RF EXPOSURE EVALUATION

SPECIFIC ABSORPTION RATE

SAR TEST REPORT

FOR

MAGELLAN NAVIGATION

DUAL-BAND GSM/GPRS MODULE

INSTALLED IN

Z-MAX.NET WIRELESS SURVEYING SYSTEM

WITH

BLUETOOTH

IDENTIFIER(S)	FCC ID: NZI800964	IC: 4713A-800964
Test Standard(s) and Procedure(s)	FCC OET Bulletin 65, Supplement C (01-01)	
	Industry Canada RSS-102 Issue 2	

Test Report Serial No.

111506NZI-T789-S24G

Test Report Revision No.

Revision 1.1 (2nd Release - 01/18/07)
Revision 1.0 (Initial Release - 01/17/07)

Test Lab and Location

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Test Report Prepared By:	Test Report Reviewed By:
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DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

Test Lab and Location

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Test Requirement(s):	FCC	47 CFR §2.1093		IC	Health Canada Safety Code 6			
Test Procedure(s):	FCC	OET Bulletin 65, Supplement C (01-01)		IC	RSS-102 Issue 2			
Device Classification(s):	FCC	PCS Licensed Transmitter (PCB)		47 CFR Part 24 Subpart E				
	IC	2 GHz Personal Communication Services		RSS-133 Issue 3				
		800 MHz Cellular Telephones Employing New Technologies		RSS-132 Issue 2				
Device Identifier(s):	FCC ID: NZI800964		IC: 4713A-800964	P/N: 800964		S/N: 200515027		
Device Description:	Dual-Band GSM/GPRS Module installed in Z-Max.Net Wireless Surveying System with Bluetooth							
	Internal Transmitter Manufacturer/Type:			Motorola G24-F6403 Dual-Band GSM/GPRS Module				
Transmit Frequency Range(s):	1850.2 - 1909.8 MHz			PCS GSM/GPRS				
	824.2 - 848.8 MHz			Cellular GSM/GPRS				
	2402 - 2480 MHz			Bluetooth				
Max. RF Output Power Tested:	**Band**	**Freq. (MHz)**	**Peak Conducted**		**Band**	**Freq. (MHz)**	**Peak Conducted**	
			dBm	**Watts**			**dBm**	**Watts**
	PCS GPRS	1880.0	29.94	0.986	Cellular GPRS	836.6	32.62	1.83
	Bluetooth	2441	3.20	0.0021	-			
Source-Based Time-Averaged:	23.74 dBm	0.237 Watts		Peak Conducted		1880.0 MHz		PCS GPRS
	26.43 dBm	0.439 Watts		Peak Conducted		836.6 MHz		Cellular GPRS
GSM Transmit Class:	Class B GSM 0.710 multiplexing protocol			Modulation Type:			GMSK	
GPRS Multislot Class:	Class 10	2 Uplink Slots		**Max. Source-Based Time-Averaged Duty Cycle:**			24%	
Transmit Power Class:	GPRS 850: Class 4			GPRS 1900: Class 1				
Antenna Type(s) Tested:	External Stubby			Length: 53 mm				
Battery Type(s) Tested:	Battery Module 8.8 Ah			P/N: 800965-01				
Body-Worn Accessories Tested:	Z-Max.Net Backpack			P/N: 205917				
Max. SAR Level(s) Evaluated:	**Body-worn**	**PCS Band**		**0.370 W/kg (1g average)**				
		Cellular Band		**0.702 W/kg (1g average)**				

Celltech Labs Inc. declares under its sole responsibility that this wireless 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 2 for the General Population / Uncontrolled Exposure environment. All measurements were performed in accordance with the SAR system manufacturer recommendations.

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

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

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1.0 INTRODUCTION

This measurement report demonstrates that the MAGELLAN NAVIGATION Dual-Band GSM/GPRS Module FCC ID: NZI800964 with co-located Bluetooth installed in the Z-Max.Net Wireless Surveying System complies with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]) and Health Canada's Safety Code 6 (see reference [2]) for the General Population / Uncontrolled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]) and IC RSS-102 Issue 2 (see reference [4]) were employed. A description of the product and 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)**	Health Canada Safety Code 6			
Test Procedure(s)	FCC OET Bulletin 65, Supplement C (01-01)				Industry Canada RSS-102 Issue 2			
RF Exposure Category	General Population / Uncontrolled Environment							
FCC Device Classification	PCS Licensed Transmitter (PCB)				47 CFR Part 24 Subpart E			
IC Device Classification	2 GHz Personal Communication Services				RSS 133 Issue 3			
	800MHz Cellular Telephones Employing New Technologies				RSS-132 Issue 2			
Device Description	Dual-Band GSM//GPRS Module installed in Wireless Surveying System with Bluetooth							
	Internal Transmitter Manufacturer/Type:			Motorola G24-F6403 Dual-Band GSM/GPRS Module				
Device Model(s)	Z-Max.Net			**Device Part No.**	800964			
FCC IDENTIFIER	NZI800964			**IC IDENTIFIER**	4713A-800964			
Test Sample Serial No.(s)	200626035	Wireless Surveying System			Production Unit			
	200515027	Dual-Band GSM/GPRS Module			Production Unit			
Transmit Frequency Range(s)	1850.2 - 1909.8 MHz				PCS GSM/GPRS			
	824.2 - 848.8 MHz				Cellular GSM/GPRS			
	2402 - 2480 MHz				Bluetooth			
Max. RF Conducted Output Power Level(s) Tested	**Band**	**Mode**	**Frequency**	**Peak Conducted**		**Source-Based Time-Averaged**		
			MHz	**dBm**	**Watts**	**dBm**	**Watts**	**Duty Cycle**
	Cellular	GPRS	836.6	32.62	1.83	26.42	0.439	24%
	PCS	GPRS	1880.0	29.94	0.986	23.74	0.237	24%
	Bluetooth		2441	3.20	0.0021	-		
GPRS Multislot Class	Class 10			2 Uplink Slots		Crest Factor: 1:4.16		
GSM Transmit Class	Class B GSM 0.710 multiplexing protocol							
GSM Power Class	850 MHz	Class 4		2 Watts	1900 MHz	Class 1		1 Watt
Modulation Type(s)	GPRS: GMSK				Bluetooth: FHSS			
Antenna Type(s) Tested	External Stubby				Length: 53 mm			
Battery Type(s) Tested	8.8 Ah				P/N: 800965-01			
Body-Worn Accessories Tested	Z-Max.Net Backpack				P/N: 205917			
Audio Accessories Tested	None (not applicable)							

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 Measurement System with SAM Phantom and device holder

DASY4 Measurement System with SAM Phantom and validation dipole

4.0 MEASUREMENT SUMMARY

BODY-WORN SAR EVALUATION RESULTS

Test Mode	Uplink Slots	Duty Cycle	Freq. MHz	Chan.	Antenna Position	Battery Type	Device Position to Planar Phantom	Accessories: Body-worn	Accessories: Accessory Spacing to Planar Phantom	Cond. Power Before Test dBm	SAR Drift During Test dB	Measured SAR 1g W/kg
PCS GPRS	2 Slots	24%	1880.0	661	Fixed Stubby	8.8 Ah	GSM/GPRS Module Side	Backpack	1.0 cm	29.94	-0.147	**0.370**
PCS GPRS	2 Slots	24%	1880.0	661	Fixed Stubby	8.8 Ah	GSM/GPRS Module Side	Backpack	1.0 cm	29.94	-0.124	0.357
Bluetooth co-transmit	Modulated Fixed Frequency		2441	39						3.20		
Cellular GPRS	2 Slots	24%	836.6	190	Fixed Stubby	8.8 Ah	GSM/GPRS Module Side	Backpack	1.0 cm	32.62	-0.113	0.671
Cellular GPRS	2 Slots	24%	836.6	190	Fixed Stubby	8.8 Ah	GSM/GPRS Module Side	Backpack	1.0 cm	32.62	-0.0973	**0.702**
Bluetooth co-transmit	Modulated Fixed Frequency		2441	39						3.20		
ANSI / IEEE C95.1 2005 - SAFETY LIMIT			**BODY: 1.6 W/kg (averaged over 1 gram)**					**Spatial Peak - Uncontrolled Exposure / General Population**				

Test Date(s)	January 09, 2007				January 05, 2007				Measured Fluid Type	1880 MHz	835 MHz	Unit
Dielectric Constant ε_r	1880 MHz Body				835 MHz Body				Relative Humidity	36	36	%
	IEEE Target		Meas.	Dev.	IEEE Target		Meas.	Dev.	Atmospheric Pressure	102.2	102.2	kPa
	53.3	± 5%	51.4	-3.6%	55.2	± 5%	57.3	+3.8%	Ambient Temperature	23.4	23.4	°C
Conductivity σ (mho/m)	1880 MHz Body				835 MHz Body				Fluid Temperature	22.5	22.5	°C
	IEEE Target		Meas.	Dev.	IEEE Target		Meas.	Dev.	Fluid Depth	≥ 15	≥ 15	cm
	1.52	± 5%	1.53	+0.7%	0.97	± 5%	0.98	+1.0%	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 SAR levels measured at the mid channel were ≥ 3 dB below the SAR limit, SAR evaluation for the low and high channels was optional (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).
3. The DUT was evaluated for SAR using an over-the-air signal with the Anritsu MT8820A communications test set for maximum power and duty cycle.
4. The power drifts measured by the DASY4 system for the duration of the SAR evaluations were <5% from the start power.
5. The DUT battery was fully charged prior to the SAR evaluations.
6. The fluid temperature was measured prior to and after each of the SAR evaluations to ensure the temperature remained within +/-2°C of the fluid temperature reported during the dielectric parameter measurements.
7. The dielectric parameters of the simulated tissue mixtures were measured prior to the SAR evaluations using an ALS-PR-DIEL Dielectric Probe Kit and an HP 8753ET Network Analyzer (see Appendix C).
8. The SAR evaluations were performed within 24 hours of the system performance check.

5.0 DETAILS OF SAR EVALUATION

The MAGELLAN NAVIGATION Dual-Band GSM/GPRS Module FCC ID: NZI800964 with co-located Bluetooth installed in Z-Max.Net Wireless Surveying System was compliant for localized Specific Absorption Rate (Uncontrolled Exposure) based on the test provisions and conditions described below. The detailed test setup photographs are shown in Appendix D.

Test Configuration(s)

1. The DUT was tested for body-worn SAR with the Wireless Surveying System placed inside the Z-Max.Net backpack accessory and the GSM/GPRS Module side (antenna side) of the Wireless Surveying System facing parallel to the outer surface of the SAM phantom (planar section). The back side of the backpack accessory was touching the outer surface of the SAM phantom (planar section) and provided a spacing of 1.0 cm between the GSM/GPRS Module side (antenna side) of the DUT and the outer surface of the SAM phantom (planar section).
2. A stack of low-density, low-loss dielectric foamed polystyrene was used in place of the device holder.

Test Mode(s) & Power Setting(s)

3. The GSM/GPRS peak conducted power levels were measured prior to the SAR evaluations using a spectrum analyzer according to the procedures described in FCC 47 CFR §2.1046 (spectrum analyzer settings: RBW - 3 MHz, VBW - 3 MHz, Detector - Peak, Trace - Max Hold, Span - 25 MHz).
4. The DUT was evaluated for SAR with the DUT transmitting at maximum power in 2 time slots (24% duty cycle with a crest factor of 1:4.16) using an over-the-air signal via the Anritsu MT8820A communications test set.
5. The power drift of the DUT during the SAR evaluations was measured by the DASY4 system.
6. The DUT battery was fully charged prior to the SAR evaluations.

Test Conditions

7. The fluid temperature was measured prior to and after each of the SAR evaluations to ensure the temperature remained within +/-2°C of the fluid temperature reported during the dielectric parameter measurements.
8. The dielectric parameters of the simulated tissue mixtures were measured prior to the SAR evaluations using an ALS-PR-DIEL Dielectric Probe Kit and an HP 8753ET Network Analyzer (see Appendix C).
9. The SAR evaluations were performed within 24 hours of the system performance check.

6.0 EVALUATION PROCEDURES

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

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

An area scan was determined as follows:

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

d. A linear search is applied to find all the candidate maxima. Subsequently, all maxima are removed that are >2 dB from the global maximum. The remaining maxima are then used to position the cube scans.

A 1g and 10g spatial peak SAR was determined as follows:

e. Extrapolation is used to find the points between the dipole center of the probe and the surface of the phantom. This data cannot be measured, since the center of the dipoles is 2.7 mm away form the tip of the probe and the distance between the surface and the lowest measuring point is 1.4 mm (see probe calibration document in Appendix F). The extrapolation was based on trivariate quadratics computed from the previously calculated 3D interpolated points nearest the phantom surface.

f. Interpolated data is used to calculate the average SAR over 1g and 10g cubes by spatially discretizing the entire measured cube. The volume used to determine the averaged SAR is a 1mm grid (42875 interpolated points).

g. A zoom scan volume of 32 mm x 32 mm x 30 mm (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 points) to ensure complete capture of the peak spatial-average SAR.

7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluations a system check was performed using a planar phantom with an 835MHz dipole and a 1900MHz dipole (see Appendix E for system validation procedures). The dielectric parameters of the simulated tissue mixtures were measured prior to the system performance check using an ALS-PR-DIEL Dielectric Probe Kit and an HP 8753ET Network Analyzer (see Appendix C). 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). See Table 1 below for the SAR system manufacturer's reference body SAR values from the DASY4 Operation Manual (see reference [7]).

SYSTEM PERFORMANCE CHECK EVALUATIONS

Test Date	Equiv. Tissue	SAR 1g (W/kg)			Dielectric Constant ε_r			Conductivity σ (mho/m)			ρ (Kg/m³)	Amb. Temp. (°C)	Fluid Temp. (°C)	Fluid Depth (cm)	Humid. (%)	Barom. Press. (kPa)
	Body (MHz)	SPEAG Target	Meas.	Dev.	IEEE Target	Meas.	Dev.	IEEE Target	Meas.	Dev.						
Jan. 5	835	2.43 ±10%	2.62	+7.8%	55.2 ±5%	57.3	+3.8%	0.97 ±5%	0.98	+1.0%	1000	23.4	22.5	≥ 15	36	102.2
Jan. 9	1900	9.95 ±10%	10.8	+8.5%	53.3 ±5%	51.2	-3.9%	1.52 ±5%	1.54	+1.3%	1000	23.4	22.5	≥ 15	36	102.2

Note(s)		
	1.	The fluid temperature was measured prior to and after each of the SAR evaluations to ensure the temperature remained within +/-2°C of the fluid temperature reported during the dielectric parameter measurements.
	2.	The SAR evaluations were performed within 24 hours of the system performance check.

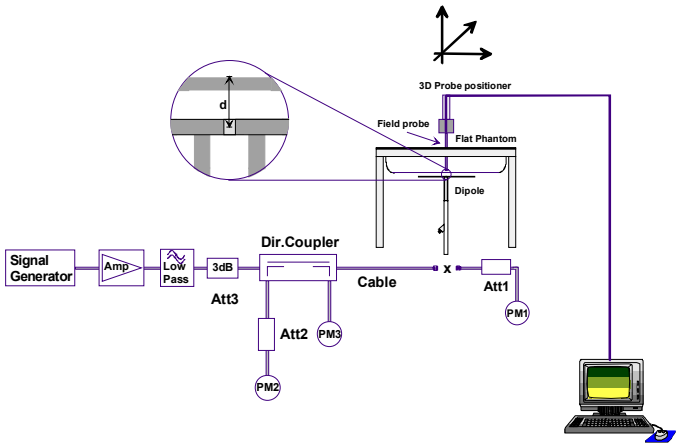


Figure 1. System Performance Check Measurement Setup

835MHz Dipole Setup

Dipole Type	Distance [mm]	Frequency [MHz]	SAR (1g) [W/kg]	SAR (10g) [W/kg]	SAR (peak) [W/kg]
D300V2	15	300	3.02	2.06	4.36
D450V2	15	450	5.01	3.36	7.22
D835V2	15	835	9.71	6.38	14.1
D900V2	15	900	11.1	7.17	16.3
D1450V2	10	1450	29.6	16.6	49.8
D1500V2	10	1500	30.8	17.1	52.1
D1640V2	10	1640	34.4	18.7	59.4
D1800V2	10	1800	38.5	20.3	67.5
D1900V2	10	1900	39.8	20.8	69.6
D2000V2	10	2000	40.9	21.2	71.5
D2450V2	10	2450	51.2	23.7	97.6
D3000V2	10	3000	61.9	24.8	136.7

Table 32.1: Numerical reference SAR values for SPEAG dipoles and flat phantom filled with body-tissue simulating liquid. Note: All SAR values normalized to 1 W forward power.

Table 1. SAR System Manufacturer's Reference Body SAR Values

1900MHz Dipole Setup

8.0 SIMULATED EQUIVALENT TISSUES

The 1880/1900MHz simulated equivalent tissue mixture consisted of Glycol-monobutyl, water, and salt. The 835MHz simulated equivalent tissue mixture consisted of a viscous gel using saline solution. Preservation with a bactericide was added and visual inspection was made to ensure air bubbles were not trapped during the mixing process. The fluids were prepared according to standardized procedures and measured for dielectric parameters (permittivity and conductivity).

1880/1900MHz TISSUE MIXTURE		
INGREDIENT	1900 MHz Body	1880 MHz Body
	System Performance Check	DUT Evaluation
Water	69.85 %	69.85 %
Glycol Monobutyl	29.89 %	29.89 %
Salt	0.26 %	0.26 %

835MHz TISSUE MIXTURE		
INGREDIENT	835 MHz Body	835 MHz Body
	System Performance Check	DUT Evaluation
Water	53.79 %	53.79 %
Sugar	45.13 %	45.13 %
Salt	0.98 %	0.98 %
Bactericide	0.10 %	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
The Spatial Average value of the SAR averaged over the whole body.		
The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.		
The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.		
Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.		
Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.		

10.0 ROBOT SYSTEM SPECIFICATIONS

Specifications	
Positioner	Stäubli Unimation Corp. Robot Model: RX60L
Repeatability	0.02 mm
No. of axis	6
Data Acquisition Electronic (DAE) System	
Cell Controller	
Processor	AMD Athlon XP 2400+
Clock Speed	2.0 GHz
Operating System	Windows XP Professional
Data Converter	
Features	Signal Amplifier, multiplexer, A/D converter, and control logic
Software	Measurement Software: DASY4, V4.7 Build 44
	Postprocessing Software: SEMCAD, V1.8 Build 171
Connecting Lines	Optical downlink for data and status info.; Optical uplink for commands and clock
DASY4 Measurement Server	
Function	Real-time data evaluation for field measurements and surface detection
Hardware	PC/104 166MHz Pentium CPU; 32 MB chipdisk; 64 MB RAM
Connections	COM1, COM2, DAE, Robot, Ethernet, Service Interface
E-Field Probe	
Model	ET3DV6
Serial No.	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)	
Type	SAM V4.0C
Shell Material	Fiberglass
Thickness	2.0 ±0.1 mm
Volume	Approx. 25 liters

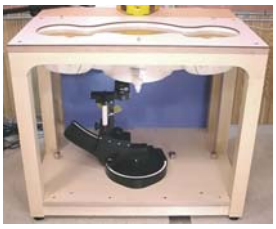
11.0 PROBE SPECIFICATION (ET3DV6)

Construction:	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, 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 Detect:	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Dimensions:	Overall length: 330 mm Tip length: 16 mm Body diameter: 12 mm Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 3 GHz Compliance tests of mobile phone

ET3DV6 E-Field Probe

12.0 SAM PHANTOM V4.0C

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



SAM Phantom V4.0C

13.0 DEVICE HOLDER

The DASY4 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. For evaluations of larger devices such as Laptop and Tablet PCs, a Plexiglas platform is attached to the device holder.

Device Holder

14.0 TEST EQUIPMENT LIST

TEST EQUIPMENT		ASSET NO.	SERIAL NO.	DATE CALIBRATED		CALIBRATION DUE DATE
USED	DESCRIPTION					
x	Schmid & Partner DASY4 System	-	-	-		-
x	-DASY4 Measurement Server	00158	1078	N/A		N/A
x	-Robot	00046	599396-01	N/A		N/A
x	-DAE4	00019	353	21Jun06		21Jun07
	-DAE3	00018	370	08Feb06		08Feb07
x	-ET3DV6 E-Field Probe	00016	1387	16Mar06		16Mar07
	-EX3DV4 E-Field Probe	00125	3547	14Feb06		14Feb07
	-300MHz Validation Dipole	00023	135	23Oct06		23Oct07
	-450MHz Validation Dipole	00024	136	07Dec06		07Dec07
	-835MHz Validation Dipole	00022	411	**Brain**	28Mar06	28Mar07
x				**Body**	27Mar06	27Mar07
	-900MHz Validation Dipole	00020	054	**Brain**	06Jun06	06Jun07
				Body	06Jun06	06Jun07
	-1640MHz Validation Dipole	00212	0175	**Brain**	14Aug06	14Aug07
	-1800MHz Validation Dipole	00021	247	**Brain**	08Jun06	08Jun07
				Body	09Jun06	09Jun07
	-1900MHz Validation Dipole	00032	151	**Brain**	09Jun06	09Jun07
x				**Body**	12Jun06	12Jun07
	-2450MHz Validation Dipole	00025	150	**Body**	24Apr06	24Apr07
	5GHz Validation Dipole 5200MHz	00126	1031	**Body**	18Jul06	18Jul07
	5GHz Validation Dipole 5500MHz			**Body**	14Nov06	14Nov07
	5GHz Validation Dipole 5800MHz			**Brain**	15Mar06	15Mar07
				Body	18Jul06	18Jul07
x	-SAM Phantom V4.0C	00154	1033	N/A		N/A
	-Barski Planar Phantom	00155	03-01	N/A		N/A
	-Plexiglas Side Planar Phantom	00156	161	N/A		N/A
	-Plexiglas Validation Planar Phantom	00157	137	N/A		N/A
x	ALS-PR-DIEL Dielectric Probe Kit	00160	260-00953	N/A		N/A
x	Gigatronics 8652A Power Meter	00110	1835801	12Apr06		12Apr07
	Gigatronics 8652A Power Meter	00007	1835272	03Feb06		03Feb07
	Gigatronics 80701A Power Sensor	00011	1833542	03Feb06		03Feb07
x	Gigatronics 80701A Power Sensor	00013	1833713	03Feb06		03Feb07
x	HP 8753ET Network Analyzer	00134	US39170292	18Apr06		18Apr07
	HP 8648D Signal Generator	00005	3847A00611	N/A		N/A
	Rohde & Schwarz SMR40 Signal Generator	00006	100104	06Apr06		06Apr07
x	Amplifier Research 5S1G4 Power Amplifier	00106	26235	N/A		N/A
x	HP E4408B Spectrum Analyzer	00015	US39240170	02Feb06		02Feb07
x	Anritsu Radio Communication Analyzer	00208	6200241241	06Jun06		06Jun07

15.0 MEASUREMENT UNCERTAINTIES

UNCERTAINTY BUDGET FOR DEVICE EVALUATION						
Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**ci 1g**	**Uncertainty Value ±% (1g)**	**V_i or V_{eff}**
Measurement System						
Probe calibration (1900 MHz)	7.0	Normal	1	1	7.0	∞
Probe calibration (835 MHz)	5.5	Normal	1	1	5.5	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	0.7	1.9	∞
Spherical isotropy of the probe	9.6	Rectangular	1.732050808	0.7	3.9	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	1	Rectangular	1.732050808	1	0.6	∞
Probe linearity	4.7	Rectangular	1.732050808	1	2.7	∞
Detection limit	1	Rectangular	1.732050808	1	0.6	∞
Readout electronics	0.3	Normal	1	1	0.3	∞
Response time	0.8	Rectangular	1.732050808	1	0.5	∞
Integration time	2.6	Rectangular	1.732050808	1	1.5	∞
RF ambient conditions	3	Rectangular	1.732050808	1	1.7	∞
Mech. constraints of robot	0.4	Rectangular	1.732050808	1	0.2	∞
Probe positioning	2.9	Rectangular	1.732050808	1	1.7	∞
Extrapolation & integration	1	Rectangular	1.732050808	1	0.6	∞
Test Sample Related						
Device positioning	2.9	Normal	1	1	2.9	12
Device holder uncertainty	3.6	Normal	1	1	3.6	8
Power drift	5	Rectangular	1.732050808	1	2.9	∞
Phantom and Setup						
Phantom uncertainty	4	Rectangular	1.732050808	1	2.3	∞
Liquid conductivity (target)	5	Rectangular	1.732050808	0.64	1.8	∞
Liquid conductivity (measured)	5	Normal	1	0.64	3.2	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	5	Normal	1	0.6	3.0	∞
Combined Standard Uncertainty (1900 MHz)					**12.05**	
Combined Standard Uncertainty (835 MHz)					**11.24**	
Expanded Uncertainty (k=2) (1900 MHz)					**24.09**	
Expanded Uncertainty (k=2) (835 MHz)					**22.48**	

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**	**ci 1g**	**Uncertainty Value ±% (1g)**	**V_i or V_{eff}**
Measurement System						
Probe calibration (1900 MHz)	7.0	Normal	1	1	7.0	∞
Probe calibration (835 MHz)	5.5	Normal	1	1	5.5	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	1	2.7	∞
Spherical isotropy of the probe	0	Rectangular	1.732050808	1	0.0	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	1	Rectangular	1.732050808	1	0.6	∞
Probe linearity	4.7	Rectangular	1.732050808	1	2.7	∞
Detection limit	1	Rectangular	1.732050808	1	0.6	∞
Readout electronics	0.3	Normal	1	1	0.3	∞
Response time	0	Rectangular	1.732050808	1	0.0	∞
Integration time	0	Rectangular	1.732050808	1	0.0	∞
RF ambient conditions	3	Rectangular	1.732050808	1	1.7	∞
Mech. constraints of robot	0.4	Rectangular	1.732050808	1	0.2	∞
Probe positioning	2.9	Rectangular	1.732050808	1	1.7	∞
Extrapolation & integration	1	Rectangular	1.732050808	1	0.6	∞
Test Sample Related						
Dipole Positioning	2	Normal	1.732050808	1	1.2	∞
Power & Power Drift	4.7	Normal	1.732050808	1	2.7	∞
Phantom and Setup						
Phantom uncertainty	4	Rectangular	1.732050808	1	2.3	∞
Liquid conductivity (target)	5	Rectangular	1.732050808	0.64	1.8	∞
Liquid conductivity (measured)	5	Normal	1	0.64	3.2	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	5	Normal	1	0.6	3.0	∞
Combined Standard Uncertainty (1900 MHz)					**10.51**	
Combined Standard Uncertainty (835 MHz)					**9.57**	
Expanded Uncertainty (k=2) (1900 MHz)					**21.01**	
Expanded Uncertainty (k=2) (835 MHz)					**19.14**	

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

16.0 REFERENCES

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

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

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

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

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

[6] ANSI/IEEE C95.1-2005 - “American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 300 GHz”, New York: IEEE, April 2006.

[7] Schmid & Partner Engineering AG - “DASY4 Manual”, V4.5 March 2005.

APPENDIX A - SAR MEASUREMENT DATA

Date Tested: 01/09/2007

Body SAR - PCS Band - GPRS Mode (2 Slots) - 1880.0 MHz - Channel 661 - Module/Antenna Side

DUT: Magellan; P/N: 800964; Type: Dual-Band GSM/GPRS Module in Z-Max.Net Wireless Surveying System; S/N: 200515027

Body-Worn Accessory: Z-Max.Net Backpack (P/N: 205917); Audio Accessory: None

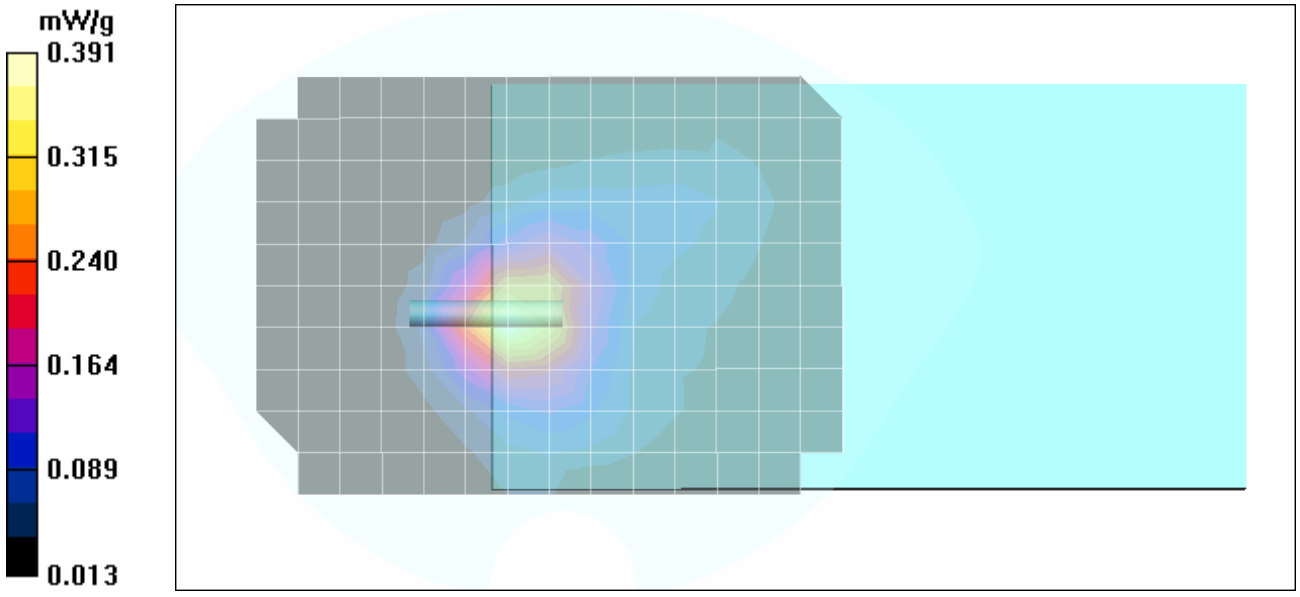
Ambient Temp: 23.4°C; Fluid Temp: 22.5°C; Barometric Pressure: 102.2 kPa; Humidity: 36%

Battery Module 8.8 Ah (P/N: 800965-01)
RF Output Power: 29.94 dBm (Conducted)
Communication System: PCS GPRS (24%)
Frequency: 1880.0 MHz; Duty Cycle: 1:4.16
Medium: M1880 Medium parameters used: f = 1880 MHz; σ = 1.53 mho/m; ε_r = 51.4; ρ = 1000 kg/m^3

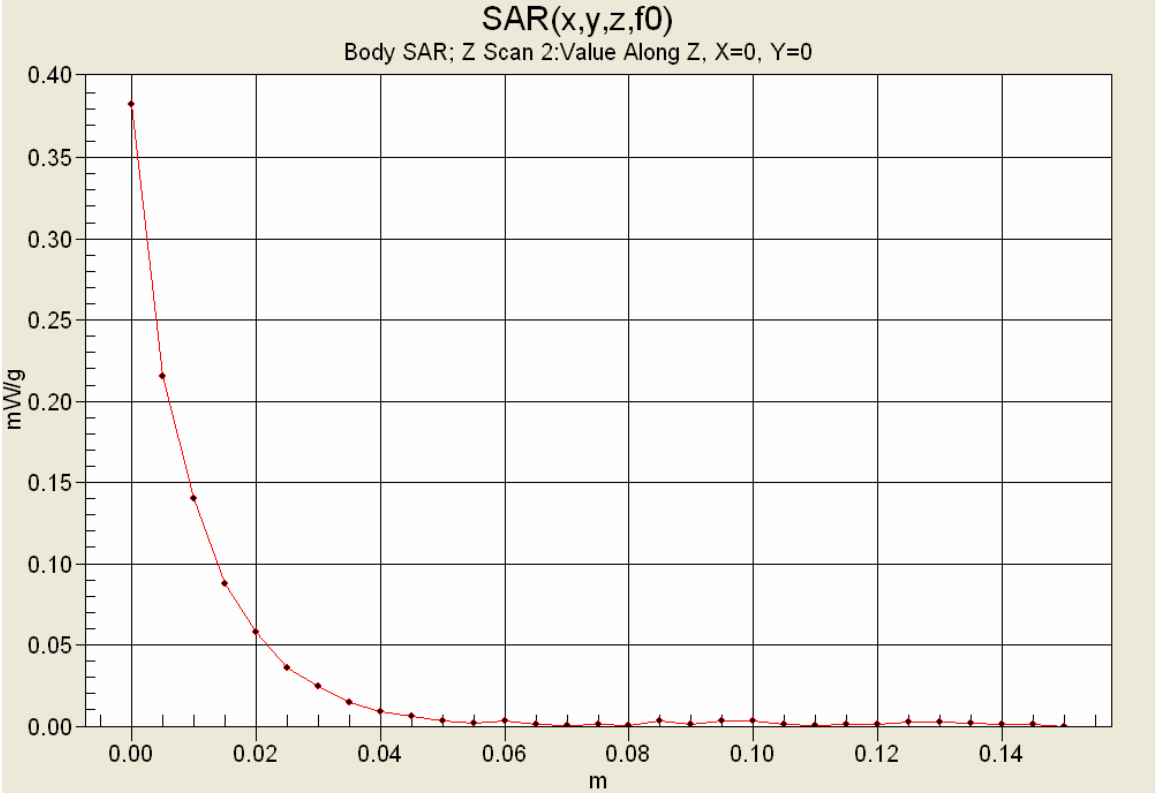
- Probe: ET3DV6 - SN1387; ConvF(4.8, 4.8, 4.8); Calibrated: 16/03/2006
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body SAR - 1.0 cm Backpack Accessory Spacing from Module/Antenna Side of DUT to Phantom - Channel 661
Area Scan (11x15x1): Measurement grid: dx=15mm, dy=15mm

Body SAR - 1.0 cm Backpack Accessory Spacing from Module/Antenna Side of DUT to Phantom - Channel 661
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.1 V/m; Power Drift = -0.147 dB
Peak SAR (extrapolated) = 0.758 W/kg
SAR(1 g) = 0.370 mW/g; SAR(10 g) = 0.214 mW/g
Maximum value of SAR (measured) = 0.391 mW/g



Z-Axis Scan



Date Tested: 01/09/2007

Body SAR - PCS Band - GPRS Mode (2 Slots) - 1880.0 MHz - Channel 661 - Module/Antenna Side Simultaneous Transmit with Co-located Bluetooth

DUT: Magellan; P/N: 800964; Type: Dual-Band GSM/GPRS Module in Z-Max.Net Wireless Surveying System; S/N: 200515027

Body-Worn Accessory: Z-Max.Net Backpack (P/N: 205917); Audio Accessory: None

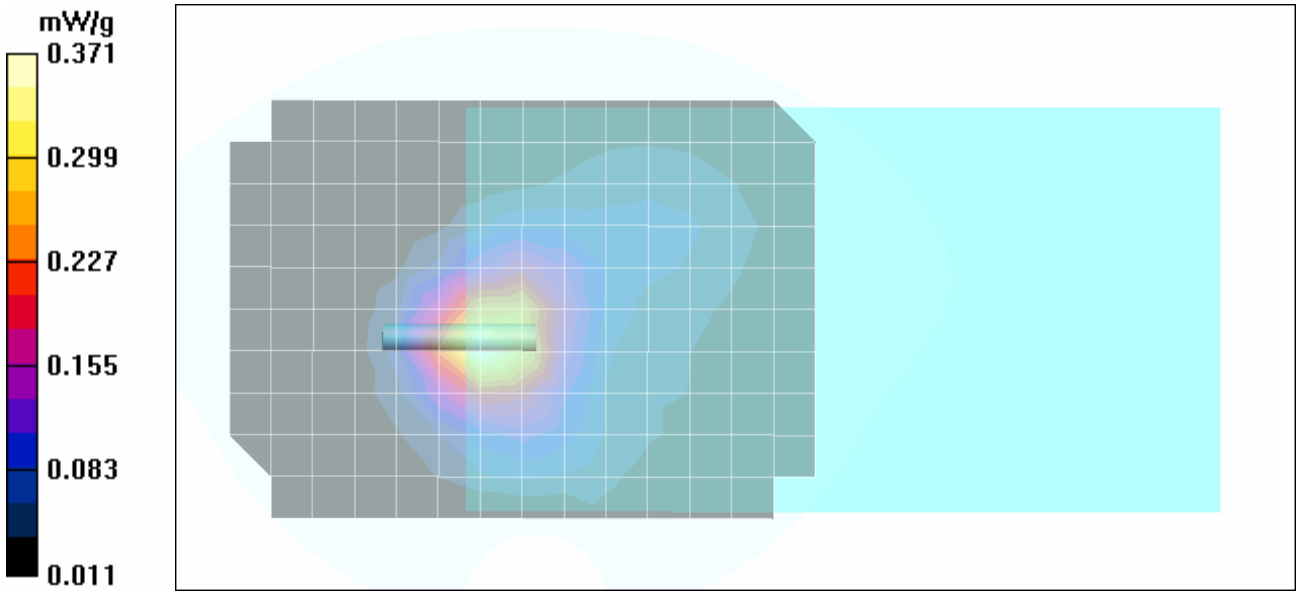
Ambient Temp: 23.4°C; Fluid Temp: 22.5°C; Barometric Pressure: 102.2 kPa; Humidity: 36%

Battery Module 8.8 Ah (P/N: 800965-01)
RF Output Power: 29.94 dBm (Conducted)
Communication System: PCS GPRS (24%)
Frequency: 1880.0 MHz; Duty Cycle: 1:4.16
RF Output Power: 3.20 dBm (Conducted) Bluetooth
Communication System: Modulated Fixed Frequency (Bluetooth)
Frequency: 2441 MHz; Duty Cycle: 1:1 (Bluetooth)
Medium: M1880 Medium parameters used: f = 1880 MHz; σ = 1.53 mho/m; ε_r = 51.4; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1387; ConvF(4.8, 4.8, 4.8); Calibrated: 16/03/2006
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body SAR - 1.0 cm Backpack Accessory Spacing from Module/Antenna Side of DUT to Phantom - Channel 661
Area Scan (11x15x1): Measurement grid: dx=15mm, dy=15mm

Body SAR - 1.0 cm Backpack Accessory Spacing from Module/Antenna Side of DUT to Phantom - Channel 661
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.2 V/m; Power Drift = -0.124 dB
Peak SAR (extrapolated) = 0.709 W/kg
SAR(1 g) = 0.357 mW/g; SAR(10 g) = 0.209 mW/g
Maximum value of SAR (measured) = 0.371 mW/g



Date Tested: 01/05/2007

Body SAR - Cellular Band - GPRS Mode (2 Slots) - 836.6 MHz - Channel 190 - Module/Antenna Side

DUT: Magellan; P/N: 800964; Type: Dual-Band GSM/GPRS Module in Z-Max.Net Wireless Surveying System; S/N: 200515027

Body-Worn Accessory: Z-Max.Net Backpack (P/N: 205917); Audio Accessory: None

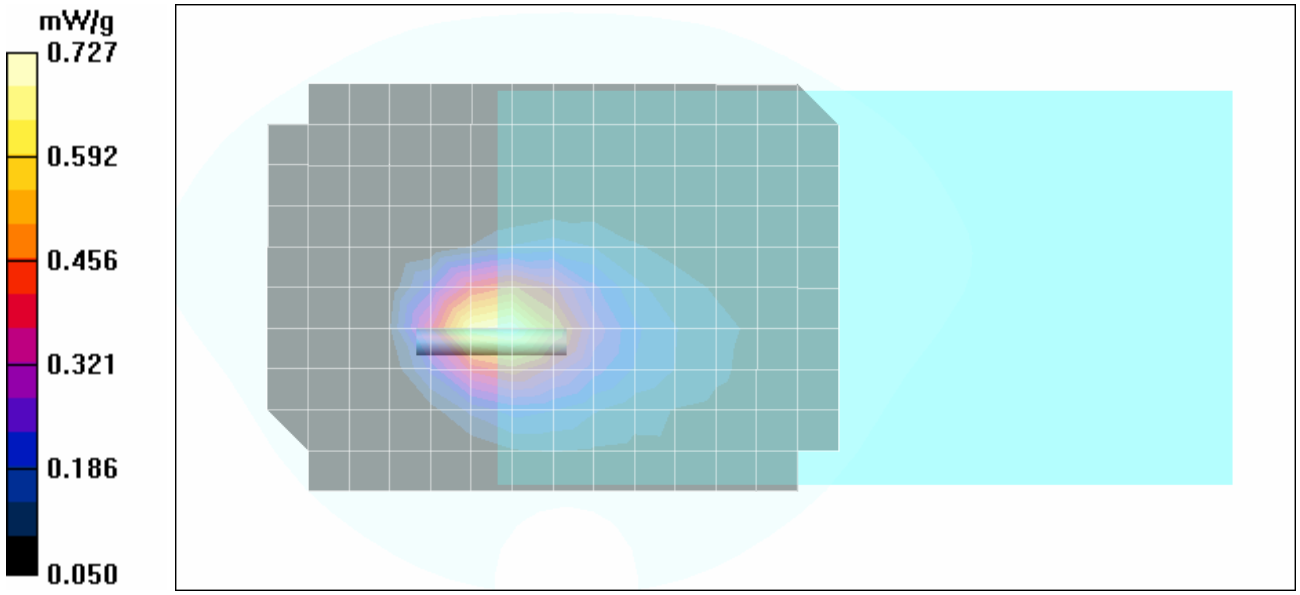
Ambient Temp: 23.4°C; Fluid Temp: 22.5°C; Barometric Pressure: 102.2 kPa; Humidity: 36%

Battery Module 8.8 Ah (P/N: 800965-01)
RF Output Power: 32.62 dBm (Conducted)
Communication System: Cellular GPRS (24%)
Frequency: 836.6 MHz; Duty Cycle: 1:4.16
Medium: M835 Medium parameters used: f = 836.6 MHz; σ = 0.98 mho/m; ε_r = 57.3; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1387; ConvF(6.04, 6.04, 6.04); Calibrated: 16/03/2006
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body SAR - 1.0 cm Backpack Accessory Spacing from Module/Antenna Side of DUT to Phantom - Channel 190
Area Scan (11x15x1): Measurement grid: dx=15mm, dy=15mm

Body SAR - 1.0 cm Backpack Accessory Spacing from Module/Antenna Side of DUT to Phantom - Channel 190
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 21.1 V/m; Power Drift = -0.113 dB
Peak SAR (extrapolated) = 0.976 W/kg
SAR(1 g) = 0.671 mW/g; SAR(10 g) = 0.436 mW/g
Maximum value of SAR (measured) = 0.727 mW/g



Date Tested: 01/05/2007

Body SAR - Cellular Band - GPRS Mode (2 Slots) - 836.6 MHz - Channel 190 - Module/Antenna Side Simultaneous Transmit with Co-located Bluetooth

DUT: Magellan; P/N: 800964; Type: Dual-Band GSM/GPRS Module in Z-Max.Net Wireless Surveying System; S/N: 200515027

Body-Worn Accessory: Z-Max.Net Backpack (P/N: 205917); Audio Accessory: None

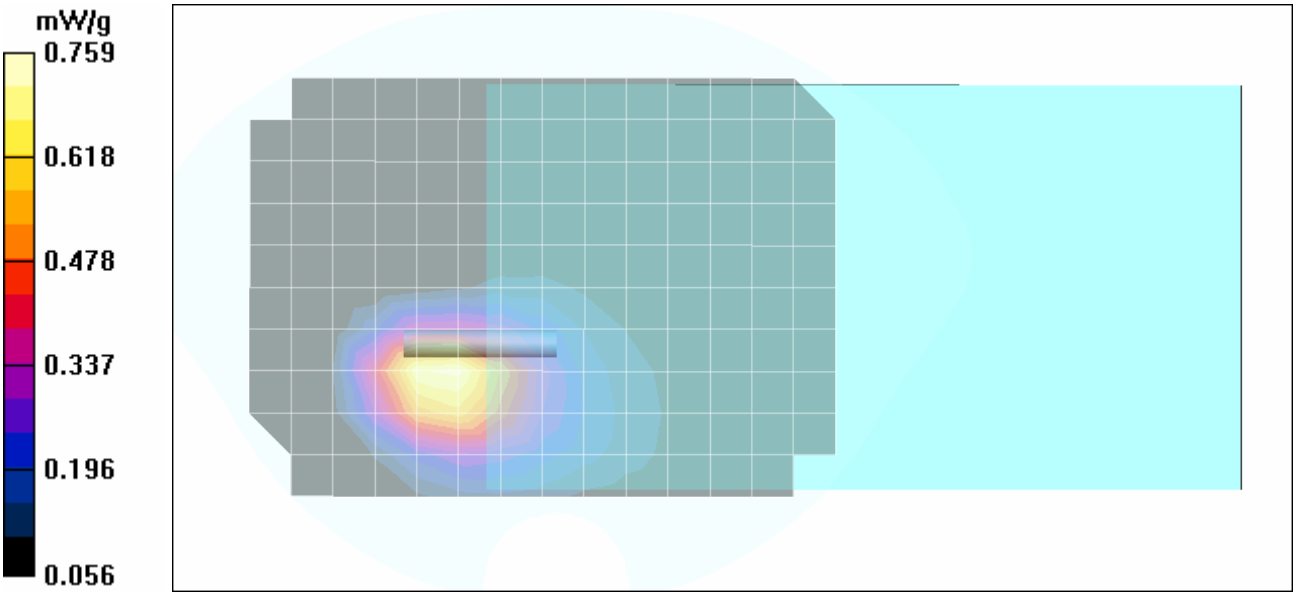
Ambient Temp: 23.4°C; Fluid Temp: 22.5°C; Barometric Pressure: 102.2 kPa; Humidity: 36%

Battery Module 8.8 Ah (P/N: 800965-01)
RF Output Power: 32.62 dBm (Conducted)
Communication System: Cellular GPRS (24%)
Frequency: 836.6 MHz; Duty Cycle: 1:4.16
RF Output Power: 3.20 dBm (Conducted) Bluetooth
Communication System: Modulated Fixed Frequency (Bluetooth)
Frequency: 2441 MHz; Duty Cycle: 1:1 (Bluetooth)
Medium: M835 Medium parameters used: f = 836.6 MHz; σ = 0.98 mho/m; ε_r = 57.3; ρ = 1000 kg/m^3

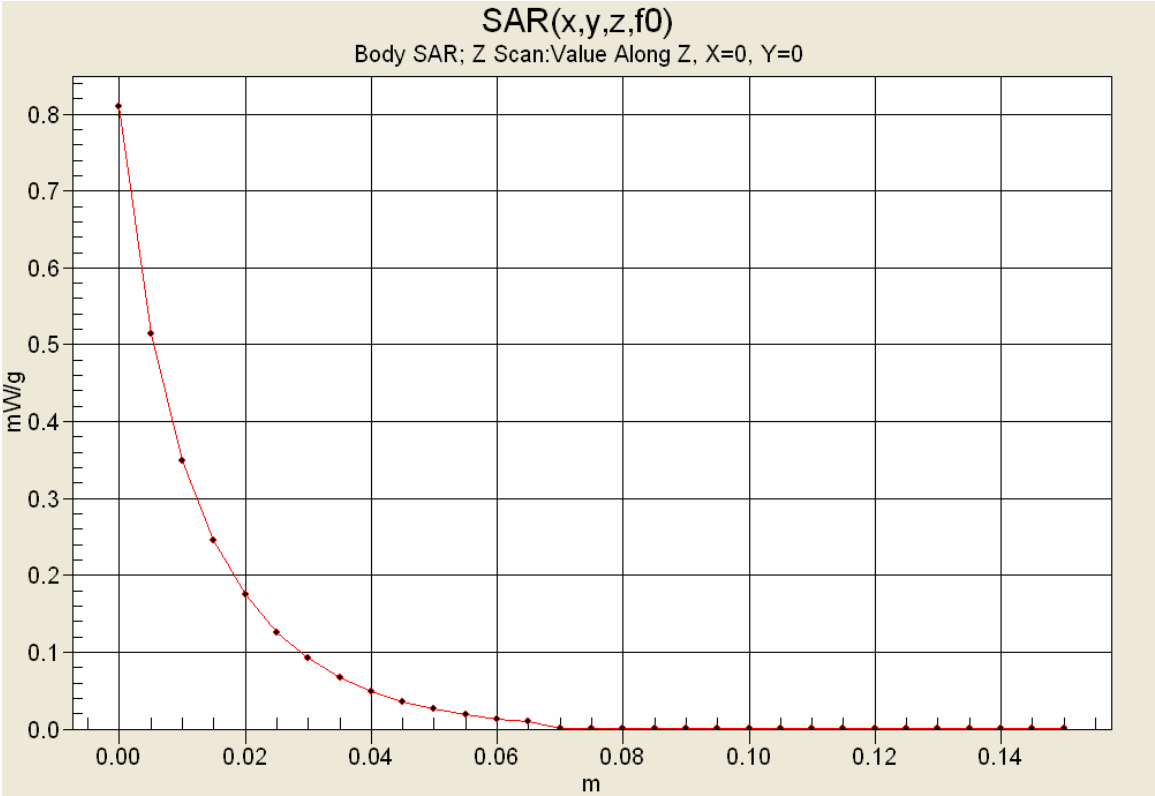
- Probe: ET3DV6 - SN1387; ConvF(6.04, 6.04, 6.04); Calibrated: 16/03/2006
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body SAR - 1.0 cm Backpack Accessory Spacing from Module/Antenna Side of DUT to Phantom - Channel 190
Area Scan (11x15x1): Measurement grid: dx=15mm, dy=15mm

Body SAR - 1.0 cm Backpack Accessory Spacing from Module/Antenna Side of DUT to Phantom - Channel 190
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.5 V/m; Power Drift = -0.0973 dB
Peak SAR (extrapolated) = 1.05 W/kg
SAR(1 g) = 0.702 mW/g; SAR(10 g) = 0.455 mW/g
Maximum value of SAR (measured) = 0.759 mW/g



Z-Axis Scan



APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 01/05/2007

System Performance Check - 835 MHz Dipole

DUT: Dipole 835 MHz; Asset: 00022; Serial: 411; Validation: 03/27/2006

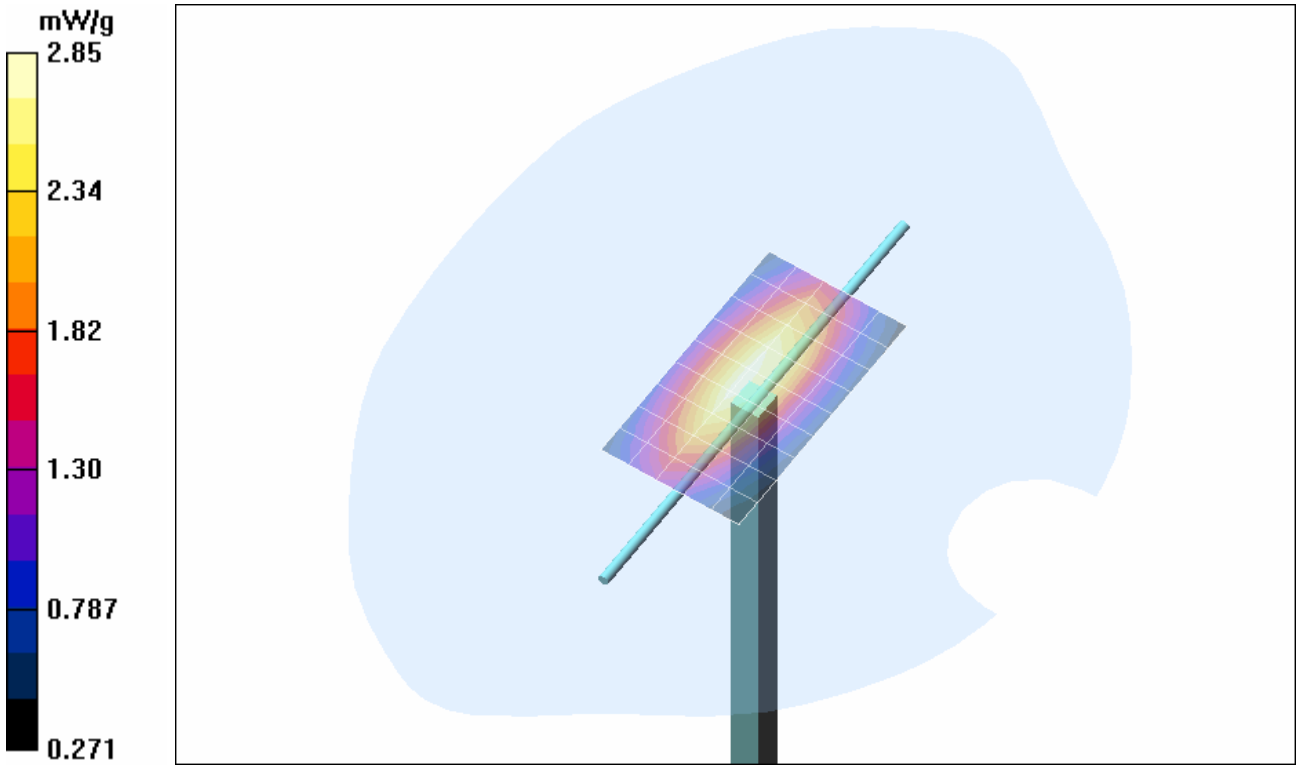
Ambient Temp: 23.4°C; Fluid Temp: 22.5°C; Barometric Pressure: 102.2 kPa; Humidity: 36%

Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: M835 Medium parameters used: f = 835 MHz; σ = 0.98 mho/m; ε_r = 57.3; ρ = 1000 kg/m^3

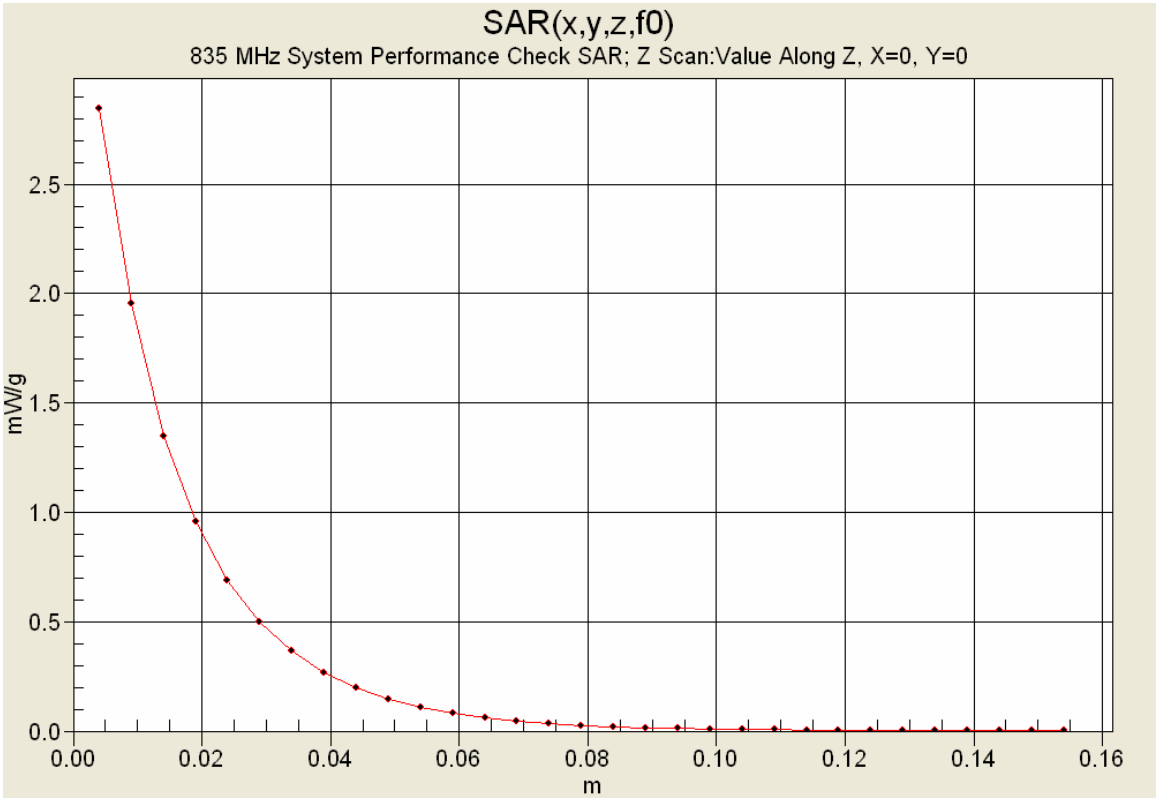
- Probe: ET3DV6 - SN1387; ConvF(6.04, 6.04, 6.04); Calibrated: 16/03/2006
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

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

835 MHz Dipole - System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.1 V/m; Power Drift = -0.047 dB
Peak SAR (extrapolated) = 3.82 W/kg
SAR(1 g) = 2.62 mW/g; SAR(10 g) = 1.73 mW/g
Maximum value of SAR (measured) = 2.85 mW/g



Z-Axis Scan



Date Tested: 01/09/2007

System Performance Check - 1900 MHz Dipole

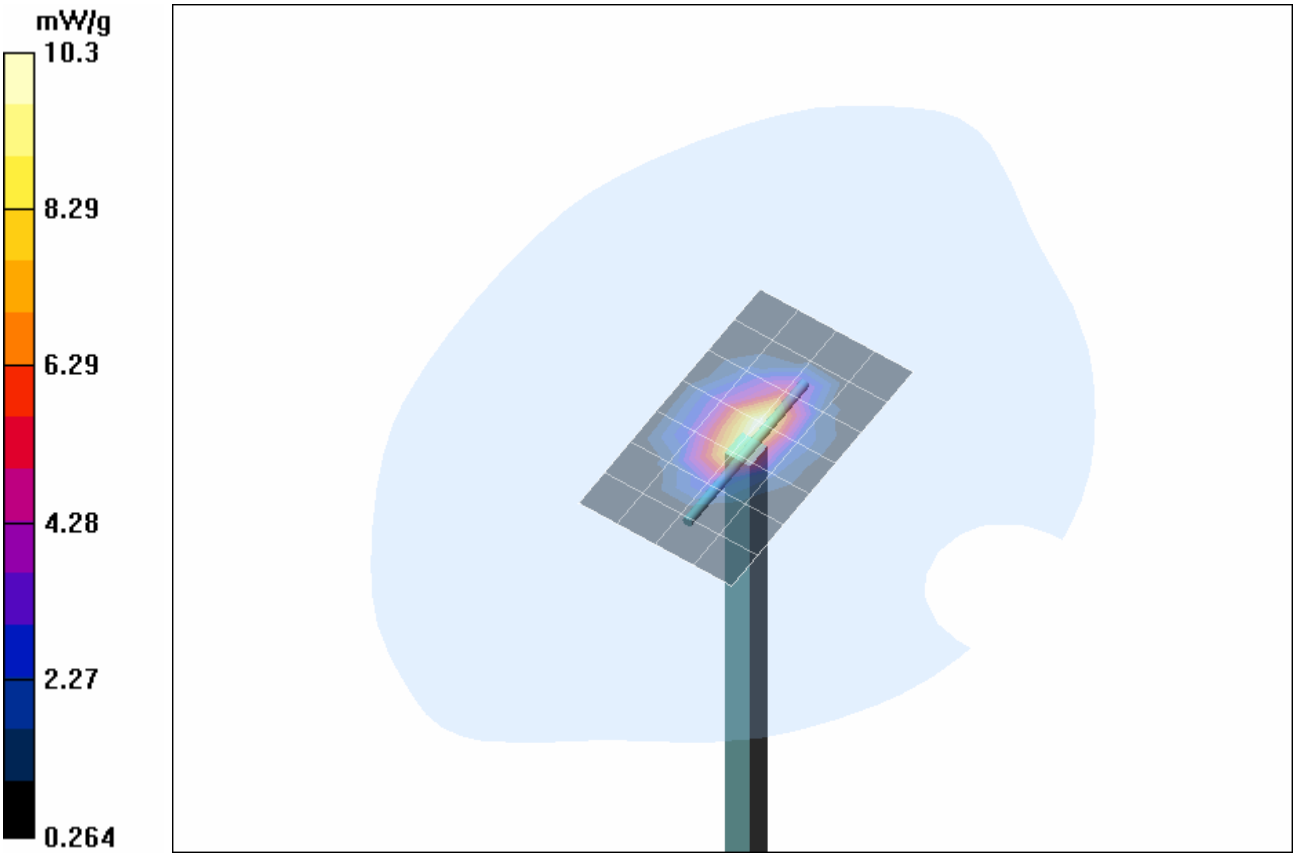
DUT: Dipole 1900 MHz; Asset: 00032; Serial: 151; Validation: 06/12/2006

Ambient Temp: 23.4°C; Fluid Temp: 22.5°C; Barometric Pressure: 102.2 kPa; Humidity: 36%

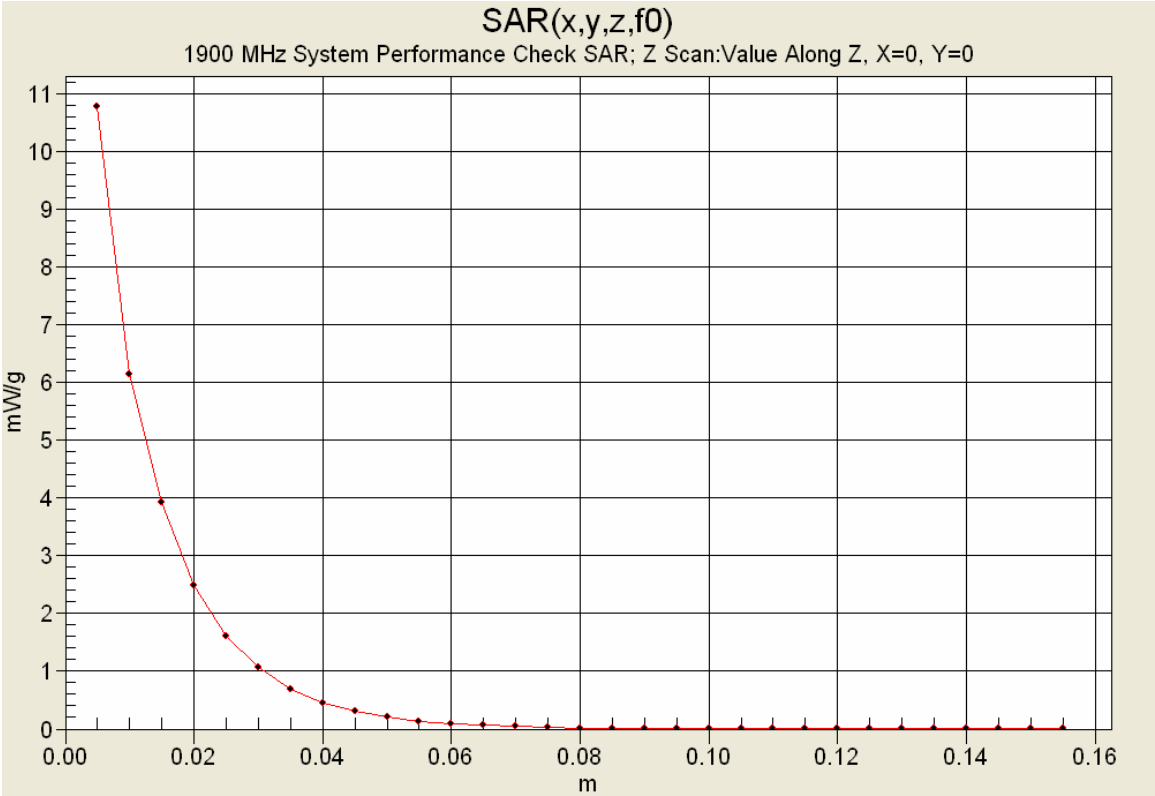
Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: M1900 Medium parameters used: f = 1900 MHz; σ = 1.54 mho/m; ε_r = 51.2; ρ = 1000 kg/m^3
- Probe: ET3DV6 - SN1387; ConvF(4.7, 4.7, 4.7); Calibrated: 16/03/2006
- Sensor-Surface: 5mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

1900 MHz Dipole - System Performance Check/Area Scan (5x8x1):
Measurement grid: dx=15mm, dy=15mm

1900 MHz Dipole - System Performance Check/Zoom Scan 2 (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 83.4 V/m; Power Drift = -0.078 dB
Peak SAR (extrapolated) = 22.7 W/kg
SAR(1 g) = 10.8 mW/g; SAR(10 g) = 5.62 mW/g
Maximum value of SAR (measured) = 10.3 mW/g



Z-Axis Scan



APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

835 MHz System Performance Check & DUT Evaluation (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Fri 05/Jan/2007
Frequency (GHz)
FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB FCC Limits for Body Epsilon
FCC_sB FCC Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.7350	55.59	0.96	57.72	0.90
0.7450	55.55	0.96	57.59	0.91
0.7550	55.51	0.96	57.54	0.91
0.7650	55.47	0.96	57.45	0.93
0.7750	55.43	0.97	57.51	0.93
0.7850	55.39	0.97	57.53	0.94
0.7950	55.36	0.97	57.25	0.95
0.8050	55.32	0.97	57.28	0.96
0.8150	55.28	0.97	57.34	0.96
0.8250	55.24	0.97	57.17	0.97
0.8350	55.20	0.97	57.26	0.98
0.8450	55.17	0.98	57.06	0.99
0.8550	55.14	0.99	57.00	0.99
0.8650	55.11	1.01	56.99	1.00
0.8750	55.08	1.02	56.91	1.02
0.8850	55.05	1.03	56.96	1.02
0.8950	55.02	1.04	56.82	1.03
0.9050	55.00	1.05	56.97	1.04
0.9150	55.00	1.06	56.81	1.05
0.9250	54.98	1.06	56.77	1.06
0.9350	54.96	1.07	56.81	1.07

1900 MHz System Performance Check & 1880 MHz DUT Evaluation (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Tue 09/Jan/2007
Frequency (GHz)
FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB FCC Limits for Body Epsilon
FCC_sB FCC Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eB	FCC_sB	Test_e	Test_s
1.8000	53.30	1.52	52.05	1.47
1.8100	53.30	1.52	51.88	1.47
1.8200	53.30	1.52	51.83	1.49
1.8300	53.30	1.52	51.62	1.50
1.8400	53.30	1.52	51.53	1.50
1.8500	53.30	1.52	51.45	1.52
1.8600	53.30	1.52	51.49	1.52
1.8700	53.30	1.52	51.35	1.52
1.8800	53.30	1.52	51.36	1.53
1.8900	53.30	1.52	51.27	1.54
1.9000	53.30	1.52	51.23	1.54
1.9100	53.30	1.52	51.20	1.55
1.9200	53.30	1.52	51.00	1.57
1.9300	53.30	1.52	51.11	1.58
1.9400	53.30	1.52	51.00	1.58
1.9500	53.30	1.52	50.91	1.58
1.9600	53.30	1.52	50.83	1.59
1.9700	53.30	1.52	50.83	1.60
1.9800	53.30	1.52	50.88	1.62
1.9900	53.30	1.52	50.70	1.63
2.0000	53.30	1.52	50.63	1.64

APPENDIX D - SAR TEST SETUP PHOTOGRAPHS

BODY-WORN SAR TEST SETUP PHOTOGRAPHS

1.0 cm Backpack Spacing from Module/Antenna Side of DUT to Phantom

DUT PHOTOGRAPHS

Front Side of Z-Max.Net Wireless Surveying System

Back Side of Z-Max.Net Wireless Surveying System

DUT PHOTOGRAPHS

GSM/GPRS Module/Antenna Side of Z-Max.Net

Z-Max.Net GSM/GPRS Module Compartment

GSM/GPRS Module and Antenna

GSM/GPRS Module and Antenna

DUT PHOTOGRAPHS

Battery Side of Z-Max.Net Wireless Surveying System

Z-Max.Net Battery Compartment

Z-Max.Net Battery Module

DUT PHOTOGRAPHS

Top end of Z-Max.Net with GPS Antenna

Top end of Z-Max.Net with GPS Antenna Removed (SAR test configuration)

Bottom end of Z-Max.Net

Dual-Band GSM/GPRS Stubby Antenna

DUT PHOTOGRAPHS

Front Side of Z-Max.Net Backpack Accessory (P/N: 205917)

Back Side of Z-Max.Net Backpack Accessory (P/N: 205917)
Placed on User's Back (GSM/GPRS Module/Antenna facing User)

DUT PHOTOGRAPHS

Z-Max.Net positioned inside Backpack Accessory (GSM/GPRS Module/Antenna facing User)

Z-Max.Net positioned inside Backpack Accessory with 1.0 cm accessory spacing between module/antenna and User's Back

APPENDIX E - SYSTEM VALIDATION

835 MHz SYSTEM VALIDATION DIPOLE

Type:	**835 MHz Validation Dipole**
Asset Number:	**00022**
Serial Number:	**411**
Place of Validation:	**Celltech Labs Inc.**
Date of Validation:	**March 27, 2006**

Celltech Labs Inc. hereby certifies that the 835 MHz System Validation (Body) was performed on the date indicated above.

Performed by:	**Sean Johnston**
Approved by:	**Spencer Watson**

Celltech Labs Inc. 1955 Moss Court, Kelowna, B.C. Canada V1Y 9L3
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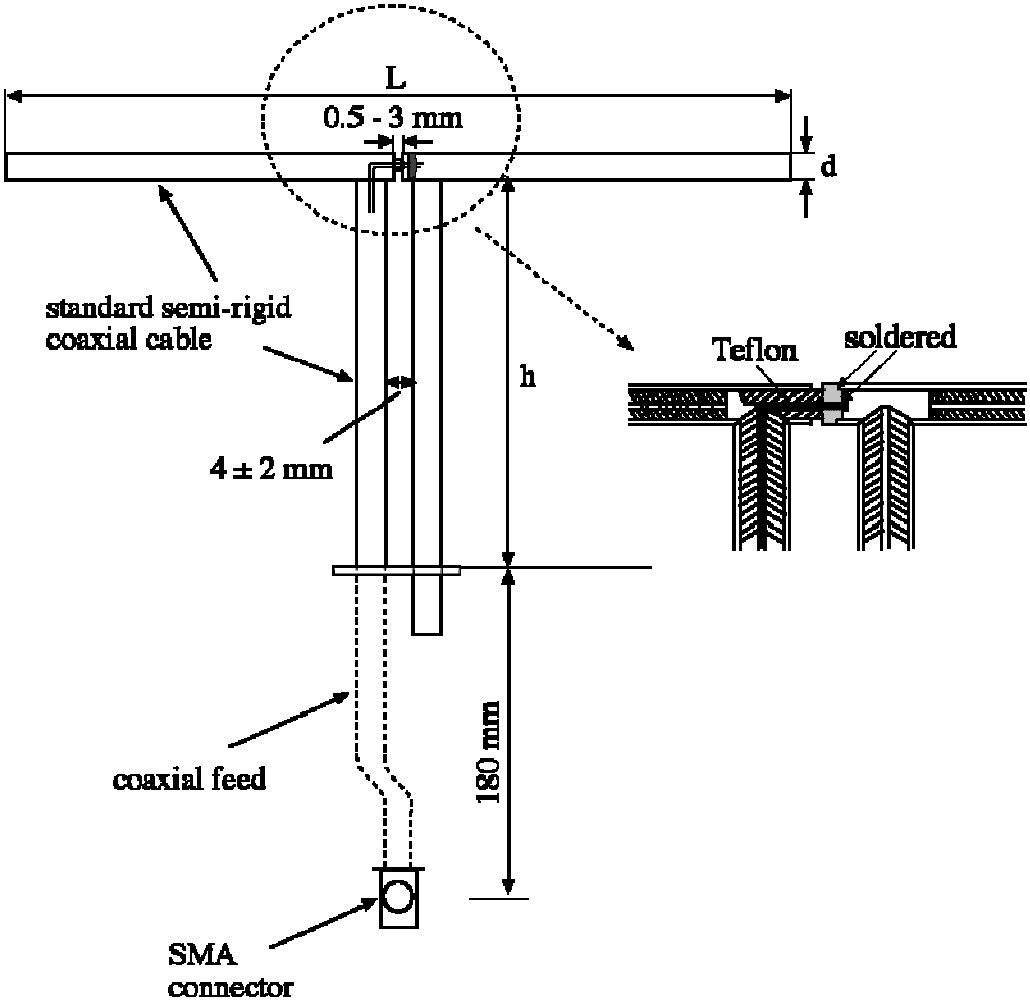
www.celltechlabs.com

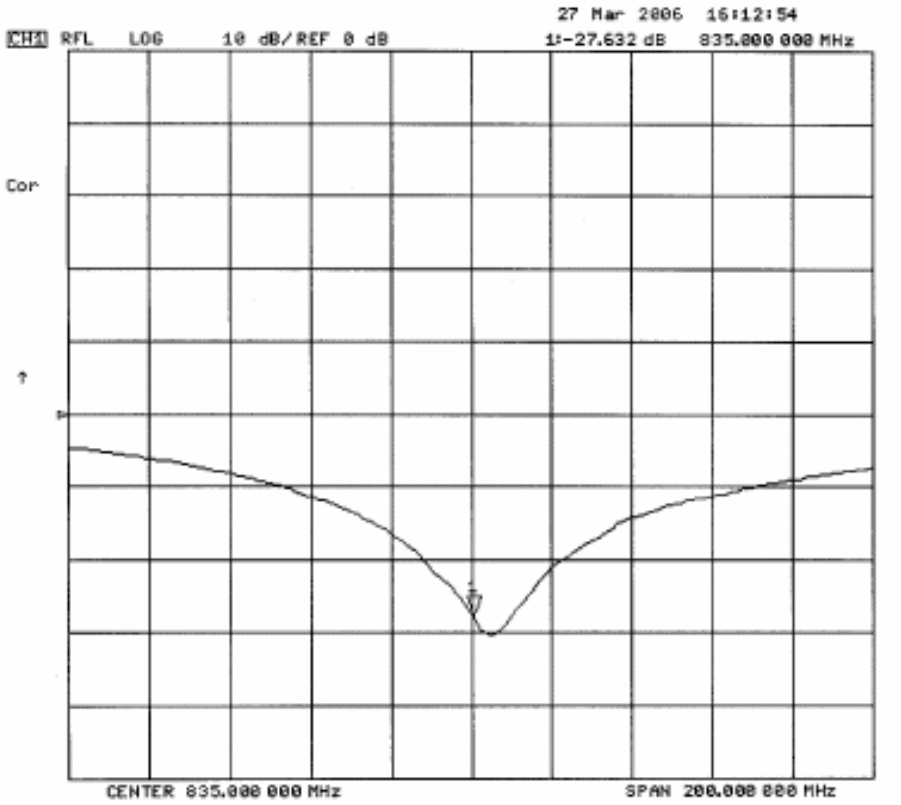
1. Validation Dipole Construction & Electrical Characteristics

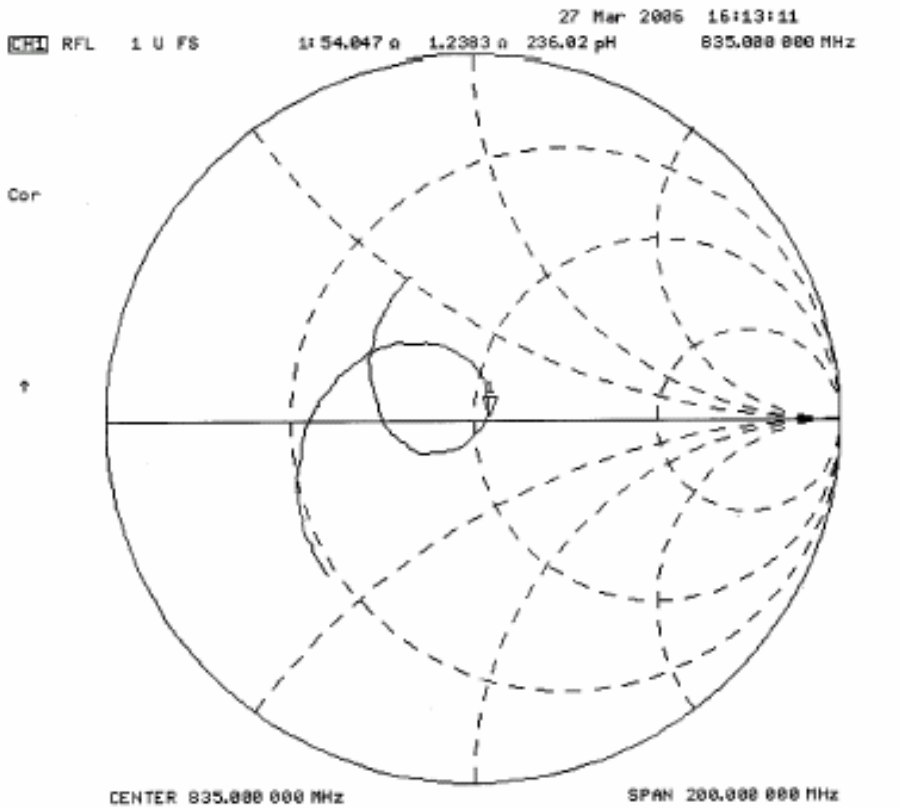
The validation dipole was constructed in accordance with the IEEE Standard "Annex G (informative) Reference dipoles for use in system validation". The electrical properties were measured using an HP 8753ET Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector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

Feed point impedance at 835MHz	Re{Z} = 47.627Ω
	Im{Z} = -0.67188Ω
Return Loss at 835MHz	-31.954dB



2. Validation Dipole VSWR Data





3. 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

4. Validation Phantom

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

Shell Thickness: 2.0 ± 0.1 mm
Filling Volume: Approx. 25 liters
Dimensions: 50 cm (W) x 100 cm (L)

5. 835 MHz System Validation Setup

6. 835 MHz Validation Dipole Setup

7. Measurement Conditions

The SAM phantom was filled with 835 MHz body tissue simulant with the following parameters:

Relative Permittivity: 53.7 (-2.7% from target)
Conductivity: 0.94 mho/m (-3% from target)
Fluid Temperature: 20.8 °C
Fluid Depth: ≥ 15.0 cm

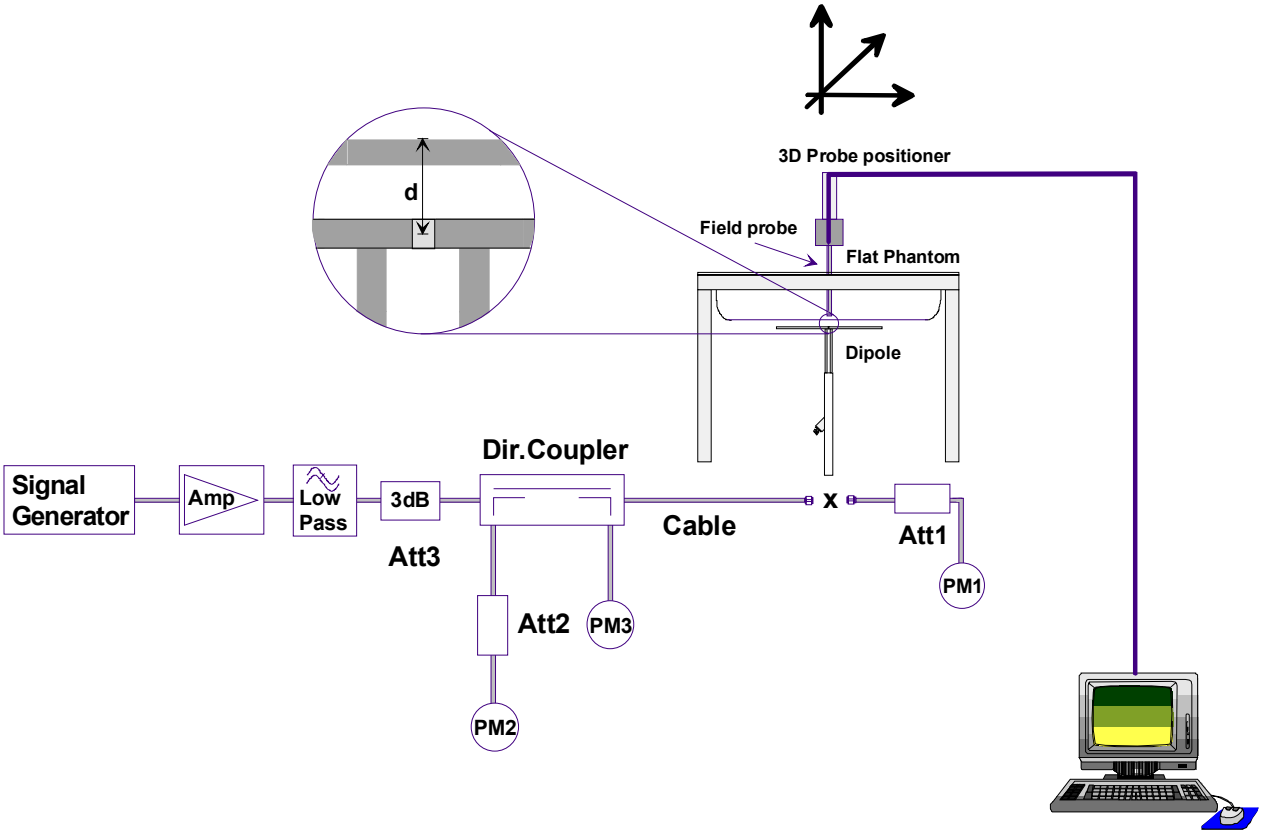
Environmental Conditions:
Ambient Temperature: 22.6 °C
Barometric Pressure: 101.8 kPa
Humidity: 30 %

The 835 MHz body tissue simulant consisted of the following ingredients:

Ingredient	Percentage by weight
Water	53.79%
Sugar	45.13%
Salt	0.98%
Dowicil 75	0.10%
Target Dielectric Parameters at 22 °C	ε_r = 55.2 (+/- 5%) σ = 0.97 S/m (+/- 5%)

8. SAR Measurement

Measurements were made at the planar section of the SAM phantom using a dosimetric E-field probe ET3DV5 (S/N: 1590, conversion factor 6.47). 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.

9. Validation Dipole SAR Test Results

Ten SAR measurements were performed in order to achieve repeatability and to establish an average target value (W/kg).

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	Max SAR @ 0.25W Input
Test 1	2.46	9.84	1.62	6.48	2.65
Test 2	2.46	9.84	1.62	6.48	2.66
Test 3	2.46	9.84	1.62	6.48	2.67
Test 4	2.47	9.88	1.62	6.48	2.68
Test 5	2.43	9.72	1.60	6.40	2.64
Test 6	2.43	9.72	1.59	6.36	2.63
Test 7	2.42	9.68	1.59	6.36	2.59
Test 8	2.46	9.84	1.62	6.48	2.64
Test 9	2.47	9.88	1.62	6.48	2.65
Test10	2.45	9.80	1.62	6.48	2.61
Average SAR	**2.451**	**9.804**	**1.612**	**6.448**	**2.642**

IEEE Target SAR @ 1 Watt Input averaged over 1 gram (W/kg)		Measured SAR @ 1 Watt Input averaged over 1 gram (W/kg)	Deviation from Target (%)	IEEE Target SAR @ 1 Watt Input averaged over 10 grams (W/kg)		Measured SAR @ 1 Watt Input averaged over 10 grams (W/kg)	Deviation from Target (%)
9.71	+/- 10%	9.804	+1.0%	6.38	+/- 10%	6.448	+1.1%

Dipole Type	Distance [mm]	Frequency [MHz]	SAR (1g) [W/kg]	SAR (10g) [W/kg]	SAR (peak) [W/kg]
D300V2	15	300	3.02	2.06	4.36
D450V2	15	450	5.01	3.36	7.22
D835V2	15	835	9.71	6.38	14.1
D900V2	15	900	11.1	7.17	16.3
D1450V2	10	1450	29.6	16.6	49.8
D1500V2	10	1500	30.8	17.1	52.1
D1640V2	10	1640	34.4	18.7	59.4
D1800V2	10	1800	38.5	20.3	67.5
D1900V2	10	1900	39.8	20.8	69.6
D2000V2	10	2000	40.9	21.2	71.5
D2450V2	10	2450	51.2	23.7	97.6
D3000V2	10	3000	61.9	24.8	136.7

Table 32.1: Numerical reference SAR values for SPEAG dipoles and flat phantom filled with body-tissue simulating liquid. Note: All SAR values normalized to 1 W forward power.

835 MHz Dipole System Validation (Body) - March 27, 2006

DUT: Dipole 835 MHz; Model: D835V2; Serial: 411; Calibrated: 03/27/2006
Ambient Temp: 22.6 °C; Fluid Temp: 20.8 °C; Barometric Pressure: 101.8 kPa; Humidity: 30%
Communication System: CW
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: M835 (σ = 0.94 mho/m; ε_r = 53.7; ρ = 1000 kg/m^3)
- Probe: ET3DV6 - SN1590; ConvF(6.47, 6.47, 6.47); Calibrated: 20/05/2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

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

835 MHz Dipole System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.0 V/m; Power Drift = 0.027 dB
SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.62 mW/g
Maximum value of SAR (measured) = 2.65 mW/g

835 MHz Dipole System Validation/Zoom Scan 3 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.8 V/m; Power Drift = 0.029 dB
SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.62 mW/g
Maximum value of SAR (measured) = 2.66 mW/g

835 MHz Dipole System Validation/Zoom Scan 4 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.5 V/m; Power Drift = 0.075 dB
SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.62 mW/g
Maximum value of SAR (measured) = 2.67 mW/g

835 MHz Dipole System Validation/Zoom Scan 5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.9 V/m; Power Drift = 0.010 dB
SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g
Maximum value of SAR (measured) = 2.68 mW/g

835 MHz Dipole System Validation/Zoom Scan 6 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.0 V/m; Power Drift = -0.087 dB
SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.6 mW/g
Maximum value of SAR (measured) = 2.64 mW/g

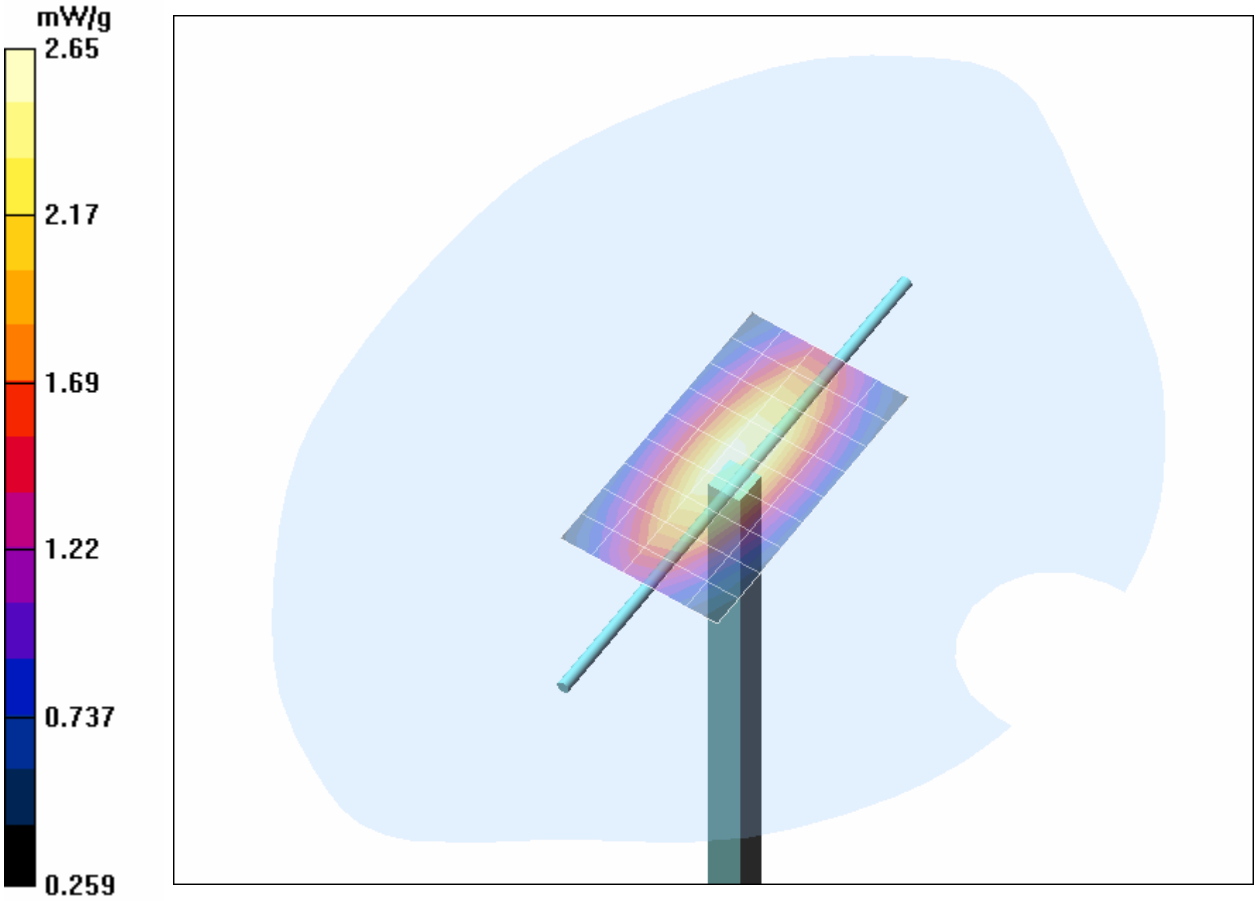
835 MHz Dipole System Validation/Zoom Scan 7 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.6 V/m; Power Drift = -0.017 dB
SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.59 mW/g
Maximum value of SAR (measured) = 2.63 mW/g

835 MHz Dipole System Validation/Zoom Scan 8 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.1 V/m; Power Drift = -0.023 dB
SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.59 mW/g
Maximum value of SAR (measured) = 2.59 mW/g

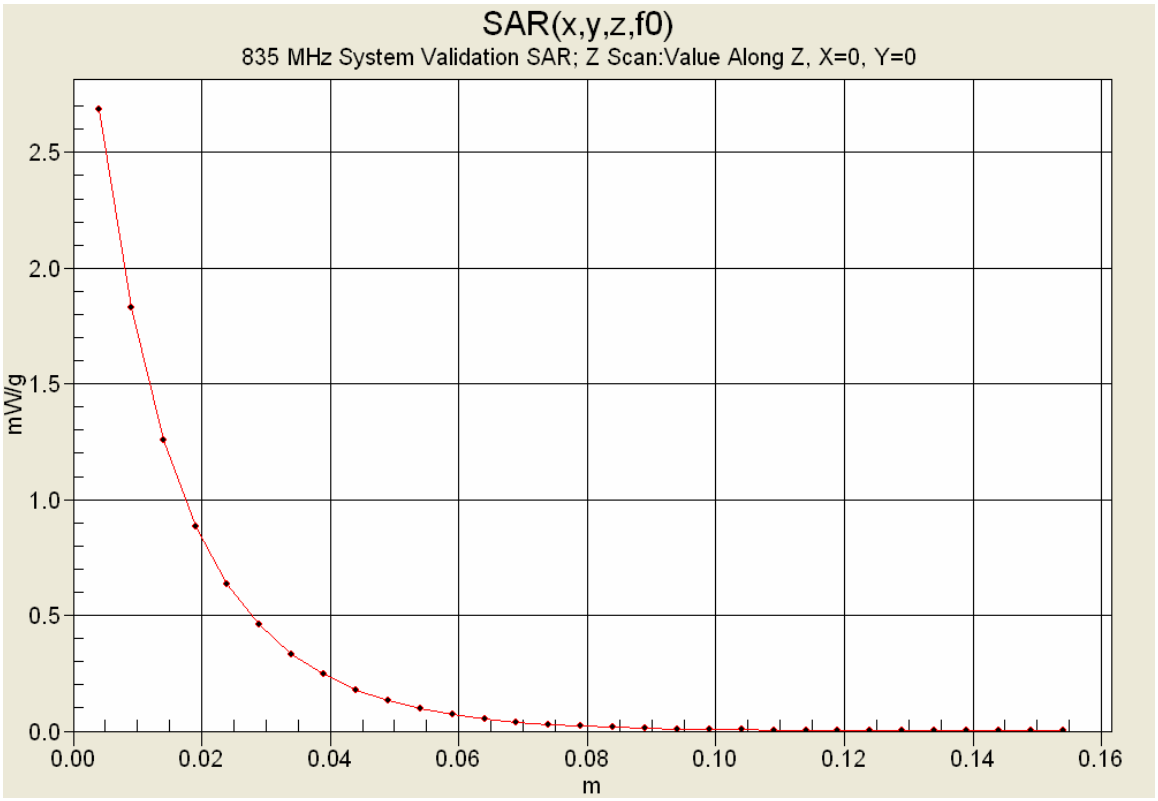
835 MHz Dipole System Validation/Zoom Scan 9 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.6 V/m; Power Drift = -0.004 dB
SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.62 mW/g
Maximum value of SAR (measured) = 2.64 mW/g

835 MHz Dipole System Validation/Zoom Scan 10 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.5 V/m; Power Drift = 0.012 dB
SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g
Maximum value of SAR (measured) = 2.65 mW/g

835 MHz Dipole System Validation/Zoom Scan 11 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.5 V/m; Power Drift = -0.005 dB
SAR(1 g) = 2.45 mW/g; SAR(10 g) = 1.62 mW/g
Maximum value of SAR (measured) = 2.61 mW/g



1 g average of 10 measurements: 2.451 mW/g
10 g average of 10 measurements: 1.612 mW/g



10. Measured Fluid Dielectric Parameters

835 MHz System Validation (Body)

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Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Mon 27/Mar/2006
Frequency(GHz)
FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB FCC Limits for Body Epsilon
FCC_sB FCC Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.7350	55.59	0.96	54.23	0.86
0.7450	55.55	0.96	54.00	0.87
0.7550	55.51	0.96	54.00	0.88
0.7650	55.47	0.96	54.04	0.89
0.7750	55.43	0.97	53.97	0.90
0.7850	55.39	0.97	54.01	0.90
0.7950	55.36	0.97	53.96	0.91
0.8050	55.32	0.97	53.85	0.92
0.8150	55.28	0.97	53.79	0.93
0.8250	55.24	0.97	53.69	0.94
0.8350	55.20	0.97	53.68	0.94
0.8450	55.17	0.98	53.35	0.95
0.8550	55.14	0.99	53.18	0.96
0.8650	55.11	1.01	53.25	0.98
0.8750	55.08	1.02	53.26	0.98
0.8850	55.05	1.03	53.11	0.99
0.8950	55.02	1.04	53.11	1.00
0.9050	55.00	1.05	52.96	1.01
0.9150	55.00	1.06	52.91	1.02
0.9250	54.98	1.06	52.93	1.03
0.9350	54.96	1.07	52.58	1.03

1900 MHz SYSTEM VALIDATION

Type:	**1900 MHz Validation Dipole**
Asset Number:	**00032**
Serial Number:	**151**
Place of Validation:	**Celltech Labs Inc.**
Date of Validation:	**June 12, 2006**

Celltech Labs Inc. certifies that the 1900 MHz System Validation (Body) was performed on the date indicated above.

Performed by:	**Sean Johnston**
Approved by:	**Spencer Watson**

Celltech Labs Inc. 1955 Moss Court, Kelowna, B.C. Canada V1Y 9L3
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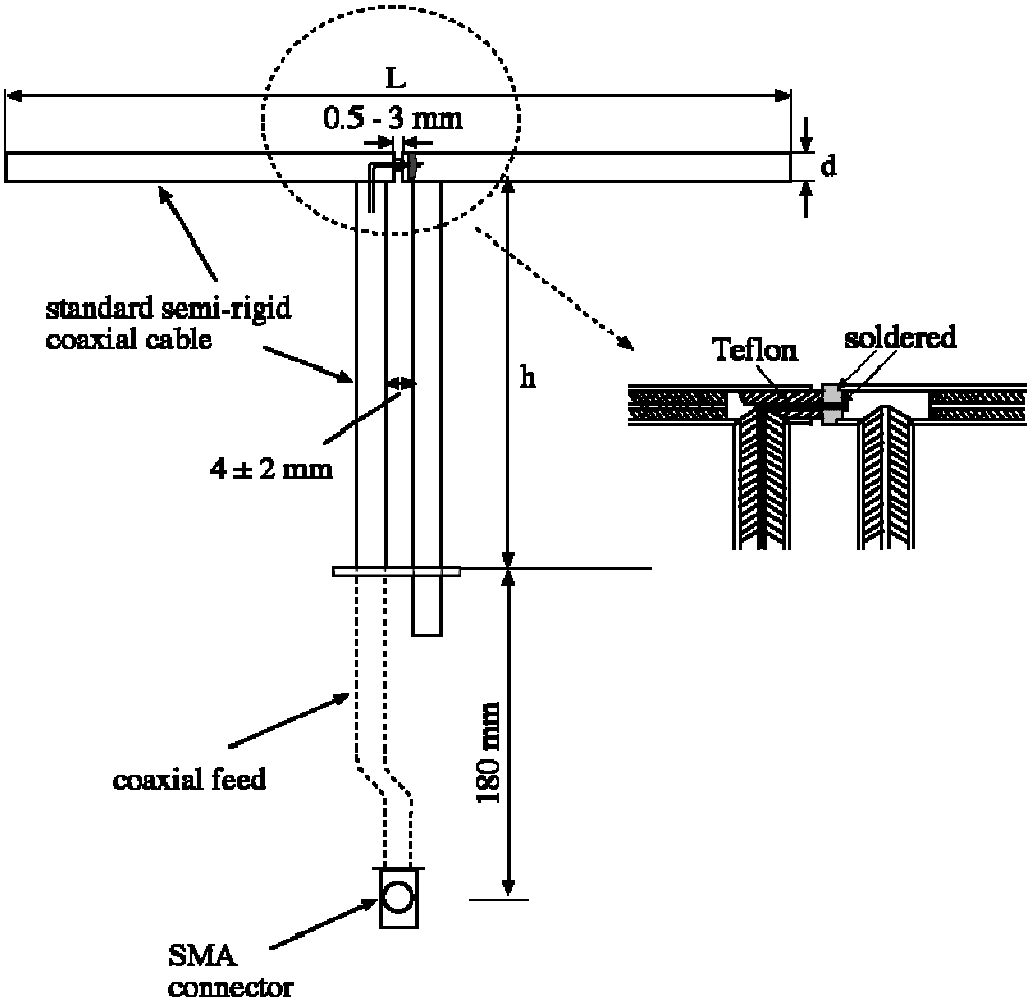
www.celltechlabs.com

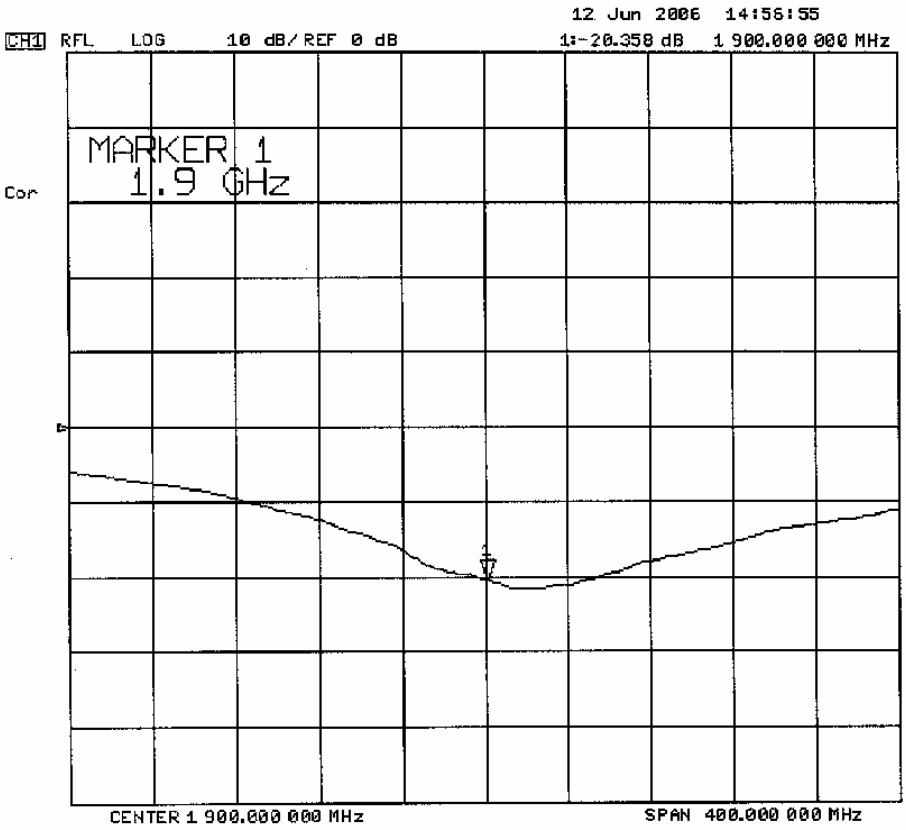
1. Dipole Construction & Electrical Characteristics

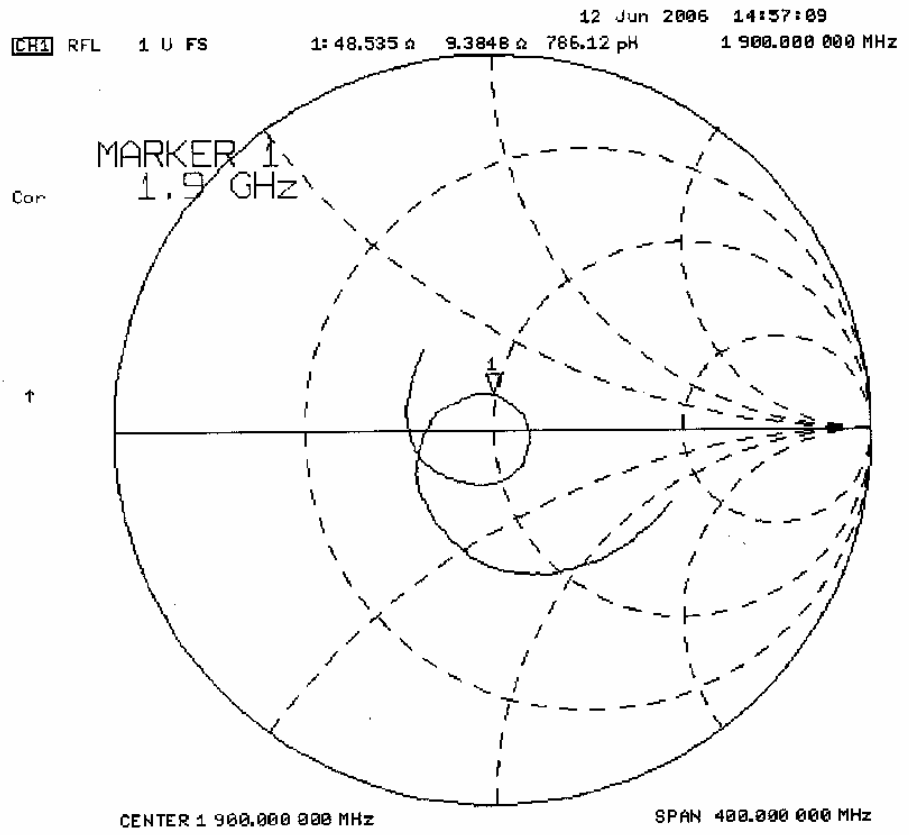
The validation dipole was constructed in accordance with the IEEE Standard "Annex G (informative) Reference dipoles for use in system validation". The electrical properties were measured using an HP 8753ET Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector feed point using an HP85032E Type N calibration kit. The dipole was placed parallel to a planar phantom at a separation distance of 10.0mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

Feed point impedance at 1900MHz	Re{Z} = 48.535Ω
	Im{Z} = 9.3848Ω
Return Loss at 1900MHz	-20.358dB



2. Validation Dipole VSWR Data





3. 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

4. Validation Phantom

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

Shell Thickness: 2.0 ± 0.1 mm
Filling Volume: Approx. 25 liters
Dimensions: 50 cm (W) x 100 cm (L)

5. 1900 MHz System Validation Setup

6. 1900 MHz Dipole Setup

7. Measurement Conditions

The phantom was filled with 1900 MHz Body tissue simulant.

Relative Permittivity: 51.4 (-3.5% deviation from target)
Conductivity: 1.51 mho/m (-0.5% deviation from target)
Fluid Temperature: 23.5 °C
Fluid Depth: ≥ 15.0 cm

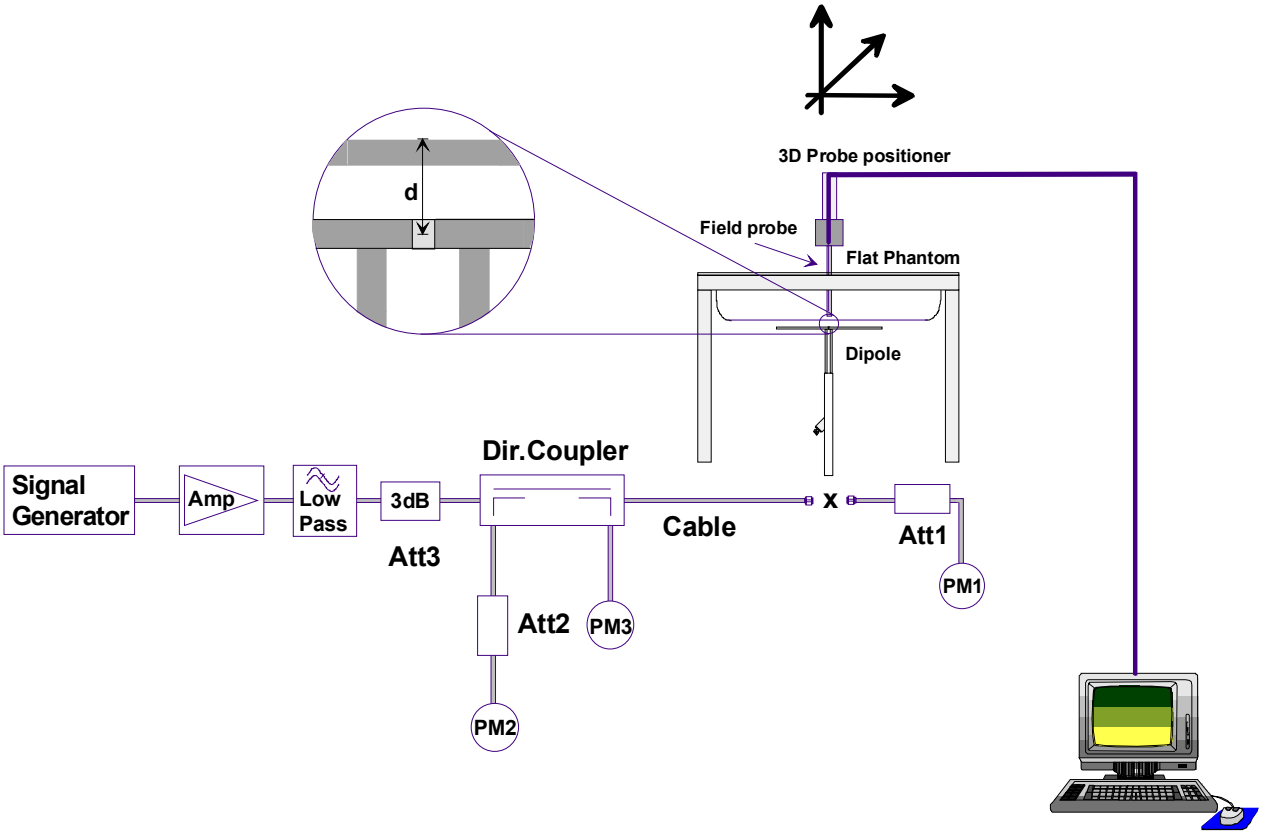
Environmental Conditions:
Ambient Temperature: 23.2 °C
Barometric Pressure: 101.2 kPa
Humidity: 44%

The 1900 MHz Body tissue simulant consisted of the following ingredients:

Ingredient	Percentage by weight
Water	69.85%
Glycol	29.89%
Salt	0.26%
Target Dielectric Parameters at 25 °C	ε_r = 53.3 (+/-5%) σ = 1.52 S/m (+/-5%)

8. 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 50dB below the forward power.

9. 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	10.50	42.00	5.40	21.60	11.90
Test 2	10.40	41.60	5.37	21.48	11.80
Test 3	10.40	41.60	5.37	21.48	11.80
Test 4	10.60	42.40	5.47	21.88	12.00
Test 5	10.30	41.20	5.30	21.20	11.60
Test 6	10.20	40.80	5.28	21.12	11.60
Test 7	10.20	40.80	5.27	21.08	11.60
Test 8	10.30	41.20	5.34	21.36	11.70
Test 9	10.30	41.20	5.31	21.24	11.60
Test 10	10.30	41.20	5.32	21.28	11.70
Average	**10.35**	**41.40**	**5.34**	**21.37**	**11.73**

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

Target SAR @ 1 Watt Input averaged over 1 gram (W/kg)		Measured SAR @ 1 Watt Input averaged over 1 gram (W/kg)	Deviation from Target (%)	Target SAR @ 1 Watt Input averaged over 10 grams (W/kg)		Measured SAR @ 1 Watt Input averaged over 10 grams (W/kg)	Deviation from Target (%)
39.8	+/- 10%	41.40	+4.02	20.8	+/- 10%	21.37	+2.74

Dipole Type	Distance [mm]	Frequency [MHz]	SAR (1g) [W/kg]	SAR (10g) [W/kg]	SAR (peak) [W/kg]
D300V2	15	300	3.02	2.06	4.36
D450V2	15	450	5.01	3.36	7.22
D835V2	15	835	9.71	6.38	14.1
D900V2	15	900	11.1	7.17	16.3
D1450V2	10	1450	29.6	16.6	49.8
D1500V2	10	1500	30.8	17.1	52.1
D1640V2	10	1640	34.4	18.7	59.4
D1800V2	10	1800	38.5	20.3	67.5
D1900V2	10	1900	39.8	20.8	69.6
D2000V2	10	2000	40.9	21.2	71.5
D2450V2	10	2450	51.2	23.7	97.6
D3000V2	10	3000	61.9	24.8	136.7

Table 32.1: Numerical reference SAR values for SPEAG dipoles and flat phantom filled with body-tissue simulating liquid. Note: All SAR values normalized to 1 W forward power.

System Validation (Body) - 1900 MHz Dipole - June 12, 2006

Dipole: 1900 MHz; Serial: 151
Ambient Temp: 23.2 °C; Fluid Temp: 23.5°C; Barometric Pressure: 101.2 kPa; Humidity: 44%
Communication System: CW
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: M1900 (σ = 1.51 mho/m; ε_r = 51.4; ρ = 1000 kg/m^3)
- Probe: EX3DV4 - SN3547; ConvF(7.84, 7.84, 7.84); Calibrated: 14/02/2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn370; Calibrated: 08/02/2006
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161

1900 MHz System Validation/Area Scan (5x8x1): Measurement grid: dx=15mm, dy=15mm

1900 MHz System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.7 V/m; Power Drift = -0.024 dB
SAR(1 g) = 10.5 mW/g; SAR(10 g) = 5.4 mW/g
Maximum value of SAR (measured) = 11.9 mW/g

1900 MHz System Validation/Zoom Scan 2 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.7 V/m; Power Drift = -0.033 dB
SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.37 mW/g
Maximum value of SAR (measured) = 11.8 mW/g

1900 MHz System Validation/Zoom Scan 3 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.5 V/m; Power Drift = -0.011 dB
SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.37 mW/g
Maximum value of SAR (measured) = 11.8 mW/g

1900 MHz System Validation/Zoom Scan 4 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.3 V/m; Power Drift = 0.003 dB
SAR(1 g) = 10.6 mW/g; SAR(10 g) = 5.47 mW/g
Maximum value of SAR (measured) = 12.0 mW/g

1900 MHz System Validation/Zoom Scan 5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.9 V/m; Power Drift = -0.004 dB
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.3 mW/g
Maximum value of SAR (measured) = 11.6 mW/g

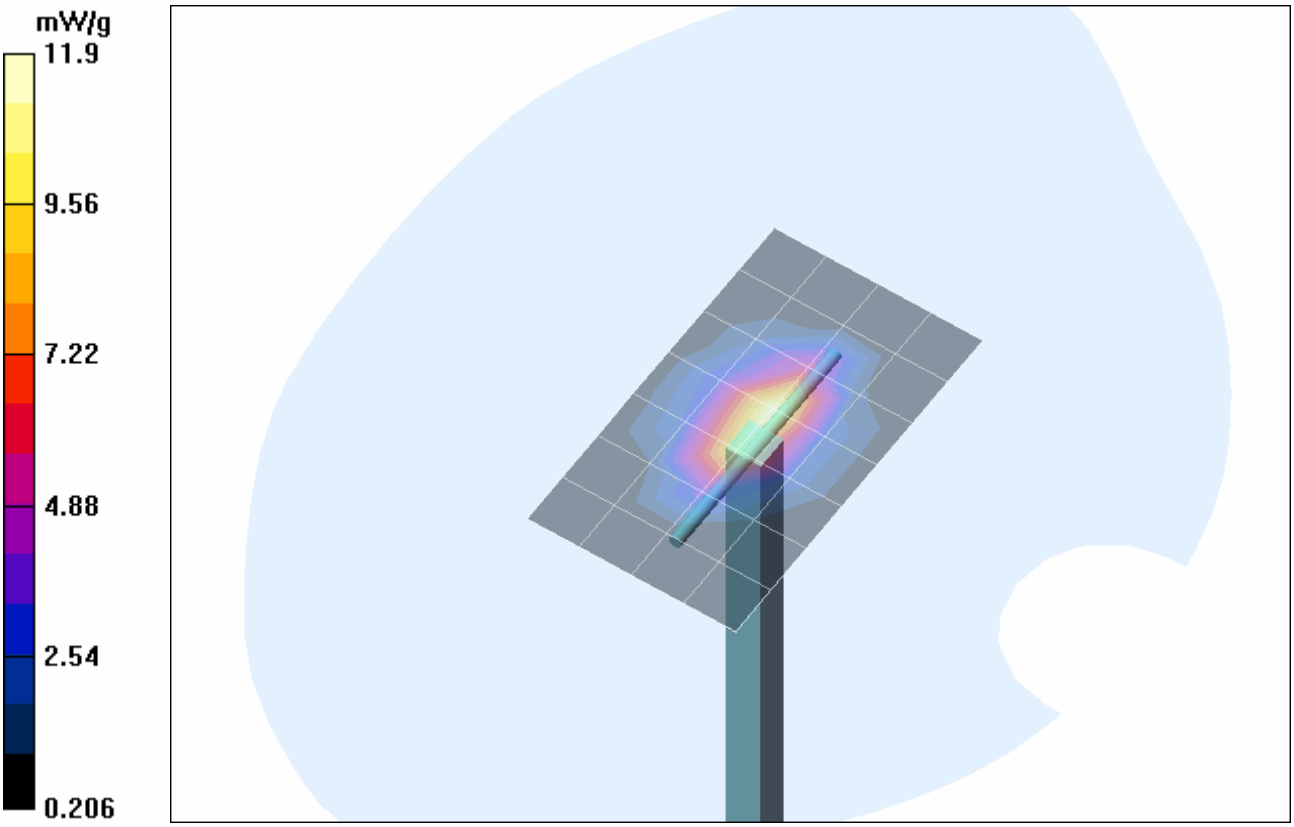
1900 MHz System Validation/Zoom Scan 6 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.9 V/m; Power Drift = -0.007 dB
SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.28 mW/g
Maximum value of SAR (measured) = 11.6 mW/g

1900 MHz System Validation/Zoom Scan 7 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.6 V/m; Power Drift = -0.008 dB
SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.27 mW/g
Maximum value of SAR (measured) = 11.6 mW/g

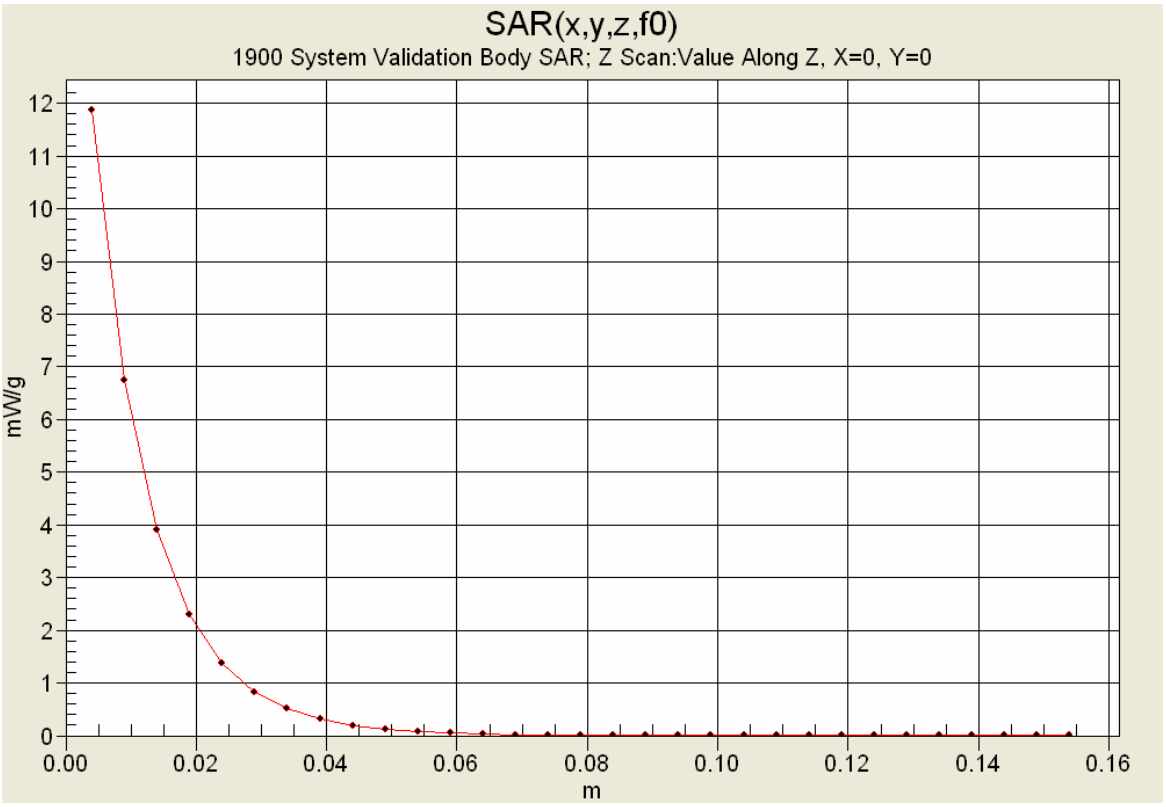
1900 MHz System Validation/Zoom Scan 8 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.3 V/m; Power Drift = -0.006 dB
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.34 mW/g
Maximum value of SAR (measured) = 11.7 mW/g

1900 MHz System Validation/Zoom Scan 9 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.9 V/m; Power Drift = -0.019 dB
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.31 mW/g
Maximum value of SAR (measured) = 11.6 mW/g

1900 MHz System Validation/Zoom Scan 10 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.2 V/m; Power Drift = -0.013 dB
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.32 mW/g
Maximum value of SAR (measured) = 11.7 mW/g



1 g average of 10 measurements: 10.35 mW/g
10 g average of 10 measurements: 5.34 mW/g



10. Measured Fluid Dielectric Parameters

1900 MHz Dipole System Validation (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Mon 12/Jun/2006
Frequency(GHz)
FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB FCC Limits for Body Epsilon
FCC_sB FCC Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eB	FCC_sB	Test_e	Test_s
1.8000	53.30	1.52	51.68	1.43
1.8100	53.30	1.52	51.72	1.44
1.8200	53.30	1.52	51.59	1.44
1.8300	53.30	1.52	51.60	1.45
1.8400	53.30	1.52	51.57	1.46
1.8500	53.30	1.52	51.47	1.46
1.8600	53.30	1.52	51.50	1.48
1.8700	53.30	1.52	51.46	1.49
1.8800	53.30	1.52	51.51	1.49
1.8900	53.30	1.52	51.37	1.52
1.9000	53.30	1.52	51.36	1.51
1.9100	53.30	1.52	51.28	1.54
1.9200	53.30	1.52	51.23	1.54
1.9300	53.30	1.52	51.23	1.55
1.9400	53.30	1.52	51.25	1.56
1.9500	53.30	1.52	51.31	1.57
1.9600	53.30	1.52	51.16	1.59
1.9700	53.30	1.52	51.21	1.59
1.9800	53.30	1.52	51.19	1.61
1.9900	53.30	1.52	51.12	1.62
2.0000	53.30	1.52	51.13	1.63

APPENDIX F - PROBE CALIBRATION

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

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

Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client Celltech Labs

Certificate No: ET3-1387_Mar06

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1387
Calibration procedure(s)	QA CAL-01.v5 Calibration procedure for dosimetric E-field probes
Calibration date:	March 16, 2006
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41495277	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41498087	3-May-05 (METAS, No. 251-00466)	May-06
Reference 3 dB Attenuator	SN: S5054 (3c)	11-Aug-05 (METAS, No. 251-00499)	Aug-06
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-05 (METAS, No. 251-00467)	May-06
Reference 30 dB Attenuator	SN: S5129 (30b)	11-Aug-05 (METAS, No. 251-00500)	Aug-06
Reference Probe ES3DV2	SN: 3013	2-Jan-06 (SPEAG, No. ES3-3013_Jan06)	Jan-07
DAE4	SN: 654	2-Feb-06 (SPEAG, No. DAE4-654_Feb06)	Feb-07

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov 06

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

Issued: March 16, 2006

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

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

Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

Methods Applied and Interpretation of Parameters:

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

Probe ET3DV6

SN:1387

Manufactured:	September 21, 1999
Last calibrated:	March 18, 2005
Recalibrated:	March 16, 2006

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1387

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

NormX	**1.62** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**92** mV
NormY	**1.72** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**92** mV
NormZ	**1.72** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**92** mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL **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	9.3	5.0
SAR_{be} [%]	With Correction Algorithm	0.1	0.2

Sensor Offset

Probe Tip to Sensor Center	**2.7** mm

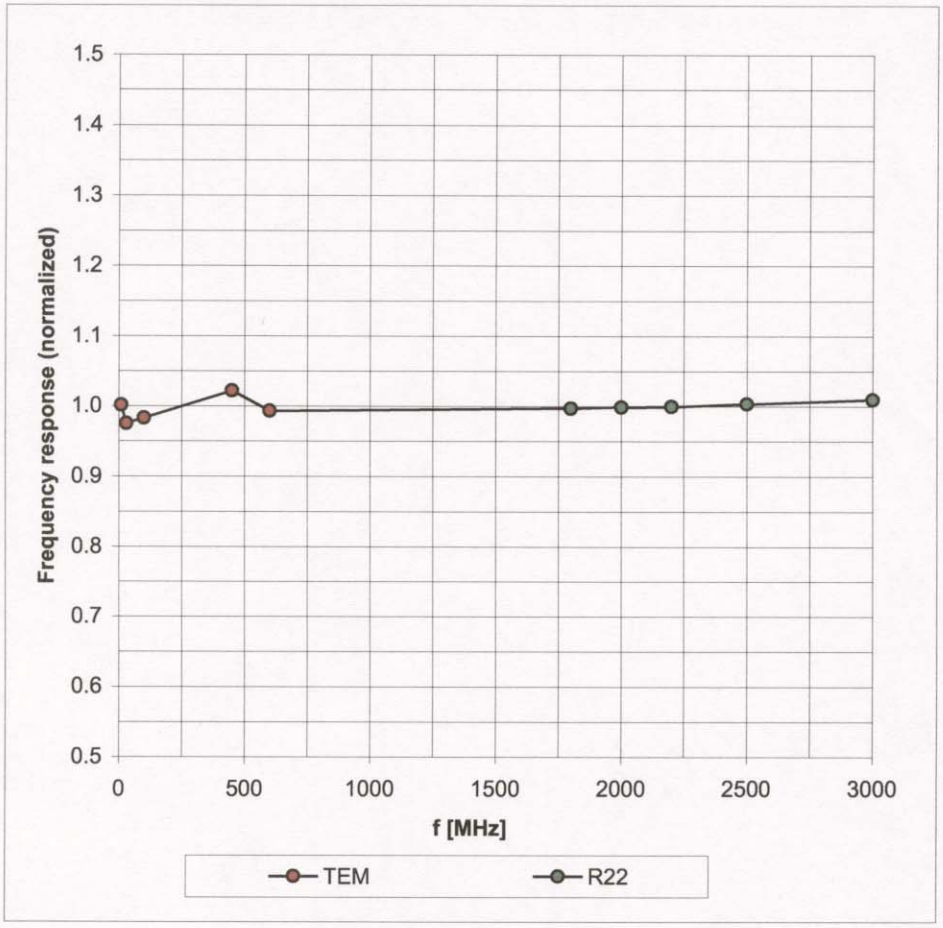
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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

[B] Numerical linearization parameter: uncertainty not required.

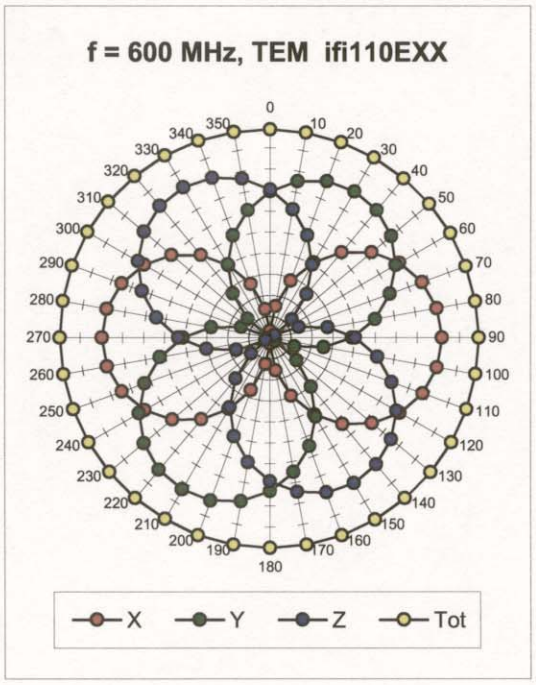
Frequency Response of E-Field

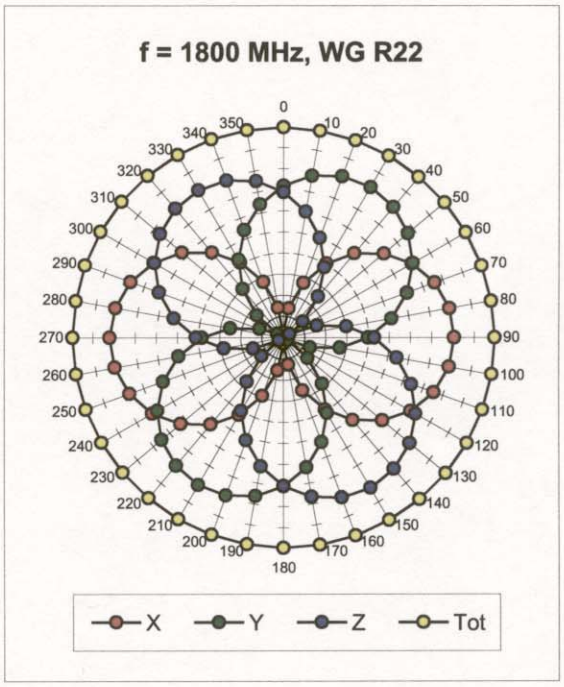
(TEM-Cell:ifi110 EXX, Waveguide: R22)

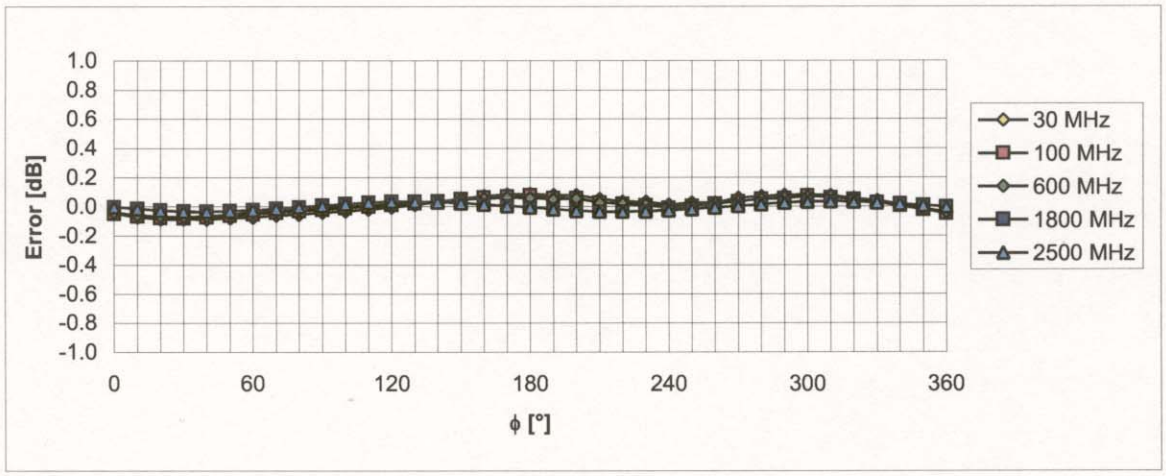


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



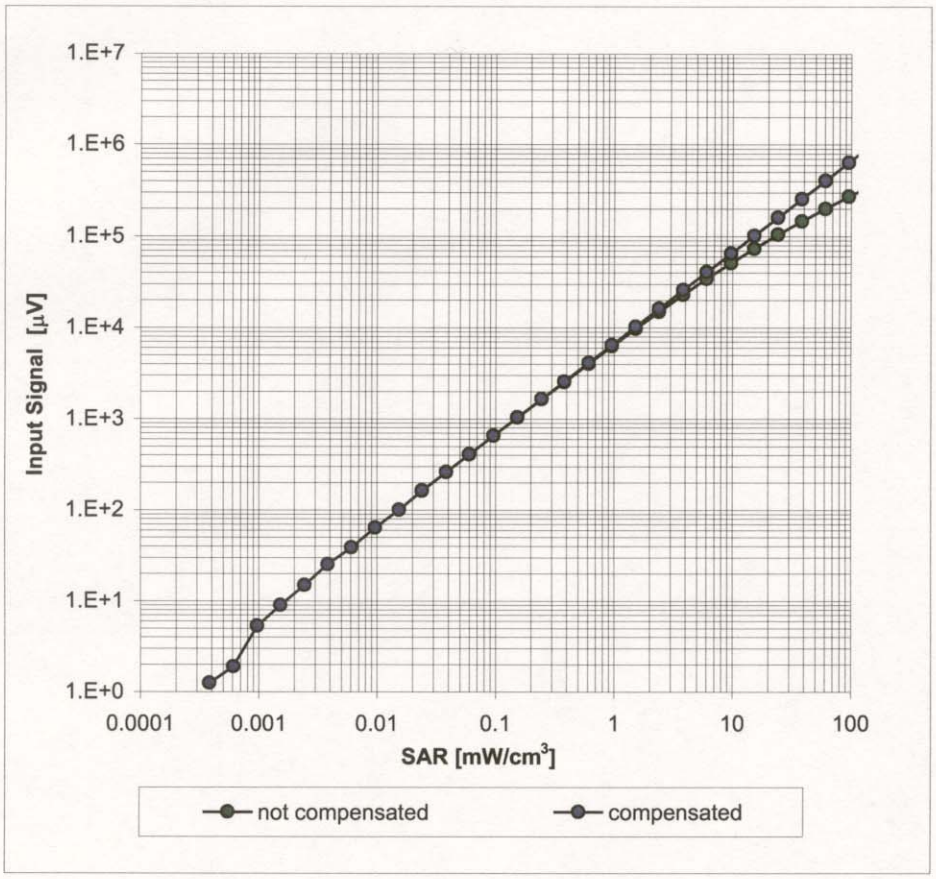


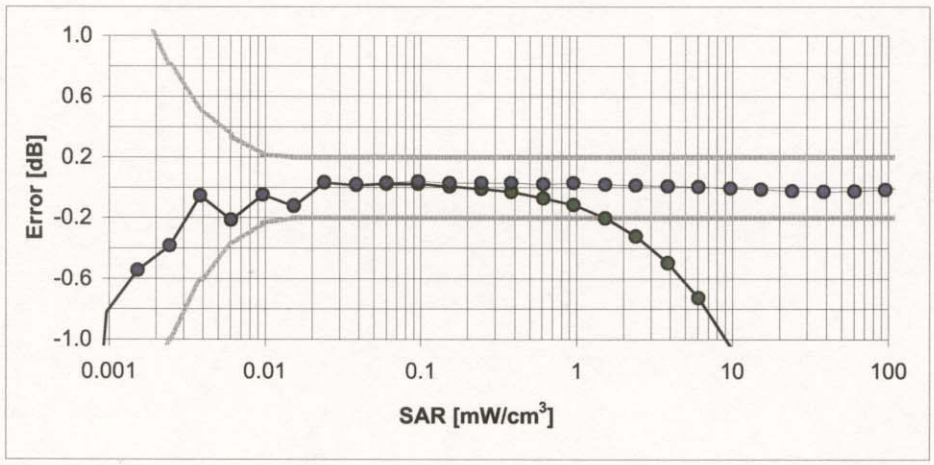


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

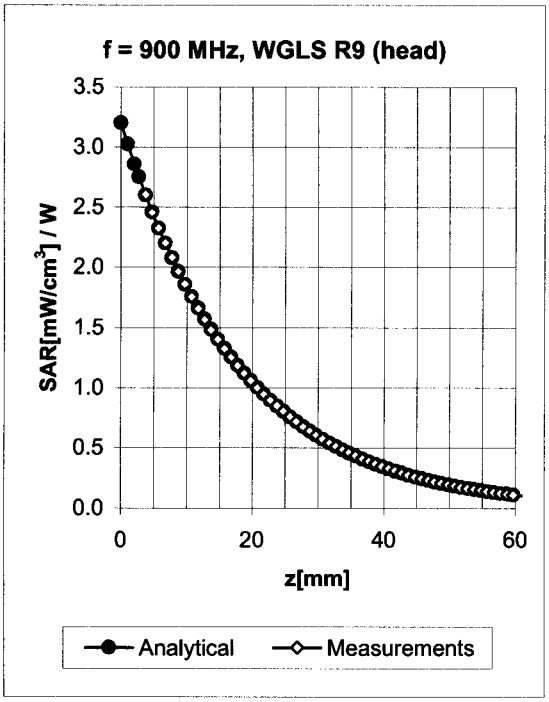
(Waveguide R22, f = 1800 MHz)

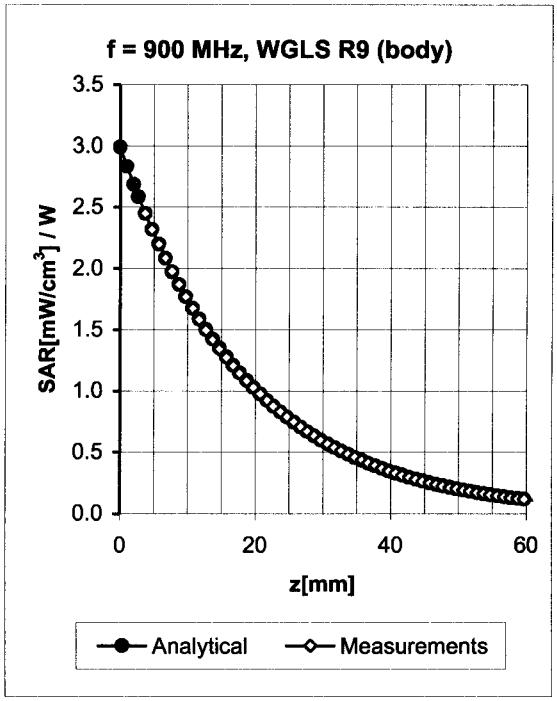




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



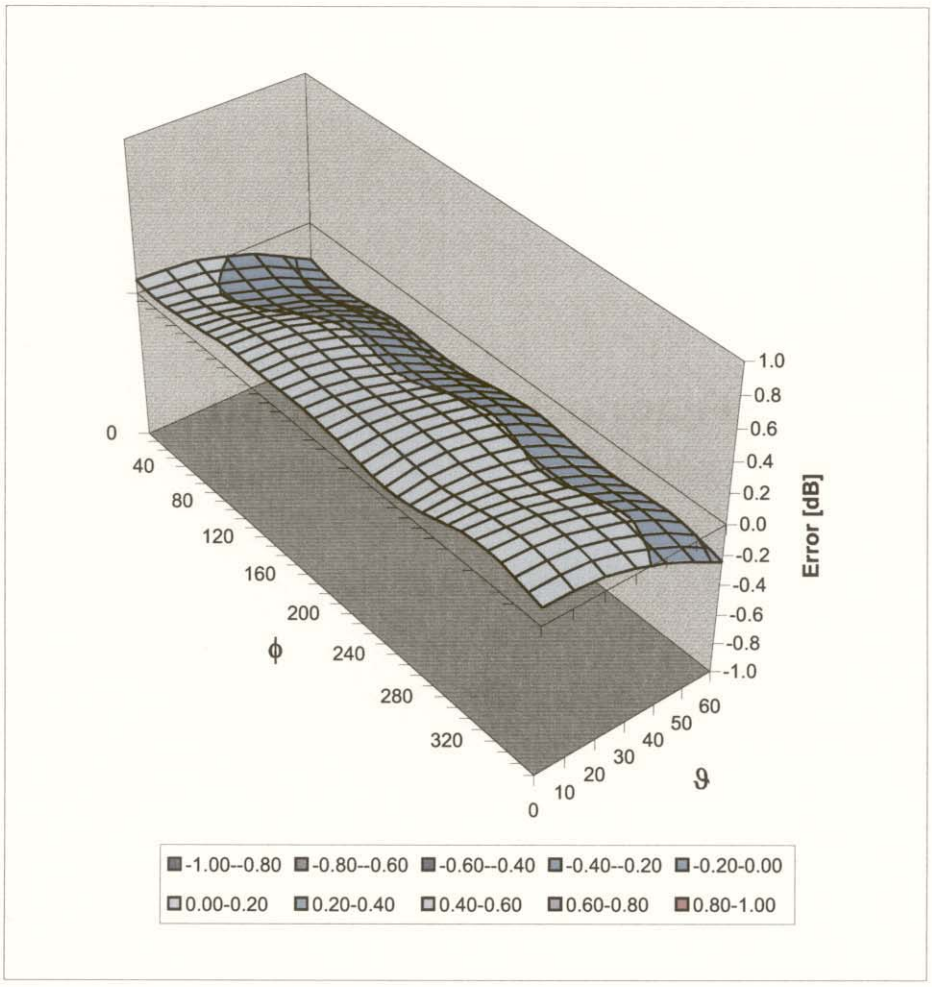


f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.62	1.86	6.35 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.59	1.97	6.04 ± 11.0% (k=2)

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

Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

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

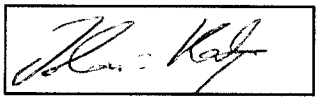
Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1387**
Place of Assessment:	**Zurich**
Date of Assessment:	**March 18, 2006**
Probe Calibration Date:	**March 16, 2006**

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:



Schmid & Partner Engineering AG

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

Dosimetric E-Field Probe ET3DV6 SN:1387

Conversion factor (± standard deviation)

150 ± 50 MHz	ConvF	**8.6 ± 10%**	**ε_r = 52.3 ± 5%** **σ = 0.76 ± 5% mho/m** (head tissue)
150 ± 50 MHz	ConvF	**8.2 ± 10%**	**ε_r = 61.9 ± 5%** **σ = 0.80 ± 5% mho/m** (body tissue)
300 ± 50 MHz	ConvF	**7.8 ± 9%**	**ε_r = 45.3 ± 5%** **σ = 0.87 ± 5% mho/m** (head tissue)
450 ± 50 MHz	ConvF	**7.4 ± 8%**	**ε_r = 43.5 ± 5%** **σ = 0.87 ± 5% mho/m** (head tissue)
450 ± 50 MHz	ConvF	**7.3 ± 8%**	**ε_r = 56.7 ± 5%** **σ = 0.94 ± 5% mho/m** (body tissue)
750 ± 50 MHz	ConvF	**6.6± 7%**	**ε_r = 41.8 ± 5%** **σ = 0.89 ± 5% mho/m** (head tissue)
750 ± 50 MHz	ConvF	**6.4 ± 7%**	**ε_r = 55.4 ± 5%** **σ = 0.96 ± 5% mho/m** (body tissue)
1925 ± 50 MHz	ConvF	**5.0 ± 7%**	**ε_r = 39.8 ± 5%** **σ = 1.48 ± 5% mho/m** (head tissue)
1925 ± 50 MHz	ConvF	**4.7 ± 7%**	**ε_r = 53.2 ± 5%** **σ = 1.60 ± 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.

Schmid & Partner Engineering AG

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Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

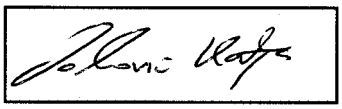
Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1387**
Place of Assessment:	**Zurich**
Date of Assessment:	**December 18, 2006**
Probe Calibration Date:	**March 16, 2006**

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:



Schmid & Partner Engineering AG

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Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Dosimetric E-Field Probe ET3DV6 SN:1387

Conversion factor (± standard deviation)

1850 ± 50 MHz	ConvF	**4.80 ± 7%**	ε_r = **53.3 ± 5%** σ = **1.52 ± 5% mho/m** (body tissue)

Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.
Please see also Section 4.7 of the DASY4 Manual.

APPENDIX G - SAM PHANTOM CERTIFICATE OF CONFORMITY

Schmid & Partner
Engineering AG

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

Certificate of conformity / First Article Inspection

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

Tests

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

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

Standards

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

Conformity

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

Date 18.11.2001

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