

**Appendix 4**  
**Probe Calibration Certificate**

# Schmid & Partner Engineering AG

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## 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**

<b>Manufactured:</b>	<b>October 24, 1999</b>
<b>Last calibration:</b>	<b>August 31, 2001</b>
<b>Recalibrated:</b>	<b>September 6, 2002</b>

**Calibrated for System DASY3**

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

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

**Sensitivity in Tissue Simulating Liquid**

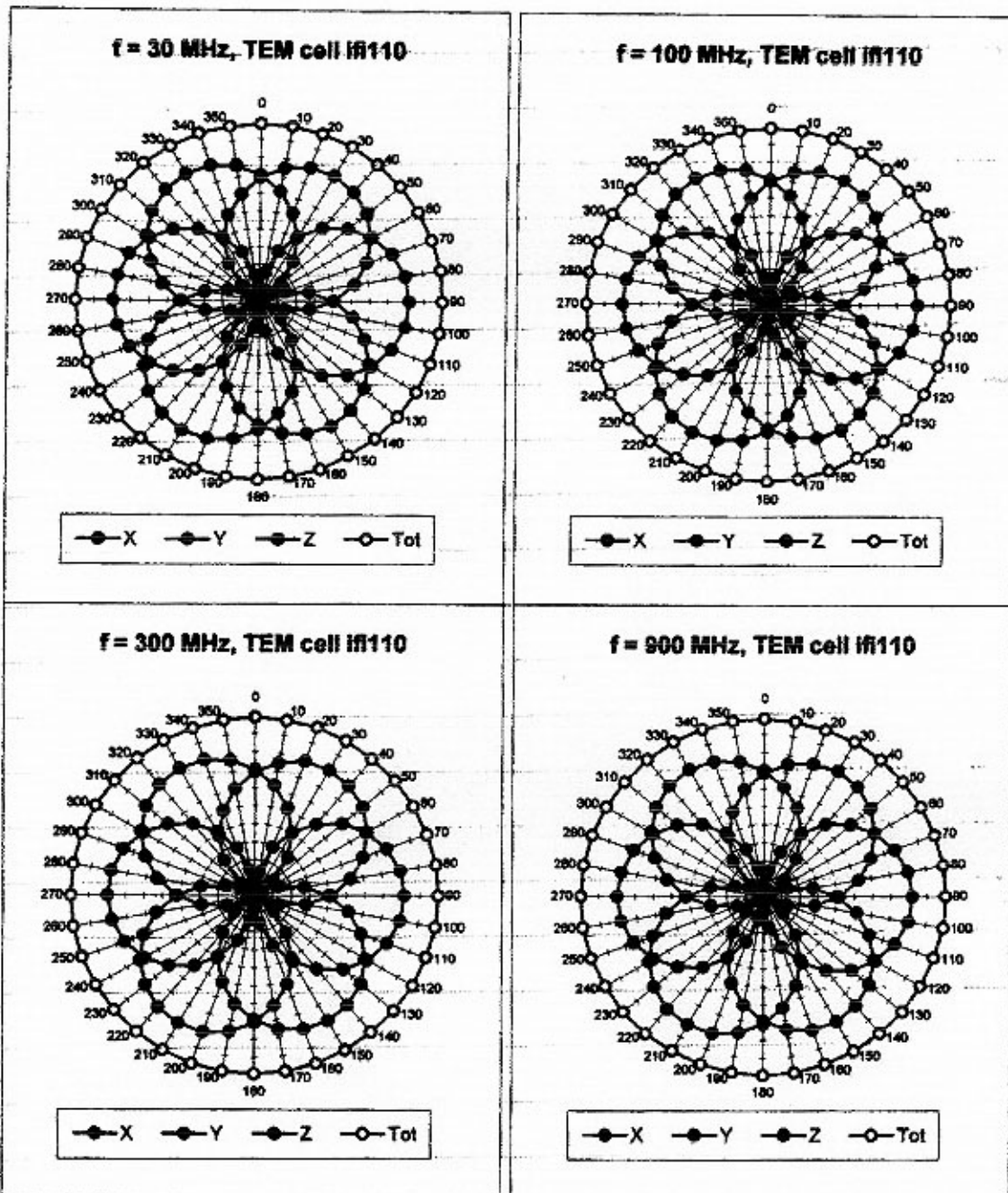
Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\%$ mho/m
ConvF X	6.2 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.2 $\pm 9.5\%$ (k=2)	Alpha	0.35
ConvF Z	6.2 $\pm 9.5\%$ (k=2)	Depth	2.80
Head	1800 MHz	$\epsilon_r = 40.0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

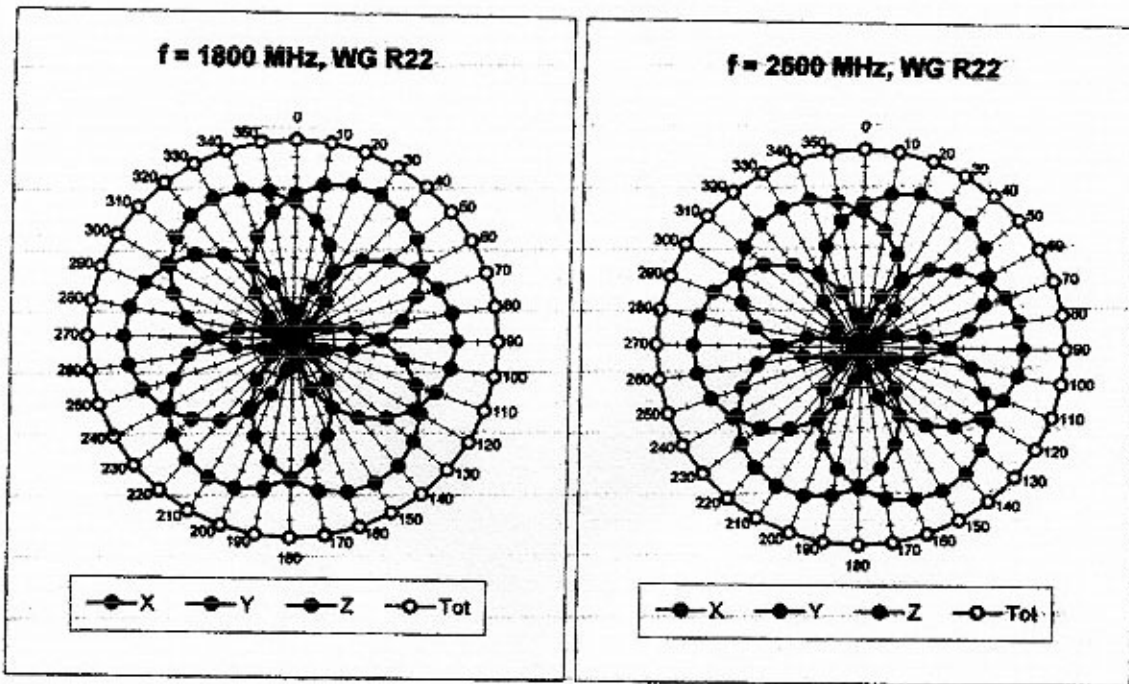
**Boundary Effect**

Head	900 MHz	Typical SAR gradient: 5 % per mm	
	Probe Tip to Boundary	1 mm	2 mm
	SAR <sub>be</sub> [%] Without Correction Algorithm	10.9	6.3
	SAR <sub>be</sub> [%] 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 <sub>be</sub> [%] Without Correction Algorithm	12.8	8.3
	SAR <sub>be</sub> [%] With Correction Algorithm	0.1	0.1

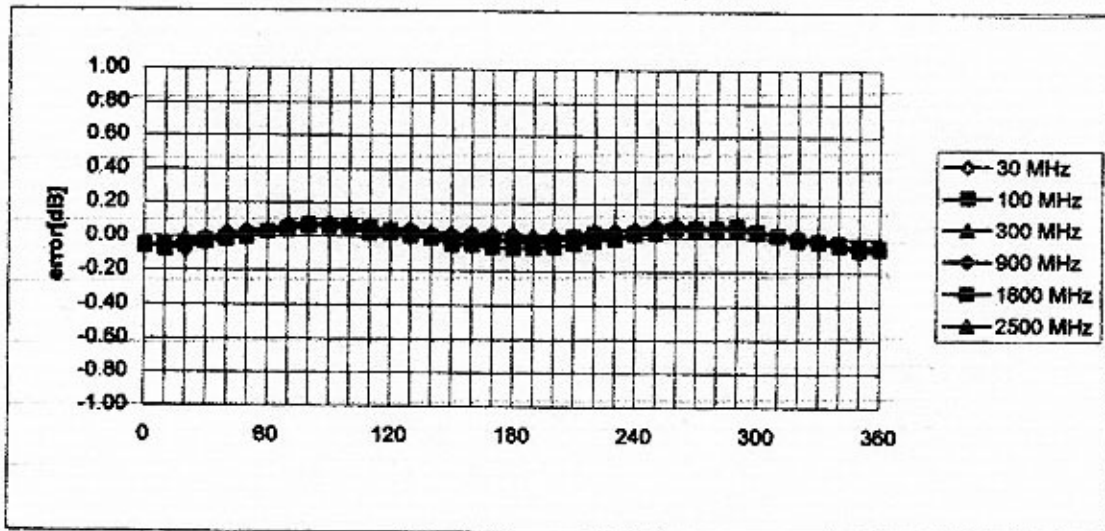
**Sensor Offset**

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

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

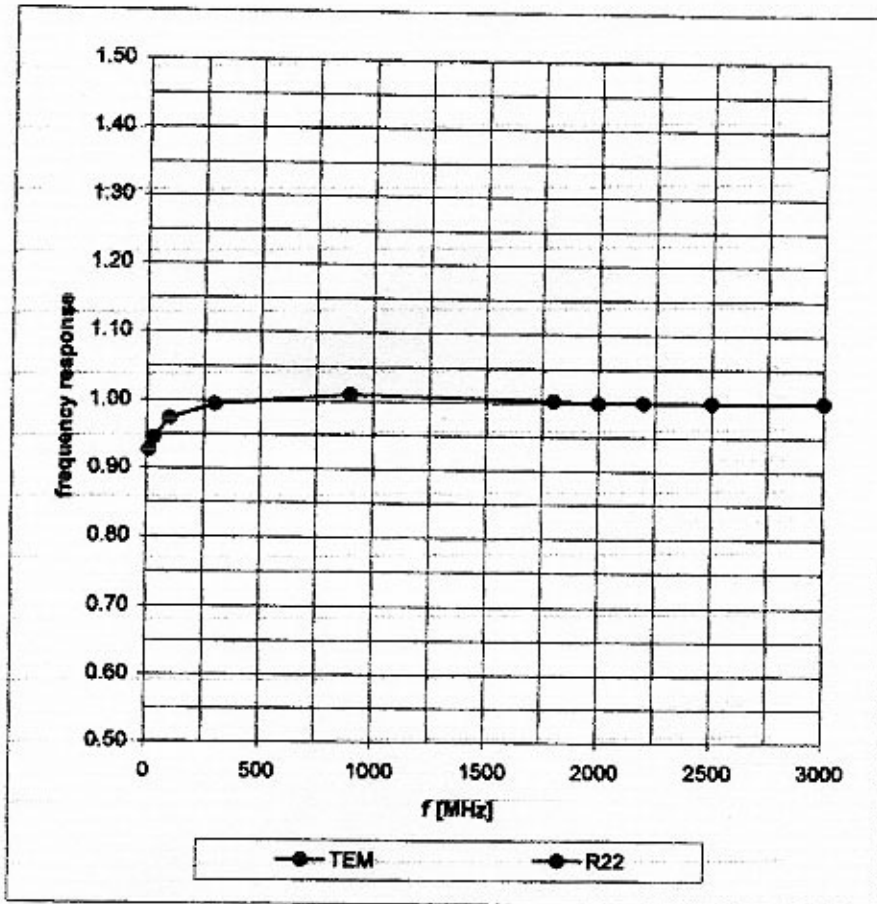


Isotropy Error ( $\phi$ ),  $\theta = 0^\circ$

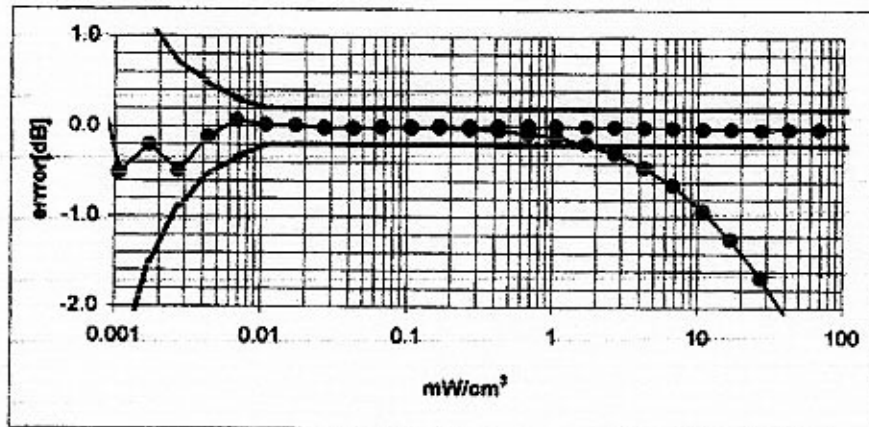
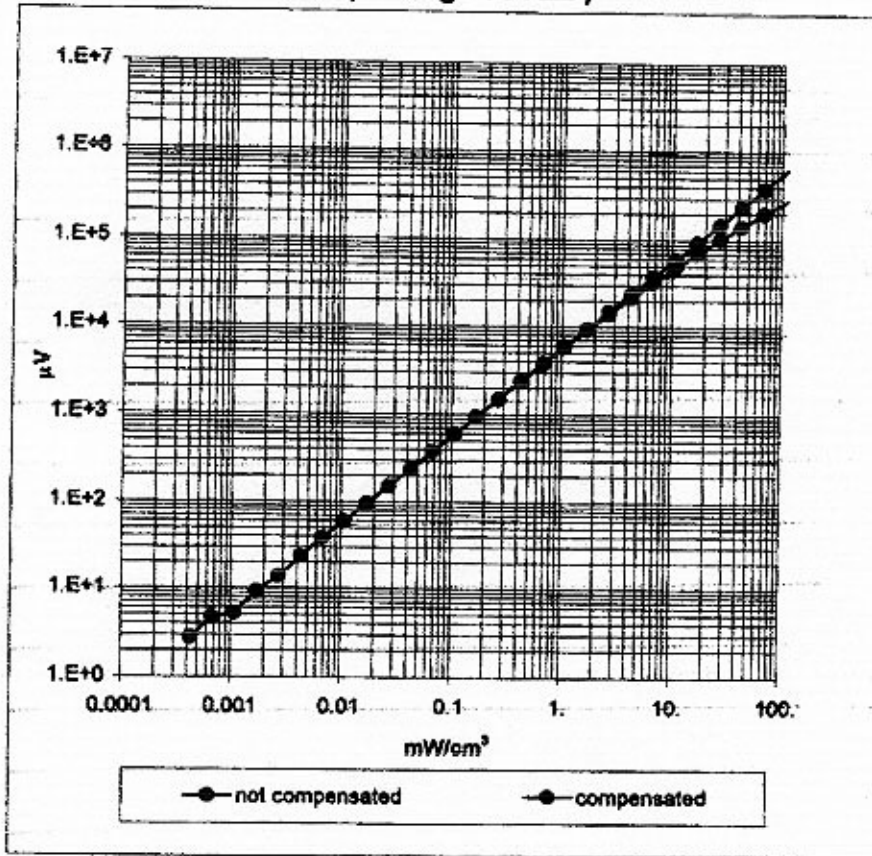


## Frequency Response of E-Field

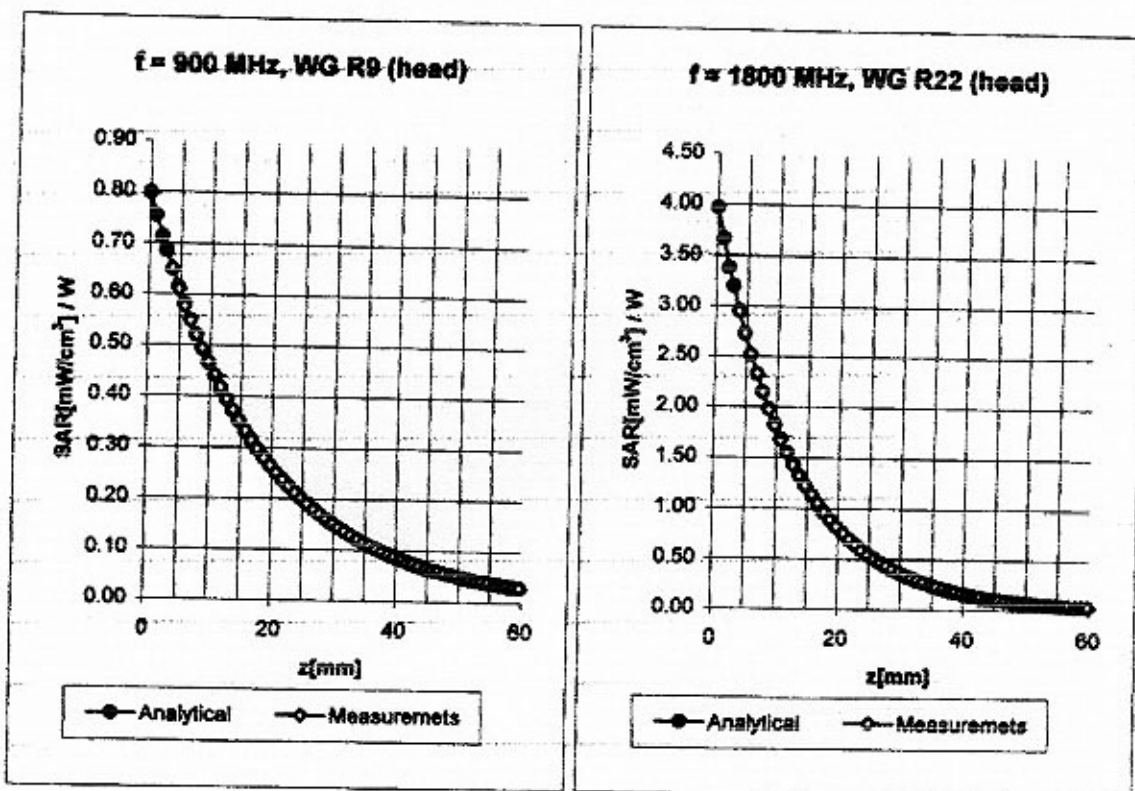
( TEM-Cell: ifi110, Waveguide R22)



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

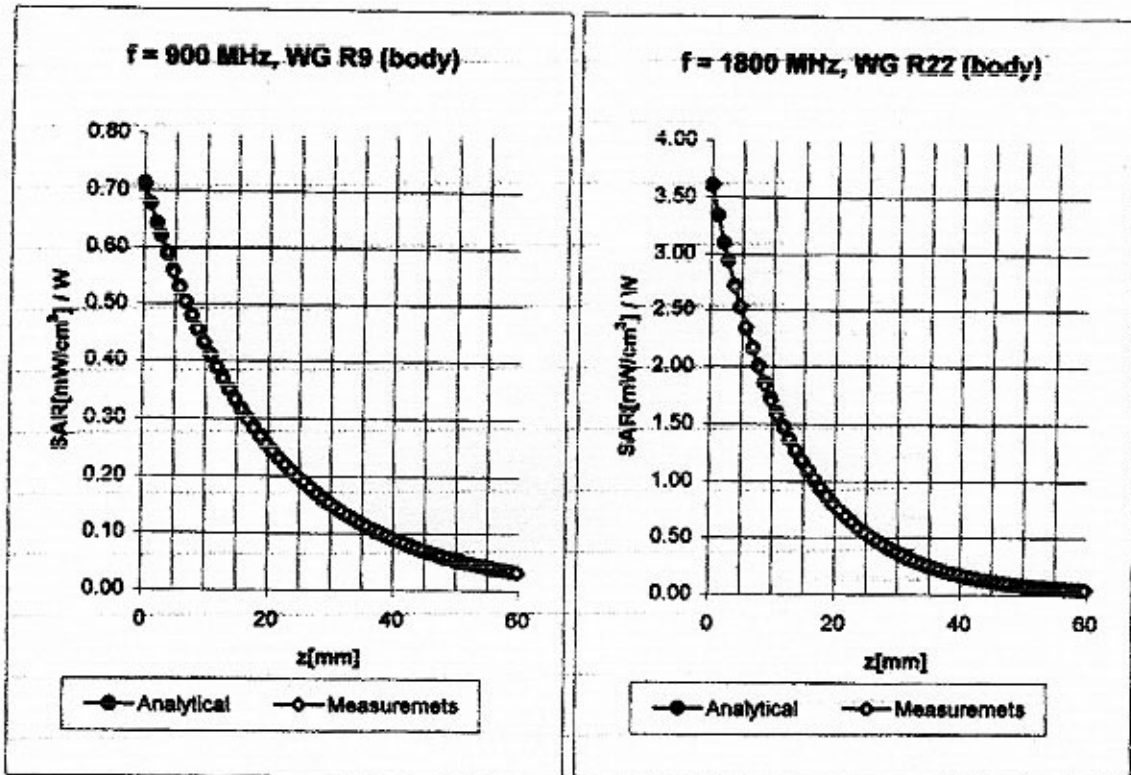


## Conversion Factor Assessment



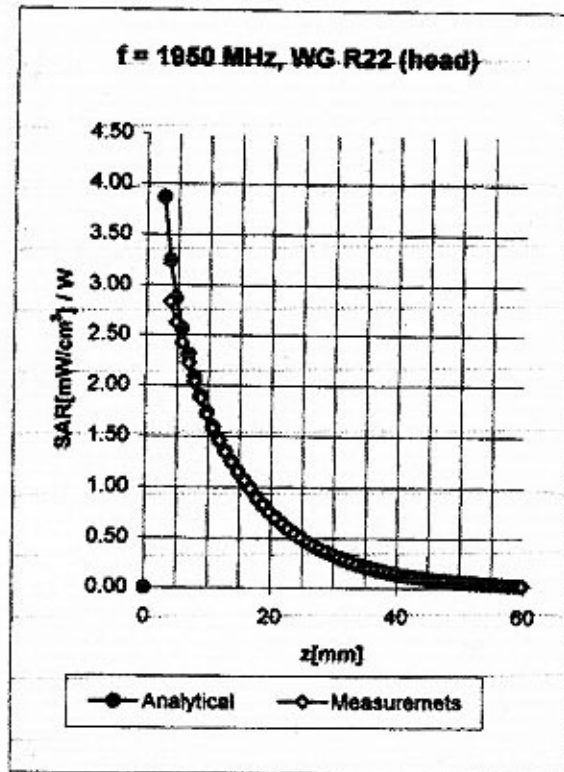
Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m	
Head	935 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\%$ mho/m	
	ConvF X	$6.2 \pm 9.5\%$ (k=2)	Boundary effect:	
	ConvF Y	$6.2 \pm 9.5\%$ (k=2)	Alpha	0.35
	ConvF Z	$6.2 \pm 9.5\%$ (k=2)	Depth	2.80
Head	1800 MHz	$\epsilon_r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



<b>Body</b>	<b>900 MHz</b>	$\epsilon_r = 55.0 \pm 5\%$	$\sigma = 1.05 \pm 5\%$ mho/m
<b>Body</b>	<b>835 MHz</b>	$\epsilon_r = 55.2 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
	ConvF X	$5.9 \pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	$5.9 \pm 9.5\%$ (k=2)	Alpha <b>0.40</b>
	ConvF Z	$5.9 \pm 9.5\%$ (k=2)	Depth <b>2.70</b>
<b>Body</b>	<b>1800 MHz</b>	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\%$ mho/m
<b>Body</b>	<b>1900 MHz</b>	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\%$ mho/m
	ConvF X	$4.9 \pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	$4.9 \pm 9.5\%$ (k=2)	Alpha <b>0.61</b>
	ConvF Z	$4.9 \pm 9.5\%$ (k=2)	Depth <b>2.41</b>

## Conversion Factor Assessment

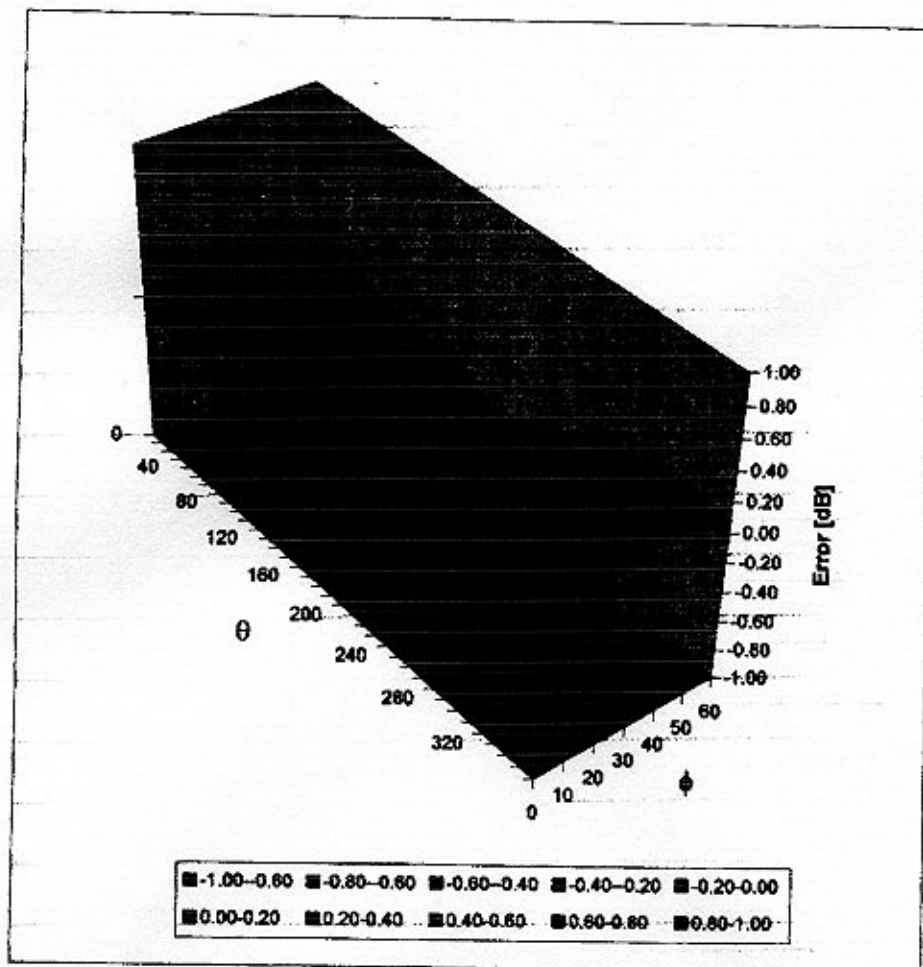


Head                      1950 MHz                       $\epsilon_r = 40.0 \pm 5\%$                        $\sigma = 1.40 \pm 5\%$  mho/m

ConvF X	<b>4.9 ± 9.5% (k=2)</b>	Boundary effect:	
ConvF Y	<b>4.9 ± 9.5% (k=2)</b>	Alpha	<b>0.63</b>
ConvF Z	<b>4.9 ± 9.5% (k=2)</b>	Depth	<b>2.32</b>

# Deviation from Isotropy in HSL

Error ( $\theta, \phi$ ),  $f = 900$  MHz



## Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1398

Place of Assessment:

Zurich

Date of Assessment:

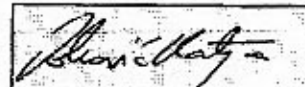
September 8, 2002

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       $4.6 \pm 8\%$

$\epsilon_r = 53.3 \pm 5\%$ $\sigma = 1.52 \pm 5\% \text{ mho/m}$ (body tissue)
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