

## ATTACHMENT R – PROBE CALIBRATION DATA

## 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:

**1609**

Place of Calibration:

**Zurich**

Date of Calibration:

**June 20, 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. Vetterli*

Approved by:

*Poleon's Katz*

**Schmid & Partner  
Engineering AG**

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

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# Probe ET3DV6

## SN:1609

Manufactured:	July 27, 2001
Last calibration:	August 10, 2001
Recalibrated:	June 20, 2002

**Calibrated for System DASY3**

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June 20, 2002

## DASY3 - Parameters of Probe: ET3DV6 SN:1609

### Sensitivity in Free Space

NormX	1.74 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.76 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.76 $\mu\text{V}/(\text{V}/\text{m})^2$

### Diode Compression

DCP X	95	mV
DCP Y	95	mV
DCP Z	95	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	6.5 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	6.5 $\pm 9.5\%$ (k=2)	Alpha 0.38
	ConvF Z	6.5 $\pm 9.5\%$ (k=2)	Depth 2.56
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	5.4 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	5.4 $\pm 9.5\%$ (k=2)	Alpha 0.60
	ConvF Z	5.4 $\pm 9.5\%$ (k=2)	Depth 2.14

### 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	10.1	5.9
	SAR <sub>be</sub> [%] With Correction Algorithm	0.3	0.5
Head	1800 MHz	Typical SAR gradient: 10 % per mm	
	Probe Tip to Boundary	1 mm	2 mm
	SAR <sub>be</sub> [%] Without Correction Algorithm	11.5	7.3
	SAR <sub>be</sub> [%] With Correction Algorithm	0.3	0.2

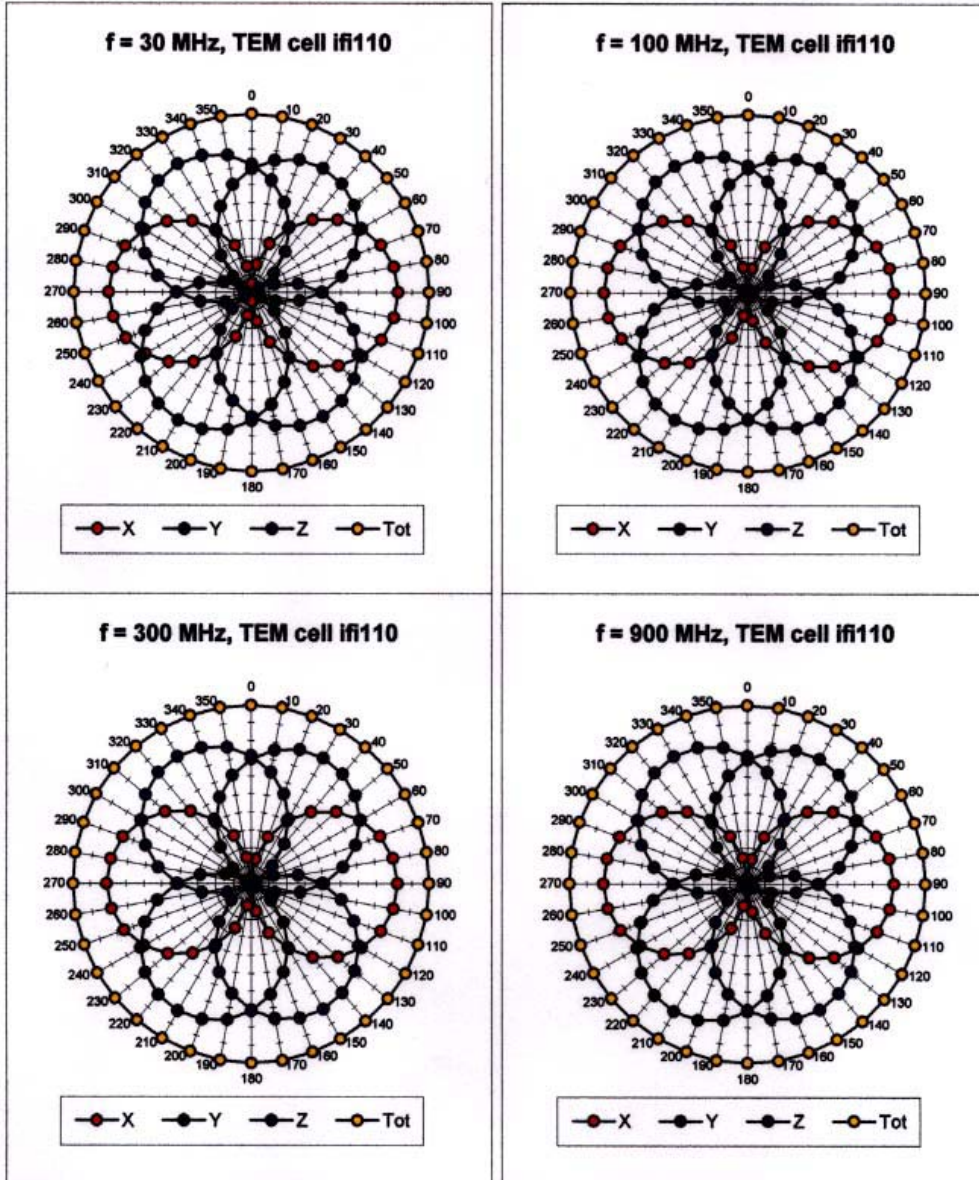
### Sensor Offset

Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.3 $\pm$ 0.2	mm

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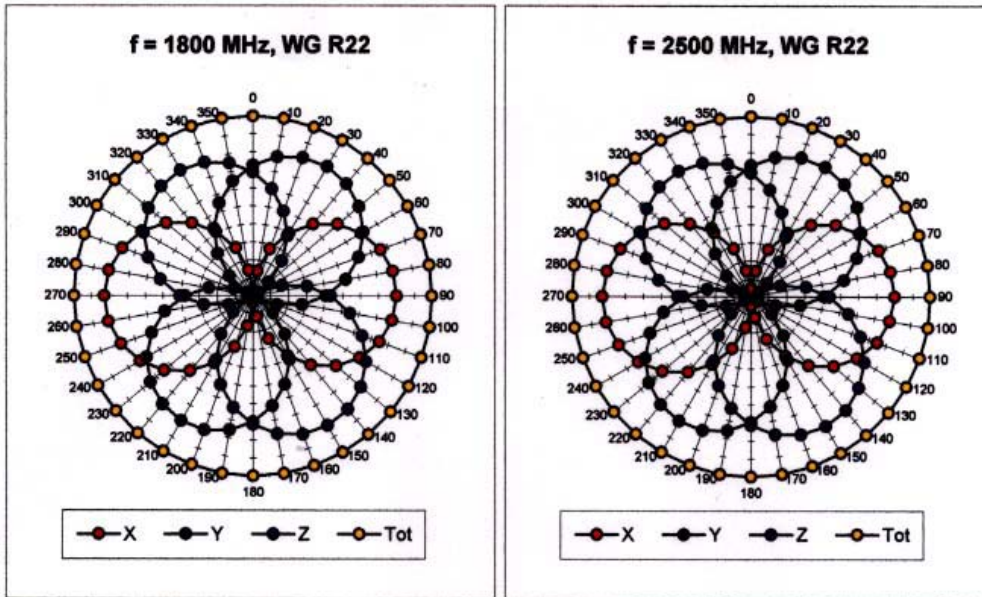
### Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$



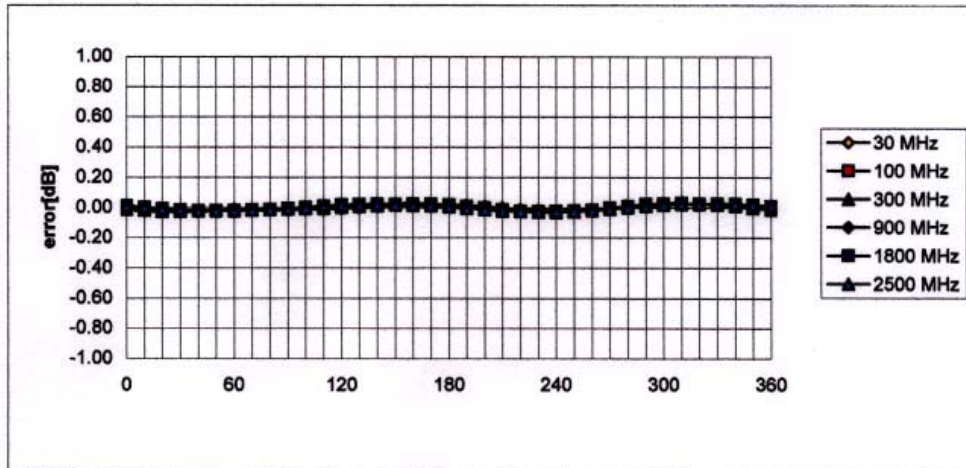


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**Isotropy Error ( $\phi$ ),  $\theta = 0^\circ$**

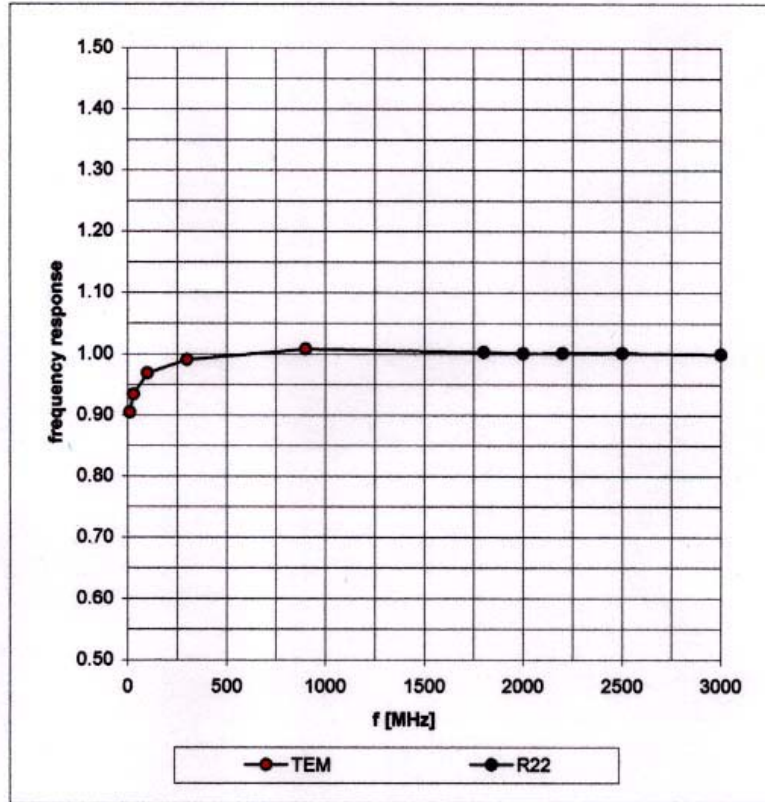


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### Frequency Response of E-Field

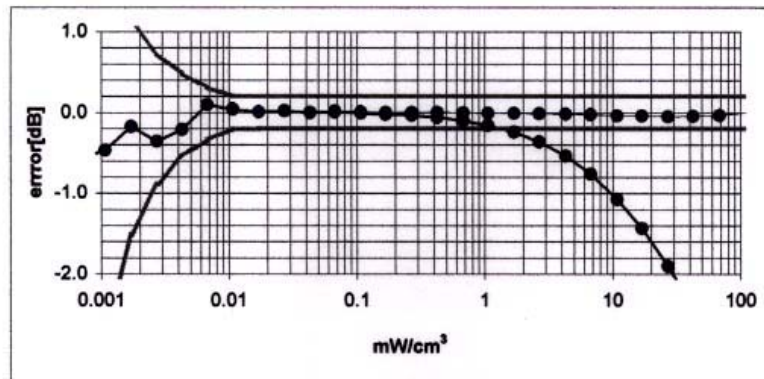
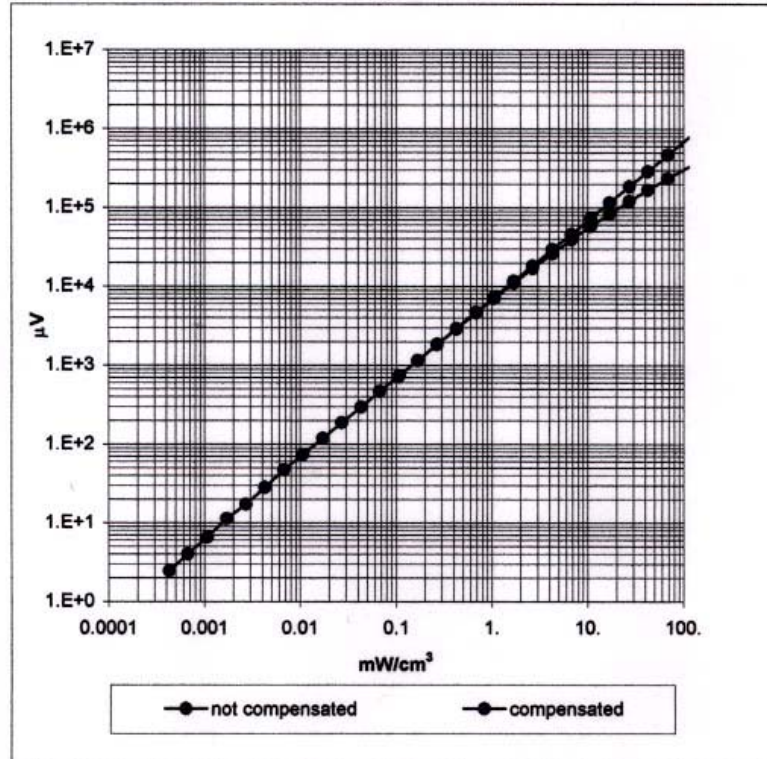
( TEM-Cell:ifi110, Waveguide R22)



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### Dynamic Range f(SAR<sub>brain</sub>) ( Waveguide R22 )

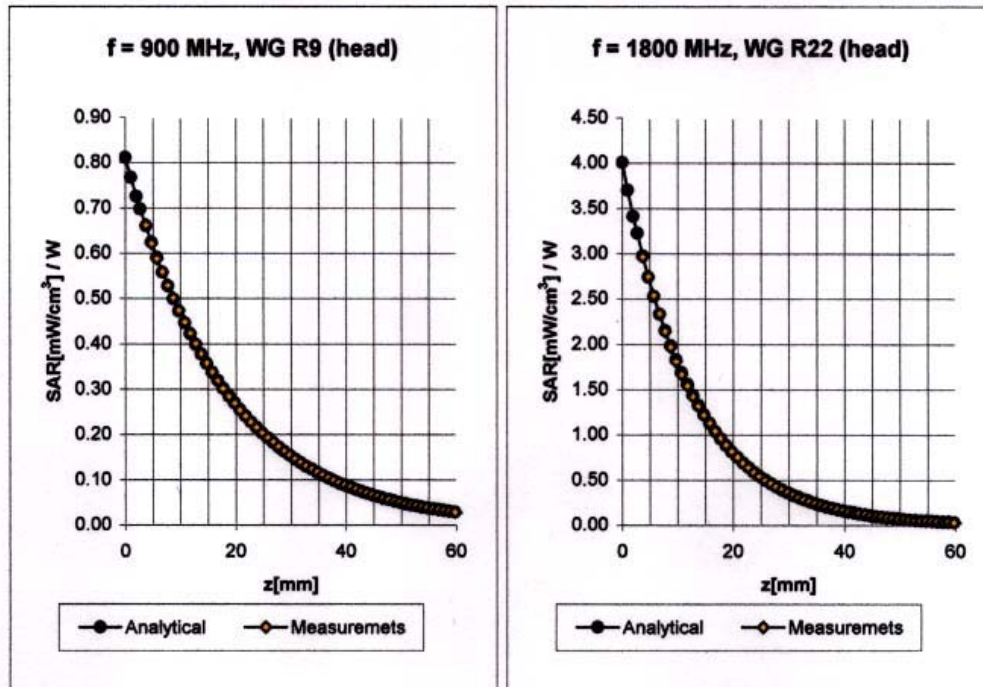




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## Conversion Factor Assessment

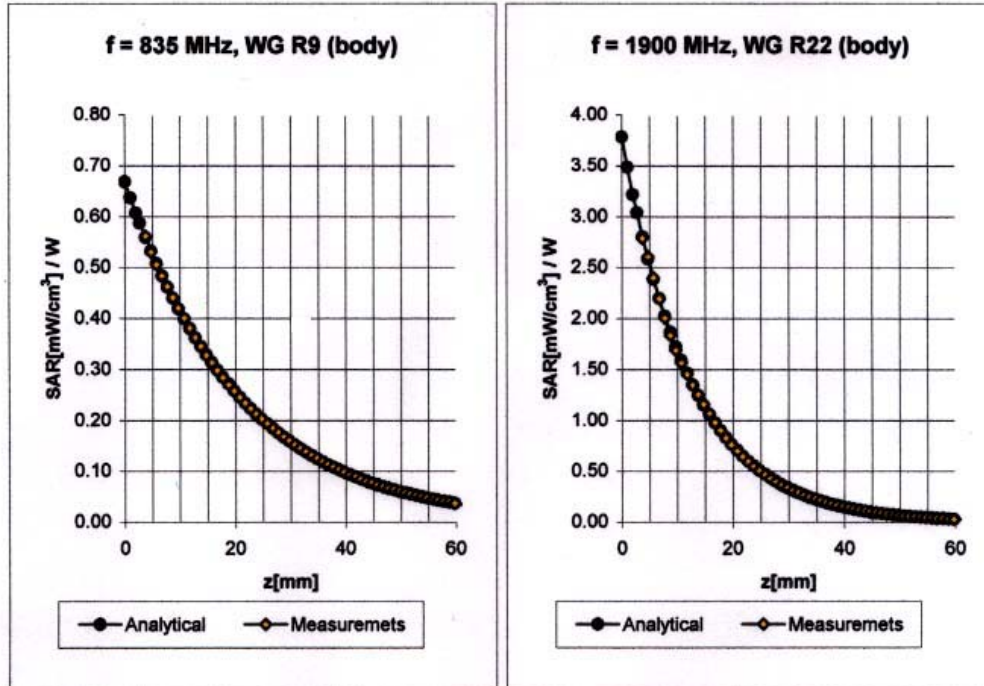


<b>Head</b>	<b>900 MHz</b>	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
<b>Head</b>	<b>835 MHz</b>	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\%$ mho/m
	ConvF X	$6.5 \pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	$6.5 \pm 9.5\%$ (k=2)	Alpha <b>0.38</b>
	ConvF Z	$6.5 \pm 9.5\%$ (k=2)	Depth <b>2.56</b>
<b>Head</b>	<b>1800 MHz</b>	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
<b>Head</b>	<b>1900 MHz</b>	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
	ConvF X	$5.4 \pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	$5.4 \pm 9.5\%$ (k=2)	Alpha <b>0.60</b>
	ConvF Z	$5.4 \pm 9.5\%$ (k=2)	Depth <b>2.14</b>

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## Conversion Factor Assessment



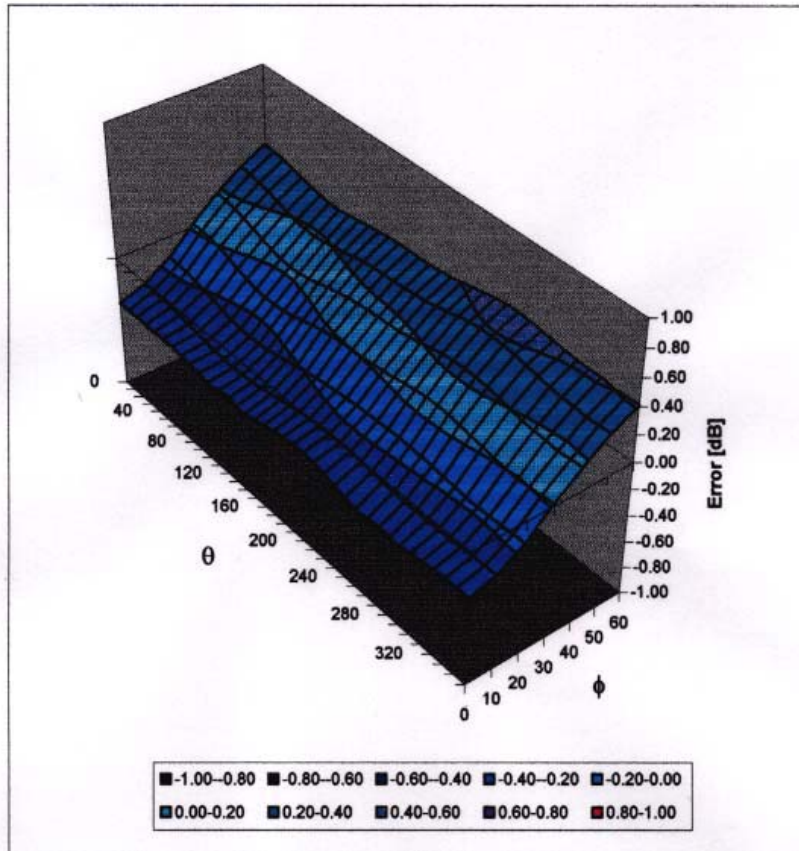
<b>Body</b>	<b>835 MHz</b>	$\epsilon_r = 55.2 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
<b>Body</b>	<b>900 MHz</b>	$\epsilon_r = 55.0 \pm 5\%$	$\sigma = 1.05 \pm 5\%$ mho/m
	ConvF X	$6.3 \pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	$6.3 \pm 9.5\%$ (k=2)	Alpha <b>0.36</b>
	ConvF Z	$6.3 \pm 9.5\%$ (k=2)	Depth <b>2.71</b>
<b>Body</b>	<b>1900 MHz</b>	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\%$ mho/m
<b>Body</b>	<b>1800 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>0.77</b>
	ConvF Z	$4.9 \pm 9.5\%$ (k=2)	Depth <b>2.05</b>

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### Deviation from Isotropy in HSL

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



## Schmid & Partner Engineering AG

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### Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1609

Place of Assessment:

Zurich

Date of Assessment:

June 21, 2002

Probe Calibration Date:

June 20, 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. The evaluation is coupled with measured conversion factors. 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:1609**

Conversion factor ( $\pm$  standard deviation)

**450 MHz**                  ConvF                  **7.4  $\pm$  8%**

$\epsilon_r = 43.5 \pm 5\%$ $\sigma = 0.87 \pm 5\%$ mho/m (head tissue)
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**450 MHz**                  ConvF                  **7.6  $\pm$  8%**

$\epsilon_r = 56.7 \pm 5\%$ $\sigma = 0.94 \pm 5\%$ mho/m (body tissue)
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