



**Date:** November 18, 2002

**Subject:** Request for additional information (FCC ID IHDT56CG1; reference 5284)

**Reference:**

|                                  |           |
|----------------------------------|-----------|
| Correspondence Reference Number: | 5688      |
| Confirmation Number:             | TC516641  |
| Date of Original Email:          | 11/4/2002 |

**Prepared by:**

Steven Hauswirth  
Motorola Personal Communications Sector Product Safety Laboratory  
Harvard, Illinois

Andrew Bachler, Principal Staff Engineer  
Motorola Personal Communications Sector  
Libertyville, Illinois



**MOTOROLA**

November 18, 2002

Supplement to SAR Test Report for Motorola portable cellular phone (FCC ID IHDT56CG1)

Prepared by:

Steven Hauswirth

Motorola Personal Communications Sector Product Safety Laboratory

Harvard, Illinois

## Summary of FCC request for additional information

There was a request for additional information regarding Motorola's SAR Test Report for Motorola portable cellular phone (FCC ID IHDT56CG1). The requested information is addressed below in the same numbering sequence received.

- 1) Regarding your answer to question 2 of correspondence 5284. The FCC has been aware of differences in conversion factor between 1800 and 1900 MHz. Because of the difference in frequency we do not believe that the conversion factor would be necessarily the same even though the liquid parameters are the same. Please remeasure with certified probe calibration. Alternatively for this application only, demonstrate that the conversion factors are identical. For example use the validation setup to show that there is no change in SAR for the two frequencies in liquids with the identical target parameters. Please also describe what steps are being taken to obtain fully calibrated probes for future measurements.

**Response:** Motorola is not aware of differences in conversion factors between 1800MHz and 1900MHz for the same simulated tissue. Our probe supplier (SPEAG™) has been providing the same probe conversion factor the 1800MHz and 1900MHz head for quite some time. Please see "Page 2 of 8" of the Probe SN1508 Calibration Certificate in Appendix A for an example). SPEAG™ has begun to provide probe conversion factors that are common for 1800MHz and 1900MHz body on the newer probe calibration certificates (please see page "8 of 10" in the Probe SN1398 Calibration Certificate in Appendix B for an example). It is our belief that these probes have been fully calibrated by the manufacturer and properly utilized by Motorola.

If the "Additional Conversion Factors" for Probe SN1508 ("Page 2 of 2" in Appendix A) are examined, it can be seen that the conversion factor for 1800MHz body factor differs from the 1950MHz body conversion factor by only 6%. This is well within the stated 8% uncertainty of the probe conversion factor. The 1950MHz body probe conversion factor is included for the testing of 3G/UMTS products for Europe.

Motorola believes that if a single validation setup were to be measured at two different frequencies using the same simulated tissue, that different values would be measured. This is because the dipole is centered or "tuned" for only a single frequency. Using a frequency different than the center frequency of the dipole will result in a different efficiency and radiated power value. Thus the measured SAR would be different.

## Appendix 1

### Probe SN1508 Calibration Certificate

# 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:

**1508**

Place of Calibration:

**Zurich**

Date of Calibration:

**October 25, 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:

*N. Edlör-E. Meriana*

Approved by:

*Alain Käfer*

# Probe ET3DV6

## SN:1508

|               |                  |
|---------------|------------------|
| Manufactured: | October 24, 1999 |
| Remade:       | October 11, 2001 |
| Recalibrated: | October 25, 2001 |

Calibrated for System DASY3

## DASY3 - Parameters of Probe: ET3DV6 SN:1508

### Sensitivity in Free Space

|       |                                                 |
|-------|-------------------------------------------------|
| NormX | <b>1.62</b> $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormY | <b>1.51</b> $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormZ | <b>1.49</b> $\mu\text{V}/(\text{V}/\text{m})^2$ |

### Diode Compression

|       |              |
|-------|--------------|
| DCP X | <b>97</b> mV |
| DCP Y | <b>97</b> mV |
| DCP Z | <b>97</b> mV |

### Sensitivity in Tissue Simulating Liquid

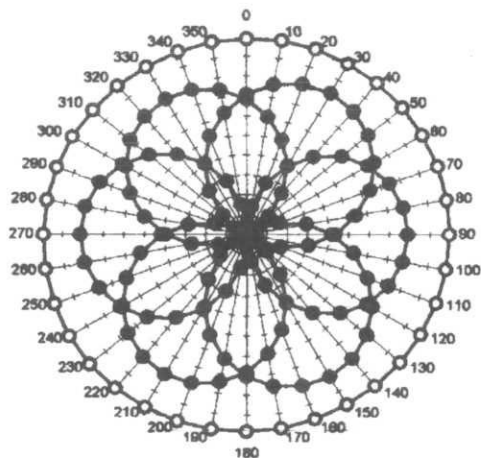
|             |                 |                                               |                                            |
|-------------|-----------------|-----------------------------------------------|--------------------------------------------|
| <b>Head</b> | <b>450 MHz</b>  | <b><math>\epsilon_r = 40.4 \pm 5\%</math></b> | <b><math>s = 0.87 \pm 5\%</math> mho/m</b> |
| ConvF X     | <b>6.82</b>     | extrapolated                                  | Boundary effect:                           |
| ConvF Y     | <b>6.82</b>     | extrapolated                                  | Alpha <b>0.25</b>                          |
| ConvF Z     | <b>6.82</b>     | extrapolated                                  | Depth <b>2.86</b>                          |
| <b>Head</b> | <b>900 MHz</b>  | <b><math>\epsilon_r = 41.5 \pm 5\%</math></b> | <b><math>s = 0.97 \pm 5\%</math> mho/m</b> |
| <b>Head</b> | <b>835 MHz</b>  | <b><math>\epsilon_r = 41.5 \pm 5\%</math></b> | <b><math>s = 0.90 \pm 5\%</math> mho/m</b> |
| ConvF X     | <b>6.35</b>     | $\pm 9.5\%$ (k=2)                             | Boundary effect:                           |
| ConvF Y     | <b>6.35</b>     | $\pm 9.5\%$ (k=2)                             | Alpha <b>0.35</b>                          |
| ConvF Z     | <b>6.35</b>     | $\pm 9.5\%$ (k=2)                             | Depth <b>2.68</b>                          |
| <b>Head</b> | <b>1500 MHz</b> | <b><math>\epsilon_r = 40.4 \pm 5\%</math></b> | <b><math>s = 1.23 \pm 5\%</math> mho/m</b> |
| ConvF X     | <b>5.72</b>     | interpolated                                  | Boundary effect:                           |
| ConvF Y     | <b>5.72</b>     | interpolated                                  | Alpha <b>0.47</b>                          |
| ConvF Z     | <b>5.72</b>     | interpolated                                  | Depth <b>2.43</b>                          |
| <b>Head</b> | <b>1800 MHz</b> | <b><math>\epsilon_r = 40.0 \pm 5\%</math></b> | <b><math>s = 1.40 \pm 5\%</math> mho/m</b> |
| <b>Head</b> | <b>1900 MHz</b> | <b><math>\epsilon_r = 40.0 \pm 5\%</math></b> | <b><math>s = 1.40 \pm 5\%</math> mho/m</b> |
| ConvF X     | <b>5.41</b>     | $\pm 9.5\%$ (k=2)                             | Boundary effect:                           |
| ConvF Y     | <b>5.41</b>     | $\pm 9.5\%$ (k=2)                             | Alpha <b>0.53</b>                          |
| ConvF Z     | <b>5.41</b>     | $\pm 9.5\%$ (k=2)                             | Depth <b>2.31</b>                          |

### Sensor Offset

|                            |                                 |    |
|----------------------------|---------------------------------|----|
| Probe Tip to Sensor Center | <b>2.7</b>                      | mm |
| Optical Surface Detection  | <b><math>1.4 \pm 0.2</math></b> | mm |

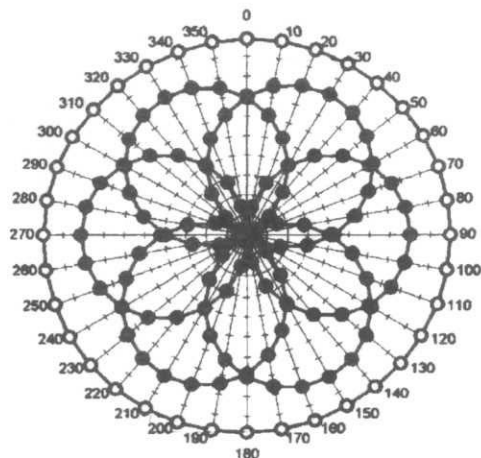
## Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$

**f = 30 MHz, TEM cell if110**



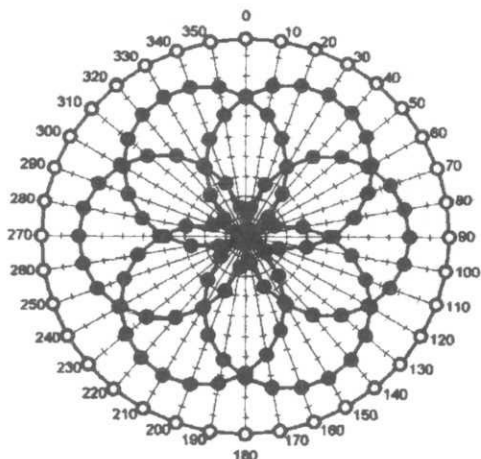
—●— X —●— Y —●— Z —○— Tot

**f = 100 MHz, TEM cell if110**



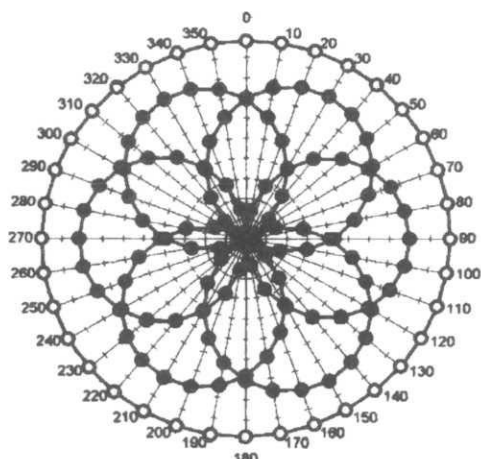
—●— X —●— Y —●— Z —○— Tot

**f = 300 MHz, TEM cell if110**



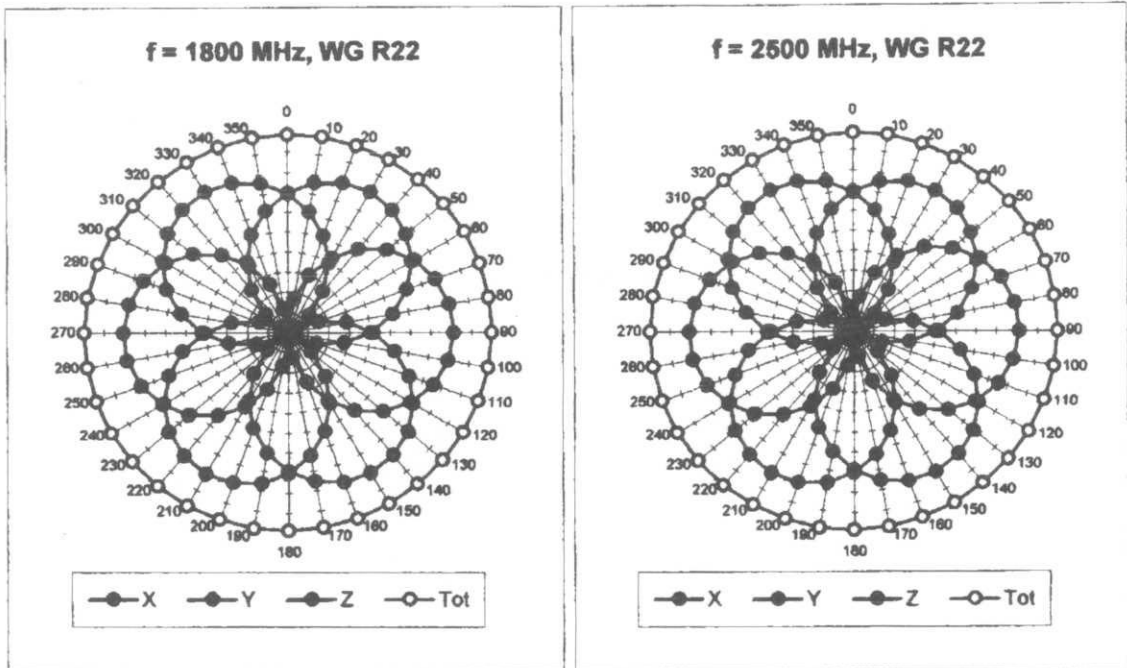
—●— X —●— Y —●— Z —○— Tot

**f = 900 MHz, TEM cell if110**

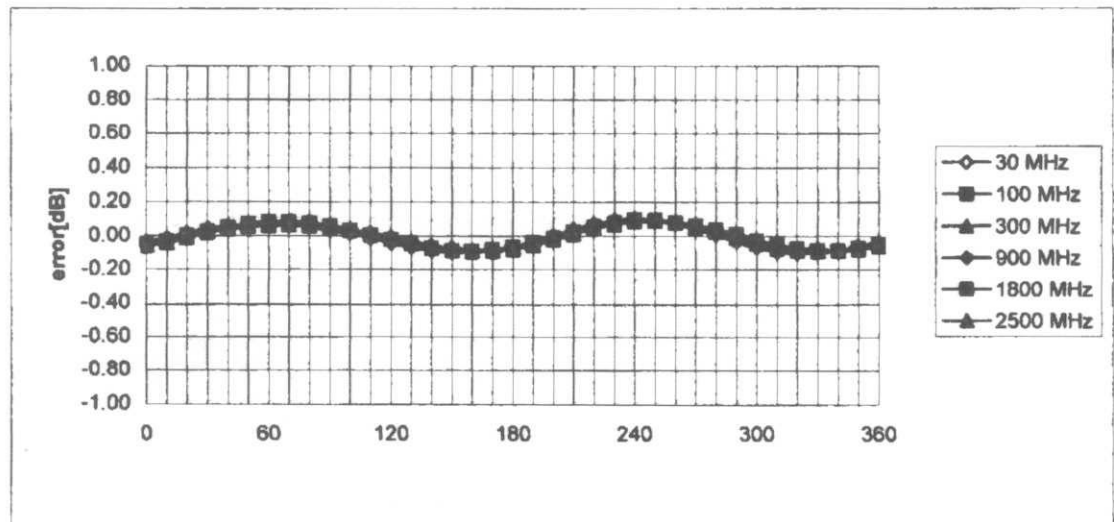


—●— X —●— Y —●— Z —○— Tot



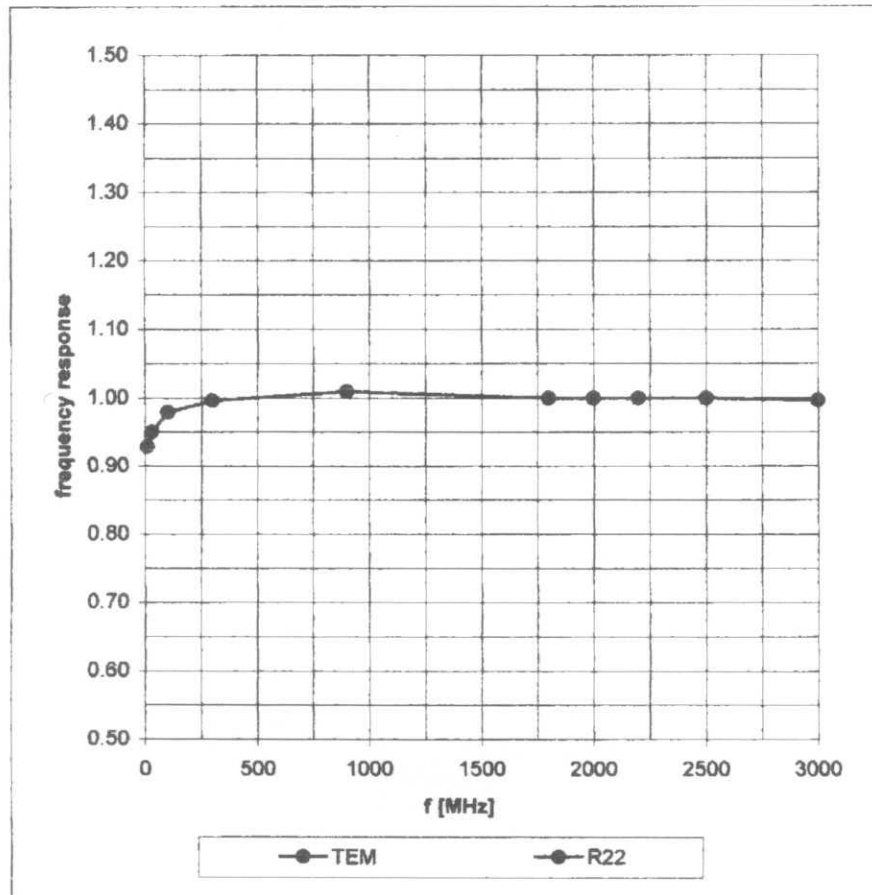


### Isotropy Error ( $\phi$ ), $\theta = 0^\circ$

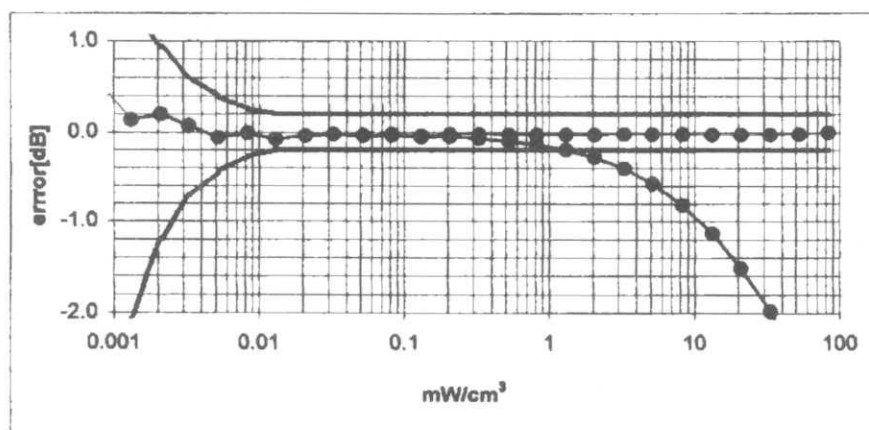
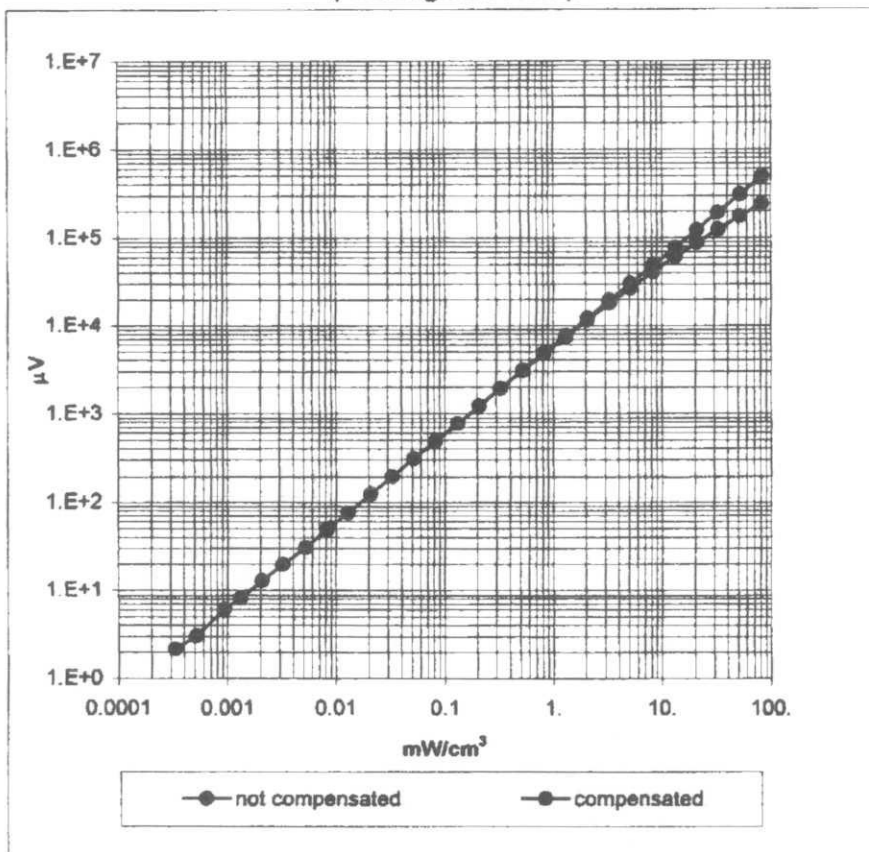


## Frequency Response of E-Field

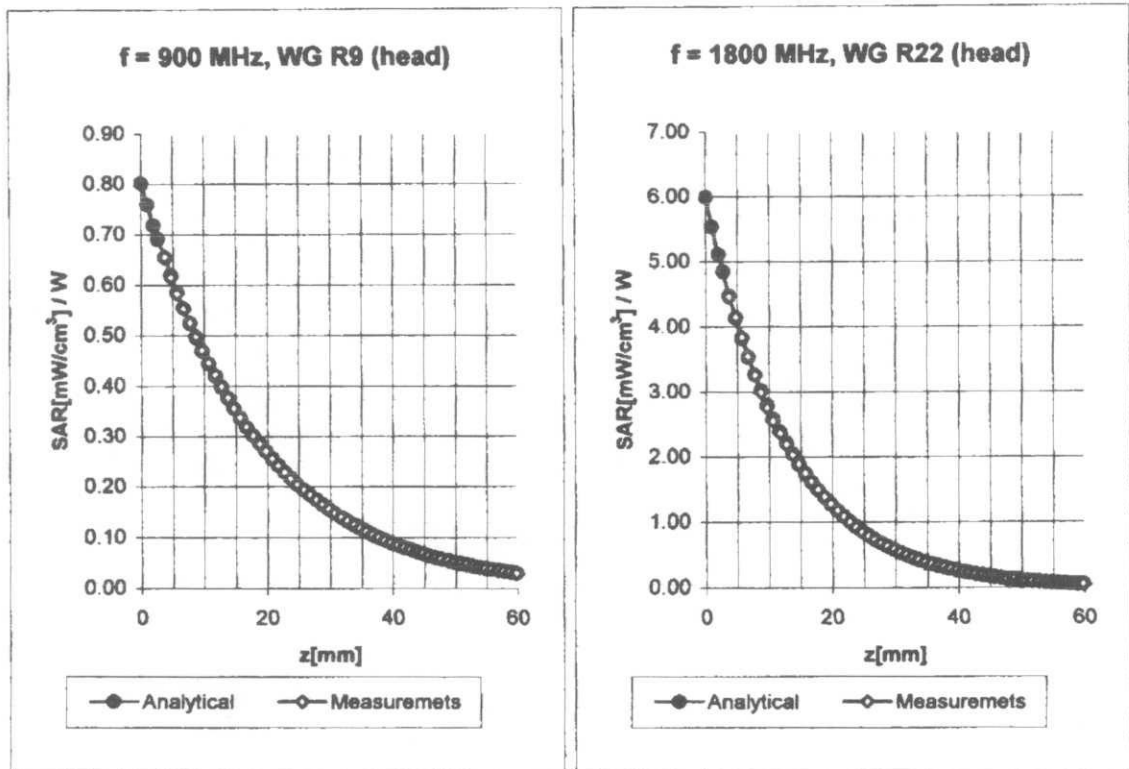
( TEM-Cell:ifi110, Waveguide R22)



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



## Conversion Factor Assessment



Head 800 - 1000 MHz

$\epsilon_r = 39.0 - 43.5$

$\sigma = 0.80 - 1.10$  mho/m

ConvF X **6.35**  $\pm 9.5\%$  (k=2)

Boundary effect:

ConvF Y **6.35**  $\pm 9.5\%$  (k=2)

Alpha **0.35**

ConvF Z **6.35**  $\pm 9.5\%$  (k=2)

Depth **2.68**

Head 1700 - 1910 MHz

$\epsilon_r = 39.5 - 41.0$

$\sigma = 1.20 - 1.55$  mho/m

ConvF X **5.41**  $\pm 9.5\%$  (k=2)

Boundary effect:

ConvF Y **5.41**  $\pm 9.5\%$  (k=2)

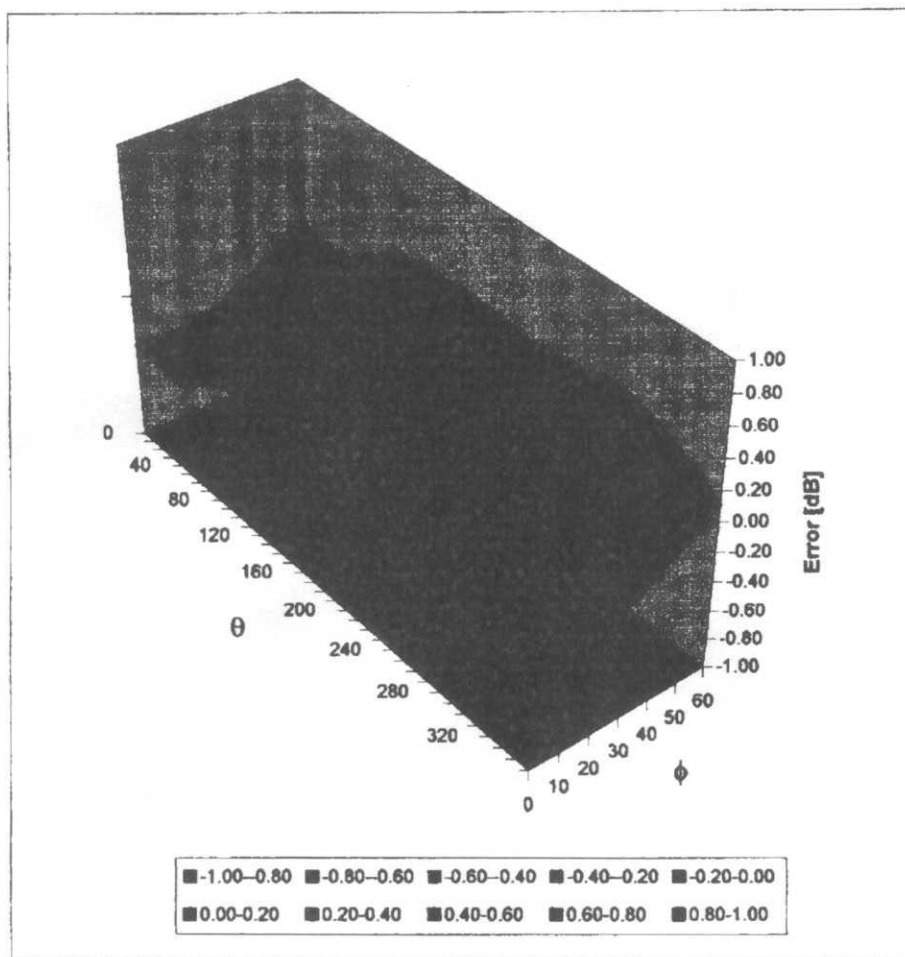
Alpha **0.53**

ConvF Z **5.41**  $\pm 9.5\%$  (k=2)

Depth **2.31**

## Deviation from Isotropy in HSL

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



## Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1508

Place of Assessment:

Zurich

Date of Assessment:

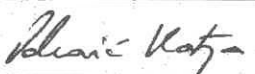
November 14, 2001

Probe Calibration Date:

October 25, 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:1508

Conversion factor ( $\pm$  standard deviation)

|          |       |               |                                                                       |
|----------|-------|---------------|-----------------------------------------------------------------------|
| 835 MHz  | ConvF | $6.5 \pm 8\%$ | $\epsilon_r = 41.5$<br>$\sigma = 0.90 \text{ mho/m}$<br>(head tissue) |
| 1950 MHz | ConvF | $5.1 \pm 8\%$ | $\epsilon_r = 40.0$<br>$\sigma = 1.40 \text{ mho/m}$<br>(head tissue) |
| 835 MHz  | ConvF | $6.2 \pm 8\%$ | $\epsilon_r = 55.2$<br>$\sigma = 0.97 \text{ mho/m}$<br>(body tissue) |
| 900 MHz  | ConvF | $6.1 \pm 8\%$ | $\epsilon_r = 55.0$<br>$\sigma = 1.05 \text{ mho/m}$<br>(body tissue) |
| 1800 MHz | ConvF | $5.0 \pm 8\%$ | $\epsilon_r = 53.3$<br>$\sigma = 1.52 \text{ mho/m}$<br>(body tissue) |
| 1950 MHz | ConvF | $4.7 \pm 8\%$ | $\epsilon_r = 53.3$<br>$\sigma = 1.52 \text{ mho/m}$<br>(body tissue) |

## Appendix 2

### Probe SN1398 Calibration Certificate



# 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**

|                          |                          |
|--------------------------|--------------------------|
| <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 $\mu\text{V}/(\text{V/m})^2$ | 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**

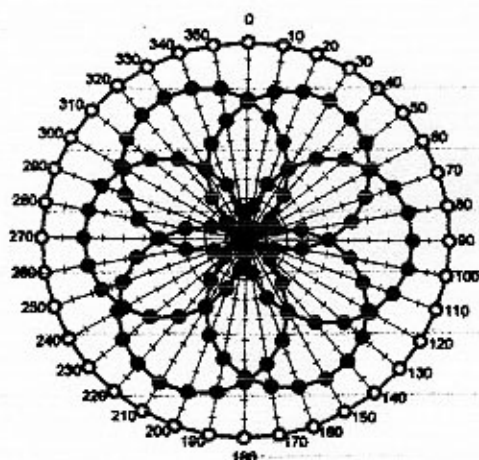
|         |                       |                             |                                       |
|---------|-----------------------|-----------------------------|---------------------------------------|
| Head    | 900 MHz               | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.97 \pm 5\% \text{ mho/m}$ |
| 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**

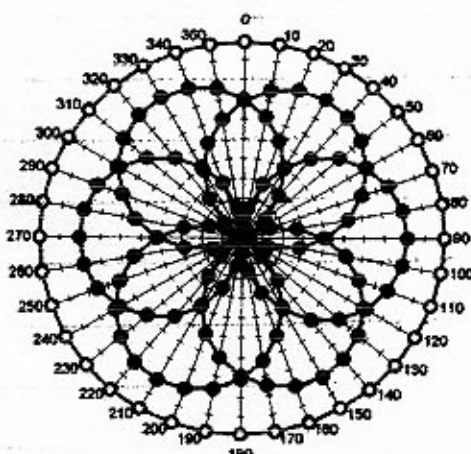
|                       |                              |                                   |      |  |
|-----------------------|------------------------------|-----------------------------------|------|--|
| Head                  | 900 MHz                      | Typical SAR gradient: 5 % per mm  |      |  |
| Probe Tip to Boundary |                              | 1 mm                              | 2 mm |  |
| SAR <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**

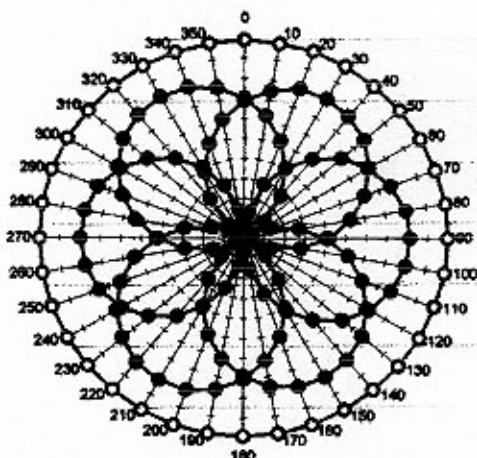
|                            |               |    |
|----------------------------|---------------|----|
| Probe Tip to Sensor Center | 2.7           | mm |
| Optical Surface Detection  | 1.0 $\pm$ 0.2 | mm |

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

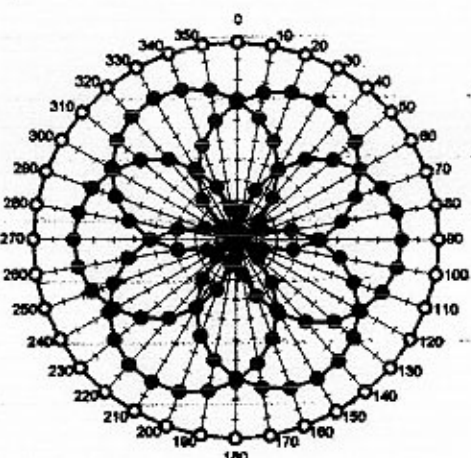
—●— X —●— Y —●— Z —○— Tot

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

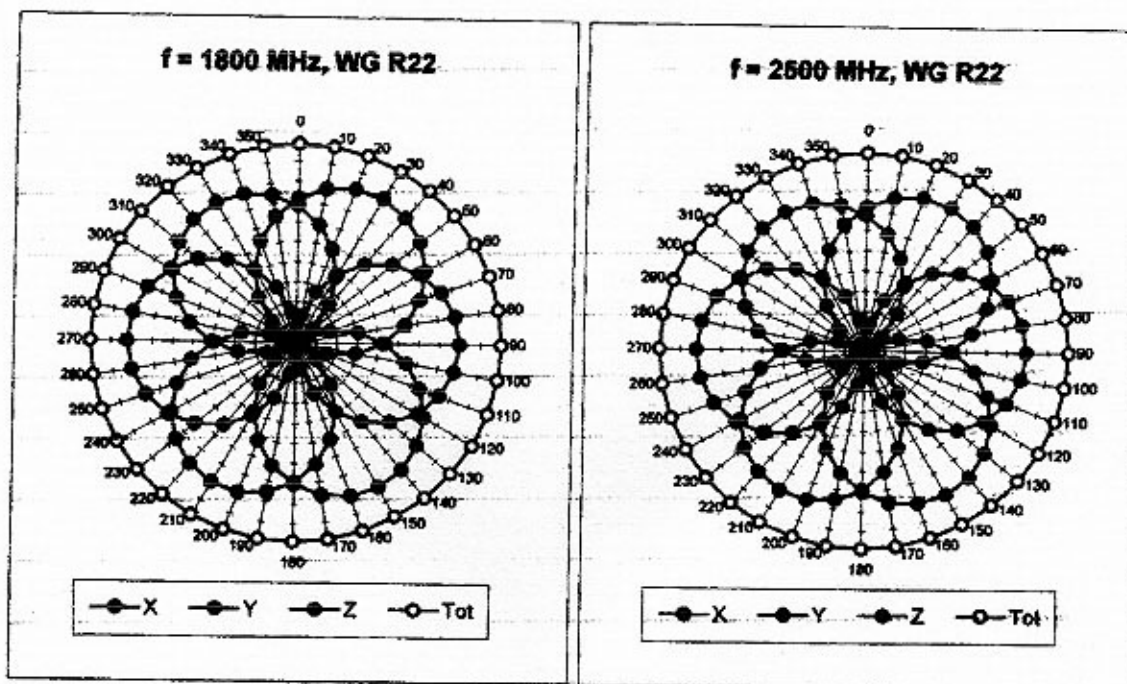
—●— X —●— Y —●— Z —○— Tot

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

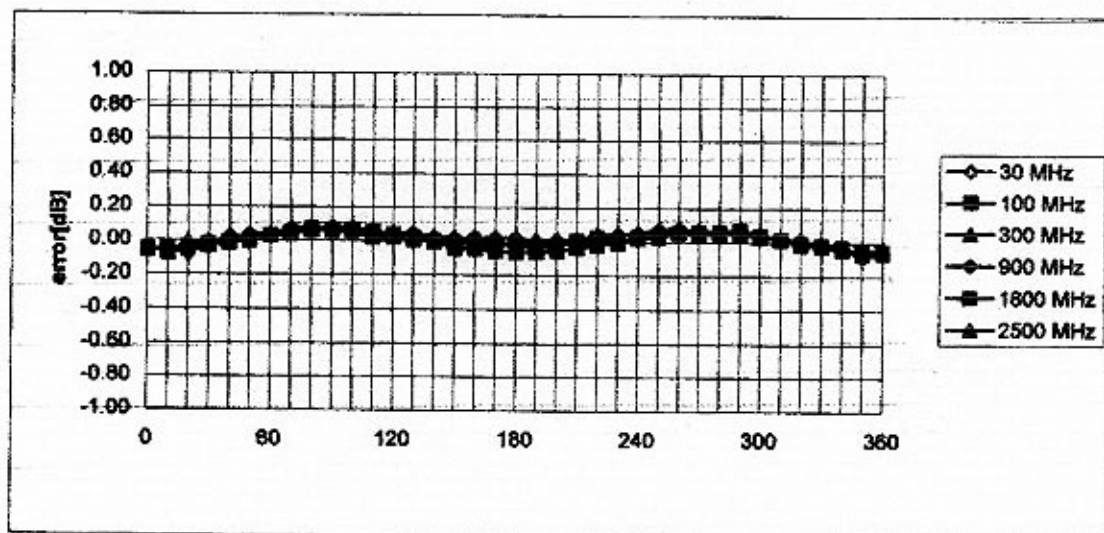
—●— X —●— Y —●— Z —○— Tot

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

—●— X —●— Y —●— Z —○— Tot

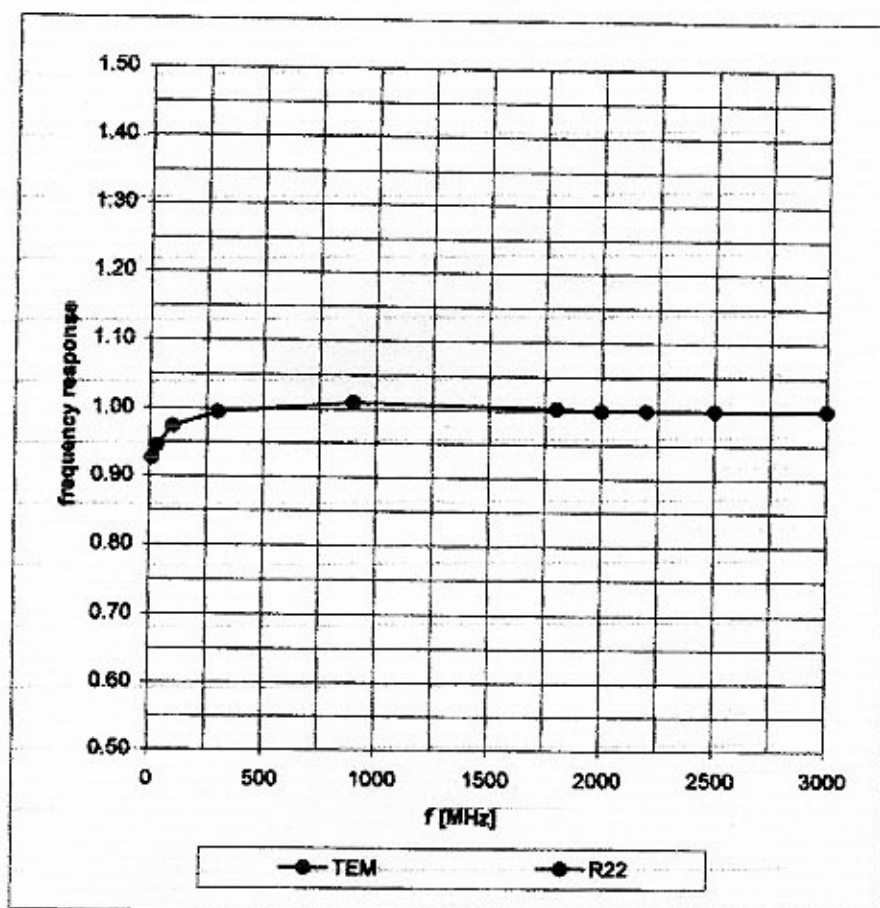


### Isotropy Error ( $\phi$ ), $\theta = 0^\circ$



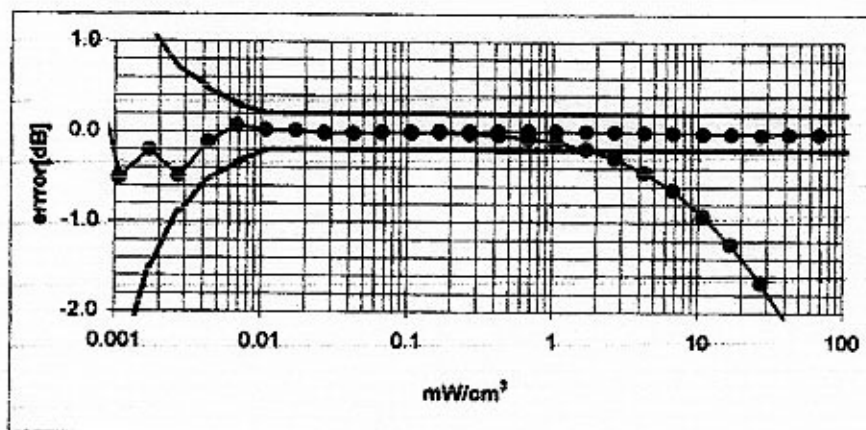
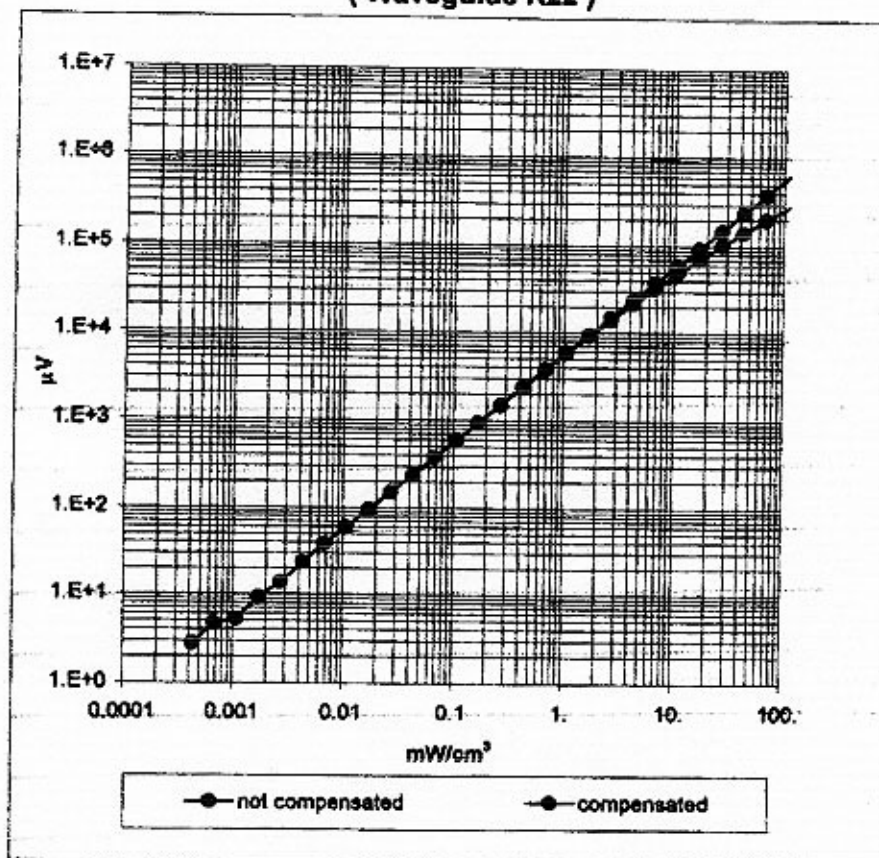
## Frequency Response of E-Field

( TEM-Cell:ifi110, Waveguide R22)

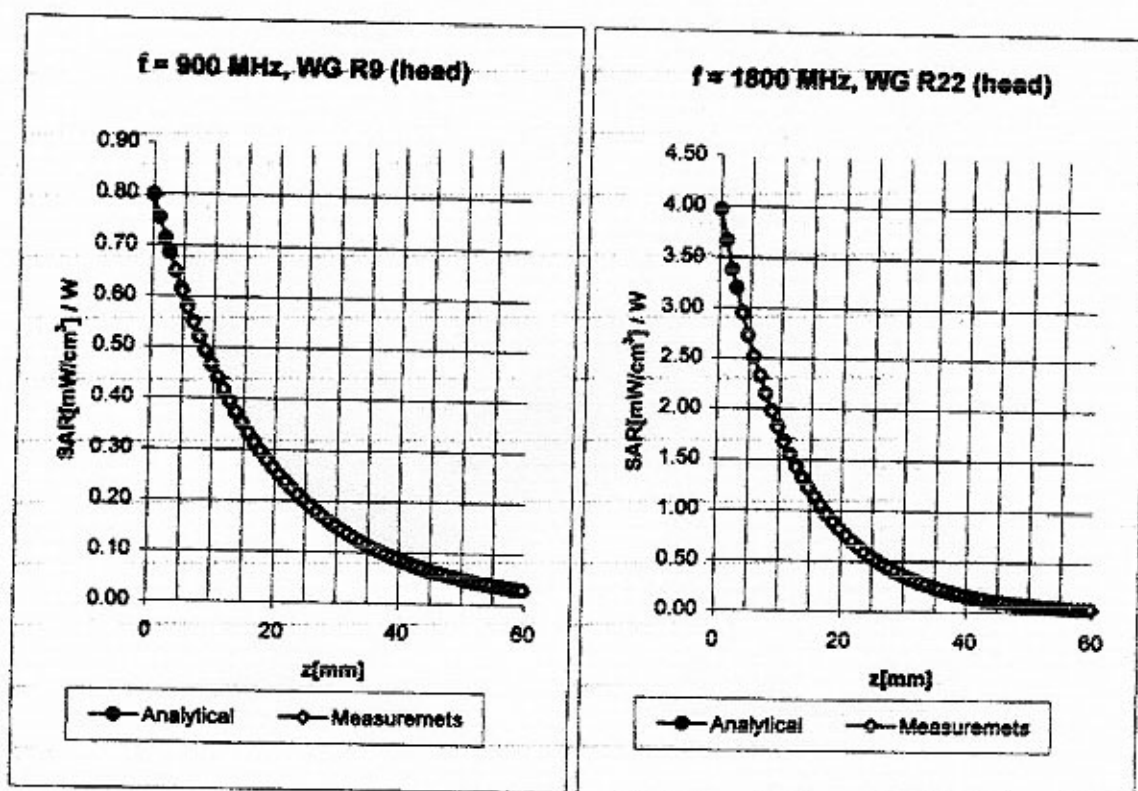




# Dynamic Range $f(\text{SAR}_{\text{brain}})$ ( Waveguide R22 )



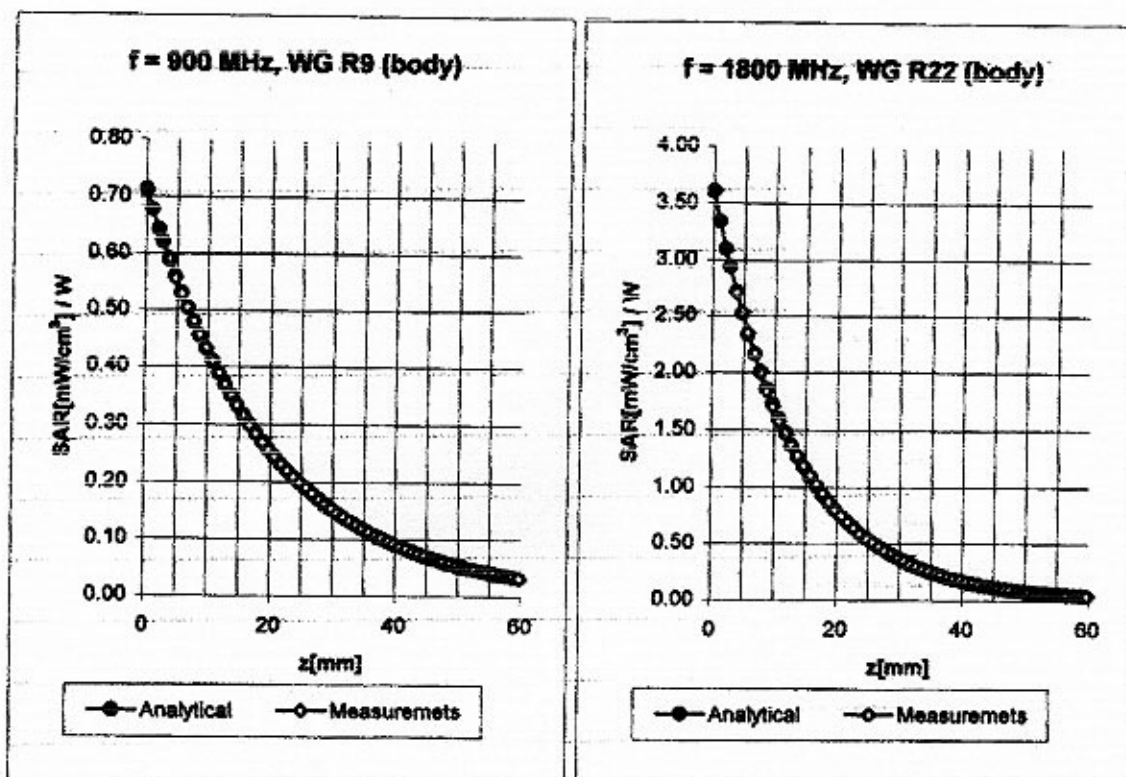
# Conversion Factor Assessment



|      |          |                             |                                       |
|------|----------|-----------------------------|---------------------------------------|
| Head | 900 MHz  | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.97 \pm 5\% \text{ mho/m}$ |
| 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                            |

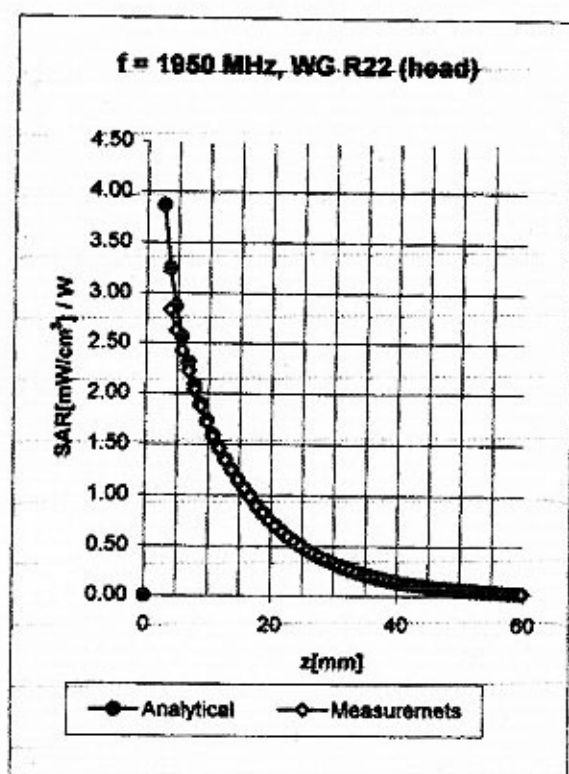


# Conversion Factor Assessment



|      |          |                             |                                       |
|------|----------|-----------------------------|---------------------------------------|
| 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

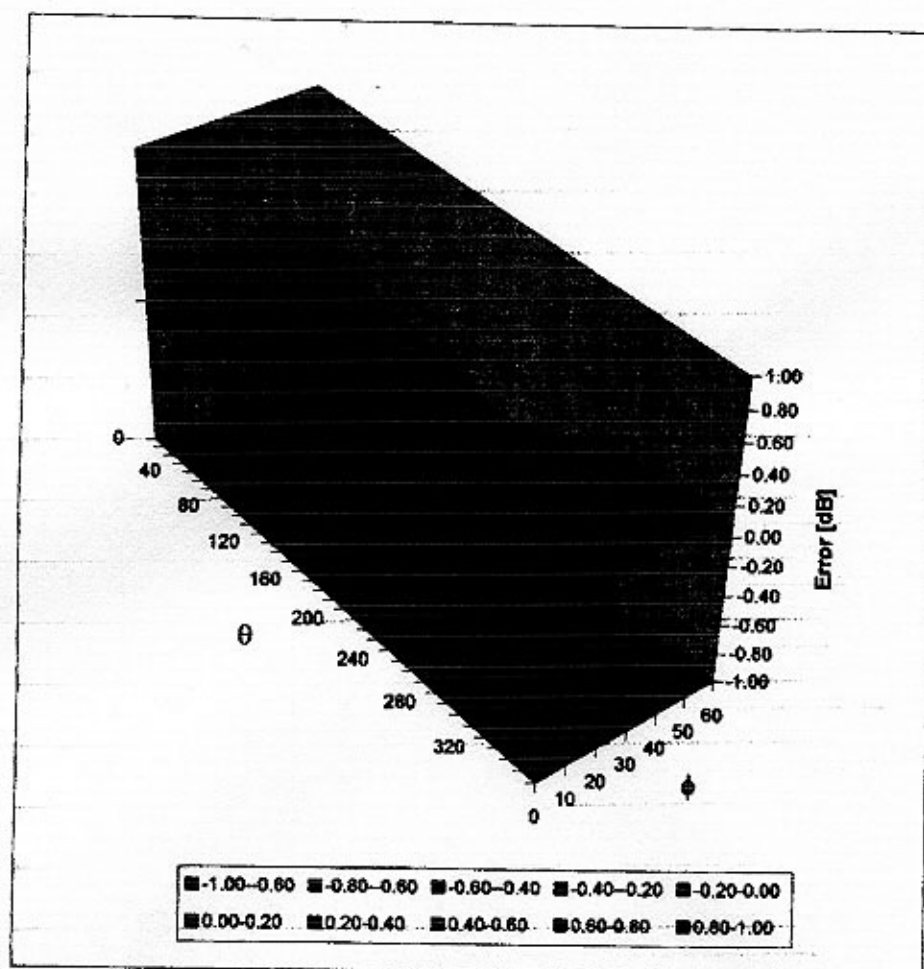
 $\epsilon_r = 40.0 \pm 5\%$  $\sigma = 1.40 \pm 5\%$  mho/mConvF X      **4.9  $\pm$  9.5% (k=2)**

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



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

Type:

ET3DV6

Serial Number:

1398

Place of Assessment:

Zurich

Date of Assessment:

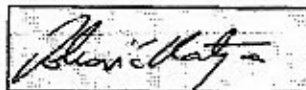
September 8, 2002

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)