SAR TEST REPORT (FCC/IC)

RF EXPOSURE EVALUATION — SPECIFIC ABSORPTION RATE

APPLICANT	VOCOLLECT INC.	
DEVICE UNDER TEST (DUT)	PORTABLE BODY-WORN RFID READER (902.3 - 927.7 MHz)	
DEVICE MODEL(S)	WR-700-100	
DEVICE IDENTIFIER(S)	FCC ID:	MQOWR700-10000
	IC:	2570A-WR700100
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	
RF EXPOSURE CATEGORY	General Population / Uncontrolled	
RF EXPOSURE EVALUATION(S)	Body-worn	
DATE(S) OF EVALUATION(S)	May 22, 2008	
TEST REPORT SERIAL NO.	051308MQO-T907-S15R	
TEST REPORT REVISION NO.	Revision 1.0	Initial Release — June 03, 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
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TEST LAB ACCREDITATION(S)	ilac-MRA ACCREDITED 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**	**VOCOLLECT INC.**
	Address	703 Rodi Road, Pittsburgh, PA 15235 United States
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
Device Identifier(s)	**FCC**	MQOWR700-10000
	IC	2570A-WR700100
Device Description	Portable Body-worn RFID Reader	
Device Model(s)	WR-700-100	
Test Sample Serial No.	P2-0002 (Identical Prototype)	
Internal Transmitter	SkyeTek M7	
Mode(s) of Operation	Frequency Hopping Spread Spectrum (FHSS)	
Transmit Frequency Range(s)	902.3 - 927.7 MHz (ISM Band)	

Max. RF Output Power Tested	**Frequency**	**Channel**	**Conducted Power**			
	MHz		**Average**		**Peak**	
	902.3	Low	21.0 dBm	126 mW	24.4 dBm	275 mW
	915.0	Middle	21.6 dBm	145 mW	25.3 dBm	339 mW
	927.7	High	21.5 dBm	141 mW	24.9 dBm	309 mW

Max. Duty Cycle Tested	50% (Source-Based Time-Averaged)			
Antenna Type(s) Tested	Internal			
Power Source(s) Tested	Lithium-ion Battery (from T5 Terminal)	3.7 V	4400 mAh	Model: 730022
	T5 Terminal Model No.	TT-700-100 R WF	Serial No.	206445473
Body-worn Accessory Tested	Belt-Strap with Belt-Clip	P/N: BL-601-105	1.0 cm thickness	Contains no metallic components

Max. SAR Level(s) Measured	**Body-worn**	**0.177 W/kg**	**1g average**	General Population / Uncontrolled Exposure
FCC/IC Spatial Peak SAR Limit	**Body-worn**	**1.6 W/kg**	**1g average**	General Population / Uncontrolled Exposure

Celltech Labs Inc. declares under its sole responsibility that this wireless portable device was compliant 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 General Population / Uncontrolled 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 and IEEE 1528-2003. 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.

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

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1.0 INTRODUCTION

This measurement report demonstrates that the Vocollect Inc. Model: WR-700-100 Portable Body-worn RFID Reader 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 General Population / Uncontrolled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]), IC RSS-102 Issue 2 (see reference [4]) and IEEE 1528-2003 (see reference [5]) were employed. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 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 Measurement System with Fiberglas Planar Phantom

DASY4 Measurement Server

3.0 MEASUREMENT SUMMARY

BODY SAR EVALUATION RESULTS

Freq.	Chan.	Test Mode	Duty Cycle	Crest Factor	Power Source	Body-worn Accessory	DUT Spacing To Planar Phantom	DUT Position To Planar Phantom	Cond. Power Before Test	SAR Drift During Test	Measured SAR 1g
MHz									dBm	dB	W/kg
902.3	Low	Modulated Fixed Freq.	50%	1:2	Li-ion Battery (T5 Terminal)	Belt-Strap & Belt-Clip	1.0 cm	Back Side	21.0 av.	0.102	**0.177**
915.0	Mid	Modulated Fixed Freq.	50%	1:2	Li-ion Battery (T5 Terminal)	Belt-Strap & Belt-Clip	1.0 cm	Back Side	21.6 av.	-0.054	0.172
927.7	High	Modulated Fixed Freq.	50%	1:2	Li-ion Battery (T5 Terminal)	Belt-Strap & Belt-Clip	1.0 cm	Back Side	21.5 av.	-0.159	0.136

SAR LIMIT(S)		BODY	SPATIAL PEAK	RF EXPOSURE CATEGORY
FCC 47 CFR 2.1093	Health Canada Safety Code 6	1.6 W/kg	averaged over 1 gram	General Population / Uncontrolled

Test Date(s)	May 22, 2008				Relative Humidity	31	%
Measured Fluid Type	900 MHz Body				Atmospheric Pressure	100.4	kPa
Dielectric Constant ε	IEEE Target		Measured	Deviation	Ambient Temperature	22.8	°C
	55.0	±5%	54.8	-0.4%	Fluid Temperature	23.3	°C
Conductivity σ (mho/m)	IEEE Target		Measured	Deviation	Fluid Depth	≥ 15	cm
	1.05	±5%	1.01	-3.8%	ρ (Kg/m^3)	1000	

Notes

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 power drift of the DUT during the SAR evaluations was measured by the DASY4 system.
3.	The battery power source was fully charged prior to the SAR evaluations.
4.	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.
5.	The dielectric parameters of the simulated tissue mixture were measured prior to the SAR evaluations using a Dielectric Probe Kit and a Network Analyzer (see Appendix C).
6.	The SAR evaluations were performed within 24 hours of the system performance check.

4.0 DETAILS OF SAR EVALUATION

The Vocollect Inc. Model: WR-700-100 Portable Body-worn RFID Reader was compliant for localized Specific Absorption Rate (Uncontrolled Exposure) based on the test provisions and conditions described below. The SAR test setup photographs are shown in Appendix D.

Test Configuration(s)

1. The DUT was tested for body-worn SAR with the back side placed parallel to the outer surface of the SAM phantom (planar section). The attached belt-strap with belt-clip accessory provided a 1.0 cm spacing from the back of the DUT to the outer surface of the planar section. The DUT was connected to the Vocollect T5 Terminal (Li-ion battery power source) for the duration of the SAR evaluations.

Test Mode(s) & Output Power

2. The DUT was placed into test mode using proprietary software provided by the customer and controlled via PC with programming cable connected to the DUT. Once the DUT was placed in the appropriate test mode at maximum RF output power and channel setting, the programming cable was then removed from the DUT prior to each SAR evaluation and the DUT was connected to the Vocollect T5 Terminal via cable provided by the customer.
3. The DUT was tested at maximum power with a modulated signal on a fixed frequency (frequency hopping disabled) at 50% duty cycle (source-based time-averaged).
4. The conducted output power levels of the DUT were measured prior to the SAR evaluations by Rhein Tech Labs.
5. The battery power source was fully charged prior to the SAR evaluations.

Test Conditions

6. 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.
7. 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).
8. The SAR evaluations were performed within 24 hours of the system performance check.

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.

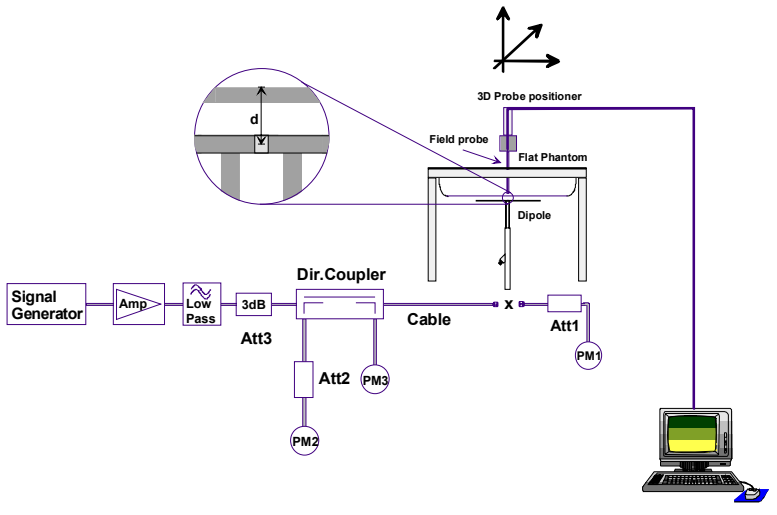
6.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluations a system check was performed with a planar phantom and 900 MHz validation 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 a Dielectric Probe Kit and a Network Analyzer (see Appendix C). A forward power of 250 mW was applied to the dipole and the system was verified to a tolerance of ±10% from the system validation target SAR value (see Appendix B for system performance check test plot).

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.						
May-22	Body 900	2.62 ±10%	2.70	+3.0%	57.2 ±5%	54.8	-4.2%	1.04 ±5%	1.01	-2.8%	1000	22.8	23.3	≥ 15	31	100.4

Note(s)	
	1. The target SAR values are referenced from the System Validation procedures performed by Celltech Labs Inc. (see Appendix E).
	2. The target dielectric parameters are referenced from the System Validation procedures performed by Celltech Labs Inc. (see Appendix E).
	3. The fluid temperature was measured prior to and after the system performance check. The fluid temperature remained within +/-2°C of the fluid temperature from the dielectric parameter measurements.
	4. The SAR evaluations were performed within 24 hours of the system performance check.



System Performance Check Measurement Setup Diagram

900 MHz Validation Dipole Setup

7.0 SIMULATED EQUIVALENT TISSUES

The 900MHz simulated equivalent tissue mixture consisted of a viscous gel using saline solution. Preservation with a bactericide was added and visual inspection was made to ensure air bubbles were not trapped during the mixing process. The fluids were prepared according to standardized procedures and measured for dielectric parameters (permittivity and conductivity).

SIMULATED TISSUE MIXTURE		
INGREDIENT	**900 MHz Body**	**900 MHz Body**
	System Performance Check	DUT Evaluation
Water	53.79 %	53.79 %
Sugar	45.13 %	45.13 %
Salt	0.98 %	0.98 %
Bactericide	0.10 %	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.	1387
Construction	Triangular core fiber optic detection system
Frequency	10 MHz to 6 GHz
Linearity	±0.2 dB (30 MHz to 3 GHz)
Phantom(s)	
Type	Planar Phantom
Shell Material	Fiberglas
Thickness	2.0 ±0.1 mm
Volume	94 cm (L) x 44 cm (W) x 22 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 PLANAR PHANTOM

The planar phantom is a Fiberglas shell phantom with a 2.0 mm (+/-0.2mm) thick device measurement area at the center of the phantom for SAR evaluations of devices with a larger surface area than the planar section of the SAM phantom. The planar phantom is mounted to the wooden table of the DASY4 compact system. The planar phantom is also used for system validations (≥ 835 MHz). See Appendix G for the dimensions and specifications.

Fiberglas Planar Phantom

12.0 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

13.0 TEST EQUIPMENT LIST

TEST EQUIPMENT			ASSET NO.	SERIAL NO.	DATE CALIBRATED		CALIBRATION DUE DATE
USED	DESCRIPTION						
x	Schmid & Partner DASY4 System		-	-	-		-
x	-DASY4 Measurement Server		00158	1078	N/A		N/A
x	-Robot		00046	599396-01	N/A		N/A
x	-DAE4		00019	353	22Apr08		22Apr09
	-EX3DV4 E-Field Probe		00213	3600	19Apr08		19Apr09
x	-ET3DV6 E-Field Probe		00016	1387	22Apr08		22Apr09
	-300 MHz Validation Dipole		00023	135	30Apr08		30Apr09
	-450 MHz Validation Dipole		00024	136	01May08		01May09
	-835 MHz Validation Dipole		00022	411	**Brain**	07Jun07	07Jun08
					Body	02May08	02May09
	-900 MHz Validation Dipole		00020	054	**Brain**	07Jun07	07Jun08
x					**Body**	20May08	20May09
	-1800 MHz Validation Dipole		00021	247	**Brain**	06Jun07	06Jun08
					Body	06Jun07	06Jun08
	-1900 MHz Validation Dipole		00032	151	**Brain**	06Jun07	06Jun08
					Body	06Jun07	06Jun08
	-2450 MHz Validation Dipole		00025	150	**Brain**	16Jul07	16Jul08
					Body	08Jun07	08Jun08
	5GHz Validation Dipole	-5200 MHz	00126	1031	**Body**	21Apr08	21Apr09
		-5500 MHz			**Body**	21Apr08	21Apr09
		-5800 MHz			**Brain**	21Apr08	21Apr09
					Body	21Apr08	21Apr09
	-SAM Phantom V4.0C		00154	1033	N/A		N/A
x	-Barski Planar Phantom		00155	03-01	N/A		N/A
	-Plexiglas Side Planar Phantom		00156	161	N/A		N/A
	-Plexiglas Validation Planar Phantom		00157	137	N/A		N/A
	ALS-PR-DIEL Dielectric Probe Kit		00160	260-00953	N/A		N/A
x	HP 85070C Dielectric Probe Kit		00033	US39240170	N/A		N/A
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	NCR		NCR
	Rohde & Schwarz SMR20 Signal Generator		00006	100104	NCR		NCR
x	Amplifier Research 5S1G4 Power Amplifier		00106	26235	NCR		NCR
	Amplifier Research 10W1000C Power Amplifier		00041	27887	NCR		NCR
	Nextec NB00383 Microwave Amplifier		00151	0535	NCR		NCR

14.0 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 (900 MHz)	5.5	Normal	1	1	5.5	∞
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	0.9	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	3.7	Rectangular	1.732050808	1	2.1	∞
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)	3.8	Normal	1	0.64	2.4	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	0.4	Normal	1	0.6	0.2	∞
Combined Standard Uncertainty					**10.45**	
Expanded Uncertainty (k=2)					**20.91**	

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

MEASUREMENT UNCERTAINTIES (Cont.)

UNCERTAINTY BUDGET FOR SYSTEM VALIDATION

Error Description	Uncertainty Value ±%	Probability Distribution	Divisor	ci 1g	Uncertainty Value ±% (1g)	V_i or V_{eff}
Measurement System						
Probe calibration (900 MHz)	5.5	Normal	1	1	5.5	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	1	2.7	∞
Spherical isotropy of the probe	0	Rectangular	1.732050808	1	0.0	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	0.9	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)	2.8	Normal	1	0.64	1.8	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	4.2	Normal	1	0.6	2.5	∞
Combined Standard Uncertainty					**9.05**	
Expanded Uncertainty (k=2)					**18.10**	

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

15.0 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.

APPENDIX A - SAR MEASUREMENT DATA

Date Tested: 05/22/2008

Body-worn SAR - ISM Band - 902.3 MHz - Low Channel

DUT: Vocollect Inc.; Model: WR-700-100; Type: Body-worn RFID Reader; Serial: P2-0002

Body-worn Accessory: Belt-Strap with Belt-Clip

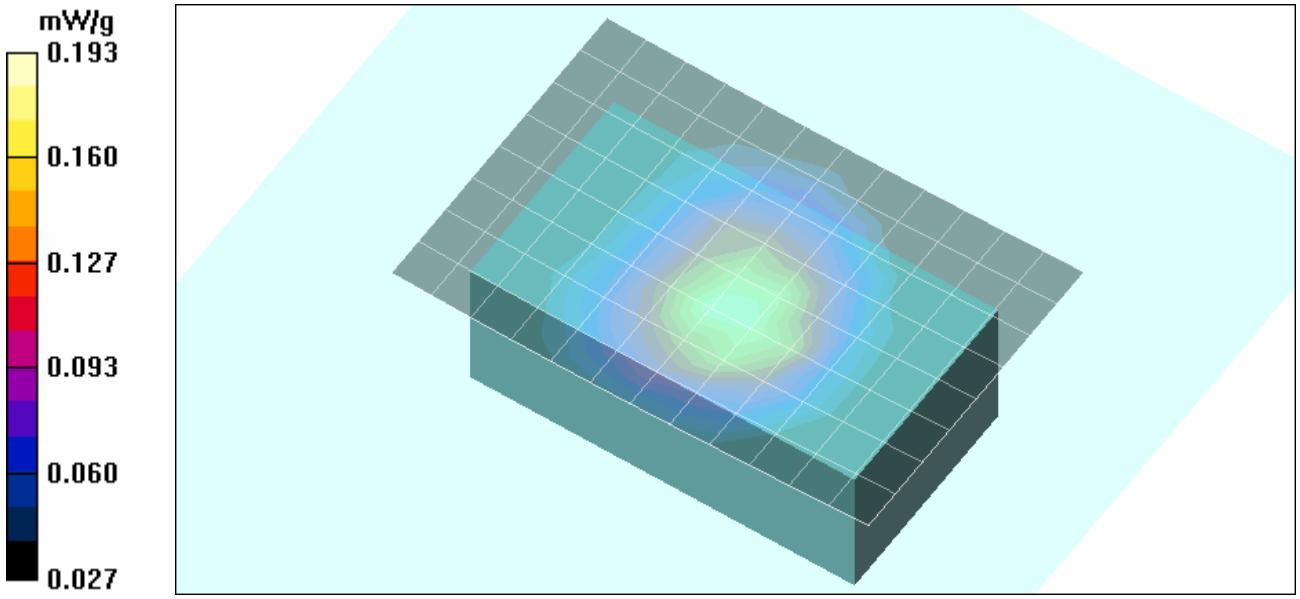
Ambient Temp: 22.8ºC; Fluid Temp: 23.3ºC; Barometric Pressure: 100.4 kPa; Humidity: 31%

Communication System: Modulated
Frequency: 902.3 MHz; Duty Cycle: 1:2
RF Conducted Output Power: 21.0 dBm
Power Source: 3.7V, 4400mAh Li-ion Battery (T5 Terminal)
Medium: M900 Medium parameters used: f = 902 MHz; σ = 1.01 mho/m; ε_r = 54.8; ρ = 1000 kg/m^3

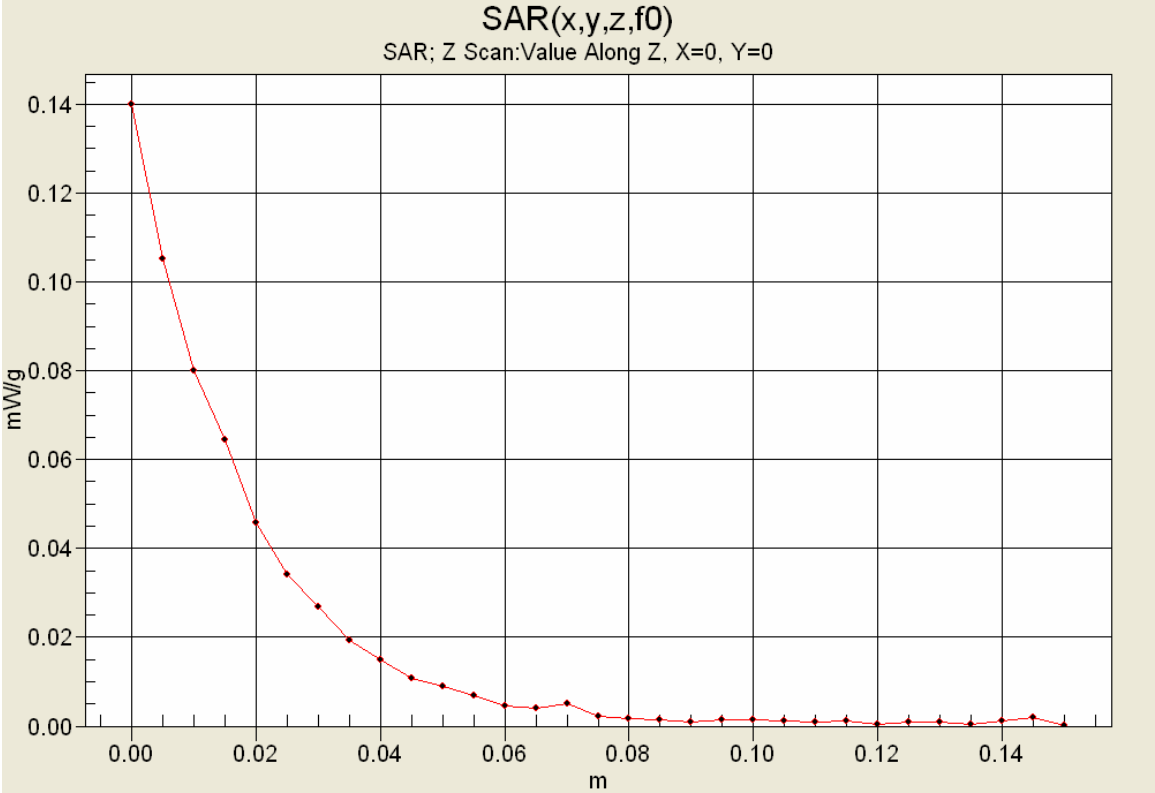
- Probe: ET3DV6 - SN1387; ConvF(5.96, 5.96, 5.96); Calibrated: 22/04/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - 1.0 cm Belt-Strap & Belt-Clip Spacing from Back Side of DUT to Planar Phantom - 902.3 MHz
Area Scan (13x9x1): Measurement grid: dx=15mm, dy=15mm

Body-worn SAR - 1.0 cm Belt-Strap & Belt-Clip Spacing from Back Side of DUT to Planar Phantom - 902.3 MHz
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.9 V/m; Power Drift = 0.102 dB
Peak SAR (extrapolated) = 0.243 W/kg
SAR(1 g) = 0.177 mW/g; SAR(10 g) = 0.131 mW/g
Maximum value of SAR (measured) = 0.193 mW/g



Z-Axis Scan



Date Tested: 05/22/2008

Body-worn SAR - ISM Band - 915.0 MHz - Mid Channel

DUT: Vocollect Inc.; Model: WR-700-100; Type: Body-worn RFID Reader; Serial: P2-0002

Body-worn Accessory: Belt-Strap with Belt-Clip

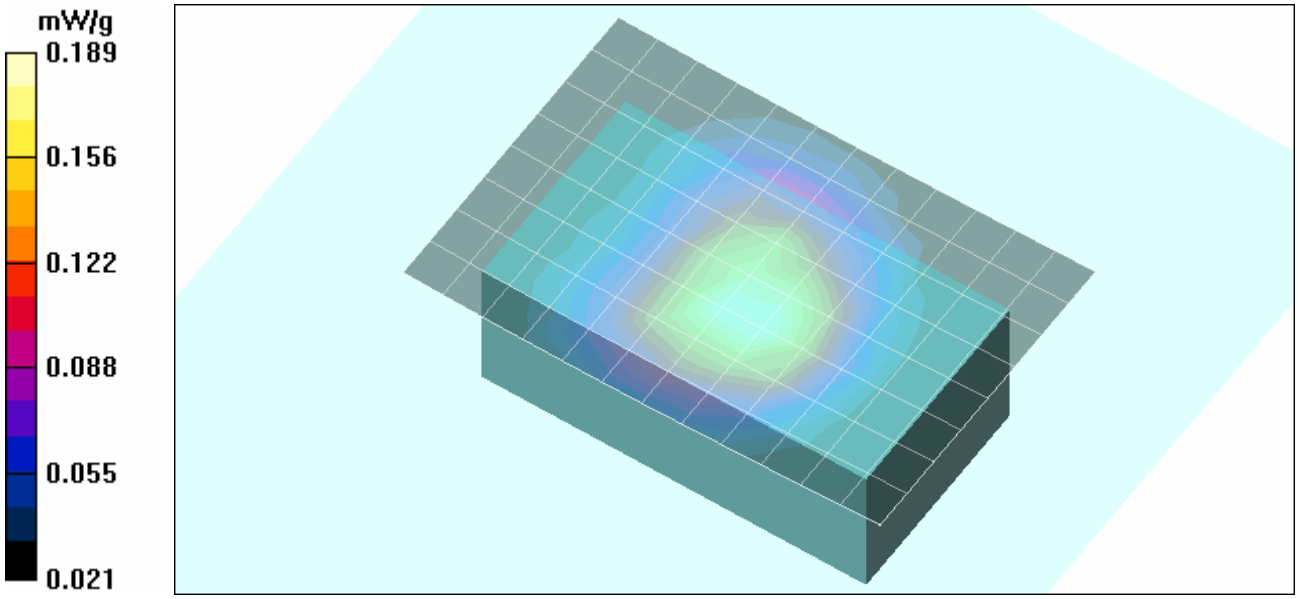
Ambient Temp: 22.8ºC; Fluid Temp: 23.3ºC; Barometric Pressure: 100.4 kPa; Humidity: 31%

Communication System: Modulated
Frequency: 915.0 MHz; Duty Cycle: 1:2
RF Conducted Output Power: 21.6 dBm
Power Source: 3.7V, 4400mAh Li-ion Battery (T5 Terminal)
Medium: M900 Medium parameters used: f = 915 MHz; σ = 1.01 mho/m; ε_r = 54.8; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1387; ConvF(5.96, 5.96, 5.96); Calibrated: 22/04/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - 1.0 cm Belt-Strap & Belt-Clip Spacing from Back Side of DUT to Planar Phantom - 915.0 MHz
Area Scan (13x9x1): Measurement grid: dx=15mm, dy=15mm

Body-worn SAR - 1.0 cm Belt-Strap & Belt-Clip Spacing from Back Side of DUT to Planar Phantom - 915.0 MHz
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.2 V/m; Power Drift = -0.054 dB
Peak SAR (extrapolated) = 0.239 W/kg
SAR(1 g) = 0.172 mW/g; SAR(10 g) = 0.128 mW/g
Maximum value of SAR (measured) = 0.189 mW/g



Date Tested: 05/22/2008

Body-worn SAR - ISM Band - 927.7 MHz - High Channel

DUT: Vocollect Inc.; Model: WR-700-100; Type: Body-worn RFID Reader; Serial: P2-0002

Body-worn Accessory: Belt-Strap with Belt-Clip

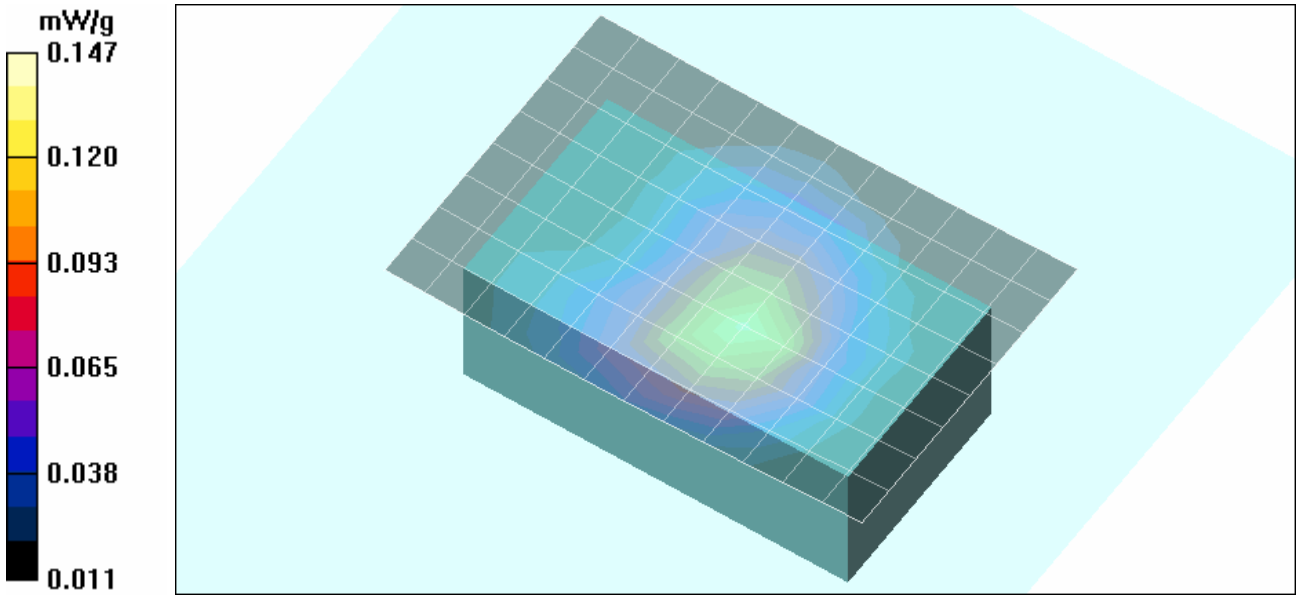
Ambient Temp: 22.8ºC; Fluid Temp: 23.3ºC; Barometric Pressure: 100.4 kPa; Humidity: 31%

Communication System: Modulated
Frequency: 927.7 MHz; Duty Cycle: 1:2
RF Conducted Output Power: 21.5 dBm
Power Source: 3.7V, 4400mAh Li-ion Battery (T5 Terminal)
Medium: M900 Medium parameters used: f = 928 MHz; σ = 1.01 mho/m; ε_r = 54.8; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1387; ConvF(5.96, 5.96, 5.96); Calibrated: 22/04/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - 1.0 cm Belt-Strap & Belt-Clip Spacing from Back Side of DUT to Planar Phantom - 927.7 MHz
Area Scan (13x9x1): Measurement grid: dx=15mm, dy=15mm

Body-worn SAR - 1.0 cm Belt-Strap & Belt-Clip Spacing from Back Side of DUT to Planar Phantom - 927.7 MHz
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.8 V/m; Power Drift = -0.159 dB
Peak SAR (extrapolated) = 0.179 W/kg
SAR(1 g) = 0.136 mW/g; SAR(10 g) = 0.099 mW/g
Maximum value of SAR (measured) = 0.147 mW/g



APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 05/22/2008

System Performance Check - 900 MHz Dipole - MSL

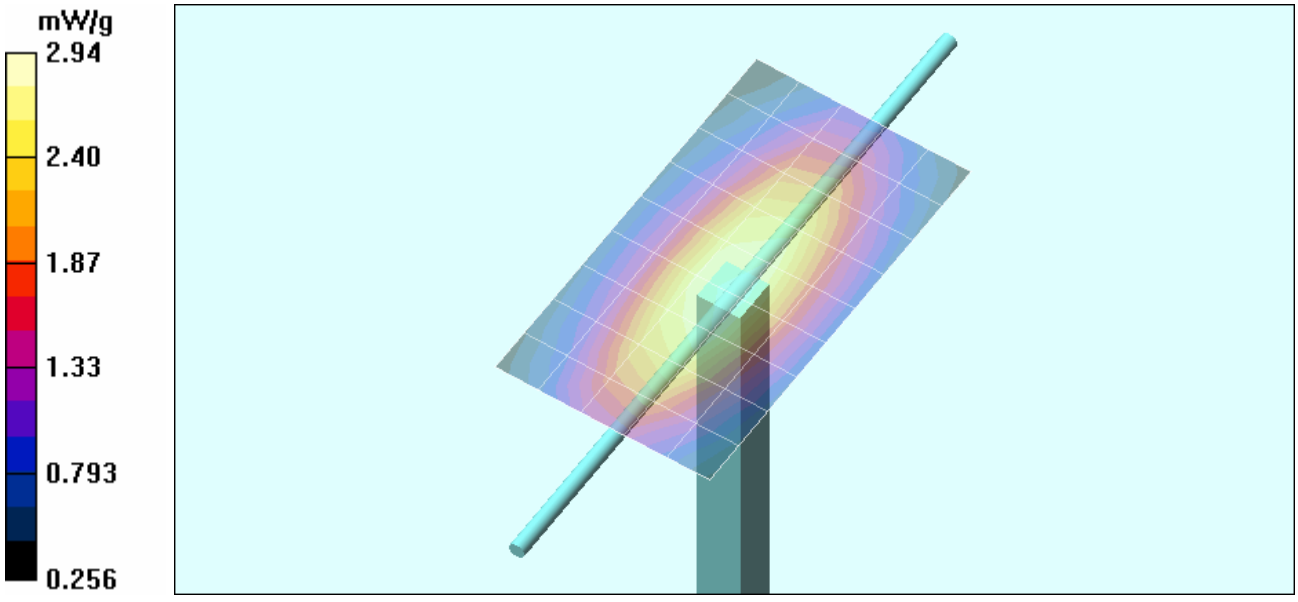
DUT: Dipole 900 MHz; Asset: 00020; Serial: 054; Validation: 05/20/2008

Ambient Temp: 22.8ºC; Fluid Temp: 23.3ºC; Barometric Pressure: 100.4 kPa; Humidity: 31%

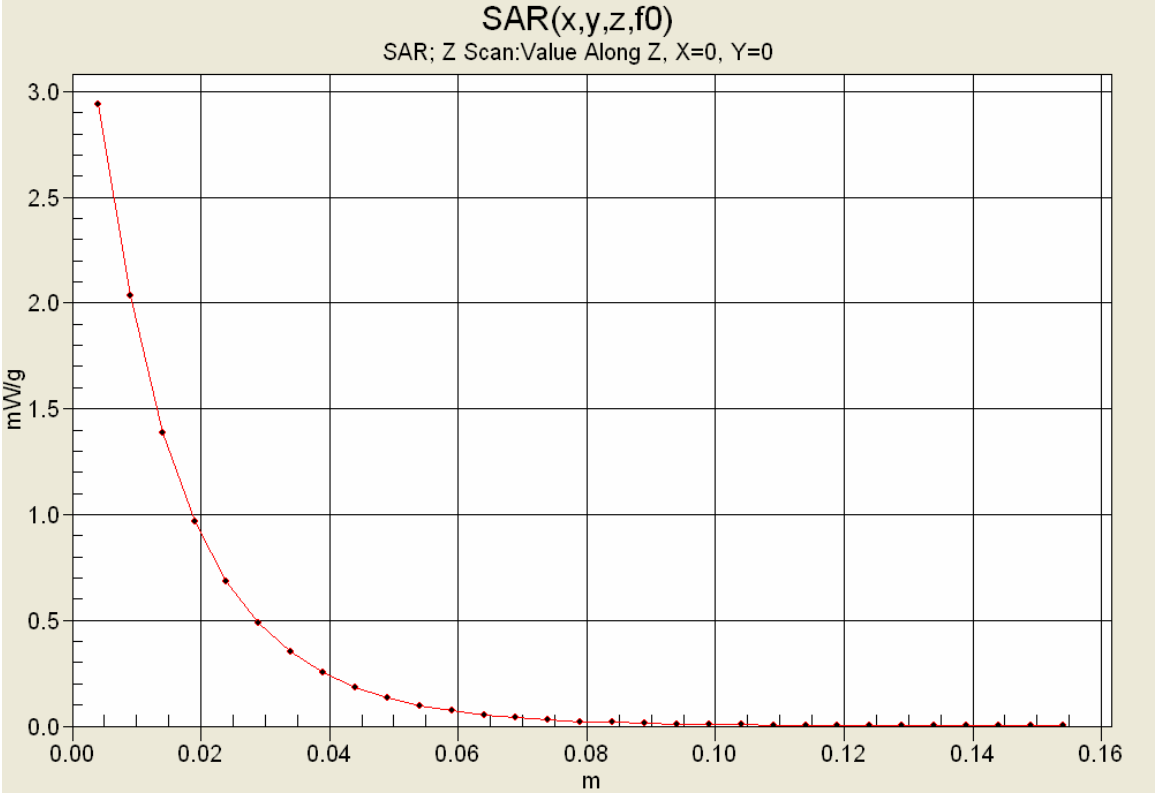
Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 900 MHz; Duty Cycle: 1:1
Medium: M900 Medium parameters used: f = 900 MHz; σ = 1.01 mho/m; ε_r = 54.8; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1387; ConvF(5.96, 5.96, 5.96); Calibrated: 22/04/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

900 MHz Dipole - System Performance Check
Area Scan (6x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 2.90 mW/g
900 MHz Dipole - System Performance Check
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.0 V/m; Power Drift = -0.084 dB
Peak SAR (extrapolated) = 3.81 W/kg
SAR(1 g) = 2.7 mW/g; SAR(10 g) = 1.78 mW/g
Maximum value of SAR (measured) = 2.94 mW/g



Z-Axis Scan



APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

900 MHz System Performance Check & DUT Evaluation (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Thu 22/May/2008
Frequency (GHz)
FCC_eB FCC Limits for Body Epsilon
FCC_sB FCC Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

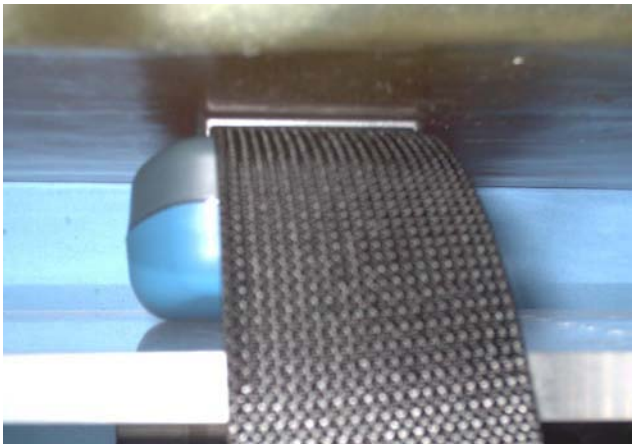
****

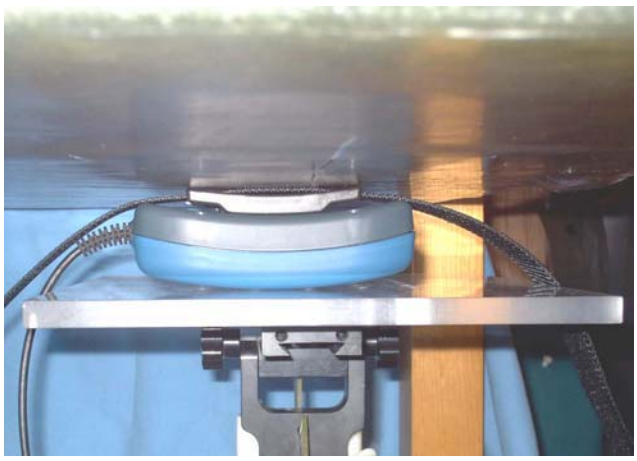
Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.8000	55.34	0.97	55.43	0.91
0.8100	55.30	0.97	55.58	0.92
0.8200	55.26	0.97	55.72	0.94
0.8300	55.22	0.97	55.27	0.94
0.8400	55.18	0.98	55.23	0.96
0.8500	55.15	0.99	55.21	0.96
0.8600	55.12	1.00	55.19	0.97
0.8700	55.09	1.01	55.44	0.98
0.8800	55.06	1.03	55.30	0.99
0.8900	55.03	1.04	55.06	1.00
0.9000	55.00	1.05	54.81	1.01
0.9100	55.00	1.06	54.78	1.04
0.9200	54.99	1.06	54.86	1.04
0.9300	54.97	1.07	54.69	1.06
0.9400	54.95	1.07	54.68	1.06
0.9500	54.93	1.08	54.63	1.07
0.9600	54.92	1.08	54.53	1.08
0.9700	54.90	1.08	54.47	1.10
0.9800	54.88	1.09	54.68	1.09
0.9900	54.86	1.09	54.49	1.12
1.0000	54.84	1.10	54.28	1.12

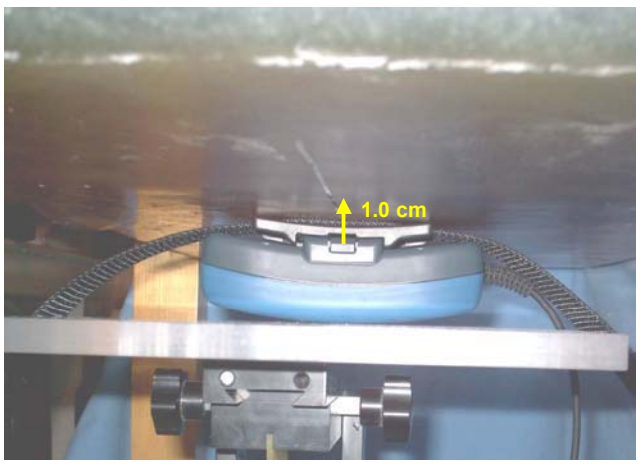
APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS

BODY SAR TEST SETUP PHOTOGRAPHS

1.0 cm Belt-Strap and Belt-Clip Spacing from Back Side of DUT to Planar Phantom







DUT PHOTOGRAPHS

Front Side Top View of DUT

Back Side Top View of DUT

DUT PHOTOGRAPHS

Front Side Top View of DUT and T5 Terminal

Back Side Top View of DUT and T5 Terminal

DUT PHOTOGRAPHS

Front Side of DUT (with Belt-Strap)

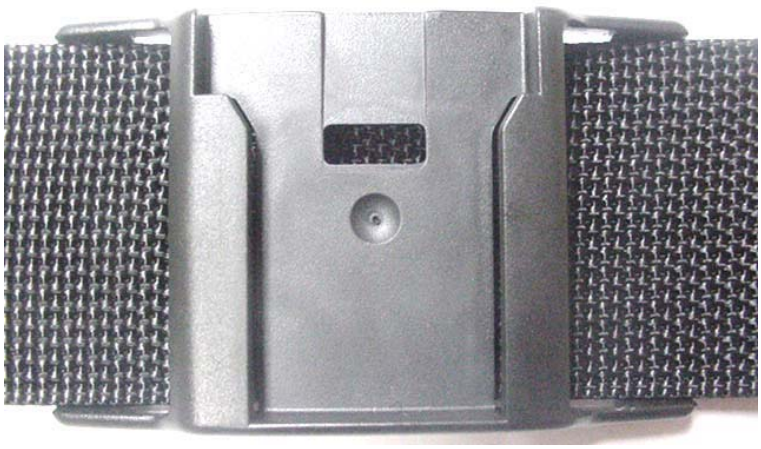
Back Side of DUT with Belt-Strap and Belt-Clip

Front Side of DUT

Back Side of DUT

Side Views of DUT

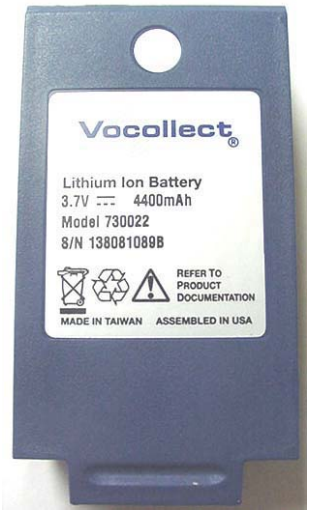
DUT PHOTOGRAPHS



Belt-Strap with Belt-Clip

Front Side of Belt-Clip

Back Side of Belt-Clip



Battery Power Source (3.7V, 4400mAh Lithium-ion)

T5 Terminal Battery Housing

T5 Terminal Connectors

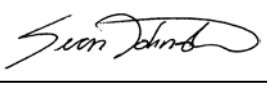
DUT cable connected to T5 Terminal

APPENDIX E - SYSTEM VALIDATION

900 MHz SYSTEM VALIDATION

Type:	**900 MHz Validation Dipole**
Asset Number:	**00020**
Serial Number:	**054**
Place of Validation:	**Celltech Labs Inc.**
Date of Validation:	**May 20, 2008**

Celltech Labs Inc. certifies that the 900 MHz System Validation was performed on the date indicated above.

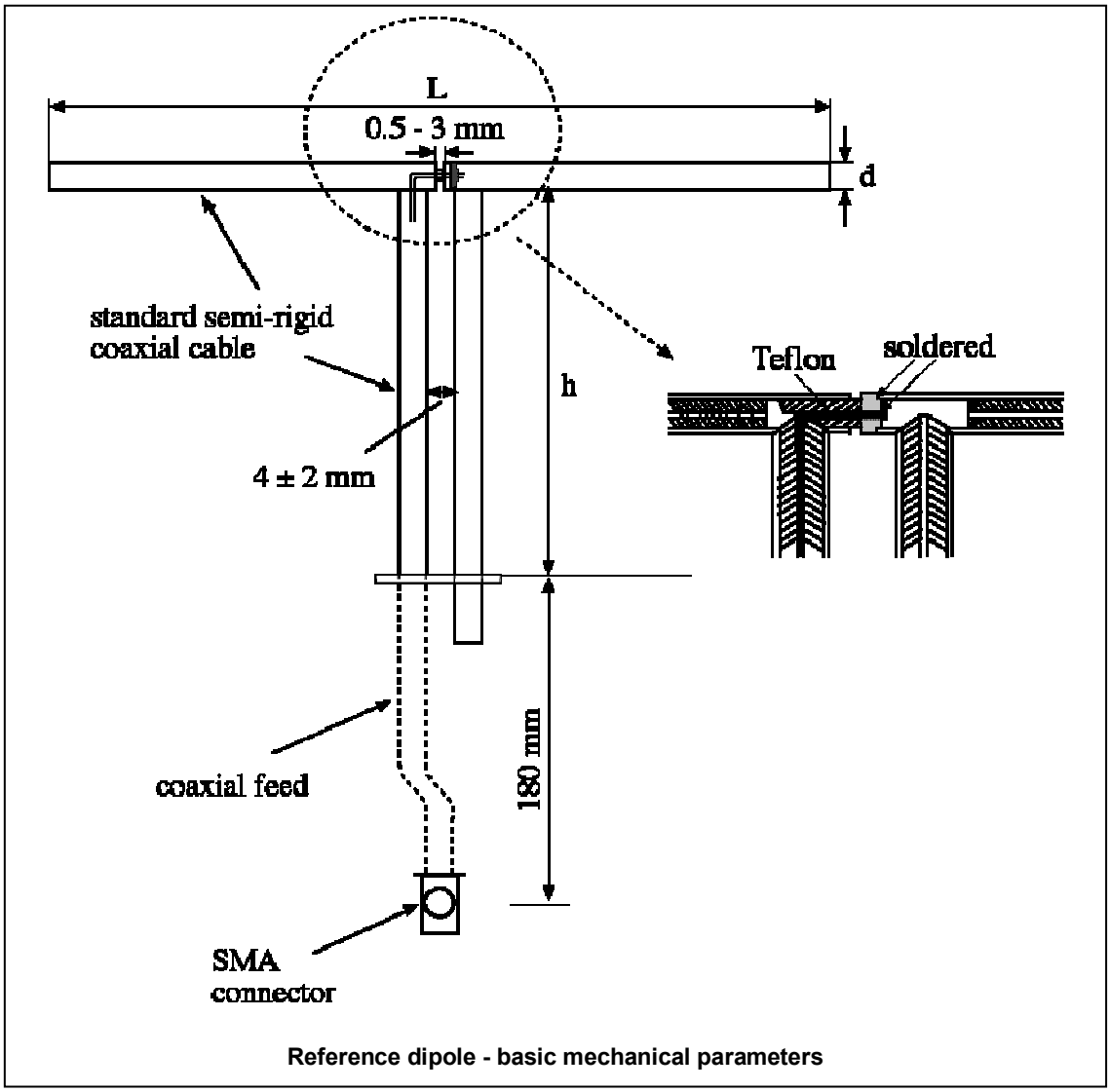
Performed by:	**Sean Johnston**
Signature:	

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

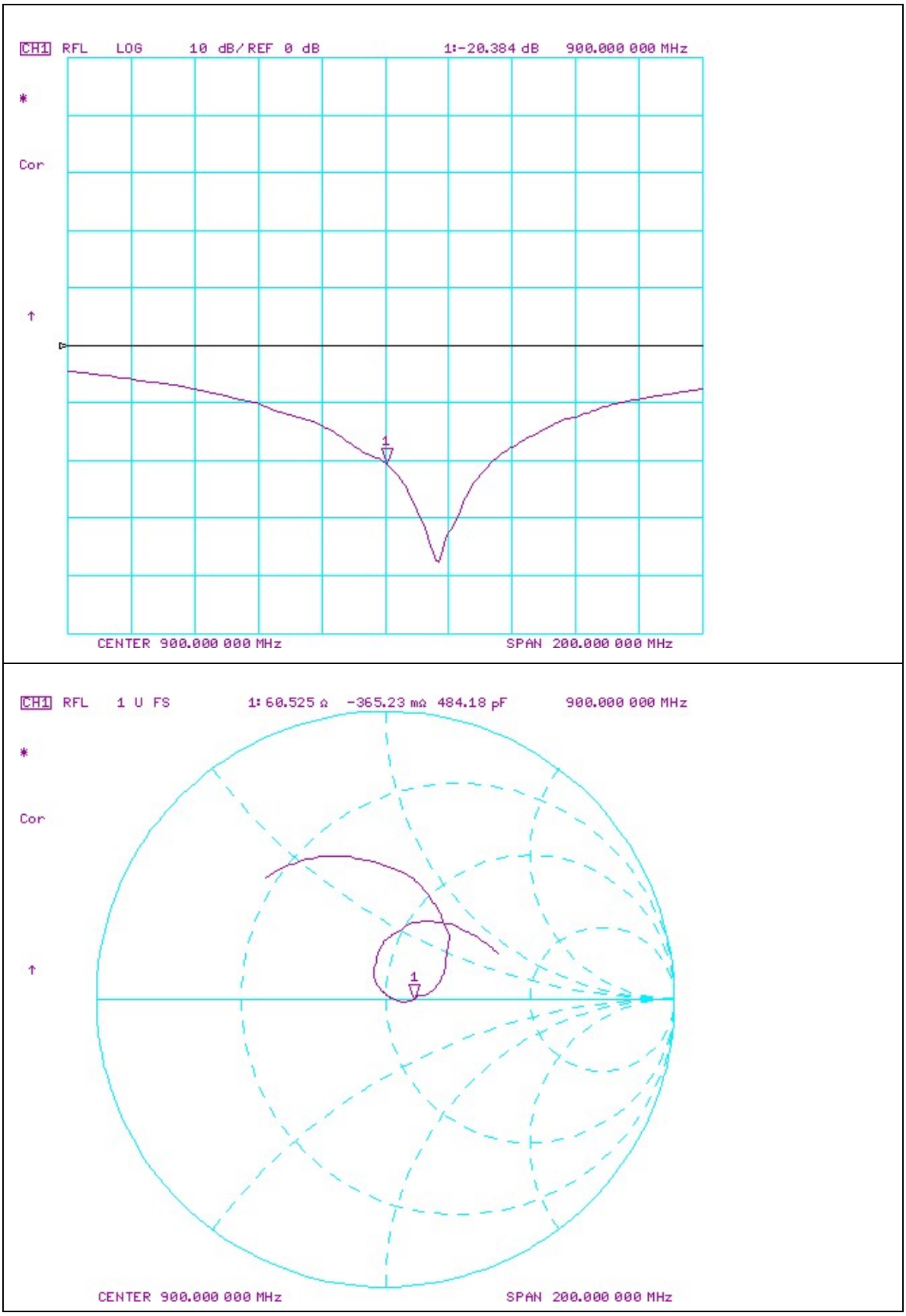
The validation dipole was constructed in accordance with the requirements specified in IEEE Standard 1528-2003 and International Standard IEC 62209-1:2005. The electrical properties were measured using an HP 8753ET Network Analyzer. The network analyzer was calibrated to the validation dipole N-type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

Feed point impedance at 900 MHz	Re{Z} = 60.525Ω
	Im{Z} = -365.23mΩ
Return Loss at 900 MHz	-20.384dB



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 is a Fiberglass shell planar phantom manufactured by Barski Industries Ltd. The phantom is in conformance with the requirements defined by IEEE SCC34-SC2 for the dosimetric evaluations of body-worn and lap-held operating configurations. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids.

Shell Thickness: 2.0 ± 0.1 mm
Filling Volume: Approx. 55 liters
Dimensions: 94 cm (L) x 44 cm (W) x 22 cm (H)

5. Test Equipment List

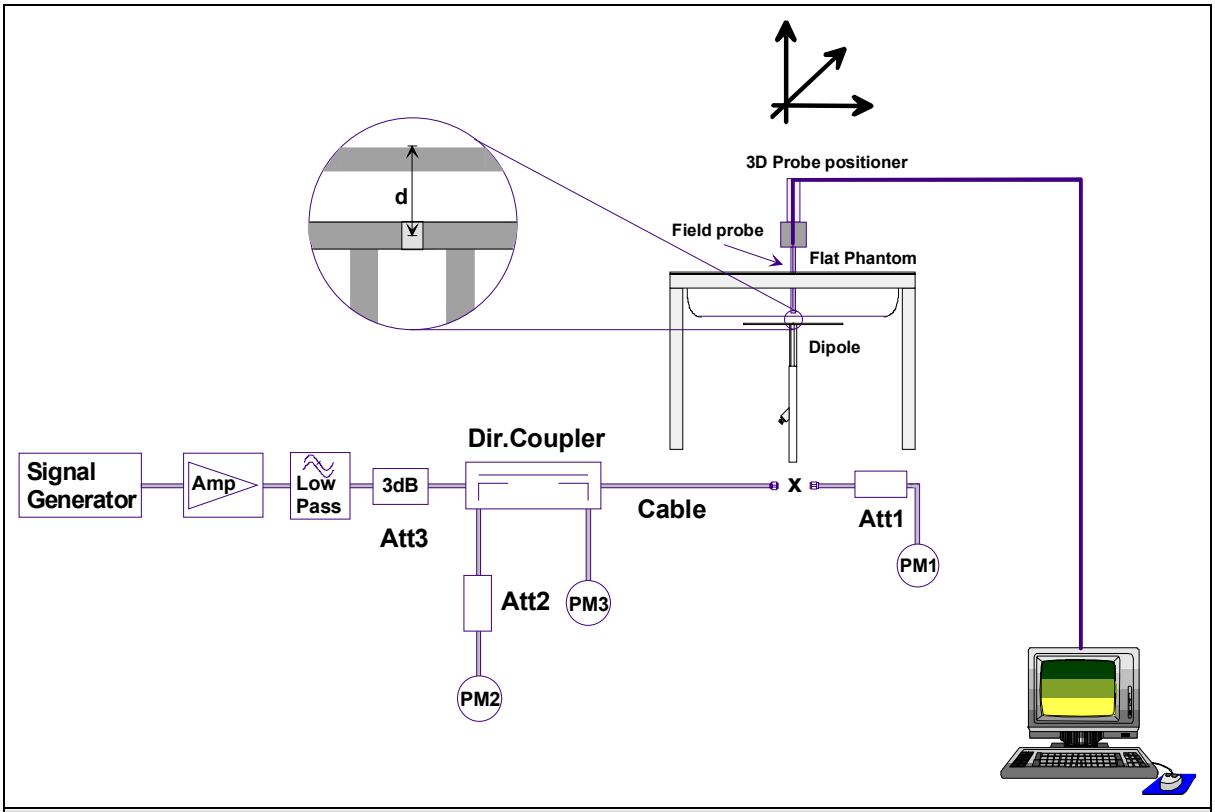
TEST EQUIPMENT	ASSET NO.	SERIAL NO.	DATE OF CAL.	CAL. DUE DATE
SPEAG DASY4 Measurement Server	00158	1078	N/A	N/A
SPEAG Robot	00046	599396-01	N/A	N/A
SPEAG DAE4	00019	353	22Apr08	22Apr09
SPEAG ET3DV6 E-Field Probe	00016	1387	22Apr08	22Apr09
900 MHz Validation Dipole	00020	054	20May08	20May09
Barski Planar Phantom	00155	03-01	N/A	N/A
ALS-PR-DIEL Dielectric Probe Kit	00160	260-00953	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. 900 MHz Validation Dipole & Planar Phantom

7. SAR Measurement

Measurements were made using a dosimetric E-field probe ET3DV6 (S/N: 1387, Conversion Factor 5.96). The SAR measurement was performed with the E-field probe in mechanical and optical surface detection mode. 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.



System Validation Measurement Setup Diagram

8. Measurement Conditions

The planar phantom was filled with 900 MHz Body tissue simulant.

Relative Permittivity: 57.2 (+4.0% deviation from target)
Conductivity: 1.04 mho/m (-1.0% deviation from target)
Fluid Temperature: 23.3 °C (Start of Test) / 23.2 °C (End of Test)
Fluid Depth: ≥ 15.0 cm

Environmental Conditions:
Ambient Temperature: 23.0°C
Barometric Pressure: 100.4 kPa
Humidity: 31%

The 900 MHz Body tissue simulant consisted of the following ingredients:

Ingredient	Percentage by weight	
Water	53.79%	
Sugar	45.13%	
Salt	0.98%	
Dowicil 75	0.10%	
IEEE/IEC Target Dielectric Parameters (900 MHz):	**ε_r = 55.0 (+/- 5%)**	**σ = 1.05 S/m (+/- 5%)**

9. System Validation SAR Results

SAR @ 0.25W Input averaged over 1g (W/kg)				SAR @ 1W Input averaged over 1g (W/kg)			
SPEAG Target		Measured	Deviation	SPEAG Target		Measured	Deviation
2.78	+/- 10%	2.62	-5.7%	11.1	+/- 10%	10.48	-5.6%
SAR @ 0.25W Input averaged over 10g (W/kg)				**SAR @ 1W Input averaged over 10g (W/kg)**			
SPEAG Target		Measured	Deviation	SPEAG Target		Measured	Deviation
1.79	+/- 10%	1.72	-3.9%	7.17	+/- 10%	6.88	-4.0%

Dipole Type	Distance [mm]	Frequency [MHz]	SAR (1g) [W/kg]	SAR (10g) [W/kg]	SAR (peak) [W/kg]
D300V2	15	300	3.02	2.06	4.36
D450V2	15	450	5.01	3.36	7.22
D835V2	15	835	9.71	6.38	14.1
D900V2	15	900	11.1	7.17	16.3
D1450V2	10	1450	29.6	16.6	49.8
D1500V2	10	1500	30.8	17.1	52.1
D1640V2	10	1640	34.4	18.7	59.4
D1800V2	10	1800	38.5	20.3	67.5
D1900V2	10	1900	39.8	20.8	69.6
D2000V2	10	2000	40.9	21.2	71.5
D2450V2	10	2450	51.2	23.7	97.6
D3000V2	10	3000	61.9	24.8	136.7

Table 32.1: Numerical reference SAR values for SPEAG dipoles and flat phantom filled with body-tissue simulating liquid. Note: All SAR values normalized to 1 W forward power.

Date Tested: 05/20/2008

System Validation - 900 MHz Dipole - MSL

DUT: Dipole 900 MHz; Asset: 00020; Serial: 054; Validation: 05/20/2008

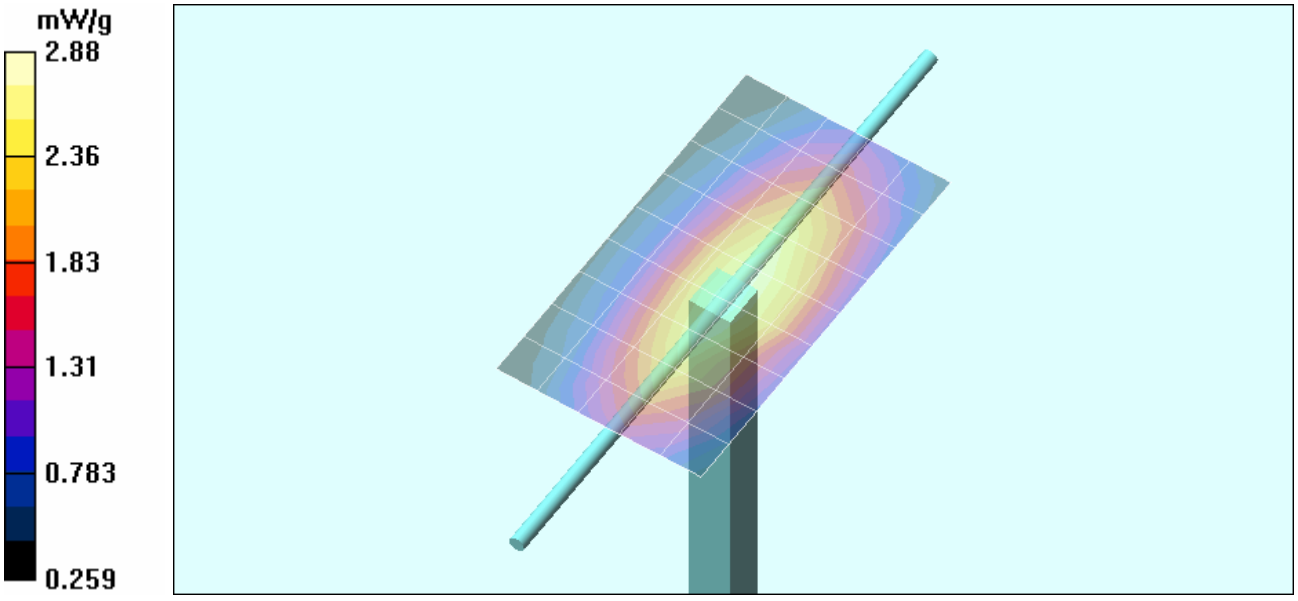
Ambient Temp: 23ºC; Fluid Temp: 23.3ºC; Barometric Pressure: 100.4 kPa; Humidity: 31%

Communication System: CW
Frequency: 900 MHz; Duty Cycle: 1:1
Forward Conducted Power: 250 mW
Medium: M900 Medium parameters used: f = 900 MHz; σ = 1.04 mho/m; ε_r = 57.2; ρ = 1000 kg/m^3

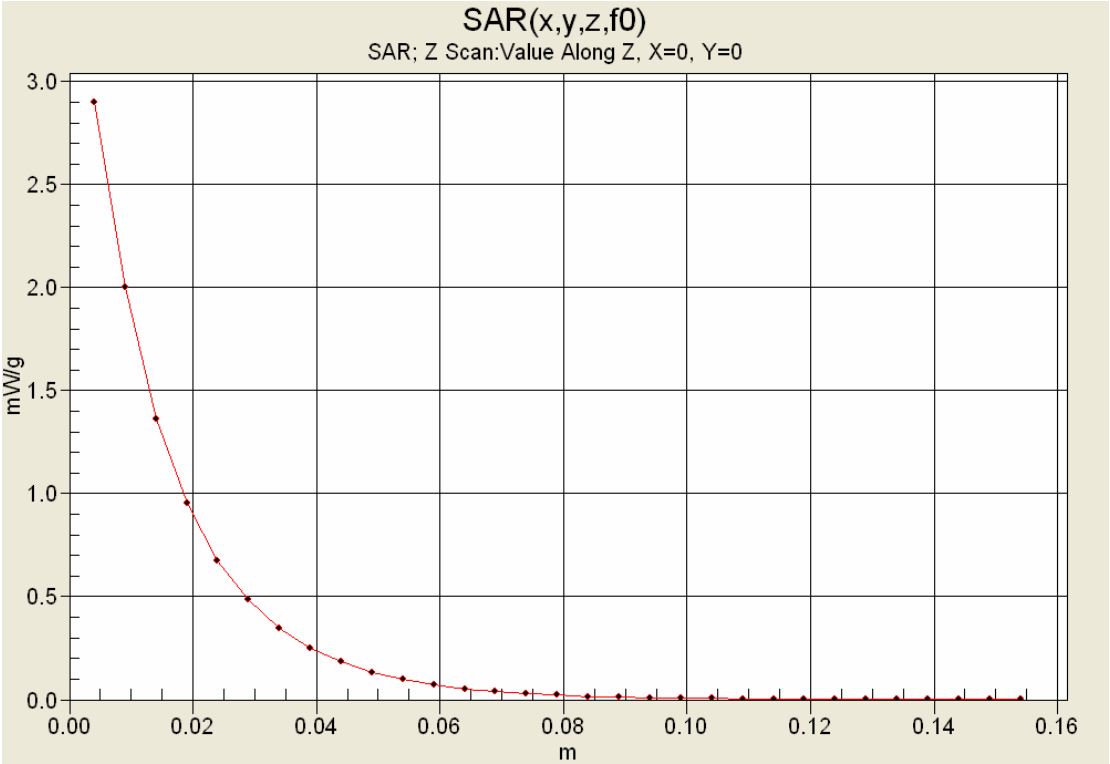
- Probe: ET3DV6 - SN1387; ConvF(5.96, 5.96, 5.96); Calibrated: 22/04/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

System Validation - 900 MHz Dipole
Area Scan (6x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 2.82 mW/g

System Validation - 900 MHz Dipole
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 51.9 V/m; Power Drift = 0.109 dB
Peak SAR (extrapolated) = 3.69 W/kg
SAR(1 g) = 2.62 mW/g; SAR(10 g) = 1.72 mW/g
Maximum value of SAR (measured) = 2.88 mW/g



Z-Axis Scan



10. Measured Fluid Dielectric Parameters

System Validation - 900 MHz (Body)

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Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Tue 20/May/2008
Frequency (GHz)
IEEE 1528-2003 Limits for Body Epsilon
IEEE 1528-2003 Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	IEEE_eB	IEEE_sB	Test_e	Test_s
0.8000	55.34	0.97	57.64	0.94
0.8100	55.30	0.97	57.73	0.94
0.8200	55.26	0.97	57.62	0.97
0.8300	55.22	0.97	57.71	0.95
0.8400	55.18	0.98	57.24	0.97
0.8500	55.15	0.99	57.54	0.99
0.8600	55.12	1.00	57.66	1.00
0.8700	55.09	1.01	57.28	1.00
0.8800	55.06	1.03	57.24	1.02
0.8900	55.03	1.04	57.00	1.02
0.9000	55.00	1.05	57.20	1.04
0.9100	55.00	1.06	56.92	1.05
0.9200	54.99	1.06	57.03	1.06
0.9300	54.97	1.07	56.58	1.08
0.9400	54.95	1.07	56.77	1.07
0.9500	54.93	1.08	56.69	1.08
0.9600	54.92	1.08	56.65	1.09
0.9700	54.90	1.08	56.69	1.10
0.9800	54.88	1.09	56.84	1.12
0.9900	54.86	1.09	56.41	1.13
1.0000	54.84	1.10	56.63	1.15

11. 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 (900 MHz)	5.5	Normal	1	1	5.5	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	1	2.7	∞
Spherical isotropy of the probe	0	Rectangular	1.732050808	1	0.0	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	0.9	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)	1	Normal	1	0.64	0.6	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	4	Normal	1	0.6	2.4	∞
Combined Standard Uncertainty					**8.86**	
Expanded Uncertainty (k=2)					**17.72**	
Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 and IEC Standard 62209-1:2005						

APPENDIX G - PLANAR PHANTOM CERTIFICATE OF CONFORMITY

2378 Westlake Road
Kelowna, B.C. Canada
V1Z-2V2

BARSKI INDUSTRIES (1985) LTD.

Ph. # 250-769-6848
Fax # 250-769-6334
E-mail: barskiind@shaw.ca
Web: www.bcfiberglass.com

FIBERGLASS FABRICATORS

Certificate of Conformity

Item : Flat Planar Phantom Unit # 03-01
Date: June 16, 2003
Manufacturer: Barski Industries (1985 Ltd)

Test	Requirement	Details
Shape	Compliance to geometry according to drawing	Supplied CAD drawing
Material Thickness	Compliant with the requirements	2mm +/- 0.2mm in measurement area
Material Parameters	Dielectric parameters for required frequencies Based on Dow Chemical technical data	100 MHz-5 GHz Relative permittivity<5 Loss Tangent<0.05

Conformity

Based on the above information, we certify this product to be compliant to the requirements specified.

Signature: _____

Daniel Chailler

Fiberglass Planar Phantom - Top View

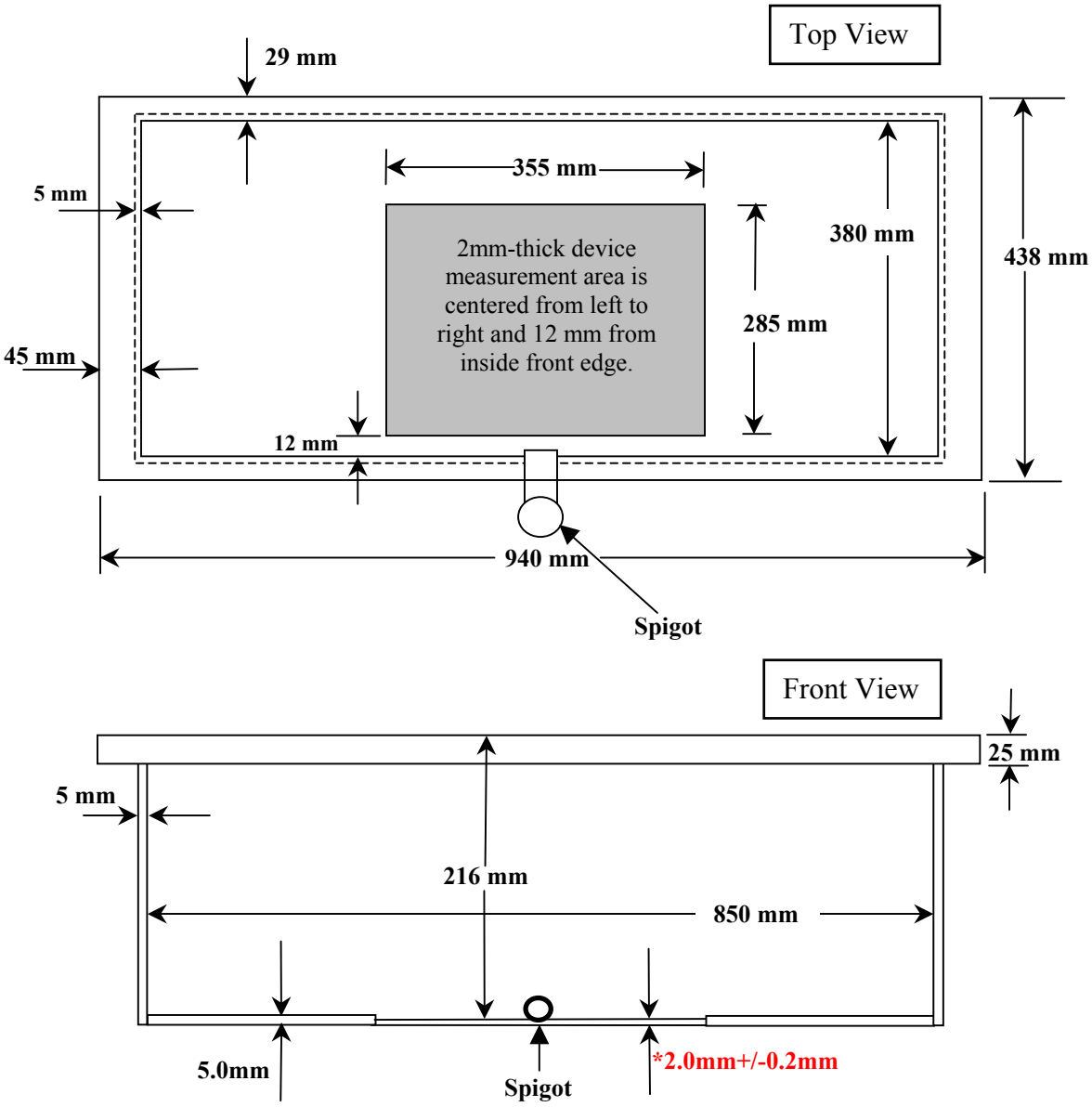
Fiberglass Planar Phantom - Front View

Fiberglass Planar Phantom - Back View

Fiberglass Planar Phantom - Bottom View

Dimensions of Fiberglass Planar Phantom

(Manufactured by Barski Industries Ltd. - Unit# 03-01)



Note: Measurements that aren't repeated for the opposite sides are the same as the side measured. This drawing is not to scale.