



Accredited testing-laboratory

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

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

Test report no.: 4-0601/02_1_1

Type identification : ISL37305P WLAN PC card

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1 General Information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.6. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.

1.2 Statement of Compliance

The SAR values found for the WLAN card ISL37305P WLAN PC card are below the maximum recommended levels of 1.6 W/Kg as averaged over any 1 g tissue according the FCC rule §2.1093, the ANSI/IEEE C 95.1:1992 and the NCRP Report Number 86 for uncontrolled environment.

Tester operator:



2002-05-15

Fabien Coulet

Date

Name

Signature

Technical responsibility for area of testing:



2002-05-15

Bernd Rebmann

Date

Name

Signature

1.3 Testing laboratory

CETECOM ICT Services GmbH

Untertürkheimer Straße 6-10, D-66117 Saarbrücken

Germany

Telephone: +49 681 598 - 0

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Internet: <http://www.cetecom.com>

State of accreditation: The Test laboratory SAR is accredited according to DIN EN 45001.

DAR-No.:TTI-P-G-166/98

Test location, if different from CETECOM ICT Services GmbH

Name: ---

Street: ---

Town: ---

Country: ---

Phone: ---

Fax: ---

1.4 Details of applicant

Name: Intersil B.V.

Address: Rembrandlaan 1a
3723 BG Bilthoven

Country: The Netherlands

Contact: Mr. Derick Sariredjo

Phone: +31 30 225 9742

1.5 Application details

Date of receipt of application: 2002-05-03

Date of receipt of test item: 2002-05-05

Date of test: 2002-05-10

Person who have been present during the test: ---

1.6 Test item

Description of test item: 2.4 GHz WLAN PC card built into a notebook
type Thinkpad 390E, brand IBM
Type designation: ISL37305P
Frequency: 2412 MHz (channel 1) to 2472 MHz (channel 13)
Max. measured effective radiated power (ERP): 19.2 dBm or 83.2 mW -measured by 2442 MHz (channel 7)-
Antenna: integrated antenna,
Manufacturer: see applicant

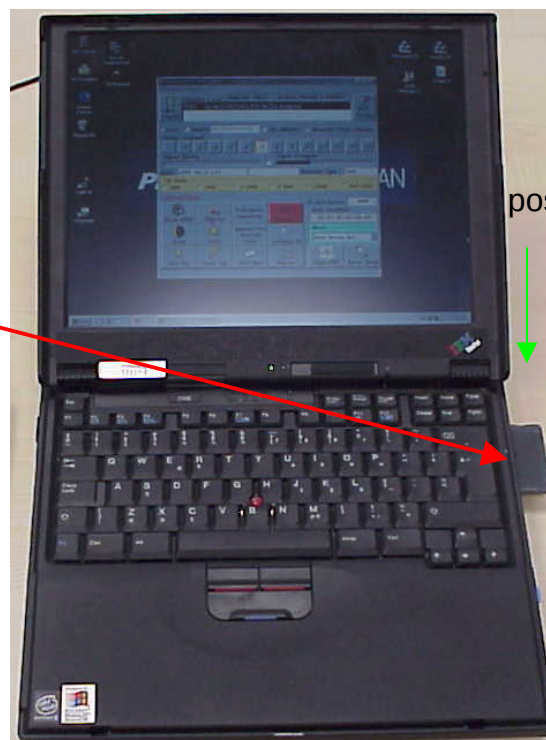
Auxiliary equipment: IBM Thinkpad 390E notebook

Max. measured effective radiated output power (ERP) - 19.2 dBm (83.2 mW)

1.6.2 Test position

The WLAN card built into the notebook were measured in four different positions. To simulate the worst case configuration, the EUT were placed directly on the flat phantom.

**position of the
WLAN card with
transmit antenna**



position „top“

position „rear“

position „right“

position „under“

1.7 Test specifications

Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01)

Draft IEEE Std 1528-200X: Version 6.4: July 2001

1.7.1 RF exposure limits

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR* (Brain)	1.60 mW/g	8.00 mW/g
Spatial Average SAR** (Whole Body)	0.08 mW/g	0.40 mW/g
Spatial Peak SAR*** (Hands/Feet/Ankle/Wrist)	4.00 mW/g	20.00 mW/g

Table 1: RF exposure limits

Notes:

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time

** The Spatial Average value of the SAR averaged over the whole body.

*** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

2 Technical test

2.1. Summary of test results

- ☒ No deviations from the technical specification(s) were ascertained in the course of the tests performed.
- ☐ The deviations as specified in 2.4 were ascertained in the course of the tests performed.

2.2 Test environment

Ambient temperature: 21°C – 23°C

Tissue simulating liquid: 21°C – 23°C

2.3 Test equipment used

Manufacturer	Device	Type	Serial number	Date of last calibration
Schmid & Partner Engineering AG	Dosimetric E-Fiel Probe	ET3DV6	1558	March 22, 2002
Schmid & Partner Engineering AG	900 MHz System Validation Dipole	D900V2	102	February 13, 2001
Schmid & Partner Engineering AG	1800 MHz System Validation Dipol	D1800V2	287	February 13, 2001
Schmid & Partner Engineering AG	Data acquisition electronics	DAE3V1	413	January 15, 2001
Schmid & Partner Engineering AG	Software	DASY 3 V3.1c	---	Calibration isn't necessary
Schmid & Partner Engineering AG	Phantom	SAM	---	Calibration isn't necessary
Rohde & Schwarz	Universal Radio Communication Tester	CMU 200	U-972406/000	August 30, 2001
Hewlett Packard	Network Analyser S-Param. Test Set	HP 8510C HP 8515 A	2643A03725 2723A01379	January18, 2001
Agilent	Dielectric Probe Kit	Agilent 85070C	US99360146	March 8, 2001

Table 2: Test equipment

2.4 Test results (Body SAR)

The table contain the measured SAR values averaged over a mass of 1 g			
Channel (frequency)	Position	SAR value	Limit
7 (2442 MHz)	1: right side	0.378 W/kg	1.6 W/kg
7 (2442 MHz)	2: rear side	0.0187 W/kg	1.6 W/kg
7 (2442 MHz)	3: top side	0.0256 W/kg	1.6 W/kg
7 (2442 MHz)	3: under side	0.118 W/kg	1.6 W/kg

Table 3: Body results

Note: Upper and lower frequencies were not measured because the values at the middle frequency did not exceed 1.27 W/kg (1.60 W/kg reduced of 2dB)

2.5 Tissue dielectric properties

The following materials are used for producing the tissue-equivalent materials:

Ingredients (% by weight)	Frequency (MHz)									
	☐ 450		☐ 835		☐ 915		☐ 1900		☒ 2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	52.64	69.91	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.40	1.35	0.76	0.36	0.13	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	0.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	0.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	47.0	29.96	0.0	26.7

Table 4: Tissue dielectric properties

Salt: 99+% Pure Sodium Chloride

Sugar: 98+% Pure Sucrose

Water: De-ionized, 16MΩ+ resistivity

HEC: Hydroxyethyl Cellulose

DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1,3,3-tetramethylbutyl)phenyl]ether

2.6 Tissue parameters

Used Target Frequency	Target Head Tissue		Target Body Tissue		Measured Head Tissue		Measured Body Tissue		Measured Date
[GHz]	Permittivity	Conductivity [S/m]	Permittivity	Conductivity [S/m]	Permittivity	Conductivity [S/m]	Permittivity	Conductivity [S/m]	
☐ 450	43.5	0.87	56.7	0.94	---	---	60.6	0.84	2002-04-15
☐ 835	41.5	0.90	55.2	0.97	---	---	---	---	---
☐ 900	41.5	0.97	55.0	1.05	40.7	0.95	56.7	0.96	2002-04-15
☐ 915	41.5	0.98	55.0	1.06	---	---	---	---	---
☐ 1900	40.0	1.40	53.3	1.52	40.5	1.45	40.5	52.9	2002-04-15
☒ 2450	39.2	1.80	52.7	1.95	40.7	1.88	54.6	1.92	2002-04-15

Table 5: Parameter of the tissue simulating liquid

Note: The dielectric properties have been measured by the contact probe method at 22°C.

2.7 Measurement uncertainties

The overall combined measurement uncertainty of the measurement system is +/-12,1% (K=1). The breakdown of the individual uncertainties is as follows:

Calibration Error:				
	Probability Distribution	Standard Uncertainty		
		900 MHz	1500 MHz	1800 MHz
Incident power	Rectangular	+/- 1,2 %	+/- 1,2 %	+/- 1,2 %
Mismatch uncertainty	Rectangular	+/- 0,6 %	+/- 0,6 %	+/- 0,6 %
Exp. fitting error (95% confidence)	Normal	+/- 0,4 %	+/- 0,2 %	+/- 0,2 %
Liquid permittivity	Rectangular	+/- 2,3 %	+/- 2,8 %	+/- 2,9 %
Probe positioning	Normal	+/- 0,5 %	+/- 0,8 %	+/- 1,0 %
Field homogeneity	Rectangular	+/- 0,6 %	+/- 1,2 %	+/- 1,4 %
Combined Standard Uncertainty		+/- 2,8 %	+/- 3,4 %	+/- 3,6 %
E-Field Probe Error:				
Error Description	Error	Probability Distribution	Weight	Standard Uncertainty
Isotropy around axis	+/- 0,2 dB	U-shape	0,5	+/- 2,4 %
Spherical Isotropy	+/- 0,4 dB	U-shape	0,5	+/- 4,8 %
Isotropy from gradient	+/- 0,5 dB	U-shape	0	
Spatial resolution	+/- 0,5 %	normal	1	+/- 0,5 %
Linearity error	+/- 0,2 dB	rectangular	1	+/- 2,5 %
Calibration error	+/- 3,6 %	normal	1	+/- 3,6 %
Combined Standard Uncertainty:				+/- 6,9 %
Source Uncertainty:				

Error Description	Error	Probability Distribution	Weight	Standard Uncertainty	
Device positioning	+/- 6%	normal	1	+/- 6%	
Laboratory set-up	+/- 3 %	normal	1	+/- 3%	
Combined Standard Uncertainty:				+/- 6,7 %	
SAR Evaluation Error					
Error Description	Error	Probability Distribution	Weight	Standard Uncertainty	Offset
Data acquisition error	+/- 1%	rectangular	1	+/- 0,6 %	
ELF and RF disturbances	+/- 0,25 %	normal	1	+/- 0,25 %	
Conductivity assessment	+/- 10 %	rectangular	1	+/- 5,8 %	
Extrapolation and boundary effects	+/- 3 %	normal	1	+/- 3 %	+ 5 %
Probe positioning	+/- 0,1 mm	normal	1	+/- 1 %	
Integration and cube orientation	+/- 3 %	normal	1	+/- 3 %	
Cube shape inaccuracies	+/- 2 %	rectangular	1	+/- 1.2 %	
Combined Standard Uncertainty:				+/- 7,4 %	

Combined Uncertainties		
Error Description	Standard Uncertainty	Offset
E-field probe errors	+/- 6.9 %	
SAR evaluation error	+/- 7.4 %	+/- 5 %
Source uncertainty	+/- 6,7 %	
Combined Standard Uncertainty:	+/- 12.1 %	
Expanded Uncertainty (k=2):	+/- 24,2 %	

Table 6: Measurement uncertainties

The measurement uncertainties were performed by Schmid & Partner Engineering AG.

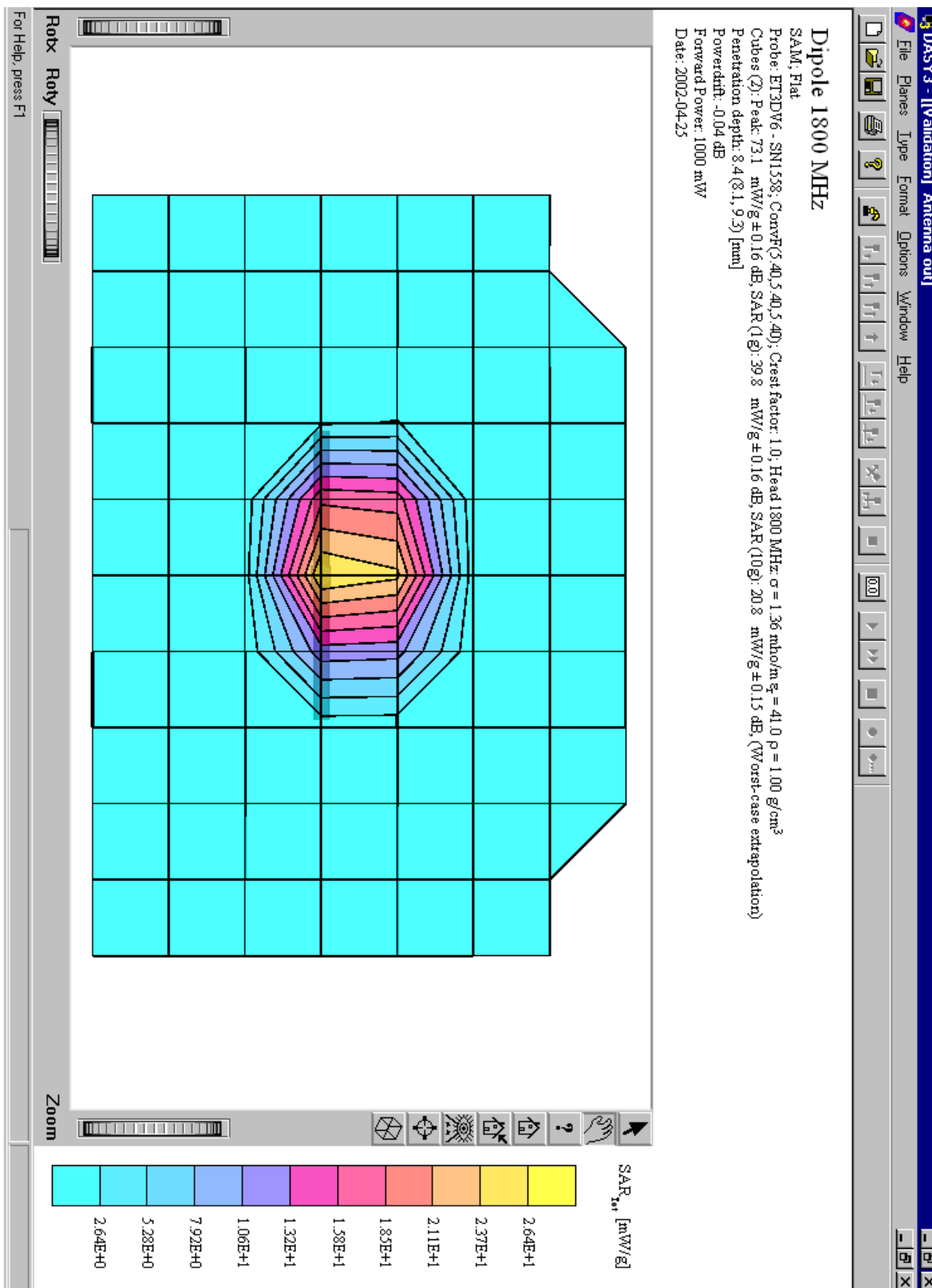
2.8 System validation

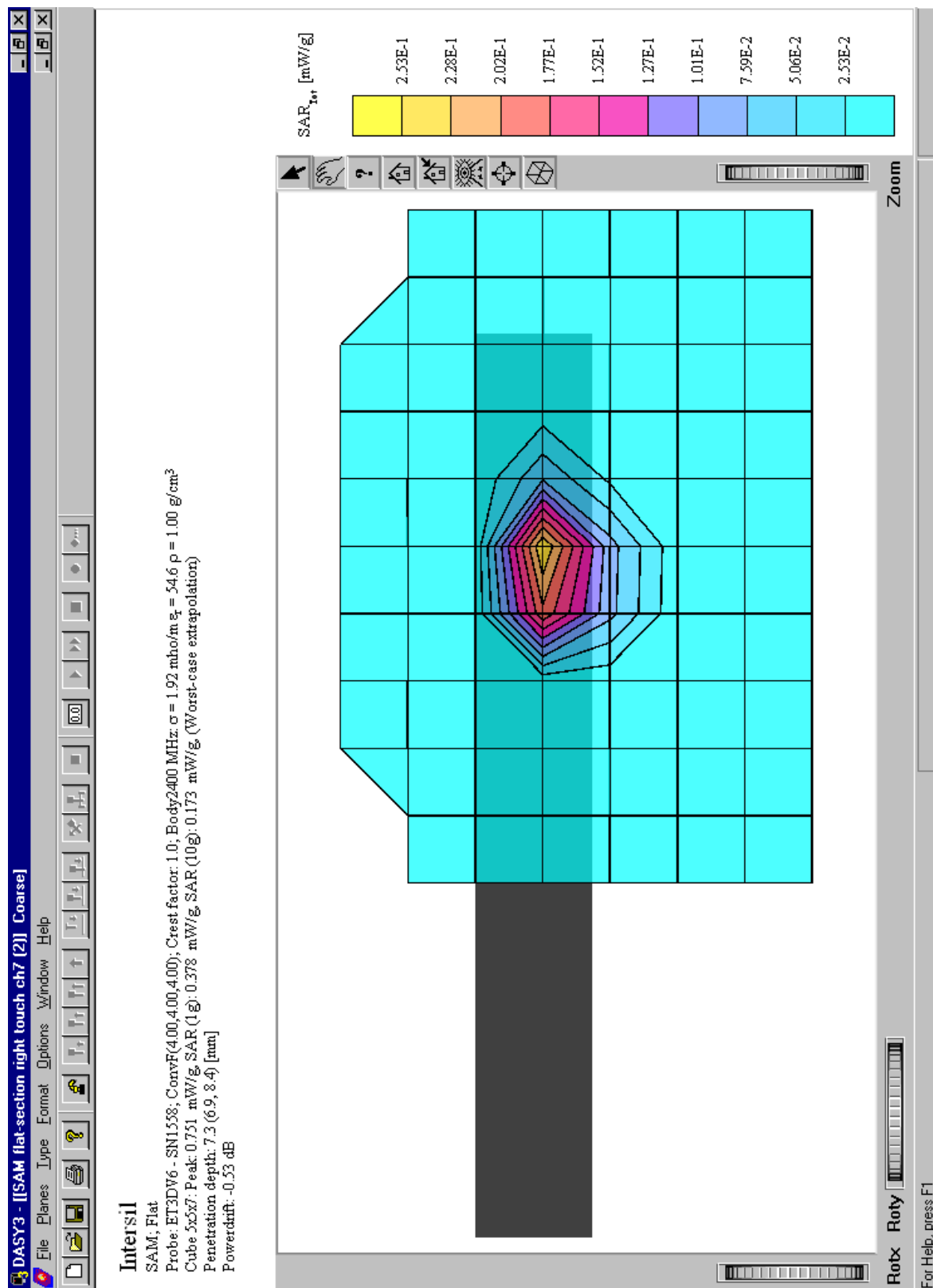
The system validation is used for verifying the accuracy of the complete measurement system and performance of the software. The system validation is performed with 1800 MHz head tissue equivalent material according IEEE Std 1528-200X: 2001. (graphic plot attached).

Validation Kit	Frequency	Target SAR _{1g}	Target SAR _{10g}	Measured SAR _{1g}	Measured SAR _{10g}	Measured date
DV2 1800, S/N:287	1800 MHz	38.1 mW/g	19.8 mW/g	39.8 mW/g	20.8 mW/g	2002.04.25

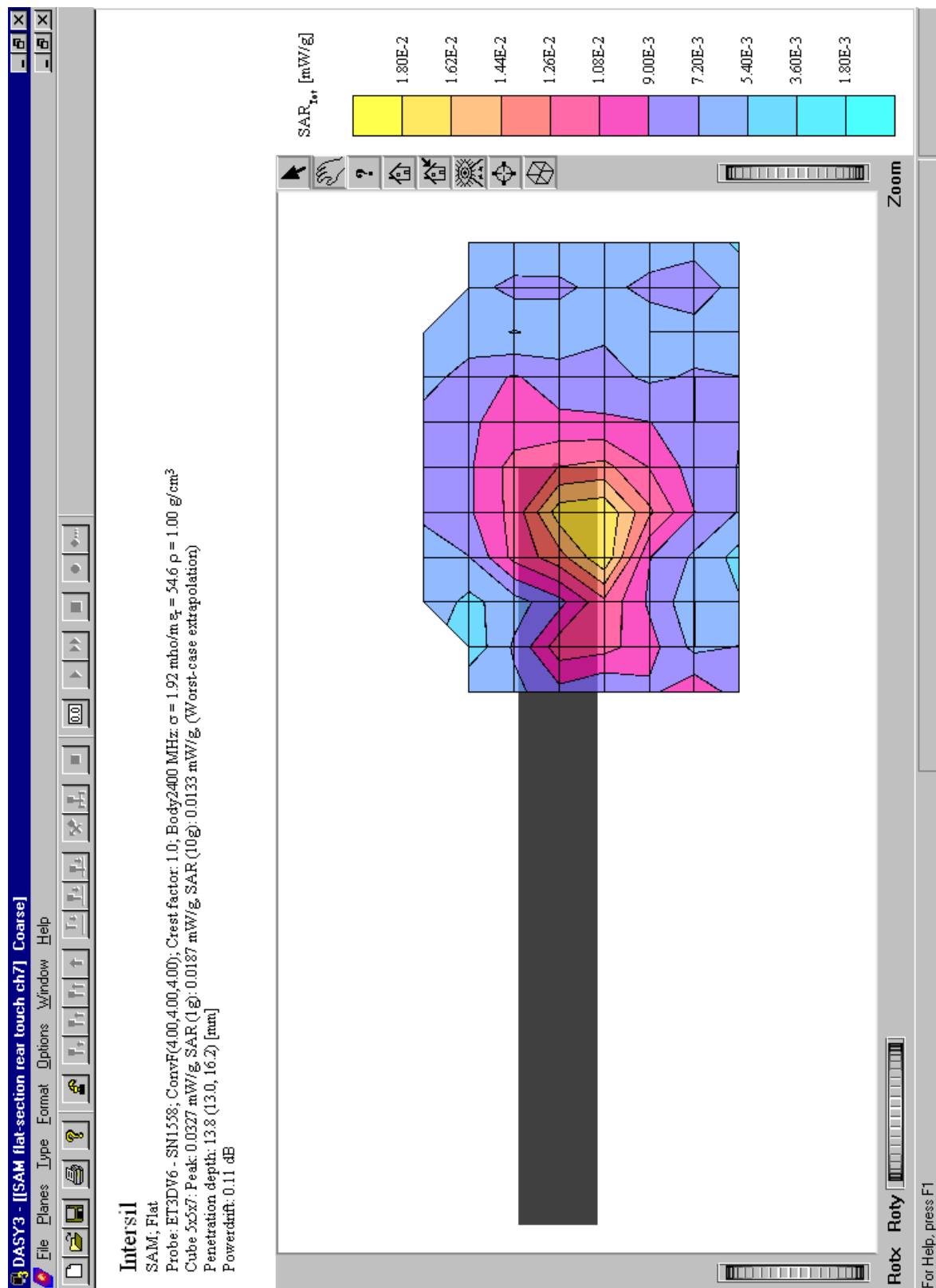
Table 7: Results system validation

Appendix 1: System performance verification

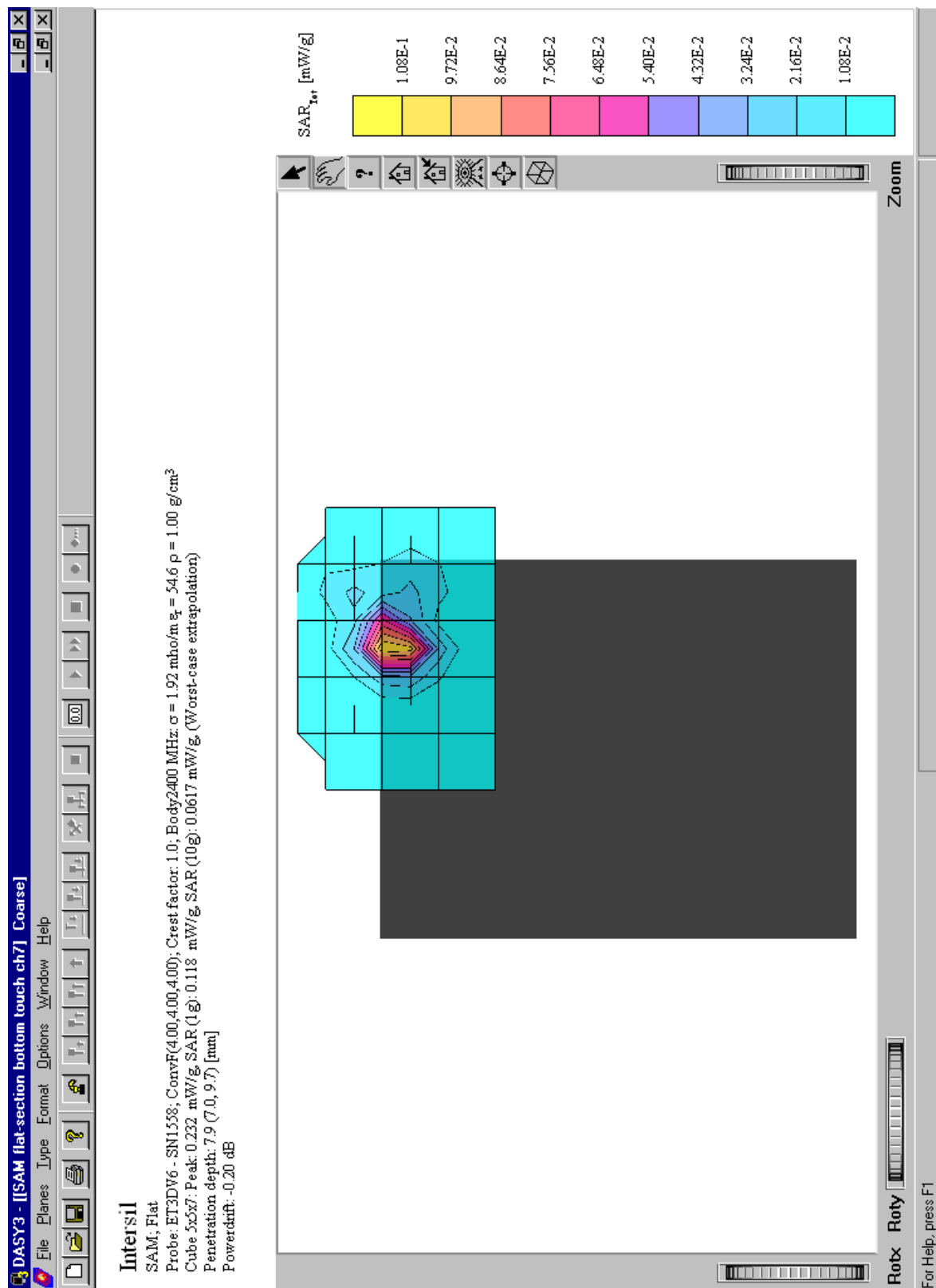


Appendix 2: Measurement results (printout from DASYTM)

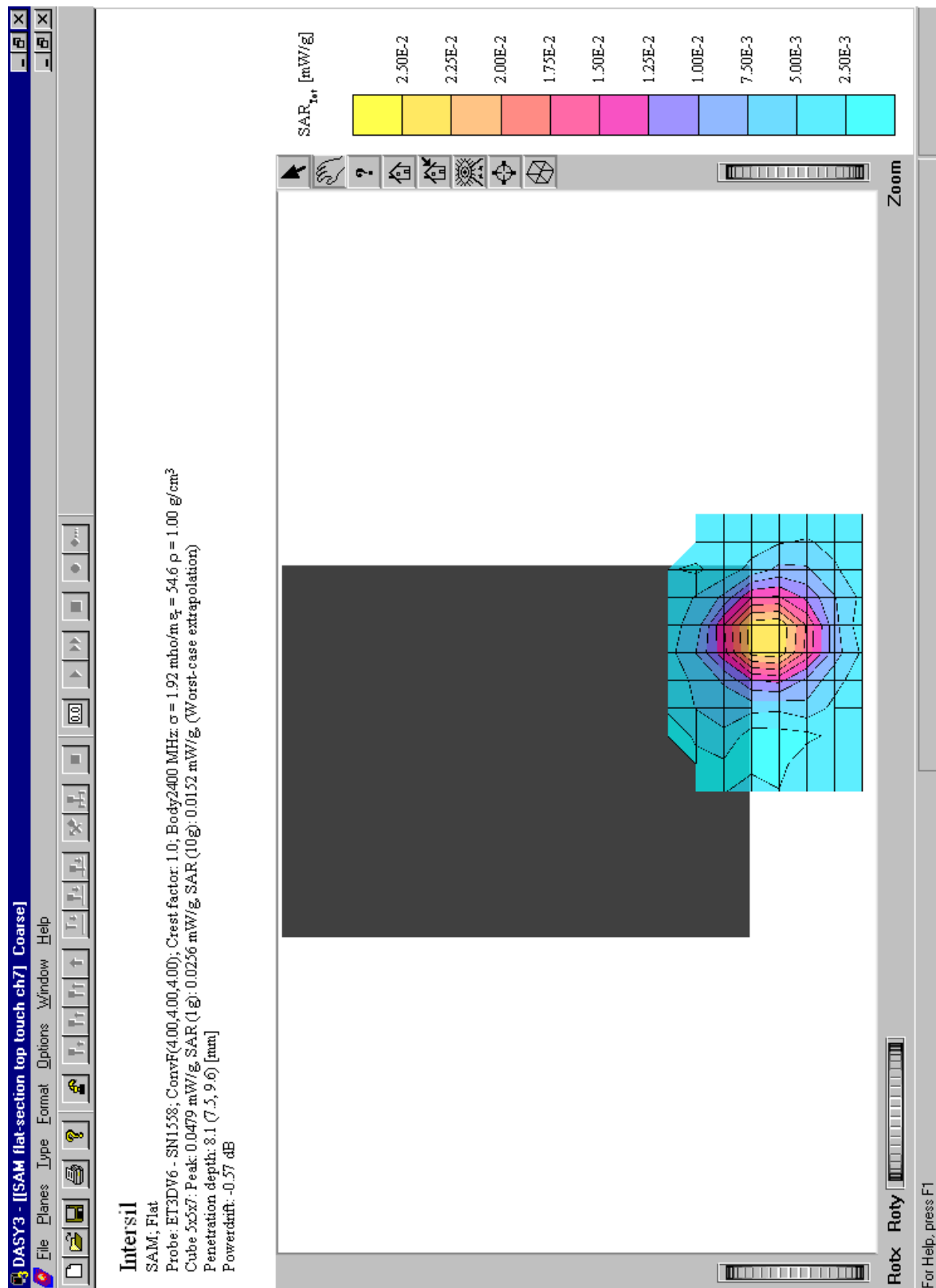
Position 1: right side



Position 2: rear side



Position 3: under side



Position 4: top side

Appendix 3: Photo documentation



Photo 1: Measurement System DASY 3

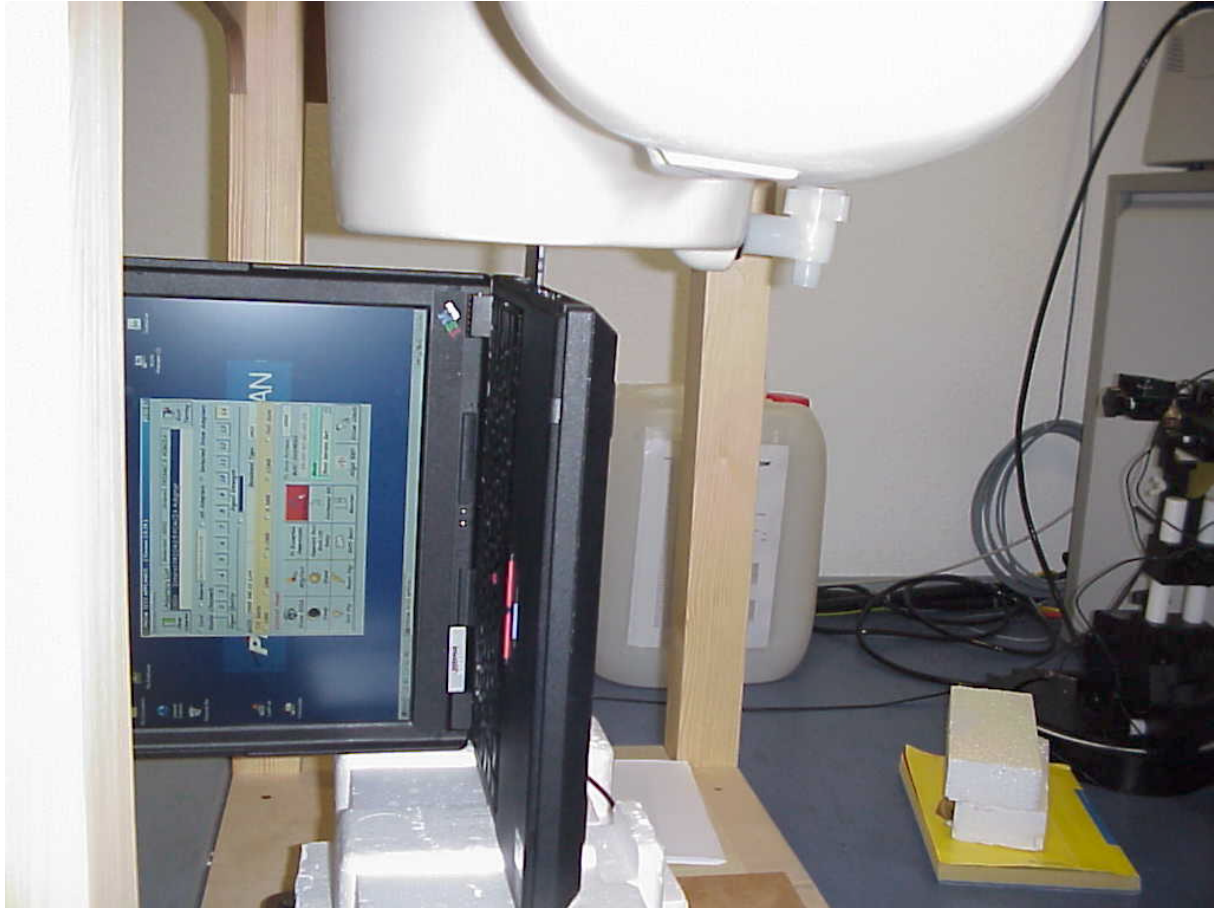


Photo 2: position “right side”



Photo 3: position "front side"



Photo 4: position “under side”



Photo 4: position “rear side”



Photo 5: EUT built into a notebook type Thinkpad 390E,



Photo 6: EUT front side



Photo 7: EUT rear side

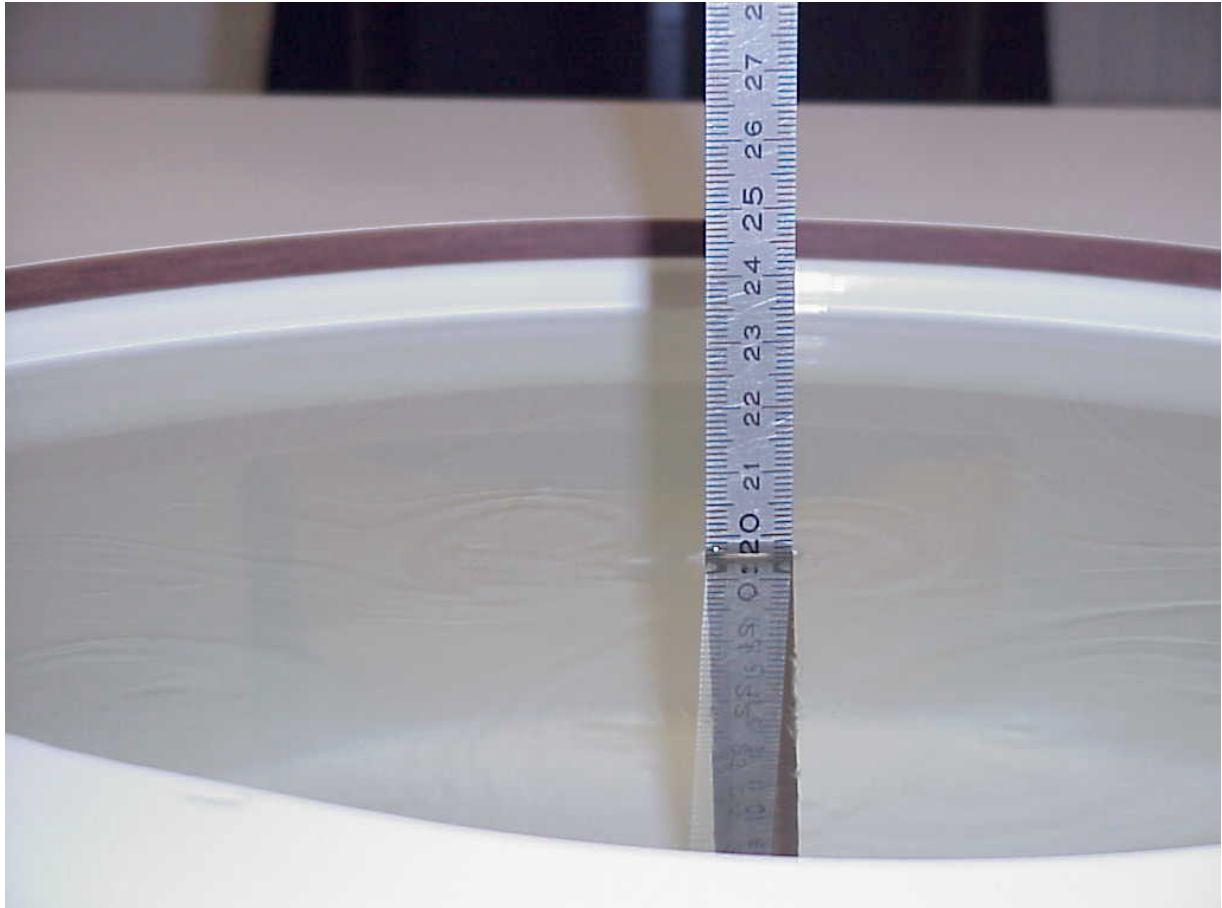


Photo 8: Liquid depth, body measurement

Appendix 4: Calibration parameters of E-field probe**Schmid & Partner
Engineering AG**

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

Calibration Certificate**Dosimetric E-Field Probe**

Type:

ET3DV6

Serial Number:

1558

Place of Calibration:

Zurich

Date of Calibration:

March 22, 2002

Calibration Interval:

12 months

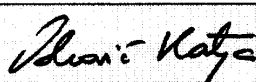
Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

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:



ET3DV6 SN:1558

March 22, 2002

DASY3 - Parameters of Probe: ET3DV6 SN:1558

Sensitivity in Free Space

NormX	1.47 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.34 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.39 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

DCP X	98	mV
DCP Y	98	mV
DCP Z	98	mV

Sensitivity in Tissue Simulating Liquid

Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
ConvF X	6.8 $\pm 8.9\%$ (k=2)	Boundary effect:	
ConvF Y	6.8 $\pm 8.9\%$ (k=2)	Alpha	0.37
ConvF Z	6.8 $\pm 8.9\%$ (k=2)	Depth	2.28
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
ConvF X	5.4 $\pm 8.9\%$ (k=2)	Boundary effect:	
ConvF Y	5.4 $\pm 8.9\%$ (k=2)	Alpha	0.43
ConvF Z	5.4 $\pm 8.9\%$ (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 $\pm$ 0.2	mm

**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:

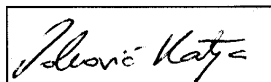
March 25, 2002

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:1558Conversion factor ($\pm$ standard deviation)2450 MHz ConvF $4.4 \pm 8\%$ $\epsilon_r = 39.2 \pm 5\%$
 $\sigma = 1.80 \pm 5\% \text{ mho/m}$
(head tissue)2450 MHz ConvF $4.0 \pm 8\%$ $\epsilon_r = 52.7 \pm 5\%$
 $\sigma = 1.95 \pm 5\% \text{ mho/m}$
(body tissue)