540000000 GHz	37.2362	14.1327
2.550000000 GHz	37.1823	14.1747

2450 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

November 25, 2003

Frequency	e'	e''
2.350000000 GHz	51.3859	14.4022
2.360000000 GHz	51.3540	14.4420
2.370000000 GHz	51.3163	14.4818
2.380000000 GHz	51.3231	14.5205
2.390000000 GHz	51.2838	14.5563
2.400000000 GHz	51.2517	14.5875
2.410000000 GHz	51.2149	14.6288
2.420000000 GHz	51.1711	14.6720
2.430000000 GHz	51.1302	14.7345
2.440000000 GHz	51.0921	14.7648
2.450000000 GHz	51.0552	14.8277
2.460000000 GHz	51.0125	14.8578
2.470000000 GHz	50.9896	14.9085
2.480000000 GHz	50.9691	14.9568
2.490000000 GHz	50.9437	14.9971
2.500000000 GHz	50.9055	15.0170
2.510000000 GHz	50.8604	15.0686
2.520000000 GHz	50.8248	15.1090
2.530000000 GHz	50.7623	15.1621
2.540000000 GHz	50.7322	15.2044
2.550000000 GHz	50.6810	15.2524

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

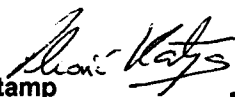
- [1] CENELEC EN 50361
- [2] IEEE P1528-200x draft 6.5
- [3] IEC PT 62209 draft 0.9
- (*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

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



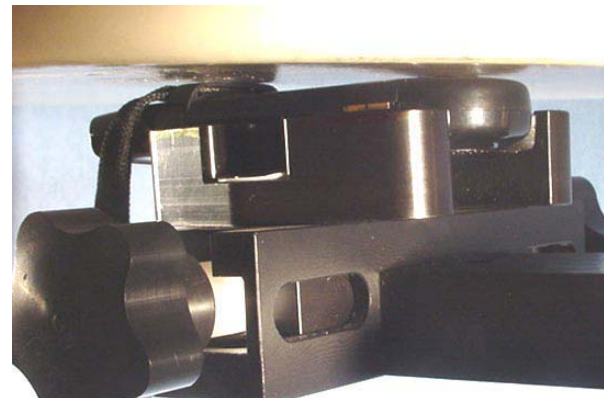
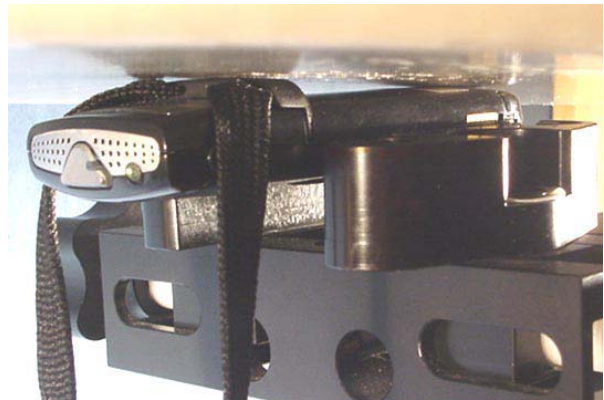
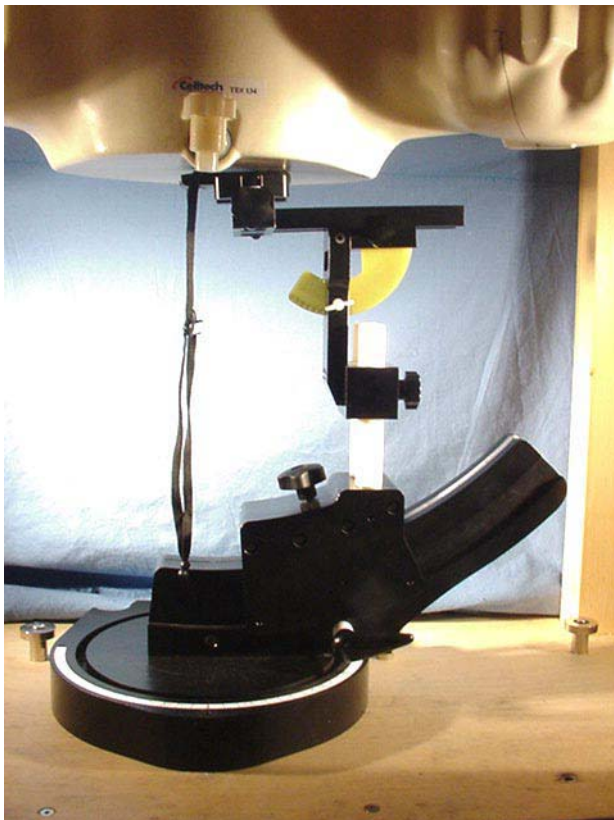
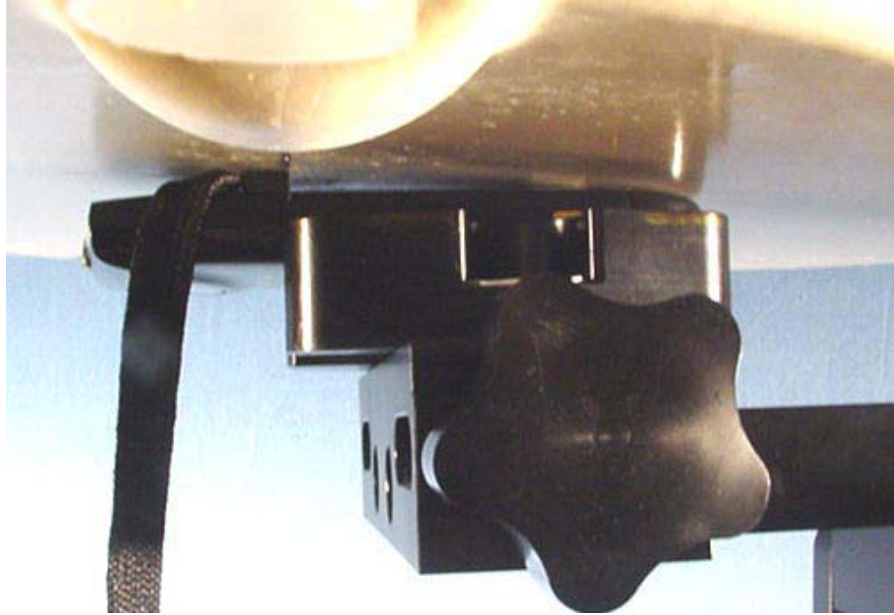
**Schmid & Partner
Engineering AG**



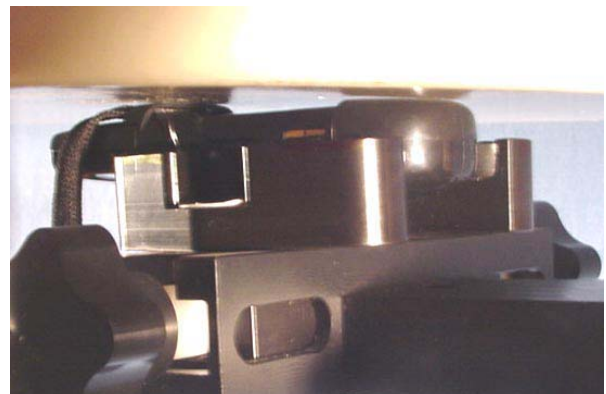
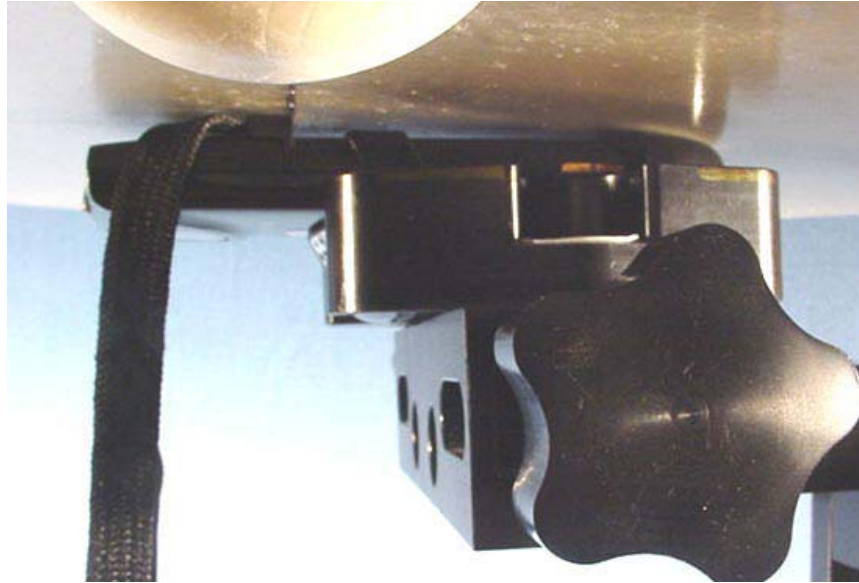
Zeughausstrasse 43, CH-8004 Zurich
Tel. +41 1 245 97 00, Fax +41 1 245 97 79

APPENDIX G - SAR TEST SETUP & DUT PHOTOGRAPHS

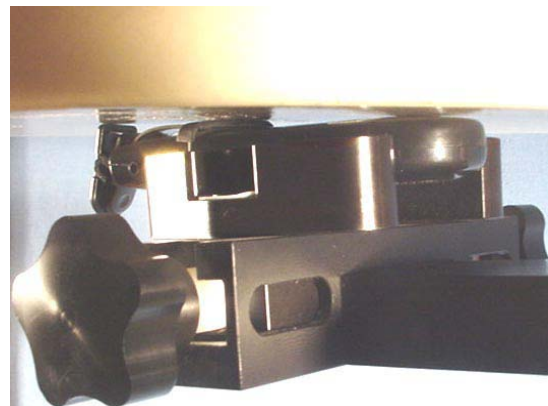
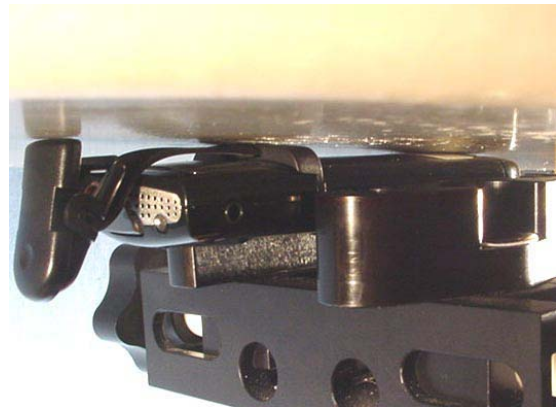
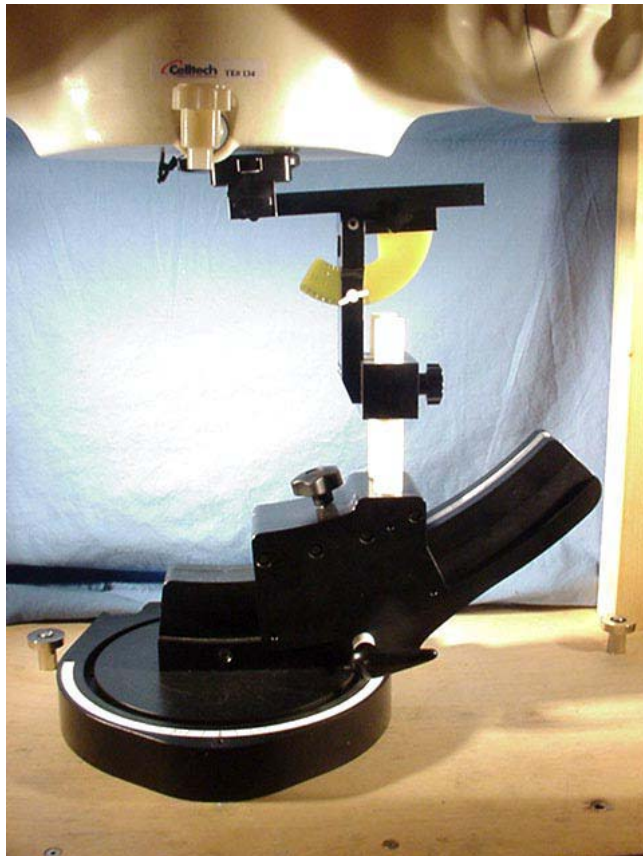
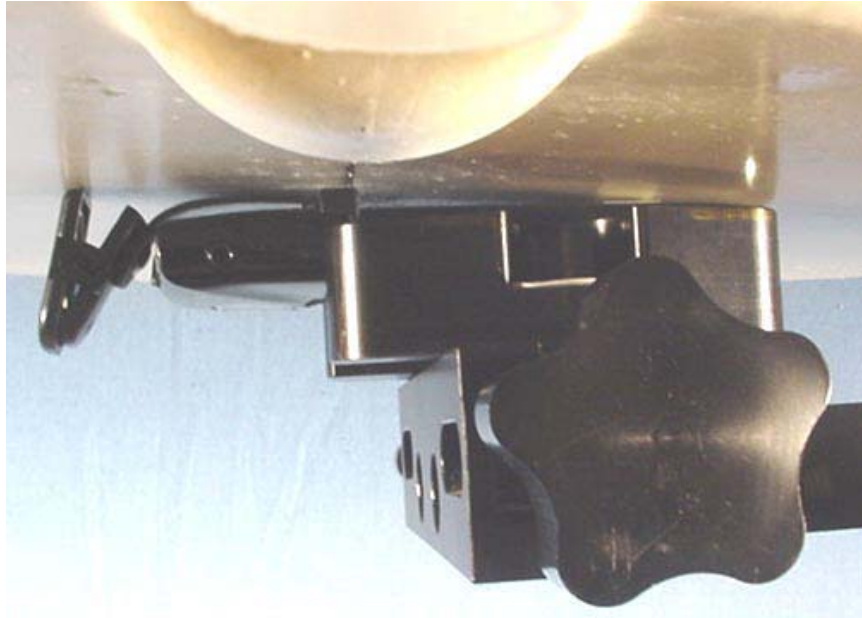
BODY-WORN SAR TEST SETUP PHOTOGRAPHS
Back Side of DUT with Lanyard Accessory & Standard Battery
0.0 cm Separation Distance to Planar Phantom



BODY-WORN SAR TEST SETUP PHOTOGRAPHS
Back Side of DUT with Lanyard and Speaker Horn Accessories & Standard Battery
0.0 cm Separation Distance to Planar Phantom

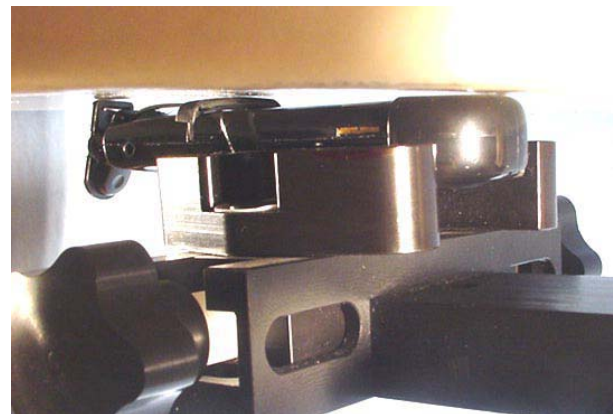
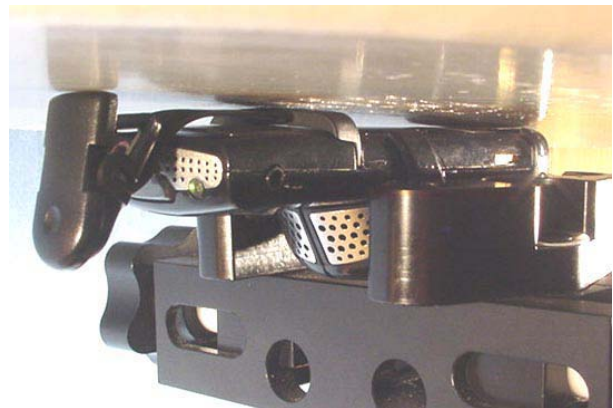
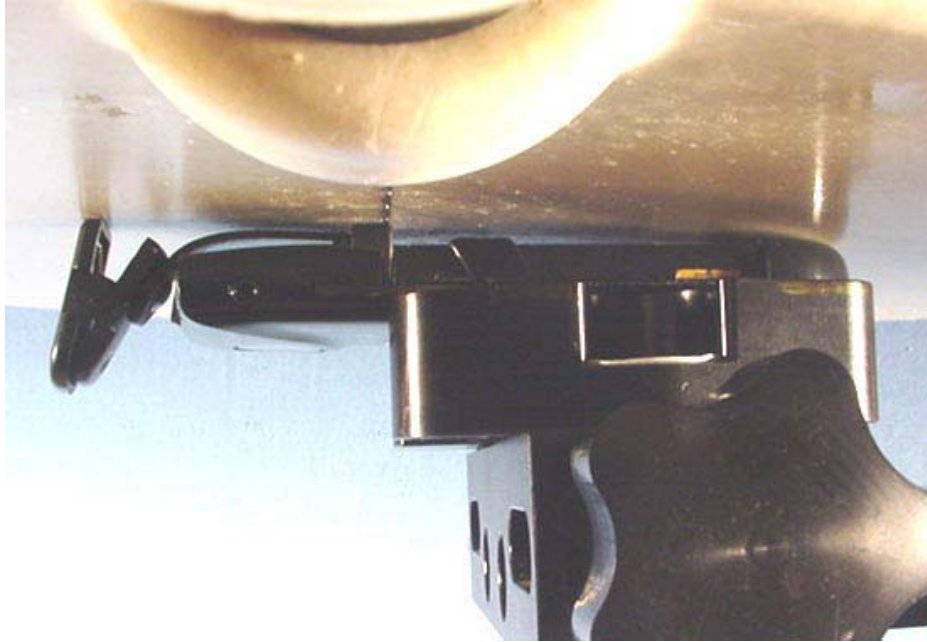


BODY-WORN SAR TEST SETUP PHOTOGRAPHS
Back Side of DUT with Universal Clip Accessory & Standard Battery
0.0 cm Separation Distance to Planar Phantom

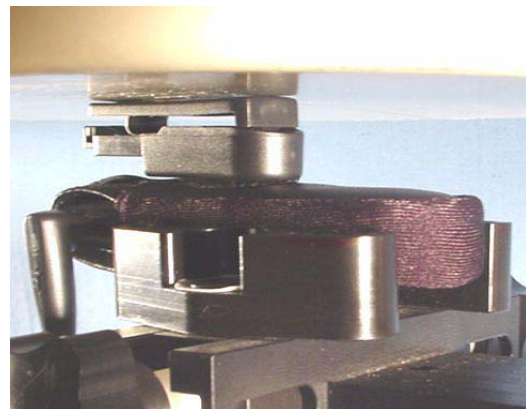
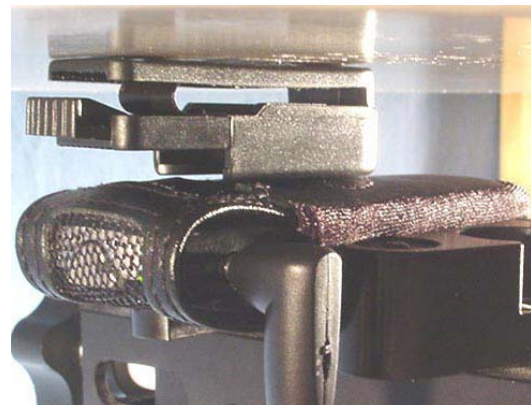
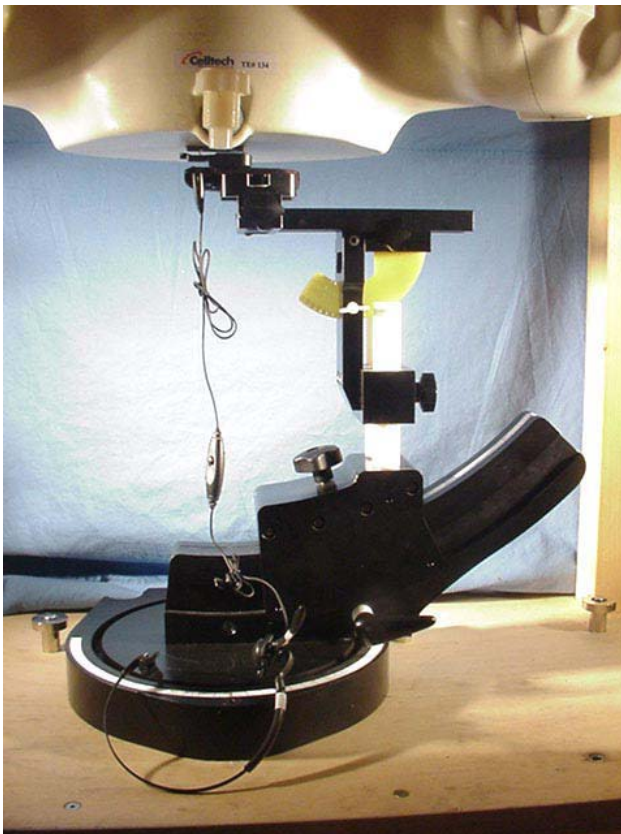
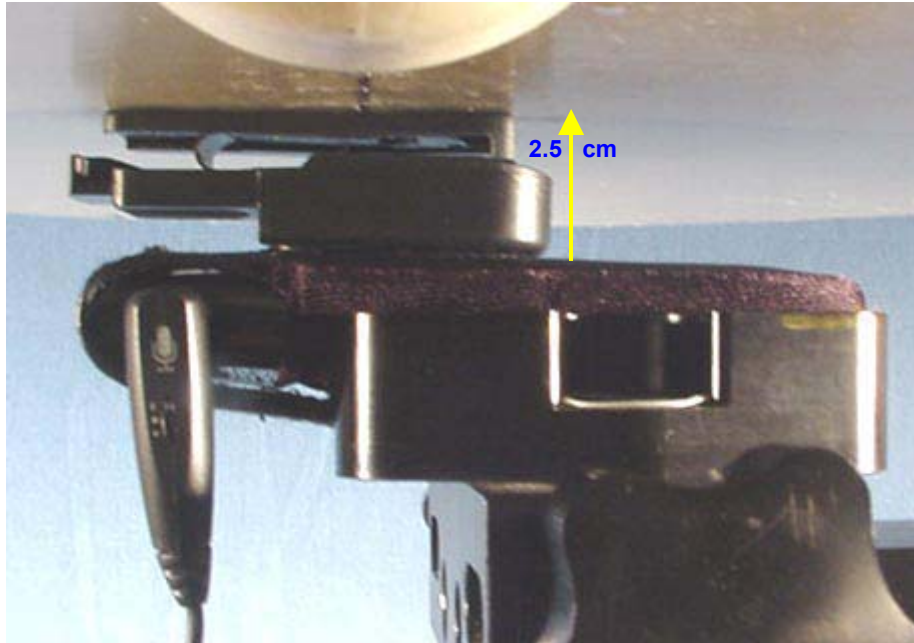


BODY-WORN SAR TEST SETUP PHOTOGRAPHS

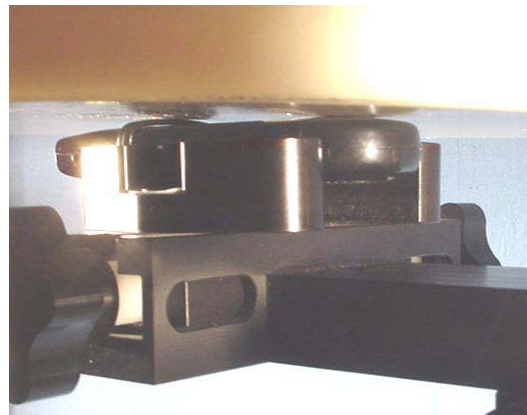
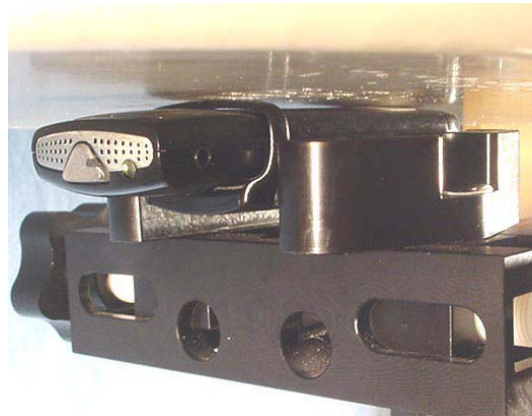
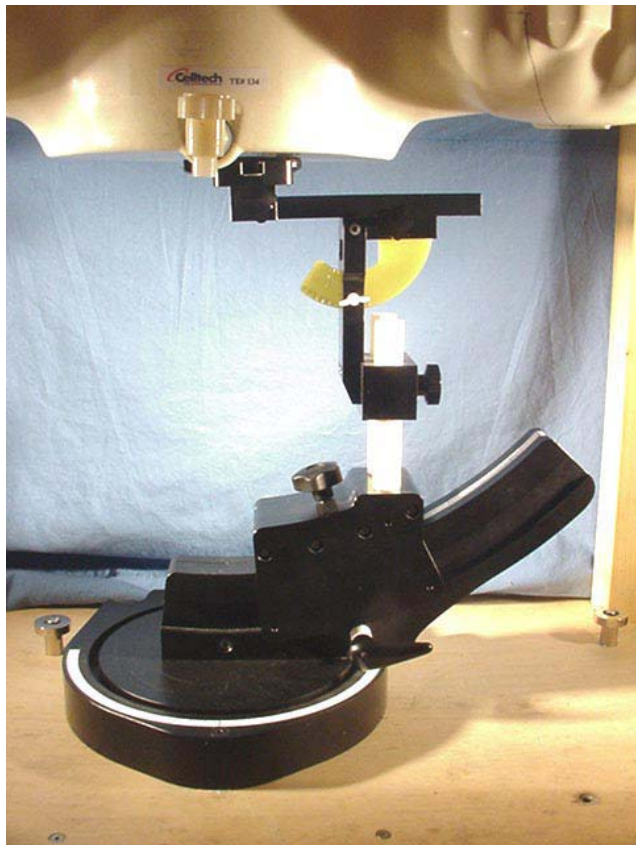
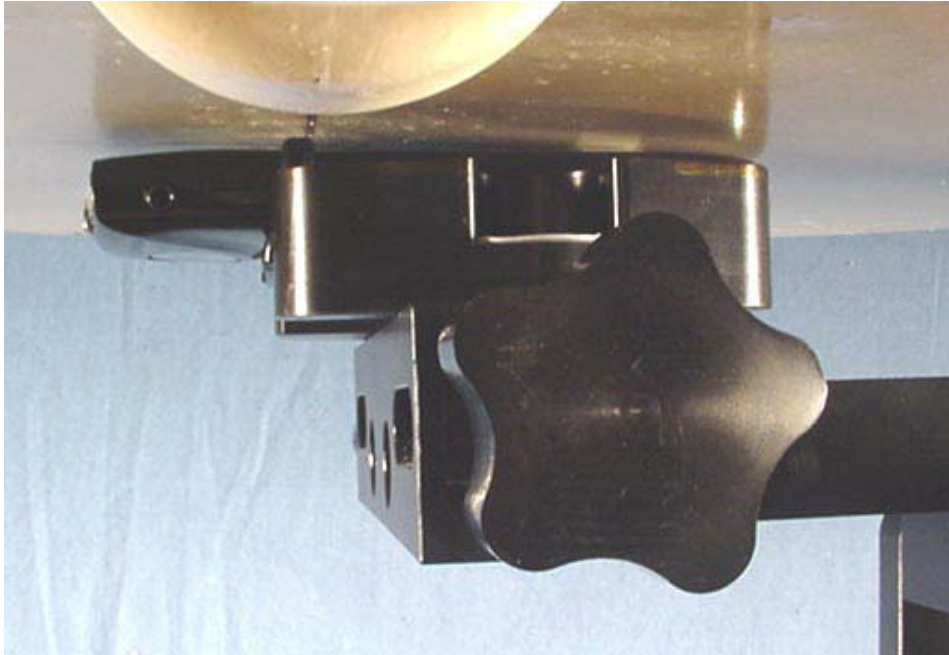
**Back Side of DUT with Universal Clip and Speaker Horn Accessories & Standard Battery
0.0 cm Separation Distance to Planar Phantom**



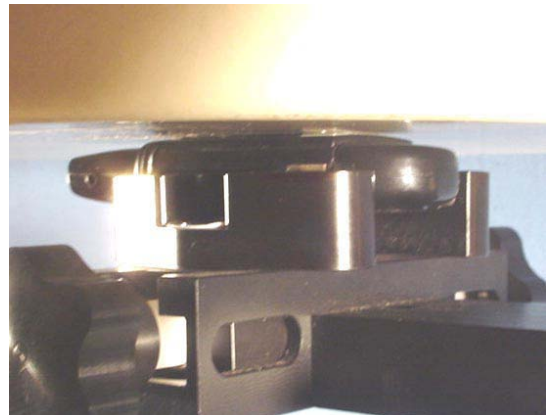
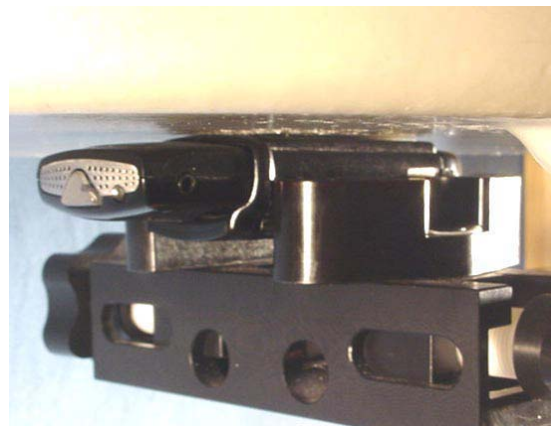
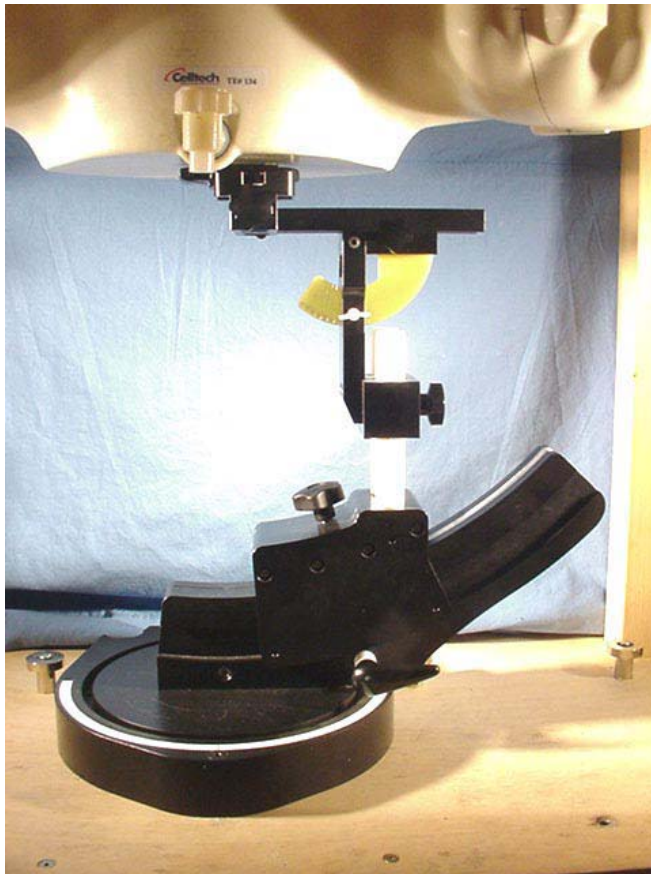
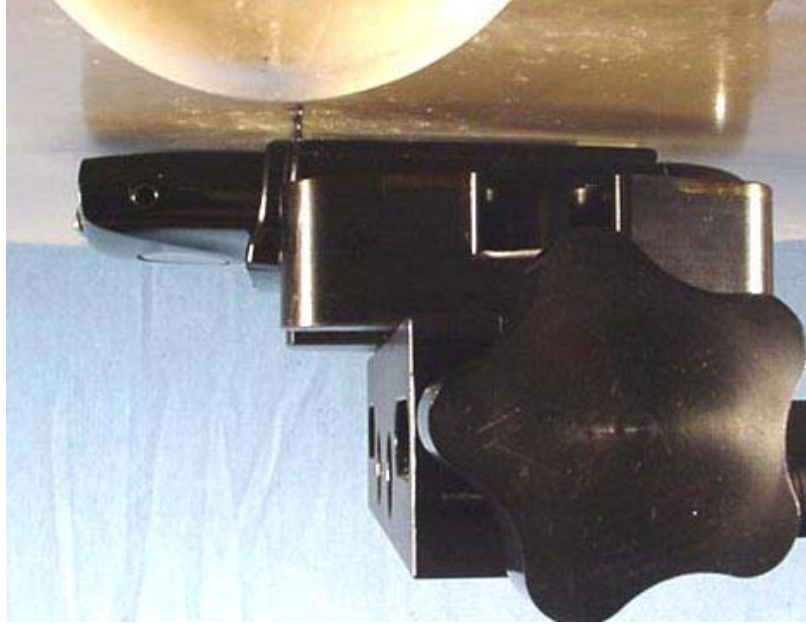
BODY-WORN SAR TEST SETUP PHOTOGRAPHS
Back Side of Holster, Belt-Clip, and Headset-Mic Accessories & Standard Battery
2.5 cm Holster & Belt-Clip Separation Distance to Planar Phantom



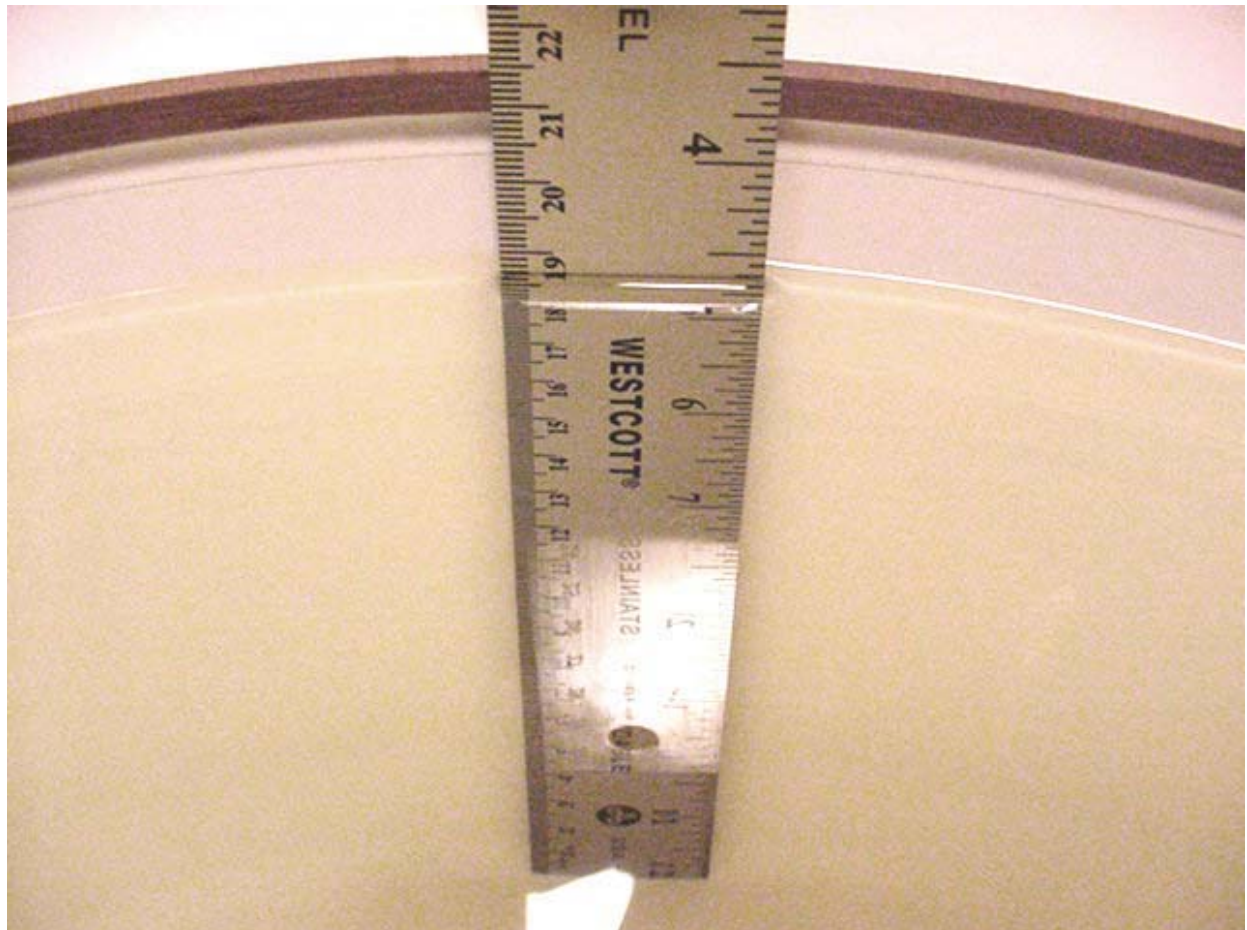
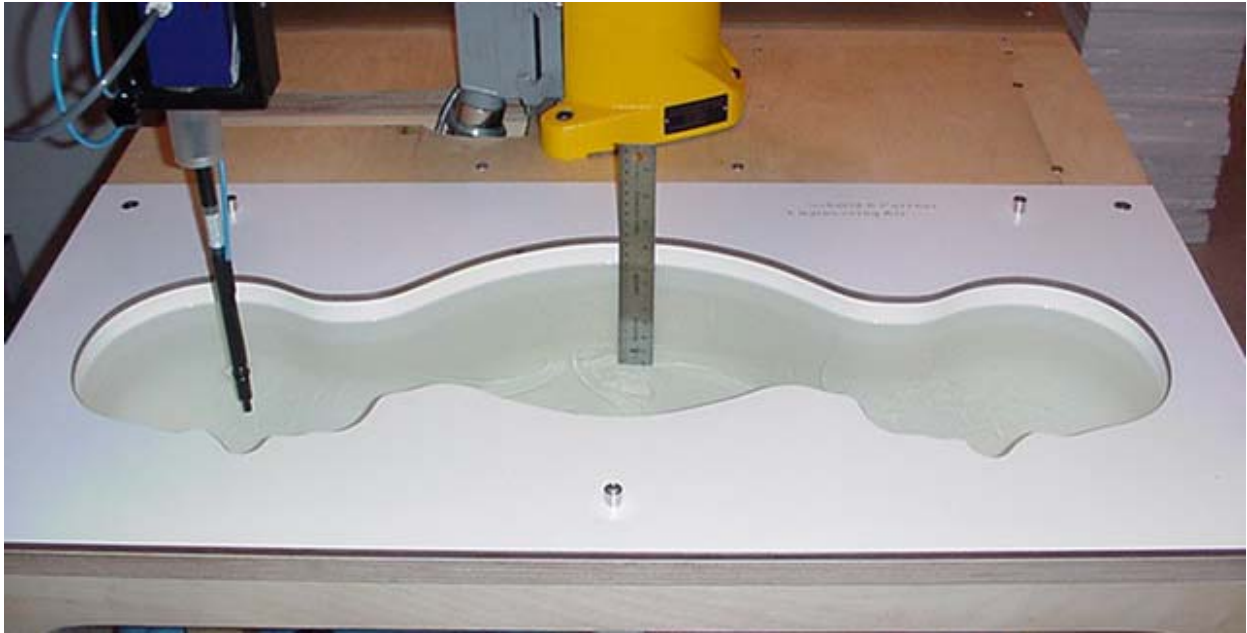
BODY-WORN SAR TEST SETUP PHOTOGRAPHS
Back Side of DUT with Pocket Clip Accessory & Standard Battery
0.0 cm Separation Distance to Planar Phantom



BODY-WORN SAR TEST SETUP PHOTOGRAPHS
Back Side of DUT with Pocket Clip Accessory & Extended Battery
0.0 cm Separation Distance to Planar Phantom



BODY-WORN SAR TEST SETUP PHOTOGRAPHS
Fluid Depth (≥ 15 cm)



DUT PHOTOGRAPHS



**Front Side of Badge
(Speaker & Antenna Side)**



**Back Side of Badge
(with Standard Battery)**



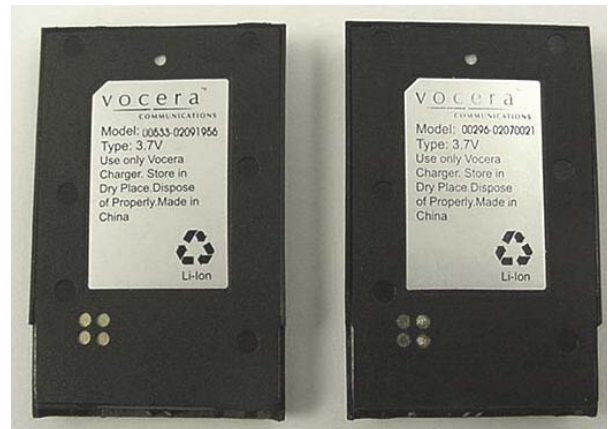
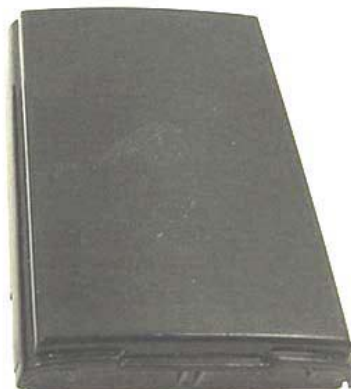
**Back Side of Badge
with Extended Battery**



**Back Side of Badge
with Battery Removed**

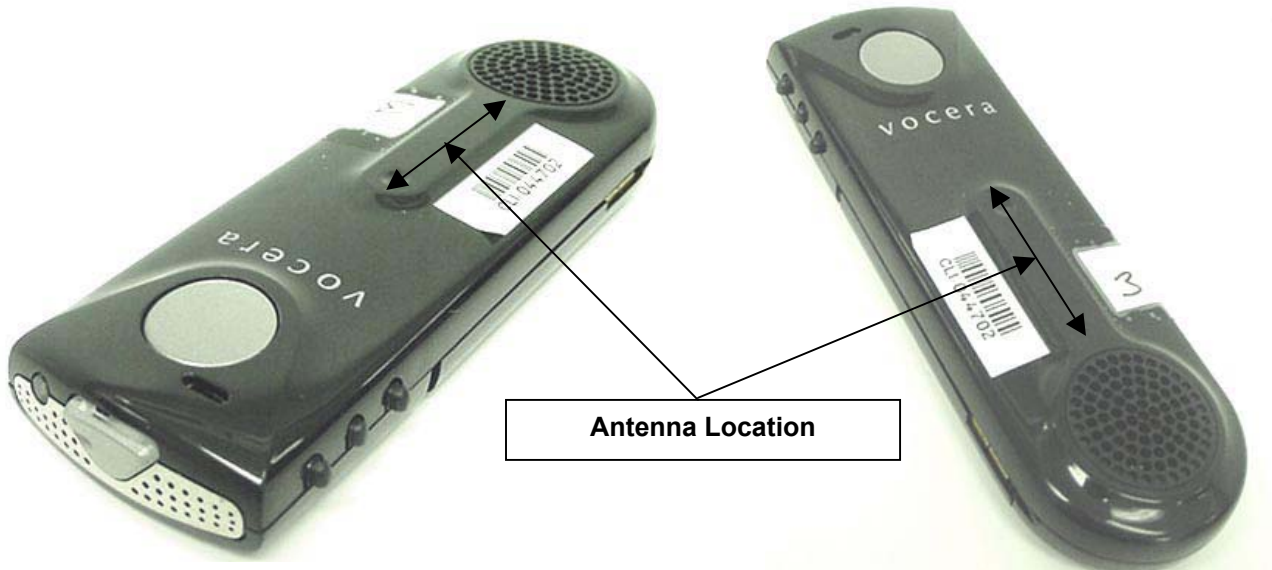


Standard & Extended Batteries - Front Side



Standard & Extended Batteries - Back Side

DUT PHOTOGRAPHS



Top End / Front Left Side of Badge

Bottom End / Front Right Side of Badge



Badge with Standard Battery



Badge with Extended Battery

DUT PHOTOGRAPHS



**Front Side of Badge
with Lanyard Accessory**

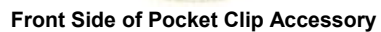


**Back Side of Badge
with Lanyard Accessory**



Lanyard Accessory

DUT PHOTOGRAPHS



DUT PHOTOGRAPHS



**Back Side of Badge
with Universal Clip Accessory**



Front Side / Top End of Universal Clip



Back Side / Top End of Universal Clip



Front Side / Bottom End of Universal Clip



Back Side / Bottom End of Universal Clip

DUT PHOTOGRAPHS



Front Side / Top End Speaker Horn



Back Side / Top End Speaker Horn



Bottom End Speaker Horn



Side View Speaker Horn



Back Side of Badge with Speaker Horn and Universal Clip



Top Side of Badge with Speaker Horn



Front side of Badge with Speaker Horn and Universal Clip

DUT PHOTOGRAPHS



**Front Side of Badge with
Speaker Horn and Lanyard**



Top Side of Badge with Speaker Horn and Lanyard



Left Side of Badge with Speaker Horn and Lanyard



Right Side of Badge with Speaker Horn and Lanyard

DUT PHOTOGRAPHS



**Front of Badge
with Holster & Belt-Clip Accessory**



**Back of Badge
with Holster & Belt-Clip Accessory**



Holster & Belt-Clip Accessory



Left Side of Holster & Belt-Clip Accessory



Right Side of Holster & Belt-Clip Accessory



**Holster & Belt Clip Accessory
& Headset-Mic Accessory**