Deutscher Akkreditierungs Rat

DAR

TTI-P-G 158

IMST

Appendix for the Report

Dosimetric Assessment of the Siemens S55 (FCC ID: PWX-S55) According to the FCC Requirements

Calibration Data

July 17, 2002

IMST GmbH
Carl-Friedrich-Gauß-Str. 2
D-47475 Kamp-Lintfort

Customer
Siemens Information & Communication Mobile LCC
16745 West Bernardo Drive, Suite 400
San Diego-CA 92127

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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:	**1579**
Place of Calibration:	**Zurich**
Date of Calibration:	**May 3, 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: D. Vetter

Approved by: [signature]

Probe ET3DV6

SN:1579

Manufactured:	May 7, 2001
Last calibration:	January 29, 2002
Repaired:	April 26, 2002
Recalibrated:	May 3, 2002

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV6 SN:1579

Sensitivity in Free Space

NormX	**1.61**	$V/(V/m)^2$
NormY	**1.58**	$V/(V/m)^2$
NormZ	**1.59**	$V/(V/m)^2$

Diode Compression

DCP X	**93**	mV
DCP Y	**93**	mV
DCP Z	**93**	mV

Sensitivity in Tissue Simulating Liquid

Head **900 MHz** e_r **= 41.5 ± 5%** s **= 0.97 ± 5% mho/m**
Head **835 MHz** e_r **= 41.5 ± 5%** s **= 0.90 ± 5% mho/m**

ConvF X	**6.7**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.7**	± 9.5% (k=2)	Alpha	**0.32**
ConvF Z	**6.7**	± 9.5% (k=2)	Depth	**2.54**

Head **1800 MHz** e_r **= 40.0 ± 5%** s **= 1.40 ± 5% mho/m**
Head **1900 MHz** e_r **= 40.0 ± 5%** s **= 1.40 ± 5% mho/m**

ConvF X	**5.4**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**5.4**	± 9.5% (k=2)	Alpha	**0.45**
ConvF Z	**5.4**	± 9.5% (k=2)	Depth	**2.48**

Boundary Effect

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

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	8.3	4.9
SAR_{be} [%]	With Correction Algorithm	0.3	0.4

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

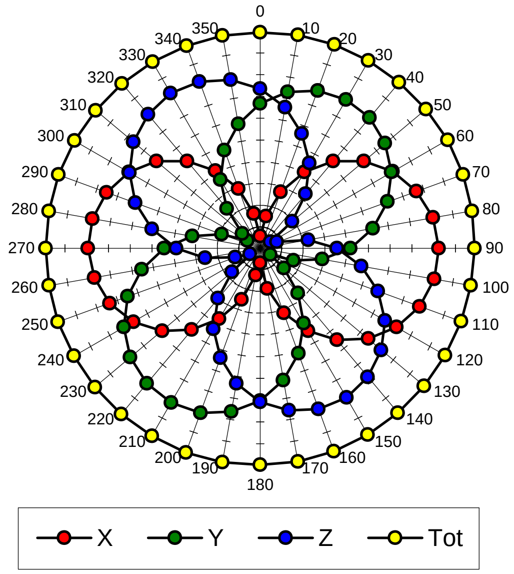
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	11.2	7.6
SAR_{be} [%]	With Correction Algorithm	0.2	0.3

Sensor Offset

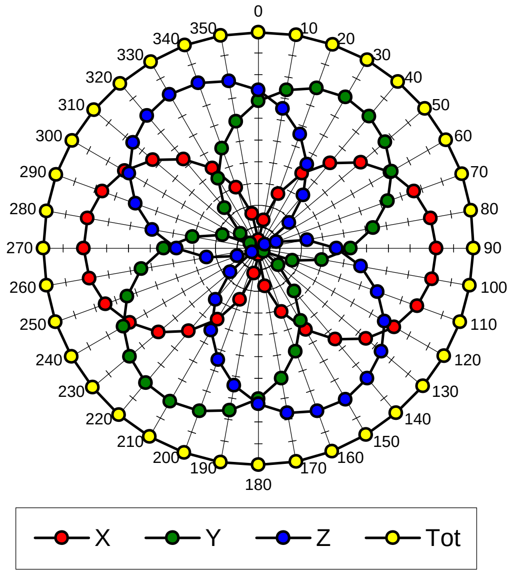
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.5 ± 0.2**	mm

Receiving Pattern (f), q = 0°

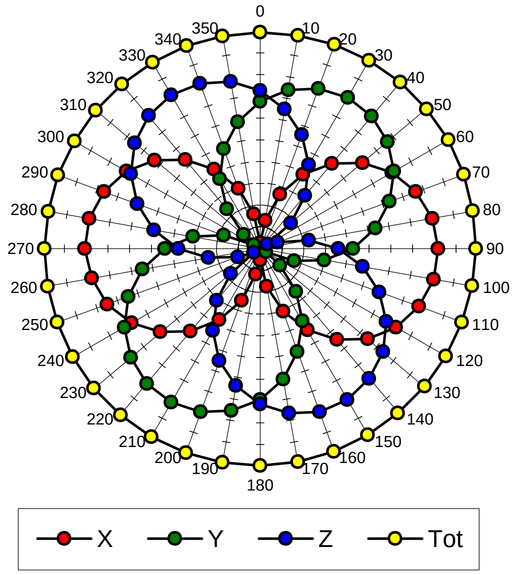
f = 30 MHz, TEM cell ifi110



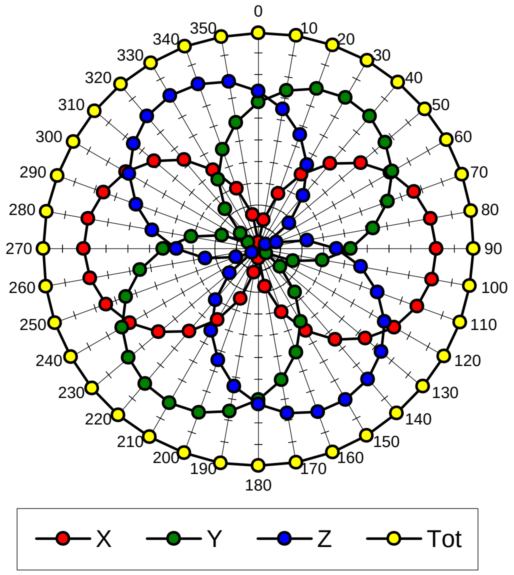
f = 100 MHz, TEM cell ifi110

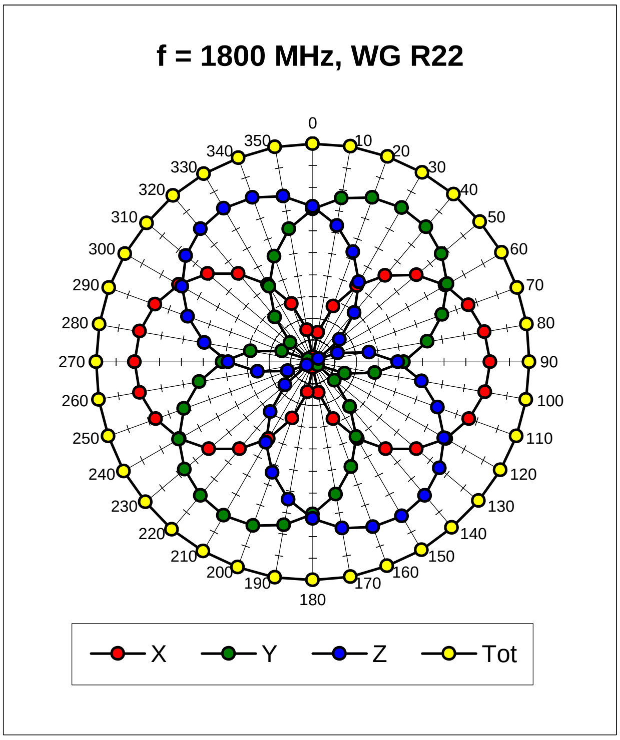


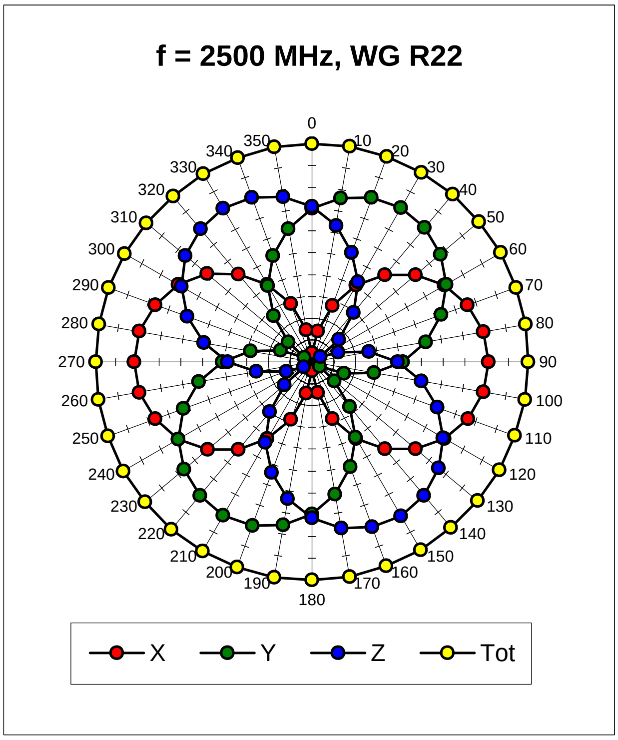
f = 300 MHz, TEM cell ifi110



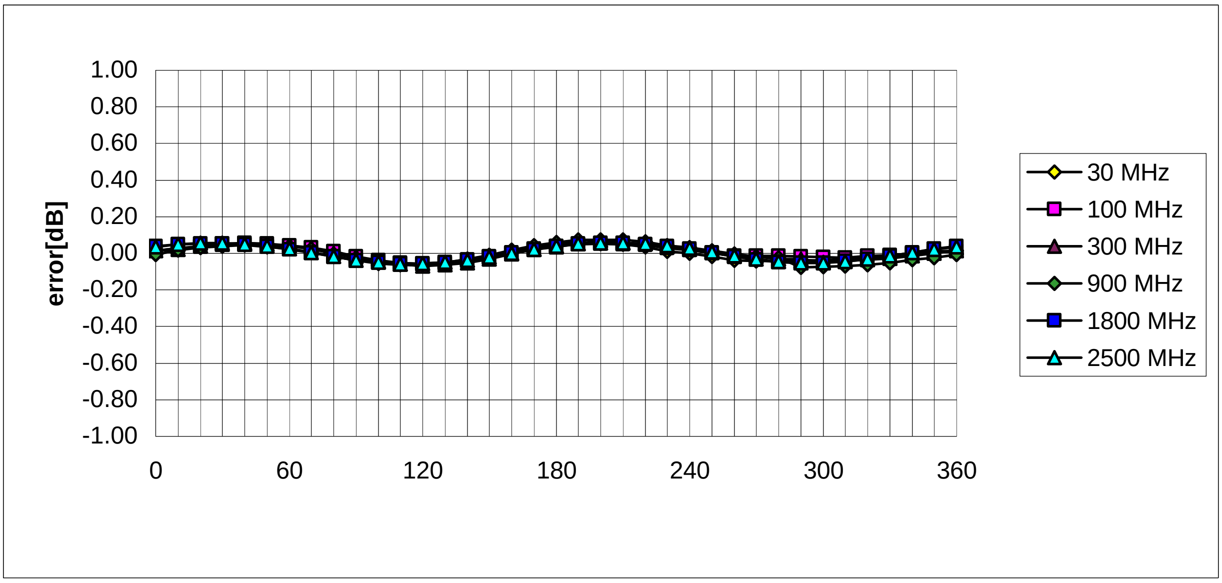
f = 900 MHz, TEM cell ifi110





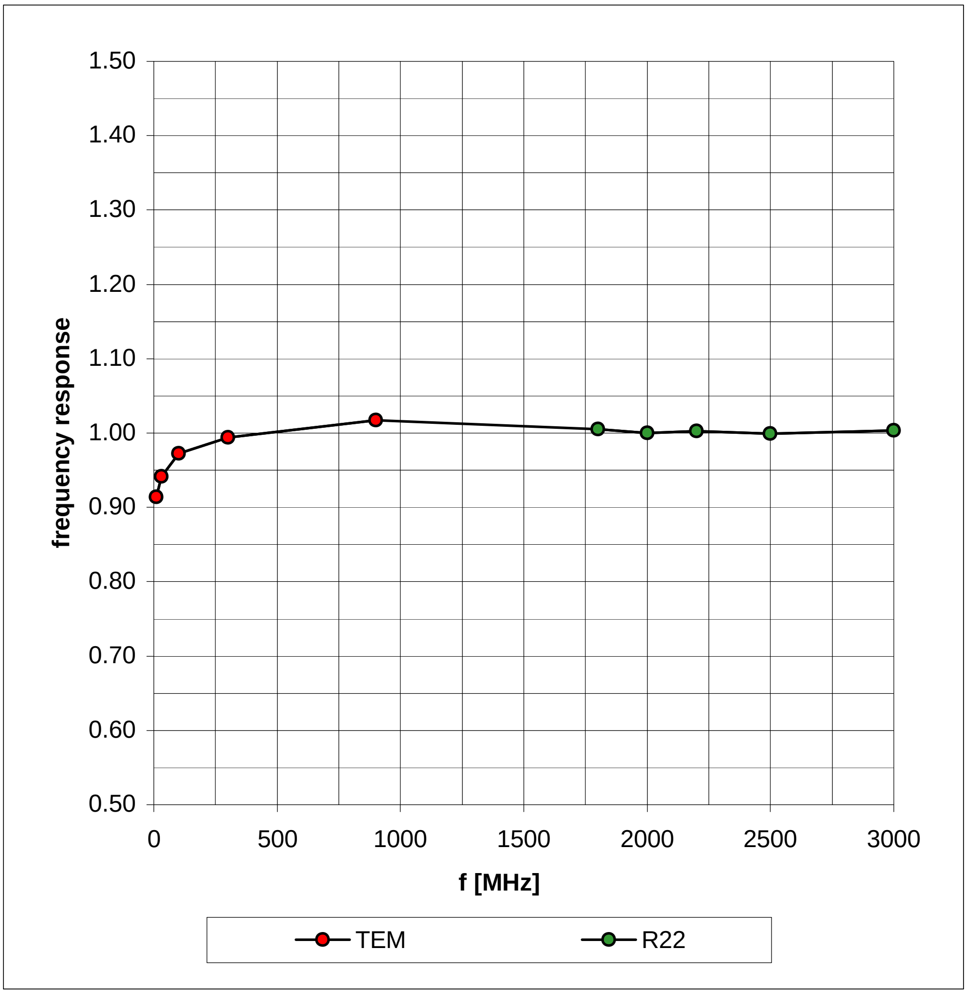


Isotropy Error (f), q = 0°



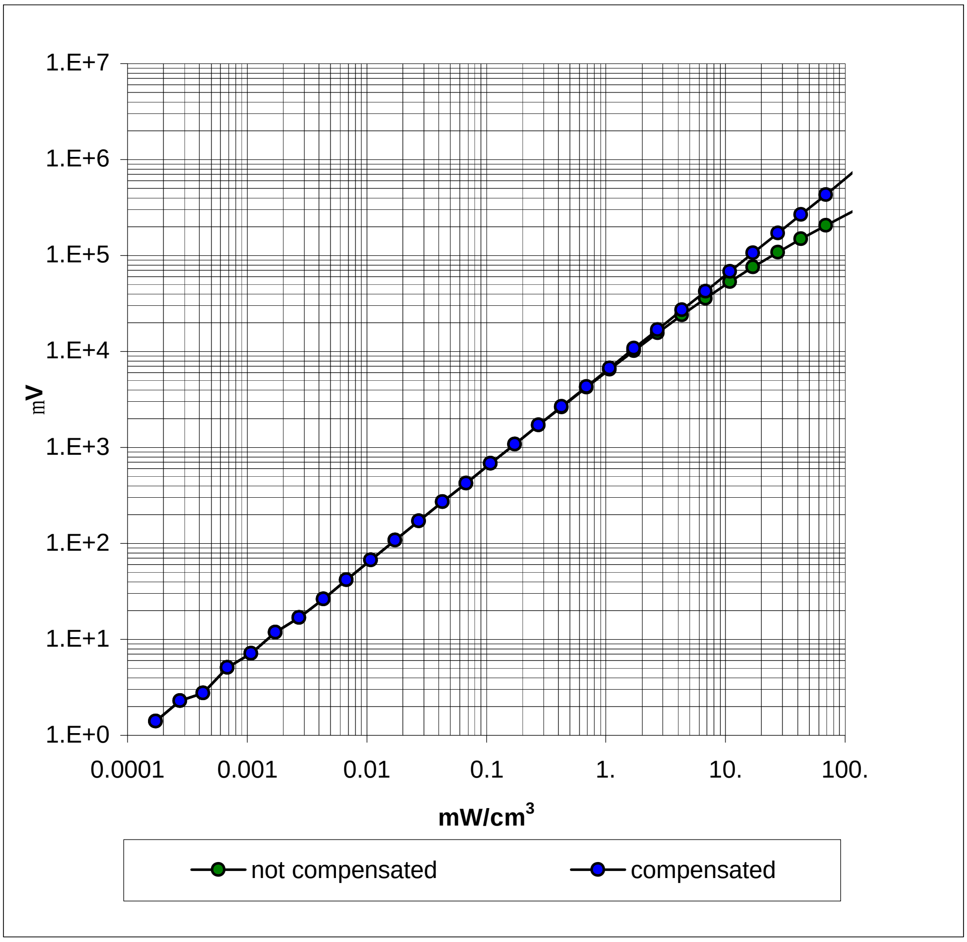
Frequency Response of E-Field

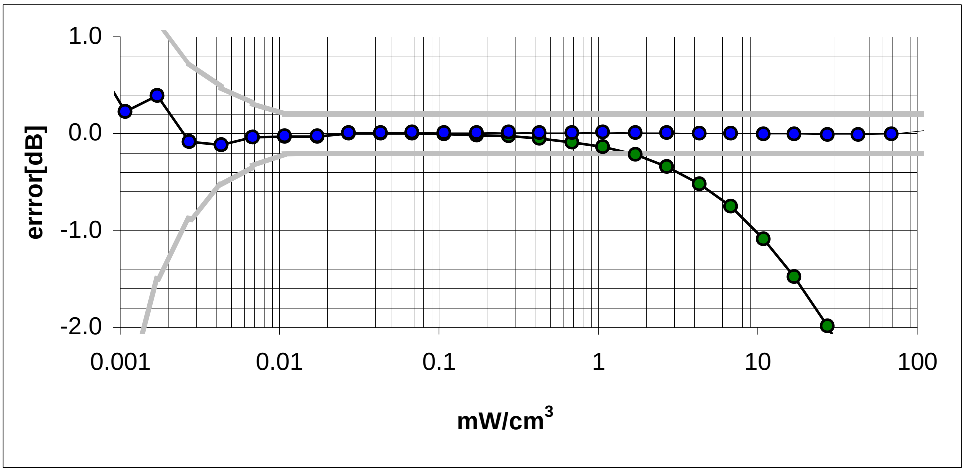
(TEM-Cell:ifi110, Waveguide R22)



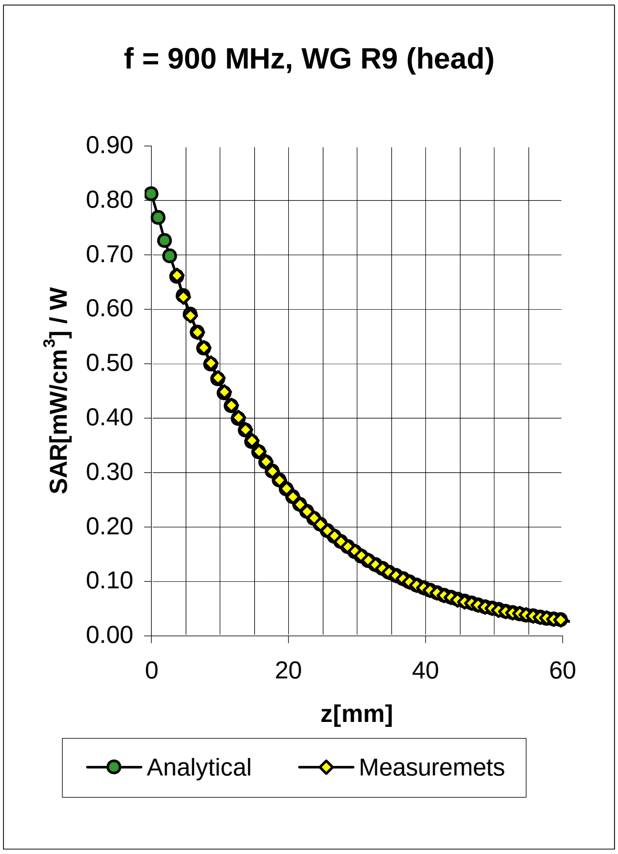
Dynamic Range f(SAR_{brain})

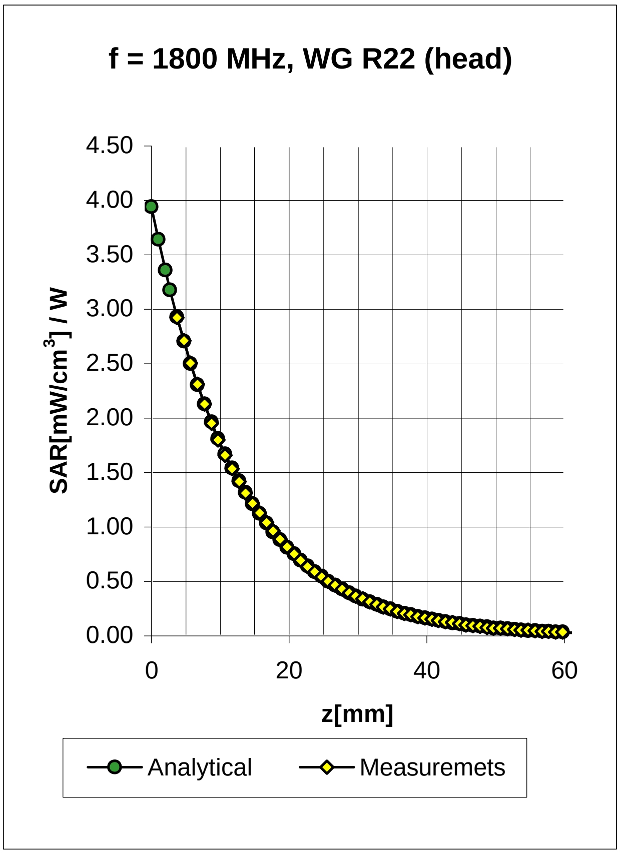
(Waveguide R22)





Conversion Factor Assessment



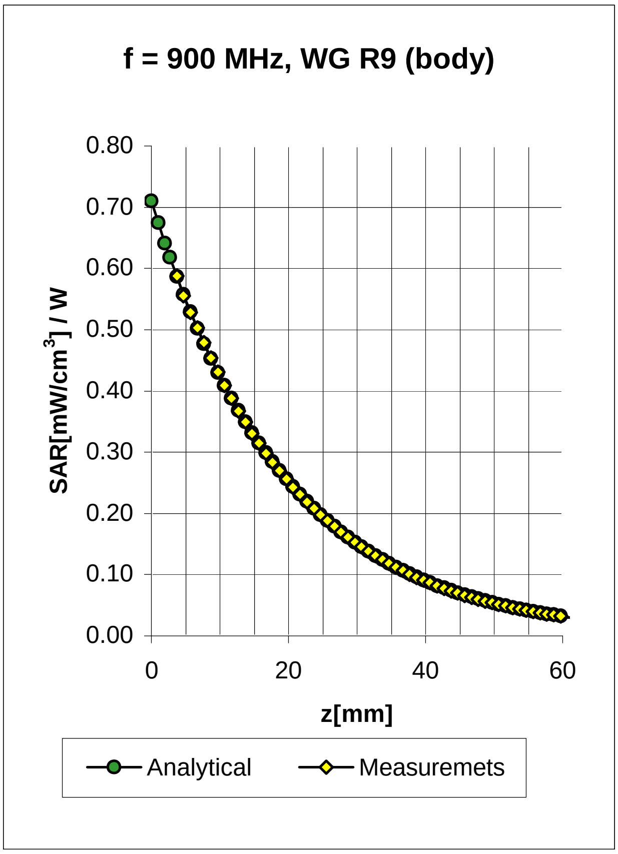


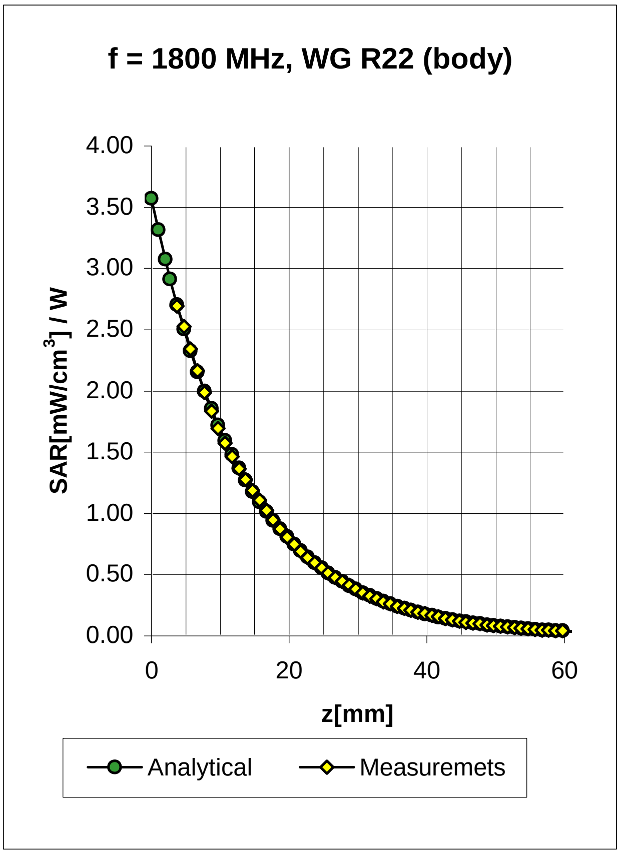
Head		**900 MHz**		e_r = **41.5 ± 5%**	s = **0.97 ± 5% mho/m**	
Head		**835 MHz**		e_r = **41.5 ± 5%**	s = **0.90 ± 5% mho/m**	
	ConvF X	**6.7**	± 9.5% (k=2)		Boundary effect:	
	ConvF Y	**6.7**	± 9.5% (k=2)		Alpha	**0.32**
	ConvF Z	**6.7**	± 9.5% (k=2)		Depth	**2.54**

Head		**1800 MHz**		e_r = **40.0 ± 5%**	s = **1.40 ± 5% mho/m**	
Head		**1900 MHz**		e_r = **40.0 ± 5%**	s = **1.40 ± 5% mho/m**	
	ConvF X	**5.4**	± 9.5% (k=2)		Boundary effect:	
	ConvF Y	**5.4**	± 9.5% (k=2)		Alpha	**0.45**
	ConvF Z	**5.4**	± 9.5% (k=2)		Depth	**2.48**

ET3DV6 SN:1579 **May 3, 2002**

Conversion Factor Assessment



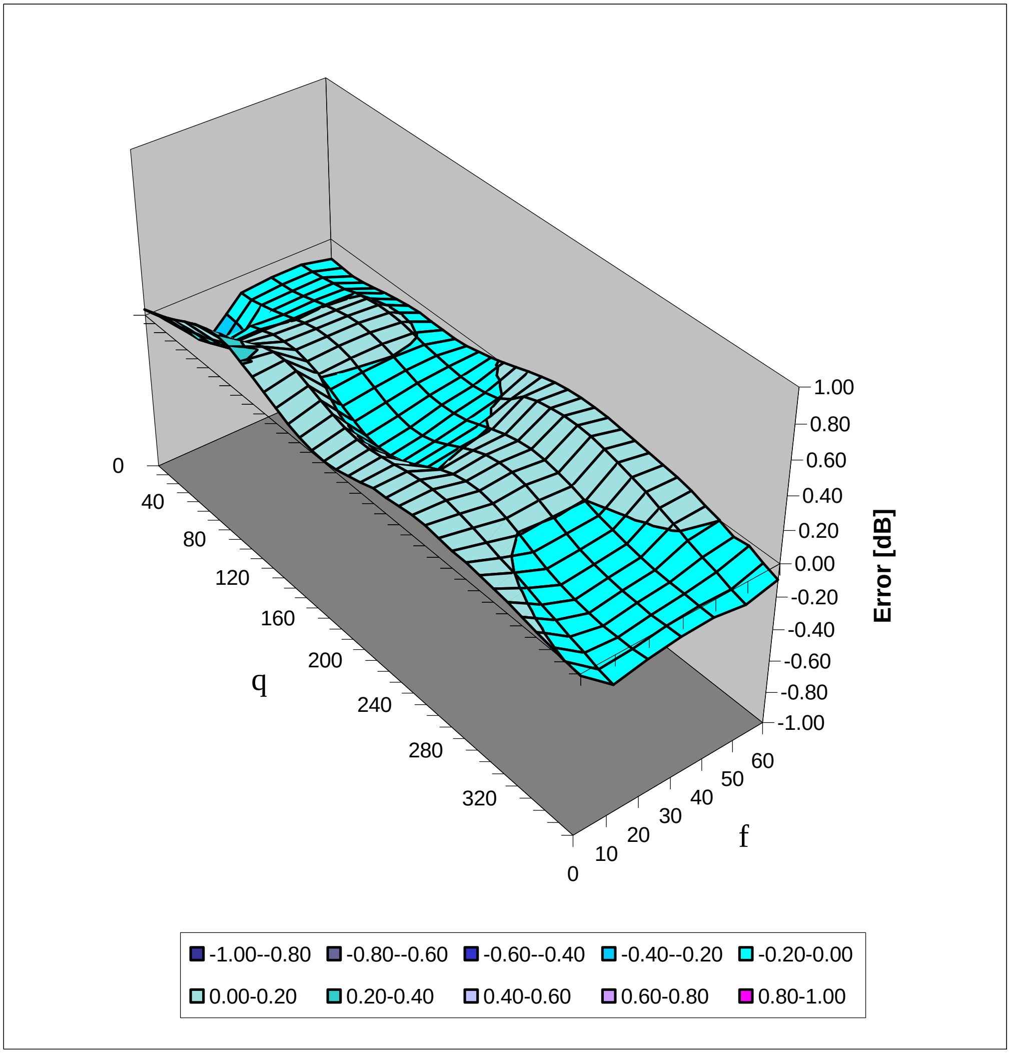


Body	**900 MHz**		**e_r = 55.0 ± 5%**	**s = 1.05 ± 5% mho/m**	
Body	**835 MHz**		**e_r = 55.2 ± 5%**	**s = 0.97 ± 5% mho/m**	
	ConvF X	**6.4**	± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**6.4**	± 9.5% (k=2)	Alpha	**0.33**
	ConvF Z	**6.4**	± 9.5% (k=2)	Depth	**2.60**

Body	**1800 MHz**		**e_r = 53.3 ± 5%**	**s = 1.52 ± 5% mho/m**	
Body	**1900 MHz**		**e_r = 53.3 ± 5%**	**s = 1.52 ± 5% mho/m**	
	ConvF X	**5.1**	± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**5.1**	± 9.5% (k=2)	Alpha	**0.56**
	ConvF Z	**5.1**	± 9.5% (k=2)	Depth	**2.39**

Deviation from Isotropy in HSL

Error (q, f), f = 900 MHz



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Engineering AG

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Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1579**
Place of Assessment:	**Zurich**
Date of Assessment:	**May 8, 2002**
Probe Calibration Date:	**May 3, 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: [signature]

Dosimetric E-Field Probe ET3DV6 SN:1579

Conversion factor (± standard deviation)

835 MHz	ConvF	**6.8 ± 8%**	**ε_r = 41.5 ± 5%** **σ = 0.90 ± 5% mho/m** (head tissue)
835 MHz	ConvF	**6.6 ± 8%**	**ε_r = 55.2 ± 5%** **σ = 0.97 ± 5% mho/m** (body tissue)
1900 MHz	ConvF	**5.2 ± 8%**	**ε_r = 40.0 ± 5%** **σ = 1.40 ± 5% mho/m** (head tissue)
1900 MHz	ConvF	**4.8 ± 8%**	**ε_r = 53.3 ± 5%** **σ = 1.52 ± 5% mho/m** (body tissue)

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Calibration Certificate

1900 MHz System Validation Dipole

Type:	**D1900V2**
Serial Number:	**535**
Place of Calibration:	**Zurich**
Date of Calibration:	**Apr. 24, 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:	Nikoloski Neviana
Approved by:	Pokovic Katja

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: 535

Manufactured: March 22, 2001
Calibrated: April 24, 2001

1. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with brain simulating sugar 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:	**43.2 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:	**1.204 ns**	(one direction)
Transmission factor:	**0.988**	(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} = **51.0 Ω**
	Im {Z} = **-0.1 Ω**
Return Loss at 1900 MHz	**- 40.3 dB**

4. 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.

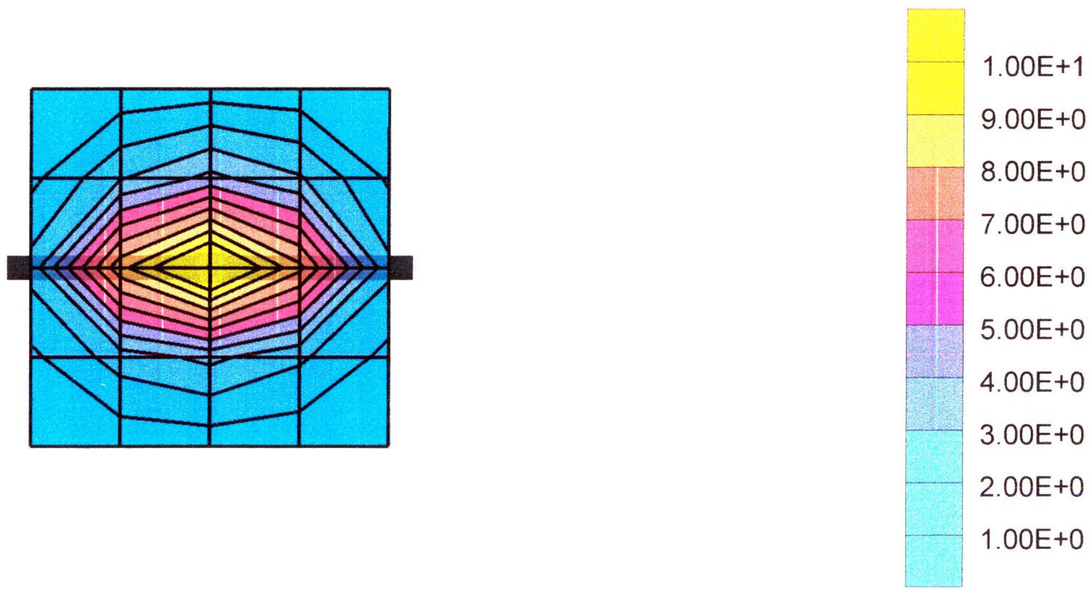
Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

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

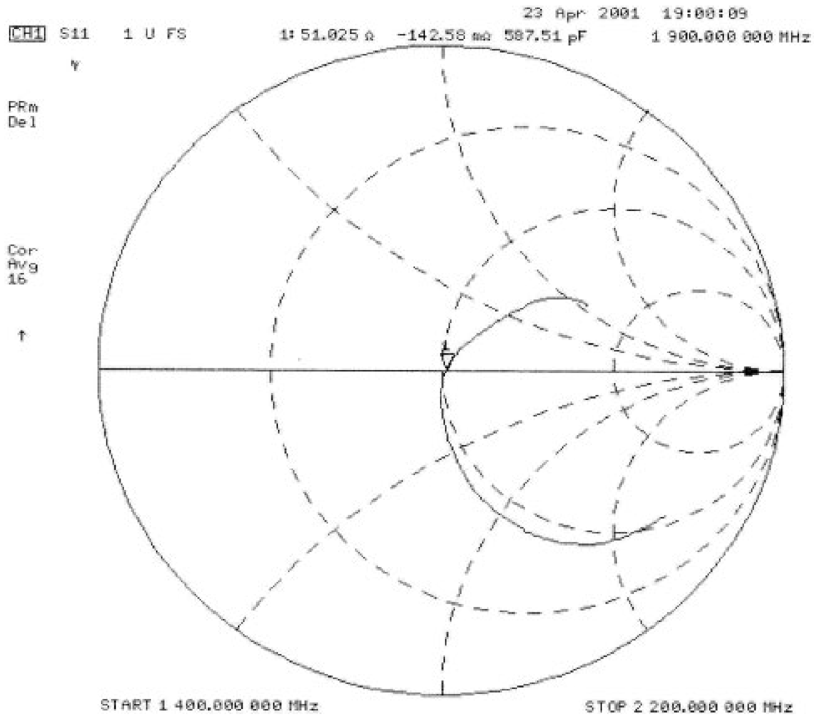
04/23/01

Validation Dipole D1900V2 SN:535, 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: 20.8 mW/g ± 0.04 dB, SAR (1g): 10.8 mW/g ± 0.03 dB, SAR (10g): 5.48 mW/g ± 0.02 dB, (Worst-case extrapolation)
Penetration depth: 7.8 (7.4, 8.9) [mm]
Powerdrift: 0.01 dB



Schmid & Partner Engineering AG, Zurich, Switzerland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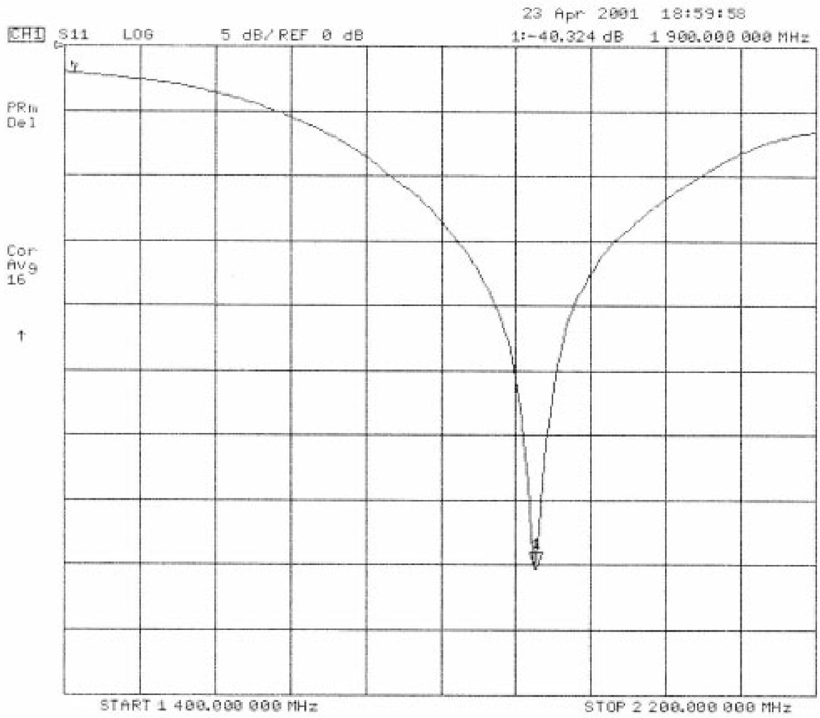
CH1 S11 1 U FS
1: 51.025 Ω -142.58 mΩ 587.51 pF
1 900.000 000 MHz
PRm
Del
Cor
Avg
16
START 1 400.000 000 MHz
STOP 2 200.000 000 MHz


23 Apr 2001 18:59:58
CH1 S11 LOG 5 dB/ REF 0 dB
1:-40.324 dB 1 900.000 000 MHz
PRm
Del
Cor
Avg
16
START 1 400.000 000 MHz
STOP 2 200.000 000 MHz

Schmid & Partner
Engineering AG

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

Calibration Certificate

1900 MHz System Validation Dipole (Muscle Tissue)

Type:	**D1900V2**
Serial Number:	**535**
Place of Calibration:	**Zurich**
Date of Calibration:	**August 23, 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: D1900V2

Serial: 535

Manufactured: March 22, 2001
Calibrated: August 23, 2001

1. 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 Dielectricity	**53.5**	± 5%
Conductivity	**1.46 mho/m**	± 5%

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.0 at 1900 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 20mm 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:	**40.8 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**21.2 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:	**1.203 ns**	(one direction)
Transmission factor:	**0.993**	(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} = **42.0 Ω**
	Im {Z} = **-9.5 Ω**
Return Loss at 1900 MHz	**-17.5 dB**

4. 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.

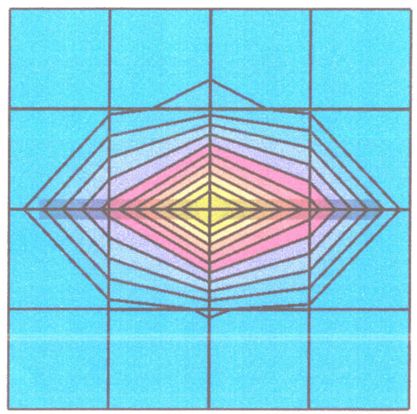
Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

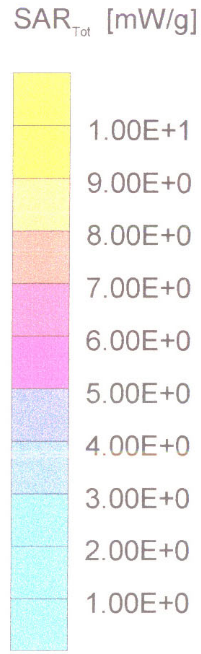
After prolonged use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

08/23/01

Validation Dipole D1900V2 SN:535, d = 10 mm

Frequency: 1900 MHz; Antenna Input Power: 250 [mW]
SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(5.00,5.00,5.00) at 1900 MHz; Muscle 1900 MHz; σ = 1.46 mho/m ε_r = 53.5 ρ = 1.00 g/cm^3
Cubes (2): Peak: 19.1 mW/g ± 0.04 dB, SAR (1g): 10.2 mW/g ± 0.03 dB, SAR (10g): 5.29 mW/g ± 0.03 dB, (Worst-case extrapolation)
Penetration depth: 8.8 (7.9, 10.5) [mm]
Powerdrift: 0.01 dB





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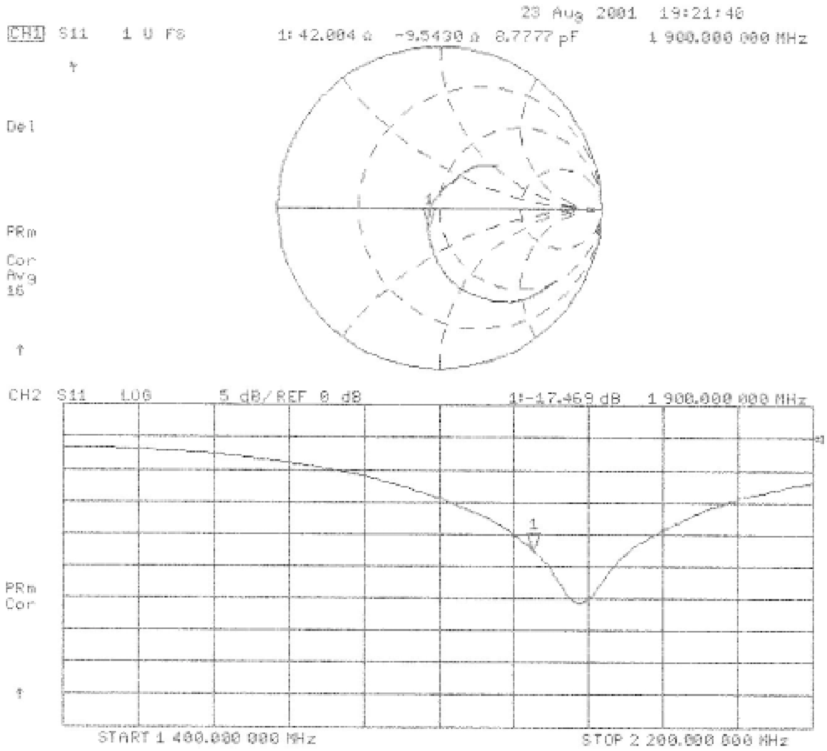
23 Aug 2001 19:21:40
CH1 S11 1 U FS 1: 42.004 Ω -9.5430 Ω 8.7777 pF 1 900.000 000 MHz
Del
PRm
Cor
Avg
16
CH2 S11 LOG 5 dB/ REF 0 dB 1:-17.469 dB 1 900.000 000 MHz
PRm
Cor
START 1 400.000 000 MHz
STOP 2 200.000 000 MHz