DECLARATION OF COMPLIANCE - SAR RF EXPOSURE EVALUATION (FCC/IC) - VHF MARINE

Test Lab Information	**Name**	**CELLTECH LABS INC.**			
	Address	21-364 Lougheed Road, Kelowna, B.C. V1X 7R8 Canada			
Test Lab Accreditation(s)	**A2LA**	ISO/IEC 17025:2005 (A2LA Test Lab Certificate No. 2470.01)			
Applicant Information	**Name**	**UNIDEN AMERICA CORPORATION**			
	Address	4700 Amon Carter Boulevard, Fort Worth, Texas 76155 United States			
Application Type(s)	**FCC**	TCB Certification	**IC**	CB Certification	
Standard(s) Applied	**FCC**	47 CFR §2.1093	**IC**	Health Canada Safety Code 6	
Procedure(s) Applied	**FCC**	OET Bulletin 65, Supplement C	**FCC**	KDB 447498 D01v04	
	IC	RSS-102 Issue 4	**IEEE**	1528-2003	
	IEC	62209-1:2005			
Device Classification(s)	**FCC**	Licensed Non-Broadcast Transmitter Held to Face (TNF)			
	IC	Maritime Radio Transmitter and Receiver (RSS-182)			
Device RF Exposure Category	**FCC/IC**	General Population / Uncontrolled Environment			
Device Identifier(s)	**FCC ID:**	AMWUT638			
	IC:	513C-UT638			
Device Model(s)	**Model(s)**	VHF255			
Test Sample Serial No.	No. 4 (Identical Prototype)				
Hardware / Firmware Revision No.s	**Hardware**	EPP10	**Firmware**	Ver. 1.02	
Date of Sample Receipt	January 12, 2011				
Date(s) of Evaluations	January 18, 2011				
Device-Under-Test Description (DUT)	Portable Marine/GMRS/FRS Push-To-Talk (PTT) Radio Transceiver (VHF Marine Band)				
Device Mode(s) of Operation	Analog FM				
VHF Transmit Frequency Range(s)	**FCC/IC**	156.025 - 157.425 MHz (VHF Marine Band)			
Manuf. Rated Output Power	5 Watts Conducted		**Manuf. Tolerance Specification**	+0.25W / -1W	
Measured RF Output Power	5.0 Watts	37.0 dBm	Conducted	156.7 MHz	
Antenna Type Tested	External Whip (Non-detachable)			P/N: AT-510	
Battery Type Tested	Lithium-ion	7.4 V	1040 mAh	P/N: 12012555	
Body-worn Accessory Tested	Swivel Belt-Clip	Contains Metal	2.5 cm Spacing to DUT	P/N: 7830458	
Audio Accessory Tested	Speaker-Microphone			P/N: 12012597	

Max. SAR Level(s) Evaluated	Face-held	**0.925 W/kg**	1g	50% PTT duty cycle	General Population / Uncontrolled
	Body-worn	**0.253 W/kg**	1g	50% PTT duty cycle	
FCC/IC Spatial Peak SAR Limit	Head/Body	1.6 W/kg	1g	50% PTT 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 Safety Code 6 for the General Population / Uncontrolled Exposure environment. The device was tested in accordance with the measurement procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01), Industry Canada RSS-102 Issue 4, IEEE Standard 1528-2003 and IEC International Standard 62209-1:2005. All measurements were performed in accordance with the SAR system manufacturer recommendations.

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

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

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

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REVISION HISTORY			
REVISION NO.	**DESCRIPTION**	**IMPLEMENTED BY**	**RELEASE DATE**
1.0	Initial Release	Jon Hughes	February 03, 2011
1.1	Corrected antenna description	Jon Hughes	February 11, 2011
1.2	**Corrected power tolerance spec.** **Revised Section 5.0 (SAR Scaling)**	**Jon Hughes**	**February 24, 2011**

TEST REPORT SIGN-OFF			
DEVICE TESTED BY	**REPORT PREPARED BY**	**QA REVIEW BY**	**REPORT APPROVED BY**
Scott Kulifaj	Scott Kulifaj	Jon Hughes	Sean Johnston

1.0 INTRODUCTION

This measurement report demonstrates that the Uniden America Corporation Model: VHF255 Portable FM VHF PTT Marine Radio Transceiver (FCC ID: AMWUT638 / IC: 513C-UT638) 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 measurement procedures described in FCC OET Bulletin 65, Supplement C 01-01 (see reference [3]), IC RSS-102 Issue 4 (see reference [4]), IEEE Standard 1528-2003 (see reference [5]) and IEC Standard 62209-1:2005 (see reference [6]) were employed. A description of the device, operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used and the various provisions of the rules are included within this test report.

2.0 SAR MEASUREMENT SYSTEM

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

3.0 RF CONDUCTED OUTPUT POWER MEASUREMENT

MEASURED RF CONDUCTED OUTPUT POWER

Band	Frequency	Channel	Mode	Power Setting	Measured Power Level		Method
					dBm	Watts	
VHF	156.7 MHz	14	CW	5 Watt	37.0	5.0	Average Conducted

Notes

1. The test channels were selected in accordance with the procedures specified in FCC KDB 447498 Section 6) c) (see reference [7]).

2. The RF conducted output power levels of the DUT were measured by Celltech prior to the SAR evaluations using a Gigatronics 8652A Universal Power Meter at the antenna connector of the radio in accordance with FCC 47 CFR §2.1046 (see reference [12]) and IC RSS-Gen (see reference [13]).

4.0 SAR MEASUREMENT SUMMARY

SAR EVALUATION RESULTS (VHF MARINE)

Test Config.	Test Date	Freq.	Ch.	Batt. Type	Cond. Power Before Test	Accessory Type(s)		Device Distance to Planar Phantom		Measured SAR 1g (W/kg) PTT Duty Cycle		SAR Drift During Test	Scaled SAR with droop 1g (W/kg) PTT Duty Cycle	
		MHz			Watts	Body-worn	Audio	DUT	Antenna	100%	50%	dB	100%	50%
FACE	Jan 18	156.7	14	Li-ion	5.0	n/a	n/a	2.5 cm	5.7 cm	1.57	0.785	-0.710	1.85	**0.925**
BODY	Jan 18	156.7	14	Li-ion	5.0	Belt-Clip	Spkr-Mic	2.5 cm	3.5 cm	0.466	0.233	-0.359	0.506	**0.253**

SAR LIMIT(S)		HEAD / 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

Date of Measurement	January 18, 2011				January 18, 2011				Evaluation Type	Face	Body	Unit
Measured Fluid Type	150MHz Head		156.7 MHz Meas.*		150MHz Body		156.7 MHz Meas.*		Atmospheric Pressure	101.1	101.1	kPa
Dielectric Constant ε_r	IEEE Target		Meas.	Dev.	IEEE Target		Meas.	Dev.	Relative Humidity	35	35	%
	52.3	± 5%	52.9	+1.1%	61.9	± 5%	61.8	-0.2%	Ambient Temperature	23.0	23.0	°C
Measured Fluid Type	150MHz Head		156.7 MHz Meas.*		150MHz Body		156.7 MHz Meas.*		Fluid Temperature	22.5	22.1	°C
Conductivity σ (mho/m)	IEEE Target		Meas.	Dev.	IEEE Target		Meas.	Dev.	Fluid Depth	≥ 15	≥ 15	cm
	0.76	± 5%	0.75	-1.3%	0.80	± 5%	0.773	-3.4%	ρ (Kg/m^3)	1000		

* Note: Interpolated using DASY4 Software

Notes

1. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
2. The number of test channels was selected in accordance with the procedures specified in FCC KDB 447498 Section 6) c) (see reference [7]).
3. The SAR droop measured by the DASY4 system for the duration of the SAR evaluation was added to the measured SAR level to report the scaled SAR result as shown in the above test data table.
4. The DUT was tested in unmodulated continuous transmit operation (Continuous Wave mode at 100% duty cycle) with the transmit key constantly depressed.
5. The fluid temperature was measured prior to and after the SAR evaluations to ensure the temperature remained within +/-2°C of the fluid temperature reported during the dielectric parameter measurements. The measured fluid remained within +/-2°C.
6. The dielectric parameters of the simulated tissue mixtures were measured prior to the SAR evaluations using a Dielectric Probe Kit and a Network Analyzer (see Appendix C).
7.

SAR Evaluation Power Thresholds for PTT Devices, $f \leq 0.5$ GHz (FCC KDB 447498 D01v04 Section 5)b)i))			Measured RF Conducted Output Power	
Exposure Conditions	***P* mW (General Population)**	***P* mW (Occupational)**	**100% PTT Duty Cycle**	**50% PTT Duty Cycle**
Held to face, $d \geq 2.5$ cm	**250**	1250	5 Watts	**2.5 Watts**
Body-worn, $d \geq 1.5$ cm	**200**	1000	5 Watts	**2.5 Watts**
Body-worn, $d \geq 1.0$ cm	150	750	n/a	n/a

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

* Per FCC KDB 447498 D01v04 Section 5)b)i) (see reference [7]).

1. The conducted output power level of the DUT exceeds the FCC power threshold and therefore SAR evaluation is required.

5.0 SAR SCALING (MANUFACTURER TOLERANCE)

SAR SCALING TO UNIDEN MAXIMUM TOLERANCE SPECIFICATION

Test Config.	Test Freq. (MHz)	Chan.	Band	Measured Conducted Power (W)	Measured SAR Level with droop 1g (W/kg)	Scaling to 5.25 W (5.0 W + 0.21 dB*) Scaled SAR (1g)
Face-held	156.7	14	VHF	5.0	0.925	**0.971 W/kg**
Body-worn	156.7	14	VHF	5.0	0.253	**0.266 W/kg**

Notes:

1. Manufacturer's rated power and tolerance specification is 5W +0.25W.
2. The SAR levels reported are based on a 50% PTT duty factor.
3. The scaled SAR levels are below the FCC/IC General Population / Uncontrolled SAR Limit of 1.6 W/kg.

6.0 FLUID DIELECTRIC PARAMETERS

FLUID DIELECTRIC PARAMETERS						
Date: 01/18/2011		Frequency: 150 MHz			Tissue: Head	
Freq	Test_e	Test_s	150 MHz Target_e	150 MHz Target_s	Deviation Permittivity	Deviation Conductivity
0.050	76.18	0.71	52.3	0.76	45.66%	-6.58%
0.060	62.63	0.69	52.3	0.76	19.75%	-9.21%
0.070	57.86	0.67	52.3	0.76	10.63%	-11.84%
0.080	60.95	0.68	52.3	0.76	16.54%	-10.53%
0.090	51.56	0.68	52.3	0.76	-1.41%	-10.53%
0.100	54.45	0.72	52.3	0.76	4.11%	-5.26%
0.110	58.03	0.73	52.3	0.76	10.96%	-3.95%
0.120	56.13	0.73	52.3	0.76	7.32%	-3.95%
0.130	54.35	0.73	52.3	0.76	3.92%	-3.95%
0.140	53.94	0.74	52.3	0.76	3.14%	-2.63%
0.150	52.72	0.75	52.3	0.76	0.80%	-1.32%
0.1567*	52.90	0.75	52.3	0.76	1.15%	-1.32%
0.160	53.05	0.75	52.3	0.76	1.43%	-1.32%
0.170	49.88	0.77	52.3	0.76	-4.63%	1.32%
0.180	52.12	0.78	52.3	0.76	-0.34%	2.63%
0.190	51.18	0.79	52.3	0.76	-2.14%	3.95%
0.200	52.05	0.79	52.3	0.76	-0.48%	3.95%
0.210	51.82	0.79	52.3	0.76	-0.92%	3.95%
0.220	50.17	0.79	52.3	0.76	-4.07%	3.95%
0.230	49.96	0.81	52.3	0.76	-4.47%	6.58%
0.240	48.30	0.83	52.3	0.76	-7.65%	9.21%
0.250	48.93	0.84	52.3	0.76	-6.44%	10.53%

*interpolated using DASY4 software

FLUID DIELECTRIC PARAMETERS (CONT.)

FLUID DIELECTRIC PARAMETERS

Date: 01/18/2011		Frequency: 150 MHz			Tissue: Body	
Freq	Test_e	Test_s	150 MHz Target_e	150 MHz Target_s	Deviation Permittivity	Deviation Conductivity
0.050	81.67	0.68	61.9	0.80	31.94%	-15.00%
0.060	57.13	0.72	61.9	0.80	-7.71%	-10.00%
0.070	65.73	0.72	61.9	0.80	6.19%	-10.00%
0.080	66.49	0.71	61.9	0.80	7.42%	-11.25%
0.090	66.45	0.74	61.9	0.80	7.35%	-7.50%
0.100	63.31	0.74	61.9	0.80	2.28%	-7.50%
0.110	62.73	0.75	61.9	0.80	1.34%	-6.25%
0.120	62.26	0.73	61.9	0.80	0.58%	-8.75%
0.130	63.58	0.73	61.9	0.80	2.71%	-8.75%
0.140	63.12	0.77	61.9	0.80	1.97%	-3.75%
0.150	61.97	0.78	61.9	0.80	0.11%	-2.50%
0.1567*	61.80	0.773	61.9	0.80	-0.16%	-3.38%
0.160	61.73	0.77	61.9	0.80	-0.27%	-3.75%
0.170	57.56	0.78	61.9	0.80	-7.01%	-2.50%
0.180	63.73	0.79	61.9	0.80	2.96%	-1.25%
0.190	59.17	0.80	61.9	0.80	-4.41%	0.00%
0.200	60.50	0.79	61.9	0.80	-2.26%	-1.25%
0.210	60.35	0.80	61.9	0.80	-2.50%	0.00%
0.220	59.56	0.82	61.9	0.80	-3.78%	2.50%
0.230	60.07	0.83	61.9	0.80	-2.96%	3.75%
0.240	59.87	0.84	61.9	0.80	-3.28%	5.00%
0.250	59.25	0.84	61.9	0.80	-4.28%	5.00%

*interpolated using DASY4 software

7.0 SAR PROBE CALIBRATION & MEASUREMENT FREQUENCIES

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

Probe Calibration Freq.	Device Measurement Freq.	Frequency Interval	±25 MHz ≤ 300 MHz
150 MHz	156.7 MHz	6.7 MHz	< 25 MHz
Note: The probe calibration and measurement frequency interval is < 25 MHz; therefore additional steps were not required.			

8.0 NO. OF TEST CHANNELS (N_c)

Antenna Part No.	Device Frequency Range	Band	N_c	Test Frequencies (MHz)
AT-510	156.025 - 157.425 MHz	VHF Marine	1	156.7 MHz
Note: The number of test channels per antenna frequency range was calculated in accordance with the procedures specified in FCC KDB 447498 Section 6) c) (see reference [7]).				

9.0 MANUFACTURER'S DISCLOSED ACCESSORY LISTING

Part No.	Description	Accessory Category
AT-510	Whip Antenna	Antenna
12012555	Lithium-Ion Battery	Battery
12303038	Alkaline Battery Case	
7830458	Swivel Belt-Clip (Contains Metal)	Body-worn
12012597	Speaker-Microphone	Audio

Notes:

1. Manufacturer's disclosed accessory listing information provided by Uniden America Corporation.

10.0 DETAILS OF SAR EVALUATION

The Uniden America Corporation VHF255 Portable Marine/GMRS/FRS PTT Radio Transceiver (FCC ID: AMWUT638 / IC: 513C-UT638) 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 face-held SAR evaluation was performed with the front of the radio placed parallel to the outer surface of the planar phantom. A 2.5 cm spacing was maintained between the front side of the DUT and the outer surface of the planar phantom.
2. The body-worn SAR evaluation was performed with the swivel belt-clip body-worn accessory attached to the DUT and touching the outer surface of the planar phantom (battery parallel to phantom).
3. The body-worn SAR evaluation was performed with the customer supplied speaker-microphone audio accessory connected to the DUT.
4. 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.
5. The DUT was tested at the maximum conducted output power level 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.
6. The SAR drift of the DUT was measured by the DASY4 system for the duration of the SAR evaluations. A SAR-versus-Time power slump evaluation was performed in the test configuration that reported the maximum measured SAR droop. See Appendix A (SAR Test Plots) for SAR-versus-Time power droop evaluation plot.

11.0 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.

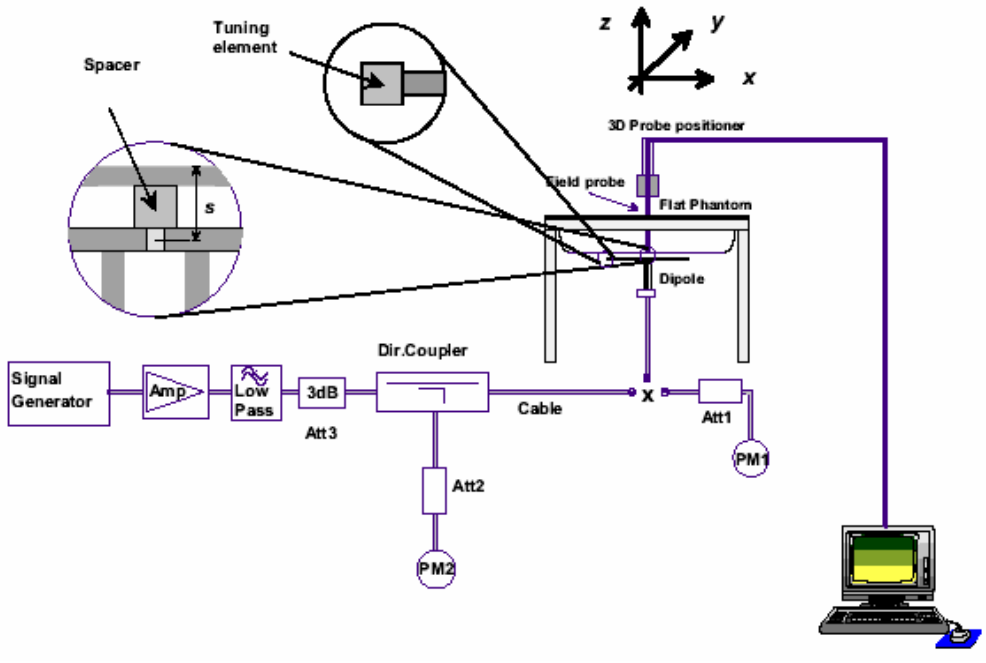
12.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluations a daily system check was performed with a planar phantom and 300 MHz SPEAG validation dipole (see Appendix B for system performance check test plot) in accordance with the procedures described in IEEE Standard 1528-2003 (see reference [5]) and IEC Standard 62209-1:2005 (see reference [6]). The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer (see Appendix C for measured fluid dielectric parameters). A forward power of 398 mW was applied to the dipole and the system was verified to a tolerance of ±10% from the system manufacturer's dipole calibration target SAR value (see Appendix E for system manufacturer's dipole calibration procedures).

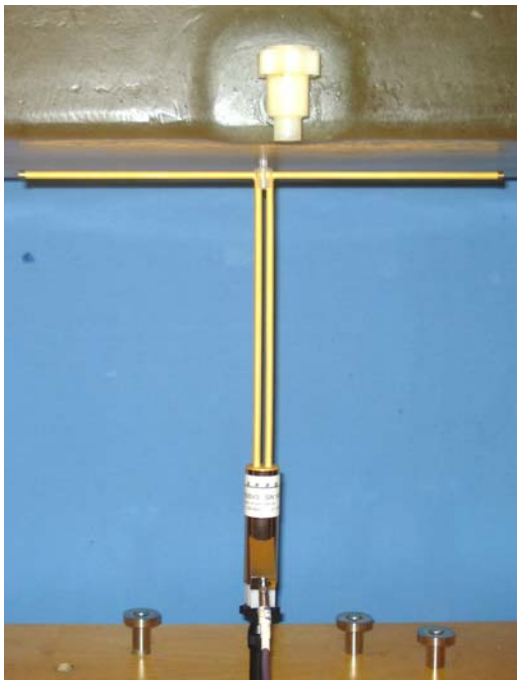
SYSTEM PERFORMANCE CHECK EVALUATION

Test Date	Equiv. Tissue	SAR 1g (W/kg)			Dielectric Constant ε_r			Conductivity σ (mho/m)			ρ (Kg/m^3)	Amb. Temp. (°C)	Fluid Temp. (°C)	Fluid Depth (cm)	Humid. (%)	Barom. Press. (kPa)
	Freq. (MHz)	SPEAG Target	Meas.	Dev.	SPEAG Target	Meas.	Dev.	SPEAG Target	Meas.	Dev.						
Jan 18	Head 300	1.14 ±10%	1.24	+8.8%	45.3 ±5%	45.9	+1.3%	0.87 ±5%	0.87	0.0%	1000	23.0	22.0	≥ 15	35	101.1

Notes		
	1.	The target SAR values are the measured values from the SAR system manufacturer's dipole calibration (see Appendix E).
	2.	The target dielectric parameters are the nominal values from the SAR system manufacturer's dipole calibration (see Appendix E).
	3.	The fluid temperature was measured prior to and after the system performance check to ensure the temperature remained within +/-2°C of the fluid temperature reported during the dielectric parameter measurements.
	4.	The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer (see Appendix C).



System Performance Check Measurement Setup (IEEE Standard 1528-2003)



SPEAG 300 MHz Validation Dipole Setup

13.0 SIMULATED EQUIVALENT TISSUES

The simulated equivalent tissue recipes in the table below are derived from the SAR system manufacturer's suggested recipes in the DASY4 manual (see references [9] and [10]) in accordance with the procedures and requirements specified in IEEE Standard 1528-2003 (see reference [5]) and IEC Standard 62209-1:2005 (see reference [6]). The ingredient percentage may have been adjusted minimally in order to achieve the appropriate target dielectric parameters within the specified tolerance.

SIMULATED TISSUE MIXTURES							
INGREDIENT	Water	300 MHz Head Tissue Mixture	37.56 %	150 MHz Head Tissue Mixture	38.35 %	150 MHz Body Tissue Mixture	46.6 %
	Sugar		55.32 %		55.5%		49.7 %
	Salt		5.95 %		5.15%		2.6 %
	HEC		0.98 %		0.9%		1.0 %
	Bactericide		0.19 %		0.1%		0.1 %

14.0 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.			

15.0 ROBOT SYSTEM SPECIFICATIONS

Specifications	
Positioner	Stäubli Unimation Corp. Robot Model: RX60L
Repeatability	0.02 mm
No. of axis	6
Data Acquisition Electronic (DAE) System	
Cell Controller	
Processor	AMD Athlon XP 2400+
Clock Speed	2.0 GHz
Operating System	Windows XP Professional
Data Converter	
Features	Signal Amplifier, multiplexer, A/D converter, and control logic
Software	Measurement Software: DASY4, V4.7 Build 44
	Postprocessing Software: SEMCAD, V1.8 Build 171
Connecting Lines	Optical downlink for data and status info., Optical uplink for commands and clock
DASY4 Measurement Server	
Function	Real-time data evaluation for field measurements and surface detection
Hardware	PC/104 166MHz Pentium CPU; 32 MB chipdisk; 64 MB RAM
Connections	COM1, COM2, DAE, Robot, Ethernet, Service Interface
E-Field Probe	
Model	ET3DV6
Serial No.	1590
Construction	Triangular core fiber optic detection system
Frequency	10 MHz to 6 GHz
Linearity	±0.2 dB (30 MHz to 3 GHz)
Evaluation Phantom	
Type	Side Planar Phantom
Shell Material	Plexiglas
Bottom Thickness	2.0 mm ± 0.1 mm
Outer Dimensions	75.0 cm (L) x 22.5 cm (W) x 20.5 cm (H); Back Plane: 25.7 cm (H)
Validation Phantom	
Type	Barski Planar Phantom
Shell Material	Fiberglass
Thickness	2.0 ±0.1 mm
Volume	Approx. 70 liters

16.0 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 Body 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 Body tissue (rotation around probe axis) ± 0.4 dB in Body 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

17.0 SIDE PLANAR PHANTOM

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

Plexiglas Side Planar Phantom

18.0 BARSKI PLANAR PHANTOM

The Barski Planar Phantom is a fiberglass 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 integrated in a wooden table. The planar phantom was used for the DUT SAR evaluations and the system performance check evaluations. See Appendix G for dimensions and specifications of the Barski planar phantom.

Barski Planar Phantom

19.0 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. Face-held SAR evaluations (PTT radios) are performed with the device holder in the body axis.

Device Holder

20.0 TEST EQUIPMENT LIST

TEST EQUIPMENT		ASSET NO.	SERIAL NO.	DATE CALIBRATED	CALIBRATION INTERVAL
USED	DESCRIPTION				
x	Schmid & Partner DASY4 System	-	-	-	-
x	-DASY4 Measurement Server	00158	1078	CNR	CNR
x	-Robot	00046	599396-01	CNR	CNR
x	-DAE4	00019	353	27Apr10	Annual
x	-ET3DV6 E-Field Probe	00017	1590	15Jul10	Annual
x	-SPEAG D300V3 Validation Dipole	000216	1009	18Jan10	Biennial
x	Side Planar Phantom	00156	161	CNR	CNR
x	Barski Planar Phantom	00155	03-01	CNR	CNR
x	HP 85070C Dielectric Probe Kit	00033	none	CNR	CNR
x	Gigatronics 8652A Power Meter	00007	1835272	04May10	Biennial
x	Gigatronics 80701A Power Sensor	00014	1833699	04May10	Biennial
x	HP 8753ET Network Analyzer	00134	US39170292	04May10	Biennial
x	Rohde & Schwarz SMR20 Signal Generator	00006	100104	CNR	CNR
x	Amplifier Research 5S1G4 Power Amplifier	00106	26235	CNR	CNR
Abbr.	CNR = Calibration Not Required				

21.0 MEASUREMENT UNCERTAINTIES

UNCERTAINTY BUDGET FOR DEVICE EVALUATION									
Uncertainty Component	**IEEE 1528 Section**	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**ci 1g**	**ci 10g**	**Uncertainty Value ±% (1g)**	**Uncertainty Value ±% (10g)**	**V_i or V_{eff}**
Measurement System									
Probe Calibration (150 MHz)	E.2.1	10.0	Normal	1	1	1	10.0	10	∞
Axial Isotropy	E.2.2	4.7	Rectangular	1.732050808	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	Rectangular	1.732050808	0.7	0.7	3.9	3.9	∞
Boundary Effect	E.2.3	2.5	Rectangular	1.732050808	1	1	1.4	1.4	∞
Linearity	E.2.4	4.7	Rectangular	1.732050808	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	Normal	1	1	1	0.3	0.3	∞
Response Time	E.2.7	0.8	Rectangular	1.732050808	1	1	0.5	0.5	∞
Integration Time	E.2.8	2.6	Rectangular	1.732050808	1	1	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3	Rectangular	1.732050808	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	Rectangular	1.732050808	1	1	0.2	0.2	∞
Probe Positioning wrt Phantom Shell	E.6.3	2.9	Rectangular	1.732050808	1	1	1.7	1.7	∞
Extrapolation, interpolation & integration algorithms for max. SAR evaluation	E.5	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	2.9	Normal	1	1	1	2.9	2.9	12
Device Holder Uncertainty	E.4.1	3.6	Normal	1	1	1	3.6	3.6	8
SAR Drift Measurement	6.6.2	5	Rectangular	1.732050808	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4	Rectangular	1.732050808	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5	Rectangular	1.732050808	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measured)	E.3.3	3.4	Normal	1	0.64	0.43	2.2	1.5	∞
Liquid Permittivity (target)	E.3.2	5	Rectangular	1.732050808	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measured)	E.3.3	1.2	Normal	1	0.6	0.49	0.7	0.5	∞
Combined Standard Uncertainty			**RSS**				**13.56**	**13.35**	
Expanded Uncertainty (95% Confidence Interval)			**k=2**				**27.12**	**26.70**	
Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003									

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2

22.0 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 (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)”, Radio Standards Specification RSS-102 Issue 4: March 2010.

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

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

[7] Federal Communications Commission, Office of Engineering and Technology - “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”; KDB 447498 D01v04: November 2009.

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

[9] Schmid & Partner Engineering AG - DASY4 Manual V4.6, Chapter 16 Application Note, Head Tissue Recipe: Sept. 2005.

[10] Schmid & Partner Engineering AG - DASY4 Manual V4.6, Chapter 17 Application Note, Body Tissue Recipe: Sept. 2005.

[11] ISO/IEC 17025 - “General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2005).”

[12] Federal Communications Commission - “Measurements Required: RF Power Output”; Rule Part 47 CFR §2.1046.

[13] Industry Canada - “General Requirements and Information for the Certification of Radiocommunication Equipment”, Radio Standards Specification RSS-Gen Issue 3: December 2010.

APPENDIX A - SAR MEASUREMENT DATA

Date Tested: 01/18/2011

Face-held SAR - Channel 14 - 156.7 MHz

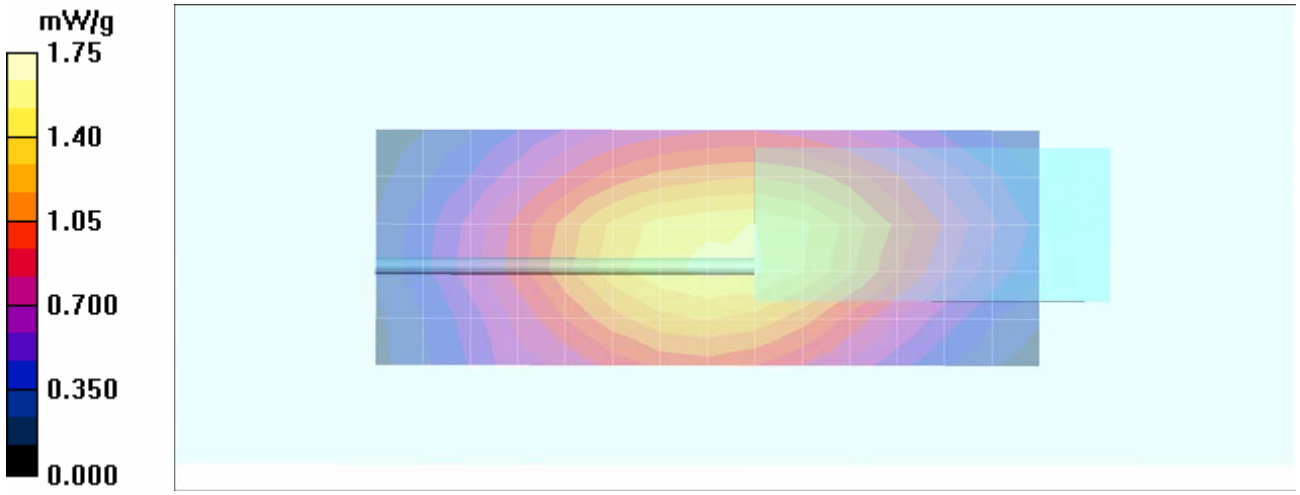
DUT: Uniden Model: VHF255; Type: Portable FM VHF PTT Marine Radio Transceiver; Serial: No. 4 (Pre-production)

Ambient Temp: 23.0°C; Fluid Temp: 22.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

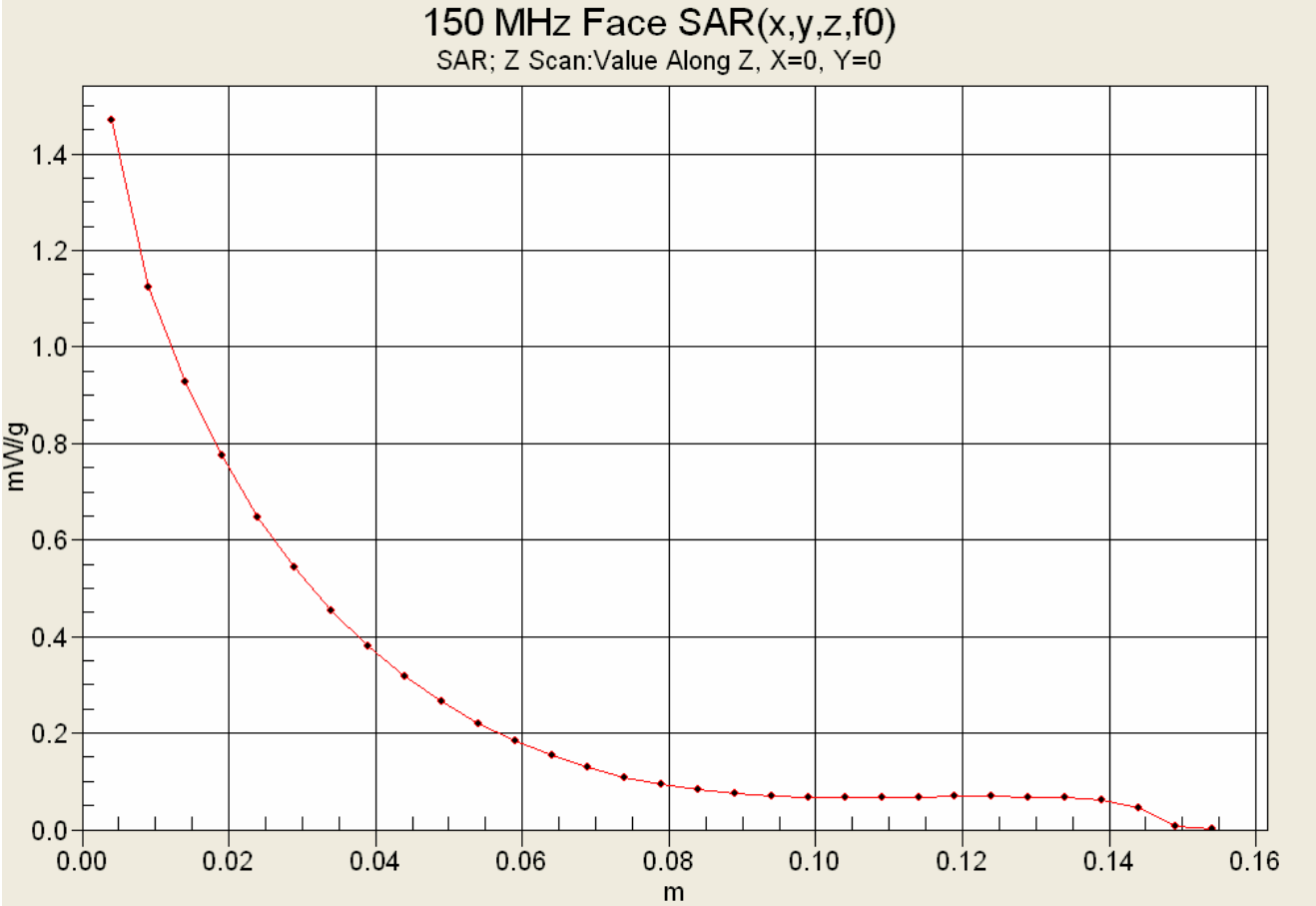
Communication System: FM VHF (CW)
Frequency: 156.7 MHz; Duty Cycle: 1:1
Medium: HSL150 Medium parameters used (interpolated): f = 156.7 MHz; σ = 0.75 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(8.5, 8.5, 8.5); Calibrated: 15/07/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 27/04/2010
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Face-held SAR - 2.5 cm Spacing from Front Side of DUT to Planar Phantom
Area Scan (6x15x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (measured) = 1.55 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 47.9 V/m; Power Drift = -0.710 dB
Peak SAR (extrapolated) = 2.27 W/kg
SAR(1 g) = 1.57 mW/g; SAR(10 g) = 1.22 mW/g
Maximum value of SAR (measured) = 1.75 mW/g

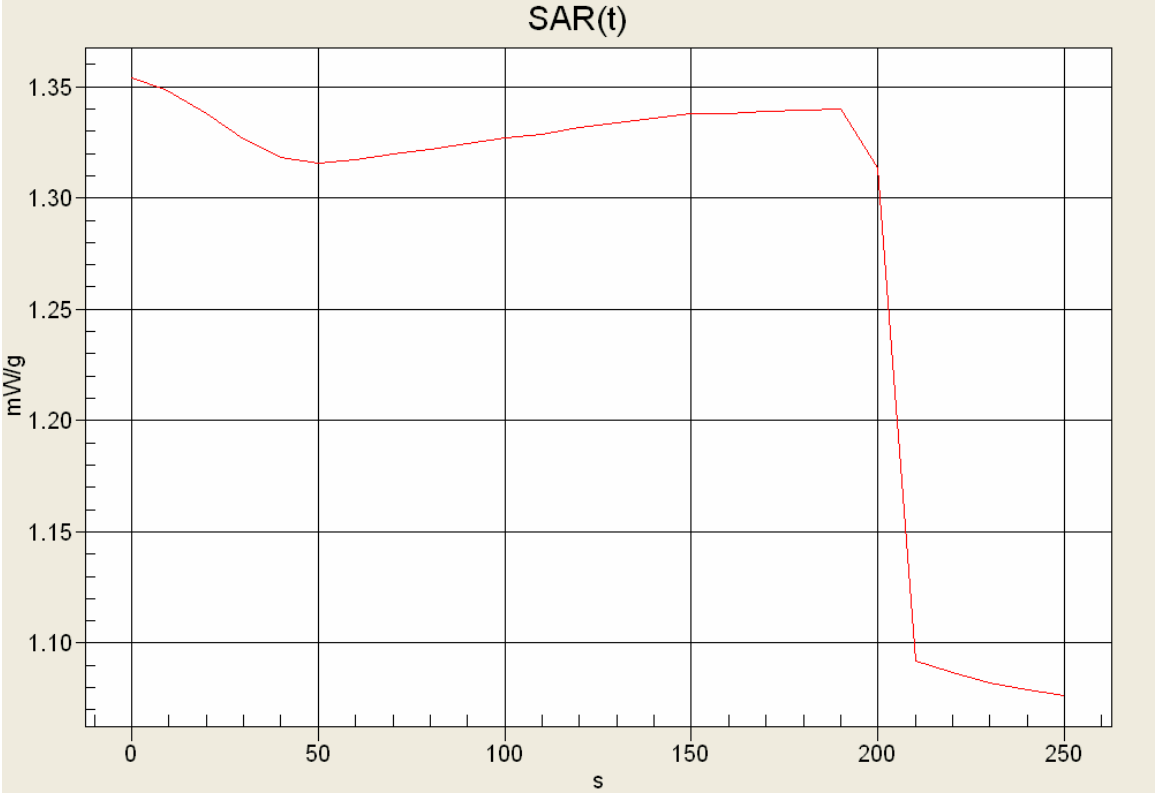


Z-Axis Scan



SAR vs. Time

Face-held Configuration
Test Frequency 156.7 MHz



Start SAR: 1.354 mW/g
End SAR (after 250s): 1.077 mW/g (-0.994 dB)

Date Tested: 01/18/2011

Body-worn SAR - Channel 14 - 156.7 MHz

DUT: Uniden Model: VHF255; Type: Portable FM VHF PTT Marine Radio Transceiver; Serial: No. 4 (Pre-production)

Body-worn Accessory: Swivel Belt-Clip (P/N: 7830458)

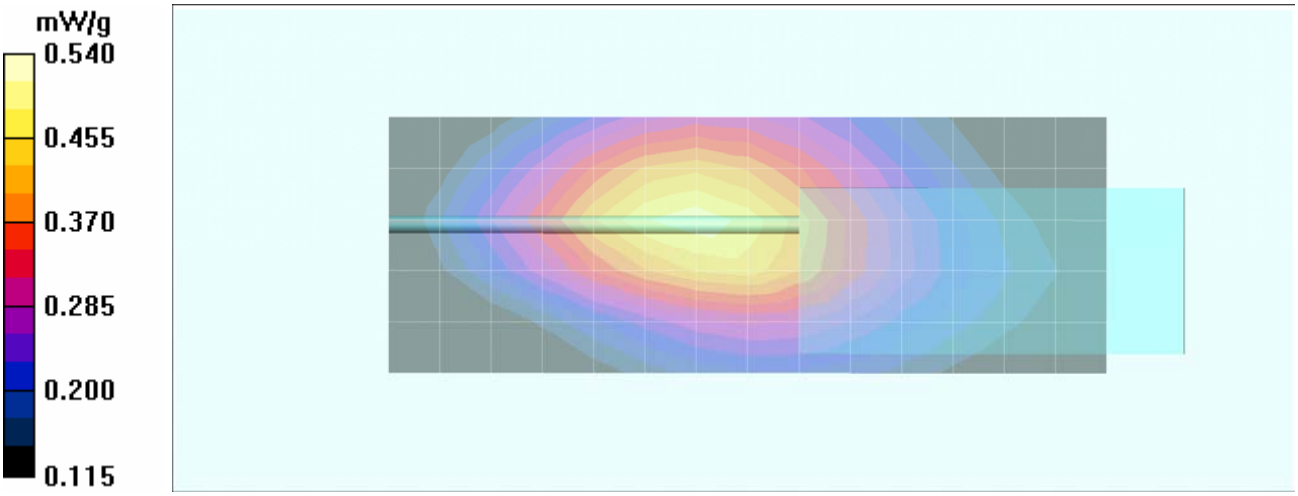
Audio Accessory: Speaker-Microphone (P/N: 12012597)

Ambient Temp: 23.0°C; Fluid Temp: 22.1°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

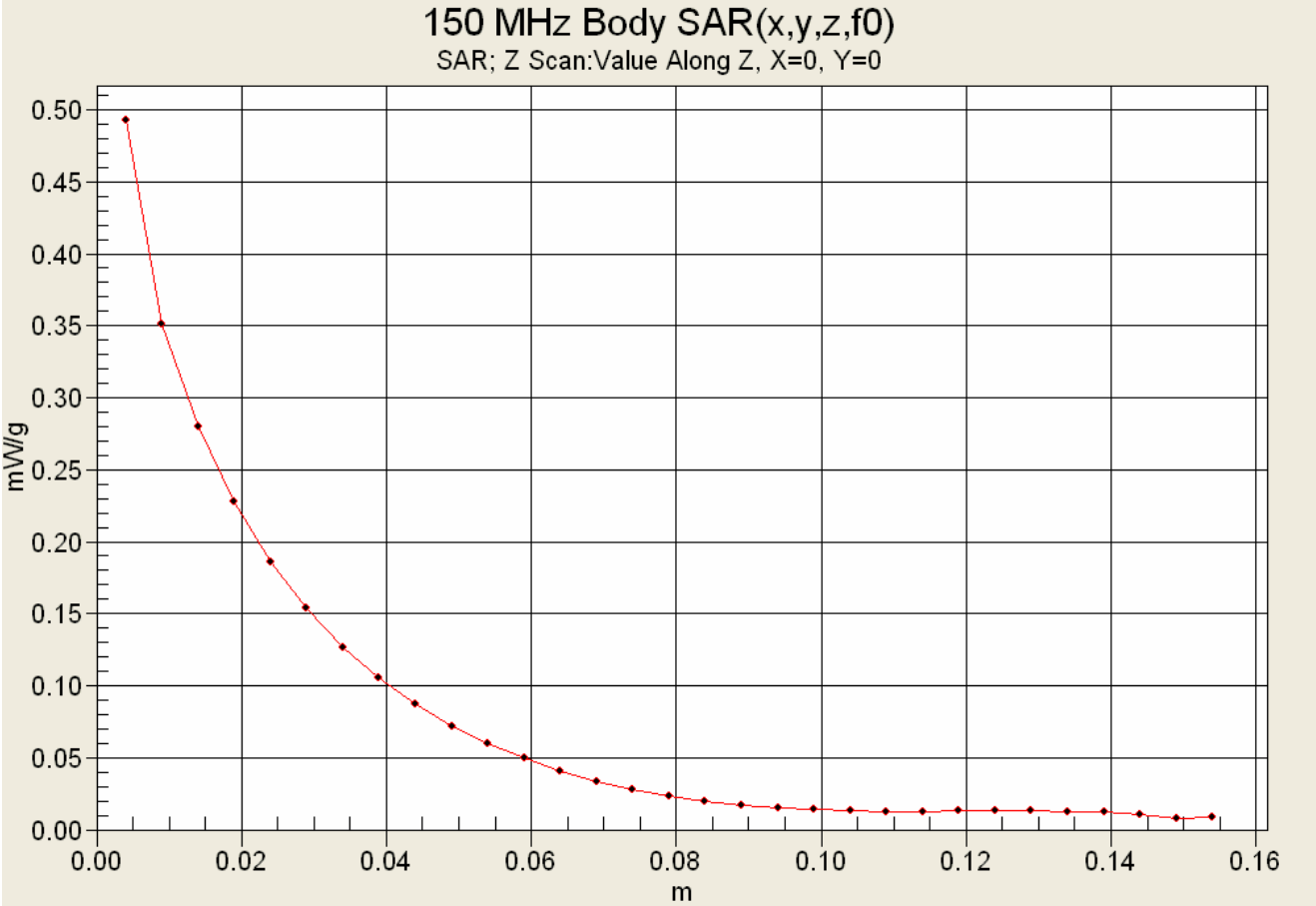
Communication System: FM VHF (CW)
Frequency: 156.7 MHz; Duty Cycle: 1:1
Medium: M150 Medium parameters used (interpolated): f = 156.7 MHz; σ = 0.773 mho/m; ε_r = 61.8; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(7.9, 7.9, 7.9); Calibrated: 15/07/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 27/04/2010
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - 2.5 cm Swivel Belt-Clip Spacing from Back Side of DUT to Planar Phantom
Area Scan (7x15x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (measured) = 0.505 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 23.5 V/m; Power Drift = -0.359 dB
Peak SAR (extrapolated) = 0.801 W/kg
SAR(1 g) = 0.466 mW/g; SAR(10 g) = 0.350 mW/g
Maximum value of SAR (measured) = 0.540 mW/g



Z-Axis Scan



APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 01/18/2011

System Performance Check - 300 MHz Dipole - Head

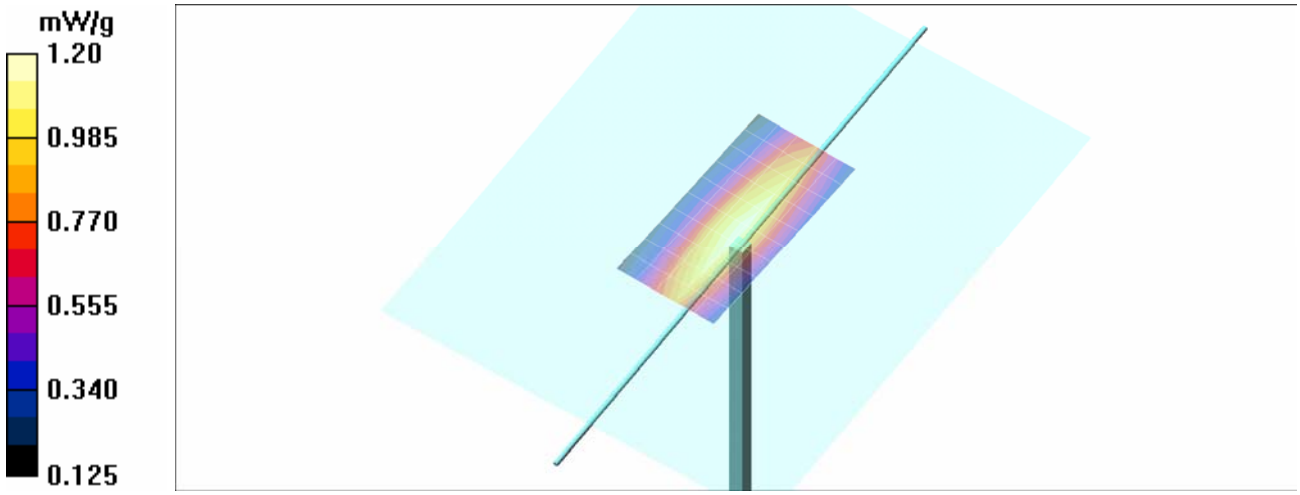
DUT: Dipole D300V3; Asset: 000216; Serial: 1009; Calibration: 01/18/2010

Ambient Temp: 23.0°C; Fluid Temp: 22.0°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

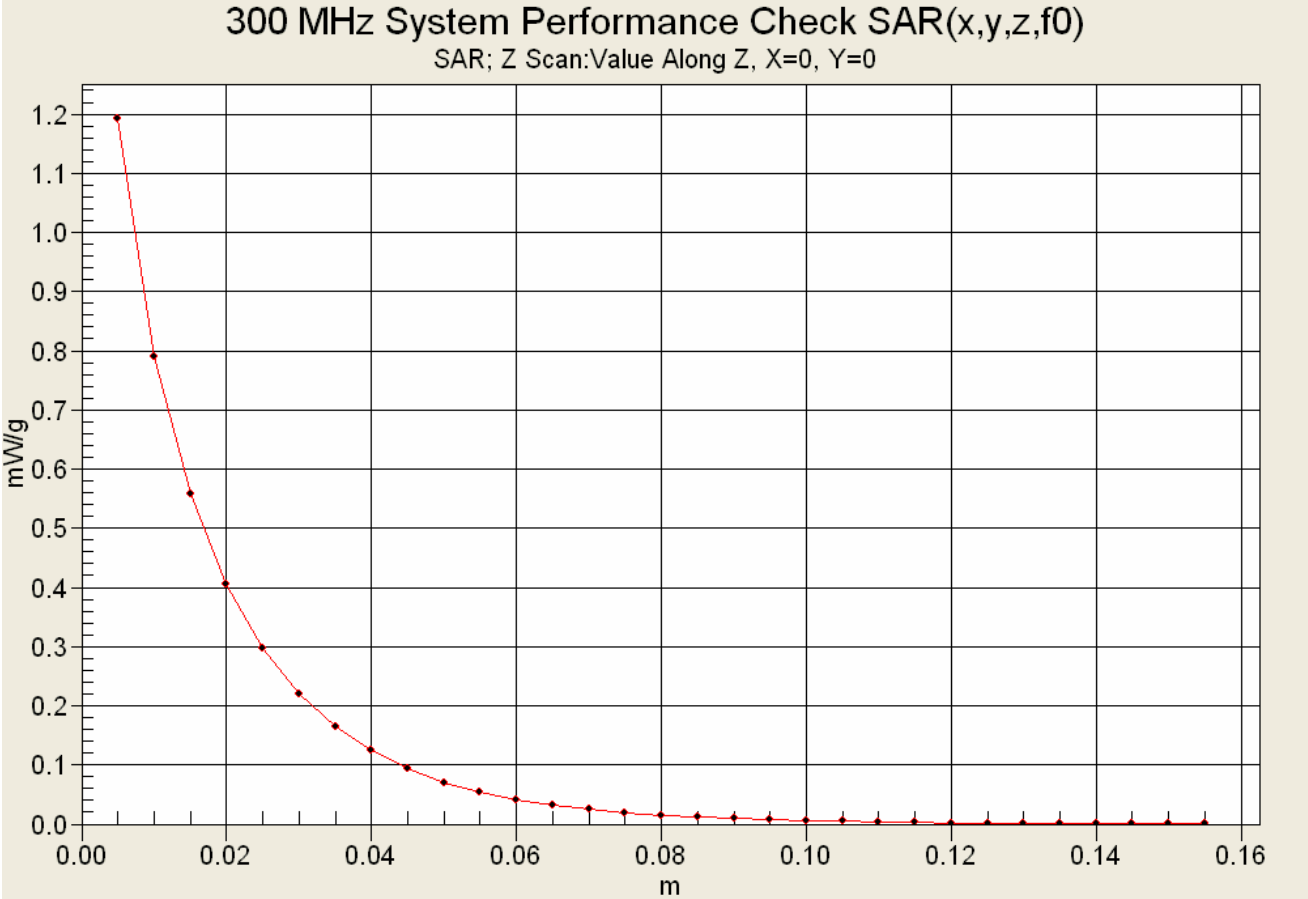
Communication System: CW
Forward Conducted Power: 398 mW
Frequency: 300 MHz; Duty Cycle: 1:1
Medium: 300 HSL Medium parameters used: f = 300 MHz; σ = 0.87 mho/m; ε_r = 45.9; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(7.7, 7.7, 7.7); Calibrated: 15/07/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 27/04/2010
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

System Performance Check - 300 MHz Dipole
d=15mm, Pin = 398mW/Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.19 mW/g
d=15mm, Pin = 398mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 36.2 V/m; Power Drift = -0.033 dB
Peak SAR (extrapolated) = 2.00 W/kg
SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.821 mW/g
Maximum value of SAR (measured) = 1.20 mW/g



Z-Axis Scan



APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

300 MHz System Performance Check (Head)

****

Celltech Labs
Test Result for UIM Dielectric Parameter
18/Jan/2011
Frequency (GHz)
FCC_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
0.2000	49.97	0.80	48.17	0.79
0.2100	49.50	0.80	50.02	0.79
0.2200	49.03	0.81	49.45	0.81
0.2300	48.57	0.82	48.19	0.81
0.2400	48.10	0.83	47.22	0.81
0.2500	47.63	0.83	46.79	0.83
0.2600	47.17	0.84	47.60	0.84
0.2700	46.70	0.85	45.96	0.83
0.2800	46.23	0.86	46.98	0.84
0.2900	45.77	0.86	45.33	0.85
0.3000	45.30	0.87	45.94	0.87
0.3100	45.18	0.87	45.64	0.86
0.3200	45.06	0.87	44.63	0.88
0.3300	44.94	0.87	44.90	0.90
0.3400	44.82	0.87	44.62	0.93
0.3500	44.70	0.87	44.38	0.92
0.3600	44.58	0.87	43.50	0.92
0.3700	44.46	0.87	43.95	0.93
0.3800	44.34	0.87	43.89	0.93
0.3900	44.22	0.87	43.43	0.93
0.4000	44.10	0.87	43.46	0.95
0.4000	44.10	0.87	43.55	1.01

150 MHz DUT Evaluation (Head)

****

Celltech Labs
Test Result for UIM Dielectric Parameter
18/Jan/2011
Frequency (GHz)
FCC_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
0.0500	56.97	0.69	76.18	0.71
0.0600	56.50	0.69	62.63	0.69
0.0700	56.03	0.70	57.86	0.67
0.0800	55.57	0.71	60.95	0.68
0.0900	55.10	0.72	51.56	0.68
0.1000	54.63	0.72	54.45	0.72
0.1100	54.17	0.73	58.03	0.73
0.1200	53.70	0.74	56.13	0.73
0.1300	53.23	0.75	54.35	0.73
0.1400	52.77	0.75	53.94	0.74
0.1500	52.30	0.76	52.72	0.75
0.1600	51.83	0.77	53.05	0.75
0.1700	51.37	0.77	49.88	0.77
0.1800	50.90	0.78	52.12	0.78
0.1900	50.43	0.79	51.18	0.79
0.2000	49.97	0.80	52.05	0.79
0.2100	49.50	0.80	51.82	0.79
0.2200	49.03	0.81	50.17	0.79
0.2300	48.57	0.82	49.96	0.81
0.2400	48.10	0.83	48.30	0.83
0.2500	47.63	0.83	48.93	0.84

150 MHz DUT Evaluation (Body)

****

Celltech Labs
Test Result for UIM Dielectric Parameter
18/Jan/2011
Frequency (GHz)
FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB FCC Limits for Body Epsilon
FCC_sB FCC Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

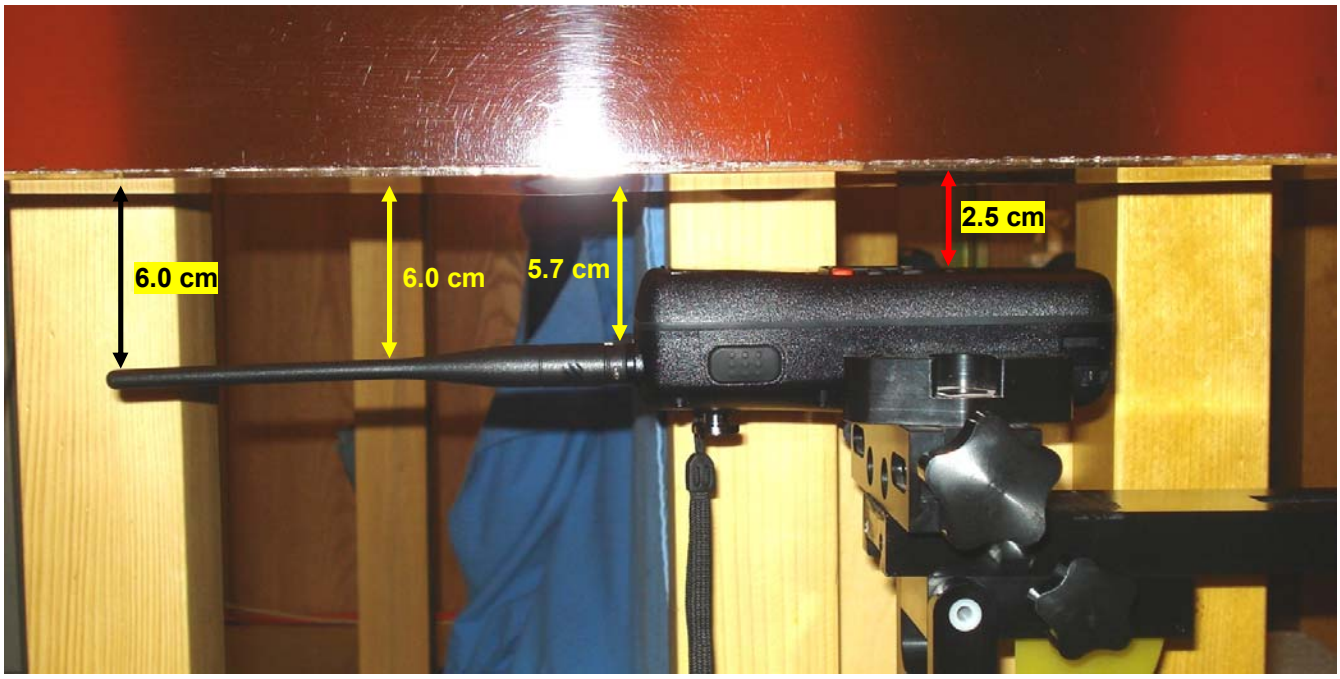
Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.0500	64.37	0.72	81.67	0.68
0.0600	64.12	0.73	57.13	0.72
0.0700	63.87	0.74	65.73	0.72
0.0800	63.63	0.74	66.49	0.71
0.0900	63.38	0.75	66.45	0.74
0.1000	63.13	0.76	63.31	0.74
0.1100	62.89	0.77	62.73	0.75
0.1200	62.64	0.78	62.26	0.73
0.1300	62.39	0.78	63.58	0.73
0.1400	62.15	0.79	63.12	0.77
0.1500	61.90	0.80	61.97	0.78
0.1600	61.65	0.81	61.73	0.77
0.1700	61.41	0.82	57.56	0.78
0.1800	61.16	0.82	63.73	0.79
0.1900	60.91	0.83	59.17	0.80
0.2000	60.67	0.84	60.50	0.79
0.2100	60.42	0.85	60.35	0.80
0.2200	60.17	0.86	59.56	0.82
0.2300	59.93	0.86	60.07	0.83
0.2400	59.68	0.87	59.87	0.84
0.2500	59.43	0.88	59.25	0.84

APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS

FACE-HELD SAR TEST SETUP PHOTOGRAPHS

Face-held Configuration - DUT with 2.5 cm spacing from front keypad side of radio to planar phantom

FACE-HELD SAR TEST SETUP PHOTOGRAPHS

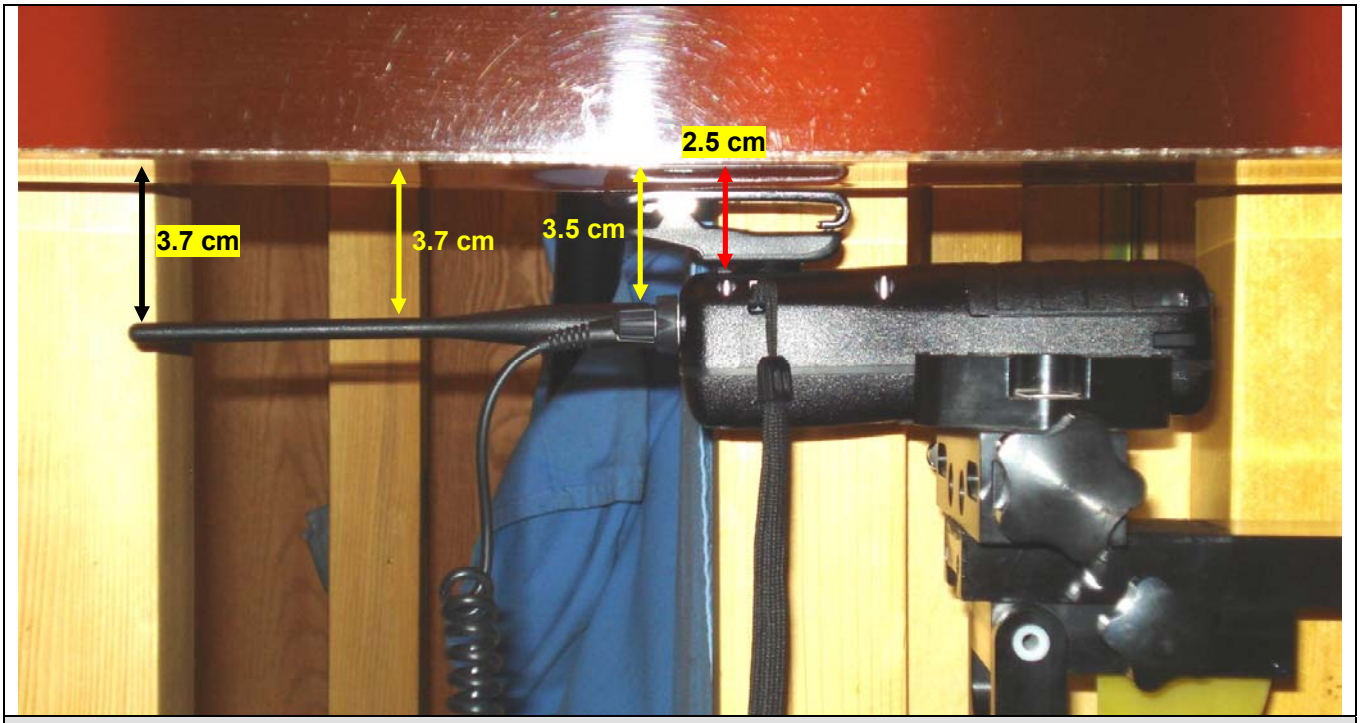


Face-held Configuration - DUT with Li-ion Battery

BODY-WORN SAR TEST SETUP PHOTOGRAPHS

Body-worn Configuration - DUT with Belt-Clip Accessory & Speaker-Microphone Audio Accessory (P/N: 12012597)

BODY-WORN SAR TEST SETUP PHOTOGRAPHS



DUT with Li-ion Battery, Belt-Clip & Speaker-Microphone (Battery Parallel to Planar Phantom)

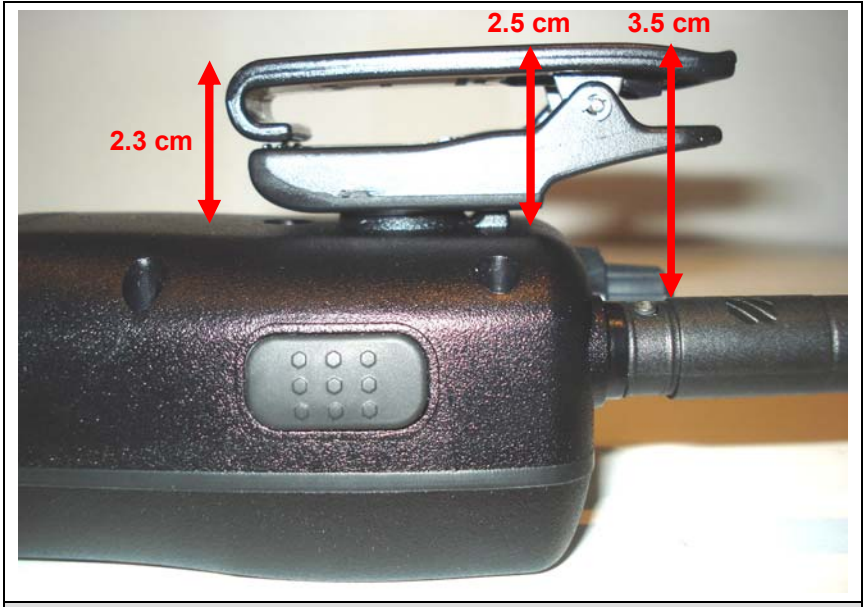
DUT PHOTOGRAPHS

Front of DUT with non-detachable antenna

Back of DUT with Swivel Belt-Clip

Back of DUT without Swivel Belt-Clip

DUT PHOTOGRAPHS



Swivel Belt-Clip Distances from Back of Radio and Antenna Base

DUT PHOTOGRAPHS

Swivel Belt-Clip Accessory Assembly P/N: 7830458 (contains metal)

Swivel Belt-Clip Accessory Assembly P/N: 7830458 (contains metal)

DUT PHOTOGRAPHS

Front of Li-ion Battery (P/N: 12012555)

Back of Li-ion Battery (P/N: 12012555)

DUT PHOTOGRAPHS

Front Side of DUT with Speaker-Microphone P/N: 12012597

Back Side of DUT with Speaker-Microphone P/N: 12012597

APPENDIX E - DIPOLE CALIBRATION

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

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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **Celltech**

Certificate No: D300V3-1009_Jan10

CALIBRATION CERTIFICATE

Object **D300V3 - SN: 1009**

Calibration procedure(s) **QA CAL-15.v5**
Calibration Procedure for dipole validation kits below 800 MHz

Calibration date: **January 18, 2010**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ET3DV6 (LF)	SN: 1507	03-Jul-09 (No. ET3-1507_Jul09)	Jul-10
DAE4	SN: 654	04-May-09 (No. DAE4-654_May09)	May-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	04-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-09)	In house check: Oct-10

	Name	Function	Signature
Calibrated by:	**Jeton Kastrati**	**Laboratory Technician**	i.V.
Approved by:	**Katja Pokovic**	**Technical Manager**	

Issued: January 20, 2010

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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
ConF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V5.2
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Area Scan Resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	300 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	45.3	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	45.8 ± 6 %	0.84 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	398 mW input power	1.14 mW / g
SAR normalized	normalized to 1W	2.86 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**2.95 mW / g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	398 mW input power	0.76 mW / g
SAR normalized	normalized to 1W	1.92 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**1.97 mW / g ± 17.6 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	56.3 Ω - 8.5 jΩ
Return Loss	- 20.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.747 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	February 26, 2009

DASY5 Validation Report for Head TSL

Date/Time: 1/18/2010 2:57:54 PM

DUT: Dipole 300 MHz; Type: D300V3; Serial: D300V3 - SN:1009

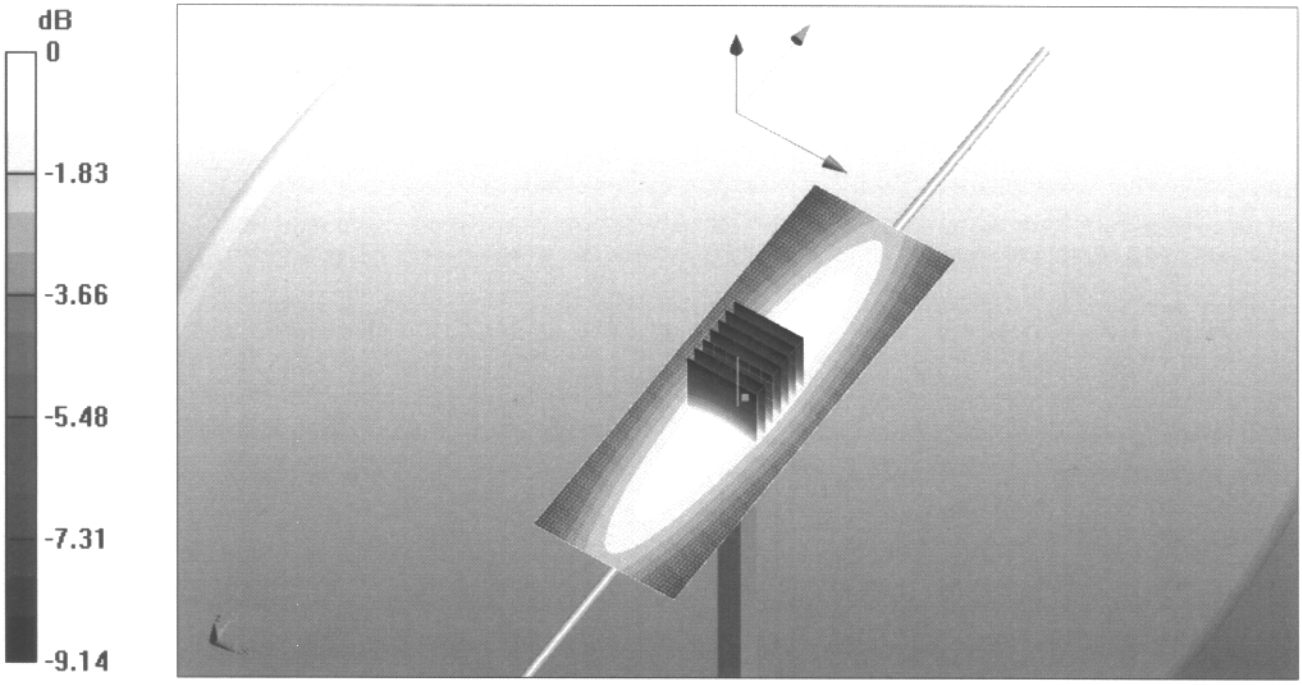
Communication System: CW; Frequency: 300 MHz; Duty Cycle: 1:1
Medium: HSL300
Medium parameters used: f = 300 MHz; σ = 0.84 mho/m; ε_r = 45.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ET3DV6 - SN1507 (LF); ConvF(7.5, 7.5, 7.5); Calibrated: 7/3/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 5/4/2009
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 57

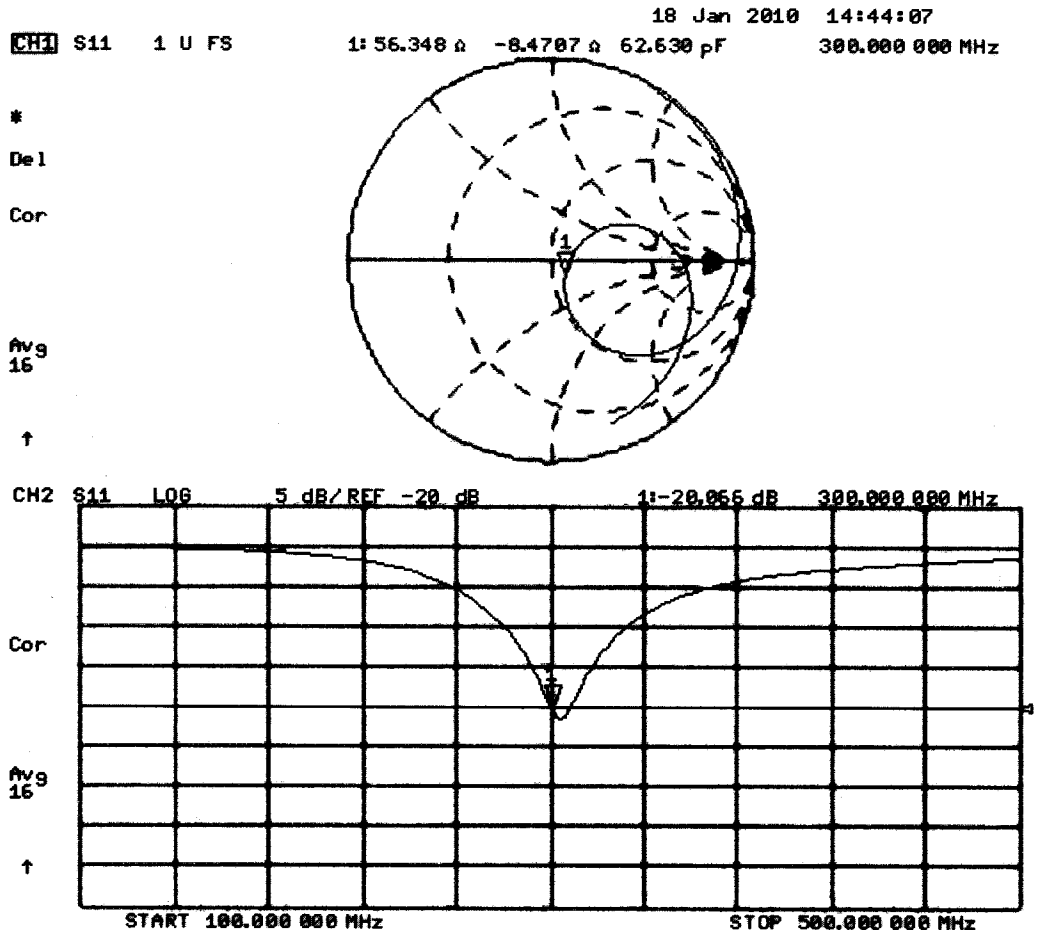
Head/d=15mm, Pin=398mW/Area Scan (41x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.2 mW/g

Head/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 38.7 V/m; Power Drift = 0.00736 dB
Peak SAR (extrapolated) = 1.85 W/kg
SAR(1 g) = 1.14 mW/g; SAR(10 g) = 0.763 mW/g
Maximum value of SAR (measured) = 1.21 mW/g



0 dB = 1.21mW/g

Impedance Measurement Plot for Head TSL



APPENDIX F - PROBE CALIBRATION

Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 108

Client **Celltech**

Certificate No: ET3-1590_Jul10

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1590**

Calibration procedure(s) **QA CAL-01.v6, QA CAL-12.v6, QA CAL-23.v3 and QA CAL-25.v2**
Calibration procedure for dosimetric E-field probes

Calibration date: **July 15, 2010**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

	Name	Function	Signature
Calibrated by	**Jeton Kastrati**	**Laboratory Technician**	
Approved by:	**Katja Pokovic**	**Technical Manager**	

Issued: July 15, 2010

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Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

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

Probe ET3DV6

SN:1590

Manufactured:	March 19, 2001
Last calibrated:	July 16, 2009
Recalibrated:	July 15, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ET3DV6 SN:1590

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.86	2.06	1.77	± 10.1%
DCP (mV)[B]	91.4	92.4	83.5	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300.0	± 1.5%
			Y	0.00	0.00	1.00	300.0	
			Z	0.00	0.00	1.00	300.0	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6)

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ET3DV6 SN:1590

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	43.5 ± 5%	0.87 ± 5%	7.25	7.25	7.25	0.20	2.19 ± 13.3%
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	6.27	6.27	6.27	0.32	2.49 ± 11.0%
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	6.12	6.12	6.12	0.27	2.86 ± 11.0%

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

DASY/EASY - Parameters of Probe: ET3DV6 SN:1590

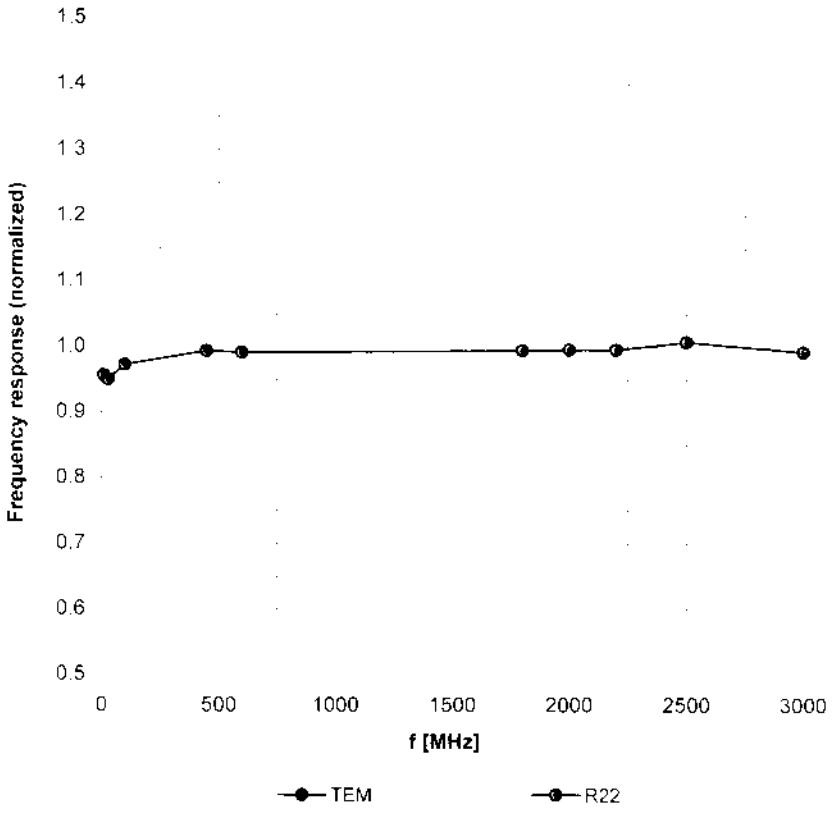
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	56.7 ± 5%	0.94 ± 5%	7.73	7.73	7.73	0.13	2.06 ± 13.3%
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	6.33	6.33	6.33	0.22	3.60 ± 11.0%
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	6.15	6.15	6.15	0.28	2.94 ± 11.0%

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

Frequency Response of E-Field

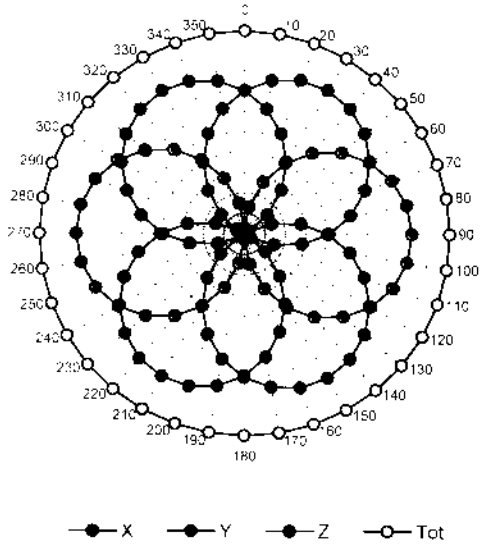
(TEM-Cell:ifi110 EXX, Waveguide: R22)



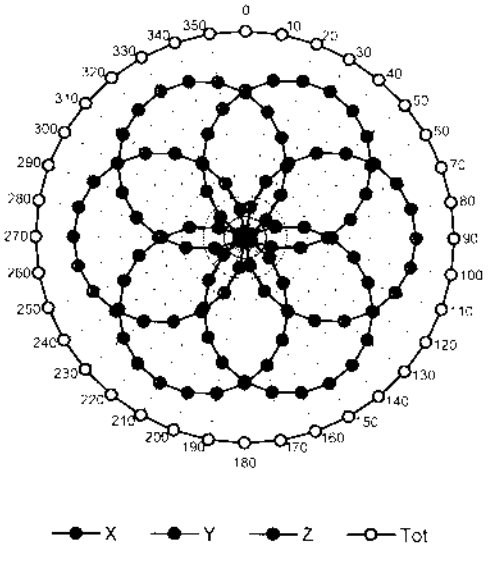
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

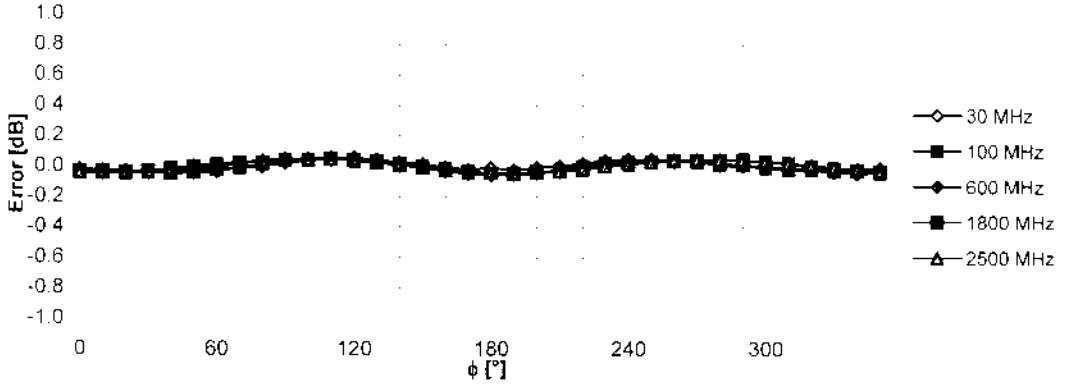
Receiving Pattern (ϕ), ϑ = 0°

f = 600 MHz, TEM ifi110EXX



f = 1800 MHz, WG R22

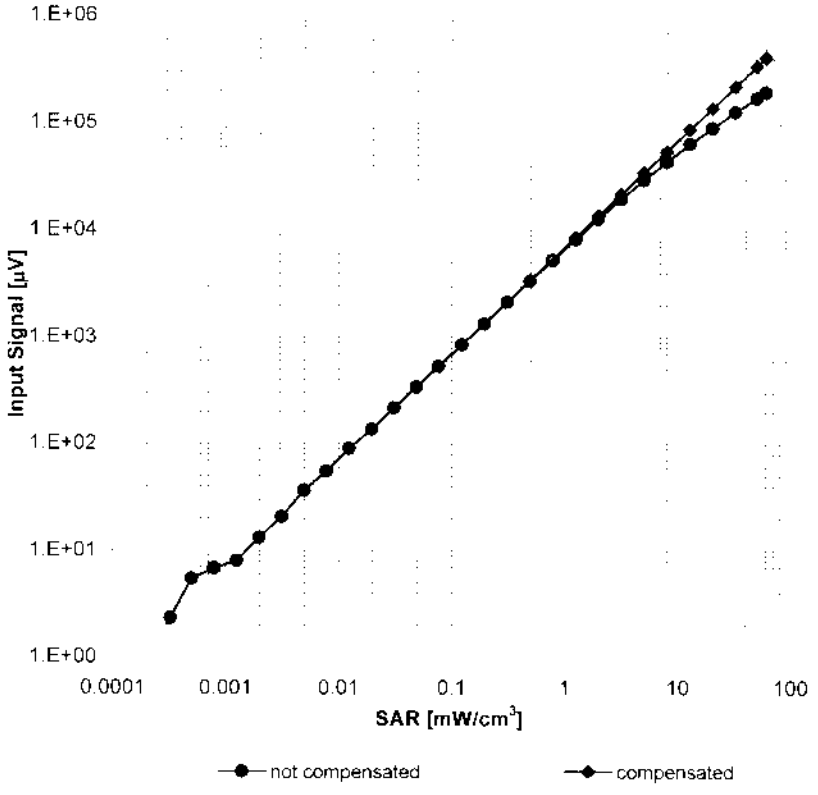


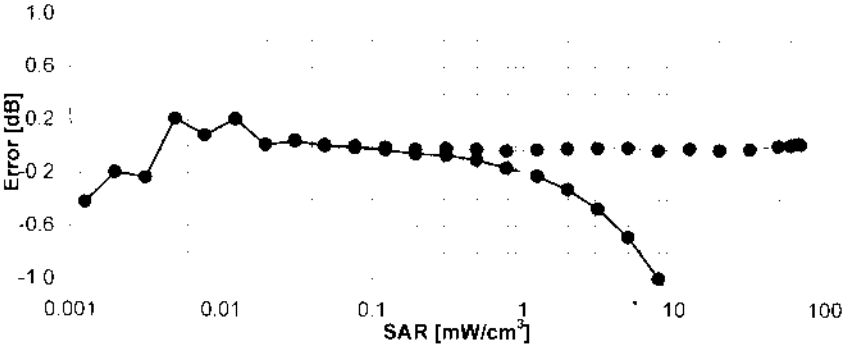


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

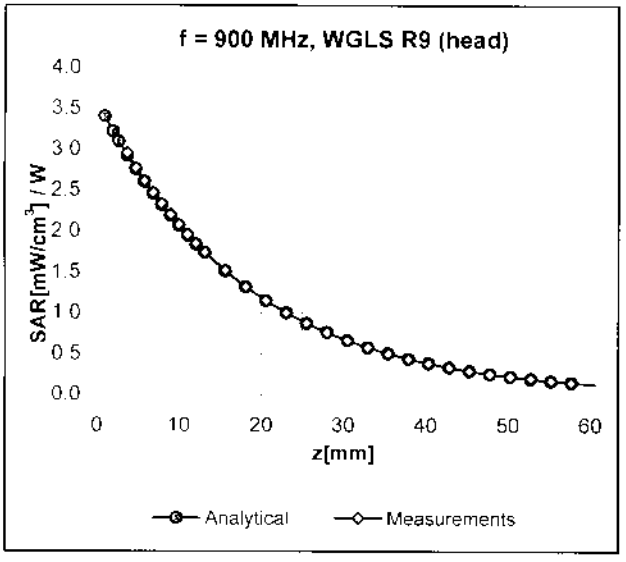
(Waveguide R22, f = 1800 MHz)

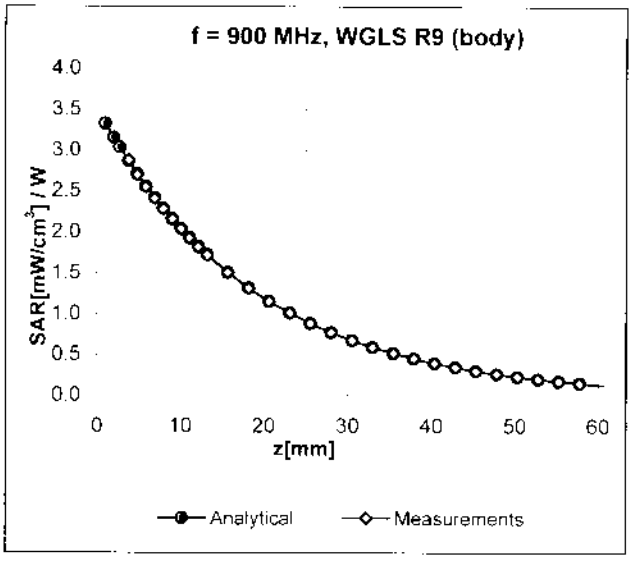




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

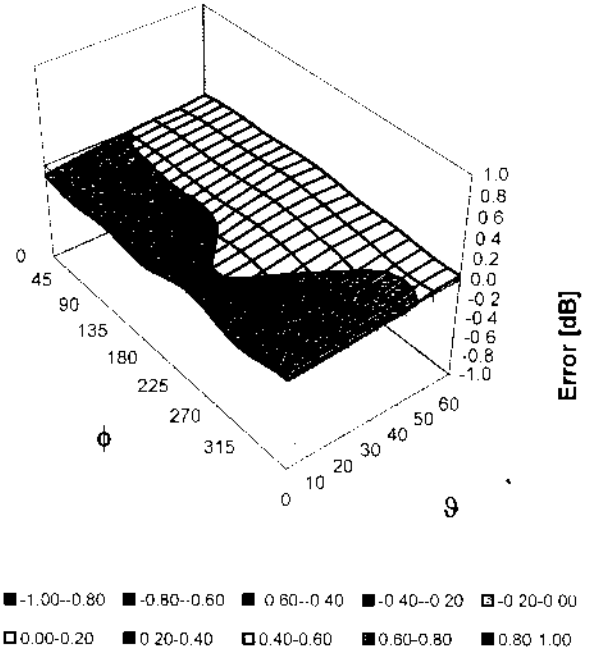
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

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info@speag.com, http://www.speag.com

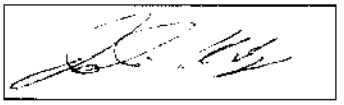
Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1590**
Place of Assessment:	**Zurich**
Date of Assessment:	**July 17, 2010**
Probe Calibration Date:	**July 15, 2010**

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 450 and 835 MHz.

Assessed by:



Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Dosimetric E-Field Probe ET3DV6 SN:1590

Conversion factor (± standard deviation)

150 MHz	*ConvF*	**8.5 ± 10%**	ε_r = 52.3 σ = 0.76 mho/m (head tissue)
300 MHz	*ConvF*	**7.7 ± 9%**	ε_r = 45.3 σ = 0.87 mho/m (head tissue)
150 MHz	*ConvF*	**7.9 ± 10%**	ε_r = 61.9 σ = 0.80 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 DASY4 Manual.

APPENDIX G - BARSKI 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

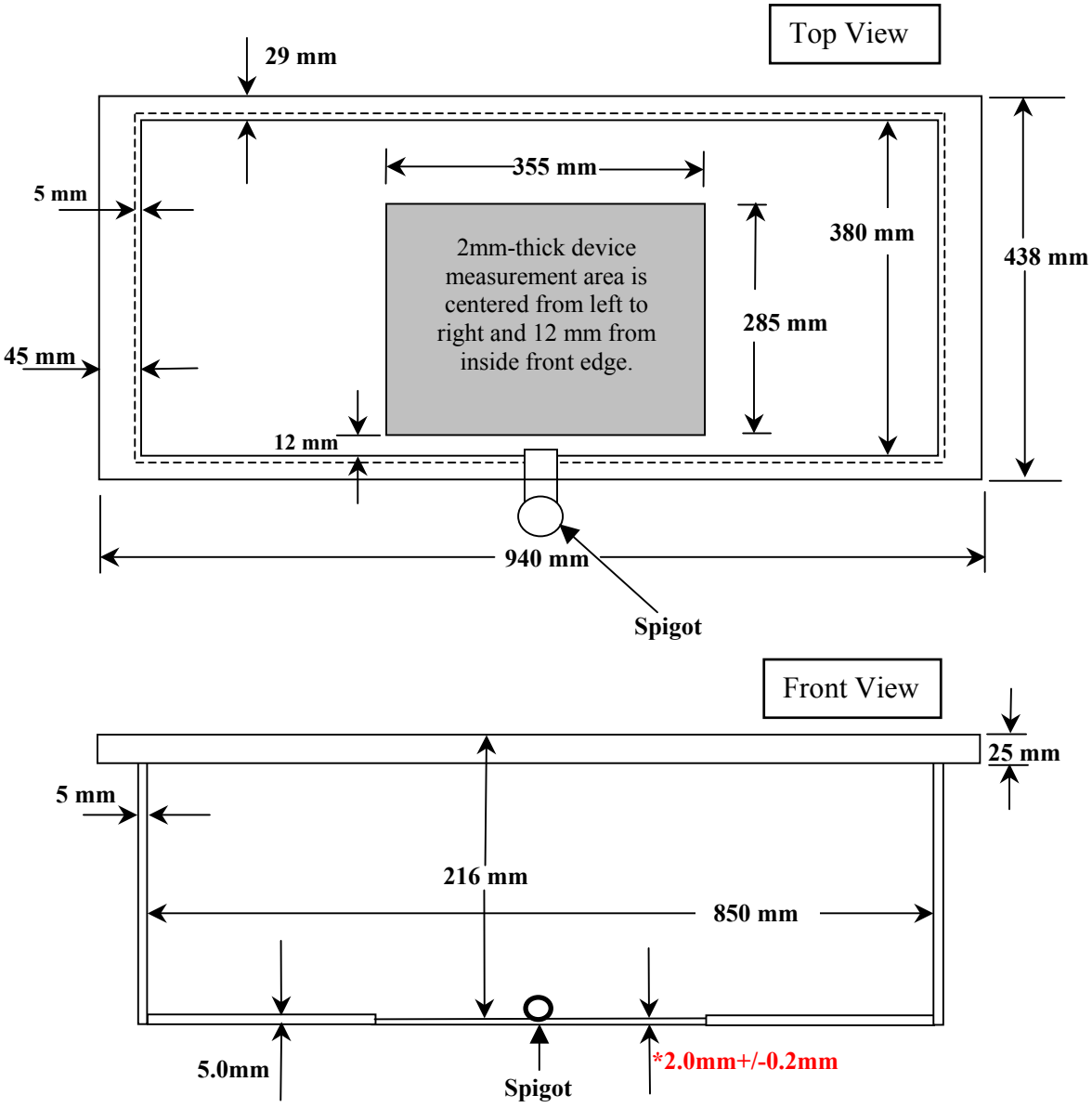
Fiberglass Planar Phantom - Front View

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.