

Client **Samsung (Dymstec)**

## CALIBRATION CERTIFICATE

Object(s) **ET3DV6 - SN:1551**

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

Calibration date: **August 28, 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<br><b>Nico Vetterli</b> | Function<br><b>Technician</b>          | Signature<br> |
| Approved by:   | Name<br><b>Katia Pokovic</b> | Function<br><b>Laboratory Director</b> | Signature<br> |

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:1551

|                   |                  |
|-------------------|------------------|
| Manufactured:     | October 16, 2000 |
| Last calibration: | May 22, 2003     |
| Recalibrated:     | August 28, 2003  |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

## DASY - Parameters of Probe: ET3DV6 SN:1551

### Sensitivity in Free Space

### Diode Compression

|       |                                                 |       |           |    |
|-------|-------------------------------------------------|-------|-----------|----|
| NormX | <b>1.50</b> $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP X | <b>94</b> | mV |
| NormY | <b>1.54</b> $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP Y | <b>94</b> | mV |
| NormZ | <b>1.43</b> $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP Z | <b>94</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>6.7</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>6.7</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.27</b> |
| ConvF Z | <b>6.7</b> $\pm 9.5\%$ (k=2) | Depth            | <b>3.11</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>5.4</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>5.4</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.45</b> |
| ConvF Z | <b>5.4</b> $\pm 9.5\%$ (k=2) | Depth            | <b>2.77</b> |

### Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm

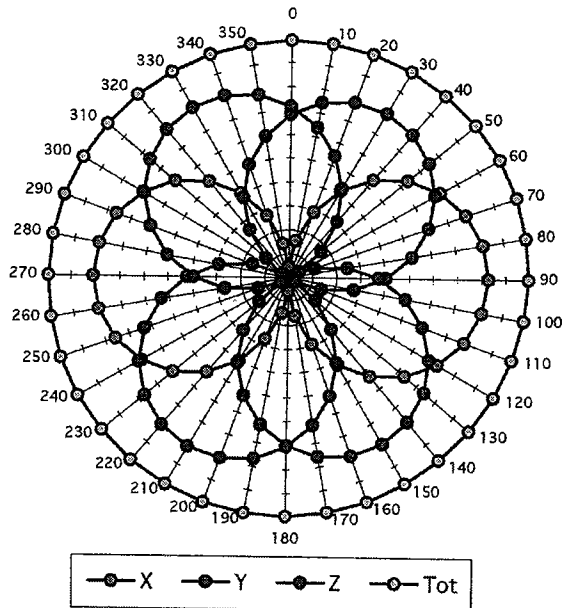
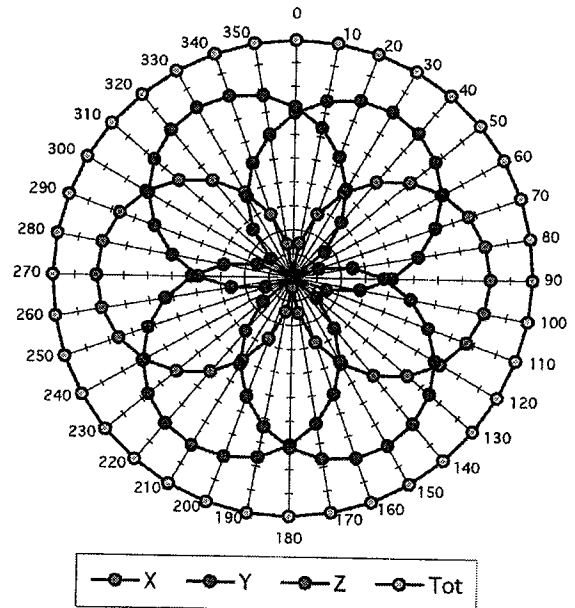
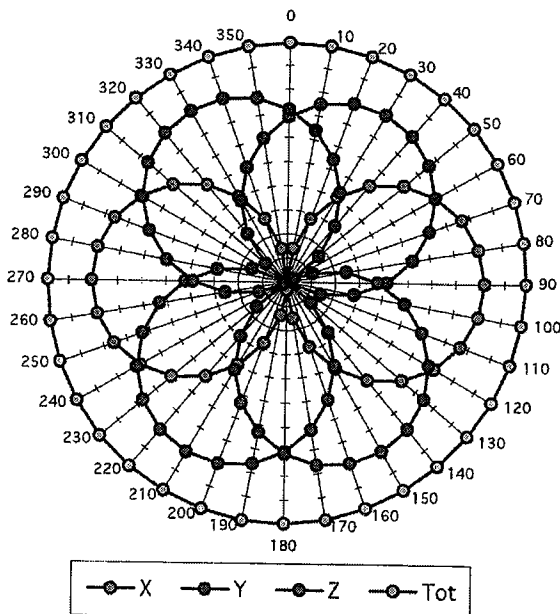
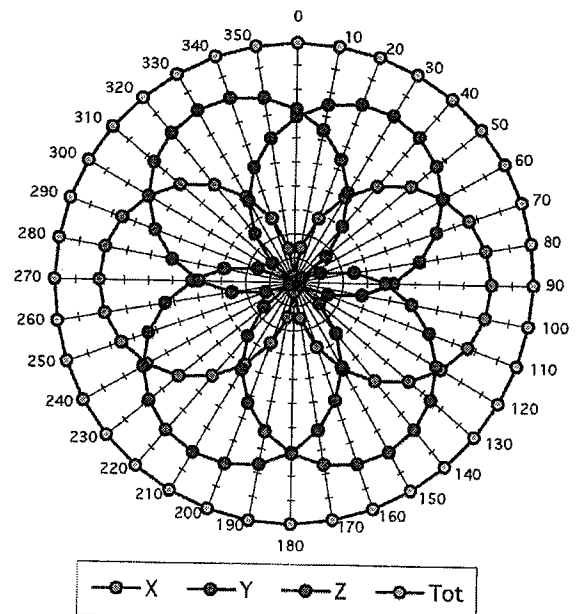
|                       |                              |      |      |
|-----------------------|------------------------------|------|------|
| Probe Tip to Boundary |                              | 1 mm | 2 mm |
| SAR <sub>be</sub> [%] | Without Correction Algorithm | 9.5  | 5.9  |
| SAR <sub>be</sub> [%] | With Correction Algorithm    | 0.4  | 0.5  |

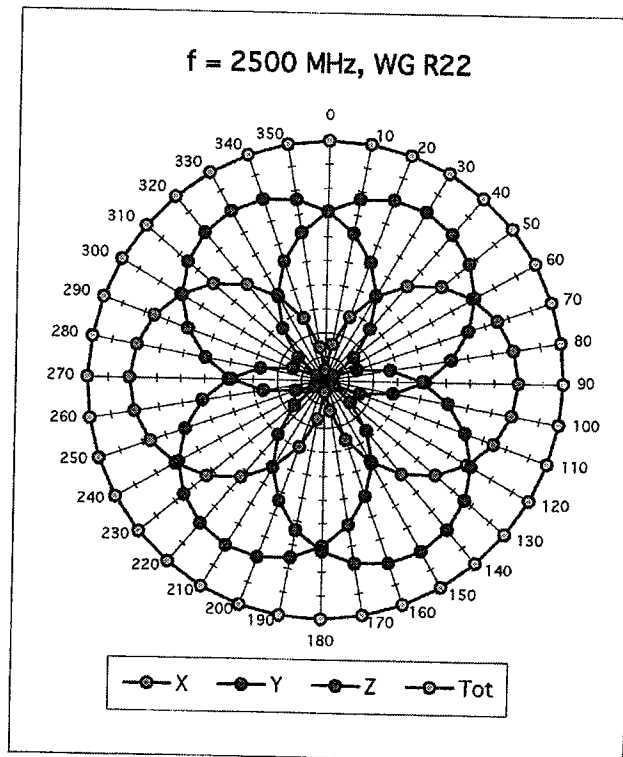
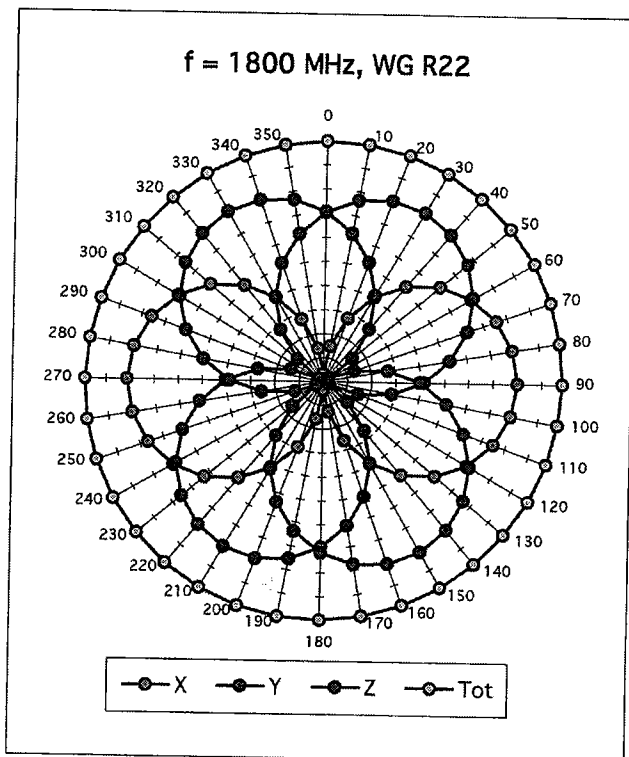
Head 1800 MHz Typical SAR gradient: 10 % per mm

|                       |                              |      |      |
|-----------------------|------------------------------|------|------|
| Probe Tip to Boundary |                              | 1 mm | 2 mm |
| SAR <sub>be</sub> [%] | Without Correction Algorithm | 13.1 | 9.0  |
| SAR <sub>be</sub> [%] | With Correction Algorithm    | 0.2  | 0.1  |

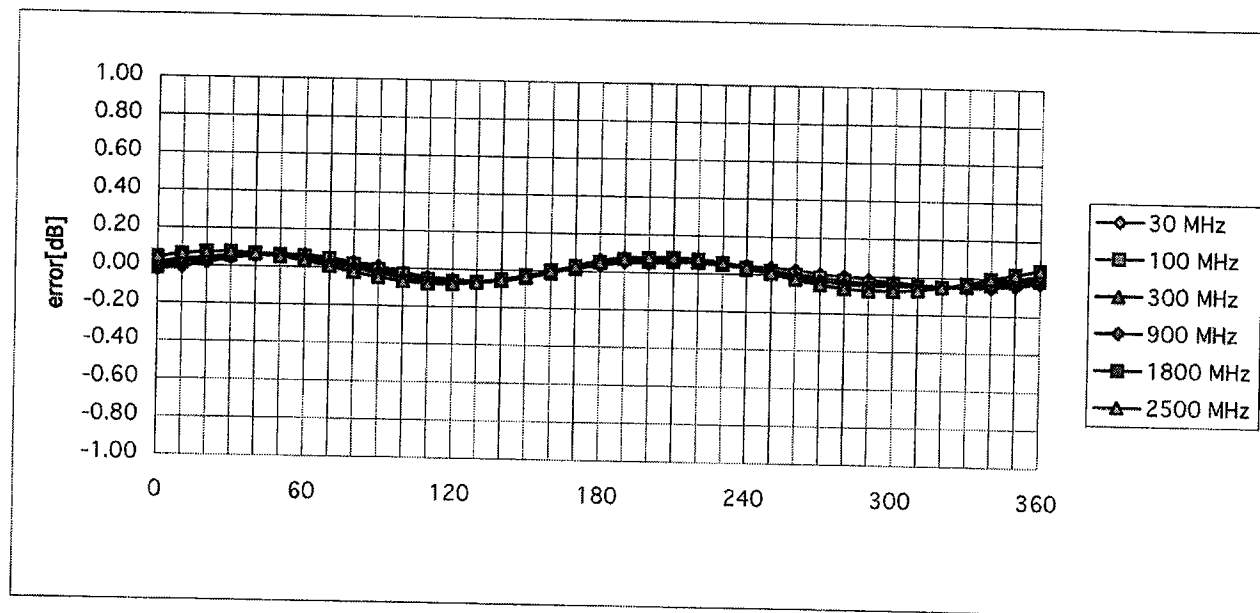
### Sensor Offset

|                            |                                 |    |
|----------------------------|---------------------------------|----|
| 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 MHz, TEM cell ifi110****f = 100 MHz, TEM cell ifi110****f = 300 MHz, TEM cell ifi110****f = 900 MHz, TEM cell ifi110**

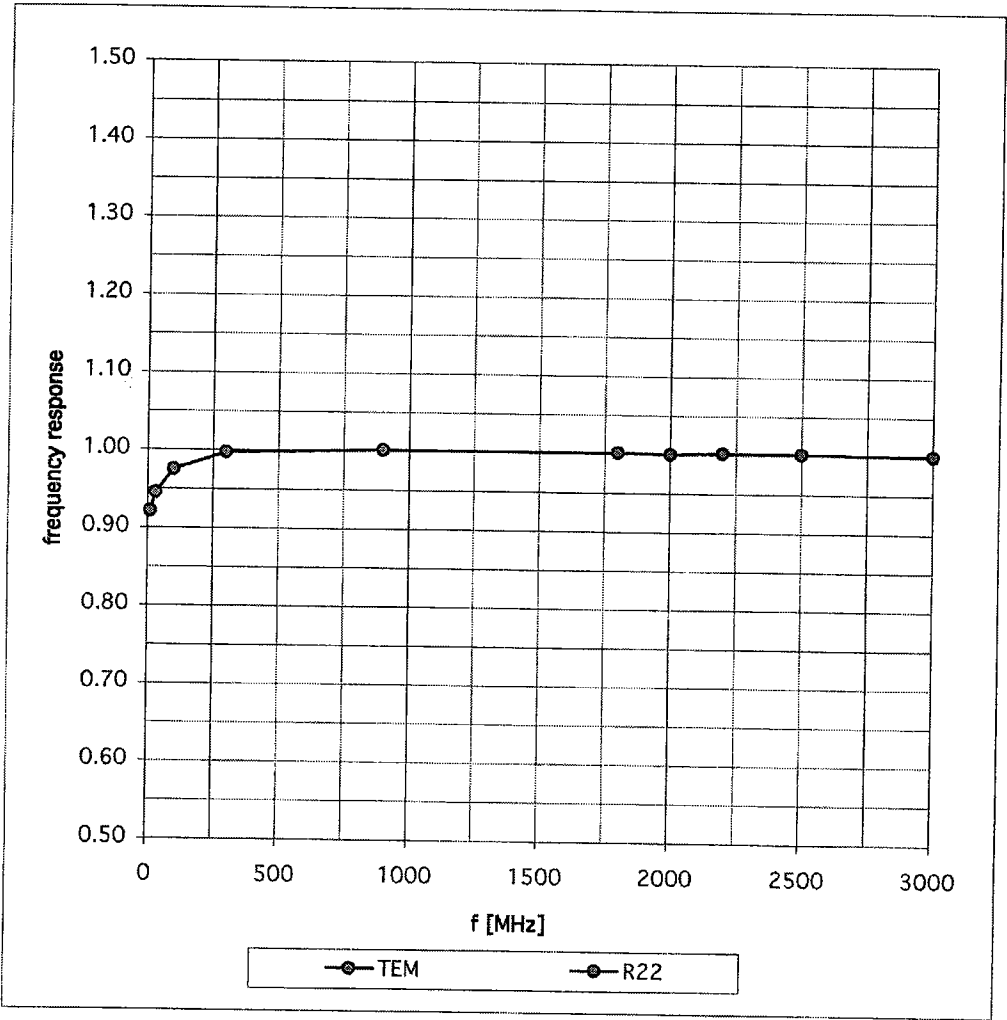


### Isotropy Error ( $\phi$ ), $\theta = 0^\circ$



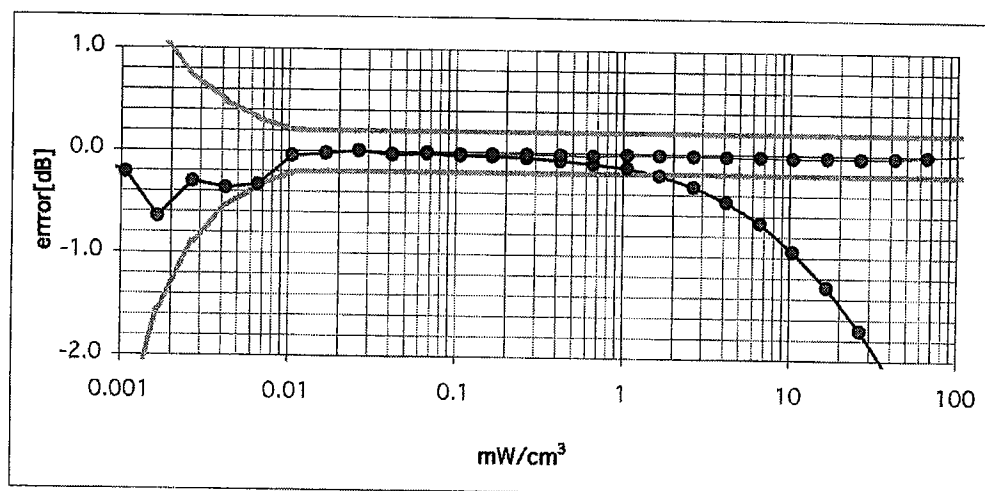
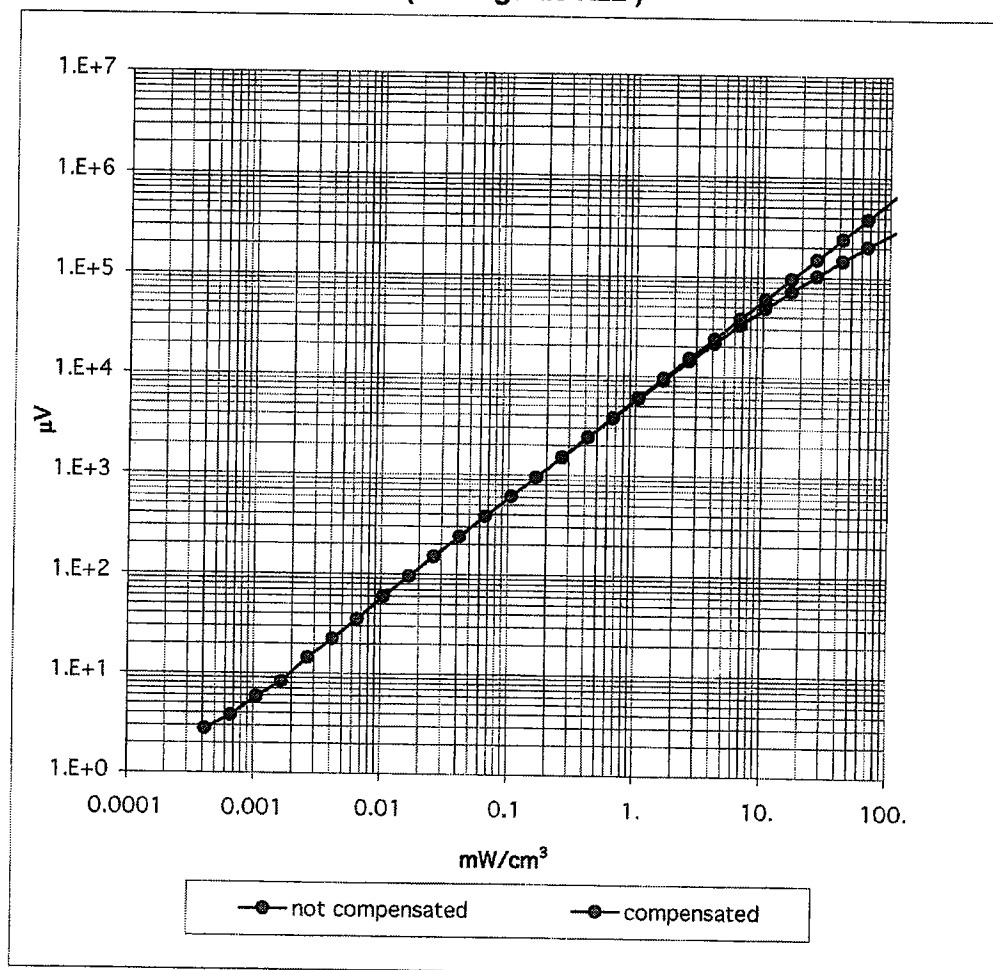
# Frequency Response of E-Field

( TEM-Cell:ifi110, Waveguide R22)

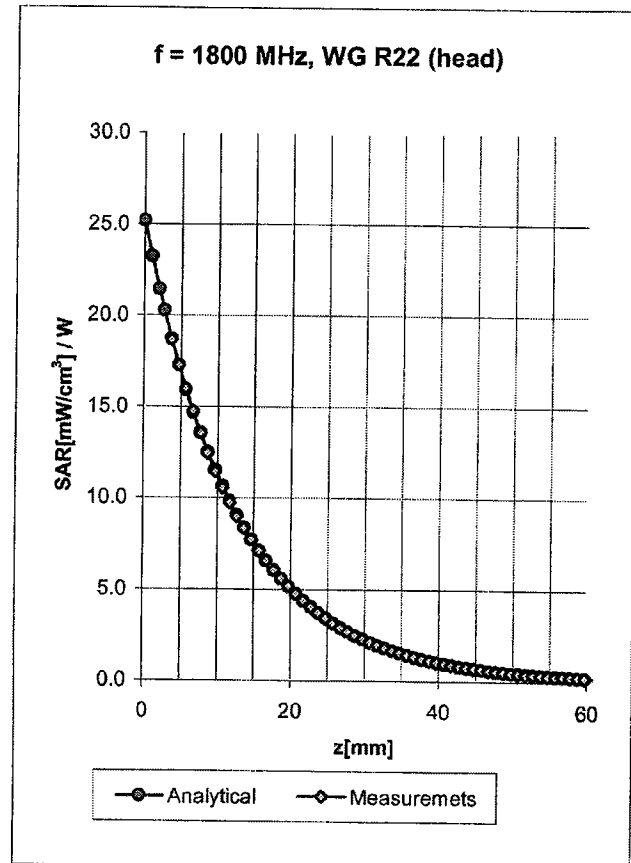
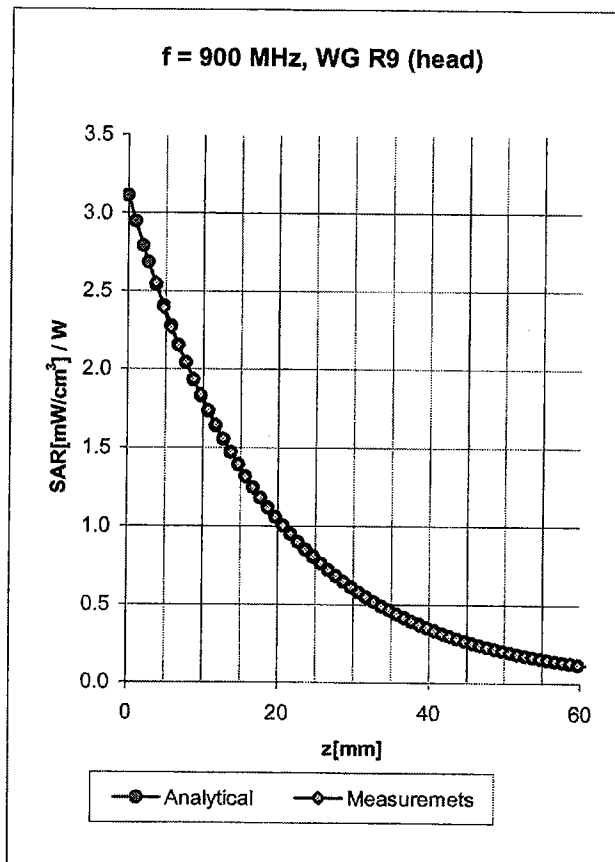


# Dynamic Range f(SARhead)

( 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

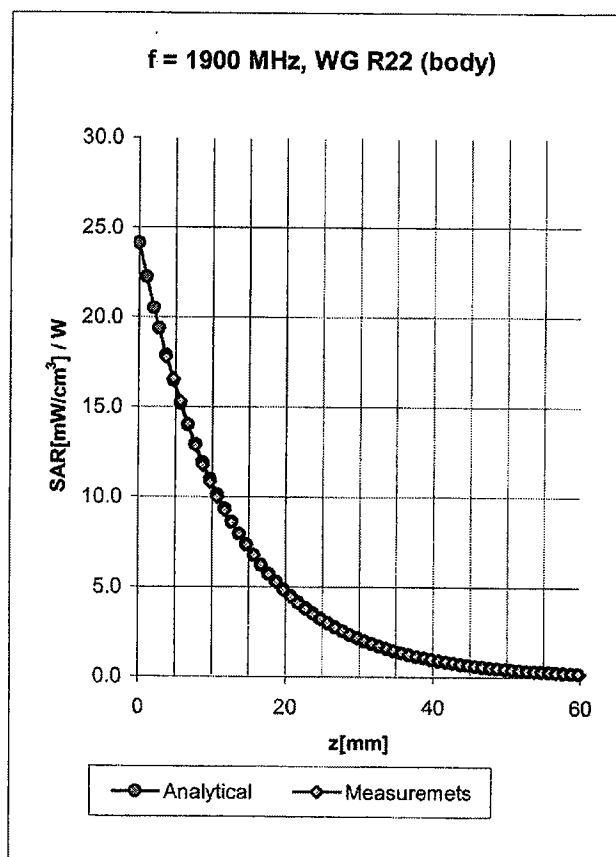
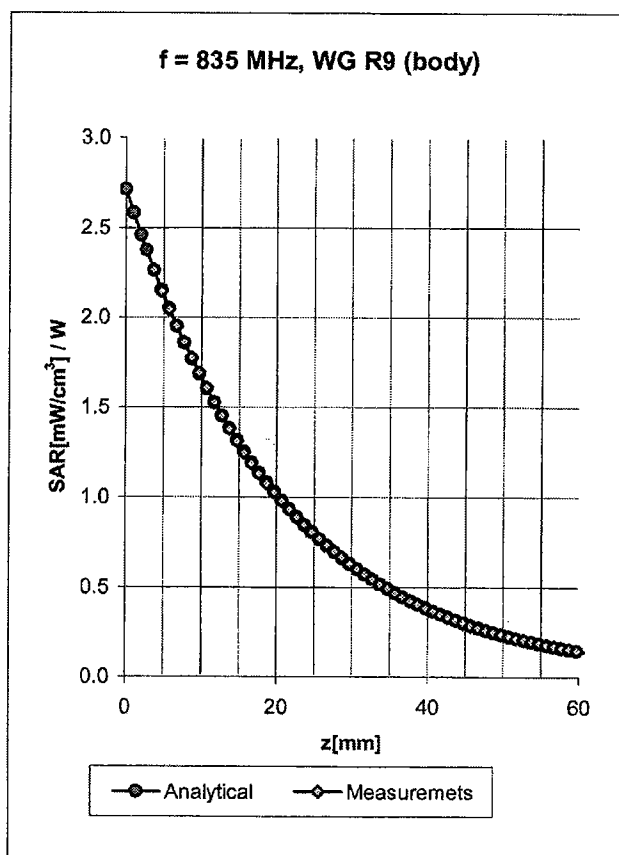
|         |                              |                  |             |
|---------|------------------------------|------------------|-------------|
| ConvF X | <b>6.7</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>6.7</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.27</b> |
| ConvF Z | <b>6.7</b> $\pm 9.5\%$ (k=2) | Depth            | <b>3.11</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>5.4</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>5.4</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.45</b> |
| ConvF Z | <b>5.4</b> $\pm 9.5\%$ (k=2) | Depth            | <b>2.77</b> |

## 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 | <b>6.9</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>6.9</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.37</b> |
| ConvF Z | <b>6.9</b> $\pm 9.5\%$ (k=2) | Depth            | <b>2.46</b> |

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 | <b>4.8</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>4.8</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.57</b> |
| ConvF Z | <b>4.8</b> $\pm 9.5\%$ (k=2) | Depth            | <b>2.70</b> |

## Deviation from Isotropy in HSL

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

