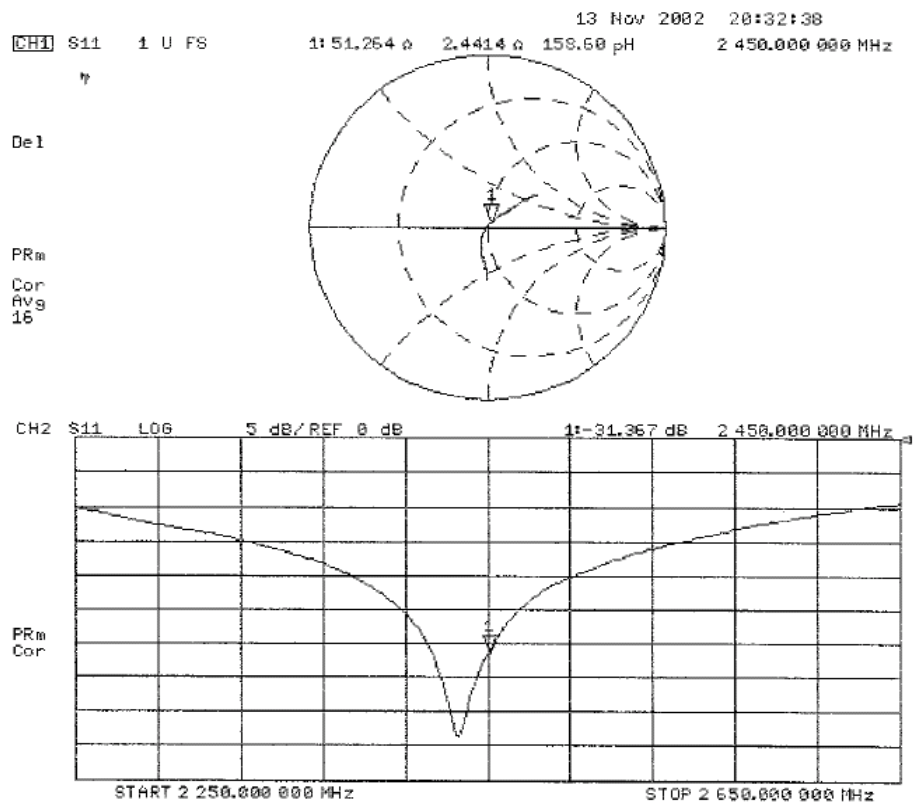




Date/Time: 11/15/02 14:25:17

Test Laboratory: SPEAG, Zurich, Switzerland  
File Name: SN713\_SN1507\_M2450\_141102.da4

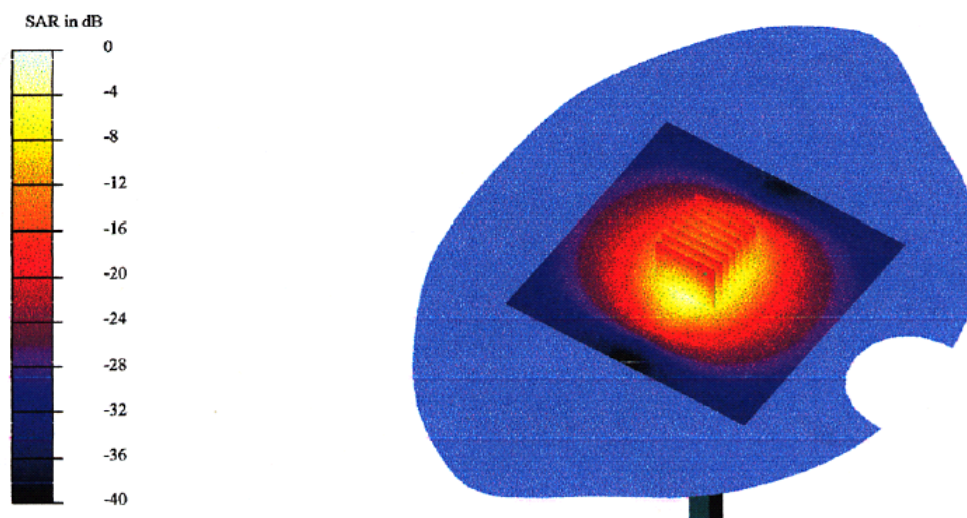
**DUT: Dipole 2450 MHz Type & Serial Number: D2450V2 - SN713**  
**Program: Dipole Calibration; Pin = 250 mW; d = 10 mm**

Communication System: CW-2450; Frequency: 2450 MHz; Duty Cycle: 1:1  
Medium: Muscle 2450 MHz ( $\sigma = 1.96$  mho/m,  $\epsilon = 51.15$ ,  $\rho = 1000$  kg/m<sup>3</sup>)  
Phantom section: FlatSection

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(4.5, 4.5, 4.5); Calibrated: 1/24/2002
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN410; Calibrated: 7/18/2002
- Phantom: SAM 4.0 - TP:1006
- Software: DASY4, V4.0 Build 35

**Area Scan (81x81x1):** Measurement grid: dx=15mm, dy=15mm  
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm  
Reference Value = 95.2 V/m  
Peak SAR = 25 mW/g  
SAR(1 g) = 12.9 mW/g; SAR(10 g) = 5.99 mW/g  
Power Drift = 0.02 dB



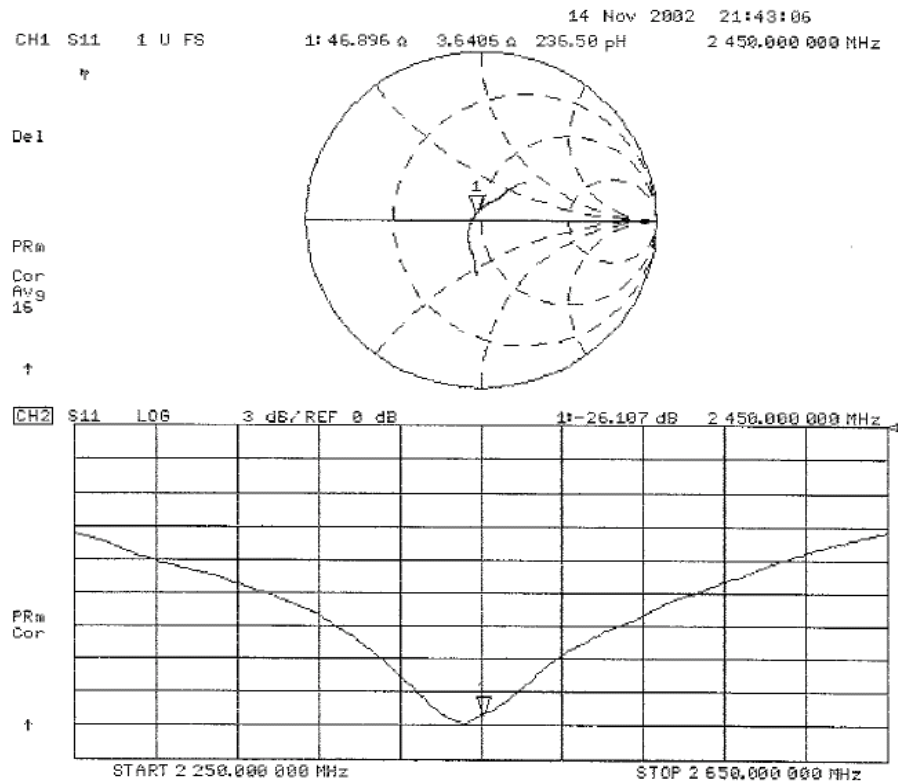
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## **APPENDIX 5 : Dosimetric E-Field Probe Calibration (ET3DV6,S/N: 1685)**

Schmid & Partner Engineering AG

**s p e a g**

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Phone +41 1 245 9700, Fax +41 1 245 9779  
info@speag.com, <http://www.speag.com>

## IMPORTANT NOTICE

### USAGE OF PROBES IN ORGANIC SOLVENTS

Diethylene Glycol Monobutyl Ether (the basis for liquids above 1 GHz), as many other organic solvents, is a very effective softener for synthetic materials. These solvents can cause irreparable damage to certain SPEAG products, except those which are explicitly declared as compliant with organic solvents.

**Compatible Probes:**

- ET3DV6
- ET3DV6R
- ES3DV2
- ER3DV6
- H3DV6

**Important Note for ET3DV6 Probes:**

The ET3DV6 probes shall not be exposed to solvents longer than necessary for the measurements and shall be cleaned daily after use with warm water and stored dry.

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Technical Note 01.06.15-1

June 2002

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

**Client** **UL Apex (MTT)**

| CALIBRATION CERTIFICATE                                                                                                                                                                                                        |                                                                     |                                           |                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------|----------------------------------------------------------------------------------------------------|
| Object(s)                                                                                                                                                                                                                      | ET3DV6 - SN:1685                                                    |                                           |                                                                                                    |
| Calibration procedure(s)                                                                                                                                                                                                       | QA CAL-01.v2<br>Calibration procedure for dosimetric E-field probes |                                           |                                                                                                    |
| Calibration date:                                                                                                                                                                                                              | October 10, 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 23, 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. |                                                                     |                                           |                                                                                                    |

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# Probe ET3DV6

## SN:1685

|                   |                  |
|-------------------|------------------|
| Manufactured:     | April 3, 2002    |
| Last calibration: | May 10, 2002     |
| Recalibrated:     | October 10, 2003 |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1685

October 10, 2003

## DASY - Parameters of Probe: ET3DV6 SN:1685

### Sensitivity in Free Space

|       |                                                 |
|-------|-------------------------------------------------|
| NormX | <b>1.60</b> $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormY | <b>1.65</b> $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormZ | <b>1.56</b> $\mu\text{V}/(\text{V}/\text{m})^2$ |

### Diode Compression

|       |           |    |
|-------|-----------|----|
| DCP X | <b>95</b> | mV |
| DCP Y | <b>95</b> | mV |
| DCP Z | <b>95</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>6.6</b> $\pm 9.5\%$ (k=2) | Boundary effect:  |
| ConvF Y | <b>6.6</b> $\pm 9.5\%$ (k=2) | Alpha <b>0.26</b> |
| ConvF Z | <b>6.6</b> $\pm 9.5\%$ (k=2) | Depth <b>3.07</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>5.2</b> $\pm 9.5\%$ (k=2) | Boundary effect:  |
| ConvF Y | <b>5.2</b> $\pm 9.5\%$ (k=2) | Alpha <b>0.41</b> |
| ConvF Z | <b>5.2</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                              | <b>1 mm</b> | <b>2 mm</b> |
| SAR <sub>pe</sub> [%] Without Correction Algorithm | 8.9         | 5.4         |
| SAR <sub>pe</sub> [%] With Correction Algorithm    | 0.4         | 0.5         |

Head                      **1800 MHz**                      Typical SAR gradient: 10 % per mm

|                                                    |             |             |
|----------------------------------------------------|-------------|-------------|
| Probe Tip to Boundary                              | <b>1 mm</b> | <b>2 mm</b> |
| SAR <sub>pe</sub> [%] Without Correction Algorithm | 11.8        | 8.4         |
| SAR <sub>pe</sub> [%] With Correction Algorithm    | 0.4         | 0.2         |

### 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 |

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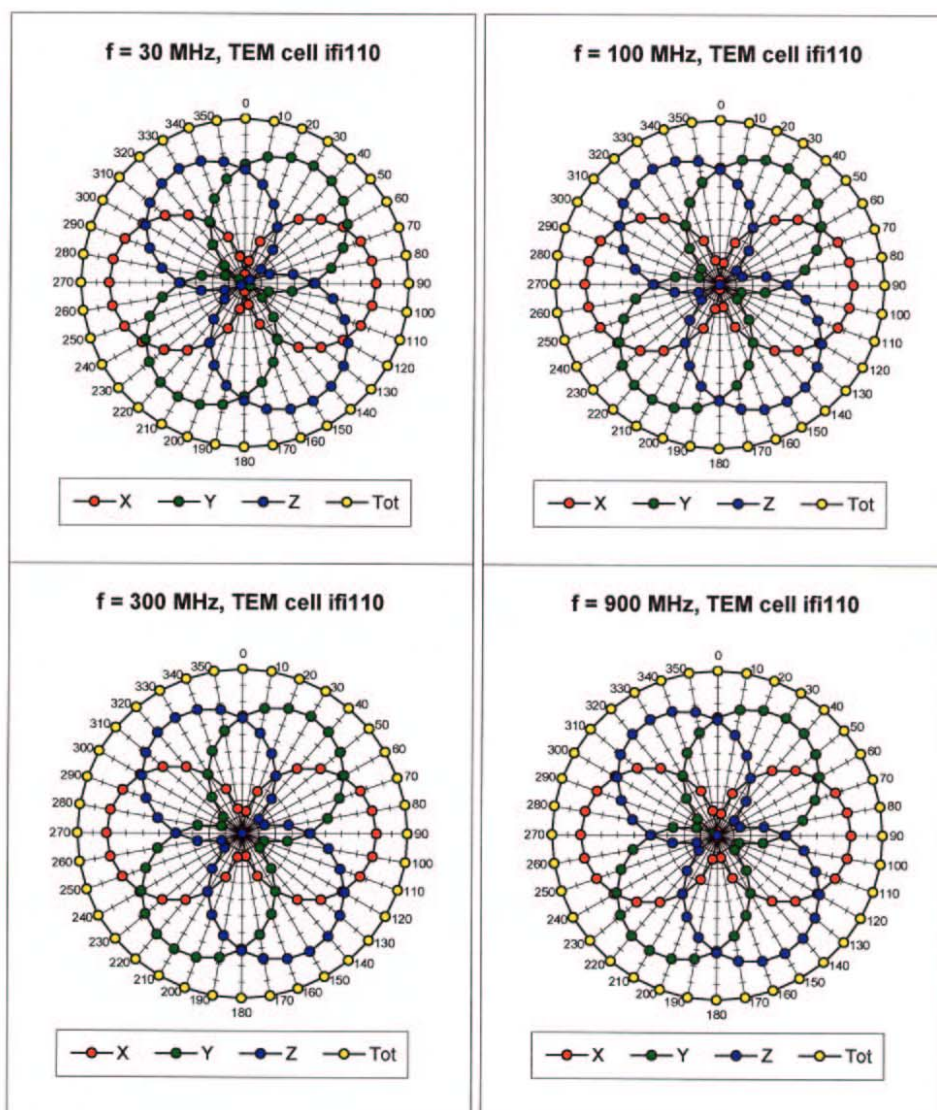
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ET3DV6 SN:1685

October 10, 2003

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



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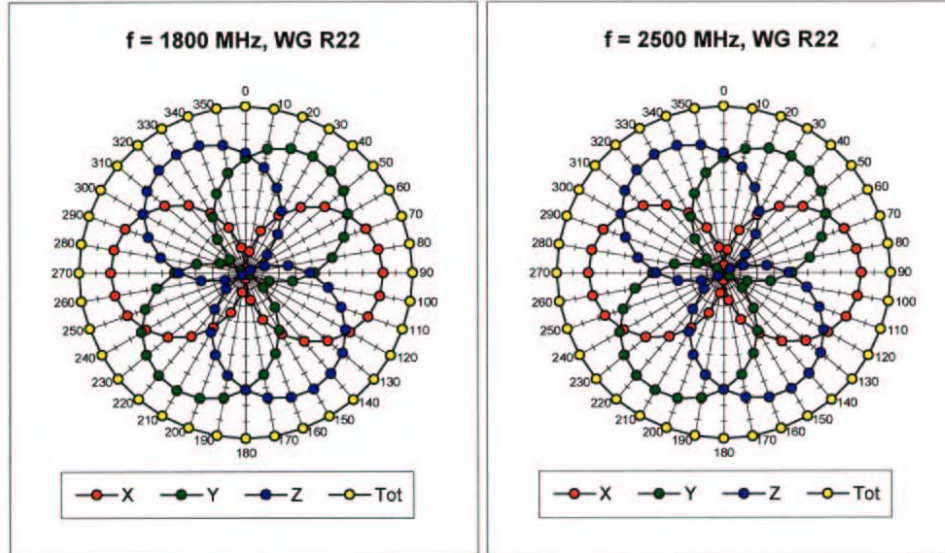
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Telephone: +81 596 24 8116

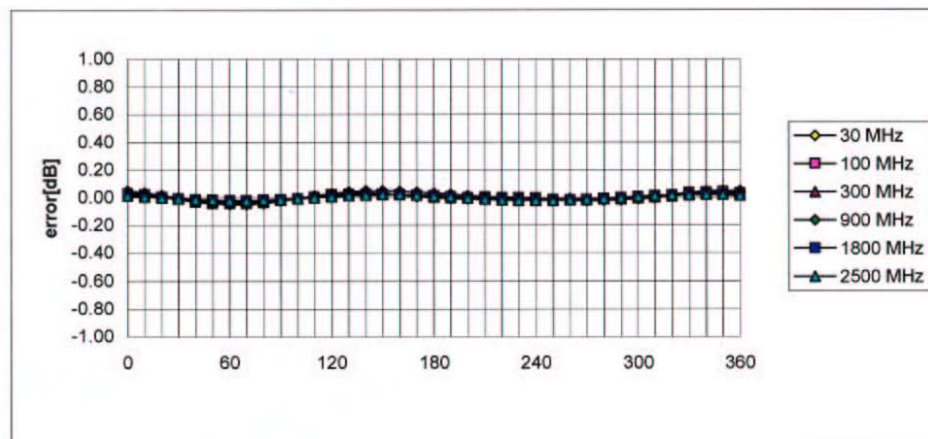
Facsimile: +81 596 24 8124

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October 10, 2003



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

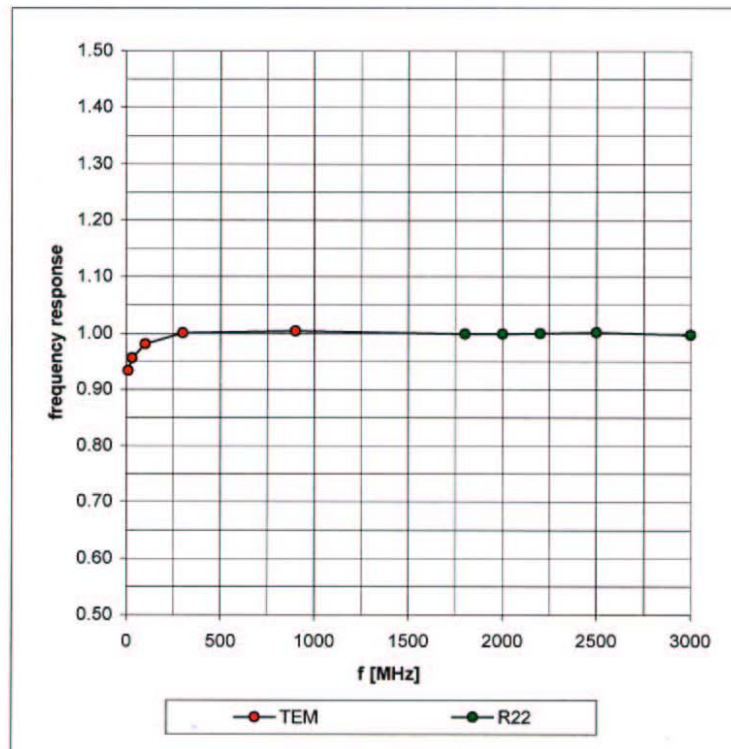


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## Frequency Response of E-Field

( TEM-Cell:ifi110, Waveguide R22)



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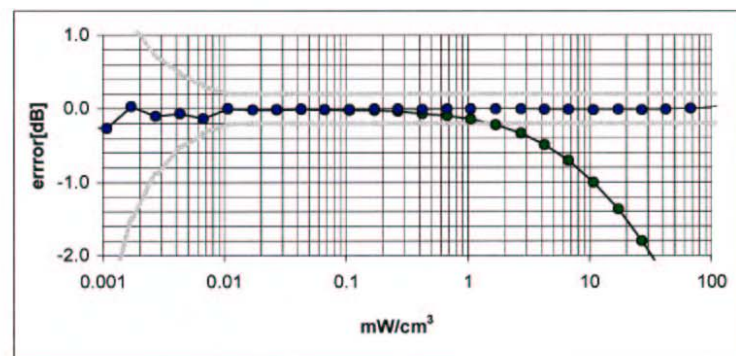
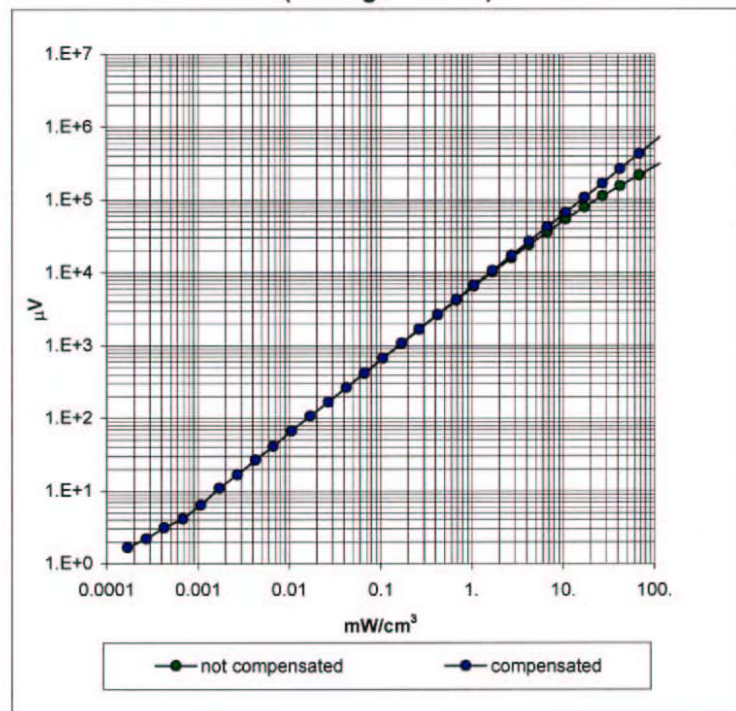
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**Dynamic Range f(SAR<sub>brain</sub>)**  
( Waveguide R22 )



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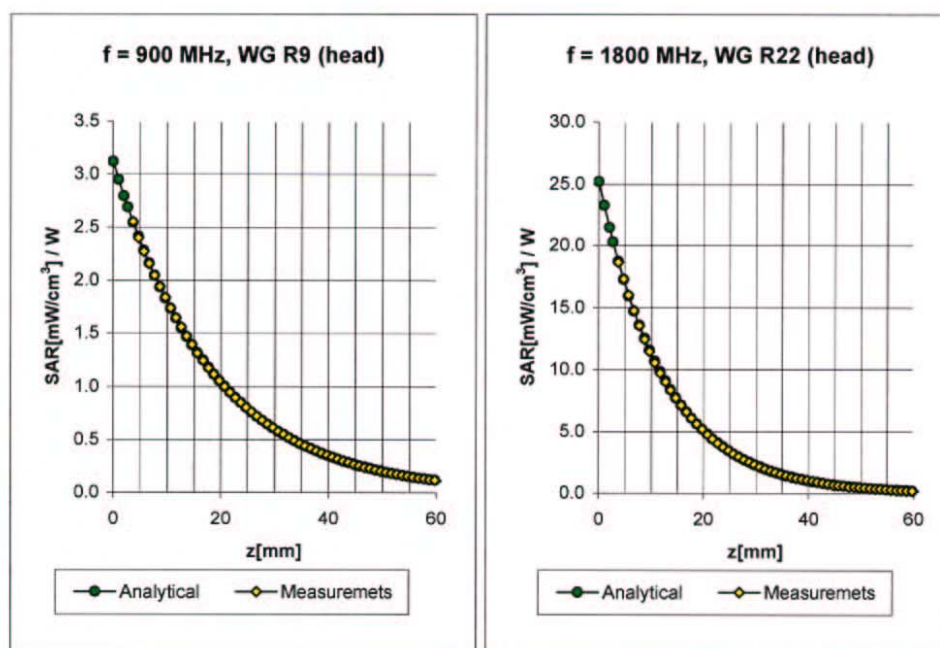
Telephone: +81 596 24 8116

Facsimile: +81 596 24 8124

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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 | <b>6.6</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>6.6</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.26</b> |
| ConvF Z | <b>6.6</b> $\pm 9.5\%$ (k=2) | Depth            | <b>3.07</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>5.2</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>5.2</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.41</b> |
| ConvF Z | <b>5.2</b> $\pm 9.5\%$ (k=2) | Depth            | <b>2.77</b> |

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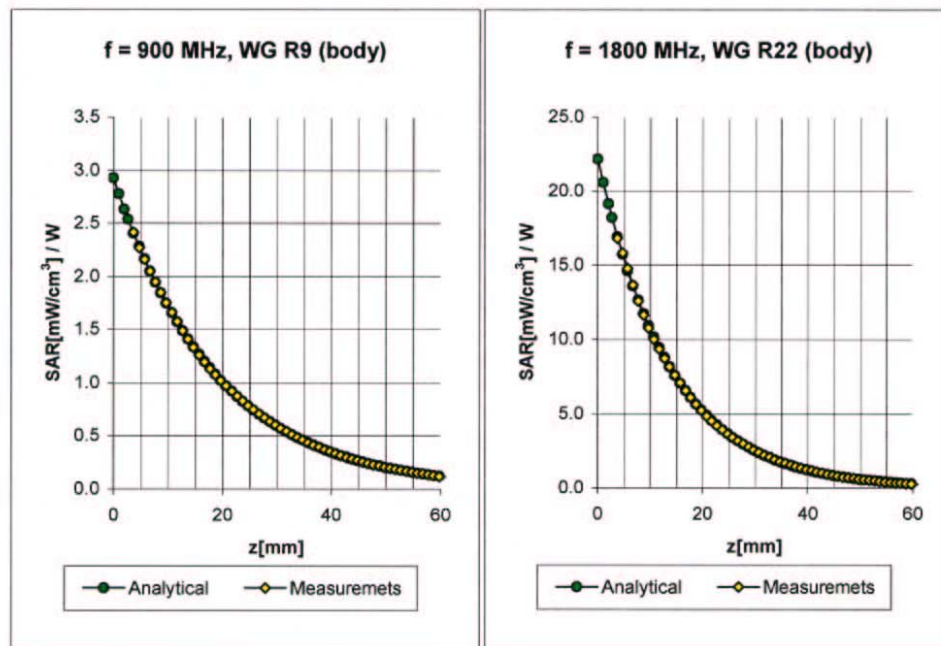
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## Conversion Factor Assessment



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 | <b>6.4</b> $\pm 9.5\%$ (k=2) | Boundary effect:  |
| ConvF Y | <b>6.4</b> $\pm 9.5\%$ (k=2) | Alpha <b>0.27</b> |
| ConvF Z | <b>6.4</b> $\pm 9.5\%$ (k=2) | Depth <b>3.22</b> |

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 | <b>4.7</b> $\pm 9.5\%$ (k=2) | Boundary effect:  |
| ConvF Y | <b>4.7</b> $\pm 9.5\%$ (k=2) | Alpha <b>0.48</b> |
| ConvF Z | <b>4.7</b> $\pm 9.5\%$ (k=2) | Depth <b>2.94</b> |

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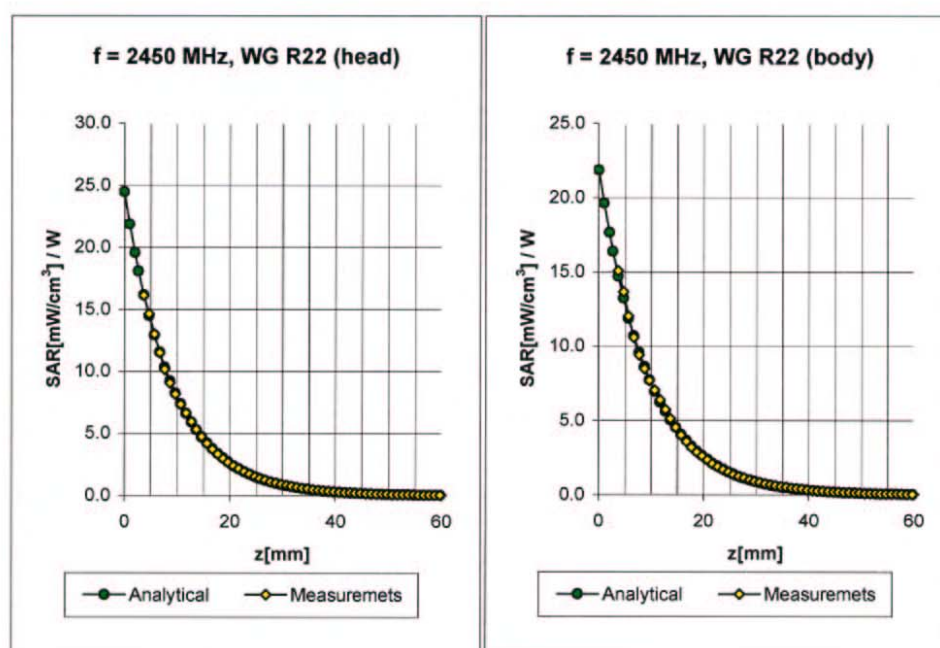
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## Conversion Factor Assessment



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

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

|         |                              |                  |             |
|---------|------------------------------|------------------|-------------|
| ConvF X | <b>4.7</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>4.7</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.78</b> |
| ConvF Z | <b>4.7</b> $\pm 9.5\%$ (k=2) | Depth            | <b>2.04</b> |

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

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

|         |                              |                  |             |
|---------|------------------------------|------------------|-------------|
| ConvF X | <b>4.3</b> $\pm 9.5\%$ (k=2) | Boundary effect: |             |
| ConvF Y | <b>4.3</b> $\pm 9.5\%$ (k=2) | Alpha            | <b>0.80</b> |
| ConvF Z | <b>4.3</b> $\pm 9.5\%$ (k=2) | Depth            | <b>1.89</b> |

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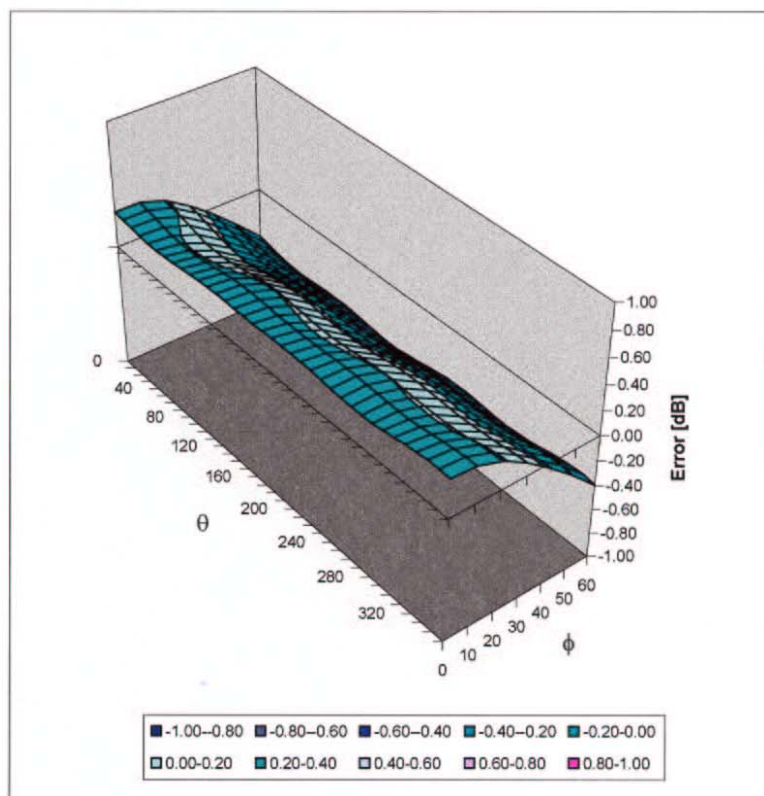
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## Deviation from Isotropy in HSL

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



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