DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

Test Lab

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Applicant Information

LECTROSONICS, INC.
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FCC IDENTIFIER:	**DBZSM**
Model(s):	**SM**
Rule Part(s):	**FCC 47 CFR §2.1093; IC RSS-102, Issue 1 (Provisional)**
Test Procedure(s):	**FCC OET Bulletin 65, Supplement C (Edition 01-01)**
FCC Device Classification:	**Licensed Broadcast Transmitter Worn on Body (TBT)**
Device Description:	**Wireless Belt-Pack Body-Worn Audio Transmitter**
Modulation Type:	**FM**
Tx Frequency Range Tested:	**742.4 - 767.9 MHz (Block 29)**
Max. RF Output Power Tested:	**0.106 Watts ERP (755 MHz)**
Antenna Type(s) Tested:	**Fixed (Quarter-Wave)**
Battery Type(s) Tested:	**NiMH x1 (1.2 V AA), Lithium x1 (1.5 V AA), Alkaline x1 (1.5 V AA)** **Alkaline Type 1: Rayovac 2600 mAh** **Alkaline Type 2: Duracell Procell 2850 mAh**
Body-Worn Accessories Tested:	**Belt-Clip Holster (P/N: 35903)** **Electret Microphone (P/N: M-150)**
Max. SAR Level(s) Evaluated:	**Body-worn: 0.511 W/kg (1g average)**

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

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

Performed By:

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Compliance Technologist
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Reviewed By:

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1.0 INTRODUCTION

This measurement report demonstrates that the Lectrosonics Model: SM Wireless Belt-Pack Body-Worn Audio Transmitter FCC ID: DBZSM complies with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]), and Health Canada's Safety Code 6 (see reference [2]) for the General Population / Uncontrolled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]) and IC RSS-102, Issue 1 (Provisional) (see reference [4]), 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 DESCRIPTION OF DEVICE UNDER TEST (DUT)

FCC Rule Part(s)	47 CFR §2.1093				
IC Rule Part(s)	RSS-102 Issue 1 (Provisional)				
Test Procedure(s)	FCC OET Bulletin 65, Supplement C (Edition 01-01)				
FCC Device Classification	Licensed Broadcast Transmitter Worn on Body (TBT)				
Device Description	Wireless Belt-Pack Body-Worn Audio Transmitter				
Modulation Type	FM				
FCC IDENTIFIER	DBZSM				
Model(s)	SM				
Serial No.(s)	P358		Production Unit		
Tx Frequency Range Tested	742.4 - 767.9 MHz		Block 29		
Max. RF Output Power Measured	0.106 Watts		ERP		755 MHz
Antenna Type(s) Tested	Fixed (Quarter-Wave)				
Battery Type(s) Tested	**Battery Type**		**Brand**	**Voltage (V)**	**mAh**
	NiMH	AA (x1)	Olympus	1.2	1300
	Lithium	AA (x1)	Energizer E-Squared	1.5	3000
	Alkaline	AA (x1)	Rayovac	1.5	2600
			Duracell Procell		2850
Body-worn Accessories Tested	Electret Microphone		P/N: M-150		
	Belt-Clip Holster		P/N: 35903		

3.0 SAR MEASUREMENT SYSTEM

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

DASY4 SAR Measurement System with SAM phantom

DASY4 Measurement System with SAM Phantom

4.0 SAR MEASUREMENT SUMMARY

BODY-WORN SAR EVALUATION RESULTS

Freq. (MHz)	Chan.	Test Mode	Antenna Type	Battery Type	DUT Position to Planar Phantom	Body-worn Accessories	Separation Distance to Planar Phantom (cm)	ERP Start Power (Watts)	SAR Drift During Test (dB)	Measured SAR 1g (W/kg)
755	Mid	CW	Fixed	Olympus NiMH	Back Side	Belt-Clip Holster and Microphone	1.5	0.106	0.0233	0.510
755	Mid	CW	Fixed	Olympus NiMH	Front Side	Belt-Clip Holster and Microphone	1.5	0.106	0.0688	0.332
755	Mid	CW	Fixed	Energizer Lithium	Back Side	Belt-Clip Holster and Microphone	1.5	0.106	0.0215	0.500
755	Mid	CW	Fixed	Energizer Lithium	Front Side	Belt-Clip Holster and Microphone	1.5	0.106	0.0408	0.285
755	Mid	CW	Fixed	Rayovac Alkaline	Back Side	Belt-Clip Holster and Microphone	1.5	0.106	0.0204	0.493
755	Mid	CW	Fixed	Rayovac Alkaline	Front Side	Belt-Clip Holster and Microphone	1.5	0.106	0.0393	0.312
755	Mid	CW	Fixed	Duracell Alkaline	Back Side	Belt-Clip Holster and Microphone	1.5	0.106	0.0156	0.511

ANSI / IEEE C95.1 1999 - SAFETY LIMIT
BODY: 1.6 W/kg (averaged over 1 gram)
Spatial Peak - Uncontrolled Exposure / General Population

Test Date	March 2, 2005			Relative Humidity	30	%
Measured Fluid Type	755 MHz Body			Atmospheric Pressure	102.0	kPa
Dielectric Constant ε_r	IEEE Target (Interpolated)		Measured	Ambient Temperature	24.4	°C
	55.5	± 5%	55.0	Fluid Temperature	22.1	°C
Conductivity σ (mho/m)	IEEE Target (Interpolated)		Measured	Fluid Depth	≥ 15	cm
	0.96	± 5%	0.93	ρ (Kg/m^3)	1000	

Note(s):

1. The measurement results were obtained with the DUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
2. If the measured SAR levels at the mid channel 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 DUT was evaluated for SAR with a Rayovac alkaline battery. To report a SAR comparison between alternate alkaline battery types, the maximum SAR level configuration evaluated with the Rayovac alkaline battery was repeated using a Duracell Procell alkaline battery as shown in the above test data table.
4. The power drift of the DUT was measured during each test by the DASY4 system. The power drifts measured by the DASY4 system were <5% from the start power.
5. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluations. The temperatures reported were consistent for all measurement periods.
6. The dielectric parameters of the simulated tissue mixture were measured prior to the evaluations using an HP 85070C Dielectric Probe Kit and an HP 8753E Network Analyzer (see Appendix C for printout of measured fluid dielectric parameters).
7. SAR measurements were performed within 24 hours of the daily system performance check.

5.0 DETAILS OF SAR EVALUATION

The Lectrosonics Model: SM Wireless Belt-Pack Body-Worn Audio Transmitter FCC ID: DBZSM was compliant for localized Specific Absorption Rate (General Population / Uncontrolled Exposure) based on the test provisions and conditions described below. Detailed photographs of the test setup are shown in Appendix D.

1. The DUT was tested in a body-worn configuration placed inside the belt-clip holster. The back side of the DUT was placed facing parallel to the outer surface of the SAM phantom (planar section) with the attached belt-clip accessory touching the phantom surface. The belt-clip holster accessory provided a 1.5 cm separation distance between the back side of the DUT and the outer surface of the SAM phantom (planar section). The belt-clip is a plastic material, the holster a nylon material, and neither contains any metallic components. The DUT was evaluated with the Electret microphone connected to the audio input jack.
2. The DUT was tested in a body-worn configuration placed inside the belt-clip holster. The front side of the DUT (LCD side) was facing parallel to the outer surface of the SAM phantom (planar section) with the attached belt-clip accessory touching the phantom surface. The belt-clip holster accessory provided a 1.5 cm separation distance between the front side of the DUT (LCD side) and the outer surface of the SAM phantom (planar section). The belt-clip is a plastic material, the holster a nylon material, and neither contains any metallic components. The DUT was evaluated with the Electret microphone connected to the audio input jack.
3. The conducted output power of the DUT could not be measured for the SAR evaluation due to a non-detachable antenna. The DUT was evaluated for SAR at the maximum conducted power level preset by the manufacturer.
4. The DUT was evaluated for SAR at the maximum ERP level measured prior to the SAR evaluation on a 3-meter Open Area Test Site using the signal substitution method in accordance with ANSI/TIA-603-C-2004 (see reference [6]).
5. The power drift of the DUT was measured by the DASY4 system for the duration of each evaluation. The power drifts measured by the DASY4 system were <5% from the start power.
6. The DUT was tested in unmodulated continuous transmit operation.
7. The DUT was tested with a fully charged battery for all evaluations.
8. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluations. The temperatures reported were consistent for all measurement periods.
9. The dielectric parameters of the simulated tissue mixture were measured prior to the evaluations using an HP 85070C Dielectric Probe Kit and an HP 8753E Network Analyzer (see Appendix C for printout of measured fluid dielectric parameters).
10. The SAR evaluations were performed within 24 hours of the system performance check.

6.0 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 form 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 D). 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 (5x5x7 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 (7x7x7) to ensure complete capture of the peak spatial-average SAR.

7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluations a system check was performed at the planar section of the SAM phantom with an 835 MHz dipole (see Appendix E for system validation procedures). Prior to the system performance check the dielectric parameters of the simulated tissue mixture were measured using an HP 85070C Dielectric Probe Kit and an HP 8753E Network Analyzer (see Appendix C for printout of 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% (see Appendix B for system performance check test plot).

SYSTEM PERFORMANCE CHECK

Test Date	835MHz 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)
		IEEE Target	Measured	IEEE Target	Measured	IEEE Target	Measured						
03/02/05	**Brain**	**2.38 (±10%)**	2.57 (+8.0%)	**41.5 ±5%**	41.4	**0.90 ±5%**	0.92	1000	23.5	22.8	≥ 15	30	102.0

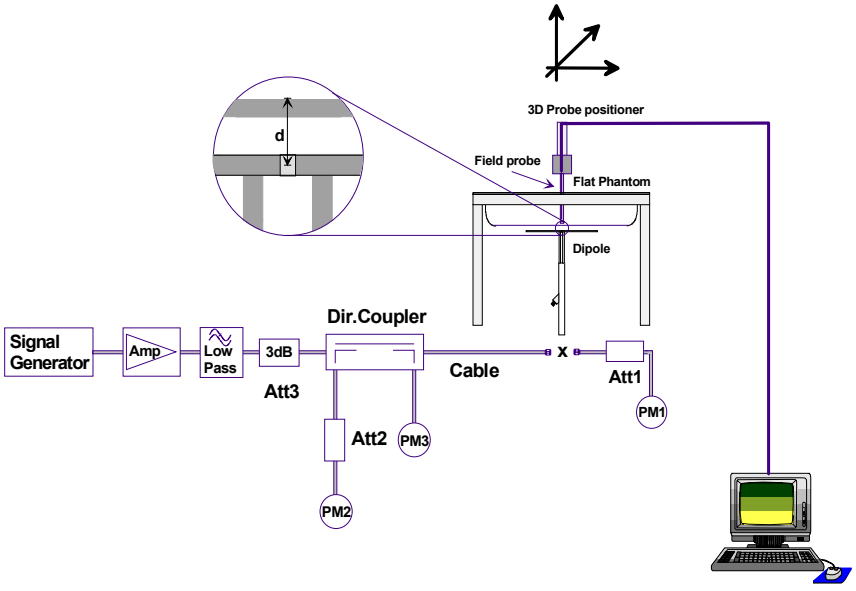


Figure 1. System Performance Check Setup Diagram

835MHz Dipole Setup

8.0 SIMULATED EQUIVALENT TISSUES

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

SIMULATED TISSUE MIXTURES		
INGREDIENT	835 MHz Brain	755 MHz Body
	System Performance Check	DUT Evaluation
Water	40.71 %	53.79 %
Sugar	56.63 %	45.13 %
Salt	1.48 %	0.98 %
HEC	0.99 %	--
Bactericide	0.19 %	0.10 %

9.0 SAR SAFETY LIMITS

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

Notes:
1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. 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: DASY4 software
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)

Phantom(s)

Type: SAM V4.0C
Shell Material: Fiberglass
Thickness: 2.0 ±0.1 mm
Volume: Approx. 25 liters

11.0 PROBE SPECIFICATION (ET3DV6)

Construction:	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g. glycol)
Calibration:	In air from 10 MHz to 2.5 GHz In brain simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy ± 8%)
Frequency:	10 MHz to >6 GHz; Linearity: ±0.2 dB (30 MHz to 3 GHz)
Directivity:	±0.2 dB in brain tissue (rotation around probe axis) ±0.4 dB in brain tissue (rotation normal to probe axis)
Dynamic Range:	5 □W/g to >100 mW/g; Linearity: ±0.2 dB
Surface Detection:	±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 SAM PHANTOM V4.0C

The SAM phantom V4.0C is a fiberglass shell phantom with a 2.0 mm (+/-0.2 mm) shell thickness for left and right head and flat planar area integrated in a wooden table. The shape of the fiberglass shell corresponds to the phantom defined by SCC34-SC2. The device holder positions are adjusted to the standard measurement positions in the three sections (see Appendix G for specifications of the SAM phantom V4.0C).

SAM Phantom

13.0 DEVICE HOLDER

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

Device Holder

14.0 TEST EQUIPMENT LIST

TEST EQUIPMENT	SERIAL NO.	DATE CALIBRATED	CALIBRATION DUE DATE
Schmid & Partner DASY4 System	-	-	-
-DASY4 Measurement Server	1078	N/A	N/A
-Robot	599396-01	N/A	N/A
-DAE3	353	July 2004	July 2005
-DAE3	370	January 2005	January 2006
-ET3DV6 E-Field Probe	1387	March 2004	March 2005
-ET3DV6 E-Field Probe	1590	May 2004	May 2005
-EX3DV4 E-Field Probe	3547	January 2005	January 2006
-300MHz Validation Dipole	135	October 2004	October 2005
-450MHz Validation Dipole	136	November 2004	November 2005
-835MHz Validation Dipole	411	March 2004	March 2005
		March 2005	March 2006
-900MHz Validation Dipole	054	June 2004	June 2005
-1800MHz Validation Dipole	247	June 2004	June 2005
-1900MHz Validation Dipole	151	June 2004	June 2005
-2450MHz Validation Dipole	150	September 2004	September 2005
-5000MHz Validation Dipole	1031	January 2005	January 2006
-SAM Phantom V4.0C	1033	N/A	N/A
-Barski Planar Phantom	03-01	N/A	N/A
-Plexiglas Planar Phantom	161	N/A	N/A
-Validation Planar Phantom	137	N/A	N/A
HP 85070C Dielectric Probe Kit	N/A	N/A	N/A
Gigatronics 8651A Power Meter	8650137	April 2004	April 2005
Gigatronics 8652A Power Meter	1835267	April 2004	April 2005
Gigatronics 80701A Power Sensor	1833535	April 2004	April 2005
Gigatronics 80701A Power Sensor	1833542	April 2004	April 2005
Gigatronics 80701A Power Sensor	1834350	April 2004	April 2005
HP 8594E Spectrum Analyzer	3543A02721	April 2004	April 2005
HP 8753E Network Analyzer	US38433013	April 2004	April 2005
HP 8753ET Network Analyzer	US39170292	February 2005	February 2006
HP 8648D Signal Generator	3847A00611	April 2004	April 2005
Amplifier Research 5S1G4 Power Amplifier	26235	N/A	N/A

15.0 MEASUREMENT UNCERTAINTIES

UNCERTAINTY BUDGET FOR DEVICE EVALUATION						
Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**c_i 1g**	**Standard Uncertainty ±% (1g)**	**v_i or v_{eff}**
Measurement System						
Probe calibration	± 5.95	Normal	1	1	± 5.95	∞
Axial isotropy of the probe	± 4.7	Rectangular	√3	$(1-c_p)$	± 1.9	∞
Spherical isotropy of the probe	± 9.6	Rectangular	√3	(c_p)	± 3.9	∞
Spatial resolution	± 0.0	Rectangular	√3	1	± 0.0	∞
Boundary effects	± 5.5	Rectangular	√3	1	± 3.2	∞
Probe linearity	± 4.7	Rectangular	√3	1	± 2.7	∞
Detection limit	± 1.0	Rectangular	√3	1	± 0.6	∞
Readout electronics	± 1.0	Normal	1	1	± 1.0	∞
Response time	± 0.8	Rectangular	√3	1	± 0.5	∞
Integration time	± 1.4	Rectangular	√3	1	± 0.8	∞
RF ambient conditions	± 3.0	Rectangular	√3	1	± 1.7	∞
Mech. constraints of robot	± 0.4	Rectangular	√3	1	± 0.2	∞
Probe positioning	± 2.9	Rectangular	√3	1	± 1.7	∞
Extrapolation & integration	± 3.9	Rectangular	√3	1	± 2.3	∞
Test Sample Related						
Device positioning	± 6.0	Normal	√3	1	± 6.7	12
Device holder uncertainty	± 5.0	Normal	√3	1	± 5.9	8
Power drift	± 5.0	Rectangular	√3		± 2.9	∞
Phantom and Setup						
Phantom uncertainty	± 4.0	Rectangular	√3	1	± 2.3	∞
Liquid conductivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid conductivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					**± 13.76**	
Expanded Uncertainty (k=2)					**± 27.51**	

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

MEASUREMENT UNCERTAINTIES (CONT.)

UNCERTAINTY BUDGET FOR SYSTEM VALIDATION

Error Description	Uncertainty Value ±%	Probability Distribution	Divisor	c_i 1g	Standard Uncertainty ±% (1g)	v_i or v_{eff}
Measurement System						
Probe calibration	± 5.95	Normal	1	1	± 5.95	∞
Axial isotropy of the probe	± 4.7	Rectangular	√3	$(1-c_p)$	± 1.9	∞
Spherical isotropy of the probe	± 9.6	Rectangular	√3	(c_p)	± 3.9	∞
Spatial resolution	± 0.0	Rectangular	√3	1	± 0.0	∞
Boundary effects	± 5.5	Rectangular	√3	1	± 3.2	∞
Probe linearity	± 4.7	Rectangular	√3	1	± 2.7	∞
Detection limit	± 1.0	Rectangular	√3	1	± 0.6	∞
Readout electronics	± 1.0	Normal	1	1	± 1.0	∞
Response time	± 0.8	Rectangular	√3	1	± 0.5	∞
Integration time	± 1.4	Rectangular	√3	1	± 0.8	∞
RF ambient conditions	± 3.0	Rectangular	√3	1	± 1.7	∞
Mech. constraints of robot	± 0.4	Rectangular	√3	1	± 0.2	∞
Probe positioning	± 2.9	Rectangular	√3	1	± 1.7	∞
Extrapolation & integration	± 3.9	Rectangular	√3	1	± 2.3	∞
Dipole						
Dipole Axis to Liquid Distance	± 2.0	Rectangular	√3	1	± 1.2	∞
Input Power	± 4.7	Rectangular	√3	1	± 2.7	∞
Phantom and Setup						
Phantom uncertainty	± 4.0	Rectangular	√3	1	± 2.3	∞
Liquid conductivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid conductivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					**± 10.54**	
Expanded Uncertainty (k=2)					**± 21.09**	

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

16.0 REFERENCES

[1] Federal Communications Commission, “Radiofrequency radiation exposure evaluation: portable devices”, Rule Part 47 CFR §2.1093: 1999.

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

[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, “Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada’s Safety Code 6 for Exposure of Humans to Radio Frequency Fields”, Radio Standards Specification RSS-102 Issue 1 (Provisional): September 1999.

[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] ANSI/TIA-603-C, “Land Mobile FM or PM Communications Equipment - Measurement and Performance Standards”: December 2004.

APPENDIX A - SAR MEASUREMENT DATA

Date Tested: 03/02/05

Body-Worn SAR - NiMH Battery - Back Side of DUT

DUT: Lectrosonic Model: SM; Type: Wireless Belt-Pack Body-Worn Audio Transmitter; Serial: P358

Body-Worn Accessories: Belt-Clip Holster (P/N: 35903), Electret Microphone (P/N: M-150)

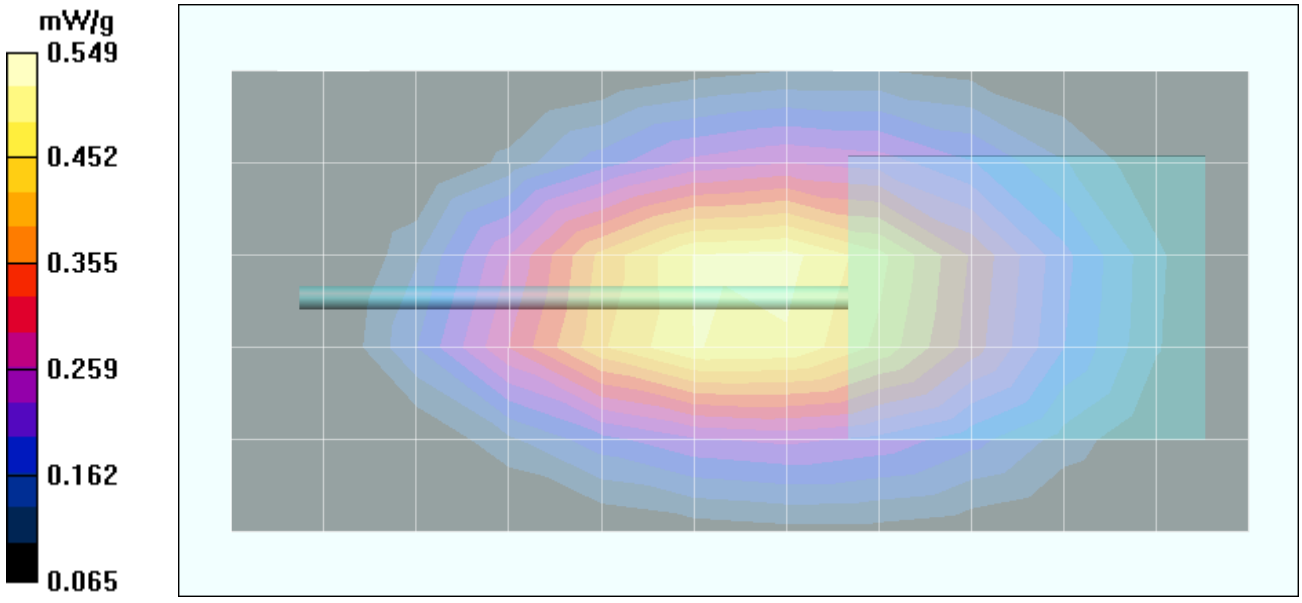
Ambient Temp: 24.4 °C; Fluid Temp: 22.1 °C; Barometric Pressure: 102.0 kPa; Humidity: 30%

Communication System: FM
RF Output Power: 0.106 W (ERP)
1.2V 1300mAh NiMH AA Battery (x1)
Frequency: 755 MHz; Duty Cycle: 1:1
Medium: M755 (σ = 0.93 mho/m; ε_r = 55.0; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 25/01/2005
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Area Scan (6x12x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 23.9 V/m; Power Drift = 0.0233 dB
Peak SAR (extrapolated) = 0.694 W/kg
SAR(1 g) = 0.510 mW/g; SAR(10 g) = 0.356 mW/g



Date Tested: 03/02/05

Body-Worn SAR - NiMH Battery - Front Side of DUT

DUT: Lectrosonic Model: SM; Type: Wireless Belt-Pack Body-Worn Audio Transmitter; Serial: P358

Body-Worn Accessories: Belt-Clip Holster (P/N: 35903), Electret Microphone (P/N: M-150)

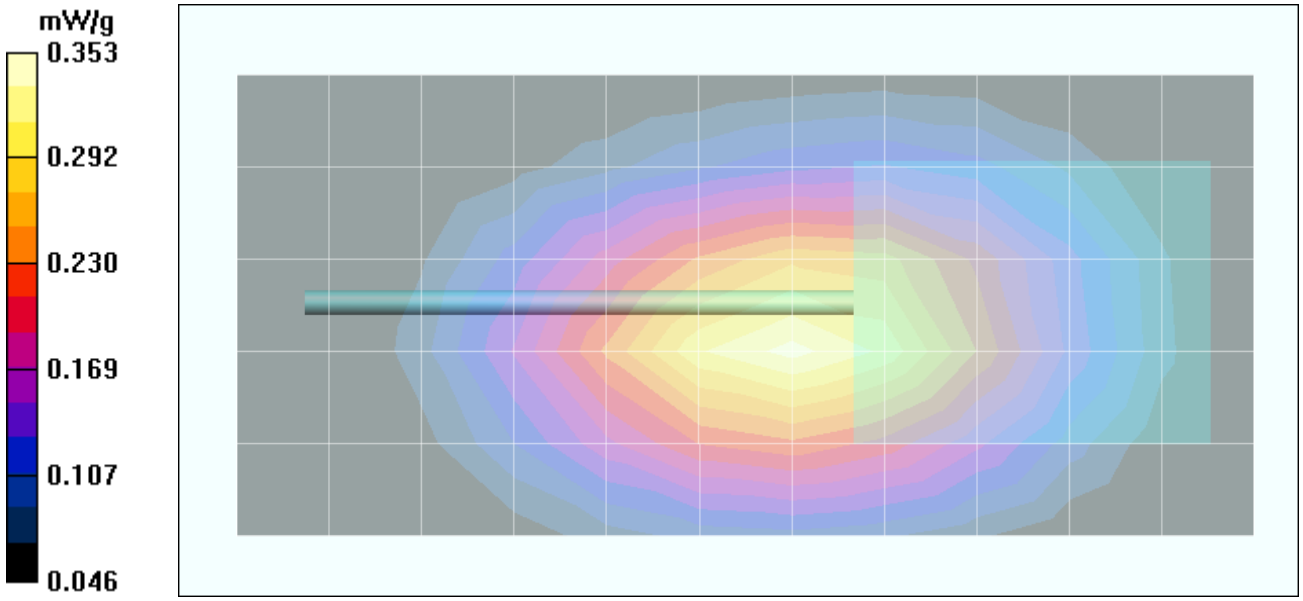
Ambient Temp: 24.4 °C; Fluid Temp: 22.1 °C; Barometric Pressure: 102.0 kPa; Humidity: 30%

Communication System: FM
RF Output Power: 0.106 W (ERP)
1.2V 1300mAh NiMH AA Battery (x1)
Frequency: 755 MHz; Duty Cycle: 1:1
Medium: M755 (σ = 0.93 mho/m; ε_r = 55.0; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 25/01/2005
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Area Scan (6x12x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.5 V/m; Power Drift = 0.0688 dB
Peak SAR (extrapolated) = 0.446 W/kg
SAR(1 g) = 0.332 mW/g; SAR(10 g) = 0.234 mW/g



Date Tested: 03/02/05

Body-Worn SAR - Lithium Battery - Back Side of DUT

DUT: Lectrosonic Model: SM; Type: Wireless Belt-Pack Body-Worn Audio Transmitter; Serial: P358

Body-Worn Accessories: Belt-Clip Holster (P/N: 35903), Electret Microphone (P/N: M-150)

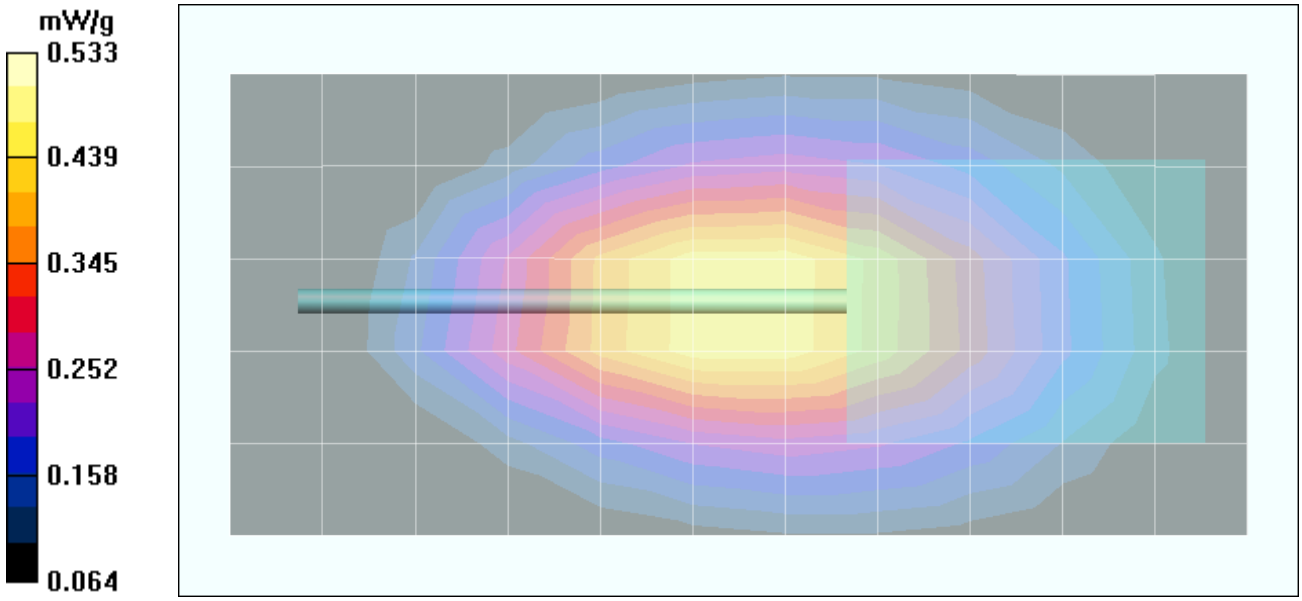
Ambient Temp: 24.4 °C; Fluid Temp: 22.1 °C; Barometric Pressure: 102.0 kPa; Humidity: 30%

Communication System: FM
RF Output Power: 0.106 W (ERP)
Frequency: 755 MHz; Duty Cycle: 1:1
1.5V 3000mAh Energizer E-Squared Lithium AA Battery (x1)
Medium: M755 (σ = 0.93 mho/m; ε_r = 55.0; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 25/01/2005
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Area Scan (6x12x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 23.6 V/m; Power Drift = 0.0215 dB
Peak SAR (extrapolated) = 0.693 W/kg
SAR(1 g) = 0.500 mW/g; SAR(10 g) = 0.348 mW/g



Date Tested: 03/02/05

Body-Worn SAR - Lithium Battery - Front Side of DUT

DUT: Lectrosonic Model: SM; Type: Wireless Belt-Pack Body-Worn Audio Transmitter; Serial: P358

Body-Worn Accessories: Belt-Clip Holster (P/N: 35903), Electret Microphone (P/N: M-150)

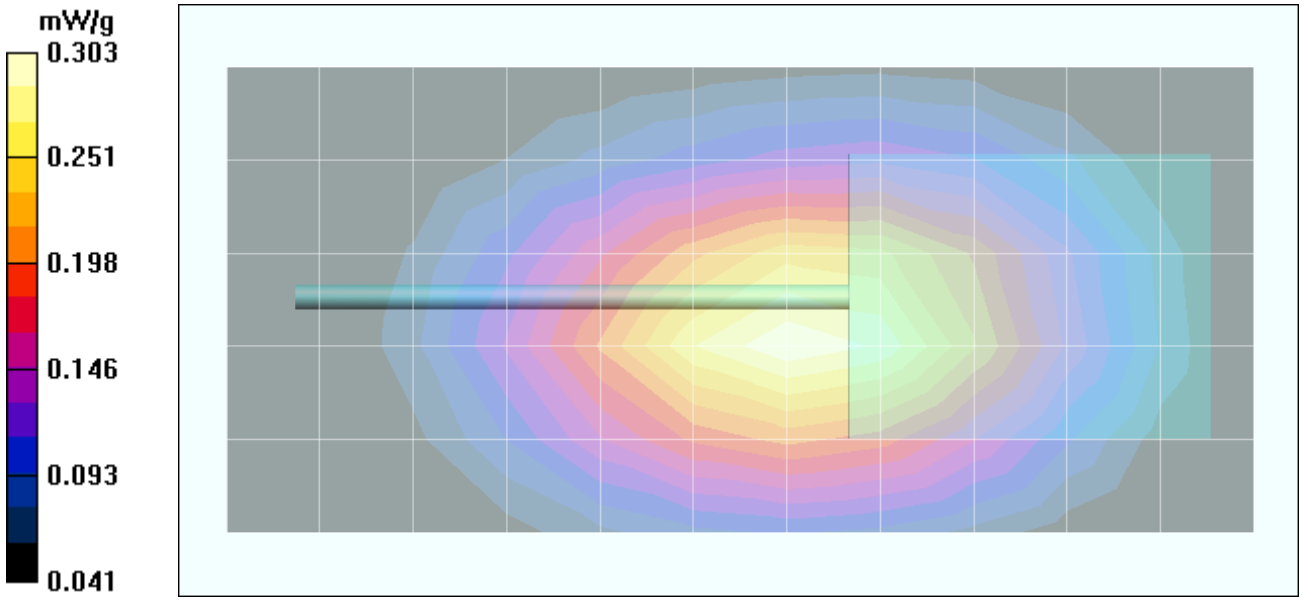
Ambient Temp: 24.4 °C; Fluid Temp: 22.1 °C; Barometric Pressure: 102.0 kPa; Humidity: 30%

Communication System: FM
RF Output Power: 0.106 W (ERP)
Frequency: 755 MHz; Duty Cycle: 1:1
1.5V 3000mAh Energizer E-Squared Lithium AA Battery (x1)
Medium: M755 (σ = 0.93 mho/m; ε_r = 55.0; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 25/01/2005
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Area Scan (6x12x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.2 V/m; Power Drift = 0.0408 dB
Peak SAR (extrapolated) = 0.379 W/kg
SAR(1 g) = 0.285 mW/g; SAR(10 g) = 0.203 mW/g



Date Tested: 03/02/05

Body-Worn SAR - Alkaline Battery (Rayovac) - Back Side of DUT

DUT: Lectrosonic Model: SM; Type: Wireless Belt-Pack Body-Worn Audio Transmitter; Serial: P358

Body-Worn Accessories: Belt-Clip Holster (P/N: 35903), Electret Microphone (P/N: M-150)

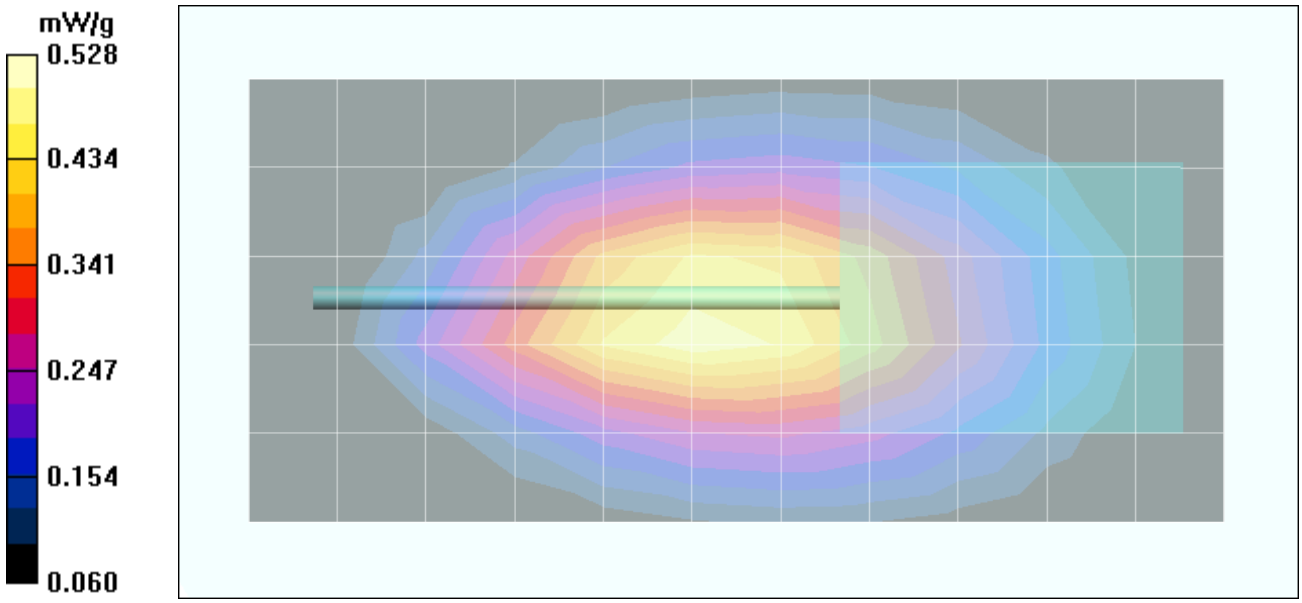
Ambient Temp: 24.4 °C; Fluid Temp: 22.1 °C; Barometric Pressure: 102.0 kPa; Humidity: 30%

Communication System: FM
RF Output Power: 0.106 W (ERP)
Frequency: 755 MHz; Duty Cycle: 1:1
1.5V 2600mAh Rayovac Alkaline AA Battery (x1)
Medium: M755 (σ = 0.93 mho/m; ε_r = 55.0; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 25/01/2005
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Area Scan (6x12x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 22.6 V/m; Power Drift = 0.0204 dB
Peak SAR (extrapolated) = 0.691 W/kg
SAR(1 g) = 0.493 mW/g; SAR(10 g) = 0.339 mW/g



Date Tested: 03/02/05

Body-Worn SAR - Alkaline Battery (Rayovac) - Front Side of DUT

DUT: Lectrosonic Model: SM; Type: Wireless Belt-Pack Body-Worn Audio Transmitter; Serial: P358

Body-Worn Accessories: Belt-Clip Holster (P/N: 35903), Electret Microphone (P/N: M-150)

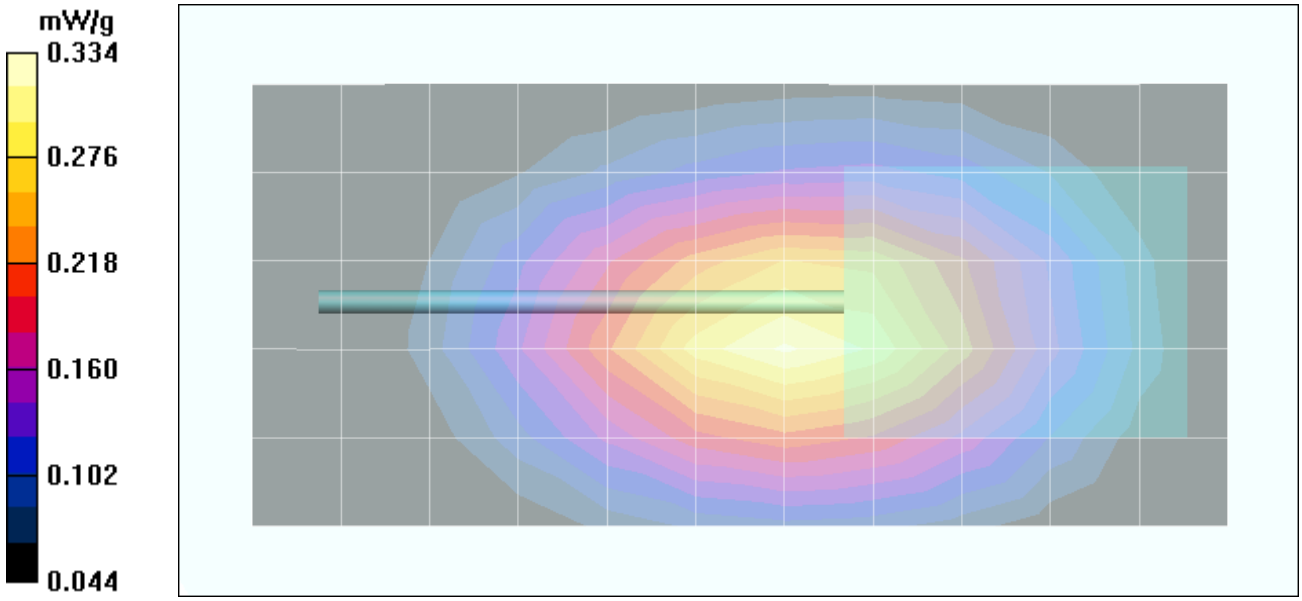
Ambient Temp: 24.4 °C; Fluid Temp: 22.1 °C; Barometric Pressure: 102.0 kPa; Humidity: 30%

Communication System: FM
RF Output Power: 0.106 W (ERP)
Frequency: 755 MHz; Duty Cycle: 1:1
1.5V 2600mAh Rayovac Alkaline AA Battery (x1)
Medium: M755 (σ = 0.93 mho/m; ε_r = 55.0; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 25/01/2005
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Area Scan (6x12x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.8 V/m; Power Drift = 0.0393 dB
Peak SAR (extrapolated) = 0.425 W/kg
SAR(1 g) = 0.312 mW/g; SAR(10 g) = 0.220 mW/g



Date Tested: 03/02/05

Body-Worn SAR - Alkaline Battery (Duracell Procell) - Back Side of DUT

DUT: Lectrosonic Model: SM; Type: Wireless Belt-Pack Body-Worn Audio Transmitter; Serial: P358

Body-Worn Accessories: Belt-Clip Holster (P/N: 35903), Electret Microphone (P/N: M-150)

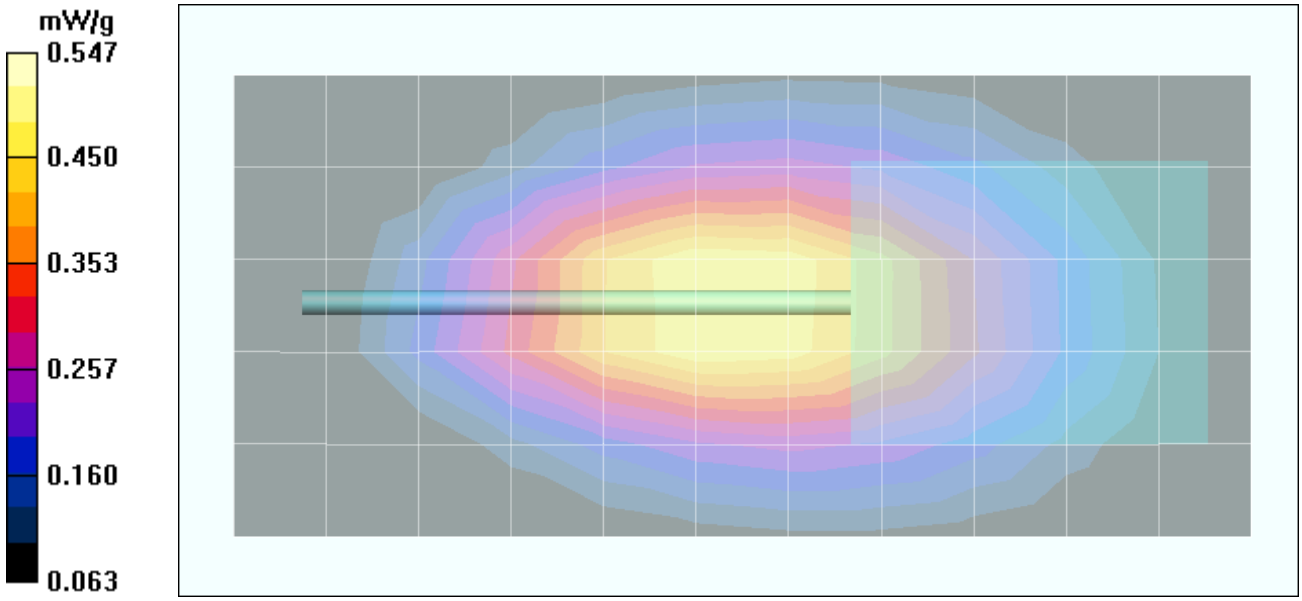
Ambient Temp: 24.4 °C; Fluid Temp: 22.1 °C; Barometric Pressure: 102.0 kPa; Humidity: 30%

Communication System: FM
RF Output Power: 0.106 W (ERP)
Frequency: 755 MHz; Duty Cycle: 1:1
1.5V 2850mAh Duracell Procell Alkaline AA Battery (x1)
Medium: M755 (σ = 0.93 mho/m; ε_r = 55.0; ρ = 1000 kg/m^3)

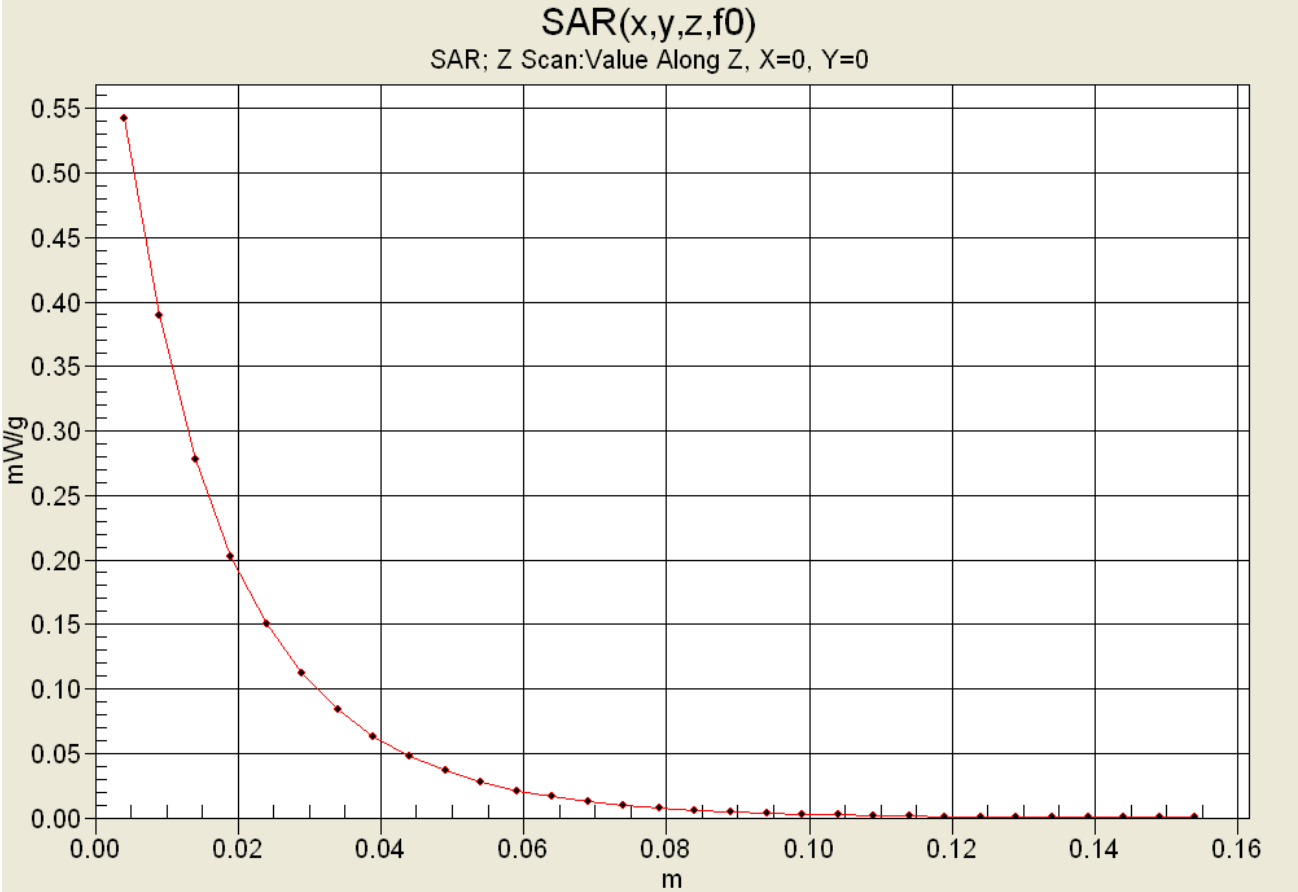
- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 25/01/2005
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Area Scan (6x12x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn - 1.5 cm Belt-Clip Separation Distance - Mid Channel/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 23.3 V/m; Power Drift = 0.0156 dB
Peak SAR (extrapolated) = 0.705 W/kg
SAR(1 g) = 0.511 mW/g; SAR(10 g) = 0.353 mW/g



Z-Axis Scan



APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 03/02/05

System Performance Check - 835 MHz Dipole

DUT: Dipole 835 MHz; Model: D835V2; Type: System Performance Check; Serial: 411; Calibrated: 03/16/2004

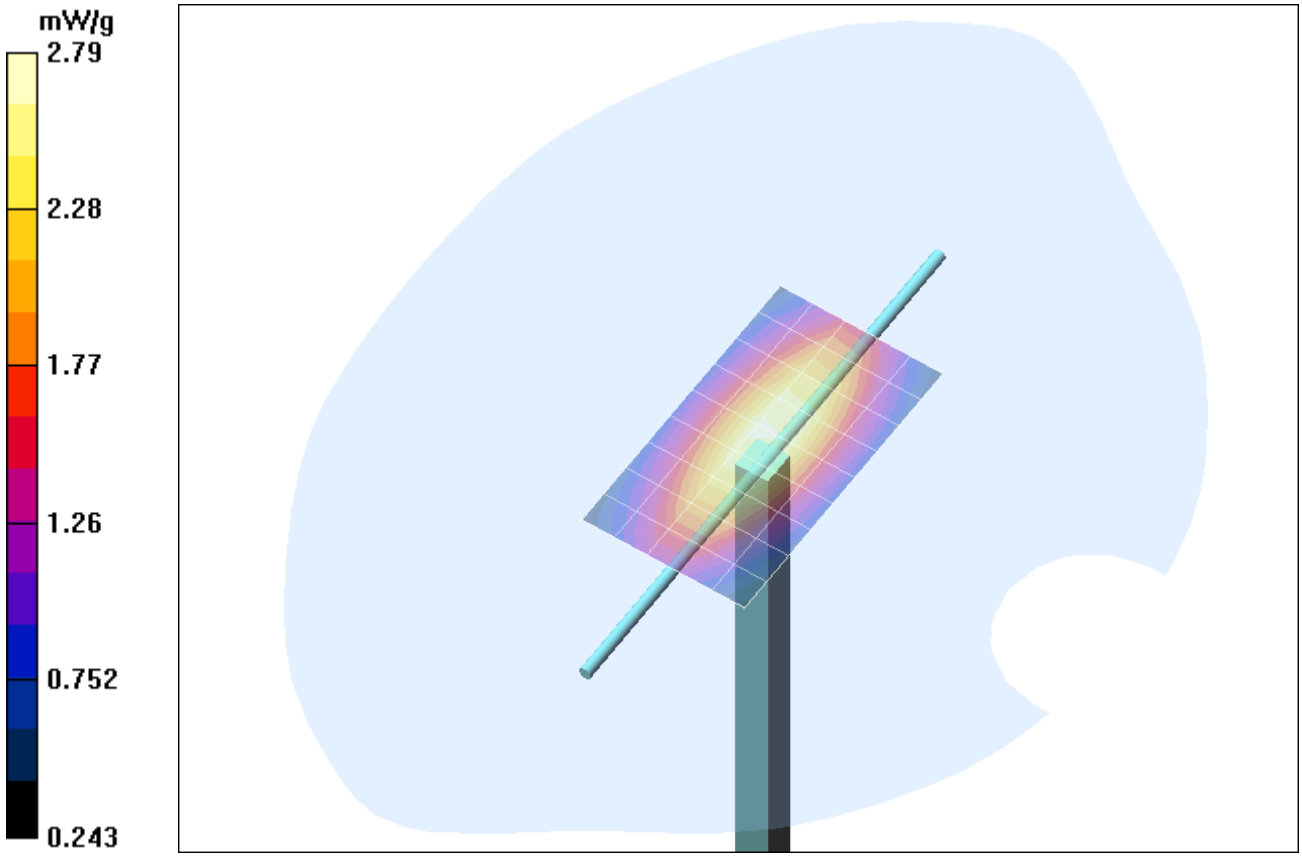
Ambient Temp: 23.5 °C; Fluid Temp: 22.8 °C; Barometric Pressure: 102.0 kPa; Humidity: 30%

Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL835 (σ = 0.92 mho/m; ε_r = 41.4; ρ = 1000 kg/m^3)

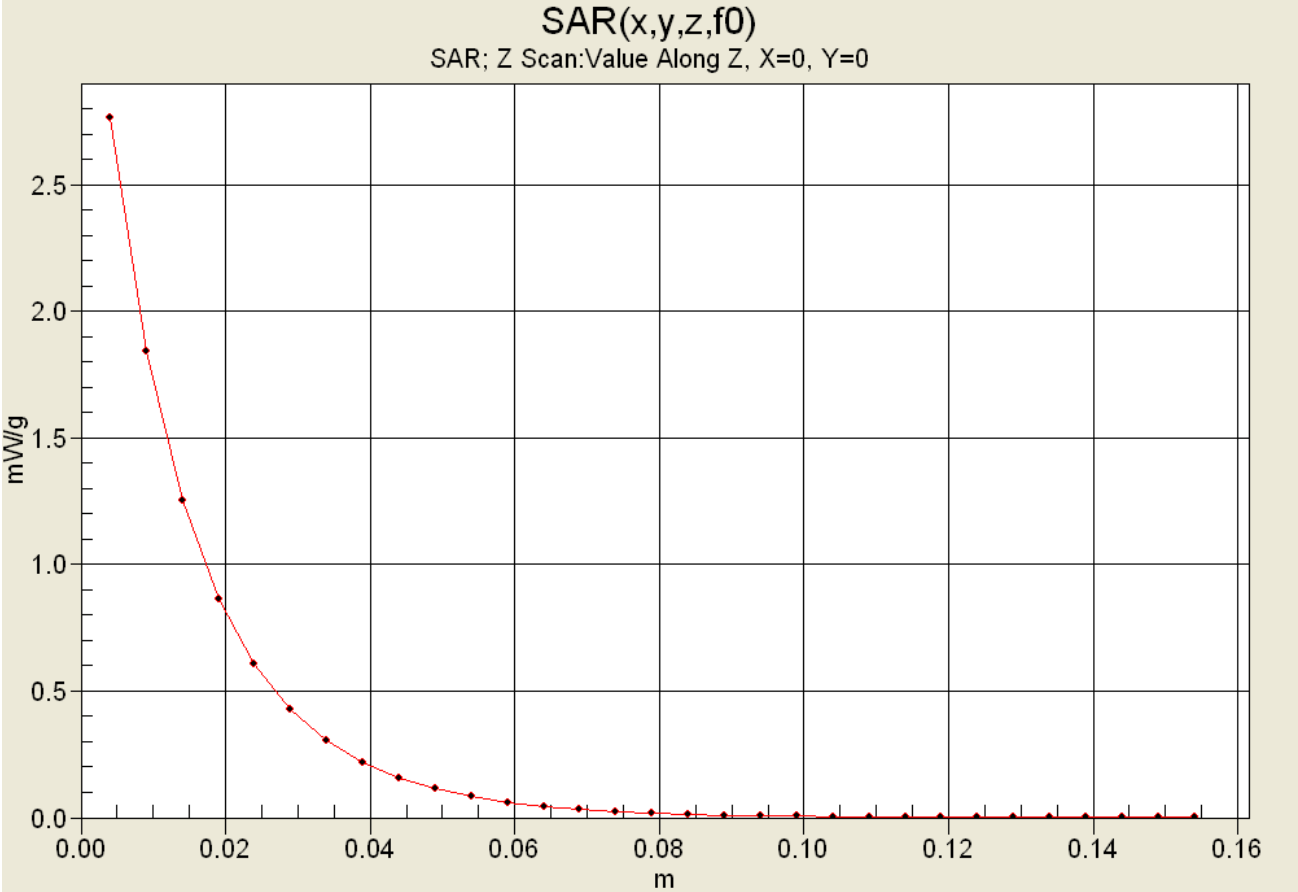
- Probe: ET3DV6 - SN1590; ConvF(6.71, 6.71, 6.71); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 25/01/2005
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

835 MHz Dipole - System Performance Check/Area Scan (6x10x1):
Measurement grid: dx=10mm, dy=10mm

835 MHz Dipole - System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.9 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 3.86 W/kg
SAR(1 g) = 2.57 mW/g; SAR(10 g) = 1.67 mW/g



Z-Axis Scan



APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

755 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

March 02, 2005

Frequency	e'	e''
655.000000 MHz	56.1611	22.9593
665.000000 MHz	56.0596	22.8917
675.000000 MHz	55.9177	22.7594
685.000000 MHz	55.8088	22.6334
695.000000 MHz	55.5995	22.5799
705.000000 MHz	55.4788	22.4632
715.000000 MHz	55.4081	22.3708
725.000000 MHz	55.2981	22.3359
735.000000 MHz	55.1768	22.3056
745.000000 MHz	55.0790	22.2382
755.000000 MHz	55.0145	22.2030
765.000000 MHz	54.9857	22.1381
775.000000 MHz	54.8600	22.0894
785.000000 MHz	54.7023	22.0011
795.000000 MHz	54.5848	21.9472
805.000000 MHz	54.5255	21.8515
815.000000 MHz	54.3993	21.7812
825.000000 MHz	54.2894	21.7125
835.000000 MHz	54.1758	21.7132
845.000000 MHz	54.0656	21.7242
855.000000 MHz	53.9486	21.6890

835 MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

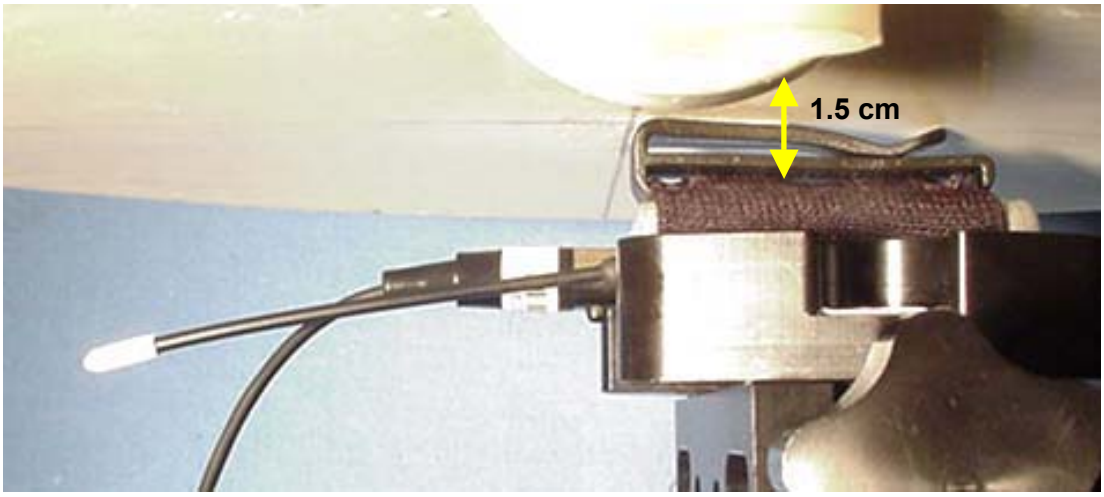
March 02, 2005

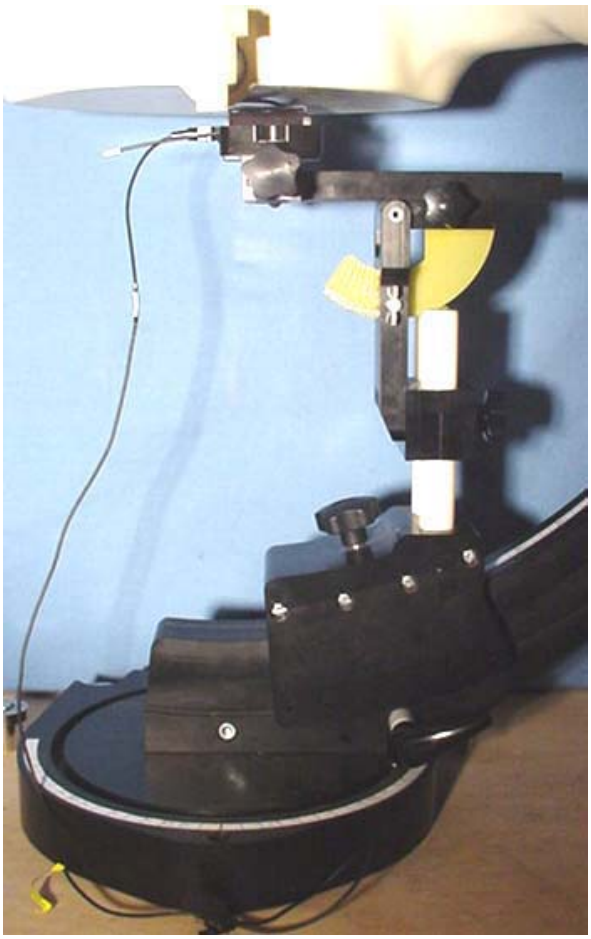
Frequency	e'	e''
735.000000 MHz	42.6245	20.1458
745.000000 MHz	42.4537	20.1136
755.000000 MHz	42.2935	20.0117
765.000000 MHz	42.1066	19.9426
775.000000 MHz	41.9939	19.8792
785.000000 MHz	41.8968	19.8190
795.000000 MHz	41.7643	19.7371
805.000000 MHz	41.6411	19.7960
815.000000 MHz	41.5721	19.7591
825.000000 MHz	41.5088	19.7907
835.000000 MHz	41.4293	19.7892
845.000000 MHz	41.2794	19.7296
855.000000 MHz	41.1296	19.6926
865.000000 MHz	41.0268	19.6081
875.000000 MHz	40.8282	19.5684
885.000000 MHz	40.6967	19.4663
895.000000 MHz	40.5507	19.4059
905.000000 MHz	40.4474	19.3942
915.000000 MHz	40.3186	19.3517
925.000000 MHz	40.2636	19.4147
935.000000 MHz	40.1927	19.4142

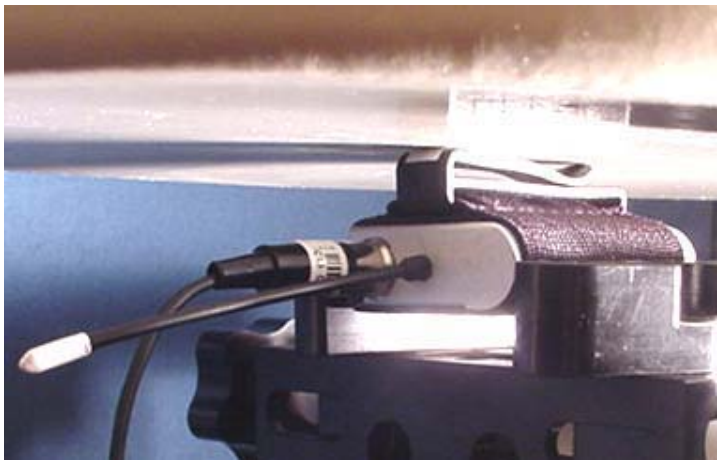
APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS

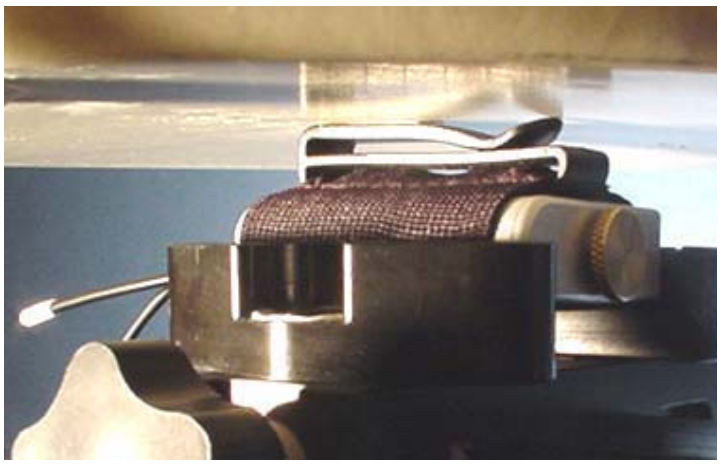
BODY-WORN SAR TEST SETUP PHOTOGRAPHS

Front Side of DUT with Belt-Clip Holster Accessory
1.5 cm Belt-Clip Separation Distance to Planar Phantom



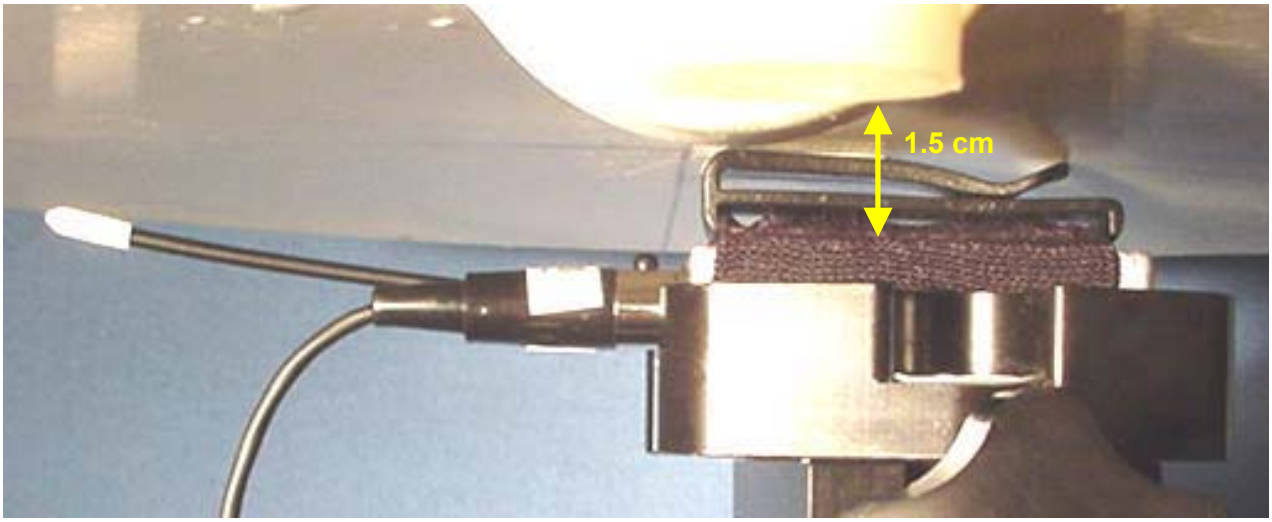


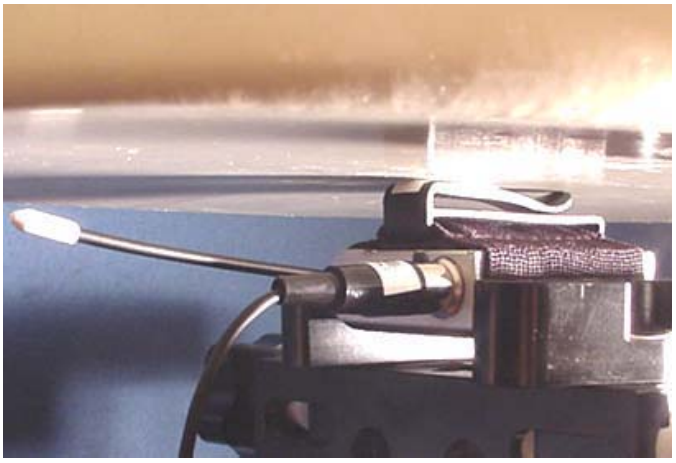


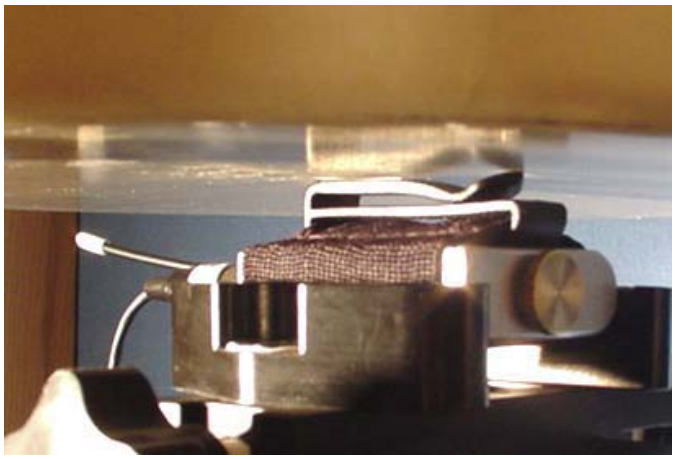


BODY-WORN SAR TEST SETUP PHOTOGRAPHS

Back Side of DUT with Belt-Clip Holster Accessory
1.5 cm Belt-Clip Separation Distance to Planar Phantom







DUT PHOTOGRAPHS

Front of DUT

Back of DUT

DUT PHOTOGRAPHS

Top of DUT

Bottom of DUT

Left Side of DUT

Right Side of DUT

DUT PHOTOGRAPHS

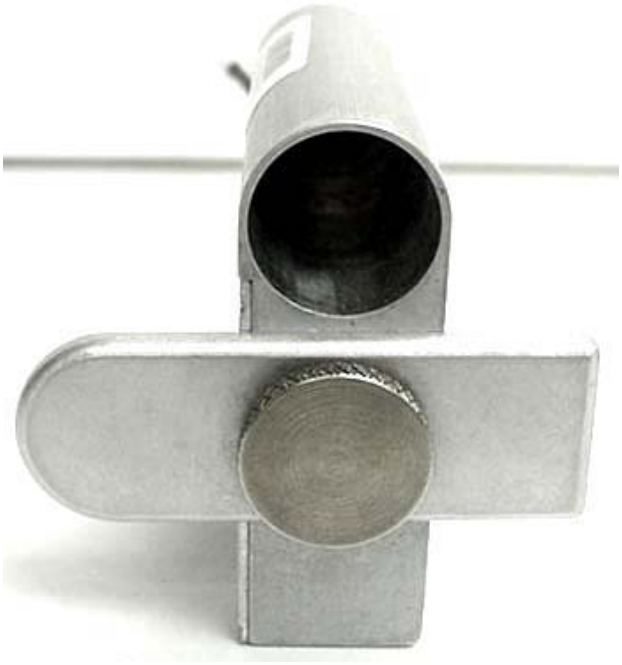
Front of Belt-Clip Holster with Microphone
Back of DUT Facing Front of Holster

Back of Belt-Clip Holster with Microphone
Back of DUT Facing Front of Holster

Front of Belt-Clip Holster with Microphone
Front of DUT Facing Front of Holster

Back of Belt-Clip Holster with Microphone
Front of DUT Facing Front of Holster

DUT PHOTOGRAPHS



DUT Battery Compartment

Rayovac Alkaline Battery

Duracell Procell Alkaline Battery

Olympus NiMH Battery

Energizer E-Squared Lithium Battery

APPENDIX E - SYSTEM VALIDATION

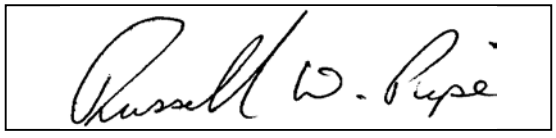
Celltech
Testing and Engineering Services Lab

835 MHz SYSTEM VALIDATION DIPOLE

Type:	**835 MHz Validation Dipole**
Serial Number:	**411**
Place of Calibration:	**Celltech Labs Inc.**
Date of Calibration:	**March 16, 2004**

Celltech Labs Inc. hereby certifies that this device has been calibrated on the date indicated above.

Calibrated by: 

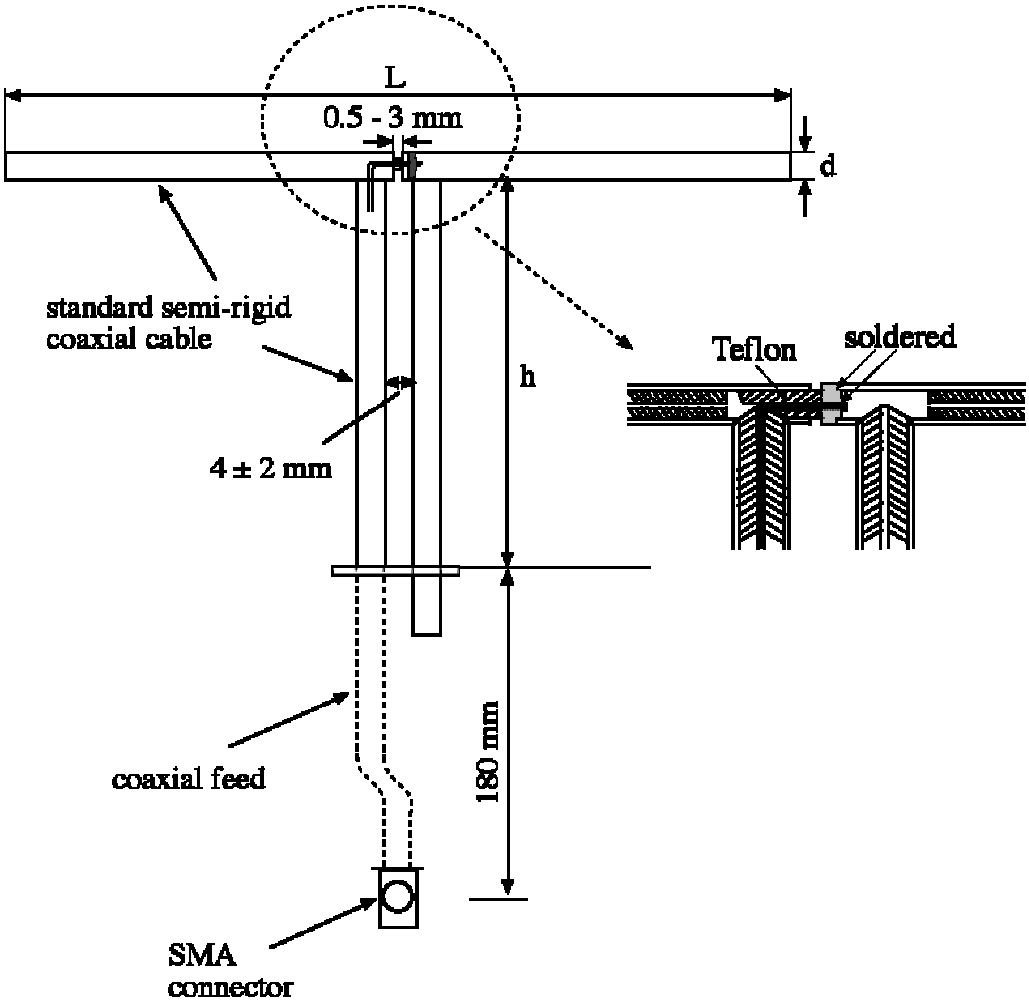
Approved by: 

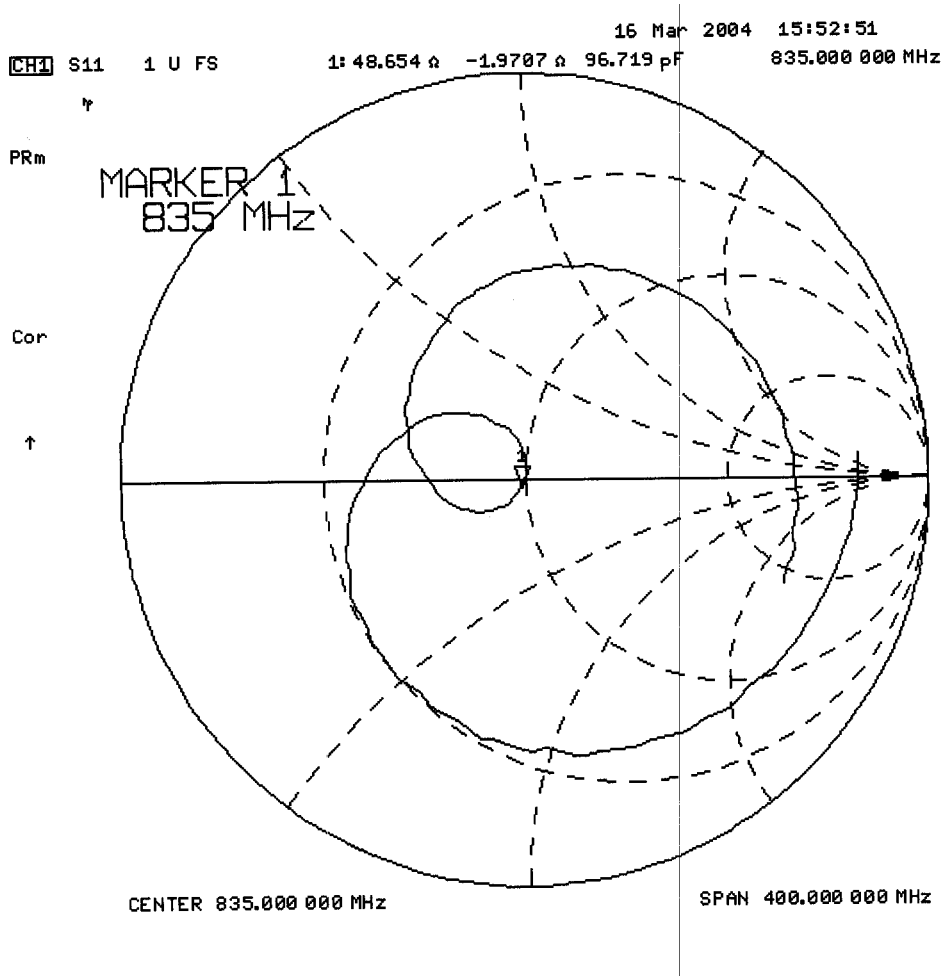
Celltech Labs Inc. 1955 Moss Court, Kelowna, B.C. Canada V1Y 9L3
Tel. 250-448-7047 • Fax. 250-448-7046 • e-mail: info@celltechlabs.com
www.celltechlabs.com

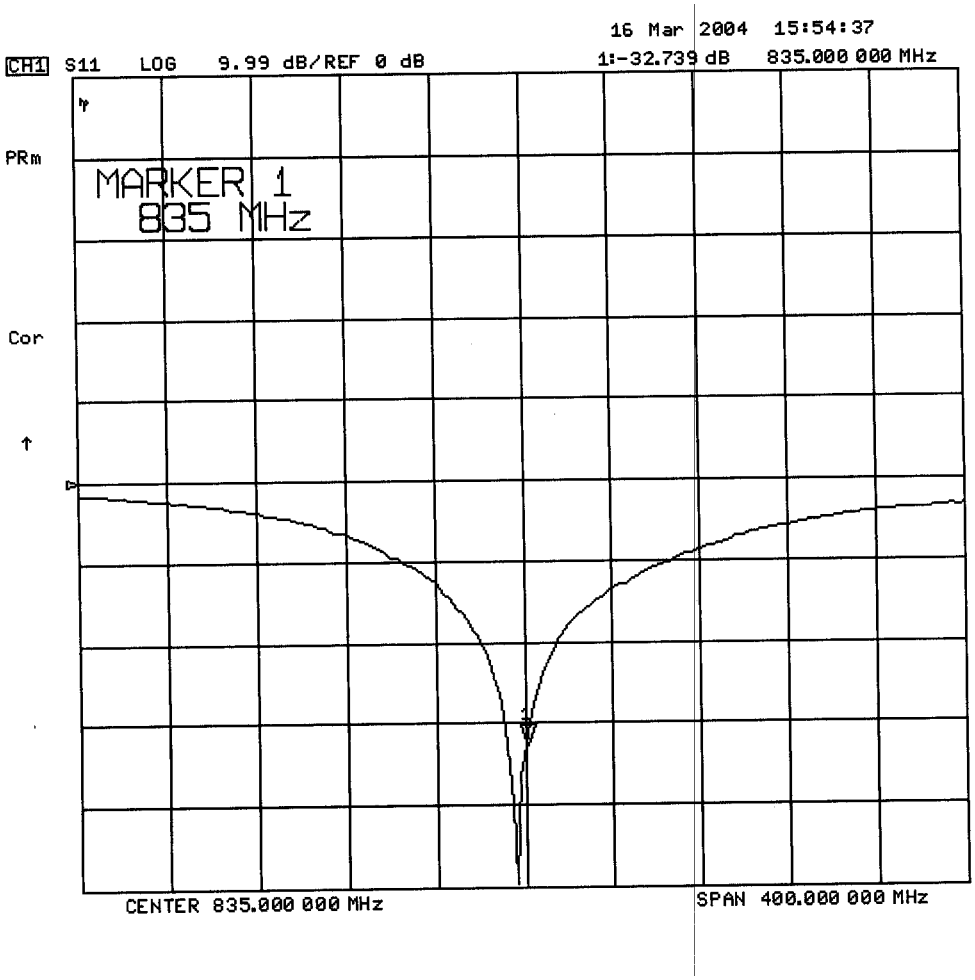
1. Dipole Construction & Electrical Characteristics

The validation dipole was constructed in accordance with the IEEE Standard "Annex G (informative) Reference dipoles for use in system validation". The electrical properties were measured using an HP 8753E Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector feed point using an HP85032E Type N calibration kit. The dipole was placed parallel to a planar phantom at a separation distance of 15.0mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

Feed point impedance at 835MHz	Re{Z} = 48.654Ω
	Im{Z} = -1.9707Ω
Return Loss at 835MHz	-32.739dB




16 Mar 2004 15:52:51
CH1 S11 1 U FS
1: 48.654 Ω -1.9707 Ω 96.719 pF
835.000 000 MHz
PRm
MARKER 1
835 MHz
Cor
CENTER 835.000 000 MHz
SPAN 400.000 000 MHz


16 Mar 2004 15:54:37
CH1 S11 LOG 9.99 dB/REF 0 dB
1:-32.739 dB 835.000 000 MHz
PRm
MARKER 1
835 MHz
Cor
CENTER 835.000 000 MHz
SPAN 400.000 000 MHz

Validation Dipole Dimensions

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

2. Validation Phantom

The validation phantom is the SAM (Specific Anthropomorphic Mannequin) phantom manufactured by Schmid & Partner Engineering AG. The SAM phantom is a Fiberglass shell integrated in a wooden table. The shape of the shell corresponds to the phantom defined by SCC34-SC2. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

Shell Thickness: 2.0 ± 0.1 mm
Filling Volume: Approx. 20 liters
Dimensions: 50 cm (W) x 100 cm (L)

835 MHz System Validation Setup

835 MHz System Validation Setup

3. Measurement Conditions

The SAM phantom was filled with 835 MHz brain simulating tissue.

Relative Permittivity:	42.6
Conductivity:	0.94 mho/m
Ambient Temperature:	24.6 °C
Fluid Temperature:	21.9 °C
Fluid Depth:	≥ 15.0 cm
Barometric Pressure:	101.6 kPa
Humidity:	31%

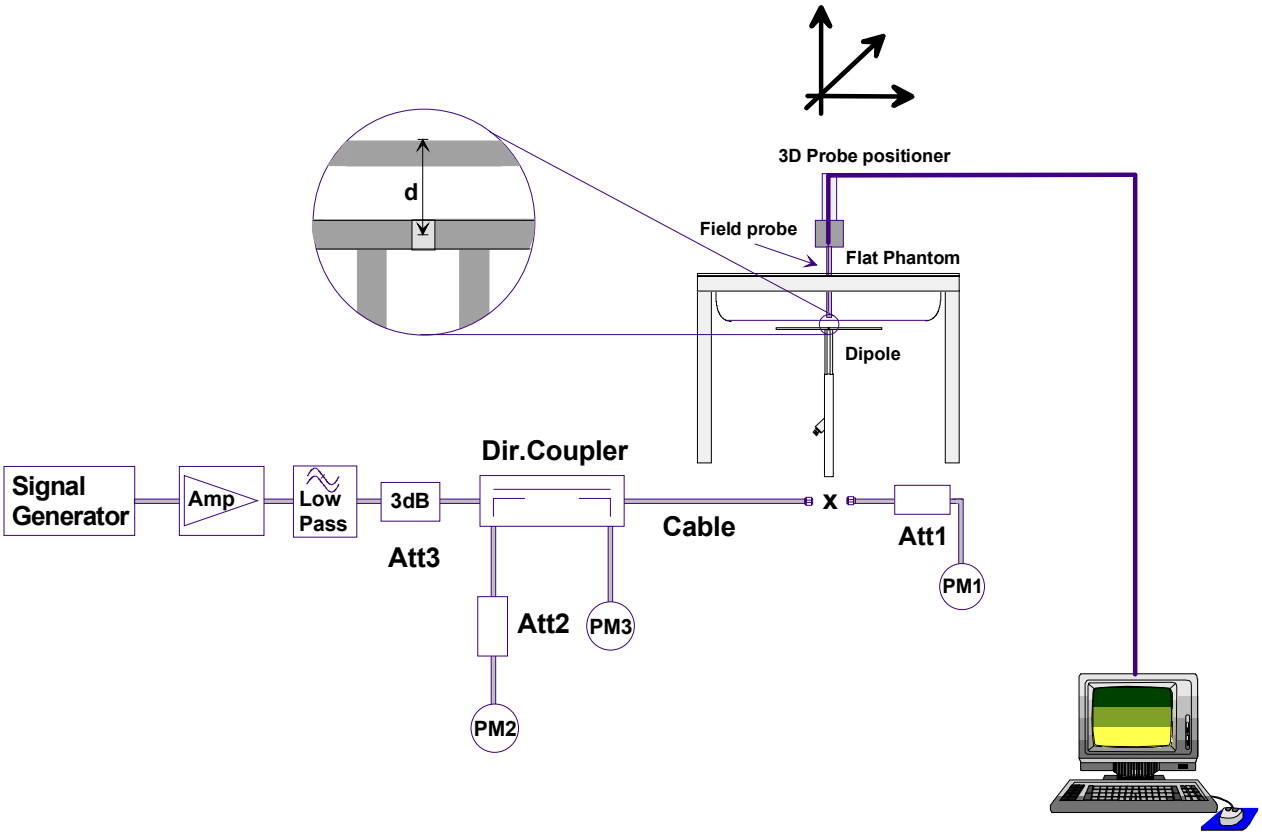
The 835 MHz simulating tissue consists of the following ingredients:

Ingredient	Percentage by weight
Water	40.71%
Sugar	56.63%
Salt	1.48%
HEC	0.99%
Dowicil 75	0.19%
Target Dielectric Parameters at 22 °C	ε_r = 41.5 σ = 0.90 S/m

Measurements were taken in the flat section of the SAM phantom using a dosimetric E-field probe ET3DV6 (s/n: 1590, conversion factor 7.0).

4. SAR Measurement

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



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

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

Validation Dipole SAR Test Results

Validation Measurement	SAR @ 0.25W Input averaged over 1g	SAR @ 1W Input averaged over 1g	SAR @ 0.25W Input averaged over 10g	SAR @ 1W Input averaged over 10g	Peak SAR @ 0.25W Input
Test 1	2.46	9.84	1.61	6.44	3.56
Test 2	2.45	9.80	1.60	6.40	3.56
Test 3	2.45	9.80	1.61	6.44	3.56
Test 4	2.44	9.76	1.60	6.40	3.55
Test 5	2.43	9.72	1.60	6.40	3.53
Test 6	2.44	9.76	1.60	6.40	3.53
Test 7	2.44	9.76	1.60	6.40	3.55
Test 8	2.44	9.76	1.60	6.40	3.54
Test 9	2.47	9.88	1.62	6.48	3.58
Test10	2.47	9.88	1.62	6.48	3.62
Average Value	2.45	9.80	1.61	6.42	3.56

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

Averaged over 1cm (1g) of tissue: 9.80 mW/g

Averaged over 10cm (10g) of tissue: 6.42 mW/g

835 MHz System Validation - March 16, 2004

DUT: Dipole 835 MHz; Type: D835V2; Serial: 411
Ambient Temp: 24.6°C; Fluid Temp: 21.9°C; Barometric Pressure: 101.6 kPa; Humidity: 31%

Communication System: CW
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL835 (σ = 0.94 mho/m; ε_r = 42.6; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(7, 7, 7); Calibrated: 15/05/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 19/12/2003
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.2 Build 37; Postprocessing SW: SEMCAD, V1.8 Build 109

835 MHz System Validation/Area Scan (6x10x1): Measurement grid: dx=10mm, dy=10mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB

835 MHz System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.56 W/kg
SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.61 mW/g

835 MHz System Validation/Zoom Scan 2 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.56 W/kg
SAR(1 g) = 2.45 mW/g; SAR(10 g) = 1.6 mW/g

835 MHz System Validation/Zoom Scan 3 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.56 W/kg
SAR(1 g) = 2.45 mW/g; SAR(10 g) = 1.61 mW/g

835 MHz System Validation/Zoom Scan 5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.55 W/kg
SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g

835 MHz System Validation/Zoom Scan 6 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.53 W/kg
SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.6 mW/g

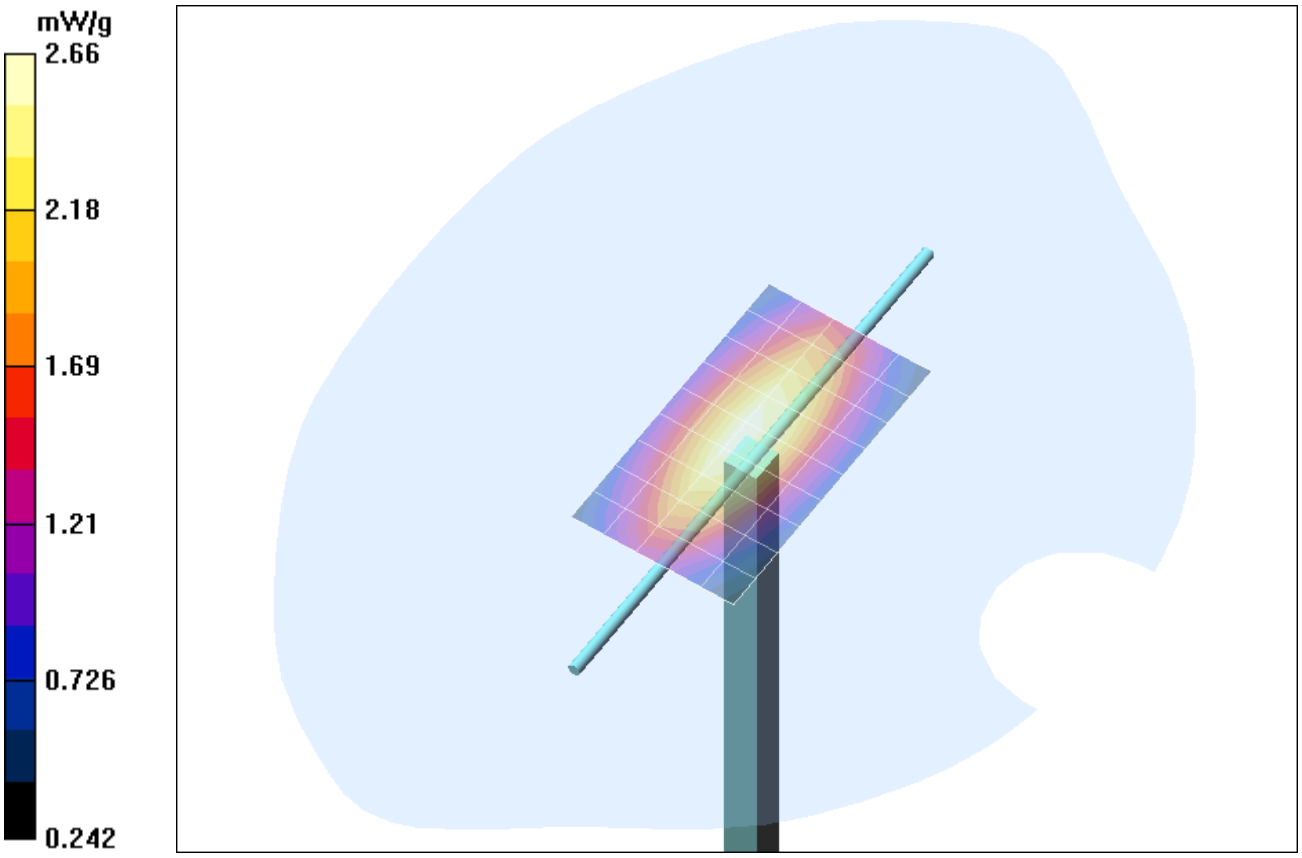
835 MHz System Validation/Zoom Scan 7 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.53 W/kg
SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g

835 MHz System Validation/Zoom Scan 8 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.55 W/kg
SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g

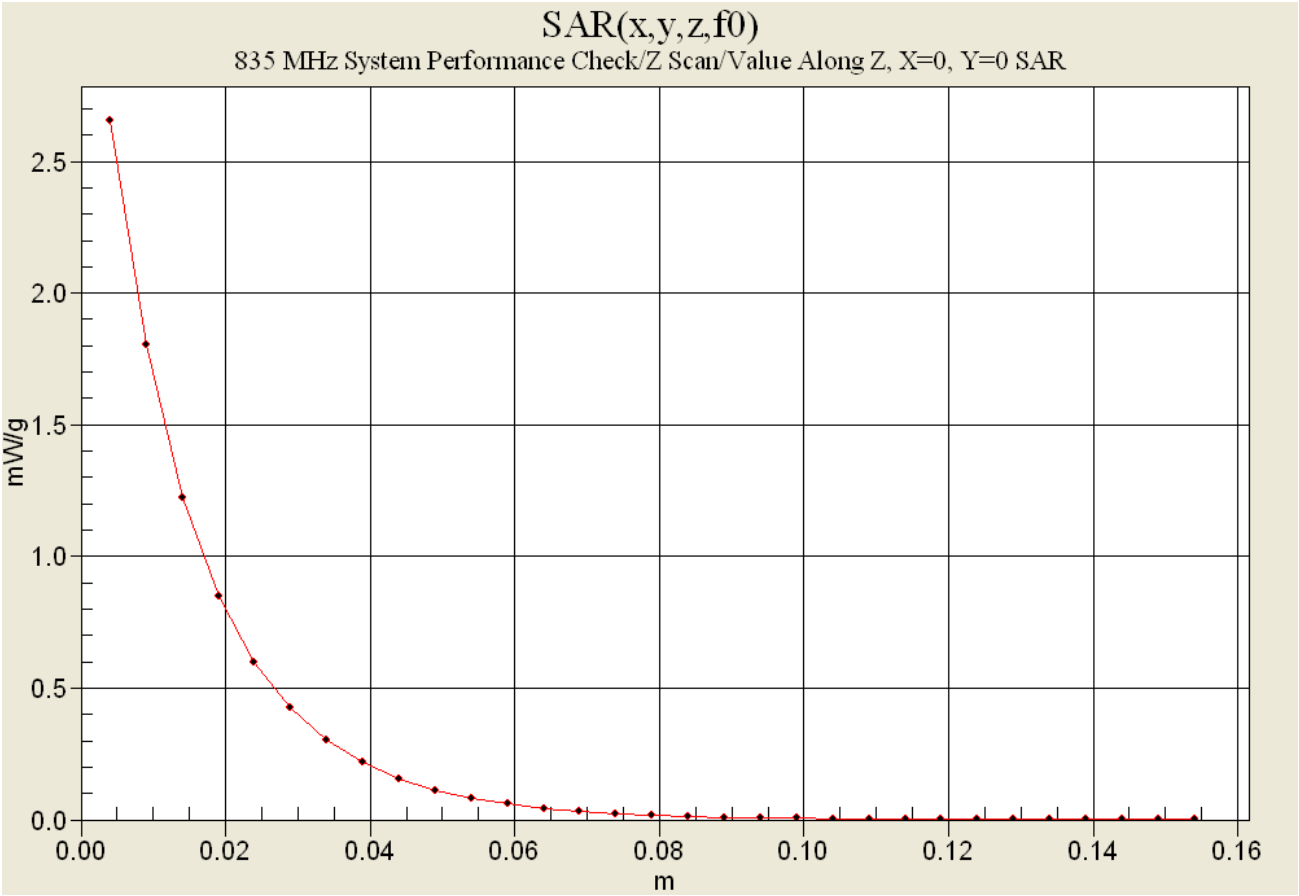
835 MHz System Validation/Zoom Scan 9 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.54 W/kg
SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g

835 MHz System Validation/Zoom Scan 11 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.58 W/kg
SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g

835 MHz System Validation/Zoom Scan 12 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.62 W/kg
SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g



1 g average of 10 measurements: 2.449 mW/g
10 g average of 10 measurements: 1.606 mW/g



835 MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

March 16, 2004

Frequency	e'	e"
735.000000 MHz	43.8577	20.6938
745.000000 MHz	43.6899	20.6481
755.000000 MHz	43.5341	20.5840
765.000000 MHz	43.4161	20.5576
775.000000 MHz	43.3026	20.5312
785.000000 MHz	43.2065	20.5122
795.000000 MHz	43.1067	20.5061
805.000000 MHz	43.0154	20.4762
815.000000 MHz	42.8927	20.4182
825.000000 MHz	42.7420	20.3806
835.000000 MHz	42.6206	20.2993
845.000000 MHz	42.4357	20.2595
855.000000 MHz	42.2984	20.1872
865.000000 MHz	42.1422	20.1432
875.000000 MHz	42.0082	20.1253
885.000000 MHz	41.8996	20.1110
895.000000 MHz	41.8514	20.0192
905.000000 MHz	41.7550	20.0083
915.000000 MHz	41.6535	19.9701
925.000000 MHz	41.5521	19.9380
935.000000 MHz	41.4477	19.9175

APPENDIX F - PROBE CALIBRATION

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

Client **Celltech Labs**

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1590
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	May 24, 2004
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

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: environ ment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E4419B	GB41293874	5-May-04 (METAS, No 251-00388)	May-05
Power sensor E4412A	MY41495277	5-May-04 (METAS, No 251-00388)	May-05
Reference 20 dB Attenuator	SN: 5086 (20b)	3-May-04 (METAS, No 251-00389)	May-05
Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-03)	In house check: Oct 05

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: May 24, 2004

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

Probe ET3DV6

SN:1590

Manufactured:	March 19, 2001
Last calibrated:	May 15, 2003
Recalibrated:	May 24, 2004

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1590

Sensitivity in Free Space

Diode Compression[A]

NormX	**1.85** $\mu V/(V/m)^2$	DCP X	**91**	mV
NormY	**2.01** $\mu V/(V/m)^2$	DCP Y	**91**	mV
NormZ	**1.73** $\mu V/(V/m)^2$	DCP Z	**91**	mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Plese see Page 7.

Boundary Effect

Head **900 MHz** **Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	8.0	4.4
SAR_{be} [%]	With Correction Algorithm	0.1	0.2

Head **1800 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	12.2	8.5
SAR_{be} [%]	With Correction Algorithm	0.2	0.1

Sensor Offset

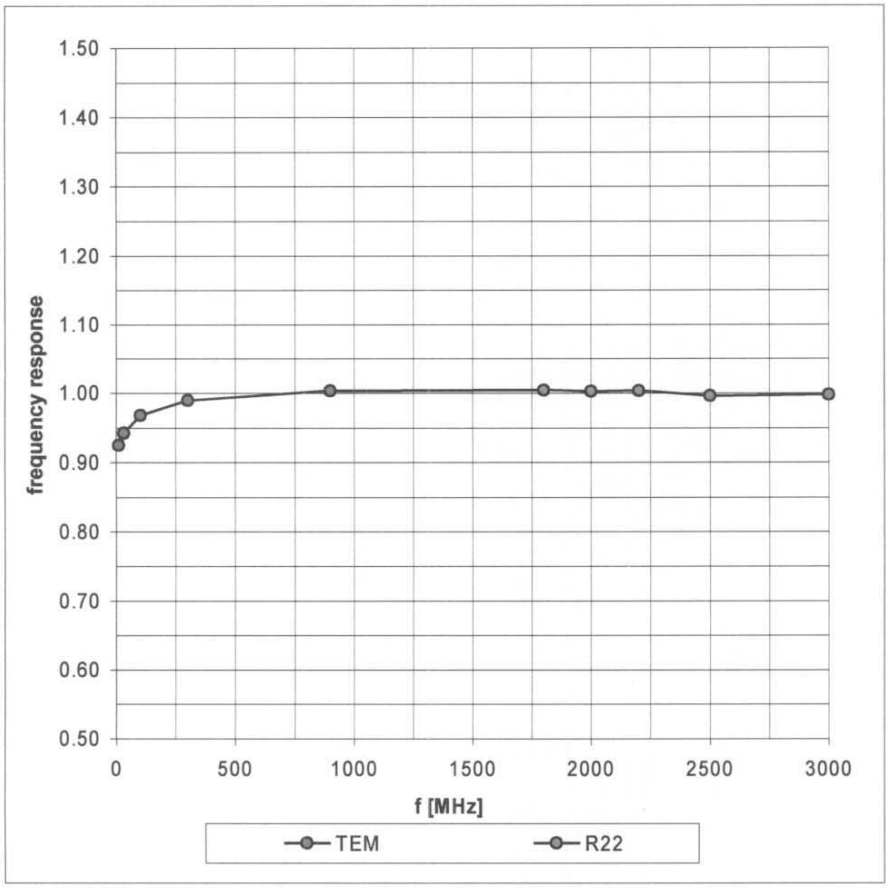
Probe Tip to Sensor Center	**2.7** mm
Optical Surface Detection	**in tolerance**

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%.

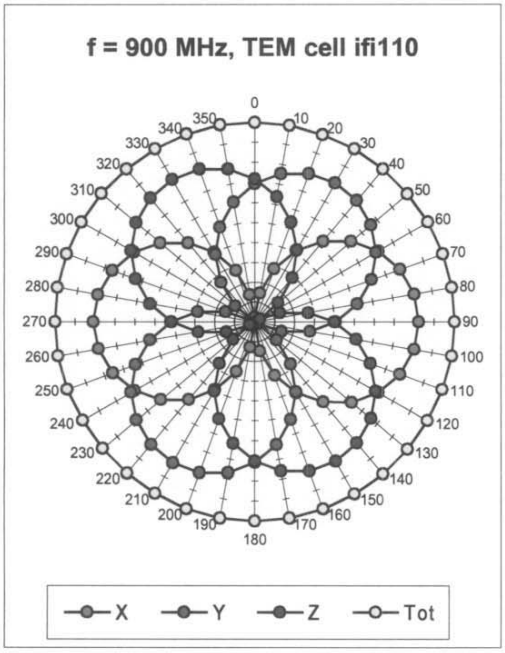
[A] numerical linearization parameter: uncertainty not required

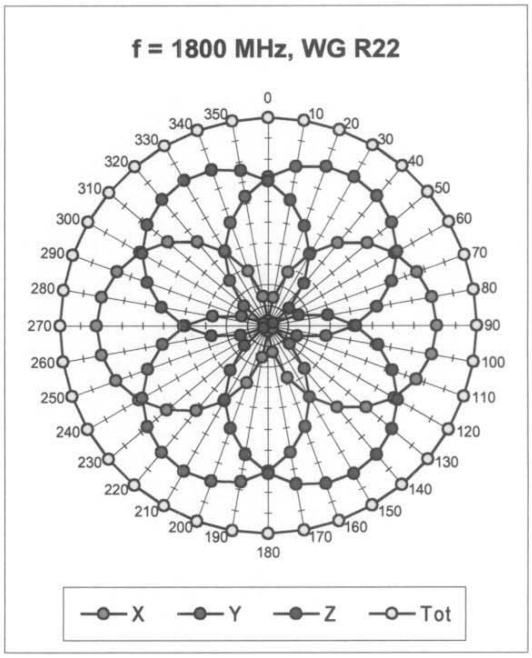
Frequency Response of E-Field

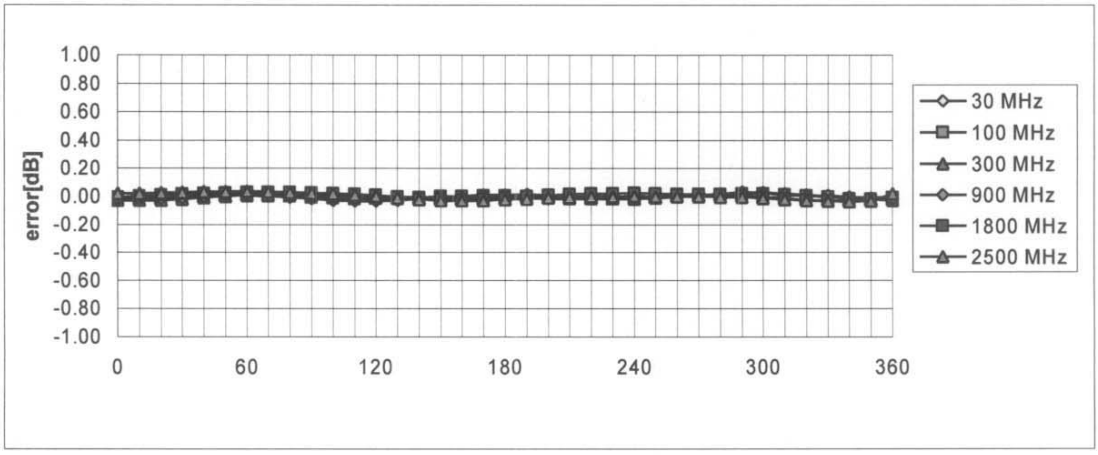
(TEM-Cell:ifi110, Waveguide R22)



Receiving Pattern (ϕ), θ = 0°



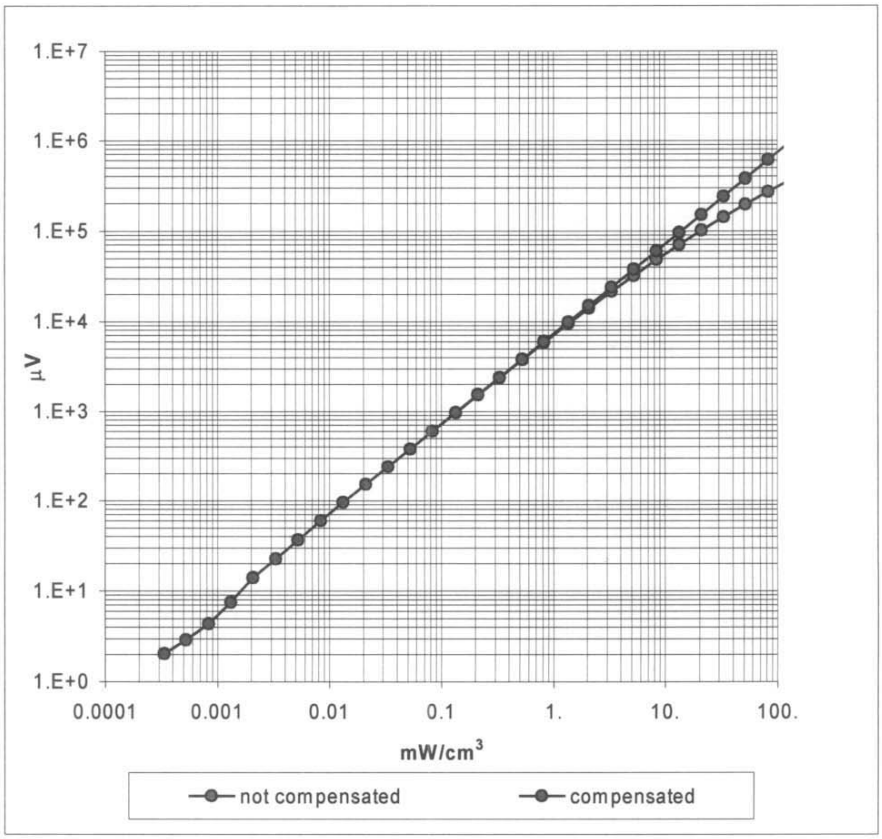


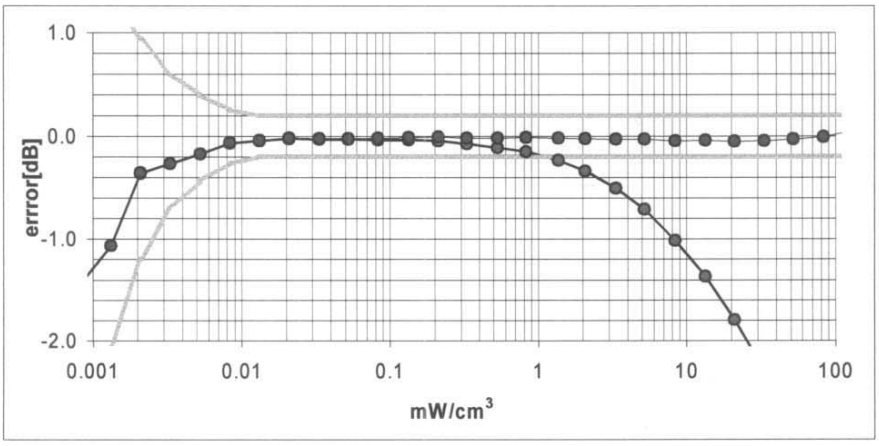


Axial Isotropy Error < ± 0.2 dB

Dynamic Range f(SAR_{head})

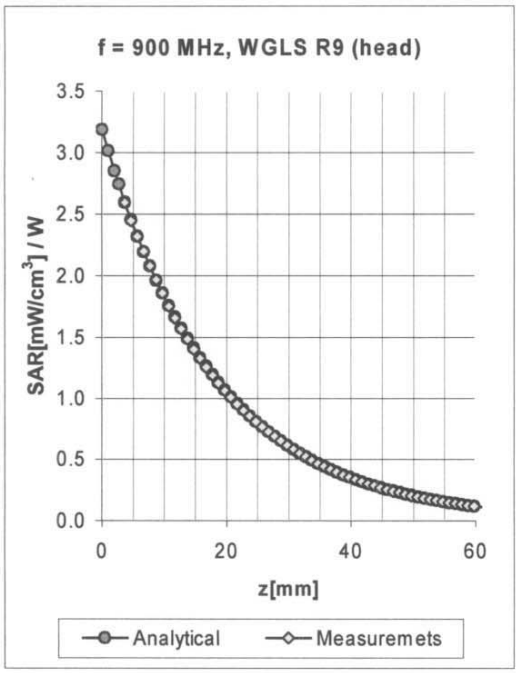
(Waveguide R22)

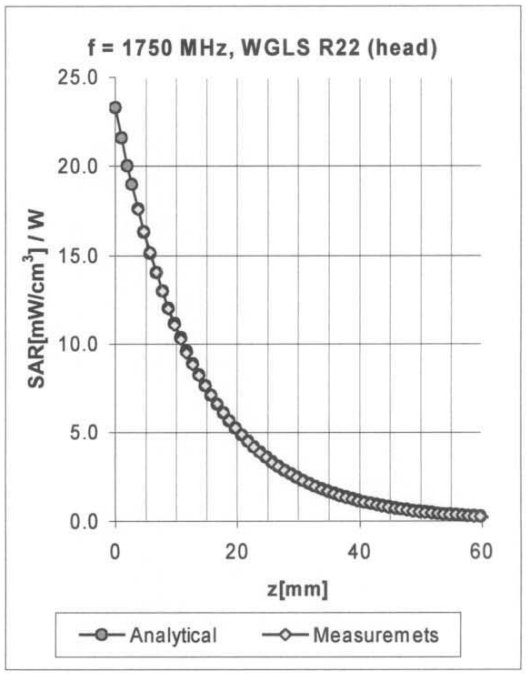




Probe Linearity Error < ± 0.2 dB

Conversion Factor Assessment



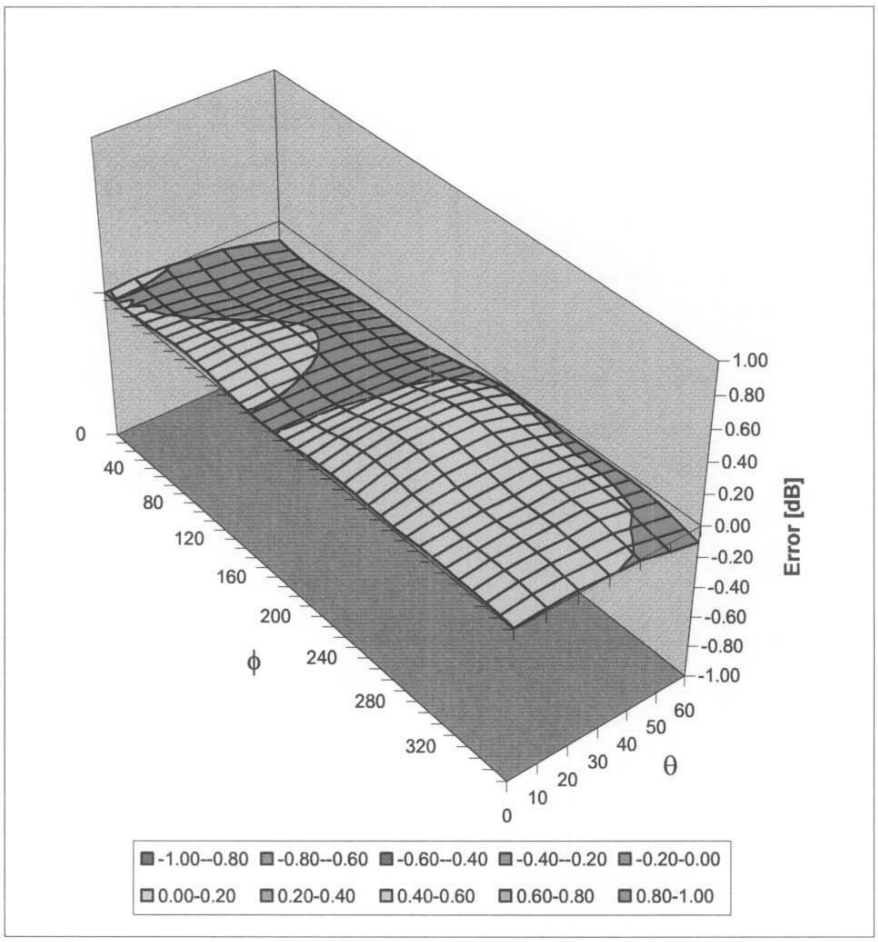


f [MHz]	Validity [MHz][B]	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	750-950	Head	41.5 ± 5%	0.90 ± 5%	0.68	1.64	6.71 ± 11.9% (k=2)
1750	1700-1800	Head	40.0 ± 5%	1.40 ± 5%	0.43	2.67	5.28 ± 9.7% (k=2)
1900	1850-1950	Head	40.0 ± 5%	1.40 ± 5%	0.46	2.81	5.03 ± 9.7% (k=2)
2450	2400-2500	Head	39.2 ± 5%	1.80 ± 5%	0.81	1.95	4.44 ± 9.7% (k=2)
835	750-950	Body	55.2 ± 5%	0.97 ± 5%	0.49	1.99	6.54 ± 11.9% (k=2)
1750	1700-1800	Body	53.3 ± 5%	1.52 ± 5%	0.50	2.87	4.68 ± 9.7% (k=2)
1900	1850-1950	Body	53.3 ± 5%	1.52 ± 5%	0.52	2.93	4.58 ± 9.7% (k=2)
2450	2400-2500	Body	52.7 ± 5%	1.95 ± 5%	0.91	1.78	4.22 ± 9.7% (k=2)

[B] The total standard uncertainty is calculated as root-sum-square of standard uncertainty of the Conversion Factor at calibration frequency and the standard uncertainty for the indicated frequency band.

Deviation from Isotropy in HSL

Error (θ, φ), f = 900 MHz



Spherical Isotropy Error < ± 0.4 dB

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s p e a g

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

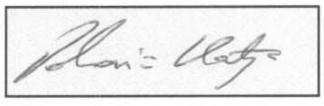
Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1590**
Place of Assessment:	**Zurich**
Date of Assessment:	**May 25, 2004**
Probe Calibration Date:	**May 24, 2004**

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

Assessed by:



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Dosimetric E-Field Probe ET3DV6 SN:1590

Conversion factor (± standard deviation)

150 MHz	ConvF	**9.1 ± 8%**	ε_r = **52.3 ± 5%** σ = **0.76 ± 5% mho/m** (head tissue)
300 MHz	ConvF	**7.9 ± 8%**	ε_r = **45.3 ± 5%** σ = **0.87 ± 5% mho/m** (head tissue)
450 MHz	ConvF	**7.5 ± 8%**	ε_r = **43.5 ± 5%** σ = **0.87 ± 5% mho/m** (head tissue)
150 MHz	ConvF	**8.8 ± 8%**	ε_r = **61.9 ± 5%** σ = **0.80 ± 5% mho/m** (body tissue)
450 MHz	ConvF	**7.7 ± 8%**	ε_r = **56.7 ± 5%** σ = **0.94 ± 5% mho/m** (body tissue)

Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

Please see also Section 4.7 of the DASY4 Manual.

APPENDIX G - SAM PHANTOM CERTIFICATE OF CONFORMITY

Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Certificate of conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 BA
Series No	TP-1002 and higher
Manufacturer / Origin	Untersee Composites Hauptstr. 69 CH-8559 Fruthwilen Switzerland

Tests

The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series units (called samples).

Test	Requirement	Details	Units tested
Shape	Compliance with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness	Compliant with the requirements according to the standards	2mm +/- 0.2mm in specific areas	First article, Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz – 3 GHz Relative permittivity < 5 Loss tangent < 0.05.	Material sample TP 104-5
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards	Liquid type HSL 1800 and others according to the standard.	Pre-series, First article

Standards

[1] CENELEC EN 50361
[2] IEEE P1528-200x draft 6.5
[3] IEC PT 62209 draft 0.9
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

Date 18.11.2001

Signature / Stamp Schmid & Partner Engineering AG
Zeughausstrasse 43, CH-8004 Zurich
Tel. +41 1 245 97 00, Fax +41 1 245 97 79