

Calibration Certificate

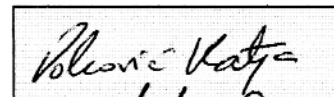
Dosimetric E-Field Probe

Type:	ET3DV6
Serial Number:	1578
Place of Calibration:	Zurich
Date of Calibration:	February 22, 2002
Calibration Interval:	12 months

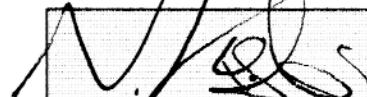
Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

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:1578

Manufactured:	April 6, 2001
Last calibration:	April 20, 2001
Recalibrated:	February 22, 2002

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV6 SN:1578

Sensitivity in Free Space

NormX	1.72 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.83 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.68 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

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

Sensitivity in Tissue Simulating Liquid

Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\%$ mho/m
ConvF X	7.0 $\pm 9.5\%$ (k=2)		Boundary effect:
ConvF Y	7.0 $\pm 9.5\%$ (k=2)		Alpha 0.33
ConvF Z	7.0 $\pm 9.5\%$ (k=2)		Depth 2.34
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
ConvF X	5.5 $\pm 9.5\%$ (k=2)		Boundary effect:
ConvF Y	5.5 $\pm 9.5\%$ (k=2)		Alpha 0.47
ConvF Z	5.5 $\pm 9.5\%$ (k=2)		Depth 2.20

Boundary Effect

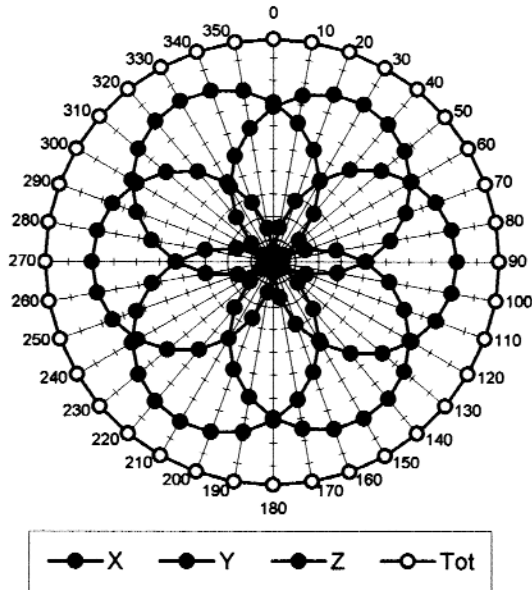
Head	900 MHz	Typical SAR gradient: 5 % per mm	
	Probe Tip to Boundary	1 mm	2 mm
	SAR _{be} [%] Without Correction Algorithm	7.6	4.3
	SAR _{be} [%] With Correction Algorithm	0.2	0.4
Head	1800 MHz	Typical SAR gradient: 10 % per mm	
	Probe Tip to Boundary	1 mm	2 mm
	SAR _{be} [%] Without Correction Algorithm	9.5	6.3
	SAR _{be} [%] With Correction Algorithm	0.2	0.3

Sensor Offset

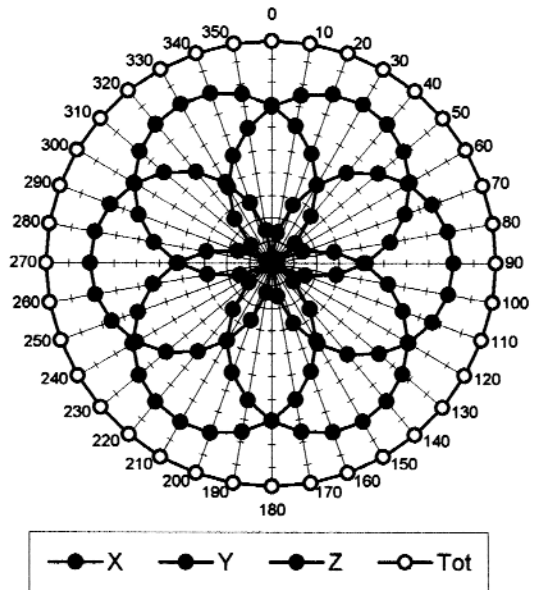
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.5 \pm 0.2	mm

Receiving Pattern (ϕ), $\theta = 0^\circ$

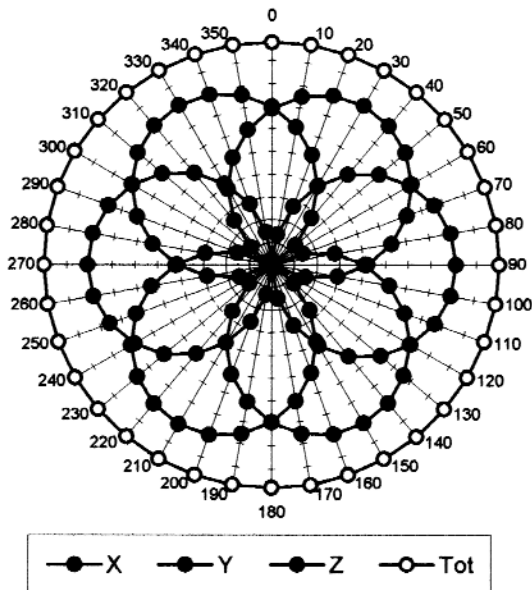
f = 30 MHz, TEM cell ifi110



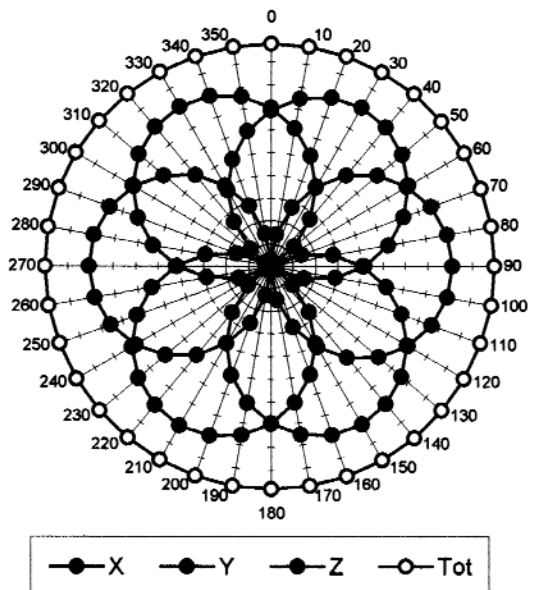
f = 100 MHz, TEM cell ifi110

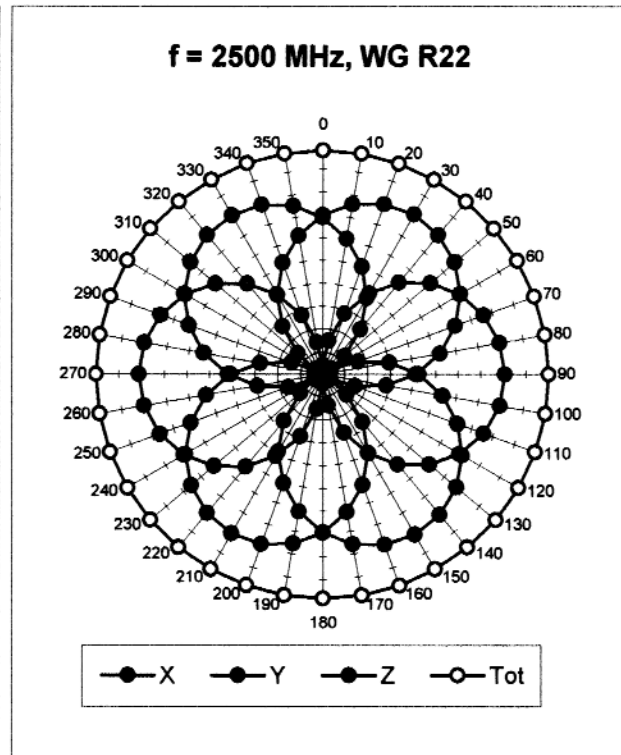
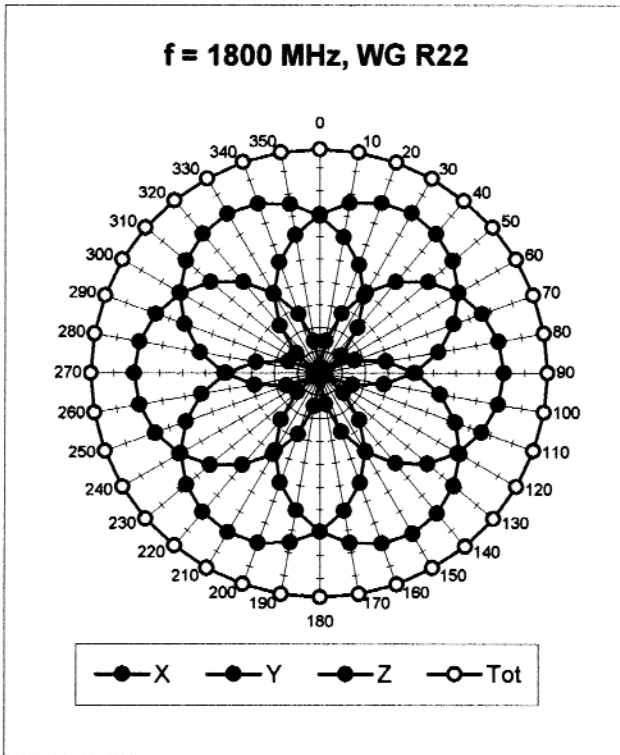


f = 300 MHz, TEM cell ifi110

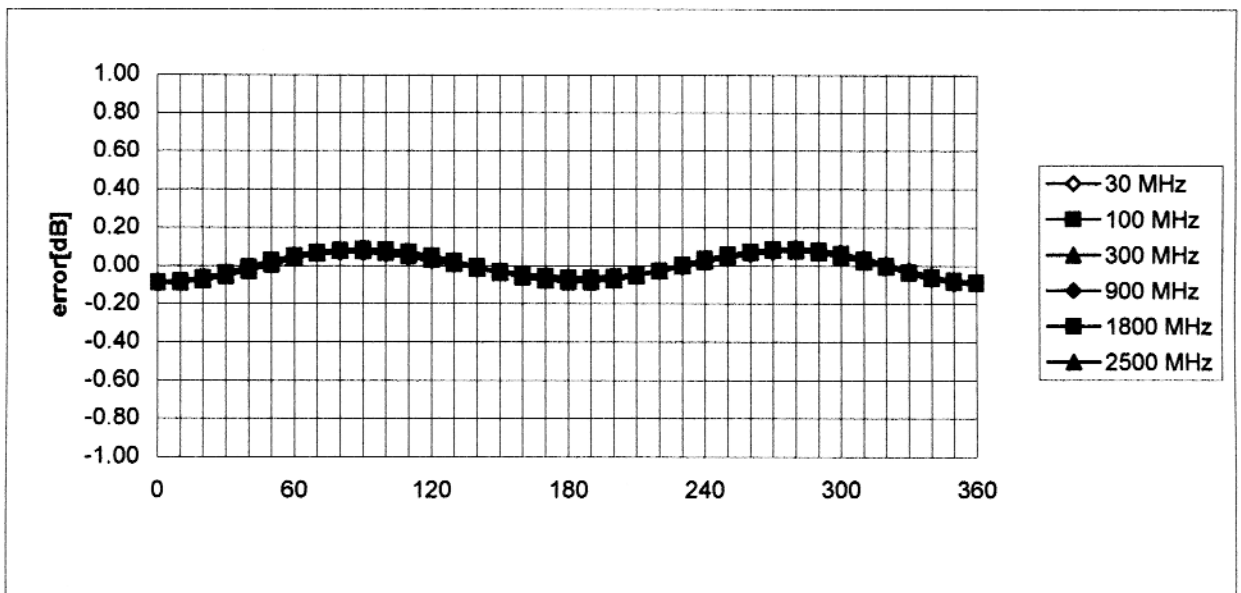


f = 900 MHz, TEM cell ifi110



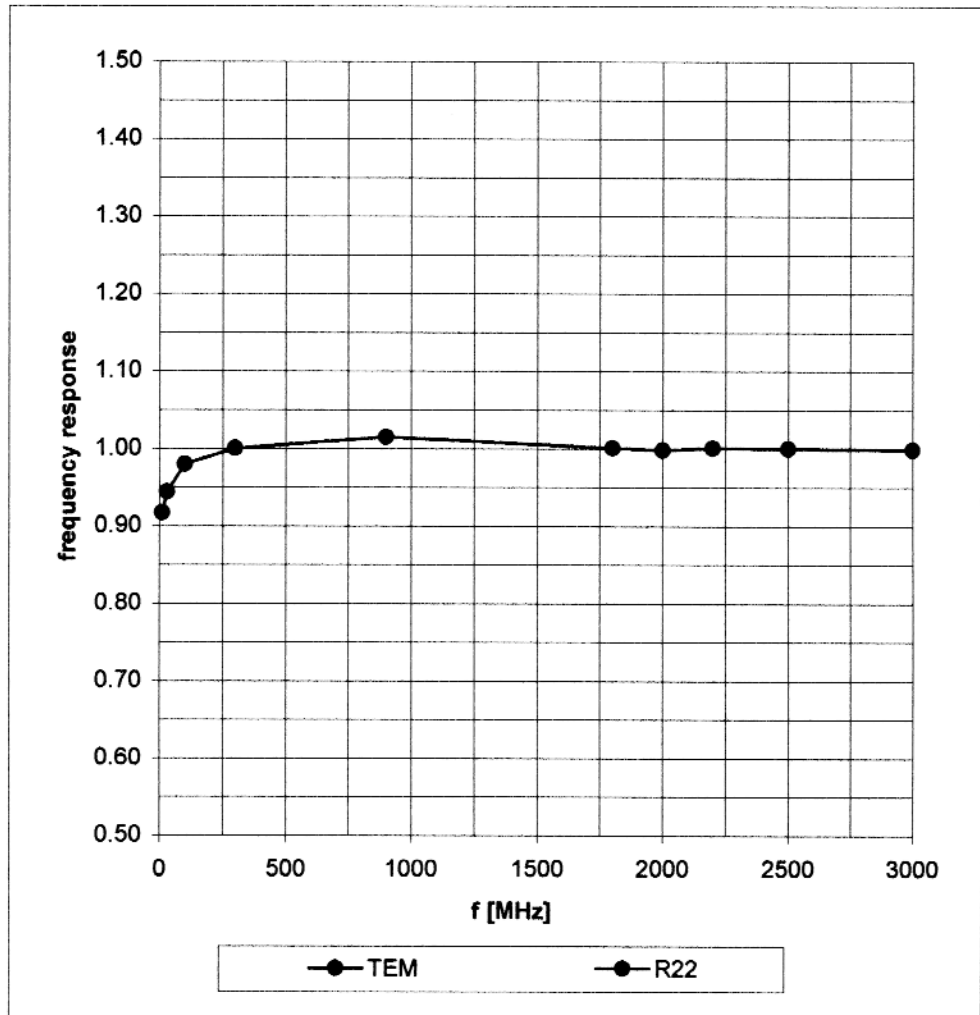


Isotropy Error (ϕ), $\theta = 0^\circ$

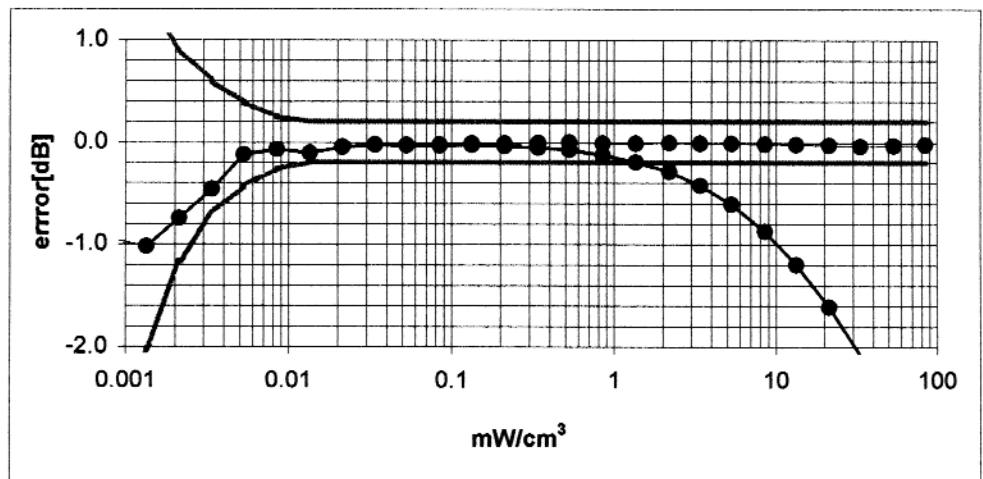
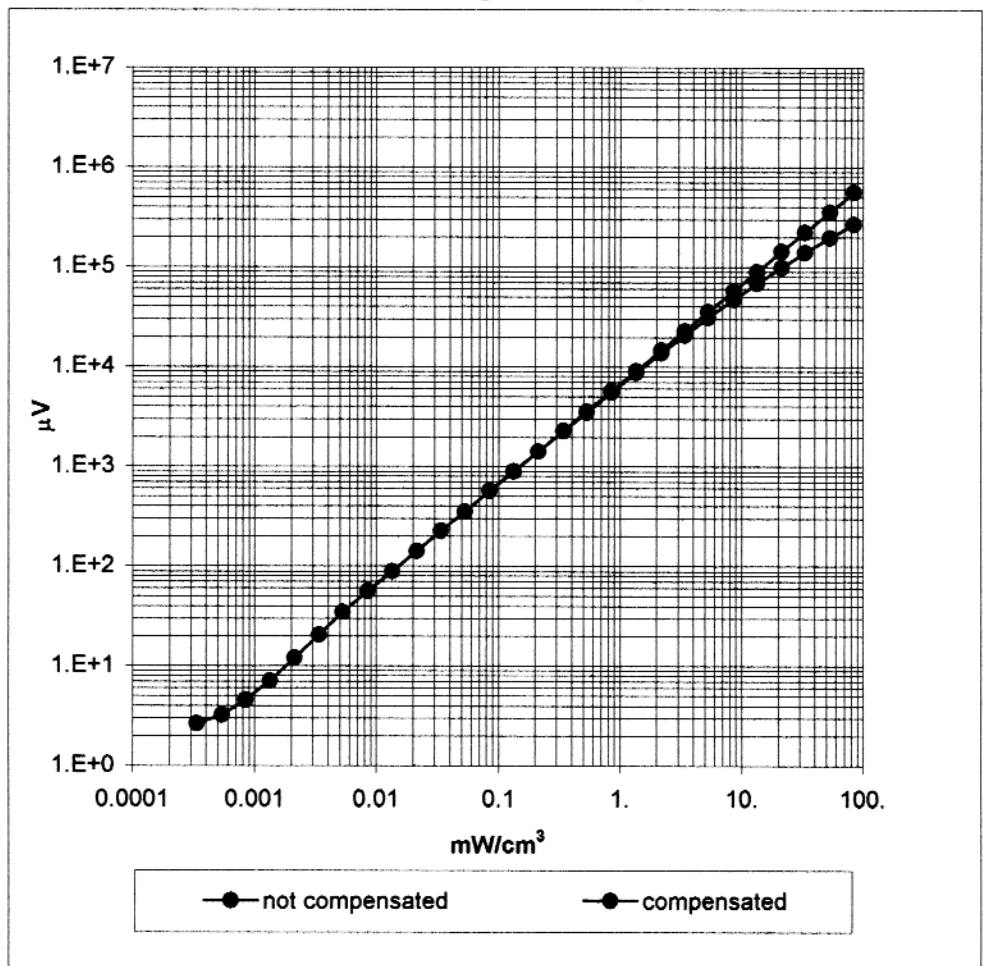


Frequency Response of E-Field

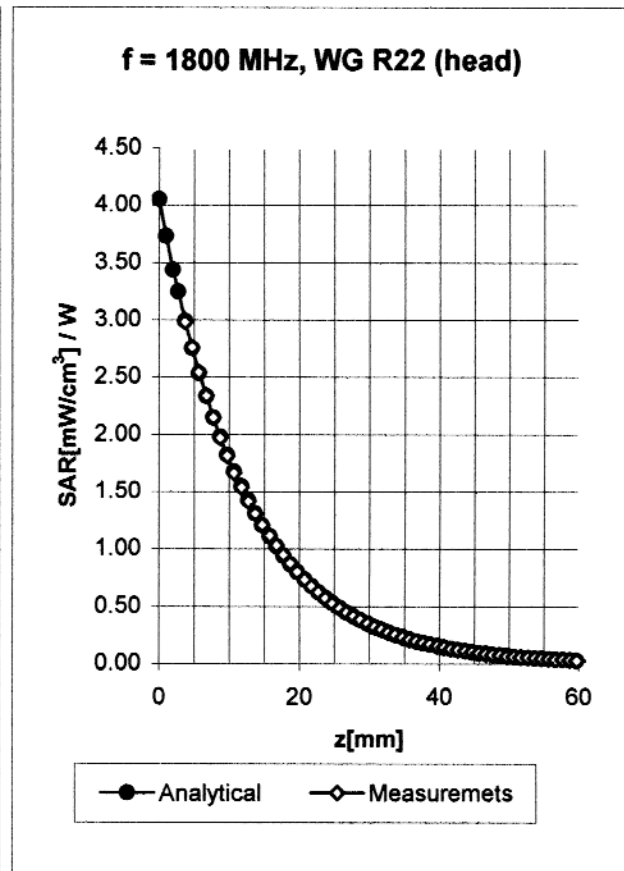
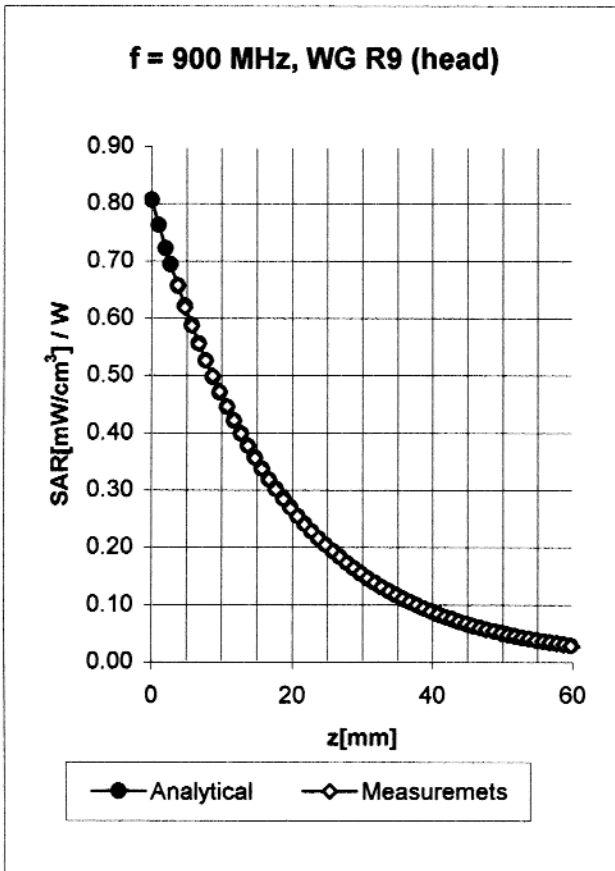
(TEM-Cell:ifi110, Waveguide R22)



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

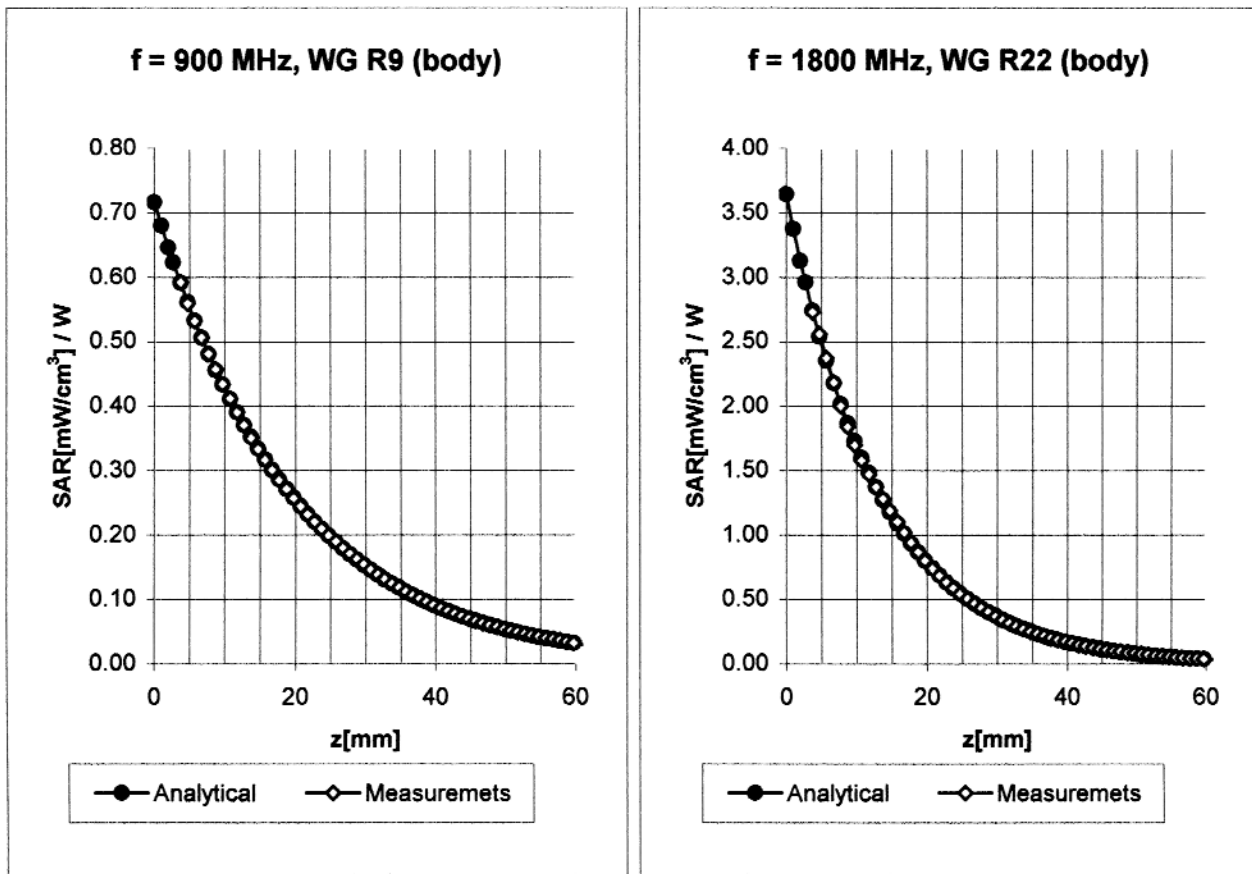


Conversion Factor Assessment



Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\%$ mho/m
	ConvF X	7.0 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	7.0 $\pm 9.5\%$ (k=2)	Alpha 0.33
	ConvF Z	7.0 $\pm 9.5\%$ (k=2)	Depth 2.34
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
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	ConvF Z	5.5 $\pm 9.5\%$ (k=2)	Depth 2.20

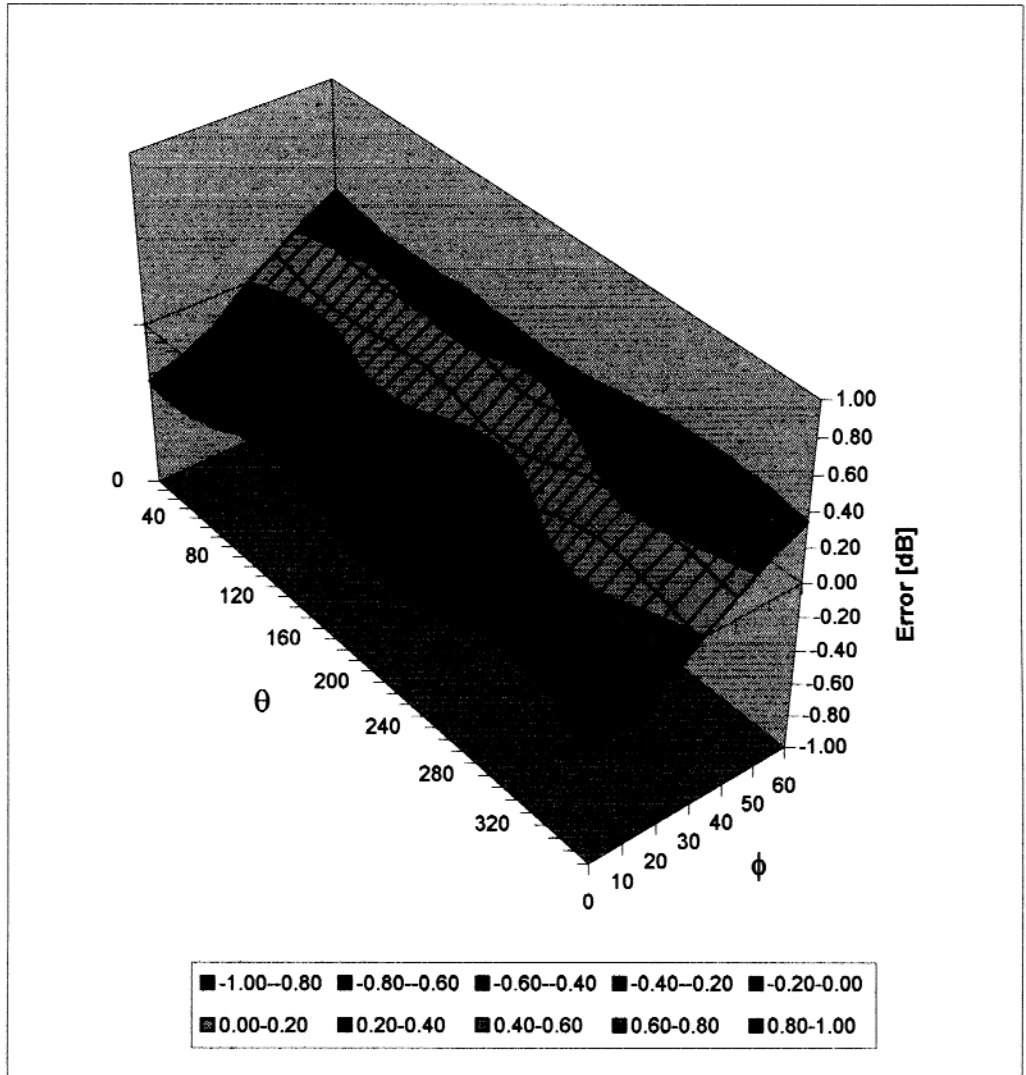
Conversion Factor Assessment



Body	900 MHz	$\epsilon_r = 55.0 \pm 5\%$	$\sigma = 1.05 \pm 5\% \text{ mho/m}$
Body	835 MHz	$\epsilon_r = 55.2 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
	ConvF X	6.7 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	6.7 $\pm 9.5\%$ (k=2)	Alpha 0.29
	ConvF Z	6.7 $\pm 9.5\%$ (k=2)	Depth 2.76
Body	1800 MHz	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\% \text{ mho/m}$
Body	1900 MHz	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\% \text{ mho/m}$
	ConvF X	5.1 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	5.1 $\pm 9.5\%$ (k=2)	Alpha 0.58
	ConvF Z	5.1 $\pm 9.5\%$ (k=2)	Depth 2.19

Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz



Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1578

Place of Assessment:

Zurich

Date of Assessment:

February 25, 2002

Probe Calibration Date:

February 22, 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:

Johnie Katz

Dosimetric E-Field Probe ET3DV6 SN:1578

Conversion factor (\pm standard deviation)

450 MHz	ConvF	8.0\pm 8%	$\epsilon_r = 43.5$ $\sigma = 0.87$ mho/m (head tissue)
450 MHz	ConvF	8.1 \pm 8%	$\epsilon_r = 56.7$ $\sigma = 0.94$ mho/m (body tissue)
2450 MHz	ConvF	4.5 \pm 8%	$\epsilon_r = 39.2$ $\sigma = 1.80$ mho/m (head tissue)
2450 MHz	ConvF	4.1 \pm 8%	$\epsilon_r = 52.7$ $\sigma = 1.95$ mho/m (body tissue)

Schmid & Partner Engineering AG

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

Calibration Certificate

2450 MHz System Validation Dipole

Type:

D2450V2

Serial Number:

706

Place of Calibration:

Zurich

Date of Calibration:

June 4, 2002

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:

D. Keller

Approved by:

Thomas Keller

DASY3

Dipole Validation Kit

Type: D2450V2

Serial: 706

Manufactured: May 28, 2002

Calibrated: June 4, 2002

1. Measurement Conditions

The measurements were performed in the flat section of the new SAM twin phantom filled with head simulating solution of the following electrical parameters at 2450 MHz:

Relative permittivity	38.3	$\pm 5\%$
Conductivity	1.90 mho/m	$\pm 10\%$

The DASY3 System (Software version 3.1d) with a dosimetric E-field probe ET3DV6 (SN:1507, conversion factor 5.0 at 2450 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 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 $\pm 3\%$. The results are normalized to 1W input power.

2.1. SAR Measurement with DASY3 System

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

averaged over 1 cm ³ (1 g) of tissue:	57.6 mW/g
averaged over 10 cm ³ (10 g) of tissue:	26.6 mW/g

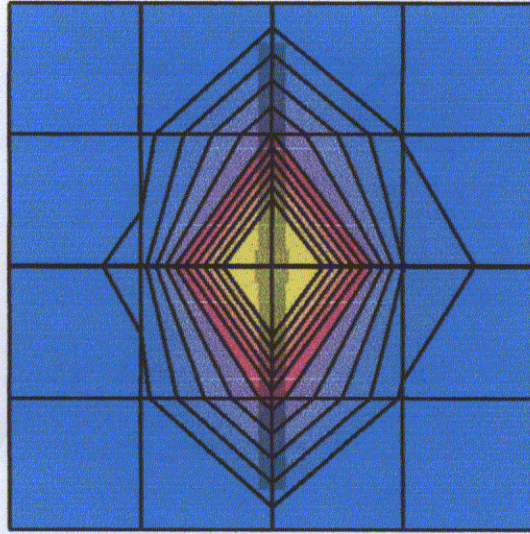
2.2. SAR Measurement with DASY4 System

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

averaged over 1 cm ³ (1 g) of tissue:	54.4 mW/g
averaged over 10 cm ³ (10 g) of tissue:	25.4 mW/g

Validation Dipole D2450V2 SN706, d = 10 mm

Frequency: 2450 MHz; Antenna Input Power: 250 [mW]
SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3D6 - SN1507; ConvF(5.00, 5.00) at 2450 MHz; IEEE1528 2450 MHz; $\sigma = 1.90$ mho/m $\epsilon_r = 38.3$ $\rho = 1.00$ g/cm³
Cubes (2): Peak: 27.0 mW/g ± 0.05 dB, SAR (1g): 13.6 mW/g ± 0.03 dB, SAR (10g): 6.36 mW/g ± 0.02 dB, (Advanced extrapolation)
Penetration depth: 6.9 (6.7, 7.1) [mm]
Powerdrift: -0.01 dB

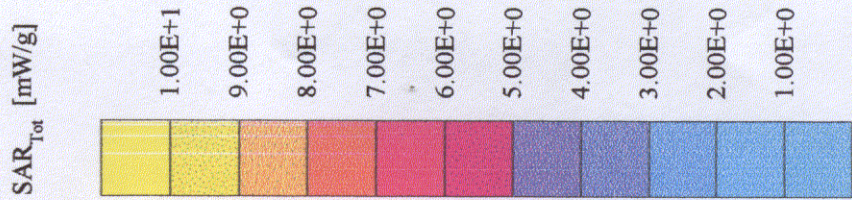
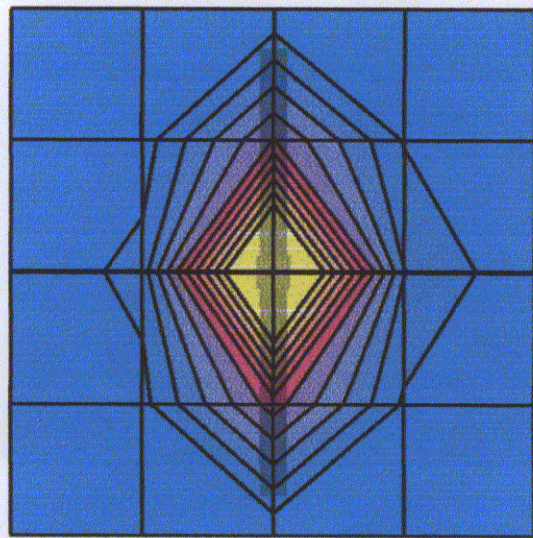


SAR_{Tot} [mW/g]



Validation Dipole D2450V2 SN706, d = 10 mm

Frequency: 2450 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 2450 MHz; IEEE1528 2450 MHz: $\sigma = 1.90$ mho/m $\epsilon_r = 38.3$ $\rho = 1.00$ g/cm³
Cubes (2): Peak: 29.6 mW/g ± 0.05 dB, SAR (1g): 14.4 mW/g ± 0.03 dB, SAR (10g): 6.66 mW/g ± 0.02 dB, (Worst-case extrapolation)
Penetration depth: 6.6 (6.4, 7.1) [mm]
Powerdrift: -0.01 dB



CH1 S11 1 U FS

1: 49.566 Ω 1.4473 Ω 94.016 pF

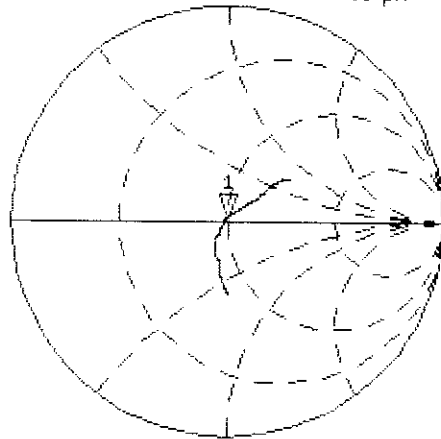
2 450.000 000 MHz

Del

PRM

Cor
Avg
16

↑

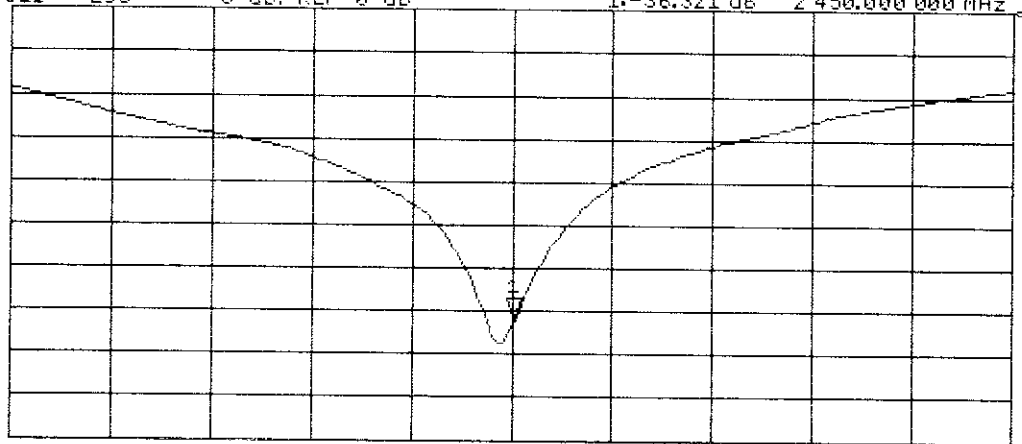


CH2 S11 LOG 5 dB/REF 0 dB

1: -36.321 dB 2 450.000 000 MHz

PRM
Cor

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CENTER 2 450.000 000 MHz

SPAN 450.000 000 MHz