

**Exhibit 11: SAR Test Report QDJ-0303BEN01**

Date of test: 21-22 August, 2003
Date of Report: 22 August, 2003

Test Laboratory: Motorola Personal Communications Sector Product Safety & Compliance Laboratory
600 N. US Highway 45
Room: MW113
Libertyville, Illinois 60048

Test Responsible: Steven Hauswirth
Principal Staff Engineer

Accreditation: This laboratory is accredited to ISO/IEC 17025-1999 to perform the following tests:



Tests:
Electromagnetic Specific Absorption Rate

Procedures:
ANSI/IEEE C95.1-1992, 1999
(SAR) IEEE C95.3-1991
IEEE P1528 (*DRAFT*)
FCC OET Bulletin 65 (*including Supplements A, B, C*)
Australian Communications Authority Radio
Communications (Electromagnetic Radiation – Human
Exposure) Standard 1999
CENELEC EN 50361 (2001)
APP-0247
DOI-0876, 0900, 0902, 0904, 0915

Simulated Tissue Preparation
RF Power Measurement

On the following products or types of products:

Wireless Communications Devices (Examples): Two Way Radios; Portable Phones (including Cellular,
Licensed Non-Broadcast and PCS); Low Frequency Readers; and Pagers

A2LA certificate #1651-01

**Statement of
Compliance:**

Motorola declares that portable cellular telephone FCC ID QDJ-0303BEN01 to which this declaration relates, is in conformity with the appropriate General Population/Uncontrolled RF exposure standards, recommendations and guidelines (FCC 47 CFR §2.1093). 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.

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

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1. Introduction

The Motorola Personal Communications Sector Product Safety Laboratory has performed measurements of the maximum potential exposure to the user of portable cellular phone (FCC ID QDJ-0303BEN01). The Specific Absorption Rate (SAR) of this product was measured. The portable cellular phone was tested in accordance with FCC OET Bulletin 65 Supplement C 01-01.

2. Description of the Device Under Test

Antenna description

Type	Internal	
Location	Top Rear of Phone	
Dimensions	Length	32mm
	Width	7mm
Configuration	Patch	

Device description

FCC ID Number	QDJ-0303BEN01		
Serial number	351638-00-000871-6		
Mode(s) of Operation	EGSM900	GSM 1800	GSM 1900
Modulation Mode(s)	GSM	GSM	GSM
Maximum Output Power Setting	33.4dBm	30.5dBm	30.8dBm
Duty Cycle	1:8	1:8	1:8
Transmitting Frequency Rang(s)	880.2-914.8MHz	1710.2-1784.8MHz	1850.2-1909.8MHz
Production Unit or Identical Prototype (47 CFR §2..908)	Identical Prototype		
Device Category	Portable		
RF Exposure Limits	General Population / Uncontrolled		

3. Test Equipment Used

3.1 Dosimetric System

The Motorola Personal Communications Sector Product Safety & Compliance Laboratory utilizes a Dosimetric Assessment System (Dasy3™ v3.1d) manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. All the SAR measurements are taken within a shielded enclosure. The overall RSS uncertainty of the measurement system is $\pm 11.7\%$ (K=1) with an expanded uncertainty of $\pm 23.0\%$ (K=2). The measurement uncertainty budget is given in Appendix 6. Per IEEE 1528, this uncertainty budget is applicable to the SAR range of 0.4 W/kg to 10 W/kg. The list of calibrated equipment used for the measurements is shown below.

Description	Serial Number	Cal Due Date
DASY3 DAE V1	SN365	10-Dec-03
E-Field Probe ET3DV6	SN1502	27-Sep-03
Dipole Validation Kit, D1800V2	SN272TR	24-Jun-05
S.A.M. Phantom used for 1900MHz	TP-1250	

3.2 Additional Equipment

Description	Serial Number	Cal Due Date
Signal Generator HP8648C	3847A04845	11/5/2004
Power Meter E4419B	GB39511086	2/6/2004
Power Sensor #1 - 8481A	US37296471	11/5/2003
Power Sensor #2 - 8481A	US37296473	11/5/2003
Network Analyzer HP8753ES	US39172529	6/18/2003
Dielectric Probe Kit HP85070B	US33020235	

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 HP85070 Dielectric Probe Kit. These values, along with the temperature of the tissue simulate are shown in the table below. The recommended limits for maximum permittivity and minimum conductivity are also shown. These come from the Federal Communication Commission, OET Bulletin 65 Supplement C 01-01. It is seen that the measured parameters are satisfactory for compliance testing.

f (MHz)	Tissue type	Limits / Measured	Dielectric Parameters		
			ϵ_r	σ (S/m)	Temp (°C)
1880	Head	Measured, 21-Aug-03	39.9	1.47	19.3
		Recommended Limits	40.0	1.40	20-25
	Body	Measured, 22-Aug-03	52.7	1.59	20.0
		Recommended Limits	53.3	1.52	20-25

The list of ingredients and the percent composition used for the tissue simulates are indicated in the table below.

Ingredient	800MHz Head	800MHz Body	1900MHz Head	1900MHz Body
Sugar	57.0	44.9	--	30.80
DGBE	--	--	47.0	--
Water	40.45	53.06	52.8	68.91
Salt	1.45	0.94	0.2	0.29
HEC	1.0	1.0	--	--
Bact.	0.1	0.1	--	--

5. System Accuracy Verification

A system accuracy verification of the DASY3 was performed using the measurement equipment listed in Section 3.1. The daily system accuracy verification occurs within center section of the SAM phantom.

A SAR measurement was performed to see if the measured SAR was within +/- 10% from the target SAR indicated on the dipole certification sheet. These tests were done at 900MHz and/or 1800MHz. These frequencies are within 100MHz of the mid-band frequency of the test device. This is within the allowable window given in Supplement C 01-01 *Appendix D System Verification* section item #5. The test was conducted on the same days as the measurement of the DUT. Recommended limits for maximum permittivity, minimum conductivity are shown in the table below. These come from the Federal Communication Commission, OET Bulletin 65 Supplement C 01-01. The

obtained results from the system accuracy verification are displayed in the table below. The distributions of SAR compare well with those of the reference measurements (see Appendix 1). The tissue stimulant depth was verified to be 15.0cm \pm 0.5cm. Z-axis scans showing the SAR penetration are also included in Appendix 1. SAR values are normalized to 1W forward power delivered to the dipole.

f (MHz)	Description	SAR (W/kg) , 1gram	Dielectric Parameters		Ambient Temp (°C)	Tissue Temp (°C)
			ϵ_r	σ (S/m)		
1800	Measured, 21-Aug-03	40.40	40.5	1.40	21	19.5
	Measured, 22-Aug-03	40.96	40.7	1.38	21	19.9
	Recommended Limits	39.70	38 – 42	1.33 – 1.47	15-30	15-30

The following probe conversion factors were used on the E-Field probe(s) used for the system accuracy verification measurements:

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ETDV6	SN1502	900		
		1800	5.60	2 of 10

6. Test Results

The test sample was operated in a test mode that allows control of the transmitter without the need to place actual phone calls. For the purposes of this test the unit is commanded to test mode and manually set to the proper channel, transmitter power level and transmit mode of operation. The phone was tested in the configurations stipulated in OET Bulletin 65 Supplement C 01-01. Motorola also followed the requirements in Supplement. C / Appendix D: SAR Measurement Procedures, section titled “*Devices Operating Next To A Person’s Ear* “. These directions state “The device should be tested on the left and right side of the head phantom in the “Cheek/Touch” and “Ear/Tilt” positions. When applicable, each configuration should be tested with the antenna in its fully extended and fully retracted positions. These test configurations should be tested at the high, middle and low frequency channels of each operating mode; for example, AMPS, CDMA, and TDMA. If the SAR measured at the middle channel for each test configuration (left, right, Cheek/Touch, Tile/Ear, extended and retracted) is at least 2.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).”

The DASY v3.1d SAR measurement system specified in section 3.1 was utilized within the intended operations as set by the SPEAG™ setup. The phone was positioned into the measurement configurations using the positioner supplied with the DASY 3.1d SAR measurement system. The measured dielectric constant of the material used for the positioner is less than 2.9 and the loss tangent is less than 0.02 (\pm 30%) at 850MHz. The default settings for the “coarse” and “cube” scans were chosen and use for measurements. The grid spacing of the course scan was set to 15cm as shown in the SAR plots included in appendix 2 and 3. Please refer to the DASY manual for additional information on SAR scanning procedures and algorithms used.

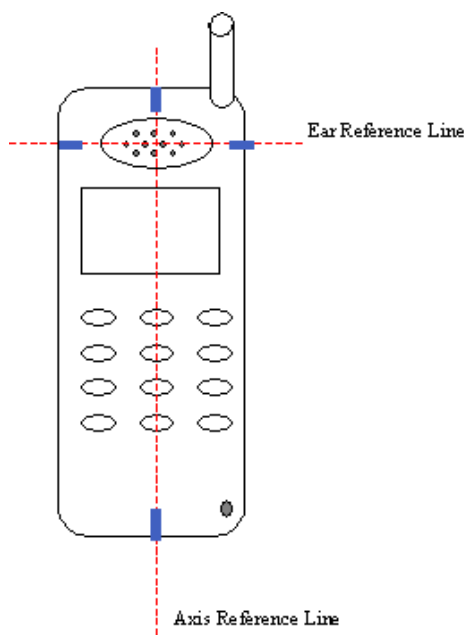
The Cellular Phone (FCC ID QDJ-0303BEN01) has the SNN5681A as the only available battery options. The phone was placed in the SAR measurement system with a fully charged battery.

6.1 Head Adjacent Test Results

To aid in positioning repeatability, the ear reference line of the device and the axis reference line of the device have been physically added using a non-metallic marker.

- Per Figure 1, the "Ear Reference Line" is centered vertically through the center of the listening area (as defined by the speaker holes in the housing).
- The "Axis Reference Line" bisects the front surface of the device at its top and bottom edges.
- The intersection of these two lines defines the location of the "Ear Reference Point".

The lines drawn on the device extended to the outside edges, as shown in blue in the figure below, & wrap around the sides of the device.



The SAR results shown in tables 1 through 4 are maximum SAR values averaged over 1 gram of phantom tissue. Also shown are the measured conducted output powers, the temperature of the test facility during the test, the temperature of the tissue simulate after the test, the measured drift and the extrapolated SAR. The exact method of extrapolation is $\text{New SAR} = \text{Old SAR} * 10^{(-\text{drift}/10)}$. The SAR reported at the end of the measurement process by the DASY™ measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process. This is the most conservative SAR because it corresponds to the average output power at the beginning of the SAR test. This extrapolation has been done because when the DUT is operating properly it may exhibit a slump in radiated power and SAR over time. This is verified by measuring the SAR drift after the test. The test conditions indicated as bold numbers in the following table are included in Appendix 2

The SAR measurements were performed using the SAM phantoms listed in section 3.1. Since same phantoms and tissue simulate are used for the system accuracy verification as the device SAR measurements, the Z-axis scans included in within Appendix 1 are applicable for verification of tissue simulate depth to be $15.0\text{cm} \pm 0.5\text{cm}$. All other test conditions measured lower SAR values than those included in Appendix 2. Note that 800MHz digital mode SAR measurements were performed in accordance with Supplement C.

The following probe conversion factors were used on the E-Field probe(s) used for the head adjacent measurements:

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ETDV6	SN1502	835		
		1900	5.60	2 of 10

f (MHz)	Description	Conducted Output Power (dBm)	Cheek / Touch Position							
			Left Head				Right Head			
			Measured (W/kg)	Drift (dB)	Extrapolated (W/kg)	Simulate Temp (°C)	Measured (W/kg)	Drift (dB)	Extrapolated (W/kg)	Simulate Temp (°C)
Digital 1900MHz	Channel 512	31.03								
	Channel 661	31.05	0.103	-0.59	0.12	19.3	0.109	-0.04	0.11	19.2
	Channel 810	30.78								

Table 1: SAR measurement results for the portable cellular telephone FCC ID QDJ-0303BEN01 at highest possible output power. Measured against the left head in the Cheek/Touch Position.

f (MHz)	Description	Conducted Output Power (dBm)	15° Tilt Position							
			Left Head				Right Head			
			Measured (W/kg)	Drift (dB)	Extrapolated (W/kg)	Simulate Temp (°C)	Measured (W/kg)	Drift (dB)	Extrapolated (W/kg)	Simulate Temp (°C)
Digital 1900MHz	Channel 512	31.03								
	Channel 661	31.05	0.0234	-0.04	0.02	19.1	0.0216	0.08	0.02	19.2
	Channel 810	30.78								

Table 2: SAR measurement results for the portable cellular telephone FCC ID QDJ-0303BEN01 at highest possible output power. Measured against the right head in the 15° Tilt Position.

6.2 Body-Worn Test Results

The SAR results shown in table 5 are the maximum SAR values averaged over 1 gram of phantom tissue. Also shown are the measured conducted output powers, the temperature of the test facility during the test, the temperature of the tissue simulate after the test, the measured drift and the extrapolated SAR. The exact method of extrapolation is $\text{New SAR} = \text{Old SAR} * 10^{-(\text{drift}/10)}$. The SAR reported at the end of the measurement process by the DASY™ measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process. This is the most conservative SAR because it corresponds to the average output power at the beginning of the SAR test. This extrapolation has been done because when the DUT is operating properly it may exhibit a slump in radiated power and SAR over time. This is verified by measuring the SAR drift after the test. The test conditions indicated as bold numbers in the following table are included in Appendix 3. Note that 800MHz digital mode SAR measurements were performed in accordance with OET Bulletin 65 Supplement C 01-01. All other test conditions measured lower SAR values than those included in Appendix 3.

A “flat” phantom was for the body-worn tests. This “flat” phantom is made out of 1” thick natural High Density Polyethylene with a thickness at the bottom equal to 2.0mm. It measures 52.7cm(long) x 26.7cm(wide) x 21.2cm(tall). The measured dielectric constant of the material used is less than 2.3 and the loss tangent is less than 0.0046 all the way up to 2.184GHz.

The tissue stimulant depth was verified to be 15.0cm ±0.5cm. The same device holder described in section 6 was used for positioning the phone. The functional accessories were divided into two categories, the ones with metal components and the ones with non-metal components. For non-metallic component accessories, testing was performed on the accessory that displayed the closest proximity to the flat phantom. Each metallic component accessory, if any, was checked for uniqueness of metal component so that each is tested with the device. If multiple accessories shared an identical metal component, only the accessory that dictates the closest spacing to the body was tested. The cellular phone was tested with a headset connected to the device for all body-worn SAR measurements.

There are two Body-Worn Accessories available for this phone:

A Leather Pouch with Belt Clip: Model #SYN9902A w/ wishbone belt clip

A Leather Pouch with Belt Clip: Model #SYN9902A w/ universal belt clip

Since the belt clips do differ in metal components, both body-worn accessories were used for the SAR measurements.

The following probe conversion factors were used on the E-Field probe(s) used for the body worn measurements:

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ETDV6	SN1502	835		
		1900	5.30	8 of 10

f (MHz)	Description	Conducted Output Power (dBm)	Body Worn							
			SYN9902A with Wishbone Clip				SYN9902A with Universal Clip			
			Measured (W/kg)	Drift (dB)	Extrapolated (W/kg)	Simulate Temp (°C)	Measured (W/kg)	Drift (dB)	Extrapolated (W/kg)	Simulate Temp (°C)
Digital 1900MHz	Channel 512	31.03								
	Channel 661	31.05	0.312	-0.06	0.32	20.0	0.432	-0.04	0.44	20.0
	Channel 810	30.78								

Table 5: SAR measurement results for the portable cellular telephone FCC ID QDJ-0303BEN01 at highest possible output power. Measured against the body.

Appendix 1

SAR distribution comparison for the system accuracy verification

Dipole 1800 MHz

1800 MHz Dipole Validation / Dipole Sn# 272tr

Forward Power = 247mW Reflected Power = -24.70db

Room Temp at time of measurement = 21.0*C. Simulant Temp at time of measurement =19.5*C.

R4 1-005 Amy Twin Phantom Rev.4 (22Aug02); section 2

Probe: ET3DV6 - SN1502 - VALIDATION; ConvF(5.60,5.60,5.60); Crest factor: 1.0; 1800 MHz VALIDATION: $\sigma = 1.40$ mho/m $\epsilon_r = 40.5$ $\rho = 1.00$ g/cm³

Cubes (2): Peak: 18.4 mW/g ± 0.08 dB, SAR (1g): 9.98 mW/g ± 0.06 dB, SAR (10g): 5.27 mW/g ± 0.05 dB, (Worst-case extrapolation)

Penetration depth: 8.4 (8.0, 9.3) [mm]

Powerdrift: -0.02 dB



Dipole 1800 MHz

1800 MHz Dipole Validation / Dipole Sn# 272tr

Forward Power = 247mW Reflected Power = -24.70db

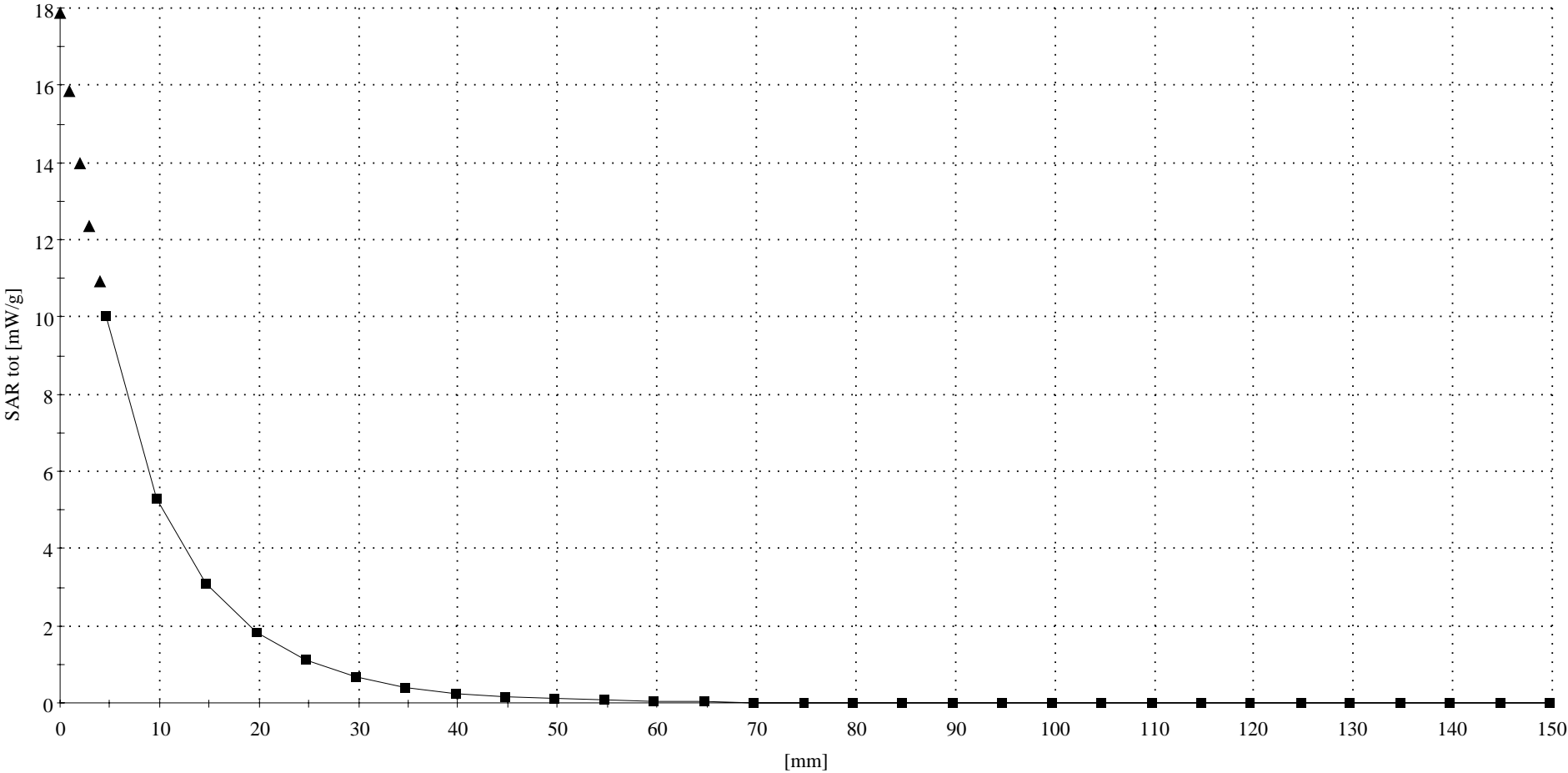
Room Temp at time of measurement = 21.0*C. Simulant Temp at time of measurement =19.5*C.

R4 1-005 Amy Twin Phantom Rev.4 (22Aug02);

Probe: ET3DV6 - SN1502 - VALIDATION; ConvF(5.60,5.60,5.60); Crest factor: 1.0; 1800 MHz VALIDATION: $\sigma = 1.40$ mho/m $\epsilon_r = 40.5$ $\rho = 1.00$ g/cm³

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Penetration depth: 8.3 (7.9, 9.3) [mm]



Dipole 1800 MHz

1800 MHz Dipole Validation / Dipole Sn# 272tr

Forward Power = 249mW Reflected Power = -24.70db

Room Temp at time of measurement = 21.0*C. Simulant Temp at time of measurement =19.9*C.

R4 1-005 Amy Twin Phantom Rev.4 (22Aug02); section 2

Probe: ET3DV6 - SN1502 - VALIDATION; ConvF(5.60,5.60,5.60); Crest factor: 1.0; 1800 MHz VALIDATION: $\sigma = 1.38$ mho/m $\epsilon_r = 40.7$ $\rho = 1.00$ g/cm³

Cubes (2): Peak: 18.7 mW/g ± 0.08 dB, SAR (1g): 10.2 mW/g ± 0.06 dB, SAR (10g): 5.32 mW/g ± 0.03 dB, (Worst-case extrapolation)

Penetration depth: 8.4 (8.0, 9.3) [mm]

Powerdrift: -0.00 dB



Dipole 1800 MHz

1800 MHz Dipole Validation / Dipole Sn# 272tr

Forward Power = 249mW Reflected Power = -24.70db

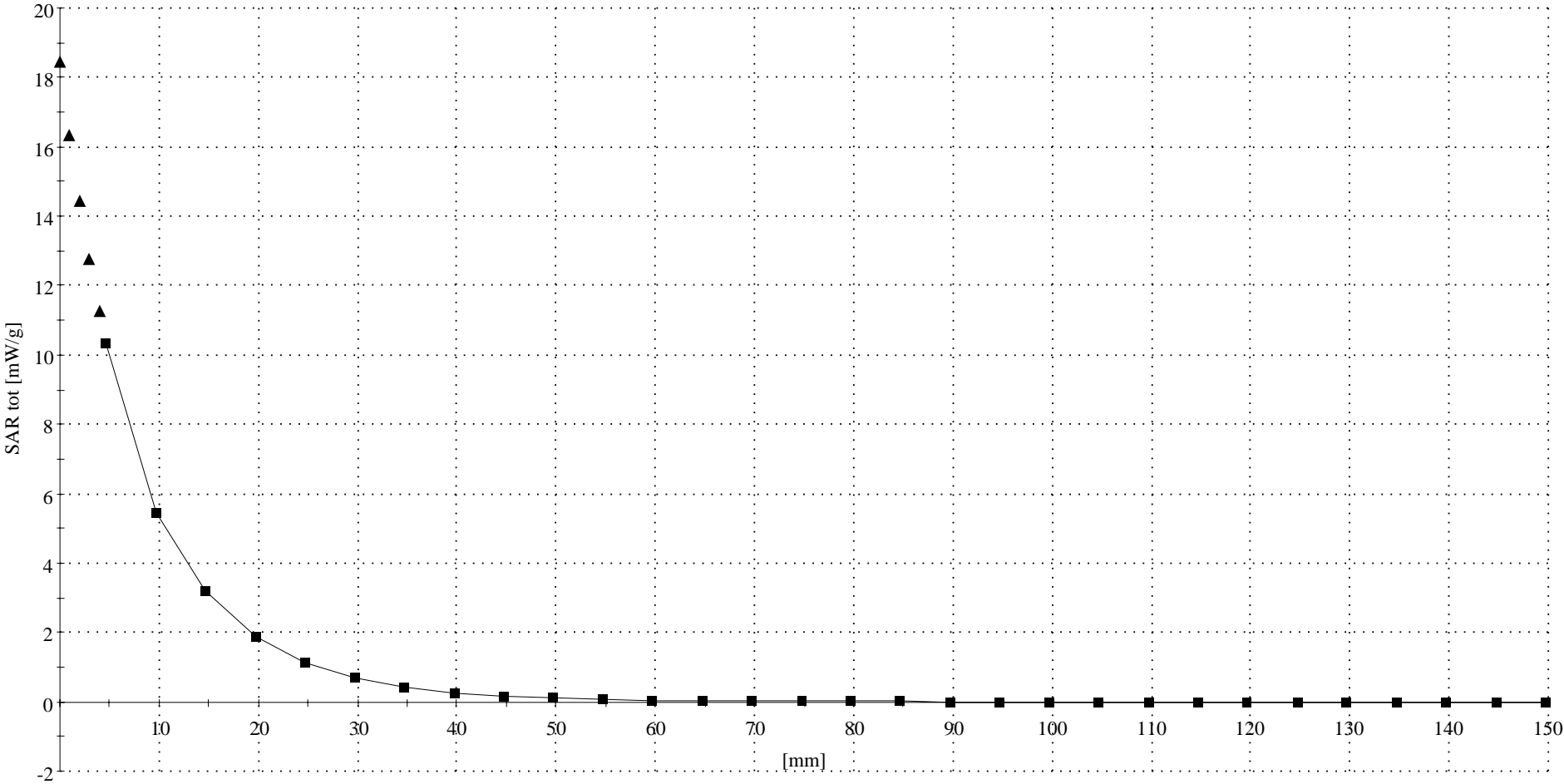
Room Temp at time of measurement = 21.0*C. Simulant Temp at time of measurement =19.9*C.

R4 1-005 Amy Twin Phantom Rev.4 (22Aug02);

Probe: ET3DV6 - SN1502 - VALIDATION; ConvF(5.60,5.60,5.60); Crest factor: 1.0; 1800 MHz VALIDATION: $\sigma = 1.38$ mho/m $\epsilon_r = 40.7$ $\rho = 1.00$ g/cm³

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Penetration depth: 8.3 (7.9, 9.2) [mm]



Appendix 2

SAR distribution plots for Phantom Head Adjacent Use

s/n: 351638-00-000871-6

Ch# 661 / Pwr Step: 0

Antenna Position: Internal

Type of Modulation: GSM 1900

DEVICE POSITION (cheek or rotated): Cheek

R4 TP-1250 GLYCOL sam expanded (Rev. 2)-9Jan03 Phantom; Left Hand Section; Position: (90°,180°); Frequency: 1880 MHz

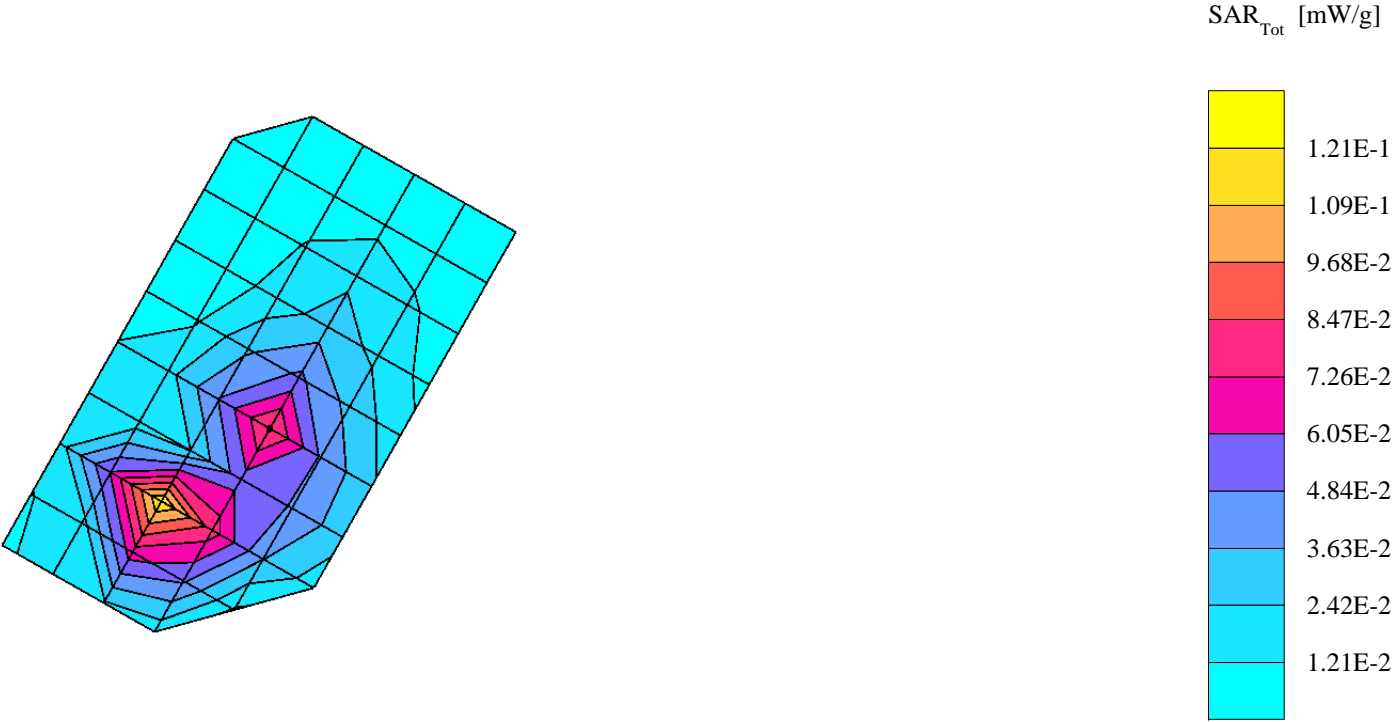
Probe: ET3DV6 - SN1502 - IEEE HEAD; ConvF(5.60,5.60,5.60); Crest factor: 8.0; 1880 MHz Head & Body: $\sigma = 1.47$ mho/m $\epsilon_r = 39.9$ $\rho = 1.00$ g/cm³

Cube 7x7x7: SAR (1g): 0.103 mW/g, SAR (10g): 0.0539 mW/g, (Worst-case extrapolation)

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

Penetration depth: 9.6 (8.1, 12.1) [mm]

Powerdrift: -0.59 dB



s/n: 351638-00-000871-6

Ch# 661 / Pwr Step: 0

Type of Modulation: GSM 1900

Antenna Position: Internal

DEVICE POSITION (cheek or rotated): Rotated

R4 TP-1250 GLYCOL sam expanded (Rev. 2)-9Jan03 Phantom; Left Hand Section; Position: (90°,180°); Frequency: 1880 MHz

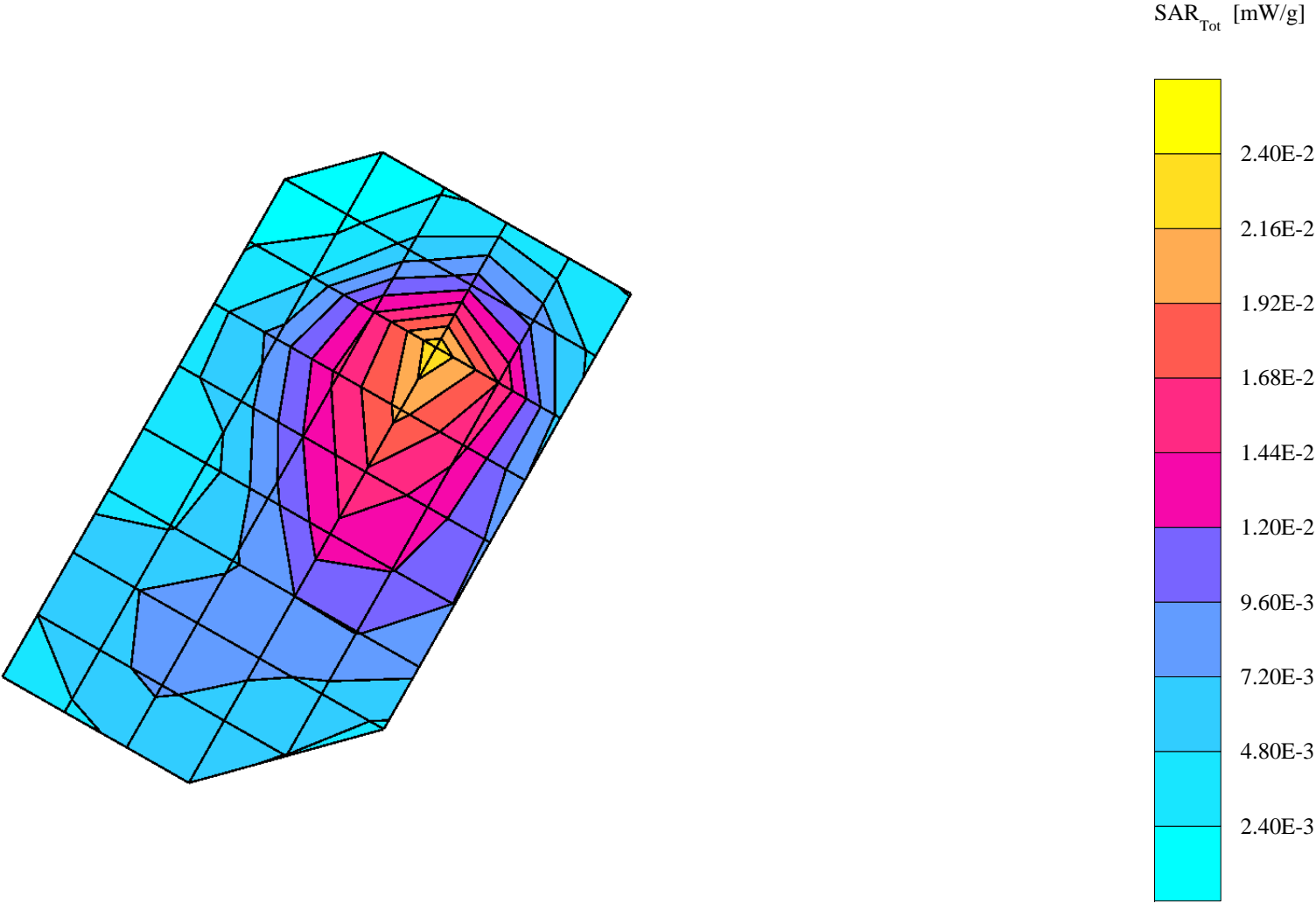
Probe: ET3DV6 - SN1502 - IEEE HEAD; ConvF(5.60,5.60,5.60); Crest factor: 8.0; 1880 MHz Head & Body: $\sigma = 1.47 \text{ mho/m}$ $\epsilon_r = 39.9$ $\rho = 1.00 \text{ g/cm}^3$

Cube 7x7x7: SAR (1g): 0.0234 mW/g, SAR (10g): 0.0139 mW/g, (Worst-case extrapolation)

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

Penetration depth: 9.8 (9.5, 10.5) [mm]

Powerdrift: -0.04 dB



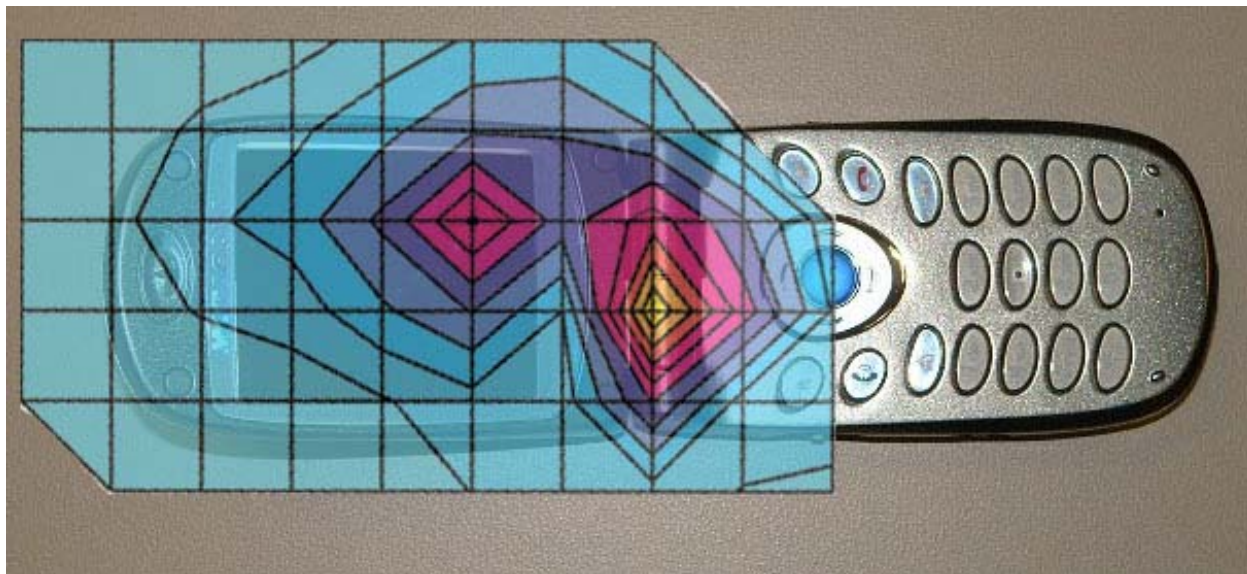


Figure 1. Typical 1900MHz Head Adjacent Contour Overlaid on Phone (Cheek Touch)

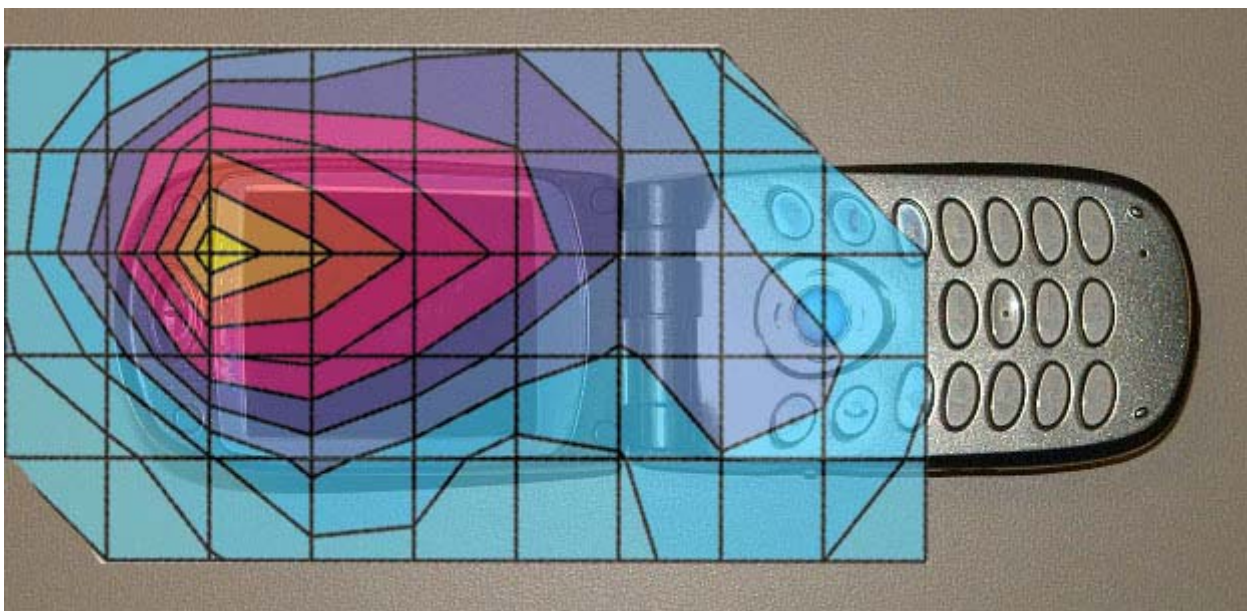


Figure 2. Typical 1900MHz Head Adjacent Contour Overlaid on Phone (15 ° Tilt)

Appendix 3

SAR distribution plots for Body Worn Configuration

s/n: 351638-00-000871-6

Ch# 661 Pwr Step: 0 (OTA)

Antenna Position: INTERNAL

Type of Modulation: 1900 GSM

Accessory Model #: SYN9920A w/ wishbone belt clip

R4 1-005 Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 2 Section; Position: (0°,0°); Frequency: 1880 MHz

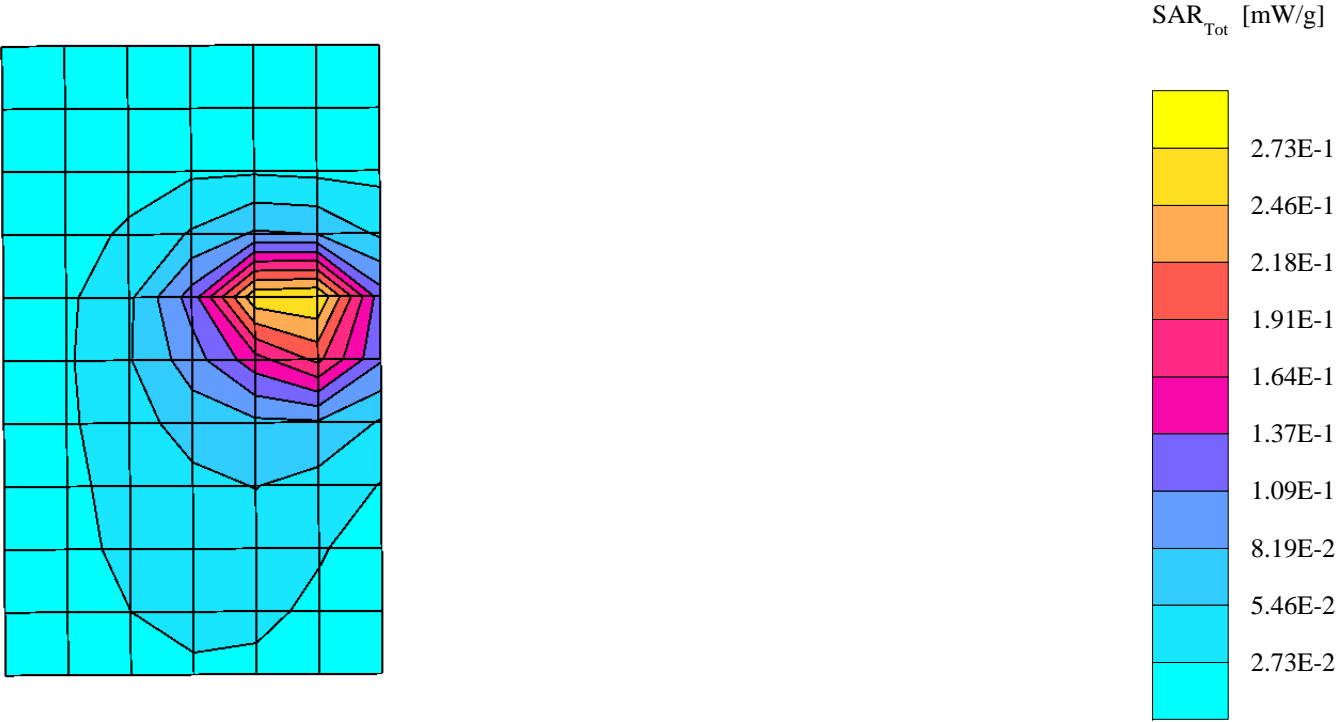
Probe: ET3DV6 - SN1502 - FCC Body; ConvF(5.30,5.30,5.30); Crest factor: 8.0; 1880 MHz Head & Body: $\sigma = 1.59$ mho/m $\epsilon_r = 52.7$ $\rho = 1.00$ g/cm³

Cube 7x7x7: SAR (1g): 0.312 mW/g, SAR (10g): 0.170 mW/g, (Worst-case extrapolation)

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

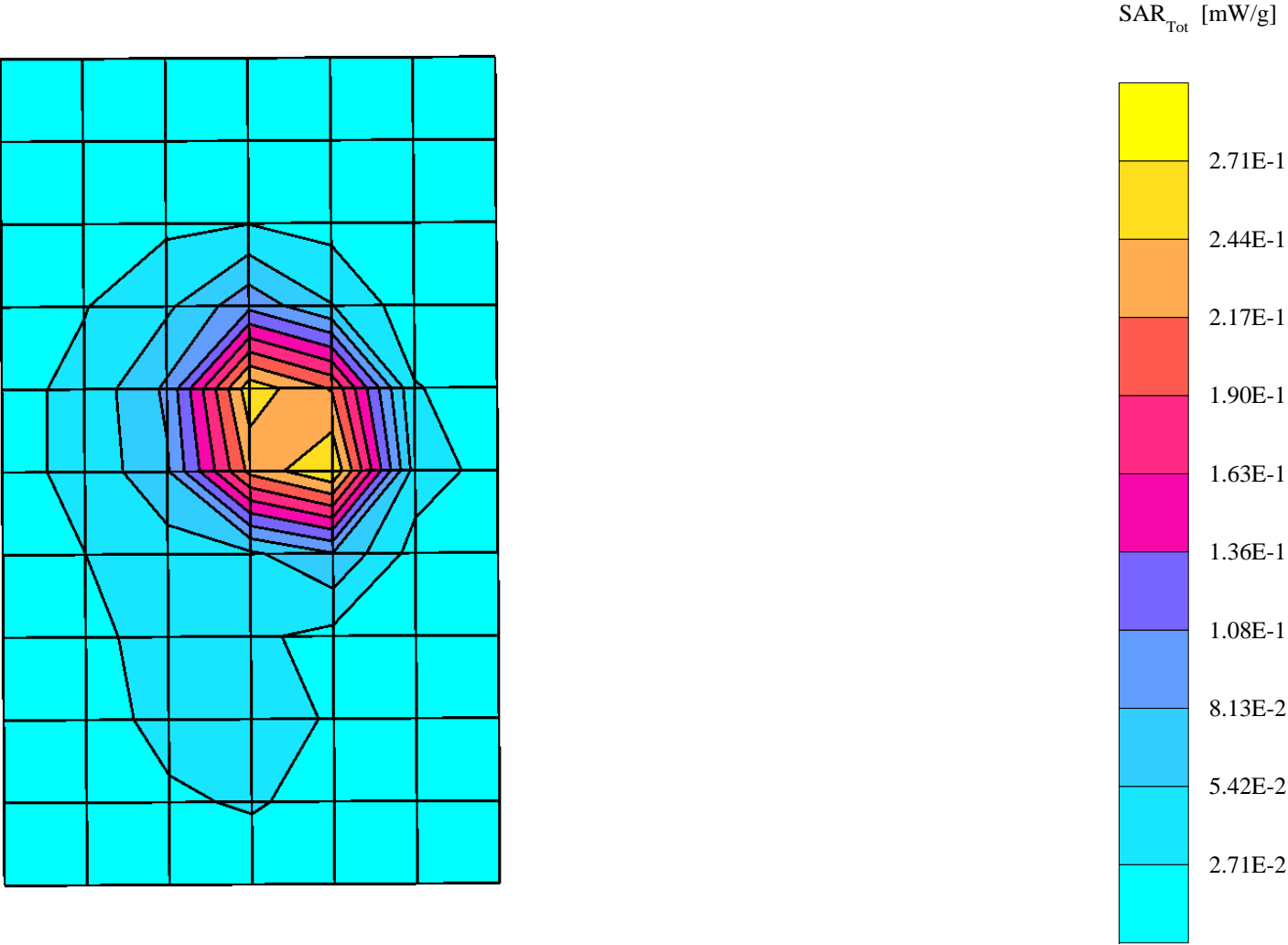
Penetration depth: 10.0 (9.1, 11.2) [mm]

Powerdrift: -0.06 dB



s/n: 351638-00-000871-6

Ch# 661 Pwr Step: 0 (OTA) Antenna Position: INTERNAL
Type of Modulation: 1900 GSM Accessory Model #: SYN9920A w/ universal belt clip
R4 1-005 Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 2 Section; Position: (0°,0°); Frequency: 1880 MHz
Probe: ET3DV6 - SN1502 - FCC Body; ConvF(5.30,5.30,5.30); Crest factor: 8.0; 1880 MHz Head & Body: $\sigma = 1.59$ mho/m $\epsilon_r = 52.7$ $\rho = 1.00$ g/cm³
Cube 7x7x7: SAR (1g): 0.432 mW/g, SAR (10g): 0.200 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 7.8 (7.5, 8.6) [mm]
Powerdrift: -0.04 dB



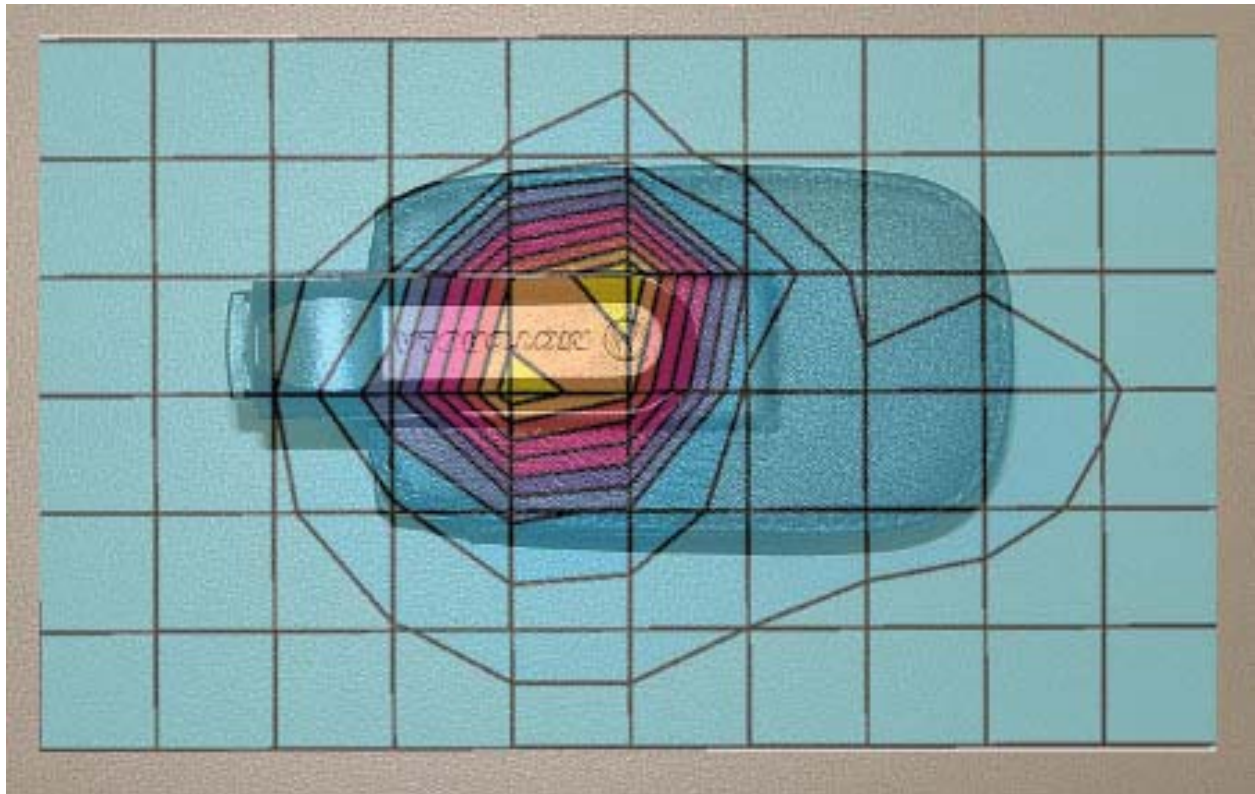


Figure 3. Typical 1900 MHz Body-Worn Contour Overlaid on Phone

Appendix 4

Probe Calibration Certificate

Calibration Certificate

Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1502

Place of Calibration:

Zurich

Date of Calibration:

September 27, 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:

N. Vetter

Approved by:

Blaise Käfer

Probe ET3DV6

SN:1502

Manufactured:	October 24, 1999
Last calibration:	September 26, 2001
Recalibrated:	September 27, 2002

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1502

Sensitivity in Free Space

NormX	1.84 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.89 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.87 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

DCP X	93	mV
DCP Y	93	mV
DCP Z	93	mV

Sensitivity in Tissue Simulating Liquid

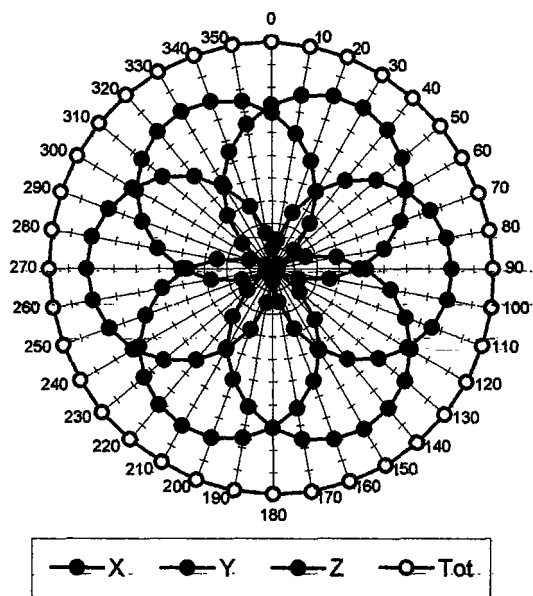
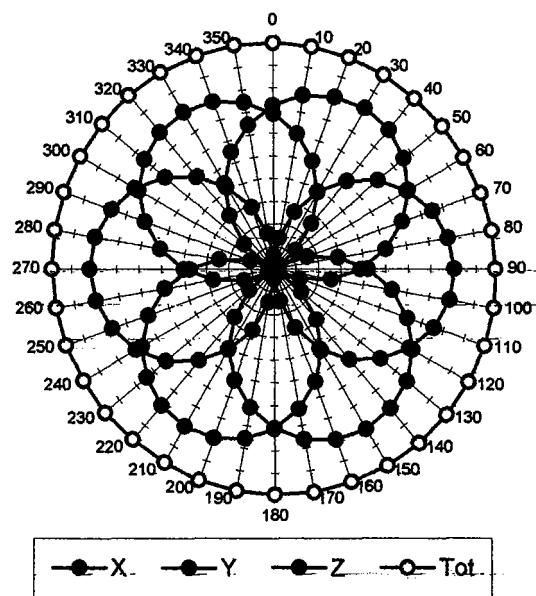
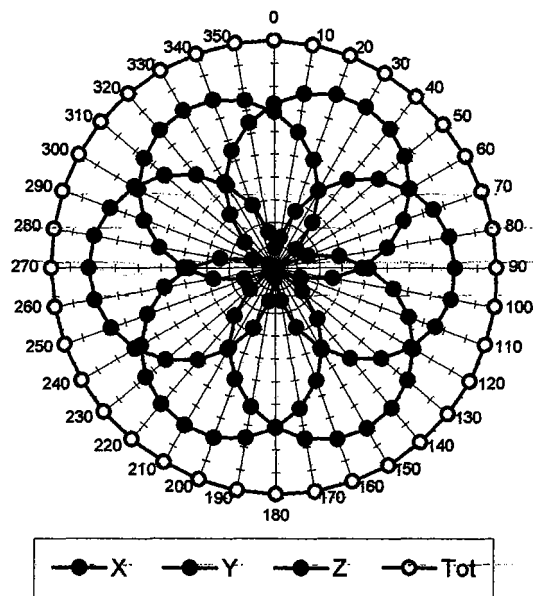
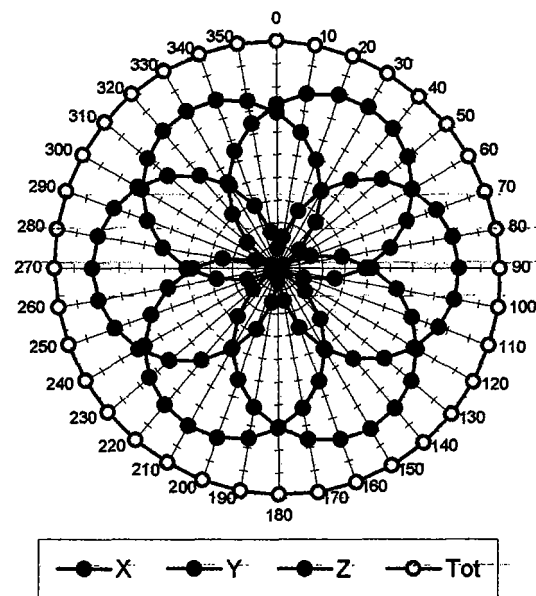
Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\% \text{ mho/m}$
ConvF X	6.5 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.5 $\pm 9.5\%$ (k=2)	Alpha	0.46
ConvF Z	6.5 $\pm 9.5\%$ (k=2)	Depth	2.27
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
ConvF X	5.6 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	5.6 $\pm 9.5\%$ (k=2)	Alpha	0.56
ConvF Z	5.6 $\pm 9.5\%$ (k=2)	Depth	2.24

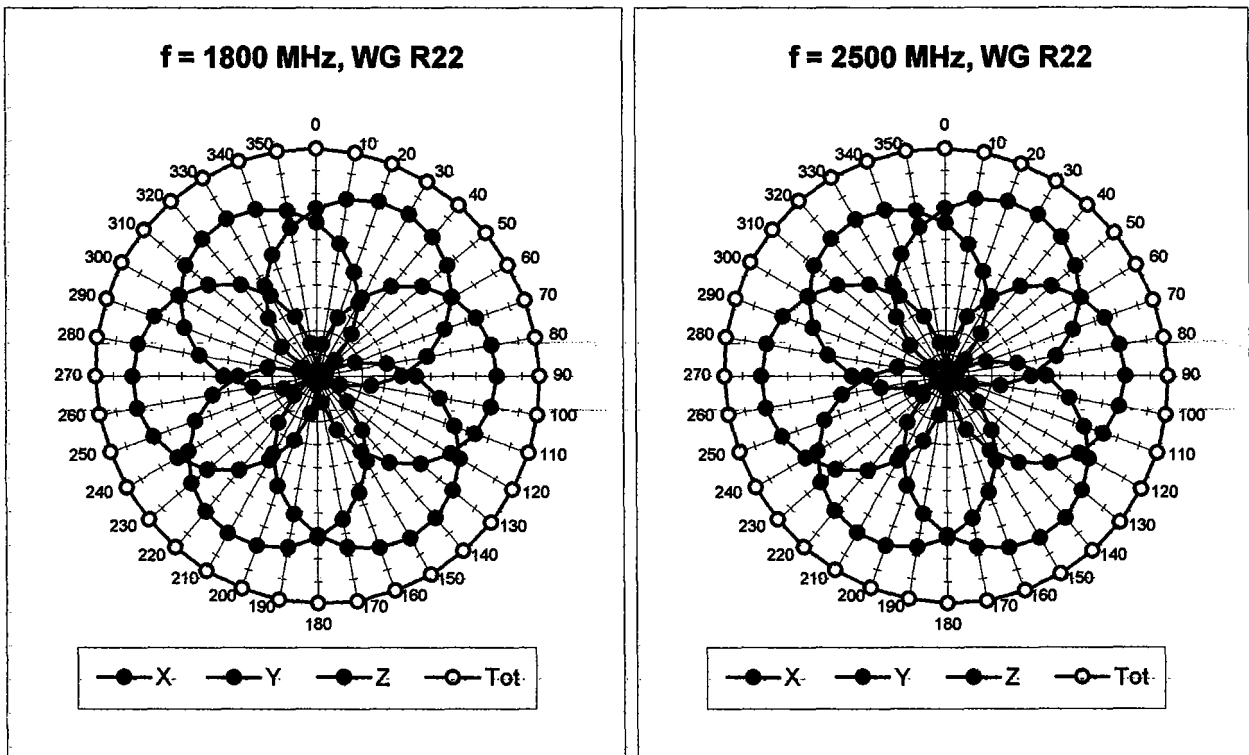
Boundary Effect

Head	900 MHz	Typical SAR gradient: 5 % per mm	
Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%]	Without Correction Algorithm	10.2	5.7
SAR _{be} [%]	With Correction Algorithm	0.3	0.4
Head	1800 MHz	Typical SAR gradient: 10 % per mm	
Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%]	Without Correction Algorithm	11.9	7.7
SAR _{be} [%]	With Correction Algorithm	0.1	0.3

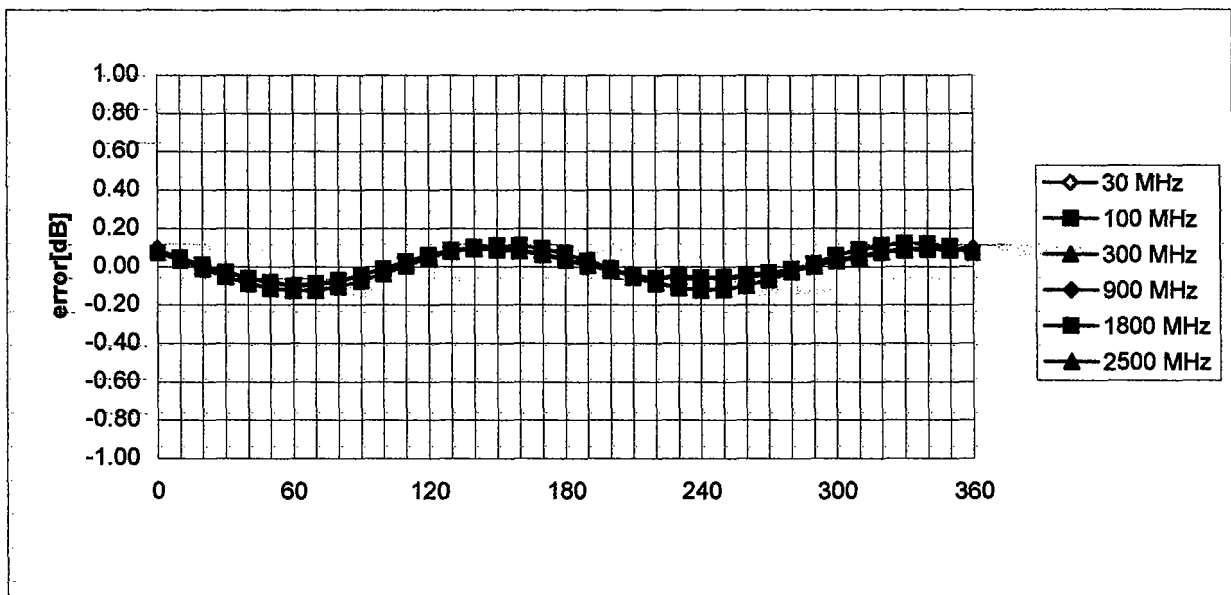
Sensor Offset

Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.4 \pm 0.2	mm

Receiving Pattern (ϕ), $\theta = 0^\circ$ **f = 30 MHz, TEM cell ifi110****f = 100 MHz, TEM cell ifi110****f = 300 MHz, TEM cell ifi110****f = 900 MHz, TEM cell ifi110**

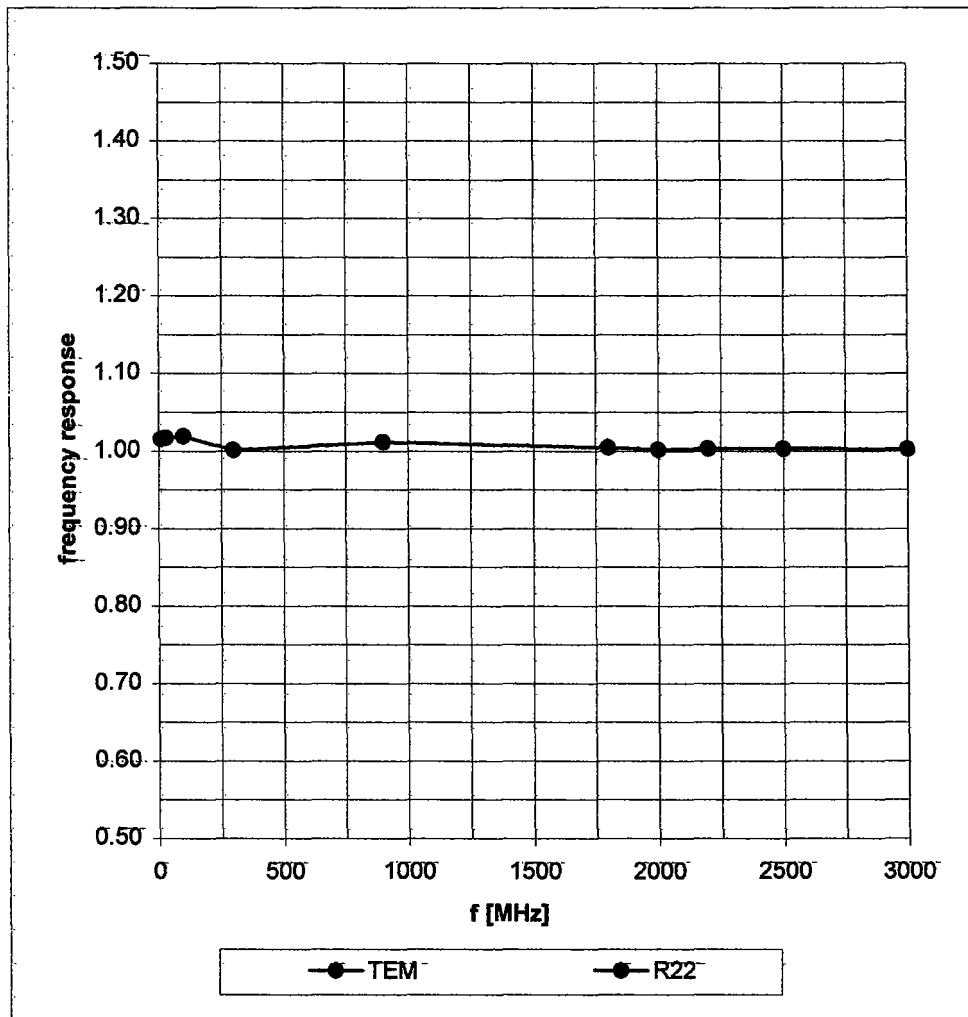


Isotropy Error (ϕ), $\theta = 0^\circ$

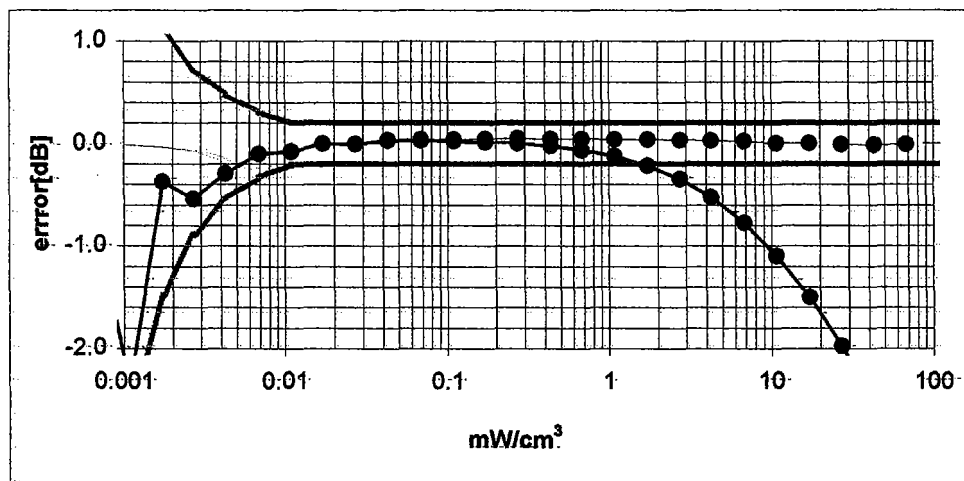
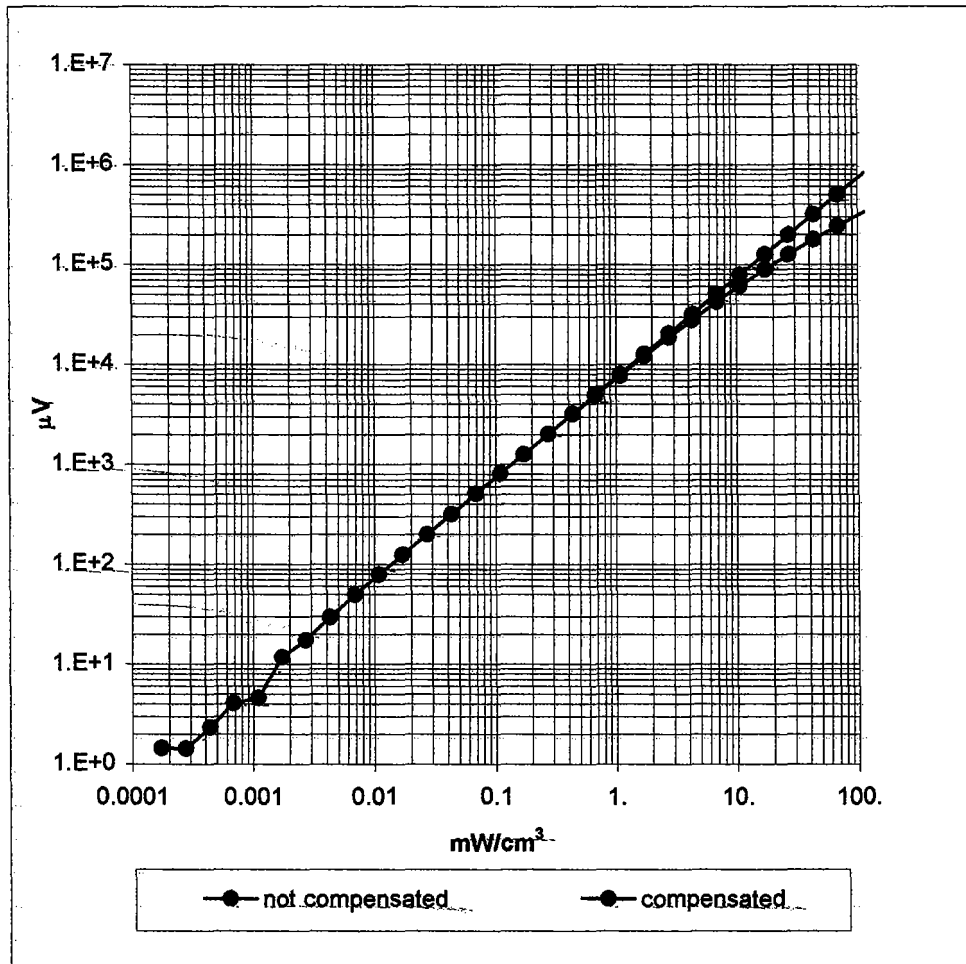


Frequency Response of E-Field

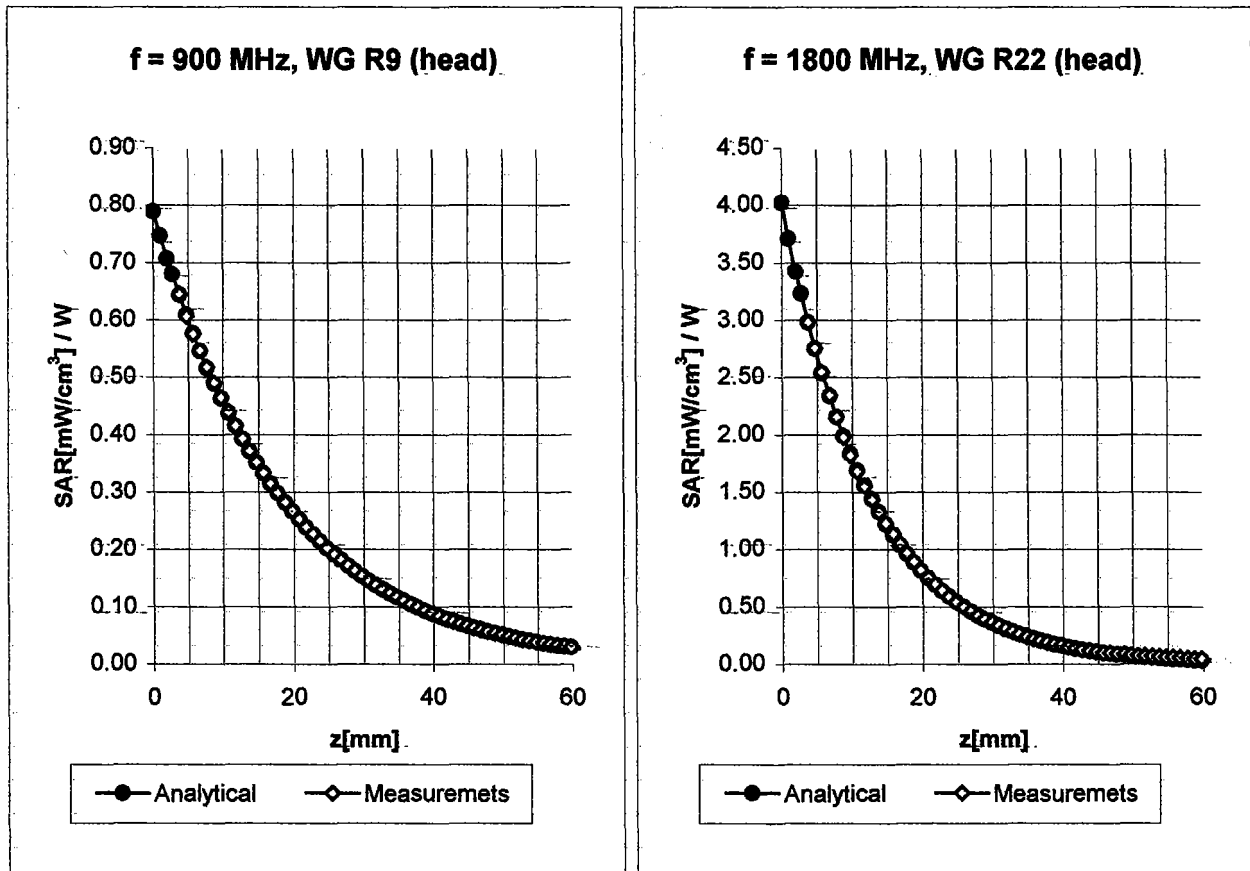
(TEM-Cell:ifi110, Waveguide R22)



Dynamic Range $f(\text{SAR}_{\text{brain}})$ (Waveguide R22)

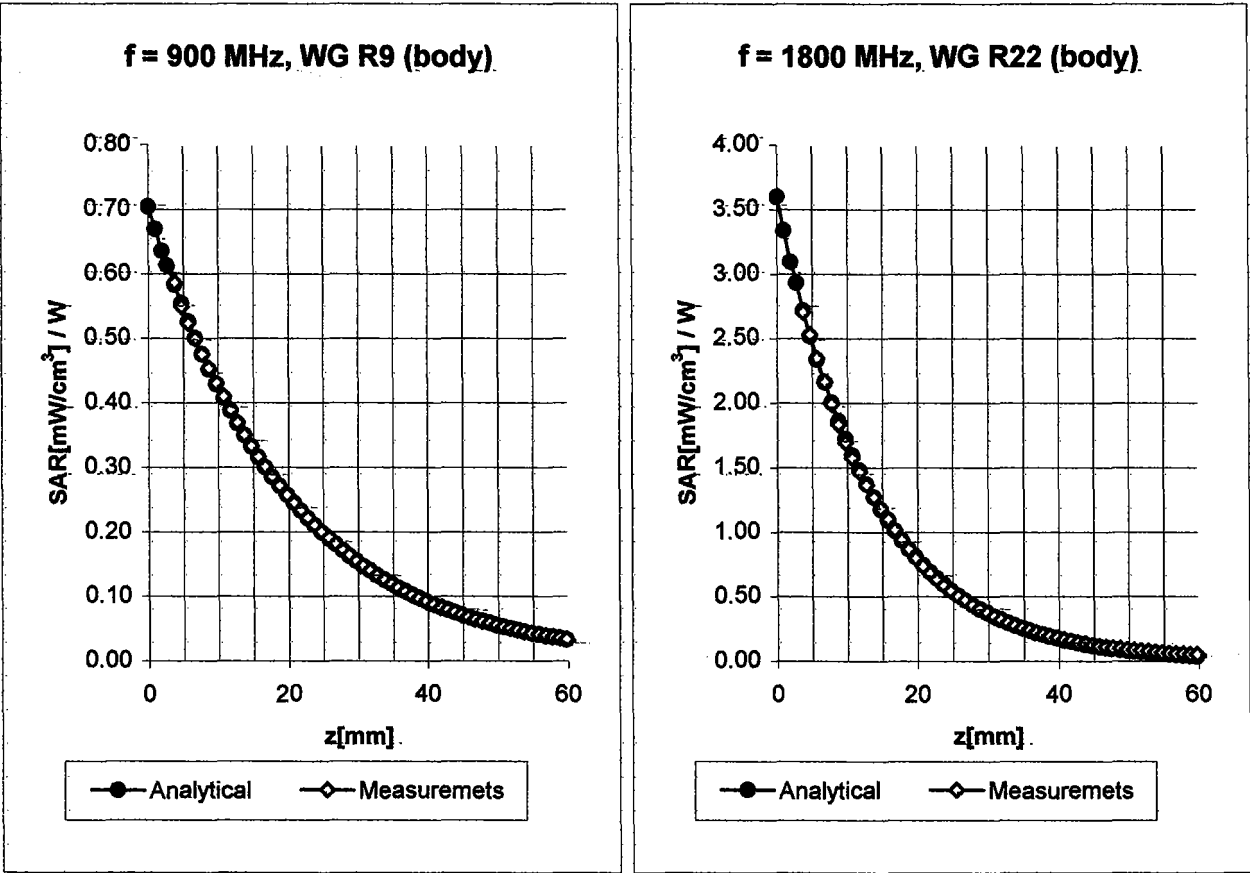


Conversion Factor Assessment



Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\% \text{ mho/m}$
	ConvF X	6.5 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	6.5 $\pm 9.5\%$ (k=2)	Alpha 0.46
	ConvF Z	6.5 $\pm 9.5\%$ (k=2)	Depth 2.27
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
	ConvF X	5.6 $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	5.6 $\pm 9.5\%$ (k=2)	Alpha 0.56
	ConvF Z	5.6 $\pm 9.5\%$ (k=2)	Depth 2.24

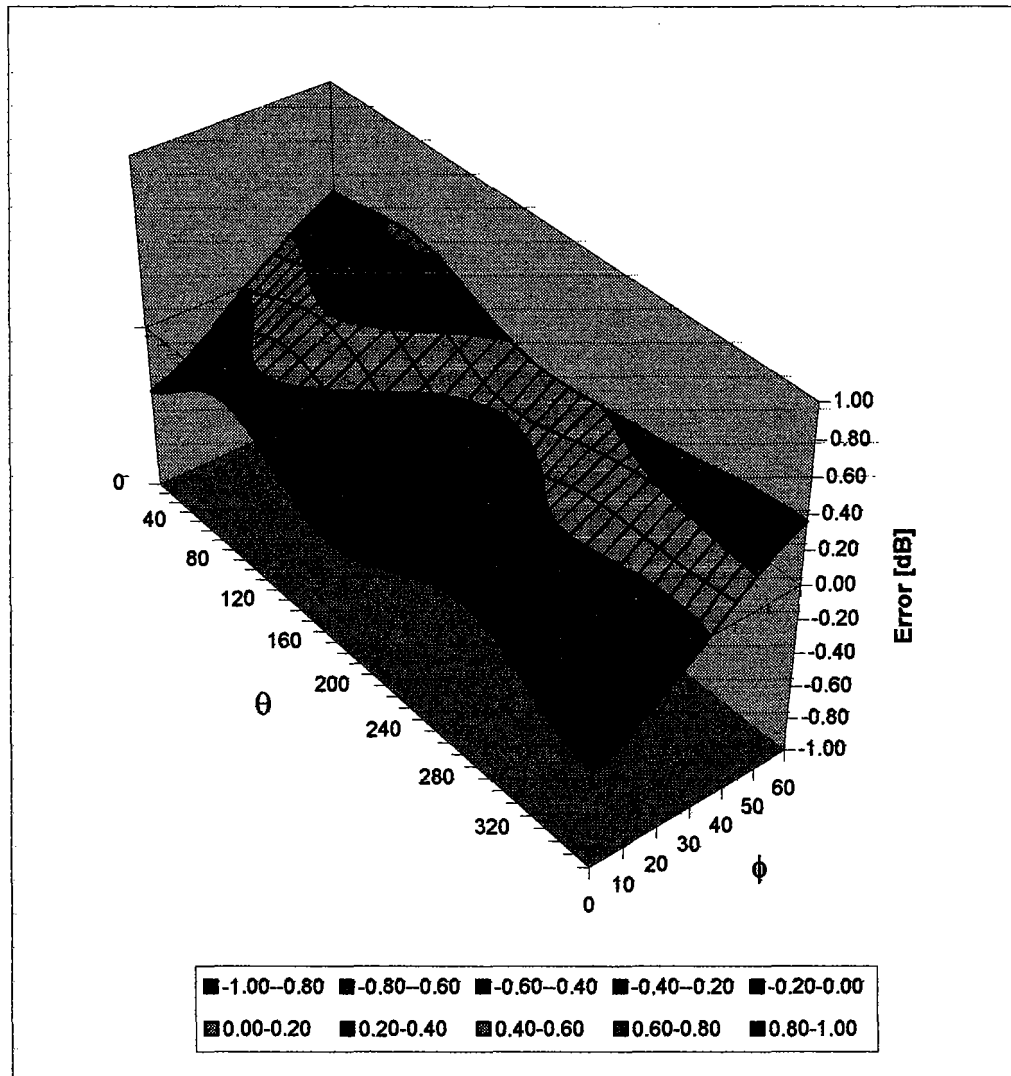
Conversion Factor Assessment



Body	900 MHz	$\epsilon_r = 55.0 \pm 5\%$	$\sigma = 1.05 \pm 5\% \text{ mho/m}$	
Body	835 MHz	$\epsilon_r = 55.2 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$	
	ConvF X	$6.3 \pm 9.5\% (k=2)$	Boundary effect:	
	ConvF Y	$6.3 \pm 9.5\% (k=2)$	Alpha	0.29
	ConvF Z	$6.3 \pm 9.5\% (k=2)$	Depth	3.55
Body	1800 MHz	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\% \text{ mho/m}$	
Body	1900 MHz	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\% \text{ mho/m}$	
	ConvF X	$5.3 \pm 9.5\% (k=2)$	Boundary effect:	
	ConvF Y	$5.3 \pm 9.5\% (k=2)$	Alpha	0.63
	ConvF Z	$5.3 \pm 9.5\% (k=2)$	Depth	2.34

Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz



Appendix 5

Dipole Characterization Certificate

Certification of System Performance Check Targets

Based on APP-0396

-Historical Data-

	835MHz	900MHz	1800MHz	1900MHz	
P1528 Target: Advanced Extrapolation	9.5	10.8	38.1	39.7	(W/kg)
Measurement Uncertainty (k=1):	10.2%	10.2%	10.2%	10.2%	
Measurement Period:	November '02 - June '03	November '02 - June '03	November '02 - June '03	November '02 - June '03	
# of tests performed:	169	728	868	26	
Grand Average: Worst Case Extrapolation	10.1	11.6	39.7	42.0	(W/kg)
% Delta (Average - P1528 Target)	6.5%	7.7%	4.2%	5.9%	
Is % Delta <= Measurement Uncertainty?	Yes	Yes	Yes	Yes	
Accept/Reject <u>Average</u> as new system performance check target?	ACCEPT	ACCEPT	ACCEPT	ACCEPT	
	Applicable 835MHz Dipole Serial Numbers:	Applicable 900MHz Dipole Serial Numbers:	Applicable 1800MHz Dipole Serial Numbers:	Applicable 1900MHz Dipole Serial Numbers:	
	420(TR), 421(TR)	77, 78	246(TR), 250(TR)	514(TR), 518(TR)	
	422(TR), 423(TR)	79, 80	251(TR), 258(TR)	519(TR), 520(TR)	
	424(TR), 425(TR)	91, 92	259(TR), 262(TR)	523(TR), 524(TR)	
	431(TR), 432(TR)	93, 94	263(TR), 271(TR)	526(TR), 527(TR)	
	433(TR), 434(TR)	95, 96	272(TR), 273(TR)	528(TR), 529(TR)	
	436(TR)	97	276(TR), 277(TR)	530(TR), 533(TR)	
			279(TR), 280(TR)		
			281(TR), 282(TR)		
			283(TR), 284(TR)		

-New System Performance Check Targets- per APP-0396
(based on analysis of historical data)

Frequency	SAR Target (W/kg)	Permittivity	Conductivity (S/m)
835MHz	10.1	41.5 ± 5%	0.90 ± 5%
900MHz	11.6	41.5 ± 5%	0.97 ± 5%
1800MHz	39.7	40.0 ± 5%	1.40 ± 5%
1900MHz	42.0	40.0 ± 5%	1.40 ± 5%

-Approvals-

Submitted by:

Marge Kaunas

Date:

24-Jun-03

Signed:

Marge Kaunas

Comments:

spreadsheet detailing all measurements available upon request

Approved by:

Antonio Faraone

Date:

24-Jun-03

Signed:

Antonio Faraone

Comments:

Targets and associated simulant properties are derived from the IEEE P1528 draft standard

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Appendix 6
Measurement Uncertainty Budget

Uncertainty Budget for Device Under Test									
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e = f(d,k)</i>	<i>f</i>	<i>g</i>	<i>h = c x f / e</i>	<i>i = c x g / e</i>	<i>k</i>
Uncertainty Component	Sec.	Tol. (± %)	Prob. Dist.	Div.	<i>c_i</i> (1 g)	<i>c_i</i> (10 g)	1 g <i>u_i</i> (±%)	10 g <i>u_i</i> (±%)	<i>v_i</i>
Measurement System									
Probe Calibration	E.2.1	9.5	N	2.00	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	5.8	R	1.73	1	1	3.3	3.3	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1.0	N	1.00	1	1	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	1.3	R	1.73	1	1	0.8	0.8	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.3	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	1.1	R	1.73	1	1	0.6	0.6	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	3.9	R	1.73	1	1	2.3	2.3	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.6	N	1.00	1	1	3.6	3.6	29
Device Holder Uncertainty	E.4.1	2.8	N	1.00	1	1	2.8	2.8	8
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	10.0	R	1.73	0.64	0.43	3.7	2.5	∞
Liquid Permittivity - deviation from target values	E.3.2	10.0	R	1.73	0.6	0.49	3.5	2.8	∞
Liquid Permittivity - measurement uncertainty	E.3.3	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Combined Standard Uncertainty			RSS				11.72	11.09	1363
Expanded Uncertainty (95% CONFIDENCE LEVEL)			<i>k</i> = 2				22.98	21.75	

Uncertainty Budget for System Performance Check (dipole & flat phantom)

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	$e = f(d, k)$	<i>f</i>	<i>g</i>	$h = c \times f / e$	$i = c \times g / e$	<i>k</i>
Uncertainty Component	Sec.	Tol. (± %)	Prob. Dist.	Div.	c_i (1 g)	c_i (10 g)	1 g u_i (±%)	10 g u_i (±%)	v_i
Measurement System									
Probe Calibration	E.2.1	9.5	N	2.00	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	5.8	R	1.73	1	1	3.3	3.3	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1.0	N	1.00	1	1	1.0	1.0	∞
Response Time	E.2.7	0.0	R	1.73	1	1	0.0	0.0	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.3	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	1.1	R	1.73	1	1	0.6	0.6	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	3.9	R	1.73	1	1	2.3	2.3	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	1.0	R	1.73	1	1	0.6	0.6	∞
Input Power and SAR Drift Measurement	8, 6.6.2	4.7	R	1.73	1	1	2.7	2.7	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	10.0	R	1.73	0.64	0.43	3.7	2.5	∞
Liquid Permittivity - deviation from target values	E.3.2	10.0	R	1.73	0.6	0.49	3.5	2.8	∞
Liquid Permittivity - measurement uncertainty	E.3.3	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Combined Standard Uncertainty			RSS				10.16	9.43	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			$k=2$				19.92	18.48	

Appendix 7

Photographs of the device under test

