APPENDIX A: RF EXPOSURE

Please see the SAR Evaluation that follows.

DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

Test Lab

CELLTECH LABS INC.
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1955 Moss Court
Kelowna, B.C.
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Phone: 250-448-7047
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Applicant Information

E.F. JOHNSON CO.
123 N. State Street
Waseca, MN 56093
United States

FCC IDENTIFIER:	**ATH2425191**
Model(s):	**5191**
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 Non-Broadcast Transmitter Held to Face (TNF)**
Device Description:	**Portable FM PTT Radio Transceiver**
Tx Frequency Range(s):	**896 - 901 MHz (Transmit)** **935 - 940 MHz (Receive & Transmit Talk-Around)**
Max. RF Output Power Tested:	**34.59 dBm Conducted (898.0125 MHz)** **34.96 dBm Conducted (937.0125 MHz)**
Antenna Type(s) Tested:	**Detachable ½-Wave Whip**
Battery Type(s) Tested:	**NiMH 7.5 V 3600 mAh (P/N: 587-5100-360)** **Alkaline 1.5 V AA x12 (Battery Case P/N: 250-5100-280)** **(Type 1: Duracell Procell 2850 mAh, Type 2: Energizer E91 2850 mAh)**
Body-Worn Accessories:	**Speaker-Microphone with Antenna (P/N: 589-0015-058)** **Speaker-Microphone (P/N: 589-0015-057)** **Boom-Microphone Headset (P/N: 589-0015-059)** **Plastic Belt-Clip with Metal Spring (P/N: 585-5100-128)**
Max. SAR Level(s) Evaluated:	**Face-held: 1.58 W/kg (50% Duty Cycle)** **Body-worn: 3.63 W/kg (50% Duty Cycle)**

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 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 that the E.F. Johnson Model: 5191 Portable FM PTT Radio Transceiver FCC ID: ATH2425191 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 Occupational / Controlled 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.

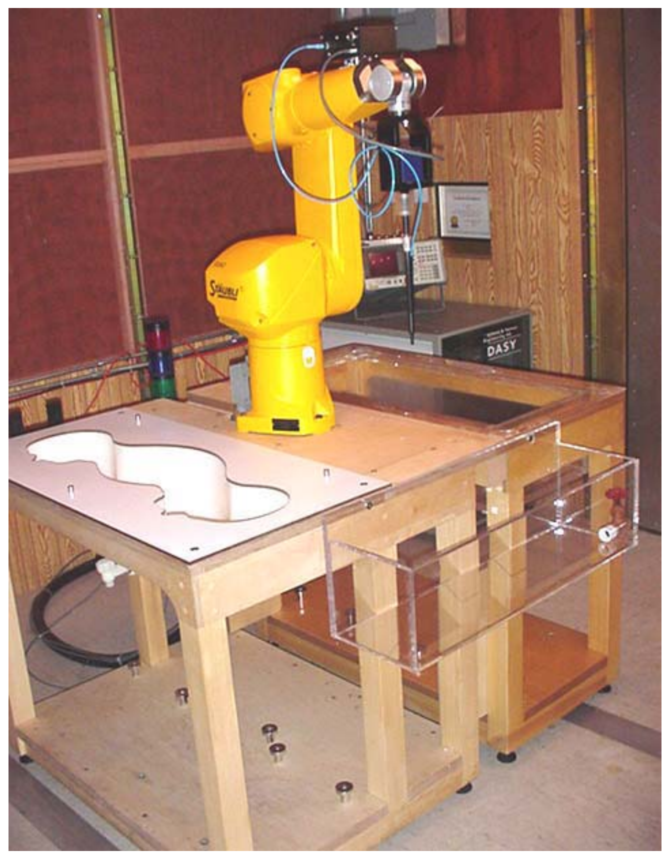
2.0 DESCRIPTION OF DEVICE UNDER TEST (DUT)

<table>
<tr><td>FCC Rule Part(s)</td><td colspan="6">47 CFR §2.1093</td></tr>
<tr><td>IC Rule Part(s)</td><td colspan="6">RSS-102 Issue 1 (Provisional)</td></tr>
<tr><td>Test Procedure(s)</td><td colspan="6">FCC OET Bulletin 65, Supplement C (Edition 01-01)</td></tr>
<tr><td>FCC Device Classification</td><td colspan="6">Licensed Non-Broadcast Transmitter Held to Face (TNF)</td></tr>
<tr><td>Device Description</td><td colspan="6">Portable FM PTT Radio Transceiver</td></tr>
<tr><td>FCC IDENTIFIER</td><td colspan="6">ATH2425191</td></tr>
<tr><td>Model(s)</td><td colspan="6">5191</td></tr>
<tr><td>Serial No.(s)</td><td colspan="4">PK#9</td><td colspan="2">Identical Prototype</td></tr>
<tr><td rowspan="2">Tx Frequency Range(s)</td><td colspan="2">Low Band</td><td colspan="2">896 - 901</td><td colspan="2">Transmit</td></tr>
<tr><td colspan="2">High Band</td><td colspan="2">935 - 940</td><td colspan="2">Receive and Transmit Talk-Around</td></tr>
<tr><td rowspan="2">Max. RF Output Power Measured</td><td colspan="3">34.59 dBm</td><td colspan="2">Conducted</td><td>898.0125 MHz</td></tr>
<tr><td colspan="3">34.96 dBm</td><td colspan="2">Conducted</td><td>937.0125 MHz</td></tr>
<tr><td>Antenna Type(s) Tested</td><td colspan="5">Detachable ½-Wave Whip</td><td>Length: 171 mm</td></tr>
<tr><td rowspan="3">Battery Type(s) Tested</td><td>NiMH</td><td colspan="2">7.5 V</td><td colspan="2">3600 mAh</td><td>P/N: 587-5100-360</td></tr>
<tr><td rowspan="2">Alkaline</td><td colspan="2" rowspan="2">1.5 V AA
(x12)</td><td colspan="2">Duracell Procell 2850 mAh</td><td rowspan="2">With Battery Case
P/N: 250-5100-280</td></tr>
<tr><td colspan="2">Energizer E91 2850 mAh</td></tr>
<tr><td rowspan="4">Body-worn Accessories Tested</td><td colspan="5">Speaker-Microphone with Antenna</td><td>P/N: 589-0015-058</td></tr>
<tr><td colspan="5">Speaker-Microphone</td><td>P/N: 589-0015-057</td></tr>
<tr><td colspan="5">Boom-Microphone Headset</td><td>P/N: 589-0015-059</td></tr>
<tr><td colspan="5">Plastic Belt-Clip with Metal Spring</td><td>P/N: 585-5100-128</td></tr>
</table>

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 SAR Measurement System with Plexiglas planar phantom

4.0 SAR MEASUREMENT SUMMARY

FACE-HELD SAR EVALUATION RESULTS												
Freq. (MHz)	Chan.	Test Mode	DUT Type	Antenna Type	Battery Type	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%
898.0125	LB Mid	CW	Radio	Whip	NiMH	2.5	34.54	2.43	1.22	-0.960	3.03	1.52
898.0125	LB Mid	CW	Radio	Whip	Duracell Alkaline	2.5	34.55	2.20	1.10	-0.737	2.61	1.30
898.0125	LB Mid	CW	SMA	Whip	NiMH	2.5	34.58	2.34	1.17	-0.0866	2.39	1.19
937.0125	HB Mid	CW	Radio	Whip	NiMH	2.5	34.70	1.78	0.890	-1.29	2.40	1.20
937.0125	HB Mid	CW	Radio	Whip	Duracell Alkaline	2.5	34.82	P 1.82	0.910	-1.84	P 2.78	1.39
							34.90	S 1.49	0.745	-1.61	S 2.16	1.08
937.0125	HB Mid	CW	SMA	Whip	NiMH	2.5	34.50	2.33	1.17	-1.32	3.16	1.58
937.0125	HB Mid	CW	SMA	Whip	Ext. Power (to NiMH)	2.5	34.53	2.33	1.17	-0.875	2.85	1.43

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

Test Date(s)	January 25, 2005			January 25, 2005			**Evaluation Frequency**	**900 MHz**	**938 MHz**	**Unit**
Measured Fluid Type	**900 MHz Brain**			**938 MHz Brain**			**Relative Humidity**	30	30	**%**
Dielectric Constant ε_r	**IEEE Target**		**Measured**	**Interpolated IEEE Target**		**Measured**	**Atmospheric Pressure**	102.3	102.3	**kPa**
	41.5	**± 5%**	41.7	**41.4**	**± 5%**	40.5	**Ambient Temperature**	23.3	23.4	**°C**
Conductivity σ **(mho/m)**	**900 MHz Brain**			**938 MHz Brain**			**Fluid Temperature**	21.4	21.7	**°C**
	IEEE Target		**Measured**	**Interpolated IEEE Target**		**Measured**	**Fluid Depth**	≥ 15	≥ 15	**cm**
	0.97	**± 5%**	0.98	**0.99**	**± 5%**	1.01	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. The transmission bands of the DUT were less than 10 MHz, therefore mid channel data only is reported (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).
3. Secondary peak SAR levels measured within 2 dB of the primary were reported (P = Primary, S = Secondary).
4. 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. It was noted that the majority of the measured power drifts were significant. This is typically due to the high conducted power level of the radio and the subsequent heating of the radio in a constant transmit state for the duration of the SAR evaluation.
5. In order to verify that the scaled SAR levels were conservative, an additional evaluation was performed in the worst-case power drift configuration using the NiMH battery with an external power source connected to the NiMH battery terminals and with a ferrite dampener on the power leads. A SAR-versus-Time power drift evaluation was also performed with the external power source. Please note that the alkaline battery pack was not used for the external power source evaluation based on the fact that the radio would require modification to connect the leads internally. See Appendix A (SAR Test Plots) for the SAR-versus-Time power drift evaluation data.
6. 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.
7. 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 C for printout of measured fluid dielectric parameters).
8. SAR measurements were performed within 24 hours of the system performance check.
9. Abbreviation(s): SMA - Speaker-Microphone with Antenna; LB - Low Band; HB - High Band

SAR MEASUREMENT SUMMARY (CONT.)

BODY-WORN SAR EVALUATION RESULTS

Test Date	Freq. (MHz)	Chan.	Test Mode	DUT Type	Battery Type	Antenna Type	Body-worn Accessories	Separation Distance to Planar Phantom (cm)	Cond. Power Before Test (dBm)	Meas. SAR 1g (W/kg)		SAR Drift During Test (dB)	Scaled SAR 1g (W/kg)	
										Duty Cycle			Duty Cycle	
										100%	50%		100%	50%
Jan 27	898.0125	LB Mid	CW	Radio	NiMH	Whip	Speaker-Mic and Belt-Clip	1.3	34.56	5.88	2.94	-0.768	7.02	3.51
Jan 27	898.0125	LB Mid	CW	Radio	NiMH	Whip	Headset-Mic and Belt-Clip	1.3	34.58	5.68	2.84	-1.06	7.25	3.63
Jan 27	898.0125	LB Mid	CW	Radio	Duracell Alkaline	Whip	Speaker-Mic and Belt-Clip	1.3	34.56	4.44	2.22	-0.833	5.38	2.69
Jan 27	898.0125	LB Mid	CW	Radio	Duracell Alkaline	Whip	Headset-Mic and Belt-Clip	1.3	34.56	4.21	2.11	-0.655	4.90	2.45
Jan 27	898.0125	LB Mid	CW	SMA	NiMH	Whip	Lapel-Clip	1.2	34.59	4.09	2.05	-0.168	4.25	2.13
Jan 27	937.0125	HB Mid	CW	Radio	Duracell Alkaline	Whip	Speaker-Mic and Belt-Clip	1.3	34.96	3.41	1.71	-1.72	5.07	2.53
Jan 27	937.0125	HB Mid	CW	Radio	Duracell Alkaline	Whip	Headset-Mic and Belt-Clip	1.3	34.95	3.49	1.75	-1.81	5.29	2.65
Jan 27	937.0125	HB Mid	CW	SMA	NiMH	Whip	Lapel-Clip	1.2	34.67	4.73	2.37	-1.28	6.35	3.18
Jan 28	937.0125	HB Mid	CW	Radio	NiMH	Whip	Headset-Mic and Belt-Clip	1.3	34.47	3.95	1.98	-1.32	5.35	2.68
Jan 28	937.0125	HB Mid	CW	Radio	NiMH	Whip	Speaker-Mic and Belt-Clip	1.3	34.60	4.40	2.20	-1.45	6.14	3.07
Jan 28	937.0125	HB Mid	CW	Radio	Ext. Pwr. (to NiMH)	Whip	Speaker-Mic and Belt-Clip	1.3	34.55	4.28	2.14	-0.794	5.14	2.57
Jan 28	898.0125	LB Mid	CW	Radio	Duracell Energizer	Whip	Speaker-Mic and Belt-Clip	1.3	34.57	4.28	2.14	-0.814	5.16	2.58

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

Test Date(s)	January 27-28, 2005				January 27-28, 2005			
Dielectric Constant ε_r	900 MHz Body				938 MHz Body			
	IEEE Target		Measured		Interpolated IEEE Target		Measured	
	55.0	± 5%	Jan 27	52.5	54.9	± 5%	Jan 27	53.1
			Jan 28	53.0			Jan 28	52.2
Conductivity σ (mho/m)	900 MHz Body				938 MHz Body			
	IEEE Target		Measured		Interpolated IEEE Target		Measured	
	1.05	± 5%	Jan 27	1.05	1.07	± 5%	Jan 27	1.11
			Jan 28	1.06			Jan 28	1.09

Evaluation Frequency	900 MHz		938 MHz		Units
	Jan 27	Jan 28	Jan 27	Jan 28	
Atmospheric Pressure	101.6	101.8	101.7	101.8	kPa
Relative Humidity	30	30	30	30	%
Ambient Temperature	22.8	23.0	23.7	23.0	°C
Fluid Temperature	21.6	21.6	21.4	21.6	°C
Fluid Depth	≥ 15	≥ 15	≥ 15	≥ 15	cm
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. The transmission bands of the DUT were less than 10 MHz; therefore mid channel data only is reported (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. It was noted that the majority of the measured power drifts were significant. This is typically due to the high conducted power level of the radio and the subsequent heating of the radio in a constant transmit state for the duration of the SAR evaluation.
4. In order to verify that the scaled SAR levels were conservative, an additional evaluation was performed in the worst-case power drift configuration using the NiMH battery with an external power source connected to the NiMH battery terminals and with a ferrite dampener on the power leads. A SAR-versus-Time power drift evaluation was also performed with the external power source. Please note that the alkaline battery pack was not used for the external power source evaluation based on the fact that the radio would require modification to connect the leads internally. See Appendix A (SAR Test Plots) for the SAR-versus-Time power drift evaluation data.
5. The DUT was evaluated for SAR with Duracell Procell alkaline batteries. To report a SAR comparison between alternate alkaline battery types, the maximum SAR level configuration evaluated with Duracell Procell alkaline batteries was repeated using Energizer E91 alkaline batteries as shown in the above table.
6. A SAR-versus-Time power drift evaluation was performed in the test configuration that reported the maximum scaled SAR level (50% duty cycle). See Appendix A (SAR Test Plots) for the SAR-versus-Time power drift evaluation data.
7. SAR measurements were performed within 24 hours of the system performance check.
8. Abbreviation(s): SMA - Speaker-Microphone with Antenna; LB - Low Band; HB - High Band

5.0 DETAILS OF SAR EVALUATION

The E.F. Johnson Model: 5191 Portable FM PTT Radio Transceiver FCC ID: ATH2425191 was compliant for localized Specific Absorption Rate (Occupational / Controlled Exposure) based on the test provisions and conditions described below. Detailed photographs of the test setup are shown in Appendix D.

1. The Radio Transceiver (DUT) was evaluated for face-held configuration with the front of the DUT placed parallel to the outer surface of the planar phantom at a 2.5 cm separation distance.
2. The Speaker-Microphone with Antenna (DUT) was evaluated for face-held configuration connected to the Radio Transceiver with the front of the DUT placed parallel to the outer surface of the planar phantom at a 2.5 cm separation distance. The Speaker-Microphone with Antenna was evaluated with the NiMH battery option only. The alkaline battery pack is not intended for operation in the Speaker-Microphone with Antenna configuration.
3. The Radio Transceiver (DUT) was evaluated for body-worn configuration with the back of the DUT placed parallel to the outer surface of the planar phantom. The attached Belt-Clip accessory was touching the outer surface of the planar phantom and provided a 1.3 cm separation distance between the back of the DUT and the planar phantom. The DUT was evaluated with both the speaker-microphone and boom-microphone headset accessories consecutively connected to the audio accessory port.
4. The Speaker-Microphone with Antenna (DUT) was evaluated for body-worn configuration connected to the Radio Transceiver with the back of the DUT placed parallel to the outer surface of the planar phantom. The attached Lapel-Clip was touching the outer surface of the planar phantom and provided a 1.2 cm separation distance between the back of the DUT and the planar phantom. The Speaker-Microphone with Antenna was evaluated with the NiMH battery option only. The alkaline battery pack is not intended for operation in the Speaker-Microphone with Antenna configuration.
5. The conducted power levels were measured at the antenna connector port prior to each test using a Gigatronics 8652A Universal Power Meter according to the procedures described in FCC 47 CFR §2.1046.
6. The power drifts measured by the DASY4 system during the SAR evaluations were added to the measured SAR levels to report scaled SAR results as shown in the test data tables (pages 5-6). It was noted that the majority of the measured power drifts were significant. This is typically due to the high conducted power level of the radio and the subsequent heating of the radio in a constant transmit state for the duration of the SAR evaluation.
7. In order to verify that the scaled SAR levels were conservative, an additional evaluation was performed in the worst-case power drift configuration using the NiMH battery with an external power source connected to the NiMH battery terminals and with a ferrite dampener on the power leads. A SAR-versus-Time power drift evaluation was also performed with the external power source. Please note that the alkaline battery pack was not used for the external power source evaluation based on the fact that the radio would require modification to connect the leads internally. See Appendix A (SAR Test Plots) for the SAR-versus-Time power drift evaluation data.
8. A SAR-versus-Time power drift evaluation was performed in the test configuration that reported the maximum-scaled SAR level (50% duty cycle). See Appendix A (SAR Test Plots) for the SAR-versus-Time power drift evaluation data.
9. The area scan evaluation was performed with fully charged batteries. After the area scan was completed the DUT was cooled down to room temperature and the batteries were replaced with fully charged batteries prior to the zoom scan evaluation.
10. 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.
11. The SAR evaluations were performed using a Plexiglas planar phantom.
12. 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.
13. 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 C for printout of measured fluid dielectric parameters).
14. SAR measurements 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 daily system check was performed at the planar section of the SAM phantom with a 900 MHz dipole (see Appendix C 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 plots).

SYSTEM PERFORMANCE CHECK													
Test Date	Equiv. Tissue	SAR 1g (W/kg)		Dielectric Constant ε_r		Conductivity σ (mho/m)		ρ (Kg/m^3)	Amb. Temp. (°C)	Fluid Temp. (°C)	Fluid Depth (cm)	Humid. (%)	Barom. Press. (kPa)
	900 MHz	IEEE Target	Measured	IEEE Target	Measured	IEEE Target	Measured						
01/25/05	Brain	2.70 (±10%)	2.69 (-0.4%)	41.5 ±5%	41.7	0.97 ±5%	0.98	1000	22.3	21.4	≥ 15	32	102.3
01/27/05	Brain	2.70 (±10%)	2.57 (-4.8%)	41.5 ±5%	40.8	0.97 ±5%	0.98	1000	22.4	21.6	≥ 15	30	101.6
01/28/05	Brain	2.70 (±10%)	2.57 (-4.8%)	41.5 ±5%	41.2	0.97 ±5%	0.99	1000	22.3	21.6	≥ 15	30	101.7

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.

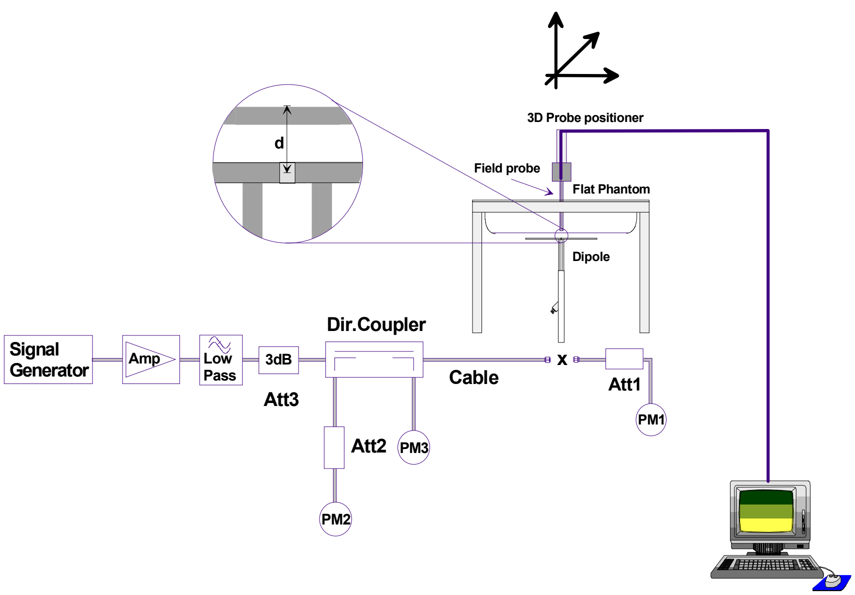


Figure 1. System Performance Check Setup Diagram

900MHz 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	900 MHz Brain System Performance Check	900/938 MHz Brain DUT Evaluation	900/938 MHz Body DUT Evaluation
Water	40.71 %	40.71 %	53.79 %
Sugar	56.63 %	56.63 %	45.13 %
Salt	1.48 %	1.48 %	0.98 %
HEC	0.99 %	0.99 %	--
Bactericide	0.19 %	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.:	1387
Construction:	Triangular core fiber optic detection system
Frequency:	10 MHz to 6 GHz
Linearity:	±0.2 dB (30 MHz to 3 GHz)

Phantom(s)

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

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

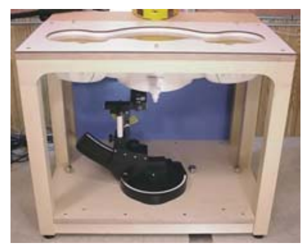
11.0 PROBE SPECIFICATION (ET3DV6)

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 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 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 F for specifications of the SAM phantom V4.0C).



SAM Phantom

13.0 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 handheld radio transceivers. The planar phantom is mounted on the side of the DASY4 compact system table.

Plexiglas 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.	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	May 2004	May 2005
-ET3DV6 E-Field Probe	1387	March 2004	March 2005
-ET3DV6 E-Field Probe	1590	May 2004	May 2005
-300MHz Validation Dipole	135	October 2004	October 2005
-450MHz Validation Dipole	136	November 2004	November 2005
-835MHz Validation Dipole	411	March 2004	March 2005
-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
-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 8648D Signal Generator	3847A00611	April 2004	April 2005
Amplifier Research 5S1G4 Power Amplifier	26235	N/A	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	± 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])

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 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": June 2003.

APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 01/25/05

System Performance Check - 900 MHz Dipole

DUT: Dipole 900 MHz; Model: D900V2; Type: System Performance Check; Serial: 054; Calibrated: 06/10/2004

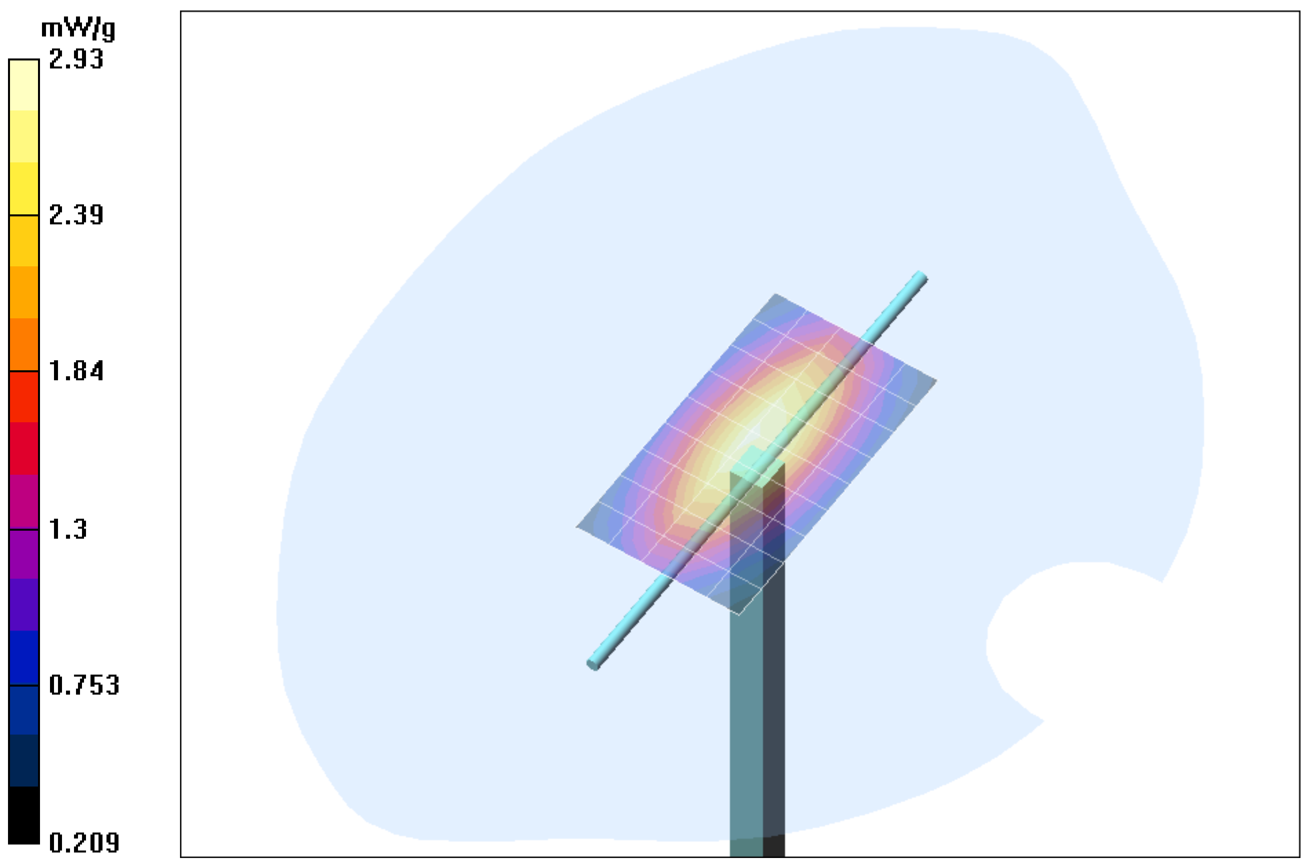
Ambient Temp: 22.3 °C; Fluid Temp: 21.4 °C; Barometric Pressure: 102.3 kPa; Humidity: 32%

Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 900 MHz; Duty Cycle: 1:1
Medium: HSL900 (σ = 0.98 mho/m; ε_r = 41.7; ρ = 1000 kg/m^3)

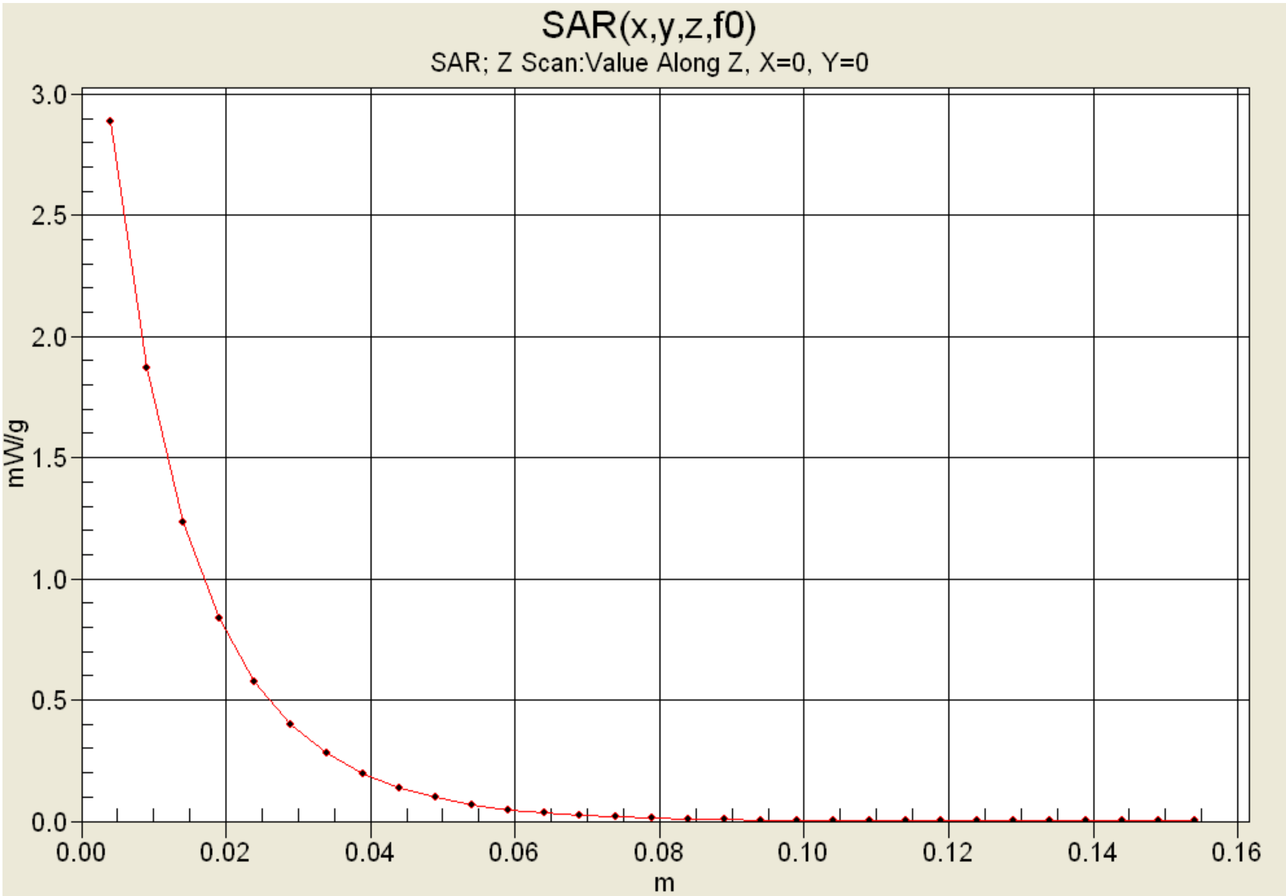
- Probe: ET3DV6 - SN1387; ConvF(6.71, 6.71, 6.71); Calibrated: 18/03/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 06/07/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

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

900 MHz Dipole - System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 4.19 W/kg
SAR(1 g) = 2.69 mW/g; SAR(10 g) = 1.7 mW/g



Z-Axis Scan


SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

Date Tested: 01/27/05

System Performance Check - 900 MHz Dipole

DUT: Dipole 900 MHz; Model: D900V2; Type: System Performance Check; Serial: 054; Calibrated: 06/10/2004

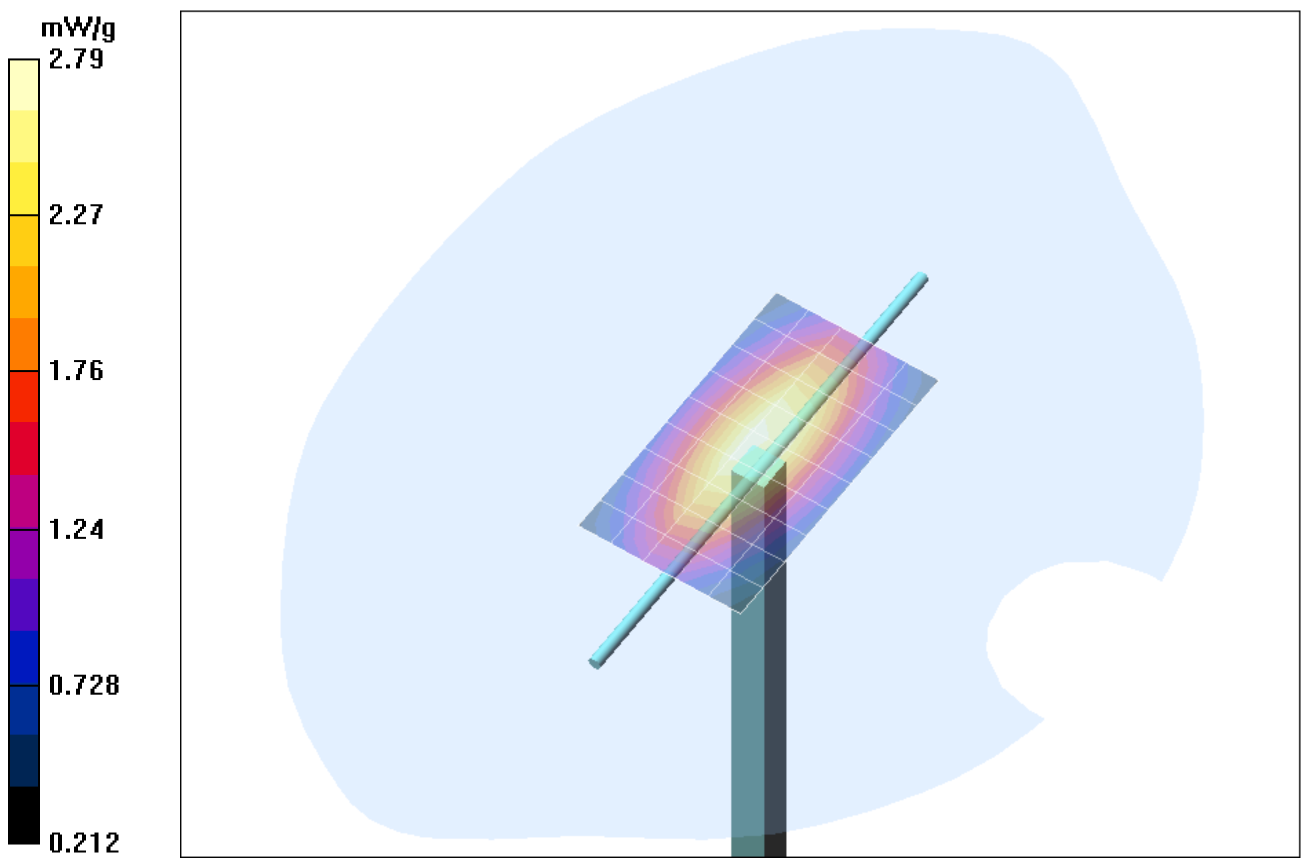
Ambient Temp: 22.4 °C; Fluid Temp: 21.6 °C; Barometric Pressure: 101.6 kPa; Humidity: 30%

Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 900 MHz; Duty Cycle: 1:1
Medium: HSL900 (σ = 0.98 mho/m; ε_r = 40.8; ρ = 1000 kg/m^3)

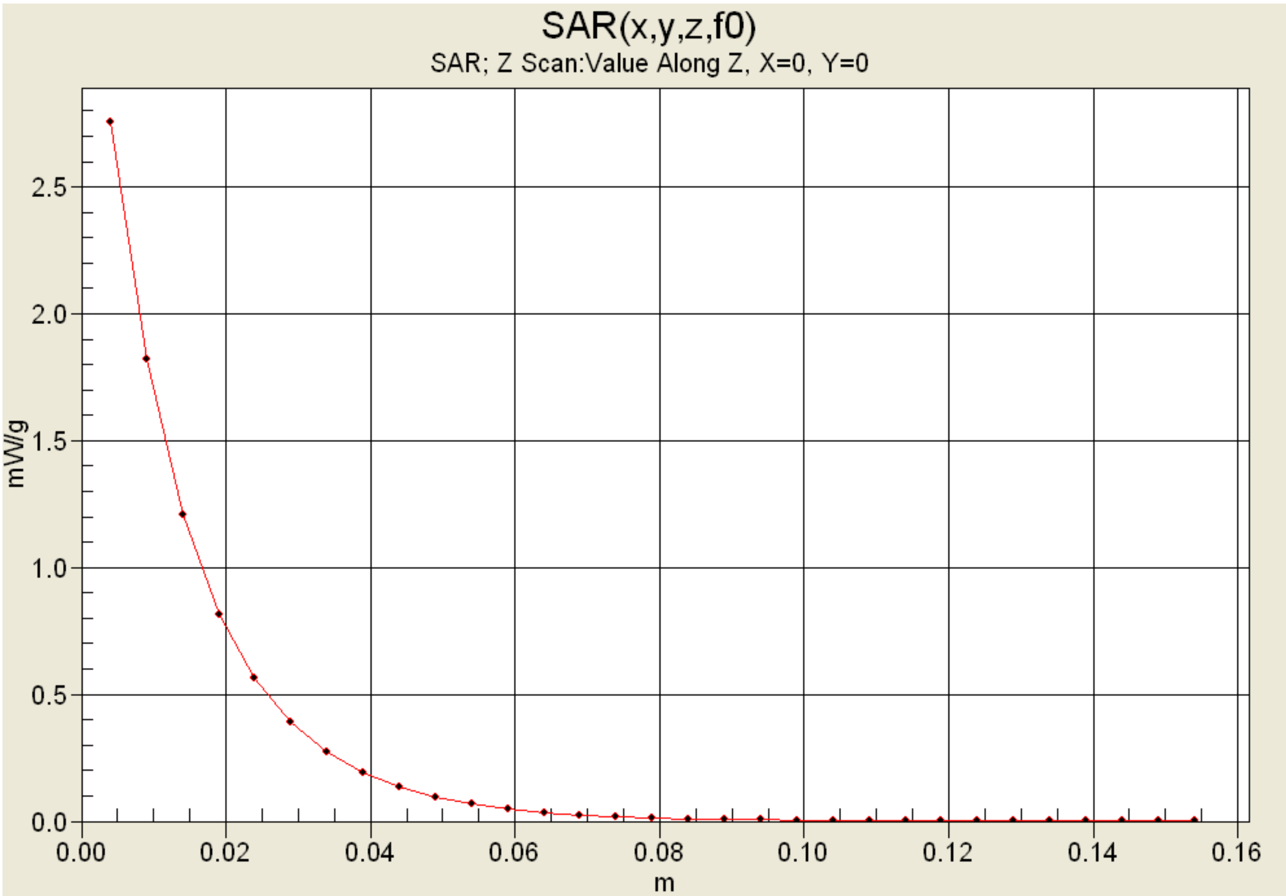
- Probe: ET3DV6 - SN1387; ConvF(6.71, 6.71, 6.71); Calibrated: 18/03/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 06/07/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

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

900 MHz Dipole - System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.3 V/m; Power Drift = -0.003 dB
Peak SAR (extrapolated) = 3.86 W/kg
SAR(1 g) = 2.57 mW/g; SAR(10 g) = 1.64 mW/g



Z-Axis Scan



SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
2.5
2.0
1.5
1.0
0.5
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

Date Tested: 01/28/05

System Performance Check - 900 MHz Dipole

DUT: Dipole 900 MHz; Model: D900V2; Type: System Performance Check; Serial: 054; Calibrated: 06/10/2004

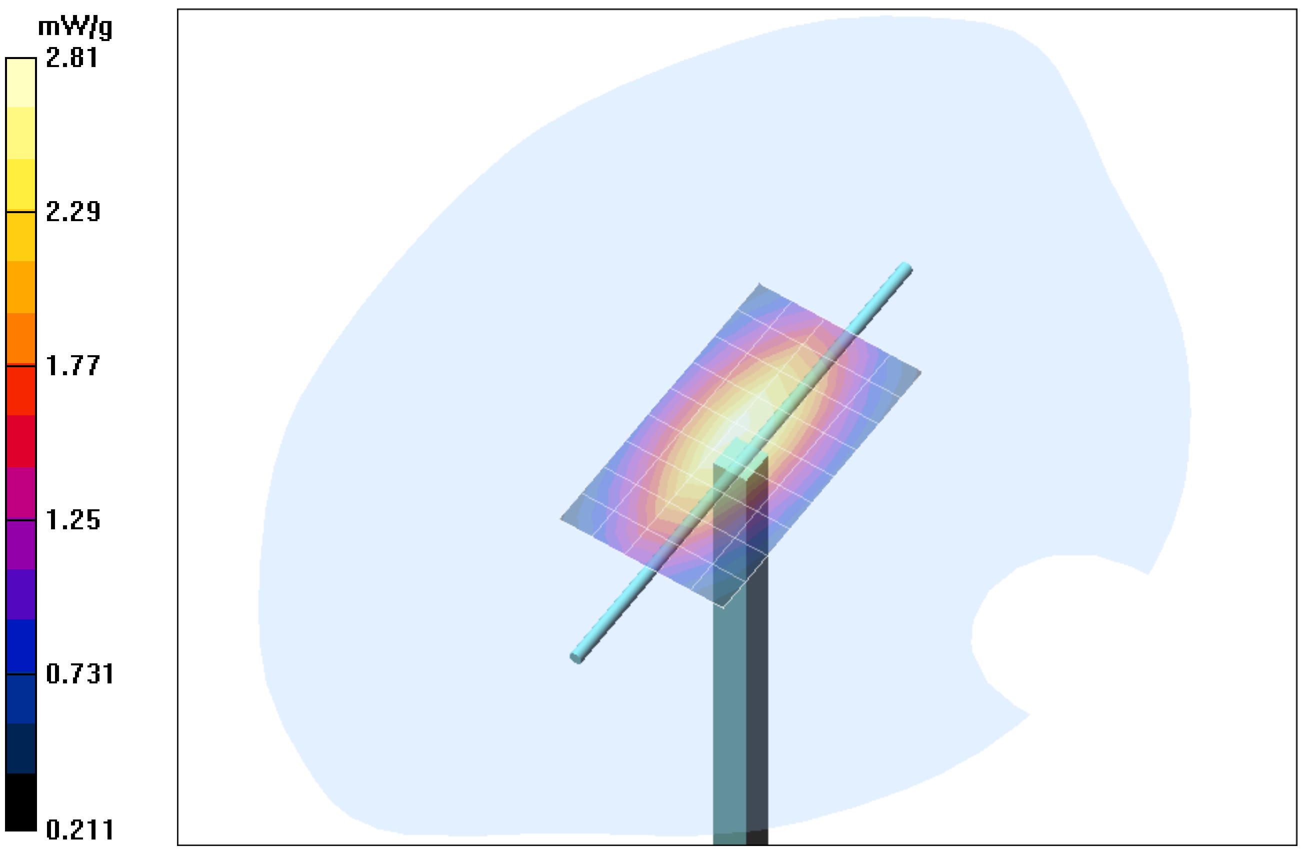
Ambient Temp: 22.3 °C; Fluid Temp: 21.6 °C; Barometric Pressure: 101.7 kPa; Humidity: 30%

Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 900 MHz; Duty Cycle: 1:1
Medium: HSL900 (σ = 0.99 mho/m; ε_r = 41.2; ρ = 1000 kg/m^3)

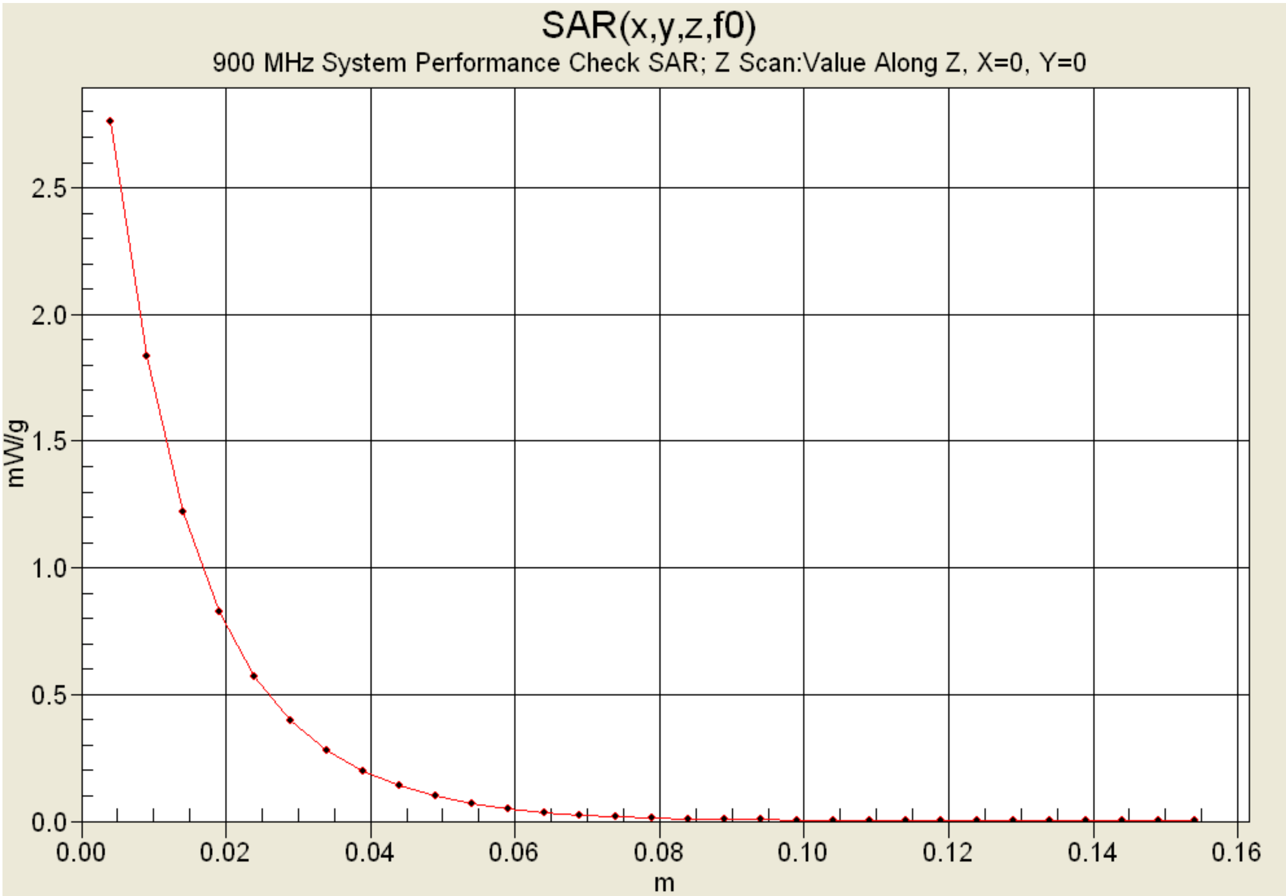
- Probe: ET3DV6 - SN1387; ConvF(6.71, 6.71, 6.71); Calibrated: 18/03/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 06/07/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.3 Build 22; Postprocessing SW: SEMCAD, V1.8 Build 127

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

900 MHz Dipole - System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.8 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 3.84 W/kg
SAR(1 g) = 2.57 mW/g; SAR(10 g) = 1.65 mW/g



Z-Axis Scan


SAR(x,y,z,f0)
900 MHz System Performance Check SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
2.5
2.0
1.5
1.0
0.5
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

900 MHz System Performance Check & DUT Evaluation (Face)

Measured Fluid Dielectric Parameters (Brain)

January 25, 2005

Frequency	e'	e"
800.000000 MHz	42.8635	19.9969
810.000000 MHz	42.8090	20.0175
820.000000 MHz	42.6963	20.0487
830.000000 MHz	42.5147	20.0461
840.000000 MHz	42.3538	20.0232
850.000000 MHz	42.1893	19.9715
860.000000 MHz	42.0553	19.9027
870.000000 MHz	41.8809	19.8581
880.000000 MHz	41.7989	19.7680
890.000000 MHz	41.7186	19.7094
900.000000 MHz	41.7021	19.6229
910.000000 MHz	41.5950	19.6886
920.000000 MHz	41.4393	19.7100
930.000000 MHz	41.2530	19.6493
940.000000 MHz	41.1146	19.6050
950.000000 MHz	41.0265	19.5275
960.000000 MHz	40.9084	19.5275
970.000000 MHz	40.7576	19.4729
980.000000 MHz	40.6666	19.4197
990.000000 MHz	40.6171	19.3590
1.000000000 GHz	40.5360	19.3785

938 MHz DUT Evaluation (Face)

Measured Fluid Dielectric Parameters (Brain)

January 25, 2005

Frequency	e'	e"
838.000000 MHz	41.6852	19.7731
848.000000 MHz	41.5293	19.7350
858.000000 MHz	41.4187	19.6961
868.000000 MHz	41.2740	19.6683
878.000000 MHz	41.1669	19.6512
888.000000 MHz	41.0329	19.6329
898.000000 MHz	40.9468	19.5618
908.000000 MHz	40.8449	19.5119
918.000000 MHz	40.7232	19.4839
928.000000 MHz	40.6463	19.4485
938.000000 MHz	40.4870	19.3863
948.000000 MHz	40.4340	19.3793
958.000000 MHz	40.3182	19.3448
968.000000 MHz	40.1879	19.3441
978.000000 MHz	40.1119	19.3273
988.000000 MHz	40.0303	19.2990
998.000000 MHz	39.8958	19.2839
1.008000000 GHz	39.7965	19.2405
1.018000000 GHz	39.6753	19.2189
1.028000000 GHz	39.5450	19.2149
1.038000000 GHz	39.4581	19.1709

900 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

January 27, 2005

Frequency	e'	e"
800.000000 MHz	53.5268	21.4889
810.000000 MHz	53.4637	21.5194
820.000000 MHz	53.3789	21.5233
830.000000 MHz	53.2485	21.5104
840.000000 MHz	53.1701	21.4905
850.000000 MHz	53.0490	21.4322
860.000000 MHz	52.9457	21.2935
870.000000 MHz	52.8044	21.2466
880.000000 MHz	52.7014	21.1765
890.000000 MHz	52.5941	21.1411
900.000000 MHz	52.5155	21.0750
910.000000 MHz	52.3819	21.0727
920.000000 MHz	52.2731	21.0823
930.000000 MHz	52.1808	21.0450
940.000000 MHz	52.1145	21.0389
950.000000 MHz	52.0824	21.0091
960.000000 MHz	52.0114	20.9753
970.000000 MHz	51.9160	20.9225
980.000000 MHz	51.8440	20.8712
990.000000 MHz	51.7574	20.8365
1.000000000 GHz	51.6375	20.8072

938 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

January 27, 2005

Frequency	e'	e"
838.000000 MHz	54.0699	21.6355
848.000000 MHz	53.9513	21.6345
858.000000 MHz	53.8124	21.5657
868.000000 MHz	53.7406	21.5489
878.000000 MHz	53.6186	21.5302
888.000000 MHz	53.5138	21.5166
898.000000 MHz	53.4491	21.4197
908.000000 MHz	53.3610	21.3493
918.000000 MHz	53.2786	21.3245
928.000000 MHz	53.2022	21.2415
938.000000 MHz	53.0783	21.2606
948.000000 MHz	52.9965	21.2226
958.000000 MHz	52.8871	21.2069
968.000000 MHz	52.7884	21.2076
978.000000 MHz	52.7018	21.2038
988.000000 MHz	52.6364	21.1719
998.000000 MHz	52.5084	21.1575
1.008000000 GHz	52.4368	21.1297
1.018000000 GHz	52.3013	21.0918
1.028000000 GHz	52.2192	21.0799
1.038000000 GHz	52.1146	21.0311

900 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

January 28, 2005

Frequency	e'	e"
800.000000 MHz	53.9713	21.6531
810.000000 MHz	53.9281	21.6042
820.000000 MHz	53.8209	21.5394
830.000000 MHz	53.7075	21.5228
840.000000 MHz	53.6007	21.4660
850.000000 MHz	53.4606	21.4556
860.000000 MHz	53.3102	21.3745
870.000000 MHz	53.1961	21.3785
880.000000 MHz	53.1095	21.3302
890.000000 MHz	53.0129	21.3289
900.000000 MHz	52.9529	21.2355
910.000000 MHz	52.8716	21.2139
920.000000 MHz	52.7894	21.1677
930.000000 MHz	52.6823	21.1016
940.000000 MHz	52.5822	21.0951
950.000000 MHz	52.5254	21.0616
960.000000 MHz	52.4378	21.0063
970.000000 MHz	52.3404	21.0157
980.000000 MHz	52.2433	20.9811
990.000000 MHz	52.1334	20.9773
1.000000000 GHz	52.0552	20.9706

938 MHz DUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

January 28, 2005

Frequency	e'	e"
838.000000 MHz	53.2199	21.3281
848.000000 MHz	53.0815	21.2882
858.000000 MHz	52.9678	21.2730
868.000000 MHz	52.8197	21.2393
878.000000 MHz	52.7532	21.2403
888.000000 MHz	52.6541	21.2009
898.000000 MHz	52.5939	21.1163
908.000000 MHz	52.5048	21.0443
918.000000 MHz	52.3991	21.0007
928.000000 MHz	52.3084	20.9728
938.000000 MHz	52.2229	20.9234
948.000000 MHz	52.1336	20.9068
958.000000 MHz	52.0253	20.8586
968.000000 MHz	51.9362	20.8732
978.000000 MHz	51.8387	20.8816
988.000000 MHz	51.7578	20.8738
998.000000 MHz	51.6639	20.8381
1.008000000 GHz	51.5534	20.8008
1.018000000 GHz	51.4576	20.8014
1.028000000 GHz	51.3547	20.7772
1.038000000 GHz	51.2516	20.7447

900 MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

January 27, 2005

Frequency	e'	e"
800.000000 MHz	42.0774	20.0041
810.000000 MHz	41.9775	20.0090
820.000000 MHz	41.8449	19.9589
830.000000 MHz	41.7045	19.9234
840.000000 MHz	41.5657	19.8784
850.000000 MHz	41.4214	19.8368
860.000000 MHz	41.2978	19.7806
870.000000 MHz	41.1483	19.7643
880.000000 MHz	41.0245	19.7519
890.000000 MHz	40.9083	19.7182
900.000000 MHz	40.8251	19.6164
910.000000 MHz	40.7254	19.6005
920.000000 MHz	40.6261	19.5755
930.000000 MHz	40.5440	19.5172
940.000000 MHz	40.4226	19.5107
950.000000 MHz	40.3140	19.4725
960.000000 MHz	40.2039	19.4503
970.000000 MHz	40.0607	19.4020
980.000000 MHz	39.9578	19.4123
990.000000 MHz	39.8421	19.3719
1.000000000 GHz	39.7363	19.3390

900 MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

January 28, 2005

Frequency	e'	e"
800.000000 MHz	42.4580	20.0755
810.000000 MHz	42.3738	20.0517
820.000000 MHz	42.2833	19.9927
830.000000 MHz	42.1213	20.0085
840.000000 MHz	42.0075	19.9534
850.000000 MHz	41.8423	19.9252
860.000000 MHz	41.7090	19.8481
870.000000 MHz	41.5450	19.8641
880.000000 MHz	41.4521	19.8296
890.000000 MHz	41.3374	19.8127
900.000000 MHz	41.2484	19.7194
910.000000 MHz	41.1480	19.6957
920.000000 MHz	41.0445	19.6348
930.000000 MHz	40.9232	19.5858
940.000000 MHz	40.8275	19.5785
950.000000 MHz	40.7295	19.5535
960.000000 MHz	40.6320	19.5057
970.000000 MHz	40.5337	19.5063
980.000000 MHz	40.4163	19.4810
990.000000 MHz	40.3089	19.4767
1.000000000 GHz	40.1978	19.4515

APPENDIX E - SYSTEM VALIDATION

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

Client **Celltech Labs**

CALIBRATION CERTIFICATE

Object(s)	D900V2 - SN:054
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date:	June 10, 2004
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment 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 E442	GB37480704	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	US37292783	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-03)	In house check: Oct 05

	Name	Function	Signature
Calibrated by:	Judith Mueller	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: June 14, 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.

Schmid & Partner Engineering AG

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DASY

Dipole Validation Kit

Type: D900V2

Serial: 054

Manufactured: August 25, 1999
Calibrated: June 10, 2004

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with **head simulating solution** of the following electrical parameters at 900 MHz:

Relative Dielectricity	**42.0**	± 5%
Conductivity	**1.00 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.18 at 900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15mm from dipole center to the solution surface. The included distance spacer was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250 mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**11.0 mW/g** ± 16.8 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue:	**7.00 mW/g** ± 16.2 % (k=2)[1]

[1] validation uncertainty

3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.396 ns**	(one direction)
Transmission factor:	**0.992**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance spacer was in place during impedance measurements.

Feedpoint impedance at 900 MHz:	Re{Z} = **49.5 Ω**
	Im {Z} = **-2.6 Ω**
Return Loss at 900 MHz	**-32.5 dB**

4. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

5. Design

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

6. Power Test

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

Date/Time: 06/10/04 11:48:00

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN054

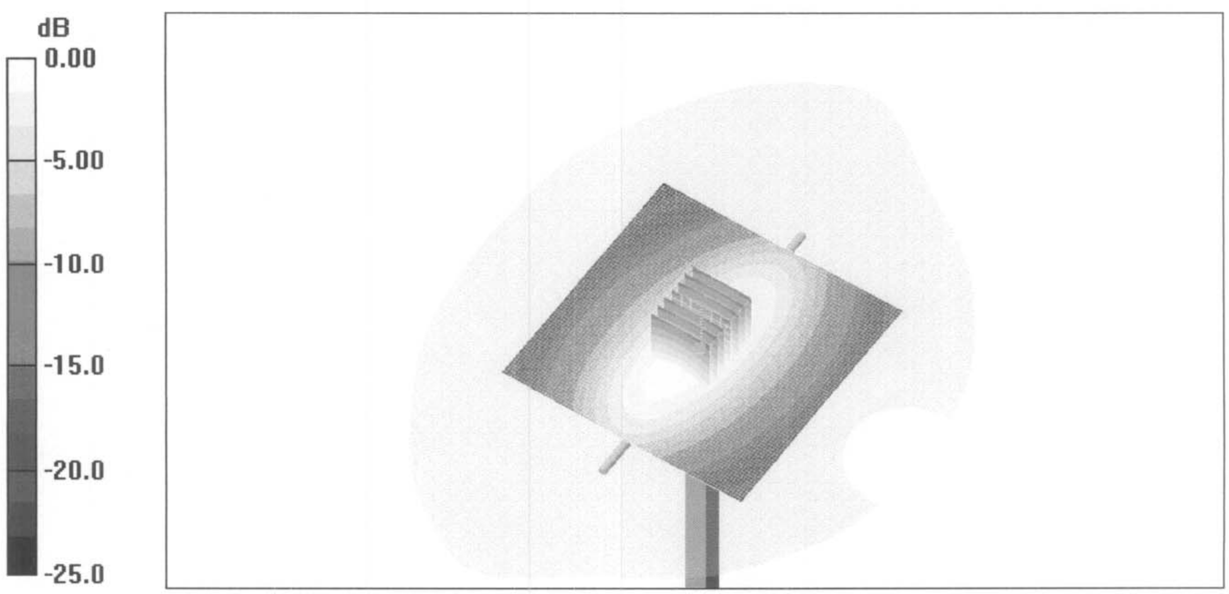
Communication System: CW-900; Frequency: 900 MHz;Duty Cycle: 1:1
Medium: HSL 900 MHz;
Medium parameters used: f = 900 MHz; σ = 1 mho/m; ε_r = 42; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.18, 6.18, 6.18); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn411; Calibrated: 11/6/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006;
- Measurement SW: DASY4, V4.2 Build 56; Postprocessing SW: SEMCAD, V2.0 Build 34

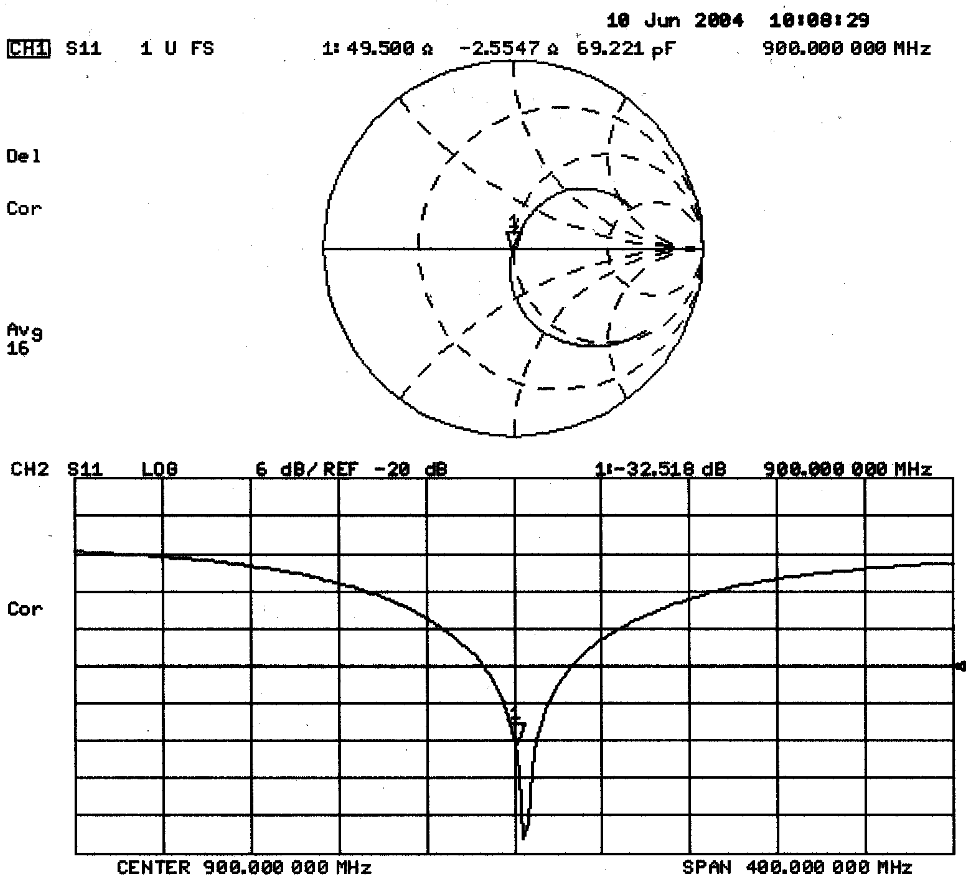
Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 56.4 V/m; Power Drift = 0.02 dB
Maximum value of SAR (interpolated) = 2.96 mW/g

Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.4 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 4.18 W/kg
SAR(1 g) = 2.75 mW/g; SAR(10 g) = 1.75 mW/g
Maximum value of SAR (measured) = 2.96 mW/g



0 dB = 2.96mW/g

054
Head


10 Jun 2004 10:08:29
CH1 S11 1 U FS
1: 49.500 Ω -2.5547 Ω 69.221 pF 900.000 000 MHz
Del
Cor
Avg
16
CH2 S11 LOG 6 dB/ REF -20 dB 1:-32.518 dB 900.000 000 MHz
Cor
CENTER 900.000 000 MHz
SPAN 400.000 000 MHz

APPENDIX F - PROBE CALIBRATION

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

Client **Celltech**

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1387
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	March 18, 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: environment 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	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Reference 20 dB Attenuator	SN: 5086 (20b)	3-Apr-03 (METAS, No. 251-0340)	Apr-04
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: March 18, 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:1387

Manufactured:	September 21, 1999
Last calibrated:	February 26, 2003
Recalibrated:	March 18, 2004

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1387

Sensitivity in Free Space

NormX	**1.62** $\mu V/(V/m)^2$
NormY	**1.71** $\mu V/(V/m)^2$
NormZ	**1.71** $\mu V/(V/m)^2$

Diode Compression[A]

DCP X	**92**	mV
DCP Y	**92**	mV
DCP Z	**92**	mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Plese see Page 7.

Boundary Effect

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

Sensor Cener to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	9.3	4.4
SAR_{be} [%]	With Correction Algorithm	0.0	0.1

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

Sensor to Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	14.8	10.0
SAR_{be} [%]	With Correction Algorithm	0.2	0.0

Sensor Offset

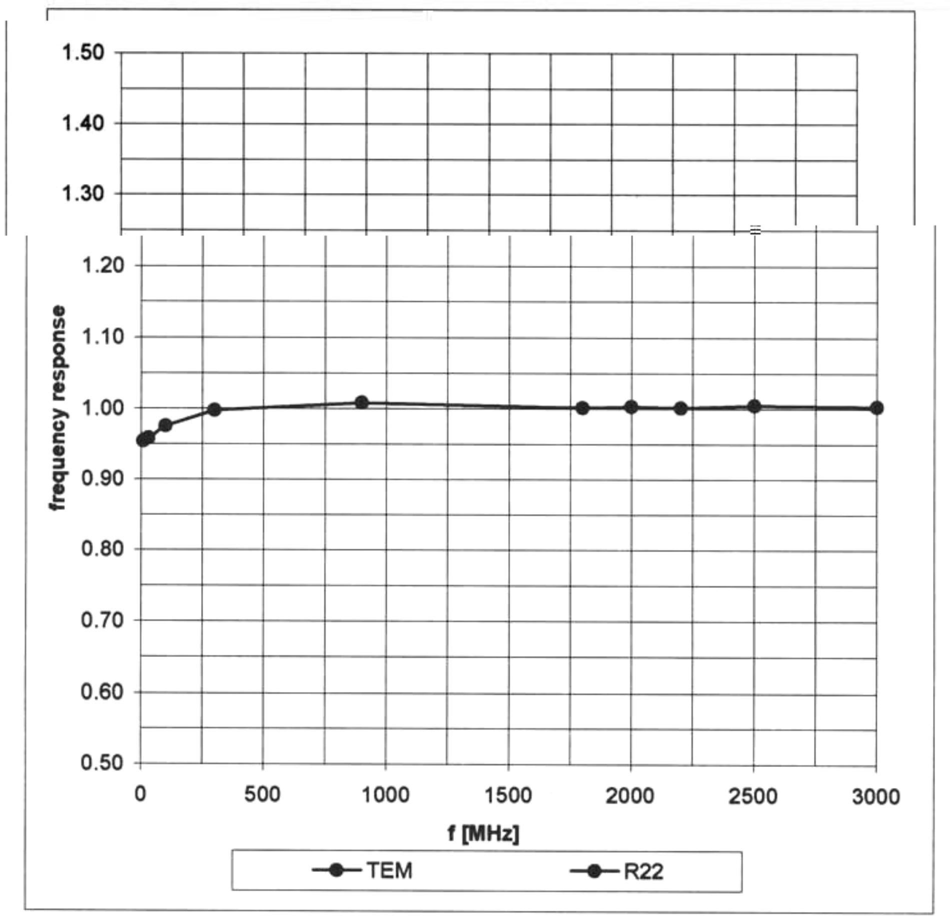
Probe Tip to Sensor Center	**2.7** mm
Optical Surface Detection	**in tolerance**

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%.

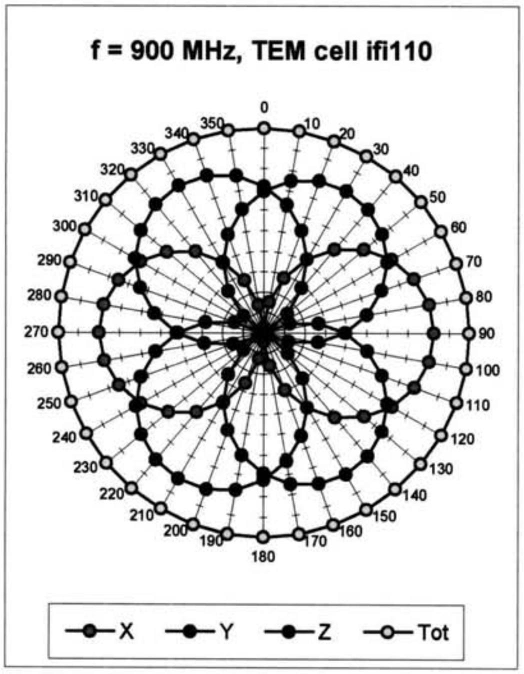
[A] numerical linearization parameter: uncertainty not required

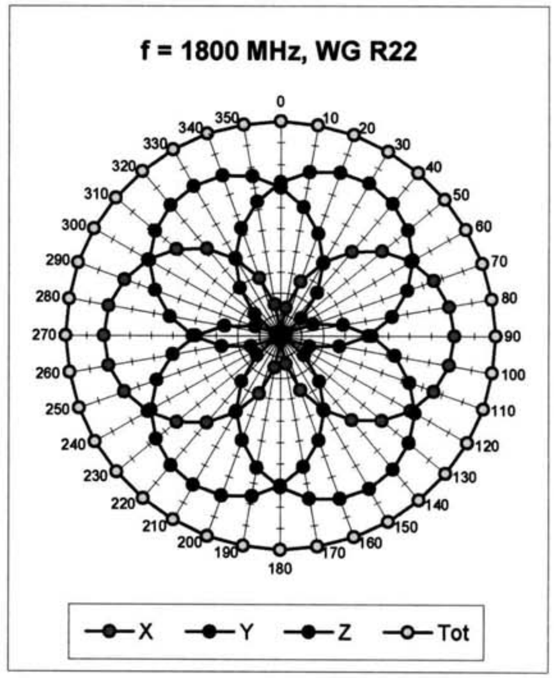
Frequency Response of E-Field

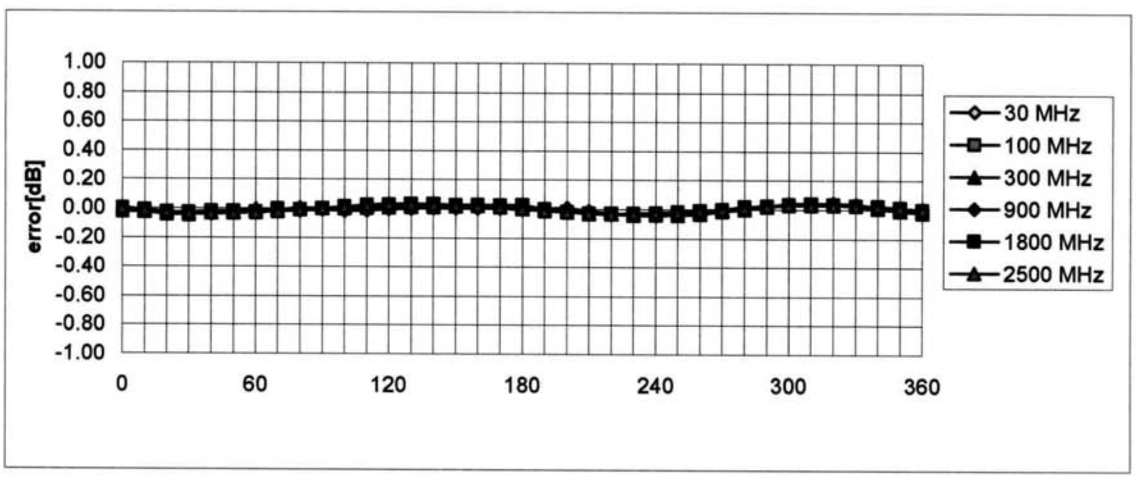
(TEM-Cell:ifi110, Waveguide R22)



Receiving Pattern (φ), θ = 0°



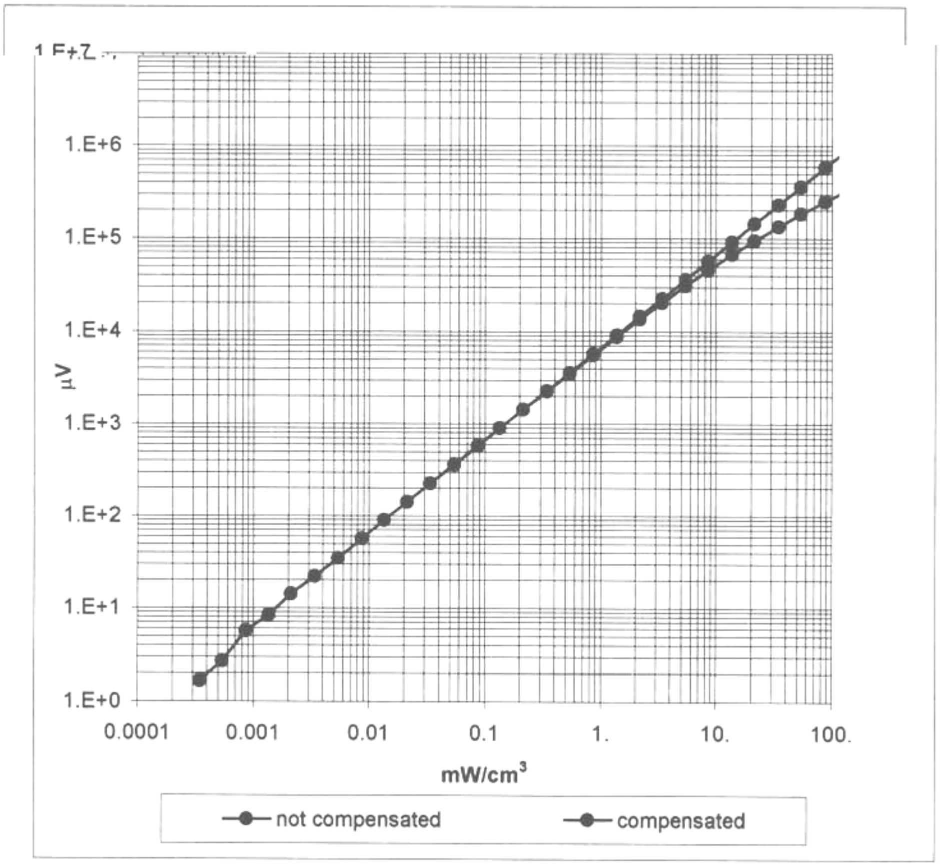


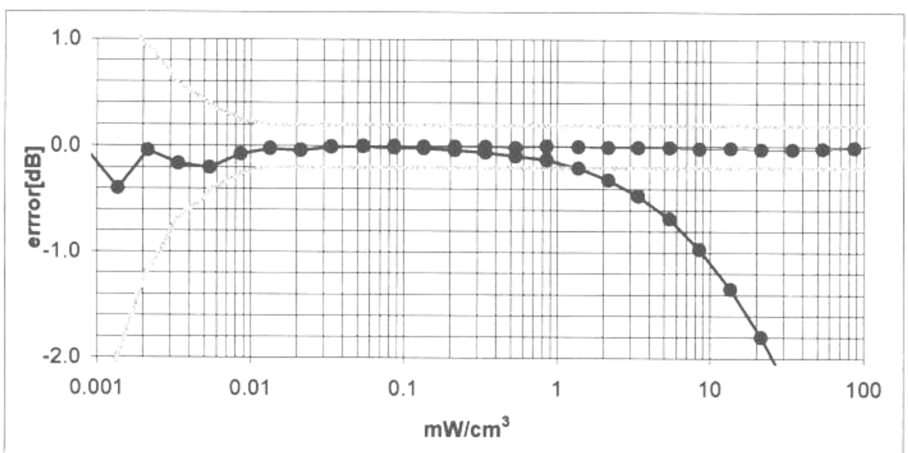


Axial Isotropy Error < ± 0.2 dB

Dynamic Range f(SAR_{head})

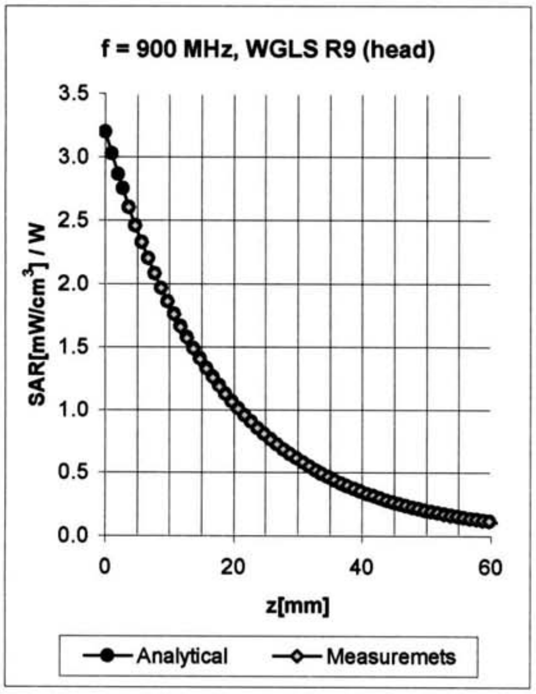
(Waveguide R22)

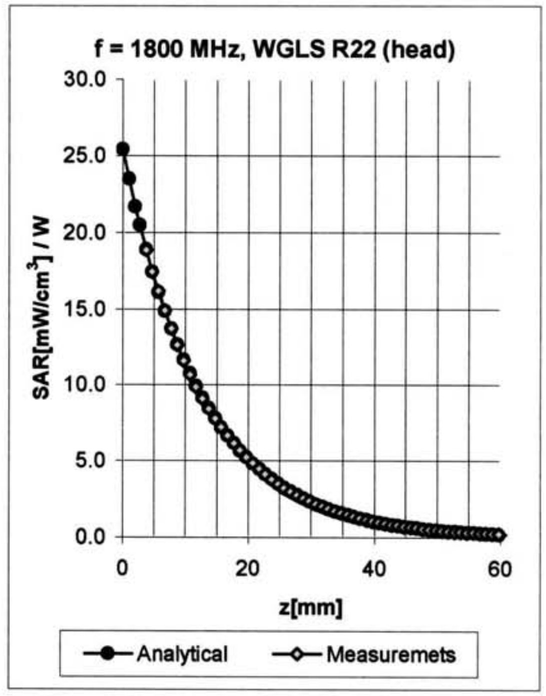




Probe Linearity < ± 0.2 dB

Conversion Factor Assessment



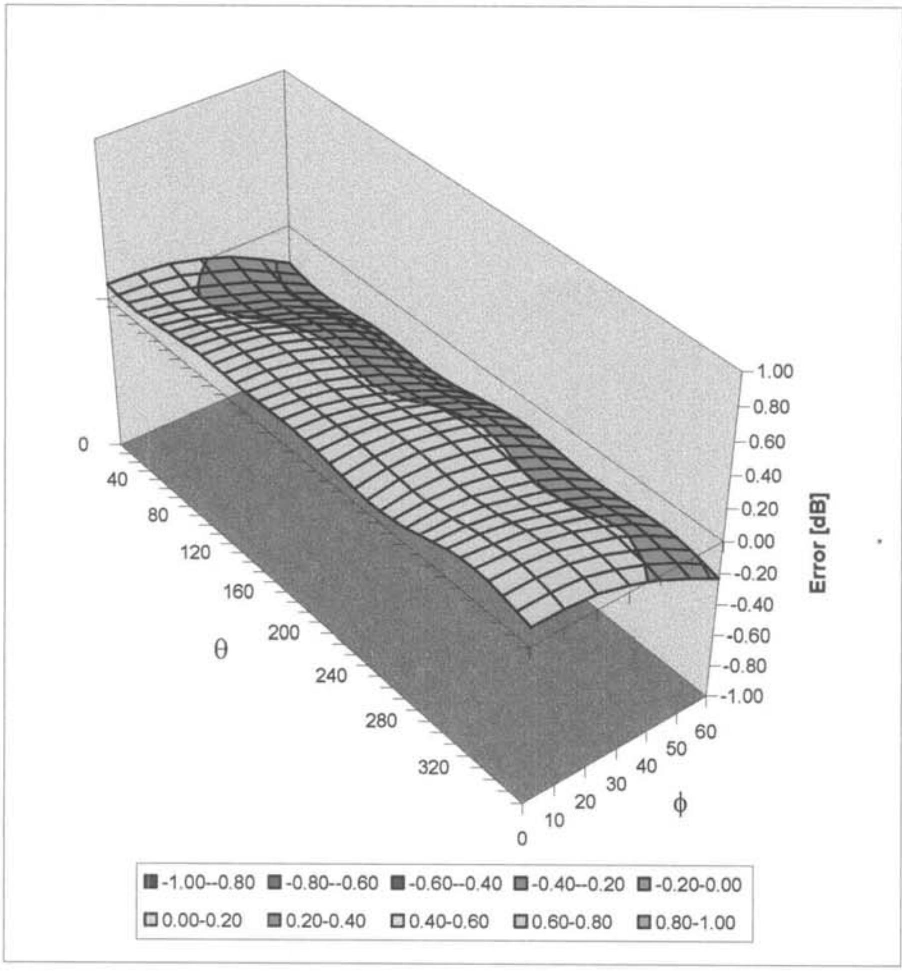


f [MHz]	Validity [MHz][B]	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
835	750-950	Head	41.5 ± 5%	0.90 ± 5%	0.72	1.78	6.71	± 11.9% (k=2)
1750	1700-1800	Head	40.0 ± 5%	1.40 ± 5%	0.51	2.67	5.38	± 9.7% (k=2)
1900	1850-1950	Head	40.0 ± 5%	1.40 ± 5%	0.55	2.66	5.25	± 9.7% (k=2)
2450	2400-2500	Head	39.2 ± 5%	1.80 ± 5%	0.99	1.89	4.77	± 9.7% (k=2)
835	750-950	Body	55.2 ± 5%	0.97 ± 5%	0.56	2.04	6.24	± 11.9% (k=2)
1750	1700-1800	Body	53.3 ± 5%	1.52 ± 5%	0.58	2.82	4.68	± 9.7% (k=2)
1900	1850-1950	Body	53.3 ± 5%	1.52 ± 5%	0.62	2.77	4.57	± 9.7% (k=2)
2450	2400-2500	Body	52.7 ± 5%	1.95 ± 5%	1.75	1.28	4.50	± 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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Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1387**
Place of Assessment:	**Zurich**
Date of Assessment:	**March 22, 2004**
Probe Calibration Date:	**March 18, 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: [signature]

Schmid & Partner Engineering AG

s p e a g

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

Dosimetric E-Field Probe ET3DV6 SN:1387

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	**7.8 ± 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	**8.7 ± 8%**	**ε_r = 61.9 ± 5%** **σ = 0.80 ± 5% mho/m** (body tissue)
450 MHz	ConvF	**7.6 ± 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
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