
 Testing and Engineering Services Ltd	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	 Certificate No. 2470.01
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

## RF EXPOSURE EVALUATION

## SPECIFIC ABSORPTION RATE

## **SAR TEST REPORT**

FOR

## **COBRA ELECTRONICS CORPORATION**

## **PORTABLE UHF FRS/GMRS PTT RADIO TRANSCEIVER**

**MODEL(S): PR4100 / PR4500**

<b>IDENTIFIER(S)</b>	<b>FCC ID: BBOPR4100</b>	<b>IC: 906B-PR4100</b>
<b>Test Standard(s) and Procedure(s)</b>	<b>FCC OET Bulletin 65, Supplement C (01-01)</b>	
	<b>Industry Canada RSS-102 Issue 2</b>	

### Test Report Serial No.

101206BBO-T781-S95U

### Test Report Revision No.

Revision 1.0 (Initial Release)

### Test Lab and Location



Celltech Compliance Testing & Engineering Lab  
(Celltech Labs Inc.)  
1955 Moss Court  
Kelowna, BC  
Canada  
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Certificate No. 2470.01

<u>Test Report Prepared By:</u> <b>Cheri Frangiadakis</b> Test Report Writer Celltech Labs Inc.	<u>Test Report Reviewed By:</u> <b>Jonathan Hughes</b> General Manager Celltech Labs Inc.
--	--

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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Certificate No. 2470.01				

## DECLARATION OF COMPLIANCE SAR RF EXPOSURE EVALUATION

### Test Lab and Location

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### Company Information

#### **COBRA ELECTRONICS CORPORATION**

6500 West Cortland Street  
Chicago, IL 60707  
United States

#### **FCC IDENTIFIER:**

**BBOPR4100**

#### **IC IDENTIFIER:**

**906B-PR4100**

#### **Model(s):**

**PR4100 / PR4500**

#### **Test Requirement(s):**

**FCC 47 CFR §2.1093; Health Canada Safety Code 6**

#### **Test Procedure(s):**

**FCC OET Bulletin 65, Supplement C (Edition 01-01)  
Industry Canada RSS-102 Issue 2**

#### **Device Description:**

**Portable UHF FRS/GMRS PTT Radio Transceiver**

#### **Modulation Type:**

**FM (UHF)**

#### **Transmit Frequency Range(s):**

**462.5500 - 462.7250 MHz (GMRS Channels 15-22)  
462.5625 - 462.7125 MHz (FRS/GMRS Channels 1-7)  
467.5625 - 467.7125 MHz (FRS Channels 8-14)**

#### **Max. RF Output Power Tested:**

**0.741 Watts (28.7 dBm) ERP (462.7250 MHz) GMRS Ch. 22**

#### **Antenna Type(s) Tested:**

**External Fixed Stubby**

#### **Battery Type(s) Tested:**

**NiMH AAA x4 (1.2 V, 600 mAh)  
Alkaline Duracell Procell AAA x4 (1.5 V, 1150 mAh)**

#### **Body-Worn Accessories Tested:**

**Plastic Belt-Clip (7 mm thickness)**

#### **Audio Accessories Tested:**

**Earbud with Lapel-Microphone (P/N: GA-EBM2)**

#### **Max. SAR Level(s) Evaluated:**

**Face-held: 0.288 W/kg (1g) - 50% duty cycle  
Body-worn: 1.05 W/kg (1g) - 50% duty cycle**

Celltech Labs Inc. declares under its sole responsibility that this wireless portable device has demonstrated compliance with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC 47 CFR §2.1093 and Health Canada's Safety Code 6. The device was tested in accordance with the measurement standards and procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01) and Industry Canada RSS-102 Issue 2 for the General Population / Uncontrolled Exposure environment. All measurements were performed in accordance with the SAR system manufacturer recommendations.

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



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

### Test Report Approved By:

**Sean Johnston**  
**SAR Lab Manager**  
**Celltech Labs Inc.**






Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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## 1.0 INTRODUCTION

This measurement report demonstrates compliance of the Cobra Electronics Corporation Model(s): PR4100 / PR4500 Portable UHF FRS/GMRS PTT Radio Transceiver FCC ID: BBOPR4100 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 General Population / Uncontrolled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C (Edition 01-01) (see reference [3]) and IC RSS-102 Issue 2 (see reference [4]) were employed. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the provisions of the rules are included within this test report.

## 2.0 DESCRIPTION OF DEVICE UNDER TEST (DUT)

Test Requirement(s)	FCC Rule Part 47 CFR §2.1093					
	Health Canada Safety Code 6					
Test Procedure(s)	FCC OET Bulletin 65, Supplement C (01-01)					
	Industry Canada RSS-102 Issue 2					
Device Description	Portable FM UHF FRS/GMRS PTT Radio Transceiver					
RF Exposure Category	General Population / Uncontrolled Environment					
FCC IDENTIFIER	BBOPR4100					
IC IDENTIFIER	906B-PR4100					
Model(s)	PR4100 / PR4500					
Test Sample Serial No.	S610000001			Production Unit		
Modulation Type	FM (UHF)					
Transmit Frequency Range(s)	462.5500 - 462.7250 MHz			GMRS Channels 15-22		
	462.5625 - 462.7125 MHz			FRS/GMRS Channels 1-7		
	467.5625 - 467.7125 MHz			FRS Channels 8-14		
Max. RF Output Power Tested	0.741 Watts	28.7 dBm	ERP	462.7250 MHz	Channel 22	
Antenna Type(s) Tested	External Fixed Stubby					
Battery Type(s) Tested	NiMH AAA (x4)			1.2 V, 600 mAh		
	Alkaline AAA (x4)		1.5 V, 1150 mAh		Duracell Procell	
Body-Worn Accessories Tested	Plastic Belt-Clip (7 mm thickness)			P/N: n/a		
Audio Accessories Tested	Earbud with Lapel-Microphone			P/N: GA-EBM2		

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
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### 3.0 SAR MEASUREMENT SYSTEM


Celltech Labs Inc. SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY4 measurement system is comprised of the measurement server, robot controller, computer, near-field probe, probe alignment sensor, specific anthropomorphic mannequin (SAM) phantom, and various planar phantoms for brain and/or body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the DASY4 measurement server. The DAE4 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the DASY4 measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.





DASY4 SAR Measurement System with Plexiglas validation phantom



DASY4 SAR Measurement System with Plexiglas side planar phantom

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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## 4.0 MEASUREMENT SUMMARY

SAR EVALUATION RESULTS													
Test Type	Freq.	Channel		Test Mode	Battery Type	Accessory Type(s)	DUT Separation Distance to Planar Phantom	Start Power (ERP)	Measured SAR 1g (W/kg)		SAR Drift During Test	Scaled SAR with droop 1g (W/kg)	
	Body-Worn					Duty Cycle			Duty Cycle				
	MHz					Audio		Watts	100%	50%	dB	100%	50%
Face	462.7250	22	GMRS	CW	NiMH	--	2.5 cm	0.741	0.426	0.213	-0.0492	0.431	0.215
						Front Side							
Face	462.7250	22	GMRS	CW	Alkaline	--	2.5 cm	0.741	0.545	0.273	-0.246	0.577	0.288
						Front Side							
Body	462.7250	22	GMRS	CW	NiMH	Belt-Clip	0.7 cm	0.741	1.75	0.875	-0.756	2.08	1.04
						Ear-Bud	Back Side						
Body	462.7250	22	GMRS	CW	Alkaline	Belt-Clip	0.7 cm	0.741	1.68	0.840	-0.962	2.10	1.05
						Ear-Bud	Back Side						
ANSI / IEEE C95.1 1999 - SAFETY LIMIT				BRAIN / BODY: 1.6 W/kg (averaged over 1 gram)				Spatial Peak Uncontrolled Exposure / General Population					
Test Date(s)		October 17, 2006			October 17, 2006			Measured Fluid Type		Brain	Body	Unit	
Dielectric Constant $\epsilon_r$		450 MHz Brain			450 MHz Body			Atmospheric Pressure		99.8	101.3	kPa	
		IEEE Target	Meas.	Dev.	IEEE Target	Meas.	Dev.	Relative Humidity		32	33	%	
		43.5	± 5%	42.8	-1.6%	56.7	± 5%	56.2	-0.9%	Ambient Temperature		24.0	24.0
Conductivity $\sigma$ (mho/m)		450 MHz Brain			450 MHz Body			Fluid Temperature		22.9	21.7	°C	
		IEEE Target	Meas.	Dev.	IEEE Target	Meas.	Dev.	Fluid Depth		≥ 15	≥ 15	cm	
		0.87	± 5%	0.83	-4.6%	0.94	± 5%	0.90	-4.3%	$\rho$ (Kg/m <sup>3</sup> )		1000	
Note(s)		1.	The measurement results were obtained with the DUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.										
		2.	The transmission band of the DUT is less than 10 MHz; therefore single channel data only is reported (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).										
		3.	The area scan evaluation was performed with fully charged batteries. After the area scan was completed the radio was cooled down and the batteries were replaced with fully charged batteries prior to the zoom scan evaluation.										
		4.	The power droops measured by the DASY4 system for the duration of the SAR evaluations were added to the measured SAR levels to report scaled SAR results as shown in the above test data table.										
		5.	A SAR-versus-Time power droop evaluation was performed in the test configuration that reported the maximum SAR level. See Appendix A (SAR Test Plots) for SAR-versus-Time power droop evaluation plot.										
		6.	The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluations. The temperatures reported were consistent for all measurement periods.										
		7.	The dielectric parameters of the simulated tissue mixtures were measured prior to the SAR evaluations using an ALS-PR-DIEL Dielectric Probe Kit and an HP 8753ET Network Analyzer (see Appendix C).										
		8.	The SAR evaluations were performed within 24 hours of the system performance check.										

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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## 5.0 DETAILS OF SAR EVALUATION



The Cobra Electronics Corporation Model(s): PR4100 / PR4500 Portable FM UHF FRS/GMRS PTT Radio Transceiver FCC ID: BBOPR4100 was compliant for localized Specific Absorption Rate (General Population / Uncontrolled Exposure) based on the test provisions and conditions described below. The detailed test setup photographs are shown in Appendix D.

1. The DUT was evaluated in a face-held configuration with the front of the radio placed parallel to the outer surface of the planar phantom. A 2.5 cm separation distance was maintained between the front of the DUT and the outer surface of the planar phantom.
2. The DUT was tested in a body-worn configuration with the back of the radio placed parallel to the outer surface of the planar phantom. The attached plastic belt-clip accessory was touching the planar phantom and provided a 0.7 cm separation distance from the back of the DUT to the outer surface of the planar phantom. The DUT was evaluated for body-worn SAR with an earbud lapel-microphone audio accessory connected to the audio port.
3. The RF conducted output power of the DUT could not be measured due to a non-detachable antenna. The DUT was evaluated for SAR at the maximum conducted power level preset by the manufacturer.
4. The DUT was evaluated for SAR at the maximum ERP channel measured prior to the SAR evaluations by Timco Engineering (radiated power measurements using the signal substitution method).
5. The power drift of the DUT during the SAR evaluations was measured by the DASY4 system.
6. 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.
7. The DUT was tested in unmodulated continuous transmit operation (Continuous Wave mode at 100% duty cycle) with the transmit key constantly depressed. For a push-to-talk device the 50% duty cycle compensation reported assumes a transmit/receive cycle of equal time base.
8. The SAR evaluations were performed using a Plexiglas side-planar phantom.

## 6.0 EVALUATION PROCEDURES

- (i) The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For devices held to the ear during normal operation, both the left and right ear positions were evaluated using the SAM phantom.  
(ii) For body-worn and face-held devices a planar phantom was used.
- The SAR was determined by a pre-defined procedure within the DASY4 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 15mm x 15mm.  
An area scan was determined as follows:
- Based on the defined area scan grid, a more detailed grid is created to increase the points by a factor of 10. The interpolation function then evaluates all field values between corresponding measurement points.
- A linear search is applied to find all the candidate maxima. Subsequently, all maxima are removed that are >2 dB from the global maximum. The remaining maxima are then used to position the cube scans.  
A 1g and 10g spatial peak SAR was determined as follows:
- Extrapolation is used to find the points between the dipole center of the probe and the surface of the phantom. This data cannot be measured, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.4 mm (see probe calibration document in Appendix F). The extrapolation was based on trivariate quadratics computed from the previously calculated 3D interpolated points nearest the phantom surface.
- Interpolated data is used to calculate the average SAR over 1g and 10g cubes by spatially discretizing the entire measured cube. The volume used to determine the averaged SAR is a 1mm grid (42875 interpolated points).
- 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.

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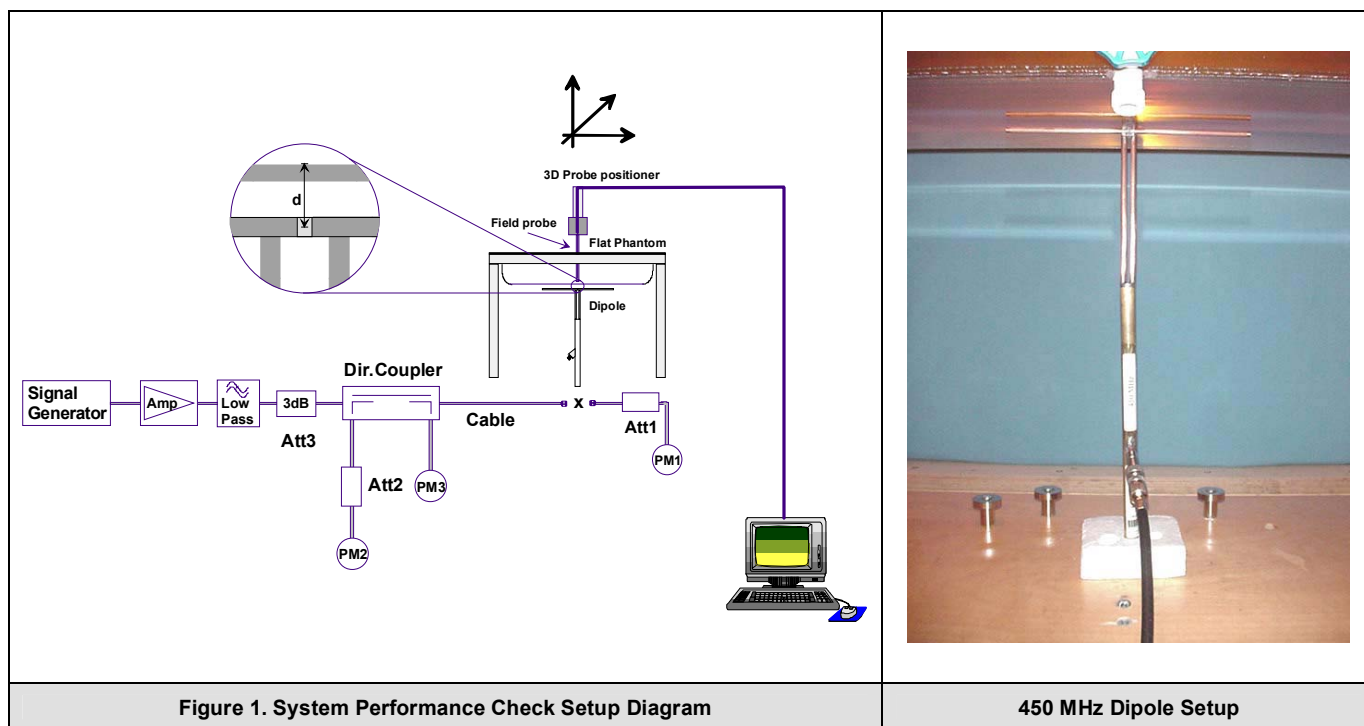
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## 7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluations a system check was performed using a Plexiglas planar phantom and 450MHz dipole (see Appendix E for system validation procedures). The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using an ALS-PR-DIEL Dielectric Probe Kit and HP 8753ET Network Analyzer (see Appendix C). A forward power of 250 mW was applied to the dipole and the system was verified to a tolerance of  $\pm 10\%$  (see Appendix B for system performance check test plot).



### SYSTEM PERFORMANCE CHECK EVALUATION

Test Date	Equiv. Tissue	SAR 1g (W/kg)			Dielectric Constant $\epsilon_r$			Conductivity $\sigma$ (mho/m)			$\rho$ (Kg/m <sup>3</sup> )	Amb. Temp. (°C)	Fluid Temp. (°C)	Fluid Depth (cm)	Humid. (%)	Barom. Press. (kPa)
	Freq. MHz	IEEE Target	Meas.	Dev.	IEEE Target	Meas.	Dev.	IEEE Target	Meas.	Dev.						
10/16/06	Brain 450	1.23 $\pm 10\%$	1.24	+0.8%	43.5 $\pm 5\%$	43.7	+0.5%	0.87 $\pm 5\%$	0.85	-2.3%	1000	25.0	22.3	$\geq 15$	34	101.3
Note(s)		1. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the system performance check. The temperatures listed in the table above were consistent for all measurement periods.														



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## 8.0 SIMULATED EQUIVALENT TISSUES

The 450MHz brain and body simulated tissue mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution. Preservation with a bactericide is added and visual inspection is made to ensure air bubbles are not trapped during the mixing process. The fluid was prepared according to standardized procedures, and measured for dielectric parameters (permittivity and conductivity).

SIMULATED TISSUE MIXTURES		
INGREDIENT	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 %



## 9.0 SAR SAFETY LIMITS

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

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## 15.0 TEST EQUIPMENT LIST

TEST EQUIPMENT		ASSET NO.	SERIAL NO.	DATE CALIBRATED		CALIBRATION DUE DATE
USED	DESCRIPTION					
x	Schmid & Partner DASY4 System	-	-	-	-	-
x	-DASY4 Measurement Server	00158	1078	N/A	N/A	N/A
x	-Robot	00046	599396-01	N/A	N/A	N/A
x	-DAE4	00019	353	21Jun06	21Jun07	21Jun07
	-DAE3	00018	370	08Feb06	08Feb07	08Feb07
x	-ET3DV6 E-Field Probe	00016	1387	16Mar06	16Mar07	16Mar07
	-EX3DV4 E-Field Probe	00125	3547	14Feb06	14Feb07	14Feb07
	-300MHz Validation Dipole	00023	135	25Oct05	25Oct06	25Oct06
x	-450MHz Validation Dipole	00024	136	25Oct05	25Oct06	25Oct06
	-835MHz Validation Dipole	00022	411	Brain	28Mar06	28Mar07
				Body	27Mar06	27Mar07
	-900MHz Validation Dipole	00020	054	Brain	06Jun06	06Jun07
				Body	06Jun06	06Jun07
	-1640MHz Validation Dipole	00211	0180	Brain	07Aug06	07Aug07
	-1800MHz Validation Dipole	00021	247	Brain	08Jun06	08Jun07
				Body	09Jun06	09Jun07
	-1900MHz Validation Dipole	00032	151	Brain	09Jun06	09Jun07
				Body	12Jun06	12Jun07
	-2450MHz Validation Dipole	00025	150	Body	24Apr06	24Apr07
	-5800MHz Validation Dipole	00126	1031	Brain	15Mar06	15Mar07
	-SAM Phantom V4.0C	00154	1033	N/A	N/A	N/A
	-Barski Planar Phantom	00155	03-01	N/A	N/A	N/A
x	-Plexiglas Side Planar Phantom	00156	161	N/A	N/A	N/A
x	-Plexiglas Validation Planar Phantom	00157	137	N/A	N/A	N/A
x	ALS-PR-DIEL Dielectric Probe Kit	00160	260-00953	N/A	N/A	N/A
x	Gigatronics 8652A Power Meter	00110	1835801	12Apr06	12Apr07	12Apr07
	Gigatronics 8652A Power Meter	00007	1835272	03Feb06	03Feb07	03Feb07
x	Gigatronics 80701A Power Sensor	00011	1833542	03Feb06	03Feb07	03Feb07
x	Gigatronics 80701A Power Sensor	00013	1833713	03Feb06	03Feb07	03Feb07
x	HP 8753ET Network Analyzer	00134	US39170292	18Apr06	18Apr07	18Apr07
x	HP 8648D Signal Generator	00005	3847A00611	N/A	N/A	N/A
	Rohde & Schwarz SMR40 Signal Generator	00006	100104	06Apr06	06Apr07	06Apr07
x	Amplifier Research 5S1G4 Power Amplifier	00106	26235	N/A	N/A	N/A

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	



## 16.0 MEASUREMENT UNCERTAINTIES

UNCERTAINTY BUDGET FOR DEVICE EVALUATION						
Error Description	Uncertainty Value ±%	Probability Distribution	Divisor	ci 1g	Uncertainty Value ±% (1g)	V <sub>i</sub> or V <sub>eff</sub>
<b>Measurement System</b>						
Probe calibration	4.0	Normal	1	1	4.0	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	0.7	1.9	∞
Spherical isotropy of the probe	9.6	Rectangular	1.732050808	0.7	3.9	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	1	Rectangular	1.732050808	1	0.6	∞
Probe linearity	4.7	Rectangular	1.732050808	1	2.7	∞
Detection limit	1	Rectangular	1.732050808	1	0.6	∞
Readout electronics	0.3	Normal	1	1	0.3	∞
Response time	0.8	Rectangular	1.732050808	1	0.5	∞
Integration time	2.6	Rectangular	1.732050808	1	1.5	∞
RF ambient conditions	3	Rectangular	1.732050808	1	1.7	∞
Mech. constraints of robot	0.4	Rectangular	1.732050808	1	0.2	∞
Probe positioning	2.9	Rectangular	1.732050808	1	1.7	∞
Extrapolation & integration	1	Rectangular	1.732050808	1	0.6	∞
<b>Test Sample Related</b>						
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	∞
<b>Phantom and Setup</b>						
Phantom uncertainty	4	Rectangular	1.732050808	1	2.3	∞
Liquid conductivity (target)	5	Rectangular	1.732050808	0.64	1.8	∞
Liquid conductivity (measured)	2.5	Normal	1	0.64	1.6	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	2.5	Normal	1	0.6	1.5	∞
<b>Combined Standard Uncertainty</b>					<b>9.88</b>	
<b>Expanded Uncertainty (k=2)</b>					<b>19.77</b>	

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

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

## MEASUREMENT UNCERTAINTIES (Cont.)

UNCERTAINTY BUDGET FOR SYSTEM VALIDATION						
Error Description	Uncertainty Value ±%	Probability Distribution	Divisor	ci 1g	Uncertainty Value ±% (1g)	V <sub>i</sub> or V <sub>eff</sub>
<b>Measurement System</b>						
Probe calibration	4.0	Normal	1	1	4.0	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	1	2.7	∞
Spherical isotropy of the probe	0	Rectangular	1.732050808	1	0.0	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	1	Rectangular	1.732050808	1	0.6	∞
Probe linearity	4.7	Rectangular	1.732050808	1	2.7	∞
Detection limit	1	Rectangular	1.732050808	1	0.6	∞
Readout electronics	0.3	Normal	1	1	0.3	∞
Response time	0	Rectangular	1.732050808	1	0.0	∞
Integration time	0	Rectangular	1.732050808	1	0.0	∞
RF ambient conditions	3	Rectangular	1.732050808	1	1.7	∞
Mech. constraints of robot	0.4	Rectangular	1.732050808	1	0.2	∞
Probe positioning	2.9	Rectangular	1.732050808	1	1.7	∞
Extrapolation & integration	1	Rectangular	1.732050808	1	0.6	∞
<b>Test Sample Related</b>						
Dipole Positioning	2	Normal	1.732050808	1	1.2	∞
Power & Power Drift	4.7	Normal	1.732050808	1	2.7	∞
<b>Phantom and Setup</b>						
Phantom uncertainty	4	Rectangular	1.732050808	1	2.3	∞
Liquid conductivity (target)	5	Rectangular	1.732050808	0.64	1.8	∞
Liquid conductivity (measured)	2.5	Normal	1	0.64	1.6	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	2.5	Normal	1	0.6	1.5	∞
<b>Combined Standard Uncertainty</b>					<b>7.93</b>	
<b>Expanded Uncertainty (k=2)</b>					<b>15.87</b>	


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

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	
				Certificate No. 2470.01

## 17.0 REFERENCES


- [1] Federal Communications Commission - "Radiofrequency radiation exposure evaluation: portable devices", Rule Part 47 CFR §2.1093: 1999.
- [2] Health Canada - "Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz", Safety Code 6: 1999.
- [3] Federal Communications Commission - "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.
- [4] Industry Canada - "Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)", Radio Standards Specification RSS-102 Issue 2: November 2005.
- [5] IEEE Standard 1528-2003 - "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques": December 2003.

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

Certificate No. 2470.01

## APPENDIX A - SAR MEASUREMENT DATA

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	
				Certificate No. 2470.01

Date Tested: 10/17/2006

## Face-Held SAR - NiMH Batteries - GMRS Channel 22 - 462.7250 MHz

**DUT: Cobra Model: PR4500; Type: Portable UHF FRS/GMRS PTT Radio Transceiver; Serial: S610000001**

Ambient Temp: 24.0°C; Fluid Temp: 22.9°C; Barometric Pressure: 99.8 kPa; Humidity: 32%

Communication System: FM UHF

RF Output Power: 0.741 Watts (ERP)

Frequency: 462.7250 MHz; Duty Cycle: 1:1

1.2 V, 600 mAh NiMH Batteries AAA (x4)

Medium: HSL450 Medium parameters used:  $\sigma = 0.83$  mho/m;  $\epsilon_r = 42.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Probe: ET3DV6 - SN1387; ConvF(7.4, 7.4, 7.4); Calibrated: 16/03/2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- 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 Separation Distance from Front of DUT to Planar Phantom - Ch. 22

**Area Scan (8x14x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.428 mW/g

### Face-Held SAR - 2.5 cm Separation Distance from Front of DUT to Planar Phantom - Ch. 22

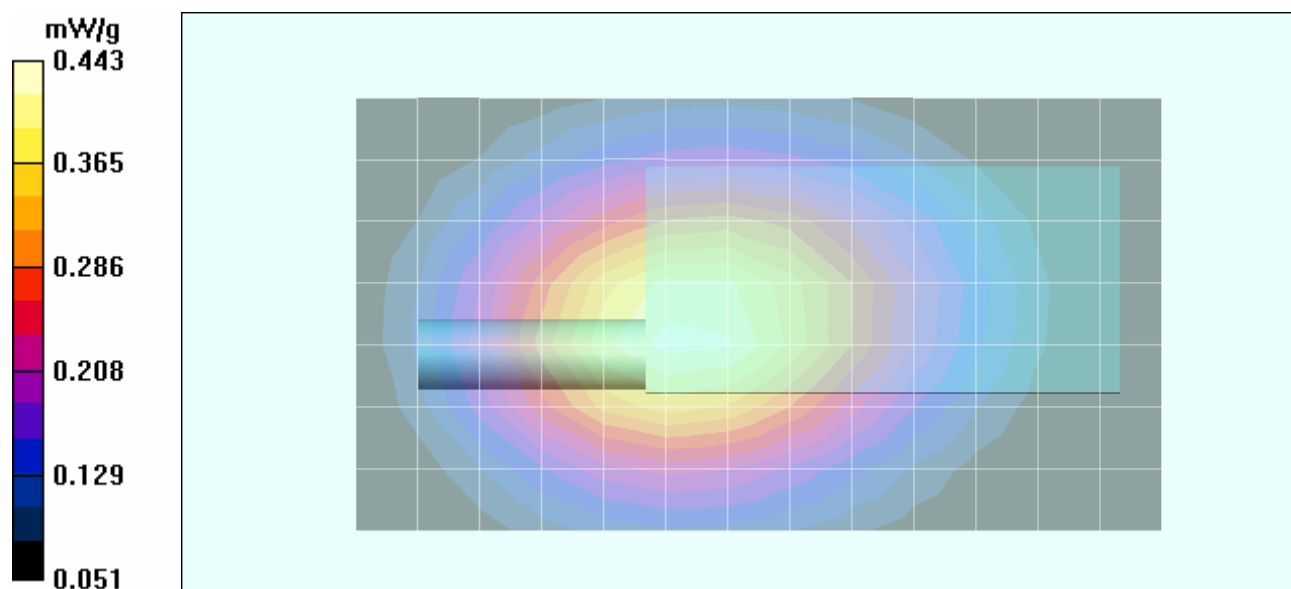
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm


Reference Value = 22.0 V/m; Power Drift = -0.0492 dB



Peak SAR (extrapolated) = 0.685 W/kg

**SAR(1 g) = 0.426 mW/g; SAR(10 g) = 0.296 mW/g**

Maximum value of SAR (measured) = 0.443 mW/g



Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	
				Certificate No. 2470.01

Date Tested: 10/17/2006

## Face-Held SAR - Alkaline Batteries - GMRS Channel 22 - 462.7250 MHz

**DUT: Cobra Model: PR4500; Type: Portable UHF FRS/GMRS PTT Radio Transceiver; Serial: S610000001**

Ambient Temp: 24.0°C; Fluid Temp: 22.9°C; Barometric Pressure: 99.8 kPa; Humidity: 32%

Communication System: FM UHF

RF Output Power: 0.741 Watts (ERP)

Frequency: 462.7250 MHz; Duty Cycle: 1:1

1.5 V, 1150 mAh Duracell Procell Alkaline Batteries AAA (x4)

Medium: HSL450 Medium parameters used:  $\sigma = 0.83 \text{ mho/m}$ ;  $\epsilon_r = 42.8$ ;  $\rho = 1000 \text{ kg/m}^3$

- Probe: ET3DV6 - SN1387; ConvF(7.4, 7.4, 7.4); Calibrated: 16/03/2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- 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 Separation Distance from Front of DUT to Planar Phantom - Ch. 22

**Area Scan (8x14x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.540 mW/g

### Face-Held SAR - 2.5 cm Separation Distance from Front of DUT to Planar Phantom - Ch. 22

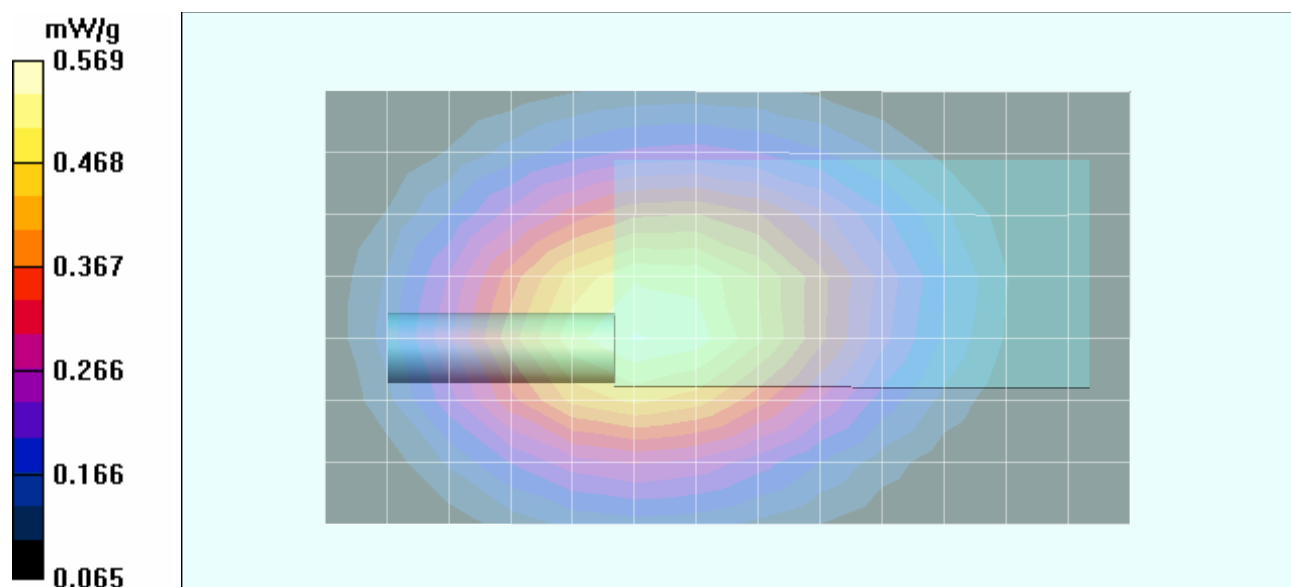
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm


Reference Value = 25.4 V/m; Power Drift = -0.246 dB

Peak SAR (extrapolated) = 0.866 W/kg

**SAR(1 g) = 0.545 mW/g; SAR(10 g) = 0.381 mW/g**

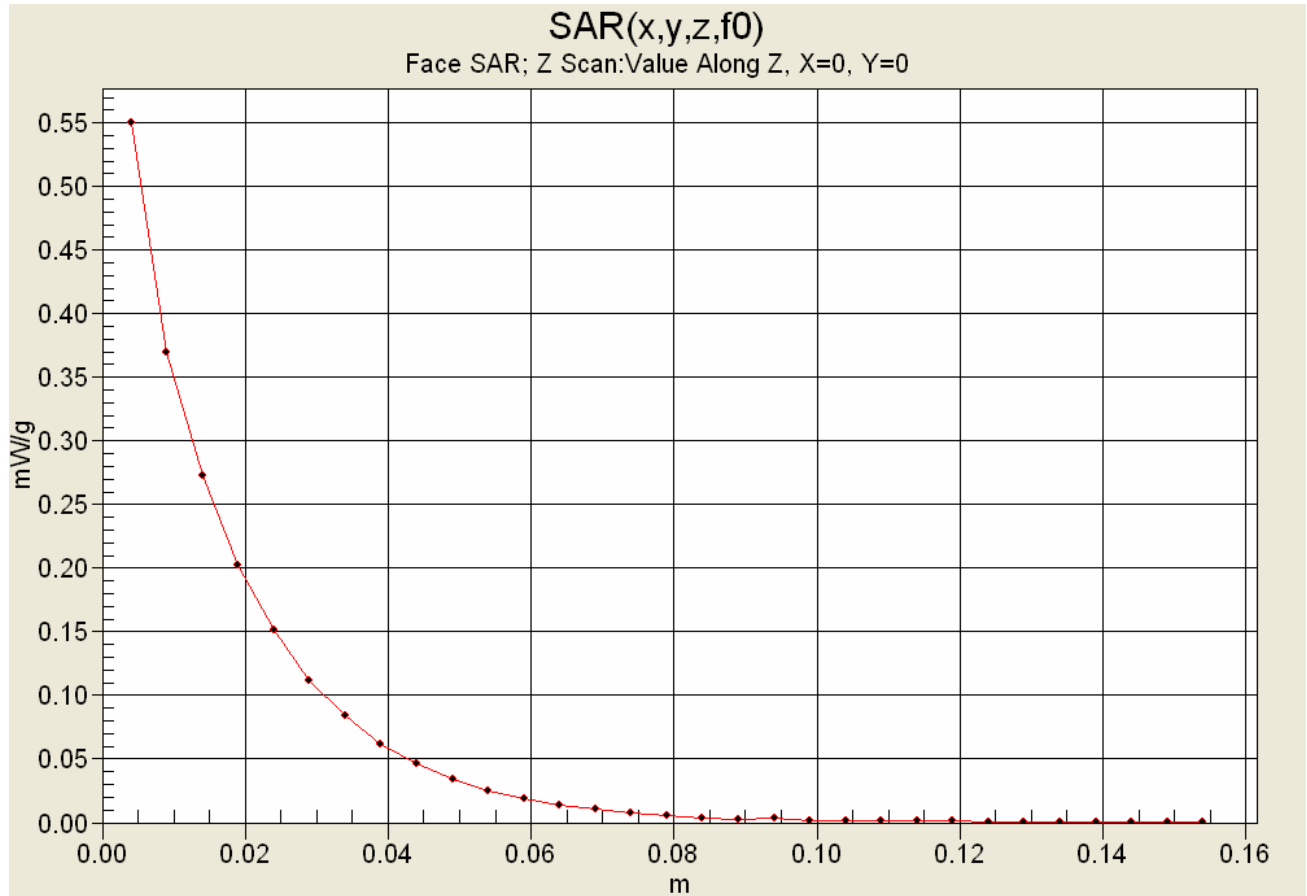
Maximum value of SAR (measured) = 0.569 mW/g





Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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## Z-Axis Scan



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	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

Date Tested: 10/17/2006

## Body-Worn SAR - NiMH Batteries - GMRS Channel 22 - 462.7250 MHz

**DUT: Cobra Model: PR4500; Type: Portable UHF FRS/GMRS PTT Radio Transceiver; Serial: S610000001**

**Body-Worn Accessory: Plastic Belt-Clip; Audio Accessory: Earbud with Lapel-Microphone (P/N: GA-EBM2)**

Ambient Temp: 24.0°C; Fluid Temp: 21.7°C; Barometric Pressure: 101.3 kPa; Humidity: 33%

Communication System: FM UHF

RF Output Power: 0.741 Watts (ERP)

Frequency: 462.7250 MHz; Duty Cycle: 1:1

1.2 V, 600 mAh NiMH Batteries AAA (x4)

Medium: M450 Medium parameters used:  $\sigma = 0.90$  mho/m;  $\epsilon_r = 56.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Probe: ET3DV6 - SN1387; ConvF(7.3, 7.3, 7.3); Calibrated: 16/03/2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

### Body-Worn SAR - 0.7 cm Belt-Clip Separation Distance from Back of DUT to Planar Phantom - Ch. 22

**Area Scan (8x14x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.876 mW/g

### Body-Worn SAR - 0.7 cm Belt-Clip Separation Distance from Back of DUT to Planar Phantom - Ch. 22

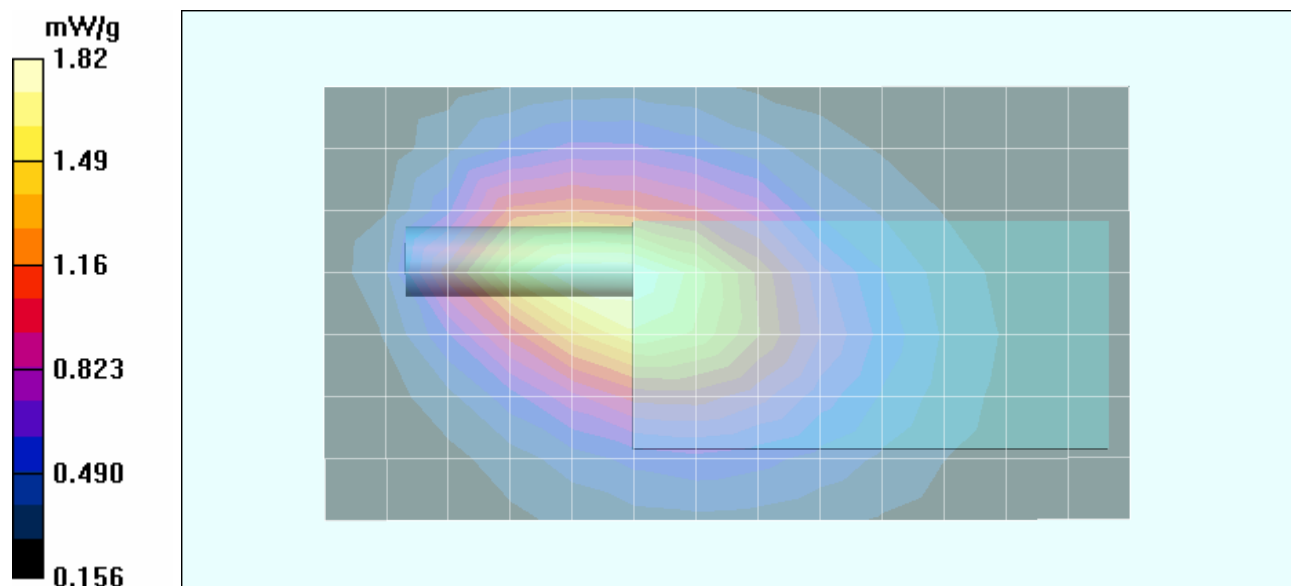
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm


Reference Value = 45.1 V/m; Power Drift = -0.756 dB

Peak SAR (extrapolated) = 2.91 W/kg

**SAR(1 g) = 1.75 mW/g; SAR(10 g) = 1.18 mW/g**

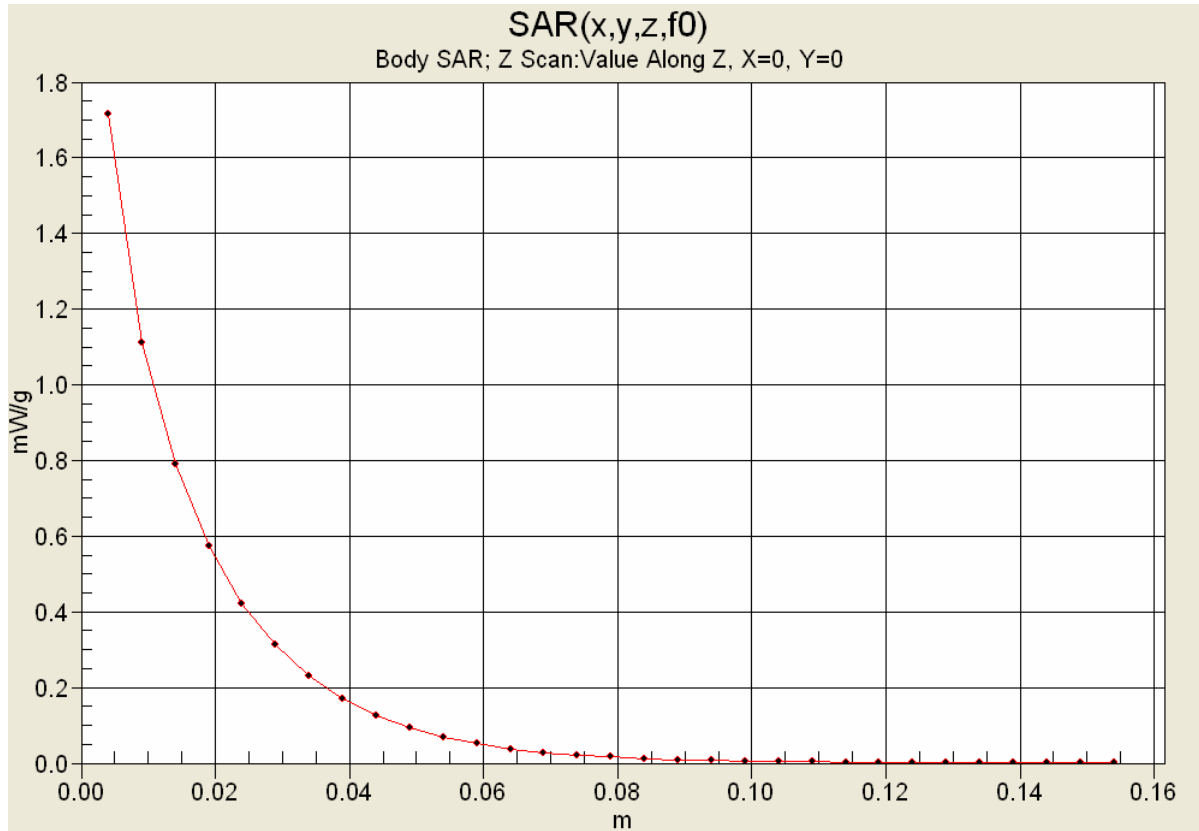
Maximum value of SAR (measured) = 1.82 mW/g




Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

## Z-Axis Scan



Company:	Cobra Electronics Corporation		FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver				
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	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

Date Tested: 10/17/2006

## Body-Worn SAR - Alkaline Batteries - GMRS Channel 22 - 462.7250 MHz

**DUT: Cobra Model: PR4500; Type: Portable UHF FRS/GMRS PTT Radio Transceiver; Serial: S610000001**

**Body-Worn Accessory: Plastic Belt-Clip; Audio Accessory: Earbud with Lapel-Microphone (P/N: GA-EBM2)**

Ambient Temp: 24.0°C; Fluid Temp: 21.7°C; Barometric Pressure: 101.3 kPa; Humidity: 33%

Communication System: FM UHF

RF Output Power: 0.741 Watts (ERP)

Frequency: 462.725 MHz; Duty Cycle: 1:1

1.5 V, 1150 mAh Duracell Procell Alkaline Batteries AAA (x4)

Medium: M450 Medium parameters used:  $\sigma = 0.90$  mho/m;  $\epsilon_r = 56.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Probe: ET3DV6 - SN1387; ConvF(7.3, 7.3, 7.3); Calibrated: 16/03/2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

### Body-Worn SAR - 0.7 cm Belt-Clip Separation Distance from Back of DUT to Planar Phantom - Ch. 22

**Area Scan (8x14x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 1.58 mW/g

### Body-Worn SAR - 0.7 cm Belt-Clip Separation Distance from Back of DUT to Planar Phantom - Ch. 22

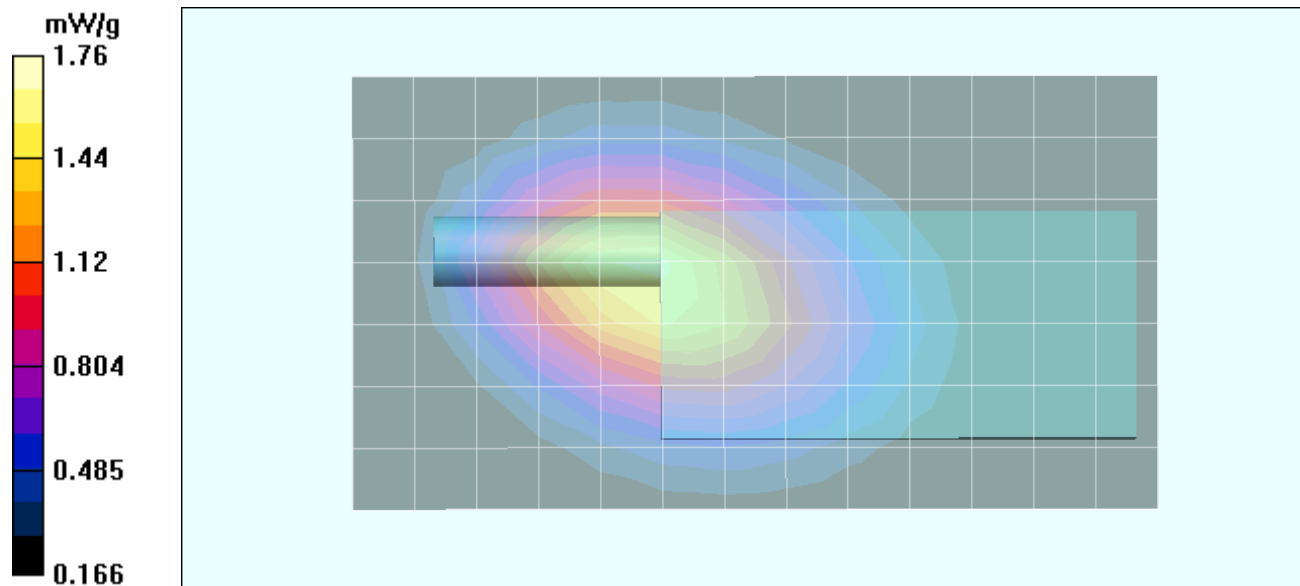
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm


Reference Value = 42.7 V/m; Power Drift = -0.962 dB

Peak SAR (extrapolated) = 2.87 W/kg

**SAR(1 g) = 1.68 mW/g; SAR(10 g) = 1.1 mW/g**

Maximum value of SAR (measured) = 1.76 mW/g

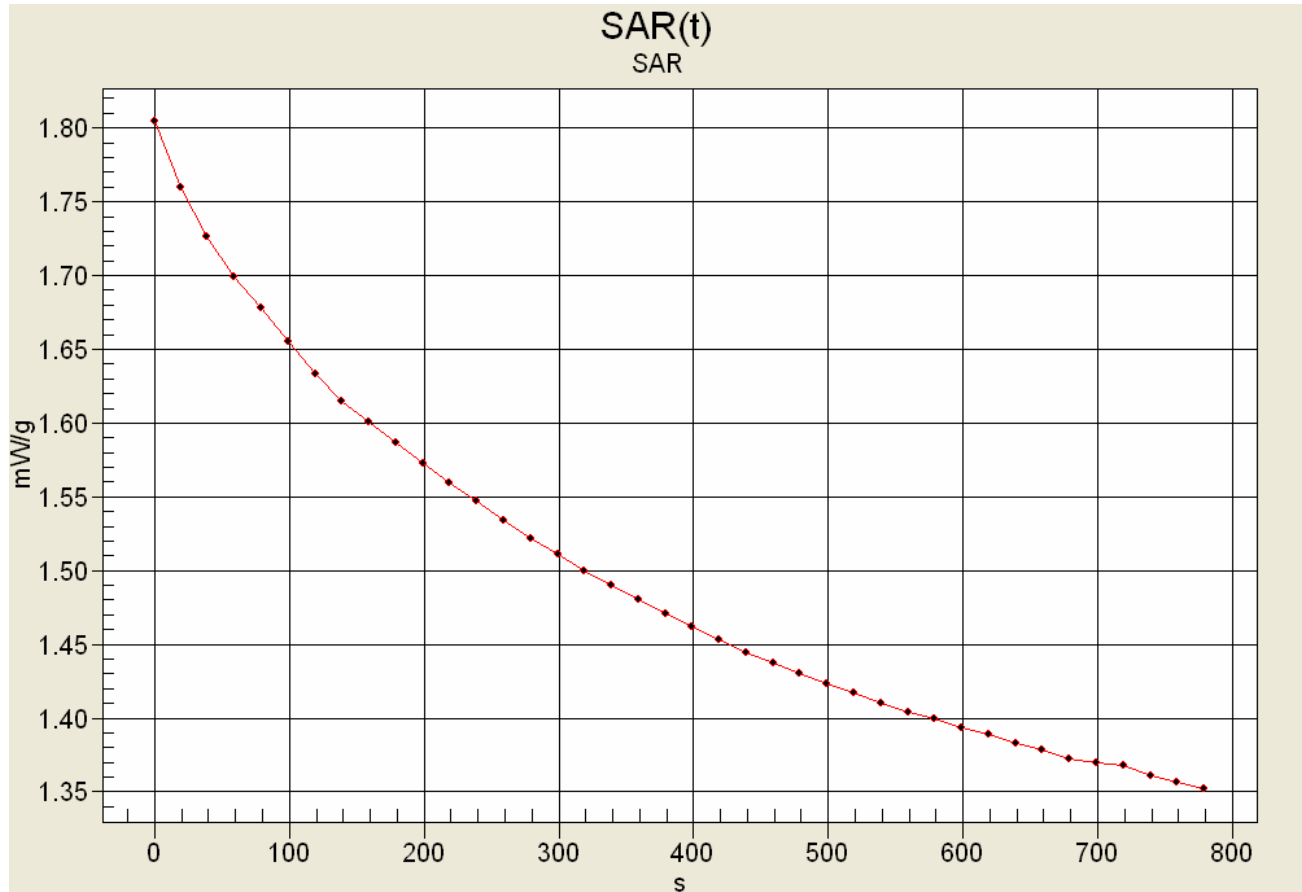


Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

## SAR-versus-Time Power Droop Evaluation


Body-Worn Configuration  
4xAAA Alkaline Batteries  
GMRS Channel 22  
462.7250 MHz



**Max. SAR: 1.80439 mW/g**  
**Min. SAR: 1.35237 mW/g (- 1.25 dB)**  
**SAR after 340s: 1.49037 mW/g (- 1.09 dB)**  
(340s = Zoom Scan Duration)  
(780s = Area Scan Duration)


Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

Certificate No. 2470.01

## APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	
				Certificate No. 2470.01

Date Tested: 10/16/2006

## System Performance Check - 450 MHz Dipole

**DUT: Dipole 450 MHz; Model: D450V2; Serial: 136; Validation: 10/25/2005**

Ambient Temp: 25.0°C; Fluid Temp: 22.3°C; Barometric Pressure: 101.3 kPa; Humidity: 34%

Communication System: CW

Forward Conducted Power: 250 mW

Frequency: 450 MHz; Duty Cycle: 1:1

Medium: HSL450 Medium parameters used:  $\sigma = 0.85$  mho/m;  $\epsilon_r = 43.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Probe: ET3DV6 - SN1387; ConvF(7.4, 7.4, 7.4); Calibrated: 16/03/2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

### 450 MHz Dipole - System Performance Check/Area Scan (6x11x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 1.25 mW/g

### 450 MHz Dipole - System Performance Check/Zoom Scan (5x5x7)/Cube 0:

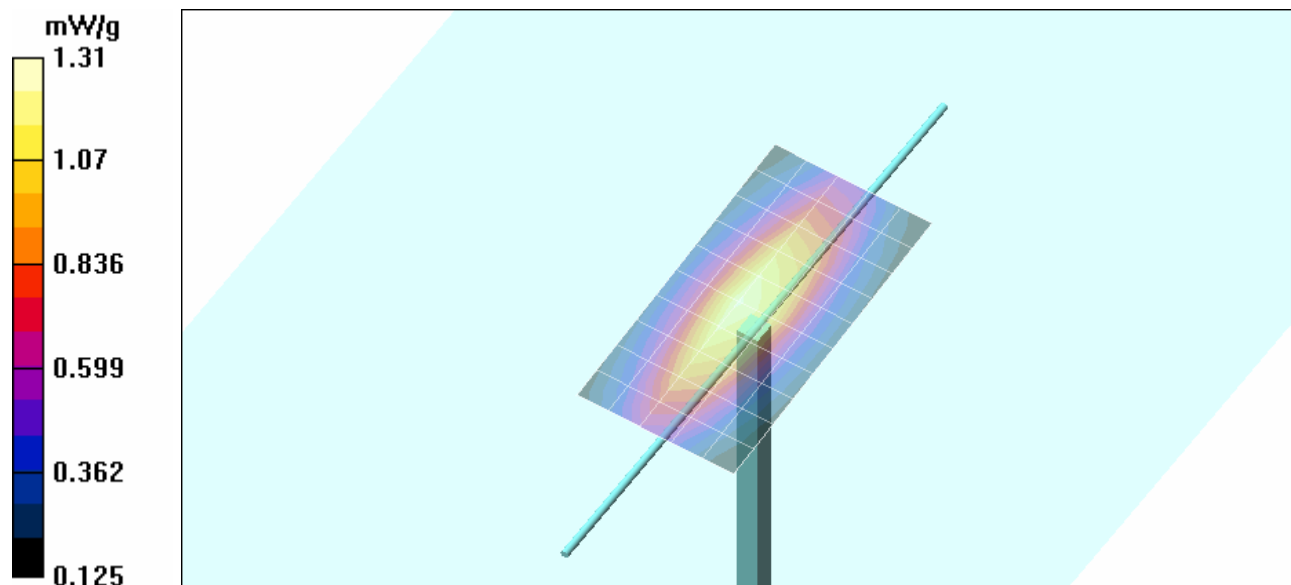
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm


Reference Value = 39.1 V/m; Power Drift = 0.018 dB

Peak SAR (extrapolated) = 2.18 W/kg

**SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.796 mW/g**

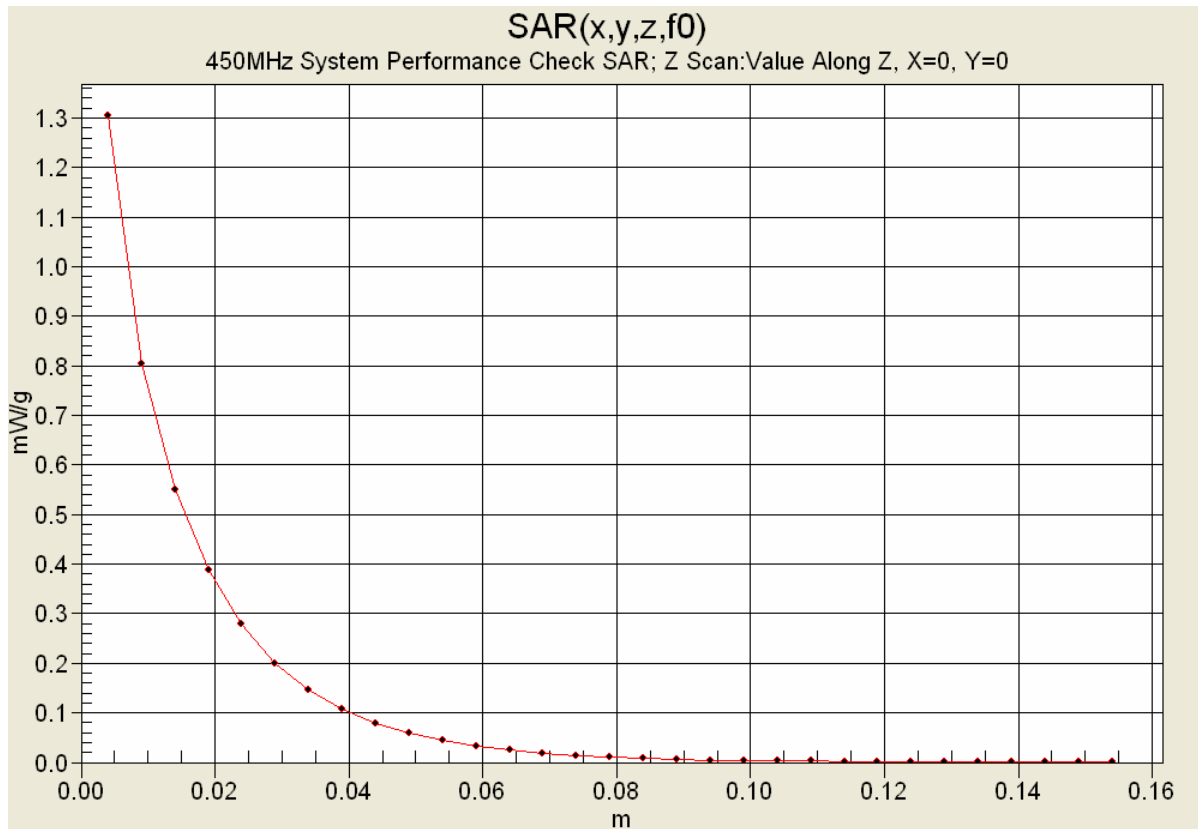
Maximum value of SAR (measured) = 1.31 mW/g



Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	 Certificate No. 2470.01
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

## Z-Axis Scan






Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

Certificate No. 2470.01

## APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

Company:	Cobra Electronics Corporation		FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver				
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	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	
				Certificate No. 2470.01

### 450 MHz System Performance Check (Brain)

\*\*\*\*\*

Celltech Labs Inc.

Test Result for UIM Dielectric Parameter

Mon 16/Oct/2006

Frequency (GHz)

FCC\_eHFCC OET 65 Supplement C (June 2001) Limits for Head Epsilon

FCC\_sHFCC OET 65 Supplement C (June 2001) Limits for Head Sigma

Test\_e Epsilon of UIM



Test\_s Sigma of UIM

\*\*\*\*\*

Freq	FCC_eHFCC	sH	Test_e	Test_s
0.3500	44.70	0.87	46.59	0.77
0.3600	44.58	0.87	46.50	0.77
0.3700	44.46	0.87	46.00	0.78
0.3800	44.34	0.87	45.33	0.79
0.3900	44.22	0.87	45.42	0.80
0.4000	44.10	0.87	44.95	0.81
0.4100	43.98	0.87	44.75	0.82
0.4200	43.86	0.87	44.75	0.82
0.4300	43.74	0.87	44.33	0.83
0.4400	43.62	0.87	44.13	0.84
0.4500	43.50	0.87	43.69	0.85
0.4600	43.45	0.87	43.49	0.86
0.4700	43.40	0.87	43.20	0.87
0.4800	43.34	0.87	43.40	0.87
0.4900	43.29	0.87	43.20	0.88
0.5000	43.24	0.87	43.04	0.89
0.5100	43.19	0.87	42.80	0.90
0.5200	43.14	0.88	42.53	0.91
0.5300	43.08	0.88	42.25	0.91
0.5400	43.03	0.88	42.18	0.92
0.5500	42.98	0.88	41.89	0.93

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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 Testing and Engineering Services Ltd	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	
Certificate No. 2470.01				


### 450 MHz DUT Evaluation (Face)



\*\*\*\*\*

Celltech Labs Inc.  
Test Result for UIM Dielectric Parameter  
Tue 17/Oct/2006  
Frequency (GHz)  
FCC\_eHFCC OET 65 Supplement C (June 2001) Limits for Head Epsilon  
FCC\_sHFCC OET 65 Supplement C (June 2001) Limits for Head Sigma  
Test\_e Epsilon of UIM  
Test\_s Sigma of UIM

\*\*\*\*\*

Freq	FCC_eHFCC	sH	Test_e	Test_s
0.3500	44.70	0.87	45.30	0.74
0.3600	44.58	0.87	44.94	0.75
0.3700	44.46	0.87	44.85	0.75
0.3800	44.34	0.87	44.63	0.76
0.3900	44.22	0.87	44.20	0.77
0.4000	44.10	0.87	44.05	0.78
0.4100	43.98	0.87	44.09	0.79
0.4200	43.86	0.87	43.67	0.80
0.4300	43.74	0.87	43.26	0.81
0.4400	43.62	0.87	43.13	0.82
0.4500	43.50	0.87	42.83	0.83
0.4600	43.45	0.87	42.61	0.83
0.4700	43.40	0.87	42.43	0.84
0.4800	43.34	0.87	42.26	0.84
0.4900	43.29	0.87	42.30	0.85
0.5000	43.24	0.87	42.25	0.86
0.5100	43.19	0.87	41.56	0.87
0.5200	43.14	0.88	41.58	0.88
0.5300	43.08	0.88	41.61	0.88
0.5400	43.03	0.88	41.31	0.90
0.5500	42.98	0.88	41.22	0.90

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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 Testing and Engineering Services Ltd	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	 Certificate No. 2470.01
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

### 450 MHz DUT Evaluation (Body)

\*\*\*\*\*

Celltech Labs Inc.  
Test Result for UIM Dielectric Parameter  
Tue 17/Oct/2006  
Frequency (GHz)  
FCC\_eHFCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon  
FCC\_sHFCC 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	0.82
0.3600	57.60	0.93	57.99	0.83
0.3700	57.50	0.93	57.76	0.84
0.3800	57.40	0.93	57.30	0.85
0.3900	57.30	0.93	57.60	0.86
0.4000	57.20	0.93	56.87	0.86
0.4100	57.10	0.93	56.97	0.87
0.4200	57.00	0.94	56.98	0.87
0.4300	56.90	0.94	56.67	0.88
0.4400	56.80	0.94	56.62	0.89
0.4500	56.70	0.94	56.24	0.90
0.4600	56.66	0.94	56.24	0.91
0.4700	56.62	0.94	55.87	0.92
0.4800	56.58	0.94	56.02	0.92
0.4900	56.54	0.94	55.79	0.93
0.5000	56.51	0.94	55.74	0.93
0.5100	56.47	0.94	55.52	0.95
0.5200	56.43	0.95	55.41	0.94
0.5300	56.39	0.95	55.15	0.96
0.5400	56.35	0.95	55.23	0.97
0.5500	56.31	0.95	54.96	0.98

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	 Certificate No. 2470.01
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

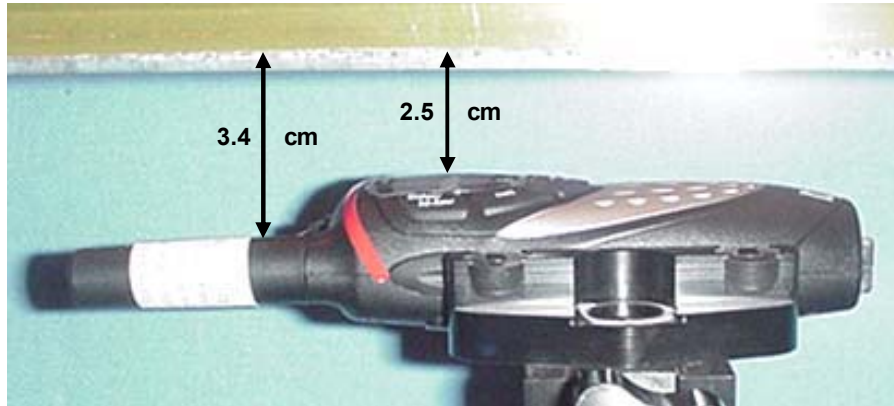
## APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS


Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	 Certificate No. 2470.01
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

## FACE-HELD SAR TEST SETUP PHOTOGRAPHS

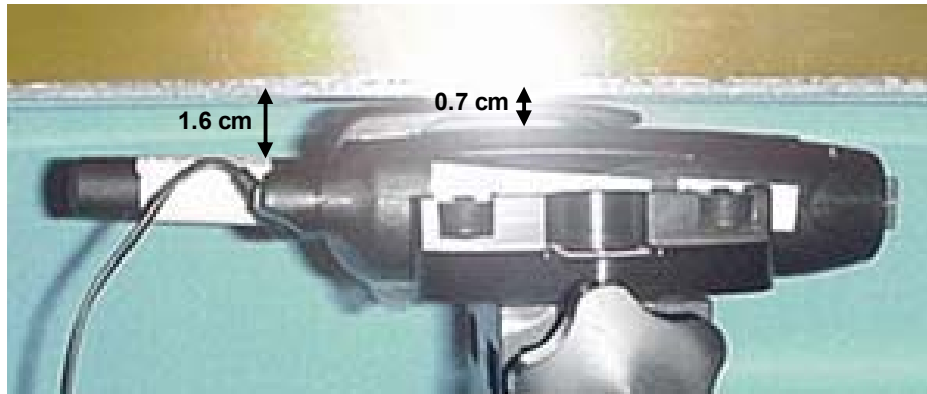
### 2.5 cm Separation Distance from Front of DUT to Planar Phantom




Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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 Testing and Engineering Services Ltd	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	 Certificate No. 2470.01
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

**BODY-WORN SAR TEST SETUP PHOTOGRAPHS**  
**0.7 cm Belt-Clip Spacing from Back of DUT to Planar Phantom**  
**With Earbud Lapel-Microphone Audio Accessory**



Company:	Cobra Electronics Corporation		FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver				
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	Date(s) of Evaluation October 16-17, 2006	Test Report Serial No. 101206BBO-T781-S95U	Report Revision No. Revision 1.0	
	Report Issue Date October 23, 2006	Description of Test(s) Specific Absorption Rate	RF Exposure Category General Population	

Certificate No. 2470.01

## DUT PHOTOGRAPHS



Front of DUT



Back of DUT




Back of DUT with Plastic Belt-Clip



Top end of DUT



Bottom end of DUT

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	Date(s) of Evaluation October 16-17, 2006	Test Report Serial No. 101206BBO-T781-S95U	Report Revision No. Revision 1.0	
	Report Issue Date October 23, 2006	Description of Test(s) Specific Absorption Rate	RF Exposure Category General Population	

Certificate No. 2470.01

## DUT PHOTOGRAPHS



Left Side of DUT with Plastic Belt-Clip



Right Side of DUT with Plastic Belt-Clip



DUT Battery Compartment




DUT with Alkaline AAA Batteries



DUT with NiMH AAA Batteries

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	 Certificate No. 2470.01
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

## DUT PHOTOGRAPHS





DUT with Earbud Lapel-Microphone Audio Accessory (P/N: GA-EBM2)

Company:	Cobra Electronics Corporation		FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver				
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	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	 Certificate No. 2470.01
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

## APPENDIX E - SYSTEM VALIDATION

Company:	Cobra Electronics Corporation	FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver			
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	Date of Evaluation:	October 25, 2005	Document Issue No.:	SV450B-102505-R1.1
	Evaluation Type:	System Validation	Validation Dipole:	450 MHz
			Fluid Type:	Brain

## 450 MHz SYSTEM VALIDATION DIPOLE

Type:

**450 MHz Validation Dipole**

Asset Number:

**00024**

Serial Number:

**136**

Place of Validation:

**Celltech Labs Inc.**

Date of Validation:

**October 25, 2005**

**Celltech Labs Inc. hereby certifies that the system validation was performed on the date indicated above.**

Validated by:



Approved by:



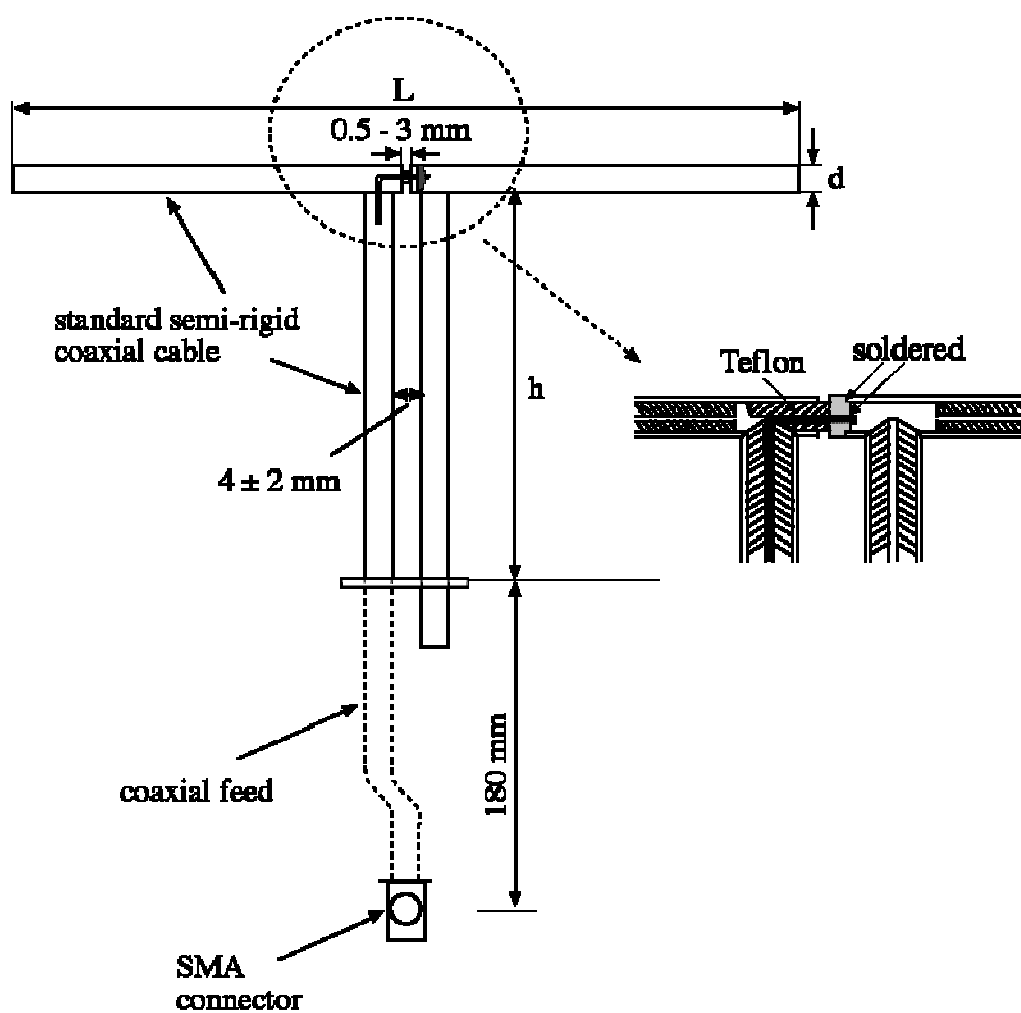
	Date of Evaluation:	October 25, 2005	Document Issue No.:	SV450B-102505-R1.1
	Evaluation Type:	System Validation	Validation Dipole:	450 MHz

## 1. Dipole Construction & Electrical Characteristics

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

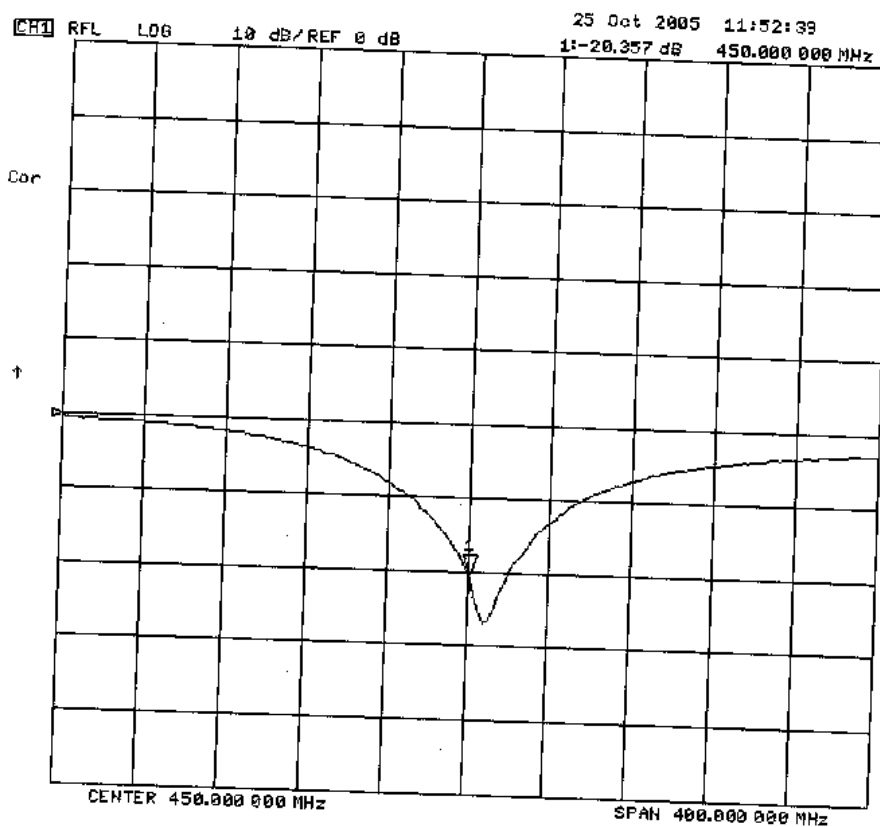
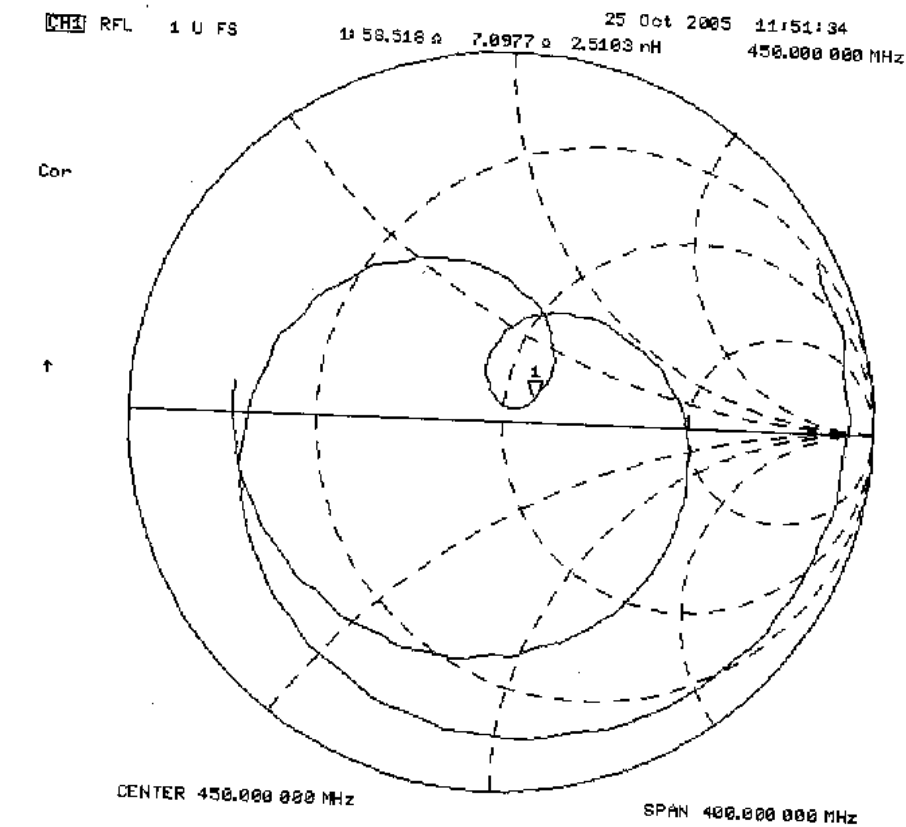
Feed point impedance at 450MHz       $\text{Re}\{Z\} = 58.518\Omega$   
 $\text{Im}\{Z\} = 7.0977\Omega$

Return Loss at 450MHz                      -20.357dB



	Date of Evaluation:	October 25, 2005	Document Issue No.:	SV450B-102505-R1.1
	Evaluation Type:	System Validation	Validation Dipole:	450 MHz

## 2. Validation Dipole VSWR Data



	Date of Evaluation:	October 25, 2005	Document Issue No.:	SV450B-102505-R1.1
	Evaluation Type:	System Validation	Validation Dipole:	450 MHz

### **3. Validation Dipole Dimensions**

Frequency (MHz)	L (mm)	h (mm)	d (mm)
300	420.0	250.0	6.2
450	288.0	167.0	6.2
835	161.0	89.8	3.6
900	149.0	83.3	3.6
1450	89.1	51.7	3.6
1800	72.0	41.7	3.6
1900	68.0	39.5	3.6
2000	64.5	37.5	3.6
2450	51.8	30.6	3.6
3000	41.5	25.0	3.6

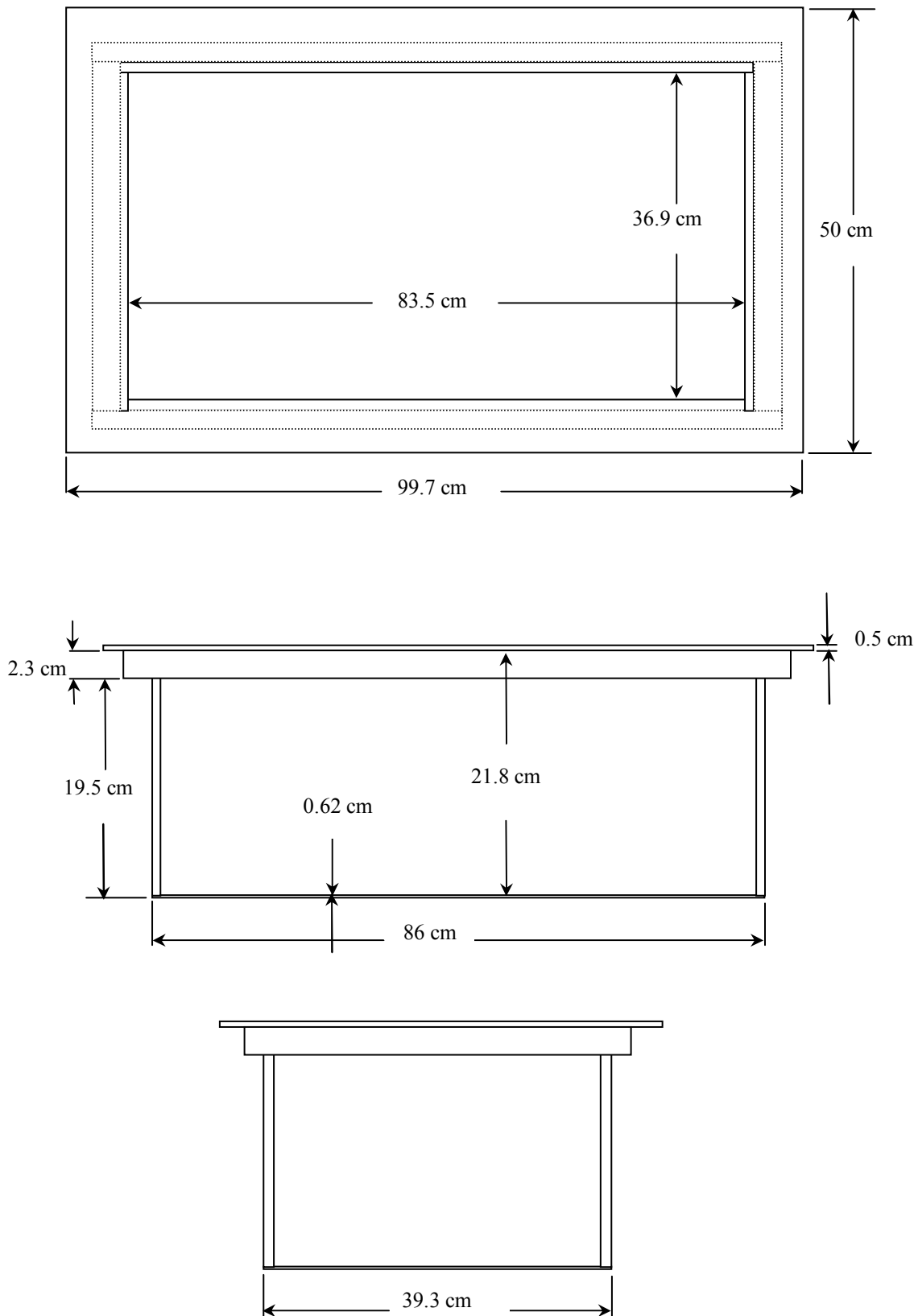
### **4. Validation Phantom**

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

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

The bottom section of the validation phantom is constructed of  $6.2 \pm 0.1$ mm Plexiglas.

## 5. Dimensions of Plexiglas Planar Phantom





	Date of Evaluation:	October 25, 2005	Document Issue No.:	SV450B-102505-R1.1
	Evaluation Type:	System Validation	Validation Dipole:	450 MHz

## 6. 450 MHz System Validation Setup



	Date of Evaluation:	October 25, 2005	Document Issue No.:	SV450B-102505-R1.1
	Evaluation Type:	System Validation	Validation Dipole:	450 MHz

## 7. 450 MHz Validation Dipole Setup



	Date of Evaluation:	October 25, 2005	Document Issue No.:	SV450B-102505-R1.1
	Evaluation Type:	System Validation	Validation Dipole:	450 MHz

## 8. Measurement Conditions

The planar phantom was filled with 450 MHz brain tissue simulant:


Relative Permittivity: 43.2 (-0.7% deviation from target)  
 Conductivity: 0.84 mho/m (-3.4% deviation from target)  
 Fluid Temperature: 22.5 °C  
 Fluid Depth:  $\geq 15.0$  cm

Environmental Conditions:

Ambient Temperature: 23.5 °C  
 Humidity: 34 %  
 Barometric Pressure: 101.4 kPa

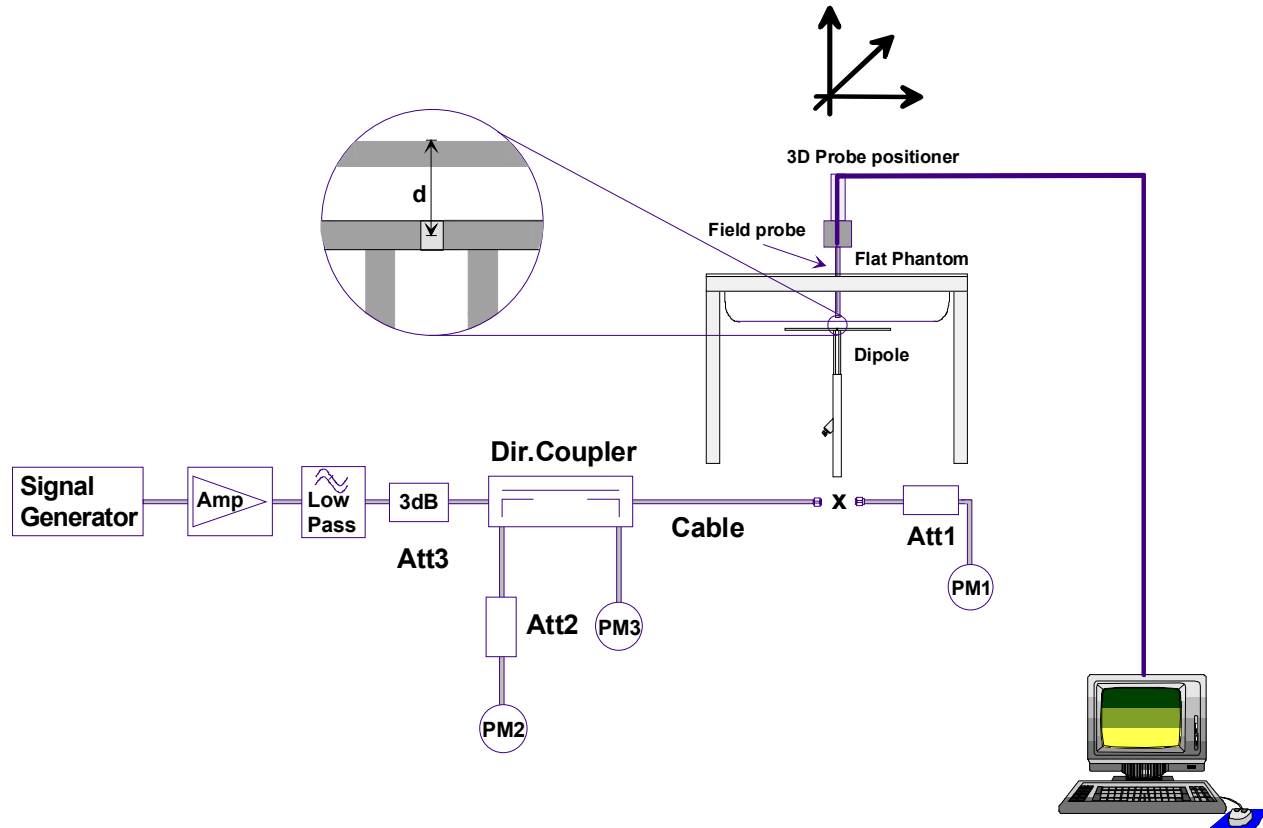
The 450 MHz brain tissue simulant consisted of the following ingredients:

Ingredient	Percentage by weight
Water	38.56%
Sugar	56.32%
Salt	3.95%
HEC	0.98%
Dowicil 75	0.19%
450 MHz Target Dielectric Parameters at 22 °C	$\epsilon_r = 43.5$ (+/- 5%) $\sigma = 0.87$ S/m (+/- 5%)

	Date of Evaluation:	October 25, 2005	Document Issue No.:	SV450B-102505-R1.1
	Evaluation Type:	System Validation	Validation Dipole:	450 MHz

## 9. SAR Measurement

The SAR measurement was performed with the E-field probe in mechanical detection mode only. The setup and determination of the forward power into the dipole was performed using the following procedures.



First the power meter PM1 (including attenuator Att1) is connected to the cable to measure the forward power at the location of the dipole connector (X). The signal generator is adjusted for the desired forward power at the dipole connector (taking into account the attenuation of Att1) as read by power meter PM2. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2. If the signal generator does not allow adjustment in 0.01dB steps, the remaining difference at PM2 must be taken into consideration. PM3 records the reflected power from the dipole to ensure that the value is not changed from the previous value. The reflected power should be 20dB below the forward power.

	Date of Evaluation:	October 25, 2005	Document Issue No.:	SV450B-102505-R1.1
	Evaluation Type:	System Validation	Validation Dipole:	450 MHz

## 10. Validation Dipole SAR Test Results

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

Validation Measurement	SAR @ 0.25W Input averaged over 1g	SAR @ 1W Input averaged over 1g	SAR @ 0.25W Input averaged over 10g	SAR @ 1W Input averaged over 10g	Peak SAR @ 0.25W Input
Test 1	1.24	4.96	0.800	3.200	1.31
Test 2	1.24	4.96	0.798	3.192	1.31
Test 3	1.24	4.96	0.798	3.192	1.31
Test 4	1.24	4.96	0.799	3.196	1.31
Test 5	1.24	4.96	0.799	3.196	1.31
Test 6	1.24	4.96	0.799	3.196	1.31
Test 7	1.24	4.96	0.801	3.204	1.31
Test 8	1.24	4.96	0.802	3.208	1.31
Test 9	1.25	5.00	0.807	3.228	1.31
Test 10	1.25	5.00	0.806	3.224	1.31
<b>Average</b>	<b>1.24</b>	<b>4.97</b>	<b>0.801</b>	<b>3.204</b>	<b>1.31</b>

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

Target SAR @ 1 Watt Input averaged over 1 gram (W/kg)		Measured SAR @ 1 Watt Input averaged over 1 gram (W/kg)	Deviation from Target (%)	Target SAR @ 1 Watt Input averaged over 10 grams (W/kg)		Measured SAR @ 1 Watt Input averaged over 10 grams (W/kg)	Deviation from Target (%)
4.90	+/- 10%	4.97	+1.4%	3.30	+/- 10%	3.204	-2.9%



	Date of Evaluation:	October 25, 2005	Document Issue No.:	SV450B-102505-R1.1
	Evaluation Type:	System Validation	Validation Dipole:	450 MHz

## 450 MHz System Validation (Brain) - October 25, 2005

Dipole: 450 MHz; Model: D450V2; Serial: 136  
Ambient Temp: 23.5 °C; Fluid Temp: 22.5 °C; Barometric Pressure: 101.4 kPa; Humidity: 34%  
Communication System: CW  
Frequency: 450 MHz; Duty Cycle: 1:1  
Medium: HSL450 ( $\sigma = 0.84$  mho/m;  $\epsilon_r = 43.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>)  
- Probe: ET3DV6 - SN1387; ConvF(7.5, 7.5, 7.5); Calibrated: 18/03/2005  
- Sensor-Surface: 4mm (Mechanical Surface Detection)  
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005  
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137  
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

**450 MHz System Validation/Area Scan (6x11x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (measured) = 1.27 mW/g

**450 MHz System Validation/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 39.3 V/m; Power Drift = -0.025 dB  
**SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.800 mW/g**  
Maximum value of SAR (measured) = 1.31 mW/g

**450 MHz System Validation/Zoom Scan 2 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 39.1 V/m; Power Drift = 0.004 dB  
**SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.798 mW/g**  
Maximum value of SAR (measured) = 1.31 mW/g

**450 MHz System Validation/Zoom Scan 3 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 39.0 V/m; Power Drift = 0.014 dB  
**SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.798 mW/g**  
Maximum value of SAR (measured) = 1.31 mW/g

**450 MHz System Validation/Zoom Scan 4 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 39.0 V/m; Power Drift = 0.040 dB  
**SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.799 mW/g**  
Maximum value of SAR (measured) = 1.31 mW/g

**450 MHz System Validation/Zoom Scan 5 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 39.0 V/m; Power Drift = 0.014 dB  
**SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.799 mW/g**  
Maximum value of SAR (measured) = 1.31 mW/g

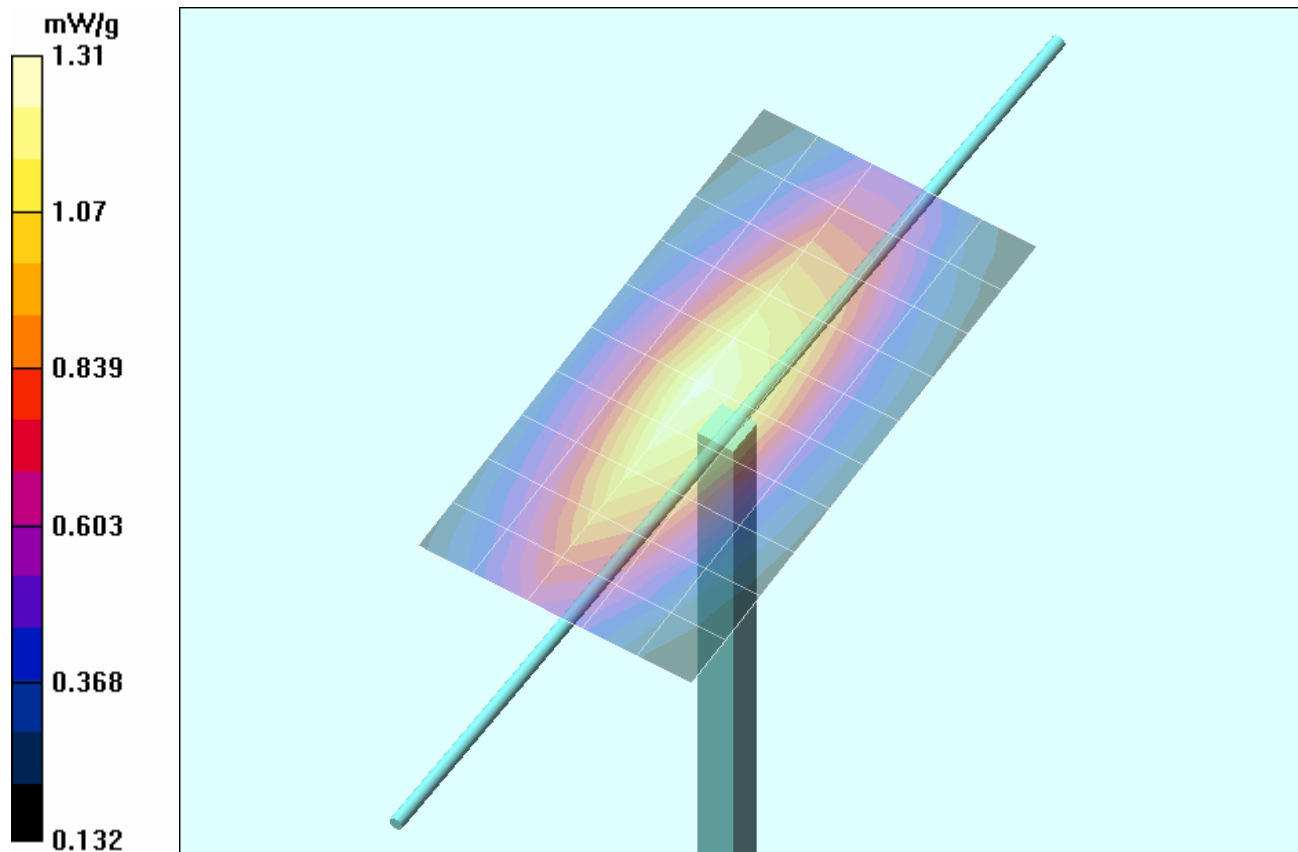
**450 MHz System Validation/Zoom Scan 6 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 39.1 V/m; Power Drift = 0.016 dB  
**SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.799 mW/g**  
Maximum value of SAR (measured) = 1.31 mW/g

**450 MHz System Validation/Zoom Scan 7 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 39.1 V/m; Power Drift = 0.008 dB  
**SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.801 mW/g**  
Maximum value of SAR (measured) = 1.31 mW/g

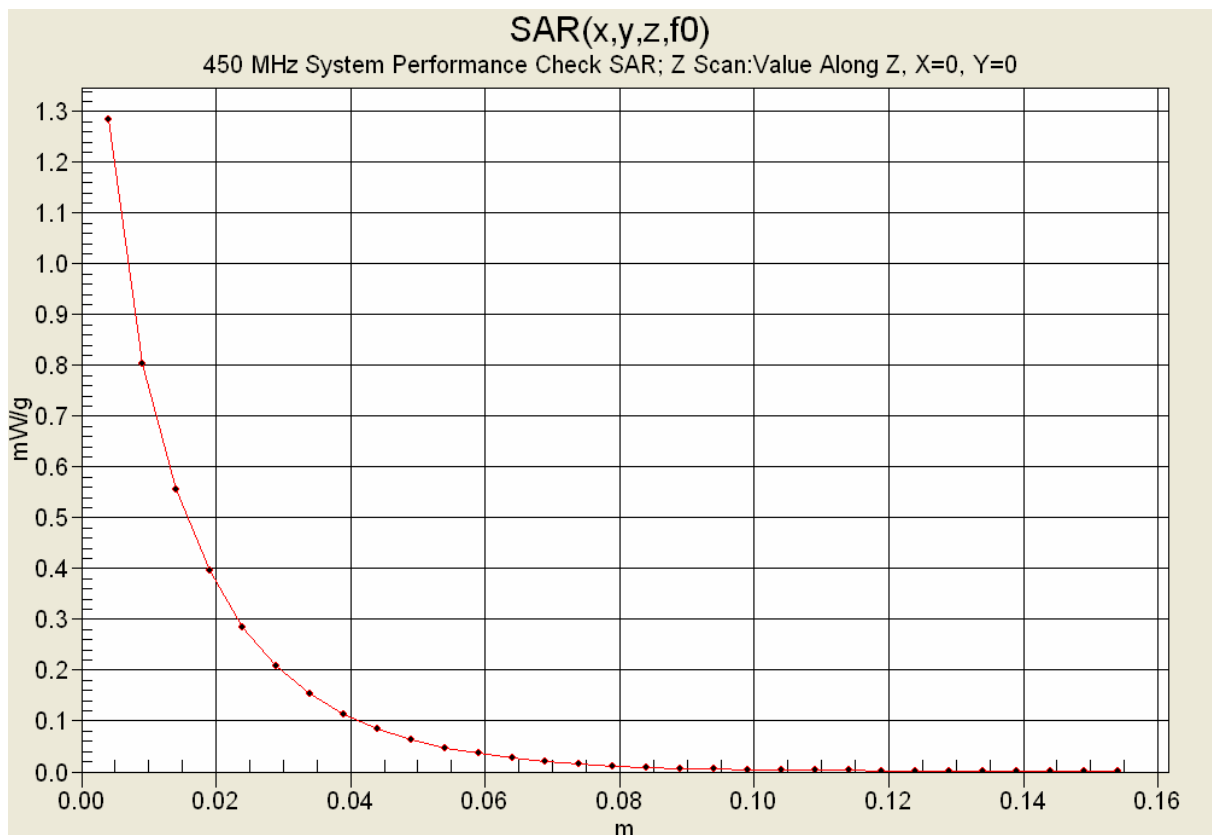
**450 MHz System Validation/Zoom Scan 8 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 39.6 V/m; Power Drift = -0.031 dB  
**SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.802 mW/g**  
Maximum value of SAR (measured) = 1.31 mW/g

**450 MHz System Validation/Zoom Scan 9 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 39.2 V/m; Power Drift = 0.016 dB  
**SAR(1 g) = 1.25 mW/g; SAR(10 g) = 0.807 mW/g**  
Maximum value of SAR (measured) = 1.31 mW/g

**450 MHz System Validation/Zoom Scan 10 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 39.2 V/m; Power Drift = -0.010 dB  
**SAR(1 g) = 1.25 mW/g; SAR(10 g) = 0.806 mW/g**  
Maximum value of SAR (measured) = 1.31 mW/g



1 g average of 10 measurements: 1.24 mW/g  
 10 g average of 10 measurements: 0.801 mW/g





	Date of Evaluation:	October 25, 2005	Document Issue No.:	SV450B-102505-R1.1
	Evaluation Type:	System Validation	Validation Dipole:	450 MHz

## 11. Measured Fluid Dielectric Parameters

### System Validation (Brain) - 450 MHz Dipole

\*\*\*\*\*

Celltech Labs Inc.

Test Result for UIM Dielectric Parameter

Tue 25/Oct/2005 12:07:39

Freq Frequency (GHz)

FCC\_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon

FCC\_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma

Test\_e Epsilon of UIM


Test\_s Sigma of UIM

\*\*\*\*\*

Freq	FCC_eH	FCC_sH	Test_e	Test_s
0.3500	44.70	0.87	46.08	0.7567
0.3600	44.58	0.87	45.12	0.7628
0.3700	44.46	0.87	45.10	0.7809
0.3800	44.34	0.87	45.43	0.7839
0.3900	44.22	0.87	43.97	0.7737
0.4000	44.10	0.87	43.78	0.7898
0.4100	43.98	0.87	43.52	0.8094
0.4200	43.86	0.87	43.40	0.8252
0.4300	43.74	0.87	43.32	0.8299
0.4400	43.62	0.87	43.32	0.8412
0.4500	43.50	0.87	43.20	0.8371
0.4600	43.45	0.87	42.91	0.8381
0.4700	43.40	0.87	42.76	0.8474
0.4800	43.34	0.87	42.33	0.8578
0.4900	43.29	0.87	42.63	0.8839
0.5000	43.24	0.87	42.19	0.8784
0.5100	43.19	0.87	41.77	0.8958
0.5200	43.14	0.88	41.64	0.8896
0.5300	43.08	0.88	41.13	0.9037
0.5400	43.03	0.88	40.85	0.9328
0.5500	42.98	0.88	40.94	0.9272

	<u>Date(s) of Evaluation</u> October 16-17, 2006	<u>Test Report Serial No.</u> 101206BBO-T781-S95U	<u>Report Revision No.</u> Revision 1.0	 Certificate No. 2470.01
	<u>Report Issue Date</u> October 23, 2006	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

## APPENDIX F - PROBE CALIBRATION

Company:	Cobra Electronics Corporation		FCC ID:	BBOPR4100	IC ID:	906B-PR4100	
Model(s):	PR4100 / PR4500	DUT Type:	Portable FM UHF FRS/GMRS PTT Radio Transceiver				
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Accredited by the Swiss Federal Office of Metrology and Accreditation  
**The Swiss Accreditation Service is one of the signatories to the EA**  
**Multilateral Agreement for the recognition of calibration certificates**

**Accreditation No.: SCS 108**

**Client** **Celltech Labs**

**Certificate No: ET3-1387\_Mar06**

## CALIBRATION CERTIFICATE

**Object** **ET3DV6 - SN:1387**

**Calibration procedure(s)** **QA CAL-01.v5**  
**Calibration procedure for dosimetric E-field probes**

**Calibration date:** **March 16, 2006**

**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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41495277	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41498087	3-May-05 (METAS, No. 251-00466)	May-06
Reference 3 dB Attenuator	SN: S5054 (3c)	11-Aug-05 (METAS, No. 251-00499)	Aug-06
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-05 (METAS, No. 251-00467)	May-06
Reference 30 dB Attenuator	SN: S5129 (30b)	11-Aug-05 (METAS, No. 251-00500)	Aug-06
Reference Probe ES3DV2	SN: 3013	2-Jan-06 (SPEAG, No. ES3-3013_Jan06)	Jan-07
DAE4	SN: 654	2-Feb-06 (SPEAG, No. DAE4-654_Feb06)	Feb-07
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov 06

**Calibrated by:** **Katja Pokovic** **Technical Manager**

**Approved by:** **Niels Kuster** **Quality Manager**

**Signature**

Issued: March 16, 2006

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



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 The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

## Glossary:

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ 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:

- 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
- CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

## Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>:** Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not effect the  $E^2$ -field uncertainty inside TSL (see below *ConvF*).
- NORM( $f$ )<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* 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*.
- DCP<sub>x,y,z</sub>:** 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 NORM<sub>x,y,z</sub> \* *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  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy):** in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset:** The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

# Probe ET3DV6

## SN:1387

Manufactured:	September 21, 1999
Last calibrated:	March 18, 2005
Recalibrated:	March 16, 2006

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

## DASY - Parameters of Probe: ET3DV6 SN:1387

### Sensitivity in Free Space<sup>A</sup>

### Diode Compression<sup>B</sup>

NormX	1.62 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	92 mV
NormY	1.72 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	92 mV
NormZ	1.72 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	92 mV

### Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

### Boundary Effect

TSL                      900 MHz      Typical SAR gradient: 5 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR <sub>be</sub> [%]	Without Correction Algorithm	9.3	5.0
SAR <sub>be</sub> [%]	With Correction Algorithm	0.1	0.2

### Sensor Offset

Probe Tip to Sensor Center                      2.7 mm

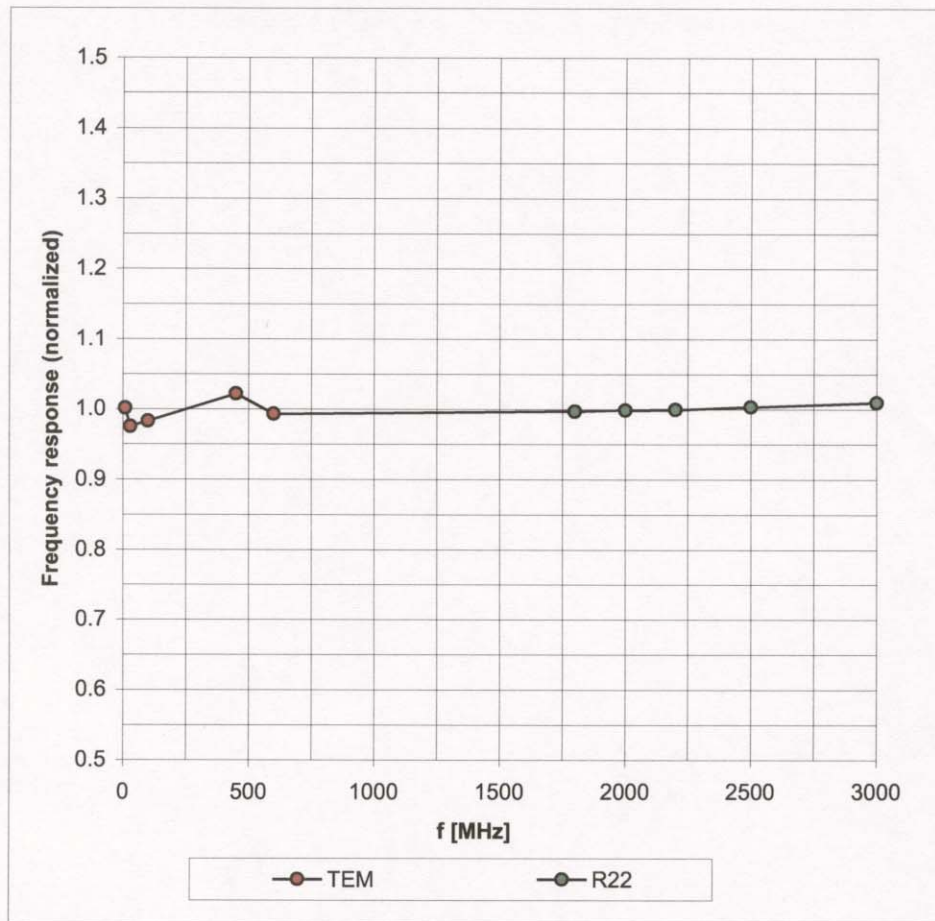
**The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.**

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 8).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

## Frequency Response of E-Field

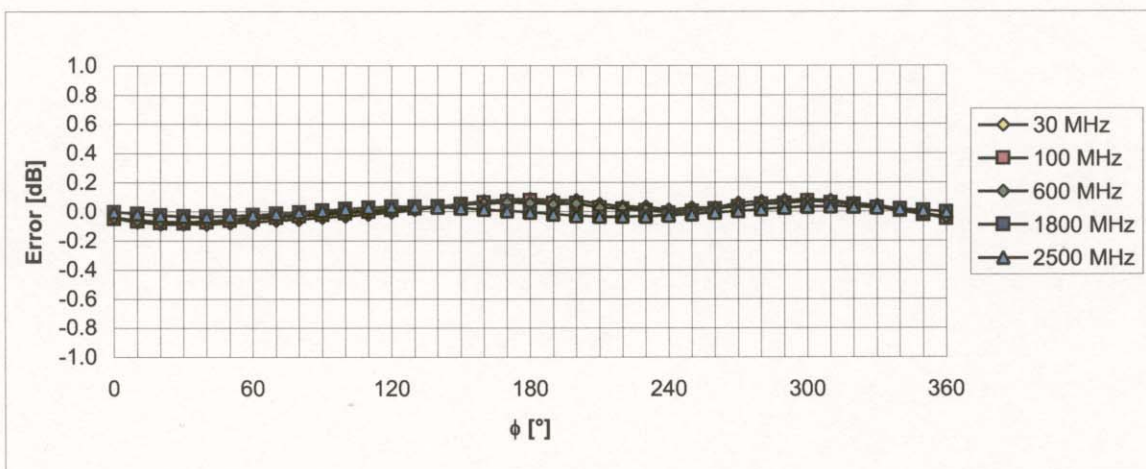
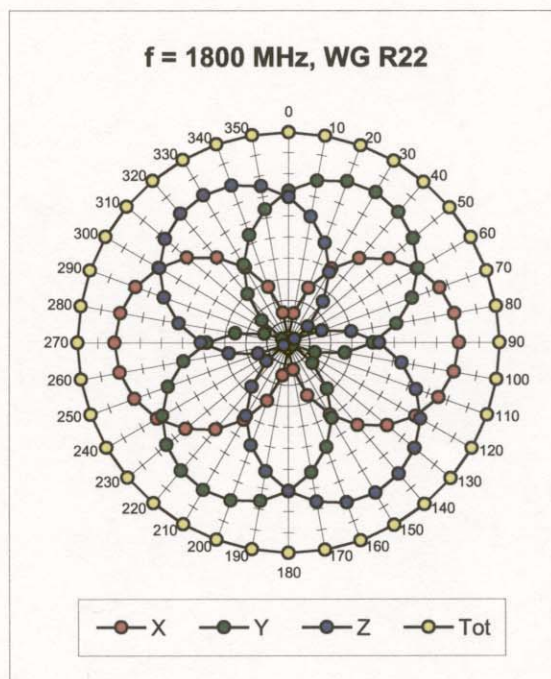
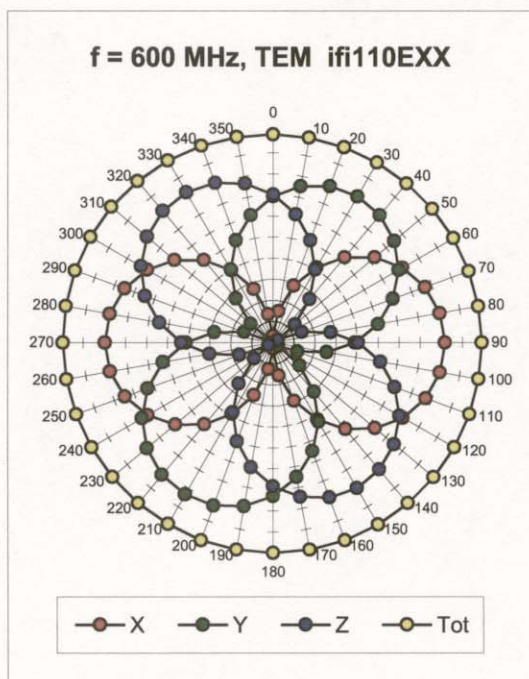
(TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

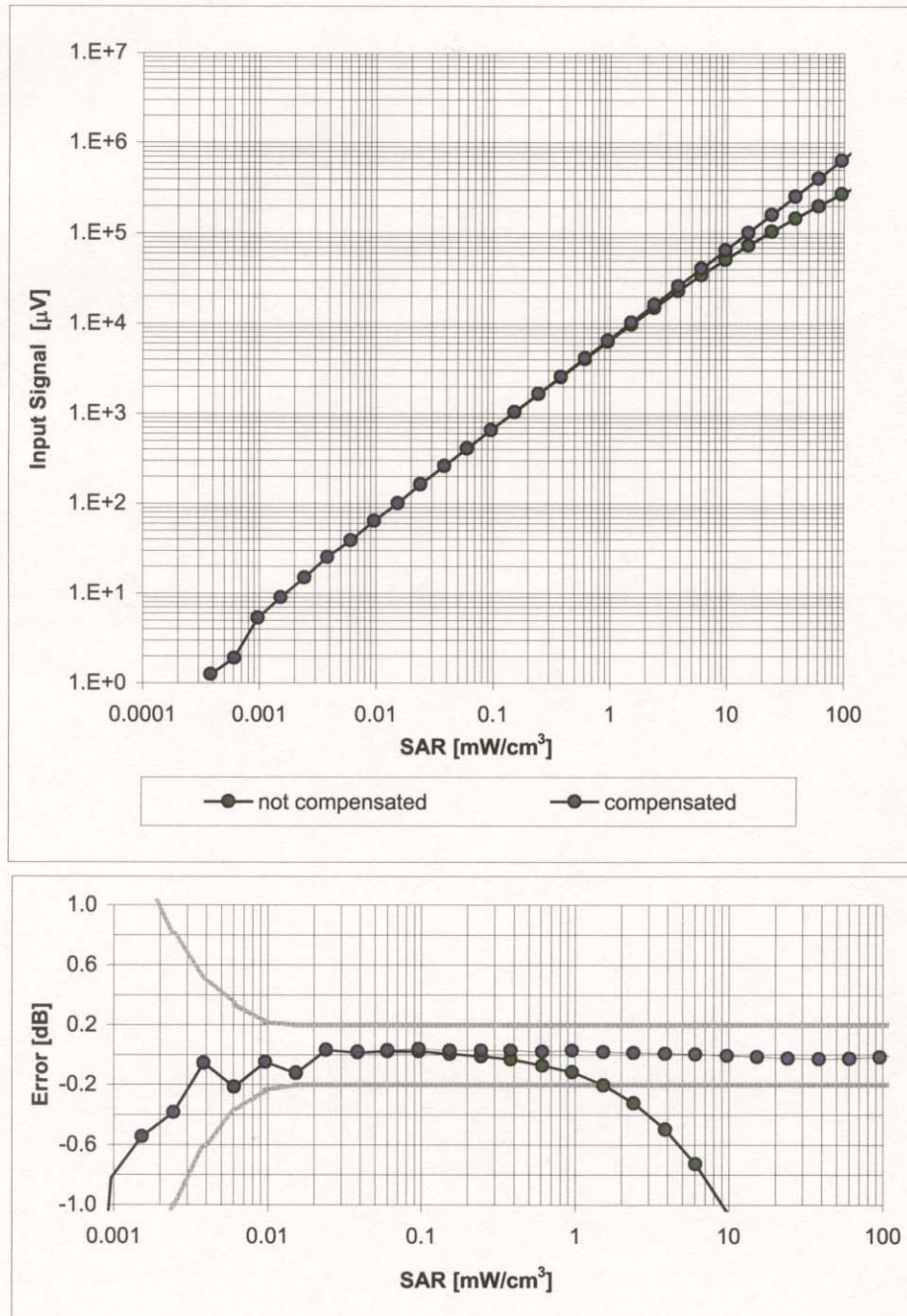


# Receiving Pattern ( $\phi$ ), $\vartheta = 0^\circ$



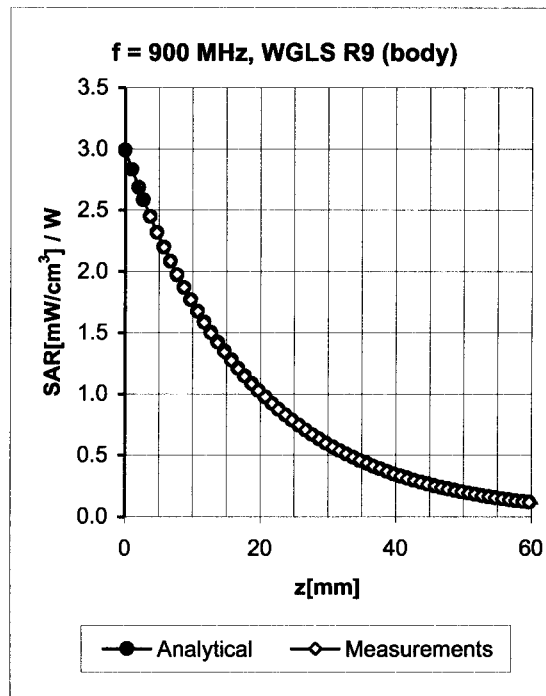
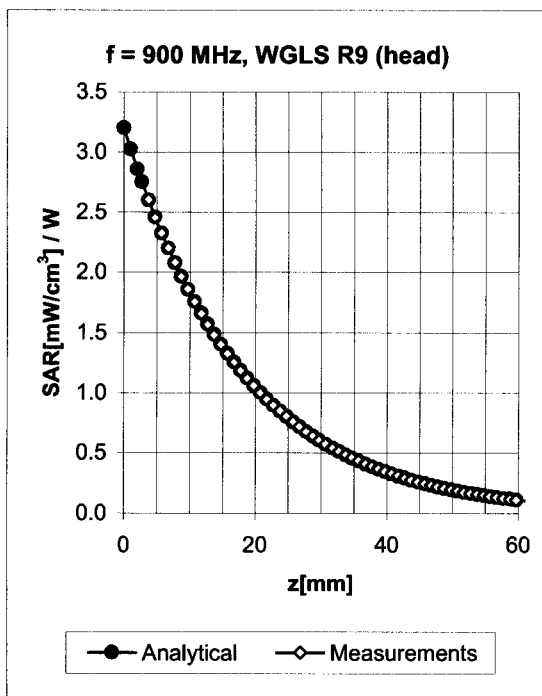
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

# Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide R22, $f = 1800 \text{ MHz}$ )



Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment

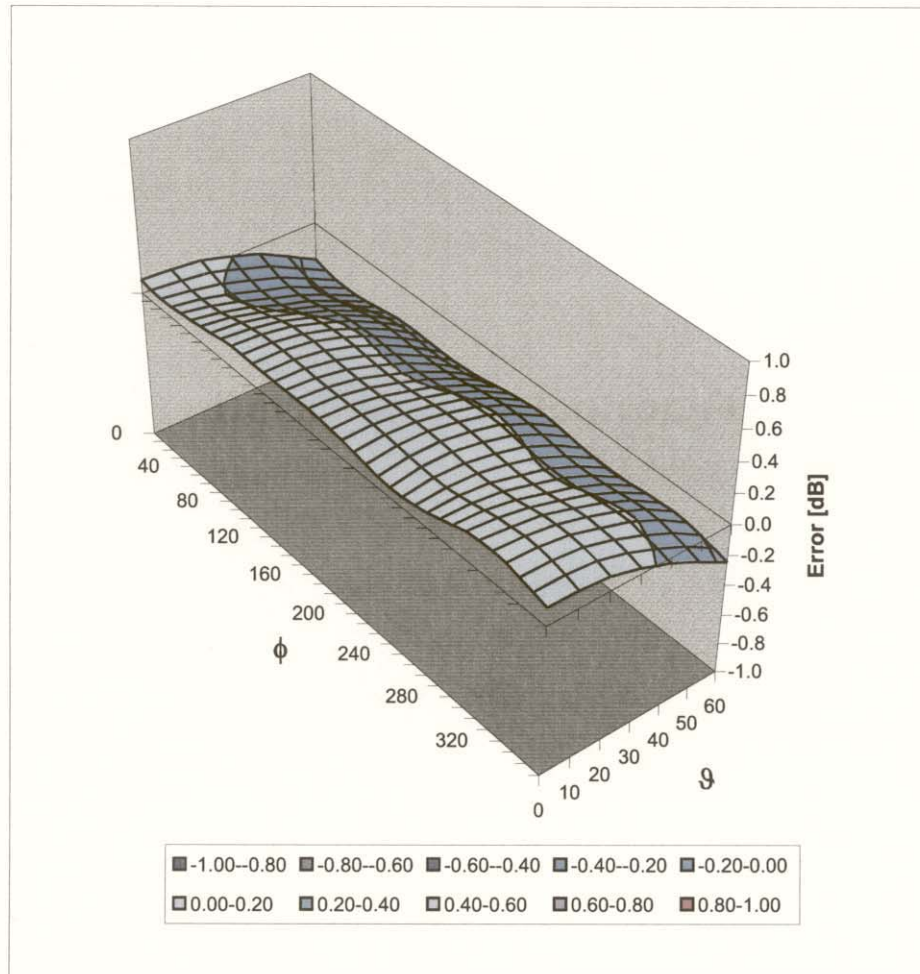


f [MHz]	Validity [MHz] <sup>c</sup>	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.62	1.86	6.35 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.59	1.97	6.04 ± 11.0% (k=2)

<sup>c</sup> 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 ( $\phi$ ,  $\theta$ ),  $f = 900$  MHz



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

## **Additional Conversion Factors**

**for Dosimetric E-Field Probe**

Type:

**ET3DV6**

Serial Number:

**1387**

Place of Assessment:

**Zurich**

Date of Assessment:

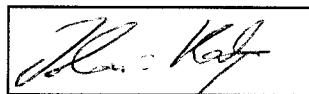
**March 18, 2006**

Probe Calibration Date:

**March 16, 2006**

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

Assessed by:



## Dosimetric E-Field Probe ET3DV6 SN:1387

Conversion factor ( $\pm$  standard deviation)

150 $\pm$ 50 MHz	ConvF	8.6 $\pm$ 10%	$\epsilon_r = 52.3 \pm 5\%$ $\sigma = 0.76 \pm 5\%$ mho/m (head tissue)
150 $\pm$ 50 MHz	ConvF	8.2 $\pm$ 10%	$\epsilon_r = 61.9 \pm 5\%$ $\sigma = 0.80 \pm 5\%$ mho/m (body tissue)
300 $\pm$ 50 MHz	ConvF	7.8 $\pm$ 9%	$\epsilon_r = 45.3 \pm 5\%$ $\sigma = 0.87 \pm 5\%$ mho/m (head tissue)
450 $\pm$ 50 MHz	ConvF	7.4 $\pm$ 8%	$\epsilon_r = 43.5 \pm 5\%$ $\sigma = 0.87 \pm 5\%$ mho/m (head tissue)
450 $\pm$ 50 MHz	ConvF	7.3 $\pm$ 8%	$\epsilon_r = 56.7 \pm 5\%$ $\sigma = 0.94 \pm 5\%$ mho/m (body tissue)
750 $\pm$ 50 MHz	ConvF	6.6 $\pm$ 7%	$\epsilon_r = 41.8 \pm 5\%$ $\sigma = 0.89 \pm 5\%$ mho/m (head tissue)
750 $\pm$ 50 MHz	ConvF	6.4 $\pm$ 7%	$\epsilon_r = 55.4 \pm 5\%$ $\sigma = 0.96 \pm 5\%$ mho/m (body tissue)
1925 $\pm$ 50 MHz	ConvF	5.0 $\pm$ 7%	$\epsilon_r = 39.8 \pm 5\%$ $\sigma = 1.48 \pm 5\%$ mho/m (head tissue)
1925 $\pm$ 50 MHz	ConvF	4.7 $\pm$ 7%	$\epsilon_r = 53.2 \pm 5\%$ $\sigma = 1.60 \pm 5\%$ mho/m (body tissue)

### Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.  
 Please see also Section 4.7 of the DASY4 Manual.