DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

Test Lab

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Applicant Information

KENWOOD USA CORPORATION
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FCC IDENTIFER:	**ALH34713130**
IC IDENTIFIER:	**282D-34713130**
Model(s):	**TK-3170-K3, TK-3170-K6**
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)**
Device Classification:	**Licensed Non-Broadcast Transmitter Held to Face (TNF)**
Device Description:	**Portable FM UHF PTT Radio Transceiver**
Modulation:	**FM (UHF)**
Tx Frequency Range:	**400 - 430 MHz**
Max. RF Output Power Measured:	**36.40 dBm Conducted (400.05 MHz)** **36.43 dBm Conducted (415.05 MHz)** **36.39 dBm Conducted (429.95 MHz)**
Antenna Type(s) Tested:	**Stubby 403 - 430 MHz (P/N: KRA-17M3)** **Whip 400 - 450 MHz (P/N: KRA-27M3)**
Battery Type(s) Tested:	**Alkaline 1.5 V AA x6 (Battery Case P/N: KBP-5)** **(1. Duracell Procell 2850 mAh, 2. Energizer E91 2850 mAh)** **Li-ion 7.4 V, 1400 mAh (P/N: KNB-35L)** **Li-ion 7.4 V, 1400 mAh (P/N: KNB-24L)** **NiCd 7.2 V, 1200 mAh (P/N: KNB-25A)** **NiMH 7.2 V, 2000 mAh (P/N: KNB-26N)**
Body-Worn Accessories Tested:	**Plastic Belt-Clip with Metal Spring (P/N: KBH-12)** **Speaker-Microphone (P/N: KMC-17)** **Headset (P/N: KHS-21)**
Max. SAR Levels Evaluated:	**Face-held: 3.63 W/kg (50% Duty Cycle)** **Body-worn: 6.80 W/kg (50% Duty Cycle)**

Celltech Labs Inc. declares under its sole responsibility that this wireless portable device has demonstrated compliance with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC 47 CFR §2.1093 and Health Canada's Safety Code 6. The device was tested in accordance with the measurement standards and procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01) and Industry Canada RSS-102 Issue 1 (Provisional) for the Occupational / Controlled 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:

Spencer Watson
Compliance Technologist
Celltech Labs Inc.

Reviewed By:

Russell W. Pipe
Senior Compliance Technologist
Celltech Labs Inc.

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1.0 INTRODUCTION

This measurement report demonstrates compliance of the Kenwood USA Corporation Models: TK-3170-K3, TK-3170-K6 Portable FM UHF PTT Radio Transceiver FCC ID: ALH34713130 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 Occupational / Controlled Exposure environment. The measurement 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 product, 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.

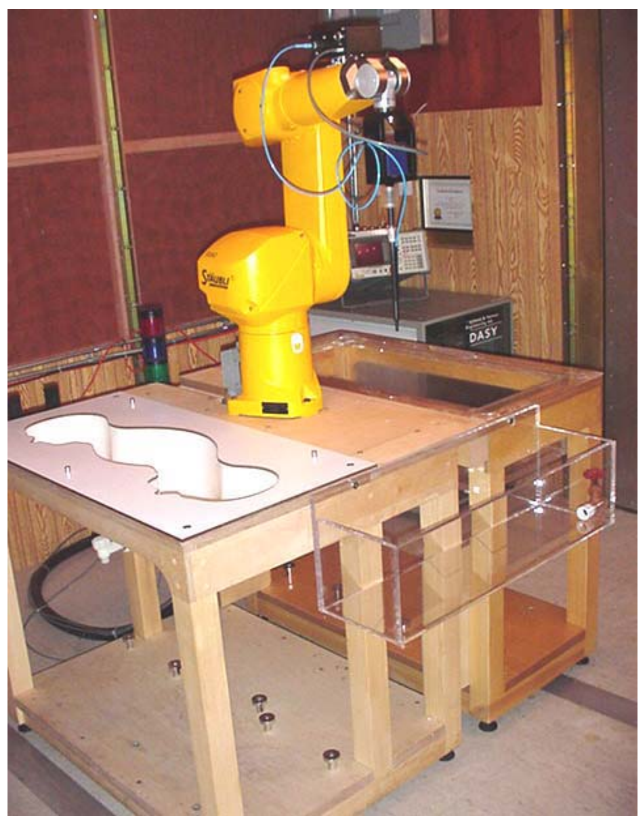
2.0 DESCRIPTION OF DEVICE UNDER TEST (DUT)

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)			
Device Classification	Licensed Non-Broadcast Transmitter Held to Face (TNF)			
Device Description	Portable FM UHF PTT Radio Transceiver			
FCC IDENTIFIER	ALH34713130			
IC IDENTIFIER	282D-34713130			
Model(s)	TK-3170-K3, TK-3170-K6			
Serial No.	1S-U3-19	Identical Prototype		
Modulation	FM (UHF)			
Tx Frequency Range	400 - 430 MHz			
Max. RF Output Power Measured	36.40 dBm	Conducted	400.05 MHz	
	36.43 dBm	Conducted	415.05 MHz	
	36.39 dBm	Conducted	429.95 MHz	
Antenna Type(s) Tested	Stubby	403 - 430 MHz	Length: 90 mm	P/N: KRA-17M3
	Whip	400 - 450 MHz	Length: 175 mm	P/N: KRA-27M3
Battery Type(s) Tested	Alkaline	1.5 V AA (x6)	Duracell 2850 mAh	Battery Case P/N: KBP-5
			Energizer 2850 mAh	
	Li-ion	7.4 V	1400 mAh	P/N: KNB-35L
	Li-ion	7.4 V	1400 mAh	P/N: KNB-24L
	NiCd	7.2 V	1200 mAh	P/N: KNB-25A
	NiMH	7.2 V	2000 mAh	P/N: KNB-26N
Body-Worn Accessories Tested	Plastic Belt-Clip (with Metal Spring)	P/N: KBH-12		
	Speaker-Microphone	P/N: KMC-17		
	Headset	P/N: KHS-21		

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 validation phantom



DASY4 SAR Measurement System with Plexiglas planar phantom

4.0 MEASUREMENT SUMMARY

FACE-HELD SAR EVALUATION RESULTS												
Freq. (MHz)	Chan.	Test Mode	Antenna Type	Antenna Part No.	Battery Type	Separation Distance to Planar Phantom (cm)	Cond. Power Before Test (dBm)	Measured SAR 1g (W/kg) Duty Cycle		SAR Drift During Test (dB)	Scaled SAR 1g (W/kg) Duty Cycle	
								100%	50%		100%	50%
415.05	Mid	CW	Stubby	KRA-17M3	KBP-5 Duracell	2.5	36.12	6.15	3.08	-0.695	7.22	3.61
415.05	Mid	CW	Stubby	KRA-17M3	KNB-35L Li-ion	2.5	36.37	7.26	3.63	0.0907	7.26	3.63
415.05	Mid	CW	Stubby	KRA-17M3	KNB-24L Li-ion	2.5	36.21	6.86	3.43	-0.0717	6.97	3.49
415.05	Mid	CW	Stubby	KRA-17M3	KNB-25A Ni-Cd	2.5	36.33	7.14	3.57	0.0659	7.14	3.57
415.05	Mid	CW	Stubby	KRA-17M3	KNB-26N Ni-MH	2.5	36.28	7.17	3.59	0.0642	7.17	3.59
415.05	Mid	CW	Whip	KRA-27M3	KBP-5 Duracell	2.5	36.16	4.42	2.21	-0.995	5.56	2.78
415.05	Mid	CW	Whip	KRA-27M3	KNB-35L Li-ion	2.5	36.31	4.81	2.41	-0.154	4.98	2.49
415.05	Mid	CW	Whip	KRA-27M3	KNB-24L Li-ion	2.5	36.26	4.54	2.27	-0.181	4.73	2.37
415.05	Mid	CW	Whip	KRA-27M3	KNB-25A Ni-Cd	2.5	36.34	4.94	2.47	0.0624	4.94	2.47
415.05	Mid	CW	Whip	KRA-27M3	KNB-26N Ni-MH	2.5	36.33	4.74	2.37	-0.156	4.91	2.46

ANSI / IEEE C95.1 1999 - SAFETY LIMIT
Spatial Peak - Controlled Exposure / Occupational
BRAIN: 8.0 W/kg (averaged over 1 gram)

Test Date	Oct 15, 2004			**Relative Humidity**	34	**%**
Measured Fluid Type	**450 MHz Brain**			**Atmospheric Pressure**	102.2	**KPa**
Dielectric Constant ε_r	**IEEE Target**		**Measured**	**Ambient Temperature**	24.2	**°C**
	43.5	**± 5%**	42.4	**Fluid Temperature**	23.4	**°C**
Conductivity **σ (mho/m)**	**IEEE Target**		**Measured**	**Fluid Depth**	≥ 15	**cm**
	0.87	**± 5%**	0.84	**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 scaled SAR levels at the mid channel (50% 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 power drifts measured by the DASY4 system for the duration of the SAR evaluations were added to the measured SAR levels to report scaled SAR results as shown in the above table.
4. The SAR evaluations were performed within 24 hours of the system performance check.

MEASUREMENT SUMMARY (Cont.)

BODY-WORN SAR EVALUATION RESULTS															
Test Date	Freq. (MHz)	Chan.	Test Mode	Antenna Type	Antenna Part No.	Battery Type	Body-worn Accessories	Separation Distance to Planar Phantom (cm)	Cond. Power Before Test (dBm)	Measured SAR 1g (W/kg) Duty Cycle		SAR Drift During Test (dB)	Scaled SAR 1g (W/kg) Duty Cycle	
										100%	50%		100%	50%
Oct-13	415.05	Mid	CW	Stubby	KRA-17M3	KBP-5 Duracell	Speaker-Mic Belt-Clip	1.0	36.09	9.97	4.99	-0.829	12.1	6.03
Oct-13	415.05	Mid	CW	Stubby	KRA-17M3	KNB-35L Li-ion	Speaker-Mic Belt-Clip	1.4	36.29	12.2	6.10	-0.190	12.7	6.37
Oct-13	415.05	Mid	CW	Stubby	KRA-17M3	KNB-24L Li-ion	Speaker-Mic Belt-Clip	1.4	36.30	11.9	5.95	-0.399	13.0	6.52
Oct-13	415.05	Mid	CW	Stubby	KRA-17M3	KNB-25A Ni-Cd	Speaker-Mic Belt-Clip	0.9	36.32	11.7	5.85	-0.291	12.5	6.26
Oct-13	415.05	Mid	CW	Stubby	KRA-17M3	KNB-26N Ni-MH	Speaker-Mic Belt-Clip	0.9	36.32	12.3	6.15	-0.320	13.2	6.62
Oct-13	400.05	Low	CW	Stubby	KRA-17M3	KNB-26N Ni-MH	Speaker-Mic Belt-Clip	0.9	36.40	6.62	3.31	0.285	6.62	3.31
Oct-13	429.95	High	CW	Stubby	KRA-17M3	KNB-26N Ni-MH	Speaker-Mic Belt-Clip	0.9	36.28	9.72	4.86	-0.702	11.4	5.71
Oct-13	415.05	Mid	CW	Stubby	KRA-17M3	KBP-5 Duracell	Headset Belt-Clip	1.0	36.05	9.49	4.75	-1.16	12.4	6.20
Oct-13	415.05	Mid	CW	Stubby	KRA-17M3	KNB-35L Li-ion	Headset Belt-Clip	1.4	36.34	11.5	5.75	-0.252	12.2	6.09
Oct-13	415.05	Mid	CW	Stubby	KRA-17M3	KNB-24L Li-ion	Headset Belt-Clip	1.4	36.25	10.8	5.40	-0.330	11.7	5.83
Oct-13	415.05	Mid	CW	Stubby	KRA-17M3	KNB-25A Ni-Cd	Headset Belt-Clip	0.9	36.35	12.5	6.25	-0.364	13.6	6.80
Oct-13	415.05	Mid	CW	Stubby	KRA-17M3	KNB-26N Ni-MH	Headset Belt-Clip	0.9	36.36	12.0	6.00	-0.343	13.0	6.49
Oct-14	400.05	Low	CW	Stubby	KRA-17M3	KNB-25A Ni-Cd	Headset Belt-Clip	0.9	36.40	7.23	3.62	0.338	7.23	3.62
Oct-14	429.95	High	CW	Stubby	KRA-17M3	KNB-25A Ni-Cd	Headset Belt-Clip	0.9	36.34	8.60	4.30	-0.652	9.99	5.00

ANSI / IEEE C95.1 1999 - SAFETY LIMIT
Spatial Peak - Controlled Exposure / Occupational
BODY: 8.0 W/kg (averaged over 1 gram)

Test Date(s)	Oct-13, 2004			Oct-14, 2004			Test Date(s)	Oct-13	Oct-14	Unit
Measured Fluid Type	450 MHz Body			450 MHz Body			Relative Humidity	32	36	%
Dielectric Constant ε_r	IEEE Target		Measured	IEEE Target		Measured	Atmospheric Pressure	103.7	103.0	kPa
	56.7	± 5%	57.1	56.7	± 5%	57.9	Ambient Temperature	24.2	24.3	°C
Conductivity σ (mho/m)	450 MHz Body			450 MHz Body			Fluid Temperature	23.1	23.6	°C
	IEEE Target		Measured	IEEE Target		Measured	Fluid Depth	≥ 15	≥ 15	cm
	0.94	± 5%	0.92	0.94	± 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 scaled SAR levels at the mid channel (50% 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 power drifts measured by the DASY4 system for the duration of the SAR evaluations were added to the measured SAR levels to report scaled SAR results as shown in the above table.
4. A SAR-versus-Time power drift evaluation was performed in the test configuration that reported the maximum-scaled SAR level (body-worn, mid channel, Ni-Cd Battery, Stubby Antenna, with Headset and Belt-Clip accessories). See Appendix A (SAR Test Plots) for SAR-versus-Time power drift evaluation plot.
5. The SAR evaluations were performed within 24 hours of the system performance check.

MEASUREMENT SUMMARY (Cont.)

BODY-WORN SAR EVALUATION RESULTS

Test Date	Freq. (MHz)	Chan.	Test Mode	Antenna Type	Antenna Part No.	Battery Type	Body-worn Accessories	Separation Distance to Planar Phantom (cm)	Cond. Power Before Test (dBm)	Measured SAR 1g (W/kg) Duty Cycle 100%	Measured SAR 1g (W/kg) Duty Cycle 50%	SAR Drift During Test (dB)	Scaled SAR 1g (W/kg) Duty Cycle 100%	Scaled SAR 1g (W/kg) Duty Cycle 50%
Oct-14	415.05	Mid	CW	Whip	KRA-27M3	KBP-5 Duracell	Speaker-Mic Belt-Clip	1.0	36.02	7.07	3.54	-1.09	9.09	4.54
Oct-14	415.05	Mid	CW	Whip	KRA-27M3	KNB-35L Li-ion	Speaker-Mic Belt-Clip	1.4	36.43	8.09	4.05	0.473	8.09	4.05
Oct-14	415.05	Mid	CW	Whip	KRA-27M3	KNB-24L Li-ion	Speaker-Mic Belt-Clip	1.4	36.24	6.82	3.41	-0.387	7.46	3.73
Oct-14	415.05	Mid	CW	Whip	KRA-27M3	KNB-25A Ni-Cd	Speaker-Mic Belt-Clip	0.9	36.42	7.85	3.93	-0.328	8.47	4.23
Oct-14	415.05	Mid	CW	Whip	KRA-27M3	KNB-26N Ni-MH	Speaker-Mic Belt-Clip	0.9	36.38	8.54	4.27	-0.376	9.31	4.66
Oct-14	400.05	Low	CW	Whip	KRA-27M3	KNB-26N Ni-MH	Speaker-Mic Belt-Clip	0.9	36.37	6.92	3.46	-0.304	7.42	3.71
Oct-14	429.05	High	CW	Whip	KRA-27M3	KNB-26N Ni-MH	Speaker-Mic Belt-Clip	0.9	36.39	9.13	4.57	-0.441	10.1	5.05
Oct-14	415.05	Mid	CW	Whip	KRA-27M3	KBP-5 Duracell	Headset Belt-Clip	1.0	36.01	7.14	3.57	-1.01	9.01	4.50
Oct-14	415.05	Mid	CW	Whip	KRA-27M3	KNB-35L Li-ion	Headset Belt-Clip	1.4	36.41	6.94	3.47	-0.0567	7.03	3.52
Oct-14	415.05	Mid	CW	Whip	KRA-27M3	KNB-24L Li-ion	Headset Belt-Clip	1.4	36.33	6.84	3.42	-0.129	7.05	3.52
Oct-14	415.05	Mid	CW	Whip	KRA-27M3	KNB-25A Ni-Cd	Headset Belt-Clip	0.9	36.39	8.56	4.28	-0.115	8.79	4.39
Oct-14	415.05	Mid	CW	Whip	KRA-27M3	KNB-26N Ni-MH	Headset Belt-Clip	0.9	36.39	8.00	4.00	-0.281	8.53	4.27
Oct-15	400.05	Low	CW	Whip	KRA-27M3	KBP-5 Duracell	Headset Belt-Clip	1.0	36.12	6.01	3.01	-0.877	7.35	3.68
Oct-15	429.95	High	CW	Whip	KRA-27M3	KBP-5 Duracell	Headset Belt-Clip	1.0	36.07	8.07	4.04	-0.958	10.1	5.03
Oct-15	415.05	Mid	CW	Stubby	KRA-17M3	KBP-5 Energizer*	Headset Belt-Clip	1.0	36.09	9.83	4.92	-1.28	13.2	6.60

ANSI / IEEE C95.1 1999 - SAFETY LIMIT
Spatial Peak - Controlled Exposure / Occupational
BODY: 8.0 W/kg (averaged over 1 gram)

Test Date(s)	October 14, 2004			October 15, 2004			Test Date(s)	Oct-14	Oct-15	Unit
Measured Fluid Type	450 MHz Body			450 MHz Body			Relative Humidity	36	36	%
Dielectric Constant ε_r	IEEE Target		Measured	IEEE Target		Measured	Atmospheric Pressure	103.0	102.4	KPa
	56.7	± 5%	57.9	56.7	± 5%	56.5	Ambient Temperature	24.3	23.0	°C
Conductivity σ (mho/m)	450 MHz Body			450 MHz Body			Fluid Temperature	23.6	23.3	°C
	IEEE Target		Measured	IEEE Target		Measured	Fluid Depth	≥ 15	≥ 15	cm
	0.94	± 5%	0.93	0.94	± 5%	0.90	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 scaled SAR levels at the mid channel (50% 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 power drifts measured by the DASY4 system for the duration of the SAR evaluations were added to the measured SAR levels to report scaled SAR results as shown in the above table.
4. The SAR evaluations were performed within 24 hours of the system performance check.

* The DUT was evaluated for SAR with Duracell Procell alkaline batteries. To report a SAR comparison between alternate alkaline battery types, the maximum scaled SAR level configuration evaluated with Duracell Procell alkaline batteries (Mid Channel, Stubby Antenna, with Headset audio accessory, tested on October 13, 2004) was repeated using Energizer E91 alkaline batteries as shown in the above table.

5.0 DETAILS OF SAR EVALUATION

The Kenwood USA Corporation Models: TK-3170-K3, TK-3170-K6 Portable FM UHF PTT Radio Transceiver FCC ID: ALH34713130 was compliant for localized Specific Absorption Rate (Occupational / Controlled Exposure) based on the test provisions and conditions described below. The detailed test setup photographs are shown in Appendix F.

1. The DUT was evaluated in a face-held configuration with the front of the radio placed parallel to the outer surface of the planar phantom. A 2.5 cm separation distance was maintained between the front side of the DUT and the outer surface of the planar phantom for the duration of the tests.
2. The DUT was evaluated in a body-worn configuration with the back of the radio placed parallel to the outer surface of the planar phantom. The attached belt-clip accessory was touching the planar phantom. With the Alkaline Battery Case the belt-clip accessory provided a 1.0 cm separation distance between the back of the DUT and the outer surface of the planar phantom. With the Li-ion battery the belt-clip accessory provided a 1.4 cm separation distance between the back of the DUT and the outer surface of the planar phantom. With the NiCd and NiMH batteries, the belt-clip accessory provided a 0.9 cm separation distance between the back of the DUT and the outer surface of the planar phantom. The DUT was evaluated for body-worn SAR with the speaker-microphone and headset audio accessories connected.
3. The conducted power levels were measured before each test using a Gigatronics 8652A Universal Power Meter according to the procedures described in FCC 47 CFR §2.1046. It was noted that the power levels measured with the alkaline batteries resulted in up to 10% lower conducted power levels than with the Li-ion, NiMH, and NiCd batteries. The power measurement procedure was consistent for all battery types and measurement durations, therefore it was determined that the power measurements taken with alkaline batteries were reporting a worst-case conducted power level.
4. A SAR-versus-Time power drift evaluation was performed in the test configuration that reported the highest scaled SAR level (Body-Worn, Mid Channel, Stubby Antenna, NiCd Battery, Headset audio accessory). See Appendix A (SAR Test Plots) for SAR-versus-Time power drift evaluation plot.
5. The area scan evaluation was performed with a fully charged battery. After the area scan was completed the radio was cooled down to room temperature and the battery was replaced with a fully charged battery prior to the zoom scan evaluation.
6. The DUT was tested in unmodulated continuous transmit operation (Continuous Wave mode at 100% duty cycle) with the transmit key constantly depressed. For a push-to-talk device the 50% duty cycle compensation reported assumes a transmit/receive cycle of equal time base.
7. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluation. The temperatures reported were consistent for all measurement periods.
8. The dielectric parameters of the simulated tissue mixture were measured prior to the evaluation using an HP 85070C Dielectric Probe Kit and an HP 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters).
9. The SAR evaluations were performed using a Plexiglas planar phantom.
10. A stack of low-density, low-loss dielectric foamed polystyrene was used in place of the device holder.

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 (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.

7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation a system check was performed using a planar phantom with a 450MHz dipole (see Appendix C for system validation procedure). The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using an HP 85070C Dielectric Probe Kit and an HP 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters). A forward power of 250mW was applied to the dipole and the system was verified to a tolerance of ±10% (see Appendix B for system performance check test plots).

SYSTEM PERFORMANCE CHECK

Test Date	450MHz 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						
10/13/04	**Brain**	**1.23** (±10%)	1.29 (+4.9%)	**43.5 ±5%**	42.9	**0.87 ±5%**	0.87	1000	24.4	23.5	≥ 15	34	103.8
10/14/04	**Brain**	**1.23** (±10%)	1.28 (+4.1%)	**43.5 ±5%**	44.1	**0.87 ±5%**	0.88	1000	23.9	23.7	≥ 15	36	103.0
10/15/04	**Brain**	**1.23** (±10%)	1.24 (+0.8%)	**43.5 ±5%**	42.4	**0.87 ±5%**	0.84	1000	24.3	23.4	≥ 15	38	102.3

Note(s):
1. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the system performance check. The temperatures listed in the table above were consistent for all measurement periods.

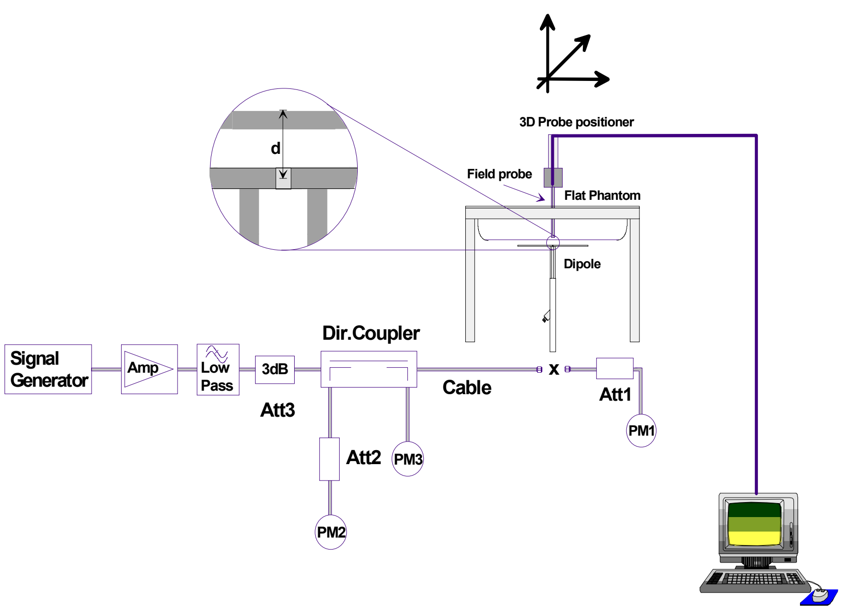
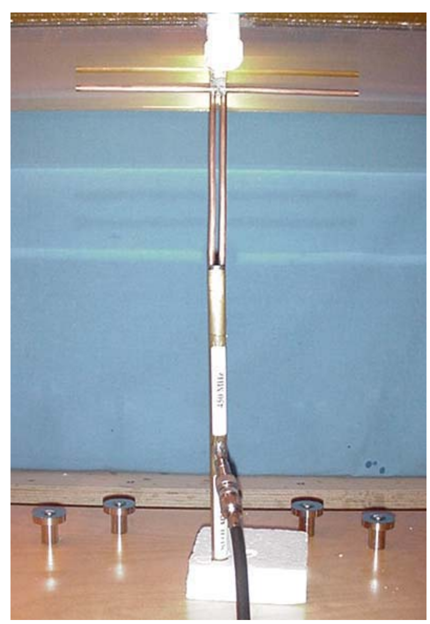


Figure 1. System Performance Check Setup Diagram



450MHz Dipole Setup

8.0 SIMULATED EQUIVALENT TISSUES

The 450MHz 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 and measured for dielectric parameters (permittivity and conductivity) according to standardized procedures.

SIMULATED TISSUE MIXTURES		
INGREDIENT	**450 MHz Brain (System Check & DUT Evaluation)**	**450 MHz Body (DUT Evaluation)**
Water	38.56 %	52.00 %
Sugar	56.32 %	45.65 %
Salt	3.95 %	1.75 %
HEC	0.98 %	0.50 %
Bactericide	0.19 %	0.10 %

9.0 SAR SAFETY LIMITS

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

Evaluation Phantom

Type:	Planar Phantom
Shell Material:	Plexiglas
Bottom Thickness:	2.0 mm ± 0.1 mm
Outer Dimensions:	75.0 cm (L) x 22.5 cm (W) x 20.5 cm (H); Back Plane: 25.7 cm (H)

Validation Phantom (≤ 450MHz)

Type:	Planar Phantom
Shell Material:	Plexiglas
Bottom Thickness:	6.2 mm ± 0.1 mm
Outer Dimensions:	86.0 cm (L) x 39.5 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, 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 μW/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 PLANAR PHANTOM

The 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 planar phantom is mounted on the side of the DASY4 compact system table.

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 in the table of the DASY4 compact system.

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	SERIAL NO.	CALIBRATION DATE
Schmid & Partner DASY4 System	-	-
DASY4 Measurement Server	1078	N/A
-Robot	599396-01	N/A
DAE3	353	Dec 2003
DAE3	370	May 2004
-ET3DV6 E-Field Probe	1387	Mar 2004
-ET3DV6 E-Field Probe	1590	May 2004
-300MHz Validation Dipole	135	Oct 2004
-450MHz Validation Dipole	136	Nov 2003
-835MHz Validation Dipole	411	Mar 2004
-900MHz Validation Dipole	054	June 2004
-1800MHz Validation Dipole	247	June 2004
-1900MHz Validation Dipole	151	June 2004
-2450MHz Validation Dipole	150	Sept 2004
-SAM Phantom V4.0C	1033	N/A
-Barski Planar Phantom	03-01	N/A
-Plexiglas Planar Phantom	161	N/A
-Validation Planar Phantom	137	N/A
HP 85070C Dielectric Probe Kit	N/A	N/A
Gigatronics 8651A Power Meter	8650137	April 2004
Gigatronics 8652A Power Meter	1835267	April 2004
Gigatronics 80701A Power Sensor	1833535	April 2004
Gigatronics 80701A Power Sensor	1833542	April 2004
Gigatronics 80701A Power Sensor	1834350	April 2004
HP E4408B Spectrum Analyzer	US39240170	Dec 2003
HP 8594E Spectrum Analyzer	3543A02721	April 2004
HP 8753E Network Analyzer	US38433013	April 2004
HP 8648D Signal Generator	3847A00611	April 2004
Amplifier Research 5S1G4 Power Amplifier	26235	N/A

16.0 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	± 4.0	Normal	1	1	± 4.0	∞
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					**± 13.03**	
Expanded Uncertainty (k=2)					**± 26.07**	

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	± 4.0	Normal	1	1	± 4.0	∞
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					**± 9.58**	
Expanded Uncertainty (k=2)					**± 19.16**	

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

17.0 REFERENCES

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

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

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

APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 10/13/04

System Performance Check - 450 MHz Dipole

DUT: Dipole 450 MHz; Model: D450V2; Type: System Performance Check; Serial: 136; Calibrated: 11/04/2003

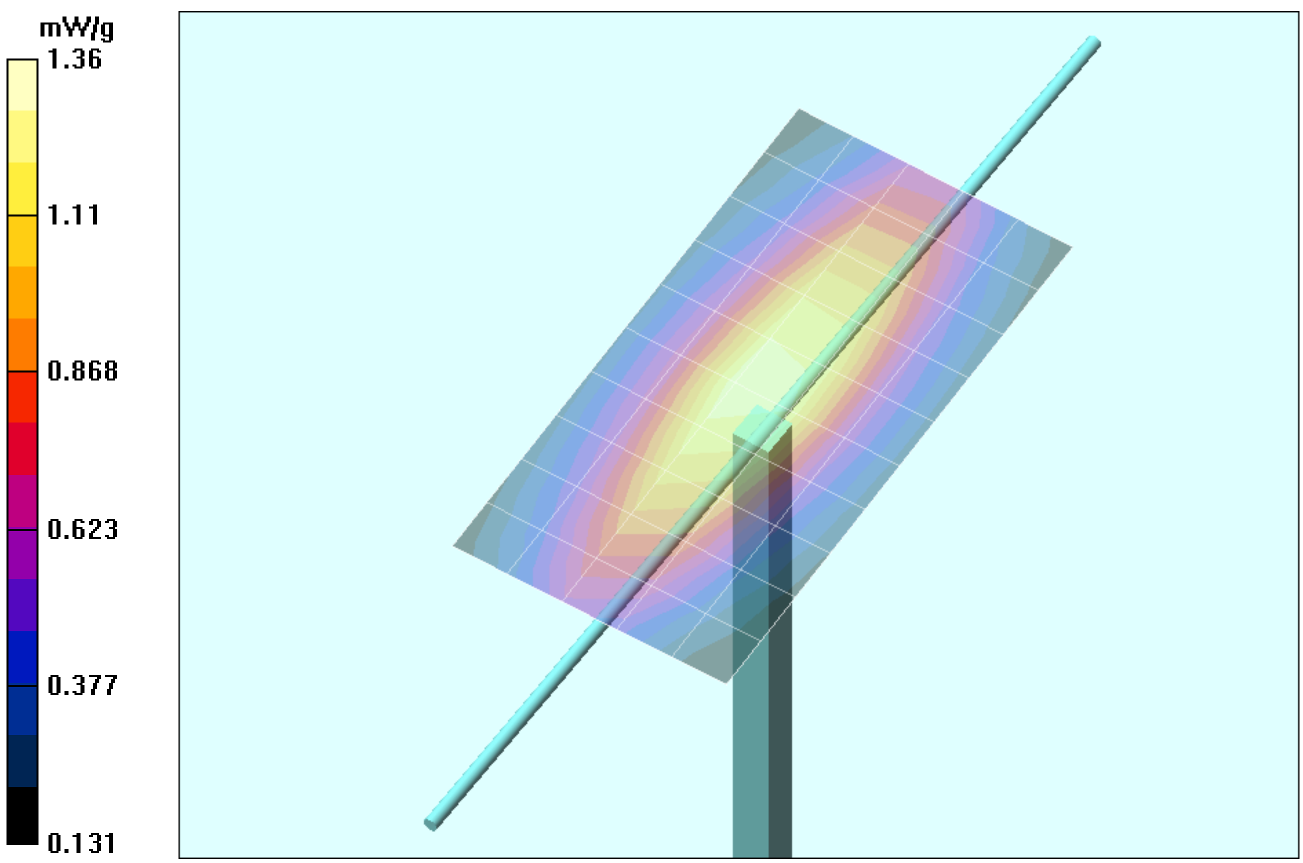
Ambient Temp: 24.4 °C; Fluid Temp: 23.5 °C; Barometric Pressure: 103.8 kPa; Humidity: 34%

Communication System: CW
Forward Conducted Power: 250mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.87 mho/m; ε_r = 42.9; ρ = 1000 kg/m^3)

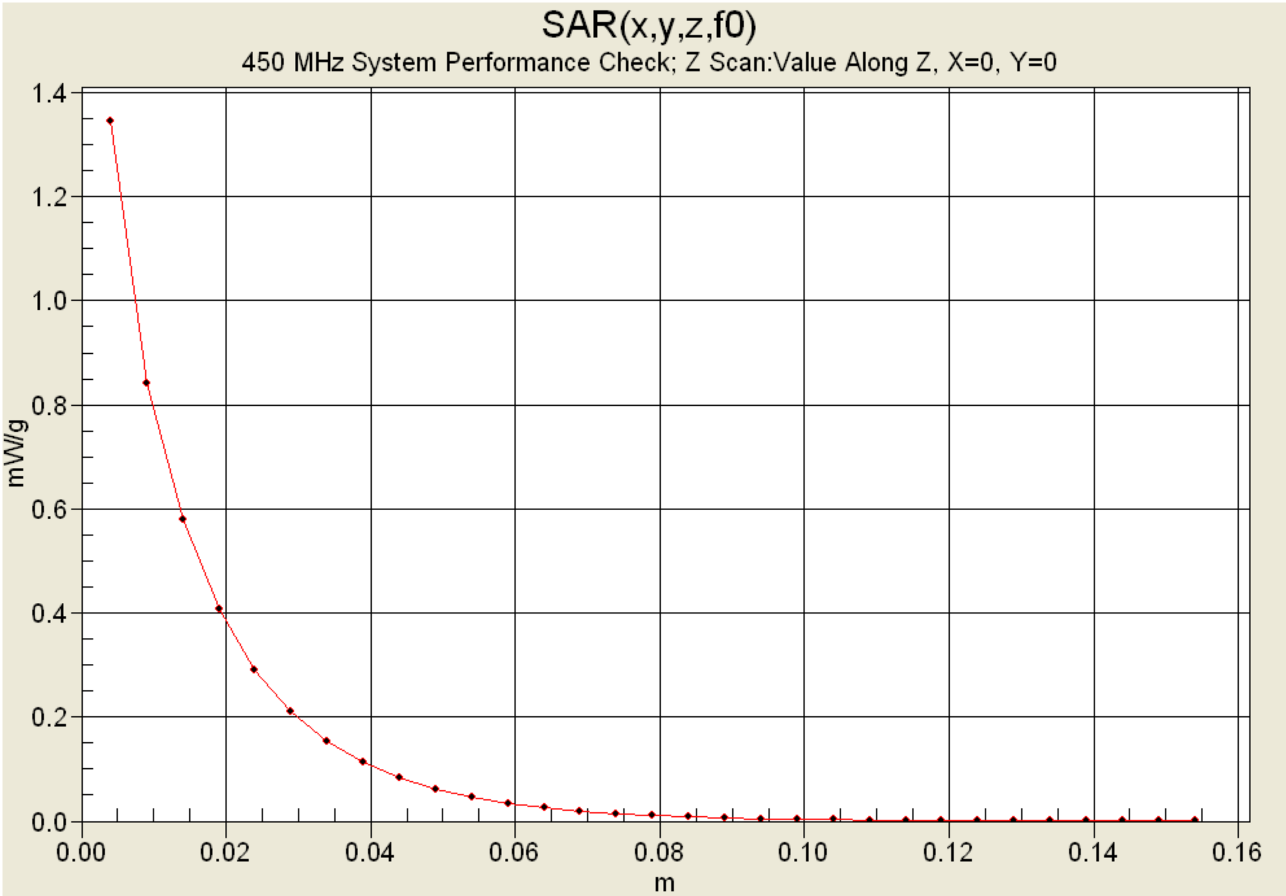
- Probe: ET3DV6 - SN1590; ConvF(7.5, 7.5, 7.5); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

450 MHz System Performance Check/Area Scan (6x11x1):
Measurement grid: dx=15mm, dy=15mm

450 MHz System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.7 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 2.19 W/kg
SAR(1 g) = 1.29 mW/g; SAR(10 g) = 0.833 mW/g



Z-Axis Scan


SAR(x,y,z,f0)
450 MHz System Performance Check; Z Scan:Value Along Z, X=0, Y=0
mW/g
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

Date Tested: 10/14/04

System Performance Check - 450 MHz Dipole

DUT: Dipole 450 MHz; Model: D450V2; Type: System Performance Check; Serial: 136; Calibrated: 11/04/2003

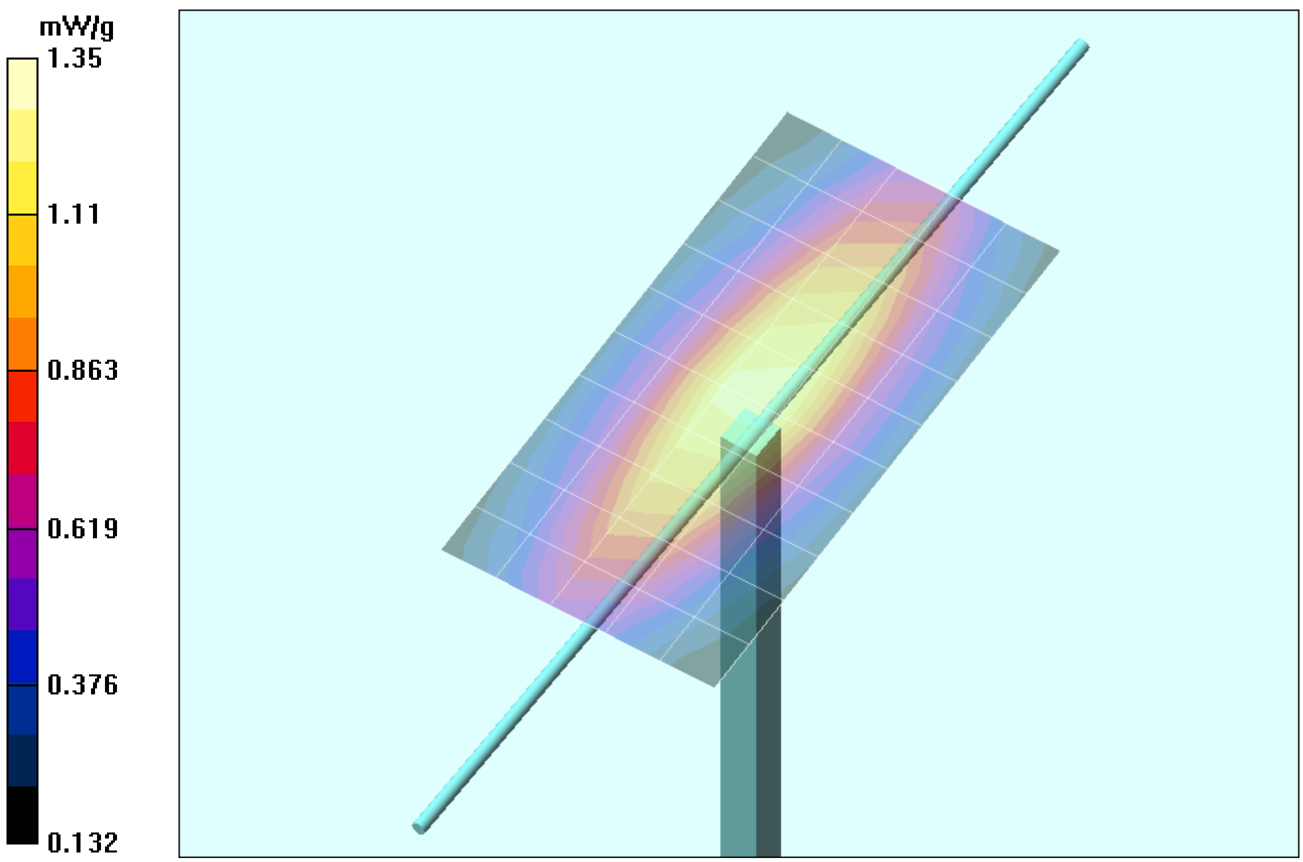
Ambient Temp: 23.9 °C; Fluid Temp: 23.7 °C; Barometric Pressure: 103.0 kPa; Humidity: 36%

Communication System: CW
Forward Conducted Power: 250mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.88 mho/m; ε_r = 44.1; ρ = 1000 kg/m^3)

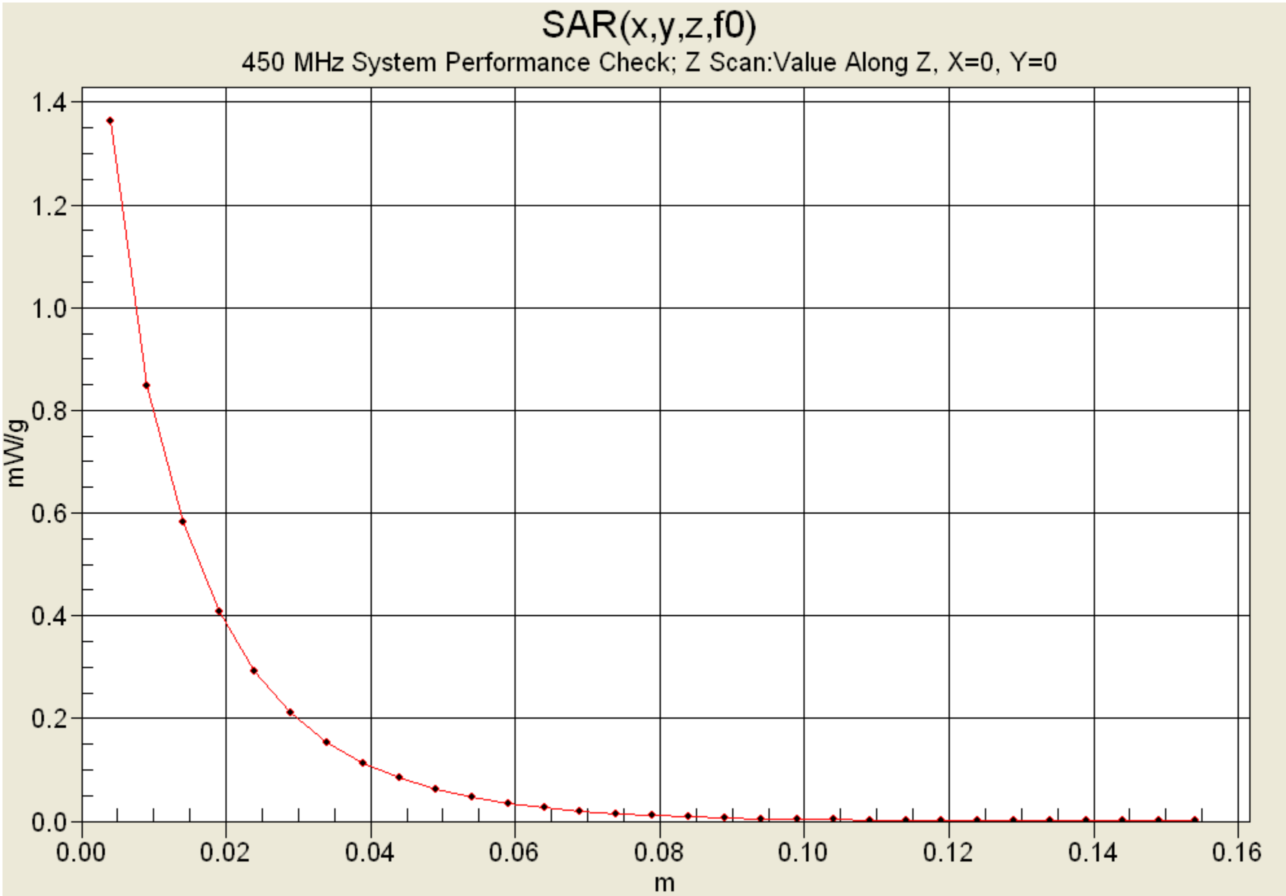
- Probe: ET3DV6 - SN1590; ConvF(7.5, 7.5, 7.5); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

450 MHz System Performance Check/Area Scan (6x11x1):
Measurement grid: dx=15mm, dy=15mm

450 MHz System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.7 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 2.18 W/kg
SAR(1 g) = 1.28 mW/g; SAR(10 g) = 0.827 mW/g



Z-Axis Scan


SAR(x,y,z,f0)
450 MHz System Performance Check; Z Scan:Value Along Z, X=0, Y=0
mW/g
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

Date Tested: 10/15/04

System Performance Check - 450 MHz Dipole

DUT: Dipole 450 MHz; Model: D450V2; Type: System Performance Check; Serial: 136; Calibrated: 11/04/2003

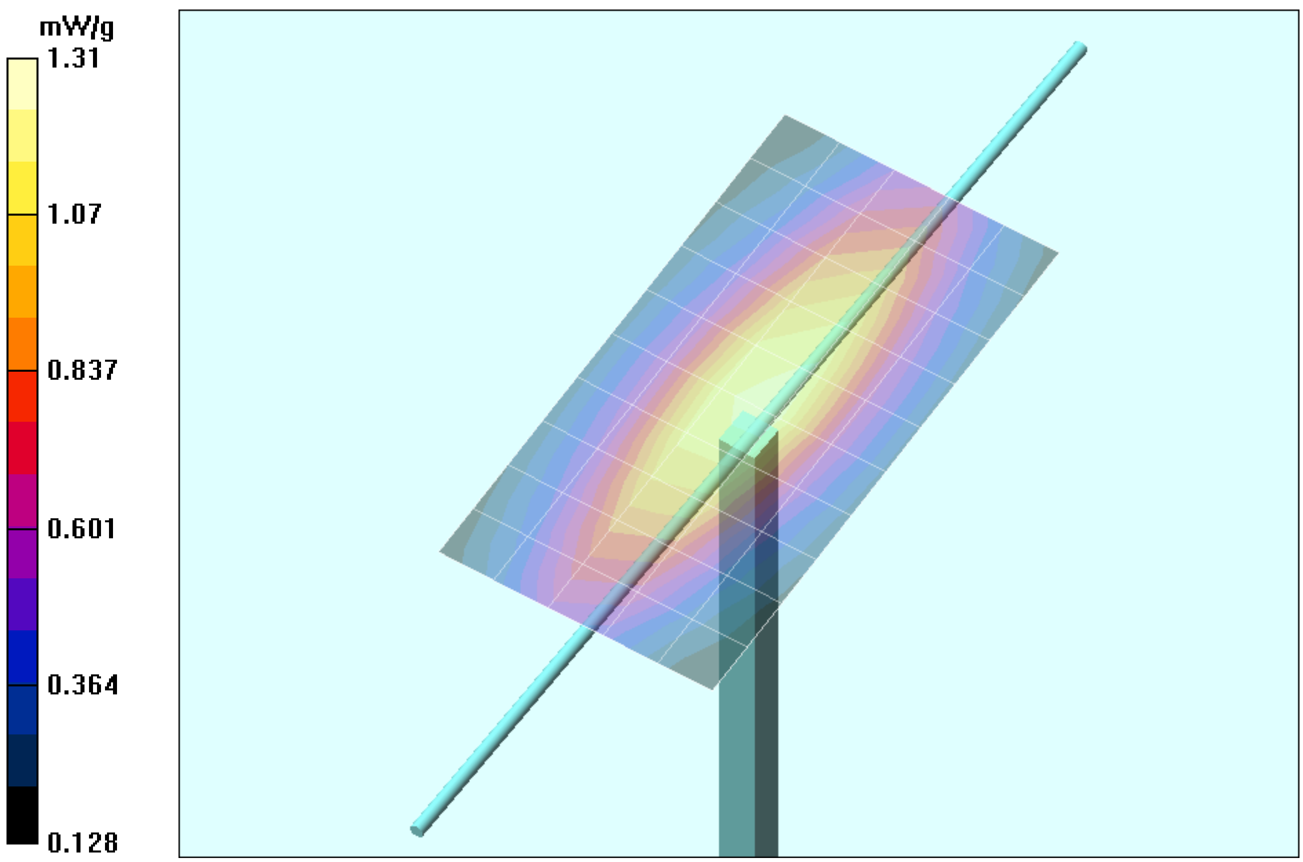
Ambient Temp: 24.3 °C; Fluid Temp: 23.4 °C; Barometric Pressure: 102.3 kPa; Humidity: 38%

Communication System: CW
Forward Conducted Power: 250mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.84 mho/m; ε_r = 42.4; ρ = 1000 kg/m^3)

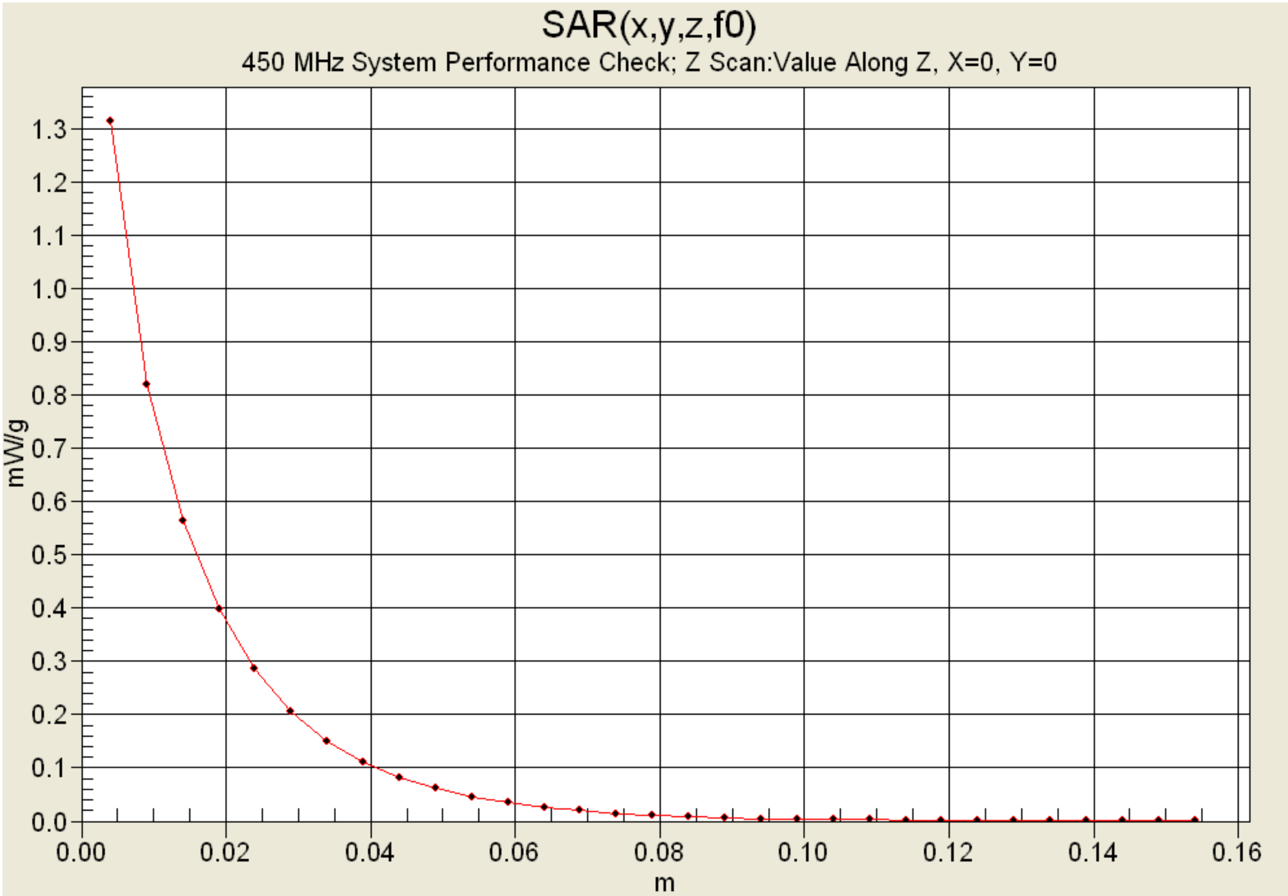
- Probe: ET3DV6 - SN1590; ConvF(7.5, 7.5, 7.5); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 14/05/2004
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

450 MHz System Performance Check/Area Scan (6x11x1):
Measurement grid: dx=15mm, dy=15mm

450 MHz System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.7 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 2.13 W/kg
SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.801 mW/g



Z-Axis Scan


SAR(x,y,z,f0)
450 MHz System Performance Check; Z Scan:Value Along Z, X=0, Y=0
mW/g
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

APPENDIX C - SYSTEM VALIDATION

Celltech
Testing and Engineering Services Lab

450MHz SYSTEM VALIDATION DIPOLE

Type:	**450MHz Validation Dipole**
Serial Number:	**136**
Place of Calibration:	**Celltech Labs Inc.**
Date of Calibration:	**November 4, 2003**

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

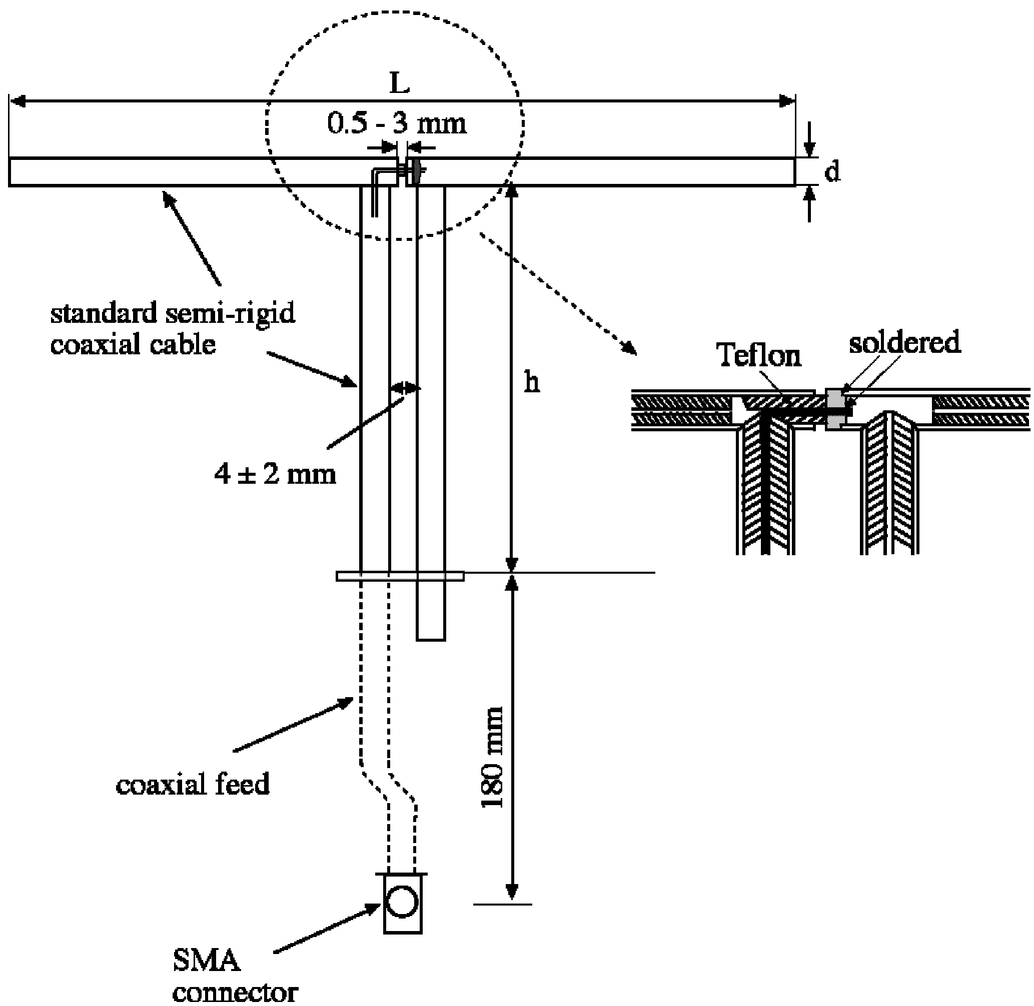
Calibrated by:	Spencer Watson
Approved by:	Russell W. Pipe

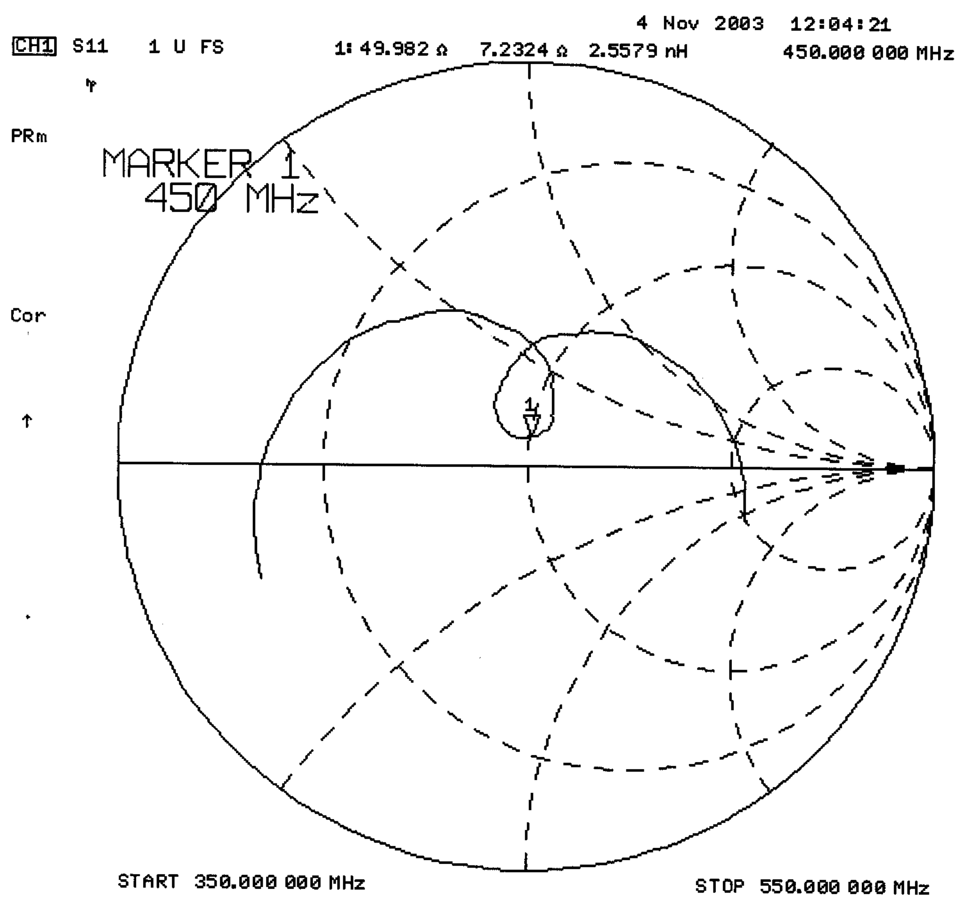
Celltech Labs Inc. 1955 Moss Court, Kelowna, B.C. Canada V1Y 9L3
Tel. 250-448-7047 • Fax. 250-448-7046 • e-mail: info@celltechlabs.com
www.celltechlabs.com

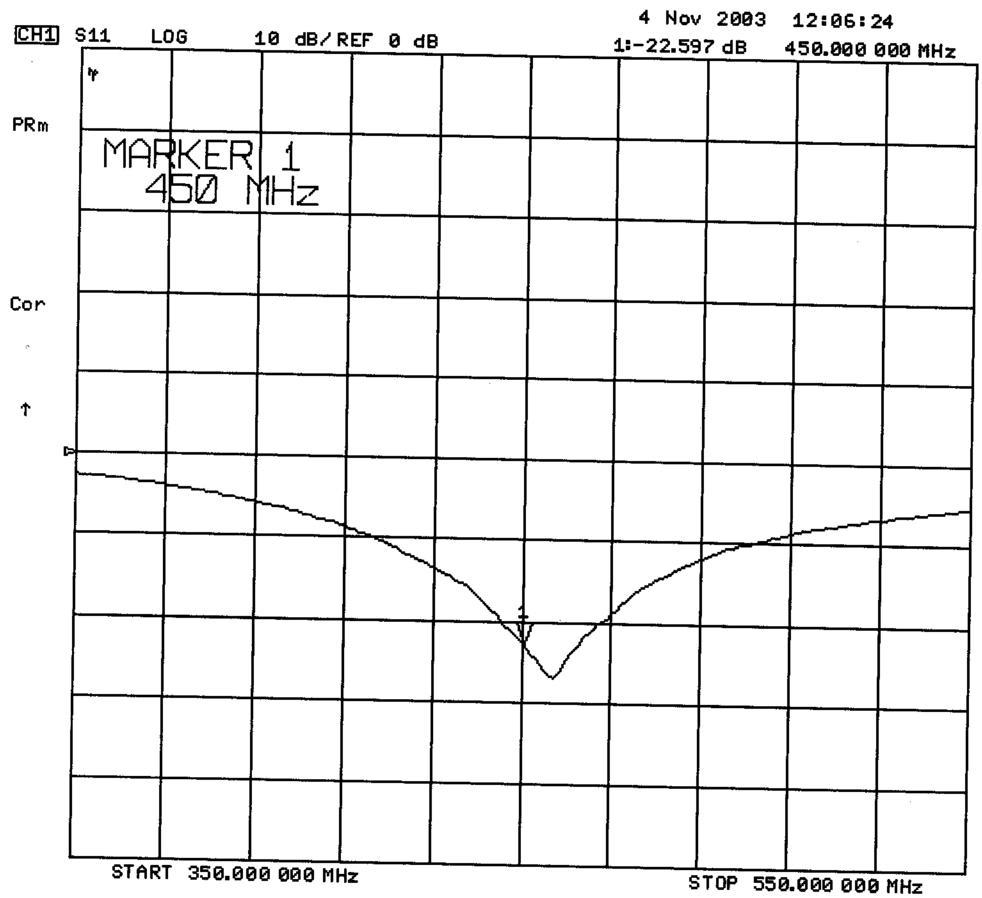
1. Dipole Construction & Electrical Characteristics

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

Feed point impedance at 450MHz	Re{Z} = 49.982Ω
	Im{Z} = 7.2324Ω
Return Loss at 450MHz	-22.597dB




4 Nov 2003 12:04:21
CH1 S11 1 U FS
1: 49.982 Ω 7.2324 Ω 2.5579 nH
450.000 000 MHz
PRm
MARKER 1
450 MHz
Cor
START 350.000 000 MHz
STOP 550.000 000 MHz



CH1 S11 LOG 10 dB/ REF 0 dB
4 Nov 2003 12:06:24
1:-22.597 dB 450.000 000 MHz
PRm
MARKER 1
450 MHz
Cor
START 350.000 000 MHz
STOP 550.000 000 MHz

2. 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

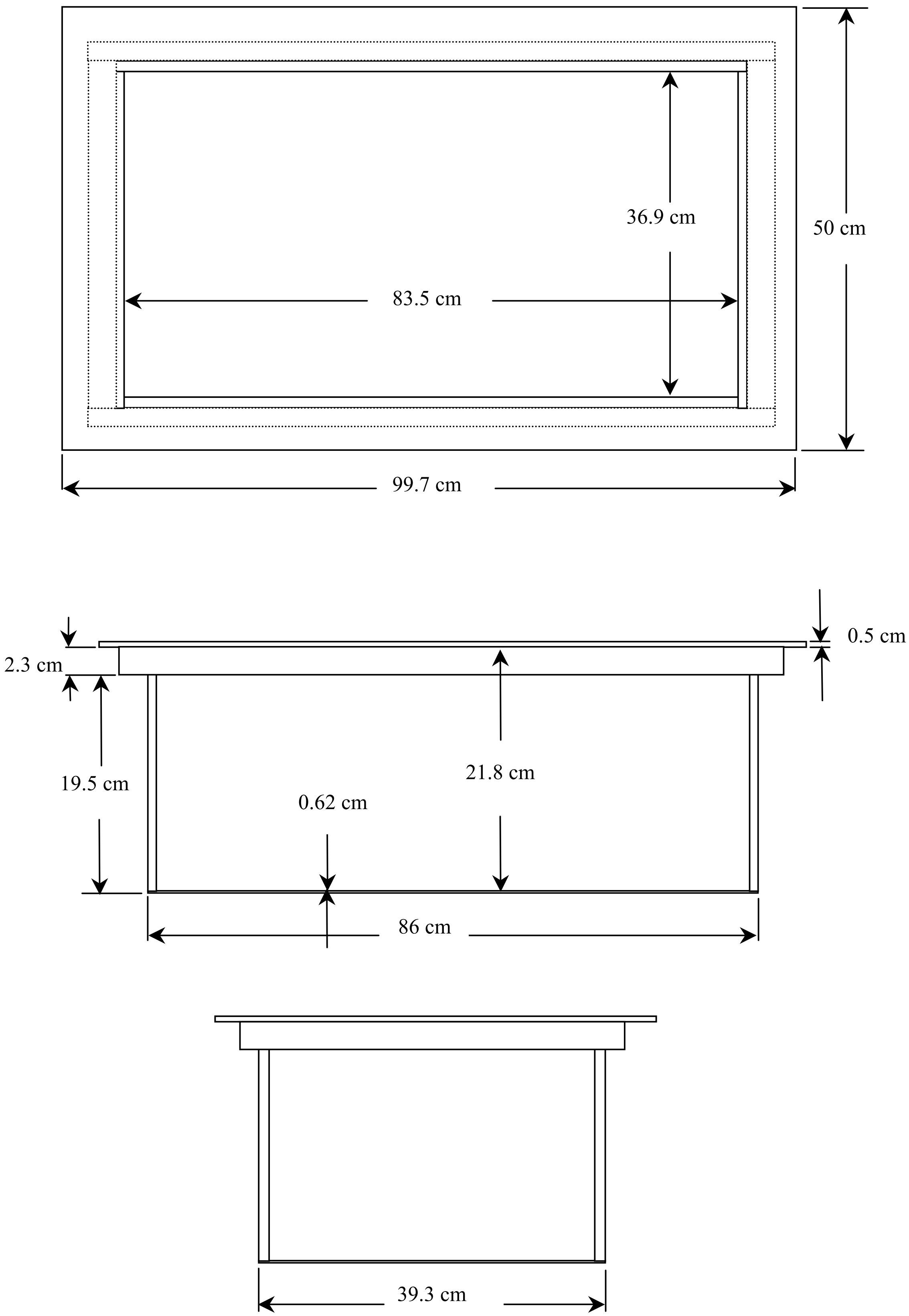
3. Validation Phantom

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

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

The bottom section of the validation phantom is constructed of 6.2 ± 0.1mm Plexiglas.

4. Dimensions of Plexiglas Planar Phantom



5. 450MHz System Validation Setup

450MHz System Validation Setup

6. Measurement Conditions

The planar phantom was filled with brain simulating tissue having the following parameters at 450MHz:

Relative Permittivity:	43.7
Conductivity:	0.88 mho/m
Fluid Temperature:	22.0 °C
Fluid Depth:	≥ 15.0 cm

Environmental Conditions:

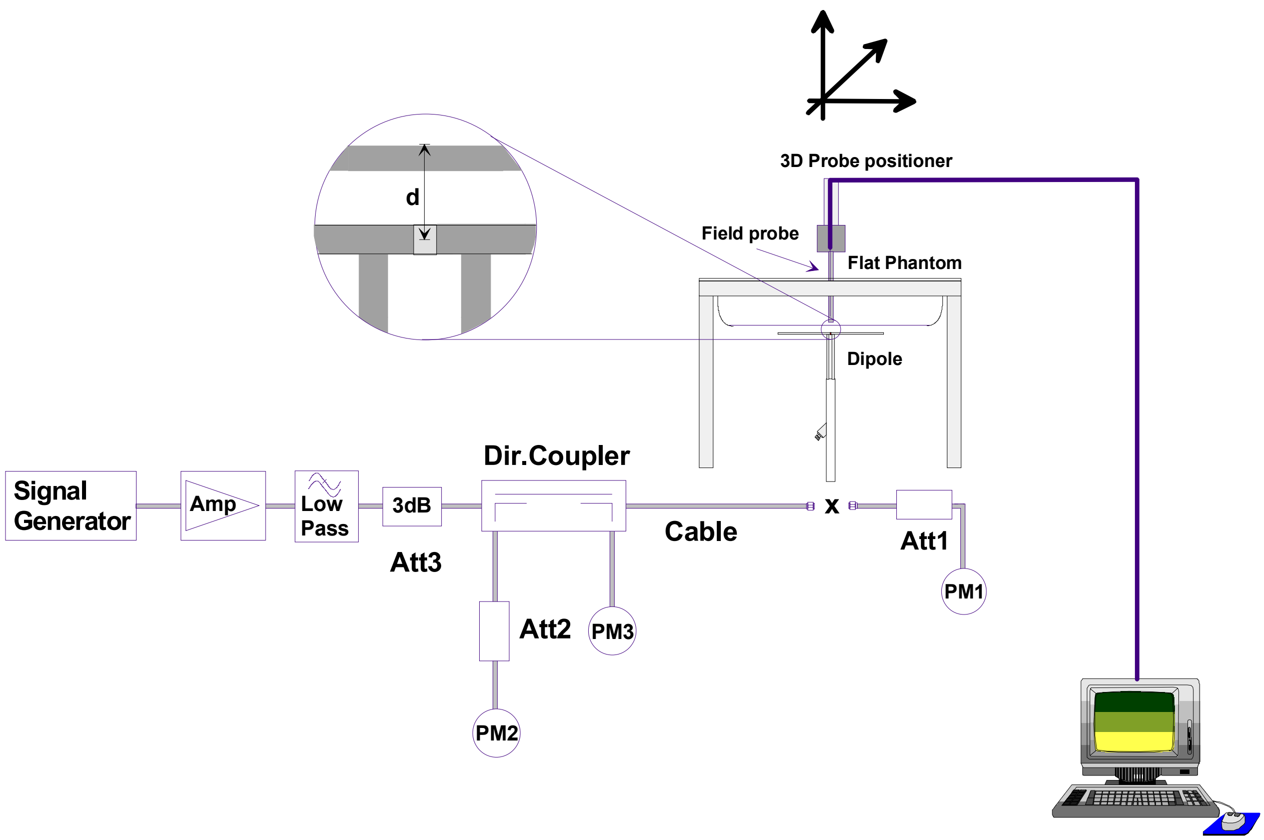
Ambient Temperature:	22.1 °C
Humidity:	49 %
Barometric Pressure:	102.8 kPa

The 450MHz simulated brain tissue mixture consists of the following ingredients:

Ingredient	Percentage by weight
Water	38.56%
Sugar	56.32%
Salt	3.95%
HEC	0.98%
Dowicil 75	0.19%
450MHz Target Dielectric Parameters at 22 °C	ε_r = 43.5 σ = 0.87 S/m

7. 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.

8. Validation Dipole SAR Test Results

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

Validation Measurement	SAR @ 0.25W Input averaged over 1g	SAR @ 1W Input averaged over 1g	SAR @ 0.25W Input averaged over 10g	SAR @ 1W Input averaged over 10g	Peak SAR @ 0.25W Input
Test 1	1.29	5.16	0.810	3.24	2.28
Test 2	1.31	5.24	0.827	3.31	2.31
Test 3	1.30	5.20	0.823	3.29	2.29
Test 4	1.30	5.20	0.822	3.29	2.29
Test 5	1.29	5.16	0.819	3.28	2.28
Test 6	1.30	5.20	0.826	3.30	2.28
Test 7	1.31	5.24	0.826	3.30	2.30
Test 8	1.31	5.24	0.829	3.32	2.30
Test 9	1.30	5.20	0.822	3.29	2.28
Test 10	1.31	5.24	0.822	3.29	2.33
Average Value	1.30	5.21	0.823	3.29	2.29

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

IEEE Target over 1cm^3 (1g) of tissue: 1.23 mW/g (+/- 10%)

Averaged over 1cm (1g) of tissue: 5.21 mW/g

Averaged over 10cm (10g) of tissue: 3.29 mW/g

Test Date: 11/04/03

DUT: Dipole 450MHz; Model: D450V2; Type: System Performance Check; Serial: 136

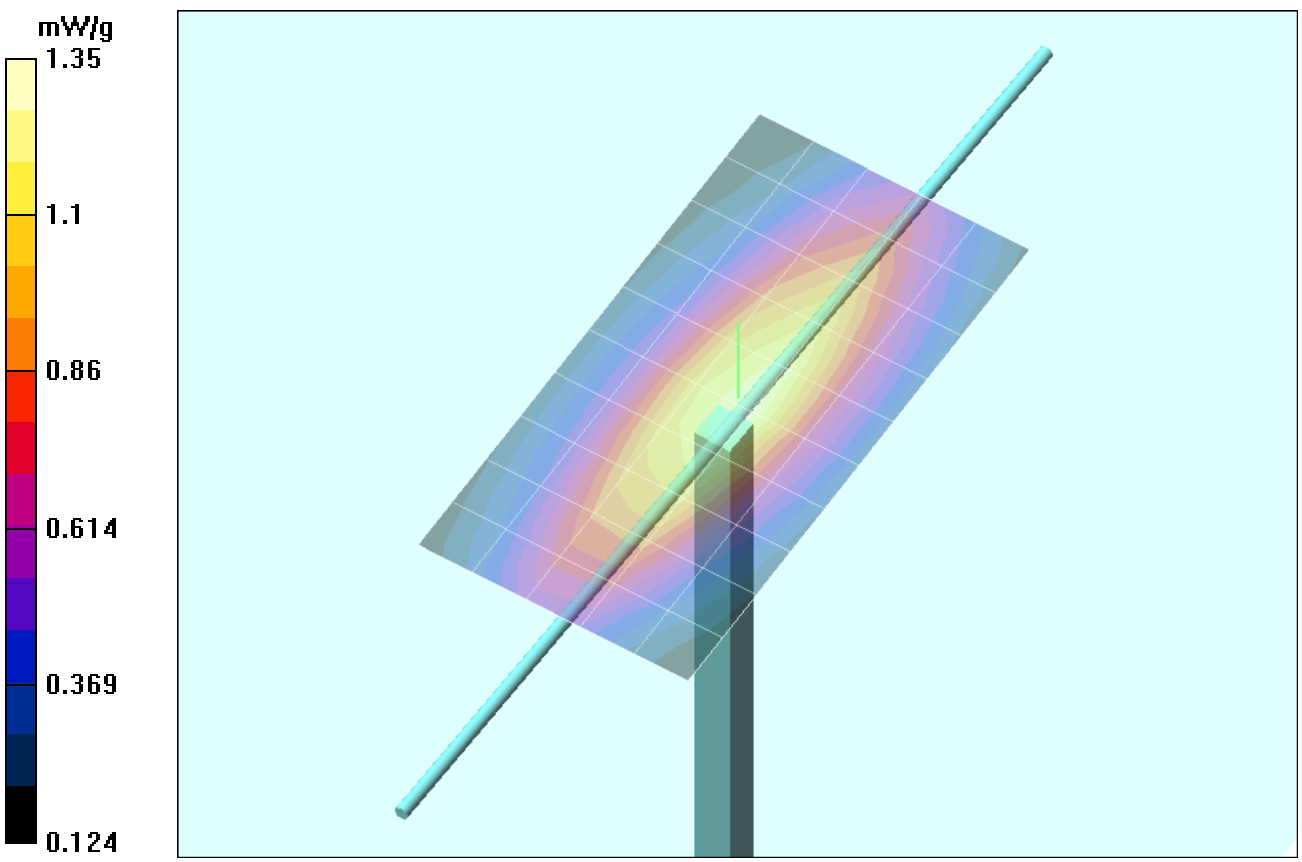
Ambient Temp: 22.1°C; Fluid Temp: 22.0°C; Barometric Pressure: 102.8 kPa; Humidity: 49%

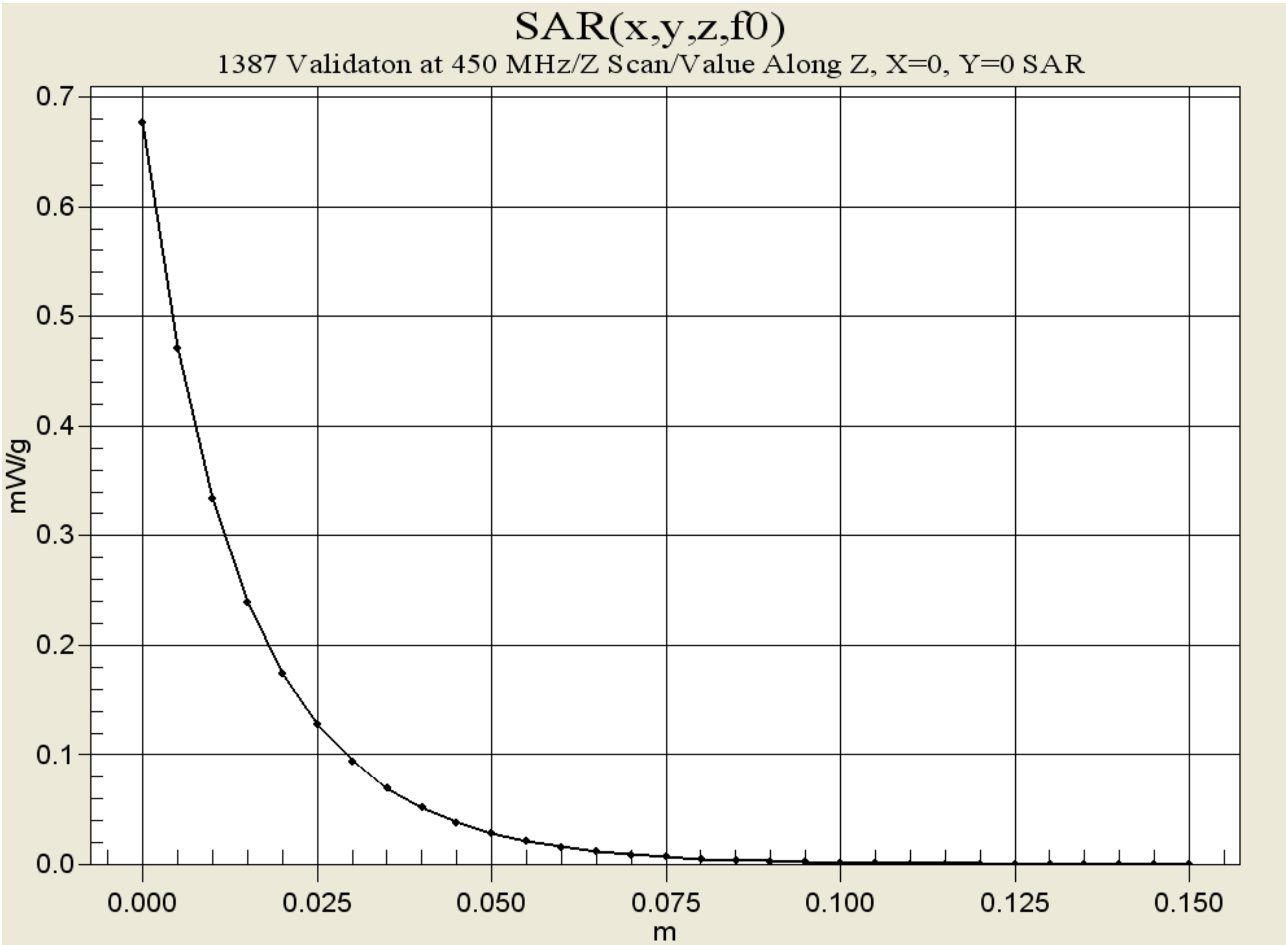
Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 (σ = 0.88 mho/m, ε_r = 43.7, ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1387; ConvF(7.5, 7.5, 7.5); Calibrated: 26/02/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 19/05/2003
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 116

450 MHz Validation/Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 39 V/m
Power Drift = -0.08 dB
Maximum value of SAR = 1.3 mW/g

450 MHz Validation/Zoom Scan 8 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 2.28 W/kg
SAR(1 g) = 1.3 mW/g; SAR(10 g) = 0.822 mW/g
Reference Value = 39 V/m
Power Drift = 0.08 dB




SAR(x,y,z,f0)
1387 Validaton at 450 MHz/Z Scan/Value Along Z, X=0, Y=0 SAR
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
mW/g
0.000
0.025
0.050
0.075
0.100
0.125
0.150
m

450MHz System Validation

Measured Fluid Dielectric Parameters (Brain)

November 04, 2003

Frequency	e'	e''
350.000000 MHz	46.2660	40.8224
360.000000 MHz	45.9937	40.0986
370.000000 MHz	45.7556	39.4543
380.000000 MHz	45.5625	38.7387
390.000000 MHz	45.2820	38.1140
400.000000 MHz	45.0146	37.4981
410.000000 MHz	44.7508	36.9734
420.000000 MHz	44.5046	36.4917
430.000000 MHz	44.2494	35.9460
440.000000 MHz	43.9621	35.5647
450.000000 MHz	43.7384	35.2106
460.000000 MHz	43.5513	34.7930
470.000000 MHz	43.2846	34.3970
480.000000 MHz	43.0654	33.9576
490.000000 MHz	42.8566	33.6391
500.000000 MHz	42.6744	33.2270
510.000000 MHz	42.5036	32.8459
520.000000 MHz	42.3492	32.5261
530.000000 MHz	42.1783	32.1727
540.000000 MHz	41.9985	31.7385
550.000000 MHz	41.8097	31.4862

APPENDIX D - 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

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

Diode Compression[A]

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

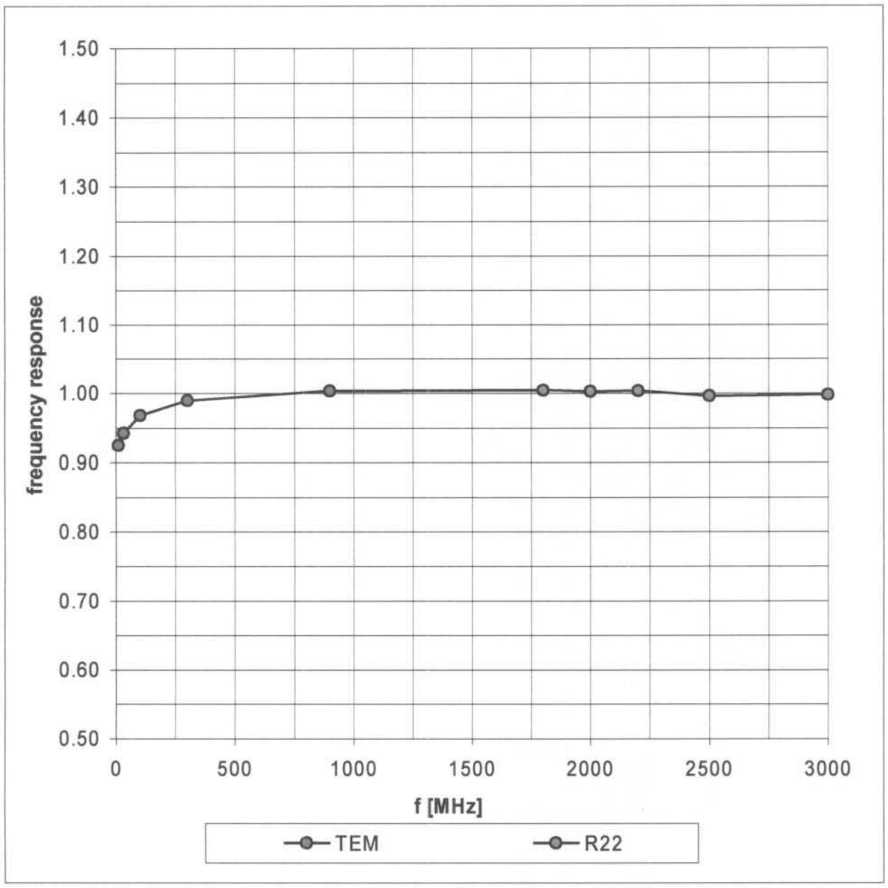
Probe Tip to Sensor Center	**2.7** mm
Optical Surface Detection	**in tolerance**

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%.

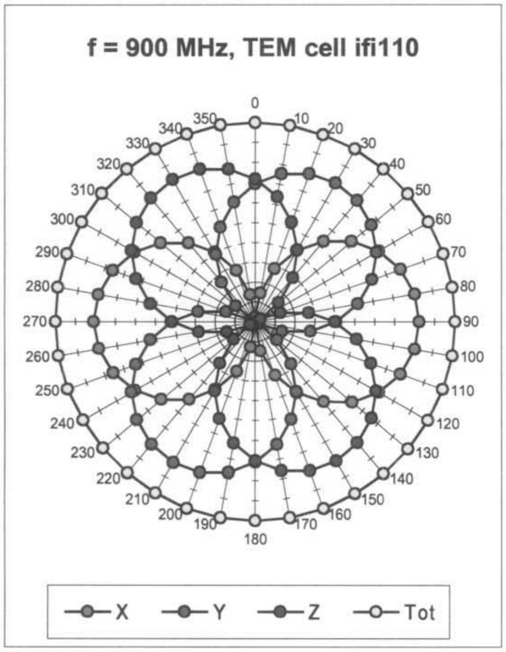
[A] numerical linearization parameter: uncertainty not required

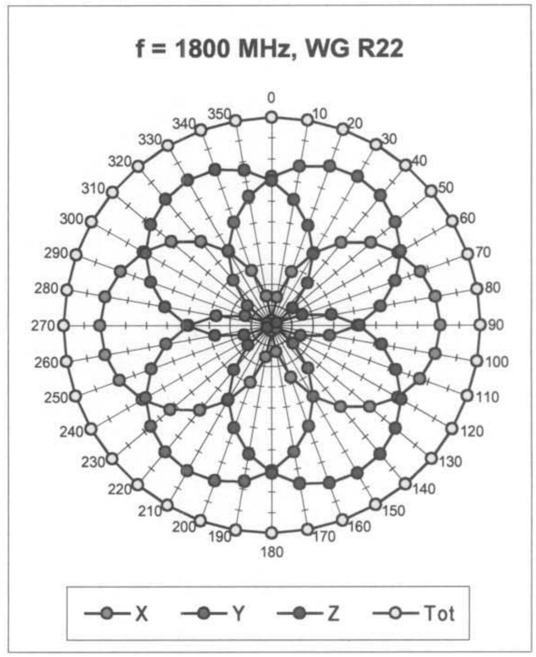
Frequency Response of E-Field

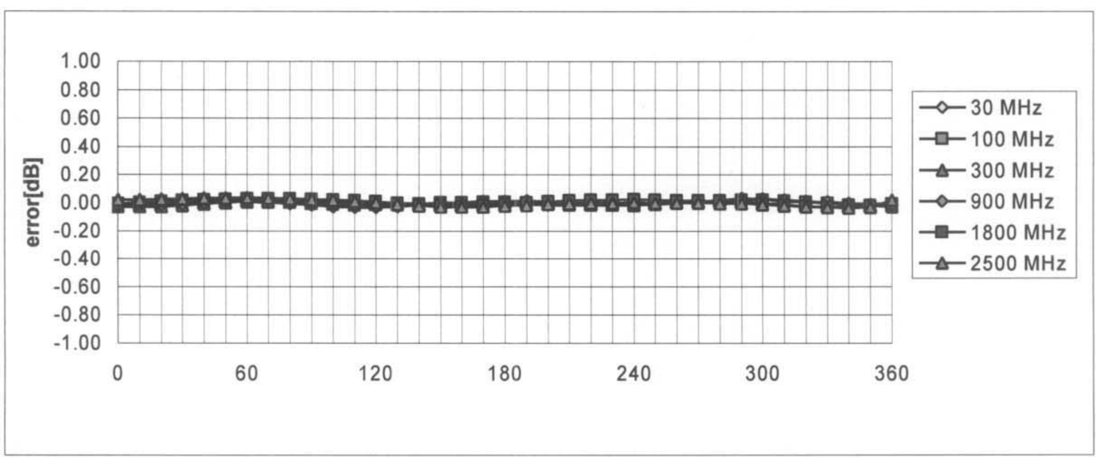
(TEM-Cell:ifi110, Waveguide R22)



Receiving Pattern (ϕ), θ = 0°



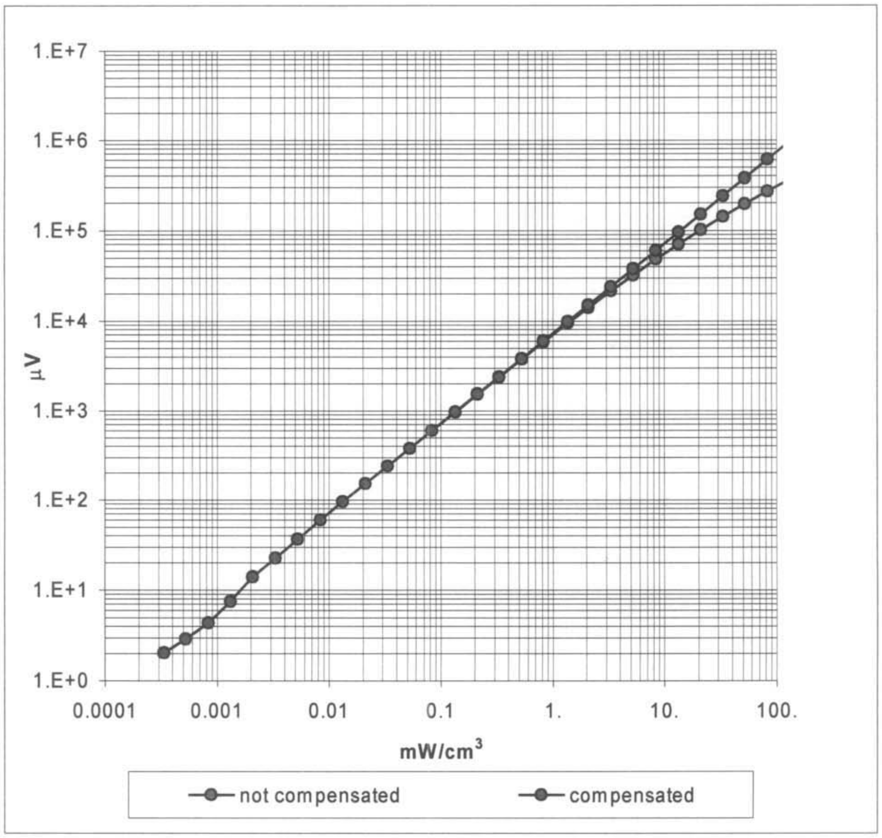


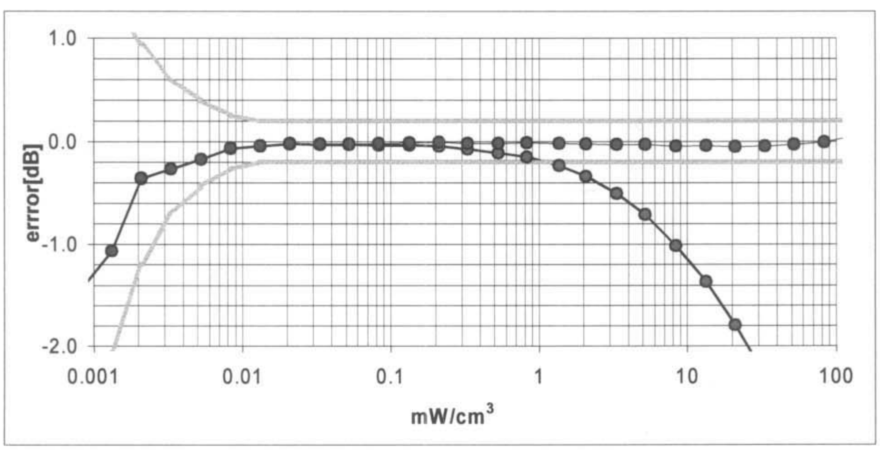


Axial Isotropy Error < ± 0.2 dB

Dynamic Range f(SAR_{head})

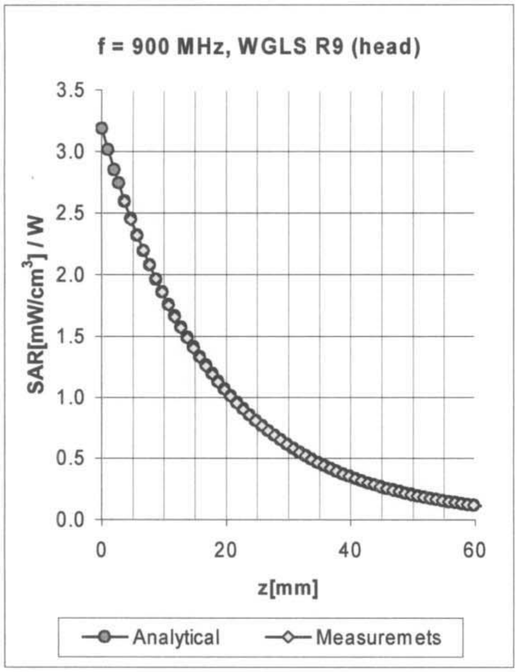
(Waveguide R22)

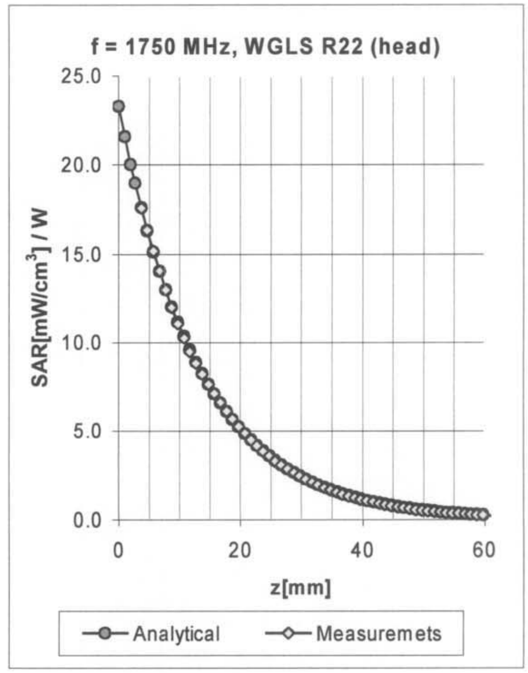




Probe Linearity Error < ± 0.2 dB

Conversion Factor Assessment



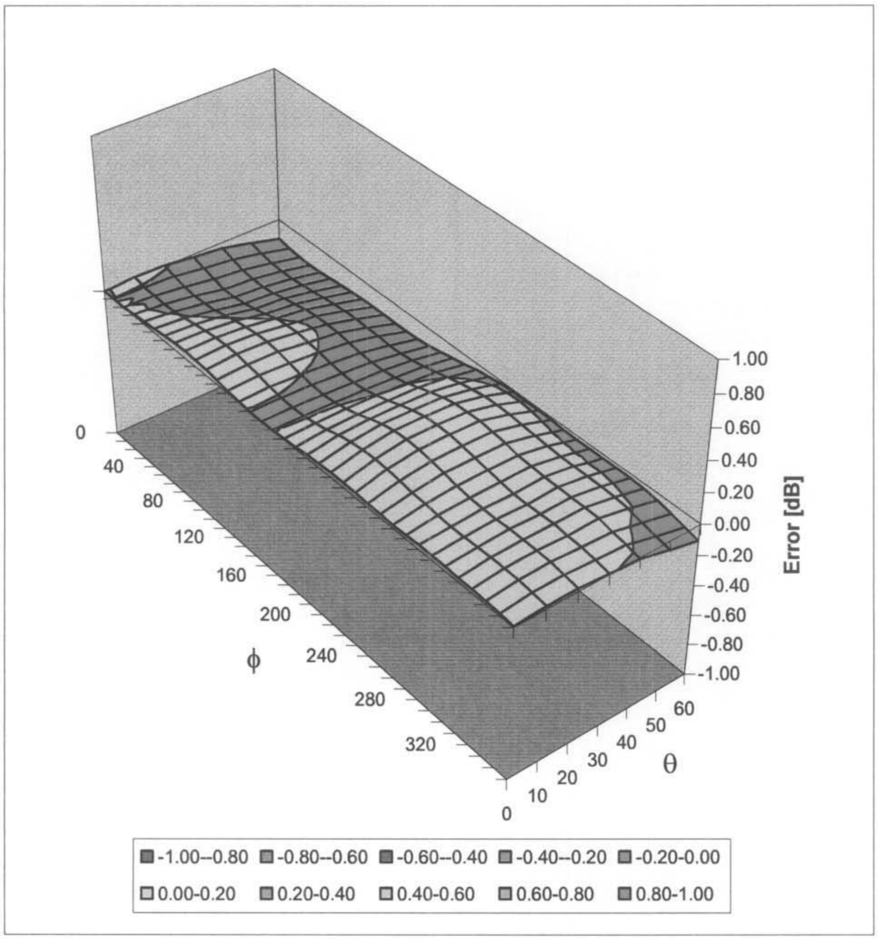


f [MHz]	Validity [MHz][B]	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
835	750-950	Head	41.5 ± 5%	0.90 ± 5%	0.68	1.64	6.71	± 11.9% (k=2)
1750	1700-1800	Head	40.0 ± 5%	1.40 ± 5%	0.43	2.67	5.28	± 9.7% (k=2)
1900	1850-1950	Head	40.0 ± 5%	1.40 ± 5%	0.46	2.81	5.03	± 9.7% (k=2)
2450	2400-2500	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

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
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:

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

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 E - MEASURED FLUID DIELECTRIC PARAMETERS

450 MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

October 13, 2004

Frequency	e'	e''
350.000000 MHz	45.2207	40.4451
360.000000 MHz	44.9623	39.7243
370.000000 MHz	44.6428	39.0503
380.000000 MHz	44.4220	38.4323
390.000000 MHz	44.1685	37.8180
400.000000 MHz	43.9269	37.2121
410.000000 MHz	43.7333	36.7312
420.000000 MHz	43.5833	36.2167
430.000000 MHz	43.3684	35.6861
440.000000 MHz	43.1749	35.2435
450.000000 MHz	42.9024	34.7858
460.000000 MHz	42.7416	34.3867
470.000000 MHz	42.5137	33.9789
480.000000 MHz	42.2686	33.5207
490.000000 MHz	41.9951	33.1558
500.000000 MHz	41.7920	32.8461
510.000000 MHz	41.5416	32.5070
520.000000 MHz	41.3875	32.1983
530.000000 MHz	41.2199	31.8715
540.000000 MHz	41.0554	31.4849
550.000000 MHz	40.8741	31.2403

450 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

October 13, 2004

Frequency	e'	e"
350.000000 MHz	58.5732	43.4303
360.000000 MHz	58.3488	42.6243
370.000000 MHz	58.1530	41.8662
380.000000 MHz	58.0142	41.1357
390.000000 MHz	57.8982	40.4461
400.000000 MHz	57.8006	39.7204
410.000000 MHz	57.6778	39.0727
420.000000 MHz	57.5516	38.4941
430.000000 MHz	57.4290	37.8593
440.000000 MHz	57.2955	37.3502
450.000000 MHz	57.0626	36.8914
460.000000 MHz	56.9398	36.4199
470.000000 MHz	56.7578	35.9513
480.000000 MHz	56.5890	35.4710
490.000000 MHz	56.3352	35.0632
500.000000 MHz	56.1381	34.7114
510.000000 MHz	56.0040	34.3761
520.000000 MHz	55.8619	34.0543
530.000000 MHz	55.7483	33.6874
540.000000 MHz	55.7340	33.2761
550.000000 MHz	55.6025	33.0093

450 MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

October 14, 2004

Frequency	e'	e"
350.000000 MHz	46.3342	41.0750
360.000000 MHz	46.0108	40.3162
370.000000 MHz	45.7957	39.5843
380.000000 MHz	45.5766	39.0007
390.000000 MHz	45.2901	38.4779
400.000000 MHz	45.0882	38.0120
410.000000 MHz	44.9499	37.3543
420.000000 MHz	44.7425	36.8773
430.000000 MHz	44.5708	36.3189
440.000000 MHz	44.3662	35.8192
450.000000 MHz	44.1218	35.3762
460.000000 MHz	43.8529	34.8924
470.000000 MHz	43.5687	34.4776
480.000000 MHz	43.3037	34.1135
490.000000 MHz	43.0118	33.7350
500.000000 MHz	42.8106	33.4260
510.000000 MHz	42.5507	33.0224
520.000000 MHz	42.3723	32.7528
530.000000 MHz	42.2099	32.4425
540.000000 MHz	42.0667	32.0288
550.000000 MHz	41.9071	31.8052

450 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

October 14, 2004

Frequency	e'	e"
350.000000 MHz	59.3254	43.8256
360.000000 MHz	59.1091	42.9548
370.000000 MHz	58.9826	42.2275
380.000000 MHz	58.8801	41.6090
390.000000 MHz	58.7681	41.0314
400.000000 MHz	58.6392	40.3334
410.000000 MHz	58.5445	39.5760
420.000000 MHz	58.3856	38.9041
430.000000 MHz	58.1962	38.2069
440.000000 MHz	58.0721	37.6630
450.000000 MHz	57.8684	37.1763
460.000000 MHz	57.7014	36.6927
470.000000 MHz	57.5217	36.2492
480.000000 MHz	57.2676	35.8484
490.000000 MHz	57.0040	35.5196
500.000000 MHz	56.8461	35.1460
510.000000 MHz	56.6696	34.7387
520.000000 MHz	56.6009	34.4055
530.000000 MHz	56.5071	34.0223
540.000000 MHz	56.3967	33.5573
550.000000 MHz	56.2839	33.2362

450 MHz System Performance Check & DUT Evaluation (Face)

Measured Fluid Dielectric Parameters (Brain)

October 15, 2004

Frequency	e'	e''
350.000000 MHz	44.5503	39.1558
360.000000 MHz	44.2327	38.5263
370.000000 MHz	43.9855	37.8889
380.000000 MHz	43.8117	37.3082
390.000000 MHz	43.6263	36.8221
400.000000 MHz	43.4246	36.1538
410.000000 MHz	43.2542	35.5130
420.000000 MHz	43.1005	35.0190
430.000000 MHz	42.8836	34.5176
440.000000 MHz	42.6475	34.0228
450.000000 MHz	42.3656	33.6600
460.000000 MHz	42.1336	33.3065
470.000000 MHz	41.9005	32.9420
480.000000 MHz	41.6589	32.5772
490.000000 MHz	41.3559	32.2034
500.000000 MHz	41.1047	31.8714
510.000000 MHz	40.8999	31.5624
520.000000 MHz	40.7363	31.2589
530.000000 MHz	40.5622	30.9529
540.000000 MHz	40.4694	30.5336
550.000000 MHz	40.3170	30.2947

450 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

October 15, 2004

Frequency	e'	e''
350.000000 MHz	58.0432	42.3133
360.000000 MHz	57.8855	41.5294
370.000000 MHz	57.7288	40.7845
380.000000 MHz	57.6343	40.1094
390.000000 MHz	57.4912	39.3869
400.000000 MHz	57.3281	38.7647
410.000000 MHz	57.1428	38.1019
420.000000 MHz	57.0323	37.5864
430.000000 MHz	56.9215	36.9431
440.000000 MHz	56.7617	36.4329
450.000000 MHz	56.5494	35.9638
460.000000 MHz	56.4069	35.5653
470.000000 MHz	56.2805	35.1697
480.000000 MHz	56.0874	34.7310
490.000000 MHz	55.8986	34.3616
500.000000 MHz	55.7100	33.9976
510.000000 MHz	55.4715	33.6073
520.000000 MHz	55.3201	33.3046
530.000000 MHz	55.2390	32.9220
540.000000 MHz	55.1020	32.5321
550.000000 MHz	54.9764	32.2722