

Client

Auden > Chunghwa Telecom

## CALIBRATION CERTIFICATE

Object(s)

ET3DV6 - SN:1790

Calibration procedure(s)

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

Calibration date:

August 29, 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  |
|-----------------------------------|--------------|-------------------------------------------|------------------------|
| RF generator HP 8684C             | US3642U01700 | 4-Aug-99 (SPEAG, in house check Aug-02)   | In house check: Aug-05 |
| Power sensor E4412A               | MY41495277   | 2-Apr-03 (METAS, No 252-0250)             | Apr-04                 |
| Power sensor HP 8481A             | MY41092180   | 18-Sep-02 (Agilent, No. 20020918)         | Sep-03                 |
| Power meter EPM E4419B            | GB41293874   | 2-Apr-03 (METAS, No 252-0250)             | Apr-04                 |
| Network Analyzer HP 8753E         | US37390585   | 18-Oct-01 (Agilent, No. 24BR1033101)      | In house check: Oct 03 |
| Fluke Process Calibrator Type 702 | SN: 6295803  | 3-Sep-01 (ELCAL, No.2360)                 | Sep-03                 |

Calibrated by:

Name

Nico Vetterli

Function

Technician

Signature



Approved by:

Katja Pokovic

Laboratory Director



Date issued: August 28, 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.

# Probe ET3DV6

SN:1790

|                   |                 |
|-------------------|-----------------|
| Manufactured:     | May 28, 2003    |
| Last calibration: | August 29, 2003 |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

## DASY - Parameters of Probe: ET3DV6 SN:1790

### Sensitivity in Free Space

### Diode Compression

|       |                                                 |       |           |    |
|-------|-------------------------------------------------|-------|-----------|----|
| NormX | <b>1.74</b> $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP X | <b>96</b> | mV |
| NormY | <b>1.69</b> $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP Y | <b>96</b> | mV |
| NormZ | <b>1.76</b> $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP Z | <b>96</b> | 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 | <b>6.4</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>6.4</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.48</b> |
| ConvF Z | <b>6.4</b> $\pm 9.5\%$ (k=2) | Depth            | <b>2.13</b> |

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 | <b>5.1</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>5.1</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.49</b> |
| ConvF Z | <b>5.1</b> $\pm 9.5\%$ (k=2) | Depth            | <b>2.70</b> |

### Boundary Effect

Head                      900 MHz                      Typical SAR gradient: 5 % per mm

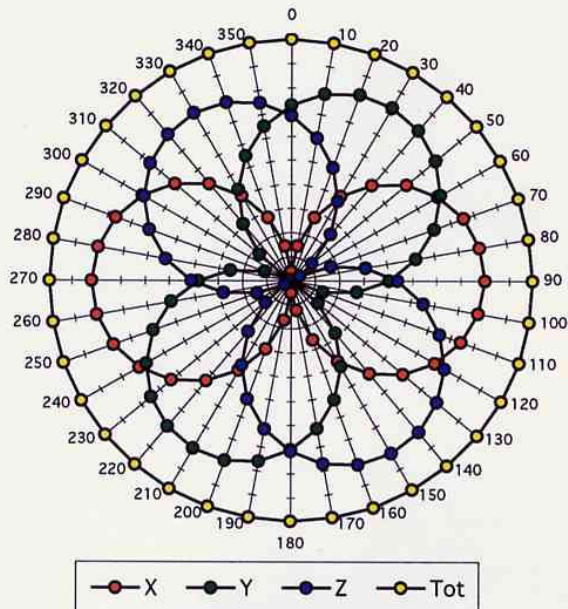
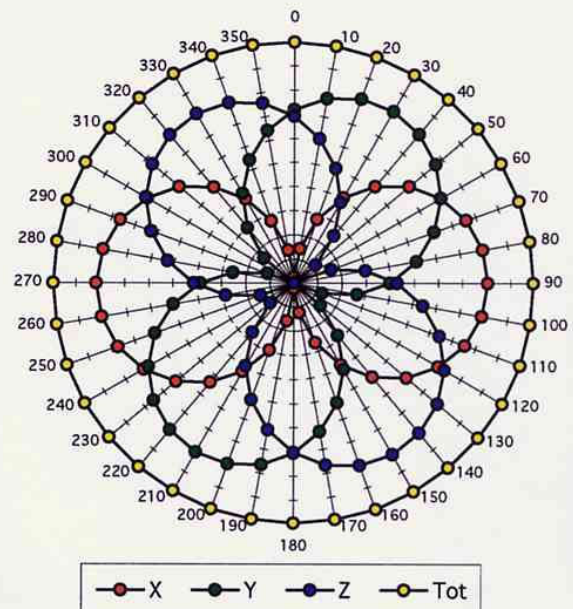
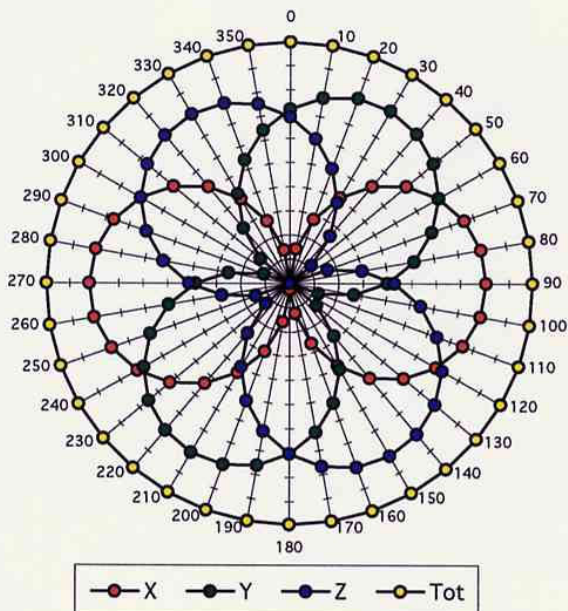
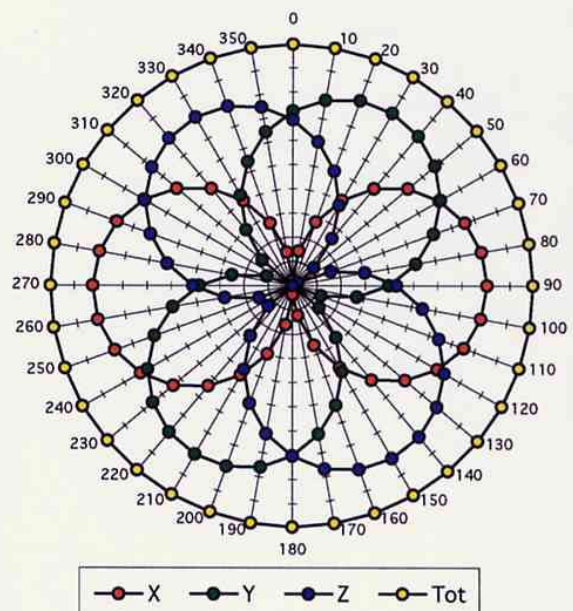
|                       |                              |             |             |
|-----------------------|------------------------------|-------------|-------------|
| Probe Tip to Boundary |                              | <b>1 mm</b> | <b>2 mm</b> |
| SAR <sub>be</sub> [%] | Without Correction Algorithm | 9.4         | 5.2         |
| SAR <sub>be</sub> [%] | With Correction Algorithm    | 0.2         | 0.4         |

Head                      1800 MHz                      Typical SAR gradient: 10 % per mm

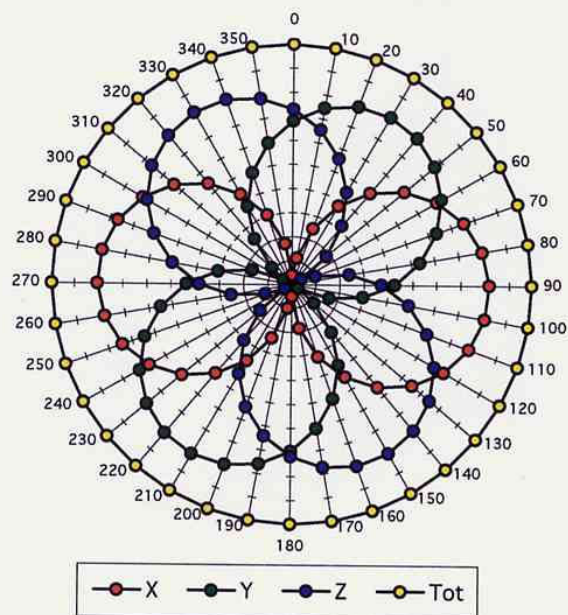
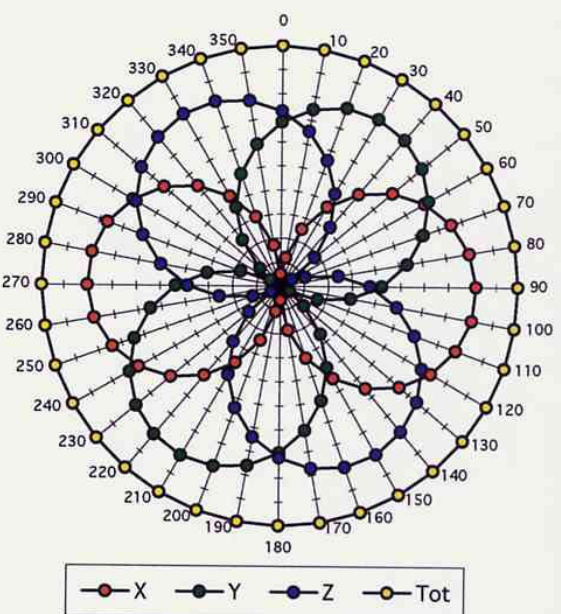
|                       |                              |             |             |
|-----------------------|------------------------------|-------------|-------------|
| Probe Tip to Boundary |                              | <b>1 mm</b> | <b>2 mm</b> |
| SAR <sub>be</sub> [%] | Without Correction Algorithm | 13.9        | 9.5         |
| SAR <sub>be</sub> [%] | With Correction Algorithm    | 0.2         | 0.1         |

### Sensor Offset

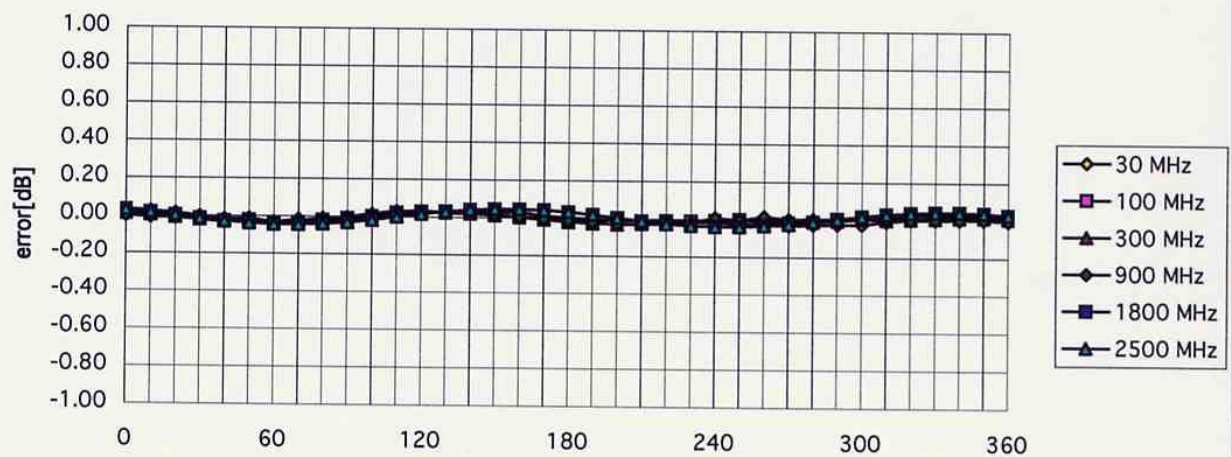
|                            |                                 |    |
|----------------------------|---------------------------------|----|
| Probe Tip to Sensor Center | <b>2.7</b>                      | mm |
| Optical Surface Detection  | <b>1.6 <math>\pm</math> 0.2</b> | mm |

Receiving Pattern ( $\phi$ ),  $\theta = 0^\circ$  $f = 30 \text{ MHz}$ , TEM cell ifi110 $f = 100 \text{ MHz}$ , TEM cell ifi110 $f = 300 \text{ MHz}$ , TEM cell ifi110 $f = 900 \text{ MHz}$ , TEM cell ifi110



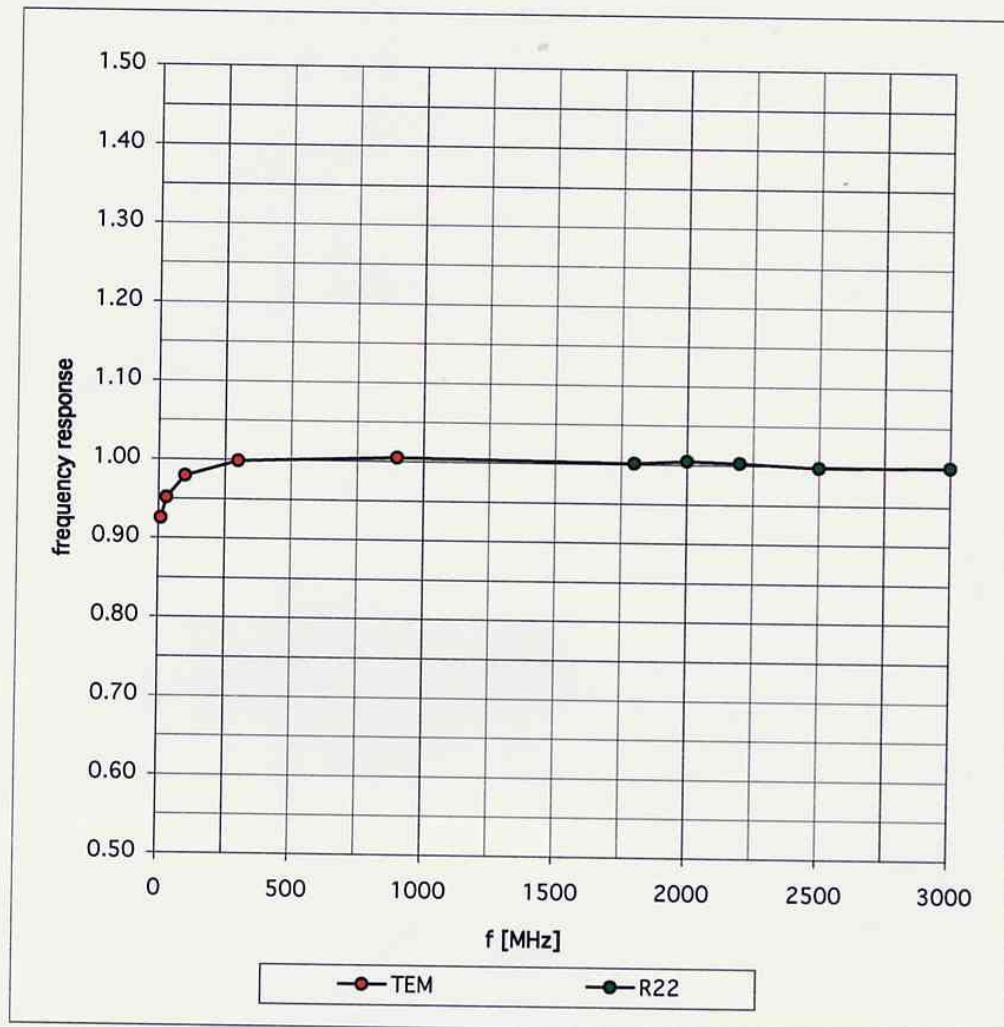
$f = 1800 \text{ MHz}$ , WG R22 $f = 2500 \text{ MHz}$ , WG R22

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



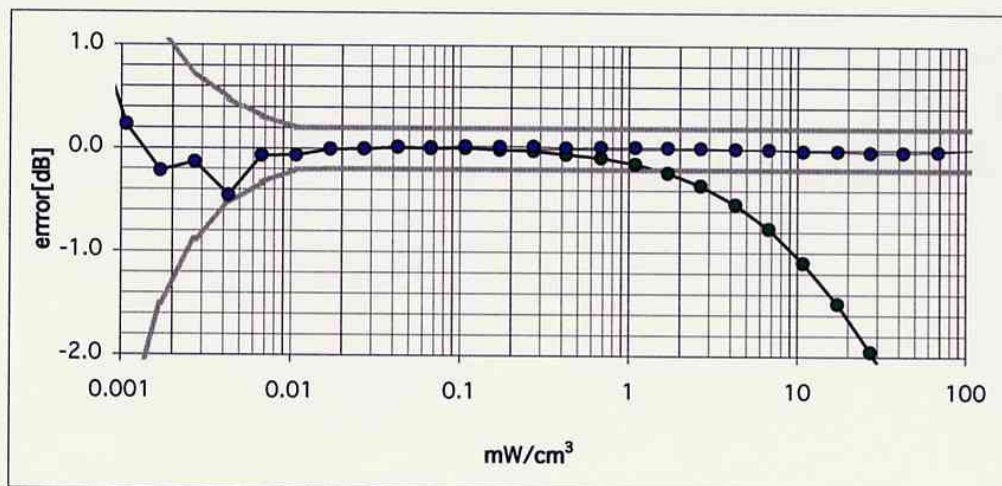
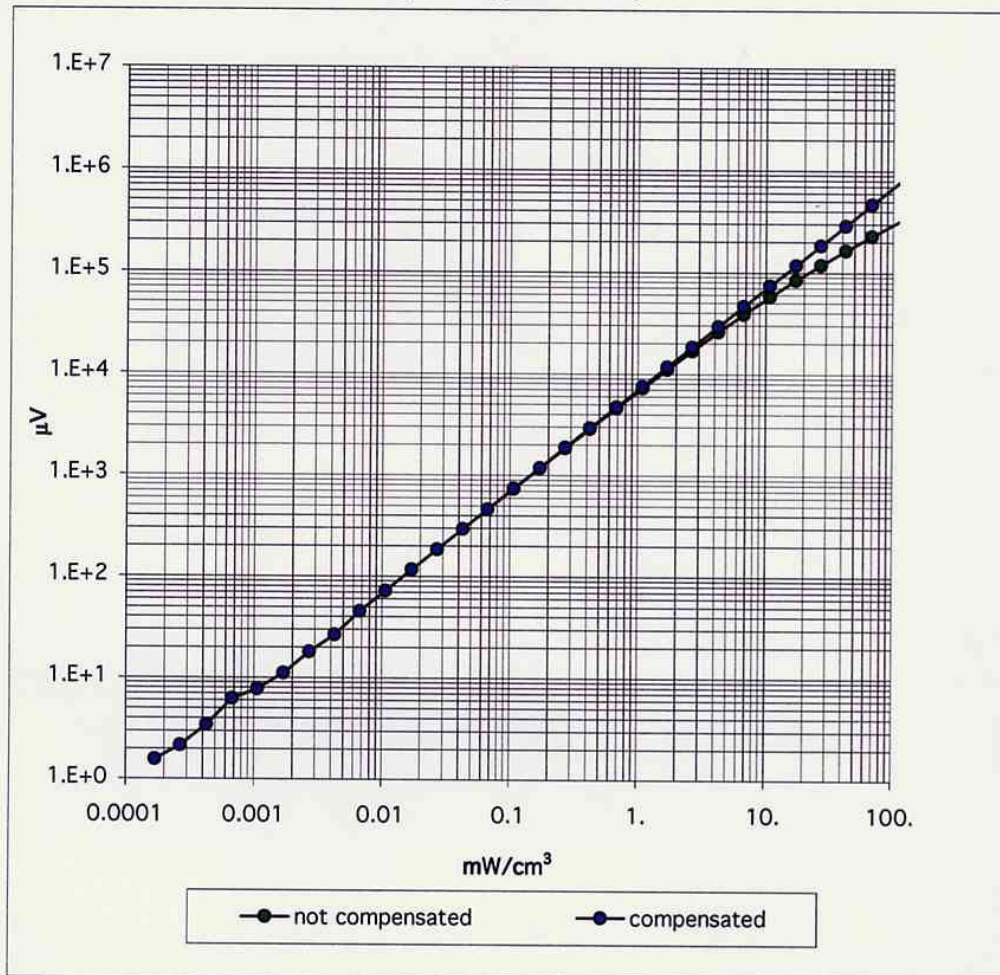
## Frequency Response of E-Field

( TEM-Cell:ifi110, Waveguide R22)



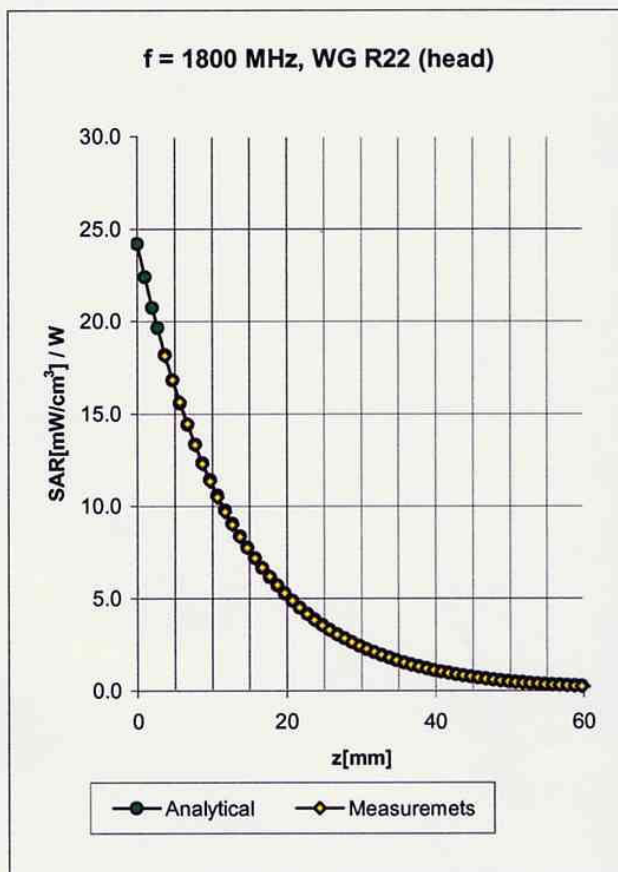
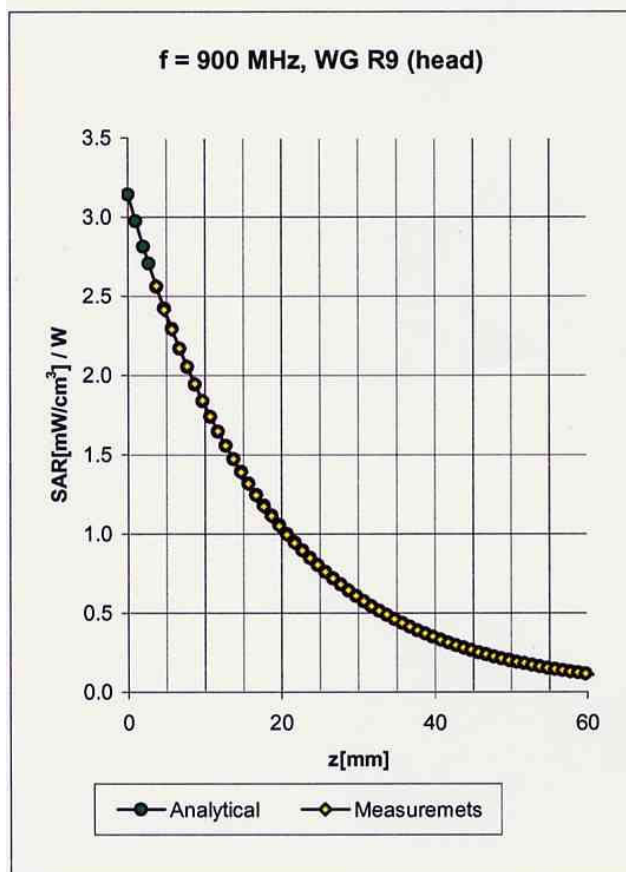
# Dynamic Range f(SAR<sub>brain</sub>)

( Waveguide R22 )





## 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 | <b>6.4</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>6.4</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.48</b> |
| ConvF Z | <b>6.4</b> $\pm 9.5\%$ (k=2) | Depth            | <b>2.13</b> |

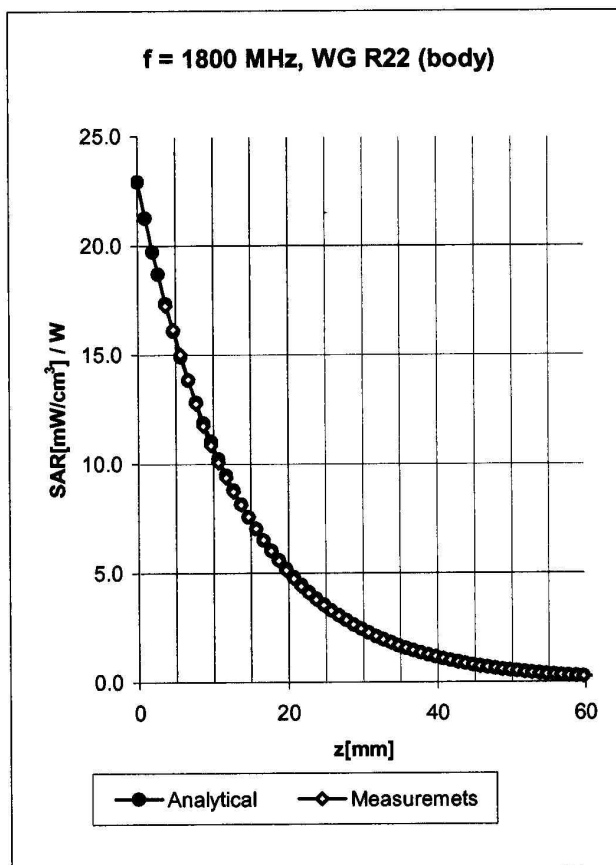
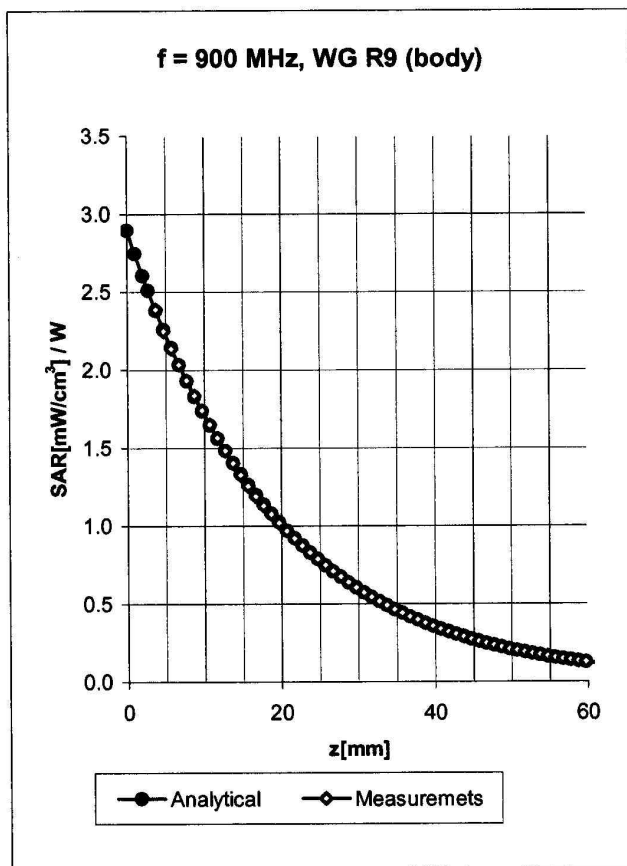
Head                      1800 MHz                       $\epsilon_r = 40.0 \pm 5\%$                        $\sigma = 1.40 \pm 5\%$  mho/m

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

|         |                              |                  |             |
|---------|------------------------------|------------------|-------------|
| ConvF X | <b>5.1</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>5.1</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.49</b> |
| ConvF Z | <b>5.1</b> $\pm 9.5\%$ (k=2) | Depth            | <b>2.70</b> |



## Conversion Factor Assessment



Body

900 MHz

 $\epsilon_r = 55.0 \pm 5\%$  $\sigma = 1.05 \pm 5\%$  mho/m

Valid for f=800-1000 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X

**6.2**  $\pm 9.5\%$  (k=2)

Boundary effect:

ConvF Y

**6.2**  $\pm 9.5\%$  (k=2)

Alpha

**0.40**

ConvF Z

**6.2**  $\pm 9.5\%$  (k=2)

Depth

**2.57**

Body

1800 MHz

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

Valid for f=1710-1910 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X

**4.8**  $\pm 9.5\%$  (k=2)

Boundary effect:

ConvF Y

**4.8**  $\pm 9.5\%$  (k=2)

Alpha

**0.54**

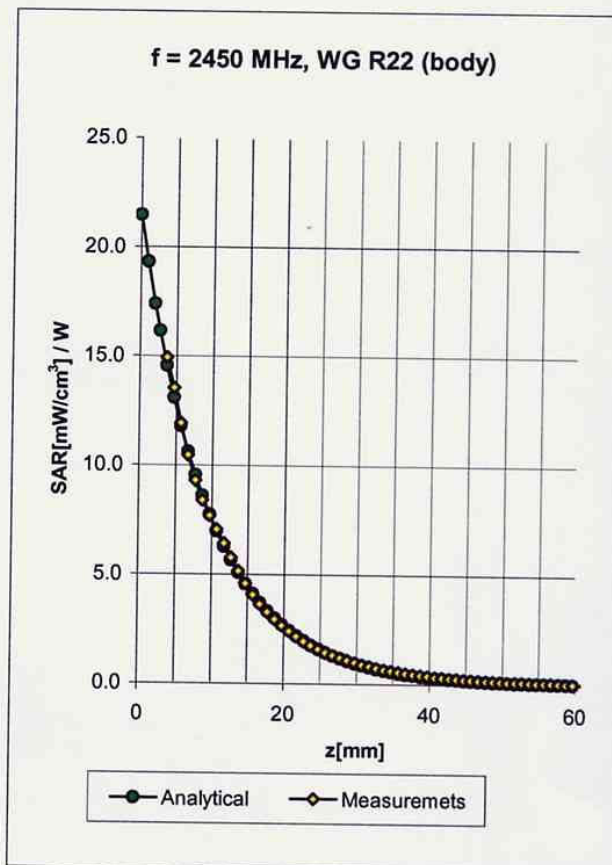
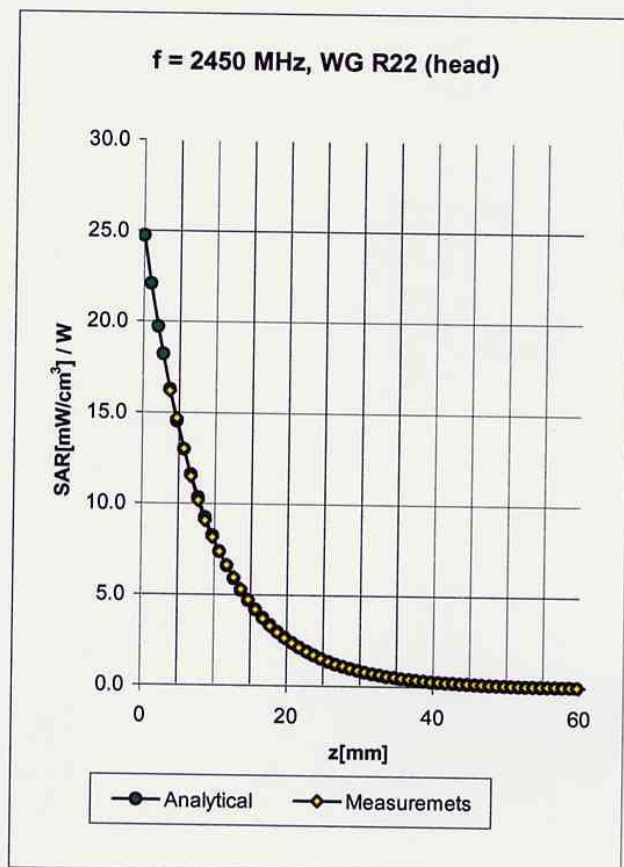
ConvF Z

**4.8**  $\pm 9.5\%$  (k=2)

Depth

**2.76**

## Conversion Factor Assessment



Head      2450      MHz       $\epsilon_r = 39.2 \pm 5\%$        $\sigma = 1.80 \pm 5\%$  mho/m

Valid for f=2400-2500 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

|         |                      |                  |             |
|---------|----------------------|------------------|-------------|
| ConvF X | 4.7 $\pm$ 8.9% (k=2) | Boundary effect: |             |
| ConvF Y | 4.7 $\pm$ 8.9% (k=2) | Alpha            | <b>1.00</b> |
| ConvF Z | 4.7 $\pm$ 8.9% (k=2) | Depth            | <b>1.89</b> |

Body      2450      MHz       $\epsilon_r = 52.7 \pm 5\%$        $\sigma = 1.95 \pm 5\%$  mho/m

Valid for f=2400-2500 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

|         |                      |                  |             |
|---------|----------------------|------------------|-------------|
| ConvF X | 4.4 $\pm$ 8.9% (k=2) | Boundary effect: |             |
| ConvF Y | 4.4 $\pm$ 8.9% (k=2) | Alpha            | <b>1.21</b> |
| ConvF Z | 4.4 $\pm$ 8.9% (k=2) | Depth            | <b>1.59</b> |