CETECOM ICT Services GmbH
Untertuerkheimer Str. 6-10, 66117 Saarbruecken, Germany Phone: +49 (0) 681 598-0 Fax: -8475
SAR-Laboratory Phone: +49 (0) 681 598-8454 .

Accredited testing laboratory

DAR registration number: TTI-P-G 166/98

Federal Motor Transport Authority (KBA)
DAR registration number: KBA-P 00070-97

Appendix to the Report 2-2859-1-2/02 Calibration Data, Phantom Certificate and detail Information of the DASY 3 System

Schmid & Partner
Engineering AG

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

Probe ET3DV6

SN:1558

Manufactured:	December 1, 2000
Last calibration:	February 20, 2001
Recalibrated:	March 22, 2002

Calibrated for System DASY3

ET3DV6 SN:1558 **March 22, 2002**

DASY3 - Parameters of Probe: ET3DV6 SN:1558

Sensitivity in Free Space

NormX	**1.47**	$\mu V/(V/m)^2$	DCP X	**98**	mV
NormY	**1.34**	$\mu V/(V/m)^2$	DCP Y	**98**	mV
NormZ	**1.39**	$\mu V/(V/m)^2$	DCP Z	**98**	mV

Sensitivity in Tissue Simulating Liquid

Head **900 MHz** ε_r **= 41.5 ± 5%** σ **= 0.97 ± 5% mho/m**

ConvF X	**6.8**	± 8.9% (k=2)	Boundary effect:	
ConvF Y	**6.8**	± 8.9% (k=2)	Alpha	**0.37**
ConvF Z	**6.8**	± 8.9% (k=2)	Depth	**2.28**

Head **1800 MHz** ε_r **= 40.0 ± 5%** σ **= 1.40 ± 5% mho/m**

ConvF X	**5.4**	± 8.9% (k=2)	Boundary effect:	
ConvF Y	**5.4**	± 8.9% (k=2)	Alpha	**0.43**
ConvF Z	**5.4**	± 8.9% (k=2)	Depth	**2.49**

Boundary Effect

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

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	8.1	4.5
SAR_{be} [%]	With Correction Algorithm	0.2	0.4

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

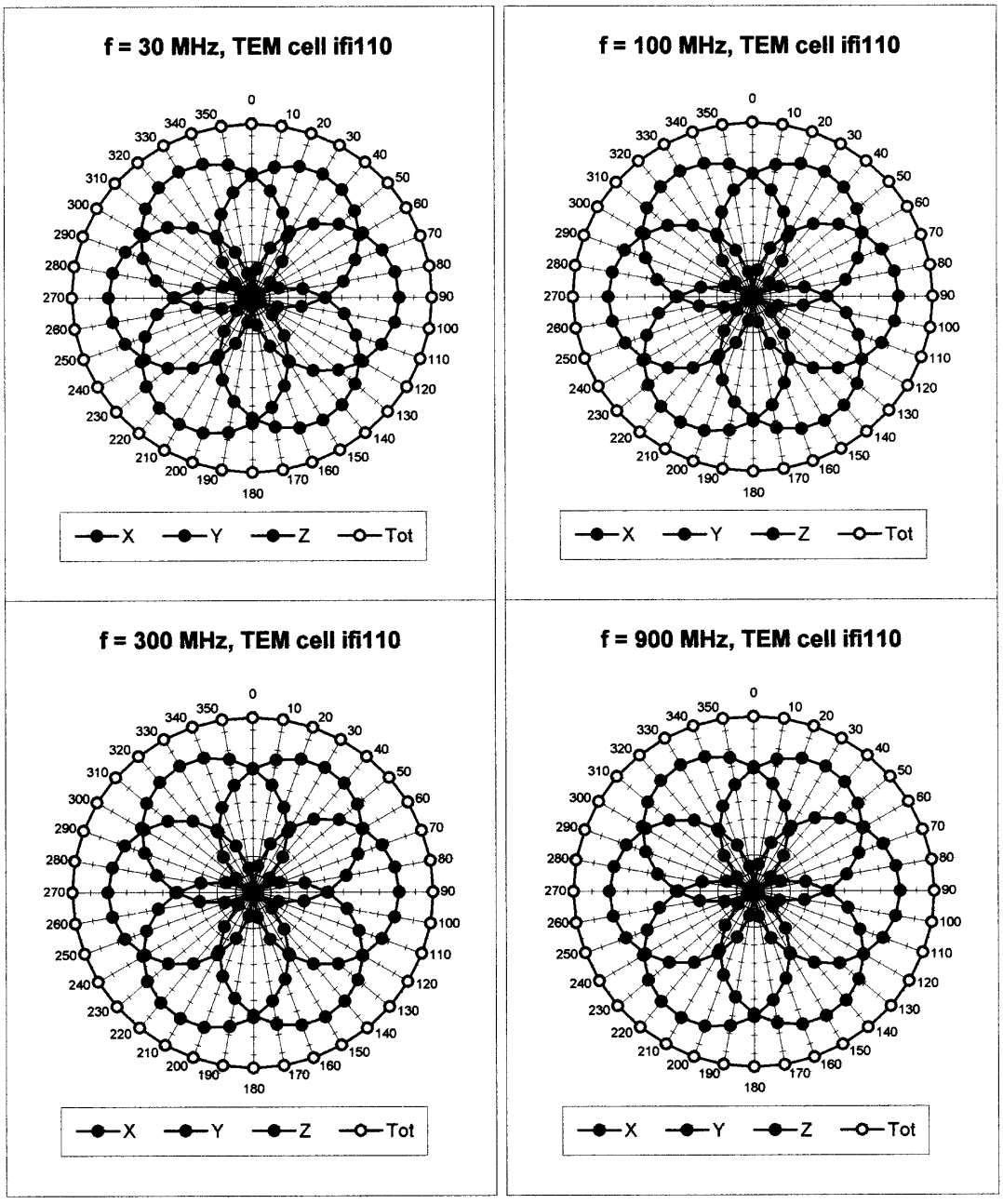
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	10.6	7.2
SAR_{be} [%]	With Correction Algorithm	0.2	0.2

Sensor Offset

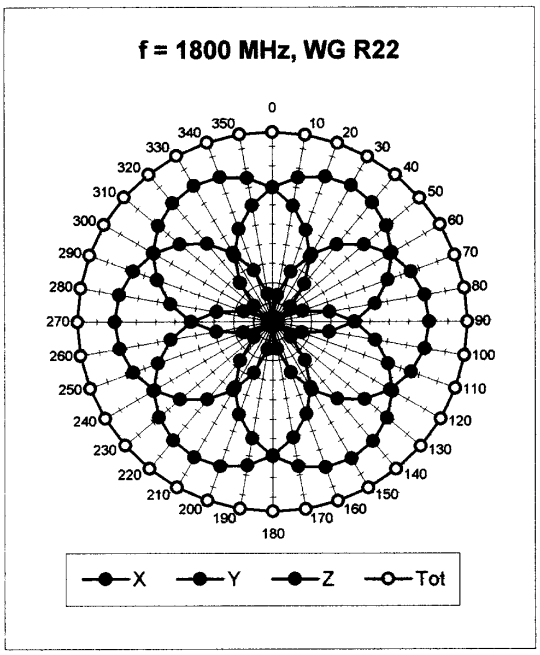
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.7 ± 0.2**	mm

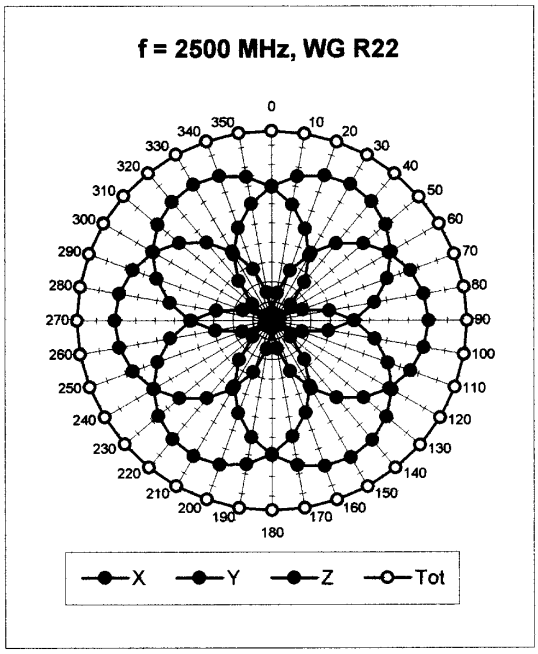
ET3DV6 SN:1558 **March 22, 2002**

Receiving Pattern (ϕ), θ = 0°

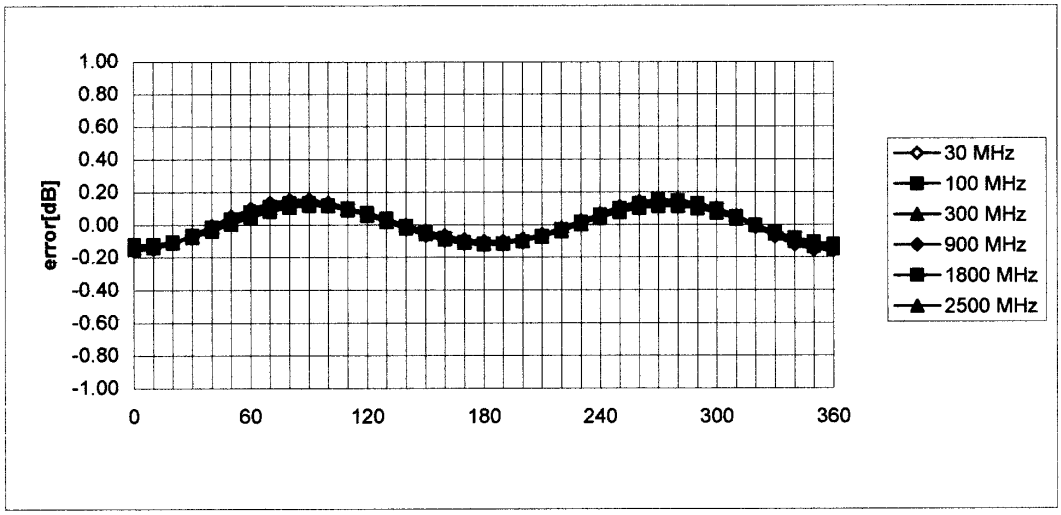


ET3DV6 SN:1558 **March 22, 2002**





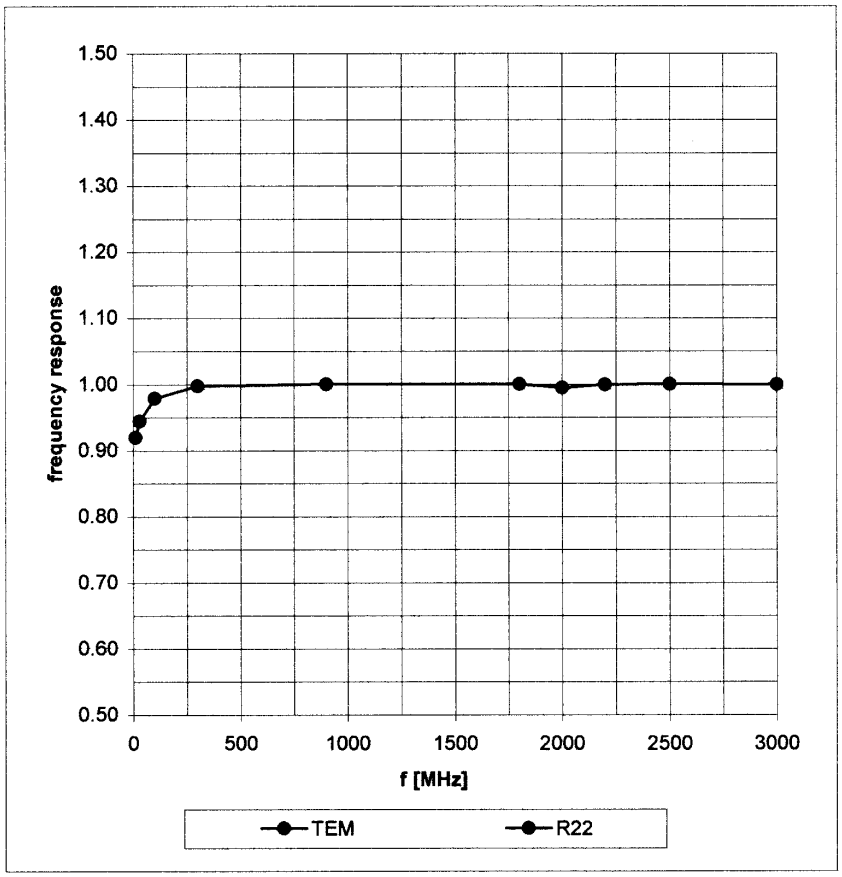
Isotropy Error (ϕ), θ = 0°



ET3DV6 SN:1558 **March 22, 2002**

Frequency Response of E-Field

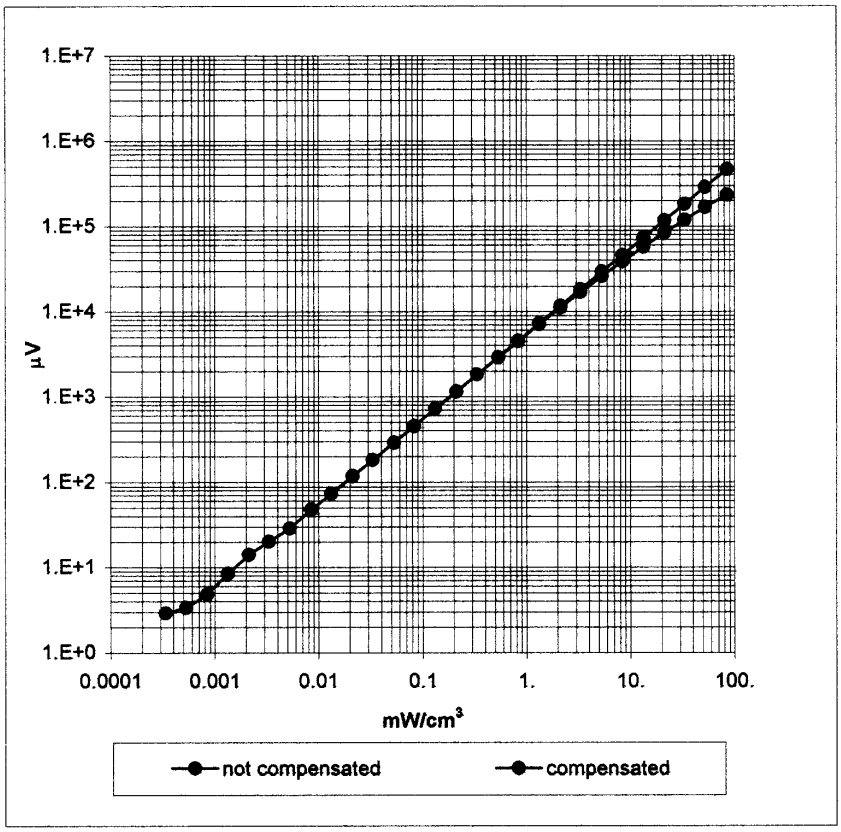
(TEM-Cell:ifi110, Waveguide R22)

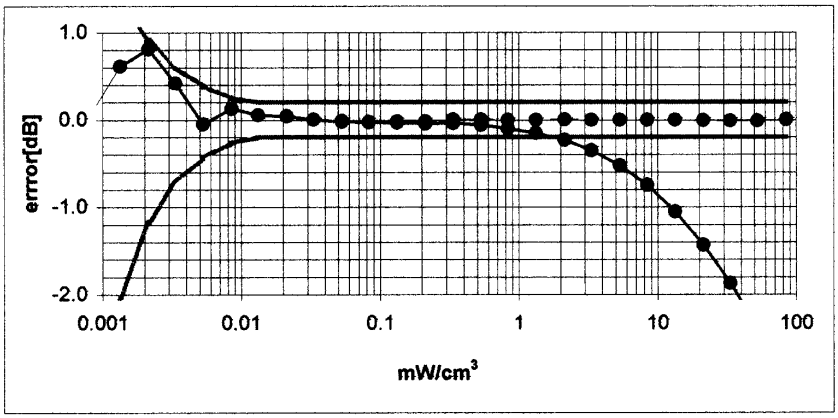


ET3DV6 SN:1558 **March 22, 2002**

Dynamic Range f(SAR_{brain})

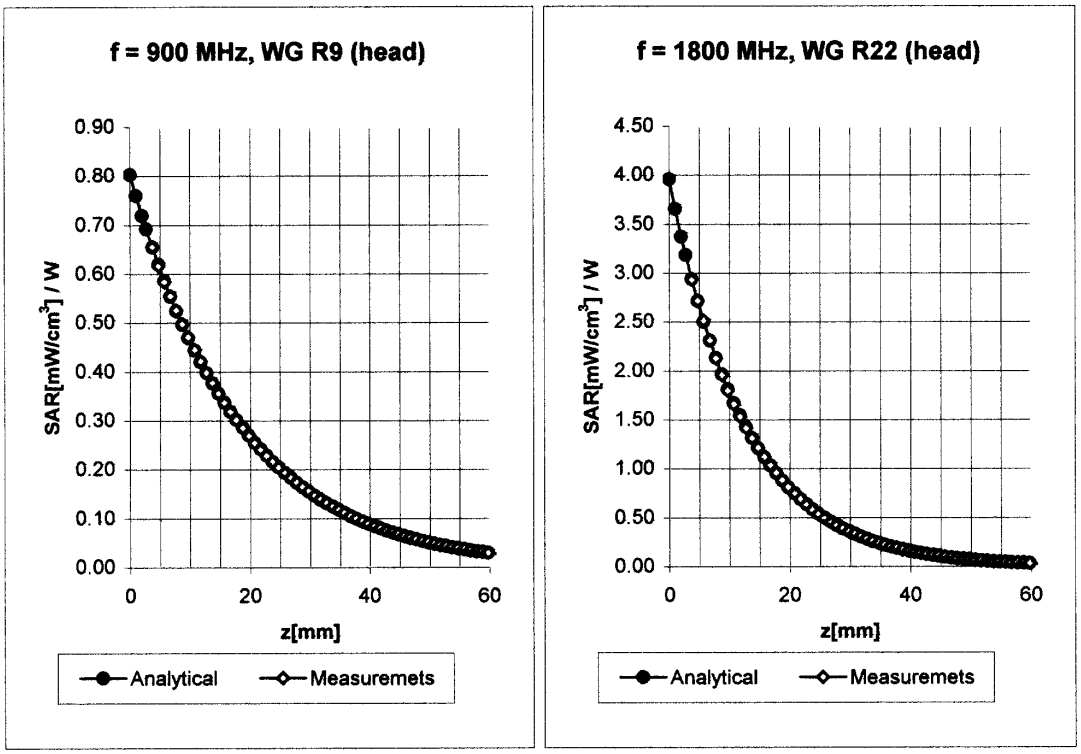
(Waveguide R22)





ET3DV6 SN:1558 **March 22, 2002**

Conversion Factor Assessment



Head **900 MHz** **ε_r = 41.5 ± 5%** **σ = 0.97 ± 5% mho/m**

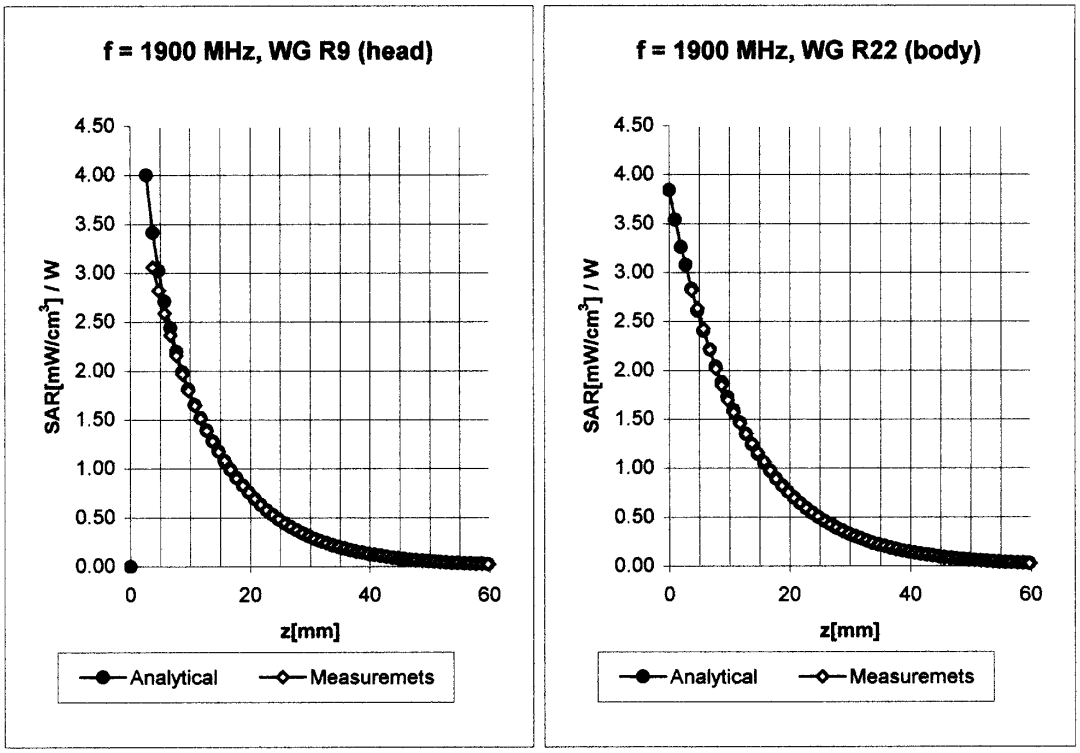
ConvF X	**6.8** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**6.8** ± 8.9% (k=2)	Alpha	**0.37**
ConvF Z	**6.8** ± 8.9% (k=2)	Depth	**2.28**

Head **1800 MHz** **ε_r = 40.0 ± 5%** **σ = 1.40 ± 5% mho/m**

ConvF X	**5.4** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**5.4** ± 8.9% (k=2)	Alpha	**0.43**
ConvF Z	**5.4** ± 8.9% (k=2)	Depth	**2.49**

ET3DV6 SN:1558 **March 22, 2002**

Conversion Factor Assessment



Head **1900 MHz** ε_r **= 40.0 ± 5%** σ **= 1.40 ± 5% mho/m**

ConvF X	**5.2** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**5.2** ± 8.9% (k=2)	Alpha	**0.48**
ConvF Z	**5.2** ± 8.9% (k=2)	Depth	**2.42**

Body **1900 MHz** ε_r **= 53.3 ± 5%** σ **= 1.52 ± 5% mho/m**

ConvF X	**4.6** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**4.6** ± 8.9% (k=2)	Alpha	**0.68**
ConvF Z	**4.6** ± 8.9% (k=2)	Depth	**2.10**

Schmid & Partner
Engineering AG

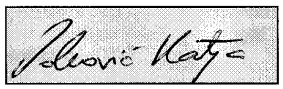
Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1558**
Place of Assessment:	**Zurich**
Date of Assessment:	**March 25, 2002**
Probe Calibration Date:	**March 22, 2002**

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:1558

Conversion factor (± standard deviation)

2450 MHz	ConvF	**4.4 ± 8%**	**ε_r = 39.2 ± 5%** **σ = 1.80 ± 5% mho/m** (head tissue)
2450 MHz	ConvF	**4.0 ± 8%**	**ε_r = 52.7 ± 5%** **σ = 1.95 ± 5% mho/m** (body tissue)

Schmid & Partner
Engineering AG

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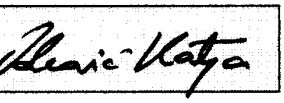
Calibration Certificate

1900 MHz System Validation Dipole

Type:	**D1900V2**
Serial Number:	**5d009**
Place of Calibration:	**Zurich**
Date of Calibration:	**June 13, 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:	
Approved by:	

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Engineering AG

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DASY3

Dipole Validation Kit

Type: D1900V2

Serial: 5d009

Manufactured: February 22, 2002
Calibrated: June 13, 2002

1. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with brain simulating sugar solution of the following electrical parameters at 1900 MHz:

Relative permitivity	**38.5**	± 5%
Conductivity	**1.44 mho/m**	± 10%

The DASY3 System (Software version 3.1d) with a dosimetric E-field probe ET3DV6 (SN:1507, conversion factor 5.2 at 1900 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 20mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

2.1. SAR Measurement with DASY3 System

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 and applying the worst-case extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**43.6 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**22.5 mW/g**

2.2 SAR Measurement with DASY4 System

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 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**40.0 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**21.0 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:	**1.187 ns**	(one direction)
Transmission factor:	**0.986**	(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 1900 MHz:	Re{Z} = **50.4 Ω**
	Im {Z} = **1.7 Ω**
Return Loss at 1900 MHz	**- 35.1 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.

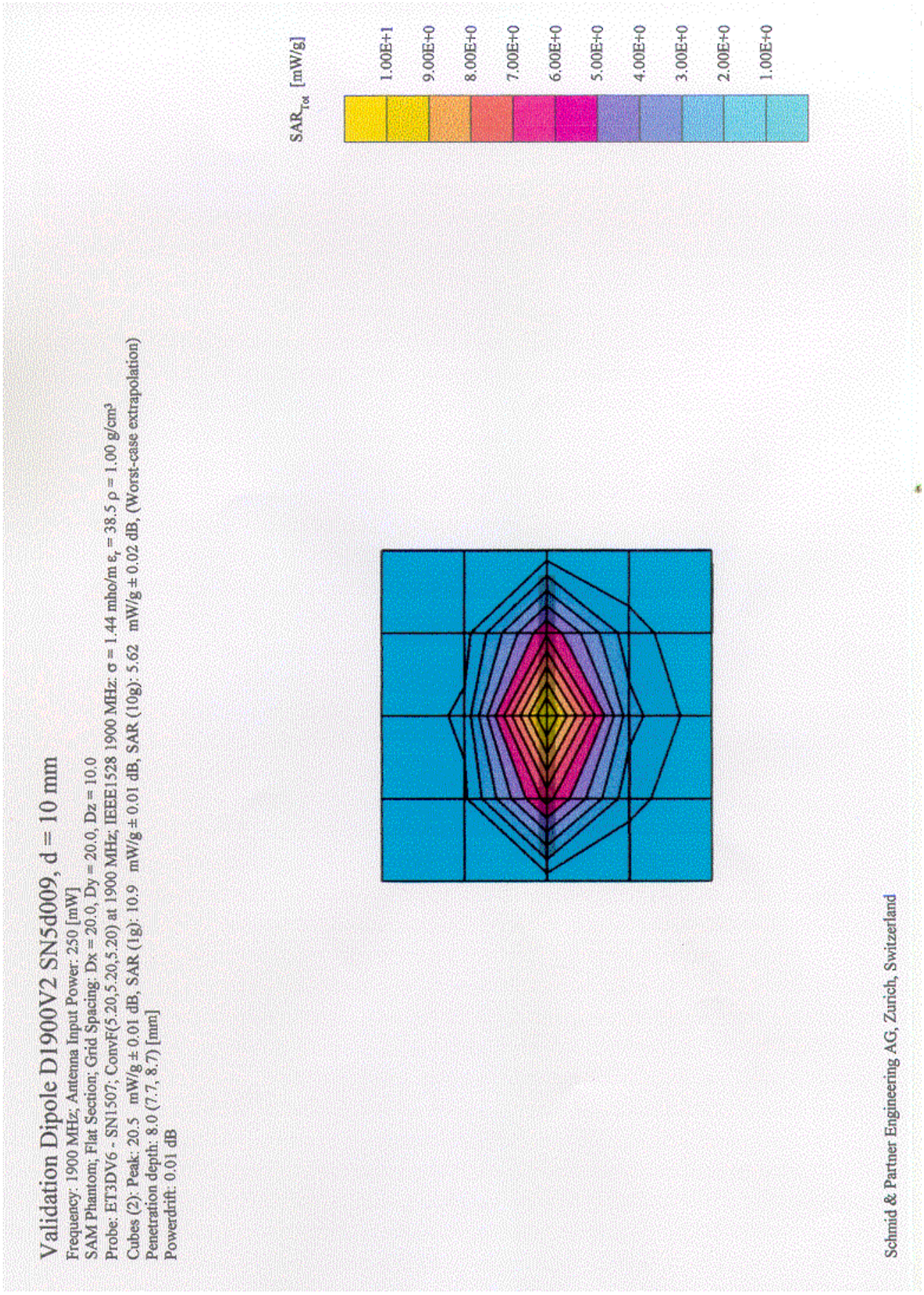
5. Design

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.


Validation Dipole D1900V2 SN5d009, d = 10 mm
Frequency: 1900 MHz; Antenna Input Power: 250 [mW]
SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(5.20,5.20,5.20) at 1900 MHz; IEEE1528 1900 MHz: σ = 1.44 mho/m εr = 38.5 ρ = 1.00 g/cm³
Cubes (2): Peak: 20.5 mW/g ± 0.01 dB, SAR (1g): 10.9 mW/g ± 0.01 dB, SAR (10g): 5.62 mW/g ± 0.02 dB, (Worst-case extrapolation)
Penetration depth: 8.0 (7.7, 8.7) [mm]
Powerdrift: 0.01 dB
SAR_Tot [mW/g]
1.00E+1
9.00E+0
8.00E+0
7.00E+0
6.00E+0
5.00E+0
4.00E+0
3.00E+0
2.00E+0
1.00E+0
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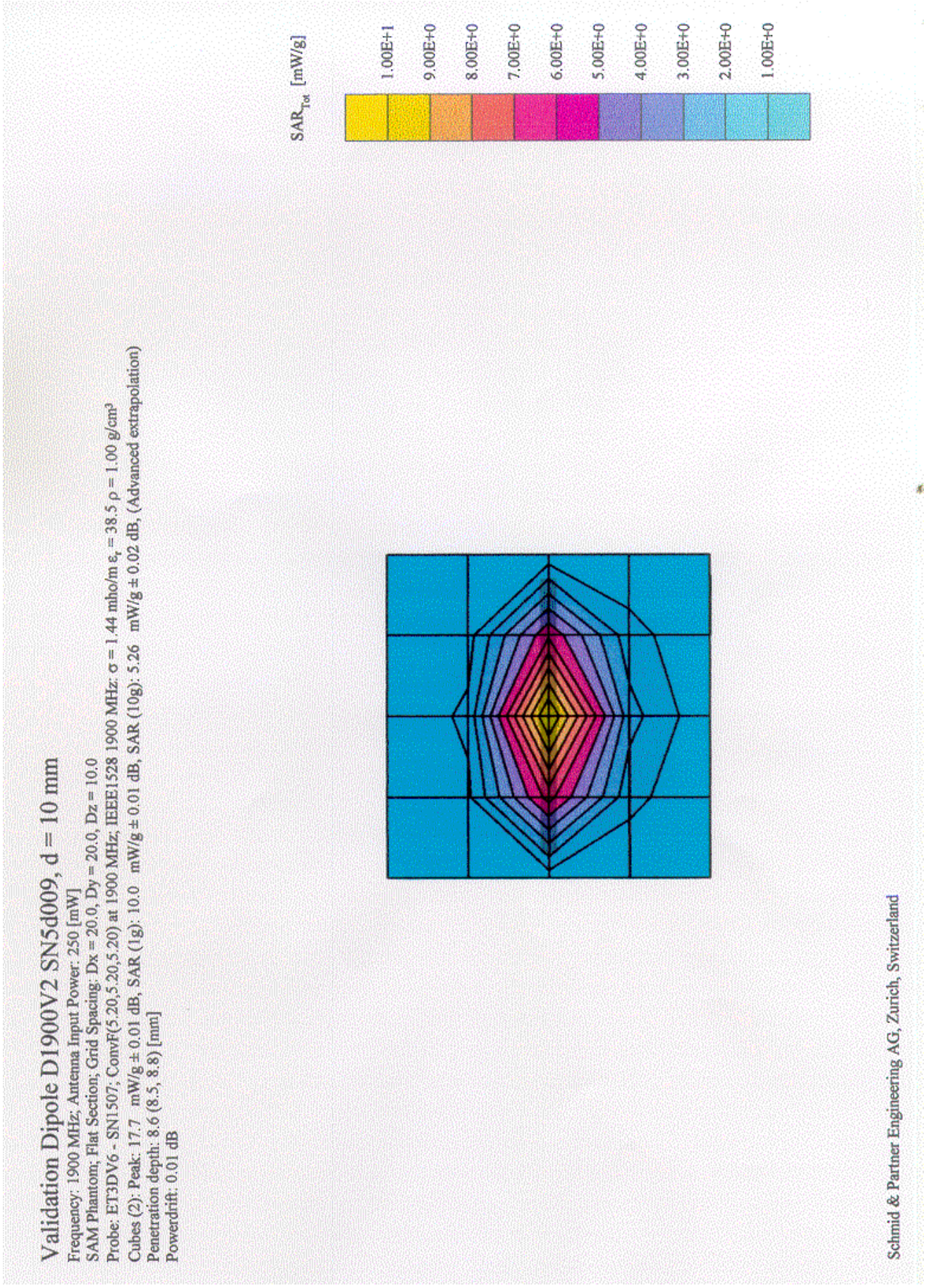
Validation Dipole D1900V2 SN5d009, d = 10 mm
Frequency: 1900 MHz; Antenna Input Power: 250 [mW]
SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(5.20,5.20,5.20) at 1900 MHz; IEEE1528 1900 MHz: σ = 1.44 mho/m ε_r = 38.5 ρ = 1.00 g/cm³
Cubes (2): Peak: 17.7 mW/g ± 0.01 dB, SAR (1g): 10.0 mW/g ± 0.01 dB, SAR (10g): 5.26 mW/g ± 0.02 dB, (Advanced extrapolation)
Penetration depth: 8.6 (8.5, 8.8) [mm]
Powerdrift: 0.01 dB
SAR_Tot [mW/g]
1.00E+1
9.00E+0
8.00E+0
7.00E+0
6.00E+0
5.00E+0
4.00E+0
3.00E+0
2.00E+0
1.00E+0
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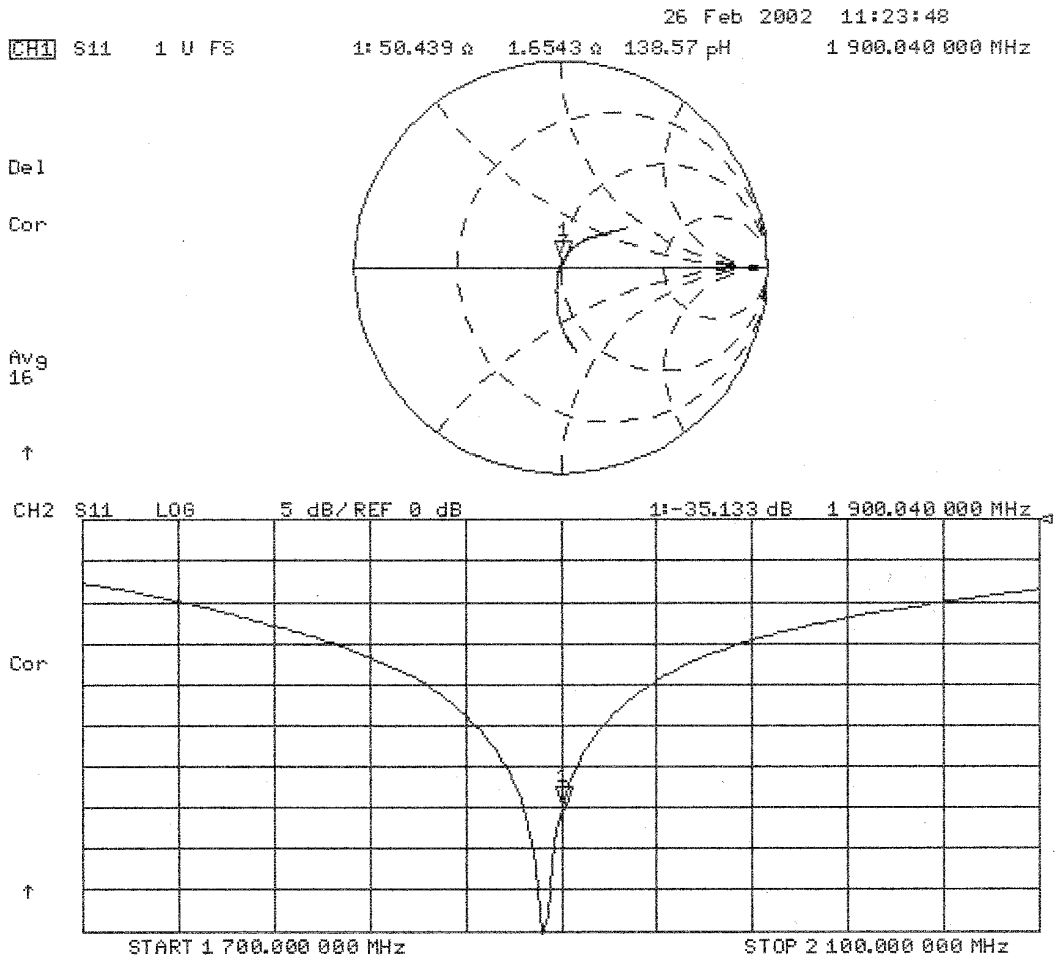
26 Feb 2002 11:23:48
CH1 S11 1 U FS
1: 50.439 Ω 1.6543 Ω 138.57 pH
1 900.040 000 MHz
Del
Cor
Avg
16
CH2 S11 LOG 5 dB/ REF 0 dB
1:-35.133 dB 1 900.040 000 MHz
Cor
START 1 700.000 000 MHz
STOP 2 100.000 000 MHz

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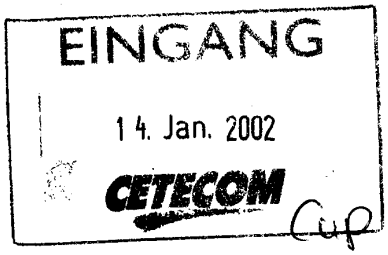

CETECOM ICT Services GmbH
Bernd Rebmann
Untertürkheimer Str. 6-10
66117 Saarbrücken
Deutschland

Zurich, January 10, 2002

Certificate of Conformity

Dear Bernd

It has been a while since you have received your SAM Twin Phantom V4.0/V4.0C.

Several of our customers have required a document to justify to the authorities that the SAM phantom used for SAR measurements is conformant with the respective standards.

For your documentation please find enclosed a copy of the duly signed "Certificate of Conformity/First Article Inspection" (Document No. 881 - QD 000 P40 BA - B). With this certificate we confirm conformity with the CENELEC EN 50361, IEEE P1528-200x draft 6.5 and the IEC PT 62209 draft 0.9 standards.

Please do not hesitate to contact us in case you have any questions or are in need of further clarification. You can always reach us at +41-1-245 97 00 or by e-mail to info@speag.com.

Best regards,

Schmid & Partner Engineering AG

Sibyl Akrong

Schmid & Partner Engineering AG

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

Certificate of conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 BA
Series No	TP-1002 and higher
Manufacturer / Origin	Untersee Composites Hauptstr. 69 CH-8559 Fruthwilen Switzerland

Tests

The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series units (called samples).

Test	Requirement	Details	Units tested
Shape	Compliance with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness	Compliant with the requirements according to the standards	2mm +/- 0.2mm in specific areas	First article, Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz – 3 GHz Relative permittivity < 5 Loss tangent < 0.05.	Material sample TP 104-5
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards	Liquid type HSL 1800 and others according to the standard.	Pre-series, First article

Standards

[1] CENELEC EN 50361
[2] IEEE P1528-200x draft 6.5
[3] IEC PT 62209 draft 0.9
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

Date 18.11.2001

Signature / Stamp Schmid & Partner Engineering AG
Zeughausstrasse 43, CH-8004 Zurich
Tel. +41 1 245 97 00, Fax +41 1 245 97 79

Doc No 881 – QD 000 P40 BA – B Page 1 (1)