

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:

ET3DVs

Serial Number:

1397

Place of Calibration:

Zurich

Date of Calibration:

November 23, 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:

Approved by:

Probe ET3DV6

SN:1397

Manufactured:	October 24, 1999
Repaired:	November 15, 2001
Recalibrated:	November 23, 2001

Calibrated for System DASY3

ET3DV6 SN:1397

DASY3 - Parameters of Probe: ET3DV6 SN:1397

Sensitivity in Free Space

NormX	2.05 $\mu\text{V}/(\text{V/m})^2$
NormY	2.01 $\mu\text{V}/(\text{V/m})^2$
NormZ	2.03 $\mu\text{V}/(\text{V/m})^2$

Diode Compression

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

Sensitivity in Tissue Simulating Liquid

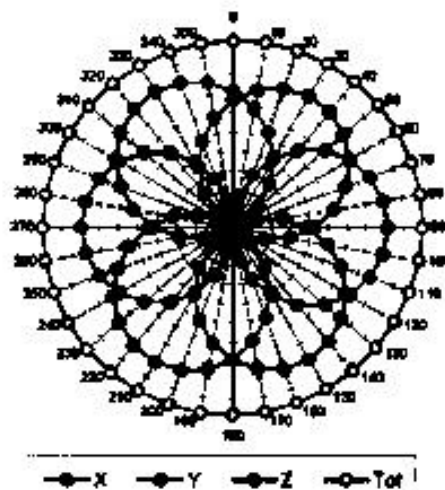
Head	450 MHz	$\epsilon_r = 43.5 \pm 5\%$	$\sigma = 0.87 \pm 10\% \text{ mho/m}$	
ConvF X	7.17	extrapolated	Boundary effect:	
ConvF Y	7.17	extrapolated	Alpha	0.40
ConvF Z	7.17	extrapolated	Depth	2.15
Head	800 - 1000 MHz	$\epsilon_r = 39.0 - 43.5$	$\sigma = 0.80 - 1.10 \text{ mho/m}$	
ConvF X	6.61	$\pm 9.5\% (k=2)$	Boundary effect:	
ConvF Y	6.61	$\pm 9.5\% (k=2)$	Alpha	0.46
ConvF Z	6.61	$\pm 9.5\% (k=2)$	Depth	2.18
Head	1500 MHz	$\epsilon_r = 40.4 \pm 5\%$	$\sigma = 1.23 \pm 10\% \text{ mho/m}$	
ConvF X	5.85	interpolated	Boundary effect:	
ConvF Y	5.85	interpolated	Alpha	0.54
ConvF Z	5.85	interpolated	Depth	2.21
Head	1700 - 1910 MHz	$\epsilon_r = 39.5 - 41.0$	$\sigma = 1.20 - 1.55 \text{ mho/m}$	
ConvF X	5.47	$\pm 9.5\% (k=2)$	Boundary effect:	
ConvF Y	5.47	$\pm 9.5\% (k=2)$	Alpha	0.57
ConvF Z	5.47	$\pm 9.5\% (k=2)$	Depth	2.23

Sensor Offset

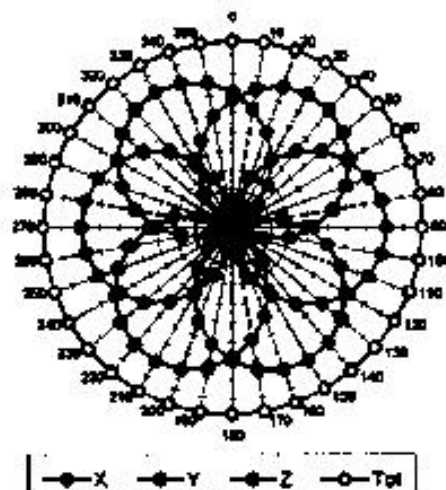
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.5 $\pm$ 0.2	mm

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

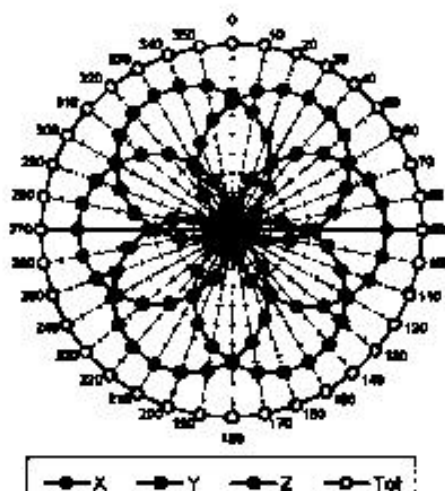
$f = 30 \text{ MHz}$, TEM cell NR110



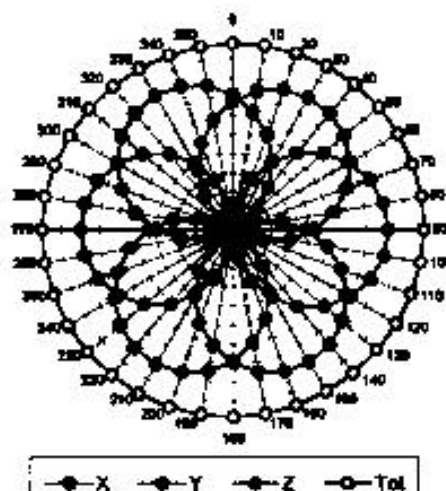
$f = 100 \text{ MHz}$, TEM cell NR110



$f = 300 \text{ MHz}$, TEM cell NR110

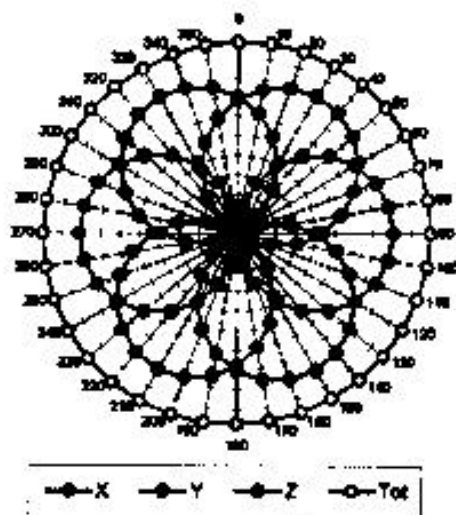


$f = 900 \text{ MHz}$, TEM cell NR110

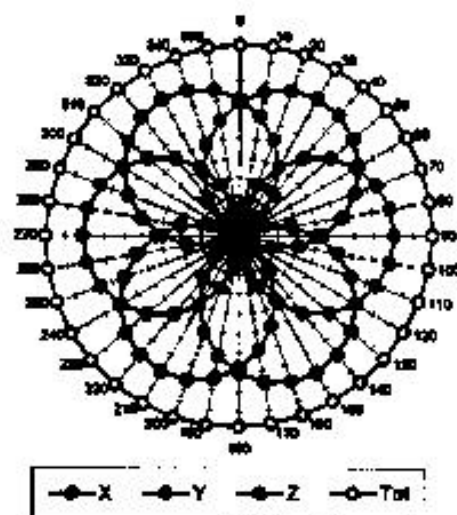


ET3DV6 SN:1397

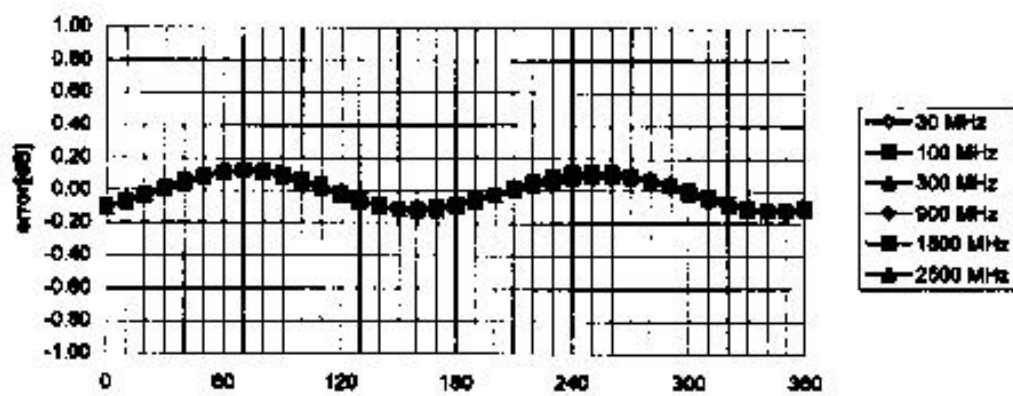
$f = 1800 \text{ MHz}$, WG R22



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



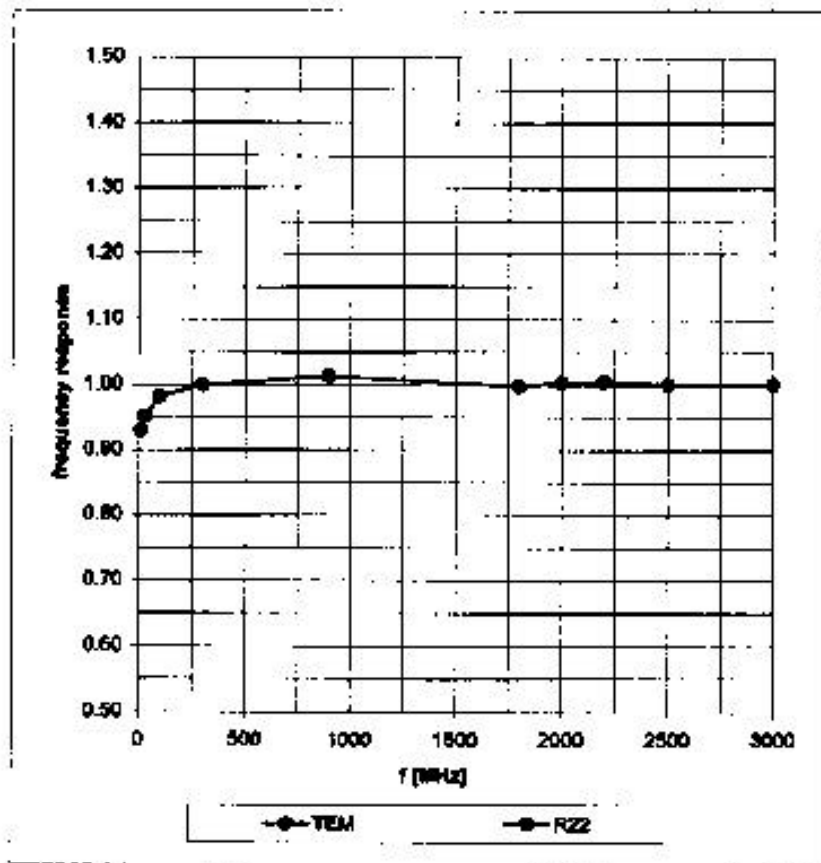
Isotropy Error (ϕ), $\theta = 0^\circ$



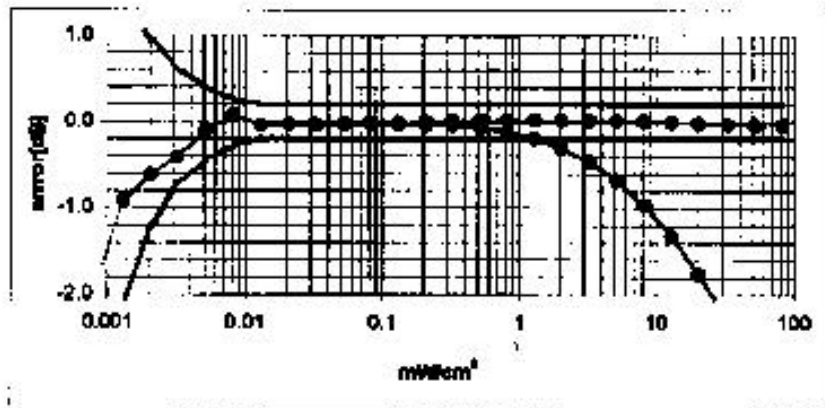
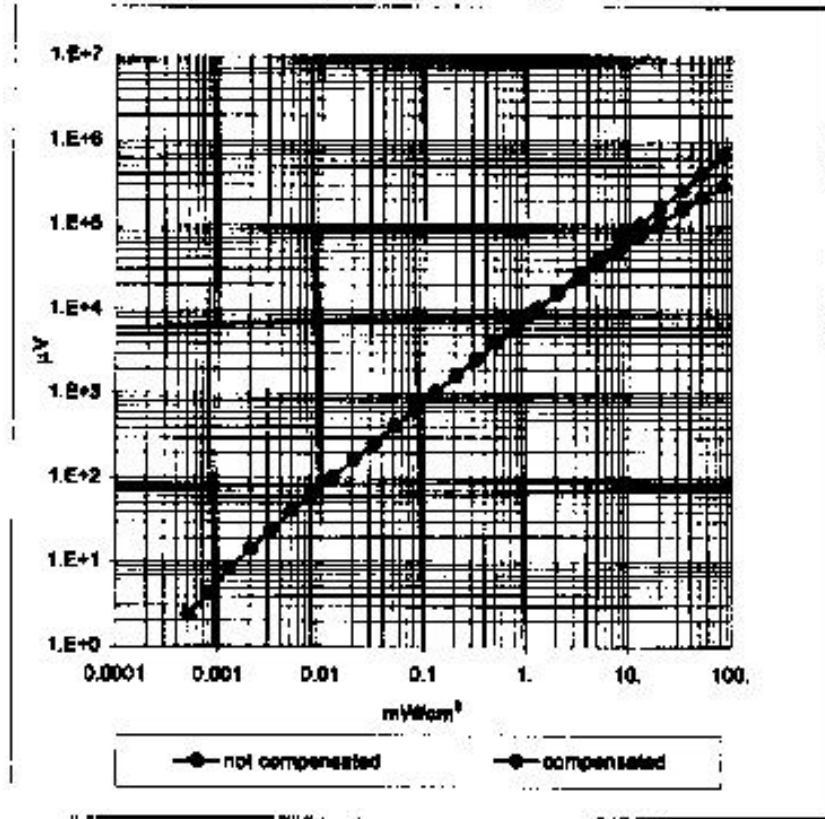
ET3DV6 SN:1397

Frequency Response of E-Field

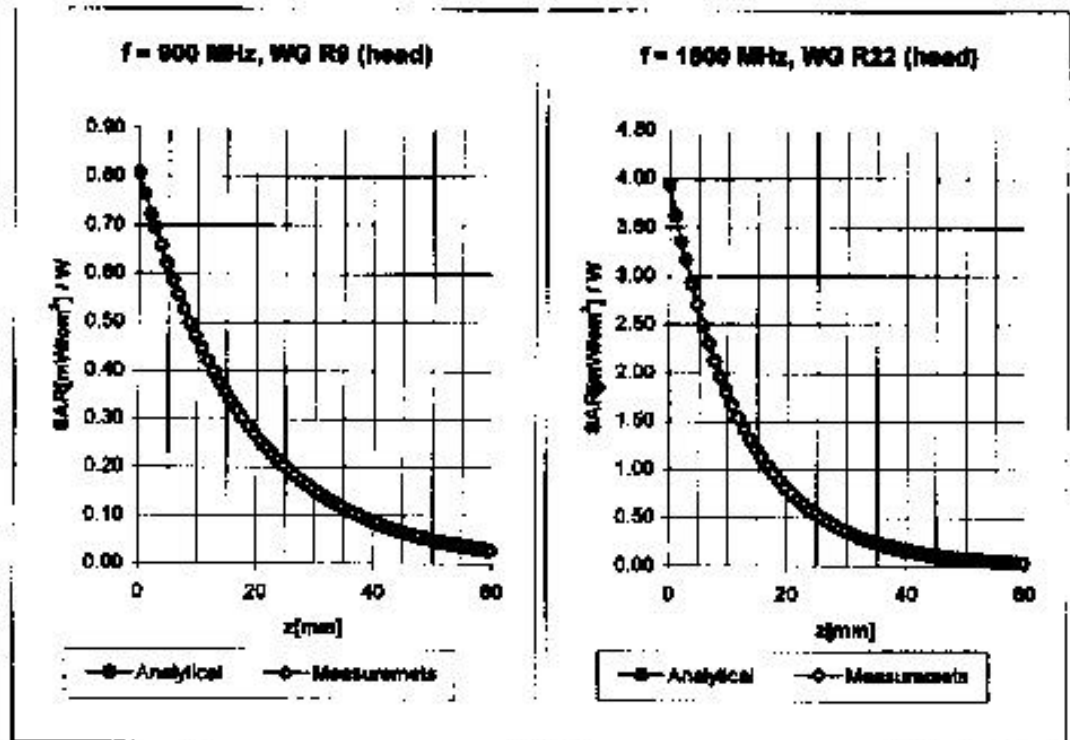
(TEM-Cell:W1110, Waveguide R22)



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



Conversion Factor Assessment



Head 900 - 1080 MHz $z_c = 39.0 - 43.6$ $\sigma = 0.80 - 1.10$ mho/m

ConvF X $6.61 \pm 9.5\%$ (k=2)

ConvF Y $6.61 \pm 9.6\%$ (k=2)

ConvF Z $6.61 \pm 9.5\%$ (k=2)

Boundary effect:

Alpha 0.45

Depth 2.15

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

ConvF X $6.47 \pm 9.5\%$ (k=2)

ConvF Y $6.47 \pm 9.6\%$ (k=2)

ConvF Z $6.47 \pm 9.5\%$ (k=2)

Boundary effect:

Alpha 0.67

Depth 2.23

Schmid & Partner Engineering AG

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Additional Conversion Factors

for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1899

Place of Assessment:

Zurich

Date of Assessment:

November 25, 2001

Probe Calibration Date:

November 23, 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 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:

Alain Kappeler

Dosimetric E-Field Probe ET3DV6 SN:1397

Conversion factor ($\pm$ standard deviation)

835 MHz	ConvF	$6.7 \pm 8\%$	$\epsilon_r = 41.5$ $\sigma = 0.90 \text{ mho/m}$ (head tissue)
1950 MHz	ConvF	$5.2 \pm 8\%$	$\epsilon_r = 40.8$ $\sigma = 1.40 \text{ mho/m}$ (head tissue)
835 MHz	ConvF	$6.5 \pm 8\%$	$\epsilon_r = 55.2$ $\sigma = 0.97 \text{ mho/m}$ (body tissue)
900 MHz	ConvF	$6.4 \pm 8\%$	$\epsilon_r = 55.0$ $\sigma = 1.05 \text{ mho/m}$ (body tissue)
1800 MHz	ConvF	$5.1 \pm 8\%$	$\epsilon_r = 53.3$ $\sigma = 1.52 \text{ mho/m}$ (body tissue)
1950 MHz	ConvF	$4.9 \pm 8\%$	$\epsilon_r = 53.3$ $\sigma = 1.52 \text{ mho/m}$ (body tissue)

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Calibration Certificate

Dosimetric E-Field Probe

Type:

ET3DV4

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:

M. J. J. J. J.

Approved by:

M. J. J. J. J.

Engineering AG

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Probe ET3DV6

SN:1398

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

Calibrated for System DASY3

ET3DV6 SN:1398

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

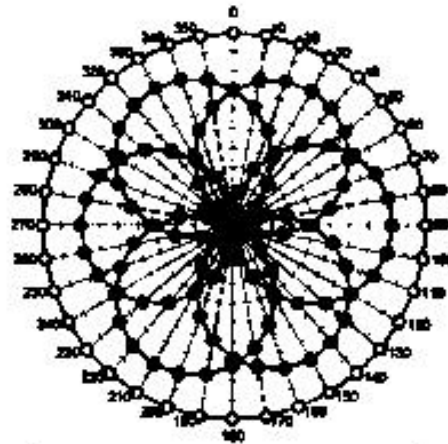
Head	450 MHz	$\epsilon_r = 43.5 \pm 5\%$	$\sigma = 0.87 \pm 10\% \text{ mho/m}$	
ConvF X	6.95	extrapolated	Boundary effect:	
ConvF Y	6.95	extrapolated	Alpha	0.45
ConvF Z	6.95	extrapolated	Depth	2.12
Head	900 MHz	$\epsilon_r = 42 \pm 5\%$	$\sigma = 0.97 \pm 10\% \text{ mho/m}$	
ConvF X	6.43	$\pm 7\%$ (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	$\epsilon_r = 40.4 \pm 8\%$	$\sigma = 1.23 \pm 10\% \text{ mho/m}$	
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	$\epsilon_r = 40 \pm 8\%$	$\sigma = 1.48 \pm 10\% \text{ mho/m}$	
ConvF X	5.39	$\pm 7\%$ (k=2)	Boundary effect:	
ConvF Y	5.39	$\pm 7\%$ (k=2)	Alpha	0.58
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

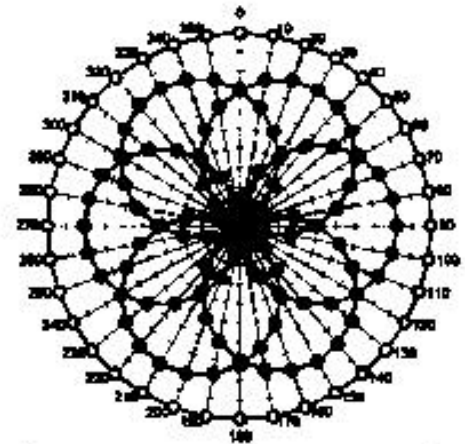
Receiving Pattern (ϕ), $\theta = 0^\circ$

$f = 30 \text{ MHz}$, TEM cell M110



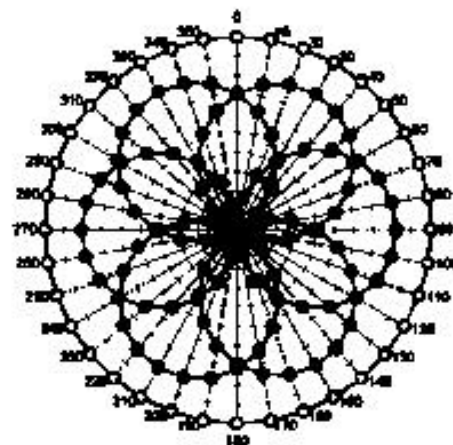
—●— X —●— Y —●— Z —○— Tot

$f = 100 \text{ MHz}$, TEM cell M110



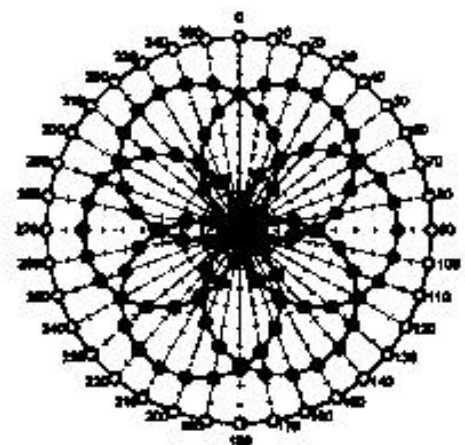
—●— X —●— Y —●— Z —○— Tot

$f = 300 \text{ MHz}$, TEM cell M110



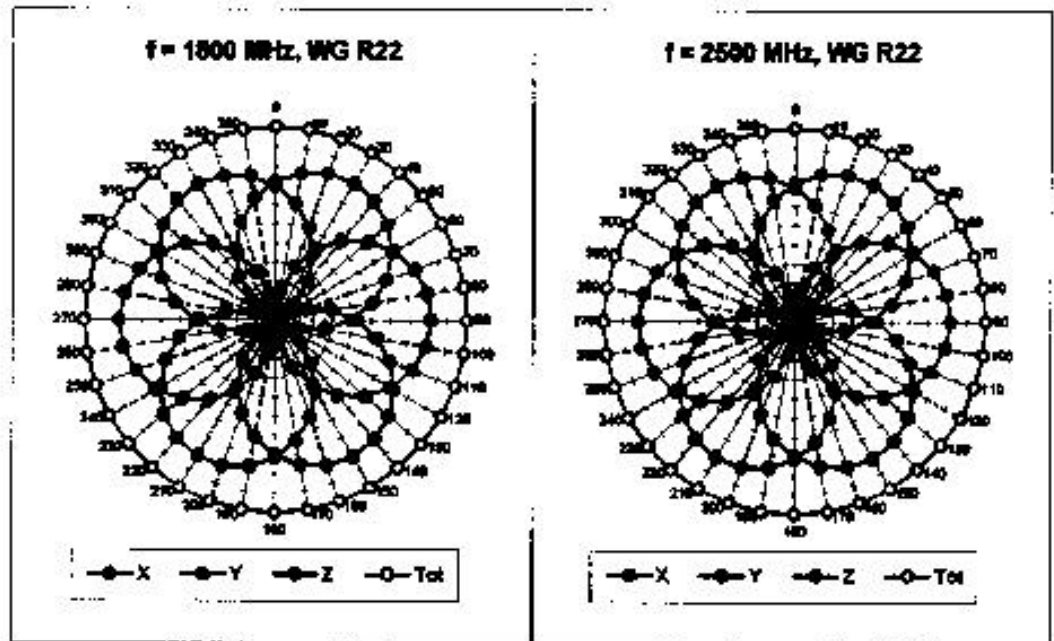
—●— X —●— Y —●— Z —○— Tot

$f = 900 \text{ MHz}$, TEM cell M110

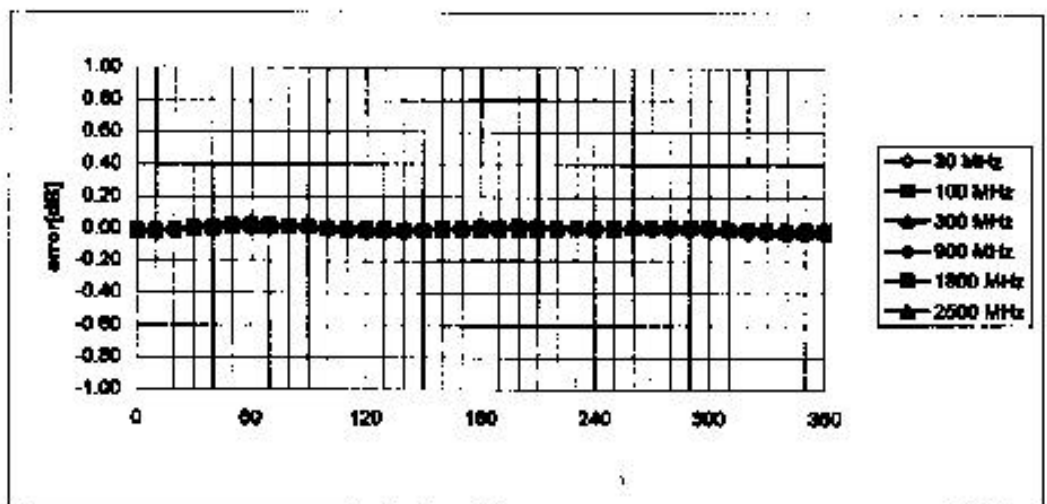


—●— X —●— Y —●— Z —○— Tot

ET3DV8 SN:1388

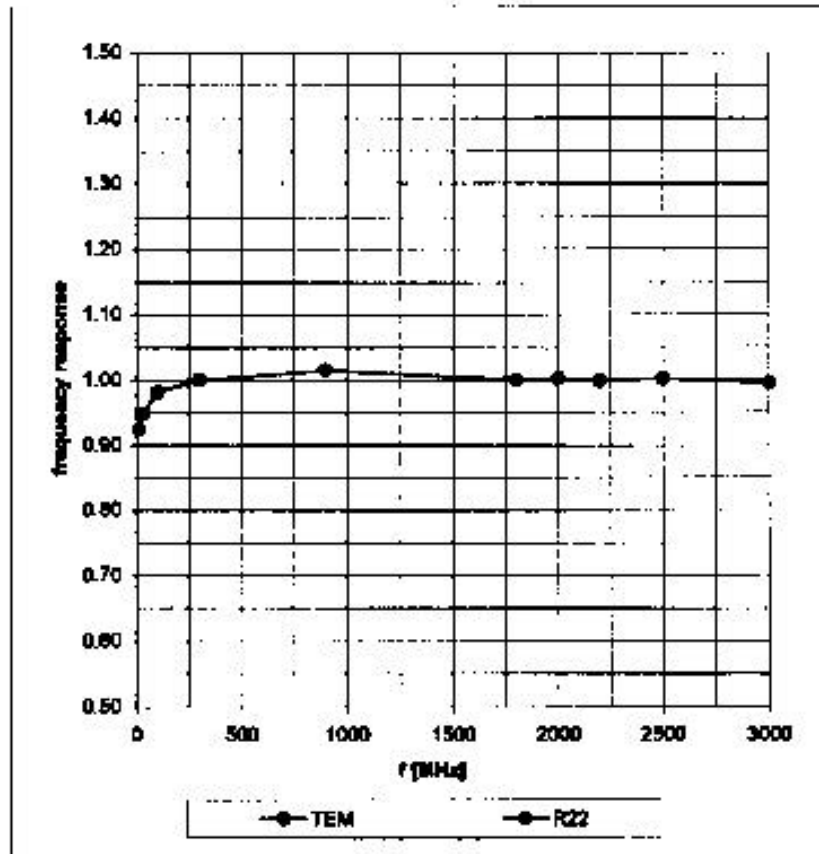


Isotropy Error (ϕ), $\theta = 0^\circ$

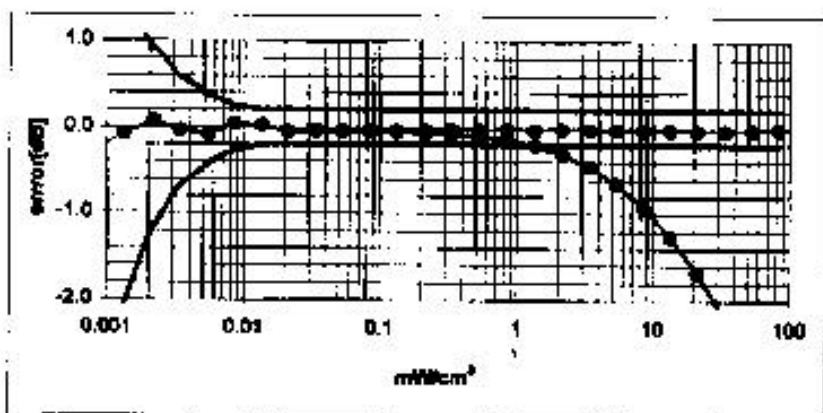
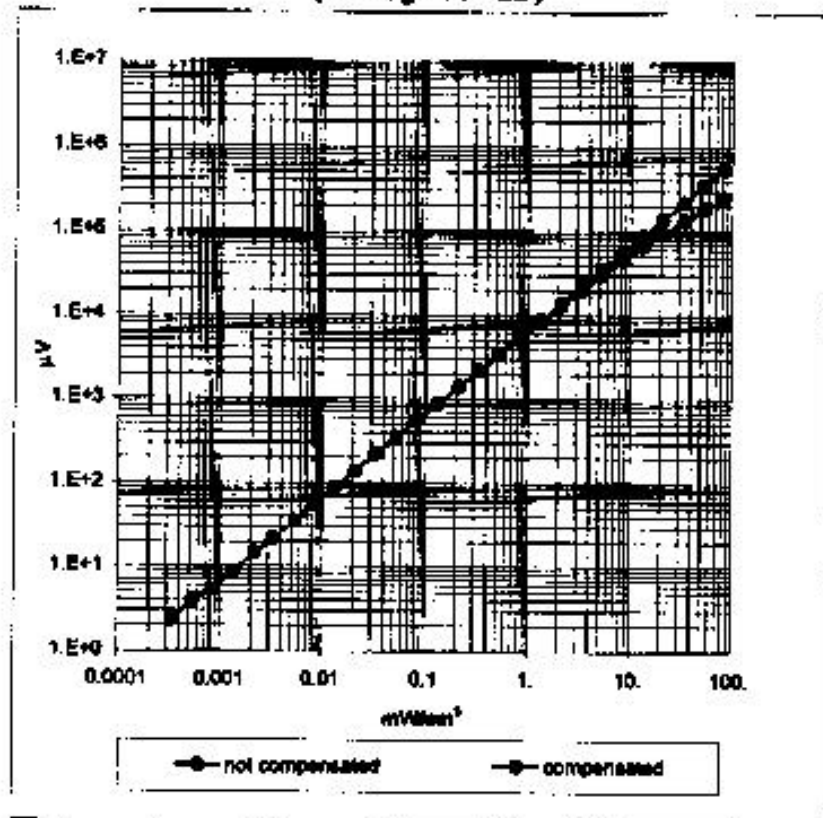


Frequency Response of E-Field

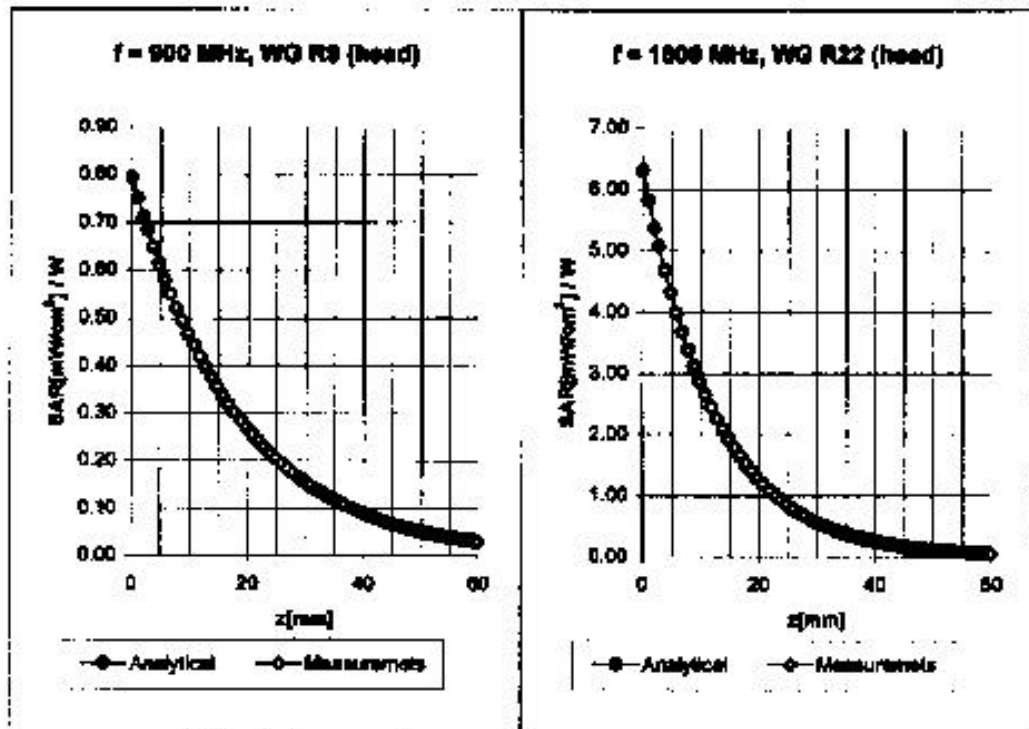
(TEM-Cell: Ifi110, Waveguide R22)



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



Conversion Factor Assessment



Head	900 MHz	$\epsilon_r = 42 \pm 5\%$	$\sigma = 0.97 \pm 10\%$ 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	$\epsilon_r = 40 \pm 5\%$	$\sigma = 1.40 \pm 10\%$ mho/m	
ConvF X	$6.39 \pm 7\%$ (k=2)		Boundary effect:	
ConvF Y	$6.39 \pm 7\%$ (k=2)		Alpha	0.56
ConvF Z	$6.39 \pm 7\%$ (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:

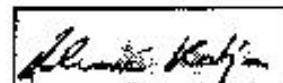
September 7, 2001

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 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:



Dosimetric E-Field Probe ET3DV6 SN:1398

Conversion factor ($\pm$ standard deviation)

835 MHz	ConvF	$6.5 \pm 8\%$	$\epsilon_r = 41.5$ $\sigma = 0.90 \text{ mho/m}$ (head tissue)
835 MHz	ConvF	$6.3 \pm 8\%$	$\epsilon_r = 53.2$ $\sigma = 0.97 \text{ mho/m}$ (body tissue)
900 MHz	ConvF	$6.2 \pm 8\%$	$\epsilon_r = 55.0$ $\sigma = 1.05 \text{ mho/m}$ (body tissue)
1950 MHz	ConvF	$5.1 \pm 8\%$	$\epsilon_r = 40.0$ $\sigma = 1.40 \text{ mho/m}$ (head tissue)
1800 MHz	ConvF	$5.0 \pm 8\%$	$\epsilon_r = 53.3$ $\sigma = 1.52 \text{ mho/m}$ (body tissue)
1950 MHz	ConvF	$4.7 \pm 8\%$	$\epsilon_r = 53.3$ $\sigma = 1.52 \text{ mho/m}$ (body tissue)

Dosimetric E-Field Probe ET3DV6 SN:1398

Conversion factor ($\pm$ standard deviation)

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

