SAR TEST REPORT (FCC/IC)

RF EXPOSURE EVALUATION | SPECIFIC ABSORPTION RATE

APPLICANT / MANUFACTURER	VERTEX STANDARD CO., LTD.			
DEVICE UNDER TEST (DUT)	PORTABLE FM UHF PUSH-TO-TALK RADIO TRANSCEIVER			
DEVICE FREQUENCY RANGE	400 - 470 MHz			
DEVICE MODEL(S)	VX-231-AG6B-5			
DEVICE IDENTIFIER(S)	FCC ID:	K6610854620	IC:	511B-10854620
APPLICATION TYPE	Certification			
STANDARD(S) APPLIED	FCC 47 CFR §2.1093			
	Health Canada Safety Code 6			
PROCEDURE(S) APPLIED	FCC OET Bulletin 65, Supplement C (01-01)			
	FCC Mobile & Portable RF Exp. Proc. (KDB 447498 D01 v03r03)			
	Industry Canada RSS-102 Issue 2			
	IEEE 1528-2003			
	IEC 62209-1:2005			
FCC DEVICE CLASSIFICATION	Licensed Non-Broadcast Transmitter Held to Face (TNF)			
IC DEVICE CLASSIFICATION	Land Mobile Radio Transmitter/Receiver (27.41-960 MHz)			
RF EXPOSURE CATEGORY	Occupational / Controlled			
RF EXPOSURE EVALUATION(S)	Face-held & Body-worn			
DATE(S) OF EVALUATION	February 05, 2009			
TEST REPORT SERIAL NO.	020509K66-T952-S90U			
TEST REPORT REVISION NO.	Revision 1.0	Initial Release	February 18, 2009	
TEST REPORT SIGNATORIES	Testing Performed By		Test Report Prepared By	
	Sean Johnston Celltech Labs Inc.		Jonathan Hughes Celltech Labs Inc.	
TEST LAB AND LOCATION	Celltech Compliance Testing and Engineering Lab			
	21-364 Lougheed Road, Kelowna, B.C. V1X 7R8 Canada			
TEST LAB CONTACT INFO.	Tel.: 250-765-7650		Fax: 250-765-7645	
	info@celltechlabs.com		www.celltechlabs.com	
TEST LAB ACCREDITATION(S)	Test Lab Certificate No. 2470.01			

DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

Test Lab Information	**Name**	**CELLTECH LABS INC.**			
	Address	21-364 Lougheed Road, Kelowna, B.C. V1X 7R8 Canada			
Applicant Information	**Name**	**VERTEX STANDARD CO., LTD.**			
	Address	4-8-8 Nakameguro, Meguro-ku, Tokyo 153-8664 Japan			
Standard(s) Applied	**FCC**	47 CFR §2.1093	**IC**	Health Canada Safety Code 6	
Procedure(s) Applied	**FCC**	OET Bulletin 65, Supplement C (Edition 01-01)			
	FCC	Mobile & Portable RF Exposure Procedures (KDB 447498 D01 v03r03)			
	IC	RSS-102 Issue 2			
	IEEE	1528-2003	**IEC**	62209-1:2005	
Device Classification(s)	**FCC**	Licensed Non-Broadcast Transmitter Held to Face (TNF)			
	IC	Land Mobile Radio Transmitter/Receiver (27.41-960 MHz)			
Device RF Exposure Category	**Portable**	Occupational / Controlled Environment			
Device Identifier(s)	**FCC ID:**	K6610854620	**IC:**	511B-10854620	
Device Model(s)	VX-231-AG6B-5				
Test Sample Serial No.	8H000019 (Identical Prototype)				
Device Description	Portable FM UHF Push-To-Talk (PTT) Radio Transceiver				
Transmit Frequency Range(s)	400 - 470 MHz				
Max. RF Output Power Tested	5.2 Watts	37.16 dBm	Conducted	400 MHz	Low Channel
	5.0 Watts	36.99 dBm	Conducted	435 MHz	Mid Channel
	5.1 Watts	37.08 dBm	Conducted	470 MHz	High Channel
Antenna Type(s) Tested	Detachable Whip	400 - 430 MHz	P/N: ATU-6A	Length: 166 mm	
	Detachable Whip	420 - 450 MHz	P/N: ATU-6B	Length: 163 mm	
	Detachable Whip	450 - 490 MHz	P/N: ATU-6D	Length: 153 mm	
Battery Type(s) Tested	Lithium-ion	7.4 V	1150 mAh	P/N: FNB-V103LI	
	Lithium-ion	7.4 V	2000 mAh	P/N: FNB-V104LI	
Body-worn Accessories Tested	Belt-Clip	Contains Metal Components		Model: CLIP-18	
Audio Accessories Tested	Speaker-Microphone	P/N: MH-45B4B	VOX Headset	P/N: VC-25	
Additional Audio Accessories	Speaker-Microphone	P/N: MH-360S	Speaker-Microphone	P/N: MH-450S	
	Note: additional audio accessories not tested based on minor difference to audio accessory tested				

Max. SAR Level(s) Evaluated	Face-held	**4.62 W/kg**	1g	50% duty cycle	Occupational / Controlled Exposure
	Body-worn	**7.50 W/kg**	1g	50% duty cycle	Occupational / Controlled Exposure
FCC/IC Spatial Peak SAR Limit	Head/Body	8.0 W/kg	1g	50% duty cycle	Occupational / Controlled Exposure

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 for the Occupational / Controlled Exposure environment. The device was tested in accordance with the measurement standards and procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01), Industry Canada RSS-102 Issue 2, IEEE Standard 1528-2003 and IEC International Standard 62209-1:2005. 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.

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

This test report shall not be reproduced partially, or in full, without the prior written approval of Celltech Labs Inc.

Test Report Approved By		**Sean Johnston**	**Celltech Labs Inc.**

TABLE OF CONTENTS

1.0 INTRODUCTION

This measurement report demonstrates that the Vertex Standard Co., Ltd. Model: VX-231-AG6B-5 Portable FM UHF PTT Radio Transceiver complies with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]) and Health Canada's Safety Code 6 (see reference [2]) for the Occupational / Controlled Exposure environment. The measurement procedures described in FCC OET Bulletin 65, Supplement C (Edition 01-01) (see reference [3]), IC RSS-102 Issue 2 (see reference [4]), IEEE Standard 1528-2003 (see reference [5]) and IEC International Standard 62209-1:2005 (see reference [6]) were employed. A description of the device, 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 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 Head 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 a controller with a built in VME-bus computer.

DASY4 SAR System with Plexiglas validation phantom

DASY4 SAR System with Plexiglas side planar phantom

3.0 MEASUREMENT SUMMARY

SAR EVALUATION RESULTS

Test Type	Freq.	Ch.	Antenna Part No.	Li-ion Battery	Accessory Type(s)		Device Distance to Planar Phantom		Cond. Power Before Test	Measured SAR 1g (W/kg) Duty Cycle		SAR Drift During Test	Scaled SAR with droop 1g (W/kg) Duty Cycle	
	MHz			mAh	Body-worn	Audio	DUT	Antenna	Watts	100%	50%	dB	100%	50%
Face	435	Mid	ATU-6B	1150	n/a	n/a	2.5 cm	3.9 cm	5.0	4.48	2.24	-0.076	4.56	2.28
Face	435	Mid	ATU-6B	2000	n/a	n/a	2.5 cm	3.9 cm	5.0	4.67	2.34	-0.109	4.79	2.39
Face	400	Low	ATU-6A	2000	n/a	n/a	2.5 cm	3.9 cm	5.2	8.81	4.41	-0.206	9.24	**4.62**
Face	470	High	ATU-6D	2000	n/a	n/a	2.5 cm	3.9 cm	5.1	6.77	3.39	-0.212	7.11	3.55
Body	435	Mid	ATU-6B	1150	Belt-Clip	Spkr-Mic	1.5 cm	3.0 cm	5.0	9.66	4.83	-0.102	9.89	4.94
Body	435	Mid	ATU-6B	2000	Belt-Clip	Spkr-Mic	1.5 cm	2.8 cm	5.0	10.7	5.35	-0.075	10.9	5.44
Body	435	Mid	ATU-6B	2000	Belt-Clip	Headset	1.5 cm	2.8 cm	5.0	10.8	5.40	-0.107	11.1	5.54
Body	400	Low	ATU-6A	2000	Belt-Clip	Headset	1.5 cm	2.8 cm	5.2	14.7	7.35	-0.093	15.0	**7.50**
Body	470	High	ATU-6D	2000	Belt-Clip	Headset	1.5 cm	2.8 cm	5.1	11.1	5.55	-0.216	11.7	5.83

SAR LIMIT(S)		HEAD & BODY	SPATIAL PEAK	RF EXPOSURE CATEGORY
FCC 47 CFR 2.1093	Health Canada Safety Code 6	8.0 W/kg	averaged over 1 gram	Occupational / Controlled

Test Date	February 05, 2009				February 05, 2009				Measured Fluid Type	Head	Body	Unit
Fluid Type	430 MHz Head				430 MHz Body				Atmospheric Pressure	101.1	101.1	kPa
Dielectric Constant ε_r	Interp. Target*		Meas.	Dev.	Interp. Target*		Meas.	Dev.	Relative Humidity	35	35	%
	43.7	± 5%	45.9	+5.0%	56.9	± 5%	58.2	+2.3%	Ambient Temperature	23.0	23.2	°C
Fluid Type	430 MHz Head				430 MHz Body				Fluid Temperature	22.8	22.5	°C
Conductivity σ (mho/m)	Interp. Target*		Meas.	Dev.	Interp. Target*		Meas.	Dev.	Fluid Depth	≥ 15	≥ 15	cm
	0.87	± 5%	0.89	+2.3%	0.94	± 5%	0.92	-2.1%	ρ (Kg/m^3)	1000		

Notes

*	The target dielectric parameters listed in FCC OET Bulletin 65, Supplement C are specified within the frequency range of 150 MHz and 5800 MHz at specific frequencies. In the dielectric property measurement software program supplied by Aprel Laboratories the dielectric properties specified were derived by interpolation method using linear model (see Appendix C).
1.	Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
2.	If the scaled SAR levels evaluated at the mid channel (50% duty cycle) were ≥ 3 dB below the SAR limit, SAR evaluation for the low and high channels was optional (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).
3.	The SAR drift of the DUT measured by the DASY4 system for the duration of the SAR evaluations was < 5% from the start power.
4.	The DUT was tested in unmodulated continuous transmit operation (Continuous Wave mode at 100% duty cycle) with PTT depressed.

5. **SAR Evaluation Power Thresholds for PTT Devices, $f \leq 0.5$ GHz (FCC KDB 447498 D01 v03r03 Section 5)b)i) - Mobile & Portable RF Exp. Proc.)**

Exposure Conditions	*P* mW (General Population)	*P* mW (Occupational)	Measured RF Conducted Output Power: 100% PTT Duty Cycle	50% PTT Duty Cycle
Held to face, $d \geq 2.5$ cm	250	1250	5.2 Watts	2.6 Watts
Body-worn, $d \geq 1.5$ cm	200	1000	5.2 Watts	2.6 Watts
Body-worn, $d \geq 1.0$ cm	150	750	-	-

1. The time-averaged output power, corresponding to the required PTT duty factor, is compared with these thresholds.
2. The closest distance between the user and the device or its antenna is used to determine the power thresholds.

4.0 DETAILS OF SAR EVALUATION

The Vertex Standard Co., Ltd. Model: VX-231-AG6B-5 Portable FM UHF PTT Radio Transceiver described in this report was compliant for localized Specific Absorption Rate (Occupational / Controlled Exposure) based on the test provisions and conditions described below. Detailed photographs of the test setup 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 spacing was maintained between the front side of the DUT and the outer surface of the planar phantom.
2. The DUT was evaluated 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 1.5 cm spacing from the back of the DUT to the outer surface of the planar phantom. The DUT was evaluated for body-worn SAR with the manufacturer-supplied speaker-microphone accessory and VOX headset accessory connected to the audio port consecutively.
3. The DUT was tested at maximum power 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.
4. The conducted output power levels referenced in this report were measured prior to the SAR evaluations at the antenna connector of the DUT using a Gigatronics 8652A Universal Power Meter in accordance with FCC 47 CFR §2.1046 and IC RSS-Gen.
5. The area scan evaluation was performed with a fully charged battery. After the area scan was completed the radio was cooled down and the battery was replaced with a fully charged battery prior to the zoom scan evaluation.
6. The SAR drift of the DUT was measured by the DASY4 system for the duration of the SAR evaluations.
7. The fluid temperature was measured prior to and after the SAR evaluations to ensure the temperature remained within +/-2°C of the fluid temperature reported during the dielectric parameter measurements.
8. The dielectric parameters of the simulated tissue mixtures were measured prior to the SAR evaluations using a Dielectric Probe Kit and a Network Analyzer (see Appendix C).

5.0 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 E). 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.

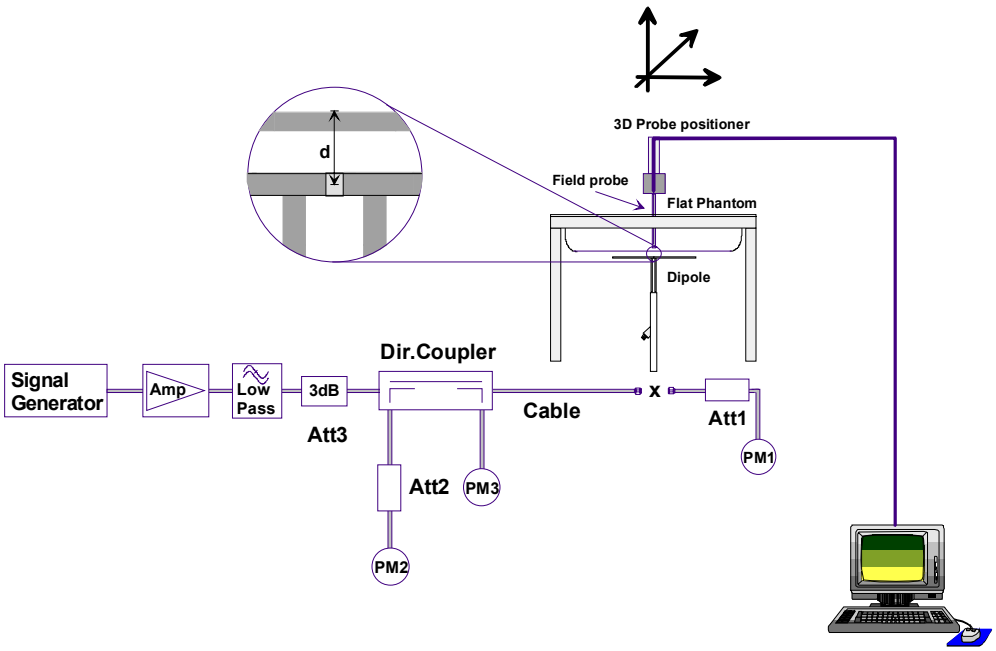
6.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluations a daily system check was performed using a Plexiglas planar phantom and 450 MHz dipole (see Appendix B for system performance check test plot) in accordance with the procedures described in IEEE Standard 1528-2003 (see reference [5]) and IEC International Standard 62209-1:2005 (see reference [6]). The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer (see Appendix C for measured fluid dielectric parameters). A forward power of 250 mW was applied to the dipole and the system was verified to a tolerance of ±10% from the system validation target SAR value (see Appendix E for system validation target SAR value listed on page 10 of the dipole calibration report).

SYSTEM PERFORMANCE CHECK EVALUATION

Test Date	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)
	Freq. (MHz)	Sys. Val. Target	Meas.	Dev.	Sys. Val. Target	Meas.	Dev.	Sys. Val. Target	Meas.	Dev.						
Feb-05	Head 450	1.22 ±10%	1.21	-0.8%	43.8 ±5%	45.6	+4.1%	0.86 ±5%	0.89	+3.5%	1000	23.0	22.8	≥ 15	35	101.1

Notes		
	1.	The target SAR value is referenced from the System Validation performed by Celltech Labs Inc. (see Appendix E).
	2.	The target dielectric parameters are referenced from the System Validation performed by Celltech Labs Inc. (see Appendix E).
	3.	The fluid temperature was measured prior to and after the system performance check to ensure the temperature remained within +/-2°C of the fluid temperature reported during the dielectric parameter measurements.
	4.	The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer (see Appendix C).



System Performance Check Measurement Setup Diagram

450 MHz Validation Dipole Setup

7.0 SAR PROBE CALIBRATION & MEASUREMENT FREQUENCIES

The following procedures are recommended for measurements at 150 MHz - 3 GHz to minimize probe calibration and tissue dielectric parameter discrepancies. In general, SAR measurements below 300 MHz should be within ±50 MHz of the probe calibration frequency. At 300 MHz to 3 GHz, measurements should be within ±100 MHz of the probe calibration frequency. Measurements exceeding 50% of these intervals, ±25 MHz < 300 MHz and ±50 MHz ≥300 MHz, require additional steps (per FCC KDB 450824 D01 v01r01, SAR Probe Calibration and System Verification Considerations for Measurements at 150 MHz - 3 GHz - see reference [8]).

Probe Calibration Freq.	Device Measurement Freq.	Frequency Interval	±50 MHz ≥ 300 MHz
450 MHz	400 MHz	50 MHz	- 50 MHz
	435 MHz	15 MHz	< 50 MHz
	470 MHz	20 MHz	< 50 MHz
The probe calibration and measurement frequency intervals do not exceed ± 50 MHz; therefore the additional steps are not required.			

8.0 SIMULATED EQUIVALENT TISSUES

The simulated tissue mixtures consisted of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution. Preservation with a bactericide was added and visual inspection made to ensure air bubbles were 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	Water	450 MHz Head Tissue Mixture	38.56 %	450 MHz Body Tissue Mixture	52.00 %
	Sugar		56.32 %		45.65 %
	Salt		3.95 %		1.75 %
	HEC		0.98 %		0.50 %
	Bactericide		0.19 %		0.10 %

9.0 SAR LIMITS

SAR RF EXPOSURE LIMITS			
FCC 47 CFR 2.1093	Health Canada Safety Code 6	(General Population / Uncontrolled Exposure)	(Occupational / Controlled Exposure)
Spatial Average (averaged over the whole body)		0.08 W/kg	0.4 W/kg
Spatial Peak (averaged over any 1 g of tissue)		1.6 W/kg	**8.0 W/kg**
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)		4.0 W/kg	20.0 W/kg
The Spatial Average value of the SAR averaged over the whole body.			
The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.			
The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.			
Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.			
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	Measurement Software: DASY4, V4.7 Build 44
	Postprocessing Software: SEMCAD, V1.8 Build 171
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.	1590
Construction	Triangular core fiber optic detection system
Frequency	10 MHz to 6 GHz
Linearity	±0.2 dB (30 MHz to 3 GHz)
Evaluation Phantom	
Type	Side Planar Phantom
Shell Material	Plexiglas
Bottom Thickness	2.0 mm ± 0.1 mm
Inner Dimensions	72.6 cm (L) x 20.3 cm (W) x 20.3 cm (H)
Validation Phantom (≤ 450MHz)	
Type	Planar Phantom
Shell Material	Plexiglas
Bottom Thickness	6 mm ± 0.1 mm
Inner Dimensions	83.5 cm (L) x 36.9 cm (W) x 21.8 cm (H)

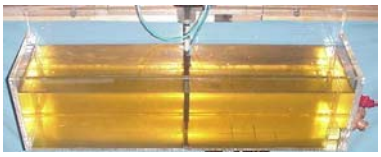
11.0 PROBE SPECIFICATION (ET3DV6)

Construction:	Symmetrical design with triangular core; Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, glycol)
Calibration:	In air from 10 MHz to 2.5 GHz In head 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 head tissue (rotation around probe axis) ± 0.4 dB in head tissue (rotation normal to probe axis)
Dynamic Range:	5 μW/g to > 100 mW/g; Linearity: ± 0.2 dB
Surface Detect:	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Dimensions:	Overall length: 330 mm; Tip length: 16 mm; Body diameter: 12 mm; Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 3 GHz; Compliance tests of 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 portable 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 to the table of the DASY4 compact system.

Plexiglas 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

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	CNR	CNR
x	-Robot	00046	599396-01	CNR	CNR
x	-DAE4	00019	353	22Apr08	22Apr09
x	-ET3DV6 E-Field Probe	00017	1590	21Jul08	21Jul09
x	-Celltech 450 MHz Validation Dipole	00024	136	19Jan09	19Jan10
x	-Plexiglas Side Planar Phantom	00156	161	CNR	CNR
x	-Plexiglas Validation Planar Phantom	00157	137	CNR	CNR
x	HP 85070C Dielectric Probe Kit	00033	US39240170	CNR	CNR
x	Gigatronics 8652A Power Meter	00007	1835272	23Apr08	23Apr09
x	Gigatronics 80701A Power Sensor	00014	1833699	23Apr08	23Apr09
x	HP 8753ET Network Analyzer	00134	US39170292	28Apr08	28Apr09
x	HP 8648D Signal Generator	00005	3847A00611	CNR	CNR
x	Amplifier Research 5S1G4 Power Amplifier	00106	26235	CNR	CNR
Abbr.	CNR = Calibration Not Required				

16.0 MEASUREMENT UNCERTAINTIES

UNCERTAINTY BUDGET FOR DEVICE EVALUATION

Uncertainty Component	IEEE 1528 Section	Uncertainty Value ±%	Probability Distribution	Divisor	ci 1g	ci 10g	Uncertainty Value ±% (1g)	Uncertainty Value ±% (10g)	V_i or V_{eff}
Measurement System									
Probe Calibration (450 MHz)	E.2.1	6.65	Normal	1	1	1	6.65	6.65	∞
Axial Isotropy	E.2.2	4.7	Rectangular	1.732050808	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	Rectangular	1.732050808	0.7	0.7	3.9	3.9	∞
Boundary Effect	E.2.3	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	Rectangular	1.732050808	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	Normal	1	1	1	0.3	0.3	∞
Response Time	E.2.7	0.8	Rectangular	1.732050808	1	1	0.5	0.5	∞
Integration Time	E.2.8	2.6	Rectangular	1.732050808	1	1	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3	Rectangular	1.732050808	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	Rectangular	1.732050808	1	1	0.2	0.2	∞
Probe Positioning wrt Phantom Shell	E.6.3	2.9	Rectangular	1.732050808	1	1	1.7	1.7	∞
Extrapolation, interpolation & integration algorithms for max. SAR evaluation	E.5	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	2.9	Normal	1	1	1	2.9	2.9	12
Device Holder Uncertainty	E.4.1	3.6	Normal	1	1	1	3.6	3.6	8
SAR Drift Measurement	6.6.2	5	Rectangular	1.732050808	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4	Rectangular	1.732050808	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5	Rectangular	1.732050808	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measured)	E.3.3	2.3	Normal	1	0.64	0.43	1.5	1.0	∞
Liquid Permittivity (target)	E.3.2	5	Rectangular	1.732050808	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measured)	E.3.3	5	Normal	1	0.6	0.49	3.0	2.5	∞
Combined Standard Uncertainty			**RSS**				**11.50**	**11.19**	
Expanded Uncertainty (95% Confidence Interval)			**k=2**				**23.00**	**22.38**	

Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 and IEC International Standard 62209-1:2005

17.0 REFERENCES

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

[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.

[6] IEC International Standard 62209-1:2005 - “Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures.”

[7] Federal Communications Commission, Office of Engineering and Technology - “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”; KDB 447498 D01 v03r03: January 2009.

[8] Federal Communications Commission, Office of Engineering and Technology - “Application Note: SAR Probe Calibration and System Verification Considerations for Measurements at 150 MHz - 3 GHz”; KDB 450824 D01 v01r01: January 2007.

APPENDIX A - SAR MEASUREMENT DATA

Date Tested: 02/05/2009

Face-held SAR - Antenna P/N: ATU-6B - 1150mAh Li-ion Battery - Mid Channel - 435 MHz

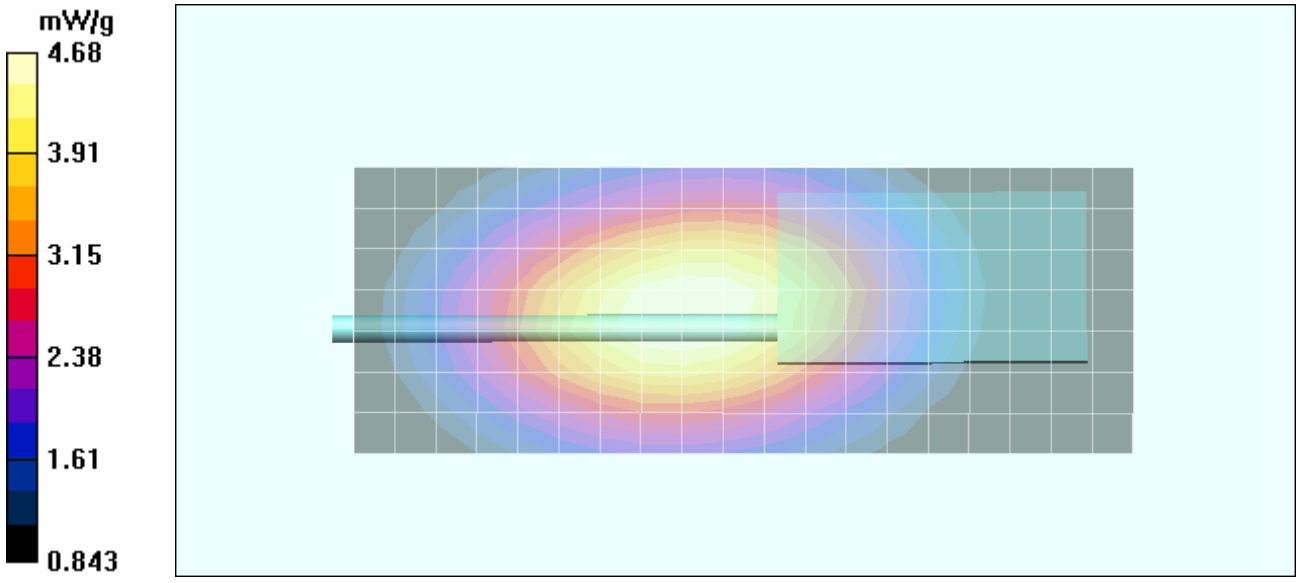
DUT: Vertex Model: VX-231-AG6B-5; Type: Portable FM UHF PTT Radio Transceiver; Serial: 9C000011

Ambient Temp: 23.0°C; Fluid Temp: 22.8°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Frequency: 435 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.0 Watts (Conducted)
7.4V 1150mAh Lithium-ion Battery (P/N: FNB-V103LI)
Medium: HSL450 Medium parameters used: f = 435 MHz; σ = 0.89 mho/m; ε_r = 45.9; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(7.66, 7.66, 7.66); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Face-held SAR - 2.5 cm Spacing from Front Side of DUT to Planar Phantom
Area Scan (8x20x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 4.80 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 70.5 V/m; Power Drift = -0.076 dB
Peak SAR (extrapolated) = 6.12 W/kg
SAR(1 g) = 4.48 mW/g; SAR(10 g) = 3.34 mW/g
Maximum value of SAR (measured) = 4.68 mW/g



Date Tested: 02/05/2009

Face-held SAR - Antenna P/N: ATU-6B - 2000mAh Li-ion Battery - Mid Channel - 435 MHz

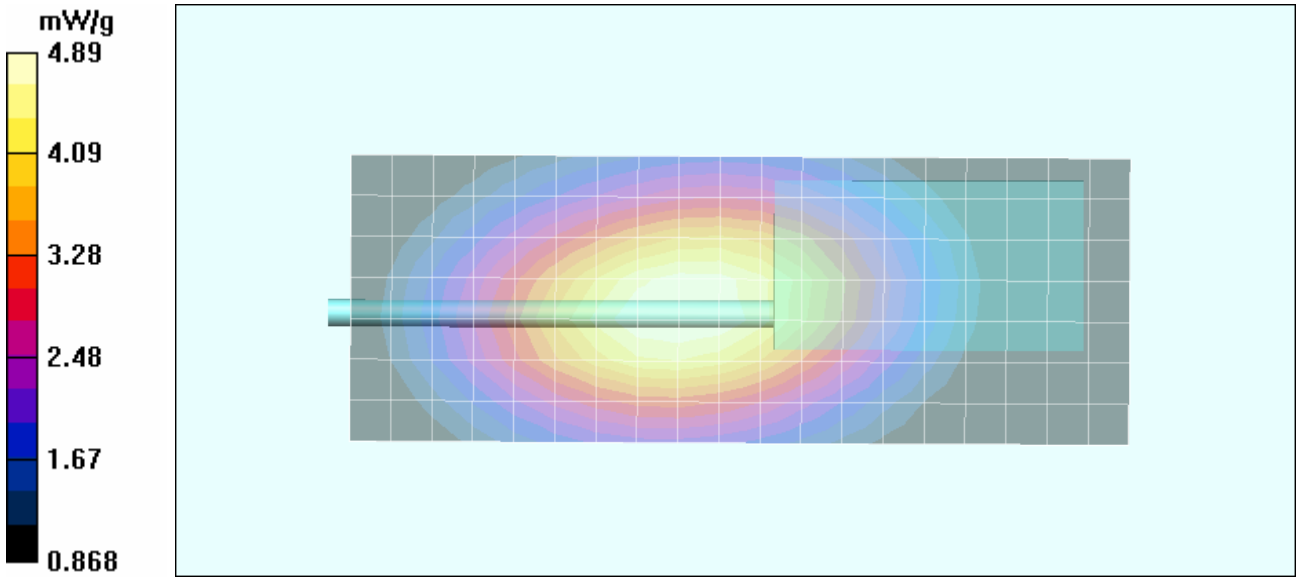
DUT: Vertex Model: VX-231-AG6B-5; Type: Portable FM UHF PTT Radio Transceiver; Serial: 9C000011

Ambient Temp: 23.0°C; Fluid Temp: 22.8°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Frequency: 435 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.0 Watts (Conducted)
7.4V 2000mAh Lithium-ion Battery (P/N: FNB-V104LI)
Medium: HSL450 Medium parameters used: f = 435 MHz; σ = 0.89 mho/m; ε_r = 45.9; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(7.66, 7.66, 7.66); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Face-held SAR - 2.5 cm Spacing from Front Side of DUT to Planar Phantom
Area Scan (8x20x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 4.99 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 71.1 V/m; Power Drift = -0.109 dB
Peak SAR (extrapolated) = 6.43 W/kg
SAR(1 g) = 4.67 mW/g; SAR(10 g) = 3.48 mW/g
Maximum value of SAR (measured) = 4.89 mW/g



Date Tested: 02/05/2009

Face-held SAR - Antenna P/N: ATU-6A - 2000mAh Li-ion Battery - Low Channel - 400 MHz

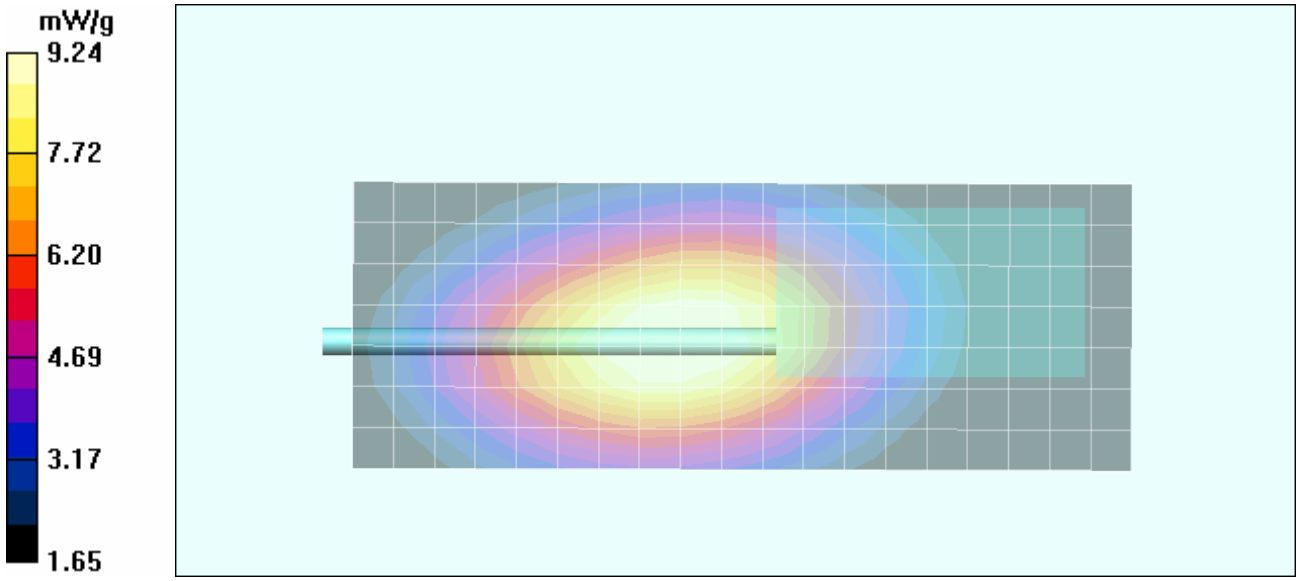
DUT: Vertex Model: VX-231-AG6B-5; Type: Portable FM UHF PTT Radio Transceiver; Serial: 9C000011

Ambient Temp: 23.0°C; Fluid Temp: 22.8°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

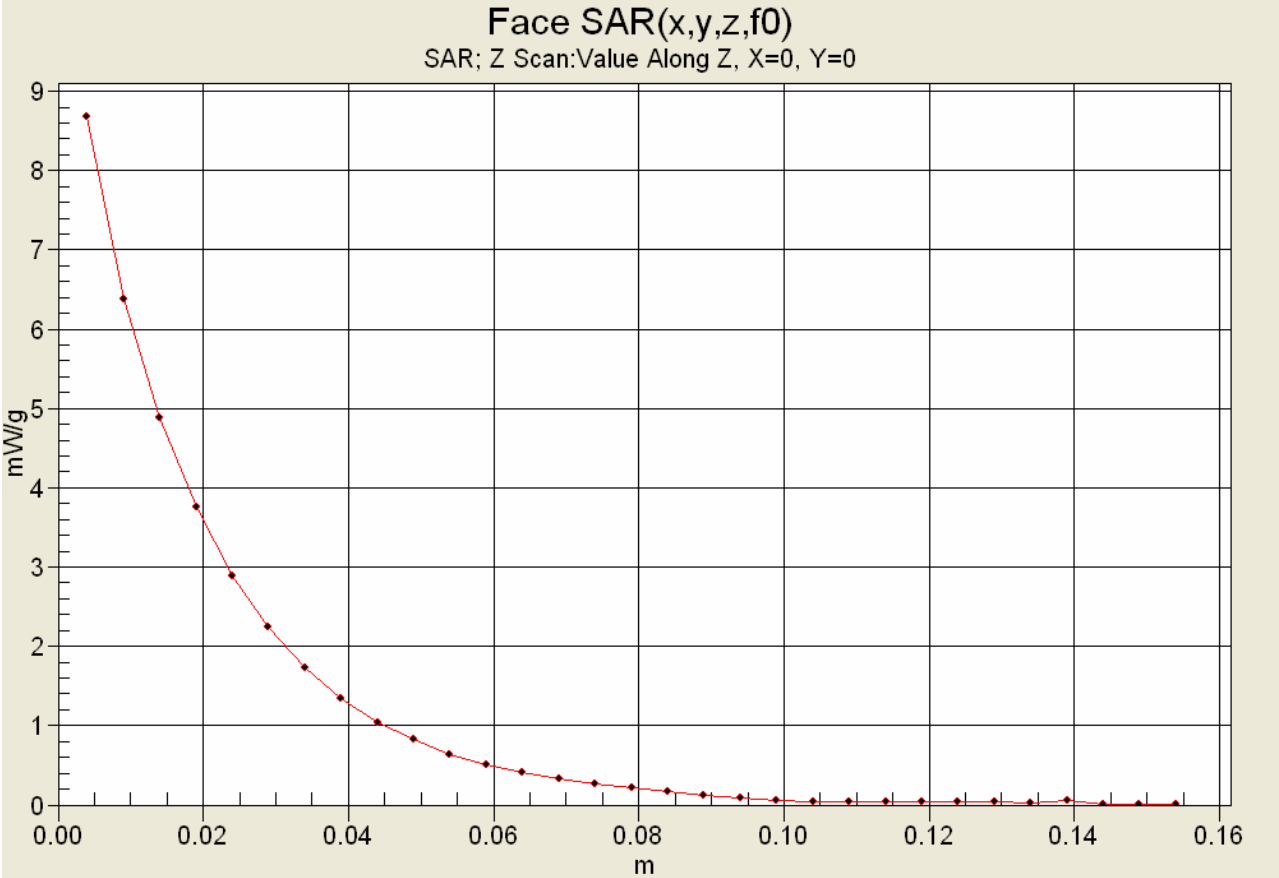
Frequency: 400 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.2 Watts (Conducted)
7.4V 2000mAh Lithium-ion Battery (P/N: FNB-V104LI)
Medium: HSL450 Medium parameters used: f = 400 MHz; σ = 0.89 mho/m; ε_r = 45.9; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(7.66, 7.66, 7.66); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Face-held SAR - 2.5 cm Spacing from Front Side of DUT to Planar Phantom
Area Scan (8x20x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 9.81 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 95.5 V/m; Power Drift = -0.206 dB
Peak SAR (extrapolated) = 12.2 W/kg
SAR(1 g) = 8.81 mW/g; SAR(10 g) = 6.53 mW/g
Maximum value of SAR (measured) = 9.24 mW/g



Z-Axis Scan



Date Tested: 02/05/2009

Face-held SAR - Antenna P/N: ATU-6D - 2000mAh Li-ion Battery - High Channel - 470 MHz

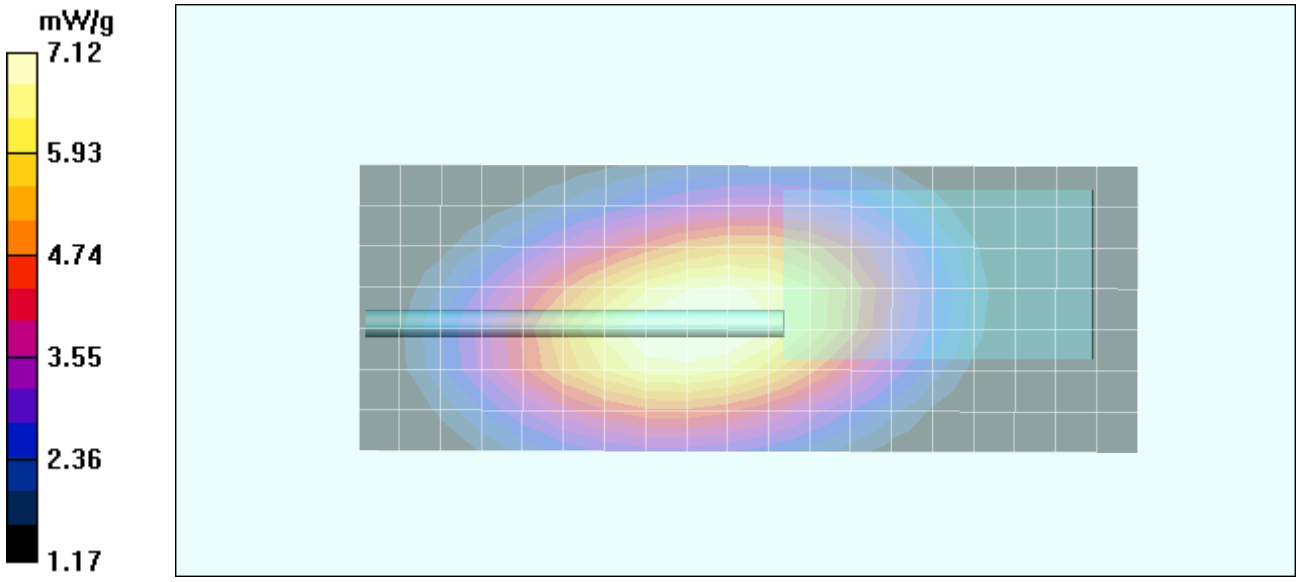
DUT: Vertex Model: VX-231-AG6B-5; Type: Portable FM UHF PTT Radio Transceiver; Serial: 9C000011

Ambient Temp: 23.0°C; Fluid Temp: 22.8°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Frequency: 470 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.1 Watts (Conducted)
7.4V 2000mAh Lithium-ion Battery (P/N: FNB-V104LI)
Medium: HSL450 Medium parameters used: f = 470 MHz; σ = 0.89 mho/m; ε_r = 45.9; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(7.66, 7.66, 7.66); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Face-held SAR - 2.5 cm Spacing from Front Side of DUT to Planar Phantom
Area Scan (8x20x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 7.42 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 85.0 V/m; Power Drift = -0.212 dB
Peak SAR (extrapolated) = 9.47 W/kg
SAR(1 g) = 6.77 mW/g; SAR(10 g) = 4.95 mW/g
Maximum value of SAR (measured) = 7.12 mW/g



Date Tested: 02/05/2009

Body-worn SAR - Antenna P/N: ATU-6B - 1150mAh Li-ion Battery - Mid Channel - 435 MHz

DUT: Vertex Model: VX-231-AG6B-5; Type: Portable FM UHF PTT Radio Transceiver; Serial: 9C000011

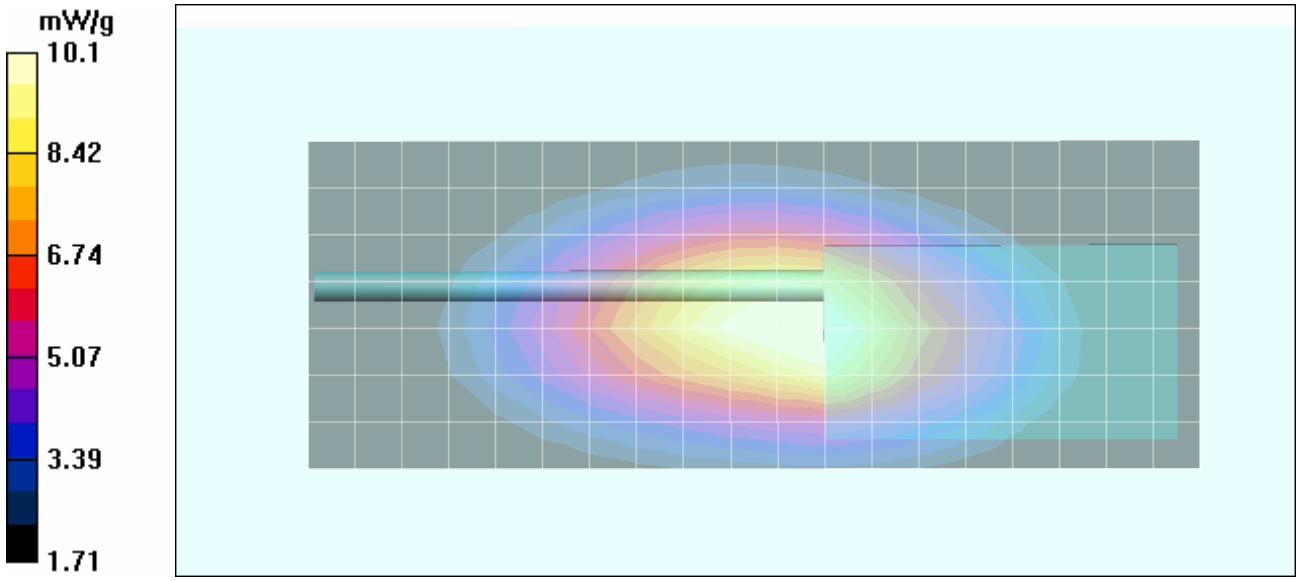
Body-worn Accessory: Belt-Clip (Model: CLIP-18); Audio Accessory: Speaker-Microphone (P/N: MH-45B4B)

Ambient Temp: 23.2°C; Fluid Temp: 22.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Frequency: 435 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.0 Watts (Conducted)
7.4V 1150mAh Lithium-ion Battery (P/N: FNB-V103LI)
Medium: M450 Medium parameters used: f = 435 MHz; σ = 0.92 mho/m; ε_r = 58.2; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(8.27, 8.27, 8.27); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - 1.5 cm Belt-Clip Spacing from Back Side of DUT to Planar Phantom
Area Scan (8x20x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 10.7 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 105.8 V/m; Power Drift = -0.102 dB
Peak SAR (extrapolated) = 13.7 W/kg
SAR(1 g) = 9.66 mW/g; SAR(10 g) = 7.07 mW/g
Maximum value of SAR (measured) = 10.1 mW/g



Date Tested: 02/05/2009

Body-worn SAR - Antenna P/N: ATU-6B - 2000mAh Li-ion Battery - Mid Channel - 435 MHz

DUT: Vertex Model: VX-231-AG6B-5; Type: Portable FM UHF PTT Radio Transceiver; Serial: 9C000011

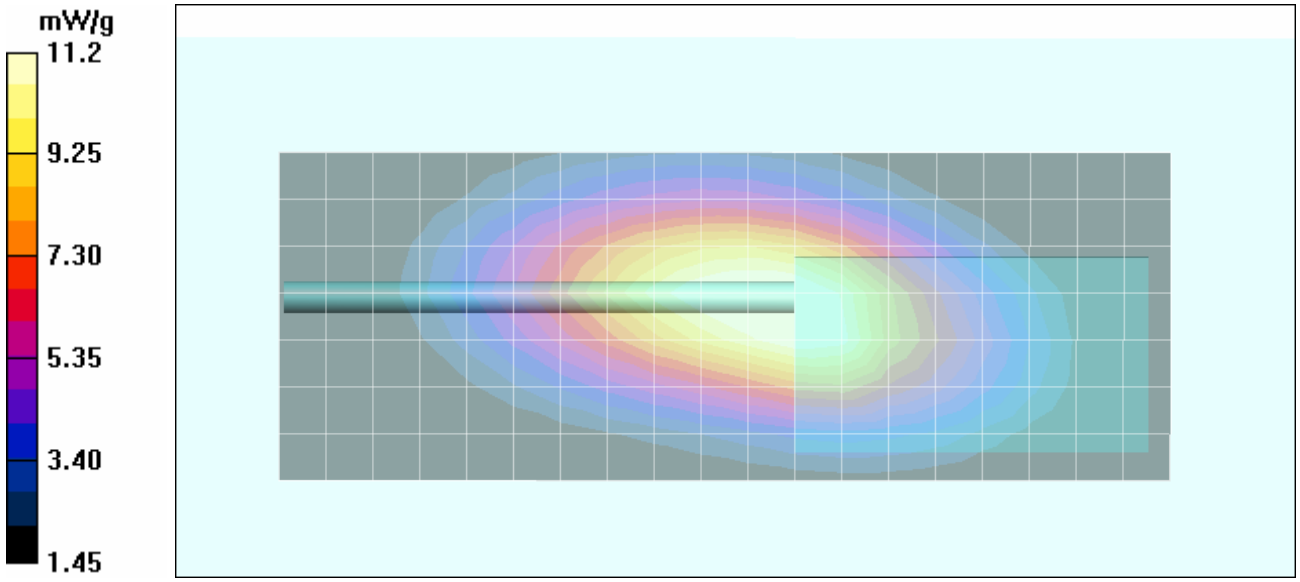
Body-worn Accessory: Belt-Clip (Model: CLIP-18); Audio Accessory: Speaker-Microphone (P/N: MH-45B4B)

Ambient Temp: 23.2°C; Fluid Temp: 22.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Frequency: 435 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.0 Watts (Conducted)
7.4V 2000mAh Lithium-ion Battery (P/N: FNB-V104LI)
Medium: M450 Medium parameters used: f = 435 MHz; σ = 0.92 mho/m; ε_r = 58.2; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(8.27, 8.27, 8.27); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - 1.5 cm Belt-Clip Spacing from Back Side of DUT to Planar Phantom
Area Scan (8x20x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 11.8 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 109.3 V/m; Power Drift = -0.075 dB
Peak SAR (extrapolated) = 15.1 W/kg
SAR(1 g) = 10.7 mW/g; SAR(10 g) = 7.78 mW/g
Maximum value of SAR (measured) = 11.2 mW/g



Date Tested: 02/05/2009

Body-worn SAR - Antenna P/N: ATU-6B - 2000mAh Li-ion Battery - Mid Channel - 435 MHz

DUT: Vertex Model: VX-231-AG6B-5; Type: Portable FM UHF PTT Radio Transceiver; Serial: 9C000011

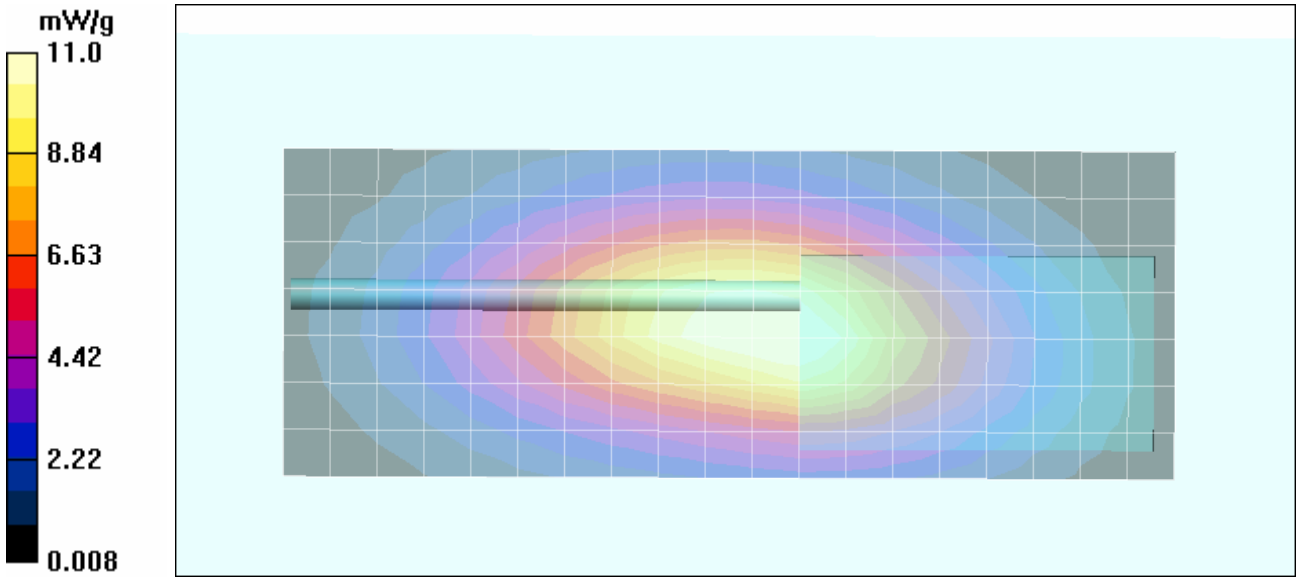
Body-worn Accessory: Belt-Clip (Model: CLIP-18); Audio Accessory: VOX Headset (P/N: VC-25)

Ambient Temp: 23.2°C; Fluid Temp: 22.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Frequency: 435 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.0 Watts (Conducted)
7.4V 2000mAh Lithium-ion Battery (P/N: FNB-V104LI)
Medium: M450 Medium parameters used: f = 435 MHz; σ = 0.92 mho/m; ε_r = 58.2; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(8.27, 8.27, 8.27); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - 1.5 cm Belt-Clip Spacing from Back Side of DUT to Planar Phantom
Area Scan (8x20x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 11.6 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 113.0 V/m; Power Drift = -0.107 dB
Peak SAR (extrapolated) = 15.3 W/kg
SAR(1 g) = 10.8 mW/g; SAR(10 g) = 7.96 mW/g
Maximum value of SAR (measured) = 11.0 mW/g



Date Tested: 02/05/2009

Body-worn SAR - Antenna P/N: ATU-6A - 2000mAh Li-ion Battery - Low Channel - 400 MHz

DUT: Vertex Model: VX-231-AG6B-5; Type: Portable FM UHF PTT Radio Transceiver; Serial: 9C000011

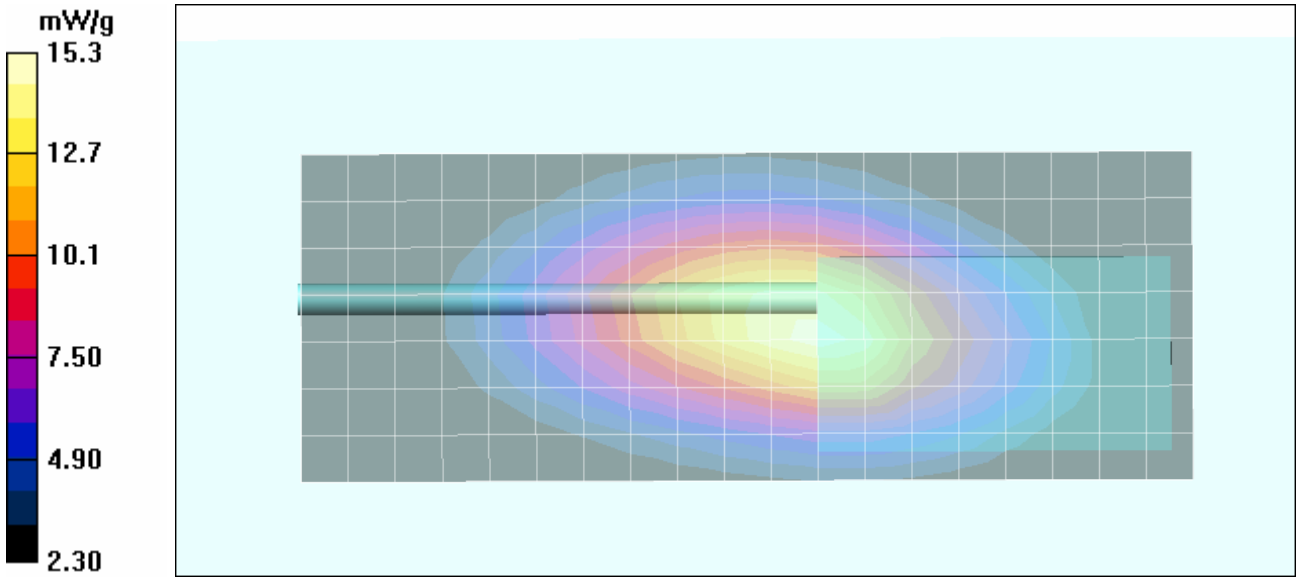
Body-worn Accessory: Belt-Clip (Model: CLIP-18); Audio Accessory: VOX Headset (P/N: VC-25)

Ambient Temp: 23.2°C; Fluid Temp: 22.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

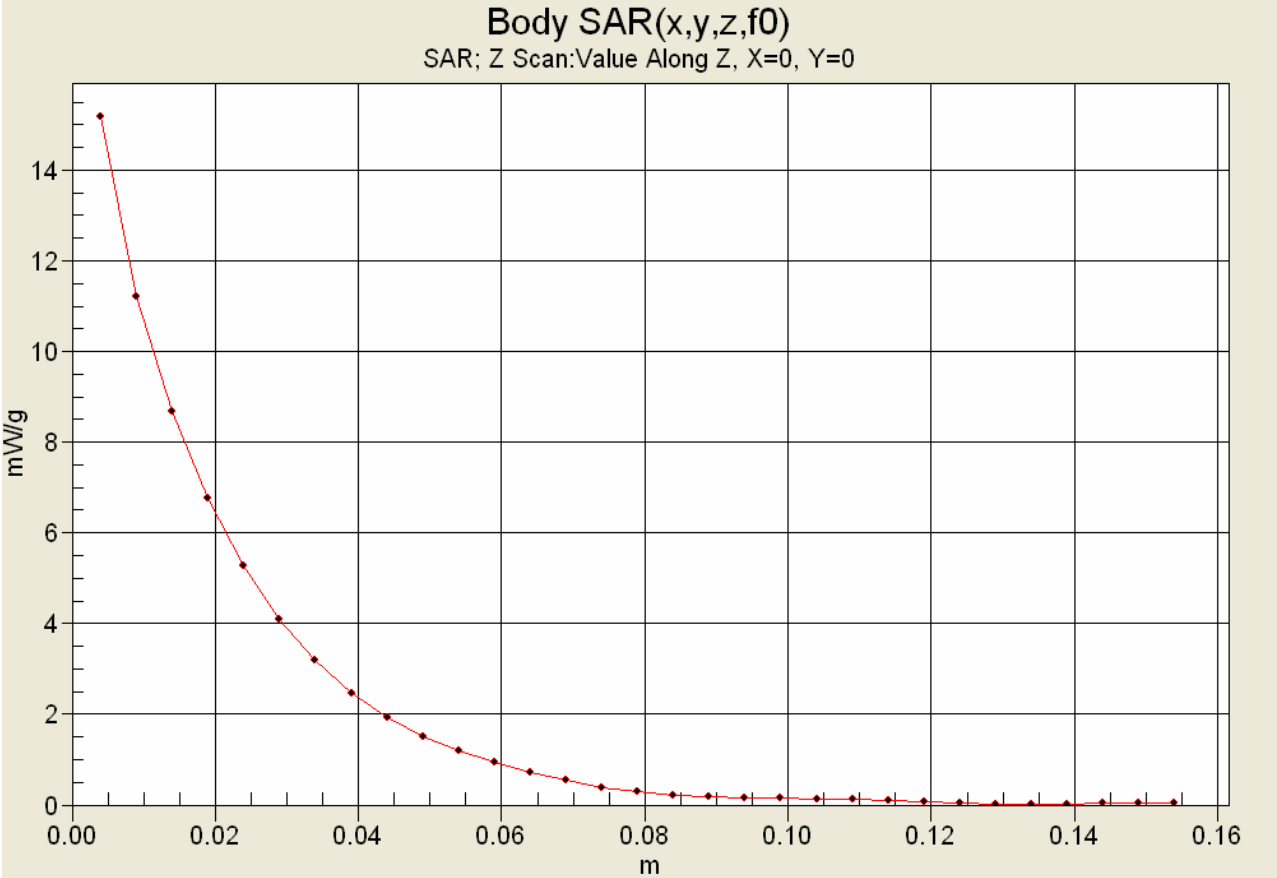
Frequency: 400 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.2 Watts (Conducted)
7.4V 2000mAh Lithium-ion Battery (P/N: FNB-V104LI)
Medium: M450 Medium parameters used: f = 400 MHz; σ = 0.92 mho/m; ε_r = 58.2; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(8.27, 8.27, 8.27); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - 1.5 cm Belt-Clip Spacing from Back Side of DUT to Planar Phantom
Area Scan (8x20x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 14.9 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 129.2 V/m; Power Drift = -0.093 dB
Peak SAR (extrapolated) = 20.4 W/kg
SAR(1 g) = 14.7 mW/g; SAR(10 g) = 10.9 mW/g
Maximum value of SAR (measured) = 15.3 mW/g



Z-Axis Scan



Date Tested: 02/05/2009

Body-worn SAR - Antenna P/N: ATU-6A - 2000mAh Li-ion Battery - High Channel - 470 MHz

DUT: Vertex Model: VX-231-AG6B-5; Type: Portable FM UHF PTT Radio Transceiver; Serial: 9C000011

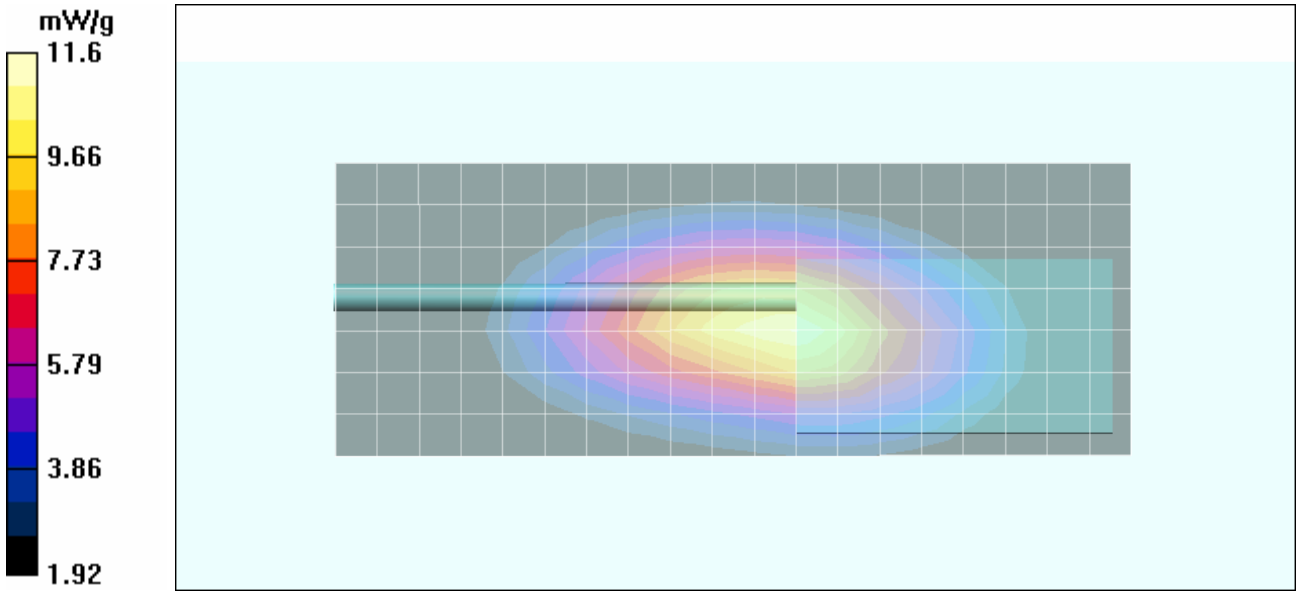
Body-worn Accessory: Belt-Clip (Model: CLIP-18); Audio Accessory: VOX Headset (P/N: VC-25)

Ambient Temp: 23.2°C; Fluid Temp: 22.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Frequency: 470 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.1 Watts (Conducted)
7.4V 2000mAh Lithium-ion Battery (P/N: FNB-V104LI)
Medium: M450 Medium parameters used: f = 470 MHz; σ = 0.92 mho/m; ε_r = 58.2; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(8.27, 8.27, 8.27); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - 1.5 cm Belt-Clip Spacing from Back Side of DUT to Planar Phantom
Area Scan (8x20x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 11.0 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 111.4 V/m; Power Drift = -0.216 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 11.1 mW/g; SAR(10 g) = 8.07 mW/g
Maximum value of SAR (measured) = 11.6 mW/g



APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 02/05/2009

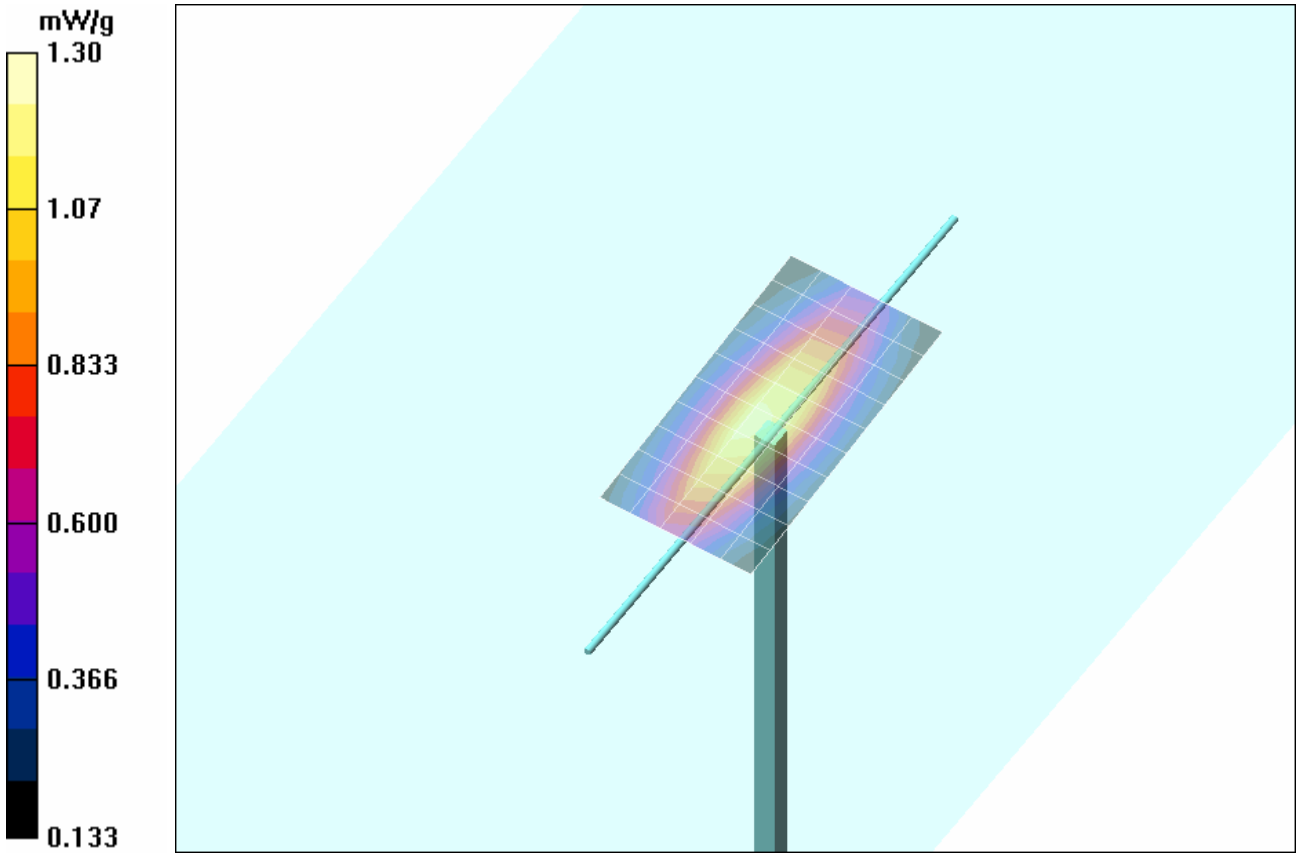
System Performance Check - 450 MHz Dipole - HSL

DUT: Dipole 450 MHz; Asset: 00024; Serial: 136; Calibration: 01/19/2009

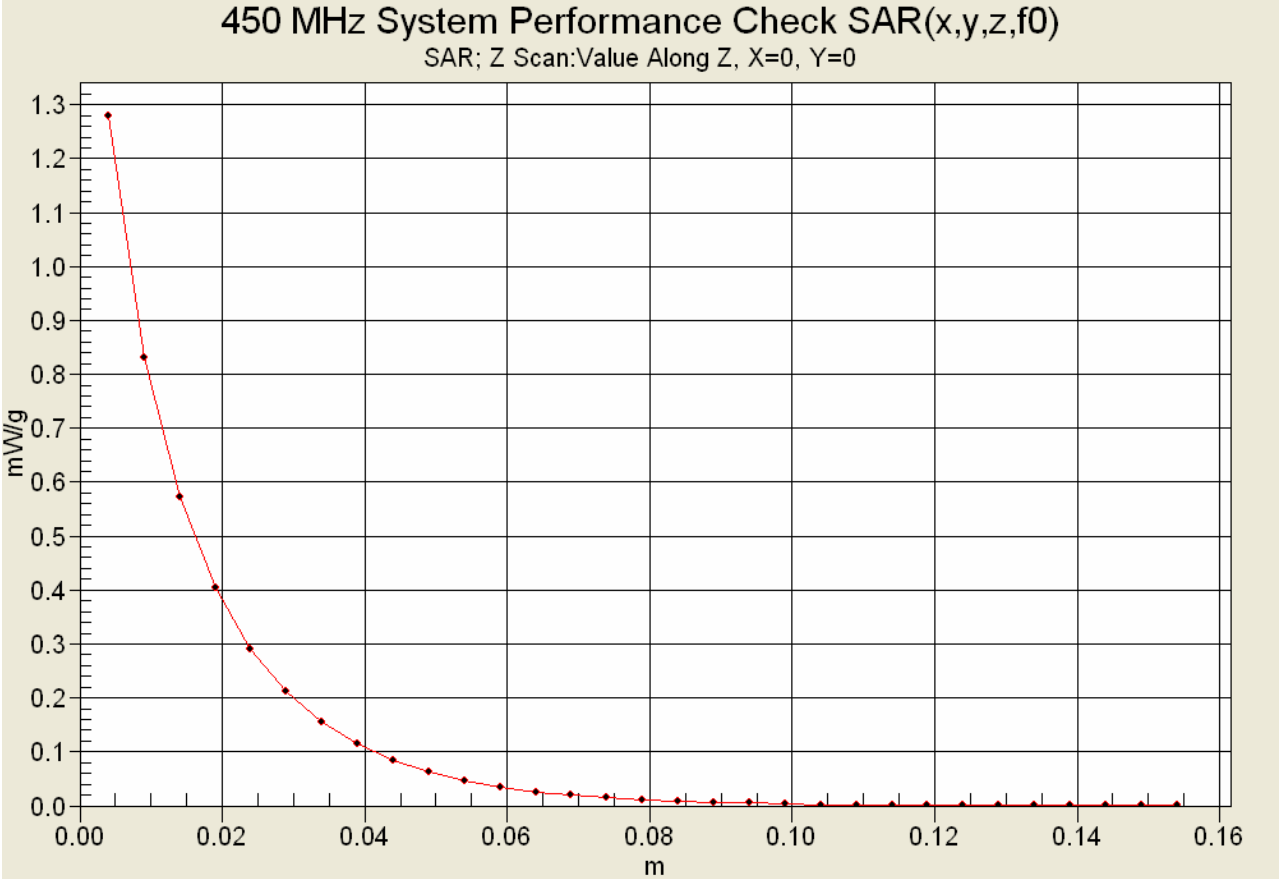
Ambient Temp: 23.0°C; Fluid Temp: 22.8°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 Medium parameters used: f = 450 MHz; σ = 0.89 mho/m; ε_r = 45.6; ρ = 1000 kg/m^3
- Probe: ET3DV6 - SN1590; ConvF(7.66, 7.66, 7.66); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Validation Planar; Type: Plexiglas; Serial: TE#137
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

System Performance Check - 450 MHz Dipole
Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.18 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 38.6 V/m; Power Drift = -0.026 dB
Peak SAR (extrapolated) = 1.93 W/kg
SAR(1 g) = 1.21 mW/g; SAR(10 g) = 0.796 mW/g
Maximum value of SAR (measured) = 1.30 mW/g



Z-Axis Scan



APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

450 MHz System Performance Check & 430 MHz DUT Evaluation (Head)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
05/Feb/2009
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
0.3500	44.70	0.87	47.58	0.81
0.3600	44.58	0.87	47.65	0.82
0.3700	44.46	0.87	47.98	0.84
0.3800	44.34	0.87	46.71	0.85
0.3900	44.22	0.87	47.72	0.85
0.4000	44.10	0.87	46.37	0.86
0.4100	43.98	0.87	46.21	0.87
0.4200	43.86	0.87	46.24	0.87
0.4300	43.74	0.87	45.86	0.89
0.4400	43.62	0.87	45.89	0.89
0.4500	43.50	0.87	45.59	0.89
0.4600	43.45	0.87	45.15	0.92
0.4700	43.40	0.87	45.42	0.91
0.4800	43.34	0.87	45.14	0.92
0.4900	43.29	0.87	44.06	0.93
0.5000	43.24	0.87	44.67	0.95
0.5100	43.19	0.87	44.74	0.95
0.5200	43.14	0.88	44.14	0.96
0.5300	43.08	0.88	44.00	0.96
0.5400	43.03	0.88	43.82	0.98
0.5500	42.98	0.88	43.80	0.98

430 MHz DUT Evaluation (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
05/Feb/2009
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

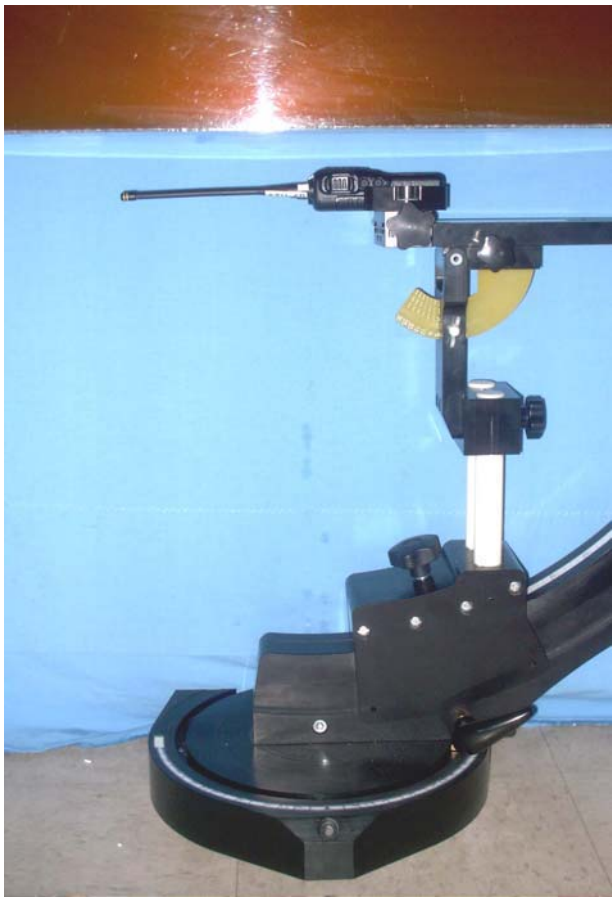
****

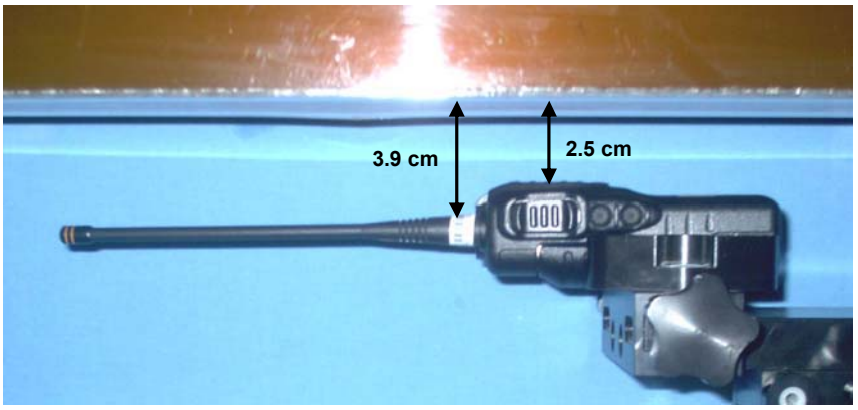
Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.3500	57.70	0.93	59.62	0.88
0.3600	57.60	0.93	59.79	0.88
0.3700	57.50	0.93	59.63	0.89
0.3800	57.40	0.93	59.94	0.91
0.3900	57.30	0.93	60.00	0.92
0.4000	57.20	0.93	59.09	0.91
0.4100	57.10	0.93	58.91	0.92
0.4200	57.00	0.94	59.00	0.92
0.4300	56.90	0.94	58.21	0.92
0.4400	56.80	0.94	58.46	0.94
0.4500	56.70	0.94	58.74	0.93
0.4600	56.66	0.94	58.34	0.95
0.4700	56.62	0.94	58.91	0.97
0.4800	56.58	0.94	58.79	0.97
0.4900	56.54	0.94	58.22	0.98
0.5000	56.51	0.94	58.32	0.98
0.5100	56.47	0.94	57.95	0.99
0.5200	56.43	0.95	57.93	1.00
0.5300	56.39	0.95	57.54	0.98
0.5400	56.35	0.95	57.72	1.01
0.5500	56.31	0.95	57.95	1.01

APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS

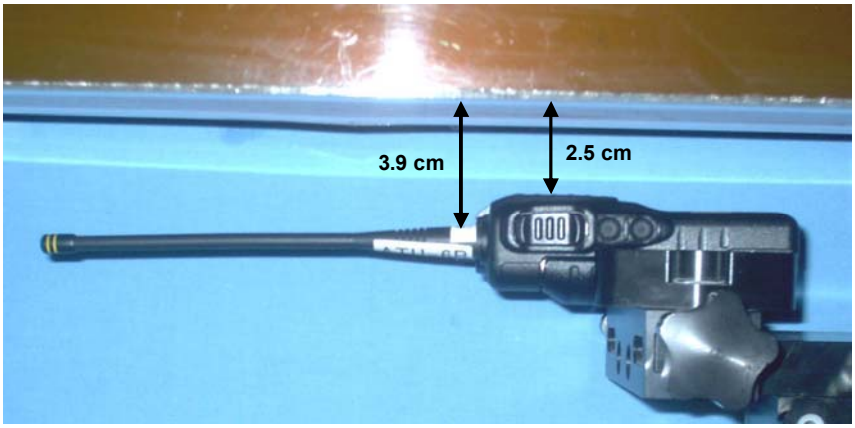
FACE-HELD SAR TEST SETUP PHOTOGRAPHS

2.5 cm Spacing from Front of DUT to Planar Phantom

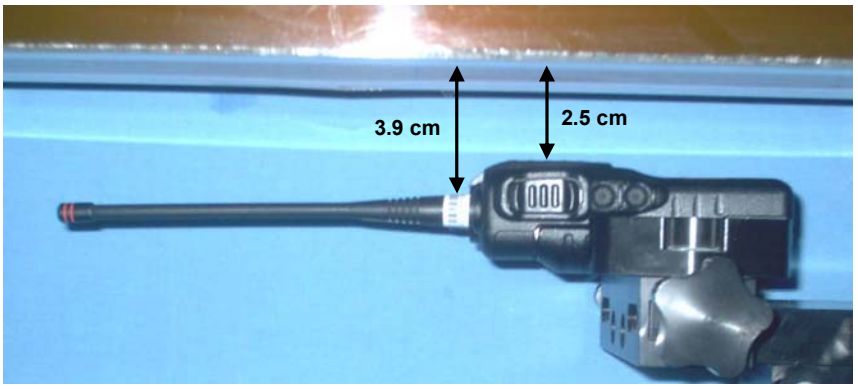




DUT with ATU-6A Antenna



DUT with ATU-6B Antenna

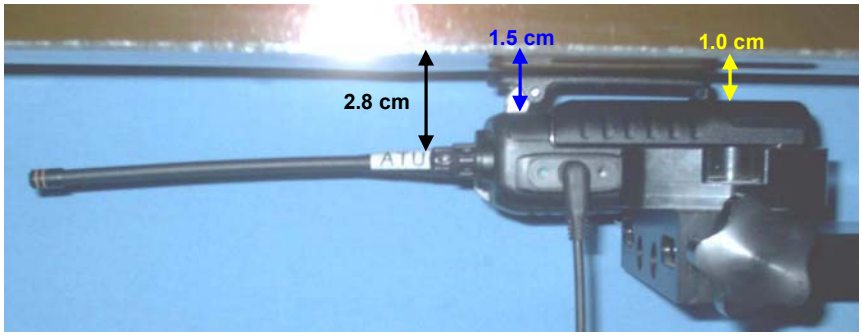


DUT with ATU-6D Antenna

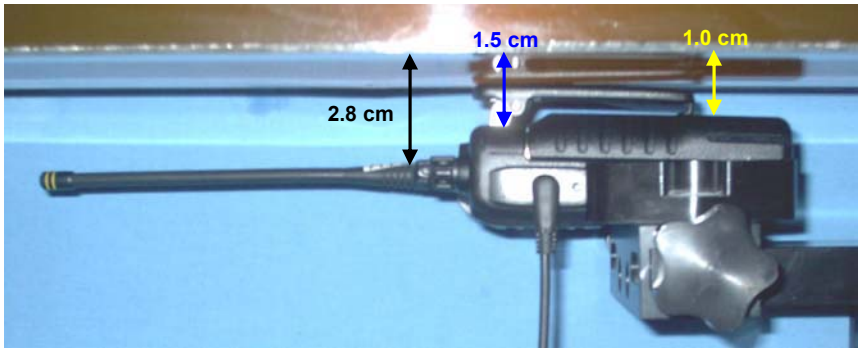
BODY-WORN SAR TEST SETUP PHOTOGRAPHS

1.5 cm Belt-Clip Spacing from Back of DUT to Planar Phantom
DUT with VOX Headset Audio Accessory

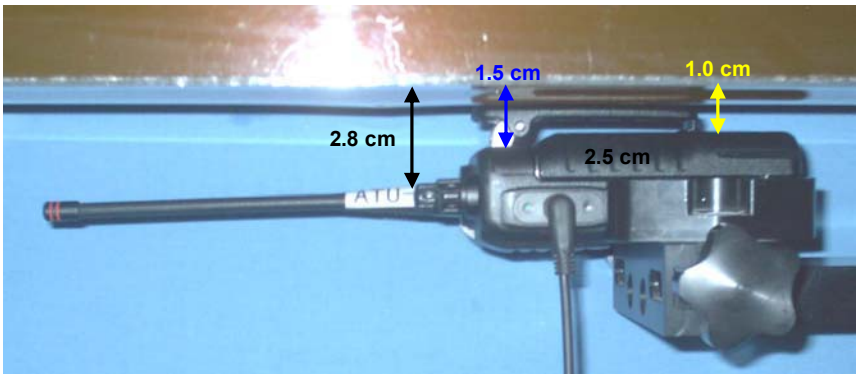
DUT with 2000mAh Lithium-ion Battery & Headset accessory



DUT with 2000mAh Li-ion Battery, ATU-6A Antenna and Headset accessory



DUT with 2000mAh Li-ion Battery, ATU-6B Antenna and Headset accessory

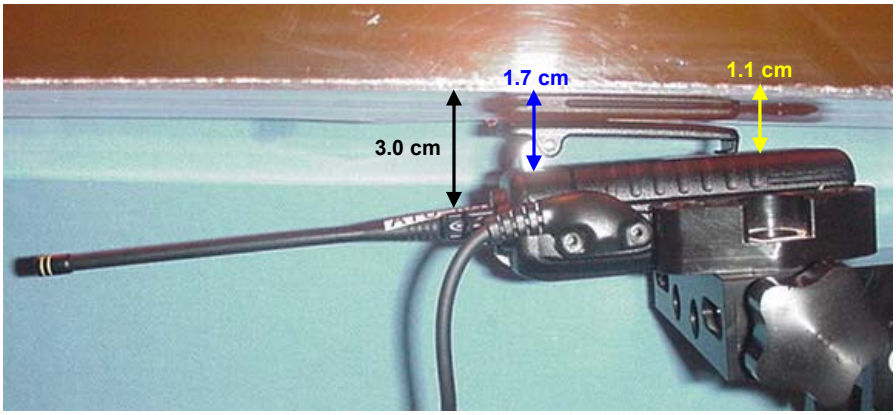


DUT with 2000mAh Li-ion Battery, ATU-6D Antenna and Headset accessory

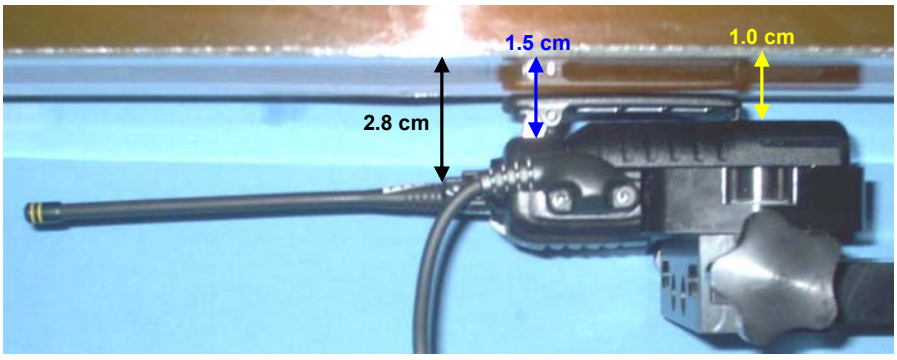
BODY-WORN SAR TEST SETUP PHOTOGRAPHS

1.5 cm Belt-Clip Spacing from Back of DUT to Planar Phantom
DUT with Speaker-Microphone Audio Accessory

DUT with 1150mAh Li-ion Battery & Speaker-Mic accessory



DUT with 1150mAh Li-ion Battery, ATU-6B Antenna and Speaker-Microphone accessory



DUT with 2000mAh Li-ion Battery, ATU-6B Antenna and Speaker-Microphone accessory

DUT PHOTOGRAPHS

Front of DUT with ATU-6A Antenna	Front of DUT with ATU-6B Antenna	Front of DUT with ATU-6D Antenna
Back of DUT with ATU-6A Antenna	Back of DUT with ATU-6B Antenna	Back of DUT with ATU-6D Antenna

DUT PHOTOGRAPHS

Left & Right Sides of DUT with Lithium-ion 1150mAh Battery & Belt-Clip accessory

Back of DUT with Li-ion 1150mAh Batt & Belt-Clip

Bottom end of DUT with Li-ion 1150mAh Battery & Belt-Clip

Top end of DUT with Li-ion 1150mAh Battery & Belt-Clip

DUT PHOTOGRAPHS

Left & Right Sides of DUT with Lithium-ion 2000mAh Battery & Belt-Clip accessory

Back of DUT with Li-ion 2000mAh Batt & Belt-Clip

Bottom end of DUT with Li-ion 2000mAh Battery & Belt-Clip

Top end of DUT with Li-ion 2000mAh Battery & Belt-Clip

DUT PHOTOGRAPHS

2000mAh Li-ion Battery FNB-V104Li | 1150mAh Li-ion Battery FNB-V103Li

Belt-Clip Model: CLIP-18

2000mAh Li-ion Battery FNB-V104Li | 1150mAh Li-ion Battery FNB-V103Li

Back Side of DUT with Battery removed

DUT PHOTOGRAPHS

Whip Antenna Part No. ATU-6A (400-430 MHz)

Whip Antenna Part No. ATU-6B (420-450 MHz)

Whip Antenna Part No. ATU-6D (450-490 MHz)

DUT PHOTOGRAPHS

DUT with Speaker-Microphone Audio Accessory (P/N: MH-45B4B)

DUT with VOX Headset Audio Accessory (P/N: VC-25)

APPENDIX E - DIPOLE CALIBRATION (FCC KDB 250418) & PROBE CALIBRATION

FCC Federal Communications Commission

FCC Home | Search | Updates | E-Filing | Initiatives | For Consumers | Find People

OET

Office of Engineering and Technology

Inquiry:
Uploading 300 MHz and 450 MHz Dipole Calibration Reports

Response:
FCC confirmation attached for Celltech Labs Dipoles with following identifications:

Serial #: 136 / 450 MHz / Head Tissue-Equivalent Medium / Expires 02/28/2010
Serial #: 135 / 300 MHz / Head Tissue-Equivalent Medium / Expires 02/28/2010

A copy of the confirmation and corresponding Dipole Report(s) are required to be included in SAR reports of applicable equipment certification filings. Each filing must have KDB tracking number 250418 included on 731 Form.

OET

The dipoles listed below have prior coordination with the FCC Lab for use in SAR system validation and verification by Celltech Labs through February 2010. The SAR target values, specific operating parameters and identifications are indicated below. SAR measurements using these dipoles must be in accordance with the parameters specified below; for example, phantom shell and tissue dielectric requirements etc. These will be verified during each equipment certification by the FCC or TCB, according to measurement protocols required for testing the specific device and wireless technology, to support the test methodologies and measurement results.

This confirmation and copies of the dipole calibration reports are required to be included in SAR reports for equipment certification containing SAR system verification results involving these dipoles. The information is available and can be verified through the KDB inquiry tracking number provided to Celltech Labs. The same tracking number must also be included on the 731 Form of the corresponding equipment certifications.

Dipole Serial Number	136	135
Calibration Document No.	DC450H-021209-R1.2	DC300H-021209-R1.2
Frequency	450 MHz	300 MHz
Dipole Impedance	58.21 + j 5.69 Ohms	46.39 + j 6.25 Ohms
Dipole Return Loss	-20.7 dB	- 22.6 dB
Tissue-Equivalent Dielectric Type	Head	
Tissue Dielectric Constant	43.5	45.3
Tissue Conductivity	0.87 S/m	0.87 S/m
Phantom Shell Thickness	6.0 mm Plexiglas	
Phantom Shell Dielectric Constant	2.7	
Dipole Axis to Tissue Medium Separation Distance	15.175 mm	
Numerical Simulation:	FDTD	
1-g SAR Target Value	4.893 W/kg @ 1.0 W	3.019 W/kg @ 1.0 W
10-g SAR Target Value	3.263 W/kg @ 1.0 W	2.051 W/kg @ 1.0 W
SAR at Phantom Surface above Dipole Feed-Point	6.845 W/kg @ 1.0 W	4.046 W/kg @ 1.0 W
SAR at Phantom Surface at 2.0 cm offset from Dipole Feed-Point	3.101 W/kg @ 1.0 W	2.049 W/kg @ 1.0 W
Experimental Verification:	SAR Measurements	
1-g SAR Target Value	1.21 ~ 1.23 W/kg @ 0.25 W	0.753 ~ 0.765 W/kg @ 0.25 W
10-g SAR Target Value	0.787 ~ 0.803 W/kg @ 0.25W	0.503 ~ 0.509 W/kg @ 0.25 W
SAR at Phantom Surface above Dipole Feed-Point	1.93 W/kg (average) @ 0.25 W	1.20 W/kg (average) @ 0.25 W
SAR at Phantom Surface at 2.0 cm offset from Dipole Feed-Point	0.79 W/kg @ 0.25 W	0.56 W/kg @ 0.25 W

Expires February 2010 Celltech Labs Inc. February 13, 2009

450 MHz Dipole Calibration

Type:	**450 MHz Validation Dipole**
Asset Number:	**00024**
Serial Number:	**136**
Place of Calibration:	**Celltech Labs Inc.**
Date(s) of Calibration:	**Jan. 19 & Feb. 09, 2009**

Celltech Labs Inc. certifies that the 450 MHz Dipole Calibration was performed on the date(s) indicated above.

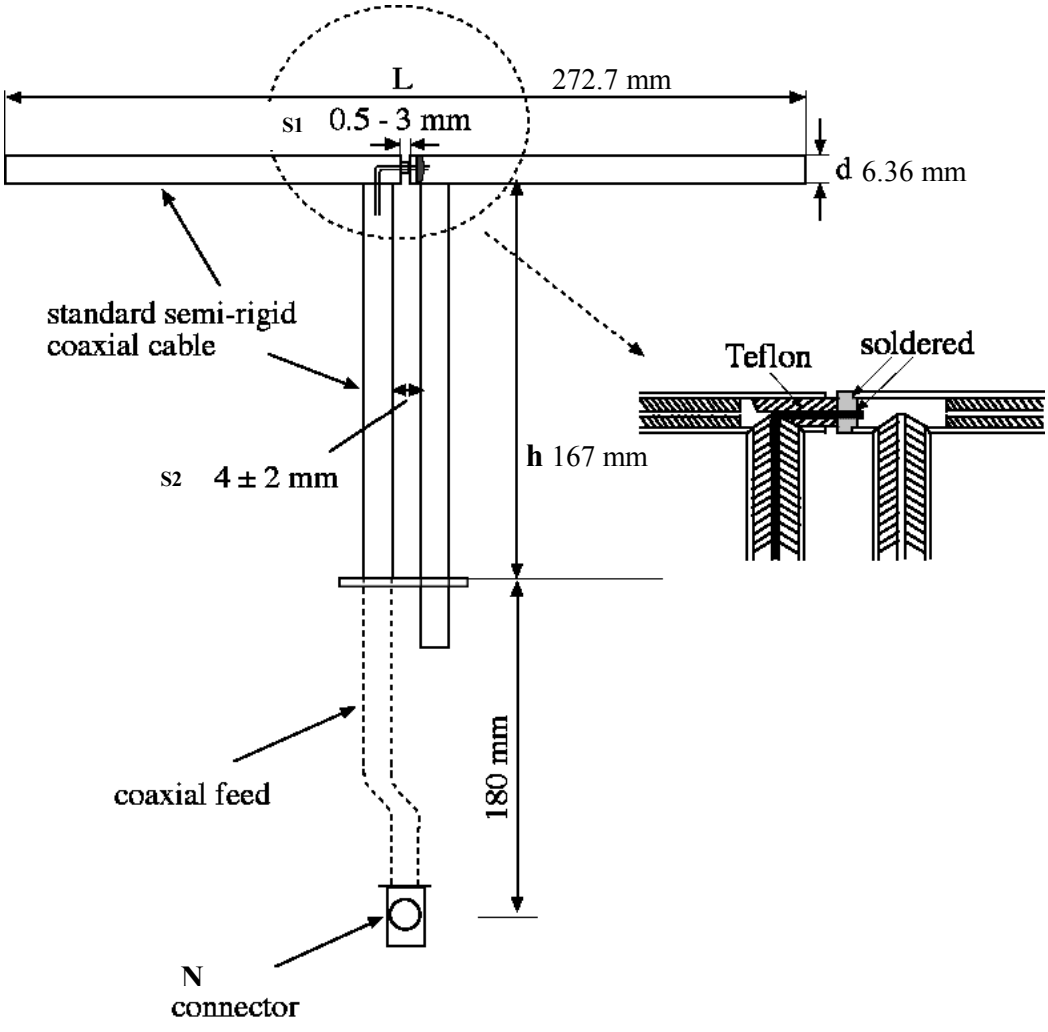
Calibrated by:	**Sean Johnston**
Signature:	

Celltech Labs Inc. 21-364 Lougheed Rd., Kelowna, B.C. V1X 7R8 Canada
Tel. 250-765-7650 • Fax. 250-765-7645 • e-mail: info@celltechlabs.com
www.celltechlabs.com

1. Dipole Construction & Electrical Characteristics

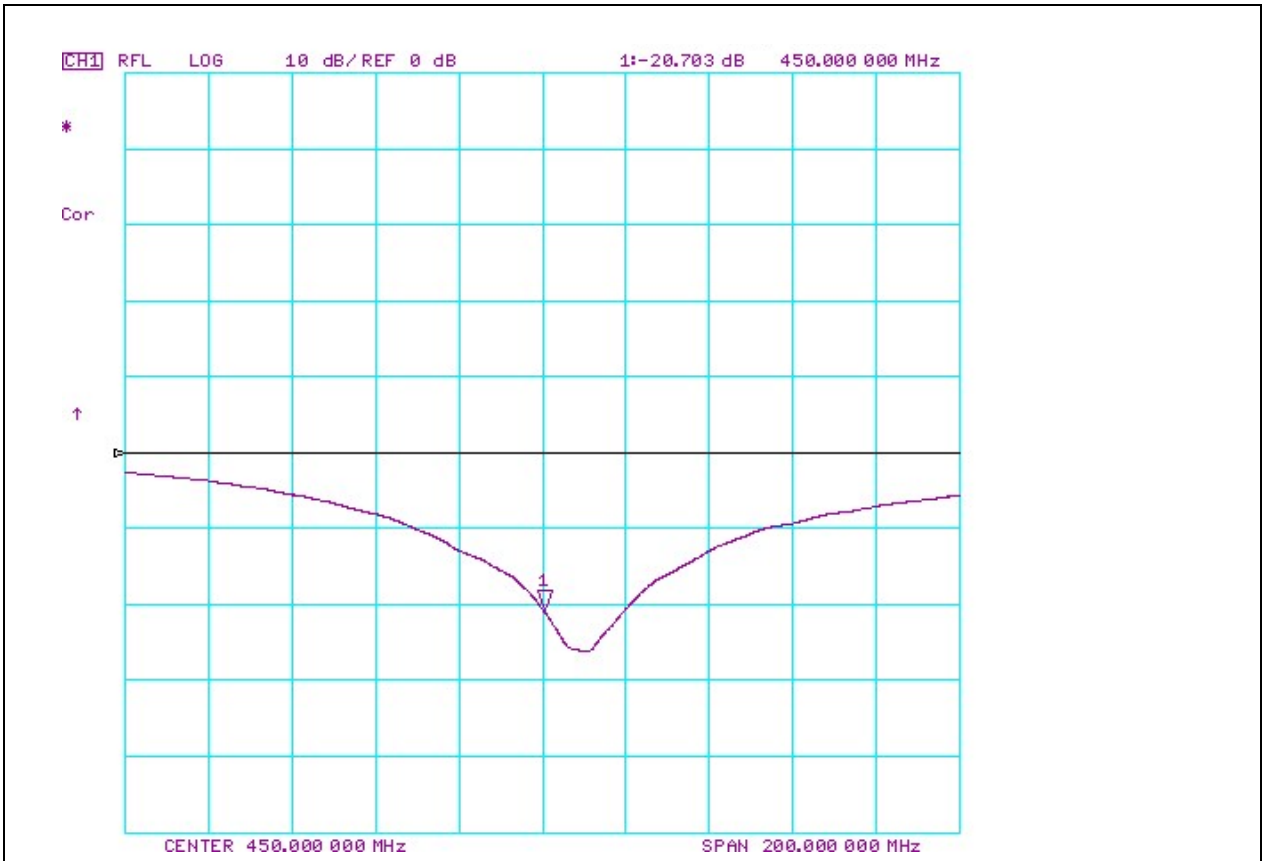
The validation dipole was constructed with RG401/U semi-rigid coax in accordance with the requirements specified in IEEE Standard 1528-2003 and International Standard IEC 62209-1:2005. The electrical properties were measured using an HP 8753ET Network Analyzer. The network analyzer was calibrated to 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 15.1 mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

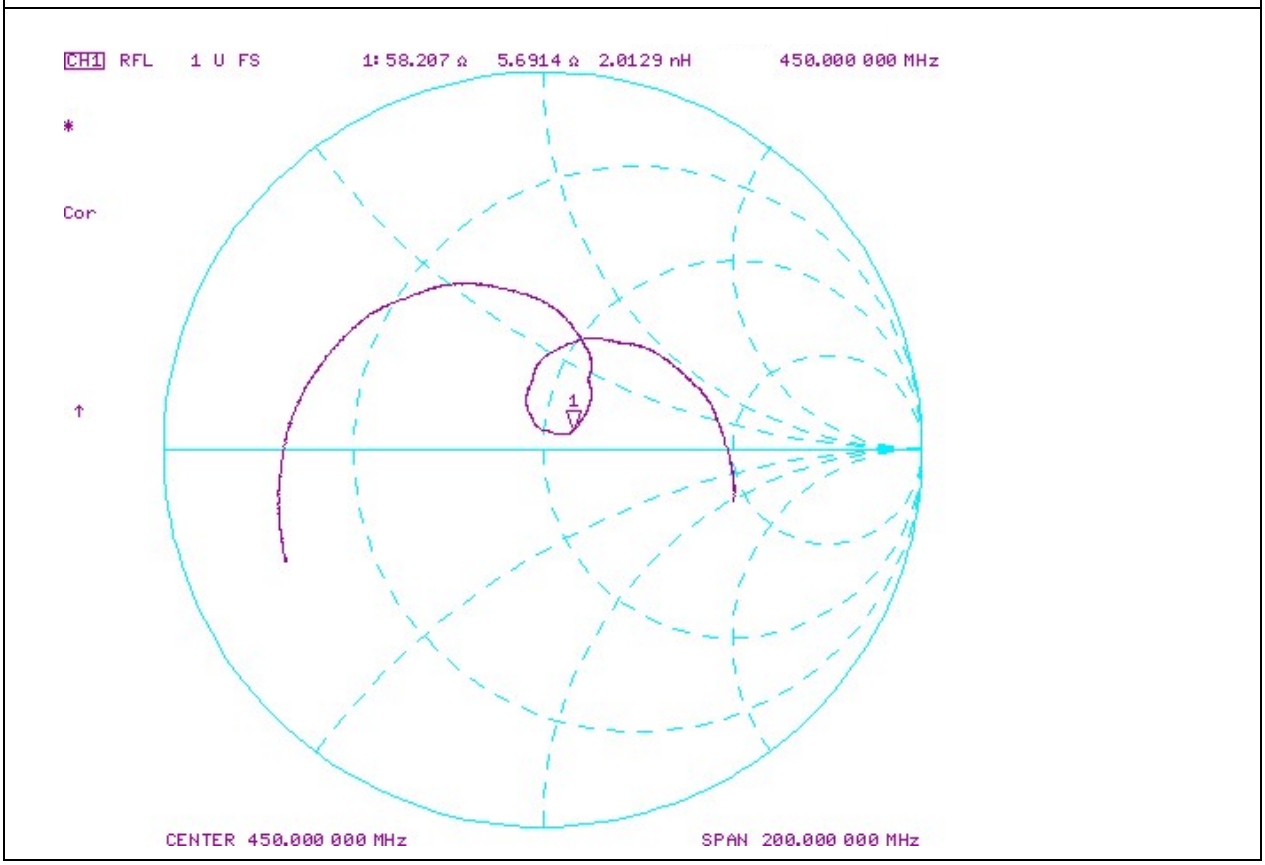
Feed point impedance at 450 MHz	Re{Z} = 58.207 Ω
	Im{Z} = 5.6914 Ω
Return Loss at 450 MHz	-20.703 dB



Reference dipole - basic mechanical parameters

2. Validation Dipole VSWR Data





3. Validation Dipole Dimensions

Dimension	IEEE 1528 (mm)	Measured (mm)	Difference (mm)	Tolerance (1528 1%)
L (mm)	270.0	272.7	+2.7	+1%
h (mm)	166.7	167.0	+0.3	+0.2%
d (mm)	6.35	6.36	+0.01	+0.2%

The L, h and d dimensions should be within ±1% tolerance per 1528-2003.

4. Validation Phantom

The validation phantom (planar) was constructed using relatively low-loss tangent Plexiglas material. The dielectric constant used for the numerical analysis was 2.7. The typical range of 2.5 - 3 was selected and the mean of this value was used for the simulation.

The inner dimensions of the validation phantom are as follows:

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

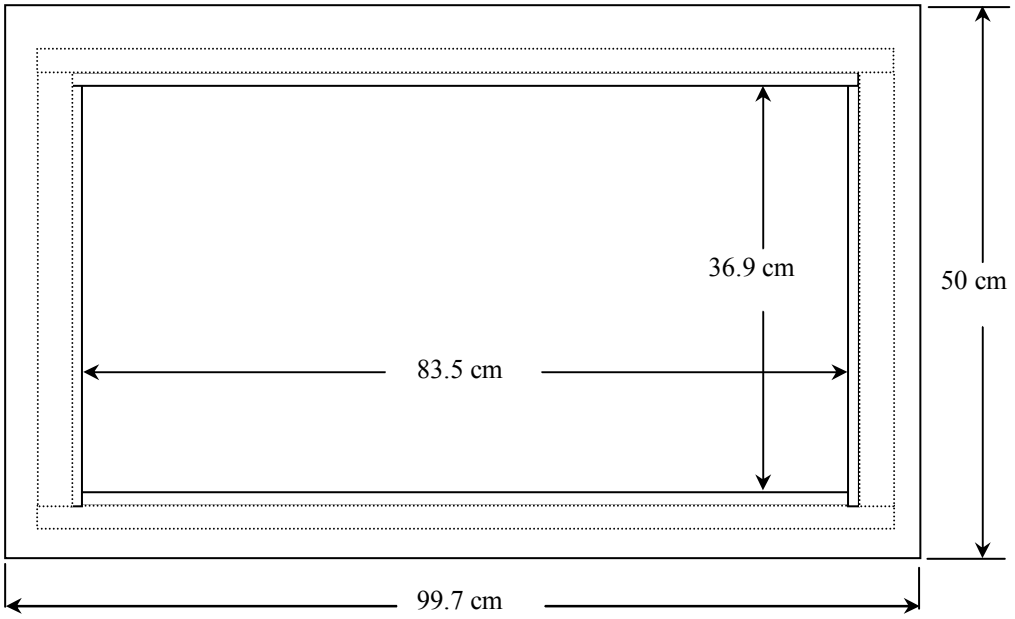
The bottom section of the validation phantom is constructed of 6.0 ± 0.1mm Plexiglas.

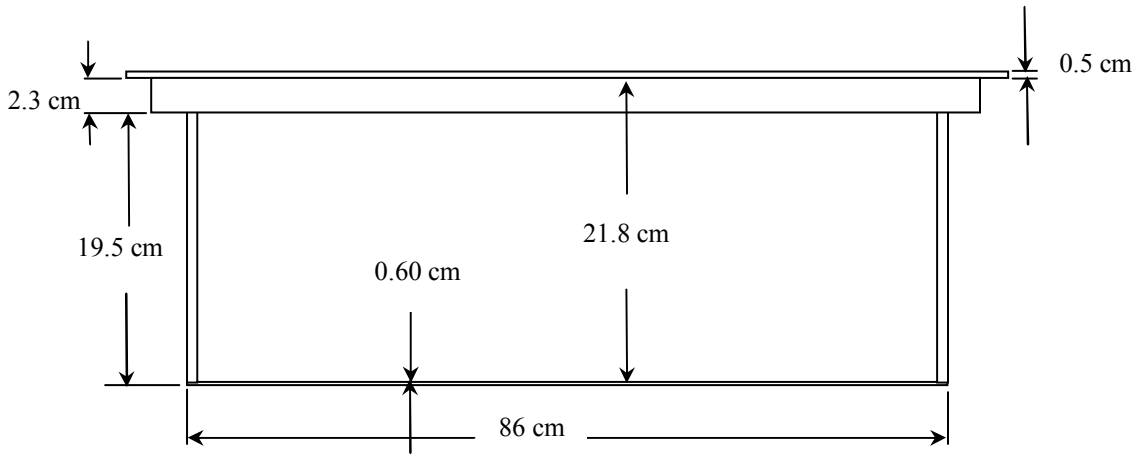
s = 3.175mm(d/2) + 6.0mm(phantom) + 6.0mm(spacer) = 15.175mm

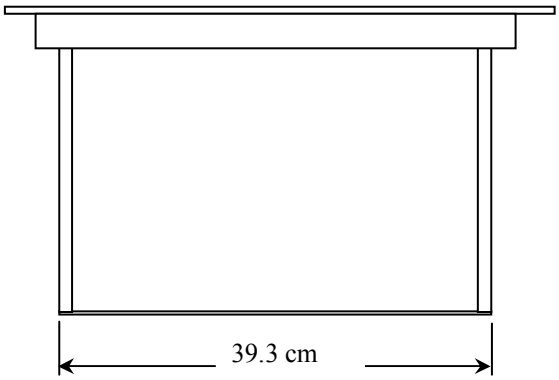
5. Test Equipment List

TEST EQUIPMENT	ASSET NO.	SERIAL NO.	DATE OF CAL.	CAL. DUE DATE
SPEAG DASY4 Measurement Server	00158	1078	CNR	CNR
SPEAG Robot	00046	599396-01	CNR	CNR
SPEAG DAE4	00019	353	22Apr08	22Apr09
SPEAG ET3DV6 E-Field Probe	00017	1590	21Jul08	21Jul09
Plexiglas Validation Planar Phantom	00157	137	CNR	CNR
HP 85070C Dielectric Probe Kit	00033	US39240170	CNR	CNR
Gigatronics 8652A Power Meter	00007	1835272	23Apr08	23Apr09
Gigatronics 80701A Power Sensor	00014	1833699	23Apr08	23Apr09
HP 8753ET Network Analyzer	00134	US39170292	28Apr08	28Apr09
HP 8648D Signal Generator	00005	3847A00611	CNR	CNR
Amplifier Research 5S1G4 Power Amplifier	00106	26235	CNR	CNR
CNR = Calibration Not Required				

6. Dimensions of Plexiglas Planar Validation Phantom







7. Plexiglas Planar Validation Phantom

8. 450 MHz Validation Dipole

9. SAR Target Validation

Parameter															Result			
	Frequency (MHz)	Shell thickness (mm)	Shell permittivity	Shell permeability	Shell Conductivity (σ) (S/m)	Phantom dimensions (mm) [x, y, z]	Liquid Relative permittivity	Liquid Conductivity (σ) (S/m)	Liquid permeability	Reference dipole distances from the liquid (mm)	Spacer (mm)	Dipole L (mm)	Dipole h (mm)	Dipole d (mm)	Distance between dipole feedpoint gap S1 (mm)	Distance between dipole balun elements S2 (mm)	1 g SAR (1 Watt)	10 g SAR (1 Watt)	Local SAR at surface (above feed-point)	Local SAR at surface (y = 2 cm offset from feed-point)
SEMCAD Simulation	450	6	2.7	1	0	700, 600, 170	43.5	0.87	1	15.175	6	270	166.7	6.35	1	4	4.893	3.263	6.845	3.101

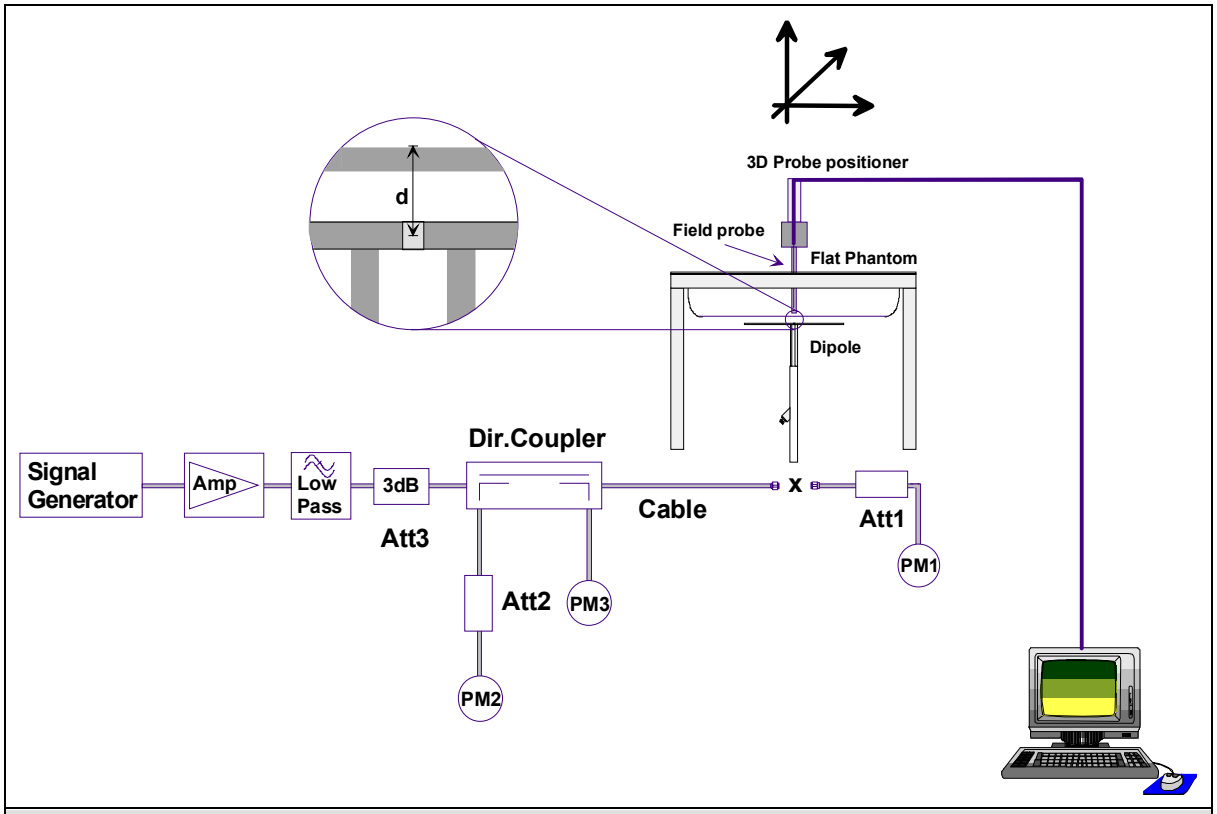
CELLTECH TARGET		
1.223 W/kg	1g	0.25 W
0.816 W/kg	10g	0.25 W

1. Standard dipole dimensions used in simulation per 1528-2003 mechanical dimensions of the reference dipole.
2. Reference distance from liquid is actual measured distance.

10. SAR Measurement

Measurements were made using a dosimetric E-field probe ET3DV6 (S/N: 1590, Conversion Factor 7.66). 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 procedures described below.

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.



System Performance Check Measurement Setup Diagram

11. Measurement Conditions

The validation phantom was filled with 450 MHz Head tissue simulant.

Relative Permittivity: 43.8 (+0.7% deviation from target)
Conductivity: 0.86 mho/m (-1.1% deviation from target)
Fluid Temperature: 22.1°C (Start of Test) / 22.3°C (End of Test)
Fluid Depth: ≥ 15.0 cm

Environmental Conditions:
Ambient Temperature: 23.1°C
Barometric Pressure: 101.1 kPa
Humidity: 35%

The 450 MHz Head tissue simulant consisted of the following ingredients:

Ingredient	Percentage by weight	
Water	38.56%	
Sugar	56.32%	
Salt	3.95%	
HEC	0.98%	
Dowicil 75	0.19%	
IEEE/IEC Target Dielectric Parameters (450 MHz):	**ε_r = 43.5 (+/- 5%)**	**σ = 0.87 S/m (+/- 5%)**

12. System Performance Check SAR Results

SAR @ 0.25W Input averaged over 1g (W/kg)				SAR @ 1W Input averaged over 1g (W/kg)			
Validation Target (450)		**Measured**	**Deviation**	**Validation Target (450)**		**Measured**	**Deviation**
1.223	**+/- 10%**	1.216	-0.57%	**4.892**	**+/- 10%**	4.864	-0.57%
SAR @ 0.25W Input averaged over 10g (W/kg)				**SAR @ 1W Input averaged over 10g (W/kg)**			
Validation Target (450)		**Measured**	**Deviation**	**Validation Target (450)**		**Measured**	**Deviation**
0.816	**+/- 10%**	0.799	-2.08%	**3.264**	**+/- 10%**	3.196	-2.08%

450 MHz System Performance Check @ 250mW (1g)					
	SAR 1g (mW/g)	Deviation From 450 MHz Numerical Simulation (1.223 mW/g)	STDEV	Mean	Coefficient of Variation
Test 1	1.21	-1.06%	0.008	1.216	**0.007**
Test 2	1.22	-0.25%			
Test 3	1.22	-0.25%			
Test 4	1.21	-1.06%			
Test 5	1.22	-0.25%			
Test 6	1.20	-1.88%			
Test 7	1.22	-0.25%			
Test 8	1.22	-0.25%			
Test 9	1.23	0.57%			
Test 10	1.21	-1.06%			
	1.216	-0.57%			

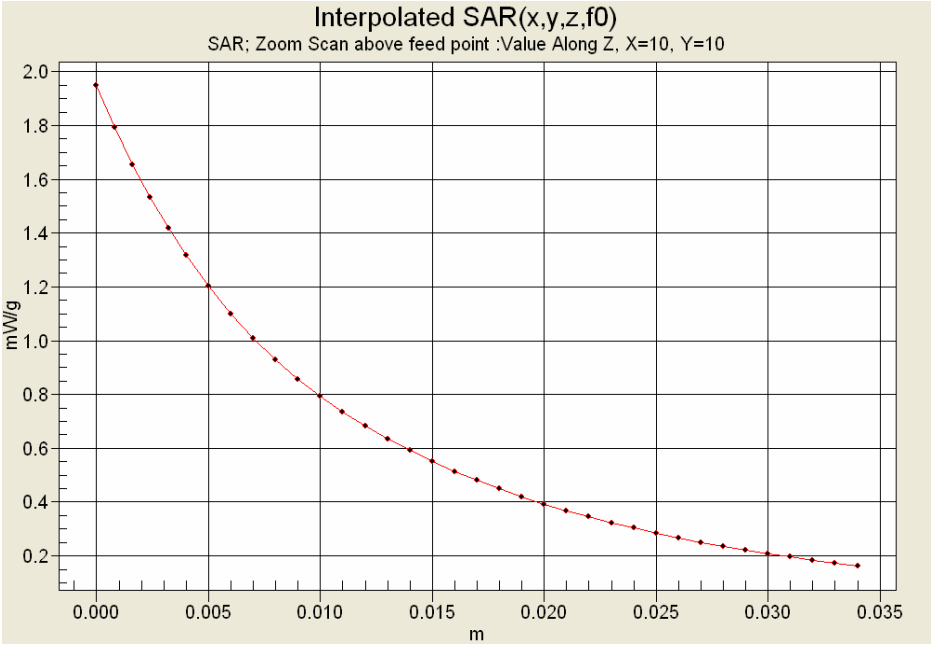
450 MHz System Performance Check @ 250mW (10g)					
	SAR 10g (mW/g)	Deviation From 450 MHz Numerical Simulation (0.816 mW/g)	STDEV	Mean	Coefficient of Variation
Test 1	0.799	-2.08%	0.006	0.799	**0.007**
Test 2	0.800	-1.96%			
Test 3	0.803	-1.59%			
Test 4	0.796	-2.45%			
Test 5	0.801	-1.84%			
Test 6	0.793	-2.82%			
Test 7	0.802	-1.72%			
Test 8	0.802	-1.72%			
Test 9	0.807	-1.10%			
Test 10	0.787	-3.55%			
	0.799	-2.08%			

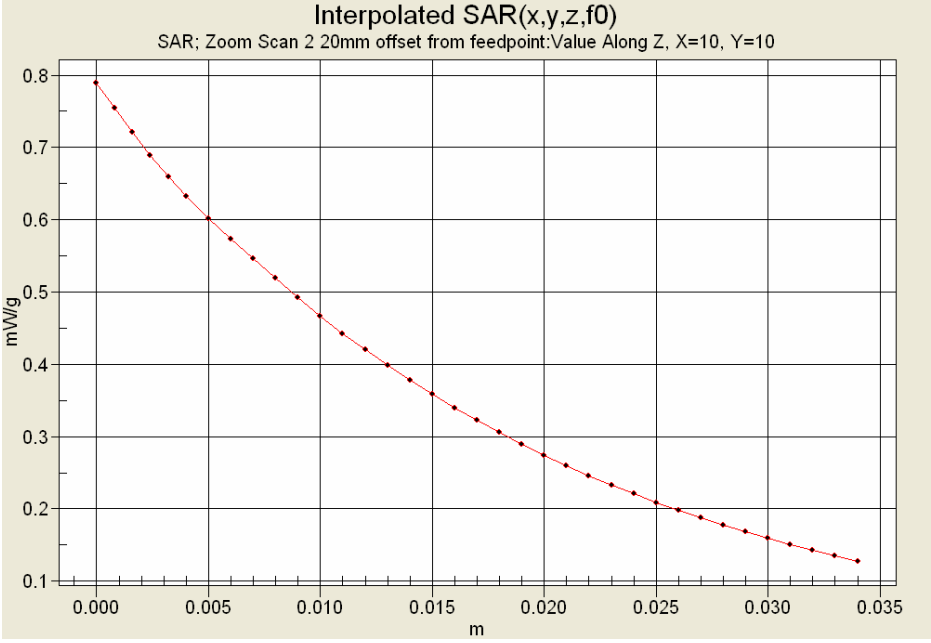
b) Extrapolation Routine:

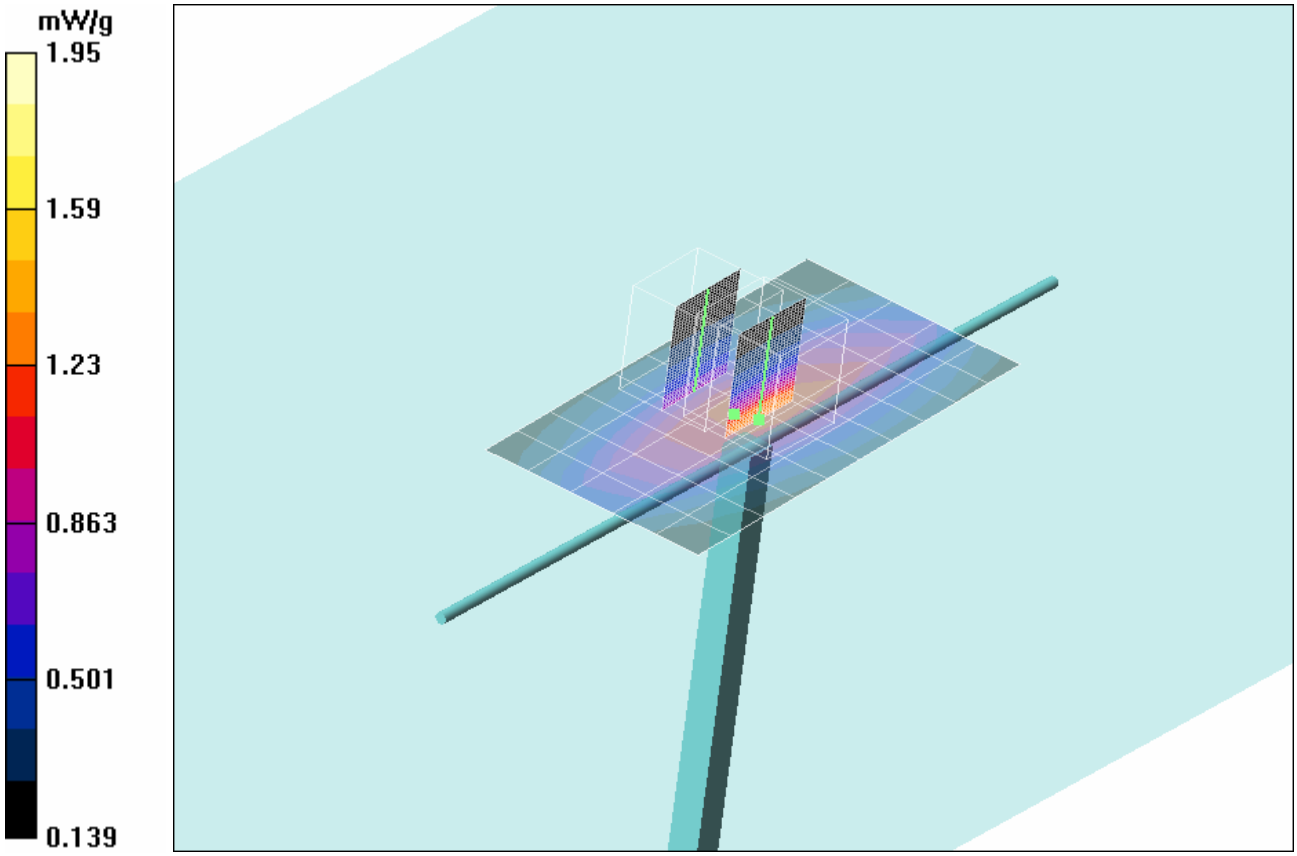
The zoom scan routine was used to extrapolate the peak SAR above the feed point and offset at 20mm. Two zoom scans were used, the first centered above the feedpoint and the second offset 20mm. The interpolated SAR at these points are shown in the table below. Note: Center point of zoom scan located at x=10, y=10.

Measurement Location	Measured SAR mW/g	SAR 1W Normalized	Peak Target mW/g	Deviation	System Performance Check Expanded Uncertainty +-%
Feed Point	1.93*	7.72	6.85	12.7%	17.86
2 cm Offset	0.79	3.16	3.10	1.9%	17.86

*Note: measured SAR level is the average from the 10 evaluations





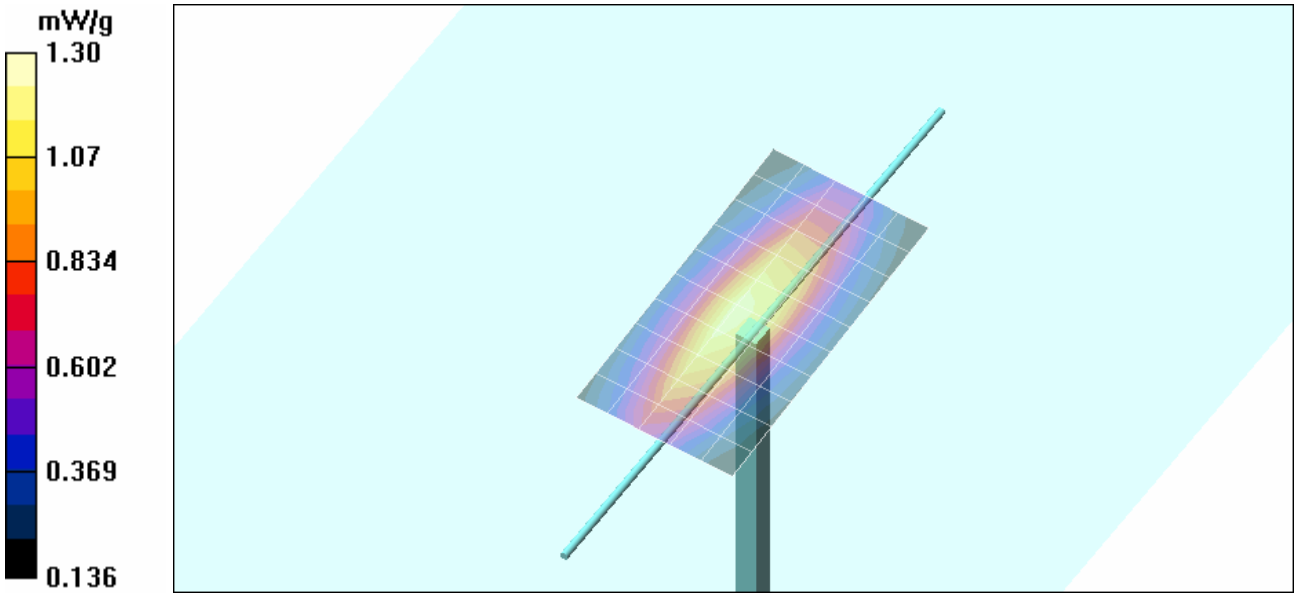

mW/g
1.95
1.59
1.23
0.863
0.501
0.139

System Performance Check - 450 MHz Dipole - HSL

DUT: Dipole 450 MHz; Asset: 00024; Serial: 136

Ambient Temp: 23.1°C; Fluid Temp: 22.1°C; Barometric Pressure: 101.1 kPa; Humidity: 35%
Communication System: CW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 Medium parameters used: f = 450 MHz; σ = 0.86 mho/m; ε_r = 43.8; ρ = 1000 kg/m^3
- Probe: ET3DV6 - SN1590; ConvF(7.66, 7.66, 7.66); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Validation Planar; Type: Plexiglas; Serial: TE#137
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

450 MHz Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.20 mW/g
450 MHz Zoom Scan 1 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 39.6 V/m; Power Drift = -0.035 dB
Peak SAR (extrapolated) = 1.92 W/kg
SAR(1 g) = 1.21 mW/g; SAR(10 g) = 0.799 mW/g
Maximum value of SAR (measured) = 1.30 mW/g
450 MHz Zoom Scan 2 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 39.5 V/m; Power Drift = -0.022 dB
Peak SAR (extrapolated) = 1.93 W/kg
SAR(1 g) = 1.22 mW/g; SAR(10 g) = 0.800 mW/g
Maximum value of SAR (measured) = 1.30 mW/g
450 MHz Zoom Scan 3 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 39.4 V/m; Power Drift = 0.010 dB
Peak SAR (extrapolated) = 1.92 W/kg
SAR(1 g) = 1.22 mW/g; SAR(10 g) = 0.803 mW/g
Maximum value of SAR (measured) = 1.30 mW/g
450 MHz Zoom Scan 4 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 39.3 V/m; Power Drift = 0.001 dB
Peak SAR (extrapolated) = 1.92 W/kg
SAR(1 g) = 1.21 mW/g; SAR(10 g) = 0.796 mW/g
Maximum value of SAR (measured) = 1.29 mW/g
450 MHz Zoom Scan 5 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 39.5 V/m; Power Drift = 0.006 dB
Peak SAR (extrapolated) = 1.94 W/kg
SAR(1 g) = 1.22 mW/g; SAR(10 g) = 0.801 mW/g
Maximum value of SAR (measured) = 1.32 mW/g
450 MHz Zoom Scan 6 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 39.3 V/m; Power Drift = -0.017 dB
Peak SAR (extrapolated) = 1.90 W/kg
SAR(1 g) = 1.20 mW/g; SAR(10 g) = 0.793 mW/g
Maximum value of SAR (measured) = 1.29 mW/g
450 MHz Zoom Scan 7 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 39.4 V/m; Power Drift = 0.006 dB
Peak SAR (extrapolated) = 1.94 W/kg
SAR(1 g) = 1.22 mW/g; SAR(10 g) = 0.802 mW/g
Maximum value of SAR (measured) = 1.31 mW/g
450 MHz Zoom Scan 8 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 39.7 V/m; Power Drift = 0.010 dB
Peak SAR (extrapolated) = 1.93 W/kg
SAR(1 g) = 1.22 mW/g; SAR(10 g) = 0.802 mW/g
Maximum value of SAR (measured) = 1.30 mW/g
450 MHz Zoom Scan 9 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 39.6 V/m; Power Drift = -0.009 dB
Peak SAR (extrapolated) = 1.95 W/kg
SAR(1 g) = 1.23 mW/g; SAR(10 g) = 0.807 mW/g
Maximum value of SAR (measured) = 1.32 mW/g
450 MHz Zoom Scan 10 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 39.3 V/m; Power Drift = 0.007 dB
Peak SAR (extrapolated) = 1.92 W/kg
SAR(1 g) = 1.21 mW/g; SAR(10 g) = 0.787 mW/g
Maximum value of SAR (measured) = 1.29 mW/g



13. Measured Fluid Dielectric Parameters

450 MHz (Head)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
19/Jan/2009
Frequency (GHz)
IEEE_eH IEEE 1528-2003 Limits for Head Epsilon
IEEE_sH IEEE 1528-2003 Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
0.3500	44.70	0.87	44.61	0.78
0.3600	44.58	0.87	46.57	0.79
0.3700	44.46	0.87	45.58	0.79
0.3800	44.34	0.87	44.52	0.80
0.3900	44.22	0.87	44.68	0.82
0.4000	44.10	0.87	44.30	0.83
0.4100	43.98	0.87	43.79	0.84
0.4200	43.86	0.87	44.67	0.85
0.4300	43.74	0.87	43.93	0.86
0.4400	43.62	0.87	43.86	0.86
0.4500	43.50	0.87	43.79	0.86
0.4600	43.45	0.87	43.00	0.86
0.4700	43.40	0.87	42.82	0.88
0.4800	43.34	0.87	42.69	0.89
0.4900	43.29	0.87	42.38	0.91
0.5000	43.24	0.87	42.02	0.90
0.5100	43.19	0.87	42.04	0.92
0.5200	43.14	0.88	42.26	0.95
0.5300	43.08	0.88	41.66	0.94
0.5400	43.03	0.88	41.84	0.95
0.5500	42.98	0.88	41.33	0.96

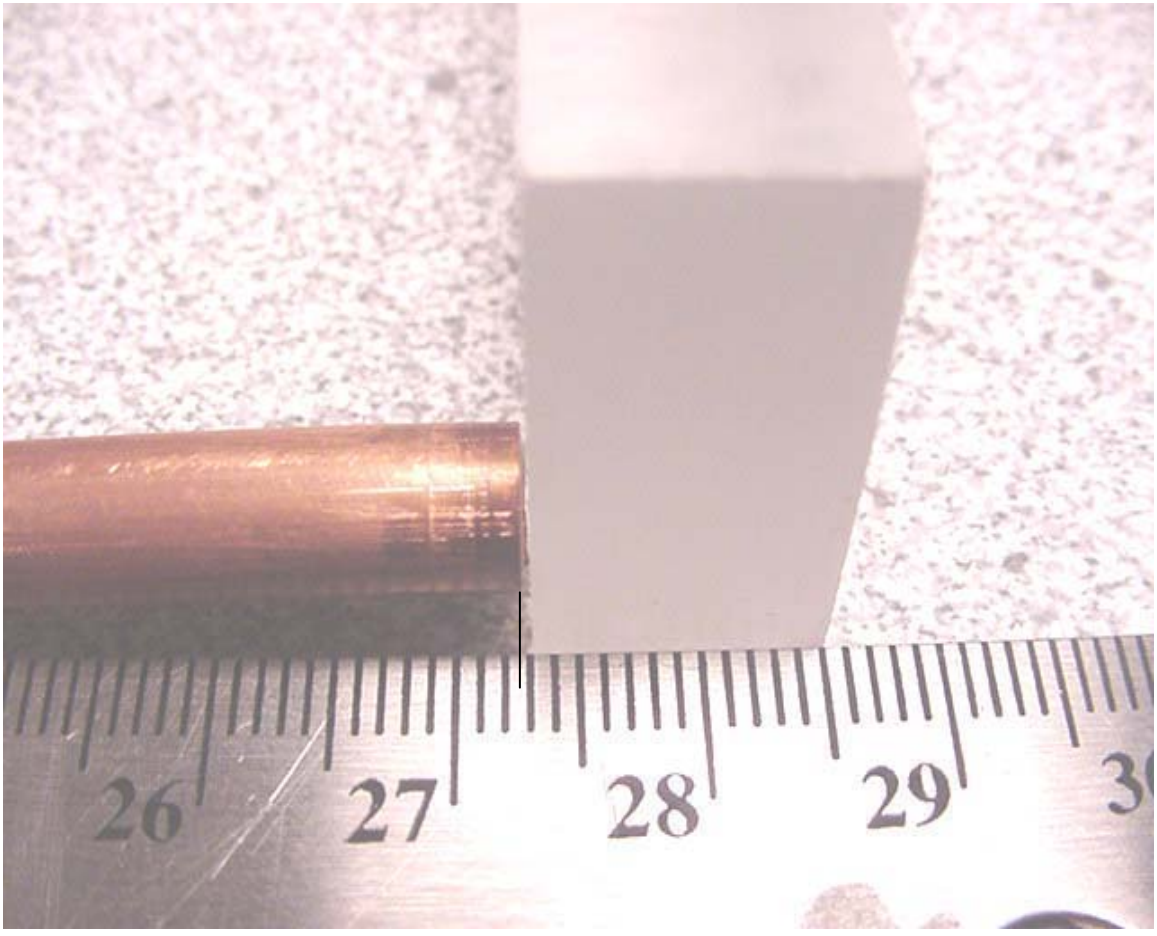
14. Measurement Uncertainties

UNCERTAINTY BUDGET FOR SYSTEM PERFORMANCE CHECK									
Uncertainty Component	**IEEE 1528 Section**	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**ci 1g**	**ci 10g**	**Uncertainty Value ±% (1g)**	**Uncertainty Value ±% (10g)**	**V_i or V_{eff}**
Measurement System									
Probe Calibration (450 MHz)	E.2.1	6.65	Normal	1	1	1	6.65	6.65	∞
Axial Isotropy	E.2.2	4.7	Rectangular	1.732050808	1	1	2.7	2.7	∞
Hemispherical Isotropy	E.2.2	0	Rectangular	1.732050808	1	1	0.0	0.0	∞
Boundary Effect	E.2.3	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	Rectangular	1.732050808	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	Normal	1	1	1	0.3	0.3	∞
Response Time	E.2.7	0	Rectangular	1.732050808	1	1	0.0	0.0	∞
Integration Time	E.2.8	0	Rectangular	1.732050808	1	1	0.0	0.0	∞
RF Ambient Conditions	E.6.1	3	Rectangular	1.732050808	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	Rectangular	1.732050808	1	1	0.2	0.2	∞
Probe Positioning wrt Phantom Shell	E.6.3	2.9	Rectangular	1.732050808	1	1	1.7	1.7	∞
Extrapolation, interpolation & integration algorithms for max. SAR evaluation	E.5	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Dipole									
Dipole Positioning	E.4.2	2	Normal	1.732050808	1	1	1.2	1.2	∞
SAR Drift Measurement	6.6.2	0.5	Normal	1.732050808	1	1	0.3	0.3	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4	Rectangular	1.732050808	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5	Rectangular	1.732050808	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measured)	E.3.3	1.1	Normal	1	0.64	0.43	0.7	0.5	∞
Liquid Permittivity (target)	E.3.2	5	Rectangular	1.732050808	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measured)	E.3.3	0.7	Normal	1	0.6	0.49	0.4	0.3	∞
Combined Standard Uncertainty			**RSS**				**8.93**	**8.75**	
Expanded Uncertainty (95% Confidence Interval)			**k=2**				**17.86**	**17.50**	
Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 and IEC International Standard 62209-1:2005									

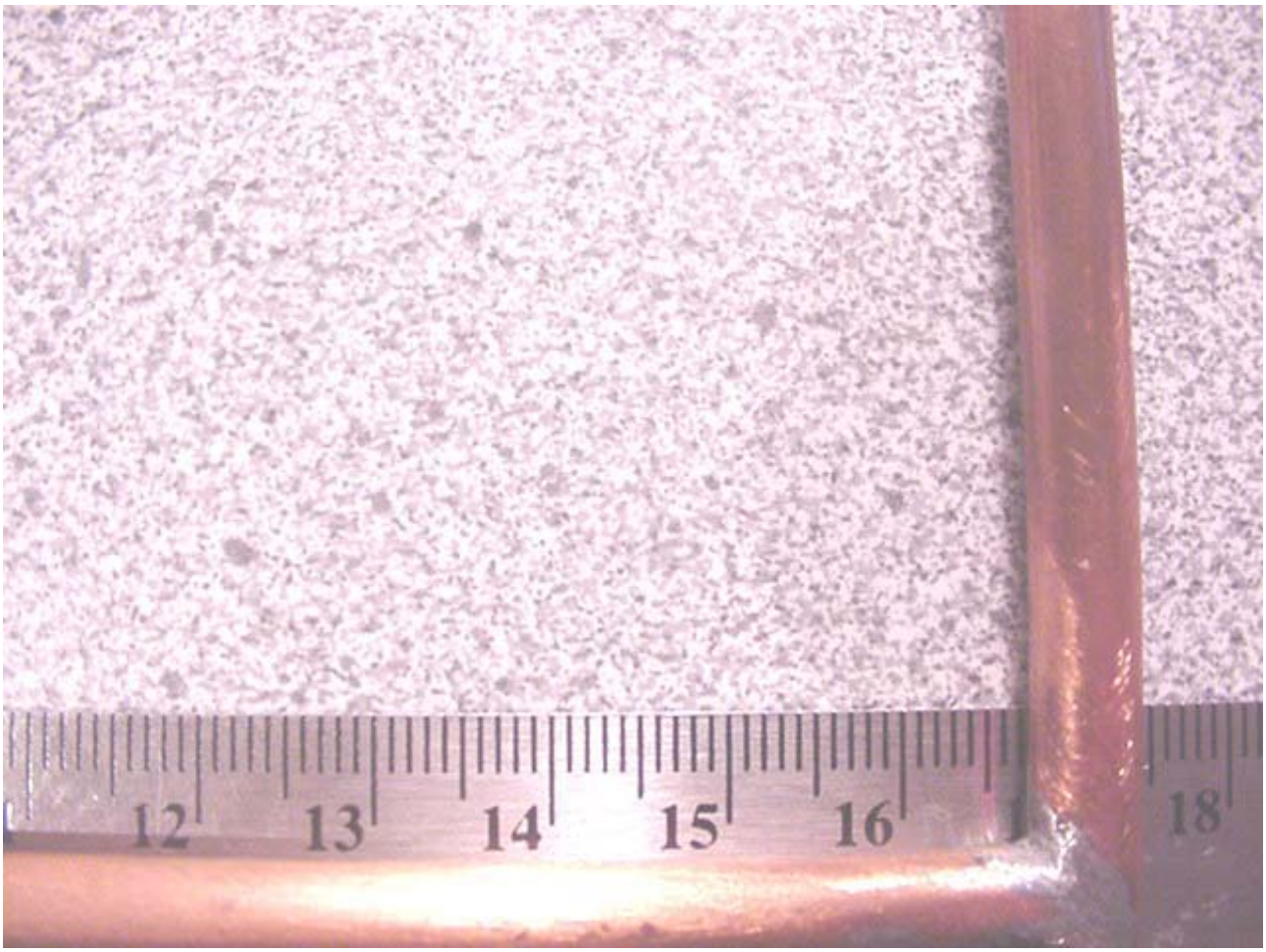
15. Dipole Calibration History

450 MHz Dipole Calibration History										
Dipole Calibration Date	SAR Probe Information			Celltech Measured Data						
	Serial Number	Calibration Factor	Calibration Procedure	SAR (W/kg) Measured at 250 mW	% Deviation from IEEE 1528 Target (4.9 W/kg @ 1 W)	% Deviation from Target validated by Celltech (4.893 W/kg @ 1 W)	Dielectric Parameters		RL (dB)	Impedance
							ε_r	σ		
2003	1387	7.50	Numerical	1.30	6.12		43.70	0.88	-22.60	49.98
2004	1387	7.50	Numerical	1.23	0.41		42.90	0.85	-23.74	54.04
2005	1387	7.50	Numerical	1.24	1.22		43.20	0.84	-20.40	58.50
2006	1387	7.40	Numerical	1.27	3.67		44.70	0.90	-21.60	56.17
2007	1387	7.00	Numerical	1.29	5.31		43.10	0.85	-22.20	55.20
2008	1387	7.32	Measured	1.19		-2.72	43.60	0.86	-23.10	55.60
2008	1590	7.66	Measured	1.18		-3.53	43.44	0.89	-20.70	58.20
2008	1590	7.66	Measured	1.22		-0.26	43.80	0.86	-20.70	58.20
Target Dielectric Parameters: $\varepsilon_r = 43.5$, $\sigma = 0.87$ s/m										

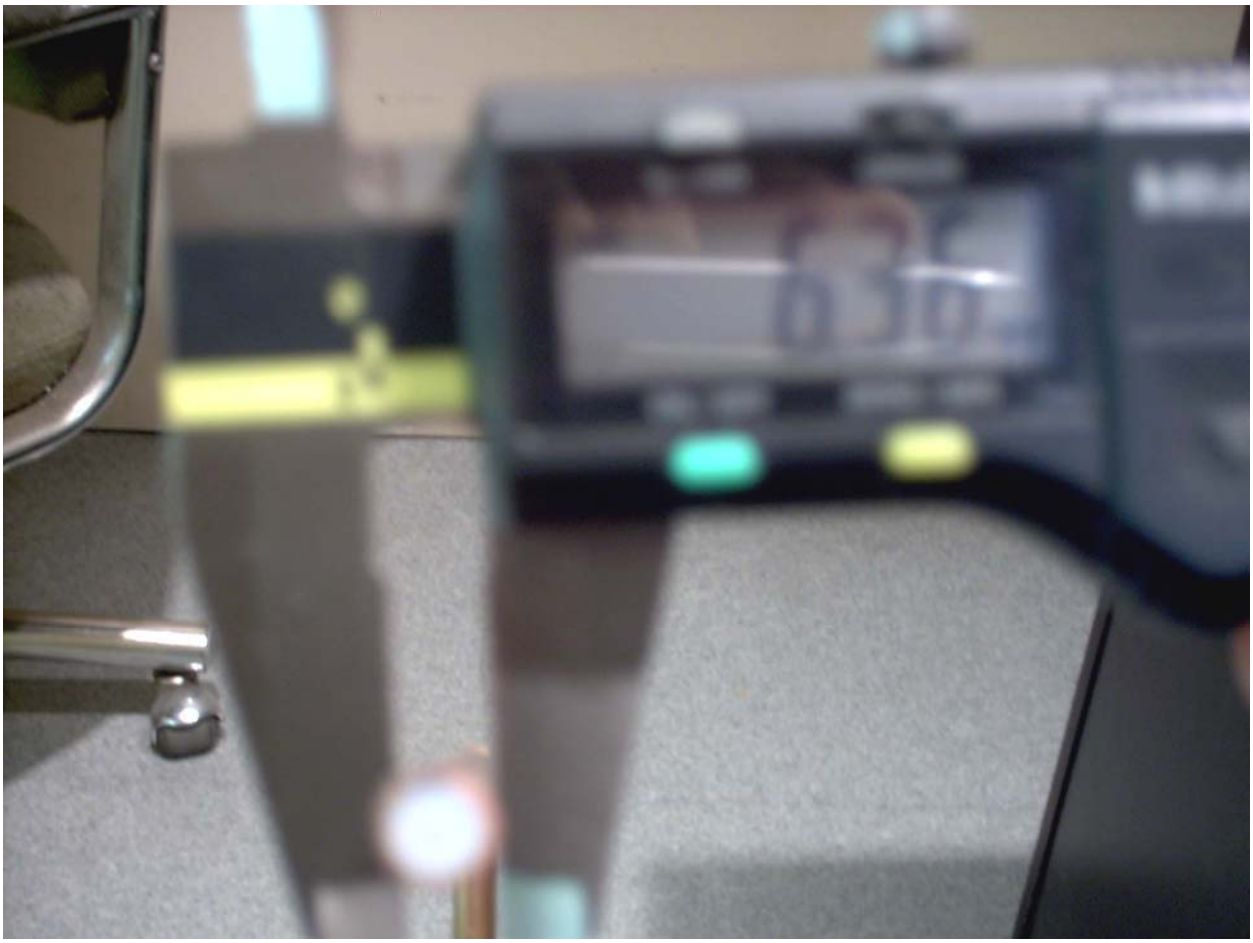
APPENDIX A - PHOTOGRAPHS



Dipole Dimension L = 272.7mm



Dipole Dimension h = 167mm



Dipole Dimension d = 6.36mm

Dipole Spacer Dimension = 6.0mm

APPENDIX B - SEMCAD SIMULATION LOG FILE

```
iSolve X, Version 13.4, Build 34, 64Bit Windows, Single Precision
Simulation name 'Dielec Const = 2.7, Low Conduct'
Maxwell Solver started the 2009-Feb-09 10:40:20.
Initializing FDTD (x1 CFL) Harmonic Simulation at 450 MHz

Overall discretization:
Smallest number of cells per wavelength = 20.202, largest = 422.988, average = 113.419
Simulation time-step = 9.781e-013 s
Simulation time-step / minimum of CFL criteria = 0.999938
Maximum of CFL criteria / minimum of CFL criteria = 64.6059
Average of CFL criteria / minimum of CFL criteria = 9.92029

Discretization by solids:
Background: epsr = 1, mur = 1, sigma = 0, sigma* = 0 - smallest number of cells per wavelength =
133.241, largest = 422.988, average = 145.219
Phantom/Shell: epsr = 2.7, mur = 1, sigma = 0, sigma* = 0 - smallest number of cells per wavelength =
81.0879, largest = 237.738, average = 120.104
Phantom/Liquid: epsr = 43.5, mur = 1, sigma = 0.87, sigma* = 0 - smallest number of cells per
wavelength = 20.202, largest = 55.4378, average = 23.1303

Boundary conditions:
Side X-: U-PML(8)
Side X+: U-PML(8)
Side Y-: U-PML(8)
Side Y+: U-PML(8)
Side Z-: U-PML(8)
Side Z+: U-PML(8)

Grid:
Number of nodes=285x233x175, number of voxels=11464512

Excitations:
Initializing (Voltage) edge source Quelle
Overall duration : 3.33333e-008 s or 34080 iterations

Probes & Sensors:
Initializing near-field sensor 1g
Initializing near-field sensor 10g
Initializing near to far field transformation
Initializing near-field sensor Overall Field
Initializing near-field sensor Unnamed
Initializing port sensor Sensor of Quelle
Initializing port sensor TDSensor
Initializing port sensor FDSensor
Initializing port sensor ObererSensor

Enable monitoring:
Sensor of Quelle, V(t)
Sensor of Quelle, I(t)
TDSensor, V(t)
TDSensor, I(t)
FDSensor, V(t)
FDSensor, I(t)
ObererSensor, V(t)
ObererSensor, I(t)

Checking out the license feature ISOLVEX_SOLVER_FDTD, expiring the 1-mar-2009, version 10.0, (1).

Calculating update coefficients:
Created thread pool with 2 thread(s).
Calculating update coefficients: completed. Time: 17.8 seconds.

Hardware acceleration not used, please contact SPEAG for more information.
Yee (explicit) iterations starting using U-PML Boundary Condition.
0% - iterations: 8 / 34079 - [9.38 MCells/s] - Estimated time to completion: 11:34:02
0% - iterations: 16 / 34079 - [7.64 MCells/s] - Estimated time to completion: 14:11:34
0% - iterations: 24 / 34079 - [8.34 MCells/s] - Estimated time to completion: 13:00:25
0% - iterations: 32 / 34079 - [7.64 MCells/s] - Estimated time to completion: 14:11:10
0% - iterations: 43 / 34079 - [11.5 MCells/s] - Estimated time to completion: 09:27:16
0% - iterations: 53 / 34079 - [10.4 MCells/s] - Estimated time to completion: 10:23:48
0% - iterations: 62 / 34079 - [9.38 MCells/s] - Estimated time to completion: 11:32:56
```

```
0% - iterations: 70 / 34079 - [8.34 MCells/s] - Estimated time to completion: 12:59:22
0% - iterations: 77 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:50:31
0% - iterations: 84 / 34079 - [6.69 MCells/s] - Estimated time to completion: 16:11:17
0% - iterations: 91 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:50:09
0% - iterations: 100 / 34079 - [9.38 MCells/s] - Estimated time to completion: 11:32:09
0% - iterations: 110 / 34079 - [10.4 MCells/s] - Estimated time to completion: 10:22:45
0% - iterations: 118 / 34079 - [8.34 MCells/s] - Estimated time to completion: 12:58:16
0% - iterations: 126 / 34079 - [7.64 MCells/s] - Estimated time to completion: 14:08:49
0% - iterations: 133 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:49:03
0% - iterations: 140 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:48:52
0% - iterations: 147 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:48:41
0% - iterations: 154 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:48:30
0% - iterations: 161 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:48:19
0% - iterations: 170 / 34079 - [9.38 MCells/s] - Estimated time to completion: 11:30:44
1% - iterations: 179 / 34079 - [9.38 MCells/s] - Estimated time to completion: 11:30:33
1% - iterations: 186 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:47:40
1% - iterations: 191 / 34079 - [5.21 MCells/s] - Estimated time to completion: 20:42:33
1% - iterations: 198 / 34079 - [6.69 MCells/s] - Estimated time to completion: 16:08:01
1% - iterations: 203 / 34079 - [4.78 MCells/s] - Estimated time to completion: 22:35:02
1% - iterations: 208 / 34079 - [4.78 MCells/s] - Estimated time to completion: 22:34:50
1% - iterations: 214 / 34079 - [6.25 MCells/s] - Estimated time to completion: 17:14:45
1% - iterations: 221 / 34079 - [6.69 MCells/s] - Estimated time to completion: 16:07:22
1% - iterations: 228 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:46:34
1% - iterations: 235 / 34079 - [6.69 MCells/s] - Estimated time to completion: 16:06:58
1% - iterations: 243 / 34079 - [8.34 MCells/s] - Estimated time to completion: 12:55:24
1% - iterations: 252 / 34079 - [7.94 MCells/s] - Estimated time to completion: 13:34:21
1% - iterations: 257 / 34079 - [5.21 MCells/s] - Estimated time to completion: 20:40:08
1% - iterations: 262 / 34079 - [5.21 MCells/s] - Estimated time to completion: 20:39:57
1% - iterations: 269 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:45:30
1% - iterations: 277 / 34079 - [8.34 MCells/s] - Estimated time to completion: 12:54:37
1% - iterations: 286 / 34079 - [8.6 MCells/s] - Estimated time to completion: 12:30:57
1% - iterations: 290 / 34079 - [3.82 MCells/s] - Estimated time to completion: 28:09:27
1% - iterations: 295 / 34079 - [4.78 MCells/s] - Estimated time to completion: 22:31:21
1% - iterations: 300 / 34079 - [4.78 MCells/s] - Estimated time to completion: 22:31:09
1% - iterations: 305 / 34079 - [5.21 MCells/s] - Estimated time to completion: 20:38:22
1% - iterations: 313 / 34079 - [8.34 MCells/s] - Estimated time to completion: 12:53:48
1% - iterations: 320 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:44:09
1% - iterations: 327 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:43:58
1% - iterations: 339 / 34079 - [12.5 MCells/s] - Estimated time to completion: 08:35:28
1% - iterations: 347 / 34079 - [8.34 MCells/s] - Estimated time to completion: 12:53:01
1% - iterations: 355 / 34079 - [8.34 MCells/s] - Estimated time to completion: 12:52:50
1% - iterations: 362 / 34079 - [6.69 MCells/s] - Estimated time to completion: 16:03:20
1% - iterations: 369 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:42:52
1% - iterations: 376 / 34079 - [6.69 MCells/s] - Estimated time to completion: 16:02:56
1% - iterations: 383 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:42:30
1% - iterations: 391 / 34079 - [7.64 MCells/s] - Estimated time to completion: 14:02:12
1% - iterations: 400 / 34079 - [8.6 MCells/s] - Estimated time to completion: 12:28:25
1% - iterations: 407 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:41:53
1% - iterations: 415 / 34079 - [8.34 MCells/s] - Estimated time to completion: 12:51:28
1% - iterations: 424 / 34079 - [9.38 MCells/s] - Estimated time to completion: 11:25:33
1% - iterations: 433 / 34079 - [8.6 MCells/s] - Estimated time to completion: 12:27:41
1% - iterations: 442 / 34079 - [9.38 MCells/s] - Estimated time to completion: 11:25:11
1% - iterations: 449 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:40:47
1% - iterations: 456 / 34079 - [6.69 MCells/s] - Estimated time to completion: 16:00:39
1% - iterations: 461 / 34079 - [5.21 MCells/s] - Estimated time to completion: 20:32:39
1% - iterations: 468 / 34079 - [6.69 MCells/s] - Estimated time to completion: 16:00:18
1% - iterations: 475 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:40:06
1% - iterations: 481 / 34079 - [6.25 MCells/s] - Estimated time to completion: 17:06:36
1% - iterations: 486 / 34079 - [4.78 MCells/s] - Estimated time to completion: 22:23:43
1% - iterations: 491 / 34079 - [5.21 MCells/s] - Estimated time to completion: 20:31:33
1% - iterations: 498 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:39:30
1% - iterations: 504 / 34079 - [5.73 MCells/s] - Estimated time to completion: 18:39:10
1% - iterations: 510 / 34079 - [5.29 MCells/s] - Estimated time to completion: 20:12:12
2% - iterations: 516 / 34079 - [5.73 MCells/s] - Estimated time to completion: 18:38:46
2% - iterations: 523 / 34079 - [7.3 MCells/s] - Estimated time to completion: 14:38:50
2% - iterations: 531 / 34079 - [8.34 MCells/s] - Estimated time to completion: 12:48:48
2% - iterations: 539 / 34079 - [8.34 MCells/s] - Estimated time to completion: 12:48:37
2% - iterations: 548 / 34079 - [9.38 MCells/s] - Estimated time to completion: 11:23:02
2% - iterations: 557 / 34079 - [9.38 MCells/s] - Estimated time to completion: 11:22:51
2% - iterations: 566 / 34079 - [8.6 MCells/s] - Estimated time to completion: 12:24:44
2% - iterations: 575 / 34079 - [9.38 MCells/s] - Estimated time to completion: 11:22:29
```

```
62% - iterations: 21213 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:22:05
62% - iterations: 21221 / 34079 - [7.64 MCells/s] - Estimated time to completion: 05:21:27
62% - iterations: 21229 / 34079 - [8.34 MCells/s] - Estimated time to completion: 04:54:28
62% - iterations: 21238 / 34079 - [8.6 MCells/s] - Estimated time to completion: 04:45:21
62% - iterations: 21246 / 34079 - [8.34 MCells/s] - Estimated time to completion: 04:54:05
62% - iterations: 21254 / 34079 - [8.34 MCells/s] - Estimated time to completion: 04:53:54
62% - iterations: 21263 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:21:03
62% - iterations: 21271 / 34079 - [8.34 MCells/s] - Estimated time to completion: 04:53:31
62% - iterations: 21280 / 34079 - [8.6 MCells/s] - Estimated time to completion: 04:44:25
62% - iterations: 21289 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:20:32
62% - iterations: 21298 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:20:21
63% - iterations: 21307 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:20:10
63% - iterations: 21316 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:19:59
63% - iterations: 21329 / 34079 - [13.5 MCells/s] - Estimated time to completion: 02:59:48
63% - iterations: 21340 / 34079 - [10.5 MCells/s] - Estimated time to completion: 03:51:37
63% - iterations: 21349 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:19:18
63% - iterations: 21358 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:19:07
63% - iterations: 21367 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:18:56
63% - iterations: 21376 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:18:45
63% - iterations: 21383 / 34079 - [7.3 MCells/s] - Estimated time to completion: 05:32:30
63% - iterations: 21390 / 34079 - [6.69 MCells/s] - Estimated time to completion: 06:02:32
63% - iterations: 21397 / 34079 - [6.69 MCells/s] - Estimated time to completion: 06:02:20
63% - iterations: 21404 / 34079 - [6.69 MCells/s] - Estimated time to completion: 06:02:08
63% - iterations: 21411 / 34079 - [7.3 MCells/s] - Estimated time to completion: 05:31:46
63% - iterations: 21418 / 34079 - [7.3 MCells/s] - Estimated time to completion: 05:31:35
63% - iterations: 21425 / 34079 - [7.3 MCells/s] - Estimated time to completion: 05:31:24
63% - iterations: 21433 / 34079 - [8.34 MCells/s] - Estimated time to completion: 04:49:48
63% - iterations: 21442 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:17:25
63% - iterations: 21451 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:17:14
63% - iterations: 21457 / 34079 - [6.25 MCells/s] - Estimated time to completion: 06:25:40
63% - iterations: 21462 / 34079 - [5.21 MCells/s] - Estimated time to completion: 07:42:37
63% - iterations: 21467 / 34079 - [5.21 MCells/s] - Estimated time to completion: 07:42:26
63% - iterations: 21473 / 34079 - [5.29 MCells/s] - Estimated time to completion: 07:35:13
63% - iterations: 21482 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:16:36
63% - iterations: 21491 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:16:25
63% - iterations: 21499 / 34079 - [8.34 MCells/s] - Estimated time to completion: 04:48:17
63% - iterations: 21508 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:16:04
63% - iterations: 21516 / 34079 - [8.34 MCells/s] - Estimated time to completion: 04:47:54
63% - iterations: 21525 / 34079 - [8.6 MCells/s] - Estimated time to completion: 04:38:58
63% - iterations: 21534 / 34079 - [9.38 MCells/s] - Estimated time to completion: 04:15:32
63% - iterations: 21546 / 34079 - [12.5 MCells/s] - Estimated time to completion: 03:11:28
63% - iterations: 21557 / 34079 - [11.5 MCells/s] - Estimated time to completion: 03:28:42
63% - iterations: 21569 / 34079 - [12.5 MCells/s] - Estimated time to completion: 03:11:07
63% - iterations: 21581 / 34079 - [12.5 MCells/s] - Estimated time to completion: 03:10:56
Steady state detected at iteration: 21585 - the simulation will end shortly.
Please wait ... saving the sensor 'Overall Field' (E-fields) on disk.

Please wait ... saving the sensor 'Overall Field' (H-fields) on disk.

Please wait ... saving the sensor 'Unnamed' (E-fields) on disk.

Please wait ... saving the sensor 'Unnamed' (H-fields) on disk.

97% - iterations: 21585 / 22153 - [0.0356 MCells/s] - Estimated time to completion: 50:45:54
97% - iterations: 21592 / 22153 - [6.69 MCells/s] - Estimated time to completion: 00:16:01
98% - iterations: 21600 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:12:40
98% - iterations: 21609 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:11:04
98% - iterations: 21618 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:10:53
98% - iterations: 21627 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:10:42
98% - iterations: 21636 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:10:31
98% - iterations: 21644 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:11:39
98% - iterations: 21653 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:10:11
98% - iterations: 21662 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:10:00
98% - iterations: 21671 / 22153 - [8.6 MCells/s] - Estimated time to completion: 00:10:42
98% - iterations: 21680 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:09:38
98% - iterations: 21689 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:09:27
98% - iterations: 21698 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:09:16
98% - iterations: 21706 / 22153 - [7.64 MCells/s] - Estimated time to completion: 00:11:10
98% - iterations: 21713 / 22153 - [7.3 MCells/s] - Estimated time to completion: 00:11:31
98% - iterations: 21720 / 22153 - [7.3 MCells/s] - Estimated time to completion: 00:11:20
98% - iterations: 21727 / 22153 - [6.69 MCells/s] - Estimated time to completion: 00:12:10
```

```
98% - iterations: 21735 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:09:34
98% - iterations: 21743 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:09:23
98% - iterations: 21751 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:09:12
98% - iterations: 21760 / 22153 - [8.6 MCells/s] - Estimated time to completion: 00:08:44
98% - iterations: 21769 / 22153 - [8.6 MCells/s] - Estimated time to completion: 00:08:32
98% - iterations: 21778 / 22153 - [8.6 MCells/s] - Estimated time to completion: 00:08:20
98% - iterations: 21786 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:08:24
98% - iterations: 21794 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:08:13
98% - iterations: 21802 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:08:02
98% - iterations: 21810 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:07:51
98% - iterations: 21818 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:07:40
99% - iterations: 21826 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:07:29
99% - iterations: 21834 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:07:18
99% - iterations: 21841 / 22153 - [7.3 MCells/s] - Estimated time to completion: 00:08:10
99% - iterations: 21849 / 22153 - [7.64 MCells/s] - Estimated time to completion: 00:07:36
99% - iterations: 21857 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:06:47
99% - iterations: 21865 / 22153 - [7.64 MCells/s] - Estimated time to completion: 00:07:12
99% - iterations: 21873 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:06:25
99% - iterations: 21881 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:06:14
99% - iterations: 21889 / 22153 - [7.64 MCells/s] - Estimated time to completion: 00:06:36
99% - iterations: 21897 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:05:52
99% - iterations: 21905 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:05:41
99% - iterations: 21913 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:05:30
99% - iterations: 21921 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:05:19
99% - iterations: 21929 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:05:08
99% - iterations: 21938 / 22153 - [8.6 MCells/s] - Estimated time to completion: 00:04:46
99% - iterations: 21947 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:04:11
99% - iterations: 21956 / 22153 - [8.6 MCells/s] - Estimated time to completion: 00:04:22
99% - iterations: 21965 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:03:49
99% - iterations: 21972 / 22153 - [7.3 MCells/s] - Estimated time to completion: 00:04:44
99% - iterations: 21981 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:03:30
99% - iterations: 21990 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:03:19
99% - iterations: 22001 / 22153 - [11.5 MCells/s] - Estimated time to completion: 00:02:32
99% - iterations: 22012 / 22153 - [11.5 MCells/s] - Estimated time to completion: 00:02:21
99% - iterations: 22021 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:02:41
99% - iterations: 22030 / 22153 - [8.6 MCells/s] - Estimated time to completion: 00:02:44
99% - iterations: 22039 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:02:19
100% - iterations: 22048 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:02:08
100% - iterations: 22056 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:02:13
100% - iterations: 22065 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:01:47
100% - iterations: 22072 / 22153 - [7.3 MCells/s] - Estimated time to completion: 00:02:07
100% - iterations: 22078 / 22153 - [6.25 MCells/s] - Estimated time to completion: 00:02:17
100% - iterations: 22084 / 22153 - [6.25 MCells/s] - Estimated time to completion: 00:02:06
100% - iterations: 22092 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:01:23
100% - iterations: 22101 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:01:03
100% - iterations: 22109 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:01:00
100% - iterations: 22118 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:00:42
100% - iterations: 22126 / 22153 - [8.34 MCells/s] - Estimated time to completion: 00:00:37
100% - iterations: 22135 / 22153 - [9.38 MCells/s] - Estimated time to completion: 00:00:22
100% - iterations: 22144 / 22153 - [8.6 MCells/s] - Estimated time to completion: 00:00:12
Please wait ... saving the sensor 'Overall Field' (E-fields) on disk.

Please wait ... saving the sensor 'Overall Field' (H-fields) on disk.

Please wait ... saving the sensor 'Unnamed' (E-fields) on disk.

Please wait ... saving the sensor 'Unnamed' (H-fields) on disk.

100% - iterations: 22153 / 22153 - [0.0834 MCells/s] - Estimated time to completion: 00:00:00

Convert time-domain data to frequency-domain data.

Maxwell Solver run ended the 2009-Feb-09 21:12:38. Total simulation time was 10:32:18 (hh:mm:ss, wall-
clock time).
```

APPENDIX C - PROBE CALIBRATION REPORT

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

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

Accredited by the Swiss Accreditation Service (SAS)
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

Certificate No: ET3-1590_Jul08

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1590
Calibration procedure(s)	QA CAL-01.v6, QA CAL-12.v5 and QA CAL-23.v3 Calibration procedure for dosimetric E-field probes
Calibration date:	July 21, 2008
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 (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe ES3DV2	SN: 3013	2-Jan-08 (No. ES3-3013_Jan08)	Jan-09
DAE4	SN: 660	3-Sep-07 (No. DAE4-660_Sep07)	Sep-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-07)	In house check: Oct-08

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: July 21, 2008

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	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) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

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:1590

Manufactured:	March 19, 2001
Last calibrated:	May 20, 2005
Recalibrated:	July 21, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1590

Sensitivity in Free Space[A] Diode Compression[B]

NormX	**1.81** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**87** mV
NormY	**2.00** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**92** mV
NormZ	**1.72** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**85** mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL **835 MHz** **Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	10.7	7.2
SAR_{be} [%]	With Correction Algorithm	0.8	0.5

Sensor Offset

Probe Tip to Sensor Center	**2.7** mm

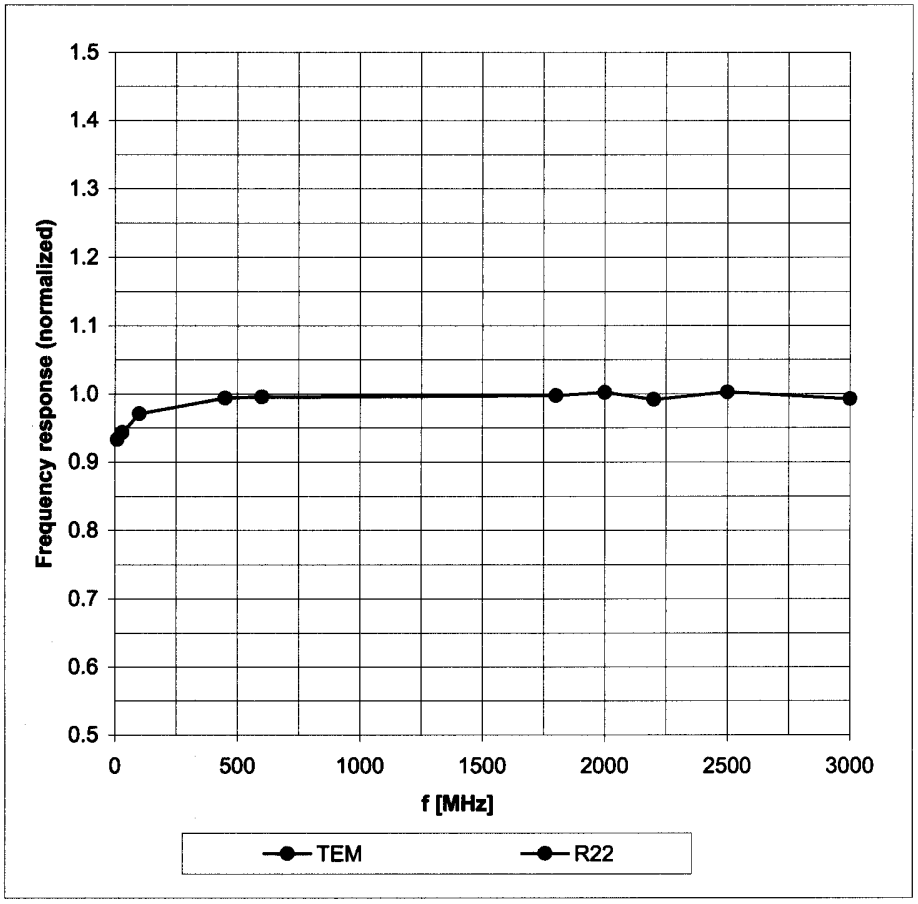
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[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.

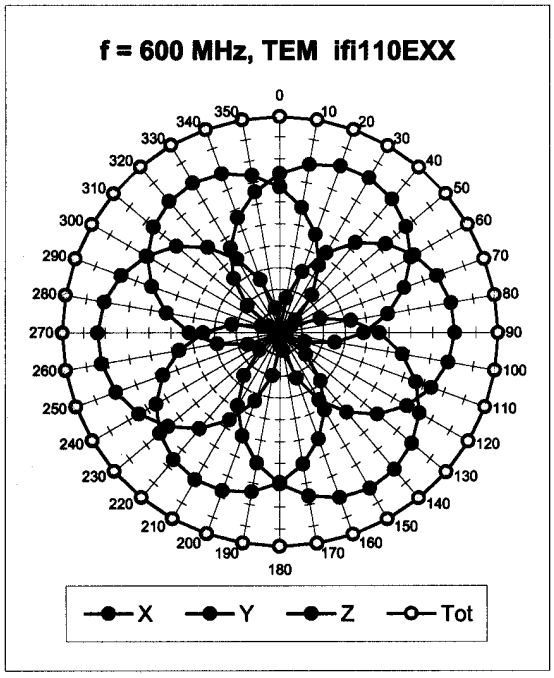
Frequency Response of E-Field

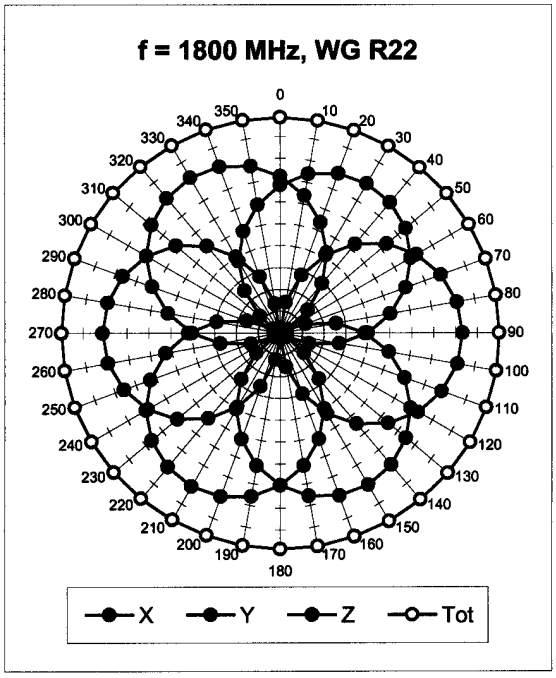
(TEM-Cell:ifi110 EXX, Waveguide: R22)

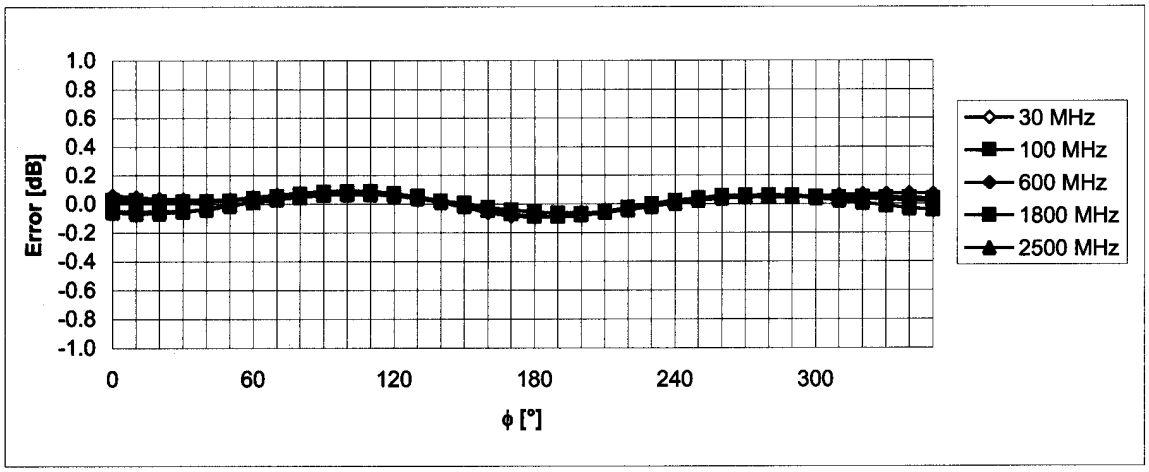


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



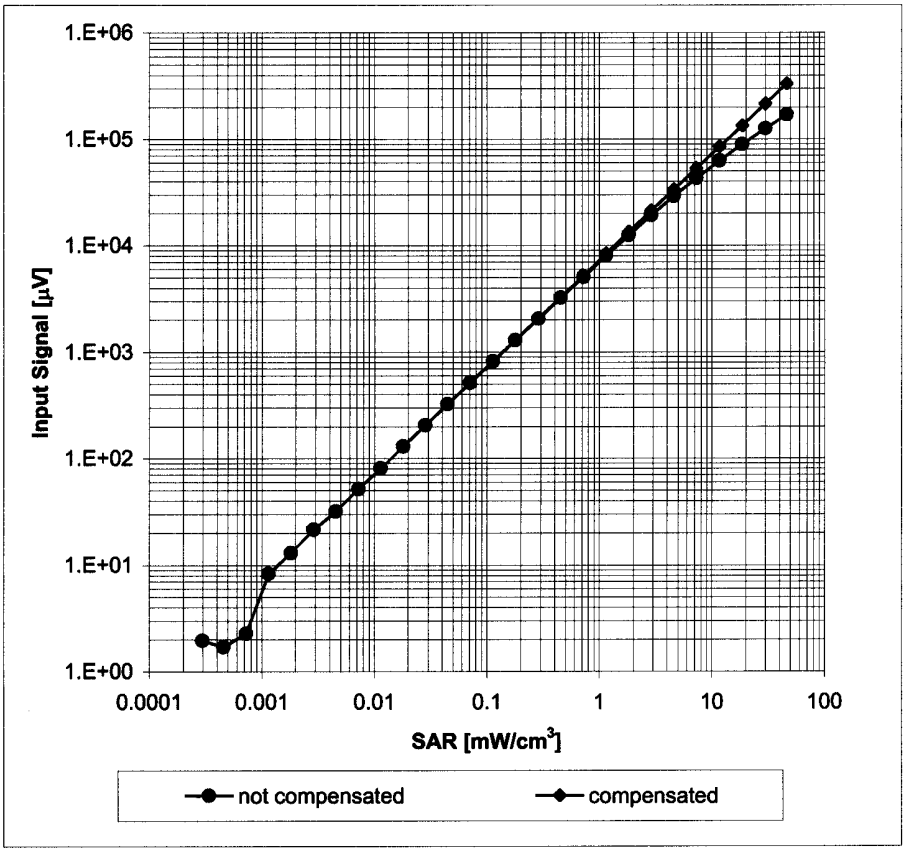


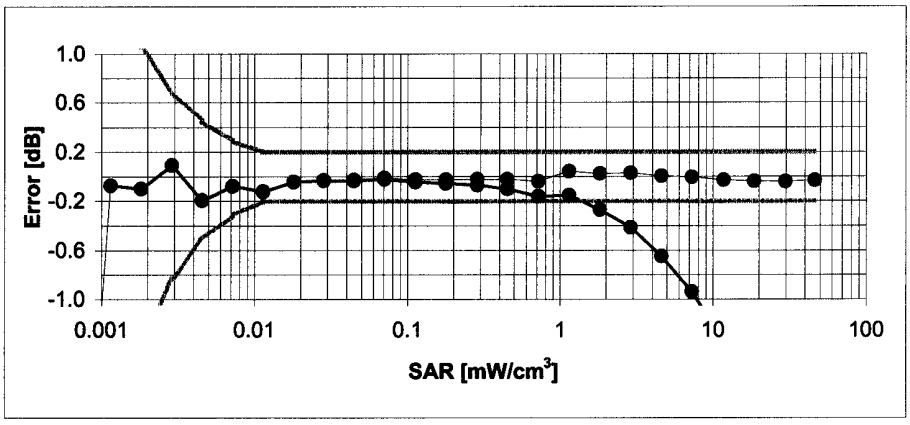


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

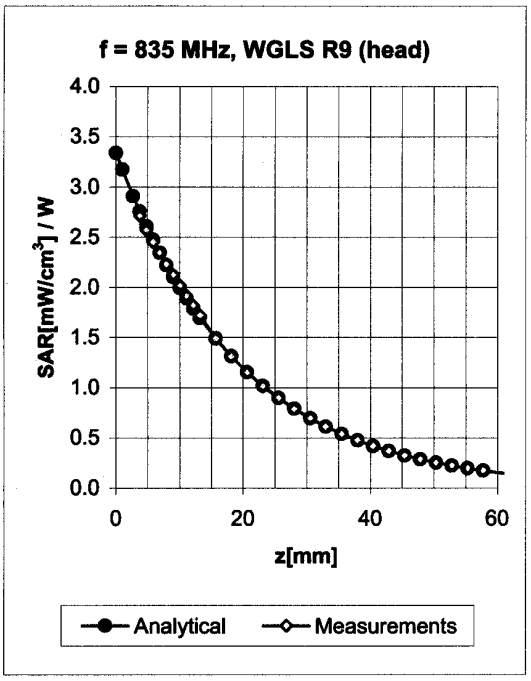
(Waveguide R22, f = 1800 MHz)

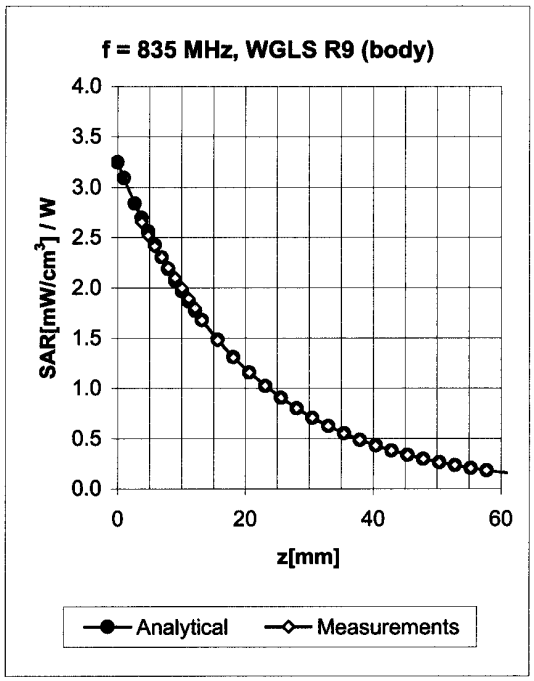




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



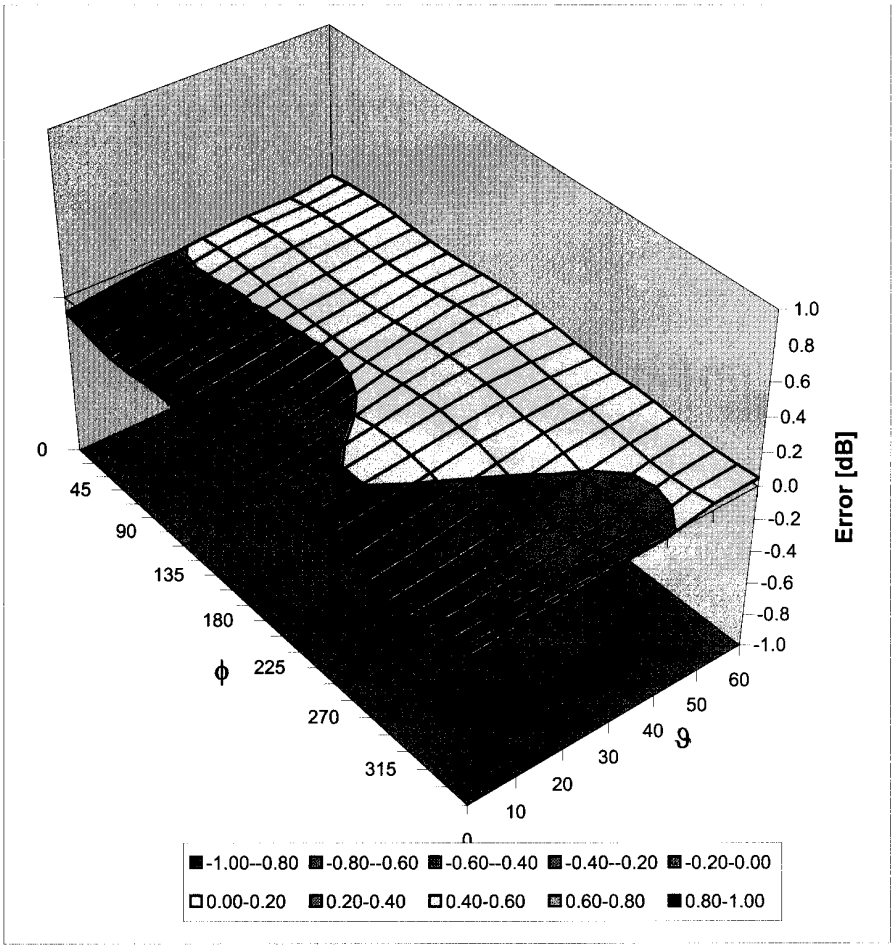


f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty	
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.34	1.75	7.66	± 13.3% (k=2)
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.32	3.52	6.54	± 11.0% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.28	1.77	8.27	± 13.3% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.36	3.31	6.39	± 11.0% (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)