
10. ANNEX B: VALIDATION PLOTS

12/10/01 Temp = 23° C ± 1°

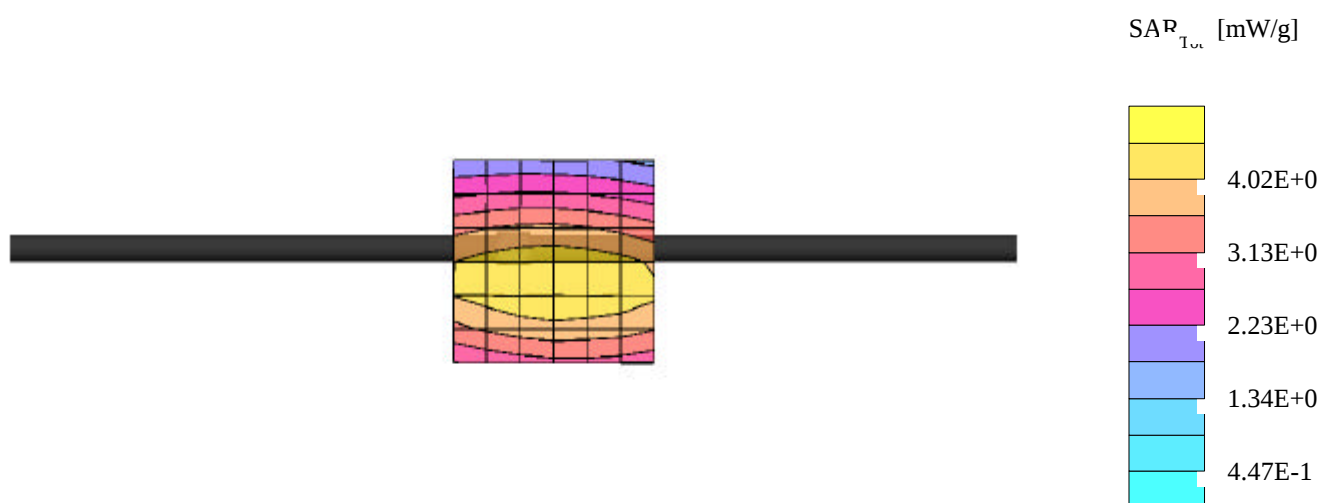
Dipole 900 MHz

SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 900 MHz

; 10; Probe: ET3DV6R - SN1429-1; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 900 MHz (SAM): $\sigma = 0.95$ mho/m $\epsilon_r = 40.9$ $\rho = 1.00$ g/cm³

Cube 7x7x7: SAR (1g): 2.87 mW/g, SAR (10g): 1.83 mW/g, (Worst-case extrapolation)

Cube 7x7x7: Dx = 5.0, Dy = 5.0, Dz = 5.0



12/10/01 Temp = 23° C ± 1°

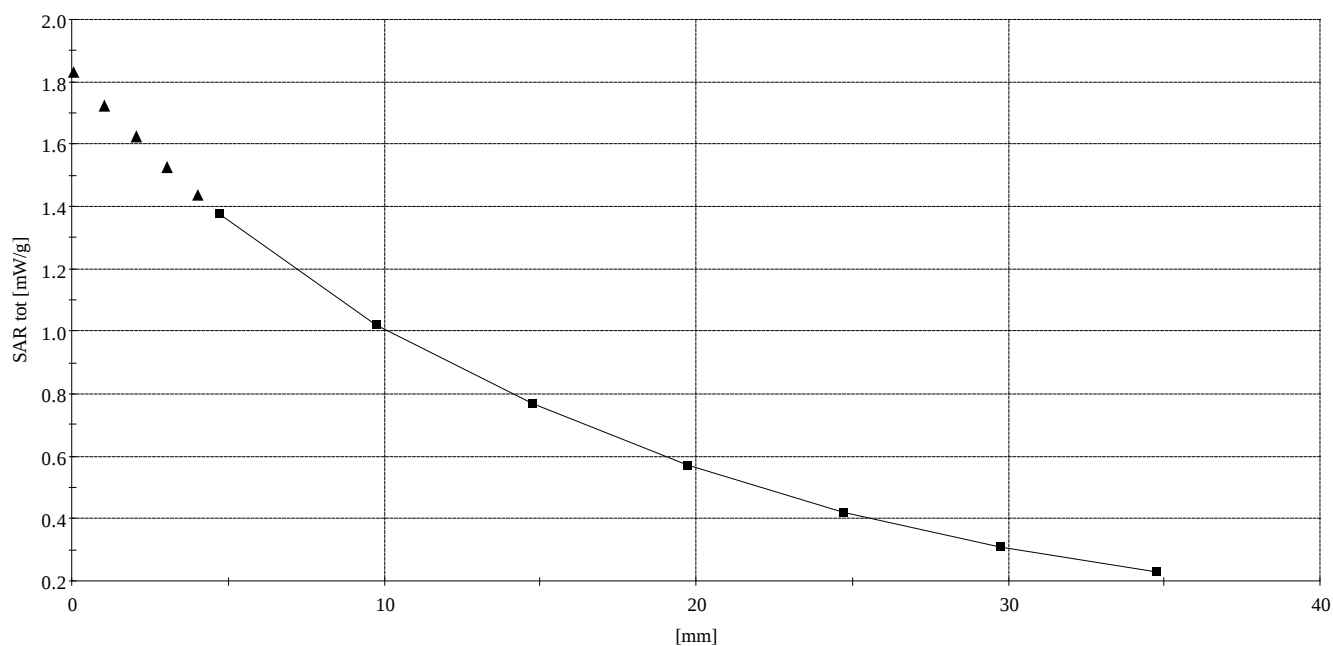
Dipole 900 MHz

SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 900 MHz

; 10; Probe: ET3DV6R - SN1429-1; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 900 MHz (SAM): $\sigma = 0.95$ mho/m $\epsilon_r = 40.9$ $\rho = 1.00$ g/cm³

Cube 7x7x7: SAR (1g): 2.87 mW/g, SAR (10g): 1.83 mW/g, (Worst-case extrapolation)

Cube 7x7x7: Dx = 5.0, Dy = 5.0, Dz = 5.0



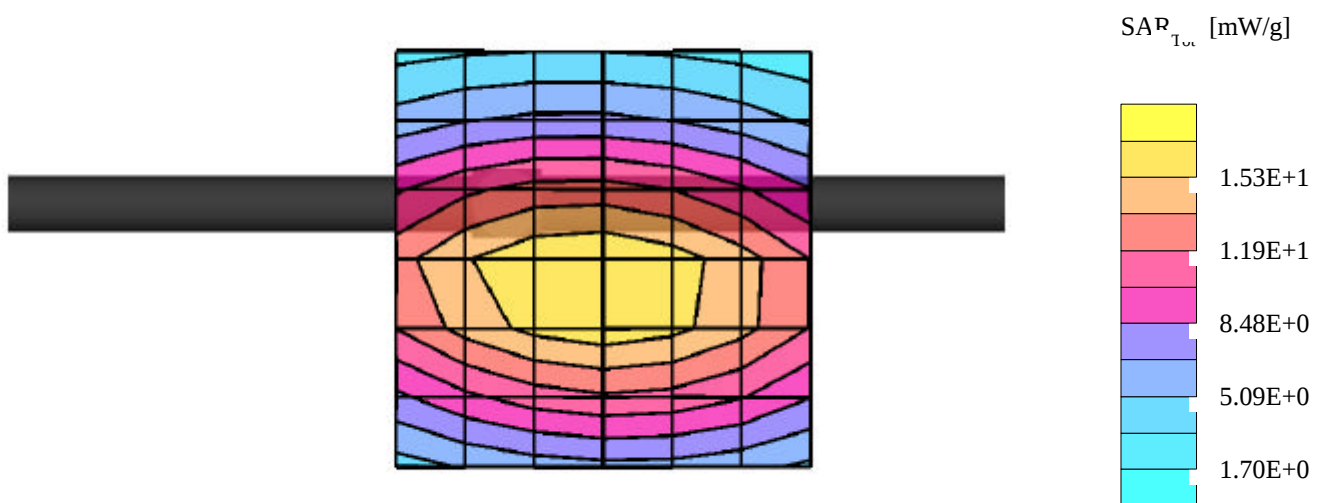
Dipole 1800 MHz

SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1800 MHz

; 11; Probe: ET3DV6R - SN1429-1; ConvF(5.17,5.17,5.17); Crest factor: 1.0; Brain 1800 MHz (SAM): $\sigma = 1.35$ mho/m $\epsilon_r = 38.7$ $\rho = 1.00$ g/cm³

Cube 7x7x7: SAR (1g): 9.52 mW/g, SAR (10g): 4.99 mW/g, (Worst-case extrapolation)

Cube 7x7x7: Dx = 5.0, Dy = 5.0, Dz = 5.0



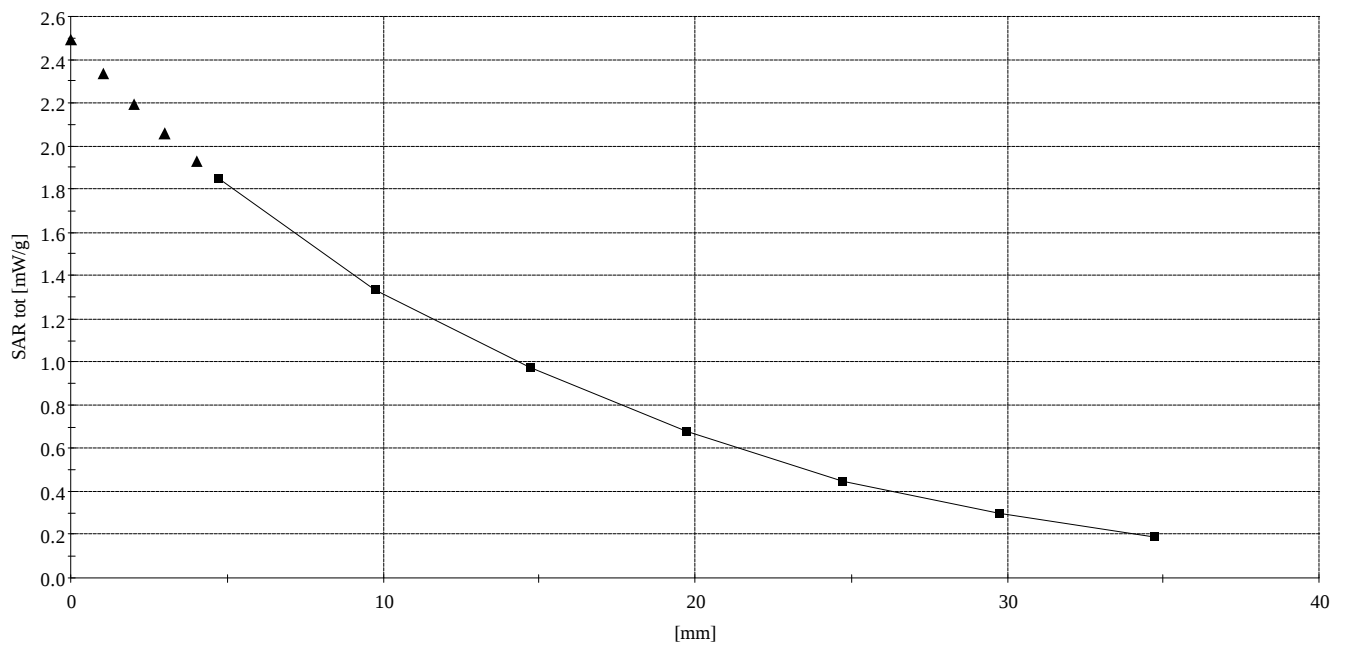
Dipole 1800 MHz

SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1800 MHz

; 11; Probe: ET3DV6R - SN1429-1; ConvF(5.17,5.17,5.17); Crest factor: 1.0; Brain 1800 MHz (SAM): $\sigma = 1.35$ mho/m $\epsilon_r = 38.7$ $\rho = 1.00$ g/cm³

Cube 7x7x7: SAR (1g): 9.64 mW/g, SAR (10g): 5.05 mW/g, (Worst-case extrapolation)

Cube 7x7x7: Dx = 5.0, Dy = 5.0, Dz = 5.0



12/10/01 Temp = 23° C ± 1°

Dipole 900 MHz

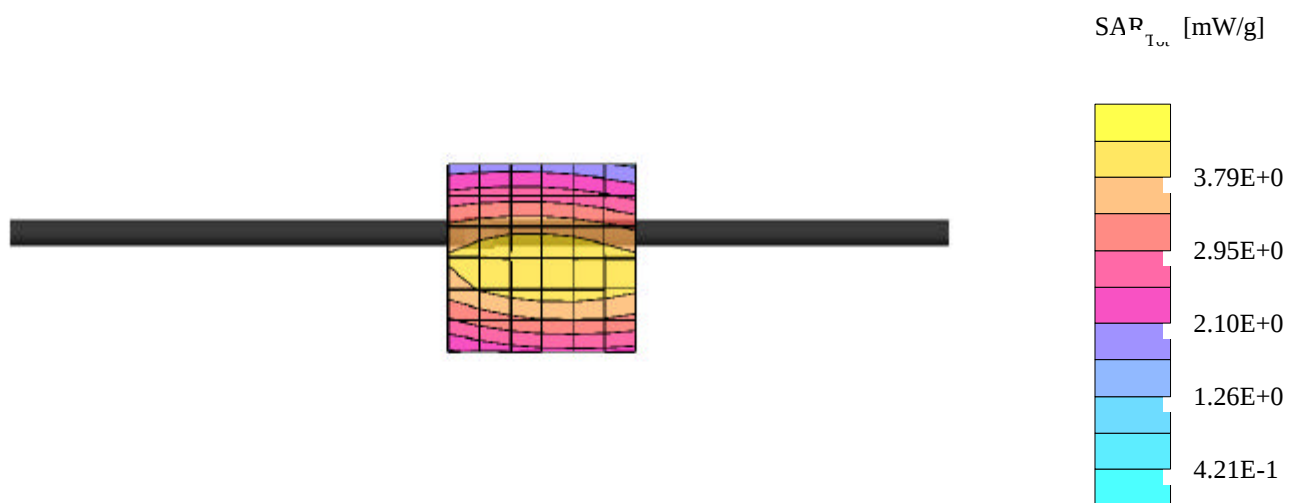
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 900 MHz

; 10; Probe: ET3DV6R - SN1429-1; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Validation Body 836 (SAM): $\sigma = 1.00$ mho/m

$\epsilon_r = 56.3$ $\rho = 1.00$ g/cm³

Cube 7x7x7: SAR (1g): 2.77 mW/g, SAR (10g): 1.79 mW/g, (Worst-case extrapolation)

Cube 7x7x7: Dx = 5.0, Dy = 5.0, Dz = 5.0



12/10/01 Temp = 23° C ± 1°

Dipole 900 MHz

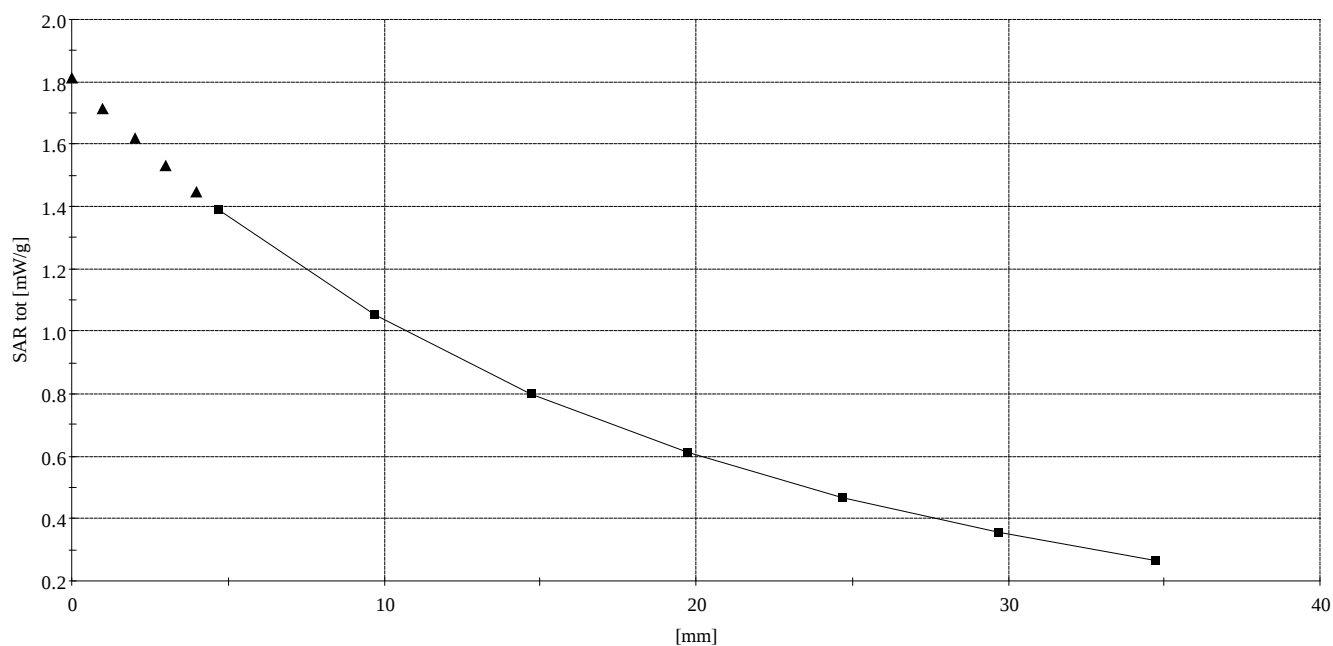
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 900 MHz

; 10; Probe: ET3DV6R - SN1429-1; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Validation Body 836 (SAM): $\sigma = 1.00$ mho/m

$\epsilon_r = 56.3$ $\rho = 1.00$ g/cm³

Cube 7x7x7: SAR (1g): 2.77 mW/g, SAR (10g): 1.79 mW/g, (Worst-case extrapolation)

Cube 7x7x7: Dx = 5.0, Dy = 5.0, Dz = 5.0



11. ANNEX C: CALIBRATION CERTIFICATES

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:

ET3DV6R

Serial Number:

1431

17752

Place of Calibration:

Zurich

Date of Calibration:

December 19, 2001

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:

Michael Meier

Approved by:

John H. H.

Probe ET3DV6R

SN:1431

Manufactured:	May 18, 2001
Calibrated:	December 19, 2001

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV6R SN:1431

Sensitivity in Free Space

NormX	2.33 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	2.23 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	2.02 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

DCP X	99 mV
DCP Y	99 mV
DCP Z	99 mV

Sensitivity in Tissue Simulating Liquid

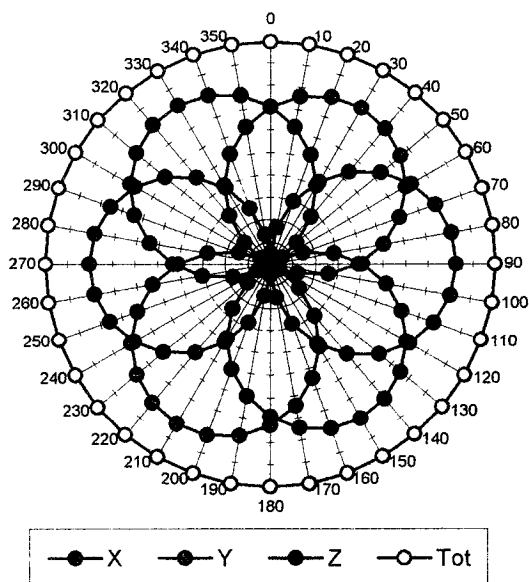
Head	450 MHz	$\epsilon_r = 43.5 \pm 5\%$	$\sigma = 0.87 \pm 10\% \text{ mho/m}$
ConvF X	6.65 extrapolated	Boundary effect:	
ConvF Y	6.65 extrapolated	Alpha	0.57
ConvF Z	6.65 extrapolated	Depth	1.84
Head	800 - 1000 MHz	$\epsilon_r = 39.0 - 43.5$	$\sigma = 0.80 - 1.10 \text{ mho/m}$
ConvF X	6.09 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.09 $\pm 9.5\%$ (k=2)	Alpha	0.57
ConvF Z	6.09 $\pm 9.5\%$ (k=2)	Depth	1.95
Head	1500 MHz	$\epsilon_r = 40.4 \pm 5\%$	$\sigma = 1.23 \pm 10\% \text{ mho/m}$
ConvF X	5.33 interpolated	Boundary effect:	
ConvF Y	5.33 interpolated	Alpha	0.57
ConvF Z	5.33 interpolated	Depth	2.10
Head	1700 - 1910 MHz	$\epsilon_r = 39.5 - 41.0$	$\sigma = 1.20 - 1.55 \text{ mho/m}$
ConvF X	4.95 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	4.95 $\pm 9.5\%$ (k=2)	Alpha	0.57
ConvF Z	4.95 $\pm 9.5\%$ (k=2)	Depth	2.17

Sensor Offset

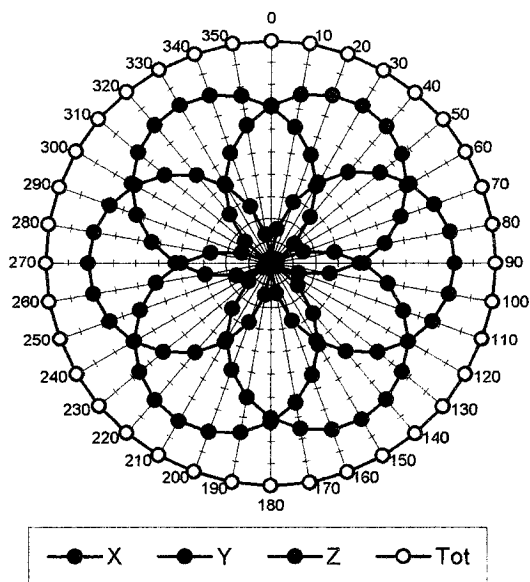
Probe Tip to Sensor Center	2.7	mm
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Receiving Pattern (ϕ), $\theta = 0^\circ$

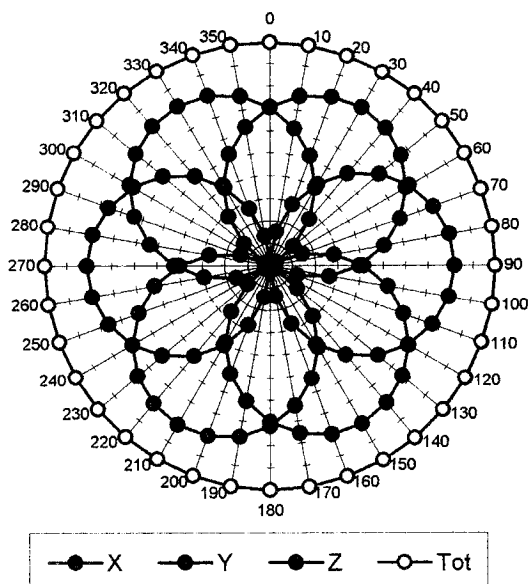
f = 30 MHz, TEM cell ifi110



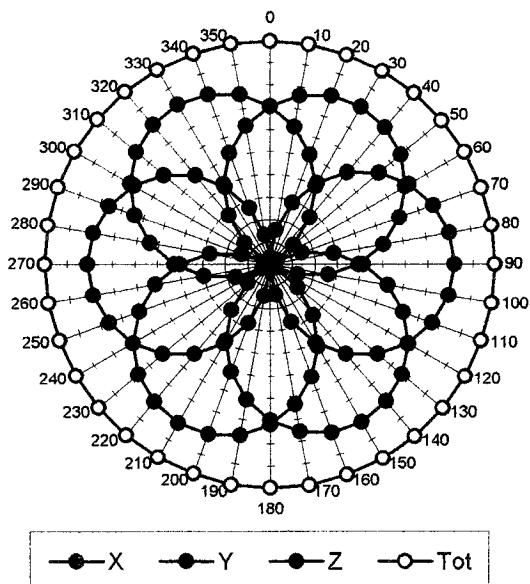
f = 100 MHz, TEM cell ifi110

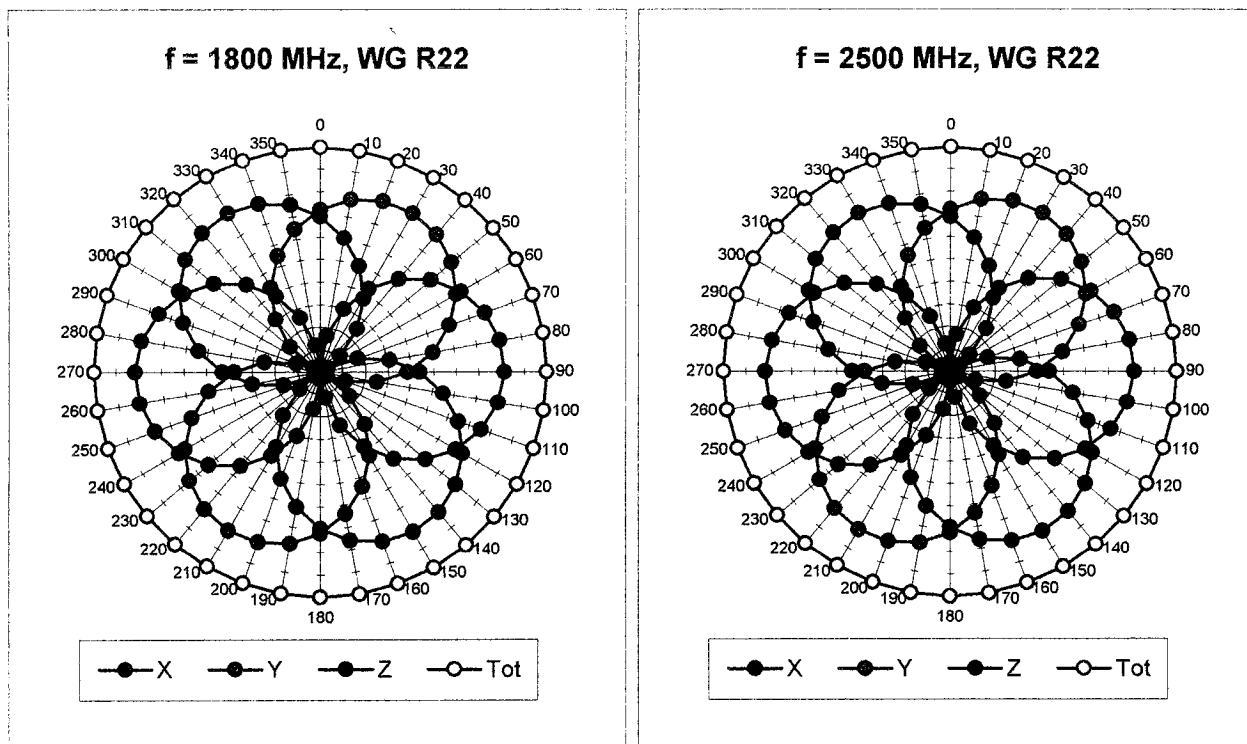


f = 300 MHz, TEM cell ifi110

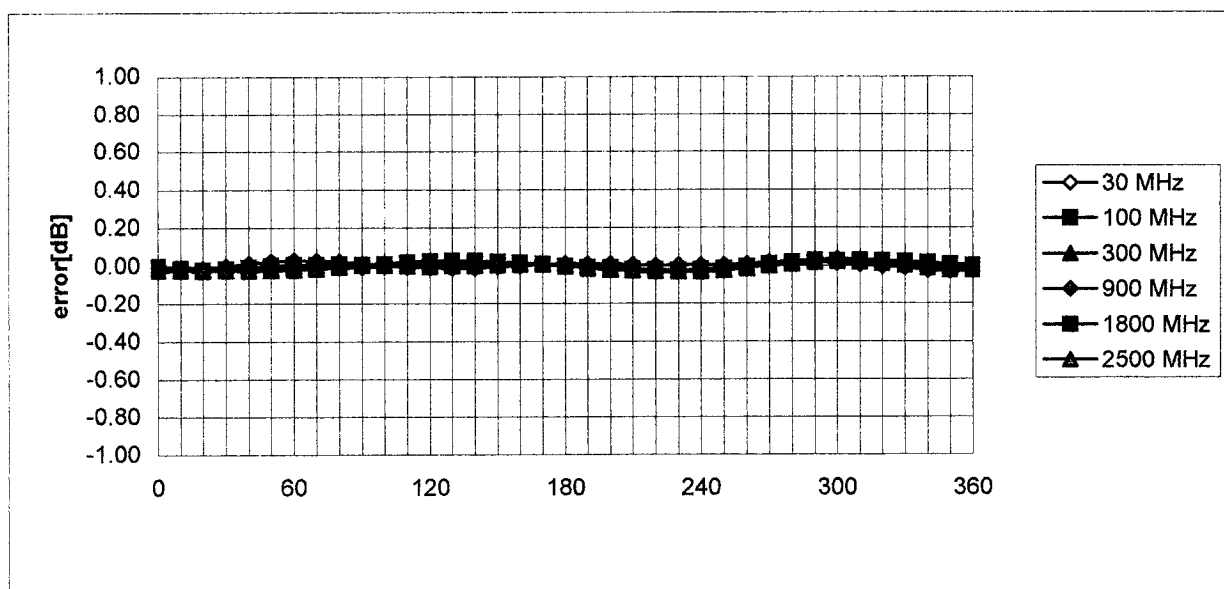


f = 900 MHz, TEM cell ifi110



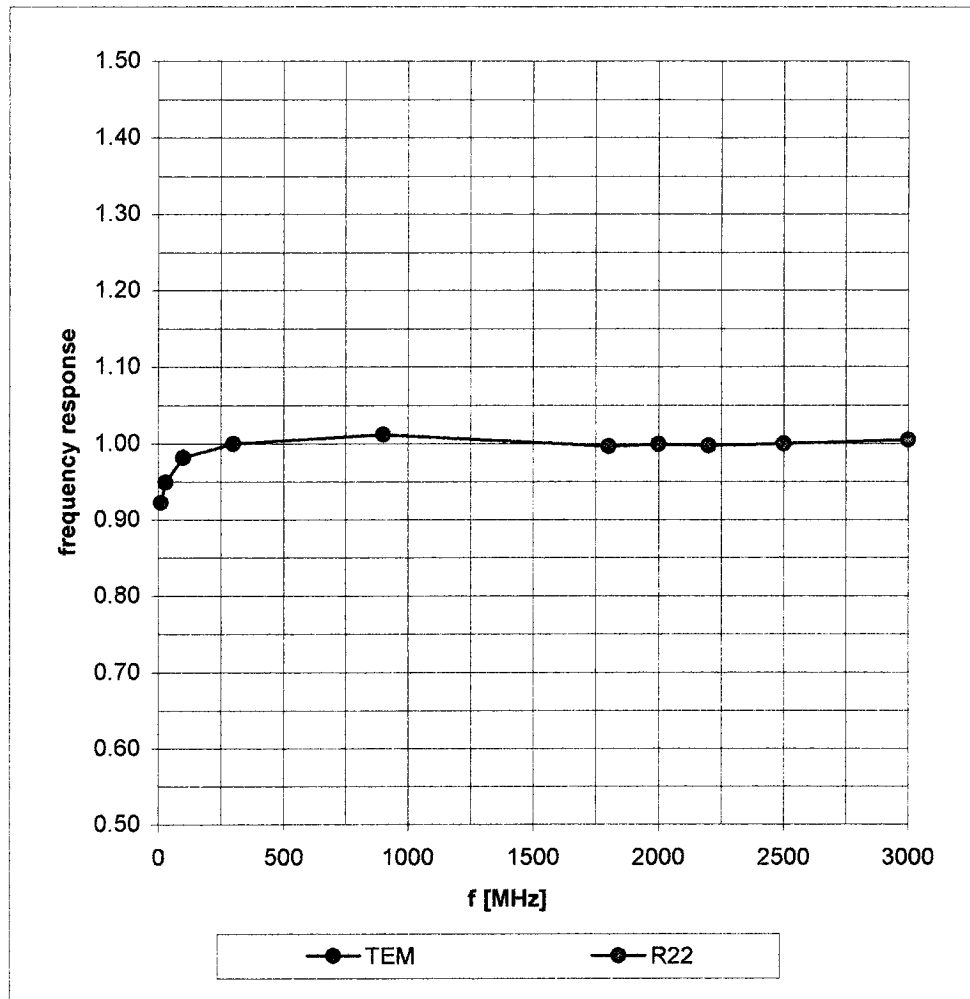


Isotropy Error (ϕ), $\theta = 0^\circ$

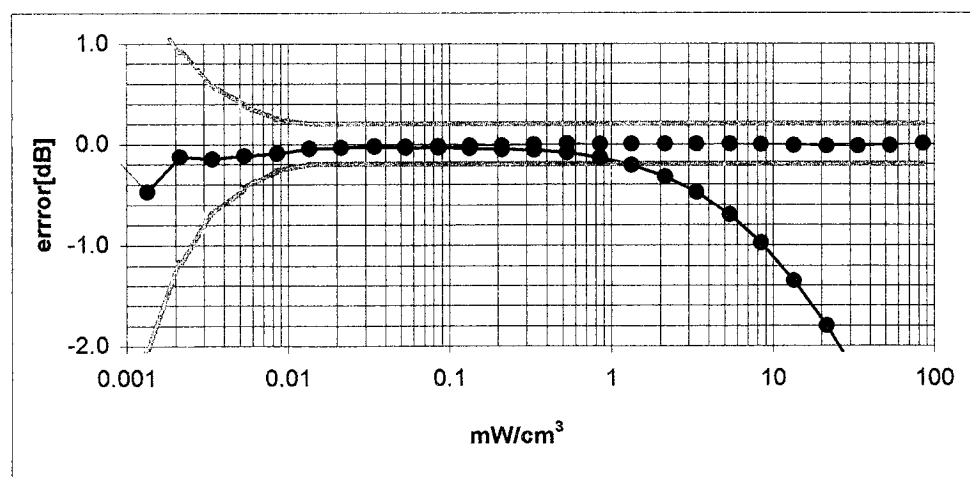
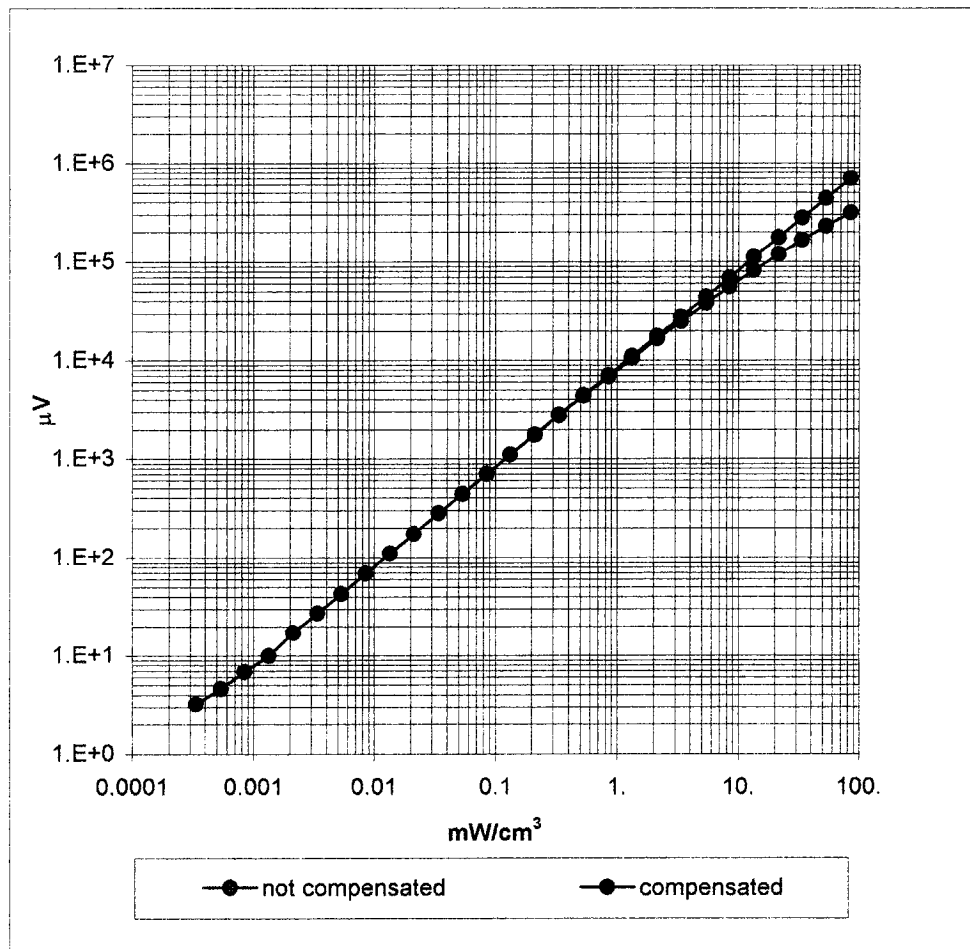


Frequency Response of E-Field

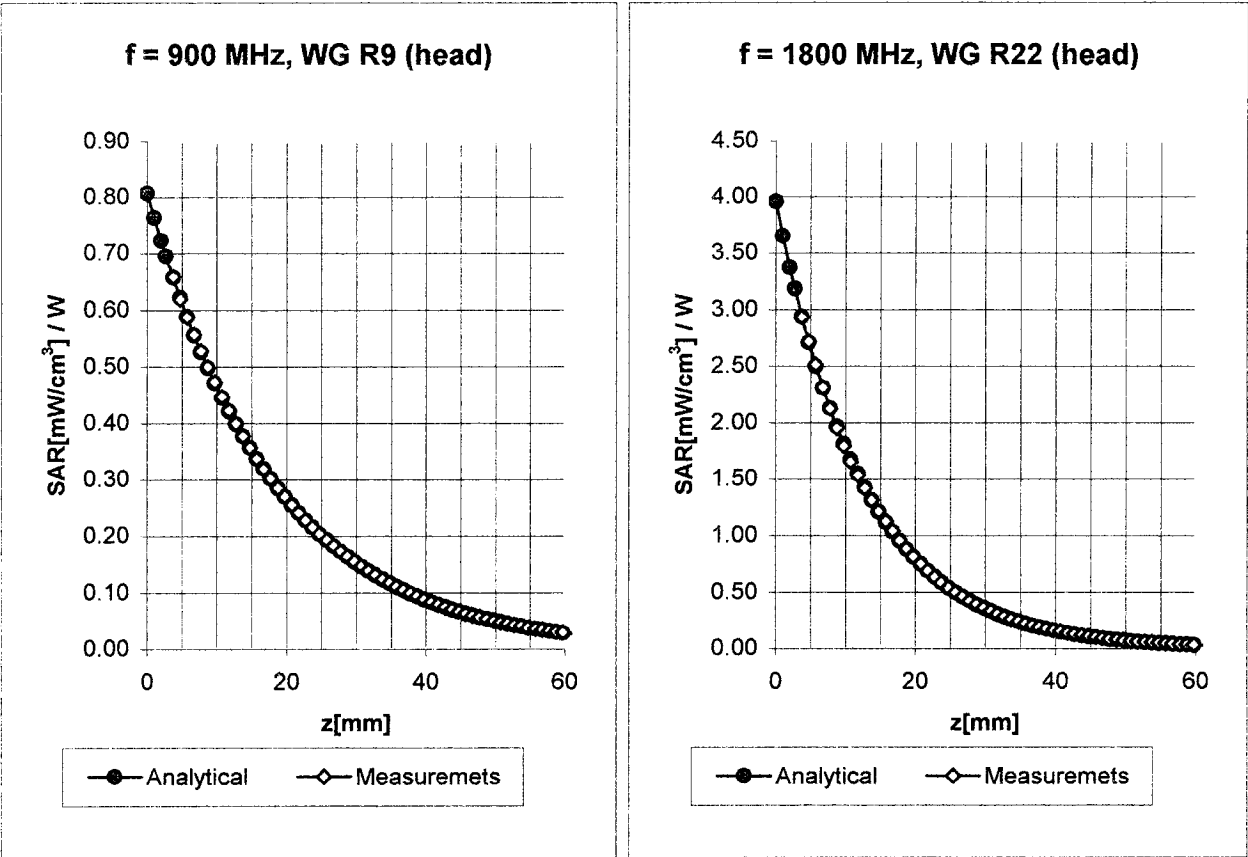
(TEM-Cell:ifi110, Waveguide R22)



Dynamic Range $f(\text{SAR}_{\text{brain}})$ (Waveguide R22)



Conversion Factor Assessment



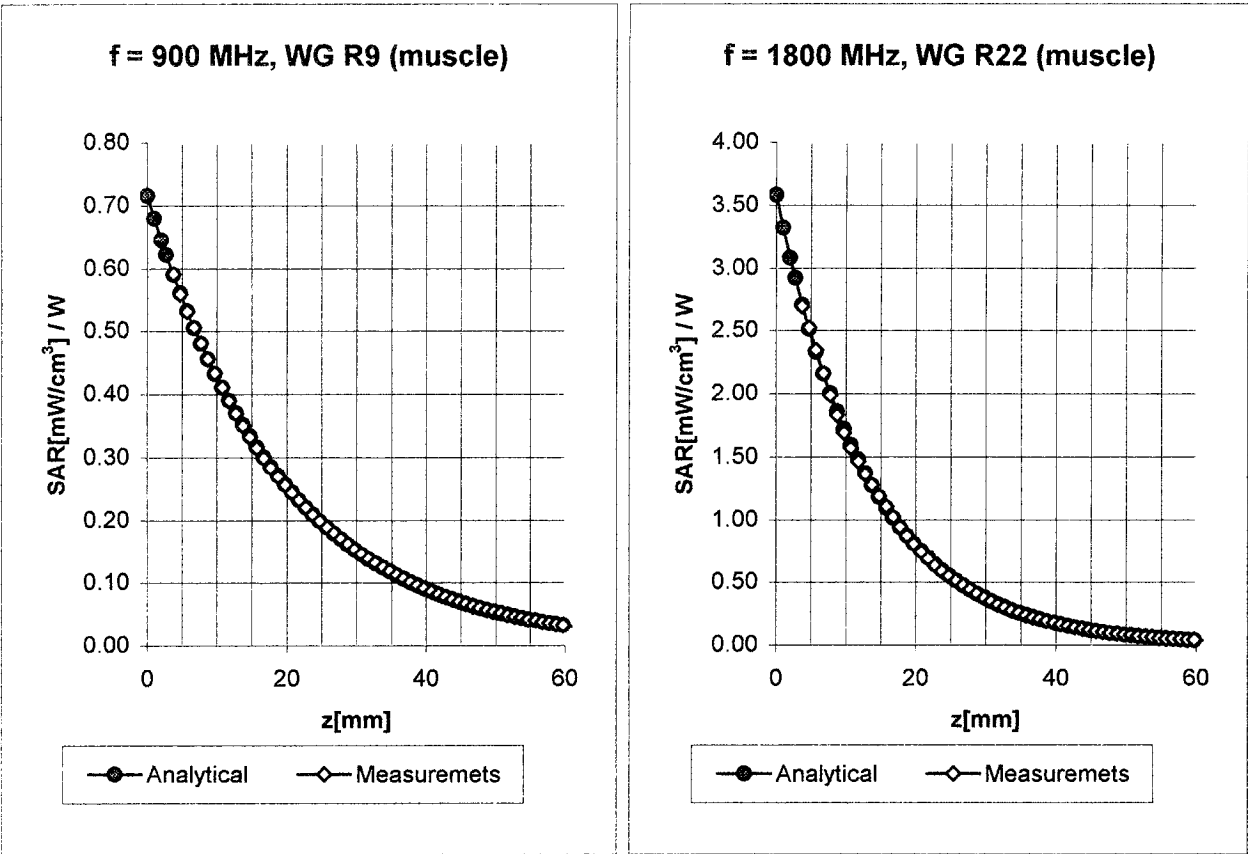
Head 800 - 1000 MHz $\epsilon_r = 39.0 - 43.5$ $\sigma = 0.80 - 1.10$ mho/m

ConvF X	6.09 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	6.09 $\pm 9.5\%$ (k=2)	Alpha 0.57
ConvF Z	6.09 $\pm 9.5\%$ (k=2)	Depth 1.95

Head 1700 - 1910 MHz $\epsilon_r = 39.5 - 41.0$ $\sigma = 1.20 - 1.55$ mho/m

ConvF X	4.95 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	4.95 $\pm 9.5\%$ (k=2)	Alpha 0.57
ConvF Z	4.95 $\pm 9.5\%$ (k=2)	Depth 2.17

Conversion Factor Assessment



Muscle 900 MHz $\epsilon_r = 52.3 - 57.8$ $\sigma = 0.96 - 1.15$ mho/m

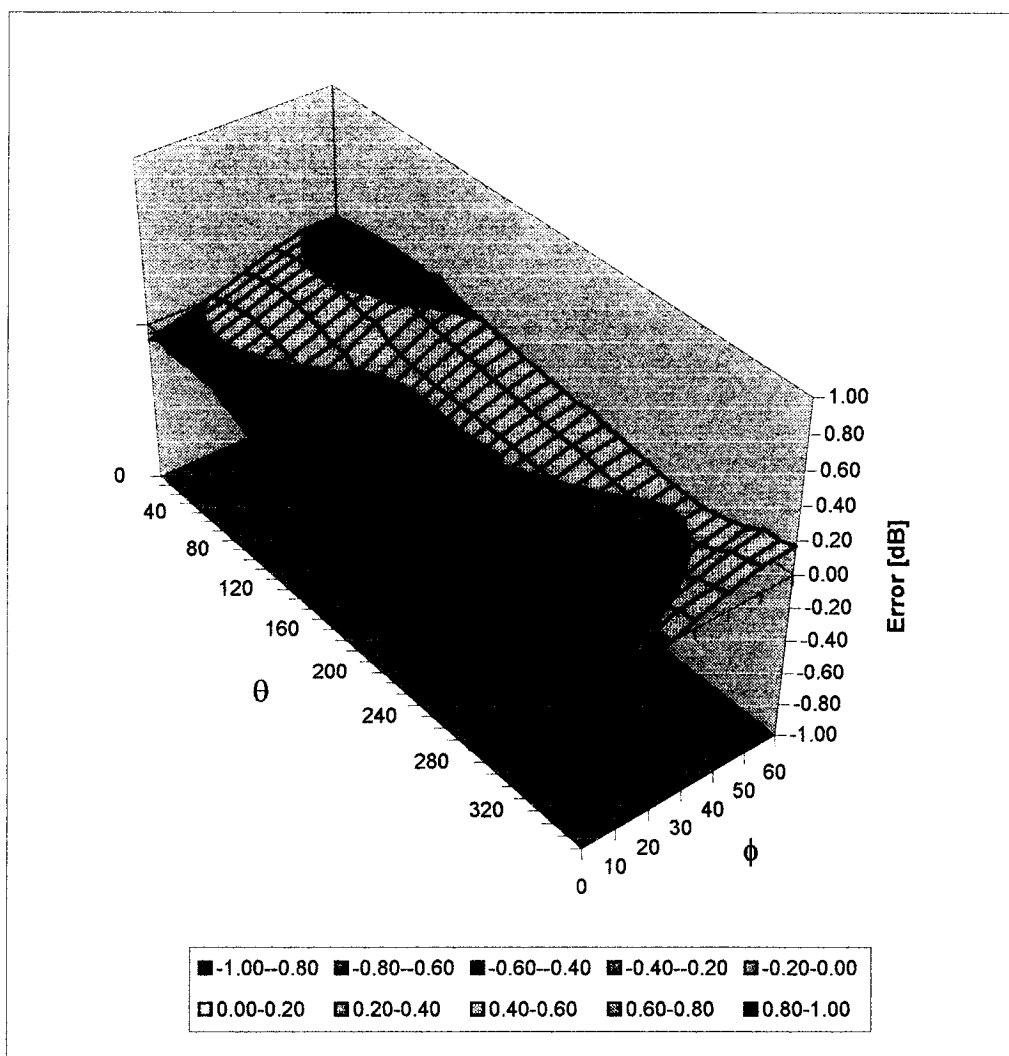
ConvF X	5.85 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	5.85 $\pm 9.5\%$ (k=2)	Alpha 0.58
ConvF Z	5.85 $\pm 9.5\%$ (k=2)	Depth 2.01

Muscle 1800 MHz $\epsilon_r = 50.6 - 56.0$ $\sigma = 1.35 - 1.65$ mho/m

ConvF X	4.52 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	4.52 $\pm 9.5\%$ (k=2)	Alpha 0.70
ConvF Z	4.52 $\pm 9.5\%$ (k=2)	Depth 2.17

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

Calibration Certificate

Dosimetric E-Field Probe

Type:

ET3DV6R

Serial Number:

1429

Place of Calibration:

Zurich

Date of Calibration:

September 4, 2001

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:

Robert Meyer

Approved by:

Alain Kapp

Probe ET3DV6R

SN:1429

Manufactured:	May 7, 2001
Calibrated:	September 4, 2001

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV6R SN:1429

Sensitivity in Free Space

NormX	2.22 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	2.11 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	2.31 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

DCP X	98 mV
DCP Y	98 mV
DCP Z	98 mV

Sensitivity in Tissue Simulating Liquid

Head **450 MHz** $\epsilon_r = 43.5 \pm 5\%$ $\sigma = 0.87 \pm 10\%$ mho/m

ConvF X	6.71 extrapolated	Boundary effect:	
ConvF Y	6.71 extrapolated	Alpha	0.39
ConvF Z	6.71 extrapolated	Depth	2.05

Head **900 MHz** $\epsilon_r = 42 \pm 5\%$ $\sigma = 0.97 \pm 10\%$ mho/m

ConvF X	6.20 $\pm 7\%$ (k=2)	Boundary effect:	
ConvF Y	6.20 $\pm 7\%$ (k=2)	Alpha	0.44
ConvF Z	6.20 $\pm 7\%$ (k=2)	Depth	2.10

Head **1500 MHz** $\epsilon_r = 40.4 \pm 5\%$ $\sigma = 1.23 \pm 10\%$ mho/m

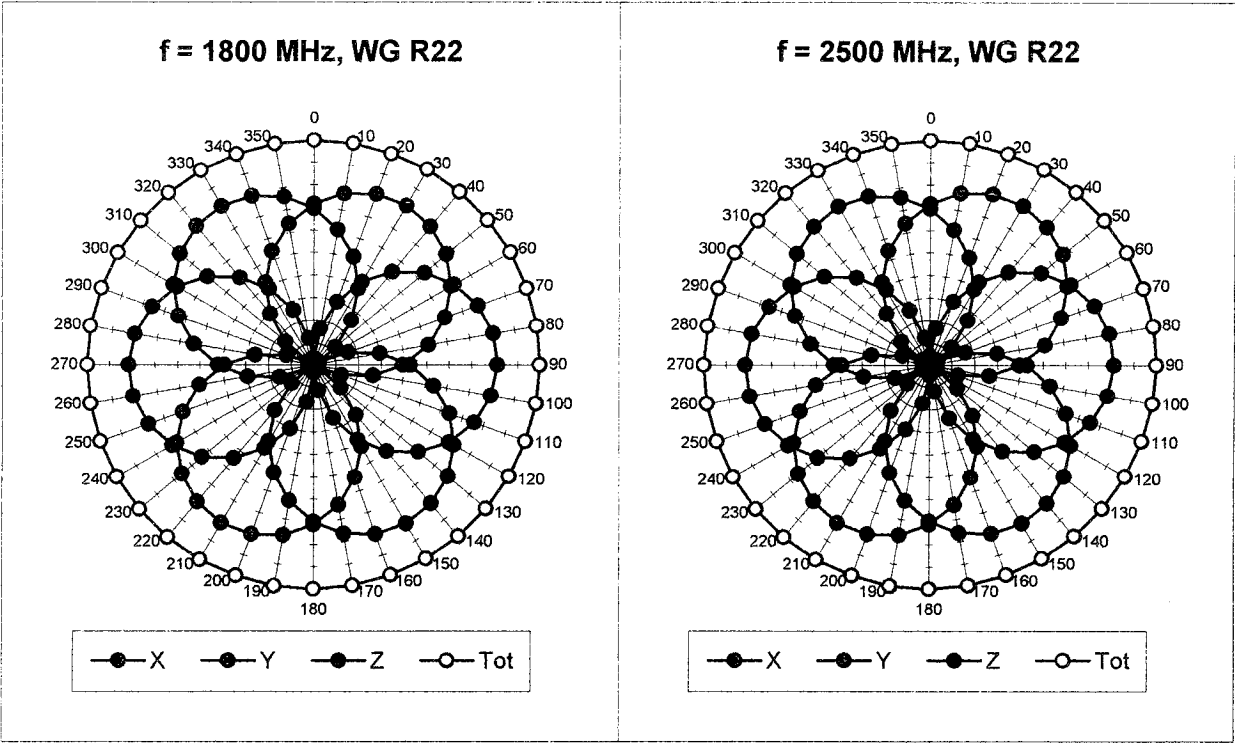
ConvF X	5.51 interpolated	Boundary effect:	
ConvF Y	5.51 interpolated	Alpha	0.51
ConvF Z	5.51 interpolated	Depth	2.16

Head **1800 MHz** $\epsilon_r = 40 \pm 5\%$ $\sigma = 1.40 \pm 10\%$ mho/m

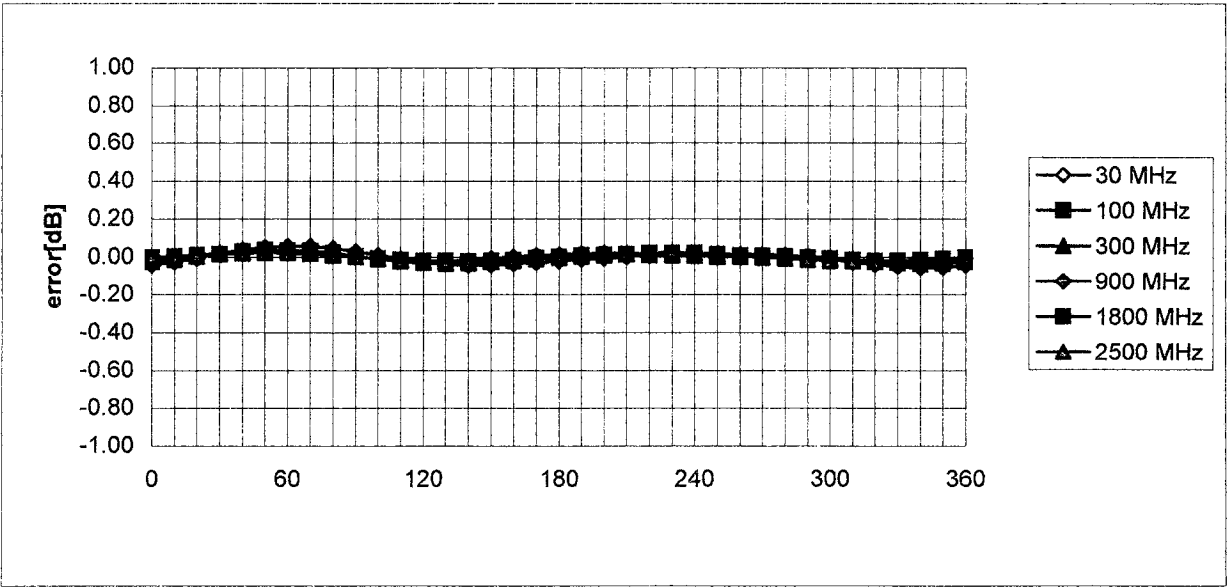
ConvF X	5.17 $\pm 7\%$ (k=2)	Boundary effect:	
ConvF Y	5.17 $\pm 7\%$ (k=2)	Alpha	0.54
ConvF Z	5.17 $\pm 7\%$ (k=2)	Depth	2.18

Sensor Offset

Probe Tip to Sensor Center **2.7** mm

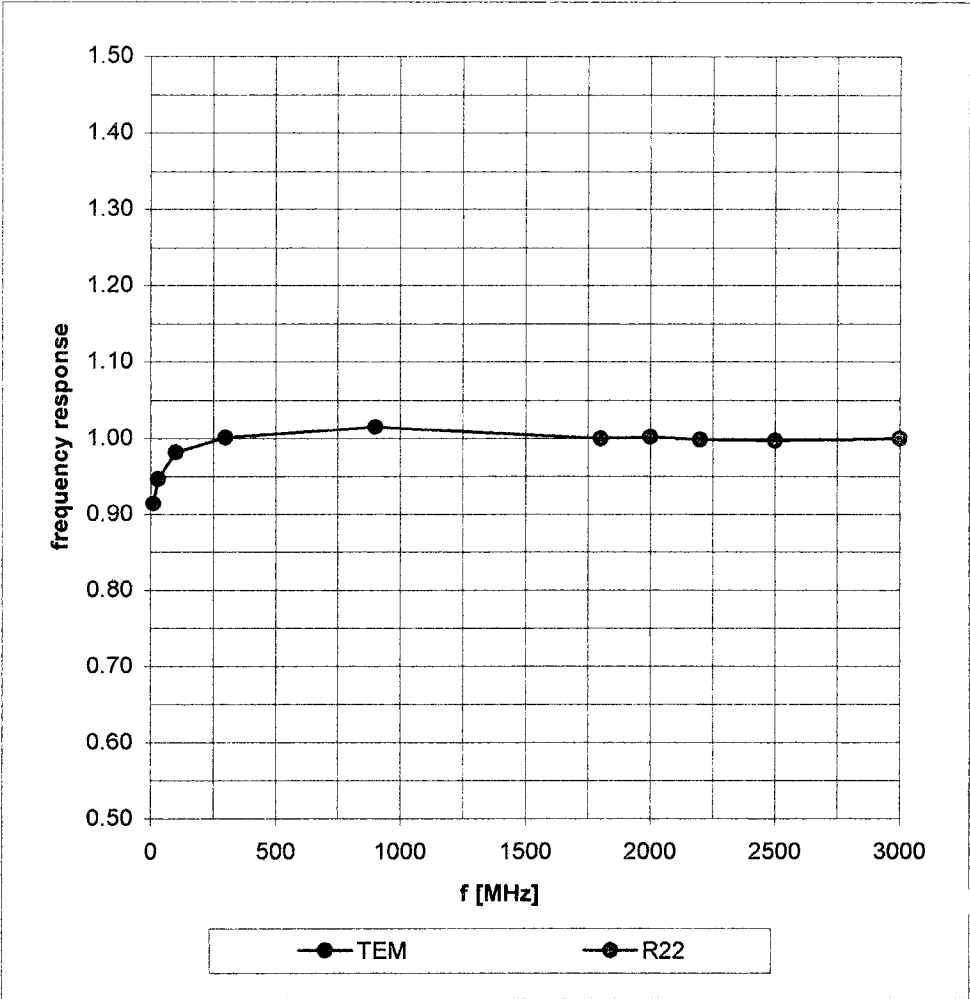


Isotropy Error (ϕ), $\theta = 0^\circ$

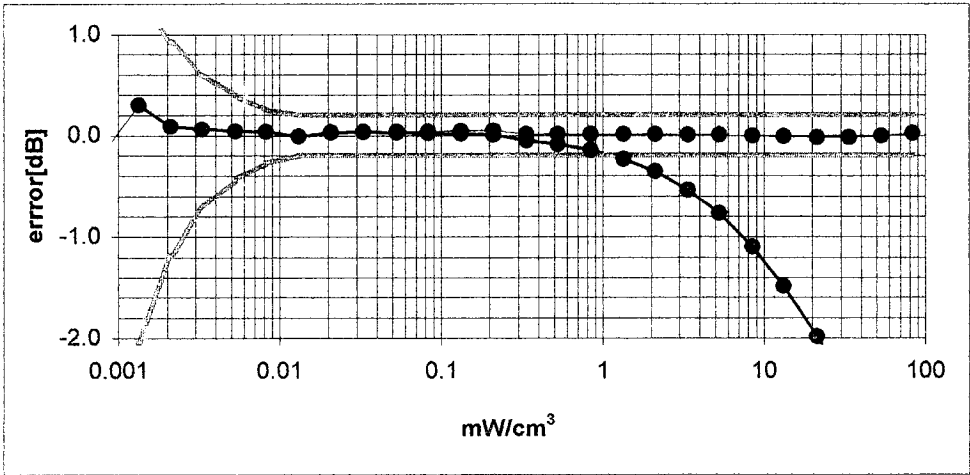
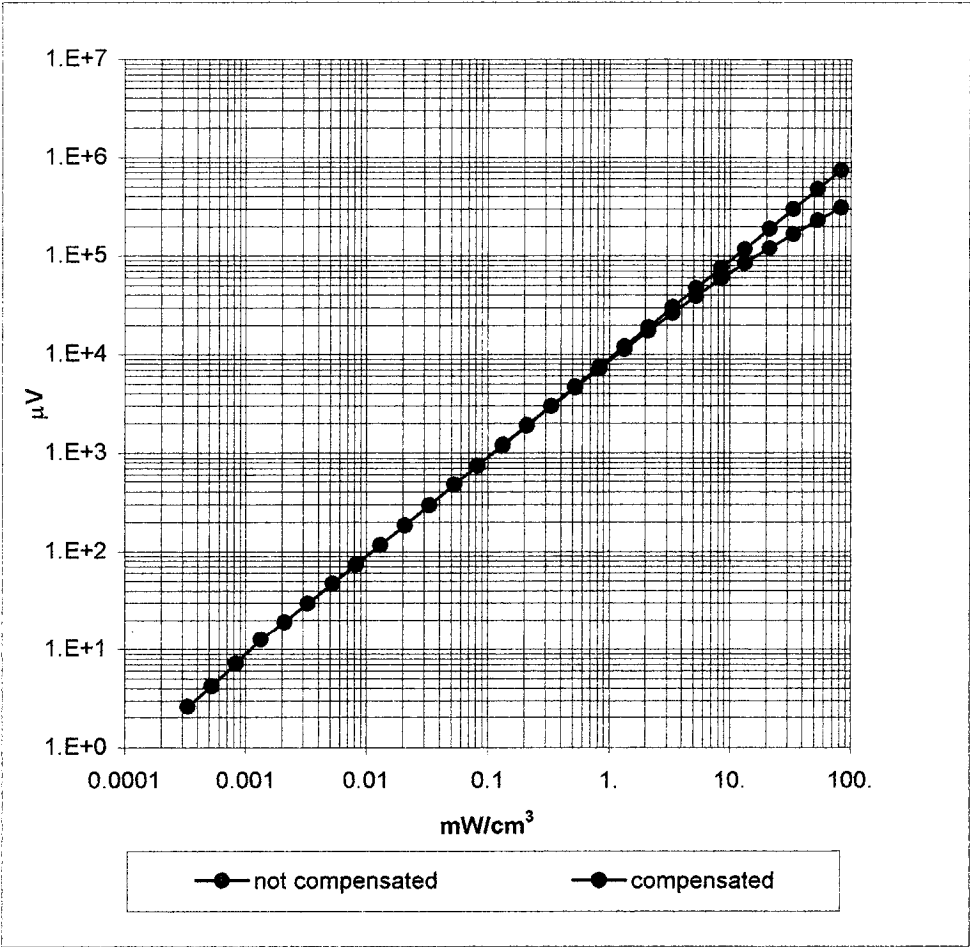


Frequency Response of E-Field

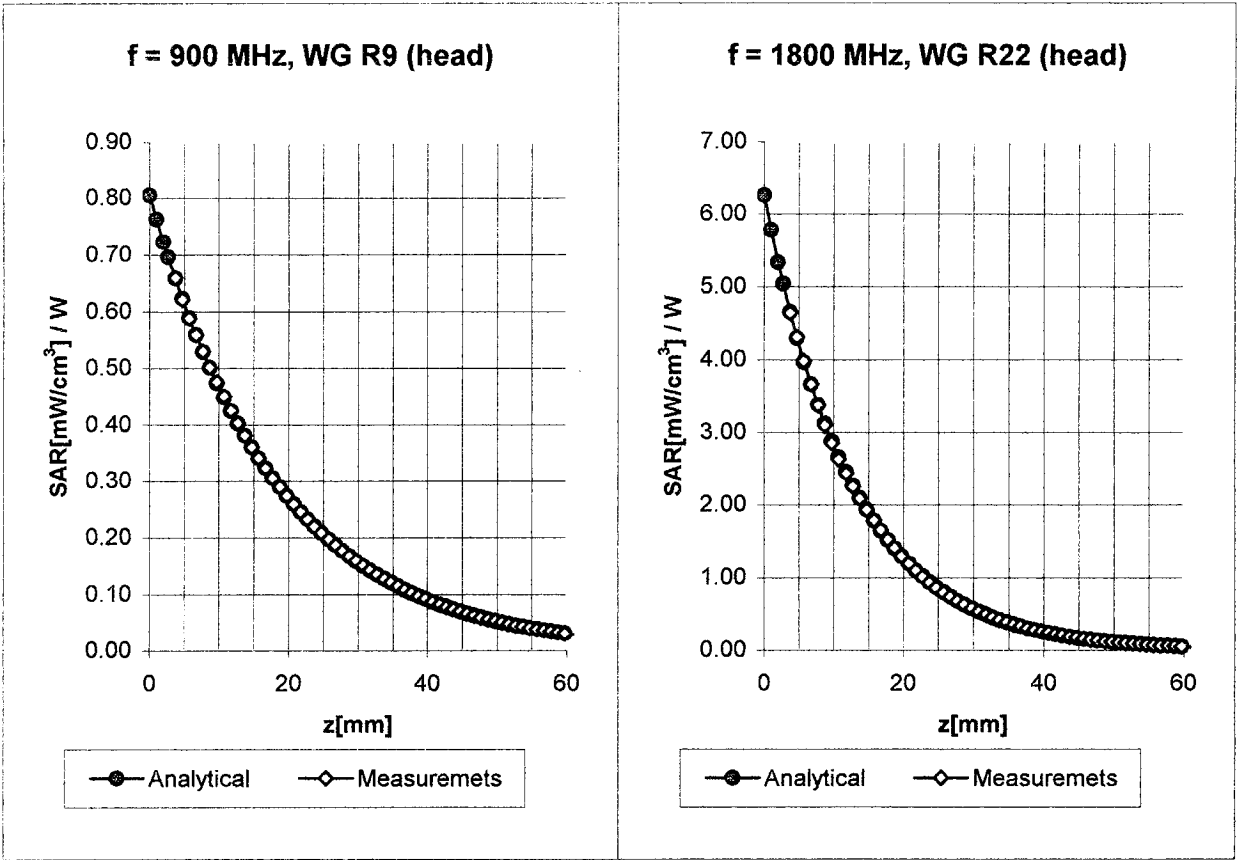
(TEM-Cell:ifi110, Waveguide R22)



Dynamic Range f(SAR_{brain})
(Waveguide R22)



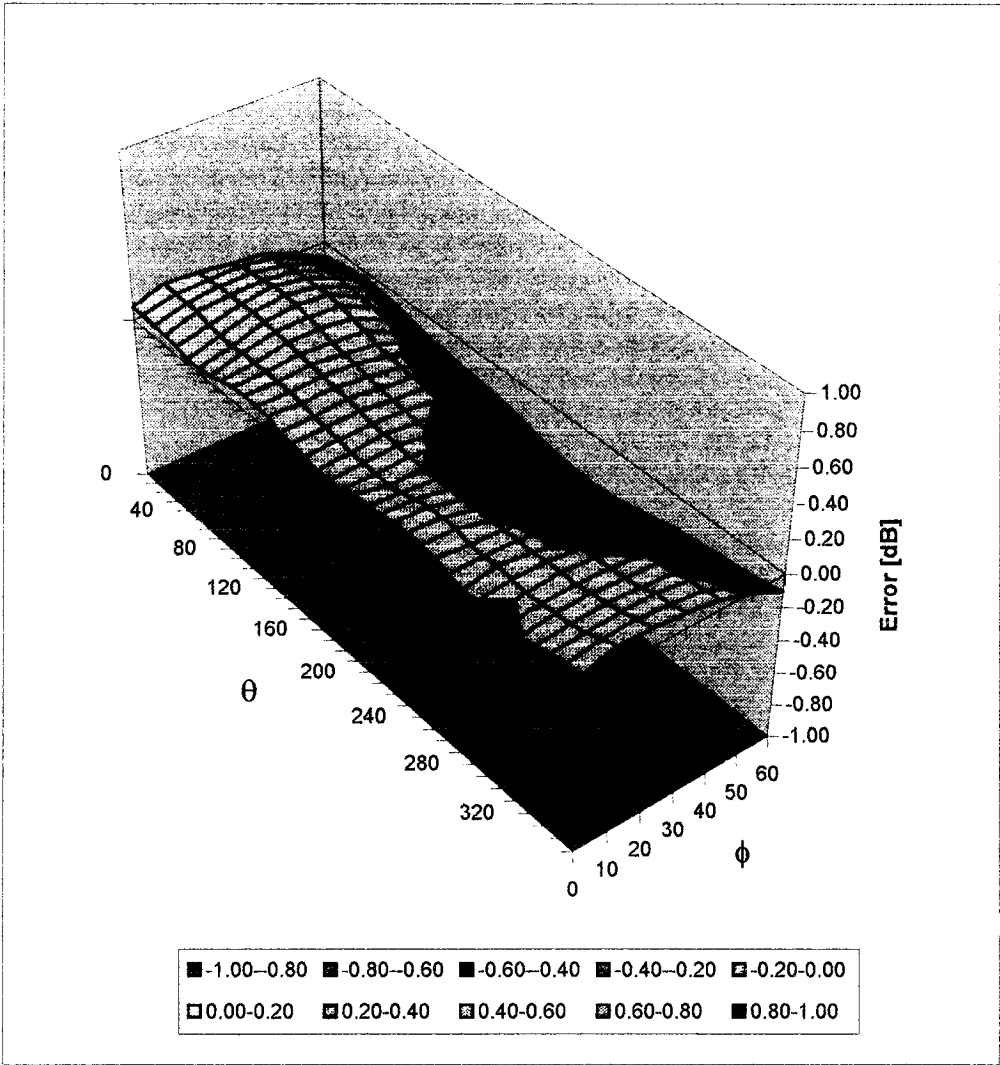
Conversion Factor Assessment



Head	900 MHz	$\epsilon_r = 42 \pm 5\%$	$\sigma = 0.97 \pm 10\% \text{ mho/m}$
	ConvF X	6.20 $\pm 7\%$ (k=2)	Boundary effect:
	ConvF Y	6.20 $\pm 7\%$ (k=2)	Alpha 0.44
	ConvF Z	6.20 $\pm 7\%$ (k=2)	Depth 2.10
Head	1800 MHz	$\epsilon_r = 40 \pm 5\%$	$\sigma = 1.40 \pm 10\% \text{ mho/m}$
	ConvF X	5.17 $\pm 7\%$ (k=2)	Boundary effect:
	ConvF Y	5.17 $\pm 7\%$ (k=2)	Alpha 0.54
	ConvF Z	5.17 $\pm 7\%$ (k=2)	Depth 2.18

Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900 \text{ MHz}$



Calibration Certificate

1800 MHz System Validation Dipole

Type:

D1800V2

Serial Number:

230

Place of Calibration:

Zurich

Date of Calibration:

October 25, 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:

Blancic Katja

Approved by:

M. K. S.

DASY

Dipole Validation Kit

Type: D1800V2

Serial: 230

Manufactured: February 26, 1998

Calibrated: October 25, 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	40.7	$\pm 5\%$
Conductivity	1.35 mho/m	$\pm 5\%$

The DASY3 System (Software version 3.1d) 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 $\pm 3\%$. 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:	37.4 mW/g
averaged over 10 cm ³ (10 g) of tissue:	19.7 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:	1.213 ns	(one direction)
Transmission factor:	0.990	(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:	$\text{Re}\{Z\} = $ 49.3 Ω
----------------------------------	---

	$\text{Im}\{Z\} = $ -6.2 Ω
--	---

Return Loss at 1800 MHz	-24.0dB
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4. Measurement Conditions

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

Relative Dielectricity	53.5	$\pm 5\%$
Conductivity	1.45 mho/m	$\pm 5\%$

The DASY3 System (Software version 3.1d) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 4.85 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 $\pm 3\%$. 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 cm³ (1 g) of tissue: **40.8 mW/g**

averaged over 10 cm³ (10 g) of tissue: **21.4 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. Dipole Impedance and Return Loss

The dipole was positioned at the flat phantom sections according to section 4 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 1800 MHz: $\text{Re}\{Z\} = 44.7 \Omega$

$\text{Im}\{Z\} = -6.5\Omega$

Return Loss at 1800 MHz **-21.1 dB**

7. Handling

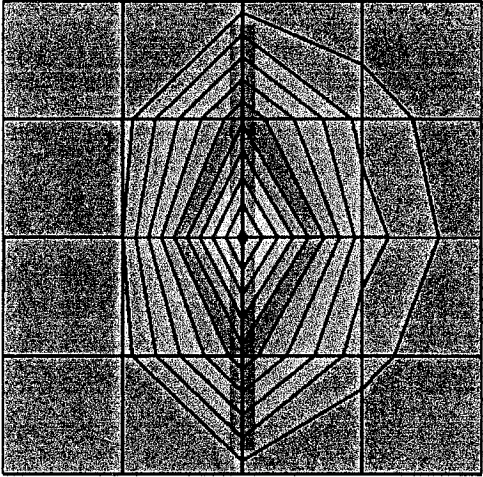
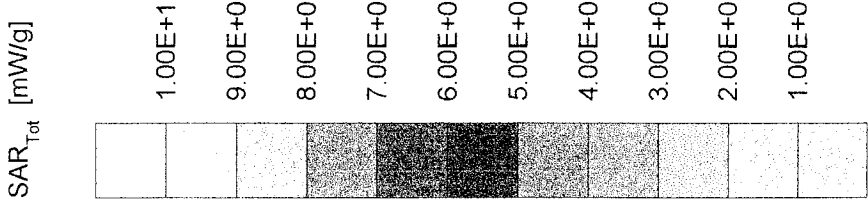
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

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 D1800V2 SN:230, d = 10 mm

Frequency: 1800 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(5.57,5.57,5.57) at 1800 MHz; IEEE1528 1800 MHz; $\sigma = 1.35 \text{ mho/m}$ $\epsilon_r = 40.7$ $\rho = 1.00 \text{ g/cm}^3$
Cubes (2): Peak: 17.5 mW/g $\pm 0.02 \text{ dB}$, SAR (1g): 9.36 mW/g $\pm 0.01 \text{ dB}$, SAR (10g): 4.92 mW/g $\pm 0.02 \text{ dB}$, (Worst-case extrapolation)
Penetration depth: 8.5 (7.9, 9.6) [mm]
Powerdrift: -0.03 dB



24 Oct 2001 16:31:05

S11 1 U F8 J: 49.246 Ω -6.1252 Ω 14.272 pF 1 800.000 000 MHz

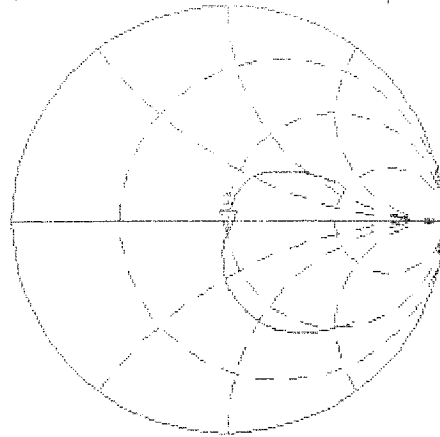
↑

Del

PRM

Cor

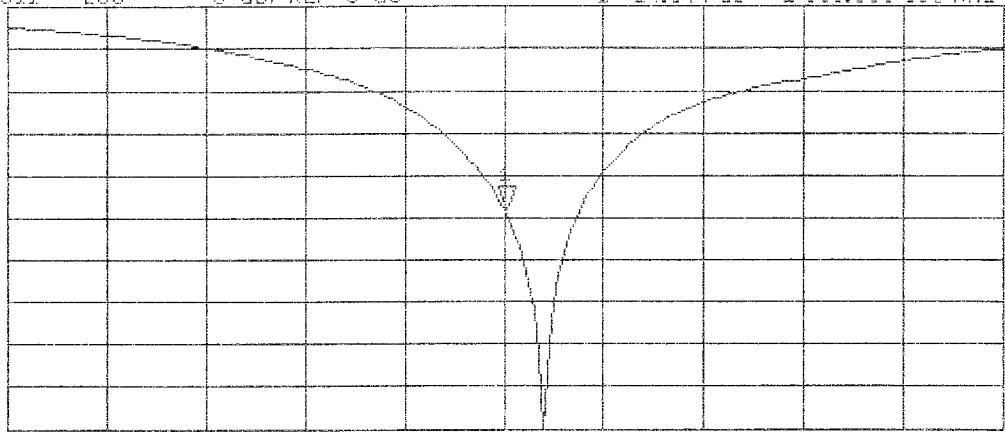
↑



CH2 S11 LOG 5 dB/REF 0 dB 1:-24.044 dB 1 800.000 000 MHz

PRM
Cor

↑

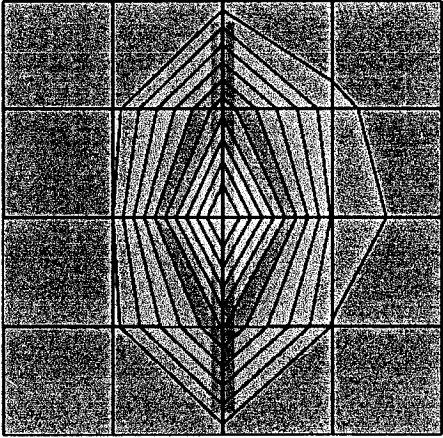
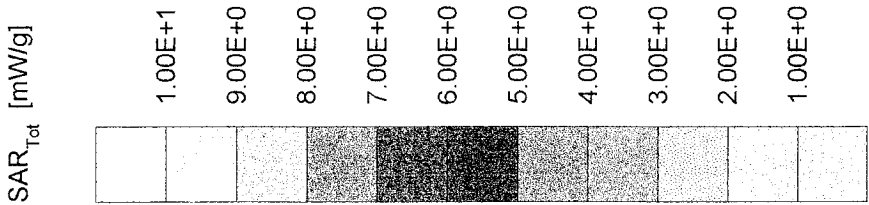


START 1 400.000 000 MHz

STOP 2 200.000 000 MHz

Validation Dipole D1800V2 SN:230, d = 10 mm

Frequency: 1800 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(4.85,4.85,4.85) at 1800 MHz; Muscle 1800 MHz; $\sigma = 1.45 \text{ mho/m}$ $\epsilon_r = 53.5$ $\rho = 1.00 \text{ g/cm}^3$
Cubes (2): Peak: 19.2 mW/g $\pm 0.01 \text{ dB}$, SAR (1g): 10.2 mW/g $\pm 0.02 \text{ dB}$, SAR (10g): 5.34 mW/g $\pm 0.02 \text{ dB}$, (Worst-case extrapolation)
Penetration depth: 8.8 (7.9, 10.3) [mm]
Powerdrift: -0.03 dB



24 Oct 2021 20:24:30

[S11] S11 1 U F3 1: 44.738 n -5.5410 n 13.518 pF 1 800.000 000 MHz

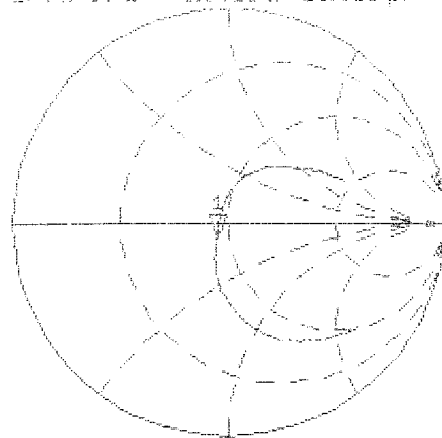
?

Del

PRm

Cor

↑

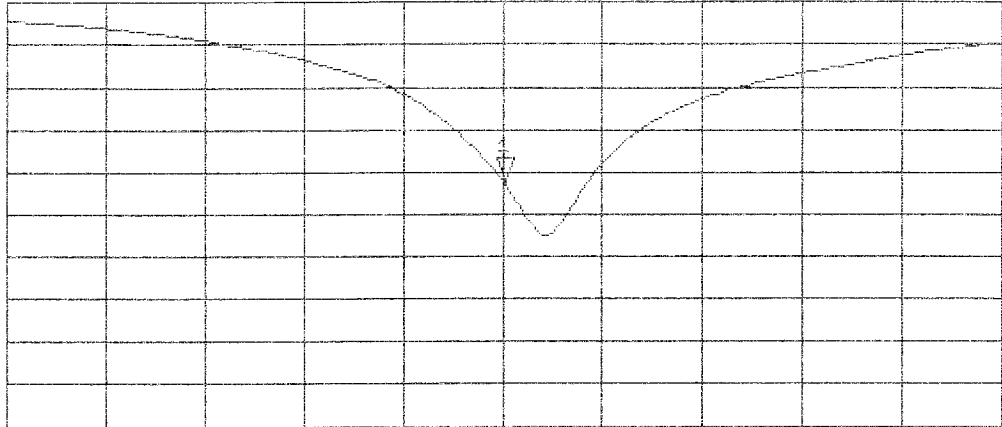


CH2 S11 LOG S dB/REF 0 dB 1: -21.069 dB 1 800.000 000 MHz

PRm

Cor

↑



START 1 400.000 000 MHz

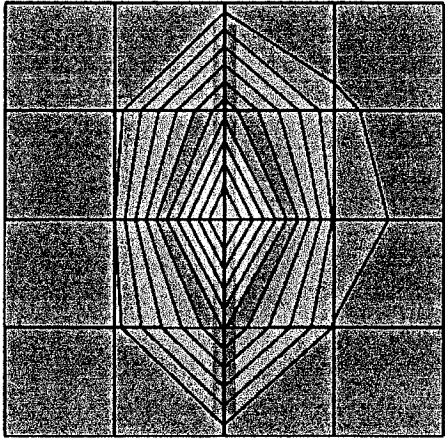
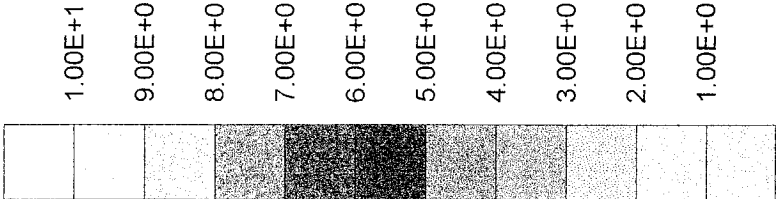
STOP 2 200.000 000 MHz

1.9 GHz

Validation Dipole D1800V2 SN:230, d = 10 mm

Frequency: 1800 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(4.85,4.85,4.85) at 1800 MHz; Muscle 1800 MHz; $\sigma = 1.45$ mho/m $\epsilon_r = 53.5$ $\rho = 1.00$ g/cm³
Cubes (2): Peak: 19.2 mW/g $\pm$ 0.01 dB, SAR (1g): 10.2 mW/g $\pm$ 0.02 dB, SAR (10g): 5.34 mW/g $\pm$ 0.02 dB, (Worst-case extrapolation)
Penetration depth: 8.8 (7.9, 10.3) [mm]
Powerdrift: -0.03 dB

SAR_{Tot} [mW/g]



CH1 S11 1 U F8 1: 44.738 n -6.5410 n 13.515 pF 1 000.000 000 MHz

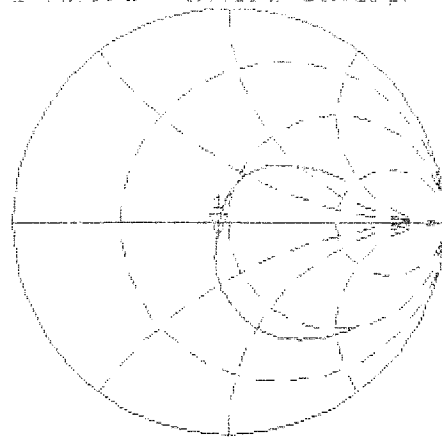
y

Del

PRm

Cor

↑

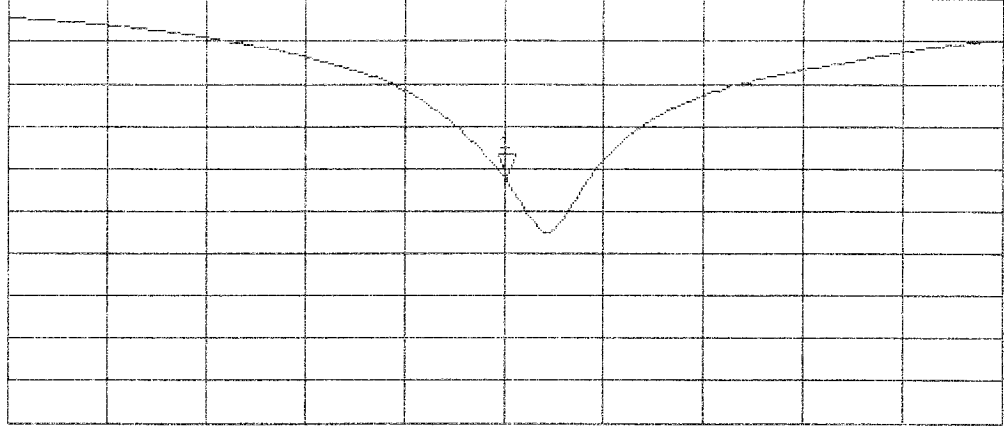


CH2 S11 LOG 5 dB/REF 0 dB 1:-21.053 dB 1 000.000 000 MHz

PRm

Cor

↑



START 1 400.000 000 MHz

STOP 2 200.000 000 MHz

Calibration Certificate

900 MHz System Validation Dipole

Type:

D900V2

Serial Number:

033

Place of Calibration:

Zurich

Date of Calibration:

October 23, 2001

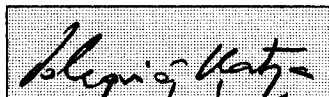
Calibration Interval:

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:



DASY

Dipole Validation Kit

Type: D900V2

Serial: 033

Manufactured: July 9, 1998
Calibrated: October 23, 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 900 MHz:

Relative Dielectricity	41.5	$\pm 5\%$
Conductivity	0.97 mho/m	$\pm 5\%$

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.27 at 900 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 15mm 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 $\pm 3\%$. 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:	11.44 mW/g
averaged over 10 cm ³ (10 g) of tissue:	7.24 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.

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:	1.417 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 900 MHz:	$\text{Re}\{Z\} = $ 50.5 Ω
	$\text{Im}\{Z\} = $ -1.8 Ω
Return Loss at 900 MHz	-34.7 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 900 MHz:

Relative Dielectricity	55.4	$\pm 5\%$
Conductivity	1.04 mho/m	$\pm 5\%$

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.02 at 900 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 15mm 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 $\pm 3\%$. 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:	11.84 mW/g
averaged over 10 cm ³ (10 g) of tissue:	7.52 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.

6. Dipole Impedance and Return Loss

The dipole was positioned at the flat phantom sections according to section 4 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 900 MHz:	$\text{Re}\{Z\} = 47.1 \Omega$
	$\text{Im}\{Z\} = -3.7 \Omega$
Return Loss at 900 MHz	-25.8 dB

7. Handling

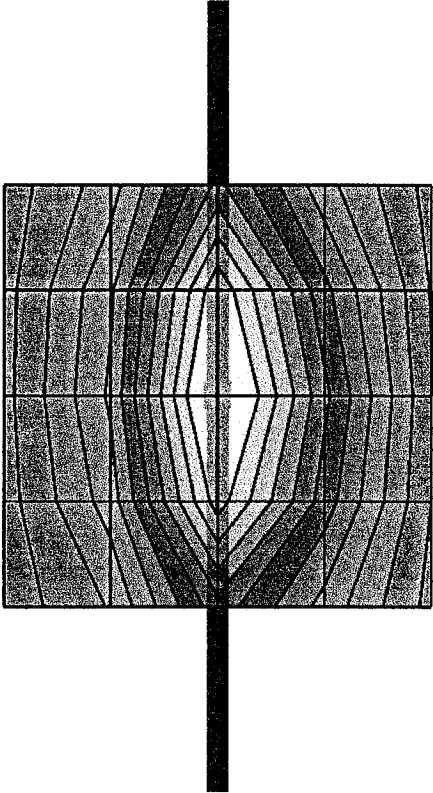
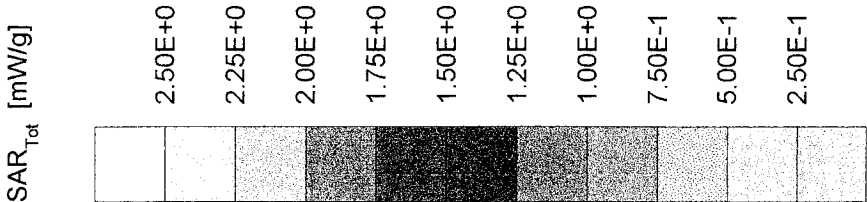
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

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 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Validation Dipole D900V2 SN:033, d = 15 mm

Frequency: 900 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(6.27,6.27,6.27) at 900 MHz; IEEE1528 900 MHz; $\sigma = 0.97$ mho/m $\epsilon_r = 41.5$ $\rho = 1.00$ g/cm³
Cubes (2): Peak: 4.62 mW/g $\pm$ 0.04 dB, SAR (1g): 2.86 mW/g $\pm$ 0.02 dB, SAR (10g): 1.81 mW/g $\pm$ 0.01 dB, (Worst-case extrapolation)
Penetration depth: 11.5 (10.2, 13.2) [mm]
Powerdrift: 0.00 dB



23 Oct 2001 11:28:00

CH1 S11 1 U FS 1: 50.498 Ω -1.7734 Ω 99.605 pF 900.000 000 MHz

↑

Del

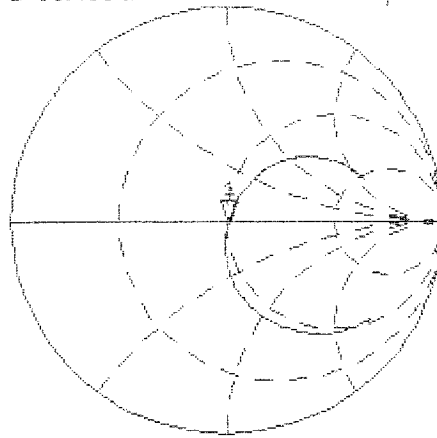
PRM

Cor

Avg

16

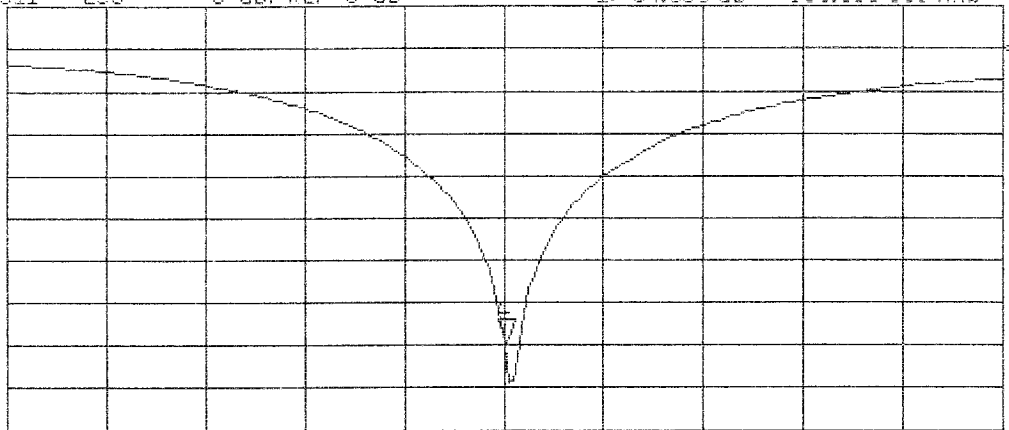
↑



CH2 S11 LOG 5 dB/REF 0 dB 1:-34.669 dB 900.000 000 MHz

PRM
Cor

↑

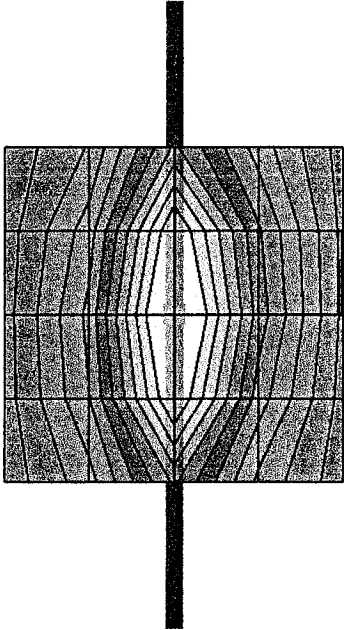
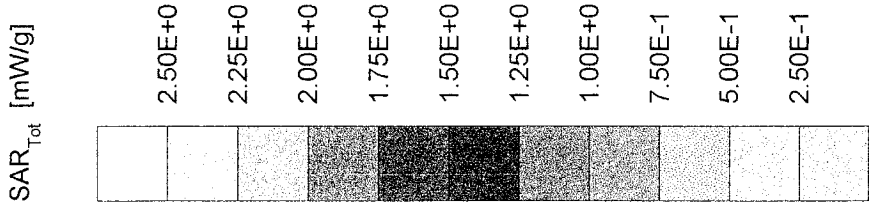


START 700.000 000 MHz

STOP 1 100.000 000 MHz

Validation Dipole D900V2 SN:033, d = 15 mm

Frequency: 900 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(6.02,6.02,6.02) at 900 MHz; Muscle 900 MHz; $\sigma = 1.04$ mho/m $\epsilon_r = 55.4$ $\rho = 1.00$ g/cm³
Cubes (2): Peak: 4.76 mW/g $\pm$ 0.02 dB, SAR (1g): 2.96 mW/g $\pm$ 0.02 dB, SAR (10g): 1.88 mW/g $\pm$ 0.01 dB, (Worst-case extrapolation)
Penetration depth: 11.9 (10.5, 13.7) [mm]
Powerdrift: -0.01 dB



23 Oct 2001 09:45:24

[CH1] S11 1 U F3

1: 47.049 ω -3.6992 Δ 47.894 pF

900.000 000 MHz

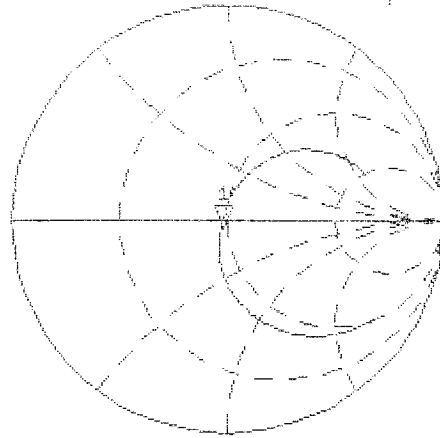
↑

De1

PRm

Cor
Avg
15

↑



CH2 S11 LOG

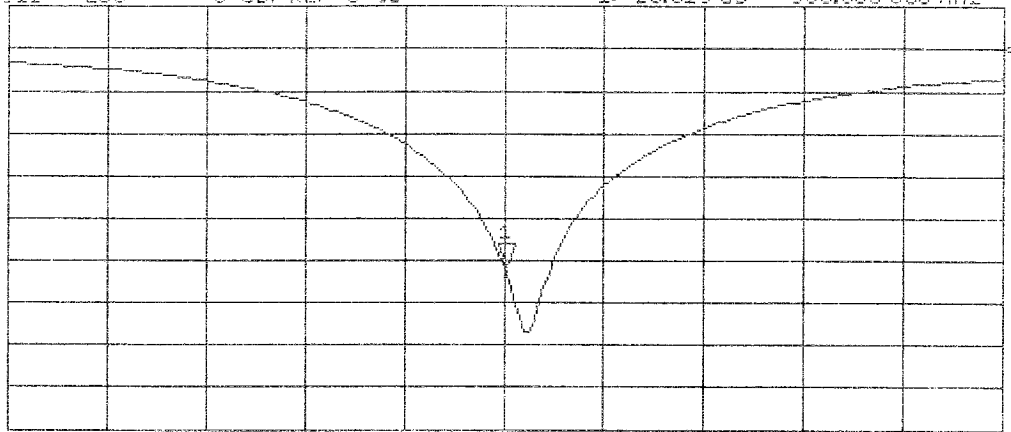
5 dB/REF 0 dB

1: -25.619 dB

900.000 000 MHz

PRm
Cor

↑



START 700.000 000 MHz

STOP 1 100.000 000 MHz