

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:

1398

Place of Calibration:

Zurich

Date of Calibration:

September 6, 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:

Thomas Kötter

Probe ET3DV6

SN:1398

Manufactured:	October 24, 1999
Last calibration:	August 31, 2001
Recalibrated:	September 6, 2002

Calibrated for System DASY3

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

NormX	1.31 $\mu\text{V}/(\text{V/m})^2$	DCP X	96	mV
NormY	1.33 $\mu\text{V}/(\text{V/m})^2$	DCP Y	96	mV
NormZ	1.48 $\mu\text{V}/(\text{V/m})^2$	DCP Z	96	mV

Sensitivity in Tissue Simulating Liquid

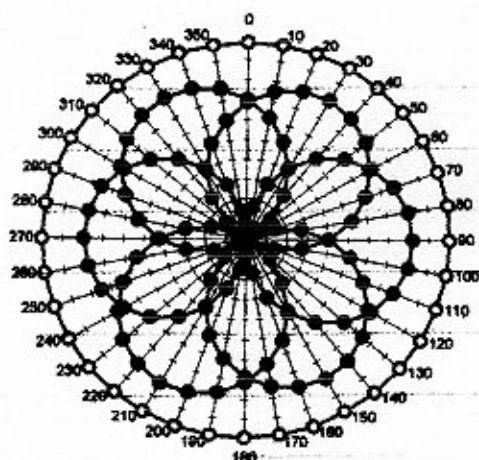
Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\% \text{ mho/m}$
ConvF X	6.2 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.2 $\pm 9.5\%$ (k=2)	Alpha	0.35
ConvF Z	6.2 $\pm 9.5\%$ (k=2)	Depth	2.80
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
ConvF X	5.2 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	5.2 $\pm 9.5\%$ (k=2)	Alpha	0.55
ConvF Z	5.2 $\pm 9.5\%$ (k=2)	Depth	2.37

Boundary Effect

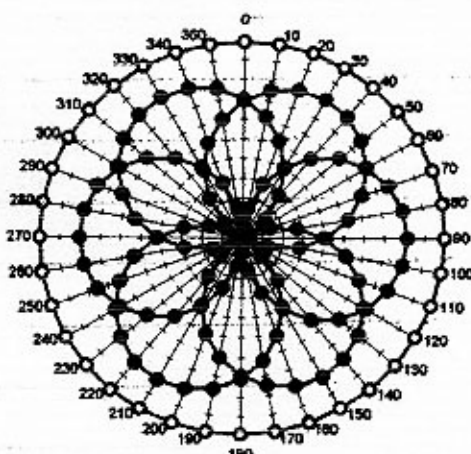
Head	900 MHz	Typical SAR gradient: 5 % per mm		
Probe Tip to Boundary		1 mm	2 mm	
SAR _{be} [%]	Without Correction Algorithm	10.9	6.3	
SAR _{be} [%]	With Correction Algorithm	0.5	0.7	
Head	1800 MHz	Typical SAR gradient: 10 % per mm		
Probe Tip to Boundary		1 mm	2 mm	
SAR _{be} [%]	Without Correction Algorithm	12.8	8.3	
SAR _{be} [%]	With Correction Algorithm	0.1	0.1	

Sensor Offset

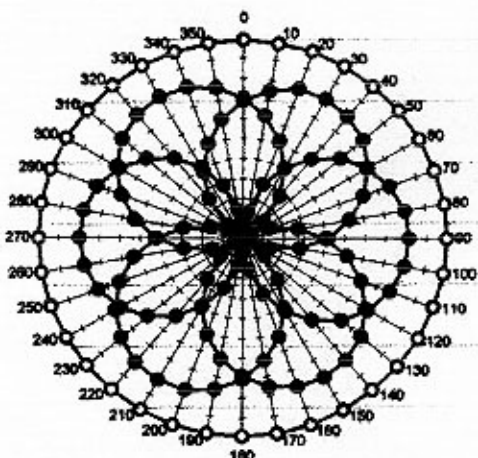
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.0 $\pm$ 0.2	mm

Receiving Pattern (ϕ), $\theta = 0^\circ$ $f = 30 \text{ MHz}$, TEM cell in110

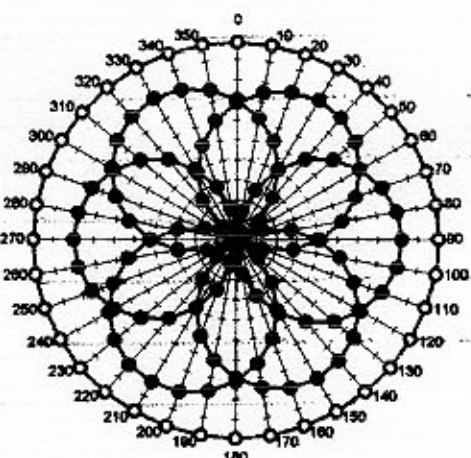
—●— X —●— Y —●— Z —○— Tot

 $f = 100 \text{ MHz}$, TEM cell in110

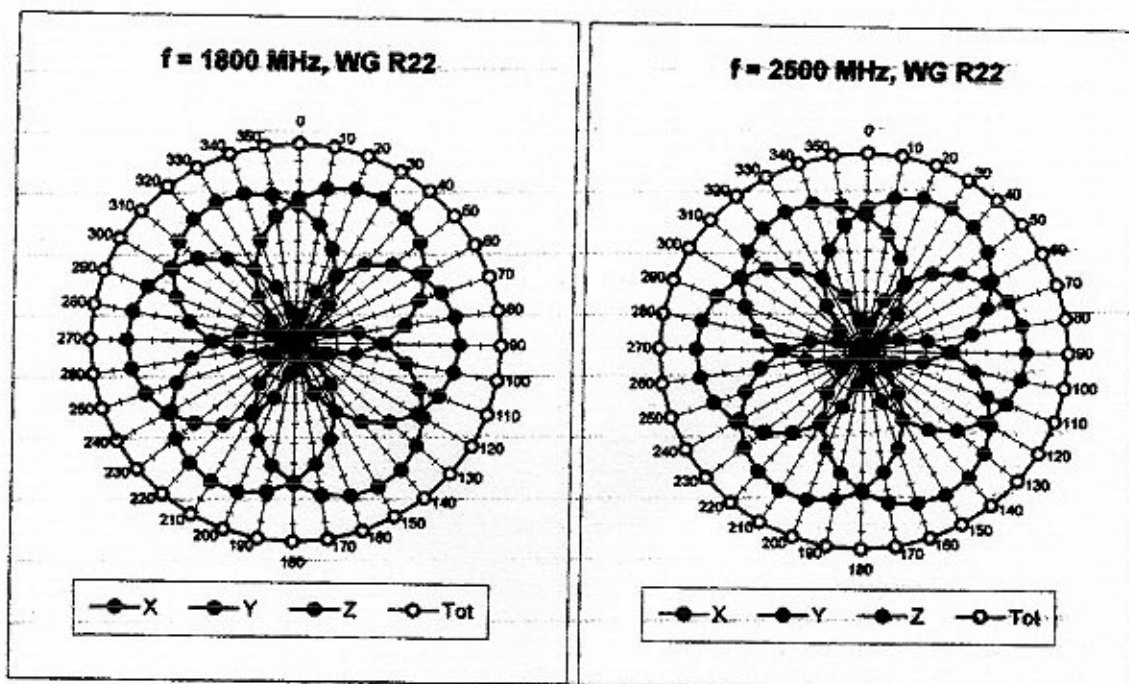
—●— X —●— Y —●— Z —○— Tot

 $f = 300 \text{ MHz}$, TEM cell in110

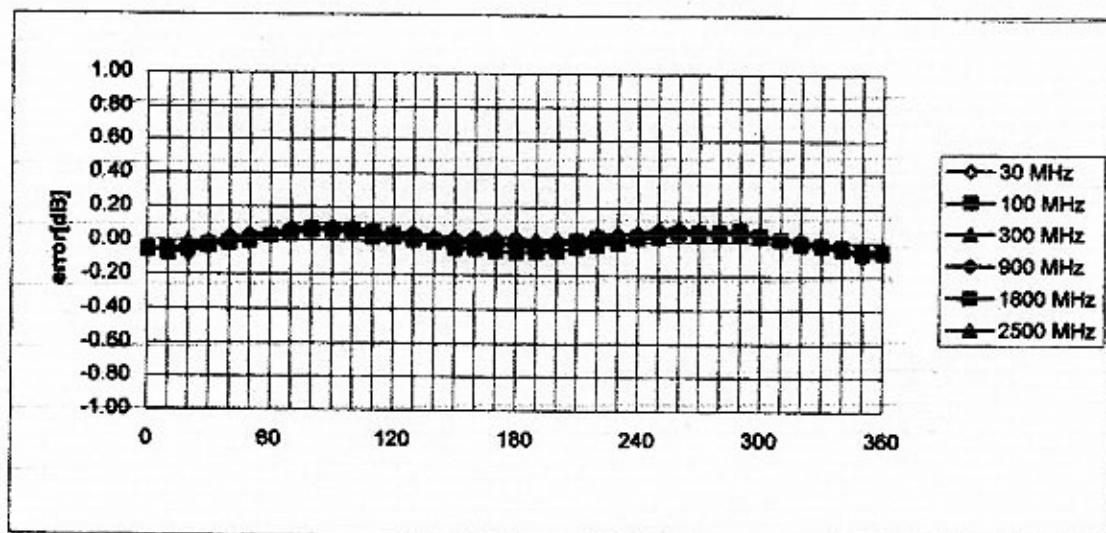
—●— X —●— Y —●— Z —○— Tot

 $f = 900 \text{ MHz}$, TEM cell in110

—●— X —●— Y —●— Z —○— Tot

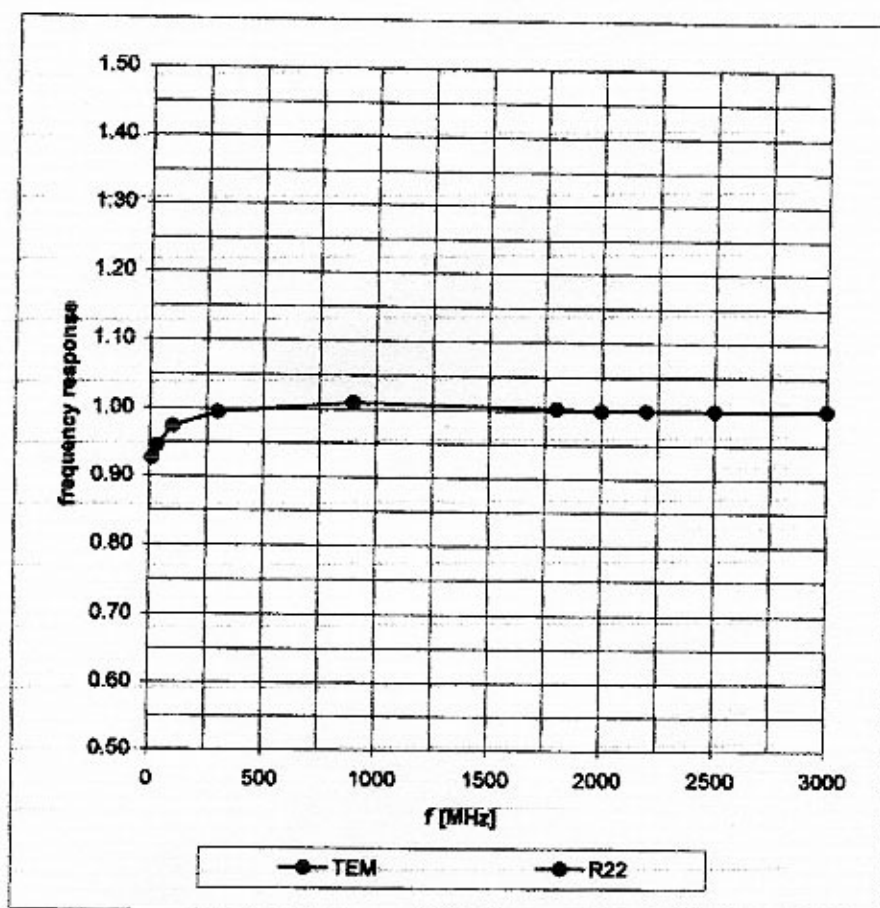


Isotropy Error (ϕ), $\theta = 0^\circ$

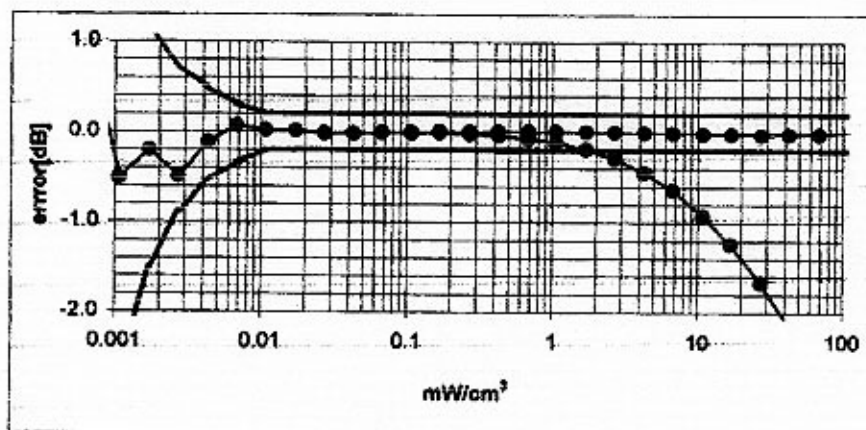
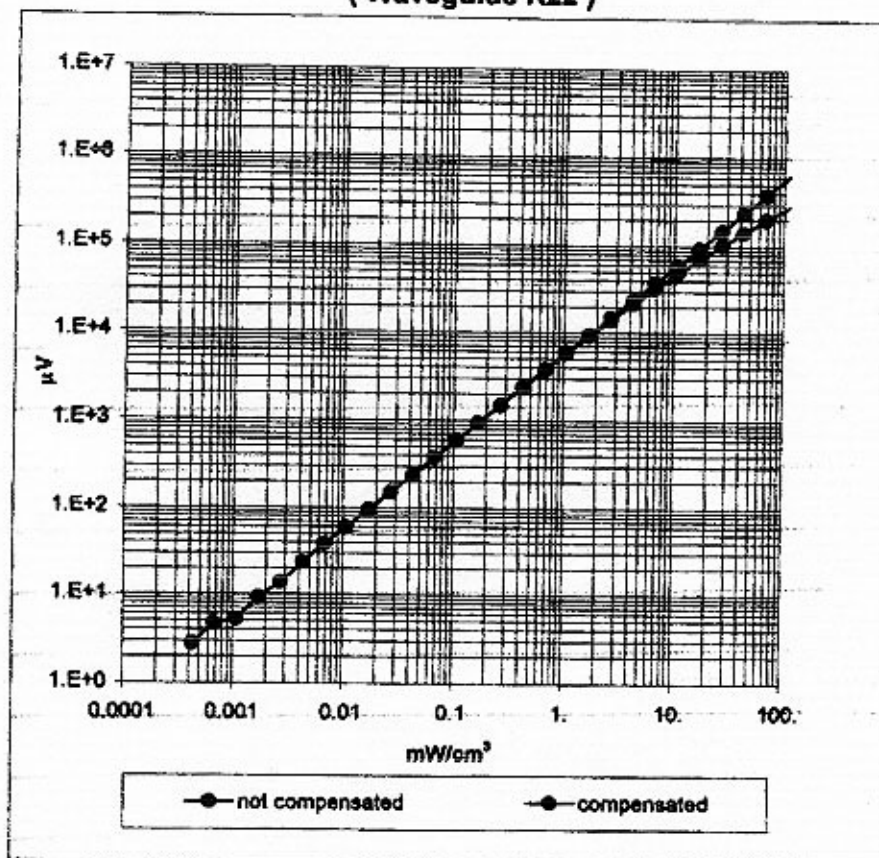


Frequency Response of E-Field

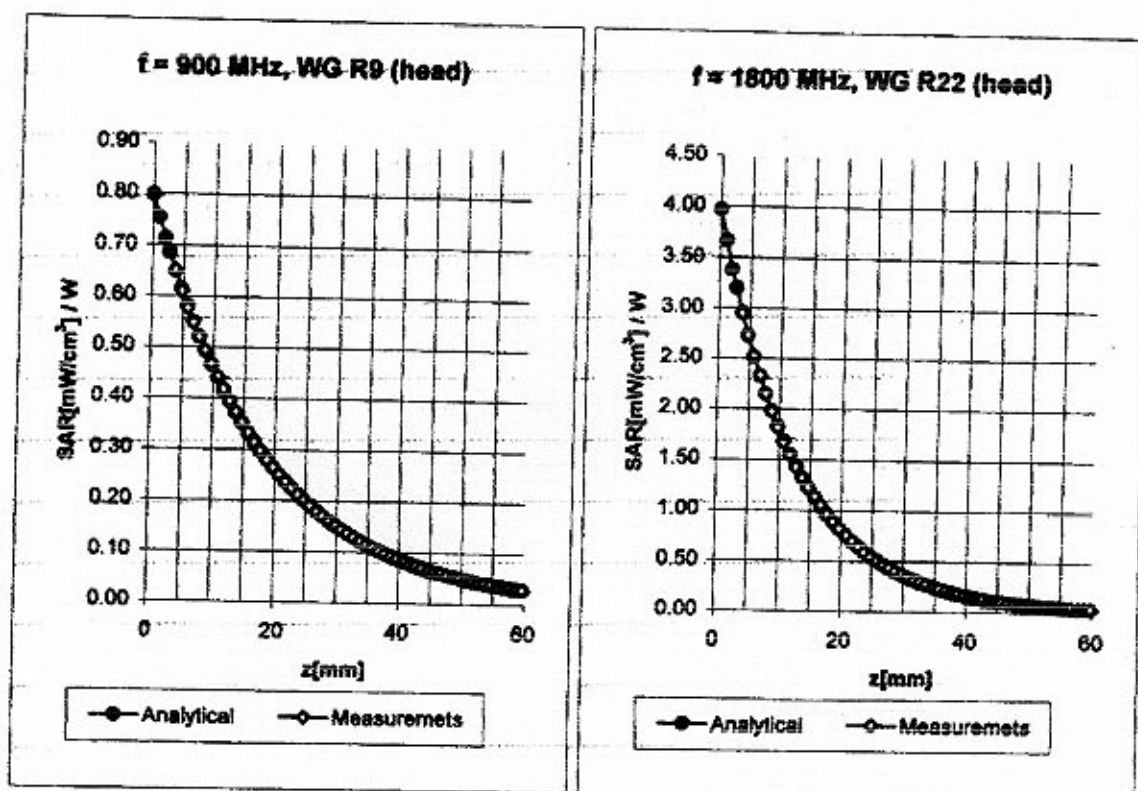
(TEM-Cell:ifi110, Waveguide R22)



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

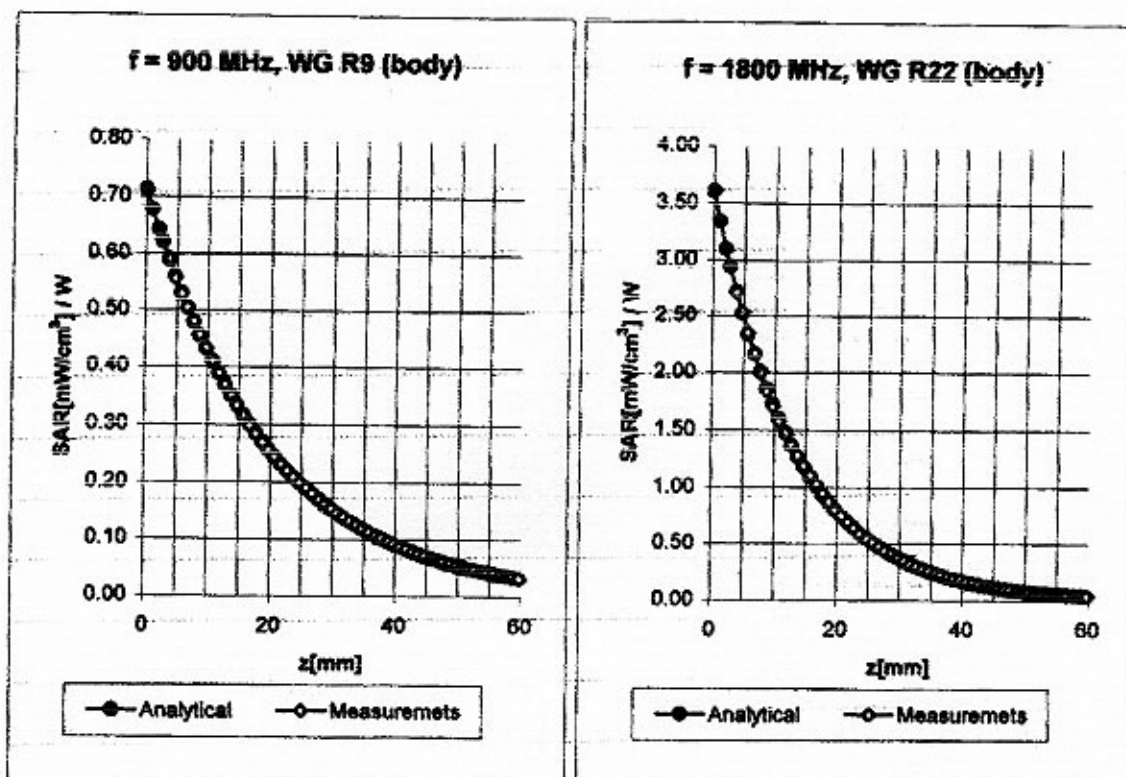


Conversion Factor Assessment



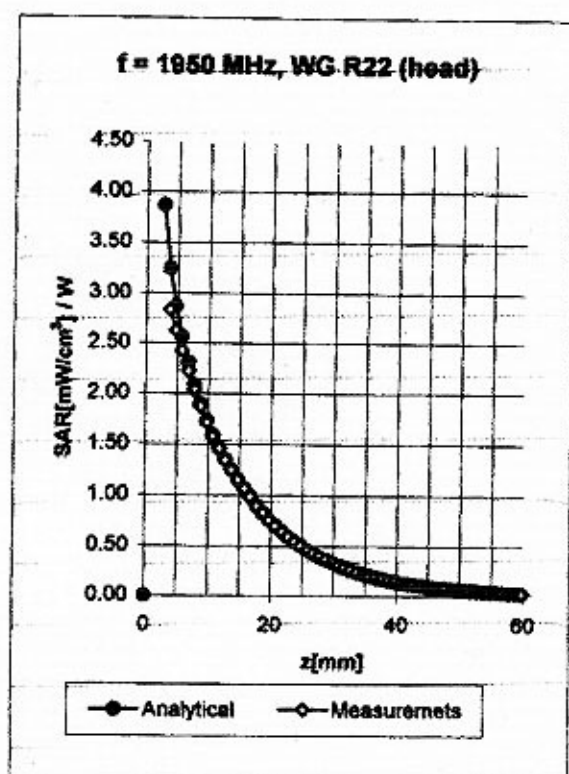
Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
Head	935 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\% \text{ mho/m}$
	ConvF X	$6.2 \pm 9.5\% (k=2)$	Boundary effect:
	ConvF Y	$6.2 \pm 9.5\% (k=2)$	Alpha 0.35
	ConvF Z	$6.2 \pm 9.5\% (k=2)$	Depth 2.80
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
	ConvF X	$5.2 \pm 9.5\% (k=2)$	Boundary effect:
	ConvF Y	$5.2 \pm 9.5\% (k=2)$	Alpha 0.55
	ConvF Z	$5.2 \pm 9.5\% (k=2)$	Depth 2.37

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	$5.9 \pm 9.5\% (k=2)$	Boundary effect:
	ConvF Y	$5.9 \pm 9.5\% (k=2)$	Alpha 0.40
	ConvF Z	$5.9 \pm 9.5\% (k=2)$	Depth 2.70
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	$4.9 \pm 9.5\% (k=2)$	Boundary effect:
	ConvF Y	$4.9 \pm 9.5\% (k=2)$	Alpha 0.61
	ConvF Z	$4.9 \pm 9.5\% (k=2)$	Depth 2.41

Conversion Factor Assessment



Head

1950 MHz

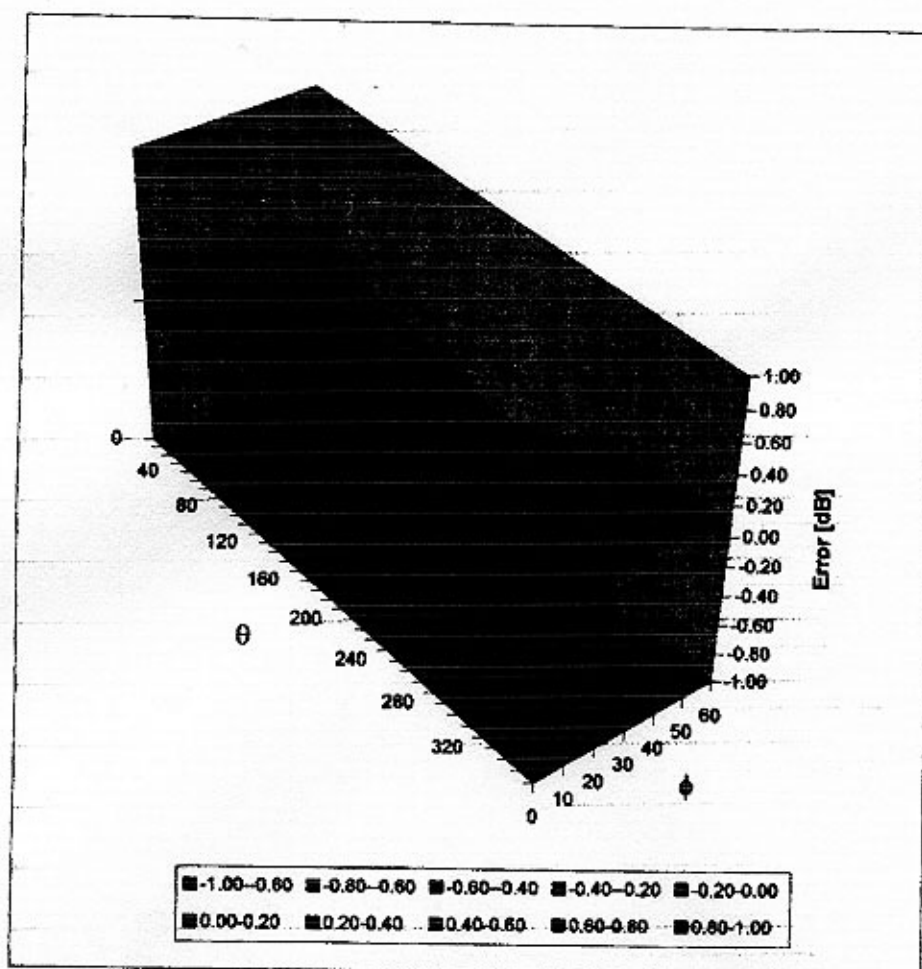
 $\epsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\%$ mho/mConvF X $4.9 \pm 9.5\%$ (k=2)

Boundary effect:

ConvF Y $4.9 \pm 9.5\%$ (k=2)Alpha **0.63**ConvF Z $4.9 \pm 9.5\%$ (k=2)Depth **2.32**

Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz



Additional Conversion Factors
for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1398

Place of Assessment:

Zurich

Date of Assessment:

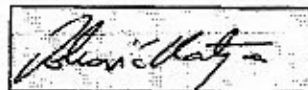
September 8, 2002

Probe Calibration Date:

September 6, 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:



Dosimetric E-Field Probe ET3DV6 SN:1398

Conversion factor ($\pm$ standard deviation)

1950 MHz

ConvF

$4.6 \pm 8\%$

$\epsilon_r = 53.3 \pm 5\%$

$\sigma = 1.52 \pm 5\%$ mho/m

(body tissue)