CETECOM ICT Services GmbH

Untertuerkheimer Str. 6-10, 66117 Saarbruecken, Germany
SAR-Laboratory

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Accredited EMC-Test-Laboratory
accredited by:
Regulatory Authority for Telecommunications and Posts (Reg TP)
DAR-No.: TTI-P-G-166/98-30

Federal Motor Transport Authority (KBA)
DAR registration number: KBA-P 00070-97 from January –19-1999

Listed by
FEDERAL COMMUNICATIONS COMMISSION (FCC)
Registration Number: 90462
FCC Website: WWW.FCC.GOV

Test report no.: 5-3781-01-03/01
Type identification : GIGASET 4820/4840

Table of Content

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 portable phone Siemens GIGASET 4820/4840 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 95.1:1999 and the NCRP Report Number 86 for uncontrolled environment.

Tester operator:

20.11.2001 Fabien Coulet

Date Name Signature

Technical responsibility for area of testing:

20.11.2001 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
Fax: + 49 681 598 - 8475
e-mail: info@ict.cetecom.de
Internet: http://www.cetecom.com
State of accreditation: The Test laboratory SAR is accredited according to DIN EN ISO / IEC 17025. DAR-No.:TTI-P-G-166/98-30

Test location, if different from CETECOM ICT Services GmbH

Name: ---
Street: ---
Town: ---
Country: ---
Phone: ---
Fax: ---

1.4 Details of applicant

Name: SIEMENS AG
Street: Frankenstrasse 2
Town: 46395 Bocholt
Country: Germany
Phone: +49 2871 91 0
Fax: +48 2871 91 2495

Contact: Mr. Uwe Alt
Phone: +49 2871 2948

1.5 Application details

Date of receipt of application: 30.10.01
Date of receipt of test item: 30.10.01
Date of test: 30.10.01-5.11.01
Person who have been present during the test: --

1.6 Test item

Description of test item:

EUT Type:	Home RF-Voice Phone, mobile part
Trade Name:	Siemens
Model:	GIGASET 4820/4840
SW:	10_29
Frequency:	2400 – 2483.5 MHz (2403-2477 MHz)
Modulation:	800KFXD / 75M0FXD (FHSS) TDMA
Max RF output power rad.:	199.6 mW EIRP
Antenna Type:	integral antenna
Used battery:	2 x SAFT RH6 Ni-MH; 1.2V 1300 mAh

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 and 2.5 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	February 20, 2001
Schmid & Partner Engineering AG	Dosimetric E-Fiel Probe	ET3DV6	1559	February 20, 2001
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	Pre SAM	---	Calibration isn't necessary
Rohde & Schwarz	Universal Radio Communication Tester	CMU 200	U-972406/000	August 30, 2001
Hewlett Packard	Network Analyser 300 kHz to 3 GHz	HP 8753C	2936A00872	Mai 11, 1998
Agilent	Dielectric Probe Kit	Agilent 85070C	US99360146	March 8, 2001

2.4 Test results (Head SAR)

The table contain the measured SAR values averaged over a mass of 1 g				
Channel (frequency)	Position	Left hand position	Right hand position	Limit
37 (2366 MHz)	Cheek:	0.108 W/kg	0.119 W/kg	1.6 W/kg
37 (2366 MHz)	tilted 15°:	0.119 W/kg	0.117 W/kg	1.6 W/kg

Table 2: Test results (Head SAR)

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 2 dB)

2.5 Test results (Body SAR)

The table contain the measured SAR values averaged over a mass of 1 g			
Channel (frequency)	Position	Touch on the flat phantom	Limit
37 (2366 MHz)	Front	0.101 W/kg	1.6 W/kg
37 (2366 MHz)	Back	0.0646 W/kg	1.6 W/kg

Table 3: Test results (Body SAR)

Note 1: The body measurement were performed only with the mobile phone without ancillary equipment. To simulate the worst case configuration, the EUT were placed directly on the flat phantom.
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 2 dB)

Note2: The used conversion factor during the measurement was 5.4 at 1800 MHz, this value was not extrapolated to a frequency of 2400 MHz since use of a conversion of 5.40is the worst case condition

Note 3: Crest factor 8 represents the worst operation condition.

2.6 Tissue dielectric properties

The dielectric properties have been measured by the contact probe method at 22-24°C. The following materials are used for producing the tissue-equivalent materials:

Ingredients (% by weight)	**Frequency (MHz)**									
Used frequency	☐ 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	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.40	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	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	44.92	0.0	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

2.7 Tissue parameters

Used Target Frequency	**Target Head Tissue**		**Target Body Tissue**		**Measured Head Tissue**		**Measured Body Tissue**		**Measured Date**
[MHz]	ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]	
☐ 450	43.5	0.87	56.7	0.94	---	---	---	---	---
☐ 835	41.5	0.90	55.2	0.97	---	---	---	---	---
☐ 900	41.5	0.97	55.0	1.05	---	---	---	---	---
☐ 915	41.5	0.98	55.0	1.06	---	---	---	---	---
☐ 1800 - 2000	40.0	1.40	53.3	1.52	---	---	---	---	---
☒ 2450	39.2	1.80	52.7	1.95	36.3	1.92	53.0	2.14	30th August 01

Table 5: Parameter of the tissue simulating liquid

2.8 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.

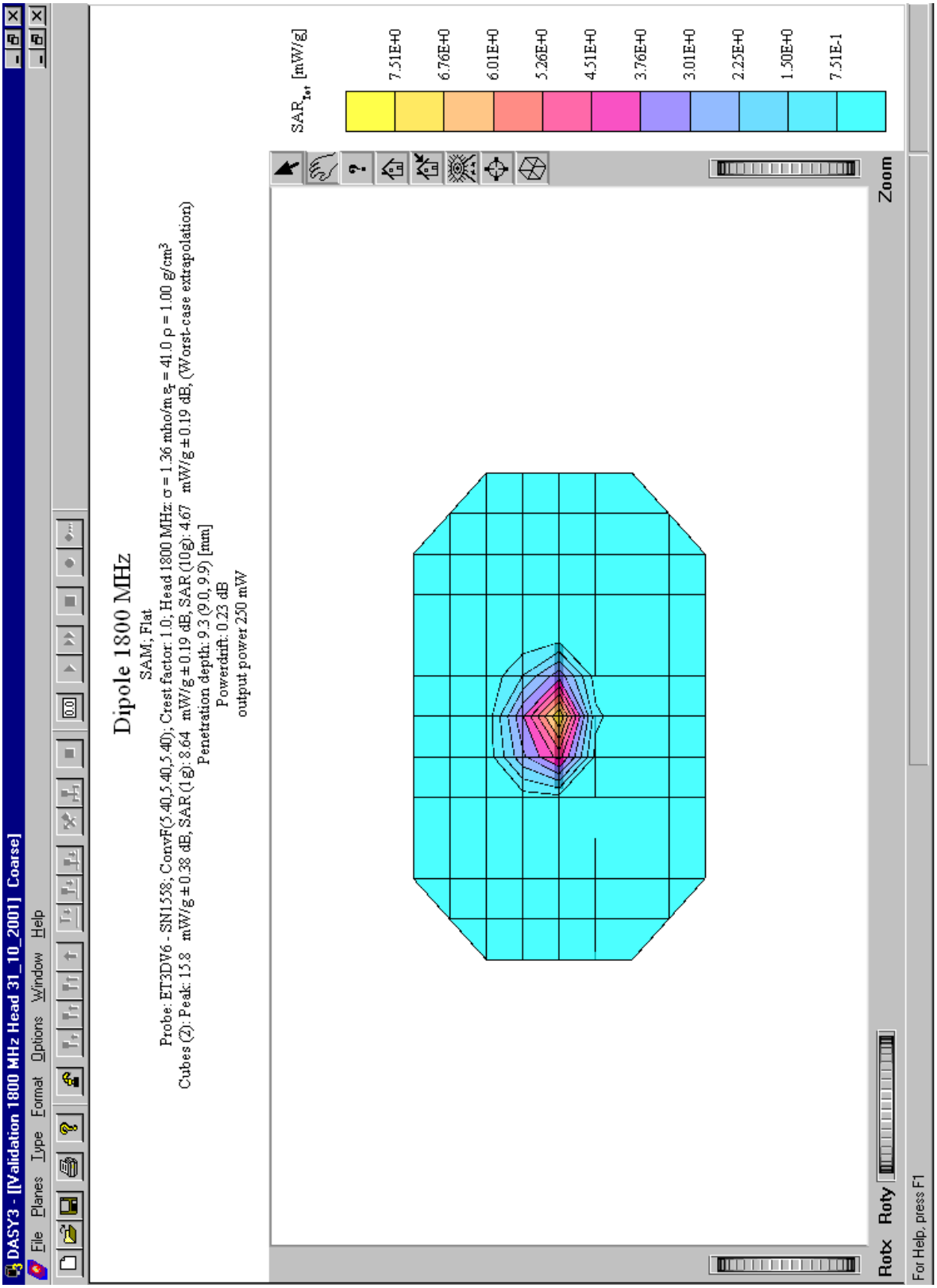
2.9 System validation

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. (graphics plots attached).

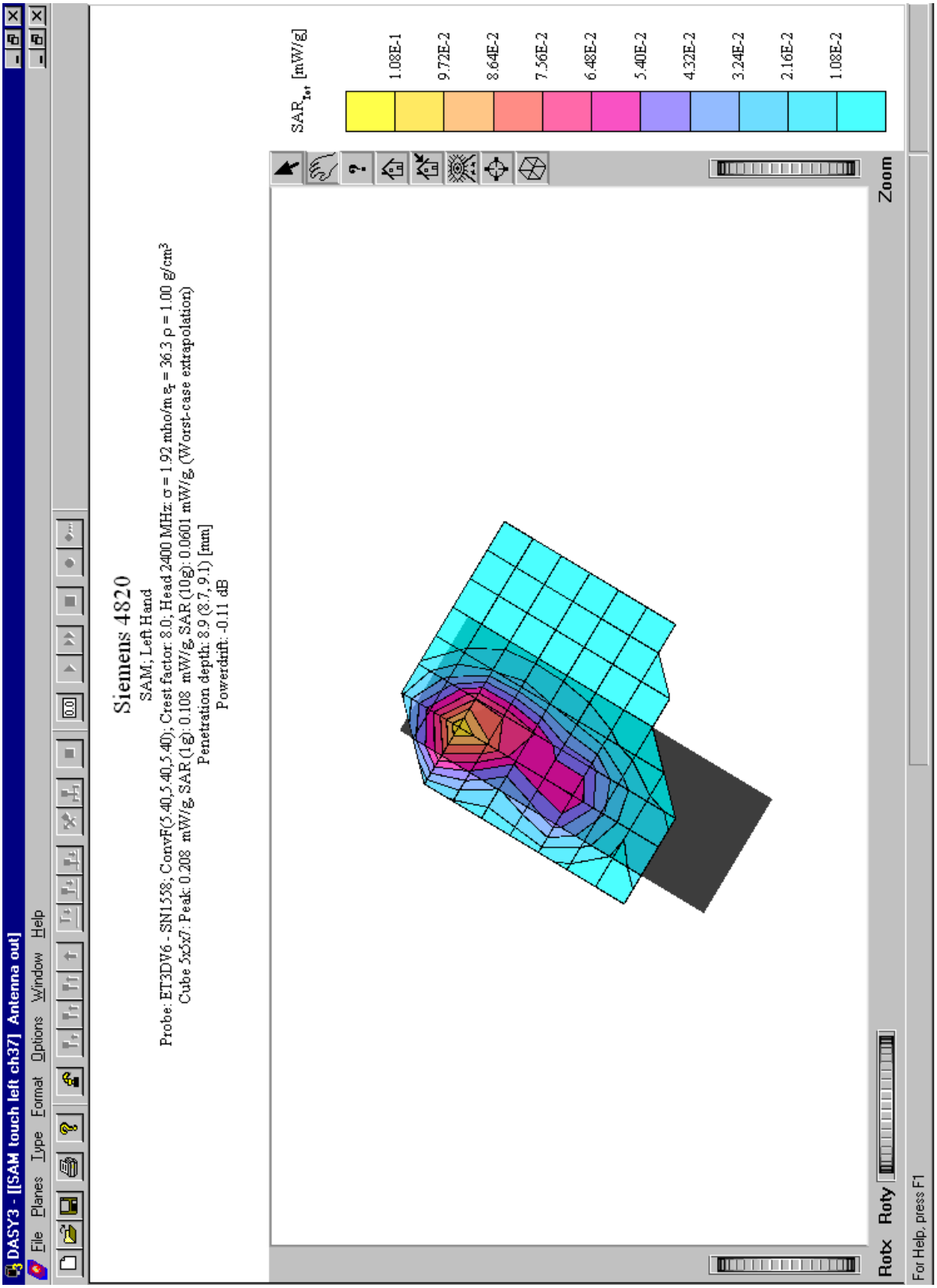
Validation Kit	Frequency	Target SAR_{1g}	Target SAR_{10g}	Measured SAR_{1g}	Measured SAR_{10g}	Measured date
D1800V2, S/N:287	1800 MHz	9.52 mW/g	4.95 mW/g	8.64 mW/g	4.67 mW/g	31/10/2001

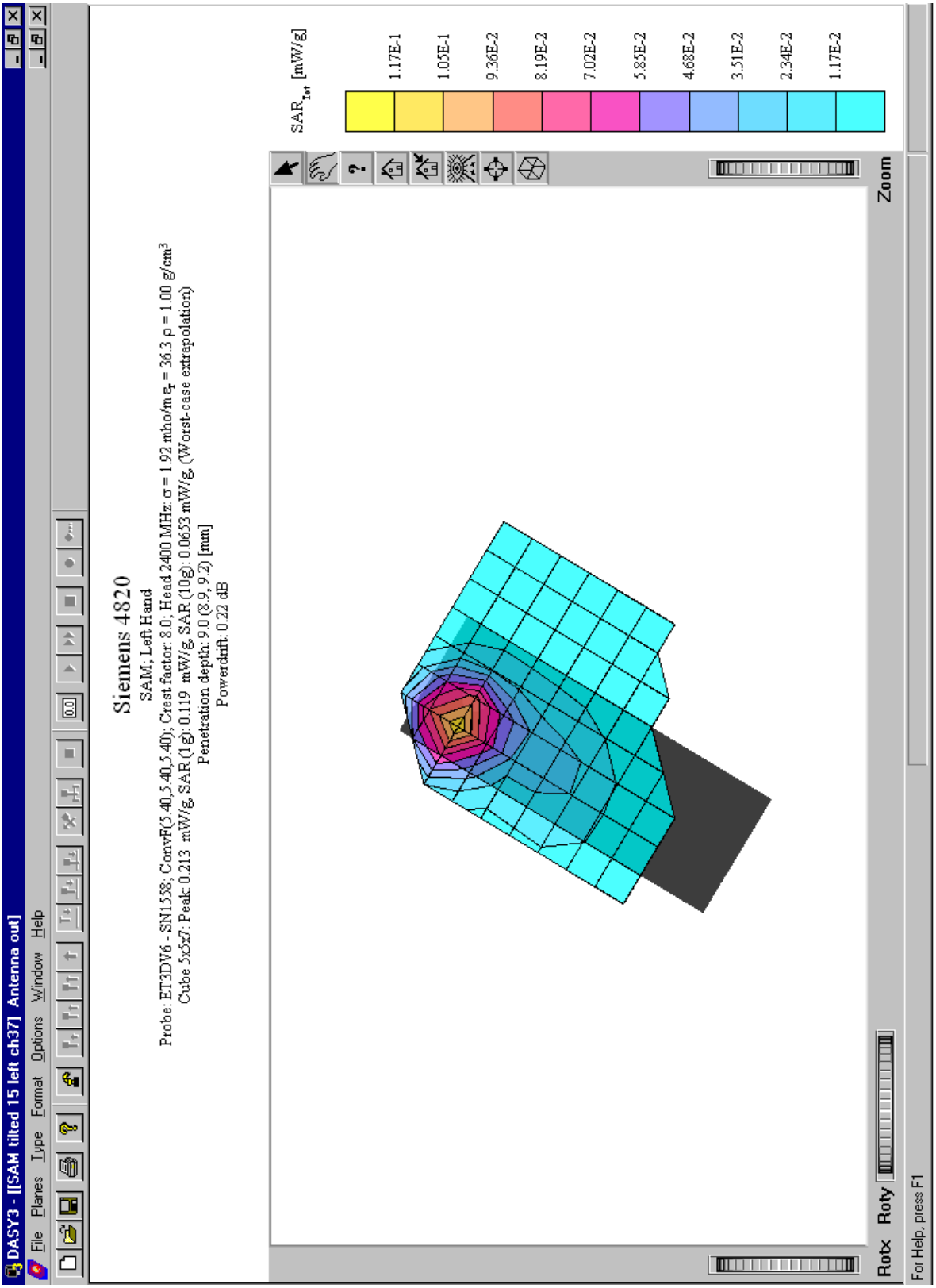
Table 7: Test results (system validation)

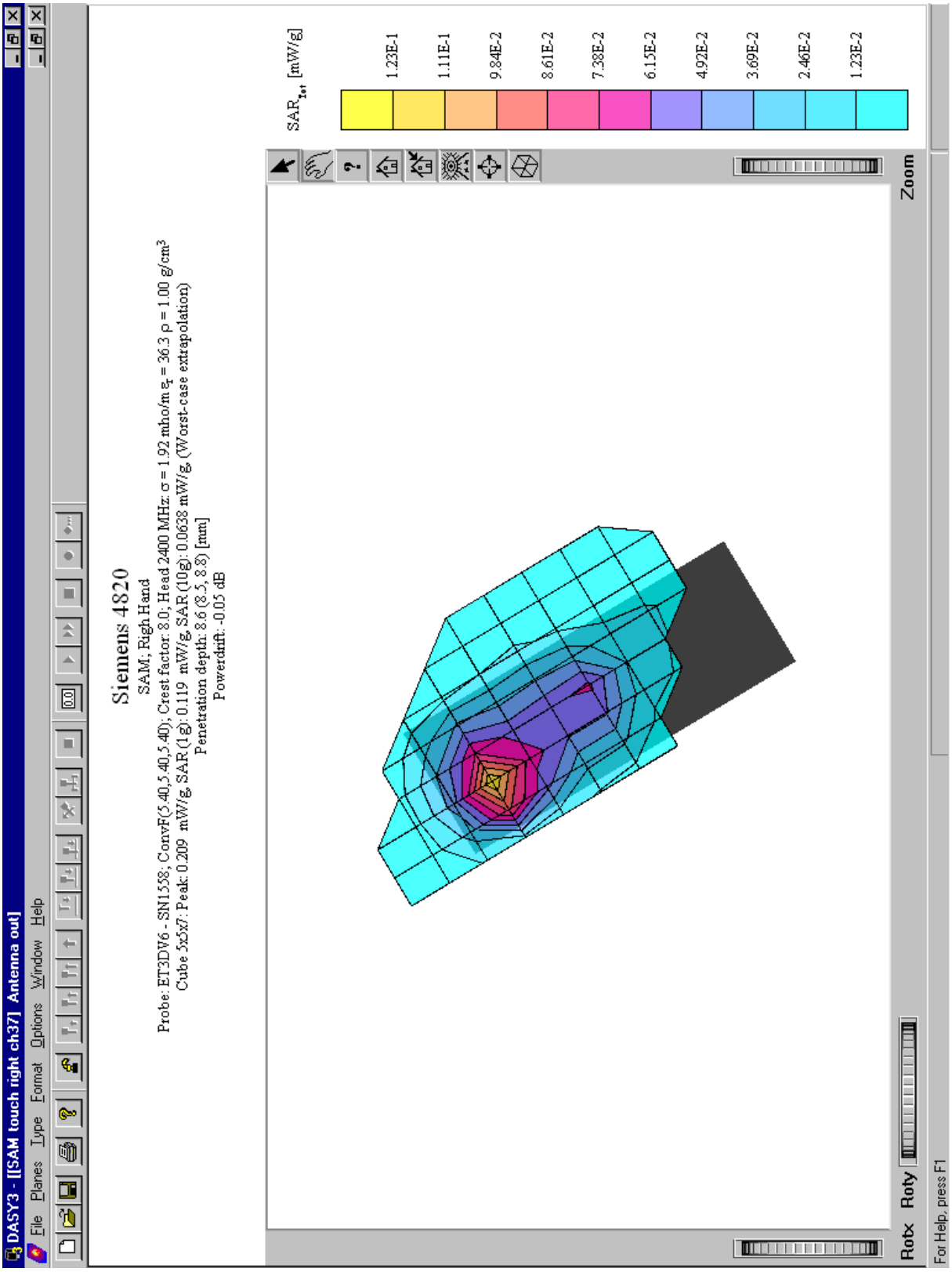
Appendix 1: System performance verification

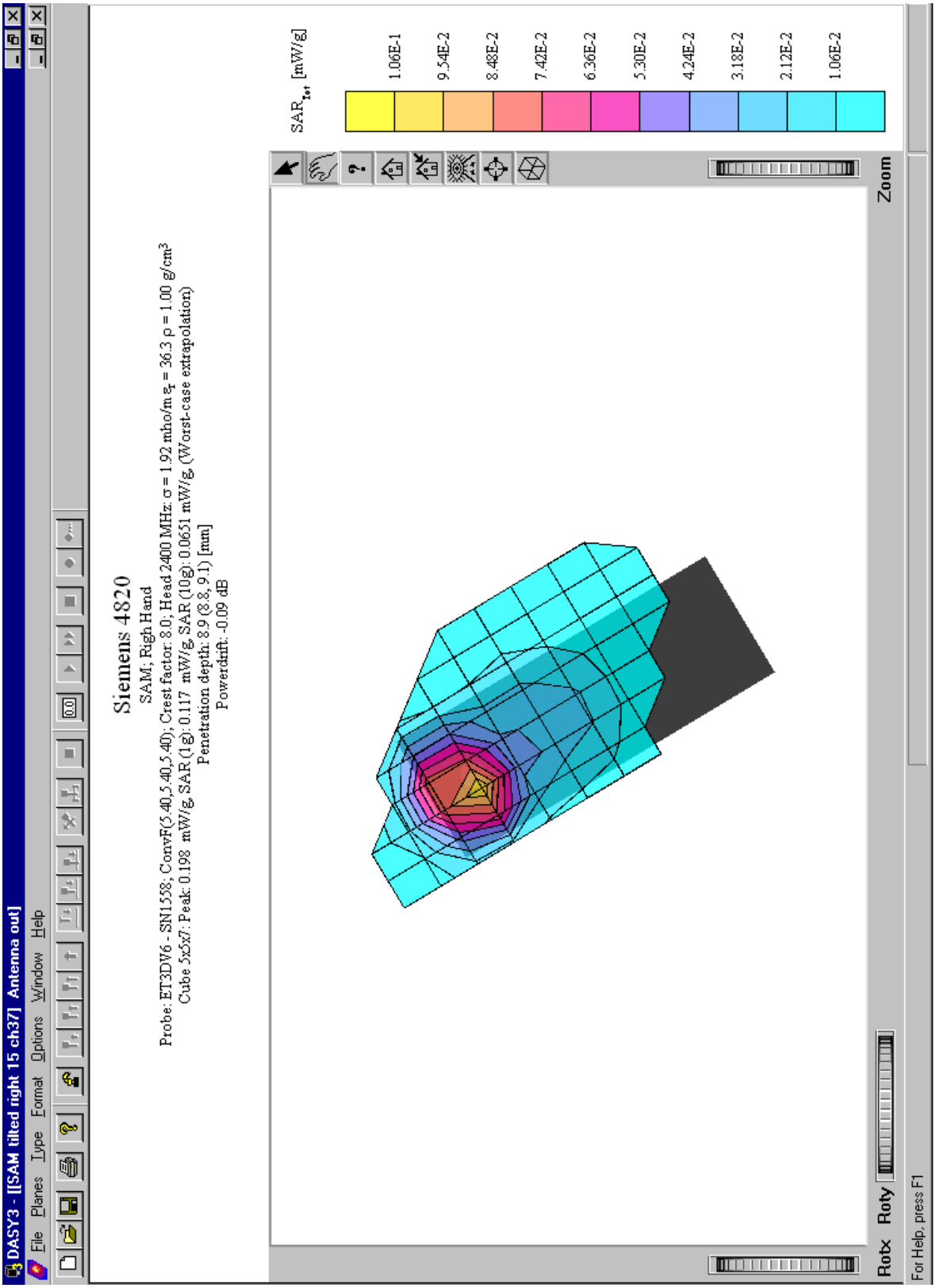


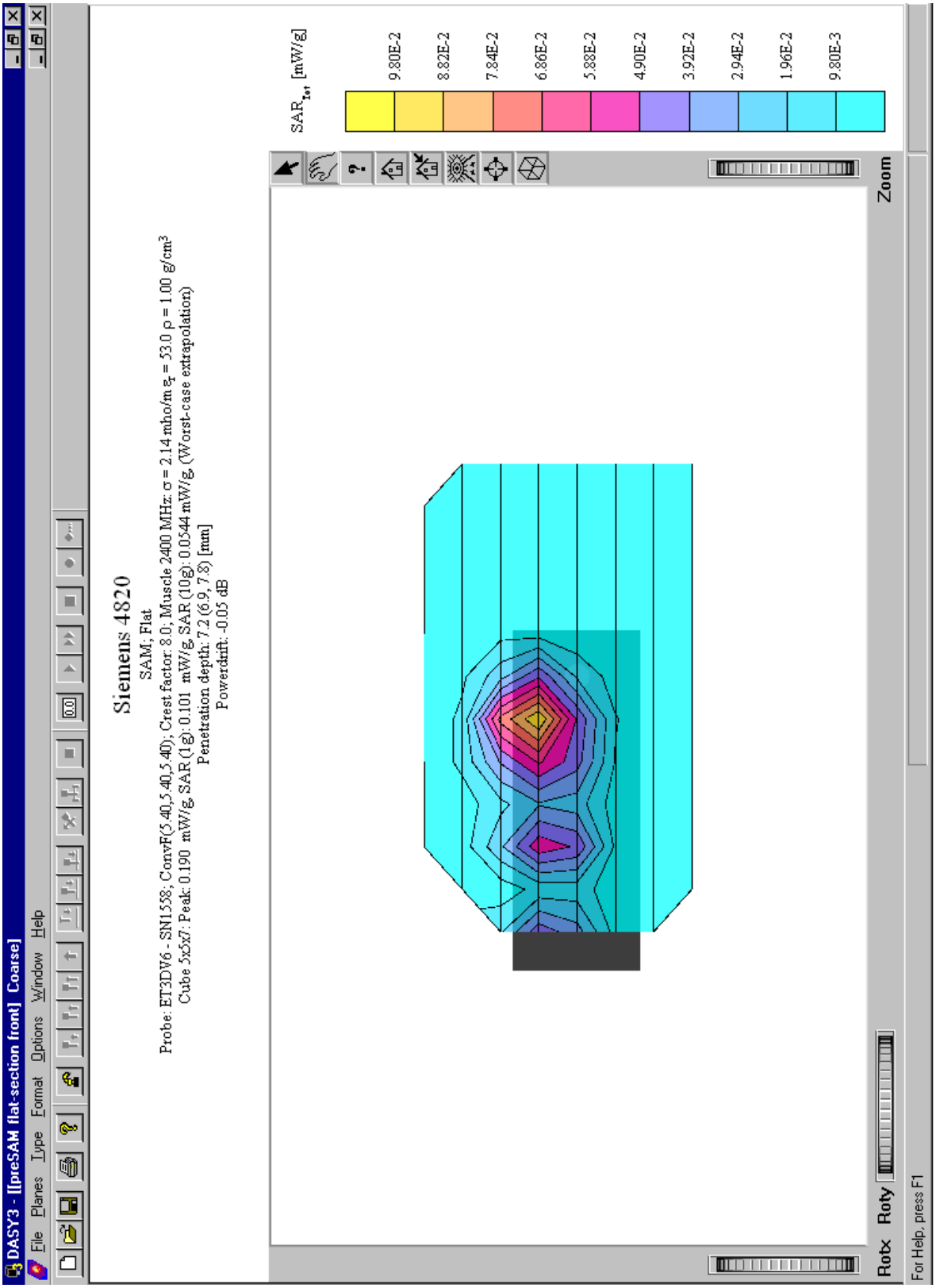
Appendix 2: Measurement results (printout from DASY ™)

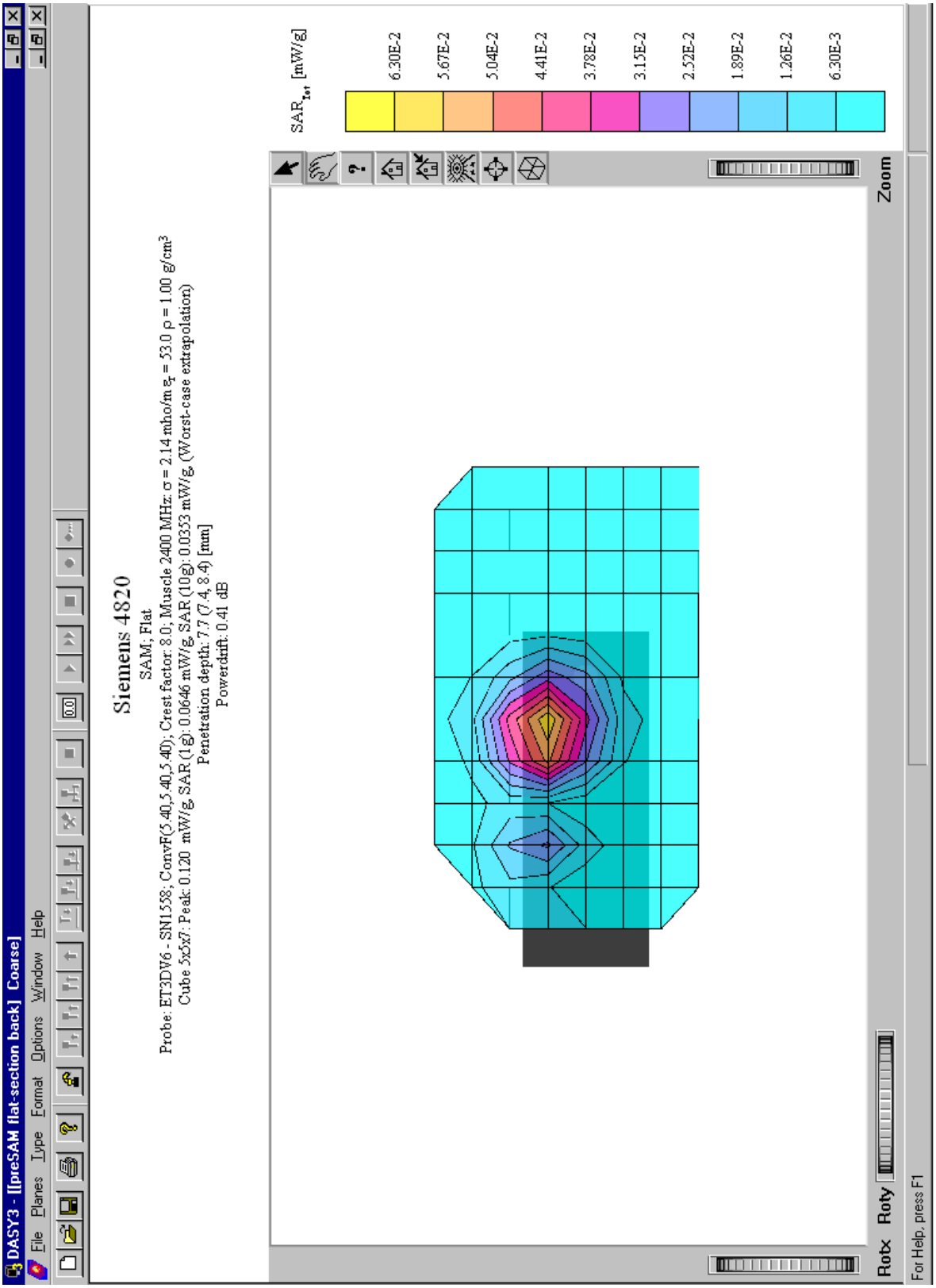



DASY3 - [SAM tilted 15 left ch37] Antenna out]
File Planes Type Format Options Window Help
Siemens 4820
SAM; Left Hand
Probe: ET3DV6 - SN1558; ConvF(5.40,5.40,5.40); Crest factor: 8.0; Head 2400 MHz: σ = 1.92 mho/m ε_r = 36.3 ρ = 1.00 g/cm³
Cube 5x5x7: Peak: 0.213 mW/g, SAR (1g): 0.119 mW/g, SAR (10g): 0.0653 mW/g, (Worst-case extrapolation)
Penetration depth: 9.0 (8.9, 9.2) [mm]
Powerdrift: 0.22 dB
SAR_tot [mW/g]
1.17E-1
1.05E-1
9.36E-2
8.19E-2
7.02E-2
5.85E-2
4.68E-2
3.51E-2
2.34E-2
1.17E-2
Zoom
Rotx
Roty
For Help, press F1


DASY3 - [SAM touch right ch37] Antenna out]
File Planes Type Format Options Window Help
Siemens 4820
SAM, Righ Hand
Probe: ET3DV6 - SN1558; ConvF(5.40,5.40,5.40); Crest factor: 8.0; Head 2400 MHz: σ = 1.92 mho/m ε_r = 36.3 ρ = 1.00 g/cm³
Cube 5x5x7: Peak: 0.209 mW/g, SAR (1g): 0.119 mW/g, SAR (10g): 0.0638 mW/g (Worst-case extrapolation)
Penetration depth: 8.6 (8.5, 8.8) [mm]
Powerdrift: -0.05 dB
SAR_tot [mW/g]
1.23E-1
1.11E-1
9.84E-2
8.61E-2
7.38E-2
6.15E-2
4.92E-2
3.69E-2
2.46E-2
1.23E-2
Zoom
Rotx Roty
For Help, press F1


DASY3 - [SAM tilted right 15 ch37] Antenna out]
File Planes Type Format Options Window Help
Siemens 4820
SAM; Righ Hand
Probe: ET3DV6 - SN1558; ConvF(5.40,5.40,5.40); Crest factor: 8.0; Head 2400 MHz: σ = 1.92 mho/m ε_r = 36.3 ρ = 1.00 g/cm³
Cube 5x5x7: Peak: 0.198 mW/g, SAR (1g): 0.117 mW/g, SAR (10g): 0.0651 mW/g, (Worst-case extrapolation)
Penetration depth: 8.9 (8.8, 9.1) [mm]
Powerdrift: -0.09 dB
SAR_tot [mW/g]
1.06E-1
9.54E-2
8.48E-2
7.42E-2
6.36E-2
5.30E-2
4.24E-2
3.18E-2
2.12E-2
1.06E-2
Zoom
Rotx
Roty
For Help, press F1


DASY3 - [[preSAM flat-section front] Coarse]
File Planes Type Format Options Window Help
Siemens 4820
SAM; Flat
Probe: ET3DV6 - SN1558; ConvF(5.40,5.40,5.40); Crest factor: 8.0; Muscle 2400 MHz: σ = 2.14 mho/m ε_r = 53.0 ρ = 1.00 g/cm³
Cube 5x5x7: Peak: 0.190 mW/g, SAR (1g): 0.101 mW/g, SAR (10g): 0.0544 mW/g, (Worst-case extrapolation)
Penetration depth: 7.2 (6.9, 7.8) [mm]
Powerdrift: -0.05 dB
SAR_tot [mW/g]
9.80E-2
8.82E-2
7.84E-2
6.86E-2
5.88E-2
4.90E-2
3.92E-2
2.94E-2
1.96E-2
9.80E-3
Zoom
Rotx
Roty
For Help, press F1


DASY3 - [[preSAM flat-section back] Coarse]
File Planes Type Format Options Window Help
Siemens 4820
SAM; Flat
Probe: ET3DV6 - SN1558; ConvF(5.40,5.40,5.40); Crest factor: 8.0; Muscle 2400 MHz: σ = 2.14 mho/m εr = 53.0 ρ = 1.00 g/cm³
Cube 5x5x7: Peak: 0.120 mW/g, SAR (1g): 0.0646 mW/g, SAR (10g): 0.0353 mW/g (Worst-case extrapolation)
Penetration depth: 7.7 (7.4, 8.4) [mm]
Powerdrift: 0.41 dB
SAR [mW/g]
6.30E-2
5.67E-2
5.04E-2
4.41E-2
3.78E-2
3.15E-2
2.52E-2
1.89E-2
1.26E-2
6.30E-3
Zoom
Rotx
Roty
For Help, press F1

Appendix 3: Photo documentation

Photo 1: Measurement System DASY 3

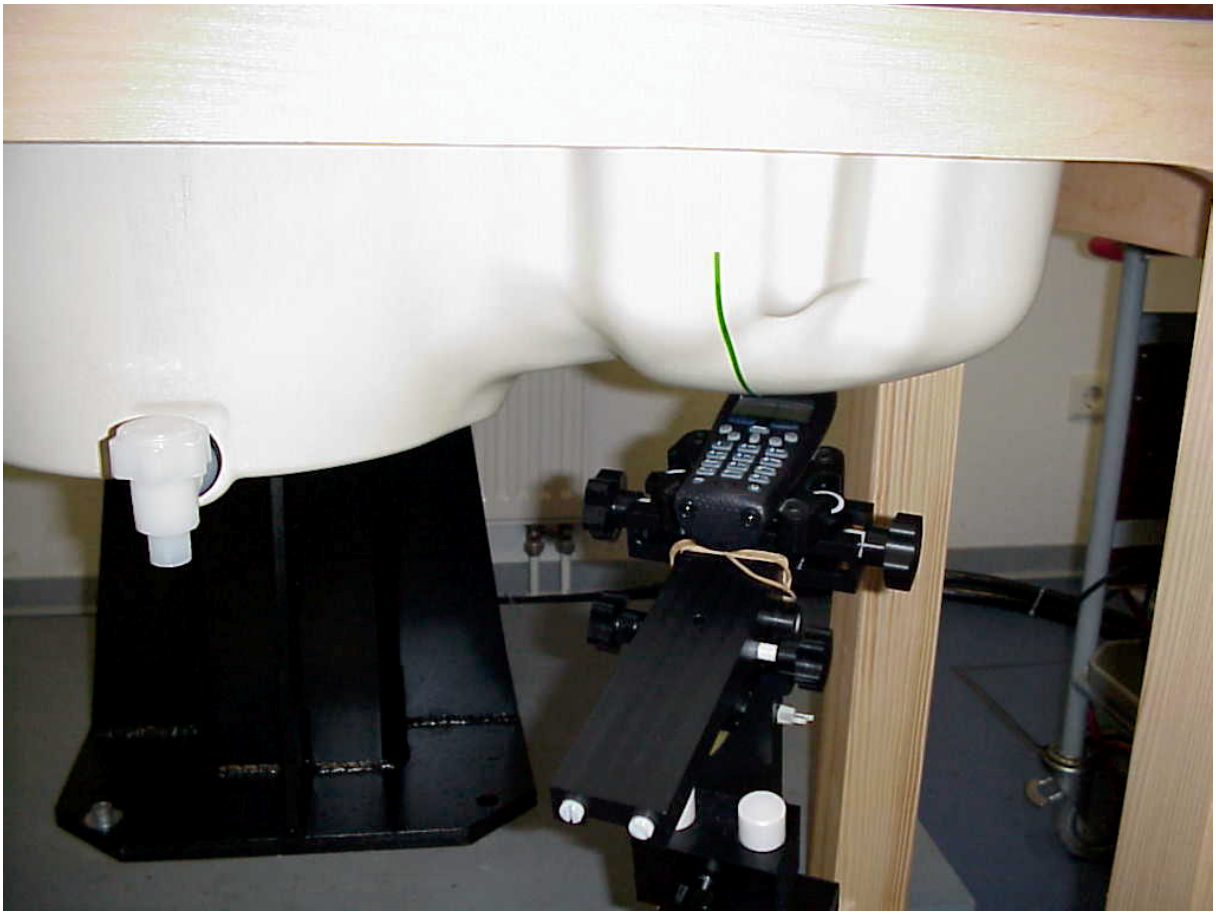


Photo 2: Position tilted 15° (head SAR measurement)

Photo 3: Body measurement (flat phantom)

Photo 4: EUT front side

Photo 5: EUT rear side

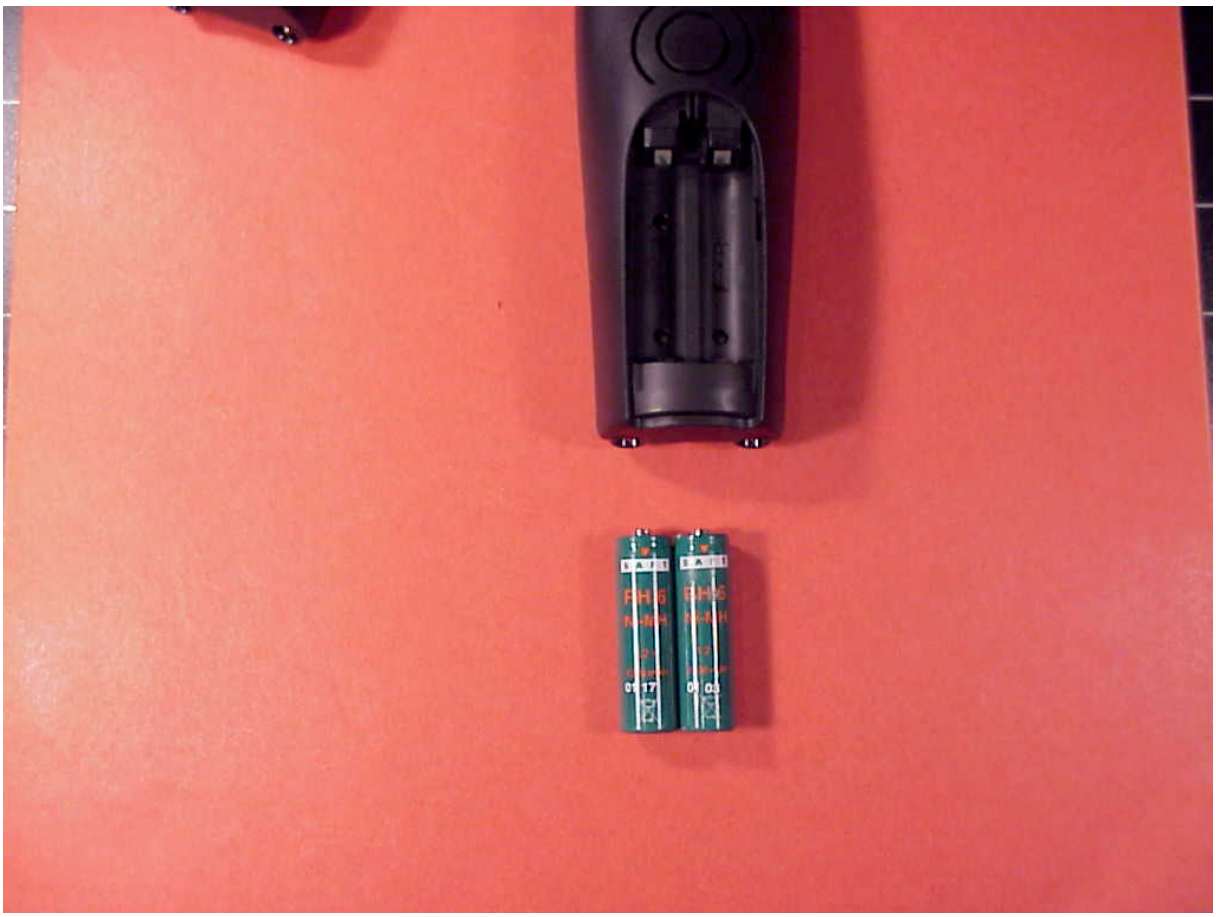


Photo 6: Used batteries

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:	**Feb. 20, 2001**
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

DASY3 - Parameters of Probe: ET3DV6 SN:1558

Sensitivity in Free Space

NormX	**1.48**	μV/(V/m)^2	
NormY	**1.35**	μV/(V/m)^2	
NormZ	**1.40**	μV/(V/m)^2	

Diode Compression

DCP X	**100**	mV
DCP Y	**100**	mV
DCP Z	**100**	mV

Sensitivity in Tissue Simulating Liquid

Head **450 MHz** ε_r **= 43.5 ± 5%** σ **= 0.87 ± 10% mho/m**

ConvF X	**7.12**	extrapolated	Boundary effect:	
ConvF Y	**7.12**	extrapolated	Alpha	**0.18**
ConvF Z	**7.12**	extrapolated	Depth	**3.71**

Head **900 MHz** ε_r **= 42 ± 5%** σ **= 0.97 ± 10% mho/m**

ConvF X	**6.55**	± 7% (k=2)	Boundary effect:	
ConvF Y	**6.55**	± 7% (k=2)	Alpha	**0.27**
ConvF Z	**6.55**	± 7% (k=2)	Depth	**3.26**

Head **1500 MHz** ε_r **= 40.4 ± 5%** σ **= 1.23 ± 10% mho/m**

ConvF X	**5.78**	interpolated	Boundary effect:	
ConvF Y	**5.78**	interpolated	Alpha	**0.39**
ConvF Z	**5.78**	interpolated	Depth	**2.65**

Head **1800 MHz** ε_r **= 40 ± 5%** σ **= 1.40 ± 10% mho/m**

ConvF X	**5.40**	± 7% (k=2)	Boundary effect:	
ConvF Y	**5.40**	± 7% (k=2)	Alpha	**0.45**
ConvF Z	**5.40**	± 7% (k=2)	Depth	**2.35**

Sensor Offset

Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.9 ± 0.2**	mm