RF EXPOSURE EVALUATION

SPECIFIC ABSORPTION RATE

SAR TEST REPORT

FOR

COMMERCIANT, L.P.

PORTABLE CREDIT CARD TRANSACTION TERMINAL

WITH

DUAL-BAND CELLULAR/PCS CDMA-2000 MODEM

MODEL: M-106X

FCC ID: QWL-M-106X

Test Report Serial Number

013006QWL-T716-S24C

Test Report Issue No.

S716C-030106-R0

Test Lab

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DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

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Applicant Information

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FCC IDENTIFIER:	**QWL-M-106X**
Model(s):	**M-106X**
SAR Test Requirement(s):	**FCC 47 CFR §2.1093; Health Canada Safety Code 6**
SAR Test Procedure(s):	**FCC OET Bulletin 65, Supplement C (Edition 01-01)** **Industry Canada RSS-102 Issue 2**
FCC Device Classification:	**PCS Licensed Transmitter (PCB)**
IC Device Classification:	**2 GHz Personal Communication Services (RSS-133 Issue 3)** **800 MHz Cellular Telephones Employing New Technologies (RSS-132 Issue 2)**
Device Description:	**Portable Wireless Credit Card Transaction Terminal**
Internal Transmitter:	**Dual-Band PCS/Cellular CDMA-2000 Modem**
Transmit Frequency Range(s):	**1851.25 - 1908.75 MHz (PCS Band)** **824.70 - 848.31 MHz (Cellular Band)**
Max. RF Output Power Tested:	**24.33 dBm (0.271 Watts) Conducted (PCS CDMA)** **24.98 dBm (0.315 Watts) Conducted (Cellular CDMA)**
Power Source(s) Tested:	**Lithium Ion 3.7 V, 1800 mAh (P/N: UBBP01)**
Antenna Type(s) Tested:	**Internal**
Configuration(s) Tested:	**Back of DUT - with Body-worn accessory** **Back of DUT - Touch position (without Body-worn accessory)**
Body-Worn Accessories:	**Nylon Holster with Belt-Strap (P/N: AC0002002)**
Max. SAR Level(s) Evaluated:	**Body: 0.485 W/kg (1g average) - PCS Band** **Body: 0.697 W/kg (1g average) - Cellular Band**

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.

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The results and statements contained in this report pertain only to the device(s) evaluated.

Tested By:	Reviewed By:
Sean Johnston **Compliance Technologist** **Celltech Labs Inc.**	**Spencer Watson** **Senior Compliance Technologist** **Celltech Labs Inc.**

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1.0 INTRODUCTION

This measurement report demonstrates that the COMMERCIANT, L.P. Model: M-106X Portable Wireless Credit Card Transaction Terminal FCC ID: QWL-M-106X, incorporating the Wavecom Q2438F Dual-Band PCS/Cellular CDMA-2000 Modem, 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)

SAR Test Requirement(s)	FCC Rule Part 47 CFR §2.1093				
	Health Canada Safety Code 6				
SAR Test Procedure(s)	FCC OET Bulletin 65, Supplement C (01-01)				
	Industry Canada RSS-102 Issue 2				
FCC Device Classification	PCS Licensed Transmitter (PCB)			24E, 22H	
IC Device Classification	2 GHz Personal Communication Services			RSS 133 Issue 3	
	800MHz Cellular Telephones Employing New Technologies			RSS-132 Issue 2	
Device Description	Portable Wireless Credit Card Transaction Terminal				
Internal Transmitter(s)	Dual-Band PCS/Cellular CDMA-2000 Modem				
RF Exposure Category	General Population / Uncontrolled Environment				
FCC IDENTIFIER	QWL-M-106X				
Model(s)	M-106X				
Test Sample Serial No.(s)	None	M-106X Credit Card Transaction Terminal		Identical Prototype	
	F60B83E4 513 019 08 PP	Wavecom Q2438F CDMA-2000 Modem		Production Unit	
Transmit Frequency Range(s)	1851.25 - 1908.75 MHz		PCS Band		
	824.70 - 848.31 MHz		Cellular Band		
Max. Conducted RF Output Power Level(s) Measured	24.33 dBm	0.271 Watts	1880.00 MHz	Channel 600	PCS Band
	24.98 dBm	0.315 Watts	836.52 MHz	Channel 384	Cellular Band
Radio Configuration(s) Tested	**PCS Band**	RC2	**Cellular Band**	RC1	
Service Option(s) Tested	**PCS Band**	SO9	**Cellular Band**	SO2	
Operating Mode(s)	1x CDMA-2000		Data Only		
Power Control Setting(s)	All Bits Up	Communication Test Set	**CDMA MS Protocol Revision No.**	6	
Antenna Type(s) Tested	Internal				
Battery Type(s) Tested	Internal Lithium-ion	3.7 V, 1800 mAh	P/N: UBBP01		
Configuration(s) Tested	Back Side of DUT - with body-worn accessory	Back side of DUT - touch position (without accessory)			
Body-Worn Accessories Tested	Nylon Holster with Belt-Strap	P/N: AC0002002			
Audio Accessories Tested	None	not applicable			

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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 planar phantom

DASY4 SAR Measurement System with planar phantom and validation dipole

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4.0 MEASUREMENT SUMMARY

Conducted Power Measurements - Radio Configurations and Service Options						
Cellular Band		**RC1**	**RC2**	**RC3**	**RC4**	**RC5**
SO2	**1013**	24.96	x	-	-	x
	384	**24.98**		24.86	24.87	
	777	25.00		-	-	
SO9	**1013**	x	-	x	x	-
	384		24.96			24.85
	777		-			-
SO55	**1013**	-	-	-	-	-
	384	24.97	24.97	24.87	24.89	24.87
	777	-	-	-	-	-
SO32 (+F-SCH)	**1013**	x	x	-	-	x
	384			24.92	24.93	
	777			-	-	
SO32 (+SCH)	**1013**	x	x	-	-	-
	384			24.89	24.91	
	777			-	-	
PCS Band		**RC1**	**RC2**	**RC3**	**RC4**	**RC5**
SO2	**25**	-	x	-	-	x
	600	24.32		24.26	24.28	
	1175	-		-	-	
SO9	**25**	x	24.08	x	x	-
	600		**24.33**			24.26
	1175		24.38			-
SO55	**25**	-	-	-	-	-
	600	24.32	24.32	24.26	24.27	24.25
	1175	-	-	-	-	-
SO32 (+F-SCH)	**25**	x	x	-	-	x
	600			24.27	24.26	
	1175			-	-	
SO32 (+SCH)	**25**	x	x	-	-	x
	600			24.27	24.27	
	1175			-	-	

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MEASUREMENT SUMMARY (Cont.)

BODY-WORN SAR EVALUATION RESULTS

OPERATING MODE: 1x CDMA-2000

Test Date	Band	Mode	Freq. (MHz)	Chan.	Antenna Position	Battery Type	Body-Worn Accessory	DUT Position to Planar Phantom	Separation Distance to Planar Phantom (cm)	Conducted Power Before SAR Test			SAR Drift During Test (dB)	Measured SAR 1g (W/kg)
										dBm	RC	SO		
Feb 2	Cellular	CDMA	836.52	384	Internal	Li-ion	--	Back Side	0.0	24.98	1	2	0.009	0.697
Feb 2	Cellular	CDMA	836.52	384	Internal	Li-ion	Nylon Holster	Back Side	0.8	24.98	1	2	0.041	0.455
Feb 3	PCS	CDMA	1880.00	600	Internal	Li-ion	--	Back Side	0.0	24.33	2	9	-0.0287	0.485
Feb 3	PCS	CDMA	1880.00	600	Internal	Li-ion	Nylon Holster	Back Side	0.8	24.33	2	9	0.277	0.186

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

Test Date(s)	February 03, 2006				February 02, 2006				Measured Fluid Type	1880 MHz	835 MHz	Unit
Dielectric Constant ε_r	1880 MHz Body				835 MHz Body				Relative Humidity	30	30	%
	IEEE Target		Meas.	Dev.	IEEE Target		Meas.	Dev.	Atmospheric Pressure	101.2	101.1	kPa
	53.3	± 5%	51.7	-3.0%	55.2	± 5%	53.2	-3.6%	Ambient Temperature	23.3	23.0	°C
Conductivity σ (mho/m)	1880 MHz Body				835 MHz Body				Fluid Temperature	23.8	22.5	°C
	IEEE Target		Meas.	Dev,	IEEE Target		Meas.	Dev,	Fluid Depth	≥ 15	≥ 15	cm
	1.52	± 5%	1.54	+1.3%	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 measured SAR levels evaluated 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 battery was fully charged prior to the SAR evaluations.
4. The power drift of the DUT during the SAR evaluations was measured by the DASY4 system.
5. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluations. The temperatures reported in the table above were consistent for all measurement periods.
6. 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).
7. The SAR evaluations were performed within 24 hours of the system performance check.

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5.0 DETAILS OF SAR EVALUATION

The COMMERCIANT, L.P. Model: M-106X Wireless Portable Credit Card Transaction Terminal FCC ID: QWL-M-106X, with internal Dual-Band PCS/Cellular CDMA-2000 Modem, was demonstrated to be 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.

Body SAR Test Configurations

1. The DUT was tested for body SAR with the bottom side of the Tablet PC placed parallel to, and touching, the outer surface of the planar phantom.
2. The DUT was tested for body SAR in a body-worn configuration placed inside the Nylon Holster with Belt-Strap accessory (P/N: AC0002002) with the back side of the DUT facing parallel to the outer surface of the planar phantom. The Nylon Holster with Belt-Strap was touching the outer surface of the planar phantom and provided 0.8 cm spacing between the back of the DUT and the outer surface of the planar phantom.

Test Modes & Power Settings

3. The DUT was tested with a modulated CDMA signal generated by the Agilent E5515C Communications Test Set at maximum power level in the “all bits up” power control setting.
4. The conducted power levels of the DUT were measured prior to the SAR evaluations using a Gigatronics 8652A Universal Power Meter according to the procedures described in FCC 47 CFR §2.1046.
5. The power drifts were measured by the DASY4 system for the duration of the SAR evaluations.
6. The DUT battery was fully charged prior to the SAR evaluations.

Test Conditions

7. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter checks and the SAR evaluations. The temperatures reported were consistent for all measurement periods.
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 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 from the tip of the probe and the distance between the surface and the lowest measuring point is 1.4 mm (see probe calibration document in Appendix F). The extrapolation was based on trivariate quadratics computed from the previously calculated 3D interpolated points nearest the phantom surface.

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

g. A zoom scan volume of 32 mm x 32 mm x 30 mm (5 x 5 x 7 points) centered at the peak SAR location determined from the area scan is used for all zoom scans for devices with a transmit frequency < 800 MHz. Zoom scans for frequencies ≥ 800 MHz are determined with a scan volume of 30 mm x 30 mm x 30 mm (7 x 7 x 7) to ensure complete capture of the peak spatial-average SAR.

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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, March 2005 (see reference [6]).

SYSTEM PERFORMANCE CHECK EVALUATIONS

Test Date	Equiv. Tissue	SAR 1g (W/kg)			Dielectric Constant ε_r			Conductivity σ (mho/m)			ρ (Kg/m^3)	Amb. Temp. (ºC)	Fluid Temp. (ºC)	Fluid Depth (cm)	Humid. (%)	Barom. Press. (kPa)
	Body (MHz)	IEEE Target	Meas.	Dev.	IEEE Target	Meas.	Dev.	IEEE Target	Meas.	Dev.						
02/02/06	**835**	**2.43 ±10%**	2.43	0.0%	**55.2 ±5%**	53.2	-3.6%	**0.97 ±5%**	0.98	-1.0%	1000	23.0	22.5	≥ 15	30	101.1
02/03/06	**1900**	**9.95 ±10%**	10.5	+5.5%	**53.3 ±5%**	51.6	-3.2%	**1.52 ±5%**	1.56	+2.6%	1000	23.3	23.8	≥ 15	30	101.2

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.

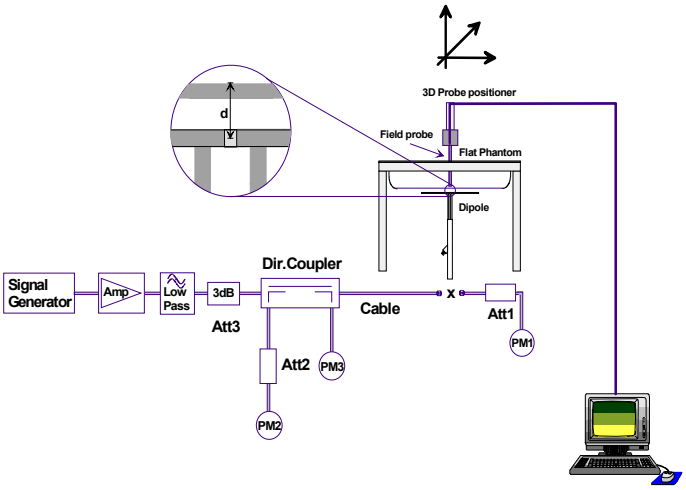

Figure 1. System Performance Check Setup Diagram

1900MHz Dipole 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

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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 is added and visual inspection is made to ensure air bubbles are 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 System Performance Check	1880 MHz Body 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 System Performance Check	835 MHz Body 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

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.

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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
s

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.(s): 1590
Construction: Triangular core fiber optic detection system
Frequency: 10 MHz to 6 GHz
Linearity: ±0.2 dB (30 MHz to 3 GHz)

Phantom(s)

Type: Planar Phantom
Shell Material: Fiberglass
Thickness: 2.0 ±0.1 mm
Volume: Approx. 72 liters

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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 portable devices

ET3DV6 E-Field Probe

12.0 PLANAR PHANTOM

The planar phantom is a fiberglass shell phantom with a 2.0 mm (+/-0.2mm) thick device measurement area at the center of the phantom for SAR evaluations of devices with a larger surface area than the planar section of the SAM phantom. The planar phantom is integrated in a wooden table (see Appendix G for dimensions and specifications of the planar phantom).

Planar Phantom

13.0 DEVICE HOLDER

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

Device Holder

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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	15Jun05		15Jun06
	-ET3DV6 E-Field Probe	00016	1387	18Mar05		18Mar06
x	-ET3DV6 E-Field Probe	00017	1590	20May05		20May06
	-300MHz Validation Dipole	00023	135	25Oct05		25Oct06
	-450MHz Validation Dipole	00024	136	25Oct05		25Oct06
	-835MHz Validation Dipole	00022	411	**Brain**	30Mar05	30Mar06
x				**Body**	12Apr05	12Apr06
	-900MHz Validation Dipole	00020	054	**Brain**	10Jun05	10Jun06
				Body	10Jun05	10Jun06
	-1800MHz Validation Dipole	00021	247	**Brain**	14Jun05	14Jun06
				Body	14Jun05	14Jun06
	-1900MHz Validation Dipole	00032	151	**Brain**	17Jun05	17Jun06
x				**Body**	22Apr05	22Apr06
	-2450MHz Validation Dipole	00025	150	**Brain**	20Sep05	20Sep06
				Body	22Apr05	22Apr06
	-SAM Phantom V4.0C	00154	1033	N/A		N/A
x	-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
	HP 85070C Dielectric Probe Kit	00033	N/A	N/A		N/A
x	ALS-PR-DIEL Dielectric Probe Kit	00160	260-00953	N/A		N/A
	Gigatronics 8652A Power Meter	00110	1835801	16Apr05		16Apr06
x	Gigatronics 8652A Power Meter	00008	1835267	29Apr05		29Apr06
x	Gigatronics 80701A Power Sensor	00012	1834350	12Sep05		12Sep06
x	Gigatronics 80701A Power Sensor	00014	1833699	07Sep05		07Sep06
	Gigatronics 80701A Power Sensor	00109	1834366	16Apr05		16Apr06
x	HP 8753ET Network Analyzer	00134	US39170292	04May05		04May06
x	HP 8648D Signal Generator	00005	3847A00611	29Apr05		29Apr06
x	Agilent E5515C Communication Test Set	80008	GB41070432	06Jul05		06Jul07
	Rohde & Schwarz SMR40 Signal Generator	00006	100104	12Apr05		12Apr06
x	Amplifier Research 5S1G4 Power Amplifier	00106	26235	N/A		N/A

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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	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)	2.5	Normal	1	0.64	1.6	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	2.5	Normal	1	0.6	1.5	∞
Combined Standard Uncertainty					**10.58**	
Expanded Uncertainty (k=2)					**21.16**	

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

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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	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)	2.5	Normal	1	0.64	1.6	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	2.5	Normal	1	0.6	1.5	∞
Combined Standard Uncertainty					**8.79**	
Expanded Uncertainty (k=2)					**17.57**	

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

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

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APPENDIX A - SAR MEASUREMENT DATA

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Date Tested: 02/02/2006

Body SAR - Cellular Band - Back Side of DUT Touching Planar Phantom - Mid Channel 384

DUT: Commerciant; Model: M-106X; Type: Portable Credit Card Transaction Terminal with Dual-Band CDMA; Serial: None

Body-Worn Accessory: None

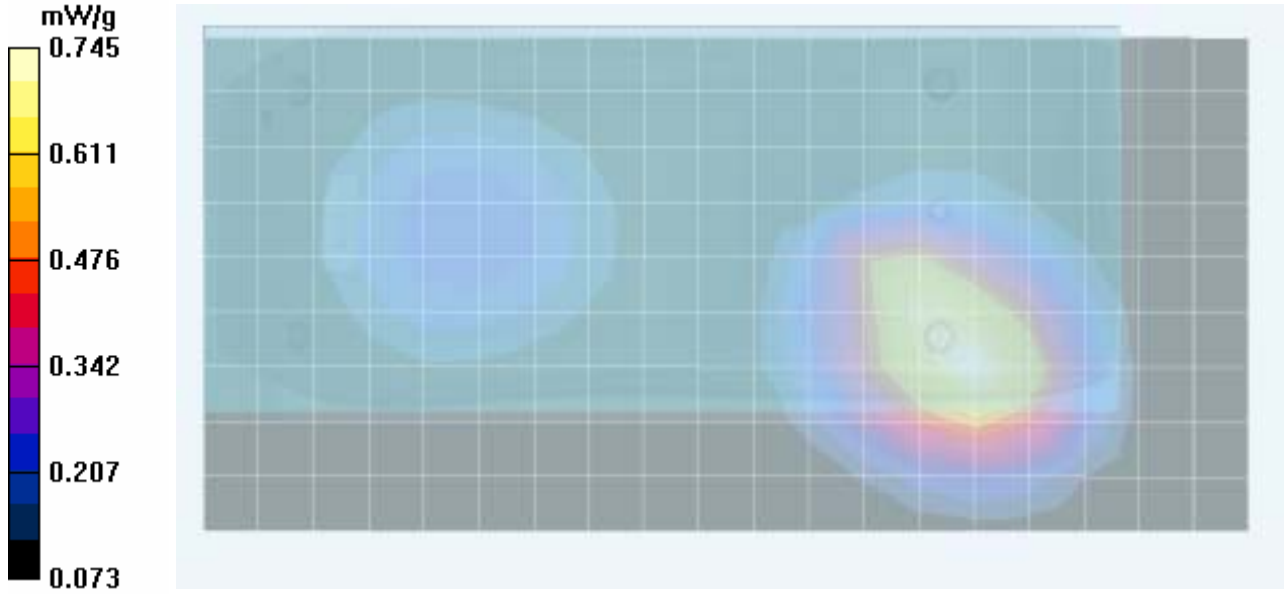
Ambient Temp: 23.0 °C; Fluid Temp: 22.5 °C; Barometric Pressure: 101.1 kPa; Humidity: 30%

Communication System: Cellular CDMA
RF Output Power: 24.98 dBm (Conducted)
3.7V, 1800mAh Lithium-ion Battery (P/N: UBBP01)
Frequency: 836.52 MHz; Channel 384; Duty Cycle: 1:1
Medium: M835 (σ = 0.98 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.47, 6.47, 6.47); Calibrated: 20/05/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Body SAR - Cellular Band - Back Side of DUT Touching Planar Phantom - Mid Channel
Area Scan (10x20x1): Measurement grid: dx=15mm, dy=15mm

Body SAR - Cellular Band - Back Side of DUT Touching Planar Phantom - Mid Channel
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.89 V/m; Power Drift = 0.009 dB
Peak SAR (extrapolated) = 0.986 W/kg
SAR(1 g) = 0.697 mW/g; SAR(10 g) = 0.471 mW/g



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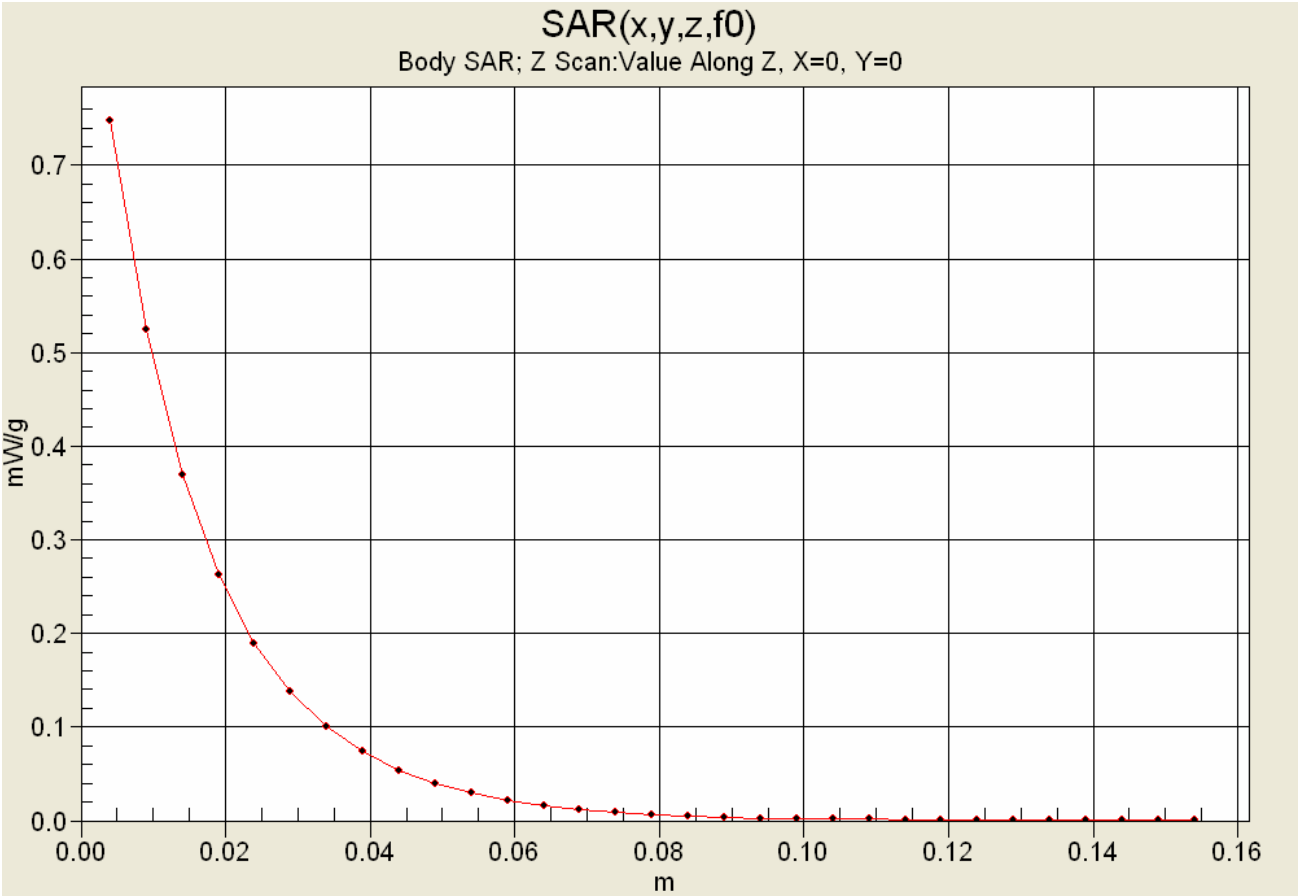
Z-Axis Scan



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Date Tested: 02/02/2006

Body-Worn SAR - Cellular Band - Back Side of DUT Facing Planar Phantom - Mid Channel 384

DUT: Commerciant; Model: M-106X; Type: Portable Credit Card Transaction Terminal with Dual-Band CDMA; Serial: None

Body-Worn Accessory: Nylon Holster with Belt-Strap (P/N: AC0002002)

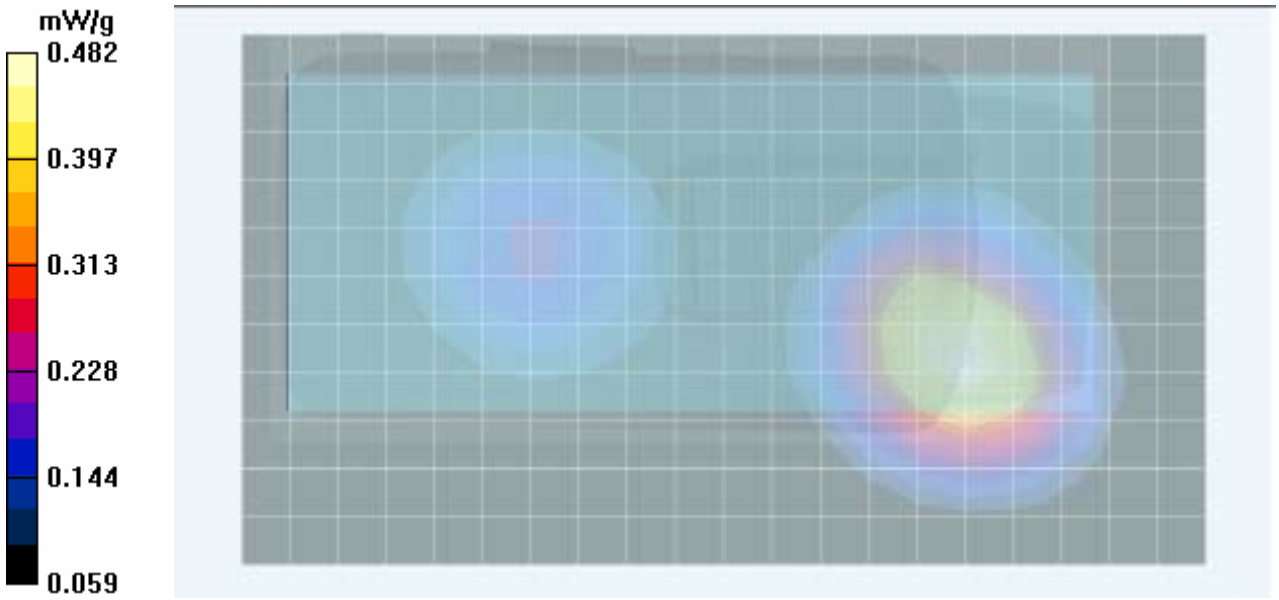
Ambient Temp: 23.0 °C; Fluid Temp: 22.5 °C; Barometric Pressure: 101.1 kPa; Humidity: 30%

Communication System: Cellular CDMA
RF Output Power: 24.98 dBm (Conducted)
3.7V, 1800mAh Lithium-ion Battery (P/N: UBBP01)
Frequency: 836.52 MHz; Channel 384; Duty Cycle: 1:1
Medium: M835 (σ = 0.98 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.47, 6.47, 6.47); Calibrated: 20/05/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Body-Worn SAR - Cellular Band - 0.8 cm Holster Thickness between Back Side of DUT & Planar Phantom - Mid Channel
Area Scan (12x21x1): Measurement grid: dx=15mm, dy=15mm

Body-Worn SAR - Cellular Band - 0.8 cm Holster Thickness between Back Side of DUT & Planar Phantom - Mid Channel
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.89 V/m; Power Drift = 0.041 dB
Peak SAR (extrapolated) = 0.607 W/kg
SAR(1 g) = 0.455 mW/g; SAR(10 g) = 0.322 mW/g



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Date Tested: 02/03/2006

Body SAR - PCS Band - Back Side of DUT Touching Planar Phantom - Mid Channel 600

DUT: Commerciant; Model: M-106X; Type: Portable Credit Card Transaction Terminal with Dual-Band CDMA; Serial: None

Body-Worn Accessory: None

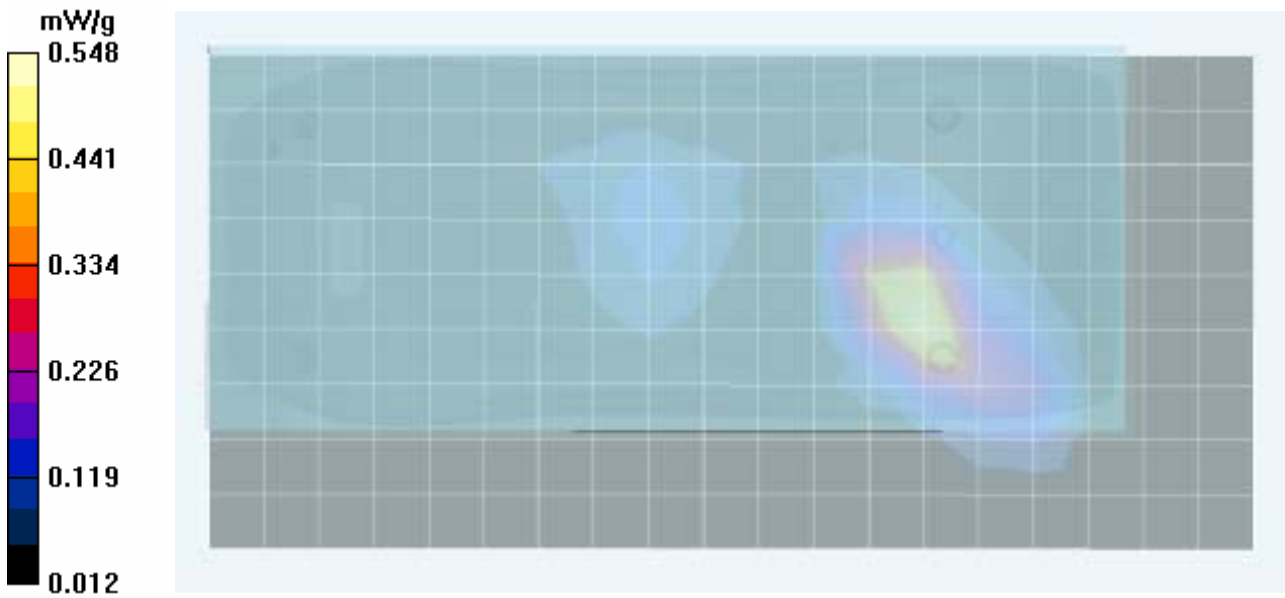
Ambient Temp: 23.3 °C; Fluid Temp: 23.8 °C; Barometric Pressure: 101.2 kPa; Humidity: 30%

Communication System: PCS CDMA
RF Output Power: 24.33 dBm (Conducted)
3.7V, 1800mAh Lithium-ion Battery (P/N: UBBP01)
Frequency: 1880.00 MHz; Channel 600; Duty Cycle: 1:1
Medium: M1880 (σ = 1.54 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(4.85, 4.85, 4.85); Calibrated: 20/05/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Body SAR - PCS Band - Back Side of DUT Touching Planar Phantom - Mid Channel
Area Scan (10x20x1): Measurement grid: dx=15mm, dy=15mm

Body SAR - PCS Band - Back Side of DUT Touching Planar Phantom - Mid Channel
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.98 V/m; Power Drift = -0.0287 dB
Peak SAR (extrapolated) = 0.867 W/kg
SAR(1 g) = 0.485 mW/g; SAR(10 g) = 0.259 mW/g



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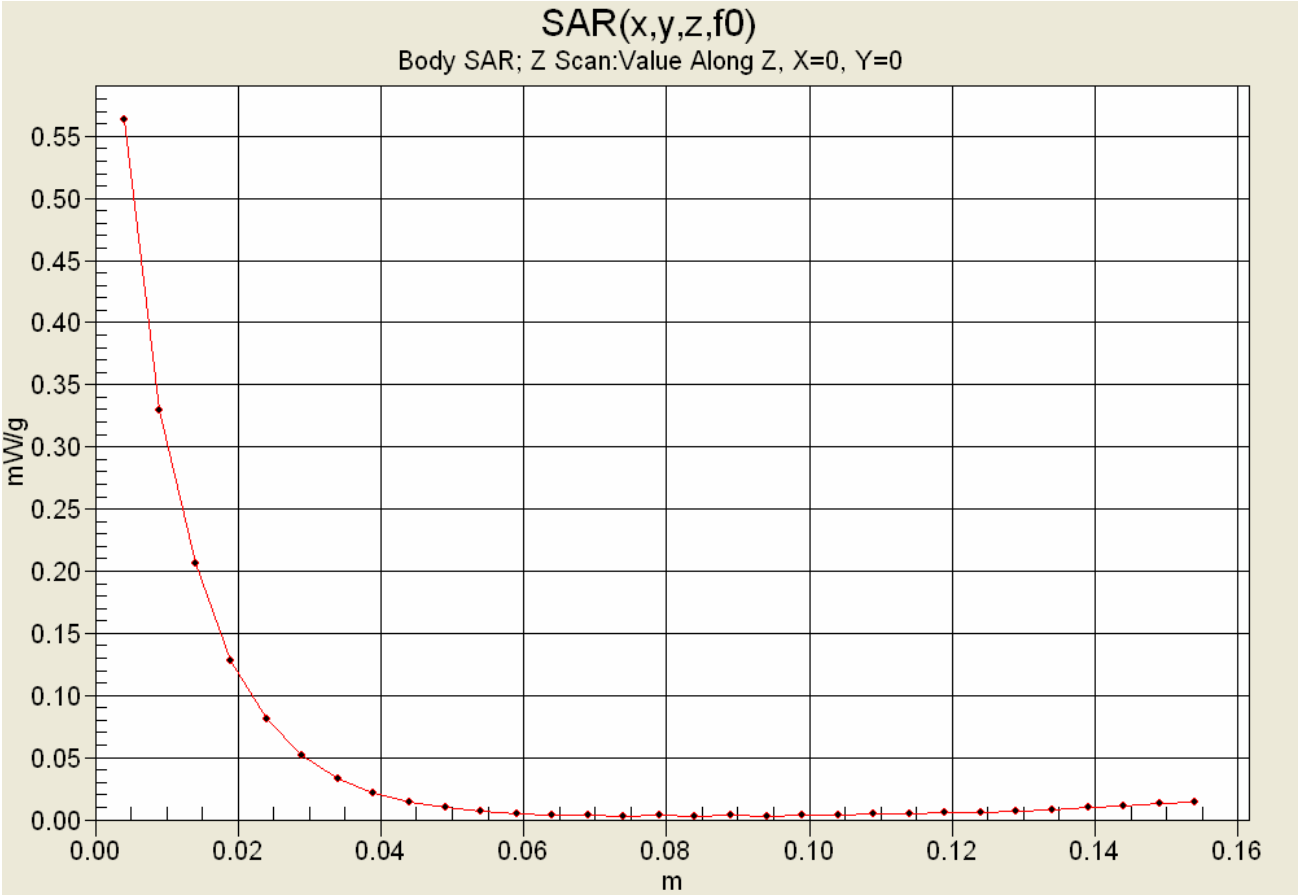
Z-Axis Scan



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Date Tested: 02/03/2006

Body-Worn SAR - PCS Band - Back Side of DUT Facing Planar Phantom - Mid Channel 600

DUT: Commerciant; Model: M-106X; Type: Portable Credit Card Transaction Terminal with Dual-Band CDMA; Serial: None

Body-Worn Accessory: Nylon Holster with Belt-Strap (P/N: AC0002002)

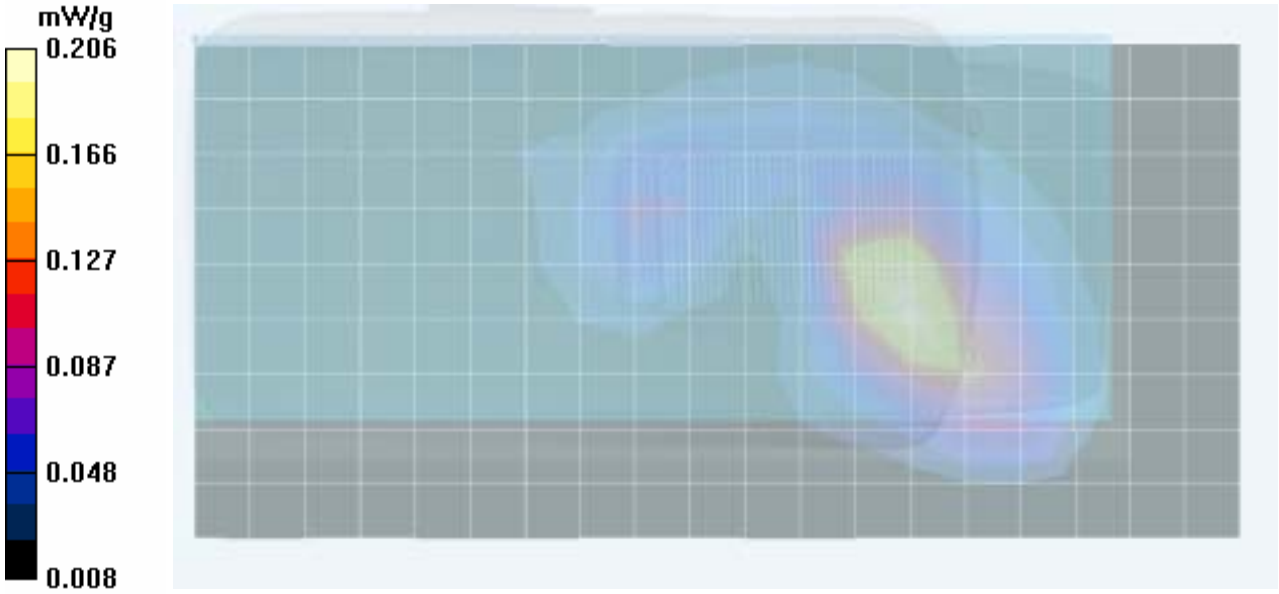
Ambient Temp: 23.3 °C; Fluid Temp: 23.8 °C; Barometric Pressure: 101.2 kPa; Humidity: 30%

Communication System: PCS CDMA
RF Output Power: 24.33 dBm (Conducted)
3.7V, 1800mAh Lithium-ion Battery (P/N: UBBP01)
Frequency: 1880.00 MHz; Channel 600; Duty Cycle: 1:1
Medium: M1880 (σ = 1.54 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(4.85, 4.85, 4.85); Calibrated: 20/05/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Body-Worn SAR - PCS Band - 0.8 cm Holster Thickness between Back Side of DUT & Planar Phantom - Mid Channel
Area Scan (10x20x1): Measurement grid: dx=15mm, dy=15mm

Body-Worn SAR - PCS Band - 0.8 cm Holster Thickness between Back Side of DUT & Planar Phantom - Mid Channel
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.95 V/m; Power Drift = 0.277 dB
Peak SAR (extrapolated) = 0.301 W/kg
SAR(1 g) = 0.186 mW/g; SAR(10 g) = 0.109 mW/g



APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

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Date Tested: 02/02/2006

System Performance Check (Body) - 835 MHz Dipole

DUT: Dipole 835 MHz; Model: D835V2; Type: System Performance Check; Serial: 411; Calibrated: 04/12/2005

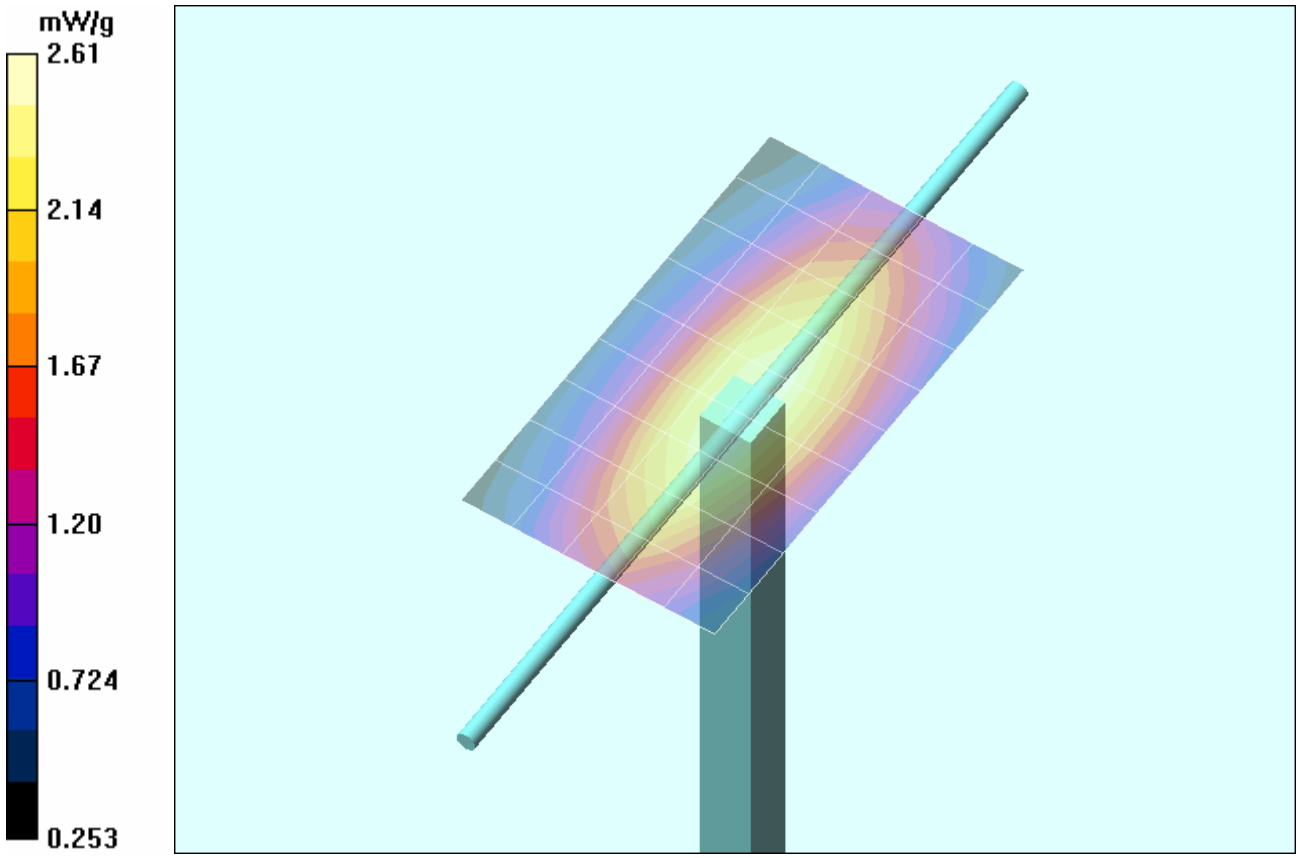
Ambient Temp: 23.0 °C; Fluid Temp: 22.5 °C; Barometric Pressure: 101.1 kPa; Humidity: 30%

Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: M835 (σ = 0.98 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(6.47, 6.47, 6.47); Calibrated: 20/05/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

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 = 52.9 V/m; Power Drift = -0.002 dB
Peak SAR (extrapolated) = 3.53 W/kg
SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.59 mW/g



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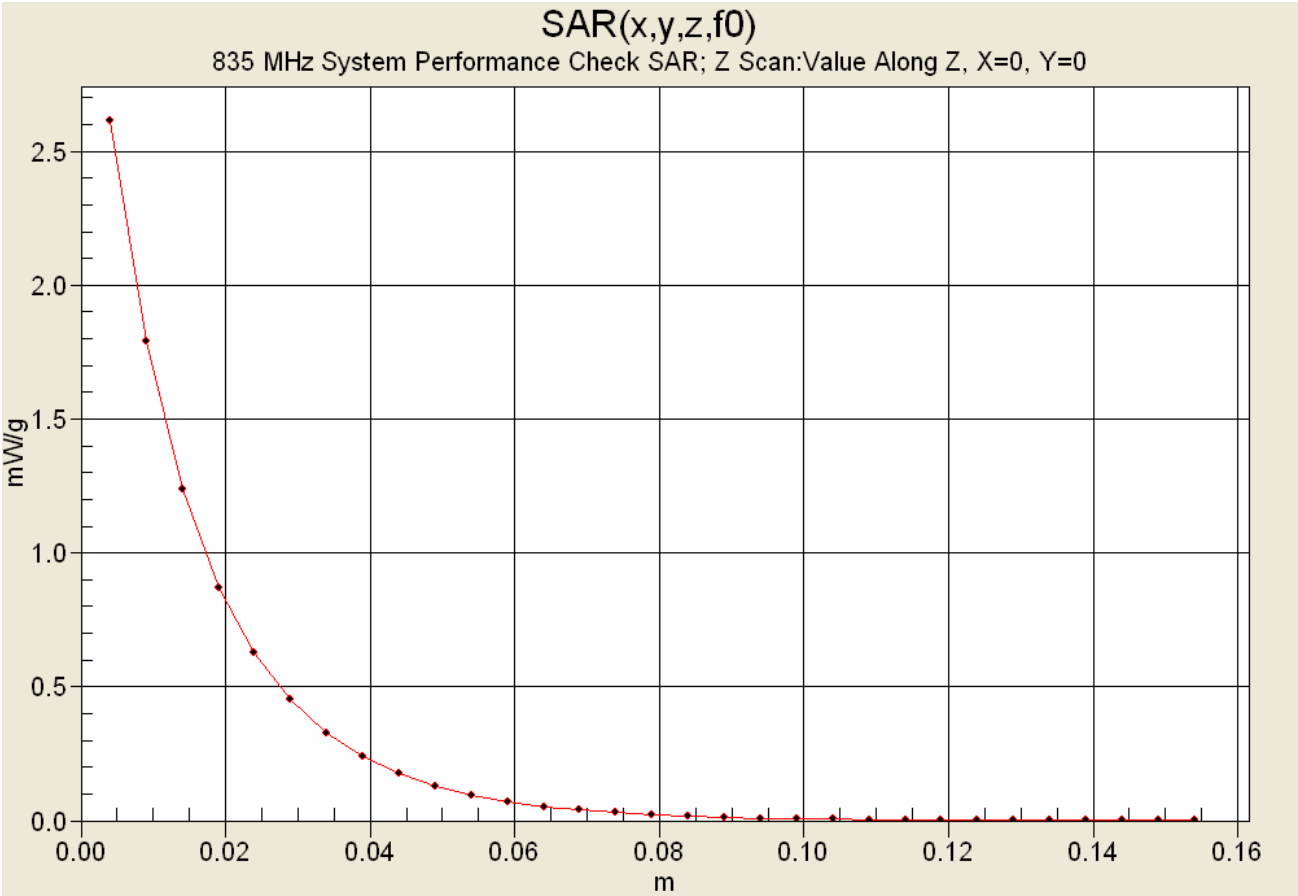
Z-Axis Scan



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Date Tested: 02/03/2006

System Performance Check (Body) - 1900 MHz Dipole

DUT: Dipole 1900 MHz; Model: D1900V2; Type: System Performance Check; Serial: 151; Calibrated: 04/22/2005

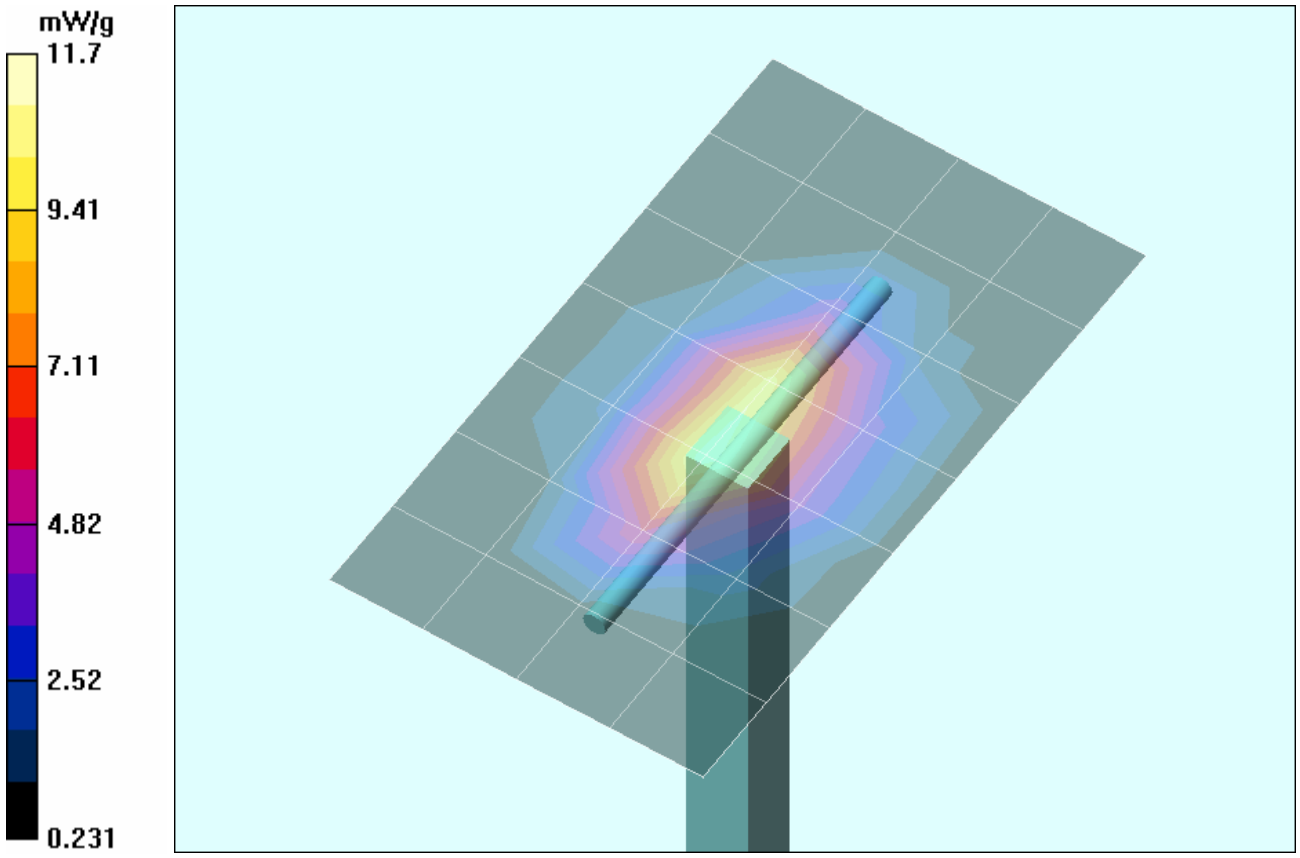
Ambient Temp: 23.3 °C; Fluid Temp: 23.8 °C; Barometric Pressure: 101.2 kPa; Humidity: 30%

Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: M1900 (σ = 1.56 mho/m; ε_r = 51.6; ρ = 1000 kg/m^3)

- Probe: ET3DV6 - SN1590; ConvF(4.85, 4.85, 4.85); Calibrated: 20/05/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

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

1900 MHz Dipole - System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.0 V/m; Power Drift = 0.036 dB
Peak SAR (extrapolated) = 17.8 W/kg
SAR(1 g) = 10.5 mW/g; SAR(10 g) = 5.59 mW/g



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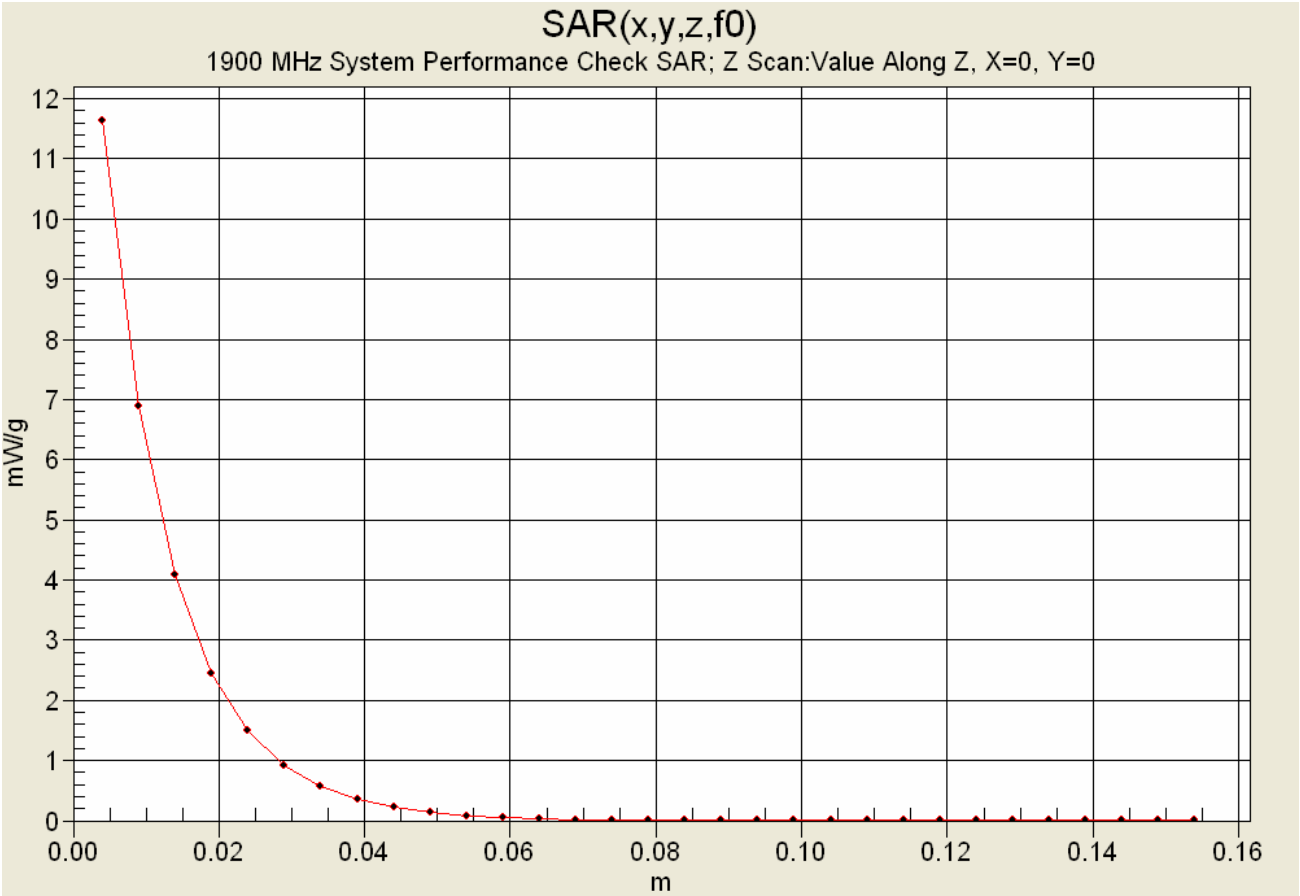
Z-Axis Scan



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APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

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835 MHz System Performance Check & DUT Evaluation (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Thu 02/Feb/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	54.27	0.87
0.7450	55.55	0.96	54.03	0.88
0.7550	55.51	0.96	54.04	0.89
0.7650	55.47	0.96	53.78	0.90
0.7750	55.43	0.97	53.82	0.91
0.7850	55.39	0.97	53.69	0.92
0.7950	55.36	0.97	53.59	0.93
0.8050	55.32	0.97	53.50	0.95
0.8150	55.28	0.97	53.46	0.95
0.8250	55.24	0.97	53.24	0.96
0.8350	55.20	0.97	53.24	0.98
0.8450	55.17	0.98	53.07	0.98
0.8550	55.14	0.99	53.07	0.99
0.8650	55.11	1.01	52.83	1.00
0.8750	55.08	1.02	52.67	1.01
0.8850	55.05	1.03	52.56	1.03
0.8950	55.02	1.04	52.54	1.03
0.9050	55.00	1.05	52.54	1.04
0.9150	55.00	1.06	52.41	1.05
0.9250	54.98	1.06	52.37	1.06
0.9350	54.96	1.07	52.26	1.07

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

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Fri 03/Feb/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	52.20	1.44
1.8100	53.30	1.52	52.06	1.46
1.8200	53.30	1.52	52.01	1.46
1.8300	53.30	1.52	51.93	1.48
1.8400	53.30	1.52	51.95	1.49
1.8500	53.30	1.52	51.93	1.50
1.8600	53.30	1.52	51.87	1.52
1.8700	53.30	1.52	51.75	1.52
1.8800	53.30	1.52	51.70	1.54
1.8900	53.30	1.52	51.63	1.54
1.9000	53.30	1.52	51.60	1.56
1.9100	53.30	1.52	51.57	1.58
1.9200	53.30	1.52	51.49	1.58
1.9300	53.30	1.52	51.45	1.60
1.9400	53.30	1.52	51.37	1.61
1.9500	53.30	1.52	51.37	1.62
1.9600	53.30	1.52	51.15	1.63
1.9700	53.30	1.52	51.12	1.65
1.9800	53.30	1.52	51.12	1.66
1.9900	53.30	1.52	50.99	1.68
2.0000	53.30	1.52	51.04	1.68

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APPENDIX D - SAR TEST SETUP PHOTOGRAPHS

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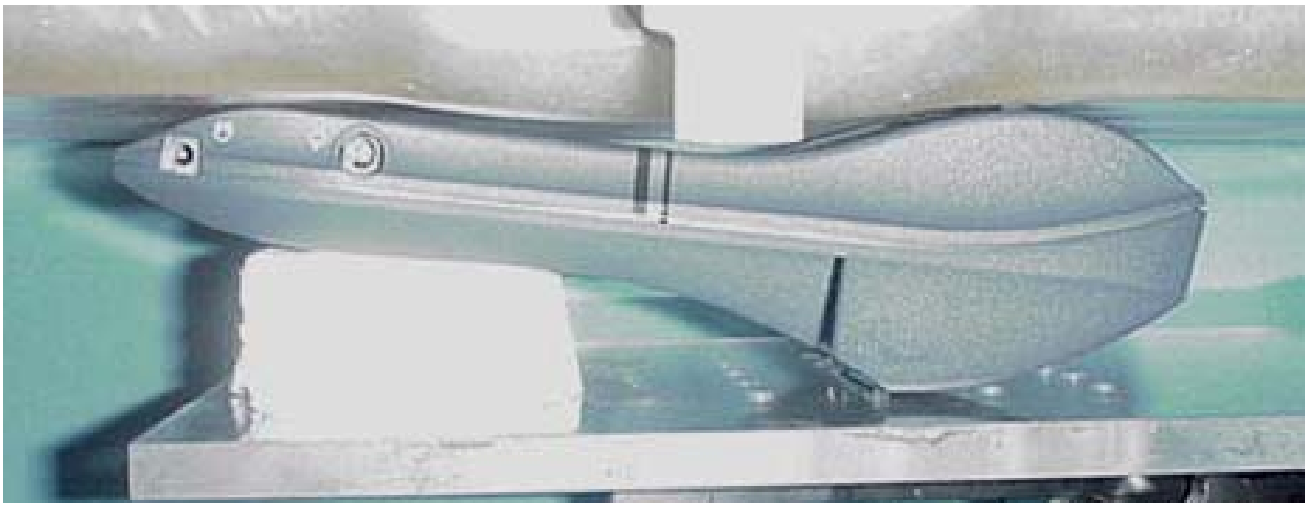
BODY SAR TEST SETUP PHOTOGRAPHS

Back Side of DUT Touching Planar Phantom



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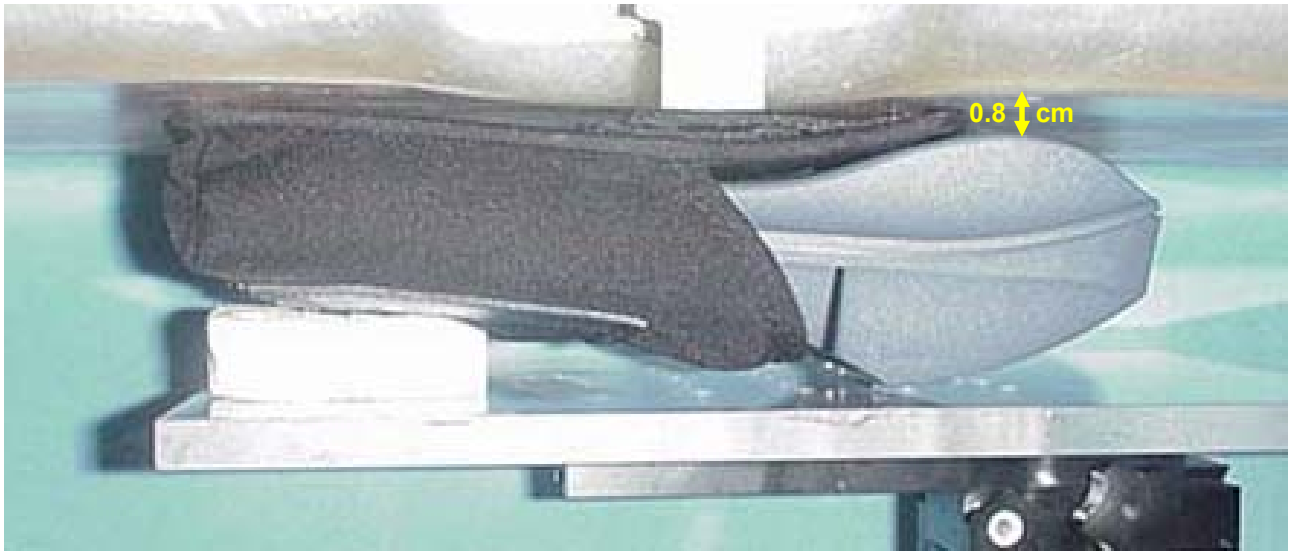
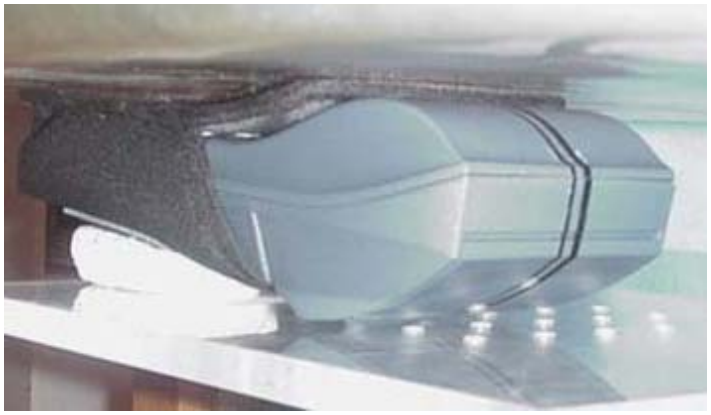
BODY SAR TEST SETUP PHOTOGRAPHS

DUT with Nylon Holster and Belt-Strap Accessory (P/N: AC0002002)
0.8 cm Nylon Holster Thickness between Back of DUT and Planar Phantom





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APPENDIX E - SYSTEM VALIDATION

2006 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

835 MHz SYSTEM VALIDATION DIPOLE

Type:	**835 MHz Validation Dipole**
Serial Number:	**411**
Place of Calibration:	**Celltech Labs Inc.**
Date of Calibration:	**April 12, 2005**

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

Calibrated by:

Approved by:

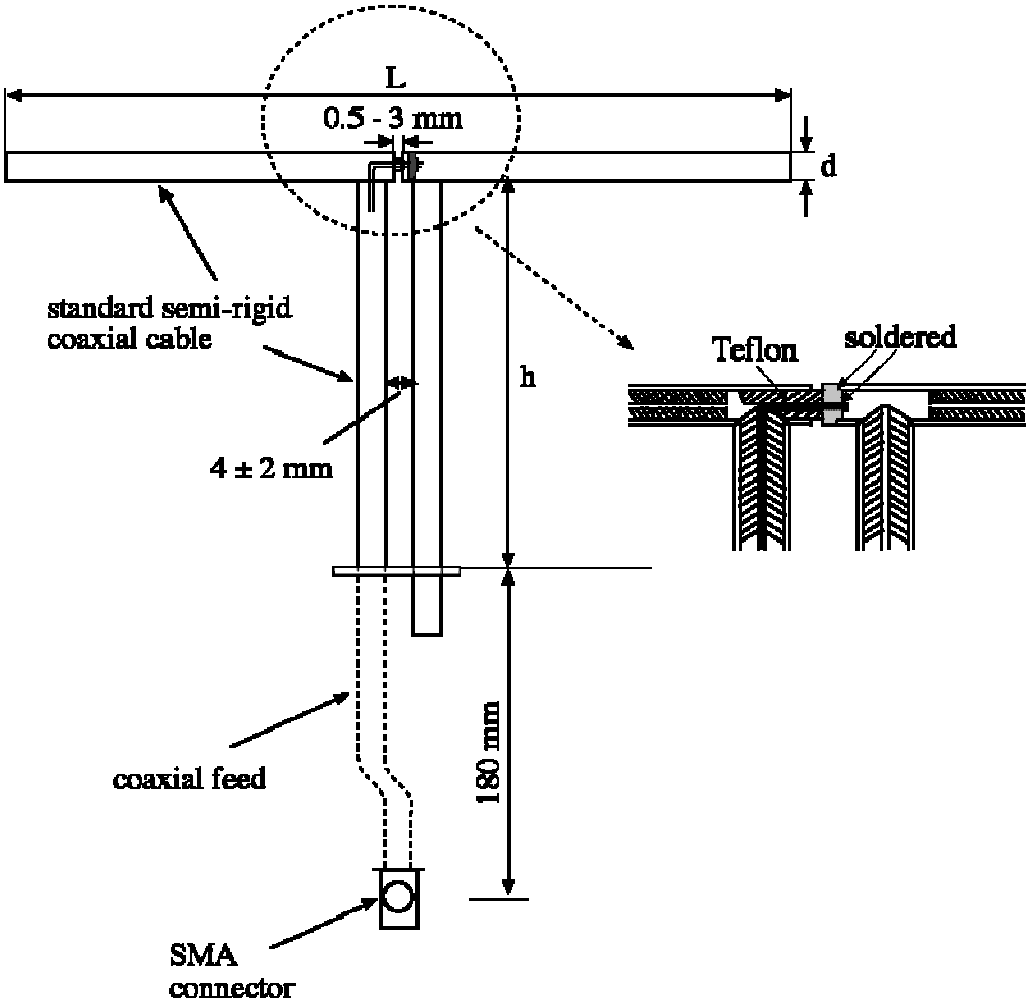
Celltech Labs Inc. 1955 Moss Court, Kelowna, B.C. Canada V1Y 9L3
Tel. 250-448-7047 • Fax. 250-448-7046 • e-mail: info@celltechlabs.com
www.celltechlabs.com

2005 Celltech Labs Inc.

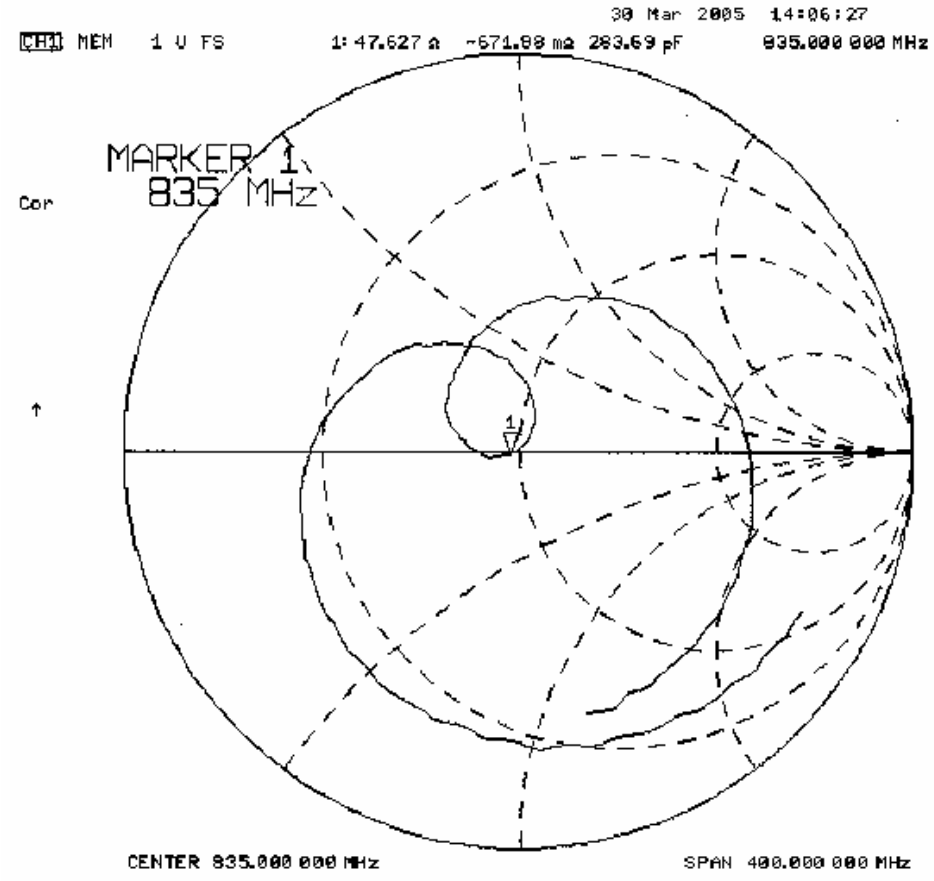
1. Validation Dipole Construction & Electrical Characteristics

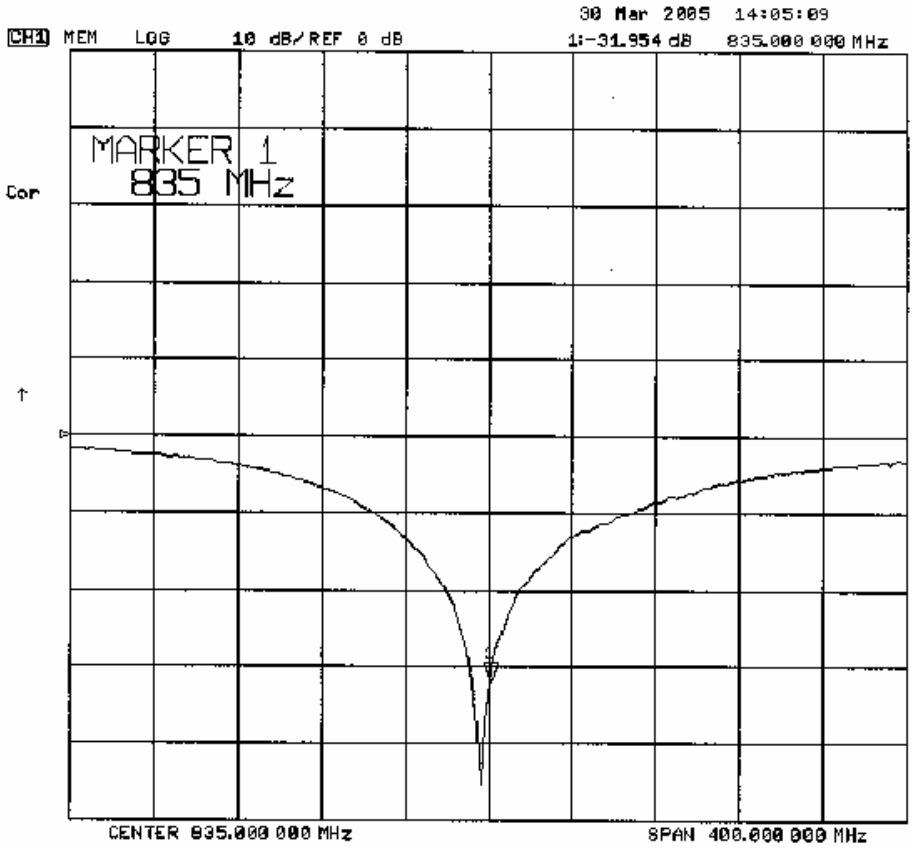
The validation dipole was constructed in accordance with the IEEE Standard "Annex G (informative) Reference dipoles for use in system validation". The electrical properties were measured using an HP 8753ET Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector 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 simulated body tissue mixture having the following parameters:

Relative Permittivity:	53.0
Conductivity:	0.98 mho/m
Fluid Temperature:	21.2 °C
Fluid Depth:	≥ 15.0 cm

Environmental Conditions:

Ambient Temperature:	22.6 °C
Barometric Pressure:	103.4 kPa
Humidity:	36 %

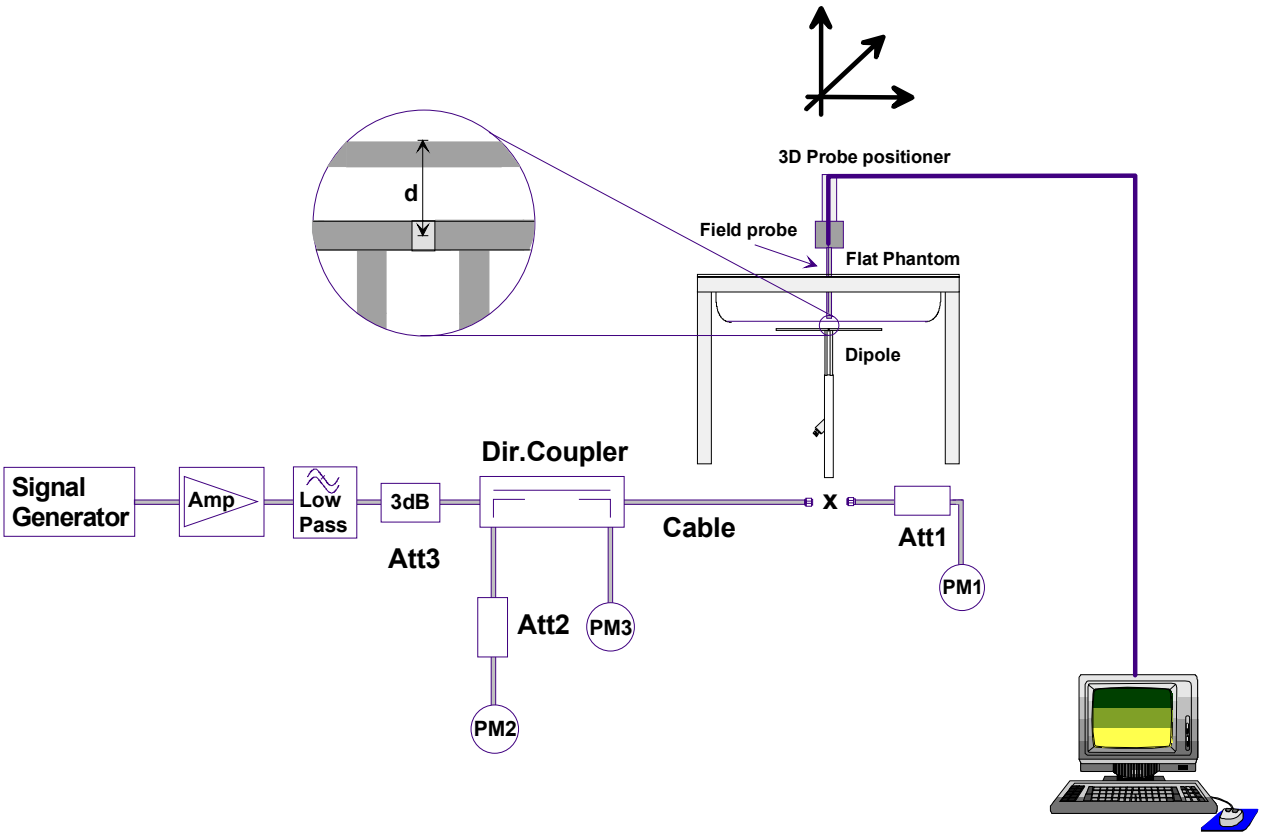
Measurements were made at the planar section of the SAM phantom using a dosimetric E-field probe ET3DV5 (S/N: 1590, conversion factor 6.71).

The 835 MHz simulated body tissue mixture 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 σ = 0.97 S/m

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 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.

Validation Measurement	SAR @ 0.25W Input averaged over 1g	SAR @ 1W Input averaged over 1g	SAR @ 0.25W Input averaged over 10g	SAR @ 1W Input averaged over 10g	Peak SAR @ 0.25W Input
Test 1	2.61	10.44	1.72	6.88	3.79
Test 2	2.61	10.44	1.72	6.88	3.83
Test 3	2.60	10.40	1.71	6.84	3.79
Test 4	2.60	10.40	1.71	6.84	3.80
Test 5	2.59	10.36	1.71	6.84	3.77
Test 6	2.60	10.40	1.71	6.84	3.77
Test 7	2.60	10.40	1.71	6.84	3.78
Test 8	2.60	10.40	1.71	6.84	3.81
Test 9	2.59	10.36	1.71	6.84	3.76
Test10	2.61	10.44	1.72	6.88	3.80
Average SAR	2.60	10.40	1.71	6.85	3.79

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 (%)
9.71	+/- 10%	10.4	+ 7.2	6.38	+/- 10%	6.85	+ 7.4

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 System Validation (Body) - April 12, 2005

DUT: Dipole 835 MHz; Type: D835V2; Serial: 411
Ambient Temp: 22.6°C; Fluid Temp: 21.2°C; Barometric Pressure: 103.4 kPa; Humidity: 36%
Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: MSL835 Medium parameters used: f = 835 MHz; σ = 0.98 mho/m; ε_r = 53; ρ = 1000 kg/m^3
- Probe: ET3DV6 - SN1590; ConvF(6.54, 6.54, 6.54); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 06/07/2004
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

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

835 MHz System Performance Check/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.2 V/m; Power Drift = 0.020 dB
Peak SAR (extrapolated) = 3.79 W/kg
SAR(1 g) = 2.61 mW/g; SAR(10 g) = 1.72 mW/g

835 MHz System Performance Check/Zoom Scan 2 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.7 V/m; Power Drift = -0.054 dB
Peak SAR (extrapolated) = 3.83 W/kg
SAR(1 g) = 2.61 mW/g; SAR(10 g) = 1.72 mW/g

835 MHz System Performance Check/Zoom Scan 3 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.4 V/m; Power Drift = -0.025 dB
Peak SAR (extrapolated) = 3.79 W/kg
SAR(1 g) = 2.60 mW/g; SAR(10 g) = 1.71 mW/g

835 MHz System Performance Check/Zoom Scan 4 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.3 V/m; Power Drift = -0.010 dB
Peak SAR (extrapolated) = 3.80 W/kg
SAR(1 g) = 2.60 mW/g; SAR(10 g) = 1.71 mW/g

835 MHz System Performance Check/Zoom Scan 5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.2 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.77 W/kg
SAR(1 g) = 2.59 mW/g; SAR(10 g) = 1.71 mW/g

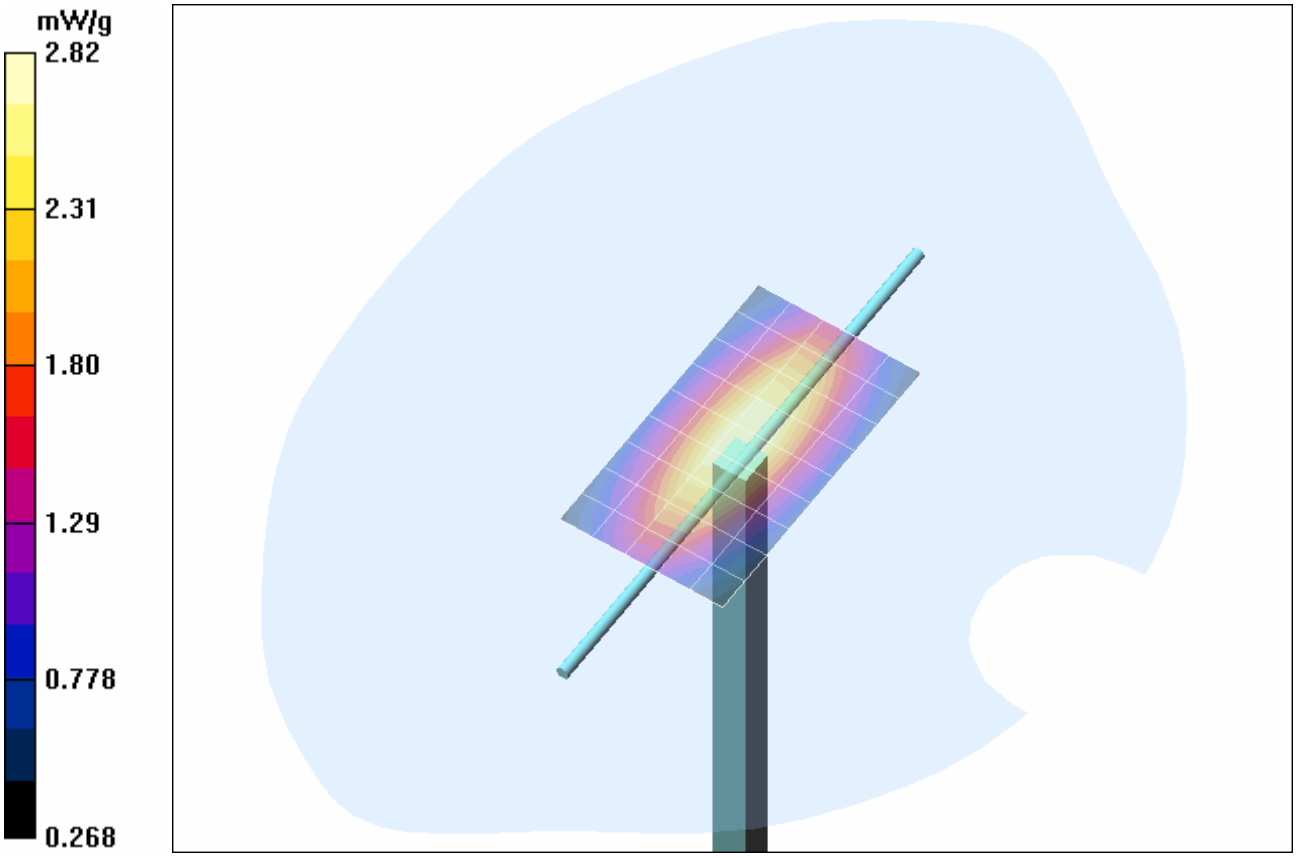
835 MHz System Performance Check/Zoom Scan 6 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.2 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.77 W/kg
SAR(1 g) = 2.60 mW/g; SAR(10 g) = 1.71 mW/g

835 MHz System Performance Check/Zoom Scan 7 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.4 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.78 W/kg
SAR(1 g) = 2.60 mW/g; SAR(10 g) = 1.71 mW/g

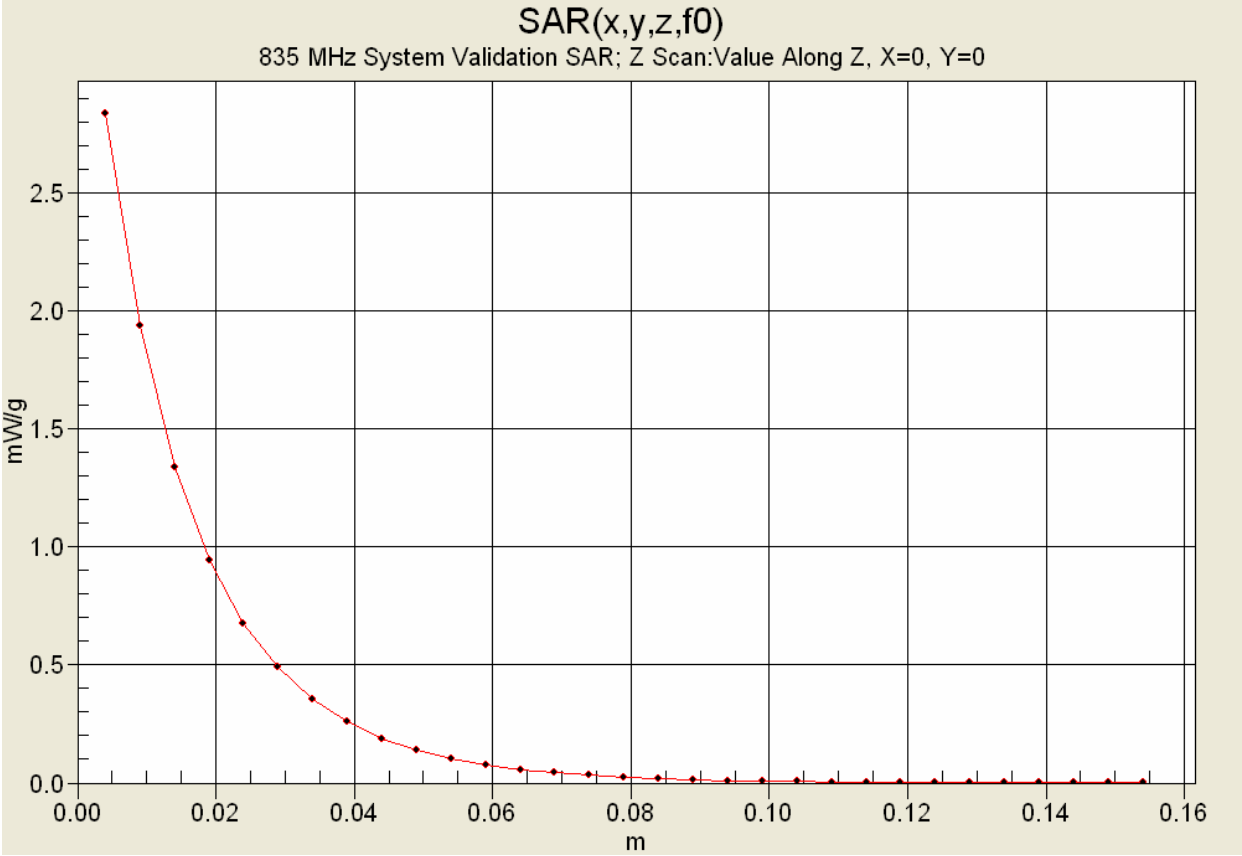
835 MHz System Performance Check/Zoom Scan 8 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.1 V/m; Power Drift = 0.013 dB
Peak SAR (extrapolated) = 3.81 W/kg
SAR(1 g) = 2.60 mW/g; SAR(10 g) = 1.71 mW/g

835 MHz System Performance Check/Zoom Scan 9 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.5 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.76 W/kg
SAR(1 g) = 2.59 mW/g; SAR(10 g) = 1.71 mW/g

835 MHz System Performance Check/Zoom Scan 10 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.2 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.80 W/kg
SAR(1 g) = 2.61 mW/g; SAR(10 g) = 1.72 mW/g



1 g average of 10 measurements: 2.60 mW/g
10 g average of 10 measurements: 1.71 mW/g



10. Measured Fluid Dielectric Parameters

835 MHz System Validation (Body)

Measured Fluid Dielectric Parameters (Muscle)

April 12, 2005

Frequency	e'	e"
735.000000 MHz	54.0378	21.6286
745.000000 MHz	53.8896	21.5691
755.000000 MHz	53.8006	21.4920
765.000000 MHz	53.6592	21.4574
775.000000 MHz	53.5651	21.4082
785.000000 MHz	53.4598	21.3813
795.000000 MHz	53.3996	21.3224
805.000000 MHz	53.2805	21.2791
815.000000 MHz	53.2061	21.2382
825.000000 MHz	53.1022	21.1974
835.000000 MHz	52.9838	21.1959
845.000000 MHz	52.8546	21.1661
855.000000 MHz	52.7335	21.1454
865.000000 MHz	52.5991	21.1198
875.000000 MHz	52.4868	21.0980
885.000000 MHz	52.4035	21.0714
895.000000 MHz	52.3499	21.0447
905.000000 MHz	52.2262	21.0295
915.000000 MHz	52.1465	20.9572
925.000000 MHz	52.0498	20.9643
935.000000 MHz	51.9344	20.8879

1900 MHz SYSTEM VALIDATION DIPOLE

Type:	**1900 MHz Validation Dipole**
Serial Number:	**151**
Place of Calibration:	**Celltech Labs Inc.**
Date of Calibration:	**April 22, 2005**

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

Calibrated by:

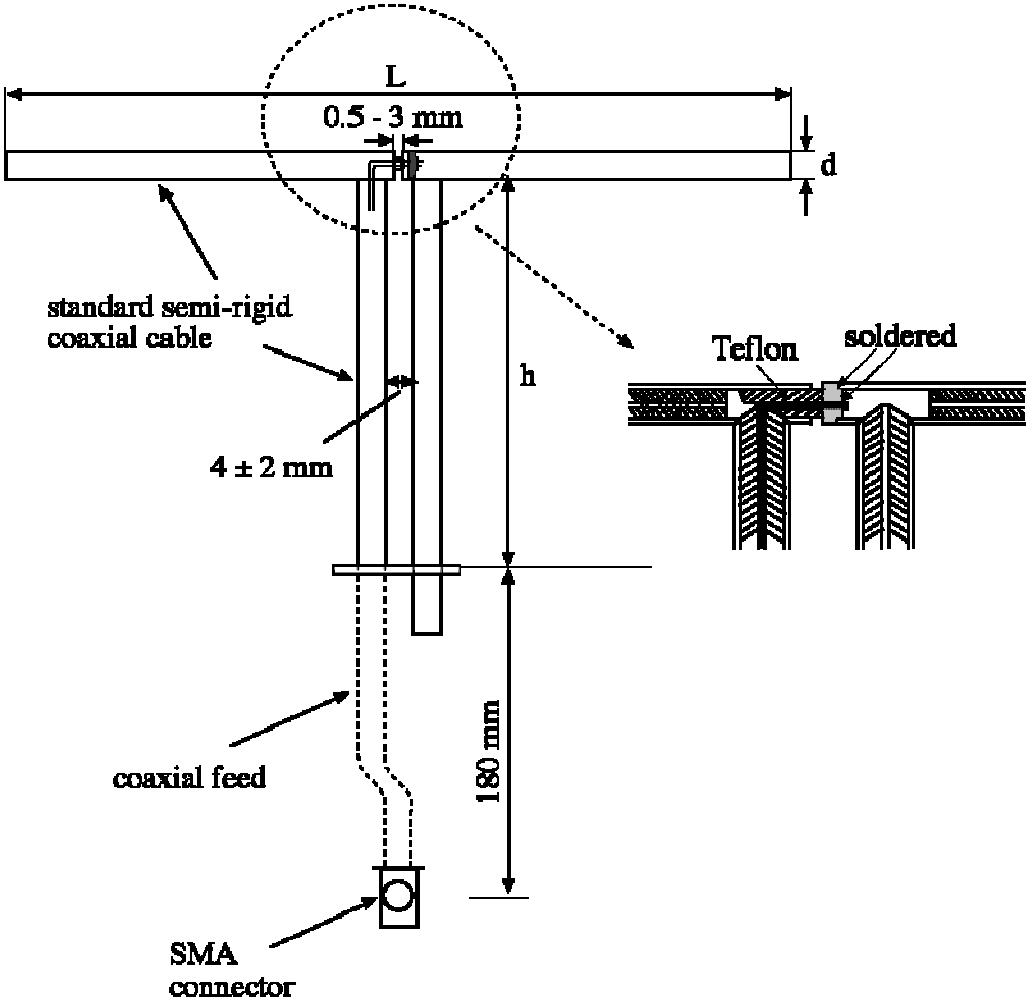
Approved by:

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

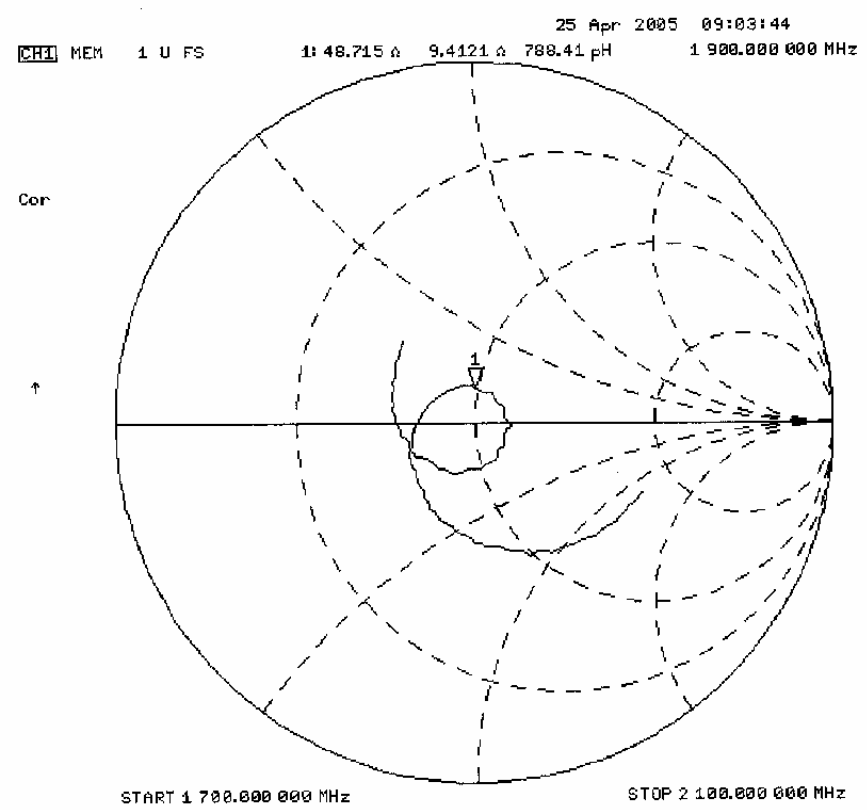
1. Dipole Construction & Electrical Characteristics

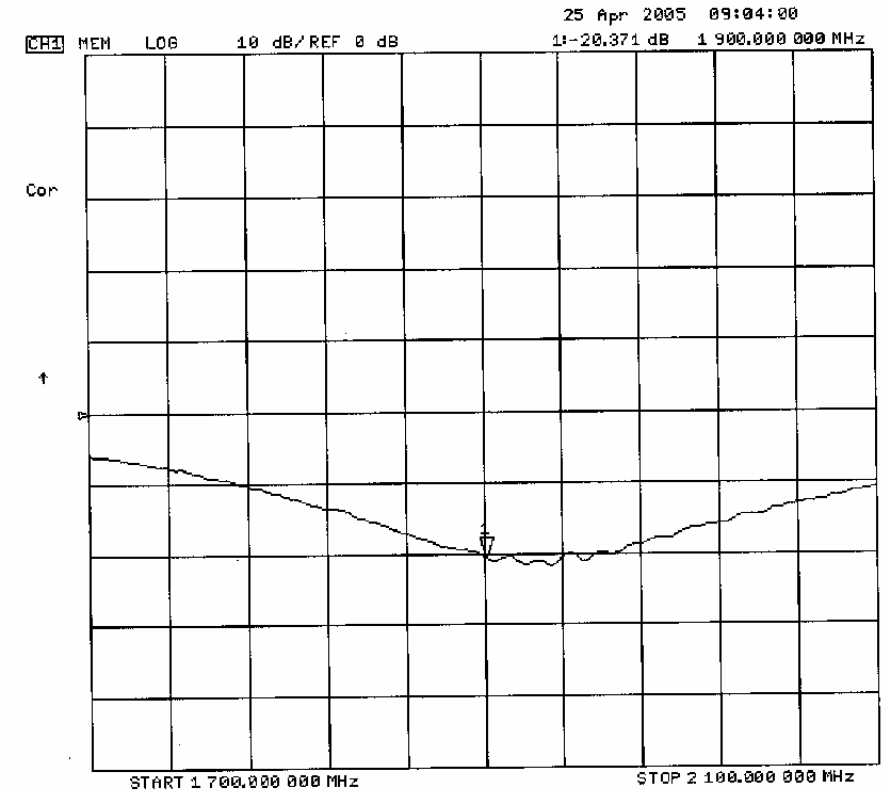
The validation dipole was constructed in accordance with the IEEE Standard "Annex G (informative) Reference dipoles for use in system validation". The electrical properties were measured using an HP 8753E Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector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

Feed point impedance at 1900MHz	Re{Z} = 48.715Ω
	Im{Z} = 9.412Ω
Return Loss at 1900MHz	-20.371dB



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 a Fiberglass shell planar phantom manufactured by Barski Industries Ltd. The phantom is in conformance with the requirements defined by IEEE SCC34-SC2 for the dosimetric evaluations of body-worn and lap-held operating configurations. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids.

Shell Thickness: 2.0 ± 0.1 mm
Filling Volume: Approx. 55 liters
Dimensions: 44 cm (W) x 94 cm (L)

5. 1900 MHz System Validation Setup

6. 1900 MHz System Validation Setup

7. Measurement Conditions

The phantom was filled with 1900 MHz Body simulating tissue.

Relative Permittivity:	50.7
Conductivity:	1.59 mho/m
Fluid Temperature:	23.8 °C
Fluid Depth:	≥ 15.0 cm

Environmental Conditions:

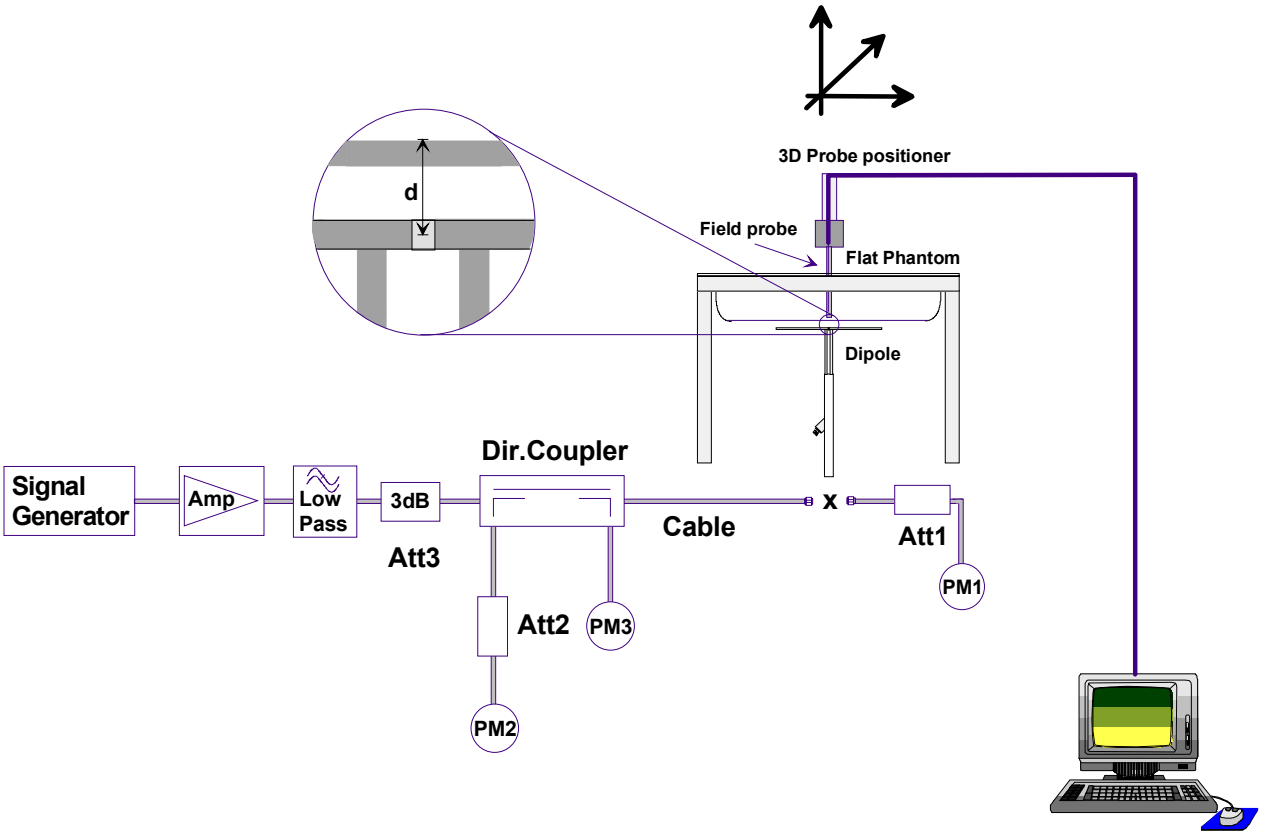
Ambient Temperature:	25.6 °C
Barometric Pressure:	102.1 kPa
Humidity:	30%

The 1900 MHz simulated Body tissue mixture consists of the following ingredients:

Ingredient	Percentage by weight
Water	69.85%
Glycol	29.89%
Salt	0.26%
Target Dielectric Parameters at 22 °C	ε_r = 53.3 σ = 1.52 S/m

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	10.7	42.80	5.71	22.84	17.7
Test 2	10.7	42.80	5.72	22.88	17.6
Test 3	10.7	42.80	5.73	22.92	17.6
Test 4	10.7	42.80	5.73	22.92	17.6
Test 5	10.7	42.80	5.72	22.88	17.6
Test 6	10.7	42.80	5.70	22.80	17.5
Test 7	10.7	42.80	5.70	22.80	17.5
Test 8	10.6	42.40	5.69	22.76	17.4
Test 9	10.6	42.40	5.69	22.76	17.4
Test 10	10.6	42.40	5.69	22.76	17.5
Average	10.67	42.68	5.71	22.83	17.54

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%	42.68	+7.24	20.8	+/- 10%	22.83	+9.76

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.

1900 MHz System Validation (Body) - April 22, 2005

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 151; Calibrated: 04/22/2005
Ambient Temp: 25.6 ºC; Fluid Temp: 23.8 ºC; Barometric Pressure: 102.1 kPa; Humidity: 30%
Communication System: CW
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: M1900 Medium parameters used: f = 1900 MHz; σ = 1.59 mho/m; ε_r = 50.7; ρ = 1000 kg/m^3
- Probe: ET3DV6 - SN1590; ConvF(4.58, 4.58, 4.58); Calibrated: 24/05/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn353; Calibrated: 06/07/2004
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

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 = 93.9 V/m; Power Drift = -0.079 dB
Peak SAR (extrapolated) = 17.7 W/kg
SAR(1 g) = 10.7 mW/g; SAR(10 g) = 5.71 mW/g

1900 MHz System Validation/Zoom Scan 2 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.7 V/m; Power Drift = -0.026 dB
Peak SAR (extrapolated) = 17.6 W/kg
SAR(1 g) = 10.7 mW/g; SAR(10 g) = 5.72 mW/g

1900 MHz System Validation/Zoom Scan 3 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.3 V/m; Power Drift = -0.026 dB
Peak SAR (extrapolated) = 17.6 W/kg
SAR(1 g) = 10.7 mW/g; SAR(10 g) = 5.73 mW/g

1900 MHz System Validation/Zoom Scan 4 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.2 V/m; Power Drift = -0.025 dB
Peak SAR (extrapolated) = 17.6 W/kg
SAR(1 g) = 10.7 mW/g; SAR(10 g) = 5.73 mW/g

1900 MHz System Validation/Zoom Scan 5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.2 V/m; Power Drift = -0.027 dB
Peak SAR (extrapolated) = 17.6 W/kg
SAR(1 g) = 10.7 mW/g; SAR(10 g) = 5.72 mW/g

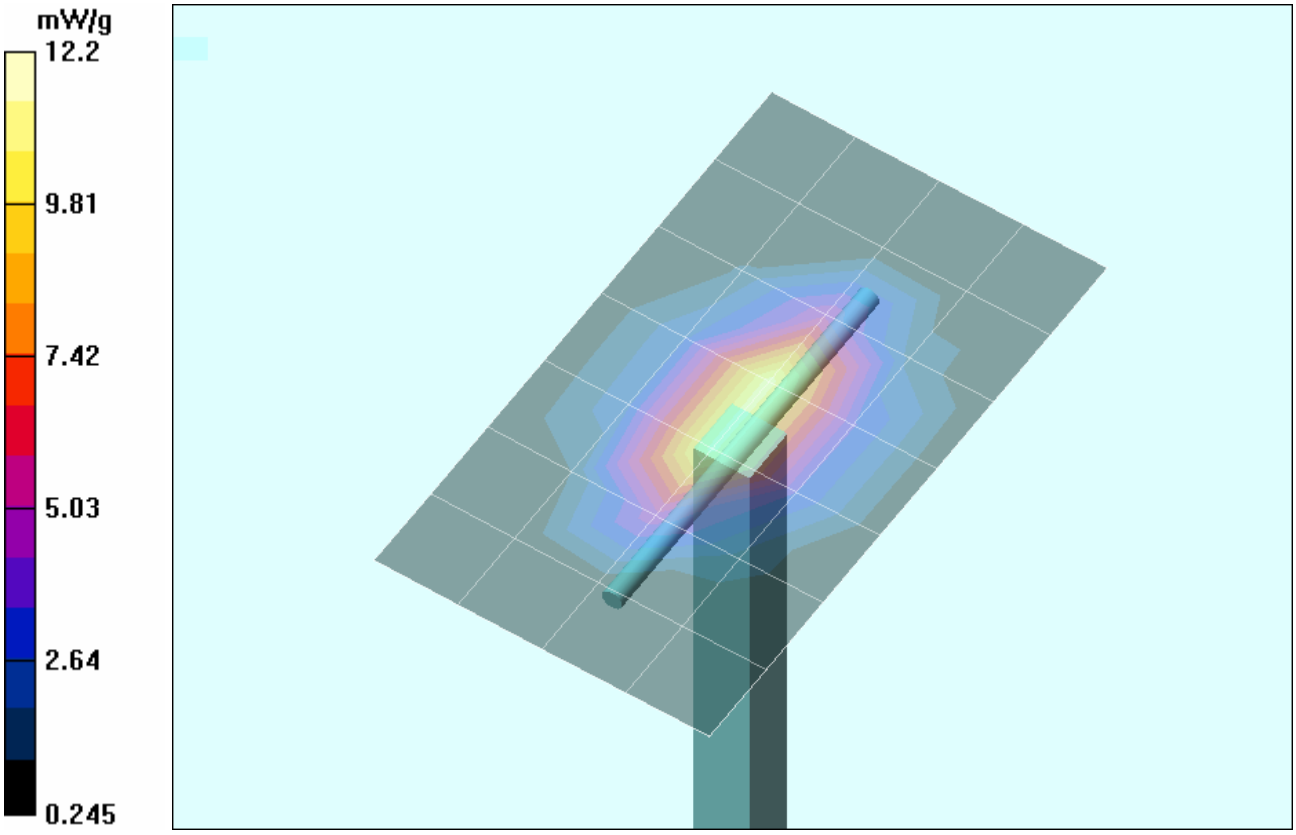
1900 MHz System Validation/Zoom Scan 6 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.8 V/m; Power Drift = -0.056 dB
Peak SAR (extrapolated) = 17.5 W/kg
SAR(1 g) = 10.7 mW/g; SAR(10 g) = 5.70 mW/g

1900 MHz System Validation/Zoom Scan 7 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.8 V/m; Power Drift = -0.043 dB
Peak SAR (extrapolated) = 17.5 W/kg
SAR(1 g) = 10.7 mW/g; SAR(10 g) = 5.70 mW/g

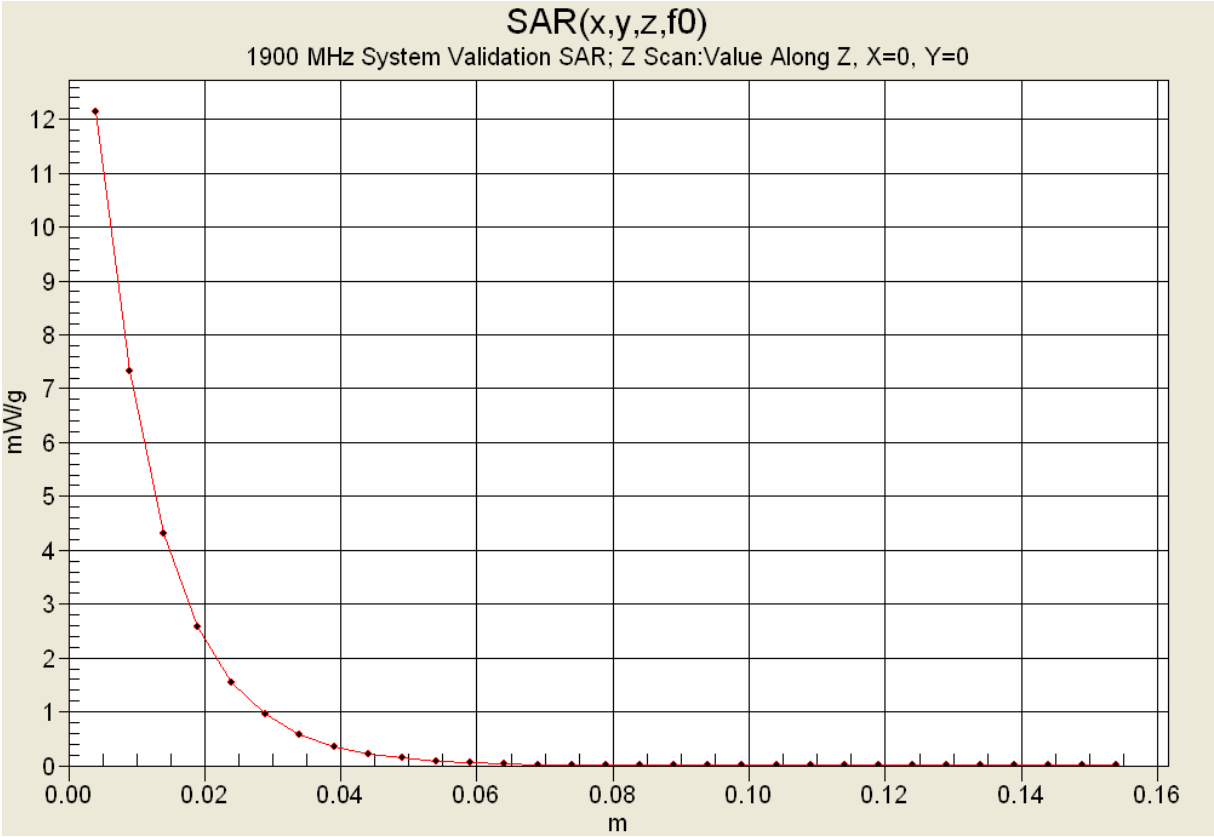
1900 MHz System Validation/Zoom Scan 8 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.6 V/m; Power Drift = -0.050 dB
Peak SAR (extrapolated) = 17.4 W/kg
SAR(1 g) = 10.6 mW/g; SAR(10 g) = 5.69 mW/g

1900 MHz System Validation/Zoom Scan 9 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.7 V/m; Power Drift = -0.033 dB
Peak SAR (extrapolated) = 17.4 W/kg
SAR(1 g) = 10.6 mW/g; SAR(10 g) = 5.69 mW/g

1900 MHz System Validation/Zoom Scan 10 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.5 V/m; Power Drift = -0.045 dB
Peak SAR (extrapolated) = 17.5 W/kg
SAR(1 g) = 10.6 mW/g; SAR(10 g) = 5.69 mW/g



1 g average of 10 measurements: 10.67 mW/g
10 g average of 10 measurements: 5.71 mW/g



10. Measured Fluid Dielectric Parameters

System Validation - 1900 MHz Dipole

Measured Fluid Dielectric Parameters (Muscle)

April 22, 2005

Frequency	e'	e"
1.800000000 GHz	51.0964	14.7202
1.810000000 GHz	51.0396	14.7503
1.820000000 GHz	51.0220	14.7911
1.830000000 GHz	50.9811	14.8228
1.840000000 GHz	50.9466	14.8388
1.850000000 GHz	50.9152	14.8773
1.860000000 GHz	50.8658	14.8924
1.870000000 GHz	50.8337	14.9214
1.880000000 GHz	50.7654	14.9640
1.890000000 GHz	50.7233	15.0059
1.900000000 GHz	50.6734	15.0407
1.910000000 GHz	50.6457	15.0744
1.920000000 GHz	50.6058	15.1083
1.930000000 GHz	50.5785	15.1423
1.940000000 GHz	50.5378	15.1671
1.950000000 GHz	50.4983	15.1913
1.960000000 GHz	50.4575	15.2240
1.970000000 GHz	50.4075	15.2443
1.980000000 GHz	50.3458	15.2616
1.990000000 GHz	50.3079	15.3071
2.000000000 GHz	50.2546	15.3145

APPENDIX F - PROBE CALIBRATION

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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

Certificate No: ET3-1590_May05

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1590
Calibration procedure(s)	QA CAL-01.v5 Calibration procedure for dosimetric E-field probes
Calibration date:	May 20, 2005
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)	10-Aug-04 (METAS, No. 251-00403)	Aug-05
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-05 (METAS, No. 251-00467)	May-06
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-04 (METAS, No. 251-00404)	Aug-05
Reference Probe ES3DV2	SN: 3013	7-Jan-05 (SPEAG, No. ES3-3013_Jan05)	Jan-06
DAE4	SN: 617	19-Jan-05 (SPEAG, No. DAE4-617_Jan05)	Jan-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov 05

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Laboratory Technician	N. Vetterli
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 21, 2005

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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:1590

Manufactured:	March 19, 2001
Last calibrated:	May 24, 2004
Recalibrated:	May 20, 2005

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1590

Sensitivity in Free Space[A]

NormX	**1.82** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**87** mV
NormY	**1.97** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**87** mV
NormZ	**1.70** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**87** mV

Diode Compression[B]

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	7.6	3.9
SAR_{be} [%]	With Correction Algorithm	0.1	0.2

TSL **1810 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	11.8	8.3
SAR_{be} [%]	With Correction Algorithm	0.6	0.1

Sensor Offset

Probe Tip to Sensor Center **2.7** mm

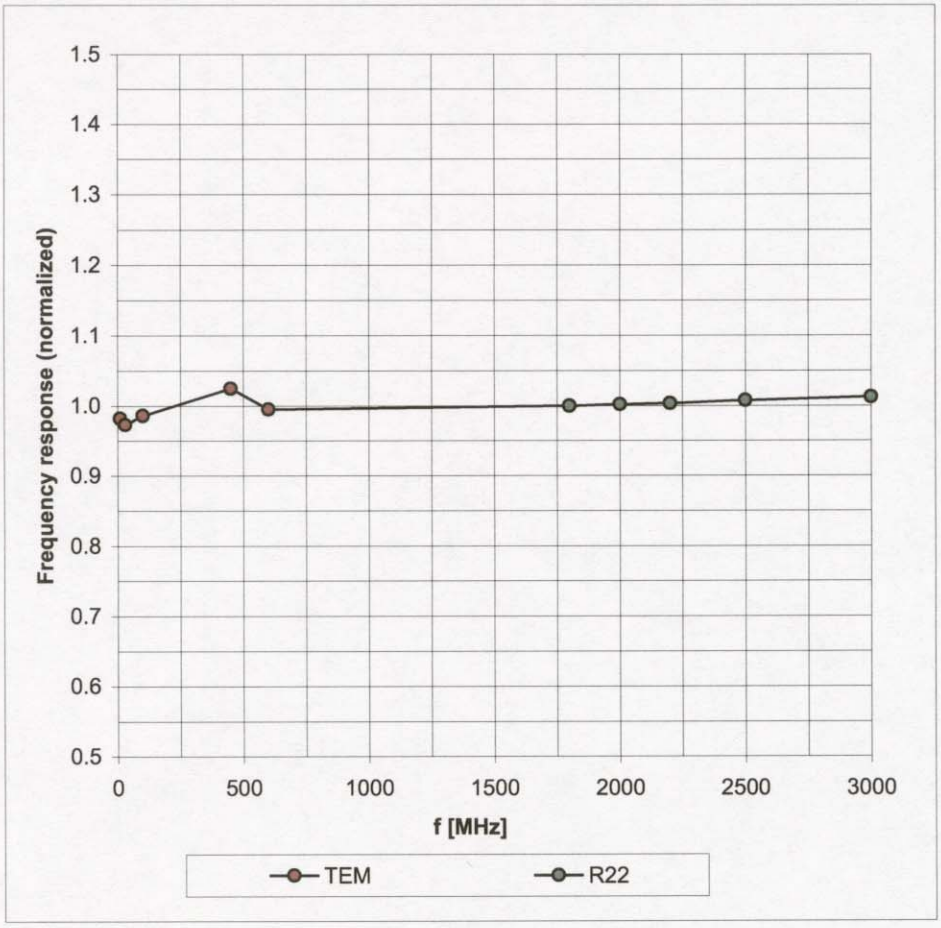
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[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.

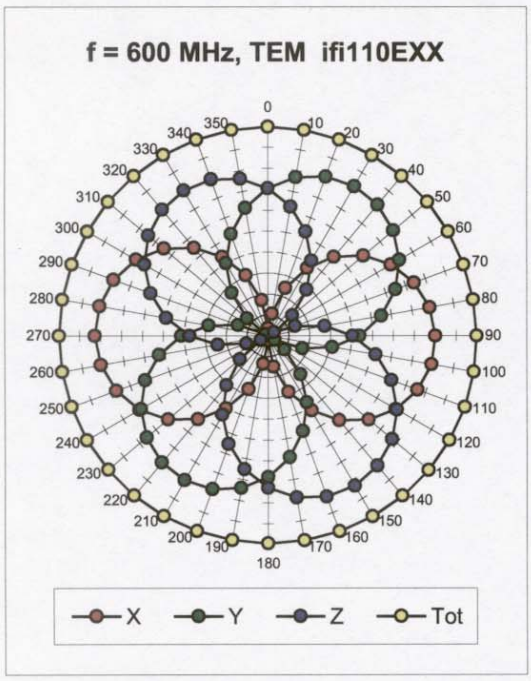
Frequency Response of E-Field

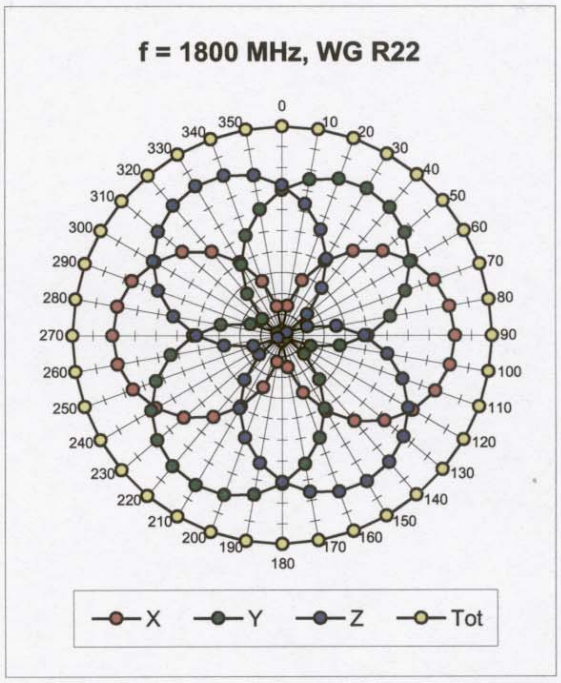
(TEM-Cell:ifi110 EXX, Waveguide: R22)

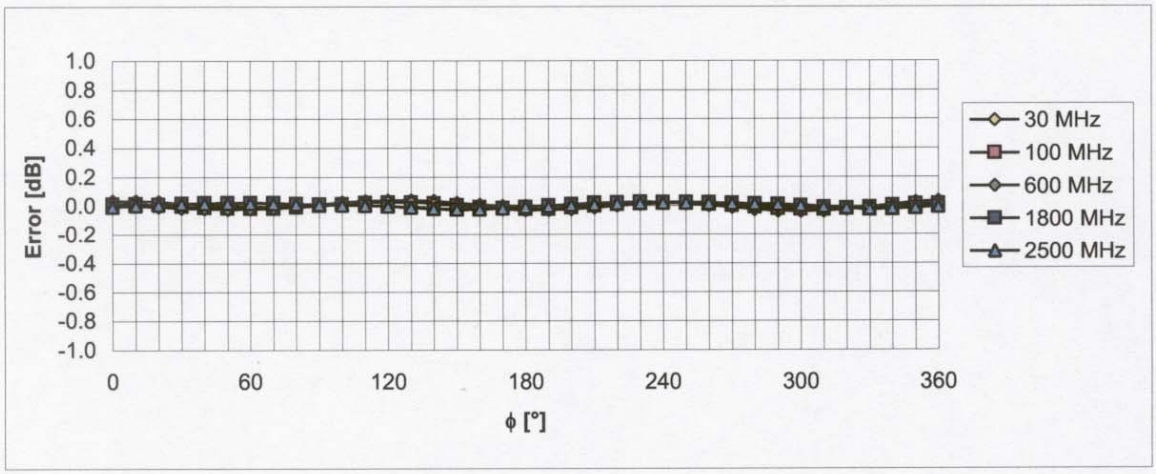


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



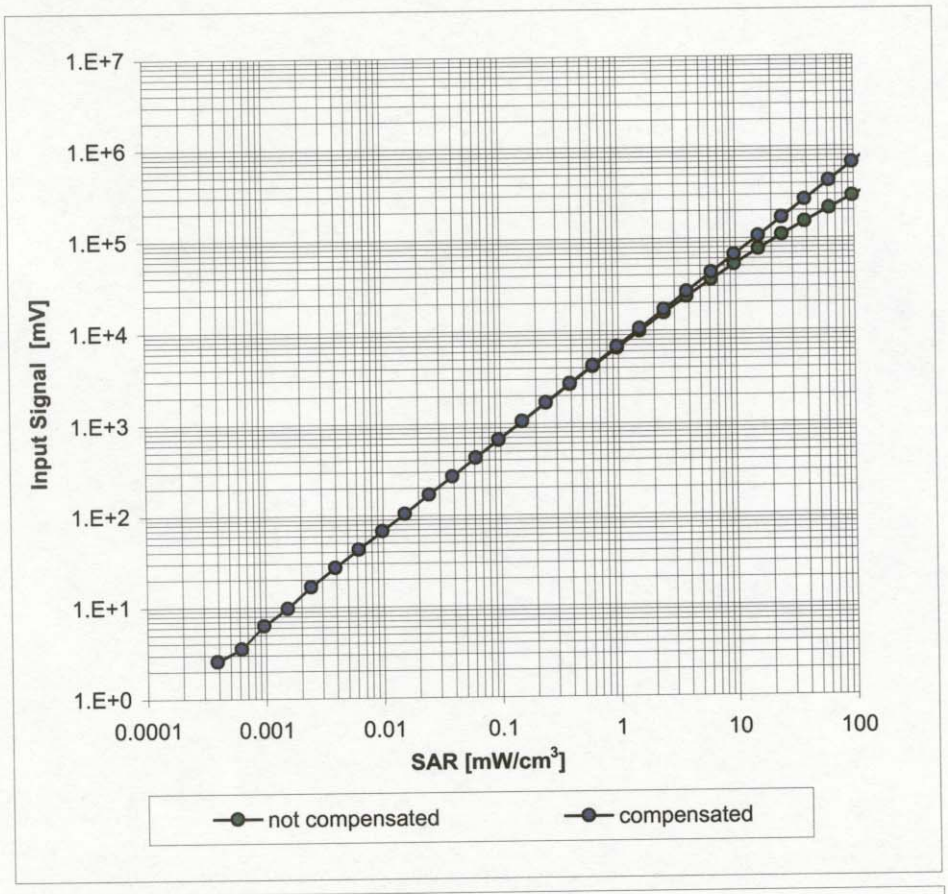


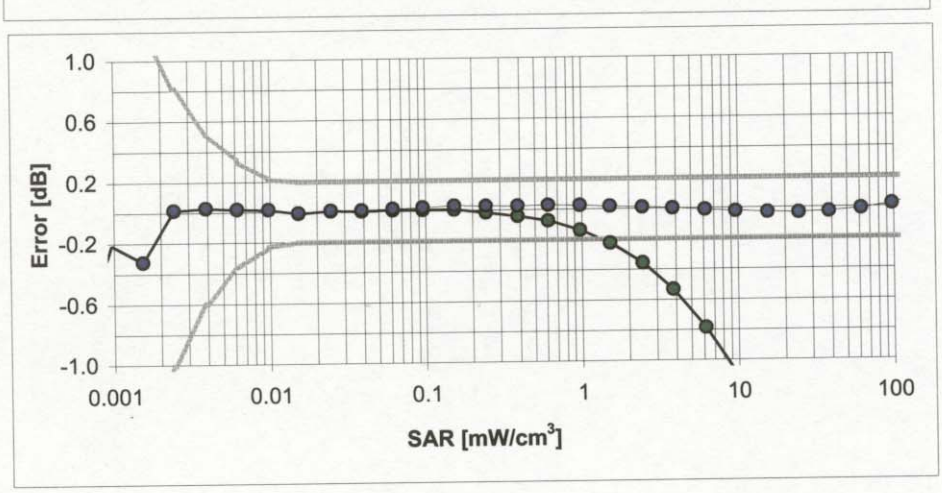


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

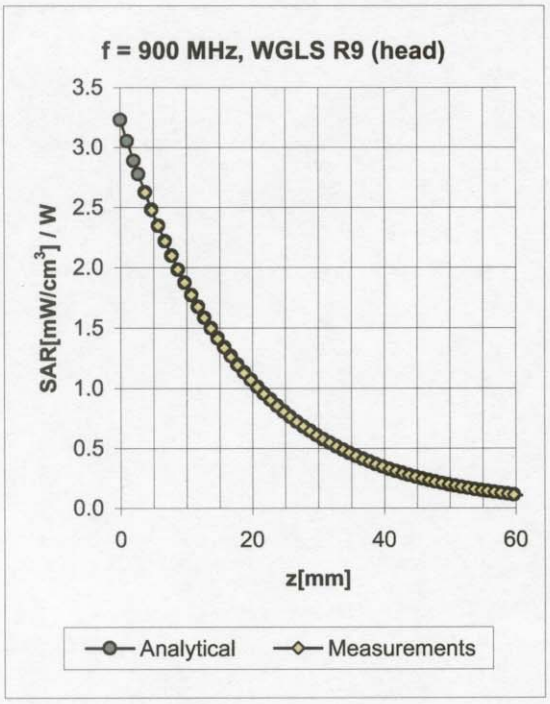
(Waveguide R22, f = 1800 MHz)

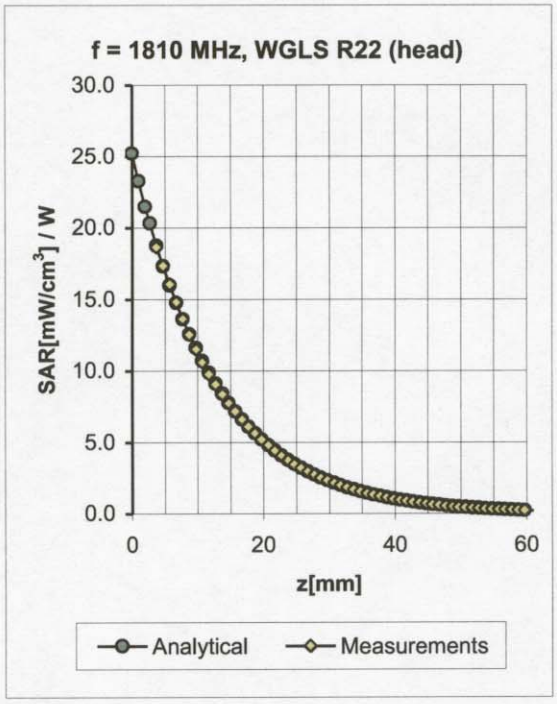




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



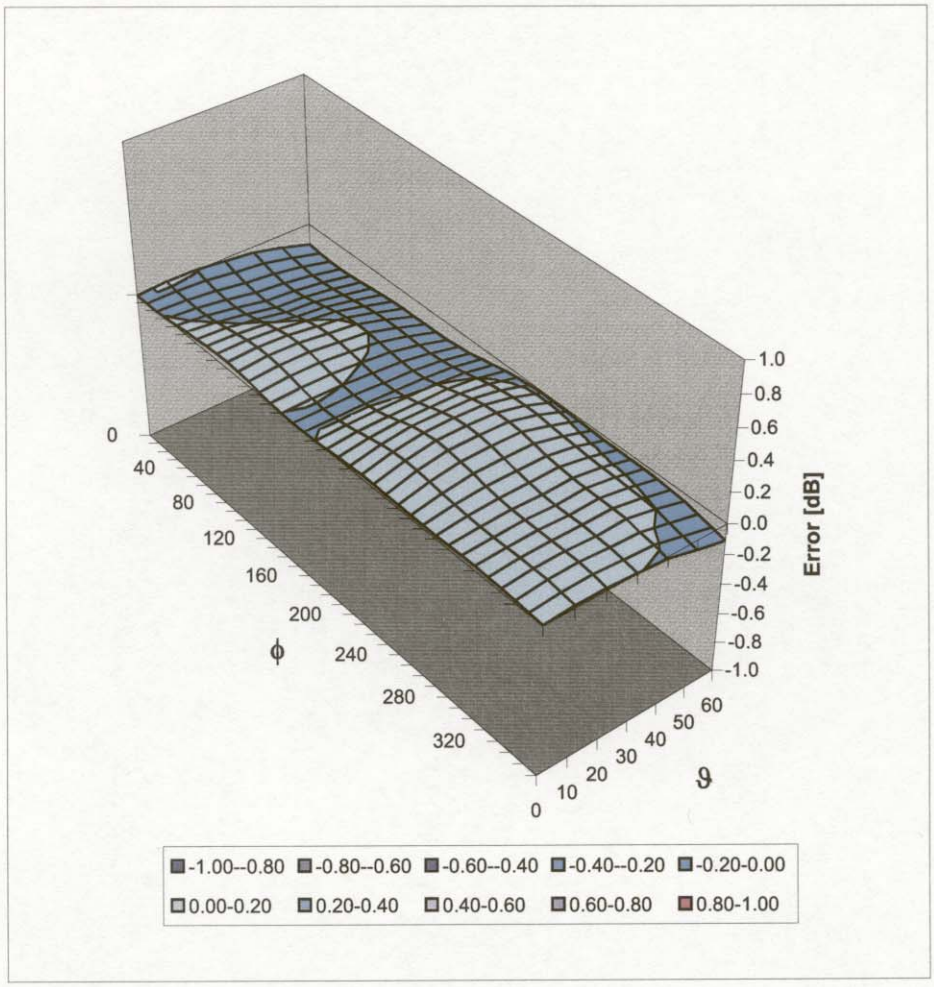


f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.54	1.81	6.67	± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.46	2.62	5.44	± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.50	2.53	4.56	± 11.8% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.46	2.09	6.47	± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.44	3.00	4.85	± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.50	2.42	4.22	± 11.8% (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)

Schmid & Partner Engineering AG

s p e a g

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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:	**1590**
Place of Assessment:	**Zurich**
Date of Assessment:	**May 23, 2005**
Probe Calibration Date:	**May 20, 2005**

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

Assessed by:

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

Dosimetric E-Field Probe ET3DV6 SN:1590

Conversion factor (± standard deviation)

f = 150 MHz	ConvF	**9.1 ± 10%**	**ε_r = 52.3 ± 5%** **σ = 0.76 ± 5% mho/m** (head tissue)
f = 300 MHz	ConvF	**8.1 ± 9%**	**ε_r = 45.3 ± 5%** **σ = 0.87 ± 5% mho/m** (head tissue)
f = 450 MHz	ConvF	**7.8 ± 8%**	**ε_r = 43.5 ± 5%** **σ = 0.87 ± 5% mho/m** (head tissue)
f = 150 MHz	ConvF	**8.6 ± 10%**	**ε_r = 61.9 ± 5%** **σ = 0.80 ± 5% mho/m** (body tissue)
f = 450 MHz	ConvF	**7.7 ± 8%**	**ε_r = 56.7 ± 5%** **σ = 0.94 ± 5% mho/m** (body tissue)

Important Note:

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

Please see also Section 4.7 of the DASY4 Manual.

APPENDIX G - PLANAR PHANTOM CERTIFICATE OF CONFORMITY

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2378 Westlake Road
Kelowna, B.C. Canada
V1Z-2V2

BARSKI INDUSTRIES (1985) LTD.

Ph. # 250-769-6848
Fax # 250-769-6334
E-mail: barskiind@shaw.ca
Web: www.bcfiberglass.com

FIBERGLASS FABRICATORS

Certificate of Conformity

Item : Flat Planar Phantom Unit # 03-01
Date: June 16, 2003
Manufacturer: Barski Industries (1985 Ltd)

Test	Requirement	Details
Shape	Compliance to geometry according to drawing	Supplied CAD drawing
Material Thickness	Compliant with the requirements	2mm +/- 0.2mm in measurement area
Material Parameters	Dielectric parameters for required frequencies Based on Dow Chemical technical data	100 MHz-5 GHz Relative permittivity<5 Loss Tangent<0.05

Conformity

Based on the above information, we certify this product to be compliant to the requirements specified.

Signature: _____

Daniel Chailler

Fiberglass Planar Phantom - Top View

Fiberglass Planar Phantom - Front View

Fiberglass Planar Phantom - Back View

Fiberglass Planar Phantom - Bottom View

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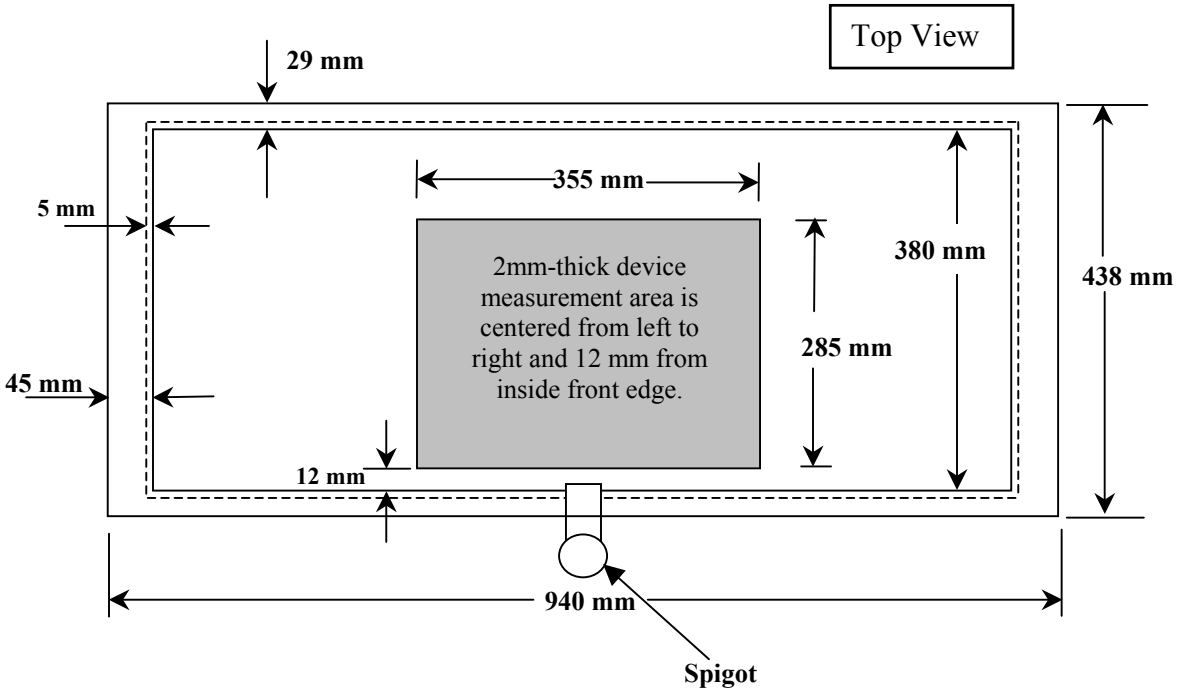
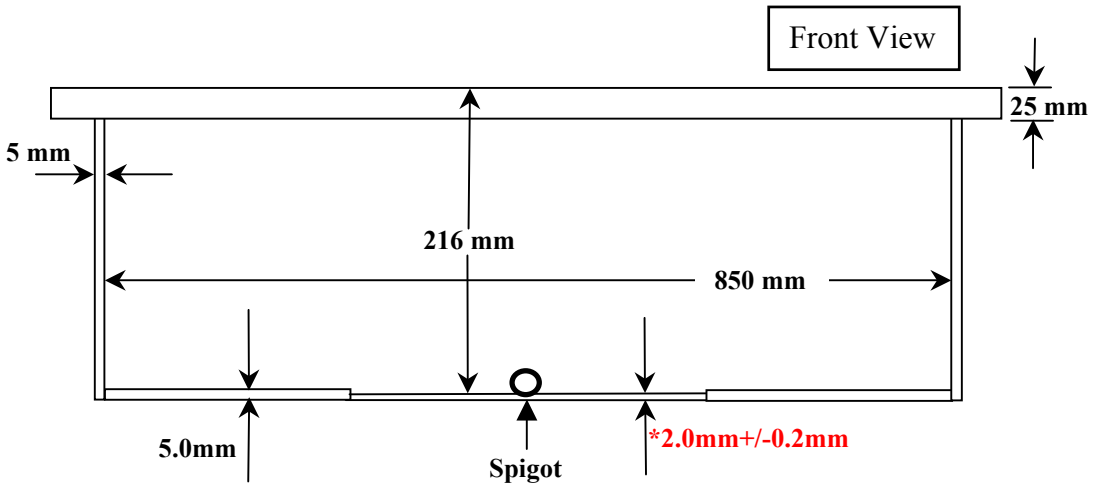
Dimensions of Fiberglass Planar Phantom

(Manufactured by Barski Industries Ltd. - Unit# 03-01)





Note: Measurements that aren't repeated for the opposite sides are the same as the side measured. This drawing is not to scale.

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