

Appendix 4

Probe Calibration Certificates

Calibration Certificate

Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1391

Place of Calibration:

Zurich

Date of Calibration:

October 25, 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 of the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by:

M. Solari-Meriano

Approved by:

Alvaro Katja

Probe ET3DV6

SN:1391

Manufactured:	October 1, 1999
Remade:	October 11, 2001
Recalibrated:	October 25, 2001

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV6 SN:1391**Sensitivity in Free Space**

NormX	1.86 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.73 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.76 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

DCP X	97 mV
DCP Y	97 mV
DCP Z	97 mV

Sensitivity in Tissue Simulating Liquid

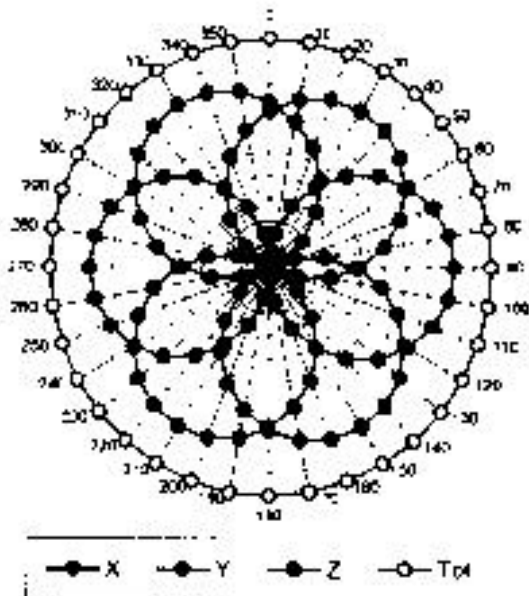
Head	450 MHz	$\epsilon_r = 43.5 \pm 5\%$	$\sigma = 0.87 \pm 10\%$ mho/m
ConvF X	6.75 extrapolated		Boundary effect
ConvF Y	6.75 extrapolated		Alpha 0.39
ConvF Z	6.75 extrapolated		Depth 2.39
Head	800 - 1000 MHz	$\epsilon_r = 39.0 - 43.5$	$\sigma = 0.80 - 1.10$ mho/m
ConvF X	6.31 $\pm 9.5\%$ (k=2)		Boundary effect
ConvF Y	6.31 $\pm 9.5\%$ (k=2)		Alpha 0.47
ConvF Z	6.31 $\pm 9.5\%$ (k=2)		Depth 2.30
Head	1500 MHz	$\epsilon_r = 40.4 \pm 5\%$	$\sigma = 1.23 \pm 10\%$ mho/m
ConvF X	5.73 interpolated		Boundary effect
ConvF Y	5.73 interpolated		Alpha 0.58
ConvF Z	5.73 interpolated		Depth 2.19
Head	1700 - 1910 MHz	$\epsilon_r = 39.6 - 41.0$	$\sigma = 1.20 - 1.55$ mho/m
ConvF X	5.43 $\pm 9.5\%$ (k=2)		Boundary effect
ConvF Y	5.43 $\pm 9.5\%$ (k=2)		Alpha 0.63
ConvF Z	5.43 $\pm 9.5\%$ (k=2)		Depth 2.13

Sensor Offset

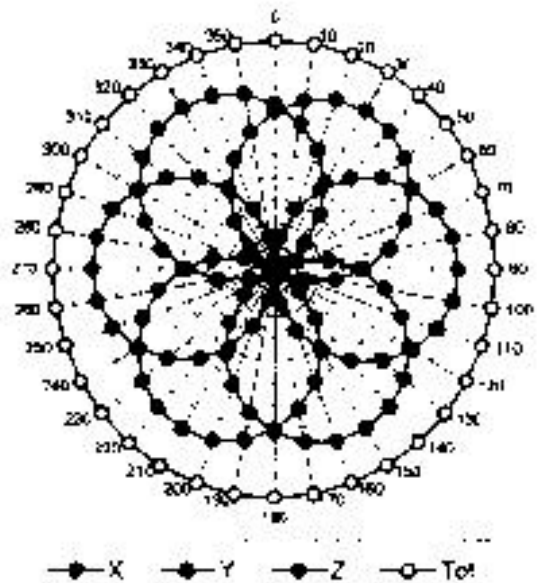
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.5 \pm 0.2	mm

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

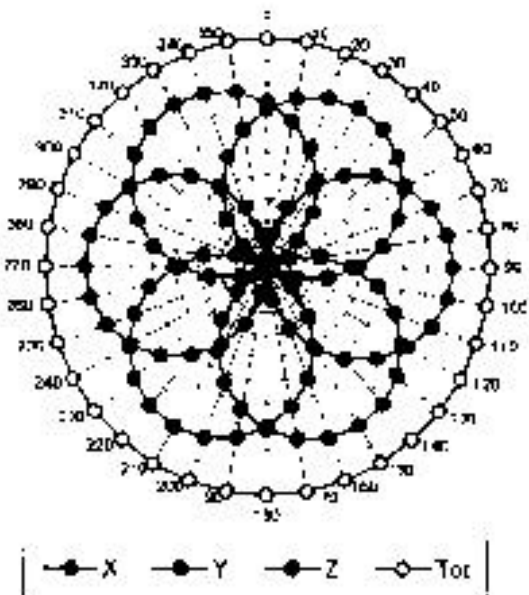
$f = 30 \text{ MHz}$, TEM cell i#110



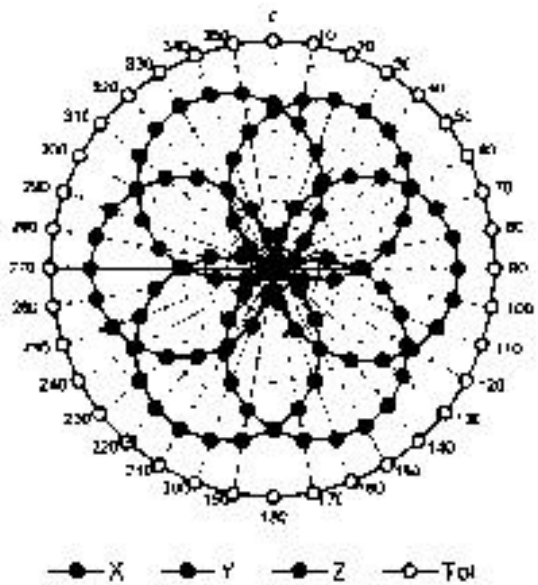
$f = 100 \text{ MHz}$, TEM cell i#110



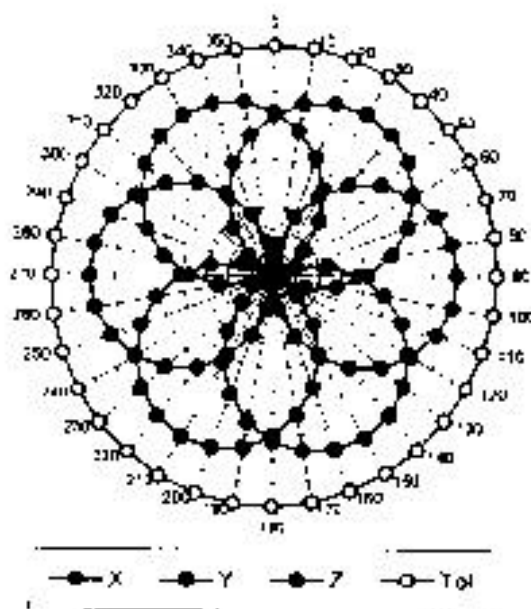
$f = 300 \text{ MHz}$, TEM cell i#110



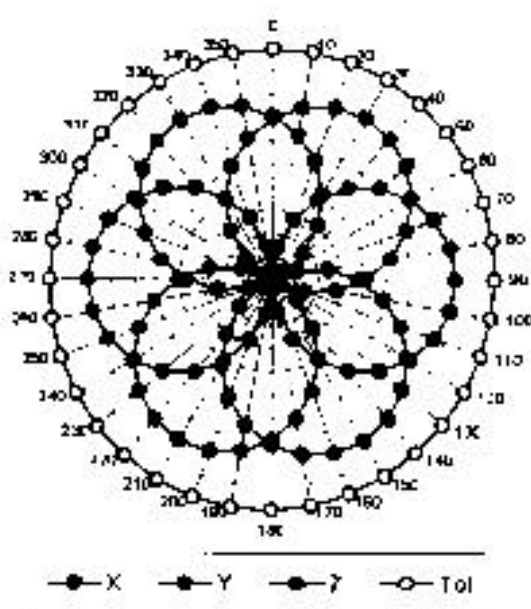
$f = 900 \text{ MHz}$, TEM cell i#110



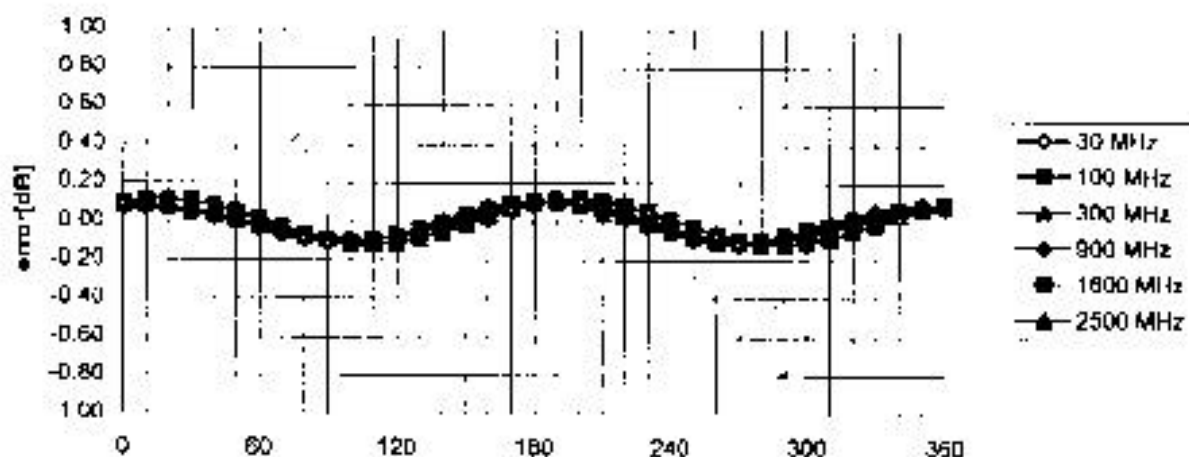
$f = 1800 \text{ MHz, WG R22}$



$f = 2500 \text{ MHz, WG R22}$

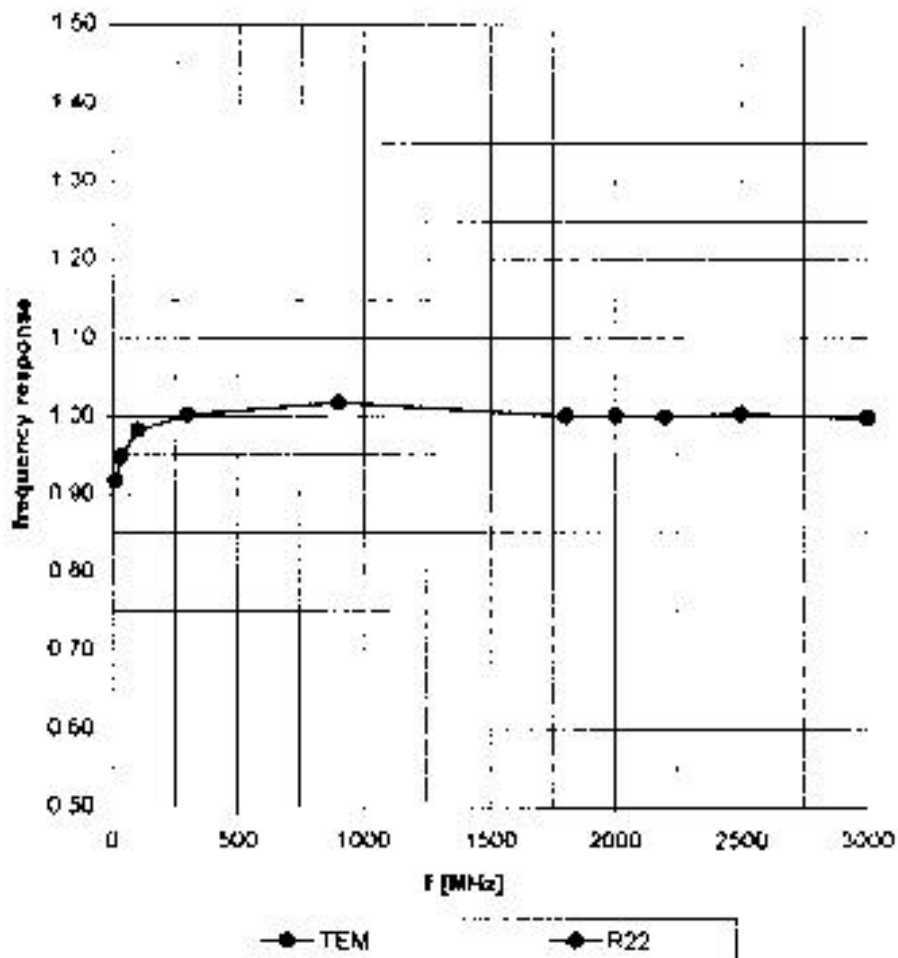


Isotropy Error (ϕ), $\theta = 0^\circ$

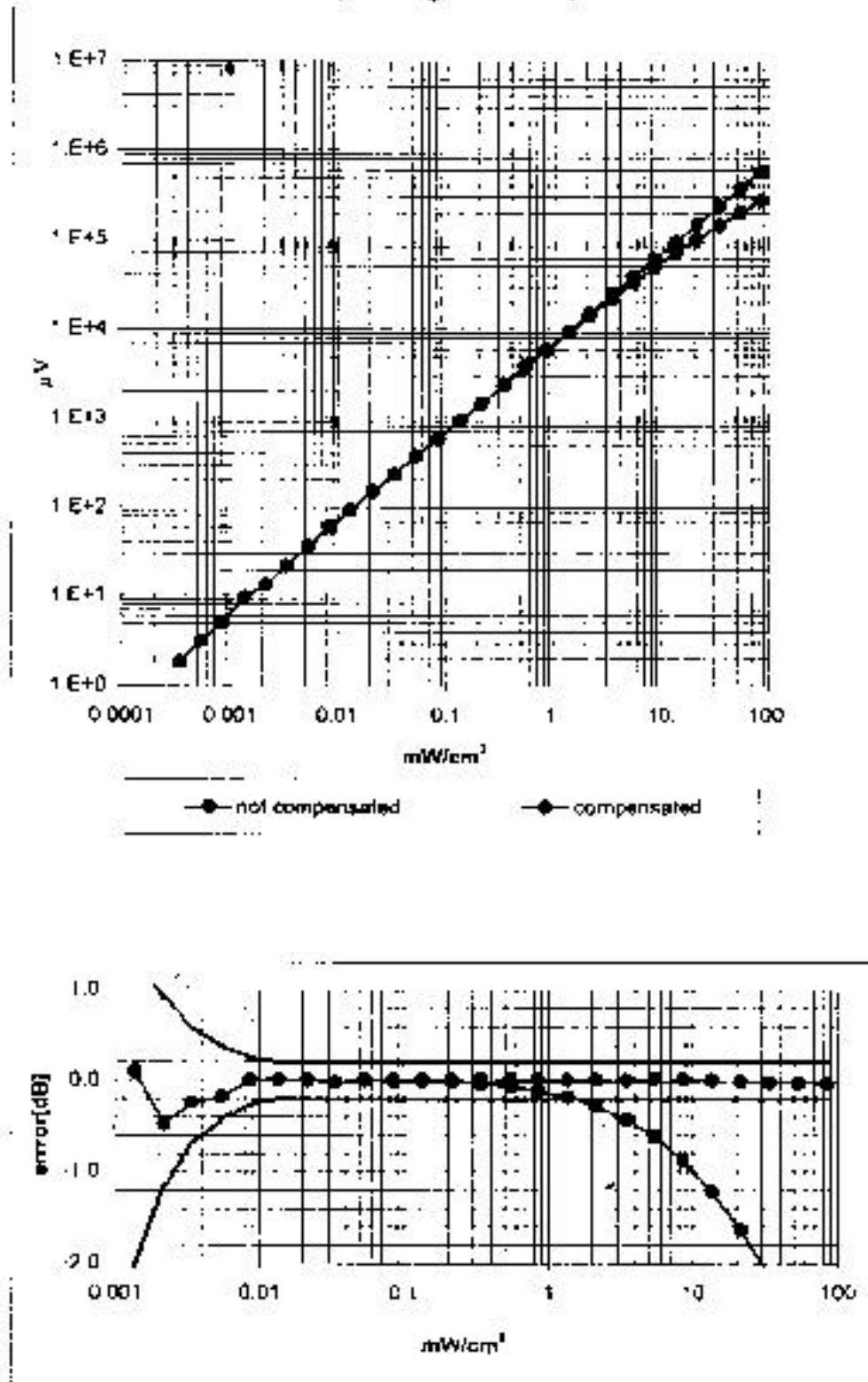


Frequency Response of E-Field

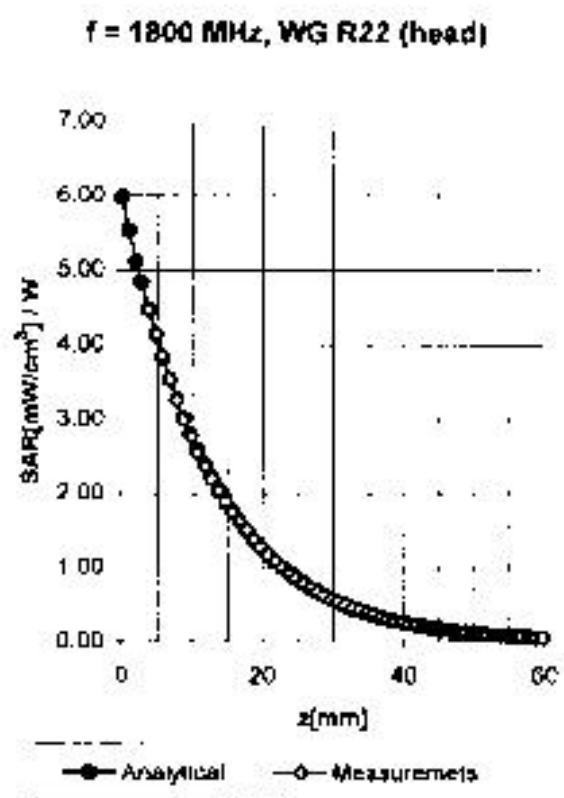
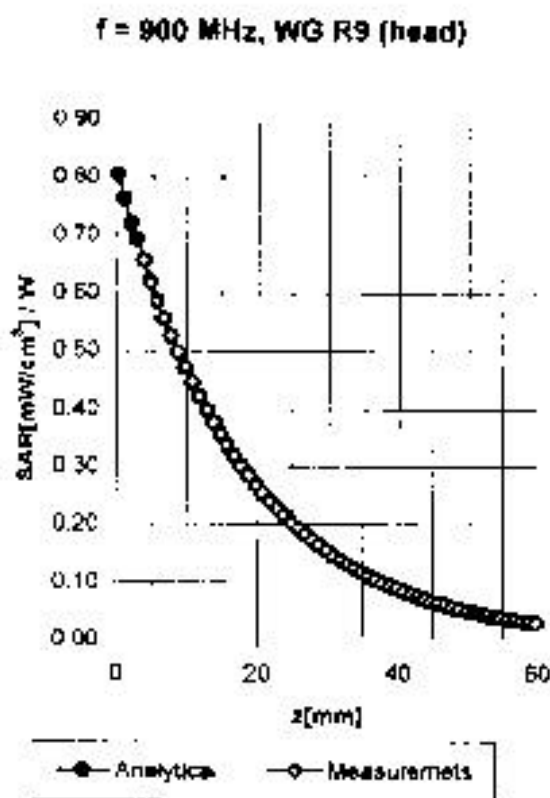
(TEM-Cell:ifi110, Waveguide R22)



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



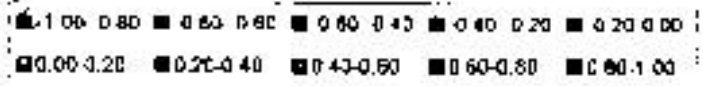
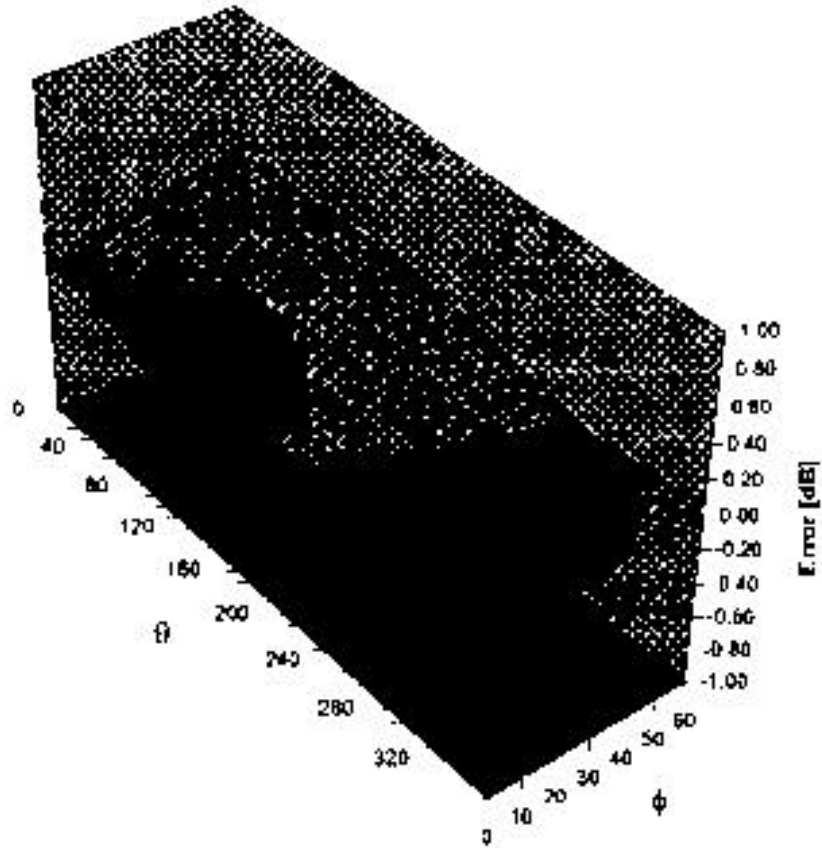
Conversion Factor Assessment



Head	800 - 1000 MHz	$\epsilon_r = 39.0 - 43.5$	$\sigma = 0.80 - 1.10$ mho/m
ConvF X	6.31 $\pm 9.5\%$ (k=2)	Boundary effect.	
ConvF Y	6.31 $\pm 9.5\%$ (k=2)	Alpha	0.47
ConvF Z	6.31 $\pm 9.5\%$ (k=2)	Depth	2.30
Head	1700 - 1910 MHz	$\epsilon_r = 39.5 - 41.0$	$\sigma = 1.20 - 1.56$ mho/m
ConvF X	5.43 $\pm 9.5\%$ (k=2)	Boundary effect	
ConvF Y	5.43 $\pm 9.5\%$ (k=2)	Alpha	0.63
ConvF Z	5.43 $\pm 9.5\%$ (k=2)	Depth	2.13

Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz



Schmid & Partner Engineering AG

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Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1391

Place of Assessment:

Zurich

Date of Assessment:

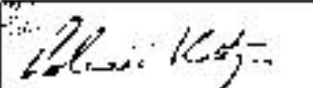
November 14, 2001

Probe Calibration Date:

October 25, 2001

Schmid & Partner Engineering AG hereby certifies that conversion factors of this probe have been evaluated on the date indicated above. The assessment was performed using the EFIELD numerical code SFMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e. following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by:



Dosimetric E-Field Probe ET3DV6 SN:1391

(Conversion factor \pm standard deviation)

835 MHz	ConvF	6.4 \pm 8%	$\epsilon_r = 41.5$ $\sigma = 0.90$ mho/m (head tissue)
1950 MHz	ConvF	5.2 \pm 8%	$\epsilon_r = 40.0$ $\sigma = 1.40$ mho/m (head tissue)
835 MHz	ConvF	6.2 \pm 8%	$\epsilon_r = 55.2$ $\sigma = 0.9$ mho/m (body tissue)
900 MHz	ConvF	6.1 \pm 8%	$\epsilon_r = 55.0$ $\sigma = 1.05$ mho/m (body tissue)
1800 MHz	ConvF	5.0 \pm 8%	$\epsilon_r = 53.3$ $\sigma = 1.52$ mho/m (body tissue)
1950 MHz	ConvF	4.7 \pm 8%	$\epsilon_r = 53.3$ $\sigma = 1.52$ mho/m (body tissue)

Calibration Certificate

Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1398

Place of Calibration:

Zurich

Date of Calibration:

August 31, 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:

H. Eulack, Geneva

Approved by:

Blaise Klutjen

Engineering AG

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

Probe ET3DV6

SN:1398

Manufactured:	October 24, 1999
Repaired:	August 24, 2001
Calibrated:	August 31, 2001

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV6 SN:1398**Sensitivity in Free Space**

NormX	1.62 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.57 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.71 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

DCP X	97 mV
DCP Y	97 mV
DCP Z	97 mV

Sensitivity in Tissue Simulating Liquid

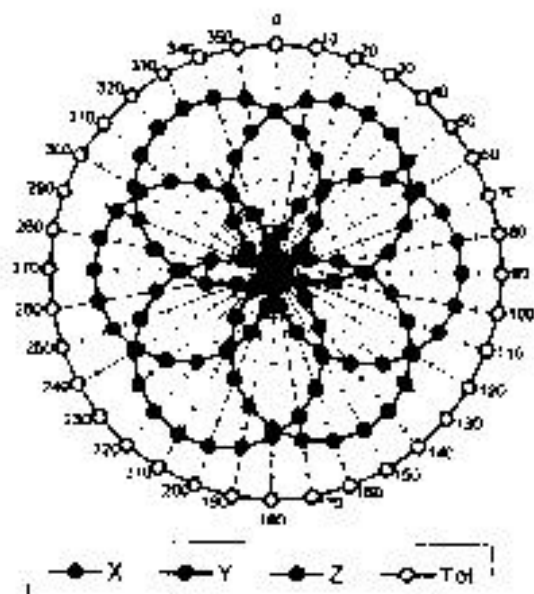
Head	450 MHz	$\epsilon_r = 43.6 \pm 6\%$	$\sigma = 0.87 \pm 10\%$ mho/m
ConvF X	6.95 extrapolated		Boundary effect
ConvF Y	6.95 extrapolated		Alpha 0.45
ConvF Z	6.95 extrapolated		Depth 2.12
Head	900 MHz	$\epsilon_r = 42 \pm 6\%$	$\sigma = 0.97 \pm 10\%$ mho/m
ConvF X	6.43 $\pm 7\%$ (k=2)		Boundary effect
ConvF Y	6.43 $\pm 7\%$ (k=2)		Alpha 0.49
ConvF Z	6.43 $\pm 7\%$ (k=2)		Depth 2.18
Head	1500 MHz	$\epsilon_r = 40.4 \pm 6\%$	$\sigma = 1.23 \pm 10\%$ mho/m
ConvF X	5.74 interpolated		Boundary effect
ConvF Y	5.74 interpolated		Alpha 0.54
ConvF Z	5.74 interpolated		Depth 2.26
Head	1800 MHz	$\epsilon_r = 40 \pm 6\%$	$\sigma = 1.40 \pm 10\%$ mho/m
ConvF X	5.39 $\pm 7\%$ (k=2)		Boundary effect
ConvF Y	5.39 $\pm 7\%$ (k=2)		Alpha 0.56
ConvF Z	5.39 $\pm 7\%$ (k=2)		Depth 2.30

Sensor Offset

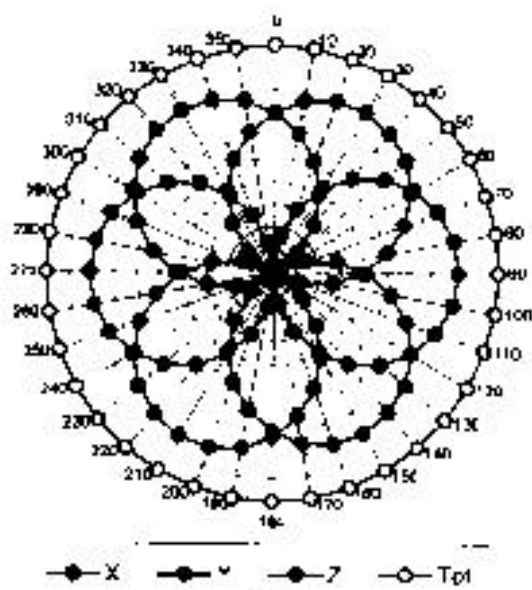
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.2 \pm 0.2	mm

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

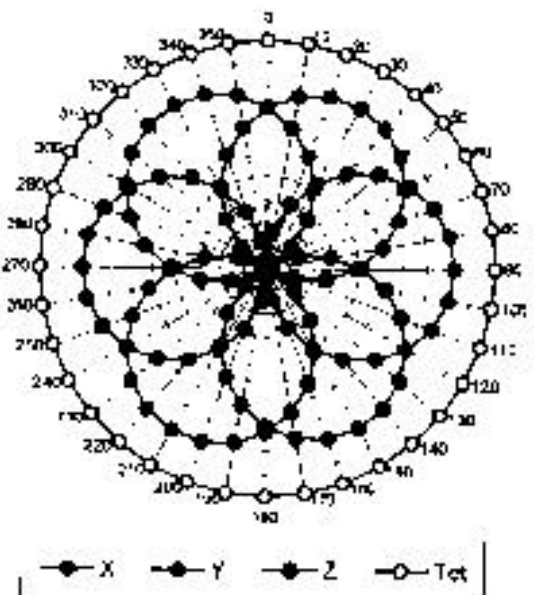
$f = 30$ MHz, TEM cell #110



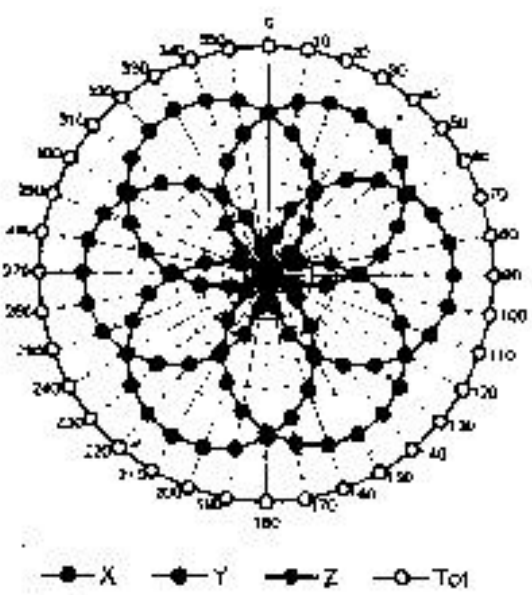
$f = 100$ MHz, TEM cell #110



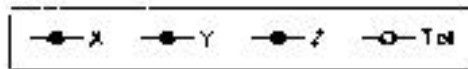
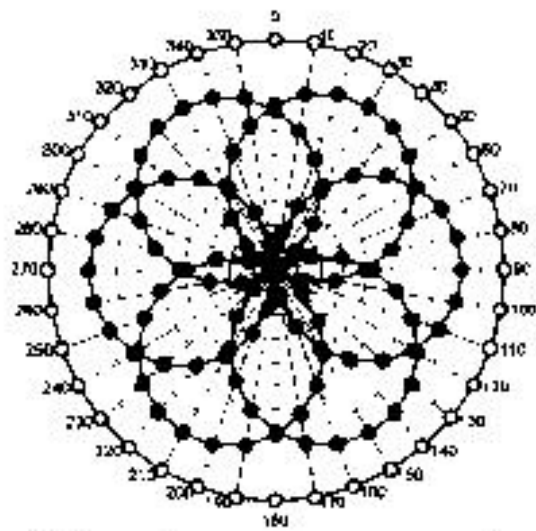
$f = 300$ MHz, TEM cell #110



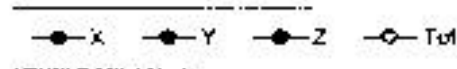
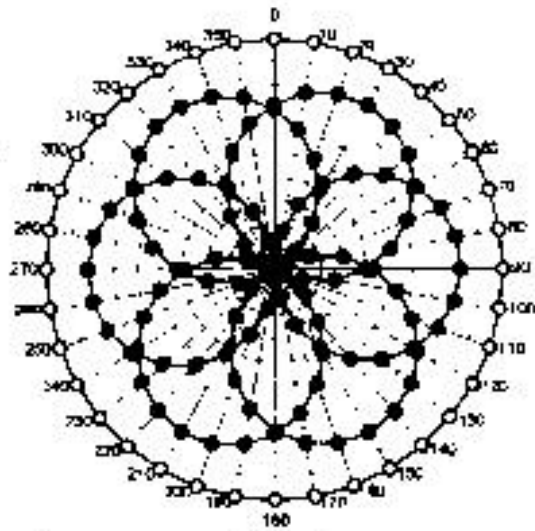
$f = 900$ MHz, TEM cell #110



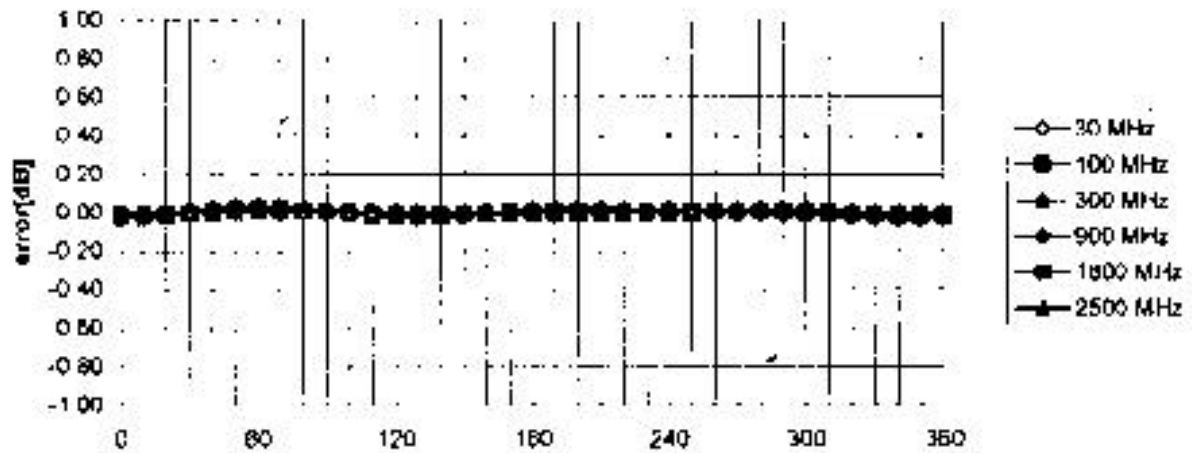
f = 1800 MHz, WG R22



f = 2500 MHz, WG R22

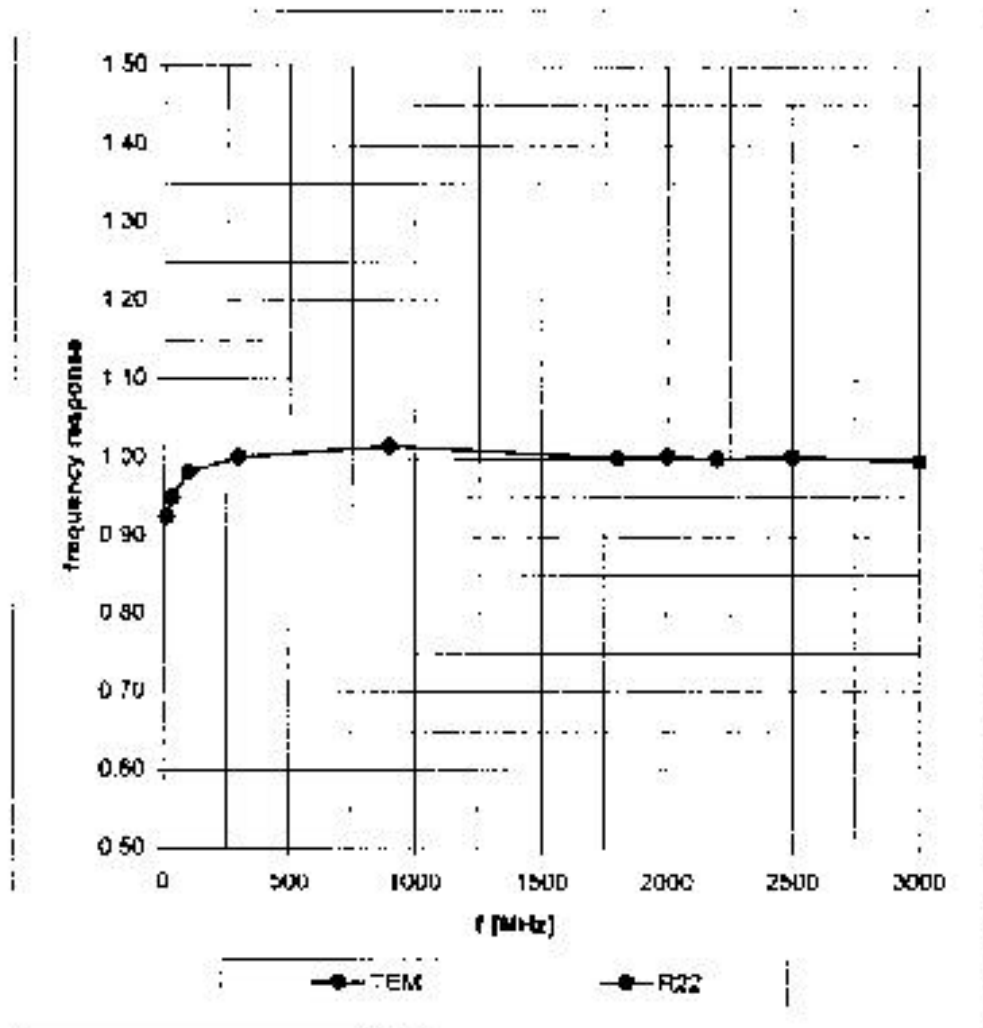


Isotropy Error (ϕ), $\theta = 0^\circ$

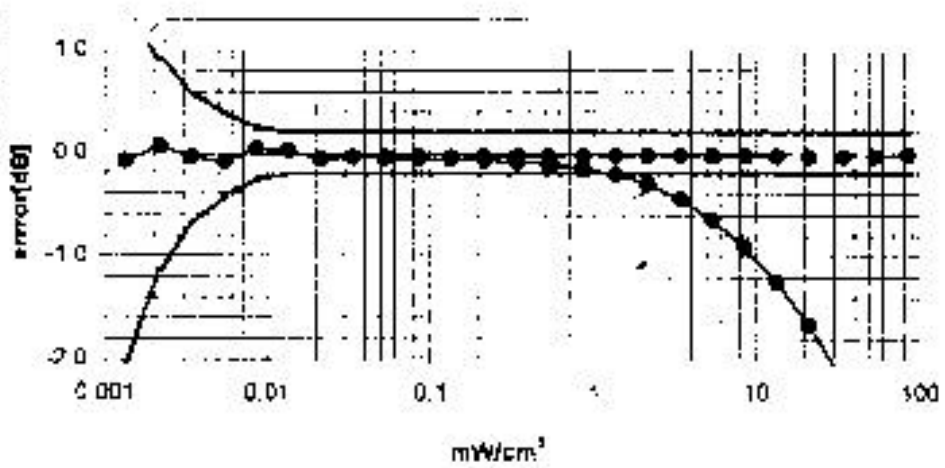
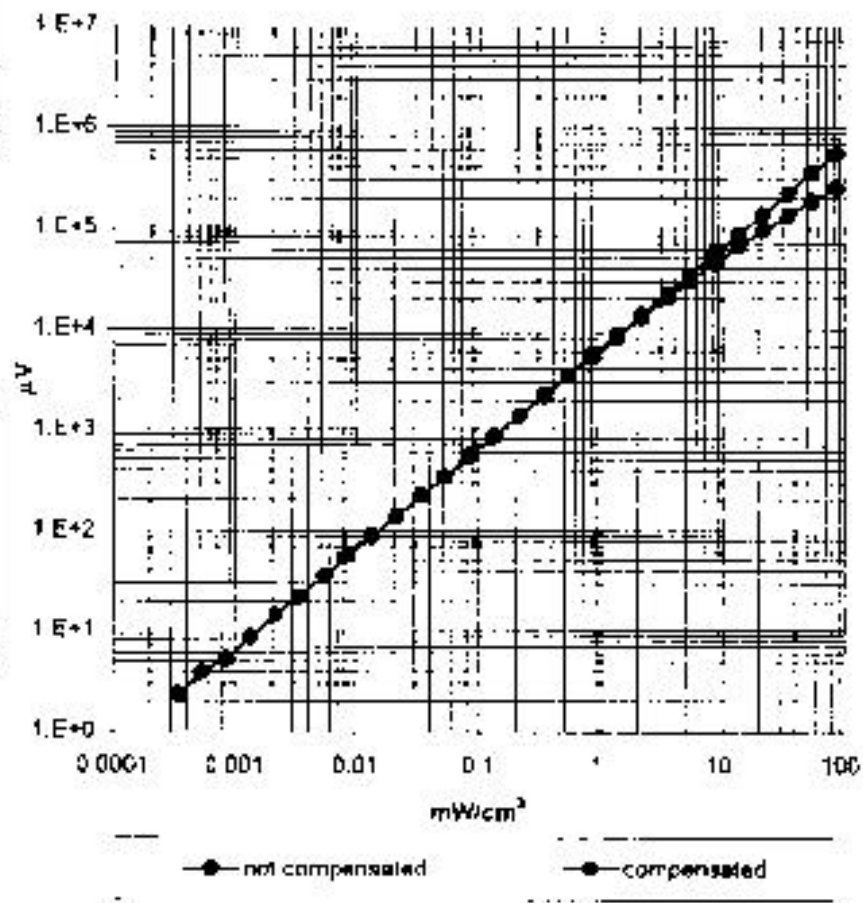


Frequency Response of E-Field

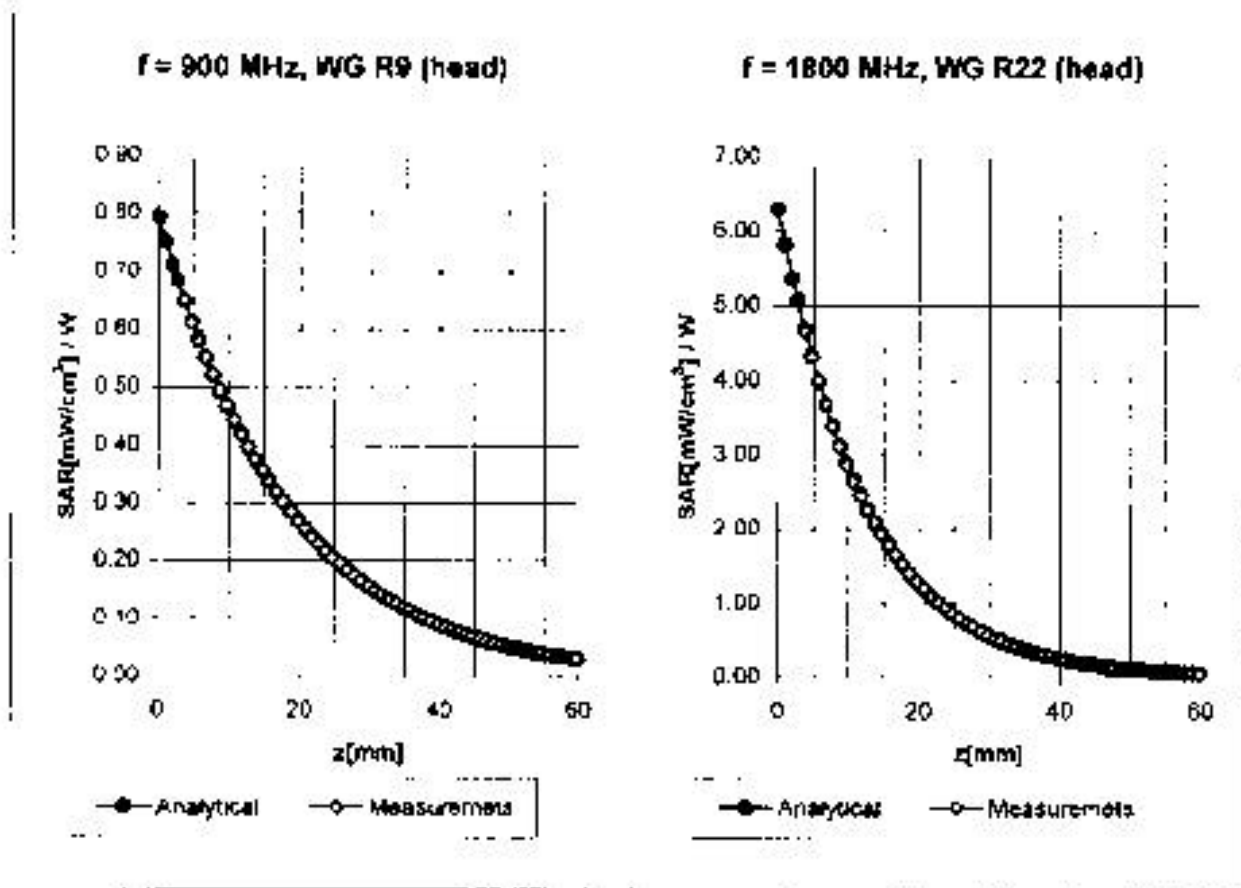
(TEM-Cell:ifi110, Waveguide R22)



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



Conversion Factor Assessment



Head	900 MHz	$\epsilon_1 = 42 \pm 5\%$	$\sigma = 0.97 \pm 10\%$ mho/m
	ConvF X	6.43 $\pm 7\%$ (k=2)	Boundary effect:
	ConvF Y	6.43 $\pm 7\%$ (k=2)	Alpha 0.49
	ConvF Z	6.43 $\pm 7\%$ (k=2)	Depth 2.18

Head	1800 MHz	$\epsilon_1 = 40 \pm 5\%$	$\sigma = 1.40 \pm 10\%$ mho/m
	ConvF X	5.39 $\pm 7\%$ (k=2)	Boundary effect:
	ConvF Y	5.39 $\pm 7\%$ (k=2)	Alpha 0.56
	ConvF Z	5.39 $\pm 7\%$ (k=2)	Depth 2.30

Schmid & Partner Engineering AG

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Additional Conversion Factors for Dosimetric E-Field Probe

Type

ET3DV6

Serial Number:

1398

Place of Assessment:

Zurich

Date of Assessment:

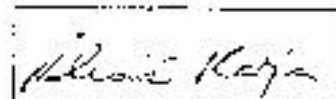
September 7, 2001

Probe Calibration Date:

August 31, 2001

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 SIMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by:



Dosimetric E-Field Probe ET3DV6 SN:1398

Conversion factor (\pm standard deviation)

835 MHz	Conv.F	$6.5 \pm 8\%$	$\epsilon_r = 41.5$ $\sigma = 0.90 \text{ mho/m}$ (head tissue)
835 MHz	Conv.F	$6.3 \pm 8\%$	$\epsilon_r = 55.2$ $\sigma = 0.97 \text{ mho/m}$ (body tissue)
900 MHz	Conv.F	$6.2 \pm 8\%$	$\epsilon_r = 55.0$ $\sigma = 1.05 \text{ mho/m}$ (body tissue)
1950 MHz	Conv.F	$5.1 \pm 8\%$	$\epsilon_r = 40.0$ $\sigma = 1.40 \text{ mho/m}$ (head tissue)
1800 MHz	Conv.F	$5.0 \pm 8\%$	$\epsilon_r = 53.3$ $\sigma = 1.52 \text{ mho/m}$ (body tissue)
1950 MHz	Conv.F	$4.7 \pm 8\%$	$\epsilon_r = 53.3$ $\sigma = 1.52 \text{ mho/m}$ (body tissue)

Dosimetric E-Field Probe ET3DV6 SN:1398

Conversion factor (± standard deviation)

835 MHz	ConvF	6.5 ± 8%	$\epsilon_r = 44.0$ $\sigma = 0.90 \text{ mho/m}$ (brain tissue)
835 MHz	ConvF	6.4 ± 8%	$\epsilon_r = 52.0$ $\sigma = 1.10 \text{ mho/m}$ (muscle tissue)
900 MHz	ConvF	6.4 ± 8%	$\epsilon_r = 42.5$ $\sigma = 0.86 \text{ mho/m}$ (brain tissue)
925 MHz	ConvF	6.3 ± 8%	$\epsilon_r = 44.0$ $\sigma = 0.93 \text{ mho/m}$ (brain tissue)
925 MHz	ConvF	6.3 ± 8%	$\epsilon_r = 52.0$ $\sigma = 1.20 \text{ mho/m}$ (muscle tissue)
1800 MHz	ConvF	5.4 ± 8%	$\epsilon_r = 40.3$ $\sigma = 1.35 \text{ mho/m}$ (brain tissue)
1800 MHz	ConvF	5.5 ± 8%	$\epsilon_r = 41.0$ $\sigma = 1.69 \text{ mho/m}$ (brain tissue)
1900 MHz	ConvF	5.2 ± 8%	$\epsilon_r = 39.9$ $\sigma = 1.42 \text{ mho/m}$ (brain tissue)
1800 MHz	ConvF	5.1 ± 8%	$\epsilon_r = 50.0$ $\sigma = 1.58 \text{ mho/m}$ (muscle tissue)
1900 MHz	ConvF	5.0 ± 8%	$\epsilon_r = 50.0$ $\sigma = 1.64 \text{ mho/m}$ (muscle tissue)