

Calibration Laboratory of  
Schmid & Partner  
Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland

Client HCT (Dymstec)

## CALIBRATION CERTIFICATE

Object(s) ET3DV6 - SN:1798

Calibration procedure(s) QA CAL-01.v2  
Calibration procedure for dosimetric E-field probes

Calibration date: October 7, 2003

Condition of the calibrated item In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

| Model Type                        | ID #           | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration  |
|-----------------------------------|----------------|-------------------------------------------|------------------------|
| Power meter EPM E4419B            | GB41293874     | 2-Apr-03 (METAS, No 252-0250)             | Apr-04                 |
| Power sensor E4412A               | MY41495277     | 2-Apr-03 (METAS, No 252-0250)             | Apr-04                 |
| Reference 20 dB Attenuator        | SN: 5086 (20b) | 3-Apr-03 (METAS No. 251-0340)             | Apr-04                 |
| Fluke Process Calibrator Type 702 | SN: 6295803    | 8-Sep-03 (Sintrel SCS No. E-030020)       | Sep-04                 |
| Power sensor HP 8481A             | MY41092180     | 18-Sep-02 (Agilent, No. 20020918)         | In house check: Oct 03 |
| RF generator HP 8684C             | US3642U01700   | 4-Aug-99 (SPEAG, in house check Aug-02)   | In house check: Aug-05 |
| Network Analyzer HP 8753E         | US37390585     | 18-Oct-01 (Agilent, No. 24BR1033101)      | In house check: Oct 03 |

|                |                       |                        |                                                                                                    |
|----------------|-----------------------|------------------------|----------------------------------------------------------------------------------------------------|
| Calibrated by: | Name<br>Nico Vetterli | Function<br>Technician | Signature<br> |
|----------------|-----------------------|------------------------|----------------------------------------------------------------------------------------------------|

|              |                       |                                 |                                                                                                    |
|--------------|-----------------------|---------------------------------|----------------------------------------------------------------------------------------------------|
| Approved by: | Name<br>Katja Pokovic | Function<br>Laboratory Director | Signature<br> |
|--------------|-----------------------|---------------------------------|----------------------------------------------------------------------------------------------------|

Date issued: October 8, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

Schmid & Partner Engineering AG

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# Probe ET3DV6

## SN:1798

Manufactured: August 14, 2003  
Last calibration: October 7, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1798

October 7, 2003

## DASY - Parameters of Probe: ET3DV6 SN:1798

### Sensitivity in Free Space

### Diode Compression

|       |                                          |       |    |    |
|-------|------------------------------------------|-------|----|----|
| NormX | 1.82 $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP X | 96 | mV |
| NormY | 1.72 $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP Y | 96 | mV |
| NormZ | 1.64 $\mu\text{V}/(\text{V}/\text{m})^2$ | 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

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

|         |                       |                  |      |
|---------|-----------------------|------------------|------|
| ConvF X | 6.6 $\pm 9.5\%$ (k=2) | Boundary effect: |      |
| ConvF Y | 6.6 $\pm 9.5\%$ (k=2) | Alpha            | 0.29 |
| ConvF Z | 6.6 $\pm 9.5\%$ (k=2) | Depth            | 3.00 |

Head 1800 MHz  $\epsilon_r = 40.0 \pm 5\%$   $\sigma = 1.40 \pm 5\%$  mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

|         |                       |                  |      |
|---------|-----------------------|------------------|------|
| ConvF X | 5.2 $\pm 9.5\%$ (k=2) | Boundary effect: |      |
| ConvF Y | 5.2 $\pm 9.5\%$ (k=2) | Alpha            | 0.44 |
| ConvF Z | 5.2 $\pm 9.5\%$ (k=2) | Depth            | 2.78 |

### 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 | 9.6  | 5.8  |
| SAR <sub>be</sub> [%] | With Correction Algorithm    | 0.4  | 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 | 12.9 | 9.0  |
| SAR <sub>be</sub> [%] | With Correction Algorithm    | 0.2  | 0.2  |

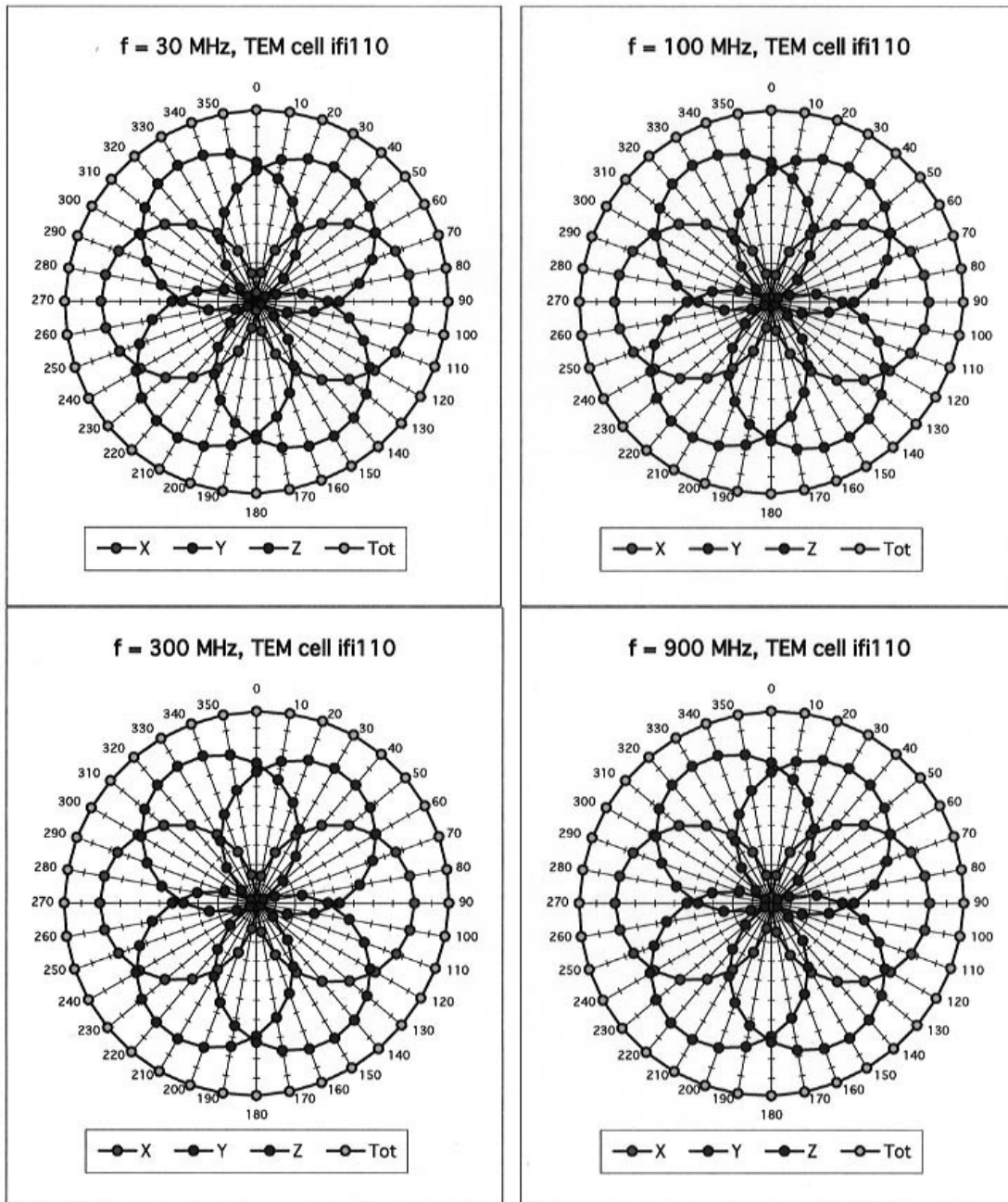
### Sensor Offset

|                            |               |    |
|----------------------------|---------------|----|
| Probe Tip to Sensor Center | 2.7           | mm |
| Optical Surface Detection  | 1.7 $\pm$ 0.2 | mm |

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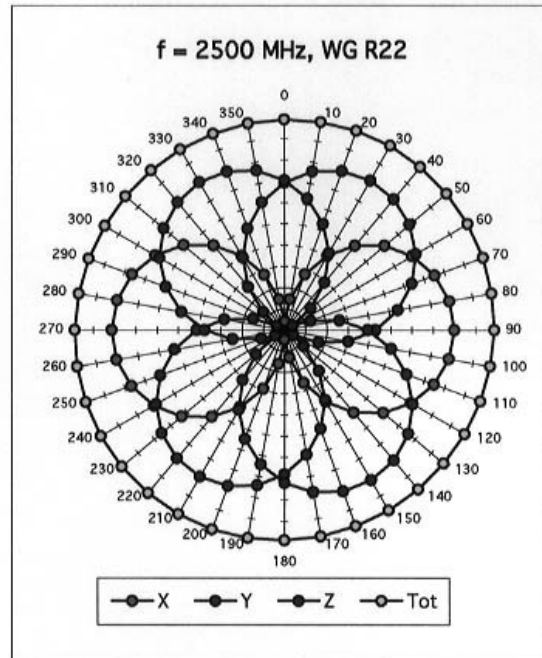
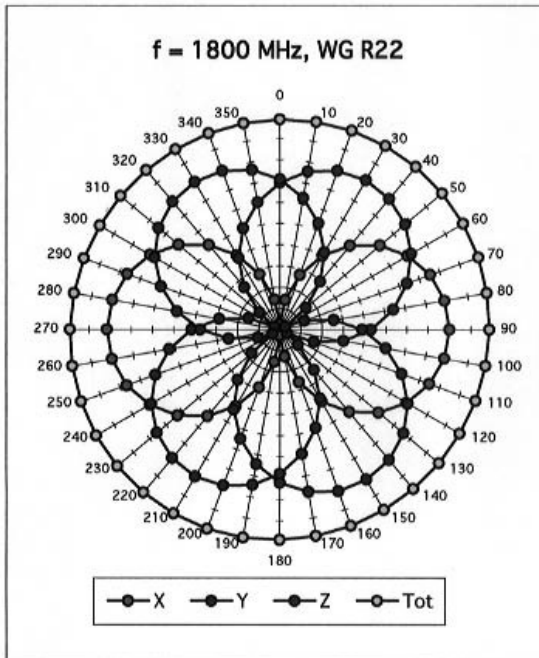
October 7, 2003

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

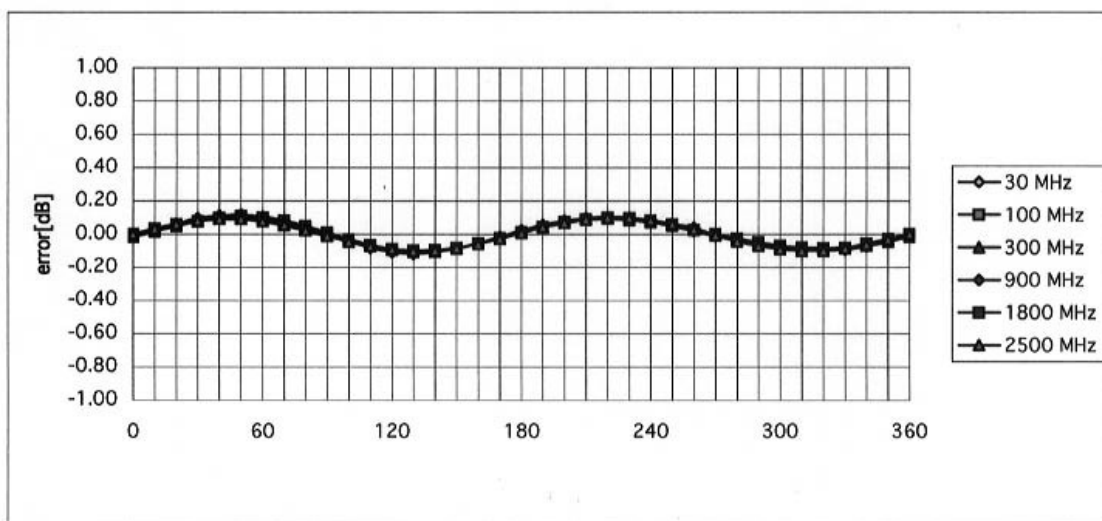


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### Isotropy Error ( $\phi$ ), $\theta = 0^\circ$

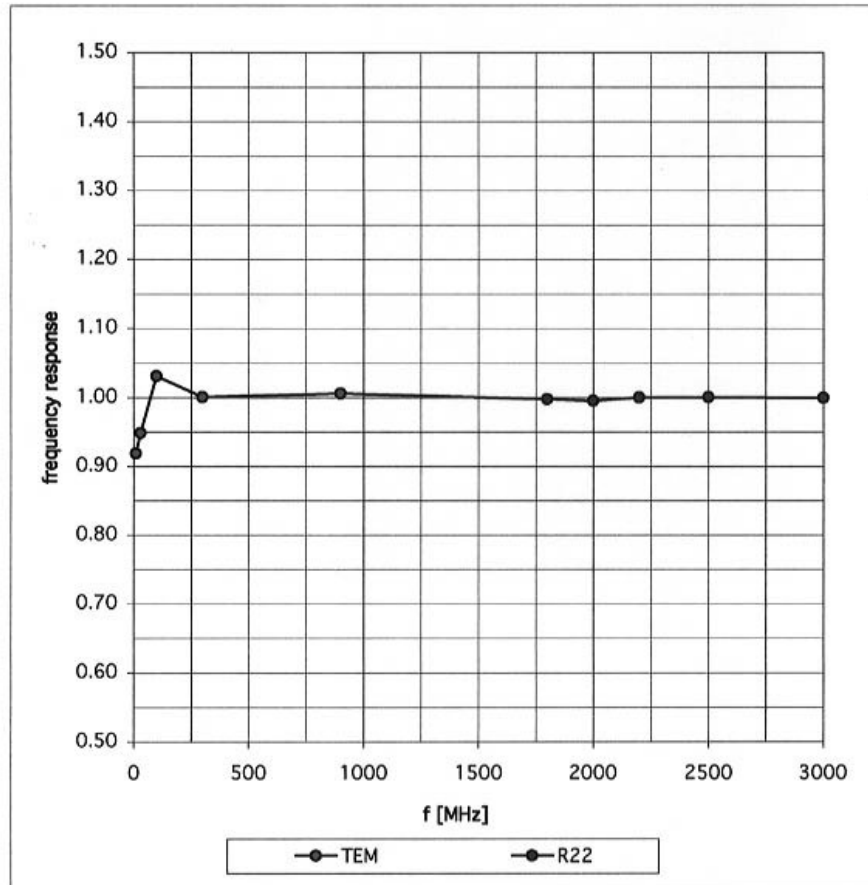


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## Frequency Response of E-Field

( TEM-Cell:ifi110, Waveguide R22)

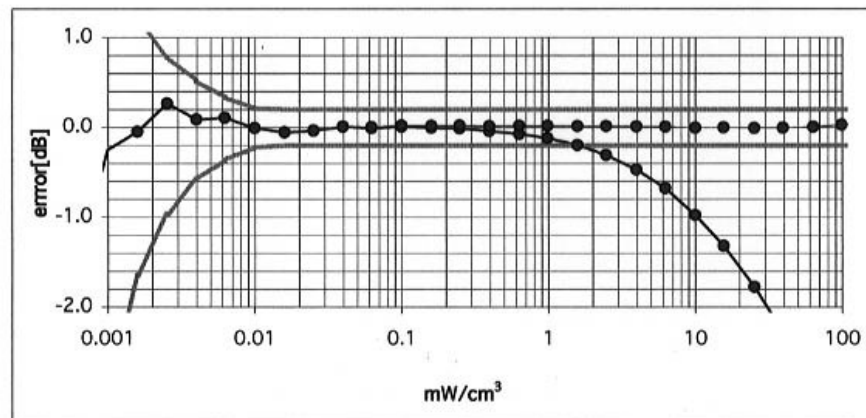
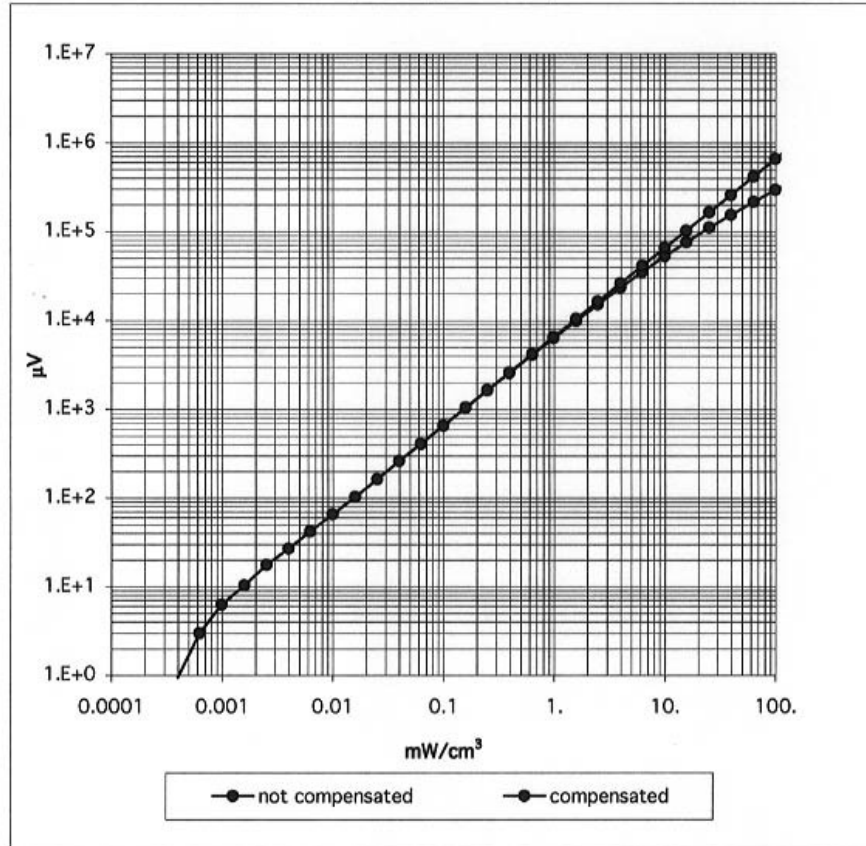


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## Dynamic Range f(SARhead)

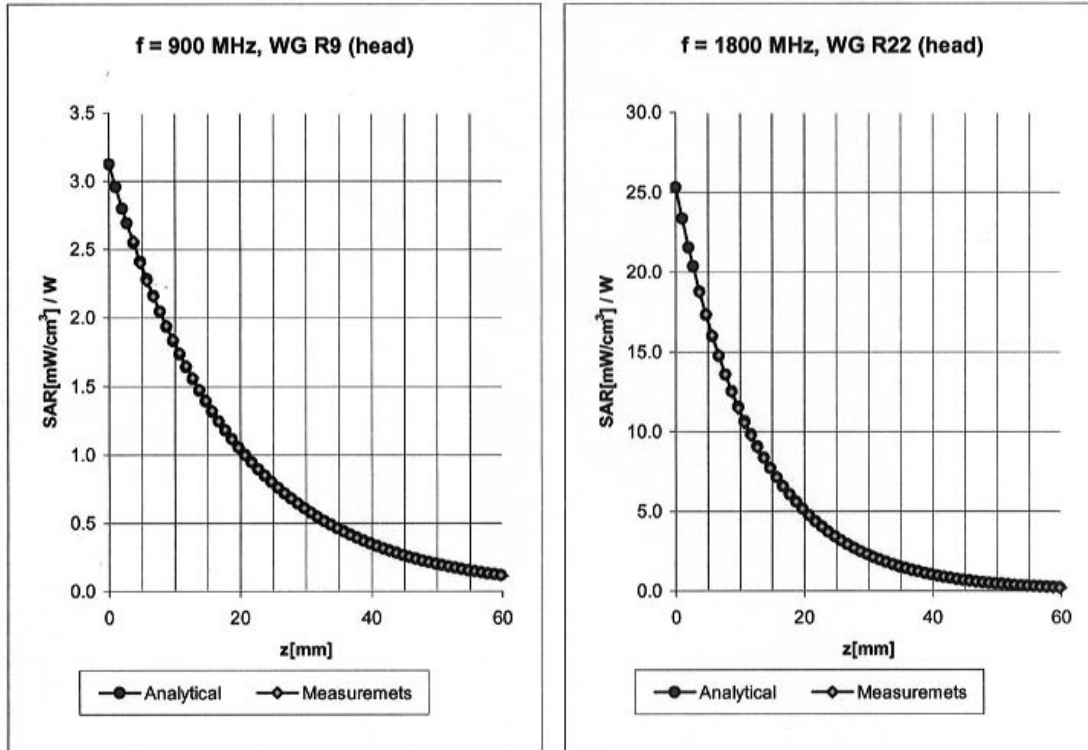
( Waveguide R22 )



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## Conversion Factor Assessment



Head 900 MHz  $\epsilon_r = 41.5 \pm 5\%$   $\sigma = 0.97 \pm 5\%$  mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

|         |                       |                  |      |
|---------|-----------------------|------------------|------|
| ConvF X | 6.6 $\pm 9.5\%$ (k=2) | Boundary effect: |      |
| ConvF Y | 6.6 $\pm 9.5\%$ (k=2) | Alpha            | 0.29 |
| ConvF Z | 6.6 $\pm 9.5\%$ (k=2) | Depth            | 3.00 |

Head 1800 MHz  $\epsilon_r = 40.0 \pm 5\%$   $\sigma = 1.40 \pm 5\%$  mho/m

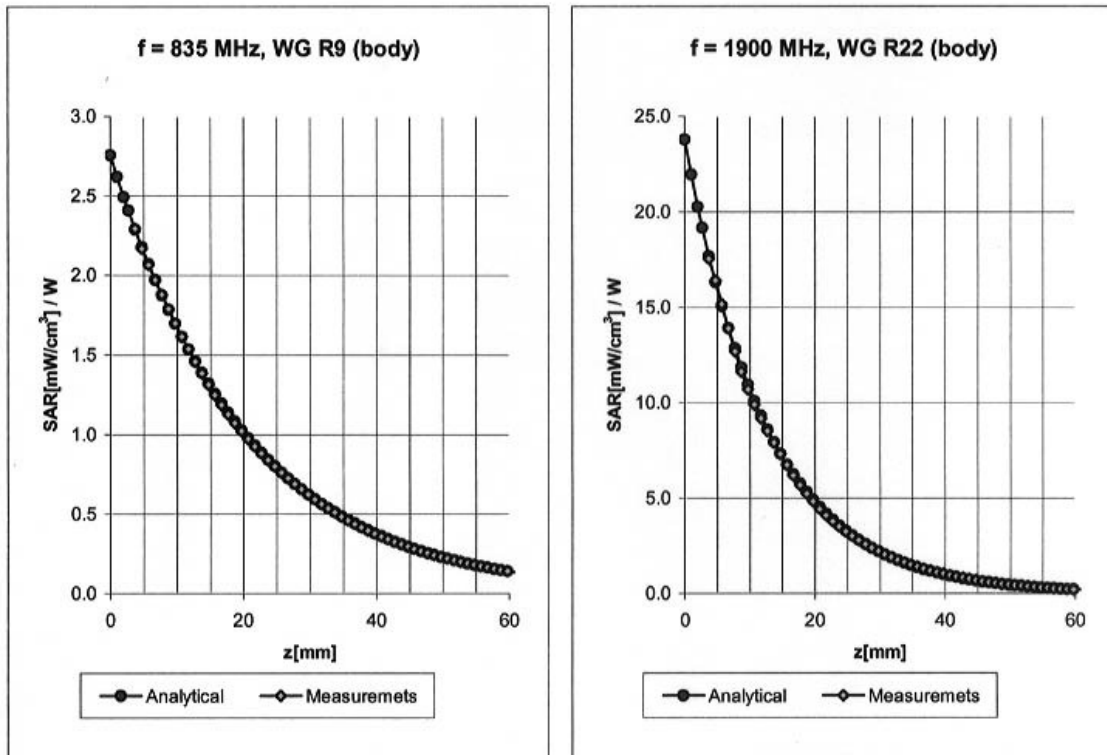
Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

|         |                       |                  |      |
|---------|-----------------------|------------------|------|
| ConvF X | 5.2 $\pm 9.5\%$ (k=2) | Boundary effect: |      |
| ConvF Y | 5.2 $\pm 9.5\%$ (k=2) | Alpha            | 0.44 |
| ConvF Z | 5.2 $\pm 9.5\%$ (k=2) | Depth            | 2.78 |

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## Conversion Factor Assessment



Body 835 MHz  $\epsilon_r = 55.2 \pm 5\%$   $\sigma = 0.97 \pm 5\%$  mho/m

Valid for f=750-950 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

|         |                       |                  |      |
|---------|-----------------------|------------------|------|
| ConvF X | 6.3 $\pm 9.5\%$ (k=2) | Boundary effect: |      |
| ConvF Y | 6.3 $\pm 9.5\%$ (k=2) | Alpha            | 0.37 |
| ConvF Z | 6.3 $\pm 9.5\%$ (k=2) | Depth            | 2.50 |

Body 1900 MHz  $\epsilon_r = 53.3 \pm 5\%$   $\sigma = 1.52 \pm 5\%$  mho/m

Valid for f=1800-2000 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

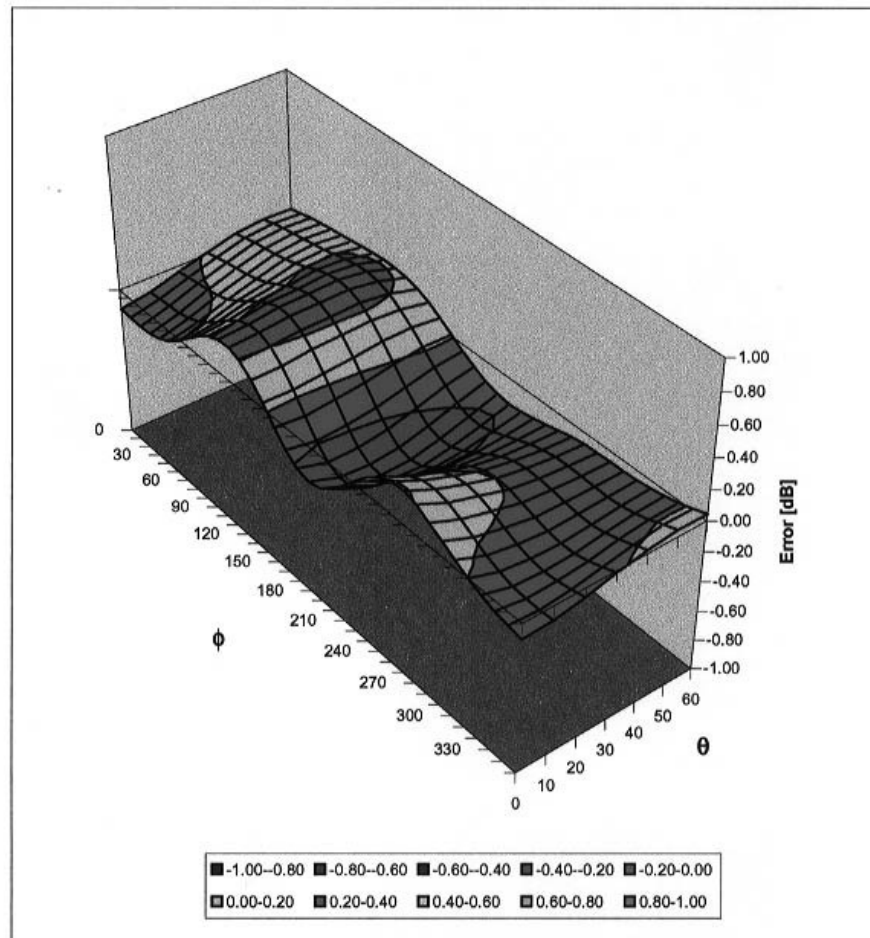
|         |                       |                  |      |
|---------|-----------------------|------------------|------|
| ConvF X | 4.7 $\pm 9.5\%$ (k=2) | Boundary effect: |      |
| ConvF Y | 4.7 $\pm 9.5\%$ (k=2) | Alpha            | 0.58 |
| ConvF Z | 4.7 $\pm 9.5\%$ (k=2) | Depth            | 2.58 |

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## Deviation from Isotropy in HSL

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



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## Additional Conversion Factors

for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1798

Place of Assessment:

Zurich

Date of Assessment:

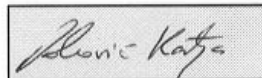
October 9, 2003

Probe Calibration Date:

October 7, 2003

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:



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**Dosimetric E-Field Probe ET3DV6 SN:1798**Conversion factor ( $\pm$  standard deviation)450 MHz      ConvF       $7.5 \pm 8\%$ 

$\epsilon_r = 43.5 \pm 5\%$   
 $\sigma = 0.87 \pm 5\%$  mho/m  
(head tissue)

450 MHz      ConvF       $7.6 \pm 8\%$ 

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