SAR TEST REPORT (FCC/IC)

RF EXPOSURE EVALUATION | SPECIFIC ABSORPTION RATE

APPLICANT / MANUFACTURER	COBRA ELECTRONICS CORPORATION			
DEVICE UNDER TEST (DUT)	PORTABLE FM VHF PTT MARINE RADIO TRANSCEIVER			
DEVICE FREQUENCY RANGE	156.025 - 157.425 MHz			
DEVICE MODEL(S) TESTED	MR HH330 (without Bluetooth)		MR HH475 (with Bluetooth)	
DEVICE IDENTIFIER(S)	FCC ID:	BBOMRHH330	IC:	906B-MRHH330
APPLICATION TYPE	Certification			
STANDARD(S) APPLIED	FCC 47 CFR §2.1093			
	Health Canada Safety Code 6			
PROCEDURE(S) APPLIED	FCC OET Bulletin 65, Supplement C (01-01)			
	FCC Mobile & Portable RF Exp. Proc. (KDB 447498 D01 v03r03)			
	Industry Canada RSS-102 Issue 2			
	IEEE 1528-2003			
	IEC 62209-1:2005			
FCC DEVICE CLASSIFICATION	Part 80 VHF Hand Held Transmitter (GMDSS) - GHH			
IC DEVICE CLASSIFICATION	Maritime Radio Transmitter and Receiver (RSS-182)			
RF EXPOSURE CATEGORY	General Population / Uncontrolled			
RF EXPOSURE EVALUATION(S)	Face-held & Body-worn			
DATE(S) OF EVALUATION	May 06, 2009			
TEST REPORT SERIAL NO.	050409BBO-T964-S80V			
TEST REPORT REVISION NO.	Revision 1.0	Initial Release	May 13, 2009	
TEST REPORT SIGNATORIES	Testing Performed By		Test Report Prepared By	
	Sean Johnston Celltech Labs Inc.		Jonathan Hughes Celltech Labs Inc.	
TEST LAB AND LOCATION	Celltech Compliance Testing and Engineering Lab			
	21-364 Lougheed Road, Kelowna, B.C. V1X 7R8 Canada			
TEST LAB CONTACT INFO.	Tel.: 250-765-7650		Fax: 250-765-7645	
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TEST LAB ACCREDITATION(S)	Test Lab Certificate No. 2470.01			

DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

Test Lab Information	**Name**	**CELLTECH LABS INC.**			
	Address	21-364 Lougheed Road, Kelowna, B.C. V1X 7R8 Canada			
Applicant Information	**Name**	**COBRA ELECTRONICS CORPORATION**			
	Address	6500 West Cortland Street, Chicago, IL 60707 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)			
	FCC	Mobile & Portable RF Exposure Procedures (KDB 447498 D01 v03r03)			
	IC	RSS-102 Issue 2			
	IEEE	1528-2003	**IEC**	62209-1:2005	
Application Type(s)	**FCC/IC**	New Certification			
Device Classification(s)	**FCC**	Part 80 VHF Hand Held Transmitter (GMDSS) - GHH			
	IC	Maritime Radio Transmitter and Receiver (RSS-182)			
Device RF Exposure Category	**Portable**	General Population / Uncontrolled Environment			
Device Identifier(s)	**FCC ID:**	BBOMRHH330	**IC:**	906B-MRHH330	
	Model(s)	MR HH330 (without Bluetooth)	MR HH475 (with Bluetooth)		
	Serial No.	20090320008 (MR HH330)	20090320004 (MR HH475)		

Device Description	Portable FM VHF Push-To-Talk (PTT) Marine Radio Transceiver			
Transmit Frequency Range(s)	156.025 - 157.425 MHz			
Max. Rated RF Output Power	5.5 Watts	+/- 0.3 Watts	Conducted	MR HH330 / HH475
Max. RF Output Power Tested	6.0 Watts	37.78 dBm	Conducted	MR HH330 / HH475
Battery Type(s) Tested	Lithium Polymer	7.4 V	1000 mAh	P/N: 110-021
	Alkaline Case	1.5 V AA (x6)	Duracell Procell	P/N: 110-011
Body-worn Accessory Tested	Belt-Clip	Model: 240-003	Contains Metal	2.5 cm Spacing
Audio Accessory Tested	Speaker-Microphone (P/N: CM 330-001)			
Antenna Type(s) Tested	Fixed External (Length: 160 mm)			

Max. SAR Level(s) Evaluated	Face-held	**1.49 W/kg**	1g	50% ptt duty cycle	MR HH475	General Population (Uncontrolled) RF Exposure Environment
	Body-worn	**0.149 W/kg**	1g	50% ptt duty cycle		
FCC/IC Spatial Peak SAR Limit	Head/Body	1.6 W/kg	1g	50% ptt duty cycle	General Population / Uncontrolled	

Celltech Labs Inc. declares under its sole responsibility that this wireless portable device has demonstrated compliance with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC 47 CFR §2.1093 and Health Canada's Safety Code 6 for the General Population / Uncontrolled Exposure environment. The device was tested in accordance with the measurement procedures described in FCC OET Bulletin 65, Supplement C (Edition 01-01), Industry Canada RSS-102 Issue 2, IEEE Standard 1528-2003 and IEC International Standard 62209-1:2005. All measurements were performed in accordance with the SAR system manufacturer recommendations.

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

The results and statements contained in this report pertain only to the device(s) evaluated. This test report shall not be reproduced partially, or in full, without the prior written approval of Celltech Labs Inc.

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

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1.0 INTRODUCTION

This measurement report demonstrates that the Cobra Electronics Corporation Models: MR HH330, MR HH475 Portable FM VHF PTT Marine Radio Transceiver complies with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]) and Health Canada's Safety Code 6 (see reference [2]) for the General Population / Uncontrolled Exposure environment. The measurement procedures described in FCC OET Bulletin 65, Supplement C (Edition 01-01) (see reference [3]), IC RSS-102 Issue 2 (see reference [4]), IEEE Standard 1528-2003 (see reference [5]) and IEC International Standard 62209-1:2005 (see reference [6]) were employed. A description of the device, operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used and the various provisions of the rules are included within this test report.

2.0 SAR MEASUREMENT SYSTEM

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

DASY4 SAR System with Plexiglas validation phantom

DASY4 SAR System with Plexiglas side planar phantom

3.0 MEASUREMENT SUMMARY

SAR EVALUATION RESULTS

Test Type	Freq.	Ch.	Radio Model	Battery 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	156.8	16	HH330	Li-Poly	6	n/a	n/a	2.5 cm	3.5 cm	P 1.82	0.910	-1.09	P 2.34	1.17
										S 1.54	0.770		S 1.98	0.990
Face	156.8	16	HH475	Li-Poly	6	n/a	n/a	2.5 cm	3.5 cm	2.32	1.16	-1.09	2.98	**1.49**
Face	156.8	16	HH475	Alkaline	6	n/a	n/a	2.5 cm	3.5 cm	1.36	0.680	-0.967	1.70	0.850
Body	156.8	16	HH330	Li-Poly	6	Belt-Clip	Spkr-Mic	2.5 cm	3.6 cm	0.206	0.103	-0.580	0.235	0.118
Body	156.8	16	HH475	Li-Poly	6	Belt-Clip	Spkr-Mic	2.5 cm	3.6 cm	P 0.261	0.131	-0.580	P 0.298	**0.149**
										S 0.222	0.111		S 0.254	0.127
Body	156.8	16	HH475	Alkaline	6	Belt-Clip	Spkr-Mic	2.5 cm	3.6 cm	0.245	0.123	-0.705	0.288	0.144

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	May 6, 2009				May 6, 2009				Measured Fluid Type	Head	Body	Unit
Measured Fluid Type	150 MHz Head				150 MHz Body				Atmospheric Pressure	101.1	101.1	kPa
Dielectric Constant ε_r	IEEE Target		Meas.	Dev.	IEEE Target		Meas.	Dev.	Relative Humidity	35	35	%
	52.3	± 5%	54.7	+4.6%	61.9	± 5%	62.5	+1.0%	Ambient Temperature	23.8	24.3	°C
Measured Fluid Type	150 MHz Head				150 MHz Body				Fluid Temperature	22.5	22.9	°C
Conductivity σ (mho/m)	IEEE Target		Meas.	Dev.	IEEE Target		Meas.	Dev.	Fluid Depth	≥ 15	≥ 15	cm
	0.76	± 5%	0.76	0.0%	0.80	± 5%	0.80	0.0%	ρ (Kg/m^3)	1000		

Notes

1. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
2. If the SAR levels (scaled) evaluated at the mid channel (50% PTT duty cycle) were ≥ 3 dB below the SAR limit, SAR evaluation for the low and high channels was optional (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).
3. The body-worn SAR evaluations were also verified without the speaker-microphone accessory attached. The subsequent SAR levels were significantly higher without the speaker-microphone accessory; therefore a coupling effect is contributed to the low SAR with the accessory.
4. The SAR droop of the DUT for each SAR evaluation could not be measured accurately due to the internal PA temperature sensor caused the radio to power down after approximately 244 seconds. The SAR droop of the DUT was measured by performing SAR-versus-Time droop evaluations for approximately 244 seconds before the radio powered down. The measured SAR-versus-Time droops were subsequently added to the measured SAR levels to report scaled SAR results as shown in the above test data table.
5. Secondary peak SAR levels measured within 2 dB of the primary are reported (P = Primary, S = Secondary).
6. SAR Evaluation Power Thresholds for PTT Devices, $f \leq 0.5$ GHz (FCC KDB 447498 D01 v03r03 Section 5)b)i) - Mobile & Portable RF Exposure Procedures)

Exposure Conditions	*P* mW (General Population)	*P* mW (Occupational)	Measured RF Conducted Output Power: 100% PTT Duty Cycle	50% PTT Duty Cycle
Held to face, $d \geq 2.5$ cm	250	1250	6 Watts	3 Watts
Body-worn, $d \geq 1.5$ cm	200	1000	6 Watts	3 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.

4.0 DETAILS OF SAR EVALUATION

The Cobra Electronics Corporation Models: MR HH330, MR HH475 BT Portable FM VHF PTT Marine Radio Transceiver described in this report was compliant for localized Specific Absorption Rate (General Population / Uncontrolled Exposure) based on the test provisions and conditions described below. Photographs of the test setup are shown in Appendix D.

1. The MR HH330 radio model does not contain a Bluetooth transmitter whereas the MR HH475 radio model does contain a Bluetooth transmitter. Both radio models were evaluated for SAR in order to report a comparison between the radio transmitter configurations. The manufacturer specifies that the VHF transmitter and the Bluetooth transmitter do not transmit simultaneously; therefore co-transmit SAR evaluations were not required. The Bluetooth is exempt from FCC and IC individual transmitter SAR evaluation requirements based on the radio manufacturer's maximum RF output power specification is 0.0025 Watts which is below the RF output power threshold for SAR evaluation requirement per FCC KDB 447498 D01 v03r03 (see reference [7]).
2. The MR HH475 was evaluated with lithium polymer and alkaline batteries. The MR HH330 was evaluated with the lithium polymer battery and does not support alkaline batteries.
3. The DUT was evaluated in a face-held configuration with the front of the radio placed parallel to the outer surface of the planar phantom. A 2.5 cm spacing was maintained between the front side of the DUT and the outer surface of the planar phantom.
4. The DUT was tested in a body-worn configuration with the back of the radio placed parallel to the outer surface of the planar phantom. The attached swivel belt-clip accessory was touching the planar phantom and provided a 2.5 cm spacing from the back of the DUT to the outer surface of the planar phantom. The DUT was evaluated for body-worn SAR with the Cobra supplied speaker-microphone audio accessory connected to the audio port.
5. The DUT was tested at maximum power in unmodulated continuous transmit operation (Continuous Wave mode at 100% duty cycle) with the transmit key constantly depressed. For a push-to-talk device the 50% duty cycle compensation reported assumes a transmit/receive cycle of equal time base.
6. The conducted output power level referenced in this report was measured by Celltech Labs Inc. prior to the SAR evaluations with an SMA connector and a Gigatronics 8652A Universal Power Meter in accordance with the requirements of FCC 47 CFR §2.1046 and IC RSS-Gen.
7. The fluid temperature was measured prior to and after the SAR evaluations to ensure the temperature remained within +/-2°C of the fluid temperature reported during the dielectric parameter measurements.
8. The dielectric parameters of the simulated tissue mixtures were measured prior to the SAR evaluations using a Dielectric Probe Kit and a Network Analyzer (see Appendix C).

5.0 EVALUATION PROCEDURES

a. (i) The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For devices held to the ear during normal operation, both the left and right ear positions were evaluated using the SAM phantom.
(ii) For body-worn and face-held devices a planar phantom was used.

b. The SAR was determined by a pre-defined procedure within the DASY4 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 15mm x 15mm.
An area scan was determined as follows:

c. Based on the defined area scan grid, a more detailed grid is created to increase the points by a factor of 10. The interpolation function then evaluates all field values between corresponding measurement points.

d. A linear search is applied to find all the candidate maxima. Subsequently, all maxima are removed that are >2 dB from the global maximum. The remaining maxima are then used to position the cube scans.
A 1g and 10g spatial peak SAR was determined as follows:

e. Extrapolation is used to find the points between the dipole center of the probe and the surface of the phantom. This data cannot be measured, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.4 mm (see probe calibration document in Appendix 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.

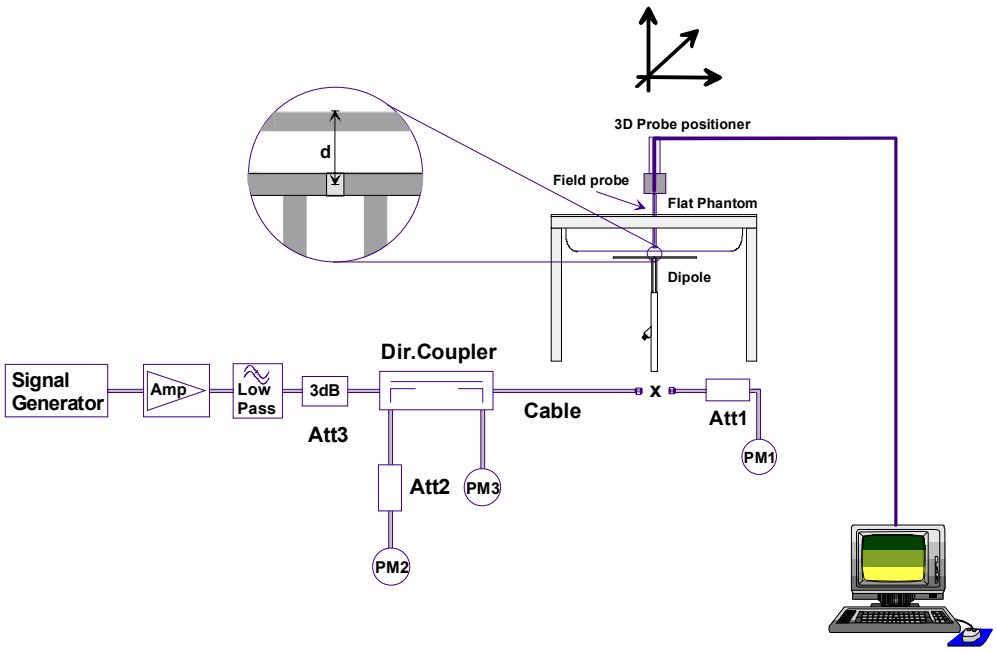
6.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluations a daily system check was performed using a Plexiglas planar phantom and 300 MHz dipole (see Appendix B for system performance check test plot) in accordance with the procedures described in IEEE Standard 1528-2003 (see reference [5]) and IEC International Standard 62209-1:2005 (see reference [6]). The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer (see Appendix C for measured fluid dielectric parameters). A forward power of 250 mW was applied to the dipole and the system was verified to a tolerance of ±10% from the system validation target SAR value (see Appendix E for system validation target SAR value listed on page 10 of the dipole calibration report).

SYSTEM PERFORMANCE CHECK EVALUATION

Test Date	Equiv. Tissue	SAR 1g (W/kg)			Dielectric Constant ε_r			Conductivity σ (mho/m)			ρ (Kg/m^3)	Amb. Temp. (°C)	Fluid Temp. (°C)	Fluid Depth (cm)	Humid. (%)	Barom. Press. (kPa)
	Freq. (MHz)	Sys. Val. Target	Meas.	Dev.	Sys. Val. Target	Meas.	Dev.	Sys. Val. Target	Meas.	Dev.						
May 06	Head 300	0.760 ±10%	0.788	+3.7%	44.9 ±5%	46.1	+2.7%	0.85 ±5%	0.88	+3.5%	1000	23.5	22.2	≥ 15	35	101.1

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



System Performance Check Measurement Setup Diagram

300 MHz Validation Dipole Setup

7.0 SAR PROBE CALIBRATION & MEASUREMENT FREQUENCIES

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

Probe Calibration Freq.	Device Measurement Freq.	Frequency Interval	±25 MHz < 300 MHz
150 MHz	156.8 MHz	6.8 MHz	< 25 MHz
The probe calibration and measurement frequency interval is < 25 MHz; therefore the additional steps are not required.			

8.0 SIMULATED EQUIVALENT TISSUES

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

SIMULATED TISSUE MIXTURES							
INGREDIENT	Water	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 %

9.0 SAR LIMITS

SAR RF EXPOSURE LIMITS			
FCC 47 CFR 2.1093	Health Canada Safety Code 6	(General Population / Uncontrolled Exposure)	(Occupational / Controlled Exposure)
Spatial Average (averaged over the whole body)		0.08 W/kg	0.4 W/kg
Spatial Peak (averaged over any 1 g of tissue)		**1.6 W/kg**	8.0 W/kg
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)		4.0 W/kg	20.0 W/kg
The Spatial Average value of the SAR averaged over the whole body.			
The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.			
The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.			
Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.			
Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.			

10.0 ROBOT SYSTEM SPECIFICATIONS

Specifications	
Positioner	Stäubli Unimation Corp. Robot Model: RX60L
Repeatability	0.02 mm
No. of axis	6
Data Acquisition Electronic (DAE) System	
Cell Controller	
Processor	AMD Athlon XP 2400+
Clock Speed	2.0 GHz
Operating System	Windows XP Professional
Data Converter	
Features	Signal Amplifier, multiplexer, A/D converter, and control logic
Software	Measurement Software: DASY4, V4.7 Build 44
	Postprocessing Software: SEMCAD, V1.8 Build 171
Connecting Lines	Optical downlink for data and status info., Optical uplink for commands and clock
DASY4 Measurement Server	
Function	Real-time data evaluation for field measurements and surface detection
Hardware	PC/104 166MHz Pentium CPU; 32 MB chipdisk; 64 MB RAM
Connections	COM1, COM2, DAE, Robot, Ethernet, Service Interface
E-Field Probe	
Model	ET3DV6
Serial No.	1590
Construction	Triangular core fiber optic detection system
Frequency	10 MHz to 6 GHz
Linearity	±0.2 dB (30 MHz to 3 GHz)
Evaluation Phantom	
Type	Side Planar Phantom
Shell Material	Plexiglas
Bottom Thickness	2.0 mm ± 0.1 mm
Inner Dimensions	72.6 cm (L) x 20.3 cm (W) x 20.3 cm (H)
Validation Phantom (≤ 450MHz)	
Type	Planar Phantom
Shell Material	Plexiglas
Bottom Thickness	6 mm ± 0.1 mm
Inner Dimensions	83.5 cm (L) x 36.9 cm (W) x 21.8 cm (H)

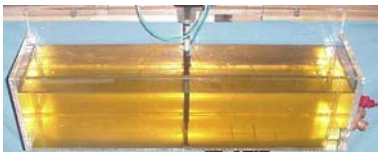
11.0 PROBE SPECIFICATION (ET3DV6)

Construction:	Symmetrical design with triangular core; Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, glycol)
Calibration:	In air from 10 MHz to 2.5 GHz In head simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy ± 8%)
Frequency:	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity:	± 0.2 dB in head tissue (rotation around probe axis) ± 0.4 dB in head tissue (rotation normal to probe axis)
Dynamic Range:	5 μW/g to > 100 mW/g; Linearity: ± 0.2 dB
Surface Detect:	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Dimensions:	Overall length: 330 mm; Tip length: 16 mm; Body diameter: 12 mm; Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 3 GHz; Compliance tests of mobile phone

ET3DV6 E-Field Probe

12.0 SIDE PLANAR PHANTOM

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



Plexiglas Side Planar Phantom

13.0 VALIDATION PLANAR PHANTOM

The validation planar phantom is constructed of Plexiglas material with a 6.0 mm shell thickness for system validations at 450MHz and below. The validation planar phantom is mounted to the table of the DASY4 compact system.

Plexiglas Validation Planar Phantom

14.0 DEVICE HOLDER

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

Device Holder

15.0 TEST EQUIPMENT LIST

TEST EQUIPMENT		ASSET NO.	SERIAL NO.	DATE CALIBRATED	CALIBRATION DUE DATE
USED	DESCRIPTION				
x	Schmid & Partner DASY4 System	-	-	-	-
x	-DASY4 Measurement Server	00158	1078	CNR	CNR
x	-Robot	00046	599396-01	CNR	CNR
x	-DAE4	00019	353	28Apr09	28Apr10
x	-ET3DV6 E-Field Probe	00017	1590	21Jul08	21Jul09
x	-Celltech 300 MHz Validation Dipole	00023	135	26Jan09	26Jan10
x	-Plexiglas Side Planar Phantom	00156	161	CNR	CNR
x	-Plexiglas Validation Planar Phantom	00157	137	CNR	CNR
x	HP 85070C Dielectric Probe Kit	00033	US39240170	CNR	CNR
x	Gigatronics 8652A Power Meter	00007	1835272	23Apr08	21Jul09
x	Gigatronics 80701A Power Sensor	00014	1833699	23Apr08	21Jul09
x	HP 8753ET Network Analyzer	00134	US39170292	28Apr08	28Apr10
x	HP 8648D Signal Generator	00005	3847A00611	CNR	CNR
x	Amplifier Research 10W1000C Power Amplifier	00041	27887	CNR	CNR
Abbr.	CNR = Calibration Not Required				

16.0 MEASUREMENT UNCERTAINTIES

UNCERTAINTY BUDGET FOR DEVICE EVALUATION

Uncertainty Component	IEEE 1528 Section	Uncertainty Value ±%	Probability Distribution	Divisor	ci 1g	ci 10g	Uncertainty Value ±% (1g)	Uncertainty Value ±% (10g)	V_i or V_{eff}
Measurement System									
Probe Calibration (150 MHz)	E.2.1	10	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	0	Normal	1	0.64	0.43	0.0	0.0	∞
Liquid Permittivity (target)	E.3.2	5	Rectangular	1.732050808	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measured)	E.3.3	4.6	Normal	1	0.6	0.49	2.8	2.3	∞
Combined Standard Uncertainty			**RSS**				**13.65**	**13.45**	
Expanded Uncertainty (95% Confidence Interval)			**k=2**				**27.30**	**26.90**	

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

17.0 REFERENCES

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

[2] Health Canada - “Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz”, Safety Code 6: 1999.

[3] Federal Communications Commission - “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields”, OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.

[4] Industry Canada - “Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)”, Radio Standards Specification RSS-102 Issue 2: November 2005.

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

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

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

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

APPENDIX A - SAR MEASUREMENT DATA

Date Tested: 05/06/2009

Face-held SAR - MR HH330 - Channel 16 - 156.8 MHz - Li-Poly Battery Pack

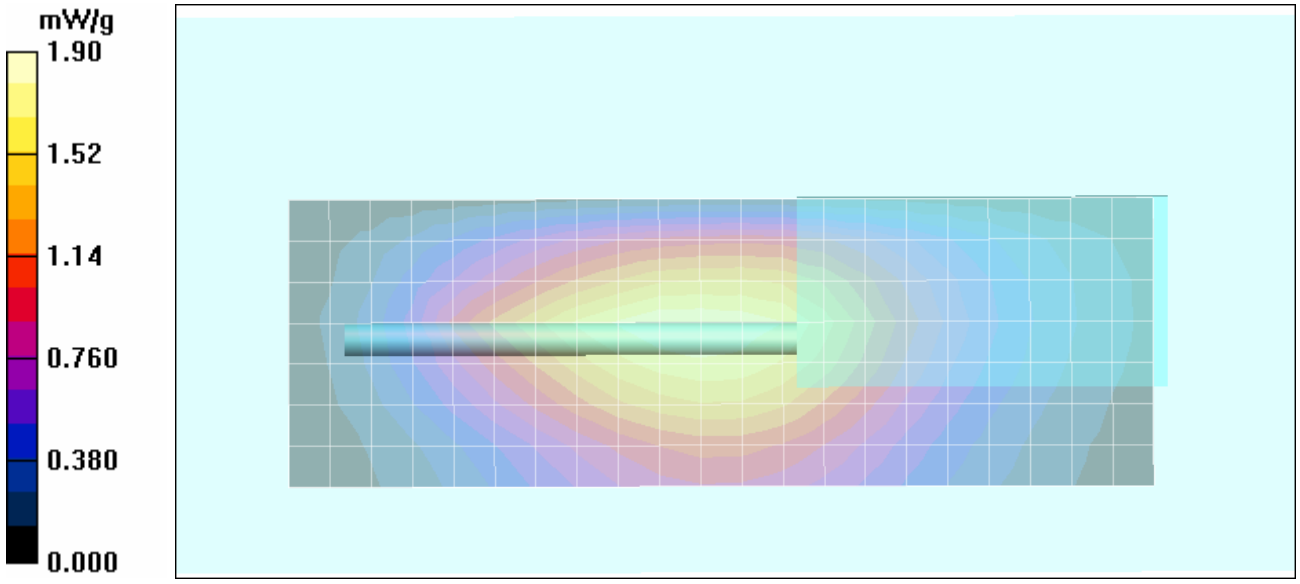
DUT: Cobra Model: MR HH330; Type: Portable FM VHF PTT Marine Radio Transceiver; Serial: 20090320008

Ambient Temp: 23.8°C; Fluid Temp: 22.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: CW
Frequency: 156.8 MHz; Duty Cycle: 1:1
Medium: HSL150 Medium parameters used: f = 156.8 MHz; σ = 0.76 mho/m; ε_r = 54.7; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(8.9, 8.9, 8.9); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- 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 (8x22x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.77 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 49.5 V/m; Power Drift = 0.446 dB
Peak SAR (extrapolated) = 2.63 W/kg
SAR(1 g) = 1.82 mW/g; SAR(10 g) = 1.31 mW/g
Maximum value of SAR (measured) = 1.90 mW/g
Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 49.5 V/m; Power Drift = 0.446 dB
Peak SAR (extrapolated) = 2.37 W/kg
SAR(1 g) = 1.54 mW/g; SAR(10 g) = 1.09 mW/g
Maximum value of SAR (measured) = 1.72 mW/g



Date Tested: 05/06/2009

Face-held SAR - MR HH475 - Channel 16 - 156.8 MHz - Li-Poly Battery Pack

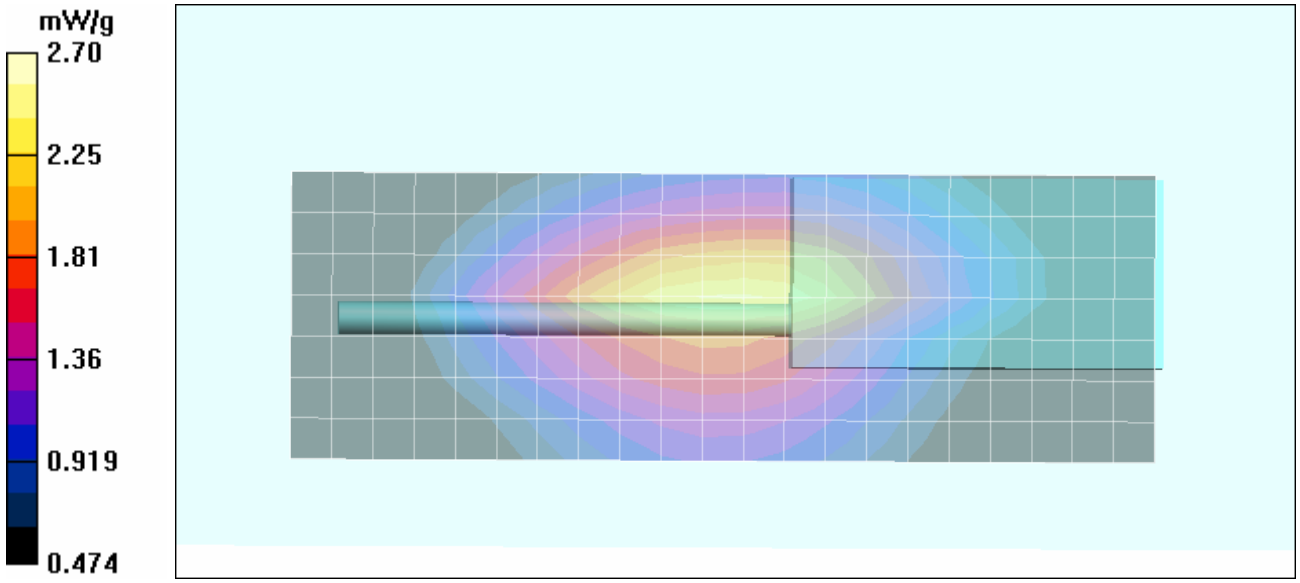
DUT: Cobra Model: MR HH475; Type: Portable FM VHF PTT Marine Radio Transceiver; Serial: 20090320004

Ambient Temp: 23.8°C; Fluid Temp: 22.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

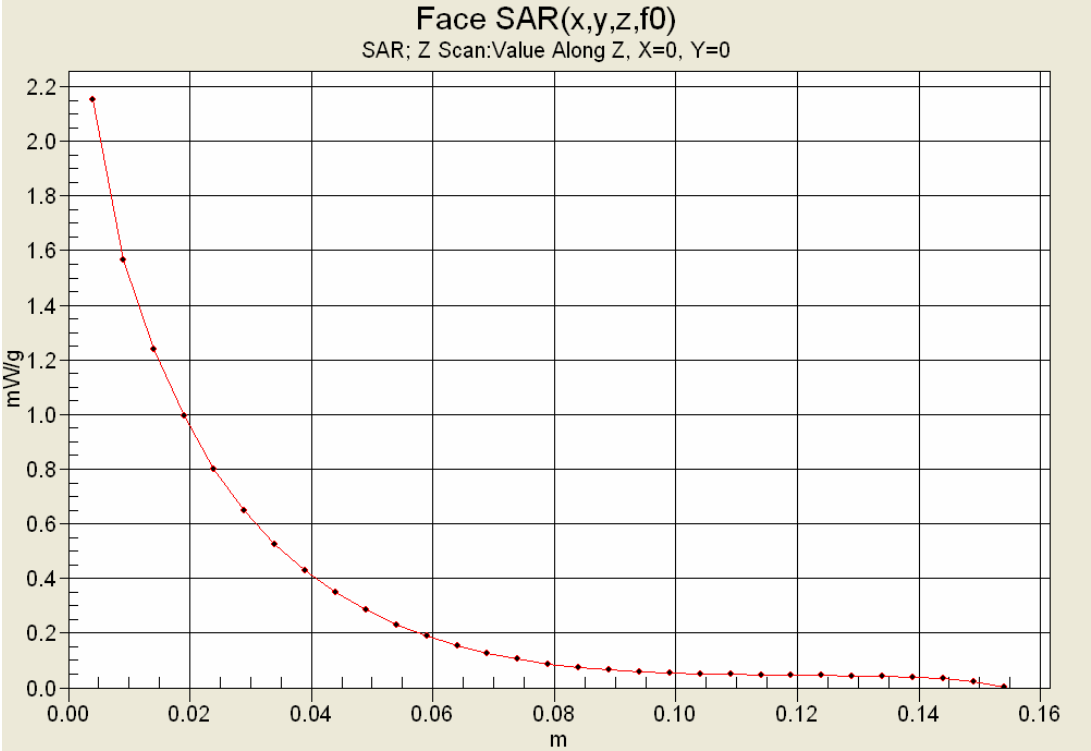
Communication System: CW
Frequency: 156.8 MHz; Duty Cycle: 1:1
Medium: HSL150 Medium parameters used: f = 156.8 MHz; σ = 0.76 mho/m; ε_r = 54.7; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(8.9, 8.9, 8.9); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- 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 (8x22x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.43 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 53.4 V/m; Power Drift = -0.312 dB
Peak SAR (extrapolated) = 3.95 W/kg
SAR(1 g) = 2.32 mW/g; SAR(10 g) = 1.64 mW/g
Maximum value of SAR (measured) = 2.70 mW/g

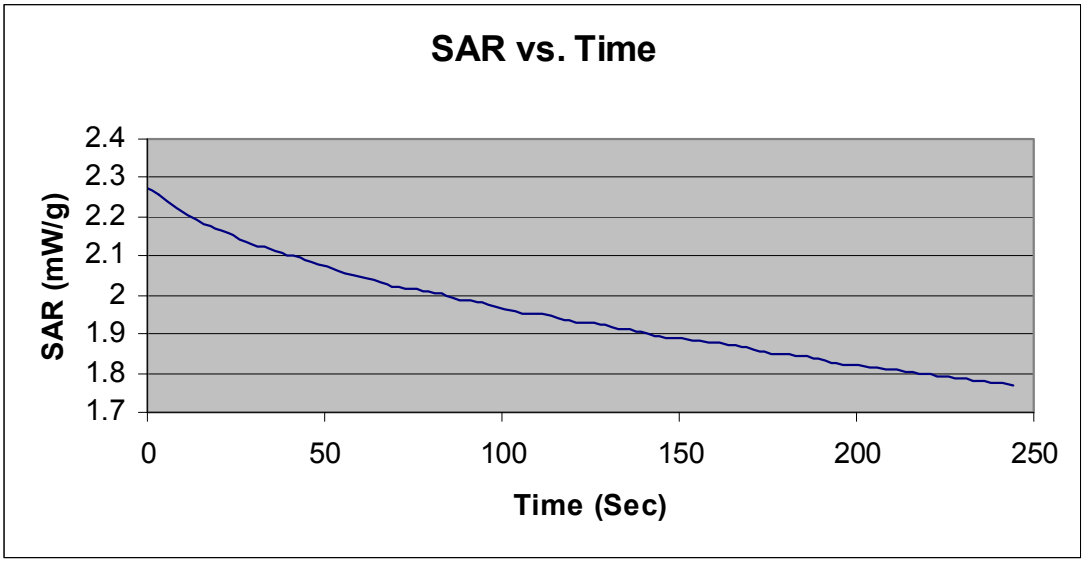


Z-Axis Scan



SAR-versus-Time Droop Evaluation

Face-held Configuration
Lithium Polymer Battery
Channel 16 - 156.8 MHz



Start SAR: 2.27604 mW/g
SAR after 244s: 1.77016 mW/g (-1.09 dB)

Date Tested: 05/06/2009

Face-held SAR - MR HH475 - Channel 16 - 156.8 MHz - Alkaline Battery Tray (x6 AA)

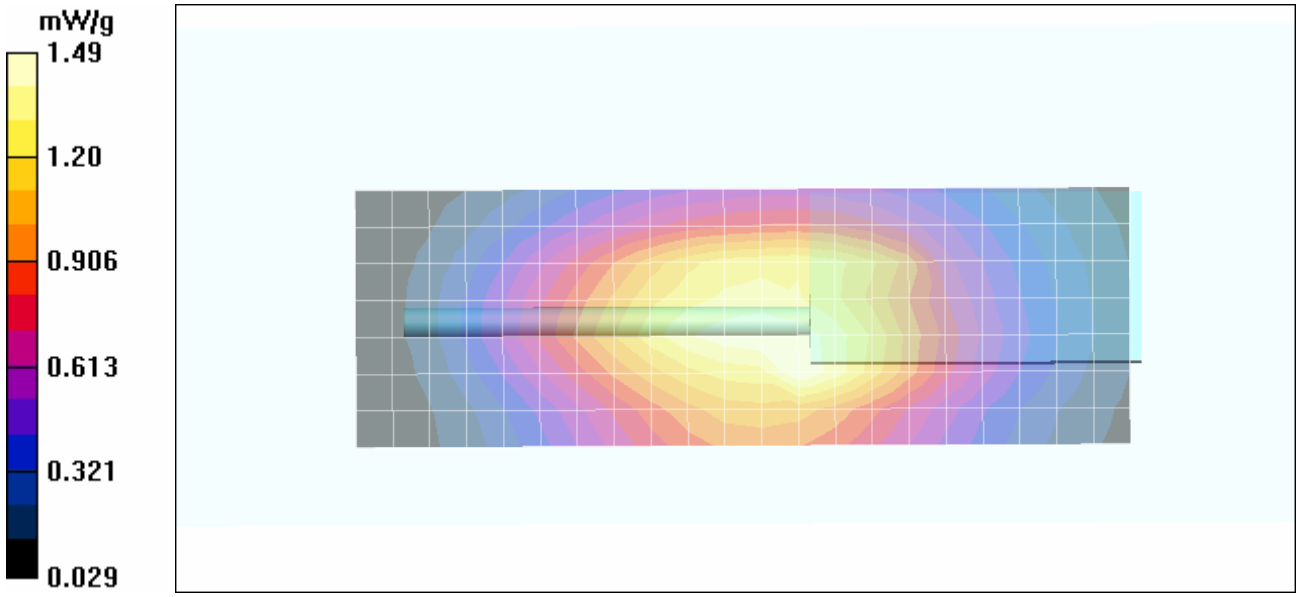
DUT: Cobra Model: MR HH475; Type: Portable FM VHF PTT Marine Radio Transceiver; Serial: 20090320004

Ambient Temp: 23.8°C; Fluid Temp: 22.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: CW
Frequency: 156.8 MHz; Duty Cycle: 1:1
Medium: HSL150 Medium parameters used: f = 156.8 MHz; σ = 0.76 mho/m; ε_r = 54.7; ρ = 1000 kg/m^3

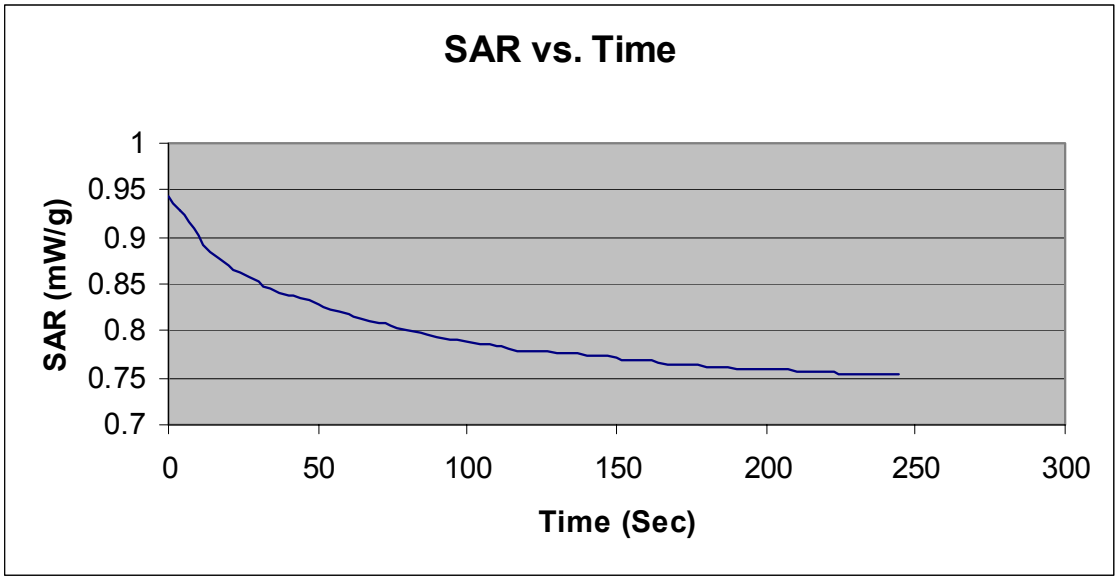
- Probe: ET3DV6 - SN1590; ConvF(8.9, 8.9, 8.9); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Face-held SAR - 2.5 cm Spacing from Front Side of DUT to Planar Phantom
Area Scan (8x22x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.53 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 43.1 V/m; Power Drift = -1.01 dB
Peak SAR (extrapolated) = 2.14 W/kg
SAR(1 g) = 1.36 mW/g; SAR(10 g) = 0.990 mW/g
Maximum value of SAR (measured) = 1.49 mW/g



SAR-versus-Time Droop Evaluation

Face-held Configuration
Alkaline Battery Tray
Channel 16 - 156.8 MHz



Start SAR: 0.942542 mW/g
SAR after 244s: 0.754336 mW/g (-0.967 dB)

Date Tested: 05/06/2009

Body-worn SAR - MR HH330 - Channel 16 - 156.8 MHz - Li-Poly Battery Pack

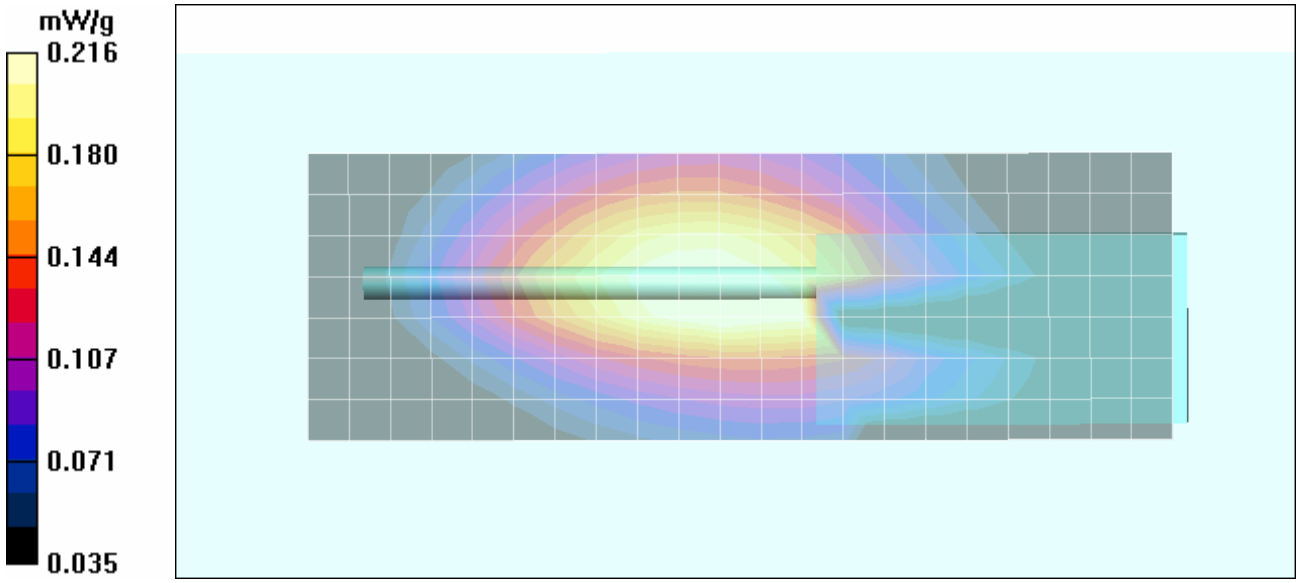
DUT: Cobra Model: MR HH330; Type: Portable FM VHF PTT Marine Radio Transceiver; Serial: 20090320008

Ambient Temp: 24.3°C; Fluid Temp: 22.9°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: CW
Frequency: 156.8 MHz; Duty Cycle: 1:1
Medium: M150 Medium parameters used: f = 156.8 MHz; σ = 0.8 mho/m; ε_r = 62.5; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(8.5, 8.5, 8.5); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- 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 Belt-Clip Spacing from Back Side of DUT to Planar Phantom
Area Scan (8x22x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.223 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 15.0 V/m; Power Drift = -0.152 dB
Peak SAR (extrapolated) = 0.313 W/kg
SAR(1 g) = 0.206 mW/g; SAR(10 g) = 0.137 mW/g
Maximum value of SAR (measured) = 0.216 mW/g



Date Tested: 05/06/2009

Body-worn SAR - MR HH475 - Channel 16 - 156.8 MHz - Li-Poly Battery Pack

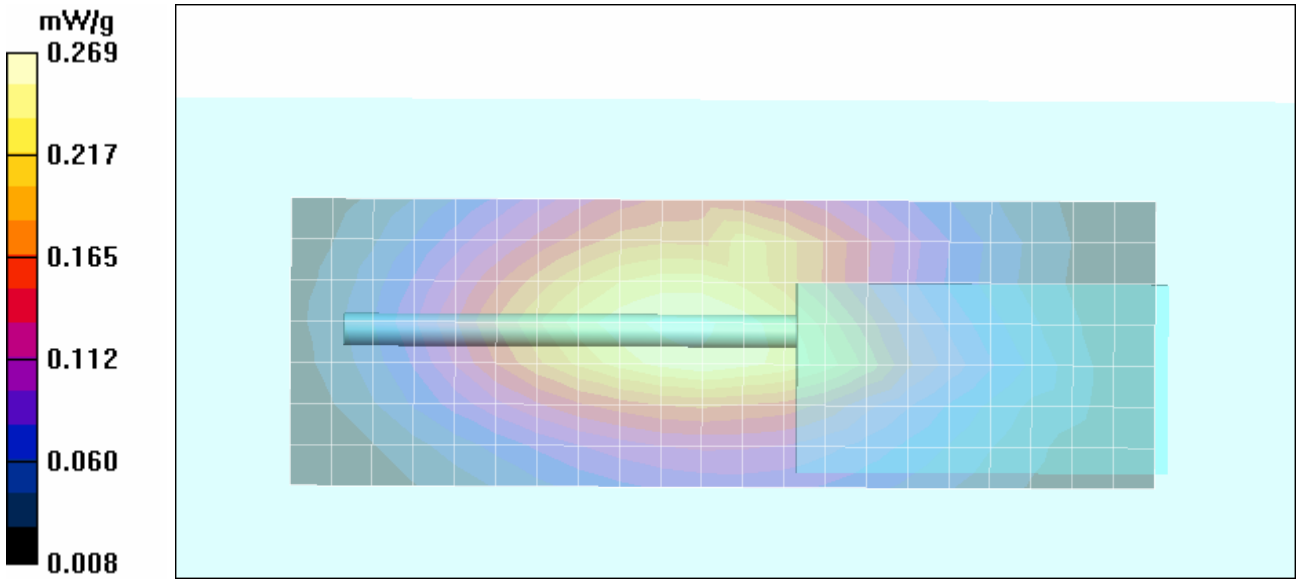
DUT: Cobra Model: MR HH475; Type: Portable FM VHF PTT Marine Radio Transceiver; Serial: 20090320004

Ambient Temp: 24.3°C; Fluid Temp: 22.9°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

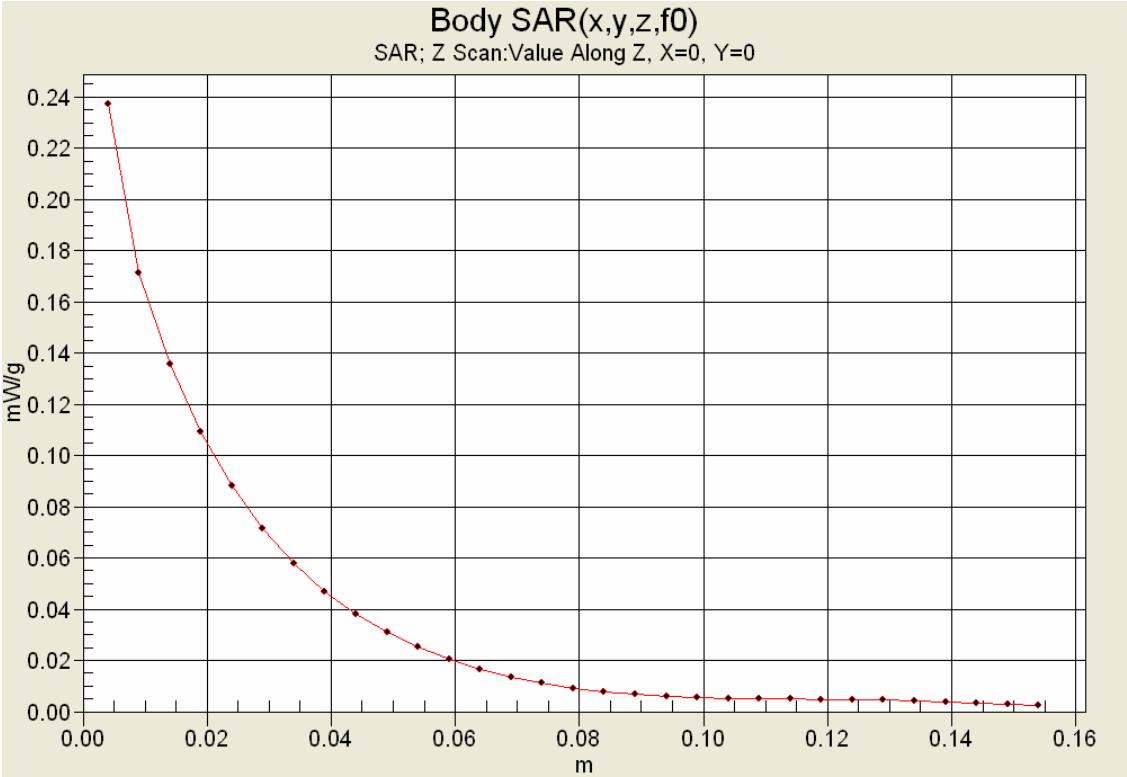
Communication System: CW
Frequency: 156.8 MHz; Duty Cycle: 1:1
Medium: M150 Medium parameters used: f = 156.8 MHz; σ = 0.8 mho/m; ε_r = 62.5; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(8.5, 8.5, 8.5); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- 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 Belt-Clip Spacing from Back Side of DUT to Planar Phantom
Area Scan (8x22x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.256 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 16.5 V/m; Power Drift = -0.051 dB
Peak SAR (extrapolated) = 0.423 W/kg
SAR(1 g) = 0.261 mW/g; SAR(10 g) = 0.182 mW/g
Maximum value of SAR (measured) = 0.269 mW/g
Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 16.5 V/m; Power Drift = -0.051 dB
Peak SAR (extrapolated) = 0.419 W/kg
SAR(1 g) = 0.222 mW/g; SAR(10 g) = 0.159 mW/g
Maximum value of SAR (measured) = 0.258 mW/g

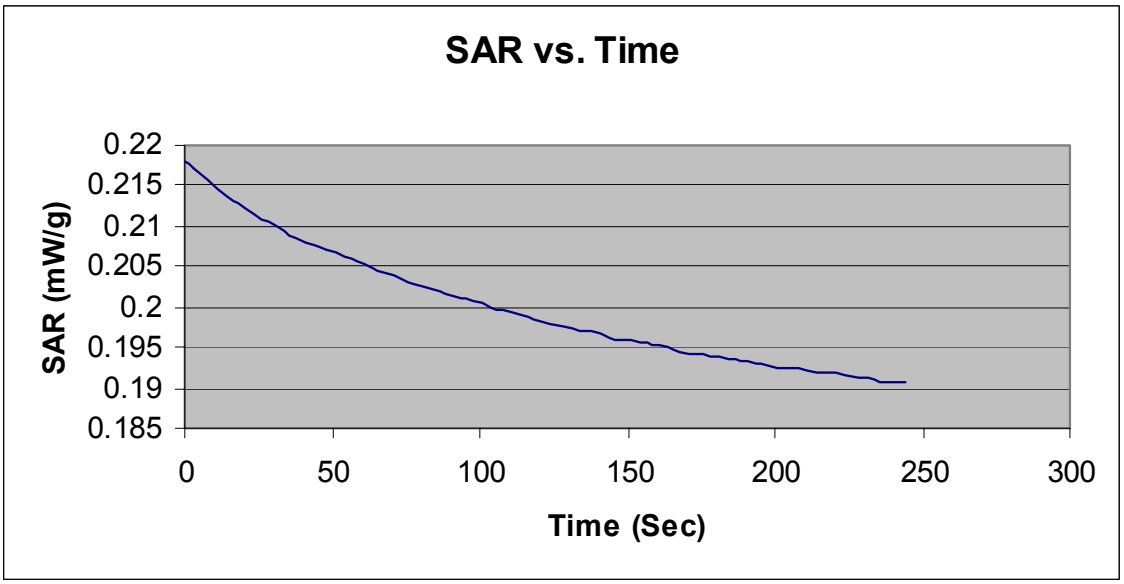


Z-Axis Scan



SAR-versus-Time Droop Evaluation

Body-worn Configuration
Lithium Polymer Battery
Channel 16 - 156.8 MHz



Start SAR: 0.217858 mW/g
SAR after 244s: 0.190633 mW/g (-0.580 dB)

Date Tested: 05/06/2009

Body-worn SAR - MR HH475 - Channel 16 - 156.8 MHz - Alkaline Battery Tray (x6 AA)

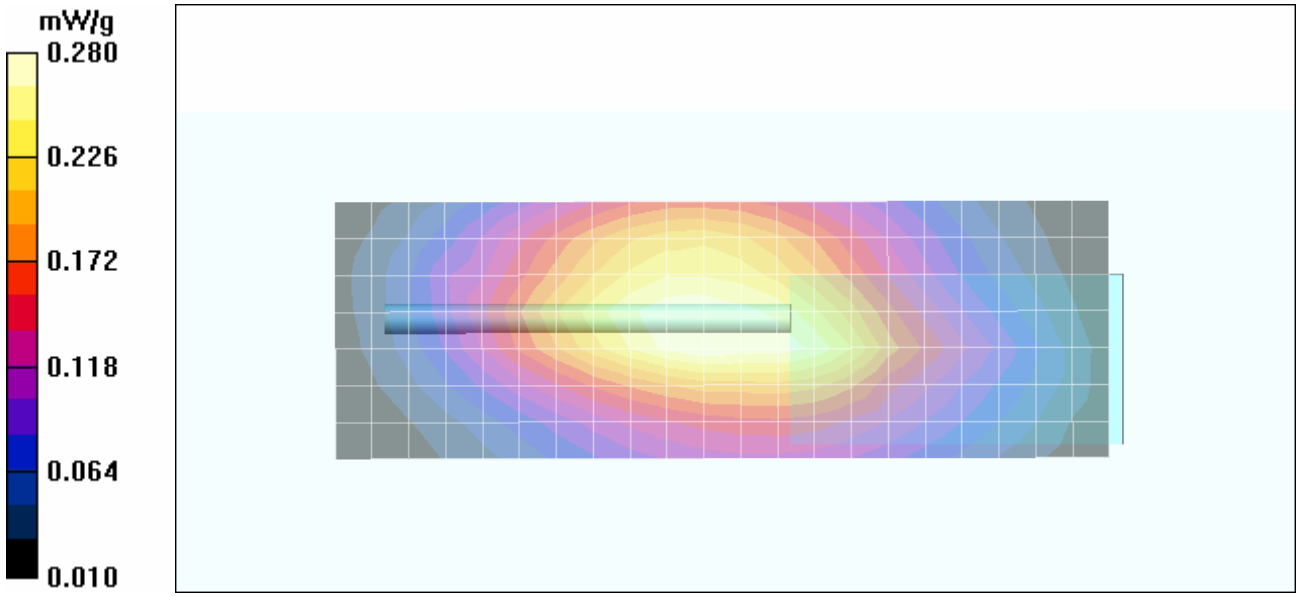
DUT: Cobra Model: MR HH475; Type: Portable FM VHF PTT Marine Radio Transceiver; Serial: 20090320004

Ambient Temp: 24.3°C; Fluid Temp: 22.9°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: CW
Frequency: 156.8 MHz; Duty Cycle: 1:1
Medium: M150 Medium parameters used: f = 156.8 MHz; σ = 0.8 mho/m; ε_r = 62.5; ρ = 1000 kg/m^3

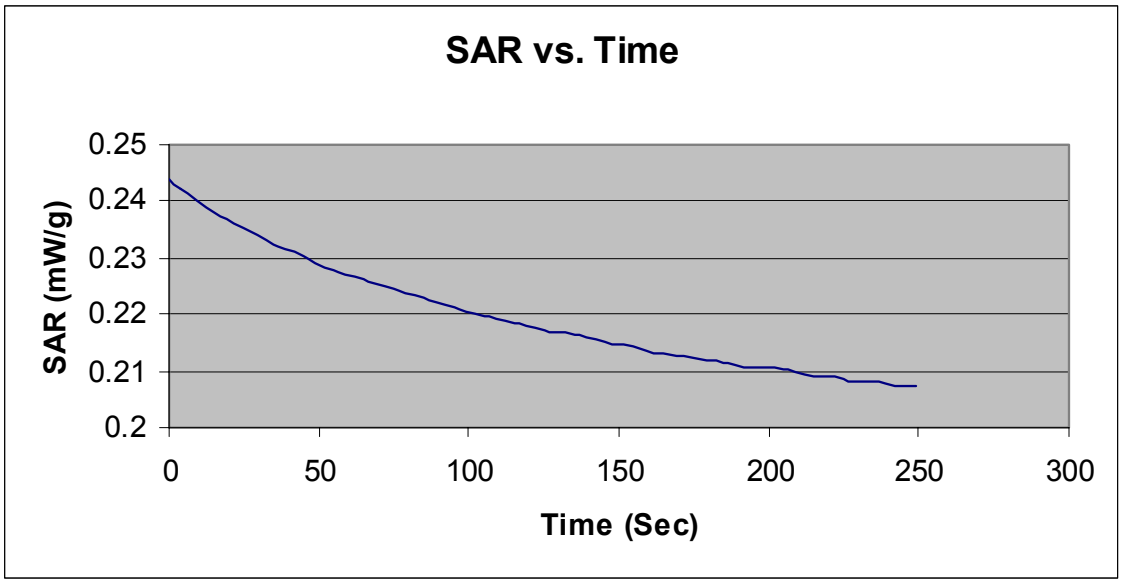
- Probe: ET3DV6 - SN1590; ConvF(8.5, 8.5, 8.5); Calibrated: 21/07/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - 2.5 cm Belt-Clip Spacing from Back Side of DUT to Planar Phantom
Area Scan (8x22x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.280 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 16.8 V/m
Peak SAR (extrapolated) = 0.451 W/kg
SAR(1 g) = 0.245 mW/g; SAR(10 g) = 0.182 mW/g
Maximum value of SAR (measured) = 0.280 mW/g



SAR-versus-Time Droop Evaluation

Body-worn Configuration
Alkaline Battery Tray
Channel 16 - 156.8 MHz



Start SAR: 0.243898 mW/g
SAR after 244s: 0.207345 mW/g (-0.705 dB)

APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 05/06/2009

System Performance Check - 300 MHz Dipole - HSL

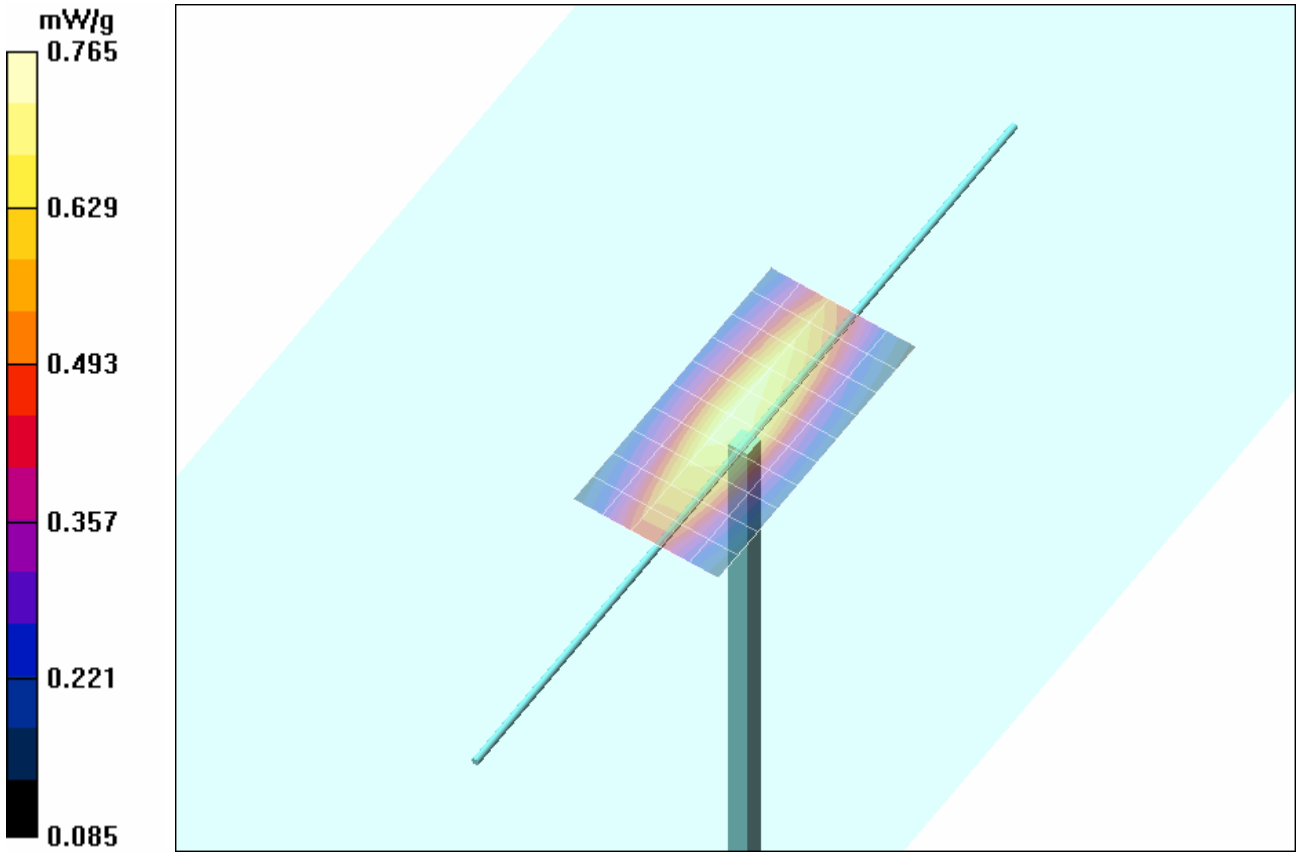
DUT: Dipole 300 MHz; Asset: 00023; Serial: 135; Calibrated: 01/26/2009

Ambient Temp: 23.5°C; Fluid Temp: 22.2°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

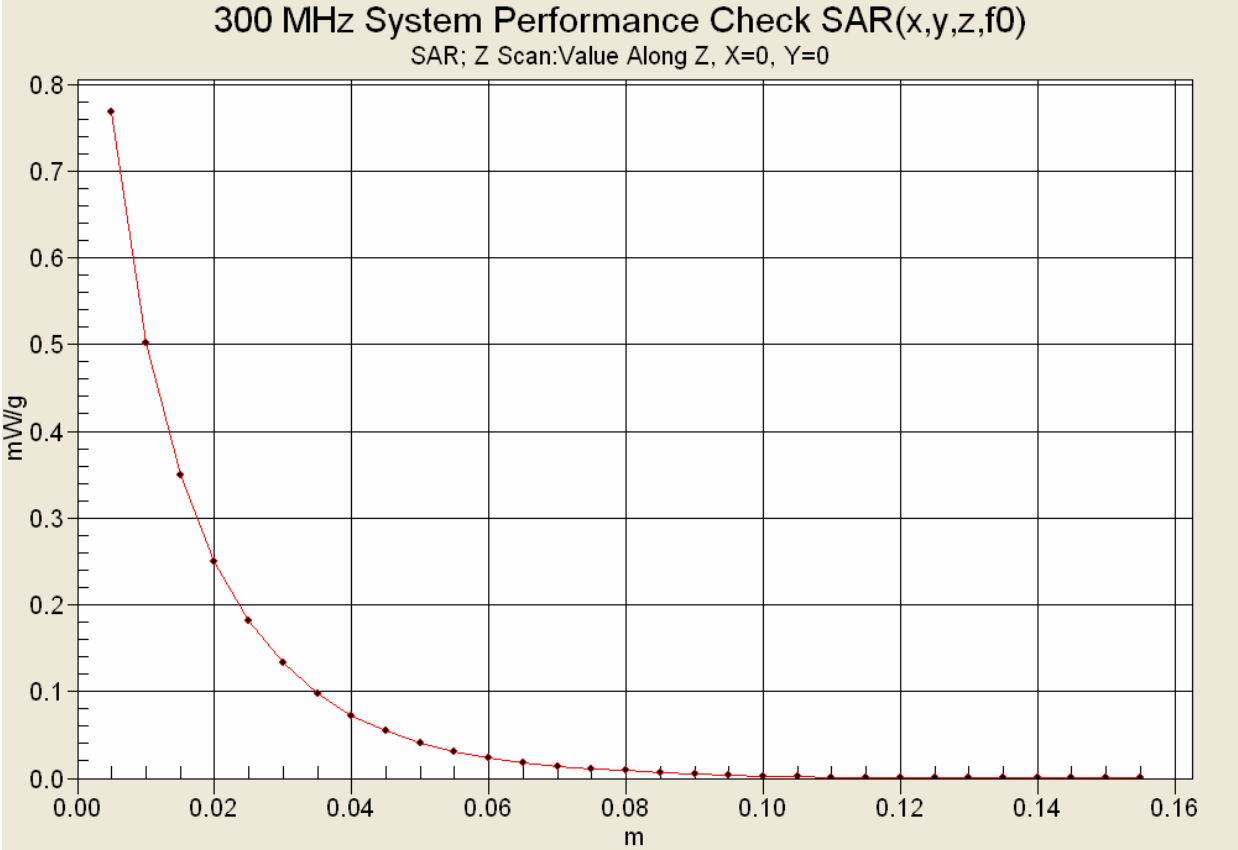
Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 300 MHz; Duty Cycle: 1:1
Medium: 300 HSL Medium parameters used: f = 300 MHz; σ = 0.88 mho/m; ε_r = 46.1; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(8, 8, 8); Calibrated: 21/07/2008
- Sensor-Surface: 5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- Phantom: Validation Planar; Type: Plexiglas; Serial: TE#137
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

System Performance Check - 300 MHz Dipole
Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.726 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 29.4 V/m; Power Drift = 0.013 dB
Peak SAR (extrapolated) = 1.27 W/kg
SAR(1 g) = 0.788 mW/g; SAR(10 g) = 0.520 mW/g
Maximum value of SAR (measured) = 0.765 mW/g



Z-Axis Scan



APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

300 MHz System Performance Check (Head)

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Celltech Labs
Test Result for UIM Dielectric Parameter
06/May/2009
Frequency (GHz)
FCC_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
0.2000	49.97	0.80	48.36	0.79
0.2100	49.50	0.80	48.40	0.82
0.2200	49.03	0.81	48.56	0.82
0.2300	48.57	0.82	48.65	0.83
0.2400	48.10	0.83	48.12	0.84
0.2500	47.63	0.83	47.38	0.85
0.2600	47.17	0.84	46.43	0.85
0.2700	46.70	0.85	45.79	0.86
0.2800	46.23	0.86	45.09	0.88
0.2900	45.77	0.86	46.26	0.88
0.3000	45.30	0.87	46.05	0.88
0.3100	45.18	0.87	44.54	0.90
0.3200	45.06	0.87	44.71	0.90
0.3300	44.94	0.87	44.33	0.91
0.3400	44.82	0.87	44.43	0.91
0.3500	44.70	0.87	43.69	0.93
0.3600	44.58	0.87	43.02	0.93
0.3700	44.46	0.87	43.20	0.94
0.3800	44.34	0.87	43.21	0.95
0.3900	44.22	0.87	41.96	0.96
0.4000	44.10	0.87	42.00	0.98

150 MHz DUT Evaluation (Head)

****

Celltech Labs
Test Result for UIM Dielectric Parameter
06/May/2009
Frequency (GHz)
FCC_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
0.0500	56.97	0.69	79.88	0.67
0.0600	56.50	0.69	80.74	0.71
0.0700	56.03	0.70	56.17	0.69
0.0800	55.57	0.71	65.72	0.70
0.0900	55.10	0.72	58.48	0.70
0.1000	54.63	0.72	56.44	0.71
0.1100	54.17	0.73	61.85	0.71
0.1200	53.70	0.74	57.30	0.70
0.1300	53.23	0.75	57.46	0.74
0.1400	52.77	0.75	56.19	0.73
0.1500	52.30	0.76	54.71	0.76
0.1600	51.83	0.77	55.39	0.75
0.1700	51.37	0.77	54.47	0.78
0.1800	50.90	0.78	53.09	0.77
0.1900	50.43	0.79	52.43	0.79
0.2000	49.97	0.80	52.22	0.79
0.2100	49.50	0.80	51.70	0.81
0.2200	49.03	0.81	49.87	0.81
0.2300	48.57	0.82	49.83	0.82
0.2400	48.10	0.83	50.53	0.82
0.2500	47.63	0.83	49.12	0.85

150 MHz DUT Evaluation (Body)

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Celltech Labs
Test Result for UIM Dielectric Parameter
06/May/2009
Frequency (GHz)
FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB FCC Limits for Body Epsilon
FCC_sB FCC Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.0500	64.37	0.72	70.96	0.74
0.0600	64.12	0.73	55.84	0.84
0.0700	63.87	0.74	62.86	0.79
0.0800	63.63	0.74	69.75	0.79
0.0900	63.38	0.75	62.53	0.81
0.1000	63.13	0.76	64.14	0.81
0.1100	62.89	0.77	67.39	0.82
0.1200	62.64	0.78	64.52	0.83
0.1300	62.39	0.78	67.44	0.83
0.1400	62.15	0.79	64.38	0.82
0.1500	61.90	0.80	62.48	0.80
0.1600	61.65	0.81	61.14	0.83
0.1700	61.41	0.82	62.85	0.84
0.1800	61.16	0.82	63.03	0.85
0.1900	60.91	0.83	63.06	0.85
0.2000	60.67	0.84	61.79	0.86
0.2100	60.42	0.85	61.71	0.87
0.2200	60.17	0.86	60.99	0.88
0.2300	59.93	0.86	60.93	0.87
0.2400	59.68	0.87	60.20	0.89
0.2500	59.43	0.88	61.85	0.89

APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS

FACE-HELD SAR TEST SETUP PHOTOGRAPHS

2.5 cm Spacing from Front Side of DUT to Planar Phantom

MR HH330

MR HH475

BODY-WORN SAR TEST SETUP PHOTOGRAPHS

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

MR HH330

MR HH475

DUT PHOTOGRAPHS

Front Side of MR HH330

Back of MR HH330 w/ Li-Poly Battery

Back of MR HH330 w/ Belt-Clip

MR HH330 Battery Removed

Left & Right Sides of MR HH330 w/ Swivel Belt-Clip Accessory

Top end of MR HH330

Bottom end of MR HH330

DUT PHOTOGRAPHS

Front Side of MR HH475

Back of MR HH475 w/ Li-Poly Batt.

MR HH475 w/ Alkaline

MR HH475 w/ Belt-Clip & Li-Poly

MR HH475 w/ Belt-Clip & Alk.

Left & Right Sides of MR HH475 w/ Swivel Belt-Clip Accessory

Top end of MR HH475

Bottom end of MR HH475

DUT PHOTOGRAPHS

MR HH475 Battery Removed

Duracell Procell Alkaline AA Batteries (x6)

Alkaline Battery Tray P/N: 110-011

Lithium Polymer Battery P/N: 110-021

DUT PHOTOGRAPHS

Swivel Belt-Clip Model: 240-003

DUT PHOTOGRAPHS

MR HH330 w/ Speaker-Microphone P/N: CM 330-001

MR HH475 w/ Speaker-Microphone P/N: CM 330-001

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

FCC Federal Communications Commission

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

OET

Office of Engineering and Technology

Inquiry:
Uploading 300 MHz and 450 MHz Dipole Calibration Reports

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

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

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

OET

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

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

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

Expires February 2010 Celltech Labs Inc. February 13, 2009

300 MHz Dipole Calibration

Type:	**300 MHz Validation Dipole**
Asset Number:	**00023**
Serial Number:	**135**
Place of Calibration:	**Celltech Labs Inc.**
Date of Calibration:	**Jan. 26 & Feb. 09, 2009**

Celltech Labs Inc. certifies that the 300 MHz Dipole Calibration was performed on the date(s) indicated above.

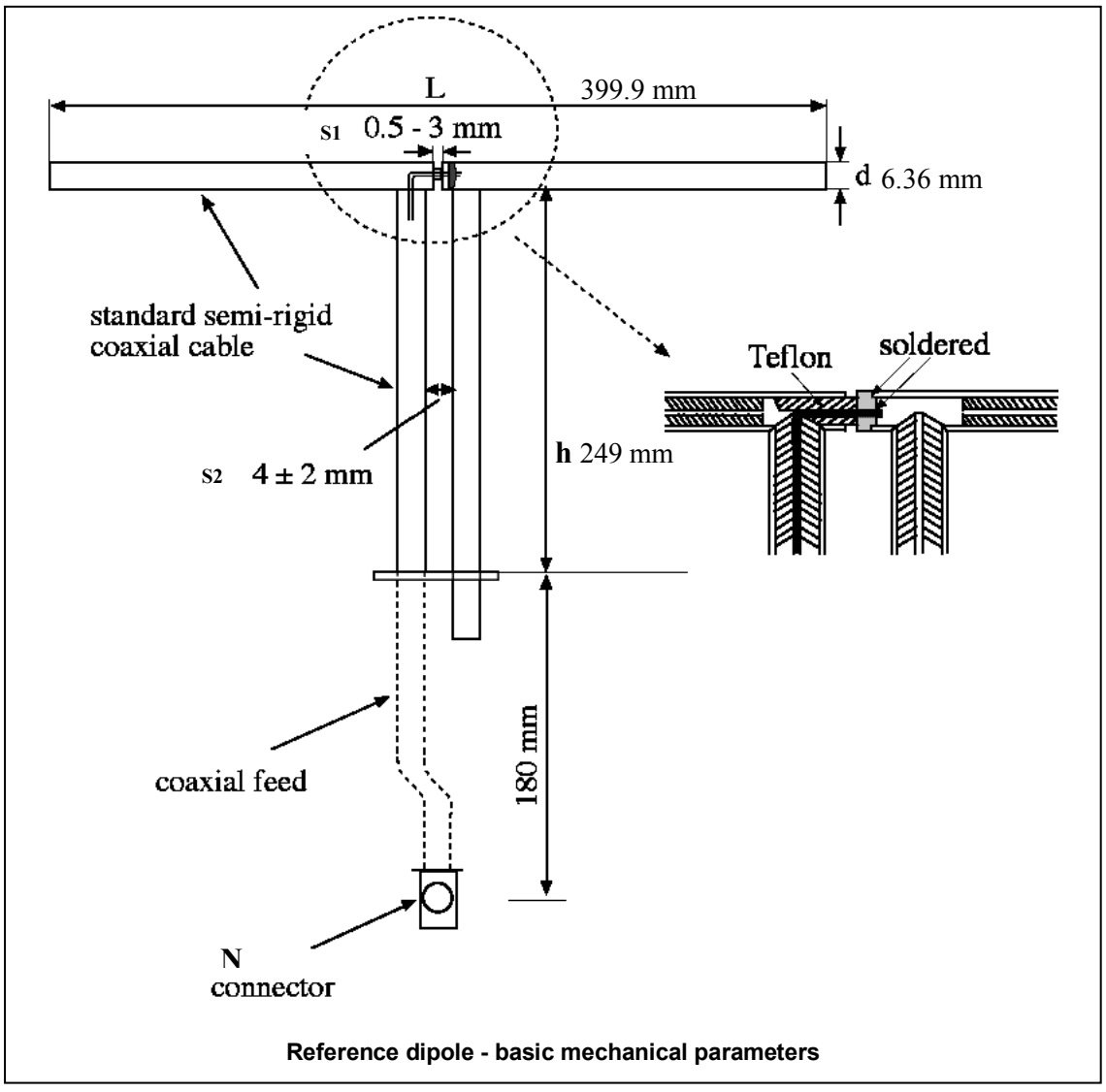
Validated by:	**Sean Johnston**
Signature:	

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

1. Dipole Construction & Electrical Characteristics

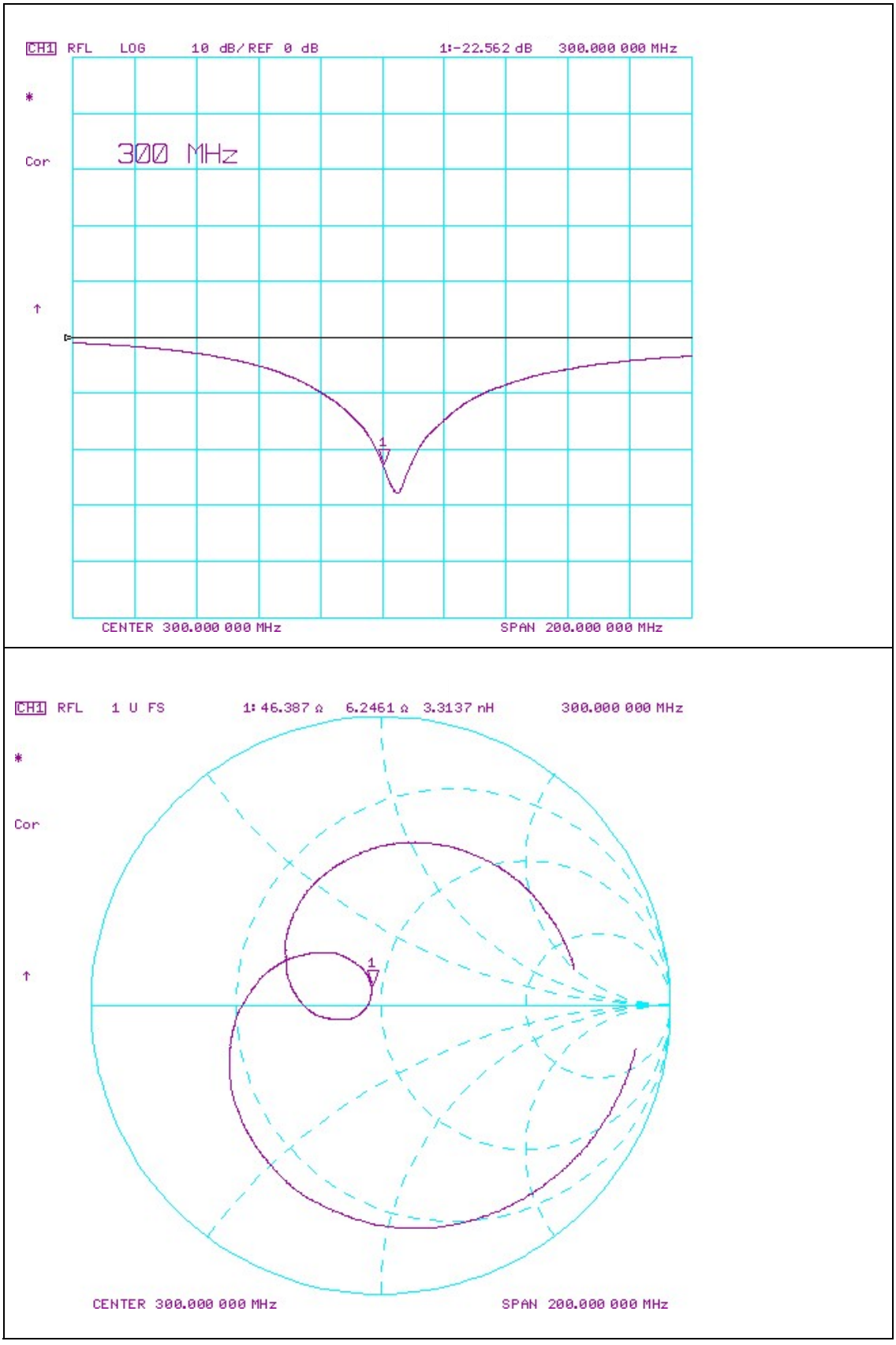
The validation dipole was constructed in accordance with the requirements specified in IEEE Standard 1528-2003 and International Standard IEC 62209-1:2005. The electrical properties were measured using an HP 8753ET Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector feed point using an HP85032E Type N calibration kit. The dipole was placed parallel to a planar phantom at a separation distance of 15.1mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

Feed point impedance at 300 MHz	Re{Z} = 46.387Ω
	Im{Z} = 6.2461Ω
Return Loss at 300 MHz	-22.562dB



Reference dipole - basic mechanical parameters

2. Validation Dipole VSWR Data



3. Validation Dipole Dimensions

Dimension	IEEE 1528 (mm)	Measured (mm)	Difference (mm)	Tolerance (1528 1%)
L (mm)	396.0	399.9	+3.9	+0.98%
h (mm)	250.0	249.0	-1.0	-0.4%
d (mm)	6.35	6.36	+0.01	+0.2%

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

4. Validation Phantom

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

The inner dimensions of the validation phantom are as follows:

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

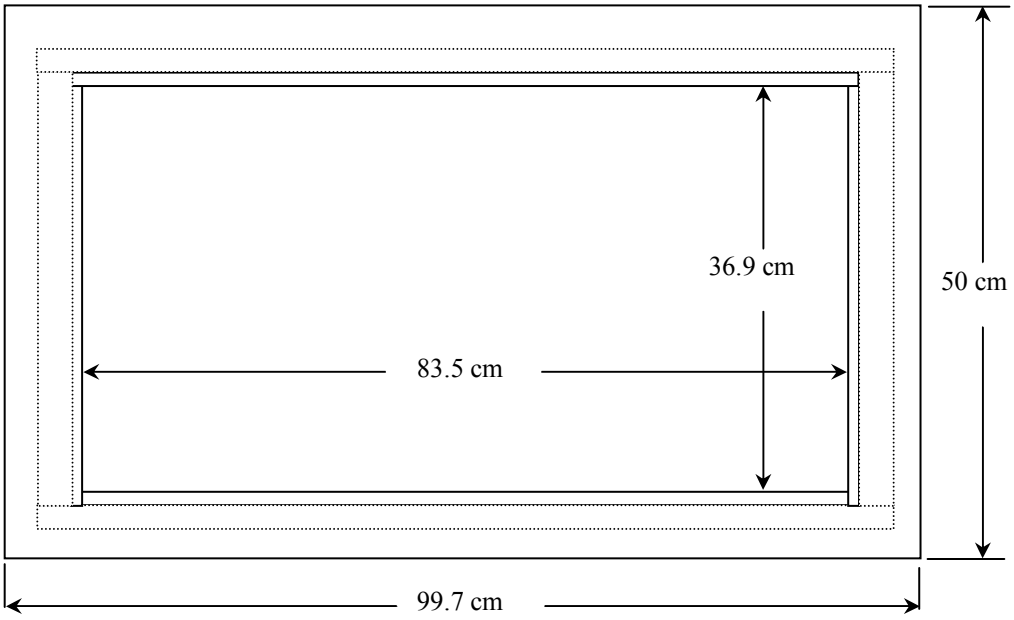
The bottom section of the validation phantom is constructed of 6.0 ± 0.1mm Plexiglas.

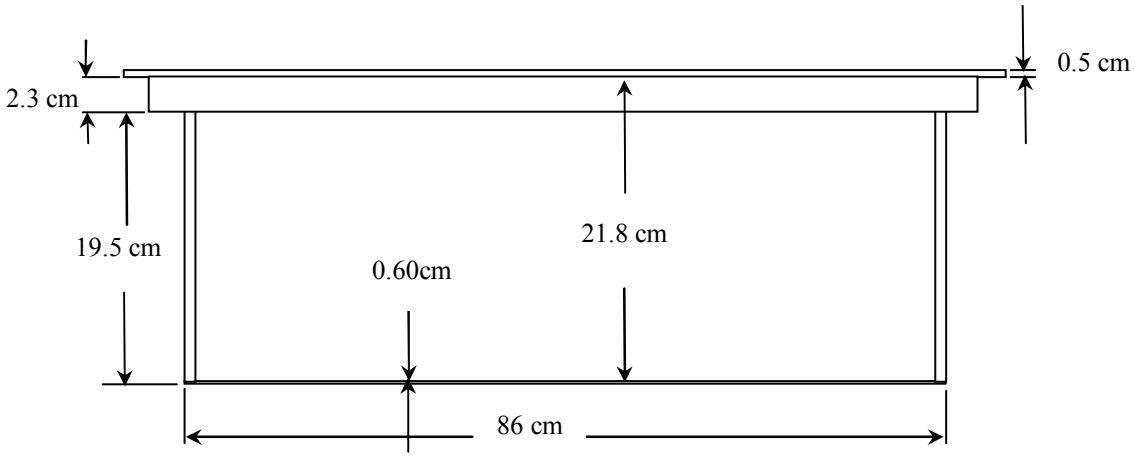
s = 3.175mm(d/2) + 6.0mm(phantom) + 6.0mm(spacer) = 15.175mm

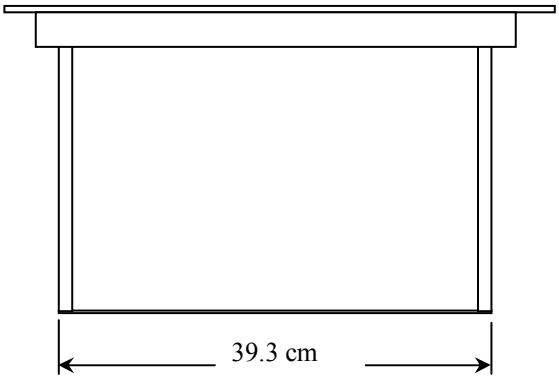
5. Test Equipment List

TEST EQUIPMENT	ASSET NO.	SERIAL NO.	DATE OF CAL.	CAL. DUE DATE
SPEAG DASY4 Measurement Server	00158	1078	CNR	CNR
SPEAG Robot	00046	599396-01	CNR	CNR
SPEAG DAE4	00019	353	22Apr08	22Apr09
SPEAG ET3DV6 E-Field Probe	00017	1590	21Jul08	21Jul09
Plexiglas Validation Planar Phantom	00157	137	CNR	CNR
HP 85070C Dielectric Probe Kit	00033	US39240170	CNR	CNR
Gigatronics 8652A Power Meter	00007	1835272	23Apr08	23Apr09
Gigatronics 80701A Power Sensor	00014	1833699	23Apr08	23Apr09
HP 8753ET Network Analyzer	00134	US39170292	28Apr08	28Apr09
HP 8648D Signal Generator	00005	3847A00611	CNR	CNR
Amplifier Research 10W1000C Power Amplifier	00041	27887	CNR	CNR
CNR = Calibration Not Required				

6. Dimensions of Plexiglas Planar Phantom







7. Plexiglas Planar Validation Phantom

8. 300 MHz Validation Dipole

9. SAR Target Validation

Parameter															Result			
	Frequency (MHz)	Shell thickness (mm)	Shell permittivity	Shell permeability	Shell Conductivity (σ) (S/m)	Phantom dimensions (mm) [x, y, z]	Liquid Relative permittivity	Liquid Conductivity (σ) (S/m)	Liquid permeability	Reference dipole distances from the liquid (mm)	Spacer (mm)	Dipole L (mm)	Dipole h (mm)	Dipole d (mm)	Distance between dipole feedpoint gap S1 (mm)	Distance between dipole balun elements S2 (mm)	1 g SAR (1 Watt)	10 g SAR (1 Watt)	Local SAR at surface (above feed-point)	Local SAR at surface (y = 2 cm offset from feed-point)
SEMCAD Simulation	300	6	2.7	1	0	1000, 800, 170	45.3	0.87	1	15.175	6	396	250	6.35	1	4	3.019	2.051	4.046	2.049

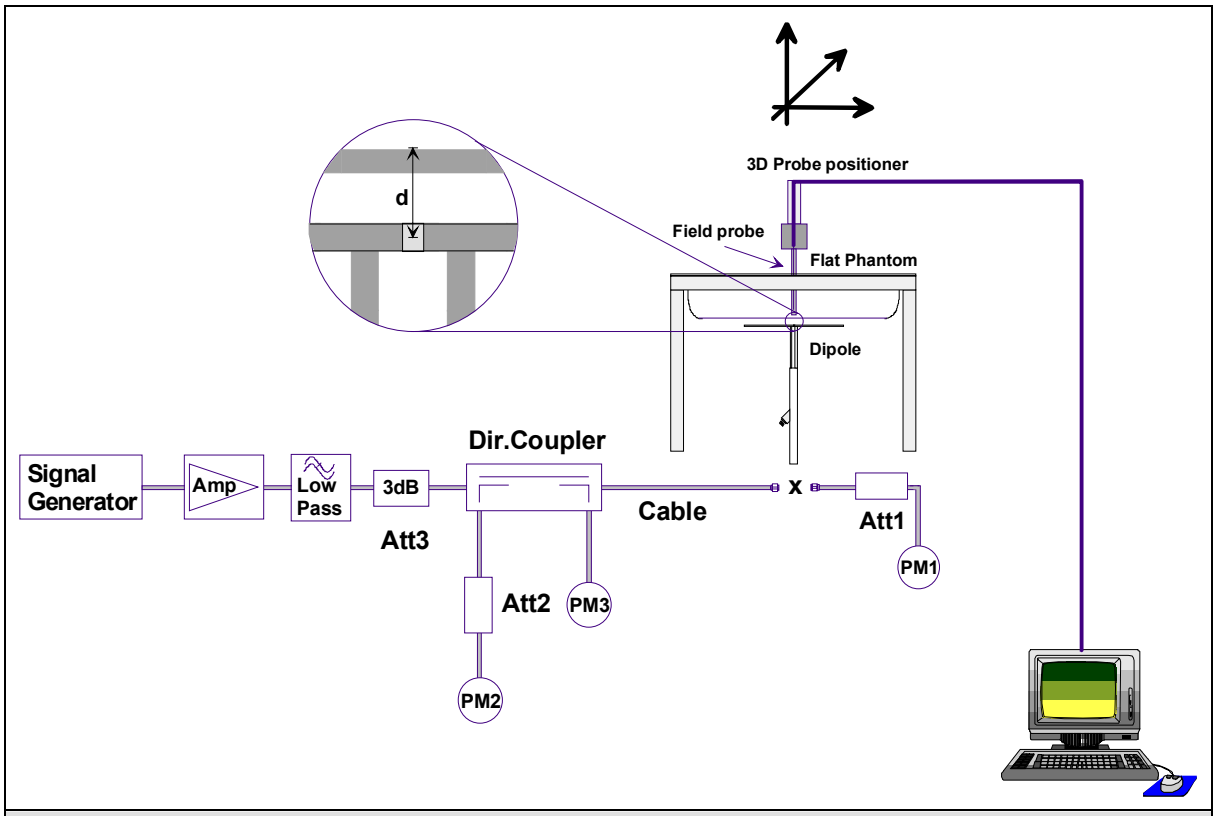
CELLTECH TARGET		
0.755 W/kg	1g	0.25 W
0.513 W/kg	10g	0.25 W

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

10. SAR Measurement

Measurements were made using a dosimetric E-field probe ET3DV6 (S/N: 1590, Conversion Factor 8.0). The SAR measurement was performed with the E-field probe in mechanical detection mode only. The setup and determination of the forward power into the dipole was performed using the procedures described below.

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



System Performance Check Measurement Setup Diagram

11. Measurement Conditions

The validation phantom was filled with 300 MHz Head tissue simulant.

Relative Permittivity: 44.9 (-1.0% deviation from target)
Conductivity: 0.85 mho/m (-2.3% deviation from target)
Fluid Temperature: 21.8 °C (Start of Test) / 22.0 °C (End of Test)
Fluid Depth: ≥ 15 cm

Environmental Conditions:
Ambient Temperature: 23.0 °C
Barometric Pressure: 100.7 kPa
Humidity: 34%

The 300 MHz Head tissue simulant consisted of the following ingredients:

Ingredient	Percentage by weight	
Water	37.56%	
Sugar	55.32%	
Salt	5.95%	
HEC	0.98%	
Dowicil 75	0.19%	
IEEE/IEC Target Dielectric Parameters (300 MHz):	**ε_r = 45.3 (+/- 5%)**	**σ = 0.87 S/m (+/- 5%)**

12. System Performance Check SAR Results

SAR @ 0.25W Input averaged over 1g (W/kg)				SAR @ 1W Input averaged over 1g (W/kg)			
Validation Target (300)		**Measured**	**Deviation**	**Validation Target (300)**		**Measured**	**Deviation**
0.755	**+/- 10%**	0.760	+0.7%	**3.020**	**+/- 10%**	3.040	+0.7%
SAR @ 0.25W Input averaged over 10g (W/kg)				**SAR @ 1W Input averaged over 10g (W/kg)**			
Validation Target (300)		**Measured**	**Deviation**	**Validation Target (300)**		**Measured**	**Deviation**
0.513	**+/- 10%**	0.506	-1.36%	**2.052**	**+/- 10%**	2.024	-1.36%

300 MHz System Performance Check @ 250mW (1g)					
	SAR (mW/g)	Deviation From 300 MHz Numerical Simulation (0.755 mW/g)	STDEV	Mean	Coefficient of Variation
Test 1	0.763	1.73%	0.004	0.760	**0.005**
Test 2	0.762	1.60%			
Test 3	0.759	1.20%			
Test 4	0.761	1.47%			
Test 5	0.763	1.73%			
Test 6	0.762	1.60%			
Test 7	0.753	0.40%			
Test 8	0.760	1.33%			
Test 9	0.754	0.53%			
Test 10	0.765	2.00%			
	0.760	1.36%			

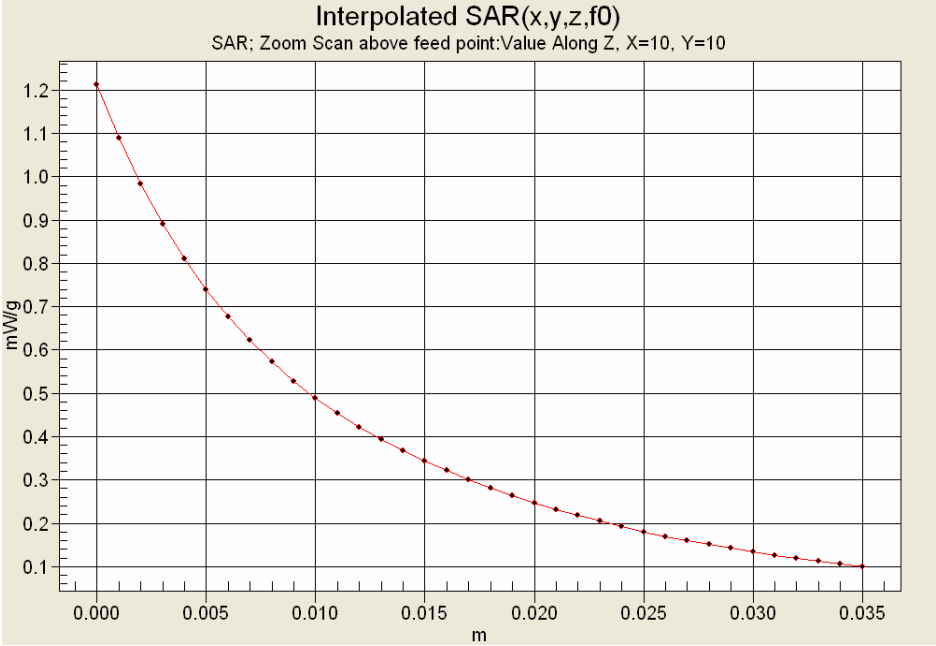
300 MHz System Performance Check @ 250mW (10g)					
	SAR (mW/g)	Deviation From 300 MHz Numerical Simulation (0.513 mW/g)	STDEV	Mean	Coefficient of Variation
Test 1	0.507	-1.17%	0.002	0.506	**0.004**
Test 2	0.507	-1.17%			
Test 3	0.505	-1.56%			
Test 4	0.505	-1.56%			
Test 5	0.507	-1.17%			
Test 6	0.507	-1.17%			
Test 7	0.503	-1.95%			
Test 8	0.508	-0.97%			
Test 9	0.504	-1.75%			
Test 10	0.509	-0.78%			
	0.506	-1.33%			

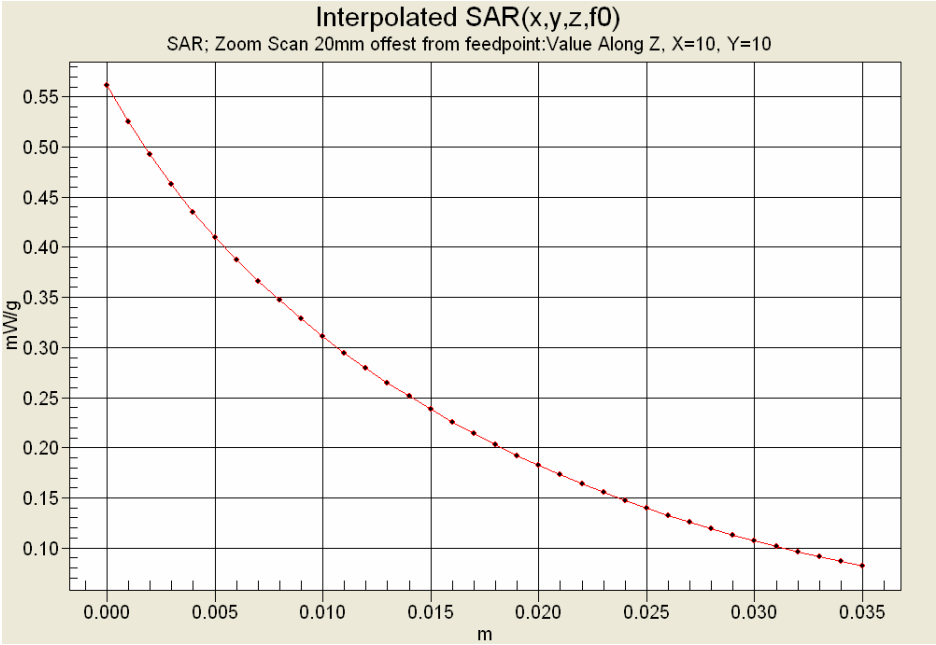
b) Extrapolation Routine:

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

Measurement Location	Measured SAR mW/g	SAR 1W Normalized	Peak Target mW/g	Deviation	System Performance Check Expanded Uncertainty +-%
Feed Point	1.20*	4.80	4.05	18.5%	21.98
2 cm Offset	0.56	2.24	2.05	9.3%	21.98

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



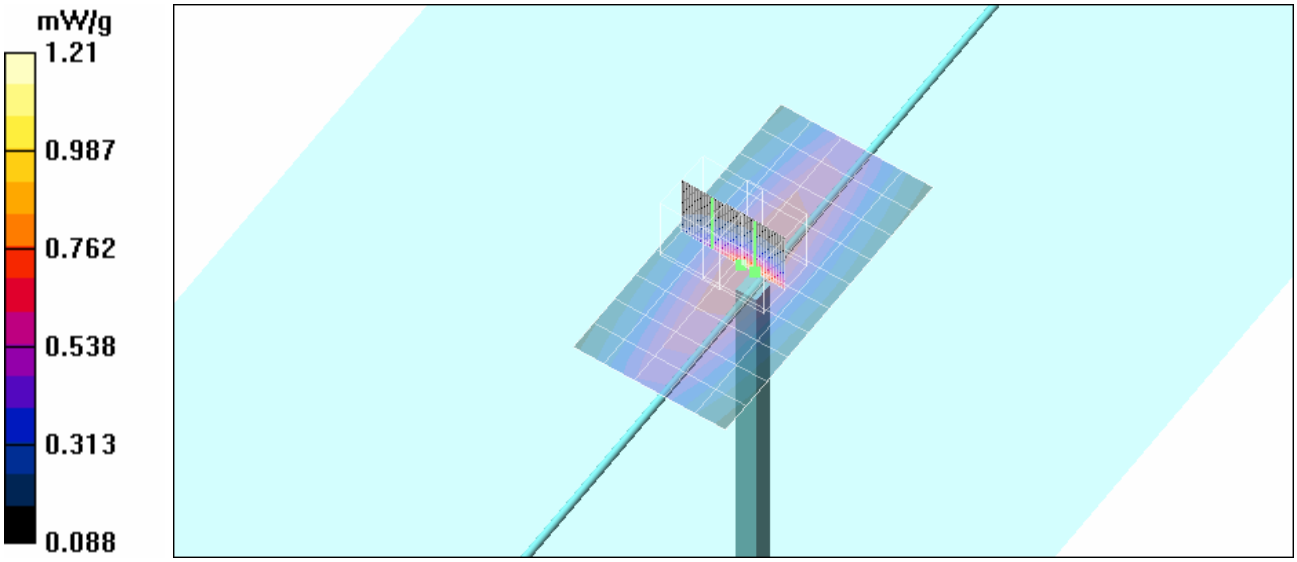


System Performance Check - 300 MHz Dipole - HSL

DUT: Dipole 300 MHz; Asset: 00023; Serial: 135

Ambient Temp: 23.0°C; Fluid Temp: 21.8°C; Barometric Pressure: 100.7 kPa; Humidity: 34%
Communication System: CW
Frequency: 300 MHz; Duty Cycle: 1:1
Medium: 300 HSL Medium parameters used: f = 300 MHz; σ = 0.85 mho/m; ε_r = 44.9; ρ = 1000 kg/m^3
- Probe: ET3DV6 - SN1590; ConvF(8, 8, 8); Calibrated: 21/07/2008
- Sensor-Surface: 5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 22/04/2008
- Phantom: Validation Planar; Type: Plexiglas; Serial: TE#137
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

300 MHz Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.699 mW/g
300 MHz Zoom Scan 1 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 29.4 V/m; Power Drift = -0.012 dB
Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.763 mW/g; SAR(10 g) = 0.507 mW/g
Maximum value of SAR (measured) = 0.743 mW/g
300 MHz Zoom Scan 2 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 29.3 V/m; Power Drift = 0.000 dB
Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.762 mW/g; SAR(10 g) = 0.507 mW/g
Maximum value of SAR (measured) = 0.740 mW/g
300 MHz Zoom Scan 3 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 29.3 V/m; Power Drift = 0.002 dB
Peak SAR (extrapolated) = 1.20 W/kg
SAR(1 g) = 0.759 mW/g; SAR(10 g) = 0.505 mW/g
Maximum value of SAR (measured) = 0.736 mW/g
300 MHz Zoom Scan 4 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 29.3 V/m; Power Drift = -0.015 dB
Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.761 mW/g; SAR(10 g) = 0.505 mW/g
Maximum value of SAR (measured) = 0.741 mW/g
300 MHz Zoom Scan 5 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 29.4 V/m; Power Drift = -0.040 dB
Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.763 mW/g; SAR(10 g) = 0.507 mW/g
Maximum value of SAR (measured) = 0.742 mW/g
300 MHz Zoom Scan 6 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 29.4 V/m; Power Drift = -0.062 dB
Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.762 mW/g; SAR(10 g) = 0.507 mW/g
Maximum value of SAR (measured) = 0.741 mW/g
300 MHz Zoom Scan 7 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 29.4 V/m; Power Drift = -0.064 dB
Peak SAR (extrapolated) = 1.18 W/kg
SAR(1 g) = 0.753 mW/g; SAR(10 g) = 0.503 mW/g
Maximum value of SAR (measured) = 0.715 mW/g
300 MHz Zoom Scan 8 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 29.3 V/m; Power Drift = -0.027 dB
Peak SAR (extrapolated) = 1.19 W/kg
SAR(1 g) = 0.760 mW/g; SAR(10 g) = 0.508 mW/g
Maximum value of SAR (measured) = 0.723 mW/g
300 MHz Zoom Scan 9 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 29.4 V/m; Power Drift = -0.056 dB
Peak SAR (extrapolated) = 1.17 W/kg
SAR(1 g) = 0.754 mW/g; SAR(10 g) = 0.504 mW/g
Maximum value of SAR (measured) = 0.707 mW/g
300 MHz Zoom Scan 10 (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 29.5 V/m; Power Drift = 0.001 dB
Peak SAR (extrapolated) = 1.20 W/kg
SAR(1 g) = 0.765 mW/g; SAR(10 g) = 0.509 mW/g
Maximum value of SAR (measured) = 0.714 mW/g


mW/g
1.21
0.987
0.762
0.538
0.313
0.088

13. Measured Fluid Dielectric Parameters

300 MHz (Head)

****

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

****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
0.2000	49.97	0.80	50.36	0.75
0.2100	49.50	0.80	48.48	0.78
0.2200	49.03	0.81	48.95	0.77
0.2300	48.57	0.82	47.15	0.79
0.2400	48.10	0.83	46.67	0.79
0.2500	47.63	0.83	47.33	0.80
0.2600	47.17	0.84	47.88	0.81
0.2700	46.70	0.85	47.19	0.81
0.2800	46.23	0.86	46.24	0.83
0.2900	45.77	0.86	44.89	0.83
0.3000	45.30	0.87	44.85	0.85
0.3100	45.18	0.87	44.70	0.85
0.3200	45.06	0.87	45.13	0.88
0.3300	44.94	0.87	44.44	0.87
0.3400	44.82	0.87	43.21	0.87
0.3500	44.70	0.87	43.24	0.89
0.3600	44.58	0.87	43.79	0.91
0.3700	44.46	0.87	43.54	0.91
0.3800	44.34	0.87	42.64	0.91
0.3900	44.22	0.87	42.01	0.92
0.4000	44.10	0.87	41.81	0.94

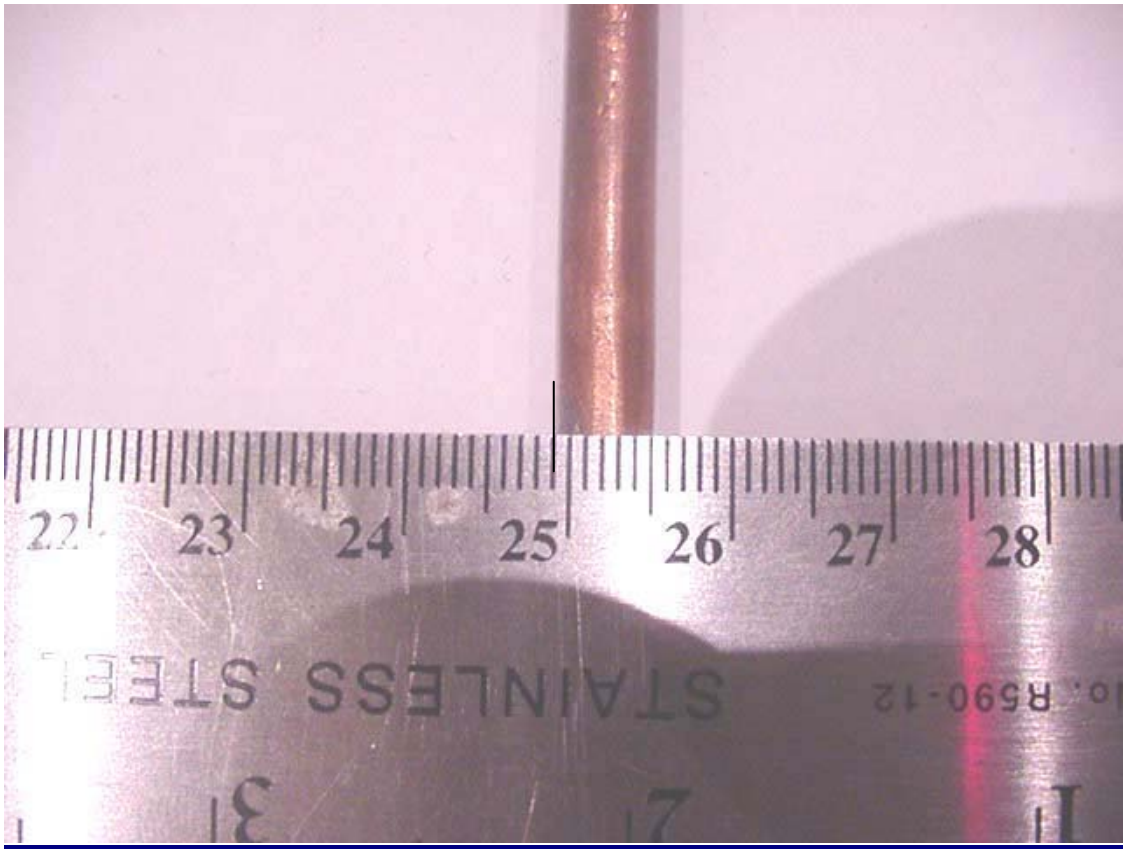
14. Measurement Uncertainties

UNCERTAINTY BUDGET FOR SYSTEM PERFORMANCE CHECK									
Uncertainty Component	**IEEE 1528 Section**	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**ci 1g**	**ci 10g**	**Uncertainty Value ±% (1g)**	**Uncertainty Value ±% (10g)**	**V_i or V_{eff}**
Measurement System									
Probe Calibration (300 MHz)	E.2.1	9	Normal	1	1	1	9	9	∞
Axial Isotropy	E.2.2	4.7	Rectangular	1.732050808	1	1	2.7	2.7	∞
Hemispherical Isotropy	E.2.2	0	Rectangular	1.732050808	1	1	0.0	0.0	∞
Boundary Effect	E.2.3	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	Rectangular	1.732050808	1	1	0.0	0.0	∞
Integration Time	E.2.8	0	Rectangular	1.732050808	1	1	0.0	0.0	∞
RF Ambient Conditions	E.6.1	3	Rectangular	1.732050808	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	Rectangular	1.732050808	1	1	0.2	0.2	∞
Probe Positioning wrt Phantom Shell	E.6.3	2.9	Rectangular	1.732050808	1	1	1.7	1.7	∞
Extrapolation, interpolation & integration algorithms for max. SAR evaluation	E.5	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Dipole									
Dipole Positioning	E.4.2	2	Normal	1.732050808	1	1	1.2	1.2	∞
SAR Drift Measurement	6.6.2	1.5	Normal	1.732050808	1	1	0.9	0.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4	Rectangular	1.732050808	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5	Rectangular	1.732050808	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measured)	E.3.3	2.3	Normal	1	0.64	0.43	1.5	1.0	∞
Liquid Permittivity (target)	E.3.2	5	Rectangular	1.732050808	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measured)	E.3.3	1	Normal	1	0.6	0.49	0.6	0.5	∞
Combined Standard Uncertainty			**RSS**				**10.99**	**10.80**	
Expanded Uncertainty (95% Confidence Interval)			**k=2**				**21.98**	**21.60**	
Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 and IEC International Standard 62209-1:2005									

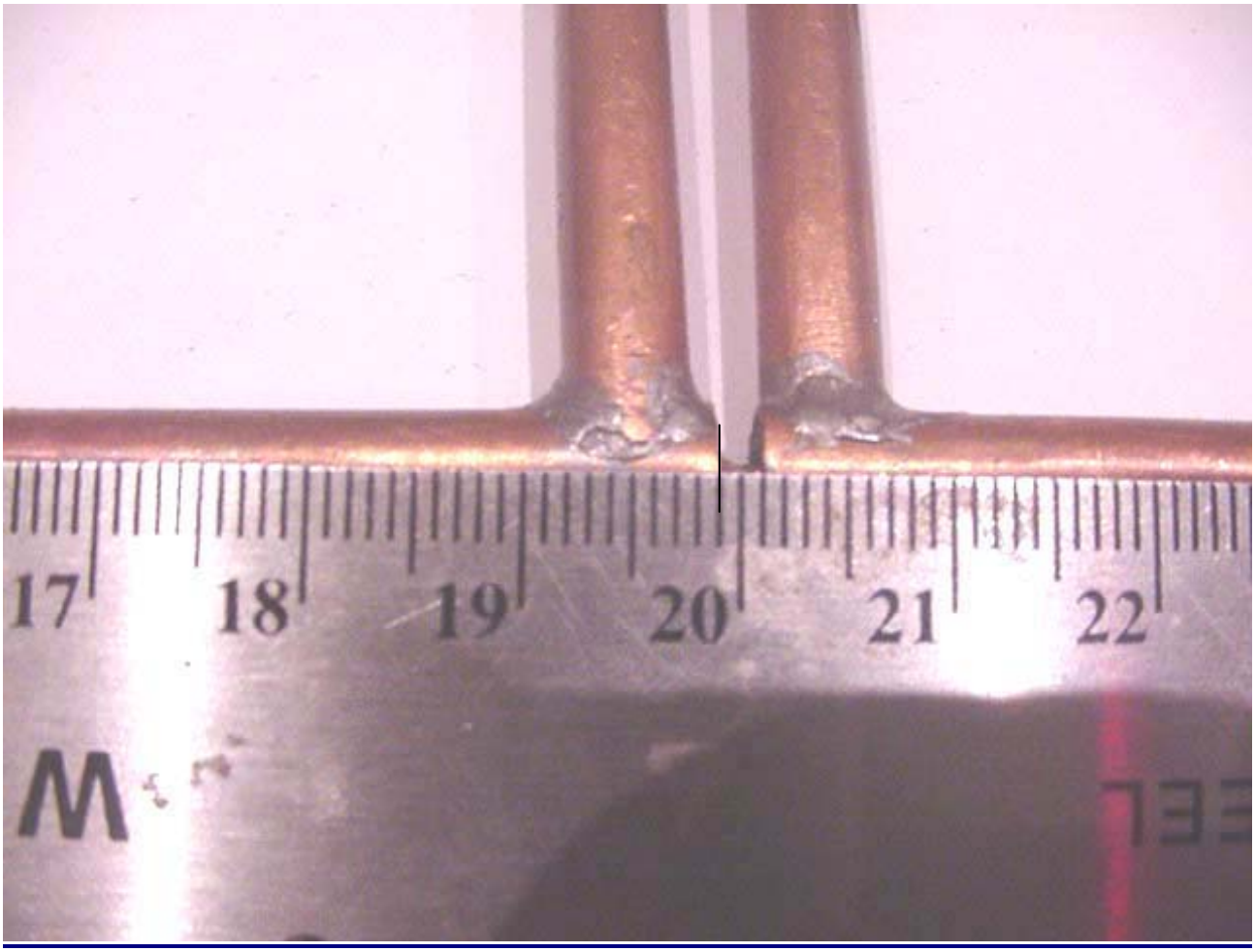
15. Dipole Calibration History

300 MHz Dipole Calibration History										
Dipole Calibration Date	SAR Probe Information			Celltech Measured Data						
	Serial Number	Calibration Factor	Calibration Procedure	SAR (W/kg) Measured at 250 mW	% Deviation from IEEE 1528 Target (0.750 W/kg @ 1W)	% Deviation from Target Validated by Celltech (3.019 W/kg @ 1W)	Dielectric Parameters		RL (dB)	Impedance
							ε_r	σ		
2003	1387	7.9	Numerical	0.782	4.27%		45.7	0.88	-21.70	43.59
2004	1387	7.8	Numerical	0.742	-1.07%		45.9	0.87	-25.00	45.20
2005	1387	7.9	Numerical	0.750	0.00%		44.3	0.84	-24.30	44.40
2006	1387	7.8	Numerical	0.760	1.33%		45.4	0.85	-24.30	44.40
2007	1387	7.3	Numerical	0.768	2.40%		45.2	0.89	-20.30	45.80
2008	1387	7.8	Measured	0.794		5.20%	45.6	0.90	-20.20	46.70
2008	1590	8.0	Measured	0.768		1.76%	43.5	0.89	-22.50	46.70
2008	1590	8.0	Measured	0.777		2.95%	44.9	0.85	-22.50	46.40
Target Dielectric Parameters: ε_r = 45.3, σ = 0.87 s/m										

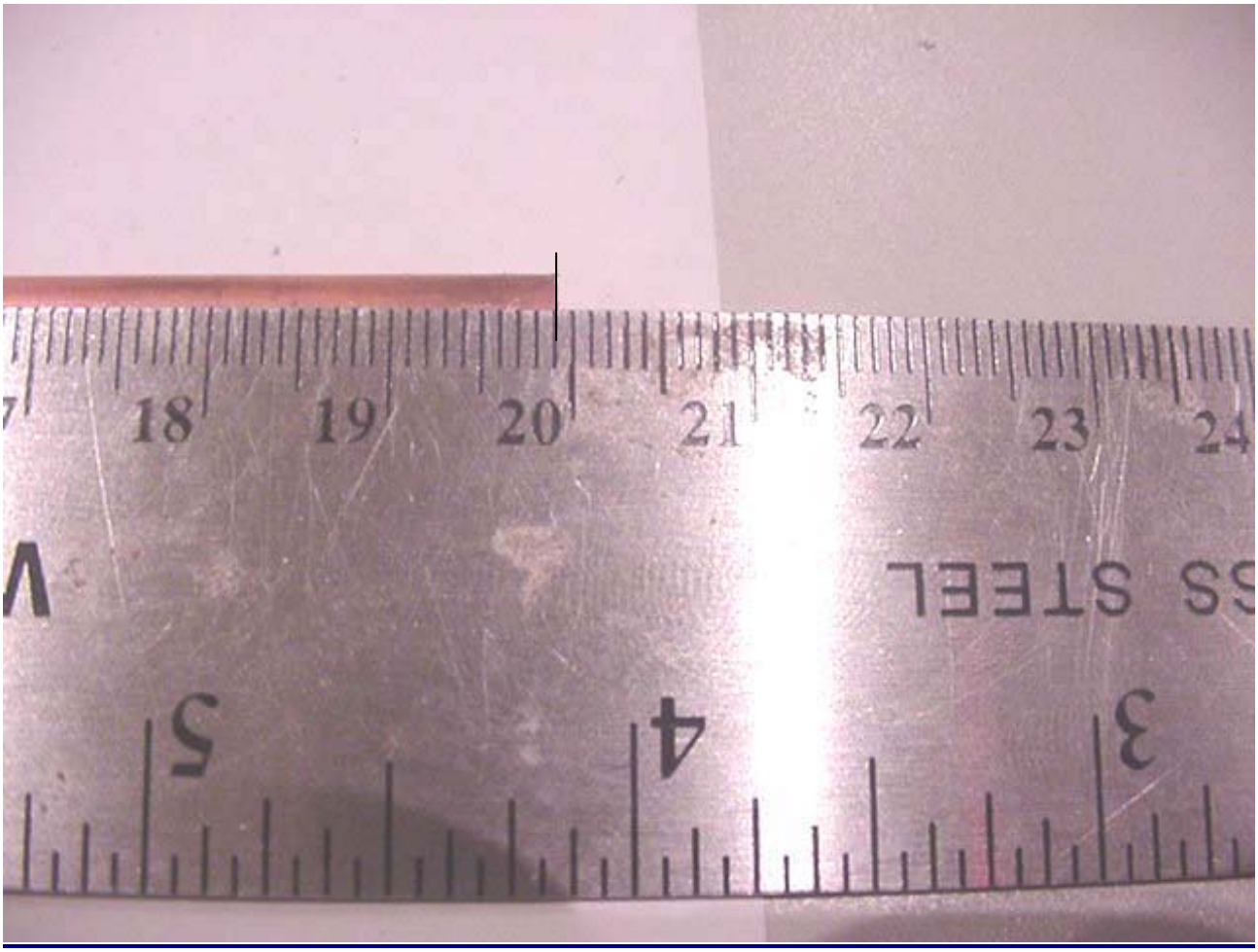
APPENDIX A - PHOTOGRAPHS



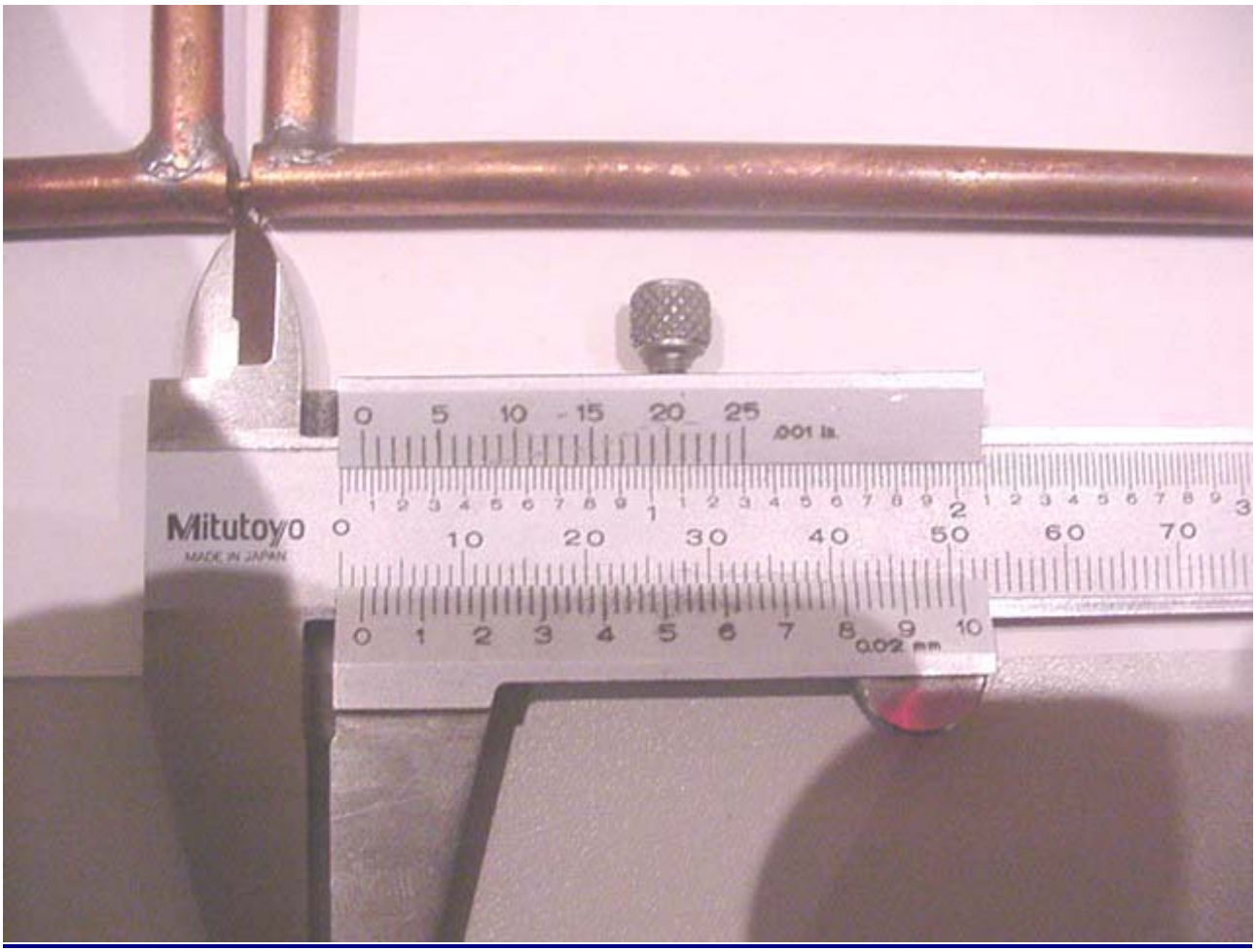
Dipole Dimension h = 249mm



Right Element = 199mm

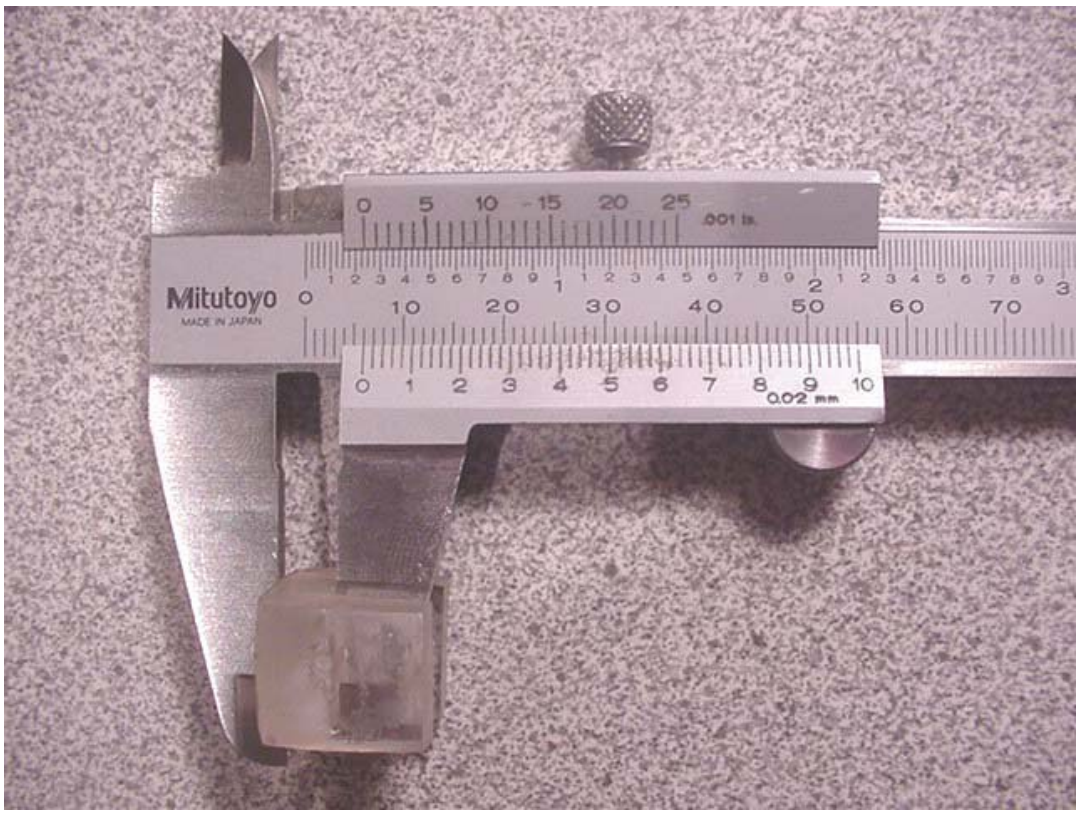


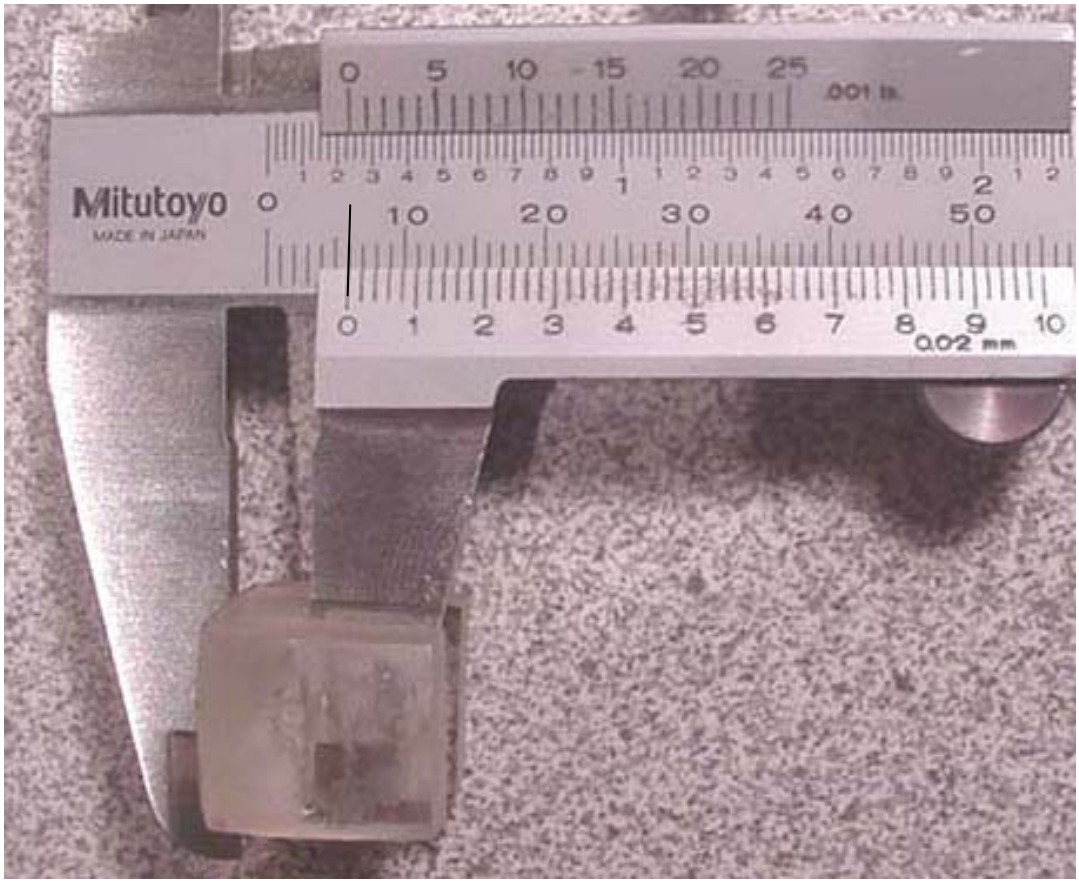
Left Element = 199mm



Dimension Between Elements = 1.88mm

Total Dimension L: 199mm + 199mm + 1.88mm = 399.9mm





Dipole Spacer Dimension = 6.0mm

APPENDIX B - SEMCAD SIMULATION LOG FILE

```
iSolve X, Version 13.4, Build 34, 64Bit Windows, Single Precision
Simulation name 'Dielectric Const = 2.7'
Maxwell Solver started the 2009-Feb-09 10:40:13.
Initializing FDTD (x1 CFL) Harmonic Simulation at 300 MHz

Overall discretization:
Smallest number of cells per wavelength = 29.6948, largest = 395.114, average = 163.379
Simulation time-step = 1.257e-012 s
Simulation time-step / minimum of CFL criteria = 0.998584
Maximum of CFL criteria / minimum of CFL criteria = 51.1583
Average of CFL criteria / minimum of CFL criteria = 9.93237

Discretization by solids:
Background: epsr = 1, mur = 1, sigma = 0, sigma* = 0 - smallest number of cells per wavelength =
199.862, largest = 395.114, average = 205.114
Phantom/Shell: epsr = 2.7, mur = 1, sigma = 0, sigma* = 0 - smallest number of cells per
wavelength = 122.674, largest = 240.458, average = 141.978
Phantom/Liquid: epsr = 45.3, mur = 1, sigma = 0.87, sigma* = 0 - smallest number of cells per
wavelength = 29.6948, largest = 64.3059, average = 31.9627

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

Grid:
Number of nodes=323x275x177, number of voxels=15528128

Excitations:
Initializing (Voltage) edge source Quelle
Overall duration : 4.33333e-008 s or 34474 iterations

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

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

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

Calculating update coefficients:
Created thread pool with 2 thread(s).
Calculating update coefficients: completed. Time: 24 seconds.

Hardware acceleration not used, please contact SPEAG for more information.
Yee (explicit) iterations starting using U-PML Boundary Condition.
0% - iterations: 5 / 34473 - [8.47 MCells/s] - Estimated time to completion: 17:33:11
0% - iterations: 11 / 34473 - [7.76 MCells/s] - Estimated time to completion: 19:08:44
0% - iterations: 17 / 34473 - [7.76 MCells/s] - Estimated time to completion: 19:08:32
0% - iterations: 23 / 34473 - [8.47 MCells/s] - Estimated time to completion: 17:32:38
0% - iterations: 32 / 34473 - [11.6 MCells/s] - Estimated time to completion: 12:45:21
0% - iterations: 41 / 34473 - [12.7 MCells/s] - Estimated time to completion: 11:41:23
0% - iterations: 53 / 34473 - [16.9 MCells/s] - Estimated time to completion: 08:45:51
```

```
0% - iterations: 63 / 34473 - [14.1 MCells/s] - Estimated time to completion: 10:30:51
0% - iterations: 73 / 34473 - [14.1 MCells/s] - Estimated time to completion: 10:30:40
0% - iterations: 82 / 34473 - [11.6 MCells/s] - Estimated time to completion: 12:44:14
0% - iterations: 88 / 34473 - [8.47 MCells/s] - Estimated time to completion: 17:30:39
0% - iterations: 95 / 34473 - [9.88 MCells/s] - Estimated time to completion: 15:00:22
0% - iterations: 102 / 34473 - [9.88 MCells/s] - Estimated time to completion: 15:00:11
0% - iterations: 108 / 34473 - [7.17 MCells/s] - Estimated time to completion: 20:40:57
0% - iterations: 114 / 34473 - [7.76 MCells/s] - Estimated time to completion: 19:05:18
0% - iterations: 120 / 34473 - [7.17 MCells/s] - Estimated time to completion: 20:40:31
0% - iterations: 126 / 34473 - [7.76 MCells/s] - Estimated time to completion: 19:04:54
0% - iterations: 131 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:59:12
0% - iterations: 136 / 34473 - [6.47 MCells/s] - Estimated time to completion: 22:53:28
0% - iterations: 140 / 34473 - [4.78 MCells/s] - Estimated time to completion: 30:59:42
0% - iterations: 144 / 34473 - [4.78 MCells/s] - Estimated time to completion: 30:59:29
0% - iterations: 149 / 34473 - [5.97 MCells/s] - Estimated time to completion: 24:47:22
0% - iterations: 154 / 34473 - [6.47 MCells/s] - Estimated time to completion: 22:52:45
0% - iterations: 160 / 34473 - [8.47 MCells/s] - Estimated time to completion: 17:28:27
0% - iterations: 166 / 34473 - [8.47 MCells/s] - Estimated time to completion: 17:28:16
1% - iterations: 173 / 34473 - [9.06 MCells/s] - Estimated time to completion: 16:19:59
1% - iterations: 179 / 34473 - [7.76 MCells/s] - Estimated time to completion: 19:03:08
1% - iterations: 184 / 34473 - [6.47 MCells/s] - Estimated time to completion: 22:51:33
1% - iterations: 189 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:57:04
1% - iterations: 194 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:56:53
1% - iterations: 198 / 34473 - [5.18 MCells/s] - Estimated time to completion: 28:33:45
1% - iterations: 203 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:56:34
1% - iterations: 210 / 34473 - [9.06 MCells/s] - Estimated time to completion: 16:18:56
1% - iterations: 217 / 34473 - [9.06 MCells/s] - Estimated time to completion: 16:18:44
1% - iterations: 223 / 34473 - [7.17 MCells/s] - Estimated time to completion: 20:36:48
1% - iterations: 227 / 34473 - [5.18 MCells/s] - Estimated time to completion: 28:32:18
1% - iterations: 235 / 34473 - [11.3 MCells/s] - Estimated time to completion: 13:04:37
1% - iterations: 244 / 34473 - [11.6 MCells/s] - Estimated time to completion: 12:40:38
1% - iterations: 248 / 34473 - [5.18 MCells/s] - Estimated time to completion: 28:31:15
1% - iterations: 252 / 34473 - [4.78 MCells/s] - Estimated time to completion: 30:53:38
1% - iterations: 256 / 34473 - [4.78 MCells/s] - Estimated time to completion: 30:53:25
1% - iterations: 261 / 34473 - [6.47 MCells/s] - Estimated time to completion: 22:48:28
1% - iterations: 266 / 34473 - [6.47 MCells/s] - Estimated time to completion: 22:48:16
1% - iterations: 269 / 34473 - [4.23 MCells/s] - Estimated time to completion: 34:50:14
1% - iterations: 273 / 34473 - [4.78 MCells/s] - Estimated time to completion: 30:52:30
1% - iterations: 278 / 34473 - [6.47 MCells/s] - Estimated time to completion: 22:47:48
1% - iterations: 283 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:53:38
1% - iterations: 288 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:53:27
1% - iterations: 293 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:53:16
1% - iterations: 298 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:53:05
1% - iterations: 304 / 34473 - [7.76 MCells/s] - Estimated time to completion: 18:58:58
1% - iterations: 310 / 34473 - [8.47 MCells/s] - Estimated time to completion: 17:23:52
1% - iterations: 315 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:52:27
1% - iterations: 319 / 34473 - [4.78 MCells/s] - Estimated time to completion: 30:50:00
1% - iterations: 323 / 34473 - [4.78 MCells/s] - Estimated time to completion: 30:49:47
1% - iterations: 327 / 34473 - [4.78 MCells/s] - Estimated time to completion: 30:49:34
1% - iterations: 331 / 34473 - [5.65 MCells/s] - Estimated time to completion: 26:04:50
1% - iterations: 336 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:51:41
1% - iterations: 340 / 34473 - [4.78 MCells/s] - Estimated time to completion: 30:48:52
1% - iterations: 345 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:51:21
1% - iterations: 350 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:51:10
1% - iterations: 355 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:50:59
1% - iterations: 362 / 34473 - [9.06 MCells/s] - Estimated time to completion: 16:14:35
1% - iterations: 369 / 34473 - [9.88 MCells/s] - Estimated time to completion: 14:53:12
1% - iterations: 375 / 34473 - [7.76 MCells/s] - Estimated time to completion: 18:56:36
1% - iterations: 381 / 34473 - [7.76 MCells/s] - Estimated time to completion: 18:56:24
1% - iterations: 388 / 34473 - [9.06 MCells/s] - Estimated time to completion: 16:13:51
1% - iterations: 395 / 34473 - [9.06 MCells/s] - Estimated time to completion: 16:13:39
1% - iterations: 400 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:49:20
1% - iterations: 405 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:49:09
1% - iterations: 409 / 34473 - [4.44 MCells/s] - Estimated time to completion: 33:07:04
1% - iterations: 413 / 34473 - [4.78 MCells/s] - Estimated time to completion: 30:44:55
1% - iterations: 417 / 34473 - [4.78 MCells/s] - Estimated time to completion: 30:44:42
1% - iterations: 421 / 34473 - [4.78 MCells/s] - Estimated time to completion: 30:44:29
1% - iterations: 425 / 34473 - [4.78 MCells/s] - Estimated time to completion: 30:44:16
1% - iterations: 430 / 34473 - [7.06 MCells/s] - Estimated time to completion: 20:48:14
1% - iterations: 437 / 34473 - [9.06 MCells/s] - Estimated time to completion: 16:12:27
1% - iterations: 444 / 34473 - [9.06 MCells/s] - Estimated time to completion: 16:12:15
```

```
72% - iterations: 24653 / 34473 - [12.7 MCells/s] - Estimated time to completion: 03:20:02
72% - iterations: 24663 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:59:51
72% - iterations: 24673 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:59:40
72% - iterations: 24683 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:59:29
72% - iterations: 24692 / 34473 - [12.7 MCells/s] - Estimated time to completion: 03:19:14
72% - iterations: 24702 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:59:08
72% - iterations: 24712 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:58:57
72% - iterations: 24722 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:58:46
72% - iterations: 24731 / 34473 - [12.7 MCells/s] - Estimated time to completion: 03:18:26
72% - iterations: 24741 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:58:25
72% - iterations: 24751 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:58:14
72% - iterations: 24761 / 34473 - [12.9 MCells/s] - Estimated time to completion: 03:14:14
72% - iterations: 24771 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:57:52
72% - iterations: 24781 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:57:41
72% - iterations: 24791 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:57:30
72% - iterations: 24800 / 34473 - [12.7 MCells/s] - Estimated time to completion: 03:17:02
72% - iterations: 24810 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:57:09
72% - iterations: 24820 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:56:58
72% - iterations: 24829 / 34473 - [12.7 MCells/s] - Estimated time to completion: 03:16:27
72% - iterations: 24839 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:56:37
72% - iterations: 24849 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:56:26
72% - iterations: 24859 / 34473 - [12.9 MCells/s] - Estimated time to completion: 03:12:16
72% - iterations: 24869 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:56:04
72% - iterations: 24879 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:55:53
72% - iterations: 24888 / 34473 - [12.7 MCells/s] - Estimated time to completion: 03:15:15
72% - iterations: 24898 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:55:32
72% - iterations: 24908 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:55:21
72% - iterations: 24918 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:55:10
72% - iterations: 24927 / 34473 - [12.7 MCells/s] - Estimated time to completion: 03:14:27
72% - iterations: 24937 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:54:49
72% - iterations: 24947 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:54:38
72% - iterations: 24957 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:54:27
72% - iterations: 24966 / 34473 - [12.7 MCells/s] - Estimated time to completion: 03:13:39
72% - iterations: 24976 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:54:06
72% - iterations: 24986 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:53:55
73% - iterations: 24995 / 34473 - [12.7 MCells/s] - Estimated time to completion: 03:13:04
73% - iterations: 25005 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:53:34
73% - iterations: 25015 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:53:23
73% - iterations: 25025 / 34473 - [12.9 MCells/s] - Estimated time to completion: 03:08:57
73% - iterations: 25035 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:53:01
73% - iterations: 25045 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:52:50
73% - iterations: 25055 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:52:39
73% - iterations: 25064 / 34473 - [12.7 MCells/s] - Estimated time to completion: 03:11:39
73% - iterations: 25074 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:52:18
73% - iterations: 25084 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:52:07
73% - iterations: 25094 / 34473 - [12.9 MCells/s] - Estimated time to completion: 03:07:34
73% - iterations: 25104 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:51:45
73% - iterations: 25114 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:51:34
73% - iterations: 25123 / 34473 - [12.7 MCells/s] - Estimated time to completion: 03:10:27
73% - iterations: 25133 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:51:14
73% - iterations: 25143 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:51:03
73% - iterations: 25153 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:50:52
73% - iterations: 25162 / 34473 - [12.7 MCells/s] - Estimated time to completion: 03:09:40
73% - iterations: 25172 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:50:31
73% - iterations: 25182 / 34473 - [14.1 MCells/s] - Estimated time to completion: 02:50:20
73% - iterations: 25192 / 34473 - [12.9 MCells/s] - Estimated time to completion: 03:05:37
Steady state detected at iteration: 25195 - the simulation will end shortly.
Please wait ... saving the sensor 'Overall Field' (E-fields) on disk.

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

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

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

97% - iterations: 25195 / 25858 - [0.0214 MCells/s] - Estimated time to completion: 133:42:18
97% - iterations: 25205 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:11:58
98% - iterations: 25215 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:11:47
98% - iterations: 25225 / 25858 - [12.9 MCells/s] - Estimated time to completion: 00:12:39
98% - iterations: 25235 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:11:25
98% - iterations: 25245 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:11:14
98% - iterations: 25255 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:11:03
98% - iterations: 25264 / 25858 - [12.7 MCells/s] - Estimated time to completion: 00:12:06
98% - iterations: 25274 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:10:42
```

```
98% - iterations: 25284 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:10:31
98% - iterations: 25294 / 25858 - [12.9 MCells/s] - Estimated time to completion: 00:11:16
98% - iterations: 25304 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:10:09
98% - iterations: 25314 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:09:58
98% - iterations: 25324 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:09:47
98% - iterations: 25333 / 25858 - [12.7 MCells/s] - Estimated time to completion: 00:10:41
98% - iterations: 25343 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:09:26
98% - iterations: 25352 / 25858 - [12.7 MCells/s] - Estimated time to completion: 00:10:18
98% - iterations: 25362 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:09:05
98% - iterations: 25372 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:08:54
98% - iterations: 25381 / 25858 - [12.7 MCells/s] - Estimated time to completion: 00:09:43
98% - iterations: 25391 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:08:33
98% - iterations: 25401 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:08:22
98% - iterations: 25410 / 25858 - [12.7 MCells/s] - Estimated time to completion: 00:09:07
98% - iterations: 25420 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:08:01
98% - iterations: 25428 / 25858 - [10.4 MCells/s] - Estimated time to completion: 00:10:45
98% - iterations: 25437 / 25858 - [12.7 MCells/s] - Estimated time to completion: 00:08:34
98% - iterations: 25446 / 25858 - [12.7 MCells/s] - Estimated time to completion: 00:08:23
98% - iterations: 25456 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:07:22
98% - iterations: 25466 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:07:11
99% - iterations: 25476 / 25858 - [12.9 MCells/s] - Estimated time to completion: 00:07:38
99% - iterations: 25486 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:06:49
99% - iterations: 25496 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:06:38
99% - iterations: 25506 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:06:27
99% - iterations: 25515 / 25858 - [12.7 MCells/s] - Estimated time to completion: 00:06:59
99% - iterations: 25525 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:06:06
99% - iterations: 25535 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:05:55
99% - iterations: 25544 / 25858 - [12.7 MCells/s] - Estimated time to completion: 00:06:23
99% - iterations: 25554 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:05:34
99% - iterations: 25564 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:05:23
99% - iterations: 25574 / 25858 - [12.9 MCells/s] - Estimated time to completion: 00:05:40
99% - iterations: 25584 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:05:01
99% - iterations: 25594 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:04:50
99% - iterations: 25604 / 25858 - [12.9 MCells/s] - Estimated time to completion: 00:05:04
99% - iterations: 25614 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:04:28
99% - iterations: 25624 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:04:17
99% - iterations: 25634 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:04:06
99% - iterations: 25643 / 25858 - [12.7 MCells/s] - Estimated time to completion: 00:04:22
99% - iterations: 25653 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:03:45
99% - iterations: 25663 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:03:34
99% - iterations: 25673 / 25858 - [12.9 MCells/s] - Estimated time to completion: 00:03:42
99% - iterations: 25683 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:03:12
99% - iterations: 25693 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:03:01
99% - iterations: 25703 / 25858 - [12.9 MCells/s] - Estimated time to completion: 00:03:06
99% - iterations: 25713 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:02:39
99% - iterations: 25723 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:02:28
100% - iterations: 25733 / 25858 - [12.9 MCells/s] - Estimated time to completion: 00:02:30
100% - iterations: 25743 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:02:06
100% - iterations: 25753 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:01:55
100% - iterations: 25763 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:01:44
100% - iterations: 25771 / 25858 - [11.3 MCells/s] - Estimated time to completion: 00:01:59
100% - iterations: 25779 / 25858 - [10.4 MCells/s] - Estimated time to completion: 00:01:58
100% - iterations: 25787 / 25858 - [10.4 MCells/s] - Estimated time to completion: 00:01:46
100% - iterations: 25795 / 25858 - [11.3 MCells/s] - Estimated time to completion: 00:01:26
100% - iterations: 25805 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:00:58
100% - iterations: 25814 / 25858 - [12.7 MCells/s] - Estimated time to completion: 00:00:53
100% - iterations: 25824 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:00:37
100% - iterations: 25834 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:00:26
100% - iterations: 25844 / 25858 - [14.1 MCells/s] - Estimated time to completion: 00:00:15
100% - iterations: 25853 / 25858 - [12.7 MCells/s] - Estimated time to completion: 00:00:06
Please wait ... saving the sensor 'Overall Field' (E-fields) on disk.

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

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

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

100% - iterations: 25858 / 25858 - [0.0357 MCells/s] - Estimated time to completion: 00:00:00

Convert time-domain data to frequency-domain data.

Maxwell Solver run ended the 2009-Feb-10 00:57:28. Total simulation time was 14:17:15 (hh:mm:ss,
wall-clock time).
```

APPENDIX C - PROBE CALIBRATION REPORT

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

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

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

Accreditation No.: SCS 108

Client Celltech

Certificate No: ET3-1590_Jul08

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1590
Calibration procedure(s)	QA CAL-01.v6, QA CAL-12.v5 and QA CAL-23.v3 Calibration procedure for dosimetric E-field probes
Calibration date:	July 21, 2008
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe ES3DV2	SN: 3013	2-Jan-08 (No. ES3-3013_Jan08)	Jan-09
DAE4	SN: 660	3-Sep-07 (No. DAE4-660_Sep07)	Sep-08

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

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

Issued: July 21, 2008

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ET3DV6

SN:1590

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

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1590

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

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

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

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

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

Sensor Offset

Probe Tip to Sensor Center	**2.7** mm

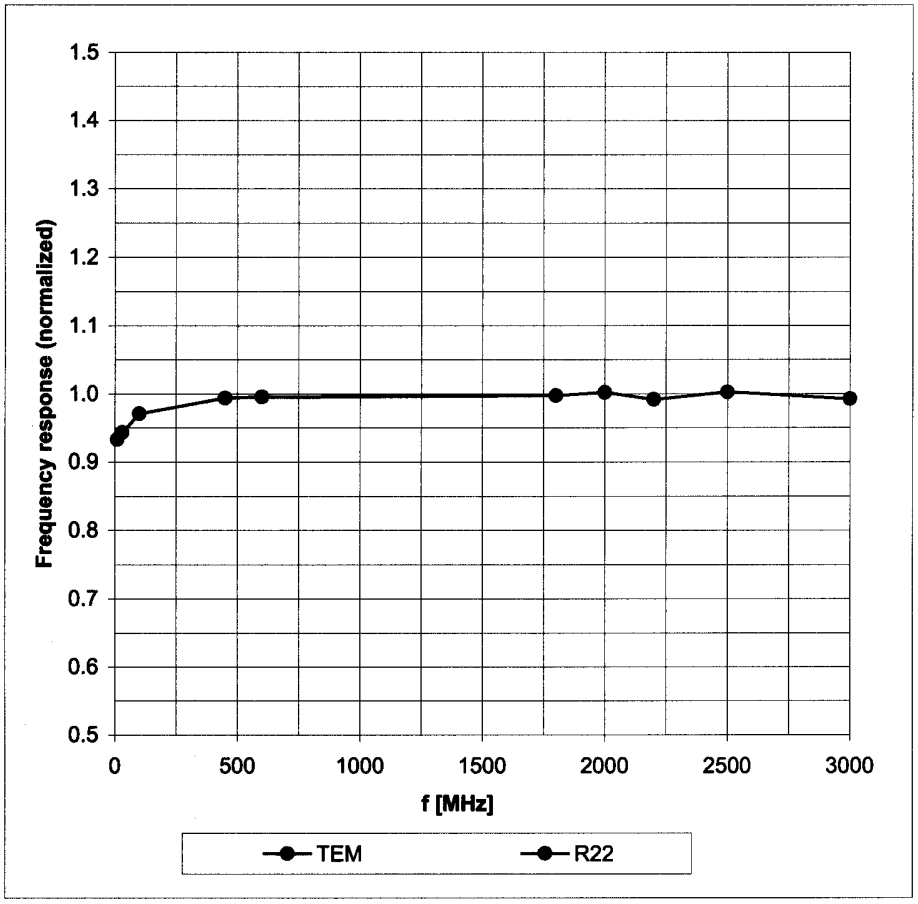
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Page 8).

[B] Numerical linearization parameter: uncertainty not required.

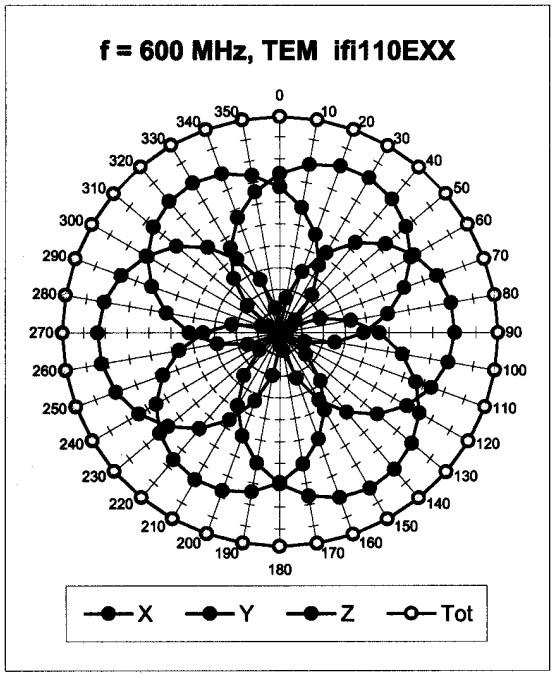
Frequency Response of E-Field

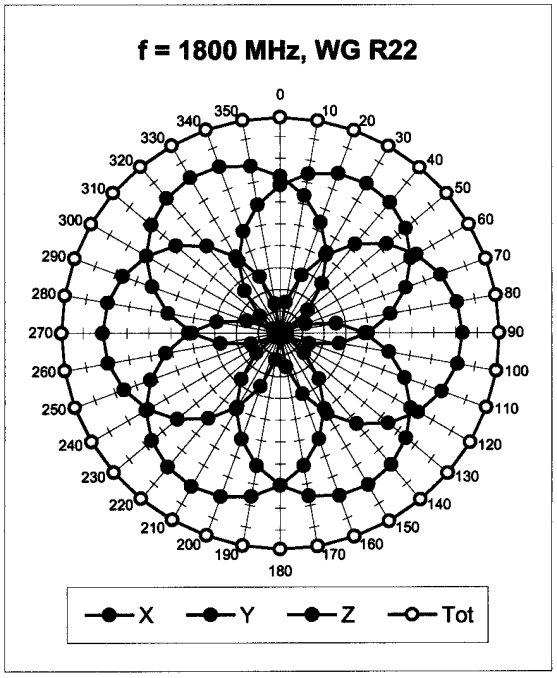
(TEM-Cell:ifi110 EXX, Waveguide: R22)

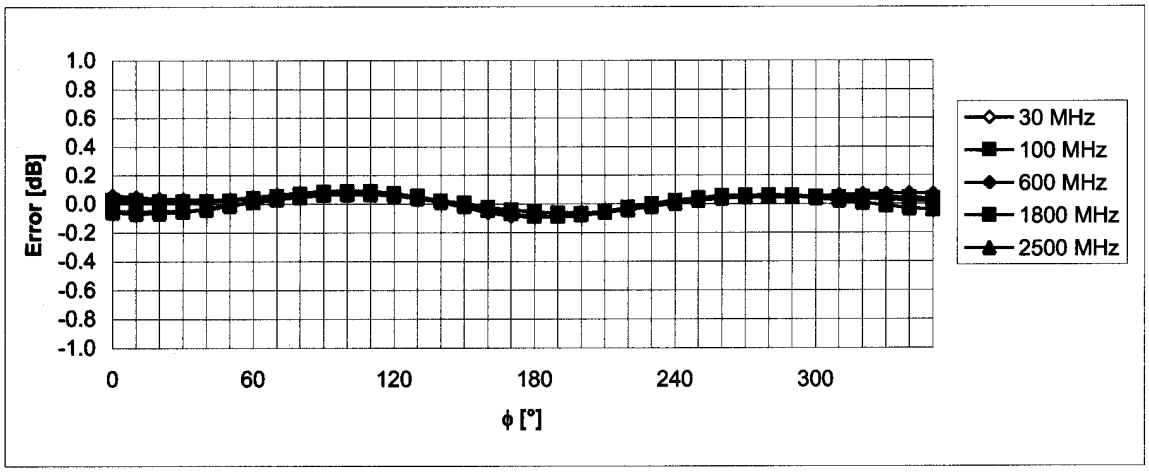


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



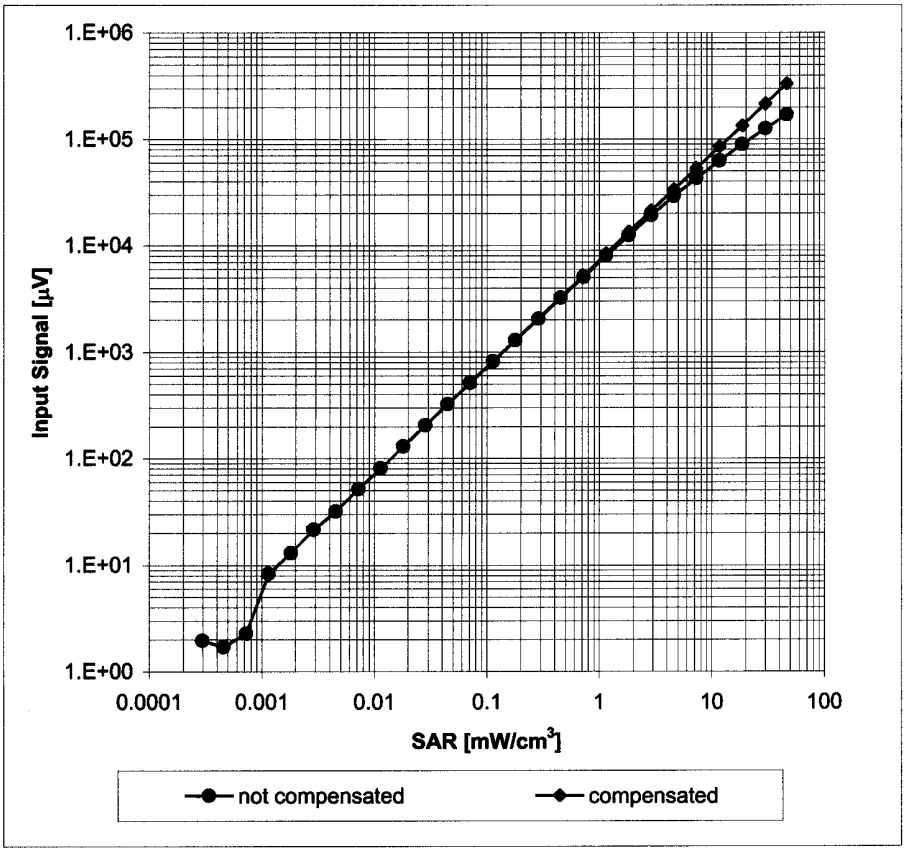


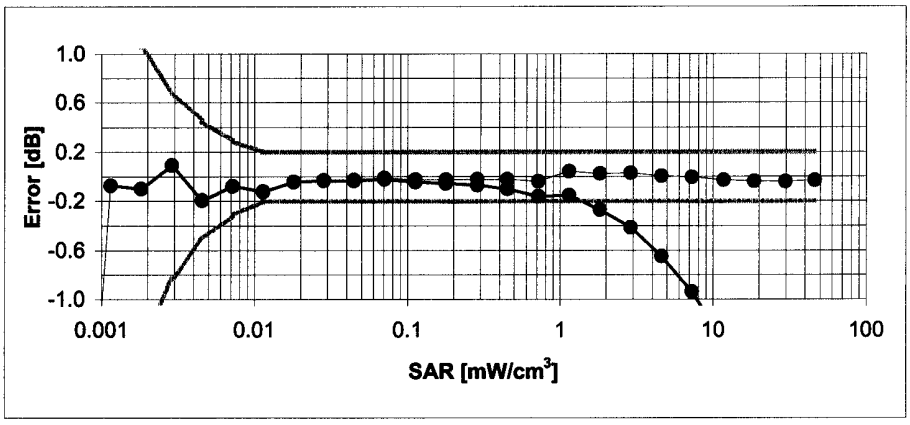


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

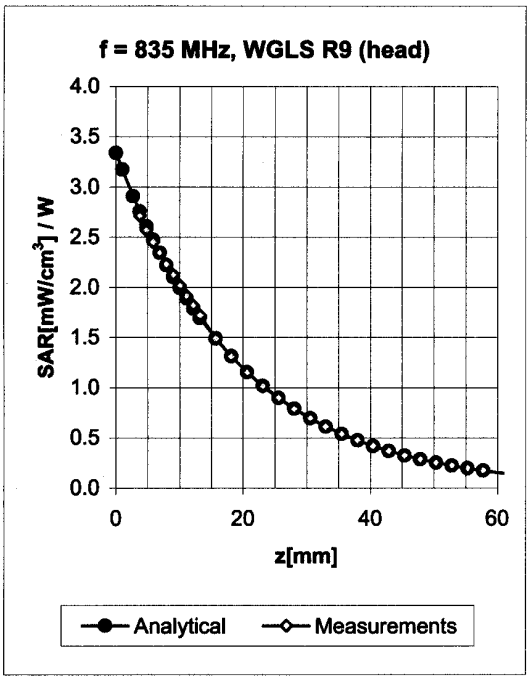
(Waveguide R22, f = 1800 MHz)

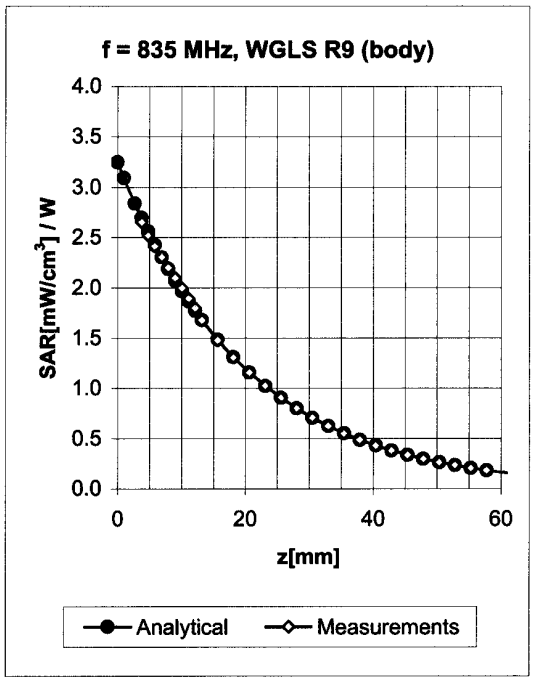




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



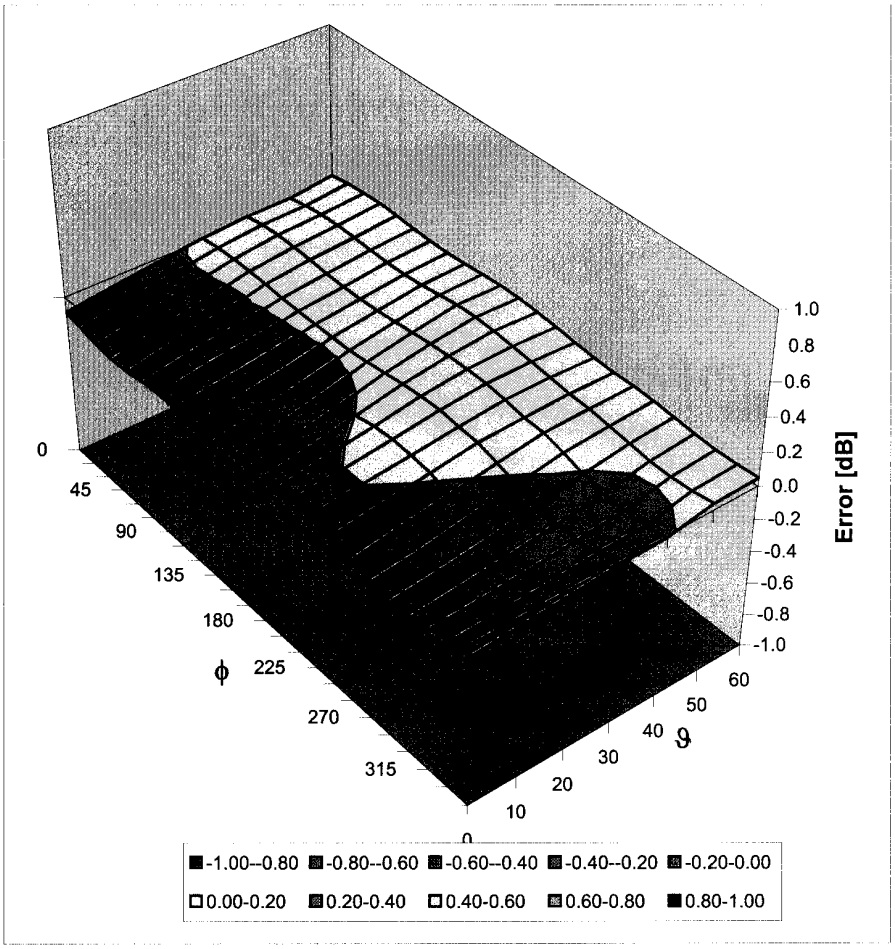


f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty	
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.34	1.75	7.66	± 13.3% (k=2)
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.32	3.52	6.54	± 11.0% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.28	1.77	8.27	± 13.3% (k=2)
835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

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

Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

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Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1590**
Place of Assessment:	**Zurich**
Date of Assessment:	**July 23, 2008**
Probe Calibration Date:	**July 21, 2008**

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*	**8.9 ± 10%**	**ε_r = 52.3** **σ = 0.76 mho/m** (head tissue)
300 MHz	*ConvF*	**8.0 ± 9%**	**ε_r = 45.3** **σ = 0.87 mho/m** (head tissue)
150 MHz	*ConvF*	**8.5 ± 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 Section 4.7 of the DASY4 Manual.