Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Calibration Certificate

2450 MHz System Validation Dipole

Type:	**D2450V2**
Serial Number:	**724**
Place of Calibration:	**Zurich**
Date of Calibration:	**November 9, 2002**
Calibration Interval:	**24 months**

Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by:	N. Vetter
Approved by:	[signature]

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

DASY

Dipole Validation Kit

Type: D2450V2

Serial: 724

Manufactured: October 16, 2002
Calibrated: November 9, 2002

1. Measurement Conditions

The measurements were performed in the flat section of the new SAM twin phantom filled with head simulating solution of the following electrical parameters at 2450 MHz:

Relative permitivity	**38.0**	± 5%
Conductivity	**1.87 mho/m**	± 10%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, conversion factor 5.0 at 2450 MHz) was used for the measurements.

The dipole feedpoint was positioned below the center marking and oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15 mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

2 SAR Measurement

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 are:

averaged over 1 cm^3 (1 g) of tissue:	**55.6 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**24.7 mW/g**

3. Dipole impedance and return loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.151 ns**	(one direction)
Transmission factor:	**0.997**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 2450 MHz:	Re{Z} = **53.2 Ω**
	Im {Z} = **5.2 Ω**
Return Loss at 2450 MHz	**- 24.6 dB**

4. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

5. Design

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

Small end caps have been added to the dipole arms in order to improve matching when loaded according to the position as explained in Section 1. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

6. Power Test

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Date/Time: 11/09/02 13:43:54

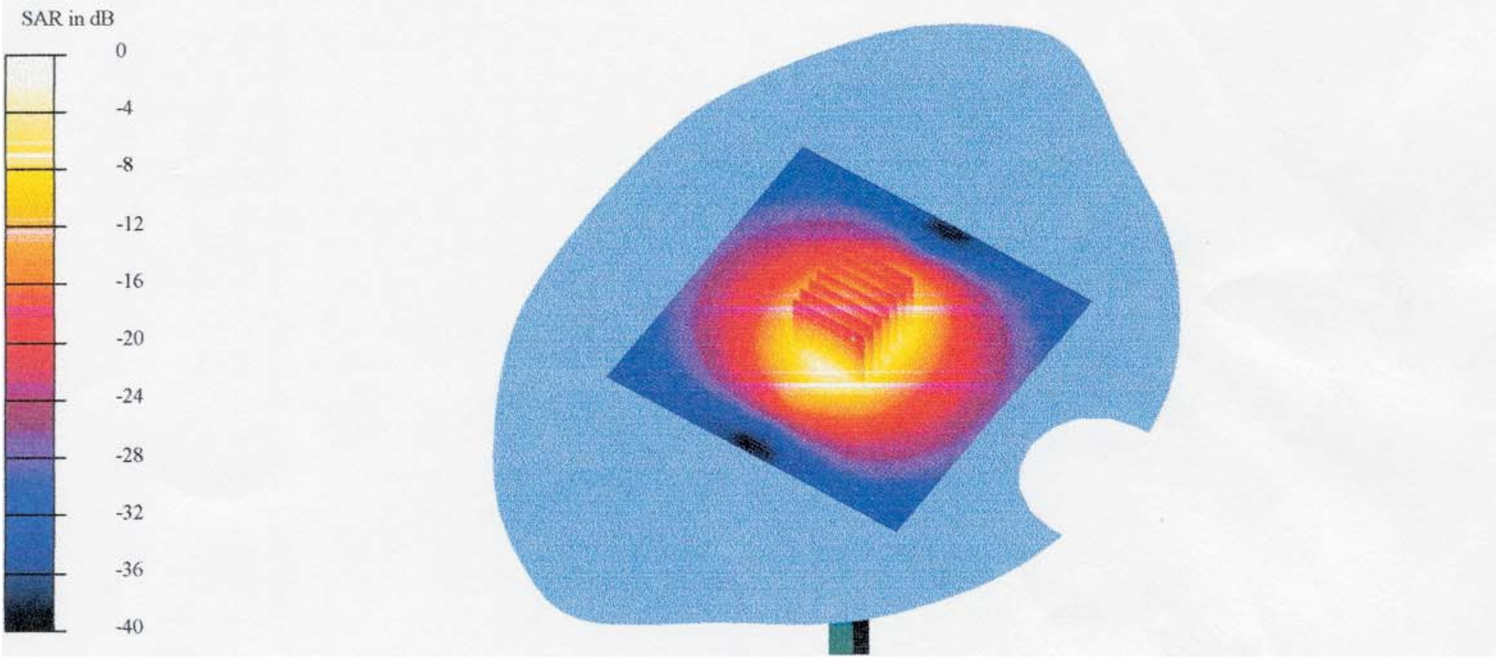
Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN724_SN1507_HSL2450_061102.da4

DUT: Dipole 2450 MHz Type & Serial Number: D2450V2 - SN724
Program: Dipole Calibration; Pin = 250 mW; d = 10 mm

Communication System: CW-2450; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL 2450 MHz (σ = 1.87 mho/m, ε = 38.03, ρ = 1000 kg/m3)
Phantom section: FlatSection

DASY4 Configuration:
- Probe: ET3DV6 - SN1507; ConvF(5, 5, 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 = 96.6 V/m
Peak SAR = 30.9 mW/g
SAR(1 g) = 13.9 mW/g; SAR(10 g) = 6.17 mW/g
Power Drift = 0.002 dB



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

Client **EMC Technologies (AUS)**

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1380
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	July 18, 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
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (Agilent, No. 20020918)	Sep-03
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01 (ELCAL, No.2360)	Sep-03

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	D.Vetterli
Approved by:	Katja Pokovic	Laboratory Director	Pokovic Katja

Date issued: July 18, 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.

Schmid & Partner Engineering AG

s p e a g

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

Probe ET3DV6

Additional Conversion Factors

SN:1380

Manufactured:	August 16, 1999
Last calibration:	November 9, 2002
Add ConvF:	July 18, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1380

Sensitivity in Free Space

NormX	**1.67**	$\mu V/(V/m)^2$
NormY	**1.57**	$\mu V/(V/m)^2$
NormZ	**1.73**	$\mu V/(V/m)^2$

Diode Compression

DCP X	**90**	mV
DCP Y	**90**	mV
DCP Z	**90**	mV

Sensitivity in Tissue Simulating Liquid

Head **2450 MHz** ε_r **= 39.2 ± 5%** σ **= 1.80 ± 5% mho/m**

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

ConvF X	**4.8**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.8**	± 9.5% (k=2)	Alpha	**1.10**
ConvF Z	**4.8**	± 9.5% (k=2)	Depth	**1.76**

Body **2450 MHz** ε_r **= 52.7 ± 5%** σ **= 1.95 ± 5% mho/m**

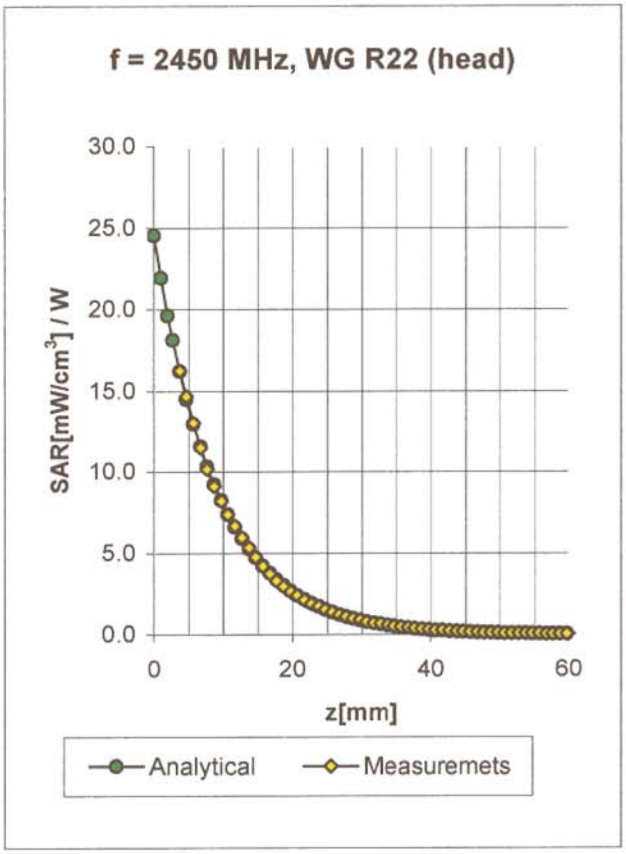
Valid for f=2400-2500 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

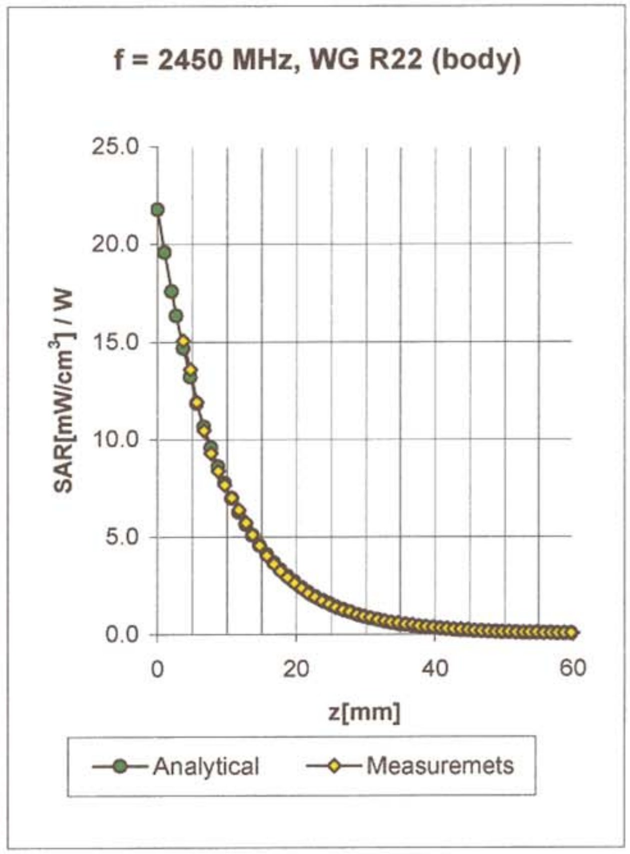
ConvF X	**4.5**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.5**	± 9.5% (k=2)	Alpha	**1.52**
ConvF Z	**4.5**	± 9.5% (k=2)	Depth	**1.42**

Sensor Offset

Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.5 ± 0.2**	mm

Conversion Factor Assessment





Head 2450 MHz ε_r **= 39.2 ± 5%** σ **= 1.80 ± 5% mho/m**

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

ConvF X	**4.8**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.8**	± 9.5% (k=2)	Alpha	**1.10**
ConvF Z	**4.8**	± 9.5% (k=2)	Depth	**1.76**

Body 2450 MHz ε_r **= 52.7 ± 5%** σ **= 1.95 ± 5% mho/m**

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

ConvF X	**4.5**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.5**	± 9.5% (k=2)	Alpha	**1.52**
ConvF Z	**4.5**	± 9.5% (k=2)	Depth	**1.42**

Title

SubTitle

March 20, 2003 02:54 AM

Frequency	e'	e''/e'
300.000000 MHz	4.6029	0.0208
344.000000 MHz	4.3846	-0.0209
388.000000 MHz	4.5963	0.0008
432.000000 MHz	4.4582	-0.0061
476.000000 MHz	4.5861	0.0127
520.000000 MHz	4.4932	0.0044
564.000000 MHz	4.5140	0.0167
608.000000 MHz	4.5535	0.0030
652.000000 MHz	4.4146	0.0020
696.000000 MHz	4.4890	0.0104
740.000000 MHz	4.4702	0.0150
784.000000 MHz	4.5612	0.0199
828.000000 MHz	4.4420	0.0145
872.000000 MHz	4.4165	0.0220
916.000000 MHz	4.4464	0.0082
960.000000 MHz	4.4586	0.0224
1.004000000 GHz	4.3909	0.0215
1.048000000 GHz	4.4336	0.0192
1.092000000 GHz	4.4031	0.0218
1.136000000 GHz	4.4546	0.0180
1.180000000 GHz	4.4111	0.0254
1.224000000 GHz	4.4472	0.0244
1.268000000 GHz	4.4522	0.0251
1.312000000 GHz	4.4401	0.0260
1.356000000 GHz	4.4953	0.0214
1.400000000 GHz	4.4405	0.0218
1.444000000 GHz	4.4588	0.0266
1.488000000 GHz	4.4277	0.0248
1.532000000 GHz	4.4716	0.0286
1.576000000 GHz	4.4530	0.0250
1.620000000 GHz	4.4487	0.0289
1.664000000 GHz	4.4442	0.0231
1.708000000 GHz	4.4210	0.0267
1.752000000 GHz	4.4473	0.0234

1.796000000 GHz	4.4257	0.0285
1.840000000 GHz	4.4162	0.0301
1.884000000 GHz	4.4008	0.0237
1.928000000 GHz	4.3629	0.0293
1.972000000 GHz	4.3700	0.0235
2.016000000 GHz	4.3536	0.0259
2.060000000 GHz	4.3282	0.0198
2.104000000 GHz	4.3064	0.0114
2.148000000 GHz	4.3269	0.0099
2.192000000 GHz	4.4059	0.0058
2.236000000 GHz	4.4015	0.0116
2.280000000 GHz	4.4687	0.0181
2.324000000 GHz	4.4551	0.0221
2.368000000 GHz	4.5100	0.0287
2.412000000 GHz	4.5291	0.0304
2.456000000 GHz	4.4896	0.0299
2.500000000 GHz	4.5201	0.0379