

# Schmid & Partner Engineering AG

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## Calibration Certificate

### Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1515

Place of Calibration:

Zurich

Date of Calibration:

July 25, 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. Vellea

Approved by:

Thomas Kofler

# Probe ET3DV6

**SN:1515**

|                          |                         |
|--------------------------|-------------------------|
| <b>Manufactured:</b>     | <b>February 1, 2000</b> |
| <b>Last calibration:</b> | <b>August 31, 2001</b>  |
| <b>Recalibrated:</b>     | <b>July 25, 2002</b>    |

**Calibrated for System DASY3**

**DASY3 - Parameters of Probe: ET3DV6 SN:1515****Sensitivity in Free Space**

|       |   |
|-------|---|
| NormX | <b>1.67</b> $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormY | <b>1.87</b> $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormZ | <b>1.74</b> $\mu\text{V}/(\text{V}/\text{m})^2$ |

**Diode Compression**

|       |           |    |
|-------|-----------|----|
| DCP X | <b>96</b> | mV |
| DCP Y | <b>96</b> | mV |
| DCP Z | <b>96</b> | mV |

**Sensitivity in Tissue Simulating Liquid**

|         |                              |                             |                               |
|---------|------------------------------|-----------------------------|-------------------------------|
| Head    | <b>900 MHz</b>               | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.97 \pm 5\%$ mho/m |
| Head    | <b>835 MHz</b>               | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.90 \pm 5\%$ mho/m |
| ConvF X | <b>6.5</b> $\pm 9.5\%$ (k=2) |                             | Boundary effect:              |
| ConvF Y | <b>6.5</b> $\pm 9.5\%$ (k=2) |                             | Alpha <b>0.52</b>             |
| ConvF Z | <b>6.5</b> $\pm 9.5\%$ (k=2) |                             | Depth <b>2.10</b>             |
| Head    | <b>1800 MHz</b>              | $\epsilon_r = 40.0 \pm 5\%$ | $\sigma = 1.40 \pm 5\%$ mho/m |
| Head    | <b>1900 MHz</b>              | $\epsilon_r = 40.0 \pm 5\%$ | $\sigma = 1.40 \pm 5\%$ mho/m |
| ConvF X | <b>5.4</b> $\pm 9.5\%$ (k=2) |                             | Boundary effect:              |
| ConvF Y | <b>5.4</b> $\pm 9.5\%$ (k=2) |                             | Alpha <b>0.56</b>             |
| ConvF Z | <b>5.4</b> $\pm 9.5\%$ (k=2) |                             | Depth <b>2.27</b>             |

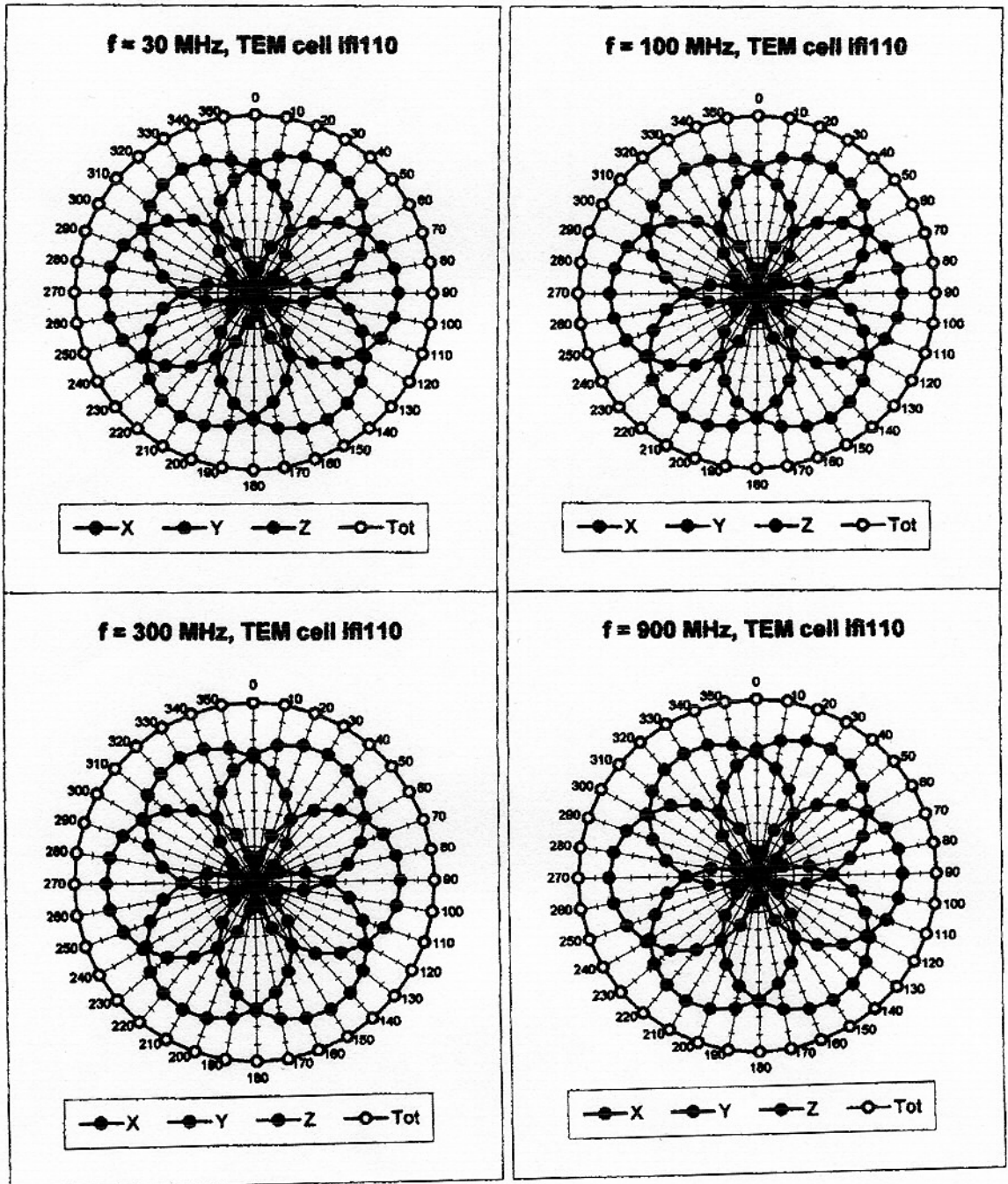
**Boundary Effect**

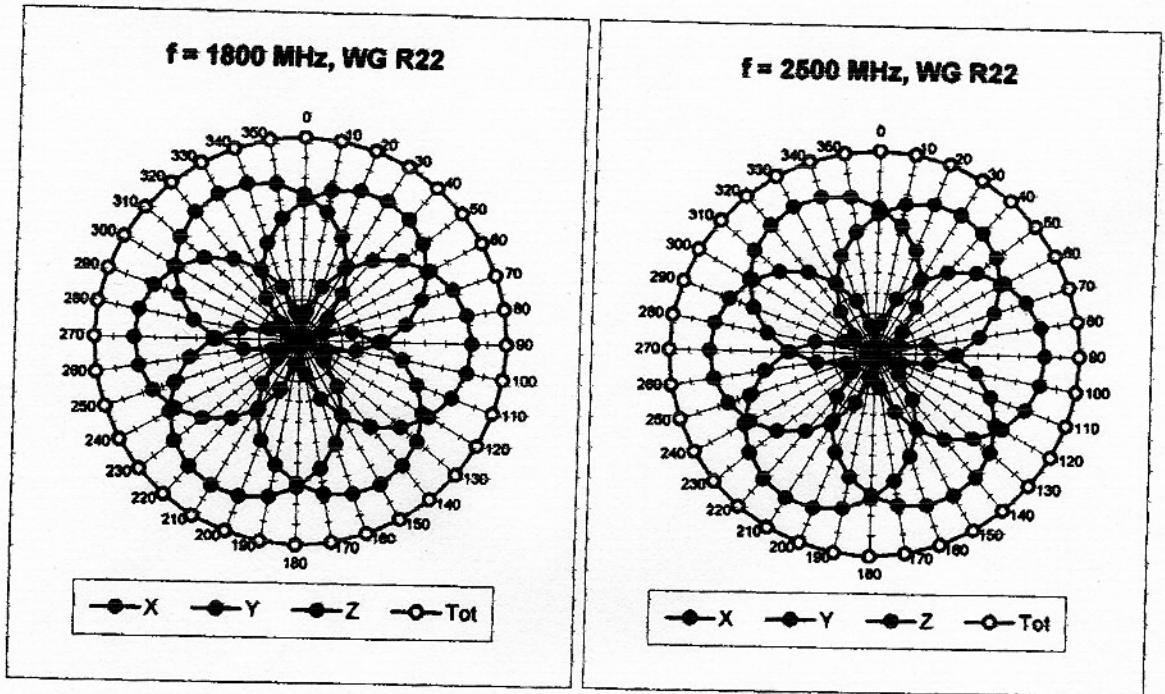
|      |  |  |             |
|------|--|--|-------------|
| Head | <b>900 MHz</b>                                     | <b>Typical SAR gradient: 5 % per mm</b>  |             |
|      | Probe Tip to Boundary                              | <b>1 mm</b>                              | <b>2 mm</b> |
|      | SAR <sub>be</sub> [%] Without Correction Algorithm | <b>10.0</b>                              | <b>5.3</b>  |
|      | SAR <sub>be</sub> [%] With Correction Algorithm    | <b>0.2</b>                               | <b>0.5</b>  |
| Head | <b>1800 MHz</b>                                    | <b>Typical SAR gradient: 10 % per mm</b> |             |
|      | Probe Tip to Boundary                              | <b>1 mm</b>                              | <b>2 mm</b> |
|      | SAR <sub>be</sub> [%] Without Correction Algorithm | <b>12.2</b>                              | <b>7.7</b>  |
|      | SAR <sub>be</sub> [%] With Correction Algorithm    | <b>0.2</b>                               | <b>0.1</b>  |

**Sensor Offset**

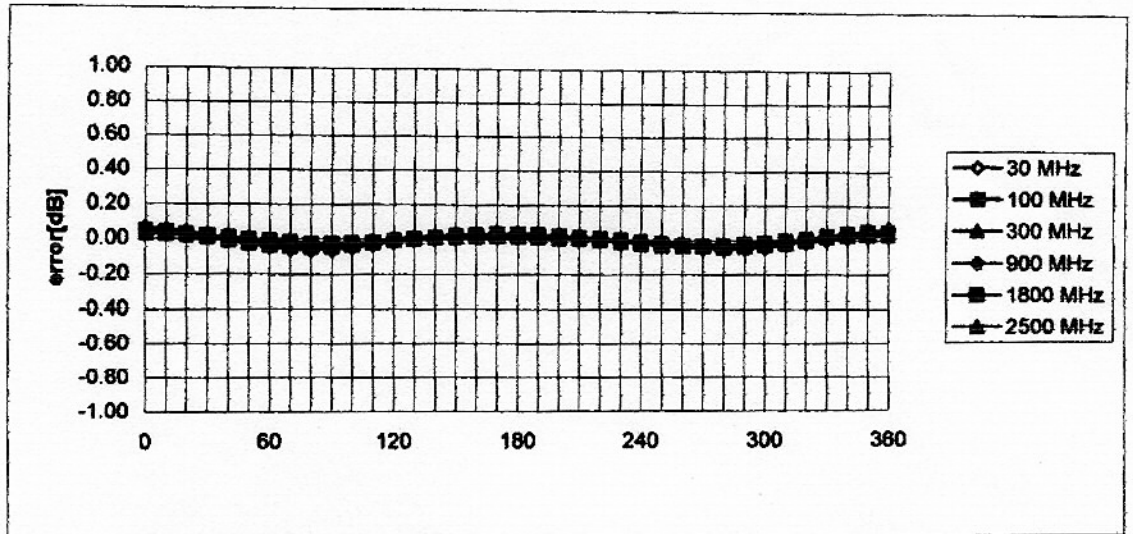
|                            |                                 |    |
|----------------------------|---------------------------------|----|
| Probe Tip to Sensor Center | <b>2.7</b>                      | mm |
| Optical Surface Detection  | <b>1.3 <math>\pm</math> 0.2</b> | mm |

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



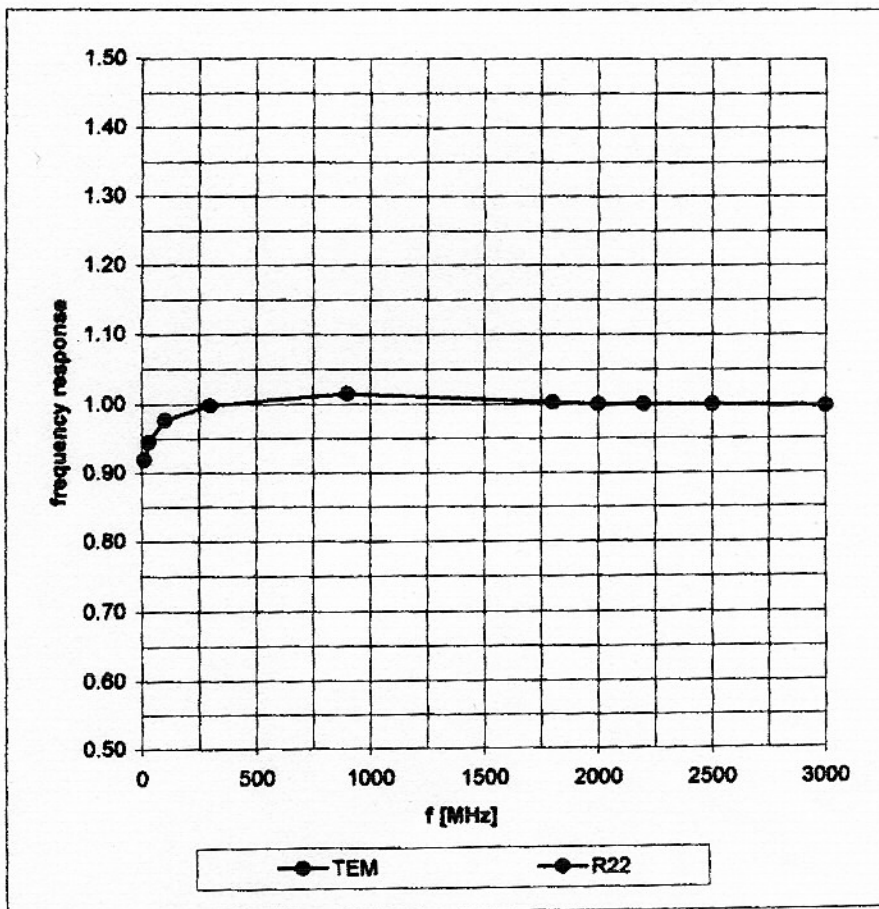


Isotropy Error ( $\phi$ ),  $\theta = 0^\circ$

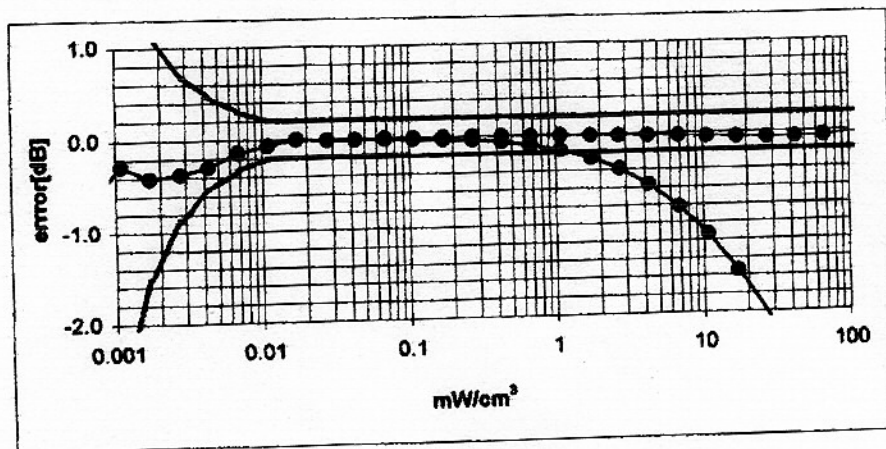
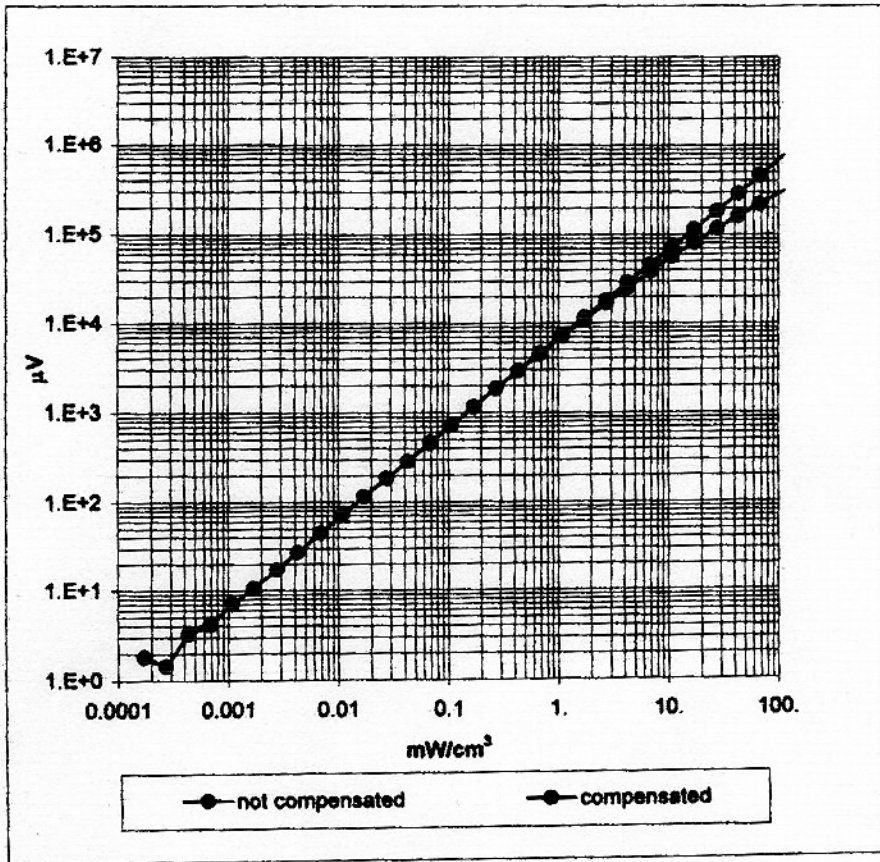


# Frequency Response of E-Field

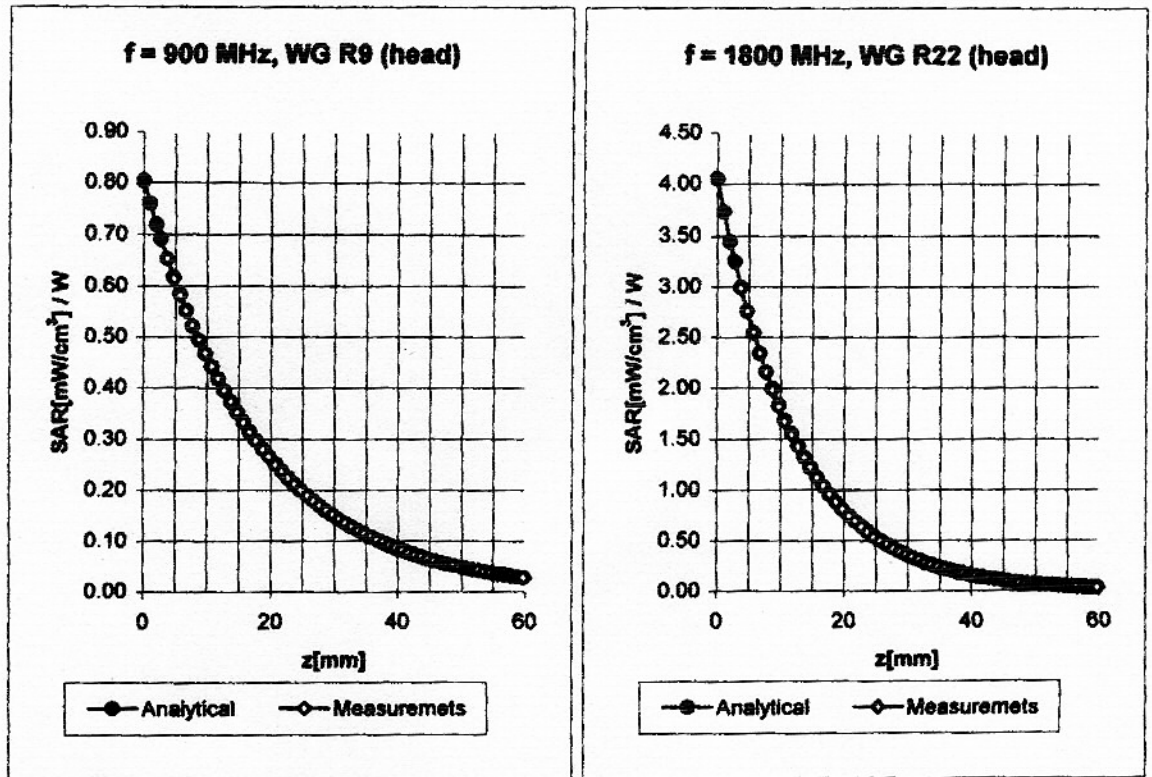
( TEM-Cell:ifi110, Waveguide R22)



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



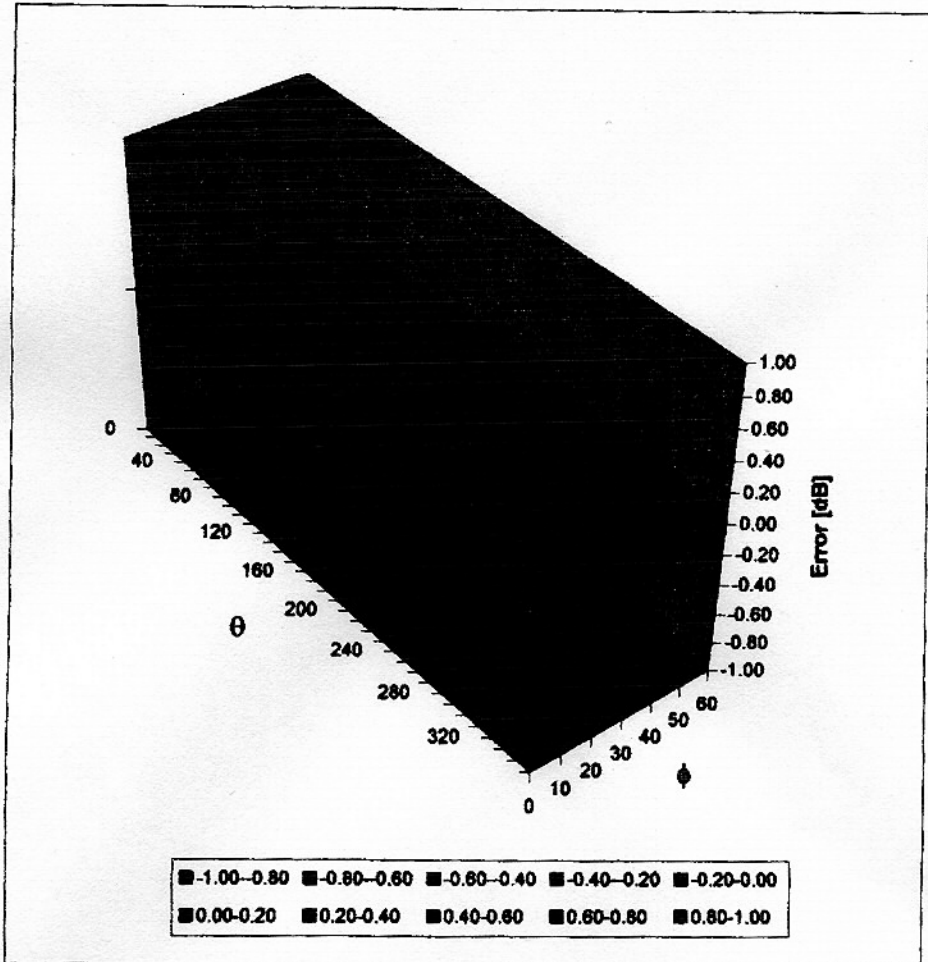
# Conversion Factor Assessment



|      |          |                             |                               |             |
|------|----------|-----------------------------|-------------------------------|-------------|
| Head | 900 MHz  | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.97 \pm 5\%$ mho/m |             |
| Head | 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                         | <b>0.52</b> |
|      | ConvF Z  | $6.5 \pm 9.5\%$ (k=2)       | Depth                         | <b>2.10</b> |
|      |          |                             |                               |             |
| 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                         | <b>0.56</b> |
|      | ConvF Z  | $5.4 \pm 9.5\%$ (k=2)       | Depth                         | <b>2.27</b> |

# Deviation from Isotropy in HSL

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



## Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1515

Place of Assessment:

Zurich

Date of Assessment:

July 26, 2002

Probe Calibration Date:

July 25, 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:1515

Conversion factor ( $\pm$  standard deviation)

|          |       |              |   |
|----------|-------|--------------|---|
| 835 MHz  | ConvF | 6.4 $\pm$ 8% | $\epsilon_r = 55.2 \pm 5\%$<br>$\sigma = 0.97 \pm 5\%$ mho/m<br>(body tissue) |
| 900 MHz  | ConvF | 6.3 $\pm$ 8% | $\epsilon_r = 55.0 \pm 5\%$<br>$\sigma = 1.05 \pm 5\%$ mho/m<br>(body tissue) |
| 1800 MHz | ConvF | 5.0 $\pm$ 8% | $\epsilon_r = 53.3 \pm 5\%$<br>$\sigma = 1.52 \pm 5\%$ mho/m<br>(body tissue) |
| 1900 MHz | ConvF | 4.7 $\pm$ 8% | $\epsilon_r = 53.3 \pm 5\%$<br>$\sigma = 1.52 \pm 5\%$ mho/m<br>(body tissue) |
| 1950 MHz | ConvF | 4.7 $\pm$ 8% | $\epsilon_r = 53.3 \pm 5\%$<br>$\sigma = 1.52 \pm 5\%$ mho/m<br>(body tissue) |
| 1950 MHz | ConvF | 5.1 $\pm$ 8% | $\epsilon_r = 40.0 \pm 5\%$<br>$\sigma = 1.40 \pm 5\%$ mho/m<br>(head tissue) |