

# PROBE CALIBRATION

# DIGITAL EMC

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

Client **Digital EMC (Dymstec)**

## CALIBRATION CERTIFICATE

Object(s) **ET3DV6 - SN:1702**

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

Calibration date: **February 17, 2004**

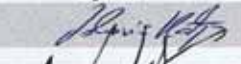

Condition of the calibrated item **In Tolerance (according to the specific calibration document)**

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 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 8451A	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	US37390565	16-Oct-01 (SPEAG, in house check Oct-03)	In house check: Oct 05

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Laboratory Director	
Approved by:	Niels Kusler	Quality Manager	

Date issued: February 17, 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.

# Probe ET3DV6

SN:1702

Manufactured:	July 3, 2002
Last calibrated:	July 29, 2002
Recalibrated:	February 17, 2004

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

**DASY - Parameters of Probe: ET3DV6 SN:1702**

## Sensitivity in Free Space

Diode Compression<sup>^</sup>

NormX	1.66 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	96	mV
NormY	1.71 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	96	mV
NormZ	1.67 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	96	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		3.7 mm	4.7 mm
SAR <sub>95%</sub> [%]	Without Correction Algorithm	7.5	3.9
SAR <sub>95%</sub> [%]	With Correction Algorithm	0.0	0.2

Head                    1800 MHz    Typical SAR gradient: 10 % per mm

Sensor to Surface Distance		3.7 mm	4.7 mm
SAR <sub>95%</sub> [%]	Without Correction Algorithm	11.5	8.0
SAR <sub>95%</sub> [%]	With Correction Algorithm	0.2	0.4

## Sensor Offset

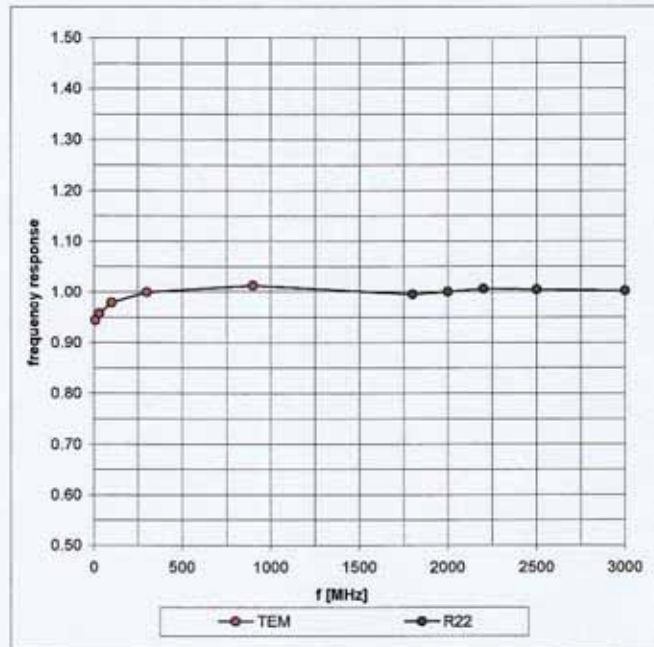
Probe Tip to Sensor Center	2.7 mm
Optical Surface Detection	In tolerance

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%.

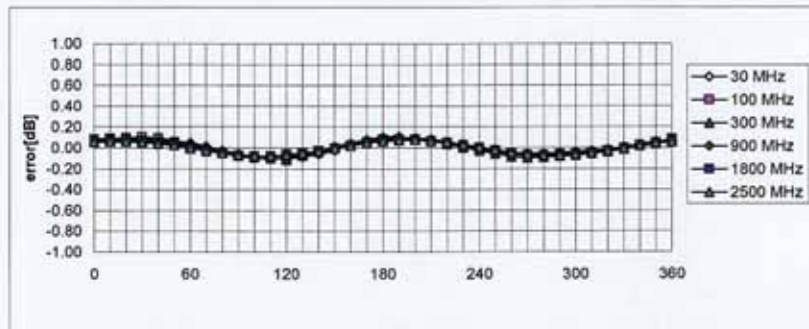
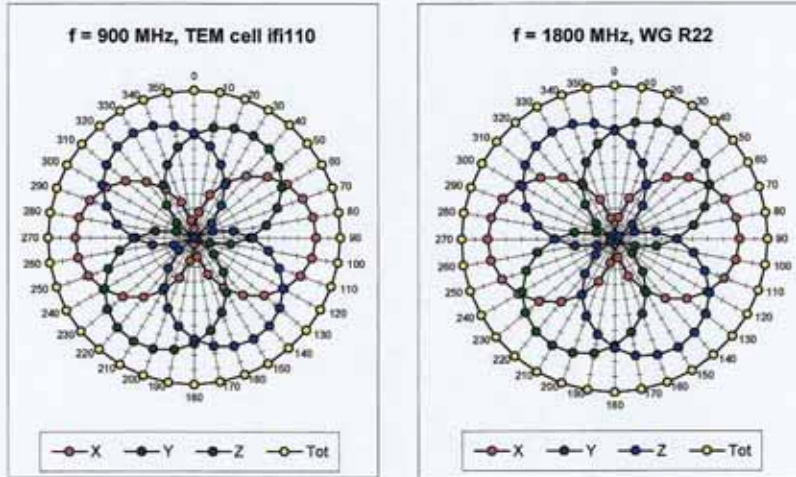
<sup>^</sup> numerical linearization parameter: uncertainty not required

### Frequency Response of E-Field

( TEM-Cell:ifi110, Waveguide R22)

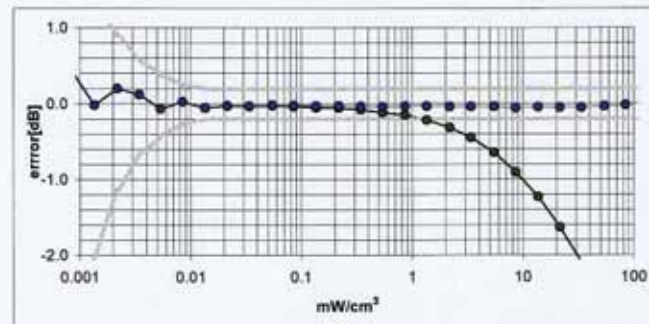
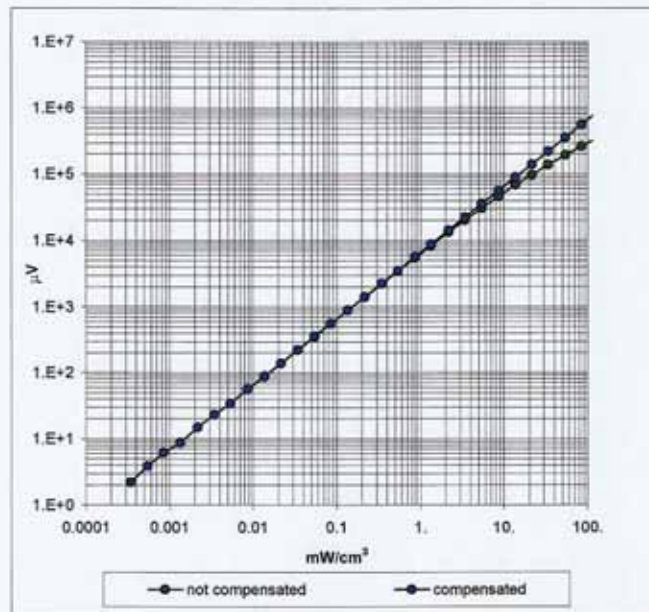


### Receiving Pattern ( $\phi$ ) , $\theta = 0^\circ$



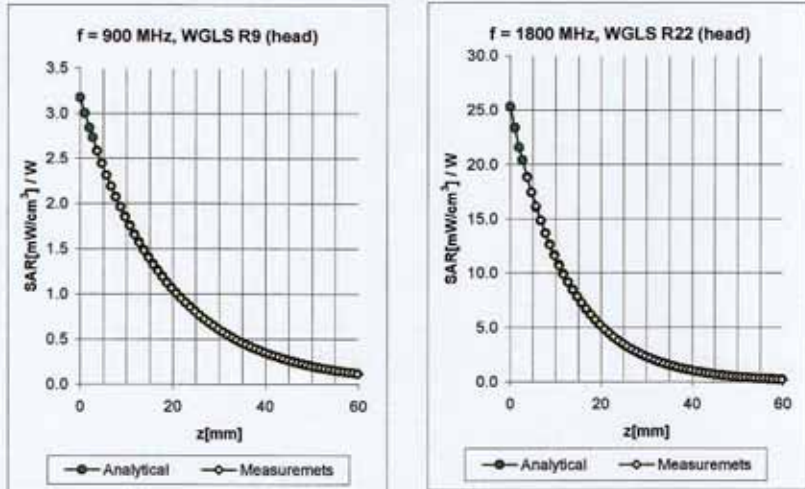
**Axial Isotropy Error <math>\lt; \pm 0.2 \text{ dB}</math>**

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



Probe Linearity  $< \pm 0.2$  dB

### Conversion Factor Assessment

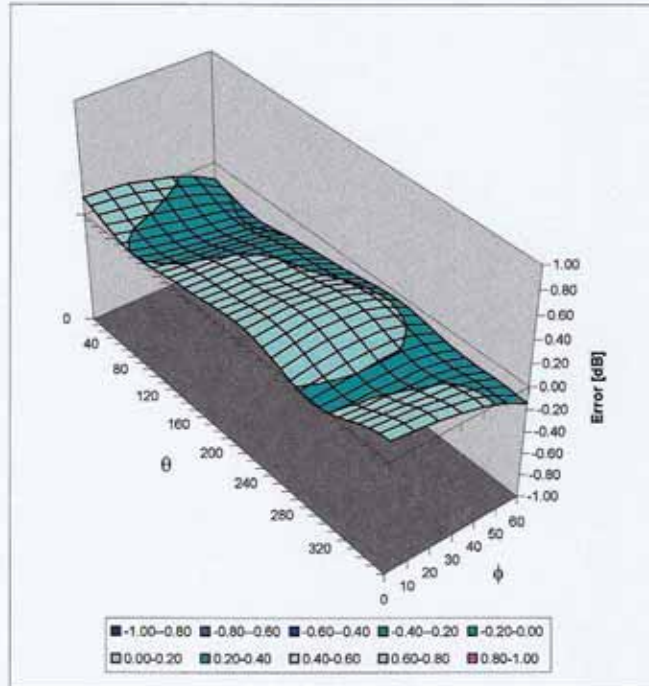


f [MHz]	Validity [MHz] <sup>8</sup>	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
900	800-1000	Head	41.5 ± 5%	0.97 ± 5%	0.58	1.74	6.52 ± 11.3%	(k=2)
1800	1710-1910	Head	40.0 ± 5%	1.40 ± 5%	0.44	2.57	5.21 ± 11.7%	(k=2)
2450	2400-2500	Head	39.2 ± 5%	1.80 ± 5%	0.82	2.00	4.67 ± 9.7%	(k=2)
2450	2400-2500	Body	52.7 ± 5%	1.95 ± 5%	0.95	1.82	4.19 ± 9.7%	(k=2)

<sup>8</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

## Additional Conversion Factors

for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1702

Place of Assessment:

Zurich

Date of Assessment:

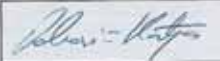
February 20, 2004

Probe Calibration Date:

February 17, 2004

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by:



**Dosimetric E-Field Probe ET3DV6 SN:1702**Conversion factor ( $\pm$  standard deviation)

<b>900 MHz</b>	ConvF	<b>6.3 <math>\pm</math> 8%</b>	$\epsilon_r = 55.0 \pm 5\%$ $\sigma = 1.05 \pm 5\%$ mho/m (body tissue)
<b>1800 MHz</b>	ConvF	<b>4.8 <math>\pm</math> 8%</b>	$\epsilon_r = 53.3 \pm 5\%$ $\sigma = 1.52 \pm 5\%$ mho/m (body tissue)
<b>1900 MHz</b>	ConvF	<b>4.6 <math>\pm</math> 8%</b>	$\epsilon_r = 53.2 \pm 5\%$ $\sigma = 1.52 \pm 5\%$ mho/m (body tissue)

**Important Note:**

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

**Please see also Section 4.7 of the DASY4 Manual.**

## Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1702

Place of Assessment:

Zurich

Date of Assessment:

February 20, 2004

Probe Calibration Date:

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Assessed by:



### Dosimetric E-Field Probe ET3DV6 SN:1702

Conversion factor ( $\pm$  standard deviation)

450 MHz      ConvF      7.7  $\pm$  8%

$\epsilon_r = 43.5 \pm 5\%$   
 $\sigma = 0.87 \pm 5\%$  mho/m  
(head tissue)

450 MHz      ConvF      7.6  $\pm$  8%

$\epsilon_r = 56.7 \pm 5\%$   
 $\sigma = 0.94 \pm 5\%$  mho/m  
(body tissue)