Supplemental SAR Compliance Test Report for DTX04969-EN

Test report no.:	Not numbered	Date of report:	2002-11-05
Number of pages:	32	Contact person:	Pentti Pärnänen
		Responsible test engineer:	Pertti Mäkikyrö

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Tested devices: LJPNPM-6
HS-1C

Supplement reports: -

Testing has been carried out in accordance with:

47CFR §2.1093
Radiofrequency Radiation Exposure Evaluation: Portable Devices

IEEE P1528-200X Draft 6.4
Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques

FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01)
Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

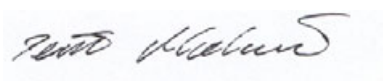
Documentation: The documentation of the testing performed on the tested devices is archived for 15 years at TCC Oulu

Test results: The tested device complies with the requirements in respect of all parameters subject to the test.

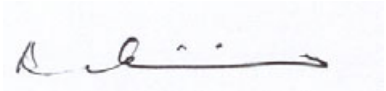
The test results and statements relate only to the items tested. The test report shall not be reproduced except in full, without written approval of the laboratory.

Date and signatures: 2002-11-05

For the contents:



Pertti Mäkikyrö
Engineering Manager, EMC



Anne Kiviniemi
Test Engineer

CONTENTS

1. SUMMARY FOR SAR TEST REPORT

Date of test	2002-11-01
Contact person	Pentti Pärnänen
Test plan referred to	-
FCC ID	LJPNPM-6
SN, HW, SW and DUT numbers of tested device	SN:00440021646201 HW:0503 SW:1.50
Accessories used in testing	Battery BL-4C, headset HS-1C, carry case MBA-8
Notes	Headset HS-1C
Document code	DTX 05746
Responsible test engineer	Pertti Mäkikyrö
Measurement performed by	Anne Kiviviemi

1.1 Maximum Results Found during SAR Evaluation

The equipment is deemed to fulfil the requirements if the measured values are less than or equal to the limit. Maximum found results are reported per operating band.

1.1.1 Body Worn Configuration

Ch / *f* (MHz)	Power EIRP	Accessory	Limit	Measured	Result
661/1880.00	28.30 dBm	HS-1C	1.6 mW/g	1.20 mW/g	PASSED

1.1.2 Measurement Uncertainty

Combined Standard Uncertainty	± 13.6%
Expanded Standard Uncertainty (k=2)	± 27.1%

2. TEST DESCRIPTION

Phone tested and described in DTX04969-EN report was retested using strap MBA-8 and camera headset HS-1C.

- Headset HS-1C

3. TEST CONDITIONS

3.1 Ambient Conditions

Ambient temperature (°C)	22±1
Tissue simulating liquid temperature (°C)	22±1
Humidity	35

3.2 RF characteristics of the test site

Tests were performed in a fully enclosed RF shielded environment.

3.3 Test Signal, Frequencies, and Output Power

The phone was put into operation by using a radio tester. Communication between the phone and the tester was established by air link. Though LJPNPM-6 is able to use two timeslots for transmitting data in GPRS mode, testing was done with single timeslot transmission. This is because GPRS mode can be used only while having a stable infrared connection to an another device or through a data cable, which is not available yet. IR connection can not be maintained if the phone is body worn. Since the cable will be available later on, body worn measurement values are doubled to correspond the body worn use of GPRS mode.

The measurement was performed on middle channel.

The phone was set to maximum power level during the test and at the beginning of the test the battery was fully charged. Power output was measured by CETECOM ICT Services GmbH from the same unit that was used in SAR testing.

4. DESCRIPTION OF THE TEST EQUIPMENT

The measurements were performed with an automated near-field scanning system, DASY3, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland.

Test Equipment	Serial Number	Due Date
DASY3 DAE V1	405	02/03
E-field Probe ET3DV6	1379	02/03
Dipole Validation Kit, D1900V2	511	02/03

E-field probe calibration records are presented in Appendix C.

Additional equipment needed in validation

Test Equipment	Model	Serial Number	Due Date
Signal Generator	Agilent E4433B	GB40050947	09/04
Amplifier	Amplifier Research 5S1G4	27573	-
Power Meter	R&S NRT	835065/049	04/03
Power Sensor	R&S NRT-Z44	835374/021	04/03
Thermometer	DO9416	1505985462	-
Vector Network Analyzer	Hewlett Packard 8753E	US38432701	05/03
Dielectric Probe Kit	Agilent 85070C	-	-

4.1 System Accuracy Verification

The probes are calibrated annually by the manufacturer. Dielectric parameters of the simulating liquids are measured by using a dielectric probe kit and a vector network analyzer.

The SAR measurement of the DUT were done within 24 hours of system accuracy verification, which was done using the dipole validation kit.

The dipole antenna, which is manufactured by Schmid & Partner Engineering AG, is matched to be used near flat phantom filled with tissue simulating solution. Dipole length for 1900 MHz is 68 mm with overall height of 300mm. A specific distance holder is used in the positioning of antenna to ensure correct spacing between the phantom and the dipole. Manufacturer's reference dipole data is presented in Appendix C.

Power level of 250 mW was supplied to a dipole antenna placed under the flat section of SAM phantom. The validation results are in the table below and printout of the validation test is presented in Appendix A. All the measured parameters were within the specification.

Tissue	*f* (MHz)	Description	SAR (W/kg), 1g	Dielectric Parameters		Temp (°C)
				ε_r	σ (S/m)	
Muscle	1900	Measured 11/01/02	10.9	51.8	1.52	22
		Reference Result	10.6	53.5	1.46	N/A

4.2 Tissue Simulant

All dielectric parameters of tissue simulant was measured within 24 hours of SAR measurement. The depth of the tissue simulant in the ear reference point of the phantom was 15cm ± 5mm during the test. Volume for tissue simulant was 26 liters.

4.2.1 Muscle Tissue Simulant

The composition of the muscle tissue simulating liquid for 1900MHz

69.02% De-Ionized Water
30.76% Diethylene Glycol Monobutyl Ether
0.22% Salt

f (MHz)	Description	Dielectric Parameters		Temp (°C)
		ε_r	σ (S/m)	
1880	Measured 11/01/02	51.8	1.51	22
	Recommended Values	53.3	1.52	20-26

Recommended values are adopted from OET Bulletin 65 (97-01) Supplement C (01-01).

5. RESULTS

Corresponding SAR distribution printout of maximum result is shown in Appendix B. It also includes Z-plot of maximum measurement result.

5.1 Body Worn Configuration

Mode	Channel/ *f* (MHz)	Power EIRP (dBm)	SAR, averaged over 1g (mW/g)
			HS-1C
GSM 1900	661/1880.00	28.30	0.60

Doubled body worn SAR value to correspond body worn use of GPRS mode:

Mode	Channel/ *f* (MHz)	Power EIRP (dBm)	SAR, averaged over 1g (mW/g)
			HS-1C
GSM 1900	661/1880.00	28.30	1.20

APPENDIX A.

Validation Test Printouts

Dipole 1900 MHz

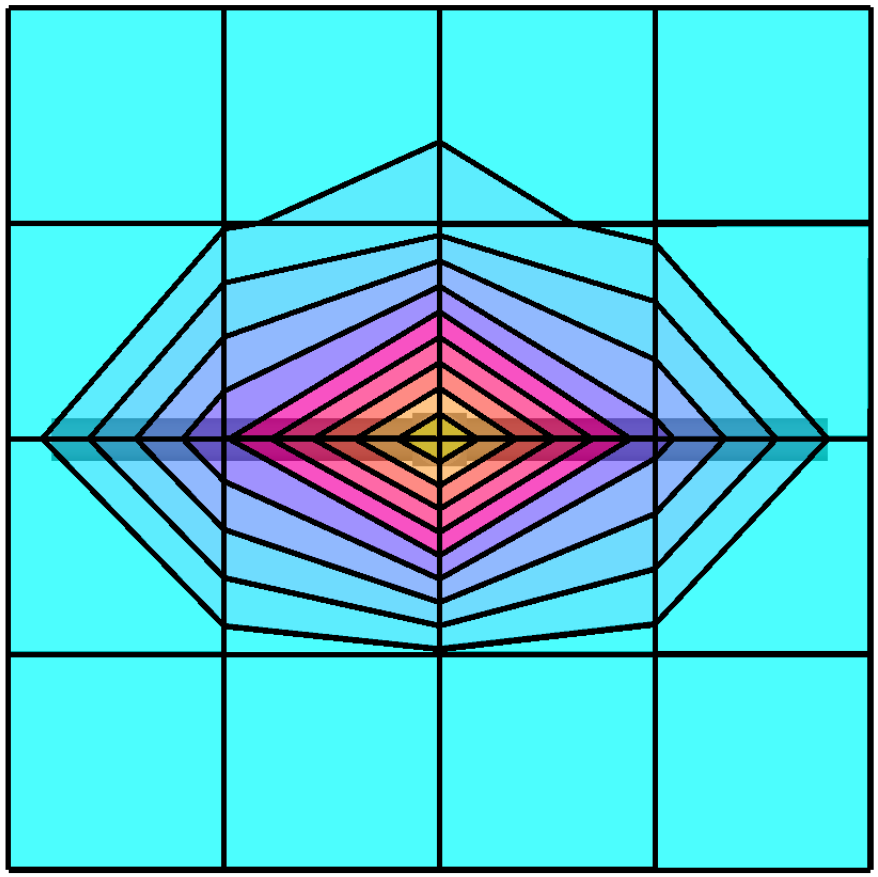
SAM 1; Flat

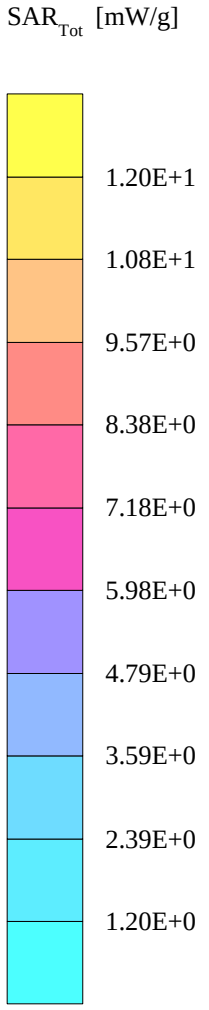
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 1.0; Muscle 1900 MHz: σ = 1.52 mho/m ε_r = 51.8 ρ = 1.00 g/cm^3, liquid temperature: 21.2 C

Cubes (2): Peak: 20.7 mW/g ± 0.02 dB, SAR (1g): 10.9 mW/g ± 0.03 dB, SAR (10g): 5.55 mW/g ± 0.05 dB

Penetration depth: 8.5 (7.8, 9.8) [mm]

Powerdrift: 0.02 dB



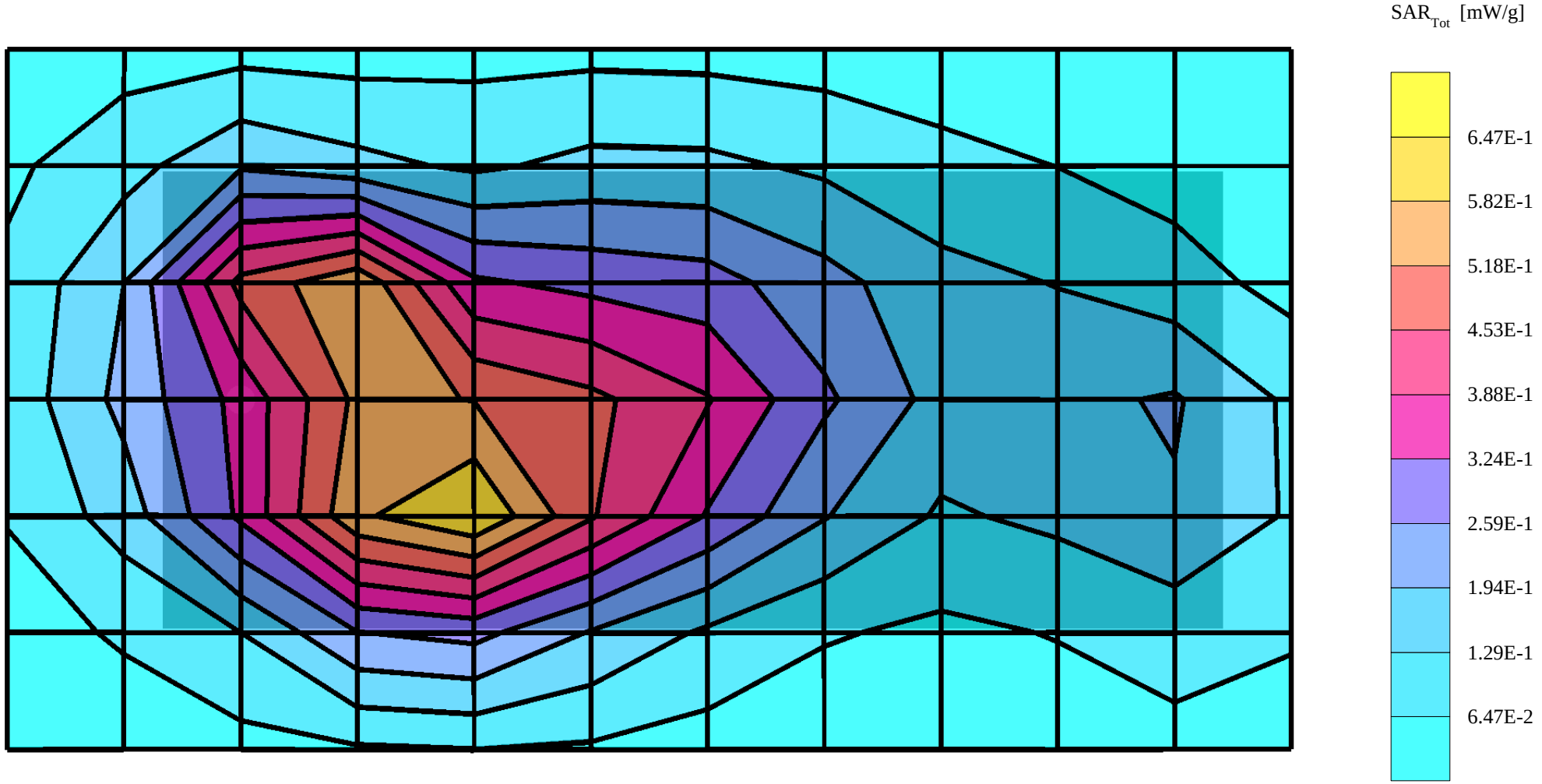


APPENDIX B.

SAR Distribution Printouts

LJPNPM-6, MBA-8, HS-1C

SAM 1 Phantom; Flat Section; Position: body worn; Frequency: 1880 MHz, GSM
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 8.0; Muscle 1880 MHz: σ = 1.51 mho/m ε_r = 51.8 ρ = 1.00 g/cm^3, liquid temperature: 21.2 C
Cube 5x5x7: SAR (1g): 0.604 mW/g, SAR (10g): 0.339 mW/g
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: -0.00 dB



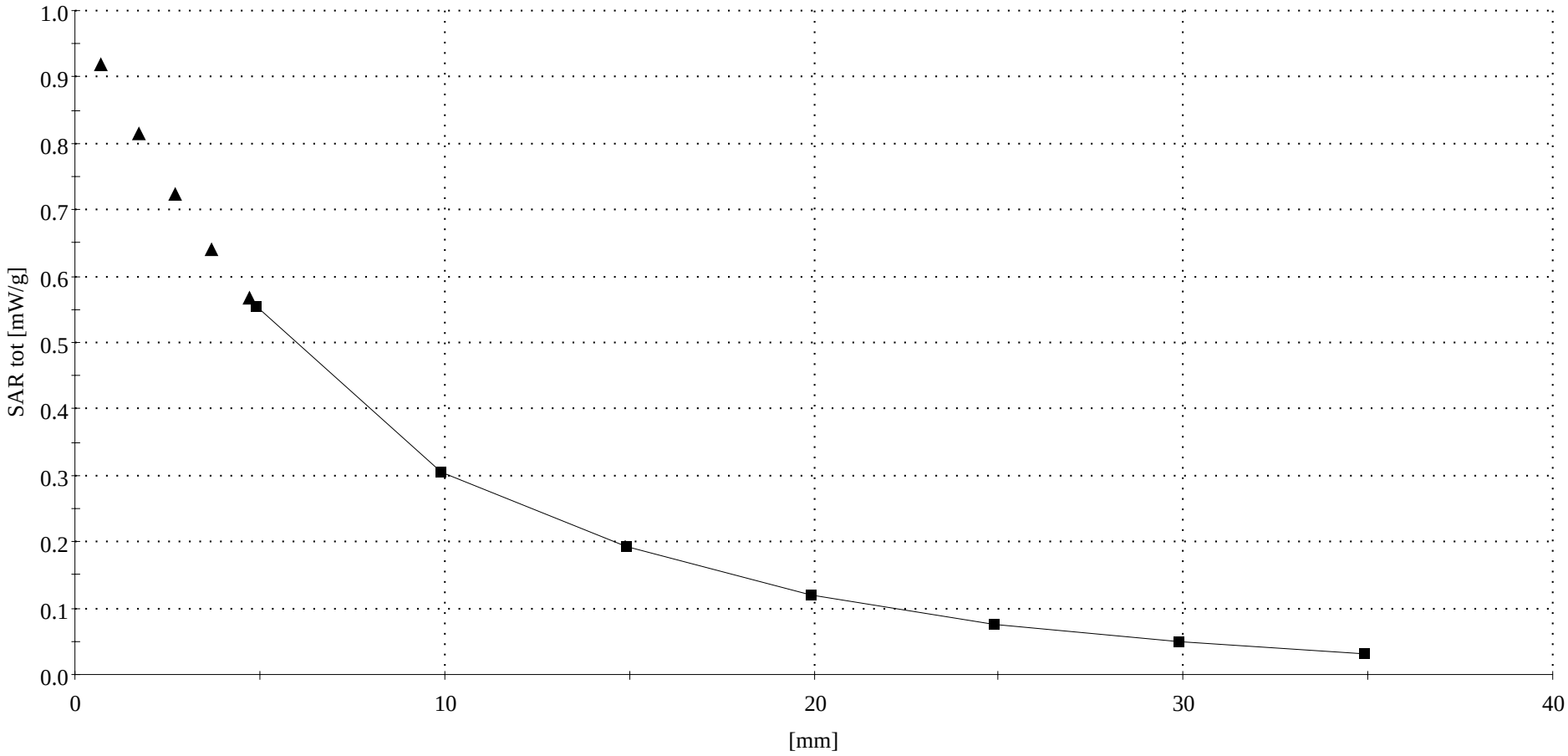
LJPNPM-6,MBA-8, HS-1C

SAM 1 Phantom; Flat Section; Position: body worn; Frequency: 1880 MHz, GSM

Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 8.0; Muscle 1880 MHz: σ = 1.51 mho/m ε_{r} = 51.8 ρ = 1.00 g/cm^3, liquid temperature: 21.2 C

Cube 5x5x7: SAR (1g): 0.604 mW/g, SAR (10g): 0.339 mW/g

Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0



APPENDIX C.

Calibration Certificate(s)

530065

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:	**1379**
Place of Calibration:	**Zurich**
Date of Calibration:	**February 22, 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:	

Probe ET3DV6

SN:1379

Manufactured:	September 21, 1999
Last calibration:	February 20, 2001
Recalibrated:	February 22, 2002

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV6 SN:1379

Sensitivity in Free Space

Diode Compression

NormX	**1.74**	$\mu V/(V/m)^2$	DCP X	**95**	mV
NormY	**1.72**	$\mu V/(V/m)^2$	DCP Y	**95**	mV
NormZ	**1.75**	$\mu V/(V/m)^2$	DCP Z	**95**	mV

Sensitivity in Tissue Simulating Liquid

Head **900 MHz** e_r **= 41.5 ± 5%** s **= 0.97 ± 5% mho/m**

ConvF X	**6.5**	± 8.9% (k=2)	Boundary effect:	
ConvF Y	**6.5**	± 8.9% (k=2)	Alpha	**0.45**
ConvF Z	**6.5**	± 8.9% (k=2)	Depth	**2.34**

Head **1800 MHz** e_r **= 40.0 ± 5%** s **= 1.40 ± 5% mho/m**

ConvF X	**5.4**	± 8.9% (k=2)	Boundary effect:	
ConvF Y	**5.4**	± 8.9% (k=2)	Alpha	**0.62**
ConvF Z	**5.4**	± 8.9% (k=2)	Depth	**2.15**

Boundary Effect

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

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	10.6	5.8
SAR_{be} [%]	With Correction Algorithm	0.3	0.6

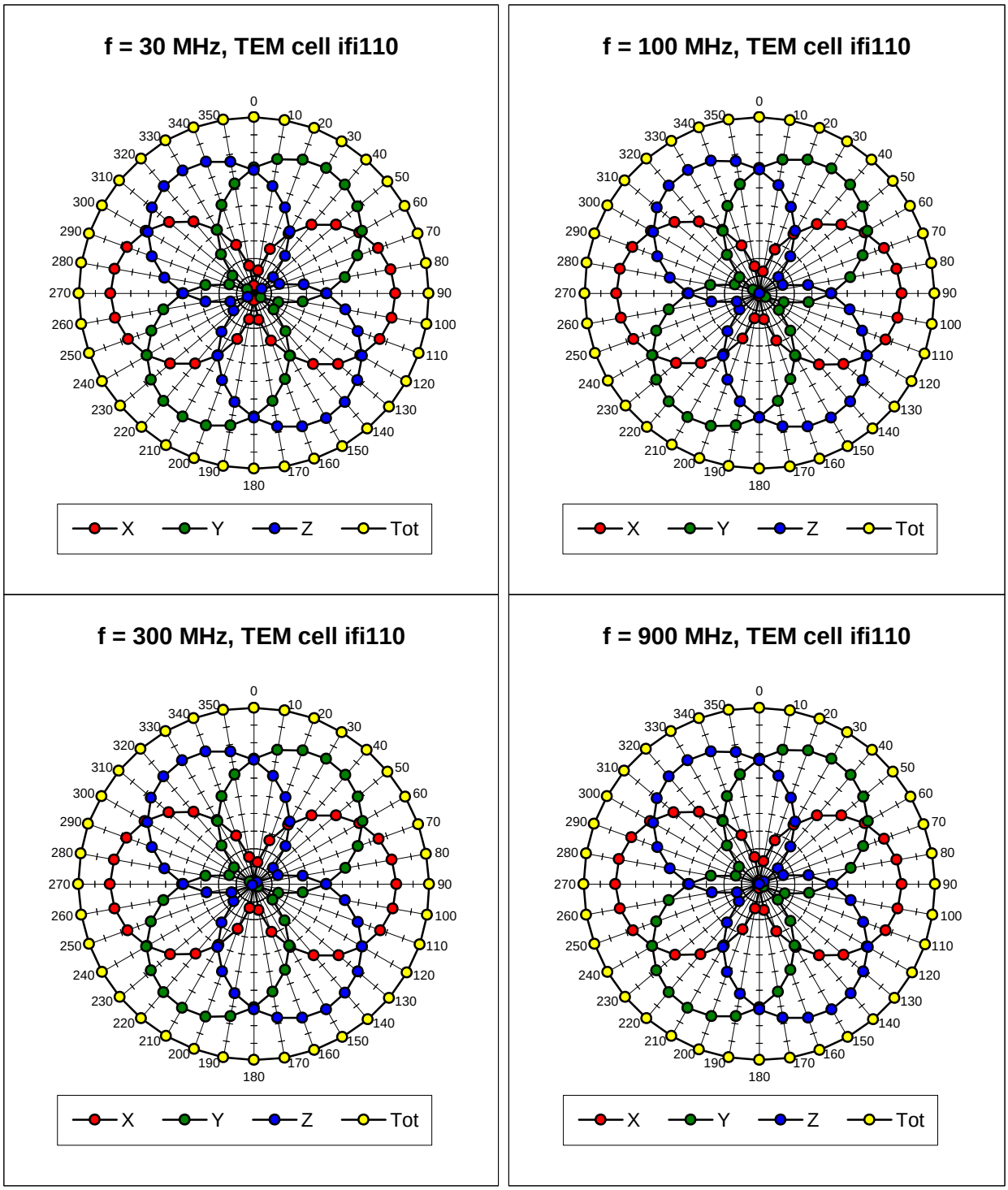
Head **1800 MHz** **Typical SAR gradient: 10 % per mm**

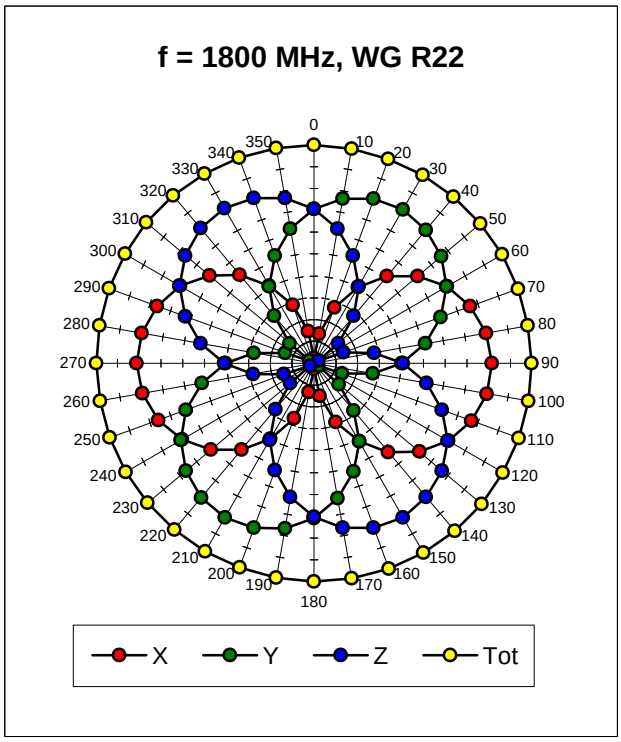
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	12.3	7.6
SAR_{be} [%]	With Correction Algorithm	0.1	0.2

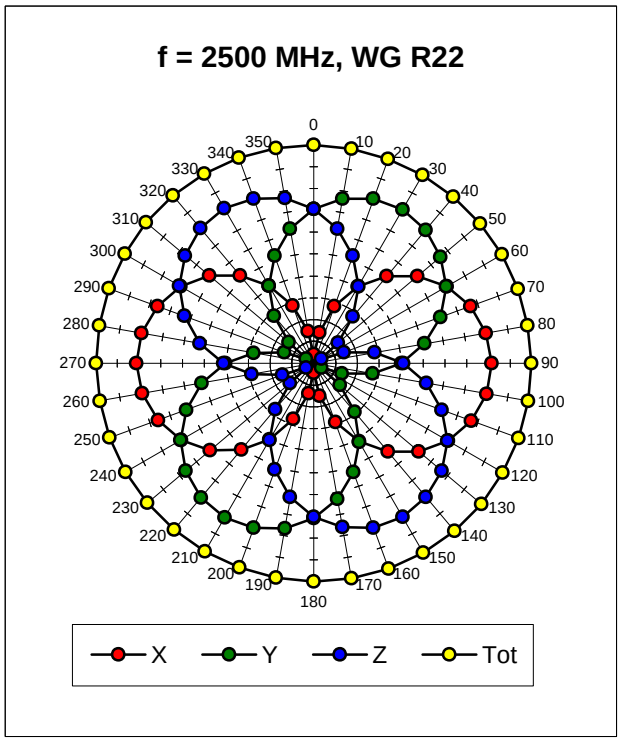
Sensor Offset

Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.5 ± 0.2**	mm

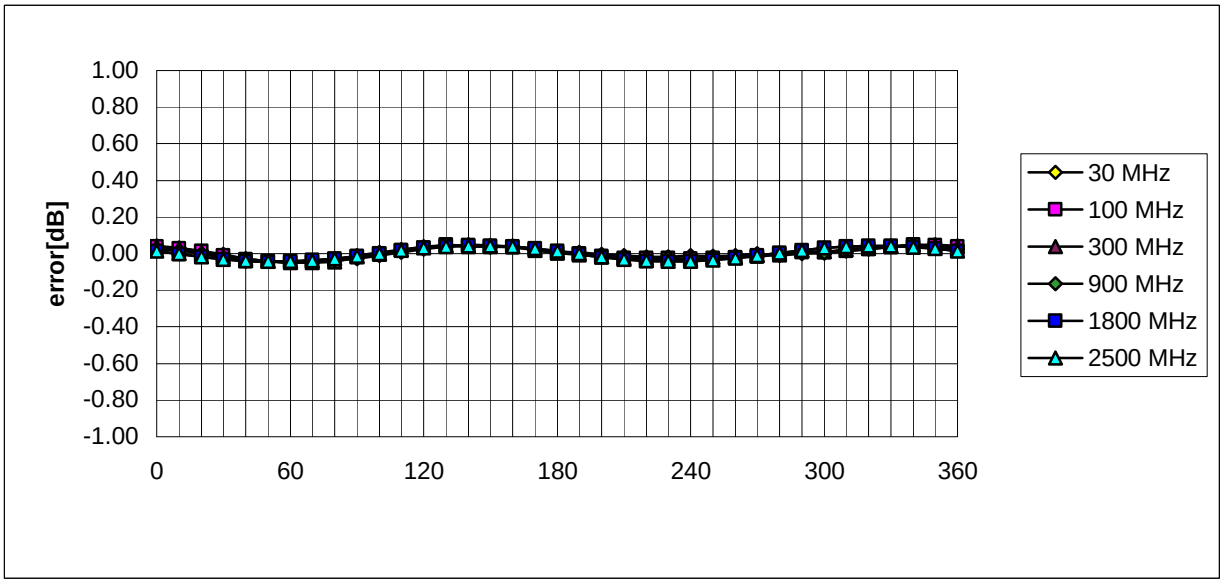
Receiving Pattern (f), q = 0°





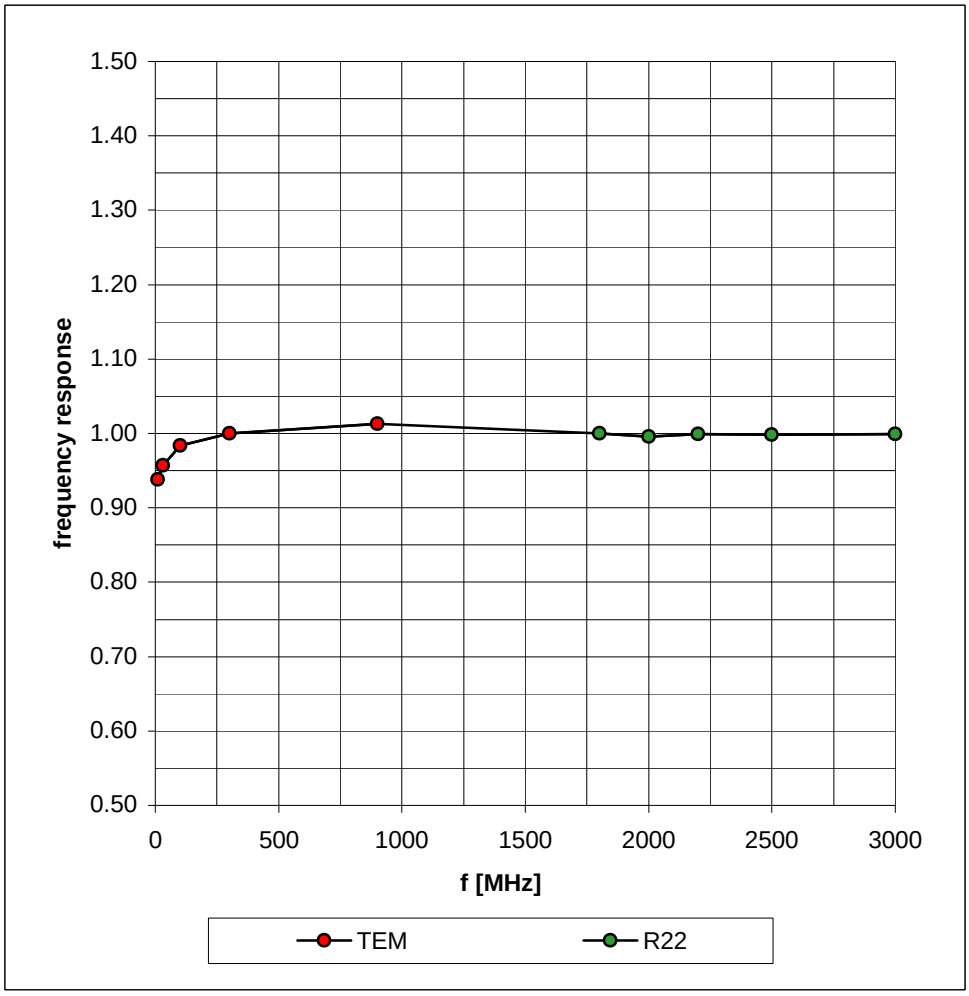


Isotropy Error (f), q = 0°



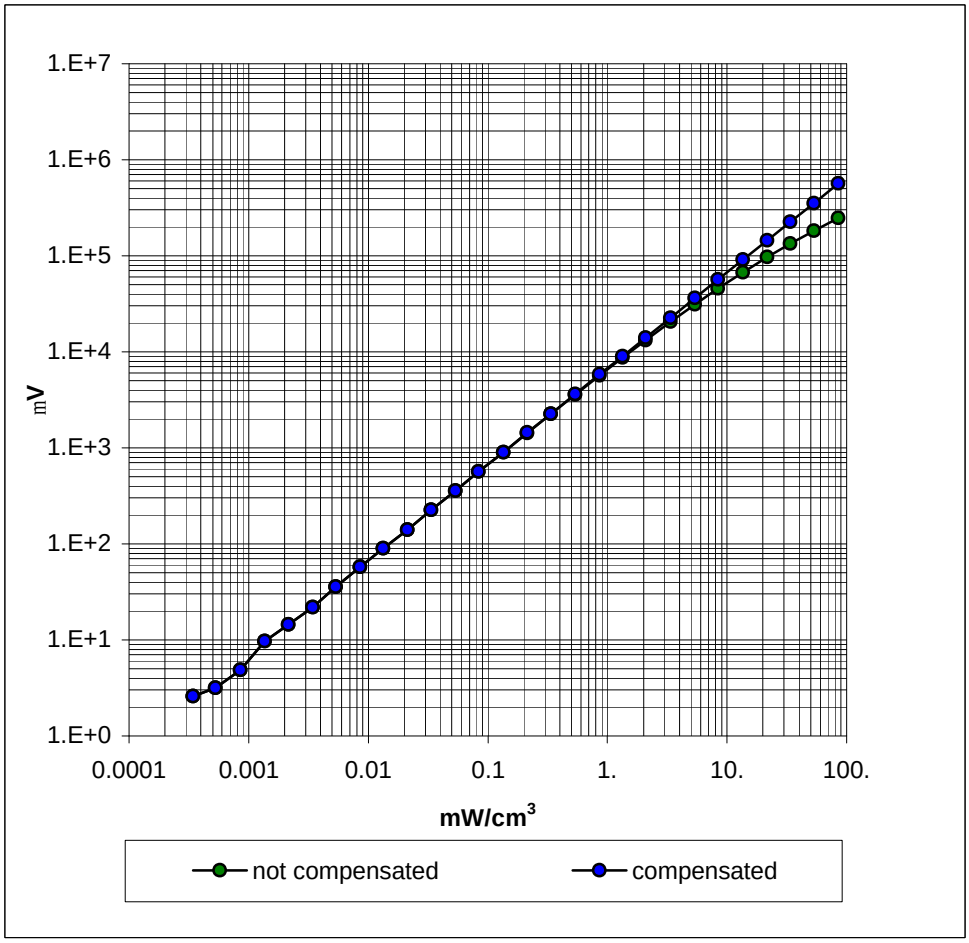
Frequency Response of E-Field

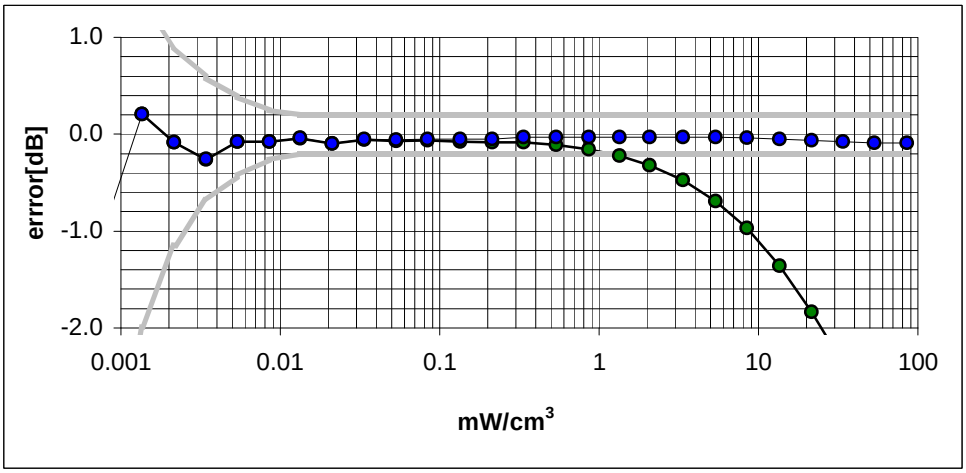
(TEM-Cell:ifi110, Waveguide R22)



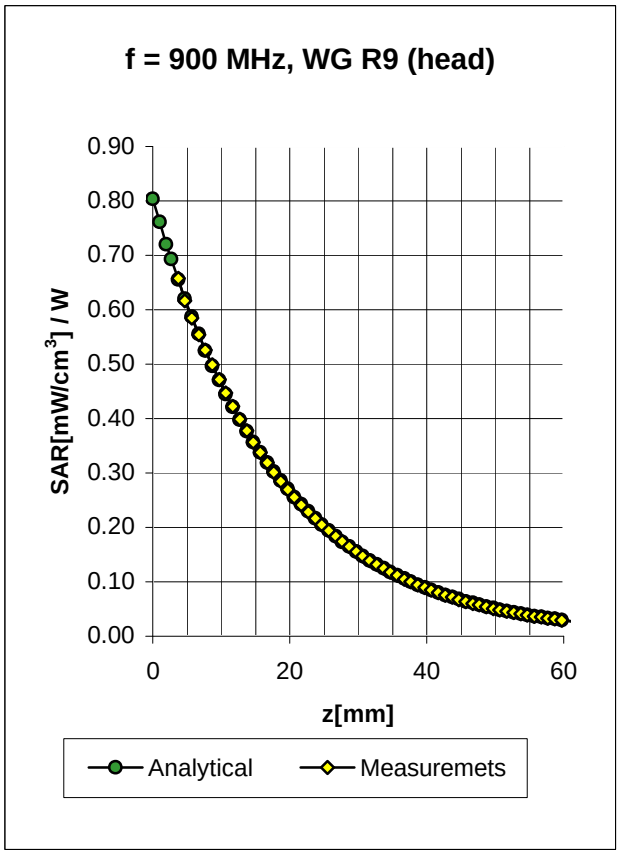
Dynamic Range f(SAR_{brain})

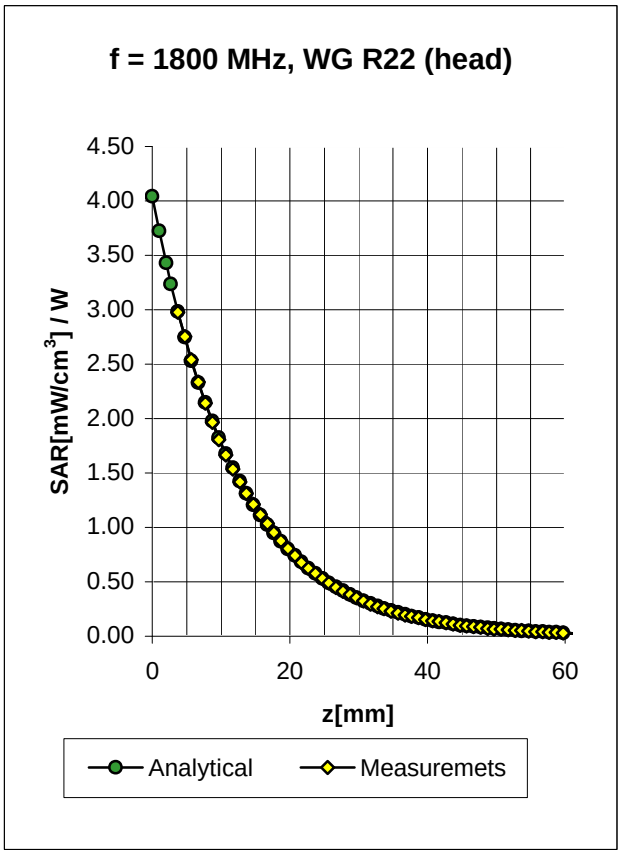
(Waveguide R22)





Conversion Factor Assessment





Head **900 MHz** e_r **= 41.5 ± 5%** s **= 0.97 ± 5% mho/m**

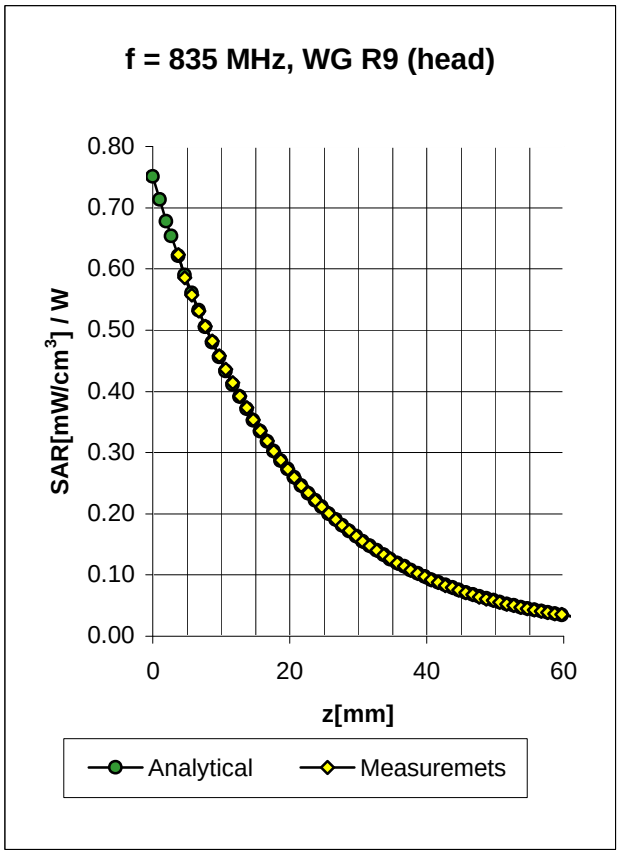
ConvF X	**6.5** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**6.5** ± 8.9% (k=2)	Alpha	**0.45**
ConvF Z	**6.5** ± 8.9% (k=2)	Depth	**2.34**

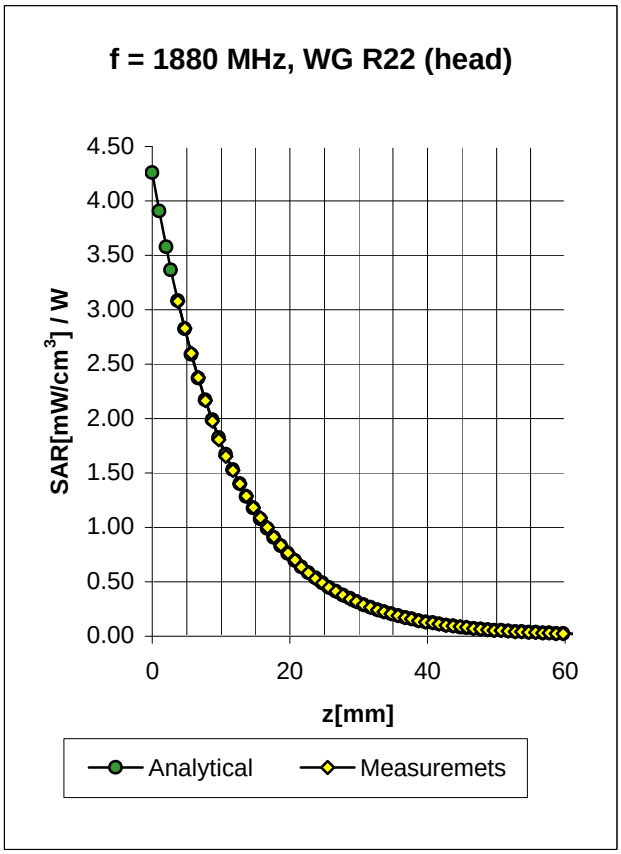
Head **1800 MHz** e_r **= 40.0 ± 5%** s **= 1.40 ± 5% mho/m**

ConvF X	**5.4** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**5.4** ± 8.9% (k=2)	Alpha	**0.62**
ConvF Z	**5.4** ± 8.9% (k=2)	Depth	**2.15**

ET3DV6 SN:1379 **February 22, 2002**

Conversion Factor Assessment





Head **835 MHz** e_r **= 41.5 ± 5%** s **= 0.90 ± 5% mho/m**

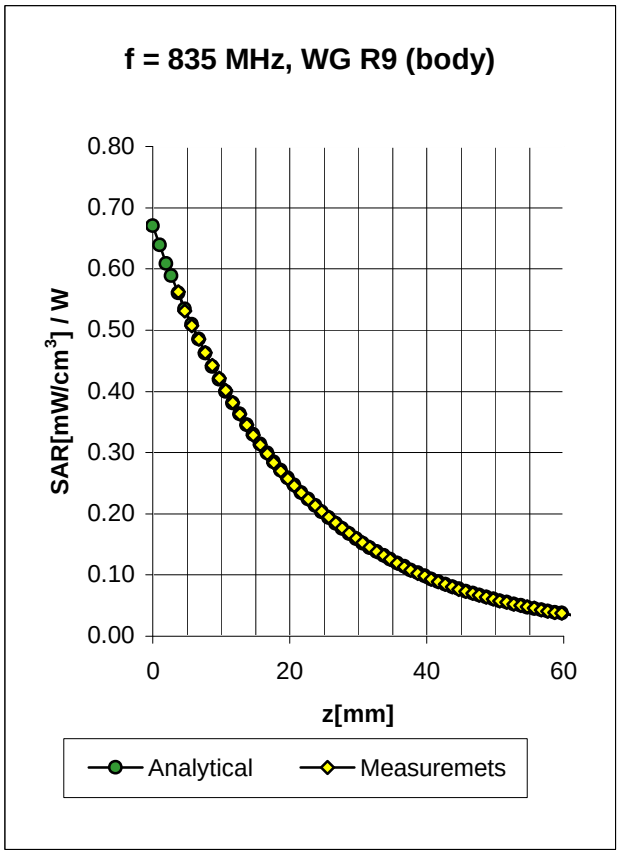
ConvF X	**6.6** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**6.6** ± 8.9% (k=2)	Alpha	**0.42**
ConvF Z	**6.6** ± 8.9% (k=2)	Depth	**2.44**

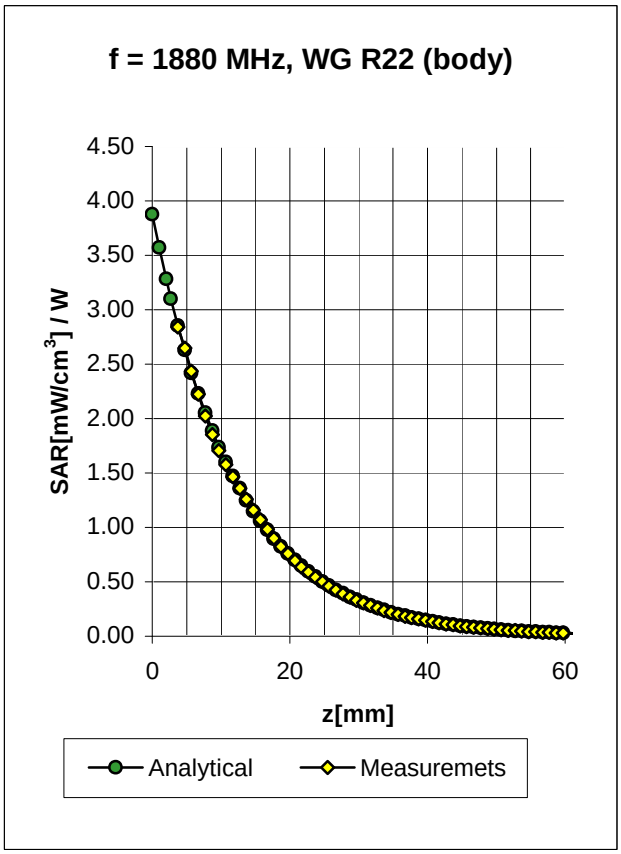
Head **1880 MHz** e_r **= 40.0 ± 5%** s **= 1.40 ± 5% mho/m**

ConvF X	**5.3** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**5.3** ± 8.9% (k=2)	Alpha	**0.64**
ConvF Z	**5.3** ± 8.9% (k=2)	Depth	**2.15**

ET3DV6 SN:1379 **February 22, 2002**

Conversion Factor Assessment





Body **835 MHz** e_r **= 55.2 ± 5%** s **= 0.97 ± 5% mho/m**

ConvF X	**6.2** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**6.2** ± 8.9% (k=2)	Alpha	**0.42**
ConvF Z	**6.2** ± 8.9% (k=2)	Depth	**2.56**

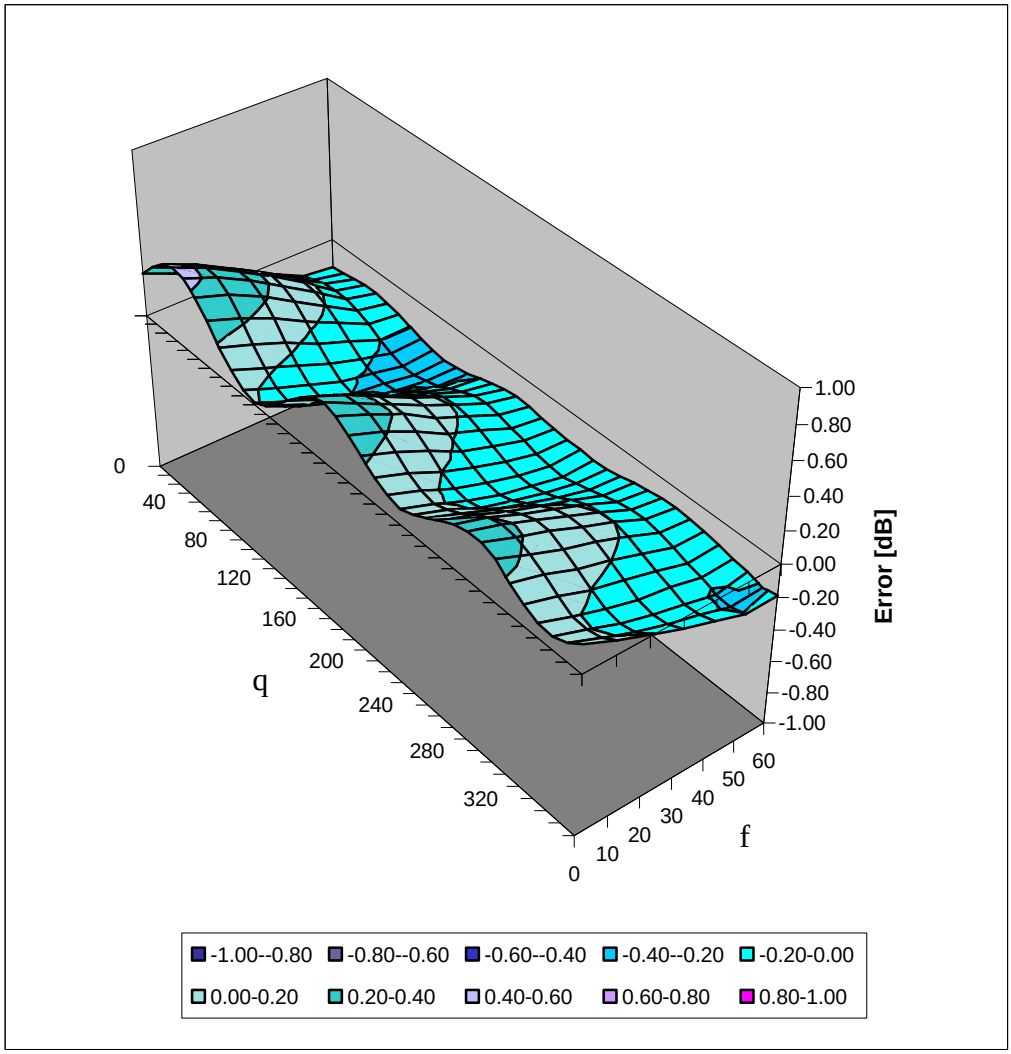
Body **1880 MHz** e_r **= 53.3 ± 5%** s **= 1.52 ± 5% mho/m**

ConvF X	**4.8** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**4.8** ± 8.9% (k=2)	Alpha	**0.92**
ConvF Z	**4.8** ± 8.9% (k=2)	Depth	**1.86**

ET3DV6 SN:1379 **February 22, 2002**

Deviation from Isotropy in HSL

Error (q, f), f = 900 MHz



Schmid & Partner
Engineering AG

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

DASY3

Dipole Validation Kit

Type: D1900V2

Serial: 511

Manufactured: October 20, 1999
Calibrated: February 13, 2001

1. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with head simulating solution of the following electrical parameters at 1900 MHz:

Relative permitivity	**39.2**	± 5%
Conductivity	**1.47 mho/m**	± 10%

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 feedpoint was positioned below the center marking and 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 head phantom according to the measurement conditions described in section 1. The results (see figure) 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:	**42.8 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**21.9 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:	**1.205 ns**	(one direction)
Transmission factor:	**0.983**	(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 1900 MHz:	Re{Z} = **50.1 Ω**
	Im {Z} = **-1.5 Ω**
Return Loss at 1900 MHz	**- 34.9 dB**

4. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with muscle simulating solution of the following electrical parameters at 1900 MHz:

Relative permitivity	**53.5**	± 5%
Conductivity	**1.46 mho/m**	± 10%

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, conversion factor 4.85 at 1800 MHz) was used for the measurements.

The dipole feedpoint was positioned below the center marking and 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.

6. SAR Measurement

Standard SAR-measurements were performed with the head phantom according to the measurement conditions described in section 1. The results (see figure) 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:	**42.4 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**22.0 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.

7. 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:	**1.205 ns**	(one direction)
Transmission factor:	**0.983**	(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 1900 MHz:	Re{Z} = **45.3 Ω**
	Im {Z} = **-1.0 Ω**
Return Loss at 1900 MHz	**- 25.6 dB**

8. Handling

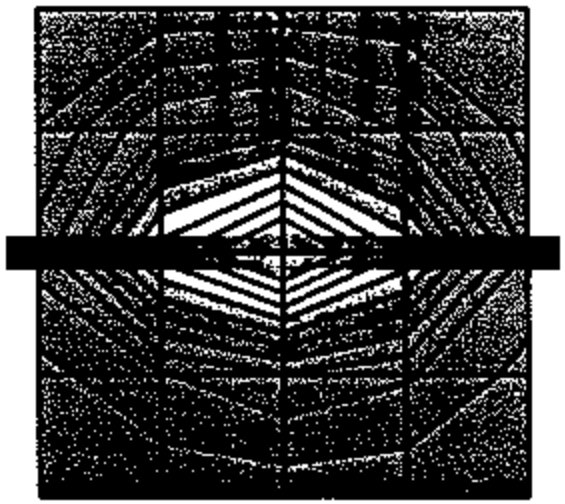
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

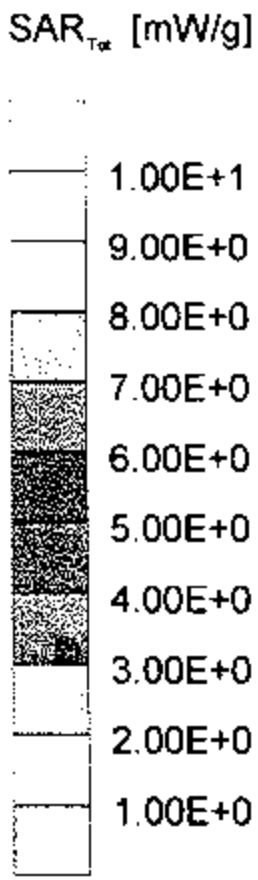
Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

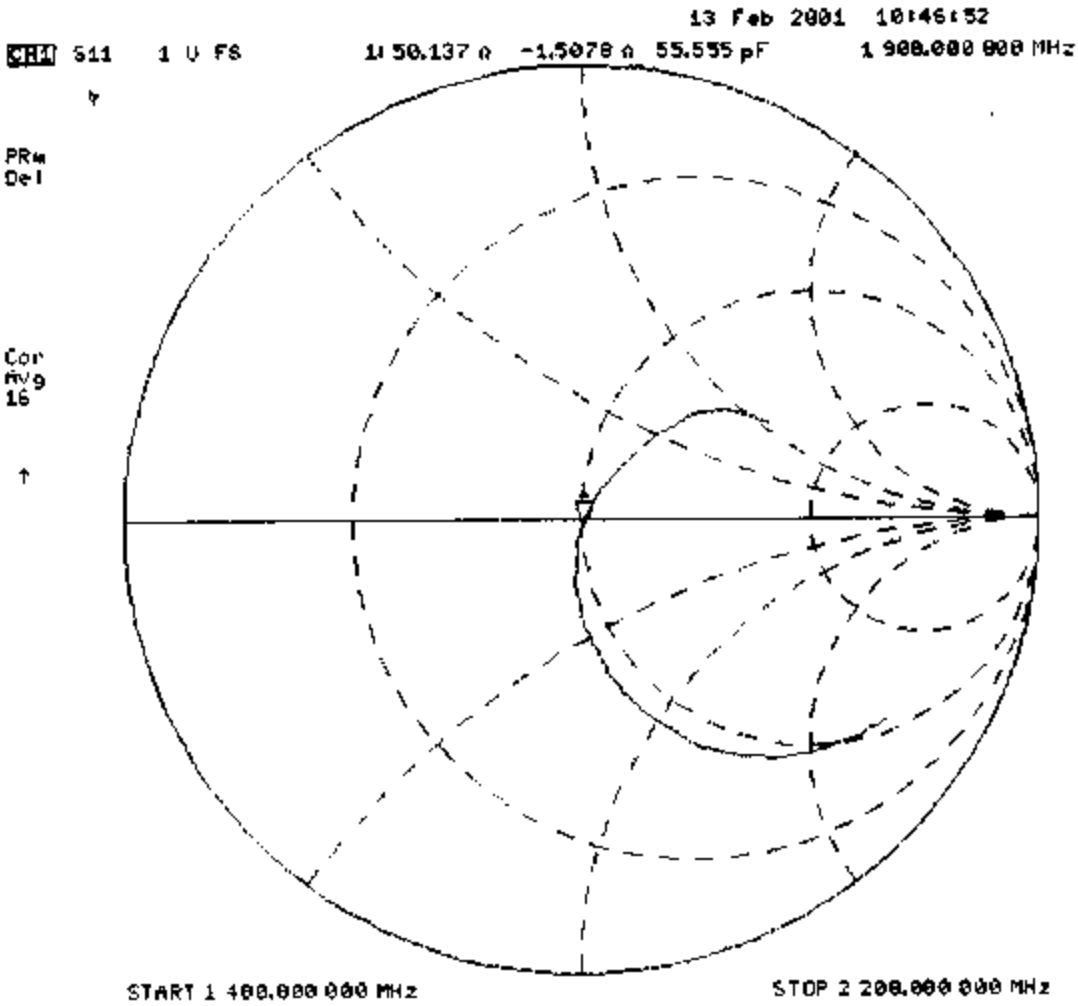
After prolonged use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

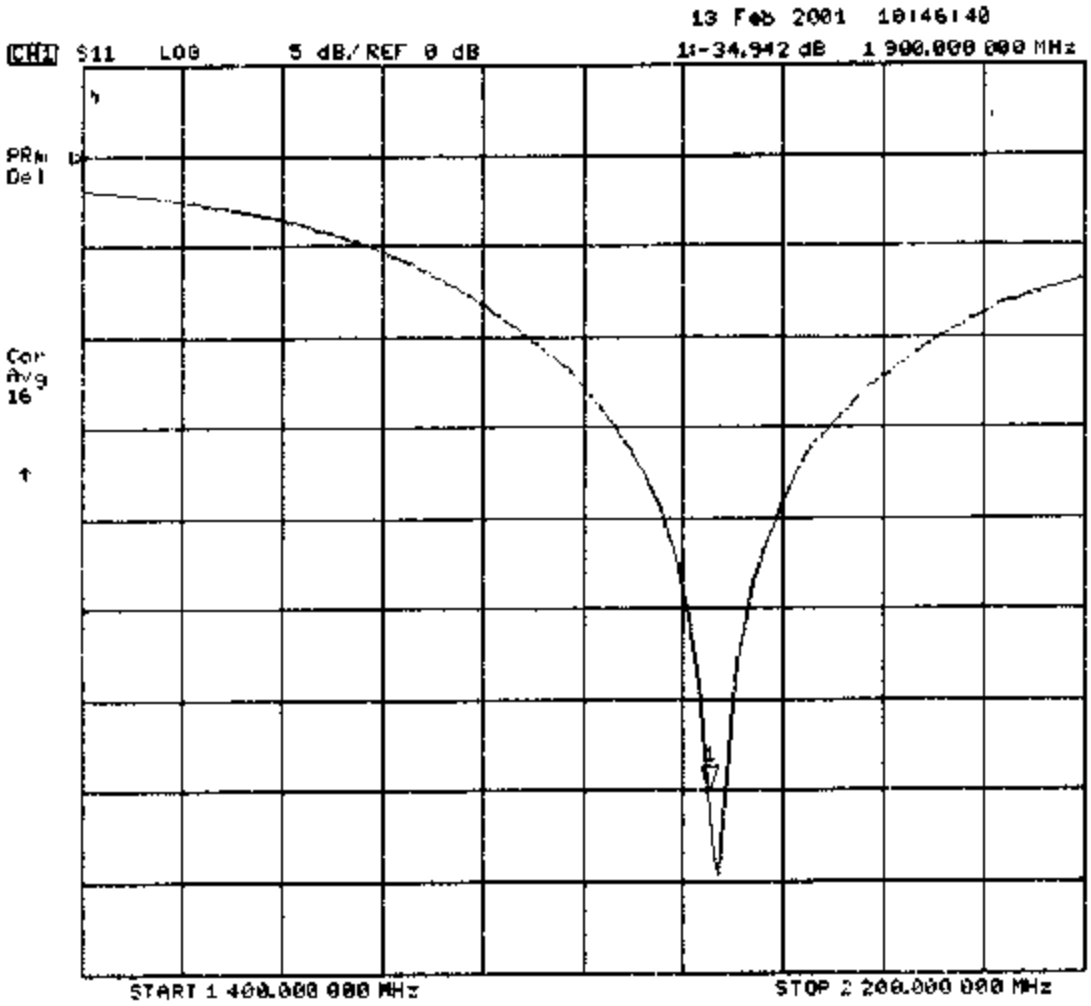
Validation Dipole D1900V2 SN:511, d = 10 mm

Frequency: 1900 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) at 1800 MHz: IEEE1528 1900 MHz ; σ = **1.47 mho/m** ε_r = **39.2** ρ = 1.00 g/cm^3
Cubes (2). Peak: 20.6 mW/g ± 0.02 dB, SAR (1g). **10.7** mW/g ± 0.03 dB, SAR (10g): 5.47 mW/g ± 0.03 dB, (Worst-case extrapolation)
Penetration depth. 7.9 (7.4, 9.1) [mm]
Powerdrift. 0.00 dB



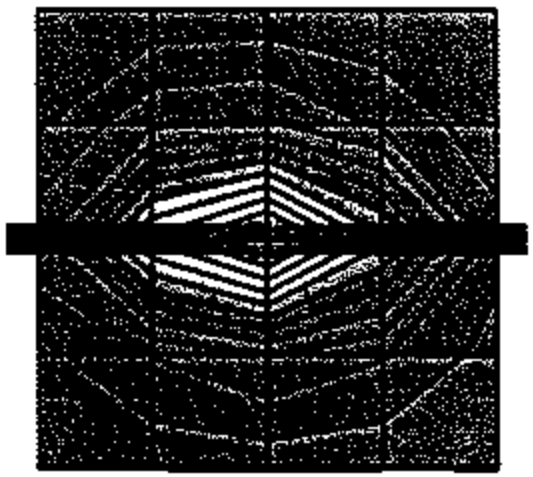


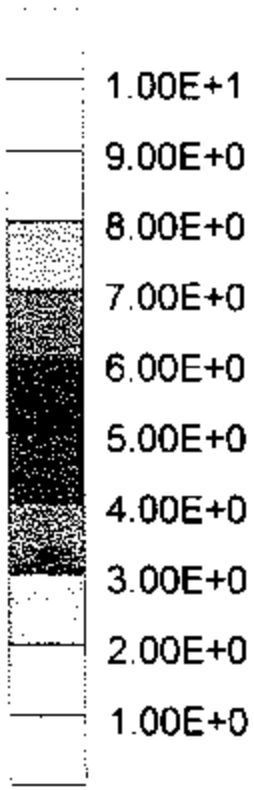

13 Feb 2001 10:46:52
CH1 S11 1 U FS
1: 50.137 Ω -1.5078 Ω 55.555 pF
1 900.000 000 MHz
PRm
Del
Cor
MV9
16
START 1 400.000 000 MHz
STOP 2 200.000 000 MHz

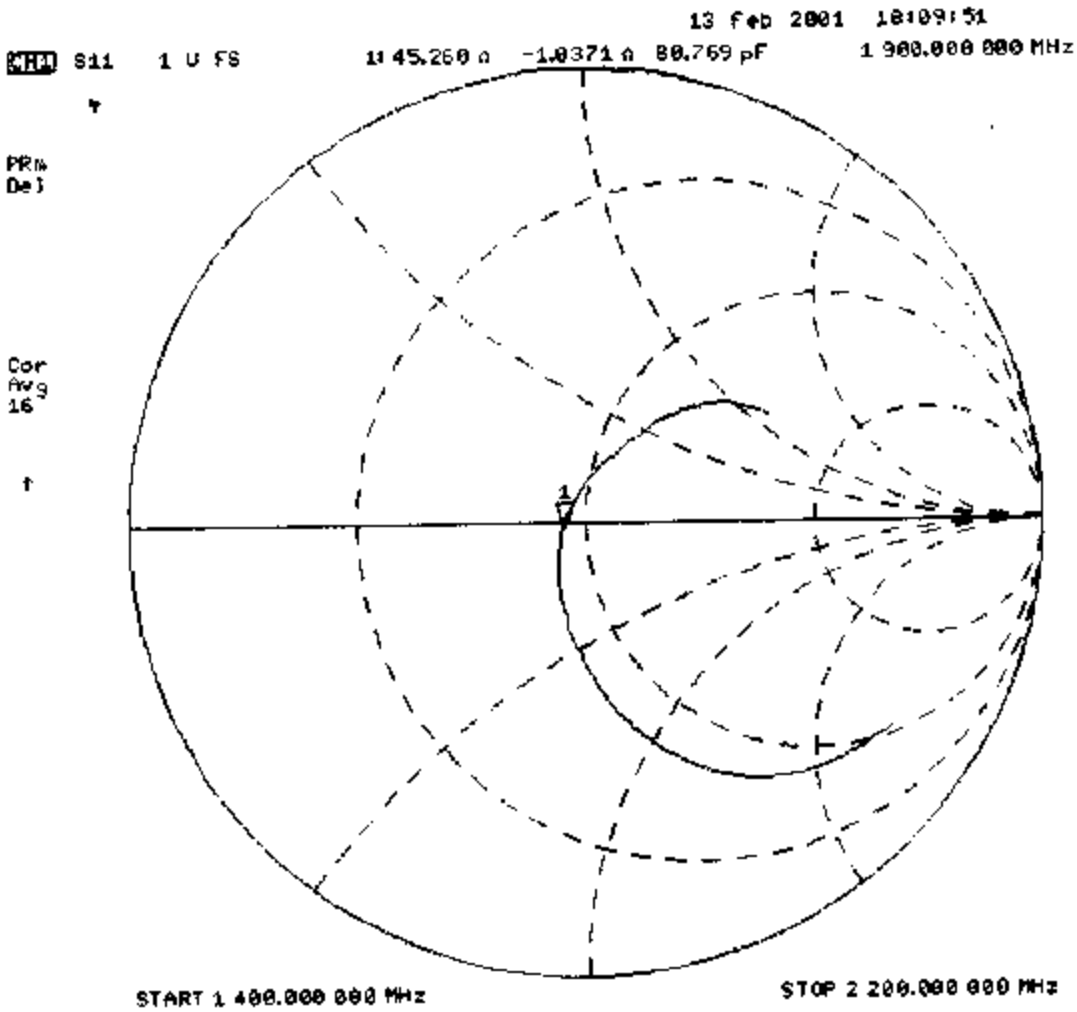

13 Feb 2001 10:46:40
CH1 S11 LOG 5 dB/ REF 0 dB
1:-34.942 dB 1 900.000 000 MHz
PRm
Del
Cor
Avg
16
START 1 400.000 000 MHz
STOP 2 200.000 000 MHz

Validation Dipole D1900V2 SN:511, d = 10 mm

Frequency: 1900 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(4.85,4.85,4.85) at 1800 MHz; **Muscle 1900 MHz**, σ = 1.46 mho/m ε_r = 53.5 ρ = 1.00 g/cm^3
Cubes (2): Peak: 20.0 mW/g ± 0.06 dB, SAR (1g): 10.6 mW/g ± 0.05 dB, SAR (10g): 5.49 mW/g ± 0.04 dB, (Worst-case extrapolation)
Penetration depth: 8.7 (7.9, 10.3) [mm]
Powerdrift: 0.01 dB






13 Feb 2001 18:09:51
CH1 S11 1 U FS
1: 45.260 Ω -1.0371 Ω 80.769 pF
1 900.000 000 MHz
PRm
Del
Cor
Avg
16
START 1 400.000 000 MHz
STOP 2 200.000 000 MHz