PROBE CALIBRATION

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

Client

Digital EMC (Dymstec)

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 252-0250) 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-03 (SPEAG, in house check Oct-03) In house check: Oct 03 RF generator HP 8684C US3642U01700 4-Aug-99 (SPEAG, in house check Aug-02) In house check: Aug-0 Network Analyzer HP 8753E US37390585 18-Oct-01 (SPEAG, in house check Oct-03) In house check: Oct 03 Name Function Signature	Object(s)	ET3DV6 - SN:	1702	
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 8481A MY41092180 18-Sep-02 (SPEAG, in house check Oct-03) In house check: Aug-0 Network Analyzer HP 8753E US37390585 18-Oct-01 (SPEAG, in house check Oct-03) In house check: Oct 05 Name Function Signature	Calibration procedure(s)	AND THE RESIDENCE OF THE PARTY		nes .
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Approved by: Niels Kuster Quality Manager	Calibration Equipment used (M&TE Model Type Power meter EPM E4419B Power sensor E4412A Reference 20 dB Attenuator Fluke Process Calibrator Type 702 Power sensor HP 8481A RF generator HP 8684C Network Analyzer HP 8753E	ID# GB41293874 MY41495277 SN: 5086 (20b) SN: 6295803 MY41092180 US3642U01700 US37390585 Name	Cal Date (Calibrated by, Certificate No.) 2-Apr-03 (METAS, No 252-0250) 2-Apr-03 (METAS, No 252-0250) 3-Apr-03 (METAS, No 251-0340) 8-Sep-03 (Sintrel SCS No. E-030020) 18-Sep-02 (SPEAG, in house check Oct-03) 4-Aug-99 (SPEAG, in house check Aug-02) 18-Oct-01 (SPEAG, in house check Oct-03)	Scheduled Calibration Apr-04 Apr-04 Sep-04 In house check: Oct 05 In house check: Oct 05

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

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1702

DASY - Parameters of Probe: ET3DV6 SN:1702

Sensitivity in Fre	ee Space	Diode Compression			n ^A
NormX	1.66 μV/(V/m) ²	DCP X	96	mV	
NormY	1.71 μV/(V/m) ²	DCP Y	96	mV	
NormZ	1.67 μV/(V/m) ²	DCP Z	96	mV	

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Plese see Page 7.

Boundary Effect

Head	900 MHz	Typical SAR gradient: 5 % per mm	

Sensor Cener t	3.7 mm	4.7 mm	
SAR _{be} [%]	Without Correction Algorithm	7.5	3.9
SAR _{be} [%]	With Correction Algorithm	0.0	0.2

Head 1800 MHz Typical SAR gradient: 10 % per mm

Sensor to Su	rface Distance	3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	11.5	8.0
SAR _{be} [%]	With Correction Algorithm	0.2	0.4

Sensor Offset

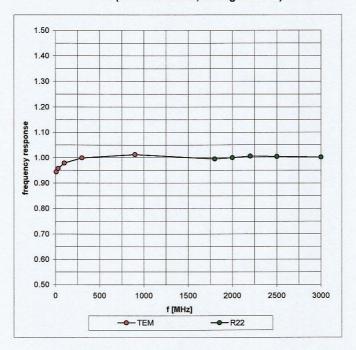
Probe Tip to Sensor Center	2.7 mm	
Optical Surface Detection		in tolerance

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%.

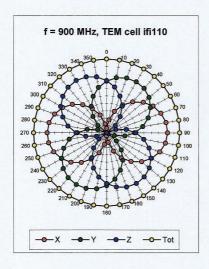
^A numerical linearization parameter: uncertainty not required

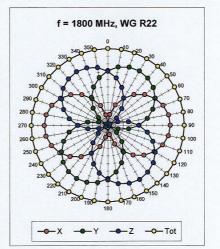
Frequency Response of E-Field

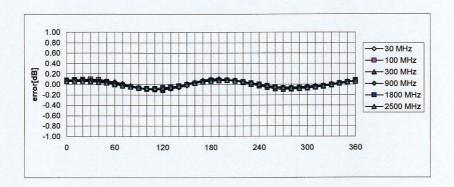
(TEM-Cell:ifi110, Waveguide R22)



Receiving Pattern (ϕ) , θ = 0°



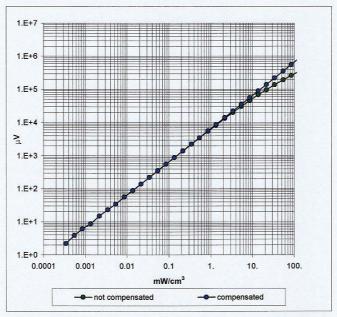


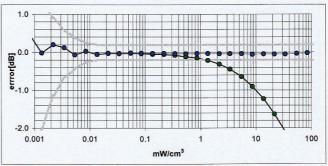


Axial Isotropy Error $< \pm 0.2 \text{ dB}$

Dynamic Range f(SAR_{head})

(Waveguide R22)

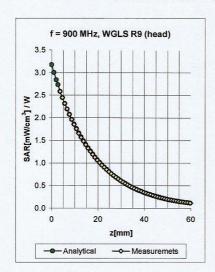


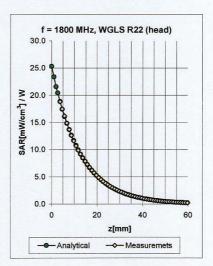


Probe Linearity < ± 0.2 dB

ET3DV6 SN:1702

Conversion Factor Assessment





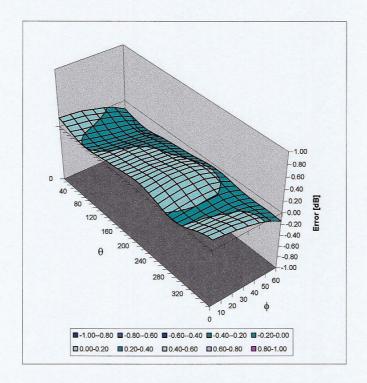
f [MHz]	Validity [MHz] ^B	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	800-1000	Head	41.5 ± 5%	0.07 1.5%	0.50	1.74	6 52 + 44 39/ /k=2\
1800	1710-1910	Head	40.0 ± 5%	0.97 ± 5% 1.40 ± 5%	0.58	2.57	6.52 ± 11.3% (k=2) 5.21 ± 11.7% (k=2)
2450	2400-2500	Head	39.2 ± 5%	1.80 ± 5%	0.82	2.00	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)

⁸ 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.

ET3DV6 SN:1702

Deviation from Isotropy in HSL

Error (θ , ϕ), f = 900 MHz



Spherical Isotropy Error < ± 0.4 dB

Zeughausstrasse 43, 8004 Zurich, Switzerland Phone +41 1 245 9700, Fax +41 1 245 9779 info@speag.com, http://www.speag.com

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:

Blow - Matyes

Zeughausstrasse 43, 8004 Zurich, Switzerland Phone +41 1 245 9700, Fax +41 1 245 9779 info@speag.com, http://www.speag.com

Dosimetric E-Field Probe ET3DV6 SN:1702

Conversion factor (± standard deviation)

900 MHz	ConvF	$6.3 \pm 8\%$	$\varepsilon_r = 55.0 \pm 5\%$
			$\sigma = 1.05 \pm 5\% \text{ mho/m}$
			(body tissue)

1800 MHz ConvF
$$4.8 \pm 8\%$$
 $\epsilon_r = 53.3 \pm 5\%$ $\sigma = 1.52 \pm 5\%$ mho/m

1900 MHz ConvF 4.6
$$\pm$$
 8% $\epsilon_r = 53.2 \pm 5\%$ $\sigma = 1.52 \pm 5\%$ 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.