

S-039-19

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

**Client** **EMC Technologies**

## CALIBRATION CERTIFICATE

**Object(s)** ES3DV3 - SN:3029

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

**Calibration date:** September 23, 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                 |
| Fuke 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: Katja Pokovic Function: Laboratory Director

**Approved by:** Name: Niels Kuster Function: Quality Manager

Signature

Date issued: October 5, 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 ES3DV3

## SN:3029

|                   |                    |
|-------------------|--------------------|
| Manufactured:     | August 18, 2003    |
| Last calibration: | September 23, 2003 |

**Calibrated for DASY Systems**

(Note: non-compatible with DASY2 system!)

# DASY - Parameters of Probe: ES3DV3 SN:3029

## Sensitivity in Free Space

## Diode Compression

|       |                                                 |       |           |    |
|-------|-------------------------------------------------|-------|-----------|----|
| NormX | <b>0.91</b> $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP X | <b>98</b> | mV |
| NormY | <b>1.02</b> $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP Y | <b>98</b> | mV |
| NormZ | <b>1.04</b> $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP Z | <b>98</b> | mV |

## Sensitivity in Tissue Simulating Liquid

**Body**                      **5200 MHz**                       $\epsilon_r = 53.3 \pm 5\%$                        $\sigma = 1.52 \pm 5\% \text{ mho/m}$

Valid for f=4940-5460 MHz with Body Tissue Simulating Liquid according to OET65-SuppC

|         |                                |                  |             |
|---------|--------------------------------|------------------|-------------|
| ConvF X | <b>2.05</b> $\pm 16.6\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>2.05</b> $\pm 16.6\%$ (k=2) | Alpha            | <b>0.95</b> |
| ConvF Z | <b>2.05</b> $\pm 16.6\%$ (k=2) | Depth            | <b>1.75</b> |

**Body**                      **5800 MHz**                       $\epsilon_r = 48.2 \pm 5\%$                        $\sigma = 6.0 \pm 5\% \text{ mho/m}$

Valid for f=5510-6090 MHz with Body Tissue Simulating Liquid according to OET65-SuppC

|         |                                |                  |             |
|---------|--------------------------------|------------------|-------------|
| ConvF X | <b>1.80</b> $\pm 16.6\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>1.80</b> $\pm 16.6\%$ (k=2) | Alpha            | <b>1.10</b> |
| ConvF Z | <b>1.80</b> $\pm 16.6\%$ (k=2) | Depth            | <b>1.70</b> |

## Boundary Effect

**Body**                      **5200 MHz**                      **Typical SAR gradient: 25 % per mm**

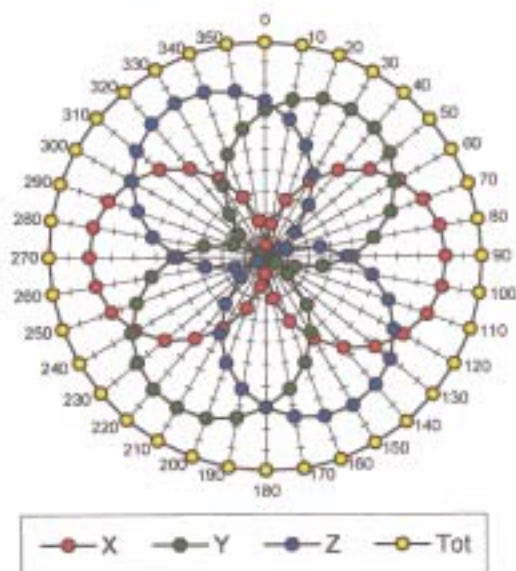
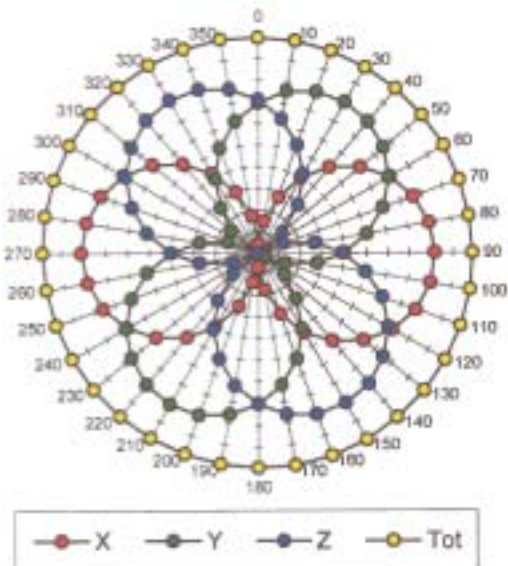
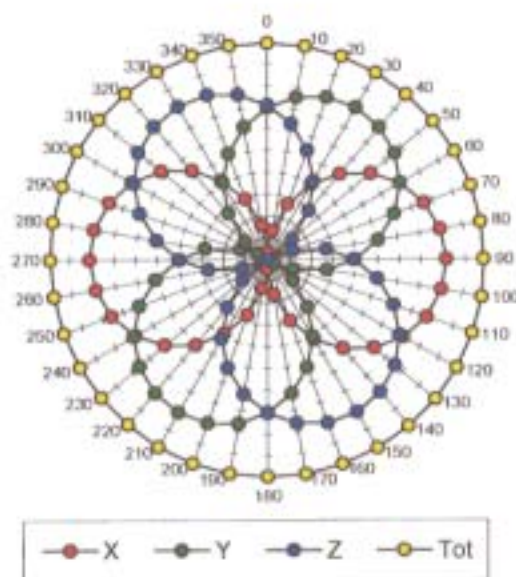
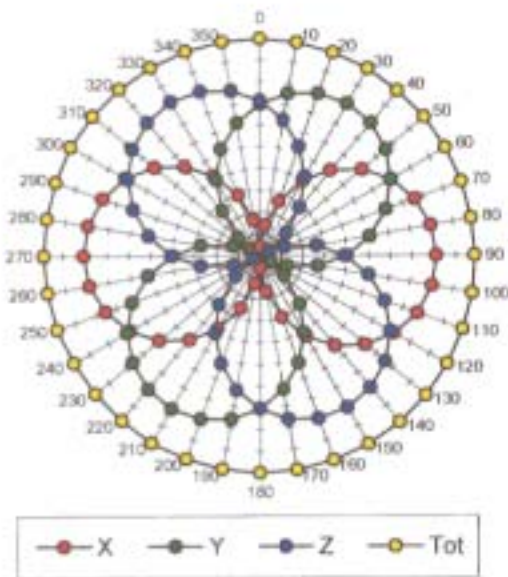
|                                                    |  |             |             |
|----------------------------------------------------|--|-------------|-------------|
| Probe Tip to Boundary                              |  | <b>1 mm</b> | <b>2 mm</b> |
| SAR <sub>be</sub> [%] Without Correction Algorithm |  | 27.8        | 10.0        |
| SAR <sub>be</sub> [%] With Correction Algorithm    |  | 0.1         | 0.0         |

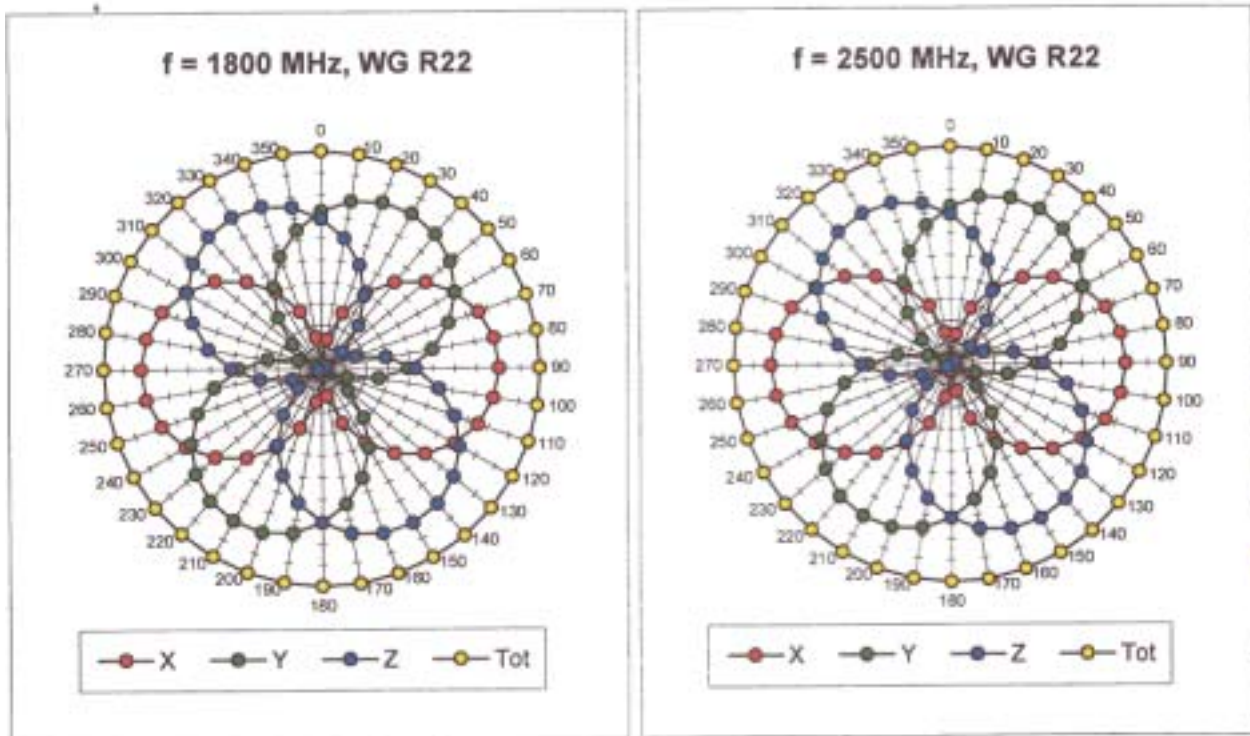
**Body**                      **5800 MHz**                      **Typical SAR gradient: 30 % per mm**

|                                                    |  |             |             |
|----------------------------------------------------|--|-------------|-------------|
| Probe Tip to Boundary                              |  | <b>1 mm</b> | <b>2 mm</b> |
| SAR <sub>be</sub> [%] Without Correction Algorithm |  | 30.1        | 10.1        |
| SAR <sub>be</sub> [%] With Correction Algorithm    |  | 0.1         | 0.0         |

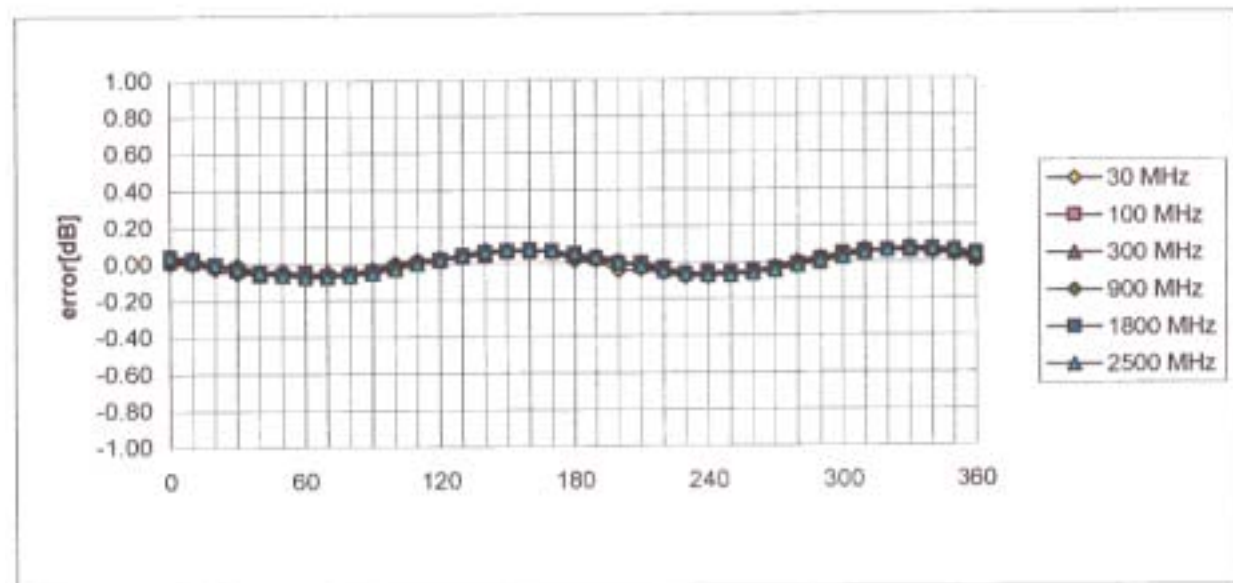
## Sensor Offset

|                            |            |    |
|----------------------------|------------|----|
| Probe Tip to Sensor Center | <b>2.0</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

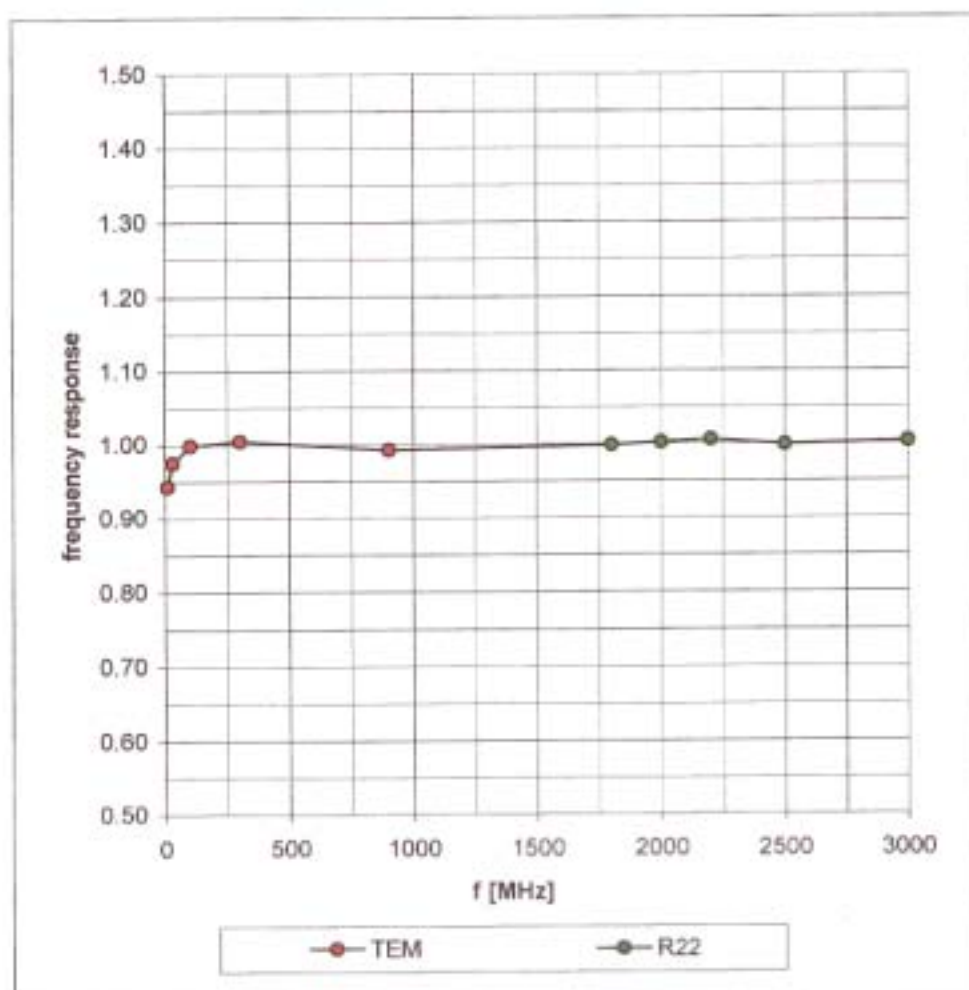


### Isotropy Error ( $\phi$ ), $\theta = 0^\circ$

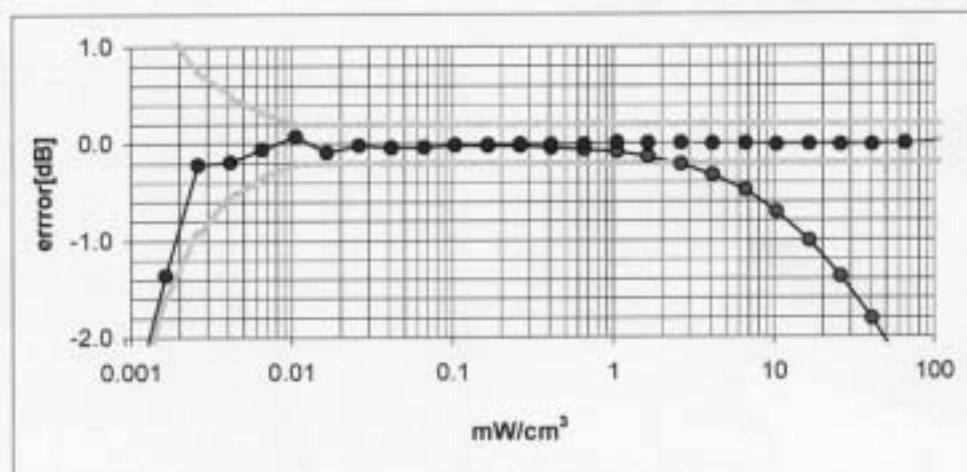
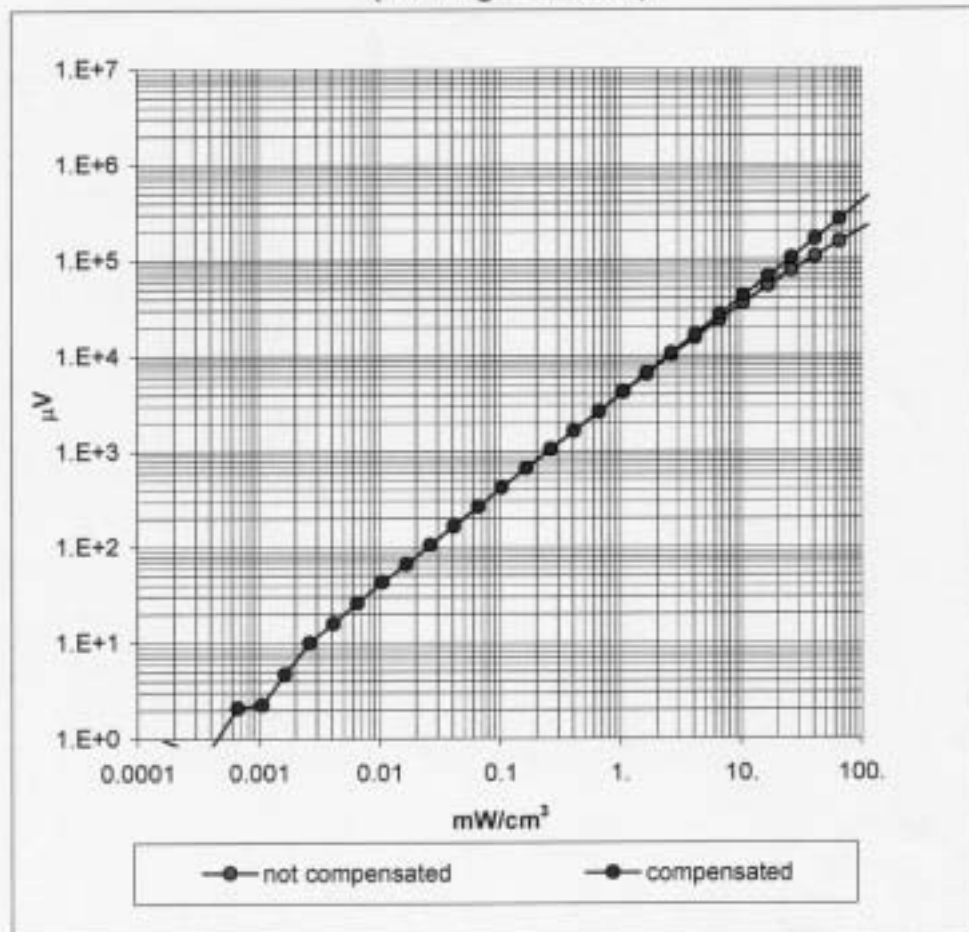


## Frequency Response of E-Field

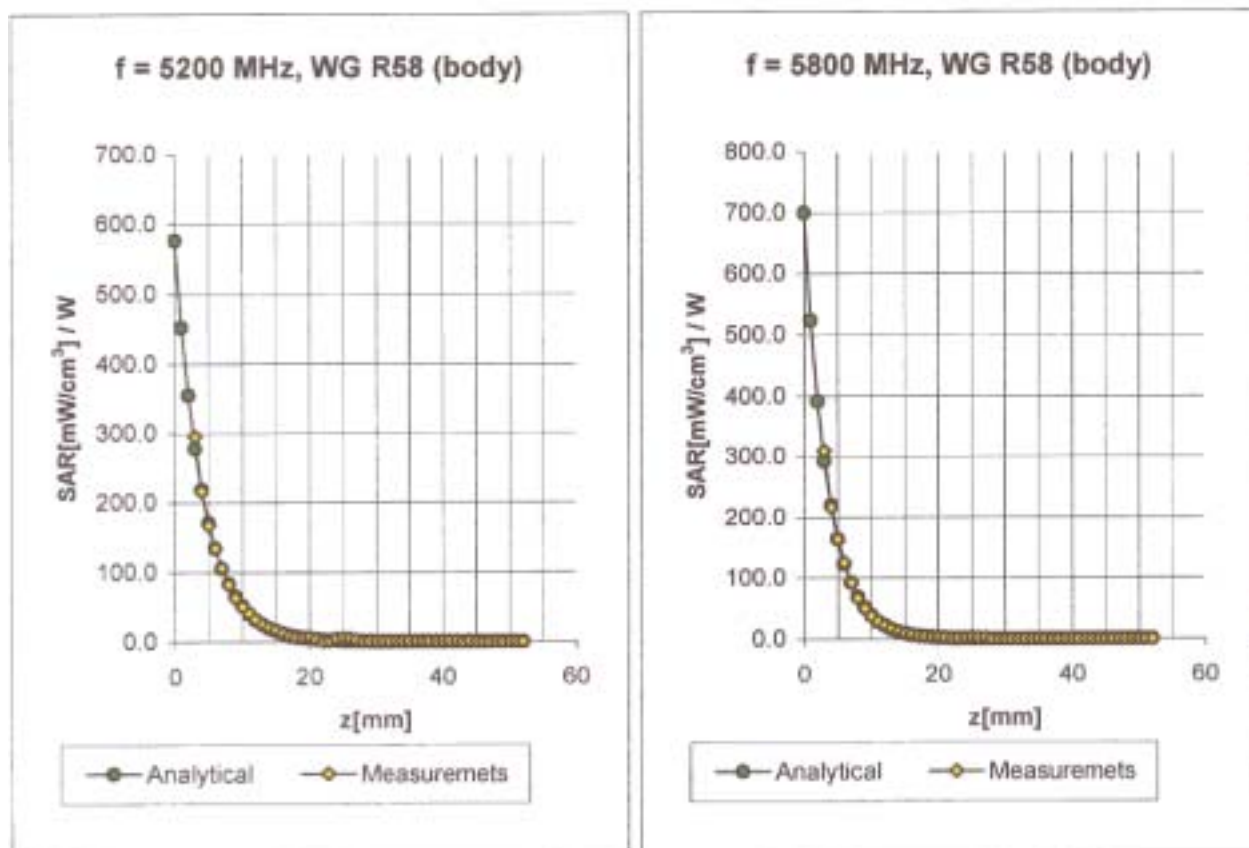
( TEM-Cell:ifi110, Waveguide R22)



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



## Conversion Factor Assessment



Body      5200 MHz       $\epsilon_r = 53.3 \pm 5\%$        $\sigma = 1.52 \pm 5\%$  mho/m

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## Deviation from Isotropy in HSL

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

