DECLARATION OF COMPLIANCE
SAR EVALUATION

Test Lab

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Applicant Information

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FCC Rule Part(s):	**47 CFR §2.1093**
Test Procedure(s):	**FCC OET Bulletin 65, Supplement C (01-01); IEEE Std 1528-200X (Draft)**
FCC ID:	**ABLSH-G1000**
Model(s):	**SH-G1000**
Device Type:	**PCS CDMA Phone / PDA Combination with Wireless Capabilities**
FCC Classification:	**Part 24 Licensed Portable Transmitter held to ear (PCE)**
Mode(s) of Operation:	**PCS CDMA**
Tx Frequency Range:	**1851.25 - 1908.75 MHz**
Conducted Power Tested:	**24.5 dBm (Max.)**
Antenna Type:	**Fixed Stubby**
Battery Type:	**3.7V Lithium-Ion (Model: SH-G1000BAT)**
Body-Worn Accessories:	**Softcase with Belt-Clip, Ear-Microphone**
Max. SAR Measured:	**1.44 W/kg (Head)** **0.401 W/kg (Body-worn)** **1.17 W/kg (Lap held)**

Celltech Labs Inc. declares under its sole responsibility that this device was found to be in compliance with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC 47 CFR §2.1093. The device was tested in accordance with the measurement standards and procedures specified in FCC OET Bulletin 65, Supplement C, Edition 01-01 and IEEE Standard 1528-200X (Draft) for the General Population / Uncontrolled Exposure environment.

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 W. Pipe
Senior Compliance Technologist
Celltech Labs Inc.

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1.0 INTRODUCTION

This measurement report shows that the HITACHI LTD. Model: SH-G1000 Single-Mode PCS CDMA Phone / PDA Combination with Wireless Capabilities FCC ID: ABLSH-G1000 complies with FCC 47 CFR §2.1093 (see reference [1]) (General Population / Uncontrolled Exposure environment). The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [2]), and IEEE 1528-200X (see reference [3]) 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 Equipment Under Test (EUT)

EUT Type	Single-Mode PCS CDMA Phone / PDA Combination with Wireless Capabilities
Equipment Class	Licensed Portable Transmitter Held to Ear (PCE)
FCC Rule Part(s)	47 CFR §2.1093
Test Procedure(s)	FCC OET Bulletin 65, Supplement C (01-01) IEEE 1528-200X (DRAFT)
FCC ID	ABLSH-G1000
Model No.(s)	SH-G1000
Tx Frequency Range	1851.25 - 1908.75 MHz
Measured RF Conducted Power	24.5 dBm (Max.)
Mode(s) of Operation	PCS CDMA
Battery Type(s)	3.7V Lithium-ion (Model: SG-G1000BAT)
Antenna Type	Fixed Stubby (Length: 34 mm)
Body-Worn Accessories Tested	Softcase with Belt-Clip, Ear-Microphone

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 face-held and/or body-worn 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

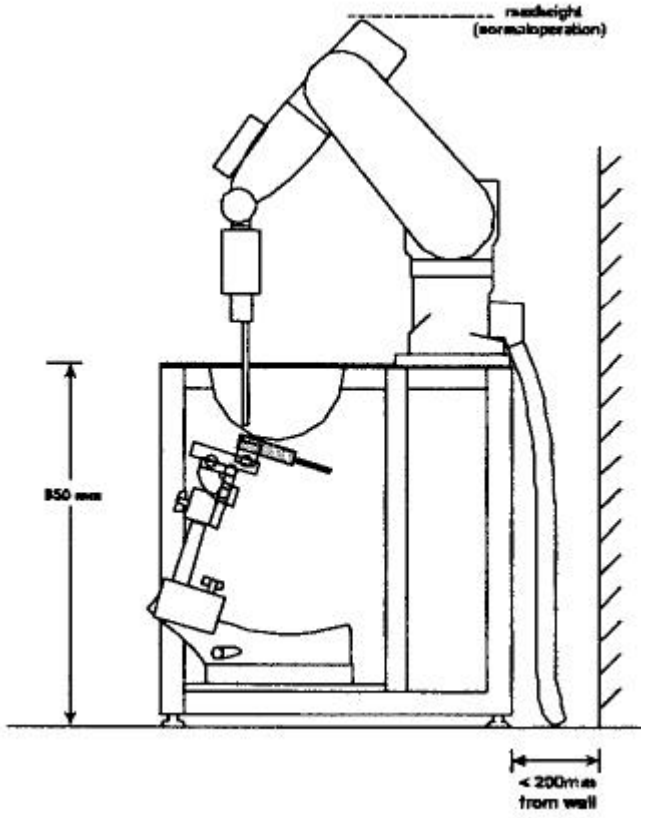


Figure 1. DASY3 Compact Version - Side View

4.0 MEASUREMENT SUMMARY

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the EUT are reported in Appendix A.

HEAD SAR MEASUREMENT RESULTS									
Freq. (MHz)	Channel	Test Mode	Battery Type	Conducted Power (dBm)		Antenna Position	Phantom Section	Test Position	Measured SAR 1g (W/kg)
				Before	After				
1851.25	25	PCS CDMA	Standard	24.5	24.3	Fixed	Left Ear	Cheek/Touch	1.29
1880.00	600	PCS CDMA	Standard	24.5	24.4	Fixed	Left Ear	Cheek/Touch	1.17
1908.75	1175	PCS CDMA	Standard	24.5	24.3	Fixed	Left Ear	Cheek/Touch	1.44
1851.25	25	PCS CDMA	Standard	24.5	24.4	Fixed	Left Ear	Ear/Tilt (15°)	0.736
1880.00	600	PCS CDMA	Standard	24.5	24.4	Fixed	Left Ear	Ear/Tilt (15°)	0.681
1908.75	1175	PCS CDMA	Standard	24.5	24.3	Fixed	Left Ear	Ear/Tilt (15°)	0.759
1851.25	25	PCS CDMA	Standard	24.5	24.4	Fixed	Right Ear	Cheek/Touch	0.914
1880.00	600	PCS CDMA	Standard	24.5	24.5	Fixed	Right Ear	Cheek/Touch	1.14
1908.75	1175	PCS CDMA	Standard	24.5	24.4	Fixed	Right Ear	Cheek/Touch	1.11
1851.25	25	PCS CDMA	Standard	24.5	24.4	Fixed	Right Ear	Ear/Tilt (15°)	0.532
1880.00	600	PCS CDMA	Standard	24.5	24.5	Fixed	Right Ear	Ear/Tilt (15°)	0.582
1908.75	1175	PCS CDMA	Standard	24.5	24.3	Fixed	Right Ear	Ear/Tilt (15°)	0.574

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

Test Date(s)	03/10/03		**Relative Humidity**	68 %
Measured Mixture Type	1900MHz Brain		**Atmospheric Pressure**	101.5 kPa
Dielectric Constant ε_r	**IEEE Target**	**Measured**	**Ambient Temperature**	22.8 °C
	40.0 ±5%	38.4	**Fluid Temperature**	22.0 °C
Conductivity σ (mho/m)	**IEEE Target**	**Measured**	**Fluid Depth**	≥ 15 cm
	1.40 ±5%	1.42	**ρ (Kg/m^3)**	1000

Note(s):

1. 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 above were consistent for all measurement periods.
2. The dielectric properties of the simulated body fluid were verified 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).

MEASUREMENT SUMMARY (Cont.)

BODY SAR MEASUREMENT RESULTS											
Freq. (MHz)	Chan.	Test Mode	Battery Type	Conducted Power (dBm)		EUT Position	Antenna Position	Test Config.	Accessory	Separation Distance to Planar Phantom	Measured SAR 1g (W/kg)
				Before	After						
1851.25	25	PCS CDMA	Standard	24.5	24.3	Back	Fixed	Body-worn	Softcase Belt-Clip	2.3 cm	0.342
1880.00	600	PCS CDMA	Standard	24.5	24.5	Back	Fixed	Body-worn	Softcase Belt-Clip	2.3 cm	0.401
1908.75	1175	PCS CDMA	Standard	24.5	24.4	Back	Fixed	Body-worn	Softcase Belt-Clip	2.3 cm	0.271
1851.25	25	PCS CDMA	Standard	24.5	24.4	Back	Fixed	Lap held	Softcase	1.0 cm	1.17
1880.00	600	PCS CDMA	Standard	24.5	24.4	Back	Fixed	Lap held	Softcase	1.0 cm	1.07
1908.75	1175	PCS CDMA	Standard	24.5	24.4	Back	Fixed	Lap held	Softcase	1.0 cm	0.922

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)	03/10/03		**Relative Humidity**	68%
Mixture Type	1900MHz Body		**Atmospheric Pressure**	101.5 kPa
Dielectric Constant ε_r	**IEEE Target**	**Measured**	**Ambient Temperature**	22.8 °C
	53.3 ±5%	51.7	**Fluid Temperature**	22.0 °C
Conductivity σ (mho/m)	**Target**	**Measured**	**Fluid Depth**	≥ 15 cm
	1.52 ±5%	1.55	**ρ (Kg/m^3)**	1000

Note(s):

1. 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 above were consistent for all measurement periods.
2. The dielectric properties of the simulated body fluid were verified 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).
3. An ear-microphone accessory was connected to the EUT for the duration of the tests.

5.0 DETAILS OF SAR EVALUATION

The HITACHI LTD. Model: SH-G1000 Single-Mode PCS CDMA Phone / PDA Combination with Wireless Capabilities FCC ID: ABLSH-G1000 was found to be compliant for localized Specific Absorption Rate (SAR) based on the test provisions and conditions described below. The detailed test setup photographs are shown in Appendix G.

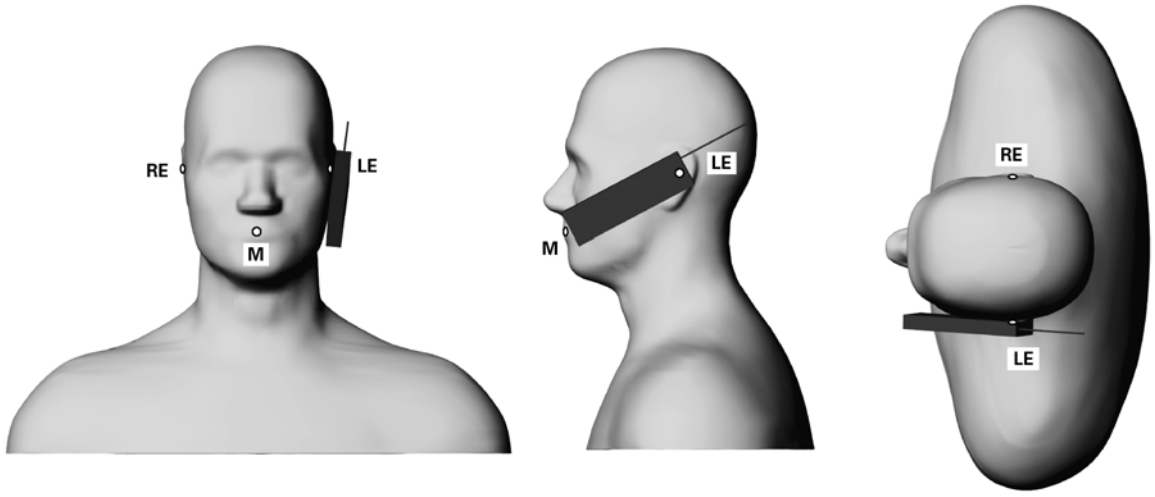
1) The EUT was tested in an ear-held configuration on both the left and right sections of the SAM at the middle channel of the operating band. If the SAR value of the middle channel for each test configuration (left ear, right ear, cheek/touch or ear/tilt) was 3dB or greater below the SAR limit, measurements at the low and high channels were optional for those test configurations (head and body SAR).

a) The handset was placed in the device holder in a normal operating position with the test device reference point located along the vertical centerline on the front of the device aligned to the ear reference point, with the center of the earpiece touching the center of the ear spacer of the SAM phantom.

b) With the handset positioned parallel to the cheek, the test device reference point was aligned to the ear reference point on the head phantom, and the vertical centerline was aligned to the phantom reference plane (initial ear position).

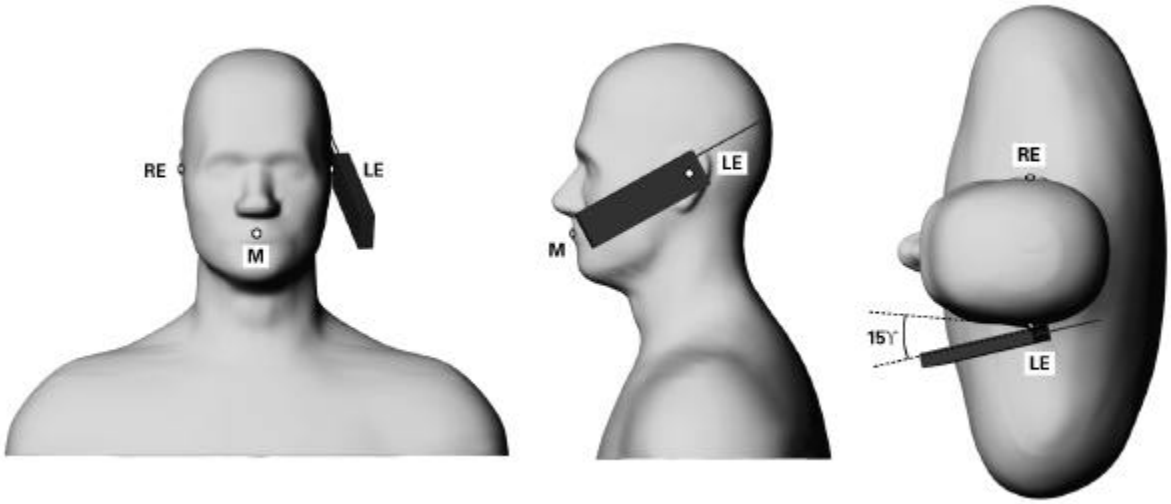
c) While maintaining the three alignments, the body of the handset was gradually adjusted to each of the following test positions:

- Cheek/Touch Position: the handset was brought toward the mouth of the head phantom by pivoting against the ear reference point until any point of the mouthpiece or keypad touched the phantom.



Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated (Shoulders are shown for illustration only).

- Ear/Tilt Position: With the phone aligned in the Cheek/Touch position, the handset was tilted away from the mouth with respect to the test device reference point by 15 degrees.



Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated (Shoulders are shown for illustration only).

2) The EUT was tested in a body-worn configuration placed inside the softcase accessory. The back of the EUT inside the softcase was positioned parallel to the outer surface of the SAM phantom (planar section). The belt-clip attached to the back of the softcase provided a 2.3 cm separation distance between the back of the EUT and the outer surface of the SAM phantom (planar section). An ear-microphone accessory was connected to the EUT for the duration of the test.
3) The EUT was tested in a lap held configuration placed inside the softcase accessory. The front flip-cover of the softcase was folded back behind the rear surface of the softcase. The back of the EUT inside the softcase was positioned parallel to the outer surface of the SAM phantom (planar section). The softcase with the front flip-cover folded behind the rear surface (with belt-clip removed) provided a 1.0 cm separation distance between the back of the EUT and the outer surface of the SAM phantom (planar section). An ear-microphone accessory was connected to the EUT for the duration of the test.
4) The softcase with belt-clip accessory does not have a part number due to the fact that this accessory is the only body-worn accessory available and is provided with the device. Subsequently, the model name of this accessory is Softcase with Belt-Clip. The ear-microphone accessory used was a generic ear-microphone.
5) The EUT was placed into modulated CDMA test mode via internal software at a full data rate in the "always up" power control mode.
6) The conducted power levels were measured before and after each test according to the procedures described in FCC 47 CFR §2.1046 using a Gigatronics 8652A Universal Power Meter. If the conducted power levels measured after each evaluation varied more than 5% from the initial power level, then the EUT was retested. Any unusual anomalies over the course of the test also warranted a re-evaluation.
7) The location of the maximum spatial SAR distribution (Hot Spot) was determined relative to the device and its antenna.
8) The EUT 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 1.3 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 [4]). Through the points in the first 3 cm in each z-axis, polynomials of the fourth order were calculated. These polynomials were 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 [4]).

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.

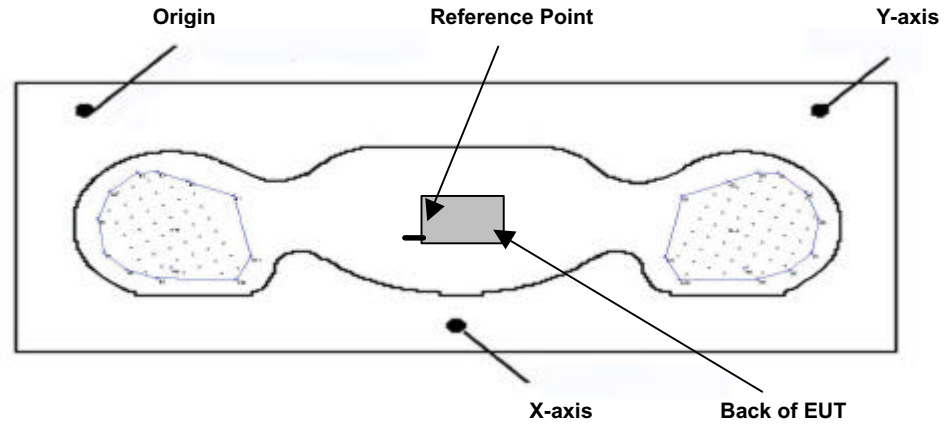


Figure 2. Device Positioning & Reference Point (Body SAR - Back of EUT)

EVALUATION PROCEDURES (Cont.)

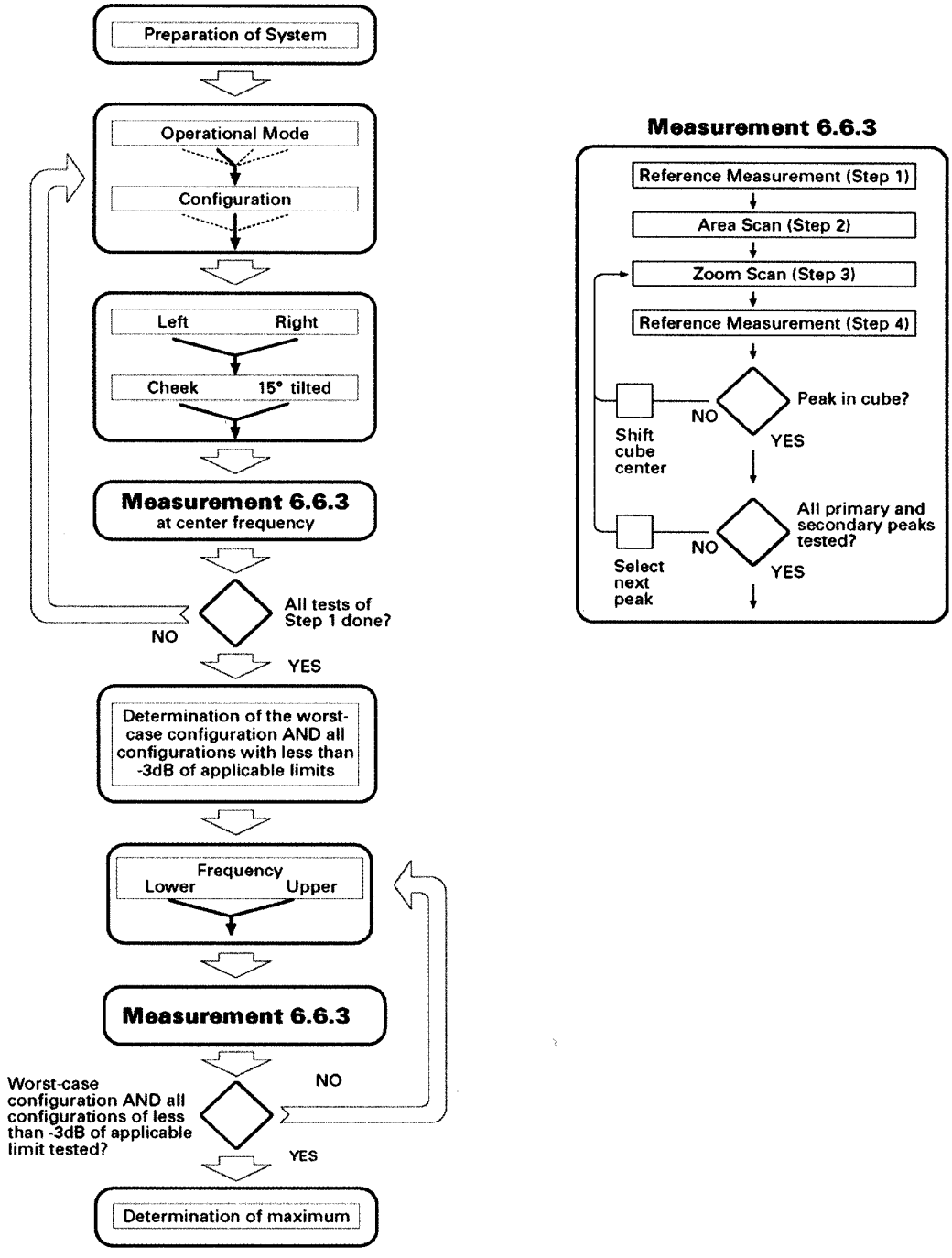


Figure 3. Flow Chart of the recommended practices and procedures per IEEE Std 1528-200X - Draft (see reference [3])

7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation a system check was performed at the planar section of the SAM phantom with an 1800MHz dipole (see Appendix C for detailed system validation procedures). The fluid dielectric parameters were measured 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 250 mW 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				
03/10/03	Brain	9.53 ±10%	9.82	40.0 ±5%	38.6	1.40 ±5%	1.41	1000	22.8 °C	22.0 °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.

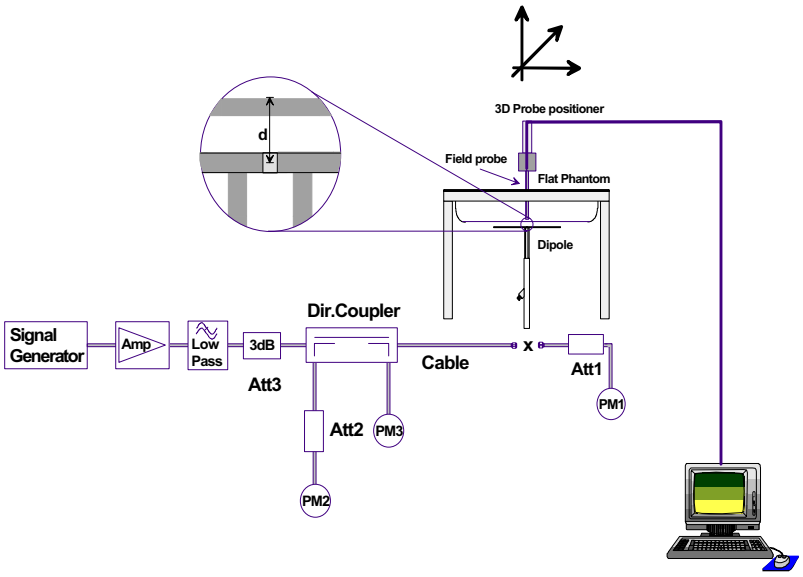


Figure 3. System Check Setup Diagram

1800MHz System Check Setup

8.0 SIMULATED 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			
INGREDIENT	**1800MHz Brain (System Check)**	**1900MHz Brain (EUT Evaluation)**	**1900MHz Body (EUT Evaluation)**
Water	548.0 g	552.40 g	716.60 g
Glycol Monobutyl	448.5 g	444.52 g	300.70 g
Salt	3.20 g	3.06 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.:	1590
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

13.0 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)
Dynam. Rnge:	5 µW/g to >100 mW/g; Linearity: ±0.2 dB
Srfce. 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 VALIDATION PLANAR PHANTOM

The validation planar phantom is constructed of Plexiglas material with a 6.0 mm shell thickness for system validations at and below 450MHz. The validation planar phantom is mounted in the DASY3 compact system in place of the SAM phantom.

Validation Planar Phantom

11.0 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 V4.0C

12.0 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

SAR MEASUREMENT SYSTEM		
EQUIPMENT	**SERIAL NO.**	**CALIBRATION DATE**
DASY3 System -Robot -ET3DV6 E-Field Probe -300MHz Validation Dipole -450MHz Validation Dipole -900MHz Validation Dipole -1800MHz Validation Dipole -2450MHz Validation Dipole -SAM Phantom V4.0C -Plexiglas Planar Phantom	 599396-01 1590 135 136 054 247 150 N/A N/A	 N/A Dec 2002 Oct 2002 Oct 2002 June 2001 June 2001 Oct 2002 N/A N/A
85070C Dielectric Probe Kit	N/A	N/A
Gigatronics 8652A Power Meter -Power Sensor 80701A -Power Sensor 80701A	1835272 1833535 1833542	Feb 2003 Feb 2003 Mar 2003
E4408B Spectrum Analyzer	US39240170	Nov 2002
8594E Spectrum Analyzer	3543A02721	Feb 2003
8753E Network Analyzer	US38433013	Feb 2003
8648D Signal Generator	3847A00611	Feb 2003
5S1G4 Amplifier Research Power Amplifier	26235	N/A

15.0 MEASUREMENT UNCERTAINTIES

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	∞
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					**± 13.7**	
Expanded Uncertainty (k=2)					**± 27.5**	

Measurement Uncertainty Table in accordance with IEEE Std 1528-200X (Draft - see reference [3])

16.0 REFERENCES

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

[2] 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.

[3] 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”.

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

APPENDIX A - SAR MEASUREMENT DATA

APPENDIX B - SYSTEM CHECK DATA

System Performance Check - 1800MHz Dipole

SAM Phantom; Flat Section

Probe: ET3DV6 - SN1590; ConvF(5.60,5.60,5.60); Crest factor: 1.0; 1800 MHz Brain: σ = 1.41 mho/m ε_r = 38.6 ρ = 1.00 g/cm^3

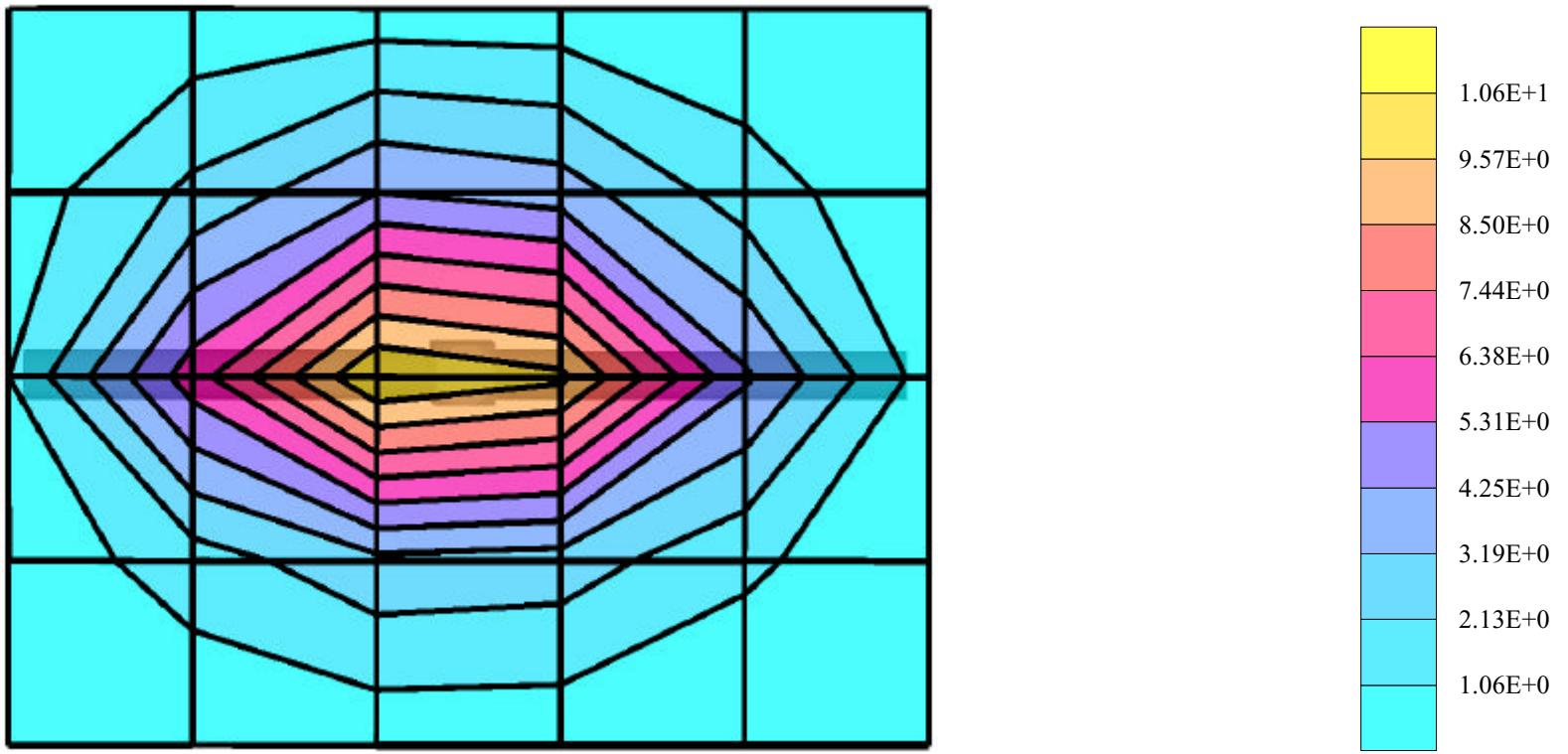
Cube 5x5x7: Peak: 18.4 mW/g, SAR (1g): 9.82 mW/g, SAR (10g): 5.12 mW/g, (Worst-case extrapolation)

Penetration depth: 8.3 (7.7, 9.4) [mm]; Powerdrift: -0.01 dB

Ambient Temp. 22.8°C; Fluid Temp. 22.0°C

Forward Conducted Power: 250 mW

Date Tested: March 10, 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: 

Approved by: 

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**

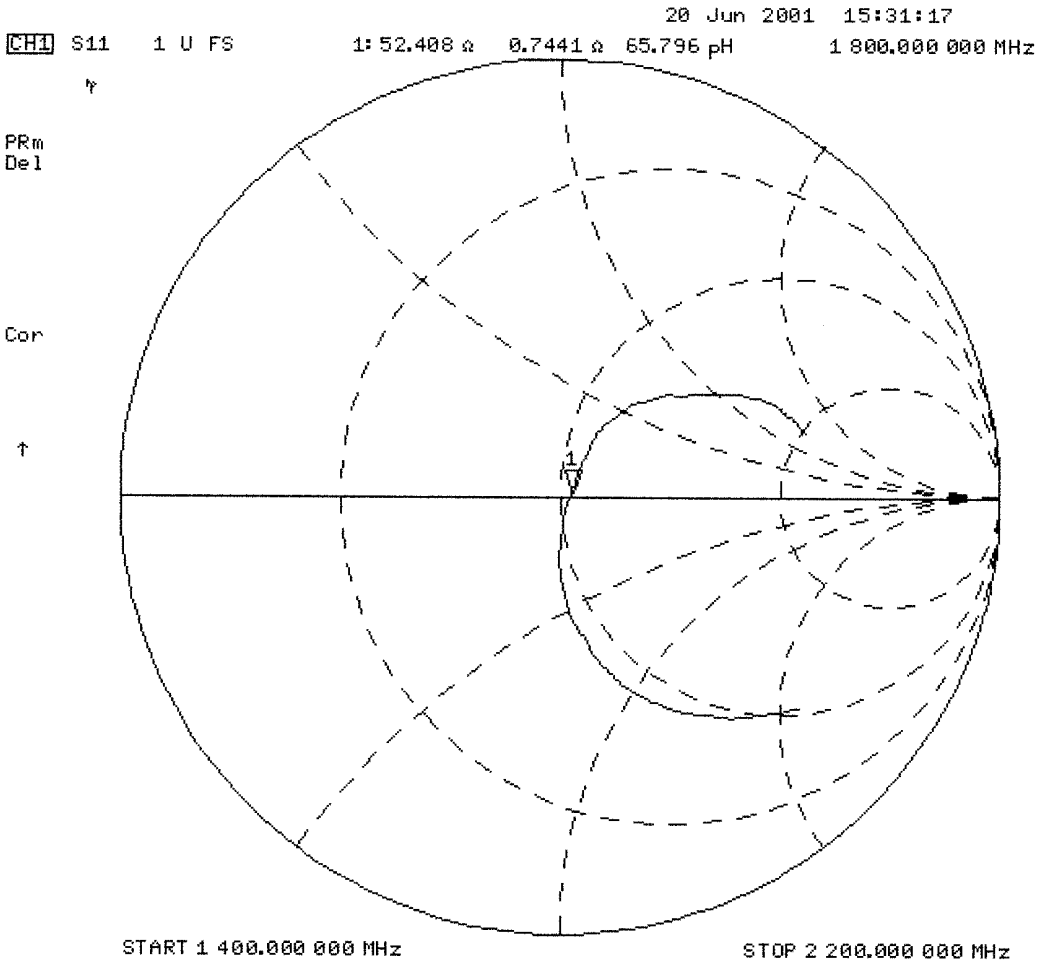
Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well. The estimated sensitivities of SAR-values and penetration depths to the liquid parameters are listed in the DASY Application Note 4: 'SAR Sensitivities'.

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
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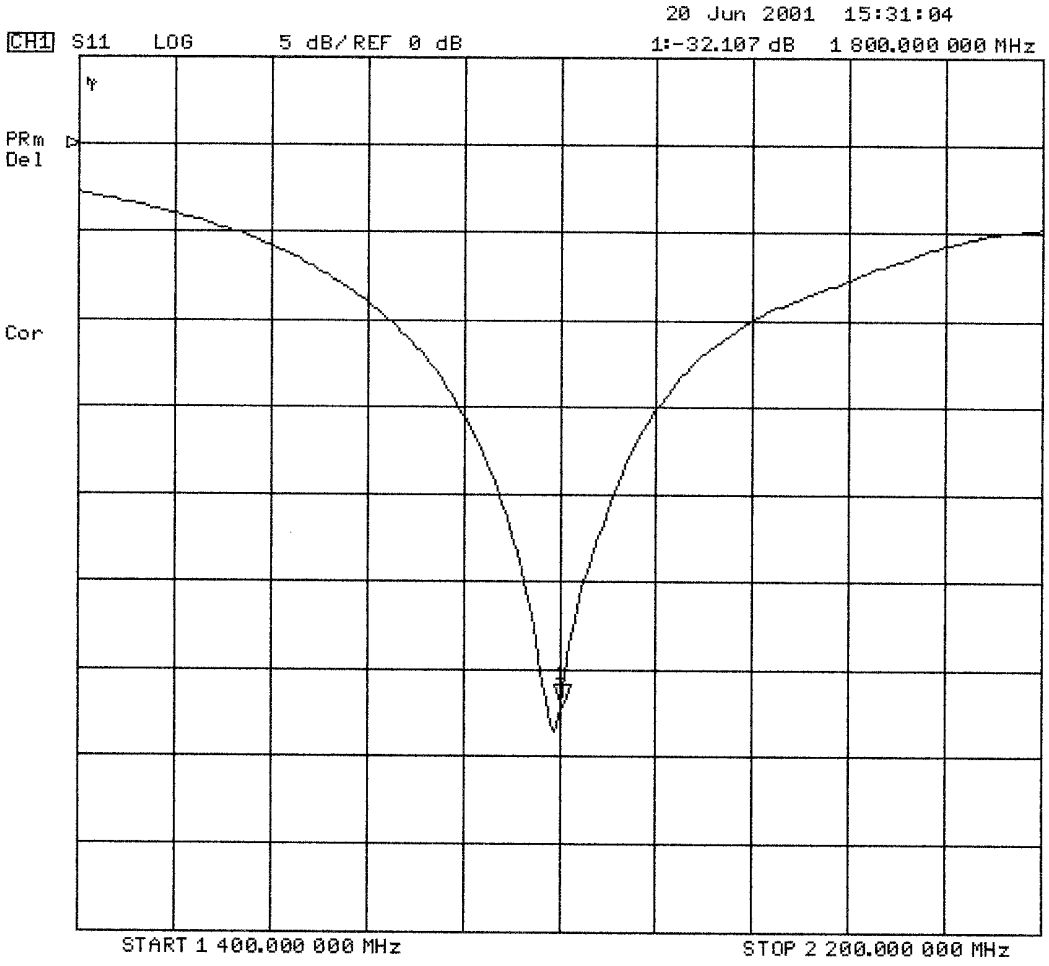
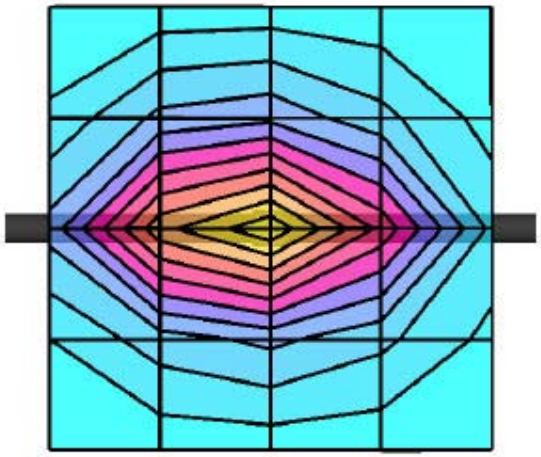
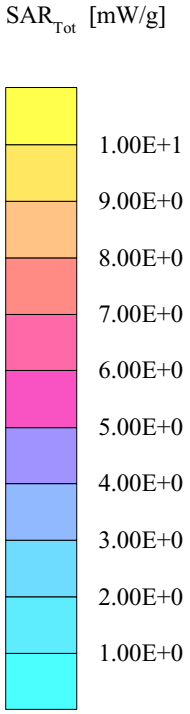
1 800.000 000 MHz
PRm
Del
Cor
START 1 400.000 000 MHz
STOP 2 200.000 000 MHz


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





APPENDIX D - PROBE CALIBRATION

Schmid & Partner
Engineering AG

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

Calibration Certificate

Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1590**
Place of Calibration:	**Zurich**
Date of Calibration:	**December 1, 2002**
Calibration Interval:	**12 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:	
Approved by:	

Schmid & Partner
Engineering AG

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

Probe ET3DV6

SN:1590

Manufactured:	March 19, 2001
Last calibration:	April 26, 2002
Recalibrated:	December 1, 2002

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1590

Sensitivity in Free Space

NormX	**1.75**	$\mu V/(V/m)^2$	
NormY	**1.89**	$\mu V/(V/m)^2$	
NormZ	**1.63**	$\mu V/(V/m)^2$	

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**	
	ConvF X	**6.9** ± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**6.9** ± 9.5% (k=2)	Alpha	**0.30**
	ConvF Z	**6.9** ± 9.5% (k=2)	Depth	**2.71**
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	**5.6** ± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**5.6** ± 9.5% (k=2)	Alpha	**0.42**
	ConvF Z	**5.6** ± 9.5% (k=2)	Depth	**2.56**

Boundary Effect

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

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	8.7	5.0
SAR_{be} [%]	With Correction Algorithm	0.3	0.5

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

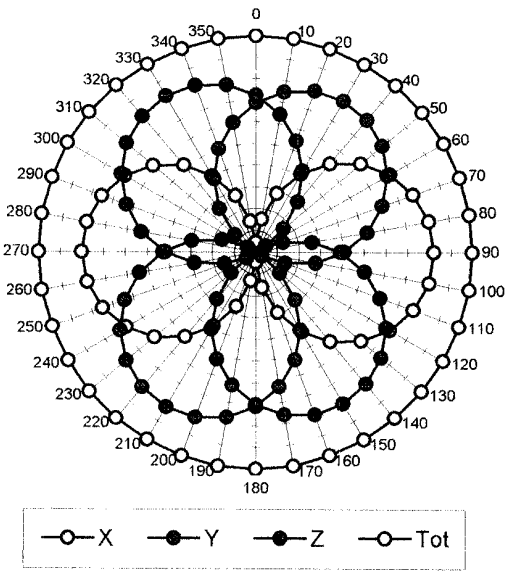
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	10.7	7.4
SAR_{be} [%]	With Correction Algorithm	0.1	0.3

Sensor Offset

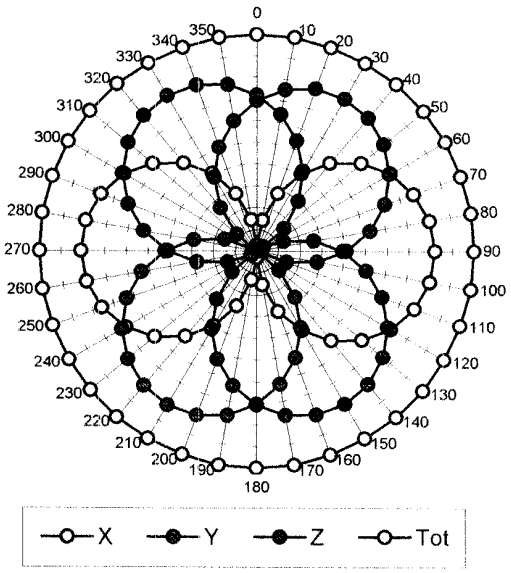
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.2 ± 0.2**	mm

Receiving Pattern (ϕ), θ = 0°

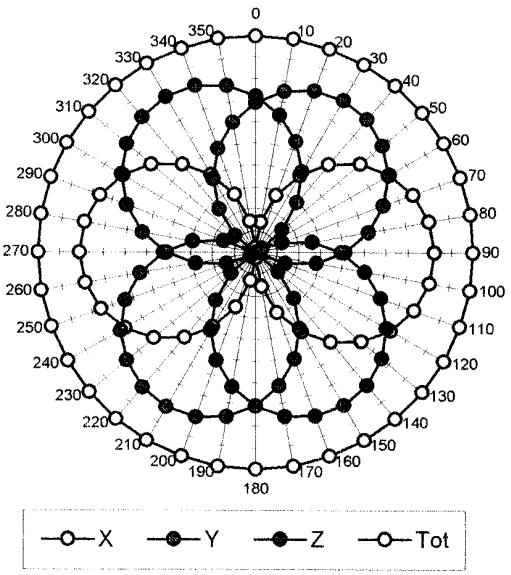
f = 30 MHz, TEM cell ifi110



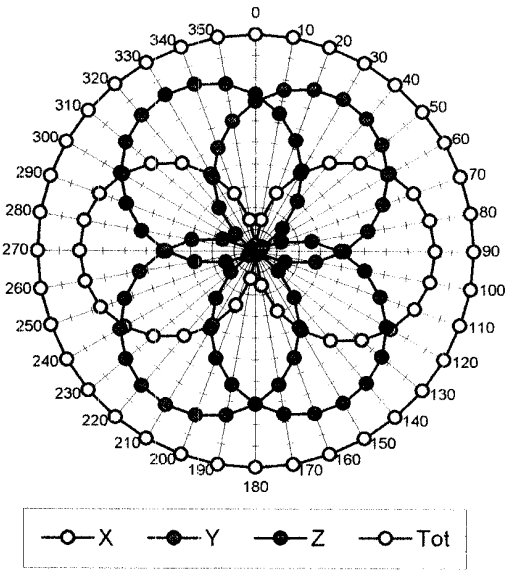
f = 100 MHz, TEM cell ifi110

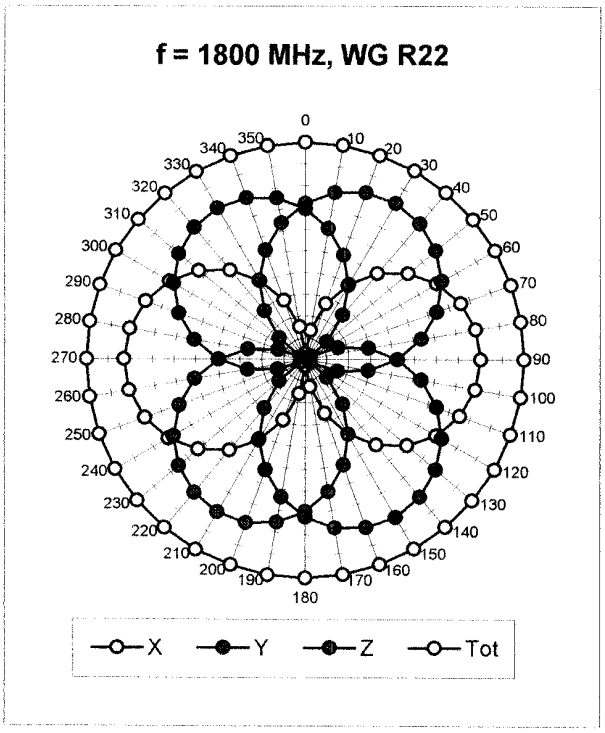


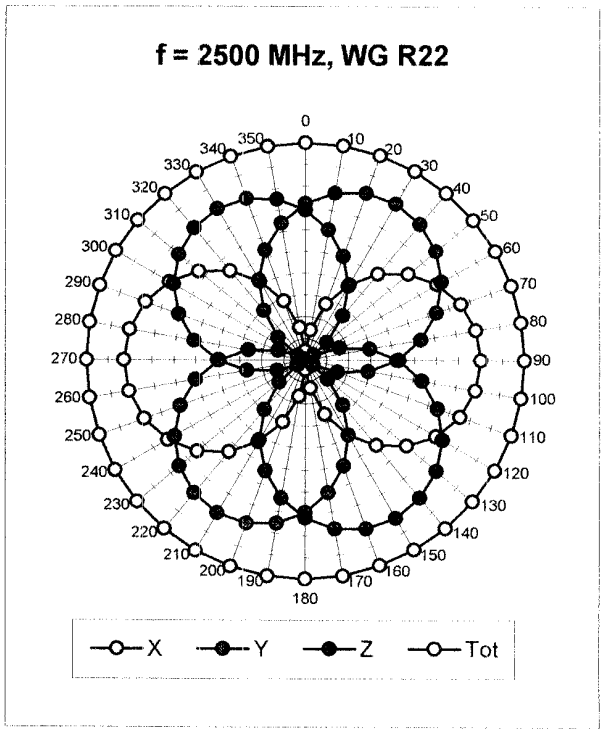
f = 300 MHz, TEM cell ifi110



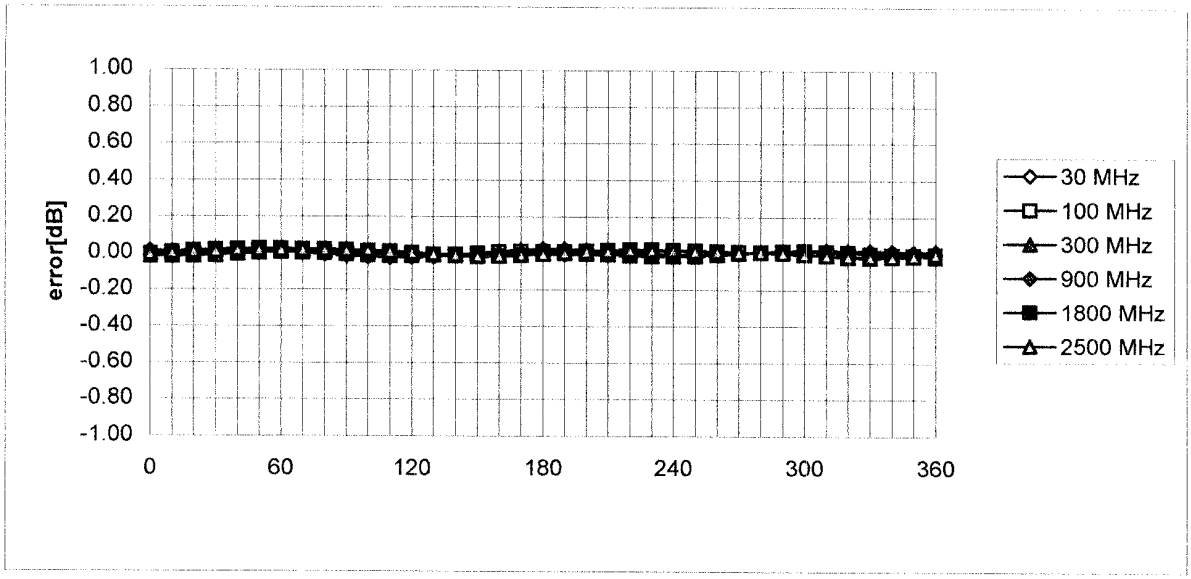
f = 900 MHz, TEM cell ifi110





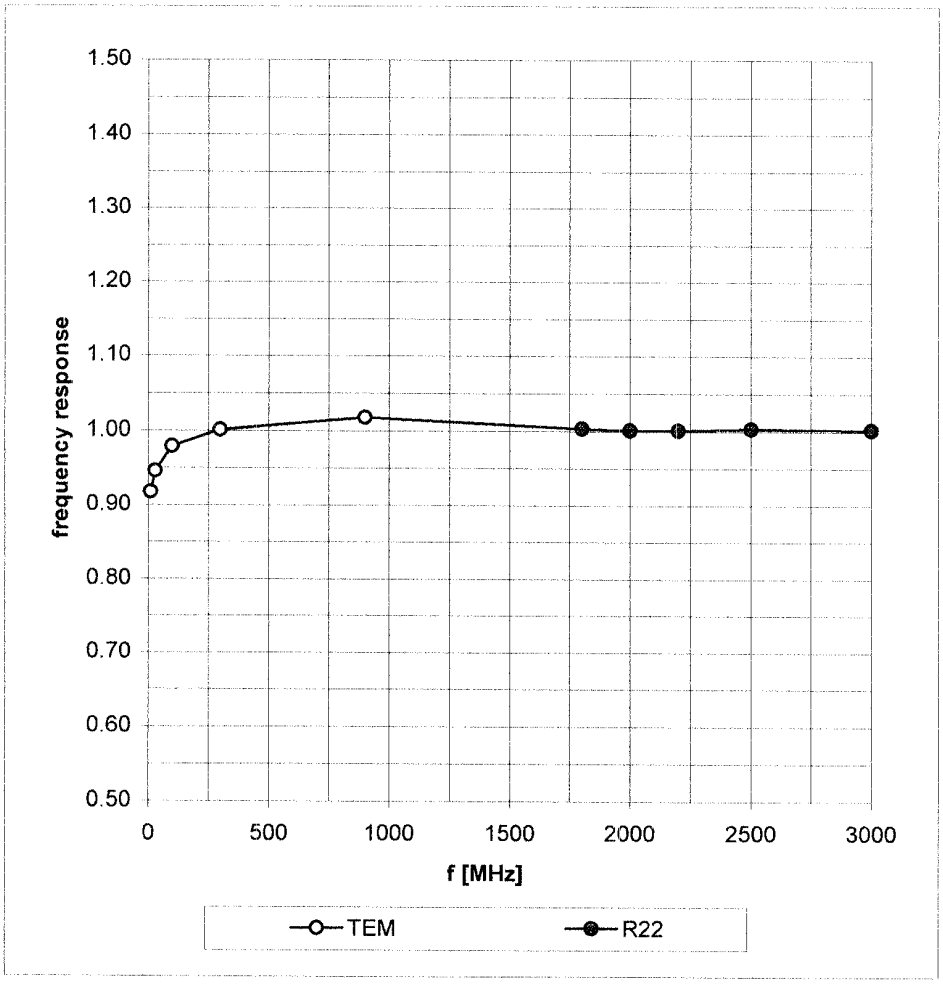


Isotropy Error (ϕ), θ = 0°



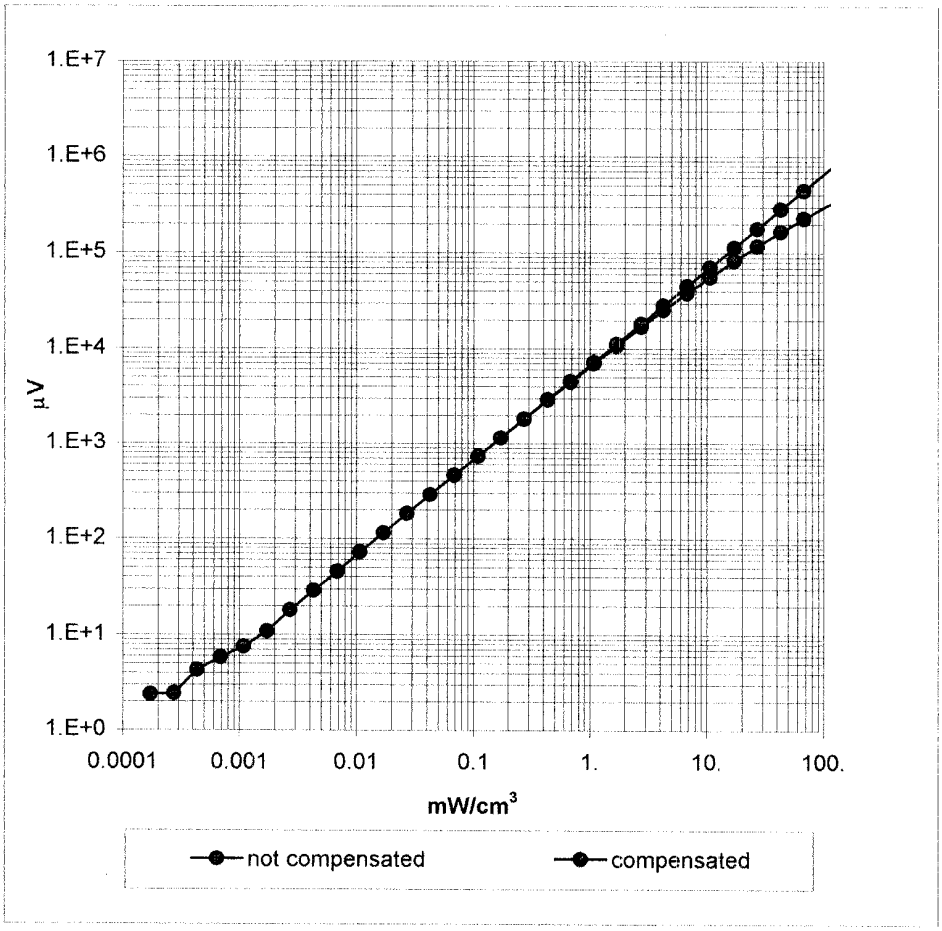
Frequency Response of E-Field

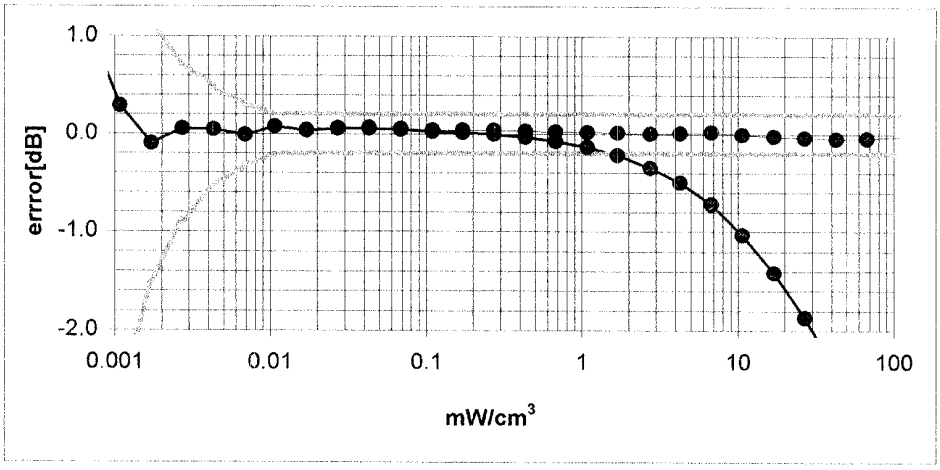
(TEM-Cell:ifi110, Waveguide R22)



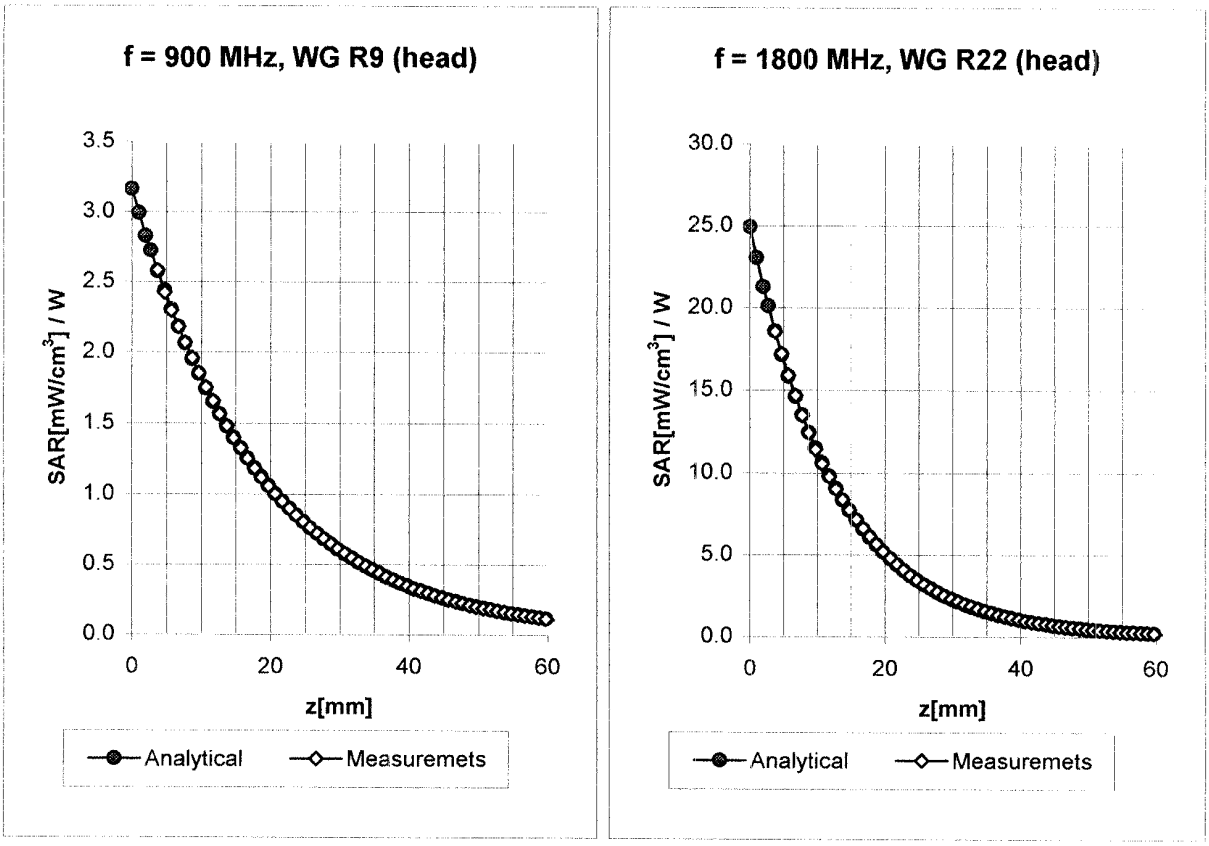
Dynamic Range f(SAR_{brain})

(Waveguide R22)





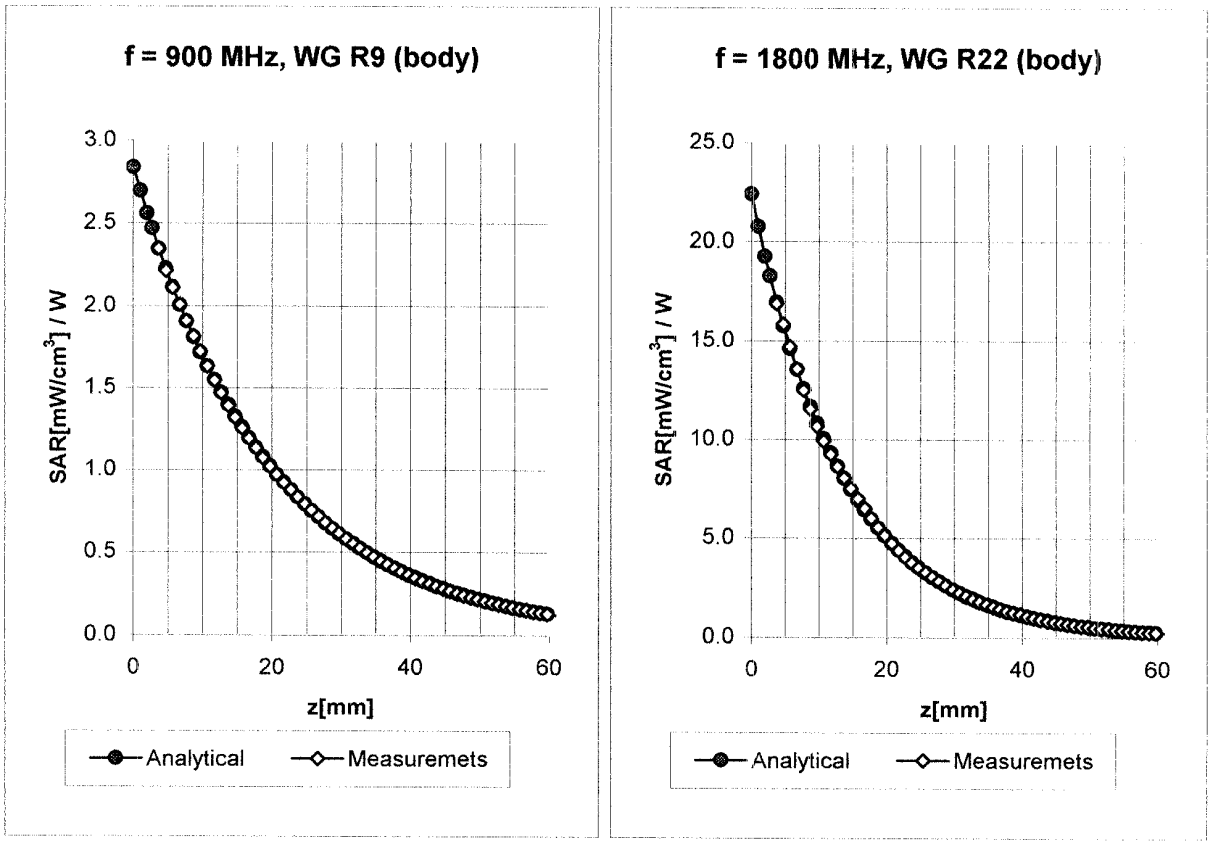
Conversion Factor Assessment



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	**6.9** ± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**6.9** ± 9.5% (k=2)	Alpha	**0.30**
	ConvF Z	**6.9** ± 9.5% (k=2)	Depth	**2.71**

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	**5.6** ± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**5.6** ± 9.5% (k=2)	Alpha	**0.42**
	ConvF Z	**5.6** ± 9.5% (k=2)	Depth	**2.56**

Conversion Factor Assessment

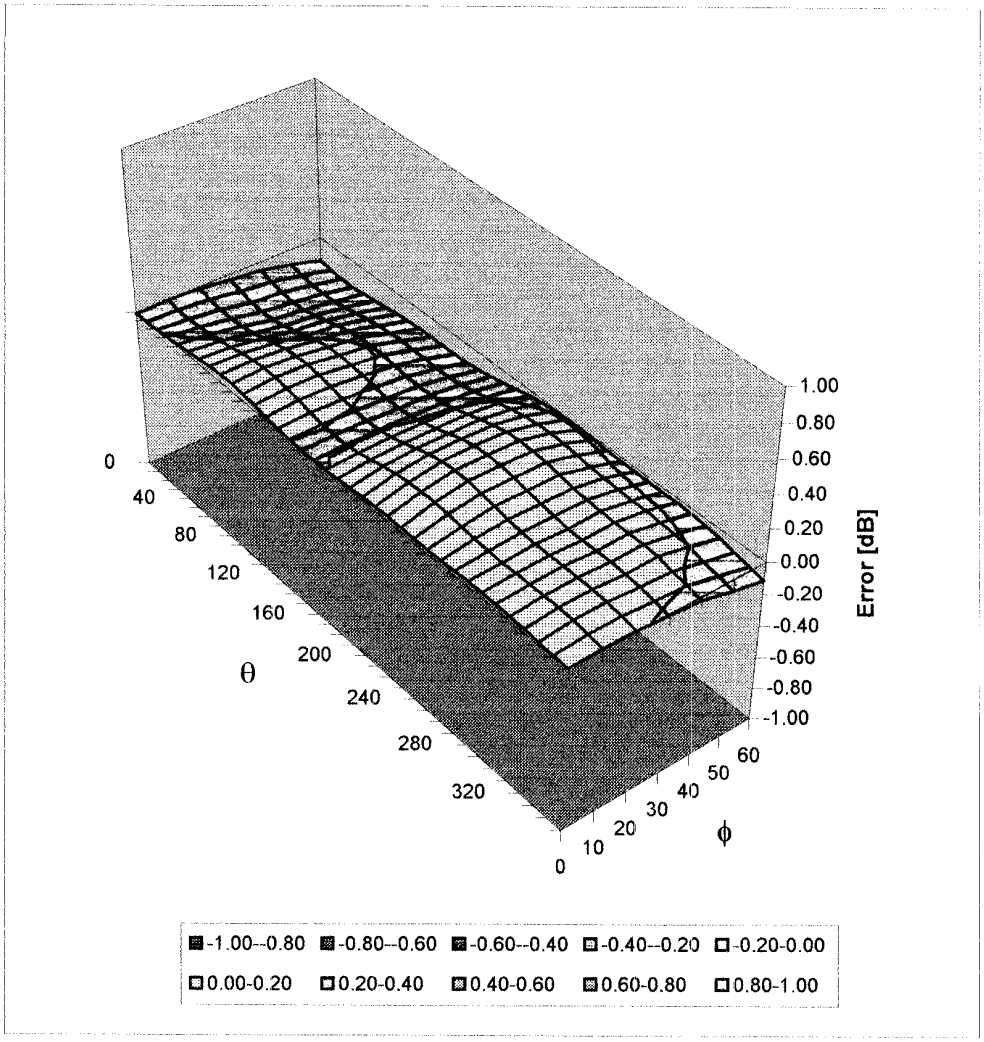


Body	**900 MHz**	ε_r = **55.0 ± 5%**	σ = **1.05 ± 5% mho/m**	
Body	**835 MHz**	ε_r = **55.2 ± 5%**	σ = **0.97 ± 5% mho/m**	
	ConvF X	**6.7** ± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**6.7** ± 9.5% (k=2)	Alpha	**0.34**
	ConvF Z	**6.7** ± 9.5% (k=2)	Depth	**2.57**

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	**5.3** ± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**5.3** ± 9.5% (k=2)	Alpha	**0.52**
	ConvF Z	**5.3** ± 9.5% (k=2)	Depth	**2.46**

Deviation from Isotropy in HSL

Error (θ,φ), f = 900 MHz



Schmid & Partner
Engineering AG

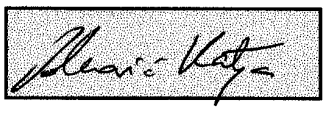
Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1590**
Place of Assessment:	**Zurich**
Date of Assessment:	**May 1, 2002**
Probe Calibration Date:	**April 26, 2002**

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:1590

Conversion factor (± standard deviation)

150 MHz	ConvF	**9.4 ± 8%**	**ε_r = 52.3** **σ = 0.76 mho/m** (head tissue)
300 MHz	ConvF	**8.2 ± 8%**	**ε_r = 45.3** **σ = 0.87 mho/m** (head tissue)
450 MHz	ConvF	**7.8 ± 8%**	**ε_r = 43.5** **σ = 0.87mho/m** (head tissue)
150 MHz	ConvF	**9.1 ± 8%**	**ε_r = 61.9** **σ = 0.80 mho/m** (body tissue)
450 MHz	ConvF	**7.9 ± 8%**	**ε_r = 56.7** **σ = 0.94 mho/m** (body tissue)
2450 MHz	ConvF	**4.5 ± 8%**	**ε_r = 39.2** **σ = 1.80 mho/m** (head tissue)
2450 MHz	ConvF	**4.1 ± 8%**	**ε_r = 52.7** **σ = 1.95 mho/m** (body tissue)

APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

1800MHz System Performance Check

Measured Fluid Dielectric Parameters (Brain)

March 10, 2003

Frequency	e'	e''
1.700000000 GHz	39.0061	13.8009
1.710000000 GHz	38.9733	13.8098
1.720000000 GHz	38.9382	13.8292
1.730000000 GHz	38.9126	13.8524
1.740000000 GHz	38.8715	13.9054
1.750000000 GHz	38.8335	13.9505
1.760000000 GHz	38.7868	13.9883
1.770000000 GHz	38.7670	14.0289
1.780000000 GHz	38.7124	14.0533
1.790000000 GHz	38.6603	14.0852
1.800000000 GHz	38.6190	14.1231
1.810000000 GHz	38.5656	14.1531
1.820000000 GHz	38.5030	14.1856
1.830000000 GHz	38.4698	14.1952
1.840000000 GHz	38.4129	14.2278
1.850000000 GHz	38.3683	14.2444
1.860000000 GHz	38.3407	14.2628
1.870000000 GHz	38.2906	14.2859
1.880000000 GHz	38.2470	14.3082
1.890000000 GHz	38.2163	14.3403
1.900000000 GHz	38.1770	14.3515

1900MHz EUT Evaluation (Head SAR)

Measured Fluid Dielectric Parameters (Brain)

March 10, 2003

Frequency	e'	e''
1.780000000 GHz	38.9698	13.0327
1.790000000 GHz	38.9363	13.0593
1.800000000 GHz	38.9028	13.1040
1.810000000 GHz	38.8525	13.1436
1.820000000 GHz	38.7945	13.1879
1.830000000 GHz	38.7579	13.2105
1.840000000 GHz	38.6933	13.2441
1.850000000 GHz	38.6512	13.2880
1.860000000 GHz	38.6095	13.2962
1.870000000 GHz	38.5585	13.3309
1.880000000 GHz	38.5067	13.3575
1.890000000 GHz	38.4737	13.3932
1.900000000 GHz	38.4286	13.4218
1.910000000 GHz	38.3784	13.4449
1.920000000 GHz	38.3349	13.4815
1.930000000 GHz	38.2905	13.5101
1.940000000 GHz	38.2408	13.5422
1.950000000 GHz	38.2068	13.5558
1.960000000 GHz	38.1476	13.5508
1.970000000 GHz	38.0992	13.5884
1.980000000 GHz	38.0557	13.5914

1900MHz EUT Evaluation (Body SAR)

Measured Fluid Dielectric Parameters (Muscle)

March 10, 2003

Frequency	e'	e''
1.800000000 GHz	52.0836	14.3436
1.810000000 GHz	52.0164	14.3992
1.820000000 GHz	51.9782	14.4271
1.830000000 GHz	51.9240	14.4761
1.840000000 GHz	51.8991	14.5148
1.850000000 GHz	51.8747	14.5352
1.860000000 GHz	51.8469	14.5660
1.870000000 GHz	51.8050	14.5950
1.880000000 GHz	51.7634	14.6383
1.890000000 GHz	51.7359	14.6589
1.900000000 GHz	51.6906	14.7098
1.910000000 GHz	51.6345	14.7422
1.920000000 GHz	51.5813	14.7796
1.930000000 GHz	51.5408	14.8132
1.940000000 GHz	51.5114	14.8372
1.950000000 GHz	51.4583	14.8725
1.960000000 GHz	51.4247	14.9153
1.970000000 GHz	51.3844	14.9255
1.980000000 GHz	51.3327	14.9716
1.990000000 GHz	51.3031	15.0012
2.000000000 GHz	51.2398	15.0271

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 Schmid & Partner Engineering AG
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