DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

Test Lab

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Applicant Information

ITRONIX CORPORATION
801 South Stevens Street
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Rule Part(s):	**FCC 47 CFR §2.1093; IC RSS-102 Issue 1 (Provisional)**
Test Procedure(s):	**FCC OET Bulletin 65, Supplement C (Edition 01-01)**
FCC Device Classification:	**PCS Licensed Transmitter (PCB)**
IC Device Classification:	**2GHz Personal Communication Services**
FCC ID:	**KBCIX260A750MPIBT**
Model(s):	**IX260**
Device Type:	**Rugged Laptop PC with Sierra Wireless AirCard 750 PCS GSM/GPRS Modem (Co-located with Cisco Systems MPI-350 Mini-PCI DSSS WLAN & Mitsumi WML-C11 Bluetooth Transmitter)**
Modulation:	**GMSK**
Tx Frequency Range(s):	**1850.2 - 1909.8 MHz (GSM/GPRS) 2412 - 2462 MHz (WLAN) 2402 - 2480 MHz (Bluetooth)**
RF Output Power Tested:	**27.9 dBm Peak Conducted (1850.2 MHz) (March 24, 2003) 27.9 dBm Peak Conducted (1880.0 MHz) (March 24, 2003) 27.8 dBm Peak Conducted (1909.8 MHz) (March 24, 2003) 28.1 dBm Peak Conducted (1850.2 MHz) (August 05, 2003) 28.1 dBm Peak Conducted (1880.0 MHz) (August 05, 2003) 28.0 dBm Peak Conducted (1909.8 MHz) (August 05, 2003)**
Antenna Type(s):	**External Dipole (GSM/GPRS) Internal - upper right edge of LCD display (WLAN) Internal - upper left edge of LCD display (Bluetooth)**
Battery Type:	**11.1V Lithium-Ion, 6.0Ah (Model: A2121-2)**
Max. SAR Measured:	**1.04 W/kg (1g average)**

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

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

Russell Pipe
Senior Compliance Technologist
Celltech Labs Inc.

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1.0 INTRODUCTION

This measurement report demonstrates that the ITRONIX CORPORATION Model: IX260 FCC ID: KBCIX260A750MPIBT Rugged Laptop PC with Sierra Wireless AirCard 750 PCS GSM/GPRS PCMCIA Modem Card co-located with Cisco Systems MPI-350 Mini-PCI DSSS WLAN Card & Mitsumi WML-C11 Bluetooth Transmitter complies with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]) and Health Canada Safety Code 6 (see reference [2]) for the General Population environment. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]) and IC RSS-102 Issue 1 (Provisional) (see reference [4]) were employed. A description of the product, operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 DESCRIPTION OF DEVICE UNDER TEST (DUT)

FCC Rule Part(s)	47 CFR §2.1093
IC Rule Part(s)	IC RSS-102 Issue 1 (Provisional)
Test Procedure(s)	FCC OET Bulletin 65, Supplement C (01-01)
FCC Device Classification	PCS Licensed Transmitter (PCB)
IC Device Classification	2GHz Personal Communication Services
Device Type	Rugged Laptop PC with Sierra Wireless AirCard 750 PCS GSM/GPRS Modem (Co-located with Cisco Systems MPI-350 Mini-PCI DSSS WLAN & Mitsumi WML-C11 Bluetooth Transmitter)
FCC ID	KBCIX260A750MPIBT
Model(s)	IX260
Serial No.	Pre-production
Modulation	GMSK
Tx Frequency Range(s)	1850.2 - 1909.8 MHz (GSM/GPRS) 2412 - 2462 MHz (WLAN) 2402 - 2480 MHz (Bluetooth)
RF Output Power Tested	27.9 dBm Peak Conducted (1850.2 MHz) (March 24, 2003) 27.9 dBm Peak Conducted (1880.0 MHz) (March 24, 2003) 27.8 dBm Peak Conducted (1909.8 MHz) (March 24, 2003) 28.1 dBm Peak Conducted (1850.2 MHz) (August 05, 2003) 28.1 dBm Peak Conducted (1880.0 MHz) (August 05, 2003) 28.0 dBm Peak Conducted (1909.8 MHz) (August 05, 2003)
Antenna Type(s)	External Dipole (GSM/GPRS) Internal - upper right edge of LCD display (WLAN) Internal - upper left edge of LCD display (Bluetooth)
Battery Type	11.1V Lithium-Ion, 6.0Ah (Model: A2121-2)

3.0 SAR MEASUREMENT SYSTEM

Celltech Labs SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY system is comprised of the 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 PC plug-in card. The DAE3 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 PC-card 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. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

DASY3 SAR Measurement System with SAM phantom

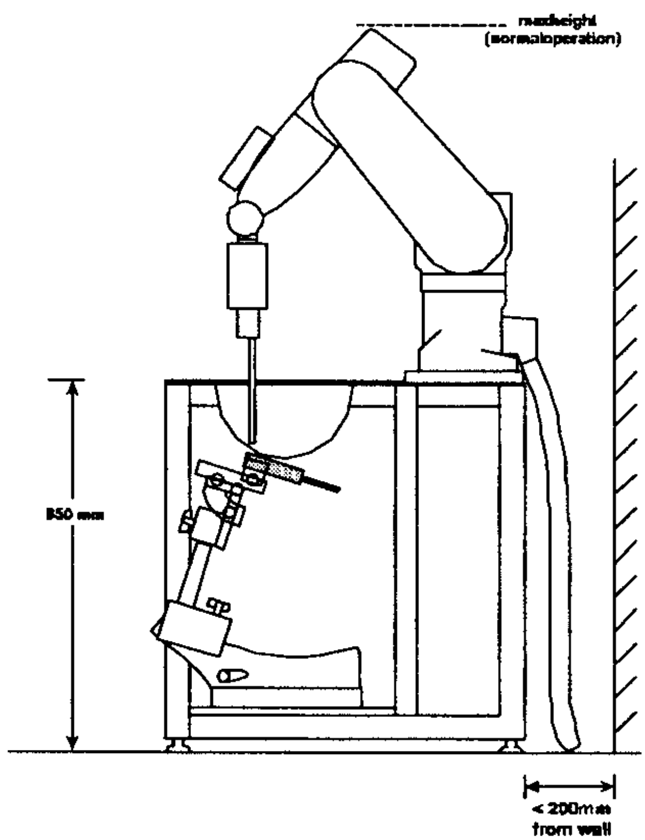


Figure 1. DASY3 Compact Version - Side View

4.0 MEASUREMENT SUMMARY

BODY SAR MEASUREMENT RESULTS

Transmit Mode	Freq. (MHz)	Channel	Test Mode	Conducted Power (dBm)		Antenna Position to Planar Phantom	Laptop PC Position to Planar Phantom	Separation Distance (cm)	Measured SAR 1g (W/kg)	Scaled SAR 1g (W/kg)
				Before	After					
GPRS	1880.0	661	GPRS	27.9	27.7	Parallel (Stowed)	Back of LCD (LCD Closed)	1.5	P 0.192 S 0.189	P 0.201 S 0.198
GPRS	1880.0	661	GPRS	27.9	27.7	Perpendicular (180°)	Back of LCD (LCD Closed)	1.5	0.0361	0.0378
GPRS & WLAN	1880.0	661	GPRS	27.9	27.7	Parallel (Stowed)	Back of LCD (LCD Closed)	1.5	P 0.215 S 0.187	P 0.225 S 0.196
GPRS & WLAN	1880.0	661	GPRS	27.9	27.7	Perpendicular (180°)	Back of LCD (LCD Closed)	1.5	0.149	0.156
GPRS	1880.0	661	GPRS	27.9	27.7	Parallel (Stowed)	Bottom Side of PC (LCD Closed)	0.0	0.0537	0.0562
GPRS	1880.0	661	GPRS	27.9	27.7	Perpendicular (Extended)	Bottom Side of PC (LCD Closed)	0.0	0.0837	0.0876
GPRS & WLAN	1880.0	661	GPRS	27.9	27.7	Parallel (Stowed)	Bottom Side of PC (LCD Closed)	0.0	P 0.0828 S 0.0706	P 0.0884 S 0.0739
GPRS & WLAN	1880.0	661	GPRS	27.9	27.7	Perpendicular (Extended)	Bottom Side of PC (LCD Closed)	0.0	0.104	0.109
GPRS	1880.0	661	GPRS	27.9	27.7	Parallel (Stowed)	Right Side of LCD (LCD Closed)	1.5	P 0.756 S 0.452	P 0.792 S 0.473
GPRS	1880.0	661	GPRS	27.9	27.7	Parallel (Extended)	Right Side of LCD (LCD Closed)	1.5	0.438	0.459
GPRS & WLAN	1880.0	661	GPRS	27.9	27.7	Parallel (Stowed)	Right Side of LCD (LCD Closed)	1.5	P 0.990 S 0.408	P 1.04 S 0.427
GPRS & WLAN	1850.2	512	GPRS	27.9	27.7	Parallel (Stowed)	Right Side of LCD (LCD Closed)	1.5	0.793	0.830
GPRS & WLAN	1909.8	810	GPRS	27.8	27.7	Parallel (Stowed)	Right Side of LCD (LCD Closed)	1.5	0.886	0.928
GPRS & WLAN	1880.0	661	GPRS	27.9	27.7	Parallel (Extended)	Right Side of LCD (LCD Closed)	1.5	P 0.309 S 0.221	P 0.324 S 0.231

ANSI / IEEE C95.1 1992 - SAFETY LIMIT
BODY: 1.6 W/kg (averaged over 1 gram)
Spatial Peak - Uncontrolled Exposure / General Population

Test Date(s)	03/24/03		**Relative Humidity**	55 %
Measured Mixture Type	1900MHz Body		**Atmospheric Pressure**	101.4 kPa
Dielectric Constant ε_r	**IEEE Target**	**Measured**	**Ambient Temperature**	22.8 °C
	53.3 ±5%	51.1	**Fluid Temperature**	23.1 °C
Conductivity σ **(mho/m)**	**IEEE Target**	**Measured**	**Fluid Depth**	≥ 15 cm
	1.52 ±5%	1.55	ρ **(Kg/m^3)**	1000

Notes:

1. Scaled SAR levels are reported with + 0.2 dB conducted power to show SAR results at the conducted power levels tested for co-located simultaneous transmit operation with GPRS, WLAN, and Bluetooth transmitters (see next page).
2. All secondary peak SAR locations within 2 dB of the primary peak value were evaluated (P = Primary, S = Secondary).

4.0 MEASUREMENT SUMMARY (Cont.)

BODY SAR MEASUREMENT RESULTS									
Transmit Mode	Freq. (MHz)	Channel	Test Mode	Conducted Power (dBm)		Antenna Position to Planar Phantom	Laptop PC Position to Planar Phantom	Separation Distance (cm)	Measured SAR 1g (W/kg)
				Before	After				
GPRS, WLAN & Buetooth	1880.00	661	GPRS	28.1	27.9	Parallel (Stowed)	Back of LCD (LCD Closed)	1.5	P 0.233 S 0.238
GPRS, WLAN & Buetooth	1880.00	661	GPRS	28.1	27.9	Perpendicular (180°)	Back of LCD (LCD Closed)	1.5	0.180
GPRS, WLAN & Buetooth	1880.00	661	GPRS	28.1	27.9	Parallel (Stowed)	Bottom Side of PC (LCD Closed)	0.0	0.0795
GPRS, WLAN & Buetooth	1880.00	661	GPRS	28.1	27.9	Perpendicular (180°)	Bottom Side of PC (LCD Closed)	0.0	0.0832
GPRS, WLAN & Buetooth	1880.00	661	GPRS	28.1	27.9	Parallel (Stowed)	Right Side of LCD (LCD Closed)	1.5	P 0.925 S 0.607
GPRS, WLAN & Buetooth	1880.00	661	GPRS	28.1	27.9	Perpendicular (Extended)	Right Side of LCD (LCD Closed)	1.5	P 0.451 S 0.284
GPRS, WLAN & Buetooth	1850.2	512	GPRS	28.1	27.9	Parallel (Stowed)	Right Side of LCD (LCD Closed)	1.5	P 0.903 S 0.503
GPRS, WLAN & Buetooth	1909.8	810	GPRS	28.0	27.8	Parallel (Stowed)	Right Side of LCD (LCD Closed)	1.5	P 0.773 S 0.527
ANSI / IEEE C95.1 1992 - SAFETY LIMIT BODY: 1.6 W/kg (averaged over 1 gram) Spatial Peak - Uncontrolled Exposure / General Population									

Test Date(s)	08/05/03		Relative Humidity	38%
Measured Mixture Type	1900MHz Body		Atmospheric Pressure	101.3 kPa
Dielectric Constant ε_r	IEEE Target	Measured	Ambient Temperature	23.9 °C
	53.3 ±5%	50.6	Fluid Temperature	25.5 °C
Conductivity σ (mho/m)	IEEE Target	Measured	Fluid Depth	≥ 15 cm
	1.52 ±5%	1.57	ρ (Kg/m^3)	1000

Notes:

3. If the SAR measurements performed at the middle channel were ≥ 3dB 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]).
4. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluation. The temperatures listed in the table shown above were consistent for all measurement periods.
5. The dielectric properties of the simulated body fluid were measured prior to the evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters).
6. The DUT was tested with the LCD display lid in the closed position, which was determined to be the worst-case configuration based on both internal transmitters transmitting when the LCD display lid is closed.

5.0 DETAILS OF SAR EVALUATION

The ITRONIX CORPORATION Model: IX260 FCC ID: KBCIX260A750MPIBT Rugged Laptop PC with Sierra Wireless AirCard 750 PCS GSM/GPRS PCMCIA Modem Card co-located with Cisco Systems MPI-350 Mini-PCI DSSS WLAN Card & Mitsumi WML-C11 Bluetooth Transmitter was found to be compliant for localized Specific Absorption Rate based on the following test provisions and conditions described below. The detailed test setup photographs are shown in Appendix G.

1. The DUT was tested for body SAR with the LCD display closed and the back of the LCD display facing parallel to the outer surface of the SAM phantom (planar section) with a 1.5 cm separation distance. The DUT was tested with the dipole antenna in both the parallel (stowed) and perpendicular (180°) positions to the outer surface of the SAM phantom (planar section).
2. The DUT was tested for body SAR with the LCD display closed and the bottom of the Laptop PC facing parallel to, and touching, the outer surface of the SAM phantom (planar section). The DUT was tested with the dipole antenna in both the parallel (stowed) and perpendicular (extended) positions to the outer surface of the SAM phantom (planar section).
3. The DUT was tested for body SAR with the LCD display closed and the right side of the LCD display (dipole antenna side) facing parallel to the outer surface of the SAM phantom (planar section) and a 1.5 cm separation distance between the dipole antenna and the SAM phantom (planar section). The DUT was tested with the dipole antenna parallel to the outer surface of the SAM phantom (planar section) in both the stowed and extended positions.
4. Due to the dimensions of the DUT the initial coarse scans did not cover the entire area of the Laptop PC. Subsequently, a second coarse scan was performed for the highest SAR configurations to show there were no secondary peak SAR locations within 2 dB of the primary peak values. All secondary peak SAR locations within 2 dB of the primary peak value were evaluated and reported (see SAR Plots - Appendix A).
5. Due to the dimensions of the DUT, a stack of low-density, low-loss dielectric foamed polystyrene was used in place of the device holder.
6. The conducted power levels were measured before and after each test using a Gigatronics 8652A Universal Power Meter according to the procedures described in FCC 47 CFR §2.1046.
7. The DUT was controlled in test mode via internal software. SAR measurements were performed with the DUT transmitting continuously at maximum power on 4 time slots in GPRS mode (Crest factor: 2). This is the maximum output condition since the DUT is a Class 12 multi-slot GSM/GPRS modem.
8. For the simultaneous transmit tests the co-located Cisco MPI-350 DSSS WLAN Card was set to the maximum conducted power level (21.1 dBm) at the mid channel (2437MHz) with a CW signal.
9. For the simultaneous transmit tests the co-located Mitsumi WML-C11 Bluetooth Transmitter was set to the maximum conducted power level (14.5 dBm) at the mid channel (2441MHz) in modulated continuous transmit mode with the frequency hopping disabled.
10. The DUT was tested with a fully charged battery.

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 in accordance with FCC OET Bulletin 65, Supplement C (Edition 01-01) 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 DASY3 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 20mm x 20mm.

c. Based on the area scan data, the area of maximum absorption was determined by spline interpolation. Around this point, a volume of 40 x 40 x 35 mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 7 points.

d. The 1g and 10g spatial peak SAR was determined as follows:

1. The first step was an extrapolation to find the points between the dipole center of the probe and the surface of the phantom. This data cannot be measured, since the center of the dipoles is 2.7 mm away form the tip of the probe and the distance between the surface and the lowest measuring point is 1.4 mm (see probe calibration document in Appendix D). The extrapolation was based on a least square algorithm [W. Gander, Computermathematik, p.168-180] (see reference [6]). Through the points in the first 3 cm in all z-axis, polynomials of the fourth order were calculated. This polynomial was then used to evaluate the points between the surface and the probe tip.

2. The next step used 3D-spline interpolation to get all points within the measured volume in a 1mm grid (35000 points). The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition [W. Gander, Computermathematik, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff] (see reference [6]).

3. The maximal interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-spline interpolation algorithm. 8000 points (20x20x20) were interpolated to calculate the average.

6.0 EVALUATION PROCEDURES (Cont.)

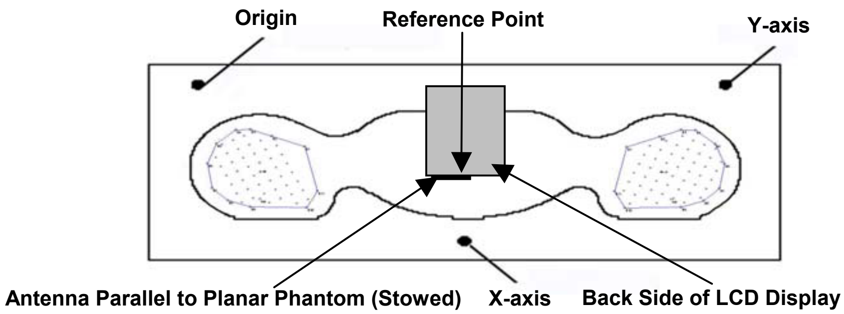


Figure 2. Phantom Reference Point & DUT Positioning
Back Side of LCD Display (Closed)

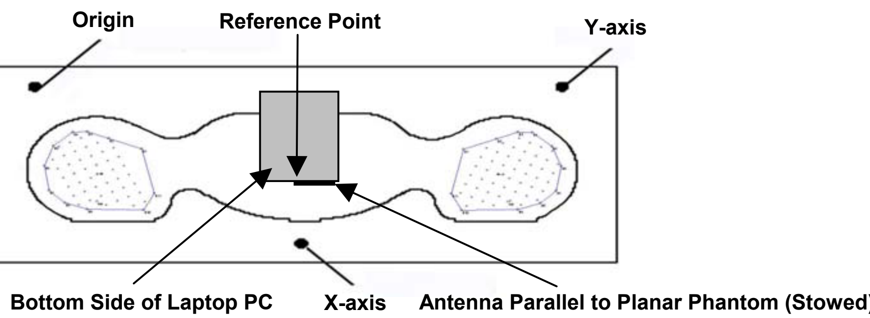


Figure 3. Phantom Reference Point & DUT Positioning
Bottom Side of Laptop PC (LCD Display Closed)

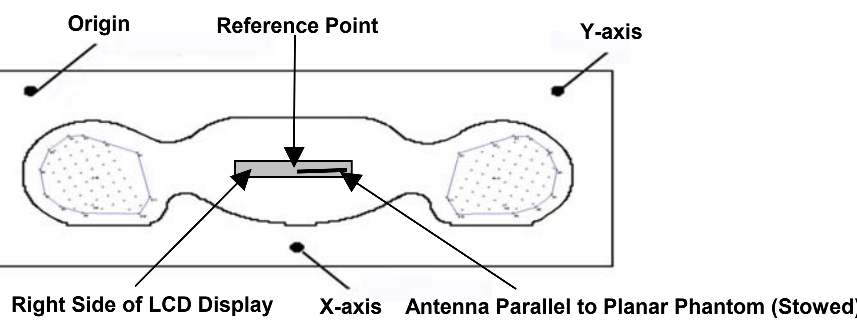


Figure 4. Phantom Reference Point & DUT Positioning
Right Side of LCD Display (Closed)

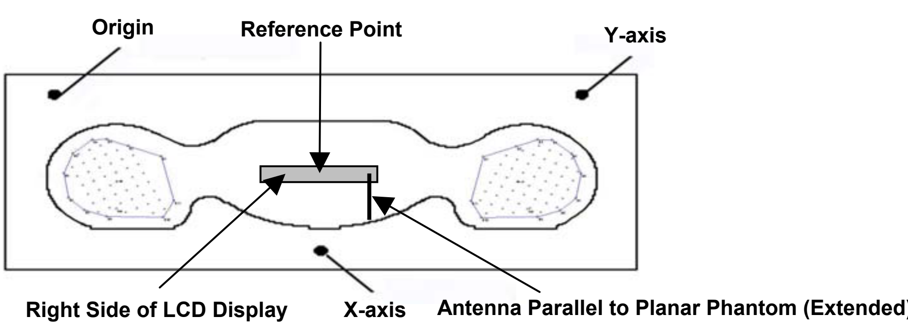


Figure 5. Phantom Reference Point & DUT Positioning
Right Side of LCD Display (Closed)

7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation a system check was performed in the planar section of the SAM phantom with an 1800MHz dipole (see Appendix C for system validation procedures). The fluid dielectric parameters were measured prior to the system check using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer (see Appendix E for printout of measured fluid dielectric parameters). A forward power of 250mW was applied to the dipole and the system was verified to a tolerance of ±10% (see Appendix B for system check test plot).

SYSTEM PERFORMANCE CHECK											
Test Date	Equiv. Tissue (1800MHz)	SAR 1g (W/kg)		Dielectric Constant ε_r		Conductivity σ (mho/m)		ρ (Kg/m^3)	Ambient Temp.	Fluid Temp.	Fluid Depth
		IEEE Target	Measured	IEEE Target	Measured	IEEE Target	Measured				
03/24/03	Brain	9.53 ±10%	10.1	40.0 ±5%	40.8	1.40 ±5%	1.38	1000	22.8 °C	23.0 °C	≥ 15 cm
08/05/03	Brian	9.53 ±10%	9.55	40.0 ±5%	39.3	1.40 ±5%	1.37	1000	24.2 °C	21.8 °C	≥ 15 cm

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.

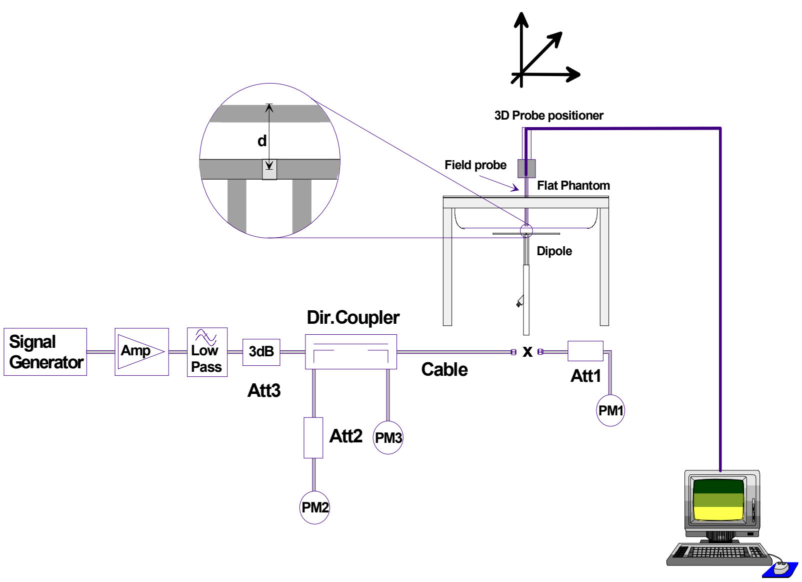


Figure 6. System Check Setup Diagram

1800MHz System Check Setup Photograph

8.0 EQUIVALENT TISSUES

The 1800MHz and 1900MHz simulated tissue mixtures consist of Glycol-monobutyl, water, and salt. The fluid was prepared according to standardized procedures and measured for dielectric parameters (permittivity and conductivity).

TISSUE MIXTURES (1 Liter Yields)		
INGREDIENT	1800MHz Brain (System Check)	1900MHz Body (DUT Evaluation)
Water	548.0 g	716.60 g
Glycol Monobutyl	448.5 g	300.70 g
Salt	3.20 g	3.10 g

9.0 SAR SAFETY LIMITS

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

Notes:

1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

10.0 ROBOT SYSTEM SPECIFICATIONS

Specifications

POSITIONER:	Stäubli Unimation Corp. Robot Model: RX60L
Repeatability:	0.02 mm
No. of axis:	6

Data Acquisition Electronic (DAE) System

Cell Controller

Processor:	Pentium III
Clock Speed:	450 MHz
Operating System:	Windows NT
Data Card:	DASY3 PC-Board

Data Converter

Features:	Signal Amplifier, multiplexer, A/D converter, and control logic
Software:	DASY3 software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock

PC Interface Card

Function:	24 bit (64 MHz) DSP for real time processing Link to DAE3 16-bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot

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

Type:	SAM V4.0C
Shell Material:	Fiberglass
Thickness:	2.0 ±0.1 mm
Volume:	Approx. 20 liters

11.0 PROBE SPECIFICATION (ET3DV6)

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


SAM Phantom

13.0 DEVICE HOLDER

The DASY3 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.


Device Holder

14.0 TEST EQUIPMENT LIST

TEST EQUIPMENT	SERIAL NO.	CALIBRATION DATE
Schmid & Partner DASY3 System	-	-
-Robot	599396-01	N/A
-ET3DV6 E-Field Probe	1387	Feb 2003
-300MHz Validation Dipole	135	Oct 2002
-450MHz Validation Dipole	136	Oct 2002
-900MHz Validation Dipole	054	June 2003
-1800MHz Validation Dipole	247	June 2003
-2450MHz Validation Dipole	150	Oct 2002
-SAM Phantom V4.0C	1033	N/A
-Planar Phantom	161	N/A
-Validation Planar Phantom	137	N/A
HP 85070C Dielectric Probe Kit	N/A	N/A
Gigatronics 8651A Power Meter	8650137	April 2003
Gigatronics 8652A Power Meter	1835267	April 2003
Power Sensor 80701A	1833542	Feb 2003
Power Sensor 80701A	1833699	April 2003
HP E4408B Spectrum Analyzer	US39240170	Dec 2002
HP 8594E Spectrum Analyzer	3543A02721	Feb 2003
HP 8753E Network Analyzer	US38433013	Feb 2003
HP 8648D Signal Generator	3847A00611	Feb 2003
Amplifier Research 5S1G4 Power Amplifier	26235	N/A

15.0 MEASUREMENT UNCERTAINTIES

UNCERTAINTY BUDGET FOR DEVICE EVALUATION						
Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**c_i 1g**	**Standard Uncertainty ±% (1g)**	**v_i or v_{eff}**
Measurement System						
Probe calibration	± 4.8	Normal	1	1	± 4.8	∞
Axial isotropy of the probe	± 4.7	Rectangular	√3	$(1\text{-}c_p)$	± 1.9	∞
Spherical isotropy of the probe	± 9.6	Rectangular	√3	(c_p)	± 3.9	∞
Spatial resolution	± 0.0	Rectangular	√3	1	± 0.0	∞
Boundary effects	± 5.5	Rectangular	√3	1	± 3.2	∞
Probe linearity	± 4.7	Rectangular	√3	1	± 2.7	∞
Detection limit	± 1.0	Rectangular	√3	1	± 0.6	∞
Readout electronics	± 1.0	Normal	1	1	± 1.0	∞
Response time	± 0.8	Rectangular	√3	1	± 0.5	∞
Integration time	± 1.4	Rectangular	√3	1	± 0.8	∞
RF ambient conditions	± 3.0	Rectangular	√3	1	± 1.7	∞
Mech. constraints of robot	± 0.4	Rectangular	√3	1	± 0.2	∞
Probe positioning	± 2.9	Rectangular	√3	1	± 1.7	∞
Extrapolation & integration	± 3.9	Rectangular	√3	1	± 2.3	∞
Test Sample Related						
Device positioning	± 6.0	Normal	√3	1	± 6.7	12
Device holder uncertainty	± 5.0	Normal	√3	1	± 5.9	8
Power drift	± 5.0	Rectangular	√3		± 2.9	∞
Phantom and Setup						
Phantom uncertainty	± 4.0	Rectangular	√3	1	± 2.3	∞
Liquid conductivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid conductivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					**± 13.3**	
Expanded Uncertainty (k=2)					**± 26.6**	

Measurement Uncertainty Table in accordance with IEEE Std 1528-200X (Draft - see reference [5])

MEASUREMENT UNCERTAINTIES (Cont.)

UNCERTAINTY BUDGET FOR SYSTEM VALIDATION						
Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**c_i 1g**	**Standard Uncertainty ±% (1g)**	**v_i or v_{eff}**
Measurement System						
Probe calibration	± 4.8	Normal	1	1	± 4.8	∞
Axial isotropy of the probe	± 4.7	Rectangular	√3	$(1-c_p)$	± 1.9	∞
Spherical isotropy of the probe	± 9.6	Rectangular	√3	(c_p)	± 3.9	∞
Spatial resolution	± 0.0	Rectangular	√3	1	± 0.0	∞
Boundary effects	± 5.5	Rectangular	√3	1	± 3.2	∞
Probe linearity	± 4.7	Rectangular	√3	1	± 2.7	∞
Detection limit	± 1.0	Rectangular	√3	1	± 0.6	∞
Readout electronics	± 1.0	Normal	1	1	± 1.0	∞
Response time	± 0.8	Rectangular	√3	1	± 0.5	∞
Integration time	± 1.4	Rectangular	√3	1	± 0.8	∞
RF ambient conditions	± 3.0	Rectangular	√3	1	± 1.7	∞
Mech. constraints of robot	± 0.4	Rectangular	√3	1	± 0.2	∞
Probe positioning	± 2.9	Rectangular	√3	1	± 1.7	∞
Extrapolation & integration	± 3.9	Rectangular	√3	1	± 2.3	∞
Dipole						
Dipole Axis to Liquid Distance	± 2.0	Rectangular	√3	1	± 1.2	∞
Input Power	± 4.7	Rectangular	√3	1	± 2.7	∞
Phantom and Setup						
Phantom uncertainty	± 4.0	Rectangular	√3	1	± 2.3	∞
Liquid conductivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid conductivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					**± 9.9**	
Expanded Uncertainty (k=2)					**± 19.8**	

Measurement Uncertainty Table in accordance with IEEE Std 1528-200X (Draft - see reference [5])

16.0 REFERENCES

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

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

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

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

[5] IEEE Standards Coordinating Committee 34, Std 1528-200X, “DRAFT Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”.

[6] W. Gander, *Computermathematick*, Birkhaeuser, Basel: 1992.

APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

System Performance Check - 1800MHz Dipole

SAM Phantom; Flat Section

Probe: ET3DV6 - SN1387; ConvF(5.20,5.20,5.20); Crest factor: 1.0; 1800 MHz Brain: $\sigma = 1.38$ mho/m $\varepsilon_r = 40.8$ $\rho = 1.00$ g/cm^3

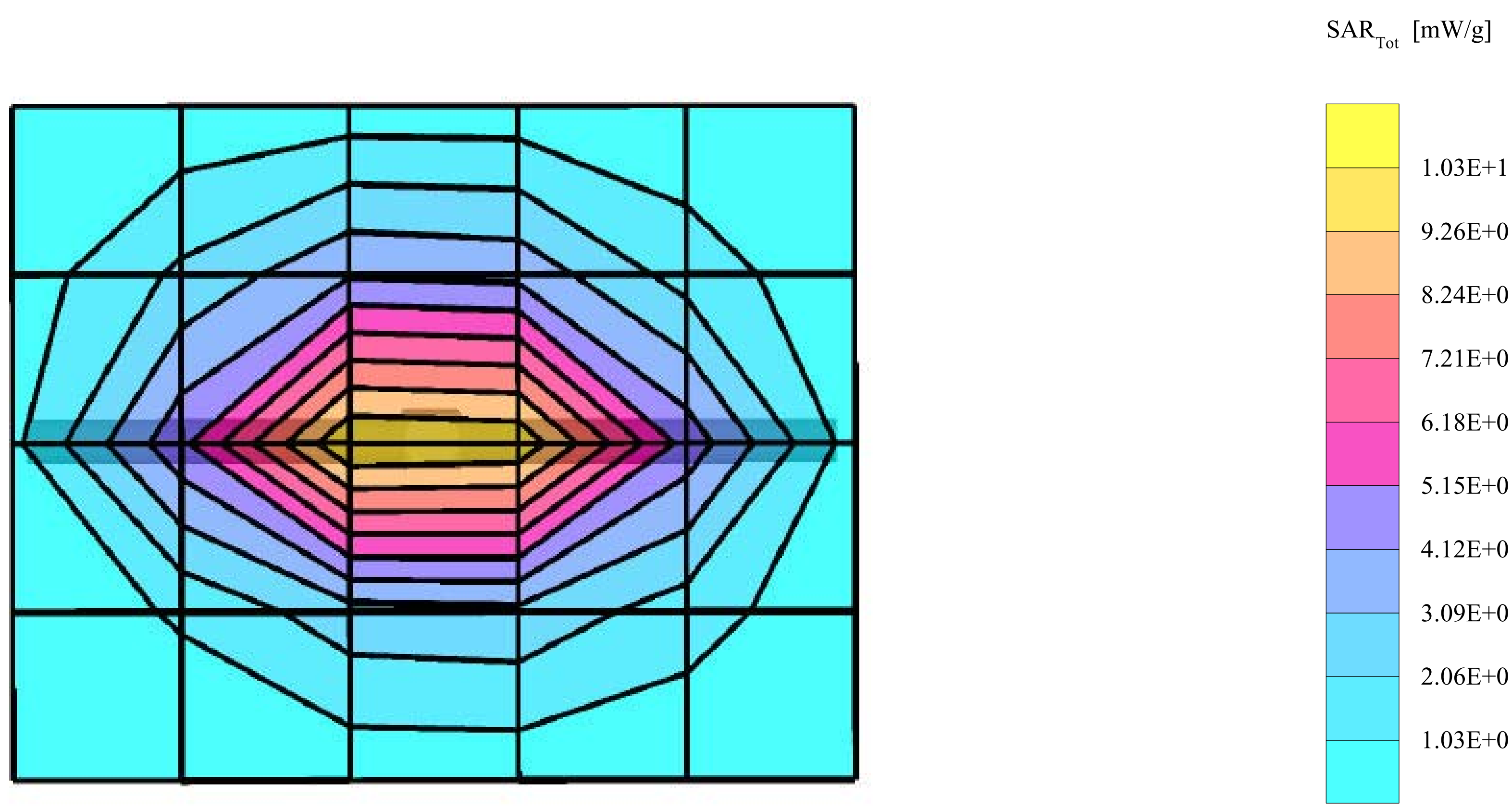
Cube 5x5x7: Peak: 19.4 mW/g, SAR (1g): 10.1 mW/g, SAR (10g): 5.16 mW/g, (Worst-case extrapolation)

Penetration depth: 8.0 (7.5, 9.2) [mm]; Powerdrift: -0.02 dB

Ambient Temp: 22.8°C; Fluid Temp: 23.0°C

Forward Conducted Power: 250 mW

Date Tested: March 24, 2003



Dipole 1800 MHz

SAM Phantom; Flat Section

Probe: ET3DV6 - SN1387; ConvF(5.20,5.20,5.20); Crest factor: 1.0; Brain 1800 MHz: $\sigma = 1.37$ mho/m $\varepsilon_r = 39.3$ $\rho = 1.00$ g/cm^3

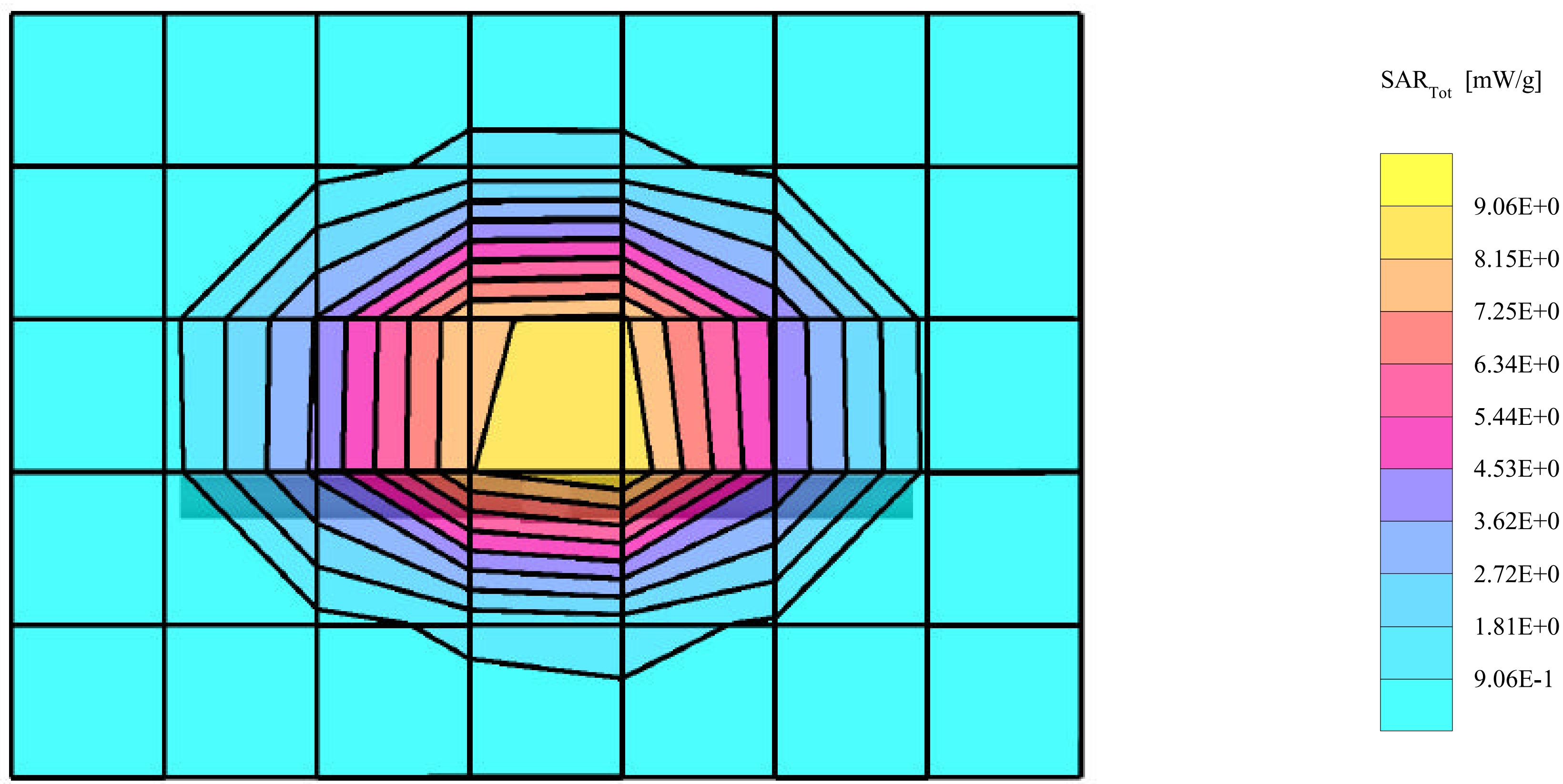
Cube 5x5x7: Peak: 16.9 mW/g, SAR (1g): 9.55 mW/g, SAR (10g): 5.08 mW/g, (Worst-case extrapolation)

Penetration depth: 8.9 (8.8, 9.3) [mm]; Powerdrift: -0.00 dB

Ambient Temp. 24.2°C; Fluid Temp. 21.8°C

Forward Conducted Power: 250 mW

Date Tested: August 5, 2003



Dipole 1800 MHz

SAM Phantom

Probe: ET3DV6 - SN1387; ConvF(5.20,5.20,5.20); Crest factor: 1.0

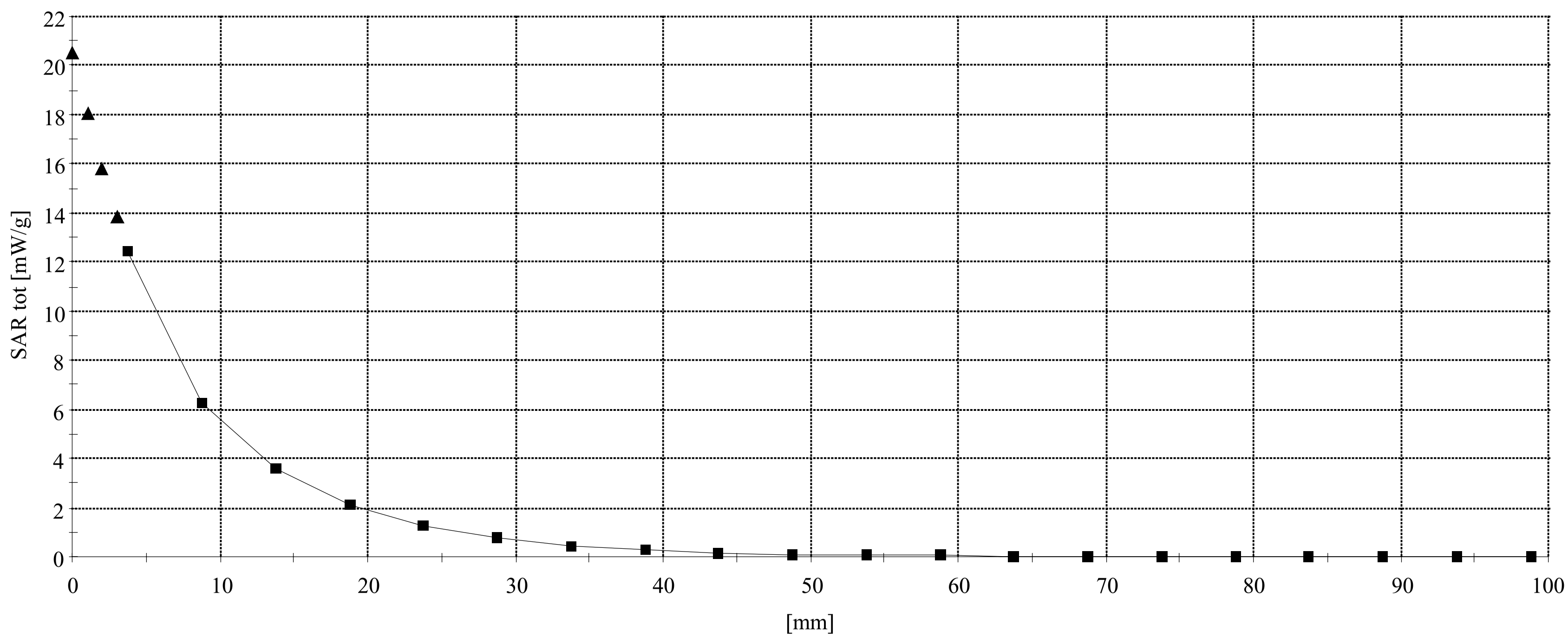
Brain 1800 MHz: $\sigma = 1.37$ mho/m $\varepsilon_r = 39.3$ $\rho = 1.00$ g/cm^3

Z-Axis Extrapolation at Peak SAR Location

Forward Conducted Power: 250 mW

Ambient Temp. 24.2°C; Fluid Temp. 21.8°C

Date Tested: August 05, 2003



APPENDIX C - SYSTEM VALIDATION

Schmid & Partner
Engineering AG

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

Calibration Certificate

1800 MHz System Validation Dipole

Type:	D1800V2
Serial Number:	247
Place of Calibration:	Zurich
Date of Calibration:	June 20, 2001
Calibration Interval:	24 months

Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by: [signature]

Approved by: [signature]

Schmid & Partner
Engineering AG

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

DASY

Dipole Validation Kit

Type: D1800V2

Serial: 247

Manufactured: August 25, 1999
Calibrated: June 20, 2001

1. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with head simulating glycol solution of the following electrical parameters at 1800 MHz:

Relative Dielectricity	**40.0**	± 5%
Conductivity	**1.36 mho/m**	± 5%

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.57 at 1800 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement

Standard SAR-measurements were performed with the phantom according to the measurement conditions described in section 1. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm^3 (1 g) of tissue:	**38.64 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**20.08 mW/g**

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well. The estimated sensitivities of SAR-values and penetration depths to the liquid parameters are listed in the DASY Application Note 4: 'SAR Sensitivities'.

3. Dipole Impedance and return loss

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

Electrical delay:	**1.208 ns**	(one direction)
Transmission factor:	**0.995**	(voltage transmission, one direction)

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

Feedpoint impedance at 1800 MHz:	Re{Z} = **52.4 Ω**
	Im {Z} = **0.7 Ω**
Return Loss at 1800 MHz	**-32.1 dB**

4. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with brain sugar-water solution of the following electrical parameters at 1800 MHz:

Relative Dielectricity	**40.1**	± 5%
Conductivity	**1.71 mho/m**	± 5%

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.63 at 1800 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

5. SAR Measurement

Standard SAR-measurements were performed with the phantom according to the measurement conditions described in section 4. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm^3 (1 g) of tissue:	**43.6 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**21.6 mW/g**

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well. The estimated sensitivities of SAR-values and penetration depths to the liquid parameters are listed in the DASY Application Note 4: 'SAR Sensitivities'.

6. Handling

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

Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

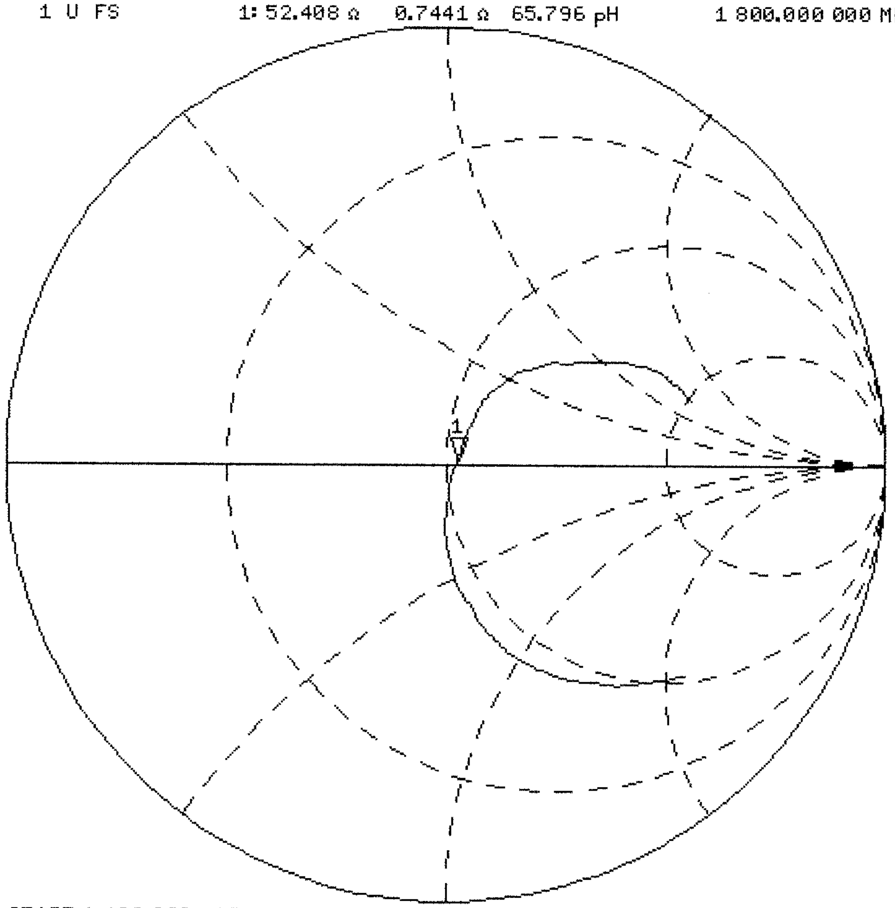
After prolonged use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

20 Jun 2001 15:31:17

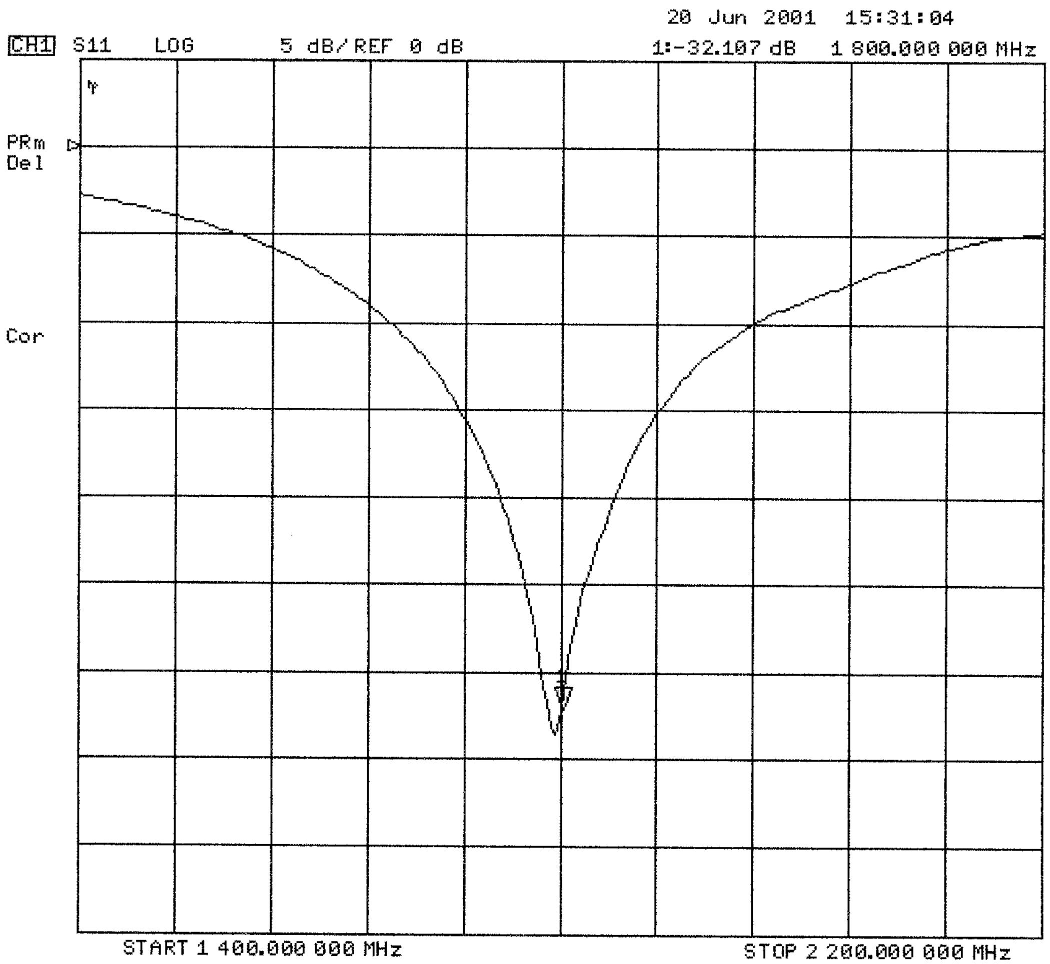
CH1 S11 1 U FS 1: 52.408 Ω 0.7441 Ω 65.796 pH 1 800.000 000 MHz

PRm
Del

Cor

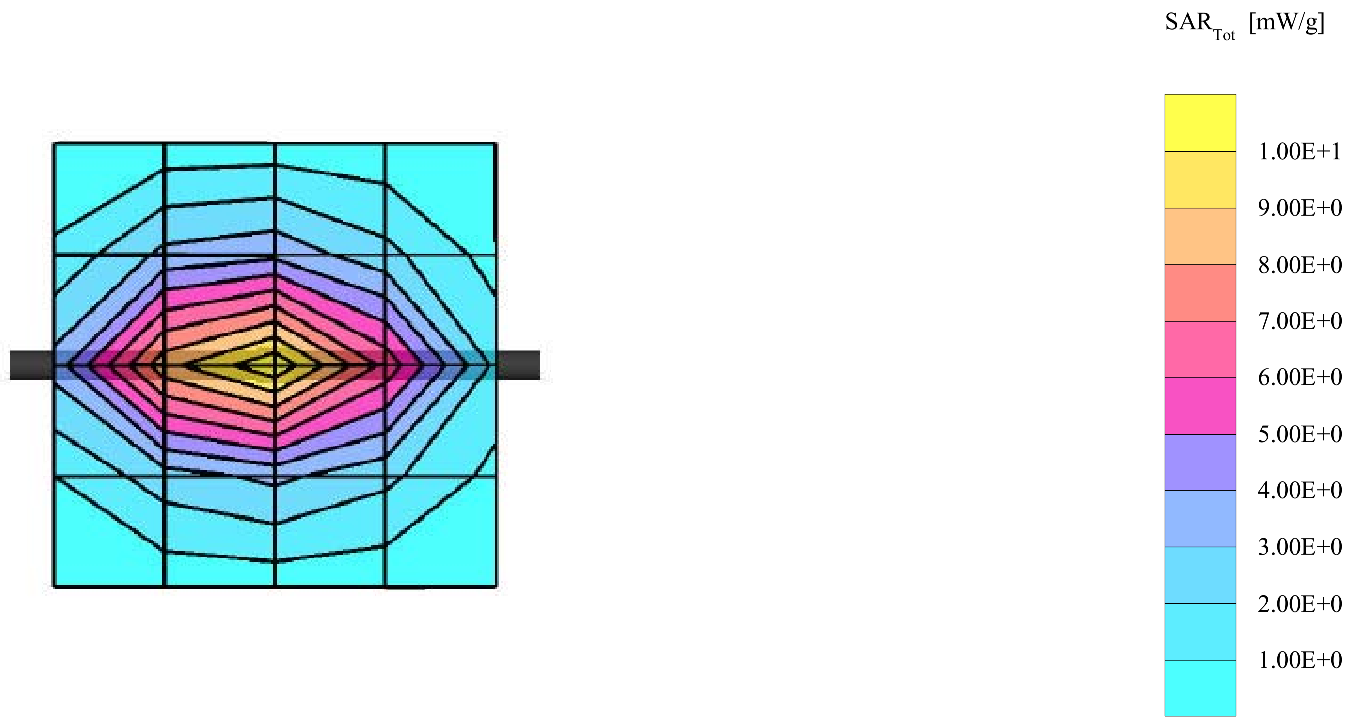


START 1 400.000 000 MHz STOP 2 200.000 000 MHz


20 Jun 2001 15:31:04
CH1 S11 LOG 5 dB/ REF 0 dB 1:-32.107 dB 1 800.000 000 MHz
PRm
Del
Cor
START 1 400.000 000 MHz
STOP 2 200.000 000 MHz

Validation Dipole D1800V2 SN:247, d = 10 mm

Frequency: 1800 MHz; Antenna Input Power: 250 [mW]
Generic Twin Phantom; Flat Section; Grid Spacing:Dx = 15.0, Dy = 15.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(5.57,5.57,5.57); Crest factor: 1.0; IEEE1528 1800 MHz : σ = 1.36 mho/m ε_r = 40.0 ρ = 1.00 g/cm^3
Cubes (2): Peak: 18.2 mW/g ± 0.04 dB, SAR (1g): 9.66 mW/g ± 0.03 dB, SAR (10g): 5.02 mW/g ± 0.03 dB, (Worst-case extrapolation)
Penetration depth: 8.2 (7.6, 9.4) [mm]
Powerdrift: -0.01 dB



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

Client Celltech Labs

CALIBRATION CERTIFICATE

Object(s)	D1800V2 - SN:247
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date:	June 4, 2003
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

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

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05
Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04
Power sensor HP 8481A	US37292783	30-Oct-02 (METAS, No. 252-0236)	Oct-03
Power meter EPM E442	GB37480704	30-Oct-02 (METAS, No. 252-0236)	Oct-03
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03

	Name	Function	Signature
Calibrated by:	Judith Mueller	Technician	i.V. F. Bomholt
Approved by:	Katja Pokovic	Laboratory Director	Pokovic Katja

Date issued: June 4, 2003

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

Schmid & Partner Engineering AG

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

DASY

Dipole Validation Kit

Type: D1800V2

Serial: 247

Manufactured: August 25, 1999
Calibrated: June 4, 2003

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with **head simulating solution** of the following electrical parameters at 1800 MHz:

Relative Dielectricity	**39.2**	± 5%
Conductivity	**1.36 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.3 at 1800 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance spacer was used during measurements for accurate distance positioning.

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

2. SAR Measurement with DASY4 System

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

averaged over 1 cm^3 (1 g) of tissue:	**39.6 mW/g** ± 16.8 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue:	**20.9 mW/g** ± 16.2 % (k=2)[1]

[1] validation uncertainty

3. Dipole Impedance and Return Loss

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

Electrical delay:	**1.190 ns**	(one direction)
Transmission factor:	**0.998**	(voltage transmission, one direction)

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

Feedpoint impedance at 1800 MHz:	Re{Z} = **48.5 Ω**
	Im {Z} = **-6.5 Ω**
Return Loss at 1800 MHz	**-23.3 dB**

4. Handling

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

5. Design

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

6. Power Test

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Date/Time: 06/04/03 14:55:26

Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN247_SN1507_HSL1800_040603.da4

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN247
Program: Dipole Calibration

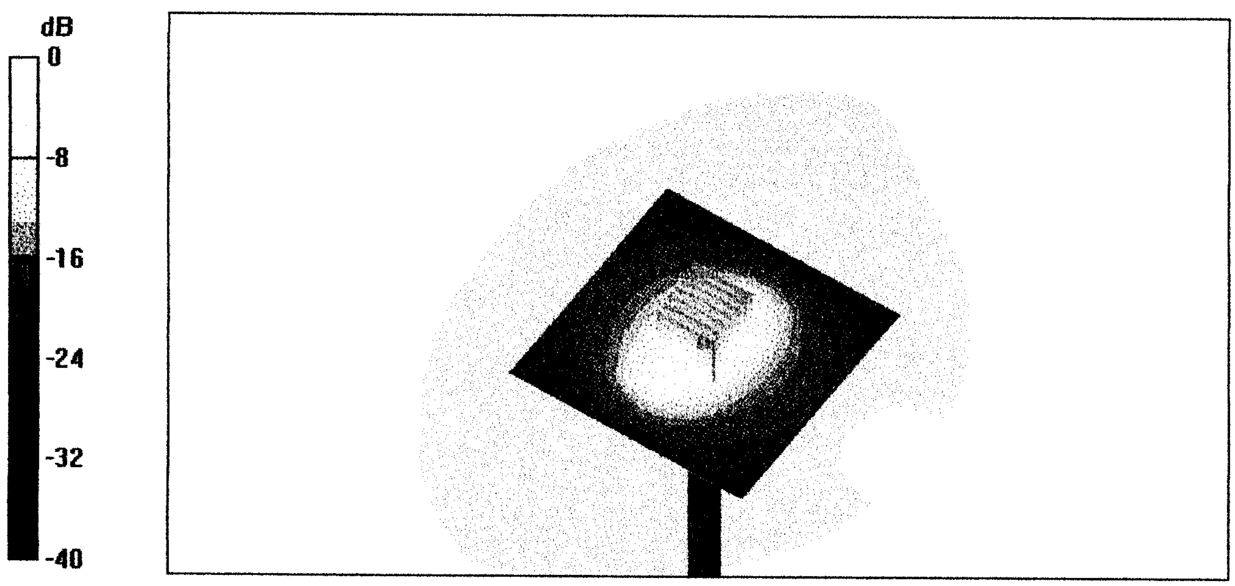
Communication System: CW-1800; Frequency: 1800 MHz;Duty Cycle: 1:1
Medium: HSL 1800 MHz (σ = 1.36 mho/m, ε_r = 39.22, ρ = 1000 kg/m^3)
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

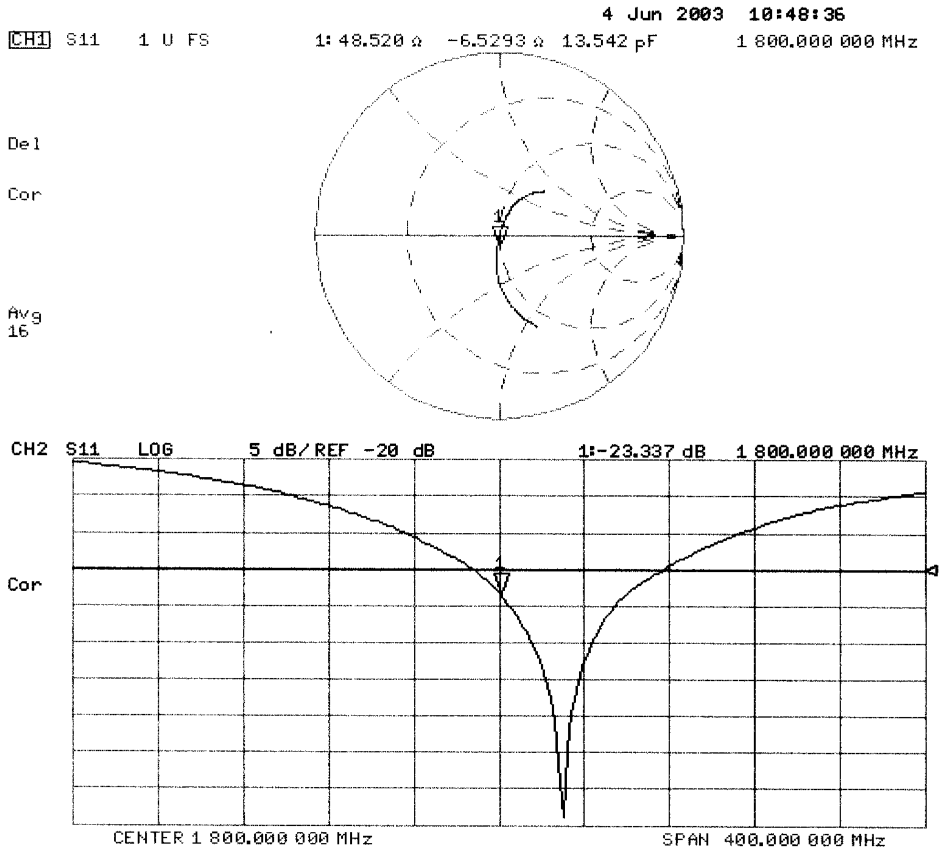
- Probe: ET3DV6 - SN1507; ConvF(5.3, 5.3, 5.3); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006
- *Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115*

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 96 V/m
Power Drift = -0.004 dB
Maximum value of SAR = 11 mW/g

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 16.9 W/kg
SAR(1 g) = 9.9 mW/g; SAR(10 g) = 5.22 mW/g
Reference Value = 96 V/m
Power Drift = -0.004 dB
Maximum value of SAR = 11.1 mW/g



0 dB = 11.1mW/g


4 Jun 2003 10:48:36
CH1 S11 1 U FS
1: 48.520 Ω -6.5293 Ω 13.542 pF
1 800.000 000 MHz
Del
Cor
Avg
16
CH2 S11 LOG 5 dB/ REF -20 dB
1:-23.337 dB 1 800.000 000 MHz
Cor
CENTER 1 800.000 000 MHz
SPAN 400.000 000 MHz

APPENDIX D - PROBE CALIBRATION

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

Client Celltech Labs

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1387
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	February 26, 2003
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

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

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date	Scheduled Calibration
RF generator HP 8684C	US3642U01700	4-Aug-99 (in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	8-Mar-02	Mar-03
Power sensor HP 8481A	MY41092180	18-Sep-02	Sep-03
Power meter EPM E4419B	GB41293874	13-Sep-02	Sep-03
Network Analyzer HP 8753E	US38432426	3-May-00	In house check: May 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01	Sep-03

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

Date issued: February 26, 2003

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

Schmid & Partner Engineering AG

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

Probe ET3DV6

SN:1387

Manufactured:	September 21, 1999
Last calibration:	February 22, 2002
Recalibrated:	February 26, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1387

Sensitivity in Free Space

NormX	**1.55**	$\mu V/(V/m)^2$
NormY	**1.65**	$\mu V/(V/m)^2$
NormZ	**1.64**	$\mu V/(V/m)^2$

Diode Compression

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

Sensitivity in Tissue Simulating Liquid

Head 900 MHz ε_r **= 41.5 ± 5%** σ **= 0.97 ± 5% mho/m**
Head 835 MHz ε_r **= 41.5 ± 5%** σ **= 0.90 ± 5% mho/m**

			Boundary effect:	
ConvF X	**6.6**	± 9.5% (k=2)		
ConvF Y	**6.6**	± 9.5% (k=2)	Alpha	**0.37**
ConvF Z	**6.6**	± 9.5% (k=2)	Depth	**2.61**

Head 1800 MHz ε_r **= 40.0 ± 5%** σ **= 1.40 ± 5% mho/m**
Head 1900 MHz ε_r **= 40.0 ± 5%** σ **= 1.40 ± 5% mho/m**

			Boundary effect:	
ConvF X	**5.2**	± 9.5% (k=2)		
ConvF Y	**5.2**	± 9.5% (k=2)	Alpha	**0.50**
ConvF Z	**5.2**	± 9.5% (k=2)	Depth	**2.73**

Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	10.2	5.9
SAR_{be} [%]	With Correction Algorithm	0.4	0.6

Head 1800 MHz Typical SAR gradient: 10 % per mm

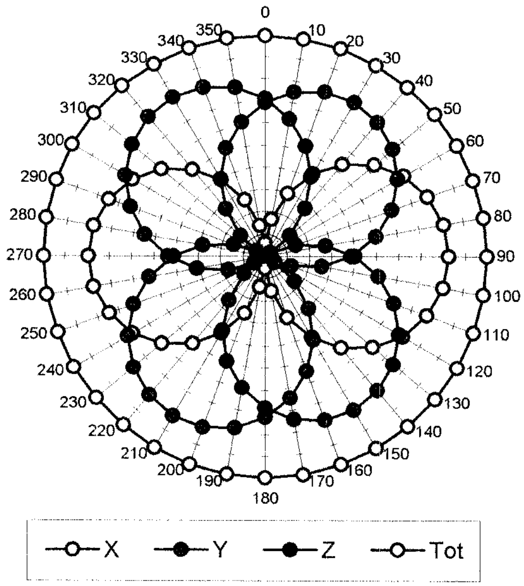
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	14.6	9.8
SAR_{be} [%]	With Correction Algorithm	0.2	0.0

Sensor Offset

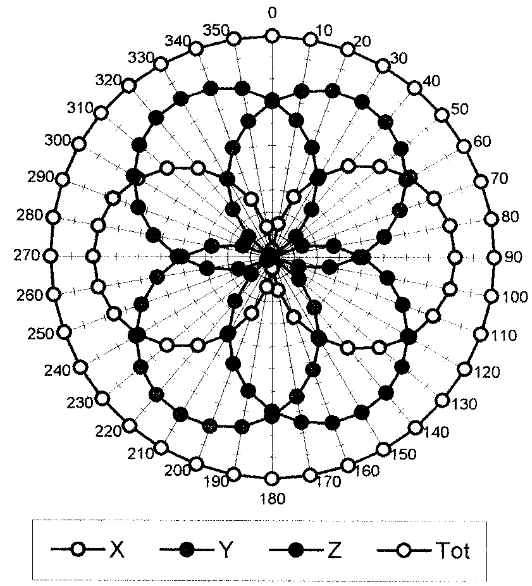
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.4 ± 0.2**	mm

Receiving Pattern (ϕ), $\theta = 0°$

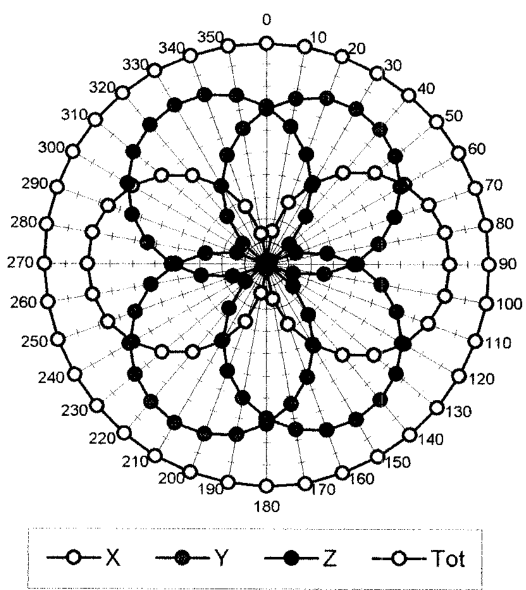
f = 30 MHz, TEM cell ifi110



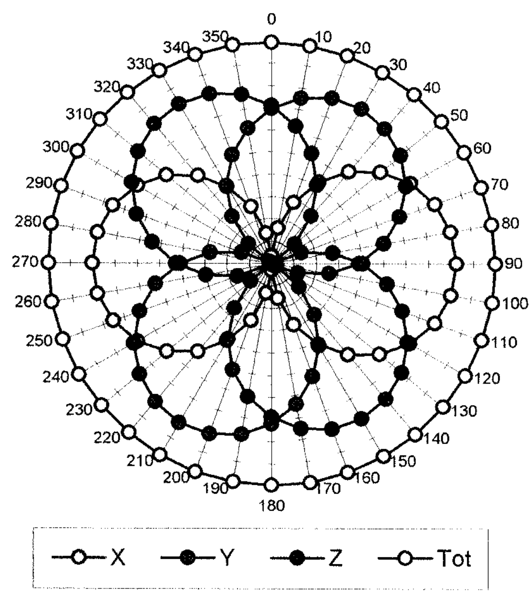
f = 100 MHz, TEM cell ifi110

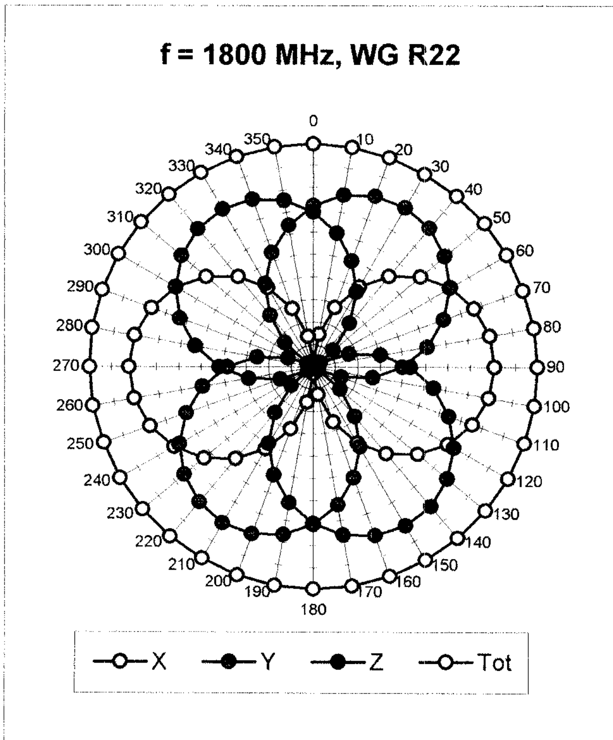


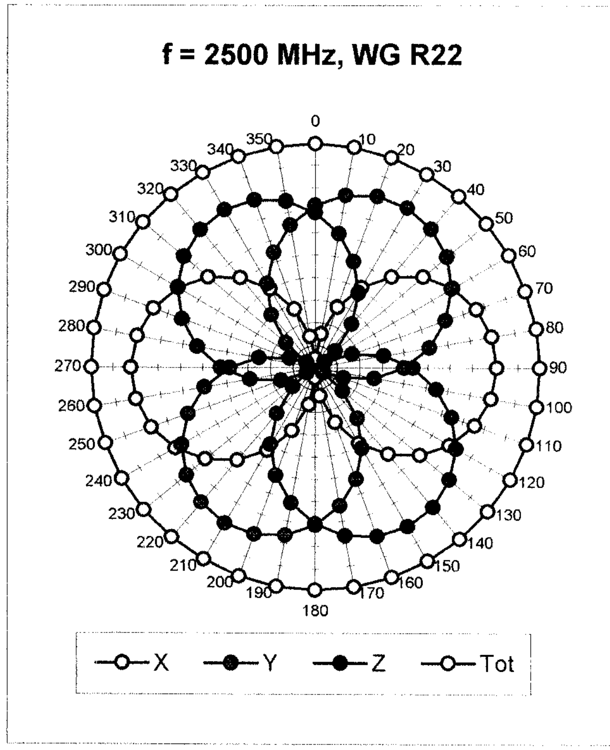
f = 300 MHz, TEM cell ifi110



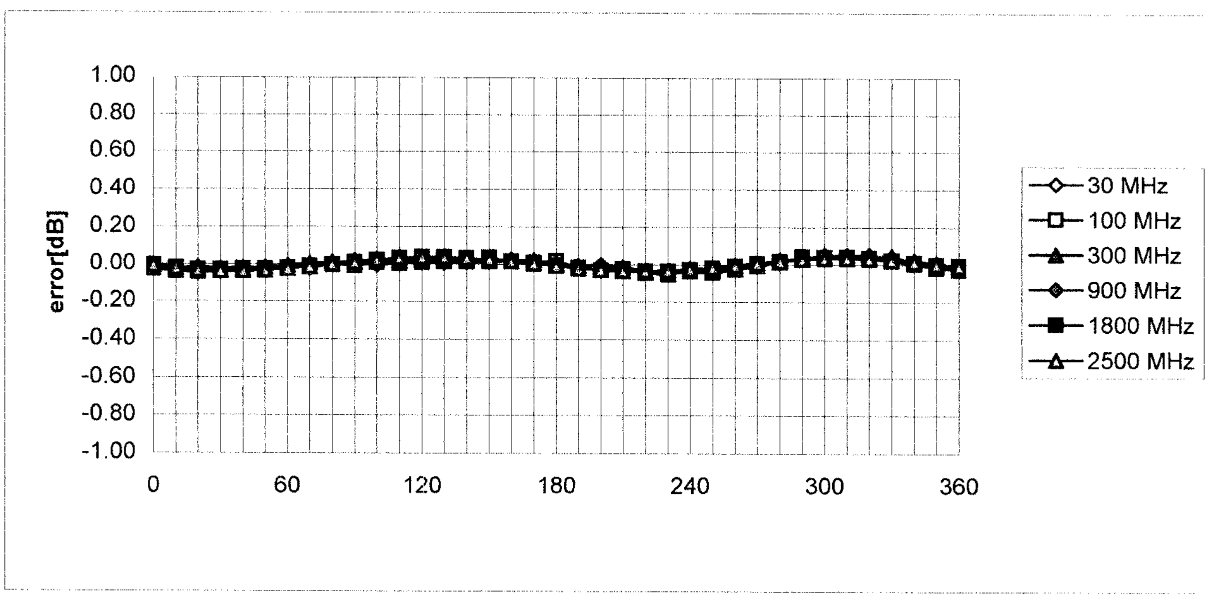
f = 900 MHz, TEM cell ifi110





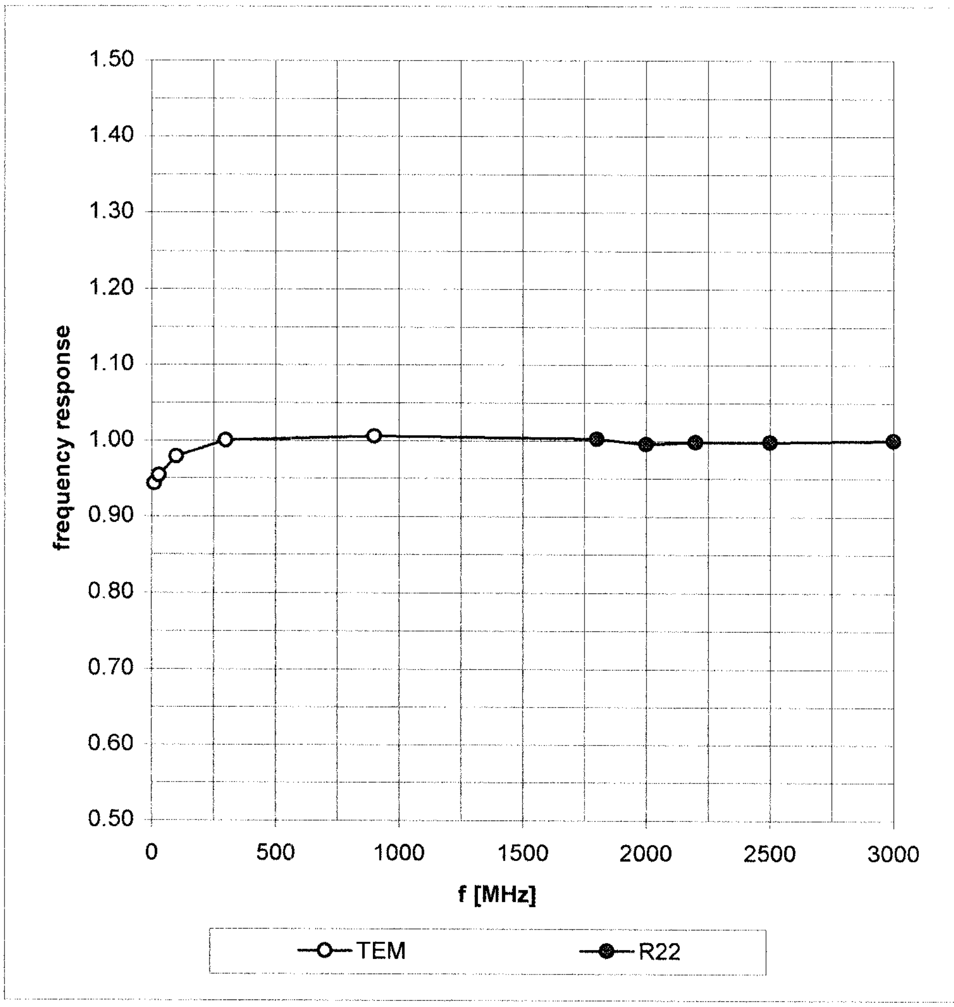


Isotropy Error (ϕ), θ = 0°



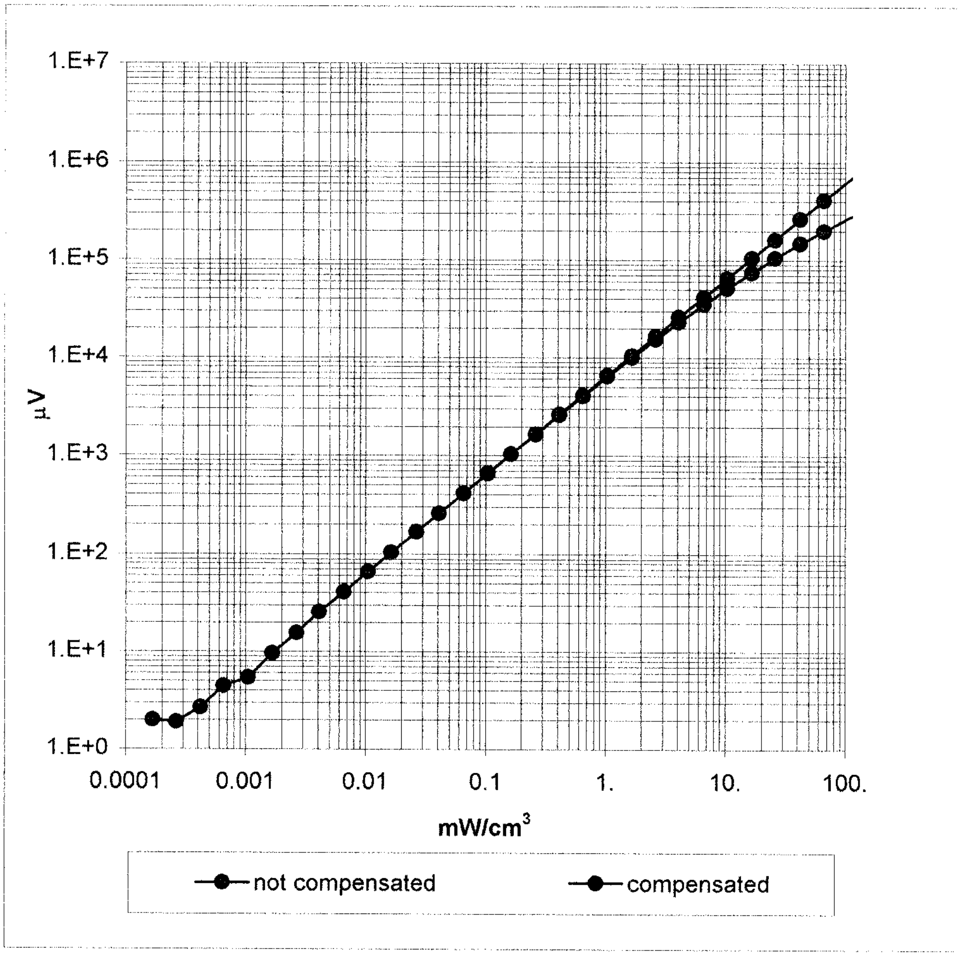
Frequency Response of E-Field

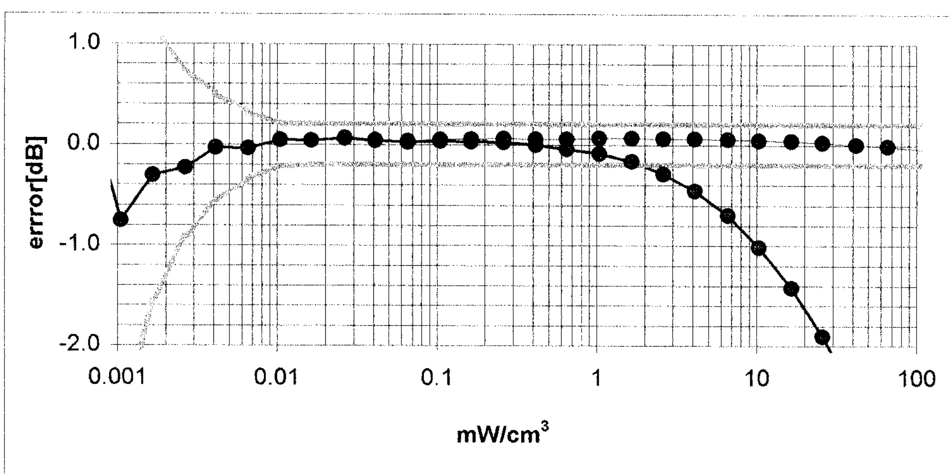
(TEM-Cell:ifi110, Waveguide R22)



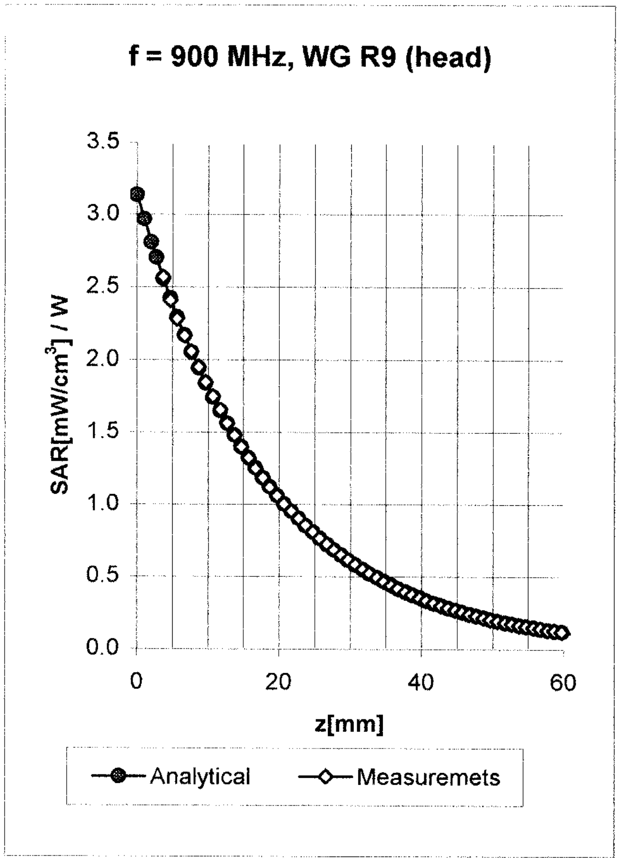
Dynamic Range f(SAR_{brain})

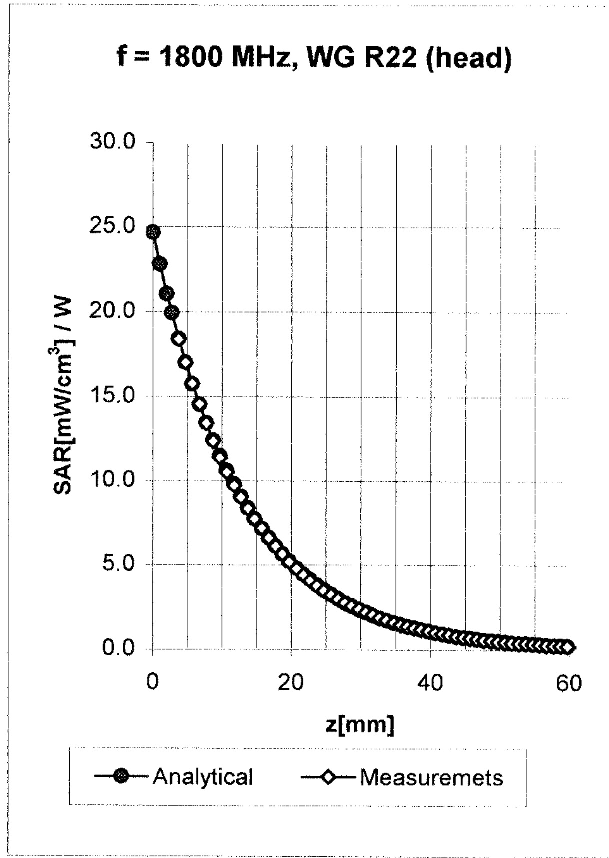
(Waveguide R22)





Conversion Factor Assessment

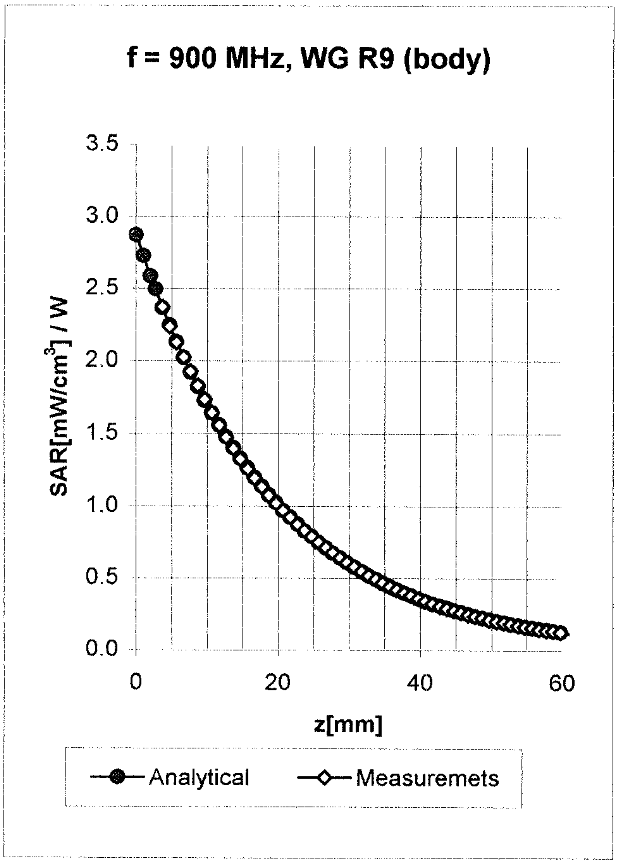


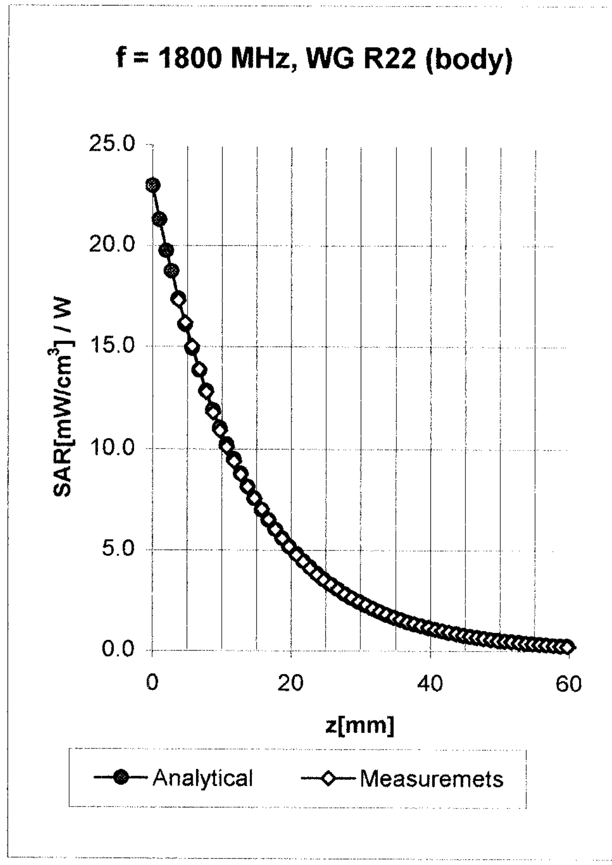


Head	**900 MHz**		ε_r **= 41.5 ± 5%**	σ **= 0.97 ± 5% mho/m**	
Head	**835 MHz**		ε_r **= 41.5 ± 5%**	σ **= 0.90 ± 5% mho/m**	
	ConvF X	**6.6**	± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**6.6**	± 9.5% (k=2)	Alpha	**0.37**
	ConvF Z	**6.6**	± 9.5% (k=2)	Depth	**2.61**

Head	**1800 MHz**		ε_r **= 40.0 ± 5%**	σ **= 1.40 ± 5% mho/m**	
Head	**1900 MHz**		ε_r **= 40.0 ± 5%**	σ **= 1.40 ± 5% mho/m**	
	ConvF X	**5.2**	± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**5.2**	± 9.5% (k=2)	Alpha	**0.50**
	ConvF Z	**5.2**	± 9.5% (k=2)	Depth	**2.73**

Conversion Factor Assessment

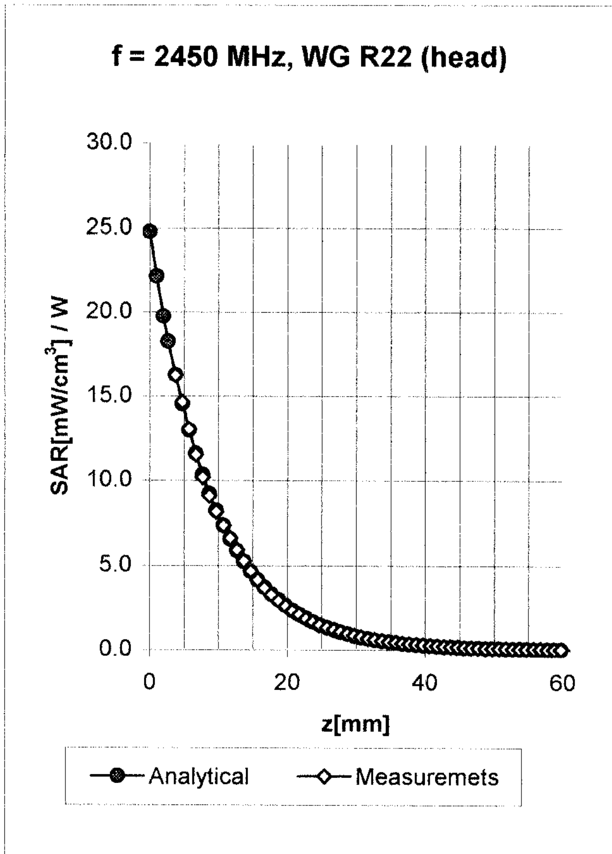


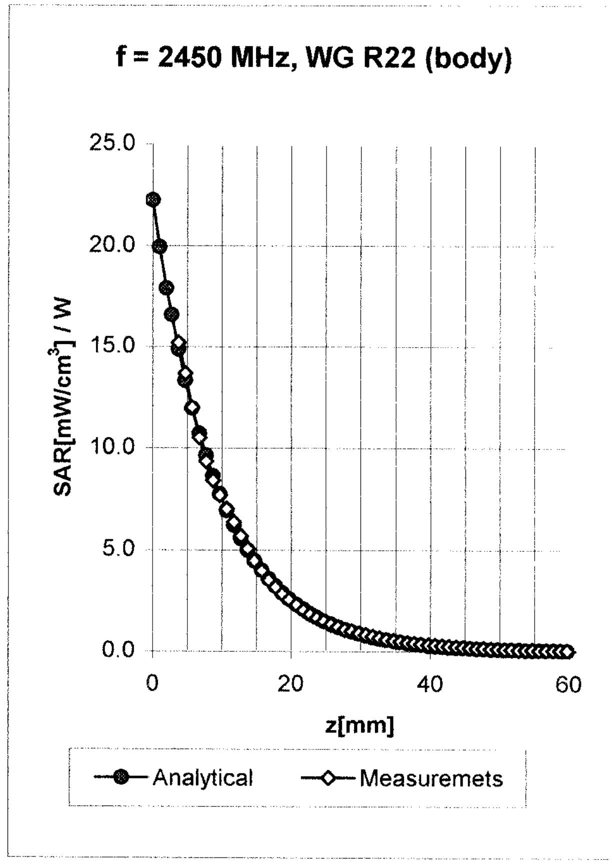


Body	**900 MHz**	ε_r **= 55.0 ± 5%**	σ **= 1.05 ± 5% mho/m**	
Body	**835 MHz**	ε_r **= 55.2 ± 5%**	σ **= 0.97 ± 5% mho/m**	
	ConvF X	**6.4** ± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**6.4** ± 9.5% (k=2)	Alpha	**0.45**
	ConvF Z	**6.4** ± 9.5% (k=2)	Depth	**2.35**

Body	**1800 MHz**	ε_r **= 53.3 ± 5%**	σ **= 1.52 ± 5% mho/m**	
Body	**1900 MHz**	ε_r **= 53.3 ± 5%**	σ **= 1.52 ± 5% mho/m**	
	ConvF X	**4.9** ± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**4.9** ± 9.5% (k=2)	Alpha	**0.60**
	ConvF Z	**4.9** ± 9.5% (k=2)	Depth	**2.59**

Conversion Factor Assessment

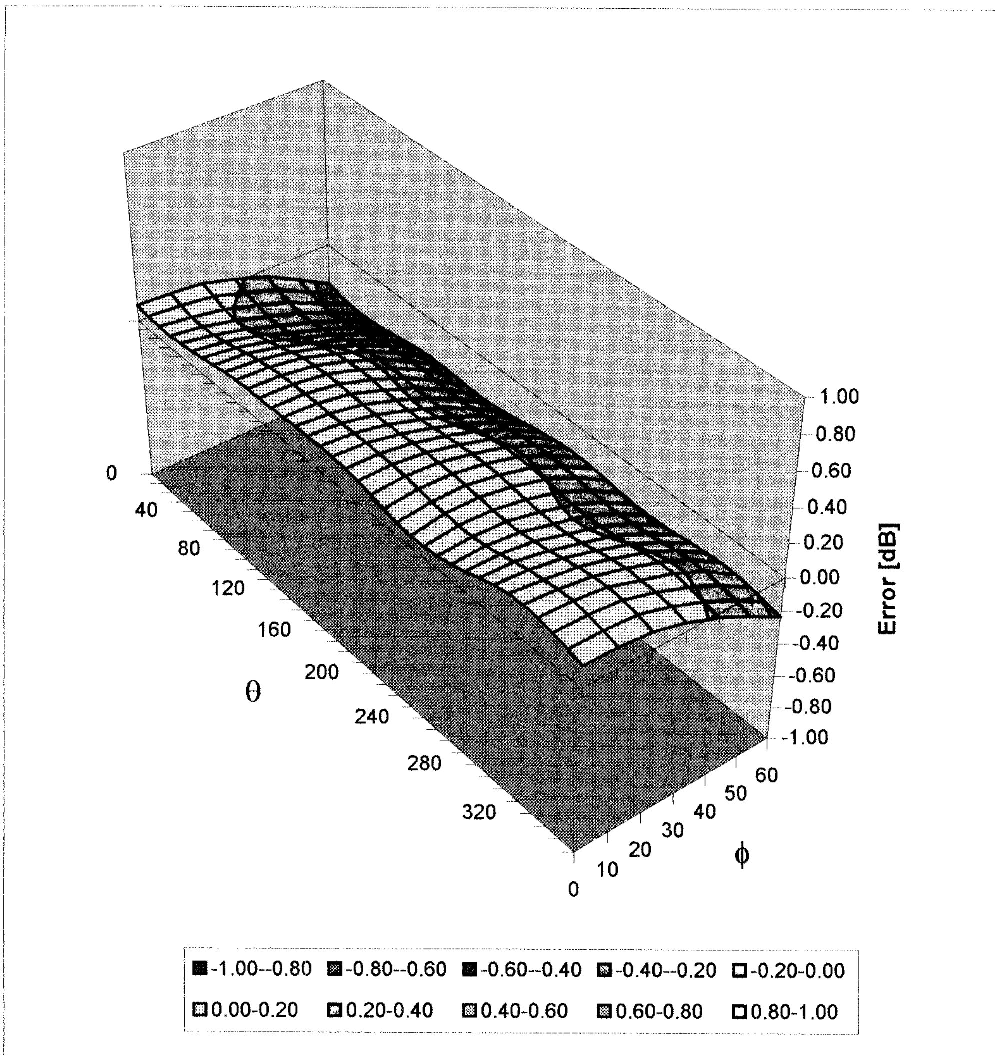




Head	**2450**	**MHz**		**ε_r = 39.2 ± 5%**	**σ = 1.80 ± 5% mho/m**	
	ConvF X		**5.0**	± 8.9% (k=2)	Boundary effect:	
	ConvF Y		**5.0**	± 8.9% (k=2)	Alpha	**1.04**
	ConvF Z		**5.0**	± 8.9% (k=2)	Depth	**1.85**
Body	**2450**	**MHz**		**ε_r = 52.7 ± 5%**	**σ = 1.95 ± 5% mho/m**	
	ConvF X		**4.6**	± 8.9% (k=2)	Boundary effect:	
	ConvF Y		**4.6**	± 8.9% (k=2)	Alpha	**1.20**
	ConvF Z		**4.6**	± 8.9% (k=2)	Depth	**1.60**

Deviation from Isotropy in HSL

Error (θ,φ), f = 900 MHz



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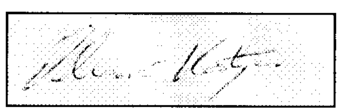
Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1387**
Place of Assessment:	**Zurich**
Date of Assessment:	**February 28, 2003**
Probe Calibration Date:	**February 26, 2003**

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:



Dosimetric E-Field Probe ET3DV6 SN:1387

Conversion factor (± standard deviation)

150 MHz	ConvF	**9.1 ± 8%**	ε_r = **52.3** **σ = 0.76 mho/m** (head tissue)
300 MHz	ConvF	**7.9 ± 8%**	ε_r = **45.3** **σ = 0.87 mho/m** (head tissue)
450 MHz	ConvF	**7.5 ± 8%**	ε_r = **43.5** **σ = 0.87 mho/m** (head tissue)
150 MHz	ConvF	**8.8 ± 8%**	ε_r = **61.9** **σ = 0.80 mho/m** (body tissue)
300 MHz	ConvF	**8.0 ± 8%**	ε_r = **58.2** **σ = 0.92 mho/m** (body tissue)
450 MHz	ConvF	**7.7 ± 8%**	ε_r = **56.7** **σ = 0.94 mho/m** (body tissue)

APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

1800MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

March 24, 2003

Frequency	e'	e''
1.700000000 GHz	41.1614	13.5085
1.710000000 GHz	41.1392	13.5114
1.720000000 GHz	41.0987	13.5347
1.730000000 GHz	41.0593	13.5575
1.740000000 GHz	41.0167	13.5884
1.750000000 GHz	40.9817	13.6242
1.760000000 GHz	40.9460	13.6667
1.770000000 GHz	40.8994	13.6940
1.780000000 GHz	40.8594	13.7298
1.790000000 GHz	40.8193	13.7532
1.800000000 GHz	40.7597	13.7828
1.810000000 GHz	40.7121	13.8144
1.820000000 GHz	40.6472	13.8261
1.830000000 GHz	40.5930	13.8623
1.840000000 GHz	40.5661	13.8813
1.850000000 GHz	40.5236	13.8980
1.860000000 GHz	40.4985	13.9160
1.870000000 GHz	40.4537	13.9254
1.880000000 GHz	40.4176	13.9416
1.890000000 GHz	40.3807	13.9736
1.900000000 GHz	40.3351	13.9811

1900MHz EUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

March 24, 2003

Frequency	e'	e''
1.780000000 GHz	51.5870	14.2946
1.790000000 GHz	51.5506	14.3269
1.800000000 GHz	51.4925	14.3737
1.810000000 GHz	51.4408	14.4085
1.820000000 GHz	51.3912	14.4348
1.830000000 GHz	51.3549	14.4789
1.840000000 GHz	51.3205	14.5144
1.850000000 GHz	51.2935	14.5438
1.860000000 GHz	51.2622	14.5701
1.870000000 GHz	51.2231	14.6140
1.880000000 GHz	51.1776	14.6566
1.890000000 GHz	51.1305	14.6867
1.900000000 GHz	51.1015	14.7192
1.910000000 GHz	51.0299	14.7575
1.920000000 GHz	51.0089	14.7908
1.930000000 GHz	50.9661	14.8294
1.940000000 GHz	50.9380	14.8624
1.950000000 GHz	50.8825	14.8708
1.960000000 GHz	50.8402	14.8960
1.970000000 GHz	50.7832	14.9068
1.980000000 GHz	50.7447	14.9402

1800MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

August 05, 2003

Frequency	e'	e''
1.700000000 GHz	39.7177	13.3950
1.710000000 GHz	39.6913	13.4172
1.720000000 GHz	39.6567	13.4285
1.730000000 GHz	39.6056	13.4679
1.740000000 GHz	39.5675	13.5060
1.750000000 GHz	39.5212	13.5488
1.760000000 GHz	39.4815	13.6002
1.770000000 GHz	39.4479	13.6386
1.780000000 GHz	39.3952	13.6577
1.790000000 GHz	39.3587	13.6918
1.800000000 GHz	39.2999	13.7118
1.810000000 GHz	39.2552	13.7631
1.820000000 GHz	39.1875	13.7587
1.830000000 GHz	39.1458	13.8054
1.840000000 GHz	39.1081	13.8316
1.850000000 GHz	39.0721	13.8388
1.860000000 GHz	39.0385	13.8627
1.870000000 GHz	38.9966	13.8859
1.880000000 GHz	38.9620	13.9046
1.890000000 GHz	38.9157	13.9456
1.900000000 GHz	38.8819	13.9760

1900MHz EUT Evaluation (Body)

Measured Fluid Dielectric Parameters (Muscle)

August 05, 2003

Frequency	e'	e''
1.800000000 GHz	50.9867	14.5857
1.810000000 GHz	50.9556	14.6132
1.820000000 GHz	50.8795	14.6354
1.830000000 GHz	50.8560	14.6890
1.840000000 GHz	50.8050	14.7197
1.850000000 GHz	50.7694	14.7413
1.860000000 GHz	50.7347	14.7660
1.870000000 GHz	50.7053	14.7866
1.880000000 GHz	50.6878	14.8148
1.890000000 GHz	50.6510	14.8597
1.900000000 GHz	50.6062	14.8766
1.910000000 GHz	50.5662	14.9214
1.920000000 GHz	50.5244	14.9540
1.930000000 GHz	50.4904	15.0012
1.940000000 GHz	50.4498	15.0230
1.950000000 GHz	50.4109	15.0367
1.960000000 GHz	50.3587	15.0415
1.970000000 GHz	50.3103	15.0645
1.980000000 GHz	50.2622	15.1017
1.990000000 GHz	50.2206	15.1441
2.000000000 GHz	50.1900	15.1734

APPENDIX F - 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

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