RF EXPOSURE EVALUATION

SPECIFIC ABSORPTION RATE

SAR TEST REPORT

FOR

VERTEX STANDARD CO., LTD.

PORTABLE VHF PTT MARINE RADIO TRANSCEIVER

MODEL(S): HX500S

FCC ID: K6630183X20

IC ID: 511B-30183X20

Test Report Serial Number

121405K66-F706-S80V

Test Report Issue No.

S706-011206-R0

Test Lab

Celltech Compliance Testing & Engineering Lab
(Celltech Labs Inc.)
1955 Moss Court
Kelowna, BC
Canada
V1Y 9L3

Test Report Prepared By:	Test Report Approved By:
Cheri Frangiadakis	
Cheri Frangiadakis Test Report Writer Celltech Labs Inc.	Jonathan Hughes General Manager Celltech Labs Inc.

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

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

VERTEX STANDARD CO., LTD.
4-8-8 Nakameguro, Meguro-Ku
Tokyo 153-8644
Japan

FCC IDENTIFIER:	**K6630183X20**
IC IDENTIFIER:	**511B-30183X20**
Model(s):	**HX500S**
SAR Test Requirement(s):	**FCC 47 CFR §2.1093; Health Canada Safety Code 6**
SAR Test Procedure(s):	**FCC OET Bulletin 65, Supplement C (Edition 01-01)** **Industry Canada RSS-102 Issue 2**
FCC Device Classification:	**Part 80 VHF Hand Held Transmitter (GMDSS) - GHH**
Device Description:	**Portable VHF PTT Marine Radio Transceiver**
Modulation Type:	**FM (VHF)**
Transmit Frequency Range:	**156.0 - 157.425 MHz**
Max. RF Output Power Measured:	**4.73 Watts (36.75 dBm) Conducted (156.7 MHz)**
Antenna Type(s) Tested:	**Detachable Whip (P/N: CAT460)**
Battery Type(s) Tested:	**NiMH 7.2 V, 1400 mAh (P/N: FNB-83)** **Alkaline 1.5 V 2850 mAh (Duracell Procell AA x6)** **Alkaline Battery Case (P/N: FBA-25A)**
Body-Worn Accessories Tested:	**Plastic Belt-Clip with Metal Spring (P/N: BA0102700)**
Audio Accessories Tested:	**Speaker-Microphone (P/N: MH-57A4B)** **Noise-Canceling Speaker-Microphone (P/N: CMP460)** **VOX Headset (P/N: VC-24)** **VOX Earpiece (P/N: VC-27)**
Max. SAR Level(s) Evaluated:	**Face-held: 0.712 W/kg (1g) - 50% Duty Cycle** **Body-worn: 0.730 W/kg (1g) - 50% Duty Cycle**

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 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 2 for the Occupational / Controlled 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.

Tested By:	Reviewed By:
Sean Johnston **Sean Johnston** **Compliance Technologist** **Celltech Labs Inc.**	Spencer Watson **Spencer Watson** **Senior Compliance Technologist** **Celltech Labs Inc.**

TABLE OF CONTENTS

1.0 INTRODUCTION ____ 4
2.0 DESCRIPTION OF DEVICE UNDER TEST (DUT) ____ 4
3.0 SAR MEASUREMENT SYSTEM ____ 5
4.0 MEASUREMENT SUMMARY ____ 6
5.0 DETAILS OF SAR EVALUATION ____ 7
6.0 EVALUATION PROCEDURES ____ 7
7.0 SYSTEM PERFORMANCE CHECK ____ 8
8.0 SIMULATED EQUIVALENT TISSUES ____ 9
9.0 SAR SAFETY LIMITS ____ 9
10.0 ROBOT SYSTEM SPECIFICATIONS ____ 10
11.0 PROBE SPECIFICATION (ET3DV6) ____ 11
12.0 SIDE PLANAR PHANTOM ____ 11
13.0 VALIDATION PLANAR PHANTOM ____ 11
14.0 DEVICE HOLDER ____ 11
15.0 TEST EQUIPMENT LIST ____ 12
16.0 MEASUREMENT UNCERTAINTIES ____ 13
17.0 REFERENCES ____ 15
APPENDIX A - SAR MEASUREMENT DATA ____ 16
APPENDIX B - SYSTEM PERFORMANCE CHECK DATA ____ 27
APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS ____ 30
APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS ____ 34
APPENDIX E - SYSTEM VALIDATION ____ 49
APPENDIX F - PROBE CALIBRATION ____ 50

2006 Celltech Labs Inc. | This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

1.0 INTRODUCTION

This measurement report demonstrates compliance of the VERTEX STANDARD CO., LTD. Model(s): HX500S Portable VHF PTT Marine Radio Transceiver FCC ID: K6630183X20 with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]) and Health Canada Safety Code 6 (see reference [2]) for the Occupational / Controlled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C (Edition 01-01) (see reference [3]) and IC RSS-102 Issue 2 (see reference [4]) were employed. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 DESCRIPTION OF DEVICE UNDER TEST (DUT)

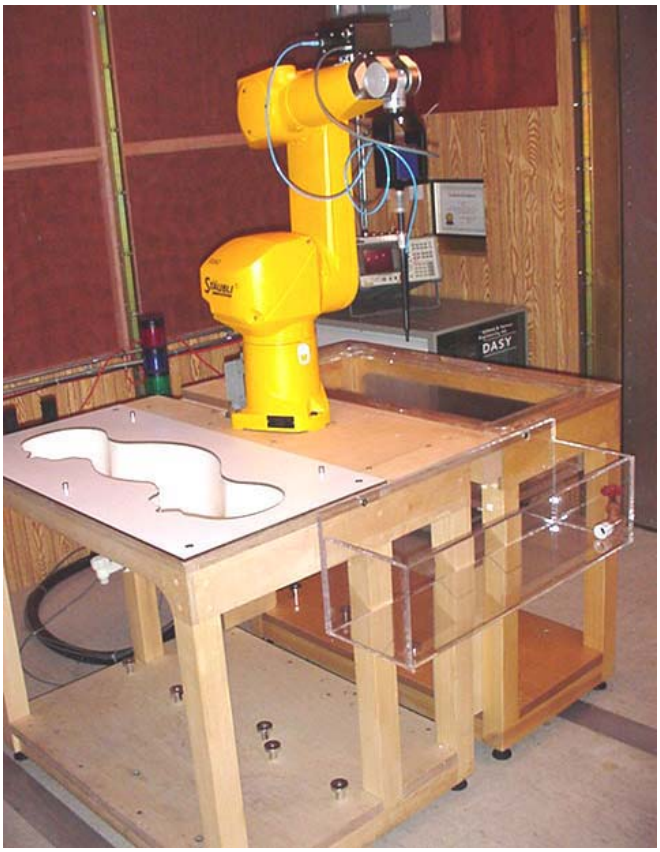
SAR Test Requirement(s)	FCC 47 CFR §2.1093			
	Health Canada Safety Code 6			
SAR Test Procedure(s)	FCC OET Bulletin 65, Supplement C (Edition 01-01)			
	Industry Canada RSS-102 Issue 2			
FCC Device Classification	Part 80 VHF Hand Held Transmitter (GMDSS) - GHH			
IC Device Classification	RSS-182 - Maritime Radio Transmitter			
Device Description	Portable VHF PTT Marine Radio Transceiver			
RF Exposure Category	Occupational / Controlled Exposure Environment			
FCC IDENTIFIER	K6630183X20			
IC IDENTIFIER	511B-30183X20			
Model(s)	HX500S			
Test Sample Serial No.	5M000003		Identical Prototype	
Modulation Type	FM (VHF)			
Transmit Frequency Range	156.0 - 157.425 MHz			
Max. RF Output Power Measured	4.73 Watts	36.75 dBm	156.7 MHz	Conducted
Battery Type(s) Tested	NiMH (Pack)	7.2 V	1400 mAh	P/N: FNB-83
	Alkaline (6x AA)	9 V	2850 mAh	P/N: FBA-25A (Case)
Antenna Type(s) Tested	Detachable Whip	Length: 188 mm		P/N: CAT460
Body-Worn Accessories Tested	Belt-Clip (Plastic with Metal Spring)	1.3 cm thickness		P/N: BA0102700
Audio Accessories Tested	Speaker-Microphone			P/N: MH-57A4B
	Noise-Canceling Speaker-Microphone			P/N: CMP460
	VOX Headset			P/N: VC-24
	VOX Earpiece			P/N: VC-27

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

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 Plexiglas validation phantom



DASY4 SAR Measurement System with Plexiglas side planar phantom

4.0 MEASUREMENT SUMMARY

SAR EVALUATION RESULTS

Test Type	Freq. (MHz)	Chan.	Test Mode	Antenna Position	Battery Type	Accessories Tested: Body-worn	Accessories Tested: Audio	Separ. Distance to Planar Phantom (cm)	Cond. Power Before Test (Watts)		Measured SAR 1g (W/kg) Duty Cycle 100%	Measured SAR 1g (W/kg) Duty Cycle 50%	SAR Drift During Test (dB)	Scaled SAR with droop 1g (W/kg) Duty Cycle 100%	Scaled SAR with droop 1g (W/kg) Duty Cycle 50%
Face	156.7	14	CW	Fixed	NiMH	--	--	2.5	4.70		1.26	0.630	-0.529	1.42	**0.712**
Face	156.7	14	CW	Fixed	Alkaline	--	--	2.5	4.73		1.21	0.605	-0.643	1.40	0.702
Body	156.7	14	CW	Fixed	NiMH	Belt-Clip	Speaker-Mic (P/N: MH-57A4B)	1.3	4.72	P	1.11	0.555	0.141	-	-
									4.72	S	0.940	0.470	0.109	-	-
Body	156.7	14	CW	Fixed	NiMH	Belt-Clip	Noise-Canceling Speaker-Mic (P/N: CMP460)	1.3	4.73		0.909	0.455	0.169	-	-
Body	156.7	14	CW	Fixed	NiMH	Belt-Clip	VOX Headset (P/N: VC-24)	1.3	4.73	P	1.06	0.530	0.206	-	-
									4.72	S	0.886	0.443	0.155	-	-
Body	156.7	14	CW	Fixed	NiMH	Belt-Clip	VOX Earpiece (P/N: VC-27)	1.3	4.72		1.29	0.645	-0.141	-	-
Body	156.7	14	CW	Fixed	Alkaline	Belt-Clip	VOX Earpiece (P/N: VC-27)	1.3	4.71		1.46	**0.730**	0.134	-	-

ANSI / IEEE C95.1 1999 - SAFETY LIMIT	FACE / BODY: 8.0 W/kg (averaged over 1 gram)	Spatial Peak - Controlled Exposure / Occupational

Test Date	December 23, 2005				December 23, 2005				Fluid Type	Brain	Body	Unit
Dielectric Constant ε_r	150 MHz Brain				150 MHz Body				Relative Humidity	30	30	%
	IEEE Target		Meas.	Dev.	IEEE Target		Meas.	Dev.	Atmospheric Pressure	102.4	102.6	kPa
	52.3	**± 5%**	54.9	+5.0%	**61.9**	**± 5%**	62.8	+1.5%	Ambient Temperature	23.6	23.0	°C
Conductivity σ (mho/m)	150 MHz Brain				150 MHz Body				Fluid Temperature	23.0	22.8	°C
	IEEE Target		Meas.	Dev.	IEEE Target		Meas.	Dev.	Fluid Depth	≥ 15	≥ 15	cm
	0.76	**± 5%**	0.795	+4.6%	**0.80**	**± 5%**	0.80	0.0%	ρ (Kg/m^3)	1000		

Note(s):

1. 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.
2. The transmission band of the DUT was < 10 MHz; therefore only the middle channel of the frequency band was evaluated (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).
3. Secondary peak SAR levels measured within 2 dB of the primary were reported (P = Primary, S = Secondary).
4. The area scan evaluation was performed with a fully charged battery. After the area scan was completed the radio was cooled down to room temperature and the battery was replaced with a fully charged battery prior to the zoom scan evaluation.
5. The power droops (> 5% from the start power) measured by the DASY4 system for the duration of the SAR evaluations were added to the measured SAR levels to report scaled SAR results as shown in the above test data table.
6. A SAR-versus-Time power drift evaluation was performed in the test configuration that reported the maximum power droop. See Appendix A (SAR Test Plots) for SAR-versus-Time power droop evaluation plot.
7. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluations. The temperatures reported were consistent for all measurement periods.
8. The dielectric parameters of the simulated tissue mixtures were measured prior to the SAR evaluations using an ALS-PR-DIEL Dielectric Probe Kit and an HP 8753ET Network Analyzer (see Appendix C).
9. The SAR evaluations were performed within 24 hours of the system performance check.

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

5.0 DETAILS OF SAR EVALUATION

The VERTEX STANDARD CO., LTD. Model(s): HX500S Portable VHF PTT Marine Radio Transceiver FCC ID: K6630183X20 was compliant for localized Specific Absorption Rate (Occupational / Controlled Exposure) based on the test provisions and conditions described below. The detailed test setup photographs are shown in Appendix D.

1. The DUT was evaluated in a face-held configuration with the front of the radio placed parallel to the outer surface of the planar phantom. A 2.5 cm separation distance was maintained between the front side of the DUT and the outer surface of the planar phantom.
2. The DUT was tested in a body-worn configuration with the back of the radio placed parallel to the outer surface of the planar phantom. The attached belt-clip accessory was touching the planar phantom and provided a 1.3 cm separation distance from the back of the DUT to the outer surface of the planar phantom. The DUT was evaluated for body-worn SAR with speaker-microphone, noise-canceling speaker-microphone, VOX earpiece, and VOX headset audio accessories.
3. The conducted power levels were measured prior to the SAR evaluations using a Gigatronics 8652A Universal Power Meter according to the procedures described in FCC 47 CFR §2.1046.
4. The area scan evaluation was performed with a fully charged battery. After the area scan was completed the radio was cooled down to room temperature and the battery was replaced with a fully charged battery prior to the zoom scan evaluation.
5. The power drift of the DUT for the duration of the SAR evaluations was measured by the DASY4 system.
6. The DUT was tested in unmodulated continuous transmit operation (Continuous Wave mode at 100% duty cycle) with the transmit key constantly depressed. For a push-to-talk device the 50% duty cycle compensation reported assumes a transmit/receive cycle of equal time base.
7. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluations. The temperatures reported were consistent for all measurement periods.
8. The dielectric parameters of the simulated tissue mixtures were measured prior to the SAR evaluations using an ALS-PR-DIEL Dielectric Probe Kit and an HP 8753ET Network Analyzer (see Appendix C).
9. The SAR evaluations were performed using a Plexiglas side planar phantom.
10. The SAR evaluations were performed within 24 hours of the system performance check.

6.0 EVALUATION PROCEDURES

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

b. 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:

c. 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.

d. 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:

e. 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 F). The extrapolation was based on trivariate quadratics computed from the previously calculated 3D interpolated points nearest the phantom surface.

f. 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).

g. A zoom scan volume of 32 mm x 32 mm x 30 mm (5 x 5 x 7 points) centered at the peak SAR location determined from the area scan is used for all zoom scans for devices with a transmit frequency < 800 MHz. Zoom scans for frequencies ≥ 800 MHz are determined with a scan volume of 30 mm x 30 mm x 30 mm (7 x 7 x 7) to ensure complete capture of the peak spatial-average SAR.

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluations a system check was performed using a planar phantom and a 300 MHz dipole (see Appendix E for system validation procedures). The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using an ALS-PR-DIEL Dielectric Probe Kit and an HP 8753ET Network Analyzer (see Appendix C). A forward power of 250 mW was applied to the dipole and the system was verified to a tolerance of ±10% (see Appendix B for system performance check test plot).

SYSTEM PERFORMANCE CHECK EVALUATION

Test Date	300MHz Equiv. Tissue	SAR 1g (W/kg)			Dielectric Constant ε_r			Conductivity σ (mho/m)			ρ (Kg/m³)	Amb. Temp. (°C)	Fluid Temp. (°C)	Fluid Depth (cm)	Humid. (%)	Barom. Press. (kPa)
		IEEE Target	Meas.	Dev.	IEEE Target	Meas.	Dev.	IEEE Target	Meas.	Dev.						
12/22/05	**Brain**	**0.750 ±10%**	0.803	+7.1%	**45.3 ±5%**	45.0	-0.7%	**0.87 ±5%**	0.87	0.0%	1000	24.4	22.3	≥ 15	30	100.6

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.

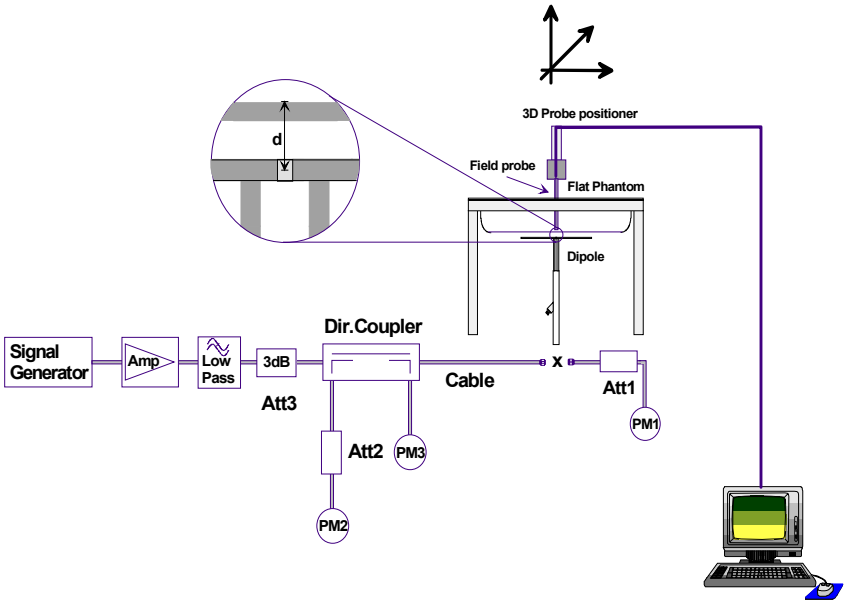


Figure 1. System Performance Check Setup Diagram

300MHz Dipole Setup

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

8.0 SIMULATED EQUIVALENT TISSUES

The simulated tissue mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution. Preservation with a bactericide is added and visual inspection is made to ensure air bubbles are not trapped during the mixing process. The fluid was prepared according to standardized procedures and measured for dielectric parameters (permittivity and conductivity).

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

9.0 SAR SAFETY LIMITS

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10g)	4.0	20.0

Notes:

1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

10.0 ROBOT SYSTEM SPECIFICATIONS

Specifications

POSITIONER: Stäubli Unimation Corp. Robot Model: RX60L
Repeatability: 0.02 mm
No. of axis: 6

Data Acquisition Electronic (DAE) System

Cell Controller

Processor: 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)

Evaluation Phantom

Type: Side Planar Phantom
Shell Material: Plexiglas
Bottom Thickness: 2.0 mm ± 0.1 mm
Outer Dimensions: 75.0 cm (L) x 22.5 cm (W) x 20.5 cm (H); Back Plane: 25.7 cm (H)

Validation Phantom (≤ 450MHz)

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

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

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 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 SIDE PLANAR PHANTOM

The side planar phantom is constructed of Plexiglas material with a 2.0 mm shell thickness for face-held and body-worn SAR evaluations of handheld and body-worn radio transceivers. The side planar phantom is mounted on the side of the DASY4 compact system table.

Plexiglas Side Planar Phantom

13.0 VALIDATION PLANAR PHANTOM

The validation planar phantom is constructed of Plexiglas material with a 6.0 mm shell thickness for system validations at 450MHz and below. The validation planar phantom is mounted in the table of the DASY4 compact system.

Validation Planar Phantom

14.0 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

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

15.0 TEST EQUIPMENT LIST

TEST EQUIPMENT		ASSET NO.	SERIAL NO.	DATE CALIBRATED		CALIBRATION DUE DATE
USED	DESCRIPTION					
x	Schmid & Partner DASY4 System	-	-	-		-
x	-DASY4 Measurement Server	00158	1078	N/A		N/A
x	-Robot	00046	599396-01	N/A		N/A
x	-DAE4	00019	353	15Jun05		15Jun06
	-DAE3	00018	370	25Jan05		25Jan06
x	-ET3DV6 E-Field Probe	00016	1387	18Mar05		18Mar06
	-ET3DV6 E-Field Probe	00017	1590	20May05		20May06
	-EX3DV4 E-Field Probe	00125	3547	21Jan05		21Jan06
x	-300MHz Validation Dipole	00023	135	25Oct05		25Oct06
	-450MHz Validation Dipole	00024	136	25Oct05		25Oct06
	-835MHz Validation Dipole	00022	411	**Brain**	30Mar05	30Mar06
				Body	12Apr05	12Apr06
	-900MHz Validation Dipole	00020	054	**Brain**	10Jun05	10Jun06
				Body	10Jun05	10Jun06
	-1800MHz Validation Dipole	00021	247	**Brain**	14Jun05	14Jun06
				Body	14Jun05	14Jun06
	-1900MHz Validation Dipole	00032	151	**Brain**	17Jun05	17Jun06
				Body	22Apr05	22Apr06
	-2450MHz Validation Dipole	00025	150	**Brain**	20Sep05	20Sep06
				Body	22Apr05	22Apr06
	-5000MHz Validation Dipole	00126	1031	**Brain**	11Jan05	11Jan06
				Body	11Jan05	11Jan06
	-SAM Phantom V4.0C	00154	1033	N/A		N/A
	-Barski Planar Phantom	00155	03-01	N/A		N/A
x	-Plexiglas Side Planar Phantom	00156	161	N/A		N/A
x	- Plexiglas Validation Planar Phantom	00157	137	N/A		N/A
	HP 85070C Dielectric Probe Kit	00033	N/A	N/A		N/A
x	ALS-PR-DIEL Dielectric Probe Kit	00160	260-00953	N/A		N/A
x	Gigatronics 8652A Power Meter	00110	1835801	16Apr05		16Apr06
	Gigatronics 8652A Power Meter	00008	1835267	29Apr05		29Apr06
x	Gigatronics 80701A Power Sensor	00012	1834350	12Sep05		12Sep06
x	Gigatronics 80701A Power Sensor	00014	1833699	07Sep05		07Sep06
	Gigatronics 80701A Power Sensor	00109	1834366	16Apr05		16Apr06
x	HP 8753ET Network Analyzer	00134	US39170292	04May05		04May06
x	HP 8648D Signal Generator	00005	3847A00611	29Apr05		29Apr06
	Rohde & Schwarz SMR40 Signal Generator	00006	100104	12Apr05		12Apr06
x	Amplifier Research 5S1G4 Power Amplifier	00106	26235	N/A		N/A

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

16.0 MEASUREMENT UNCERTAINTIES

UNCERTAINTY BUDGET FOR DEVICE EVALUATION						
Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**ci 1g**	**Uncertainty Value ±% (1g)**	**V_i or V_{eff}**
Measurement System						
Probe calibration	5.0	Normal	1	1	5.0	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	0.7	1.9	∞
Spherical isotropy of the probe	9.6	Rectangular	1.732050808	0.7	3.9	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	1	Rectangular	1.732050808	1	0.6	∞
Probe linearity	4.7	Rectangular	1.732050808	1	2.7	∞
Detection limit	1	Rectangular	1.732050808	1	0.6	∞
Readout electronics	0.3	Normal	1	1	0.3	∞
Response time	0.8	Rectangular	1.732050808	1	0.5	∞
Integration time	2.6	Rectangular	1.732050808	1	1.5	∞
RF ambient conditions	3	Rectangular	1.732050808	1	1.7	∞
Mech. constraints of robot	0.4	Rectangular	1.732050808	1	0.2	∞
Probe positioning	2.9	Rectangular	1.732050808	1	1.7	∞
Extrapolation & integration	1	Rectangular	1.732050808	1	0.6	∞
Test Sample Related						
Device positioning	2.9	Normal	1	1	2.9	12
Device holder uncertainty	3.6	Normal	1	1	3.6	8
Power drift	5	Rectangular	1.732050808	1	2.9	∞
Phantom and Setup						
Phantom uncertainty	4	Rectangular	1.732050808	1	2.3	∞
Liquid conductivity (target)	5	Rectangular	1.732050808	0.64	1.8	∞
Liquid conductivity (measured)	2.5	Normal	1	0.64	1.6	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	2.5	Normal	1	0.6	1.5	∞
Combined Standard Uncertainty					**10.33**	
Expanded Uncertainty (k=2)					**20.66**	

Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 (see reference [5])

MEASUREMENT UNCERTAINTIES (CONT.)

UNCERTAINTY BUDGET FOR SYSTEM VALIDATION						
Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**ci 1g**	**Uncertainty Value ±% (1g)**	**V_i or V_{eff}**
Measurement System						
Probe calibration	4.5	Normal	1	1	4.5	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	1	2.7	∞
Spherical isotropy of the probe	0	Rectangular	1.732050808	1	0.0	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	1	Rectangular	1.732050808	1	0.6	∞
Probe linearity	4.7	Rectangular	1.732050808	1	2.7	∞
Detection limit	1	Rectangular	1.732050808	1	0.6	∞
Readout electronics	0.3	Normal	1	1	0.3	∞
Response time	0	Rectangular	1.732050808	1	0.0	∞
Integration time	0	Rectangular	1.732050808	1	0.0	∞
RF ambient conditions	3	Rectangular	1.732050808	1	1.7	∞
Mech. constraints of robot	0.4	Rectangular	1.732050808	1	0.2	∞
Probe positioning	2.9	Rectangular	1.732050808	1	1.7	∞
Extrapolation & integration	1	Rectangular	1.732050808	1	0.6	∞
Test Sample Related						
Dipole Positioning	2	Normal	1.732050808	1	1.2	∞
Power & Power Drift	4.7	Normal	1.732050808	1	2.7	∞
Phantom and Setup						
Phantom uncertainty	4	Rectangular	1.732050808	1	2.3	∞
Liquid conductivity (target)	5	Rectangular	1.732050808	0.64	1.8	∞
Liquid conductivity (measured)	2.5	Normal	1	0.64	1.6	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	2.5	Normal	1	0.6	1.5	∞
Combined Standard Uncertainty					**8.20**	
Expanded Uncertainty (k=2)					**16.39**	

Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 (see reference [5])

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

17.0 REFERENCES

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

[2] Health Canada, "Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz", Safety Code 6: 1999.

[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, "Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)", Radio Standards Specification RSS-102 Issue 2: November 2005.

[5] IEEE Standard 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques": December 2003.

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

APPENDIX A - SAR MEASUREMENT DATA

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

Date Tested: 12/23/2005

Face-Held SAR - NiMH Battery Pack - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

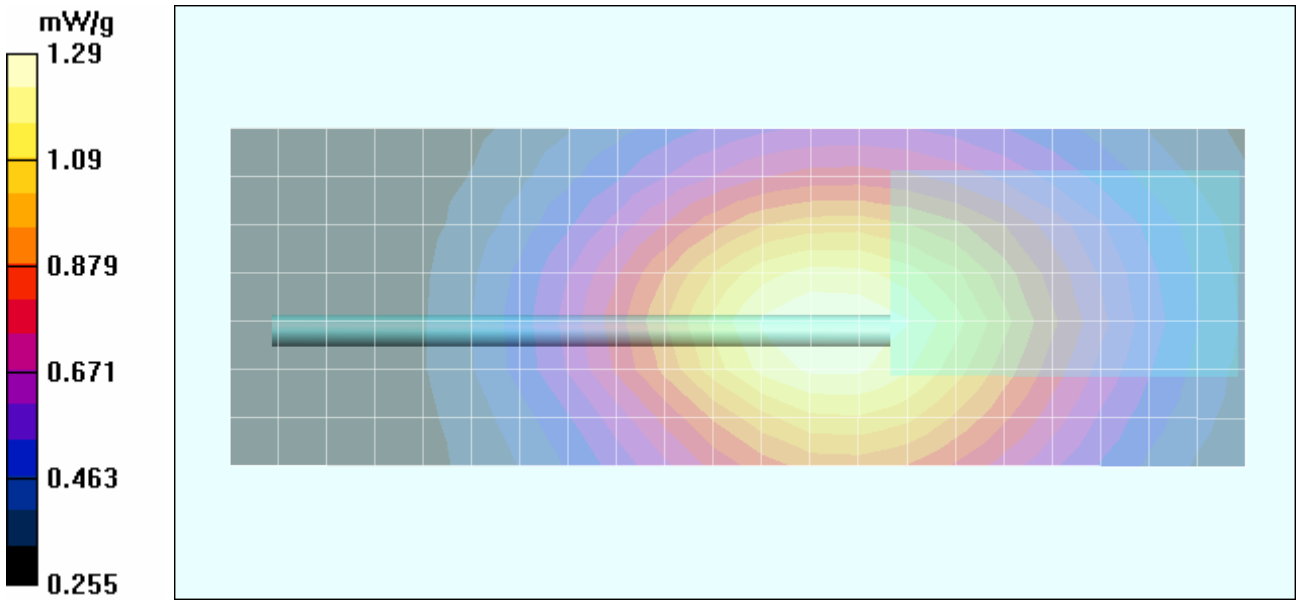
Ambient Temp: 23.6 °C; Fluid Temp: 23.0 °C; Barometric Pressure: 102.4 kPa; Humidity: 30%

Communication System: FM VHF (CW)
RF Output Power: 4.70 Watts (Conducted)
Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
7.2V 1400mAh NiMH Battery Pack (P/N: FNB-83)
Medium: HSL150 (σ = 0.795 mho/m; ε_r = 54.9; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1387; ConvF(8.8, 8.8, 8.8); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

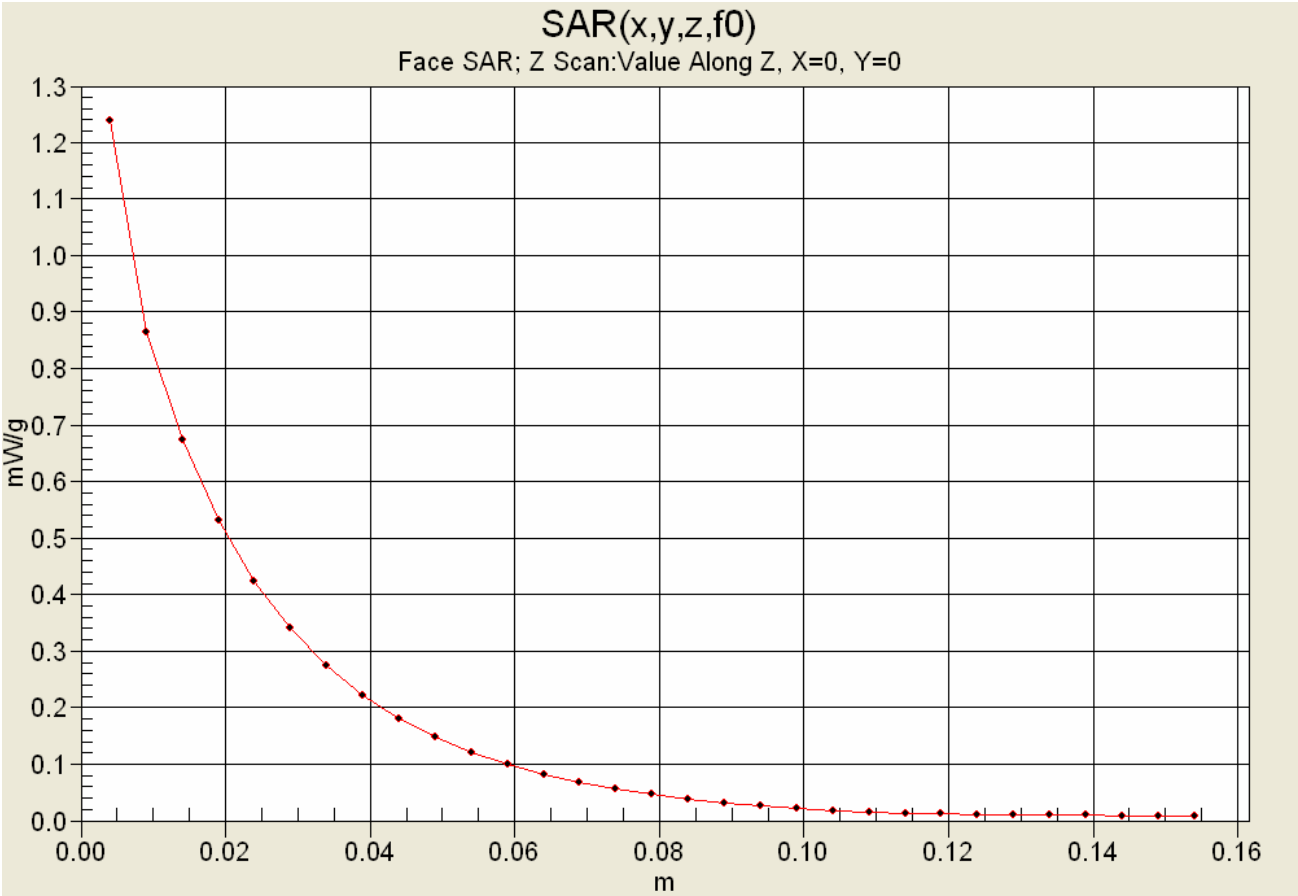
Face-Held SAR - 2.5 cm Separation Distance to Planar Phantom - Mid Channel/Area Scan (8x22x1):
Measurement grid: dx=15mm, dy=15mm

Face-Held SAR - 2.5 cm Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 38.4 V/m; Power Drift = -0.529 dB
Peak SAR (extrapolated) = 2.01 W/kg
SAR(1 g) = 1.26 mW/g; SAR(10 g) = 0.921 mW/g



2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

Z-Axis Scan



2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

Date Tested: 12/23/2005

Face-Held SAR - Alkaline Batteries (Duracell Procell) - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

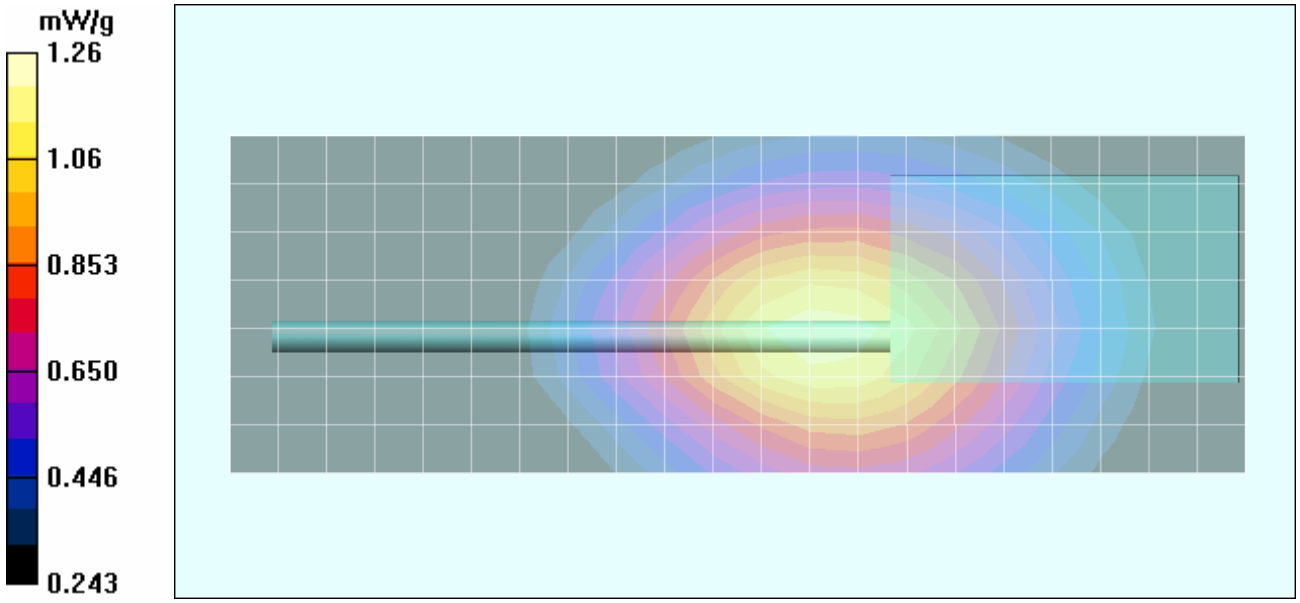
Ambient Temp: 23.6 °C; Fluid Temp: 23.0 °C; Barometric Pressure: 102.4 kPa; Humidity: 30%

Communication System: FM VHF (CW)
RF Output Power: 4.73 Watts (Conducted)
Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
9V AA Duracell Procell Alkaline Battery Pack (P/N: FBA-25A)
Medium: HSL150 (σ = 0.795 mho/m; ε_r = 54.9; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1387; ConvF(8.8, 8.8, 8.8); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

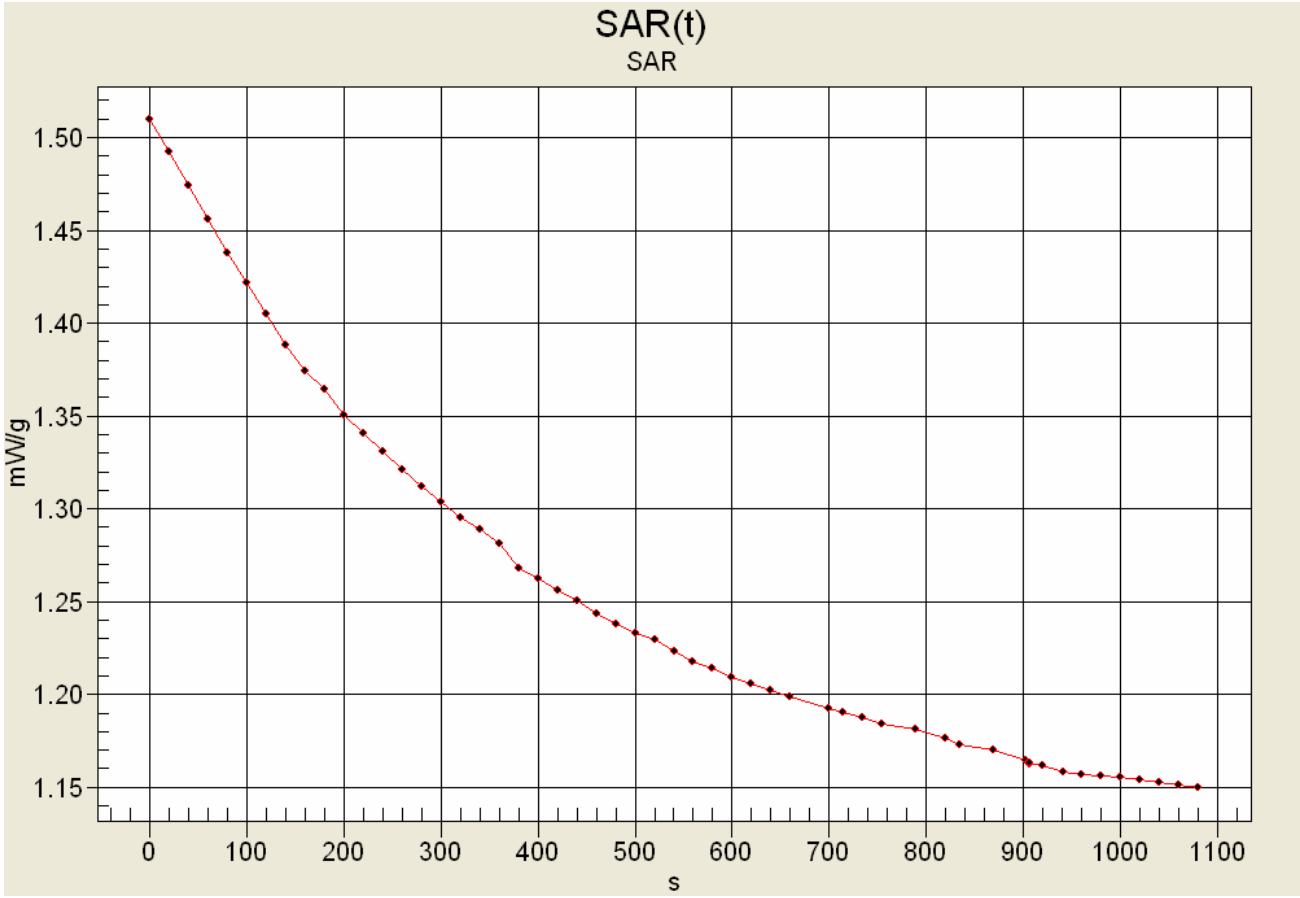
Face-Held SAR - 2.5 cm Separation Distance to Planar Phantom - Mid Channel/Area Scan (8x22x1):
Measurement grid: dx=15mm, dy=15mm

Face-Held SAR - 2.5 cm Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 38.3 V/m; Power Drift = -0.643 dB
Peak SAR (extrapolated) = 1.94 W/kg
SAR(1 g) = 1.21 mW/g; SAR(10 g) = 0.887 mW/g



SAR-versus-Time Power Drift Evaluation

Face-Held Configuration
Duracell Procell Alkaline Battery Pack (P/N: FBA-25A)
Channel 14 - 156.7 MHz



Max SAR: 1.5097 mW/g
Low SAR: 1.14998 mW/g (-1.1820 dB)
SAR after 340s: 1.28872 mW/g (-0.6873 dB)
(340s = Zoom Scan Duration)
(1080s = Area Scan Duration)

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

Date Tested: 12/23/2005

Body-Worn SAR - NiMH Battery Pack - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

Body-Worn Accessory: Belt-Clip (P/N: BA0102700); Audio Accessory: Speaker-Microphone (P/N: MH-57A4B)

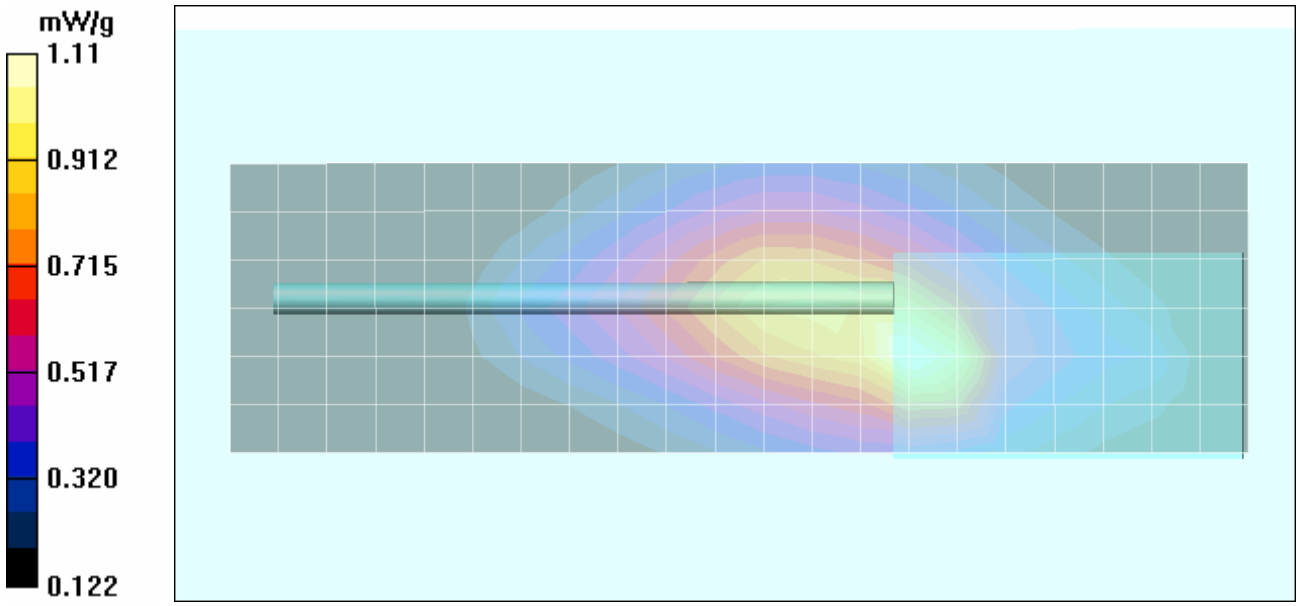
Ambient Temp: 23.0 °C; Fluid Temp: 22.8 °C; Barometric Pressure: 102.6 kPa; Humidity: 30%

Communication System: FM VHF (CW)
RF Output Power: 4.72 Watts (Conducted)
RF Output Power: 4.72 Watts (Conducted) 2nd Maximum
Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
7.2V 1400mAh NiMH Battery Pack (P/N: FNB-83)
Medium: M150 (σ = 0.80 mho/m; ε_r = 62.8; ρ = 1000 kg/m^3)
- Probe: ET3DV6 - SN1387; ConvF(8.4, 8.4, 8.4); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Area Scan (7x22x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 34.6 V/m; Power Drift = 0.141 dB
Peak SAR (extrapolated) = 2.63 W/kg
SAR(1 g) = 1.11 mW/g; SAR(10 g) = 0.684 mW/g

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan 2 (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 35.3 V/m; Power Drift = 0.109 dB
Peak SAR (extrapolated) = 1.56 W/kg
SAR(1 g) = 0.940 mW/g; SAR(10 g) = 0.667 mW/g



Date Tested: 12/23/2005

Body-Worn SAR - NiMH Battery Pack - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

Body-Worn Accessory: Belt-Clip (P/N: BA0102700); Audio Accessory: Noise-Canceling Speaker-Microphone (P/N: CMP460)

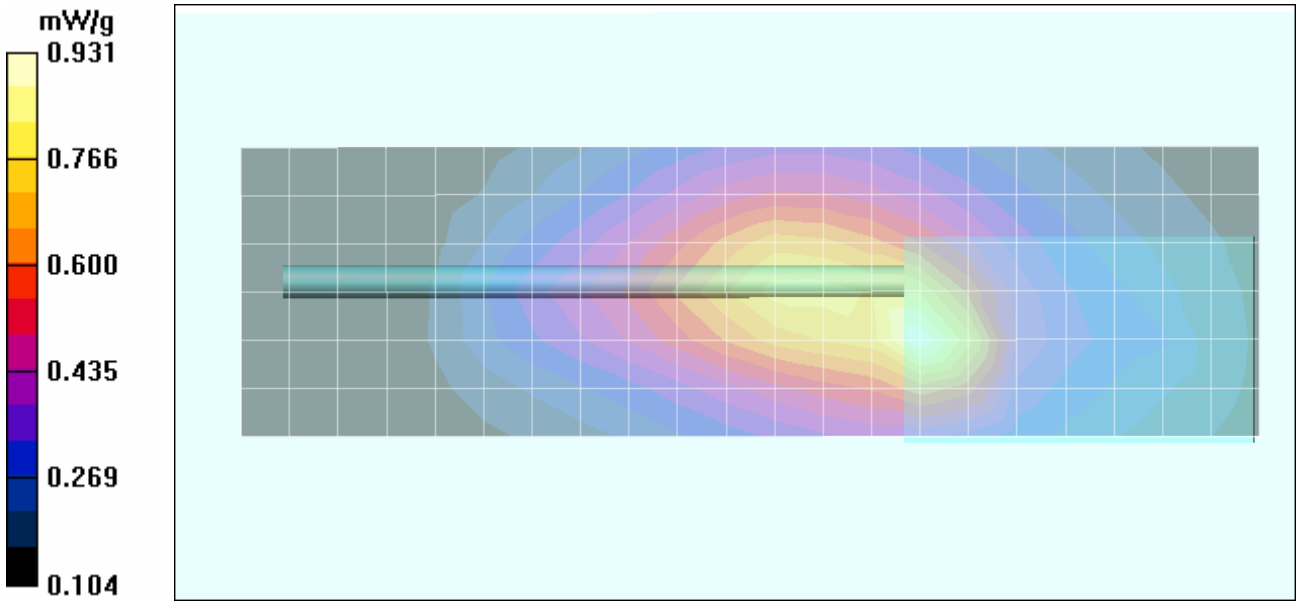
Ambient Temp: 23.0 °C; Fluid Temp: 22.8 °C; Barometric Pressure: 102.6 kPa; Humidity: 30%

Communication System: FM VHF (CW)
RF Output Power: 4.73 Watts (Conducted)
Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
7.2V 1400mAh NiMH Battery Pack (P/N: FNB-83)
Medium: M150 (σ = 0.80 mho/m; ε_r = 62.8; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1387; ConvF(8.4, 8.4, 8.4); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Area Scan (7x22x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 31.0 V/m; Power Drift = 0.169 dB
Peak SAR (extrapolated) = 2.07 W/kg
SAR(1 g) = 0.909 mW/g; SAR(10 g) = 0.567 mW/g



Date Tested: 12/23/2005

Body-Worn SAR - NiMH Battery Pack - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

Body-Worn Accessory: Belt-Clip (P/N: BA0102700); Audio Accessory: VOX Headset (P/N: VC-24)

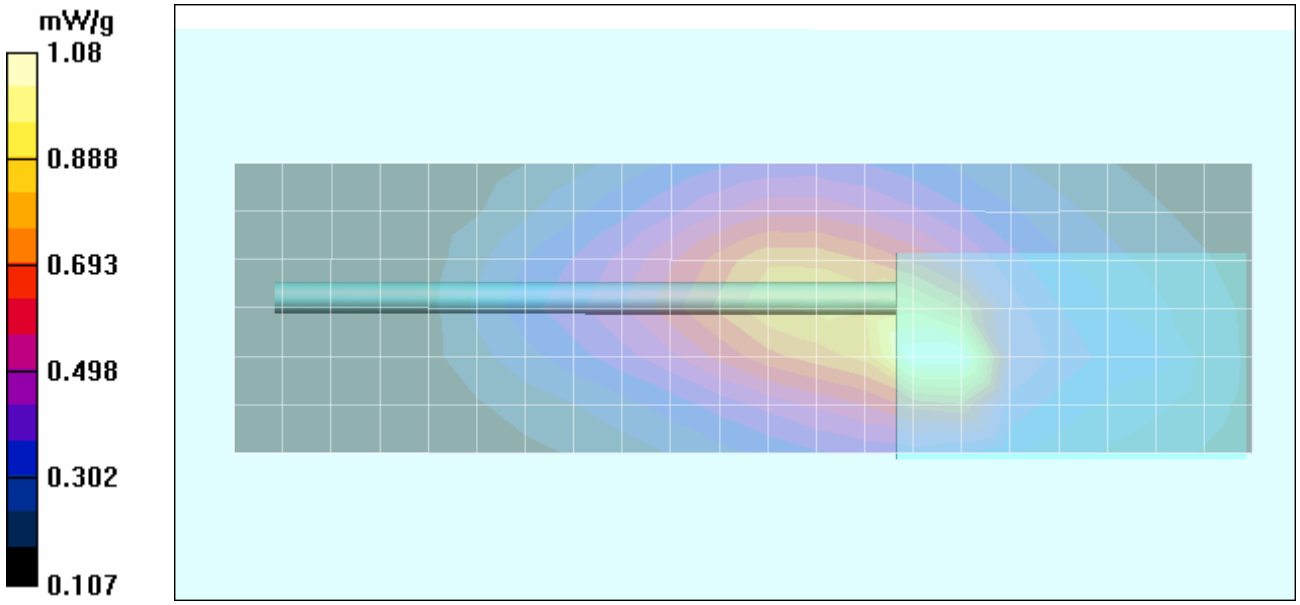
Ambient Temp: 23.0 °C; Fluid Temp: 22.8 °C; Barometric Pressure: 102.6 kPa; Humidity: 30%

Communication System: FM VHF (CW)
RF Output Power: 4.73 Watts (Conducted)
RF Output Power: 4.72 Watts (Conducted) 2nd Maximum
Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
7.2V 1400mAh NiMH Battery Pack (P/N: FNB-83)
Medium: M150 (σ = 0.80 mho/m; ε_r = 62.8; ρ = 1000 kg/m^3)
- Probe: ET3DV6 - SN1387; ConvF(8.4, 8.4, 8.4); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Area Scan (7x22x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 33.3 V/m; Power Drift = 0.206 dB
Peak SAR (extrapolated) = 2.44 W/kg
SAR(1 g) = 1.06 mW/g; SAR(10 g) = 0.656 mW/g

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan 2 (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 34.1 V/m; Power Drift = 0.155 dB
Peak SAR (extrapolated) = 1.47 W/kg
SAR(1 g) = 0.886 mW/g; SAR(10 g) = 0.634 mW/g



2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

Date Tested: 12/23/2005

Body-Worn SAR - NiMH Battery Pack - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

Body-Worn Accessory: Belt-Clip (P/N: BA0102700); Audio Accessory: VOX Earpiece (P/N: VC-27)

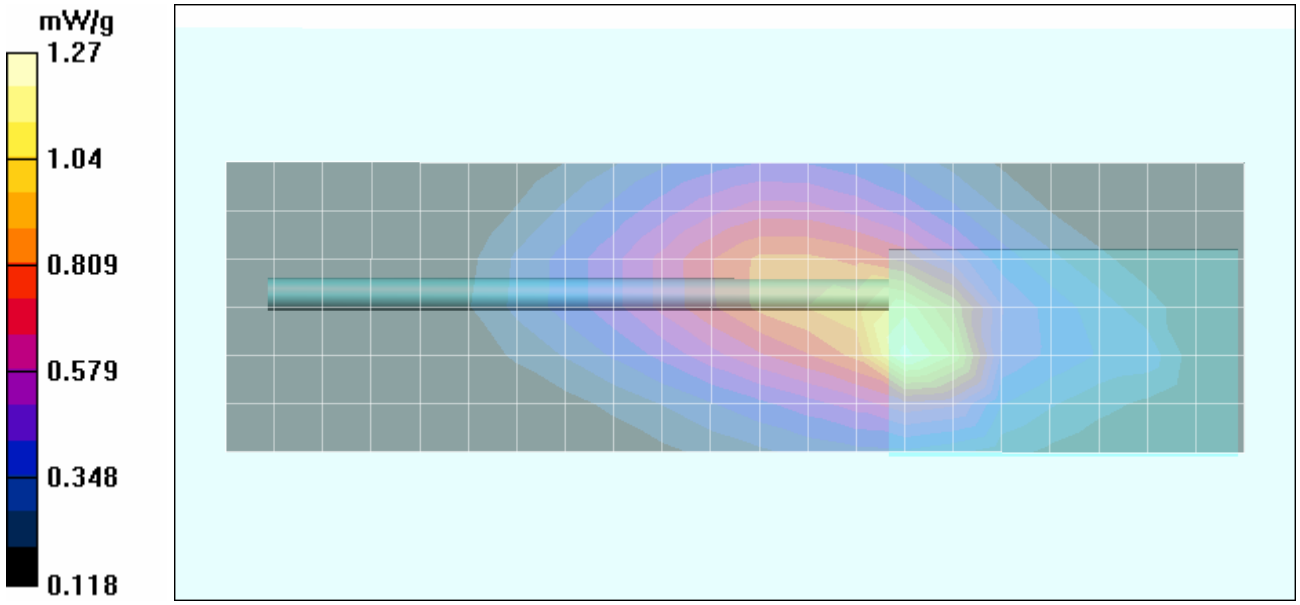
Ambient Temp: 23.0 °C; Fluid Temp: 22.8 °C; Barometric Pressure: 102.6 kPa; Humidity: 30%

Communication System: FM VHF (CW)
RF Output Power: 4.72 Watts (Conducted)
Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
7.2V 1400mAh NiMH Battery Pack (P/N: FNB-83)
Medium: M150 (σ = 0.80 mho/m; ε_r = 62.8; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1387; ConvF(8.4, 8.4, 8.4); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Area Scan (7x22x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 36.2 V/m; Power Drift = -0.141 dB
Peak SAR (extrapolated) = 3.42 W/kg
SAR(1 g) = 1.29 mW/g; SAR(10 g) = 0.741 mW/g



Date Tested: 12/23/2005

Body-Worn SAR - Alkaline Batteries (Duracell Procell) - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

Body-Worn Accessory: Belt-Clip (P/N: BA0102700); Audio Accessory: VOX Earpiece (P/N: VC-27)

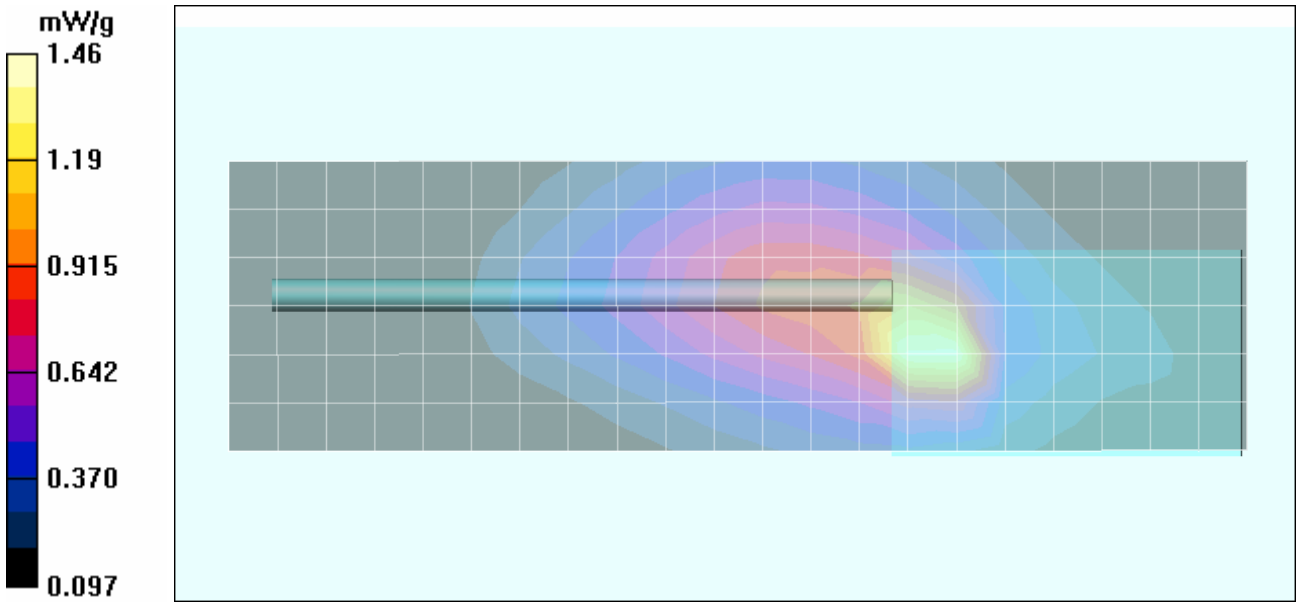
Ambient Temp: 23.0 °C; Fluid Temp: 22.8 °C; Barometric Pressure: 102.6 kPa; Humidity: 30%

Communication System: FM VHF (CW)
RF Output Power: 4.71 Watts (Conducted)
Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
9V AA Duracell Procell Alkaline Battery Pack (P/N: FBA-25A)
Medium: M150 (σ = 0.80 mho/m; ε_r = 62.8; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1387; ConvF(8.4, 8.4, 8.4); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

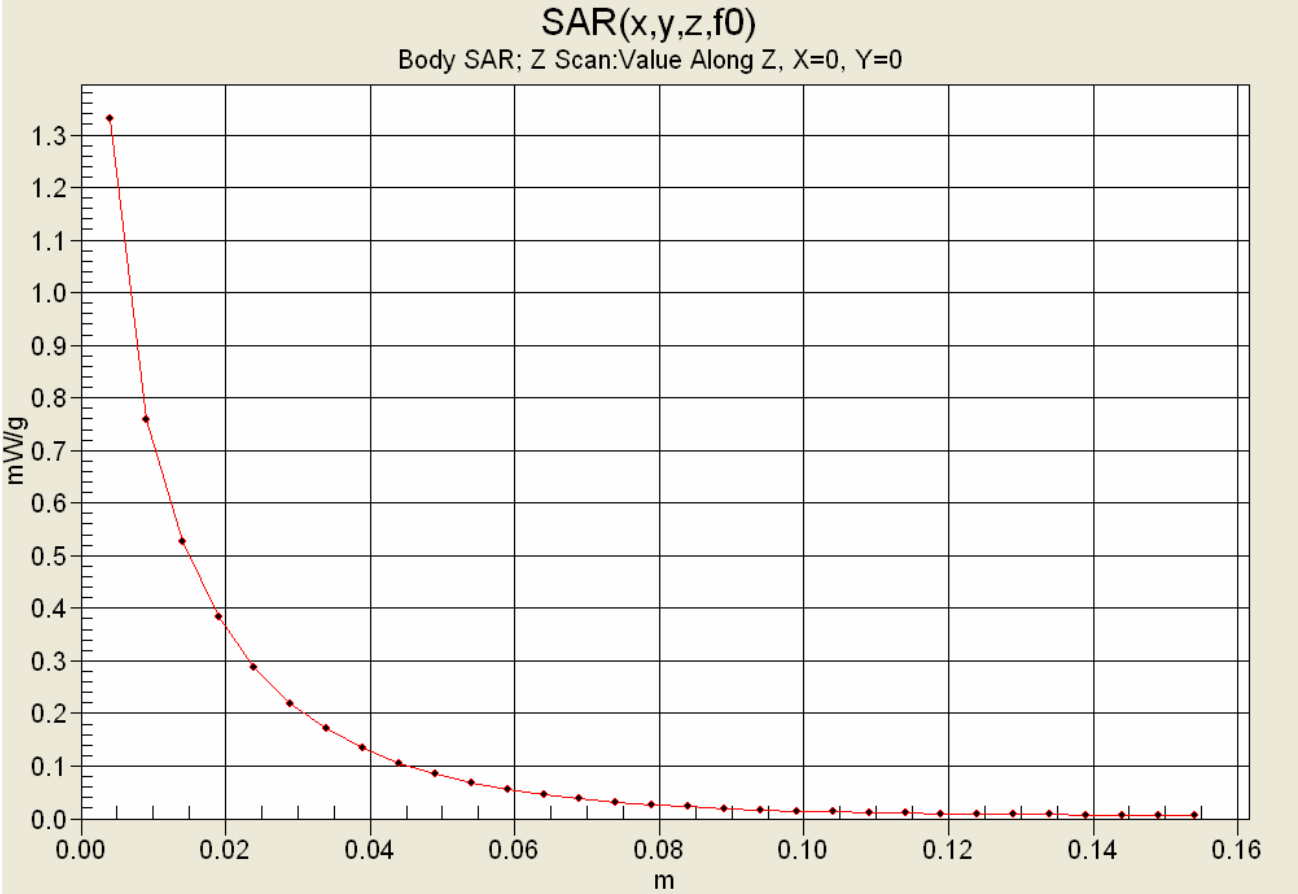
Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Area Scan (7x22x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 36.0 V/m; Power Drift = 0.134 dB
Peak SAR (extrapolated) = 4.08 W/kg
SAR(1 g) = 1.46 mW/g; SAR(10 g) = 0.815 mW/g



2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

Z-Axis Scan



2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

Date Tested: 12/22/2005

System Performance Check (Brain) - 300 MHz Dipole

DUT: Dipole 300 MHz; Model: D300V2; Type: System Performance Check; Serial: 135; Calibrated: 10/25/2005

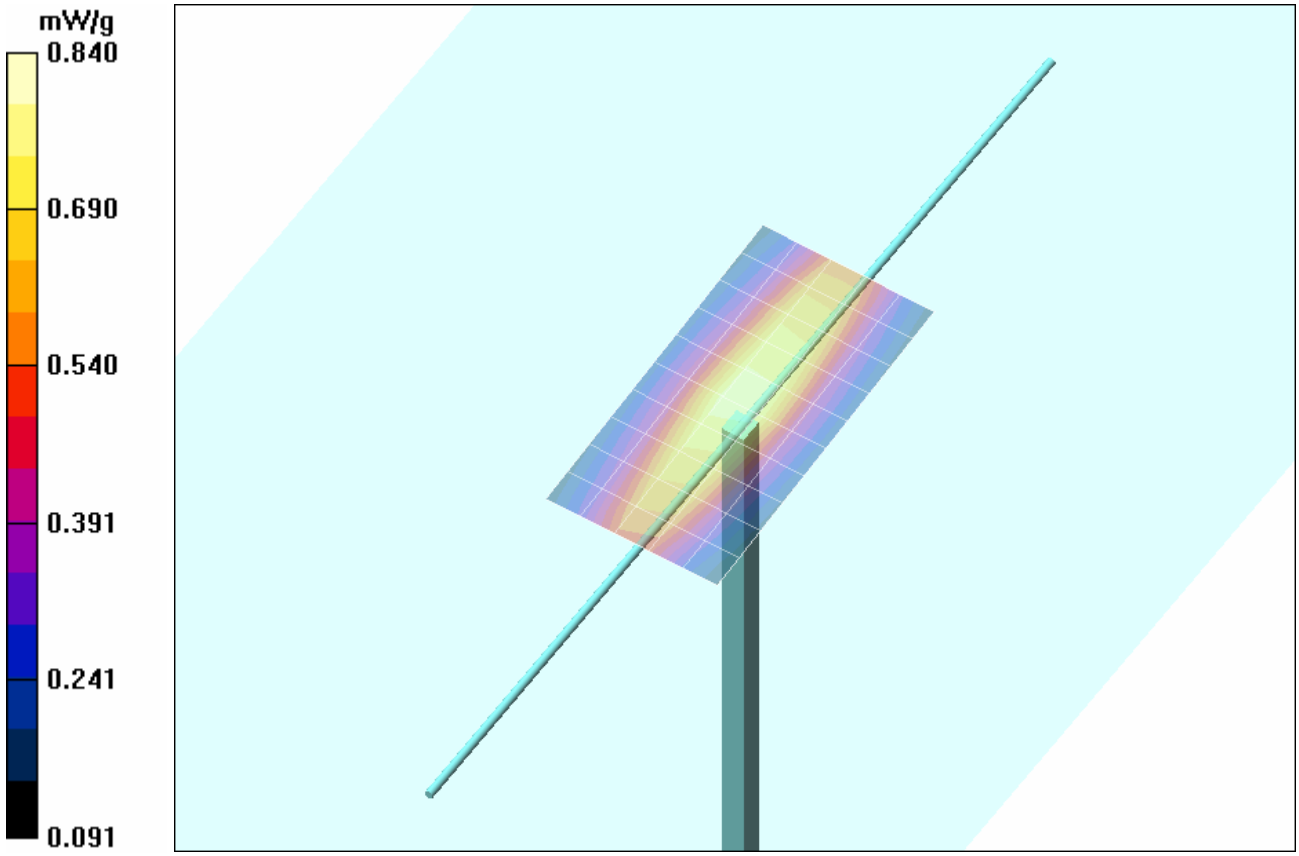
Ambient Temp: 24.4 °C; Fluid Temp: 22.3 °C; Barometric Pressure: 100.6 kPa; Humidity: 30%

Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 300 MHz; Duty Cycle: 1:1
Medium: 300 HSL (σ = 0.87 mho/m; ε_r = 45.0; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1387; ConvF(7.9, 7.9, 7.9); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

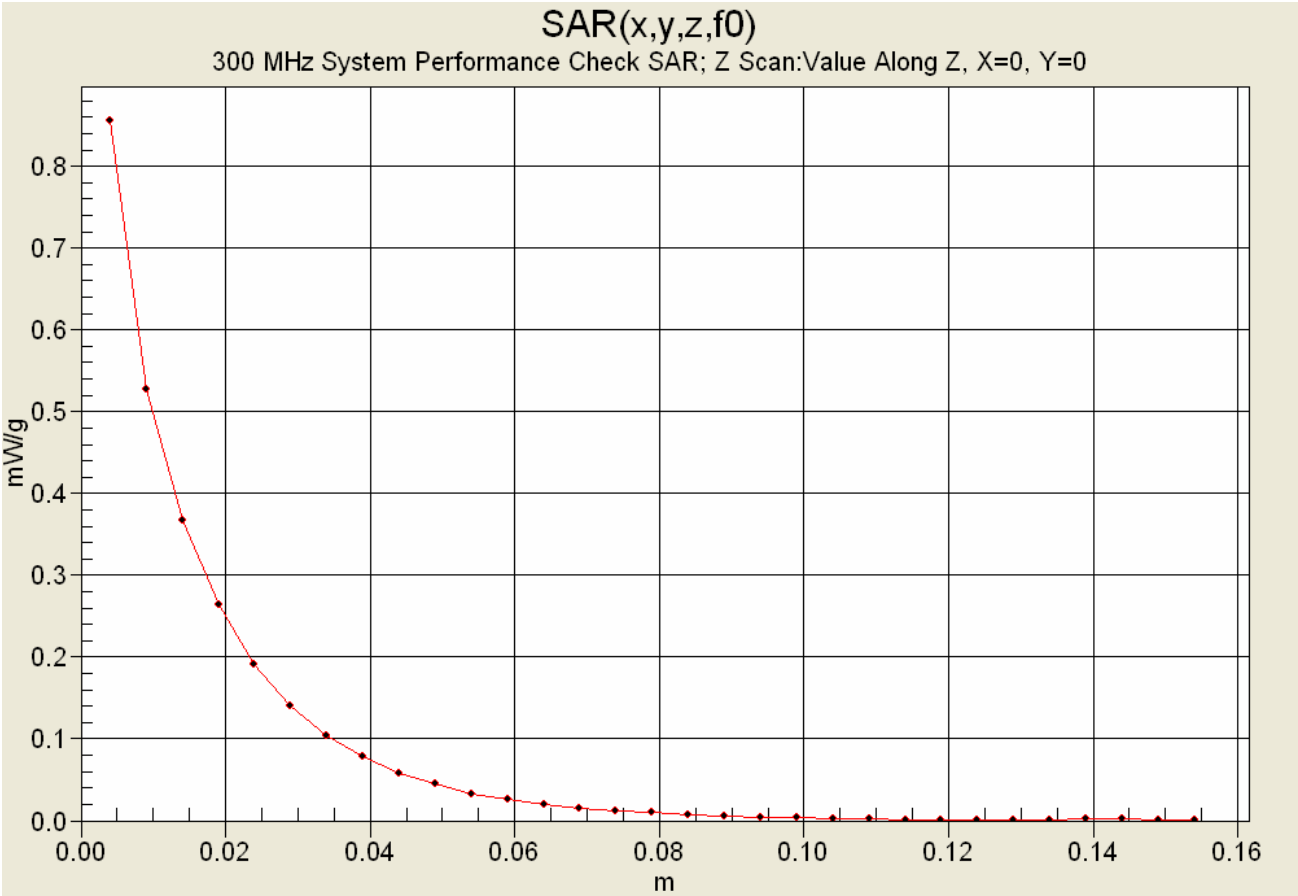
300 MHz Dipole - System Performance Check/Area Scan (6x11x1):
Measurement grid: dx=15mm, dy=15mm

300 MHz Dipole - System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 31.4 V/m; Power Drift = -0.002 dB
Peak SAR (extrapolated) = 1.41 W/kg
SAR(1 g) = 0.803 mW/g; SAR(10 g) = 0.523 mW/g



2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

Z-Axis Scan



2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

300 MHz System Performance Check (Brain)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Thu 22/Dec/2005
Frequency(GHz)
FCC_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
0.2000	49.97	0.80	49.49	0.79
0.2100	49.50	0.80	47.92	0.80
0.2200	49.03	0.81	47.58	0.80
0.2300	48.57	0.82	47.49	0.81
0.2400	48.10	0.83	46.47	0.82
0.2500	47.63	0.83	46.67	0.83
0.2600	47.17	0.84	46.12	0.84
0.2700	46.70	0.85	45.75	0.84
0.2800	46.23	0.86	45.53	0.86
0.2900	45.77	0.86	45.19	0.86
0.3000	45.30	0.87	45.01	0.87
0.3100	45.18	0.87	44.42	0.88
0.3200	45.06	0.87	43.98	0.88
0.3300	44.94	0.87	43.79	0.89
0.3400	44.82	0.87	43.57	0.90
0.3500	44.70	0.87	43.12	0.91
0.3600	44.58	0.87	42.86	0.91
0.3700	44.46	0.87	42.45	0.93
0.3800	44.34	0.87	42.35	0.94
0.3900	44.22	0.87	42.01	0.95
0.4000	44.10	0.87	41.89	0.96

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

150 MHz DUT Evaluation (Face)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Fri 23/Dec/2005
Frequency(GHz)
FCC_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
0.0500	56.97	0.69	59.91	0.74
0.0600	56.50	0.69	58.37	0.74
0.0700	56.03	0.70	57.28	0.73
0.0800	55.57	0.71	58.46	0.76
0.0900	55.10	0.72	59.06	0.75
0.1000	54.63	0.72	58.09	0.76
0.1100	54.17	0.73	58.11	0.77
0.1200	53.70	0.74	55.66	0.77
0.1300	53.23	0.75	56.04	0.78
0.1400	52.77	0.75	54.88	0.79
0.1500	52.30	0.76	54.91	0.7953
0.1600	51.83	0.77	53.72	0.81
0.1700	51.37	0.77	52.65	0.81
0.1800	50.90	0.78	52.92	0.82
0.1900	50.43	0.79	52.15	0.84
0.2000	49.97	0.80	51.71	0.85
0.2100	49.50	0.80	51.49	0.86
0.2200	49.03	0.81	50.93	0.86
0.2300	48.57	0.82	50.58	0.88
0.2400	48.10	0.83	50.57	0.87
0.2500	47.63	0.83	49.89	0.89

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

150 MHz DUT Evaluation (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Fri 23/Dec/2005
Frequency(GHz)
FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB FCC Limits for Body Epsilon
FCC_sB FCC Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.0500	64.37	0.72	63.78	0.77
0.0600	64.12	0.73	63.80	0.76
0.0700	63.87	0.74	62.29	0.76
0.0800	63.63	0.74	64.27	0.78
0.0900	63.38	0.75	65.99	0.77
0.1000	63.13	0.76	65.47	0.78
0.1100	62.89	0.77	64.56	0.79
0.1200	62.64	0.78	62.43	0.79
0.1300	62.39	0.78	63.74	0.79
0.1400	62.15	0.79	62.92	0.80
0.1500	61.90	0.80	62.76	0.80
0.1600	61.65	0.81	62.51	0.82
0.1700	61.41	0.82	61.03	0.81
0.1800	61.16	0.82	61.10	0.83
0.1900	60.91	0.83	61.17	0.84
0.2000	60.67	0.84	60.75	0.85
0.2100	60.42	0.85	60.36	0.85
0.2200	60.17	0.86	60.83	0.86
0.2300	59.93	0.86	59.85	0.88
0.2400	59.68	0.87	59.88	0.87
0.2500	59.43	0.88	59.36	0.88

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

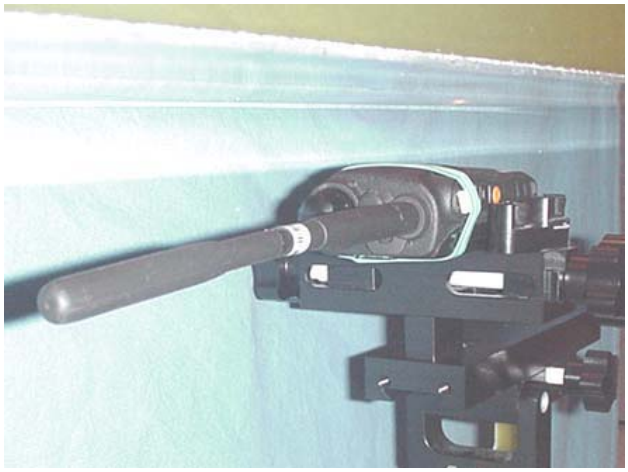
FACE-HELD SAR TEST SETUP PHOTOGRAPHS

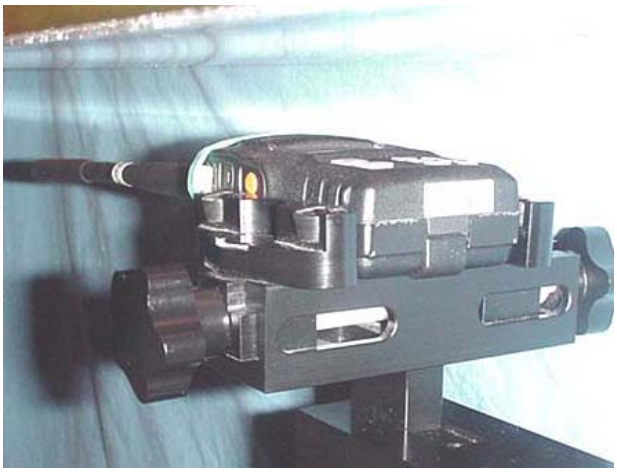
2.5 cm Separation Distance from Front of Radio to Planar Phantom with NiMH Battery Pack (P/N: FNB-83)

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

FACE-HELD SAR TEST SETUP PHOTOGRAPHS

2.5 cm Separation Distance from Front of Radio to Planar Phantom with Alkaline Battery Case (P/N: FBA-25A)

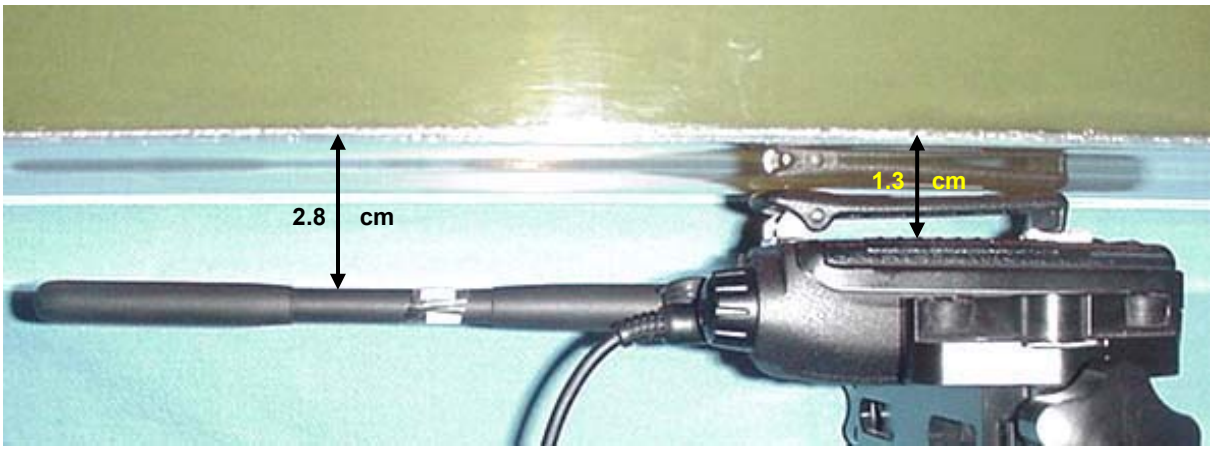




2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

BODY-WORN SAR TEST SETUP PHOTOGRAPHS

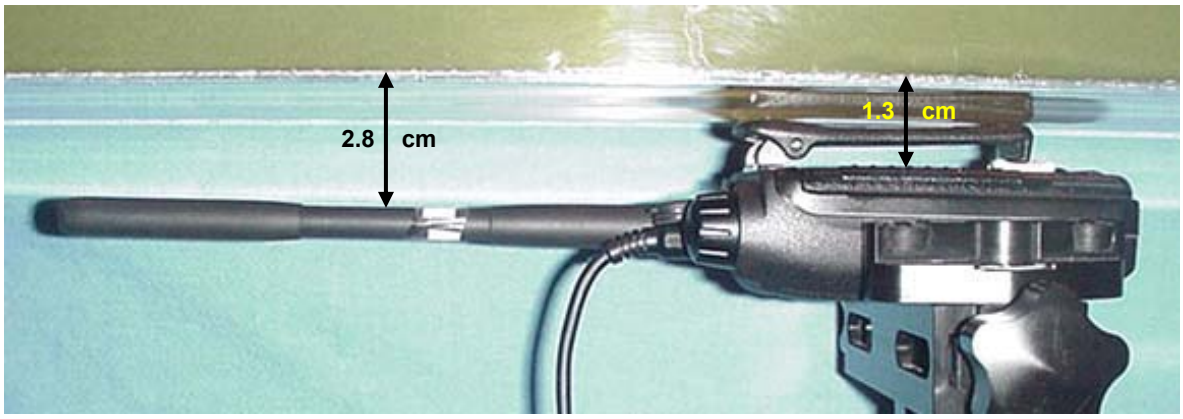
1.3 cm Belt-Clip Separation Distance to Planar Phantom
Speaker-Microphone Audio Accessory (P/N: MH-57A4B)
NiMH Battery Pack (P/N: FNB-83)

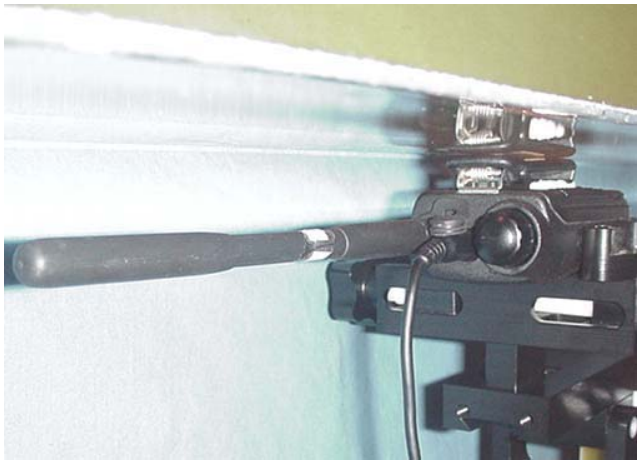


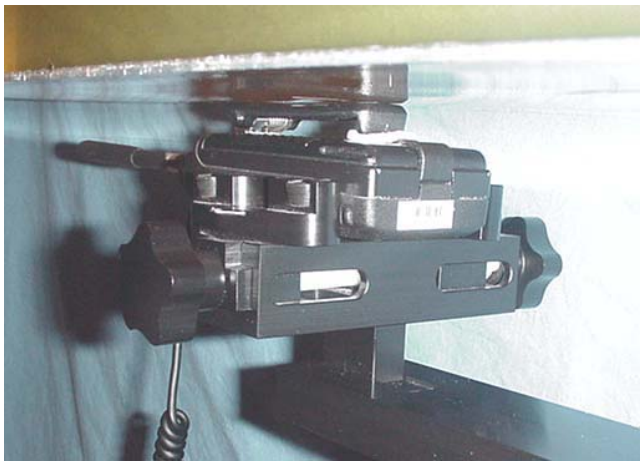
2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

BODY-WORN SAR TEST SETUP PHOTOGRAPHS

1.3 cm Belt-Clip Separation Distance to Planar Phantom
Noise-Canceling Speaker Microphone Audio Accessory (P/N: CMP460)
NiMH Battery Pack (P/N: FNB-83)



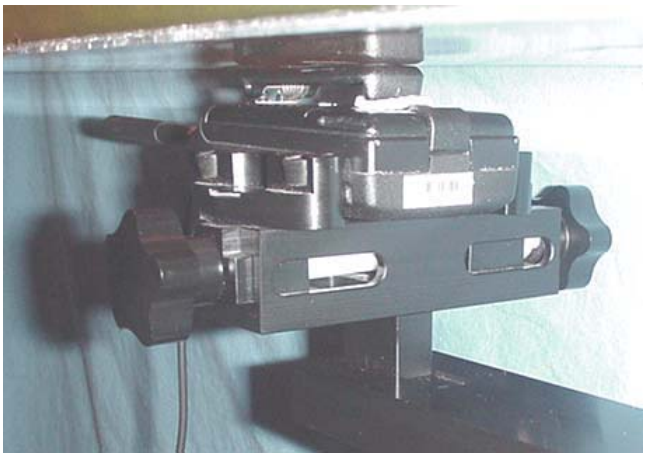




2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

BODY-WORN SAR TEST SETUP PHOTOGRAPHS

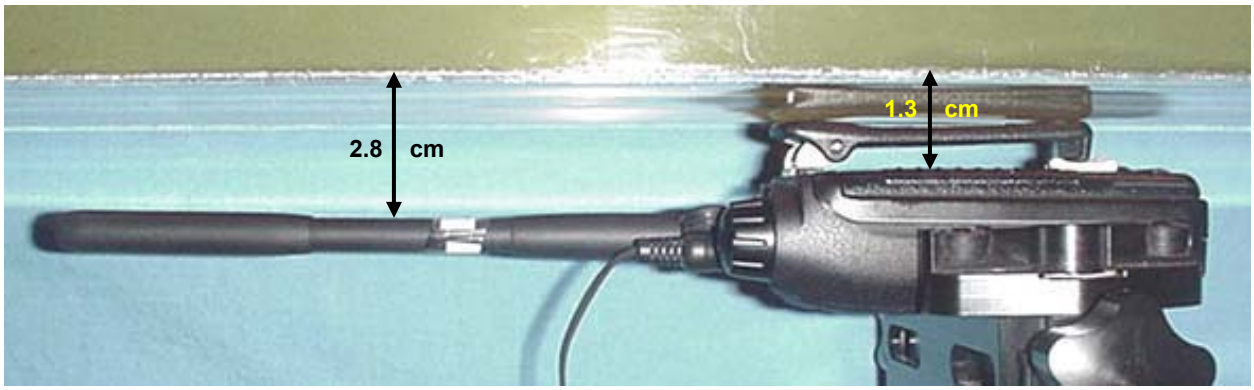
1.3 cm Belt-Clip Separation Distance to Planar Phantom
VOX Headset Audio Accessory (P/N: VC-24)
NiMH Battery Pack (P/N: FNB-83)

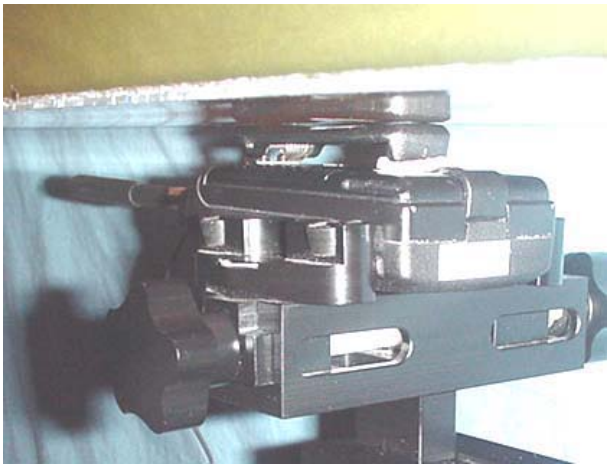


2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

BODY-WORN SAR TEST SETUP PHOTOGRAPHS

1.3 cm Belt-Clip Separation Distance to Planar Phantom
VOX Earpiece Audio Accessory (P/N: VC-27)
NiMH Battery Pack (P/N: FNB-83)

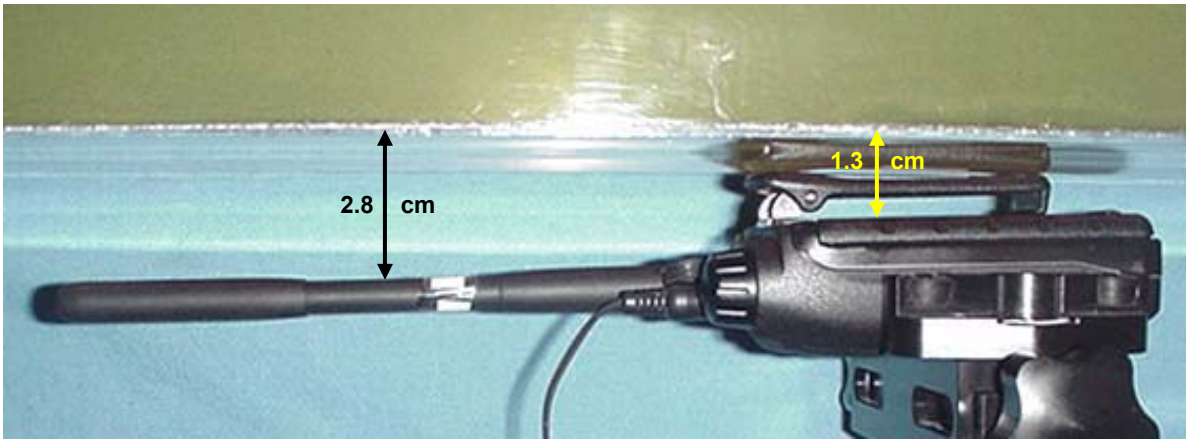




2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

BODY-WORN SAR TEST SETUP PHOTOGRAPHS

1.3 cm Belt-Clip Separation Distance to Planar Phantom
VOX Earpiece Audio Accessory (P/N: VC-27)
Alkaline Battery Case (P/N: FBA-25A)



2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

SAR TEST SETUP PHOTOGRAPHS

Face-Held Test Setup Configuration

Body-Worn Test Setup Configuration

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

DUT PHOTOGRAPHS

Front of DUT

Back of DUT

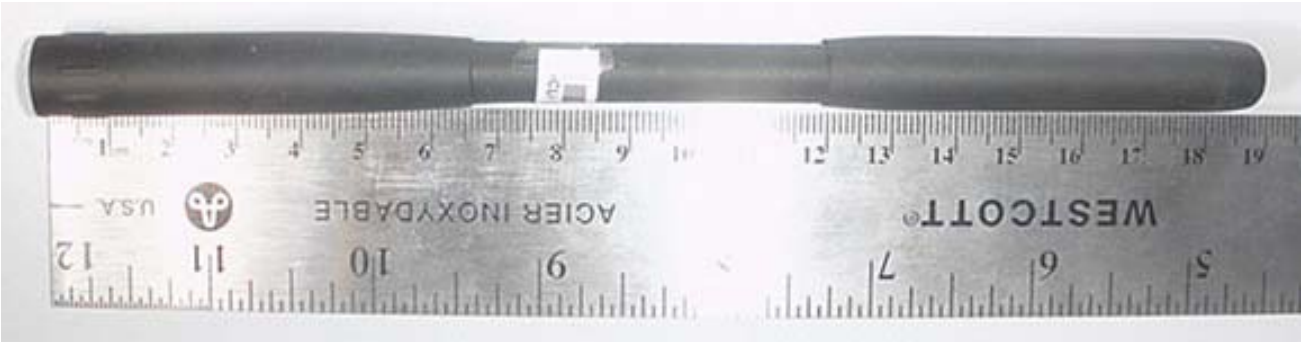
Back of DUT with Belt-Clip

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

DUT PHOTOGRAPHS

Top end view of DUT

Bottom end view of DUT



Whip Antenna (P/N: CAT460)

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

DUT PHOTOGRAPHS

Left Side of DUT with Belt-Clip

Right Side of DUT with Belt-Clip

Belt-Clip accessory - 1.3 cm thickness
(Plastic with metal spring - P/N: BA0102700)

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

DUT PHOTOGRAPHS

DUT Battery Compartment

NiMH Battery Pack (P/N: FNB-83)

Alkaline Battery Case (P/N: FBA-25A)

Duracell Procell Alkaline Batteries

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

DUT PHOTOGRAPHS

DUT with Speaker-Microphone Audio Accessory (P/N: MH-57A4B)

DUT with Noise-Canceling Speaker-Microphone Audio Accessory (P/N: CMP460)

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

DUT PHOTOGRAPHS

DUT with VOX Earpiece Audio Accessory (P/N: VC-27)

DUT with VOX Headset Audio Accessory (P/N: VC-24)

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

APPENDIX E - SYSTEM VALIDATION

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

300 MHz SYSTEM VALIDATION DIPOLE

Type:	**300 MHz Validation Dipole**
Asset Number:	**00023**
Serial Number:	**135**
Place of Calibration:	**Celltech Labs Inc.**
Date of Calibration:	**October 25, 2005**

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

Calibrated by:

Approved by:

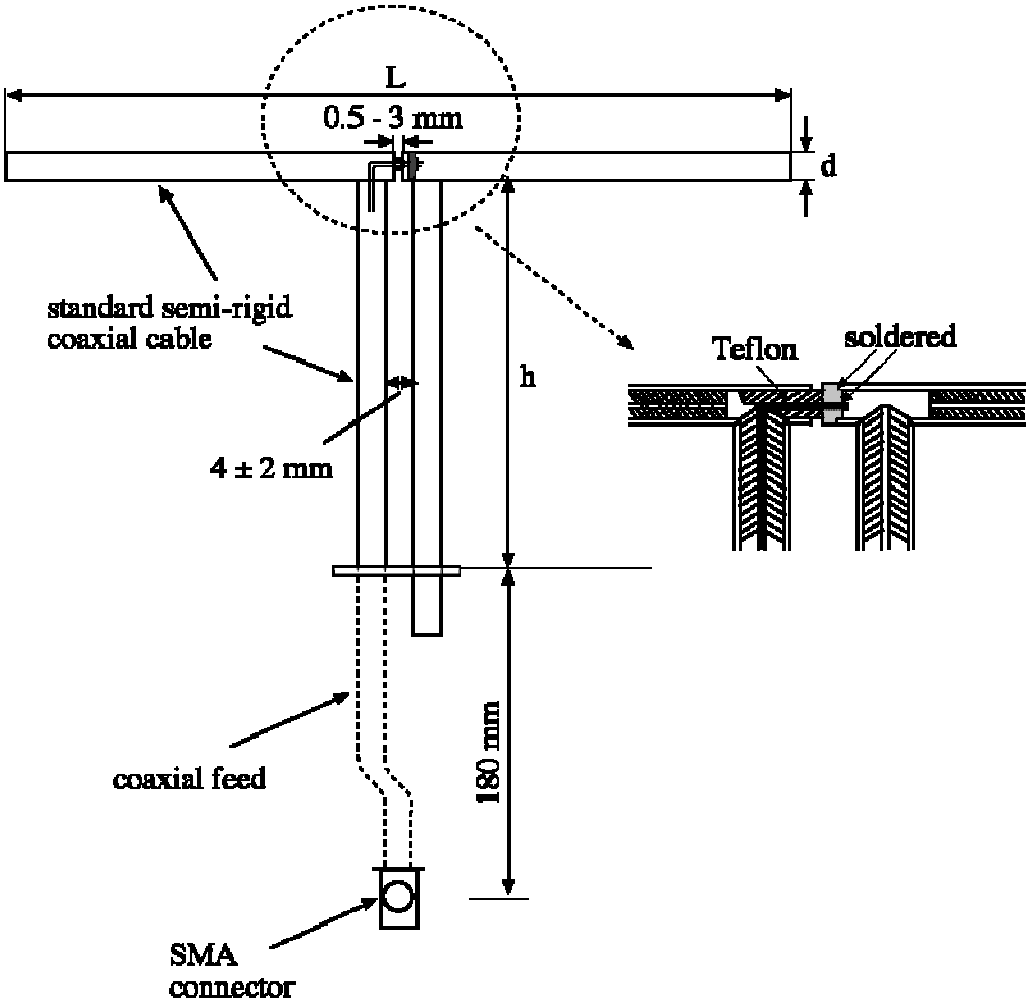
Celltech Labs Inc. 1955 Moss Court, Kelowna, B.C. Canada V1Y 9L3
Tel. 250-448-7047 • Fax. 250-448-7046 • e-mail: info@celltechlabs.com
www.celltechlabs.com

2005 Celltech Labs Inc.

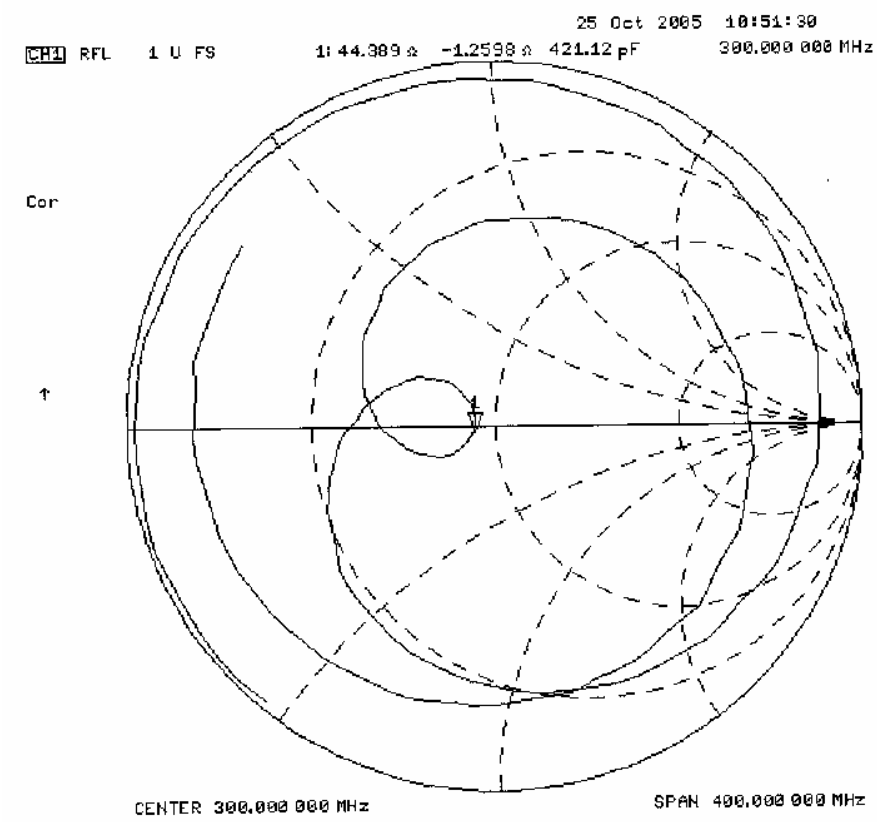
1. Validation Dipole Construction & Electrical Characteristics

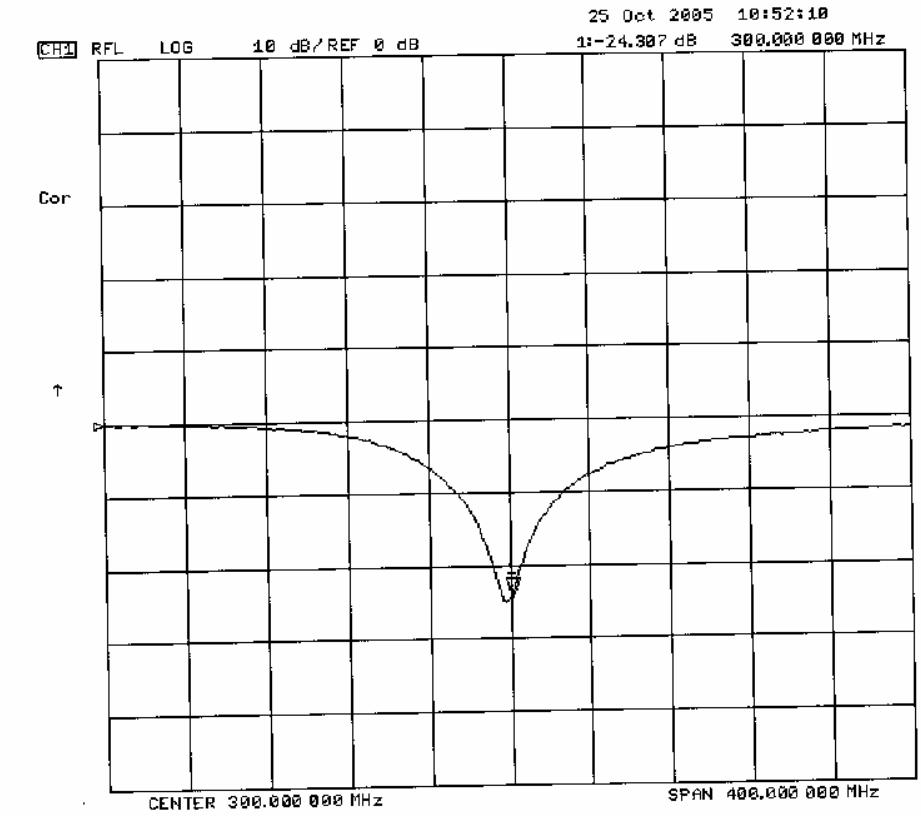
The validation dipole was constructed in accordance with the IEEE Std. "Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques". The electrical properties were measured using an HP 8753E Network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

Feed point impedance at 300MHz	Re{Z} = 44.389Ω
	Im{Z} = -1.2598Ω
Return Loss at 300MHz	-24.307dB



2. Validation Dipole VSWR Data





3. 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

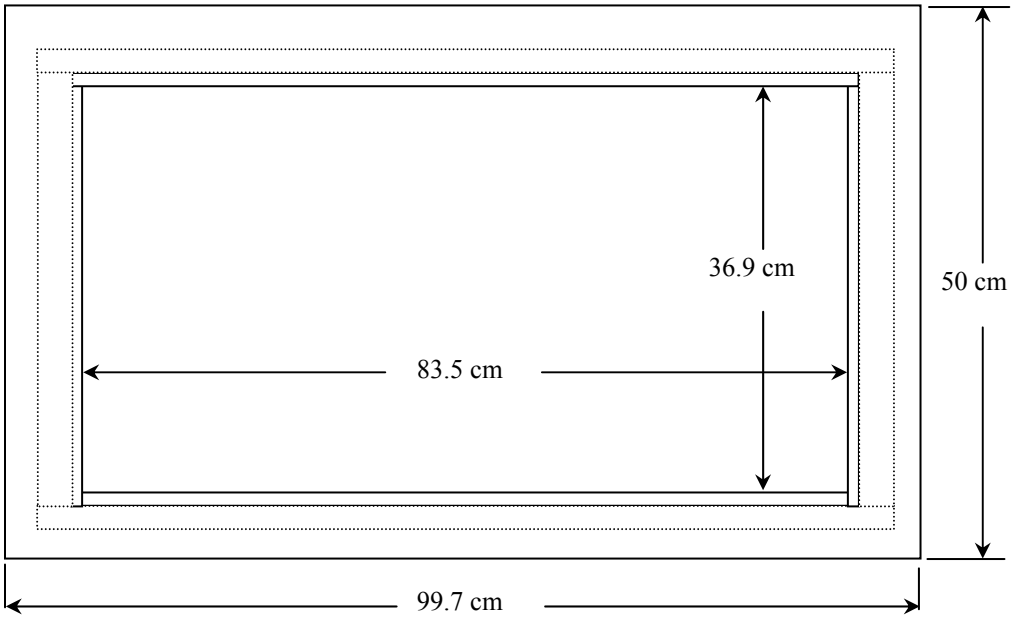
4 Validation Phantom

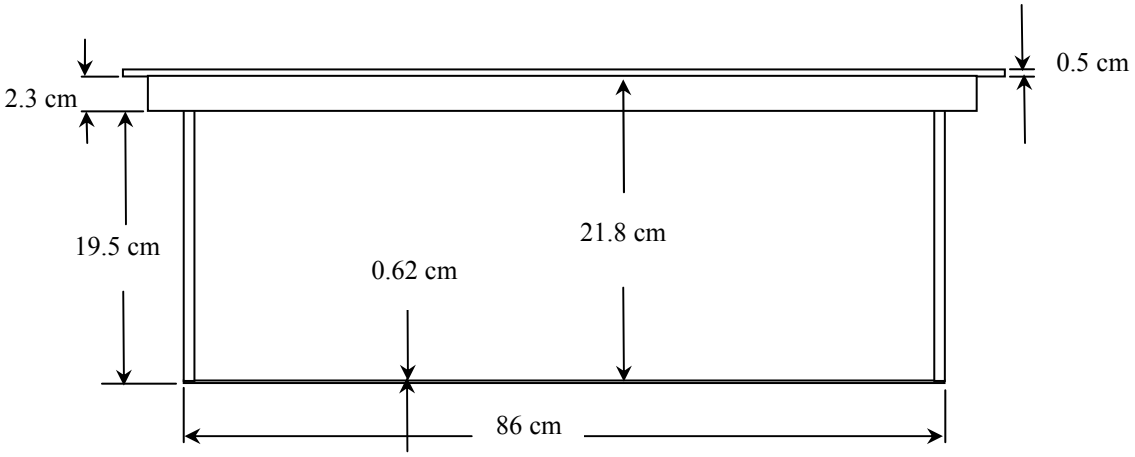
The validation phantom was constructed using relatively low-loss tangent Plexiglas material. The inner dimensions of the phantom are as follows:

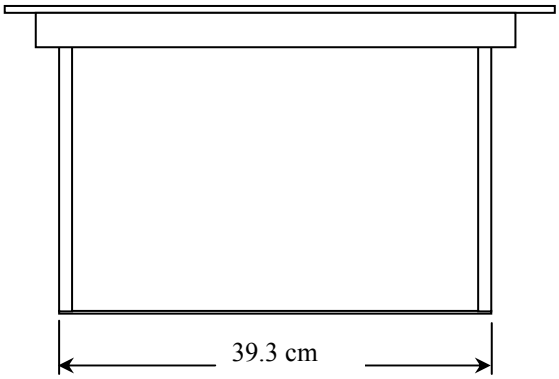
Length: 83.5 cm
Width: 36.9 cm
Height: 21.8 cm

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

5. Dimensions of Plexiglas Planar Phantom







6. 300 MHz System Validation Setup

7. 300 MHz Validation Dipole Setup

8. Measurement Conditions

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

Relative Permittivity:	44.3
Conductivity:	0.84 mho/m
Fluid Temperature:	21.8 °C
Fluid Depth:	≥ 15 cm

Environmental Conditions:

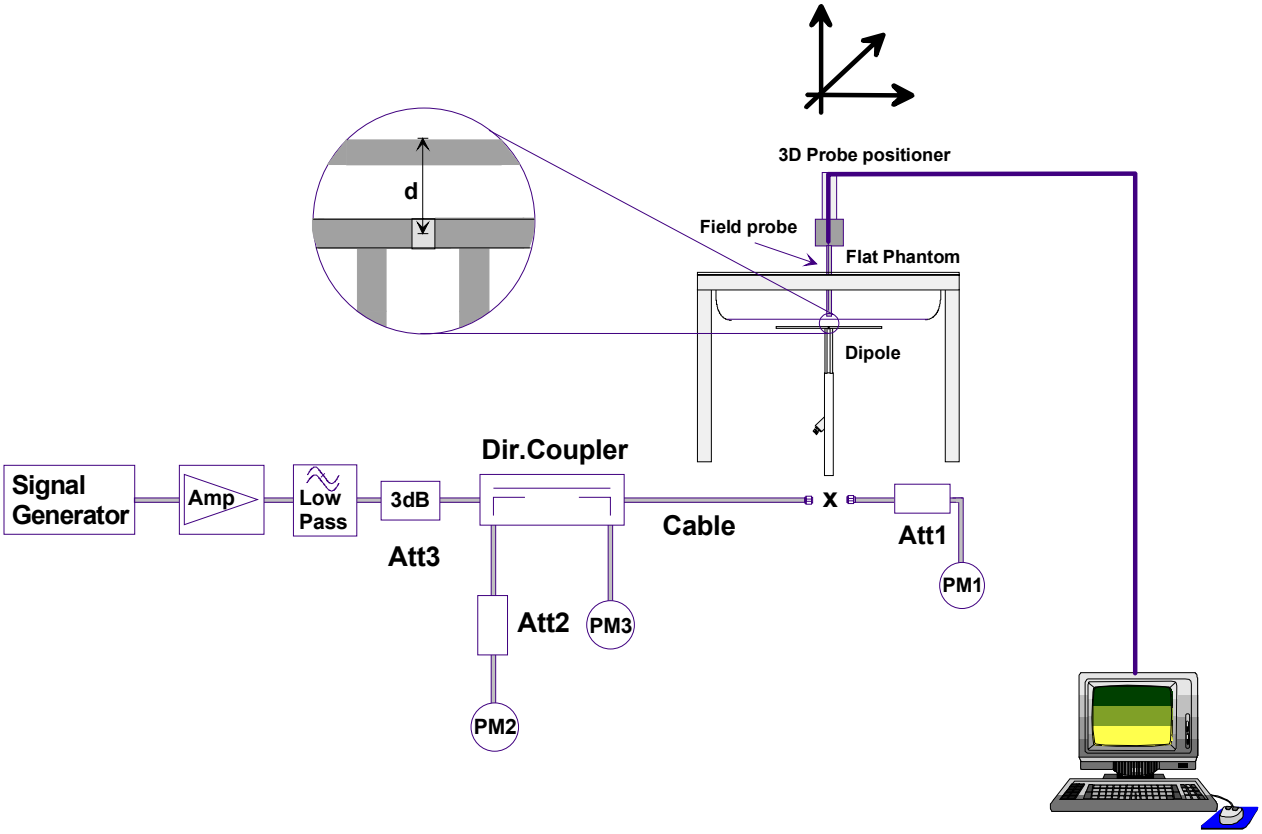
Ambient Temperature:	23.1°C
Humidity:	33 %
Barometric Pressure:	101.7 kPa

The 300 MHz brain tissue simulant consists of the following ingredients:

Ingredient	Percentage by weight
Water	37.56%
Sugar	55.32%
Salt	5.95%
HEC	0.98%
Dowicil 75	0.19%
300 MHz Target Dielectric Parameters at 22°C	ε_r = 45.3 σ = 0.87 S/m

9. 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.

10. Validation Dipole SAR Test Results

Ten SAR measurements were performed in order to achieve repeatability and to establish an average target value.

Validation Measurement	SAR @ 0.25W Input averaged over 1g	SAR @ 1W Input averaged over 1g	SAR @ 0.25W Input averaged over 10g	SAR @ 1W Input averaged over 10g	Peak SAR @ 0.25W Input
Test 1	0.747	2.988	0.487	1.948	0.786
Test 2	0.744	2.976	0.485	1.94	0.782
Test 3	0.748	2.992	0.488	1.952	0.783
Test 4	0.753	3.012	0.489	1.956	0.794
Test 5	0.751	3.004	0.488	1.952	0.792
Test 6	0.755	3.02	0.490	1.96	0.794
Test 7	0.751	3.004	0.489	1.956	0.791
Test 8	0.749	2.996	0.487	1.948	0.789
Test 9	0.749	2.996	0.487	1.948	0.788
Test 10	0.749	2.996	0.488	1.952	0.788
Average Value	0.750	2.998	0.488	1.951	0.789

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

Target SAR @ 1 Watt Input averaged over 1 gram (W/kg)		Measured SAR @ 1 Watt Input averaged over 1 gram (W/kg)	Deviation from Target (%)	Target SAR @ 1 Watt Input averaged over 10 grams (W/kg)		Measured SAR @ 1 Watt Input averaged over 10 grams (W/kg)	Deviation from Target (%)
3.00	+/- 10%	2.998	-0.07%	2.00	+/- 10%	1.951	-2.5%

450 MHz System Validation - October 25, 2005

DUT: Dipole 300 MHz; Model: D300V2; Serial: 135; Calibrated: 10/25/2005
Ambient Temp: 23.1 ºC; Fluid Temp: 21.8 ºC; Barometric Pressure: 101.7 kPa; Humidity: 33%
Communication System: CW
Frequency: 300 MHz; Duty Cycle: 1:1
Medium: 300 HSL (σ = 0.84 mho/m; ε_r = 44.3; ρ = 1000 kg/m^3)
- Probe: ET3DV6 - SN1387; ConvF(7.9, 7.9, 7.9); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

300 MHz System Validation/Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.753 mW/g

300 MHz System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.7 V/m; Power Drift = -0.056 dB
SAR(1 g) = 0.747 mW/g; SAR(10 g) = 0.487 mW/g
Maximum value of SAR (measured) = 0.786 mW/g

300 MHz System Validation/Zoom Scan 2 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.4 V/m; Power Drift = -0.016 dB
SAR(1 g) = 0.744 mW/g; SAR(10 g) = 0.485 mW/g
Maximum value of SAR (measured) = 0.782 mW/g

300 MHz System Validation/Zoom Scan 3 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.5 V/m; Power Drift = 0.001 dB
SAR(1 g) = 0.748 mW/g; SAR(10 g) = 0.488 mW/g
Maximum value of SAR (measured) = 0.783 mW/g

300 MHz System Validation/Zoom Scan 4 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.4 V/m; Power Drift = 0.013 dB
SAR(1 g) = 0.753 mW/g; SAR(10 g) = 0.489 mW/g
Maximum value of SAR (measured) = 0.794 mW/g

300 MHz System Validation/Zoom Scan 5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.6 V/m; Power Drift = 0.003 dB
SAR(1 g) = 0.751 mW/g; SAR(10 g) = 0.488 mW/g
Maximum value of SAR (measured) = 0.792 mW/g

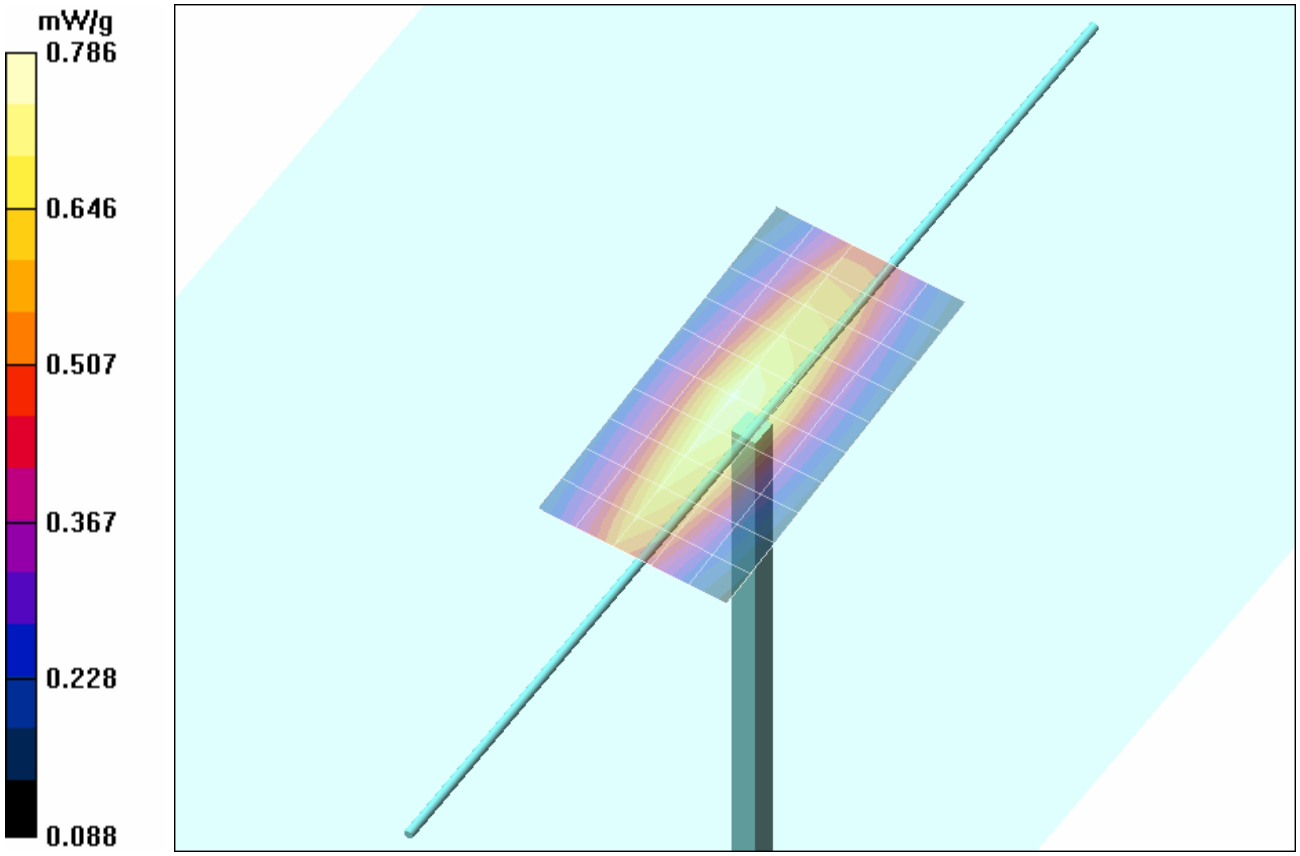
300 MHz System Validation/Zoom Scan 6 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.7 V/m; Power Drift = 0.017 dB
SAR(1 g) = 0.755 mW/g; SAR(10 g) = 0.490 mW/g
Maximum value of SAR (measured) = 0.794 mW/g

300 MHz System Validation/Zoom Scan 7 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.6 V/m; Power Drift = 0.005 dB
SAR(1 g) = 0.751 mW/g; SAR(10 g) = 0.489 mW/g
Maximum value of SAR (measured) = 0.791 mW/g

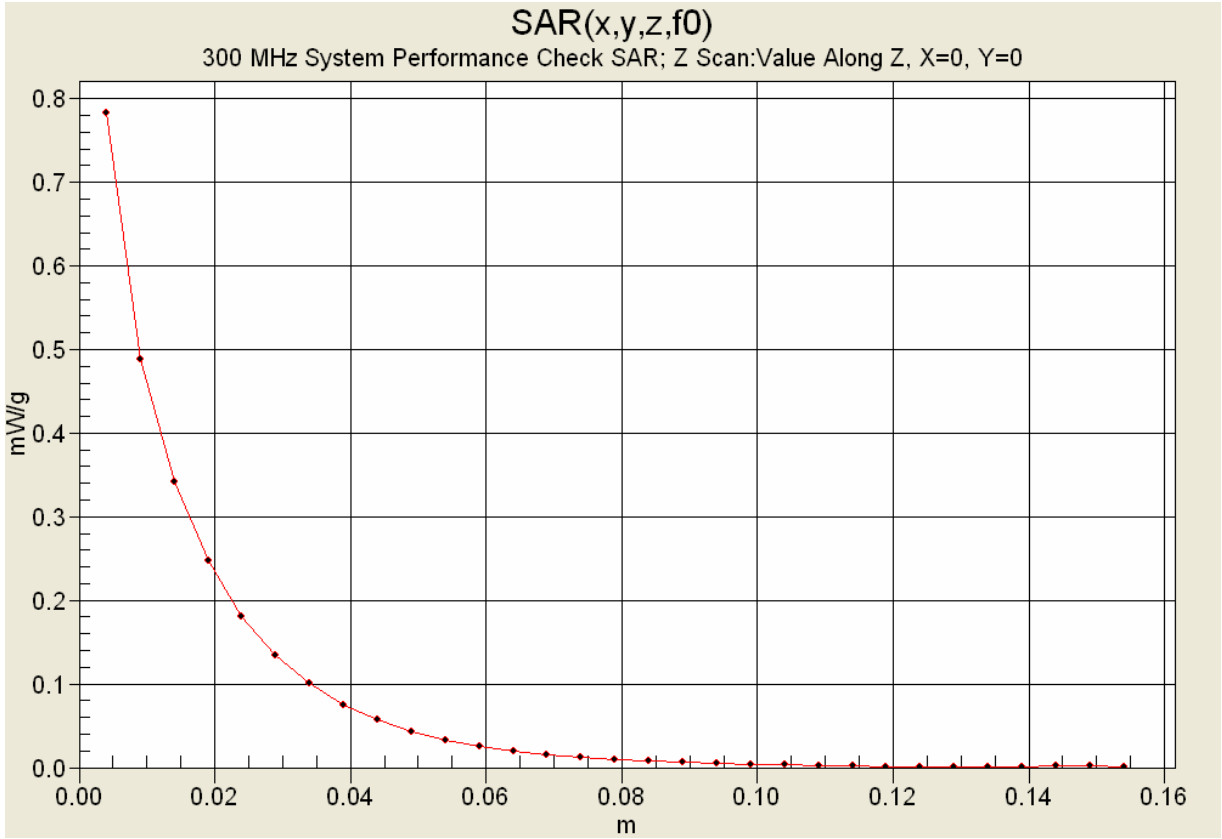
300 MHz System Validation/Zoom Scan 8 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.5 V/m; Power Drift = -0.001 dB
SAR(1 g) = 0.749 mW/g; SAR(10 g) = 0.487 mW/g
Maximum value of SAR (measured) = 0.789 mW/g

300 MHz System Validation/Zoom Scan 9 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.5 V/m; Power Drift = 0.008 dB
SAR(1 g) = 0.749 mW/g; SAR(10 g) = 0.487 mW/g
Maximum value of SAR (measured) = 0.788 mW/g

300 MHz System Validation/Zoom Scan 10 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.5 V/m; Power Drift = 0.001 dB
SAR(1 g) = 0.749 mW/g; SAR(10 g) = 0.488 mW/g
Maximum value of SAR (measured) = 0.788 mW/g



1 g average of 10 measurements: 0.750 mW/g
10 g average of 10 measurements: 0.488 mW/g



11. Measured Fluid Dielectric Parameters

System Validation (Brain) - 450 MHz Dipole

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Tue 25/Oct/2005
Freq Frequency(GHz)
FCC_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq		FCC_eH	FCC_sH	Test_e	Test_s
0.2000	49.97	0.80	50.42	0.74	
0.2100	49.50	0.80	47.25	0.76	
0.2200	49.03	0.81	48.21	0.76	
0.2300	48.57	0.82	45.83	0.78	
0.2400	48.10	0.83	46.47	0.78	
0.2500	47.63	0.83	46.33	0.79	
0.2600	47.17	0.84	44.51	0.80	
0.2700	46.70	0.85	45.05	0.80	
0.2800	46.23	0.86	44.67	0.82	
0.2900	45.77	0.86	44.68	0.83	
0.3000	45.30	0.87	44.28	0.84	
0.3100	45.18	0.87	42.39	0.84	
0.3200	45.06	0.87	43.12	0.85	
0.3300	44.94	0.87	42.20	0.85	
0.3400	44.82	0.87	42.13	0.89	
0.3500	44.70	0.87	42.29	0.89	
0.3600	44.58	0.87	41.56	0.90	
0.3700	44.46	0.87	41.43	0.89	
0.3800	44.34	0.87	41.87	0.90	
0.3900	44.22	0.87	41.01	0.92	
0.4000	44.10	0.87	40.97	0.92	

APPENDIX F - PROBE CALIBRATION

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **Celltech Labs**

Certificate No: ET3-1387_Mar05

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1387
Calibration procedure(s)	QA CAL-01.v5 Calibration procedure for dosimetric E-field probes
Calibration date:	March 18, 2005
Condition of the calibrated item	In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	5-May-04 (METAS, No. 251-00388)	May-05
Power sensor E4412A	MY41495277	5-May-04 (METAS, No. 251-00388)	May-05
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-04 (METAS, No. 251-00403)	Aug-05
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-04 (METAS, No. 251-00389)	May-05
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-04 (METAS, No. 251-00404)	Aug-05
Reference Probe ES3DV2	SN: 3013	7-Jan-05 (SPEAG, No. ES3-3013_Jan05)	Jan-06
DAE4	SN: 617	19-Jan-05 (SPEAG, No. DAE4-617_Jan05)	Jan-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov 05

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

Issued: March 18, 2005

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ET3DV6

SN:1387

Manufactured:	September 21, 1999
Last calibrated:	March 18, 2004
Recalibrated:	March 18, 2005

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1387

Sensitivity in Free Space[A]

NormX	**1.61** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**92** mV
NormY	**1.70** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**92** mV
NormZ	**1.70** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**92** mV

Diode Compression[B]

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

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

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	9.4	4.9
SAR_{be} [%]	With Correction Algorithm	0.1	0.3

TSL **1810 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	14.3	9.6
SAR_{be} [%]	With Correction Algorithm	0.6	0.1

Sensor Offset

Probe Tip to Sensor Center **2.7** mm

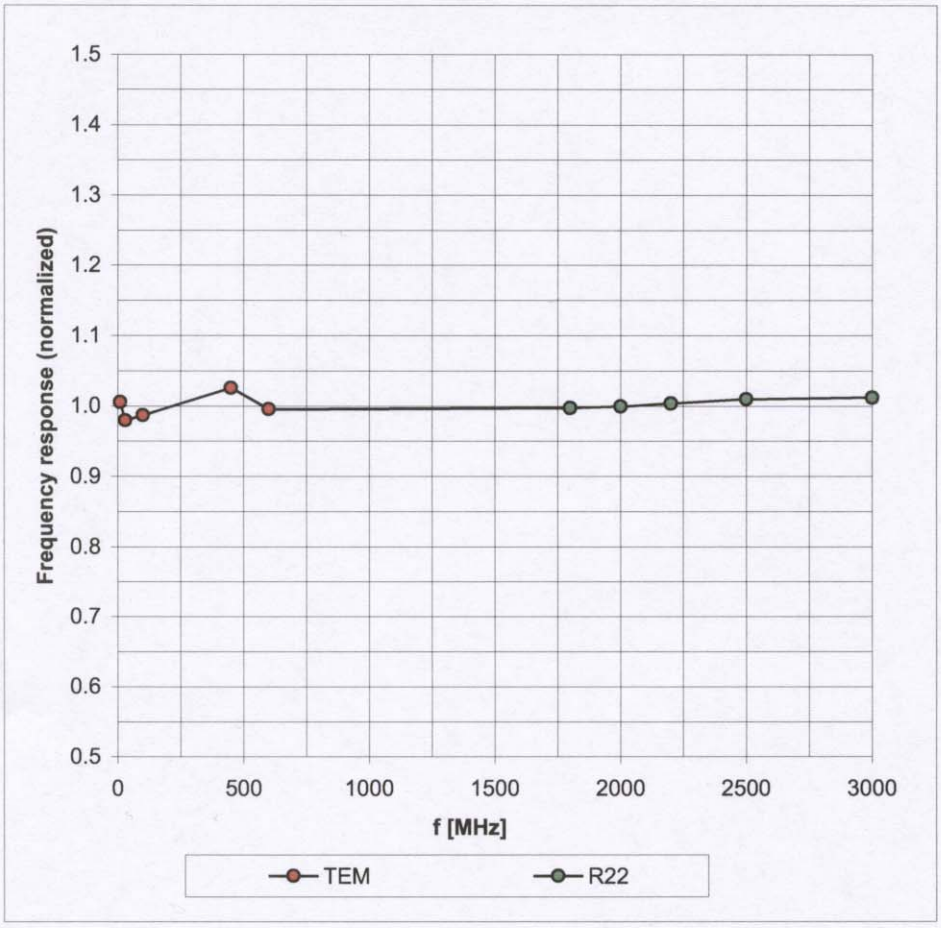
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Page 8).

[B] Numerical linearization parameter: uncertainty not required.

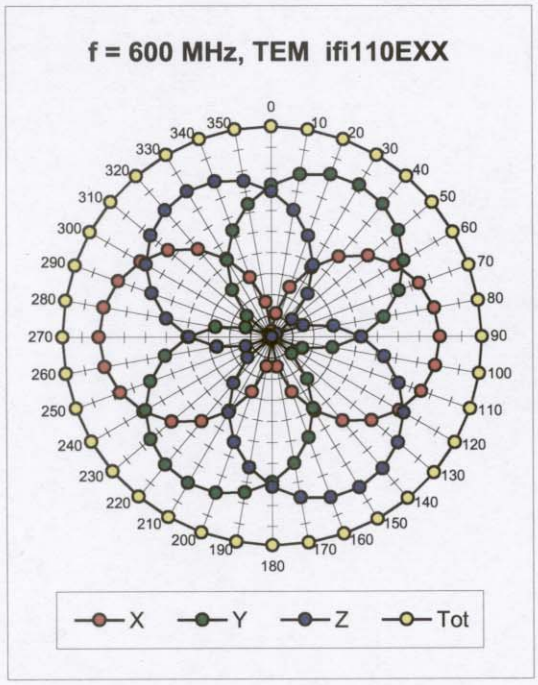
Frequency Response of E-Field

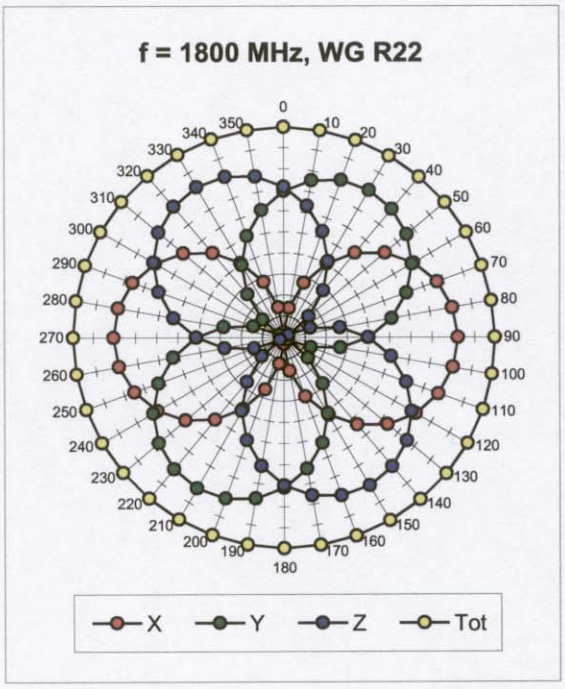
(TEM-Cell:ifi110 EXX, Waveguide: R22)

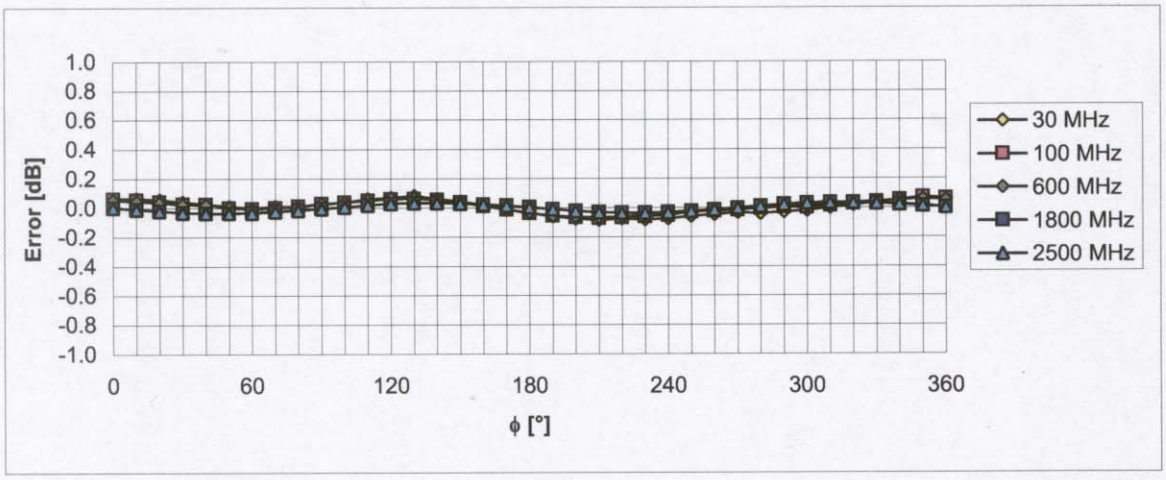


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



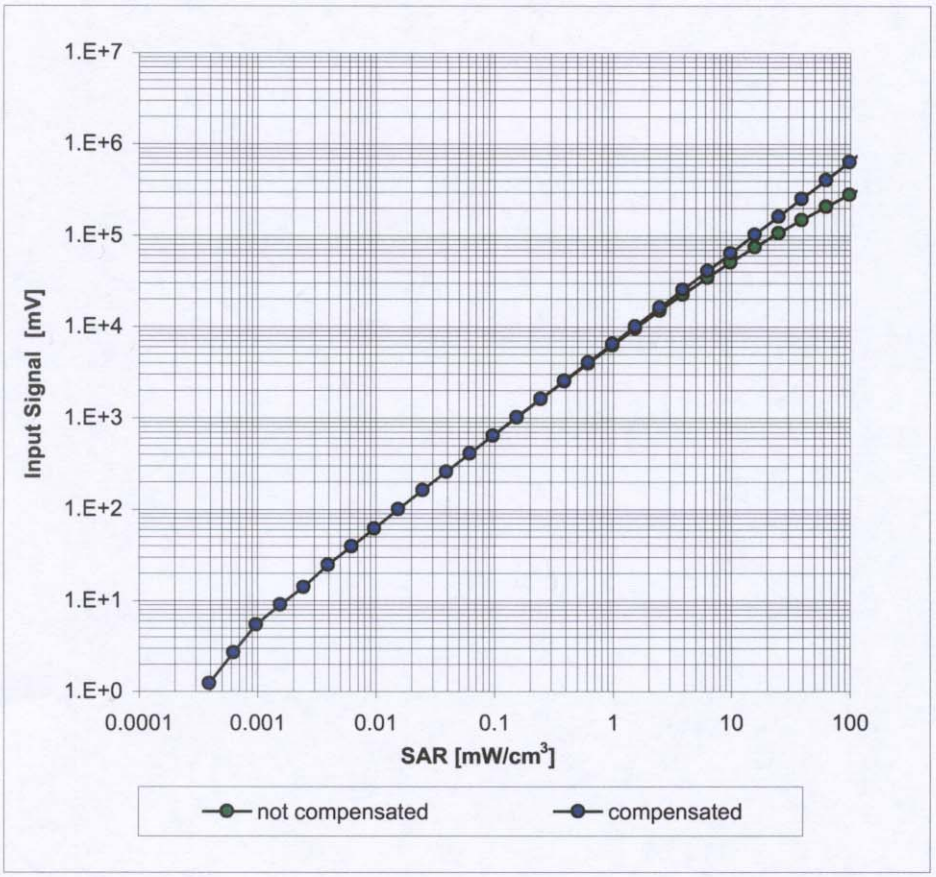


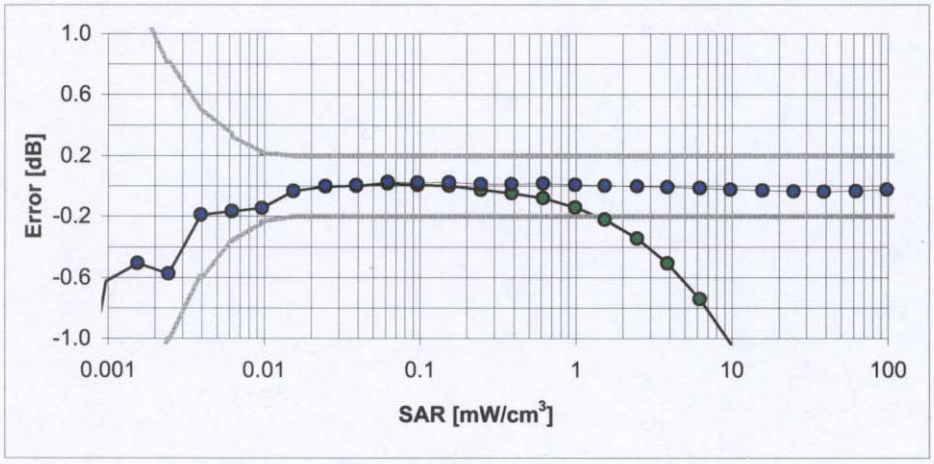


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

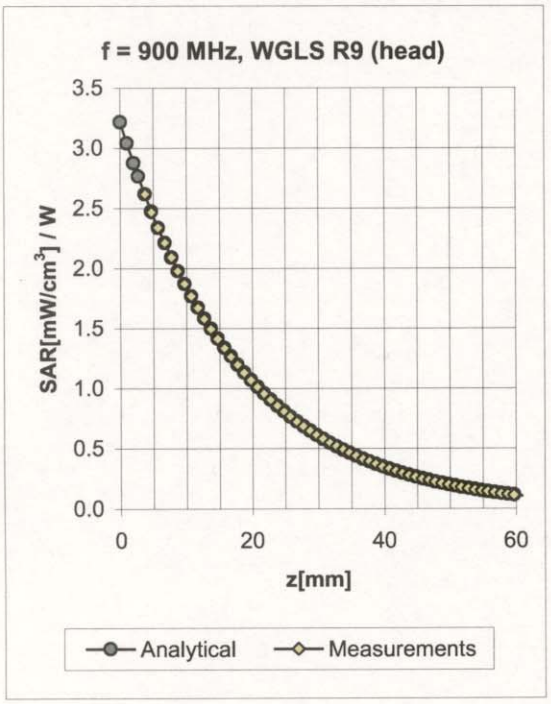
(Waveguide R22, f = 1800 MHz)

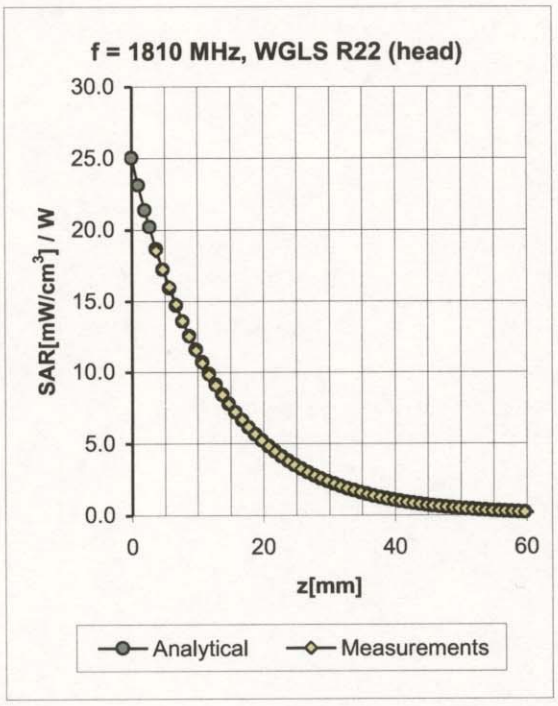




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



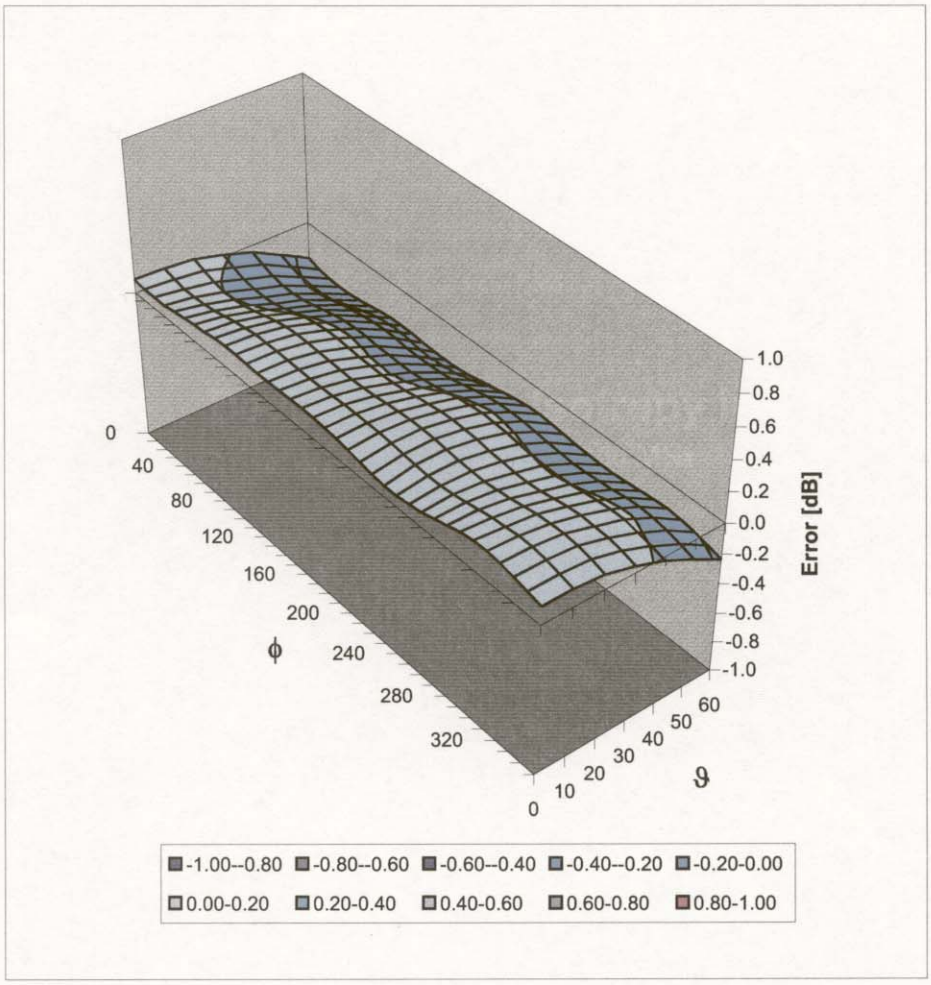


f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.65	1.81	6.47 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.62	2.39	5.18 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.76	2.09	4.56 ± 11.8% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.60	2.01	6.10 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.60	2.67	4.75 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.82	1.82	4.30 ± 11.8% (k=2)

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1387**
Place of Assessment:	**Zurich**
Date of Assessment:	**March 21, 2005**
Probe Calibration Date:	**March 18, 2005**

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:

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

Dosimetric E-Field Probe ET3DV6 SN:1387

Conversion factor (± standard deviation)

f = 150 MHz	ConvF	**8.8 ± 10%**	**ε_r = 52.3 ± 5%** **σ = 0.76 ± 5% mho/m** (head tissue)
f = 300 MHz	ConvF	**7.9 ± 9%**	**ε_r = 45.3 ± 5%** **σ = 0.87 ± 5% mho/m** (head tissue)
f = 450 MHz	ConvF	**7.5 ± 8%**	**ε_r = 43.5 ± 5%** **σ = 0.87 ± 5% mho/m** (head tissue)
f = 150 MHz	ConvF	**8.4 ± 10%**	**ε_r = 61.9 ± 5%** **σ = 0.80 ± 5% mho/m** (body tissue)
f = 450 MHz	ConvF	**7.5 ± 8%**	**ε_r = 56.7 ± 5%** **σ = 0.94 ± 5% mho/m** (body tissue)

Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

Please see also Section 4.7 of the DASY4 Manual.