SAR TEST REPORT (FCC/IC)

RF EXPOSURE EVALUATION | SPECIFIC ABSORPTION RATE

APPLICANT	BK RADIO INC. (c/o RELM Communications Inc.)			
DEVICE UNDER TEST (DUT)	PORTABLE FM UHF PUSH-TO-TALK RADIO TRANSCEIVER			
DEVICE FREQUENCY RANGE	380 - 470 MHz			
DEVICE MODEL(S)	KNG-P400			
DEVICE IDENTIFIER(S)	FCC ID:	K95KNGP400	IC:	2116A-KNGP400
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)			
	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	Face-held & Body-worn			
DATE(S) OF EVALUATION	September 23, 2008			
TEST REPORT SERIAL NO.	090208K95-T931-S90U			
TEST REPORT REVISION NO.	Revision 1.0	Initial Release	October 01, 2008	
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**	**BK RADIO INC. (C/O RELM COMMUNICATIONS INC.)**				
	Address	7100 Technology Drive, West Melbourne, FL 32904 USA				
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)				
	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:**	K95KNGP400				
	IC:	2116A-KNGP400				
	Model(s)	KNG-P400				
	Serial No.	XXXXXXXX (Pre-production)				
Device Description	Portable FM UHF Push-To-Talk (PTT) Radio Transceiver					
Transmit Frequency Range(s)	380 - 470 MHz					
Max. RF Output Power Tested	5.7 Watts	37.56 dBm	Conducted	380 MHz	Low Channel	
	5.7 Watts	37.56 dBm	Conducted	425 MHz	Mid Channel	
	5.7 Watts	37.56 dBm	Conducted	470 MHz	High Channel	
Antenna Type(s) Tested	Detachable Whip		Length: 160 mm		P/N: KAA0815	
Battery Type(s) Tested	Lithium-ion		10.8 V, 1950 mAh		P/N: KAA0100	
Body-worn Accessories Tested	Belt-Clip		Contains Metal Components		P/N: KAA0400	
Audio Accessories Tested	Speaker-Microphone (P/N: KAA0200)					
Max. SAR Level(s) Evaluated	Face-held	**5.41 W/kg**	1g	50% duty cycle	Occupational / Controlled Exposure	
	Body-worn	**7.43 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 1528-2003 and IEC 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.**

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1.0 INTRODUCTION

This measurement report demonstrates that the BK Radio Inc. (c/o RELM Communications Inc.) Model: KNG-P400 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 1528-2003 (see reference [5]) and IEC 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 brain and/or body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the DASY4 measurement server. The DAE4 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the DASY4 measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

DASY4 SAR System with Plexiglas validation phantom

DASY4 SAR System with Plexiglas side planar phantom

3.0 MEASUREMENT SUMMARY

SAR EVALUATION RESULTS

Test Type	Freq.	Ch.	Test Mode	Battery Type	Accessory Type(s)		Device Position to Planar Phantom	Device Spacing to Planar Phantom	Cond. Power Before Test	Measured SAR 1g (W/kg)		SAR Drift During Test	Scaled SAR with droop 1g (W/kg)	
										Duty Cycle			Duty Cycle	
	MHz				Body-worn	Audio		cm	Watts	100%	50%	dB	100%	50%
Face	380	Low	CW	Li-Ion	n/a	n/a	Front Side	2.5	5.7	10.3	5.15	-0.214	10.8	5.41
Face	425	Mid	CW	Li-Ion	n/a	n/a	Front Side	2.5	5.7	6.72	3.36	-0.220	7.07	3.53
Face	470	High	CW	Li-Ion	n/a	n/a	Front Side	2.5	5.7	3.32	1.66	-0.202	3.48	1.74
Body	380	Low	CW	Li-Ion	Belt-Clip	Speaker-Mic	Back Side	1.5	5.7	14.2	7.10	-0.196	14.9	7.43
Body	425	Mid	CW	Li-Ion	Belt-Clip	Speaker-Mic	Back Side	1.5	5.7	11.2	5.60	-0.219	11.8	5.89
Body	470	High	CW	Li-Ion	Belt-Clip	Speaker-Mic	Back Side	1.5	5.7	5.98	2.99	-0.166	6.21	3.11

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

Test Date	September 23, 2008				September 23, 2008				Measured Fluid Type	Brain	Body	Unit
Fluid Type	450 MHz Brain				450 MHz Body				Atmospheric Pressure	101.1	101.1	kPa
Dielectric Constant ε_r	IEEE Target		Meas.	Dev.	IEEE Target		Meas.	Dev.	Relative Humidity	35	35	%
	43.5	± 5%	44.4	+2.1%	56.7	± 5%	56.7	0.0%	Ambient Temperature	23.8	23.5	°C
Fluid Type	450 MHz Brain				450 MHz Body				Fluid Temperature	22.8	22.5	°C
Conductivity σ (mho/m)	IEEE Target		Meas.	Dev.	IEEE Target		Meas.	Dev.	Fluid Depth	≥ 15	≥ 15	cm
	0.87	± 5%	0.89	+2.3%	0.94	± 5%	0.93	-1.0%	ρ (Kg/m^3)	1000		

Notes

1. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
2. 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.
3. The power drift of the DUT was measured by the DASY4 system for the duration of the SAR evaluations. The measured power drifts were within 5% from the start power of the DUT.
4. The power droop of the DUT measured by the DASY4 system for the duration of the SAR evaluations was added to the measured SAR level to report scaled SAR results as shown in the above test data table.
5. 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.
6. 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).

4.0 DETAILS OF SAR EVALUATION

The BK Radio Inc. (c/o RELM Communications Inc.) Model: KNG-P400 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.

Test Configuration(s)

1. The DUT was evaluated for face-held SAR 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 for body-worn SAR 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 customer-supplied speaker-microphone accessory connected to the audio port.

Test Mode & Output Power

3. The DUT was tested in unmodulated continuous transmit mode (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 power levels referenced in this report were measured by Celltech Labs Inc. prior to the SAR evaluations at the antenna connector of the DUT using a Gigatronics 8652A Universal Power Meter in accordance with the procedures described in FCC 47 CFR §2.1046 and IC RSS-Gen.

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

f. Interpolated data is used to calculate the average SAR over 1g and 10g cubes by spatially discretizing the entire measured cube. The volume used to determine the averaged SAR is a 1mm grid (42875 interpolated points).

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

6.0 SYSTEM PERFORMANCE CHECK

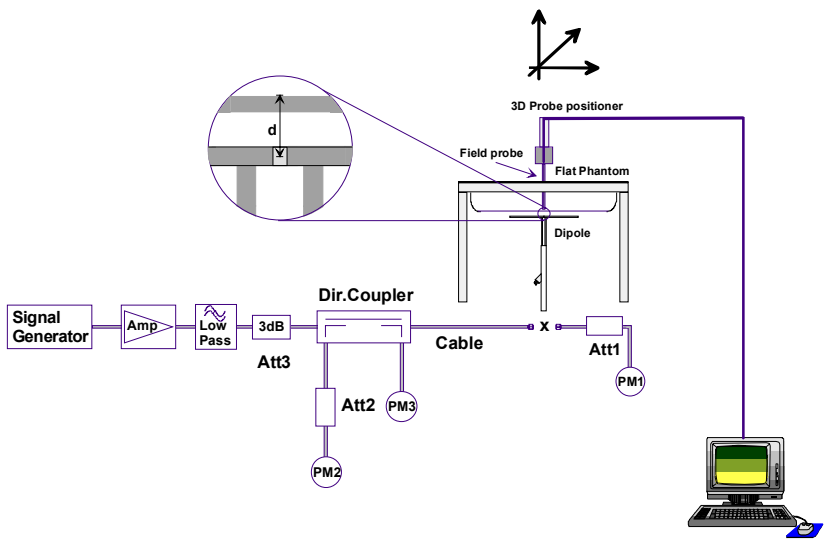
Prior to the SAR evaluations a system check was performed using a Plexiglas planar phantom and 450 MHz dipole (see Appendix B for system performance check test plot). The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe 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 procedures).

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.						
Sep 23	Brain 450	**1.18 ±10%**	1.22	+3.4%	**43.4 ±5%**	44.4	+2.3%	**0.89 ±5%**	0.89	0.0%	1000	23.8	22.8	≥ 15	35	101.1

Note(s)

1. The target SAR value is referenced from the System Validation procedure performed by Celltech Labs Inc. (see Appendix E).
2. The target dielectric parameters are referenced from the System Validation procedure 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.



System Performance Check Measurement Setup Diagram

450 MHz Validation Dipole Setup

7.0 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	450 MHz Brain	450 MHz Body
	System Check & DUT Evaluation	DUT Evaluation
Water	38.56 %	52.00 %
Sugar	56.32 %	45.65 %
Salt	3.95 %	1.75 %
HEC	0.98 %	0.50 %
Bactericide	0.19 %	0.10 %

8.0 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.			

9.0 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
Outer Dimensions	75.0 cm (L) x 22.5 cm (W) x 20.5 cm (H); Back Plane: 25.7 cm (H)
Validation Phantom (≤ 450MHz)	
Type	Planar Phantom
Shell Material	Plexiglas
Bottom Thickness	6.2 mm ± 0.1 mm
Outer Dimensions	86.0 cm (L) x 39.5 cm (W) x 21.8 cm (H)

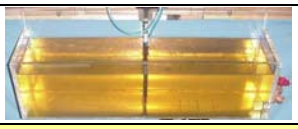
10.0 PROBE SPECIFICATION (ET3DV6)

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 brain simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy ± 8%)
Frequency:	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity:	± 0.2 dB in brain tissue (rotation around probe axis) ± 0.4 dB in brain tissue (rotation normal to probe axis)
Dynamic Range:	5 μW/g to > 100 mW/g; Linearity: ± 0.2 dB
Surface Detect:	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Dimensions:	Overall length: 330 mm Tip length: 16 mm Body diameter: 12 mm Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 3 GHz Compliance tests of mobile phone

ET3DV6 E-Field Probe

11.0 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

12.0 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

13.0 DEVICE HOLDER

The DASY4 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.

Device Holder

14.0 TEST EQUIPMENT LIST

TEST EQUIPMENT		ASSET NO.	SERIAL NO.	DATE CALIBRATED	CALIBRATION DUE DATE
USED	DESCRIPTION				
x	Schmid & Partner DASY4 System	-	-	-	-
x	-DASY4 Measurement Server	00158	1078	NA	NA
x	-Robot	00046	599396-01	NA	NA
x	-DAE4	00019	353	22Apr08	22Apr09
x	-ET3DV6 E-Field Probe	00017	1590	21Jul08	21Jul09
x	-450 MHz Validation Dipole	00024	136	25Jul08	25Jul09
	-SAM Phantom V4.0C	00154	1033	NA	NA
	-Barski Planar Phantom	00155	03-01	NA	NA
x	-Plexiglas Side Planar Phantom	00156	161	NA	NA
x	-Plexiglas Validation Planar Phantom	00157	137	NA	NA
	ALS-PR-DIEL Dielectric Probe Kit	00160	260-00953	NA	NA
x	HP 85070C Dielectric Probe Kit	00033	US39240170	NA	NA
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	NR	NR
	Rohde & Schwarz SMR20 Signal Generator	00006	100104	NR	NR
x	Amplifier Research 5S1G4 Power Amplifier	00106	26235	NR	NR
	Amplifier Research 10W1000C Power Amplifier	00041	27887	NR	NR
	Nextec NB00383 Microwave Amplifier	00151	0535	NR	NR
Abbr.	NA = Not Applicable		NR = Not Required		

15.0 MEASUREMENT UNCERTAINTIES

UNCERTAINTY BUDGET FOR DEVICE EVALUATION						
Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**ci 1g**	**Uncertainty Value ±% (1g)**	**V_i or V_{eff}**
Measurement System						
Probe calibration (450 MHz)	6.65	Normal	1	1	6.65	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	0.7	1.9	∞
Spherical isotropy of the probe	9.6	Rectangular	1.732050808	0.7	3.9	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	0.8	Rectangular	1.732050808	1	0.5	∞
Probe linearity	4.7	Rectangular	1.732050808	1	2.7	∞
Detection limit	1	Rectangular	1.732050808	1	0.6	∞
Readout electronics	0.3	Normal	1	1	0.3	∞
Response time	0.8	Rectangular	1.732050808	1	0.5	∞
Integration time	2.6	Rectangular	1.732050808	1	1.5	∞
RF ambient conditions	3	Rectangular	1.732050808	1	1.7	∞
Mech. constraints of robot	0.4	Rectangular	1.732050808	1	0.2	∞
Probe positioning	2.9	Rectangular	1.732050808	1	1.7	∞
Extrapolation & integration	1	Rectangular	1.732050808	1	0.6	∞
Test Sample Related						
Device positioning	2.9	Normal	1	1	2.9	12
Device holder uncertainty	3.6	Normal	1	1	3.6	8
Power drift	5	Rectangular	1.732050808	1	2.9	∞
Phantom and Setup						
Phantom uncertainty	4	Rectangular	1.732050808	1	2.3	∞
Liquid conductivity (target)	5	Rectangular	1.732050808	0.64	1.8	∞
Liquid conductivity (measured)	2.3	Normal	1	0.64	1.5	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	2.1	Normal	1	0.6	1.3	∞
Combined Standard Uncertainty					**11.17**	
Expanded Uncertainty (k=2)					**22.34**	
Measurement Uncertainty Table in accordance with IEEE 1528-2003 and IEC 62209-1:2005						

MEASUREMENT UNCERTAINTIES (CONT.)

UNCERTAINTY BUDGET FOR SYSTEM VALIDATION

Error Description	Uncertainty Value ±%	Probability Distribution	Divisor	ci 1g	Uncertainty Value ±% (1g)	V_i or V_{eff}
Measurement System						
Probe calibration (450 MHz)	6.65	Normal	1	1	6.65	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	1	2.7	∞
Spherical isotropy of the probe	0	Rectangular	1.732050808	1	0.0	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	0.8	Rectangular	1.732050808	1	0.5	∞
Probe linearity	4.7	Rectangular	1.732050808	1	2.7	∞
Detection limit	1	Rectangular	1.732050808	1	0.6	∞
Readout electronics	0.3	Normal	1	1	0.3	∞
Response time	0	Rectangular	1.732050808	1	0.0	∞
Integration time	0	Rectangular	1.732050808	1	0.0	∞
RF ambient conditions	3	Rectangular	1.732050808	1	1.7	∞
Mech. constraints of robot	0.4	Rectangular	1.732050808	1	0.2	∞
Probe positioning	2.9	Rectangular	1.732050808	1	1.7	∞
Extrapolation & integration	1	Rectangular	1.732050808	1	0.6	∞
Dipole						
Dipole Positioning	2	Normal	1.732050808	1	1.2	∞
Power & Power Drift	4.7	Normal	1.732050808	1	2.7	∞
Phantom and Setup						
Phantom uncertainty	4	Rectangular	1.732050808	1	2.3	∞
Liquid conductivity (target)	5	Rectangular	1.732050808	0.64	1.8	∞
Liquid conductivity (measured)	0	Normal	1	0.64	0.0	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	2.3	Normal	1	0.6	1.4	∞
Combined Standard Uncertainty					**9.39**	
Expanded Uncertainty (k=2)					**18.77**	

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

16.0 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.”

APPENDIX A - SAR MEASUREMENT DATA

Date Tested: 09/23/2008

Face-held SAR - Low Channel - 380 MHz

DUT: BK Radio Model: KNG-P400; Type: Portable FM UHF PTT Radio Transceiver; Serial: XXXXXXXX

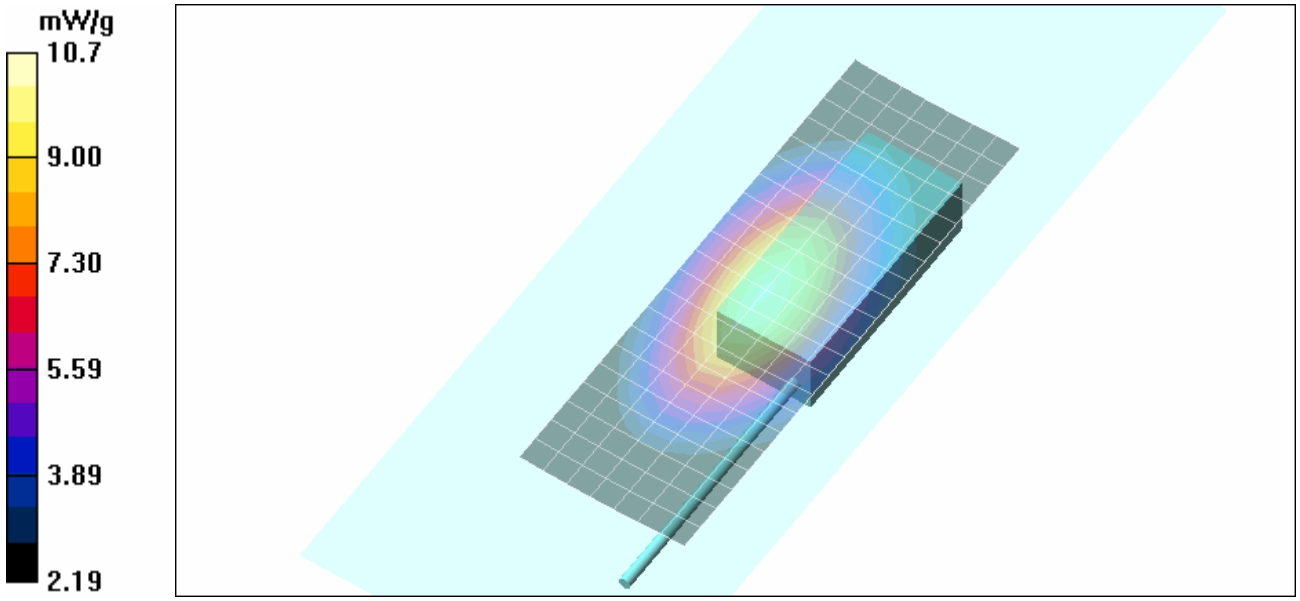
Ambient Temp: 23.8°C; Fluid Temp: 22.8°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Frequency: 380 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.7 Watts (Conducted)
10.8V 1950mAh Lithium-ion Battery (P/N: KAA0100)
Medium: HSL450 Medium parameters used: f = 450 MHz; σ = 0.89 mho/m; ε_r = 44.4; ρ = 1000 kg/m^3

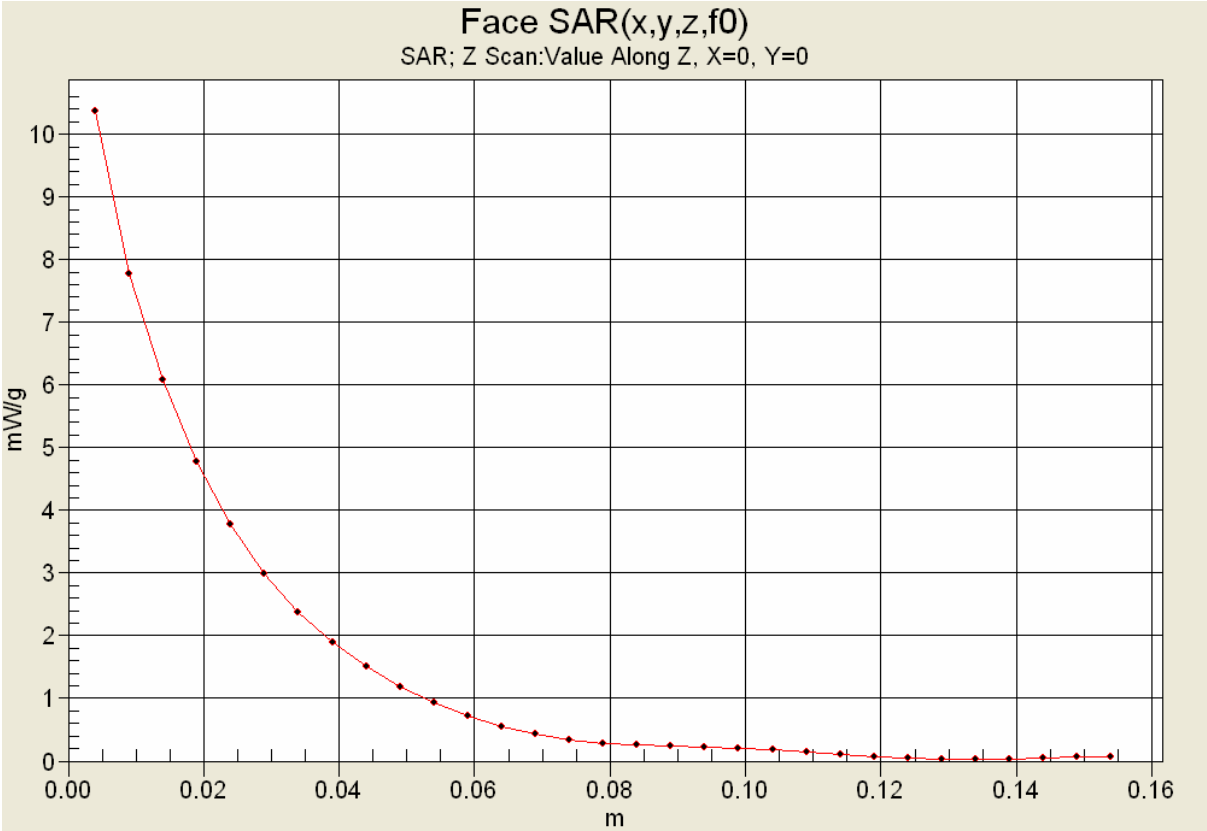
- Probe: ET3DV6 - SN1590; ConvF(7.66, 7.66, 7.66); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8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

Face-held SAR - 2.5 cm Spacing from Front Side of DUT to Planar Phantom - Low Channel
Area Scan (8x22x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 10.4 mW/g

Face-held SAR - 2.5 cm Spacing from Front Side of DUT to Planar Phantom - Low Channel
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 115.9 V/m; Power Drift = -0.214 dB
Peak SAR (extrapolated) = 13.8 W/kg
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 7.81 mW/g
Maximum value of SAR (measured) = 10.7 mW/g



Z-Axis Scan


Face SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
m
0
1
2
3
4
5
6
7
8
9
10
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16

Date Tested: 09/23/2008

Face-held SAR - Mid Channel - 425 MHz

DUT: BK Radio Model: KNG-P400; Type: Portable FM UHF PTT Radio Transceiver; Serial: XXXXXXXX

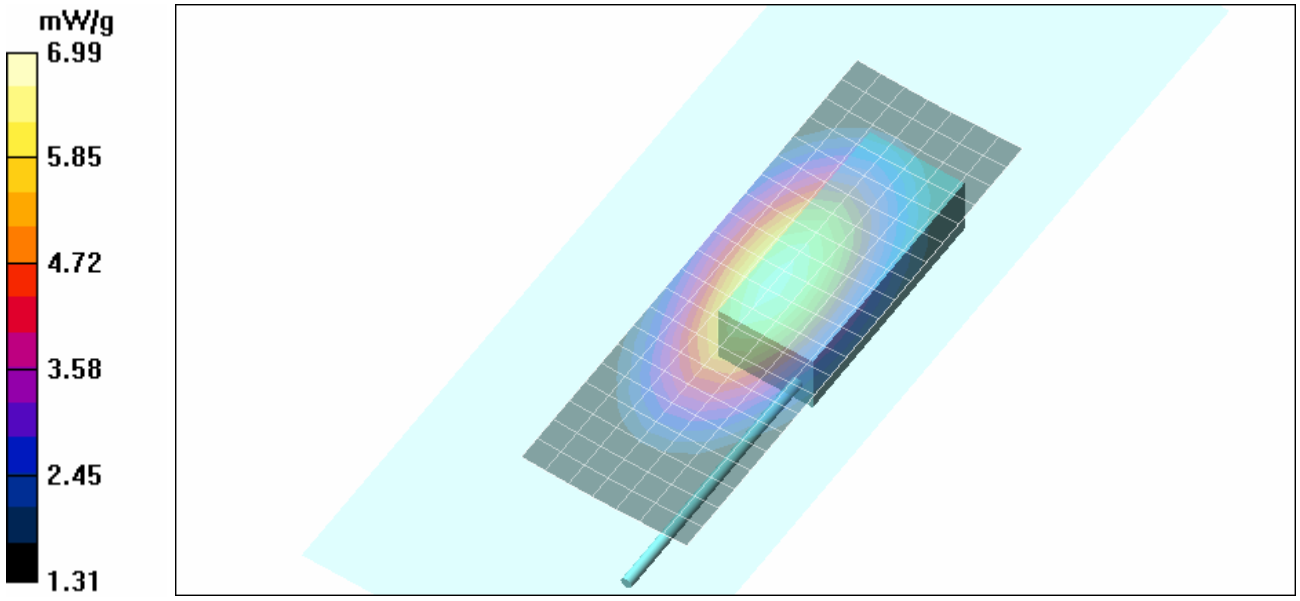
Ambient Temp: 23.8°C; Fluid Temp: 22.8°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Frequency: 425 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.7 Watts (Conducted)
10.8V 1950mAh Lithium-ion Battery (P/N: KAA0100)
Medium: HSL450 Medium parameters used: f = 450 MHz; σ = 0.89 mho/m; ε_r = 44.4; 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 - Mid Channel
Area Scan (8x22x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 6.91 mW/g

Face-held SAR - 2.5 cm Spacing from Front Side of DUT to Planar Phantom - Mid Channel
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 93.0 V/m; Power Drift = -0.220 dB
Peak SAR (extrapolated) = 9.07 W/kg
SAR(1 g) = 6.72 mW/g; SAR(10 g) = 5.08 mW/g
Maximum value of SAR (measured) = 6.99 mW/g



Date Tested: 09/23/2008

Face-held SAR - High Channel - 470 MHz

DUT: BK Radio Model: KNG-P400; Type: Portable FM UHF PTT Radio Transceiver; Serial: XXXXXXXX

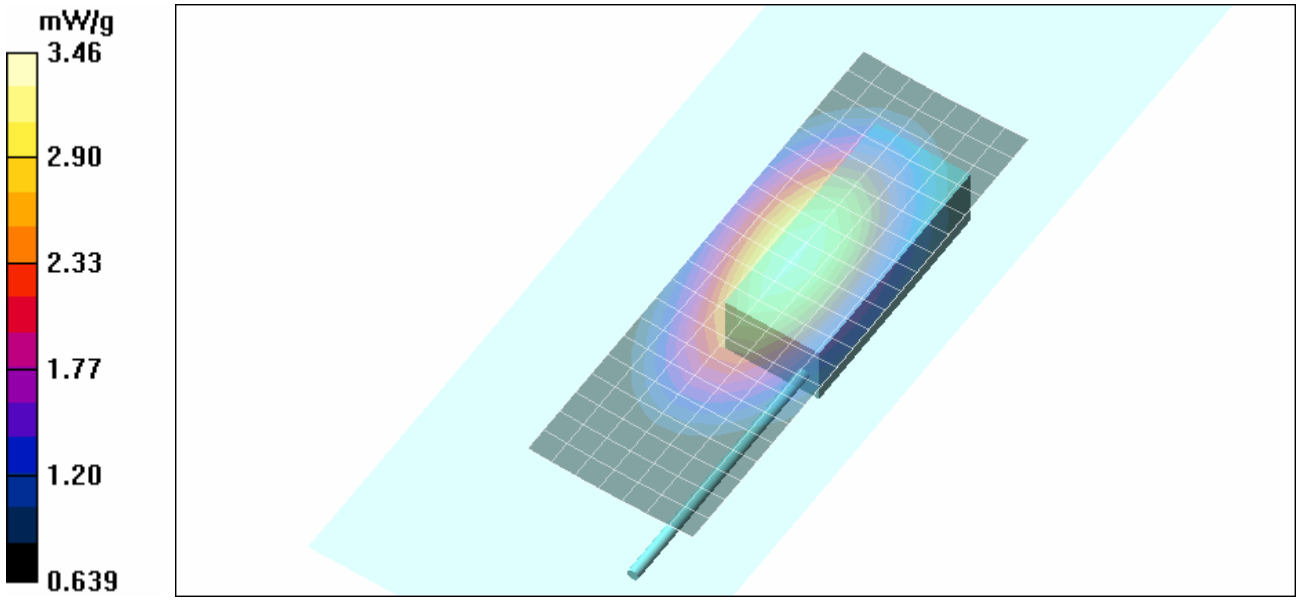
Ambient Temp: 23.8°C; Fluid Temp: 22.8°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Frequency: 470 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.7 Watts (Conducted)
10.8V 1950mAh Lithium-ion Battery (P/N: KAA0100)
Medium: HSL450 Medium parameters used: f = 450 MHz; σ = 0.89 mho/m; ε_r = 44.4; 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 - High Channel
Area Scan (8x22x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 3.35 mW/g

Face-held SAR - 2.5 cm Spacing from Front Side of DUT to Planar Phantom - High Channel
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 65.7 V/m; Power Drift = -0.202 dB
Peak SAR (extrapolated) = 4.51 W/kg
SAR(1 g) = 3.32 mW/g; SAR(10 g) = 2.5 mW/g
Maximum value of SAR (measured) = 3.46 mW/g



Date Tested: 09/23/2008

Body-worn SAR - Low Channel - 380 MHz

DUT: BK Radio Model: KNG-P400; Type: Portable FM UHF PTT Radio Transceiver; Serial: XXXXXXXX

Body-worn Accessory: Belt-Clip (P/N: KAA0400); Audio Accessory: Speaker-Microphone (P/N: KAA0200)

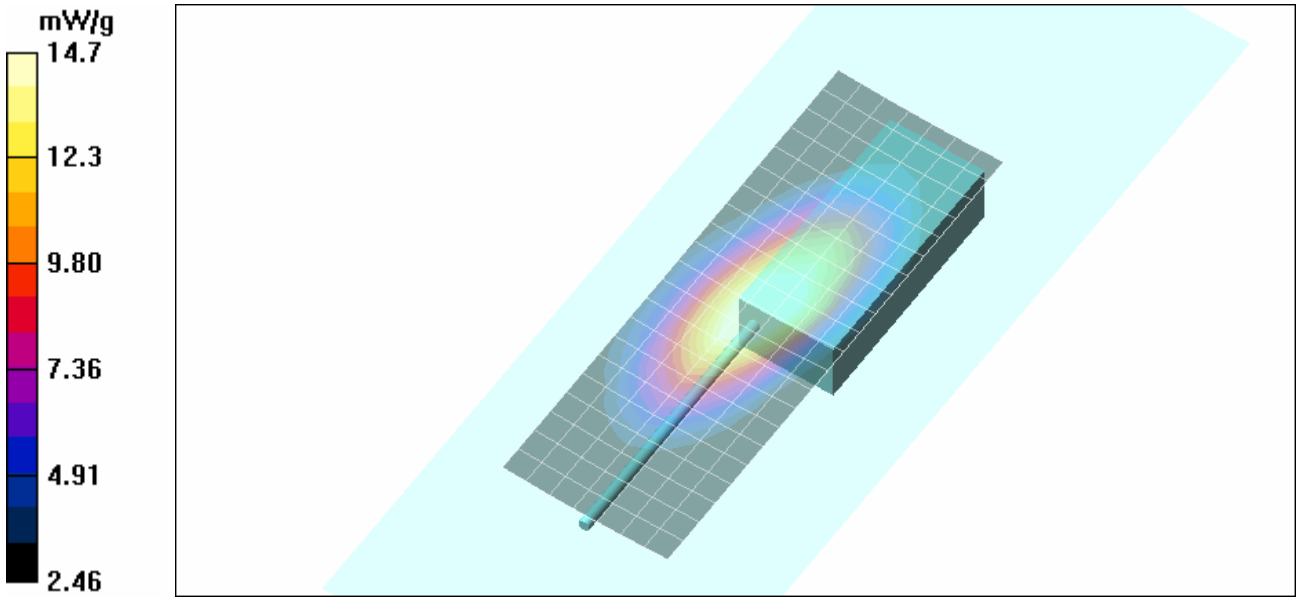
Ambient Temp: 23.5°C; Fluid Temp: 22.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Frequency: 380 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.7 Watts (Conducted)
10.8V 1950mAh Lithium-ion Battery (P/N: KAA0100)
Medium: MSL450 Medium parameters used: f = 450 MHz; σ = 0.93 mho/m; ε_r = 56.7; ρ = 1000 kg/m^3

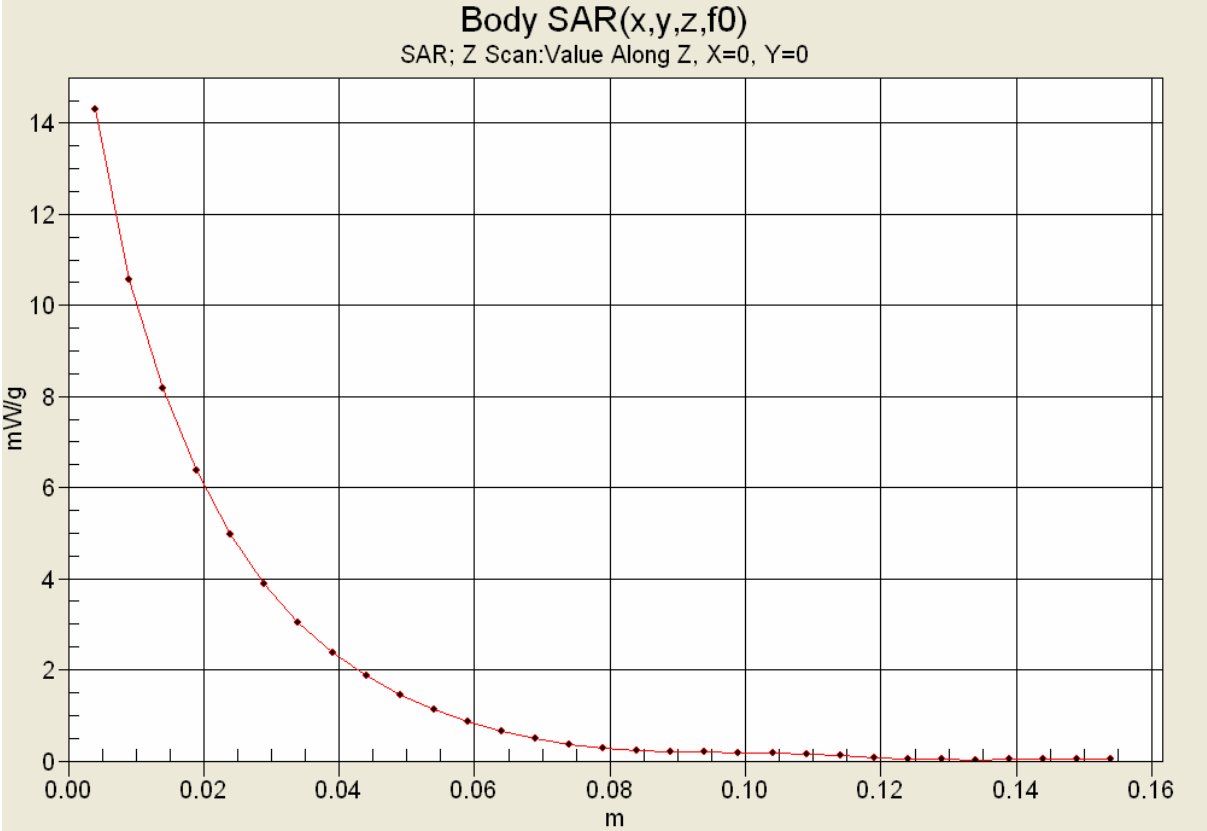
- Probe: ET3DV6 - SN1590; ConvF(8.27, 8.27, 8.27); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8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

Body-worn SAR - 1.5 cm Belt-Clip Spacing from Back Side of DUT to Planar Phantom - Low Channel
Area Scan (8x22x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 16.3 mW/g

Body-worn SAR - 1.5 cm Belt-Clip Spacing from Back Side of DUT to Planar Phantom - Low Channel
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 127.7 V/m; Power Drift = -0.196 dB
Peak SAR (extrapolated) = 19.9 W/kg
SAR(1 g) = 14.2 mW/g; SAR(10 g) = 10.5 mW/g
Maximum value of SAR (measured) = 14.7 mW/g



Z-Axis Scan



Date Tested: 09/23/2008

Body-worn SAR - Mid Channel - 425 MHz

DUT: BK Radio Model: KNG-P400; Type: Portable FM UHF PTT Radio Transceiver; Serial: XXXXXXXX

Body-worn Accessory: Belt-Clip (P/N: KAA0400); Audio Accessory: Speaker-Microphone (P/N: KAA0200)

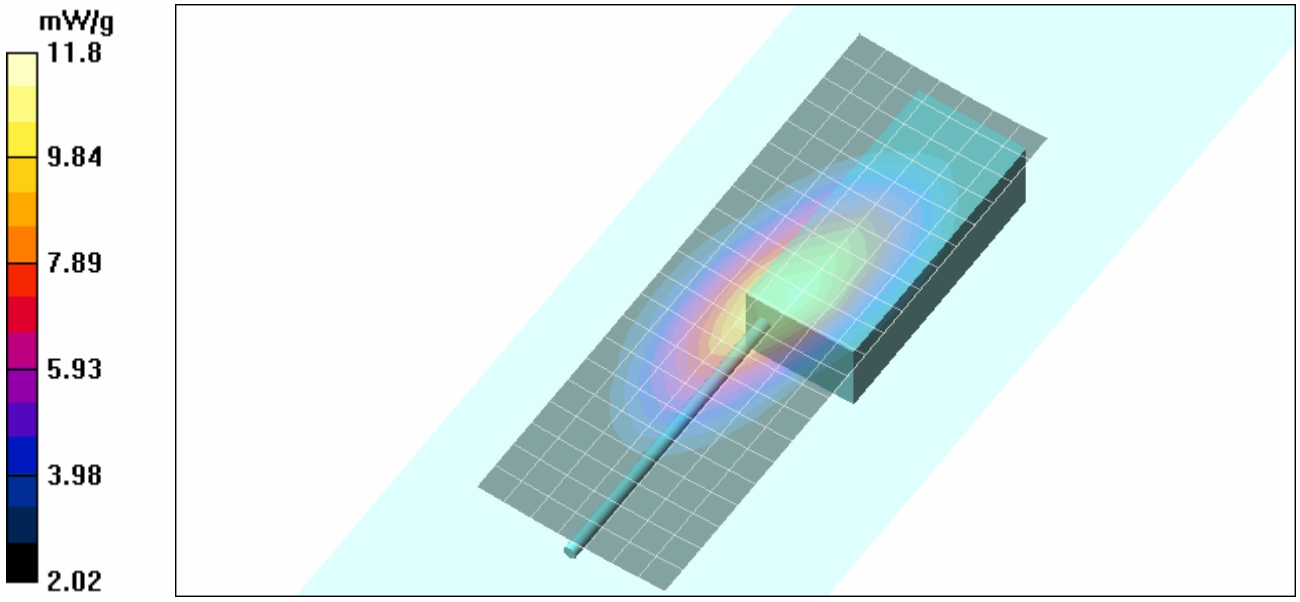
Ambient Temp: 23.5°C; Fluid Temp: 22.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Frequency: 425 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.7 Watts (Conducted)
10.8V 1950mAh Lithium-ion Battery (P/N: KAA0100)
Medium: MSL450 Medium parameters used: f = 450 MHz; σ = 0.93 mho/m; ε_r = 56.7; 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 - Mid Channel
Area Scan (8x22x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 10.9 mW/g

Body-worn SAR - 1.5 cm Belt-Clip Spacing from Back Side of DUT to Planar Phantom - Mid Channel
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 111.2 V/m; Power Drift = -0.219 dB
Peak SAR (extrapolated) = 15.9 W/kg
SAR(1 g) = 11.2 mW/g; SAR(10 g) = 8.25 mW/g
Maximum value of SAR (measured) = 11.8 mW/g



Date Tested: 09/23/2008

Body-worn SAR - High Channel - 470 MHz

DUT: BK Radio Model: KNG-P400; Type: Portable FM UHF PTT Radio Transceiver; Serial: XXXXXXXX

Body-worn Accessory: Belt-Clip (P/N: KAA0400); Audio Accessory: Speaker-Microphone (P/N: KAA0200)

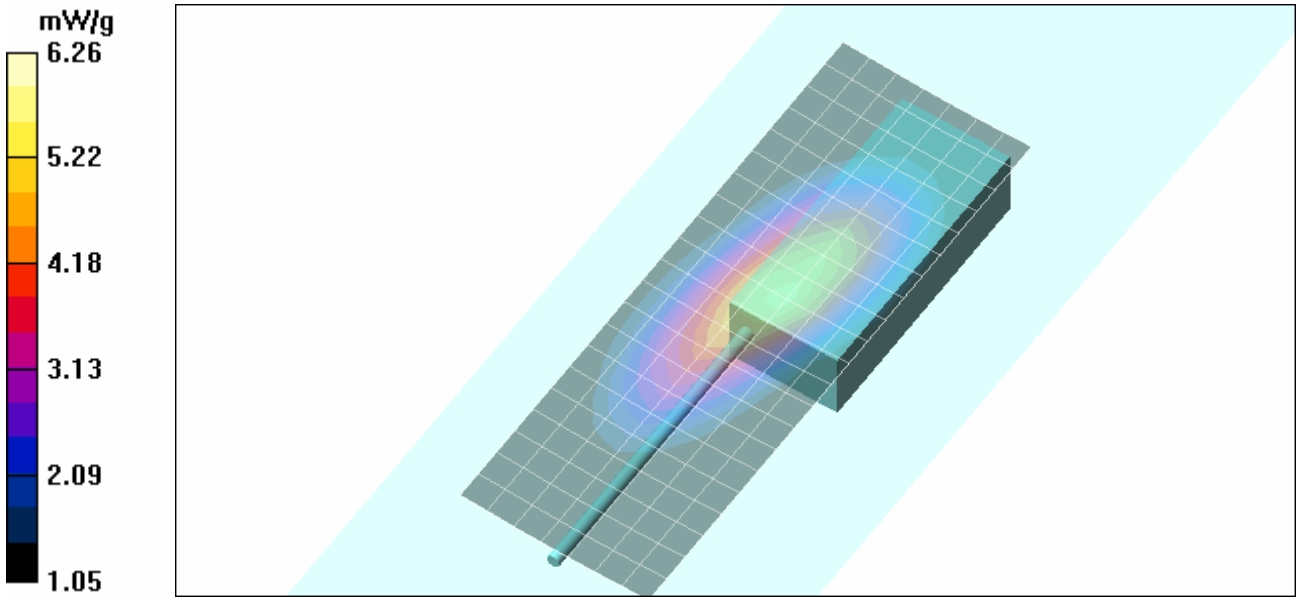
Ambient Temp: 23.5°C; Fluid Temp: 22.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Frequency: 470 MHz; Duty Cycle: 1:1
Communication System: FM UHF (CW)
RF Output Power: 5.7 Watts (Conducted)
10.8V 1950mAh Lithium-ion Battery (P/N: KAA0100)
Medium: MSL450 Medium parameters used: f = 450 MHz; σ = 0.93 mho/m; ε_r = 56.7; 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 - High Channel
Area Scan (8x22x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 5.48 mW/g

Body-worn SAR - 1.5 cm Belt-Clip Spacing from Back Side of DUT to Planar Phantom - High Channel
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 80.3 V/m; Power Drift = -0.166 dB
Peak SAR (extrapolated) = 8.45 W/kg
SAR(1 g) = 5.98 mW/g; SAR(10 g) = 4.38 mW/g
Maximum value of SAR (measured) = 6.26 mW/g



APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 09/23/2008

System Performance Check - 450 MHz Dipole - HSL

DUT: Dipole 450 MHz; Asset: 00024; Serial: 136; Validation: 07/25/2008

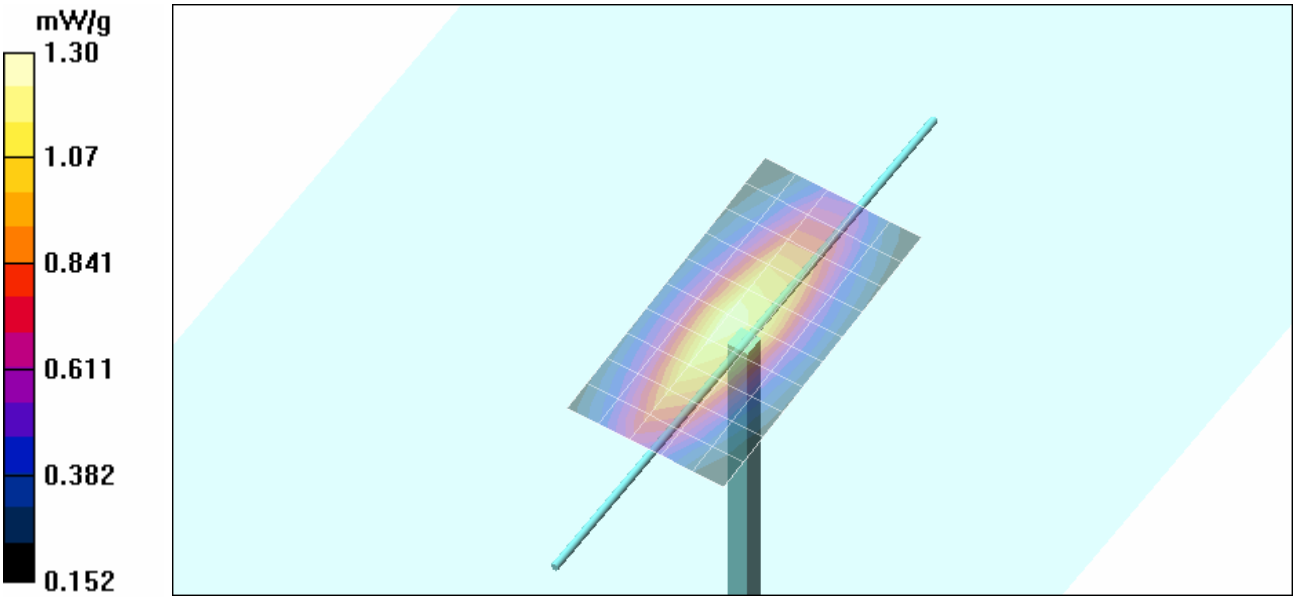
Ambient Temp: 23.8°C; Fluid Temp: 22.8°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

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 = 44.4; ρ = 1000 kg/m^3

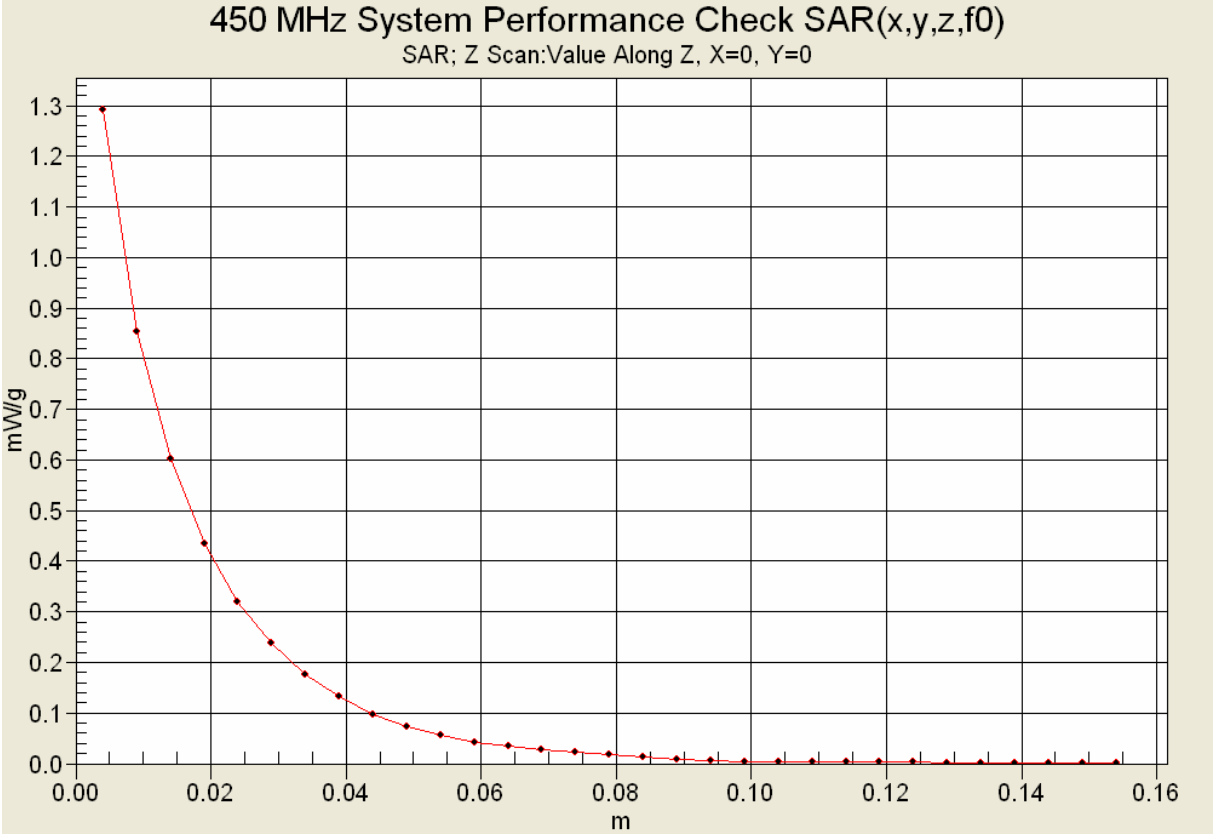
- Probe: ET3DV6 - SN1590; ConvF(7.66, 7.66, 7.66); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Validation Planar; Type: Plexiglas; Serial: TE#137
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

System Performance Check - 450 MHz Dipole
Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.21 mW/g

System Performance Check - 450 MHz Dipole
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 40.0 V/m; Power Drift = -0.032 dB
Peak SAR (extrapolated) = 1.90 W/kg
SAR(1 g) = 1.22 mW/g; SAR(10 g) = 0.812 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 & DUT Evaluation (Brain)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
23/Sep/2008
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	46.60	0.80
0.3600	44.58	0.87	46.30	0.81
0.3700	44.46	0.87	46.15	0.82
0.3800	44.34	0.87	45.58	0.83
0.3900	44.22	0.87	45.68	0.84
0.4000	44.10	0.87	45.59	0.85
0.4100	43.98	0.87	45.08	0.86
0.4200	43.86	0.87	45.01	0.87
0.4300	43.74	0.87	44.61	0.88
0.4400	43.62	0.87	44.72	0.89
0.4500	43.50	0.87	44.41	0.89
0.4600	43.45	0.87	44.13	0.90
0.4700	43.40	0.87	43.97	0.92
0.4800	43.34	0.87	43.69	0.92
0.4900	43.29	0.87	43.55	0.93
0.5000	43.24	0.87	43.27	0.94
0.5100	43.19	0.87	43.08	0.95
0.5200	43.14	0.88	42.89	0.96
0.5300	43.08	0.88	42.67	0.97
0.5400	43.03	0.88	42.63	0.98
0.5500	42.98	0.88	42.38	0.99

450 MHz DUT Evaluation (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
23/Sep/2008
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

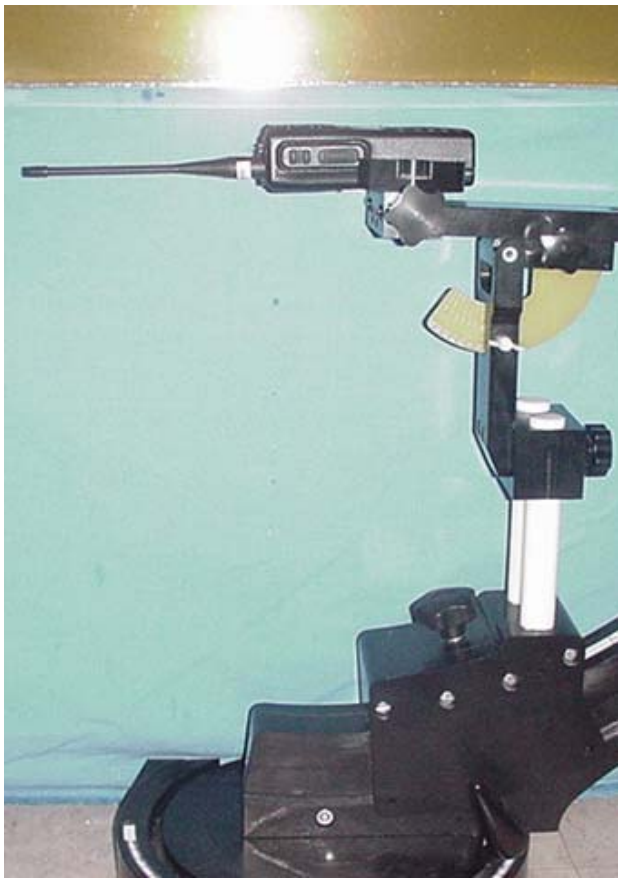
****

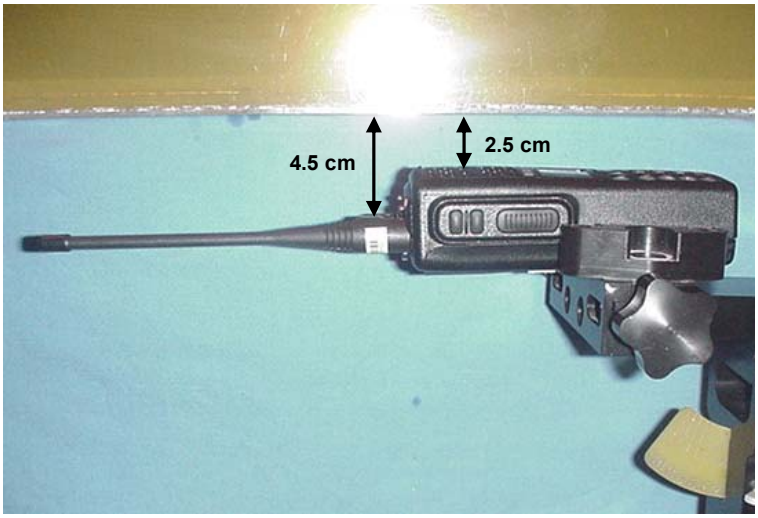
Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.3500	57.70	0.93	58.10	0.86
0.3600	57.60	0.93	58.25	0.87
0.3700	57.50	0.93	57.80	0.88
0.3800	57.40	0.93	57.95	0.88
0.3900	57.30	0.93	57.52	0.89
0.4000	57.20	0.93	57.37	0.90
0.4100	57.10	0.93	57.40	0.91
0.4200	57.00	0.94	57.29	0.92
0.4300	56.90	0.94	57.01	0.92
0.4400	56.80	0.94	56.85	0.93
0.4500	56.70	0.94	56.73	0.93
0.4600	56.66	0.94	56.63	0.94
0.4700	56.62	0.94	56.62	0.95
0.4800	56.58	0.94	56.52	0.96
0.4900	56.54	0.94	56.25	0.96
0.5000	56.51	0.94	56.14	0.98
0.5100	56.47	0.94	56.11	0.98
0.5200	56.43	0.95	55.87	0.99
0.5300	56.39	0.95	55.75	1.00
0.5400	56.35	0.95	55.86	1.00
0.5500	56.31	0.95	55.76	1.02

APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS

FACE-HELD SAR TEST SETUP PHOTOGRAPHS

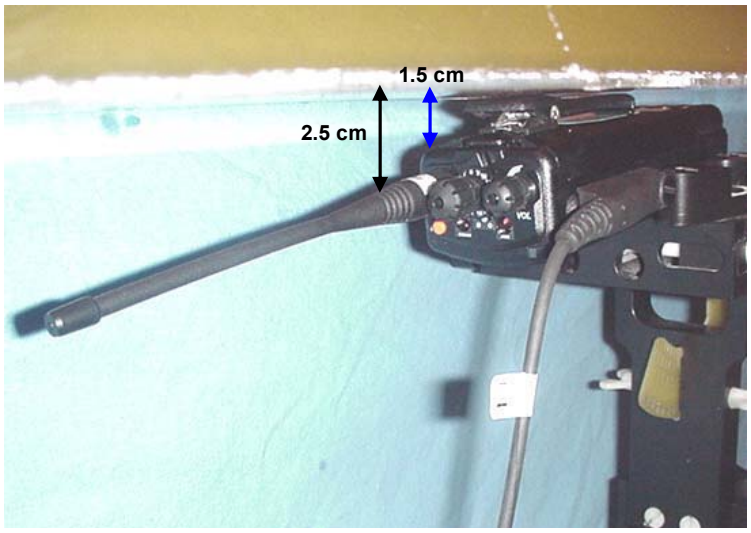
2.5 cm Spacing from Front Side of DUT to Planar Phantom





BODY-WORN SAR TEST SETUP PHOTOGRAPHS

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



DUT PHOTOGRAPHS

DUT with Speaker-Microphone Accessory (P/N: KAA0200)

Front Side of DUT

Back Side of DUT

Back Side with Belt-Clip

Detachable Whip Antenna (P/N: KAA0815)

DUT PHOTOGRAPHS

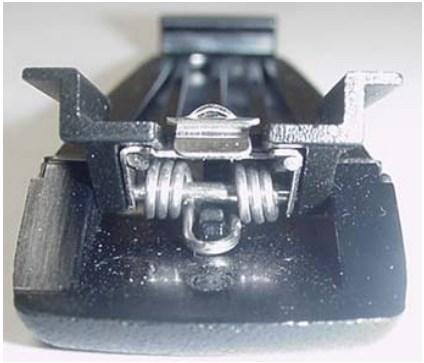
Left Side of DUT with Belt-Clip Accessory (P/N: KAA0400)

Right Side of DUT with Belt-Clip Accessory (P/N: KAA0400)

Belt-Clip (P/N: KAA0400)

Top End of DUT with Belt-Clip

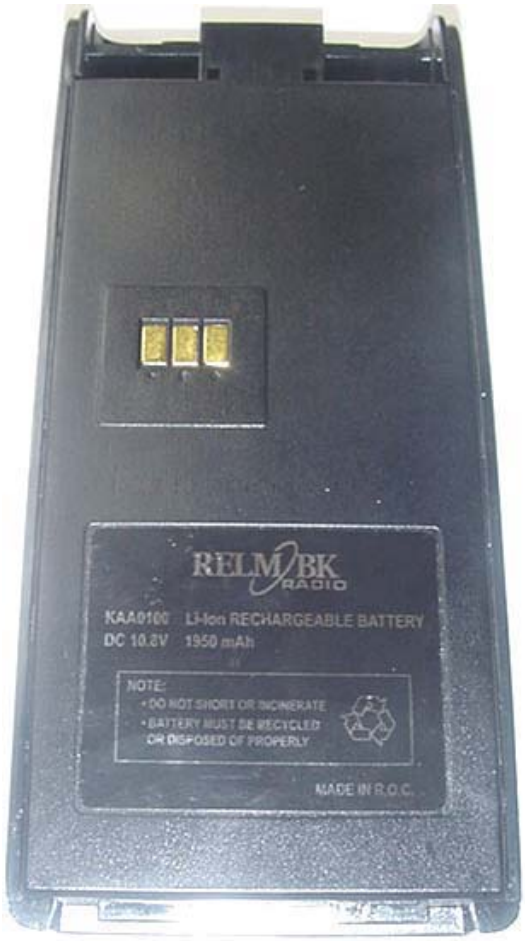
Bottom End of DUT with Belt-Clip



Belt-Clip (P/N: KAA0400)

DUT PHOTOGRAPHS

Back of DUT with Battery Removed



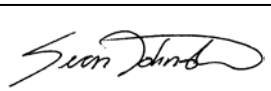
Lithium-ion Rechargeable Battery (P/N: KAA0100)

APPENDIX E - SYSTEM VALIDATION

450 MHz SYSTEM VALIDATION

Type:	**450 MHz Validation Dipole**
Asset Number:	**00024**
Serial Number:	**136**
Place of Validation:	**Celltech Labs Inc.**
Date of Validation:	**July 25, 2008**

Celltech Labs Inc. certifies that the 450 MHz System Validation was performed on the date indicated above.

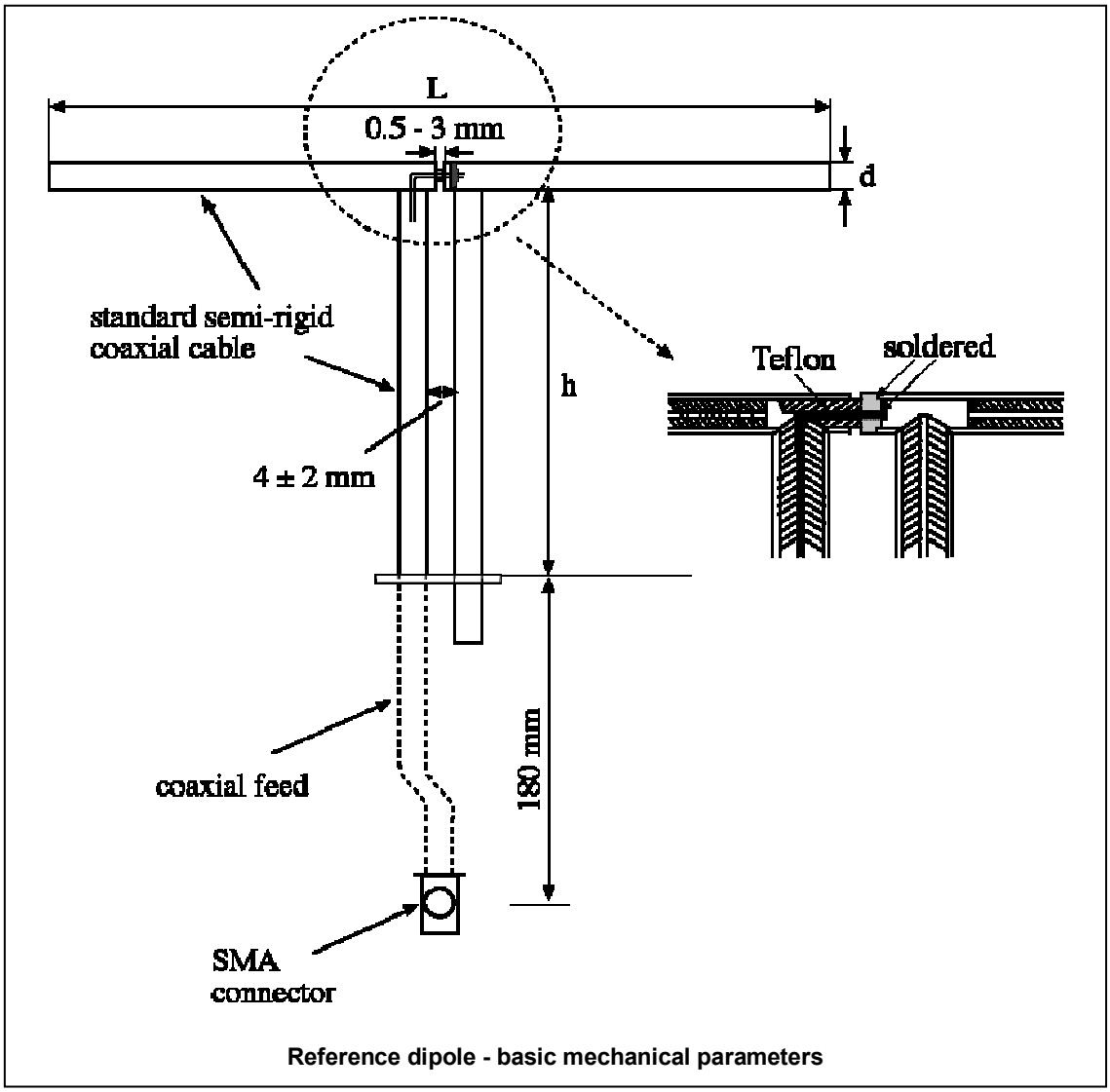
Validated by:	**Sean Johnston**
Signature:	

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

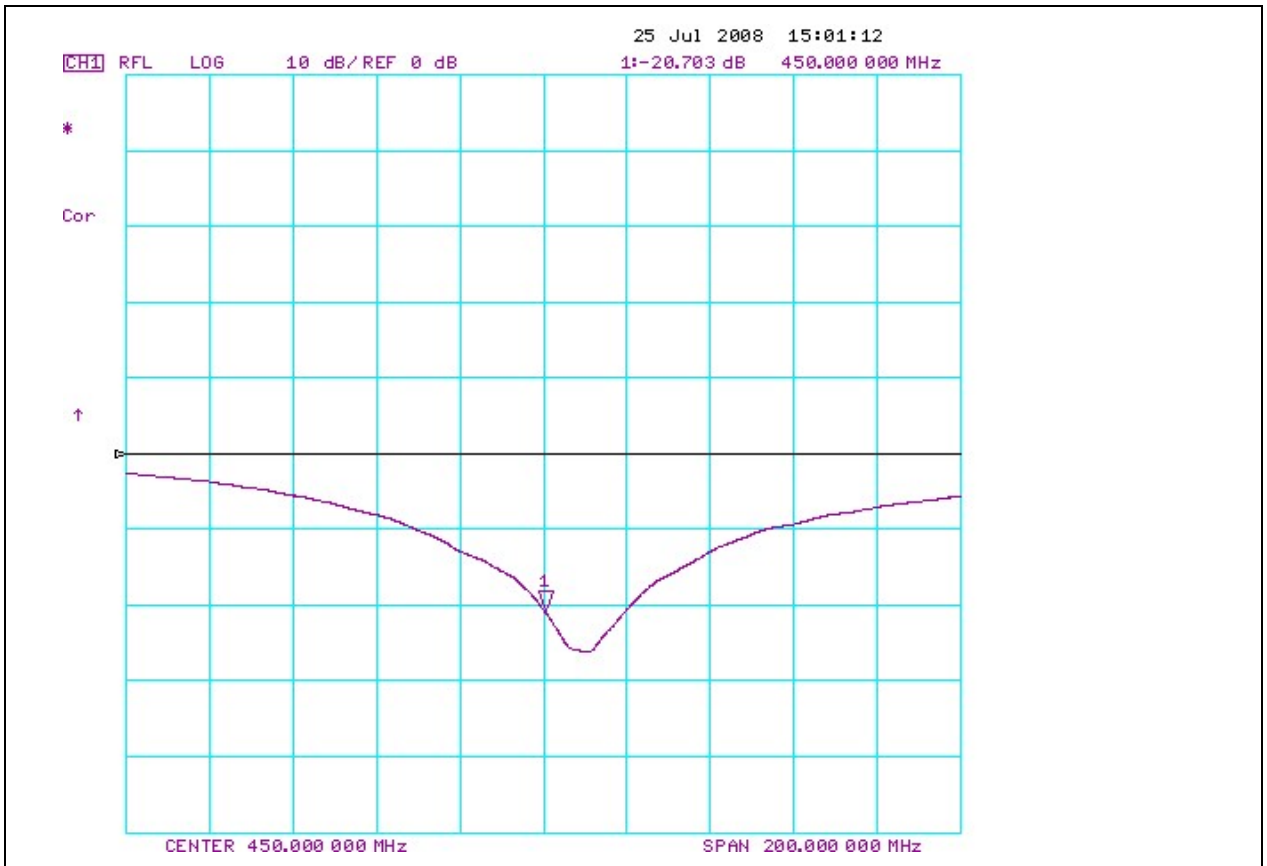
The validation dipole was constructed in accordance with the requirements specified in IEEE Standard 1528-2003 and International Standard IEC 62209-1:2005. The electrical properties were measured using an HP 8753ET Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector feed point using an HP85032E Type N calibration kit. The dipole was placed parallel to a planar phantom at a separation distance of 15.0 mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

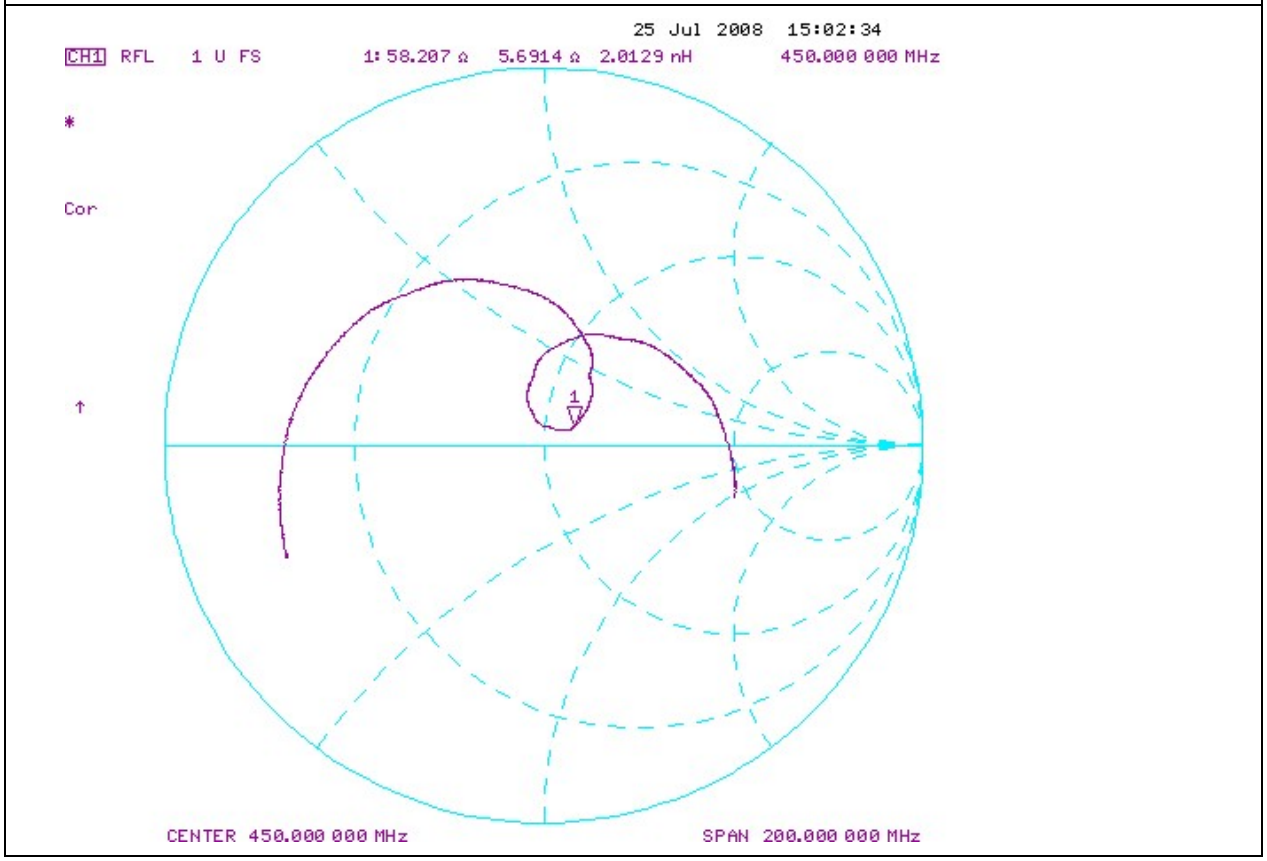
Feed point impedance at 450 MHz	Re{Z} = 58.207 Ω
	Im{Z} = 5.6914 Ω
Return Loss at 450 MHz	-20.703 dB



Reference dipole - basic mechanical parameters

2. Validation Dipole VSWR Data





3. Validation Dipole Dimensions

Frequency (MHz)	L (mm)	h (mm)	d (mm)
300	396.0	250.0	6.0
450	**270.0**	**167.0**	**6.0**
835	161.0	89.8	3.6
900	149.0	83.3	3.6
1450	89.1	51.7	3.6
1800	72.0	41.7	3.6
1900	68.0	39.5	3.6
2000	64.5	37.5	3.6
2450	51.5	30.4	3.6
3000	41.5	25.0	3.6

4. Validation Phantom

The validation phantom (planar) was constructed using relatively low-loss tangent Plexiglas material.

The inner dimensions of the validation phantom are as follows:

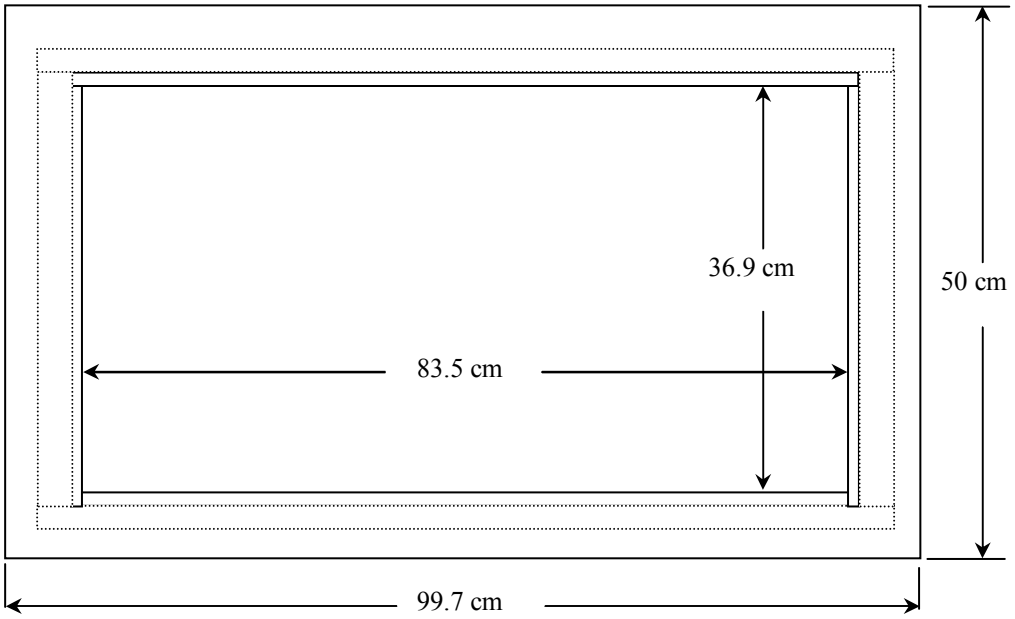
Length: 83.5 cm
Width: 36.9 cm
Height: 21.8 cm

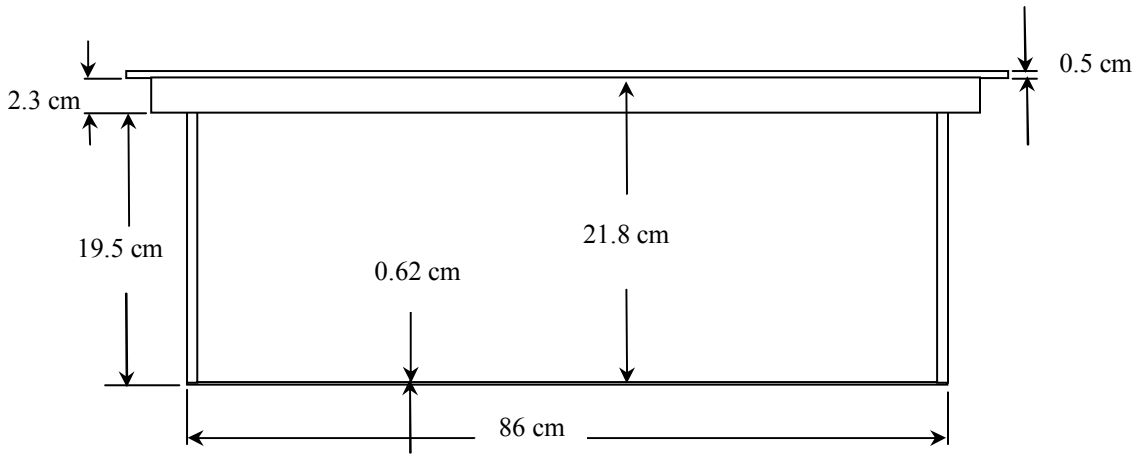
The bottom section of the validation phantom is constructed of 6.2 ± 0.1mm Plexiglas.

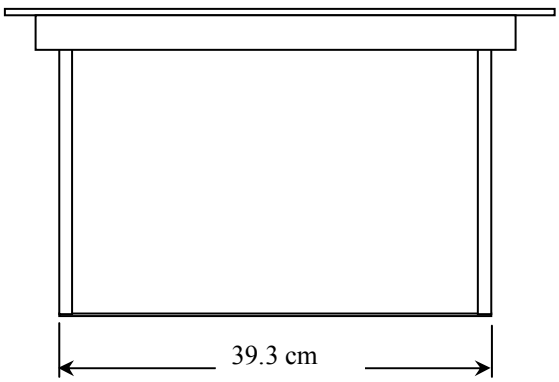
5. Test Equipment List

TEST EQUIPMENT	ASSET NO.	SERIAL NO.	DATE OF CAL.	CAL. DUE DATE
SPEAG DASY4 Measurement Server	00158	1078	N/A	N/A
SPEAG Robot	00046	599396-01	N/A	N/A
SPEAG DAE4	00019	353	22Apr08	22Apr09
SPEAG ET3DV6 E-Field Probe	00017	1590	21Jul08	21Jul09
450 MHz Validation Dipole	00024	136	25Jul08	25Jul09
Plexiglas Validation Planar Phantom	00157	137	N/A	N/A
HP 85070C Dielectric Probe Kit	00033	US39240170	N/A	N/A
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	NCR	NCR
Amplifier Research 5S1G4 Power Amplifier	00106	26235	NCR	NCR

6. Dimensions of Plexiglas Planar Phantom







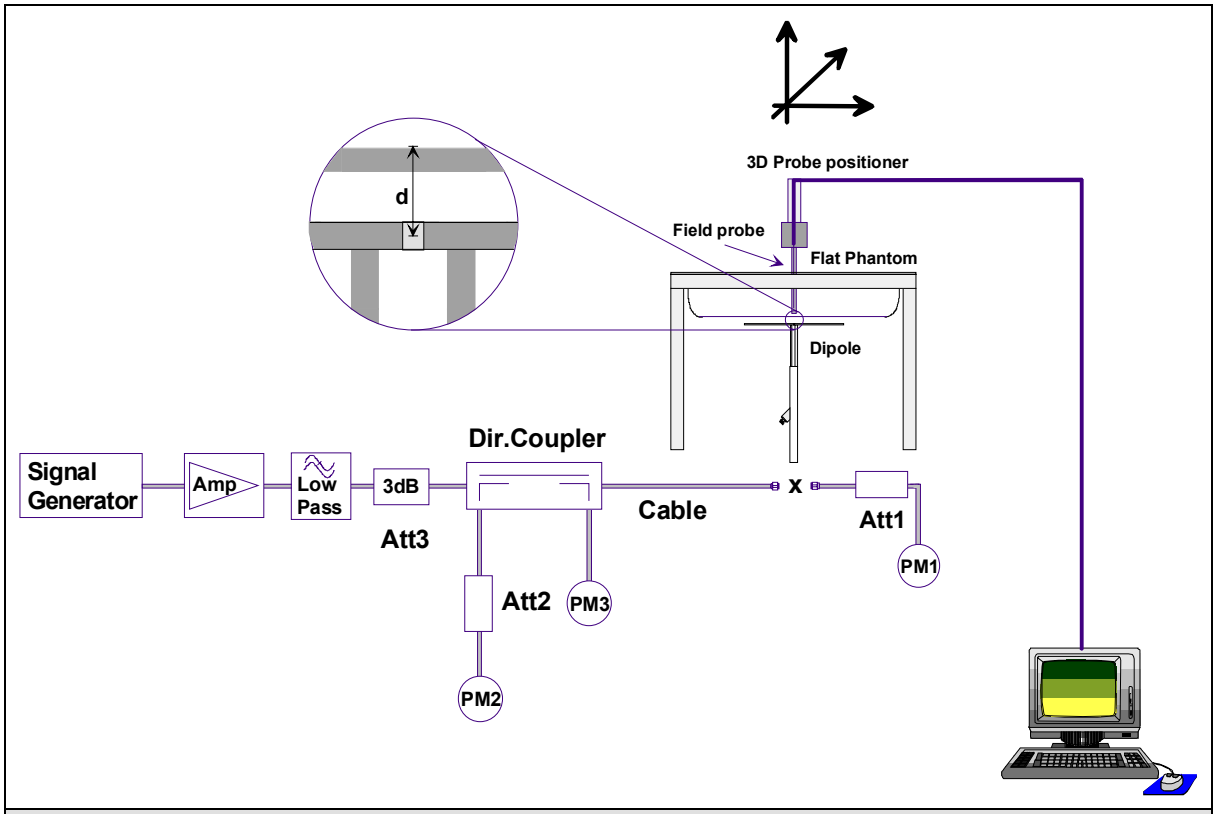
7. 450 MHz System Validation Setup

8. 450 MHz Validation Dipole Setup

9. 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 Validation Measurement Setup Diagram

10. Measurement Conditions

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

Relative Permittivity: 43.4 (-0.2% deviation from target)
Conductivity: 0.89 mho/m (+2.3% deviation from target)
Fluid Temperature: 23.1°C (Start of Test) / 23.2°C (End of Test)
Fluid Depth: ≥ 15.0 cm

Environmental Conditions:
Ambient Temperature: 24.1°C
Barometric Pressure: 100.9 kPa
Humidity: 31%

The 450 MHz Brain 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%)**

11. System Validation SAR Results

SAR @ 0.25W Input averaged over 1g (W/kg)				SAR @ 1W Input averaged over 1g (W/kg)			
IEEE/IEC Target		Measured	Deviation	IEEE/IEC Target		Measured	Deviation
1.23	**+/- 10%**	1.18	-4.0%	**4.92**	**+/- 10%**	4.72	-4.0%
SAR @ 0.25W Input averaged over 10g (W/kg)				**SAR @ 1W Input averaged over 10g (W/kg)**			
IEEE/IEC Target		Measured	Deviation	IEEE/IEC Target		Measured	Deviation
0.825	**+/- 10%**	0.775	-6.1%	**3.30**	**+/- 10%**	3.10	-6.1%

Frequency (MHz)	1 g SAR	10 g SAR	Local SAR at surface (above feed-point)	Local SAR at surface (y = 2 cm offset from feed-point)[a]
300	3.0	2.0	4.4	2.1
450	4.9	3.3	7.2	3.2
835	9.5	6.2	4.1	4.9
900	10.8	6.9	16.4	5.4
1450	29.0	16.0	50.2	6.5
1800	38.1	19.8	69.5	6.8
1900	39.7	20.5	72.1	6.6
2000	41.1	21.1	74.6	6.5
2450	52.4	24.0	104.2	7.7
3000	63.8	25.7	140.2	9.5

Numerical reference SAR values for reference dipole and flat phantom normalized to 1 W (IEEE 1528-2003; IEC 62209-1:2005)

Date Tested: 07/25/2008

System Validation - 450 MHz Dipole - HSL

DUT: Dipole 450 MHz; Asset: 00024; Serial: 136; Validation: 07/25/2008

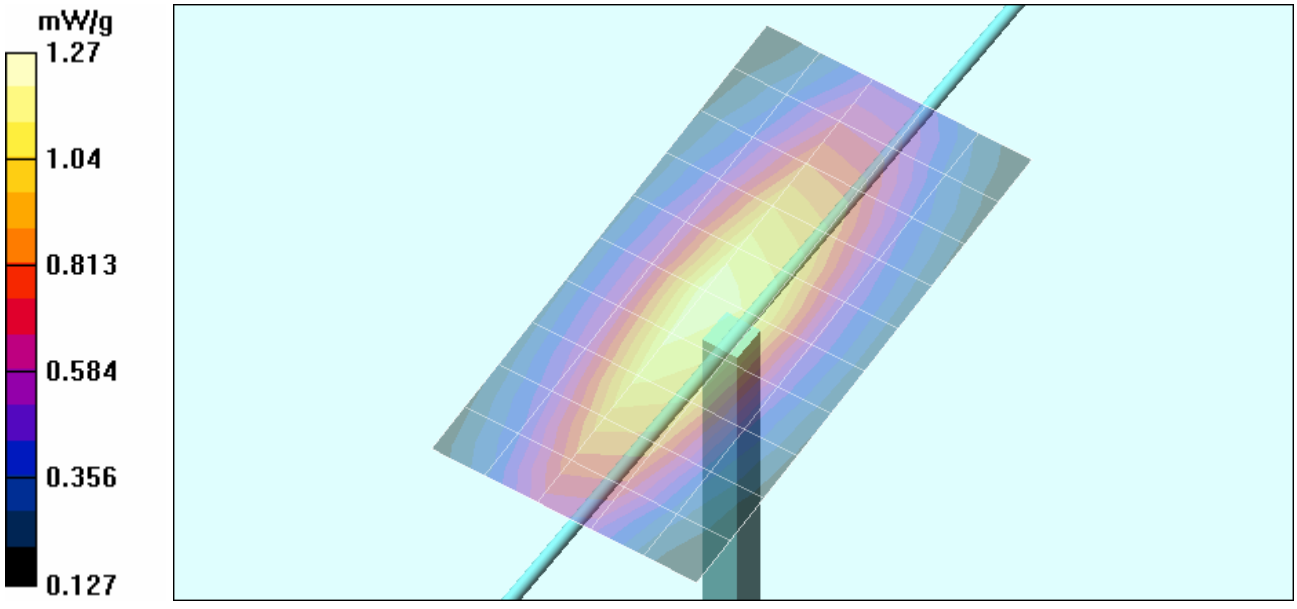
Ambient Temp: 24.1°C; Fluid Temp: 23.1°C; Barometric Pressure: 100.9 kPa; Humidity: 31%

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 = 43.4; ρ = 1000 kg/m^3

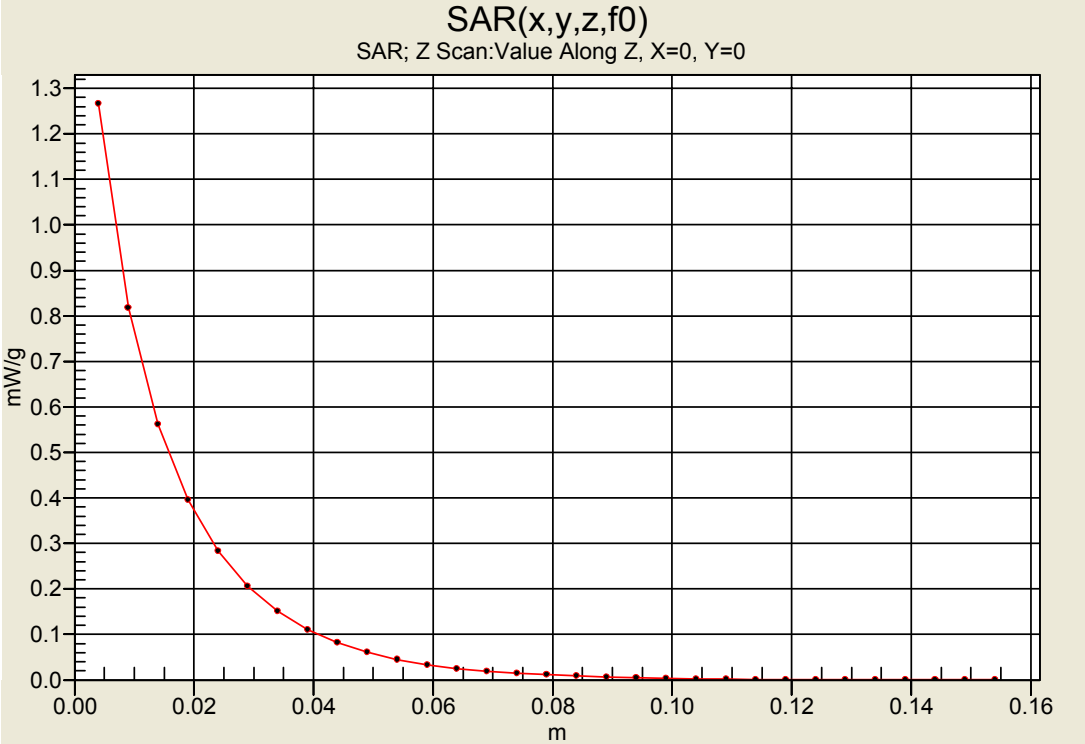
- Probe: ET3DV6 - SN1590; ConvF(7.66, 7.66, 7.66); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Validation Planar; Type: Plexiglas; Serial: TE#137
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

450 MHz Dipole - System Validation
Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.18 mW/g

450 MHz Dipole - System Validation
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 38.3 V/m; Power Drift = 0.000 dB
Peak SAR (extrapolated) = 1.88 W/kg
SAR(1 g) = 1.18 mW/g; SAR(10 g) = 0.775 mW/g
Maximum value of SAR (measured) = 1.27 mW/g



Z-Axis Scan



12. Measured Fluid Dielectric Parameters

System Validation - 450 MHz (Brain)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Fri 25/Jul/2008
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	IEEE_eH	IEEE_sH	Test_e	Test_s
0.3500	44.70	0.87	46.31	0.80
0.3600	44.58	0.87	45.65	0.82
0.3700	44.46	0.87	45.27	0.82
0.3800	44.34	0.87	45.47	0.83
0.3900	44.22	0.87	44.76	0.84
0.4000	44.10	0.87	44.57	0.87
0.4100	43.98	0.87	44.63	0.86
0.4200	43.86	0.87	44.66	0.86
0.4300	43.74	0.87	43.79	0.89
0.4400	43.62	0.87	43.68	0.87
0.4500	43.50	0.87	43.44	0.89
0.4600	43.45	0.87	43.27	0.90
0.4700	43.40	0.87	43.17	0.90
0.4800	43.34	0.87	43.66	0.91
0.4900	43.29	0.87	42.68	0.92
0.5000	43.24	0.87	42.39	0.95
0.5100	43.19	0.87	42.24	0.94
0.5200	43.14	0.88	41.96	0.95
0.5300	43.08	0.88	42.42	0.95
0.5400	43.03	0.88	41.99	0.97
0.5500	42.98	0.88	41.92	0.98

13. Measurement Uncertainties

UNCERTAINTY BUDGET FOR SYSTEM VALIDATION						
Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**ci 1g**	**Uncertainty Value ±% (1g)**	**V_i or V_{eff}**
Measurement System						
Probe calibration (450 MHz)	6.65	Normal	1	1	6.65	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	1	2.7	∞
Spherical isotropy of the probe	0	Rectangular	1.732050808	1	0.0	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	0.8	Rectangular	1.732050808	1	0.5	∞
Probe linearity	4.7	Rectangular	1.732050808	1	2.7	∞
Detection limit	1	Rectangular	1.732050808	1	0.6	∞
Readout electronics	0.3	Normal	1	1	0.3	∞
Response time	0	Rectangular	1.732050808	1	0.0	∞
Integration time	0	Rectangular	1.732050808	1	0.0	∞
RF ambient conditions	3	Rectangular	1.732050808	1	1.7	∞
Mech. constraints of robot	0.4	Rectangular	1.732050808	1	0.2	∞
Probe positioning	2.9	Rectangular	1.732050808	1	1.7	∞
Extrapolation & integration	1	Rectangular	1.732050808	1	0.6	∞
Dipole						
Dipole Positioning	2	Normal	1.732050808	1	1.2	∞
Power & Power Drift	4.7	Normal	1.732050808	1	2.7	∞
Phantom and Setup						
Phantom uncertainty	4	Rectangular	1.732050808	1	2.3	∞
Liquid conductivity (target)	5	Rectangular	1.732050808	0.64	1.8	∞
Liquid conductivity (measured)	2.3	Normal	1	0.64	1.5	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	0.2	Normal	1	0.6	0.1	∞
Combined Standard Uncertainty					**9.40**	
Expanded Uncertainty (k=2)					**18.80**	
Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 and IEC 62209-1:2005						

APPENDIX F - PROBE CALIBRATION

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

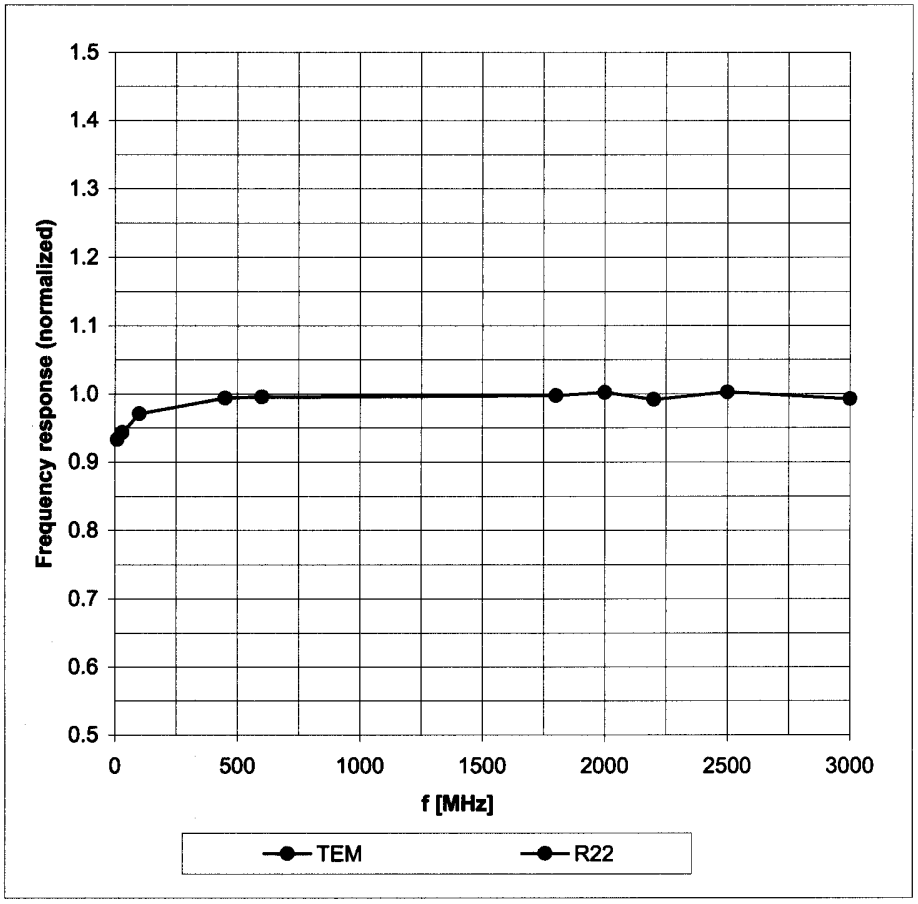
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[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.

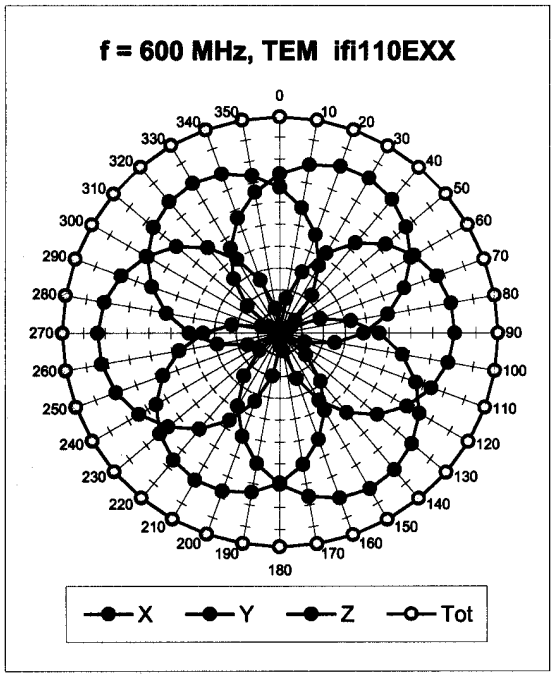
Frequency Response of E-Field

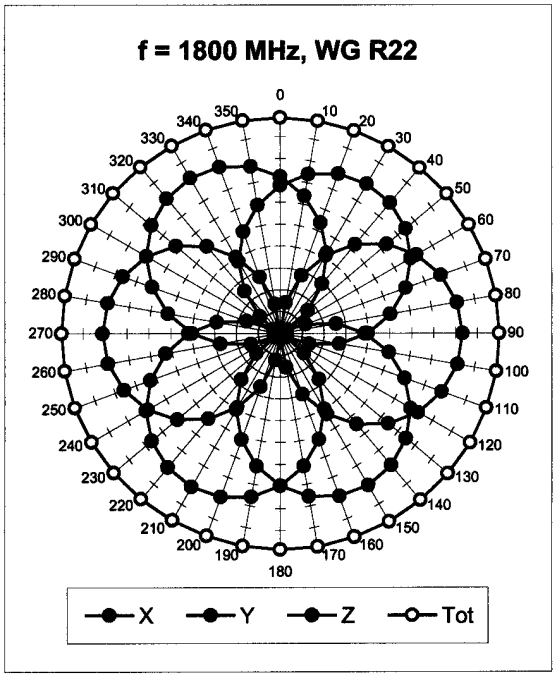
(TEM-Cell:ifi110 EXX, Waveguide: R22)

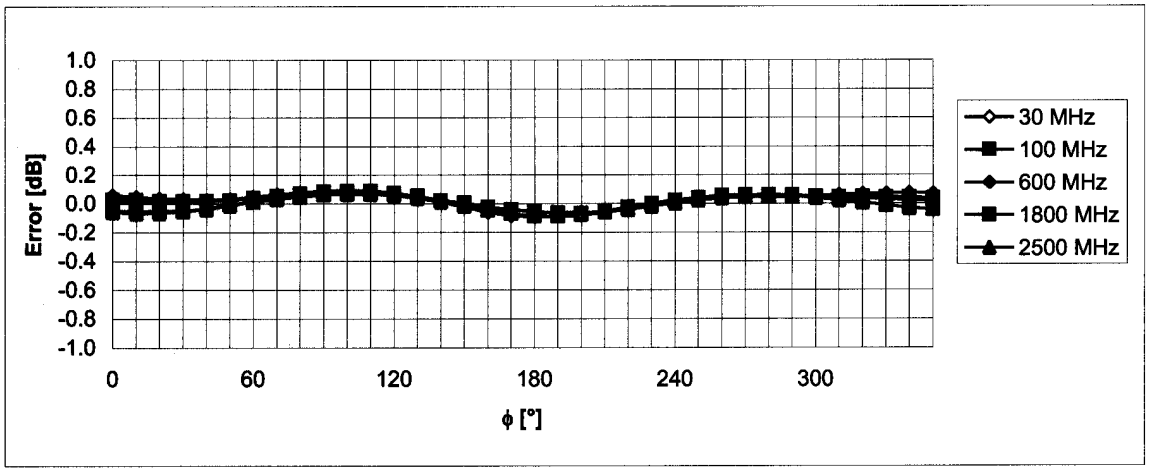


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



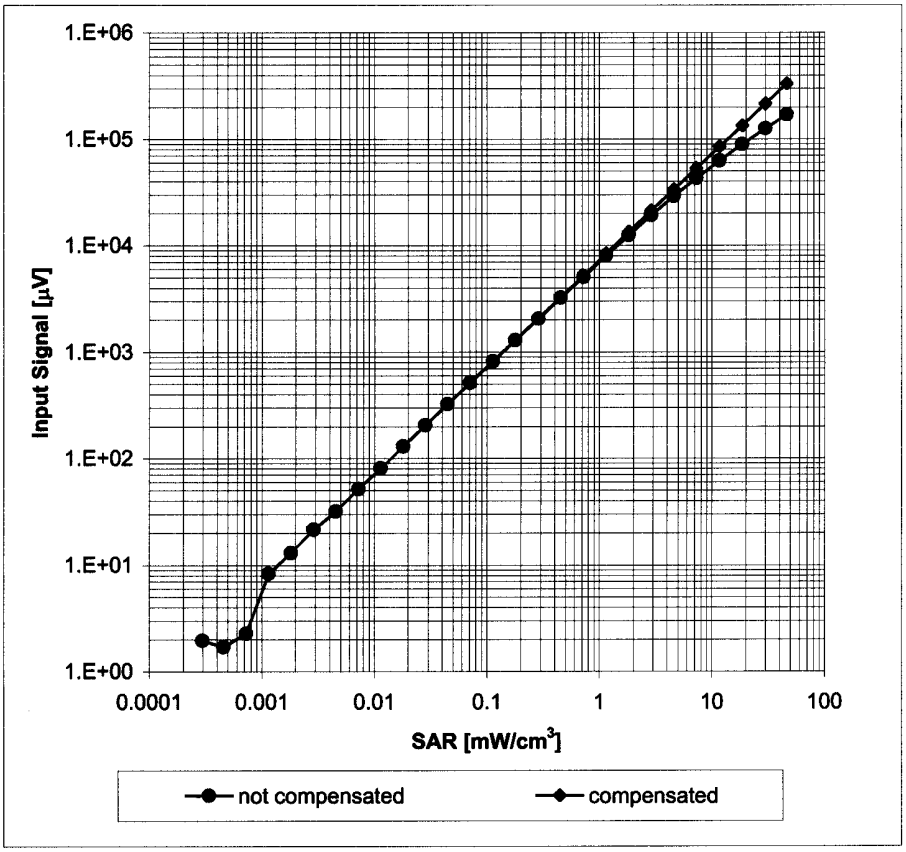


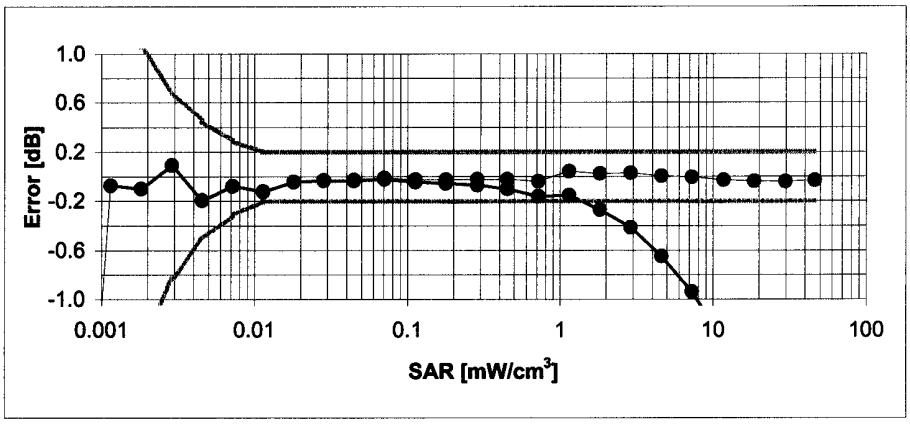


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

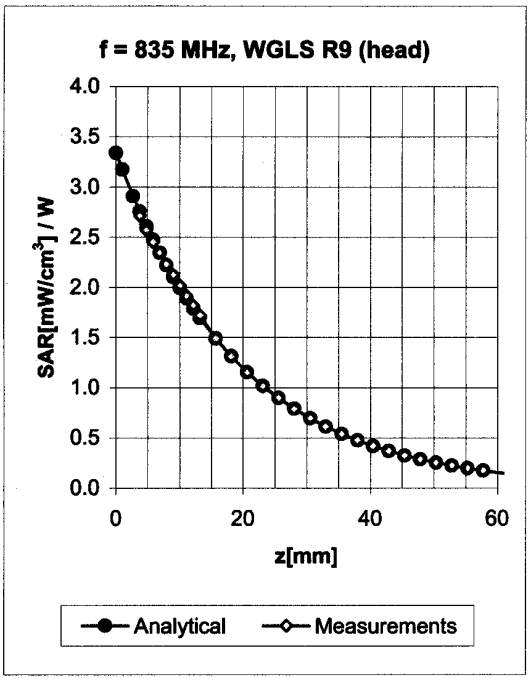
(Waveguide R22, f = 1800 MHz)

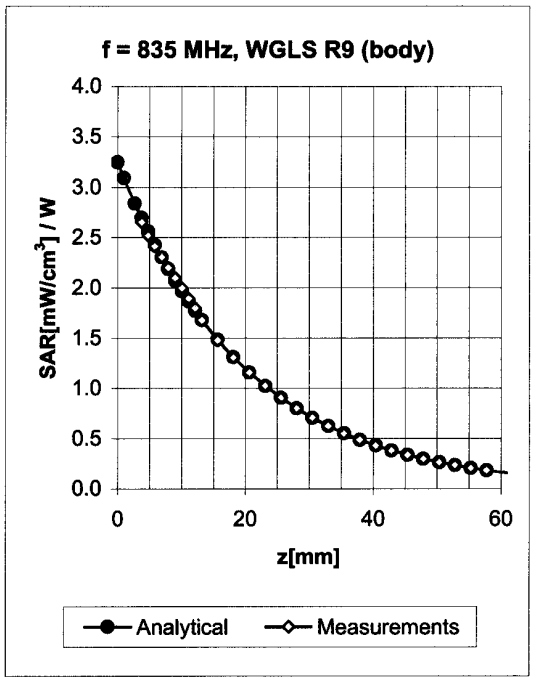




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



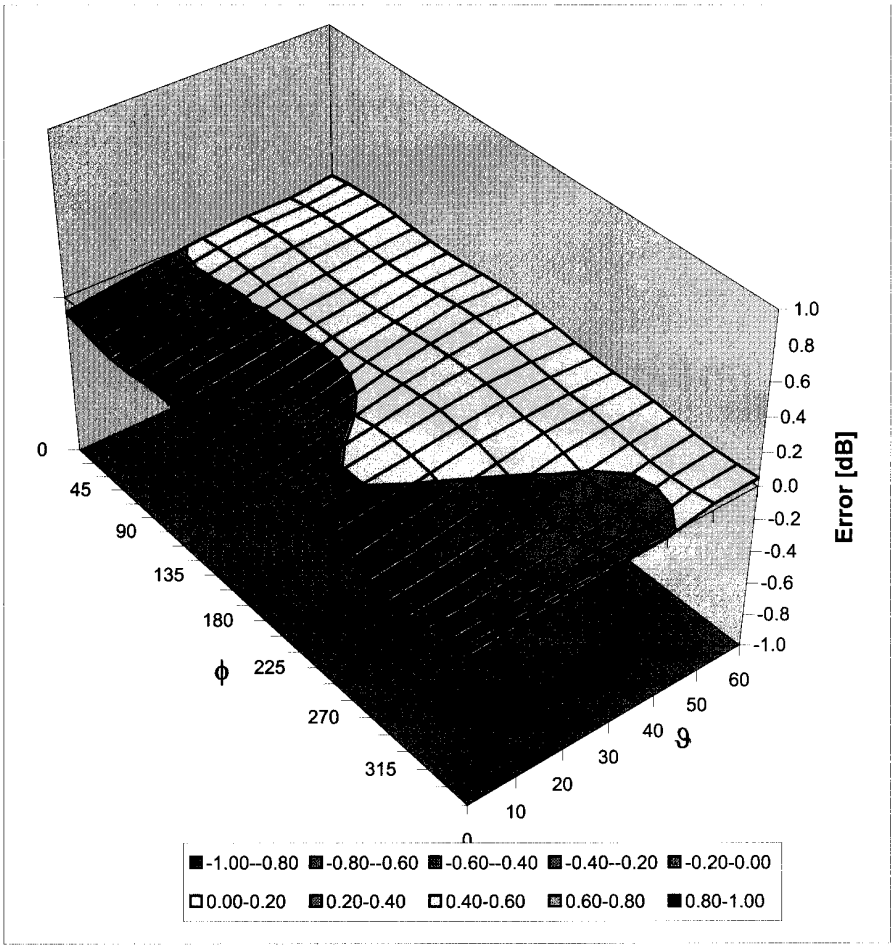


f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty	
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.34	1.75	7.66	± 13.3% (k=2)
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.32	3.52	6.54	± 11.0% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.28	1.77	8.27	± 13.3% (k=2)
835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