Prepared (also subject responsible if other)		No.		
EUS/CV/RF/P Dulce Altabella		EUS/CV/R-01:0143/REP		
Approved	Checked	Date	Rev	File
EUS/CV/RF/P Mark Douglas	MGD	2001-1-26	A	U:\FCC_TRNS\Fcc_411 Dit Margaretta\class 2\SAR r300d.doc

SAR Test Report: R300d with internal antenna

Date of test: January 16, 17, 25, and 26, 2001

Laboratory: Electromagnetic Near Field and Radio Frequency Dosimetry Laboratory
Ericsson, Inc.
7001 Development Drive, P.O. Box 13969,
Research Triangle Park, NC, 27709, USA

Test Responsible: Mark Douglas, Ph.D.
Senior Staff Engineer, Antenna Development Group

This laboratory is accredited to ISO/IEC Guide 25-1990 to perform the following electromagnetic tests:
Specific Absorption Rate (SAR), dielectric parameters, and RF power measurement on the following types of products:
Wireless communications devices

A2LA certificate Number: 1650-01

Statement of Compliance: Ericsson, Inc. declares under its sole responsibility that the product

Ericsson R300d

to which this declaration relates, is in conformity with the appropriate RF exposure standards, recommendations and guidelines. It also declares that the product was tested in accordance with the appropriate measurement standards, guidelines and recommended practices. Any deviations from these standards, guidelines and recommended practices are noted below:

(none)

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This test report shall not be reproduced except in full, without written approval of the laboratory.

The results and statements contained herein relate only to the items tested. The names of individuals involved may be mentioned only in connection with the statements or results from this report.

Ericsson encourages all feedback, both positive and negative, on this test report.

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1. Introduction

In this test report, compliance of the Ericsson R300d portable telephone with RF safety guidelines is demonstrated (applicable RF safety guidelines are given in [1]). The device was tested in accordance with the latest available test guidelines [1]. Detailed procedures of the test are described in the *Ericsson SAR Measurement Specification* [1].

2. Device Under Test

2.1 Antenna description

Type	Internal antenna	
Location	Inside the back cover, near the top	
Dimensions	length	34.5 mm
	width	41 mm
Configuration	Patch antenna	

2.2 Device description

Device model	R300d		
Serial number	2236		
Mode	800 AMPS	800 TDMA	1900 TDMA
Multiple Access Scheme	FDMA	TDMA	TDMA
Maximum Output Power Setting [1]	26.0 dBm	26.0 dBm	26.0 dBm
Factory Tolerance in Power Setting	± 0.25	± 0.25	± 0.25
Maximum Peak Output Power [2]	26.25 dBm	26.25 dBm	26.25 dBm
Duty Cycle	1	1 / 3	1 / 3
Transmitting Frequency Range	824 – 849 MHz	824 – 849 MHz	1850 – 1910 MHz
Prototype or Production Unit	Prototype		

3. Test equipment

3.1 Dosimetric system

SAR measurements were made using two DASY3 professional systems (software version 3.1c), manufactured by Schmid & Partner Engineering AG and installed in February 1998, and November 2000. The total SAR assessment uncertainty (K = 1) of the system is ±16% and includes a +15% offset (overestimation). The extended uncertainty (K = 2) is ±32% with a +15% offset. This results in a total uncertainty range of –1% to +31% for K = 1, or –17% to +47% for K = 2. The equipment list is given below.

Description	**Serial Number**	**Due Date**
DASY3 DAE V1	345	3/01
DASY3 DAE V1	392	9/01
E-field probe ET3DV5	1337	6/01
E-field probe ET3DV6	1538	9/01
Dipole Validation Kit, D900V2	035	12/01
Dipole Validation Kit, D1800V2	217	12/01

[1] This is the conducted power measured at the antenna port when the device is set to its highest power setting. It is measured at the middle of the transmit frequency band. Note that the output power may be different at other frequencies.
[2] This equals the maximum output power setting plus the factory tolerance.

3.2 Additional equipment

Description	Serial Number	Due Date
Signal Generator HP8648C	3537A01598	9/02
Dielectric probe kit HP 85070B	US33020256	10/01
Network analyser HP 8752C	3410A03105	7/01
Power meter HP 437B	3125U13729	2/01
Power sensor HP 8482H	3318A07097	2/01
Power meter HP 437B	3125U16190	4/01
Power sensor HP 8482H	2704A06235	4/01

4. Electrical parameters of the tissue simulating liquid

Prior to conducting SAR measurements, the relative permittivity, ε_r, and the conductivity, σ, of the tissue simulating liquids were measured with the dielectric probe kit. These values are shown in the table below. The mass density, ρ, entered into the DASY3 program is also given. Recommended limits for maximum permittivity, minimum conductivity and maximum mass density are also shown [2]. It is seen that the measured parameters result in an overestimation of SAR compared to the recommended values.

f (MHz)	Tissue type	Limits / Measured	Dielectric Parameters		
			ε_r	σ (S/m)	ρ (g/cm^3)
835	**Head**	**Measured, 1/16/01**	41.37	0.91	1.00
		Recommended Limits [2]	46.08	0.74	1.03
	Muscle	**Measured, 1/25/01**	55.75	0.97	1.00
		Measured, 1/26/01	55.74	0.98	1.00
		Recommended Limits [2]	56.11	0.95	1.04
1800	**Head**	**Measured, 1/17/01**	39.19	1.77	1.00
		Measured, 1/26/01	39.34	1.75	1.00
		Recommended Limits [2]	43.54	1.15	1.03
	Muscle	**Measured, 1/17/01**	39.19	1.77	1.00
		Measured, 1/26/01	39.34	1.75	1.00
		Recommended Limits [2]	54.44	1.39	1.04

5. System accuracy verification

A system accuracy verification of the DASY3 was performed using the dipole validation kits listed in Section 3.1. The system verification test was conducted on the same day as the measurement of the DUT. The obtained results are displayed in the table below. It is seen that the system is operating within its specification, as the results are within ±5% of the reference values. Reference values are based on an analysis performed at the laboratory using the dielectric parameters specified below (dielectric parameters have changed from those given in the manufacturer's reference). The distributions of SAR compare well with those of the reference measurements (see Appendix 1).

f (MHz)	Tissue type	Measured / Reference	SAR (W/kg), 1 gram	Dielectric Parameters			Chamber Temp. (°C)
				ε_r	σ (S/m)	ρ (g/cm^3)	
900	**Head**	**Measured, 1/16/01**	10.7	40.61	0.97	1.00	23.9
		Reference	10.6	40.20	0.97	1.00	23.7
	Muscle	**Measured, 1/25/01**	11.0	55.21	1.03	1.00	24.4
		Measured, 1/26/01	11.0	55.23	1.04	1.00	24.2
		Reference	11.0	55.20	1.04	1.00	22.1

1800	**Head/ Muscle**	**Measured, 1/17/01**	40.7	39.19	1.77	1.00	23.2
		Measured, 1/26/01	41.1	39.34	1.75	1.00	23.1
		Reference	40.8	40.15	1.74	1.00	23.9

6. Test results

The measured 1-gram averaged SAR values of the device are provided in Tables 1 and 2. Also shown are the measured conducted output powers and the temperature of the test facility during the test. The depth of the tissue simulating liquid was at least 15 cm. Test commands were used to control the device during the SAR measurements. The phone was supplied with a fully-charged battery for the tests.

SAR measured against the head is presented in Table 1. The device was tested on the right-hand phantom (corresponding to the right side of the head) and the left-hand phantom. For 800 AMPS and 1900 TDMA modes, the device was tested at the lowest, middle and highest frequencies of the transmit band. For 800 TDMA mode, the maximum power is significantly lower than that of AMPS mode, therefore SAR values are also lower.

mode	***f* (MHz)**	**Output Power (dBm)** [3]	**left-hand**			**right-hand**		
			Chamber Temp. (°C)	**SAR, 1g (W/kg)**		**Chamber Temp. (°C)**	**SAR, 1g (W/kg)**	
				measured	**calculated to max. power**		**measured**	**calculated to max. power**
800 AMPS	824	25.9	23.1	0.91	1.06	23.8	0.97	**1.13**
	837	25.6	23.3	0.93	1.08	23.2	0.97	1.12
	849	25.4	23.1	0.82	0.95	23.7	0.85	0.99
1900 TDMA	1850	25.7	24.6	0.45	0.50	24.3	0.44	0.49
	1880	25.8	24.5	0.59	0.65	24.4	0.56	0.62
	1910	26.0	24.7	0.73	**0.81**	24.4	0.65	0.72

Table 1: SAR measurement results for the Ericsson R300d telephone at highest possible output power. Measured against the head.

For body-worn measurements, the device was tested against a flat phantom representing the user's body, using designated carry cases (product # SXK 107 6820/55, and product # SXK 109 4342). SAR was measured at the lowest, middle and highest frequencies of the 800 AMPS and 1900 TDMA bands (800 TDMA is not necessary due to the significantly lower output power). Results are given in Tables 2 and 3.

mode	***f* (MHz)**	**Output Power (dBm)** [3]	**Front of the phone against flat phantom**			**Back of the phone against flat phantom**		
			Chamber Temp. (°C)	**SAR, 1g (W/kg)**		**Chamber Temp. (°C)**	**SAR, 1g (W/kg)**	
				measured	**calculated to max. power**		**measured**	**calculated to max. power**
800 AMPS	824	25.9	23.7	0.87	1.01	23.8	0.95	**1.10**
	837	25.6	23.7	0.89	1.03	23.7	0.82	0.95
	849	25.4	23.6	0.59	0.68	23.8	0.52	0.60
1900 TDMA	1850	25.7	23.7	0.39	0.43	23.5	0.20	0.22
	1880	25.8	23.6	0.46	0.51	23.6	0.24	0.26
	1910	26.0	23.6	0.47	**0.52**	23.7	0.25	0.27

[3] Output power was measured by Ericsson personnel outside the scope and control of the laboratory.

Table 2: SAR measurement results for the Ericsson R300d telephone at highest possible output power. Measured against the body using carry accessory SXK 109 4342.

mode	*f* (MHz)	Output Power (dBm) [4]	Chamber Temp. (°C)	SAR, 1g (W/kg)	
				measured	calculated to max. power
800 AMPS	824	25.9	24.2	0.87	**1.01**
	837	25.6	24.3	0.79	0.92
	849	25.4	24.2	0.62	0.72
1900 TDMA	1850	25.7	24.2	0.22	0.24
	1880	25.8	24.3	0.30	0.33
	1910	26.0	24.2	0.43	**0.47**

Table 3: SAR measurement results for the Ericsson R300d telephone at highest possible output power. Measured against the body using carry accessory SXK 107 6820/55.

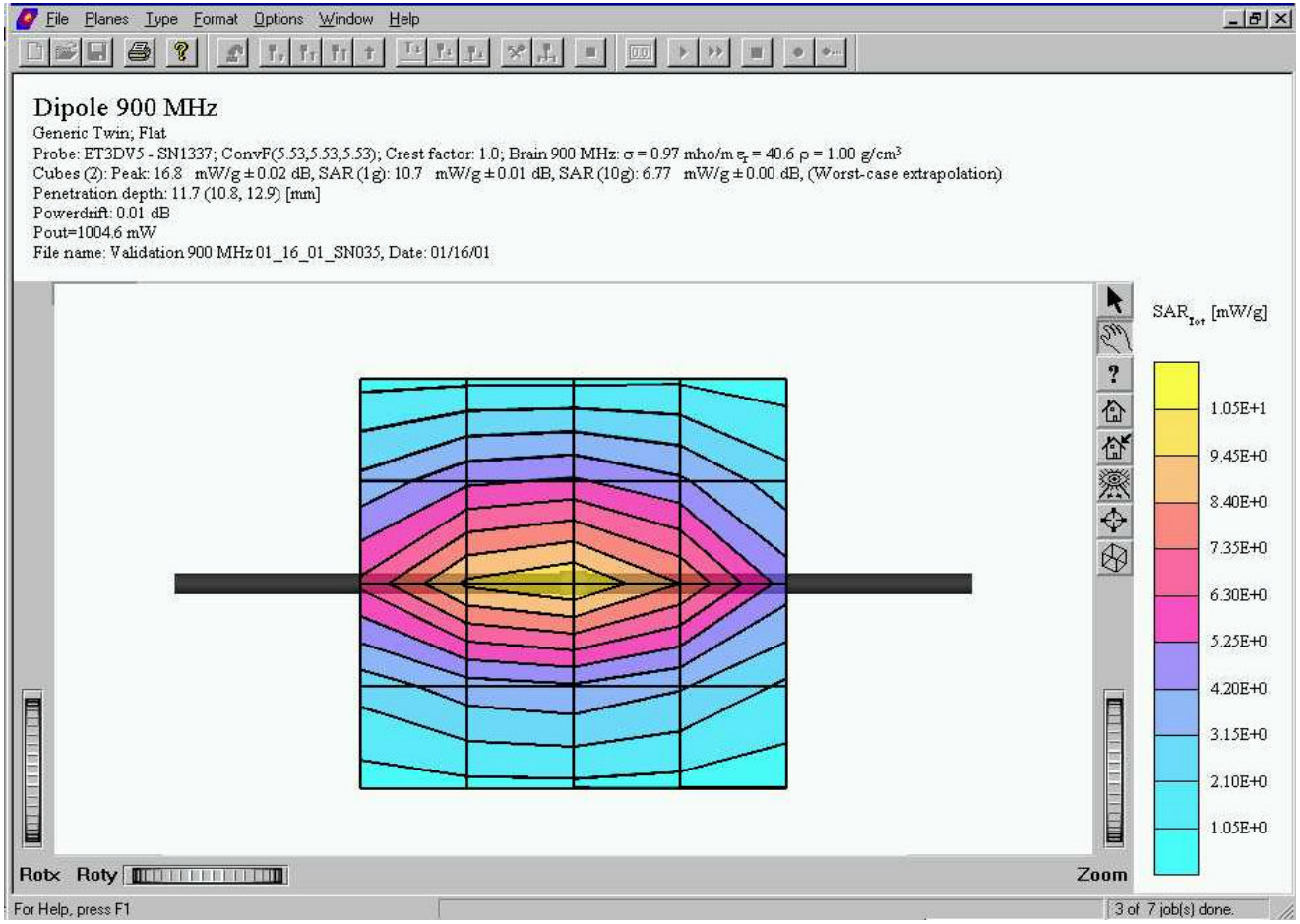
References

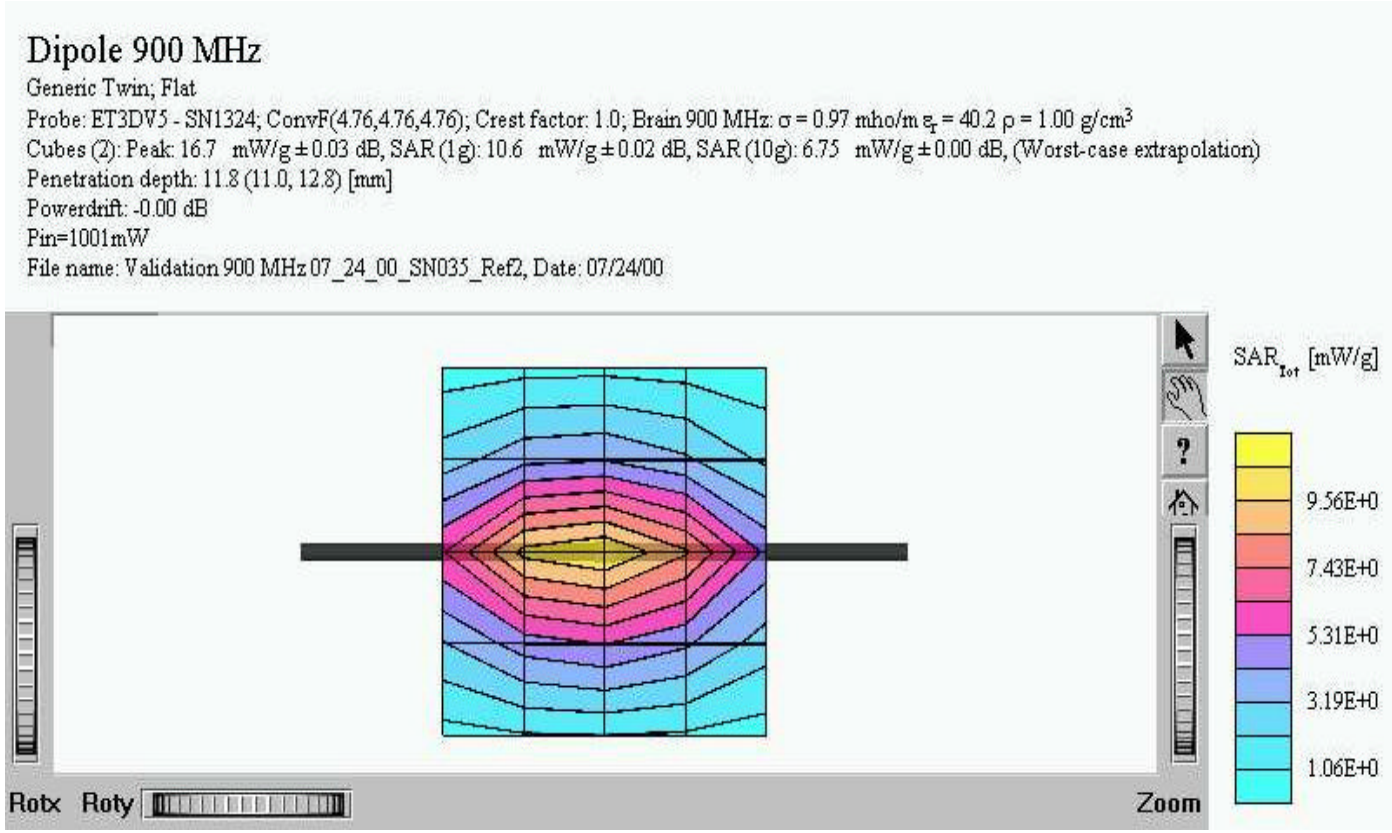
[1] C. Törnevik, M. Siegbahn, T. Persson, M. Douglas, and R. Plicanic, "Ericsson SAR measurement specification", Internal Document ERA/TF-00:037, November 2000.

[2] Federal Communications Commission, "Tissue Dielectric Properties," http://www.fcc.gov/fcc-bin/dielec.sh.

[4] Output power was measured by Ericsson personnel outside the scope and control of the laboratory.

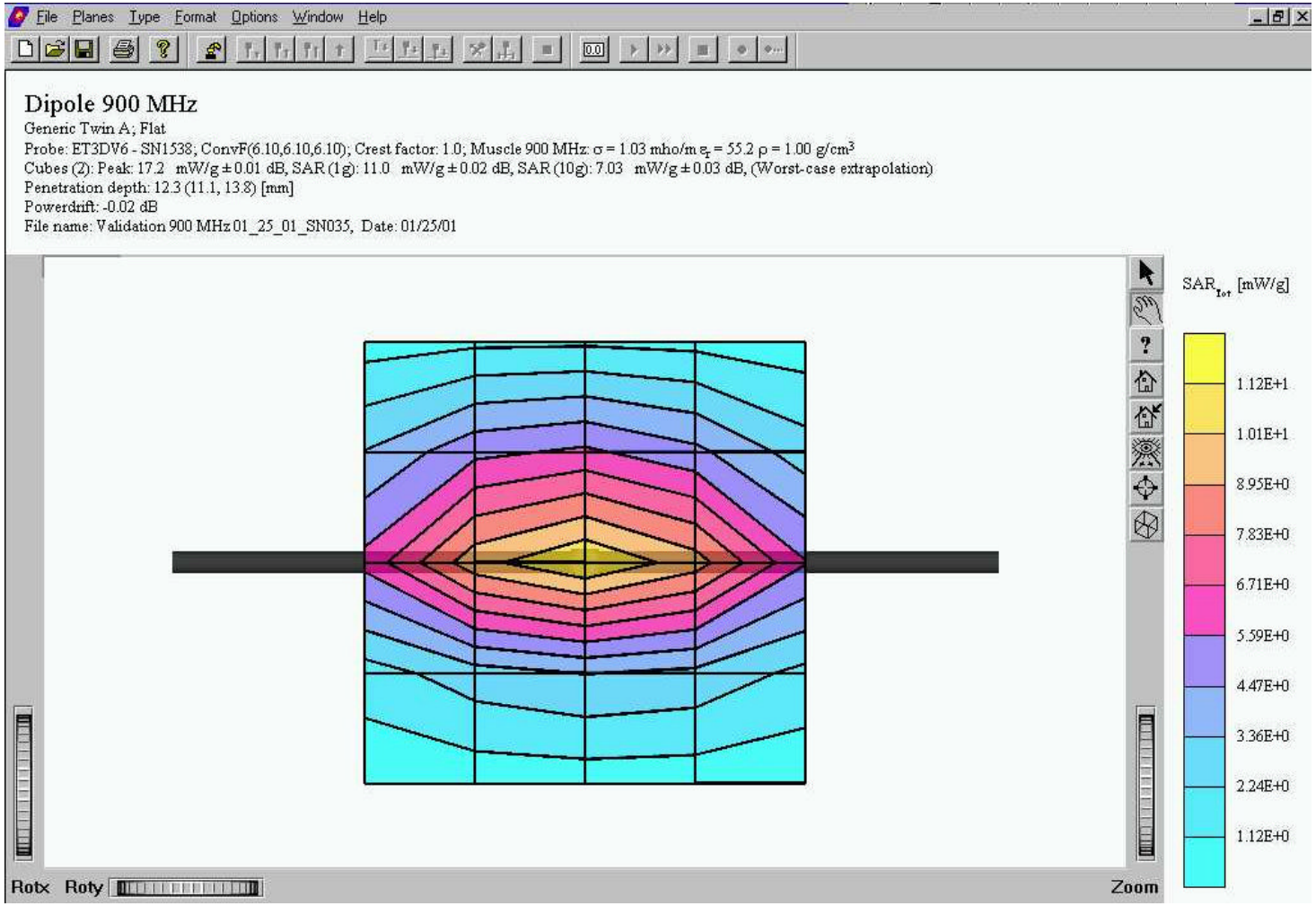
Appendix 1: SAR distribution comparison for system accuracy verification



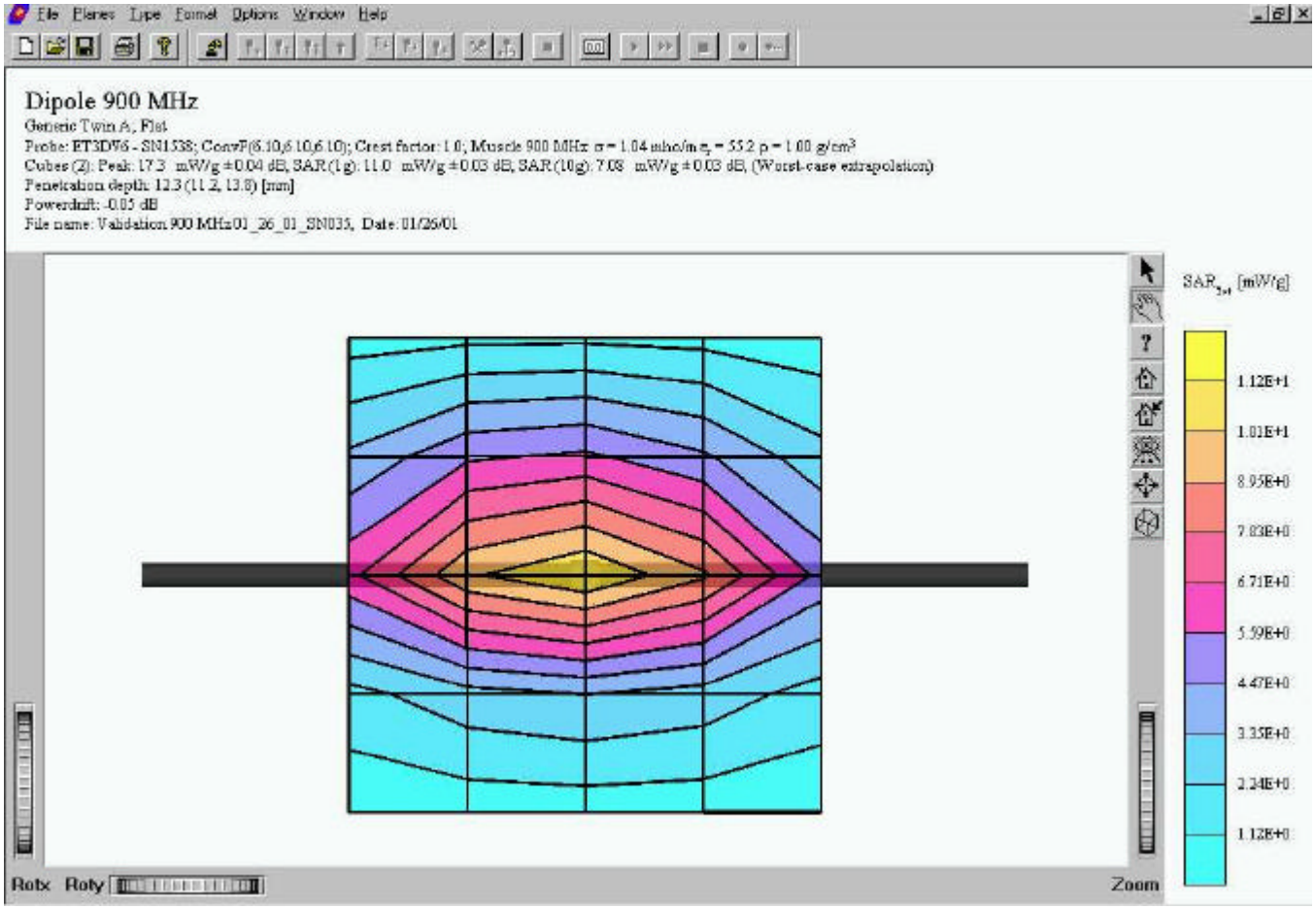


900 MHz SAR distribution of validation dipole antenna from reference measurement. Using head tissue.

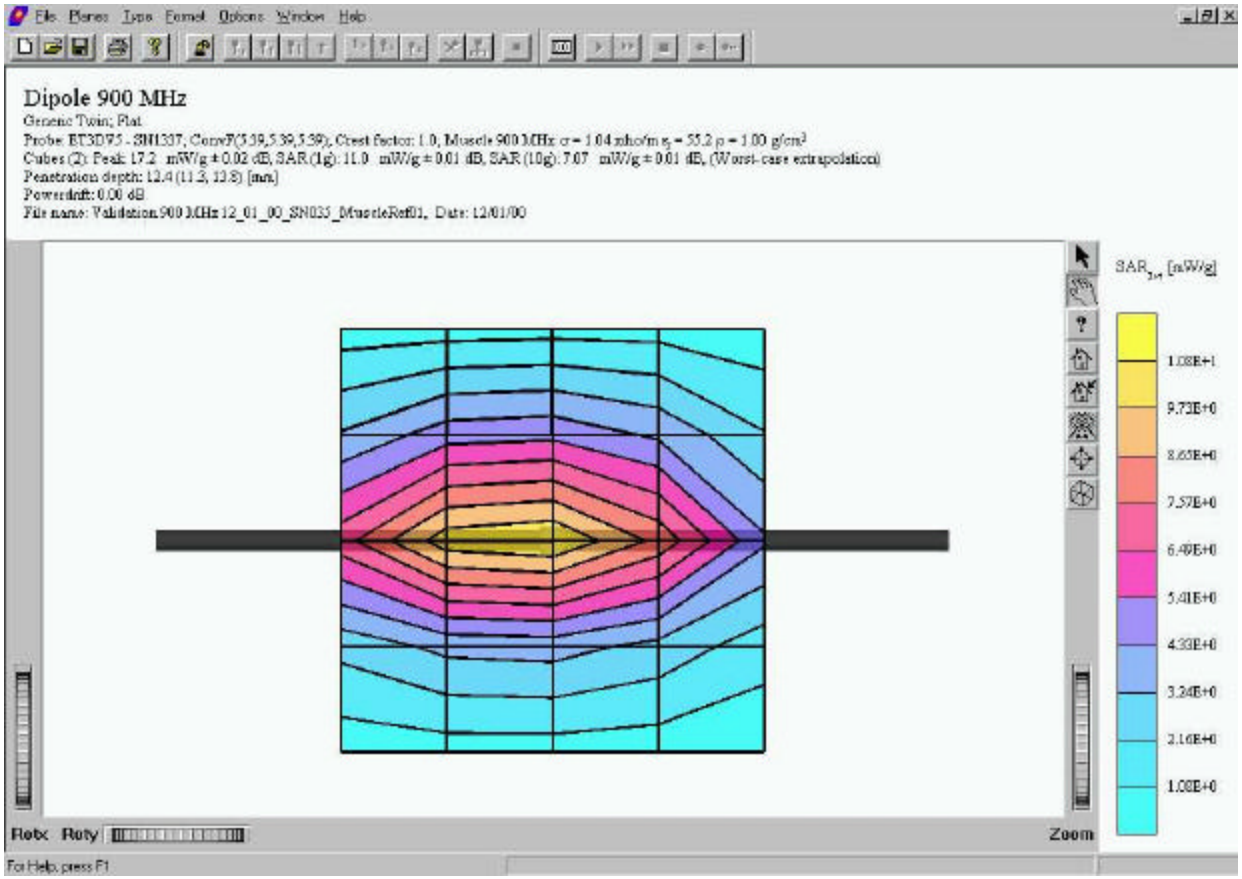
900 MHz SAR distribution of validation dipole antenna from system accuracy verification test on January 16, 2001. Using head tissue.



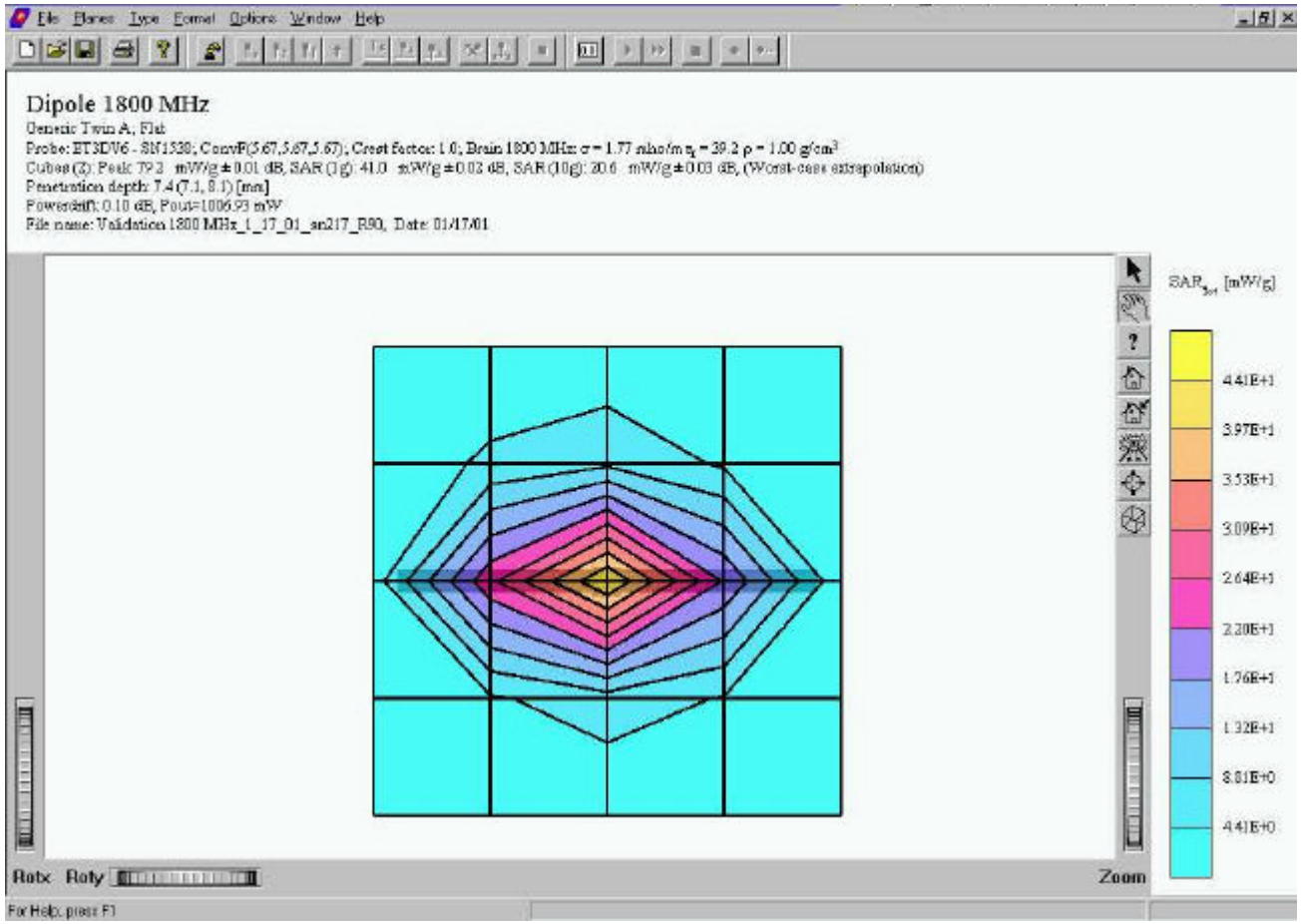
900 MHz SAR distribution of validation dipole antenna from system accuracy verification test on January 25, 2001. Using muscle tissue.



900 MHz SAR distribution of validation dipole antenna from system accuracy verification test on January 26, 2001. Using muscle tissue.

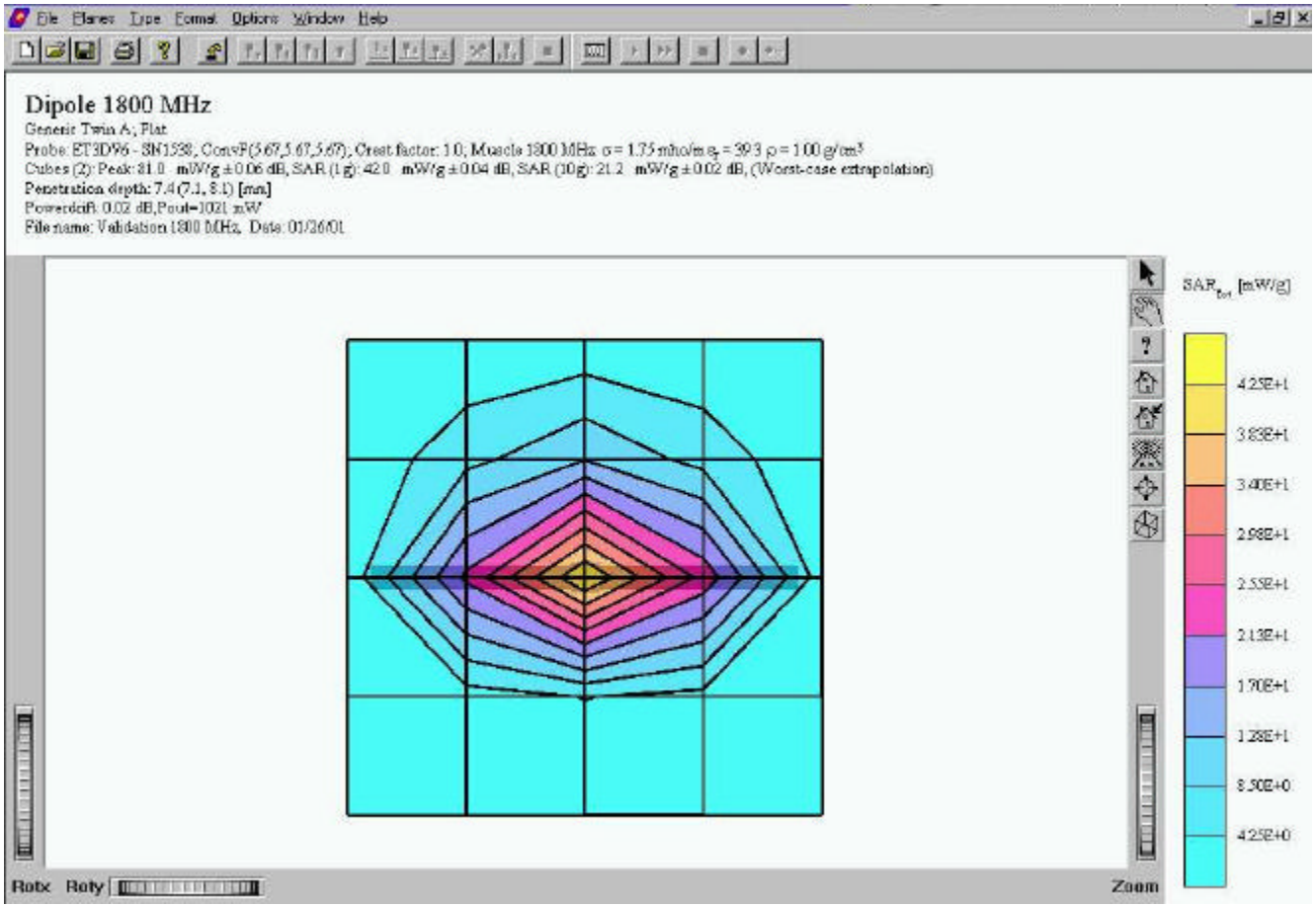


900 MHz SAR distribution of validation dipole antenna from reference measurement. Using muscle tissue.

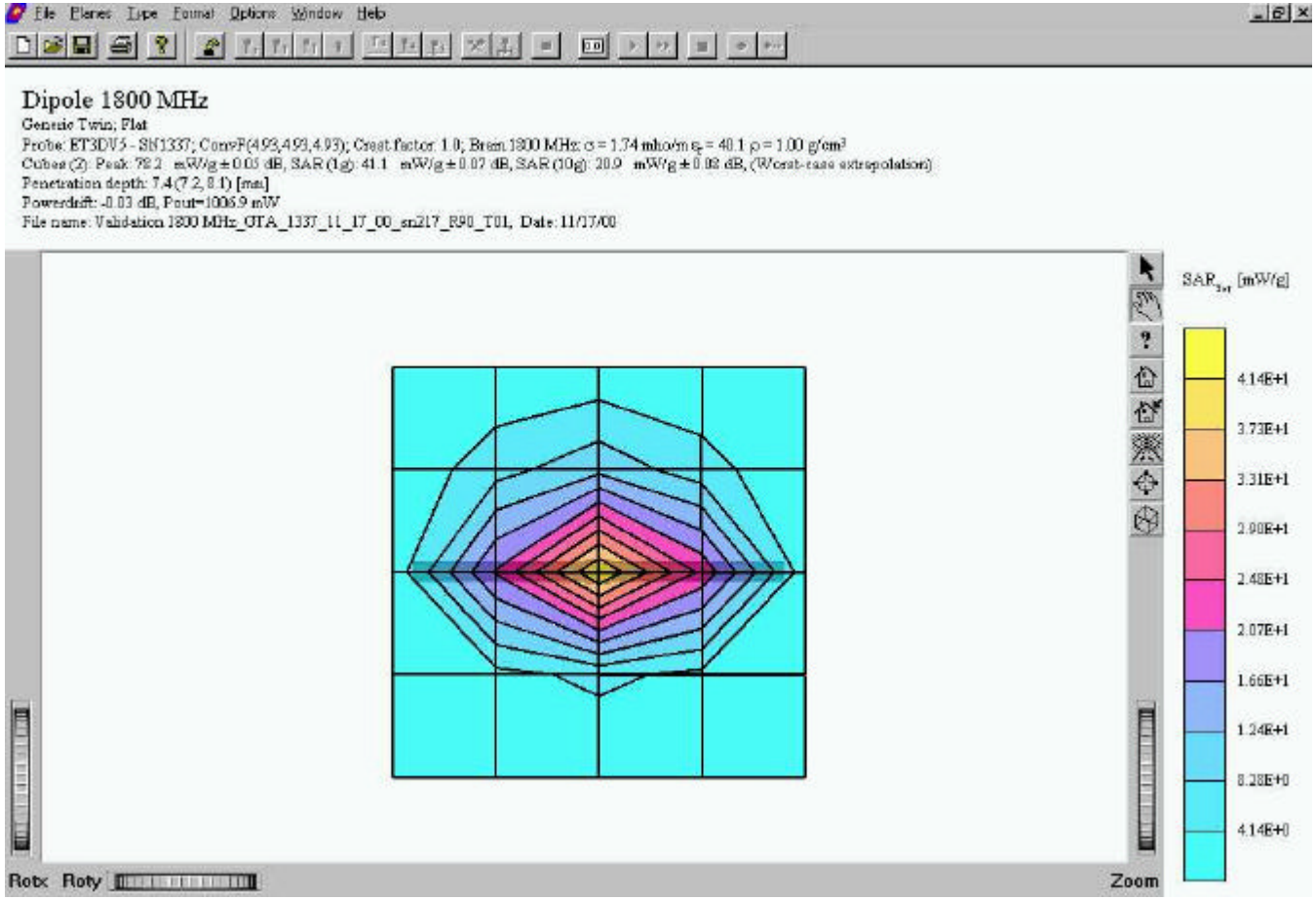


1800 MHz SAR distribution of validation dipole antenna from system accuracy verification test on January 17, 2001. Using head/muscle tissue.

Prepared (also subject responsible if other)		No.		
EUS/CV/RF/P Dulce Altabella		EUS/CV/R-01:0143/REP		
Approved	Checked	Date	Rev	File
EUS/CV/RF/P Mark Douglas	MGD	2001-1-26	A	U:\FCC_TRNS\Fcc_411 Dit Margaretta\class 2\SAR r300d.doc

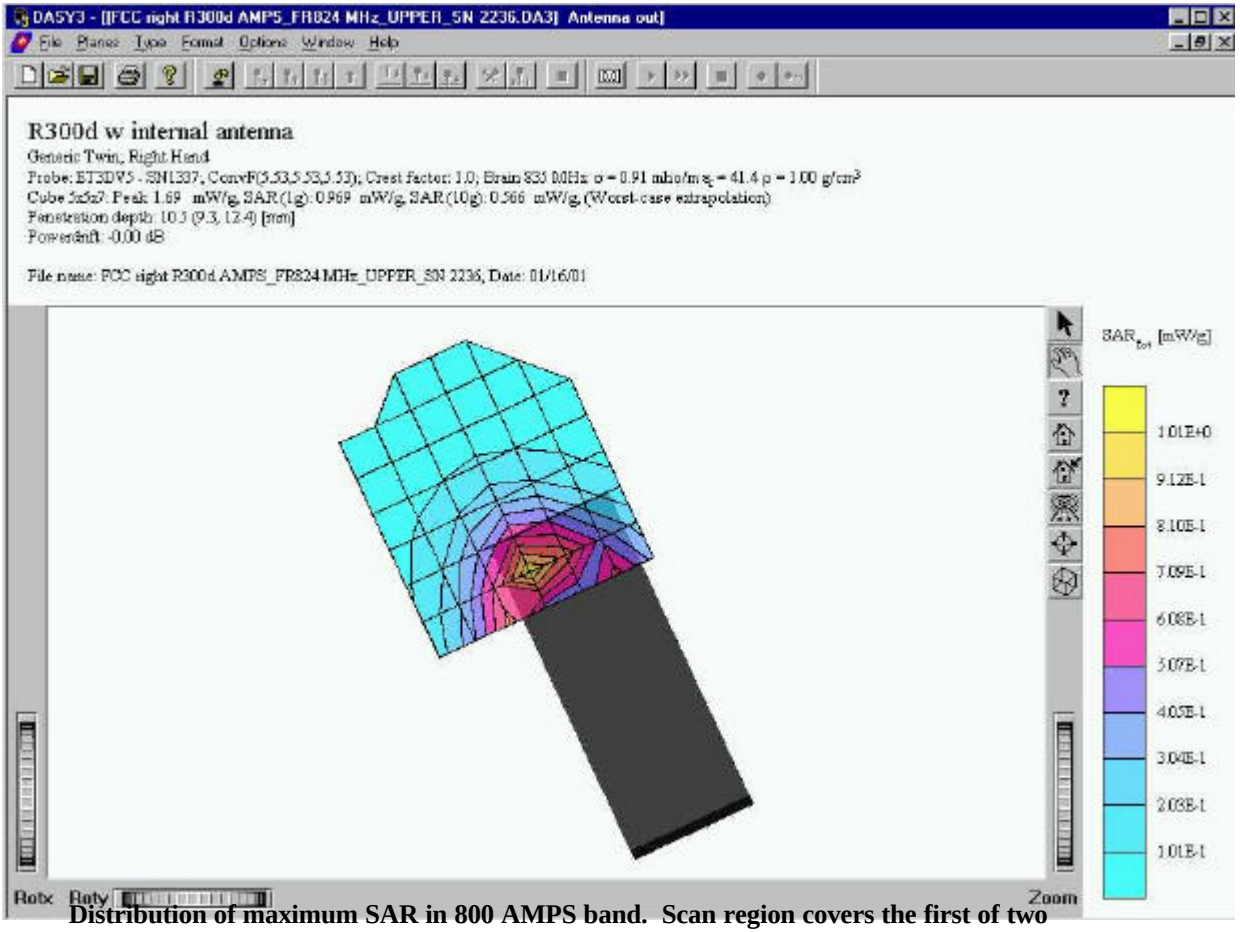


1800 MHz SAR distribution of validation dipole antenna from system accuracy verification test on January 26, 2001. Using head/muscle tissue.

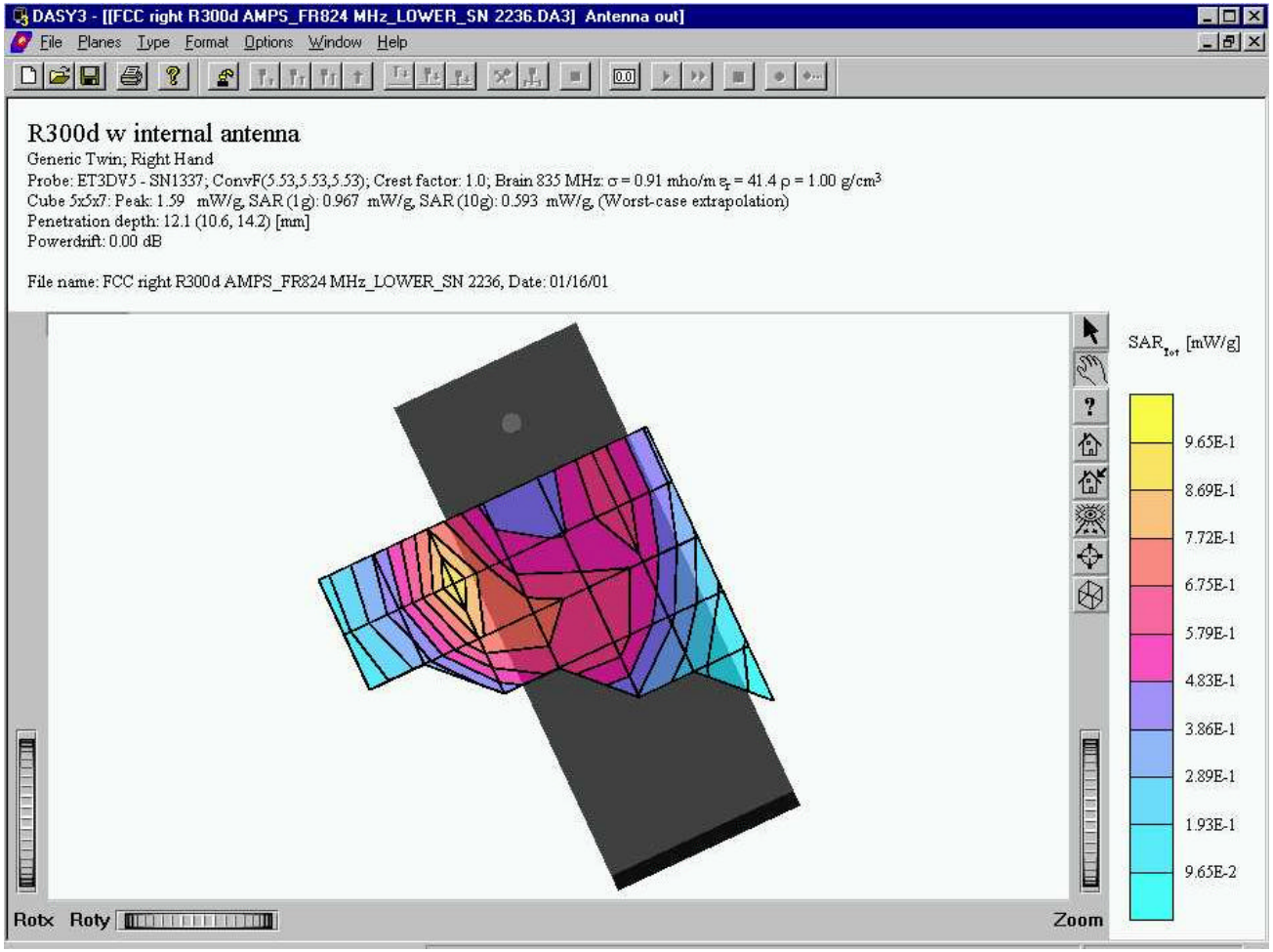


1800 MHz SAR distribution of validation dipole antenna from reference measurement. Using head/muscle tissue.

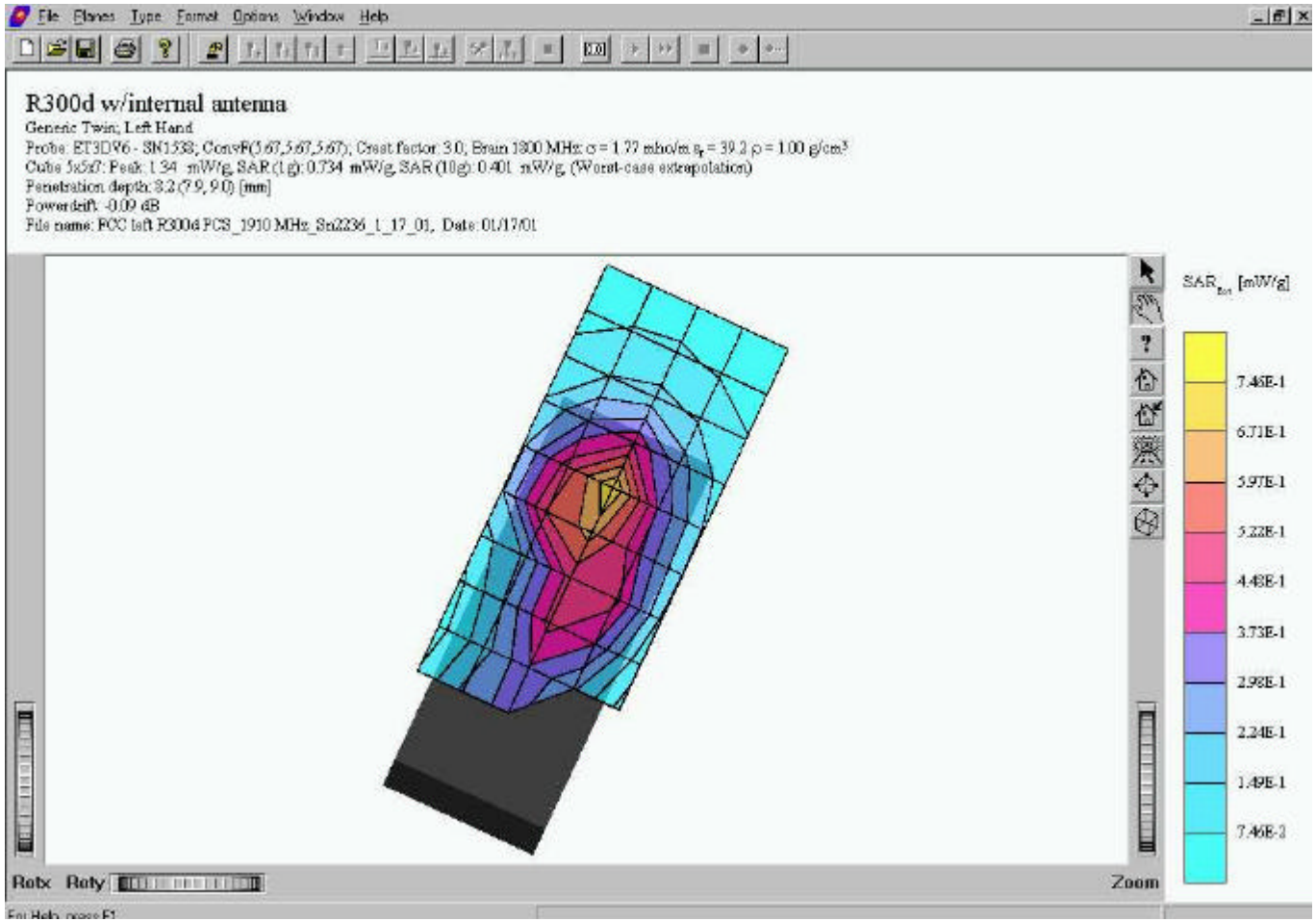
Appendix 2: SAR distribution plots



Distribution of maximum SAR in 800 AMPS band. Scan region covers the first of two SAR peaks. Measured against the head.



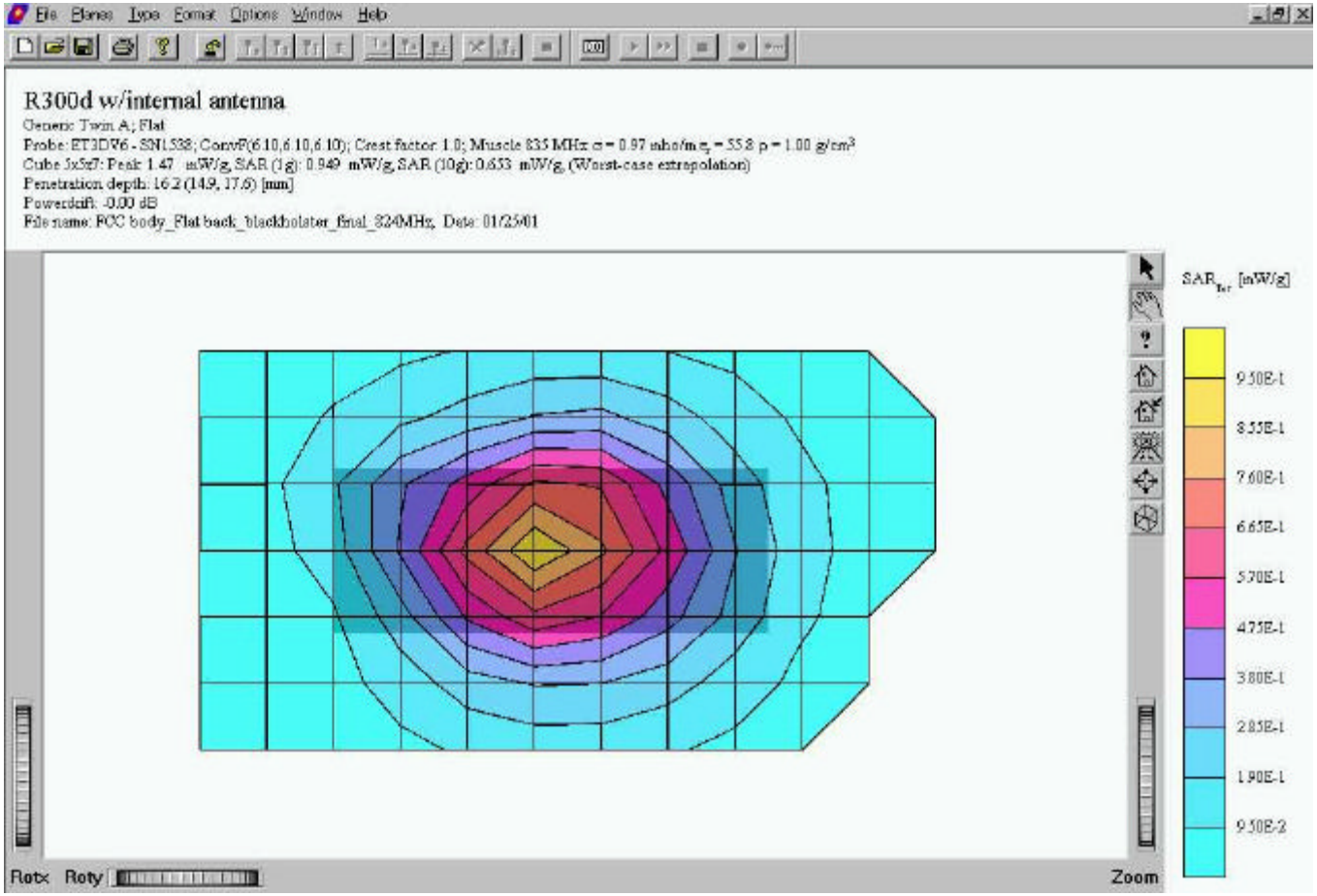
Distribution of maximum SAR in 800 AMPS band. Scan region covers the second of two SAR peaks. Measured against the head.

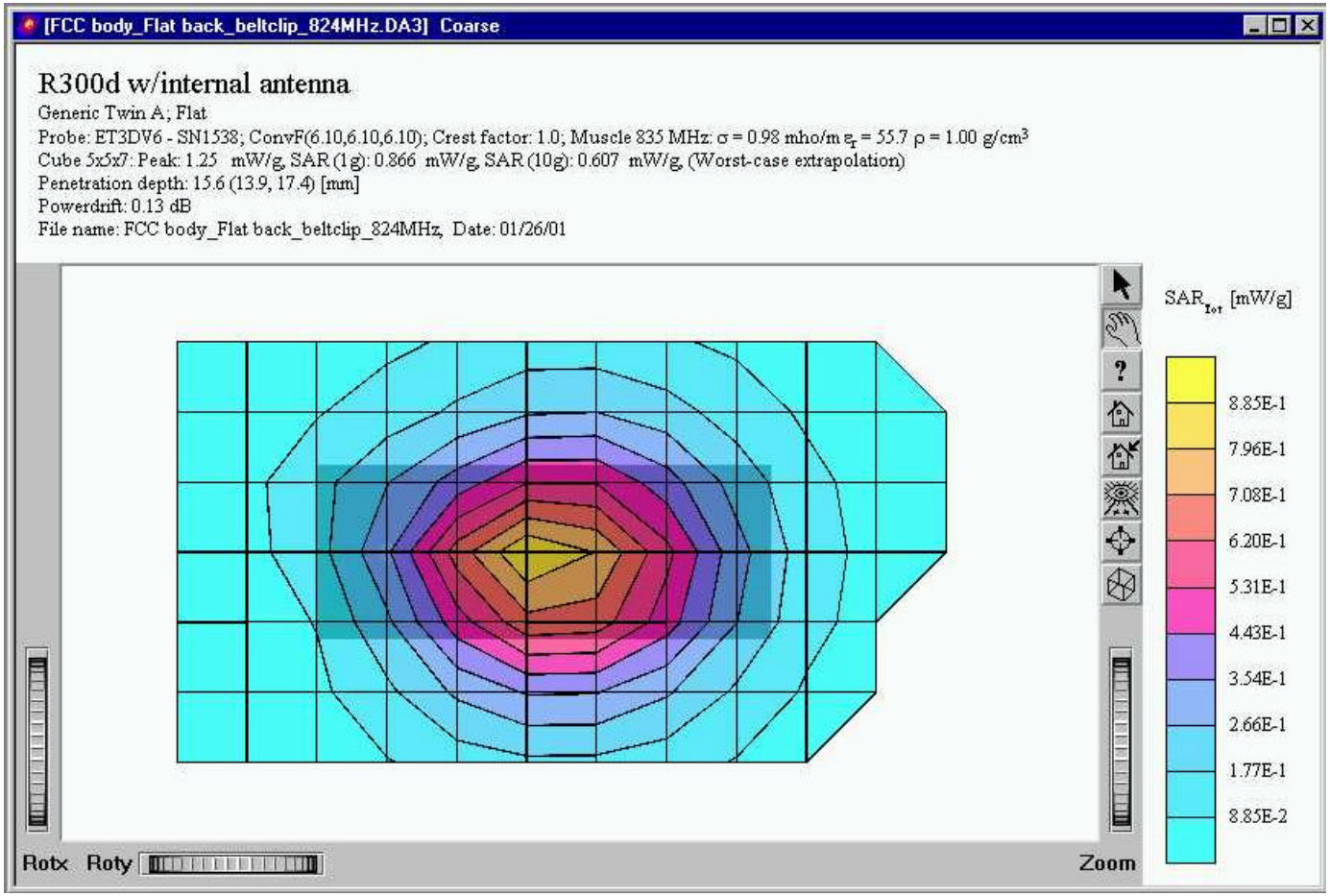


Distribution of maximum SAR in 1900 PCS band. Measured against the head.

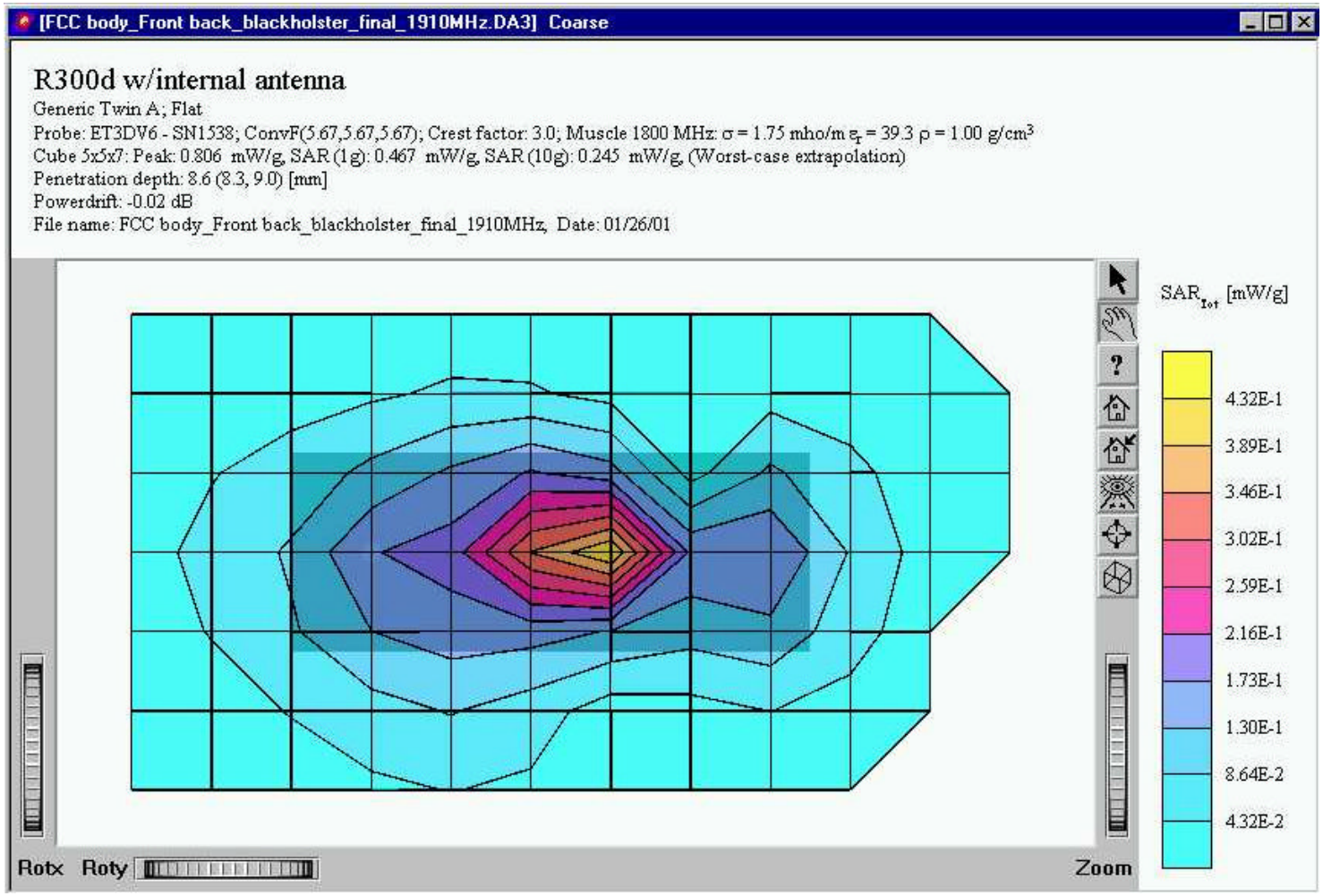
Distribution of maximum SAR in 800 AMPS band. Measured against the body using product # SXK 109 4342 as a carry case.

Prepared (also subject responsible if other)		No.		
EUS/CV/RF/P Dulce Altabella		EUS/CV/R-01:0143/REP		
Approved	Checked	Date	Rev	File
EUS/CV/RF/P Mark Douglas	MGD	2001-1-26	A	U:\FCC_TRNS\Fcc_411 Dit Margaretta\class 2\SAR r300d.doc

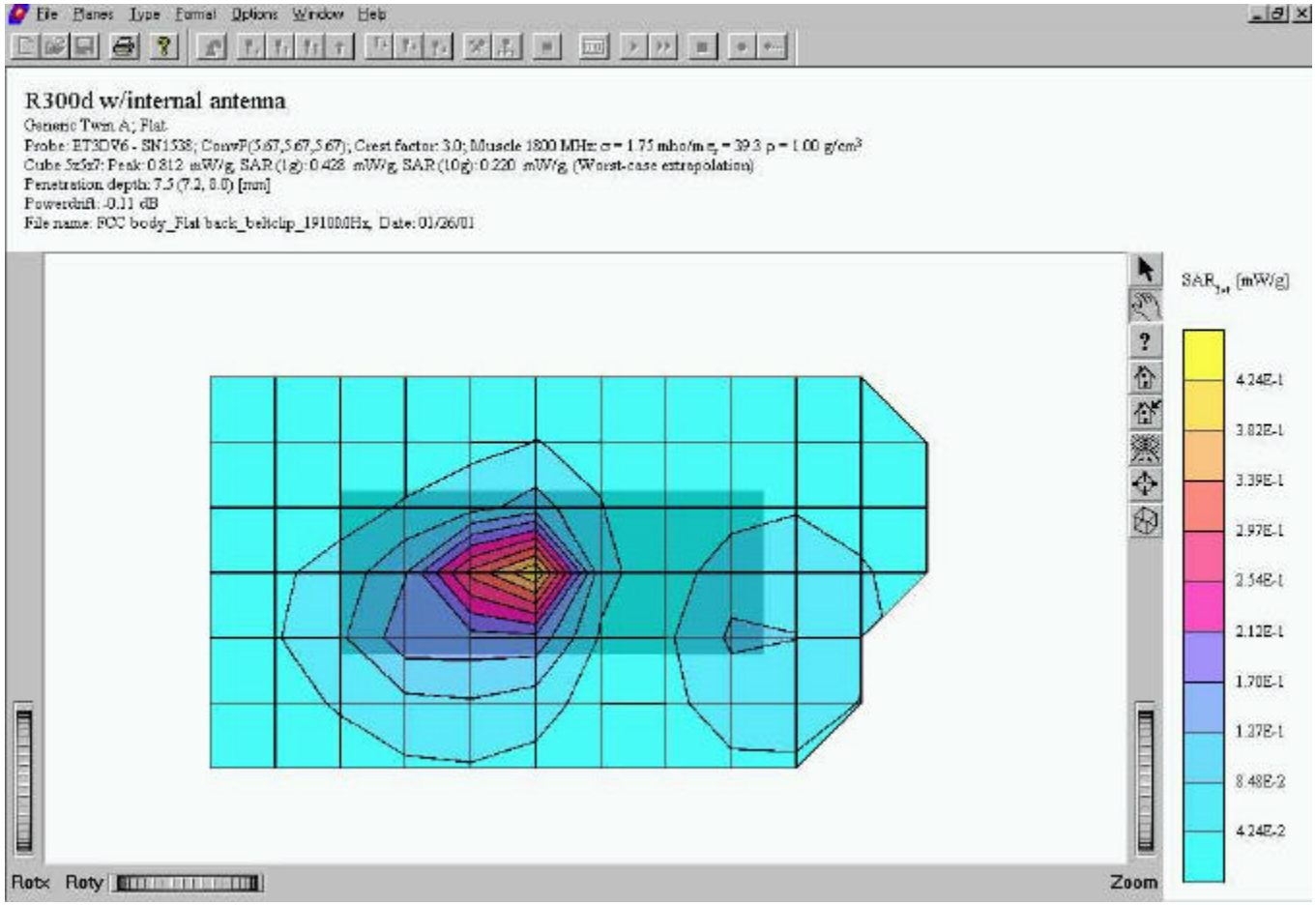




Distribution of maximum SAR in 800 AMPS band. Measured against the body using product # SXK 107 6820/55 as a carry case.



Distribution of maximum SAR in 1900 PCS band. Measured against the body using product # SXK 109 4342 as a carry case.



Distribution of maximum SAR in 1900 PCS band. Measured against the body using product # SXK 107 6820/55 as a carry accessory.

Appendix 3: Photographs of Device Under Test

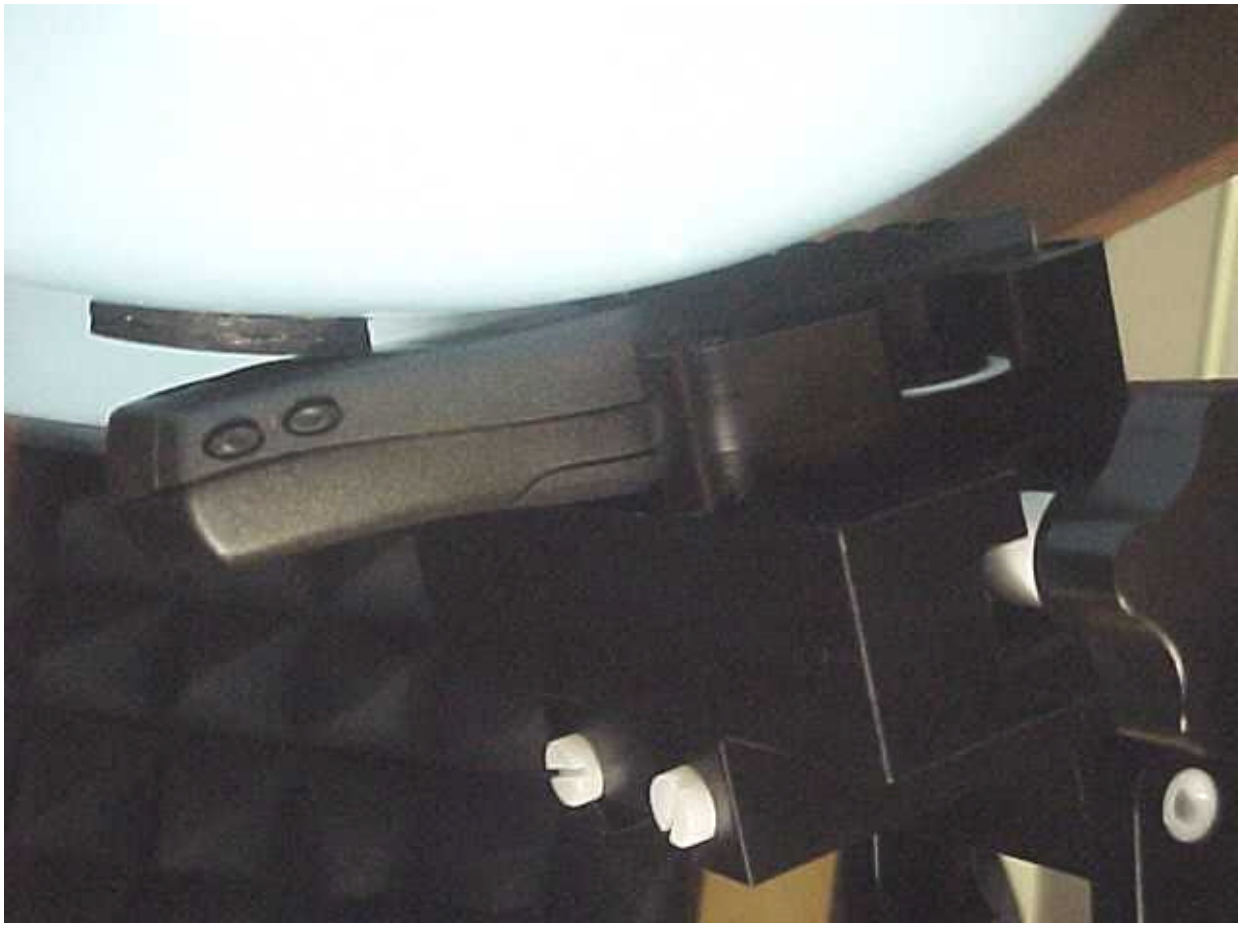
Front view of device.

Side view of device.

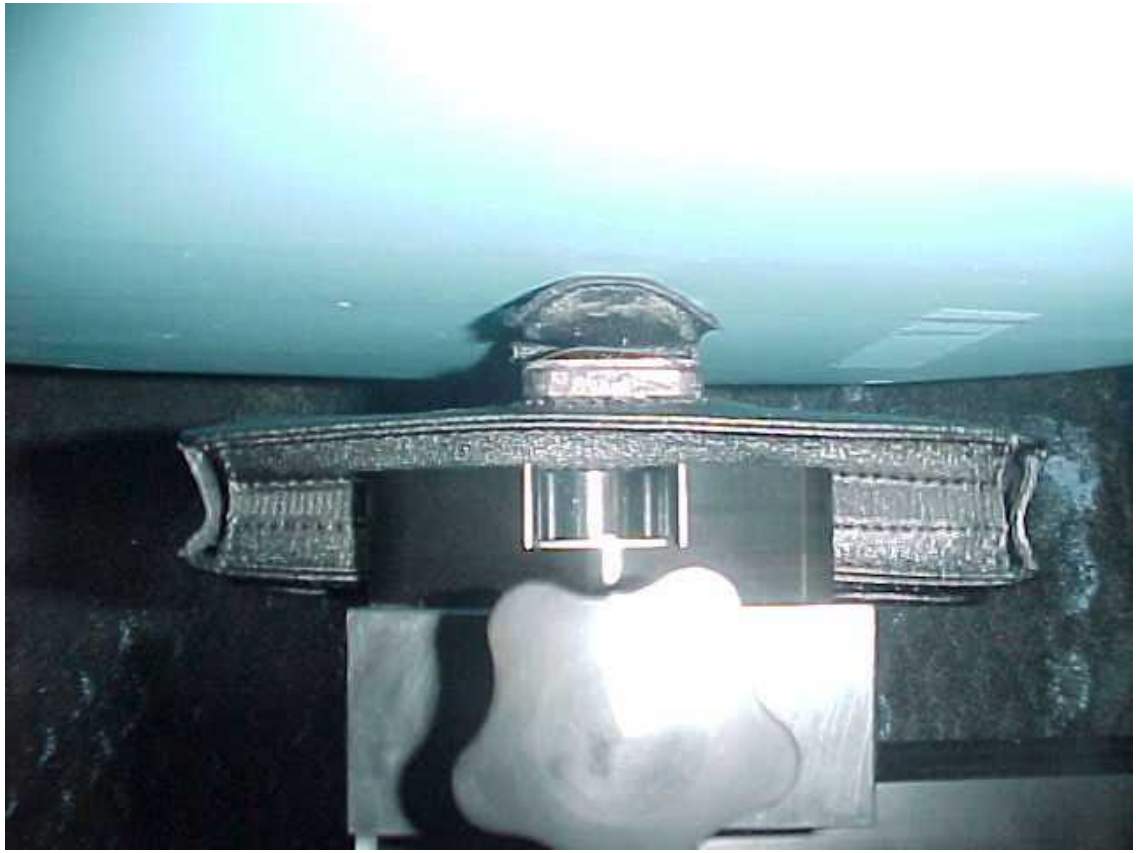
Front, back, and side views of product number SXK 109 4342.

Front, side, and back views of part number SXK 107 6820/55.

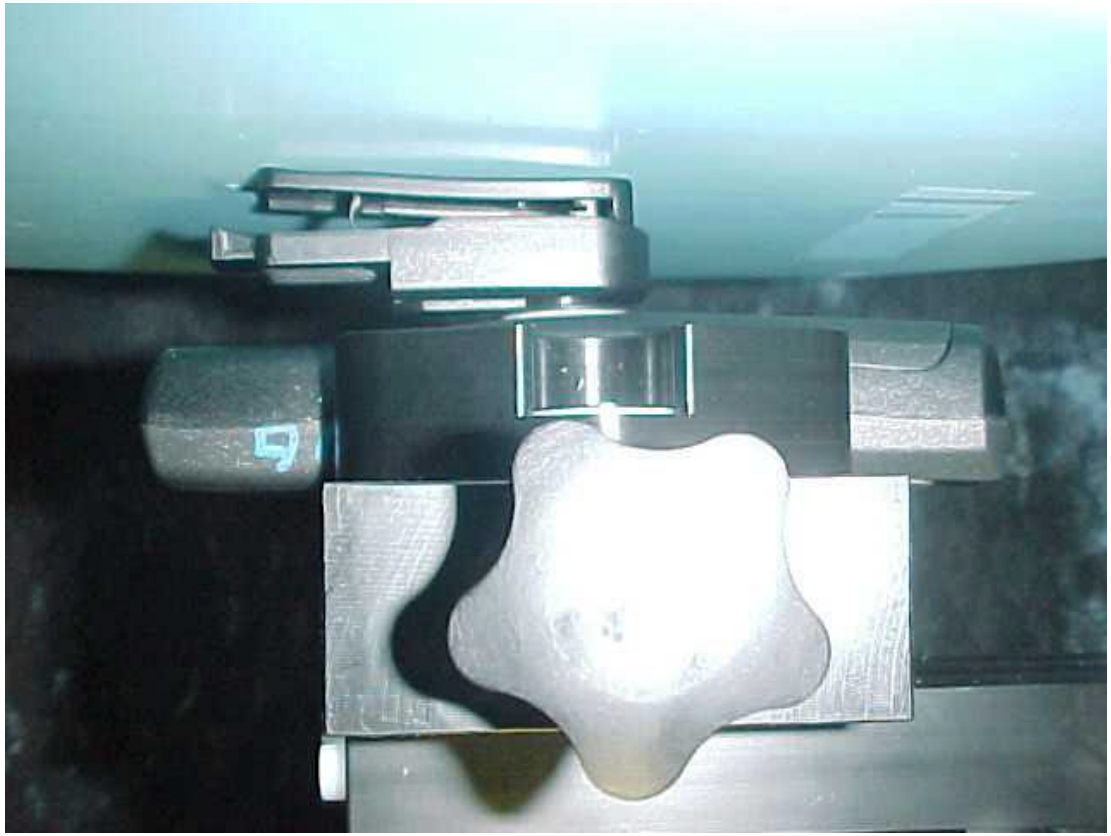
Appendix 4: Position of Device on Phantom



Position of device against head phantom.



Position of device against flat phantom using carry accessory SXK 109 4342.



Position of device against flat phantom using carry accessory SXK 107 6820/55.

Appendix 5: Probe calibration parameters

DASY3 - Parameters of Probe: ET3DV6 SN:1538

Sensitivity in Free Space

NormX	**1.31**	$\mu V/(V/m)^2$
NormY	**1.11**	$\mu V/(V/m)^2$
NormZ	**1.38**	$\mu V/(V/m)^2$

Diode Compression

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

Sensitivity in Tissue Simulating Liquid

Brain **450 MHz** ε_r **= 48 ± 5%** σ **= 0.50 ± 10% mho/m**

ConvF X	**6.62**	extrapolated	Boundary effect:	
ConvF Y	**6.62**	± 7% (k=2)	Alpha	**0.05**
ConvF Z	**6.62**	interpolated	Depth	**2.89**

Brain **900 MHz** ε_r **= 42.5 ± 5%** σ **= 0.86 ± 10% mho/m**

ConvF X	**6.30**	± 7% (k=2)	Boundary effect:	
ConvF Y	**6.30**	interpolated	Alpha	**0.42**
ConvF Z	**6.30**	± 7% (k=2)	Depth	**2.42**

Brain **1500 MHz** ε_r **= 41 ± 5%** σ **= 1.32 ± 10% mho/m**

ConvF X	**5.88**	interpolated	Boundary effect:	
ConvF Y	**5.88**	± 7% (k=2)	Alpha	**0.92**
ConvF Z	**5.88**		Depth	**1.79**

Brain **1800 MHz** ε_r **= 41 ± 5%** σ **= 1.69 ± 10% mho/m**

ConvF X	**5.67**	± 7% (k=2)	Boundary effect:	
ConvF Y	**5.67**		Alpha	**1.16**
ConvF Z	**5.67**		Depth	**1.47**

Sensor Offset

Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.6 ± 0.2**	mm

DASY3 - Parameters of Probe: ET3DV5 SN:1337

Sensitivity in Free Space

NormX	**2.29** $\mu V/(V/m)^2$
NormY	**2.05** $\mu V/(V/m)^2$
NormZ	**2.10** $\mu V/(V/m)^2$

Diode Compression

DCP X	**99** mV
DCP Y	**99** mV
DCP Z	**99** mV

Sensitivity in Tissue Simulating Liquid

Brain **450 MHz** ε_r **= 48 ± 5%** σ **= 0.50 ± 10% mho/m**

ConvF X	**5.87**	extrapolated	Boundary effect:	
ConvF Y	**5.87**	extrapolated	Alpha	**0.75**
ConvF Z	**5.87**	extrapolated	Depth	**1.45**

Brain **900 MHz** ε_r **= 42.5 ± 5%** σ **= 0.86 ± 10% mho/m**

ConvF X	**5.56**	± 7% (k=2)	Boundary effect:	
ConvF Y	**5.56**	± 7% (k=2)	Alpha	**0.74**
ConvF Z	**5.56**	± 7% (k=2)	Depth	**1.63**

Brain **1500 MHz** ε_r **= 41 ± 5%** σ **= 1.32 ± 10% mho/m**

ConvF X	**5.14**	interpolated	Boundary effect:	
ConvF Y	**5.14**	interpolated	Alpha	**0.71**
ConvF Z	**5.14**	interpolated	Depth	**1.86**

Brain **1800 MHz** ε_r **= 41 ± 5%** σ **= 1.69 ± 10% mho/m**

ConvF X	**4.93**	± 7% (k=2)	Boundary effect:	
ConvF Y	**4.93**	± 7% (k=2)	Alpha	**0.70**
ConvF Z	**4.93**	± 7% (k=2)	Depth	**1.98**

Sensor Offset

Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**2.0 ± 0.2**	mm