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SAR Test Report: T206 (PXITR-503-A2) Supplement A: Results for body-worn usage

Date of test: May 14 and 15, 2002

Laboratory: SAR Testing Laboratory
Sony Ericsson Mobile Communications, Inc.
7001 Development Drive, P.O. Box 13969,
Research Triangle Park, NC, 27709, USA

Tested by: William Stewart
Development Engineer, Antenna Development Group

Test Responsible: Dulce Altabella
Staff Engineer, Antenna Development Group

Accreditation: This laboratory is accredited to ISO/IEC 17025-1999 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: Sony Ericsson Mobile Communications, Inc. declares under its sole responsibility that the product



T206
FCC ID: PXITR-503-A2

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 using specifications that closely conform to the latest appropriate measurement standards, guidelines and recommended practices. Any deviations from these specifications or from ISO/IEC 17025-1999 are noted below:

None

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1. Introduction

This report is a supplement to the document SEM/CV/P-02:0536/REP "SAR Test Report: T206 (PXITR-503-A2)." The main document demonstrates compliance of the T206 wireless handset with RF safety guidelines while used against the head. In this report, compliance of the T206 wireless handset with RF safety guidelines is demonstrated while the device is used in body-worn configurations. The applicable RF safety guidelines and the SAR measurement specifications used for the test are described in [1].

2. Device Under Test

2.1 Antenna description

Type	Internal antenna	
Location	Inside the back cover, near the top	
Dimensions	Maximum length	20 mm
	Maximum width	40 mm
Configuration	Patch antenna	

2.2 Device description

Device model	T206		
FCC ID	PXITR-503-A2		
Serial number	UA2020NPHM		
Maximum Size	Length	113 mm	
	Width	50 mm	
	Thickness	26 mm	
Modes	800 AMPS	800 CDMA	1900 CDMA
Multiple Access Scheme	FDMA	CDMA	CDMA
Maximum Output Power Setting	26.0 dBm	23.4 dBm	23.4 dBm
Factory Tolerance in Power Setting	± 0.25	± 0.40	± 0.40
Maximum Peak Output Power	26.25 dBm	23.8 dBm	23.8 dBm
Duty Cycle	1	1	1
Transmitting Frequency Range	824 – 849 MHz	824 – 849 MHz	1850 – 1910 MHz
Prototype or Production Unit	Prototype		
Device Category	Portable		
RF Exposure Environment [2]	General population / uncontrolled		

3. Test equipment

3.1 Dosimetric system

SAR measurements were made using a DASY3 professional system (software version 3.1d) with a SAM phantom, manufactured by Schmid & Partner Engineering AG (SPEAG). The measurement uncertainty of the system is given in [1]. Below is a list of the calibrated equipment.

Description	Serial Number	Due Date
DASY3 DAE V1	415	12 / 2002
DASY3 DAE V1	416	12 / 2002
E-field probe ET3DV5	1324	12 / 2002
E-field probe ET3DV6	1539	12 / 2002
Dipole Validation Kit, D835V2	429	03 / 2003
Dipole Validation Kit, D1900V2	536	03 / 2003

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3.2 Additional calibrated equipment

<u>Description</u>	<u>Serial Number</u>	<u>Due Date</u>
Signal Generator HP8648C	3537A01598	9/2002
Dielectric probe kit HP 85070B	US33020256	10/2002
Network analyzer HP 8752C	3410A03105	8/2002
Power meter HP 437B	3125U16190	4/2003
Power sensor HP 8482H	2704A06235	3/2003
Power meter HP 437B	3125U113481	6/2002
Power sensor HP 8482H	MY41090240	6/2002
Power meter E4418B	GB40206594	9/2002
Power sensor HP 8482H	3318A09268	8/2002
Hygrometer / Thermometer	21242911	10/2002
Thermometer / Probe	350078/99172351	10/2002
Thermometer / Probe	21117674/21117824	11/2002
Spectrum Analyzer MS2623A	M07418	10/2002

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 are tabulated below. A mass density of $\rho = 1.00 \text{ g/cm}^3$ was entered into the DASY3 program in all cases. The temperatures of the tissue simulants during measurements are also given. During the tests, the ambient temperature of the laboratory was in the range 22.7 – 24.5 °C, the relative humidity was 30.0 – 35.1% and the liquid depth was above 15 cm for all the tests. It can be seen that the measured parameters are within tolerance of the recommended limits [1].

f (MHz)	Tissue type	Date	Dielectric Parameters		Simulant Temp (°C)
			ϵ_r	σ (S/m)	
835	Muscle	16MAY02	55.92	0.97	23.0
1900	Muscle	14MAY02	52.30	1.51	23.9

5. System accuracy verification

A system accuracy verification of the DASY3 was performed using the dipole validation kits listed in Section 3.1. System verification tests were 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). During the tests, the ambient temperature of the laboratory was in the range 22.7– 24.5 °C, the relative humidity was 30.0 – 35.1% and the liquid depth was above 15 cm for all the tests. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values. Reference values are taken from numerical simulations for both the 835MHz and 1900MHz muscle simulant [5]. The SAR distributions are shown in Appendix 1.

Daily, prior to conducting tests, measurements were made with RF sources powered off to determine system noise. The highest system noise value was 0.0089 W/kg, which is below the recommended limit [2].

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<i>f</i> MHz	Tissue type	Measured / Reference	SAR (W/kg) 1 g/10 g	Dielectric Parameters		Simulant Temp. (°C)
				ϵ_r	σ (S/m)	
835	Body	Measured, - 05/16/02	9.76 / 6.43	55.92	0.97	23.9
		Reference (Simulation)	9.90 / 6.46	55.2	0.97	+/-2.0 of value in §4
1900	Body	Measured, 05/14/02	38.57 / 20.54	52.3	1.51	23.7
		Reference (Simulation)	40.50 / 20.89	53.3	1.52	+/-2.0 of value in §4

6. Test results

The measured 1- and 10-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 tissue simulant during the test. The depth of the tissue simulating liquid was at least 15 cm for all the cases. The humidity and ambient temperature of the test facility were in the ranges 30.0 – 35.1% and 22.7– 24.5 °C respectively. Test commands were used to control the device during the SAR measurements.

SAR measured against the body, using battery BKB-193-1054 (800mAh) is presented in Table 1. For body worn measurements, the device was tested against a flat phantom, representing the user's body, using carry accessory KRY 105 186 and hands free accessory RLF-501-25/03. For 800 AMPS and 1900 CDMA modes, the device was tested at the lowest, middle, and highest frequencies of the transmit band.

Mode	<i>f</i> (MHz)	Output Power (dBm)	SXX 109 4705		
			Simulant Temp. (°C)	SAR, 1g /10g (W/kg)	
				measured	Calculated to max. power
800 AMPS	824	26.13	22.9	0.68/0.46	0.70/0.47
	837	26.12	22.9	0.64/0.43	0.66/0.44
	849	26.12	23.0	0.61/0.41	0.63/0.42
1900 CDMA	1850	23.57	23.8	1.05/0.60	1.09/0.62
	1880	23.63	23.8	1.20/0.67	1.24/0.70
	1910	23.79	23.8	1.22/0.66	1.27/0.69

Table 1: SAR measurement results for the T206 telephone at highest possible output power. Measured against the body using carry accessory KRY 105 186 with hands free accessory RLF 501 25/03.

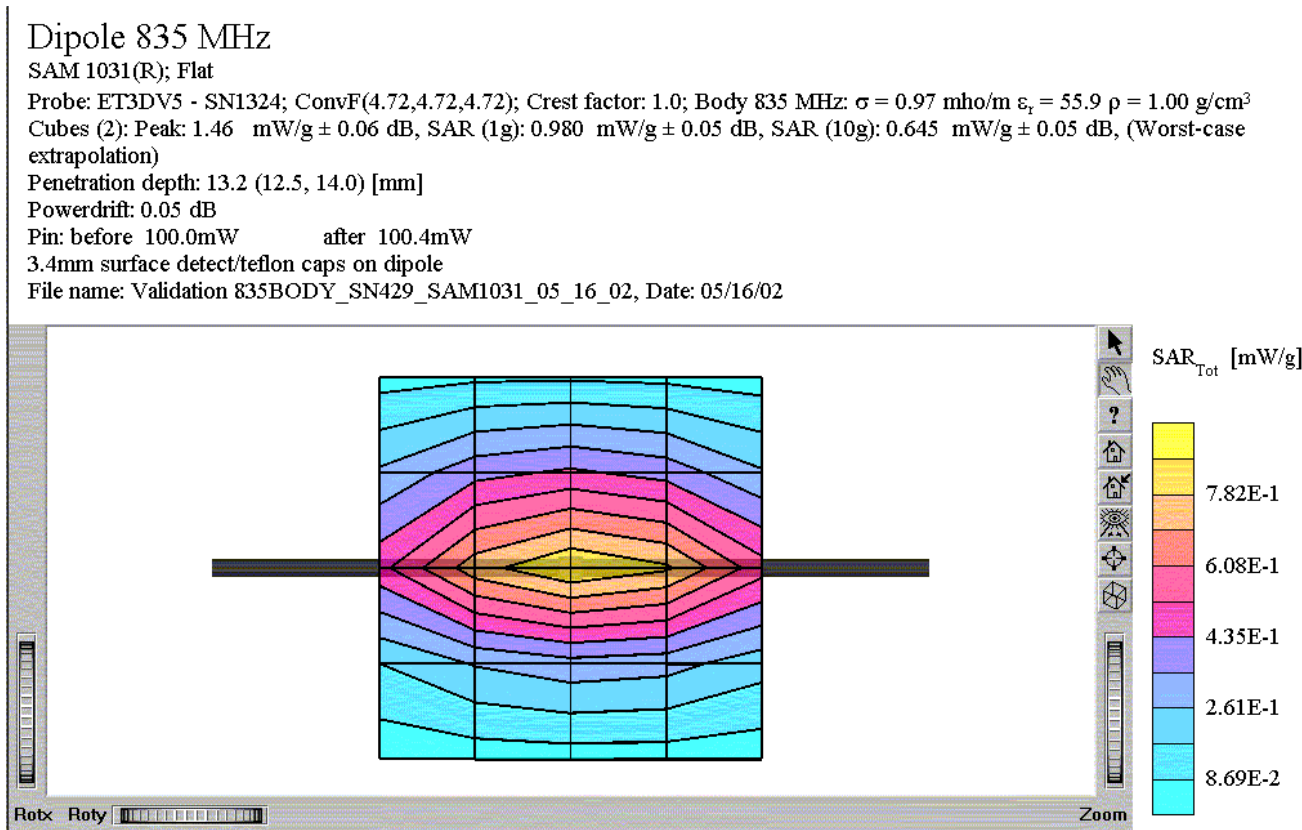
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References

- [1] D. Altabella, "SAR Measurement Specification of Wireless Handsets," Sony Ericsson internal document EUS/CV/R-01:1061/REP, February 2002.
- [2] FCC, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields: Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions," Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01).
- [3] IEEE, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques," Std 1528-200X, Draft 6.5 – August 20, 2001.
- [4] CENELEC, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz – 3 GHz)", European Standard EN 50361, July 2001.
- [5] D. Altabella, "Reference values for system validation using body material," internal Sony Ericsson document EUS/CV/R-01:1118 /REP.

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Appendix 1: SAR distribution comparison for system accuracy verification



835 MHz SAR distribution of validation dipole antenna from system accuracy verification test on May 16, 2002. Using muscle tissue.

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Dipole 1900 MHz

SAM 1020(L); Flat

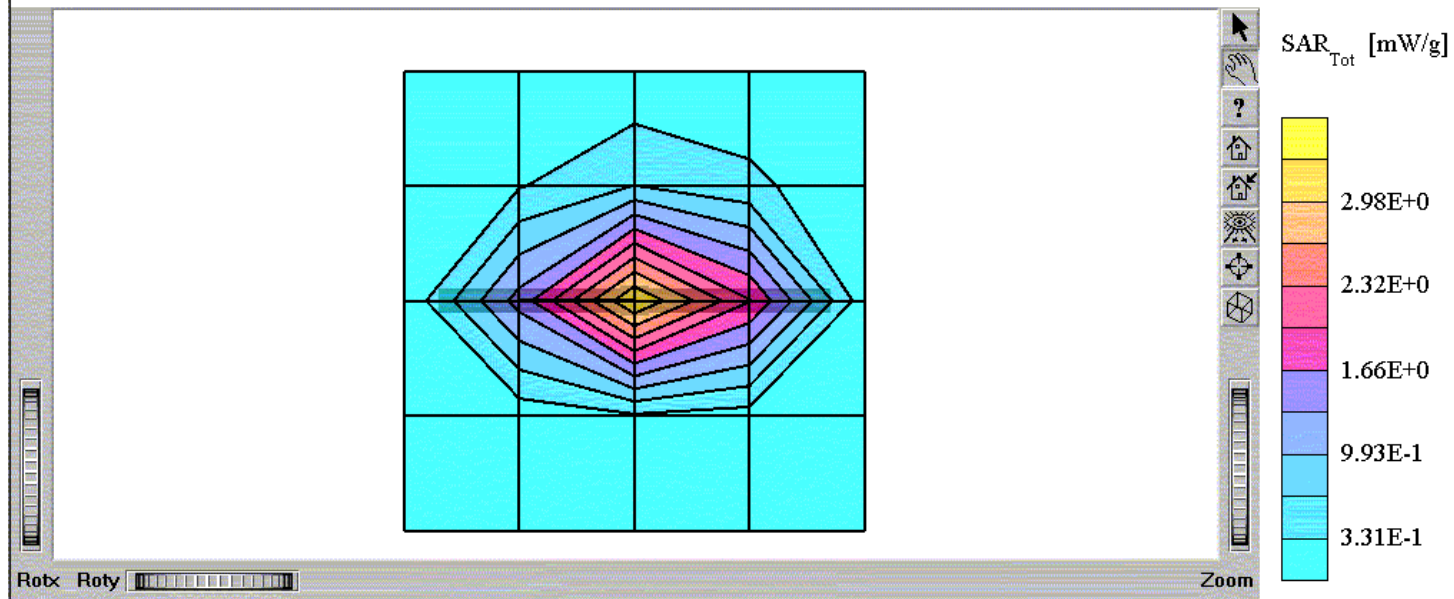
Probe: ET3DV6 - SN1539; ConvF(4.82,4.82,4.82); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.51$ mho/m $\epsilon_r = 52.3$ $\rho = 1.00$ g/cm³
 Cubes (2): Peak: 6.71 mW/g \pm 0.01 dB, SAR (1g): 3.83 mW/g \pm 0.00 dB, SAR (10g): 2.04 mW/g \pm 0.01 dB, (Worst-case extrapolation)

Penetration depth: 9.2 (8.9, 9.9) [mm]

Powerdrift: -0.16 dB

Output power: 99.3 mW

File name: Validation 1900MUSCLE_SN536_SAM1020_5_14_02, Date: 05/14/02



1900 MHz SAR distribution of validation dipole antenna from system accuracy verification test on May 14, 2002. Using muscle tissue.

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Appendix 2: SAR distribution plots

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SAM 1031(R) Phantom; Flat Section; Position: (90°,270°); Frequency: 824 MHz

Probe: ET3DV5 - SN1324; ConvF(4.72,4.72,4.72); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.97$ mho/m $\epsilon_r = 55.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.680 mW/g, SAR (10g): 0.459 mW/g, (Worst-case extrapolation)

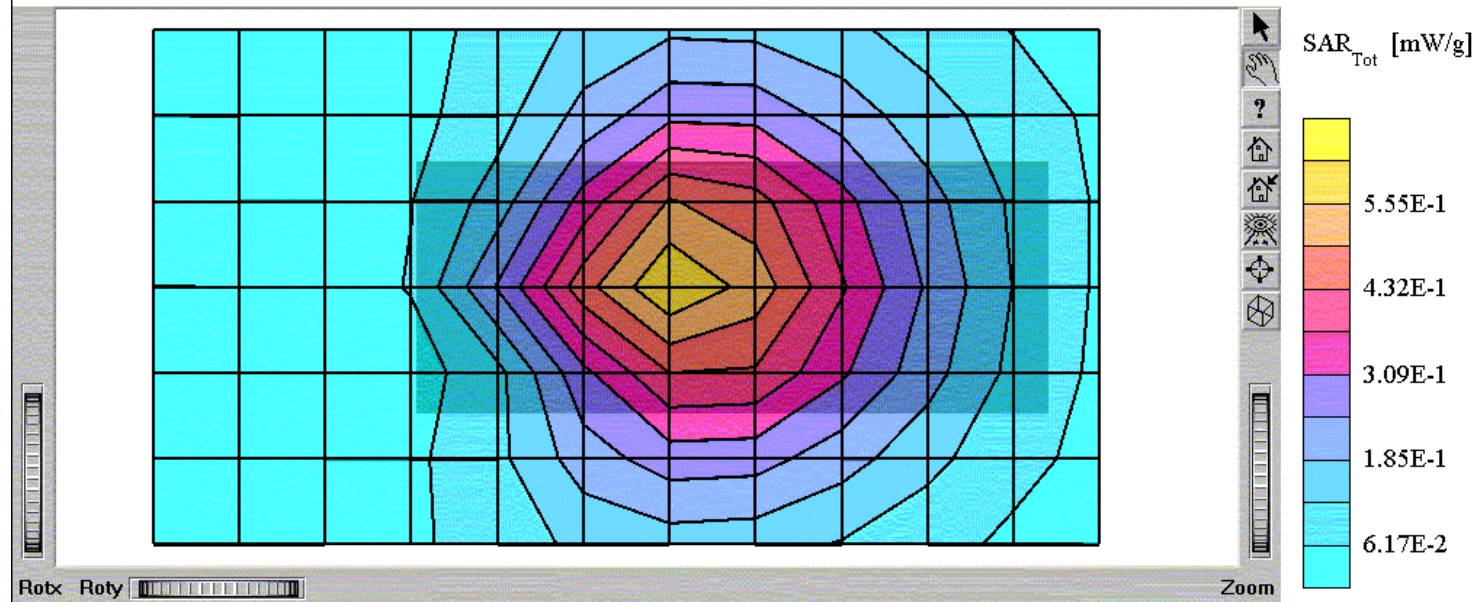
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: 0.01 dB

SN:UA2020HPHM

Battery: BKB 193 1054 Hands free: RLF 501-25/03 Holster: KRY 105 186

File name: FCC body T206 AMPS_NPHM_CH991_BB01, Date: 05/16/02



Distribution of maximum SAR in 800 AMPS band. Measured with back of device facing the body using carry accessory KRY 105 186 and hands free accessory RLF 501 25/03.

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T206

SAM 1031(R) Phantom; Flat Section; Position: (90°,270°); Frequency: 824 MHz

Probe: ET3DV5 - SN1324; ConvF(4.72,4.72,4.72); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.97$ mho/m $\epsilon_r = 55.9$ $\rho = 1.00$ g/cm³

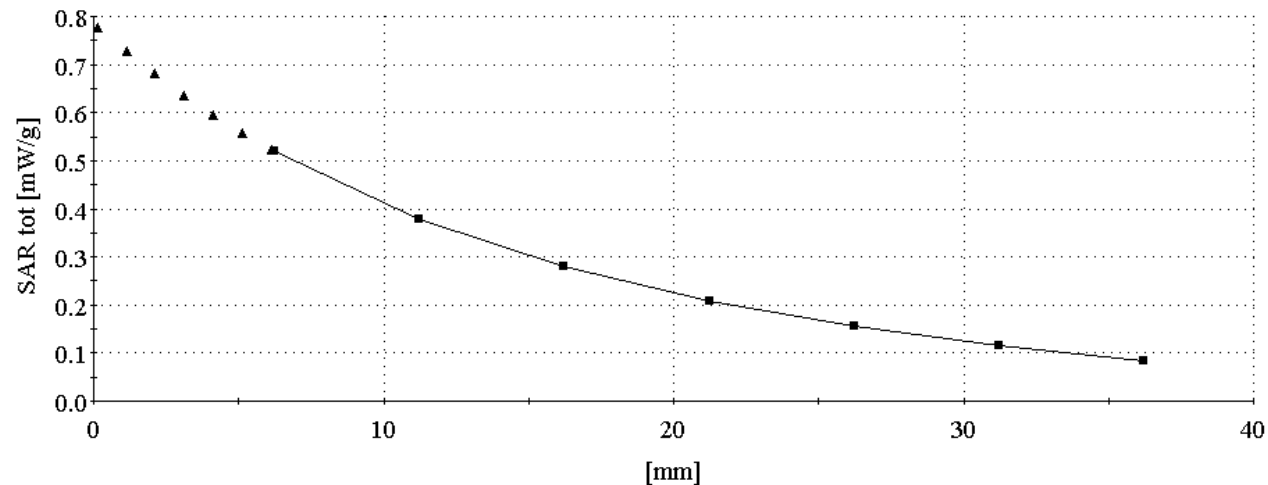
Cube 5x5x7: SAR (1g): 0.680 mW/g, SAR (10g): 0.459 mW/g, (Worst-case extrapolation)

Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0

SN:UA2020HPHM

Battery: BKB 193 1054 Hands free: RLF 501-25/03 Holster: KRY 105 186

File name: FCC body T206 AMPS_NPHM_CH991_BB01, Date: 05/16/02



SAR Extrapolation to the phantom inner surface. Measured for maximum SAR in 800 AMPS band, while phone is against the body using carry accessory KRY 105 186 and hands free accessory RLF 501 25/03

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SAM 1020(L) Phantom; Flat Section; Position: (90°, 270°); Frequency: 1910 MHz

Probe: ET3DV6 - SN1539; ConvF(4.82,4.82,4.82); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.51$ mho/m $\epsilon_r = 52.3$ $\rho = 1.00$ g/cm³

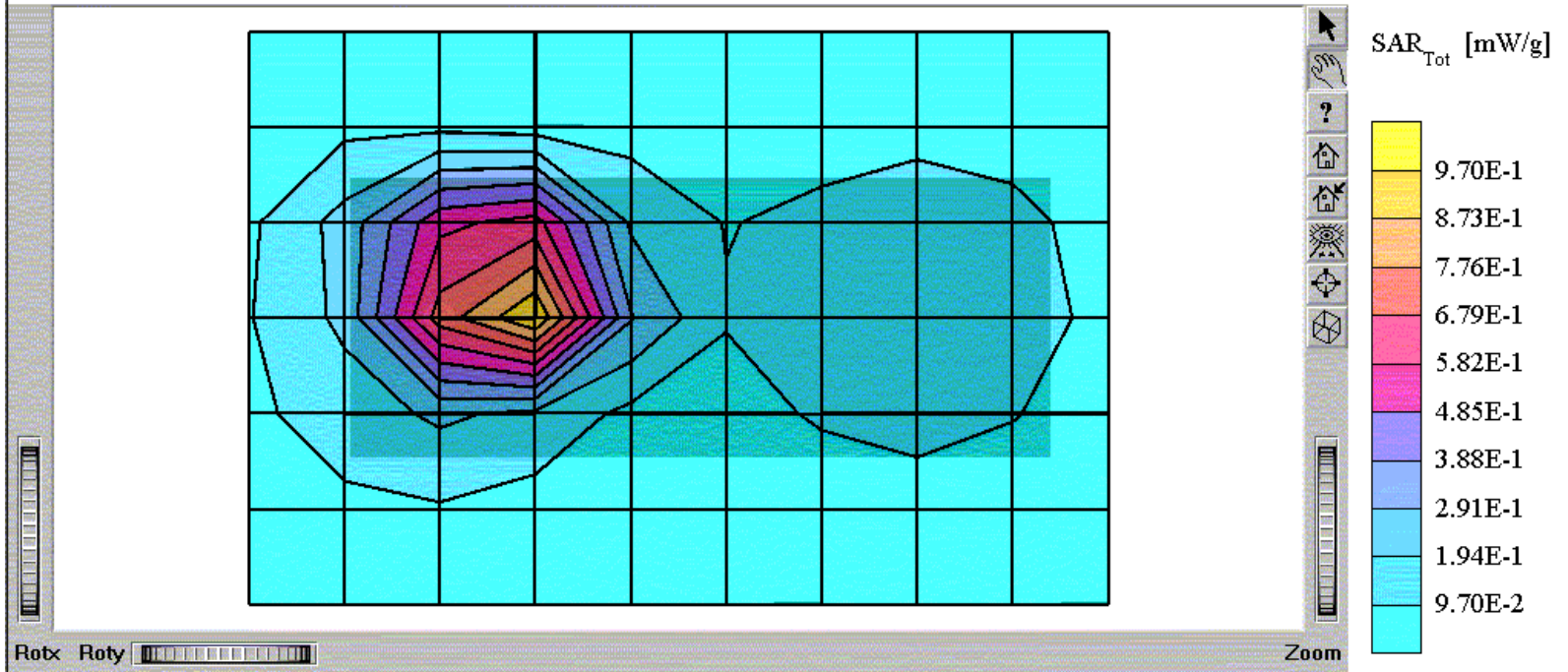
Cube 5x5x7: SAR (1g): 1.22 mW/g, SAR (10g): 0.660 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.04 dB

SN:UA2020HPPHM

File name: FCC body CDMAPCS_1910_holster SN KRY105186, Date: 05/14/02



Distribution of maximum SAR in the 1900 CDMA band. Measured with back of device facing the body using carry accessory KRY 105 186 and hands free accessory RLF 501 25/03.

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SAM 1020(L) Phantom; Flat Section; Position: (90°,270°); Frequency: 1910 MHz

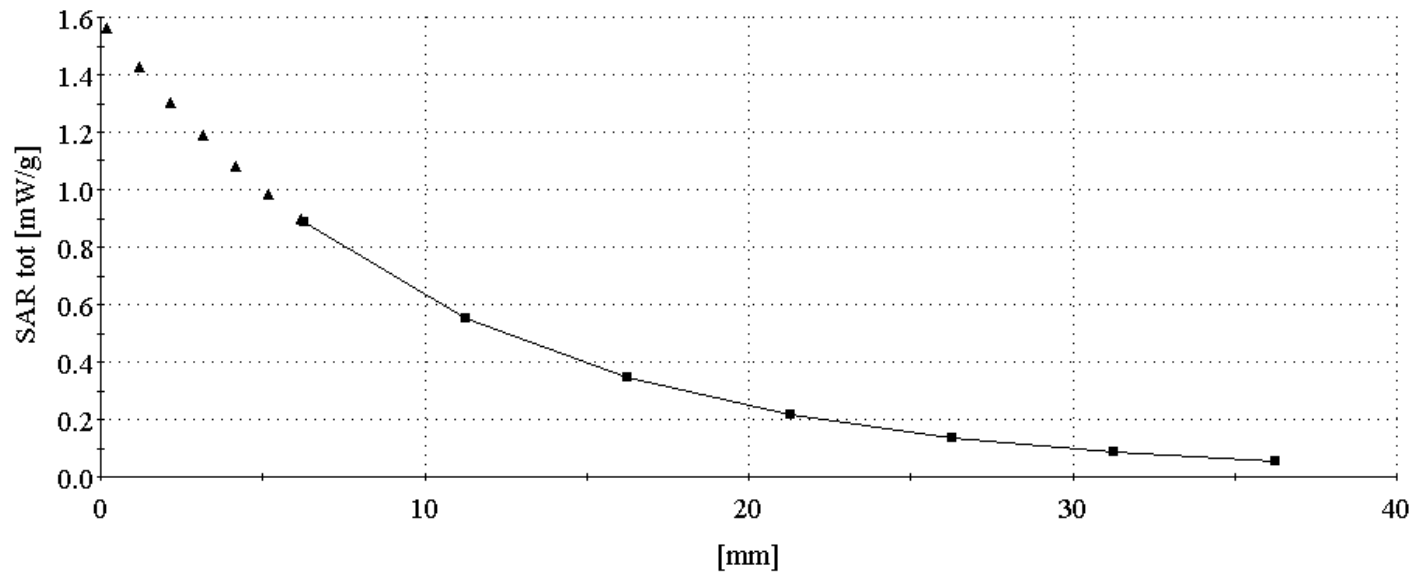
Probe: ET3DV6 - SN1539; ConvF(4.82,4.82,4.82); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.51$ mho/m $\epsilon_r = 52.3$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 1.22 mW/g, SAR (10g): 0.660 mW/g, (Worst-case extrapolation)

Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0

SN:UA2020HPHM

File name: FCC body CDMAPCS_1910_holster SN KRY105186, Date: 05/14/02



SAR Extrapolation to the phantom inner surface. Measured for maximum SAR in 1900 CDMA band, while phone is against the body using carry accessory KRY 105 186 and hands free accessory RLF 501 25/03

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Appendix 3: Photographs of Device Under Test



Front view of device



Back view of device

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Side view of device.

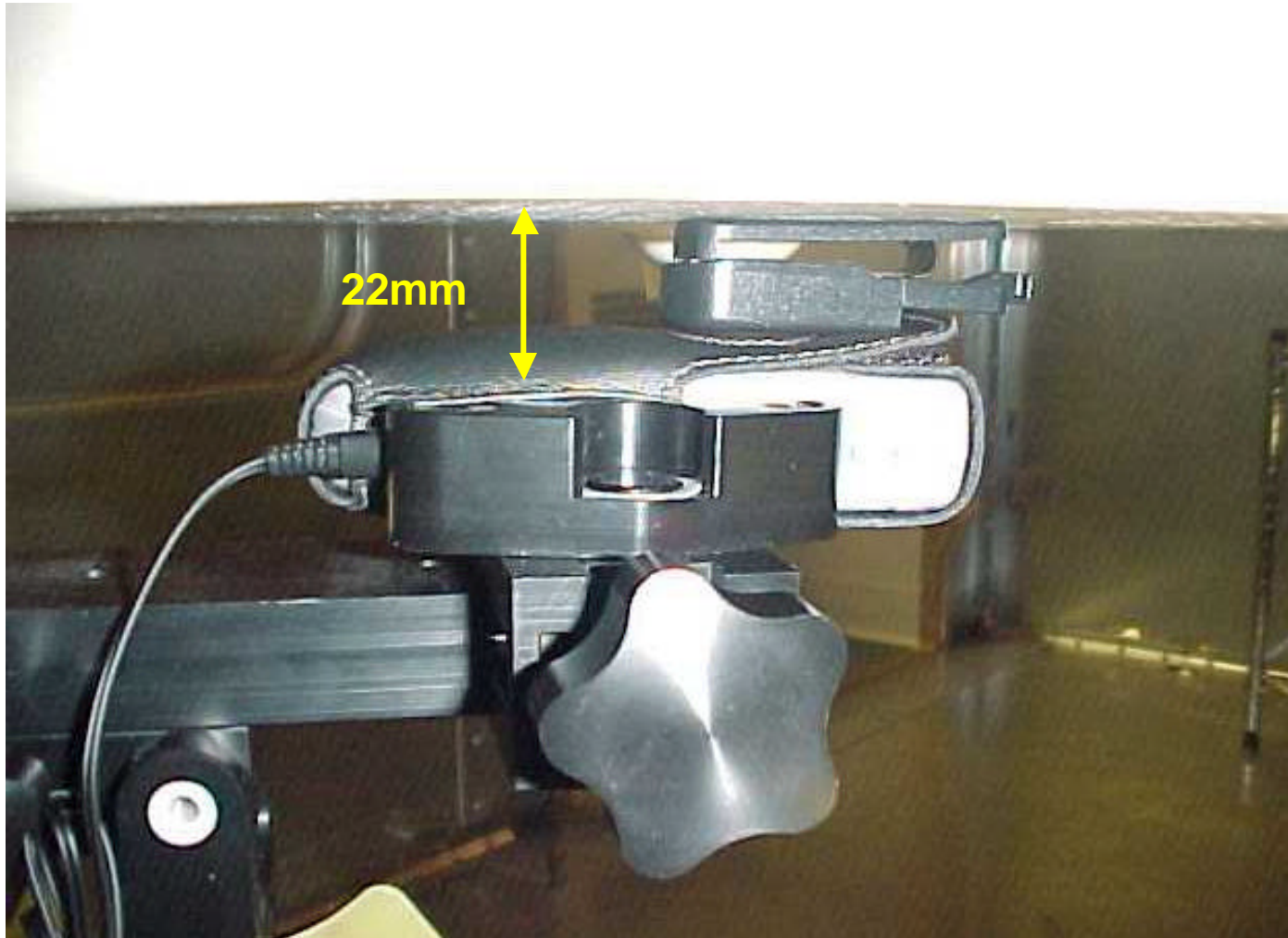
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Front, back, and side views of product number KRY 105 186. This accessory contains plastic and metal.

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Appendix 4: Position of Device on Phantom



Position of device against flat phantom using carry accessory SXX 109 4705 with hands free accessory RLF 501 25/03

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Appendix 5: Probe calibration parameters

ET3DV5 SN:1324

DASY3 - Parameters of Probe: ET3DV5 SN:1324

Sensitivity in Free Space		Diode Compression	
NormX	1.52 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	103 mV
NormY	1.73 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	103 mV
NormZ	1.53 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	103 mV

Sensitivity in Tissue Simulating Liquid

Head	450 MHz	$\epsilon_r = 43.5 \pm 5\%$	$\sigma = 0.87 \pm 10\%$ mho/m
ConvF X	5.23 extrapolated	Boundary effect:	
ConvF Y	5.23 extrapolated	Alpha	0.65
ConvF Z	5.23 extrapolated	Depth	1.63
Head	700 - 950 MHz	$\epsilon_r = 39.4 - 43.6$	$\sigma = 0.75 - 0.99$ mho/m
ConvF X	4.89 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	4.89 $\pm 9.5\%$ (k=2)	Alpha	0.67
ConvF Z	4.89 $\pm 9.5\%$ (k=2)	Depth	1.71
Brain	1500 MHz	$\epsilon_r = 41 \pm 5\%$	$\sigma = 1.32 \pm 10\%$ mho/m
ConvF X	4.43 interpolated	Boundary effect:	
ConvF Y	4.43 interpolated	Alpha	0.70
ConvF Z	4.43 interpolated	Depth	1.82
Brain	1700 - 1910 MHz	$\epsilon_r = 39.3 - 41.6$	$\sigma = 1.53 - 1.90$ mho/m
ConvF X	4.21 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	4.21 $\pm 9.5\%$ (k=2)	Alpha	0.72
ConvF Z	4.21 $\pm 9.5\%$ (k=2)	Depth	1.88

Sensor Offset

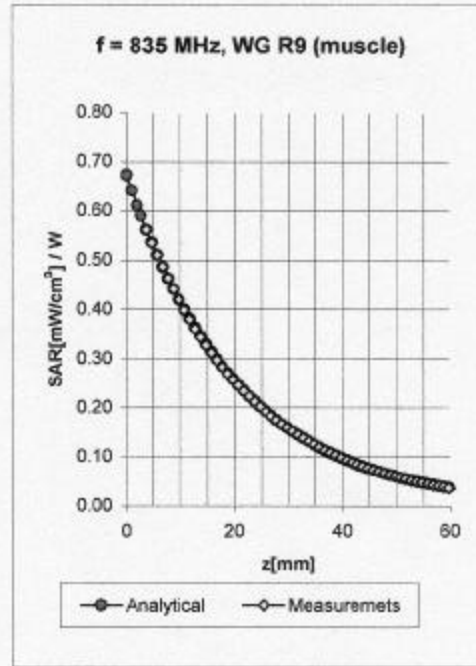
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.8 \pm 0.2	mm

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ET3DV5 SN:1324

Conversion Factor Assessment



Muscle 750 - 950 MHz $\epsilon_r = 52.4 - 58.0$ $\sigma = 0.90 - 1.05$ mho/m

ConvF X	4.72 ± 9.5% (k=2)	Boundary effect:
ConvF Y	4.72 ± 9.5% (k=2)	Alpha 0.69
ConvF Z	4.72 ± 9.5% (k=2)	Depth 1.70

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ET3DV6 SN:1539

DASY3 - Parameters of Probe: ET3DV6 SN:1539

Sensitivity in Free Space

NormX	1.30 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	95 mV
NormY	1.19 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	95 mV
NormZ	1.28 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	95 mV

Diode Compression

Sensitivity in Tissue Simulating Liquid

Head 450 MHz $\epsilon_r = 43.5 \pm 5\%$ $\sigma = 0.87 \pm 10\%$ mho/m

ConvF X	6.95	extrapolated	Boundary effect:
ConvF Y	6.95	extrapolated	Alpha 0.27
ConvF Z	6.95	extrapolated	Depth 2.88

Head 700 - 950 MHz $\epsilon_r = 39.4 - 43.6$ $\sigma = 0.75 - 0.99$ mho/m

ConvF X	6.37	$\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	6.37	$\pm 9.5\%$ (k=2)	Alpha 0.39
ConvF Z	6.37	$\pm 9.5\%$ (k=2)	Depth 2.64

Head 1500 MHz $\epsilon_r = 40.4 \pm 5\%$ $\sigma = 1.23 \pm 10\%$ mho/m

ConvF X	5.58	interpolated	Boundary effect:
ConvF Y	5.58	interpolated	Alpha 0.66
ConvF Z	5.58	interpolated	Depth 2.32

Head 1800 - 2000 MHz $\epsilon_r = 38.0 - 42.0$ $\sigma = 1.20 - 1.55$ mho/m

ConvF X	5.19	$\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	5.19	$\pm 9.5\%$ (k=2)	Alpha 0.64
ConvF Z	5.19	$\pm 9.5\%$ (k=2)	Depth 2.18

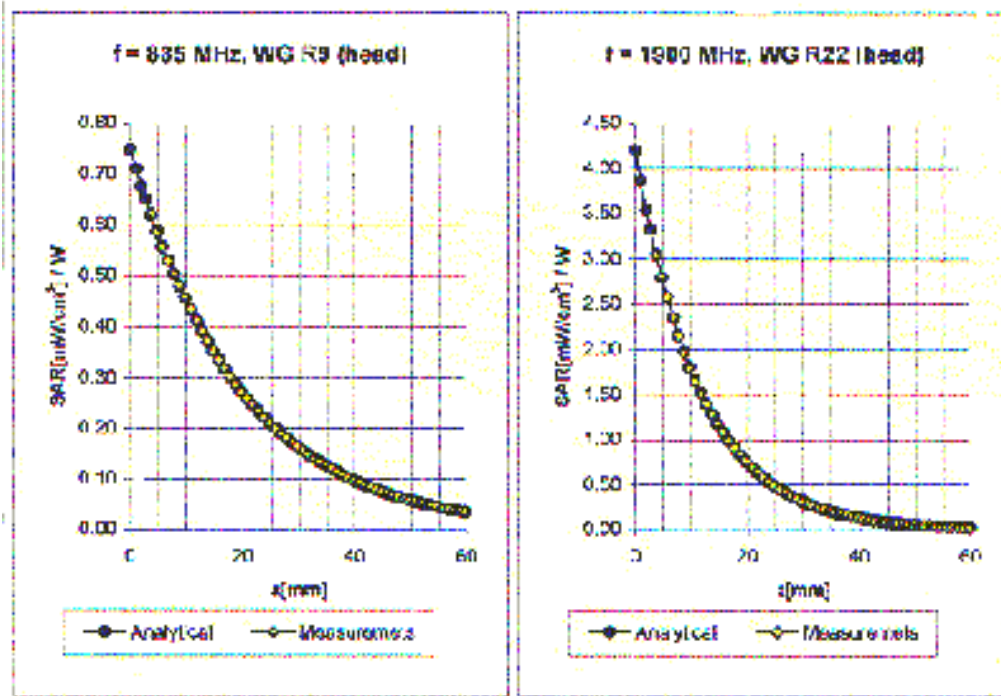
Sensor Offset

Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.3 \pm 0.2	mm

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ET3DV6 SN:1539

Conversion Factor Assessment



Head 700 - 950 MHz $\epsilon_r = 39.4 - 43.6$ $\sigma = 0.75 - 0.99$ mho/m

ConvF X	$6.37 \pm 0.6\%$ (k=2)	Boundary effect:	
ConvF Y	$6.37 \pm 0.6\%$ (k=2)	Alpha	0.39
ConvF Z	$6.37 \pm 0.6\%$ (k=2)	Depth	2.64

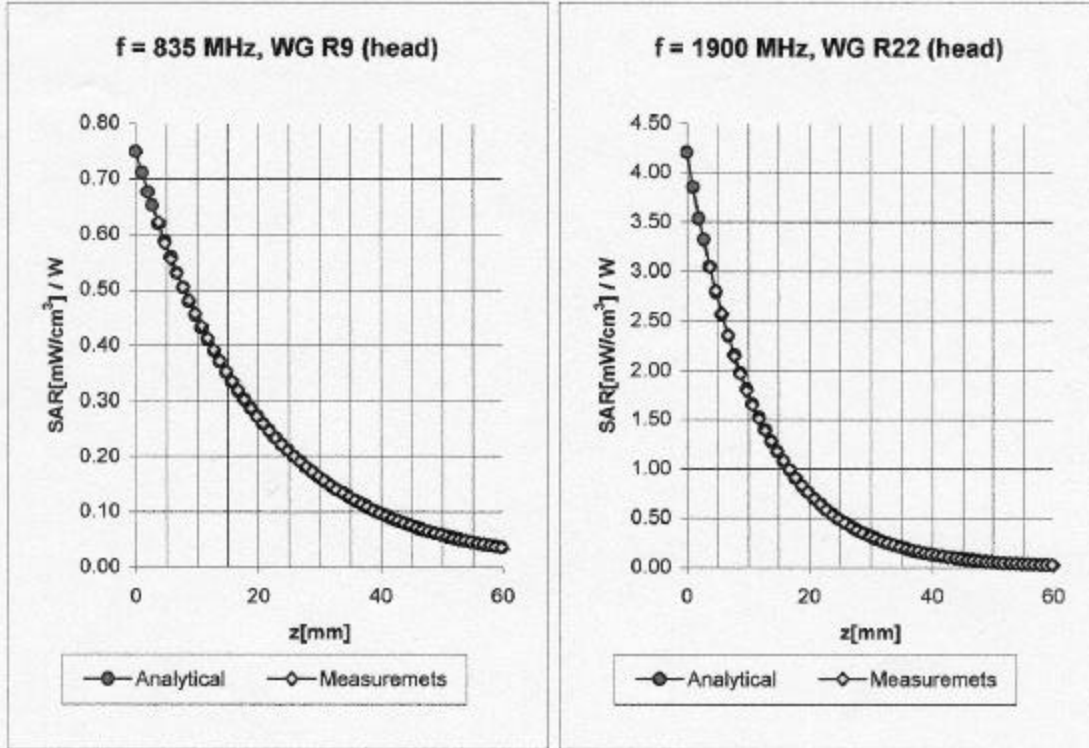
Head 1300 - 2000 MHz $\epsilon_r = 30.0 - 42.0$ $\sigma = 1.20 - 1.55$ mho/m

ConvF X	$5.19 \pm 0.6\%$ (k=2)	Boundary effect:	
ConvF Y	$5.19 \pm 0.6\%$ (k=2)	Alpha	0.54
ConvF Z	$5.19 \pm 0.6\%$ (k=2)	Depth	2.16

Prepared (also subject responsible if other) SEM/CV/PF/P Dulce Altabella		No. SEM/CV/P-02:0537/REP	
Approved SEM/CV/PF/P Dulce Altabella	Checked DA	2002-5-31	B N:\DULCE\T206\T206bodyok.doc

ET3DV6 SN:1539

Conversion Factor Assessment



Head 700 - 950 MHz $\epsilon_r = 39.4 - 43.6$ $\sigma = 0.75 - 0.99$ mho/m

ConvF X	6.37 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	6.37 $\pm 9.5\%$ (k=2)	Alpha 0.39
ConvF Z	6.37 $\pm 9.5\%$ (k=2)	Depth 2.64

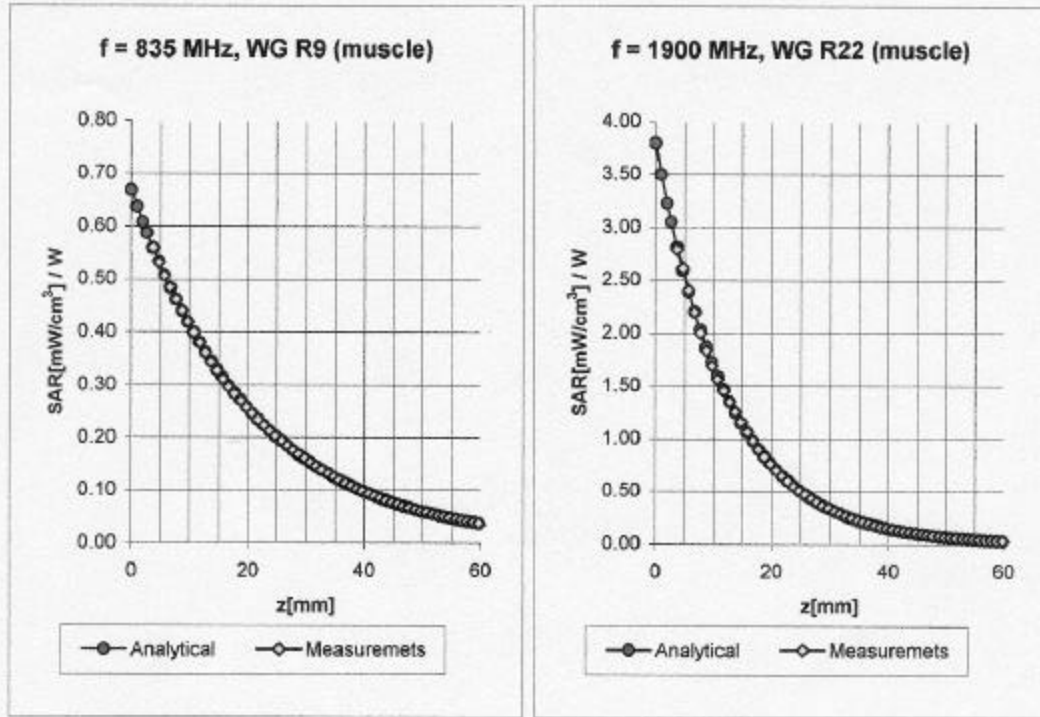
Head 1800 - 2000 MHz $\epsilon_r = 38.0 - 42.0$ $\sigma = 1.20 - 1.55$ mho/m

ConvF X	5.19 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	5.19 $\pm 9.5\%$ (k=2)	Alpha 0.64
ConvF Z	5.19 $\pm 9.5\%$ (k=2)	Depth 2.16

Prepared (also subject responsible if other) SEM/CV/PF/P Dulce Altabella		No. SEM/CV/P-02:0537/REP	
Approved SEM/CV/PF/P Dulce Altabella	Checked DA	2002-5-31	B N:\DULCE\T206\T206bodyok.doc

ET3DV6 SN:1539

Conversion Factor Assessment



Muscle 750 - 950 MHz $\epsilon_r = 52.4 - 58.0$ $\sigma = 0.90 - 1.05$ mho/m

ConvF X	6.24 \pm 9.5% (k=2)	Boundary effect:
ConvF Y	6.24 \pm 9.5% (k=2)	Alpha 0.61
ConvF Z	6.24 \pm 9.5% (k=2)	Depth 2.01

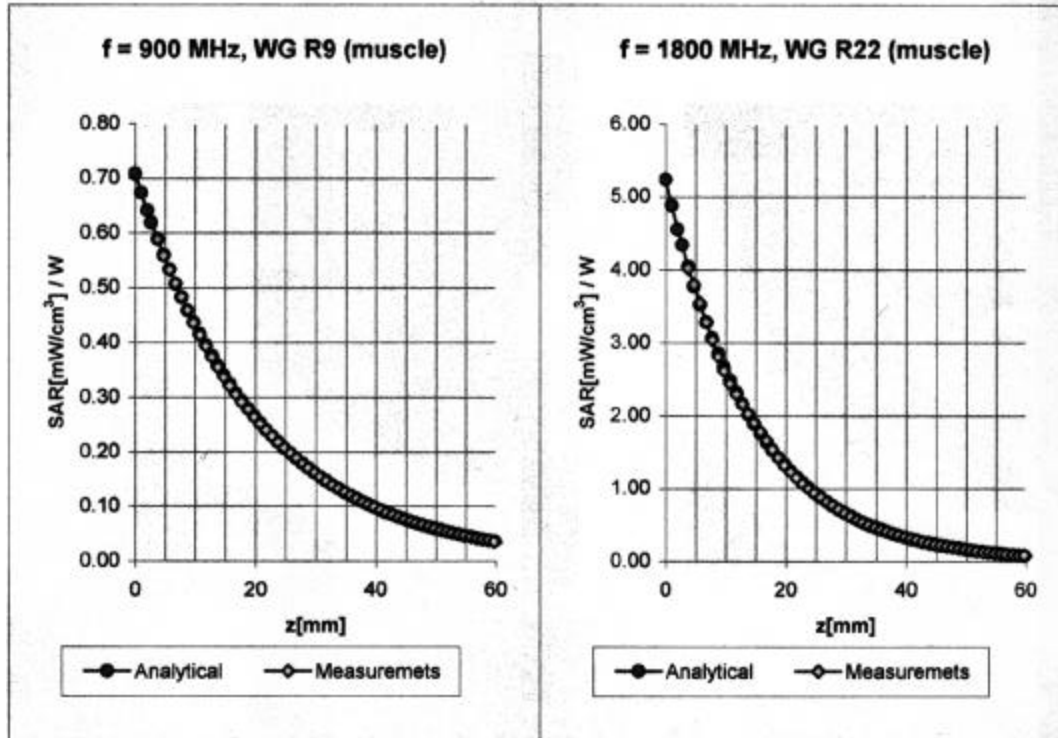
Muscle 1800 - 2050 MHz $\epsilon_r = 50.6 - 56.0$ $\sigma = 1.40 - 1.60$ mho/m

ConvF X	4.82 \pm 9.5% (k=2)	Boundary effect:
ConvF Y	4.82 \pm 9.5% (k=2)	Alpha 0.91
ConvF Z	4.82 \pm 9.5% (k=2)	Depth 1.92

Prepared (also subject responsible if other) SEM/CV/PF/P Dulce Altabella		No. SEM/CV/P-02:0537/REP	
Approved SEM/CV/PF/P Dulce Altabella	Checked DA	2002-5-31	B N:\DULCE\T206\T206bodyok.doc

ET3DV6 SN:1538

Conversion Factor Assessment



Muscle 900 MHz $\epsilon_r = 56 \pm 5\%$ $\sigma = 0.99 \pm 10\%$ mho/m

ConvF X **6.06** $\pm 7\%$ (k=2)

Boundary effect:

ConvF Y **6.06** $\pm 7\%$ (k=2)

Alpha **0.63**

ConvF Z **6.06** $\pm 7\%$ (k=2)

Depth **1.90**

Muscle 1800 MHz $\epsilon_r = 54 \pm 5\%$ $\sigma = 1.4 \pm 10\%$ mho/m

ConvF X **4.73** $\pm 7\%$ (k=2)

Boundary effect:

ConvF Y **4.73** $\pm 7\%$ (k=2)

Alpha **0.68**

ConvF Z **4.73** $\pm 7\%$ (k=2)

Depth **2.19**