

Prepared (also subject responsible if other) EUS/CV/RF/P Will Stewart		No. EUS/CV/R-01:0484/REP	
Approved EUS/CV/RF/P Mark Douglas	Checked MGD	2001-4-25	C U:\FCC Submittals\FCC_417 Ditto Nicole\XHIBIT11\New SAR.doc

## SAR Test Report: T60d

**Date of test:** April 10-12, and 16, 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 Technical Leader, 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

### T60d

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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## 1. Introduction

In this report, compliance of the Ericsson T60d 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

<b>Type</b>	Internal antenna	
<b>Location</b>	Inside the back cover, near the top	
<b>Dimensions</b>	Maximum length	38 mm
	Maximum width	51 mm
<b>Configuration</b>	Patch antenna	

### 2.2 Device description

<b>Device model</b>	T60d		
<b>FCC ID</b>	AXATR-417-A2		
<b>Serial number</b>	UA2020480H		
<b>Mode</b>	800 AMPS	800 TDMA	1900 TDMA
<b>Multiple Access Scheme</b>	FDMA	TDMA	TDMA
<b>Maximum Output Power Setting<sup>1</sup></b>	26.0 dBm	26.0 dBm	26.0 dBm
<b>Factory Tolerance in Power Setting</b>	± 0.25	± 0.25	± 0.25
<b>Maximum Peak Output Power<sup>2</sup></b>	26.25 dBm	26.25 dBm	26.25 dBm
<b>Duty Cycle</b>	1	1 / 3	1 / 3
<b>Transmitting Frequency Range</b>	824 – 849 MHz	824 – 849 MHz	1850 – 1910 MHz
<b>Prototype or Production Unit</b>	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 extended SAR assessment uncertainty ( $K = 2$ ) is  $\pm 32\%$  with a  $+15\%$  offset. This assessment uncertainty includes measurement uncertainty ( $\pm 24\%$ ) and phantom uncertainty ( $\pm 10\%$ ), as described in [1]. This results in a total uncertainty range of  $-17\%$  to  $+47\%$ . The equipment list is given below.

<b>Description</b>	<b>Serial Number</b>	<b>Due Date</b>
DASY3 DAE V1	369	12/01
E-field probe ET3DV6	1538	9/01
E-field probe ET3DV5	1337	6/01
Dipole Validation Kit, D900V2	049	1/03
Dipole Validation Kit, D1800V2	217	12/01

<sup>1</sup> 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.

<sup>2</sup> This equals the maximum output power setting plus the factory tolerance.

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### 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 E4418B	GB40206594	10/01
Power sensor HP 8482H	3318A09268	8/01
Power meter HP 437B	3125U16190	3/02
Power sensor HP 8482H	2704A06235	4/01
Power meter HP 437B	3125U13729	1/02
Power sensor HP 8482H	3318A07097	2/02

### 4. Electrical parameters of the tissue simulating liquid

Prior to conducting SAR measurements, the relative permittivity,  $\epsilon_r$ , and the conductivity,  $\sigma$ , of the tissue simulating liquids were measured with the dielectric probe kit. These values are shown in the table below. The mass density,  $\rho$ , 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			Chamber Temp. (°C)
			$\epsilon_r$	$\sigma$ (S/m)	$\rho$ (g/cm <sup>3</sup> )	
835	Head	Measured, 4/10/01	41.63	0.91	1.00	24.6
		Recommended Limits [2]	46.08	0.74	1.03	--
	Muscle	Measured, 4/12/01	55.63	0.98	1.00	21.1
		Measured, 4/16/01	55.52	0.98	1.00	22.0
		Recommended Limits [2]	56.11	0.95	1.04	--
1800	Head	Measured, 4/11/01	39.17	1.76	1.00	24.1
		Recommended Limits [2]	43.54	1.15	1.03	--
	Muscle	Measured, 4/11/01	39.17	1.76	1.00	24.1
		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 (SAR values are scaled to 1 Watt power delivered to the antenna). It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values. At 900 MHz and 1800MHz, reference values are taken from the system manufacturer. The distributions of SAR compare well with those of the reference measurements (see Appendix 1).

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$f$ (MHz)	Tissue type	Measured / Reference	SAR (W/kg), 1 gram/10 gram	Dielectric Parameters			Chamber Temp. (°C)
				$\epsilon_r$	$s$ (S/m)	$r$ (g/cm <sup>3</sup> )	
900	Head	Measured, 4/10/01	10.80 / 6.87	40.89	0.97	1.00	24.7
		Reference	10.96 / 6.92	41.7	0.94	1.00	--
900	Muscle	Measured, 4/12/01	11.36 / 7.24	55.03	1.04	1.00	22.2
		Measured, 4/16/01	11.20 / 7.16	54.94	1.04	1.00	21.8
		Reference	11.08 / 7.08	56.1	0.99	1.00	--
1800	Head/ Muscle	Measured, 4/11/01	41.04 / 20.60	39.17	1.76	1.00	22.6
		Reference	40.00 / 20.20	40.0	1.72	1.00	--

## 6. Test results

The measured 1and 10-gram averaged SAR values of the device are provided in Tables 1 through 3. 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)	Left hand			Right hand		
			Chamber Temp. (°C)	SAR, 1g /10g (W/kg)		Chamber Temp. (°C)	SAR, 1g /10g (W/kg)	
				measured	Calculated to max. power		measured	Calculated to max. power
800 AMPS	824	26.35	24.5	1.35 / 0.97	<b>1.35 / 0.97</b>	24.7	1.35 / 0.92	<b>1.35 / 0.92</b>
	837	26.25	24.5	1.31 / 0.91	1.31 / 0.91	24.4	1.26 / 0.86	1.26 / 0.86
	849	26.08	24.3	1.25 / 0.86	1.25 / 0.86	24.5	1.08 / 0.73	1.08 / 0.73
1900 TDMA	1850	25.82	22.1	0.29 / 0.14	0.30 / 0.15	22.5	0.31 / 0.16	<b>0.33 / 0.17</b>
	1880	26.01	22.2	0.25 / 0.14	0.27 / 0.15	22.5	0.25 / 0.13	0.26 / 0.14
	1910	26.21	22.2	0.23 / 0.13	0.25 / 0.14	22.5	0.18 / 0.09	0.19 / 0.10

**Table 1: SAR measurement results for the Ericsson T60d 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 product # SXX 109 4518/1, product # SXX 109 4518/2, and product # SXX 107 6820/55. 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 through 3.

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mode	f (MHz)	Output Power (dBm)	SXX 109 4518/1			SXX 109 4518/2		
			Chamber Temp. (°C)	SAR, 1g /10g (W/kg)		Chamber Temp. (°C)	SAR, 1g /10g (W/kg)	
				measured	Calculated to max. power		measured	Calculated to max. power
800 AMPS	824	26.35	21.7	0.83 / 0.58	<b>0.83 / 0.58</b>	22.3	0.78 / 0.54	<b>0.78 / 0.54</b>
	837	26.25	21.7	0.66 / 0.46	0.66 / 0.46	22.3	0.67 / 0.46	0.67 / 0.46
	849	26.08	21.9	0.53 / 0.37	0.53 / 0.37	22.3	0.58 / 0.40	0.58 / 0.40
1900 TDMA	1850	25.82	22.2	0.10 / 0.05	<b>0.11 / 0.05</b>	22.6	0.59 / 0.31	0.62 / 0.33
	1880	26.01	22.1	0.10 / 0.05	0.10 / 0.05	22.8	0.61 / 0.32	0.65 / 0.34
	1910	26.21	22.1	0.09 / 0.04	0.09 / 0.05	22.7	0.72 / 0.38	<b>0.76 / 0.40</b>

**Table 2: SAR measurement results for the Ericsson T60d telephone at highest possible output power.  
Measured against the body using carry accessory SXX 109 4518/1 and SXX-109-4518/2.**

mode	f (MHz)	Output Power (dBm)	SXX 107 6820/55		
			Chamber Temp. (°C)	SAR, 1g /10g (W/kg)	
				measured	Calculated to max. power
800 AMPS	824	26.35	22.1	0.77 / 0.55	<b>0.77 / 0.55</b>
	837	26.25	21.8	0.72 / 0.50	0.72 / 0.50
	849	26.08	21.9	0.64 / 0.44	0.64 / 0.44
1900 TDMA	1850	25.82	22.2	0.49 / 0.26	0.52 / 0.27
	1880	26.01	22.3	0.62 / 0.32	0.65 / 0.34
	1910	26.21	22.4	0.64 / 0.34	<b>0.68 / 0.36</b>

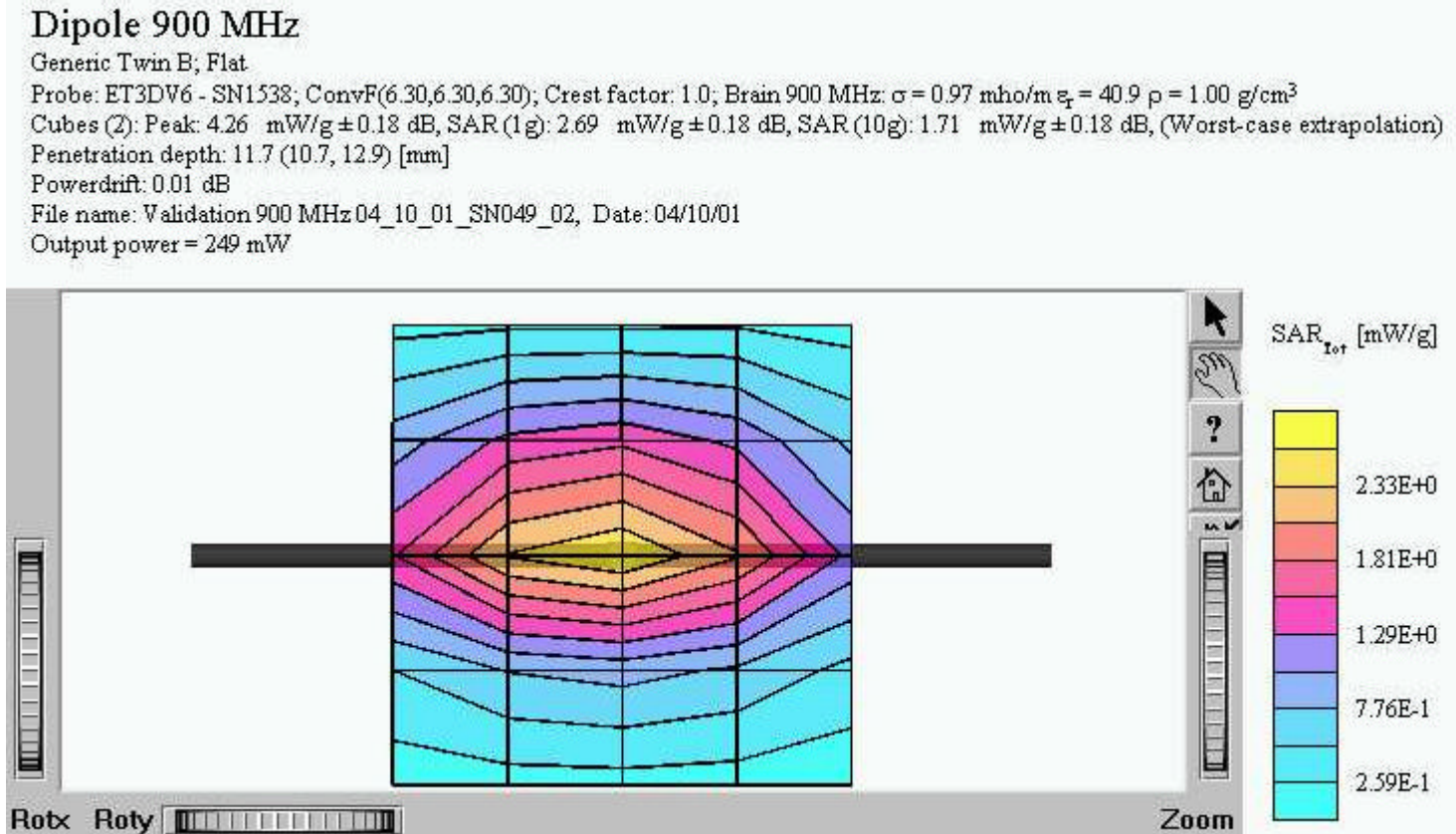
**Table 3: SAR measurement results for the Ericsson T60d telephone at highest possible output power.  
Measured against the body using carry accessory SXX 107 6820/55.**

## References

- [1] C. Törnevik, M. Siegbahn, T. Persson, M. Douglas, and R. Plicanic, "Ericsson SAR measurement specification", Internal Document ERA/TF-00:037, March 2001.
- [2] Federal Communications Commission, "Tissue Dielectric Properties," <http://www.fcc.gov/fcc-bin/dielec.sh>.

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## Appendix 1: SAR distribution comparison for system accuracy verification



**900 MHz SAR distribution of validation dipole antenna from system accuracy verification test on April 10, 2001.  
Using brain tissue.**

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**Validation Dipole D900V2 SN:049, d = 15 mm**

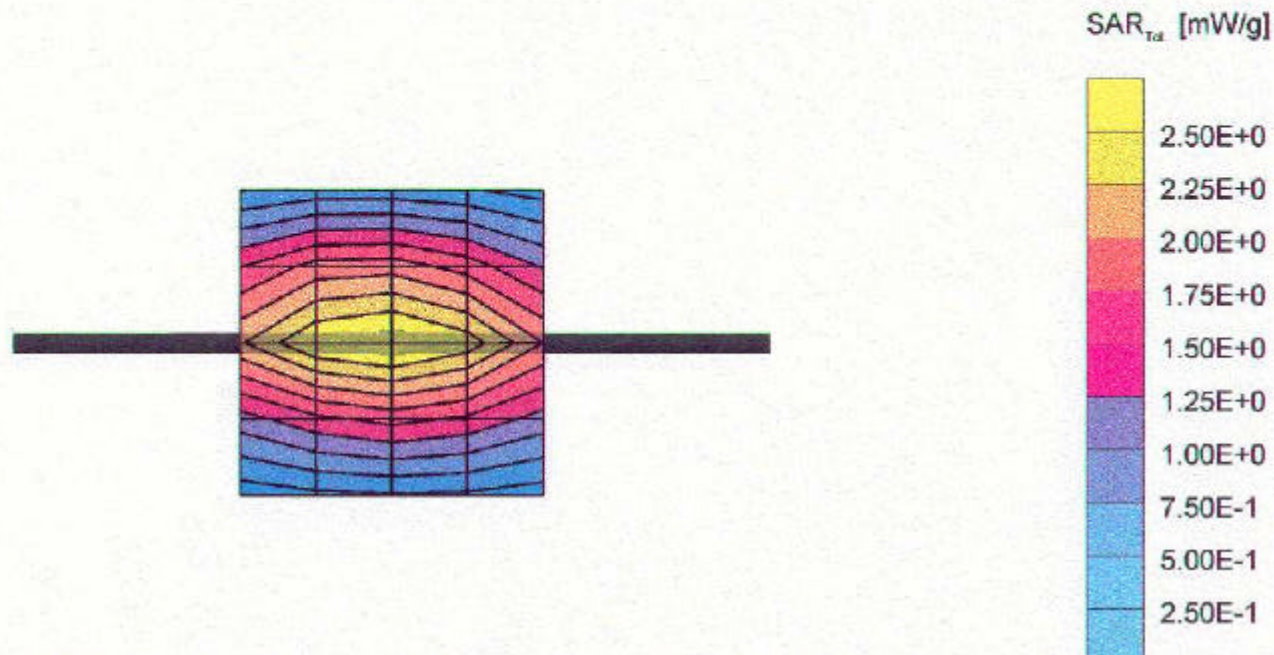
Frequency: 900 MHz; Antenna Input Power: 250 [mW]

Generic Twin Phantom: Flat Section; Grid Spacing: Dx = 15.0, Dy = 15.0, Dz = 10.0

Probe: ET3DV6 - SN1507; ConvF(6.35,6.35,6.35) at 900 MHz; IEEE1528 900 MHz;  $\sigma = 0.94$  mho/m  $\epsilon_r = 41.7$   $\rho = 1.00$  g/cm<sup>3</sup>Cubes (2): Peak: 4.43 mW/g  $\pm 0.03$  dB, SAR (1g): 2.74 mW/g  $\pm 0.02$  dB, SAR (10g): 1.73 mW/g  $\pm 0.02$  dB, (Worst-case extrapolation)

Penetration depth: 11.6 (10.4, 13.2) [mm]

Powerdrift: -0.00 dB



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

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## Dipole 900 MHz

Generic Twin B, Flat

Probe: ET3DV5 - SN1337; ConvF(5.39,5.39,5.39); Crest factor: 1.0; Muscle 900 MHz:  $\sigma = 1.04 \text{ mho/m}$ ,  $\epsilon_r = 55.0$ ,  $\rho = 1.00 \text{ g/cm}^3$

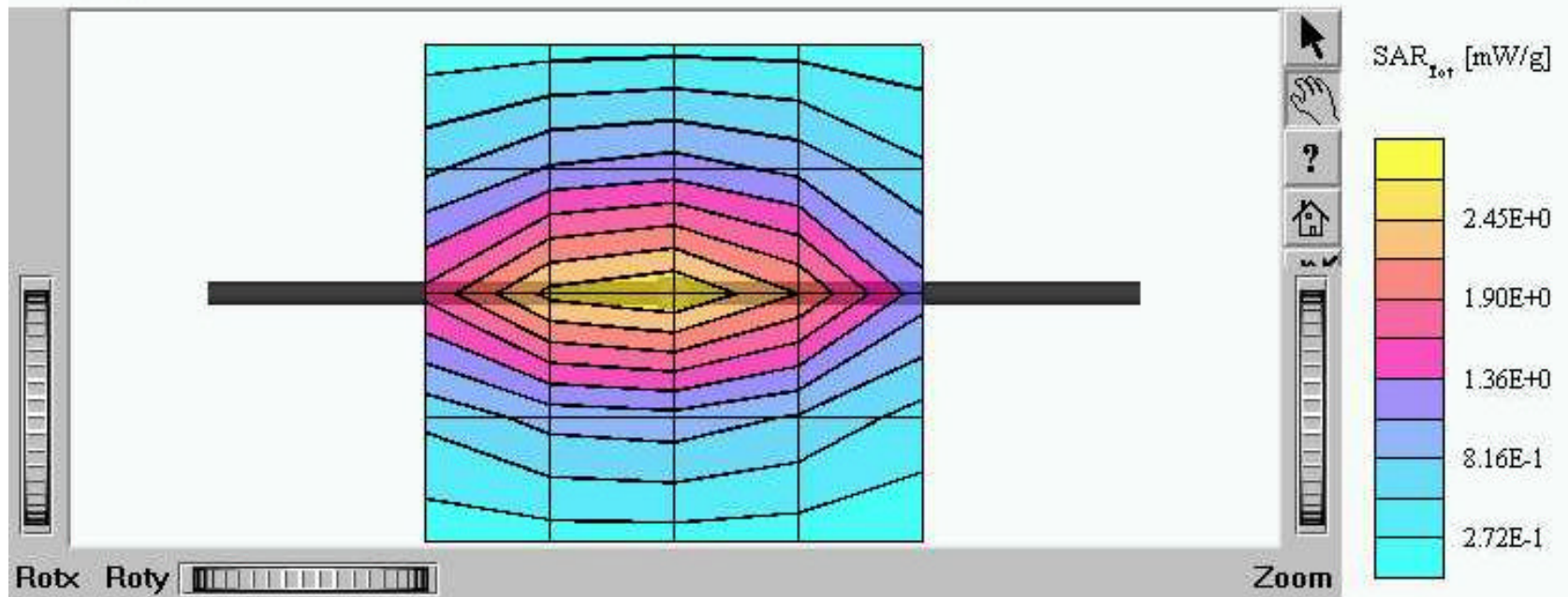
Cubes (Z): Peak:  $4.47 \text{ mW/g} \pm 0.14 \text{ dB}$ , SAR (1g):  $2.84 \text{ mW/g} \pm 0.12 \text{ dB}$ , SAR (10g):  $1.81 \text{ mW/g} \pm 0.11 \text{ dB}$ , (Worst-case extrapolation)

Penetration depth: 12.2 (11.2, 13.6) [mm]

Powerdrift: 0.01 dB

File name: Validation 900 MHz 04\_12\_01\_SN049, Date: 04/12/01

Output power = 250 mW



900 MHz SAR distribution of validation dipole antenna from system accuracy verification test on April 12, 2001. Using muscle tissue.

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## Dipole 900 MHz

Generic Twin B, Flat

Probe: ET3DV5 - SN1337; ConvF(5.39,5.39,5.39); Crest factor: 1.0; Muscle 900 MHz:  $\sigma = 1.04$  mho/m  $\epsilon_r = 54.9$   $\rho = 1.00$  g/cm<sup>3</sup>

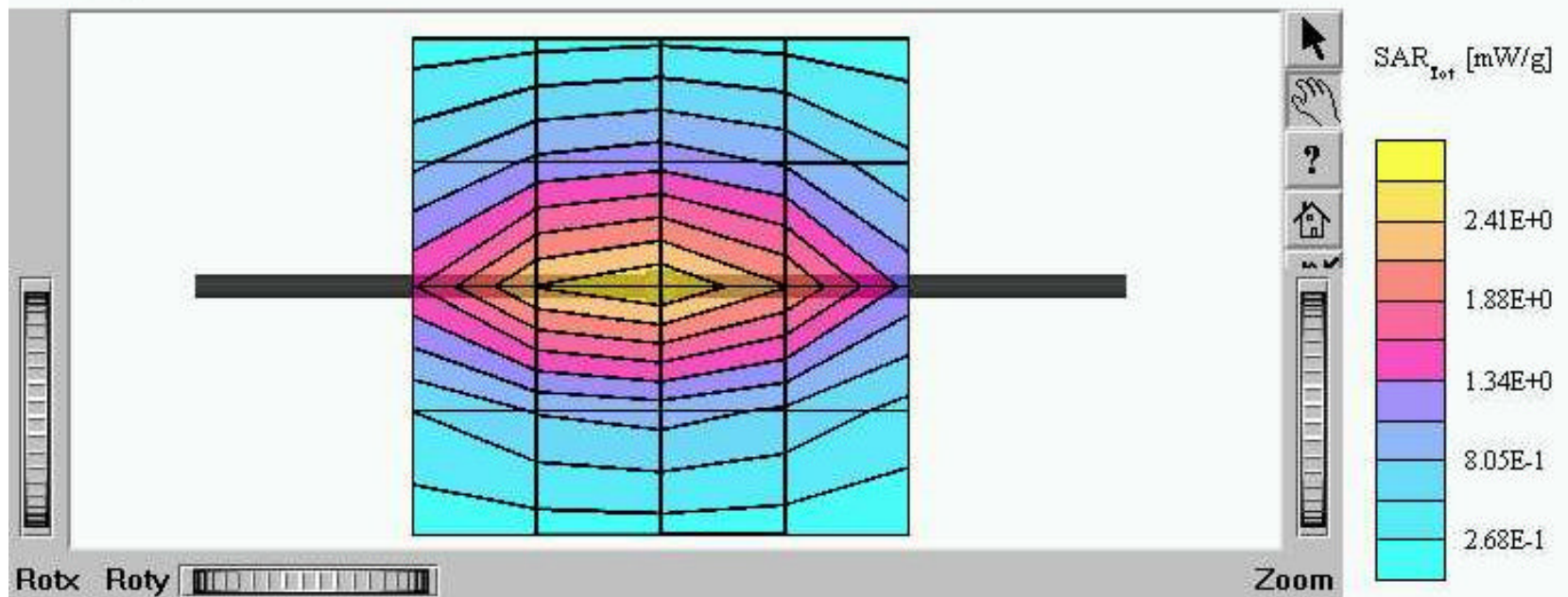
Cubes (2): Peak: 4.38 mW/g  $\pm 0.18$  dB, SAR (1g): 2.80 mW/g  $\pm 0.17$  dB, SAR (10g): 1.79 mW/g  $\pm 0.16$  dB, (Worst-case extrapolation)

Penetration depth: 12.2 (11.2, 13.6) [mm]

Powerdrift: 0.02 dB

File name: Validation 900 MHz 04\_16\_01\_SN049, Date: 04/16/01

Output power = 250 mW



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

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**Validation Dipole D900V2 SN:049, d = 15 mm**

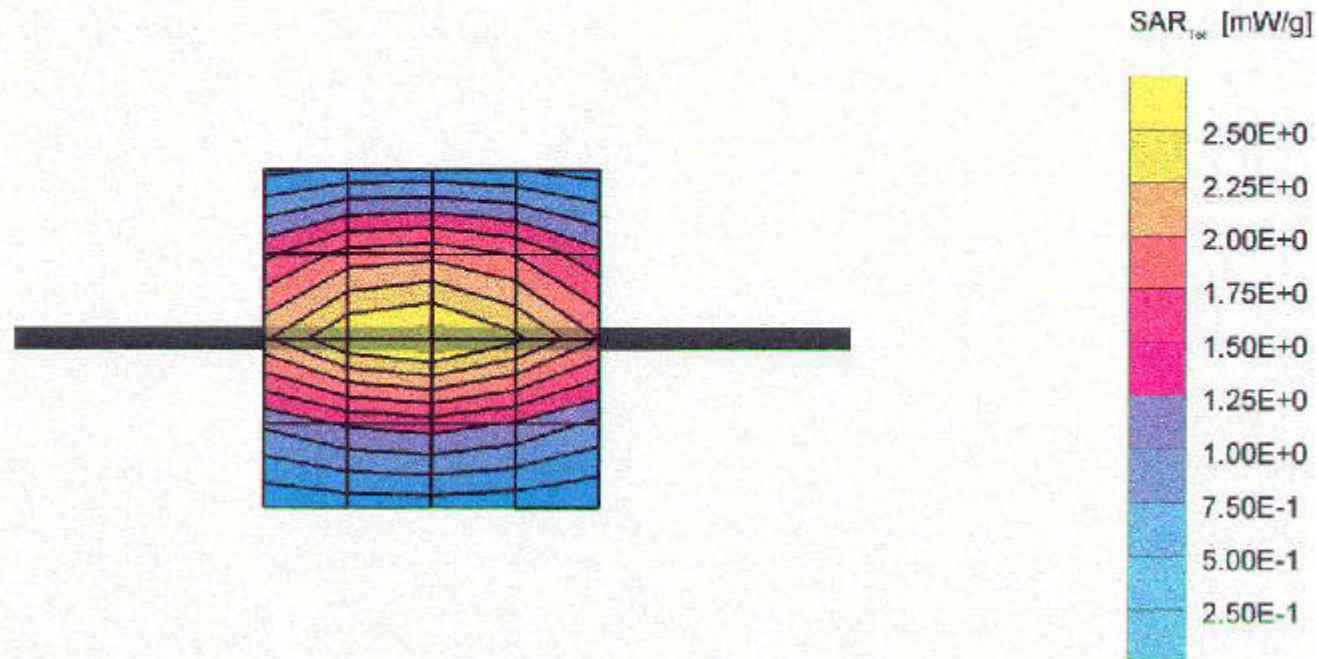
Frequency: 900 MHz; Antenna Input Power: 250 [mW]

Generic Twin Phantom; Flat Section; Grid Spacing: Dx = 15.0, Dy = 15.0, Dz = 10.0

Probe: ET3DV6 - SN1507; ConvF(6.17,6.17,6.17) at 900 MHz; Muscle 900 MHz;  $\sigma = 0.99$  mho/m  $\rho = 56.1$  p = 1.00 g/cm<sup>3</sup>Cubes (2): Peak: 4.42 mW/g  $\pm 0.03$  dB, SAR (1g): 2.77 mW/g  $\pm 0.02$  dB, SAR (10g): 1.77 mW/g  $\pm 0.02$  dB, (Worst-case extrapolation)

Penetration depth: 12.2 (10.7, 14.2) [mm]

Powerdrift: -0.01 dB



Schmid &amp; Partner Engineering AG, Zurich, Switzerland

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

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## Dipole 1800 MHz

Generic Twin A; Flat

Probe: ET3DV6 - SN1538; ConvF(5.67,5.67,5.67); Crest factor: 1.0; Brain 1800 MHz:  $\sigma = 1.76$  mho/m  $\epsilon_r = 39.2$   $\rho = 1.00$  g/cm<sup>3</sup>

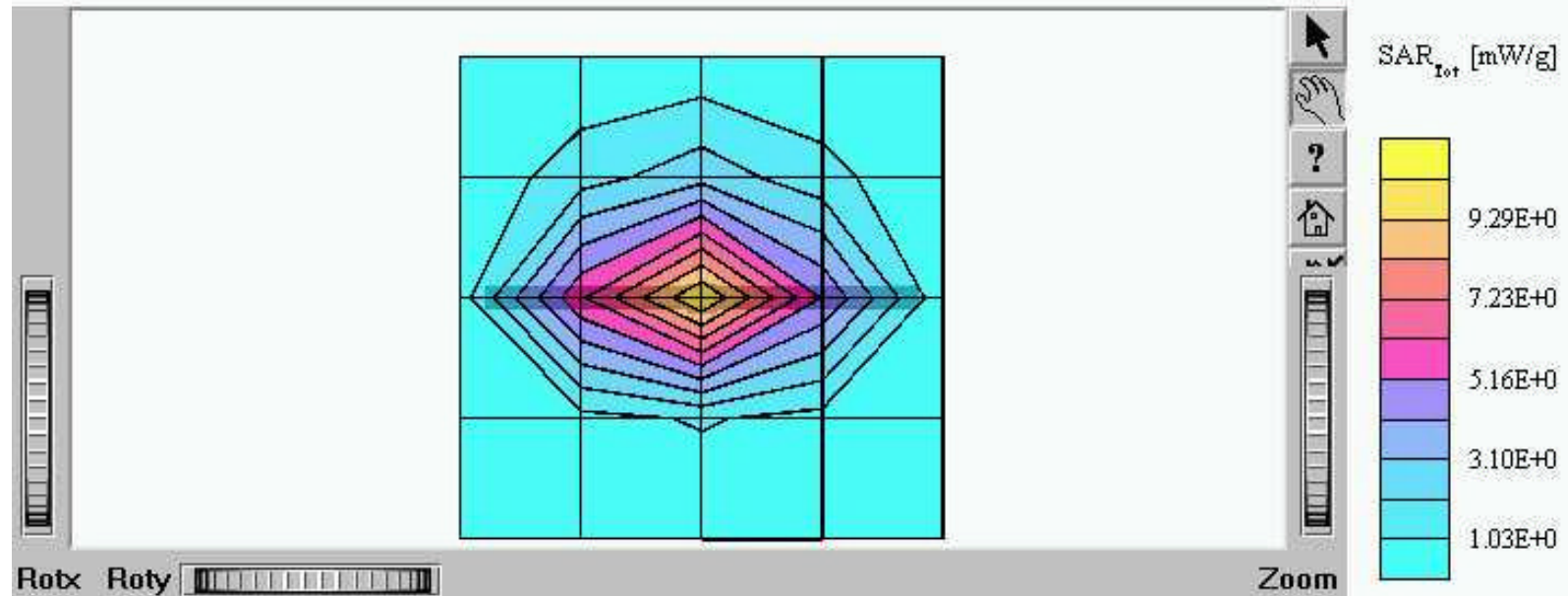
Cubes (2): Peak: 19.9 mW/g  $\pm 0.17$  dB, SAR (1g): 10.3 mW/g  $\pm 0.16$  dB, SAR (10g): 5.17 mW/g  $\pm 0.15$  dB, (Worst-case extrapolation)

Penetration depth: 7.3 (7.0, 8.0) [mm]

Powerdrift: 0.01 dB

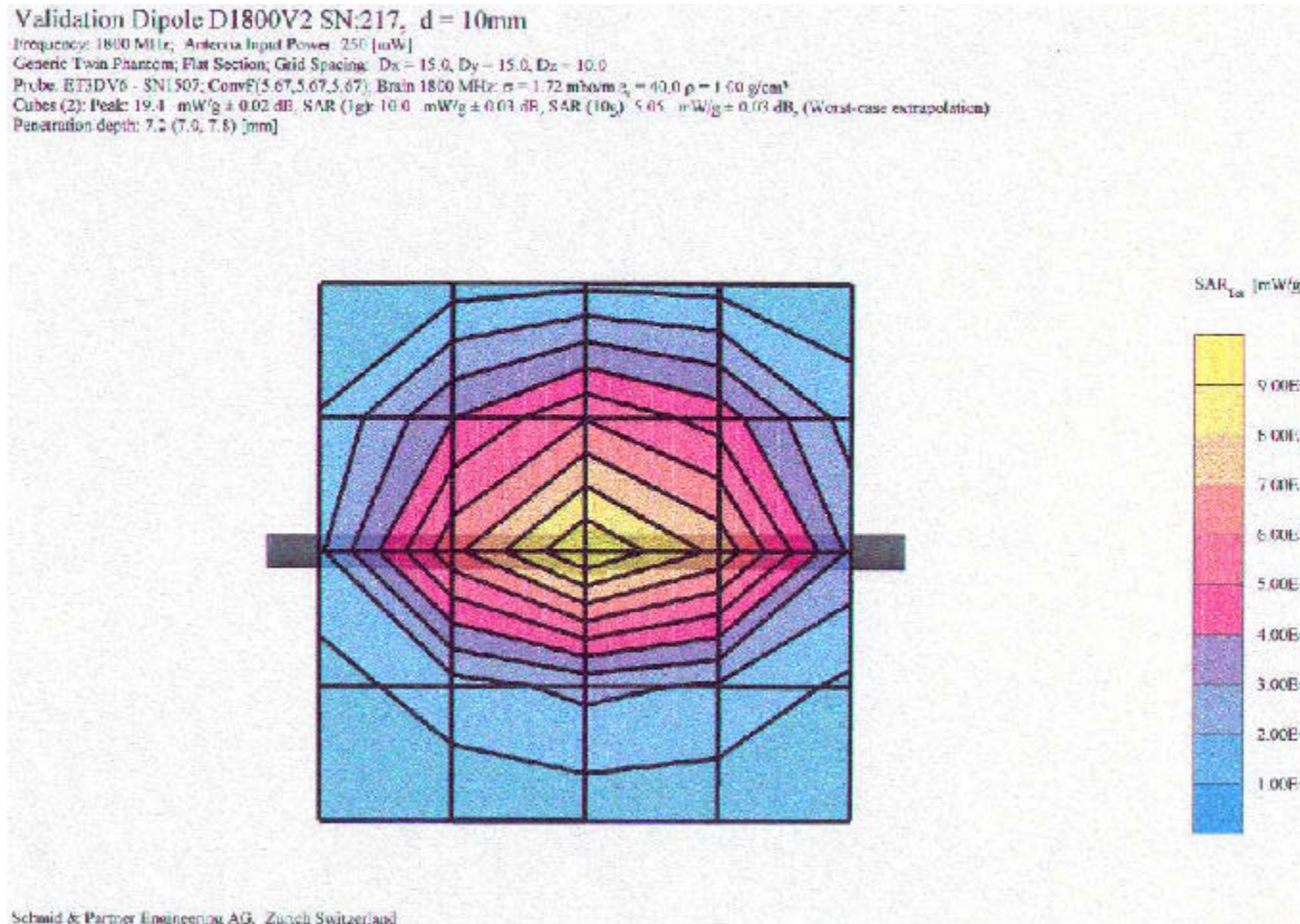
File name: Validation 1800 MHz 04\_11\_01\_SN217, Date: 04/11/01

Output power = 251 mW



1800 MHz SAR distribution of validation dipole antenna from system accuracy verification test on April 11, 2001.  
Using head/muscle tissue.

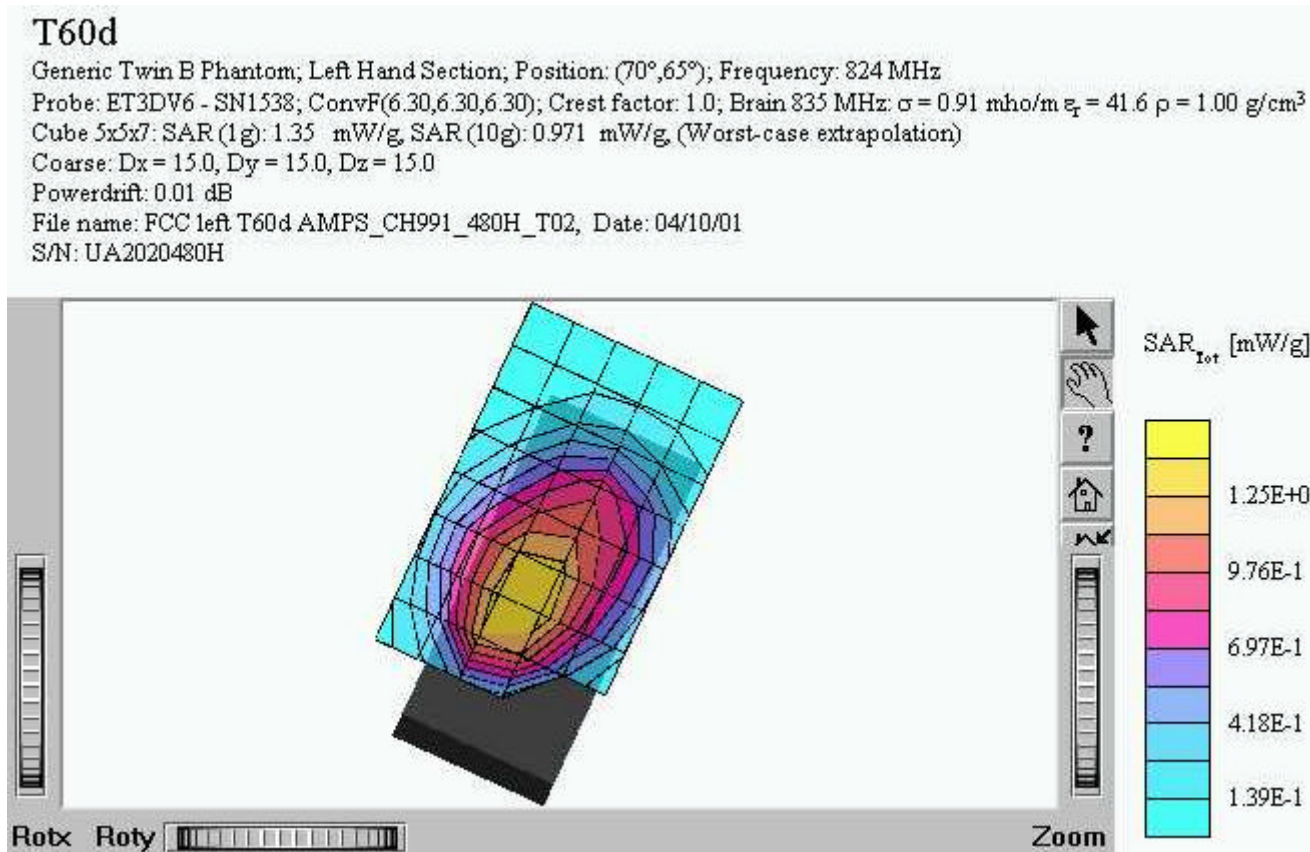
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**1800 MHz SAR distribution of validation dipole antenna from reference measurement.  
Using head/muscle tissue.**

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## Appendix 2: SAR distribution plots



**Distribution of maximum SAR in 800 AMPS band. Scan region covers left side.  
Measured against the head.**

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## T60d

Generic Twin B Phantom; Right Hand Section; Position: (70°,65°); Frequency: 824 MHz

Probe: ET3DV6 - SN1538; ConvF(6.30,6.30,6.30); Crest factor: 1.0; Brain 835 MHz:  $\sigma = 0.91$  mho/m  $\epsilon_r = 41.6$   $\rho = 1.00$  g/cm<sup>3</sup>

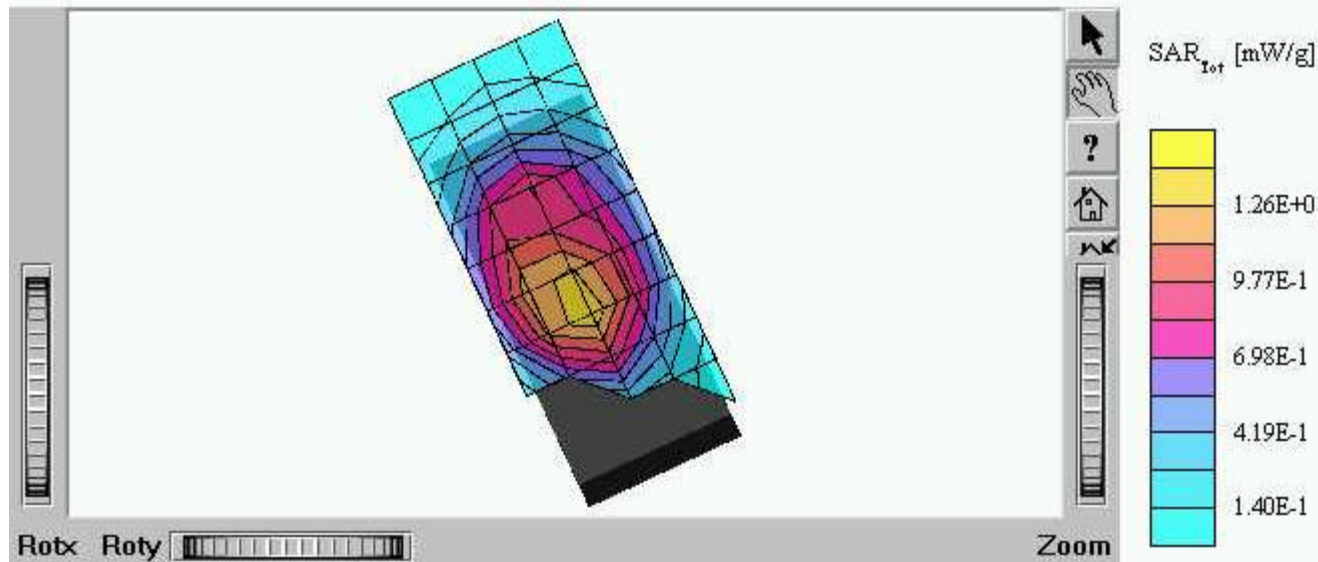
Cube 5x5x7: SAR (1g): 1.35 mW/g, SAR (10g): 0.925 mW/g, (Worst-case extrapolation)

Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: 0.01 dB

File name: FCC right T60d AMPS\_CH991\_480H\_T02, Date: 04/10/01

S/N: UA2020480H



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## T60d

Generic Twin A Phantom; Right Hand Section; Position: (70°,65°); Frequency: 1850 MHz

Probe: ET3DV6 - SN1538; ConvF(5.67,5.67,5.67); Crest factor: 3.0; Brain 1800 MHz:  $\sigma = 1.76 \text{ mho/m}$   $\epsilon_r = 39.2$   $\rho = 1.00 \text{ g/cm}^3$

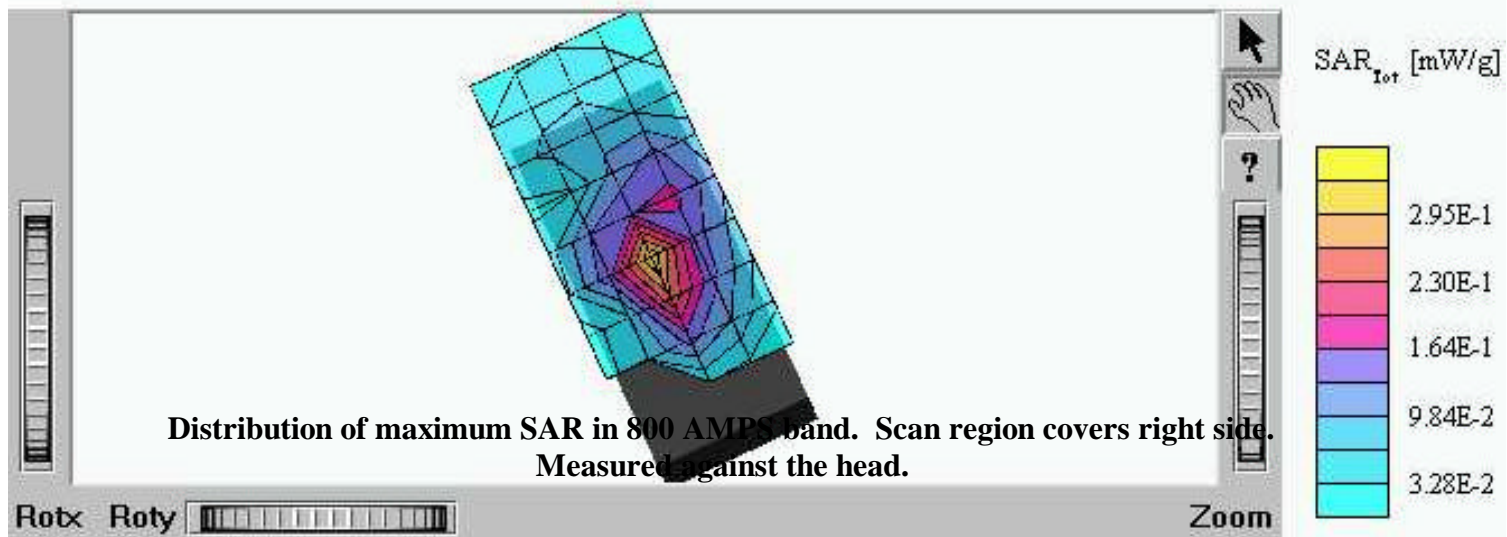
Cube 5x5x7: SAR (1g): 0.309 mW/g, SAR (10g): 0.160 mW/g, (Worst-case extrapolation)

Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: 0.07 dB

File name: FCC right T60d PCS\_CH0002\_480H\_T01, Date: 04/11/01

S/N: UA2020480H



Prepared (also subject responsible if other) EUS/CV/RF/P Will Stewart		No. EUS/CV/R-01:0484/REP	
Approved EUS/CV/RF/P Mark Douglas	Checked MGD	2001-4-25	C U:\FCC Submittals\FCC_417 Ditto Nicole\XHIBIT11\New SAR.doc

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

Prepared (also subject responsible if other) EUS/CV/RF/P Will Stewart		No. EUS/CV/R-01:0484/REP		
Approved EUS/CV/RF/P Mark Douglas	Checked MGD	2001-4-25	C	U:\FCC Submittals\FCC_417 Ditto Nicole\XHIBIT11\New SAR.doc

**T60d**

Generic Twin B; Flat

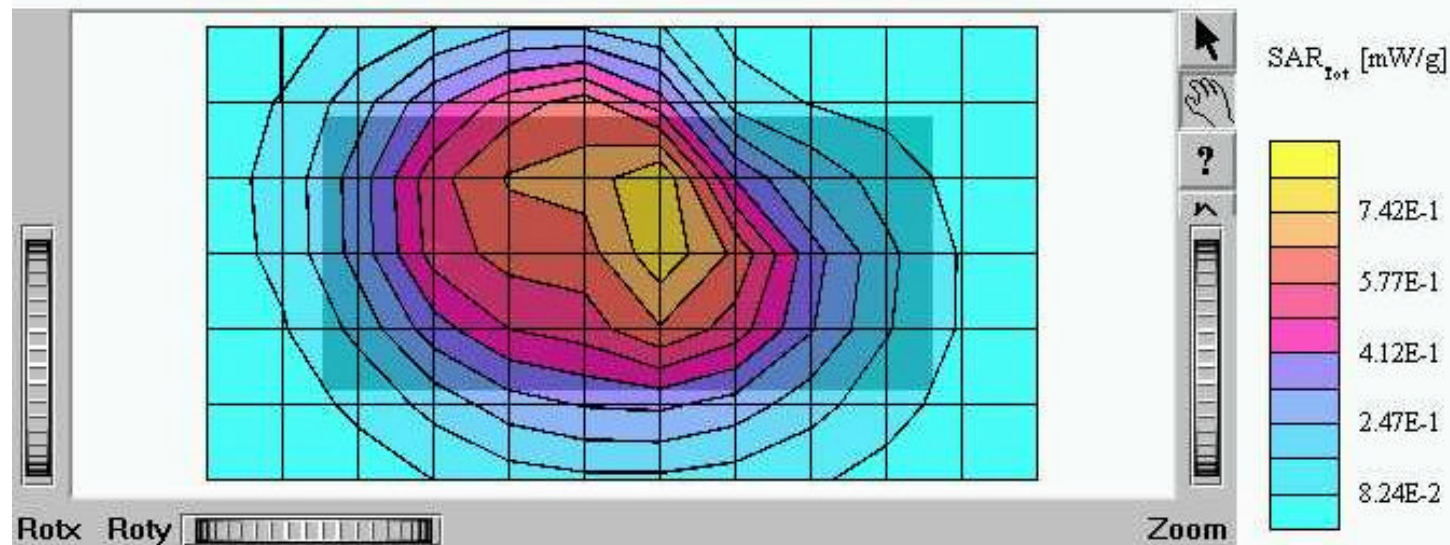
Probe: ET3DV5 - SN1337; ConvF(5.39,5.39,5.39); Crest factor: 1.0; Muscle 835 MHz:  $\sigma = 0.98$  mho/m  $\epsilon_r = 55.5$   $\rho = 1.00$  g/cm<sup>3</sup>

Cube 5x5x7: Peak: 1.29 mW/g, SAR(1g): 0.828 mW/g, SAR(10g): 0.575 mW/g, (Worst-case extrapolation)

Penetration depth: 14.8 (13.6, 16.2) [mm]

Powerdrift: 0.10 dB

File name: FCC body T60d AMPS\_CH991\_480H\_BF01, Date: 04/16/01



**Distribution of maximum SAR in 800 AMPS band. Measured against the body using product # SXX -109-4518/1 as a carry case.**