

**Client**      **Samsung Suwon (Dymstec)**

## CALIBRATION CERTIFICATE

Object(s)      ET3DV6 - SN:1551

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

Calibration date:      April 27, 2004

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

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

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

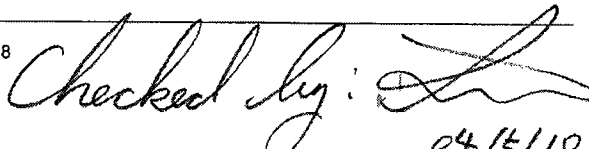
Calibration Equipment used (M&TE critical for calibration)

| Model Type                        | ID #         | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration  |
|-----------------------------------|--------------|-------------------------------------------|------------------------|
| Power meter EPM E442              | GB37480704   | 6-Nov-03 (METAS, No. 252-0254)            | Nov-04                 |
| Power sensor HP 8481A             | US37292783   | 6-Nov-03 (METAS, No. 252-0254)            | Nov-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 (SPEAG, in house check Oct-03)  | In house check: Oct 05 |
| 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 (SPEAG, in house check Oct-03)  | In house check: Oct 05 |

|                |               |                     |                                                                                       |
|----------------|---------------|---------------------|---------------------------------------------------------------------------------------|
|                | Name          | Function            | Signature                                                                             |
| Calibrated by: | Nico Vetterli | Technician          |  |
| Approved by:   | Katja Pokovic | Laboratory Director |  |

Date issued: April 27, 2004

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.

Checked by:   
04/15/10

# Probe ET3DV6

SN:1551

|                  |                  |
|------------------|------------------|
| Manufactured:    | October 16, 2000 |
| Last calibrated: | August 28, 2003  |
| Recalibrated:    | April 27, 2004   |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

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

### Sensitivity in Free Space

### Diode Compression<sup>A</sup>

|       |                                                 |       |           |    |
|-------|-------------------------------------------------|-------|-----------|----|
| NormX | <b>1.56</b> $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP X | <b>95</b> | mV |
| NormY | <b>1.58</b> $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP Y | <b>95</b> | mV |
| NormZ | <b>1.47</b> $\mu\text{V}/(\text{V}/\text{m})^2$ | DCP Z | <b>95</b> | mV |

### Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 7.

### Boundary Effect

**Head                      900 MHz      Typical SAR gradient: 5 % per mm**

|                                           |                              |               |               |
|-------------------------------------------|------------------------------|---------------|---------------|
| Sensor Center to Phantom Surface Distance |                              | <b>3.7 mm</b> | <b>4.7 mm</b> |
| SAR <sub>be</sub> [%]                     | Without Correction Algorithm | 8.5           | 4.6           |
| SAR <sub>be</sub> [%]                     | With Correction Algorithm    | 0.1           | 0.3           |

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

|                                           |                              |               |               |
|-------------------------------------------|------------------------------|---------------|---------------|
| Sensor Center to Phantom Surface Distance |                              | <b>3.7 mm</b> | <b>4.7 mm</b> |
| SAR <sub>be</sub> [%]                     | Without Correction Algorithm | 12.3          | 8.4           |
| SAR <sub>be</sub> [%]                     | With Correction Algorithm    | 0.2           | 0.1           |

### Sensor Offset

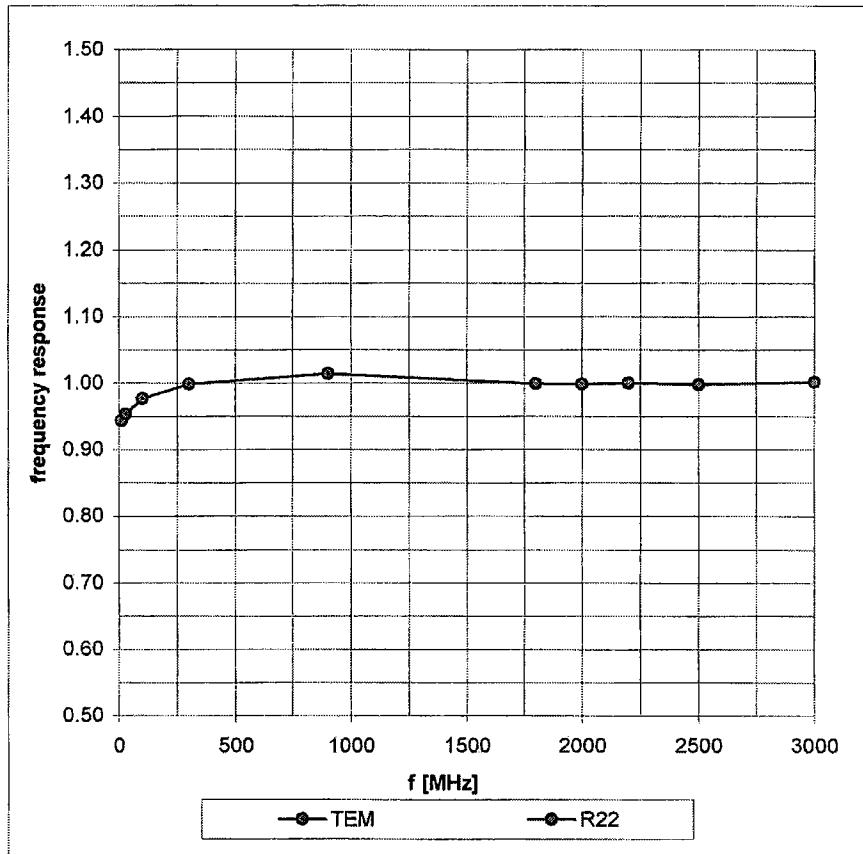
|                            |                     |
|----------------------------|---------------------|
| Probe Tip to Sensor Center | <b>2.7</b> mm       |
| Optical Surface Detection  | <b>in tolerance</b> |

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

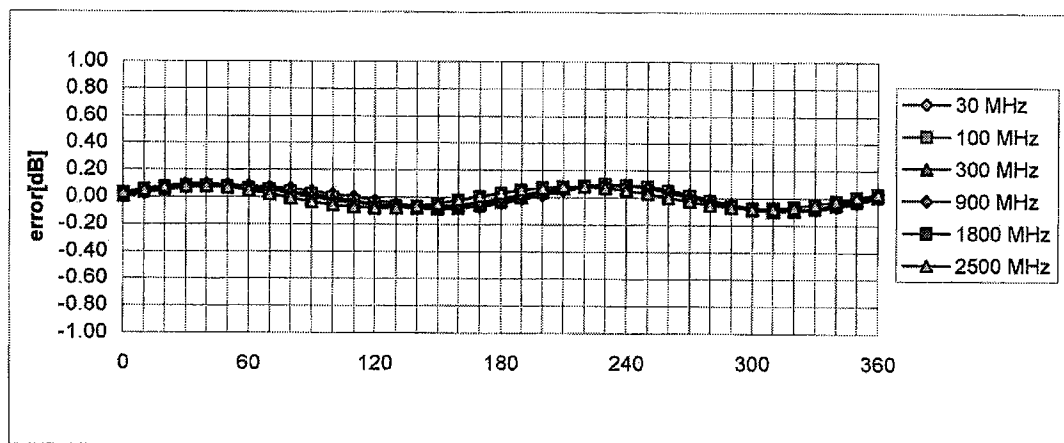
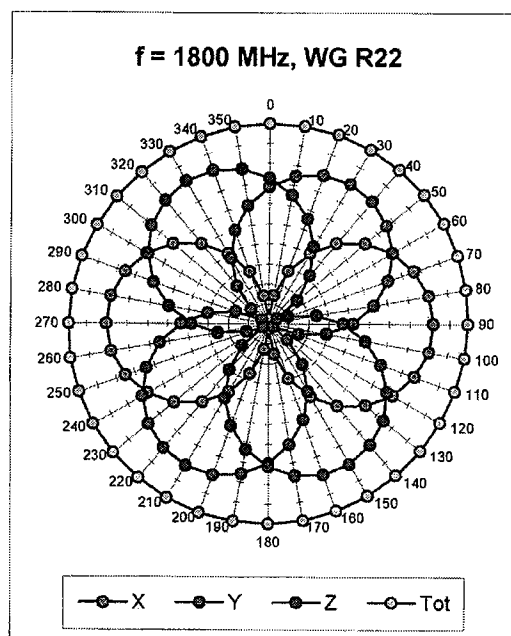
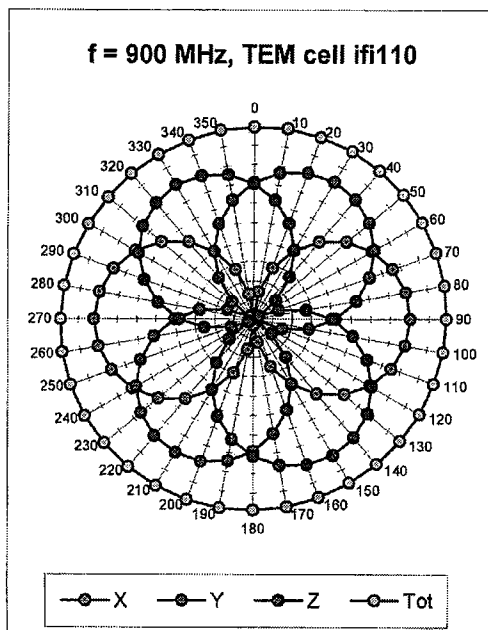
<sup>A</sup> numerical linearization parameter: uncertainty not required

## Frequency Response of E-Field

( TEM-Cell:ifi110, Waveguide R22)

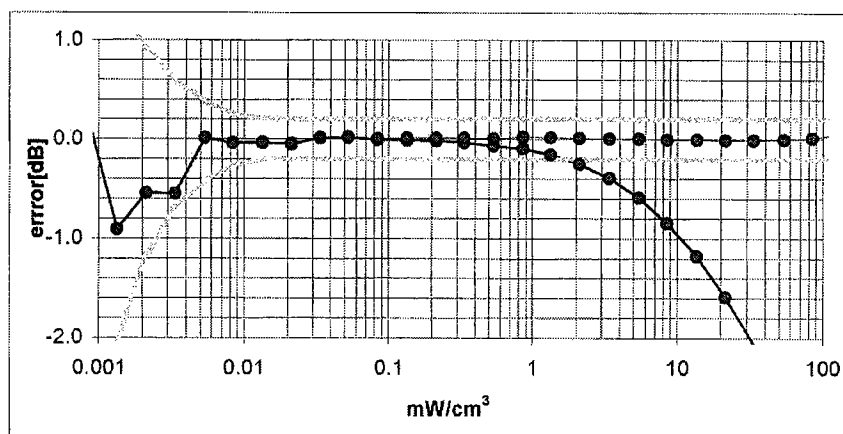
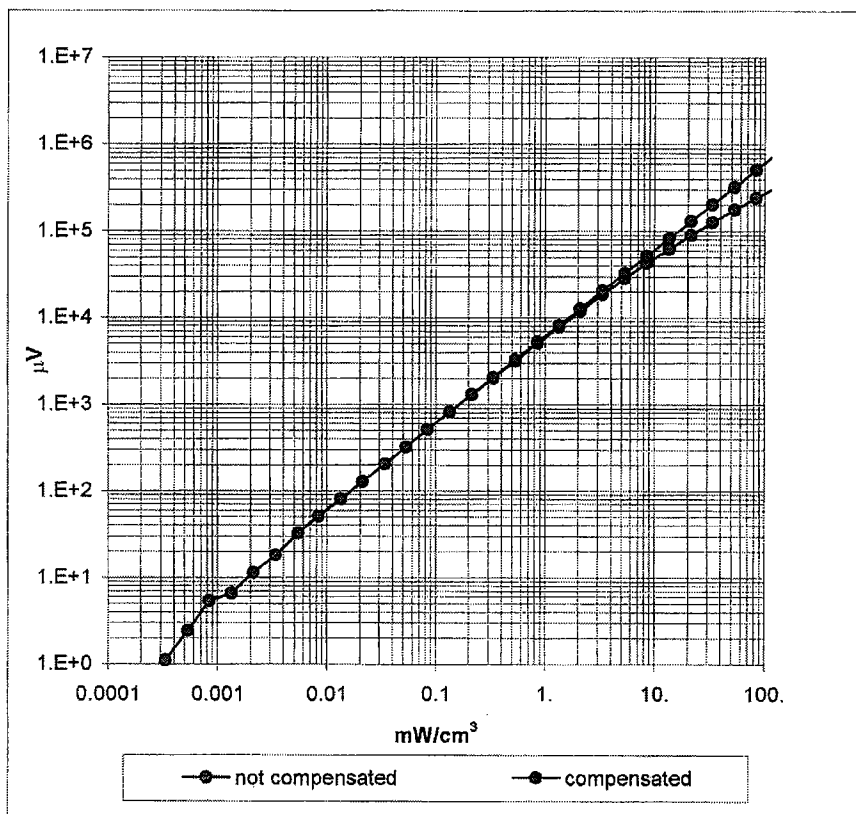


## Receiving Pattern ( $\phi$ ) , $\theta = 0^\circ$



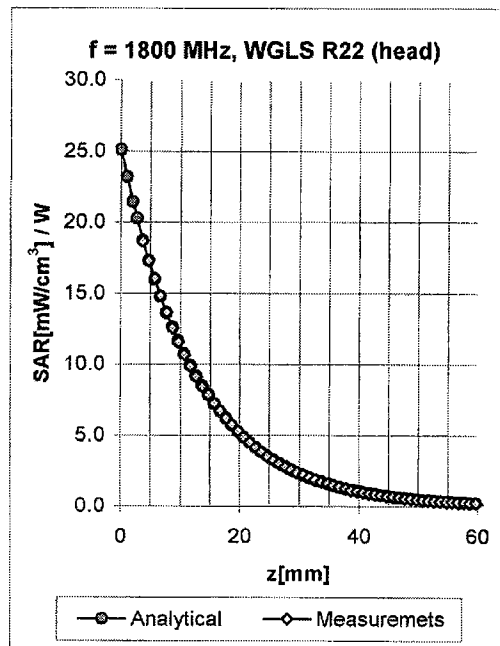
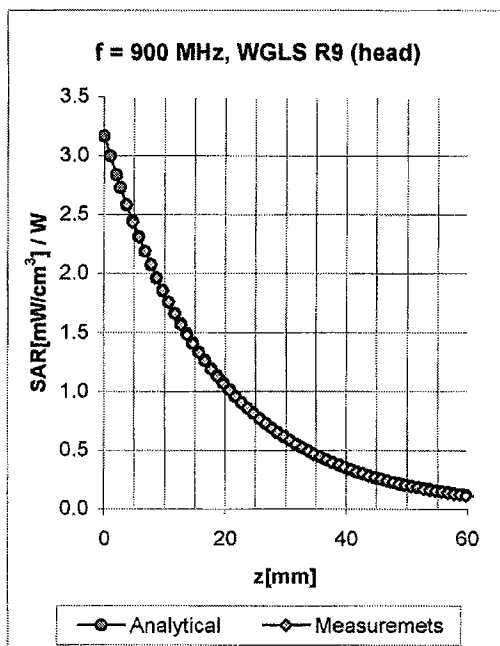
**Axial Isotropy Error  $< \pm 0.2$  dB**

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



Probe Linearity  $< \pm 0.2$  dB

## Conversion Factor Assessment

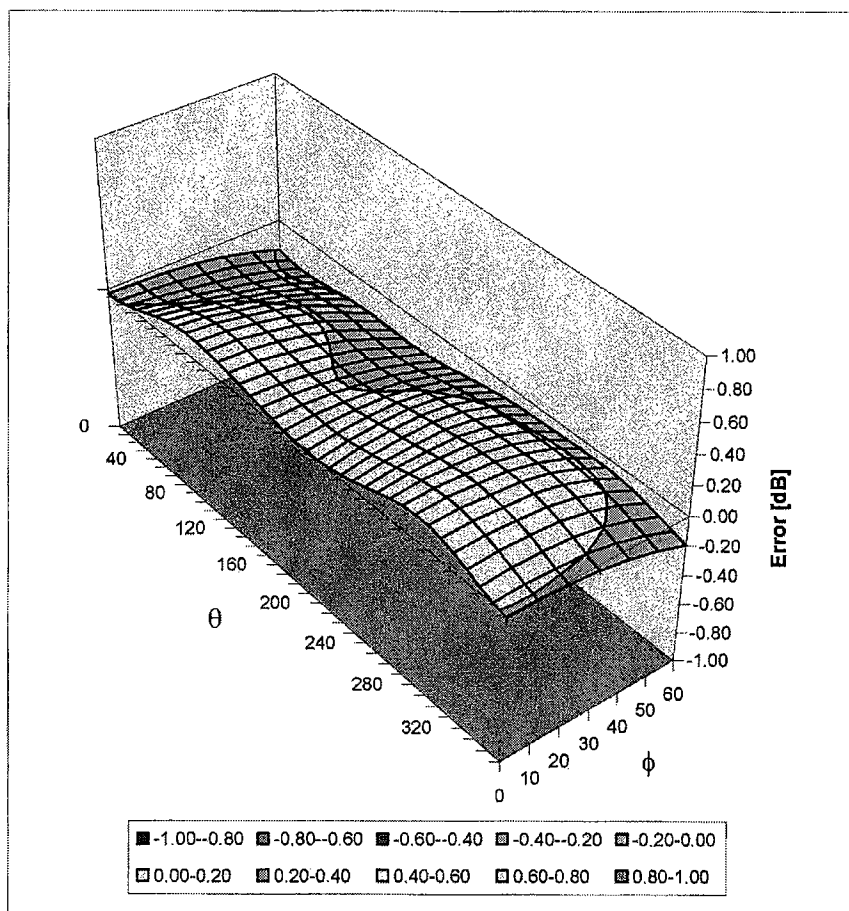


| f [MHz] | Validity [MHz] <sup>B</sup> | Tissue | Permittivity | Conductivity | Alpha | Depth | ConvF Uncertainty |
|---------|-----------------------------|--------|--------------|--------------|-------|-------|-------------------|
| 835     | 785-885                     | Head   | 41.5 ± 5%    | 0.90 ± 5%    | 0.70  | 1.62  | 6.54 ± 9.7% (k=2) |
| 900     | 850-950                     | Head   | 41.5 ± 5%    | 0.97 ± 5%    | 0.48  | 2.02  | 6.37 ± 9.7% (k=2) |
| 1750    | 1700-1800                   | Head   | 40.0 ± 5%    | 1.40 ± 5%    | 0.45  | 2.72  | 5.23 ± 9.7% (k=2) |
| 1900    | 1850-1950                   | Head   | 40.0 ± 5%    | 1.40 ± 5%    | 0.50  | 2.73  | 5.00 ± 9.7% (k=2) |
| 1950    | 1900-2000                   | Head   | 40.0 ± 5%    | 1.40 ± 5%    | 0.48  | 2.69  | 4.91 ± 9.7% (k=2) |
|         |                             |        |              |              |       |       |                   |
| 835     | 785-885                     | Body   | 55.2 ± 5%    | 0.97 ± 5%    | 0.43  | 2.28  | 6.34 ± 9.7% (k=2) |
| 900     | 850-950                     | Body   | 55.0 ± 5%    | 1.05 ± 5%    | 0.46  | 2.22  | 6.09 ± 9.7% (k=2) |
| 1750    | 1700-1800                   | Body   | 53.3 ± 5%    | 1.52 ± 5%    | 0.50  | 2.99  | 4.73 ± 9.7% (k=2) |
| 1900    | 1850-1950                   | Body   | 53.3 ± 5%    | 1.52 ± 5%    | 0.55  | 2.92  | 4.51 ± 9.7% (k=2) |
| 1950    | 1900-2000                   | Body   | 53.3 ± 5%    | 1.52 ± 5%    | 0.62  | 2.60  | 4.36 ± 9.7% (k=2) |

<sup>B</sup> The total standard uncertainty is calculated as root-sum-square of standard uncertainty of the Conversion Factor at calibration frequency and the standard uncertainty for the indicated frequency band.

## Deviation from Isotropy in HSL

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



Spherical Isotropy Error <  $\pm 0.4$  dB